The City of San Diego
Water Department
2005 Watershed Sanitary Survey

Data Collected Between 01/01/01– 12/31/05

Acknowledgments

City of San Diego Water Department
Water Quality Laboratory

Lead Project Team

Project Supervisor

Dana Chapin, Senior Chemist

Project Team

Rick Fox, Biologist III

Dennis Brown, Biologist II

Verne Chancer, Biologist II

Daniel Daft, Biologist II

Martha Greenstone, Asst. Chemist

Nita Torres, Public Information Clerk

Additional City Water Department Contributors

Jeff Pasek, Senior Biologist

The Biology Analytical Team

The Chemistry Analytical Team

Joe Weber, Lakes Program Manager

Contributing Outside Agencies

California Dept of the Interior, Bureau of Land Management

County of San Diego, Dept of Environmental Health

Otay Water District

Ramona Municipal Water District

San Diego Regional Water Quality Control Board

San Diego Zoo Wild Animal Park

USDA Forest Service, Cleveland National Forest

U.S. Dept of the Interior, Bureau of Land Management

2005 WATERSHED SANITARY SURVEY UPDATE

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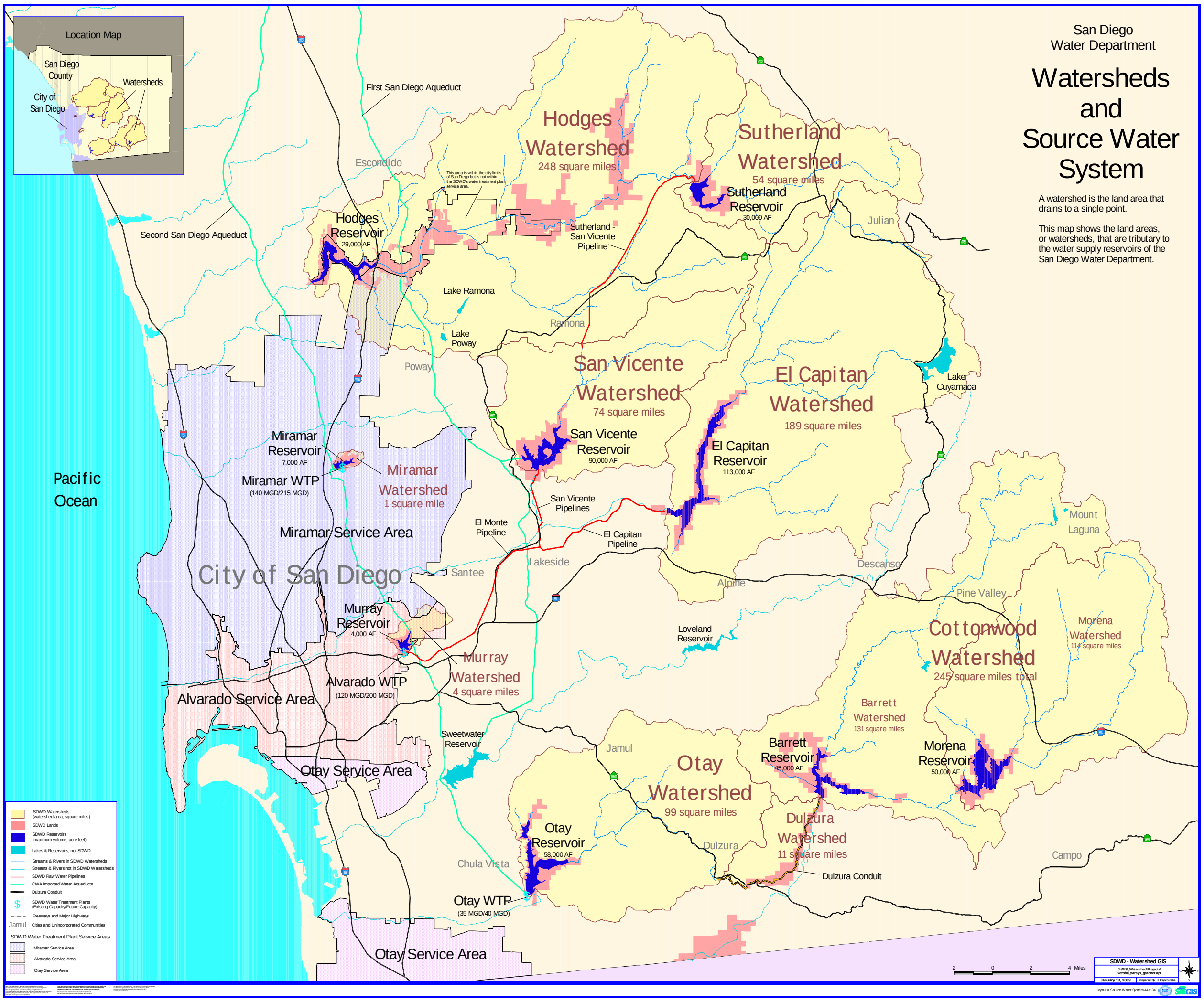

The City of San Diego Water Department 2005 Watershed Sanitary Survey

Executive Summary

Volume 1 of 5

Data Collected Between 01/01/01– 12/31/05

ABBREVIATIONS

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ADT	Average daily traffic
ADWF	Average dry weather flow
AF/Y	Acre-Feet per Year
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ESWTR	Enhanced Surface Water Treatment Rule
GIS	Geographic Information System
gpd	Gallons per day
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HAAs	Haloacetic Acids

ABBREVIATIONS

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HPC	Heterotrophic Plate Count
HSU	Hydrographic Subunit
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IOCs	Inorganic Chemicals
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LSE LF	Loose Leaf
MCL	Maximum Contaminant Level
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USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Society
VOCs	Volatile Organic Compounds
WDRs	Waste Discharge Requirements
WPCF	Water Pollution Control Facility
WRF	Water Reclamation Facility
WSS	Watershed Sanitary Survey
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

VOLUME 1
EXECUTIVE SUMMARY

CHAPTER 1: SYNOPSIS

Introduction

This is the executive summary of the 2005 Watershed Sanitary Survey Update for the City of San Diego Water Department. The Watershed Sanitary Survey (WSS) covers eight watersheds and nine surface water reservoirs, which comprise the local source waters used by the City of San Diego Water Department. The initial WSS was completed in 1996. This report is the second five-year update of that survey.

Watershed Sanitary Survey Requirements

The California Surface Water Treatment Rule, Title 22 of the State Code of Regulations, requires every public water system using surface water to conduct a comprehensive sanitary survey of its watersheds every five years. The purpose of such a survey is to identify actual or potential sources of contamination or any other watershed-related factor which might adversely affect the quality of water used for domestic drinking water.

The City of San Diego Water Department and its oversight agencies will use the Watershed Sanitary Survey Update (WSS Update) to evaluate water quality problems which might result from contaminants in the watersheds. The WSS Update will also serve as a basis for future watershed management and planning efforts.

Objectives

The main objectives of this WSS Update are to:

- Satisfy the regulatory requirement for a watershed sanitary survey.
- Identify and assess existing and potential sources of contamination in the watersheds.
- Provide a general description of existing watershed control and management practices.
- Provide general recommendations for improving watershed management practices in order to protect the quality of the surface waters entering the reservoirs.

Conduct of the Study

This update of the WSS for the San Diego River System Watersheds was produced by the staff of the City of San Diego Water Department, Water Quality Laboratory. The survey covers the water supply system from the most remote points of the San Diego River System Watersheds to the treatment facility. It was conducted by reviewing existing aerial photographs, GIS data, reports, water quality data and other record documents, and was supplemented by field surveys and personal knowledge of Water Department staff.

Report Organization

The organization of this WSS Update has been modified from that of the previous WSS Update. The watersheds and reservoirs are grouped according to the water treatment plant they supply. A separate volume is devoted to each system as follows:

- Volume 1: The Executive Summary of the entire WSS Update.
- Volume 2: The San Diego River System, comprising the San Vicente, El Capitan, Sutherland, and Murray Watersheds, which supplies the Alvarado Water Treatment Plant.

- Volume 3: The Otay-Cottonwood System, comprising the Otay, Dulzura, and Cottonwood Watersheds, which supplies the Otay Water Treatment Plant.
- Volume 4: The Miramar Watershed, which supplies the Miramar Water Treatment Plant.
- Volume 5: The Hodges Watershed, containing the Hodges Reservoir, which does not supply water to any of San Diego’s water treatment plants.

The organization of Volumes 2 through 5 has changed. The Executive Summary, formerly Chapter 1, has been removed from the individual volumes. The remaining chapters have been rearranged as follows:

Chapter 1: Synopsis
Chapter 2: Description of Watersheds/Source Water System and Review of previous Watershed Sanitary Survey Recommendations
Chapter 3: Existing Conditions in the Watersheds
Chapter 4: Water Quality Assessment
Chapter 5: Conclusions and Recommendations

CHAPTER 2: DESCRIPTION OF WATERSHEDS/SOURCE WATER SYSTEM AND REVIEW OF PREVIOUS WSS RECOMMENDATIONS

Overview of The Source Water System

The City of San Diego Water Department's local source water system consists of nine reservoirs, the watershed lands tributary to these reservoirs, and raw water conveyances connecting the reservoirs to one another and to the water treatment plants.

The Water Department operates three water treatment plants. It is useful to group the reservoirs and watersheds into three systems, each supplying raw water to a water treatment plant. The San Diego River System supplies the Alvarado Water Treatment Plant; the Otay-Cottonwood System supplies the Otay Water Treatment Plant; and the Miramar System supplies the Miramar Water Treatment Plant. The Hodges Watershed currently does not serve the San Diego Water Department, but is monitored for possible future use. Each system is described separately on the following pages.

The local source water system is located in southern and central San Diego County on the western slope of the peninsular mountains. The region has a Mediterranean climate with distinct wet and dry seasons. Precipitation generally increases from west to east, with annual precipitation ranging from an average of about 10 inches per year at Lake Murray to over 40 inches per year in the upper portions of the El Capitan and Sutherland Watersheds. Nearly all precipitation occurs from October through April. Winter snowfalls are common in the highest elevations of the watersheds. Summers are dry and hot.

The San Diego River System

Reservoirs and Watersheds -

The San Diego River System consists of four reservoirs and their watersheds, plus interconnecting raw water pipelines, all located in the central portion of San Diego County. The reservoirs are San Vicente, El Capitan, Murray, and Sutherland. The four watersheds of the San Diego River System have a combined area of 205,140 acres, or approximately 321 square miles.

The San Vicente, El Capitan, and Murray Watersheds belong to the San Diego River Basin, while the Sutherland Watershed is located in the San Dieguito River Basin. However, since water from the Sutherland Reservoir is transferred to the San Vicente Reservoir, the Sutherland Watershed is considered part of the San Diego River System.

The San Vicente Watershed covers 47,545 acres of foothills, interior valleys, and low mountains. Land use in the watershed ranges from remote and rural to highly developed and densely populated. Although the overall population density remains low, new development and population growth have accelerated over the past five years. Approximately 60% of the land in the watershed is privately owned and much of this private land is available for residential, commercial, or agricultural development.

The El Capitan Watershed is the largest of the four at 120,773 acres, and encompasses foothills, interior valleys, and the highest mountains in San Diego County. About 52% of the watershed is publicly owned land. The Cleveland National Forest is the major public land management agency in the watershed. The Cuyamaca Reservoir, owned by the Helix Water District, is located in the northeastern part of the watershed. Only 6% of the watershed is currently in residential and commercial use and the overall population density is 0.13 persons per acre. However, significant development and growth have taken place in the past five years, both in the suburban community of Alpine in the south, and the rural community of Julian to the north.

The Murray Watershed includes 2,298 acres of highly urbanized land. About 71% of the land is fully developed for residential and commercial uses. The population density is about 10 persons per acre. The remaining 29% of the watershed is publicly owned, and is nearly evenly divided between urban parks and open space parkland in the Mission Trails Regional Park. The Murray Reservoir is surrounded by a diversion ditch, which intercepts low levels of runoff and diverts it around the reservoir to a discharge point below the dam. At higher runoff levels, though, surface flow carries past the diversion system and into the reservoir.

The Sutherland Watershed covers 34,525 acres of mostly mountainous terrain at the eastern end of the San Dieguito River. It is rural and sparsely populated, about 0.03 persons per acre. Approximately 51% of the watershed is privately owned, and another 23% is Indian Reservation. Less than 2% of the watershed is devoted to residential and urban types of development, centered mainly around the small community of Santa Ysabel.

Water Supply System -

Local runoff from the San Diego River System watersheds is impounded in the San Vicente, El Capitan, Murray, Sutherland, and Cuyamaca Reservoirs. Water from the Cuyamaca Reservoir is carried along natural channels to El Capitan Reservoir. Water in Sutherland Reservoir is conveyed via a pipeline and a natural channel to San Vicente Reservoir.

Average annual runoff for El Capitan, San Vicente, and Sutherland Reservoirs is 27,800 AF/year, 7,400 AF/year, and 11,200 AF/year, respectively. Local runoff to Murray Reservoir is much less, about 100 AF/year.

Imported water from the San Diego County Water Authority can be delivered to San Vicente, El Capitan, and Murray Reservoirs and stored there for future use.

Water stored in the San Vicente, El Capitan, and Murray Reservoirs is delivered via a system of pipelines to the San Diego Water Department's Alvarado Water Treatment Plant. Water from El Capitan Reservoir is also delivered to the Helix Water District's R.M. Levy Water Treatment Plant.

The Alvarado Water Treatment Plant is a 120 MGD conventional water treatment plant using flocculation, sedimentation, and dual media filters. The plant is currently undergoing an expansion to 200 MGD. Ultimately the improvements will include ozone for primary disinfection.

The Otay-Cottonwood System

Reservoirs and Watersheds -

The Otay-Cottonwood System consists of the Morena, Barrett, Upper Otay, and Lower Otay Reservoirs, the Dulzura Conduit, and their surrounding watersheds. The system covers a combined area of 226,245 acres, or about 354 square miles.

Morena and Barrett Reservoirs are impoundments along Cottonwood Creek. Below Barrett Dam, Cottonwood Creek flows into Mexico and joins the Tijuana River. Water from Barrett Reservoir is diverted into the Dulzura Conduit, which discharges into Dulzura Creek at the headwaters of the Otay River. The water ultimately reaches the Otay Reservoir. Essentially, this system transfers water from the Tijuana River Basin to the Otay River Basin.

Natural runoff from a small area upslope of the Dulzura Conduit can be captured into the conduit, via a series of diverting structures. This area is known as the Dulzura Watershed. Since it contributes directly to Otay Reservoir, it is considered part of the Otay-Cottonwood System.

The Cottonwood Watershed covers an area of 155,984 acres and extends from steep-sided, low elevation valleys in the west to high mountains in the east. It is the least developed of all the watersheds which contribute to the San Diego Water Department's local water supply. Over 75% of the watershed is vacant and undeveloped land, and approximately 1% is devoted to residential developments. Much of the Cottonwood Watershed is under the jurisdiction of the Cleveland National Forest. Average annual runoff is 22,200 AF/year.

The Otay-Dulzura Watershed covers 70,322 acres including steep mountains in the east with gentler rolling hills and valleys to the west. Average annual runoff is 6,400AF/year. At present, more than 50% of the watershed land is vacant and undeveloped. Agriculture occurs on approximately 2% of the land, and residential development occupies another 8%.

In recent years there has been significant residential and commercial growth near the Otay Reservoir, and a number of new developments are anticipated in the western portion of Otay Watershed in the next few years.

Water Supply System -

Local runoff from the Otay-Cottonwood System is impounded in the Morena, Barrett, Upper Otay, and Lower Otay Reservoirs. Water from Morena Reservoir flows to Barrett Reservoir, by way of Cottonwood Creek. From Barrett Reservoir, the water is transferred to the Lower Otay Reservoir via the Dulzura Conduit and Dulzura

Creek. Some of the runoff from the Dulzura Watershed is captured by the Dulzura Conduit and then to Lower Otay Reservoir. Water captured in Upper Otay Reservoir is also released to Lower Otay Reservoir, which is located just below Upper Otay Dam.

Lower Otay Reservoir is the southern terminus of the San Diego County Water Authority Second San Diego Aqueduct, which carries imported water to the San Diego area. Therefore, the Lower Otay Reservoir contains a blend of local source water and imported water from the Colorado River and California State Water Project.

The Otay Water Treatment Plant is a conventional 40 MGD water treatment plant using flocculation, sedimentation, and dual media filters.

The Miramar System

Reservoir and Watershed -

The Miramar System consists solely of Miramar Reservoir and its watershed. The Miramar Watershed has an area of only 645 acres, or about one square mile. It is located within the City of San Diego, toward the City's northeastern limits. The reservoir occupies 21% of the watershed area, while 24% is used for residential purposes. The remaining 55% is taken up by surface streets, community parks, open space parks, and the Miramar Water Treatment Plant.

Water Supply System-

Miramar Reservoir depends almost entirely on water imported from the Colorado River and the California State Water Project, via the San Diego County Water Authority Second San Diego Aqueduct. Most runoff is diverted out of the watershed through storm drains. The Miramar Reservoir functions as storage against peak and emergency demands for the Miramar Water Treatment Plant.

The Miramar Water Treatment Plant is located adjacent to the Miramar Reservoir, and serves the northern section of the City. The plant currently uses flocculation, sedimentation, and dual media filters, and has a capacity of 140 MGD. Future plans are to increase the capacity to 215 MGD, and add new treatment processes, notably ozone.

The Hodges Watershed

Reservoir and Watershed -

Although it is owned and operated by the San Diego Water Department, Hodges Reservoir is not currently connected to the San Diego Water Department's system. Water impounded in Hodges Reservoir is supplied to other agencies.

The Hodges Watershed is located in the west central portion of San Diego County, and has an area of 158,417 acres, about 248 square miles. The topography ranges from steep hills and narrow valleys in the east, to lower hills and open valleys to the west. The main tributary is Santa Ysabel Creek, which begins at Sutherland Dam and flows through San Pasqual Valley to Hodges Reservoir. About 47% of the watershed is vacant and undeveloped, while 19% is given to agriculture such as intensive farming and livestock grazing. The developed areas are mostly residential and commercial.

Water collected in Hodges Reservoir is sold as raw water to the San Dieguito Water District and the Santa Fe Irrigation District. The water is treated at the Badger Filtration Plant and distributed to the communities of Rancho Santa Fe, Solana Beach, and Encinitas.

Several options are under consideration to maximize the use of water from Hodges Reservoir. One project would connect the reservoir to the San Diego Water Department's system via the Second San Diego Aqueduct, for treatment at the Miramar Filtration Plant. An alternative plan would connect Hodges Reservoir to the new Olivenhain Reservoir, for distribution to the community of Olivenhain.

Review Of The Recommendations Of The Previous WSS Update

The previous WSS Update included extensive recommendations for improved watershed management and source water control. Detailed discussions of the implementation and success of these recommendations are given in Chapter 2 of Volumes 2 through 5.

The underlying theme of all recommendations is protection of the watershed and source water quality. The recommendations fell into four categories:

- Water Quality Monitoring
- Interjurisdictional Coordination
- Watershed Management and Control Practices
- Public Education

Generally, only a few of the specific recommendations were implemented and success was limited. In the five years since the previous WSS Update, some progress was made in increased water quality monitoring at the reservoirs and in the watersheds. Inter-jurisdictional coordination became a focus of the staff of the San Diego Water Department. However, this inter-jurisdictional coordination was mostly on a person-to-person basis and included few formal agreements between jurisdictions.

CHAPTER 3: EXISTING CONDITIONS IN THE WATERSHEDS

Survey Methods

This update of the WSS was conducted entirely by staff of the City of San Diego Water Department.

The WSS Update assesses information and data for the five year period of January 2001 through December 2005. Information and data for this study were gathered from many sources, including the databases of at least seven governmental agencies. The WSS Update draws upon technical reports, aerial photographs, interviews with key contacts, and the personal knowledge of staff. All of this was supplemented by extensive field surveys by staff of the San Diego Water Department.

Much of the data and information collected for the WSS Update was transformed into geospatial formats, and analyzed and archived in the Watershed Geographic Information System in the San Diego Water Department. Details of the methods used to conduct the Survey are given in Chapter 3 of Volumes 2 through 5. Sources of information are referenced throughout those volumes.

Potential Contaminant Sources

The WSS Update identified the following as major potential contaminant sources within the watersheds:

- The Cedar Fire of 2003.
- The extreme rainy season of 2004-2005.
- Non-point source pollution from residential and commercial development.
- Spills from sewer collection systems and pump stations.
- Discharges, both intentional and accidental, at several small wastewater treatment plants.
- Discharges of partially treated sewage from failing, older septic systems.

- Livestock grazing.
- Hazardous waste spills at hazardous waste storage sites or along transportation corridors.

The Cedar Fire of 2003 has been identified as the greatest non-point source of contamination in the watersheds, followed by the extreme rainy season of 2004 to 2005. The two together have had a significant impact on sourcewater quality.

Most of these potential sources of contamination are likely to occur infrequently or at identifiable locations. However, diffuse, non-point source pollution from residential and commercial development is widespread throughout the watersheds and occurs continuously. This WSS Update finds that such non-point source pollution is a considerable potential source of contamination in the watersheds.

Watershed Management and Control Practices

Two key factors limit the San Diego Water Department's control over its watershed areas. First, the San Diego Water Department owns 6% of all watershed lands. Second, 10% percent of all watershed lands lie within the City of San Diego. Therefore, most of the watershed lands are outside the City's jurisdiction for land use planning, zoning, building codes, and enforcement of environmental regulations.

To protect its source waters, the City of San Diego must work effectively with the other governmental agencies which have jurisdiction over the watershed lands. To this end, San Diego Water Department staff has become increasingly involved in reviewing and commenting on development proposals and other land use decisions. A network of inter-agency contacts, both formal and informal, serves to alert the Water Department about contamination events in the watersheds.

CHAPTER 4: WATER QUALITY ASSESSMENT

Summary Of Source Water Quality Since 2000

As part of the WSS Update, five years of water quality monitoring data at the reservoirs and in the watersheds were compared to current and proposed regulatory standards for drinking water. An extensive discussion of source water quality versus drinking water standards can be found in Chapter 4 of Volumes 2 through 5.

Comparison of raw source water quality to drinking water standards is for reference purposes only, as the potable drinking water standards do not apply to raw source water. Keeping that in mind, raw source water commonly exceeded drinking water limits for pH, turbidity, color, odor, coliform bacteria, manganese and aluminum, and sometimes exceeded drinking water limits for arsenic, iron, total dissolved solids, and conductivity. Methyl Tertiary Butyl Ether (MTBE) was the only organic contaminant present in the source waters at levels higher than drinking water standards. Concentrations of MTBE exceeded the MCL or SMCL at El Capitan, San Vicente, and Hodges Reservoirs. Levels of MTBE are declining due to the removal of MTBE from gasoline and replacement of 2-stroke boat motors with 4-stroke motors. No radiological constituents were found at levels higher than drinking water standards in the reservoirs or watersheds. Levels of Total Organic Carbon (TOC) have risen since the Cedar Fire of 2003.

Assessment of System's Ability to Meet Drinking Water Standards

Existing water quality data shows that all three treatment plants produce water which meets current water quality standards. Some modification to the treatment plants will be necessary to meet the new requirements of the Stage 2 Disinfectants and Disinfectant Byproducts Rule (D/DBP) and the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), starting in 2012. Proposed Arsenic, Radon, and Sulfate regulations can be met with our current water supplies.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

Water Quality Monitoring

Maintain the long-term monitoring program for the watersheds and reservoirs to establish baseline conditions, identify trends in degradation, isolate sources of contamination, and determine effects of management practices. Watershed monitoring should include water quality, land use, and land conditions.

Inter-jurisdictional Coordination

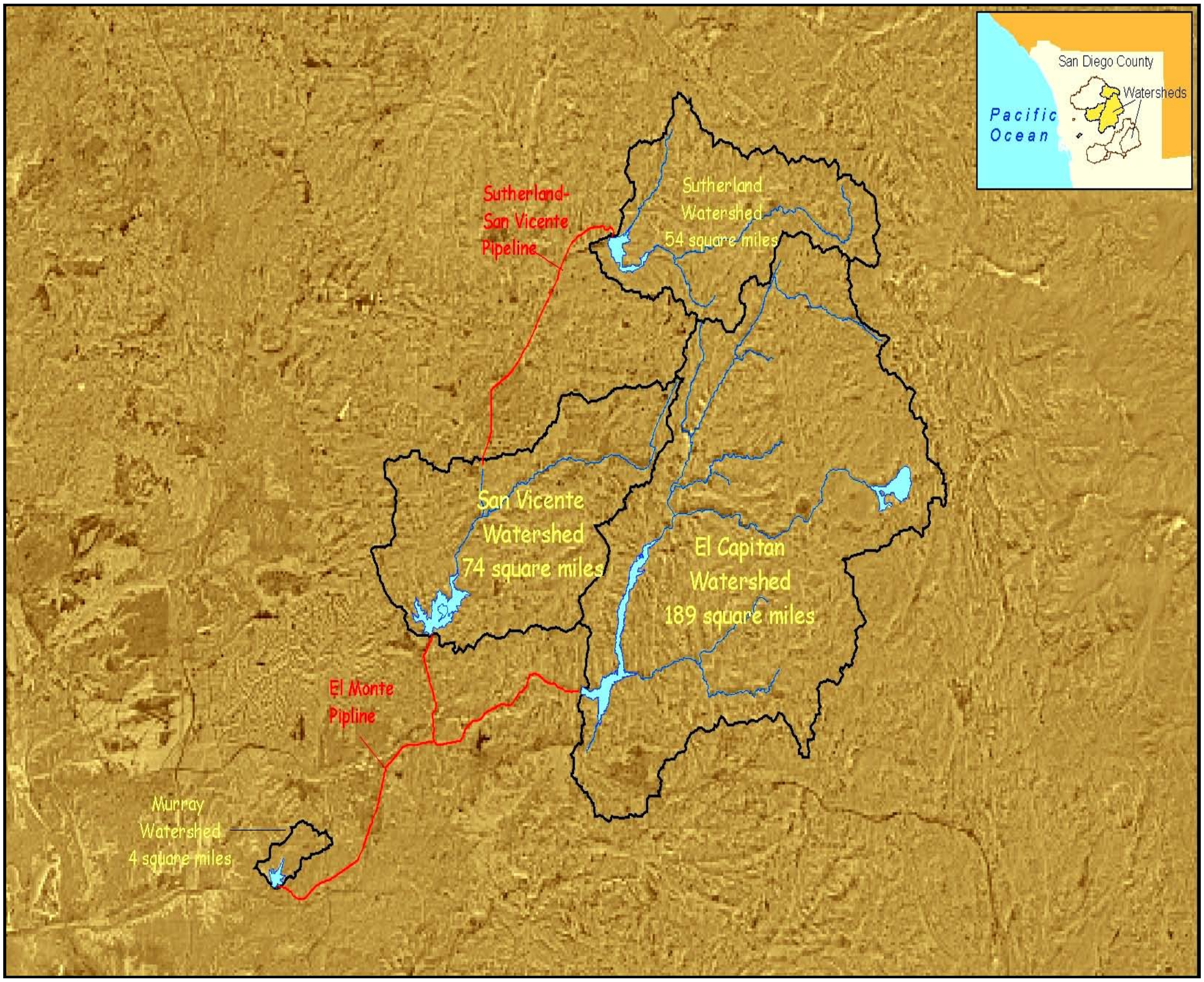
- Continue to centralize and strengthen Water Department relationships and networks with other agencies and jurisdictions in the watersheds.
- Implement written guidelines for the review of new residential or commercial development.
- Implement written guidelines for review of proposed activities that are potential contamination sources.
- Resume meetings with established workgroups and watershed agencies such as the County of San Diego Department of Planning and Land Use, the Cleveland National Forest, Native American governments, and the land use and planning functions of the cities of Chula Vista, Escondido, and Poway.

Watershed Management and Control Practices

- Continue to work with landowners and regulatory agencies in reducing the potential effects of cattle grazing.
- Formulate a watershed land strategy to acquire parcels, conservation easements, or development rights for lands proximal to the source waters that, if preserved, would protect water quality.

Public Education

Continue to generate and distribute educational materials for people living, working, or recreating in the watersheds.



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San Diego River System

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USGS	United States Geological Society
VOCs	Volatile Organic Compounds
WDRs	Waste Discharge Requirements
WPCF	Water Pollution Control Facility
WRF	Water Reclamation Facility
WSS	Watershed Sanitary Survey
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WWTP	Wastewater Treatment Plant

VOLUME 2

THE SAN DIEGO RIVER SYSTEM

CHAPTER 1: SYNOPSIS

Introduction

This volume is the second five-year update of the 1996 Watershed Sanitary Survey (WSS) for the San Diego River System Watersheds (Figure 2-1.1). The San Diego River System is comprised of four reservoirs, their watersheds, interconnecting water pipelines, and the Alvarado Water Treatment Plant. The four watersheds of the San Diego River System have a combined area of 205,140 acres, or approximately 321 square miles.

Murray Watershed consists of the Murray Reservoir and the Alvarado Water Treatment Plant. The primary function of the reservoir is to store imported water from San Diego County Water Authority and act as the terminal storage reservoir for the water transferred from San Vicente, El Capitan, and Sutherland reservoirs via the El Monte pipeline.

San Vicente Watershed consists of the San Vicente Reservoir. The primary function of the reservoir is to store imported water from the SDCWA, local runoff water, and water transferred from Sutherland Reservoir located in the Hodges Watershed via the Sutherland-San Vicente Pipeline. Water from San Vicente Reservoir is either transferred to Murray Reservoir or directly to the Alvarado Treatment Plant for immediate use, via the Lakeside Pump Station Complex using the San Vicente and El Monte pipelines.

El Capitan Watershed consists of the El Capitan Reservoir. The primary function of this reservoir is to store local runoff water, water transferred from Lake Cuyamaca via Boulder Creek, and water transferred from San Vicente Reservoir via the Lakeside Pump Station Complex, using the El Capitan & San Vicente pipelines. Water from El Capitan Reservoir is either transferred to Murray Reservoir or directly to the Alvarado Water Treatment Plant for immediate use, via the Lakeside Pump Station Complex using the El Capitan and El Monte pipelines.

Sutherland Watershed consists of the Sutherland Reservoir. The primary function of this reservoir is to store local runoff water. Water stored in Sutherland Reservoir can be transferred to San Vicente Reservoir via the Sutherland-San Vicente pipeline. Sutherland Reservoir also provides emergency storage for Ramona Municipal Water District (RMWD).

Watershed Sanitary Survey Requirements

The California Surface Water Treatment Rule (SWTR), in Title 22, Article 7, Section 64665 of the State Code of Regulations, requires every public water system using surface water to conduct a comprehensive sanitary survey of its watersheds every five years. The purpose of such a survey is to identify actual or potential sources of contamination, or any other watershed-related factor, which might adversely affect the quality of water used for domestic drinking water. The initial WSS was completed January 1, 1996 and is to be updated every five years thereafter.

The City of San Diego Water Department and its oversight agencies will use the Watershed Sanitary Survey Update (WSS Update) to evaluate water quality problems which might result from contaminants in the watersheds. The WSS Update will also serve as a basis for future watershed management and planning efforts.

Objectives

The main objectives of this WSS Update are to:

- Satisfy the regulatory requirement for a watershed sanitary survey.
- Identify and assess existing and potential future sources of contamination in the watersheds.
- Provide a general description of existing watershed control and management practices.
- Provide general recommendations for improving watershed management practices in order to protect the quality of the surface waters entering the reservoirs.

Conduct of the Study

This update of the WSS for the San Diego River System Watersheds was produced by the staff of the City of San Diego Water Department, Water Quality Laboratory. The survey covers the water supply system from the most remote points of the San Diego River System Watersheds to the treatment facility. It was conducted by reviewing existing aerial photographs, GIS data, reports, water quality data and other record documents, and was supplemented by field surveys and personal knowledge of Water Department staff.

Report Organization

The organization of this volume has changed since the 2001 WSS Update. The Executive Summary, formerly Chapter 1, has been removed from the individual volumes. The remaining chapters have been rearranged as follows:

Chapter 1:	Synopsis
Chapter 2:	Description of Watersheds/Source Water System and Review of 2001 Watershed Sanitary Survey Recommendations
Chapter 3:	Existing Conditions in the Watersheds
Chapter 4:	Water Quality Assessment
Chapter 5:	Conclusions and Recommendations

CHAPTER 2: DESCRIPTION OF WATERSHEDS/SOURCE WATER SYSTEM AND REVIEW OF 2001 WSS RECOMMENDATIONS

Introduction

The following is a summary of the findings of the 2001 San Diego River System Watershed Sanitary Survey Update. It covers Potential Contaminant sources, Water Quality, Watershed Management and Control Practices, and Conclusions and Recommendations for management of the watershed.

El Capitan Watershed

Potential Contaminant Sources -

Recreation

Potential sources of contamination from recreational use include soil erosion from off-trail biking; discarded trash from hiking, picnicking, and day-camping; excretions of personal pets; and gasoline spillage from fishing boats and other personal craft. Incidental personal contact from waterskiing occurs, however, microorganism contamination from such contact is minimal.

Runoff

Microorganisms correlated to rainfall runoff occur in the El Capitan Reservoir. The total coliform count was consistently monitored from 1995 to 2000.

Significant Events

There have been seven small to semi-large brushfires since 1996, three of which were in the El Capitan Watershed. Consequences of burning include soil erosion, stream sediment, ash and debris, and chemical fire retardants. There have been no significant earthquakes from 1996 to 2000.

Agriculture

Most agriculture consists of intensive farm plots in the southern portion of the watershed, and a number of vineyards and orchards. Orchards and intensive plots rely more heavily upon fertilizers and pesticides.

Animal Grazing

Animal grazing is permitted within the Cleveland National Forest. Loss of vegetation from grazing may increase soil erosion and sedimentation of streams and rivers.

Concentrated Animals Facilities

There are no concentrated animals facilities in the El Capitan Watershed.

Wastewater Facilities & Reclaimed Water

The Julian Water Pollution Control Facility treats wastewater from the Julian sewer system, and is able to store up to 225,000 cubic feet of treated wastewater. Plant effluent is discharged on 14 acres of land used for growing cattle feed crops.

Septic Systems and Sewer Overflows

No septic system problems have been reported within the watershed. In the populated areas using septic systems, failures are infrequent and insignificant. No sewer overflows have been reported in the last five years.

Mines

There are ten mines in the El Capitan Watershed, located mainly in the northern and central areas. There have not been any recorded incidents at the mine sites.

Hazardous Materials

Solid and liquid hazardous wastes are collected in storage areas and hauled away by licensed haulers. There is also capacity for storing 523580 gallons of hazardous liquid, most of which is gasoline, kerosene, and diesel fuel.

Water Quality -

Monitoring

Samples were taken from the surface and several outlet gauges, and from one sample point within the watershed. The Alvarado Filtration plant influent and effluent points were also sampled. Data was provided by the City of San Diego Water Quality Laboratory. The source water was analyzed for organic and inorganic constituents, microorganisms, and general physical characteristics. Results were compared to the MCL and/or SMCL standards for drinking water.

Raw Water Quality

Results from the surface and outlet gauges at times exceeded limits for turbidity, pH, color, and odor. Microbiological studies indicated the presence of microorganisms at the surface and at the two outlets that were sampled. MTBE exceeded MCL at the surface, but not at the outlets. Inorganic constituents were not monitored at any of the outlets.

Treated Water Quality

Treated water from the Alvarado WTP consistently met or exceeded all standards for drinking water. The exception was pH, with 12 out of 98 samples exceeding the SMCL of 6.5 to 8.5.

Existing water quality data show that the Alvarado WTP is now in compliance with the IESWTR and Stage 1 D/DBP Rule, and would be in compliance with the Phase I Stage 2 D/DBP. A study will be required to determine the monitoring sites having the highest DBP. The Alvarado WTP would also meet the requirements of the LT2ESWTR, as well as proposed Arsenic and Sulfate regulations.

Emergency Plans

The City has procedures in place against the event of a water treatment emergency.

Watershed Management and Control Practices -

Much of the land is owned either by National Forest, State Park, or Indian Reservation. There is no significant development in the watershed, therefore, formal management plans have not been required or implemented.

The City of San Diego monitors the watershed at El Capitan Reservoir by limiting access to the reservoir, patrolling and observation, and water quality monitoring. Other federal, state, and local agencies also exercise control over land use and activities within the watershed.

Conclusions -

Potential Contaminant Sources

Potential contaminant sources include soil erosion, animal husbandry, accidental wastewater discharge, and recreational use.

Watershed Management

No formal watershed management program exists. Land ownership patterns limit control measures in the watershed; therefore, the focus is on cooperation between agencies. However, the City of San Diego exercises a number of management practices. On City-owned land, the City directly controls land use activity. On land not owned by the City, controls include monitoring land use, permits and other regulatory actions, and coordinating with other agencies. A Watershed/ Water Quality Protection Committee was established by the City in September, 1994.

Water Quality Conditions

Raw water monitoring at the El Capitan Reservoir has detected several water quality constituents at levels that may be of concern, including turbidity, coliforms, and TOC. All of these constituents are effectively treated at the Alvarado WTP.

San Vicente Watershed

Potential Contaminant Sources -

Recreation

Potential sources of contamination from recreational use include soil erosion from biking; discarded trash from hiking, picnicking, and day-camping; excretions of personal pets; and gasoline spillage from fishing boats and other personal craft. Incidental personal contact from waterskiing occurs, however, microorganism contamination from such contact is minimal.

Runoff

Microorganisms correlated to rainfall runoff occur in the San Vicente reservoir. The total coliform count was consistently monitored from 1995 to 2000.

Significant Events

There have been seven small to semi-large brushfires since 1996, three of which were in the San Vicente watershed. Consequences of burning include soil erosion, stream sediment, ash and debris, and chemical fire retardants. There have been no significant earthquakes from 1996 to 2000.

Agriculture

Most agriculture occurs on the Barona Indian Reservation. There are also intensive farm plots, vineyards, and orchards north of San Vicente Creek.

Animal Grazing

No animal grazing occurs in the San Vicente Watershed.

Concentrated Animals Facilities

Dairy farms exist in the San Vicente watershed. Tending each cow requires approximately 50 gallons per day of wastewater discharge, which is typically collected in retention ponds. There are also poultry farms on land adjacent to, but not within, the San Vicente watershed.

Septic Systems and Sewer Overflows

No septic system problems have been reported within the watershed. There was only one sewer overflow in the last five years, which was not considered a threat to the San Vicente Reservoir.

Hazardous Materials

Solid and liquid hazardous wastes are collected in storage areas and hauled away by licensed haulers. There is also capacity for storing 6500 gallons of hazardous liquid, in the form of gasoline and diesel fuel.

Water Quality -

Monitoring

Samples were taken from the surface and several outlet gauges, and from eight sample points within the watershed. The Alvarado Filtration plant influent and effluent points were also sampled. Data was provided by the City of San Diego Water Quality Laboratory. The source water was analyzed for organic and inorganic constituents, microorganisms, and general physical characteristics. Results were compared to the MCL and/or SMCL standards for drinking water.

Raw Water Quality

Results from the surface and outlet gauges, at times exceeded limits for turbidity, pH, color, and odor. Microbiological studies indicated the presence of microorganisms at the surface and at all of the outlet gauges. Outlet gauge 130 had the highest coliform count.

Treated Water Quality

Treated water from the Alvarado WTP consistently met or exceeded all standards for drinking water. The exception was pH, with 12 out of 98 samples exceeding the SMCL of 6.5 to 8.5.

Existing water quality data shows that the Alvarado WTP is now in compliance with the IESWTR and Stage 1 D/DBP Rule, and would be in compliance with the

Phase I Stage 2 D/DBP. A study will be required to determine the monitoring sites having the highest DBP. The Alvarado WTP would also meet the requirements of the LT2ESWTR, as well as proposed Arsenic and Sulfate regulations.

Emergency Plans

The City has procedures in place against the event of a water treatment emergency.

Watershed Management and Control Practices -

Much of the land is owned either by the Barona Indian Reservation or the Cleveland National forest. There is no significant development in the watershed, therefore, formal management plans have not been required or implemented.

The City of San Diego monitors the watershed at the San Vicente Reservoir by limiting access to the reservoir, patrolling and observation, and water quality monitoring. Other federal, state, and local agencies also exercise control over land use and activities within the watershed.

Conclusions -

Potential Contaminant Sources

Land ownership patterns limit control measures in the watershed; therefore, the focus is on cooperation between agencies. Potential contaminant sources include soil erosion, animal husbandry, accidental wastewater discharge, and lack of control over wastewater treatment on the Barona Indian Reservation.

Watershed Management

No formal watershed management program exists. However, the City of San Diego exercises a number of management practices. On City-owned land, the City directly controls land use activity. On land not owned by the City, controls include monitoring land use, permits and other regulatory actions, and coordinating with other agencies. A Watershed/ Water Quality Protection Committee was established by the City in September, 1994.

Water Quality Conditions

Raw water monitoring at the San Vicente Reservoir has detected several water quality constituents at levels that may be of concern, including turbidity, coliforms, ant TOC. All of these constituents are effectively treated at the Alvarado WTP.

Sutherland Watershed

Potential Contaminant Sources -

Recreation

Potential sources of contamination from recreational use include soil erosion from off-trail biking, hiking, and horseback riding; discarded trash from hiking and picnicking; excretions of horses and personal pets; and gasoline spillage from fishing boats and other personal craft.

Runoff

The Sutherland Reservoir is not monitored for microorganisms. There is no data to infer a relationship between microorganism count and seasonal rainfall.

Significant Events

There have been seven small to semi-large brushfires since 1996, one of which was in the Sutherland Watershed. Consequences of burning include soil erosion, stream sediment, ash and debris, and chemical fire retardants. There have been no significant earthquakes from 1996 to 2000.

Agriculture

Most agriculture consists of extensive activity in the areas near Santa Ysabel Creek and Bloomdale Creek. There is a very small area of orchards in the southeast corner of the watershed.

Animal Grazing

There is no animal grazing in the Sutherland Watershed.

Concentrated Animals Facilities

There are two dairy ranches in the Sutherland Watershed. Both are located near creeks that feed into the Sutherland Reservoir.

Wastewater Facilities & Reclaimed Water -

There are no wastewater facilities in the Sutherland Watershed.

Septic Systems and Sewer Overflows

No septic system problems or sewer overflows have been reported within the watershed.

Mines

There is one mine in the Sutherland Watershed. There have not been any recorded incidents at the mine site.

Hazardous Materials

There is no permitted hazardous waste in the Sutherland watershed. There is capacity for storing 45,700 gallons of hazardous liquid, most of which is diesel fuel.

Water Quality -

Monitoring

Samples were taken from the surface near the outlet tower, and from two sample points within the watershed. Outlet gauges were not monitored. Data was provided by the City of San Diego Water Quality Laboratory. The source water was analyzed for organic and inorganic constituents, and general physical characteristics. Microorganisms were not monitored. Results were compared to the MCL and/or SMCL standards for drinking water.

Raw Water Quality

Results at times exceeded limits for turbidity, pH, color, total dissolved solids, and MTBE. Inorganic constituents that exceeded limits were aluminum, iron and manganese.

Treated Water Quality

Treated water from the Alvarado WTP consistently met or exceeded all standards for drinking water. The exception was pH, with 12 out of 98 samples exceeding the SMCL of 6.5 to 8.5.

Existing water quality data show that the Alvarado WTP is now in compliance with the IESWTR and Stage 1 D/DBP Rule, and would be in compliance with the Phase I Stage 2 D/DBP. A study will be required to determine the monitoring sites having the highest DBP. The Alvarado WTP would also meet the requirements of the LT2ESWTR, as well as proposed Arsenic and Sulfate regulations.

Emergency Plans

The City has procedures in place against the event of a water treatment emergency.

Watershed Management and Control Practices -

The Sutherland Watershed is mostly rural or undeveloped land, part of which is within the Cleveland National Forest. There is no significant development in the watershed, therefore, formal management plans have not been required or implemented.

The City of San Diego monitors the watershed at the Sutherland Reservoir by limiting access to the reservoir, patrolling and observation, and water quality monitoring. Other federal, state, and local agencies also exercise control over land use and activities within the watershed.

Conclusions -

Potential Contaminant Sources

Potential significant contaminant sources include agriculture, concentrated animal facilities, accidental wastewater discharge, recreational use, and unauthorized waste disposal.

Watershed Management

No formal watershed management program exists. Land ownership patterns limit control measures in the watershed; therefore, the focus is on cooperation between agencies. However, the City of San Diego exercises a number of

management practices. On City-owned land, the City directly controls land use activity. On land not owned by the City, controls include monitoring land use, permits and other regulatory actions, and coordinating with other agencies. A Watershed/ Water Quality Protection Committee was established by the City in September, 1994.

Water Quality Conditions

Raw water monitoring at the Sutherland Reservoir has detected several water quality constituents at levels that may be of concern, including turbidity and MTBE. All of these constituents are effectively treated at the Alvarado WTP.

Murray Watershed

Potential Contaminant Sources -

Recreation

Potential sources of contamination from recreational use include soil erosion from off-trail hiking; discarded trash from hiking and picnicking; excretions of personal pets; fertilizer or nutrient runoff the Mission Trails Golf Course; and gasoline spillage from fishing boats and other personal craft.

Runoff

The Murray Reservoir is constantly monitored for microorganisms. Indicator bacteria levels are not affected by rainfall or runoff. The reservoir captures very little runoff.

Significant Events

There were no brush fires in the Murray Watershed, and there have been no significant earthquakes from 1996 to 2000.

Agriculture

No agriculture occurs in the Murray Watershed.

Animal Grazing

There is no animal grazing in the Murray Watershed.

Concentrated Animals Facilities

There are no concentrated animals facilities in the Murray Watershed.

Wastewater Facilities & Reclaimed Water

There are no wastewater facilities in the Murray Watershed.

Septic Systems and Sewer Overflows

There is a fully-developed sewer system. There have been sewer overflows; however, no known spills have entered the reservoir in the last five years.

Mines

There are no mines in the Murray Watershed.

Hazardous Materials

There is permitted liquid and solid hazardous waste in the Murray Watershed, most of which is hauled away by licensed haulers. There is capacity for storing 611,070 gallons of hazardous liquid.

Water Quality -

Monitoring

Samples were taken from the surface near the outlet tower, from three outlets and from nine sample points within the watershed. Data was provided by the City of San Diego Water Quality Laboratory. The source water was analyzed for organic and inorganic constituents, and general physical characteristics. Results were compared to the MCL and/or SMCL standards for drinking water.

Raw Water Quality

Results for surface water at times exceeded limits for turbidity, pH, color, iron, and MTBE. Samples from the outlets had turbidity and odor in excess of MCL/SMCL. Inorganic constituents were not monitored at the outlet gauges. Microorganisms were also equally present at the surface and at the outlets.

Treated Water Quality

Treated water from the Alvarado WTP consistently met or exceeded all standards for drinking water. The exception was pH, with 12 out of 98 samples exceeding the SMCL of 6.5 to 8.5.

Existing water quality data show that the Alvarado WTP is now in compliance with the IESWTR and Stage 1 D/DBP Rule, and would be in compliance with the Phase I Stage 2 D/DBP. A study will be required to determine the monitoring sites having the highest DBP. The Alvarado WTP would also meet the requirements of the LT2ESWTR, as well as proposed Arsenic and Sulfate regulations.

Emergency Plans

The City has procedures in place against the event of a water treatment emergency.

Watershed Management and Control Practices -

The Murray Watershed is mostly urban land, within the cities of San Diego and La Mesa. There is high density development surrounding the reservoir. No formal management plans have been developed or implemented. The City of San Diego maintains a storm runoff diversion system around the reservoir.

The City of San Diego also monitors the watershed at the Murray Reservoir by limiting access to the reservoir, patrolling and observation, and water quality monitoring. Other federal, state, and local agencies also exercise control over land use and activities within the watershed.

Conclusions -

Potential Contaminant Sources

Potential contaminant sources include soil erosion, accidental wastewater discharge, fertilizer/pesticide runoff, and recreational use.

Watershed Management

No formal watershed management program exists. Land ownership patterns limit control measures in the watershed; therefore, the focus is on cooperation between agencies. However, the City of San Diego exercises a number of

management practices. On City-owned land, the City directly controls land use activity. On land not owned by the City, controls include monitoring land use, permits and other regulatory actions, and coordinating with other agencies. A Watershed/ Water Quality Protection Committee was established by the City in September, 1994.

Water Quality Conditions

Raw water monitoring at the Murray Reservoir has detected several water quality constituents at levels that may be of concern, including turbidity, pH, aluminum, iron, manganese, coliforms, and TOC. All of these constituents are effectively treated at the Alvarado WTP.

Recommendations & Review

The underlying theme of all recommendations is protection of the watershed and source water quality. The recommendations fall into four categories:

- Water Quality Monitoring,
- Interjurisdictional Coordination
- Watershed Management and Control Practices
- Public Education

Following each recommendation will be a review of the actions taken and/or current status of the recommendation.

Water Quality Monitoring –

Recommendations

1) Continue to develop and evaluate the long-term monitoring program for the watershed; and, in the final monitoring program, identify how the goals and objectives can be met with the monitoring plan.
2) Augment the existing City monitoring program with additional parameters and continue monitoring bromide.
3) Find and test methods of algae control while continuing to minimize use of copper sulfate.

Review

1) The City has instituted a program to measure flow, solids, pathogens and nutrients on a monthly basis and to measure metals and a suite of organics on a quarterly basis at 13 creeks that flow directly into the four reservoirs of this watershed system. The City has also collected bioassessment samples at three sites in the watershed system.
2) As noted above, the City has begun to test for total nitrogen and total phosphorus on a monthly basis at tributaries. Also we sample for these parameters on a monthly basis from the reservoir.
3) No change in status.

Interjurisdictional Coordination -

Recommendations

1) Establish lines of communication with neighboring agencies and overlapping jurisdictions by developing written City policies, developing workgroups, and setting up a City Control Review Committee.
2) Coordinate with Jurisdictional Agencies such as San Diego County, the USFS, and the CDF.
3) Devise an early review process for proposed land use projects with the planning departments of municipalities in the watershed.

Review

1) The City contracted with Brown & Caldwell to produce a document providing guidelines for new development in our watersheds. This document has been completed and is currently in use by the City Water Department in its review of projects. The City has established a Watershed Manager and a Watershed Project Officer and we have established contacts with other agencies by participating on watershed plan committees. The City is reviewing more projects than it has in the past; however, no formal clearinghouse has been established.

2) A Watershed Work Group comprising representatives of public agencies and non-governmental organizations was formed to guide and shape a watershed management plan for the San Diego River Watershed.
3) No change in status

Watershed Management and Control –

Recommendations

1) Develop a land acquisition strategy to gain control of lands proximate to water.

2) Work with landowners and regulatory agencies to reduce the potential impact of cattle grazing and other agricultural practices.

Review

1) The City has not adopted a strategy to acquire parcels, easements, or development rights; however, the City has worked with other agencies to purchase some privately owned lands that are proximate to water bodies for conservation purposes.
2) Lease agreements that allowed cattle grazing on City owned lands were not renewed.

Public Education –

Recommendations

1) Develop and distribute educational materials to landowners, businesses, residents, and recreational users of the land about the importance of protecting the watershed.
2) Conduct education sessions about the impact of various activities on water quality and supply.
3) Encourage a 'Friends of the Watershed' type of volunteer organization.
4) Launch a public awareness and signage campaign along transportation corridors.

Review

1) Everyone who purchases a lake permit receives a brochure that details the importance of keeping the reservoir clean because it is a source of our drinking water. In addition, posters are placed on kiosks at the reservoirs, asking people to recycle and help protect water quality.
2) As elements of the watershed management plan are developed, public outreach and education will be integrated.
3) No change in status.
4) Signs have been developed for placement on major corridors to let travelers know they are entering a watershed. The City is working with CalTrans on locations to place the signs.

CHAPTER 3: EXISTING CONDITIONS IN THE WATERSHEDS

San Diego River System

The San Diego River System is comprised of Murray Reservoir, San Vicente Reservoir, El Capitan Reservoir, Sutherland Reservoir and their respective watersheds. The effective volumes of these reservoirs comprise over half of the emergency water storage requirement for the City of San Diego. The reservoirs and associated facilities are owned and operated by the City of San Diego. The Alvarado Water Treatment Plant, located adjacent to Murray Reservoir, serves as a terminus for this system (Figure 2-3.1).

The management of the water supply system typically attempts to restrict the purchase of imported water and regulates the reservoir levels to maximize the use of local water. Under all conditions, an emergency supply is maintained in the reservoirs, should a failure occur to the imported water supply system.

All of the facilities associated with the conveyance of water from the San Diego River System to the public are mainly natural watercourses which lie in the rural and remote portions of the watershed. These natural conveyances are not likely to fail due to age and deterioration. Some problems may be encountered in the pumping process between the reservoirs and the Alvarado Water Treatment Plant. Since the pumping process is localized, any problems which may occur can be prevented through regular maintenance.

Murray Watershed

Water Sources -

> Murray Reservoir is important to the region for its supply from the SDCWA Aqueduct System carrying Colorado River and State Project water to the San Diego area. The primary function of the reservoir is to store imported water and

act as the terminal storage reservoir for the water transferred from San Vicente, El Capitan, and Sutherland Reservoirs via the El Monte Pipeline. The Reservoir is surrounded by a "first-flush bypass system" which diverts local runoff from the reservoir except for during large storm events. The reservoir and associated facilities are owned and operated by the City of San Diego.

Raw Water Reservoirs -

Murray Reservoir has the smallest capacity of all the reservoirs in the City system. Murray Dam is a multiple arch, reinforced concrete structure, with a 42-foot-wide un-gated ogee crest spillway. The spillway capacity is 2,025 cubic feet per second (cfs). The dam crest has a length of 870 feet and stands roughly 112 feet above the streambed. The reservoir has a storage capacity of 4,818 acre-feet and a surface area of 172 acres at spillway crest at 536 feet MSL.

Raw Water Intake and Conveyance Facilities -

The reservoir outlet consists of an independent wet tower with eight 30-inch saucer valves for selective level draft control. Water is released from the tower through a 48-inch outlet pipe located at the base of the dam. The water through this outlet pipe is pumped to a bypass structure to the treatment facility. The pipeline has a maximum draft rate of 90 cfs (58 mgd).

Treated Water Facilities -

All treatment facilities and treated water facilities for Murray Reservoir occur at and beyond the Alvarado Water Treatment Plant. The plant is located adjacent to Murray Reservoir and serves the Central area of the City. The Plant treats imported water and local runoff from the San Diego River system. The Alvarado Water Treatment Plant currently has 120 mgd capacity is of conventional design with flocculation, filtration, and disinfection (chloramines). The plant is operated in compliance with California's Chapter 17: Surface Water Filtration and Disinfection Treatment Regulations. Alvarado Water

Treatment Plant is currently undergoing the Phase Two expansion project scheduled for completion in 2006. This project will increase the capacity of the plant to 200 mgd.

San Vicente Watershed

Water Sources -

San Vicente Reservoir is important to the region for its supply from the SDCWA Aqueduct System carrying Colorado River and State Project water to the San Diego area. The primary function of the reservoir is to store imported water, local runoff water from the surrounding 74.5-square-mile watershed, and water transferred from Sutherland Reservoir located in the Hodges Watershed via the Sutherland-San Vicente Pipeline (Figure 2-3.1). The terminus of the Sutherland-San Vicente Pipeline empties into San Vicente Creek at Daney Canyon, two miles north of the reservoir. The reservoir and associated facilities are owned and operated by the City of San Diego. San Vicente Reservoir can also be filled with water transferred from El Capitan Reservoir via the Lakeside Pump Station Complex using the El Capitan - San Vicente pipelines.

Water from San Vicente Reservoir is either transferred to Murray Reservoir or directly to the Alvarado Water Treatment Plant for immediate use, via the Lakeside Pump Station Complex using the San Vicente and El Monte pipelines. In an effort to maximize the use of local water, an agreement between the City and CWA stipulates that water placed in storage at San Vicente by CWA is to be delivered to the City only after local water is used, and that all water owned by CWA is to spill over the dam during a local storm before any water owned by the City.

Raw Water Reservoirs -

San Vicente Reservoir has the second largest capacity of all the reservoirs in the City system. San Vicente Dam is a straight concrete gravity structure with a 275-foot-wide uncontrolled central over pour spillway. The spillway capacity is 50,500 cubic feet per second (cfs). The dam crest has a length of 980 feet and stands roughly 199 feet above the streambed. The reservoir has a storage capacity of 89,312 acre-feet and a surface area of 1,069 acres at spillway crest of 650 feet MSL. San Vicente Reservoir is in phase two of expansion as part of the San Diego County Water Authority Emergency Storage Project. During phase four scheduled for 2008 – 2012, the dam will be raised an additional 160 feet.

Raw Water Intake and Conveyance Facilities -

The reservoir outlet consists of a semi-circular wet tower upstream of the dam face with six 30-inch saucer valves for selective level draft control. Water is released from the tower through three 36-inch cast iron outlet pipes with 30-inch plug valves located at the base of the dam. One of the 36-inch outlet pipes enlarges to 42.5 inches and connects to San Vicente Pipeline No. 1. The other two outlet pipes discharge to San Vicente Pipeline No. 2 (City, 1995(b)). These two pipelines carry water from the reservoir to the Lakeside Pump Station. The San Vicente Pipelines have a maximum combined draft rate of 118 cfs (76 million gallons per day (mgd)). From the Lakeside Pump Station, the El Monte Pipeline carries water to the Alvarado Treatment Plant. The El Monte Pipeline has a maximum draft rate of 156 cfs (100 mgd).

Treated Water Facilities -

All treatment facilities and treated water facilities for San Vicente Reservoir occur at, and beyond, the Alvarado Water Treatment Plant.

El Capitan Watershed

Water Sources -

El Capitan Reservoir serves as San Diego's largest local runoff storage facility. The primary function of the reservoir is to store local runoff water from the surrounding 190-square-mile watershed, and water transferred from Lake

Cuyamaca via Boulder Creek (Figure 2-3.1). The reservoir and associated facilities are owned and operated by the City of San Diego.

El Capitan Reservoir can also be filled with water transferred from San Vicente reservoir via the Lakeside Pump Station Complex, using the El Capitan & San Vicente pipelines. Water from El Capitan Reservoir is either transferred to Murray Reservoir or directly to the Alvarado Treatment Plant for immediate use, via the Lakeside Pump Station Complex using the El Capitan and El Monte pipelines.

The Lake Cuyamaca Dam, Lake Cuyamaca, and its associated facilities are owned and operated by Helix Water District (HWD). Lake Cuyamaca is supplied with local runoff from tributary streams. All water from Lake Cuyamaca in El Capitan Reservoir belongs to HWD. Helix also has the right to 27 cfs of Upper San Diego River runoff, which is separate and exclusive of any water from Lake Cuyamaca. The water in El Capitan Reservoir owned by HWD is transferred to the R.M. Levy Water Treatment Plant via the El Monte Pump Station using the El Capitan Pipeline. The R.M. Levy Water Treatment Plant is owned and operated by HWD. Helix has a right to a minimum flow of 20 mgd (Helix, 1995).

Raw Water Reservoirs -

El Capitan Reservoir has the largest capacity of all the reservoirs in the City system. El Capitan Dam is a hydraulic fill rock embankment, with an impervious clay core and a 510-foot-wide over pour spillway. The spillway capacity is 170,600 cubic feet per second (cfs). The dam crest has a length of 1,170 feet and stands roughly 217 feet above the streambed. The reservoir has a storage capacity of 112,807 acre-feet and a surface area of 1,562 acres at spillway crest at 750 feet MSL.

Lake Cuyamaca maintains a tenth of the capacity of El Capitan Reservoir. Its purpose is to collect runoff from the natural watercourses of its tributary areas. Lake Cuyamaca Dam is an earth-fill embankment with a 30-foot-wide rectangular spillway. The spillway capacity is approximately 4,540 cfs. The dam crest has a length of 665 feet and stands approximately 33 feet above the streambed. The reservoir has a storage capacity of 11,756 acre-feet with a spillway crest at 4,635.6 ft MSL.

Raw Water Intake and Conveyance Facilities **-**

Lake Cuyamaca outlet consists of a 36-inch steel pipeline extending in a tunnel through the dam. Water is released into a concrete channel downstream of the dam. Flowing downstream via Boulder Creek, the water is collected in El Capitan Reservoir.

El Capitan Reservoir outlet consists of an outlet tunnel and a free standing wet tower with six 30-inch saucer valves for selective level draft control. Water is released from the tower through two 42-inch and two 36-inch saucer valves located within the base of the tower. The 48-inch El Capitan Pipeline extends through a tunnel toward the Lakeside Pump Station. The El Capitan Pipeline has a maximum discharge rate of 344 cfs (222 mgd).

From the Lakeside Pump Station, the El Monte Pipeline carries water to the Alvarado Water Treatment Plant. The El Monte Pipeline has a maximum draft rate of 156 cfs (100 mgd).

Treated Water Facilities -

All treatment facilities and treated water facilities for El Capitan Reservoir occur at and beyond the Alvarado Water Treatment Plant or the R.M. Levy Water Treatment Plant (HWD).

Sutherland Watershed

Water Sources -

Sutherland Reservoir is not a practical operational storage site due to its high elevation and distance from the imported water aqueducts. The primary function of the reservoir is to impound local runoff from the surrounding 53-square mile watershed and provide emergency storage for Ramona Municipal Water District (RMWD).The reservoir and associated facilities are owned and operated by the City of San Diego.

Water from Sutherland Reservoir is usually transferred to San Vicente Reservoir in the spring, when the San Vicente streambed is wet, to avoid water losses during transport. Generally, all water above RMWD's contract pool is released, provided storage capacity is available at San Vicente Reservoir. The City has contractual obligations to supply water from Sutherland Reservoir to the Ramona Municipal Water District. Under the terms of this contract, every October, the District reserves water above the gauge height of 65 feet, for the upcoming water year.

During the bass spawning season (February through April), the City schedules water transfers from Sutherland Reservoir to minimize interference with spawning.

Raw Water Reservoir -

The Sutherland Dam is a multiple-arch, reinforced concrete structure with a 168-foot-long uncontrolled over pour spillway. The concrete-lined, Ogee-type un-gated spillway is located on the eastern abutment of the dam and has a design capacity of 41,220 cubic feet per second (cfs). The dam crest has a length of 1,020 feet (1188 including spillway) and stands roughly 158 feet (162 feet including 4-foot parapet) above the streambed. The reservoir has a storage capacity of 29,684 acre-feet and a surface area of 556.8 acres at spillway crest at 2,057 feet MSL.

Raw Water Intake and Conveyance Facilities -

The original Sutherland Dam outlet design consisted of a concrete box at the tenth and eleventh arch, with two 36-inch outlet pipes behind trash racks. Each outlet line was equipped with a 30-inch gate valve. Each outlet and gate valve allowed flow to the 36-inch Sutherland-San Vicente Pipeline. A 24-inch bypass pipeline can be used for a blow off and to control water release into the downstream creek channel below the dam. The bypass has a 20-inch plug valve at the end. In 1983, RMWD modified their 36-inch outlet with a floating flexible line to permit withdrawal from the reservoir at any elevation.

The maximum discharge at Sutherland Reservoir outlet tower is 349 cfs (225 mgd) with blow offs or 101 cfs (65 mgd) without blow offs. The RMWD, through a water use agreement with the City, drafts impounded water from Sutherland Reservoir via a service connection off Sutherland-San Vicente Pipeline.

Treated Water Facilities -

All treatment facilities and treated water facilities for Sutherland Reservoir occur at and beyond the Alvarado Water Treatment Plant or the John C. Bargar Water Treatment Plant (RMWD).

Emergency Plans -

There are no written emergency plans addressing accidental or intentional disposal of contaminants to the raw water supply system for the City. However, the City does have the following two procedures which are understood policies, should an emergency occur relating to water quality:

- If a treatment plant cannot treat the water to an approved health standard level, due to upstream contaminants or treatment plant failures, the treatment

- plant shall be shut down. Treated water shall then be re-directed to the downed service area through the distribution system from other treatment plants.

- If any emergency exists, the City has a chain of communication procedure for notification of City staff.

Natural Settings

Slope -

Slope is recognized as a critical factor in soil slips/landslides. In Southern California a direct relationship exists between frequency of soil slips and slope. USGS estimates that 70% of soil slips originate in slopes between 20° and 36°.These soil slips have the potential to increase sedimentation in streams and reservoirs.

Water falling on steeply-sloped land runs off with greater velocity and infiltrates less than water falling on flat land. This response leads to increased erosion and limits the soils natural ability to absorb contaminants. Information on slope was derived from a digital elevation model provided by San Diego Data Processing Corporation and United States Geological Survey (USGS).

Murray Watershed -

No changes in slope have occurred since 2000 (Figure 2-3.2, Table 2-3.1).

Table 2-3.1
Murray Watershed

Slope	**Acres**	**Percent**
0 - 15°	1918.85	83.50
16 - 25°	201.86	8.78
26 - 50°	173.16	7.54
> 50°	4.08	0.18
Total	2297.94	100.00

El Capitan, San Vicente, and Sutherland Watersheds -

No changes in slope have occurred since 2000 (Figure 2-3.3, Table 2-3.2).

Table 2-3.2
El Capitan, San Vicente, and Sutherland Watersheds Slope

Slope	Acres	Percent
0 - 15°	44965.00	21.54
16 - 25°	111830.83	53.58
26 - 50°	29260.65	14.02
> 50°	22662.03	10.86
Total	208718.51	100.00

Soils

Most of the soils within the watershed are susceptible to erosion. The erosion of these soils is mitigated through the anchoring affect of natural vegetation (see Vegetation). Impacts to vegetation through fire, development, or other means could cause increased erosion and impact surface water quality (see Fires, Land Use, Rainfall and Runoff).

Murray Watershed -

The dominant soil types are Diablo-Urban land complex and Redding-Urban land complex (Figure 2-3.4).

San Vicente and El Capitan Watersheds -

Due to the Cedar fire of 2003 the surface soils in the El Capitan and San Vicente Watersheds became temporarily hydrophobic. This condition, combined with the loss of natural vegetation, can cause increased erosion. Soils within the San Vicente Watershed are predominantly well drained, sandy loams (Figure 2-3.5). Cieneba coarse sandy loam is the most commonly occurring soil type. Several soil types occur within the El Capitan Watershed. The most widespread include Sheephead rocky fine loam, Holland fine sandy loam, Cieneba-Fallbrook rocky sandy loam, Cieneba course sandy loam and Boomer loam (Figure 2-3.5).

Sutherland Watershed -

Soils within the Sutherland Watershed are predominantly well drained, sandy loams (Figure 2-3.5). The two most widespread soil types are Crouch sandy loam and Holland fine sandy loam.

Vegetation

Vegetation cover provides several ecological services pertinent to water quality. The root systems of plants anchor soil that could otherwise erode into streams and reservoirs (see Soils). Wetlands and other riparian plant communities act as natural filters, removing suspended sediments and contaminants. Sediments are trapped by densely growing wetland plants, and many contaminants are absorbed or chemically altered by the vegetation.

The description of the different plant communities found in the watershed (Sawer and Keeler-Wolf classification, 1995) and their respective response to fire is from the 2003 Southern California Fires Burned Area Emergency Stabilization and Rehabilitation Plan prepared by: Interagency Burned Area Emergency Response Team November, 2003. The maps of vegetation communities (Figures 2-3.6, 2-3.7, 2-3.8, Tables 2-3.3, 2-3.4, 2-3.5) have been updated using current SanGIS data.

Oak Woodlands

Vegetation Types:

Oak woodlands typically occur in the foothills and transition into mixed conifer/oak woodlands at higher elevations. Each community type can vary from open savannas in broad valleys and rolling hills, to dense woodlands in canyons and along streams. Oak woodlands are dominated by live oak trees species that include Black Oak, Coast Live Oak, Engelmann Oak, and Canyon Live Oak.

Response to Fire:

Oak woodlands have evolved with fire. Dense woodlands typically experience low frequency stand destroying fires. Oak trees that experience some canopy fire often survive unless the ground fire temperature is extreme enough to kill the root system. The complex of species associated with dense oak woodlands will either re-sprout or germinate from seed. Frequent or hot fires can affect the seed bank and the root system of Oak Woodland species, resulting in degraded habitat that is susceptible to habitat conversion.

Eucalyptus Woodland

Vegetation Types:

Eucalyptus Woodland is a non-native closed canopy community. This community is typically a monotypic stand of Eucalyptus trees with a thick mulch of Eucalyptus tree leaves.

Response to Fire:

Eucalyptus stands can be fire retardant to low intensity fires. Low intensity fires will consume the leaf litter and can be carried into the canopy where leaves are singed or tops are burned. High intensity fires are typically stand destroying.

Forests

Vegetation Types:

Coniferous forests occur in the lower to upper montane zone in the Peninsula Ranges. The lower montane forests typically include the Southern Interior Cypress Forest, which is intermixed with oak woodlands and chaparral. Upper montane forests include Coulter Pine Forest, Jeffery Pine Forest, and mixed Sierran Forest. They range from pure stands of a single species, to mixed conifer forests intermixed with oak woodlands and chaparral.

Response to Fire:

Montane forests are typically surrounded by chaparral or adjacent to forests subject to fire, and are therefore susceptible to fire. When fires occur more frequently than twenty-five years, Coulter pine habitat conversion to chaparral may result. Jeffery Pine Forests and Mixed Coniferous Forests historically experience periodic low-to-moderate intensity fires in the understory. Fuel buildup due to fire suppression can increase the risk of stand replacing crown fires.

Chaparral

Vegetation Types:

Chaparral occurs throughout the coastal lowlands, foothills, and montane region. This community typically forms a dense, almost impenetrable shrub community with no herbaceous layer. Chaparral is a highly variable plant community that includes; Chamise Chaparral, Coastal Sage-Chaparral Scrub, Mixed Chaparral, Montane Chaparral, Semi-desert Chaparral, and Scrub Oak Chaparral.

Response to Fire*:*

Chaparral is a fire adapted community, that stump sprouts or germinates from seed after a low-to–moderate intensity burn. Large fires often result in homogenous stands of chaparral. Frequent fires and hot fires can burn the root system and surface seed bank, resulting in a loss of diversity and low-density vegetative communities. For a few years after a fire, annual forbes germinate and establish on site, until the woody shrubs mature.

Coastal Sage Scrub

Vegetation Types:

Locally, Coastal Sage Scrub consists of low, woody soft-shrubs and is classified as Diegan Coastal Sage Scrub (DCSS). DCSS is dominated by California sagebrush and/or flat-topped buckwheat and often intergrades with Chaparral communities.

Response to Fire:

DCSS species are fire adapted and quickly regenerate from seed after a fire. However, frequent fires in an area can reduce the seed bank for native shrub species and increase the presence of non-native grasses and forbs resulting in degraded habitat. Once this habitat conversion occurs, DCSS species typically do not re-colonize the area due to competition from dense populations of invasive grasses that increase the fire frequency. Areas with moderate to highly degraded DCSS may convert to non-native grasslands due to the 2003 fires.

Big Sagebrush Scrub

Vegetation Types:

Locally, big sagebrush is dominated by; flat-topped buckwheat, broom snakeweed, deerweed, sawtoothed goldenbrush, and includes a variety of DCSS species.

Response to Fire:

The fire ecology of Big Sagebrush Scrub in eastern San Diego County is not well documented. Many of the associates in this community occur in DCSS and are fire adapted. Frequent fire in the vegetative community will result in habitat conversion to non-native grasslands.

Grasslands

Vegetation Types:

Perennial Grasslands vary among Valley Needlegrass and Valley Sacaton grasslands. Valley Needle Grassland is dominated by the tussock forming purple needlegrass, with a variety of native forbs including colar lupin, rancher’s fireweed, and adobe popcorn-flower; and the native bunchgrasses, foothill needle grass, and coast range melic. The species composition can vary as it transitions into the foothills and montane zone. Valley Sacaton Grassland is dominated by sacton or salt grass. This community typically occurs in the areas with a high seasonal water table and is often associated with Alkali Seeps and Alkali Meadows. Non-native grasslands are dominated by Red brome, Ripgut brome, and Softchess brome. Non native grasslands often intergrade with open oak woodlands and disturbed DCSS communities.

Response to Fire:

Grassland communities in San Diego County have evolved with, and are typically maintained by fire. Fire in non-native grasslands maintains dominance by invasive grasses and prevents establishment by native shrub species.

Meadows

Vegetation Types:

Montane Meadows occur in the montane zone and are dense growth of sedges and perennial herbs that experience wet cold winters. Montane Meadows are typically interspersed with montane forests. Wildflower Field is an amorphous community of herbaceous plant species where dominance varies from site to site and year to year, depending on climatic factors. Wildflower Field is typically associated with grasslands and oak woodlands in the valleys and foothills.

Response to Fire:

Wet meadows typically do not burn since the moisture content in the plants and soils retard fire advance. During drought times and in dry meadows fire will quickly burn through these communities. Fall fires typically have little impact on local meadows since most plants are dry and have dispersed their seed.

Riparian

Vegetation Types:

Riparian communities vary depending on the aquatic system they are associated with and can have seral stages of community succession. Mulefat Scrub and Southern Willow Scrub are typically early seral stages for Southern Cottonwood-Willow Riparian Forest, which develops into Southern Coast Live Oak Riparian Forest. In steep drainages, Mulefat Scrub and Southern Willow Scrub may be early stages for Southern Sycamore-Alder Riparian Forest or White Alder Riparian Forest.

Response to Fire:

Riparian communities often resist fire since riparian species do not experience drought. During drought, riparian species become more susceptible to fire. Stand destroying fires can assimilate flooding events in that they set communities back to early seral stages. Stump sprouting species can reestablish in the early successional communities. Most mature trees that experience high intensity fires will die.

Wetlands

Vegetation Types:

Wetland communities are highly variable. Riparian and Wet Meadows are communities that can establish in areas with sufficient hydrology to be considered wetlands. In addition, emergent wetlands occur along seeps and as emergent wetlands in shallow water. These wetlands include Alkali Seep, Freshwater Seep, and Freshwater Marsh.

Response to fire:

Historically, fire impacts to wetlands in San Diego County are not documented. Wetlands typically do not experience fire. Many wetland species are rhizomous and will likely survive fires. Woody species in scrub and forested wetlands may recover from fire by epicormic sprouting from stems or basal sprouting from roots.

Murray Watershed -

Native vegetation identified within the Murray Watershed includes scrub and chaparral, and grasslands (Figure 2-3.6, Table 2-3.3). The remainder of the watershed is developed for urban uses, which could negatively impact water quality (see Land Use, Rainfall and Runoff). Riparian and wetland habitats identified within the Murray Watershed include a small Freshwater Marsh at the northern edge of Murray Reservoir, and Willow Scrub east of the reservoir.

Table 2-3.3 Vegetation in the Murray Watershed		
Vegetation Type	**Acres**	**% of Watershed**
Wetlands	2	0
Forest	0	0
Grasslands, Vernal Pools, Meadows, other Herb Communities	23	1
Non-Native Vegetation, Developed or Un-vegetated Habitat	1902	83
Riparian	4	0
Scrub and Chaparral	366	16
Woodland	0	0
Total	2297	100.0

San Vicente Watershed -

Vegetation within the San Vicente Watershed is dominated by native scrub and chaparral (Figure 2-3.7, Table 2-3.4). Oak woodland is also a native community that is well represented within the watershed. In addition, patches of grasslands exist throughout the watershed. In several areas, native vegetation has been altered due to agriculture and urban development (see Land Use, Rainfall and Runoff). These areas possess the potential to negatively impact water quality. Several riparian and wetland habitats exist in the San Vicente watershed. They occur primarily around the perimeter of San Vicente Reservoir, and in canyons and drainages. These communities include Lakeshore Fringe, Freshwater Seep, Willow Scrub, Southern Coast Live Oak Riparian Forest and Southern Cottonwood Willow-Riparian Forest.

El Capitan Watershed -

Numerous vegetation communities exist within the El Capitan Watershed (Figure 2-3.7, Table 2-3.4). Scrub and chaparral, oak woodland, and Mixed Coniferous Forest are native communities that account for a large portion of the watershed. In addition, areas of grasslands are scattered throughout the watershed. Notably, the developed area south of El Capitan Reservoir has the potential to negatively impact water quality (see Land Use, Rainfall and Runoff). Riparian and wetland communities found within El Capitan Watershed include Willow Scrub, Southern Riparian Forest, Southern Coast Live Oak Riparian Forest, Wet Montane Meadow, seeps, and Vernal Pools.

These communities are found mostly around the edge of the lake and in canyons and drainages. Vernal pools exist near the eastern border of the watershed, near Cuyamaca Reservoir.

Table 2-3.4 Vegetation in the San Vicente & El Capitan Watersheds

Vegetation Type	**Acres**	**% of Watershed**
Wetlands	726	0
Forest	16434	10
Grasslands, Vernal Pools, Meadows, other Herb Communities	8128	5
Non-Native Vegetation, Developed or Un-vegetated Habitat	13751	8
Riparian	4390	3
Scrub and Chaparral	109764	64
Woodland	19216	11
Total	172409	100.0

Sutherland Watershed –

Several vegetation communities exist within the Sutherland Watershed (Figure 2-3.8, Table 2-3.5). The most common native communities include scrub and chaparral, oak woodlands, grasslands, and coniferous forest. Areas of non-native vegetation also occur throughout the watershed. Several riparian and wetland habitats exist in the Sutherland watershed. These communities include Wet Montane Meadow, Freshwater Seeps, emergent wetland, Southern Coast Live Oak Riparian Forest, Southern Riparian Forest and Willow Scrub.

Table 2-3.5 Vegetation in the Sutherland Watershed

Vegetation Type	**Acres**	**% of Watershed**
Wetlands	404	1
Forest	3840	11
Grasslands, Vernal Pools, Meadows, other Herb Communities	6011	17
Non-Native Vegetation, Developed or Un-vegetated Habitat	1249	4
Riparian	701	2
Scrub and Chaparral	10064	29
Woodland	12256	35
Total	34525	100.0

Rainfall and Runoff

The climate of San Diego County is classified as a Mediterranean dry summer type, where 90% of the annual rainfall occurs between the months of November and April. Annual precipitation varies from 9 inches at the coast to 25 inches near the mountains. Storm water runoff occurs when water from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, streets and parking lots prevent the runoff from naturally soaking into the ground. Storm water runoff can collect debris, sediment, nutrients, bacteria, pathogens, chemicals and deposit them directly into a lake, stream, river, wetland, or coastal water.

Rainfall and Runoff information in this section was supplied by the City of San Diego Water Department, Hydrography Section. Rainfall data is collected at each reservoir by a weather station. Runoff data is estimated monthly by measuring the following: amount of rainfall, rain amount on surface of lake, other inputs, evaporation, draft, leaks, and change in lake level.

San Diego River System Watersheds -

Table 2-3.6 shows annual rainfall and runoff at each of the reservoirs within the San Diego river watershed. Rainfall totals for years 2001-2003 were average or below average. The winter of 2004-2005 was the third wettest on record.

Table 2-3.6 Rainfall and Estimated Runoff for San Diego River System Reservoirs			
Reservoir	**Year**	**Rainfall (in.)**	**Runoff Entering Reservoirs (M.G.)**
El Capitan	2001	14.83	1254.2
	2002	9.5	38.9
	2003	14.35	1356.28
	2004	20.33	2875.07
	2005	16.05	15595.92
San Vicente	2001	15.18	53.73
	2002	8.91	278.31
	2003	14.22	586.12
	2004	18.17	1996.37
	2005	17.5	6051.19
Sutherland	2001	20.65	225.47
	2002	12.61	19.91
	2003	21.65	219.52
	2004	24.73	107.72
	2005	24.82	6379.79
Murray	2001	10.92	0
	2002	9.38	0
	2003	11.48	69.92
	2004	14.82	0
	2005	15.48	0

Fires

The California Department of Forestry (CDF) addresses all large brush fires within the watershed. The local fire districts handle structural fires only. CDF has an extensive fire prevention plan which includes three fire safe guidelines: residential, railway, and electrical power lines. CDF also provides an evaluation of burned sites and a re-growth plan to prevent erosion immediately following a fire.

Fire can indiscriminately devastate certain vegetation and wildlife communities, but is very important to the sage scrub and chaparral communities. Many taxa of coastal sage scrub plants are adapted to fire by stump sprouting or high seed production (Skinner et al., 1994). Similarly, many chaparral plants are adapted to frequent fires either through resprouting or seed carry-over (see Vegetation). While these communities are adapted to fire and usually recover in three to five years following such an event, the soils are subject to increased erosion immediately following a burn (see Soils).

Sediment from the burned areas can impact streams and the aquatic organisms within those streams, ultimately feeding into reservoirs where sediment loads may affect treatment procedures. Control of large fires is important from both a preservation perspective as well as a watershed management perspective.

The fire and water districts in the watershed do not measure the water quality impacts of the runoff from burned areas (Calhoun, Justice, Bratton, 1995). In most cases the County Office of Emergency Response or the local Fire Department contacts the RWQCB to visit the site after the fire is contained. The RWQCB participates in assessing the impact of the fire on the surface water quality, and will determine if monitoring is necessary.

Fire information in this report is supplied by the California Department of Forestry. The current data available from CDF is through December 31, 2004.

San Diego River System Watersheds -

Since 2000, there have been three fires in the San Diego River System Watersheds (Table 2-3.7). The Peak and Pines fires were relatively small and located in the outermost regions of the watershed; no effect on the water quality was observed. On October 25, 2003 the Cedar fire (Figure2-3.9) started and by the time it was contained it had burned 270,685 acres, which is the largest fire in the history of California. The fire burned 98% of the San Vicente Watershed and 94% of the El Capitan Watershed. The fire destroyed 2,232 residential structures, as well as another 588 outbuildings and other structures. The staff of the City of San Diego Water Department, which monitories the water quality of El Capitan, San Vicente and Sutherland Watersheds, observed significant sedimentation in these Watersheds from the burn areas (City Staff, personal communication). These effects were especially evident during the winter of 2004-2005 when San Diego County experienced near record rainfall. Murray Watershed had no fires since 2000.

Table 2-3.7 San Vicente, El Capitan, and Sutherland Watershed Fires

Name	Alarm Date	Acres Burned
Cedar	10/25/2003	160,906
Peak	8/9/2002	245
Pines	7/29/2002	616

SUMMARY OF POTENTIAL CONTAMINANT SOURCES

Land Use -

The section on land use includes; land ownership, category of land use, and population density.

Land Ownership

The land ownership information discussed in this section is primarily derived from SanGIS data. SanGIS maintains a database of land ownership information, by parcel, for San Diego County.

Murray Watershed:

The pattern of land ownership in the Murray Watershed has not changed in the last five years (Figure 2-3.10, Table 2-3.8). Approximately 44% of the watershed is privately owned and urbanized.

Table 2-3.8 Land Ownership in Murray Watershed		
Ownership Category	**Area (acres)**	**% of Watershed**
Indian Reservation	0	0.0
Publicly Owned		
Local	1251	54.4
State	31	1.3
Federal	1	0.0
Subtotal Publicly owned	1283	55.8
Private	1015	44.2
Total	2298	100

San Vicente Watershed:

Approximately 27% of San Vicente Watershed is currently in public ownership (Figure 2-3.11, Table 2-3.9). Indian Reservation landownership accounts for 13.5% of the watershed. The San Diego Water Department owns 6.8% of the land within the watershed.

Table 2-3.9 Land Ownership in San Vicente Watershed		
Ownership Category	**Area (acres)**	**% of Watershed**
Indian Reservation	6420	13.5
Publicly Owned		
Local	6187	13.0
State	1422	3.0
Federal	5435	11.4
Subtotal Publicly owned	13044	27.4
Private	28077	59.1
Total	47541	100

El Capitan Watershed:

Approximately 52% of El Capitan Watershed is currently in public ownership (Figure 2-3.11, Table 2-3.10). Indian Reservation landownership accounts for 13.6% of the watershed. The San Diego Water Department owns 3.3% of the land within the watershed.

Table 2-3.10 Land Ownership in El Capitan Watershed		
Ownership Category	**Area (acres)**	**% of Watershed**
Indian Reservation	16462	13.6
Publicly Owned		
Local	8166	6.8
State	9157	7.6
Federal	46362	38.4
Subtotal Publicly owned	63685	52.7
Private	40629	33.6
Total	120776	100

Sutherland Watershed:

Private land and Indian Reservations continue to be the dominate type of land ownership in the Sutherland Watershed (Figure 2-3.12, Table 2-3.11). The San Diego Water Department owns 5.7% of the watershed land.

Table 2-3.11 Land Ownership in Sutherland Watershed		
Ownership Category	**Area (acres)**	**% of Watershed**
Indian Reservation	8050	23.2
Publicly Owned		
Local	8130	23.4
State	121	0.3
Federal	497	1.4
Subtotal Publicly owned	8748	25.2
Private	17887	51.6
Total	34685	100

Existing Land Use

The information discussed in this section is based on SanGIS data. It is important to note that some areas reported in the 1996-2000 Watershed Sanitary Survey (WSS) as vacant and undeveloped land use have been updated by SanGIS to reflect its correct land use type, parks and open space preserves.

Murray Watershed:

Land use in the Murray Watershed has experienced little change since 2000 (Figure 2-3.13, Table 2-3.12). Murray Watershed is highly urbanized with approximately 29% of its land use type fitting into the categories of parks and open space and water. Approximately 41% of the watershed consists of residential developments, while commercial, institutional and other types of urban development comprise an additional 30% (see Rainfall and Runoff). No commercial agriculture occurs in the Murray Watershed.

Table 2-3.12 Existing Land Use in the Murray Watershed

Land Use Category	Area (acres)	% of Watershed
Commercial Recreation	146.02	6.35
Commercial	42.68	1.86
Parks	498.19	21.68
Schools, Hospitals, Public & Private Institutions	105.95	4.61
Multi Family Residential	81.41	3.54
Single Family Residential	854.95	37.21
Transportation, Communication & Utilities	391.15	17.02
Water	177.17	7.71
Subtotal	2297.52	99.98
Vacant & Undeveloped	0.42	0.02
Total	2297.94	100.00

San Vicente Watershed:

Land use in the San Vicente Watershed has experienced little change since 2000 (Figure 2-3.14, Table 2-3.13). San Vicente Watershed is relatively undeveloped with 84% of its land use type fitting into the following categories: vacant and undeveloped (60%), parks and open space preserves (22%), and water (2%). Approximately 10% of the watershed is devoted to residential and urban uses, which is a 1% increase since 2000. These areas include residential, commercial, and industrial developments in Ramona and San Diego Country Estates subdivision (see Rainfall and Runoff). Agriculture accounts for approximately 4% of the land area in the San Vicente Watershed.

Table 2-3.13 Existing Land Use in the San Vicente Watershed		
Land Use Category	**Area (acres)**	**% of Watershed**
Agriculture	2012.00	4.23
Commercial Recreation	641.42	1.35
Commercial	3.93	0.01
Industrial	7.15	0.02
Junkyard, Dump, Landfill	11.12	0.02
Parks	10430.35	21.94
Schools, Hospitals, Public & Private Institutions	31.96	0.07
Mobile Home Park	6.52	0.01
Multi Family Residential	36.54	0.08
Single Family Residential	1627.65	3.42
Spaced Rural Residential	2313.57	4.87
Under Construction	6.03	0.01
Transportation, Communication & Utilities	679.11	1.43
Water	1066.10	2.24
Subtotal	18873.45	39.70
Vacant & Undeveloped	28669.52	60.30
Total	47542.97	100.00

El Capitan Watershed:

Since 2000, land use in El Capitan Watershed has not changed extensively (Figure 2-3.14, Table 2-3.13). El Capitan Watershed is relatively undeveloped with 91% of its land use fitting into the following categories: vacant and undeveloped land (77%), parks and open spaced preserves (12%), and water (2%).

Approximately 6% of the total watershed is occupied by urban and suburban types of developments, such as residential and commercial land uses in the rural towns of Julian, Alpine, and Descanso (see Rainfall and Runoff). Agriculture accounts for approximately 2% of the land area in the El Capitan Watershed.

Table 2-3.14 Existing Land Use in the El Capitan Watershed		
Land Use Category	**Area (acres)**	**% of Watershed**
Agriculture	2139.45	1.77
Commercial Recreation	314.54	0.26
Commercial	99.01	0.08
Industrial	57.76	0.05
Junkyard, Dump, Landfill	0.57	0.00
Parks	14680.33	12.16
Schools, Hospitals, Public & Private Institutions	99.60	0.08
Group Quarters Residential	113.11	0.09
Mobile Home Park	29.39	0.02
Multi Family Residential	83.98	0.07
Single Family Residential	608.76	0.50
Spaced Rural Residential	6248.76	5.17
Transportation, Communication & Utilities	1118.91	0.93
Water	2270.82	1.88
Subtotal	27864.99	23.07
Vacant & Undeveloped	92909.71	76.93
Total	120774.70	100.00

Sutherland Watershed:

Since 2000, land use has changed little in Sutherland Watershed (Figure 2-3.15, Table 2-3.15). Sutherland Watershed is relatively undeveloped with 79% of its land use fitting into the following categories: vacant and undeveloped (59%), parks and open spaced preserves (17.5%) and water (1.5%).

Less than 2% of the watershed is devoted to residential and urban types of development, which is centered mainly on the small community of Santa Ysabel (see Rainfall and Runoff). Agriculture accounts for more than 19% of the land area, which is a 2% decline since 2000.

Table 2-3.15 Existing Land Use in the Sutherland Watershed		
Land Use Category	**Area (acres)**	**% of Watershed**
Agriculture	6778.15	19.63
Commercial Recreation	178.67	0.52
Commercial	13.00	0.04
Parks	6064.47	17.57
Single Family Residential	11.63	0.03
Spaced Rural Residential	271.96	0.79
Transportation, Communication & Utilities	172.76	0.50
Water	549.01	1.59
Subtotal	14039.65	40.67
Vacant & Undeveloped	20485.48	59.33
Total	34525.13	100.00

Agriculture -

Agricultural practices can be a significant source of non-point source contaminants. Contaminants that are often found in typical agricultural surface runoff include sediment, nutrients, pesticides and bacteria. Increases in salinity may also pose a significant water quality problem in the future. The United States Environmental Protection Agency (USEPA) has estimated that about 75% of the sediment, 52% of the nitrogen loading, and 70% of the phosphorus loading that enters waterways of the 48 contiguous states originates in agricultural settings. Most contaminants are transported to the water supply through either surface runoff or irrigation return flows.

Agricultural practices consist of field crops, orchards and vineyards, and intensive agriculture. Home gardens and hobby farms are not included in this report.

Field crops include; grain, alfalfa and sod. Due to the minimal use of pesticides and other chemicals, this agricultural practice is considered to have the lowest potential of impacting water quality.

Orchards and Vineyards include; apples, avocados, citrus, grapes and other non-evergreen fruit, while intensive farm plots include; row crops such as herbs, vegetables, poultry ranches, and dairy farms. Due to their reliance on pesticides and other chemicals, these practices are considered to have a greater potential of impacting water quality.

Poultry ranches are regulated by the San Diego County Department of Environmental Health for fly breeding and facilities are inspected yearly. Poultry Farms do not discharge a significant amount of wastewater, but impact to water quality is possible during periods of rain when runoff could carry manure into nearby drainages. Manure management methods include frequent cleaning, drying and coning. Manure is generally spread on the ground to dry, pushed into windrows and then removed from the ranch.

Dairy farms are permitted by the Regional Water Quality Control Board (RWQCB) and facilities are inspected quarterly. The RWQCB issues orders specific to individual dairies. These orders contain facility designs, operation specifications and discharge specifications, along with other guidelines for complying with the Watershed Basin Plan. Dairy farms are then required to submit quarterly reports to the RWQCB that describe herd size, manure disposal, groundwater monitoring results including nitrates and dissolved solids. Milk cows, corrals and barns are generally washed daily. Dairies typically have retention ponds for wastewater discharge which, during periods of rain, could overflow and impact the water quality of nearby streams.

The information discussed in this section is based on SanGIS data and two layers created by RECON Environmental Consultants using information from the San Diego County Department of Environmental Health and RWQC.

Murray Watershed:

Agricultural practices in the Murray Watershed consist only of home gardens and hobby farms which are not included in this report. No permitted poultry ranches or dairy farms exist in the Murray Watershed.

San Vicente Watershed:

Since 2000, there has been a slight decrease (278 acres) in lands used for agriculture within the San Vicente Watershed (Figure 2-3.14, Table 2-3.16). No permitted poultry ranches or dairy farms exist within the San Vicente Watershed. However, The John Van Tol Dairy straddles the Hodges and San Vicente Watershed boundary.

Table 2-3.16 Agriculture in the San Vicente Watershed

Type of Agriculture	Acres	% of Watershed
Orchard	238	0.5%
Intensive	287	0.6%
Field Crops	1486	3%
Total	**2011**	**4.1%**

El Capitan Watershed:

Since 2000, there has been a slight decrease (37 acres) in lands used for agriculture within the El Capitan Watershed (Figure 2-3.14, Table 2-3.17). There are no permitted poultry ranches or dairy farms within the El Capitan Watershed.

Table 2-3.17 Agriculture in the El Capitan Watershed

Type of Agriculture	Acres	% of Watershed
Orchard	600	0.5%
Intensive	43	0.1%
Field Crops	1495	1.2%
Total	**2138**	**1.8%**

Sutherland Watershed:

Since 2000, there has been a moderate decrease (810 acres) in lands used for agriculture within the Sutherland Watershed (Figure 2-3.15, Table 2-3.18).

No permitted poultry ranches exist in the Sutherland Watershed. Since 2000, both the Mesa Chiquita Ranch Dairy and the Santa Ysabel Ranch Dairy have closed. No permitted dairy farms exist within the Sutherland Watershed.

Table 2-3.18 Agriculture in the Sutherland Watershed

Type of Agriculture	Acres	% of Watershed
Orchard	33	0.1%
Intensive	0	0%
Field Crops	6744	19.5%
Total	**6777**	**19.6%**

Grazing -

The animal grazing data presented derives from the United States Forest Service (USFS). Although grazing on private land occurs in this watershed, no spatial data was available for such areas, and grazing on these lands is not included in this report. The USFS allows an average density of one animal per 160 acres; therefore, the risk of water contamination from manure is low. However, loss of vegetation cover associated with grazing may increase soil erosion and sedimentation of streams and reservoirs (see Vegetation, Rainfall and Runoff).

Murray Watershed:

No land is permitted for grazing in the Murray Watershed.

San Vicente Watershed:

No land is permitted for grazing in the San Vicente Watershed.

El Capitan Watershed:

Within the El Capitan Watershed, grazing is permitted on 6,779 acres of Cleveland National Forest (Figure 2-3.1, Table 2-3.19). Since 2000, all permits have been placed in nonuse status and the Sill Hill (2137 acres) rangeland permit was closed. Tule Spring (1441 acres) rangeland permit will be closed shortly (Personnel Communication, USFS Staff).

Table 2-3.19 Grazing in the El Capitan Watershed				
Range Name	**Number of Head**	**Acres in Watershed**	**Ownership**	**Permit Status**
Santa Ysabel	686	NA	USFS	Nonuse
Tule Springs	1441	21	USFS	Nonuse-Will be closed
King Creek	4215	16	USFS	Nonuse
El Capitan	437	NA	USFS	Nonuse-Since Cedar Fire

Sutherland Watershed:

No land is permitted for grazing in the Sutherland Watershed.

Population Density -

Population density is a good indicator of the level of urbanization within an area. Land areas with small population densities are usually rural areas with natural landscapes that trap rainwater and allow it to filter slowly into the ground (see Rainfall and Runoff). In contrast, large population densities are associated with urbanized areas. These areas contain impervious surfaces that prevent rain from infiltrating into the ground, which increases the amount and velocity of runoff. Urbanization increases the variety and amount of pollutants carried into streams, rivers, and lakes. These pollutants can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational areas unsafe and unpleasant. The population data presented was derived form SANDAG's 2000 Census.

San Diego River System Watersheds:

The estimated 2005 population of the San Diego River System Watersheds are outlined in Table 2-3.20 and Figures 2-3.16, 2-3.17. In the past five years the population estimates have increased by 6% in the San Vicente Watershed, over 48% in the El Capitan Watershed, and decreased by 1% in the Murray watershed and 73% within the Sutherland Watershed.

Table 2-3.20 Population San Diego River System Watersheds

Watershed	Population	Density (Persons/Acre)
Murray	23,272	10.1
San Vicente	14,793	0.31
El Capitan	29,967	0.24
Sutherland	879	0.03
Total	68,911	0.34

Mines -

San Diego River System Watersheds:

The mine data presented was obtained from USGS and SWRCB. The SWRCB and the RWQCB are given authority over mines. The most common environmental hazard is: heavy metals associated with acid-rock drainage; methyl mercury from mercury-contaminated sediments; arsenic; asbestos and chromium.

In the 1996-2000 Watershed Sanitary Survey there were eleven mines listed by the State Water Resources Control Board (SWRCB). Currently there are no active mines listed within the San Diego River System Watershed.

Hazardous Material / Waste -

The data presented in this section was obtained from the San Diego County Health Department, RWQCB, and the Solid Waste Assessment Test Program. The hazardous materials were put into three categories: Liquid

Hazardous Waste, Solid Hazardous Waste and Liquid Hazardous Storage (capacity). The majority of liquid waste is stored in 55 gallon drums and hauled away by licensed waste haulers. Automotive and Tractor fuels make up the majority of permitted liquid hazardous storage. These fuels are stored in underground fiberglass-reinforced plastic, cathodically protected steel, or steel clad with fiberglass-reinforced plastic. These tanks are installed with a leak interception and detection system.

The State Resources Control Board affected changes to the underground storage tank regulations on October 13, 2005. These changes can be found in Title 23, California Code of Regulations, Chapter 16.

San Diego River System Watersheds:
Hazardous Materials/Waste amounts and locations for the San Diego River Watersheds are illustrated in Figure 2-3.1, Table 2-3.21.

Table 2-3.21 Summary of Permitted Hazardous Material

Watershed	Liquid Waste (gals)*	Solid Waste (lbs)*	Liquid Storage (gals)*
Murray	48,851	63,265	611,070
San Vicente	510	415	6,500
El Capitan	72,852	57,046	523,580
Sutherland	0	0	45,700
Total	122,213	120,726	1,186,850

*Figures are maximum capacities

Recreation -

Murray Reservoir:
The primary purpose of Murray Reservoir is for domestic water supply, while recreation is a secondary use of the reservoir. The reservoir is open to the

public for boating use three days a week. December through September, and to all other recreational activities seven days a week year around. Recreational activities include; boating, fishing, jogging, biking, and picnicking. Water contact activities are not permitted at the reservoir (Table 2-3.22)

Table 2-3.22 Murray Reservoir Number of Permits Sold				
Year	Fishing	Launch	Rentals:	
			Motor	Row
2001	15,772	1,816	NA	2,635
2002	16,365	2,222	NA	2,835
2003	16,197	2,542	NA	3,747
2004	18,954	2,630	1,165	2,530
2005	Figures not reconciled			

The facilities consist of concession, launch, rental boats, trash receptacles, portable toilets and a comfort station. These facilities are owned and operated by the City of San Diego. There are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels. Murray Reservoir has a restricted access area encompassing the outlet tower. This area is demarcated by a floating barrier to prevent direct recreational contact to the water immediately available to the Alvarado Water Treatment Plant.

The potential sources of contamination associated with the recreational activities include; erosion, trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts. Title 22 contaminates are monitored quarterly and nutrients monthly (Figure 2-3.1). Microorganisms including Total Coliforms, E. coli, and Enterococcus are monitored weekly.

San Vicente Reservoir:

The primary purpose of San Vicente Reservoir is for domestic water supply, while recreation is a secondary use of the reservoir.

San Vicente Reservoir is open to the public for recreational use including water contact activities, four days a week, year around. Recreational activities include; boating, fishing, waterskiing, picnicking and hiking (Table 2-3.24).

Table 2-3.24 San Vicente Reservoir Number of Permits Sold

Year	Fishing	Launch	Body Contact	Rentals	
				Motor	Row
2001	27,619	24,303	48,250	NA	2,062
2002	28,615	25,347	46,485	NA	1,855
2003	27,121	24,440	47,615	NA	1,914
2004	24,658	23,499	50,438	1,230	829
2005	Figures not reconciled				

The facilities consist of concession, launch, rental boats, trash receptacles, portable toilets, two floating restroom facilities, and a comfort station. These facilities are owned and operated by the City of San Diego. San Vicente Reservoir is in phase two of expansion as part of the San Diego County Water Authority Emergency Storage Project. During phase four scheduled for 2008 – 2012, the reservoir will be closed to recreation.

Currently, there are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels. San Vicente Reservoir has a restricted access area encompassing the outlet tower. This area is demarcated by a floating barrier to prevent direct recreational contact to the water immediately available to the Alvarado Water Treatment Plant. The potential sources of contamination associated with the recreational activities include; erosion, trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts.

Title 22 contaminates are monitored quarterly and nutrients monthly (Figure 2-3.1). Microorganisms including Total Coliforms, E. coli, and Enterococcus are monitored weekly.

El Capitan Reservoir:

The primary purpose of El Capitan Reservoir is for domestic water supply, while recreation is a secondary use of the reservoir. El Capitan Reservoir is open to the public for recreational use, including water contact activities use, three days a week, February through October. Recreational activities include; boating, fishing, waterskiing, picnicking and hiking (Table 2-3.25).

Table 2-3.25 El Capitan Reservoir Number of Permits Sold

Year	Fishing	Launch	Body Contact	Rentals	
				Motor	Row
2001	18,595	12,206	6,768	NA	1,555
2002	12,179	7,936	8,538	NA	885
2003	12,048	8,115	5,038	NA	691
2004	12,447	8,271	5,888	719	362
2005	Figures not reconciled				

The facilities consist of launch, rental boats, trash receptacles, pre-fabricated restroom facility, portable toilets, floating restroom facility, and a comfort station. These facilities are owned and operated by the City of San Diego. There are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels. El Capitan Reservoir has a restricted access area encompassing the outlet tower. This area is demarcated by a floating barrier to prevent direct recreational contact to the water immediately available to the

Alvarado Water Treatment Plant.

The potential sources of contamination associated with the recreational activities include; erosion, trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts.

Title 22 contaminates are monitored quarterly and nutrients monthly (Figure 2-3.1). Microorganisms including Total Coliforms, E. coli, and Enterococcus are monitored weekly.

Sutherland Reservoir:

The primary purpose of Sutherland Reservoir is for domestic water supply, while recreation is a secondary use of the reservoir. Sutherland Reservoir is open to the public for recreational use three days a week, March through September, and two days a week, October through January. Recreational activities include; boating, fishing, hunting, picnicking and hiking (Table 2-3.26).

Table 2-3.26 Sutherland Reservoir Number of Permits Sold

Year	Fishing	Hunting	Launch	Camp Hope Body Contact	Rentals	
					Motor	Row
2001	7,161	222	1,727	NA	NA	646
2002	6,381	195	1,370	NA	NA	641
2003	4,260	191	694	125*	NA	411
2004	3,731	185	476	125*	198	163
2005	Figures not reconciled			75*	Figures not reconciled	

* Figures are estimates provided by the City of San Diego

The facilities consist of concession, launch, rental boats, trash receptacles, portable toilets, floating restroom facility, and a comfort station. These facilities are owned and operated by the City of San Diego. There are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels. The potential sources of contamination associated with the recreational activities include; erosion, trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts. Title 22 contaminates are monitored quarterly (Figure 2-3.1). Microorganisms including Total Coliforms, E. Coli, and Enterococcus are monitored monthly.

In 2003 the Camp Hope Program was initiated. This program allows water contact activities five days a week June through September (Table 2-3.26). During this period, Title 22 contaminates are monitored quarterly. Microorganisms including Total Coliforms, E. coli, and Enterococcus are monitored weekly while Cryptosproidim and Giardia are monitored monthly.

Wastewater / Reclaimed water -

The Wastewater / Reclaimed water treatment facilities permitted by the RWQCB in the San Diego River System Watersheds are identified in Figure 2-3.1 and Table 2-3.27.

Table 2-3.27 Wastewater/ Reclaimed Water Facilities

Watershed	RCQCB Facility I.D.	Facility Name	Address	Highest level of Treatment	Discharge To:	Land Disposal Order #
San Vicente	9000000076	San Vicente WRP	2278 San Vicente Rd	Tertiary	Recycled Water Use, Spray Field	93-003
El Capitan	9000000109	Julian WPCF	2936 State Rte 79	Un-disinfected Secondary	Percolation Ponds	83-009
El Capitan	9000000122	Heise Park Campground	4945 Heise Park Rd	Un-disinfected Secondary	Percolation Ponds	93-009
El Capitan	NA	Lake Cuyamaca Public Rec Area	15027 State Rte 79	Septic Tank Effluent	Leach Field	R9-2004-0015
San Vicente	NA	Barona WWTP	1932 Wildcat Canyon Rd	Tertiary	Spray Field	NA

San Vicente Watershed

San Vicente Water Reclamation Plant (WRP):

The Ramona Municipal Water District (RMWD) is the agency responsible for this facility. RWQCB Order No. 93-003 establishes the discharge specifications for the San Vicente WRP (Table 2-3.28).

The treatment system is comprised of; headwork's facility, two oxidation basins, four clarifiers, return activated biosolids pump station, reverse osmosis facility, and a chlorine contact chamber. The plant effluent is discharged to reclaimed water holding ponds located at the facility. The RWQCB requirements (Order No. 93-03, Addendum No. 2) certify an average daily design flow of up to 0.75 mgd. The Design Certification Report prepared for the RMWD in 2005 indicates that the San Vicente facilities are designed to provide preliminary, secondary, and tertiary treatment for an ultimate annual average flow of 0.80 mgd

The recipients of reclaimed water from the San Vicente Water Reclamation Facility are the Spangler Peak Ranch and the San Vicente Golf Course. The Spangler Peak Ranch is located at the end of Creelman Lane, and uses an average 14.5 million gallons per month, with higher usage during summer months and lower during winter months. The San Vicente Golf Course is located on San Vicente Road and uses on average 4.5 million gallons per month with a similar seasonal demand.

Biosolids Disposal Practices:

Biosolids from the San Vicente WRF is dewatered in drying beds at the plant site. The waste is routinely hauled to a landfill for final disposal.

Table 2-3.28 San Vicente Water Reclamation Facility Effluent Discharge Limitations, Order # 93-003, Addendum 2

Constituent	Unit	Daily Maximum[1]	30-day Average[2]	12-Month Average[3]
Biochemical Oxygen Demand (BOD_5 @ 20^0C)	mg/L	45	30	-
Total Suspended Solids	mg/L	45	30	-
pH	Within the limits of 6.0 to 9.0 at all times			
Total Dissolved Solids	mg/L	650	-	600
Chloride	mg/L	275	-	250
Manganese	mg/L	0.06	-	0.05
Iron	mg/L	0.4	-	0.3
Boron	mg/L	0.6	-	0.5
Coliform	MPN/100ml	*	*	-
Turbidity	NTU	*	*	-

1. The daily maximum effluent limitations shall apply to the results of a single composite or grab sample
2. The 30 day average effluent limitation shall apply to the arithmetic mean of the results of all samples collected during any 30 day consecutive calendar day period.
3. The 12 month average effluent limitation shall apply to the arithmetic mean of the results of all samples collected during the previous 12 months.

* Effluent used for irrigation purposes shall conform to all applicable provisions of California Code of Regulations, Title 22, Division 4, Chapter 3 (Reclamation Criteria) in its present form or as it may be amended.

Barona Wastewater Treatment Plant (WWTP):

The Barona WWTP is lacking documentation due to the fact that this facility is located on an Indian Reservation and does not require approval from the California RWQCB. The facility has therefore been in operation without any permits from the RWQCB or any other agencies. Information about the treatment and disposal system is from a newspaper article and from City of San Diego (City) staff.

The Barona WWTP serves the Barona Casino facilities located on the Barona Indian Reservation. The compact package treatment plant is capable of tertiary treatment. The plant effluent is currently stored in 50,000 and 25,000 gallon tanks and disposed of on spray fields located on the Reservation.

El Capitan Watershed

Julian Water Pollution Control Facility (WPCF):

The County of San Diego is the agency responsible for this facility. RWQCB Order No. 83-009 establishes the discharge specifications for the Julian WPCF (Table 2-3.29). The treatment and disposal system is comprised of; two 80,000 gallon oxidation basins and a 225,000-cubic-foot storage/settling basin. The RWQCB requirements certify the maximum discharge of 0.040 mgd by spray disposal.

The treated effluent is disposed on a 14 acre field where a grass crop is grown and harvested for cattle feed. During wet weather periods when irrigation cannot be successfully practiced, an interceptor ditch, underground drainage system, and storage reservoir with a 24 day capacity prevents effluent runoff from the irrigation area.

Table 2-3.29 Julian Sanitation District Effluent Discharge Limitations, Order # 83-09, Addendum 1

Constituent	Unit	Daily Maximum[1]	12-Month Average[2]
Biochemical Oxygen Demand (BOD_5 @ 20^0C)	mg/L	50	40
Total Suspended Solids	mg/L	110	95
pH	Within the limits of 6.0 to 9.0 at all times		
Total Dissolved Solids	mg/L	-	550
Chloride	mg/L	-	120
Sulfate	mg/L	-	80

1. The daily maximum effluent limitations shall apply to the results of a single composite sample collected over a period of 24 hours, or grab sample.
2. The 12 month average shall be the arithmetic mean, using the result of analysis of all samples collected during any 12 consecutive calendar month period.

Biosolids Disposal Practices:

The facility has a complete oxidation process. There is no solid waste generated from the treatment process at this facility. In the event of biosolids generation, the biosolids will be dried in adjacent containment beds, stored in covered containment structures, and disposed of after testing in a sanitary landfill.

Heise Park Campground

The County of San Diego is the agency responsible for this facility. RWQCB Order No. 93-009 establishes the discharge specifications for Heise Park Campground (Table 2-3.30).

The treatment and disposal system is comprised of; package type modified activated sludge plant, storage pond, and percolation pond. The RWQCB requirements certify a maximum discharge of 18,000 gpd. The requirements certify disposal by spray irrigation on approximately two acres of park property.

Table 2-3.30 Heise Park Campground Effluent Discharge Limitations, Order # 93-09

Constituent	Unit	Daily Maximum[1]	30-day Average[2]
Biochemical Oxygen Demand (BOD @ 20^0C)	mg/L	45	30
Total Suspended Solids	mg/L	45	30
pH	Within the limits of 6.0 to 9.0 at all times		
Total Dissolved Solids	mg/L	700	-
Chloride	mg/L	90	-

Biosolids Disposal Practices:

Biosolids are dried in adjacent containment beds, stored in covered containment structures, and disposed of after testing in a sanitary landfill.

Lake Cuyamaca Public Recreation Area

The Lake Cuyamaca Recreation and Park District is the agency responsible for this facility. RWQCB Order No. R9-2004-0015 establishes the discharge specifications for the Lake Cuyamaca Public Recreation Area (Table 2-3.31).

The treatment and disposal system is comprised of; multiple chambered septic/holding tanks, 8,000 gallon surge tank, 8,000 gallon septic tank, and a rotating subsurface disposal leach field infiltration system. The RWQCB requirements certify a maximum daily discharge of 8,000 gpd. The dispersal field is 37.47 acres of land located at the north end of Lake Cuyamaca.

Table 2-3.31 Lake Cuyamaca Recreation and Park District, Lake Cuyamaca Public Recreation Area Effluent Discharge Limitations, Order # R9-2004-0015

Constituent	Unit	Daily Maximum[1]	12-Month Average[2]
Total Dissolved Solids (TDS)	mg/L	625	310
Nitrate (as NO_3)	mg/L	9.0	4.5
Boron	mg/L	1.4	0.70
Chloride	mg/L	105	55
Sulfate	mg/L	107	54
Manganese	mg/L	0.09	0.045
Fluoride	mg/L	1.8	0.90
Methylene Blue Active Substances (MBAS)	mg/L	1.0	0.45
Iron (Fe)	mg/L	0.55	0.30

1. The daily maximum effluent limitation shall apply to the results of a single composite or grab sample.
2. The 12 month average effluent limitation shall apply to the arithmetic mean of the results of all samples collected during any 12 consecutive calendar month period.

Biosolids Disposal Practices:

All biosolids must be disposed of in a municipal solid waste landfill, reused by land application, or disposed of in a sludge-only landfill.

Septic Systems

San Diego River System Watershed -

The primary goal in this section is to identify areas where septic systems may pose a threat to water quality. Septic systems treat and disperse relatively small volumes of wastewater from individual or small numbers of homes and commercial buildings. Poorly managed systems have been named as a concern by nearly every federal and state program that deals with water resource issues.

San Diego County's Department of Environmental Health maintains records of septic tank permits at their San Marcos and El Cajon offices. Prior to 2002 no electronic database existed to query the location, type, etc. of these permits. There are an estimated 90,000-100,000 homes county-wide on septic systems.

Estimates of septic system density for the 1996-2000 WSS were calculated by using the 1990 census tract data to determine population density with in each watershed. Next, a data layer of sewered and un-sewered areas was created from the City data base and from SanGIS community plan data. The sewered areas layer was overlaid with population density to create a new data layer. This data layer was queried to pull out polygons that were un-sewered with a population density greater than zero. Graduated color was applied to the septic density field to enable visual assessment of high potential concentrations of septic tanks.

In 2002 the County of San Diego Department of Environmental Health initiated an electronic database to track septic system permits issued throughout the County. The database does not contain historical permits issued before 2002, so an exact number of permits in a given community cannot be determined. However, the database indicates where new permits are being issued and if these permits are for new construction, repair, fire rebuild, etc. In addition, the permit records the hydrologic sub area where the septic system is located.

A data layer of the hydrologic sub areas of San Diego County was obtained from SanGIS. Numbers of permits issued in each hydrologic sub area was determined from the Counties database. Graduated colors were applied to the hydrologic sub area within each watershed to enable visual assessment of high issuant of septic system permits (Figure 2-3.18).Table 2-3.32 lists the communities within the watershed along with the number and type of septic system permits issued since 2002.. No septic systems are in the Murray Watershed, a fully developed sewer system serves this area.

Table 2-3.32 Number and Type of Septic System Permits in the El Capitan, San Vicente and Sutherland Watershed

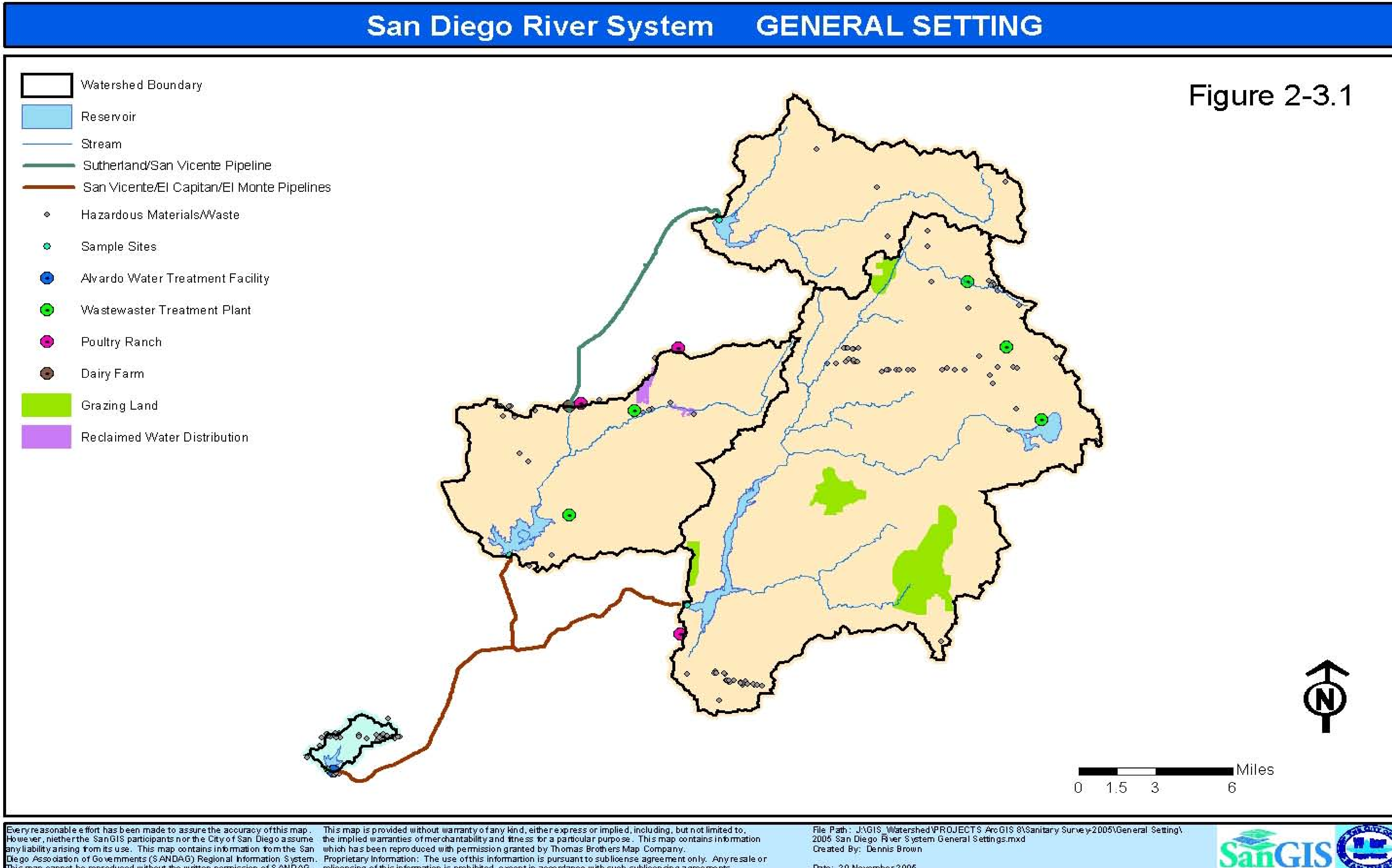
	Type of System			
Community	**New**	**Repair or Modified**	**Fire Rebuild**	**Other**
Alpine	74	54	4	2
Ramona/Fernbrook	63	33	10	0
Julian	52	47	16	0
Descanso	9	2	0	0
Lakeside	8	8	4	1
El Cajon	3	0	0	0
Harrison Park	1	2	1	0

Sanitary Sewer Overflows

San Diego River System Watersheds -

The San Diego River System includes four watersheds; Murray, San Vicente, El Capitan, and Sutherland. There were 12 sanitary sewer overflows in the San Diego River Watershed reported to the Regional Water Quality Control Board (RWQCB) from 2001 through 2004 (Table 2-3.33). The current data available from the RWQCB is through June 30, 2004. Detailed information regarding sanitary sewer overflows is available at the Regional Water Quality Control Board website (www.swrcb.ca.gov/rwqcb9).

Table 2-3.33 San Diego River Watershed Sanitary Sewer Overflows 2001 - 2004						
Watershed	Year	RWCQB Tracking No.	Total Overflow Volume (Gallons)	Overflow Volume Released to Environment (Gallons)	Reach Surface Waters other than Storm Drain?	Receiving Waters
Murray	2001	166409	75	75	N	
Murray	2001	171258	65	65	N	
Murray	2001	229768	1060	1060	N	
Murray	2002	279704	1815	0	Y	Alvarado Creek
Murray	2002	317754	910	150	Y	None
Murray	2003	342003	225	225	Y	Lake Murray Diversion Ditch
San Vicente	2001	012001	1000	1000	N	
San Vicente	2001	012003	150	140	N	
San Vicente	2003	023001	50	50	N	
San Vicente	2003	023003	500	500	N	
San Vicente	2004	034004	?	?	Y	Klondike Creek
El Capitan	2002	023004	12108	11000	N	


San Diego River System GENERAL SETTING
Figure 2-3.1
Watershed Boundary
Reservoir
Stream
Sutherland/San Vicente Pipeline
San Vicente/El Capitan/El Monte Pipelines
Hazardous Materials/Waste
Sample Sites
Alvardo Water Treatment Facility
Wastewaster Treatment Plant
Poultry Ranch
Dairy Farm
Grazing Land
Reclaimed Water Distribution
N
Miles
0 1.5 3 6
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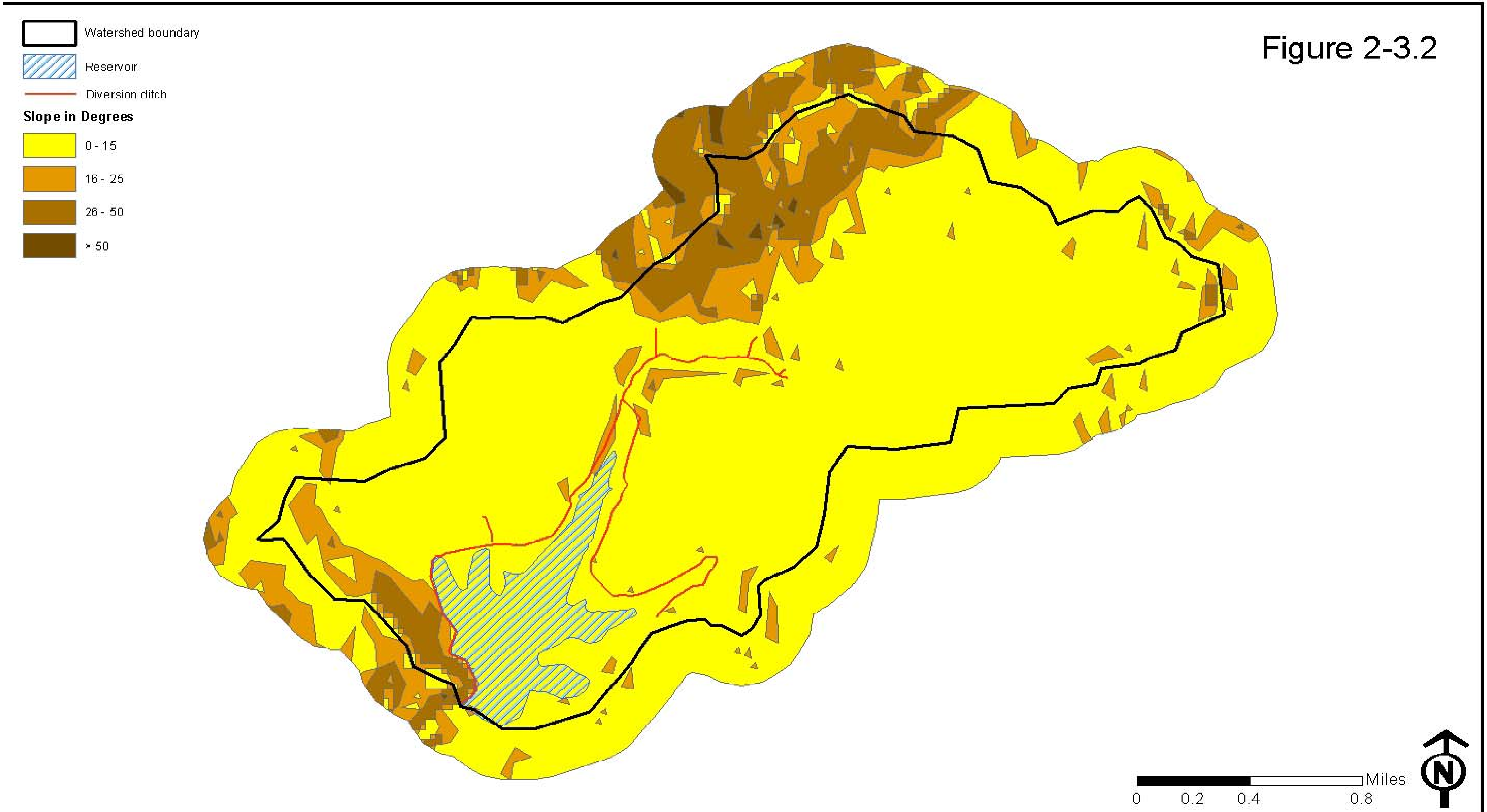
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\General Setting\ 2005 San Diego River System General Settings.mxd
Created By: Dennis Brown
Date: 30 November 2005
SanGIS

Murray Watershed SLOPE



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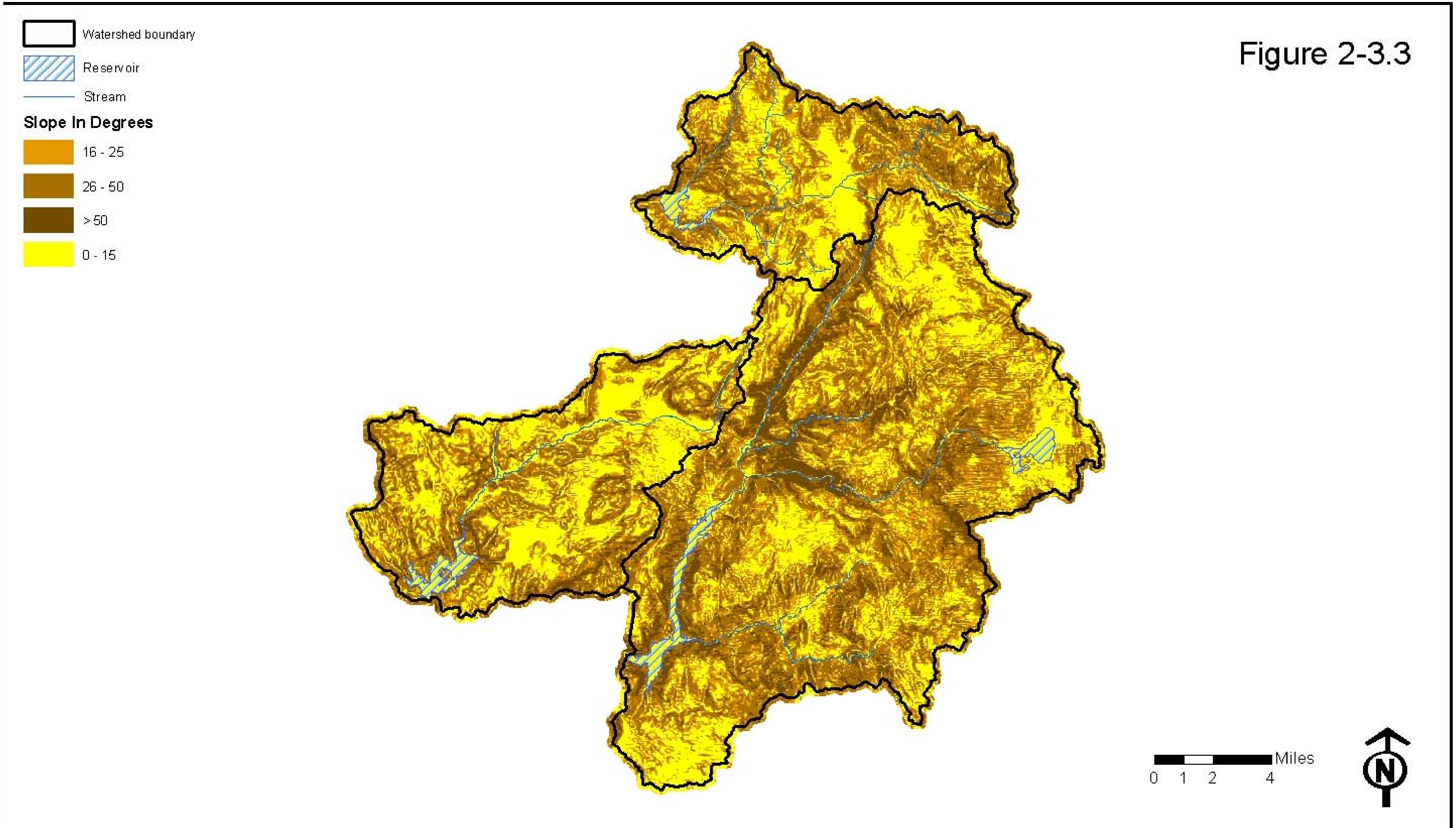
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\Slopes\Murray_watershe_slope.mxd

Created By: Dan Daft
Date: 8/2/05

San Vicente, El Capitan & Sutherland Watersheds SLOPE



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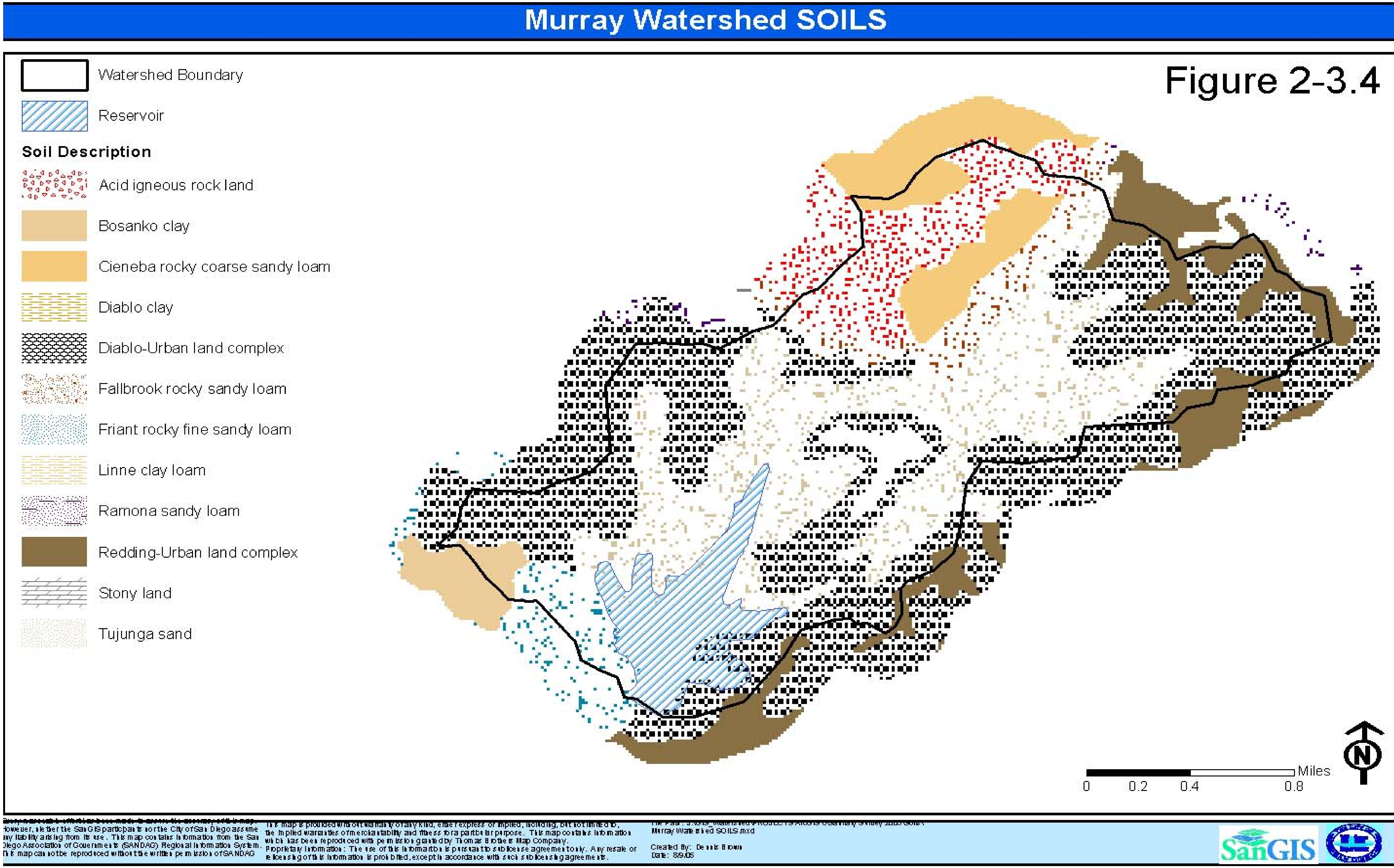
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey\Slope\EC_SV_SU_watershed_slope.mxd

Created By: Dan Daft



Murray Watershed SOILS
Figure 2-3.4
Watershed Boundary
Reservoir
Soil Description
Acid igneous rock land
Bosanko clay
Cieneba rocky coarse sandy loam
Diablo clay
Diablo-Urban land complex
Fallbrook rocky sandy loam
Friant rocky fine sandy loam
Linne clay loam
Ramona sandy loam
Redding-Urban land complex
Stony land
Tujunga sand
0 0.2 0.4 0.8 Miles
N
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Murray Watershed SOILS.mxd
Created By: Dennis Brown
Date: 8/9/05
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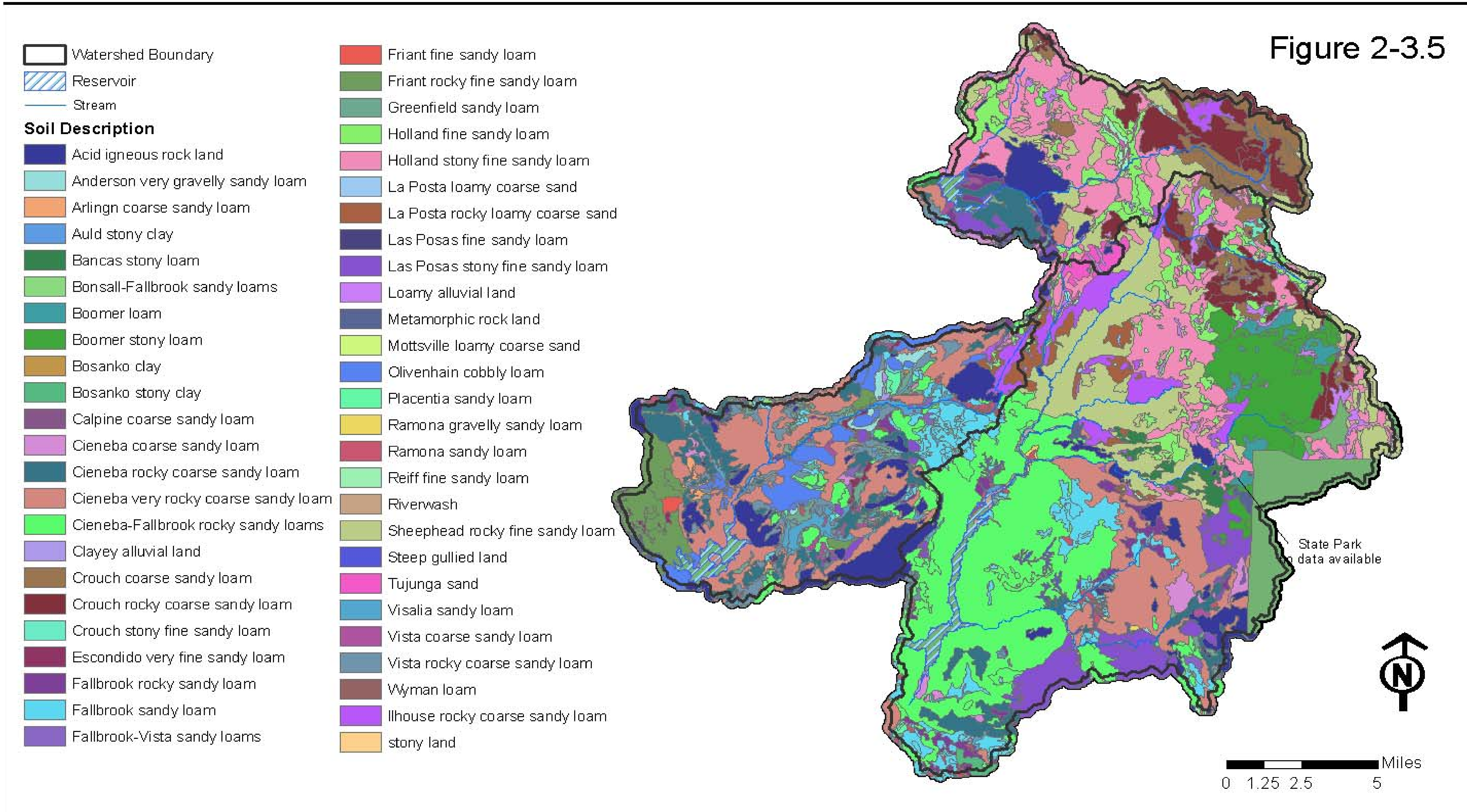
San Vicente, El Capitan & Sutherland Watersheds SOILS

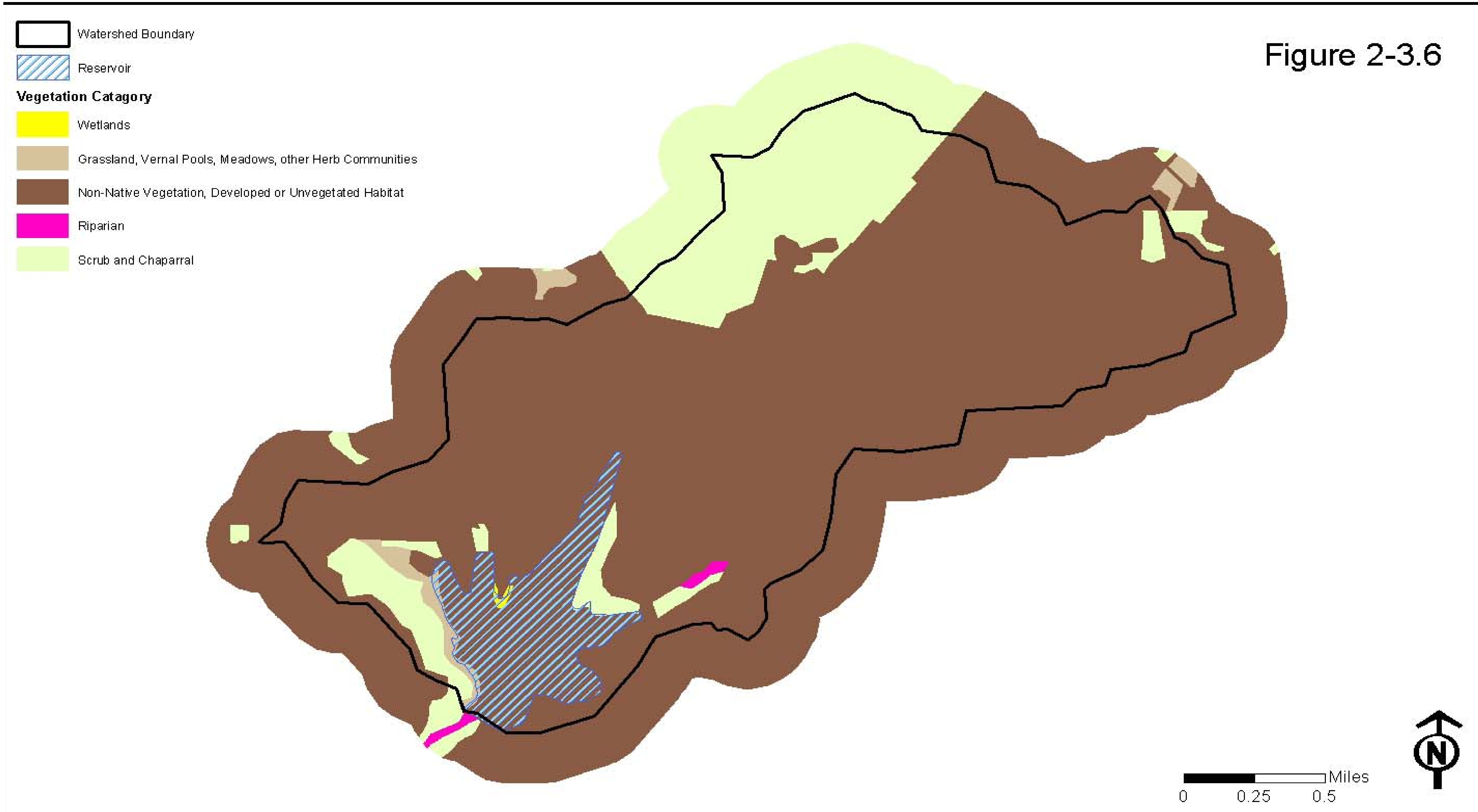


File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey2005\Soils\ San Vicente, El Capitan & Sutherland SOILS.mxd

Created By: Dennis Brown
Date: 25 August 2005

Murray Watershed VEGETATION

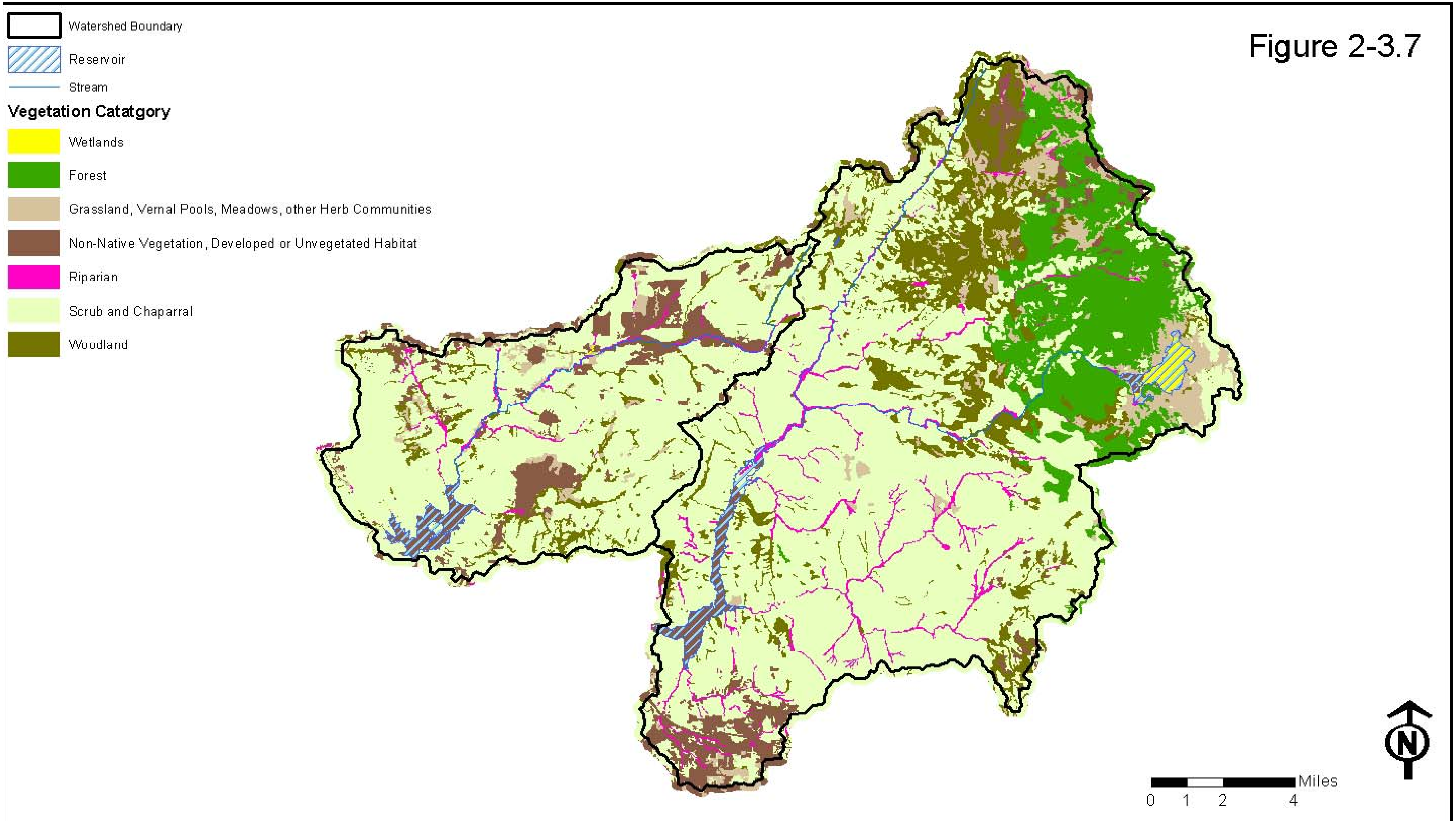
Figure 2-3.6



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\Vegetation\2005 Murray Watershed Vegetation.mxd

Created By: V.Chancer
Date: 08/15/05

San Vicente & El Capitan Watersheds VEGETATION



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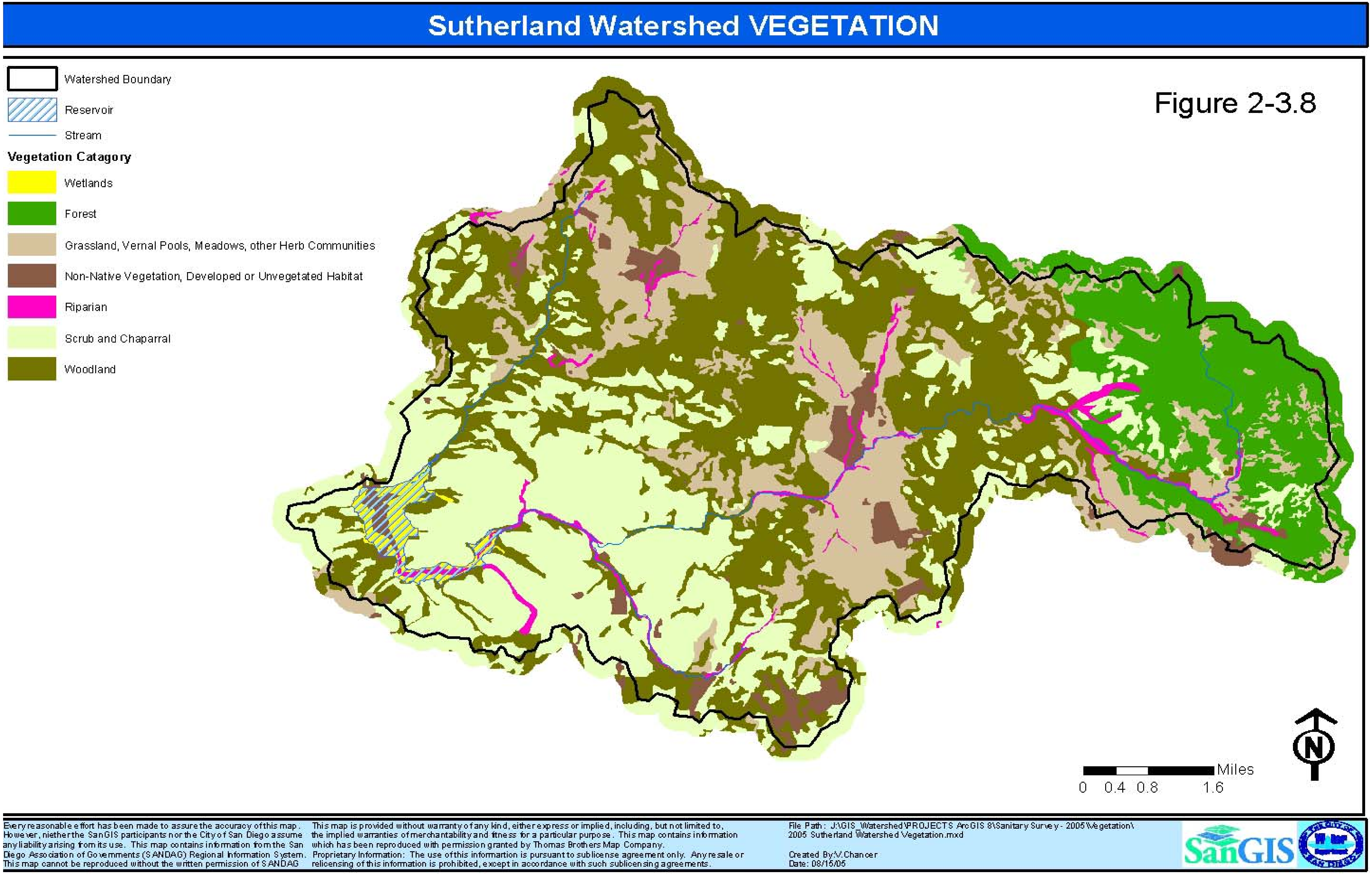
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Vegetation\2005 San Vicente & El Capitan Watersheds Vegetation.mxd

Created By: V Chances


Sutherland Watershed VEGETATION
Watershed Boundary
Reservoir
Stream
Vegetation Catagory
Wetlands
Forest
Grassland, Vernal Pools, Meadows, other Herb Communities
Non-Native Vegetation, Developed or Unvegetated Habitat
Riparian
Scrub and Chaparral
Woodland
Figure 2-3.8
Miles
0 0.4 0.8 1.6
N
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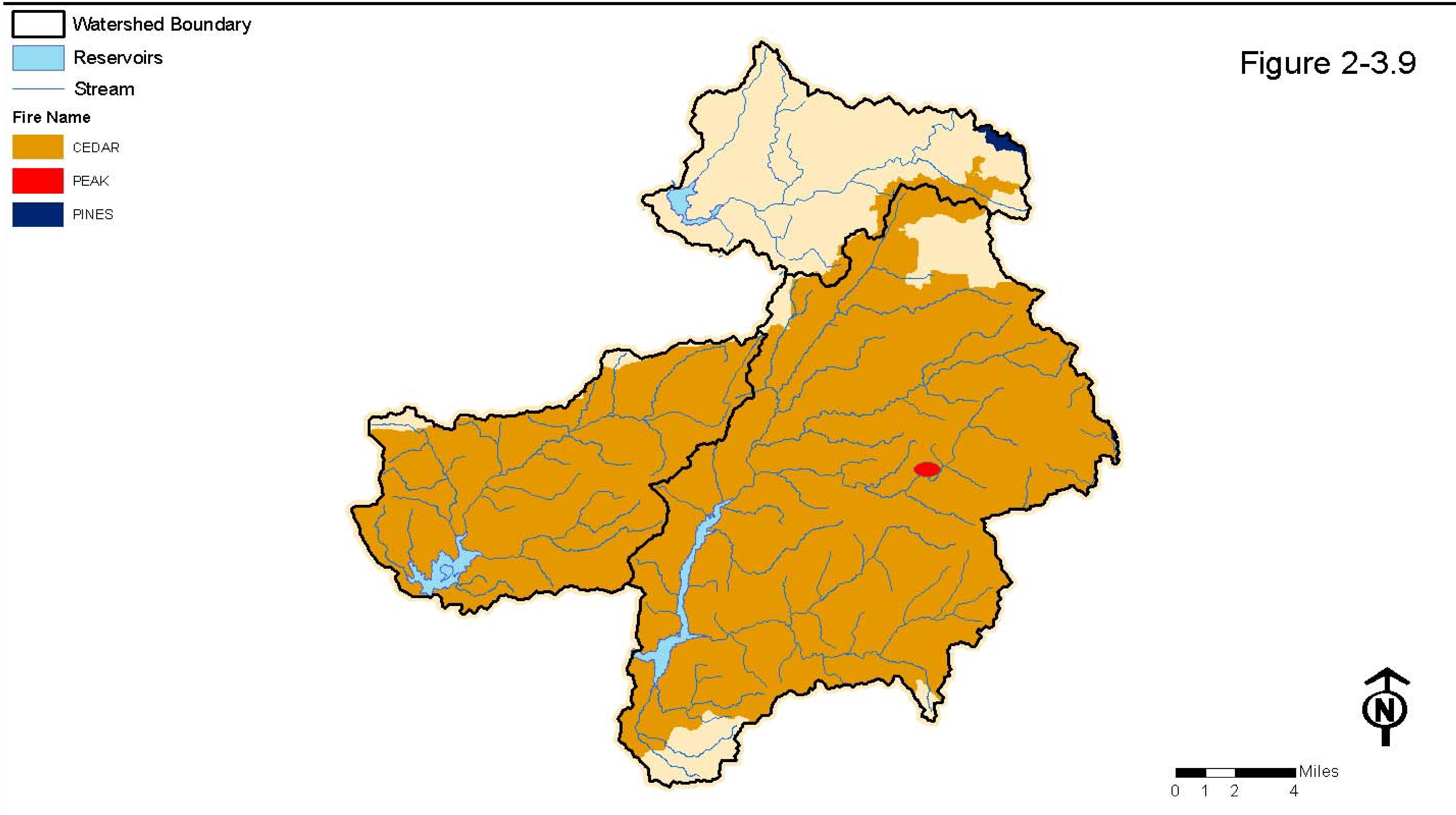
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey - 2005\Vegetation\ 2005 Sutherland Watershed Vegetation.mxd
Created By:V.Chancer
Date: 08/15/05
SanGIS

Fire Perimeters for the San Vicente, El Capitan and Sutherland Watersheds



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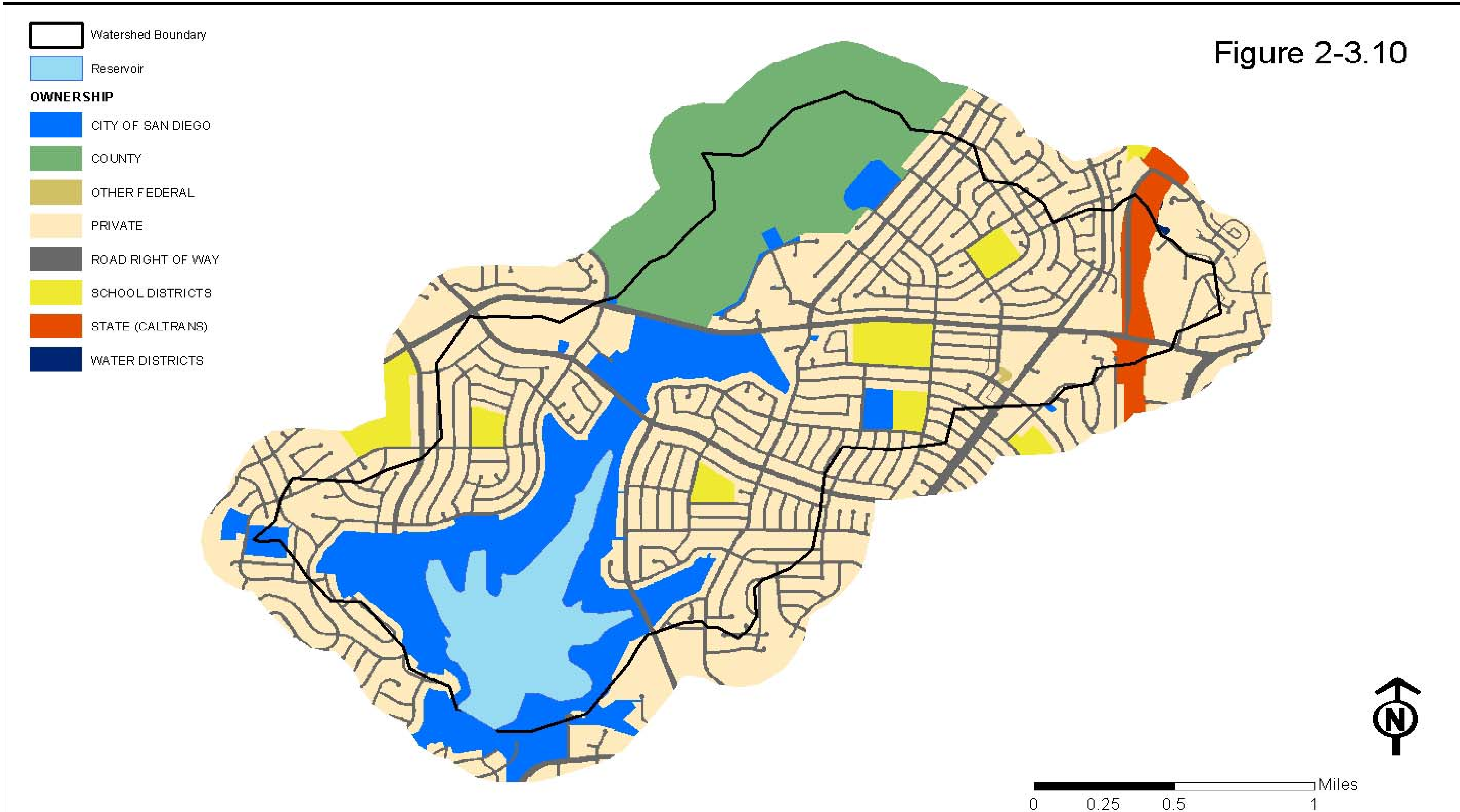
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Fire\Cedar Fire perimeters for Ec Sv and Su Watersheds.mxd
Created By: Dan Daft
Date: 11/28/05

-94-

Murray Watershed LAND OWNERSHIP



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey\land ownership\Murray watershed land ownership.mxd

Created By: Dennis Brown
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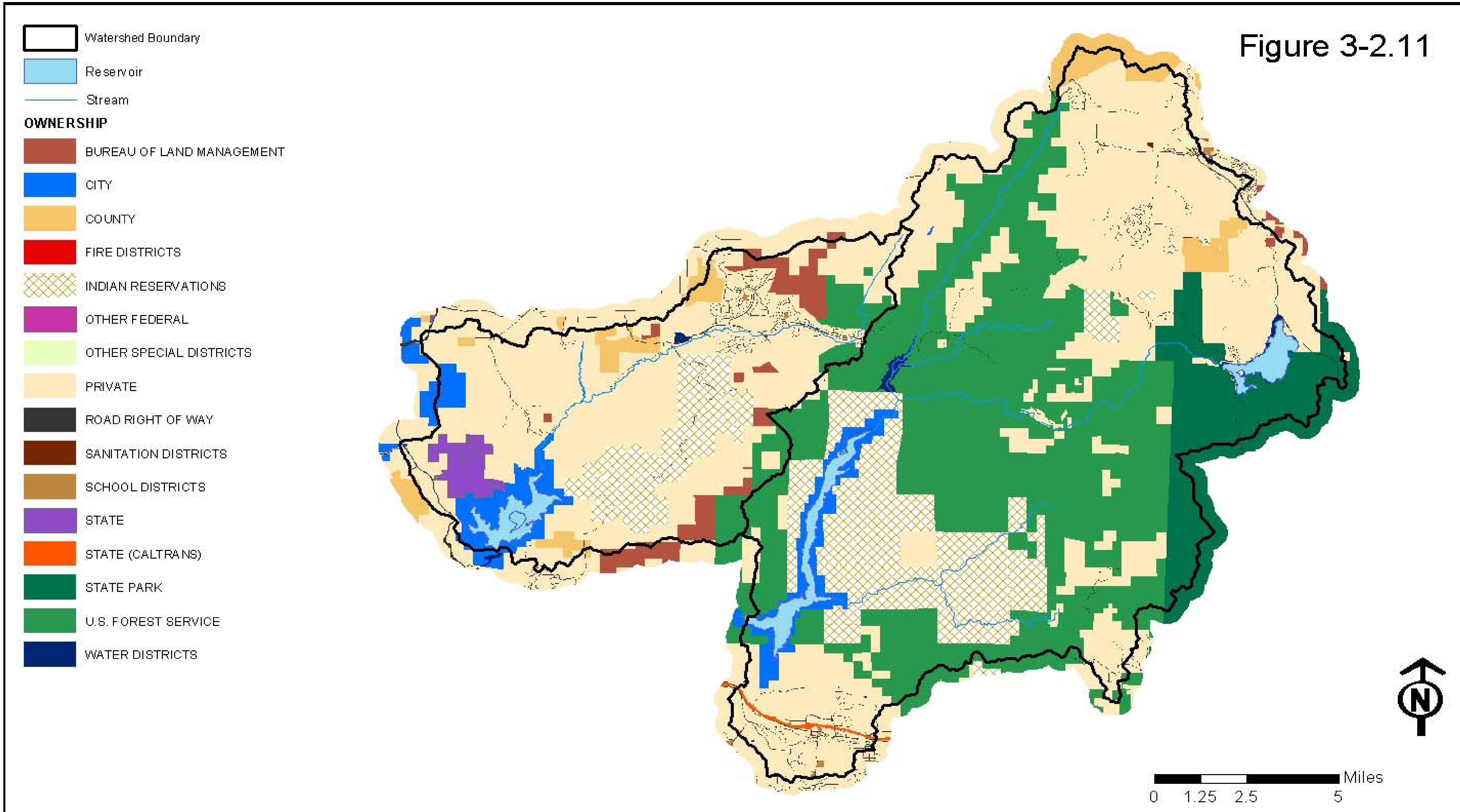
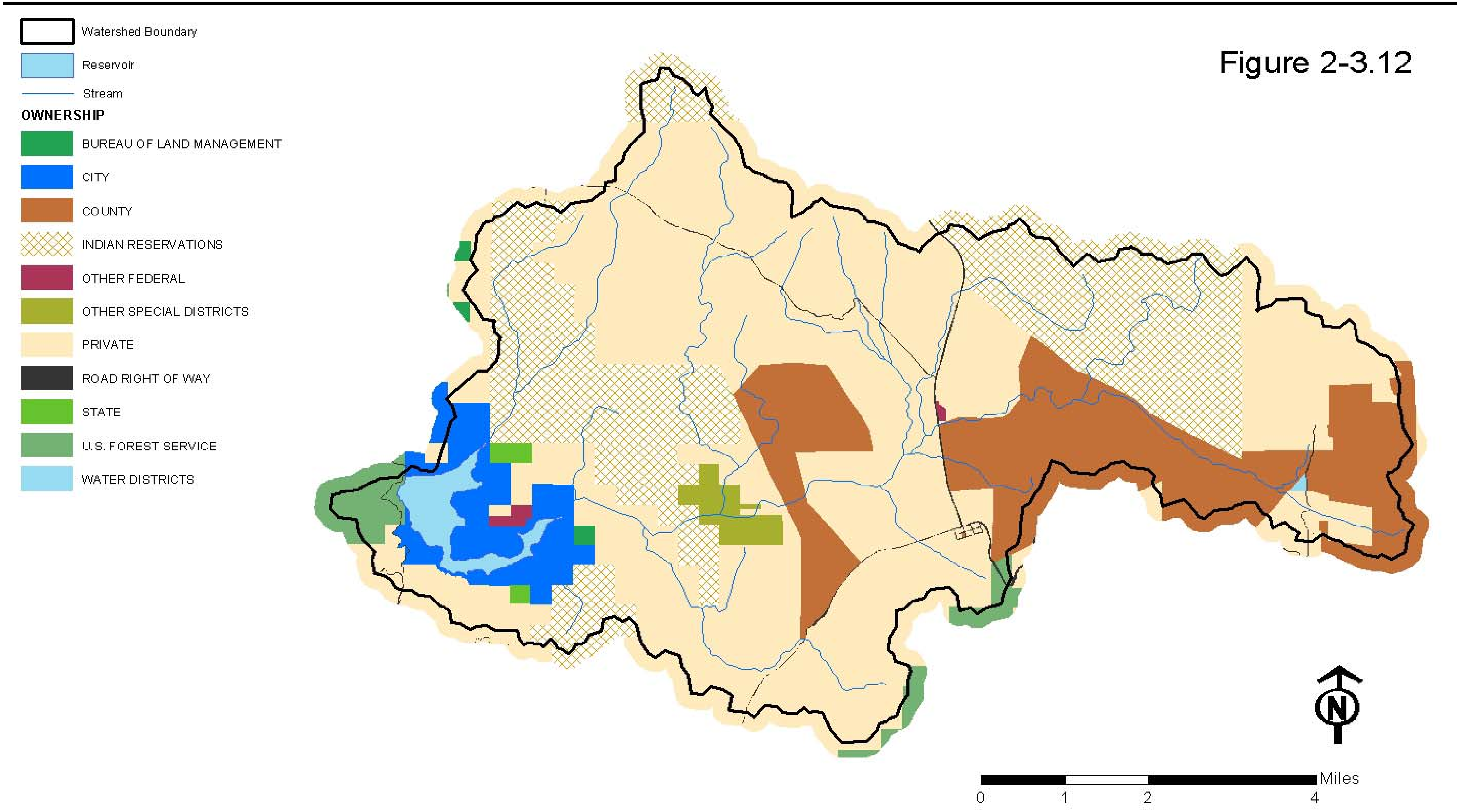
San Vicente & El Capitan Watersheds LAND OWNERSHIP



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\Landuse\El Capitan and San Vicente watersheds land Ownership.mxd

Created By: Dennis Brown
Date: 4 January 06

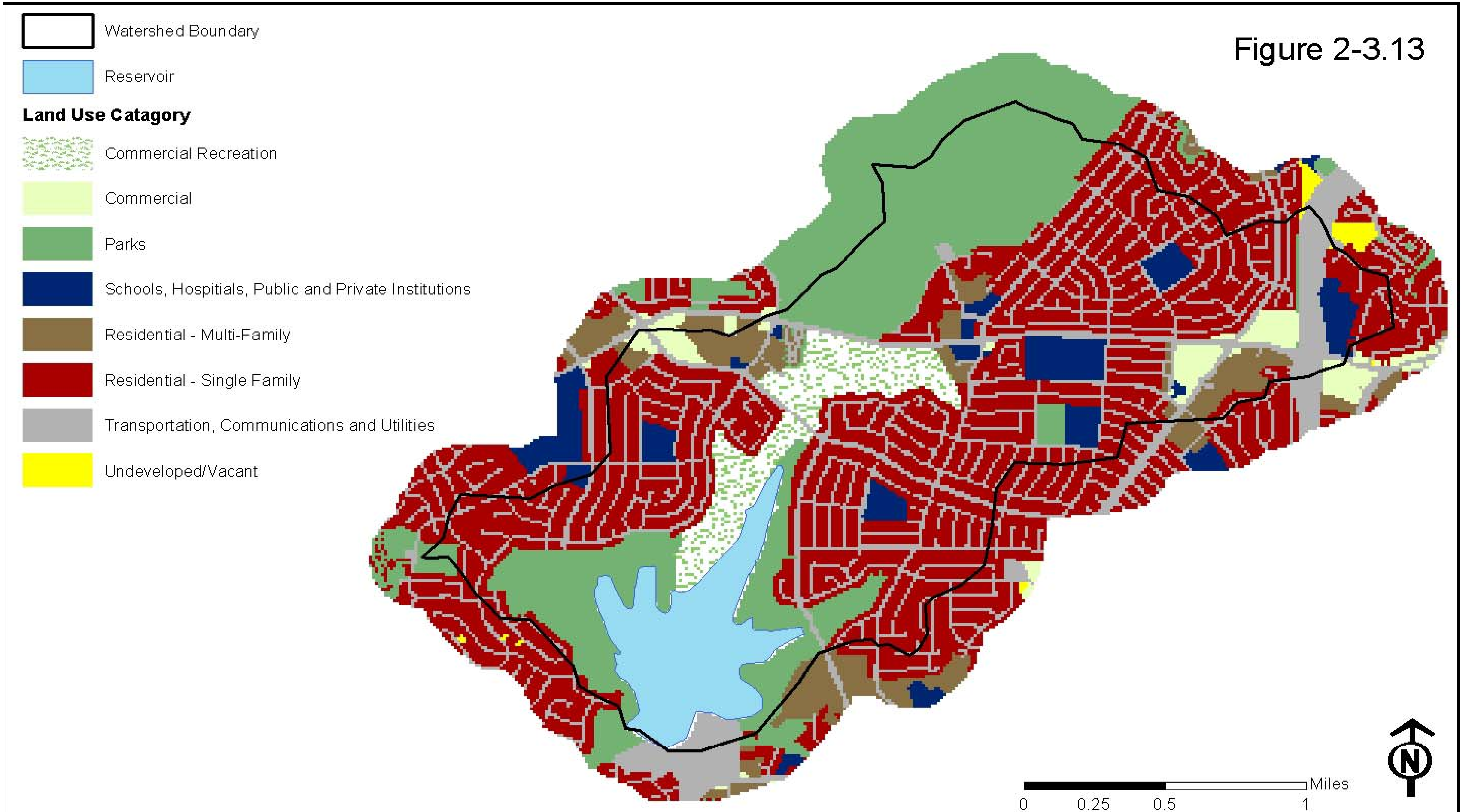
Sutherland Watershed LAND OWNERSHIP



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\landownership\Sutherland watershed Ownership.mxd

Created By: Dennis Brown
Date: January 9, 2006

Murray Watershed LANDUSE



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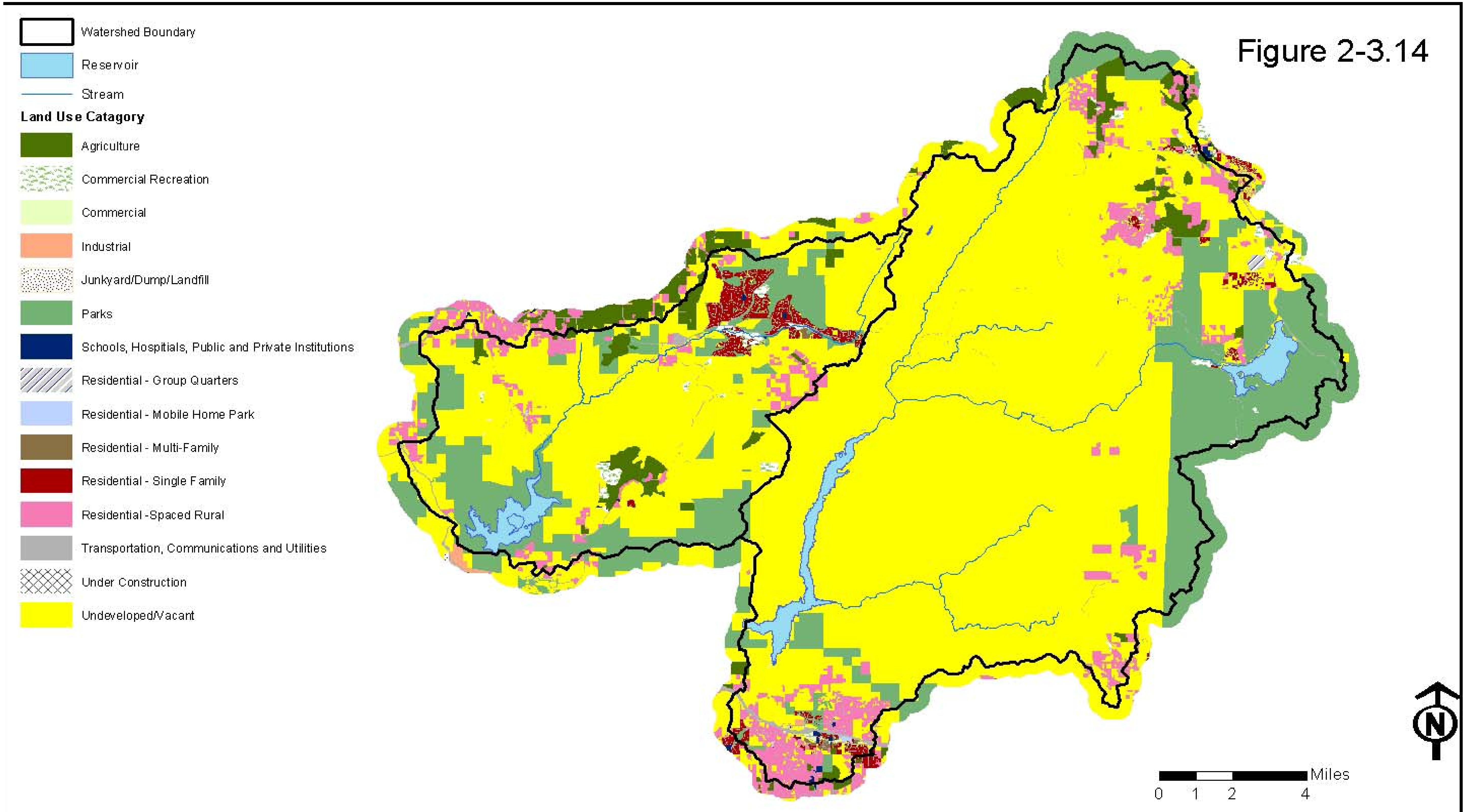
Created By: Dan Daft
Date: 8/8/05

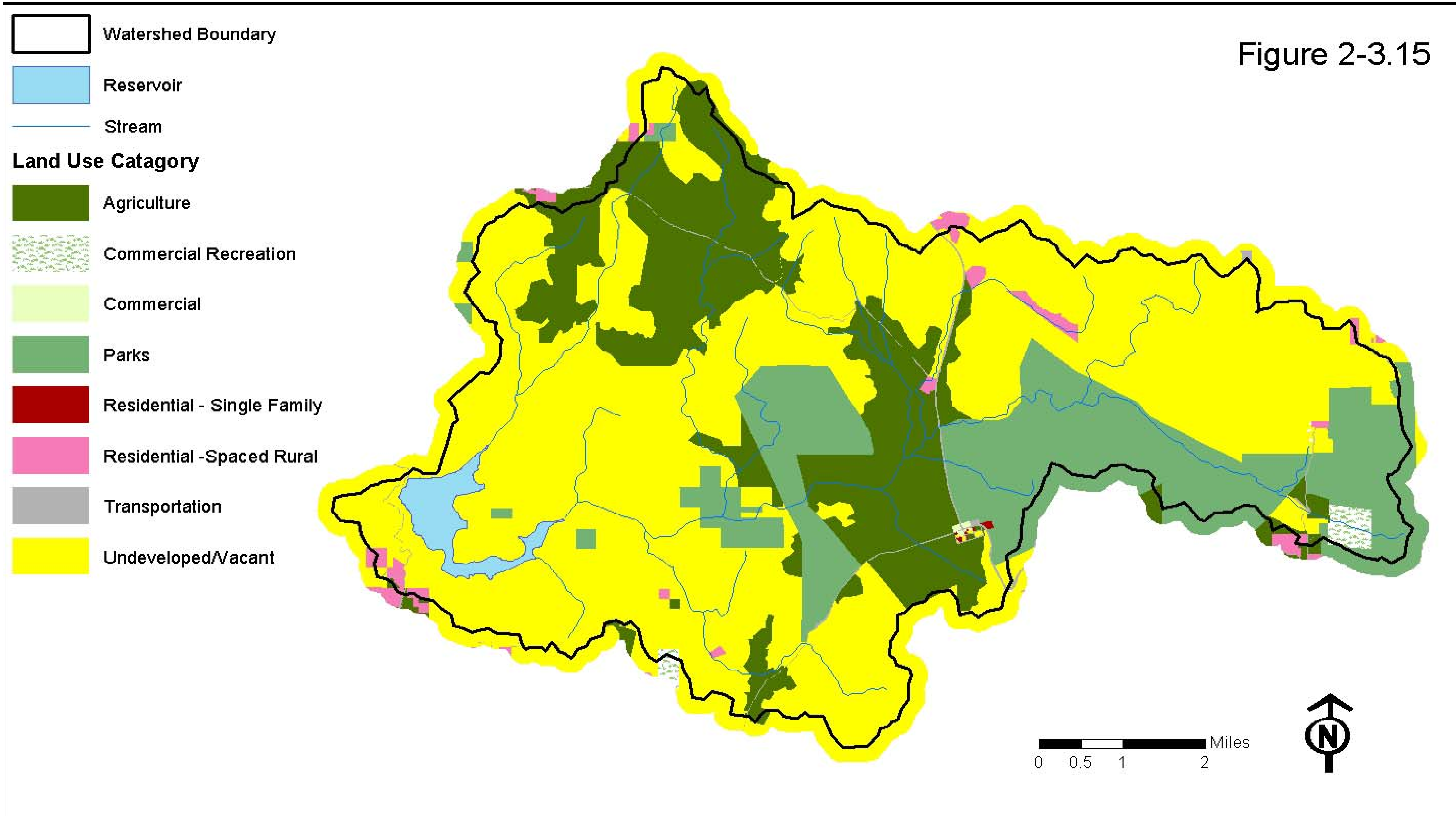
San Vicente & El Capitan Watersheds LANDUSE



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\Landuse\ El Capitan and San Vicente watersheds landuse.mxd

Created By: Dan Daft
Date: 8/9/05

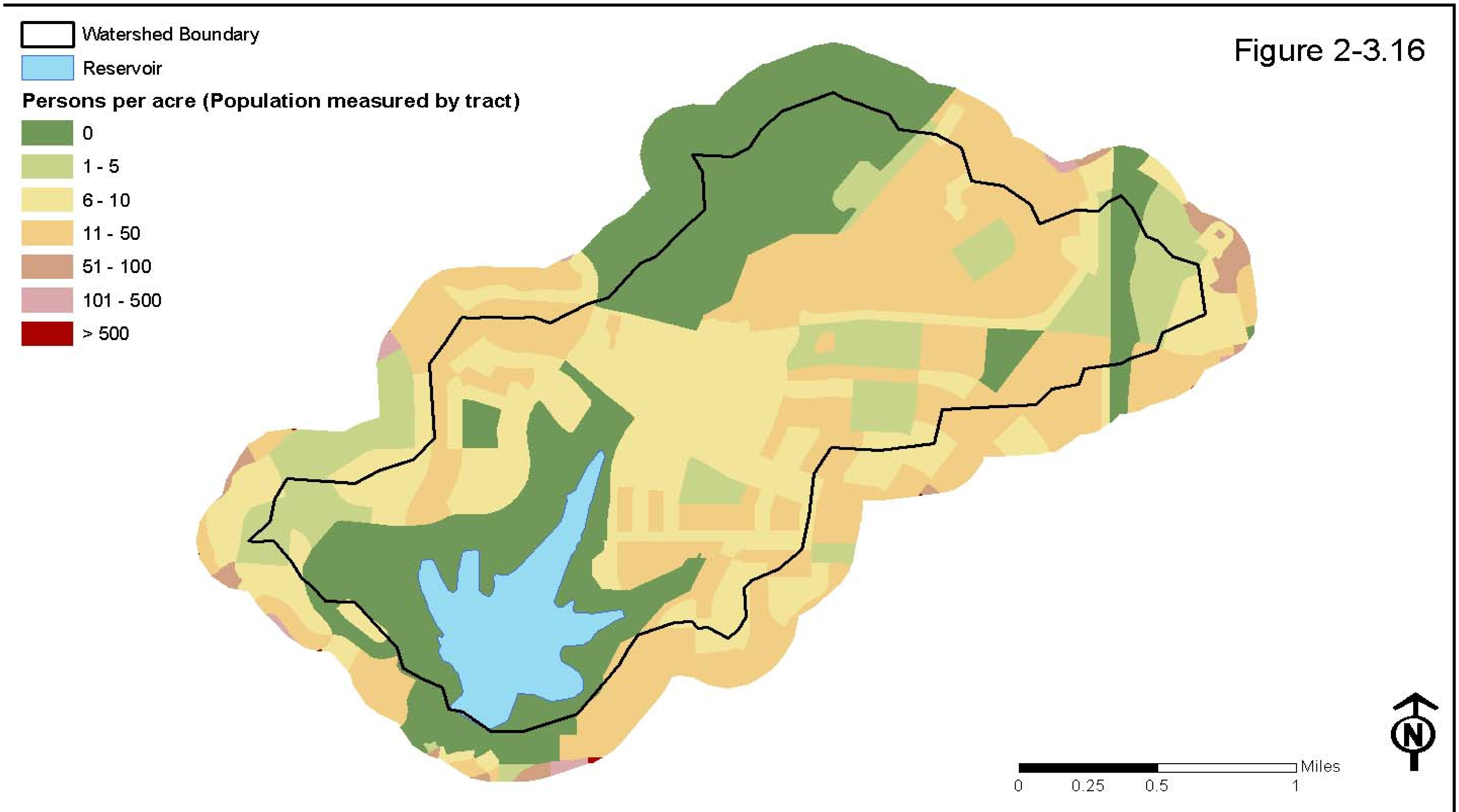
Sutherland Watershed LANDUSE



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\landuse\Sutherland watershed Landuse.mxd

Created By: Dan Daft
Date: 8/9/05

Murray Watershed POPULATION DENSITY

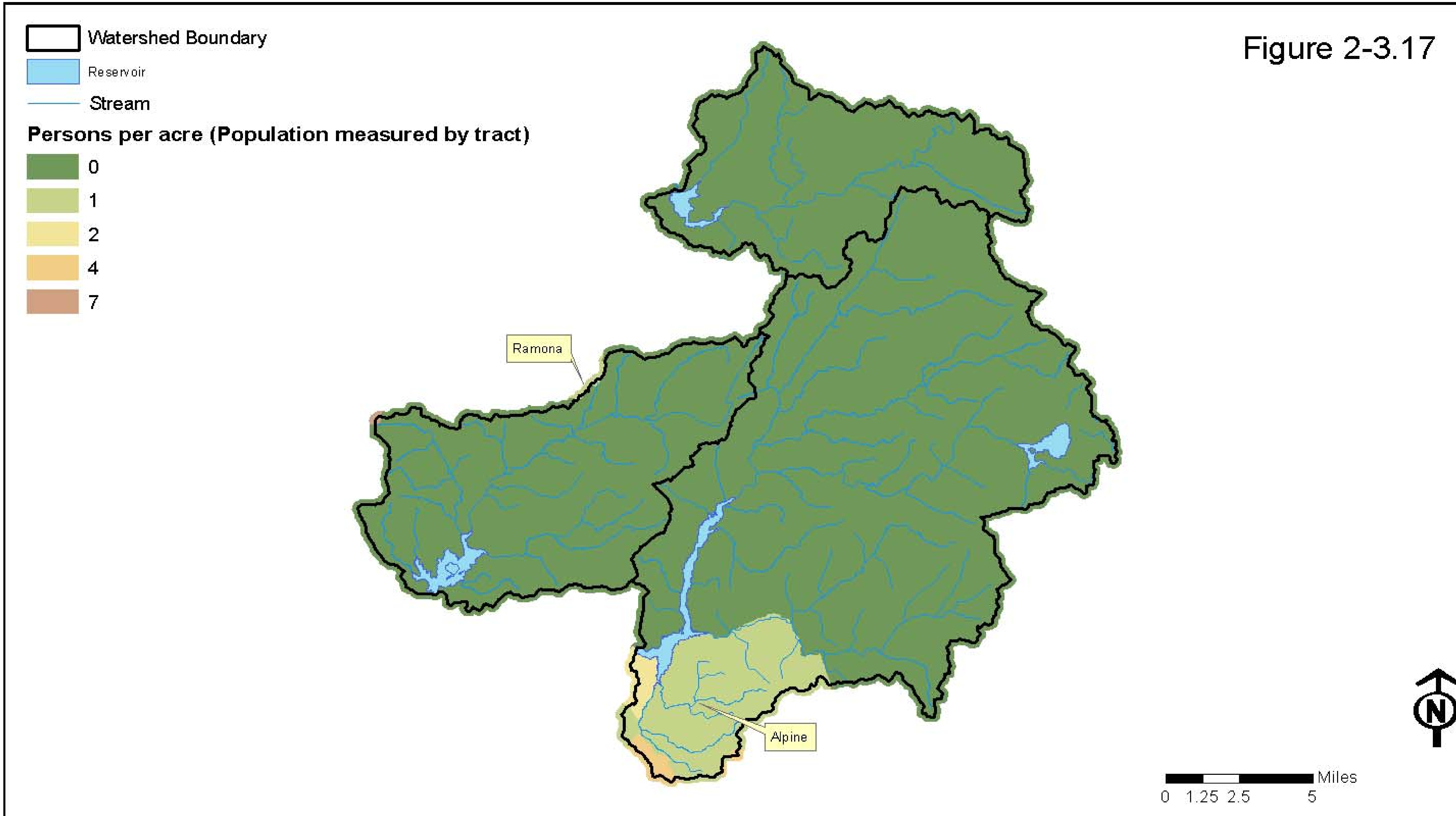


File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Population MU Pop 05.mxd
Created By: Dennis Brown

Date: 23 December 2005

San Diego River Watershed POPULATION DENSITY

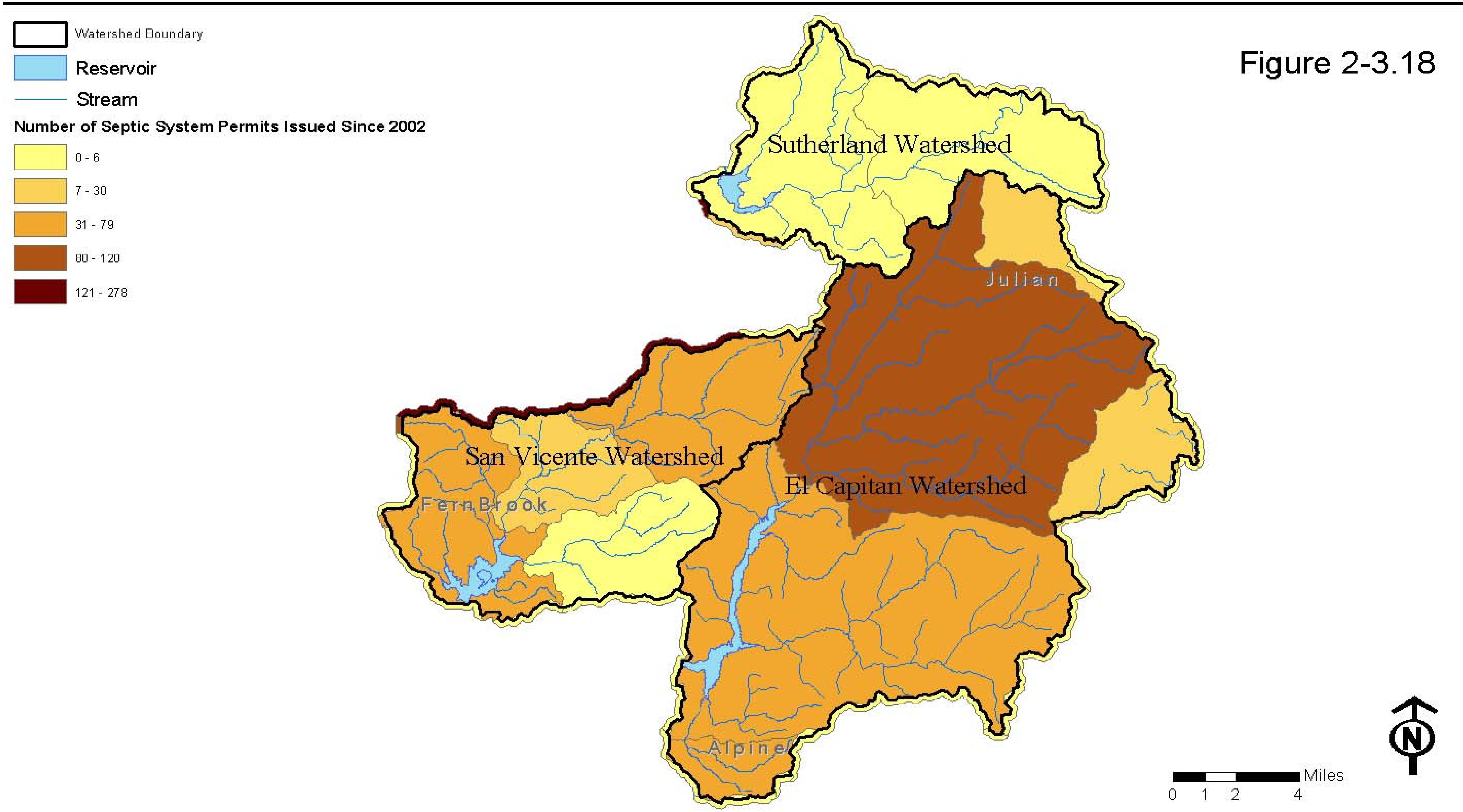
Figure 2-3.17



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Population SDWS Pop 05.mxd
Created By: Dennis Brown

Date: 23 December 2005

Septic System Permits Issued in the San Vicente, El Capitan & Sutherland Watersheds Since 2002



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Septic Systems\Ec Su Sv watershed SS.mxd

Created By: Dan Daft
Date: 11/28/05

CHAPTER 4: WATER QUALITY ASSESSMENT

Introduction

This chapter contains a summary of the quality of raw and treated water in the San Diego River System Watershed during the period of January 1, 2001, through December 31, 2005. Following the summary there is an evaluation of the system's ability to comply with current regulations and to meet anticipated future requirements.

The Water Quality Laboratory of the City of San Diego provided monitoring data from El Capitan, San Vicente, Sutherland, and Murray Reservoirs, and the Alvarado WTP.

Summary Of Monitoring Program

Each of the four reservoirs of the San Diego River System has sampling points near the outlet structure (Station "A"), at surface level, and at various outlet gauges. There are also several watershed sampling points in the El Capitan and San Vicente Watersheds, and sampling points at the influent and effluent of the Alvarado WTP. See Table 2-4.1 for a summary of the sampling frequency.

The reservoirs and treatment plant influent/effluent were monitored for general physical characteristics, organic and inorganic constituents. El Capitan, Murray, and San Vicente Reservoirs and Alvarado WTP influent were sampled for radiation. Sutherland Reservoir does not directly feed the Alvarado WTP, and so is not monitored for radiation. The watershed sample points are summarized in Table 2-4.2. The reservoirs, the outlet gauges, and the treatment plant influent and effluent, are summarized in subsequent tables.

Description Of Water Quality At Watershed Sampling Points

Of the thirty sample points in the watershed, eleven were chosen to present, based on the amount of data available. Those having fewer than five data points were deemed to be unrepresentative of a five year period. The Cedar Fire of October 2003, and the extremely wet winter the following year, prompted increased monitoring of the watershed, particularly El Capitan and San Vicente. They are the main local water sources for the Alvarado WTP. Samples were analyzed for a complete panel of trace metals, nutrients, and organic constituents. Microbiological parameters were not monitored.

The Drinking Water Standards used in Table 2-4.2 apply to treated, potable water, and are for reference only.

Description Of San Diego River Watershed Stream Water Quality

Table 2-4.2 contains a summary of water quality data for San Diego River Watershed

General Physical

Conductivity and Total Dissolved Solids were monitored. In both cases, the upper SMCL was exceeded by almost twice its value. This is to be expected due to the turbid nature of the samples. Conductivity and Total Dissolved Solids were elevated due the Cedar Fire and during high rainfall events in 2004. Initial post fire rain events resulted in significant increases in material (ash, soil, and other debris) washed into streams located in the burn area.

Inorganic Constituents

Trace metals were filtered before analysis and reported as dissolved trace metals. In the months following the Cedar Fire, there was slight elevation of aluminum and manganese. Nutrient loading was a concern during and after the rainy season of 2004-2005. Nutrient levels increased significantly in the initial post fire rain events. Nutrient levels have decreased from the highs of the initial post fire rain events, but remain higher then the pre-fire levels.

Organic Constituents

The full range of organic herbicides, pesticides, and other contaminants was monitored. Most were non-detected. Bis(2-ethylhexyl) pthalate was detected, but in amounts less than the maximum contaminant levels.

Description Of Source Surface Water Quality

El Capitan Reservoir at Surface -

Table 2-4.3 contains a summary of water quality data for El Capitan Reservoir at the surface.

General Physical

The monitored physical parameters of El Capitan Reservoir at surface were within the standards for drinking water except for pH, color, Total Dissolved Solids, and turbidity. The water quality is typical of raw water reservoirs in Southern California. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The maximum pH was 8.85, above the SMCL of 6.5 – 8.5. The turbidity reached a maximum 16.9NTU, where the MCL is 0.5NTUl. The Total Dissolved Solids only exceeded the SMCL of 1000 ppm by 10 ppm. The maximum color reading was 110cu, exceeding the SMCL of 15 cu. Threshold odor was not monitored at surface level.

Microbiological

Total coliform, E. Coli, and Enterococcus were monitored in order to obtain a background representation of microbiological conditions. Total coliforms ranged from <10 /100ml to >24,000 /100ml. The E. Coli range was from

<10 /100ml to 74 /100ml, and Enterococcus varied from <1 /100ml to 53/100ml. Wide ranges in microbiological results are expected in raw water reservoirs. Cryptosporidium and Giardia were not monitored.

Radiological

El Capitan Reservoir was monitored for gross alpha and beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the maximum contaminant levels.

Inorganic Constituents

There were twenty-eight inorganic constituents measured. Maximum values of Aluminum, Iron, and Manganese exceeded the drinking water maximum contaminant levels. Average and median values of Aluminum, Iron, and Manganese were below drinking water maximum contaminant levels (MCL).

Organic Constituents

El Capitan Reservoir was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants. The maximum Methyl t-Butyl Ether (MTBE) level exceeded the SMCL, but was below the MCL level. Two factors have resulted in a significant decrease in MTBE levels. First, MTBE has been removed from gasoline in the San Diego area. Second, rental boats have been equipped with 4-stroke motors replacing older 2-stroke motors.

El Capitan Reservoir, at Outlet Gauges -

Water quality data at five outlet gauges is summarized in Table 2-4.4. Outlet Gauges were sampled when they were 10 feet or greater under the surface. Gauges measured were ga-57, ga-82, ga-107, ga-132, and ga-157. The numbers refer to the distance (feet) above the streambed.

General Physical

Samples from all five outlet gauges exceeded the MCL for color, turbidity, and threshold odor. There is no apparent correlation between outlet depth and the data. The levels of these parameters were easily treated in the water treatment plant.

Microbiological

The outlet gauges were measured for Total Coliform, E. Coli, and Enterococcus. All gauges had positive readings. Total coliforms ranged from<10 /100ml to >24,000 /100ml. The E. Coli range was from <10 /100ml to 74 /100ml, and Enterococcus varied from <1 /100ml to 44 /100ml. This is a common occurrence in raw reservoir water.

Organic Constituents

Total Organic Carbon (TOC), Geosmin, and Methyl Isoborneol (MIB) were monitored at all five outlet gauges. TOC is a precursor to Trihalomethanes, and is monitored in source water. TOC ranged from a minimum of 3.45 mg/L at gauge 57 to a maximum of 6.38 mg/L at gauge 82. Increases in TOC can adversely impact the ability of the water treatment plant to meet Disinfection-By-Products MCLs. Geosmin and MIB were monitored for aesthetic reasons only. There are no maximum contaminant levels for these three parameters.

San Vicente Reservoir at Surface -

Table 2-4.5 contains a summary of water quality data for San Vicente Reservoir at the Surface.

General Physical

The monitored physical parameters of San Vicente Reservoir at surface were within the standards for drinking water except for pH, color, and turbidity. Since the reservoir contains raw water, and the standards are for treated water, the comparison is for reference only. Turbidity spiked after the first post Cedar Fire rain events. The pH maximum was 9.37, above the SMCL of 6.5 – 8.5. The turbidity reached a maximum 7.54 NTU, where the MCL is 0.3 NTU for 95% of samples. The maximum color reading was 26cu, exceeding the SMCL of 15 cu. These parameters were easily treated in the water treatment plant.

Microbiological

Total coliform, E. Coli, and Enterococcus were monitored in order to obtain a background representation of microbiological conditions. Total coliforms ranged from 10 /100ml to >24,000 /100ml. The E. Coli range was from <10 /100ml to 550 /100ml, and Enterococcus varied from <1 /100ml to 8.2 /100ml. Cryptosporidium and Giardia were not monitored.

Radiological

San Vicente Reservoir was monitored for gross alpha and beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the maximum contaminant levels.

Inorganic Constituents

There were twenty-eight inorganic constituents measured, of which none exceeded the maximum contaminant levels.

Organic Constituents

San Vicente Reservoir was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants. The maximum Methyl t-Butyl Ether (MTBE) level exceeded the SMCL, but was below the MCL level. Two factors have resulted in a significant decrease in MTBE levels. First ,MTBE has been removed from gasoline in the San Diego area. Second, rental boats have been equipped with 4-stroke motors replacing older 2-stroke motors.

San Vicente Reservoir, at Outlet Gauges -

Water quality data at six outlet gauges is summarized in Table 2-4.6. Outlet Gauges were sampled when they were 10 feet or greater under the surface. Gauges measured were ga-50, ga-80, ga-100, ga-110, ga-140, and ga-170. The numbers refer to the distance (feet) above the streambed.

General Physical

All six outlet gauges measured exceeded the MCL for color, turbidity, and threshold odor. Turbidity spiked after the first post Cedar Fire rain events. Turbidity returned to normal levels within days of the end of rain events. There is no apparent correlation between outlet depth and the data.

Microbiological

The outlet gauges were measured for Total Coliform, E. Coli, and Enterococcus. All gauges had positive readings. Total coliforms ranged from 10 /100ml to >24,000 /100ml. The E. Coli range was from <10 /100ml to 520 /100ml, and Enterococcus varied from <1 /100ml to 20 /100ml. This is a common occurrence in raw reservoir water.

Organic Constituents

Total Organic Carbon (TOC), Geosmin, and Methyl Isoborneol (MIB) were monitored at all six outlet gauges. TOC is a precursor to Trihalomethanes, and is monitored in source water. TOC ranged from a minimum of 4.98 mg/L at gauge 100, to a maximum of 7.96 mg/L at gauge140. Increases in TOC can adversely impact the ability of the water treatment plant to meet

Disinfection-By-Products MCLs. Geosmin and MIB were monitored for aesthetic reasons only. There are no maximum contaminant levels for these three parameters.

Sutherland Reservoir at Surface -

Table 2-4.7 contains a summary of water quality data for Sutherland Reservoir at Surface.

General Physical

The monitored physical parameters of Sutherland Reservoir at surface were within the standards for drinking water except for pH, color, and turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The parameter pH was a maximum of 9.34 above the SMCL of 6.5 – 8.5. The turbidity reached a maximum 19.5 NTU, where the MCL is 0.5NTU for 95% of samples. The maximum color reading was 39cu, exceeding the SMCL of 15 cu. Threshold odor was not monitored at surface level.

Microbiological

Total coliform, E. Coli, and Enterococcus were monitored in order to obtain a background representation of microbiological conditions. There were 72 measurements of each parameter. Total coliforms ranged from 74 /100ml to 24,000 /100ml. The E. Coli range was from <10 /100ml to 41 /100ml, and Enterococcus varied from <1 /100ml to 14 /100ml. Beginning in July of 2004, Sutherland Reservoir was sampled quarterly for Cryptosporidium and Giardia. There were no positive readings during that time.

Inorganic Constituents

There were twenty-eight inorganic constituents measured. Maximum levels of Aluminum, Antimony, Arsenic, Iron, and Manganese exceeded MCL levels. Average and median levels of Aluminum, Antimony, Arsenic, Iron, and Manganese were below MCL levels.

Organic Constituents

Sutherland Reservoir was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants. None of them exceeded the SMCL.

Murray Reservoir at Surface -

Table 2-4.8 contains a summary of water quality data for Murray Reservoir at the Surface.

General Physical

The monitored physical parameters of Murray Reservoir at surface were within the standards for drinking water except for pH and turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The parameter pH was a maximum of 8.60, above the SMCL of 6.5 – 8.5. The turbidity reached a maximum 2.5 NTU. Turbidity and pH were easily treated at the water treatment plant. Threshold odor was not monitored at surface level.

Microbiological

Total coliform, E. Coli, and Enterococcus were monitored in order to obtain a background representation of microbiological conditions. There were 249 measurements of each parameter. Total coliforms ranged from 10 /100ml to 24,000 /100ml. The E. Coli range was from 4.10 /100ml to 940 /100ml, and Enterococcus varied from <1 /100ml to 160 /100ml. Cryptosporidium and Giardia were not monitored.

Radiological

Murray Reservoir was monitored for gross alpha and beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the maximum contaminant levels.

Inorganic Constituents

There were twenty-eight inorganic constituents measured, of which none exceeded the maximum contaminant levels.

Organic Constituents

Murray Reservoir was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants. None exceeded the SMCL.

Murray Reservoir, at Outlet Gauges -

Water quality data at three outlet gauges is summarized in Table 2-4.9. Outlet Gauges were sampled when they were 10 feet or greater under the surface. Gauges measured were ga-49, ga-62, and ga-75. The numbers refer to the distance (feet) above the streambed.

General Physical

All three outlet gauges measured exceeded the MCL for color, turbidity, and threshold odor. However, gauges 62 and 75 had maximum turbidity readings within the SMCL of 5 NTU. These were easily treated at the water treatment plant. There is no apparent correlation between outlet depth and the data.

Microbiological

The outlet gauges were measured for Total Coliform, E. Coli, and Enterococcus. All three gauges had positive readings. Total coliforms ranged from <10 /100ml to 24,000 /100ml. The E. Coli range was from <10 /100ml to 780 /100ml, and Enterococcus varied from <1 /100ml to 120 /100ml. This is a common occurrence in raw reservoir water.

Organic Constituents

Total Organic Carbon (TOC), Geosmin, and Methyl Isoborneol (MIB) were monitored at all three outlet gauges. TOC is a precursor to Trihalomethanes, and is monitored in source water. TOC ranged from a minimum of 2.97 mg/L at gauge 49, to a maximum of 6.94 mg/L at gauge 62. Geosmin and MIB were monitored for aesthetic reasons only. There are no maximum contaminant levels for these three parameters.

Influent To Alvarado WTP -

Table 2-4.10 contains a summary of water quality data for the influent to the Alvarado Water Treatment Plant.

General Physical

The monitored physical parameters of Alvarado WTP influent were within the standards for drinking water except for color and turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The turbidity reached a maximum 20.4 NTU, where the MCL is 0.5NTU for 95% of samples. The maximum color reading was 66cu, where the SMCL is 15cu. These were easily treated at the water treatment plant.

Microbiological

Total coliform and Enterococcus were monitored in order to obtain a background representation of microbiological conditions. Total coliforms ranged from <2 /100ml to 2400 /100ml. Enterococcus varied from <1 /100ml to 1.60 /100ml. Elevated Total Coliform levels trigger increased water treatment requirements. *Cryptosporidium* and *Giardia* were monitored, and ranged from <0.1 /100L for both *Cryptosporidium* and *Giardia*.

Radiological

Alvarado WTP influent was monitored for gross alpha and beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the maximum contaminant levels.

Inorganic Constituents

There were twenty-eight inorganic constituents measured, of which none exceeded the maximum contaminant levels.

Organic Constituents

Alvarado WTP influent was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants. None exceeded the SMCL. TOC is a precursor to Trihalomethanes, and is monitored in source water. TOC ranged from a minimum of 1.82 mg/L, to a maximum of 6.86 mg/L.

Alvarado WTP Effluent -

Table 2-4.11 contains a summary of water quality data for the Alvarado Water Treatment Plant effluent. Water sources to the water treatment plant very from 100% imported to 100% local. Water quality is impacted by the source of water being supplied. The data in Table 2-4.11 does not distinguish between water supply sources.

General Physical

The monitored physical parameters of Alvarado WTP effluent were within the standards for drinking water except for color and pH.   The pH reached a maximum of 8.97 where the SMCL is 8.5. Only one reading out of fifty-nine exceeded the SMCL. The Turbidity MCL was not exceeded at any time.

Microbiological

Total coliform and E. Coli were monitored in order to obtain a background representation of microbiological conditions. There were no positive E. Coli samples out of 249 readings. There were five positive readings of Total coliforms, one per year. This is well below the limit of 5% per month. Cryptosporidium and Giardia were not monitored.

Inorganic Constituents

There were twenty-eight inorganic constituents measured, of which none exceeded the maximum contaminant levels.

Organic Constituents

Alvarado WTP effluent was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants. None exceeded the SMCL. TOC is a precursor of Trihalomethanes, and is monitored in source water. TOC ranged from a minimum of 1.87 mg/L, to a maximum of 6.86 mg/L. Total Trihalomethanes (TTHM) were also monitored, and ranged from 25.5 µg/L to 94.7 µg/L, with an average of 57.1 ug/L. The MCL for TTHM is 80.0 µg/L as a Distribution System Running Annual Average. Individual TTHM levels > 80.0 ug/L do not exceed MCL levels. Water sources to the water treatment plant very from 100% imported to 100% local.

Evaluation Of Source Water Quality

The sources for the Alvarado WTP are El Capitan, San Vicente, Murray, and Sutherland Reservoirs, and imported CWA raw water. The influent to Alvarado WTP varies according to the blends of the different sources.

The number of samples showing positive for microorganisms in the source water and the influent is not of concern. It is rare to find raw surface water which does not have microorganisms present. High color and turbidity are also to be expected, since the reservoirs are part of a wildlife habitat.

Evaluation Of System's Ability To Meet Current Drinking Water Standards

The source water is treated at the Alvarado WTP to comply with existing drinking water standards. Currently, the system complies with all primary standards. Compliance with the Stage 2 Disinfection, Disinfection-by-product rule will be difficult with the current water treatment plant.

Evaluation Of System's Ability To Meet Current And IESWTR and D/Dbp Standards

The Alvarado WTP has the ability to meet all current IESWTR And D/DBP standards. Compliance with the Stage 2 Disinfection, Disinfection-by-product rule will be difficult with the current water treatment plant. Stage 2 limits become effective in 2012. Capital improvements in the treatment plant likely will be required to meet the new regulations.

2005 - Stage 2 Disinfectants And Disinfection Byproducts Rule (D/DBP) -

Stage 2 D/DBP rule requires that all water supply systems meet distribution system "Locational" running annual averages (LRAA) for TTHM and Halo Acidic Acids 5, (HAA5) at locations determined by the Initial Distribution System Evaluation (ISDE). Compliance monitoring for Stage 2 starts in 2012. Currently the LRAA for the Alvarado system all are within limits, with a system-wide average of 60.7 µg/L for TTHM, and a system-wide maximum of 55.7 for HAA5.

The IDSE study will have to be completed to determine the locations of new monitoring sites having the highest TTHM and HAA5 before compliance can be determined.

Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) -

The LT2ESWTR is being developed to provide increased protection against *Cryptosporidium.* This rule incorporates system specific treatment requirements classified into categories, or 'bins', based on the results of the source water *Cryptosporidium* monitoring. Additional treatment requirements depend on the bin to which the system is assigned. Systems will choose technologies to comply with additional treatment requirements from a 'toolbox' of options.

Currently at the Alvarado WTP, the system will require 1-log treatment, since the average *Cryptosporidium* at Alvarado influent is 0.242 /100L.

Arsenic Regulation -

On January 22, 2001, a final rule revised the MCL for Arsenic from 50 µg/L to 10 µg/L. The final rule also clarifies how compliance is demonstrated for many inorganic and organic contaminants in drinking water. The compliance date is five years after the publication of the final rule. The Alvarado WTP complies with the new Arsenic regulation because the maximum Arsenic reading for Alvarado WTP effluent was <2 µg/L.

Radionuclides Regulations -

The new Radionuclides Rule went into effect in December 2003. The new rule sets a MCL of 30 mg/L for Uranium and 5 pCi/L for Combined Radium 226/228. It also sets standards of 15 pCi/L for adjusted gross alpha particles and 4 mrem/year for beta particles and photon radioactivity. Compliance with this requirement is assumed if the average concentration of gross beta particle activity is less than 50 pCi/l and if the average concentration of tritium and strontium-90 are less than those listed in Table 2-4.3. The Alvarado WTP currently complies with this rule.

Radon Regulation -

The EPA is formulating new regulations concerning Radon. The rule proposes a MCL of 300 pCi/L at the entry point to the distribution system. The EPA is proposing that initial one-year quarterly monitoring should begin three years after publication of the final rule. Radon has not been monitored at the Alvarado Treatment Plant.

Sulfate Regulation -

The current SMCL range for sulfate is 250 – 500 mg/L. The Alvarado WTP currently complies with this regulation, since the maximum sulfate reading for Alvarado WTP effluent is 235 mg/L.

Table 2-4.1
RAW WATER QUALITY MONITORING PROGRAM
ALVARADO TREATMENT PLANT INFLUENT AND EFFLUENT,
AND MURRAY, EL CAPITAN, SAN VICENTE, AND SUTHERLAND RESERVOIRS,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]		
	El Capitan/ San Vicente	Sutherland/ Murray	Alvarado WTP INF/EFF
General Physical			
Alkalinity	M	Q	D
Color	M	Q	D
Conductivity	M	Q	M
Corrosivity	M	Q	M
Foaming Agents (MBAS)	NS	NS	A
Hardness as CaCO3	M	Q	M
Odor - Threshold	NS[7]	NS[7]	D
pH	M	Q	D
Total Dissolved Solids	M	Q	M
Turbidity	M	Q	D
Microbiological			
Total Coliform	W	M	D
E. Coli	W	M	D
Enterococcus	W	M	M
Cryptosporidium	NS	Q[8]	M
Giardia	NS	Q[8]	M
Radiological			
Gross Alpha particles	(2)	(2)	(2)
Gross Beta particles	(2)	(2)	(2)
Combined Radium-226 & 228	(2)	(2)	(2)
Strontium-90	(2)	(2)	(2)
Tritium	(2)	(2)	(2)
Uranium	(2)	(2)	(2)
Inorganic Constituents			
Aluminum	M	Q	M
Antimony	M	Q	Q
Arsenic	M	Q	Q
Barium	M	Q	Q
Beryllium	M	Q	Q
Cadmium	M	Q	Q
Calcium	M	Q	M
Chloride	M	Q	M
Chromium	M	Q	Q
Copper	M	Q	M
Cyanide	Q	Q	Q
Fluoride	M	Q	M
Iron	M	Q	M

Table 2-4.1 RAW WATER QUALITY MONITORING PROGRAM ALVARADO TREATMENT PLANT INFLUENT AND EFFLUENT, AND MURRAY, EL CAPITAN, SAN VICENTE, AND SUTHERLAND RESERVOIRS, 2001 THROUGH 2005			
Parameters	Planned Sampling Frequency[1]		
	El Capitan/ San Vicente	Sutherland/ Murray	Alvarado WTP INF/EFF
Lead	M	Q	M
Magnesium	M	Q	Q
Manganese	M	Q	M
Mercury	M	Q	Q
Nickel	M	Q	Q
Nitrate**	M	M	M[3]
Nitrate + Nitrite**	Q	Q	M[3]
Nitrite as Nitrogen	Q	Q	W
Phosphate (ortho)**	M	Q	M
Phosphorus (total)**	M	Q	M
Potassium	M	Q	M
Selenium	M	Q	Q
Silver	M	Q	Q
Sulfate	M	Q	M
Thallium	M	Q	Q
Zinc	M	Q	M
Perchlorate	Q	Q	Q
Organic Constituents, Regulated			
1,1,1-Trichloroethane	Q	Q	Q[6]
1,1,2-Trichloro- 1,2,2-Trifluoroethan	Q	Q	Q[6]
1,1,2-Trichloroethane	Q	Q	Q[6]
1,1-dichloroethane	Q	Q	Q[6]
1,1-Dichloroethylene	Q	Q	Q[6]
1,2,4-Trichlorobenzene	Q	Q	Q[6]
1,2-dichloroethane	Q	Q	Q[6]
1,2-Dichloropropane	Q	Q	Q[6]
1,4-Dichlorobenzene	Q	Q	Q[6]
2,4,5 TP	Q	Q	Q[6]
2,4-D	Q	Q	Q[6]
Alachlor	Q	Q	Q[6]
Atrazine	Q	Q	Q[6]
Bentazon	Q	Q	Q[6]
Benzene	Q	Q	Q[6]
Benzo(a)pyrene	Q	Q	Q[6]
Bromodichloromethane	Q	Q	Q[6]
Bromoform	Q	Q	Q[6]
Carbofuran	Q	Q	Q[6]
Chloramine	Q	Q	Q[6]
Chlordane	Q	Q	Q[6]
Chlorine	Q	Q	Q[6]

Table 2-4.1 RAW WATER QUALITY MONITORING PROGRAM ALVARADO TREATMENT PLANT INFLUENT AND EFFLUENT, AND MURRAY, EL CAPITAN, SAN VICENTE, AND SUTHERLAND RESERVOIRS, 2001 THROUGH 2005			
Parameters	**Planned Sampling Frequency[1]**		
	El Capitan/ San Vicente	**Sutherland/ Murray**	**Alvarado WTP INF/EFF**
Chlorine Dioxide	Q	Q	Q[6]
Chloroform	Q	Q	Q[6]
cis-1,2-Dichloroethylene	Q	Q	Q[6]
Dalapon	Q	Q	Q
Di(2-ethylhexyl) adipate	Q	Q	Q[6]
Di(2-ethylhexyl) pthalate	Q	Q	Q[6]
Dibromochloromethane	Q	Q	Q[6]
Dibromochloropropane	Q	Q	Q[6]
Dichloroacetic acid	Q	Q	Q[6]
Dichloromethane (methylene chlori	Q	Q	Q[6]
Dinoseb	Q	Q	Q[6]
Diquat	Q	Q	Q
Endrin	Q	Q	Q[6]
Ethylbenzene	Q	Q	Q[6]
Glyphosate	Q	Q	Q[6]
Haloacetic acids (HAA5) (five)	Q	Q	Q
Heptachlor	Q	Q	Q[6]
Heptachlor epoxide	Q	Q	Q[6]
Hexachlorobenzene	Q	Q	Q[6]
Hexachlorocyclopentadiene	Q	Q	Q[6]
Lindane	Q	Q	Q[6]
Methoxychlor	Q	Q	Q[6]
Methyl tert-Butyl Ether (MTBE)	Q	Q	Q[6]
Molinate	Q	Q	Q[6]
Monochlorobenzene	Q	Q	Q[6]
o-Dichlorobenzene	Q	Q	Q[6]
Oxamyl	Q	Q	Q[6]
Pentachlorophenol	Q	Q	Q[6]
Picloram	Q	Q	Q[6]
Polychlorinated biphenyls (PCBs)	Q	Q	Q[6]
Simazine	Q	Q	Q[6]
Styrene	Q	Q	Q[6]
Tetrachloroethylene	Q	Q	Q[6]
Thiobencarb	Q	Q	Q[6]
Toluene	Q	Q	Q[6]
Total Organic Carbon (TOC)	M	Q	Q[6]
Total trihalomethanes (TTHM)	Q	Q	Q[6]
Toxaphene	Q	Q	Q[6]
trans-1,2-Dichloroethylene	Q	Q	Q[6]
Trichloroacetic acid	Q	Q	Q[6]
Trichloroethylene	Q	Q	Q[6]

Table 2-4.1 RAW WATER QUALITY MONITORING PROGRAM ALVARADO TREATMENT PLANT INFLUENT AND EFFLUENT, AND MURRAY, EL CAPITAN, SAN VICENTE, AND SUTHERLAND RESERVOIRS, 2001 THROUGH 2005			
Parameters	Planned Sampling Frequency[1]		
	El Capitan/ San Vicente	Sutherland/ Murray	Alvarado WTP INF/EFF
Trichlorofluoromethane	Q	Q	Q[6]
Vinyl chloride	Q	Q	Q[6]
Xylenes	Q	Q	Q[6]
Organic Constituents, Unregulated			
Ethyl-tert-Butyl Ether (ETBE)	Q	Q	Q[6]
t-Amyl-methyl ether (TAME)	Q	Q	Q[6]
1,1,1,2-Tetrachloroethane	Q	Q	Q[6]
1,1-Dichloropropene	Q	Q	Q[6]
1,2,3-Trichlorobenzene	Q	Q	Q[6]
1,2,3-Trichloropropane (TCP)	A[3]	Q	Q[6]
1,2,4-Trimethylbenzene	Q	Q	Q[6]
1,3,5-Trimethylbenzene	Q	Q	Q[6]
1,3-Dichlorobenzene	Q	Q	Q[6]
1,3-Dichloropropane	Q	Q	Q[6]
2,2-Dichloropropane	Q	Q	Q[6]
3-Hydroxycarbofuran	Q	Q	Q[6]
Aldicarb	Q	Q	Q[6]
Aldicarb sulfone	Q	Q	Q[6]
Aldicarb sulfoxide	Q	Q	Q[6]
Aldrin	Q	Q	Q[6]
Bromacil	A	A	Q
Bromobenzene	Q	Q	Q[6]
Bromochloromethane	Q	Q	Q[6]
Bromomethane	Q	Q	Q[6]
Butachlor	A	A	Q
Carbaryl	Q	Q	Q[6]
Chlorobenzene	Q	Q	Q[6]
Chloroethane	Q	Q	Q[6]
Chloromethane	Q	Q	Q[6]
Dibromomethane	Q	Q	Q[6]
Dicamba	Q	Q	Q[6]
Dichlorodifluoromethane	Q	Q	Q[6]
Dieldrin	Q	Q	Q[6]
Geosmin	M[3]	M[3, 4]	W[3, 5]
Hexachlorobutadiene	Q	Q	Q[6]
Isopropylbenzene	Q	Q	Q[6]
Methomyl	Q	Q	Q[6]
Methyl-isoborneol (MIB)	M[3]	M[3, 4]	W[3, 5]
Metolachlor	A	A	Q
Metribuzin	A	A	Q

Table 2-4.1
RAW WATER QUALITY MONITORING PROGRAM
ALVARADO TREATMENT PLANT INFLUENT AND EFFLUENT,
AND MURRAY, EL CAPITAN, SAN VICENTE, AND SUTHERLAND RESERVOIRS,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]		
	El Capitan/ San Vicente	Sutherland/ Murray	Alvarado WTP INF/EFF
Napthalene	Q	Q	Q[6]
n-Butylbenzene	Q	Q	Q[6]
n-Propylbenzene	Q	Q	Q[6]
Prometryn	A	A	Q
Propachlor	Q	Q	Q[6]
sec-Butylbenzene	Q	Q	Q[6]
tert-Butylbenzene	Q	Q	Q[6]

SAMPLING FREQUENCY DESIGNATION
D: Daily
W: Weekly
M: Monthly
Q: Quarterly
A: Annually
NS: Not Sampled

(1) Samples may be taken but not reportable due to instrumentation problems or quality control.
(2) Sample frequency is every four years. The data used in this report was obtained during 2002.
(3) Samples taken twice per month (M^3), twice per week (W^3), or twice annually (A^3).
(4) Not sampled at Sutherland Reservoir
(5) Sampled weekly at plant influent and twice weekly at plant effluent.
(6) Plant effluent was sampled more frequently than plant influent.
(7) Sampled at outlet gauges only. See Outlet Gauge Tables for El Capitan and Murray.
(8) Sampled at Sutherland only, quarterly since July 2004.

NOTE:
** Denotes the start of a new parameter since the 2000 Sanitary Survey was completed.
Sampling frequency represents current monitoring schedule as of January 2001.

Table 2-4.2
SUMMARY OF RAW WATER QUALITY**
SAN DIEGO RIVER SYSTEM WATERSHED[1] 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[2] MCLor AL	MCLG	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
General Physical									
Conductivity	µS/cm			900-1600	59	251	3120	1837	2000
Total Dissolved Solids	mg/L	10		500-1000	90	225	2080	1170	1190
Inorganic Constituents									
Aluminum	µg/L	50	1000	200	14	nd	652	183	122
Antimony	µg/L	6	6		16	nd	nd	nd	nd
Arsenic	µg/L	2	50		16	nd	nd	nd	nd
Barium	µg/L	100	1000		3	nd	224	114	147
Beryllium	µg/L	1	4		5	nd	nd	nd	nd
Cadmium	µg/L	1	5		16	nd	nd	nd	nd
Chromium	µg/L	10	50		14	nd	nd	nd	nd
Copper	µg/L	50	1300 AL	1000	16	nd	nd	nd	nd
Lead	µg/L	5	15 AL		16	nd	21.2	1.25	nd
Manganese	µg/L	20		50	15	nd	1410	310	191
Nickel	µg/L	10	100		15	nd	nd	nd	nd
Potassium	mg/L	0.5			2	4.5	11.8	8.15	8.15
Selenium	µg/L	5	50		15	nd	nd	nd	nd
Silver	µg/L	10		100	6	nd	nd	nd	nd
Thallium	µg/L	1	2		23	nd	nd	nd	nd
Zinc	µg/L	50		5000	9	nd	nd	nd	nd
Nitrate	mg/L	2	45		91	nd	68.4	17.2	11.4
Nitrate + Nitrite as Nitrogen	mg/L		10		36	nd	61.5	16.80	10.2
Total Nitrogen	mg/L				35	0.187	9.15	2.16	1.18
Phosphorus	mg/L				118	0.043	2.23	0.31	0.159
Phosphate (ortho)	mg/L				112	0.105	1.95	0.461	0.341
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		87	nd			
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		87	nd			
1,1,2-Trichloroethane	µg/L	0.5	5		87	nd			
1,1-Dichloroethane	µg/L	0.5	5		87	nd			
1,1-Dichloroethylene	µg/L	0.5	6		87	nd			
1,2,4-Trichlorobenzene	µg/L	0.5	70		87	nd			
1,2-dichloroethane	µg/L	0.5	0.5		87	nd			
1,2-Dichloropropane	µg/L	0.5	5		87	nd			
1,4-Dichlorobenzene	µg/L	0.5	5		87	nd			
Alachlor	µg/L	1	2		58	nd			
Atrazine	µg/L	1	3		57	nd			
Benzene	µg/L	2	18		87	nd			
Benzo(a)pyrene	µg/L	0.5	1		52	nd			
Bromodichloromethane	µg/L	0.1	0.2		87	nd			
Bromoform	µg/L	0.5			87	nd			
Carbofuran	µg/L	0.5			72	nd			
Chlordane	µg/L	5	18		64	nd			
Chloroform	µg/L	0.1	0.1		87	nd			
cis-1,2-Dichloroethylene	µg/L	0.5			87	nd			
Di(2-ethylhexyl) adipate	µg/L	0.5	6		55	nd			
Di(2-ethylhexyl) pthalate	µg/L	5	400		52	1.00	2.79	1.65	1.38
Dibromochloromethane	µg/L	3	4		87	nd			
Dichloromethane (methylene chloride)	µg/L	0.5			87	nd			
Endrin	µg/L	4	20		77	nd			
Ethylbenzene	µg/L	0.1	2		87	nd			
Heptachlor	µg/L	0.5	60		75	nd			
Heptachlor epoxide	µg/L	0.01	0.01		75	nd			

Table 2-4.2 SUMMARY OF RAW WATER QUALITY** SAN DIEGO RIVER SYSTEM WATERSHED[1] 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[2] MCL or AL	MCLG	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Hexachlorobenzene	µg/L	0.01	0.01		79	nd			
Hexachlorocyclopentadiene	µg/L	0.05	1		76	nd			
Lindane	µg/L	1	50		68	nd			
Methoxychlor	µg/L	0.2	0.2		77	nd			
Methyl t-Butyl Ether (MTBE)	µg/L	10	40	0.005	87	nd	0.242		
Molinate	µg/L	3	13		9	nd			
Monochlorobenzene	µg/L	2	20		87	nd			
Oxamyl	µg/L	0.5	600		72	nd			
Polychlorinated biphenyls (PCBs)	µg/L	1	500		46	nd			
Simazine	µg/L	0.5	0.5		38	nd			
Styrene	µg/L	1	4		87	nd			
Tetrachloroethylene					87	nd			
Toluene	µg/L		70		87	nd			
Toxaphene	µg/L	0.5	80		68	nd			
Trichloroethylene	µg/L	0.5	10		87	nd			
Trichlorofluoromethane	µg/L	0.5	5		87	nd			
Vinyl chloride	µg/L	5	150		87	nd			
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether (ETBE)	µg/L	0.3			87	nd			
t-Amyl-methyl ether (TAME)	µg/L	0.2			87	nd			
1,1,1,2-Tetrachloroethane	µg/L	0.5			87	nd			
1,1-Dichloropropene	µg/L	0.5			87	nd			
1,2,3-Trichlorobenzene	µg/L	0.5			87	nd			
1,2,3-Trichloropropane (TCP)	µg/L	0.5			45	nd			
1,2,4-Trimethylbenzene	µg/L	0.2			87	nd			
1,3,5-Trimethylbenzene	µg/L	0.2			87	nd			
1,3-Dichlorobenzene	µg/L	0.5			87	nd			
1,3-Dichloropropane	µg/L	0.5			87	nd			
2,2-Dichloropropane	µg/L	0.5			87	nd			
3-Hydroxycarbofuran	µg/L	3			87	nd			
Aldicarb	µg/L	3			72	nd			
Aldicarb sulfone	µg/L	4			72	nd			
Aldicarb sulfoxide	µg/L	3			68	nd	0.705		
Aldrin	µg/L	0.075			75	nd			
Bromobenzene	µg/L	0.5			87	nd			
Bromochloromethane	µg/L	0.5			87	nd			
Bromomethane	µg/L	0.5			87	nd			
Carbaryl	µg/L	5			72	nd			
Chlorobenzene	µg/L	0.5			87	nd			
Chloroethane	µg/L	0.5			87	nd			
Chloromethane	µg/L	0.5			87	nd			
Dibromomethane	µg/L	0.5			87	nd			
Dichlorodifluoromethane	µg/L	1			87	nd			
Dieldrin	µg/L	0.02			77	nd			
Hexachlorobutadiene	µg/L	0.5			87	nd			
Isopropylbenzene	µg/L	0.5			87	nd			
Methomyl	µg/L	2			72	nd			
Napthalene	µg/L	0.5			83	nd			
n-Butylbenzene	µg/L	0.5			105	nd			
tert-Butylbenzene	mg/L	0.5			87	nd			

Table 2-4.2 SUMMARY OF RAW WATER QUALITY** SAN DIEGO RIVER SYSTEM WATERSHED[1] 2001 - 2005									
Parameters	Units	DLR*/	Drinking Water Standards[2]		No. of Samples	Raw Water quality			
		MDL	MCLor AL	MCLG		MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported as MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) The sampling points summarized are: BAR4, BD3, CED3, CHC3, CON3, KIM4, PZC3, SDR2B, SDR3, SNC4, AND SNC5.

(2) State MCL and MCLG values may be more stringent then federal standards for treated water.

(3) Trace metal samples were filtered before analysis. The results reflect dissolved trace metals.

nd: non-detected at State of California DLR

Table 2-4.3
SUMMARY OF RAW WATER QUALITY**
EL CAPITAN RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			58	107	169	145	147
Color	cu	1		15	58	4.0	110	17	14.0
Conductivity	µS/cm			900-1600	57	506	1070	772	751
Corrosivity[3]	--			non-corrosive	51	0.27	1.61	0.9	0.9
Foaming Agents (MBAS)	mg/L			0.5	4	0.043	0.080	0.058	0.055
Hardness as $CaCO_3$	mg/L	2			58	151	271	220	229
pH	units			6.5-8.5	54	7.81	9.23	8.40	8.44
Total Dissolved Solids	mg/L	10		500-1000	56	159	1010	454	437
Turbidity[2]	ntu	0.07	0.5	5	58	0.11	16.9	2.22	1.77
Microbiological[4]									
Total Coliform	/100ml	10	(4)		248	nd	>24000	3739	880
Enterococcus	/100ml	1			248	nd	53	1.4	nd
E. Coli	/100ml	10			248	nd	74	1.3	nd
Radiological									
Gross Alpha particles	pCi/L	3	15		4	nd	3.28	nd	nd
Gross Beta particles	pCi/L	4	50		4	nd	7.15	4.42	5.27
Combined Radium-226 & Radium-228	pCi/L		5		4	nd	nd	nd	nd
Strontium-90	pCi/L	2	8		3	nd	nd	nd	nd
Tritium	pCi/L	100	20000		4	nd	188	nd	nd
Uranium	pCi/L	2	20		4	2.41	2.96	2.61	2.54
Inorganic Constituents									
Aluminum	µg/L	30	100	200	58	nd	524	55.3	nd
Antimony	µg/L	6	6		52	nd	nd	nd	nd
Arsenic	µg/L	2	10		52	nd	2.15	nd	nd
Barium	µg/L	100	1000		52	nd	nd	nd	nd
Beryllium	µg/L	1	4		50	nd	nd	nd	nd
Cadmium	µg/L	1	5		53	nd	nd	nd	nd
Calcium	mg/L	5			58	36.0	88.4	58.4	58.0
Chloride	mg/L	6.5		250-500	57	37.4	98.8	66.9	68.2
Chromium	µg/L	10	50		53	nd	1.29	nd	nd
Copper	µg/L	50	1300	1000	60	nd	nd	nd	nd
Cyanide	µg/L	100	200		13	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		57	0.130	0.315	0.248	0.261
Iron	µg/L	100		300	60	nd	1110	nd	nd
Lead	µg/L	5	1.5		58	nd	9.28	nd	nd
Magnesium	mg/L	3			58	4.50	30.4	18.1	18
Manganese	µg/L	20		50	60	nd	183	22.9	nd
Mercury	µg/L	1	2		44	nd	nd	nd	nd
Nickel	µg/L	10	100		63	nd	nd	nd	nd
Nitrate	mg/L	2	45		78	nd	4.14	nd	nd
Nitrate + Nitrite	mg/L		10		26	nd	4.51	nd	nd
Nitrite as Nitrogen	mg/L	0.4	1		31	nd	nd	nd	nd
Potassium	mg/L	0.5			60	2.87	7.13	4.47	4.41
Selenium	µg/L	5	50		62	nd	nd	nd	nd
Silver	µg/L	10		100	62	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	57	53	183	112	112
Thallium	µg/L	1	2		61	nd	nd	nd	nd
Zinc	µg/L	50		5000	59	nd	nd	nd	nd

Table 2-4.3 SUMMARY OF RAW WATER QUALITY** EL CAPITAN RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Perchlorate	µg/L	5			23	nd	nd	nd	nd
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		22	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		22	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		22	nd	nd	nd	nd
1,1-Dichloroethane	µg/L	0.5	5		22	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		22	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		22	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	.5		22	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		22	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		22	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		22	nd	nd	nd	nd
2,4-D	µg/L	10	70		22	nd	nd	nd	nd
Alachlor	µg/L	1	2		22	nd	nd	nd	nd
Atrazine	µg/L	1	3		22	nd	nd	nd	nd
Bentazon	µg/L	2	18		22	nd	nd	nd	nd
Benzene	µg/L	0.5	1		22	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	.2		11	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			22	nd	nd	nd	nd
Bromoform	µg/L	0.5			11	nd	nd	nd	nd
Carbofuran	µg/L	5	18		22	nd	nd	nd	nd
Chlordane	µg/L	0.1	.1		22	nd	nd	nd	nd
Chloroform	µg/L	0.5			11	nd	nd	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		22	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		22	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		22	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			22	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		22	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		22	nd	nd	nd	nd
Diquat	µg/L	4	20		22	nd	nd	nd	nd
Endrin	µg/L	0.1	2		22	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		22	nd	nd	nd	nd
Glyphosate	µg/L	25	700		22	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		22	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		22	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		22	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		22	nd	nd	nd	nd
Lindane	µg/L	0.2	.2		22	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		22	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	22	nd	6.85	nd	nd
Molinate	µg/L	2	20		22	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		22	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		22	nd	nd	nd	nd
Oxamyl	µg/L	20	200		22	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		22	nd	nd	nd	nd
Picloram	µg/L	1	500		22	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	.5		22	nd	nd	nd	nd
Simazine	µg/L	1	4		22	nd	nd	nd	nd
Styrene	µg/L	0.5	100		22	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		22	nd	nd	nd	nd

Table 2-4.3 SUMMARY OF RAW WATER QUALITY** EL CAPITAN RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
Thiobencarb	µg/L		70	1	22	nd	nd	nd	nd
Toluene	µg/L	0.5	150		22	nd	nd	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			77	3.86	7.08	5.59	5.71
Toxaphene	µg/L	1	3		22	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		22	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		22	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		22	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	.5		22	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		22	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether (ETBE)	µg/L	0.3			18	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			18	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			18	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			18	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			18	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			9	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			18	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			18	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			18	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			18	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			18	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			17	nd	nd	nd	nd
Aldicarb	µg/L	3			16	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			17	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			17	nd	nd	nd	nd
Aldrin	µg/L	0.075			20	nd	nd	nd	nd
Bromacil	µg/L	10			7	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			18	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			18	nd	nd	nd	nd
Bromomethane	µg/L	0.5			18	nd	nd	nd	nd
Butachlor	µg/L	0.38			7	nd	nd	nd	nd
Carbaryl	µg/L	5			17	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			18	nd	nd	nd	nd
Chloroethane	µg/L	0.5			18	nd	nd	nd	nd
Chloromethane	µg/L	0.5			18	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			18	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			18	nd	nd	nd	nd
Dieldrin	µg/L	0.02			19	nd	nd	nd	nd
Geosmin	µg/L	0.003			150	nd	0.043	nd	nd
Hexachlorobutadiene	µg/L	0.5			18	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			18	nd	nd	nd	nd
Methomyl	µg/L	2			17	nd	nd	nd	nd
Metolachlor	µg/L	10			7	nd	nd	nd	nd
Methyl-isoborneol	µg/L	0.004			148	nd	0.062	0.006	nd
Metribuzin	µg/L	.5			7	nd	nd	nd	nd
Napthalene	µg/L	0.5			35	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			18	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			18	nd	nd	nd	nd
Prometryn	µg/L	2			7	nd	nd	nd	nd
Propachlor	µg/L	0.5			36	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			18	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			18	nd	nd	nd	nd

Table 2-4.3
SUMMARY OF RAW WATER QUALITY**
EL CAPITAN RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

nd: non-detected at State DLR or MDL if DLR not Available

Table 2-4.4
SUMMARY OF RAW WATER QUALITY**
EL CAPITAN RESERVOIR AT OUTLET GAUGES 2001 - 2005

Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
57	**General Physical**									
	Color	cu	1		15	194	5	118	20	17
	Odor - Threshold	Odor	1		3	184	nd	17	4.5	3
	Turbidity[2]	ntu	0.07	0.5	5	196	0.1	35.7	3.22	1.5
	Microbiological[3]									
	Total Coliform	/100ml	10	(3)		192	10	>24000	1654	450
	Enterococcus	/100ml	1			192	nd	33	1.1	nd
	E. Coli	/100ml	10			192	nd	74	1.6	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			56	3.45	6.28	4.89	4.92
	Geosmin	ng/L	3			150	nd	6.56	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			167	nd	18.4	nd	nd
82	**General Physical**									
	Color	cu	1		15	192	3	135	18.8	16
	Odor - Threshold	Odor	1		3	185	nd	17	4.7	4
	Turbidity[2]	ntu	0.07	0.5	5	195	0.28	25.3	2.23	1.54
	Microbiological[3]									
	Total Coliform	/100ml	10	(3)		192	10	>24000	2288	620
	Enterococcus	/100ml	1			192	nd	44	1.1	nd
	E. Coli	/100ml	10			192	nd	63	1.5	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			55	3.67	6.38	5.13	5.18
	Geosmin	µg/L	3			150	nd	11.7	nd	nd
	Methyl Isoborneol (MIB)	µg/L	4			147	nd	28.0	3.5	nd
107	**General Physical**									
	Color	cu	1		15	145	5	135	18	15.0
	Odor - Threshold	Odor	1		3	139	nd	17	5	3
	Turbidity[2]	ntu	0.07	0.5	5	146	0.10	27.3	2.09	1.25
	Microbiological[3]									
	Total Coliform	/100ml	10	(3)		144	nd	>24000	3132	790
	Enterococcus	/100ml	1			144	nd	33.0	1.3	nd
	E. Coli	/100ml	10			144	nd	74	1.4	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			39	3.86	6.73	5.41	5.45
	Geosmin	µg/L	3			115	nd	8.66	nd	nd
	Methyl Isoborneol (MIB)	µg/L	4			115	nd	63.1	4.8	nd
132	**General Physical**									
	Color	cu	1		15	46	6	200	23.3	15.5
	Odor - Threshold	Odor	1		3	44	nd	17	6	5
	Turbidity[2]	ntu	0.07	0.5	5	46	0.17	29.4	2.45	1.01

Table 2-4.4 SUMMARY OF RAW WATER QUALITY** EL CAPITAN RESERVOIR AT OUTLET GAUGES 2001 - 2005										
Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
	Microbiological[3]									
	Total Coliform	/100ml	10	(3)		46	20	>24000	3616	575
	Enterococcus	/100ml	1			45	nd	5.2	nd	nd
	E. Coli	/100ml	10			45	nd	31	2.9	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			9	5.49	5.94	5.72	5.69
	Geosmin	µg/L	3			39	nd	6.08	nd	nd
	Methyl Isoborneol (MIB)	µg/L	4			38	nd	38.4	5.84	5.03
157	**General Physical**									
	Color	cu	1		15	20	6	30	16.9	16.0
	Odor - Threshold	Odor	1		3	20	1	17	6.55	5
	Turbidity[2]	ntu	0.07	0.5	5	20	0.690	3.48	1.87	1.83
	Microbiological[3]									
	Total Coliform	/100ml	10	(3)		20	98	>24000	7329	3400
	Enterococcus	/100ml	1			20	nd	14	2.2	nd
	E. Coli	/100ml	10			20	nd	10	nd	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			4	5.70	5.96	5.85	5.87
	Geosmin	µg/L	3			18	13.7	58.8	36.3	36.3
	Methyl Isoborneol (MIB)	µg/L	4			17	3.93	50.0	12.5	10.2

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) No more then 5% of distribution system samples can be total coliform positive

nd: non-detected at State DLR or MDL if DLR not Available

Table 2-4.5 SUMMARY OF RAW WATER QUALITY ** SAN VICENTE RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			61	93.9	147	122	124
Color	cu	1		15	61	2.0	26	6.52	6.0
Conductivity	µS/cm			900-1600	62	696	1090	853	832
Corrosivity[3]	--			non-corrosive	50	-0.03	1.43	0.7	0.86
Foaming Agents (MBAS)	mg/L			0.5	4	nd	0.090	nd	nd
Hardness as $CaCO_3$	mg/L	2			61	170	278	219	223
pH	units			6.5-8.5	51	7.61	9.37	8.42	8.48
Total Dissolved Solids	mg/L	10		500-1000	62	147	718	478	480
Turbidity[2]	ntu	0.07	0.5	5	61	0.14	7.54	0.80	0.48
Microbiological[4]									
Total Coliform	/100ml	10	(4)		261	10	>24000	2666	560
Enterococcus	/100ml	1			257	nd	8.2	nd	nd
E. Coli	/100ml	10			258	nd	550	nd	nd
Radiological									
Gross Alpha particles	pCi/L	3	15		4	nd	3.04	nd	nd
Gross Beta particles	pCi/L	4	50		4	nd	7.27	nd	nd
Combined Radium-226 & Radium-228	pCi/L		5		4	nd	1.27	nd	nd
Strontium-90	pCi/L	2	8		4	nd	nd	nd	nd
Tritium	pCi/L	1000	20000		4	nd	nd	nd	nd
Uranium	pCi/L	2	20		4	nd	2.71	nd	2.30
Inorganic Constituents[5]									
Aluminum	µg/L	50	100	200	58	nd	76.3	nd	nd
Antimony	µg/L	6	6		51	nd	nd	nd	nd
Arsenic	µg/L	2	10		51	nd	2.3	nd	nd
Barium	µg/L	100	1000		51	nd	nd	nd	nd
Beryllium	µg/L	1	4		51	nd	nd	nd	nd
Cadmium	µg/L	1	5		52	nd	nd	nd	nd
Calcium	mg/L	5			60	33.2	91.8	55.4	53.6
Chloride	mg/L	6.5		250-500	60	60.8	90.6	77.4	81.6
Chromium	µg/L	10	50		49	nd	3.98	nd	nd
Copper	µg/L	50	1300	1000	60	nd	nd	nd	nd
Cyanide	µg/L	100	200		13	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		57	0.197	0.486	0.277	0.277
Iron	µg/L	100		300	77	nd	156	nd	nd
Lead	µg/L	5	1.5		59	nd	nd	nd	nd
Magnesium	mg/L	3			60	7.6	30.9	19.7	20.1
Manganese	µg/L	20		50	76	nd	106	nd	nd
Mercury	µg/L	1	2		44	nd	nd	nd	nd
Nickel	µg/L	10	100		52	nd	nd	nd	nd
Nitrate	mg/L	2	45		96	nd	4.93	nd	nd
Nitrate + Nitrite	mg/L		10		23	nd	4.39	0.89	0.28
Nitrite as Nitrogen	mg/L	0.4	1		43	nd	nd	nd	nd
Phosphate (ortho)	mg/L				107	nd	0.212	0.02	nd
Phosphorus	mg/L				71	nd	0.150	nd	nd
Potassium	mg/L	0.5			60	3.67	6.88	4.57	4.40
Selenium	µg/L	5	50		62	nd	nd	nd	nd
Silver	µg/L	10		100	62	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	59	111	189	145	155
Thallium	µg/L	1	2		60	nd	nd	nd	nd
Zinc	µg/L	50		5000	70	nd	nd	nd	nd
Perchlorate	µg/L	5			23	nd	nd	nd	nd
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		21	nd	nd	nd	nd

Table 2-4.5
SUMMARY OF RAW WATER QUALITY **
SAN VICENTE RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		21	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		21	nd	nd	nd	nd
1,1-dichloroethane	µg/L	0.5	5		21	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		21	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		21	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	.5		21	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		21	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		21	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		19	nd	nd	nd	nd
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		27	nd	nd	nd	nd
Atrazine	µg/L	1	3		29	nd	nd	nd	nd
Bentazon	µg/L	2	18		17	nd	nd	nd	nd
Benzene	µg/L	0.5	1		21	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	.2		19	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			21	nd	nd	nd	nd
Bromoform	µg/L	0.5			21	nd	nd	nd	nd
Carbofuran	µg/L	5	18		17	nd	nd	nd	nd
Chlordane	µg/L	0.1	.1		20	nd	nd	nd	nd
Chloroform	µg/L	0.5			21	nd	nd	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		21	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		19	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		17	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			21	nd	nd	nd	nd
Dibromochloropropane	µg/L	0.1	5		21	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.5	7		21	nd	nd	nd	nd
Dinoseb	µg/L	4	20		18	nd	nd	nd	nd
Endrin	µg/L	0.1	2		37	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		21	nd	nd	nd	nd
Glyphosate	µg/L	25	700		15	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		20	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		20	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		37	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		37	nd	nd	nd	nd
Lindane	µg/L	0.2	.2		20	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		38	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	21	nd	6.65	nd	nd
Molinate	µg/L	2	20		18	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		21	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		21	nd	nd	nd	nd
Oxamyl	µg/L	20	200		17	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		17	nd	nd	nd	nd
Picloram	µg/L	1	500		18	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	.5		16	nd	nd	nd	nd
Simazine	µg/L	1	4		23	nd	nd	nd	nd
Styrene	µg/L	0.5	100		21	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		21	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	19	nd	nd	nd	nd
Toluene	µg/L	0.5	150		21	nd	nd	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			79	3.44	6.78	4.52	4.45
Toxaphene	µg/L	1	3		20	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		21	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		21	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		21	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	.5		21	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		21	nd	0.547	nd	nd

Table 2-4.5 SUMMARY OF RAW WATER QUALITY ** SAN VICENTE RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			21	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			21	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			21	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			21	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			12	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			21	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			21	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			21	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			21	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			17	nd	nd	nd	nd
Aldicarb	µg/L	3			16	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			17	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			17	nd	nd	nd	nd
Aldrin	µg/L	0.075			20	nd	nd	nd	nd
Bromacil	µg/L	10			10	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			21	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			21	nd	nd	nd	nd
Bromomethane	µg/L	0.5			21	nd	nd	nd	nd
Butachlor	µg/L	0.38			8	nd	nd	nd	nd
Carbaryl	µg/L	5			17	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
Chloroethane	µg/L	0.5			21	nd	nd	nd	nd
Chloromethane	µg/L	0.5			21	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			21	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			21	nd	nd	nd	nd
Dieldrin	µg/L	0.02			20	nd	nd	nd	nd
Geosmin	µg/L	0.003			151	nd	0.151	0.007	nd
Hexachlorobutadiene	µg/L	0.5			21	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			21	nd	nd	nd	nd
Methomyl	µg/L	2			17	nd	nd	nd	nd
Methyl Isoborneol (MIB)	µg/L	0.004			150	nd	0.025	nd	nd
Metolachlor	µg/L	10			10	nd	nd	nd	nd
Metribuzin	µg/L	.5			10	nd	nd	nd	nd
Napthalene	µg/L	0.5			40	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			21	nd	nd	nd	nd
Prometryn	µg/L	2			10	nd	nd	nd	nd
Propachlor	µg/L	.1			38	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd

Table 2-4.5 SUMMARY OF RAW WATER QUALITY ** SAN VICENTE RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/	Drinking Water Standards[1]		No. of	Raw Water quality			
		MDL	MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.
** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.
(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.
(3) Based on the Langelier Index. A plus quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.
(4) No more then 5% of distribution system samples can be total coliform positive
(5) Trace metal samples were filtered before analysis. Results reflect the dissolved trace metal fraction.
nd: non-detected at State DLR or MDL if DLR not Available

Table 2-4.6
SUMMARY OF RAW WATER QUALITY **
SAN VICENTE RESERVOIR AT OUTLET GAUGES 2001 - 2005

Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
50	**General Physical**									
	Color	cu	1		15	198	2	34	7.6	7
	Odor - Threshold				3	171	nd	17	3.30	3
	Turbidity[2]	ntu	0.07	0.5	5	199	0.19	7.12	0.66	0.42
	Microbiological[3]									
	Total Coliform	/100ml	10	(3)		195	nd	>24000	1140	230
	E. Coli	/100ml	1			195	nd	230	3.2	nd
	Enterococcus	/100ml	10			194	nd	7	nd	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			58	2.85	6.07	3.96	3.89
	Geosmin	ng/L	3			151	nd	7.41	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			150	nd	13.0	nd	nd
80	**General Physical**									
	Color	cu	1		15	201	2	20	6.75	6
	Odor - Threshold				3	172	nd	12	2.8	3
	Turbidity	ntu	0.07	0.5	5	202	0.07	3.8	0.496	0.370
	Microbiological									
	Total Coliform	/100ml	10	(3)		198	nd	17000	1220	200
	E. Coli	/100ml	1			198	nd	520	5.3	nd
	Enterococcus	/100ml	10			197	nd	4.1	nd	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			59	2.95	5.26	3.98	3.97
	Geosmin	ng/L	3			154	nd	8.51	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			153	nd	12.4	nd	nd
100	**General Physical**									
	Color	cu	1		15	32	3	19	9.6	8
	Odor - Threshold				3	33	1	12	4	3
	Turbidity	ntu	0.07	0.5	5	33	0.22	3.61	0.670	0.450
	Microbiological									
	Total Coliform	/100ml	10	(3)		37	10	>24000	2364	110
	E. Coli	/100ml	1			37	nd	420	12.5	nd
	Enterococcus	/100ml	10			37	nd	2	nd	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			5	4.13	4.98	4.43	4.34
	Geosmin	ng/L	3			33	nd	4.22	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			33	nd	17.4	1.98	nd
110	**General Physical**									
	Color	cu	1		15	201	1	27.5	7.1	6
	Odor - Threshold				3	173	nd	12	2.9	2
	Turbidity	ntu	0.07	0.5	5	201	0.10	5.81	0.562	0.380
	Microbiological									
	Total Coliform	/100ml	10	(3)		201	nd	>24000	1833	230
	E. Coli	/100ml	1			201	nd	430	4.6	nd
	Enterococcus	/100ml	10			201	nd	15	nd	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			58	3.04	5.08	4.10	4.07
	Geosmin	ng/L	3			155	nd	32.7	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			154	nd	12.5	nd	nd

Table 2-4.6
SUMMARY OF RAW WATER QUALITY **
SAN VICENTE RESERVOIR AT OUTLET GAUGES 2001 - 2005

Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
140	**General Physical**									
	Color	cu	1		15	202	2	27	7.10	6
	Odor - Threshold				3	187	nd	12.0	3.4	3
	Turbidity	ntu	0.07	0.5	5	202	0.12	5.93	0.663	0.450
	Microbiological									
	Total Coliform	/100ml	10	(3)		198	nd	>24000	2886	430
	E. Coli	/100ml	1			198	nd	520	6.2	nd
	Enterococcus	/100ml	10			198	nd	6.1	1.30	1
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			59	3.55	7.96	4.41	4.29
	Geosmin	ng/L	3			155	nd	28.3	3.71	nd
	Methyl Isoborneol (MIB)	ng/L	4			171	nd	36.1	nd	nd
170	**General Physical**									
	Color	cu	1		15	44	4	24	8.52	7
	Odor - Threshold				3	42	nd	12	4.53	3
	Turbidity	ntu	0.07	0.5	5	44	0.10	27.5	1.56	0.572
	Microbiological									
	Total Coliform	/100ml	10	(3)		43	10	14000	860	200
	E. Coli	/100ml	1			43	nd	20	nd	nd
	Enterococcus	/100ml	10			44	nd	20	1.8	1
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			11	4.05	5.54	4.78	4.73
	Geosmin	ng/L	3			39	nd	168	15.2	5.71
	Methyl Isoborneol (MIB)	ng/L	4			39	nd	47.6	3.81	nd

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) No more then 5% of distribution system samples can be total coliform positive
nd: non-detected at State DLR or MDL if DLR not Available

Table 2-4.7 SUMMARY OF RAW WATER QUALITY ** SUTHERLAND RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			20	75.9	157	131	135
Color	cu	1		15	20	7.0	39.0	25.0	25.0
Conductivity	µS/cm			900-1600	20	412	855	553	527
Corrosivity[3]	--			non-corrosive	17	-0.19	1.52	0.6	0.72
Hardness as $CaCO_3$	mg/L	2			21	103	186	152	159
pH	units			6.5-8.5	22	7.07	9.34	8.39	8.40
Total Dissolved Solids	mg/L	10		500-1000	20	221	377	310	323
Turbidity[2]	ntu	0.07	0.5	5	20	0.65	19.5	4.74	4.19
Microbiological									
Total Coliform	/100ml	10	(4)		67	74	24000	2196	930
Enterococcus	/100ml	1			73	nd	14	1.4	nd
E. Coli	/100ml	10			73	nd	41	2.1	nd
Cryptosporidium, Total[5]	/L	0.1			6	nd	nd	nd	nd
Giardia, Total[5]	/L	0.1			6	nd	nd	nd	nd
Inorganic Constituents[6]									
Aluminum	µg/L	50	100	200	21	nd	911	nd	nd
Antimony	µg/L	6	6		21	nd	28.9	nd	nd
Arsenic	µg/L	2	50		21	nd	29.9	3.99	nd
Barium	µg/L	100	1000		21	nd	725	nd	nd
Beryllium	µg/L	1	4		21	nd	nd	nd	nd
Cadmium	µg/L	1	5		21	nd	1.19	nd	nd
Calcium	mg/L	5			19	27.4	66.0	38.7	35.9
Chloride	mg/L	6.5		250-500	18	24.7	64.3	45.6	46.4
Chromium	µg/L	10	50		21	nd	16.5	nd	nd
Copper	µg/L	50	1300 AL	1000	21	nd	nd	nd	nd
Cyanide	µg/L	100	200		10	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		20	0.177	0.362	0.278	0.286
Iron	µg/L	100		300	21	nd	432	139	135
Lead	µg/L	5	15 AL		21	nd	1.01	nd	nd
Magnesium	mg/L	3			19	1.20	21.0	13.2	13.3
Manganese	µg/L	20		50	21	nd	1000	115	42.6
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		21	nd	19.3	nd	nd
Nitrate	mg/L	2	45		37	nd	3.36	nd	nd
Nitrate + Nitrite	mg/L		10		13	0.077	3.51	0.818	0.139
Nitrite as Nitrogen	mg/L	0.4	1		22	nd	nd	nd	nd
Potassium	mg/L	0.5			21	2.96	6.57	4.73	4.94
Selenium	µg/L	5	50		21	nd	11.9	nd	nd
Silver	µg/L	10		100	21	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	18	30.6	54.3	43.0	42.8
Thallium	µg/L	1	2		21	nd	nd	nd	nd
Zinc	µg/L	50		5000	21	nd	nd	nd	nd
Perchlorate	µg/L	5			21	nd	nd	nd	nd

Table 2-4.7 SUMMARY OF RAW WATER QUALITY ** SUTHERLAND RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		18	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		18	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		18	nd	nd	nd	nd
1,1-dichloroethane	µg/L	0.5	5		18	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		18	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		18	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	.5		18	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		18	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		18	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		17	nd	nd	nd	nd
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		23	nd	nd	nd	nd
Atrazine	µg/L	1	3		24	nd	nd	nd	nd
Bentazon	µg/L	2	18		17	nd	nd	nd	nd
Benzene	µg/L	0.5	1		18	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	.2		17	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			18	nd	nd	nd	nd
Bromoform	µg/L	0.5			18	nd	nd	nd	nd
Carbofuran	µg/L	5	18		17	nd	nd	nd	nd
Chlordane	µg/L	0.1	.1		18	nd	nd	nd	nd
Chloroform	µg/L	0.5			18	nd	nd	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		18	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		16	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		16	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			18	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		18	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		18	nd	nd	nd	nd
Endrin	µg/L	0.1	2		33	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		18	nd	nd	nd	nd
Glyphosate	µg/L	25	700		15	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		19	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		19	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		34	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		31	nd	nd	nd	nd
Lindane	µg/L	0.2	.2		18	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		34	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	18	nd	nd	nd	nd
Molinate	µg/L	2	20		13	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		18	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		18	nd	nd	nd	nd
Oxamyl	µg/L	20	200		17	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		17	nd	nd	nd	nd
Picloram	µg/L	1	500		18	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	.5		14	nd	nd	nd	nd
Simazine	µg/L	1	4		19	nd	nd	nd	nd
Styrene	µg/L	0.5	100		18	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		18	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	19	nd	nd	nd	nd
Toluene	µg/L	0.5	150		18	nd	nd	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			19	8.05	12.2	9.76	9.61
Toxaphene	µg/L	1	3		18	nd	nd	nd	nd

Table 2-4.7
SUMMARY OF RAW WATER QUALITY **
SUTHERLAND RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
trans-1,2-Dichloroethylene	µg/L	0.5	10		18	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		18	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		18	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	.5		18	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		18	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			18	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			18	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			18	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			18	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			18	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			18	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			18	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			18	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			18	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			18	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			18	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			17	nd	nd	nd	nd
Aldicarb	µg/L	3			16	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			17	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			17	nd	nd	nd	nd
Aldrin	µg/L	0.075			19	nd	nd	nd	nd
Bromacil	µg/L	10			7	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			18	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			18	nd	nd	nd	nd
Bromomethane	µg/L	0.5			18	nd	nd	nd	nd
Butachlor	µg/L	0.38			5	nd	0.734	nd	nd
Carbaryl	µg/L	5			17	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			18	nd	nd	nd	nd
Chloroethane	µg/L	0.5			18	nd	nd	nd	nd
Chloromethane	µg/L	0.5			18	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			18	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			18	nd	nd	nd	nd
Dieldrin	µg/L	0.02			18	nd	nd	nd	nd
Hexachlorobutadiene	µg/L	0.5			18	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			18	nd	nd	nd	nd
Methomyl	µg/L	2			17	nd	nd	nd	nd
Metolachlor	µg/L	10			7	nd	nd	nd	nd
Metribuzin	µg/L	.5			7	nd	nd	nd	nd
Napthalene	µg/L	0.5			33	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			18	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			18	nd	nd	nd	nd
Prometryn	µg/L	2			7	nd	nd	nd	nd
Propachlor	µg/L	.1			34	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			18	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			18	nd	nd	nd	nd

Table 2-4.7
SUMMARY OF RAW WATER QUALITY **
SUTHERLAND RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.
** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

(5) Beginning July of 2004

(6) Trace metal samples were filtered before analysis. Results reflect the dissolved trace metal fraction.

nd: non-detected at State DLR or MDL if DLR not Available

Table 2-4.8
SUMMARY OF RAW WATER QUALITY**
MURRAY RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			20	103	129	115	114
Color	cu	1		15	20	nd	9	4.1	4
Conductivity	µS/cm			900-1600	20	873	1200	993	967
Corrosivity[3]	--			non-corrosive	17	-0.07	1.03	0.58	0.64
Foaming Agents (MBAS)	mg/L			0.5	4	nd	0.080	0.04	0.045
Hardness as $CaCO_3$	mg/L	2			21	227	293	250	246
pH	units			6.5-8.5	18	7.46	8.60	8.25	8.31
Total Dissolved Solids	mg/L	10		500-1000	20	356	618	544	549
Turbidity[2]	ntu	0.07	0.5	5	20	0.23	2.5	0.56	0.43
Microbiological									
Total Coliform	/100ml	10	(4)		250	10	>24000	1566	470
Enterococcus	/100ml	1			250	nd	160	5.7	2
E. Coli	/100ml	10			250	nd	940	46.4	20
Radiological									
Gross Alpha particles	pCi/L	3	15		4	nd	4.45	nd	nd
Gross Beta particles	pCi/L	4	50		4	nd	7.32	nd	nd
Combined Radium-226 & Radium-228	pCi/L		5		4	nd	1.68	nd	nd
Strontium-90	pCi/L	2	8		4	nd	nd	nd	nd
Tritium	pCi/L	1000	20,000		4	nd	nd	nd	nd
Uranium	pCi/L	2	20		4	2.81	3.73	3.38	3.49
Inorganic Constituents[5]									
Aluminum	µg/L	50	1000	200	21	nd	nd	nd	nd
Antimony	µg/L	6	6		21	nd	nd	nd	nd
Arsenic	µg/L	2	10		21	nd	nd	nd	nd
Barium	µg/L	100	1000		21	nd	nd	nd	nd
Beryllium	µg/L	1	4		21	nd	nd	nd	nd
Cadmium	µg/L	1	5		21	nd	nd	nd	nd
Calcium	mg/L	5			19	nd	80.0	59.8	64.4
Chloride	mg/L	6.5		250-500	18	96.2	118	108	108
Chromium	µg/L	10	50		21	nd	1.08	nd	nd
Copper	µg/L	50	1300	1000	21	nd	nd	nd	nd
Cyanide	µg/L	100	200		13	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		20	0.236	0.353	0.283	0.286
Iron	µg/L	100		300	21	nd	0.142	nd	nd
Lead	µg/L	5	15		21	nd	nd	nd	nd
Magnesium	mg/L	3			21	nd	36.7	21.0	22.0
Manganese	µg/L	20		50	20	nd	33.4	nd	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		21	nd	nd	nd	nd
Nitrate	mg/L	2	45		48	nd	nd	nd	nd
Nitrate + Nitrite	mg/L		10		22	nd	0.773	0.343	0.252
Nitrite as Nitrogen	mg/L	0.4	1		27	nd	nd	nd	nd
Potassium	mg/L	0.5			21	3.49	5.43	4.33	4.28
Selenium	µg/L	5	50		21	nd	nd	nd	nd
Silver	µg/L	10		100	21	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	18	146	211	168	168
Thallium	µg/L	1	2		21	nd	nd	nd	nd
Zinc	µg/L	50		5000	21	nd	58.6	nd	nd
Perchlorate	µg/L	5			24	nd	nd	nd	nd

Table 2-4.8
SUMMARY OF RAW WATER QUALITY**
MURRAY RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		19	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		19	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		19	nd	nd	nd	nd
1,1-Dichloroethane	µg/L	0.5	5		19	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		19	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		19	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	.5		19	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		19	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		19	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		18	nd	nd	nd	nd
2,4-D	µg/L	10	70		18	nd	nd	nd	nd
Alachlor	µg/L	1	2		23	nd	nd	nd	nd
Atrazine	µg/L	1	3		25	nd	nd	nd	nd
Bentazon	µg/L	2	18		16	nd	nd	nd	nd
Benzene	µg/L	0.5	1		19	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	.2		17	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			19	0.823	3.71	1.84	1.60
Bromoform	µg/L	0.5			19	nd	1.17	nd	nd
Carbofuran	µg/L	5	18		17	nd	nd	nd	nd
Chlordane	µg/L	0.1	.1		20	nd	nd	nd	nd
Chloroform	µg/L	0.5			19	nd	3.24	1.82	1.36
cis-1,2-Dichloroethylene	µg/L	0.5	6		19	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		16	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		17	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			19	0.802	3.80	1.89	1.36
Dichloromethane (methylene chloride)	µg/L	0.1	5		19	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		17	nd	nd	nd	nd
Endrin	µg/L	0.1	2		37	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		19	nd	nd	nd	nd
Glyphosate	µg/L	25	700		16	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		21	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		21	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		38	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		35	nd	nd	nd	nd
Lindane	µg/L	0.2	.2		20	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		37	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	19	nd	3.67	nd	nd
Molinate	µg/L	2	20		14	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		19	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		19	nd	nd	nd	nd
Oxamyl	µg/L	20	200		17	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		17	nd	nd	nd	nd
Picloram	µg/L	1	500		17	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	.5		16	nd	nd	nd	nd
Simazine	µg/L	1	4		20	nd	nd	nd	nd
Styrene	µg/L	0.5	100		19	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		19	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	18	nd	nd	nd	nd
Toluene	µg/L	0.5	150		19	nd	nd	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			79	3.03	5.61	4.04	3.95
Toxaphene	µg/L	1	3		20	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		19	nd	nd	nd	nd

Table 2-4.8 SUMMARY OF RAW WATER QUALITY** MURRAY RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/	Drinking Water Standards[1]		No. of	Raw Water quality			
		MDL	MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN
Trichloroethylene	µg/L	0.5	5		19	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		19	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	.5		19	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		19	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			19	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			19	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			19	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			19	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			10	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			19	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			19	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			19	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			18	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			17	nd	nd	nd	nd
Aldicarb	µg/L	3			16	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			17	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			17	nd	nd	nd	nd
Aldrin	µg/L	0.075			21	nd	nd	nd	nd
Bromacil	µg/L	10			7	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			19	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			19	nd	nd	nd	nd
Bromomethane	µg/L	0.5			19	nd	nd	nd	nd
Butachlor	µg/L	0.38			7	nd	nd	nd	nd
Carbaryl	µg/L	5			17	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
Chloroethane	µg/L	0.5			19	nd	nd	nd	nd
Chloromethane	µg/L	0.5			19	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			19	nd	nd	nd	nd
Dicamba	µg/L	15			18	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			19	nd	nd	nd	nd
Dieldrin	µg/L	0.02			20	nd	nd	nd	nd
Geosmin	ng/L				176	1.59	130	12.5	6.99
Hexachlorobutadiene	µg/L	0.5			19	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			19	nd	nd	nd	nd
Methomyl	µg/L	2			17	nd	nd	nd	nd
Methyl Isoborneol (MIB)	ng/L	10			170	3.04	19.0	6.84	5.55
Metolachlor	µg/L				7	nd	nd	nd	nd
Metribuzin	µg/L	.5			7	nd	nd	nd	nd
Napthalene	µg/L	0.5			37	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			19	nd	nd	nd	nd
Prometryn	µg/L	2			7	nd	nd	nd	nd
Propachlor	µg/L	.1			38	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd

Table 2-4.8 SUMMARY OF RAW WATER QUALITY** MURRAY RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/	Drinking Water Standards[1]		No. of	Raw Water quality			
		MDL	MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

(5) Trace metal samples were filtered before analysis. Results reflect the dissolved trace metal fraction.

nd: non-detected at State DLR or MDL if DLR not Available

Table 2-4.9
SUMMARY OF RAW WATER QUALITY**
MURRAY RESERVOIR AT OUTLET GAUGES 2001 - 2005

Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
49	**General Physical**									
	Color	cu	1		15	248	2	24	6.6	6
	Odor - Threshold	Odor	1		3	224	nd	17	3.1	3
	Turbidity[2]	ntu	0.07	0.5	5	249	0.12	7.53	0.70	0.54
	Microbiological									
	Total Coliform	/100ml	10	(3)		258	nd	>24000	1701	660
	Enterococcus	/100ml	1			249	nd	120	9.6	5.1
	E. Coli	/100ml	10			249	nd	780	59.3	20
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			59	3.00	5.04	3.85	3.78
	Geosmin	ng/L	3			175	nd	74.1	4.30	3
	Methyl Isoborneol (MIB)	ng/L	4			170	nd	31.0	nd	nd
62	**General Physical**									
	Color	cu	1			248	1	17	5.78	5
	Odor - Threshold	Odor	1		3	224	nd	17	2.99	2
	Turbidity	ntu	0.07	0.5	5	248	0.15	3.14	0.57	0.46
	Microbiological									
	Total Coliform	/100ml	10	(3)		259	nd	>24000	1602	665
	Enterococcus	/100ml	1			250	nd	72	7.1	4.1
	E. Coli	/100ml	10			250	nd	330	47.2	20
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			60	3.02	6.94	3.97	3.85
	Geosmin	ng/L	3			175	nd	90.0	7.0	4.12
	Methyl Isoborneol (MIB)	ng/L	4			170	nd	15.0	nd	nd
75	**General Physical**									
	Color	cu	1			248	1	16	5.44	5
	Odor - Threshold	Odor	1		3	229	nd	17	3.40	2
	Turbidity	ntu	0.07	0.5	5	249	0.18	1.91	0.53	0.42
	Microbiological									
	Total Coliform	/100ml	10	(3)		250	10	>24000	1471	535
	Enterococcus	/100ml	1			250	nd	84	7	1
	E. Coli	/100ml	10			250	nd	320	45.9	20
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			59	2.97	6.44	4.08	4.02
	Geosmin	ng/L	3			176	nd	65.6	7.0	4.33
	Methyl Isoborneol (MIB)	ng/L	4			172	nd	24.4	nd	nd

NOTES:
* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.
** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.
(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.
(3) No more then 5% of distribution system samples can be total coliform positive
nd: non-detected at State DLR or MDL if DLR not Available

Table 2-4.10 SUMMARY OF RAW WATER QUALITY** ALVARADO WTP INFLUENT 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water Quality MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			123	95.9	151	121	122
Color	cu	1		15	1222	nd	66	7.55	7.00
Conductivity	µS/cm			900-1600	59	659	1110	880	863
Corrosivity[3]	--			non-corrosive	53	-0.35	0.97	0.45	0.52
Foaming Agents (MBAS)	mg/L			0.5	na				
Hardness as $CaCO_3$	mg/L	2			95	156	275	233	232
pH	units			6.5-8.5	55	7.30	8.47	8.04	8.10
Total Dissolved Solids	mg/L	10		500-1000	58	364	736	501	495
Turbidity[2]	ntu	0.07	0.5	5	1754	0.08	20.4	0.85	0.66
Microbiological									
Total Coliform	/100ml	2	(4)		1797	nd	2400	93.6	23
Cryptosporidium	/L	0.1	2 log removal		57	nd	nd	nd	nd
Giardia	/L	0.1	3 log removal		57	nd	nd	nd	nd
Radiological									
Gross Alpha particles	pCi/L		15		4	2.86	3.82	3.32	3.31
Gross Beta particles	pCi/L		50		4	2.80	6.25	4.49	4.46
Combined Radium-226 & Radium-228	pCi/L		5		4	0.130	1.44	0.500	0.733
Strontium-90	pCi/L		8		4	0.0	1.17	0.560	0.510
Tritium	pCi/L		20,000		4	nd	-17		
Uranium	pCi/L	1.5	20		4	2.55	4.51	3.40	3.27
Inorganic Constituents									
Aluminum	µg/L	50	1000	200	59	nd	85.4	nd	nd
Antimony	µg/L	6	6		21	nd	nd	nd	nd
Arsenic	µg/L	2	10		21	nd	3.05	nd	2.04
Barium	µg/L	100	1000		21	nd	108	nd	nd
Beryllium	µg/L	1	4		20	nd	nd	nd	nd
Cadmium	µg/L	1	5		22	nd	nd	nd	nd
Calcium	mg/L	5			58	36.9	88.0	61.0	60.6
Chloride	mg/L	6.5		250-500	69	58.2	95.8	77.4	77.3
Chromium	µg/L	10	50		22	nd	3.10	nd	nd
Copper	µg/L	50	1300	1000	59	nd	144	nd	nd
Cyanide	µg/L	100	200		18	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		57	0.198	0.520	0.263	0.262
Iron	µg/L	100		300	59	nd	262	nd	nd
Lead	µg/L	5	15		59	nd	1.75	nd	nd
Magnesium	mg/L	3			56	nd	29.2	nd	nd
Manganese	µg/L	20		50	58	nd	95.6	20.0	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		22	nd	nd	nd	nd
Nitrate	mg/L	2	45		141	nd	4.68	nd	nd
Nitrate + Nitrite	mg/L		10		50	0.492	3.21	1.66	1.40
Nitrite as Nitrogen	mg/L	0.4	1		239	nd	nd	nd	nd
Potassium	mg/L	0.5			60	2.56	6.72	4.11	3.98
Selenium	µg/L	5	50		21	nd	nd	nd	nd
Silver	µg/L	10		100	21	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	68	82.2	233	158	161
Thallium	µg/L	1	2		21	nd	nd	nd	nd
Zinc	µg/L	50		5000	57	nd	nd	nd	nd
Perchlorate	µg/L	5			35	nd	nd	nd	nd

Table 2-4.10
SUMMARY OF RAW WATER QUALITY**
ALVARADO WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water Quality MIN	MAX	MEAN	MEDIAN
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		21	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		21	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		21	nd	nd	nd	nd
1,1-Dichloroethane	µg/L	0.5	5		21	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		21	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		21	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	0.5		21	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		21	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		21	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		16	nd	nd	nd	nd
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		26	nd	nd	nd	nd
Atrazine	µg/L	1	3		27	nd	nd	nd	nd
Bentazon	µg/L	2	18		19	nd	nd	nd	nd
Benzene	µg/L	0.5	1		21	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	0.2		20	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			96	nd	2.9	nd	nd
Bromoform	µg/L	0.5			96	nd	1.13	nd	nd
Carbofuran	µg/L	5	18		20	nd	nd	nd	nd
Chlordane	µg/L	0.1	0.1		19	nd	nd	nd	nd
Chloroform	µg/L	0.5			96	nd	3.3	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		21	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		20	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		16	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			96	nd	1.37	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		21	nd	nd	nd	nd
Dalapon	µg/L	10	200		17	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		18	nd	nd	nd	nd
Diquat	µg/L	4	20		11	nd	nd	nd	nd
Endrin	µg/L	0.1	2		37	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		21	nd	nd	nd	nd
Glyphosate	µg/L	25	700		19	nd	nd	nd	nd
Haloacetic Acids (five) [5]	µg/L	0.5	60		17	nd	nd	nd	nd
Heptachlor	µg/L	0.01	0.01		19	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	0.01		21	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		38	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		34	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		37	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	21	nd	nd	nd	nd
Molinate	µg/L	2	20		17	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		21	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		21	nd	nd	nd	nd
Oxamyl	µg/L	20	200		20	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		18	nd	nd	nd	nd
Picloram	µg/L	1	500		19	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	0.5		18	nd	nd	nd	nd
Simazine	µg/L	1	4		23	nd	nd	nd	nd
Styrene	µg/L	0.5	100		21	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	19	nd	nd	nd	nd
Toluene	µg/L	0.5	150		21	nd	nd	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			464	1.82	9.35	3.29	3.2

Table 2-4.10
SUMMARY OF RAW WATER QUALITY**
ALVARADO WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water Quality MIN	MAX	MEAN	MEDIAN
Total Trihalomethanes(TTHM)[6]	µg/L	0.5	80		88	nd	77.2	4.86	41.1
Toxaphene	µg/L	1	3		19	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		21	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		21	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		21	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	0.5		21	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		21	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			21	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			21	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			21	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			21	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			12	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			21	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			21	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			21	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			21	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			20	nd	nd	nd	nd
Aldicarb	µg/L	3			20	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			20	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			19	nd	nd	nd	nd
Aldrin	µg/L	0.075			20	nd	nd	nd	nd
Bromacil	µg/L	10			8	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			21	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			21	nd	nd	nd	nd
Bromomethane	µg/L	0.5			21	nd	nd	nd	nd
Butachlor	µg/L	0.38			8	nd	nd	nd	nd
Carbaryl	µg/L	5			20	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
Chloroethane	µg/L	0.5			21	nd	nd	nd	nd
Chloromethane	µg/L	0.5			21	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			21	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			21	nd	nd	nd	nd
Dieldrin	µg/L	0.02			20	nd	nd	nd	nd
Geosmin	ng/L	0.3			273	2.11	14.3	5.29	4.53
Hexachlorobutadiene	µg/L	0.5			21	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			21	nd	nd	nd	nd
Methomyl	µg/L	2			20	nd	nd	nd	nd
Methyl Isoborneol (MIB)	ng/L	0.4			269	2.25	25.3	7.36	5.31
Metolachlor	µg/L	10			8	nd	nd	nd	nd
Metribuzin	µg/L	0.5			8	nd	nd	nd	nd
Napthalene	µg/L	0.5			38	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			21	nd	nd	nd	nd
Prometryn	µg/L	2			8	nd	nd	nd	nd
Propachlor	µg/L	0.1			38	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd

Table 2-4.10 SUMMARY OF RAW WATER QUALITY** ALVARADO WTP INFLUENT 2001 - 2005									
Parameters	Units	DLR*/	Drinking Water Standards[1]		No. of	Raw Water Quality			
		MDL	MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.
(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.
(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.
(4) No more then 5% of distribution system samples can be total coliform positive
(5) Haloacetic acids (five) is the sum of the concentrations of mon-, di-, and trichloroacetic acids and mono- and dibromoacetic acids. MCL based on Annual Average
(6) Total trihalomethanes is the sum of the concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform. MCL based on Annual Average

nd: non-detected at State DLR or MDL if DLR not Available

Table 2-4.11
SUMMARY OF RAW WATER QUALITY
ALVARADO WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water Quality MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			60	94.6	143	122	123
Color	cu	1		15	58	nd	21	2.96	3
Conductivity	µS/cm			900-1600	59	684	1200	904	885
Corrosivity[3]	--			non-corrosive	57	11.8	13.2	12.5	12.5
Foaming Agents (MBAS)	mg/L			0.5	4	nd	0.05	nd	nd
Hardness as $CaCO_3$	mg/L	2			59	156	271	230	230
pH	units			6.5-8.5	60	7.48	8.97	8.26	8.32
Total Dissolved Solids	mg/L	10		500-1000	59	379	596	507	508
Turbidity[2]	ntu	0.07	0.5	5	598	nd	0.33	0.095	0.090
Microbiological[4]									
Total Coliform	/100ml	1	(4)		1228	nd	5 pos	nd	nd
E. Coli	/100ml	1			1228	nd	nd	nd	nd
Inorganic Constituents									
Aluminum	µg/L	50	1000	200	59	nd	nd	nd	nd
Antimony	µg/L	6	6		20	nd	nd	nd	nd
Arsenic	µg/L	2	10		20	nd	nd	nd	nd
Barium	µg/L	100	1000		20	nd	102	nd	nd
Beryllium	µg/L	1	4		18	nd	nd	nd	nd
Cadmium	µg/L	1	5		21	nd	nd	nd	nd
Calcium	mg/L	5			58	35.4	84.4	60.6	60.8
Chloride	mg/L	6.5		250-500	69	65.2	118	84.6	85.4
Chromium	µg/L	10	50		21	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	60	nd	nd	nd	nd
Cyanide	µg/L	100	200		17	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		57	0.195	0.519	0.261	0.262
Iron	µg/L	100		300	59	nd	nd	nd	nd
Lead	µg/L	5	15		58	nd	nd	nd	nd
Magnesium	mg/L	3			58	6.0	27.8	18.7	20.0
Manganese	µg/L	20		50	58	nd	nd	nd	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		21	nd	10.3	nd	nd
Nitrate	mg/L	2	45		194	nd	4.39	nd	nd
Nitrate + Nitrite	mg/L		10		99	0.335	3.25	1.54	1.26
Nitrite as Nitrogen	mg/L	0.4	1		228	nd	nd	nd	nd
Potassium	mg/L	0.5			59	2.76	6.82	4.25	4.11
Selenium	µg/L	5	50		20	nd	nd	nd	nd
Silver	µg/L	10		100	20	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	68	81.8	235	158	160
Thallium	µg/L	1	2		19	nd	nd	nd	nd
Zinc	µg/L	50		5000	57	nd	nd	nd	nd
Perchlorate	µg/L	5			35	nd	nd	nd	nd
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		164	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		95	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		95	nd	nd	nd	nd
1,1-Dichloroethane	µg/L	0.5	5		92	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		97	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		1129	nd	nd	nd	nd

Table 2-4.11 SUMMARY OF RAW WATER QUALITY ALVARADO WTP EFFLUENT 2001 - 2005										
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water Quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
1,2-dichloroethane	µg/L	0.5	0.5		205	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		166	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		93	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		210	nd	nd	nd	nd
2,4-D	µg/L	10	70		91	nd	nd	nd	nd
Alachlor	µg/L	1	2		60	nd	nd	nd	nd
Atrazine	µg/L	1	3		61	nd	nd	nd	nd
Bentazon	µg/L	2	18		45	nd	nd	nd	nd
Benzene	µg/L	0.5	1		48	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	0.2		48	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			112	8.15	32.7	19.8	19.1
Bromoform	µg/L	0.5			112	nd	13.7	2.64	2.18
Carbofuran	µg/L	5	18		47	nd	nd	nd	nd
Chlordane	µg/L	0.1	0.1		45	nd	nd	nd	nd
Chloroform	µg/L	0.5			112	nd	48.4	18.3	15
cis-1,2-Dichloroethylene	µg/L	0.5	6		48	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		48	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		42	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			112	10.2	30.4	16.3	15.6
Dichloromethane (methylene chloride)	µg/L	0.1	5		48	nd	nd	nd	nd
Dalapon	µg/L	10	200		16	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		43	nd	nd	nd	nd
Diquat	µg/L	4	20		29	nd	nd	nd	nd
Endrin	µg/L	0.1	2		82	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		48	nd	nd	nd	nd
Glyphosate	µg/L	25	700		45	nd	nd	nd	nd
Haloacetic Acids (five)[5]	µg/L	0.5	60		20	16.8	46.8	30.9	32.3
Heptachlor	µg/L	0.01	.01		45	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		47	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		84	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		74	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		45	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		82	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	54	nd	nd	nd	nd
Molinate	µg/L	2	20		45	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		48	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		48	nd	nd	nd	nd
Oxamyl	µg/L	20	200		47	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		43	nd	nd	nd	nd
Picloram	µg/L	1	500		45	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	0.5		44	nd	nd	nd	nd
Simazine	µg/L	1	4		54	nd	nd	nd	nd
Styrene	µg/L	0.5	100		48	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		48	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	45	nd	nd	nd	nd
Toluene	µg/L	0.5	150		48	nd	nd	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			700	1.87	6.86	4.01	3.17
Total Trihalomethanes(TTHM)[6]	µg/L	0.5	80		112	25.5	94.7	57.1	55.3
Toxaphene	µg/L	1	3		45	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		48	nd	nd	nd	nd

Table 2-4.11 SUMMARY OF RAW WATER QUALITY ALVARADO WTP EFFLUENT 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water Quality MIN	MAX	MEAN	MEDIAN
Trichloroethylene	µg/L	0.5	5		88	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		157	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	0.5		48	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		48	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			48	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			48	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			95	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			61	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			186	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			32	nd	1.22	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			166	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			164	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			61	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			163	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			97	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			47	nd	nd	nd	nd
Aldicarb	µg/L	3			47	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			47	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			45	nd	nd	nd	nd
Aldrin	µg/L	0.075			47	nd	nd	nd	nd
Bromacil	µg/L	10			22	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			48	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			48	nd	nd	nd	nd
Bromomethane	µg/L	0.5			48	nd	nd	nd	nd
Butachlor	µg/L	0.38			22	nd	nd	nd	nd
Carbaryl	µg/L	5			47	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			48	nd	nd	nd	nd
Chloroethane	µg/L	0.5			48	nd	nd	nd	nd
Chloromethane	µg/L	0.5			48	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			95	nd	nd	nd	nd
Dicamba	µg/L	15			45	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			184	nd	nd	nd	nd
Dieldrin	µg/L	0.02			47	nd	nd	nd	nd
Geosmin	µg/L	0.3			158	nd	9.24	nd	nd
Hexachlorobutadiene	µg/L	0.5			48	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			48	nd	nd	nd	nd
Methomyl	µg/L	2			47	nd	nd	nd	nd
Methyl Isoborneol (MIB)	µg/L	0.4			153	nd	13.0	nd	nd
Metolachlor	µg/L	10			22	nd	nd	nd	nd
Metribuzin	µg/L	0.5			22	nd	nd	nd	nd
Napthalene	µg/L	0.5			82	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			48	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			48	nd	nd	nd	nd
Prometryn	µg/L	2			22	nd	nd	nd	nd
Propachlor	µg/L	0.1			84	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			48	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			48	nd	nd	nd	nd

Table 2-4.11 SUMMARY OF RAW WATER QUALITY ALVARADO WTP EFFLUENT 2001 - 2005									
Parameters	Units	DLR*/	Drinking Water Standards[1]		No. of	Raw Water Quality			
		MDL	MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

(5) Haloacetic acids (five) is the sum of the concentrations of mon-, di-, and trichloroacetic acids and mono- and dibromoacetic acids. MCL based on Annual Average

(6) Total trihalomethanes is the sum of the concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform. MCL based on Annual Average

nd: non-detected at State DLR or MDL if DLR not Available

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of the key conclusions from this survey and recommendations to improve watershed protection and enhance drinking water quality.

Conclusions

Watershed and Water Supply System -

The City owns less then five% of the land within the watershed. Private and public ownership of the remaining lands is roughly equal. Several large Native American Indian reservations are contained within the watershed. This ownership pattern limits the control measures the City can implement and focuses watershed control efforts on coordination and communication with agencies.

Most of the watershed lands support rural, agricultural and open space land uses. However, there are several rural communities, such as Alpine, Julian, Descanso, Ramona, and the Barona Indian Reservation which exhibit urban characteristics.   Potential contamination sources include many nonpoint sources which are more difficult to control than point sources.

The terrain is generally mountainous with slopes greater than 25%, creating the likelihood of transport of soils and contaminants to water bodies. The soils have generally high erosion potential. Rainfall ranges from approximately 17 inches annually in the lower watershed, to approximately 36 inches annually in the mountain areas.

Cuyamaca Lake, El Capitan Reservoir, San Vicente and Murray Reservoir provide water to the Alvarado Water Treatment Plant. The plant also receives water from the San Diego County Water Authority (SDCWA). SDCWA provides the majority of water to the Alvarado plant.

The local water quality greatly influences the treatment requirements and the quality of water produced by the water treatment plant. The City has a policy of maximizing the use of local water. This policy minimizes the purchase of imported water.

Potential Contamination Sources in the Watershed -

The watersheds in San Diego County experienced huge fires in the fall of 2003. The fires burned 98% of the San Vicente and 94% of the El Capitan watersheds. The fires were followed with very heavy rainfall in the winter of 2004. This combination of fires and rainfall resulted is large quantities of ash, soil, rocks, and debris being washed from the watershed into streams and reservoirs.

Other potential significant sources of contamination include livestock, sewage spills from Padre Dan Municipal Water District's pump station, San Vicente WRF, Barona WWTP, old and new septic systems, sewer spills, and recreational wastewater treatment facilities.

Watershed Management and Control Practices -

The City exercises a number of management practices or controls within the watershed. On City lands, land use and potentially polluting activities are controlled directly. On lands not owned by the City, the primary controls include:

1) Monitoring land use, CEQA compliance activities, water quality permit activities, and other regulatory actions.
2) Coordinating with other agencies to implement appropriate controls.

Additional City resources have been utilized in the past five years to improve City participation and control in both City owned and non-City owned land.

Water Quality Conditions -

Reservoir raw water quality monitoring indicates several constituents may be of concern. The constituents include turbidity, coliforms, MTBE, nitrogen compounds, and TOC. The concentration of each contaminant varies over time and from reservoir to reservoir. During this WSS update period, rain and fire events have had significant impacts on turbidity, nitrogen compounds, and TOC.

Recommendations

General Recommendations -

Recommendations and corrective actions were developed for the purpose of improving overall watershed protection and drinking water quality. Generally, the recommendations strengthen this first barrier to water quality degradation – protection of source watershed. By strengthening this first barrier, impacts on the second barrier – water treatment – may be reduced.

The Alvarado Water Treatment Plant is effective at treating the raw water to meet current federal and state drinking water regulations. Requirements of the Stage 2 Disinfectants and Disinfection Byproducts Rule promulgated in January 2006 modify distribution system monitoring and compliance criteria. Current treatment plant process and raw water quality make compliance with the Stage 2 rule difficult. Continued protection of the watershed is important in meeting drinking water quality regulations.

The recommendations provided are grouped by the following subjects:

- Water Quality Monitoring and Evaluation
- Interjurisdictional Coordination
- Watershed Management and Control Practices
- Public Education

Water Quality Monitoring and Evaluation -

During the 2001 – 2005 time period watershed monitoring was significantly increased. The City should continue monitoring the watersheds. The baseline data for many parameters has been collected.

Additional evaluation of the data should be used to provide guidance on actions necessary to protect the watersheds. As with any monitoring program, the program should be evaluated to help ensure the necessary data is being obtained, while conserving laboratory resources.

The monitoring program should place emphases on obtaining information necessary to assisting City and non-City forces efforts to protect the watershed. Continued interaction with all interested parties is necessary to continually improve the monitoring program.

Interjurisdictional Coordination -

Lines of communication both within the City and with neighboring agencies have been improved during the 2001 – 2005 time period. However, continued efforts are needed to further the communication and cooperation among agencies.

Specific actions pertaining to Interjurisdictional coordination include the following:

- Expand Workgroups

Workgroups have been established between many of the agencies such as County Planning, U.S. Forest service, Bureau of Land Management. The formation of the workgroups was a positive step. Participation in the workgroups is not consistent among the agencies and the City. Ensuring City forces continued participation in workgroups is important to coordination between agencies. The City should also determine if additional workgroups will be beneficial.

- Review of New Watershed Land Uses

Land use with the watersheds impacts potential contamination of the water. The City should emphasize minimizing potential water quality issues when working with other agencies on watershed land usages.

Watershed Management and Control Practices -

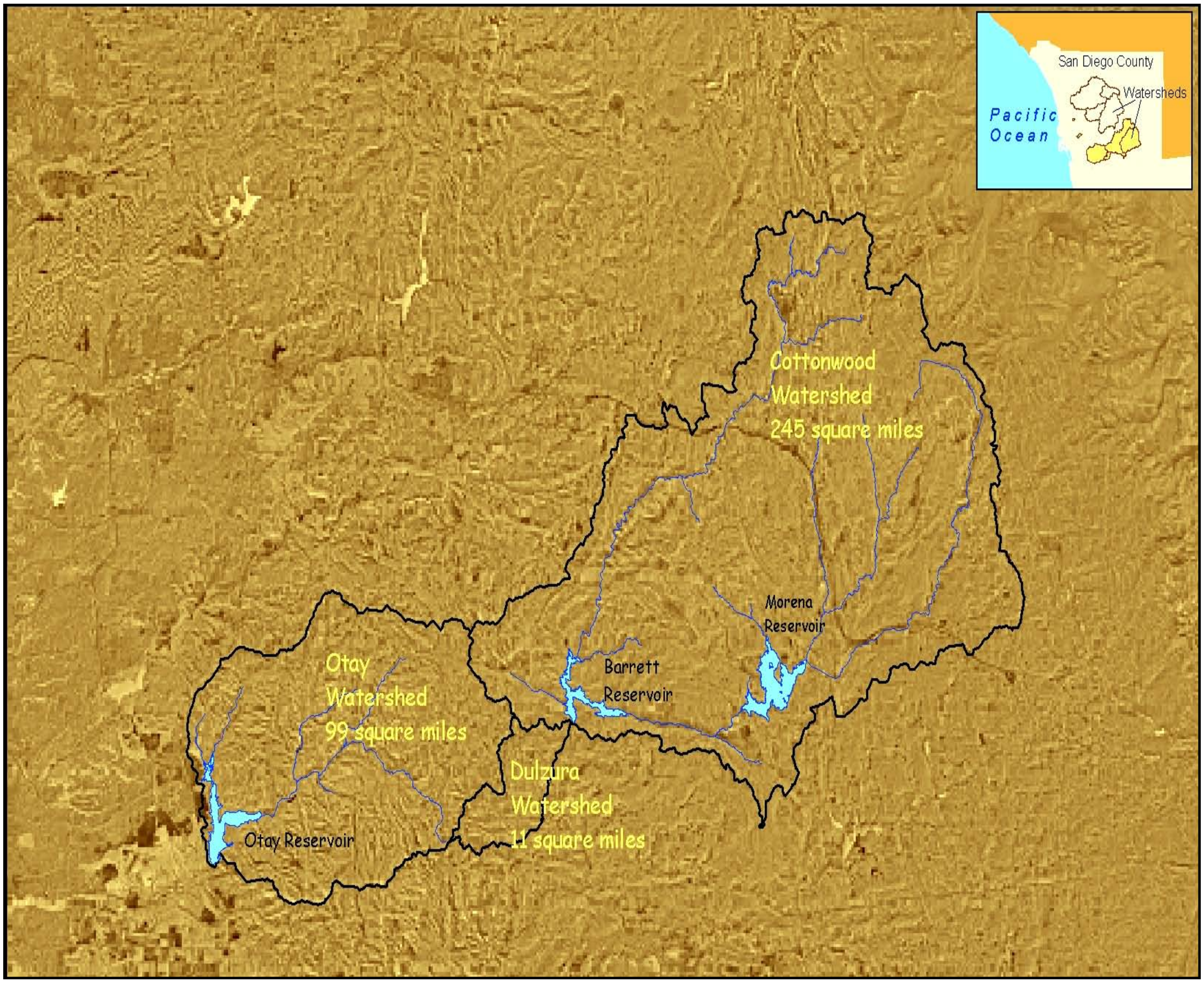
Continue to reduce the impacts from cattle grazing. Impacts can be reduced by elimination of cattle grazing from riparian corridors, prevent cattle access to streams and water bodies, control transport of cattle waste to streams and water bodies, and reduce cattle density.

Public Education -

Public education material has been developed for trail and reservoir usage. Maintaining the educational material in readily available locations will help educate the public to the importance of protecting the watershed. The material should be periodically reviewed to ensure that it is accurate and appropriate.

Residents within the watershed have a significant impact on protecting the watershed. Educational programs should emphasize what residents can do to help protect the watershed, and how protecting the watershed provides them great benefits.

Public awareness signage has been installed in several transportation corridors. The signage provides information on actions they can take to help improve water quality. The City should maintain the signage and review it for accuracy and appropriateness.



The City of San Diego Water Department 2005 Watershed Sanitary Survey

Otay/Cottonwood Watersheds

Volume 3 of 5

Data Collected Between 01/01/01– 12/31/05

ABBREVIATIONS

ACOE	Army Corps of Engineers
ADT	Average daily traffic
ADWF	Average dry weather flow
AF/Y	Acre-Feet per Year
AWWA	American Water Works Association
BLM	Bureau of Land Management – U.S. Federal
BMPs	Best Management Practices
CDF	California Department of Forestry
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
CDMG	California Division of Mines and Geology
CEQA	California Environmental Quality Act
CFR	California Federal Regulation
cfs	Cubic feet per second
City	City of San Diego
CNDDB	California Natural Diversity Database
CNF	Cleveland National Forest
CNPS	California Native Plant Society
County	County of San Diego
CWA	San Diego County Water Authority
D/DBP	Disinfection/Disinfection By-Product
DHS	Department of Health Services
DMG	Division of Mines and Geology – State of California
dS/M	Decisiemens per meter
DSOD	Division of Safety of Dams
EPA	Environmental Protection Agency
ESWTR	Enhanced Surface Water Treatment Rule
GIS	Geographic Information System
gpd	Gallons per day
Gpm	Gallons per minute
HAAs	Haloacetic Acids

ABBREVIATIONS

Helix	Helix Water District
HPC	Heterotrophic Plate Count
HSU	Hydrographic Subunit
HU	Hydrographic Unit
HUMAN CON	Human Consumption
IOCs	Inorganic Chemicals
LPG	Liquid Propane Gas
LSE LF	Loose Leaf
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MG	Million Gallons
mg/L	Milligrams per liter (parts per million)
mgd	Million gallons per day
mgy	Million gallons per year
MHCP	Multiple Species Conservation Program
MSL	Mean Sea Level
MWD	Metropolitan Water District
N-GRNHS	Nursery Greenhouse
N-OUTDR	Nursery Outdoor
NEPA	National Environmental Protection Act
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Unit
OTC	Olympic Training Center
PAHs	Polyaromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
RCA	Resource Conservation Area
RMWD	Ramona Municipal Water District
RO	Reverse Osmosis
RUIS	Regional Urban Information System

ABBREVIATIONS

RWQCB	California Regional Water Quality Board
SANDAG	San Diego Association of Governments
SCS	Soil Conservation Service – U.S.
SDWA	Safe Drinking Water Act - Federal
SMCL	Secondary Maximum Contaminant Level
SOCs	Synthetic Organic Chemicals
SP	Soluble Powder
SUB	Subtropical
SWPPPs	Storm Water Pollution Prevention Plans
TCR	Total Coliform Rule – Federal
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
THMs	Trihalomethanes
TTHMs	Total Trihalomethanes
TOC	Total Organic Carbon
TRANSPL	Transplants
ug/L	Micrograms per liter (parts per billion)
UNCUL	Uncultivated
UNSP	Unspecified
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Society
VOCs	Volatile Organic Compounds
WDRs	Waste Discharge Requirements
WPCF	Water Pollution Control Facility
WRF	Water Reclamation Facility
WSS	Watershed Sanitary Survey
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

VOLUME 3

THE COTTONWOOD-OTAY SYSTEM

CHAPTER 1: SYNOPSIS

Introduction

This volume is the second five-year update of the 1996 Watershed Sanitary Survey (WSS) for the Otay and Cottonwood Watersheds. The Otay/Cottonwood System is comprised of four reservoirs, their watersheds, the Dulzura Conduit, and the Otay Water Treatment Plant (Figure 3-1.1). The system covers a combined area of 226,245 acres, or about 354 square miles.

The Otay Watershed is made up of the Upper Otay Reservoir and the Lower Otay Reservoir. The primary function of Lower Otay Reservoir is to store imported water from the San Diego County Water Authority, local runoff water, and water transferred from Barrett and Morena Reservoirs located in the Cottonwood Watershed via the Dulzura Conduit. The Upper Otay Reservoir is no longer used for surface water storage.

The Cottonwood Watershed consists of the Morena and Barrett Reservoirs, which are impoundments along Cottonwood Creek. The primary function of these reservoirs is to store local runoff water. Below Barrett Dam, Cottonwood Creek flows into Mexico and joins the Tijuana River. Water from Barrett Reservoir is diverted by the Dulzura Conduit, which discharges into Dulzura Creek at the headwaters of the Otay River. The water ultimately reaches the Otay Reservoir. Essentially, this system transfers water from the Tijuana River Basin to the Otay River Basin.

Natural runoff from a small area upslope of the Dulzura Conduit can be captured into the conduit via a series of diverting structures. This area is known as the Dulzura Watershed. Since it contributes directly to Otay Reservoir, it is considered part of the Otay/Cottonwood System.

Watershed Sanitary Survey Requirements

The California Surface Water Treatment Rule (SWTR), in Title 22, Article 7, Section 64665 of the State Code of Regulations, requires every public water system using surface water to conduct a comprehensive sanitary survey of its watersheds every five years. The purpose of such a survey is to identify actual or potential sources of contamination, or any other watershed-related factor, which might adversely affect the quality of water used for domestic drinking water. The initial WSS was completed January 1, 1996 and is to be updated every five years thereafter.

The City of San Diego Water Department and its oversight agencies will use the Watershed Sanitary Survey Update (WSS Update) to evaluate water quality problems which might result from contaminants in the watersheds. The WSS Update will also serve as a basis for future watershed management and planning efforts.

Objectives

The main objectives of this WSS Update are to:

- Satisfy the regulatory requirement for a watershed sanitary survey.
- Identify and assess existing and potential future sources of contamination in the watersheds.
- Provide a general description of existing watershed control and management practices.
- Provide general recommendations for improving watershed management practices in order to protect the quality of the surface waters entering the reservoirs.

Conduct of the Study

This update of the WSS for the Otay/Cottonwood Watersheds was produced by the staff of the City of San Diego Water Department, Water Quality Laboratory. The survey covers the water supply system from the most remote points of the San Diego River System Watersheds to the treatment facility. It was conducted by reviewing existing aerial photographs, GIS data, reports, water quality data and other record documents, and was supplemented by field surveys and personal knowledge of Water Department staff.

Report Organization

The organization of this volume has changed since the 2001 WSS Update. The executive summary, formerly Chapter 1, has been removed from the individual volumes. The remaining chapters have been rearranged as follows:

Chapter 1:	Synopsis
Chapter 2:	Description of Watersheds/Source Water System and Review of 2001 Watershed Sanitary Survey Recommendations
Chapter 3:	Existing Conditions in the Watersheds
Chapter 4:	Water Quality Assessment
Chapter 5:	Conclusions and Recommendations

CHAPTER 2: DESCRIPTION OF WATERSHEDS/SOURCE WATER SYSTEM AND REVIEW OF 2001 WSS RECOMMENDATIONS

Introduction

The following is a summary of the findings of the 2001 Cottonwood-Otay System Watershed Sanitary Survey Update. It covers Potential Contaminant sources, Water Quality, Watershed Management and Control Practices, and Conclusions and Recommendations for management of the watershed.

Cottonwood Watershed—Barrett Reservoir

Potential Contaminant Sources -

Recreation

Potential sources of contamination from recreational use of the Barrett Reservoir are soil erosion from off-trail hiking; excretions of hunting dogs; and gasoline spillage from fishing boats.

Runoff

There is not sufficient data from which to infer a relationship between seasonal runoff and microorganism counts.

Significant Events

There have been two small brushfires since 1996, in the far northeastern part of the watershed, which were not considered a significant threat to water quality. There have been no significant earthquakes from 1996 to 2000.

Agriculture

All of the agriculture in the Cottonwood Watershed consists of extensive activity. Some fields along Cottonwood Creek are being developed for intensive cultivation.

Animal Grazing

Animal grazing occurs on much of the watershed, mostly within the Cleveland National Forest. Loss of vegetation from grazing may increase soil erosion and sedimentation of streams and rivers.

Concentrated Animals Facilities

There are no concentrated animals facilities within the Cottonwood Watershed.

Wastewater Facilities & Reclaimed Water

The Pine Valley Water Pollution Control Facility has a permit to discharge up to 40,000 gallons per day, to percolation ponds. There have been no plant spills recorded in the past five years.

Septic Systems and Sewer Overflows

There are very few septic systems in the watershed, mostly located in Morena Village, Mount Empire High School, Barrett Honor Camp, and the Pine Valley community. Occasional problems occur during high rainfalls. A small commercial area in Pine Valley is served by a sewer system.

Mines

There are twenty-one mines located in the Cottonwood Watershed, many of which are inactive. There have been no recorded incidents at the mine sites.

Hazardous Materials

Solid and liquid hazardous wastes are mostly oil based. Liquid waste is typically hauled away by licensed haulers. There is also capacity for storing 267960 gallons of hazardous liquid, most of which is gasoline. There are no hazardous waste disposal facilities in the watershed.

Water Quality –

Monitoring

Samples were taken from the reservoir surface at the outlet tower, and from eighteen sites within the watershed. Data was provided by the City of San

Diego Water Quality Laboratory. The source water was analyzed for organic and inorganic constituents, and general physical characteristics. Results were compared to the MCL and/or SMCL standards for drinking water.

Raw Water Quality

Results of surface water samples at times exceeded limits for turbidity, pH, color, aluminum, and manganese. Microbiological parameters were not monitored at Barrett Reservoir.

Treated Water Quality

The raw water at times exceeded MCL/SMCL for drinking water for turbidity, color, pH, aluminum, and manganese. Barrett Reservoir feeds into Lower Otay Reservoir, and these constituents were adequately treated at the Otay WTP, with occasional exceptions for odor, turbidity, pH, and TTHM. The Otay WTP consistently meets federal and state drinking water regulations.

The Otay WTP is currently in compliance with the IESWTR and Stage 1 D/DBP Rule. The Otay WTP would also meet the requirements of the Phase I standards of the Stage 2 D/DBP. For Phase II, a study must be conducted to determine the monitoring sites with the highest DBP. The Otay WTP apparently will also comply with the LT2ESWTR for Cryptosporidium, as well as upcoming regulations for Arsenic and Sulfate.

Watershed Management and Control Practices -

Most of the land is owned by the Cleveland National Forest and the City of San Diego Water Department. The City of San Diego monitors the watershed at Morena Reservoir by limiting access to the reservoir, patrolling and observation, and water quality monitoring. Other federal, state, and local agencies also exercise control over land use and activities within the watershed.

Conclusions -

Potential Contaminant Sources

Potential contaminant sources include corrals and animal boarding facilities, fires, animal grazing, accidental wastewater discharge, unauthorized waste disposal, and recreational use.

Watershed Management

No formal watershed management program exists. Land ownership patterns affect control measures in the watershed; therefore, the focus is on cooperation between agencies. However, the City of San Diego exercises a number of management practices. On City-owned land, the City directly controls land use activity. On land not owned by the City, controls include monitoring land use, permits and other regulatory actions, and coordinating with other agencies. A Watershed/ Water Quality Protection Committee was established by the City in September, 1994.

Water Quality Conditions

Raw water monitoring at the Barrett Reservoir has detected several water quality constituents at levels that may be of concern, including turbidity, coliforms, MTBE, and TOC. Barrett Reservoir feeds into Lower Otay Reservoir, and all of these constituents are effectively treated at the Otay WTP.

Cottonwood Watershed—Morena Reservoir

Potential Contaminant Sources -

Recreation

Potential sources of contamination from recreational use of the Morena Reservoir soil erosion from off-trail hiking and horseback riding; discarded trash from picnicking and camping; excretions of horses and personal pets; and gasoline spillage from fishing boats and other personal craft. Incidental personal contact occurs; however, microorganism contamination from such contact is minimal.

Runoff

Microorganisms are not currently monitored at Morena Reservoir, therefore, there is no existing data from which to infer a relationship between seasonal runoff and microorganism counts.

Significant Events

There have been two small brushfires since 1996, in the far northeastern part of the watershed, which were not considered a significant threat to water quality. There have been no significant earthquakes from 1996 to 2000.

Agriculture

All of the agriculture in the watershed consists of extensive activity. Some fields along Cottonwood Creek are being developed for intensive cultivation.

Animal Grazing

Animal grazing occurs on much of the watershed, mostly within the Cleveland National Forest. Loss of vegetation from grazing may increase soil erosion and sedimentation of streams and rivers.

Concentrated Animals Facilities

There are no concentrated animals facilities within the Cottonwood Watershed.

Wastewater Facilities & Reclaimed Water

The Pine Valley Water Pollution Control Facility has a permit to discharge up to 40,000 gallons per day, to percolation ponds. There have been no plant spills recorded in the past five years.

Septic Systems and Sewer Overflows

There are very few septic systems in the watershed, mostly located in Morena Village and the Pine Valley community. Occasional problems occur during high rainfalls. A small commercial area is served by a sewer system.

Mines

There are twenty-one mines located in the Cottonwood Watershed, many of which are inactive. There have been no recorded incidents at the mine sites.

Hazardous Materials

Solid and liquid hazardous wastes are mostly oil based. Liquid waste is typically hauled away by licensed haulers. There is also capacity for storing 267960 gallons of hazardous liquid, most of which is gasoline. There are no hazardous waste disposal facilities in the watershed.

Water Quality -

Monitoring

Samples were taken from the reservoir surface at the outlet tower, and from eighteen sites within the watershed. Data was provided by the City of San Diego Water Quality Laboratory. The source water was analyzed for organic and inorganic constituents, and general physical characteristics. Results were compared to the MCL and/or SMCL standards for drinking water.

Raw Water Quality

Results of surface water samples at times exceeded limits for turbidity, pH, color, manganese, and MTBE. Microbiological parameters were not monitored at Morena Reservoir.

Treated Water Quality

The raw water at times exceeded MCL/SMCL for drinking water for turbidity, color, odor, pH, manganese, and MTBE. Morena Reservoir feeds into Barrett Reservoir and ultimately to Lower Otay Reservoir, and these constituents were adequately treated at the Otay WTP, with occasional exceptions for odor, turbidity, pH, and TTHM. The Otay WTP consistently meets federal and state drinking water regulations.

The Otay WTP is currently in compliance with the IESWTR and Stage 1 D/DBP Rule. The Otay WTP would also meet the requirements of the Phase I standards of the Stage 2 D/DBP. For Phase II, a study must be conducted to determine the monitoring sites with the highest DBP. The Otay WTP apparently will also comply with the LT2ESWTR for *Cryptosporidium*, as well as upcoming regulations for Arsenic and Sulfate.

Watershed Management and Control Practices -

Most of the land is publicly owned or national forest land, with a small percentage of rural community. The City of San Diego monitors the watershed at Morena Reservoir by limiting access to the reservoir, patrolling and observation, and water quality monitoring. Other federal, state, and local agencies also exercise control over land use and activities within the watershed.

Conclusions -

Potential Contaminant Sources

Potential contaminant sources include corrals and animal boarding facilities, fires, animal grazing, accidental wastewater discharge, unauthorized waste disposal, and recreational use.

Watershed management

No formal watershed management program exists. Land ownership patterns affect control measures in the watershed; therefore, the focus is on cooperation between agencies. However, the City of San Diego exercises a number of management practices. On City-owned land, the City directly controls land use activity. On land not owned by the City, controls include monitoring land use, permits and other regulatory actions, and coordinating with other agencies. A Watershed/ Water Quality Protection Committee was established by the City in September, 1994.

Water Quality Conditions

Raw water monitoring at the Morena Reservoir has detected several water quality constituents at levels that may be of concern, including turbidity, pH, color, MTBE, and TOC. Morena Reservoir feeds via Barrett Reservoir into Lower Otay Reservoir, and all of these constituents are effectively treated at the Otay WTP.

Lower Otay-Dulzura Conduit Watershed

Potential Contaminant Sources -

Recreation

Potential sources of contamination from recreational use of the Lower Otay Reservoir include hunting, off-trail hiking and horseback riding; discarded trash from picnicking; excretions of horses and personal pets; and gasoline spillage from fishing boats and other personal craft. Incidental personal contact occurs due to water sport training; however, microorganism contamination from such contact is minimal.

Runoff

Coliform data suggest that microorganism counts correlate to seasonal rainfall runoff in the Lower Otay Reservoir.

Significant Events

There have been three fairly large brushfires since 1996, all of which were considered a significant threat to water quality. Another small fire in the Dulzura Conduit watershed had little impact on water quality. Consequences of burning include soil erosion, stream sediment, ash and debris, and chemical fire retardants. There have been no significant earthquakes from 1996 to 2000.

Agriculture

Most agriculture consists of extensive activity, especially near Dulzura and Jamul Creeks. Less than ten percent of the watershed is given to intensive farming, vineyards, and orchards. Orchards and intensive plots rely more heavily upon fertilizers and pesticides.

Animal Grazing

Animal grazing is permitted on Federal lands. There is also grazing on privately owned lands; however, the grazing lease has expired and will not be renewed. Loss of vegetation from grazing may increase soil erosion and sedimentation of streams and rivers. The City of San Diego plans to fence the area around the reservoir against livestock

Concentrated Animals Facilities

There are no concentrated animal facilities within the Lower Otay-Dulzura Conduit Watershed.

Wastewater Facilities & Reclaimed Water

There are no wastewater facilities in the Otay-Dulzura Conduit Watershed. Reclaimed water from the Otay Water District is delivered to two locations near the Lower Otay Reservoir, but not within the watershed.

Septic Systems and Sewer Overflows

There are very few septic systems in the watershed. There have been no reported septic problems or sewer overflows.

Mines

There are three mines located in the Otay Watershed. There have been no recorded incidents at the mine sites.

Hazardous Materials

Solid and liquid hazardous wastes are mostly oil waste and used oil filters. There is also capacity for storing 42700 gallons of hazardous liquid, all of which is gasoline or diesel fuel. There are no hazardous waste disposal facilities in the watershed.

Water Quality -

Monitoring

Samples were taken from the surface, from four outlet gauges, and the influent and effluent of the Otay Water Treatment Plant. Data was provided by the City of San Diego Water Quality Laboratory. The source water was analyzed for organic and inorganic constituents, microorganisms, and general physical characteristics. Results were compared to the MCL and/or SMCL standards for drinking water.

Raw Water Quality

Results of surface water samples at times exceeded limits for turbidity, pH, color, aluminum, manganese, and MTBE. Microbiological studies indicated the presence of microorganisms, including *Cryptosporidium* and *Giardia*, in all samples. Of the four outlets sampled, gauge 84 had the poorest general physical characteristics. Gauge 95 had the highest TOC levels.

Treated Water Quality

The raw water at times exceeded MCL/SMCL for drinking water for turbidity, color, odor, pH, aluminum, iron, manganese, zinc,and TTHM. These constituents were adequately treated at the Otay WTP, with occasional exceptions for odor, turbidity, pH, and TTHM. While microorganisms were present in all raw water samples, they were removed by the treatment process. The Otay WTP consistently meets federal and state drinking water regulations.

The Otay WTP is currently in compliance with the IESWTR and Stage 1 D/DBP Rule. The Otay WTP would also meet the requirements of the Phase I standards of the Stage 2 D/DBP. For Phase II, a study must be conducted to determine the monitoring sites with the highest DBP. The Otay WTP apparently will also comply with the LT2ESWTR for *Cryptosporidium*, as well as upcoming regulations for Arsenic and Sulfate.

Watershed Management and Control Practices -

Much of the land is rural and privately owned, or is unincorporated County land. The City of San Diego monitors the watershed at Lower Otay Reservoir by limiting access to the reservoir, patrolling and observation, and water quality monitoring. Other federal, state, and local agencies also exercise control over land use and activities within the watershed.

Conclusions -

Potential Contaminant Sources

Potential contaminant sources include corrals and boarding facilities, fires, animal grazing, accidental wastewater discharge, unauthorized waste disposal, filter backwash from Otay WTP, and recreational use.

Watershed Management

No formal watershed management program exists. Land ownership patterns limit control measures in the watershed; therefore, the focus is on cooperation between agencies. However, the City of San Diego exercises a number of management practices. On City-owned land, the City directly controls land use activity. On land not owned by the City, controls include monitoring land use, permits and other regulatory actions, and coordinating with other agencies. A Watershed/ Water Quality Protection Committee was established by the City in September, 1994.

Water Quality Conditions

Raw water monitoring at the Lower Otay Reservoir has detected several water quality constituents at levels that may be of concern, including turbidity, coliforms, MTBE, and TOC. All of these constituents are effectively treated at the Otay WTP.

Recommendations & Review-

The underlying theme of all recommendations is protection of the watershed and source water quality. The recommendations fall into four categories:

- Water Quality Monitoring,
- Interjurisdictional Coordination,
- Watershed Management and Control Practices,
- Public Education.

Following each recommendation will be a review of the actions taken and/or current status of the recommendation.

Water Quality Monitoring –

Recommendations

1) Continue to develop and evaluate the long-term monitoring program for the watershed; and, in the final monitoring program, identify how the goals and objectives can be met with the monitoring plan.
2) Augment the existing City monitoring program with additional parameters.
3) Find and test alternative methods for algal control while continuing to minimize the use of copper sulfate.

Review

1) The City has instituted a program to measure flow, solids, pathogens and nutrients on a monthly basis and to measure metals and a suite of organics on a quarterly basis at 13 creeks that flow directly into the three reservoirs of this watershed system. The City has also collected bioassessment samples at four sites in the watershed system.
2) As noted above, the City has begun to test for total nitrogen and total phosphorus on a monthly basis at tributaries. Also we sample for these parameters on a monthly basis from the reservoir.
3) No change in status.

Interjurisdictional Coordination –

Recommendations

1) Establish lines of communication with neighboring agencies and overlapping jurisdictions by developing written City policies, developing workgroups, and setting up a City Control Review Committee.
2) Coordinate with Jurisdictional Agencies such as San Diego County and the USFS.

Review

1) The City contracted with Brown & Caldwell to produce a document providing guidelines for new development in our watersheds. This document has been completed and is being used by the City Water Department in its review of projects. The City Water Dept has also established a Watershed Manager and a Watershed Project Officer and the City has established contacts with other agencies by participating on watershed plan committees. The City is reviewing more projects than it has in the past; however, no formal clearinghouse has been established. There has been no change in status regarding the development of workgroups.
2) A Joint Exercise of Powers Agreement (JEPA) was entered into during 2004 by the County of San Diego, City of Chula Vista, City Of Imperial Beach, and City of San Diego to produce a watershed management plan for the Otay River Watershed.

Watershed Management and Control –

Recommendations

1) Develop a land acquisition strategy to gain control of lands proximate to water.
2) Work with landowners and regulatory agencies to reduce the potential impact of cattle grazing and other agricultural practices.
3) Monitor creeks near wastewater storage ponds and facilities where there is a history of spills.

Review

1) The City has not adopted a strategy to acquire parcels, easements, or development rights; however, the City has worked with other agencies to purchase some privately owned lands that are proximate to water bodies for conservation purposes.
2) No Change in status.
3) No Change in status.

Public Education –

Recommendations

1) Develop and distribute educational materials to landowners, businesses, residents, and recreational users of the land about the importance of protecting the watershed. Establish a telephone number for reporting spills and illegal dumping.
2) Conduct public information sessions about the impact of various activities on water quality and supply.
3) Encourage a ‘Friends of the Watershed’ type of volunteer organization.
4) Launch a public awareness and signage campaign along transportation corridors.

Review

1) Everyone who purchases a lake permit receives a brochure that details the importance of keeping the reservoir clean because it is a source of our drinking water. In addition, posters are placed on kiosks at the reservoirs, asking people to recycle and help protect water quality.
2) See answer #1.
3) The “Friends of the Otay Valley Regional Park” has been encouraged to pursue cleanup efforts in the Otay River Valley. The City has provided free trash pickup for volunteer efforts on different occasions.
4) Signs have been developed for placement on major corridors that let travelers know they are entering a watershed. The City is working with CalTrans on locations to place the signs.

CHAPTER 3: EXISTING CONDITIONS IN THE WATERSHEDS

Otay and Dulzura Watersheds

Water Sources **-**

Lower Otay Reservoir is important to the region for its supply from the SDCWA Aqueduct System carrying Colorado River and State Project water to the San Diego area. The primary function of the reservoir is to store imported water, local runoff water from the surrounding 111 square-mile watershed, and water transferred from Barrett and Morena Reservoirs, located in the Cottonwood Watershed via the Dulzura Conduit (Figure 3-3.1). The reservoir and associated facilities are owned and operated by the City of San Diego.

The management of the water supply system typically attempts to restrict the purchase of imported water and regulates the reservoir levels to maximize the use of local water. Under all conditions, an emergency supply is maintained within the reservoir should a failure occur to the imported water supply system. Because of this, the City does not typically draft a significant amount of water from Lower Otay Reservoir, in an effort to reserve the majority of the impounded water for emergency storage.

All of the facilities associated with the conveyance of water from the Otay/Dulzura Watershed to the public are mainly natural watercourses which lie in the rural and remote portions of the watershed. These natural conveyances are not likely to fail due to age and deterioration. Some problems may be encountered in the pumping process between Lower Otay Reservoir and the Otay Water Treatment Plant. Since the pumping process is localized, any problems which may occur can be prevented through regular maintenance.

Raw Water Reservoirs -

Upper Otay Reservoir Dam is a thin, flat concrete arch, reinforced with wire rope and steel plates. The dam was reduced in size by a trapezoidal notch measuring 30 feet at the base and 160 feet at the top. The spillway capacity is 10,500 cfs. The dam crest has a length of 350 feet and stands approximately 68 feet above the streambed. From a seismic analysis of the dam, completed by the California State Division of Safety Dams (DSOD), a mandate was issued requiring the maximum storage level to be lowered. The mandate reduced the capacity from 2,830 acre-feet to 800 acre-feet.

Lower Otay Reservoir's Savage Dam, is a curved cyclopean concrete gravity structure. It has a 225-foot-wide over pour spillway and a 201-foot-wide independent spillway section. The combined spillway capacity is 49,400 cubic feet per second (cfs). The dam crest has a length of 741 feet and stands roughly 145 feet above the streambed. The reservoir has a storage capacity of 49,510 acre-feet and a surface area of 1,110 acres at spillway crest at 484 feet MSL.

Raw Water Intake and Conveyance Facilities -

Upper Otay Reservoir outlet consists of one low-level 16-inch conduit through the dam. Water is released with a maximum draft rate of 34 cfs (22 mgd). The water which freely flows over the notch is collected downstream into Lower Otay Reservoir.

Lower Otay Reservoir outlet consists of an independent wet tower, west of the dam face, with seven 30-inch saucer valves for selective level draft control. Water is released from the tower through a 48-inch outlet pipe located at the dam. The 48-inch pipeline has a maximum draft rate to the treatment plant of 74 cfs (48 mgd) and to the blow off and treatment plant of 349 cfs (225 mgd).

Treated Water Facilities -

All treatment facilities and treated water facilities for Lower Otay Reservoir occur at and beyond the Otay Water Treatment Plant. The plant is located adjacent to Lower Otay Reservoir and serves the South Bay area of the City. The Plant treats imported water and local runoff from the Otay/Dulzura and Cottonwood watersheds. The Otay Water Treatment Plant is of conventional design with flocculation, filtration, disinfection (chloramines) and has a 40 mgd capacity. The plant is designed and operated in compliance with California's Chapter 17: Surface Water Filtration and Disinfection Treatment Regulations.

Cottonwood Watershed

Water Sources -

The primary function of Barrett and Morena Reservoirs is to store local runoff water from the surrounding 241 square miles. Morena Reservoir collects surface runoff from the northern and eastern portions of the watershed. The water released from Morena Reservoir transfers naturally via Cottonwood Creek to Barrett Reservoir. Barrett Reservoir stores water transferred from Morena Reservoir and runoff from the remaining areas of the watershed. Downstream of the Barrett Dam, the Dulzura Conduit transports the water to Upper Dulzura Creek in the Otay Watershed, which flows to Lower Otay Reservoir and ultimately the Otay Treatment Plant (Figure 3-3.1). The reservoirs and associated facilities are owned and operated by the City of San Diego.

Both reservoirs lack the ability to provide emergency supply storage for the City due to their eastern locations, high elevations, and lack of connections to imported water aqueducts. Morena Reservoir is considered an inefficient reservoir due to its high evaporative losses. Since the evaporative losses are so great, the water from Morena Reservoir is transferred to Barrett Reservoir, provided storage capacity is available. The management of the water supply system utilizes the reservoir levels to maximize the use of local raw water. The City drafts a significant amount of water from Morena and Barrett Reservoirs, in an effort to collect the local water for storage.

Raw Water Reservoirs -

Morena Dam is a rock-fill embankment with an impervious upstream face consisting of rubble masonry and concrete with an un-gated spill crest length of approximately 312 feet. The spillway capacity is 25,000 cubic feet per second (cfs). The dam crest has a length of 550 feet and stands roughly 171 feet above the streambed. The reservoir has a storage capacity of 50,206 acre-feet and a surface area of 1,541 acres at spillway crest at 3,039 feet MSL.

Barrett Dam is a single curve gravity structure, with 26 spillway crest openings which are 13 feet each in length, and a total spillway clear length of 336 feet. The dam crest has a length of 746 feet and stands approximately 171 feet above the streambed. The reservoir has a storage capacity of 37,947 acre-feet and a surface area of 811 acres at a spillway crest of 1,607 feet MSL.

Raw Water Intake and Conveyance Facilities -

Morena Reservoir outlet consists of an independent, cylindrical reinforced concrete dry tower roughly, 100 feet from the face of the dam with three 24-inch sluice gate valves for selective level draft control. Water is released from the tower to a 30-inch vertical pipe, then to an eight-foot-high inverted U-shaped outlet tunnel through solid granite in the left abutment of the dam. The tunnel ends downstream of the reservoir to Cottonwood Creek where the water travels to Barrett Reservoir. Morena Reservoir outlet has a maximum draft rate of 300 cfs (194 mgd).

Barrett Reservoir outlet consists of an independent dry tower with three 30-inch saucer valves on the outside and 30-inch valves on the inside for selective level draft control. Water is released from the tower to a 30-inch conduit which passes through a tunnel in the right abutment of the dam and discharges to the Dulzura Conduit. Barrett Reservoir outlet has a maximum draft rate of 272 (175 mgd). The Dulzura Conduit empties through a gravity process into Upper Dulzura Creek and ultimately into Lower Otay Reservoir. The gravity-powered Dulzura Conduit has the ability to transport 40 mgd. Restorations to the Dulzura Conduit were completed in 1995. In 2004, the area received extraordinarily high rainfall which damaged the conduit; therefore, the conduit is currently unusable. Completion date for repair is unknown.

Treated Water Facilities -

All treatment facilities and treated water facilities for the Cottonwood Watershed occur at and beyond the Otay Water Treatment Plant.

Emergency Plans –

There are no written emergency plans addressing accidental or intentional disposal of contaminants to the raw water supply system for the City. However, the City does have the following two procedures which are understood policies, should an emergency occur relating to water quality:

- If a treatment plant cannot treat the water to an approved health standard level, due to upstream contaminants or treatment plant failures, the treatment plant shall be shut down. Treated water shall then be re-directed to the downed service area through the distribution system from other treatment plants.

- If any emergency exists, the City has a chain of communication procedure for notification of City staff.

Natural Settings

Slope -

Slope is recognized as a critical factor in soil slips/landslides. In Southern California a direct relationship exists between frequency of soil slips and slope. USGS estimates that 70% of soil slips originate in slopes between 20° and 36°.These soil slips have the potential to increase sedimentation in streams and reservoirs.

Water falling on steeply-sloped land runs off with greater velocity and infiltrates less than water falling on flat land. This response leads to increased erosion and limits the soils natural ability to absorb contaminants. Information on slope was derived from a digital elevation model provided by San Diego Data Processing Corporation and United States Geological Survey (USGS).

Otay & Dulzura Watersheds:

No changes in slope have occurred since 2000 (Figure 3-3.2, Table 3-3.3).

Table 3-3.2
Otay and Dulzura Watersheds Slope

Slope	Acres	Percent
0 - 15°	29752.72	41.32
16 - 25°	14505.63	20.15
26 - 50°	22554.51	31.32
> 50°	5190.16	7.21
Total	72003.02	100.00

Cottonwood Watershed:

No changes in slope have occurred since 2000 (Figure 3-3.3, Table 3-3.2).

Table 3-3.3 Cottonwood Watershed Slope		
Slope	**Acres**	**Percent**
0 - 15°	31595.74	19.40
16 - 25°	77167.40	47.37
26 - 50°	40551.09	24.89
> 50°	13583.33	8.34
Total	162897.57	100.00

Soils

Most of the soils within the watershed are susceptible to erosion. The erosion of these soils is mitigated through the anchoring affect of natural vegetation (see Vegetation). Impacts to the vegetation through fire, development or other means could cause increased erosion and impact surface water quality (see Fires, Land Use, Rainfall and Runoff).

Otay/Dulzura Watershed:

Due to the Otay Mountain fire (see Fires) of 2003 the surface soils in the burn areas of Otay/Dulzura Watershed had become temporarily hydrophobic. This condition, combined with loss of natural vegetation, can cause increased erosion. Aside from large areas of exposed bedrock, soils within the Otay Watershed are predominantly well drained loams. Friant fine sandy loam, San Miguel-Exchequer rocky silt loam and Cienenba coarse sandy loam are the dominant soil types within the watershed (Figure 3-3.4). A large portion of the Dulzura Watershed consists of acid igneous rock land (Figure 3-3.4). In addition Cieneba coarse sandy loam, Las Posas fine sandy loam and Friant fine sandy loam are well represented within the watershed.

Cottonwood Watershed

Aside from large areas of exposed bedrock, soils within the Cottonwood Watershed are predominantly well drained sandy loams. Sheephead rock fine sandy loam, La Posta loamy coarse sand and Bancas stony loam are the most widespread soil types within the watershed (Figure 3-3.5)

Vegetation

Vegetation cover provides several ecological services pertinent to water quality. The root systems of plants anchor soil that could otherwise erode into streams and reservoirs (see Soils). Wetlands and other riparian plant communities act as natural filters, removing suspended sediments and contaminants. Sediments are trapped by densely growing wetland plants, and many contaminants are absorbed or chemically altered by the vegetation.

The description of the different plant communities found in the watershed (Sawer and Keeler-Wolf classification, 1995) and their respective response to fire is from the 2003 Southern California Fires Burned Area Emergency Stabilization and Rehabilitation Plan prepared by the Interagency Burned Area Emergency Response Team November, 2003. The maps of vegetation communities (Figures 3-3.6, 3-3.7; Tables 3-3.4, 3-3.5) have been updated using current SanGIS data.

Oak Woodlands

Vegetation Types:

Oak woodlands typically occur in the foothills and transition into mixed conifer/oak woodlands at higher elevations. Each community type can vary from open savannas in broad valleys and rolling hills to dense woodlands in canyons and along streams. Oak woodlands are dominated by live oak trees species that include Black Oak, Coast Live Oak, Engelmann Oak, and Canyon Live Oak.

Response to Fire:

Oak woodlands have evolved with fire. Dense woodlands typically experience low frequency stand destroying fires. Oak trees that experience some canopy fire often survive unless the ground fire temperature is extreme enough to kill the root system. The complex of species associated with dense oak woodlands will either re-sprout or germinate from seed. Frequent or hot fires can affect the seed bank and the root system of Oak Woodland species resulting in degraded habitat that is susceptible to habitat conversion.

Eucalyptus Woodland

Vegetation Types:

Eucalyptus Woodland is a non-native closed canopy community. This community is typically a monotypic stand of Eucalyptus trees with a thick mulch of Eucalyptus tree leaves.

Response to fire:

Eucalyptus stands can be fire retardant to low intensity fires. Low intensity fires will consume the leaf litter and can be carried into the canopy where leaves are singed or tops are burned. High intensity fires are typically stand destroying.

Forests

Vegetation Types:

Coniferous forests occur in the lower to upper montane zone in the Peninsula Ranges. The lower montane forests typically include the Southern Interior Cypress Forest which is intermixed with oak woodlands and chaparral. Upper montane forests include Coulter Pine Forest, Jeffery Pine Forest, and mixed Sierran Forest. They range from pure stands of a single species to mixed conifer forests intermixed with oak woodlands and chaparral.

Response to Fire:

Montane forests are typically surrounded by chaparral or adjacent to forests subject to fire, and are therefore susceptible to fire. When fires occur more frequently than twenty-five years, Coulter pine habitat conversion to chaparral may result. Jeffery Pine Forests and Mixed Coniferous Forests historically experience periodic low-to-moderate intensity fires in the under story. Fuel buildup due to fire suppression can increase the risk of stand replacing crown fires.

Chaparral

Vegetation Types:

Chaparral occurs throughout the coastal lowlands, foothills, and montane region. This community typically forms a dense, almost impenetrable shrub community with no herbaceous layer. Chaparral is a highly variable plant community that includes; Chamise Chaparral, Coastal Sage-Chaparral Scrub, Mixed Chaparral, Montane Chaparral, Semi-desert Chaparral, and Scrub Oak Chaparral.

Response to Fire:

Chaparral is a fire adapted community that stump sprouts or germinates from seed after a low-to–moderate intensity burn. Large fires often result in homogenous stands of chaparral. Frequent fires and hot fires can burn the root system and surface seed bank resulting in a loss of diversity and low-density vegetative communities. For a few years after a fire, annual forbes germinate and establish on site until the woody shrubs mature.

Coastal Sage Scrub

Vegetation Types:

Locally, Coastal Sage Scrub consists of low, woody soft-shrubs and is classified as Diegan Coastal Sage Scrub (DCSS). DCSS is dominated by California sagebrush and/or flat-topped buckwheat and often intergrades with Chaparral communities.

Response to Fire:

DCSS species are fire adapted and quickly regenerate from seed after a fire. However, frequent fires in an area can reduce the seed bank for native shrub species and increase the presence of non-native grasses and forbs resulting in degraded habitat. Once this habitat conversion occurs, DCSS species typically do not re-colonize the area due to competition from dense populations of invasive grasses that increase the fire frequency. Areas with moderate to highly degraded DCSS may convert to non-native grasslands due to the 2003 fires.

Big Sagebrush Scrub

Vegetation Types:

Locally, big sagebrush is dominated by; flat-topped buckwheat, broom snakeweed, deerweed, sawtoothed goldenbrush, and includes a variety of DCSS species.

Response to Fire:

The fire ecology of Big Sagebrush Scrub in eastern San Diego County is not well documented. Many of the associates in this community occur in DCSS and are fire adapted. Frequent fire in the vegetative community will result in habitat conversion to non-native grasslands.

Grasslands

Vegetation Types:

Perennial Grasslands vary among Valley Needlegrass and Valley Sacaton grasslands. Valley Needle Grassland is dominated by the tussock forming purple needlegrass, with a variety of native forbs including colar lupin, rancher’s fireweed, and adobe popcorn-flower; and the native bunchgrasses, foothill needle grass, and coast range melic. The species composition can vary as it transitions into the foothills and montane zone. Valley Sacaton Grassland is dominated by sacton or salt grass. This community typically occurs in the areas with a high seasonal water table and is often associated with Alkali Seeps and Alkali Meadows. Non-native grasslands are dominated by red brome, ripgut brome, and softchess brome. Non native grasslands often intergrade with open oak woodlands and disturbed DCSS communities.

Response to Fire:

Grassland communities in San Diego County have evolved with, and are typically maintained by fire. Fire in non-native grasslands maintains dominance by invasive grasses and prevents establishment by native shrub species.

Meadows

Vegetation Types:

Montane Meadows occur in the montane zone and are dense growth of sedges and perennial herbs that experience wet cold winters. Montane Meadows are typically interspersed with montane forests. Wildflower Field is an amorphous community of herbaceous plant species where dominance varies from site to site and year to year, depending on climatic factors. Wildflower Field is typically associated with grasslands and oak woodlands in the valleys and foothills.

Response to Fire:

Wet meadows typically do not burn since the moisture content in the plants and soils retard fire advance. During drought times and in dry meadows fire will quickly burn through these communities. Fall fires typically have little impact on local meadows since most plants are dry and have dispersed their seed.

Riparian

Vegetation Types:

Riparian communities vary depending on the aquatic system they are associated with and can have seral stages of community succession. Mulefat Scrub and Southern Willow Scrub are typically early seral stages for Southern

Cottonwood-Willow Riparian Forest, which develops into Southern Coast Live Oak Riparian Forest. In steep drainages, Mulefat Scrub and Southern Willow Scrub may be early stages for Southern Sycamore-Alder Riparian Forest or White Alder Riparian Forest.

Response to Fire:

Riparian communities often resist fire since riparian species do not experience drought. During drought, riparian species become more susceptible to fire. Stand destroying fires can assimilate flooding events in that they set communities back to early seral stages. Stump sprouting species can reestablish in the early successional communities. Most mature trees that experience high intensity fires will die.

Wetlands

Vegetation Types:

Wetland communities are highly variable. Riparian and Wet Meadows are communities that can establish in areas with sufficient hydrology to be considered wetlands. In addition, emergent wetlands occur along seeps and as emergent wetlands in shallow water. These wetlands include Alkali Seep, Freshwater Seep, and Freshwater Marsh.

Response to Fire:

Historically, fire impacts to wetlands in San Diego County are not documented. Wetlands typically do not experience fire. Many wetland species are rhizomous and will likely survive fires. Woody species in scrub and forested wetlands may recover from fire by epicormic sprouting from stems or basal sprouting from roots.

Otay and Dulzura Watersheds:

Vegetation within the Otay Watershed is dominated by native scrub and chaparral (Figure 3-3.6, Table 3-3.4). Southern Interior Cypress Forest and oak woodlands are also native communities that are represented within the watershed. In addition, communities of grasslands exist throughout the watershed. In several areas, native vegetation has been altered due to agriculture and urban development. These areas possess the potential to negatively impact water quality (see Land Use, Rainfall and Runoff).

Several riparian and wetland habitats exist in the Otay Watershed. These communities include Willow Scrub, Freshwater Marsh, Cismontane Alkali Marsh, disturbed wetland, Lakeshore Fringe, Vernal Pools, and various types of riparian forest. They occur primarily around the perimeter of Otay Reservoir and in the canyons and drainages. The disturbed wetlands occur along Jamul and Dulzura Creeks. A restoration project is currently underway on Dulzura Creek, east of the Thousand Trails RV Park. Vernal Pools are found east and north of Lower Otay Reservoir. In addition, Willowy Monardella (*Monardella linoides* ssp. *viminea*) a sensitive species is known to exist east of lower Otay Reservoir.

The Dulzura Watershed is dominated by native Mixed Chaparral (Figure 3-3.6, Table 3-3.4). Patches of grasslands and non-native vegetation occur in several areas. Southern Coast Live Oak Riparian Forest is the only riparian community well represented in Dulzura Watershed

Table 3-3.4 Vegetation in the Otay and Dulzura Watersheds		
Vegetation Type	**Acres**	**% of Watershed**
Wetlands	256	0
Forest	3186	5
Grasslands, Vernal Pools, Meadows, other Herb Communities	2536	4
Non-Native Vegetation, Developed or Un-vegetated Habitat	7860	11
Riparian	863	1
Scrub and Chaparral	53226	76
Woodland	2396	3
Total	70323	100.0

Cottonwood Watershed:

The dominant vegetation community within the Cottonwood Watershed is native Mixed Chaparral (Figure 3-3.7, Table 3-3.5). Other native communities that are represented include Jeffrey Pine Forest, Mixed Coniferous Forest, and Woodlands. Patches of grasslands and non-native vegetation occur in several areas. Several riparian and wetland habitats exist in the Cottonwood Watershed. These communities include Southern Cottonwood Willow Riparian Forest, Southern Coast Live Oak Riparian Forest, White Alder Riparian Forest, Willow Riparian Scrub, Wet Montane Meadow, Lakeshore Fringe, Freshwater Seep, and Freshwater Marsh. In addition, Parish's Meadowfoam (*Limnanthes gracilis* var. *parishii*) is a sensitive species known to occur in the watershed.

Table 3-3.5 Vegetation in the Cottonwood Watershed		
Vegetation Type	**Acres**	**% of Watershed**
Wetlands	1	0
Forest	12211	8
Grasslands, Vernal Pools, Meadows, other Herb Communities	5742	4
Non-Native Vegetation, Developed or Un-vegetated Habitat	4122	3
Riparian	2454	2
Scrub and Chaparral	117332	78
Woodland	8408	6
Total	150270	100.0

Rainfall and Runoff

The climate of San Diego County is classified as a Mediterranean dry summer type where 90% of the annual rainfall occurs between the months of November and April. Annual precipitation varies from 9 inches at the coast to 25 inches near the mountains. Storm water runoff occurs when water from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, streets and parking lots prevent the runoff from naturally soaking into the ground. Storm water runoff can collect debris, sediment, nutrients, bacteria, pathogens, chemicals and deposit them directly into a lake, stream, river, wetland, or coastal water.

Rainfall and Runoff information in this section was supplied by the City of San Diego Water Department, Hydrography Section. Rainfall data is collected at each reservoir by a weather station. Runoff data is estimated monthly by measuring the following: amount of rainfall, rain amount on surface of lake, other inputs, evaporation, draft, leaks, and change in lake level.

Otay, Dulzura and Cottonwood Watersheds:
Table 3-3.6 shows annual rainfall and runoff at each of the three reservoirs in the Otay, Dulzura and Cottonwood Watersheds. Rainfall totals for years 2001-2003 were average or below average. The winter of 2004-2005 was the third wettest on record.

Table 3-3.6 Rainfall and Estimated Runoff for Cottonwood Watershed Reservoirs			
Reservoir	**Year**	**Rainfall (in.)**	**Runoff Entering Reservoirs (M.G.)**
Barrett	2001	13.69	134.83
	2002	8.15	70.92
	2003	13.61	251.69
	2004	20.68	575.24
	2005	14.88	7121.42
Otay	2001	10.4	92.36
	2002	5.96	171.92
	2003	8.48	324.67
	2004	14.24	905.8
	2005	11.78	7199.84
Morena	2001	17.43	1402.3
	2002	8.73	74.85
	2003	18.45	59.64
	2004	27.67	70.42
	2005	19.45	3717.48

Fires

The California Department of Forestry (CDF) addresses all large brush fires within the watershed. The local fire districts handle structural fires only. CDF has an extensive fire prevention plan which includes three fire safe guidelines: residential, railway, and electrical power lines. CDF also provides an evaluation of burned sites and a re-growth plan to prevent erosion immediately following a fire.

Fire can indiscriminately devastate certain vegetation and wildlife communities, but is very important to the sage scrub and chaparral communities. Many taxa of coastal sage scrub plants are adapted to fire by stump sprouting or high seed production (Skinner et al., 1994). Similarly, many chaparral plants are adapted to frequent fires either through resprouting or seed carry-over (see Vegetation). While these communities are adapted to fire and usually recover in three to five years following such an event, the soils are subject to increased erosion immediately following a burn (see Fires, Soils).

Sediment from the burned areas can impact streams and the aquatic organisms within those streams, ultimately feeding into reservoirs where sediment loads may affect treatment procedures. Control of large fires is important from both a preservation perspective as well as a watershed management perspective.

The fire and water districts in the watershed do not measure the water quality impacts of the runoff from burned areas (Calhoun, Justice, Bratton, 1995). In most cases the County Office of Emergency Response or the local Fire Department contacts the RWQCB to visit the site after the fire is contained. The RWQCB participates in assessing the impact of the fire on the surface water quality, and will determine if monitoring is necessary.   Fire information in this report is supplied by the California Department of Forestry. The current data available from CDF is through December 31, 2004

Otay, Dulzura and Cottonwood Watersheds:
Since 2000, there have been seven fires in the Otay, Dulzura and Cottonwood Watersheds (Figure 3-3.8, Table 3-3.7*)*.

Table 3-3.7 Otay, Dulzura and Cottonwood Watershed Fires

Name	Alarm Date	Acres Burned
Bobcat	8/24/2002	738
Cedar	10/25/2003	8,986
Garnet	7/13/2002	1
Mine/Otay	10/26/2003	27,907
Pines	7/29/2002	195
Sheephead	7/6/2004	16
Troy	1/3/2001	1,558

With the exception of the Otay fire, little to no impact was observed on the source water bodies in these watersheds. The Otay fire started on October 26, 2003 and by the time it was contained, more than 44,000 acres of grass, chaparral and Tecate cypress forest had burned. This area represents 45% of the Otay Watershed. The staff of the City of San Diego Water Department, which monitories the water quality of Otay Reservoir and the streams that enter it, observed significant sedimentation in the Otay Watershed from the burn areas (City Staff, personal communication). These effects were especially evident during the winter of 2004-2005 when San Diego County experienced near record rainfall.

Summary of Potential Contaminant Sources

Land Use -

The section on land use includes; land ownership, category of land use, and population density.

Land Ownership

The land ownership information discussed in this section is primarily derived from SanGIS data. SanGIS maintains a database of land ownership information, by parcel, for San Diego County.

Otay and Dulzura Watersheds:

Approximately 59% of the Otay/Dulzura Watershed is privately owned, while 41.1% is in public ownership (Figure 3-3.9, Table 3-3.8). The land area owned by the City of San Diego is 3,555 acres, or 5.1% of the watershed.

Table 3-3.8 Land Ownership in Otay/Dulzura Watershed

Ownership Category	**Area (acres)**	**% of Watershed**
Indian Reservation	7	0.0
Publicly Owned		
Local	6178	8.1
State	7539	9.8
Federal	17715	23.1
Subtotal Publicly owned	31432	41.1
Private	45128	58.9
Total	76567	100

Cottonwood Watershed:

Approximately 14% of the Cottonwood Watershed is privately owned, while 81% is in public ownership. (Figure 3-3.10, Table 3-3.9).

Table 3-3.9 Land Ownership in Cottonwood Watershed		
Ownership Category	**Area (acres)**	**% of Watershed**
Indian Reservation	7964	5.1
Publicly Owned		
Local	7945	5.1
State	3649	2.3
Federal	115400	73.8
Subtotal Publicly owned	126994	81.2
Private	21431	13.7
Total	156389	100

Existing Land Use -

The information discussed in this section is based on SanGIS data. It is important to note that some areas reported in the 1996-2000 Watershed Sanitary Survey (WSS) as vacant and undeveloped land use have been updated by SanGIS to reflect its correct land use type, parks and open space preserves.

Otay Watershed:

Land use in the Otay Watershed has experienced little change since 2000 (Figure 3-3.11, Table 3-3.10). Otay Watershed is relatively undeveloped with approximately 90% of its land use type fitting into the following categories: vacant and undeveloped (51%), parks and open space preserves (36.7%), and water (1.6%). Approximately 7% of the total watershed is occupied by urban development, such as residential and commercial land uses (see Rainfall and Runoff). Agriculture accounts for approximately 2% of the land area in the Otay Watershed.

Table 3-3.10 Existing Land Use in the Otay Watershed		
Land Use Category	**Area (acres)**	**% of Watershed**
Agriculture	1105.13	1.75
Commercial Recreation	457.49	0.72
Commercial	7.55	0.01
Industrial	22.88	0.04
Parks	23226.30	36.73
Schools, Hospitals, Public & Private Institutions	90.32	0.14
Single Family Residential	103.85	0.16
Spaced Rural Residential	4137.79	6.54
Under Construction	17.50	0.03
Transportation, Communication & Utilities	659.76	1.04
Water	1031.55	1.63
Subtotal	30860.12	48.81
Vacant and Undeveloped	32370.57	51.19
Total	63230.69	51.19

Dulzura Watershed:

Land use in the Dulzura Watershed has experienced little change since 2000 (Figure 3-3.11, Table 3-3.11). Dulzura Watershed is relatively undeveloped with approximately 90% of its land use type fitting into the following categories: vacant and undeveloped (62%), parks and open space preserves (28%). Approximately 9% of the watershed is developed for residential purposes, which is a 3% increase since the 1996-2000 WSS (see Rainfall and Runoff). No commercial agriculture occurs in the Dulzura Watershed.

Table 3-3.11 Existing Land Use in the Dulzura Watershed		
Land Use Category	**Area (acres)**	**% of Watershed**
Parks	2004.97	28.27
Group Quarters Residential	16.49	0.23
Spaced Rural Residential	643.79	9.08
Transportation, Communication & Utilities	52.27	0.74
Subtotal	2717.52	38.32
Vacant and Undeveloped	4374.22	61.68
Total	7091.74	100.00

Cottonwood Watershed:

Land use in the Cottonwood Watershed has experienced little change since 2000 (Figure 3-3.12, Table 3-3.12). Cottonwood Watershed is relatively undeveloped with approximately 96% of its land use type fitting into the following categories: vacant and undeveloped (76%), parks and open space preserves (18%), and water (1.6%). Agriculture accounts for approximately 2% of the land area in the Cottonwood Watershed.

Table 3-3.12 Existing Land Use in the Cottonwood Watershed		
Land Use Category	**Area (acres)**	**% of Watershed**
Agriculture	2591.49	1.66
Commercial Recreation	357.84	0.23
Commercial	18.80	0.01
Parks	27705.31	17.72
Schools, Hospitals, Public & Private Institutions	96.50	0.06
Group Quarters Residential	75.98	0.05
Mobile Home Parks	15.75	0.01
Single Family Residential	423.39	0.27
Spaced Rural Residential	1140.73	0.73
Transportation, Communication and Utilities	2495.44	1.60
Water	2478.28	1.58
Subtotal	37399.51	23.91
Vacant and Undeveloped	118989.58	76.09
Total	156389.09	76.09

Agriculture -

Agricultural practices can be a significant source of non-point source contaminants. Contaminants that are often found in typical agricultural surface runoff include sediment, nutrients, pesticides and bacteria. Increases in salinity may also pose a significant water quality problem in the future. The United States Environmental Protection Agency (USEPA) has estimated that about 75% of the sediment, 52% of the nitrogen loading, and 70% of the phosphorus loading that enters waterways of the 48 contiguous states originates in agricultural settings. Most contaminants are transported to the water supply through either surface runoff or irrigation return flows.

Agricultural practices consist of field crops, orchards and vineyards, and intensive agriculture; home gardens and hobby farms are not included in this report.

Field crops include; grain, alfalfa and sod. Due to the minimal use of pesticides and other chemicals, this agricultural practice is considered to have the lowest potential of impacting water quality.

Orchards and Vineyards include; apples, avocados, citrus, grapes and other non-evergreen fruit, while intensive farm plots include; row crops such as herbs, vegetables, poultry ranches, and dairy farms. Due to their reliance on pesticides and other chemicals, these practices are considered to have a greater potential of impacting water quality.

Poultry ranches are regulated by the San Diego County Department of Environmental Health for fly breeding and facilities are inspected annually. Poultry Farms do not discharge a significant amount of wastewater, but impact to water quality is possible during periods of rain when runoff could carry manure into nearby drainages. Manure management methods include frequent cleaning, drying and coning. Manure is generally spread on the ground to dry, pushed into windrows and then removed from the ranch.

Dairy farms are permitted by the Regional Water Quality Control Board (RWQCB) and facilities are inspected quarterly. The RWQCB issues orders specific to individual dairies. These orders contain facility designs, operation specifications and discharge specifications, along with other guidelines for complying with the Watershed Basin Plan. Dairy farms are then required to submit quarterly reports to the RWQCB that describe herd size, manure disposal, groundwater monitoring results including nitrates and dissolved solids. Milk cows, corrals and barns are generally washed daily. Dairies typically have retention ponds for wastewater discharge which during periods of rain could overflow and impact the water quality of nearby streams.

Otay and Dulzura Watersheds:

The information discussed in this section is based on SanGIS data and two layers created by RECON Environmental Consultants using information from the San Diego County Department of Environmental Health and RWQCB. Since 2000, lands used for agriculture in the Otay/Dulzura Watersheds have decreased from 3,075 acres to 1,180 acres (Figure 3-3.11, Table 3-3.13). No permitted poultry ranches or cattle farms exist within the Otay or Dulzura Watersheds.

Table 3-3.13 Agriculture in the Otay and Dulzura Watershed

Type of Agriculture	**Acres**	**% of Watershed**
Orchard	120	0.1%
Intensive	74	0.1%
Field Crops	986	1.5%
Total	**1180**	**1.7%**

Cottonwood Watershed:

No changes have occurred in Agriculture since 2000. Agriculture accounts for 2,778 acres of the Cottonwood watershed (Figure 3-3.12, Table 3-3.14). No permitted poultry ranches or cattle farms exist within the Cottonwood Watershed.

Table 3-3.14 Agriculture in the Cottonwood Watershed

Type of Agriculture	Acres	% of Watershed
Orchard	0	0%
Intensive	0	0%
Field Crops	2778	1.7%
Total	**2778**	**1.7%**

Grazing -

The animal grazing data presented derives from two sources: the Bureau of Land Management (BLM), and the United States Forest Service (USFS). Although grazing on private land occurs in this watershed, no spatial data was available for such areas, and grazing on these lands is not included in this report. The USFS allows an average density of one animal per 160 acres; therefore, the risk of water contamination from manure is low. However, loss of vegetation cover associated with grazing may increase soil erosion and sedimentation of streams and reservoirs (see Vegetation, Rainfall and Runoff).

Otay and Dulzura Watersheds:

Since 2000, all BLM lands permitted for grazing (6338 acres) in the Dulzura and Otay watersheds are currently in nonuse status (Figure 3-3.1, Table 3-3.15).

Table 3-3.15 Grazing in the Otay and Dulzura Watersheds				
Range Name	**Number of Head**	**Acres in Watershed**	**Ownership**	**Permit Status**
Otay Mountain	686	NA	BLM	Nonuse
Dulzura	1441	21	BLM	Nonuse
Mother Grundy	4215	16	BLM	Nonuse

Cottonwood Watershed:

Since 2000, the McCain Valley Tierra Range has been closed (447 acres) and the following rangelands permits have taken on nonuse status: Indian Creek (2780 acres), Morena (745 acres), Pine Valley (7402 acres) and Red Top (15957 acres). Currently, 54,950 acres of permitted grazing land are in the active status within the Cottonwood Watershed (Figure 3-3.1, Table 3-3.16).

Table 3-3.16 Grazing in the Cottonwood Watersheds				
Range Name	**Number of Head**	**Acres in Watershed**	**Ownership**	**Permit Status**
Clover Flat	715	49	BLM	Active
Corte Madera	79	11525	USFS	Active
Guatay	20	853	USFS	Active
Hauser Mountain	66	203	BLM	Active
Indian Creek	75	2780	USFS	Nonuse
Laguna	209	28166	USFS	Active
Laguna Meadow	175	5858	USFS	Active
Morena	0	745	USFS	Nonuse
Pine Valley	30	7402	USFS	Nonuse
Red Top	120	15957	USFS	Nonuse
Samataguma	0	958	USFS	Active
Thing Valley	22	7338	USFS	Active

Population Density -

Population density is a good indicator of the level of urbanization within an area. Land areas with small population densities are usually rural with natural landscapes that trap rainwater and allow it to filter slowly into the ground (see Rainfall and Runoff). In contrast, large population densities are associated with urbanized areas. These areas contain impervious surfaces that prevent rain from infiltrating into the ground which increases the amount and velocity of runoff. Urbanization increases the variety and amount of pollutants carried into streams, rivers, and lakes. These pollutants can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational areas unsafe and unpleasant. The population data presented was derived form SANDAG's 2000 Census.

Otay and Dulzura Watershed:

The estimated 2005 population of the watershed is approximately 9,117 people for Otay and 3,874 people for Dulzura (Table 3-3.17). This reflects a population increase of about 5% for Otay, and a 48% increase for Dulzura in the past five years. The average population density throughout the combined watersheds is approximately 0.18 persons per acre. The most densely populated area within the watershed is the well developed town of Jamul (Figure 3-3.13).

Cottonwood Watershed:

The estimated 2005 population of the watershed is approximately 6,341 people (Table 3-3.17). The population has increased 2%, in the past five years. The average population density throughout the watershed is approximately 0.04 persons per acre. The populated area concentrations within the watershed are Morena Village and Pine Valley (Figure 3-3.14).

Table 3-3.17 Populations for Cottonwood / Otay System Watersheds

Watershed	Population	Density (Persons/Acre)
Otay WS	9,117	0.14
Dulzura WS	3,874	0.54
Cottonwood WS	6,341	0.04
City of Pine Valley	1,501	0.32

Mines -

The mine data presented was obtained from USGS and SWRCB. The SWRCB and the RWQCB are given authority over mines. The most common environmental hazard is: heavy metals associated with acid-rock drainage; methyl mercury from mercury-contaminated sediments; arsenic; asbestos and chromium.

Otay, Dulzura and Cottonwood Watersheds:
In the 1996-2000 Watershed Sanitary Survey there were twenty-four mines listed by the State Water Resources Control Board (SWRCB). Currently there are no active mines listed within the Otay, Dulzura and Cottonwood Watersheds.

Hazardous Materials -

The data presented in this section was obtained from the San Diego County Health Department, RWQCB, and the Solid Waste Assessment Test Program. The hazardous materials were put into three categories: Liquid Hazardous Waste, Solid Hazardous Waste and Liquid Hazardous Storage (capacity). The majority of liquid waste is stored in 55 gallon drums and hauled away by licensed waste haulers. Automotive and Tractor fuels make up the majority of permitted liquid hazardous storage. These fuels are stored in underground fiberglass-reinforced plastic, cathodically protected steel, or steel clad with fiberglass-reinforced plastic. These tanks are installed with a leak interception and detection system.

The State Resources Control Board affected changes to the underground storage tank regulations on 13 October 2005. These changes can be found in Title 23, California Code of Regulations, Chapter 16.

Table 3-3.18 Summary of Permitted Hazardous Material			
Watershed	**Liquid Waste (gal)***	**Solid Waste (lbs)***	**Liquid Storage (gal)***
Otay & Dulzura	2,054	1,767	42,700
Cottonwood	4,870	2,918	267,960
Total	**6,924**	**4,685**	**310,660**

* Figures are maximum capacities

Otay, Dulzura and Cottonwood Watersheds:

Hazardous Materials/Waste amounts and locations for the Otay, Dulzura and Cottonwood Watersheds are illustrated in Figure 3-3.1, Table 3-3.18.

Recreation -

Otay Reservoirs

The primary purpose of Upper and Lower Otay Reservoirs are for domestic water supply, while recreation is a secondary use of the reservoirs. The reservoirs are open to the public for boating and fishing use, three days a week, February through October, and to all other recreational activities, seven days a week, year around. Recreational activities include; boating, fishing, jogging, biking, and picnicking. Water contact activities are not permitted at the reservoir (Table 3-3.19).

Table 3-3.19 Otay Reservoir Number of Permits Sold				
Year	Fishing	Launch	Rentals	
			Motor	Row
2001	19069	5081	NA	2290
2002	21695	6601	NA	2314
2003	18602	5362	NA	1642
2004	15822	4252	1399	789
2005	Figures not reconciled			

The facilities consist of concession, launch, rental boats, trash receptacles, portable toilets, two floating restroom facilities, and a comfort station. These facilities are owned and operated by the City of San Diego. There are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels.

Lower Otay Reservoir has a restricted access area encompassing the outlet tower. This area is demarcated by a floating barrier to prevent direct recreational contact to the water immediately available to the Otay Water Treatment Plant.

The potential sources of contamination associated with the recreational activities include; erosion, trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts. Title 22 contaminants are monitored quarterly and nutrients monthly (Figure 3-3.1). Microorganisms including Total Coliforms, E. coli, and Enterococcus are monitored weekly.

Barrett Reservoir:

The primary purpose of Barrett Reservoir is for domestic water supply, while recreation is a secondary use of the reservoir. Barrett reservoir is open to the public for recreational use, three days a week, April through September. Recreational activities include; boating, fishing, hunting and hiking. Water contact activities are not permitted at the reservoir (Table 3-3.20).

Table 3-3.20 Barrett Reservoir Number of Permits Sold

Year	Fishing	Hunting	Launch	Rentals	
				Motor	Row
2001	3473	381	NA	1556	286
2002	3530	330	NA	1529	244
2003	4609	447	NA	1819	307
2004	4468	365	NA	1570	291
2005	Figures not reconciled				

The facilities consist of rental boats, trash receptacles, and portable toilets. There are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels.

The potential sources of contamination associated with the recreational activities include; erosion, trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts. Title 22 contaminants are monitored quarterly (Figure 3-3.1).

Morena Reservoir:

The primary purpose of Morena Reservoir is for domestic water supply, while recreation is a secondary use of the reservoir. Morena reservoir is open to the public for recreational use seven days a week year around. Recreational activities include; boating, fishing, hiking, biking, picnicking, and over-night camping. Water contact activities are not permitted at the reservoir (Table 3-3.21).

Table 3-3.21 Morena Reservoir Number of Permits Sold

Year	Fishing	Launch	Rentals	
			Motor	Row
2001	6792	815	1035	165
2002	8161	979	1071	151
2003	7410	890	1030	195
2004	8558	1027	786	237
2005	9649*	1308*	747*	228*

* Figures are estimates provided by the County of San Diego

The facilities consist of concession, launch, rental boats, trash receptacles, portable toilets and comfort stations. These facilities are owned and operated by the County of San Diego. There are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels.

The potential sources of contamination associated with the recreational activities include; trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts. Title 22 contaminants are monitored quarterly (Figure3-3.1).

Wastewater / Reclaimed Water -

Otay and Dulzura Watersheds:

There are no Wastewater / Reclaimed Water treatment facilities permitted by the RWQCB in the Otay/Dulzura watershed. Otay Water District has a reclaimed water distribution system located on the western boundary of the watershed (Figure 3-3.1). The system is supplied by the Ralph W Chapman Water Reclamation Facility. Otay Water District is the agency responsible for the facility. The facility is not located in the Otay/Dulzura watershed.

Cottonwood Watershed:

The Pine Valley Sanitation District is the only wastewater treatment facility permitted by the RWQCB in the Cottonwood Watershed (Figure 3-3.1, Table 3-3.22).

Table 3-3.22 Wastewater / Reclaimed Water Facilities

RCQCB Facility I.D.	Facility Name	Address	Highest level of Treatment	Discharge To:	Land Disposal Order #
9000000099	Pine Valley SD	260 Sawday Street	Un-disinfected Secondary	Percolation Ponds	94-161

Pine Valley Sanitation District:

The County of San Diego is the agency responsible for this facility. RWQCB Order No. 94-161 establishes the discharge specifications for the Pine Valley SD facility (Table 3-3.23).

The treatment and disposal system is comprised of; an aerated lagoon with a 72 day detention time, and eight percolation beds. The long detention time causes a severe algae problem which contributes to high biochemical oxygen demand and suspended solids in the effluent. The RWQCB requirements certify a maximum discharge of 0.040 mgd.

Table 3-3.23 Pine Valley Sanitation District Effluent Discharge Limitations, Order # 94-161

Constituent	Unit	12-Month Average
Biochemical Oxygen Demand	mg/L	30
pH	Within the limits of 6.0 to 9.0 at all times	
Total Dissolved Solids	mg/L	750
Chloride	mg/L	250
Sulfate	mg/L	250
Nitrate (as NO_3)	mg/L	30

Biosolids Disposal Practices*:*

The facility has a complete oxidation process. There is no solid waste generated from the treatment process at this facility.

Septic Systems -

Otay, Dulzura and Cottonwood Watersheds:

The primary goal in this section is to identify areas where septic systems may pose a threat to water quality. Septic systems treat and disperse relatively small volumes of wastewater from individual or small numbers of homes and commercial buildings. Poorly managed systems have been named as a concern by nearly every federal and state program that deals with water resource issues.

San Diego County's Department of Environmental Health maintains records of septic tank permits at their San Marcos and El Cajon offices. Prior to 2002 no electronic database existed to query the location, type, etc. of these permits. There are an estimated 90,000-100,000 homes county-wide on septic systems.

Estimates of septic system density for the 1996-2000 WSS were calculated by using the 1990 census tract data to determine population density within each watershed. Next, a data layer of sewered and un-sewered areas was created from the City data base and from SanGIS community plan data. The sewered areas layer was overlaid with population density to create a new data layer. This data layer was queried to pull out polygons that were un-sewered with a population density greater than zero. Graduated color was applied to the septic density field to enable visual assessment of high potential concentrations of septic tanks.

In 2002 the County of San Diego Department of Environmental Health initiated an electronic database to track septic system permits issued throughout the County. The database does not contain historical permits issued before 2002, so an exact number of permits in a given community cannot be determined. However, the database indicates where new permits are being issued and if these permits are for new construction, repair, fire rebuild, etc. In addition, the permit records the hydrologic sub area where the septic system is located.

A data layer of the hydrologic sub areas of San Diego County was obtained from SanGIS. Numbers of permits issued in each hydrologic sub area was determined from the Counties database. Graduated colors were applied to the hydrologic sub area within each watershed to enable visual assessment of high issuant of septic system permits (Figure 3-3.15). Table 3-3.24 lists the communities within the watershed along with the number and type of septic system permits issued since 2002.

Table 3-3.24 Number and Type of Septic System Permits in the Cottonwood, Dulzura and Otay Watershed

	Type of System			
Community	**New**	**Repair or Modified**	**Fire Rebuild**	**Other**
Alpine	4	0	0	2
Campo	10	15	0	1
Dulzura	8	3	0	0
Jamul	79	25	0	1
Lake Morena	4	2	0	0
Pine Valley	19	33	0	0

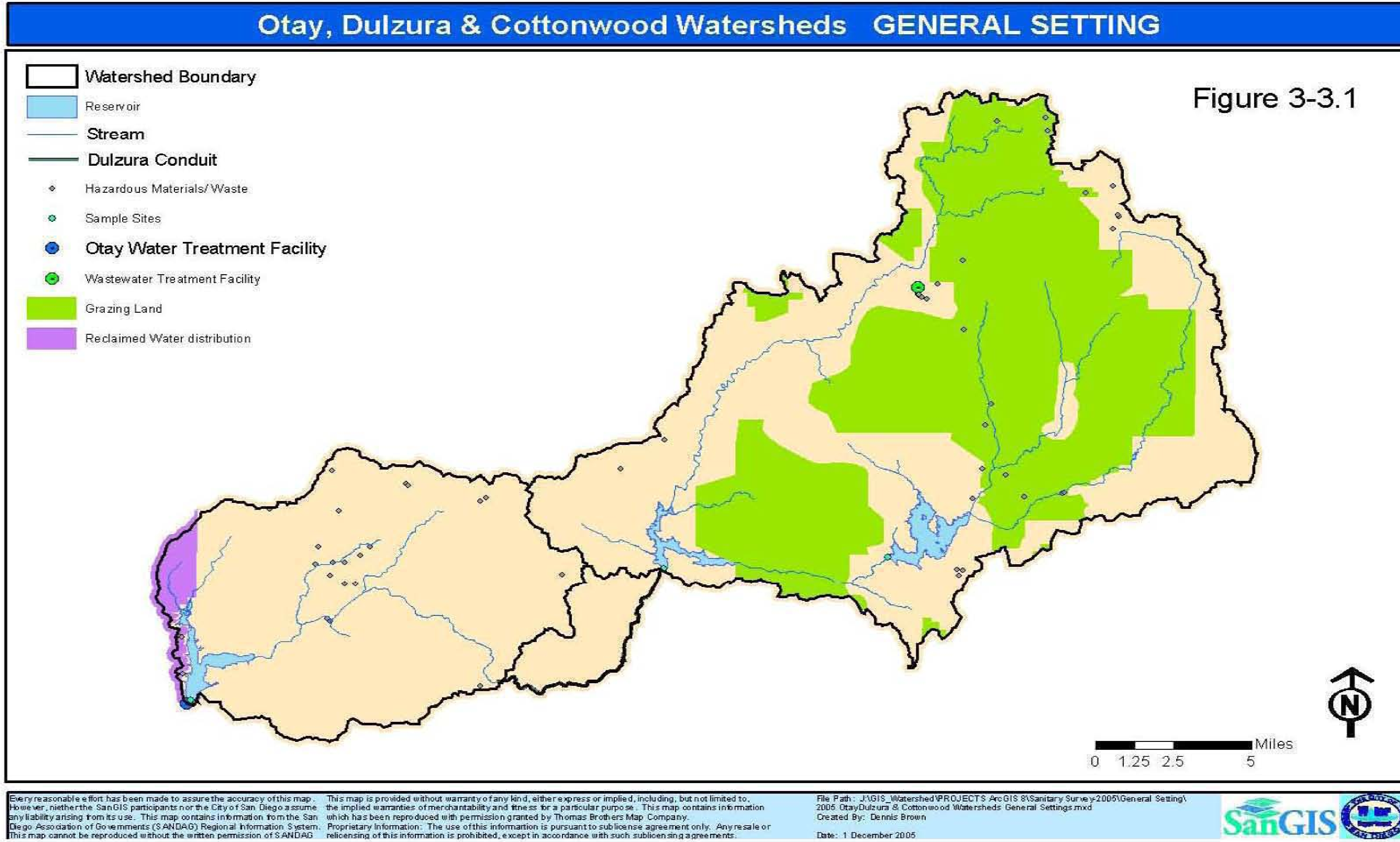
Sanitary Sewer Overflows -

Otay and Dulzura Watersheds:

There were no sanitary sewer overflows in the Otay/Dulzura Watershed reported to the Regional Water Quality Control Board (RWQCB) from 2001 through 2004. The current data available from the RWQCB is through June 30, 2004. Detailed information regarding sanitary sewer overflows is available at the Regional Water Quality Control Board website (www.swrcb.ca.gov/rwqcb9).

Cottonwood Watershed:

There were no sanitary sewer overflows in the Cottonwood Watershed reported to the Regional Water Quality Control Board (RWQCB) from 2001 through 2004. The current data available from the RWQCB is through June 30, 2004. Detailed information regarding sanitary sewer overflows is available at the Regional Water Quality Control Board website (www.swrcb.ca.gov/rwqcb9).


Otay, Dulzura & Cottonwood Watersheds GENERAL SETTING
Watershed Boundary
Reservoir
Stream
Dulzura Conduit
Hazardous Materials/ Waste
Sample Sites
Otay Water Treatment Facility
Wastewater Treatment Facility
Grazing Land
Reclaimed Water distribution
Figure 3-3.1
Miles
0 1.25 2.5 5
N
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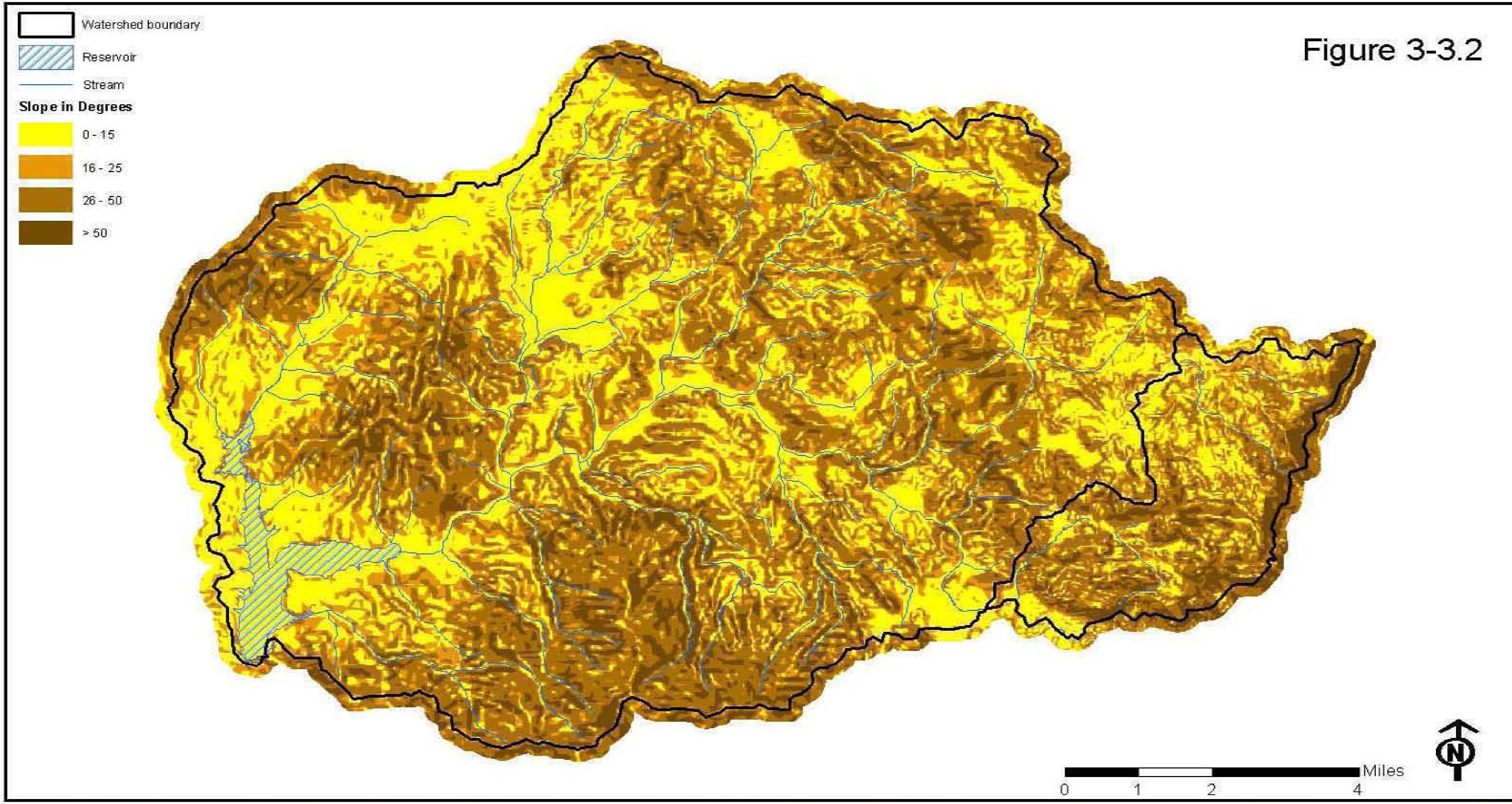
Otay & Dulzura Watersheds SLOPE



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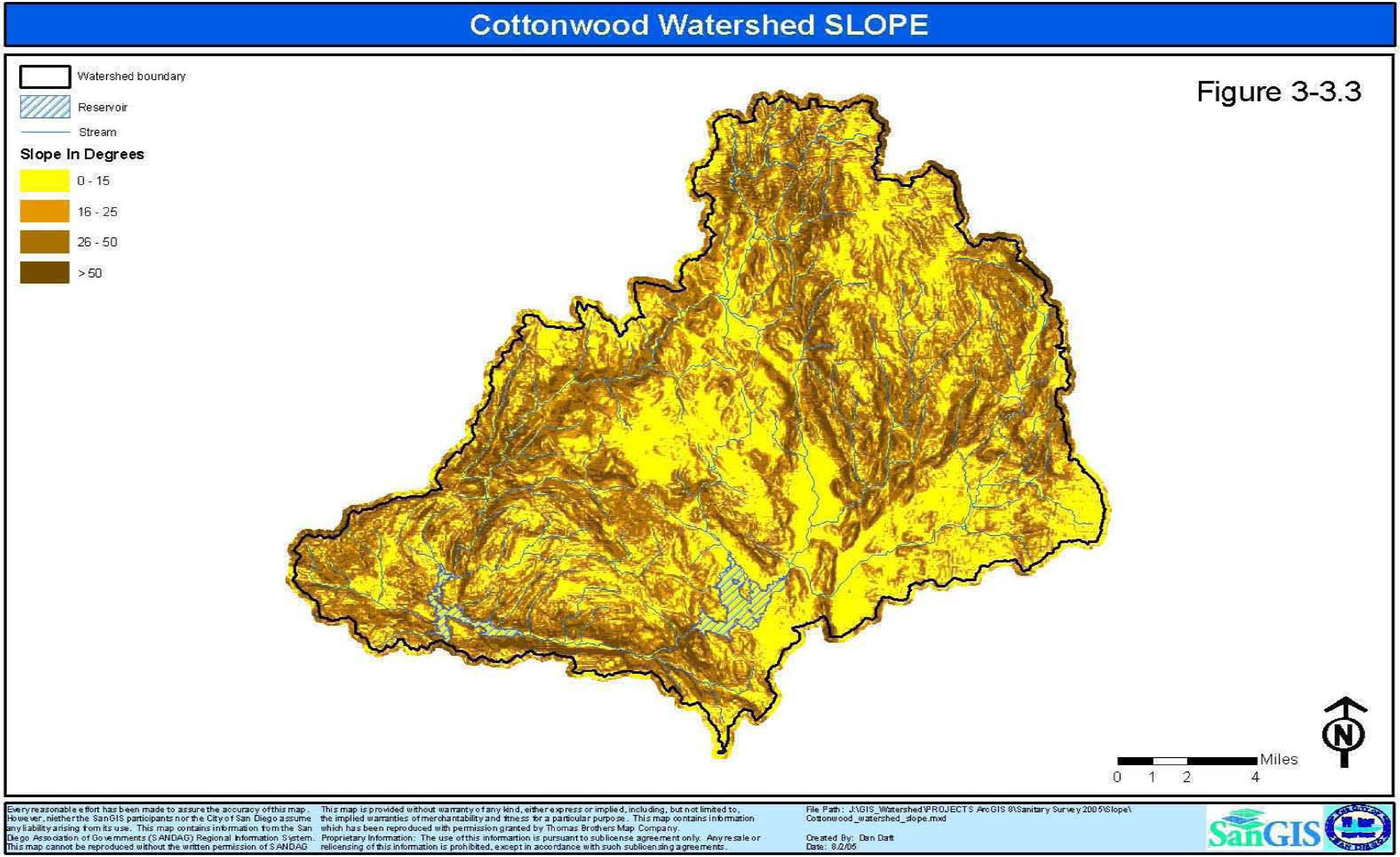

Cottonwood Watershed SLOPE
Figure 3-3.3
Watershed boundary
Reservoir
Stream
Slope In Degrees
0 - 15
16 - 25
26 - 50
> 50
Miles
0
1
2
4
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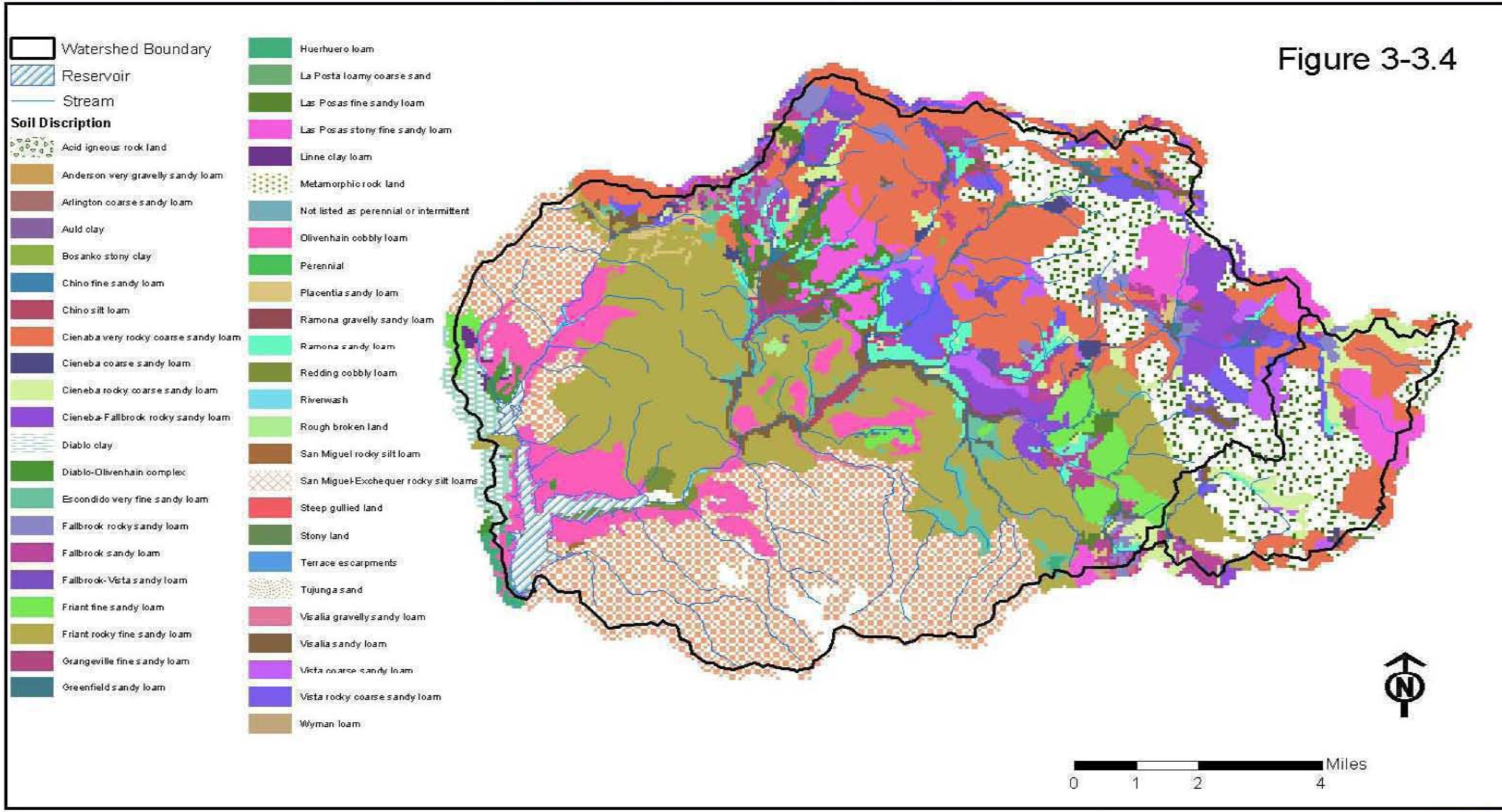
Otay & Dulzura Watersheds SOILS



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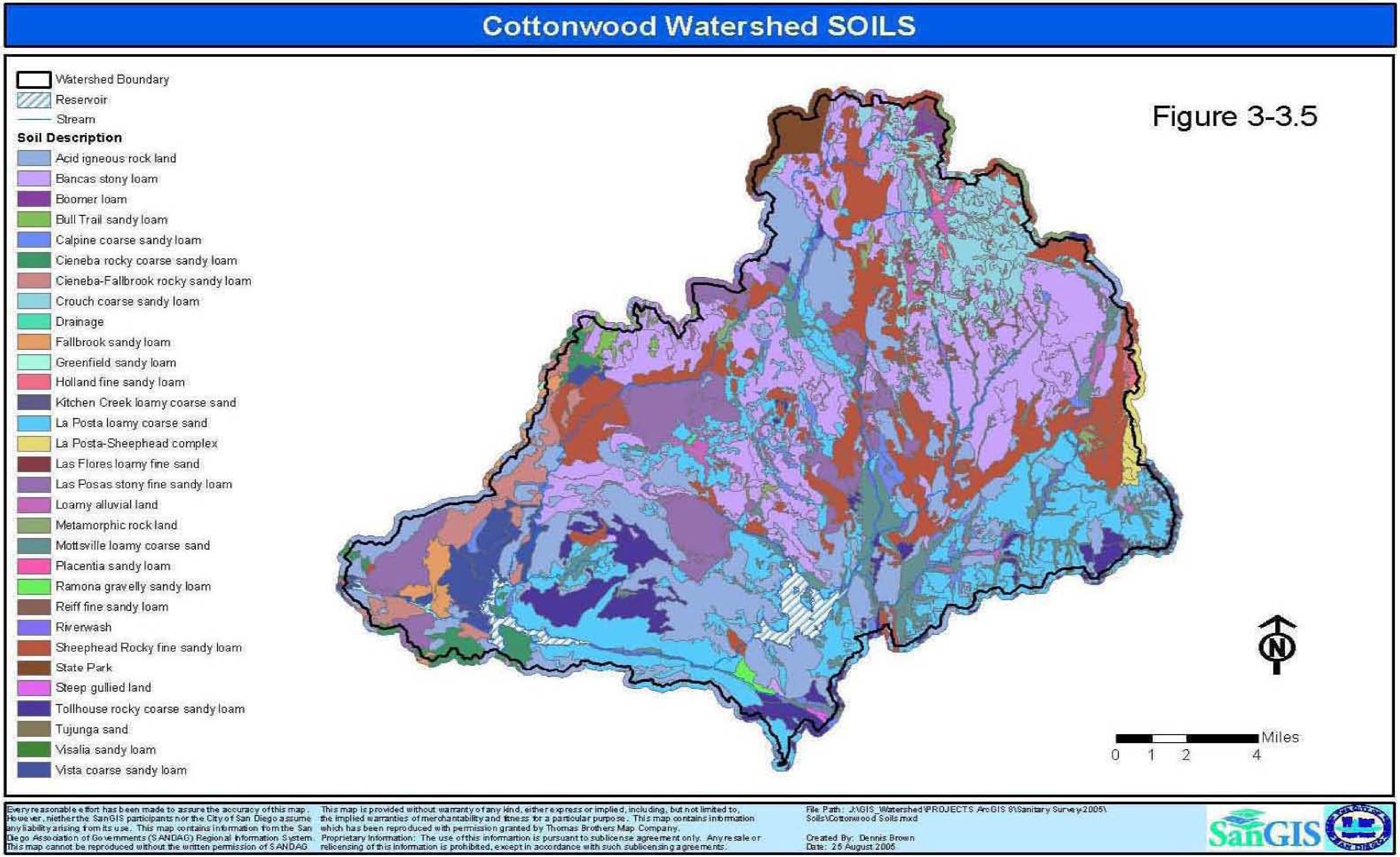
Date: 25 August 2005


Cottonwood Watershed SOILS
Watershed Boundary
Reservoir
Stream
Soil Description
Acid igneous rock land
Bancas stony loam
Boomer loam
Bull Trail sandy loam
Calpine coarse sandy loam
Cieneba rocky coarse sandy loam
Cieneba-Fallbrook rocky sandy loam
Crouch coarse sandy loam
Drainage
Fallbrook sandy loam
Greenfield sandy loam
Holland fine sandy loam
Kitchen Creek loamy coarse sand
La Posta loamy coarse sand
La Posta-Sheephead complex
Las Flores loamy fine sand
Las Posas stony fine sandy loam
Loamy alluvial land
Metamorphic rock land
Mottsville loamy coarse sand
Placentia sandy loam
Ramona gravelly sandy loam
Reiff fine sandy loam
Riverwash
Sheephead Rocky fine sandy loam
State Park
Steep gullied land
Tollhouse rocky coarse sandy loam
Tujunga sand
Visalia sandy loam
Vista coarse sandy loam
Figure 3-3.5
N
0 1 2 4
Miles
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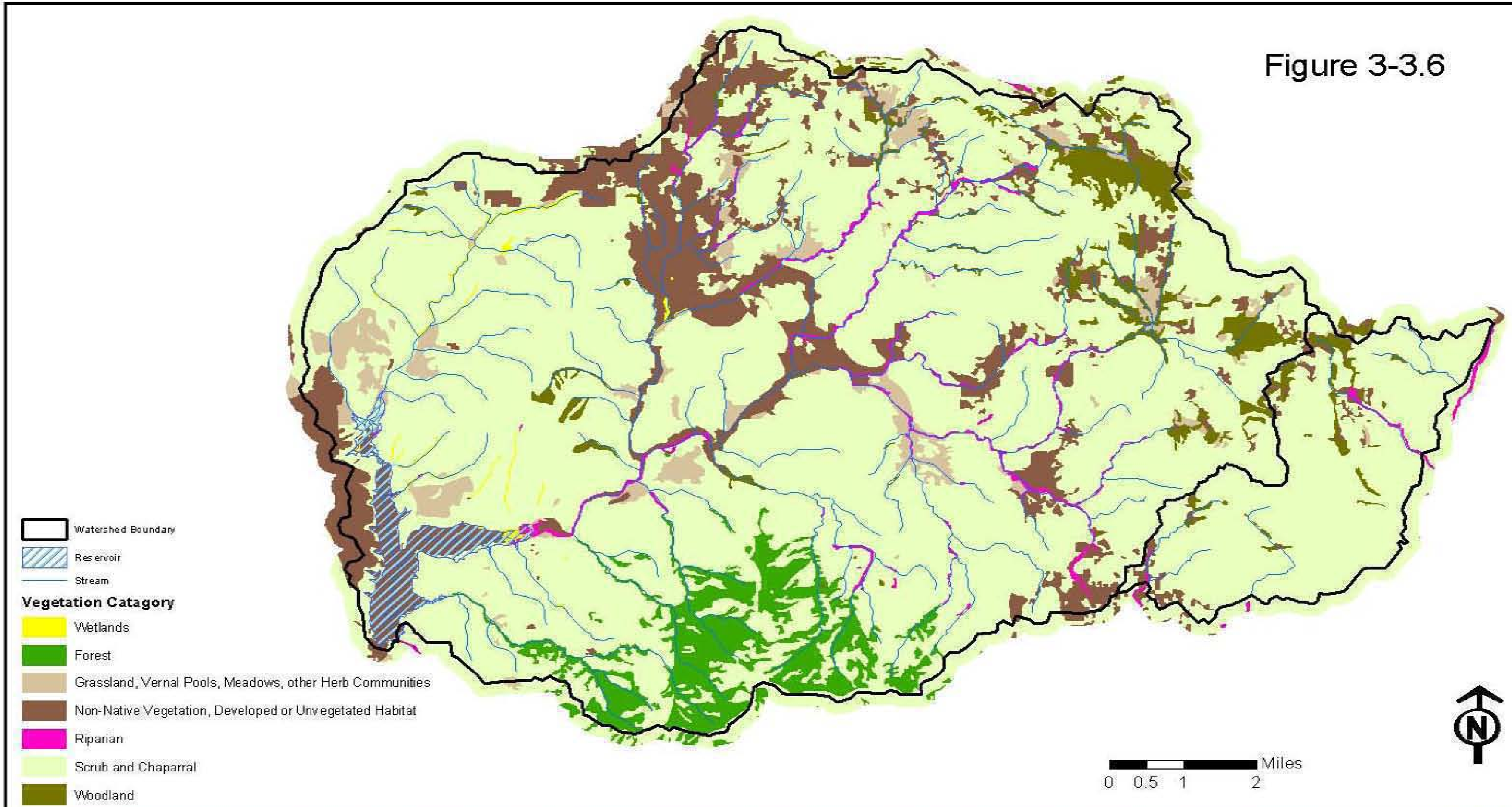
Otay & Dulzura Watersheds VEGETATION



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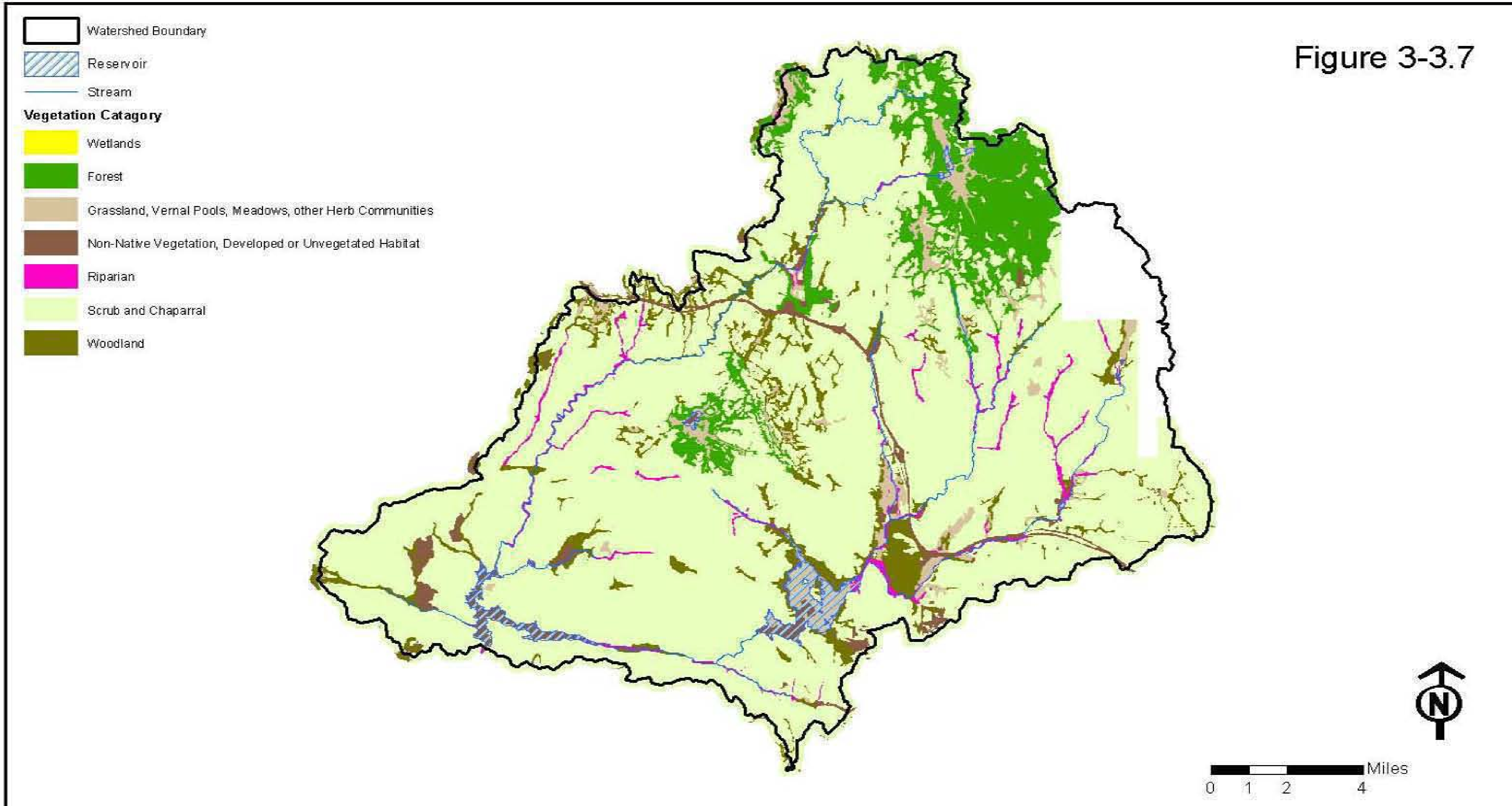
Cottonwood Watershed VEGETATION



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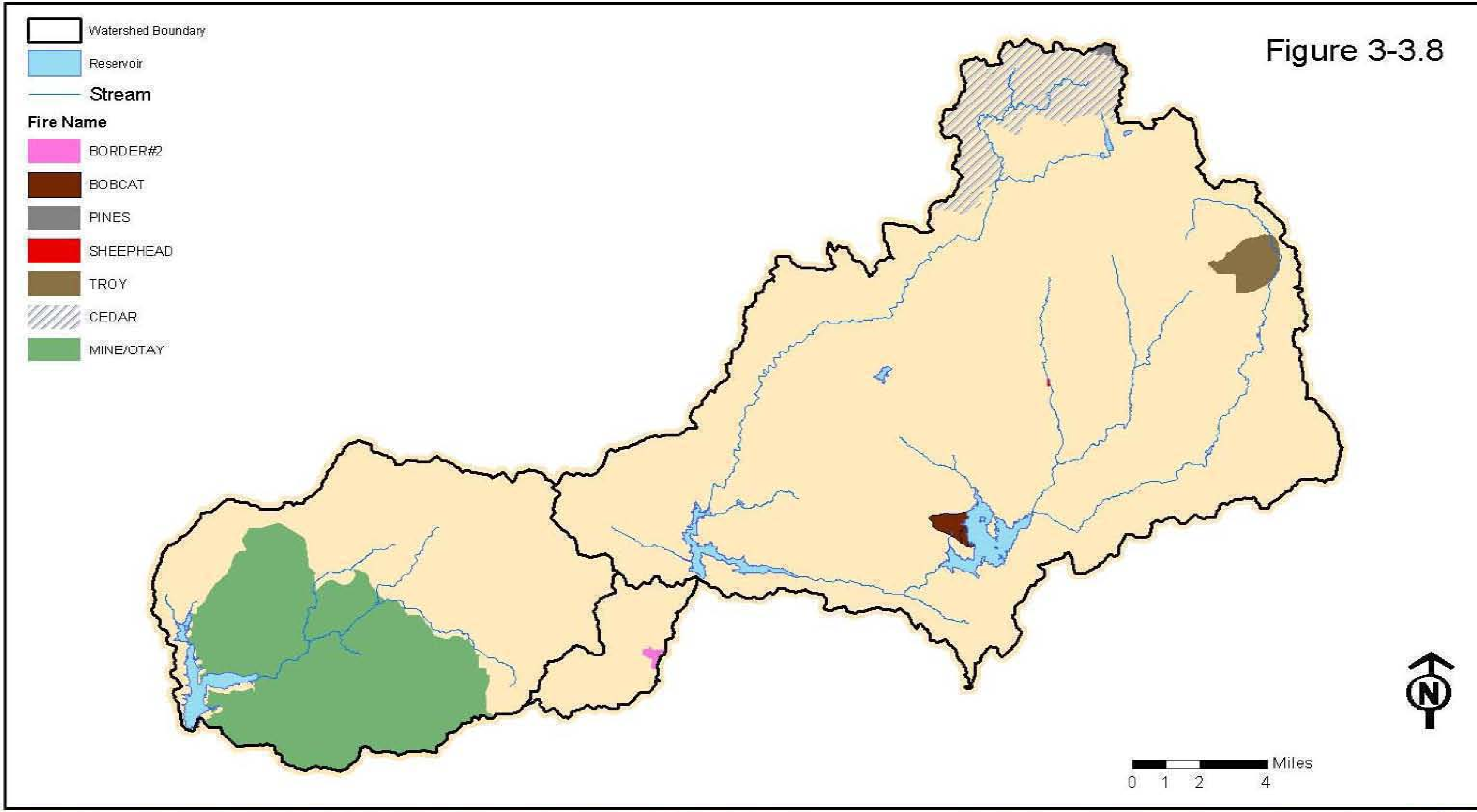
Created By: V.Chancer
Date: 08/12/05

Fire Perimeters in the Otay, Dulzua & Cottonwood Watersheds



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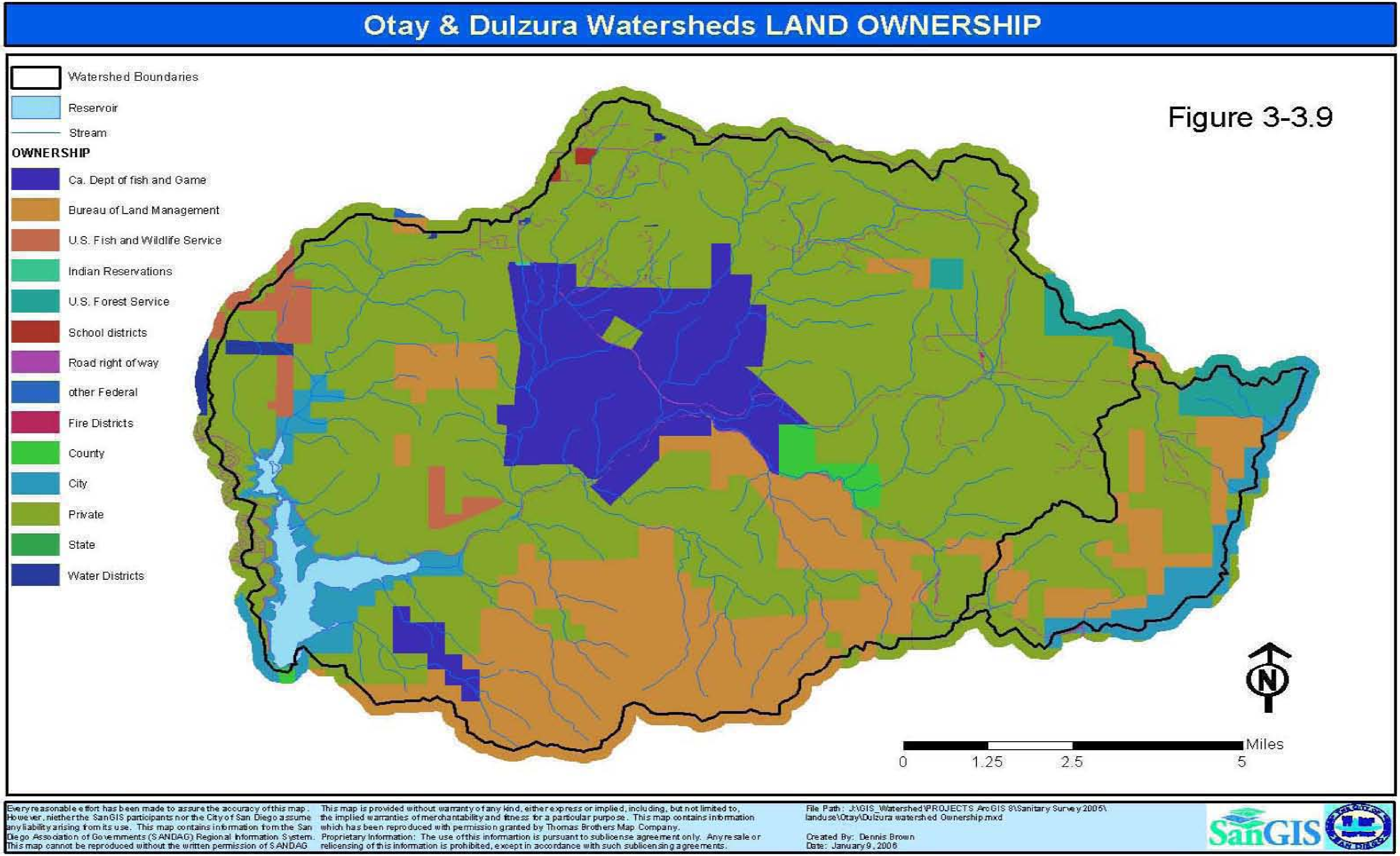

Otay & Dulzura Watersheds LAND OWNERSHIP
Figure 3-3.9
Watershed Boundaries
Reservoir
Stream
OWNERSHIP
Ca. Dept of fish and Game
Bureau of Land Management
U.S. Fish and Wildlife Service
Indian Reservations
U.S. Forest Service
School districts
Road right of way
other Federal
Fire Districts
County
City
Private
State
Water Districts
N
0
1.25
2.5
5
Miles
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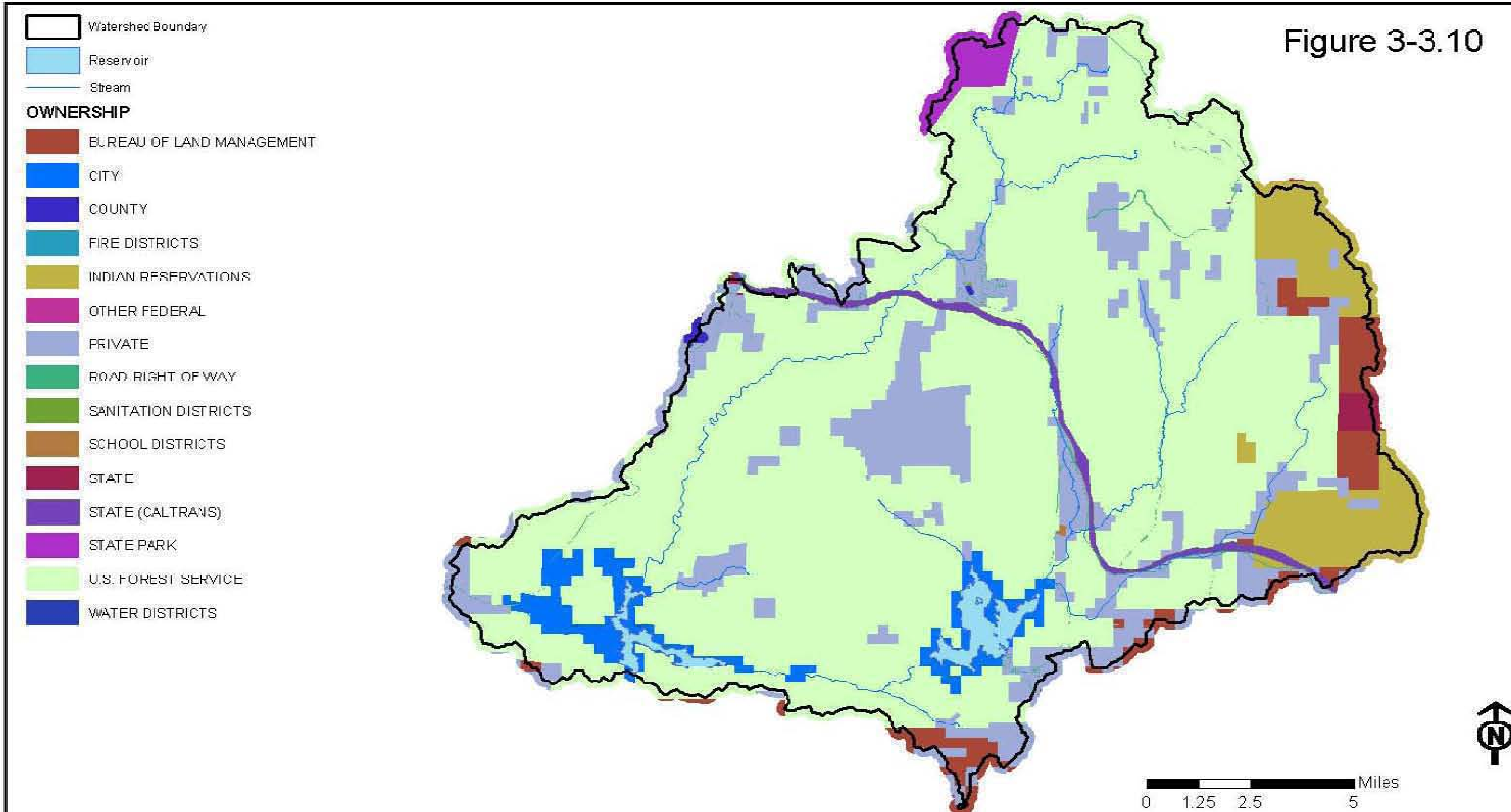
Cottonwood Watershed LAND OWNERSHIP



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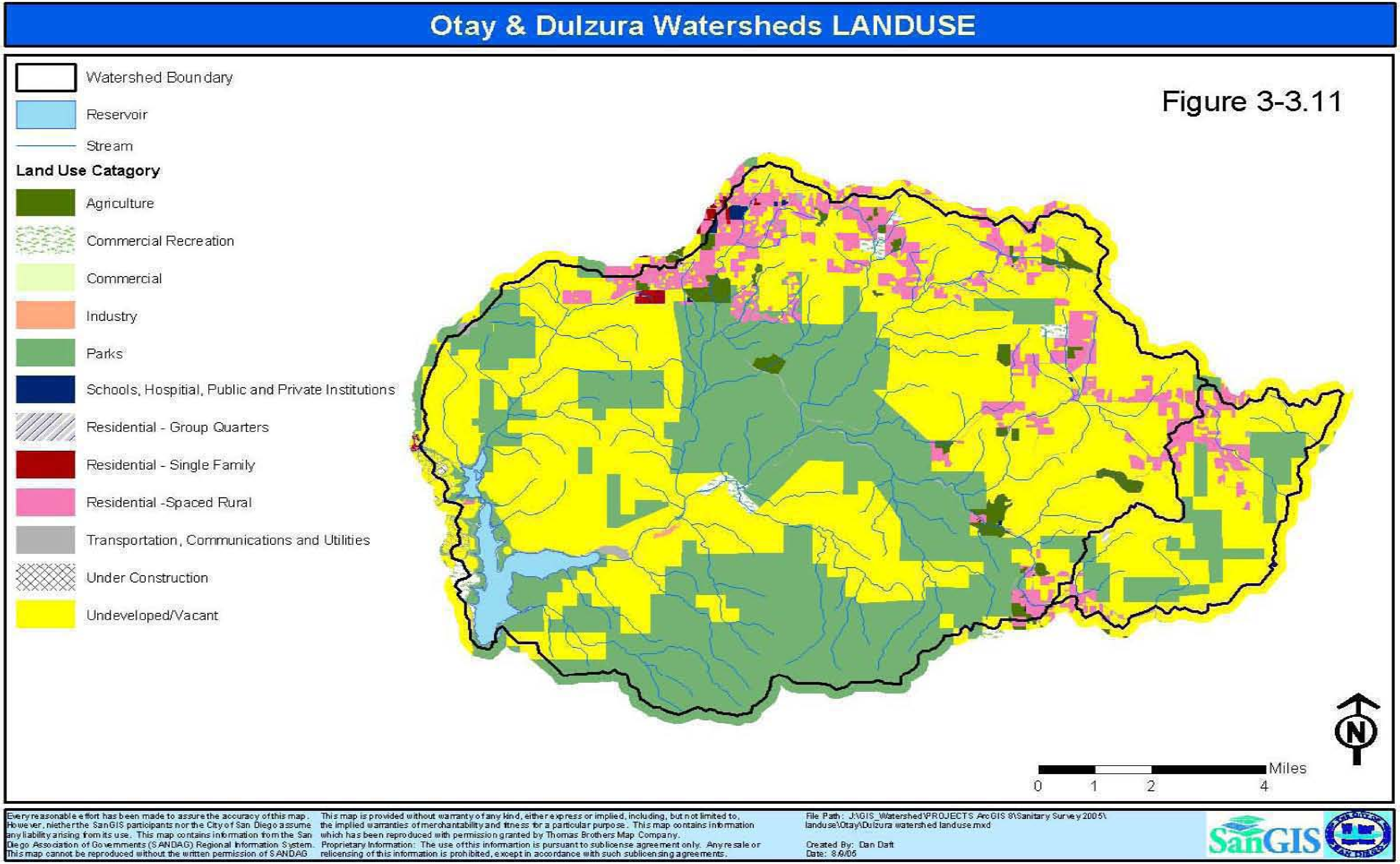

Otay & Dulzura Watersheds LANDUSE
Figure 3-3.11
Watershed Boundary
Reservoir
Stream
Land Use Catagory
Agriculture
Commercial Recreation
Commercial
Industry
Parks
Schools, Hospitial, Public and Private Institutions
Residential - Group Quarters
Residential - Single Family
Residential -Spaced Rural
Transportation, Communications and Utilities
Under Construction
Undeveloped/Vacant
Miles
0 1 2 4
N
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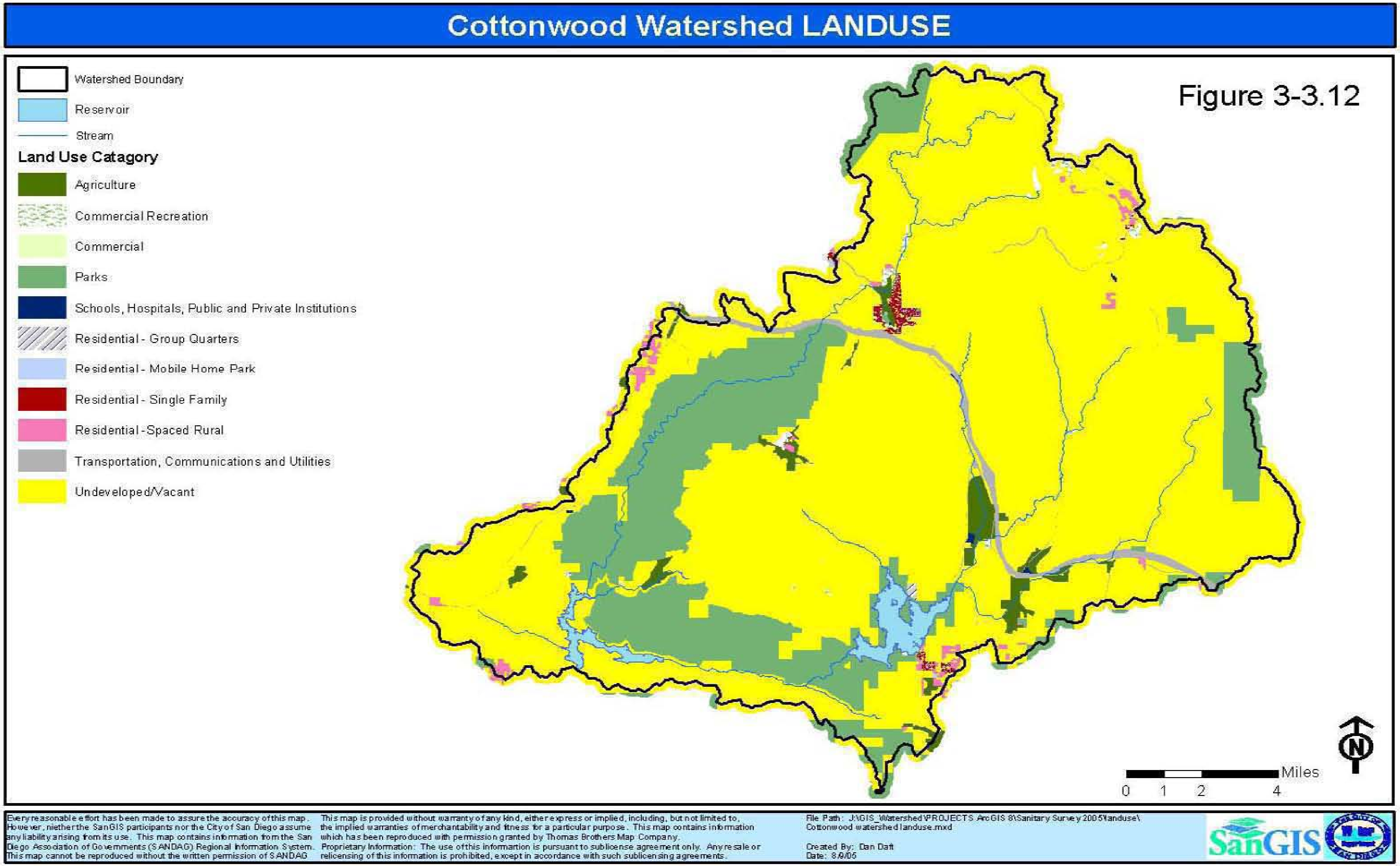
Cottonwood Watershed LANDUSE
Figure 3-3.12
Watershed Boundary
Reservoir
Stream
Land Use Catagory
Agriculture
Commercial Recreation
Commercial
Parks
Schools, Hospitals, Public and Private Institutions
Residential - Group Quarters
Residential - Mobile Home Park
Residential - Single Family
Residential -Spaced Rural
Transportation, Communications and Utilities
Undeveloped/Vacant
Miles
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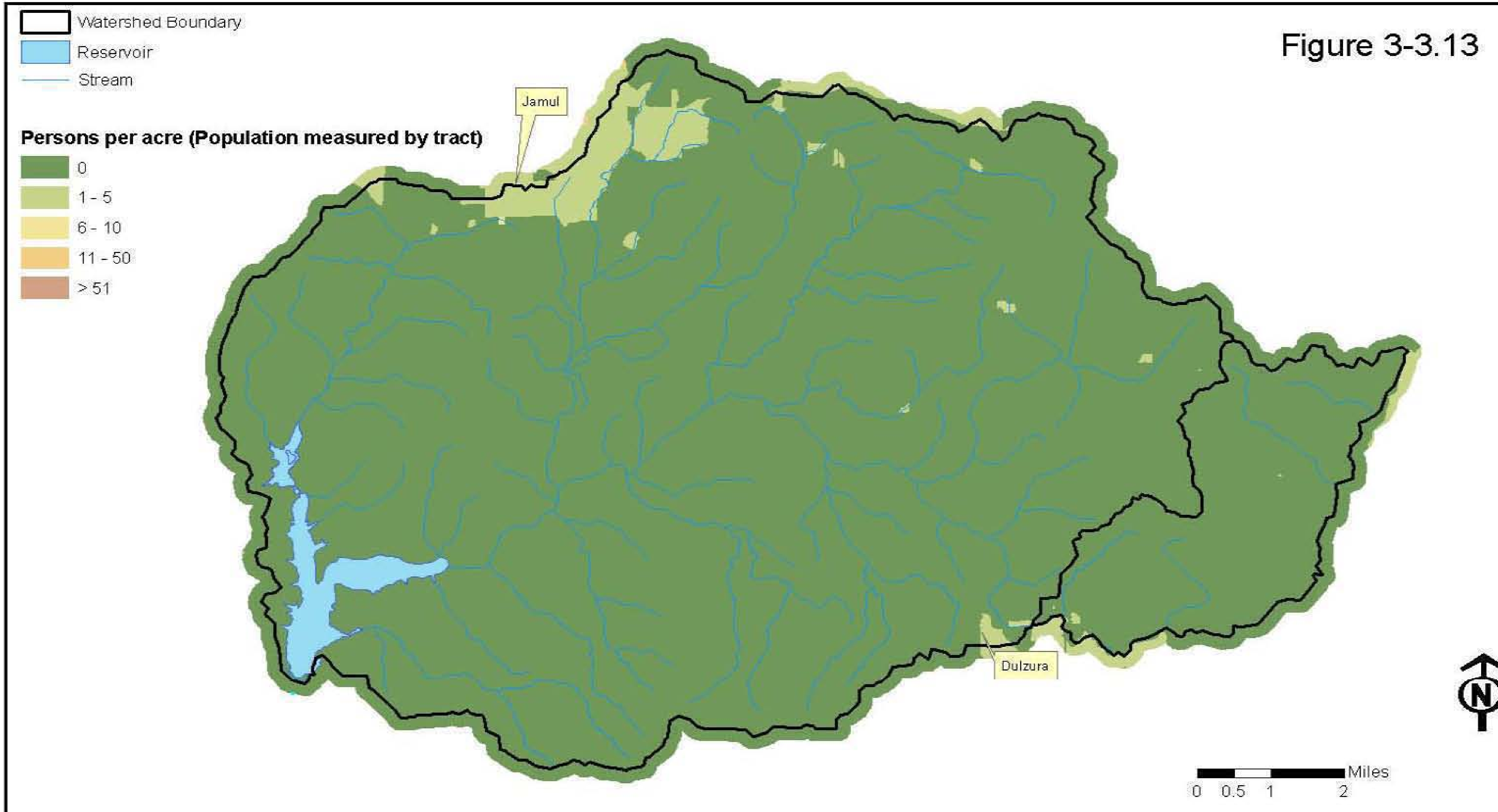
Otay & Dulzura Watersheds POPULATION DENSITY



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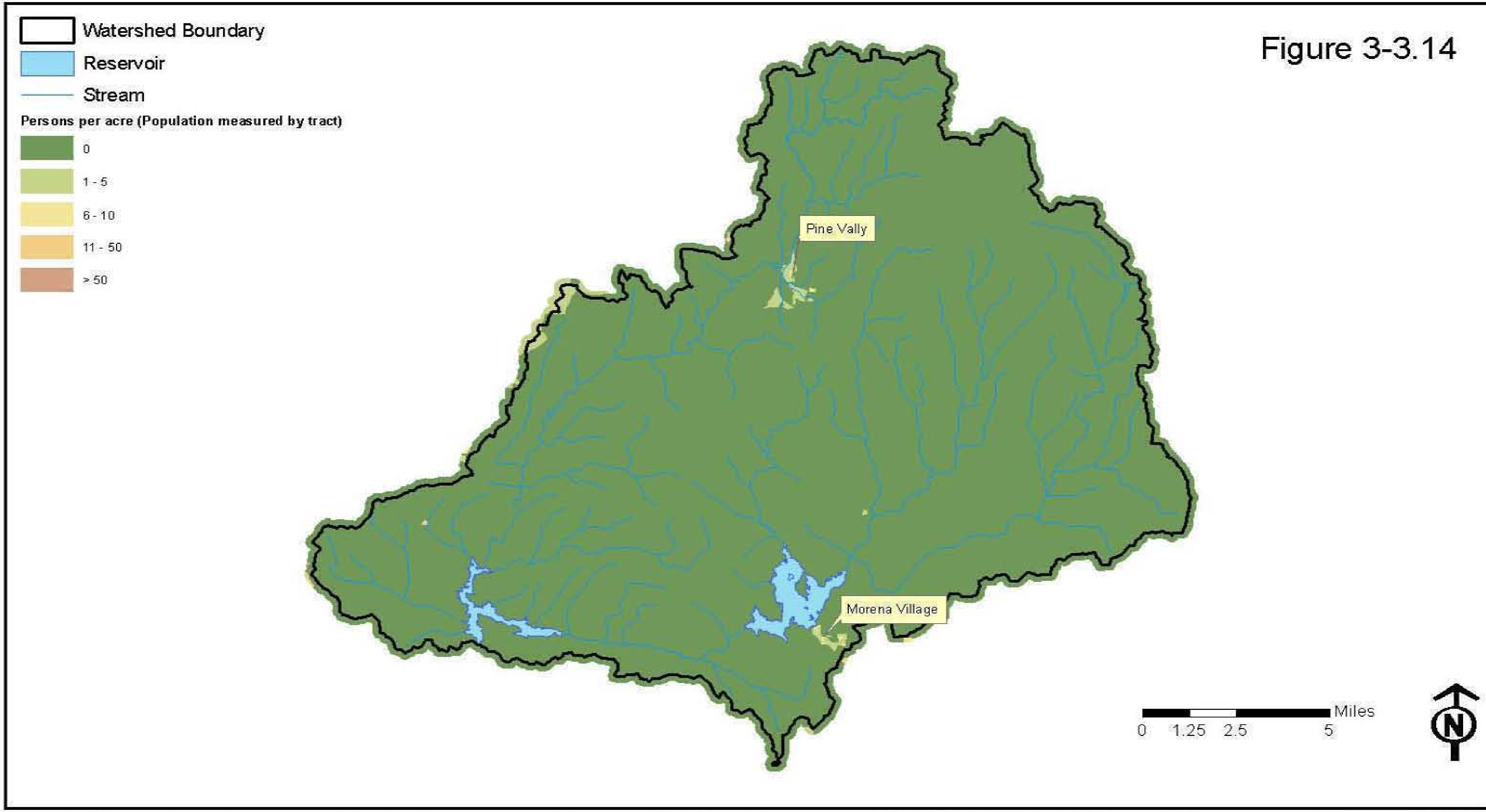
Cottonwood Watershed POPULATION DENSITY



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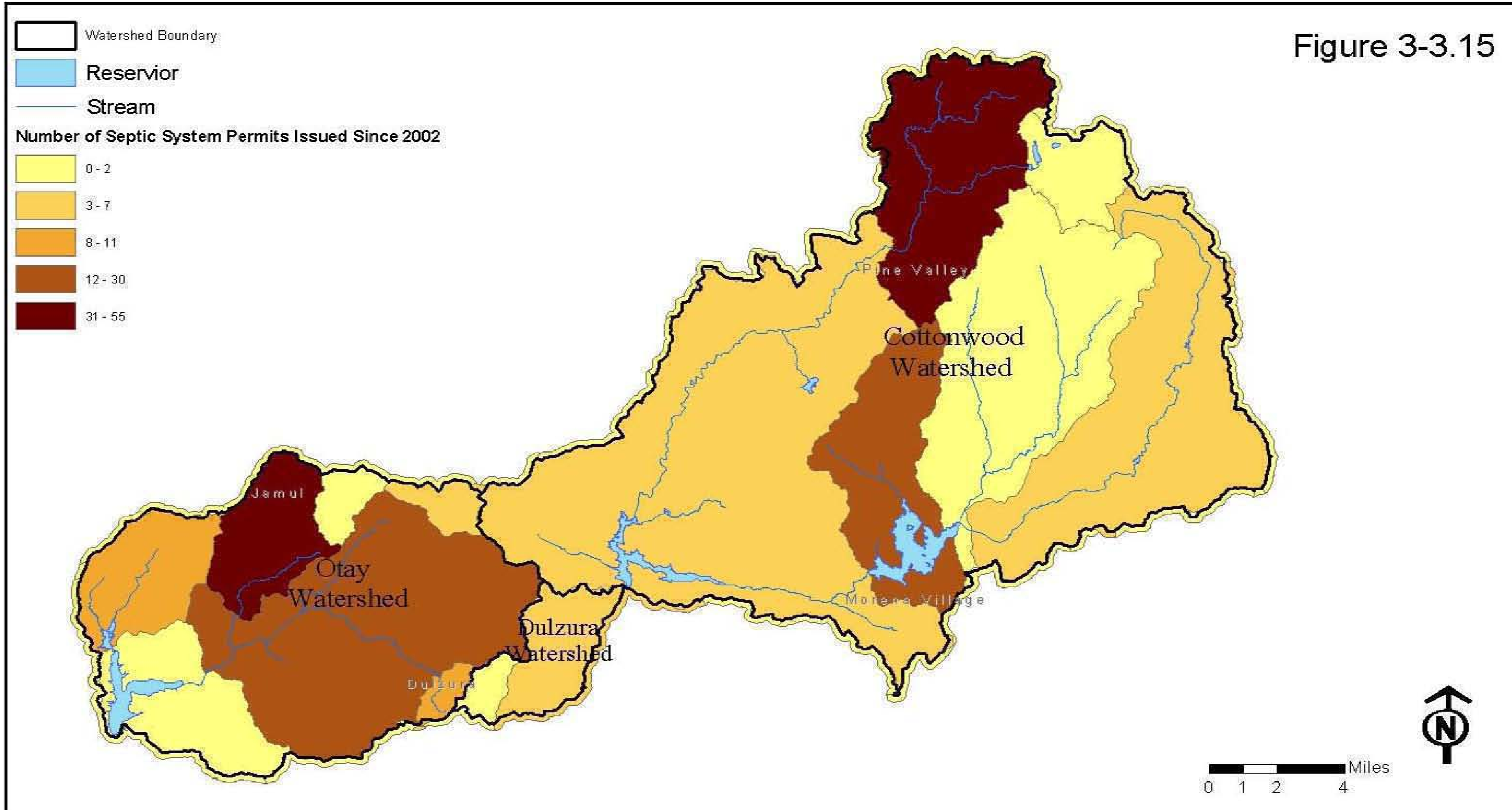
Cott Pop 05.mxd
Created By: Dennis Brown
Date: 21 December 2005

Septic System Permits in the Otay, Dulzura & Cottonwood Watersheds Since 2002



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Date: 11/04/05

CHAPTER 4: WATER QUALITY ASSESSMENT

Introduction

This chapter contains a summary of the quality of raw and treated water in the Cottonwood-Otay System Watershed during the period of January 1, 2001, through December 31, 2005.   Following the summary there is an evaluation of the system's ability to comply with current standards and to meet anticipated future standards.

The Water Quality Laboratory of the City of San Diego provided monitoring data from Barrett, Morena, and Otay Reservoirs, and the Otay WTP.

Summary of Monitoring Program

Barrett and Morena Reservoirs were sampled near the outlet structure only. Otay Reservoir was sampled near the outlet structure at surface level, and at various outlet gauges. There also were several sampling points within the Cottonwood-Otay Watershed, and sampling points at the influent and effluent of the Otay WTP. See Table 3-4.1 for a summary of the sampling frequency.

The reservoirs and treatment plant influent/effluent were monitored for general physical characteristics, organic and inorganic constituents, and radiation. The watershed sample points are summarized in Table 3-4.2. The reservoirs, the outlet gauges, and the treatment plant influent/effluent are summarized in subsequent tables.

Several general physical characteristics of the source water were monitored, as well as microbiological parameters, and organic and inorganic constituents. Radiological monitoring was conducted only at the Otay Reservoir at surface level and Otay WTP influent, and consisted of tests for gross alpha and gross beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium.

Description Of Water Quality At Watershed Sampling Points

Table 3-4.2 is a summary of the water quality data for the Cottonwood/Otay Watershed sampling points for the period of January 1, 2001 to December 31, 2005.

Of the twenty sample points in the watershed, eleven were chosen to present, based on the amount of data available. Those having fewer than five data points were deemed to be unrepresentative of a five year period. The Otay Fire of October 2003 and the extremely wet winter the following year prompted increased monitoring of the watershed. Samples have been analyzed for a broader spectrum of trace metals, nutrients, and organic constituents than in the previous five-year update. Microbiological parameters were not monitored.

The Drinking Water Standards used in Table 3-4.2 apply to treated, potable water, and are for reference only.

General Physical

Conductivity and Total Dissolved Solids were monitored. In both cases, the upper SMCL was exceeded by more than twice its value. This is to be expected due to the turbid nature of the samples.

Inorganic Constituents

Trace metals were filtered before analysis and reported as dissolved trace metals. In the months following the Otay Fire, there were high levels of many trace metals, especially aluminum, copper, zinc, and manganese. Nutrient loading was a concern during and after the rainy season of 2004-2005. Nutrient levels increased significantly in the initial post fire rain events. Nutrient levels have decreased from the highs of the initial post fire rain events, but remain higher then the pre-fire levels.

Organic Constituents

The full range of organic herbicides, pesticides, and other contaminants were monitored. None were detected at California Detection Level for Reporting (DLR).

Description Of Source Surface Water Quality At Barrett Reservoir

Table 3-4.3 contains a summary of water quality data for Barrett Reservoir at the surface.

General Physical

The monitored physical parameters of Barrett Reservoir at surface were within the standards for drinking water except for pH, color, and turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The parameter pH was a maximum of 9.48, above the SMCL of 6.5 – 8.5. The turbidity reached a maximum 27 ntu, where the MCL is 0.5 ntu. The maximum color reading was 128cu, exceeding the SMCL of 15 cu. Threshold odor was not monitored at surface level.

Inorganic Constituents

There were twenty-eight inorganic constituents measured. The maximum values for Aluminum and Iron exceeded drinking water maximum contaminant levels. Aluminum and Iron average values were below MCL levels. These constituents were at levels easily treated by the water treatment plant.

Organic Constituents

The full range of organic herbicides, pesticides, and other contaminants were monitored. None were detected at California Detection Level for Reporting (DLR).

Description Of Source Surface Water Quality At Morena Reservoir

Table 3-4.4 contains a summary of water quality data for Morena Reservoir at the surface.

General Physical

The monitored physical parameters of Morena Reservoir at surface were within the standards for drinking water except for pH, color, and turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The parameter pH was a maximum of 8.89, above the SMCL of 6.5 – 8.5. The turbidity reached a maximum 128 ntu, where the MCL is 0.5 ntu. The maximum color reading was 80cu, exceeding the SMCL of 15 cu. Threshold odor was not monitored at surface level.

Inorganic Constituents

There were twenty-eight inorganic constituents measured. The maximum values for Aluminum and Iron exceeded drinking water maximum contaminant levels. Aluminum and Iron average values were below MCL levels. These constituents were at levels easily treated by the water treatment plant.

Organic Constituents

The full range of organic herbicides, pesticides, and other contaminants were monitored. None were detected at California Detection Level for Reporting (DLR).

Description Of Source Surface Water Quality At Otay Reservoir

Table 3-4.5 contains a summary of water quality data for Otay Reservoir at the Surface.

General Physical

The monitored physical parameters of Otay Reservoir at surface were within the standards for drinking water except for color and turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The maximum color reading was 35cu, where the SMCL is 15cu. The turbidity reached a maximum 15.9 ntu, where the MCL is 0.5ntu for 95% of samples. Threshold odor was not monitored at surface level.

Microbiological

Total coliform, E. Coli, and Enterococcus were monitored in order to obtain a background representation of microbiological conditions Total coliforms ranged from <10 /100ml to >24,000 /100ml. The E. Coli range was from <10 /100ml to 652 /100ml, and Enterococcus varied from <1 /100ml to 230 /100ml. Cryptosporidium and Giardia were not monitored.

Radiological

Otay Reservoir was monitored for gross alpha and beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the maximum contaminant levels.

Inorganic Constituents

There were twenty-eight inorganic constituents measured, The maximum value for Aluminum exceeded the MCL. The average value for aluminum was below the MCL. . Aluminum was easily treated by the water treatment plant.

Organic Constituents

The full range of organic herbicides, pesticides, and other contaminants were monitored. None were detected at California Detection Level for Reporting (DLR).

Description Of Source Water Quality Of Otay Reservoir At Outlet Gauges

Water quality data at four outlet gauges is summarized in Table 3-4.6. Outlet Gauges were sampled when they were 10 feet or greater under the surface. Outlet gauges measured were ga-84, ga-95, ga-106, and ga-117. The numbers refer to the distance (feet) above the streambed.

General Physical

All four outlet gauges measured exceeded the MCL/SMCL for color, turbidity, and threshold odor. There is no apparent correlation between outlet depth and the data.

Microbiological

The outlet gauges were measured for Total Coliform, E. Coli, and Enterococcus. All three gauges had positive readings for all parameters. Enterococcus ranged from <1 /100ml to 200 /100ml. E. Coli varied from <10 /100ml to 460 /100ml. Total Coliforms ranged from 10 /100ml to 28,000/100ml. This is a common occurrence in raw reservoir water.

Organic Constituents

Total Organic Carbon (TOC), Geosmin, and Methyl Isoborneol (MIB) were monitored at all four outlet gauges. TOC is a precursor to Trihalomethanes, and is monitored in source water. TOC ranged from a minimum of 4.58 mg/L at gauge 84, to a maximum of 9.69 mg/L at gauge 117. Geosmin and MIB were monitored for aesthetic reasons only. There are no maximum contaminant levels for these three parameters.

Description Of Source Water Quality At Influent To Otay Wtp

Table 3-4.7 contains a summary of water quality data for the influent to the Otay Water Treatment Plant.

General Physical

The monitored physical parameters of Otay WTP influent were within the standards for drinking water except for turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The turbidity reached a maximum 28.9 NTU, where the MCL is 0.5ntu for 95% of samples. High turbidity was easily removed by the treatment plant.

Microbiological

Total coliform was monitored to determine the level of treatment at the Otay treatment plant. High total coliform values required additional treatment within the plant. Total coliforms ranged from <2 /100ml to >16,000 /100ml. Enterococcus was measured once and was non-detected. *Cryptosporidium* and *Giardia* were monitored, and ranged from non-detected for both to 0.1/L for *Cryptosporidium* and 0.2/L for *Giardia*.

Radiological

Otay WTP influent was monitored for gross alpha and beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the maximum contaminant levels.

<u>Inorganic Constituents</u>

There were twenty-eight inorganic constituents measured, of which only Aluminum exceeded the maximum contaminant level. Aluminum was easily removed in the treatment plant.

Organic Constituents

Otay WTP influent was monitored for both regulated and non-regulated organic substances, including herbicides, pesticides, and synthetic contaminants. Low levels of Trihalomethanes (THM) were detected. THMs resulted from Otay plant filter wash water being recycled back to Otay reservoir. TOC is a precursor to Trihalomethanes, and is monitored in source water. TOC ranged from a minimum of 1.97 mg/L, to a maximum of 7.02 mg/L. TOC levels are of particular concern in Otay reservoir. High treated water THM levels have occurred when the plant is operating on 100% Otay reservoir water.

Description Of Source Water Quality At Otay Wtp Effluent

Table 3-4.8 contains a summary of water quality data for the Otay Water Treatment Plant effluent.

General Physical

The monitored physical parameters of Otay WTP effluent were within the standards for drinking water except for pH. The pH reached a maximum of 8.75 where the SMCL is 8.5. Plant operations monitor pH every two hours and adjust as necessary to keep the water quality at high levels. The Turbidity MCL was not exceeded at any time.

Microbiological

Total coliform was monitored in order to ascertain compliance with regulations. There were four positive Total coliforms out of 1207 readings. Since there were not more than 5% positive for any one month, the limit was not exceeded. *Cryptosporidium* and *Giardia* were monitored. Both ranged from non-detected to <0.1 /100L.

Inorganic Constituents

There were twenty-eight inorganic constituents measured, of which none exceeded the maximum contaminant levels.

Organic Constituents

Otay WTP effluent was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants. None exceeded the MCL. TOC is a precursor to Trihalomethanes(THM) and haloacetic acids(HAA5), and is monitored in effluent water to determine removal rate. TOC ranged from a minimum of 1.60 mg/L, to a maximum of 6.49 mg/L. Total THMs ranged from 27.4 µg/L to 99.9 µg/L. HAA5 ranged form 12.5 ug/L to 34.1ug/L. Geosmin and Methyl Isoborneol (MIB) were monitored to help control taste and odor. All other organics were not detected at California Detection Level for Reporting (DLR).

Evaluation Of Source Water Quality

The sources for the Otay WTP are Barrett, Morena, and Otay Reservoirs, and imported CWA raw water. The influent to Otay WTP varies according to the blends of the different sources. Sources include the Otay watershed system and imported water from San Diego County Water Authority.

High color and turbidity are also to be expected, since the reservoirs are part of a wildlife habitat. These constituents are treatable at the Otay water treatment plant. High TOC in Otay reservoir can result in difficultly in minimizing THM production. Blending of Otay reservoir and imported water resulted the a minimizing of THM production.

Evaluation Of System's Ability To Meet Current Drinking Water Standards

The source water is treated at the Otay WTP to comply with existing drinking water standards. Currently, the system complies with all primary standards. The system also complies with secondary standards, except for one color reading and nine pH readings.

Evaluation Of System's Ability To Meet Current And Anticipated IESWTR And D/Dbp Standards

The Otay WTP has the ability to meet all current IESWTR And D/DBP standards.

Anticipated Regulations

Stage 2 Disinfectants And Disinfection Byproducts Rule (D/DBP) -

Phase I of the Stage 2 D/DBP rule requires that all water supply systems meet "Locational" running annual averages (LRAA) of 120 µg/L for TTHM and 100 µg/L for HAA5 by May 2005. The LRAA for the Otay system all are within these limits, with a system-wide LRAA of 60.7 µg/L for TTHM, and a system-wide maximum of 46.7 for HAA5.

Phase II reduces the LRAA to 80 µg/L for TTHM and 60 µg/L for HAA5 by 2012. Phase II also requires water system suppliers to conduct Initial Distribution System Evaluations (IDSE) to select new monitoring sites that more accurately reflect high DBP locations. This evaluation requires water monitoring to be conducted for one year.

Currently the Otay WTP meets the Phase I standards of the Stage 2 D/DBP rule. For Phase II, the IDSE study will have to be completed to determine the locations of new monitoring sites having the highest TTHM and HAA5 before compliance can be begun. The Otay system currently would not meet LRAA for TTHM levels. Capital improvement to the Otay water treatment plant may be required to meet Stage 2 LRAA THM limits.

Increases in Otay reservoir TOC will hinder the ability to comply with THM regulations.

Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) -

The LT2ESWTR is being developed to provide increased protection against *Cryptosporidium.* This rule incorporates system specific treatment requirements classified into categories, or ‘bins’, based on the results of the source water *Cryptosporidium* monitoring. Additional treatment requirements depend on the bin to which the system is assigned. Systems will choose technologies to comply with additional treatment requirements from a ‘toolbox’ of options.

Currently at the Otay WTP, the system will not require additional treatment, since the average *Cryptosporidium* at Otay influent is < 0.1 /100L.

Arsenic Regulation-

On January 22, 2001, a final rule revised the MCL for Arsenic from 50 µg/L to 10 µg/L. The final rule also clarifies how compliance is demonstrated for many inorganic and organic contaminants in drinking water. The compliance date is five years after the publication of the final rule.

The Otay WTP complies with the new Arsenic regulation because the maximum Arsenic reading for Otay WTP effluent was 2.72 µg/L.

Radionuclides Regulations -

The new Radionuclides Rule went into effect in December 2003. The new rule sets a MCL of 30 mg/L for Uranium and 5 pCi/L for Combined Radium 226/228. It also sets standards of 15 pCi/L for adjusted gross alpha particles and 4 mrem/year for beta particles and photon radioactivity. Compliance with this requirement is assumed if the average concentration of gross beta particle activity is less than 50 pCi/l and if the average concentration of tritium and strontium-90 are less than those listed in Table 3-4.3.

The Otay WTP currently complies with this rule.

Radon Regulation -

The EPA is formulating new regulations concerning Radon. The rule proposes a MCL of 300 pCi/L at the entry point to the distribution system. The EPA is proposing that initial one-year quarterly monitoring should begin three years after publication of the final rule. Radon has not been measured in the Otay system.

Sulfate Regulation -

The current SMCL range for sulfate is 250 – 500 mg/L. The Otay WTP currently complies with this regulation, since the maximum sulfate reading for Otay WTP effluent is 236 mg/L.

Table 3-4.1
RAW WATER QUALITY MONITORING PROGRAM
OTAY TREATMENT PLANT INFLUENT AND EFFLUENT,
AND BARRETT, MORENA, AND OTAY RESERVOIRS,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]		
	Barrett/ Morena	Otay	Otay WTP INF/EFF
General Physical			
Alkalinity	Q	Q	M
Color	Q	Q	D
Conductivity	Q	Q	M
Corrosivity	Q[4]	Q	M
Foaming Agents (MBAS)	NS	NS	A
Hardness as $CaCO_3$	Q	Q	M
Odor - Threshold	NS	NS[7]	D[7]
pH	Q	Q	M
Total Dissolved Solids	Q	Q	M
Turbidity	Q	Q	D
Microbiological			
Total Coliform	NS	W	D
E. Coli	NS	W	D
Enterococcus	NS	W	M
Cryptosporidium**	NS	NS	M
Giardia**	NS	NS	M
Radiological			
Gross Alpha particles	NS	(2)	(2)
Gross Beta particles	NS	(2)	(2)
Combined Radium-226 &	NS	(2)	(2)
Strontium-90	NS	(2)	(2)
Tritium	NS	(2)	(2)
Uranium	NS	(2)	(2)
Inorganic Constituents			
Aluminum	Q	Q	M
Antimony	Q	Q	Q
Arsenic	Q	Q	Q
Barium	Q	Q	Q
Beryllium	Q	Q	Q
Cadmium	Q	Q	Q
Calcium	Q[4]	Q	M
Chloride	Q	Q	M
Chromium	Q	Q	Q
Copper	Q	Q	M
Cyanide	A[3], [4]	Q	Q
Fluoride	Q	Q	M
Iron	Q	Q	M
Lead	Q	Q	M

Table 3-4.1 RAW WATER QUALITY MONITORING PROGRAM OTAY TREATMENT PLANT INFLUENT AND EFFLUENT, AND BARRETT, MORENA, AND OTAY RESERVOIRS, 2001 THROUGH 2005			
Parameters	**Planned Sampling Frequency[1]**		
	Barrett/ Morena	**Otay**	**Otay WTP INF/EFF**
Magnesium	Q[4]	Q	Q
Manganese	Q	Q	M
Mercury	Q	Q	Q
Nickel	Q	Q	Q
Nitrate**	Q	M	W[3]
Nitrate + Nitrite**	A[3, 4]	Q	M
Nitrite as Nitrogen	Q	Q	W[3]
Phosphate (ortho)**	Q	Q	M
Phosphorus (total)**	Q	Q	M
Potassium	Q	Q	M
Selenium	Q	Q	Q
Silver	Q	Q	Q
Sulfate	Q	Q	M
Thallium	Q	Q	Q
Zinc	Q	Q	M
Perchlorate	Q	Q	Q
Organic Constituents, Regulated			
1,1,1-Trichloroethane	Q	Q	Q
1,1,2-Trichloro-	Q	Q	Q
1,1,2-Trichloroethane	Q	Q	Q
1,1-dichloroethane	Q	Q	Q
1,1-Dichloroethylene	Q	Q	Q
1,2,4-Trichlorobenzene	Q	Q	Q
1,2-dichloroethane	Q	Q	Q
1,2-Dichloropropane	Q	Q	Q
1,4-Dichlorobenzene	Q	Q	Q
2,4,5 TP	Q	Q	Q
2,4-D	Q	Q	Q
Alachlor	Q	Q	Q
Atrazine	Q	Q	Q
Bentazon	Q	Q	Q
Benzene	Q	Q	Q
Benzo(a)pyrene	Q	Q	Q
Bromodichloromethane	Q	Q	Q[6]
Bromoform	Q	Q	Q[6]
Carbofuran	Q	Q	Q
Chloramine	Q	Q	Q
Chlordane	Q	Q	Q
Chlorine	Q	Q	Q

Table 3-4.1 RAW WATER QUALITY MONITORING PROGRAM OTAY TREATMENT PLANT INFLUENT AND EFFLUENT, AND BARRETT, MORENA, AND OTAY RESERVOIRS, 2001 THROUGH 2005			
Parameters	Planned Sampling Frequency[1]		
	Barrett/ Morena	Otay	Otay WTP INF/EFF
cis-1,2-Dichloroethylene	Q	Q	Q
Dalapon	Q	Q	Q
Di(2-ethylhexyl) adipate	Q	Q	Q
Di(2-ethylhexyl) pthalate	Q	Q	Q
Dibromochloromethane	Q	Q	Q[6]
Dibromochloropropane	Q	Q	Q
Dichloroacetic acid	Q	Q	Q
Dichloromethane	Q	Q	Q
Dinoseb	Q	Q	Q
Diquat	Q	NS	Q
Endrin	Q	Q	Q
Ethylbenzene	Q	Q	Q
Glyphosate	Q	Q	Q
Haloacetic acids (HAA5) (five)	Q	Q	Q
Heptachlor	Q	Q	Q
Heptachlor epoxide	Q	Q	Q
Hexachlorobenzene	Q	Q	Q
Hexachlorocyclopentadiene	Q	Q	Q
Lindane	Q	Q	Q
Methoxychlor	Q	Q	Q
Methyl tert-Butyl Ether (MTBE)	Q	Q	Q
Molinate	Q	Q	Q
Monochlorobenzene	Q	Q	Q
o-Dichlorobenzene	Q	Q	Q
Oxamyl	Q	Q	Q
Pentachlorophenol	Q	Q	Q
Picloram	Q	Q	Q
Polychlorinated biphenyls	Q	Q	Q
Simazine	Q	Q	Q
Styrene	Q	Q	Q
Tetrachloroethylene	Q	Q	Q
Thiobencarb	Q	Q	Q
Toluene	Q	Q	Q
Total Organic Carbon (TOC)	M	M	W[6]
Total Trihalomethanes (TTHM)	Q	Q	W[6]
Toxaphene	Q	Q	Q
trans-1,2-Dichloroethylene	Q	Q	Q
Trichloroacetic acid	Q	Q	Q
Trichloroethylene	Q	Q	Q
Trichlorofluoromethane	Q	Q	Q
Vinyl chloride	Q	Q	Q
Xylenes	Q	Q	Q

Table 3-4.1 RAW WATER QUALITY MONITORING PROGRAM OTAY TREATMENT PLANT INFLUENT AND EFFLUENT, AND BARRETT, MORENA, AND OTAY RESERVOIRS, 2001 THROUGH 2005			
Parameters	Planned Sampling Frequency[1]		
	Barrett/ Morena	Otay	Otay WTP INF/EFF
Organic Constituents, Unregulated			
Ethyl-tert-Butyl Ether (ETBE)	Q	Q	Q
t-Amyl-methyl ether (TAME)	Q	Q	Q
1,1,1,2-Tetrachloroethane	Q	Q	Q
1,1-Dichloropropene	Q	Q	Q
1,2,3-Trichlorobenzene	Q	Q	Q
1,2,3-Trichloropropane (TCP)	A[3]	A[3]	Q[6]
1,2,4-Trimethylbenzene	Q	Q	Q
1,3,5-Trimethylbenzene	Q	Q	Q
1,3-Dichlorobenzene	Q	Q	Q
1,3-Dichloropropane	Q	Q	Q
2,2-Dichloropropane	Q	Q	Q
3-Hydroxycarbofuran	Q	Q	Q
Aldicarb	Q	Q	Q
Aldicarb sulfone	Q	Q	Q
Aldicarb sulfoxide	Q	Q	Q
Aldrin	Q	Q	Q
Bromacil	A	A	A
Bromobenzene	Q	Q	Q
Bromochloromethane	Q	Q	Q
Bromomethane	Q	Q	Q
Butachlor	A	A	A
Carbaryl	Q	Q	Q
Chlorobenzene	Q	Q	Q
Chloroethane	Q	Q	Q
Chloromethane	Q	Q	Q
Dibromomethane	Q	Q	Q
Dicamba	Q	Q	Q
Dichlorodifluoromethane	Q	Q	Q
Dieldrin	Q	Q	Q
Geosmin	M[3]	M[3]	M[5]
Hexachlorobutadiene	Q	Q	Q
Isopropylbenzene	Q	Q	Q
Methomyl	Q	Q	Q
Methyl-isoborneol (MIB)	M[3]	M[3]	M[5]
Metolachlor	A	A	A
Metribuzin	A	A	A
Napthalene	Q	Q	Q
n-Butylbenzene	Q	Q	Q
n-Propylbenzene	Q	Q	Q
Prometryn	A	A	A
Propachlor	Q	Q	Q

Table 3-4.1 RAW WATER QUALITY MONITORING PROGRAM OTAY TREATMENT PLANT INFLUENT AND EFFLUENT, AND BARRETT, MORENA, AND OTAY RESERVOIRS, 2001 THROUGH 2005			
Parameters	Planned Sampling Frequency[1]		
	Barrett/ Morena	Otay	Otay WTP INF/EFF
sec-Butylbenzene	Q	Q	Q
tert-Butylbenzene	Q	Q	Q

SAMPLING FREQUENCY DESIGNATION
D: Daily
W: Weekly
M: Monthly
Q: Quarterly
A: Annually
NS: Not Sampled

(1) Samples may be taken but not reportable due to instrumentation problems or quality control.
(2) Sample frequency is every four years. The data used in this report was obtained during 2002.
(3) Samples taken twice per month (M^3), twice per week (W^3), or twice annually (A^3).
(4) Sampled annually at Morena Reservoir
(5) Sampled weekly at plant influent and twice weekly at plant effluent.
(6) Plant effluent was sampled more frequently than plant influent for TOC and disinfection byproducts.
(7) Sampled at plant effluent and outlet gauges only.

NOTE:
** Denotes the start of a new parameter since the 2000 Sanitary Survey was completed.
Sampling frequency represents current monitoring schedule as of January 2001.

Table 3-4.2 SUMMARY OF RAW WATER QUALITY COTTONWOOD-OTAY WATERSHED[1] 2001 - 2005										
Parameters	Units	DLR/ MDL	Drinking Water Standards[2] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
General Physical									
Conductivity	µS/cm			900-1600	179	148	4920	774	669
Total Dissolved Solids	mg/L	10		500-1000	293	183	2750	461	400
Inorganic Constituents[3]									
Aluminum	µg/L	50	100	200	25	nd	1250	253	150
Antimony	µg/L	6	6		29	nd	nd	nd	nd
Arsenic	µg/L	2	10		29	nd	9.18	nd	nd
Barium	µg/L	100	1000		14	nd	457	nd	nd
Beryllium	µg/L	1	4		13	nd	nd	nd	nd
Cadmium	µg/L	1	5		29	nd	nd	nd	nd
Chromium	µg/L	10	50		27	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	29	nd	150	nd	nd
Lead	µg/L	5	1.5		29	nd	2.78	nd	nd
Manganese	µg/L	20		50	28	nd	1430	183.0	65.1
Selenium	µg/L	5	50		28	nd	9.65	nd	nd
Silver	µg/L	10		100	16	3.82	9.65	6.74	6.74
Sulfate	mg/L	6.25		250-500	72	20.9	319	55.7	43.3
Thallium	µg/L	1	2		18	nd	nd	nd	nd
Zinc	µg/L	50		5000	16	nd	nd	nd	nd
Total Nitrogen	mg/L	0.4	1		28	0.189	9.56	1.73	1.01
Phosphorus	mg/L	0.0781			140	0.042	0.746	0.144	0.125
Phosphate (ortho)	mg/L	0.2			141	0.101	3.16	0.473	0.300
Organic Constituents, Regulated[3]									
1,1,1-Trichloroethane	µg/L	0.5	200		65	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		65	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		65	nd	nd	nd	nd
1,1-Dichloroethane	µg/L	0.5	5		65	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		65	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		65	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	.5		65	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		65	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		65	nd	nd	nd	nd
Alachlor	µg/L	1	2		50	nd	nd	nd	nd
Atrazine	µg/L	1	3		52	nd	nd	nd	nd
Benzene	µg/L	0.5	1		65	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	0.2		43	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			65	nd	nd	nd	nd
Bromoform	µg/L	0.5			65	nd	nd	nd	nd
Carbofuran	µg/L	5	18		58	nd	nd	nd	nd
Chlordane	µg/L	0.1	0.1		57	nd	nd	nd	nd
Chloroform	µg/L	0.5			65	nd	nd	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		65	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		46	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		42	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			65	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		65	nd	nd	nd	nd
Endrin	µg/L	0.1	2		62	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		65	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		63	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		63	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		63	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		61	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		57	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		62	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	65	nd	nd	nd	nd
Molinate	µg/L	2	20		8	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		65	nd	nd	nd	nd

Table 3-4.2 SUMMARY OF RAW WATER QUALITY COTTONWOOD-OTAY WATERSHED[1] 2001 - 2005									
Parameters	Units	DLR/ MDL	Drinking Water Standards[2] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
o-Dichlorobenzene	µg/L	0.5	600		65	nd	nd	nd	nd
Oxamyl	µg/L	20	200		58	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	0.5		36	nd	nd	nd	nd
Simazine	µg/L	1	4		38	nd	nd	nd	nd
Styrene	µg/L	0.5	100		65	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		65	nd	nd	nd	nd
Toluene	µg/L	0.5	150		65	nd	nd	nd	nd
Toxaphene	µg/L	1	3		57	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	0.5	5		65	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	0.5		65	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		65	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether (ETBE)	µg/L	0.3			65	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			65	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			65	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			65	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			65	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			40	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			65	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			65	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			65	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			65	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			65	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			65	nd	nd	nd	nd
Aldicarb	µg/L	3			58	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			58	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			55	nd	nd	nd	nd
Aldrin	µg/L	0.075			63	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			65	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			65	nd	nd	nd	nd
Bromomethane	µg/L	0.5			65	nd	nd	nd	nd
Carbaryl	µg/L	5			58	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			65	nd	nd	nd	nd
Chloroethane	µg/L	0.5			65	nd	nd	nd	nd
Chloromethane	µg/L	0.5			65	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			65	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			65	nd	nd	nd	nd
Dieldrin	µg/L	0.02			60	nd	nd	nd	nd
Hexachlorobutadiene	µg/L	0.5			65	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			65	nd	nd	nd	nd
Napthalene	µg/L	0.5			70	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			65	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			65	nd	nd	nd	nd

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported as MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) The sampling points summarized are: CWD9, KTC4, KTC7, LAP4, PVC1, PVC5, DUL0, DUL1A, JAM4, and UOR1.

(2) State MCL and MCLG values may be more stringent then federal standards for treated water.

(3) Trace metal samples were filtered before analysis. The results reflect dissolved trace metals.

nd: non-detected at State of California DLR

Table 3-4.3 SUMMARY OF RAW WATER QUALITY** BARRETT RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			20	122	240	208	222
Color	cu	1		15	19	13	128	37.4	28.0
Conductivity	µS/cm			900-1600	20	498	965	791	784
Corrosivity[3]	--			non-corrosive	16	0.5	1.85	1.2	1.28
Hardness as $CaCO_3$	mg/L	2			21	138	236	193	194
pH	pH			6.5-8.5	19	8.00	9.48	8.70	8.69
Total Dissolved Solids	mg/L	10		500-1000	18	308	491	429	426
Turbidity[2]	NTU	0.07	0.5	5	18	1.05	27.0	5.04	3.14
Inorganic Constituents[4]									
Aluminum	µg/L	50	100	200	20	nd	109	nd	nd
Antimony	µg/L	6	6		21	nd	nd	nd	nd
Arsenic	µg/L	2	10		21	nd	3.59	2.1	2.46
Barium	µg/L	100	1000		21	nd	nd	nd	nd
Beryllium	µg/L	1	4		21	nd	nd	nd	nd
Cadmium	µg/L	1	5		21	nd	nd	nd	nd
Calcium	mg/L	5			19	25.7	70	46.7	42.4
Chloride	mg/L	6.5		250-500	18	48.4	110	79	79.3
Chromium	µg/L	10	50		21	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	21	nd	nd	nd	nd
Cyanide	µg/L	100	200		11	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		20	0.239	0.597	0.486	0.535
Iron	µg/L	100		300	21	nd	562	nd	nd
Lead	µg/L	5	1.5		21	nd	nd	nd	nd
Magnesium	mg/L	3			19	9.10	27.8	18.0	17.7
Manganese	µg/L	20		50	21	nd	299	57.6	42.3
Mercury	µg/L	1	2		20	nd	nd	nd	nd
Nickel	µg/L	10	100		21	nd	nd	nd	nd
Nitrate	mg/L	2	45		39	nd	2.41	nd	nd
Nitrate + Nitrite	mg/L		10		12	nd	2.51	0.320	0.139
Nitrite as Nitrogen	mg/L	0.4	1		24	nd	nd	nd	nd
Potassium	mg/L	0.5			21	3.34	8.60	5.54	5.55
Selenium	µg/L	5	50		21	nd	nd	nd	nd
Silver	µg/L	10		100	21	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	19	32.1	53.6	41.9	41.6
Thallium	µg/L	1	2		21	nd	nd	nd	nd
Zinc	µg/L	50		5000	20	nd	nd	nd	nd
Perchlorate	µg/L	4			24	nd	6.95	nd	nd
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		19	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		19	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		19	nd	nd	nd	nd
1,1-Dichloroethane	µg/L	0.5	5		19	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		19	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		19	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	.5		19	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		19	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		19	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		18	nd	nd	nd	nd
2,4-D	µg/L	10	70		18	nd	nd	nd	nd
Alachlor	µg/L	1	2		20	nd	nd	nd	nd
Atrazine	µg/L	1	3		20	nd	nd	nd	nd
Bentazon	µg/L	2	18		16	nd	nd	nd	nd
Benzene	µg/L	0.5	1		19	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	.2		14	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			19	nd	nd	nd	nd
Bromoform	µg/L	0.5			19	nd	nd	nd	nd

Table 3-4.3 SUMMARY OF RAW WATER QUALITY** BARRETT RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
Carbofuran	µg/L	5	18		17	nd	nd	nd	nd
Chlordane	µg/L	0.1	.1		20	nd	nd	nd	nd
Chloroform	µg/L	0.5			19	nd	nd	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		19	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		13	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		13	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			21	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		19	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		17	nd	nd	nd	nd
Diquat	µg/L	4	20		33	nd	nd	nd	nd
Endrin	µg/L	0.1	2		19	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		21	nd	nd	nd	nd
Glyphosate	µg/L	25	700		17	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		20	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		21	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		34	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		33	nd	nd	nd	nd
Lindane	µg/L	0.2	.2		20	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		34	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	19	nd	nd	nd	nd
Molinate	µg/L	2	20		10	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		19	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		19	nd	nd	nd	nd
Oxamyl	µg/L	20	200		17	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		17	nd	nd	nd	nd
Picloram	µg/L	1	500		17	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	.5		16	nd	nd	nd	nd
Simazine	µg/L	1	4		16	nd	nd	nd	nd
Styrene	µg/L	0.5	100		19	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		19	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	18	nd	nd	nd	nd
Toluene	µg/L	0.5	150		19	nd	nd	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			12	9.62	14.6	13.0	13.1
Toxaphene	µg/L	1	3		20	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		19	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		19	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		19	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	.5		19	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		19	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			19	nd	nd	nd	nd
t-Amyl-methyl ether(TAME)	µg/L	0.2			19	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			19	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			19	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			10	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			19	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			19	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			19	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			19	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			17	nd	nd	nd	nd
Aldicarb	µg/L	3			16	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			17	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			17	nd	nd	nd	nd
Aldrin	µg/L	0.075			21	nd	nd	nd	nd
Bromacil	µg/L	10			5	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			19	nd	nd	nd	nd

Table 3-4.3
SUMMARY OF RAW WATER QUALITY**
BARRETT RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Bromochloromethane	µg/L	0.5			19	nd	nd	nd	nd
Bromomethane	µg/L	0.5			19	nd	nd	nd	nd
Butachlor	µg/L	0.38			5	nd	nd	nd	nd
Carbaryl	µg/L	5			17	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
Chloroethane	µg/L	0.5			19	nd	nd	nd	nd
Chloromethane	µg/L	0.5			19	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			19	nd	nd	nd	nd
Dicamba	µg/L	15			18	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			19	nd	nd	nd	nd
Dieldrin	µg/L	0.02			20	nd	nd	nd	nd
Hexachlorobutadiene	µg/L	0.5			19	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			19	nd	nd	nd	nd
Methomyl	µg/L	2			17	nd	nd	nd	nd
Metolachlor	µg/L	10			5	nd	nd	nd	nd
Metribuzin	µg/L	0.5			5	nd	nd	nd	nd
Napthalene	µg/L	0.5			34	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			19	nd	nd	nd	nd
o-Chlorotoluene	mg/L	0.5			19	nd	nd	nd	nd
Prometryn	µg/L	2			5	nd	nd	nd	nd
Propachlor	µg/L	0.1			35	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) Trace metal samples were filtered before analysis. Results reflect the dissolved trace metal fraction.

nd: non-detected at State DLR or MDL if DLR not Available

Table 3-4.4 SUMMARY OF RAW WATER QUALITY** MORENA RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water Quality MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			17	180	326	250	245
Color	cu	1		15	16	14.5	80	34	31.0
Conductivity	µS/cm			900-1600	17	687	1390	958	898
Corrosivity[3]	--			non-corrosive	5	0.39	1.49	1.1	1.27
Hardness as $CaCO_3$	mg/L	2			18	166	298	237	243
pH	pH			6.5-8.5	15	7.94	8.89	8.42	8.41
Total Dissolved Solids	mg/L	10		500-1000	16	373	712	502	461
Turbidity[2]	NTU	0.07	0.5	5	17	1.48	128	14.6	5.28
Inorganic Constituents[4]									
Aluminum	µg/L	50	100	200	20	nd	221	87.1	75.9
Antimony	µg/L	6	6		20	nd	nd	nd	nd
Arsenic	µg/L	2	10		20	2.65	6.85	4.25	4.06
Barium	µg/L	100	1000		20	nd	nd	nd	nd
Beryllium	µg/L	1	4		19	nd	nd	nd	nd
Cadmium	µg/L	1	5		20	nd	nd	nd	nd
Calcium	mg/L	5			5	37.4	79.2	52.3	51.2
Chloride	mg/L	6.5		250-500	15	58.9	140	89.2	85.7
Chromium	µg/L	10	50		20	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	20	nd	nd	nd	nd
Cyanide	µg/L	100	200		8	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		17	0.221	0.77	0.563	0.597
Iron	µg/L	100		300	20	nd	347	107	112
Lead	µg/L	5	1.5		20	nd	2.63	nd	nd
Magnesium	mg/L	3			5	15.3	48.8	28.1	26.1
Manganese	µg/L	20		50	20	9.10	1.06	40.1	32.4
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		19	nd	nd	nd	nd
Nitrate	mg/L	2	45		22	nd	nd	nd	nd
Nitrate + Nitrite	mg/L		10		6	0.831	1.94	1.27	1.25
Nitrite as Nitrogen	mg/L	0.4	1		19	nd	nd	nd	nd
Potassium	mg/L	0.5			19	5.12	11.3	7.68	7.34
Selenium	µg/L	5	50		20	nd	nd	nd	nd
Silver	µg/L	10		100	20	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	15	34.4	98.4	65.3	71.0
Thallium	µg/L	1	2		19	nd	nd	nd	nd
Zinc	µg/L	50		5000	20	nd	nd	nd	nd
Perchlorate	µg/L	5			23	nd	nd	nd	nd
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		18	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		18	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		18	nd	nd	nd	nd
1,1-dichloroethane	µg/L	0.5	5		18	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		18	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		18	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	.5		18	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		18	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		18	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		19	nd	nd	nd	nd

Table 3-4.4 SUMMARY OF RAW WATER QUALITY** MORENA RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water Quality MIN	MAX	MEAN	MEDIAN
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		21	nd	nd	nd	nd
Atrazine	µg/L	1	3		21	nd	nd	nd	nd
Bentazon	µg/L	2	18		17	nd	nd	nd	nd
Benzene	µg/L	0.5	1		18	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	.2		12	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			18	nd	nd	nd	nd
Bromoform	µg/L	0.5			18	nd	nd	nd	nd
Carbofuran	µg/L	5	18		17	nd	nd	nd	nd
Chlordane	µg/L	0.1	.1		19	nd	nd	nd	nd
Chloroform	µg/L	0.5			18	nd	nd	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		18	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		14	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		12	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			18	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		18	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		18	nd	nd	nd	nd
Endrin	µg/L	0.1	2		32	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		18	nd	nd	nd	nd
Glyphosate	µg/L	25	700		17	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		20	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		20	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		32	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		31	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		30	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	18	nd	nd	nd	nd
Molinate	µg/L	2	20		10	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		18	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		18	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		18	nd	nd	nd	nd
Picloram	µg/L	1	500		18	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	0.5		15	nd	nd	nd	nd
Simazine	µg/L	1	4		16	nd	nd	nd	nd
Styrene	µg/L	0.5	100		18	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		18	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	18	nd	nd	nd	nd
Toluene	µg/L	0.5	150		18	nd	nd	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			2	14.5	17.9	16.2	16.2
Toxaphene	µg/L	1	3		19	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		18	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		18	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		18	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	.5		18	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			18	nd	nd	nd	nd
t-Amyl-methyl ether(TAME)	µg/L	0.2			18	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			18	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			18	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			18	nd	nd	nd	nd

Table 3-4.4 SUMMARY OF RAW WATER QUALITY** MORENA RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water Quality MIN	MAX	MEAN	MEDIAN
1,2,3-Trichloropropane (TCP)	µg/L	0.5			9	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			18	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			18	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			18	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			18	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			18	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			17	nd	nd	nd	nd
Aldicarb	µg/L	3			16	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			17	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			17	nd	nd	nd	nd
Aldrin	µg/L	0.075			20	nd	nd	nd	nd
Bromacil	µg/L	10			6	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			18	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			18	nd	nd	nd	nd
Bromomethane	µg/L	0.5			18	nd	nd	nd	nd
Butachlor	µg/L	0.38			6	nd	nd	nd	nd
Carbaryl	µg/L	5			17	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			18	nd	nd	nd	nd
Chloroethane	µg/L	0.5			18	nd	nd	nd	nd
Chloromethane	µg/L	0.5			18	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			18	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			18	nd	nd	nd	nd
Dieldrin	µg/L	0.02			19	nd	nd	nd	nd
Hexachlorobutadiene	µg/L	0.5			18	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			18	nd	nd	nd	nd
Methomyl	µg/L	2			17	nd	nd	nd	nd
Metolachlor	µg/L	10			6	nd	nd	nd	nd
Metribuzin	µg/L	0.5			6	nd	nd	nd	nd
Napthalene	µg/L	0.5			33	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			18	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			18	nd	nd	nd	nd
o-Chlorotoluene	mg/L	0.5			18	nd	nd	nd	nd
Prometryn	µg/L	2			6	nd	nd	nd	nd
Propachlor	µg/L	0.1			33	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			18	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			18	nd	nd	nd	nd

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) Trace metal samples were filtered before analysis. Results reflect the dissolved trace metal fraction.

nd: non-detected at State DLR or MDL if DLR not Available

Table 3-4.5
SUMMARY OF RAW WATER QUALITY**
OTAY RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			19	138	204	161	159
Color	cu	1		15	20	4	35	15	13.5
Conductivity	µS/cm			900-1600	20	677	1130	856	827
Corrosivity[3]	--			non-corrosive	16	0.18	1.30	0.89	0.96
Hardness as $CaCO_3$	mg/L	2			21	159	272	227	221
pH	pH			6.5-8.5	19	7.67	8.48	8.48	8.58
Total Dissolved Solids	mg/L	10		500-1000	19	150	523	441	451
Turbidity[2]	NTU	0.07	0.5	5	19	0.48	15.9	2.23	1.10
Microbiological									
Total Coliform	/100ml	10	(4)		256	nd	>24000	4487	1130
Enterococcus	/100ml	1			256	nd	230	7.1	2
E. Coli	/100ml	10			256	nd	652	35.4	15
Radiological									
Gross Alpha particles	pCi/L	3	15		4	nd	nd	nd	nd
Gross Beta particles	pCi/L	4	50		4	nd	7.14	nd	nd
Combined Radium-226 & Radium-228	pCi/L		5		4	nd	1.30	nd	nd
Strontium-90	pCi/L	2	8		4	nd	nd	nd	nd
Tritium	pCi/L	1000	20,000		4	nd	nd	nd	nd
Uranium	pCi/L	2	20		4	nd	2.81	nd	2.47
Inorganic Constituents[5]									
Aluminum	µg/L	50	100	200	20	nd	187	nd	nd
Antimony	µg/L	6	6		21	nd	nd	nd	nd
Arsenic	µg/L	2	10		21	nd	4.92	2.18	2.02
Barium	µg/L	100	1000		21	nd	nd	nd	nd
Beryllium	µg/L	1	4		21	nd	nd	nd	nd
Cadmium	µg/L	1	5		21	nd	1.34	nd	nd
Calcium	mg/L	5			19	33.8	70.8	51.9	49.6
Chloride	mg/L	6.5		250-500	19	67.4	99.6	84.8	84.4
Chromium	µg/L	10	50		21	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	21	nd	56.8	nd	nd
Cyanide	µg/L	100	200		13	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		20	0.231	0.505	0.370	0.380
Iron	µg/L	100		300	21	52.9	267	101	87.9
Lead	µg/L	5	1.5		21	nd	nd	nd	nd
Magnesium	mg/L	3			19	9.80	26.4	19.2	19.5
Manganese	µg/L	20		50	21	nd	488	30.3	nd
Mercury	µg/L	1	2		20	nd	nd	nd	nd
Nickel	µg/L	10	100		21	nd	nd	nd	nd
Nitrate	mg/L	2	45		49	0.024	3.35	0.88	0.40
Nitrate + Nitrite	mg/L		10		26	0.085	3.35	1.00	0.50
Nitrite as Nitrogen	mg/L	0.4	1		40	0.006	0.087	0.04	0.034
Potassium	mg/L	0.5			21	3.65	6.7	4.63	4.43
Selenium	µg/L	5	50		21	nd	7.38	nd	nd
Silver	µg/L	10		100	21	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	19	42.1	148	110	111
Thallium	µg/L	1	2		21	nd	nd	nd	nd
Zinc	µg/L	50		5000	19	nd	nd	nd	nd
Perchlorate	µg/L	5			23	nd	nd	nd	nd

Table 3-4.5 SUMMARY OF RAW WATER QUALITY** OTAY RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		19	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		19	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		19	nd	nd	nd	nd
1,1-dichloroethane	µg/L	0.5	5		19	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		19	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		19	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	0.5		19	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		19	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		19	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		18	nd	nd	nd	nd
2,4-D	µg/L	10	70		18	nd	nd	nd	nd
Alachlor	µg/L	1	2		23	nd	nd	nd	nd
Atrazine	µg/L	1	3		19	nd	nd	nd	nd
Bentazon	µg/L	2	18		19	nd	nd	nd	nd
Benzene	µg/L	0.5	1		19	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	0.2		19	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			19	nd	nd	nd	nd
Bromoform	µg/L	0.5			19	nd	nd	nd	nd
Carbofuran	µg/L	5	18		17	nd	nd	nd	nd
Chlordane	µg/L	0.1	0.1		21	nd	nd	nd	nd
Chloroform	µg/L	0.5			19	nd	0.596	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		19	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		17	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		17	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		19	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		17	nd	nd	nd	nd
Endrin	µg/L	0.1	2		37	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		19	nd	nd	nd	nd
Glyphosate	µg/L	25	700		17	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		22	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		23	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		37	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		33	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		21	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		37	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	19	nd	nd	nd	nd
Molinate	µg/L	2	20		11	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		19	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		19	nd	nd	nd	nd
Oxamyl (vydate)	µg/L	20	200		17	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		17	nd	nd	nd	nd
Picloram	µg/L	1	500		17	nd	nd	nd	nd
(PCBs)	µg/L	0.5	0.5		17	nd	nd	nd	nd
Simazine	µg/L	1	4		18	nd	nd	nd	nd
Styrene	µg/L	0.5	100		19	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		19	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	17	nd	nd	nd	nd
Toluene	µg/L	0.5	150		19	nd	nd	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			86	3.98	10.2	6.36	6.07
Toxaphene	µg/L	1	3		21	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		19	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		19	nd	nd	nd	nd

Table 3-4.5 SUMMARY OF RAW WATER QUALITY** OTAY RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
Trichlorofluoromethane	µg/L	5	150		19	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	0.5		19	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		19	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			19	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			19	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			19	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			19	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			10	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			19	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			19	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			19	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			19	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			17	nd	nd	nd	nd
Aldicarb	µg/L	3			16	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			17	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			17	nd	nd	nd	nd
Aldrin	µg/L	0.075			23	nd	nd	nd	nd
Bromacil	µg/L	10			6	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			19	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			19	nd	nd	nd	nd
Bromomethane	µg/L	0.5			19	nd	nd	nd	nd
Butachlor	µg/L	0.38			6	nd	nd	nd	nd
Carbaryl	µg/L	5			17	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
Chloroethane	µg/L	0.5			19	nd	nd	nd	nd
Chloromethane	µg/L	0.5			19	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			19	nd	nd	nd	nd
Dicamba	µg/L	15			18	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			19	nd	nd	nd	nd
Dieldrin	µg/L	0.02			22	nd	nd	nd	nd
Geosmin	ng/L	3			173	nd	11.1	nd	nd
Hexachlorobutadiene	µg/L	0.5			19	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			19	nd	nd	nd	nd
Methomyl	µg/L	2			17	nd	nd	nd	nd
Methyl Isoborneol (MIB)	ng/L	4			169	nd	64.2	10.8	6.7
Metolachlor	µg/L	10			6	nd	nd	nd	nd
Metribuzin	µg/L	0.5			6	nd	nd	nd	nd
Napthalene	µg/L	0.5			33	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			19	nd	nd	nd	nd
Prometryn	µg/L	2			6	nd	nd	nd	nd
Propachlor	µg/L	0.1			38	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd

Table 3-4.5 SUMMARY OF RAW WATER QUALITY** OTAY RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of	Raw Water quality			
			MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

(5) Trace metal samples were filtered before analysis. Results reflect the dissolved trace metal fraction.

nd: non-detected at State DLR or MDL if DLR not Available

Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
84	**General Physical**									
	Color	cu	1		15	244	nd	75	16.0	14.0
	Odor - Threshold	Odor	1		3	229	nd	17	3.97	3
	Turbidity[2]	NTU	0.07	0.5	5	243	0.1	20.4	2.00	1.22
	Microbiological									
	Total Coliform	/100ml	10	(3)		254	10	28000	1737	620
	Enterococcus	/100ml	1			254	nd	47	5.5	3.1
	E. Coli	/100ml	10			254	nd	270	29.3	20
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			59	4.58	7.38	5.83	5.75
	Geosmin	ng/L	3			174	nd	11.6	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			171	nd	63.8	4.02	nd
95	**General Physical**									
	Color	cu	1		15	244	4	68	15.0	13.0
	Odor - Threshold	Odor	1		3	230	nd	17	4.09	3
	Turbidity	NTU	0.07	0.5	5	243	0.11	14.4	1.76	1.11
	Microbiological									
	Total Coliform	/100L	10	(3)		253	10	>24000	3296	910
	Enterococcus	/100L	1			253	nd	200	5.7	3
	E. Coli	/100L	10			253	nd	460	24.5	10
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			61	5.06	8.22	5.95	5.83
	Geosmin	ng/L	3			175	nd	7.90	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			172	nd	57.1	7.7	4.34
106	**General Physical**									
	Color	cu	1		15	244	3	147	13.8	11
	Odor - Threshold	Odor	1		3	232	nd	24	4.25	3
	Turbidity	NTU	0.07	0.5	5	243	0.10	53.9	1.57	1.03
	Microbiological									
	Total Coliform	/100L	10	(3)		254	20	>24000	4245	1400
	Enterococcus	/100L	1			254	nd	140	6.6	3
	E. Coli	/100L	10			254	nd	280	26.6	10
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			59	4.82	9.20	6.12	6
	Geosmin	ng/L	3			174	nd	13.4	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			172	nd	67.4	10.4	6.9
117	**General Physical**									
	Color	cu	1		15	120	2	110	16.3	13.0
	Odor - Threshold	Odor	1		118	118	nd	17	4.80	4.00
	Turbidity	NTU	0.07	0.5	5	121	0.44	9.28	1.41	1.11

Table 3-4.6
SUMMARY OF RAW WATER QUALITY**
OTAY RESERVOIR AT OUTLET GAUGES 2001 - 2005

Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
	Microbiological									
	Total Coliform	/100L	10	(3)		127	10	>24000	3479	1200
	Enterococcus	/100L	1			127	nd	16	3.2	2
	E. Coli	/100L	10			127	nd	200	16.2	10
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			27	5.38	9.69	6.81	6.41
	Geosmin	ng/L	3			107	nd	10.9	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			105	nd	68.3	11.6	7.7

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.
(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.
(3) No more then 5% of distribution system samples can be total coliform positive

nd: non-detected at State DLR or MDL if DLR not Available

Table 3-4.7
SUMMARY OF RAW WATER QUALITY**
OTAY WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			118	92.7	180	138	135
Color	cu	1		15	1202	nd	100	11.7	10.0
Conductivity	µS/cm			900-1600	58	607	1090	865	860
Corrosivity[3]	--			non-corrosive	53	-0.5	1.01	0.49	0.55
Foaming Agents (MBAS)	mg/L			0.5	5	nd	0.06	nd	0.05
Hardness as $CaCO_3$	mg/L	2			97	175	271	224	224
pH	pH			6.5-8.5	55	7.11	8.46	8.06	8.10
Total Dissolved Solids	mg/L	10		500-1000	58	358	660	484	494
Turbidity[2]	NTU	0.07	0.5	5	1728	0.08	28.9	1.10	0.77
Microbiological									
Total Coliform	/100ml	2	(4)		1763	nd	> 16000	239	28
Cryptosporidium	/L	0.1	2 log removal		59	nd	0.1	nd	nd
Giardia	/L	0.1	3 log removal		59	nd	0.2	nd	nd
Radiological									
Gross Alpha particles	pCi/L	3	15		4	nd	3.99	nd	3.39
Gross Beta particles	pCi/L	4	50		4	nd	4.45	nd	nd
Combined Radium-226 & Radium-228	pCi/L		5		4	nd	1.90	nd	nd
Strontium-90	pCi/L	2	8		4	nd	nd	nd	nd
Tritium	pCi/L	1000	20,000		4	nd	nd	nd	nd
Uranium	pCi/L	2	20		4	2.49	4.89	3.58	3.47
Inorganic Constituents									
Aluminum	µg/L	50	1000	200	43	nd	115	nd	nd
Antimony	µg/L	6	6		20	nd	nd	nd	nd
Arsenic	µg/L	2	10		20	nd	2.72	nd	2.13
Barium	µg/L	100	1000		20	nd	106	nd	nd
Beryllium	µg/L	1	4		18	nd	nd	nd	nd
Cadmium	µg/L	1	5		20	nd	nd	nd	nd
Calcium	mg/L	5			57	34.1	81.6	58.4	58.8
Chloride	mg/L	6.5		250-500	68	56.3	98.0	79.2	80.3
Chromium	µg/L	10	50		20	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	44	nd	nd	nd	nd
Cyanide	µg/L	100	200		18	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		56	0.225	0.513	0.306	0.295
Iron	µg/L	100		300	58	nd	674	nd	nd
Lead	µg/L	5	15		43	nd	nd	nd	nd
Magnesium	mg/L	3			57	3.30	27.6	18.6	20.1
Manganese	µg/L	20		50	42	nd	526	57.4	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		20	nd	nd	nd	nd
Nitrate	mg/L	2	45		133	nd	3.55	nd	nd
Nitrate + Nitrite	mg/L		10		47	0.062	3.57	1.35	1.18
Nitrite as Nitrogen	mg/L	0.4	1		116	nd	nd	nd	nd
Potassium	mg/L	0.5			59	3.34	6.74	4.22	4.06
Selenium	µg/L	5	50		20	nd	nd	nd	nd
Silver	µg/L	10		100	20	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	68	42.5	236	142	147
Thallium	µg/L	1	2		19	nd	nd	nd	nd
Zinc	µg/L	50		5000	56	nd	nd	nd	nd

Table 3-4.7
SUMMARY OF RAW WATER QUALITY**
OTAY WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		20	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		20	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-dichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		20	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	0.5		20	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		20	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		20	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		19	nd	nd	nd	nd
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		26	nd	nd	nd	nd
Atrazine	µg/L	1	3		26	nd	nd	nd	nd
Bentazon	µg/L	2	18		18	nd	nd	nd	nd
Benzene	µg/L	0.5	1		19	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	0.2		18	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			90	nd	1.04	nd	nd
Bromoform	µg/L	0.5			90	nd	1.25	nd	nd
Carbofuran	µg/L	5	18		20	nd	nd	nd	nd
Chlordane	µg/L	0.1	0.1		19	nd	nd	nd	nd
Chloroform	µg/L	0.5			90	nd	1.39	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		19	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		19	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		17	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			65	nd	1.39	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		19	nd	nd	nd	nd
Dalapon	µg/L	10	200		16	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		17	nd	nd	nd	nd
Diquat	µg/L	4	20		11	nd	nd	nd	nd
Endrin	µg/L	0.1	2		36	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		19	nd	nd	nd	nd
Glyphosate	µg/L	25	700		19	nd	nd	nd	nd
Haloacetic Acids (five) [5]	µg/L	0.5	60		16	nd	nd	nd	nd
Heptachlor	µg/L	0.01	0.01		18	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	0.01		19	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		37	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		32	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		36	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	19	0.219	1.15	0.710	0.730
Molinate	µg/L	2	20		14	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		19	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		19	nd	nd	nd	nd
Oxamyl	µg/L	20	200		20	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		16	nd	nd	nd	nd
Picloram	µg/L	1	500		18	nd	nd	nd	nd
(PCBs)	µg/L	0.5	0.5		18	nd	nd	nd	nd
Simazine	µg/L	1	4		22	nd	nd	nd	nd
Styrene	µg/L	0.5	100		19	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	18	nd	nd	nd	nd

Table 3-4.7 SUMMARY OF RAW WATER QUALITY** OTAY WTP INFLUENT 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
Toluene	µg/L	0.5	150		19	nd	nd	nd	nd
Total Trihalomethanes(TTHM)[6]	mg/L	0.5	80		84	nd	1.37	nd	nd
Total Organic Carbon (TOC)	µg/L	0.5			272	1.97	7.02	4.36	4.68
Toxaphene	µg/L	1	3		19	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		19	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		19	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		19	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	0.5		19	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		19	nd	nd	nd	nd
						nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			19	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			19	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			19	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			19	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			19	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			19	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			19	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			19	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			19	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			19	nd	nd	nd	nd
Aldicarb	µg/L	3			20	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			20	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			19	nd	nd	nd	nd
Aldrin	µg/L	0.075			19	nd	nd	nd	nd
Bromacil	µg/L	10			7	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			19	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			19	nd	nd	nd	nd
Bromomethane	µg/L	0.5			19	nd	nd	nd	nd
Butachlor	µg/L	0.38			7	nd	nd	nd	nd
Carbaryl	µg/L	5			20	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			19	nd	nd	nd	nd
Chloroethane	µg/L	0.5			19	nd	nd	nd	nd
Chloromethane	µg/L	0.5			19	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			19	nd	nd	nd	nd
Dicamba	µg/L	15			18	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			19	nd	nd	nd	nd
Dieldrin	µg/L	0.02			19	nd	nd	nd	nd
Geosmin	ng/L	0.3			255	1.34	22.2	5.15	4.38
Hexachlorobutadiene	µg/L	0.5			19	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			19	nd	nd	nd	nd
Methomyl	µg/L	2			20	nd	nd	nd	nd
Methyl Isoborneol (MIB)	ng/L	0.4			250	1.52	48.3	8.14	6.50
Metolachlor	µg/L	10			7	nd	nd	nd	nd
Metribuzin	µg/L	0.5			7	nd	nd	nd	nd
Napthalene	µg/L	0.5			35	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			19	nd	nd	nd	nd
Prometryn	µg/L	2			7	nd	nd	nd	nd
Propachlor	µg/L	0.1			37	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			19	nd	nd	nd	nd

Table 3-4.7
SUMMARY OF RAW WATER QUALITY**
OTAY WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.
(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.
(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.
(4) No more then 5% of distribution system samples can be total coliform positive
(5) Haloacetic acids (five) is the sum of the concentrations of mon-, di-, and trichloroacetic acids and mono- and dibromoacetic acids. MCL based on Annual Average
(6) Total trihalomethanes is the sum of the concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform. MCL based on Annual Average

nd: non-detected at State DLR or MDL if DLR not Available

Table 3-4.8
SUMMARY OF RAW WATER QUALITY
OTAY WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of	Raw Water quality			
			MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			58	94.8	173	128	121
Color	cu	1		15	973	nd	14.0	2.99	3
Conductivity	µS/cm			900-1600	58	648	1160	888	882
Corrosivity[3]	--			non-corrosive	52	-0.2	1.1	0.60	0.67
Foaming Agents (MBAS)	mg/L			0.5	4	nd	0.090	nd	nd
Hardness as $CaCO_3$	mg/L	2			58	166	289	221	219
Odor--Threshold	odor	1		3	835	1	2	1.17	1.00
pH	pH			6.5-8.5	60	7.42	8.75	8.21	8.21
Total Dissolved Solids	mg/L	10		500-1000	57	372	666	496	505
Turbidity[2]	NTU	0.07	0.5	5	1517	nd	0.63	0.130	0.110
Microbiological									
Total Coliform	/100ml		(4)		1206	nd	4 pos	nd	nd
Cryptosporidium	/L		2 log removal		2	nd	nd	nd	nd
Giardia	/L		3 log removal		2	nd	nd	nd	nd
Inorganic Constituents									
Aluminum	µg/L	50	1000	200	58	nd	nd	nd	nd
Antimony	µg/L	6	6		20	nd	nd	nd	nd
Arsenic	µg/L	2	10		20	nd	nd	nd	nd
Barium	µg/L	100	1000		20	nd	nd	nd	nd
Beryllium	µg/L	1	4		18	nd	nd	nd	nd
Cadmium	µg/L	1	5		20	nd	nd	nd	nd
Calcium	mg/L	5			57	35	88.4	57.5	58.8
Chloride	mg/L	6.5		250-500	68	66.4	108	89.7	90.0
Chromium	µg/L	10	50		20	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	58	nd	nd	nd	nd
Cyanide	µg/L	100	200		17	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		56	0.209	0.520	0.305	0.293
Iron	µg/L	100		300	59	nd	170	nd	nd
Lead	µg/L	5	15		58	nd	nd	nd	nd
Magnesium	mg/L	3			57	4.0	32.8	18.6	20.1
Manganese	µg/L	20		50	58	nd	nd	nd	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		20	nd	nd	nd	nd
Nitrate	mg/L	2	45		184	nd	3.71	nd	nd
Nitrate + Nitrite	mg/L		10		97	0.063	3.71	1.36	1.28
Nitrite as Nitrogen	mg/L	0.4	1		230	nd	nd	nd	nd
Potassium	mg/L	0.5			59	2.58	6.83	4.17	4.02
Selenium	µg/L	5	50		20	nd	nd	nd	nd
Silver	µg/L	10		100	20	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	68	42.0	235	143	152
Thallium	µg/L	1	2		19	nd	nd	nd	nd
Zinc	µg/L	50		5000	56	nd	nd	nd	nd
Perchlorate	µg/L	5			33	nd	4.20	nd	nd
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		20	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		20	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-dichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		20	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	0.5		20	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		20	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		20	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		19	nd	nd	nd	nd

Table 3-4.8
SUMMARY OF RAW WATER QUALITY
OTAY WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		25	nd	nd	nd	nd
Atrazine	µg/L	1	3		25	nd	nd	nd	nd
Bentazon	µg/L	2	18		19	nd	nd	nd	nd
Benzene	µg/L	0.5	1		20	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	0.2		20	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			116	9.40	35.5	21.6	22
Bromoform	µg/L	0.5			114	0.708	12.2	3.93	3.61
Carbofuran	µg/L	5	18		20	nd	nd	nd	nd
Chlordane	µg/L	0.1	0.1		20	nd	nd	nd	nd
Chloroform	µg/L	0.5			116	5.18	30.1	16.7	15.9
cis-1,2-Dichloroethylene	µg/L	0.5	6		19	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		19	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		18	nd	nd	nd	nd
Dibromochloromethane	ug/L	0.5			116	10.1	33.6	19.8	19.7
Dichloromethane (methylene chloride)	µg/L	0.1	5		20	nd	nd	nd	nd
Dalapon	µg/L	10	200		29	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		17	nd	nd	nd	nd
Diquat	µg/L	4	20		11	nd	nd	nd	nd
Endrin	µg/L	0.1	2		37	nd	nd	nd	nd
Haloacetic Acids (five) [5]	µg/L	0.5	60		15	12.5	34.1	22.5	23.7
Ethylbenzene	µg/L	0.5	700		20	nd	nd	nd	nd
Glyphosate	µg/L	25	700		19	nd	nd	nd	nd
Heptachlor	µg/L	0.01	0.01		18	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	0.01		20	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		36	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		32	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		38	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	26	nd	nd	nd	nd
Molinate	µg/L	2	20		22	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		20	nd	nd	nd	nd
Oxamyl	µg/L	20	200		20	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		16	nd	nd	nd	nd
Picloram	µg/L	1	500		19	nd	nd	nd	nd
(PCBs)	µg/L	0.5	0.5		19	nd	nd	nd	nd
Simazine	µg/L	1	4		23	nd	nd	nd	nd
Styrene	µg/L	0.5	100		20	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	19	nd	nd	nd	nd
Toluene	µg/L	0.5	150		20	nd	nd	nd	nd
Total Trihalomethanes(TTHM)[6]	mg/L	0.5	80		111	27.4	99.9	58.2	59.6
Total Organic Carbon (TOC)	µg/L	0.5			224	1.60	6.49	3.53	3.59
Toxaphene	µg/L	1	3		20	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		20	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		20	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		20	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	0.5		20	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		20	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			20	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			20	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			20	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			20	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			20	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			20	nd	nd	nd	nd

Table 3-4.8
SUMMARY OF RAW WATER QUALITY
OTAY WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
1,3-Dichlorobenzene	μg/L	0.5			20	nd	nd	nd	nd
1,3-Dichloropropane	μg/L	0.5			20	nd	nd	nd	nd
2,2-Dichloropropane	μg/L	0.5			20	nd	nd	nd	nd
3-Hydroxycarbofuran	μg/L	3			20	nd	nd	nd	nd
Aldicarb	μg/L	3			20	nd	nd	nd	nd
Aldicarb sulfone	μg/L	4			20	nd	nd	nd	nd
Aldicarb sulfoxide	μg/L	3			19	nd	nd	nd	nd
Aldrin	μg/L	0.075			20	nd	nd	nd	nd
Bromacil	μg/L	10			8	nd	nd	nd	nd
Bromobenzene	μg/L	0.5			20	nd	nd	nd	nd
Bromochloromethane	μg/L	0.5			20	nd	nd	nd	nd
Bromomethane	μg/L	0.5			20	nd	nd	nd	nd
Butachlor	μg/L	0.38			8	nd	nd	nd	nd
Carbaryl	μg/L	5			20	nd	nd	nd	nd
Chlorobenzene	μg/L	0.5			20	nd	nd	nd	nd
Chloroethane	μg/L	0.5			20	nd	nd	nd	nd
Chloromethane	μg/L	0.5			20	nd	nd	nd	nd
Dibromomethane	μg/L	0.5			20	nd	nd	nd	nd
Dicamba	μg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	μg/L	1			20	nd	nd	nd	nd
Dieldrin	μg/L	0.02			20	nd	nd	nd	nd
Geosmin	ng/L	3			156	nd	12.0	nd	nd
Hexachlorobutadiene	μg/L	0.5			20	nd	nd	nd	nd
Isopropylbenzene	μg/L	0.5			20	nd	nd	nd	nd
Methomyl	μg/L	2			20	nd	nd	nd	nd
Methyl Isoborneol (MIB)	ng/L	4			151	nd	33.3	nd	nd
Metolachlor	μg/L	10			8	nd	nd	nd	nd
Metribuzin	μg/L	0.5			8	nd	nd	nd	nd
Napthalene	μg/L	0.5			36	nd	nd	nd	nd
n-Butylbenzene	μg/L	0.5			20	nd	nd	nd	nd
n-Propylbenzene	μg/L	0.5			20	nd	nd	nd	nd
Prometryn	μg/L	2			8	nd	nd	nd	nd
Propachlor	μg/L	0.1			37	nd	nd	nd	nd
sec-Butylbenzene	μg/L	0.5			20	nd	nd	nd	nd
tert-Butylbenzene	μg/L	0.5			20	nd	nd	nd	nd

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

(5) Haloacetic acids (five) is the sum of the concentrations of mon-, di-, and trichloroacetic acids and mono- and dibromoacetic acids. MCL based on Annual Average

(6) Total trihalomethanes is the sum of the concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform. MCL based on Annual Average

nd: non-detected at State DLR or MDL if DLR not Available

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of the key conclusions from this survey and recommendations to improve watershed protection and enhance drinking water quality.

Conclusions

Watershed and Water Supply System -

The City owns less then five% of the land within the watershed. Private and public ownership of the remaining lands is roughly equal. Several large Native American Indian reservations are contained within the watershed. This ownership pattern limits the control measures the City can implement and focuses watershed control efforts on coordination and communication with agencies.

Most of the watershed lands support rural, agricultural and open space land uses. However, there are several rural communities, such as Jamul, Dulzura, Morena Village and Pine Valley which exhibit urban characteristics.   Potential contamination sources include many nonpoint sources which are more difficult to control than point sources.

The terrain is generally mountainous with slopes greater than 25%, creating the likelihood of transport of soils and contaminants to water bodies. The soils have generally high erosion potential. Rainfall ranges from approximately 13 inches annually in the lower watershed, to 20 to 30 inches annually in the mountain areas.

Morena, Barrett, Upper Otay, and Lower Otay reservoirs are interconnected and supply water to the Otay Water Treatment Plant. The reservoirs are connected in series starting at Morena Reservoir, flowing through Barrett Reservoir and ending in Otay reservoir. The plant also receives water from the San Diego County Water Authority (SDCWA).

The local water quality greatly influences the treatment requirements and the quality of water produced by the water treatment plant. The City has a policy of maximizing the use of local water. This policy minimizes the purchase of imported water.

Potential Contamination Sources in the Watershed -

The watersheds in San Diego County experienced huge fires in the fall of 2003. The fires burned 45% of the Otay Watershed. The fires were followed with very heavy rainfall in the winter of 2004. This combination of fires and rainfall resulted is large quantities of ash, soil, rocks, and debris being washed from the watershed into streams and reservoirs.

Other potential significant sources of contamination include livestock, sewage spills from Padre Dan Municipal Water District's pump station, San Vicente WRF, Barrett Honor Camp ponds, old and new septic systems, sewer spills, and recreational wastewater treatment facilities. In addition Otay WTP discharges filter backwash and sludge in Otay Reservoir.

Watershed Management and Control Practices -

The City exercises a number of management practices or controls within the watershed. On City lands, land use and potentially polluting activities are controlled directly. On lands not owned by the City, the primary controls include:

1) Monitoring land use, CEQA compliance activities, water quality permit activities, and other regulatory actions.

2) Coordinating with other agencies to implement appropriate controls. Additional City resources have been utilized in the past five years to improve City participation and control in both City owned and non-City owned land.

Water Quality Conditions -

Reservoir raw water quality monitoring indicates several constituents may be of concern. The constituents include turbidity, coliforms, nitrogen compounds, and TOC. A concentration of each contaminant varies from reservoir to reservoir and over time. Rain and fire events had significant impacts on turbidity, nitrogen compounds, and TOC.

Recommendations

General Recommendations -

Recommendations and corrective actions were developed for the purpose of improving overall watershed protection and drinking water quality. Generally, the recommendations strengthen this first barrier to water quality degradation – protection of source watershed. By strengthening this first barrier, impacts on the second barrier – water treatment – may be reduced.

The Otay Water Treatment Plant is effective at treating the raw water to meet current federal and state drinking water regulations except when operating on 100% Otay Reservoir water. Otay WTP produces high levels of TTHMs when treating 100% Otay Reservoir water. Blending of Otay Reservoir and imported water allows the Otay WTP to meet current TTHM limits. Requirements of the Stage 2 Disinfectants and Disinfection Byproducts Rule promulgated in January 2006, modify distribution system monitoring and compliance criteria. Current treatment plant process and raw water quality make compliance with the Stage 2 rule difficult. Continued protection of the watershed is important in meeting drinking water quality regulations.

The recommendations provided are grouped by the following subjects:

- Water Quality Monitoring and Evaluation
- Interjurisdictional Coordination
- Watershed Management and Control Practices
- Public Education

Water Quality Monitoring and Evaluation -

During the 2001 – 2005 time period watersheds monitoring was significantly increased. The City should continue monitoring the watersheds. The baseline data for many parameters has been collected.

Additional evaluation of the data should be used to provide guidance on actions necessary to protect the watersheds. As with any monitoring program, the program should be evaluated to help ensure the necessary data is being obtained while conserving laboratory resources.

The monitoring program should place emphases on obtaining information necessary to assisting City and non-City forces efforts to protect the watershed. Continued interaction with all interested parties is necessary to continually improve the monitoring program.

Interjurisdictional Coordination -

Lines of communication both within the City and with neighboring agencies have been improved during the 2001 – 2005 time period. However, continued efforts are needed to further the communication and cooperation among agencies. Specific actions pertaining to Interjurisdictional coordination include the following:

- Expand Workgroups

  Workgroups have been established between many of the agencies such as County Planning, U.S. Forest service, Bureau of Land Management. The formation of the workgroups was a positive step. Participation in the workgroups is not consistent among the agencies and the City. Ensuring City forces continue to participation in workgroups is important to coordination between agencies. The City should also determine if additional workgroups will be beneficial.

- Review of New Watershed Land Uses

  Land use with the watersheds impacts potential contamination of the water. The City should emphases minimizing potential water quality issues when working with other agencies on watershed land usages.

Watershed Management and Control Practices -

Continue to reduce the impacts from cattle grazing. Impacts can be reduced by elimination of cattle grazing from riparian corridors, prevent cattle access to streams and water bodies, control transport of cattle waste to streams and water bodies, and reduce cattle density.

Public Education -

Public education material has been developed for trail and reservoir usage. Maintaining the educational material in readily available locations will help educate the public to the importance of protecting the watershed. The material should be periodically reviewed to ensure that it is accurate and appropriate.

Residents within the watershed have a significant impact on protecting the watershed. Educational programs should emphasize what residents can do to help protect the watershed and how protecting the watershed provides them great benefits.

Public awareness signage has been installed in several transportation corridors. The signage provides information on actions they can take to help improve water quality. The City should maintain the signage and review it for accuracy and appropriateness.

The City of San Diego Water Department 2005 Watershed Sanitary Survey

Miramar Watershed

Volume 4 of 5

Data Collected Between 01/01/01– 12/31/05

ABBREVIATIONS

ACOE	Army Corps of Engineers
ADT	Average daily traffic
ADWF	Average dry weather flow
AF/Y	Acre-Feet per Year
AWWA	American Water Works Association
BLM	Bureau of Land Management – U.S. Federal
BMPs	Best Management Practices
CDF	California Department of Forestry
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
CDMG	California Division of Mines and Geology
CEQA	California Environmental Quality Act
CFR	California Federal Regulation
cfs	Cubic feet per second
City	City of San Diego
CNDDB	California Natural Diversity Database
CNF	Cleveland National Forest
CNPS	California Native Plant Society
County	County of San Diego
CWA	San Diego County Water Authority
D/DBP	Disinfection/Disinfection By-Product
DHS	Department of Health Services
DMG	Division of Mines and Geology – State of California
dS/M	Decisiemens per meter
DSOD	Division of Safety of Dams
EPA	Environmental Protection Agency
ESWTR	Enhanced Surface Water Treatment Rule
GIS	Geographic Information System
gpd	Gallons per day
Gpm	Gallons per minute
HAAs	Haloacetic Acids

ABBREVIATIONS

Helix	Helix Water District
HPC	Heterotrophic Plate Count
HSU	Hydrographic Subunit
HU	Hydrographic Unit
HUMAN CON	Human Consumption
IOCs	Inorganic Chemicals
LPG	Liquid Propane Gas
LSE LF	Loose Leaf
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MG	Million Gallons
mg/L	Milligrams per liter (parts per million)
mgd	Million gallons per day
mgy	Million gallons per year
MHCP	Multiple Species Conservation Program
MSL	Mean Sea Level
MWD	Metropolitan Water District
N-GRNHS	Nursery Greenhouse
N-OUTDR	Nursery Outdoor
NEPA	National Environmental Protection Act
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Unit
OTC	Olympic Training Center
PAHs	Polyaromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
RCA	Resource Conservation Area
RMWD	Ramona Municipal Water District
RO	Reverse Osmosis
RUIS	Regional Urban Information System

ABBREVIATIONS

RWQCB	California Regional Water Quality Board
SANDAG	San Diego Association of Governments
SCS	Soil Conservation Service – U.S.
SDWA	Safe Drinking Water Act - Federal
SMCL	Secondary Maximum Contaminant Level
SOCs	Synthetic Organic Chemicals
SP	Soluble Powder
SUB	Subtropical
SWPPPs	Storm Water Pollution Prevention Plans
TCR	Total Coliform Rule – Federal
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
THMs	Trihalomethanes
TTHMs	Total Trihalomethanes
TOC	Total Organic Carbon
TRANSPL	Transplants
ug/L	Micrograms per liter (parts per billion)
UNCUL	Uncultivated
UNSP	Unspecified
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Society
VOCs	Volatile Organic Compounds
WDRs	Waste Discharge Requirements
WPCF	Water Pollution Control Facility
WRF	Water Reclamation Facility
WSS	Watershed Sanitary Survey
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

VOLUME 4

THE MIRAMAR WATERSHED

CHAPTER 1: SYNOPSIS

Introduction

This volume is the second five-year update of the 1996 Watershed Sanitary Survey (WSS) for the Miramar Watershed. The Miramar Watershed is comprised of the Miramar Reservoir and Miramar Water Treatment Plant (Figure 4-1.1). The Miramar Watershed has an area of 645 acres, or about one square mile. The primary function of the reservoir is to store imported water and provide short-term emergency supply to the Miramar Water Treatment Plant.

Watershed Sanitary Survey Requirements

The California Surface Water Treatment Rule (SWTR), in Title 22, Article 7, Section 64665 of the State Code of Regulations, requires every public water system using surface water to conduct a comprehensive sanitary survey of its watersheds every five years. The purpose of such a survey is to identify actual or potential sources of contamination, or any other watershed-related factor, which might adversely affect the quality of water used for domestic drinking water. The initial WSS was completed January 1, 1996 and is to be updated every five years thereafter.

The City of San Diego Water Department and its oversight agencies will use the Watershed Sanitary Survey Update (WSS Update) to evaluate water quality problems which might result from contaminants in the watersheds. The WSS Update will also serve as a basis for future watershed management and planning efforts.

Objectives

The main objectives of this WSS Update are to:

- Satisfy the regulatory requirement for a watershed sanitary survey.
- Identify and assess existing and potential future sources of contamination in the watersheds.
- Provide a general description of existing watershed control and management practices.
- Provide general recommendations for improving watershed management practices in order to protect the quality of the surface waters entering the reservoirs.

Conduct Of The Study

This update of the WSS for the Miramar Watershed was produced by the staff of the City of San Diego Water Department, Water Quality Laboratory. The survey covers the water supply system from the most remote points of the Miramar Watershed to the treatment facility. It was conducted by reviewing existing aerial photographs, GIS data, reports, water quality data and other record documents, and was supplemented by field surveys and personal knowledge of Water Department staff.

Report Organization

The organization of this volume has changed since the 2001 WSS Update. The Executive Summary, formerly Chapter 1, has been removed from the individual volumes. The remaining chapters have been rearranged as follows:

Chapter 1:	Synopsis
Chapter 2:	Description of Watersheds/Source Water System and Review of 2001 Watershed Sanitary Survey Recommendations
Chapter 3:	Existing Conditions in the Watersheds
Chapter 4:	Water Quality Assessment
Chapter 5:	Conclusions and Recommendations

CHAPTER 2: DESCRIPTION OF WATERSHEDS/SOURCE WATER SYSTEM AND REVIEW OF 2001 WSS RECOMMENDATIONS

Introduction

The following is a summary of the findings of the 2001 Miramar Watershed Sanitary Survey Update. It covers Potential Contaminant sources, Water Quality, Watershed Management and Control Practices, and Conclusions and Recommendations for management of the watershed.

Potential Contaminant Sources

Recreation -

The Miramar Reservoir is open for recreational use year-round, seven days a week. Activities permitted include: fishing, boating, hiking, picnicking, bicycling, and foot traffic. No camping or swimming is allowed. Sources of contamination include fuel spills from boats, discarded trash, and excretions from domestic pets.

Runoff -

Average annual precipitation is less than 10 inches. Most of this runoff is diverted from the watershed via storm drains. Some soil erosion occurs on the slopes adjacent to the reservoir.

Significant Events -

There have not been any fires or significant earthquakes in the period from 1996 to 2000.

Other Sources -

There are no mines, wastewater/reclaimed water facilities, waste disposal facilities, septic systems, or hazardous material sites in this watershed. There has been only one sewer overflow, which was contained by the storm drain system.

Water Quality

Monitoring -

Samples were taken from the surface and at gauge 66 of the Miramar Reservoir, and from the treatment plant influent and effluent sampling points. There are no watershed sample points in the Miramar Watershed. Data was provided by the City of San Diego Water Quality Laboratory. The source water was monitored for physical, biological, and constituent (organic/inorganic) characteristics. Biological monitoring was confined to treatment plant influent and effluent. Results were compared to current and proposed regulatory standards for drinking water.

Raw Water Quality -

Results at times exceeded limits for treated drinking water; however, treatment at the plant produced water that consistently met all standards. Standards exceeded included turbidity, manganese, sulfate, and MTBE. Microbiological studies indicated the presence of indicator microorganisms at surface and at gauge 66.

Treated Water Quality -

Treated water quality consistently met or exceeded the requirements of the SWTR. The only exception was one pH reading of 8.7, out of 94 measurements made. Existing water quality data show that the Miramar

Water Treatment Plant would be in compliance with Phase I of the Stage 2 Disinfectants and Disinfection Byproducts Rule. A study will be required to determine the monitoring sites having the highest DBP. The Miramar WTP would also meet the requirements of the Long Term 2 Enhanced Surface Water Treatment Rule as well as proposed Arsenic and Sulfate regulations.

Emergency Plans -

The City has procedures in place against the event of a water treatment emergency.

Watershed Management and Control Practices

The City of San Diego exerts direct control over the majority of the Miramar Watershed. Management of the watershed lies with the City Water Department, Park and Recreation Department, and the Lakes Recreation Program. For privately owned lands, the City has planning and enforcement authority. A Watershed/Water Quality Protection Committee was established in September of 1994.

Conclusions

Potential contaminant sources in the watershed -

The most significant potential contaminant sources are recreational use, urban runoff, and discharge of filter backwash and sludge from the Miramar WTP.

Watershed management and control practices -

There is no formal watershed management plan. The City of San Diego directly controls City-owned land. For privately owned lands, the City monitors land use, regulates activities via permits, and coordinates with other agencies to regulate acitvities which might impact water quality. However, the coordination effort is limited to projects or actions that are known to City staff.

Existing desiltation basins upstream of the reservoir need to be better maintained and monitored. Additional desiltation and infiltration facilities may be needed for future development.

Water quality conditions -

Raw water monitoring indicates the presence of turbidity, coliforms, TOC and THM at levels of possible concern. These constituents are effectively treated by the Miramar WTP. Results of analyses of treated, finished water from the Miramar WTP show that it complies with all federal and state drinking water regulations.

Recommendations & Review

The underlying theme of all recommendations is protection of the watershed and source water quality. The recommendations fall into four categories:

- Water Quality Monitoring,
- Interjurisdictional Coordination
- Public Education

Following each recommendation will be a review of the actions taken and/or current status of the recommendation.

Water Quality Monitoring –

Recommendations

1) Continue to develop the monitoring program to include new parameters as needed. Use the program to identify trends in source water quality, and to work with landowners and agencies that may impact the watershed.
2) Augment existing City monitoring program with additional constituents, such as dissolve organic carbon, total nitrogen and total phosphorus and continue monitoring bromide.

3) Find and test methods of algae control while continuing to minimize use of copper sulfate.

Review

1) The Miramar watershed is very small, highly urbanized and approximately 100% built out. Almost all of the water draining from the small surrounding area of the reservoir is diverted to the storm drain system. Because of the above factors this recommendation will be abandoned for this watershed.
2) This recommendation will not be adopted on a watershed wide scale for this watershed. In addition to tests for by-products of algal decomposition and total organic carbon, we collect samples for total nitrogen and total phosphorus at the reservoir surface near the outlet tower.
3) No change in status

Interjurisdictional Coordination -

Recommendations

Establish working relationships with neighboring agencies by means of written City policies, workgroups, and a City Control Review Committee.

Review

The City contracted with Brown & Caldwell to produce a document providing guidelines for new development in our watersheds. This document has been completed and is being used by the City Water Department in its review of projects.The City Water Department has established a Watershed Manager and a Watershed Project Officer, and the City has established contacts with other agencies by participating on watershed plan committees. The City is reviewing more projects than it has in the past; however, no formal clearinghouse has been established.

Public Education –

Recommendations

1) Develop and distribute pamphlets to landowners and residents. Encourage a volunteer organization.
2) Establish a phone number for reporting spills and illegal dumping.
3) Conduct educational sessions on water quality.

Review

1) The City has worked with Project Wildlife and the Boy Scouts to build a kiosk at the entrance to the parking lot at Miramar Reservoir, and to develop an educational brochure concerning water quality and feeding the wildlife around Miramar Reservoir. In addition, everyone who purchases a lake permit receives a brochure that details the importance of keeping the reservoir clean because it is a source of our drinking water.
2) No change in status.
3) No change in status.

CHAPTER 3: EXISTING CONDITIONS IN THE WATERSHEDS

Miramar Watershed

Water Sources -

Miramar Reservoir is important to the region for its supply from the SDCWA Aqueduct System carrying Colorado River and State Project water to the San Diego area. The primary function of the reservoir is to store imported water and provide short-term emergency supply to the Miramar Water Treatment Plant (Figure 4-3.1). The reservoir and associated facilities are owned and operated by the City of San Diego.

Raw Water Reservoirs -

Miramar Reservoir lacks back-up storage and has the second smallest capacity of all the reservoirs in the City system. Miramar Dam is a zoned earth embankment situated on a canyon incised in volcanic rock. A forty foot-high saddle dike also exists within the reservoir. The spillway is an un-gated open channel with a 10-foot-wide concrete control section and is located between the main dam and the dike. The spillway capacity is 432 cubic feet per second (cfs). The dam crest has a length of 1,189 feet and stands roughly 150 feet above the streambed. The reservoir has a storage capacity of 7,184 acre-feet and a surface area of 162 acres at spillway crest at 714 feet MSL.

Raw Water Intake and Conveyance Facilities -

The reservoir outlet consists of an independent wet tower upstream of the dam with seven 36-inch saucer inlet valves for selective level draft control. Water is released from the tower through a 48-inch reinforced concrete conduit located at the base of the dam. The 48-inch pipeline discharges through a 24-inch blow off pipeline. The 48-inch pipeline has a maximum draft rate of 109 cfs (70 mgd) to the treatment plant and 141 cfs (91 mgd) to the treatment plant and 24-inch blow off.

Treated Water Facilities -

All treatment facilities and treated water facilities for Miramar Reservoir occur at and beyond the Miramar Water Treatment Plant. The plant is located at Miramar Reservoir and serves the northern section of the City. The plant treats imported water stored in Miramar Reservoir. The Miramar Water Treatment plant is of conventional design with flocculation, filtration, disinfection (chloramines) and has 140 mgd capacity. The plant is operated in compliance with California's Chapter 17: Surface Water Filtration and Disinfection Treatment Regulations.

Miramar Water Treatment Plant is currently undergoing the Contract A expansion project scheduled for completion in 2007. This project will increase the capacity of the plant to 215 mgd.

Emergency Plans -

There are no written emergency plans addressing accidental or intentional disposal of contaminants to the raw water supply system for the City. However, the City does have the following two procedures which are understood policies, should an emergency occur relating to water quality:

- If a treatment plant cannot treat the water to an approved health standard level, due to upstream contaminants or treatment plant failures, the treatment plant shall be shut down. Treated water shall then be re-directed to the downed service area through the distribution system from other treatment plants.

- If any emergency exists, the City has a chain of communication procedure for notification of City staff.

NATURAL SETTINGS

Slope

Slope is recognized as a critical factor in generating soil slips/landslides. In Southern California a direct relationship exists between frequency of soil slips and slope. USGS estimates that 70% of soil slips originate in slopes between 20° and 36°.These soil slips have the potential to increase sedimentation in streams and reservoirs.

Water falling on steeply-sloped land runs off with greater velocity and infiltrates less than water falling on flat land. This response leads to increased erosion and limits the soils natural ability to absorb contaminants. Information on slope was derived from a digital elevation model provided by San Diego Data Processing Corporation and United States Geological Survey (USGS).

Miramar Watershed -

No changes in slope have occurred since 2000 (Figure 4-3.2, Table 4-3.1).

Table 4-3.1
Miramar Watershed Slope

Slope	Acres	Percent
0 - 15°	385.51	59.78
16 - 25°	162.20	25.15
26 - 50°	95.86	14.87
> 50°	1.30	0.20
Total	644.87	100.00

Soils

Most of the soils within the watershed are susceptible to erosion. The erosion of these soils is mitigated through the anchoring affect of natural vegetation (see vegetation section). Impacts to the vegetation through fire, development or other means could cause increased erosion and impact surface water quality (see Fires, Land Use, Rainfall and Runoff).

Miramar Watershed -

The Miramar Watershed is comprised of the Redding-Olivenhain Association (Figure 4-3.3). This soil is predominantly well drained, cobble and gravelly loams over hardpan.

Vegetation

Vegetation cover provides several ecological services pertinent to water quality. The root systems of plants anchor soil that could otherwise erode into streams and reservoirs (see Soils). Wetlands and other riparian plant communities act as natural filters, removing suspended sediments and contaminants. Sediments are trapped by densely growing wetland plants, and many contaminants are absorbed or chemically altered by the vegetation.

The description of the different plant communities found in the watershed (Sawer and Keeler-Wolf classification, 1995) and their respective response to fire is from the 2003 Southern California Fires Burned Area Emergency Stabilization and Rehabilitation Plan prepared by: Interagency Burned Area Emergency Response Team November, 2003. The maps of vegetation communities (Figure 4-3.4, Table 4-3.2) have been updated using current SANDAG GIS data.

Eucalyptus Woodland

Vegetation Types:

Eucalyptus Woodland is a non-native closed canopy community. This community is typically a monotypic stand of Eucalyptus trees with a thick mulch of Eucalyptus tree leaves.

Response to Fire:

Eucalyptus stands can be fire retardant to low intensity fires. Low intensity fires will consume the leaf litter and can be carried into the canopy where leaves are singed or tops are burned. High intensity fires are typically stand destroying.

Chaparral

Vegetation Types:

Chaparral occurs throughout the coastal lowlands, foothills, and montane region. This community typically forms a dense, almost impenetrable shrub community with no herbaceous layer. Chaparral is a highly variable plant community that includes; Chamise Chaparral, Coastal Sage-Chaparral Scrub, Mixed Chaparral, Montane Chaparral, Semi-desert Chaparral, and Scrub Oak Chaparral.

Response to Fire:

Chaparral is a fire adapted community that stump sprouts or germinates from seed after a low-to–moderate intensity burn. Large fires often result in homogenous stands of chaparral. Frequent fires and hot fires can burn the root system and surface seed bank, resulting in a loss of diversity and low-density vegetative communities. For a few years after a fire, annual forbes germinate and establish on site, until the woody shrubs mature.

Coastal Sage Scrub

Vegetation Types:

Locally, Coastal Sage Scrub consists of low, woody soft-shrubs and is classified as Diegan Coastal Sage Scrub (DCSS). DCSS is dominated by California sagebrush and/or flat-topped buckwheat and often intergrades with Chaparral communities.

Response to Fire:

DCSS species are fire adapted and quickly regenerate from seed after a fire. However, frequent fires in an area can reduce the seed bank for native shrub species and increase the presence of non-native grasses and forbs resulting in degraded habitat. Once this habitat conversion occurs, DCSS species typically do not re-colonize the area due to competition from dense populations of invasive grasses that increase the fire frequency. Areas with moderate to highly degraded DCSS may convert to non-native grasslands due to the 2003 fires.

Big Sagebrush Scrub

Vegetation Types:

Locally, big sagebrush is dominated by; flat-topped buckwheat, broom snakeweed, deerweed, sawtoothed goldenbrush, and includes a variety of DCSS species.

Response to Fire:

The fire ecology of Big Sagebrush Scrub in eastern San Diego County is not well documented. Many of the associates in this community occur in DCSS and are fire adapted. Frequent fire in the vegetative community will result in habitat conversion to non-native grasslands.

Grasslands

Vegetation Types:

Perennial Grasslands vary among Valley Needlegrass and Valley Sacaton

grasslands. Valley Needle Grassland is dominated by the tussock forming purple needlegrass, with a variety of native forbs including colar lupin, rancher's fireweed, and adobe popcorn-flower; and the native bunchgrasses, foothill needle grass, and coast range melic. The species composition can vary as it transitions into the foothills and montane zone. Valley Sacaton Grassland is dominated by sacton or salt grass. This community typically occurs in the areas with a high seasonal water table and is often associated with Alkali Seeps and Alkali Meadows. Non-native grasslands are dominated by Red brome, Ripgut brome, and Softchess brome. Non native grasslands often intergrade with open oak woodlands and disturbed DCSS communities.
Response to fire:
Grassland communities in San Diego County have evolved with, and are typically maintained by fire. Fire in non-native grasslands maintains dominance by invasive grasses and prevents establishment by native shrub species.

Miramar Watershed:
Native vegetation identified within the Miramar Watershed includes scrub and chaparral, and grasslands (Figure 4-3.4, Table 4-3.2). The remainder of the watershed is developed for urban uses, which could negatively impact water quality (see Land Use).

Table 4-3.2 Vegetation in the Miramar Watershed

Vegetation Type	Acres	% of Watershed
Wetlands	0	0
Forest	0	0
Grasslands, Vernal Pools, Meadows, other Herb Communities	10	2
Non-Native Vegetation, Developed or Un-vegetated Habitat	405	63
Riparian	0	0
Scrub and Chaparral	230	36
Woodland	0	0
Total	645	100.0

Rainfall and Runoff

The climate of San Diego County is classified as a Mediterranean dry summer type where 90% of the annual rainfall occurs between the months of November and April. Annual precipitation varies from 9 inches at the coast to 25 inches near the mountains.

Storm water runoff occurs when water from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, streets and parking lots prevent the runoff from naturally soaking into the ground. Storm water runoff can collect debris, sediment, nutrients, bacteria, pathogens, chemicals and deposit them directly into a lake, stream, river, wetland, or coastal water.

Rainfall and Runoff information in this section was supplied by the City of San Diego Water Department, Hydrography Section. Rainfall data is collected at each reservoir by a weather station. Runoff data is estimated monthly by measuring the following: amount of rainfall, rain amount on surface of lake, other inputs, evaporation, draft, leaks, and change in lake level.

Miramar Watershed:

Table 4-3.4 shows annual rainfall and runoff at Miramar Reservoir. Rainfall totals for years 2001-2003 were average or below average. The winter of 2004-2005 was the third wettest on record.

Table 4-3.4 Rainfall and Estimated Runoff for Miramar Reservoir

Reservoir	Year	Rainfall (in.)	Runoff Entering Reservoirs (M.G.)
Miramar	2001	14.44	0
	2002	6.94	0
	2003	12.18	19.77
	2004	15.12	0
	2005	18.9	0

Fires

The California Department of Forestry (CDF) addresses all large brush fires within the watershed. The local fire districts handle structural fires only. CDF has an extensive fire prevention plan which includes three fire safe guidelines: residential, railway, and electrical power lines. CDF also provides an evaluation of burned sites and a re-growth plan to prevent erosion immediately following a fire.

Fire can indiscriminately devastate certain vegetation and wildlife communities, but is very important to the sage scrub and chaparral communities. Many taxa of coastal sage scrub plants are adapted to fire by stump sprouting or high seed production (Skinner et al., 1994). Similarly, many chaparral plants are adapted to frequent fires either through resprouting or seed carry-over (see Vegetation). While these communities are adapted to fire and usually recover in three to five years following such an event, the soils are subject to increased erosion immediately following a burn (see Fires, Soils).

Sediment from the burned areas can impact streams and the aquatic organisms within those streams, ultimately feeding into reservoirs where sediment loads may affect treatment procedures. Control of large fires is important from both a preservation perspective as well as a watershed management perspective.

The fire and water districts in the watershed do not measure the water quality impacts of the runoff from burned areas (Calhoun, Justice, Bratton, 1995). In most cases the County Office of Emergency Response or the local Fire Department contacts the RWQCB to visit the site after the fire is contained. The RWQCB participates in assessing the impact of the fire on the surface water quality, and will determine if monitoring is necessary.

Fire information in this report is supplied by the California Department of Forestry. The current data available from CDF is through December 31, 2004.

Miramar Watershed:

There were no fires in this watershed that affected water quality or the ability of Miramar Treatment Plant to meet the Enhanced Surface Water Treatment Rule.

SUMMARY OF POTENTIAL CONTAMINANT SOURCES

Land Use -

The section on land use includes; land ownership, category of land use, and population density.

Land Ownership

The land ownership information discussed in this section is primarily derived from SanGIS data. SanGIS maintains a database of land ownership information, by parcel, for San Diego County.

Miramar Watershed:

Approximately 76% of Miramar Watershed is in public ownership (Figure 4-3.5, Table 4-3.5).

Table 4-3.5 Land Ownership in Miramar Watershed

Ownership Category	Area (acres)	% of Watershed
Indian Reservation	0	0.0
Publicly Owned		
Local	492	76.3
State	0	0.0
Federal	0	0.0
Subtotal Publicly owned	492	76.3
Private	153	23.7
Total	645	100

Existing Land Use

The information discussed in this section is based on SanGIS data. It is important to note that some areas reported in the 2001 Watershed Sanitary

Survey (WSS) as vacant and undeveloped land use have been updated by SanGIS to reflect its correct land use type, parks and open space preserves.

Miramar Watershed:
Since 2000, land use in the Miramar Watershed has experienced little change (Figure 4-3.6, Table 4-3.6). Currently, parks account for almost 55% of the watershed area, while 24% of the land is used for urban and residential purposes, which is a 3% increase since 2000 (see Rainfall and Runoff). The reservoir occupies the remaining 21% of the watershed. No commercial agriculture occurs in the Murray Watershed.

Table 4-3.6 Existing Land Use in the Miramar Watershed

Land Use Category	Area (acres)	% of Watershed
Parks	353.01	54.74
Single Family Residential	108.65	16.85
Multi Family Residential	7.90	1.23
Transportation, Communications and Utilities	39.93	6.19
Water	135.38	20.99
Total	644.87	100.00

Agriculture

Miramar Watershed:
Agricultural practices in the Miramar Watershed consist only of home gardens and hobby farms which are not included in this report. No poultry ranches or dairy farms are permitted with the San Diego County Department of Environmental Health or the Regional water Quality Control Board in the Miramar Watershed.

Grazing

Miramar Watershed:
No land is permitted for grazing in Miramar Watershed.

Population Density

Population density is a good indicator of the level of urbanization within an area. Land areas with small population densities are usually rural area with natural landscapes that trap rainwater and allow it to filter slowly into the ground (see Rainfall and Runoff). In contrast, large population densities are associated with urbanized areas. These areas contain impervious surfaces that prevent rain from infiltrating into the ground which increases the amount and velocity of runoff. Urbanization increases the variety and amount of pollutants carried into streams, rivers, and lakes. These pollutants can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational area unsafe and unpleasant. The population data presented was derived form SANDAG's 2000 Census.

Miramar Watershed:
The estimated 2005 population of Miramar Watershed is 6,538 people. The average population density throughout the watershed is approximately 10.1 persons per acre. Within the past 5 years, homes were built along the northern boundary which increased the Miramar watershed population 38% (Figure 4-3.7).

Mines

Miramar Watershed:
There are no mines listed with the State Water Resources Control Board (SWRCB) in the Miramar Watershed.

Hazardous Material / Waste

The data presented in this section was obtained from the San Diego County Health Department, RWQCB, and the Solid Waste Assessment Test Program.

Miramar Watershed:

There are no permitted hazardous material / waste storage sites in Miramar Watershed.

Recreation

Miramar Reservoir:

The primary purpose of Miramar Reservoir is for domestic water supply, while recreation is a secondary use of the reservoir. The reservoir is open to the public for boating and fishing four days a week November through September, and to all other recreational activities seven days a week year around. Recreational activities include; boating, fishing, jogging, biking, and picnicking. Water contact activities are not permitted at the reservoir (Table 4-3.7).

Table 4-3.7 Miramar Reservoir Number of Permits Sold

Year	Fishing	Launch	Rentals	
			Motor	Row
2001	13133	1199	NA	1839
2002	9619	658	NA	1467
2003	Closed due to low lake level			
2004*	4133	450	290	325
2005	Figures not reconciled			

* Closed part of the year due to low lake level

The facilities consist of concession, launch, rental boats, trash receptacles, portable toilets and a comfort station. These facilities are owned and operated by the City of San Diego. There are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels.

Miramar Reservoir has a restricted access area encompassing the outlet tower. This area is demarcated by a floating barrier to prevent direct recreational contact to the water immediately available to the Miramar Water Treatment Plant.

The potential sources of contamination associated with the recreational activities include; erosion, trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts.

Title 22 contaminants are monitored quarterly and nutrients monthly (Figure 4-3.1). Microorganisms including Total Coliforms, E. coli, and Enterococcus are monitored weekly.

Wastewater / Reclaimed Water

Miramar Watershed:
There are no Wastewater treatment facilities permitted by the RWQCB or Reclaimed water distribution in the Miramar Watershed.

Septic systems

Miramar Watershed:

No septic systems are in this watershed, a fully developed sewer system serves this area.

Sanitary Sewer Overflows

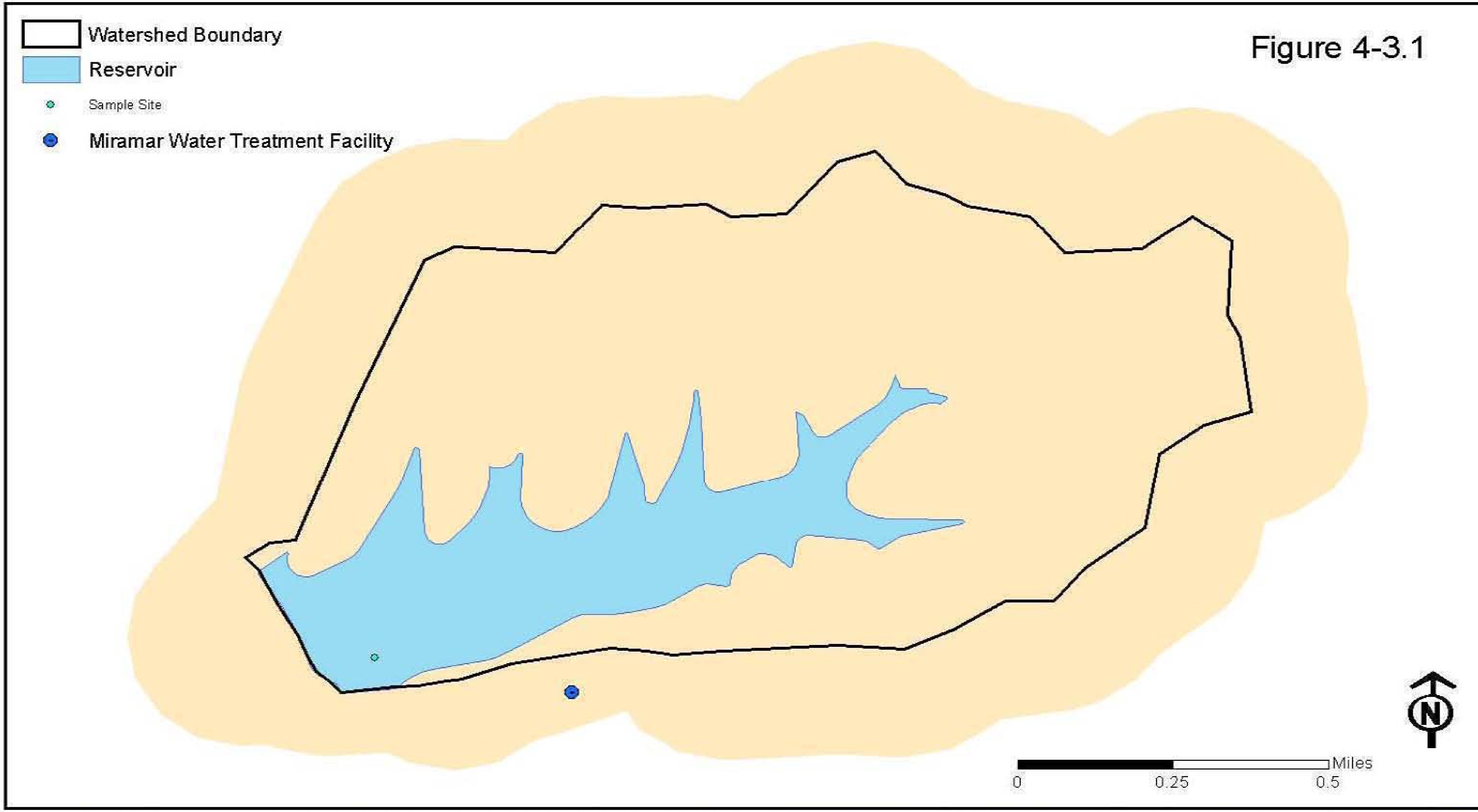
Miramar Watershed:

There was one sanitary sewer overflow in the Miramar Watershed reported to the Regional Water Quality Control Board (RWQCB) from 2001 through 2004 (Table 4-3.8). The current data available from the RWQCB is through June 30, 2004. Detailed information regarding sanitary sewer overflows is available at the Regional Water Quality Control Board website (www.swrcb.ca.gov/rwqcb9).

Table 4-3.8 Miramar Watershed Sanitary Sewer Overflows 2001 - 2004

Year	RWCQB Tracking No.	Total Overflow Volume (Gallons)	Overflow Volume Released to Environment (Gallons)	Reach Surface Waters other than Storm Drain?	Receiving Waters
2003	349439	2400	0	N	

Miramar Watershed GENERAL SETTING



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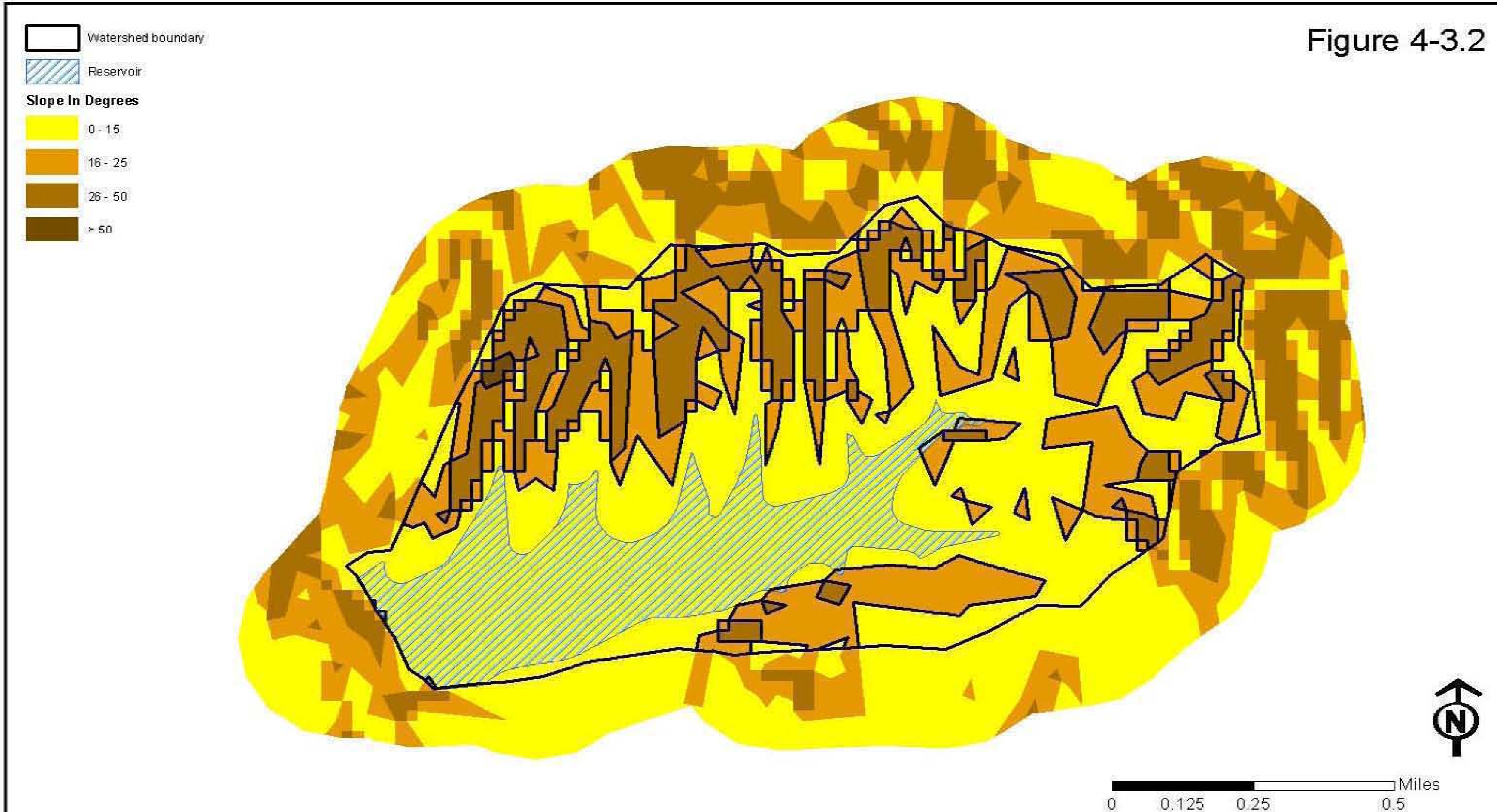
Created By: Dennis Brown

Date: 5 December 2005

Miramar Watershed SLOPE

Figure 4-3.2



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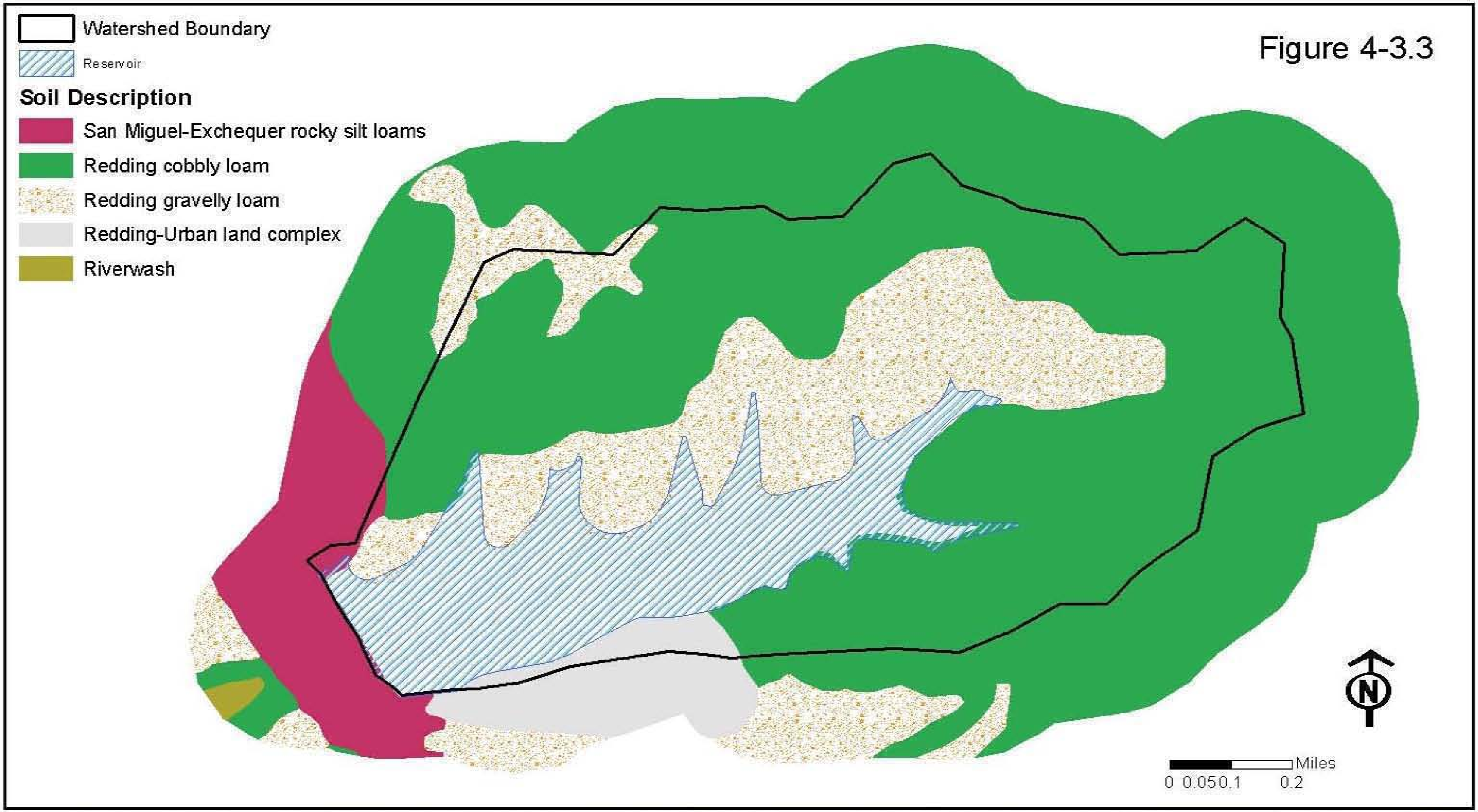
Date: 08.02.05

Miramar Watershed SOILS



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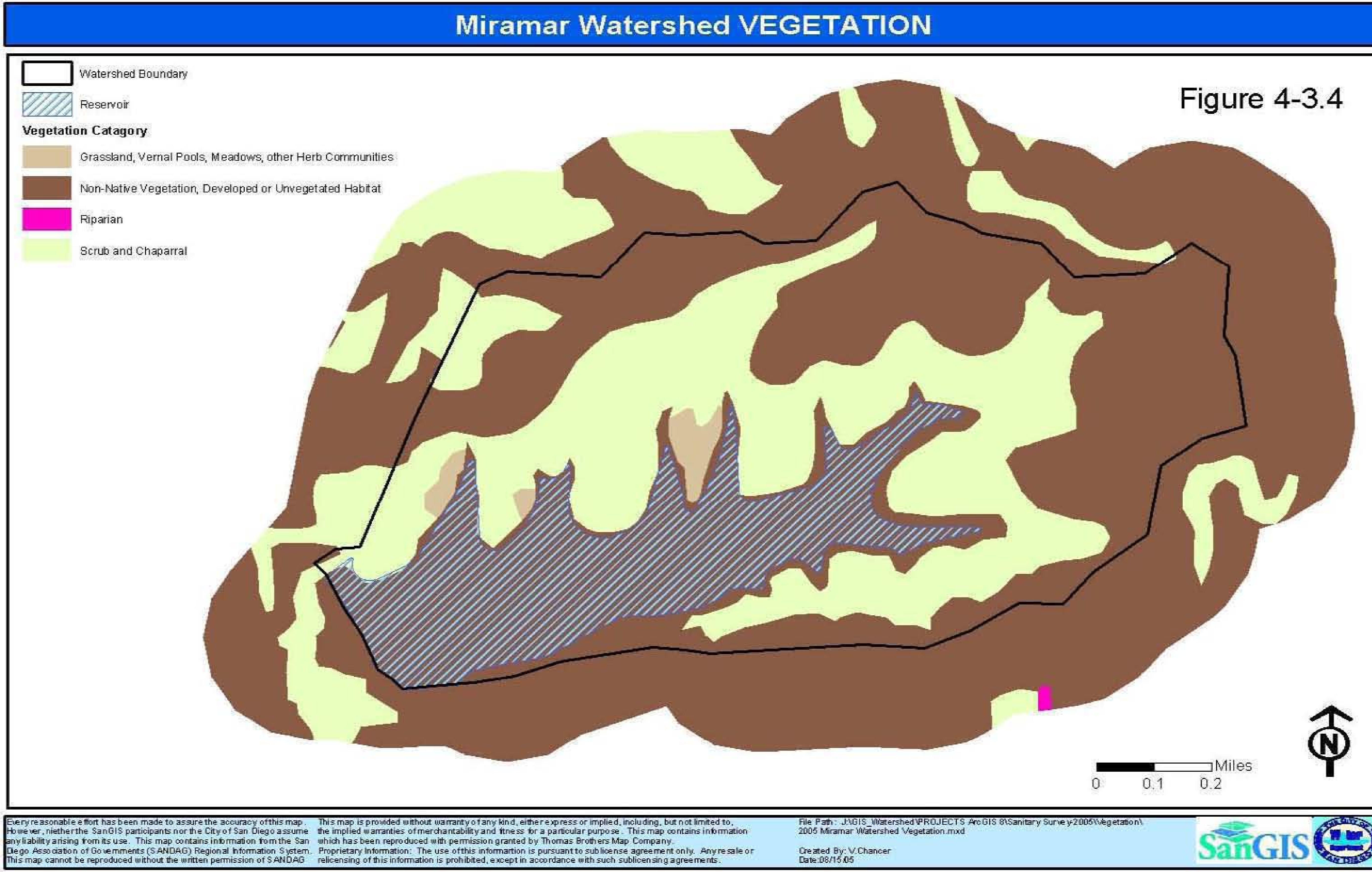
Miramar Watershed VEGETATION
Figure 4-3.4
Watershed Boundary
Reservoir
Vegetation Catagory
Grassland, Vernal Pools, Meadows, other Herb Communities
Non-Native Vegetation, Developed or Unvegetated Habitat
Riparian
Scrub and Chaparral
Miles
0
0.1
0.2
N
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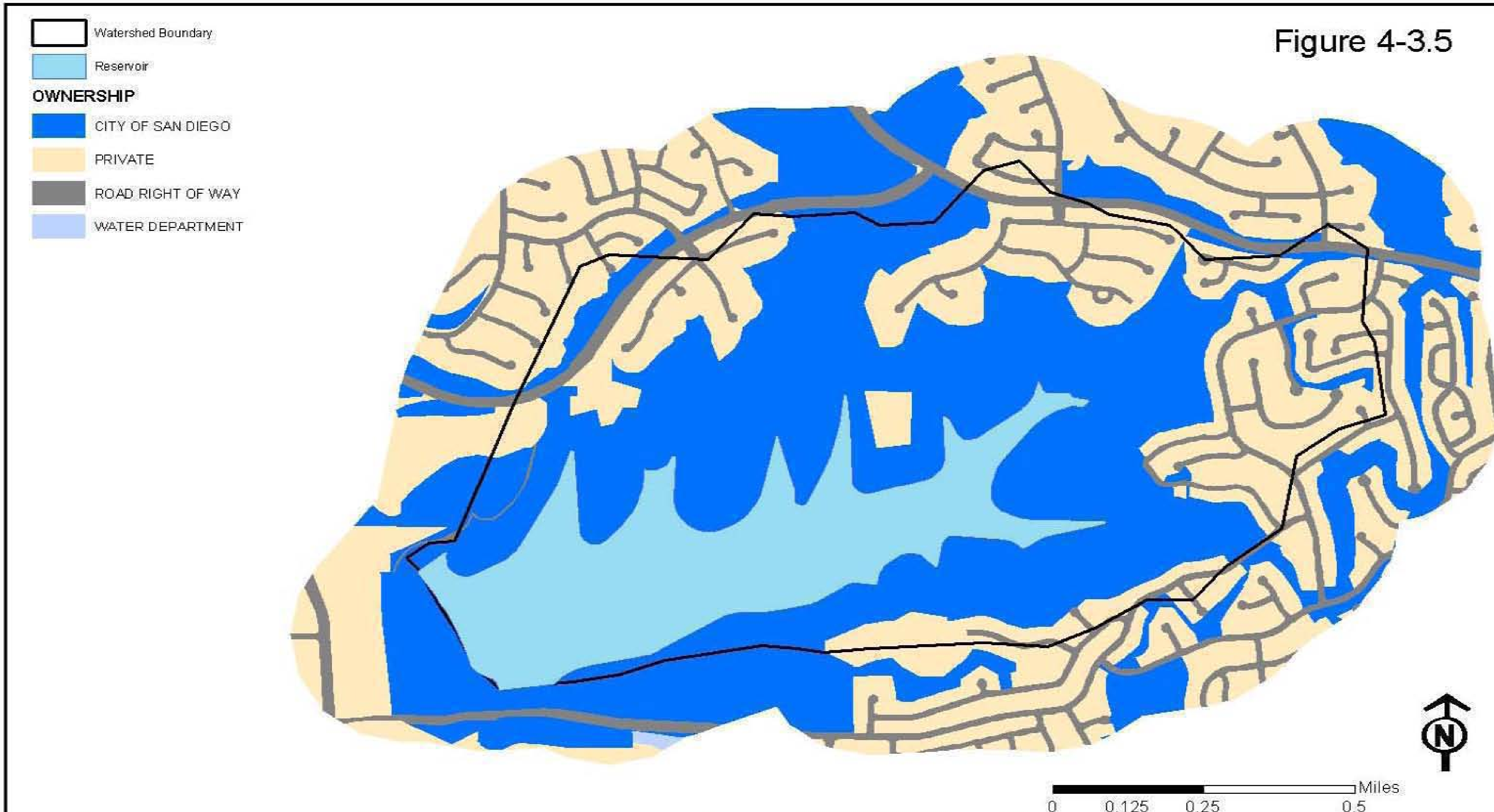
Date:08/15/05
SanGIS

Miramar Watershed LAND OWNERSHIP



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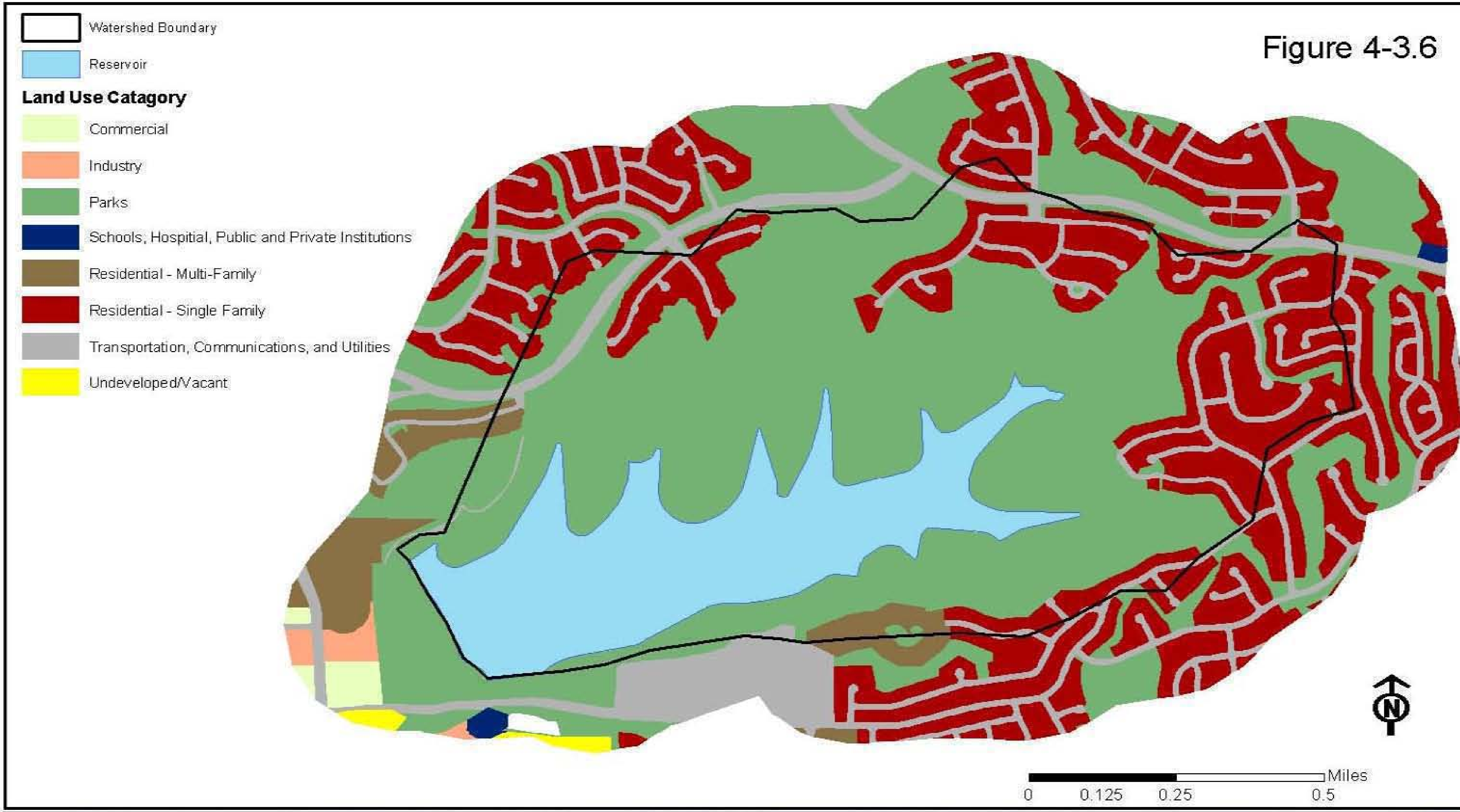
Date: 4 January 06

Miramar Watershed LANDUSE



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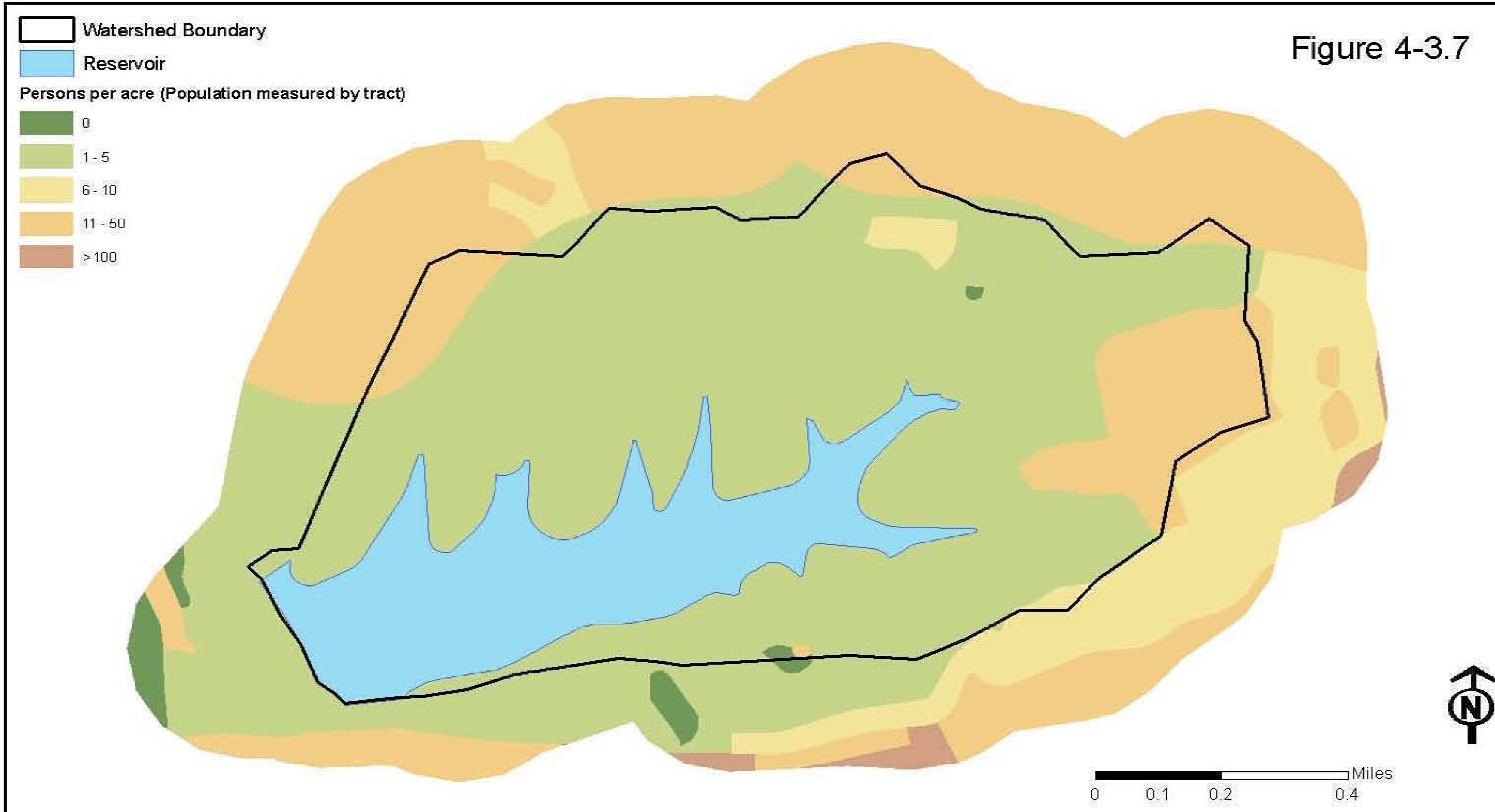
Created By: Dan Datt
Date: 8/8/05

Miramar Watershed POPULATION DENSITY



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Created By: Dennis Brown

Date: 21 December 2005

CHAPTER 4: WATER QUALITY ASSESSMENT

Introduction

This chapter contains a summary of the quality of raw and treated water in the Miramar Watershed during the period of January 1, 2001, through December 31, 2005.   Following the summary there is an evaluation of the system's ability to comply with current regulations and to meet anticipated future requirements.

The Water Quality Laboratory of the City of San Diego provided monitoring data from Miramar Reservoir, and the Miramar WTP.

Summary Of Monitoring Program

Miramar Reservoir was sampled near the outlet structure at surface level and at various outlet gauges. There also were sampling points at the influent and effluent of the Miramar WTP. See Table 4-4.1 for a summary of the sampling frequency.

The reservoir and treatment plant influent/effluent were monitored for general physical characteristics, organic and inorganic constituents, and radiation. A summary of raw water quality at surface is found in Table 4-4.2. The water quality at the outlet gauges and the treatment plant influent/effluent are summarized in subsequent tables.

Description Of Source Surface Water Quality At Miramar Reservoir

Miramar Reservoir at Surface -

> Table 4-4.3 contains a summary of water quality data for Miramar Reservoir at the surface.

General Physical

The monitored physical parameters of Miramar Reservoir at surface were within the standards for drinking water except for turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The turbidity reached a maximum 1.36NTU. Turbidity it did not exceed the SMCL of 5 NTU. Threshold odor was not monitored at surface level.

Inorganic Constituents

There were twenty-eight inorganic constituents measured. The maximum values for Iron exceeded drinking water maximum contaminant levels. Iron average values were below MCL levels. Iron is added in the water treatment process and does not impact the potable drinking water quality.

Microbiological

Total coliform, E. Coli, and Enterococcus were monitored in order to obtain a background representation of microbiological conditions. Total coliforms ranged from <10 /100ml to 20,000 /100ml. The E. Coli range was from <10 /100ml to 130 /100ml, and Enterococcus varied from <1 /100ml to 28/100ml. Cryptosporidium and Giardia were not monitored in the reservoir.

Radiological

Miramar Reservoir was monitored for gross alpha and beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the maximum contaminant levels.

Organic Constituents

Miramar Reservoir was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants. Only Trihalomethanes (THM), Geosmin and Methyl-isoborneol (MIB) were detected. Geosmin and MIB are monitored for taste and odor and are not regulated. THMs come from Miramar treatment plant filter washing.

Miramar Reservoir at Outlet Gauges

Water quality data at four outlet gauges is summarized in Table 4-4.3. Outlet Gauges were sampled when they were 10 feet or greater under the surface. Gauges measured were ga-51, ga-66, ga-81, and ga-96. The numbers refer to the distance (feet) above the streambed.

General Physical

Samples from all four outlet gauges exceeded the MCL for color, turbidity, and threshold odor. There is some correlation between outlet depth and color, but not with turbidity or odor.

Microbiological

The outlet gauges were measured for Total Coliform, E. Coli, and Enterococcus. All gauges had positive readings. Total coliforms ranged from <10 /100ml to >24,000 /100ml. The E. Coli range was from <10 /100ml to 220 /100ml, and Enterococcus varied from <1 /100ml to 1200 /100ml. This is a common occurrence in raw reservoir water.

Organic Constituents

Total Organic Carbon (TOC), Geosmin, and Methyl Isoborneol (MIB) were monitored at all five outlet gauges. TOC is a precursor to Trihalomethanes, and is monitored in source water. TOC ranged from a minimum of 2.08 mg/L at gauge 51 to a maximum of 4.37 mg/L at gauge 81. Geosmin and MIB were monitored for aesthetic reasons only. There are no maximum contaminant levels for these three parameters.

Influent to Miramar WTP

Table 4-4.4 contains a summary of water quality data for the influent to the Miramar Water Treatment Plant.

General Physical

The monitored physical parameters of Miramar WTP influent were within the standards for drinking water except for color, odor, pH and turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. The maximum pH reading was 8.55, above the SMCL of 6.5 – 8.5. The turbidity reached a maximum 10.6 NTU. The maximum color reading was 39cu, where the SMCL is 15cu. These parameters were easily treated in the Miramar treatment plant.

Microbiological

Total coliform was monitored in order to obtain a background representation of microbiological conditions. Total coliforms ranged from <2 /100ml to 16,000 /100ml. *Cryptosporidium* and *Giardia* were monitored. Neither *Cryptosporidium* or *Giardia* were typically found. *Cryptosporidium* and *Giardia* ranged from <0.1/100L for both to 0.1/100L for *Cryptosporidium* and 0.8/100L for *Giardia*.

Radiological

Miramar WTP influent was monitored for gross alpha and beta particles, as well as combined Radium-226 and Radium-228, Strontium-90, Tritium, and Uranium. All measurements were well below the maximum contaminant levels.

Inorganic Constituents

There were twenty-eight inorganic constituents measured. Maximum values for Iron and Manganese exceeded the potable water maximum contaminant levels. These constituents were easily treated in the Miramar treatment plant.

Organic Constituents

Miramar WTP influent was monitored for both regulated and non-regulated organic constituents, including herbicides, pesticides, and synthetic contaminants Low levels of Trihalomethanes (THM) were detected. THMs resulted from Miramar plant filter wash water being recycled back to Miramar reservoir. TOC is a precursor to Trihalomethanes, and is monitored in source water. TOC ranged from a minimum of 2.02 mg/L, to a maximum of 5.14 mg/L

Miramar WTP Effluent

Table 4-4.5 contains a summary of water quality data for the Miramar Water Treatment Plant effluent.

General Physical

The monitored physical parameters of Miramar WTP effluent were within the standards for drinking water. The maximum turbidity reading was 0.47. Turbidity is monitored every two hours at the treatment plant and met turbidity requirements.

Microbiological

Total coliform was monitored in order to ascertain compliance with regulations. There were no positive Total coliform samples out of 2410 samples C*ryptosporidium* and *Giardia* were monitored. The range for both was <0.1 /100L to <0.1 /100L.

Inorganic Constituents

Twenty-eight inorganic constituents were monitored, of which none exceeded the maximum contaminant levels.

Organic Constituents

Miramar WTP effluent was monitored for both regulated and non-regulated organic substances, including herbicides, pesticides, and synthetic contaminants. Total THMs (TTHM) ranged from 29.2 to 87.8 ug/L. Compliance is based on a Running Annual Average of distribution system samples. The Miramar system met all TTHM requirements.

Evaluation of Source Water Quality

The sources for the Miramar WTP are Miramar Reservoir, which is largely imported CWA raw water. The influent to Miramar WTP remains relatively constant.

The number of samples showing positive for microorganisms in the source water and the influent is not of concern. It is rare to find raw surface water which does not have microorganisms present. High color and turbidity are also to be expected, since the reservoirs are part of a wildlife habitat.

Evaluation Of System's Ability To Meet Current Drinking Water Standards

The source water is treated at the Miramar WTP to comply with existing drinking water standards. Currently, the system complies with all primary standards. Of the 105 TTHM readings, the maximum was 87.8 µg/L. The system also complies with all secondary standards.

Evaluation Of System's Ability To Meet Current And Anticipated IESWTR And D/Dbp Standards

The Miramar WTP has the ability to meet all current IESWTR And D/DBP standards.

Anticipated Regulations

Stage 2 Disinfectants And Disinfection Byproducts Rule (D/DBP) –

Phase I of the Stage 2 D/DBP rule requires that all water supply systems meet "locational" running annual averages (LRAA) of 120 µg/L for TTHM and 100 µg/L for HAA5 by May 2005. The LRAA for the Miramar system all are within these limits, with a system-wide average of 59.2 µg/L for TTHM, and a system-wide maximum of 42.1 µg/L for HAA5.

Phase II reduces the LRAA to 80 µg/L for TTHM and 60 µg/L for HAA5 in 2012. Phase II also requires water system suppliers to conduct Initial Distribution System Evaluations (IDSE) to select new monitoring sites that more accurately reflect high DBP locations. This evaluation requires water monitoring to be conducted for one year.

Currently the Miramar WTP meets the Phase I standards of the Stage 2 D/DBP rule. For Phase II, the IDSE study will have to be completed to determine the locations of new monitoring sites having the highest TTHM and HAA5 before compliance can be determined. Capital improvement to the Miramar water treatment plant may be required to meet Stage 2 LRAA THM limits.

Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) -

The LT2ESWTR is being developed to provide increased protection against *Cryptosporidium.* This rule incorporates system specific treatment requirements classified into categories, or 'bins', based on the results of the source water *Cryptosporidium* monitoring. Additional treatment requirements depend on the bin to which the system is assigned. Systems will choose technologies to comply with additional treatment requirements from a 'toolbox' of options.

Currently at the Miramar WTP, the system will not require additional treatment, since the average *Cryptosporidium* at Miramar influent is <0.100 /100L.

Arsenic Regulation -

On January 22, 2001, a final rule revised the MCL for Arsenic from 50 µg/L to 10 µg/L. The final rule also clarifies how compliance is demonstrated for many inorganic and organic contaminants in drinking water. The compliance date is five years after the publication of the final rule.

The Miramar WTP complies with the new Arsenic regulation because the maximum Arsenic reading for Miramar WTP effluent was <2 µg/L.

Radionuclides Regulations -

The new Radionuclides Rule went into effect in December 2003. The new rule sets a MCL of 30 mg/L for Uranium and 5 pCi/L for Combined Radium 226/228. It also sets standards of 15 pCi/L for adjusted gross alpha particles and 4 mrem/year for beta particles and photon radioactivity. Compliance with this requirement is assumed if the average concentration of gross beta particle activity is less than 50 pCi/l and if the average concentration of tritium and strontium-90 are less than those listed in Table 4-4.3. The Miramar WTP currently complies with this rule.

Radon Regulation -

The EPA is formulating new regulations concerning Radon. The rule proposes a MCL of 300 pCi/L at the entry point to the distribution system. The EPA is proposing that initial one-year quarterly monitoring should begin three years after publication of the final rule. Radon has not been measured in the Miramar system.

Sulfate Regulation -

The current SMCL range for sulfate is 250 – 500 mg/L. The Miramar WTP currently complies with this regulation, since the maximum sulfate reading for Miramar WTP effluent is 244 mg/L.

Table 4-4.1
RAW WATER QUALITY MONITORING PROGRAM
MIRAMAR TREATMENT PLANT INFLUENT and EFFLUENT, and MIRAMAR RESERVOIR,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]		
	Miramar Reservoir	Miramar WTP Influent	Miramar WTP Effluent
General Physical			
Alkalinity	Q	M[3]	D
Color	Q	D	D
Conductivity	Q	M	M
Corrosivity	Q	M	M
Foaming Agents (MBAS)	A	NS	A
Hardness as $CaCO_3$	Q	M[3]	M
Odor - Threshold	NS[4]	D	D
pH	Q	M	M
Total Dissolved Solids	Q	M	M
Turbidity	Q	D	D
Microbiological			
Total Coliform	W	D	D
E. Coli	W	NS	NS
Enterococcus	W	NS	NS
Cryptosporidium	NS	M	M
Giardia	NS	M	M
Radiological			
Gross Alpha particles	(2)	(2)	NS
Gross Beta particles	(2)	(2)	NS
Combined Radium-226 & Radium-228	(2)	(2)	NS
Strontium-90	(2)	(2)	NS
Tritium	(2)	(2)	NS
Uranium	(2)	(2)	NS
Inorganic Constituents			
Aluminum	Q	M	M
Antimony	Q	Q	Q
Arsenic	Q	Q	Q
Barium	Q	Q	Q
Beryllium	Q	Q	Q
Cadmium	Q	Q	Q
Calcium	Q	M	M
Chloride	Q	M	M
Chromium	Q	Q	Q
Copper	Q	M	M
Cyanide	Q	Q	Q
Fluoride	Q	M	M
Iron	Q	M	M
Lead	Q	M	M
Magnesium	Q	Q	Q
Manganese	Q	M	M
Mercury	Q	Q	Q
Nickel	Q	Q	Q

Table 4-4.1 RAW WATER QUALITY MONITORING PROGRAM MIRAMAR TREATMENT PLANT INFLUENT and EFFLUENT, and MIRAMAR RESERVOIR, 2001 THROUGH 2005			
Parameters	Planned Sampling Frequency[1]		
	Miramar Reservoir	Miramar WTP Influent	Miramar WTP Effluent
Nitrate**	M	M[3]	M[3]
Nitrate + Nitrite**	Q	M[3]	M[3]
Nitrite as Nitrogen	Q	W	W
Phosphate (ortho)**	Q	M	M
Phosphorus (total)**	Q	M	M
Potassium	Q	M	M
Selenium	Q	Q	Q
Silver	Q	Q	Q
Sulfate	Q	M	M
Thallium	Q	Q	Q
Zinc	Q	M	M
Perchlorate	Q	Q	Q
Organic Constituents, Regulated			
1,1,1-Trichloroethane	Q	Q	Q
1,1,2-Trichloro-1,2,2-Trifluoroethane	Q	Q	Q
1,1,2-Trichloroethane	Q	Q	Q
1,1-dichloroethane	Q	Q	Q
1,1-Dichloroethylene	Q	Q	Q
1,2,4-Trichlorobenzene	Q	Q	Q
1,2-dichloroethane	Q	Q	Q
1,2-Dichloropropane	Q	Q	Q
1,4-Dichlorobenzene	Q	Q	Q
2,4,5 TP	Q	Q	Q
2,4-D	Q	Q	Q
Alachlor	Q	Q	Q
Atrazine	Q	Q	Q
Bentazon	Q	Q	Q
Benzene	Q	Q	Q
Benzo(a)pyrene	Q	Q	Q
Bromodichloromethane	Q	W	W
Bromoform	Q	W	W
Carbofuran	Q	Q	Q
Chloramine	Q	Q	Q
Chlordane	Q	Q	Q
Chlorine	Q	Q	Q
Chlorine Dioxide	Q	Q	Q
Chloroform	Q	W	W
cis-1,2-Dichloroethylene	Q	Q	Q
Dalapon	Q	Q	Q
Di(2-ethylhexyl) adipate	Q	Q	Q
Di(2-ethylhexyl) pthalate	Q	Q	Q
Dibromochloromethane	Q	W	W
Dibromochloropropane	Q	Q	Q
Dichloromethane (methylene chloride)	Q	Q	Q

Table 4-4.1
RAW WATER QUALITY MONITORING PROGRAM
MIRAMAR TREATMENT PLANT INFLUENT and EFFLUENT, and MIRAMAR RESERVOIR,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]		
	Miramar Reservoir	Miramar WTP Influent	Miramar WTP Effluent
Dinoseb	Q	Q	Q
Diquat	Q	Q	Q
Endrin	Q	Q	Q
Ethylbenzene	Q	Q	Q
Glyphosate	Q	Q	Q
Haloacetic acids (HAA5) (five)	Q	M	W[3]
Heptachlor	Q	Q	Q
Heptachlor epoxide	Q	Q	Q
Hexachlorobenzene	Q	Q	Q
Hexachlorocyclopentadiene	Q	Q	Q
Lindane	Q	Q	Q
Methoxychlor	Q	Q	Q
Methyl tert-Butyl Ether (MTBE)	Q	Q	Q
Molinate	Q	Q	Q
Monochlorobenzene	Q	Q	Q
o-Dichlorobenzene	Q	Q	Q
Oxamyl	Q	Q	Q
Pentachlorophenol	Q	Q	Q
Picloram	Q	Q	Q
Polychlorinated biphenyls (PCBs)	Q	Q	Q
Simazine	Q	Q	Q
Styrene	Q	Q	Q
Tetrachloroethylene	Q	Q	Q
Thiobencarb	Q	Q	Q
Toluene	Q	Q	Q
Total Organic Carbon (TOC)	M	W	W
Total trihalomethanes (TTHM)	Q	W	W
Toxaphene	Q	Q	Q
trans-1,2-Dichloroethylene	Q	Q	Q
Trichloroethylene	Q	Q	Q
Trichlorofluoromethane	Q	Q	Q
Vinyl chloride	Q	Q	Q
Xylenes	Q	Q	Q
Organic Constituents, Unregulated			
Ethyl-tert-Butyl Ether (ETBE)	Q	Q	Q
t-Amyl-methyl ether (TAME)	Q	Q	Q
1,1,1,2-Tetrachloroethane	Q	Q	Q
1,1-Dichloropropene	Q	Q	Q
1,2,3-Trichlorobenzene	Q	Q	Q
1,2,3-Trichloropropane (TCP)	A[3]	Q	Q
1,2,4-Trimethylbenzene	Q	Q	Q
1,3,5-Trimethylbenzene	Q	Q	Q
1,3-Dichlorobenzene	Q	Q	Q
1,3-Dichloropropane	Q	Q	Q
2,2-Dichloropropane	Q	Q	Q

Table 4-4.1
RAW WATER QUALITY MONITORING PROGRAM
MIRAMAR TREATMENT PLANT INFLUENT and EFFLUENT, and MIRAMAR RESERVOIR,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]		
	Miramar Reservoir	Miramar WTP Influent	Miramar WTP Effluent
3-Hydroxycarbofuran	Q	Q	Q
Aldicarb	Q	Q	Q
Aldicarb sulfone	Q	Q	Q
Aldicarb sulfoxide	Q	Q	Q
Aldrin	Q	Q	Q
Bromacil	A	A	A
Bromobenzene	Q	Q	Q
Bromochloromethane	Q	Q	Q
Bromomethane	Q	Q	Q
Butachlor	A	A	A
Carbaryl	Q	Q	Q
Chlorobenzene	Q	Q	Q
Chloroethane	Q	Q	Q
Chloromethane	Q	Q	Q
Dibromomethane	Q	Q	Q
Dicamba	Q	Q	Q
Dichlorodifluoromethane	Q	Q	Q
Dieldrin	Q	Q	Q
Geosmin	M^3	W	W
Hexachlorobutadiene	Q	Q	Q^6
Isopropylbenzene	Q	Q	Q^6
Methomyl	Q	Q	Q^6
Methyl-isoborneol (MIB)	M^3	W	W
Metolachlor	A	A	A
Metribuzin	A	A	A
Napthalene	Q	Q	Q
n-Butylbenzene	Q	Q	Q
n-Propylbenzene	Q	Q	Q
Prometryn	A	A	A
Propachlor	Q	Q	Q
sec-Butylbenzene	Q	Q	Q
tert-Butylbenzene	Q	Q	Q

SAMPLING FREQUENCY DESIGNATION
D: Daily
W: Weekly
M: Monthly
Q: Quarterly
A: Annually
NS: Not Sampled

(1) Samples may be taken but not reportable due to instrumentation problems or quality control.
(2) Sample frequency is every four years. The data used in this report was obtained during 2002.
(3) Samples taken twice per month (M^3), twice per week (W^3), or twice annually (A^3).
(4) Sampled at plant effluent and outlet gauges only.

NOTE:
** Denotes the start of a new parameter since the 2000 Sanitary Survey was completed.
Sampling frequency represents current monitoring schedule as of January 2001.

Table 4-4.2
SUMMARY OF RAW WATER QUALITY**
MIRAMAR RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			20	102	133	119	122
Color	cu	1		15	19	nd	10	4.47	4
Conductivity	µS/cm			900-1600	19	840	1130	925	885
Corrosivity[3]	--			non-corrosive	17	-0.03	1.01	0.52	0.6
Foaming Agents (MBAS)	mg/L	.5		0.5	4	nd	nd	nd	nd
Hardness as $CaCO_3$	mg/L	2			21	203	294	243	242
pH	pH			6.5-8.5	18	7.46	8.47	8.12	8.15
Total Dissolved Solids	mg/L	10		500-1000	19	474	568	520	529
Turbidity[2]	nut	0.07	0.5	5	19	0.20	1.36	0.499	0.430
Microbiological									
Total Coliform	/100ml	10	(4)		249	<10	20000	1072	10
Enterococcus	/100ml	1			249	<1	28	1.40	1
E. Coli	/100ml	10			249	<10	130	11.2	10
Radiological									
Gross Alpha particles	pCi/L	3	15		4	nd	3.28	nd	nd
Gross Beta particles	pCi/L	4	50		4	nd	7.71	nd	nd
Combined Radium-226 & Radium-228	pCi/L		5		4	nd	1.93	nd	nd
Strontium-90	pCi/L	2	8		3	nd	nd	nd	nd
Tritium	pCi/L	1000	20000		4	nd	3070	nd	nd
Uranium	pCi/L	2	20		4	2.35	3.40	2.90	3.00
Inorganic Constituents[5]									
Aluminum	µg/L	50	1000	200	21	nd	nd	nd	nd
Antimony	µg/L	6	6		21	nd	nd	nd	nd
Arsenic	µg/L	2	10		21	nd	nd	nd	nd
Barium	µg/L	100	1000		21	nd	nd	nd	nd
Beryllium	µg/L	1	4		20	nd	nd	nd	nd
Cadmium	µg/L	1	5		20	nd	nd	nd	nd
Calcium	mg/L	5			19	46.8	86.4	62.9	62.8
Chloride	mg/L	6.5		250-500	18	63.6	95.4	79.4	82.4
Chromium	µg/L	10	50		21	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	21	nd	nd	nd	nd
Cyanide	µg/L	100	200		13	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		19	0.220	0.336	0.277	0.267
Iron	µg/L	100		300	21	nd	118	nd	nd
Lead	µg/L	5	15		20	nd	nd	nd	nd
Magnesium	mg/L	3			19	6.20	27.8	19.7	20.6
Manganese	µg/L	20		50	21	nd	38.2	nd	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		21	nd	nd	nd	nd
Nitrate	mg/L	2	45		49	nd	nd	nd	nd
Nitrate + Nitrite	mg/L		10		23	0.369	1.48	0.802	0.779
Nitrite as Nitrogen	mg/L	0.4	1		33	nd	nd	nd	nd
Potassium	mg/L	0.5			21	3.25	5.19	4.04	4.09
Selenium	µg/L	5	50		21	nd	nd	nd	nd
Silver	µg/L	10		100	21	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	18	134	216	174	174
Thallium	µg/L	1	2		21	nd	nd	nd	nd
Zinc	µg/L	50		5000	21	nd	nd	nd	nd
Perchlorate	µg/L	5			25	nd	nd	nd	nd

Table 4-4.2 SUMMARY OF RAW WATER QUALITY** MIRAMAR RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		20	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		20	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-Dichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		20	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
1,2-Dichloroethane	µg/L	0.5	.5		20	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		20	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		20	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		19	nd	nd	nd	nd
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		24	nd	nd	nd	nd
Atrazine	µg/L	1	3		26	nd	nd	nd	nd
Bentazon	µg/L	2	18		18	nd	nd	nd	nd
Benzene	µg/L	0.5	1		20	nd	nd	nd	nd
Benzopyrene	µg/L	0.1	.2		18	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			19	0.842	1.70	1.31	1.32
Bromoform	µg/L	0.5			20	nd	0.868	nd	nd
Carbofuran	µg/L	5	18		17	nd	nd	nd	nd
Chlordane	µg/L	0.1	.1		19	nd	nd	nd	nd
Chloroform	µg/L	0.5			20	0.606	1.93	1.34	1.36
cis-1,2-Dichloroethylene	µg/L	0.5	6		20	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		17	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		16	nd	nd	nd	nd
Dibromochloromethane	µg/L	0.5			20	nd	1.7	1.15	1.17
Dichloromethane (methylene chloride)	µg/L	0.1	5		20	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		18	nd	nd	nd	nd
Endrin	µg/L	0.1	2		37	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		20	nd	nd	nd	nd
Glyphosate	µg/L	25	700		16	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		21	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		21	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		37	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		32	nd	nd	nd	nd
Lindane	µg/L	0.2	.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		36	nd	nd	nd	nd
Methyl tert-Butyl Ether (MTBE)	µg/L	3	13	5	20	nd	nd	nd	nd
Molinate	µg/L	2	20		14	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		20	nd	nd	nd	nd
Oxamyl (vydate)	µg/L	20	200		17	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		18	nd	nd	nd	nd
Picloram	µg/L	1	500		18	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	.5		15	nd	nd	nd	nd
Simazine	µg/L	1	4		20	nd	nd	nd	nd
Styrene	µg/L	0.5	100		20	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		20	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	19	nd	nd	nd	nd
Toluene	µg/L	0.5	150		20	nd	nd	nd	nd

Table 4-4.2 SUMMARY OF RAW WATER QUALITY** MIRAMAR RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Total Organic Carbon (TOC)	mg/L	0.5			80	2.29	4.62	3.04	3.00
Toxaphene	µg/L	1	3		19	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		20	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		20	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		20	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	.5		20	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		20	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether (ETBE)	µg/L	0.3			20	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			20	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			20	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			20	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			11	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			20	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			20	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			20	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			19	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			17	nd	nd	nd	nd
Aldicarb	µg/L	3			16	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			17	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			17	nd	nd	nd	nd
Aldrin	µg/L	0.075			21	nd	nd	nd	nd
Bromacil	µg/L	10			8	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			20	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			20	nd	nd	nd	nd
Bromomethane	µg/L	0.5			20	nd	nd	nd	nd
Butachlor	µg/L	0.38			8	nd	nd	nd	nd
Carbaryl	µg/L	5			17	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
Chloroethane	µg/L	0.5			20	nd	nd	nd	nd
Chloromethane	µg/L	0.5			20	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			20	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			20	nd	nd	nd	nd
Dieldrin	µg/L	0.02			21	nd	nd	nd	nd
Geosmin	µg/L	0.003			169	nd	0.086	0.003	nd
Hexachlorobutadiene	µg/L	0.5			20	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			20	nd	nd	nd	nd
Methomyl	µg/L	2			17	nd	nd	nd	nd
Methyl-isoborneol (MIB)	µg/L	.004			165	nd	0.0	nd	nd
Metolachlor	µg/L	10			8	nd	nd	nd	nd
Metribuzin	µg/L	.5			8	nd	nd	nd	nd
Napthalene	µg/L	0.5			36	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			20	nd	nd	nd	nd
Prometryn	µg/L	2			8	nd	nd	nd	nd
Propachlor	µg/L	.1			37	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd

Table 4-4.2 SUMMARY OF RAW WATER QUALITY** MIRAMAR RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/	Drinking Water Standards[1]		No. of	Raw Water quality			
		MDL	MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

nd: non-detected at State DLR or MDL if DLR not Available

Table 4-4.3
SUMMARY OF RAW WATER QUALITY**
MIRAMAR RESERVOIR AT OUTLET GAUGES 2001 - 2005

Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
52	**General Physical**									
	Color	cu	1		15	784	nd	19	4.24	4
	Odor - Threshold	Odor	1		3	217	nd	12	2.64	2
	Turbidity[2]	NTU	0.07	0.5	5	248	0.10	1.45	0.383	0.330
	Microbiological									
	Total Coliform	/100ml	10	(3)		249	nd	17000	776	180
	Enterococcus	/100ml	1			249	nd	110	2.1	1
	E. Coli	/100ml	10			249	nd	150	6.1	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			60	2.08	3.75	2.89	2.86
	Geosmin	ng/L	3			170	nd	13.3	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			166	nd	20.5	nd	nd
66	**General Physical**									
	Color	cu	1		15	248	nd	16	4.79	4
	Odor - Threshold	Odor	1		3	223	nd	17	2.63	2
	Turbidity	NTU	0.07	0.5	5	248	0.11	1.21	0.369	0.320
	Microbiological									
	Total Coliform	/100ml	10	(3)		249	nd	>24000	1110	330
	Enterococcus	/100ml	1			249	nd	1200	6.5	1
	E. Coli	/100ml	10			249	nd	63	7.50	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			59	2.21	4.05	2.97	2.94
	Geosmin	ng/L	3			170	nd	36.0	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			166	nd	21.1	nd	nd
81	**General Physical**									
	Color	cu	1		15	234	nd	15	4.89	5
	Odor - Threshold	Odor	1		3	208	nd	12	2.61	2
	Turbidity	NTU	0.07	0.5	5	234	0.09	2.20	0.397	0.340
	Microbiological									
	Total Coliform	/100ml	10	(3)		235	nd	20000	1247	440
	Enterococcus	/100ml	1			235	nd	23	2.4	2
	E. Coli	/100ml	10			235	nd	220	9.9	nd
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			56	2.13	4.37	3.03	3.02
	Geosmin	ng/L	3			166	nd	25.6	nd	nd
	Methyl Isoborneol (MIB)	ng/L	4			162	nd	14.7	nd	nd

Table 4-4.3
SUMMARY OF RAW WATER QUALITY**
MIRAMAR RESERVOIR AT OUTLET GAUGES 2001 - 2005

Outlet Gauge	Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
96	**General Physical**									
	Color	cu	1		15	56	1.5	10	4.46	4
	Odor - Threshold	Odor	1		3	48	nd	4	1.62	1.40
	Turbidity	NTU	0.07	0.5	5	56	0.14	1.18	0.371	0.33
	Microbiological									
	Total Coliform	/100ml	10	(3)		56	10	17000	1509	390
	Enterococcus	/100ml	1			56	1	8.40	2.45	2
	E. Coli	/100ml	10			56	10	41	14.4	10
	Organic Constituents									
	Total Organic Carbon (TOC)	mg/L	0.5			14	2.33	3.82	2.92	2.89
	Geosmin	ng/L	3			41	nd	11.7	nd	3.19
	Methyl Isoborneol (MIB)	ng/L	4			40	nd	9.2	nd	nd

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) No more then 5% of distribution system samples can be total coliform positive

nd: non-detected at State DLR or MDL if DLR not Available

Table 4-4.4
SUMMARY OF RAW WATER QUALITY**
MIRAMAR WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			121	74.3	137	117	117
Color	cu	1		15	1198	nd	38.5	6.23	6
Conductivity	µS/cm			900-1600	1149	636	1190	866	859
Corrosivity[3]	--			non-corrosive	53	0.0	1.04	0.5	0.57
Hardness as $CaCO_3$	mg/L	2			96	182	297	235	235
Odor - Threshold	odor	1		3	1805	1	26	1.5	1.40
pH	pH			6.5-8.5	55	7.62	8.55	8.16	8.17
Total Dissolved Solids	mg/L	10		500-1000	58	422	572	505	504
Turbidity[2]	NTU	0.07	0.5	5	1738	0.12	10.6	0.89	0.73
Microbiological[4]									
Total Coliform	/100ml	2	(4)		1771	nd	16000	129	23
Cryptosporidium	/L	0.1	2 log removal		57	nd	0.1	nd	nd
Giardia	/L	0.1	3 log removal		57	nd	0.8	nd	nd
Radiological									
Gross Alpha particles	pCi/L	3	15		4	nd	5.19	nd	nd
Gross Beta particles	pCi/L	4	50		4	nd	6.55	nd	nd
Combined Radium-226 & Radium-228	pCi/L		5		4	nd	1.72	nd	nd
Strontium-90	pCi/L	2	8		4	nd	nd	nd	nd
Tritium	pCi/L	1000	20,000		4	nd	nd	nd	nd
Uranium	pCi/L	2	20		4	3.31	3.71	3.42	3.32
Inorganic Constituents									
Aluminum	µg/L	50	1000	200	58	nd	778	nd	nd
Antimony	µg/L	6	6		23	nd	n	nd	nd
Arsenic	µg/L	2	10		23	nd	3.84	nd	nd
Barium	µg/L	100	1000		23	nd	118	nd	nd
Beryllium	µg/L	1	4		21	nd	nd	nd	nd
Cadmium	µg/L	1	5		24	nd	nd	nd	nd
Calcium	mg/L	5			57	40.6	90.4	61.9	60.6
Chloride	mg/L	6.5		250-500	67	57.8	91.2	75.6	76.2
Chromium	µg/L	10	50		24	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	58	nd	nd	nd	nd
Cyanide	µg/L	100	200		16	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		56	0.169	0.520	0.253	0.254
Iron	µg/L	100		300	59	nd	535	nd	nd
Lead	µg/L	5	15		57	nd	nd	nd	nd
Magnesium	mg/L	3			57	5.10	34.9	19	20.1
Manganese	µg/L	20		50	58	nd	369	nd	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		24	nd	nd	nd	nd
Nitrate	mg/L	2	45		189	nd	2.80	nd	nd
Nitrate + Nitrite	mg/L		10		100	0.430	2.80	1.27	1.16
Nitrite as Nitrogen	mg/L	0.4	1		244	nd	nd	nd	nd
Potassium	mg/L	0.5			59	3.26	6.58	4.07	3.91
Selenium	µg/L	5	50		23	nd	nd	nd	nd
Silver	µg/L	10		100	23	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	66	110	217	173	173
Thallium	µg/L	1	2		23	nd	nd	nd	nd
Zinc	µg/L	50		5000	57	nd	nd	nd	nd

Table 4-4.4
SUMMARY OF RAW WATER QUALITY**
MIRAMAR WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		20	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		20	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-dichloroethane	µg/L	0.5	5		20	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		20	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	0.5		20	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		20	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		20	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		19	nd	nd	nd	nd
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		23	nd	nd	nd	nd
Atrazine	µg/L	1	3		23	nd	nd	nd	nd
Bentazon	µg/L	2	18		19	nd	nd	nd	nd
Benzene	µg/L	0.5	1		20	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	0.2		19	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			92	nd	3.9	nd	nd
Bromoform	µg/L	0.5			92	nd	1.43	nd	nd
Carbofuran	µg/L	5	18		19	nd	nd	nd	nd
Chlordane	µg/L	0.1	0.1		19	nd	nd	nd	nd
Chloroform	µg/L	0.5			92	nd	3.24	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		20	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		19	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		16	nd	3.82	nd	nd
Dibromochloromethane	µg/L	0.5			65	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		20	nd	nd	nd	nd
Dalapon	µg/L	10	200		18	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		18	nd	nd	nd	nd
Diquat	µg/L	4	20		11	nd	nd	nd	nd
Endrin	µg/L	0.1	2		36	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		19	nd	nd	nd	nd
Glyphosate	µg/L	25	700		18	nd	nd	nd	nd
Heptachlor	µg/L	0.01	0.01		18	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	0.01		19	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		36	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		32	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		36	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	20	nd	nd	nd	nd
Molinate	µg/L	2	20		13	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		20	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		20	nd	nd	nd	nd
Oxamyl	µg/L	20	200		19	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		18	nd	nd	nd	nd
Picloram	µg/L	1	500		19	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	0.5		18	nd	nd	nd	nd
Simazine	µg/L	1	4		20	nd	nd	nd	nd
Styrene	µg/L	0.5	100		20	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	19	nd	nd	nd	nd
Toluene	µg/L	0.5	150		20	nd	nd	nd	nd
Total Organic Carbon (TOC)	µg/L	0.5	80		272	2.02	5.14	2.84	2.8

Table 4-4.4
SUMMARY OF RAW WATER QUALITY**
MIRAMAR WTP INFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
Toxaphene	µg/L	1	3		19	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		20	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		20	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		20	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	0.5		20	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		20	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			20	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			20	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			20	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			20	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			22	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			20	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			20	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			20	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			20	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			19	nd	nd	nd	nd
Aldicarb	µg/L	3			19	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			19	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			18	nd	nd	nd	nd
Aldrin	µg/L	0.075			19	nd	nd	nd	nd
Bromacil	µg/L	10			6	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			20	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			20	nd	nd	nd	nd
Bromomethane	µg/L	0.5			20	nd	nd	nd	nd
Butachlor	µg/L	0.38			5	nd	nd	nd	nd
Carbaryl	µg/L	5			19	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			20	nd	nd	nd	nd
Chloroethane	µg/L	0.5			20	nd	nd	nd	nd
Chloromethane	µg/L	0.5			20	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			20	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			19	nd	nd	nd	nd
Dieldrin	µg/L	0.02			19	nd	nd	nd	nd
Geosmin	µg/L	0.003			254	nd	0.012	nd	nd
Hexachlorobutadiene	µg/L	0.5			20	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			20	nd	nd	nd	nd
Methomyl	µg/L	2			19	nd	nd	nd	nd
Methyl Isoborneol (MIB)	µg/L	.004			249	nd	0.019	nd	nd
Metolachlor	µg/L	10			6	nd	nd	nd	nd
Metribuzin	µg/L	0.5			6	nd	nd	nd	nd
Napthalene	µg/L	0.5			36	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			20	nd	nd	nd	nd
Prometryn	µg/L	2			6	nd	nd	nd	nd
Propachlor	µg/L	0.1			36	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			20	nd	nd	nd	nd

Table 4-4.4 SUMMARY OF RAW WATER QUALITY** MIRAMAR WTP INFLUENT 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of	Raw Water quality			
			MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A plus quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

nd: non-detected at State DLR or MDL if DLR not Available

Table 4-4.5
SUMMARY OF RAW WATER QUALITY
MIRAMAR WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			58	95.4	133	115	115
Color	cu	1		15	57	nd	5	1.8	2
Conductivity	µS/cm			900-1600	58	754	1100	917	902
Corrosivity[3]	--			non-corrosive	56	-0.12	1.07	0.6	0.67
Hardness as $CaCO_3$	mg/L	2			58	181	276	241	246
Odor - Threshold	odor	1		3	1805	nd	1	nd	nd
pH	pH			6.5-8.5	60	7.62	8.61	8.18	8.24
Total Dissolved Solids	mg/L	10		500-1000	58	430	595	519	515
Turbidity[2]	NTU	0.07	0.5	5	598	nd	0.47	0.089	0.090
Microbiological[4]									
Total Coliform	/100ml		(4)		2410	nd	nd	nd	nd
Cryptosporidium	/L	0.1	2 log removal		2	nd	nd	nd	nd
Giardia	/L	0.1	3 log removal		2	nd	nd	nd	nd
Inorganic Constituents[5]									
Aluminum	µg/L	50	1000	200	58	nd	nd	nd	nd
Antimony	µg/L	6	6		21	nd	nd	nd	nd
Arsenic	µg/L	2	10		21	nd	nd	nd	nd
Barium	µg/L	100	1000		21	nd	120	nd	nd
Beryllium	µg/L	1	4		19	nd	nd	nd	nd
Cadmium	µg/L	1	5		21	nd	nd	nd	nd
Calcium	mg/L	5			57	40.8	86.8	63.6	64.3
Chloride	mg/L	6.5		250-500	67	66.5	104	84.6	86.0
Chromium	µg/L	10	50		20	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	58	nd	nd	nd	nd
Cyanide	µg/L	100	200		17	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		56	0.181	0.520	0.264	0.265
Iron	µg/L	100		300	58	nd	131	nd	nd
Lead	µg/L	5	15		58	nd	nd	nd	nd
Magnesium	mg/L	3			57	4.5	28.0	19.4	20.6
Manganese	µg/L	20		50	58	nd	nd	nd	nd
Mercury	µg/L	1	2		19	nd	nd	nd	nd
Nickel	µg/L	10	100		21	nd	nd	nd	nd
Nitrate	mg/L	2	45		186	nd	2.66	nd	nd
Nitrate + Nitrite	mg/L		10		98	0.404	2.66	1.24	1.14
Nitrite as Nitrogen	mg/L	0.4	1		235	nd	nd	nd	nd
Potassium	mg/L	0.5			59	3.16	6.76	4.06	3.95
Selenium	µg/L	5	50		21	nd	nd	nd	nd
Silver	µg/L	10		100	21	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	66	111	244	175	175
Thallium	µg/L	1	2		21	nd	nd	nd	nd
Zinc	µg/L	50		5000	57	nd	nd	nd	nd
Perchlorate	ug/L	5			37	nd	5.47	nd	nd
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		21	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		21	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		21	nd	nd	nd	nd

Table 4-4.5 SUMMARY OF RAW WATER QUALITY MIRAMAR WTP EFFLUENT 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN
1,1-dichloroethane	µg/L	0.5	5		21	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		21	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		21	nd	nd	nd	nd
1,2-dichloroethane	µg/L	0.5	0.5		21	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		21	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		21	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		19	nd	nd	nd	nd
2,4-D	µg/L	10	70		19	nd	nd	nd	nd
Alachlor	µg/L	1	2		24	nd	nd	nd	nd
Atrazine	µg/L	1	3		25	nd	nd	nd	nd
Bentazon	µg/L	2	18		19	nd	nd	nd	nd
Benzene	µg/L	0.5	1		21	nd	nd	nd	nd
Benzo(a)pyrene	µg/L	0.1	0.2		19	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			105	nd	31.5	17.2	17.2
Bromoform	µg/L	0.5			105	0.9	10.6	3.85	3.34
Carbofuran	µg/L	5	18		20	nd	nd	nd	nd
Chlordane	µg/L	0.1	0.1		19	nd	nd	nd	nd
Chloroform	µg/L	0.5			110	5.0	37.2	13.5	14.4
cis-1,2-Dichloroethylene	µg/L	0.5	6		21	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		20	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		16	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		21	nd	nd	nd	nd
Dalapon	µg/L	10	200		17	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		18	nd	nd	nd	nd
Diquat	µg/L	4	20		11	nd	nd	nd	nd
Endrin	µg/L	0.1	2		37	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		16	nd	nd	nd	nd
Glyphosate	µg/L	25	700		18	nd	nd	nd	nd
Haloacetic Acids (five) [5]	µg/L	0.5	60		16	15.4	38.7	23.0	21.8
Heptachlor	µg/L	0.01	0.01		19	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	0.01		20	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		38	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		31	nd	nd	nd	nd
Lindane	µg/L	0.2	0.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		37	nd	nd	nd	nd
Methyl t-Butyl Ether (MTBE)	µg/L	3	13	5	27	nd	nd	nd	nd
Molinate	µg/L	2	20		18	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		21	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		21	nd	nd	nd	nd
Oxamyl	µg/L	20	200		19	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		18	nd	nd	nd	nd
Picloram	µg/L	1	500		19	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	0.5		18	nd	nd	nd	nd
Simazine	µg/L	1	4		22	nd	nd	nd	nd
Styrene	µg/L	0.5	100		21	nd	nd	nd	nd
Thiobencarb	µg/L		70	1	19	nd	nd	nd	nd
Toluene	µg/L	0.5	150		21	nd	nd	nd	nd
Total Trihalomethanes(TTHM)[6]	mg/L	0.5			105	29.2	87.8	51.3	51.1
Total Organic Carbon (TOC)	µg/L	0.5	80		224	1.82	6.51	2.60	2.53
Toxaphene	µg/L	1	3		19	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		21	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		21	nd	nd	nd	nd

Table 4-4.5
SUMMARY OF RAW WATER QUALITY
MIRAMAR WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of	Raw Water quality			
			MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN
Trichlorofluoromethane	µg/L	5	150		21	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	0.5		21	nd	nd	nd	nd
Xylenes	µg/L	0.5	1750		21	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether(ETBE)	µg/L	0.3			21	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			21	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			21	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			21	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			22	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			21	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			21	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			21	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			21	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			19	nd	nd	nd	nd
Aldicarb	µg/L	3			19	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			19	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			18	nd	nd	nd	nd
Aldrin	µg/L	0.075			20	nd	nd	nd	nd
Bromacil	µg/L	10			6	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			21	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			21	nd	nd	nd	nd
Bromomethane	µg/L	0.5			21	nd	nd	nd	nd
Butachlor	µg/L	0.38			5	nd	nd	nd	nd
Carbaryl	µg/L	5			19	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			21	nd	nd	nd	nd
Chloroethane	µg/L	0.5			21	nd	nd	nd	nd
Chloromethane	µg/L	0.5			21	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			21	nd	nd	nd	nd
Dicamba	µg/L	15			19	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			21	nd	nd	nd	nd
Dieldrin	µg/L	0.02			20	nd	nd	nd	nd
Geosmin	µg/L	0.003			156	nd	0.008	nd	nd
Hexachlorobutadiene	µg/L	0.5			21	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			21	nd	nd	nd	nd
Methomyl	µg/L	2			19	nd	nd	nd	nd
Methyl Isoborneol (MIB)	µg/L	0.004			151	nd	0.020	nd	nd
Metolachlor	µg/L	10			6	nd	nd	nd	nd
Metribuzin	µg/L	0.5			6	nd	nd	nd	nd
Napthalene	µg/L	0.5			36	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			21	nd	nd	nd	nd
Prometryn	µg/L	2			6	nd	nd	nd	nd
Propachlor	µg/L	0.1			38	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			21	nd	nd	nd	nd

Table 4-4.5
SUMMARY OF RAW WATER QUALITY
MIRAMAR WTP EFFLUENT 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1]		No. of Samples	Raw Water quality			
			MCL	SMCL		MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A positive quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

(5) Haloacetic acids (five) is the sum of the concentrations of mon-, di-, and trichloroacetic acids and mono- and dibromoacetic acids. MCL based on Annual Average

(6) Total trihalomethanes is the sum of the concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform. MCL based on Annual Average

nd: non-detected at State DLR or MDL if DLR not Available

nd: non-detected at State DLR or MDL if DLR not Available

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of the key conclusions from this survey and recommendations to improve watershed protection and enhance drinking water quality.

Conclusions

Watershed And Water Supply System -

The watershed is within San Diego City limits. The City owns the majority of the land within the watershed. The remaining land is privately owned. This ownership pattern allows the City to control and implement watershed control efforts in coordination with the citizens of San Diego.

Most of the watershed lands support residential usage. Potential contamination sources include many nonpoint sources, which are more difficult to control than point sources.

The terrain is generally characterized as gentle to moderate slopes with approximately 59% of the watershed having slopes less than 15 degrees. The soils have generally high erosion potential. Rainfall is very low, with approximately 17 inches annually. The runoff from the residential areas is diverted from Miramar Reservoir and is minimally impacted by runoff.

The local water minimally influences the treatment requirements and the quality of water produced by the Miramar water treatment plant. Future infrastructure may allow transfer of water from Hodges Reservoir to Miramar Reservoir. Water transferred from Hodges to Miramar Reservoir will have a significant impact on the water quality supplied to the Miramar WTP. The City has a policy of maximizing the use of local water. This policy minimizes the purchase of imported water.

Potential Contamination Sources in the Watershed -

Potential significant sources of contamination include soil erosion, launching ramp runoff, and discharge of filter backwash and sludge from the Miramar WTP.

Watershed Management and Control Practices -

The City exercises a number of management practices or controls within the watershed. City personnel patrol Miramar Reservoir on a routine basis. The area around the reservoir has informational signs alerting the public about ways to protect the quality of the water.

Water Quality Conditions -

Reservoir raw water quality monitoring indicates few constituents may be of concern. The constituents include turbidity, coliforms and MTBE. Removal of MTBE from gasoline and replacing of 2-stoke rental boat motors with 4-stroke motors has minimized MTBE as a concern. Turbidity and coliforms are at levels treatable in the Miramar WTP.

Recommendations

General Recommendations -

Recommendations and corrective actions were developed for the purpose of improving overall watershed protection and drinking water quality. Generally, the recommendations strengthen this first barrier to water quality degradation – protection of source watershed. By strengthening this first barrier, impacts on the second barrier – water treatment – may be reduced. This will be of significance in the event that Hodges Reservoir water becomes available to Miramar WTP.

The Miramar Water Treatment Plant is effective at treating the raw water to meet current federal and state drinking water regulations. Requirements of the Stage 2 Disinfectants and Disinfection Byproducts Rule promulgated in January 2006 modify distribution system monitoring and compliance criteria. Current treatment plant process and raw water quality make compliance with the Stage 2 rule difficult. Continued protection of the watershed is important in meeting drinking water quality regulations.

The recommendations provided are grouped by the following subjects:

- Watershed Management and Control Practices
- Public Education

Water Quality Monitoring and Evaluation -

During the 2001 – 2005 time period watersheds monitoring was significantly increased. The City should continue monitoring the watersheds. The baseline data for many parameters has been collected.

Additional evaluation of the data should be used to provide guidance on actions necessary to protect the watersheds. As with any monitoring program, the program should be evaluated to help ensure the necessary data is being obtained while conserving laboratory resources.

The monitoring program should place emphases on obtaining information necessary to assisting City and non-City forces efforts to protect the watershed. Continued interaction with all interested parties is necessary to continually improve the monitoring program.

Watershed Management and Control Practices -

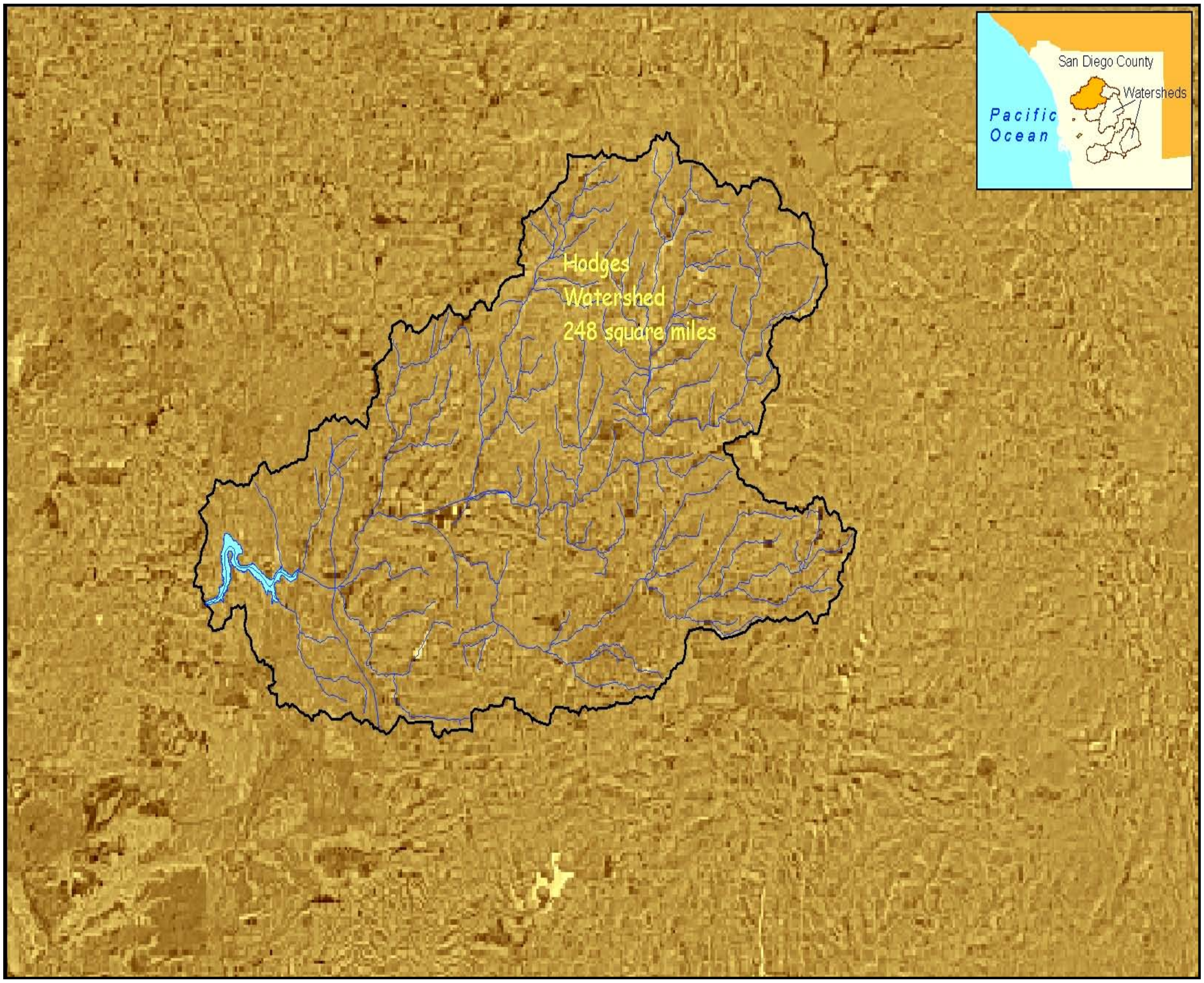
Continue to reduce the impacts from the public. Impacts can be minimized by continued reservoir monitoring by City staff and working closely with the public to keep them informed about the importance of clean water.

Public Education -

Public education material has been developed for trail and reservoir usage. Maintaining the educational material in readily available locations will help educate the public to the importance of protecting the watershed. The material should be periodically reviewed to ensure it is accurate and appropriate.

Residents within the watershed have a significant impact on protecting the watershed. Educational programs should emphasize what residents can do to help protect the watershed and how protecting the watershed provides them great benefits.

Keeping the public involved will help ensure Miramar Reservoir maintains high quality water.



The City of San Diego Water Department 2005 Watershed Sanitary Survey

Hodges Watershed

Volume 5 of 5

Data Collected Between 01/01/01– 12/31/05

ABBREVIATIONS

ACOE	Army Corps of Engineers
ADT	Average daily traffic
ADWF	Average dry weather flow
AF/Y	Acre-Feet per Year
AWWA	American Water Works Association
BLM	Bureau of Land Management – U.S. Federal
BMPs	Best Management Practices
CDF	California Department of Forestry
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
CDMG	California Division of Mines and Geology
CEQA	California Environmental Quality Act
CFR	California Federal Regulation
cfs	Cubic feet per second
City	City of San Diego
CNDDB	California Natural Diversity Database
CNF	Cleveland National Forest
CNPS	California Native Plant Society
County	County of San Diego
CWA	San Diego County Water Authority
D/DBP	Disinfection/Disinfection By-Product
DHS	Department of Health Services
DMG	Division of Mines and Geology – State of California
dS/M	Decisiemens per meter
DSOD	Division of Safety of Dams
EPA	Environmental Protection Agency
ESWTR	Enhanced Surface Water Treatment Rule
GIS	Geographic Information System
gpd	Gallons per day
Gpm	Gallons per minute
HAAs	Haloacetic Acids

ABBREVIATIONS

Helix	Helix Water District
HPC	Heterotrophic Plate Count
HSU	Hydrographic Subunit
HU	Hydrographic Unit
HUMAN CON	Human Consumption
IOCs	Inorganic Chemicals
LPG	Liquid Propane Gas
LSE LF	Loose Leaf
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MG	Million Gallons
mg/L	Milligrams per liter (parts per million)
mgd	Million gallons per day
mgy	Million gallons per year
MHCP	Multiple Species Conservation Program
MSL	Mean Sea Level
MWD	Metropolitan Water District
N-GRNHS	Nursery Greenhouse
N-OUTDR	Nursery Outdoor
NEPA	National Environmental Protection Act
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Unit
OTC	Olympic Training Center
PAHs	Polyaromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
RCA	Resource Conservation Area
RMWD	Ramona Municipal Water District
RO	Reverse Osmosis
RUIS	Regional Urban Information System

ABBREVIATIONS

RWQCB	California Regional Water Quality Board
SANDAG	San Diego Association of Governments
SCS	Soil Conservation Service – U.S.
SDWA	Safe Drinking Water Act - Federal
SMCL	Secondary Maximum Contaminant Level
SOCs	Synthetic Organic Chemicals
SP	Soluble Powder
SUB	Subtropical
SWPPPs	Storm Water Pollution Prevention Plans
TCR	Total Coliform Rule – Federal
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
THMs	Trihalomethanes
TTHMs	Total Trihalomethanes
TOC	Total Organic Carbon
TRANSPL	Transplants
ug/L	Micrograms per liter (parts per billion)
UNCUL	Uncultivated
UNSP	Unspecified
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Society
VOCs	Volatile Organic Compounds
WDRs	Waste Discharge Requirements
WPCF	Water Pollution Control Facility
WRF	Water Reclamation Facility
WSS	Watershed Sanitary Survey
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

VOLUME 5

THE HODGES WATERSHED

CHAPTER 1: SYNOPSIS

Introduction

This volume is the second five-year update of the 1996 Watershed Sanitary Survey (WSS) for the Hodges Watershed. Hodges Watershed is comprised of the Hodges Reservoir. The Hodges Watershed has an area of 158,417 acres, about 248 square miles (Figure 5-1.1). The primary function of the reservoir is to store local runoff. Although it is owned and operated by the City of San Diego Water Department, Hodges Reservoir is not currently connected to the San Diego Water Department's system. Water impounded in Hodges Reservoir is supplied to other agencies.

Watershed Sanitary Survey Requirements

The California Surface Water Treatment Rule (SWTR), in Title 22, Article 7, Section 64665 of the State Code of Regulations, requires every public water system using surface water to conduct a comprehensive sanitary survey of its watersheds every five years. The purpose of such a survey is to identify actual or potential sources of contamination, or any other watershed-related factor, which might adversely affect the quality of water used for domestic drinking water. The initial WSS was completed January 1, 1996 and is to be updated every five years thereafter.

The City of San Diego Water Department and its oversight agencies will use the Watershed Sanitary Survey Update (WSS Update) to evaluate water quality problems which might result from contaminants in the watersheds. The WSS Update will also serve as a basis for future watershed management and planning efforts.

Objectives

The main objectives of this WSS Update are to:

- Satisfy the regulatory requirement for a watershed sanitary survey.
- Identify and assess existing and potential future sources of contamination in the watersheds.
- Provide a general description of existing watershed control and management practices.
- Provide general recommendations for improving watershed management practices in order to protect the quality of the surface waters entering the reservoirs.

Conduct Of The Study

This update of the WSS for the Hodges Watershed was produced by the staff of the City of San Diego Water Department, Water Quality Laboratory. The survey covers all portions of the Hodges Watershed. It was conducted by reviewing existing aerial photographs, GIS data, reports, water quality data and other record documents, and was supplemented by field surveys and personal knowledge of Water Department staff.

Report Organization

The organization of this volume has changed since the 2001 WSS Update. The Executive Summary, formerly Chapter 1, has been removed from the individual volumes. The remaining chapters have been rearranged as follows:

Chapter 1:	Synopsis
Chapter 2:	Description of Watersheds/Source Water System and Review of 2001 Watershed Sanitary Survey Recommendations
Chapter 3:	Existing Conditions in the Watersheds
Chapter 4:	Water Quality Assessment
Chapter 5:	Conclusions and Recommendations

CHAPTER 2: DESCRIPTION OF WATERSHEDS/SOURCE WATER SYSTEM AND REVIEW OF 2001 WSS RECOMMENDATIONS

Introduction

The following is a summary of the findings of the 2001 Hodges Watershed Sanitary Survey Update. It covers Potential Contaminant sources, Water Quality, Watershed Management and Control Practices, and Conclusions and Recommendations for management of the watershed.

Potential Contaminant Sources

Recreation -

Potential sources of contamination from recreational use include soil erosion from hiking, off-trail biking and horseback riding; discarded trash from picnicking; excretions of horses and personal pets; and gasoline spillage from fishing boats and other personal craft. Incidental personal contact from sail boarding occurs; however, microorganism contamination from such contact is minimal.

Runoff -

Microorganisms correlated to seasonal rainfall runoff occur in the Hodges Reservoir. The total coliform count was consistently monitored from 1995 to 2000.

Significant Events -

There have been seven small to semi-large brushfires since 1996, one of which was considered a significant threat to water quality. Consequences of burning include soil erosion, stream sediment, ash and debris, and chemical fire retardants here have been no significant earthquakes from 1996 to 2000.

Agriculture -

Most agriculture consists of extensive activity. There is also intensive farming and a number of vineyards and orchards along the Santa Ysabel Creek. Orchards and intensive plots rely more heavily upon fertilizers and pesticides. Contamination such as sediment, nutrients, pesticides, and bacteria typically is found in runoff from agricultural areas.

Animal Grazing -

Animal grazing is permitted on Federal lands within the Cleveland National Forest. Grazing also occurs on private lands. Loss of vegetation from grazing may increase soil erosion and sedimentation of streams and rivers.

Concentrated Animal Facilities -

There are fifteen poultry farms and five dairy farms within the Hodges Watershed. Wastewater from dairy farms is discharged into retention ponds. Contaminated runoff from poultry farms is possible during rainy periods.

Wastewater Facilities & Reclaimed Water -

The San Pasqual Aquatic Reclamation Facility, Santa Maria Wastewater Reclamation Plant, and the San Pasqual Wild Animal Park Wastewater Treatment Plant operate within the Hodges Watershed. Plant effluent is discharged to spray fields or used in highway landscape irrigation. Effluent from the Wild Animal Park is used inside the park for landscape irrigation and stock watering. Reclaimed water from the San Pasqual and Santa Maria facilities is delivered to various areas for landscape and golf course irrigation.

Septic Systems and Sewer Overflows -

The majority of septic systems occur in the areas of Ramona and South Escondido. Residences are served by a mixture of sewer and septic tank facilities. Problems with septic systems occur mostly in low-lying areas, where the water table is higher and ground percolation is not as good.

There were 47 reported sewer spills, one of which posed a significant source of contamination for the Hodges Reservoir. However, since Hodges Reservoir is not connected to the City of San Diego's potable source water, it did not impact the City's ability to comply with surface water treatment regulations.

Mines -

There are nineteen mines located throughout the Hodges Watershed. There have not been any recorded incidents at the mine sites.

Hazardous Materials -

Solid and liquid hazardous wastes are collected in storage areas and hauled away by licensed haulers. There is also capacity for storing 2,600,390 gallons of hazardous liquid, most of which is automotive and tractor fuel. The Ramona area also contains stored aviation fuel.

Water Quality

Monitoring -

Samples were taken from the surface and from three sample points within the watershed. Data was provided by the City of San Diego Water Quality Laboratory. The source water was analyzed for organic and inorganic constituents, microorganisms, and general physical characteristics. Results were compared to the MCL and/or SMCL standards for drinking water.

Raw Water Quality -

Results of surface water samples at times exceeded limits for turbidity, pH, color, iron, manganese, and MTBE. Microbiological studies indicated the presence of microorganisms.

Treated Water Quality -

Hodges Reservoir is not currently part of the City of San Diego potable water system. It may, in future, serve as a secondary supply, with flow directed into the Miramar Reservoir.

Watershed Management and Control Practices

Much of the land is owned, either by the Cleveland National Forest or private parties, or is unincorporated County land. The City of San Diego monitors the watershed at Hodges Reservoir by limiting access to the reservoir, patrolling and observation, and water quality monitoring. Other federal, state, and local agencies also exercise control over land use and activities within the watershed.

Conclusions

Potential Contaminant Sources -

Potential contaminant sources include soil erosion, fires, agriculture, animal husbandry, urban runoff, accidental wastewater discharge, unauthorized waste disposal, and recreational use.

Watershed Management -

No formal watershed management program exists. Land ownership patterns limit control measures in the watershed; therefore, the focus is on cooperation between agencies. However, the City of San Diego exercises a number of

management practices. On City-owned land, the City directly controls land use activity. On land not owned by the City, controls include monitoring land use, permits and other regulatory actions, and coordinating with other agencies. A Watershed/ Water Quality Protection Committee was established by the City in September, 1994.

Water Quality Conditions -

Raw water monitoring at the El Capitan Reservoir has detected several water quality constituents at levels that may be of concern, including iron, manganese, seasonal elevations in microorganism counts, and a lack of data concerning *Cryptosporidium* and *Giardia*.

Recommendations & Review

The underlying theme of all recommendations is protection of the watershed and source water quality. The recommendations fall into four categories:

- Water Quality Monitoring,
- Interjurisdictional Coordination
- Public Education

Following each recommendation will be a review of the actions taken and/or current status of the recommendation.

Water Quality Monitoring –

Recommendations

1) Continue to develop and expand the long-term monitoring program for the watershed to establish baseline conditions, identify trends in degradation, isolate sources of contamination, and determine effects of management practices.
2) Augment the existing City monitoring program with additional parameters.
3) Implement a program to determine the source of microbiological contaminants near suspected sources.
4) Find and test alternative methods to detect and predict algal blooms.

Review

1) The City has instituted a program to measure flow, solids, pathogens and nutrients on a monthly basis; and to measure metals and a suite of organics on a quarterly basis; at five creeks that flow directly into Lake Hodges, and on several tributaries to the San Dieguito River upstream of Lake Hodges. The City has also collected bioassessment samples at three sites in the watershed.
2) Augment the existing City monitoring with additional constituents, such as dissolved organic carbon, total nitrogen, and total phosphorus.
3) As noted above, the City has begun monthly analysis for total nitrogen and total phosphorus at tributaries, and the reservoir is sampled quarterly for those parameters.
4) No change in status.

Interjurisdictional Coordination –

Recommendations

1) Establish lines of communication with neighboring agencies and overlapping jurisdictions by developing written City policies, developing workgroups, and setting up a City Control Review Committee.
2) Coordinate with Jurisdictional Agencies such as San Diego County and the cities of Escondido, Ramona, and Poway.

Review

1) The City contracted with Brown & Caldwell to produce a document providing guidelines for new development in our watersheds. This document has been completed and is being used by the San Diego Water Department in its review of projects. The City Water Department has established a watershed manager and a watershed project officer, and the City has established contacts with other agencies by participating on watershed plan committees.

The City is reviewing more projects than it has in the past; however, no formal clearinghouse has been established.

2) No change in status.

Watershed Management and Control –

Recommendations

1) Develop a land acquisition strategy to gain control of lands proximal to water.
2) Work with landowners and regulatory agencies to reduce the potential impact of cattle grazing and other agricultural practices.
3) Monitor creeks near wastewater storage ponds and facilities where there is a history of spills.

Review

1) The City has not adopted a strategy to acquire parcels, easements, or development rights. However the City has worked with other agencies such as the San Dieguito River Conservancy to purchase some privately owned lands that are proximate to water bodies for conservation purposes.
2) No change in status.
3) No change in status.

Public Education –

Recommendations

1) Develop and distribute educational materials to landowners, businesses, residents, and recreational users of the land about the importance of protecting the watershed. Establish a telephone number for reporting spills and illegal dumping.
2) Conduct public information sessions about the impact of various activities on water quality and supply.
3) Encourage a 'Friends of the Watershed' type of volunteer organization.
4) Launch a public awareness and signage campaign along transportation corridors.

Review

1) Anyone who purchases a lake permit is given a brochure that details the importance of keeping the reservoir clean because it is a source of our drinking water. In addition, posters are placed on kiosks at the reservoirs that ask people to recycle and help protect water quality.
2) No change in status
3) No change in status
4) Signage has been developed for placement on major corridors that let travelers know they are entering a watershed. The City is working with CalTrans on locations to place the signs.

CHAPTER 3: EXISTING CONDITIONS IN THE WATERSHEDS

Hodges Watershed

Water Sources -

The primary function of Hodges Reservoir is to store runoff water from its 243-square- mile watershed including water that spills over Sutherland Dam (Figure 5-3.1). The reservoir and associated facilities are owned and operated by the City of San Diego. Although the Hodges Watershed is a large watershed in the City system, it is not considered a major contributor to the City water supply system. All impounded water at Hodges Reservoir is sold as raw water to San Dieguito Water District (SDWD) and Santa Fe Irrigation District (SFID). The Badger Water Treatment Plant (BWTP), which is jointly owned by the SDWD and SFID, treats water transferred from Hodges Reservoir via the Hodges Flume to San Dieguito Reservoir. All water that flows over the dam flows directly to the Pacific Ocean.

The management of the water supply system typically attempts to regulate the reservoir levels to maximize the use of local water. Hodges reservoir is not considered a reliable source of emergency water supply due to high evaporative rates which result in low reservoir levels. There is also a relatively high-spill risk over Hodges Dam during storm events.

The City of San Diego currently has no means of delivering the water impounded in Hodges Reservoir to its service area. However, Hodges is currently involved in phase three of the San Diego Water Authority's Emergency Storage Project. During this phase (2004 – 2008), a pipeline and pump station are under construction between Hodges and Olivenhain Reservoir. Once completed, this connection will provide the ability to transfer water between Hodges Reservoir and the SDCWA Aqueduct System via Olivenhain Reservoir. Therefore, the City of San Diego will have the ability to utilize the storage capacity of Hodges Reservoir providing a greater volume of emergency water supply to the Miramar Water Treatment Plant.

Raw Water Reservoir -

The Hodges Dam is a multiple-arch, reinforced concrete structure with a 342-foot-long uncontrolled over pour spillway. The spillway crest consists of 202-foot-long Ogee weir section and 140-foot-long broad-crested weir section. The spillway design capacity is 67,440 cfs. The dam crest has a length of 729 feet (342 feet spillway and 387 feet non-overflow length) and stands roughly 130 feet above the streambed. The reservoir has a storage capacity of 30,251 acre-feet and a surface area of 1,234 acres at spillway crest at 315 feet MSL.

Raw Water Intake and Conveyance Facilities -

The Hodges Dam outlet consists of four downspouts on the face of the dam. The elevations from which water may be drafted from the reservoir are 275, 284, and 294 feet MSL. The downspouts are 20-inch diameter cast iron pipes with concrete embedded gate valves. The maximum discharge at Hodges Reservoir is 181 cfs (117 mgd). The dam is also equipped with four, 24-inch sluicing outlets in the central arches for draining of the reservoir. The outlets are located at an invert elevation of 206 feet. Water released from Hodges Reservoir flows by gravity through the 4.5 mile-long Hodges Flume to San Dieguito Reservoir. The concrete flume was constructed in 1917 and has a maximum capacity of 21 cfs (13.5 mgd). Supported by trestles through steep terrain, portions of the 72-year-old flume are highly susceptible to damage resulting from earthquake movement. The flume receives considerable sediment inflow and is subject to recurrent vandalism.

Treated Water Facilities -

The City of San Diego has no treatment facilities for water stored in Hodges Reservoir. However, at the completion of phase three of the Emergency Storage Project, the City of San Diego will have the option to treat the water from Hodges Reservoir at the Miramar Treatment Facility. The BWTP, jointly owned by the SDWD and SFID, treats water transferred from Hodges Reservoir through the Hodges Flume to the San Dieguito Reservoir.

Emergency Plans -

There are no written emergency plans addressing accidental or intentional disposal of contaminants to the raw water supply system for the City. However, the City does have the following two procedures which are understood policies, should an emergency occur relating to water quality:

- If a treatment plant cannot treat the water to an approved health standard level, due to upstream contaminants or treatment plant failures, the treatment plant shall be shut down. Treated water shall then be re-directed to the downed service area, through the distribution system from other treatment plants.

- If any emergency exists, the City has a chain of communication procedure for notification of City staff.

NATURAL SETTINGS

Slope

Slope is recognized as a critical factor in generating soil slips/landslides. In Southern California a direct relationship exists between frequency of soil slips and slope. USGS estimates that 70% of soil slips originate in slopes between 20° and 36°.These soil slips have the potential to increase sedimentation in streams and reservoirs.

Water falling on steeply-sloped land runs off with greater velocity and infiltrates less than water falling on flat land. This response leads to increased erosion and limits the soils natural ability to absorb contaminants. Information on slope was derived from a digital elevation model provided by San Diego Data Processing Corporation and United States Geological Survey (USGS).

Hodges Watershed -

No changes in slope have occurred since 2000 (Figure5-3.2, Table 5-3.1).

Table 5-3.1Hodges Watershed Slope		
Slope	**Acres**	**Percent**
0 - 15°	79473.27	50.17
16 - 25°	32710.01	20.65
26 - 50°	38534.68	24.33
> 50°	7697.98	4.86
Total	158415.94	100.00

Soils

Most of the soils within the watershed are susceptible to erosion. The erosion of these soils is mitigated through the anchoring affect of natural vegetation (see Vegetation). Impacts to the vegetation through fire, development or other means could cause increased erosion and impact surface water quality (see Fires, Land Use, Rainfall and Runoff).

Hodges Watershed -

No changes in soils have occurred since 2000. Except for exposed bedrock areas, soils in the Hodges Watershed are predominantly well-drained sandy loams (Figure 5-3.3).

Vegetation

Vegetation cover provides several ecological services pertinent to water quality. The root systems of plants anchor soil that could otherwise erode into streams and reservoirs (see Soils). Wetlands and other riparian plant communities act as natural filters, removing suspended sediments and contaminants. Sediments are trapped by densely growing wetland plants, and many contaminants are absorbed or chemically altered by the vegetation.

The description of the different plant communities found in the watershed (Sawer and Keeler-Wolf classification, 1995) and their respective response to fire is from the 2003 Southern California Fires Burned Area Emergency Stabilization and Rehabilitation Plan prepared by the Interagency Burned Area Emergency Response Team November, 2003.

The maps and corresponding table of vegetation communities (Figure 5-3.4, Table 5-3.3) have been updated using current SANDAG GIS data.

Oak Woodlands

Vegetation Types:

Oak woodlands typically occur in the foothills and transition into mixed conifer/oak woodlands at higher elevations. Each community type can vary from open savannas in broad valleys and rolling hills, to dense woodlands in canyons and along streams. Oak woodlands are dominated by live oak trees species that include Black Oak, Coast Live Oak, Engelmann Oak, and Canyon Live Oak.

Response to Fire:

Oak woodlands have evolved with fire. Dense woodlands typically experience low frequency stand destroying fires. Oak trees that experience some canopy fire often survive unless the ground fire temperature is extreme enough to kill the root system. The complex of species associated with dense oak woodlands will either re-sprout or germinate from seed. Frequent or hot fires can affect the seed bank and the root system of Oak Woodland species, resulting in degraded habitat that is susceptible to habitat conversion.

Eucalyptus Woodland

Vegetation Types:

Eucalyptus Woodland is a non-native closed canopy community. This community is typically a monotypic stand of Eucalyptus trees with a thick mulch of Eucalyptus tree leaves.

Response to Fire:

Eucalyptus stands can be fire retardant to low intensity fires. Low intensity fires will consume the leaf litter and can be carried into the canopy where leaves are singed or tops are burned. High intensity fires are typically stand destroying.

Forests

Vegetation Types:

Coniferous forests occur in the lower to upper montane zone in the Peninsula Ranges. The lower montane forests typically include the Southern Interior Cypress Forest which is intermixed with oak woodlands and chaparral. Upper montane forests include Coulter Pine Forest, Jeffery Pine Forest, and mixed Sierran Forest. They range from pure stands of a single species, to mixed conifer forests intermixed with oak woodlands and chaparral.

Response to Fire:

Montane forests are typically surrounded by chaparral or adjacent to forests subject to fire, and are therefore susceptible to fire. When fires occur more frequently than twenty-five years, Coulter pine habitat conversion to chaparral may result. Jeffery Pine Forests and Mixed Coniferous Forests historically experience periodic low-to-moderate intensity fires in the under story. Fuel buildup due to fire suppression can increase the risk of stand replacing crown fires.

Chaparral

Vegetation Types:

Chaparral occurs throughout the coastal lowlands, foothills, and montane region. This community typically forms a dense, almost impenetrable shrub community with no herbaceous layer. Chaparral is a highly variable plant community that includes; Chamise Chaparral, Coastal Sage-Chaparral Scrub, Mixed Chaparral, Montane Chaparral, Semi-desert Chaparral, and Scrub Oak Chaparral.

Response to Fire:

Chaparral is a fire adapted community that stumps sprouts or germinates from seed after a low-to–moderate intensity burn. Large fires often result in homogenous stands of chaparral. Frequent fires and hot fires can burn the root system and surface seed bank, resulting in a loss of diversity and low-density vegetative communities. For a few years after a fire, annual forbes germinate and establish on site, until the woody shrubs mature.

Coastal Sage Scrub

Vegetation Types:

Locally, Coastal Sage Scrub consists of low, woody soft-shrubs and is classified as Diegan Coastal Sage Scrub (DCSS). DCSS is dominated by California sagebrush and/or flat-topped buckwheat and often intergrades with Chaparral communities.

Response to Fire:

DCSS species are fire adapted and quickly regenerate from seed after a fire. However, frequent fires in an area can reduce the seed bank for native shrub species and increase the presence of non-native grasses and forbs resulting in degraded habitat. Once this habitat conversion occurs, DCSS species typically do not re-colonize the area due to competition from dense populations of invasive grasses that increase the fire frequency. Areas with moderate to highly degraded DCSS may convert to non-native grasslands due to the 2003 fires.

Big Sagebrush Scrub

Vegetation Types:

Locally, big sagebrush is dominated by; flat-topped buckwheat, broom snakeweed, deerweed, sawtoothed goldenbrush, and includes a variety of DCSS species.

Response to Fire:

The fire ecology of Big Sagebrush Scrub in eastern San Diego County is not well documented. Many of the associates in this community occur in DCSS and are fire adapted. Frequent fire in the vegetative community will result in habitat conversion to non-native grasslands.

Grasslands

Vegetation Types:

Perennial Grasslands vary among Valley Needlegrass and Valley Sacaton grasslands. Valley Needle Grassland is dominated by the tussock forming purple needlegrass, with a variety of native forbs including colar lupin, rancher's fireweed, and adobe popcorn-flower; and the native bunchgrasses, foothill needle grass, and coast range melic. The species composition can vary as it transitions into the foothills and montane zone. Valley Sacaton Grassland is dominated by sacton or salt grass. This community typically occurs in the areas with a high seasonal water table and is often associated with Alkali Seeps and Alkali Meadows. Non-native grasslands are dominated by Red brome, Ripgut brome, and Softchess brome. Non native grasslands are often intergraded with open oak woodlands and disturbed DCSS communities.

Response to Fire:

Grassland communities in San Diego County have evolved with, and are typically maintained by fire. Fire in non-native grasslands maintains dominance by invasive grasses and prevents establishment by native shrub species.

Meadows

Vegetation Types:

Montane Meadows occur in the montane zone and are dense growth of sedges and perennial herbs that experience wet cold winters. Montane Meadows are typically interspersed with montane forests. Wildflower Field is an amorphous community of herbaceous plant species where dominance varies from site to site and year to year, depending on climatic factors. Wildflower Field is typically associated with grasslands and oak woodlands in the valleys and foothills.

Response to Fire:

Wet meadows typically do not burn since the moisture content in the plants and soils retard fire advance. During drought times and in dry meadows fire will quickly burn through these communities. Fall fires typically have little impact on local meadows since most plants are dry and have dispersed their seed.

Riparian

Vegetation Types:

Riparian communities vary depending on the aquatic system they are associated with and can have seral stages of community succession. Mulefat Scrub and Southern Willow Scrub are typically early seral stages for Southern Cottonwood-

Willow Riparian Forest, which develops into Southern Coast Live Oak Riparian Forest. In steep drainages, Mulefat Scrub and Southern Willow Scrub may be early stages for Southern Sycamore-Alder Riparian Forest or White Alder Riparian Forest.

Response to Fire:

Riparian communities often resist fire since riparian species do not experience drought. During drought, riparian species become more susceptible to fire. Stand destroying fires can assimilate flooding events in that they set communities back to early seral stages. Stump sprouting species can reestablish in the early successional communities. Most mature trees that experience high intensity fires will die.

Wetlands

Vegetation Types:

Wetland communities are highly variable. Riparian and Wet Meadows are communities that can establish in areas with sufficient hydrology to be considered wetlands. In addition, emergent wetlands occur along seeps and as emergent wetlands in shallow water. These wetlands include Alkali Seep, Freshwater Seep, and Freshwater Marsh.

Response to Fire:

Historically, fire impacts to wetlands in San Diego County are not documented. Wetlands typically do not experience fire. Many wetland species are rhizomous and will likely survive fires. Woody species in scrub and forested wetlands may recover from fire by epicormic sprouting from stems or basal sprouting from roots.

Hodges Watershed:

Several vegetation communities exist within the Hodges Watershed. The most common native communities include scrub and chaparral, oak woodlands, and grasslands (Figure 5-3.4, Table 5-3.3). In many areas, native vegetation has been altered due to agriculture and urban development. These areas possess the potential to negatively impact water quality (see Land Use, Rainfall and Runoff).

Riparian and wetland vegetation communities occur around Hodges Reservoir and within canyons and drainages. These communities include Willow Scrub, Mulefat Scrub, Wet Montane Meadow, a variety of riparian forest types, Lakeshore Fringe, emergent wetland, Freshwater Marsh, Freshwater Seep, and Vernal Pools. In addition, disturbed wetlands occur just east of Hodges Reservoir and in a few scattered locations along streams. Tamarisk Scrub is a non-native community that has invaded some riparian areas within the watershed.

Table 5-3.3 Vegetation in the Hodges Watershed

Vegetation Type	**Acres**	**% of Watershed**
Wetlands	268	0
Forest	128	0
Grasslands, Vernal Pools, Meadows, other Herb Communities	14786	9
Non-Native Vegetation, Developed or Un-vegetated Habitat	44022	28
Riparian	4086	3
Scrub and Chaparral	73890	47
Woodland	21237	13
Total	158417	100.0

Rainfall and Runoff

The climate of San Diego County is classified as a Mediterranean dry summer type where 90% of the annual rainfall occurs between the months of November and April. Annual precipitation varies from 9 inches at the coast to 25 inches near the Mountains. Storm water runoff occurs when water from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, streets and parking lots prevent the runoff from naturally soaking into the ground. Storm water runoff can collect debris, sediment, nutrients, bacteria, pathogens, chemicals and deposit them directly into a lake, stream, river, wetland, or coastal water.

Rainfall and Runoff information in this section was supplied by the City of San Diego Water Department, Hydrography Section. Rainfall data is collected at each reservoir by a weather station. Runoff data is estimated monthly by measuring the following: amount of rainfall, rain amount on surface of lake, other inputs, evaporation, draft, leaks, and change in lake level.

Hodges Watershed:

Table 5-3.4 shows annual rainfall and runoff at Hodges Reservoir. Rainfall totals for years 2001-2003 were average or below average. The winter of 2004-2005 was the third wettest on record.

Table 5-3.4 Rainfall and Estimated Runoff for Hodges Reservoir			
Reservoir	**Year**	**Rainfall (in.)**	**Runoff Entering Reservoirs (M.G.)**
Hodges	2001	14.94	2232.51
	2002	8.5	260.84
	2003	13.15	1157.16
	2004	15.74	1269.86
	2005	19.54	31061.19

Fires

The California Department of Forestry (CDF) addresses all large brush fires within the watershed. The local fire districts handle structural fires only. CDF has an extensive fire prevention plan which includes three fire safe guidelines: residential, railway, and electrical power lines. CDF also provides an evaluation of burned sites and a re-growth plan to prevent erosion immediately following a fire.

Fire can indiscriminately devastate certain vegetation and wildlife communities, but is very important to the sage scrub and chaparral communities. Many taxa of coastal sage scrub plants are adapted to fire by stump sprouting or high seed production (Skinner et al., 1994). Similarly, many chaparral plants are adapted to frequent fires either through resprouting or seed carry-over (see Vegetation). While these communities are adapted to fire and usually recover in three to five years following such an event, the soils are subject to increased erosion immediately following a burn (see Fires, Soils).

Sediment from the burned areas can impact streams and the aquatic organisms within those streams, ultimately feeding into reservoirs where sediment loads may affect treatment procedures. Control of large fires is important from both a preservation perspective as well as a watershed management perspective.

The fire and water districts in the watershed do not measure the water quality impacts of the runoff from burned areas (Calhoun, Justice, Bratton, 1995). In most cases the County Office of Emergency Response or the local Fire Department contacts the RWQCB to visit the site after the fire is contained. The RWQCB participates in assessing the impact of the fire on the surface water quality, and will determine if monitoring is necessary.

Fire information in this report is supplied by the California Department of Forestry. The current data available from CDF is through December 31, 2004.

Hodges Watershed:

Since 2000, there have been three fires in the Hodges Watersheds (Figure 5-3.5*,* Table 5-3.5*).* The Paradise Fire started on October 26, 2003. This fire burned an area of 56,545 acres consisting of; chaparral, riparian woodland, and grasslands. The fire destroyed 221 residential structures and 192 other outbuildings. The remaining three fires were considered insignificant because of their small size and distance from the reservoir.

Table 5-3.5 Hodges Watershed Fires		
Name	Alarm Date	Acres Burned
Camino	8/6/2004	101
Cedar	10/25/2003	371
Brandy	9/6/2004	8
Paradise	10/26/2003	27,165

SUMMARY OF POTENTIAL CONTAMINANT SOURCES

Land Use -
The section on land use includes; land ownership, existing land use, agriculture, grazing, population density and mines.

Land Ownership

The land ownership information discussed in this section is primarily derived from SanGIS data. SanGIS maintains a database of land ownership information, by parcel, for San Diego County.

Hodges Watershed:

Approximately 64% of Hodges Watershed is privately owned; while 34% is in public ownership (Figure 5-3.6, Table 5-3.6) The City of San Diego owns 18,267 acres, or 10.2% of the watershed.

Table 5-3.6 Land Ownership in Hodges Watershed		
Ownership Category	**Area (acres)**	**% of Watershed**
Indian Reservation	2628	1.7
Publicly Owned		
Local	27453	17.3
State	2336	1.5
Federal	23575	14.9
Subtotal Publicly owned	53364	33.7
Private	102425	64.7
Total	158417	100

Existing Land Use

The information discussed in this section is based on SanGIS data. It is important to note that some areas reported in the 1996-2000 Watershed Sanitary Survey (WSS) as vacant and undeveloped land use have been updated by SanGIS to reflect its correct land use type, parks and open space preserves (Figure 5-3.7, Table 5-3.7).

Hodges Watershed:

Land use in the Hodges Watershed has experienced little change since 2000. The majority of the Hodges Watershed is undeveloped with approximately 67% of its land use type fitting into the following categories: vacant and undeveloped (53.6%), parks and open space preserves (13.2%), and water (0.6%). Approximately 15% of the watershed is occupied by residential and other types of urban development. These areas include residential, commercial and industrial developments in Escondido, Ramona, Rancho Bernardo, Poway and other smaller communities (see Rainfall and Runoff). Agriculture accounts for approximately 19% of the land area in the Hodges Watershed.

Table 5-3.7 Existing Land Use in the Hodges Watershed		
Land Use Category	**Area (acres)**	**% of Watershed**
Agriculture	30003.69	18.94
Commercial Recreation	2143.26	1.35
Commercial	515.85	0.33
Industrial	204.82	0.13
Junkyard, Dump, Landfill	66.00	0.04
Parks	20853.31	13.16
Schools, Hospitals, Public & Private Institutions	628.39	0.40
Group Quarters Residential	62.57	0.04
Mobile Home Park	190.45	0.12
Multi Family Residential	611.00	0.39
Single Family Residential	8119.51	5.13
Spaced Rural Residential	14376.66	9.08
Under Construction	15.42	0.01
Transportation, Communications & Utilities	4471.56	2.82
Water	1015.10	0.64
Subtotal	83277.59	52.57
Vacant and Undeveloped	75138.60	47.43
Total	158416.19	100.00

Agriculture

Agricultural practices can be a significant source of non-point source contaminants. Contaminants that are often found in typical agricultural surface runoff include sediment, nutrients, pesticides and bacteria. Increases in salinity may also pose a significant water quality problem in the future. The United States Environmental Protection Agency (USEPA) has estimated that about 75% of the sediment, 52% of the nitrogen loading, and 70% of the phosphorus loading that enters waterways of the 48 contiguous states originates in agricultural settings. Most contaminants are transported to the water supply through either surface runoff or irrigation return flows. Agricultural practices consist of field crops, orchards and vineyards, and intensive agriculture. Home gardens and hobby farms are not included in this report.

Field crops include; grain, alfalfa and sod. Due to the minimal use of pesticides and other chemicals, this agricultural practice is considered to have the lowest potential of impacting water quality.

Orchards and Vineyards include; apples, avocados, citrus, grapes and other non-evergreen fruit, while intensive farm plots include; row crops such as herbs, vegetables, poultry ranches, and dairy farms. Due to their reliance on pesticides and other chemicals, these practices are considered to have a greater potential of impacting water quality.

Poultry ranches are regulated by the San Diego County Department of Environmental Health for fly breeding and facilities are inspected annually. Poultry Farms do not discharge a significant amount of wastewater, but impact to water quality is possible during periods of rain when runoff could carry manure into nearby drainages. Manure management methods include frequent cleaning, drying and coning. Manure is generally spread on the ground to dry, pushed into windrows and then removed from the ranch.

Dairy farms are permitted by the Regional Water Quality Control Board (RWQCB) and facilities are inspected quarterly. The RWQCB issues orders specific to individual dairies. These orders contain facility designs, operation specifications and discharge specifications, along with other guidelines for complying with the Watershed Basin Plan. Dairy farms are then required to submit quarterly reports to the RWQCB that describe herd size, manure disposal, groundwater monitoring results including nitrates and dissolved solids. Milk cows, corrals and barns are generally washed daily. Dairies typically have retention ponds for wastewater discharge which during periods of rain could overflow and impact the water quality of nearby streams.

Hodges Watershed:

The information discussed in this section is based on SanGIS data and two layers created by RECON Environmental Consultants using information from the San Diego County Department of Environmental Health and RWQCB. Since 2000, Hodges Watershed has seen a slight decrease in the total acres of land used for agriculture, 31,591 acres to 31,135 acres (Figure 5-3.7, Table 5-3.8).

Table 5-3.8 Agriculture in the Hodges Watershed

Type of Agriculture	Acres	% of Watershed
Orchard and Vineyards	7213	4%
Intensive	3199	2%
Field Crops	20723	13%
Total	**31135**	**19%**

Thirteen poultry ranches exist in the Hodges Watershed (Figure 5-3.1, Table 5-3.9), which is a decrease since 2000.

Table 5-3.9 Hodges Watershed Poultry Ranches

Facility Name	Address	Maximum Number	Manure Management	Product
Fluegge Jr. Ranch	24120 CROWN HILL LN	25000	frequent cleanout	eggs
Hidden Villa Ranch	2900 HARMONY GROVE	40000	frequent cleanout	eggs
Pine Hill Ranch	25818 HIGHWAY 78	1100000	frequent cleanout	eggs
Cebe Farms - Lilac Road	P O BOX 1404	98000	floor litter	chicks
Dowle's Ranch	18409 RANGELAND RD	80000	floor litter	meat bird
Armstrong Egg Farms – Ramona #2	29550 COLEGRADE RD	100000	drying & coning	eggs
Cebe Farms – Ash/Oak Street	P O BOX 649	10000	floor litter	chicks
RAMONA EGG RANCH	941 OLD JULIAN HIGHWAY	100000	drying & coning	eggs
Swiss Mountainview Egg Ranch	249 STEFFY LN	42000	drying & coning	eggs
Armstrong Egg Farms – Ramona #3	P O BOX 1129	160000	frequent cleanout	eggs
RAMONA RANCH	1941 DYE RD	45000	floor litter	chicks
Armstrong Egg Farms – Ramona #4	P O BOX 742	110000	frequent cleanout	eggs
Ramona Duck Farm	1415 Pamo RD	N/A	N/A	ducks

Since 2000, the number of dairy farms in the Hodges Watershed has decreased by one. Currently, four dairies exist within the Hodges, with the John Van Tol Dairy straddling the Hodges and San Vicente Watershed Figure 5-3.1, Table 5-3.10).

Table 5-3.10 Hodges Watershed Dairy Farms

Facility Name	City	Acres in Watershed	# of Milk Cows	Herd Size
Bert Verger Dairy	Escondido	198	480	1070
Frank J. Konyn	Escondido	300	670	1205
John Van Tol Dairy	Ramona	NA	NA	NA
Valley View Dairy	Ramona	50	534	765

Grazing

The animal grazing data presented derives from the United States Forest Service (USFS). Although grazing on private land occurs in this watershed, no spatial data was available for such areas, and grazing on these lands is not included in this report. The USFS allows an average density of one animal per 160 acres; therefore, the risk of water contamination from manure is low. However, loss of vegetation cover associated with grazing may increase soil erosion and sedimentation of streams and reservoirs (see Vegetation, Rainfall and Runoff).

Hodges Watershed:

A total of 5,175 acres of USFS land are permitted for grazing in the Hodges Watershed (Figure 5-3.1, Table 5-3.11), which is a decrease of 7,065 acres since 2000. This is due to the closure of Quail Springs and Pamo rangelands. The

Mesa Grande Range crosses a substation portion of Temescal Creek. If permit status is activated, grazing in this area has a potential of adversely affect water quality.

Table 5-3.11 Grazing in the Hodges Watershed				
Range Name	**Number of Head**	**Acres in Watershed**	**Ownership**	**Permit Status**
Lusardi	8	383	USFS	Nonuse-Since Paradise Fire
Mesa Grande	65	4009	USFS	Nonuse-Since Paradise Fire
Gem Hill	1	311	USFS	Nonuse-Since Paradise Fire
Black Mountain	5	454	USFS	Active

Population Density

Population density is a good indicator of the level of urbanization within an area. Land areas with small population densities are usually rural areas with natural landscapes that trap rainwater and allow it to filter slowly into the ground (see Rainfall and Runoff). In contrast, large population densities are associated with urbanized areas. These areas contain impervious surfaces that prevent rain from infiltrating into the ground which increases the amount and velocity of runoff. Urbanization increases the variety and amount of pollutants carried into streams, rivers, and lakes. These pollutants can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational area unsafe and unpleasant. The population data presented was derived form SANDAG's 2000 Census.

Hodges Watershed:

The estimated 2005 population of the watershed shows that 199,786 people reside in the Hodges Watershed (Figure 5-3.8, Table 5-3.12). This reflects an increase in the total population by 44%, in the past five years. The major population centers occurred in the southern and western portions of the watershed in the communities of Rancho Bernardo, Escondido, Del Dios, Poway, and Ramona.

Table 5-3.12 The Hodges Watershed Population

Area	Population	Density (persons per Acre)
City of San Diego	37,548	6.8
City of Escondido	24,783	6.6
City of Poway	13,921	3.9
City of Ramona	15,691	3.4
SD Country Estates	4,548	8.8
County of San Diego	23,295	1.2
Total	119,786	.75

Mines

The mine data presented was obtained from USGS and SWRCB. The SWRCB and the RWQCB are given authority over mines. The most common environmental hazard is: heavy metals associated with acid-rock drainage; methyl mercury from mercury-contaminated sediments; arsenic; asbestos and chromium.

Hodges Watershed:

In the 1996-2000 Watershed Sanitary Survey there were 18 mines listed by the State Water Resources Control Board (SWRCB). Currently, there is one active mine within the Hodges Watershed, the Stoddard Borrow Pit which quarries Dimension Stone (Figure 5-3.1).

Hazardous Material / Waste

The data presented in this section was obtained from the San Diego County Health Department, RWQCB, and the Solid Waste Assessment Test Program. The hazardous materials were put into three categories: Liquid Hazardous Waste, Solid Hazardous Waste and Liquid Hazardous Storage (capacity). The majority of liquid waste is stored in 55 gallon drums and hauled away by licensed waste haulers. Automotive and Tractor fuels make up the majority of permitted liquid hazardous storage. These fuels are stored in underground fiberglass-reinforced plastic, cathodically protected steel, or steel clad with fiberglass-reinforced plastic. These tanks are installed with a leak interception and detection system.

The State Resources Control Board affected changes to the underground storage tank regulations on October 13, 2005. These changes can be found in Title 23, California Code of Regulations, Chapter 16.

Hodges Watershed:

Hazardous Materials/Waste amounts and locations for the Hodges Watershed are illustrated in Figure 5-3.1, Table 5-3.13. The area of Hodges Watershed is divided into four sub-areas: Escondido, Rancho Bernardo, San Pasqual and Ramona.

Table 5-3.13 Summary of Permitted Hazardous Material

Location	Liquid Waste (gal)*	Solid Waste (lbs)*	Liquid Storage (gal)*
Escondido	16,501	157,176	569,590
Rancho Bernardo	107,937	4,483,084	1,059,980
San Pasqual	5,477	4,630	73,760
Ramona	64,179	211,094	897,600
Total	**194,094**	**4,855,984**	**2,600,930**

*Figures are maximum capacities

Recreation

Hodges Watershed:

The primary purpose of Hodges Reservoir is for domestic water supply, while recreation is a secondary use of the reservoir. The reservoir is open to the public for boating and fishing, three days a week, February through October, water contact activities, two days a week, April through October, and to all other recreational activities seven days a week, year around. Recreational activities include; boating, fishing, windsurfing, jogging, biking, and picnicking (Table 5-3.14).

Table 5-3.14 Hodges Reservoir Number of Permits Sold					
Year	Fishing	Launch	Body Contact	Rentals	
				Motor	Row
2001	10240	2654	1143	NA	1423
2002	7192	657	335	NA	1271
2003	4052	749	0	NA	0
2004	4801	1110	0	NA	0
2005	Figures not reconciled				

The facilities consist of concession, launch, rental boats, trash receptacles, portable toilets, two floating restroom facilities, and a comfort station. These facilities are owned and operated by the City of San Diego. There are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels.

The potential sources of contamination associated with the recreational activities include; erosion, trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts. Title 22 contaminates are monitored quarterly and nutrients monthly (Figure 5-3.1). Microorganisms including Total Coliforms, E. coli, and Enterococcus are monitored monthly.

Wastewater / Reclaimed water

The Wastewater / Reclaimed water treatment facilities permitted by the RWQCB in the Hodges Watershed are identified in Table 5-3.15 and Figure 5-3.1. In 2002 The San Pasqual Aquatic Reclamation Facility (ARF) was taken out of operation.

Table 5-3.15 Wastewater / Reclaimed Water Facilities					
RCQCB Facility I.D.	**Facility Name**	**Address**	**Highest level of Treatment**	**Discharge To:**	**Land Disposal Order #**
9000000076	Santa Maria WWTP	260 Sawday Street	Tertiary	Recycled Water Use, Spray Field	2000-177
9000000109	San Pasqual Wild Animal Park STP	15500 San Pasqual Valley Road	Tertiary	Recycled Water Use	99-04
NA	Hanson Elementary School	1825 Hanson Lane	Un-disinfected Secondary	Subsurface Drip Disposal	R9-2004-00409
9000000336	San Pasqual Academy	17701 San Pasqual Valley Road	Un-disinfected Secondary	Percolation Ponds	94-004

Santa Maria Wastewater Treatment Plant (WWTP):
The Ramona Municipal Water District is the agency responsible for this facility. RWQCB Order No. 2000-177 establishes the discharge specifications for the Santa Maria WWTP (Table 5-3.16). The treatment system is comprised of; an equalization basin and pump station, aeration basins, secondary clarifiers, and an aerobic biosolids digester. The RWQCB requirements permit a 30-day average dry weather effluent flow of up to 1.00 mgd. The permit also specifies a maximum 30-day average flow of .35 mgd tertiary treated water and a twelve month total discharge of effluent to the Rangeland Road disposal fields not exceeding 873.6 acre feet per year.

The two spray fields are located approximately 2.5 miles northwest of the plant. One of the spray fields is owned by the RMWD and the other is leased. The District-owned and leased disposal fields are located directly west and east, respectively, of Rangeland Road. Two effluent storage reservoirs are located on the disposal field owned by the RMWD. The vegetation on the fields is mainly used for grazing cattle. Effluent for tertiary treatment is sent from the Santa Maria WWTP to the Mt Woodson Tertiary Treatment facility which is co-located with the disposal fields northwest of the plant. The tertiary treated water is used at the Mt Woodson Golf Course for irrigation.

Biosolids Disposal Practices:

Biosolids from the Santa Maria WRP are treated in an aerobic digester, and then dewatered by centrifuge or in drying beds at the plant site. The waste is routinely hauled to a landfill for final disposal.

Table 5-3.16 Santa Maria Wastewater Reclamation Plant Effluent Discharge Limitations, Order # 2000-177

Constituent	Unit	Daily Maximum[1]	30-day Average[2]	12-Month Average[3]
Biochemical Oxygen Demand (BOD_5 @ 20^0C)	mg/L	45	30	-
Total Suspended Solids	mg/L	45	30	-
pH	Within the limits of 6.0 to 9.0 at all times			
Total Dissolved Solids	mg/L	1000	-	800
Chloride	mg/L	250	-	200
Sulfate	mg/L	250	-	200
Manganese	mg/L	0.06	-	0.05
Iron	mg/L	0.4	-	0.3
Boron	mg/L	0.6	-	0.5
Fluoride	mg/L	1.2	-	1

1. The daily maximum effluent limitation shall apply to the results of a single composite or grab sample.
2. The 30 day average effluent limitation shall apply to the arithmetic mean of the results of all samples collected during any 30 day consecutive calendar day period.
3. The 12 month average effluent limitation shall apply to the arithmetic mean of the results of monthly averages of all samples collected during the previous 12 months.

San Pasqual Wild Animal Park Sewage Treatment Plant (STP):
The San Diego Zoological Society is the agency responsible for this facility. RWQCB Order No. 99-04 establishes the discharge specifications for the San Pasqual Wild Animal Park STP (Table 5-3.17). The treatment and disposal system is comprised of; a headwork's facility, a flow equalization basin, extended aeration and sedimentation basins, a chlorine contact tank, biosolids holding tank, and a 2.3 million gallon storage/percolation pond. The RWQCB requirements certify an average daily design flow of up to 0.150 mgd. The treated wastewater is blended with ground water to maintain an optimal operating level in the storage/percolation pond. The water is then used for irrigation within animal exhibits.

Table 5-3.17 San Pasqual Wild Animal Park STP Effluent Discharge Limitations, Order # 99-04

Constituent	Unit	Daily Maximum[1]	Monthly Average[2]
Biochemical Oxygen Demand (BOD_5 @ 20^0C)	mg/L	45	30
Total Suspended Solids	mg/L	45	30
pH	Within 6.0 to 9.0 at all times		
Total Dissolved Solids	mg/L	1000	-
Chloride	mg/L	400	-

1. The daily maximum effluent limitation shall apply to the results of a single composite or grab sample.
2. The monthly average limitation shall apply to the arithmetic mean of the results of all samples collected during any 30 day consecutive calendar day period.

Biosolids Disposal Practices:
Biosolids from the San Pasqual Wild Animal Park STP are stored at the plant site under controlled conditions. The waste is routinely hauled to a landfill for final disposal.

Hanson Elementary School:

The Ramona unified School District is the agency responsible for this facility. RWQCB Order No. R9-2004-0409 establishes the discharge specifications for the San Pasqual Wild Animal Park STP (Table 5-3.18). The treatment and disposal system is comprised of; 2,000 gallon grease interceptor, 12,000 gallon primary settling tank with four P80 Pirana denitrification units, two AX100 packed bed trickling filters, 5,000 gallon recirculation tank, 5,000-gallon dosing tank, and a rotating subsurface drip disposal system. The RWQCB requirements certify a maximum discharge of 3,645 gpd. The dispersal field is divided into four zones located at the southern end of the school.

Table 5-3.18 Ramona Unified School District, Hanson Elementary School Effluent Discharge Limitations, Order # R9-2004-0409

Constituent	Unit	Daily Maximum[1]	12-Month Average[2]
Total Dissolved Solids (TDS)	mg/L	1785	889
Nitrate (as NO_3)	mg/L	18	9
Boron	mg/L	1.3	0.67
Chloride	mg/L	714	356
Sulfate	mg/L	892	445
Manganese	mg/L	0.089	0.044
Fluoride	mg/L	1.78	0.89
Methylene Blue Active Substances (MBAS)	mg/L	0.89	0.44
Iron (Fe)	mg/L	0.54	0.27

1. The daily maximum effluent limitation shall apply to the results of a single composite or grab sample.
2. The 12 month average effluent limitation shall apply to the arithmetic mean of the results of all samples collected during any 12 consecutive calendar month period.

Biosolids Disposal Practices:

Biosolids from Hanson Elementary School are removed on an annual basis, or as needed depending on solids build-up, by a licensed hauler.

San Pasqual Academy:

The County of San Diego has recently taken over responsibility for this facility and the RWQCB is in the process of updating the Land Disposal Order.

Septic Systems

Hodges Watershed:

The primary goal in this section is to identify areas where septic systems may pose a threat to water quality. Septic systems treat and disperse relatively small volumes of wastewater from individual or small numbers of homes and commercial buildings. Poorly managed systems have been named as a concern by nearly every federal and state program that deals with water resource issues. San Diego County's Department of Environmental Health maintains records of septic tank permits at their San Marcos and El Cajon offices. Prior to 2002, no electronic database existed to query the location, type, etc. of these permits. There are an estimated 90,000-100,000 homes county-wide on septic systems.

Estimates of septic system density for the 1996-2000 WSS were calculated by using the 1990 census tract data to determine population density with in each watershed. Next, a data layer of sewered and un-sewered areas was created from the City data base and from SanGIS community plan data. The sewered areas layer was overlaid with population density to create a new data layer. This data layer was queried to pull out polygons that were un-sewered with a population density greater than zero. Graduated color was applied to the septic density field to enable visual assessment of high potential concentrations of septic tanks.

In 2002 the County of San Diego Department of Environmental Health initiated an electronic database to track septic system permits issued throughout the County. The database does not contain historical permits issued before 2002, so an exact number of permits in a given community cannot be determined. However, the database indicates where new permits are being issued and if these permits are for new construction, repair, fire rebuild, etc. In addition, the permit records the hydrologic sub area where the septic system is located.

A data layer of the hydrologic sub areas of San Diego County was obtained from SanGIS. Numbers of permits issued in each hydrologic sub area was determined from the Counties database. Graduated colors were applied to the hydrologic sub area within each watershed to enable visual assessment of high issuant of septic system permits (Figure 5-3.9).Table 5-3.19 lists the communities within the watershed along with the number and type of septic system permits issued since 2002.

Table 5-3.19 Number and Type of Septic System Permits in the Hodges Watershed

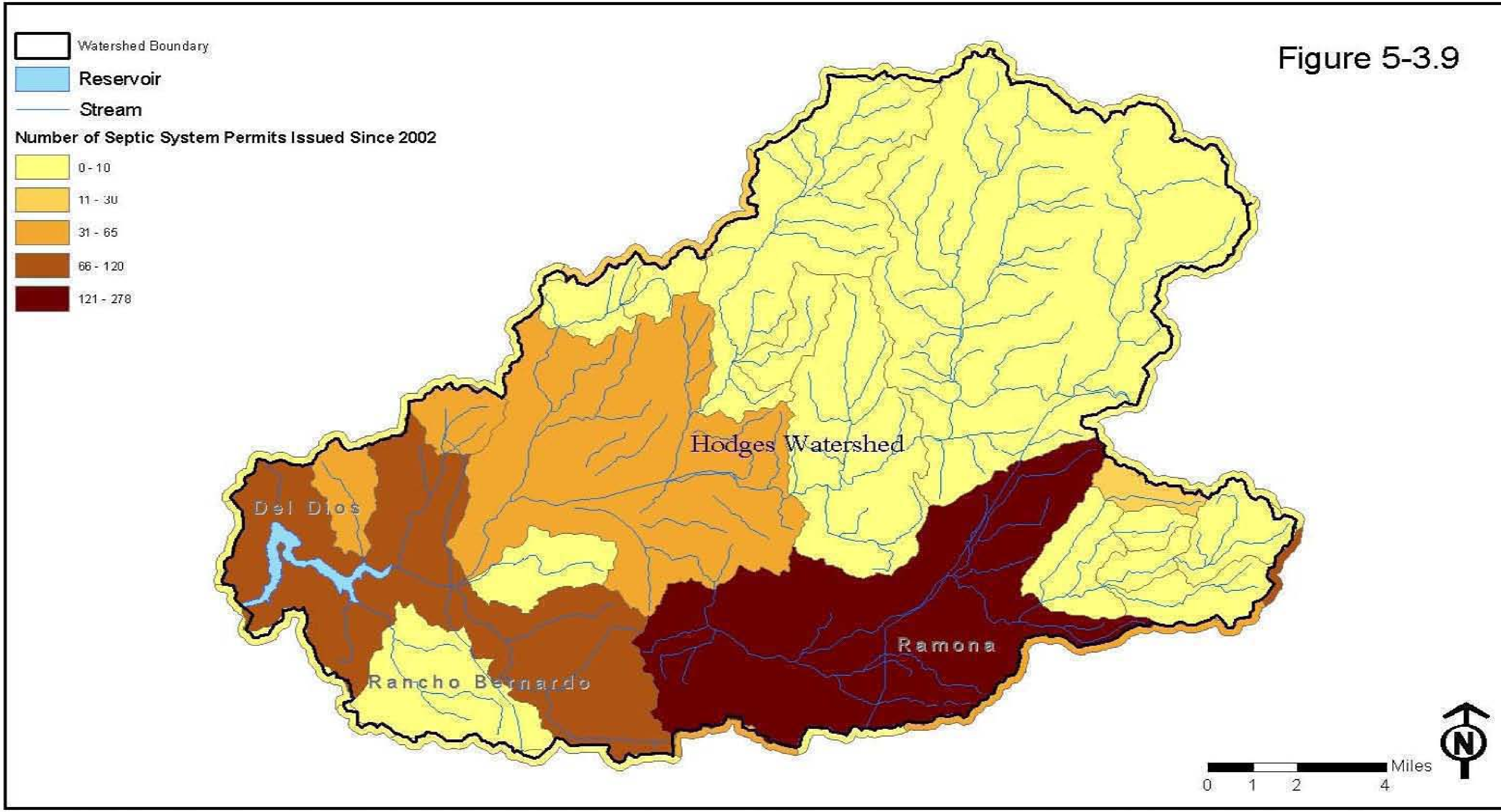
	Type of System			
Community	**New**	**Repair or Modified**	**Fire Rebuild**	**Other**
Escondido	104	130	0	12
Ramona	187	143	0	5
Del Dios	0	3	0	2

Sanitary Sewer Overflows

There were 37 sanitary sewer overflows in the Hodges Watershed reported to the Regional Water Quality Control Board (RWQCB) from 2001 through 2004 (Table 5-3.20). The current data available from the RWQCB is through June 30, 2004. Detailed information regarding sanitary sewer overflows is available at the Regional Water Quality Control Board website (www.swrcb.ca.gov/rwqcb9).

Table 5.3-20 Hodges Watershed Sanitary Sewer Overflows 2001 - 2004					
Year	RWCQB Tracking Number	Total Overflow Volume (Gallons)	Overflow Volume Released to Environment (Gallons)	Reach Surface Waters other than Storm Drain?	Receiving Waters
2001	001003	75	75	N	
2001	001004	25	0	N	
2001	001006	90	80	Y	Green Valley Creek
2001	001031	90	90	N	
2001	001036	20	0	N	
2001	001038	1500	1490	Y	Kit Carson/Dead Horse Creek
2001	001046	20	15	N	
2001	001048	710	360	Y	Pond at Kit Carson Park
2001	001224	200	20	Y	no information listed
2001	012002	450	400	N	
2001	012002	200	0	N	
2001	012004	450	120	N	
2001	012005	480	480	N	
2001	012014	50	0	N	
2001	012018	315	65	Y	Kit Carson Creek
2001	012019	300	0	N	
2001	012021	50	30	Y	Felicita Creek
2001	012022	5000	5000	Y	Felicita Creek
2001	162980	530	530	Y	"Canyon"
2001	186801	1575	1575	Y	Moon Song Creek
2001	201034	860	760	N	
2002	012001	25000	0	N	
2002	012023	750	650	Y	Felicita Creek
2002	023001	200	150	N	
2002	023002	300	100	N	
2002	023003	120	70	Y	Green Valley Creek
2002	023007	30	0	N	
2002	276811	15450	13950	Y	"Creek Bed"
2003	023004	630	630	N	
2003	023018	450	450	Y	Dead Horse Creek
2003	023019	750	750	Y	Dead Horse Creek
2003	034001	200	200	Y	Green Valley Creek
2003	034001	250	250	N	
2003	034002	500	500	Y	Green Valley Creek
2004	034002	3000	2750	Y	Santa Maria Creek
2004	034003	200	200	N	
2004	034005	500	400	Y	Green Valley Creek

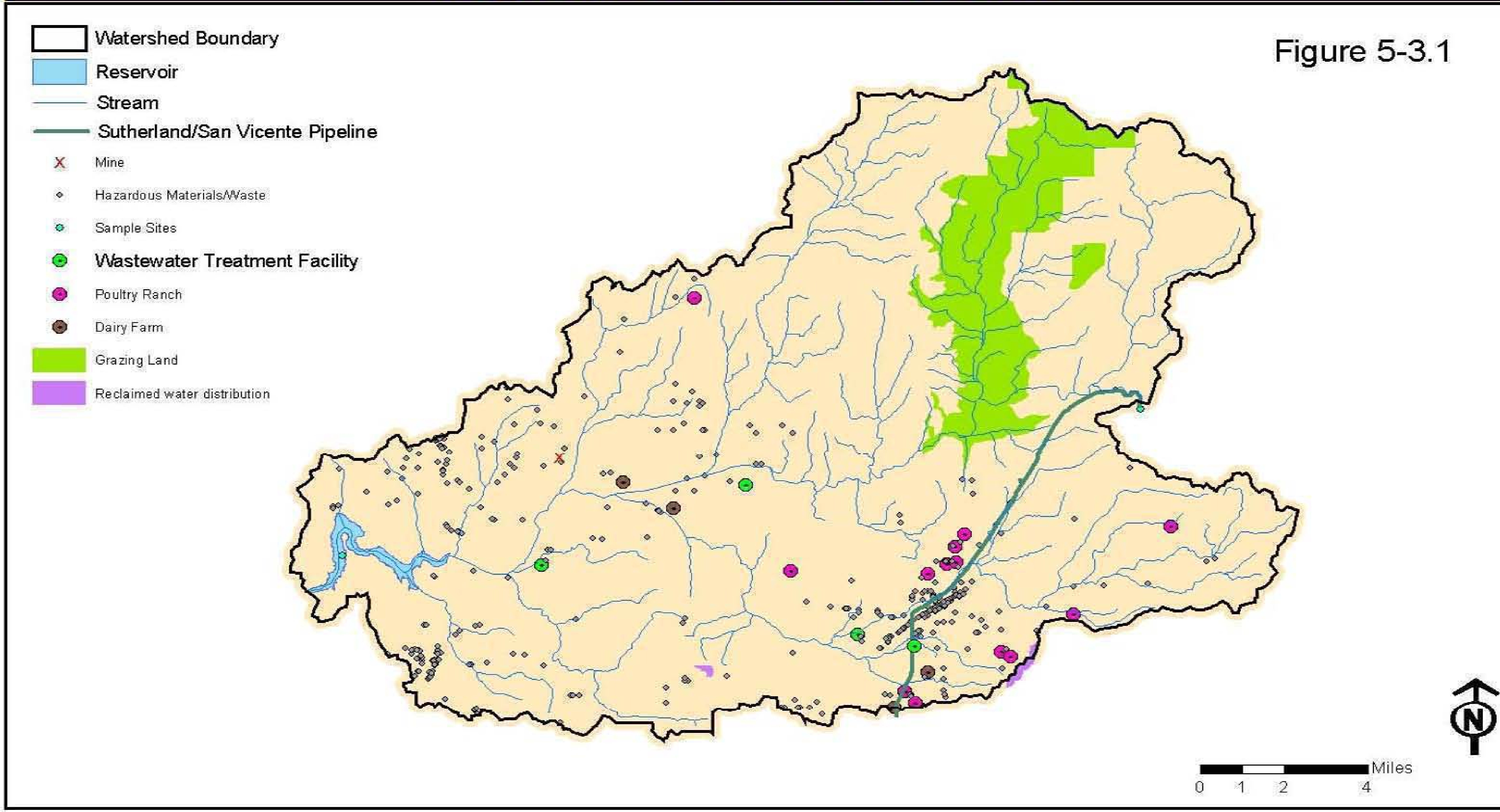
Septic System Permits Issued in the Hodges Watershed Since 2002



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Septic Systems\Hodges Watershed SS.mxd

Created By: Dan Daft
Date: 11/10/05

Hodges Watershed GENERAL SETTING



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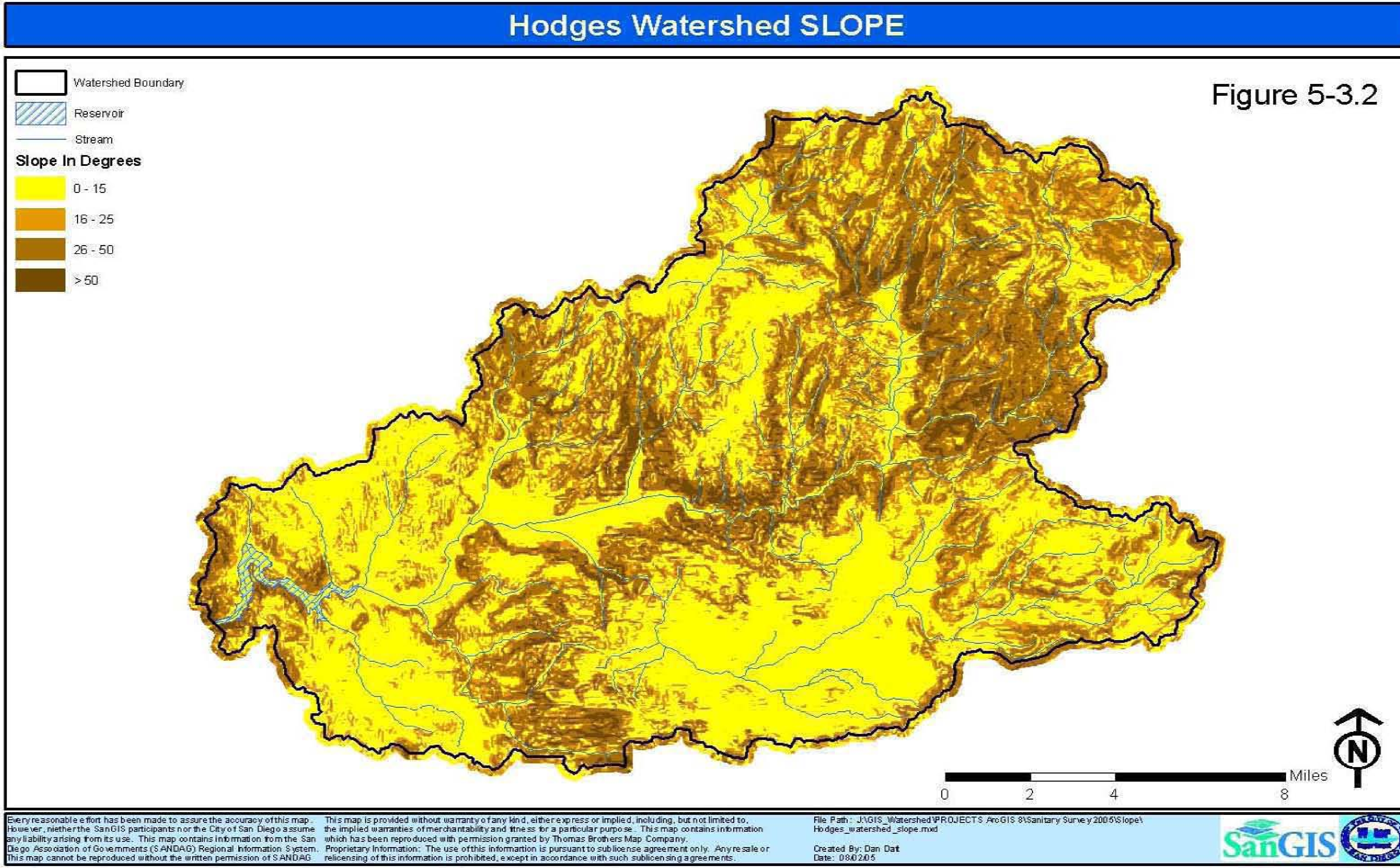
Created By: Dennis Brown

Date: 5 December 2005



Hodges Watershed SLOPE
Watershed Boundary
Reservoir
Stream
Slope In Degrees
0 - 15
16 - 25
26 - 50
> 50
Figure 5-3.2
Miles
0
2
4
8
N
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Date: 08.02.05
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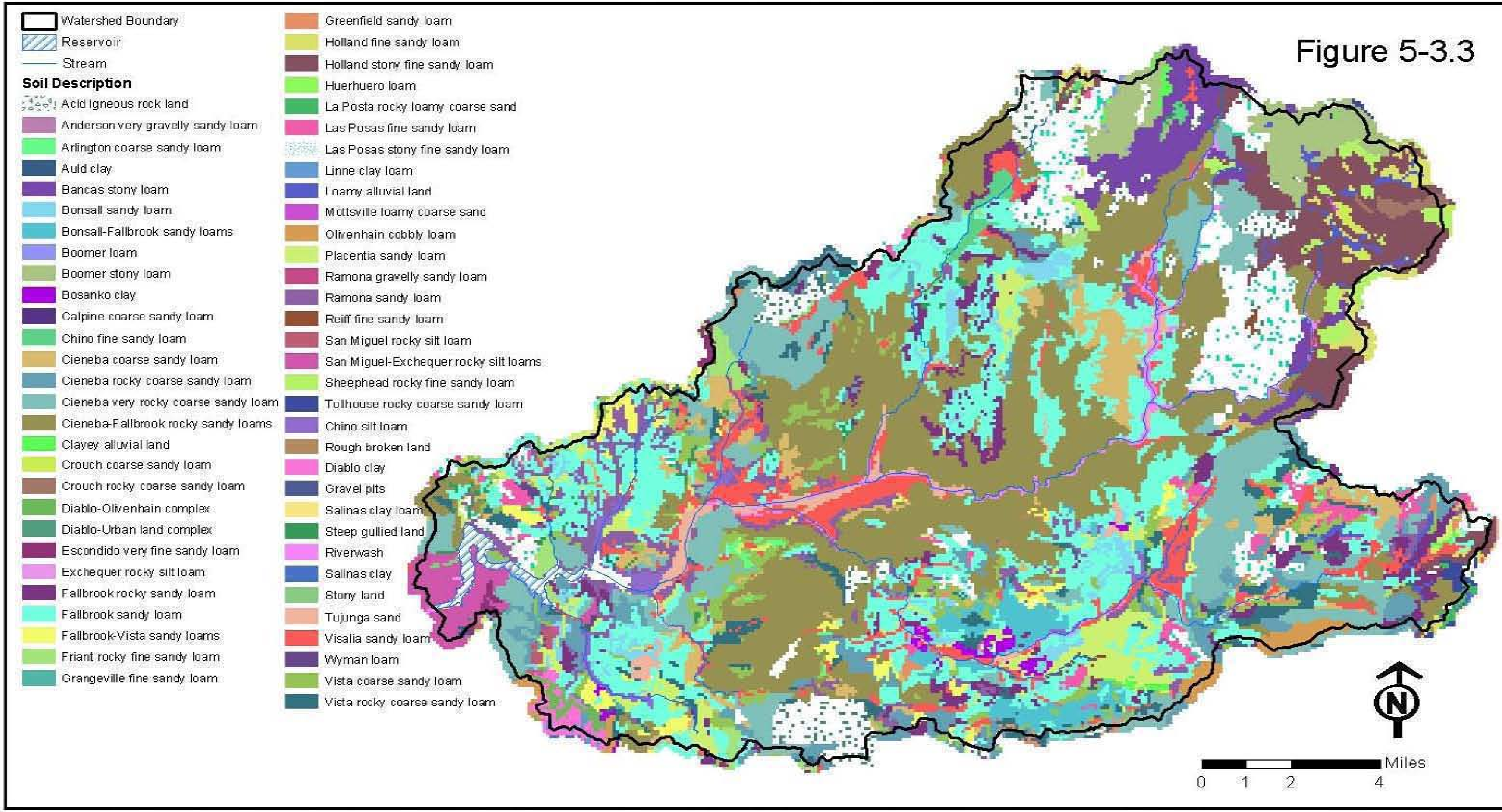
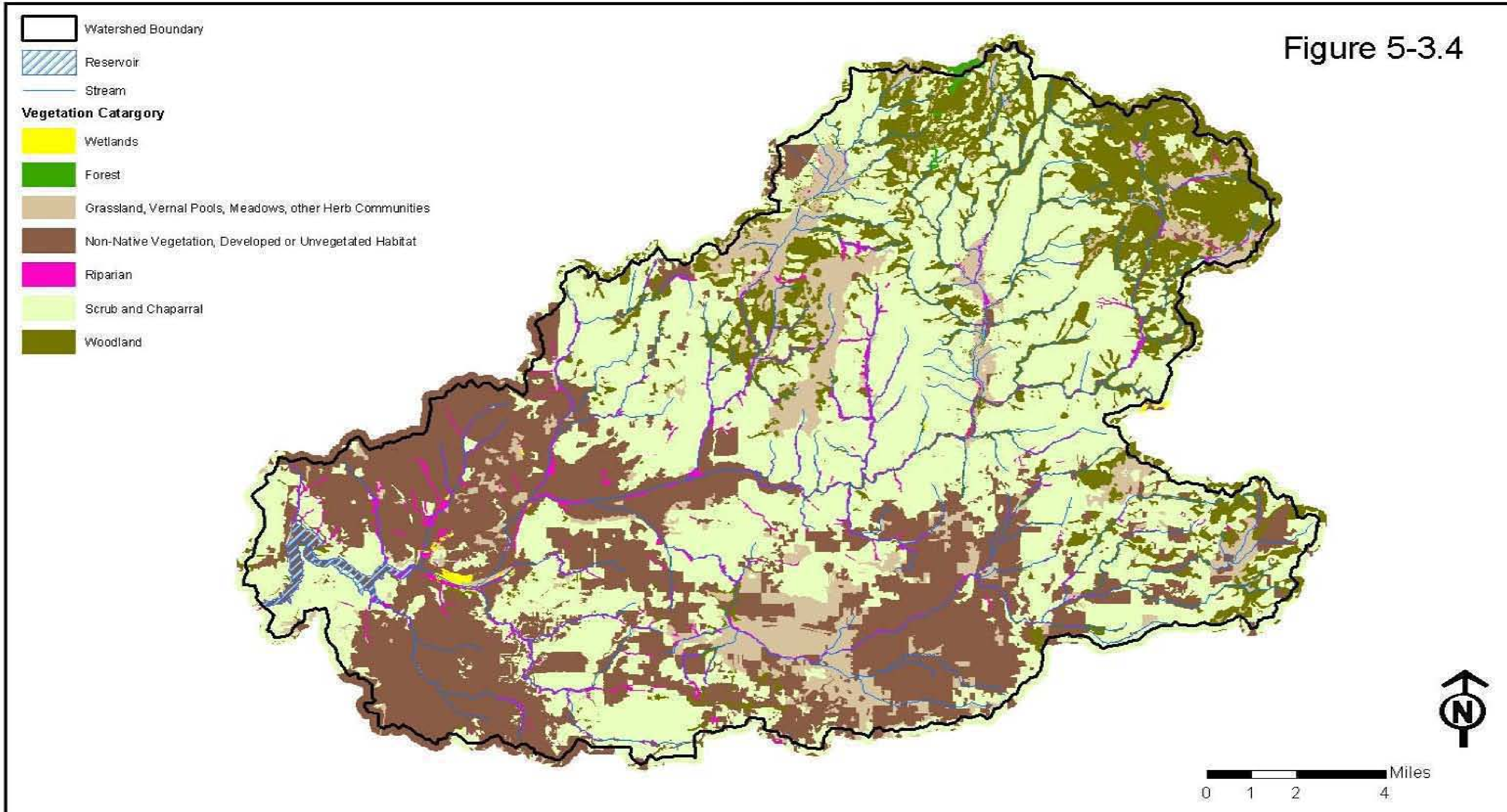
Hodges Watershed SOILS



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Soils\Hodges Soils.mxd

Created By: Dennis Brown
Date: 7 September 2005

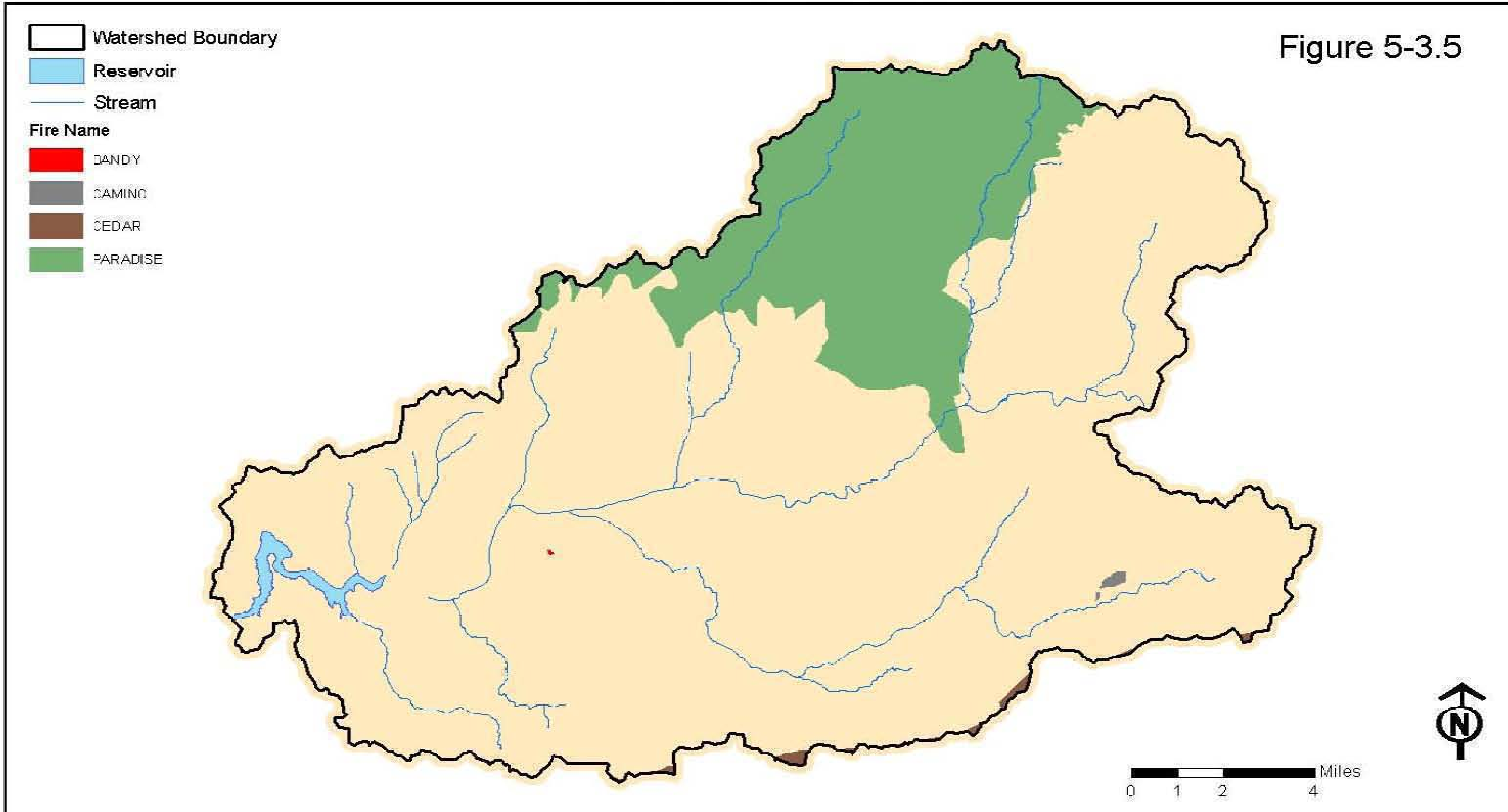
Hodges Watershed VEGETATION



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Vegetation\2005 Hodges Watershed Vegetation.mxd

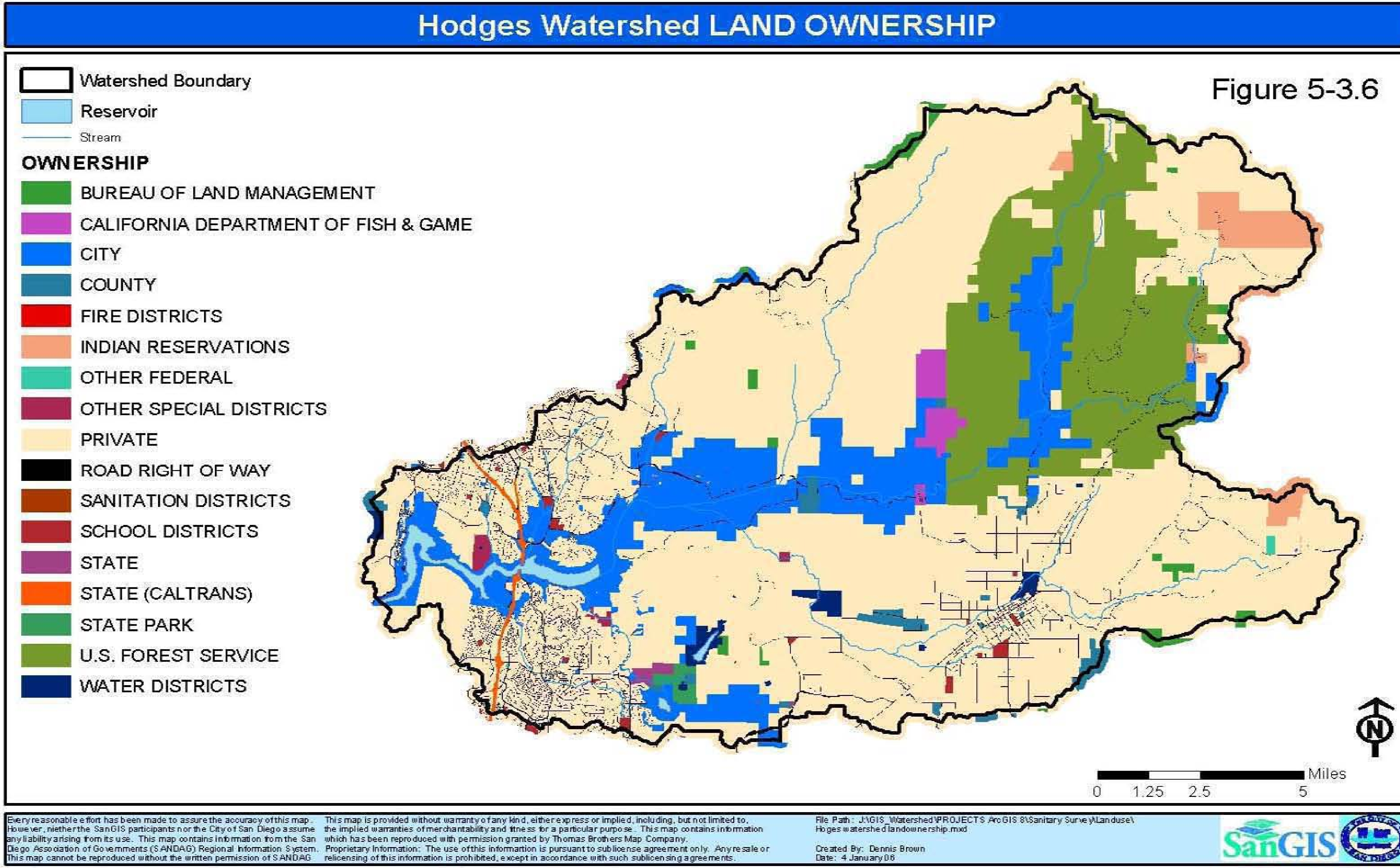
Created By: V.Chancer
Date: 08/12/05

Fire Perimeters for the Hodges Watershed



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary survey-2006\Fire\ Paradise Fire Perimeter for the Hodges Watershed.mxd

Created By: Dan Daft
Date: 11/28/05



Hodges Watershed LAND OWNERSHIP
Figure 5-3.6
Watershed Boundary
Reservoir
Stream
OWNERSHIP
BUREAU OF LAND MANAGEMENT
CALIFORNIA DEPARTMENT OF FISH & GAME
CITY
COUNTY
FIRE DISTRICTS
INDIAN RESERVATIONS
OTHER FEDERAL
OTHER SPECIAL DISTRICTS
PRIVATE
ROAD RIGHT OF WAY
SANITATION DISTRICTS
SCHOOL DISTRICTS
STATE
STATE (CALTRANS)
STATE PARK
U.S. FOREST SERVICE
WATER DISTRICTS
N
0 1.25 2.5 5 Miles
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File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey\Landuse\
Hoges watershed landownership.mxd
Created By: Dennis Brown
Date: 4 January 06
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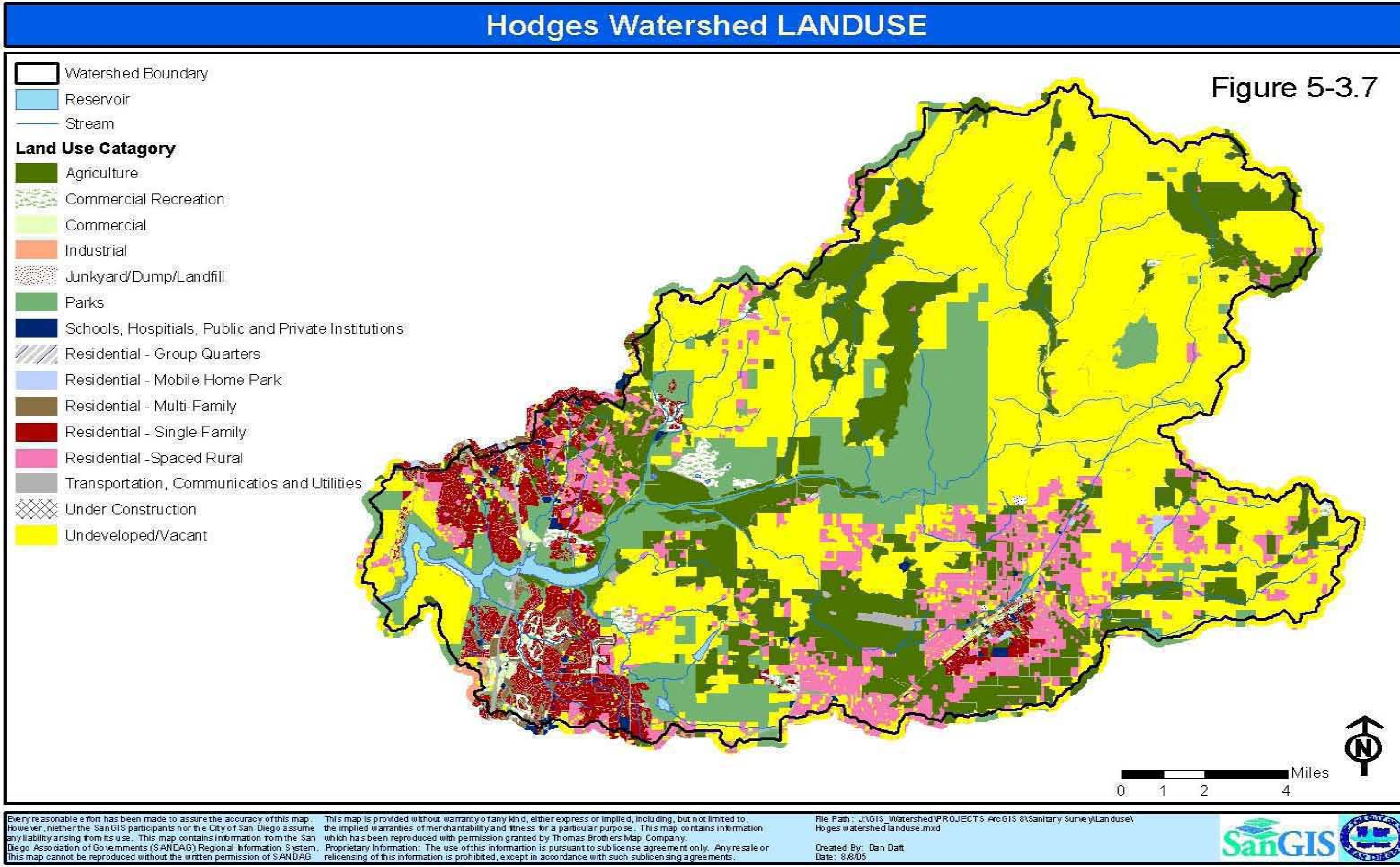
Hodges Watershed LANDUSE
Figure 5-3.7
Watershed Boundary
Reservoir
Stream
Land Use Catagory
Agriculture
Commercial Recreation
Commercial
Industrial
Junkyard/Dump/Landfill
Parks
Schools, Hospitials, Public and Private Institutions
Residential - Group Quarters
Residential - Mobile Home Park
Residential - Multi-Family
Residential - Single Family
Residential -Spaced Rural
Transportation, Communicatios and Utilities
Under Construction
Undeveloped/Vacant
Miles
0 1 2 4
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Created By: Dan Datt
Date: 8/8/05
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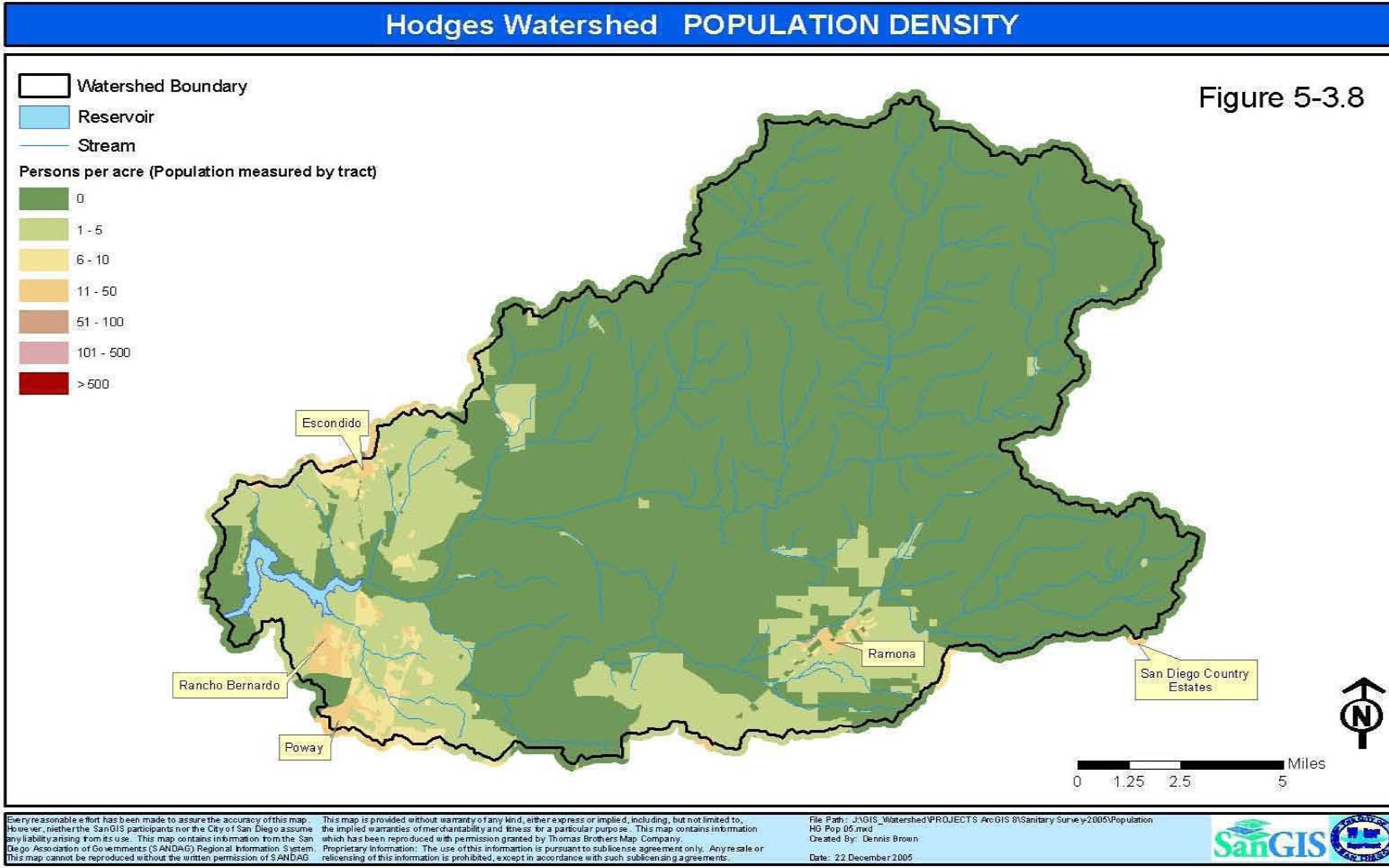
Hodges Watershed POPULATION DENSITY
Figure 5-3.8
Watershed Boundary
Reservoir
Stream
Persons per acre (Population measured by tract)
0
1 - 5
6 - 10
11 - 50
51 - 100
101 - 500
> 500
Escondido
Rancho Bernardo
Poway
Ramona
San Diego Country Estates
N
Miles
0
1.25
2.5
5
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File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Population
HG Pop 05.mxd
Created By: Dennis Brown
Date: 22 December 2005
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CHAPTER 4: – WATER QUALITY ASSESSMENT

Introduction

This chapter contains a summary of the quality of raw and treated water in the Hodges Watershed during the period of January 1, 2001, through December 31, 2005. Following the summary there is a discussion of the reservoir and its possible future use.

The Water Quality Laboratory of the City of San Diego provided monitoring data from Hodges Reservoir and the Hodges Watershed.

Summary Of Monitoring Program

Hodges Reservoir was sampled near the outlet structure at surface level and at sampling points within the watershed. See Table 5-4.1 for a summary of the sampling frequency. The watershed sample results are summarized in Table 5-4.2, and a summary of raw water quality at the reservoir surface is found in Table 5-4.3.

Description Of Water Quality At Watershed Sampling Points

Nine sample points were chosen to present, based on the amount of data available. Those having fewer than five data points were deemed to be unrepresentative of a five year period. The Cedar and Paradise Fires of October 2003 and the extremely wet winter the following year prompted increased monitoring of the watershed. Samples were analyzed for conductivity and total dissolved solids, as well as a complete panel of trace metals, nutrients, and organic constituents. Microbiological parameters were not monitored.

The Drinking Water Standards used in Table 5-4.2 apply to treated, potable water, and are for reference only.

General Physical

Conductivity and Total Dissolved Solids were monitored. In both cases, the upper SMCL was exceeded. This is to be expected due to the turbid nature of the samples.

Inorganic Constituents

Trace metals were filtered before analysis and reported as dissolved trace metals. Maximum values aluminum and manganese exceeded the MCL. Average value of aluminum was 57.8 ug/L. The average value of manganese was 135 ug/L. Nutrient loading was a concern during and after the rainy season of 2004-2005. Nutrient levels increased after the Cedar fire. Monitoring for Total Nitrogen began in January of 2003.

Organic Constituents

The full range of organic herbicides, pesticides, and other contaminants was monitored. None were detected at the DLR.

Description of Source Surface Water Quality

Hodges Reservoir at Surface -

Table 5-4.3 contains a summary of water quality data for Hodges Reservoir at the surface. The reservoir was monitored for general physical characteristics, organic and inorganic constituents, and microorganisms.

General Physical

The monitored physical parameters of Hodges Reservoir at surface met drinking water MCLs except maximum values for color, TDS, and turbidity. Since the reservoir contains raw water, and the standards are for treated, the comparison is for reference only. Color, TDS and turbidity were elevated after rain events and decreased significantly during periods of dry weather. Threshold odor was not monitored at surface level.

Microbiological

Total coliform, E. Coli, and Enterococcus were monitored in order to obtain a background representation of microbiological conditions. Total coliforms ranged from 99 /100ml to > 24,000 /100ml. The E. Coli range was from <10 /100ml to 55 /100ml, and Enterococcus varied from <1 /100ml to 26 /100ml. Cryptosporidium and Giardia were not monitored in the reservoir.

Inorganic Constituents

There were twenty-eight inorganic constituents measured. Maximum values for Aluminum, Iron, and Manganese exceeded the secondary maximum contaminant levels. Nutrients, while high in the watershed samples, were within limits in the reservoir.

Organic Constituents

The full range of organic herbicides, pesticides, and other contaminants was monitored. Methyl t-Butyl Ether(MTBE) was detected with a maximum of 9.21ug/L and an average of <DLR. MTBE has decreased in the reservoir do to two factors. First MTBE has been removed from gasoline. Second 2-stroke motors have been replaced with 4-stroke motors in the rental fleet. Toluene had one sample > DLR with a value of 0.557 ug/L.

.

Evaluation of Source Water Quality

Hodges Reservoir water has a high mineral content, color, turbidity, total hardness, TOC and alkalinity. The high TOC makes Hodges reservoir water difficult to treat using free chlorine and chloramines as disinfectants. Alternative disinfection, such as using ozone for primary disinfection may be necessary to meet TTHM MCL limits.

Hodges Reservoir supplies the Badger WTP, which is owned and operated by the San Dieguito Water District. Hodges Reservoir does not supply water to the City of San Diego at this time. Future plan include potential CIP projects to allow Miramar Reservoir to receive water from Hodges Reservoir.

Table 5-4.1
RAW WATER QUALITY MONITORING PROGRAM
HODGES RESERVOIR ,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]
General Physical	
Alkalinity	Q
Color	Q
Conductivity	Q
Corrosivity	Q
Hardness as $CaCO_3$	Q
pH	Q
Total Dissolved Solids	Q
Turbidity	Q
Microbiological	
Total Coliform	M
E. Coli	M
Enterococcus	M
Radiological	
Gross Alpha particles	(2)
Gross Beta particles	(2)
Combined Radium-226 &	(2)
Strontium-90	(2)
Tritium	(2)
Uranium	(2)
Inorganic Constituents	
Aluminum	Q
Antimony	Q
Arsenic	Q
Barium	Q
Beryllium	Q
Cadmium	Q
Calcium	Q
Chloride	Q
Chromium	Q
Copper	Q
Cyanide	Q
Fluoride	Q
Iron	Q
Lead	Q

Table 5-4.1 RAW WATER QUALITY MONITORING PROGRAM HODGES RESERVOIR , 2001 THROUGH 2005	
Parameters	**Planned Sampling Frequency[1]**
Magnesium	Q
Manganese	Q
Mercury	Q
Nickel	Q
Nitrate**	Q
Nitrate + Nitrite**	Q
Nitrite as Nitrogen	Q
Phosphate (ortho)**	Q
Phosphorus (total)**	Q
Potassium	Q
Selenium	Q
Silver	Q
Sulfate	Q
Thallium	Q
Zinc	Q
Perchlorate	Q
Organic Constituents, Regulated	
1,1,1-Trichloroethane	Q
1,1,2-Trichloro-	Q
1,1,2-Trichloroethane	Q
1,1-dichloroethane	Q
1,1-Dichloroethylene	Q
1,2,4-Trichlorobenzene	Q
1,2-dichloroethane	Q
1,2-Dichloropropane	Q
1,4-Dichlorobenzene	Q
2,4,5 TP	Q
2,4-D	Q
Alachlor	Q
Atrazine	Q
Bentazon	Q
Benzene	Q
Benzo(a)pyrene	Q
Bromodichloromethane	Q
Bromoform	Q
Carbofuran	Q
Chloramine	Q

Table 5-4.1
RAW WATER QUALITY MONITORING PROGRAM
HODGES RESERVOIR ,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]
Chlordane	Q
Chlorine	Q
Chlorine Dioxide	Q
Chloroform	Q
cis-1,2-Dichloroethylene	Q
Dalapon	Q
Di(2-ethylhexyl) adipate	Q
Di(2-ethylhexyl) pthalate	Q
Dibromochloromethane	Q
Dibromochloropropane	Q
Dichloromethane	Q
Dinoseb	Q
Diquat	Q
Endrin	Q
Ethylbenzene	Q
Glyphosate	Q
Heptachlor	Q
Heptachlor epoxide	Q
Hexachlorobenzene	Q
Hexachlorocyclopentadiene	Q
Lindane	Q
Methoxychlor	Q
Methyl tert-Butyl Ether (MTBE)	Q
Molinate	Q
Monochlorobenzene	Q
o-Dichlorobenzene	Q
Oxamyl	Q
Pentachlorophenol	Q
Picloram	Q
Polychlorinated biphenyls	Q
Simazine	Q
Styrene	Q
Tetrachloroethylene	Q
Thiobencarb	Q
Toluene	Q
Total Organic Carbon (TOC)	Q
Toxaphene	Q
trans-1,2-Dichloroethylene	Q
Trichloroethylene	Q

Table 5-4.1 RAW WATER QUALITY MONITORING PROGRAM HODGES RESERVOIR , 2001 THROUGH 2005	
Parameters	**Planned Sampling Frequency[1]**
Trichlorofluoromethane	Q
Vinyl chloride	Q
Xylenes	Q
Organic Constituents, Unregulated	
Ethyl-tert-Butyl Ether (ETBE)	M
t-Amyl-methyl ether (TAME)	M
1,1,1,2-Tetrachloroethane	M
1,1-Dichloropropene	M
1,2,3-Trichlorobenzene	NS
1,2,3-Trichloropropane (TCP)	A[3]
1,2,4-Trimethylbenzene	Q
1,3,5-Trimethylbenzene	Q
1,3-Dichlorobenzene	Q
1,3-Dichloropropane	Q
2,2-Dichloropropane	Q
3-Hydroxycarbofuran	Q
Aldicarb	Q
Aldicarb sulfone	Q
Aldicarb sulfoxide	Q
Aldrin	Q
Bromacil	A
Bromobenzene	Q
Bromochloromethane	Q
Bromomethane	Q
Butachlor	A
Carbaryl	Q
Chlorobenzene	Q
Chloroethane	Q
Chloromethane	Q
Dibromomethane	Q
Dicamba	Q
Dichlorodifluoromethane	Q
Dieldrin	Q
Geosmin**	Q
Hexachlorobutadiene	Q
Isopropylbenzene	Q
Methomyl	Q
Methyl-isoborneol (MIB)**	Q

Table 5-4.1
RAW WATER QUALITY MONITORING PROGRAM
HODGES RESERVOIR ,
2001 THROUGH 2005

Parameters	Planned Sampling Frequency[1]
Metolachlor	A
Metribuzin	A
Napthalene	Q
n-Butylbenzene	Q
n-Propylbenzene	Q
Prometryn	A
Propachlor	Q
sec-Butylbenzene	Q
tert-Butylbenzene	Q

SAMPLING FREQUENCY DESIGNATION
D: Daily
W: Weekly
M: Monthly
Q: Quarterly
A: Annually
NS: Not Sampled

(1) Samples may be taken but not reportable due to instrumentation problems or quality control.
(2) Sample frequency is every four years. The data used in this report was obtained during 2002.
(3) Samples taken twice per month (M^3), twice per week (W^3), or twice annually (A^3).

NOTE:
** Denotes the start of a new parameter since the 2000 Sanitary Survey was completed. Sampling frequency represents current monitoring schedule as of January 2001.

Table 5-4.2
SUMMARY OF RAW WATER QUALITY**
HODGES WATERSHED[1] 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[2] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
General Physical									
Conductivity	µS/cm			900-1600	249	150	3170	1846	2140
Total Dissolved Solids	mg/L	10		500-1000	393	36.0	6360	1261	1420
Inorganic Constituents[3]									
Aluminum	µg/L	50	1000	200	21	nd	360	57.8	nd
Antimony	µg/L	6	6		26	nd	nd	nd	nd
Arsenic	µg/L	2	10		26	nd	3.00	nd	nd
Barium	µg/L	100	1000		13	nd	188	nd	nd
Beryllium	µg/L	1	4		15	nd	nd	nd	nd
Cadmium	µg/L	1	5		26	nd	1.12	nd	nd
Chromium	µg/L	10	50		21	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	26	nd	62.4	nd	nd
Lead	µg/L	5	15 AL		26	nd	2.75	nd	nd
Manganese	µg/L	20		50	23	nd	570	135	52.5
Nickel	µg/L	10	100		23	nd	nd	nd	nd
Selenium	µg/L	5	50		24	nd	nd	nd	nd
Silver	µg/L	10		100	1	nd	nd	nd	nd
Thallium	µg/L	1	2		26	nd	nd	nd	nd
Zinc	µg/L	50		5000	13	nd	53.2	nd	nd
Nitrate + Nitrite	mg/L		10		149	nd	30.7	8.03	6.35
Total Nitrogen	mg/L	0.4	1		219	nd	8.55	2.38	2.35
Phosphorus	mg/L	0.0781			358	nd	3.38	0.17	0.14
Phosphate (ortho)	mg/L	0.2			364	nd	3.38	nd	nd
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		101	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		101	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		101	nd	nd	nd	nd
1,1-Dichloroethane	µg/L	0.5	5		101	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		101	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		101	nd	nd	nd	nd
1,2-Dichloroethane	µg/L	0.5	.5		101	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		101	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		101	nd	nd	nd	nd
Alachlor	µg/L	1	2		70	nd	nd	nd	nd
Atrazine	µg/L	1	3		71	nd	nd	nd	nd
Benzene	µg/L	0.5	1		101	nd	nd	nd	nd
Benzopyrene	µg/L	0.1	.2		63	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			101	nd	nd	nd	nd
Bromoform	µg/L	0.5			101	nd	nd	nd	nd
Carbofuran	µg/L	5	18		79	nd	nd	nd	nd
Chlordane	µg/L	0.1	.1		78	nd	nd	nd	nd
Chloroform	µg/L	0.5			101	nd	nd	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		101	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		70	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		65	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		101	nd	nd	nd	nd
Endrin	µg/L	0.1	2		93	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		101	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		86	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		87	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		94	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		93	nd	nd	nd	nd
Lindane	µg/L	0.2	.2		81	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		91	nd	nd	nd	nd

Table 5-4.2
SUMMARY OF RAW WATER QUALITY**
HODGES WATERSHED[1] 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[2] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Methyl tert-Butyl Ether (MTBE)	µg/L	3	13	5	101	nd	nd	nd	nd
Molinate	µg/L	2	20		14	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		101	nd	nd	nd	nd
Oxamyl	µg/L	20	200		79	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	.5		56	nd	nd	nd	nd
Simazine	µg/L	1	4		49	nd	nd	nd	nd
Styrene	µg/L	0.5	100		101	nd	10	nd	nd
Tetrachloroethylene	µg/L	0.5	5		101	nd	nd	nd	nd
Toluene	µg/L	0.5	150		101	nd	nd	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			174	2.56	13.9	6.41	6.09
Toxaphene	µg/L	1	3		82	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		101	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		101	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	.5		101	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether (ETBE)	µg/L	0.3			101	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			101	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			101	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			101	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			101	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			81	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			101	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			101	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			101	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			101	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			101	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			79	nd	nd	nd	nd
Aldicarb	µg/L	3			79	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			79	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			76	nd	nd	nd	nd
Aldrin	µg/L	0.075			87	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			101	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			101	nd	nd	nd	nd
Bromomethane	µg/L	0.5			101	nd	nd	nd	nd
Carbaryl	µg/L	5			79	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			101	nd	nd	nd	nd
Chloroethane	µg/L	0.5			101	nd	nd	nd	nd
Chloromethane	µg/L	0.5			101	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			101	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			101	nd	nd	nd	nd
Dieldrin	µg/L	0.02			101	nd	nd	nd	nd
Hexachlorobutadiene	µg/L	0.5			101	nd	nd	nd	nd
Isopropylbenzene	µg/L	0.5			101	nd	nd	nd	nd
Methomyl	µg/L	2			79	nd	nd	nd	nd
Napthalene	µg/L	0.5			102	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			101	nd	nd	nd	nd
tert-Butylbenzene	mg/L	0.5			101	nd	nd	nd	nd

Table 5-4.2 SUMMARY OF RAW WATER QUALITY** HODGES WATERSHED[1] 2001 - 2005									
Parameters	Units	DLR*/	Drinking Water Standards[2]		No. of	Raw Water quality			
		MDL	MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported as MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) The sampling points summarized are: CDC4, DDC3, FEL3, GVC2, KCC3, MON2, SYC2, TEM1, AND WCH1.

(2) State MCL and MCLG values may be more stringent then federal standards for treated water.

(3) Trace metal samples were filtered before analysis. The results reflect dissolved trace metals.

nd: non-detected at State of California DLR

nd: non-detected at State DLR or MDL if DLR not Available

Table 5-4.3
SUMMARY OF RAW WATER QUALITY**
HODGES RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
General Physical									
Alkalinity	mg/L	2			19	128	241	194	192
Color	cu	1		15	17	3	110	50.3	44
Conductivity	µS/cm			900-1600	18	1200	2350	1856	1945
Corrosivity[3]	--			non-corrosive	16	0.13	1.54	1.1	1.22
Hardness as $CaCO_3$	mg/L	2			19	223	664	446	451
pH	units			6.5-8.5	17	7.69	8.83	8.31	8.35
Total Dissolved Solids	mg/L	10		500-1000	18	507	1490	1044	1055
Turbidity[2]	NTU	0.07	0.5	5	18	0.270	70.5	9.86	7.21
Microbiological									
Total Coliform	/100ml	10	(4)		68	99	>24000	9279	5950
E. Coli	/100ml	1			68	<10	55	4.7	<10
Enterococcus	/100ml	10			68	<1	26	5.30	3.1
Inorganic Constituents									
Aluminum	µg/L	50	1000	200	17	nd	413	115	94.2
Antimony	µg/L	6	6		17	nd	nd	nd	nd
Arsenic	µg/L	2	10		17	nd	4.09	nd	2.08
Barium	µg/L	100	1000		17	nd	200	nd	nd
Beryllium	µg/L	1	4		17	nd	nd	nd	nd
Cadmium	µg/L	1	5		17	nd	nd	nd	nd
Calcium	mg/L	5			18	48.0	192	104	95.0
Chloride	mg/L	6.5		250-500	16	92.2	306	208	224
Chromium	µg/L	10	50		17	nd	nd	nd	nd
Copper	µg/L	50	1300	1000	17	nd	nd	nd	nd
Cyanide	µg/L	100	200		12	nd	nd	nd	nd
Fluoride	mg/L	0.1	2		18	0.213	0.377	0.309	0.314
Iron	µg/L	100		300	17	nd	557	253	214
Lead	µg/L	5	15		17	nd	nd	nd	nd
Magnesium	mg/L	3			18	13.2	91.2	45.2	45.0
Manganese	µg/L	20		50	17	53.9	1420	389	226
Mercury	µg/L	1	2		16	nd	nd	nd	nd
Nickel	µg/L	10	100		17	nd	nd	nd	nd
Nitrate	mg/L	2	45		41	nd	5.53	nd	nd
Nitrate + Nitrite	mg/L		10		15	0.062	1.98	0.995	1.24
Nitrite as Nitrogen	mg/L	0.4	1		25	nd	nd	nd	nd
Potassium	mg/L	0.5			17	5.61	13.1	7.78	7.72
Selenium	µg/L	5	50		17	nd	nd	nd	nd
Silver	µg/L	10		100	17	nd	nd	nd	nd
Sulfate	mg/L	6.25		250-500	16	112	474	292	272
Thallium	µg/L	1	2		17	nd	nd	nd	nd
Zinc	µg/L	50		5000	17	nd	nd	nd	nd
Perchlorate	µg/L	5			23	nd	nd	nd	nd

Table 5-4.3 SUMMARY OF RAW WATER QUALITY** HODGES RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Organic Constituents, Regulated									
1,1,1-Trichloroethane	µg/L	0.5	200		22	nd	nd	nd	nd
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	10	1200		22	nd	nd	nd	nd
1,1,2-Trichloroethane	µg/L	0.5	5		22	nd	nd	nd	nd
1,1-Dichloroethane	µg/L	0.5	5		22	nd	nd	nd	nd
1,1-Dichloroethylene	µg/L	0.5	6		22	nd	nd	nd	nd
1,2,4-Trichlorobenzene	µg/L	0.5	70		22	nd	nd	nd	nd
1,2-Dichloroethane	µg/L	0.5	.5		22	nd	nd	nd	nd
1,2-Dichloropropane	µg/L	0.5	5		22	nd	nd	nd	nd
1,4-Dichlorobenzene	µg/L	0.5	5		22	nd	nd	nd	nd
2,4,5 TP	µg/L	1	50		17	nd	nd	nd	nd
2,4-D	µg/L	10	70		17	nd	nd	nd	nd
Alachlor	µg/L	1	2		19	nd	nd	nd	nd
Atrazine	µg/L	1	3		20	nd	nd	nd	nd
Bentazon	µg/L	2	18		16	nd	nd	nd	nd
Benzene	µg/L	0.5	1		22	nd	nd	nd	nd
Benzopyrene	µg/L	0.1	.2		13	nd	nd	nd	nd
Bromodichloromethane	µg/L	0.5			22	nd	nd	nd	nd
Bromoform	µg/L	0.5			22	nd	nd	nd	nd
Carbofuran	µg/L	5	18		15	nd	nd	nd	nd
Chlordane	µg/L	0.1	.1		19	nd	nd	nd	nd
Chloroform	µg/L	0.5			22	nd	nd	nd	nd
cis-1,2-Dichloroethylene	µg/L	0.5	6		22	nd	nd	nd	nd
Di(2-ethylhexyl) adipate	µg/L	5	400		12	nd	nd	nd	nd
Di(2-ethylhexyl) pthalate	µg/L	3	4		14	nd	nd	nd	nd
Dichloromethane (methylene chloride)	µg/L	0.1	5		22	nd	nd	nd	nd
Dinoseb	µg/L	0.5	7		16	nd	nd	nd	nd
Endrin	µg/L	0.1	2		31	nd	nd	nd	nd
Ethylbenzene	µg/L	0.5	700		22	nd	nd	nd	nd
Glyphosate	µg/L	25	700		14	nd	nd	nd	nd
Heptachlor	µg/L	0.01	.01		21	nd	nd	nd	nd
Heptachlor epoxide	µg/L	0.01	.01		21	nd	nd	nd	nd
Hexachlorobenzene	µg/L	0.05	1		31	nd	nd	nd	nd
Hexachlorocyclopentadiene	µg/L	1	50		22	nd	nd	nd	nd
Lindane	µg/L	0.2	.2		19	nd	nd	nd	nd
Methoxychlor	µg/L	10	40		31	nd	nd	nd	nd
Methyl tert-Butyl Ether (MTBE)	µg/L	3	13	5	22	nd	9.21	nd	nd
Molinate	µg/L	2	20		10	nd	nd	nd	nd
Monochlorobenzene	µg/L	0.5	70		22	nd	nd	nd	nd
o-Dichlorobenzene	µg/L	0.5	600		22	nd	nd	nd	nd
Oxamyl (vydate)	µg/L	20	200		15	nd	nd	nd	nd
Pentachlorophenol	µg/L	0.2	1		16	nd	nd	nd	nd
Picloram	µg/L	1	500		16	nd	nd	nd	nd
Polychlorinated biphenyls (PCBs)	µg/L	0.5	.5		15	nd	nd	nd	nd
Simazine	µg/L	1	4		16	nd	nd	nd	nd
Styrene	µg/L	0.5	100		22	nd	nd	nd	nd
Tetrachloroethylene	µg/L	0.5	5		22	nd	nd	nd	nd

Table 5-4.3
SUMMARY OF RAW WATER QUALITY**
HODGES RESERVOIR @ SURFACE 2001 - 2005

Parameters	Units	DLR*/ MDL	Drinking Water Standards[1] MCL	SMCL	No. of Samples	Raw Water quality MIN	MAX	MEAN	MEDIAN
Thiobencarb	µg/L		70	1	16	nd	nd	nd	nd
Toluene	µg/L	0.5	150		22	nd	0.557	nd	nd
Total Organic Carbon (TOC)	mg/L	0.5			24	8.11	11.5	10.0	10.0
Toxaphene	µg/L	1	3		19	nd	nd	nd	nd
trans-1,2-Dichloroethylene	µg/L	0.5	10		22	nd	nd	nd	nd
Trichloroethylene	µg/L	0.5	5		22	nd	nd	nd	nd
Trichlorofluoromethane	µg/L	5	150		22	nd	nd	nd	nd
Vinyl chloride	µg/L	0.5	.5		22	nd	nd	nd	nd
Organic Constituents, Unregulated									
Ethyl-t-Butyl Ether (ETBE)	µg/L	0.3			22	nd	nd	nd	nd
t-Amyl-methyl ether (TAME)	µg/L	0.2			22	nd	nd	nd	nd
1,1,1,2-Tetrachloroethane	µg/L	0.5			22	nd	nd	nd	nd
1,1-Dichloropropene	µg/L	0.5			22	nd	nd	nd	nd
1,2,3-Trichlorobenzene	µg/L	0.5			22	nd	nd	nd	nd
1,2,3-Trichloropropane (TCP)	µg/L	0.5			13	nd	nd	nd	nd
1,2,4-Trimethylbenzene	µg/L	0.2			22	nd	nd	nd	nd
1,3,5-Trimethylbenzene	µg/L	0.2			22	nd	nd	nd	nd
1,3-Dichlorobenzene	µg/L	0.5			22	nd	nd	nd	nd
1,3-Dichloropropane	µg/L	0.5			22	nd	nd	nd	nd
2,2-Dichloropropane	µg/L	0.5			21	nd	nd	nd	nd
3-Hydroxycarbofuran	µg/L	3			15	nd	nd	nd	nd
Aldicarb	µg/L	3			14	nd	nd	nd	nd
Aldicarb sulfone	µg/L	4			15	nd	nd	nd	nd
Aldicarb sulfoxide	µg/L	3			15	nd	nd	nd	nd
Aldrin	µg/L	0.075			21	nd	nd	nd	nd
Bromacil	µg/L	10			6	nd	nd	nd	nd
Bromobenzene	µg/L	0.5			22	nd	nd	nd	nd
Bromochloromethane	µg/L	0.5			22	nd	nd	nd	nd
Bromomethane	µg/L	0.5			22	nd	nd	nd	nd
Butachlor	µg/L	0.38			5	nd	nd	nd	nd
Carbaryl	µg/L	5			15	nd	nd	nd	nd
Chlorobenzene	µg/L	0.5			22	nd	nd	nd	nd
Chloroethane	µg/L	0.5			22	nd	nd	nd	nd
Chloromethane	µg/L	0.5			22	nd	nd	nd	nd
Dibromomethane	µg/L	0.5			22	nd	nd	nd	nd
Dicamba	µg/L	15			17	nd	nd	nd	nd
Dichlorodifluoromethane	µg/L	1			22	nd	nd	nd	nd
Dieldrin	µg/L	0.02			20	nd	nd	nd	nd
Hexachlorobutadiene	µg/L	0.5			22	nd	nd	nd	nd
Methomyl	µg/L	2			15	nd	nd	nd	nd
Metolachlor	µg/L	10			6	nd	nd	nd	nd
Metribuzin	µg/L	.5			6	nd	nd	nd	nd
Napthalene	µg/L	0.5			32	nd	nd	nd	nd
n-Butylbenzene	µg/L	0.5			22	nd	nd	nd	nd
n-Propylbenzene	µg/L	0.5			22	nd	nd	nd	nd
Prometryn	µg/L	2			6	nd	nd	nd	nd
Propachlor	µg/L	.1			32	nd	nd	nd	nd
sec-Butylbenzene	µg/L	0.5			22	nd	nd	nd	nd
tert-Butylbenzene	µg/L	0.5			22	nd	nd	nd	nd

Table 5-4.3 SUMMARY OF RAW WATER QUALITY** HODGES RESERVOIR @ SURFACE 2001 - 2005									
Parameters	Units	DLR*/	Drinking Water Standards[1]		No. of	Raw Water quality			
		MDL	MCL	SMCL	Samples	MIN	MAX	MEAN	MEDIAN

NOTES:

* The State of California DLR values are used when available. Parameters without DLR values were reported ad MDL levels.

** The acceptance criteria in this table apply to finished, potable water, and are for reference only.

(1) State MCL and MCLG values may be more stringent then federal standards for treated water.

(2) Turbidity of treated water is not to exceed 0.3 NTU 95% of the time.

(3) Based on the Langelier Index. A plus quantity indicates non-corrosive tendencies. A negative quantity indicates corrosive tendencies.

(4) No more then 5% of distribution system samples can be total coliform positive

nd: non-detected at State DLR or MDL if DLR not Available

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of the key conclusions from this survey and recommendations to improve watershed protection and enhance drinking water quality.

Conclusions

Watershed and Water Supply System -

> The City owns less then 9% of the land within the watershed. Private and public ownership of the remaining lands is roughly 70% and 30% respectively. Large Native American Indian reservations are contained within the watershed. This ownership pattern limits the control measures the City can implement and focuses watershed control efforts on coordination and communication with agencies.
>
> Most of the watershed lands support rural, agricultural and open space land uses. However, there are urban communities, such as Escondido, Ramona and parts of San Diego. Potential contamination sources include many nonpoint sources which are more difficult to control than point sources.
>
> The terrain is generally mountainous with slopes greater than 25%, creating the likelihood of transport of soils and contaminants to water bodies. The soils have generally high erosion potential. Rainfall ranges from approximately 15 inches annually in the lower watershed, to 25 inches annually in the mountain areas.

Potential Contamination Sources in the Watershed -

> Fires were less of an impact on the Hodges watershed than the other watersheds serving the City of San Diego. Heavy rains in 2004 produced heavy inflows into Hodges Reservoir, filling the reservoir to past spill level.

Other potential significant sources of contamination include livestock, sewage, wastewater treatment plants, landfill including Ramona landfill, urban runoff, septic systems, agricultural crops, and fires.

Watershed Management and Control Practices -

The City exercises a number of management practices or controls within the watershed. On City lands, land use and potentially polluting activities are controlled directly. On lands not owned by the City, the primary controls include:

1) Monitoring land use, CEQA compliance activities, water quality permit activities, and other regulatory actions.
2) Coordinating with other agencies to implement appropriate controls.

Additional City resources have been utilized in the past five years to improve City participation and control in both City owned and non-City owned land.

Water Quality Conditions -

Reservoir raw water quality monitoring indicates several constituents may be of concern. The constituents include TDS, turbidity, coliforms, MTBE, nitrogen compounds, and TOC. Water quality in Hodges Reservoir is less desirable than the water in other San Diego reservoirs.

Recommendations

General Recommendations -

Recommendations and corrective actions were developed for the purpose of improving overall watershed protection and drinking water quality. Generally, the recommendations strengthen this first barrier to water quality degradation – protection of source watershed. By strengthening this first barrier, impacts on the second barrier – water treatment – may be reduced.

The recommendations provided are grouped by the following subjects:

- Water Quality Monitoring and Evaluation
- Interjurisdictional Coordination
- Watershed Management and Control Practices
- Public Education
- Water Supply Modifications

Water Quality Monitoring and Evaluation -

During the 2001 – 2005 time period watersheds monitoring was significantly increased. The City should continue monitoring the watersheds. The baseline data for many parameters has been collected.

Additional evaluation of the data should be used to provide guidance on actions necessary to protect the watersheds. As with any monitoring program, the program should be evaluated to help ensure the necessary data is being obtained while conserving laboratory resources.

The monitoring program should place emphasIs on obtaining information necessary to assisting City and non-City forces efforts to protect the watershed. Continued interaction with all interested parties is necessary to continually improve the monitoring program.

Interjurisdictional Coordination -

Lines of communication both within the City and with neighboring agencies have been improved during the 2001 – 2005 time period. However, continued efforts are needed to further the communication and cooperation among agencies. This is of particular importance in the Hodges watershed, due to the use of Hodges Reservoir as a water supply by other water agencies. Specific actions pertaining to Interjurisdictional coordination include the following:

- Expand Workgroups

Workgroups have been established between many of the agencies such as County Planning, U.S. Forest service, Bureau of Land Management. The formation of the workgroups was a positive step. Participation in the workgroups is not consistent among the agencies and the City. Ensuring City forces continue to participation in workgroups is important to coordination between agencies. The City should also determine if additional workgroups will be beneficial.

- Review of New Watershed Land Uses

Land use with the watersheds impacts potential contamination of the water. The City should emphases minimizing potential water quality issues when working with other agencies on watershed land usages.

Watershed Management and Control Practices -

Continue to reduce the impacts from cattle grazing. Impacts can be reduced by elimination of cattle grazing from riparian corridors, prevent cattle access to streams and water bodies, control transport of cattle waste to streams and water bodies, and reduce cattle density.

Public Education -

Public education material has been developed for trail and reservoir usage. Maintaining the educational material in readily available locations will help educate the public to the importance of protecting the watershed. The material should be periodically reviewed to ensure it is accurate and appropriate.

Residents within the watershed have a significant impact on protecting the watershed. Educational programs should emphasize what residents can do to help protect the watershed and how protecting the watershed provides them great benefits.

Public awareness signage has been installed in several transportation corridors. The signage provides information on actions they can take to help improve water quality. The City should maintain the signage and review it for accuracy and appropriateness.

Water Supply Modifications -

The addition of imported water from San Diego County Water Authority (SDCWA) is being evaluated. SDCWA is determining if a cost effective solution to adding imported water to Hodges exists and if funding can be allocated for the project. Blending of imported water, plus transfer of water from Hodges to Miramar Reservoir, will improve water quality.