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(R-2008-401) 11/13

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MEET

RESOLUTION NUMBER R- 303177

DATE OF FINAL PASSAGE NOV 20 2007

A RESOLUTION ADOPTING THE SAN PASQUAL GROUNDWATER MANAGEMENT PLAN; AND RELATED ACTIONS.

BE IT RESOLVED, by the Council of the City of San Diego, as follows:

1. That the City Council has received the San Pasqual Groundwater Management Plan on file in the office of the City Clerk as Document No. RR- 303177 and all public comments for the San Pasqual Groundwater Management Plan.

2. That the San Pasqual Groundwater Management Plan is hereby adopted.

3. That this activity is exempt from the California Environmental Quality Act [CEQA] pursuant to CEQA Guidelines section 15262 and this determination is based on CEQA Guidelines section 15004 which provides direction to lead agencies on the appropriate timing for environmental review. This project will require further review under the provisions of CEQA.

APPROVED: MICHAEL J. AGUIRRE, City Attorney

By _____
Raymond C. Palmucci
Deputy City Attorney

RCP:js
11/6/2007
Or.Dept:Water
R-2008-401

I hereby certify that the foregoing Resolution was passed by the Council of the City of San Diego, at this meeting of NOV 13 2007.

ELIZABETH S. MALAND
City Clerk

By Lara Richardson
Deputy City Clerk

Approved: 11-20-07
(date)

JERRY SANDERS, Mayor

Vetoed: _____
(date)

JERRY SANDERS, Mayor

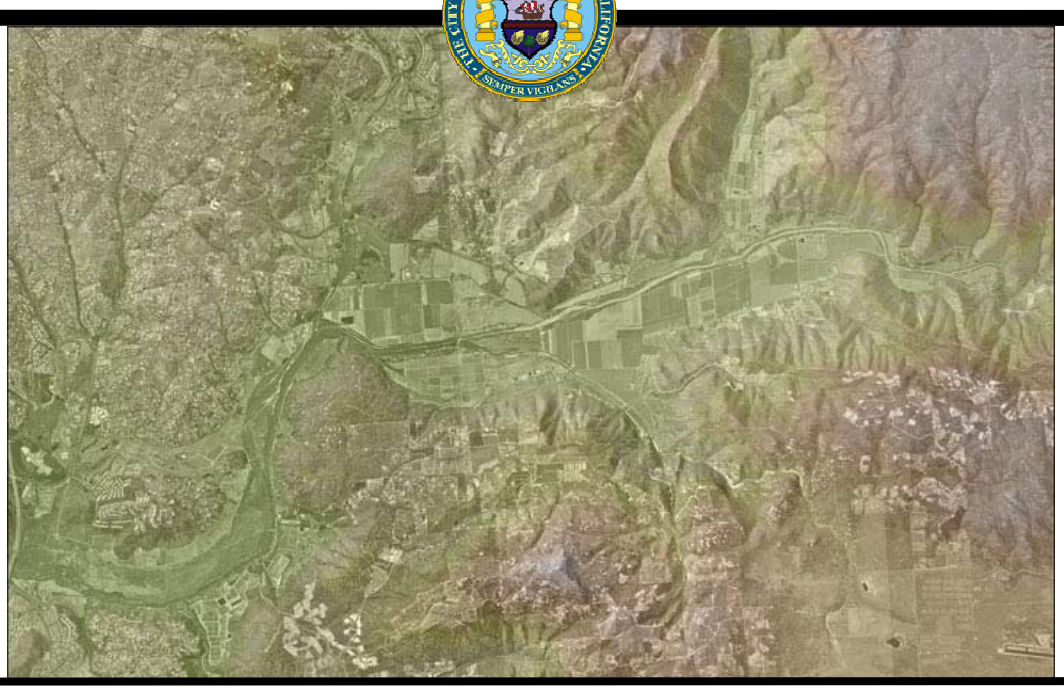
R- 303177

SAN PASQUAL

NOVEMBER 2007

GROUNDWATER MANAGEMENT PLAN

CITY OF SAN DIEGO



San Pasqual Basin Groundwater Management Plan

Adopted November 2007

San Pasqual Basin
Groundwater Management Plan

The City of San Diego Water Department

Document Prepared by:

City of San Diego Water Department

MWH Americas, Inc. **Katz & Associates**

Project Advisory Committee

Name	Organization
Dave Martens	City of San Diego Real Estate Assets Department
Bob Perotti	Department of Water Resources
Frank Konyn, Jr.	Konyn Dairy
Vicki Touchstone	Rancho Bernardo Community Planning Board
Eric Larson	San Diego County Farm Bureau
Dan Diehr	San Diego County Water Authority
Robert McClure	San Diego Zoo's Wild Animal Park
Craig Adams	San Dieguito River Valley Conservancy
Marc Linshield	San Pasqual Valley Planning Group
Dana Johnson	Santa Fe Irrigation District
Matt Witman	Witman Ranch

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Section 1 – Introduction

1.1 INTRODUCTION

San Diego has developed this Groundwater Management Plan for the San Pasqual Valley groundwater basin, referred to hereafter as the San Pasqual Groundwater Management Plan (SPGMP). This document represents a "beginning" point for understanding how to best manage the basin. This is an "adaptive management" plan and future actions will result from careful evaluation of basin response to past actions.

The SPGMP area, illustrated in **Figure 1-1**, is located within the San Dieguito Drainage Basin, which is the fourth largest drainage basin in San Diego County.

An extensive outreach effort has been conducted as part of the SPGMP development. A Project Advisory Committee (PAC) was formed to provide input to the City of San Diego during the development of the SPGMP. Appendix G details the overall outreach approach and activities.

This section provides a general background of this SPGMP effort and describes San Diego's existing and future groundwater resource planning activities within the SPGMP and adjacent areas. This section also includes a summary of other regional planning efforts within San Diego County, but outside of SPGMP area (**Figure 1-1)**.

1.2 REPORT ORGANIZATION

This section briefly describes the report organization.

Section 1. Introduction. Provides information on the geographic setting, jurisdictional boundaries and general background of San Diego and adjacent cities and water agencies. In addition, this section summarizes other Groundwater Management Plans (GMPs) and management efforts adjacent to the SPGMP area or related to San Diego's Water Department.

Section 2. Water Resources. Prior to managing a basin, available water supplies should be identified and quantified. In this section, information is presented to assist the reader in understanding the availability of different water supplies within the SPGMP area. This section also provides a description of the groundwater basin, highlighting the unique

hydrogeology within the SPGMP area. It also provides an understanding of water quality issues, and the groundwater and surface water infrastructure.

Section 3. Management Plan Elements. This section identifies the five components categories that constitute a groundwater management plan. An important aspect of this section is the identification of Basin Management Objectives (BMOs), component categories, and the actions necessary for their implementation.

Section 4. Plan Implementation. This section provides a schedule for implementing the BMOs, component categories, and actions provided in Section 3, including a presentation of reporting criteria. In addition, this section provides a description of the schedule and financing necessary to implement the SPGMP.

1.3 PURPOSE AND GOALS OF SPGMP

San Diego has prepared the following goal statement early in the development of the Groundwater Management Plan:

> *"The goal of the SPGMP is to understand and enhance the long-term sustainability and quality of groundwater within the basin, and protect this groundwater resource for beneficial uses including water supply, agriculture, and the environment."*

The purpose of this SPGMP is to serve as the initial framework for coordinating the management activities into a cohesive set of Basin Management Objectives (BMOs) and related actions to improve management of the groundwater resource in San Pasqual Valley.

1.4 SPGMP AREA

The SPGMP area boundary coincides with the California Department of Water Resources (DWR) San Pasqual Valley groundwater basin boundary as defined in Bulletin 118 and illustrated in **Figure 1-2**.[1]

[1] The basin boundary shown on this figure and presented in this GMP has been slightly modified from Bulletin 118 to better represent the physical conditions within the basin.

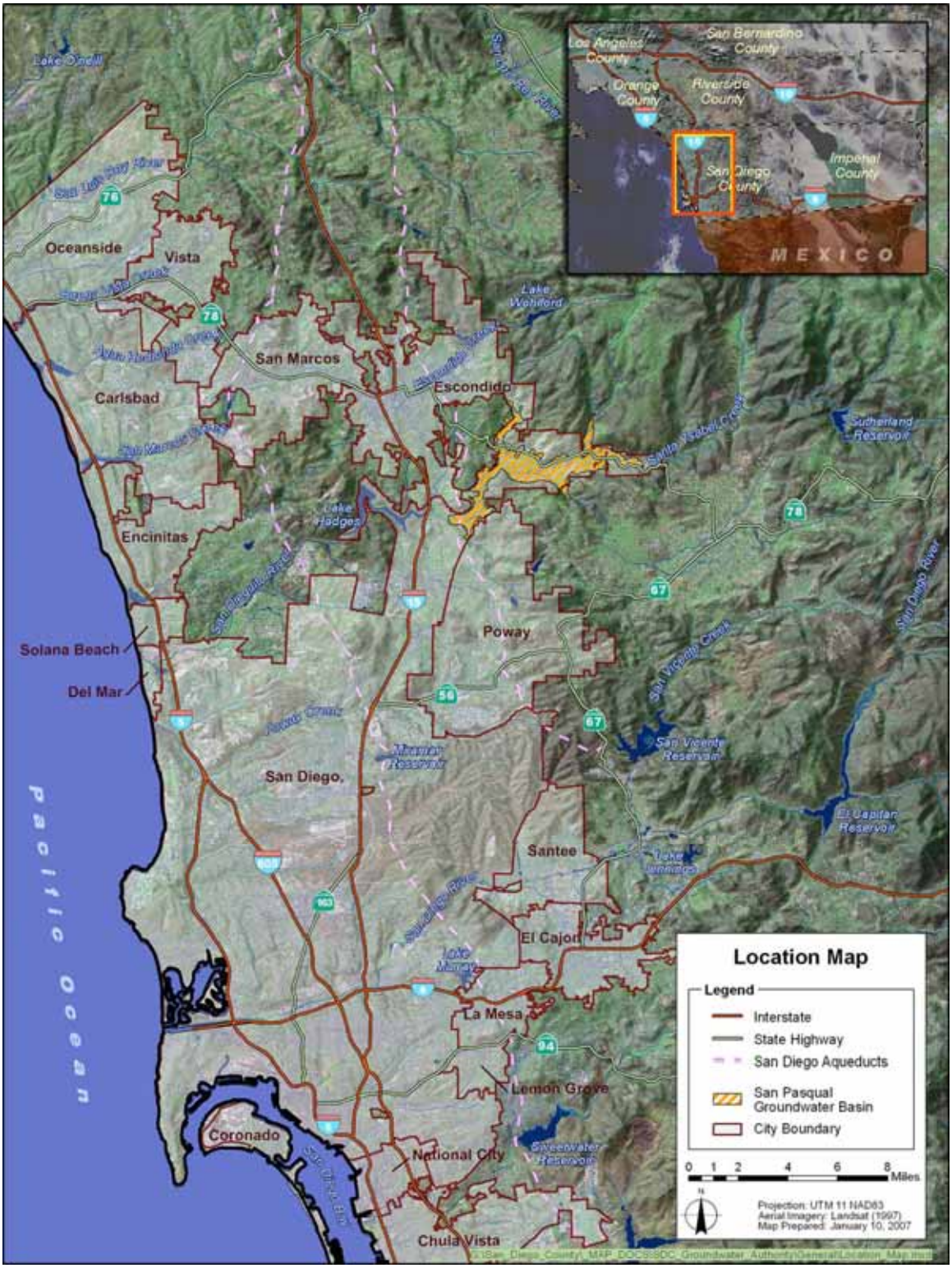

Figure 1-1 – San Pasqual GMP Area and Regional Setting

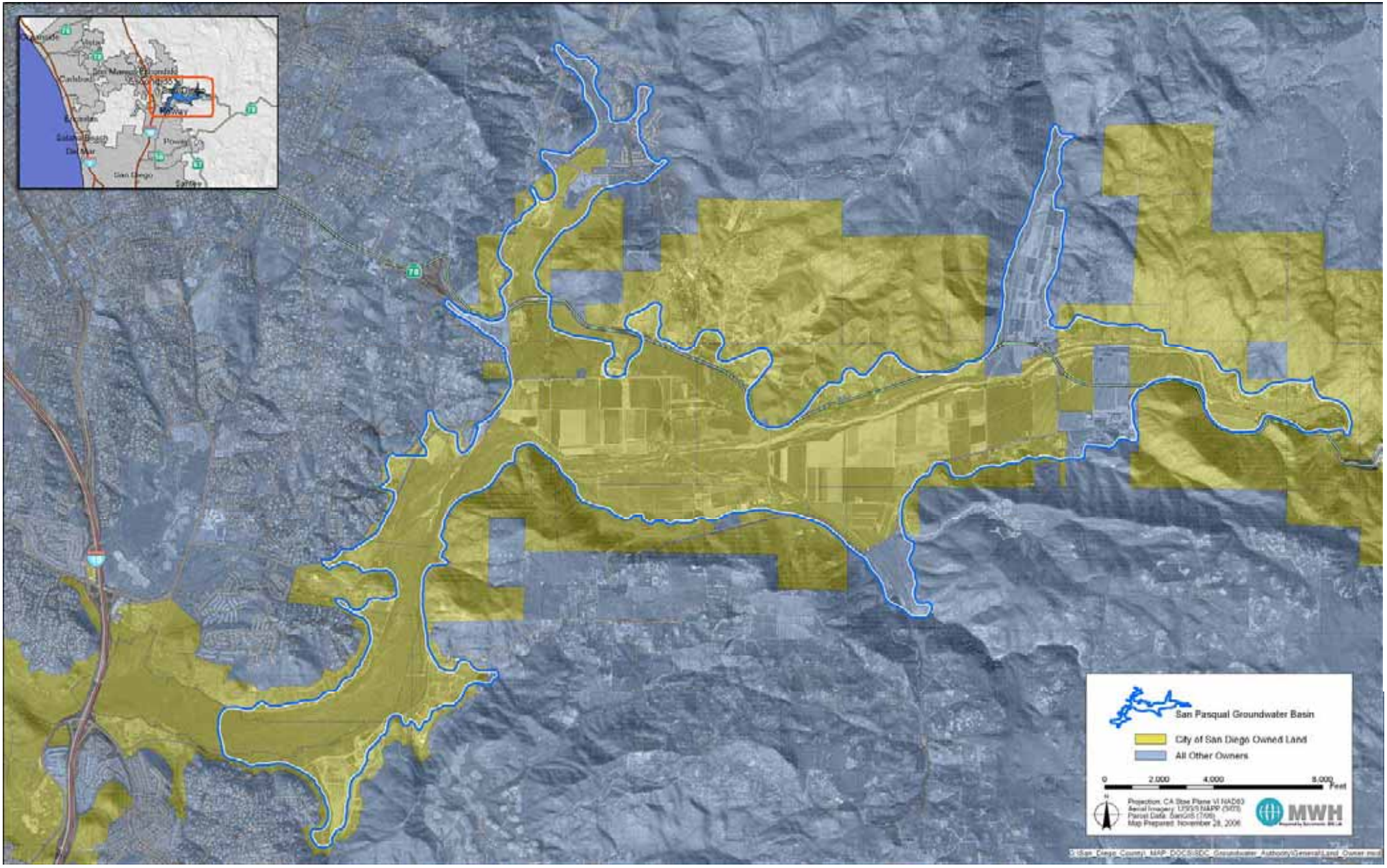

Figure 1-2 – San Pasqual Groundwater Basin Boundary[1], and City Land Ownership within the San Pasqual Valley

1.5 BACKGROUND

The following subsection provides background information on the City of San Diego, other relevant adjacent cities and water agencies surrounding the SPGMP area, and other stakeholders in the region.

1.5.1 City of San Diego

The City of San Diego is located on the southern coast of California near the Mexico border (**Figure 1-1**). The City of San Diego was the third city to be established within California in 1850. The City population in 2005 was 1,305,736 (State Department of Finance, Demographic Research Unit, 2005). The population is expected to grow to as many as 1,656,820 people by the year 2030, according to the 2030 SANDAG Regional Growth Forecast (SANDAG, 2004). This represents an approximate increase of 27 percent, over 25 years.

The City of San Diego's Water Department provides municipal water supply to its service customers. The current source of water is imported supplies via the San Diego County Water Authority (SDCWA) aqueducts, as well as from nine reservoirs fed from local runoff.

The City of San Diego's Long Range Water Resources Plan (LRWRP) outlines ways to meet future water demands, which are estimated to increase by 55 million gallons per day (MGD) or 25% over 2002 levels by the year 2030. The LRWRP outlines the use of imported water supplies and ways to improve reliability by diversifying water supply. This diversification of water supply includes:

- Development of potential groundwater resources and storage capacity, combined with surface water management to meet overall water supply and resource management objectives;
- Expansion of recycled water programs;
- Investigation and pursuit of non-traditional water supplies such as brackish groundwater and seawater desalination; and
- Pursuing water transfers.

In 1995, San Diego adopted the San Pasqual Valley Plan that includes specific goals aimed at the long-term protection and management of the San Pasqual Valley (Valley). The San Pasqual Valley Plan is now included within the City's LRWRP. The Valley was also identified as a region for development of potential groundwater resources. The City of San Diego is responsible for following through with directives written in the San Pasqual Valley Plan. The directives include the following:

- Establish a Prohibition of any Further Commercialization of the Valley;
- Tailor Zoning Within the Valley to Ensure the Preservation of the Valley's Existing Rural Character and to Encourage Appropriate Agricultural Uses;
- Protect the Quality and Capacity of the San Pasqual/Lake Hodges Surface Water and Groundwater Basin;
- Protect, Enhance and Restore the Sensitive Habitats within the Valley;
- Promote Passive Recreation and Interpretive Uses in the Valley;
- Preserve, Promote, and Sustain Agricultural Uses;
- Build Consensus Through Collaborative Partnerships Among the Adjacent Jurisdictions and Other Entities with an Interest in this Area to Preserve the Qualities and Resources of the Valley;
- Establish an Interpretive Center in the Valley;
- Inform the San Pasqual/Lake Hodges Community Planning Group and the Rancho Bernardo Community Planning Board of all Planning and Land Use Issues that Pertain to the Valley Plan Area; and
- Ensure the Long-Term Protection of the Valley's Unique Agricultural, Biological, and Water Resources.
- In 2004, the San Pasqual Vision Plan was presented to the City Council. In 2005, the City Council adopted Council Policy 600-45, which reinforces the goal of vision plan, and also requires development of a Groundwater Management Plan.

1.5.2 Other Adjacent Agencies

The following sub section provides background information on adjacent cities and water agencies to the SPGMP area as illustrated in **Figure 1-3**.

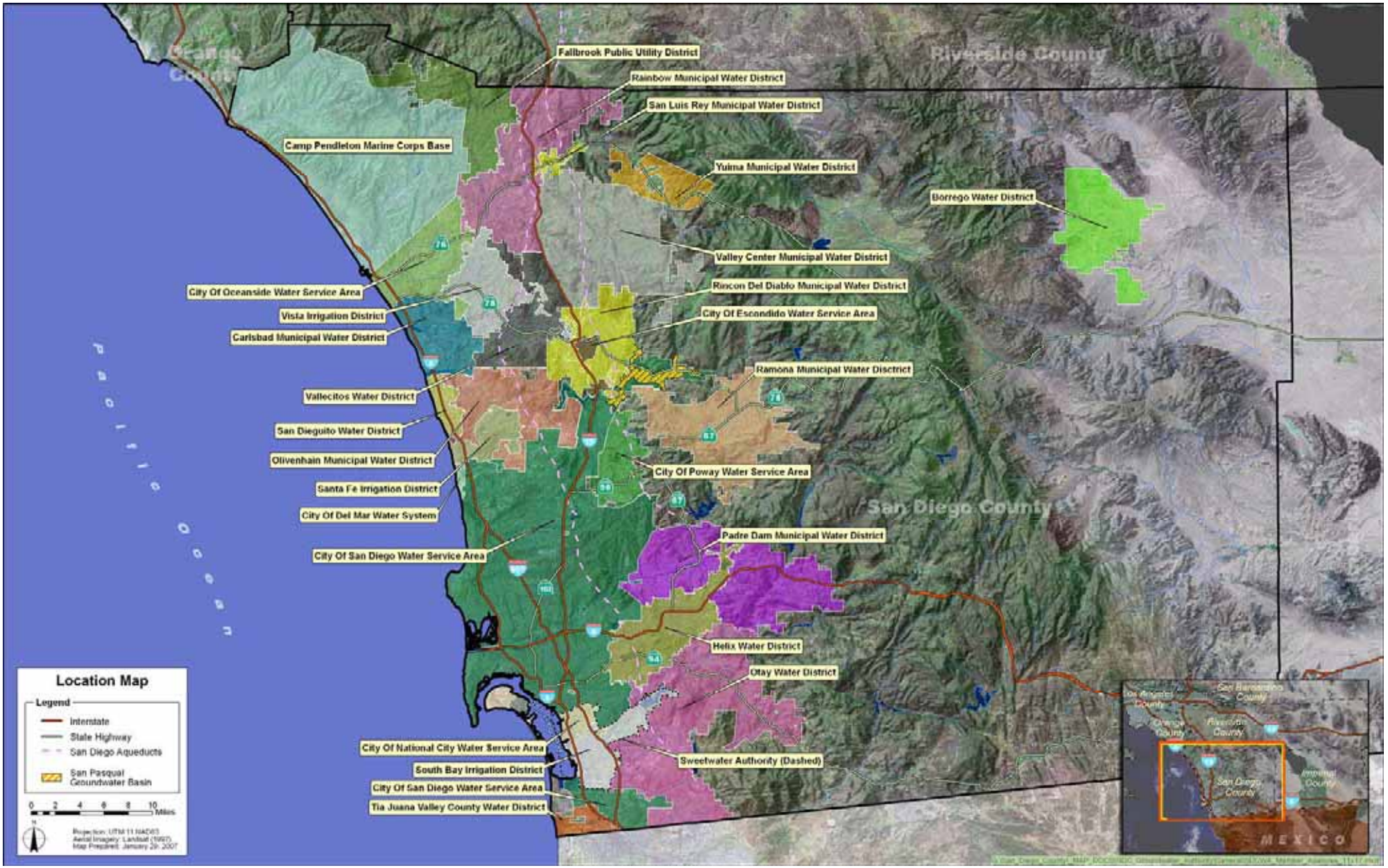

Figure 1-3 - Adjacent City and Water Agency's Service Areas

1.5.2.1 San Diego County

The County of San Diego reported a population of 2,933,462 people in 2005. The communities and cities which make up the County of San Diego are included in the **Table 1-1** below.

Table 1-1 – Communities and Cities within San Diego County

Alpine	City of Del Mar
Bonsall	City of El Cajon
Borrego Springs	City of Encinitas
Cardiff-by-the-Sea	City of Escondido
Chula Vista	City of Imperial Beach
Fallbrook	La Jolla
Golden Triangle	City of La Mesa
Julian	City of Lemon Grove
City of Lakeside	City of National City
Otay Mesa	City of Oceanside
Poway	Rancho Santa Fe
Ramona	City of Santee
San Ysidro	City of San Diego
Spring Valley	City of San Marcos
City of Carlsbad	City of Solana Beach
City of Chula Vista	City of Vista
City of Coronado	

1.5.2.2 San Diego County Water Authority

The San Diego County Water Authority (SDCWA) was formed in 1944 by the California State Legislature, and is operated under the County Water Authority Act, found in the California Water Code. SDCWA is a member of the Metropolitan Water District of Southern California (MWD) and has supplied up to 90 percent of San Diego County's water over its 60-year history. SDCWA's mission as the regional wholesaler of imported water is to provide a safe and reliable supply of water to its 23 member agencies, which supply approximately 97 percent of the water to San Diego County's 2.9 million residents. The member agencies in San Diego County are listed in **Table 1-2** below and illustrated in **Figure 1-3**.

Table 1-2 – Member agencies of the San Diego County Water Authority

Carlsbad Municipal Water District	Rainbow Municipal Water District
City of Del Mar	Ramona Municipal Water District
City of Escondido	Rincon del Diablo Municipal Water District
Fallbrook Public Utility District	City of San Diego
Helix Water District	San Dieguito Water District
Lakeside Water District	Santa Fe Irrigation District
National City (member of Sweetwater District)	South Bay Irrigation District (member or Sweetwater Authority)
City of Oceanside	Sweetwater Authority
Olivenhain Water District	Vallecitos Water District
Otay Water District	Valley Center Municipal Water District
Padre Dam Municipal District	Vista Irrigation District
Camp Pendleton Marine Corps Base	Yuima Municipal Water District
City of Poway	

1.5.2.3 City of Escondido

The City of Escondido (Escondido) was first incorporated as a city in 1888. Escondido's population as of 2006 was estimated at 140,766 by the State Department of Finance. The population in Escondido more than doubled between 1980 and 1990 (growth of 69%), and has continued to increase but at a slower rate between 1990 and 2000 (growth 23%).

Escondido's Public Utility/Water Division maintains two lakes (Dixon Lake and Lake Wohlford) and a recycled water distribution system. The goal of the Utilities Division/Water Division is to deliver high-quality water at the most economical cost. The two lakes provide raw water to the Escondido-Vista Water Treatment Plant facility which, in turn, supplies water to approximately 26,000 residents, commercial, and agricultural customers in Escondido. As listed above, Escondido is also a member agency of the SDCWA and thus primarily relies on imported water supplies from SDCWA. Escondido is located due west and northwest of the SPGMP area. Escondido also obtains groundwater supplies from the Upper San Luis Rey basin.

1.5.3 Other Stakeholders

The following section provides a description of stakeholders within the basin related to water including irrigation districts and land lessees.

1.5.3.1 Santa Fe Irrigation District and the San Dieguito Water District

Santa Fe Irrigation District (SFID) and the San Dieguito Water District (SDWD) (own a property right to local water yield in the Lake Hodges watershed). They are the only

agencies to beneficially use this drinking water source since the construction of the dam in 1918. The City of San Diego owns the dam and some of the water supplies associated with this source, but to date have not put the stored water in Lake Hodges to beneficial use. According to a 1998 agreement between the City, SFID and SDWD, 57.33 percent of the first 7,500 acre feet of water in Lake Hodges can be used by SFID and 42.67 percent can be used by SDWD. Any excess local water over 7,500 AFY will be split 50/50 between the two Districts. This agreement is subject to the conditions that:

1) The Districts request the water,

2) There is sufficient local water in Lake Hodges for the two Districts,

3) There will be at least 8,300 AF of storage in Lake Hodges available to the Districts for the remainder of the water contract year, and

4) The water will be put to beneficial use.

In 2008, the SDCWA is expected to complete the Lake Hodges Improvement Project, which will connect Olivenhain Reservoir to Lake Hodges with a pipeline and pump station. Once this project is complete, the base yield of 7,500 AFY will be reduced to 5,700 AFY available to the Districts; SFID will still be entitled to receive 57.33 percent and the SDWD will still be entitled to receive 42.67 percent of this water in any given contract year. This value is expected to remain the same through the year 2030.

1.5.3.2 Land Lessees

The City of San Diego owns the land and water rights in the illustrated regions of the basin (**Figure 1-2**), and is subject to providing reasonable amounts of water granted to various agricultural land lessees. Based on land use illustrated in this figure, the water use demands would be approximately 8,800 AF/yr for the entire basin. San Diego requires that leases follow best management practices to protect surface and groundwater quality in the basin. Examples of BMP's in recent leases include:

- Filter strips/temporary manure storage
- Pest management
- Grazing rotation
- Storm Water Pollution Plan of City, and

- Semi annual meetings with the City to review BMPs,

Exerpts from lease agreements that pertain to protection of the environment and groundwater quality are included in **Appendix A.**

1.6 ROLES OF STATE AND FEDERAL AGENCIES IN CALIFORNIA GROUNDWATER MANAGEMENT

This section describes the roles that State and federal agencies have in California groundwater management. Although the groundwater management plans are the local responsibility, State and federal agencies still have goals related to groundwater management that are focused on maintaining a reliable groundwater supply

1.6.1 California Department of Water Resources

California Department of Water Resources (DWR) role in groundwater management involves programs that directly benefit local groundwater management efforts. DWR's programs include roles such as assisting local agencies to assess basin characteristics and identify opportunities to develop additional water supply, monitoring groundwater levels and quality, and providing standards for well construction and destruction. DWR also has a Conjunctive Water Management Program which consists of developing integrated efforts to assist local agencies to improve groundwater management and increase water supply reliability. DWR Southern District has participated in the PAC meetings during the development of the SPGMP. Southern District has also assisted the City of San Diego in locating wells to be included in the groundwater monitoring program.

1.6.2 State Water Resources Control Board and Regional Water Quality Control Board

The missions of the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Board (RWQCB) are to ensure water quality in the state and to enforce water quality objectives and implement plans to protect beneficial uses of the State's waters. SWRCB's Groundwater Ambient Monitoring and Assessment (GAMA) program was developed to provide a comprehensive assessment of water quality in the state. The two main components of the Groundwater Ambient Monitoring and Assessment (GAMA) program are the California Aquifer Susceptibility (CAS) Assessment and the Voluntary Domestic Well Assessment Project. The SWRCB and RWQCB are involved in plans that include developing basin plans to identify beneficial

uses of marine water, groundwater, and surface waters. The San Diego RWQCB has been invited to participate in the PAC meetings during development of the SPGMP, but has declined. Groundwater quality objectives for San Pasqual Basin, described in Section 2, have been obtained from the San Diego RWQCB Basin Plan.

1.6.3 California Department of Public Health

The California Department of Public Health (DPH) provides oversight and inspects approximately 8,500 public water systems that are required to monitor drinking water quality under the federal Safe Drinking Water Act implemented by DHS. The public water operators are required to monitor 80 inorganic and organic contaminants and six radiological contaminants reflecting the natural environment. The public water operators are also required to monitor contaminants that impact the aesthetic properties of drinking water, which are known as the secondary MCLs. The water quality monitoring data from these analyses dating back to 1984 are stored in a database maintained by DHS.

1.6.4 California Department of Pesticide Regulation

The California Department of Pesticide Regulation (DPR) plays an important role in monitoring pesticides and in preventing further contamination of groundwater resources. DPR maintains a database that consists of pesticide sampling in groundwater and reports a summary of annual sampling and detections to the State Legislature.

1.6.5 California Department of Toxic Substances Control

The California Department of Toxic Substance Control (DTSC) is responsible for two programs that relate to the protection of groundwater resources. The two programs consist of elements focused on maintaining environmental quality and economic vitality by protecting the groundwater resources. If groundwater is threatened or impacted in a basin, DTSC provides oversight of the characterization and remediation of the soil and groundwater contamination. The DTSC coordinates with the RWQCB to ensure that groundwater quality objectives are met according to site-specific groundwater basin plans.

1.6.6 U. S. Geological Survey

The U. S. Geological Survey (USGS) has an active role in California groundwater basin studies and maintains an extensive database consisting of groundwater level and

groundwater quality monitoring data. The USGS participated in public meetings held during the development of the SPGMP.

1.6.7 County of San Diego Department of Environmental Health

The County of San Diego Department of Environmental Health (DEH) regulates the design, constructions, modification and destructions of water wells throughout San Diego a county to protect groundwater resources.

1.7 EXISTING GROUNDWATER MANAGEMENT PLANS

According to the most recent information available from the California Department Water Resources (DWR, 2004), the following districts/watersheds, in the vicinity of San Diego, have adopted GMPs: the Borrego Water District, the San Luis Rey Municipal Water District, the Sweetwater Authority, and the Rainbow Valley Basin Groundwater Management Plan. A summary description of each of these GMPs is provided in **Appendix B**.

1.8 OTHER WATER MANAGEMENT EFFORTS

The City of San Diego and adjacent water purveyors in the region have invested substantial time and resources in a series of regional planning efforts. The planning efforts were established in order to address challenges such as extended drought and wet periods and on-going and potential impacts to surface water quality and groundwater quality. In particular, the planning efforts most directly related to the San Pasqual Valley/City of San Diego efforts include:

- Rancho Bernardo Reclaimed Water Facilities Plan and San Pasqual Valley Groundwater Management Concepts, 1993
- San Pasqual Water Resources Strategic Plan Draft, 1994
- San Pasqual Valley Water Resources Management Plan, 1997
- San Diego County Water Authority's Groundwater Report, 1997
- San Diego County Water Authority's San Diego Formation Groundwater Storage and Recovery Feasibility Study: Phase 1, 1999

- San Diego County Water Authority's Lower San Luis Rey River Valley Groundwater Storage and Recovery Feasibility Study: Phase 1, 1999
- San Diego County Water Authority's Regional Water Facilities Master Plan, 2003
- San Diego County's Groundwater Ordinances Numbers 7994 (N.S.) and 9644 (N.S.)
- San Diego County Water Authority's 2005 Urban Water Management Plan (UWMP)
- City of Escondido's 2005 UWMP
- San Diego's LRWRP, 2006
- San Diego's Integrated Regional Water Management Plan (IRWMP), 2006
- San Diego's (Updated) Strategic Business Plan, 2006

A summary description of each of these water management is provided in **Appendix C**.

1.9 AUTHORITY TO PREPARE AND IMPLEMENT THE SPGMP

The authority of the City of San Diego to manage the SPGMP is based on City Council Policy. The City elected the SPGMP as one of the tools to effectively protect and manage the San Pasqual Valley basin, consistent with the City's San Pasqual Vision Plan and CWC §10755.2. On June 27, 2005 the City Council adopted the San Pasqual Vision Plan Council Policy 600-45 (included in **Appendix D**) to comprehensively protect the water, agricultural, biological and cultural resources within the San Pasqual Valley. The GMP is a required element of the policy.

In 1992, the California Legislature passed Assembly Bill (AB) 3030, which was designed to provide local public agencies increased management authority over their groundwater resources. In September 2002, new legislation, Senate Bill 1938 (SB 1938) expanded AB 3030 by requiring groundwater management plans to include certain specific components in order to be eligible for grant funding for various types of groundwater related projects.

Recently, there has been an emphasis by the State for agencies to develop integrated regional solutions for water management solutions (SB 1672), and coordinating the

conjunctive management of surface and ground water to improve regional water supply reliability and water quality.

1.10 SPGMP COMPONENTS

The California Department of Water Resources and the California Water Code provide a summary of Groundwater Management Plan components. The SPGMP includes required and voluntary components as listed in the California Water Code (CWC) § 10750 and DWR recommended components. Each of these components is addressed within the SPGMP. **Table 1-3** lists these components and indicates the section(s) in which each is addressed.

Table 1-3 – Location of SPGMP Components

Description	Section(s)
A. CWC § 10750 *et seq.*, Required Components[1]	
1. Documentation of public involvement statement.	3.4.1
2. Basin Management Objectives (BMOs).	3.2
3. Monitoring and management of groundwater elevations, groundwater quality, inelastic land surface subsidence, and changes in surface water flows and quality that directly affect groundwater levels or quality or are caused by pumping.	3.5
4. Plan to involve other agencies located within groundwater basin.	3.4
5. Adoption of monitoring protocols by basin stakeholders.	3.5
6. Map of groundwater basin showing area of agency subject to GMP, other local agency boundaries, and groundwater basin boundary as defined in DWR Bulletin 118.	1.3
7. For agencies not overlying groundwater basins, prepare GMP using appropriate geologic and hydrogeologic principles.	Not Applicable
B. DWR's Recommended Components[2]	
1. Manage with guidance of advisory committee.	3.4
2. Describe area to be managed under GMP.	1.3
3. Create link between BMOs and goals and actions of GMP.	3.0
4. Describe GMP monitoring program.	3.5
5. Describe integrated water management planning efforts.	3.8
6. Report on implementation of GMP.	4.1
7. Evaluate GMP periodically.	4.2
C. CWC § 10750 *et seq.*, Voluntary Components[3]	
1. Control of saline water intrusion.	3.6
2. Identification and management of wellhead protection areas and recharge areas.	3.6
3. Regulation of the migration of contaminated groundwater.	3.6
4. Administration of well abandonment and well destruction program.	3.6
5. Mitigation of conditions of overdraft.	3.2, 3.7
6. Replenishment of groundwater extracted by water producers.	3.7
7. Monitoring of groundwater levels and storage.	3.5
8. Facilitating conjunctive use operations.	3.7
9. Identification of well construction policies.	3.6
10. Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.	3.6
11. Development of relationships with state and federal regulatory agencies.	3.4
12. Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination.	3.4

1. CWC § 10750 *et seq.* (seven required components). Recent amendments to the CWC § 10750 *et seq.* require GMPs to include several components to be eligible for the award of funds administered by DWR for the construction of groundwater projects or groundwater quality projects. These amendments to the CWC were included in Senate Bill 1938, effective January 1, 2003.
2. DWR Bulletin 118 (2003) components (seven recommended components).
3. CWC § 10750 *et seq.* (12 voluntary components). CWC § 10750 *et seq.* includes 12 specific technical issues that could be addressed in GMPs to manage the basin optimally and protect against adverse conditions

Addressing each of these componenets in the groundwater management plan demonstrates to the State, that the local groundwater basin management authority has a plan to protect the groundwater resource in a sustainable method for the benefit of current and future interests in the basin. Once adopted by the City of San Diego, the SPGMP will be evaluated and scored by the DWR at the time that San Diego applies for grant funds from current (Proposition 50, 84, 1e and the AB303) and future state grant programs. San Diego anticipates receiving funds from these grant programs to help finance groundwater improvement projects in the basin. San Diego's potential to receive

grant funds under theses program is diminished if San Diego were not to adopt the SPGMP or if the components in the **Table 1-3** are missing from the GMP.

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Section 2 – Water Resources Setting

This section describes the water resource setting including the current understanding of the surface and subsurface features of the San Pasqual Valley Groundwater basin (basin). This section also includes a description of the groundwater and surface water supplies in the basin. Information for this section was obtained from on going monitoring efforts and results of previous studies, and represents the best available information. The charts and figures included in this section illustrate the type of information of interest and period of record for understanding the groundwater conditions within the basin. Instances where the data record appears incomplete, inconsistent or missing altogether are noted in this section and these examples are used to underscore the need for improved monitoring within the basin to collect necessary information for improved groundwater management decisions. Additional field data collection and analysis during the GMP development period was beyond the scope of the project. However, action items focused on improved field data collection and archival are presented in Section 3 of this GMP. These action items will go into effect when the GMP is adopted by the San Diego City Council.

2.1 ENVIRONMENTAL SETTING

As described in Section 1, the basin is located within San Diego County as illustrated in **Figure 1-1** and within the central portion of the San Dieguito Watershed, illustrated in **Figure 2-1.** The basin has a Mediterranean-type climate with annual mean daily temperatures ranging between 46.3 and 76.0 degrees Fahrenheit (Metcalf and Eddy, 1997). The estimated average annual rainfall across the San Dieguito Watershed is approximately 19.7 inches. However, the mean annual precipitation within the basin is between approximately 13 and 14 inches (Weston Solutions, 2006).

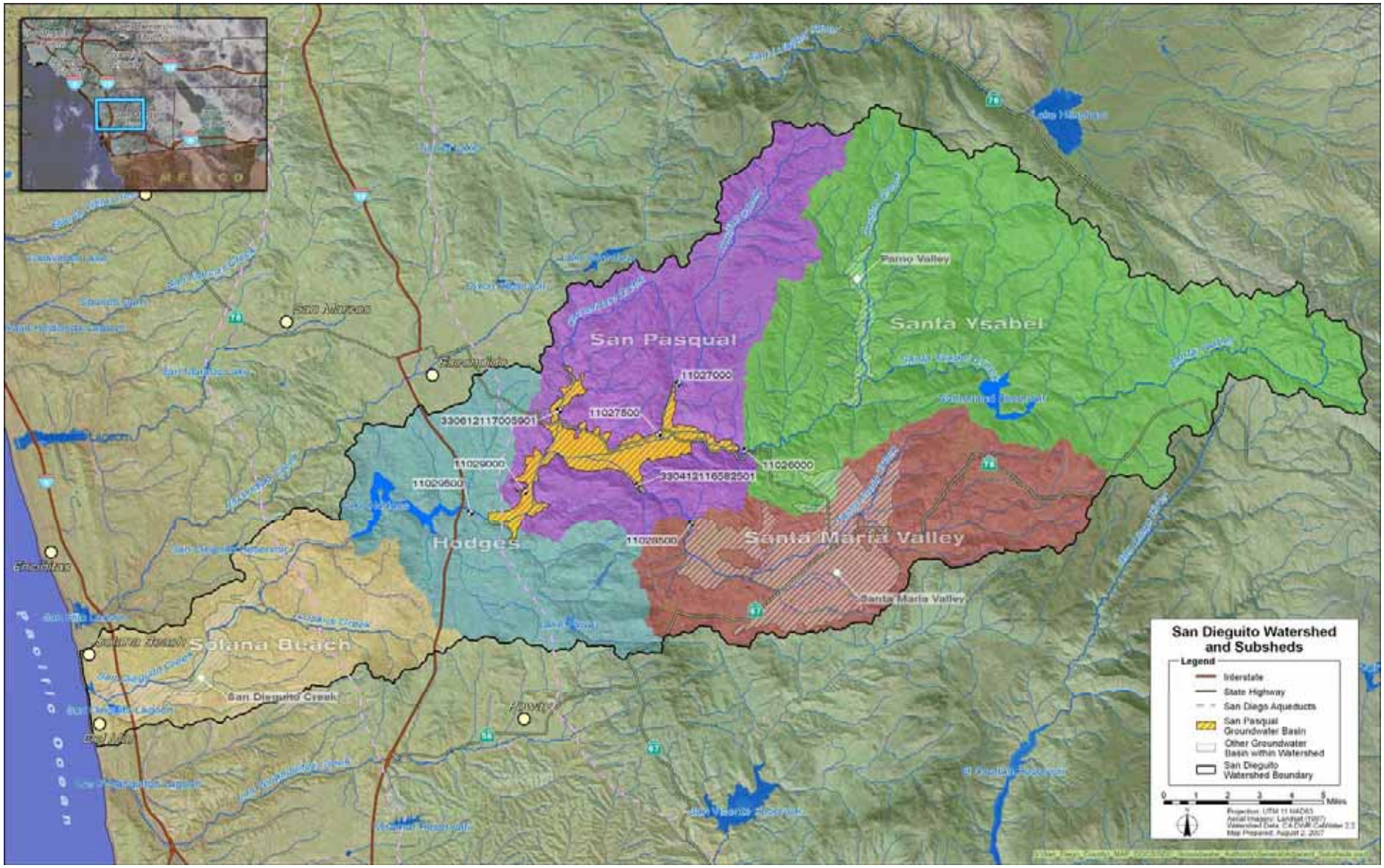

Figure 2-1 - San Dieguito Watershed and Subsheds Within and/or Surrounding the SPGMP area.

The biological resources within the San Pasqual Valley consist of numerous sensitive native vegetation types and non-native vegetative communities, which are described in detail in the San Dieguito Watershed Management Plan (SDWMP) (Weston Solutions, 2006). The San Pasqual Valley is home to over 150 wildlife and 150 plant species, several of which are endangered and/or threatened, including the arroyo toad, coastal California gnatcatcher, least Bell's vireo, and southwestern willow flycatcher (Weston Solutions, 2006). The SDWMP contains a comprehensive list of all endangered, threatened, and special concern species living in the San Pasqual Valley. During the implementation of the SPGMP monitoring plans will give special consideration to protecting these sensitive biological resources.

San Diego owns the majority of the land within the alluvial valley floor of the basin, illustrated in Figure 1-2. The land owned by the San Diego is leased to a variety of tenants for primarily agricultural-residential (AG-RES) and agriculture (AG) uses. Within the basin, AG-RES and AG water demand is met almost solely from groundwater. Outside of the basin, the City is reliant predominantly on local surface and imported water supplies to meet their consumptive use needs. In more recent years, the City has begun water planning efforts involving conjunctive use projects to meet projected future groundwater demands.

2.2 GROUNDWATER CONDITIONS

This subsection provides a description of general groundwater conditions including the groundwater basin, the geology/hydrogeology, groundwater elevation, and groundwater quality within the SPGMP area. The groundwater conditions of the basin have been investigated in a limited number of studies (DWR, 1993; Izbicki, 1983, Greeley and Hansen, 1993, CH2MHill, 2001).

The water quality, groundwater elevation, lithology, and well construction information discussed in this document have been used to populate a Data Management System (DMS). The DMS can be used to support the SPGMP and future conjunctive use opportunities as a tool to easily store, view, retrieve, and present the data from the region.

2.2.1 Groundwater Basin

The basin lies within the San Dieguito Watershed and is bounded by Lake Hodges to the southwest and by nonwater-bearing rocks of the Peninsular Ranges to the northeast

(DWR, 1959 and 2003; Izbicki, 1983). **Figure 1-2**[2] shows the land owned by the San Diego and the basin boundary from DWR Bulletin 118 (2003). Bulletin 118 provides additional information about the basin on the agency's website [3] including:

- Surface Area: 4,540 acres.
- The Santa Ysabel and Guejito Creeks drain the highlands of the neighboring watersheds and converge with Santa Maria Creek to form the San Dieguito River, which then flows out of the basin and into Lake Hodges.
- The average annual precipitation within the basin ranges from 11 to 15 inches.

2.2.2 Geology/Hydrogeology

The geology of the basin was mapped by the California Department of Water Resources (DWR 1967), and was later described by the USGS (Izbicki, 1983). The western portion of the basin was mapped in greater detail by the Department of Conservation, Division of Mines and Geology (1999) geologic map of the Escondido 7.5' Quadrangle San Diego, California which is available electronically in a digital database, courtesy of the Southern California Area Mapping Project. However, a geologic map of the eastern portion of the basin within the San Pasqual 7.5' Quadrangle San Diego, California is not currently available (USGS website: National Geologic Maps Database). Therefore, a completed detailed geologic map of the entire basin is unavailable. The fault activity map of California and adjacent areas from the Department of Conservation (Jennings, 1994) indicates that there are no active faults that cut through the basin. The nearest fault zone, the Whittier-Elsinore Fault, traverses the eastern end of the San Dieguito Watershed (Weston Solutions, 2006; Jennings, 1994).

2.2.2.1 Hydrostratigraphy

The San Pasqual Valley basin (DWR basin 9-10, 2003) is located within the San Pasqual hydrologic subarea, which is a 31 mi^2 region located within the San Dieguito River basin. The hydrologic subarea is located east of both the San Dieguito and San Elijo hydrologic

[2] **Figure 1-2** includes the DWR basin boundary overlaying aerial photographs of the basin and adjacent areas. In preparation of this figure, and analysis of the DWR basin boundary, MWH recognized that boundary did not accurately overly the alluvial groundwater bearing portions of the basin. MWH contacted DWR who validated the inaccuracy. For this reason, the basin boundary presented on this figure was originally prepared by DWR but further modified by MWH and is considered more accurate but still approximated.

[3] Source: http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/basins/pdfs_desc/9-10.pdf

subareas. Izbicki (1983) identified several geologic water-bearing units which make up the local aquifers in the San Pasqual hydrologic subarea. These units include Cretaceous age Granodiorites, Green Valley Tonalites, and deeply weathered Green Valley Tonalites, and Quaternary Alluvium.

The Cretaceous age granodiorites cover approximately 50 percent of the subarea or approximately 15.5 mi^2. These rocks form the hills and ridgetops in the subarea surrounding the San Pasqual Valley basin. They are quite resistant to weathering, although they may be weathered to a shallow depth in some areas. The granodiorites of the subarea typically contain tonalite, which is light-colored and ranges from fine-grained to coarse-grained.

The Green Valley Tonalite is exposed across approximately 30 percent of the subarea or approximately 9.3 mi^2 and is less resistant to erosion. The Green Valley Tonalite in the subarea can be deeply weathered and form residuum (also referred to as decomposed granite (DG)). The residuum is exposed across approximately 1,550 acres or 8 percent of the subarea surrounding the San Pasqual Valley basin, making up the lowlands and hilly topography in the vicinity of faults in the region. The Green Valley Tonalite is described as medium-grained gray tonalite with minor granodiorite, gabbro, and other igneous rocks.

The Alluvium stretches across 3,410 acres or approximately 15 percent of the subarea and nearly 100 percent of the San Pasqual Valley basin. Alluvial thickness in the basin ranges between 120 feet in the San Pasqual Narrows (region extending from the uppermost influence with Lake Hodges to the confluence of Cloverdale Creek) and increases to over 200 feet in the upper part of the basin. The alluvium is described as non-active Holocene age alluvial flood plain, colluvial (unconsolidated slope wash sediments), and stream deposits. The unconsolidated sediments range from silty sand with clay to silty sand with clay and gravel. The Alluvium was derived from erosion of the surrounding crystalline rocks. The Alluvium forms a generally unconfined aquifer in the hydrologic subarea, which may be locally confined by clay and silty sand.

The water-bearing units which make up the local aquifer in the San Pasqual Valley basin are the Quaternary Alluvium and the deeply weathered Green Valley Tonalites (or residuum). Previous reports have shown that the alluvial aquifer within the San Pasqual groundwater basin ranges between 120 and 200 feet in thickness and extends laterally to the surrounding foothills (Izbicki, 1983). The USGS reported well yields within the

alluvium to be as high as 1,600 gpm (Izbicki, 1983). The transmissivity of the alluvial aquifer within the San Pasqual basin was estimated by the USGS to be less than 25,000 ft^2/day. However, a small portion of the aquifer which extends along the Santa Ysabel River is believed to have a transmissivity greater than 25,000 ft^2/day. **Figure 2-2** illustrates a geologic cross section of the alluvial aquifer along a line of section shown on **Figure 2-3**. The cross section illustrates the subsurface geology from east to west across the basin.

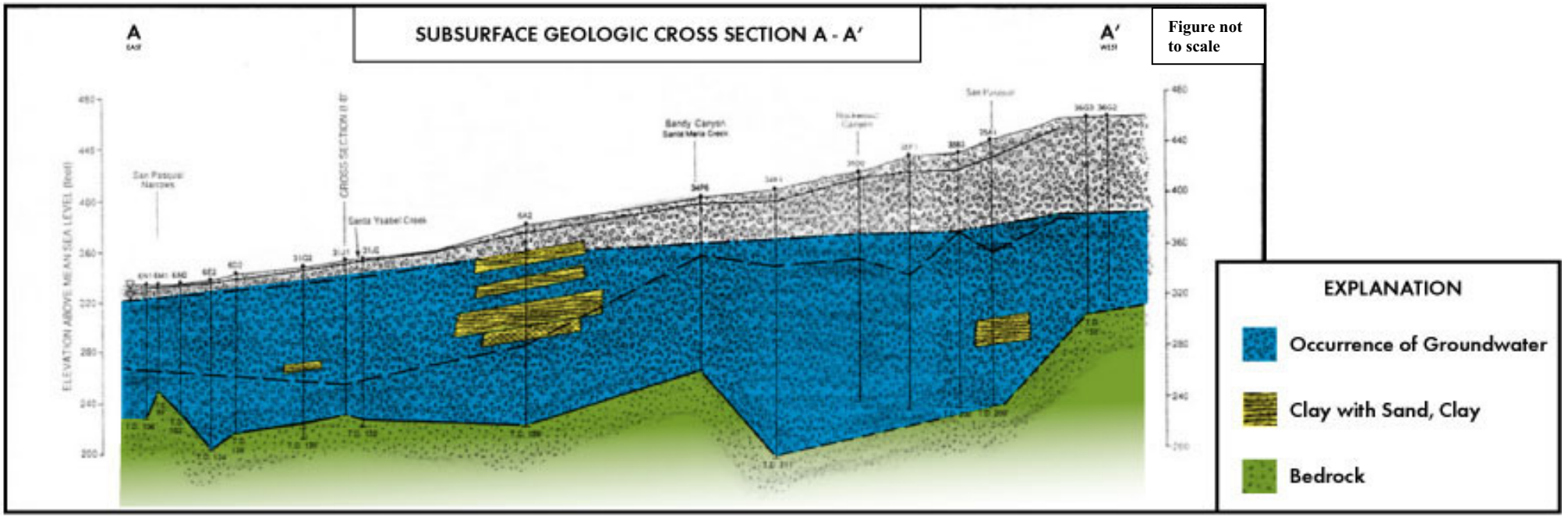

Figure 2-2 - Subsurface geology from A to A' (modified from Greeley and Hansen, 1991, courtesy of Ken Schmidt and Associates).

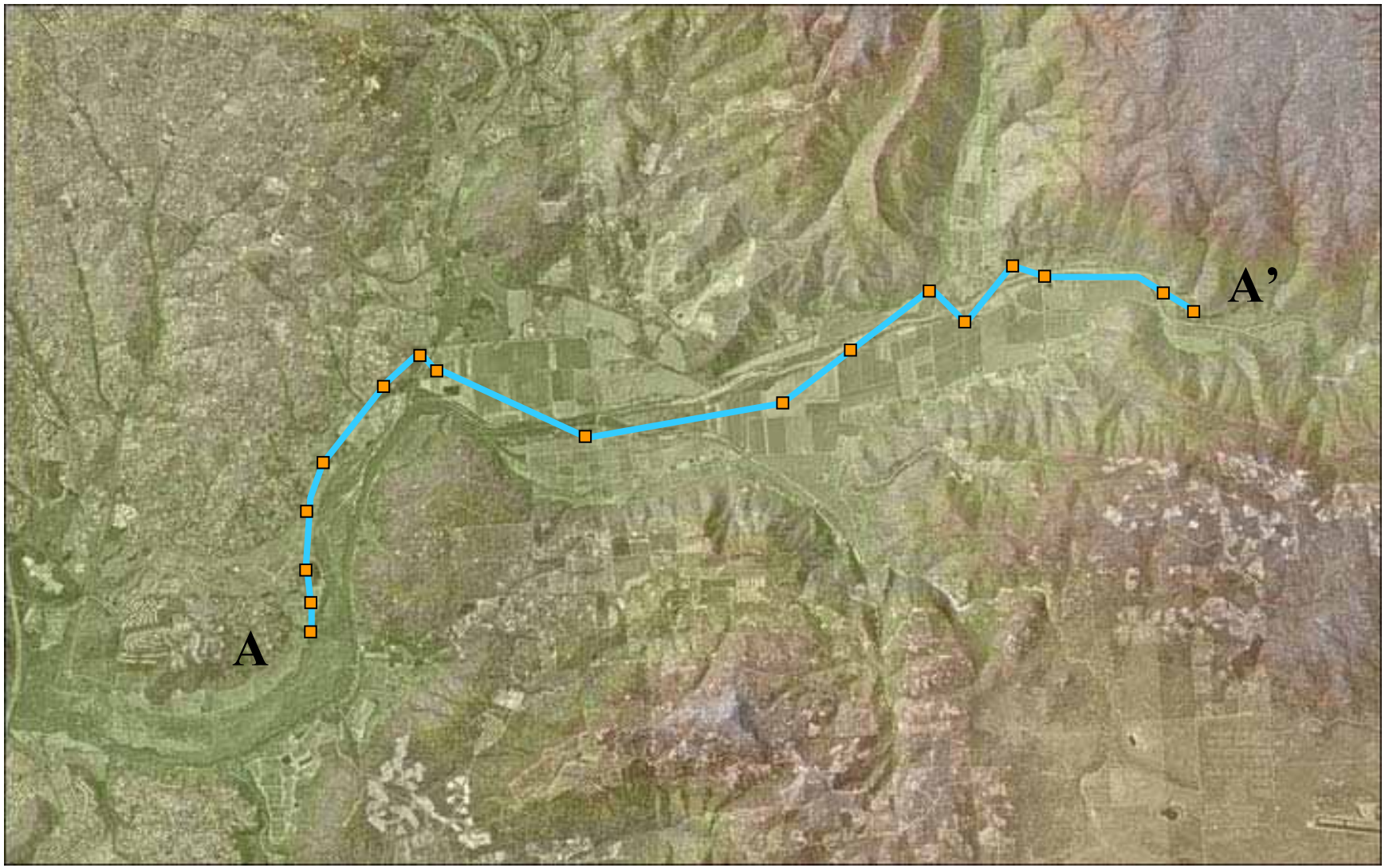

Figure 2-3 - The cross section well locations from A to A’.

The cross section shown on **Figure 2-2** illustrates the hydrostratigraphy of the basin and the shallowest and deepest groundwater elevations recorded in the identified wells between 1977 and 1990. The shallowest groundwater elevations are marked by a straight line that is close to the ground surface. The deepest measurements recorded in 1977 and 1990 are shown by a dashed line and a dash-double dot line. The units described as having the occurrence of groundwater were sand, sand and gravel, and gravel. Clay with sand or clay was identified in a few of the wells, indicated the presence of some non-continuous locally confining units. The total depth (T.D.) of each well to bedrock is also indicated on the cross section. The cross section indicates that the aquifer ranges between approximately 120 ft and 200 ft thick within the basin.

2.2.2.2 Recharge and Extraction of Groundwater

Evaluating the changes in aquifer conditions requires an understanding of the dynamic processes and interactions that are taking place as extractions and recharge of the aquifer occur. Conceptual models of the aquifer that describe recharge, aquifer storage, and differences between localized and regional effects on the aquifer are discussed below.

Recharge: Groundwater in the basin moves from sources of recharge to points of discharge.

The primary source of recharge to the alluvial aquifer within the basin originates from outside of the basin as streamflow of the Santa Ysabel, Guejito, Santa Maria, and Cloverdale Creeks (**Figure 2-1**). These creeks flow through the valley and leave the hydrologic subarea as the San Dieguito River at San Pasqual Narrows (Izbicki, 1983). Stream gauge stations exist for the Santa Ysabel, Guejito, and Santa Maria Creeks and average annual flow estimates for these creeks can be estimated. Stream gauge stations exist; and average annual flow estimates for these creeks can be estimated. No average annual flow estimates are available for the ungauged Cloverdale Creek. Izbicki (1983) stated that in a typical year, no flow from the ephemeral streams leaves the basin, and all of the surface water that is not lost to evapotranspiration becomes recharge to the alluvial aquifer. However, this statement can not be verified using gauge data because the stream gauge stations along the San Dieguito River at the outlet of the San Pasqual Valley basin have been abandoned since 1965.

The areas of recharge extend along the ephemeral stream and river channels where coarse alluvial sediments exist. A small source of recharge comes from precipitation,

streamflow that originates within the basin, and leakage from the residual aquifer. The remainder of the recharge to the alluvial aquifer comes from irrigation return water from both native groundwater and imported water.

Changes in the groundwater elevation result from changes in groundwater recharge, discharge, or extraction.

Extraction: A cone of depression develops when groundwater is extracted from a single well. Extraction of groundwater within the SPGMP area was estimated to be approximately 6,000 AF/yr in 1970. From 1980 to 2000, a steady rate of groundwater pumping was estimated at 6,300 AF/yr (CH2MHill, 2001). There is no indication from groundwater level data in 1995 (**Figure 2-4**) that extraction within the alluvial aquifer in the SPGMP area has resulted in a regional cone of depression. A groundwater elevation monitoring plan will address what actions are necessary if a regional cone of depression develops.

2.2.2.3 Groundwater Elevations

Provided within the following subsection is a description of groundwater elevation contours in 1995 and hydrographs from select wells.

Groundwater Elevation Contours. The average groundwater elevation contours for the basin for the period between 2/7/95 and 2/7/96, based on data from eight wells is illustrated on **Figure 2-4**. Generally, groundwater is deeper on the eastern edge of the basin near the Santa Ysabel Creek and Santa Maria Creek and shallower on the western edge near Lake Hodges. Over this distance of 7.1 miles, the 1995 groundwater elevation difference from the eastern portion to the western portion of the basin was approximately 96 feet. Therefore the average groundwater gradient across the entire basin during 1995 was 0.003 toward the west.

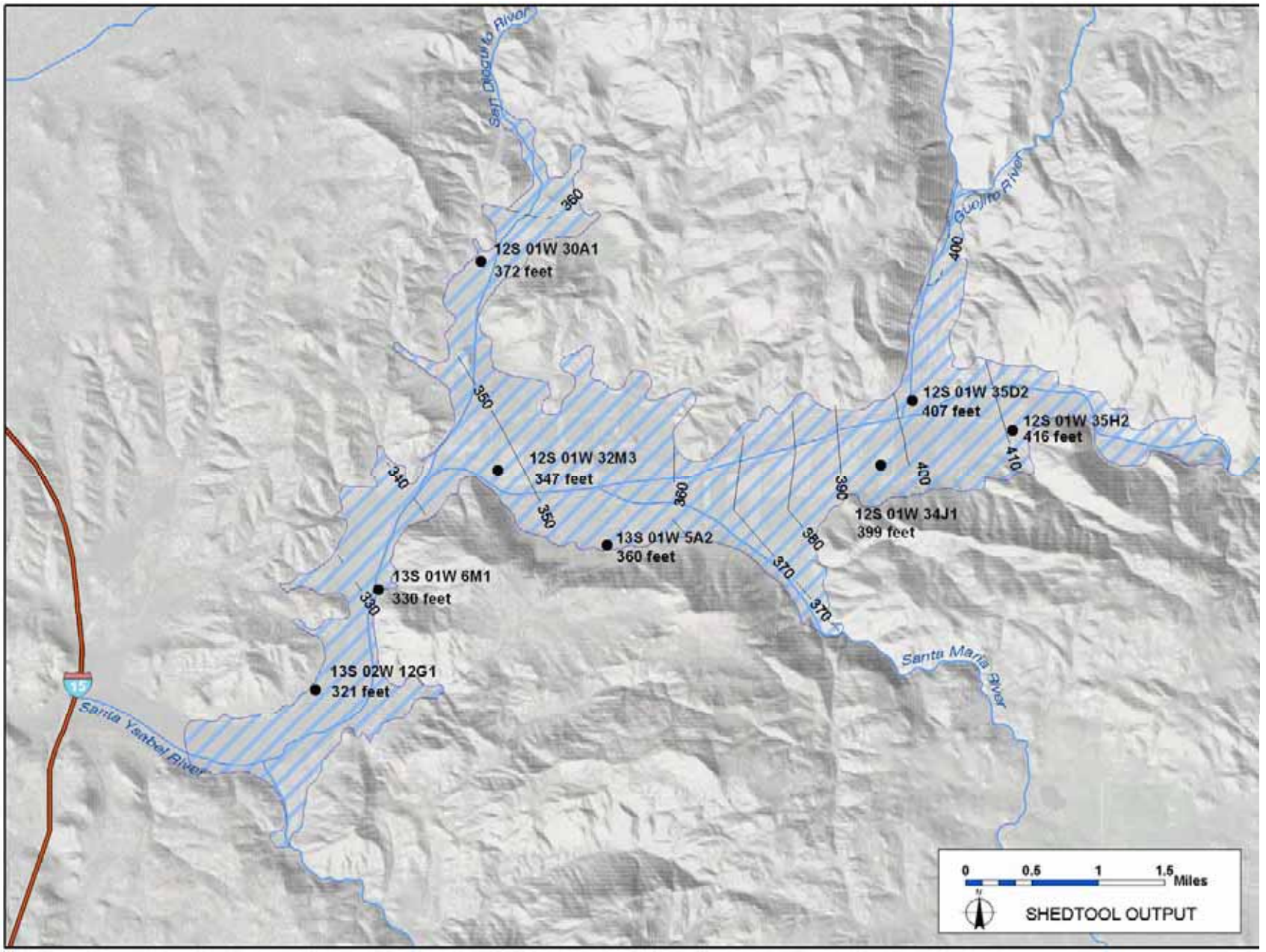

Figure 2-4 - Average Groundwater Elevations for select wells for the period between 2/7/95 and 2/7/96

Groundwater Elevation Hydrographs. Early records from wells indicate that groundwater was very near the land surface in the early 1900s and gradually began to decline in the 1940s and 1950s (Izbicki, 1983). Hydrographs for eight representative wells in the basin are shown on **Figure 2-5**, for the period between 1971 and 1995 for five wells; and between 1971 and 2000 for the three remaining wells. These hydrographs indicate that the groundwater elevations within the basin started to recover to baseline elevations after 1977 through the early 1980s. However, several of the monitoring wells then experienced another decline in the early 1990s potentially in response to a dry period or increased pumping. The hydrographs show that in general:

- Groundwater is shallow in the western area,
- Groundwater levels in the west are steady regardless of hydrologic year type,
- The drought in the late 1970s resulted in groundwater decline throughout the basin.
- Groundwater is relatively deep in the eastern area of the basin, and
- The eastern portion of the basin shows the greatest variability in groundwater levels in response to pumping and hydrologic year type.

Four wells, from the eastern, northern, central, and western regions of the basin are described in more detail below.

State well number 13S/02W-12G1 is the western-most well with groundwater elevation data shown in **Figure 2-5**. Groundwater elevations for this well extended to nearly 10 feet below the ground surface in the early 1970s. In 1977, the groundwater elevations reached a depth approximately 20 feet below the ground surface, but quickly rebounded to a very shallow depth, approximately 1.5 feet below the ground surface following a series of wet years. From 1980 to the present, the groundwater elevations at this well have fluctuated with the seasons, but have remained very near the ground surface. Spring groundwater elevations are typically one to three feet higher than during the fall season. This could indicate that the basin is replenished in the winter by rainfall and less intensive pumping from agricultural activities. This could also indicate that a prolonged dry season and extensive pumping during the summer reduces groundwater storage and lowers groundwater elevations.

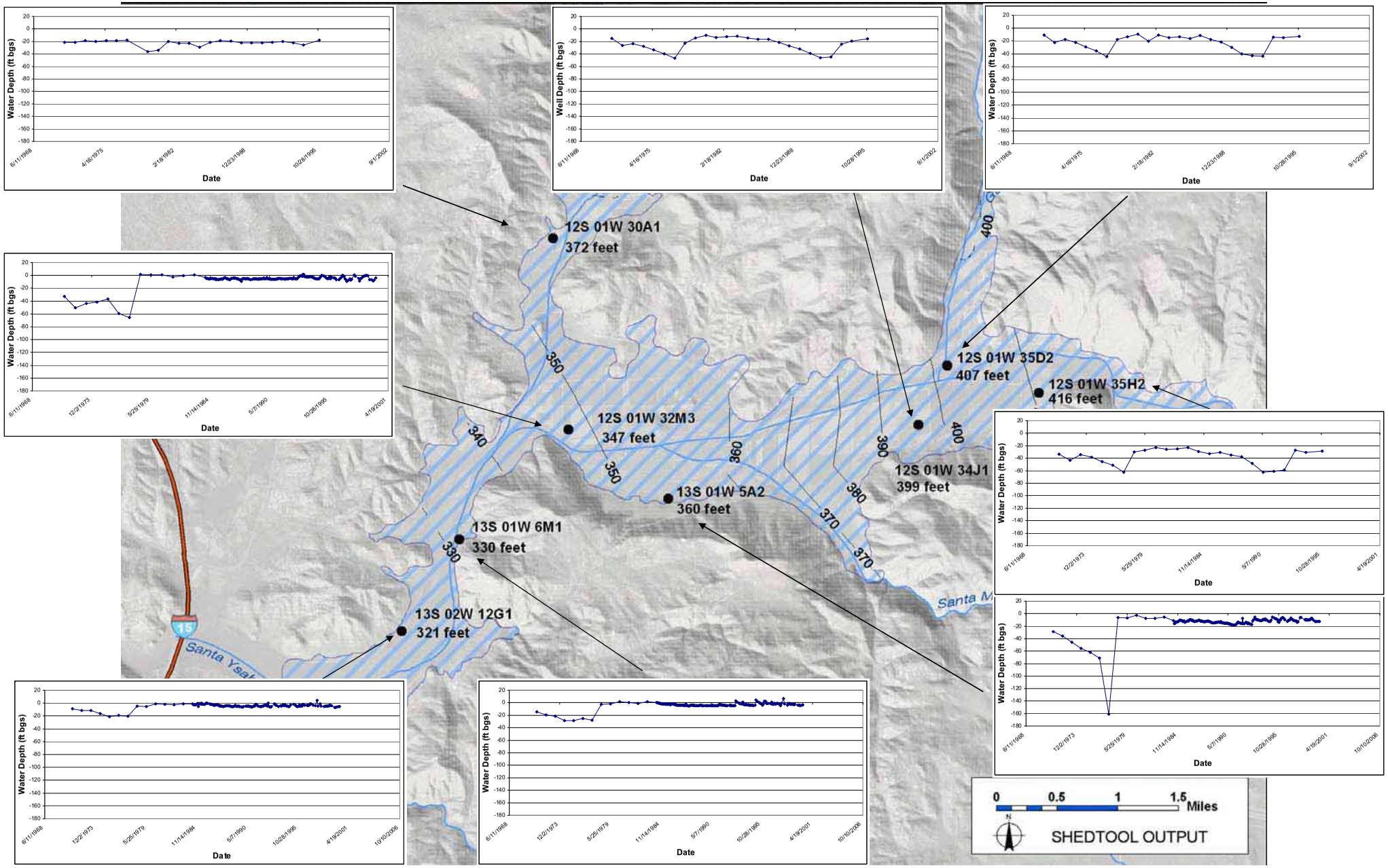

Figure 2-5 – San Pasqual Valley Groundwater Basin-Groundwater Elevation Hydrographs

[1]The 6/1/1977 data point for well 13S01W6M1 appears to be anomalous or inconsistent with data collected before and after 1978 and may be the result of an error in field data collection or achieving.

State well number 12S/01W-30A1 is located in the central area along Cloverdale Creek as shown in **Figure 2-5**. Groundwater elevations for this well extended to a depth of slightly greater than 20 feet below the ground surface for the most of the period of record, between 1971 and 1995. Unlike other wells in the basin, the groundwater elevations did not exhibit the same drop in 1977, the driest year on record, but instead showed the drop in groundwater elevation in 1979 (no measurement was recorded in 1978). The seasonal fluctuations in the groundwater elevations are unknown because monitoring reports are only available on an annual basis.

State well number 13S/01W-5A2 is located in the center of the basin shown in **Figure 2-5**. Groundwater elevations for this well experienced significant declines, which could be attributed to measurement error or the presence of confining units above the screened interval of the well. **Figure 2-2** illustrates a modified cross section from Greeley and Hansen (1991) courtesy of Ken Schmidt and Associates, passing through state well number 13S/01W-5A2. The geologic log for this well shows the potential for confining layers of clay with sand, and silt, which extend horizontally, but pinch out before intersecting the next easternmost and westernmost wells in the cross section. The well log report does not contain screen interval information, which prevents a conclusive statement that the well is confined. The decline of groundwater elevations in this well could be due to pumping, which would show a more dramatic decline when pumping in a confined aquifer, but would recover to pre-extraction conditions quickly after pumping ceases. The groundwater elevation in state well number 13S/01W-5A2 recovered to a shallower depth than the elevations experienced prior to 1977, which could indicate that this well was no longer used for pumping after 1977. Seasonal fluctuations in the groundwater elevations are unknown prior to June 1984, because monitoring reports are only available on an annual basis. The record of groundwater elevations after 1984 until approximately 1993 indicates that spring groundwater elevations were typically one to three feet higher than during the fall season. After 1993, there was a shift in the groundwater elevation baseline condition to a shallower depth, and the spring groundwater elevations were typically three to six feet higher than during the fall season.

State well number 12S01W35H2 is the eastern-most well with groundwater elevation data shown on **Figure 2-5**. Groundwater elevations for this well exhibit annual fluctuations which loosely reflect the annual precipitation record (CH2MHill, 2001[4]). The seasonal fluctuations in the groundwater elevations are unknown because monitoring reports are only available on an annual basis. The depth to groundwater during the period of record has fluctuated between 20 and 60 feet below ground surface (bgs).

2.2.3 Groundwater Quality

Groundwater quality data within the SPGMP area has been collected and reported for a period between 1950 to the present by various sources including the City of San Diego, DWR, SDCWA, USGS, and Metcalf and Eddy. This section provides a summary of the groundwater quality results and brief descriptions of constituents of interest.

The identified sources of potential contamination within the SPGMP area have been discussed and presented in the SDWMP (Weston Solutions, 2006) and include recreation, urban and industrial runoff, animal grazing, concentrated animal facilities, agriculture, wastewater discharges, septic systems, sewage spills, fires, and solid and hazardous waste. The potential water quality issues and concerns associated with the potential contamination include the following:

- Nutrients/eutrophication/oxygen depletion
- Silt and sediment
- Toxicity
- Pathogens in water
- Salinity and dissolved solids, and
- Litter/trash/debris.

Best management practice (BMPs) were developed in the SDWMP to address these potential water quality issues and concerns, (Weston Solutions, 2006).

[4] CH2MHill presented a figure with a histogram of annual precipitation, based upon the combined observed data for NOAA cooperative stations #42862 and #42863. The figure illustrated the annual precipitation for the period between 1931 and 1999 for the the Escondido Composite Station.

The DWR described groundwater quality in the San Pasqual Groundwater Basin as having a mixed character (DWR, 2003). Izbicki (1983) reported that groundwater in the eastern portion of the basin had a more dominant calcium bicarbonate character, which meant that the hardness of the water within this portion of the basin was high. Izbicki (1983) also found that the hardness of the water in the western portion of the basin was not as significant, but had a more dominant sodium chloride character with sulfate as the minor anion indicating the presence of more saline water. However, greater than 70% of the groundwater quality data used in this evaluation was collected after Izbicki's 1983 report and indicates that the hardness of the water in the western portion of the basin was greater than in the eastern portion of the basin. The concentration of salts in the western portion of the basin has been attributed to irrigation return water and imported water use which is high in salts and is prevalent in the hillside areas (SDCWA, 1983). The mixed character of groundwater in the basin was observed not only in anion and cation concentrations but also in other constituents. Groundwater quality from wells throughout the basin has been tabulated as shown in **Table 2-1**.

Table 2-1 presents a comparison of groundwater quality data with applicable California drinking water quality standards (both primary and secondary (aesthetic) maximum contaminant levels (MCLs)). Primary MCLs are derived from health-based criteria which include technologic and economic considerations. Primary MCLs are legally enforceable standards that apply to public water systems designed to protect the public health by limiting the levels of contaminants in drinking water. Secondary MCLs are designed to regulate contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. In California, public water systems are required to comply with the secondary MCLs.

Table 2-1 also presents the groundwater quality objectives of the Regional Water Quality Control Board (RWQCB) for the San Pasqual region within the San Dieguito Hydrologic Unit.

Both MCLs and RWQCB objective are used as a point of reference because groundwater has to be treated to meet MCLs before it can be used as a public drinking water supply. RWQCB objectives are of interest because groundwater in the basin cannot be degraded beyond these objectives by any activity at the surface, be it agriculture, urbanization, groundwater recharge, etc.

As shown on **Table 2-1** and described below, TDS and nitrate and other constituents of interest including Aluminum, iron, manganese, chloride, sulfate, cadmium, fluoride, selenium and zinc are present and have exceeded their respective MCLs in wells the basin.

The following description of background groundwater quality is based on known, available data used to populate the Data Management System (DMS) from 48 wells between 1950 and 2006. It is possible that additional unknown groundwater quality data exists from wells in the basin. The DMS can be used to query data and develop statistics and graphics for the constituents included in this evaluation.

Table 2-1 - Water Quality Summary from period of record (1950 to 2006)

Constituent	Primary MCL [8]	Secondary MCL [8]	RWQCB Groundwater Quality Objectives [3]	Units	Results						Exceeds Primary or Secondary MCL [1]	Exceeds RWQCB Groundwater Quality Objective [1]
					Western Portion of Basin			Eastern Portion of Basin				
					max	min	ave [7]	max	min	ave [7]		
General Mineral												
Calcium	--	--	--	mg/L	352	11	140	274	21	85	NA[2]	NA[2]
Chloride	--	250/500/600 [6]	400 [4]	mg/L	1,618	72	270	324	0.3	100	Yes	Yes
Fluoride	2	--	1.0 [4]	mg/L	2	< 0.03	0.5	62.1	< 0.03	0.6	Yes	Yes
Hardness (as CaCo3)	--	--	--	mg/L	1,390	50	500	997	127	347	NA[2]	NA[2]
Magnesium	--	--	--	mg/L	170	< 3	60	121	4.6	35	NA[2]	NA[2]
Nitrate (as NO3)	45	--	10 [4]	mg/L	174	<0.2	40	141.5	<0.2	20	Yes	Yes
Potassium	--	--	--	mg/L	28	0.604	3.5	12	<0.5	3	NA[2]	NA[2]
Sodium	--	--	--	mg/L	540	3.11	185	204	34	83	NA[2]	NA[2]
Sodium Percent	--	--	60 [5]	%	42%	19%	40%	27%	51%	33%	NA[2]	No
Sulfate	250	250/500/600 [6]	500 [4]	mg/L	1,063	3.9	310	519	10	100	Yes	Yes
Alkalinity (total)	--	--	--	mg/L	408	89.2	270	384	20	200	NA[2]	NA[2]
General Physical												
Total Dissolved Solids	500	500/1000/1500 [6]	1000 [4]	mg/L	3060	58	1300	4400	262	722	Yes	Yes
Inorganics												
Aluminum	1	0.2	--	mg/L	0.387	0.00205	0.0179	0.27	0.00136	0.0184	Yes	NA[2]
Antimony	0.006	--	--	mg/L	0.00587	0.00145	0.0039	<0.0005	<0.0005	<0.0005	No	NA[2]
Arsenic	0.01	--	--	mg/L	0.009	0.00102	0.0030	0.007	0.00075	0.0024	No	NA[2]
Barium	2	--	--	mg/L	0.135	0.00131	0.0576	0.294	0.00239	0.1280	No	NA[2]
Beryllium	0.004	--	--	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	No	NA[2]
Boron	--	--	0.75 [4]	mg/L	0.194	<0.0005	0.060	0.148	<0.0005	0.0400	NA[2]	No
Cadmium	0.005	--	--	mg/L	0.02	0.00115	0.004	0.003	0.00108	0.0030	Yes	NA[2]
Chromium	0.05	--	--	mg/L	0.0114	0.00101	0.004	0.0105	0.00101	0.0034	No	NA[2]
Copper	--	1	--	mg/L	0.05	0.00133	0.007	0.351	0.00101	0.0101	No	NA[2]
Iron	--	0.3	0.3 [4]	mg/L	35.6	0.0266	2.060	4	0.01	0.3000	Yes	Yes
Lead	0.015	--	--	mg/L	0.05	0.000561	0.021	0.05	0.000844	0.0180	No	NA[2]
Manganese	--	0.05	0.05 [4]	mg/L	2.7	0.0002	0.300	5.67	0.0002	0.2000	Yes	Yes
Mercury	0.002	--	--	mg/L	0.00037	0.0002	0.0	0.0004	0.0002	0.0002	No	NA[2]
Nickel	0.1	--	--	mg/L	0.0687	0.00056	0.005	0.0858	0.0005	0.0040	No	NA[2]
Perchlorate	--	--	--	mg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	NA[2]	NA[2]
Selenium	0.05	--	--	mg/L	0.012	0.001	0.0060	0.057	0.00137	0.0120	Yes	NA[2]
Silver	--	0.1	--	mg/L	0.01	0.00075	0.0092	0.01	0.01	0.0100	No	NA[2]
Thallium	0.002	--	--	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	No	NA[2]
Vanadium	--	--	--	mg/L	0.0253	0.00506	0.0126	0.0709	0.00301	0.0115	NA[2]	NA[2]
Zinc	--	5.0	--	mg/L	0.303	0.00201	0.0452	5.02	0.0023	0.0960	Yes	NA[2]
Organics												
Volatile Organic Compounds (Drinking Water)	-- [9]	-- [9]	-- [9]	mg/L	0.00284	<0.00001	-- [9]	0.00456	<0.00001	-- [9]	-- [9]	NA[2]

mg/L = Milligrams per Liter

-- = (Not Applicable)

[1] Indicates that at least one or more reported concentration exceeds the primary or secondary MCL or RWQCB groundwater quality objective.

[2] NA = (Not Available). To date MCLs and groundwater quality objectives have not been identified for this respective constituent.

[3] RWQCB is an acronym for the Regional Water Quality Control Board. These values represent the RWQCB groundwater quality objectives for the San Pasqual Groundwater Basin.

[4] Detailed salt balance studies are recommended for this area to determine limiting mineral concentration levels for discharge. On the basis on existing data, the tabulated objectives would probably be maintained in most areas. Upon completion of the salt balance studies, significant water quality objective revisions may be necessary. In the interim period of time, projects of ground water recharge with water quality inferior to the tabulated numerical values may be permitted following individual review and approval by the Regional Board if such projects do not degrade existing ground water quality to the aquifers affected by the recharge.

[5] Na is measured as the % Na = (Na / (Na + Ca + Mg + K)) * 100%, where Na, Ca, Mg, and K are expressed in milliequivalent per liter (meq/L)

[6] Secondary MCLs limits presented in order of Recommended/Upper/Short Term.

[7] Average was calculated only using detections recorded above the reporting limit. Therefore, non detect or less than the detection limit values were not factored into the average calculation.

[8] The lowest respective U.S. Environmental Protection Agency or California Department of Health Services constituent MCL value is presented.

[9] As multiple constituents are represented as VOCs, MCLs and average concentrations are not provided.

Based on a review of readily available data, it appears that TDS and nitrate are the two primary constituents of concern within the basin. The most recent concentrations of TDS in the southwestern-most well (state well number 13S/02W-11R1) containing water quality information is 730 mg/L, which indicates that groundwater is leaving the basin with TDS exceeding the recommended secondary MCL of 500 mg/L. Although the most recent concentration of nitrate in the same well is relatively low, average nitrate concentrations in the western SPGMP area are 40 mg/L with a maximum concentration reported at 174 mg/L. This indicates that the nitrate concentrations average just below the MCL of 45 mg/L, but exceed the MCL in some areas.

Total Dissolved Solids: The recommended secondary MCL for TDS is 500 mg/L. TDS concentrations often exceed the recommended MCL throughout the basin and on average are highest in the western, central portions of the basin. As shown on **Table 2-1**, the RWQCB objective for TDS in the San Pasqual Valley is 1000 mg/L because the predominant use of groundwater in the basin is for agricultural irrigation and not for public water supply. As shown in **Table 2-1**, TDS concentrations average 1,254 and 722 mg/L in the western and eastern portion of the basin, respectively. TDS concentrations range between approximately 58 and 4,400 mg/L within the entire basin. TDS average values exceed the secondary MCL and therefore may be a limiting factor for various water uses. **Figure 2-6** illustrates the concentrations of TDS over the time for wells within the western and eastern portions of the basin. The results from the time series data presented indicates that the concentration of TDS in the western portion of the basin has generally increased since 1950 and the TDS concentration in the eastern portion of the basin has shown little significant changes overall. However, in recent years more frequent measurements have shown that TDS has varied significantly in the west-central portion of the basin (well 5669 (12S/01W-32G1)). The results from well 5662 (12S/01W-30R1), located farther west than well 5669, shows a decreasing trend in TDS the most recent years.

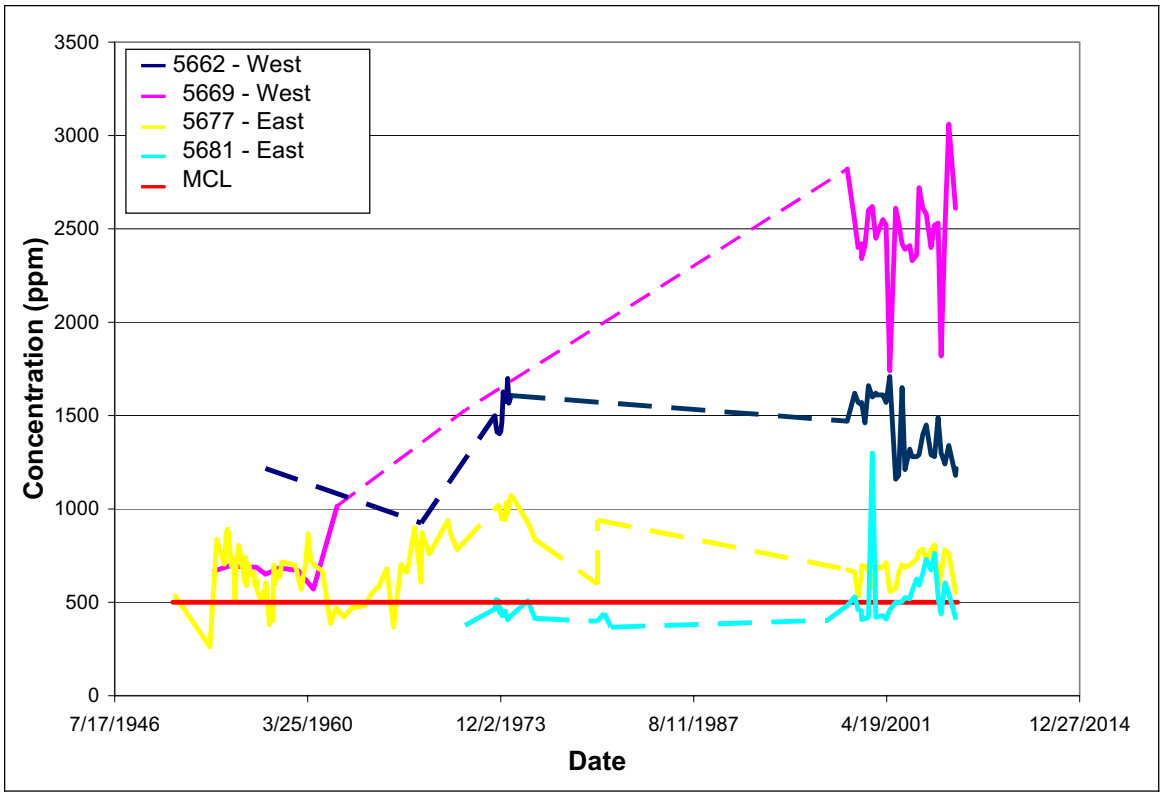

Figure 2-6 - The concentration of total dissolved solids (TDS) from four wells within the eastern and western portions of the basin and the associated Secondary Maximum Contaminant Level (MCL).

Figure 2-7 shows the most recent TDS concentrations measured from wells with water quality measurements illustrating that the wells within the east-central portion of the basin have the highest concentrations, ranging between 417 and 2,610 mg/L or ppm.

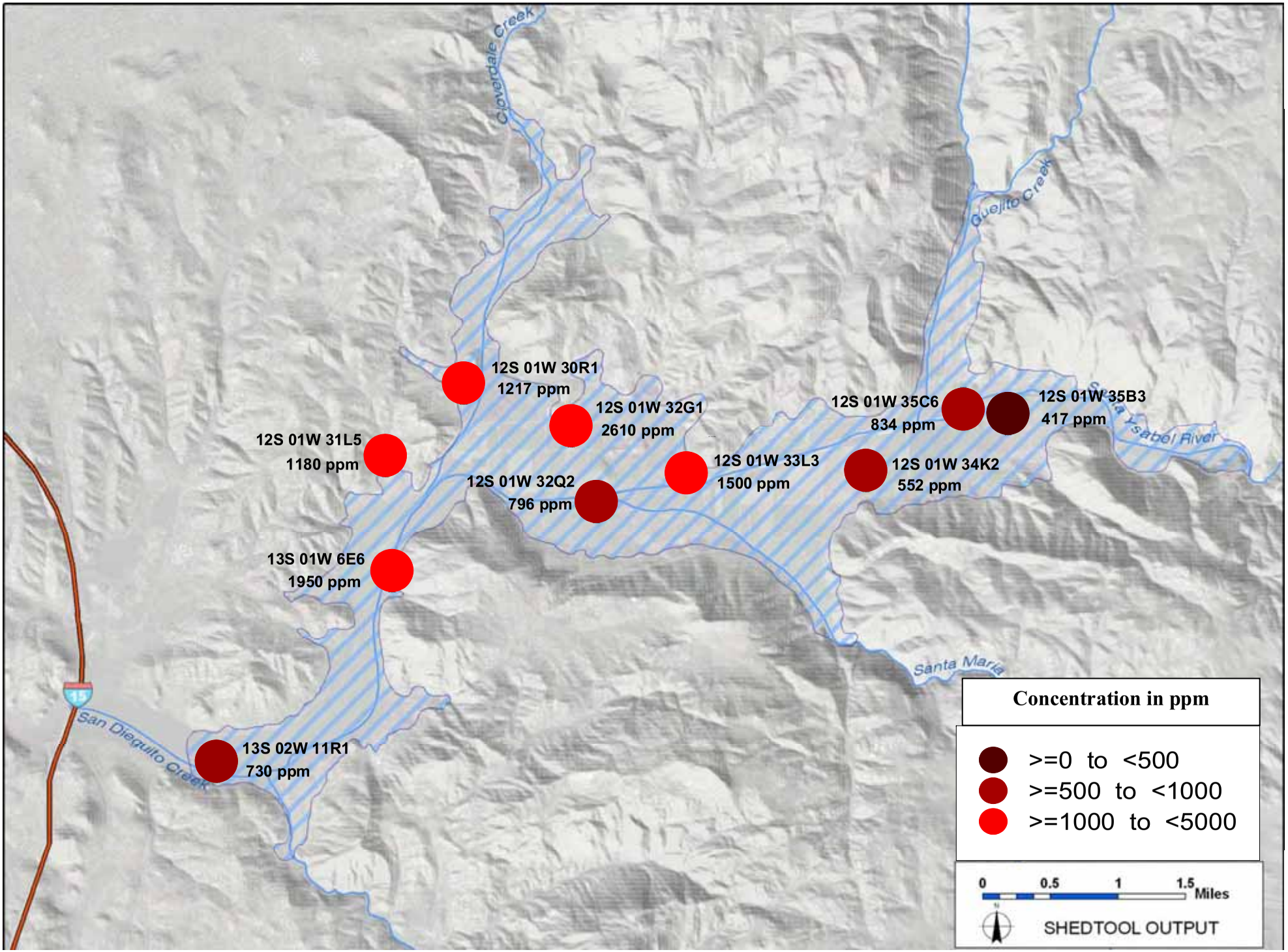

Figure 2-7 - Most recent TDS concentrations measured between 2001 and 2006.

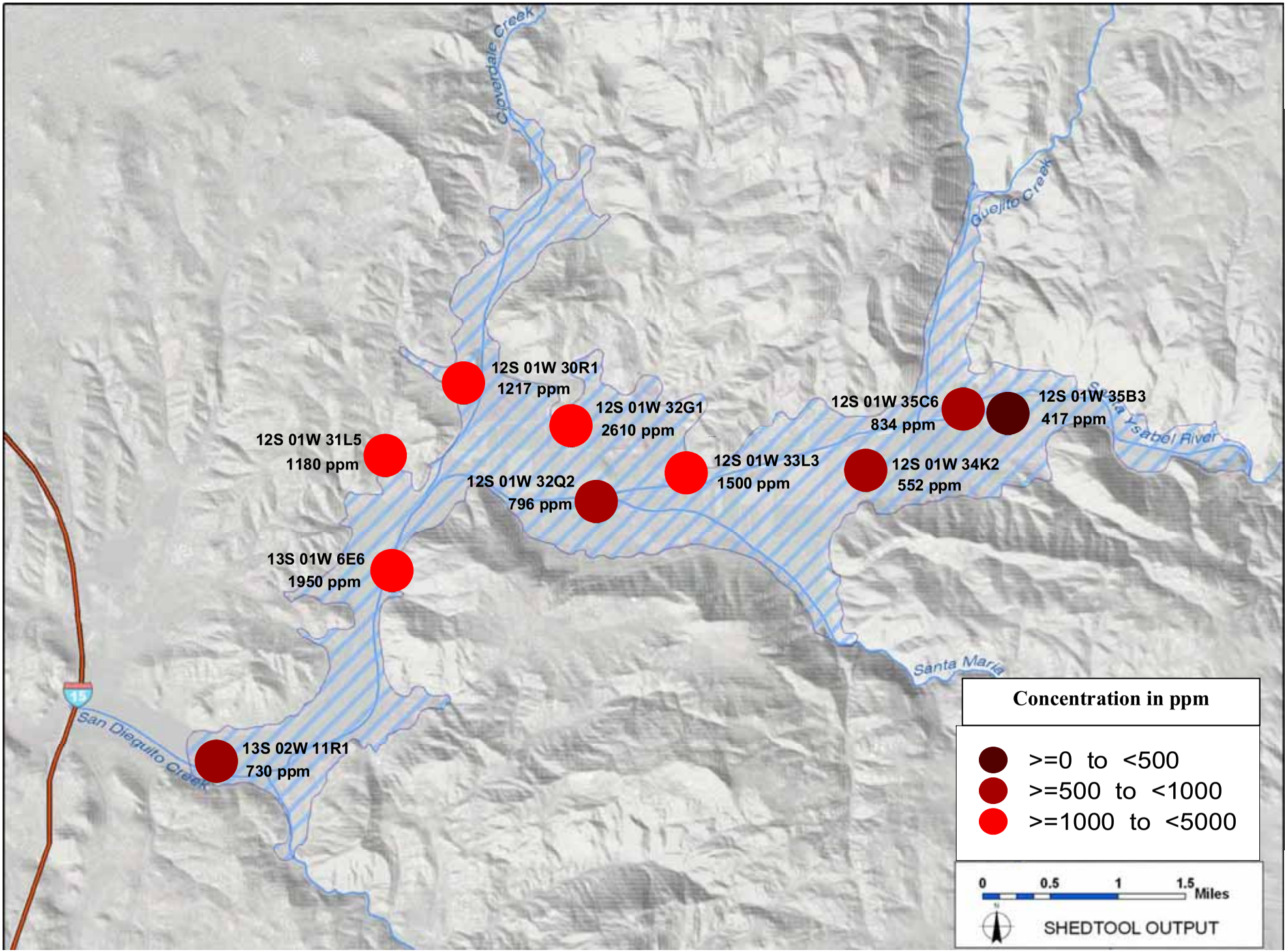

Figure 2-7 - Most recent TDS concentrations measured between 2001 and 2006.

Nitrate: The primary MCL for nitrate (as NO_3) is 45 mg/L. As shown in **Table 2-1** and illustrated on **Figure 2-8**, nitrate concentrations average just less than 45 mg/L in both the western and eastern portions of the basin. Nitrate concentrations have been reported as high as 174 mg/L from one well located in the west-central region of the basin (within the Section 12S/01W-32). Prior to 1995, there were too few wells being monitored to assess the basin-wide water quality for nitrate. However, a better collection of records in 1968 and in 1970 indicate that the highest levels of nitrate within the basin were located within the central-western portion of the basin. The results from the time series data presented in **Figure 2-9** indicates that the concentration of nitrate in the western portion of the basin has generally increased over the period of record and the nitrate concentration in the eastern portion of the basin has shown significant fluctuations. However, in recent years more frequent measurements have shown that nitrate has varied significantly in well 5669 (12S01W32G1), located in the west central portion of the basin. The results from well 5662 (12S01W30R1), located farther west than well 5669 shows a significant increase from the early 1970s, but the most recent measurement showed a significant decrease in the nitrate concentration. Future monitoring at this well may reveal if this sharp decrease in the nitrate concentration is an anomaly. The wells in the eastern portion of the basin have shown fluctuations in the nitrate concentration for the period of record.

The variability in nitrate concentrations over the period of record is potentially due to the slow migration of nitrate through the vadose zone during dry periods, and the fast migration of nitrates into the groundwater during wet periods when the groundwater level rises.

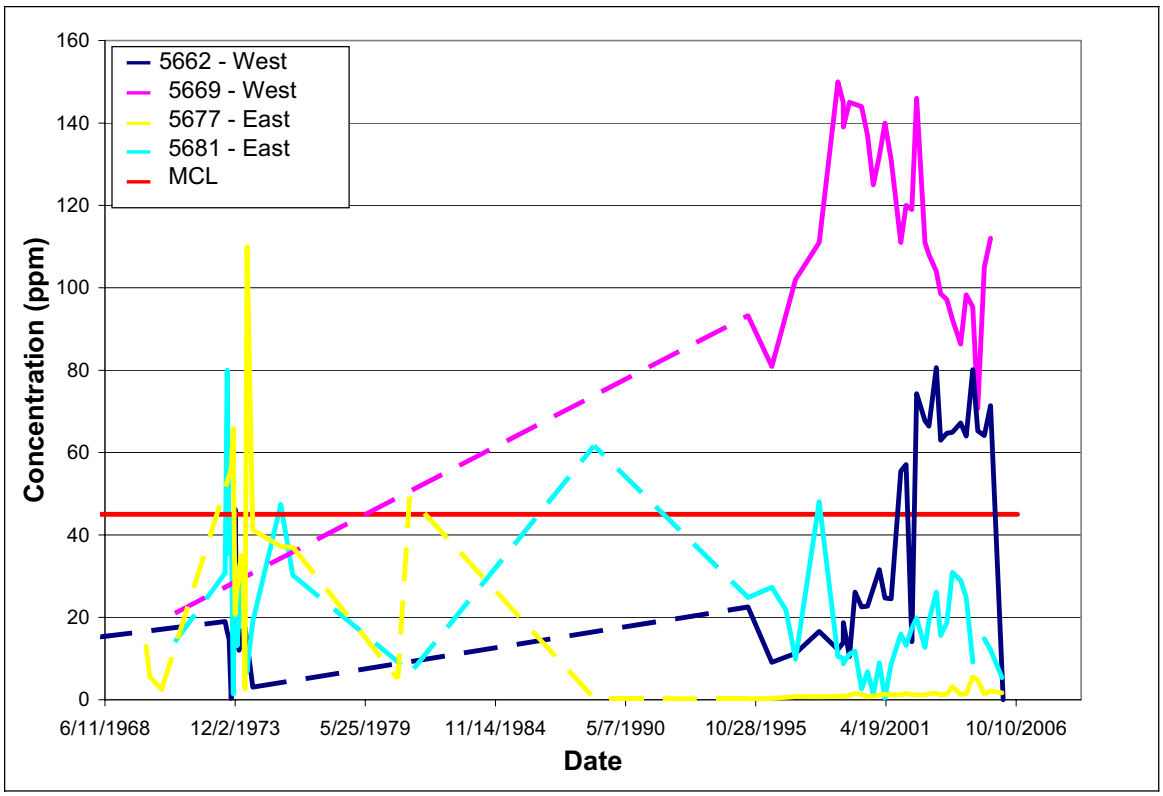

Figure 2-8 - The concentration of nitrate from four wells within the eastern and western portions of the basin and the associated Maximum Contaminant Level (MCL).

Figure 2-9 shows the most recent nitrate concentrations measured from wells with water quality measurements in the last three years, which indicates that the highest nitrate levels have been reported in the central and western portions of the basin. The potential sources of nitrate contamination are from agricultural use of fertilizers, urban and industrial runoff, wastewater discharges, septic system, and sewer overflows (Weston Solutions, 2006).

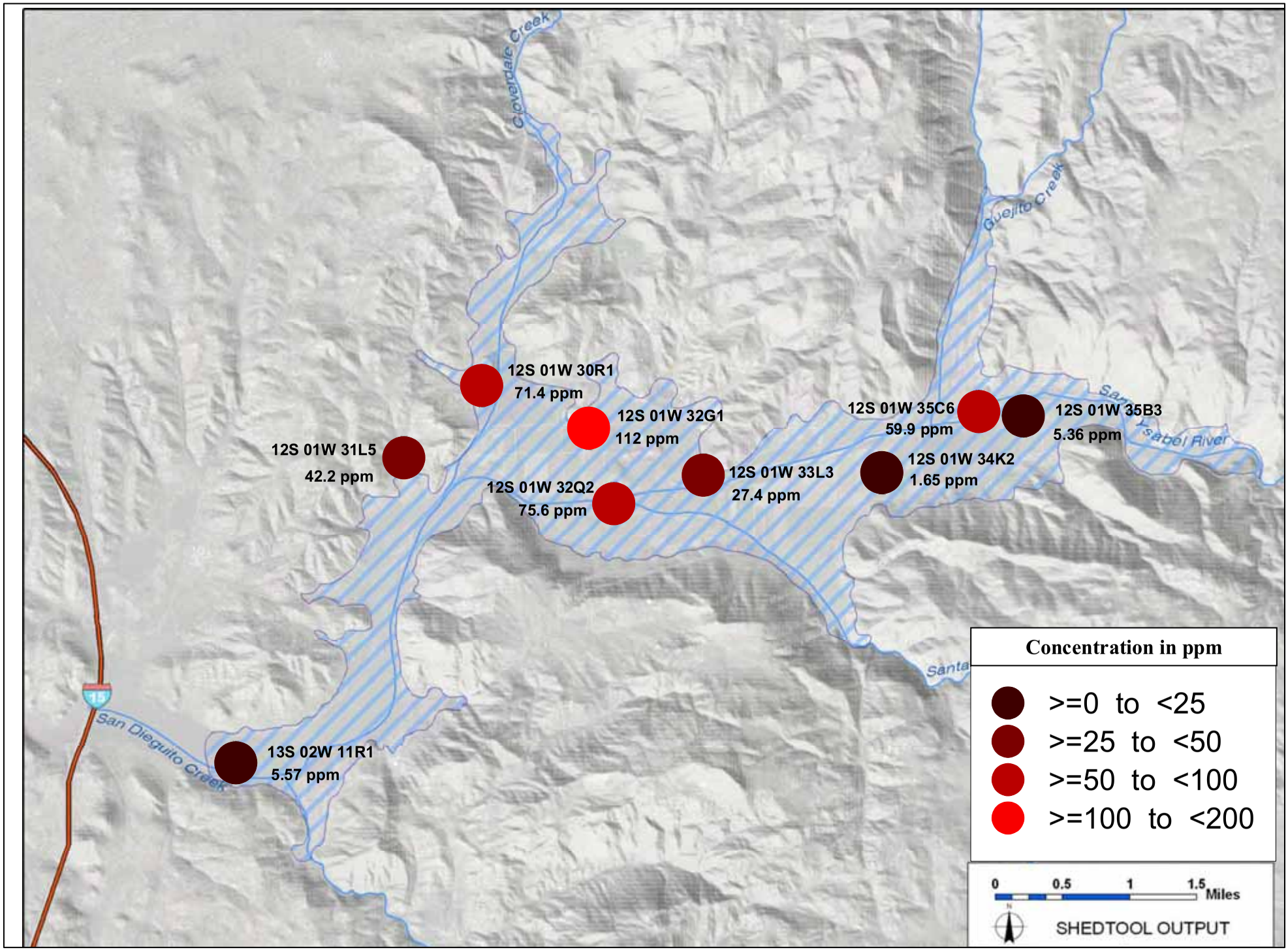

Figure 2-9 - Most recent nitrate concentrations measured between 2003 and 2006.

Iron and Manganese: The secondary MCLs for iron and manganese are 0.3 and 0.05 mg/L, respectively. Iron and manganese concentrations in groundwater often exceed these MCLs. The average concentrations for iron within the western and eastern portion of the basin are approximately 2.06 and 0.304 mg/L, respectively. For manganese, the average concentrations within the western and eastern portion of the basin are approximately 0.292 and 0.151 mg/L, respectively.

Arsenic: The primary MCL for arsenic is 0.010 mg/L, effective as of January 2006. Arsenic is present in groundwater at several locations, but based on available data concentrations have approached but not exceeded the MCL. The maximum concentrations for arsenic within the western and eastern portion of the basin are approximately 0.009 and 0.007 mg/L, respectively.

Chloride: The average chloride concentrations in the western portion of the basin exceed the recommended[5] secondary MCL of 250 mg/L, while the maximum chloride concentrations in the western portion of the basin exceed the upper[6] and short term[7] secondary MCLs of 500 and 600 mg/L, respectively. Chloride is less prevalent in the eastern portion of the basin. The maximum chloride concentration within the eastern portion of the basin exceeds the recommended MCL at 324 mg/L, but the average chloride concentrations are below the MCL at 123 mg/L.

Sulfate: The average sulfate concentrations in the western portion of the basin exceed the secondary MCL of 250 mg/L, while the maximum sulfate concentrations in the western portion of the basin exceed the short term MCL. Sulfate is less prevalent in the eastern portion of the basin. The maximum sulfate concentration within the eastern portion of the basin exceeds the upper secondary MCL at 519 mg/L, but the average sulfate concentrations are acceptable at 122 mg/L.

Selenium and Zinc: The maximum selenium concentration of 0.057 mg/L, which exceeds the primary MCL, is found in the eastern portion of the San Pasqual basin. The maximum zinc concentration of 5.02 mg/L, which exceeds the secondary MCL, is found in the eastern portion of the San Pasqual basin. The average concentrations for both

[5] Constituent concentrations lower than the recommended contaminant levels MCL are desirable for a higher degree of consumer acceptance. (Excerpt from Title 22 California Code of Regulations)
[6] Constituent concentrations ranging to the upper contaminant level MCL are acceptable if it is neither reasonable nor feasible to provide more suitable waters. (Excerpt from Title 22 California Code of Regulations)
[7] Constituent concentrations ranging to the short term contaminant level MCL are acceptable only for existing systems on a temporary basis pending construction of treatment facilities or development of acceptable new water sources (Excerpt from Title 22 California Code of Regulations)

selenium and zinc are below MCLs of 0.05 mg/L and 5 mg/L respectively, in both the eastern and western portions of the basin.

Boron: The maximum boron concentration of 0.194 mg/L is found in the western portion of the San Pasqual basin, and is below the RWQCB Groundwater Quality Objective. There is no primary or secondary MCL for boron. The average concentrations of boron 0.04 mg/L in the east and 0.06 mg/L in the west are below the RWQCB Groundwater Quality Objective.

Volatile Organics and Semivolatile Organics: Volatile and semivolatile organics have been monitored in approximately ten wells within the basin between 1999 and present day. The results from these monitoring efforts have shown that in general these constituents were reported below the detection limit. However a few constituents, including bis-(2-ethylhexyl) phthalate, bromochloromethane, chloroform, and perchlorate have been measured above their detection limits several times within the western portion of the basin. Within the eastern portion of the basin, bis-(2-ethylhexyl) phthalate was the only constituent reported above the detection limit more than once.

In summary, this section has identified 11 compounds that exceed Secondary or Primary MCLs or RWQCB Groundwater Quality Objectives, based on a review of historic groundwater quality data collected by the City of San Diego. These compounds include:

- Chloride
- Fluoride
- Nitrate
- Cadmium
- Iron
- Manganese
- Suflate
- Total Dissolved Solids
- Aluminum
- Selenium
- Zinc

The monitoring plan presented in Section 3 is designed to identify the source of these constituents in the groundwater basin, so that future groundwater quality improvement projects can be designed to remove or reduce the concentration of these compounds below the water quality objectives.

2.3 SURFACE WATER CONDITIONS

Surface water occurs as streamflow in the San Pasqual hydrologic subarea. The Santa Ysabel, Guejito, Santa Maria, and Cloverdale Creeks flow through the basin and leave the hydrologic subarea through the San Dieguito River at San Pasqual Narrows (Izbicki, 1983) as shown on **Figure 2-10**. Under natural conditions, stream flow in San Pasqual Valley is intermittent; however, irrigation runoff and waste water discharge cause protracted flow in some streams. For example, much of the flow in Santa Maria Creek comes from the effluent from the Santa Maria Wastewater Treatment Plant (WWTP), which is discharged on spray fields upstream in the Romona hydrologic subarea (DWR, 1993).

The Santa Ysabel, Guejito, and Santa Maria Creek stream gauge stations are shown on **Figure 2-10**. The average discharge into the basin from each of the creeks, reported by Izbicki (1983), was used to estimate the average percentage of flow that enters the basin from each of the creeks annually and is illustrated in **Figure 2-10**. The rough estimates of the annual input to the basin flow system do not include flow from Cloverdale Creek because it is an ungauged creek and there is no record of flow from this creek.

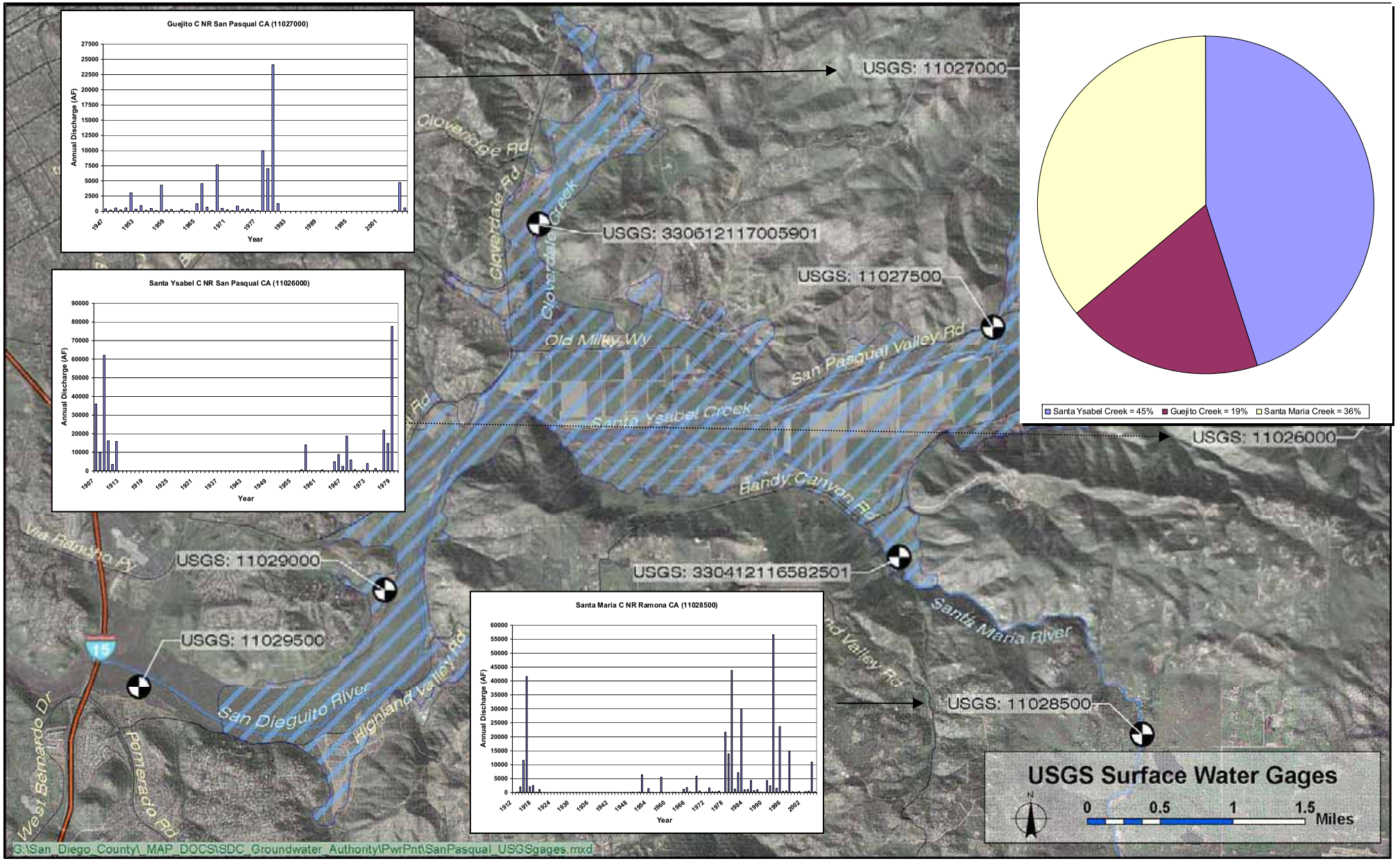

Figure 2-10 - Annual Discharge from USGS Gauging Stations.

2.3.1 Creeks and Rivers: Characteristics and Water Quality

This section describes the general characteristics of the creeks and rivers that flow through the basin in addition to surface water quality data. The creeks and rivers are influenced by surface reservoirs upstream and downstream of the basin. The locations of the major rivers and streams within the basin are illustrated on **Figure 2-10**.

2.3.1.1 Santa Ysabel Creek

Santa Ysabel is the largest creek in the San Pasqual hydrologic subarea and drains approximately 128 square miles of land, much of which is undeveloped and is within the Cleveland National Forest and several Indian reservations. Sutherland Reservoir is the principal reservoir upstream of the basin, which has been used to regulate streamflow in Santa Ysabel Creek since 1954 and has a capacity of 29,680 acre-feet. Previous reports indicate that the creek typically flows 102 days[8] during the year (Izbicki, 1983), at the location of USGS stream gauge: 11026000 shown on **Figure 2-10**. Once this flow reaches the San Pasqual Valley floor, some or all of the flow percolates beneath the steambed and into the underlying groundwater aquifer. The average annual flow for a discontinuous record between 1905 and 1980 has been estimated to be approximately 5,000 acre-feet (Izbicki, 1983). Total annual flow entering the basin on Santa Ysabel Creek is shown on **Figure 2-10**. The average annual discharge from Santa Ysabel Creek accounts for approximately 45% of the inflow into the basin on an annual basis as illustrated on **Figure 2-10**.

There is very little information available about the water quality of the Santa Ysabel Creek. Two water quality sampling surveys were conducted by the USGS, in 1981 and 1982, and showed that the Santa Ysabel Creek had good water quality with all measured constituents below the MCLs. The water quality of the Santa Ysabel Creek is a function of the water quality at Sutherland Reservoir from which the creek water is released. The water quality of the Sutherland Reservoir was monitored between 1996 and 2000 (City of San Diego). The summary of results from this period of time indicates that a few constituents exceeded primary or secondary MCLs at some point during the survey period. These constituents include: TDS (maximum = 1,150 mg/L), turbidity (average = 4.4 NTU), color (average = 31), aluminum (maximum = 1.49 mg/L), manganese (average = 0.056 mg/L), and methyl tert-butyl ether (MTBE) (maximum = 0.0171 μg/l). Surface

[8] The median number of days with flow greater than 0.1 ft^3/s as reported by Izbicki (1983).

water sampling was performed by DWR in March of 1991 (DWR, 1993). Sampling locations and a summary of results are included in **Appendix E**.

2.3.1.2 Guejito Creek

Guejito Creek drains an undeveloped watershed approximately 22 square miles in size and typically flows 148 days[9] per year (Izbicki, 1983). Once this flow reaches the San Pasqual Valley floor, some or all of the flow percolates beneath the steambed and into the underlying groundwater aquifer. Total annual flow entering the basin on Guejito Creek at USGS steam guage 11027000 is shown on **Figure 2-10**. The streamflow in this creek is unregulated except for several small diversions. The median annual discharge from this ephemeral creek is 290 acre-feet, which is the second largest annual median discharge of the three gauges creeks in the basin. The average annual flow from the creek has been reported for a period between 1946 and 1981 to be approximately 2,110 acre-feet and accounts for approximately 19% of the inflow into the basin on an annual basis. Monitoring of this stream gauge ceased in 1981, but resumed in 2004. The estimated average annual flow from 2005 and 2006 is approximately 1,860 acre-feet.

Two USGS surveys were conducted in 1981 and 1982 to measure the water quality of the Guejito Creek. The surveys revealed good water quality within the creek, with all measured constituents below MCLs. However, this limited amount of data available from this creek makes it difficult to estimate current conditions. Surface water sampling was performed by DWR in March of 1991 (DWR, 1993). Sampling locations and a summary of results are included in **Appendix E**.

2.3.1.3 Santa Maria Creek

The Santa Maria Creek drains approximately 58 mi^2 and is unregulated except for a few small diversions. Izbicki (1983) estimated that the Santa Maria Creek flows 53 days[10] per year. Once this flow reaches the San Pasqual Valley floor, some or all of the flow percolates beneath the steambed and into the underlying groundwater aquifer. Total annual flow entering the basin on Guejito Creek at USGS steam guage 11027000 is shown on **Figure 2-10**. Flows from the Santa Maria Creek are dampened by a watershed farther upstream and exhibit a mean annual discharge of 145 acre-feet, which is

[9] The median number of days with flow greater than 0.1 ft^3/s is as reported by Izbicki (1983).
[10] The median number of days with flow greater than 0.1 ft^3/s as reported by Izbicki (1983).

considerably less than expected due to the size of the watershed and average annual precipitation within the subarea of 11 to 15 inches per year (Izbicki, 1983; DWR, 2003). In many years the creek does not flow at all. The average annual flow was estimated as 4,050 acre-feet and accounts for approximately 36% of the inflow into the basin on an annual basis (Izbicki, 1983).

One USGS survey was conducted in 1982 to measure the water quality of the Santa Maria Creek. The survey revealed a TDS concentration of 714 mg/L and specific conductance of 1,190 μS/cm. Both exceeded the MCL of 500 mg/L and 900μS/cm respectively. Estimation of current water quality conditions is difficult due to the absence of data. Surface water sampling was performed by DWR in March of 1991 (DWR, 1993). Sampling locations and a summary of results are included in **Appendix E**.

2.3.1.4 Cloverdale Creek

Cloverdale Creek drains an 18 mi^2 watershed by unregulated and ungauged streamflow and has turned into a perennial stream due to irrigation return water from avocado groves. No average annual flow estimates are available for this creek; therefore the inflows from this creek into the basin can not be quantified.

One USGS survey was conducted in 1982 to measure the water quality of the Cloverdale Creek. The survey revealed a TDS concentration of 945 mg/L, and a specific conductance of 1,590 μS/cm, which exceeded the respective MCLs for these constituents. Estimation of current water quality is difficult because of the lack of recent data. Surface water sampling was performed by DWR in March of 1991 (DWR, 1993). Sampling locations and a summary of results are included in **Appendix E**.

2.3.1.5 San Dieguito River

The San Dieguito River begins at the confluence of Santa Ysabel Creek and Santa Maria Creek. The San Dieguito River drains the entire San Pasqual basin and flows out of the basin into Lake Hodges. Historical records of flow from the basin were recorded at USGS gauge stations 11029000 and 11029500, which are no longer actively monitored today. The annual discharge was measured at USGS station 11029500 between 1912 and 1915. The approximate annual discharge through the gauge station increased over the period from 2,049 acre-feet (1912), 2,043 acre-feet (1913), 21,408 acre-feet (1914), to

70,980 acre-feet (1915). Monthly storage in the Lake Hodges Reservoir is recorded by San Diego County.

Two USGS surveys were conducted in 1981 and 1982 to measure the water quality of the San Dieguito River. The survey revealed a TDS concentration of 945 mg/L, and specific conductance of 1,590 μS/cm, which exceeded the respective MCLs for these constituents. The present day water quality is difficult to estimate because no current data exists. Surface water sampling was performed by DWR in March of 1991 (DWR, 1993). Sampling locations and a summary of results are included in **Appendix E**.

2.4 WATER AND LAND USE

In 1997, 90 percent of the potable water being delivered to the San Diego region was imported from the Colorado River and northern California (Metcalf and Eddy, 1997). However, the City of San Diego has made groundwater available in the San Pasqual Valley to leaseholders for the cost of developing the wells plus the cost of pumping the water, which typically is less than the cost of imported water (City of San Diego Planning Department, 2006). It is believed that the primary water supply within the basin by leaseholders is from groundwater.

The USGS and DWR estimated net groundwater extraction for the period between 1970 and 2000 to range between 6,000 AF/yr and 6,300 AF/yr. The use of surface water and recycled water within the basin is not estimated. **Figure 2-11** is a land use map based upon the 1998 data for the region produced by DWR.[11] Although a more recent land use map for the basin is available through the City of San Diego, the DWR map was used because it included specific information about the crop types, which was then used to estimate the water use. The water use was estimated using the total acreage of each crop type and the evapotranspiration of applied water (ETAW) values for the different crops in the DWR Detailed Analysis Unit (DAU) for Temecula, CA. Temecula was the closest town in the South Coast region that had ETAW values for crops in the DAU and was selected to best represent the conditions in the San Pasqual basin. The water use estimated using the ETAW values and crop acreage was approximately 8,800 AF/yr.[12]

[11] The land use map shows a 500 ft buffer zone around the boundary of the basin, in order to capture all of the area potentially affected by the modification to the basin boundary. However, the estimated water use above only takes into account the region within the San Pasqual boundary.

[12] The estimated water use is based upon DWR calculated evapotranspiration of applied water (ETAW) factors for different crops and estimates of urban water use from an unpublished MWH report (2005). The estimated water use demand could potentially underestimate the true use due to the modification to the basin boundary.

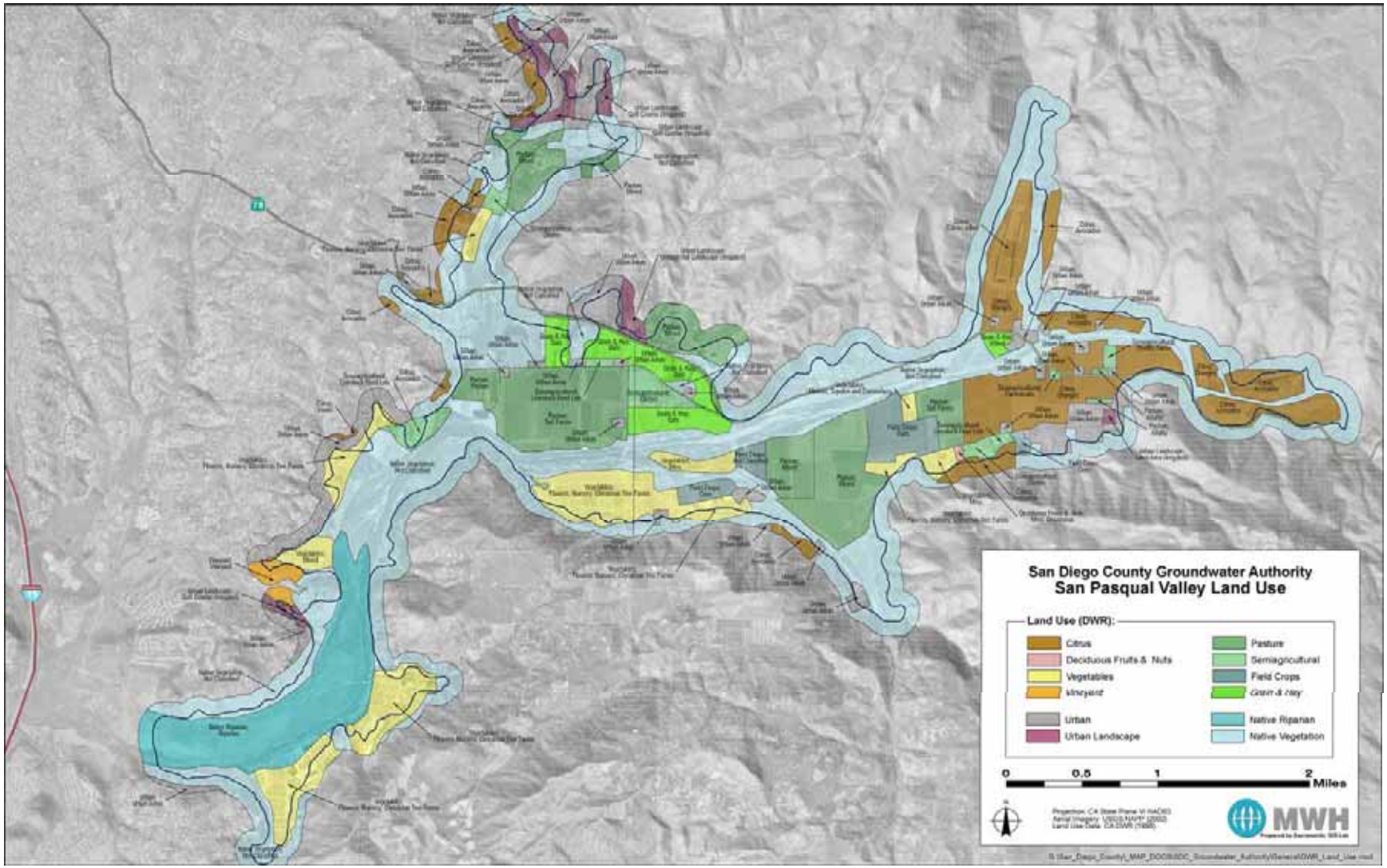

Figure 2-11 - San Pasqual Valley Land Use Map (modified from DWR, 1998)

2.4.1 Land Use

The land use within the San Pasqual Valley is illustrated in **Figure 2-11** and listed on **Table 2-2**. Native vegetation accounts for almost half of the land within the basin. Land classified as pasture accounts for approximately 17 percent of the land, while land classified as citrus for producing citrus fruits accounts for approximately 13 percent of the land. Vegetables, native riparian vegetation, and urban area account for the next largest percentages of land, ranging between 10 percent and 10 percent area of the land. The remainder of the land is split among field crops, grains and hay, semi-agricultural land (includes livestock feed lots, dairies, and farmsteads), urban landscape, and vineyards.

2.4.2 Water Budget

The following section presents the inflows and outflows from the San Pasqual basin. **Table 2-3** provides a summary of the water budget components described in this section with the source information referenced in the footnotes. The estimates summarized in this section represent best available information at the time this GMP was published. The City of San Diego recognizes that some of these estimates are old and actual values have likely changed due to changes in cropping and irrigation practices. San Diego will support efforts to update the water budget as the GMP and groundwater improvement projects are implemented in the basin.

Table 2-2 - DWR Land Use Subclasses and Acreage

DWR Subclass	Acres
Avocados	198
Citrus- other	26
Oranges	409
Misc. Deciduous	3
Corn	131
Not Classified	23
Oats	182
Wheat	17
Riparian	481
Not Classified	1716
Alfalfa	7
Mixed	443
Pasture	40
Turf Farms	347
Dairies	80
Farmsteads	3
Livestock Feed Lots	37
Poultry Farms	9
Urban Areas	238
Golf Course (Irrigated)	43
Lawn Area (Irrigated)	5
Ornamental Landscape (Irrigated)	4
Flowers, Nursery, Christmas Tree Farms	394
Melons, Squash and Cucumbers	11
Misc.	54
Mixed	37
Vineyard	5

Table 2-3 - Estimated Water Budget Components

Inflows	**Average (AF/yr)**	**Source/ Comment**	**Period of Estimate (Years)**
Streambed Infiltration	3,000	A	1947-1990
Agriculture Return Flows (from groundwater)	4,300	A	-
Agriculture Return Flows (from imported water)	1,910	B	2000
Deep Percolation of Precipitation	932	B	1931-1999
Subsurface Inflow from Tributaries	1,200	A	-
Total Inflows	11,342		
Outflows			
Groundwater Pumping	8,800	C	1998
Evapotranspiration	2,057	B	1931-1999
Underflow Out to Lake Hodges	430	B	-
Total Outflows	11,287		
Change in storage	55		

Sources:
A. Greeley and Hansen, 1993
B. CH2MHill, 2001
C. MWH, 2007

2.4.2.1.1 Inputs

The primary inflow to the basin comes from creek recharge. The four creeks which provide recharge to the basin are ephemeral and include the Santa Ysabel Creek, Guejito Creek, Santa Maria Creek and Cloverdale Creek, which meet at the confluences of the San Dieguito River. The creeks flow during storm events which primarily occur in this area between November and April. In previous investigations, the recharge from creeks was estimated to account for more than 80% of the total recharge to the basin each year (CH2MHill, 2001). Estimates of the annual recharge from streamflow infiltration in the San Pasqual basin were developed for the City of San Diego Reservoir Management Study and were estimated to be 3,000 acre-ft (Greeley and Hansen, 1993).

Additional inputs to the basin include agricultural return flows from irrigation with groundwater and imported water. Agricultural return flows of groundwater were estimated by DWR (1983) between 1970 and 2000 (projected) to be approximately 20 to 35 percent of the applied water. These values ranged between 2,860 and 3,920 AF/yr. However, in a more recent study, Greeley and Hansen (1993) estimated the agricultural return flows to be approximately 50 percent of the applied water. The agricultural return flow was estimated as approximately 4,300 AF/yr (Greeley and Hansen, 1993). In addition to agricultural return flows of native groundwater, agricultural return flows of imported water also acts to recharge the basin. Imported water use in the basin increased between 1970 and 1980 from 2,140 to 3,560 acre-ft (Izbicki, 1983). Imported water was primarily used for irrigation of avocado groves west of Cloverdale Canyon and for use in the San Diego Wild Animal Park (Izbicki, 1983). As a result, total irrigation return flow of imported water increased from 710 AF/yr to 1,160 AF/yr between 1970 and 1980 (Izbicki, 1983). In a recent study, CH2MHill (2001) used this historical data in addition to the 1998 DWR land use survey to linearly interpolate the irrigation return flows of imported water in 2000. The irrigation return flow from imported water was estimated to be 1,910 AF/yr in 2000 (CH2MHill, 2001).

Recent introduction of drip irrigation practices in the basin have likely decreased the volume of groundwater pumping required to meet crop demand. However, deep percolation of applied water and agricultural return flows of imported water has also decreased since drip irrigation was introduced, so the net impact on groundwater storage requires further evaluation in future groundwater modeling efforts.

Deep percolation from precipitation provides a small source of recharge to the basin each year. Greeley and Hansen (1993) estimated that the volume of natural recharge from precipitation was approximately 300 AF/yr, which is approximately 10 percent of the annual precipitation in the basin. In a more recent study, CH2MHill (2001) used a set of empirical relationships developed by scientists in Southern California to quantify recharge of precipitation falling on irrigated land. From the empirical relationships, the average deep percolation was estimated as 932 AF/yr for the period between 1931 and 1999.

Finally, subsurface inflows to the groundwater basin from Rockwood Canyon, Bandy Canyon, and Cloverdale Canyon provide a small source of recharge. Greeley and Hansen (1993) reported that the average historical inflows from Rockwood Canyon, Bandy Canyon, and Cloverdale Canyon were 300 AF/yr, 300 AF/yr, and 600 AF/yr respectively.

2.4.2.1.2 Outputs

The primary outflow from the basin is from groundwater pumping. The volume of groundwater pumped from the basin each year is still unknown. Estimates have reported that the net groundwater pumping, which is equivalent to the total groundwater pumped minus the groundwater returned by percolation after irrigation, ranges from 3,000 AF/yr to 7,200 AF/yr (Greeley and Hansen, 1992). However, based upon the agriculture present in the valley in 1993, Greeley and Hansen (1993) estimated the total groundwater pumped for irrigation to be approximately 8,600 AF/yr. Water use estimates using the 1998 DWR land use map (**Figure 2-11**) indicate that the water use is approximately 8,800 AF/yr.

A second source of discharge from the basin is evapotranspiration from native wetlands. CH2MHill (2001) reported that approximately 795 acres of native wetlands exist in the groundwater basin and consume groundwater at a rate ranging between 1.5 to 3 ft/yr. CH2MHill estimated that the average annual loss due to evapotranspiration of native wetlands was approximately 2,057 AF/yr.

Finally, subsurface flow occurs in the lower part of the basin where groundwater flows along a hydraulic gradient into the Lake Hodges Reservoir. Greeley and Hansen (1993) estimated the subsurface flow to be 300 AF/yr. In a more recent study, CH2MHill (2001) estimated that the underflow ranges between 285 and 575 AG/yr.

2.4.2.1.3 Change in Storage

A summary of the inflows and outflows from the basin are present in **Table 2-3** based upon the estimates of the average annual inflows and outflows to the system, the change in storage was estimated as approximately 55 AF/yr. However, the results presented above combine the most recent estimates of flows from two separate studies. The study completed in 1993 by Greeley and Hansen reported that annual average conditions in the basin indicate that there is no change in storage, which indicates that the inflows to the basin are equal to the outflows from the basin. The results from the CH2MHill (2001) report indicate that on average, there is only a small change in storage (a loss of less than 500 AF/yr) due to higher outflows than inflows within the basin. However, between 1990 and 1999, CH2MHill (2001) reported that the change in storage has ranged between approximately -6,500 AF to 12,500 AF.

2.5 INVASIVE NON-NATIVE SPECIES IN SAN PASQUAL VALLEY

The Water Department recognizes that invasive species, particularly giant reed (*Arundo donax*) and tamarisk (*Tamarix* spp.), affect the quality and quantity of water resources. The Water Department is supportive of any efforts to manage and eradicate invasive species in San Pasqual Valley, the San Dieguito River watershed, and our region at large. For example:

1) The Mission Resource Conservation District has proposed a Northern San Diego County Invasive Non-native Species Control Program (Program). San Pasqual Valley would be a target area of this Program. Work already completed for this Program includes mapping of invasive plants and detailing of the regulatory permits and permissions needed to carry out removal of invasives. Specific removal projects will be done as funding is available. The Program has applied to the IRWM Plan for Proposition 50 and Proposition 84 grant funding. A map of invasives within San Pasqual Valley, based on this effort, is provided in **Appendix F**.

2) The San Dieguito Watershed Council. The mission of the Council is to facilitate implementation of the San Dieguito Watershed Management Plan which includes among its primary goals the control and eradication of key invasive species, including Arundo and Tamarisk. The Water Department is a member.

3) The San Dieguito River Valley Conservancy is developing a Weed Management Plan for the San Dieguito Watershed. The Water Department is a cooperating partner in this effort.

4) The San Dieguito River Park JPA and the County of San Diego have a project to eradicate perennial pepperweed [*Lepidium latifolium]* in San Pasqual Valley. The Water Department contributed staff time and expertise to the project.

5) The Water Department, County of San Diego and the San Diego County Water Authority have also recently development the draft San Diego Integrated Regional Water Management Plan (IRWM Plan). The purpose of this plan is to outline and implement a multi-stakeholder strategy to protect, manage and develop the water resources of our region in a sustainable manner. The management and control of invasive species is one of the objectives of the IRWMP.

Adoption of the Groundwater Management Plan (GMP) by the City Council will allow the City to pursue grant funding to further understand the resource and implement appropriate measures to protect and develop the resource. The control and management of invasive species is a complex and challenging issue for our region that requires a continuing collective effort of all stakeholders.

In addition to the stakeholder efforts listed above, the City of San Diego has been approached by a group of leases in the basin that have solicited a proposal from a sand and gravel company to remove invasive species. The proposed work would:

- Restore approximately 3.0 miles of sediment-choked streambed from approximately the Narrows on the San Dieguito River to within 1 mile of the State Route 78 bridge over Santa Ysable Creek

- Create and maintain a 100-foot wide by 8 foot deep pilot channel free of vegetation to convey flow during normal and high events.

- Side slopes would be planted with native riparian species and an 11.23-acre upland area adjacent to the river will be enhanced for burrowing arroyo toads.

- The project would be privately funded with revenues gained from sale of sand excavated in the construction of the pilot channel

2.6 IMPLICATIONS FOR MANAGEMENT OF GROUNDWATER

This section briefly discusses the implications for management of groundwater in the SPGMP area, based on the basin conditions presented in Section 2.0.

Groundwater quality data presented in Section 2.2.3 indicates that much of the information is old and historic record is incomplete for most of the groundwater monitoring points throughout the basin. Therefore it is difficult to evaluated long term trends and, more importantly, identify source areas for groundwater contamination that exisits in the basin. This indicates that groundwater quality monitoring, following consistent data collection protocol, be a central focus for San Diego under this Groundwater Management Plan. Management actions presented in the next chapter describe ways to improve standards to protect water quality, monitor water quality, and characterize the conditions in the basin.

Information on both stream flows and groundwater elevations, provided in this Section, demonstrate that the hydrology varies greatly depending on year-type. Groundwater elevations in the eastern portion of the basin drop quickly during dry periods, but also recover very quickly during wet periods. The response of the basin to natural hydrology must be considered and accounted for if the groundwater basin is to be developed as a more sustainable supply for agriculture and municipal supply in the future. The data presented in Section 2 indicates that if groundwater extractions are increased, artificial recharge may be required in many or most years, to meet the water demands in the basin and not put the groundwater basin into overdraft. Management strategies developed in the next chapter will focus on the need to prevent groundwater overdraft in the basin.

Surface water quality data presented in this Section is old and may no longer be representative given changes in landuse in the watersheds they drain. The SDWMP states that the County of San Diego along with numerous other State and local agencies in and around the SPGMP area are covered under the National Polutant Discharge Elimination System (NPDES) for discharges of urban water runoff to the waters of the United States (Weston Solutions, 2006). Therefore, the quality of surface water from the four creeks that supply the basin with surface water should be protected under the NPDES program. However, several PAC members involved in the development of this GMP expressed concern that urban water runoff is degrading the quality of San Pasqual's groundwater. The monitoring program described in Section 3 will enable San Diego to

better characterize changes in groundwater quality in response to urban water runoff and take approriate action to protect groundwater if warrented..

2.7 DATA GAPS

A few data gaps within the SPGMP area have been identified and will be addressed through management actions described in Section 3. The more significant data gaps include:

- Groundwater levels from additional wells located in the alluvial portion of upstream tributeries, and other portions of San Pasqual Basin, not currently monitored.

- Groundwater quality from additional wells located in the alluvial portion of upstream tributeries, and other portions of San Pasqual Basin, not currently monitored.

- Surface water flow data from into and out of the basin. The current record does not include flow data on all steams entering the basin. Furthermore, the record of data on existing stream gauages is discontinuous making it impossible to evaluate long term trends. Finally, urbanization has likely changed how creeks such as Cloverdale, Santa Maria, and Santa Ysabel flow in wet years and dry, so it is important to collect and evaluate recent data when preparing water budgets for the basin.

- Groundwater production is estimated based on landuse information and estimated crop water use demands. The actual locations of groundwater pumping to meet this demand are unknown.

- Groundwater production characteristics of the bedrock underlying the alluvial portion of the San Pasqual Basin.

Management Actions are presented in the next section and many of these initial actions outline in the GMP focus on filling the data gaps listed above. This is an important first step that needs to occur to improve the planning and design of groundwater improvement projects in the basin.

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Section 3 – Management Plan Elements

Section 3 of this San Pasqual Groundwater Management Plan (SPGMP) provides a description of management plan elements developed for the San Pasqual groundwater basin (basin). **Figure 3-1** illustrates the flow of information within Section 3 from a general goal statement to five supporting basin management objectives (BMOs) from which five component categories have been established with specific measurable management actions to be implemented by the City of San Diego (San Diego). This section also describes the purpose of the goal statement, BMOs, and management actions, and how they were prepared, reviewed and finalized. Together these will result in improving the water quality and supply reliability for stakeholders within the San Pasqual Valley.

3.1 GROUNDWATER MANAGEMENT GOAL

The following goal statement was prepared by San Diego staff for the SPGMP:

> *The goal of the SPGMP is to "understand and enhance the long-term sustainability and quality of groundwater within the basin, and protect this groundwater resource for beneficial uses including water supply, agriculture, and the environment."*

This goal statement is consistent with the April 27, 2005, City Manager's report (No. 05-105), titled San Pasqual Vision Plan Council Policy. This report recommended that the City Council adopt a policy to comprehensively protect the water, agricultural, biological and cultural resources within the San Pasqual Valley. The Council adopted a policy (600-45) on June 27, 2005 that required development of a GMP in order to protect the groundwater resources within the basin.

This goal statement is also consistent with the Long-Range Water Resources Plan (LRWRP) adopted by San Diego in December 2002. The LRWRP evaluated different water supply alternatives for meeting the City's current and future water needs. The purpose of LRWRP was to find ways to reduce the City's dependence on imported water. The SPGMP will serve as a planning foundation for future water resources investigations and projects within the basin.

This goal statement was presented to, and accepted by, the Project Advisory Committee (PAC) members during the first of a series of four PAC meetings on October 26, 2006

and to the public at the first Open House on December 06, 2006. The PAC was formed to provide input and recommendations from the lessees and other stakeholders in the basin or adjacent to the basin during the development of the SPGMP. The formation of the PAC is further described in Section 3.5 and a listing of PAC members is provided within the Public Outreach Plan in **Appendix G**.

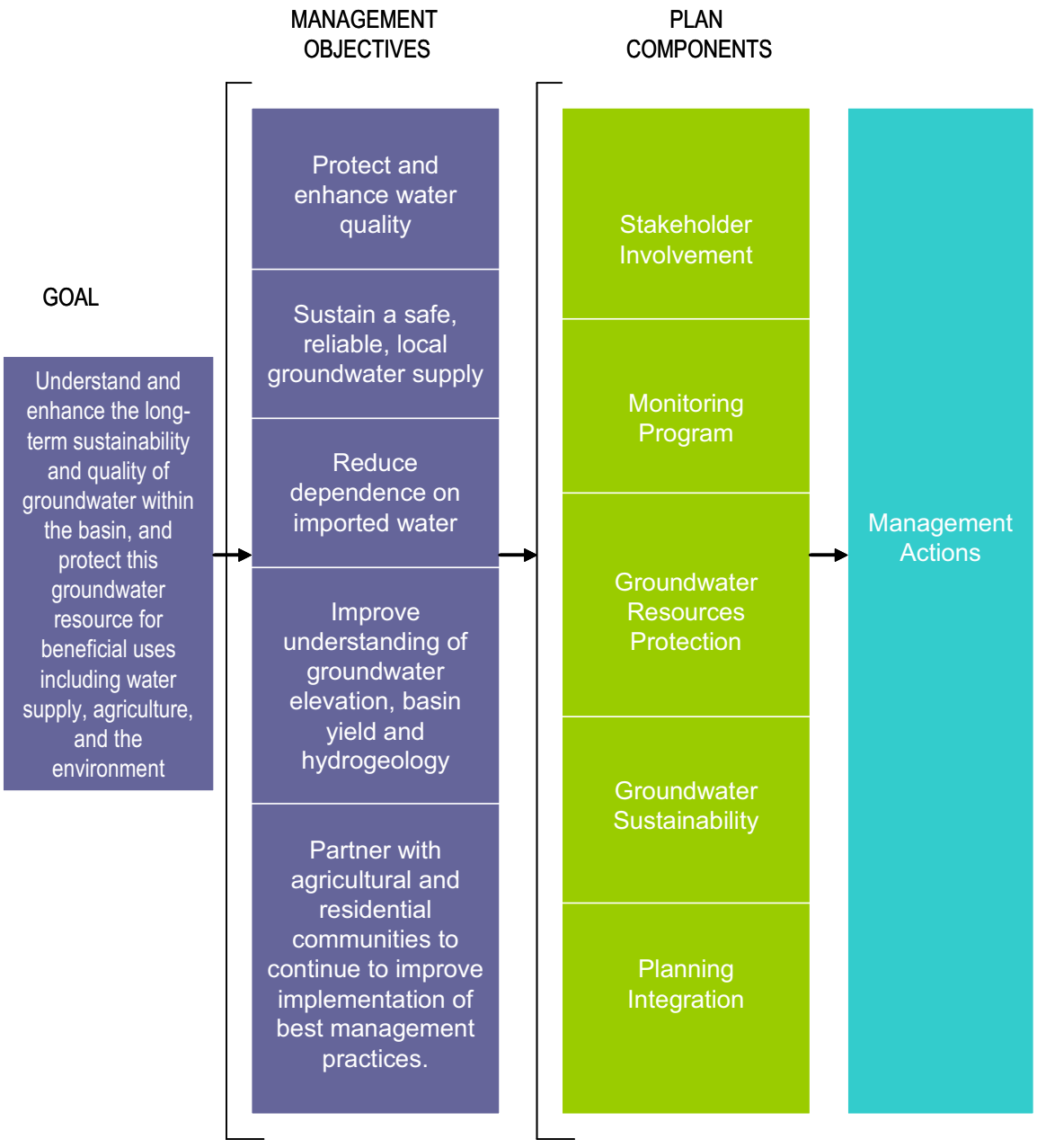


Figure 3-1 – Organization of Management Plan Elements

Development of BMOs

A BMO has five main components:

1) The background and issues related with the BMO;

2) Specific objective(s) that can be measured with some level of confidence;

3) The programs or actions that are available to remedy a problem, if one is determined to exist;

4) A clearly defined monitoring program designed to collect data necessary to evaluate the BMO's performance; and

5) A reporting method of presenting monitored data to identify success or forewarn of challenges with groundwater management.

Each of these is explained in greater detail with references to sections in the Water Code, citations from the *California Groundwater Management Guidelines* (Groundwater Resources Association of California, Second Edition, 2005).

The California State Water Code § 10753.7 (a) (1) states that the required components of a GMP include the following relative to management objectives:

> (1) Prepare and implement a groundwater management plan that includes basin management objectives for the groundwater basin that is subject to the plan. The plan shall include components relating to the monitoring and management of groundwater levels within the groundwater basin, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin.

This portion of the Water Code implies that BMOs and actions taken to achieve these objectives need to have sufficient specificity in numerical objectives so as to be measurable in its implementation through monitoring and management programs. At the same time, the BMOs are intended to be flexible so as to be adaptive to increase knowledge of how the groundwater basin behaves over time as better monitoring data is collected. To meet these co-equal objectives, San Diego has prepared general BMO

statements accompanied by specific and measurable methods for implementing. Additional specificity is provided with the actions listed under each component category provided later in this chapter.

Based on these guidelines, the City initially developed a set of six (6) draft BMOs. As a result of stakeholder input, two of the six have been combined.

The five final BMOs, accepted by the PAC, are listed below:

1) Protect and enhance groundwater quality.

2) Sustain a safe, reliable local groundwater supply.

3) Reduce dependence on imported water.

4) Improve understanding of groundwater elevations, basin yield and hydrogeology.

5) Partner with agricultural and residential communities to continue to improve implementation of best management practices.

3.2 BASIN MANAGEMENT OBJECTIVES (BMO)

This section describes the intent and general background and the method/approach to achieve the desired outcome of each BMO.

3.2.1 BMO#1 - Protect and Enhance Groundwater Quality.

BMO#1 is intended to protect and enhance the groundwater quality in the basin by locating and reducing groundwater contamination, protecting recharge areas, and improving recharge water quality.

Background

As documented in Section 2, groundwater quality within the basin changes significantly depending on location. In general, the average reported concentrations of total dissolved solids (TDS) and nitrates are approximately twice the levels in the western portion of the basin than the eastern portion. TDS and nitrate concentrations at many wells often exceed the respective Department of Health Services (DHS) drinking water standards

(Maximum Contaminant Levels {MCLs}) and Regional Water Quality Control Board (RWQCB) groundwater quality objectives, respectively.

Furthermore, it is understood that natural recharge of groundwater occurs primarily from percolation of irrigation water, infiltration along creeks and drainages, percolation of precipitation, and subsurface inflow. Protection of natural recharge is an important element of protecting and enhancing groundwater quality.

The SDWMP (Weston Solutions, 2006) identified several objectives to address this BMO, which included the following:

- Diminish and eliminate further degradation of the watershed and its resources through better management practices.
- Protect, enhance and restore beneficial uses of watershed.
- Develop an effective approach to meeting water quality regulations for the watershed.
- Promote science-based methods for water quality and environmental assessment of the watershed.
- Obtain grant funds to implement watershed improvement projects.
- Protect Reservoirs and Support Emergency Storage Project (ESP) efforts.

Methods/Approach

In order to meet this BMO, San Diego will work toward accomplishing multiple activities including:

- The City will collect and analyze additional monitoring data to better understand the sources and relative volumes of constituents in groundwater. In the future collected data will be analyzed and used to identify data gaps or additional data needs. For this reason, San Diego's monitoring program will likely be modified in the future to bridge potential gaps and meet new data needs.
- Data collected and analyzed will be the basis of developing source control strategies.

- Groundwater remediation techniques may be implemented where contamination is identified.

- San Diego will further characterize areas where water enters the basin. Identification of recharge areas will be used in conjunction with the identification of point and non-point source water quality entering into the basin, in an effort to ensure that recharge water is of the highest quality possible.

- San Diego will continue to investigate the feasibility of implementing conjunctive use and groundwater desalination in the basin. Implementation priority will be given to feasible projects that improve groundwater quality in addition to water supply reliability.

Desired Outcome

As described in San Diego's Vision Plan for San Pasqual and Council Policy 600-45, the City will work toward protecting and enhancing groundwater quality for the benefit of basin groundwater uses. As illustrated on **Figure 3-2** in general this BMO will be met when groundwater quality constituent concentrations in the basin are brought to concentrations below their respective MCLs and RWQCB Basin Objectives as shown in **Table 2-1**.

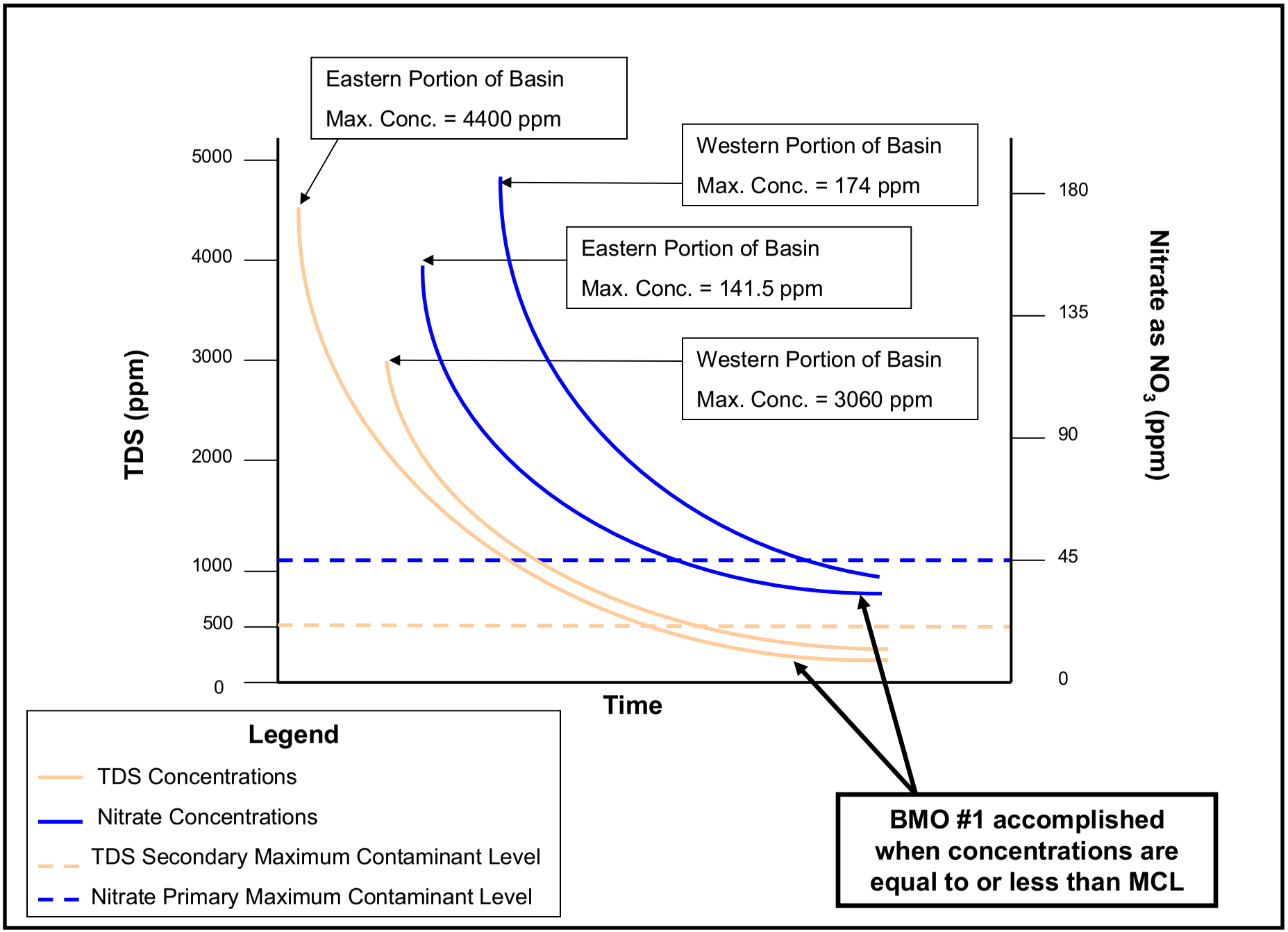


Figure 3-2 – Desired Outcome of BMO #1

3.2.2 BMO#2 - Sustain a Safe, Reliable Local Groundwater Supply

The intent of BMO#2 is to sustain a safe and reliable local groundwater supply for existing and future groundwater uses.

Background

As described in the Vision Plan for San Pasqual basin, San Diego has recognized that the San Pasqual Valley is one of the gems of San Diego County and the agricultural industry is at the foundation of the Valley's character. Specifically, the Vision Plan states that the City is committed to "Preserve, promote, and sustain agricultural uses – to make certain that San Diego's only agricultural area remains viable." Furthermore, the intent of this BMO is in line with the Council Policy 600-4 goal of maintaining the capacity of the basin ultimately to ensure that his invaluable asset is not compromised.

Water users in the basin rely almost entirely on groundwater. As a result of the basin's relatively small size, an imbalance of groundwater pumping to recharge can cause fairly rapid groundwater elevation fluctuations. For example, as described in Section 2, historic records show that groundwater elevations have declined up to 20 feet in a single year and have rebounded at even quicker rates. For this reason, in successive drought years the basin has and may continue to see large declines in groundwater elevations.

Methods/Approach

In order to meet this BMO, groundwater elevations will need to be stabilized within a safe pumping level range as not to present undo risk to users by dewatering wells, degrading groundwater quality, and adding cost to pumping groundwater from lower elevations. As most of the natural yield within the basin is currently utilized by agricultural pumpers, therefore increases in pumping for municipal supply would need to be offset by artificial recharge of the basin to prevent groundwater overdraft. San Diego will collect and analyze monitoring data to support a sustainable reliable local groundwater supply. The use of new and previous collected data will be the basis of the development of a conjunctive use project that outlines an operating groundwater elevation range.

Desired Outcome

As a conjunctive use program relies on the availability of imported water and groundwater during different hydrologic years, full implementation of a program may result in a short term drawdown in groundwater elevations below previous historical levels (this is a result of additional groundwater extraction during the drier and driest years). This BMO will be met when an operating range for groundwater elevations has been developed as part of a conjunctive use program that define upper and lower groundwater elevation thresholds for specific areas in that basin that will minimize impacts as stated above.

3.2.3 BMO#3 - Reduce Dependence on Imported water

The intent of this BMO is to reduce San Diego's dependence on imported water by utilizing groundwater stored within the basin as part of a potential future conjunctive use project.

Background

Reduced dependence on imported water is part of San Diego's LRWRP water supply vision. This vision includes developing potential groundwater resources and storage capacity, combined with surface water management strategies to meet overall water supply and resource management objectives.

Methods/Approach

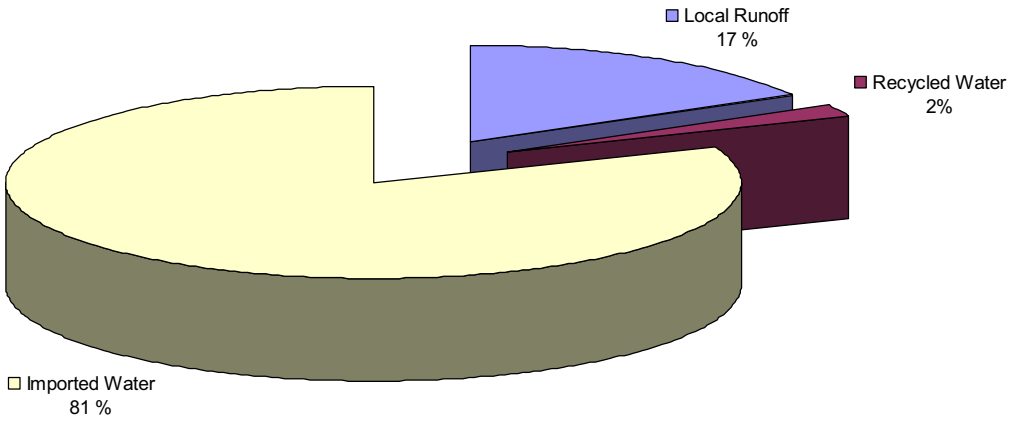
Specifically within the basin, San Diego plans to pursue partnership opportunities with other water purveyors and municipalities to seek out projects and grant opportunities to develop large scale water management/development projects. Specifically within the basin, San Diego plans to investigate conjunctive use opportunities to provide increased local supply.

Desired Outcome

This BMO will be met when San Diego decreases its dependency on imported water by implementing technically, economically and environmentally feasible water supply projects in the basin. As illustrated on **Figure 3-3**, San Diego's current estimates indicate that the 2030 goal is to have 4% of their entire water supply met from "future supplies," a

combination of desalination, surface storage, water transfers, and groundwater production from conjunctive use. As illustrated on **Figure 3-4**, San Diego's current estimates indicate that the operational yield of the basin could in increased by 10,000 to 15,000 AFY through a combination of conjunctive use on the east side of the basin and groundwater desalination on the west side.

San Diego Water Department
Water Supply Portfolio
CY 2005 - Actual



San Diego Water Department
Water Supply Portfolio
2030 - Projected

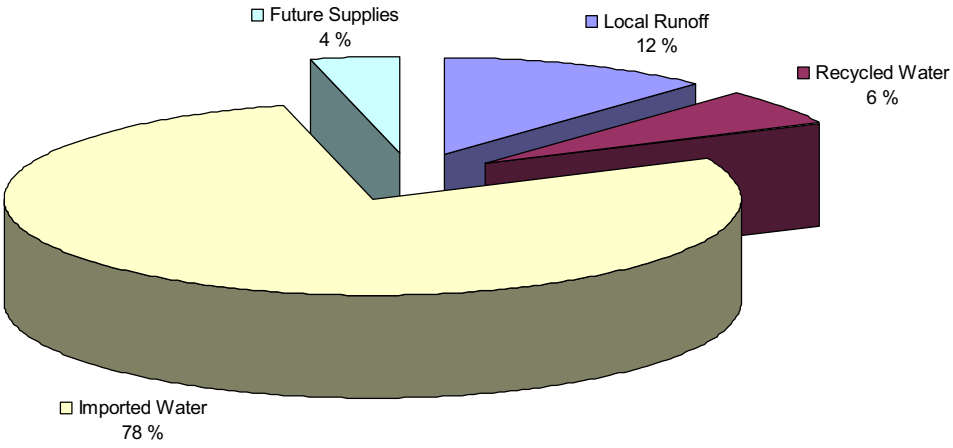


Figure 3-3 – City of San Diego 2005 Actual and 2030 Projected Water Supply Portfolio

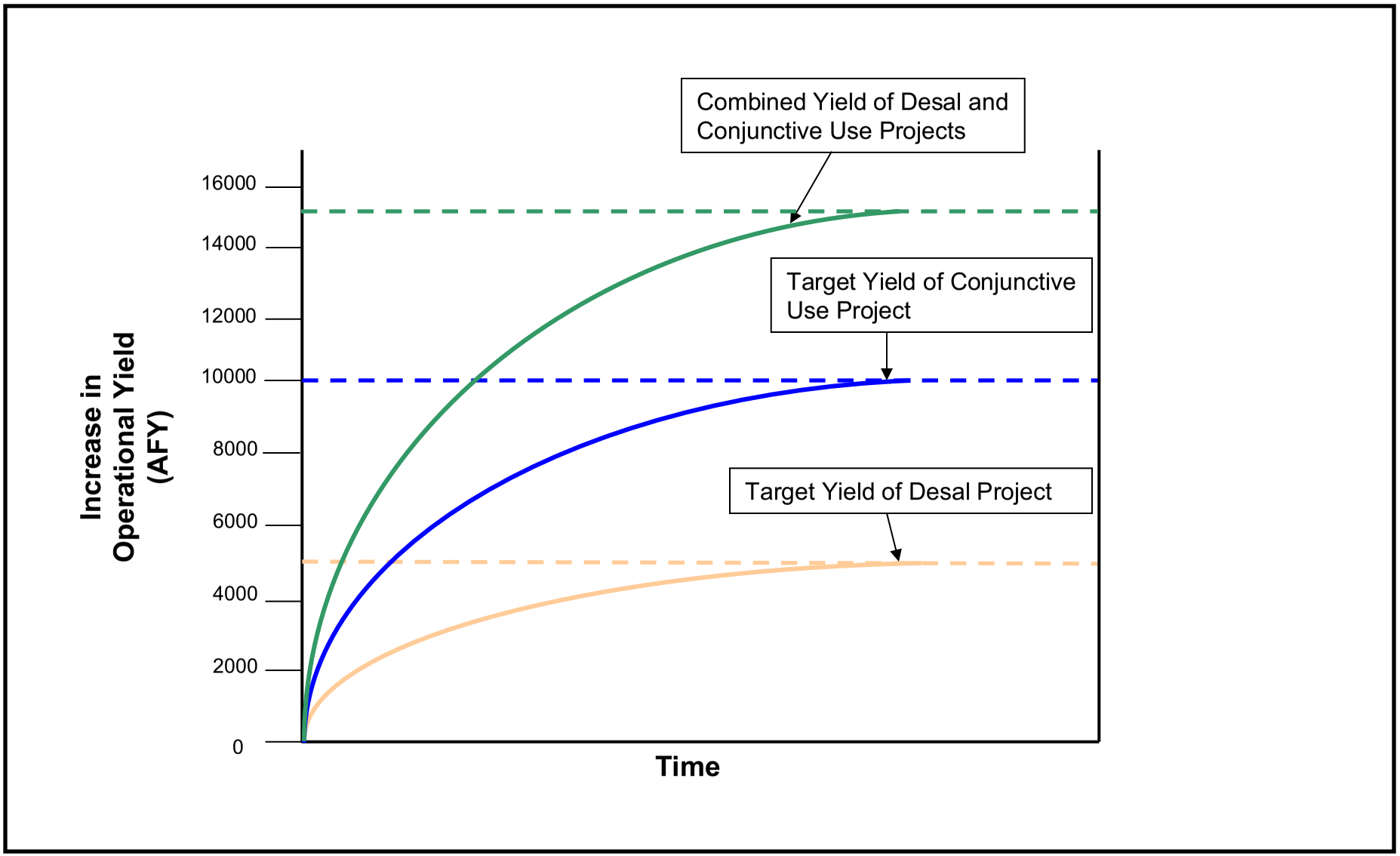


Figure 3-4 - Target Increase in Operational Yield

3.2.4 BMO#4 – Improve Understanding of Groundwater Elevations, Basin Yield and Hydrogeology

The intent of this BMO is to improve the general understanding of the basin specifically related to groundwater elevations, yield and hydrogeology.

Background

A solid understanding of groundwater elevation, seasonal fluctuations and response to pumping, existing basin yield and how groundwater is stored and transmitted through the basin is critical for meeting the other four BMOs outlined within this SPGMP. As provided in Section 2, San Diego has documented the current basin understanding by reporting on previously collected data related to well construction, groundwater elevation and quality, surface water quantity and quality, and borehole lithology.

Methods/Approach

In order to meet this objective, San Diego has developed a revised monitoring and reporting program to be implemented through the adoption of this GMP. In addition to monitoring, San Diego is committed to the collection of new data through the construction and testing of new exploratory borings and production wells in the basin and groundwater modeling efforts. The location and number of wells will be evaluated in future studies. This new information along with the monitoring data will increase the understanding of the physical conditions in the basin and allow for improved yield estimates.

Desired Outcome

This BMO will be met when San Diego has further analyzed seasonal groundwater elevation fluctuations, responses to pumping, and has quantified potential hydrogeologic connections between groundwater and surface water, existing pumping wells, and between alluvium and underlying fractured bedrock.

3.2.5 BMO#5 – Partner with Agricultural and Residential Communities to Continue to Improve Implementation of Best Management Practices.

The intent of this BMO is to partner with agricultural and residential communities to continue to improve implementation of land use best management practices (BMPs).

Background

The basin's groundwater quality, natural habitat, and general rural character can be sustained and improved when agricultural and residential communities implement the use of BMPs. Years of varied land use throughout the basin and in areas tributary to the basin have resulted in degradation of groundwater quality.

Methods/Approach

In order to meet this BMO, San Diego intends to partner with agricultural and residential communities in the basin and engage other agencies outside of the basin to consider improved standards. San Diego believes that it is mutually beneficial to work toward a collaborative solution. For this reason, similar to other BMOs, results from monitoring and analyzing groundwater quality will assist in efforts to minimize the causes of groundwater quality degradation. San Diego will review current and past land use practices to determine if adverse impacts to groundwater quality indicate contamination. If correlations between land use and groundwater contamination are observed, then San Diego will implement or encourage the implementation of BMPs. In rare cases of high levels of contamination, it is anticipated that San Diego will report poor land use practices to enforcement agencies. Enforcement agencies may utilize regulatory programs to safeguard the basin quality.

Desired Outcome

As described in San Diego's Vision Plan for San Pasqual and Council Policy 600-45, San Diego will work toward protecting and enhancing groundwater quality for the benefit of basin groundwater uses. This BMO will be met when San Diego and basin stakeholders identify and implement BMPs to protect the groundwater quality of the San Pasqual Valley.

3.3 SPGMP COMPONENTS

Table 1-3 lists a variety of components that are required, recommended and voluntary per CWC § 10750, and DWR Bulletin 118 (2003). For the purpose of the SPGMP, the individual components listed on**Table 1-3** have been grouped into five broad component categories as listed below:

1) Stakeholder involvement,

2) Monitoring program,

3) Groundwater resource protection,

4) Groundwater sustainability, and

5) Planning integration.

Each of the five component categories listed above are presented in detail in Section 3.5. For each component category, San Diego developed sets of management actions tailored to meet the BMOs. A table of the draft management actions and how they relate to the BMOs and the Public Concerns was prepared. The Public Concerns about the San Pasqual groundwater basin were gathered and reviewed at each of the four PAC meetings. Draft management actions were presented to the PAC members on January 25, 2007. As a result of this public review process management actions were finalized. The following sections provide a more detailed description of each component category and a listing of management actions within each component category.

3.4 COMPONENT CATEGORY 1: STAKEHOLDER INVOLVEMENT

The management actions taken by San Diego in implementing this GMP will impact a broad range of individuals and agencies that have a stake in the successful management of the basin. Stakeholders include: lessees, agricultural, or agricultural-residential private well owners, state and federal water resource agencies. To address the needs of all the stakeholders, this SPGMP pursues several means of achieving broader involvement in the management of the basin; These include: (1) involving members of the public; 2) involving other agencies within and adjacent to the basin; (3) developing relationships with state and federal water agencies; and, (4) pursuing a variety of partnerships to achieve the BMOs. Each of these is discussed further below.

3.4.1 Involving the Public

The Water Code requires that the public be involved during the preparation of the GMP. These requirements consist of "providing a written statement to the public describing the manner in which interested parties may participate in developing the GMP" which may include appointing a technical advisory committee (Water Code 10753.4). In the case of the SPGMP effort San Diego developed a Public Advisory Committee (PAC) to facilitate public involvement. The DWR recommends including a plan to "involve other agencies

that enables the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin." In addition, DWR suggests establishing an advisory committee for the following reasons:

- To bring a variety of perspectives to the management team,
- To provide anecdotal information and input based on previous investigations and on-going data collection efforts,
- To provide focus on the specifics of groundwater management without being distracted by the operational activities of the managing entity,
- To reduce future conflicts that could arise if some parties are negatively impacted by certain groundwater management decisions, and
- To gain the confidence of the local constituency by providing the opportunity for interested parties to participate in the management process.

The DWR does not provide any more guidance because each GMP and stakeholder process is case specific. For the SPGMP, San Diego (as the owner of the land in San Pasqual), decided to engage in a series of public outreach meetings to inform and gauge specific stakeholder group's interest and involvement in the SPGMP. The stakeholders engaged as part of this outreach are summarized in the Public Outreach Plan included in this SPGMP as **Appendix G**. San Diego created a PAC to gather input from the lessees and other stakeholders in the basin or outside the basin. San Diego also decided to host two open houses during the course of the project to allow the public to ask questions and comment on the various aspects of the documents presented. Below is a description of the activities performed and the information presented at each PAC meeting and each open house.

PAC Meeting #1

1) Explained what a GMP is and why San Diego is preparing one. Presented an overview of the San Pasqual groundwater basin, and provided a general synopsis on the fundamentals of groundwater hydrology.

2) Reviewed the PAC Mission Statement and meeting schedule. Asked if PAC members can help gather information about the basin and explained what is needed.

In addition, San Diego will visit properties in the valley to verify or gather information about wells and to ask lessees and others to provide additional information.

3) Asked the PAC for input on groundwater management issues they would like to see addressed in the GMP.

PAC Meeting #2

1) Presented the Draft Goal statement that was prepared by the project team.

2) Reviewed the groundwater management issues identified at the previous PAC meeting, and added additional ones.

3) Presented the Draft BMOs and explained how they will address the concerns expressed in the first meeting by PAC members.

4) Asked the PAC to provide additional input regarding the Draft BMOs, and prioritize them.

Open House #1

1) Presented information about the GMP preparation.

2) Presented the Draft Goal statement.

3) Presented the Draft BMOs.

4) Presented general information on the fundamental of groundwater hydrology.

5) Presented a map of the valley and ask for well identification information.

6) Asked the attendees to provide inputs and comments on the material presented.

PAC Meeting #3

1) Reviewed the identified issues and the BMOs.

2) Described “Management Actions” and show how they will implement the BMOs.

3) Asked the PAC for additional input regarding the Management Actions.

PAC #4

1) Reviewed the identified issues and describe how these have been addressed in the GMP. If not addressed, an explanation was provided. **Table 3-1** provides a summary listing of these issues and how they were resolved.

2) Provided an explanation for how PAC comments on the "Management Actions" were addressed.

3) Presented and describe the Draft San Pasqual Groundwater Management Plan.

4) Discussed location and logistics for Open House # 2.

Table 3-1 - Policy Advisory Committee (PAC) - Identified Issues or Concerns

GMP Plan Component		Identified Issue or Concern	Addressed in GMP	Not Purview of GMP	Comment
Stakeholder Involvement	A	Develop local water supplies	x		Addressed in the plan to study conjunctive use storage in the basin. The proposed plan is moving is forward as the City is hiring a consultant to perform this study. The proposed Council Action is June 2007.
	B	Ensure the GMP does not impede agriculture in the region.	x		The purpose of the GMP is to protect the resources for the basin, hence all the users. The plan is managing the resources that will be used by agriculture. The GMP is the framework document that will allow for projects and monitoring that will improve the resources.
	C	Examine the water quality and groundwater level impact of Lake Sutherland to San Pasqual groundwater basin	x		Addressed in monitoring program
	D	Work with the existing habitat plan and river park plan.	x		We included representatives of the group that prepared these plans in our PAC meetings and we will continue to reach out to them for future GW improvement projects. These representatives have had opportunities to represent their stakeholder group.
	E	Define the costs of implementing the GMP to the residents and farms in the valley?	x		The City will implement the GMP. The cost of the implementation will be born by the City. There will be no cost of implementation to the residents in the valley.
	F	Include the San Dieguito watershed plan in the analysis.	x		Some of the GMP maps include the entire watershed. The monitoring plan addressed monitoring of watershed tributaries in the San Pasqual basin..

GMP Plan Component	Identified Issue or Concern		Addressed in GMP	Not Purview of GMP	Comment
	G	Rejuvenate groundwater quality by regeneration of the connection with agricultural land.	x		Water quality monitoring is included in the monitoring plan.
Monitoring Program and Basin Understanding	**H**	Establish a safe yield/water budget for the valley	x		The GMP summarized existing water budget data, identified data gaps. A new water budget maybe prepared during the implementation of planned groundwater projects
	I	Determine the cause of the increase in salinity in groundwater over time. Determine what can be done to remedy this.	x		As the monitoring plan is implemented additional data will be acquired providing additional information on salinity. The salt loading maybe controlled in the future through potential desalination and conjunctive use storage projects.
	J	Monitor water quality and soil/sediment in Lake Hodges		x	The monitoring plan addresses water quality but does not address sediments and soil. Water quality in Lake Hodges is monitored by the City and other entities.
	K	Are metered wells an option to monitor water levels and water quality? Who would pay for this and will San Pasqual Academy be included?		x	It is not addressed in the GMP. The GMP is silent on meters but the monitoring plan addresses monitoring wells. This question should be addressed during the implementation of potential projects.
	L	Examine the four wells at the San Pasqual Academy. The Academy has about 500 staff and students living at the facility.		x	Not addressed in the GMP. We will include it in future studies.
	M	Quantify the amount of groundwater in fractured rock in the basin.	x		Identified as an action item in the GMP for future investigation.

GMP Plan Component	Identified Issue or Concern		Addressed in GMP	Not Purview of GMP	Comment
	N	Report polluters from other jurisdictions to appropriate agencies. The GMP needs "some teeth" to it.	x		See Management Actions # 36, 38, 9 and 10
Groundwater Resource Protection	**O**	Quantify salt contribution to the basin from the runoff from the developments inside and outside the basin	x		Addressed in the monitoring plan. Same as above.
	P	Identify source of pollution. Agriculture has traditionally been blamed for the cause of the pollution, but sources may be from the shopping centers and other development in the area that are outside the control of the City of San Diego.	x		Same as above
	Q	Investigate using the City of San Diego's surplus of recycled water in the basin to alleviate water shortages		x	The City already investigated this option as part of their water reuse study. It was not determined to be feasible at that time.

GMP Plan Component	Identified Issue or Concern		Addressed in GMP	Not Purview of GMP	Comment
Groundwater Sustainability	R	Remove of exotic plants from the river.		x	Please see Section 2.5 of this GMP for a description of planning efforts currently underway to eradicate non-native plant species from San Pasqual Valley.
Issue for Other Community Initiatives	S	Correspond with interdepartment/agency about stream course, flood control and channel maintenance	x		

The PAC meeting format allowed for a transparent process and for valuable input from PAC members and the public to be incorporated into this SPGMP.

In preparing the SPGMP, San Diego has filed four separate notices in the North County Times and The Daily Transcript (**Appendix H**). A notice of intent to prepare a GMP was published in the San Diego Daily Transcript on September 26, 2006. In accordance with CWC § 10753.2, a notice of intent to adopt a resolution to prepare a GMP was adopted on October 10, 2006. Upon adoption of the resolution, the text of the resolution was published in the San Diego Daily Transcript and North County Times on December 22, 2006. San Diego also provided a public comment period on the draft SPGMP, provided notice and held a meeting for the public comment on the SPGMP October 30, 2007. The final SPGMP was adopted on November 13, 2007.

San Diego has posted on its website http://www.sandiego.gov/water a copy of the SPGMP. San Diego will continue to use its website to distribute information on SPGMP implementation activities to the public.

Actions. San Diego will take the following actions related to involving the public:

- Update Public Outreach Plan every five years.
- Implement Public Outreach Plan developed for the SPGMP.
- Provide annual briefings to the PAC and invite stakeholders listed in **Appendix G**, including domestic and agricultural groundwater users, on San Pasqual GMP implementation progress.
- Create a new GMP website or use an existing San Diego website to display SPGMP information. Relevant website content may include outreach material, groundwater levels, groundwater quality and project updates.
- Annually review list of stakeholders and update as necessary.

3.4.2 Involving Other Agencies Within and Adjacent to the San Pasqual Basin

Figure 1-3 shows adjacent water agencies and municipalities within the greater San Diego county area. A description of these immediately adjacent agencies is provided in Section 1.5.2. Involving adjacent agencies in implementing this SPGMP is important to San Diego. These agencies include the Cities of Escondido, Ramona, Rancho Bernardo and Poway and the County of San Diego as each have the authority to establish land use policies within the San Dieguito watershed. Land use practices within the San Dieguito watershed influences the health of the basin. For this reason, San Diego plans to conduct the following actions specifically related to working with these agencies to improve standards and monitoring to protect basin water quality and periodically provide relevant basin reports.

Actions. San Diego will take the following actions:

- Contact the land use authorities in the watershed such as the Cities of Escondido, Ramona, Rancho Bernardo, Poway, and the County of San Diego, to determine interests in considering improved standard to protect water quality.

- Monitor and review new development proposals and projects within the watershed to ensure that these proposals incorporate appropriate measures to protect water quality and water quantity, as described in the SDWMP.

- Provide copies of the adopted SPGMP and subsequent bi-annual state of the basin assessments to representatives from the City of Escondido, Ramona, Rancho Bernardo, San Diego County Water Authority and the County of San Diego and other interested parties.

3.4.3 Developing Relationships with Local, State, and Federal Agencies

Working relationships between San Diego and local, state, and federal regulatory agencies are critical in developing and implementing the various groundwater management strategies and actions detailed in this SPGMP. This City will work toward further establishing points of contact with the agencies responsible for resource management within the basin and greater San Dieguito watershed area. Relationships will help San Diego identify those who can inform the City of new commercial,

agricultural, or development projects in watershed, enabling San Diego to review and comment on these projects. In addition, the City will be able to ensure that non compliance fees are returned to San Diego to fund water resource improvement projects in the basin.

Actions. San Diego will take the following actions:

- Partner with local, state and federal regulatory agencies to ensure that non-compliance fees are returned to the City of San Diego to fund water resource improvement programs in San Pasqual Basin.

- Establish a point of contact within local, state, and federal regulatory agencies that have responsibility for resource management within San Pasqual Basin. Please see list provided in **Appendix G**. Important resource agencies include (but are not limited to) the California Department of Water Resources (DWR), the County Department of Environmental Health (DEH), Regional Water Quality Control Board (RWQCB), Department of Health Services (DHS), U.S. Fish and Wildlife Service, California Dept of Fish and Game, San Dieguito River Park Joint Powers Authority (JPA), U.S. Department of Agriculture and the Forest Service.

- Establish a formal process whereby jurisdictions in the watershed will notify the Water Department of any new residential, commercial, or agricultural development proposals or projects in the watershed; thus providing an opportunity for the Water Department to review and comment on the development, and verify that measures to protect water quality, as described in the SDWMP are being incorporated into the designs.

3.4.4 Pursuing Partnership Opportunities

This City is committed to facilitating partnership arrangements at the local, state, and federal levels. Over a 60 year plus period, water agencies and municipalities within the County have been able to obtain 90% of their water supply from the San Diego County Water Authority (SDCWA). The SDCWA, San Diego and other local leaders have made great strides toward regional planning and collaboration on water issues. Through SDCWA's Facilities Master Plan, Groundwater Storage and Recovery studies and projects have been identified in the County.

San Diego intends to use a similar approach by forming partnerships to implement the City's LRWRP Plan goals including the potential developing of a conjunctive use project in the San Pasqual Basin. While the facilities necessary to implement, develop and expand conjunctive use programs in the SPGMP area have not been fully identified, the potential exists to develop and expand facilities to achieve broader local and regional and statewide benefits. The needed facilities, however, would require substantial resources. To investigate opportunities would likely require resources provided through partnerships with potential beneficiaries. For this reason, the City will track and develop grant applications to fund some SPGMP actions and projects within and related to the basin.

Actions. San Diego will take the following actions:

- Continue to promote partnerships with water purveyors and municipalities to achieve regional water supply reliability for the City of San Diego in San Pasqual Basin.

- Continue to track and apply for grant opportunities to fund GMP activities and local water management/development projects.

3.5 COMPONENTS CATEGORY 2: MONITORING PROGRAM (REQUIRED)

At the heart of this SPGMP is a monitoring program. Data collected under this program allows San Diego to better assess the current condition of the basin and document responses in the basin as a result of future management actions. The program includes monitoring groundwater elevations and stream flows, groundwater and surface water quality, assessing the potential for land surface subsidence resulting from groundwater extraction, and developing a better understanding of the interaction between surface water and groundwater. Also important is the establishment of monitoring protocols to ensure the accuracy and consistency of data collected.

3.5.1 Groundwater Elevation Monitoring

San Diego does not currently collect and record groundwater elevation data from the basin. **Figure 3-5** shows the locations of 18 wells to be included in a semi-annual (spring and fall) groundwater level monitoring program. Collection of groundwater levels at these locations will improve the understanding of groundwater storage conditions within San Pasqual Basin before and after the pumping season each year. The wells selected on

Figure 3-5, are to provide uniform geographic coverage throughout the approximately 15.5 square mile SPGMP area.

Protocols to be followed by City staff or their consultants in collecting groundwater measurements are included in **Appendix I** and discussed in Section 3.6.5. In addition, as described in Section 3.6.8, groundwater level data will be uploaded to the DMS as described in Section 3.6.9.

Actions. San Diego will implement the following actions:

- Identify and select production/monitoring well locations for installation of groundwater elevation data loggers.
- Collect and evaluate groundwater elevation data from existing production and monitoring wells.

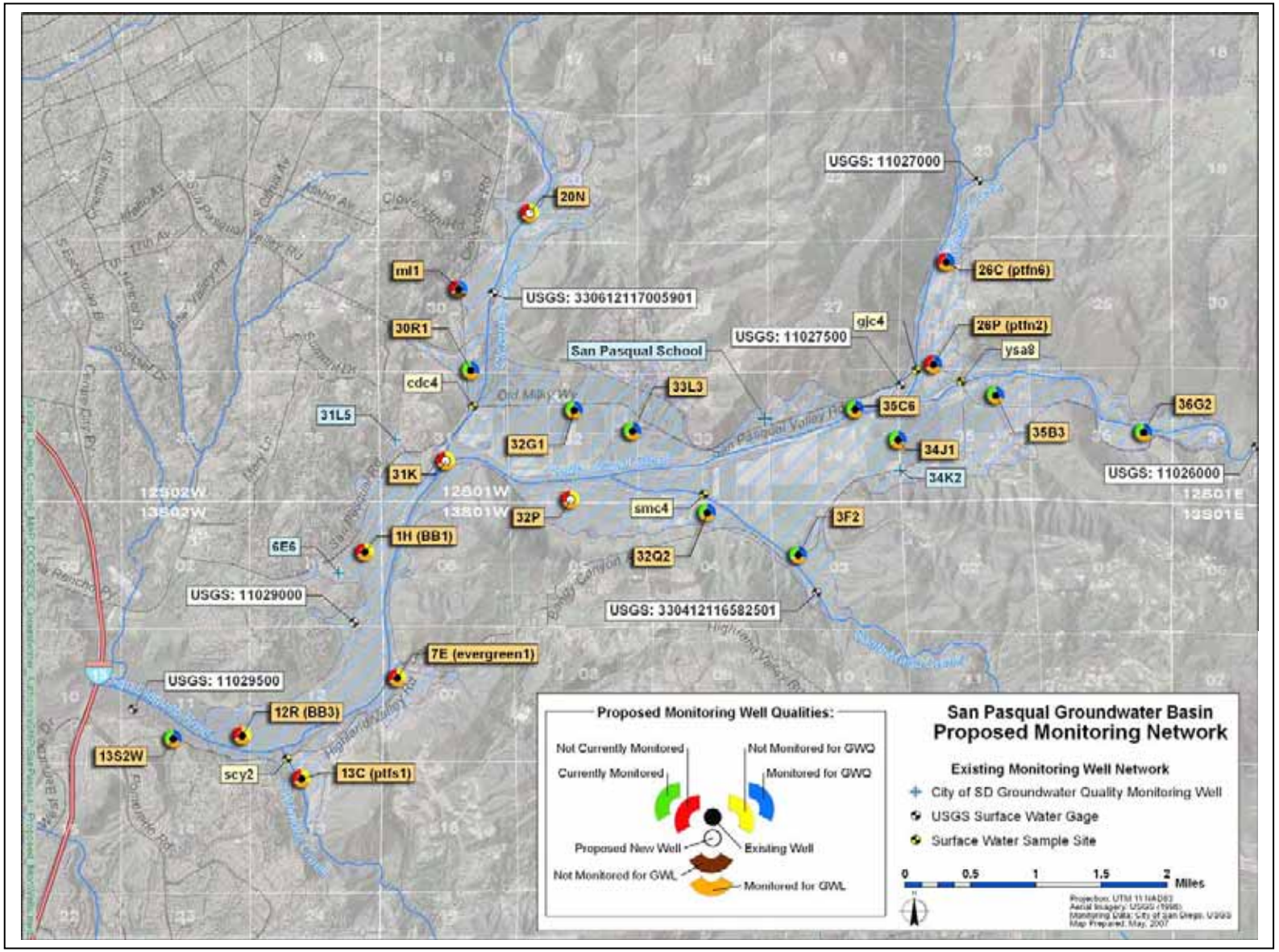


Figure 3-5 - Proposed Groundwater Monitoring Network

3.5.2 Groundwater Production

San Diego does not currently collect and record groundwater production information from their leases. Currently, total groundwater pumping in the basin is estimated based on evaluating land use and estimating consumptive use. In the future, it will be important to better understand the locations of existing active groundwater production wells in relation to proposed groundwater improvement facilities (i.e. recharge wells, recharge basins, extraction wells). This information will be required to complete CEQA documentation during the planning and design stages of future projects in order to evaluate cumulative impacts of project pumping and third party impacts.

Actions: San Diego will implement the following actions:

1) As a part of any future conjunctive use or other related project initiative, survey leases to identify locations of active production wells used for irrigation and domestic purposes.

2) As a part of any future conjunctive use or other related project initiative, estimate current and historic pumping from these wells based on evaluation of energy records and other available information and include in bi-annual "State of the Basin" reports.

3.5.3 Surface Water Flow Monitoring

For surface water flow, San Diego contracts with the USGS to maintain stream flow gauging stations at locations shown on **Figure 3-5**. Stream flow data for these locations has been archived in the DMS and are described in Section 2. San Diego will continue to contract with the USGS to maintain stream flow gauging stations at locations shown on **Figure 3-5**. Stream flow data for these locations will continue to be archived in the DMS as described in **Section 3.6.8**.

Actions. San Diego will implement the following actions:

- Continue to collect, evaluate and archive stream flow data from the creeks and streams entering and exiting the basin.

3.5.4 Groundwater Quality Monitoring

Figure 3-5 indicates that San Diego is currently collecting and analyzing groundwater quality samples from 10 wells in the basin. These samples are collected and analyzed quarterly for the following constituents:

- Volatile Organic Compounds,
- Semi-Volatile Organic Compounds, and
- General Minerals

Analytical results for these constituents for the period 1991 through 2006 have been archived in San Diego's DMS, described in Section 2.

In addition to the wells currently being sampled, San Diego will collect and analyze groundwater samples from four (4) additional locations:

- Upper reach of the San Dieguito River portion of the basin (i.e. well 30A). Purpose of this new location is to characterize the quality of groundwater in the upper reach of the basin. This data will be compared to groundwater quality from well 30R to better understand how groundwater quality changes within the San Dieguito portion of the basin.
- Mouth of Guejito Creek portion of the basin (i.e. well 26P).

- Upper reach of Guejito Creek portion of the basin. This data will be compared to groundwater quality from well 26P to better understand how groundwater quality changes within the Guejito Creek portion of the basin.

- Eastern end of the basin (i.e. Section 36G3). To improve the understanding of groundwater quality conditions at the far eastern end of the basin.

Groundwater samples will be collected semi-annually (spring and fall) from the 14 wells shown on **Figure 3-5** and analyzed for the following constituents:

- Volatile Organic Compounds,

- Semi-Volatile Organic Compounds (ML/EPA Method 525.2),

- Pesticides and Herbicides,

- General Minerals, and

- Stable Isotopes (a one time sampling event to improve understanding related to groundwater age and sources of recharge)

Protocols to be followed by City staff or their consultants in collecting groundwater samples are included in **Appendix I** of this GMP. Analytical results will be uploaded to the DMS.

The SDWMP identifies a number of actions associated with the goal to protect and enhance water quality in the watershed. The actions were written to reduce impervious surfaces and hardscape, reduce ongoing discharge impairments, evaluate and implement land-use BMPs, reduce erosion, and reduce litter. A detailed list of actions can be found in the SDWMP (Weston Solutions, 2006).

Actions. The following actions will be taken by San Diego to monitor and manage groundwater quality:

- Identify and select production/monitoring well locations for installation of groundwater quality data loggers.

- Continue to collect and evaluate relevant existing production and monitoring well groundwater quality data and further identify water quality constituents of concern.

- Evaluate the potential mobilization of water quality contaminants as a result of rising groundwater groundwater elevations in response to implementation of a conjunctive use within the groundwater basin.

- Periodically collaborate with the U.S. Geological Survey (USGS) and the State Water Resources Control Board (SWRCB) to include monitoring results from the Groundwater Ambient Monitoring and Assessment (GAMA) program in updates to the bi-annual state of the basin assessment.

3.5.5 Surface Water Quality Monitoring

For surface water quality, samples are currently collected quarterly from five (5) locations shown on **Figure 3-5** and analyzed for:

- Organics (data for all the synthetic organic compounds that are regulated in drinking water)

- Bacteria (coliform bacteria and associated bacteria)

- Inorganics (same as groundwater)

Flow in creeks is seasonal and so year round sampling is not possible, however, precipitation runoff are occasionally collected from the following locations.

- Guejito Creek

- Santa Ysabel Creek

- Santa Maria Creek

Urban water runoff plus rainfall runoff is currently monitored year round at the following locations:

- Kit Carson Creek

- Cloverdale Creek

- Sycamore Creek

Changes in the location, frequency of sampling are not proposed at this time. San Diego will sample for stable isotopes (a one time sampling event) to better understanding surface water groundwater interaction. Surface water quality data will be added to the DMS. Protocols to be followed by City staff or their consultants in collecting groundwater measurements are included in **Appendix I** of this GMP. Groundwater level data will be uploaded to the DMS.

Actions. The following actions will be taken by San Diego:

- Archive the analytical results of surface water sampling in the SPGMS
- Collect and analyze surface water samples for stable isotopes to better understand surface water/groundwater interaction.

3.5.6 Land Surface Elevation Monitoring

Monitoring inelastic subsidence of the land surface resulting from compaction of underlying formations affected by head (groundwater elevation) decline is of importance to the DWR and water managers throughout the state. During a typical pumping season, changes in land surface elevation can be observed as a result of both elastic and inelastic subsidence in the underlying basin. Elastic subsidence results from the reduction of pore fluid pressures in the aquifer and typically rebounds when pumping ceases or when groundwater is otherwise recharged resulting in increased pore fluid pressure. Inelastic subsidence occurs when pore fluid pressures decline to the point that aquitard (a clay bed of an aquifer system) sediments collapse resulting in permanent compaction and reduced ability to store water in that portion of the aquifer.

Based on the available San Pasqual Basin geologic and lithologic data as described in Section 2, the basin is comprised of fairly coarse grained alluvial deposits which range in thickness from only 120 to 200 feet. Based on this data, no evidence of laterally extensive confining units was encountered, which would exhibit the potential for inelastic subsidence.

In summary, given the relatively small size of the San Pasqual Basin and thickness and composition of alluvial material, in-elastic land surface subsidence is considered very unlikely. For these reasons, San Diego does not intend to install and maintain subsidence

monitoring points in the basin. However, if new evidence is discovered in the future indicating that subsidence warrants further investigation, San Diego will reconsider subsidence monitoring.

3.5.7 Surface Water Groundwater Interaction Monitoring

The interaction between groundwater and surface water has not been extensively evaluated within the basin. The primary occurrence of surface water and groundwater interaction exists at Lake Hodges. This occurs as a result of underflow from the basin to Lake Hodges. The existence of phreatophytes (plants that obtain water from a permanent ground supply or from the water table) and other sensitive species and habitats in around Lake Hodges necessitates the need for active monitoring of this interaction:

Actions. San Diego will pursue actions to better understand the relationship between surface and groundwater in the SPGMP area, including:

- Regularly summarize groundwater and Lake Hodges water quality in the bi-annual state of the basin assessments.
- Summarize surface water quality data from existing City of San Diego monitoring points in the bi-annual State of the Basin assessments.

3.5.8 Protocols for the Collection of Groundwater Data

Through the work completed as part of the SPGMP, MWH has evaluated the accuracy and reliability of groundwater data collected by San Diego, U.S. Geological Survey, California Department of Water Resources, and County. The evaluation indicated a significant range of techniques, frequencies and documentation methods for the collection of groundwater elevations and quality data. Although the groundwater data collection protocol may be adequate to meet the needs of individual agencies, the lack of consistency yields an incomplete picture of basin-wide groundwater conditions. In order for San Diego to ensure they collect the highest quality data which is consistent with other agencies, Standard Operation Procedures (SOPs) for the collection of future data are provided in **Appendix I**. These SOPs will be reviewed periodically and modified to reflect new data collection techniques and procedures as necessary.

Actions. To improve the comparability, reliability and accuracy of groundwater data, San Diego will take the following actions:

- Determine monitoring network adequacy and periodically review and expand as appropriate to meet the needs of the GMP on a 5-year frequency or on a special project need basis.

- Establish protocols for methods and frequency of collection, storing, and disseminating data. These protocols will be documented in **Appendix I** of the SPGMP and may be updated in the bi-annual state of the basin assessments.

3.5.9 Groundwater Reporting

A bi-annual state of the basin assessment is an essential document that will provide detailed information to stakeholders and the general public on the current status of the San Pasqual basin. This report will include the following:

- Description of current basin conditions which may include:
  - Updated land use information when available from DWR or based on information provided by leases,
  - An updated water budget,
  - Characterization and evaluation of groundwater and surface water conditions,
  - Summary of data collection methods and frequencies, and
  - Identification of water quality constituents of concern;
- Implementation status of SPGMP action items and other groundwater projects; and
- Conclusions and recommendations.

In order to ensure that San Diego continues to report on the salient information, actions and BMOs will be reviewed on a bi-annual basis to coincide with the state of the basin assessment. As suggested changes to actions and the BMOs will be provided in the assessment, it will be considered a living document.

San Diego will also evaluate the need to update a groundwater numerical model. It is likely that a fate and transport model for the basin will be prepared as part of a future conjunctive use program. The modeling objectives will likely include the following:

- To better understand the basin water budget;
- To provide an estimate of yield; and
- To evaluate various recharge and extraction scenarios, specifically:
    - Changes in groundwater elevations and impacts on existing groundwater users and the environment (phreatophytes on west side of basin).

Actions. To analyze and document basin conditions, San Diego will take the following actions:

- Determine the need for a numerical groundwater model and re-evaluate the need during development of the bi-annual state of the basin assessment. If deemed necessary, provide resources for maintaining, updating and utilizing a groundwater model. A potential application of a numerical model may be to assist in the development of a basin wide salt balance.
- Develop and present a bi-annual state of the basin assessment
- Review and update of GMP action items bi-annually. This information may be included in the bi-annual state of the basin reports.

3.5.10 Groundwater Modeling

San Diego plans to develop a numerical groundwater model for the San Pasqual Valley that is capabe of:

- Cross-checking existing information on stream flow, groundwater level, pumping, aquifer parameters and water quality provided in Chapter 2 of the GMP and the SPDMS
- Simulating the groundwater hydraulic effects (flow amounts and gradient) of various operational scenarios of spreading and withdrawal at dedicated wells.

- Assisting in evaluation water quality impacts of mixing of imported water and native groundwater through the use of particle tracking and "zone of influence" evaluations.

A preliminary steady-state groundwater flow model will be constructed and calibrated to simulate recent or near-recent conditions in which the basin is judged to be in a relative steady state condition. The domain of the model will cover the entire alluvial portion of the basin and extend west to Lake Hodges. San Diego will most likly use the MODFLOW groundwater model developed by the U.S. Geological Survey with the Groundwater Modeling System (GMS) pre- and post processor.

The groundwater flow model will be developed first using information provided in Chapter 2 of the GMP and the SPDMS, without the collection of new field data. It is anticipated that several simplifying assumptions will need to be made where data is lacking, as outlined in the modeling strategy document and refined during model calibration.

Based on the initial model, the need for collection of additional field data will be evaluated. After collection of this data, it is anticipated that improvements in the numerical model can be made based on the knowledge the field data provides. These model improvements may be performed in a second phase of the modeling efforts.

3.5.11 Evaluate Bedrock Underlying San Pasqual Valley

During a PAC meeting anecdotal information was provided indicating that a few wells may draw groundwater from the fractured bedrock system. For this reason, San Diego has developed a specific action designed to understand the underlying bedrock and how the transmission and storage of water relates to the overlying alluvial aquifer.

Action. To obtain an improved basin understanding related to the interaction of the bedrock and alluvial water bearing systems, San Diego will take the following action:

- Review well construction information to identify groups of wells screened within alluvial formations and groups screened within underlying bedrock. If information is available, evaluate grouped well data (quality and elevations) to determine if groundwater within the bedrock formation is a viable groundwater water supply resource.

3.5.12 Data Management System

In order for San Diego to achieve its goal of sustaining the groundwater resource within the basin, it was essential to develop a data storage and analysis tool, or DMS. The DMS was developed by MWH under contract with the USACE. Other local sponsors included SGA and its member agencies, DWR, and SCWA.

The DMS is a public domain application developed in a Microsoft Visual Basic environment and is linked to a SQL database containing North American Basin purveyor data. The DMS provides the end-user with ready access to both enter and retrieve data in either tabular or graphical formats. Security features in the DMS allow for access restrictions based on a variety of user permission levels. Data in the DMS include:

- Well construction details.
- Known locations of groundwater contamination and potentially contaminating activities.
- Long-term monitoring data on:
  - Monthly extraction volumes.
  - Groundwater elevations.
  - Water quality.
- Aquifer characteristics based on well completion reports.

The DMS allows for the viewing of regional trends in groundwater elevations and quality not previously available to San Diego. The DMS has the capability of quickly generating well hydrographs and groundwater elevation contour maps using historic groundwater elevations data. The DMS also has the ability to view water quality data for California Code of Regulations Title 22 required constituents as a temporal concentration graph at a single well or any constituent can be plotted with respect to concentration throughout the basin. Presentation of groundwater elevation and quality data in these ways will be useful for making groundwater basin management decisions.

San Diego is currently in the process of inputting all relevant groundwater related data in the DMS. Bi-annual summaries of groundwater monitoring data will be prepared using

the analysis tools in the DMS and presented in the update to the bi-annual basin assessment (see **Section 3.6.6**).

Once the DMS is fully populated and quality-control checked a summary of existing basin conditions will be prepared. From this initial summary analysis will be performed on at least a bi-annual basis to assess the impacts of current and future City management actions on the groundwater system.

Actions. To maintain and improve the usability of the DMS, San Diego will take the following actions:

- Bi-annual updates DMS with future groundwater elevation and quality, well construction and lithology, borehole geophysical and surface water stream gauge data.

Provide City's available resources for maintaining and updating the DMS.

3.6 COMPONENT CATEGORY 3: GROUNDWATER RESOURCES PROTECTION

San Diego considers groundwater protection to be one of the most critical components of ensuring a sustainable groundwater resource. In this SPGMP, resource protection includes both the prevention of contamination from entering the groundwater basin and the remediation of existing contaminants. Prevention measures include proper well construction and destruction practices, development of wellhead protection measures, and protection of recharge areas. Containment prevention also includes measures to prevent contamination from human activities as well as contamination from natural substances such as saline water bodies from entering the potable portion of the groundwater system.

3.6.1 Well Construction Policies

San Diego County typically administers well construction policies through a well permitting program for the entire County. San Diego County Department of Environmental Health (DEH) well permitting program is detailed in San Diego County Code of Regulatory Ordinances, Title 6 Health and Sanitation, Division 7 Water and Water Supplies, Chapter 4 Wells, Article 1. General, which define the purpose and intent of the chapter (SEC.67.401.) as:

> *"to provide for the construction, repair and reconstruction of wells to the end that the ground water of this County will not be polluted or contaminated and that water obtained from such wells will be suitable for the purpose for which used and will not jeopardize the health, safety or welfare of the people of this County, and for the destruction of abandoned wells or wells found to be public nuisances to the end that such wells will not cause pollution or contamination of ground water or otherwise jeopardize the health, safety or welfare of the people of this County."*

San Diego County Code of Regulatory Ordinance Article 3. Standards, defines the general standards (SEC.67.420.) and standards for water wells (SEC.67.420.) as:

> *"No person shall construct, repair, reconstruct or destroy any well subject to this Chapter which does not conform to the standards established herein,"*

and

> *"Standards for the construction, repair, reconstruction or destruction of water wells shall be as set forth in Chapter II of State Department of Water Resources Bulletin No. 74-81 and Bulletin No. 74-90 (three copies of which have been filed with the Clerk of the Board of Supervisors of the County of San Diego and marked as Document No. 761185 and Document No. 761185A with the following modifications to Document No. 761185A,"*

respectively.

San Diego County Code of Regulatory ordinance Article 5. Construction, Repair, Reconstruction and Destruction of Wells, specifies the Acts Prohibited (SEC.67.440.) and Permits (SEC.67.441.) as:

> *"No person shall construct, repair, reconstruct or destroy any well unless a written permit has first been obtained from the Director of the Department of Environmental Health as provided in this Chapter, and unless the work done shall conform to the standards specified in this Chapter and all the conditions of the said permit.,"*

and

> *"Applications: Applications for permits shall be made to the Director of the Department of Environmental Health and shall include the following…,"*

respectively.

Multiple permitting requirements are provided as part of the Permits Section (SEC.67.441.) and are available at the following website.

http://www.sdcounty.ca.gov/deh/lwq/sam/wells_chapter_4.html

Actions. San Diego will take the following actions:

- Ensure that future production and monitoring wells are constructed per the County DEH well ordinance and City of San Diego staff understands the proper well construction procedures.

- Inform lessees and other groundwater users who are constructing production and monitoring wells of available information related to water quality concerns to assist with proper well siting. This information may be included on the GMP website.

- Provide lessees and other groundwater users with guidance on the importance and use of exploratory borehole information (lithologic descriptions and geophysical data) in the design and construction of production and monitoring wells. This guidance information may be included on the SPGMP website.

3.6.2 Well Destruction Policies

Similar to the well construction policies, San Diego County typically administers well destruction through their well permitting program. San Diego County DEH's well destruction requirements are also detailed in San Diego County Code of Regulatory Ordinance, Title 6 Health and Sanitation, Division 7 Water and Water Supplies, Chapter 4 Wells. The code articles described in Section 3.7.1 also apply to well destruction. As described in San Diego County Code of Regulatory Ordinance Article 5. Construction, Repair, Reconstruction and Destruction of Wells, Permits (SEC.67.441.), C. Conditions:

> *"Permits shall be issued in compliance with the standards set out in "California Well Standards" Bulletin 74-81 and Bulletin 74-90 and as provided in this Chapter except that such standards shall be inapplicable or modified as expressly provided by the Director of the Department of Environmental Health in such permit upon his finding that such modifications or inapplicability will accomplish the purposes of this ordinance. Permits may also include any other condition or requirement found by the Director of the Department of Environmental Health to be necessary to accomplish the purposes of this Chapter."*

One concern expressed by San Diego is that some abandoned domestic or agricultural wells may not been properly destroyed. For this reason, the City intends to conduct the follow actions utilizing guidance set forth from the DEH well destruction policies.

Actions. San Diego will take the following actions:

- Document well status active, (operational, and currently in use), inactive (not currently being used, but operational, with potential for future use), or abandoned (inoperable, or permanently inactive, with no potential for future use) as part of a well inventory survey completed during the development of the SPGMP. Based on survey results, if wells are classified as inactive, and then resurvey every 5 years to establish current well classification and follow appropriate protocols based on well status change. Abandoned wells, not included in the groundwater monitoring program, should be properly destroyed. Based on survey results, if wells are classified as abandoned, develop phased schedule for well destruction following DWR and/or County DEH standards.

- Ensure that land lessees are provided a copy of the County DEH's code and understanding the proper destruction procedures and support implementation of these procedures. A link to this information shall be provided on the SPGMP website.

- Follow up with the County DEH on the reported abandoned and destroyed wells to confirm the information has been provided to the DWR and vice versa. The City of San Diego will also keep a record of well status in the groundwater DMS.

3.6.3 Protection of Recharge Areas

Numerous studies have evaluated the surface and subsurface geology within basin. Natural recharge of groundwater resources occurs primarily from percolation of irrigation water, infiltration along the creeks and drainages, infiltration of precipitation, and subsurface inflow. Natural recharge rates can be maintained by keeping the major recharge areas free of impervious surfaces. The SDWMP outlines a number of actions focused on reducing the amount of impervious surface and hardscape in the watershed (Weston Solutions, 2006). These actions include increasing cluster development, increasing the use of pervious surfaces during development and redevelopment, constructing parking lots with pervious pavement, creating grassy swales and/or

vegetated areas to treat urban runoff, and performing roadway improvements using vegetated medians, buffers, and/or parkways (Weston Solutions, 2006).

The efficiency of direct recharge through surface spreading, as opposed to natural recharge, is highly related to the infiltration rate of the surficial soil. Based on previous descriptions, the most favorable areas for direct recharge utilizing surface spreading techniques, based on surface and subsurface geology and historical water level measurements are within Tujunga Sands (due to relative high permeability) located approximately in the center of the basin, just south of the Ysabel creek (Greeley and Hansen/HYA, 1993). Other areas along or near natural streams may be good candidates for spreading activities due to the presence of additional exposed Tujunga sands and other subsurface alluvium. Areas where canals, treated water systems, or possibly wastewater treatment plants are nearby may also be good candidates due to the proximity to potential water sources.

Actions. San Diego will take the following action:

- If groundwater quality monitoring data indicate groundwater contamination, review current and past land use practices to determine adverse impacts on groundwater quality. If correlations between land use and groundwater contamination are observed, then implement BMPs or report to appropriate enforcement agency.

3.6.4 Wellhead Protection Measures

As no municipal production wells exist in the basin (as all wells in the basin are for agricultural and self-supplied use) historically wellhead protection measure programs have not been applied within the basin. Identification of wellhead protection areas is a component of the Drinking Water Source Assessment and Protection (DWSAP) Program administered by DHS. DHS set a goal for all public water systems statewide to complete Drinking Water Source Assessments by mid-2003. The goals of the DWSAP Program are provided below:

- Protection and benefit of public water systems of the State;
- Improve drinking water quality and support effective management of water resources;

- Inform communities and drinking water systems of contaminants and possible contaminating activities that may affect drinking water quality or the ability to permit new drinking water sources;
- Encourage a proactive approach to protecting drinking water sources and enable protection activities by communities and drinking water systems;
- Refine and target the monitoring requirements for drinking water sources;
- Focus cleanup and pollution prevention efforts on serious threats to surface and groundwater sources of drinking water;
- Meet federal requirements for establishing wellhead protection and drinking water source assessment programs; and
- Assist in meeting other regulatory requirements.

The three major components required by DHS for completion of an assessment include:

- Delineation of capture zones around source wells;
- Inventory Potential Contaminating Activities (PCAs) within protection areas; and
- Analyze the vulnerability of source wells to PCAs.

Delineation of capture zones includes using groundwater gradient and hydraulic conductivity data to calculate the surface area overlying the portion of the aquifer that contributes water to a well within specified time-of-travel periods. Typically, areas are delineated representing 2-, 5-, and 10-year time-of-travel periods. These protection areas need to be managed to protect the drinking water supply from viral, microbial, and direct chemical contamination.

Inventories of PCAs include identifying potential origins of contamination to the drinking water source and protection areas. PCAs may consist of commercial, industrial, agricultural, and residential sites, or infrastructure sources such as utilities and roads. Depending on the type of source, each PCA is assigned a risk ranking, ranging from “very high” for such sources as gas stations, dry cleaners, and landfills, to “low” for such sources as schools, lakes, and non-irrigated cropland.

Vulnerability analysis includes determining the most significant threats to the quality of the water supply by evaluating PCAs in terms of risk rankings, proximity to wells, and Physical Barrier Effectiveness (PBE). PBE takes into account factors that could limit infiltration of contaminants including type of aquifer, aquifer material (for unconfined aquifers), pathways of contamination, static water conditions, hydraulic head (for confined aquifers), well operation, and well construction. The vulnerability analysis scoring system assigns point values for PCA risk rankings, PCA locations within wellhead protection areas, and well area PBE; the PCAs to which drinking water wells are most vulnerable are apparent once vulnerability scoring is complete.

PCA and capture zone information can be added to the DMS to aid in assessing wellhead protection. The DMS includes a feature that will automatically calculate wellhead protection areas if no data are available or if new well locations are proposed.

Actions. San Diego will take the following actions:

- If a conjunctive use project is implemented, contact groundwater basin managers in other areas of the state for technical advice, effective management practices, and "lessons learned", regarding establishing wellhead protection areas.

3.6.5 Control of the Migration & Remediation of Contaminated Groundwater

Contaminated groundwater within the basin most likely results from agricultural land use and upstream point and non-point urban water runoff. Although actions identified within this section will be applicable to all types of contaminants, San Diego is primarily concerned with basin areas that have elevated levels (exceeding the MCL and RWQCB Basin Objectives) of groundwater qualiconstitutent concentrations. **Figure 2-7** and **Figure 2-9**, illustrate concentrations of TDS and nitrate, respectively, from select wells throughout the basin. It is evident that groundwater quality changes significantly depending on location in the basin.

The SDWMP (Weston Solutions, 2006) developed actions to reduce discharge impairment on water quality. The actions include the following actions:

- Divert dry weather runoff to sanitary sewer systems,

- Install and maintaining in-line separation units and/or end-of-pipe controls along all major storm drains to water bodies,
- Create wetlands to treat urban runoff,
- Enhance existing detention basins,
- Route flows to stormwater detention/retention basins to reduce flooding and to treat runoff, and
- Install Lake Hodges water circulation and/or aeration system.

Additional actions were developed in the SDWMP to address management of animal waste and erosion control (Weston Solutions, 2006). The actions of interest associated with management of animal waste focus on directing flow from storm runoff from grazing areas to catchment basins, detention ponds sanitary sewers, or septic systems before the runoff enters the San Dieguito River and its tributaries (Weston Solutions, 2006).

San Diego is committed to coordinating with responsible parties and regulatory agencies to stay informed on the status and disposition of known contamination in the basin. Furthermore, the City intends to continue to collect water quality data as part of their monitoring program to identify point and non-point sources leading to groundwater contamination. Based on this data San Diego will encourage implementation of land use BMPs as a form of remediation. If correlations between land use and groundwater contamination are observed, then in rare cases, it is anticipated that San Diego will report poor land use practices to enforcement agencies. Enforcement agencies may utilize regulatory programs to ensure that migration of contaminants is controlled.

Actions. San Diego will take the following actions:

- Continue reviewing groundwater quality data collected for potential presence of contamination and include status in bi-annual state of the basin assessment or every 5 years.
- If contaminant detections occur, San Diego will implement the appropriate groundwater protection BMP, report to appropriate enforcement agency (i.e. Regional Water Quality Control Board).

- If contaminant detection occurs, provide the County DEH and others with all information on mapped contaminant polluters and Leaky Underground Storage Tank (LUST) sites for their information in developing groundwater extraction patterns and in the siting of future production or monitoring wells.

- If contaminant detection occurs, identify point and non-point sources of groundwater contamination.

3.6.6 Control of Saline Water Intrusion

The San Pasqual Valley does not extend to the Pacific Ocean, saline water intrusion from a saline or brine water body is not possible. The classification of groundwater is based on TDS concentrations provided in **Table 3-2**.

Table 3-2 – Classification of Groundwater based on TDS (Sutch and Dirth, 2004)

Category	Units (mg/L or ppm)
Fresh	0-1,000
Brackish	1,000-10,000
Saline	10,000-100,000
Brine	>100,000

Groundwater quality data throughout the basin has shown a variety of TDS concentrations ranging from fresh to very low level brackish. The primary water bearing formation within the basin is the alluvial aquifer which ranges in thickness from 200 feet in the east to 120 feet in the west. Beneath the alluvial aquifer exists the residual aquifer which yields a small quantity of water to wells from fractures (Izbicki, 1983). As described in Section 2, based on wells screened in primarily the alluvial aquifer, TDS concentrations range from approximately 700 to 1,300 in the eastern and western portions of the basin, respectively. Groundwater quality in the residual aquifer beneath the alluvial aquifer, based on specific conductance has a median dissolved solids concentration of approximately 1,040 mg/L (Izbicki, 1983). San Diego plans to evaluate the hydrogeologic communication between residual and alluvial aquifers as part an action to improve basin understanding (Section 3.6.7). In addition, as part of San Diego's monitoring program, analyze of trends in sodium, chloride, and TDS will provide an indicator of the potential of upwelling of very low level brackish water from greater depths. However, for these reasons, San Diego plans to take no actions related to saline water intrusion.

3.7 COMPONENT CATEGORY 4: GROUNDWATER SUSTAINABILITY

To ensure a long-term sustainable supply of groundwater for agriculture and reduce dependence on imported water for municipal supply, the City of San Diego is seeking to increase the seasonal volume of groundwater stored in the basin and improve the quality of groundwater over the long-term. These objectives will be met by if an imported water conjunctive use project is implemented in the eastern portion of the basin, and a brackish groundwater desalination project is implemented in the western portion.

The conjunctive use component could be operated in a "put" and "take" mode, allowing for aquifer recharge during periods of high water availability ("put" periods) and the recovery of stored water during periods of low water supply availability ("take" periods). The conjunctive use components may be operated on a seasonal basis, with recharge occurring during winter months and recovery during summer months; or on a carry-over configuration, in which water will be recharged wet years and recovered in dry years.

For the latter configuration, consecutive "put" years could be followed by several "take" years. Nonetheless, the amount of water that can be stored for more than one year without recovery would be limited by the amount of available storage in the basin at any given time.

San Diego has developed conceptual layouts of project facilities assuming seasonal storage and recovery. The dimensions of facilities may be refined during subsequent investigations and modeling efforts, once a better understanding of the basin and its alternative management configurations is gained, in order to allow for a carry-over project.

The desalination component would consist of a desalination facility operating year round and conveying desalinated water directly to the water distribution system in the Rancho Bernardo service area. **Figure 3-6** schematically shows the project components.

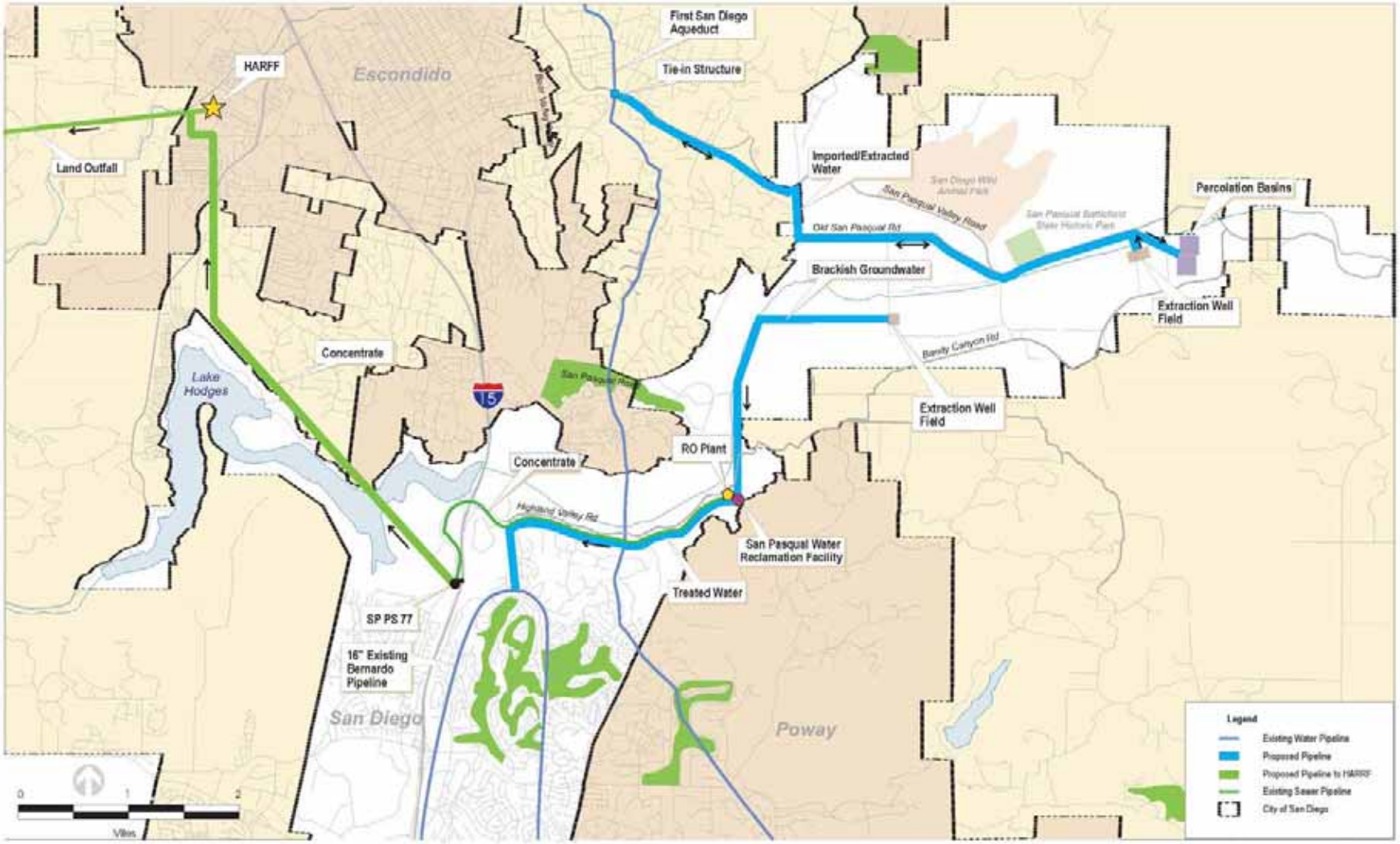


Figure 3-6 - Proposed Water Conveyance and Concentrate Disposal Facilities for Conjunctive Use and Brackish Groundwater Desalination Programs in the San Pasqual Valley

3.7.1 Conjunctive Use Component

The conjunctive use component will consist of recharging and recovering 10,000 AF of imported water. Imported water will be diverted from the First San Diego Aqueduct and recharged to the alluvial aquifer in the eastern portion of the basin by means of percolation basins. During periods of low supply of imported water, stored water will be recovered by means of extraction wells and conveyed back to the First San Diego Aqueduct for use.

A single pipeline will be used to convey imported water from the aqueduct to the recharge areas during recharge periods, and to convey recovered stored water back to the aqueduct for distribution during recovery periods. This line will have an approximate length of 30,000 linear feet and a diameter of 32 inches.

Imported water will be recharged to the aquifer by means of infiltration basins or the river bed during a six-month period. A total of 13 extraction wells with an average yield of 1,000 gpm will be needed to recover 10,000 AF of stored water during a six-month period. These wells will have an approximate depth of 125 feet and will be constructed in a grid with a separation between wells of approximately 500 feet. A pump station in the basin will be required to convey recovered water to the aqueduct.

The possibility of conveying the recovered stored water directly to the distribution system instead of back to the aqueduct, for example to the Rancho Bernardo service area, could also be considered. This delivery option would reduce the cost of the project, but may face regulatory or technical constraints. If treatment other than disinfection is required, some of the cost benefits would be offset.

3.7.2 Brackish Groundwater Desalination Component

This project component entails extracting 5,800 AFY of brackish groundwater from the western portion of the basin and desalinating it by means of a Reverse Osmosis (RO) water treatment plant. Brackish groundwater will be extracted and treated during all 12 months of the year. The water supply produced will be approximately 5,000 AFY, assuming a RO efficiency of 85 percent.

Four extraction wells with an average yield of 1,000 gpm will be necessary to produce, 5,800 AF of water in one year. The RO plant will be located within the San Pasqual Water Reclamation Facility (SPWRF) property. The SPWRF is currently out of service.

Desalinated groundwater will be conveyed to the distribution system in the Rancho Bernardo and Bernardo Oaks pressure zones. These pressure zones have a projected average day demand of 6 to 7 MGD, and thus will be able to accommodate the 4.5 MGD of produced desalinated water. A new 15,000-foot, 18-inch line will be built to connect the desalination facility to the Bernardo pipeline in Rancho Bernardo (see **Figure 3-7**).

Actions. San Diego will take the following actions:

- Continue to investigate conjunctive use opportunities and implement technically, economically environmentally feasible projects. Consideration should be given to improving the understanding of potential contaminant mobilization during recharge and rising groundwater elevations. The City Council approved the start of this project and the contractor received notice to proceed on July 24, 2007.

- Investigate groundwater desalination opportunities on the west side of the basin.

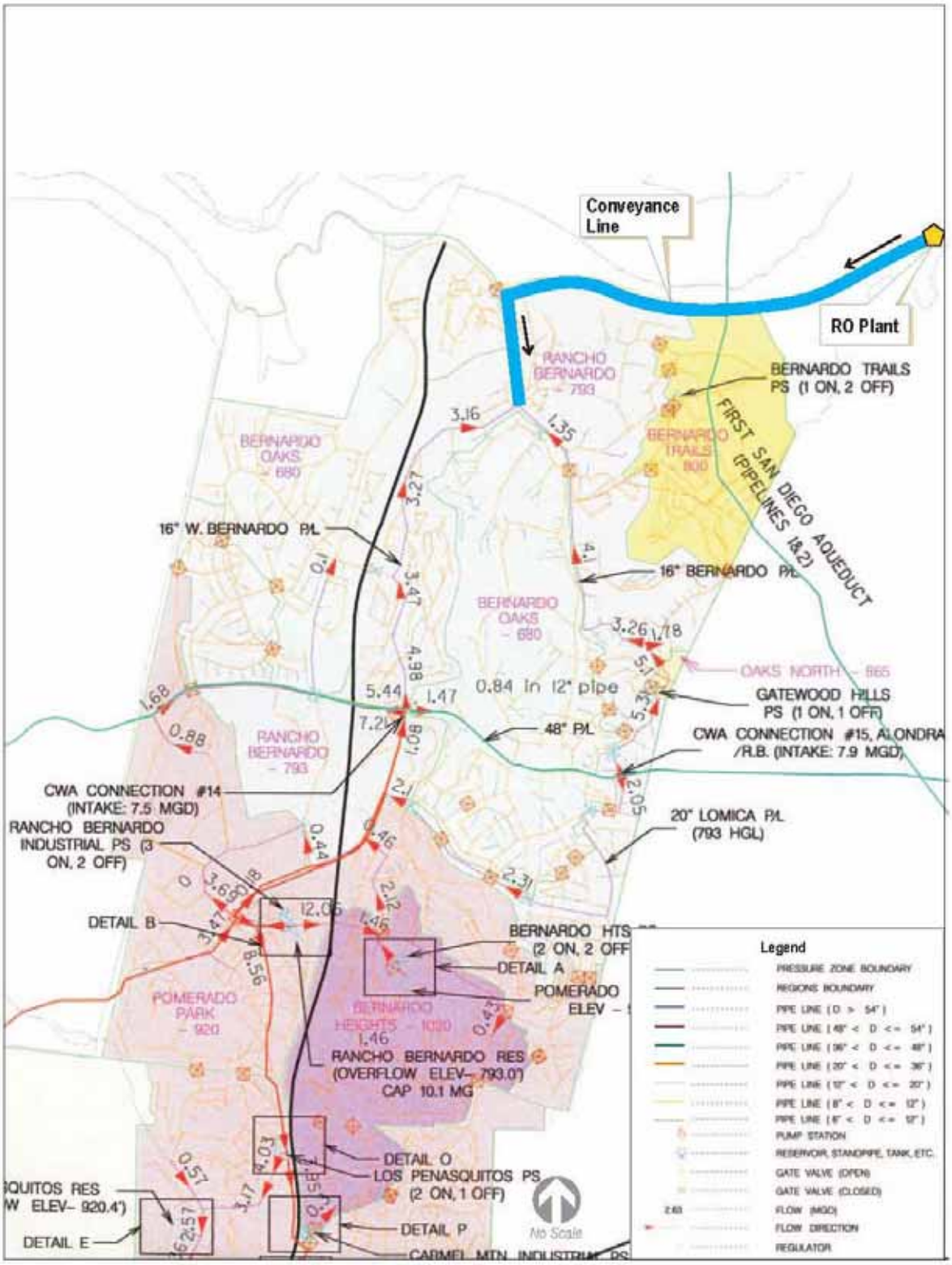


Figure 3-7 - City of San Diego Water Distribution System near San Pasqual Basin

3.8 COMPONENT CATEGORY 5: PLANNING INTEGRATION

With the significant number of water purveyors and Cities serving the San Diego County area, the need to integrate water management planning on a regional scale is a high priority. Individual purveyors and cities derive their supplies from the San Diego County Water Authority (regional wholesaler of imported water as detailed in **Section 1.5.2.2**), groundwater basins, or local surface water runoff reservoirs. Individual purveyor and cities infrastructure systems are mostly independent; where interconnections do exist between purveyors, they are typically for emergency purposes only. This section summarizes the existing planning efforts and efforts currently being developed. It is important to plan the integration of any San Pasqual groundwater projects that may results from this GMP effort as each project may have an impact on local water supplies.

3.8.1 Existing Integrated Planning Efforts

Integrated Regional Water Management Plan – San Diego is now actively participating in the preparation of the Integrated Regional Water Management Plan and will continue to do so in an effort to meet the GMP objectives. San Diego is one of the three agencies (County of San Diego, City of San Diego and San Diego County Water Authority) leading the Integrated Regional Water Management Plan effort.

The San Diego Integrated Regional Water Management planning process is a local water management approach aimed at securing long-term water supply reliability within California by first recognizing the inter-connectivity of water supplies and the environment and then pursuing projects yielding multiple benefits for water supplies, water quality, and natural resources.

The vision of the Integrated Regional Water Management Plan is “An integrated, balanced, and consensus approach to ensuring the long-term viability of San Diego’s water supply, water quality, and natural resources.”

The San Diego Integrated Regional Water Management (IRWM) Plan is being prepared to coordinate water resource management efforts and to enable the San Diego Region to apply for grants tied to IRWM Planning. The completed IRWM Plan will provide a mechanism for: coordinating, refining, and integrating existing planning efforts within a comprehensive, regional context; identifying specific regional and watershed-based

priorities for implementation projects; and providing funding support for the plans, programs, projects, and priorities of existing agencies and stakeholders.

Some Management Actions developed by this GMP may lead to projects such as the San Pasqual Conjunctive Use Storage Project. These projects will need to be integrated in the regional plans and be consistent with other projects undertaken locally and regionally. For example, it will be vital to the San Pasqual Conjunctive Use Storage Project to plan with CWA and other agencies for taking imported water from the aqueduct or putting water back into the aqueduct.

The City of San Diego has already submitted San Pasqual Projects for consideration to this planning group. Projects most relevant to San Pasqual groundwater basin listed under the IRWMP water management strategies for the San Dieguito Watershed are listed below:

- San Pasqual Conjunctive Use Groundwater Project – Feasibility Study
- San Pasqual Conjunctive Use Groundwater Project – Planning/Design
- San Pasqual Groundwater Desalination Project – 5,000 AFY Planning/Design

In addition to these, the County of San Diego is looking at a Comprehensive Groundwater Recharge Study for all San Diego region watersheds. The North San Diego County Brineline Project feasibility Study (lead by SDCWA) will look at a component of the San Pasqual Desalination project: the brine line.

As part of the San Pasqual GMP, the City of San Diego will take the following action:

- Establish a point of contact with the San Diego Integrated Regional Water Management Planning process and be involved in preparing grant application for Prop 50, Prop 84, and future funding, through the IRWMP effort.
- Continue to pursue grant of other funding to implement the adopted plans.

Urban Water Management Planning – The City of San Diego is required to prepare Urban Water Management Plans (UWMP). These plans, as defined by CWC § 10610 et seq., require public water suppliers with more than 3,000 customers or that deliver more than 3,000 AF of water annually to identify conservation and efficient water use practices to help ensure a long-term, reliable water supply. The City of San Diego has submitted

its 2005 UWMP to DWR. The plan builds upon the previously approved City of San Diego Long-Range Water resources Plan (2002-2030) and the Strategic Plan for Water Supply (1997-2015). These documents set water supply goals for future supplies. San Pasqual is a potential future water supply source. The GMP is the first step towards preparing a framework to achieve the water supply goals outlines in the UWMP.

The San Diego County Water Authority also updated its UWMP in 2005. The 2005 UWMP estimates that agencies within the Water Authority's service area used approximately 17,844 AF of groundwater in FY 2005. CWA projects that in 2030 the groundwater supply will be increased to 31,175 AF/yr by the development of various local projects such as the San Pasqual Conjunctive Use Storage Project and the San Pasqual Groundwater Desalination Project listed in the UWMP. This GMP is the first step towards meeting the goals of the UWMP.

Local Investigations and Studies Assistance Grant-funding Program (LISA Program) – In March 2007, the San Diego County Water Authority (SDCWA) sent out a request for proposals to its member agencies to receive grant funding from SDCWA under the LISA Program, established by the Board of Directors in January 2007. The program is being financially supported through funds available under California Senate Bill 1765 (SB 1765). SB 1765 appropriates funding to the Water Authority for the development and implementation of groundwater conjunctive use projects. The overall goal of the LISA Program is to encourage, through assistance in project funding, local groundwater conjunctive use studies and investigations that could lead to local water supply projects that provide new annual core (baseload) supplies or increased dry-year supplies. The City of San Diego submitted an application for the San Pasqual Conjunctive Use Storage Study on April 20th, 2007. The Funding recommendations for the LISA Program – First Funding Cycle were approved by the SDCWA Board on June 28th, 2007. The SDCWA will enter into a funding agreement totaling $750,000 with the City of San Diego for the "San Pasqual Groundwater Conjunctive Use Project". The City will continue to pursue similar local grant funding opportunities like this one.

In support of the San Pasqual GMP, the City of San Diego will take the following action:

- Prepare grant application for Prop 50, Prop 84, and future local or state funding to support the San Pasqual Conjunctive Use Storage Project, the monitoring plan or any other project in the basin.

Land Use Planning – Effective January 1, 2002, state law required (SB610 and SB221) that a water supplier take certain actions to confirm sufficiency of water supply as a condition to approval of some new development projects. These actions involve the development of Water Supply Assessments and Written Verifications at the request of the land use authority. These documents provide an assurance that adequate water supplies are available before a project moves forward. The San Pasqual GMP is anticipates a

As part of the San Pasqual GMP, the City of San Diego will take the following action:

- Participate in relevant Land Use Planning updates

San Pasqual Vision Plan – The Vision Plan addresses specific goals and tasks to be achieved in the San Pasqual Valley. One of them is directly focusing on the San Pasqual Groundwater Basin: "Protect the quality and capacity of the San Pasqual/Lake Hodges groundwater basin - to ensure that this invaluable asset as a water resource is not compromised." This GMP is a first step of a series of steps to achieve that vision.

As part of the San Pasqual GMP, the City of San Diego will take the following action:

- Participate in Vision Plan updates

Source Water Protection Plan – The City of San Diego's Water Department faces significant challenges protecting its raw water supply. This challenge results from much of the watershed lands being outside of San Diego's jurisdictional limits. Thus, much of the watershed lands are outside of San Diego's jurisdictional sphere of authority for land use planning, zoning, and building codes. In 2004, to address this, the Water Department has established a guide for development in and around water supply watersheds aimed at protecting the local source waters; "Source Water Protection Guidelines for New Development." City staff and other local agencies use these Guidelines as part of the development review, comment, and approval process. Land developers use the Guidelines when designing projects located in the areas where water supply could be affected within watersheds.

The Guidelines build upon existing land use, zoning, and building code regulations. They establish water quality control measures, specific to drinking water sources, for construction and new development, and also include recommendations for long-term maintenance of the control measures. Overall, it serves as a road map for sensible

development, increases the reliability of the water supply system, and reduces the cost of drinking water treatment.

The "Source Water Protection Guidelines for New Development Projects" can be downloaded from the following website:

http://www.sandiego.gov/water/operations/environment/swpg.shtml

As part of the San Pasqual GMP, the City of San Diego will take the following action:

- The City of San Diego will include a requirement in its Source Water Protection Plan that the City Water Department will review and comment on proposals for development in the San Pasqual/Hodges watershed

- The City of San Diego will continue to promote the Source Water Protection Guidelines for New Development.

Drinking Water Source Assessment and Protection (DWSAP) Program – The DWSAP Program is administered by DPH. As a first step to a complete source protection program, DHS required water systems to conduct a preliminary assessment. The assessment includes the "delineation of the area around a drinking water source through which contaminants might move and reach that drinking water supply; an inventory of PCAs that might lead to the release of microbiological or chemical contaminants within the delineated area; and a determination of the PCAs to which the drinking water source is most vulnerable."
(http://www.dhs.ca.gov/ps/ddwem/dwsap/overview.htm).

The assessments only apply to agencies that deliver groundwater for public drinking water supply. In 2002 and 2003, the City of San Diego completed DWSAPs for their existing five primary reservoirs and one groundwater well (El Cajon Well).

March 2006 Strategic Business Plan Update – The 2006 update outlines the strategies to be completed in 2006-2010. The fourth strategy is about effectively using existing water resources and obtaining alternative supplies. The corresponding tactics for 2007-2030 include implementing the San Diego Water Department Long-Range Water Resources Plan which recommends to develop and implement programs to meet the following objectives of the plan: Groundwater treatment program - 10 acre-feet per year;

Recycled water program 20,000 acre-feet per year; Groundwater storage program 20,000 acre-feet per year.

The City of San Diego will continue to include groundwater storage as part of their Strategic Business Plan updates.

Summary of Actions. The City of San Diego will take the following actions:

- Establish a point of contact with the San Diego Integrated Regional Water Management Planning process and be involved in preparing grant application for Prop 50, Prop 84, and future funding, through the IRWMP effort.

- Participate in Vision Plan updates, other relevant planning documents (i.e. UWMP, Land Use Planning, etc.) and water resources management activities.

- The City of San Diego will include a requirement in its Source Water Protection Plan that the City Water Department will review and comment on proposals for development in the San Pasqual/Hodges watershed.

- City of San Diego will seek an agreement with all jurisdictions in the drinking water source watershed. This agreement will ensure that those jurisdictions notify the City Water Department for comment on all land use proposals within the drinking water source watershed. Alternatively, San Diego could initiate legislation to add language to CEQA requiring jurisdictions in a drinking water source watershed to notify the water agency responsible for the drinking water source for comment on all land use proposals within the drinking water source watershed.

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Section 4 – Plan Implementation

Table 4-1 summarizes the action items presented in **Section 3** and an implementation schedule. Many of these actions involve coordination by San Diego with other local, state and federal agencies and most of these will begin within 6 months, following adoption of this SPGMP. A few activities involve assessing trends in basin monitoring data for the purpose of determining the adequacy of the monitoring network. These assessments will be made as new monitoring data become available for review by San Diego, and results will be documented in an annual Bi-Annual State of the Basin Assessment (see below).

Table 4-1 - Preliminary Summary of Proposed Management Actions for San Pasqual GMP

Action Related to BMO		BMO No. 1. *Protect and enhance groundwater quality.*	BMO No. 2. *Sustain a safe, reliable local groundwater supply.*	BMO No. 3. *Reduce dependence on imported water.*	BMO No. 4. *Improve understand-ing of groundwater elevation, basin yield and hydrogeology*	BMO No. 5. *Partner with agricultural and residential communities to continue to improve implementation of best management practices.*	Addresses Policy Advisory Committee - Identified Issue or Concern # (See Table 2)
Component No. 1 Stakeholder Involvement							
Involving the Public					✓	✓	✓
1	Update Public Outreach Plan Every Five Years.						D, F
2	Implement Public Outreach Plan Developed for the San Pasqual GMP.						D, F
3	Provide annual briefings to the Policy Advisory Committee (PAC) and invite stakeholders listed in **Attachment A,** including the domestic and agricultural groundwater users, on San Pasqual GMP implementation progress.						B,D,E,F,U
4	Create a new GMP website or use an existing San Diego website to display San Pasqual GMP information. Relevant website content may include outreach material, groundwater levels, groundwater quality and project updates.						B,D,E,F,U
5	Annually review list of stakeholders and update as necessary.						B,D,E,F,U

Action Related to BMO		BMO No. 1. *Protect and enhance groundwater quality.*	BMO No. 2. *Sustain a safe, reliable local groundwater supply.*	BMO No. 3. *Reduce dependence on imported water.*	BMO No. 4. *Improve understand-ing of groundwater elevation, basin yield and hydrogeology*	BMO No. 5. *Partner with agricultural and residential communities to continue to improve implementation of best management practices.*	Addresses Policy Advisory Committee - Identified Issue or Concern # (See Table 2)
Involving Other Agencies Within & Adjacent to the San Pasqual GMP Area		✓	✓		✓	✓	✓
6	Contact the land use authority in the watershed such as the Cities of Escondido, Poway, and the County of San Diego, to determine interests in considering improved standard to protect water quality.						A,D,F,N,Q
7	Monitor and review new development proposals and projects within the watershed to ensure that these proposals incorporate appropriate measures to protect downstream water quality and water quantity, as described in the SDWMP.						N, O, P, Q
8	Provide copies of the adopted San Pasqual GMP and subsequent bi-annual state of the basin assessments to representatives from City of Escondido, San Diego County Water Authority and the County of San Diego and other interested parties.						A,D,F,O,R,V
Developing Relationships with Local, State and Federal Agencies		✓	✓		✓		✓
9	Establish a formal process whereby jurisdictions in the watershed will notify the Water Department of any new residential, commercial, or agricultural development proposals or projects in the watershed; thus providing an opportunity for the Water Department to review and comment on the development, and verify that measures to protect water quality, as described in the SDWMP are being incorporated into the designs.						N
10	Partner with local, state and federal regulatory agencies to ensure that non-compliance fees are returned to the City of San Diego to fund water resource improvement programs in San Pasqual Basin.						N

Action Related to BMO		BMO No. 1. *Protect and enhance groundwater quality.*	BMO No. 2. *Sustain a safe, reliable local groundwater supply.*	BMO No. 3. *Reduce dependence on imported water.*	BMO No. 4. *Improve understand-ing of groundwater elevation, basin yield and hydrogeology*	BMO No. 5. *Partner with agricultural and residential communities to continue to improve implementation of best management practices.*	Addresses Policy Advisory Committee - Identified Issue or Concern # (See Table 2)
11	Establish a point of contact within local, state, and federal regulatory agencies that have responsibility for resource management within San Pasqual Basin. Please see list provided in **Attachment A**. Important resource agencies include (but not limited too) Department of Water Resources (DWR), the County Department of Environmental Health (DEH), Regional Water Quality Control Board (RWQCB), U.S. Fish and Wildlife Service, California Dept of Fish and Game, San Dieguito River Park Joint Powers Authority (JPA), USDA / Forest Service - See stakeholder list.						D,F
Pursuing Partnership Opportunities		✓	✓	✓	✓	✓	✓
12	Continue to promote partnerships with water purveyors and municipalities to achieve regional water supply reliability for the City of San Diego in San Pasqual Basin.						
13	Continue to track and apply for grant opportunities to fund GMP activities and local water management/development projects.						A,B,E
Component No. 2 Monitoring Program and Basin Understanding							
Groundwater Elevation Monitoring			✓		✓		✓
14	Identify and select production/monitoring well locations for installation of groundwater elevation data loggers.						M

Action Related to BMO		BMO No. 1. *Protect and enhance groundwater quality.*	BMO No. 2. *Sustain a safe, reliable local groundwater supply.*	BMO No. 3. *Reduce dependence on imported water.*	BMO No. 4. *Improve understand-ing of groundwater elevation, basin yield and hydrogeology*	BMO No. 5. *Partner with agricultural and residential communities to continue to improve implementation of best management practices.*	Addresses Policy Advisory Committee - Identified Issue or Concern # (See Table 2)
15	Continue to collect and evaluate groundwater elevation data from existing production and monitoring wells.						
Surface Water Flow Monitoring							
16	Continue to collect, evaluate and archive stream flow data from the creeks and streams entering and exiting the basin						
Groundwater Quality Monitoring		✓	✓		✓		✓
17	Continue to collect and evaluate relevant existing production and monitoring well groundwater quality data and further identify water quality constituents of concern.						C,J
18	Evaluate the potential mobilization of water quality contaminants as a result of rising groundwater elevations in response to implementation of a conjunctive use within the groundwater basin.						
19	Periodically collaborate with the U.S. Geological Survey (USGS) and the State Water Resources Control Board (SWRCB) to include monitoring results from the Groundwater Ambient Monitoring and Assessment (GAMA) program in updates to the bi-annual state of the basin assessment.						C,J
Surface Water Quality Monitoring		✓	✓		✓		✓
20	Archive the analytical results of surface water sampling in the SPGMP						

Action Related to BMO		BMO No. 1. *Protect and enhance groundwater quality.*	BMO No. 2. *Sustain a safe, reliable local groundwater supply.*	BMO No. 3. *Reduce dependence on imported water.*	BMO No. 4. *Improve understand-ing of groundwater elevation, basin yield and hydrogeology*	BMO No. 5. *Partner with agricultural and residential communities to continue to improve implementation of best management practices.*	Addresses Policy Advisory Committee - Identified Issue or Concern # (See Table 2)
21	Collect and analyze surface water samples for stable isotopes to better understand surface water/groundwater interaction						
Surface Water Groundwater Interaction Monitoring		✓	✓		✓		✓
22	Regularly summarize groundwater and Lake Hodges water quality in the bi-annual state of the basin assessments.						I,J,K,R
23	Summarize surface water quality data from existing City of San Diego monitoring points in the Bi-annual State of the Basin assessments.						J,O,P,Q,R
Protocols for Collection of Groundwater Data		✓	✓		✓		✓
24	Determine monitoring network adequacy and periodically review and expand as appropriate to meet the needs of the GMP on a 5 year frequency or on a special project need basis.						L,M
25	Establish protocols for methods and frequency of collection, storing, and disseminating data. These protocols will be documented in the GMP and may be updated in the bi-annual state of the basin assessments.						
Groundwater Reporting and Modeling					✓		✓
26	Determine the need for a numerical groundwater model and re-evaluate the need during development of the bi-annual state of the basin assessment. If deemed necessary, provide resources for maintaining, updating and utilizing a groundwater model. A potential application of a numerical model may be to assist in the development of a basin wide salt balance.						H

Action Related to BMO		BMO No. 1. *Protect and enhance groundwater quality.*	BMO No. 2. *Sustain a safe, reliable local groundwater supply.*	BMO No. 3. *Reduce dependence on imported water.*	BMO No. 4. *Improve understand-ing of groundwater elevation, basin yield and hydrogeology*	BMO No. 5. *Partner with agricultural and residential communities to continue to improve implementation of best management practices.*	Addresses Policy Advisory Committee - Identified Issue or Concern # (See Table 2)
27	Develop and present a bi-annual state of the basin assessment.						H,L,M,N
28	Review and update of GMP action items bi-annually. This information may be included bi-annual state of the basin reports.						
Evaluate Bedrock Underlying San Pasqual Valley		✓	✓		✓		✓
29	Review well construction information to identify groups of wells screened within alluvial formations and groups screened within underlying bedrock. If information is available, evaluate grouped well data (quality and elevations) to determine if groundwater within the bedrock system is a viable groundwater water supply resource.						N
Data Management System		✓	✓		✓		
30	Bi-annual update Data Management System (DMS) with future groundwater elevation and quality, well construction and lithology, borehole geophysical data and surface water stream gauge data.						
31	Provide City's available resources for maintaining and updating the DMS.						
Component No. 3 Groundwater Resource Protection							
Well Construction Policies		✓	✓				
32	Ensure that future production and monitoring wells are constructed per the County DEH well ordinance and City of San Diego staff understands the proper well construction procedures.						
33	Inform lessees and other groundwater users who are constructing production and monitoring wells of available information related to water quality concerns to assist with proper well siting. This information may be included on the GMP website.						

Action Related to BMO		BMO No. 1. *Protect and enhance groundwater quality.*	BMO No. 2. *Sustain a safe, reliable local groundwater supply.*	BMO No. 3. *Reduce dependence on imported water.*	BMO No. 4. *Improve understand-ing of groundwater elevation, basin yield and hydrogeology*	BMO No. 5. *Partner with agricultural and residential communities to continue to improve implementation of best management practices.*	Addresses Policy Advisory Committee - Identified Issue or Concern # (See Table 2)
34	Provide lessees and other groundwater users with guidance on the importance and use of exploratory borehole information (lithologic descriptions and geophysical data) in the design and construction of production and monitoring wells. This guidance information may be included on the GMP website.						
Well Abandonment and Destruction Policies		✓	✓				
35	Document well status (active, operational, and currently in use}, inactive {not currently being used, but operational, with potential for future use}, or abandoned {inoperable, or permanently inactive, with no potential for future use}) as part of the well inventory survey completed during the development of the GMP. Based on survey results, if wells are classified as inactive, then resurvey every 5 years to establish current well classification and follow appropriate protocols based on well status change. Abandoned wells, not included in the groundwater monitoring program, should be properly destroyed. Based on survey results, if wells are classified as abandoned, develop phased schedule for well destruction following DWR and/or County DEH standards.						
36	Ensure that land lessees are provided a copy of the County DEH's code and understanding the proper destruction procedures and support implementation of these procedures. A link to this information shall be provided on the "GMP" website.						
37	Follow up with the County DEH on the reported abandoned and destroyed wells to confirm the information has been provided to the DWR and visa versa. The City of San Diego will also keep a record of well status in the groundwater Data Management System.						
Protection of Recharge Areas		✓	✓				✓
38	If groundwater quality monitoring data indicate groundwater contamination, review current and past land use practices to determine adverse impacts on groundwater quality. If correlations between land use and groundwater contamination are						O,P,Q,S

	Action Related to BMO	BMO No. 1. *Protect and enhance groundwater quality.*	BMO No. 2. *Sustain a safe, reliable local groundwater supply.*	BMO No. 3. *Reduce dependence on imported water.*	BMO No. 4. *Improve understand-ing of groundwater elevation, basin yield and hydrogeology*	BMO No. 5. *Partner with agricultural and residential communities to continue to improve implementation of best management practices.*	Addresses Policy Advisory Committee - Identified Issue or Concern # (See Table 2)
	observed, then implement Best Management Practices (BMPs) or report to appropriate enforcement agency.						
	Wellhead Protection Measures	✓	✓				
39	If a conjunctive use project is implemented, contact groundwater basin managers in other areas of the state for technical advise, effective management practices, and "lessons learned", regarding establishing wellhead protection areas.						
	Control of the Migration and Remediation of Contaminated Groundwater	✓	✓				✓
40	Continue reviewing groundwater quality data collected for potential presence of contamination and include status in bi-annual state of the basin assessment or every 5 years.						J,S
41	If contaminant detections occur take the appropriate action to implement groundwater protection BMP or report to appropriate enforcement agency (i.e. Regional Water Quality Control Board).						J
42	If contaminant detection occurs, provide the County DEH and others with all information on mapped contaminant polluters and Leaky Underground Storage Tank (LUST) sites for their information in developing groundwater extraction patterns and in the siting of future production or monitoring wells.						
43	If contaminant detection occurs, identify point and non-point sources of groundwater contamination.						J,O,P,Q,R
	Component No. 4 Groundwater Sustainability						

Action Related to BMO		BMO No. 1. *Protect and enhance groundwater quality.*	BMO No. 2. *Sustain a safe, reliable local groundwater supply.*	BMO No. 3. *Reduce dependence on imported water.*	BMO No. 4. *Improve understand-ing of groundwater elevation, basin yield and hydrogeology*	BMO No. 5. *Partner with agricultural and residential communities to continue to improve implementation of best management practices.*	Addresses Policy Advisory Committee - Identified Issue or Concern # (See Table 2)
Conjunctive Management Activities				✓			✓
44	Continue to investigate conjunctive use opportunities and implement technically, economically environmentally feasible projects. Consideration should be given to improving the understanding of potential contaminant mobilization during recharge and rising groundwater elevations.						
45	Investigate groundwater desalination opportunities on the west side of the basin.						
	Component No. 5 Planning Integration						
Integrated Regional Water Management Planning(IRWMP), Urban Water Management Planning (UWMP), Land Use Planning, and Groundwater Modeling		✓	✓	✓	✓		✓
46	Establish a point of contact with the San Diego Integrated Regional Water Mgt. Planning process and be involved in preparing grant application for Prop 50, Prop 84, and future funding, through the IRWMP effort.						E,F,T
47	Participate in Vision Plan updates, other relevant planning documents (i.e. UWMP, Land Use Planning, etc.) and water resources management activities.						
48	The City of San Diego will include a requirement in its Source Water Protection Plan that the City Water Department will review and comment on proposals for development in the San Pasqual/Hodges watershed.						

Action Related to BMO		BMO No. 1. *Protect and enhance groundwater quality.*	BMO No. 2. *Sustain a safe, reliable local groundwater supply.*	BMO No. 3. *Reduce dependence on imported water.*	BMO No. 4. *Improve understand-ing of groundwater elevation, basin yield and hydrogeology*	BMO No. 5. *Partner with agricultural and residential communities to continue to improve implementation of best management practices.*	Addresses Policy Advisory Committee - Identified Issue or Concern # (See Table 2)
49	City of San Diego will seek an agreement with all jurisdictions in the drinking water source watershed. This agreement will ensure that those jurisdictions notify the City Water Department for comment on all land use proposals within the drinking water source watershed. Alternatively, the City could initiate legislation to add language to CEQA requiring jurisdictions in a drinking water source watershed to notify the water agency responsible for the drinking water source for comment on all land use proposals within the drinking water source watershed.						

4.1 BI-ANNUAL GMP IMPLEMENTATION REPORT

San Diego will report on progress made implementing the SPGMP in a Bi-Annual State of the Basin Assessment, which will summarize groundwater conditions in the San Pasqual area and document groundwater management activities from the previous two years. This report will include:

- Summary of hydrologic conditions and monitoring results, including a discussion of historical trends.
- Changes in well status – constructed destroyed etc.
- Summary of management actions during the period covered by the report.
- A discussion, supported by monitoring results, of whether management actions are achieving progress in meeting BMOs.
- Summary of status of BMO component category implementation.

The State of the Basin Assessment will be completed by April 1st every other year and will report on conditions and activities completed through December 31st of the preceding two years.

4.2 FUTURE REVIEW OF GMP AND RELATED PROGRAMS

This SPGMP is intended to be a framework for the first regionally-coordinated management efforts in the San Pasqual basin area. As such, many of the identified actions will likely evolve as San Diego actively manages and learns more about the basin. Many additional actions will also be identified in the annual summary report described above. The SPGMP is therefore intended to be a living document, and it will be important to evaluate all of the actions and objectives over time to determine how well they are meeting the overall goal of the plan. San Diego plans to evaluate this entire plan within five years of adoption.

4.3 FINANCING

It is envisioned that implementation of the SPGMP, as well as many other groundwater management-related activities will be funded from a variety of sources including San

Diego, state or federal grant programs, and local, state, and federal partnerships. Some of the items that would likely require additional resources include:

- Monitoring for groundwater quality or elevations in non-purveyor wells.
- Reactivation of surface water gauging
- Customization of the DMS interface.

Preparation of SPGMP bi-annual reports.

- Updates of the overall SPGMP.
- Update of data sets and recalibration/improvement of existing groundwater model.
- Collection of additional subsidence data.
- Construction of monitoring wells where critical data gaps exist.
- Stream-aquifer interaction studies.
- Implementation of the SPGMP including:
- Committee coordination.
- Project management.
- Implementation of regional conjunctive use program.
- During year one of plan implementation, an estimate of some of the likely costs associated with the above activities will be prepared.

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SAN PASQUAL

GROUNDWATER MANAGEMENT PLAN

Appendix A

Lease Agreements – Excerpts Pertaining to Environmental Protection

of LESSEE under this provision shall explicitly be subject to the provisions of Section 5.3, Waste, Damage or Destruction, hereof.

b. LESSEE shall prepare the land for planting in a manner consistent with good agricultural practice, taking maximum advantage of natural water sources. Such actions of LESSEE shall be performed in a manner satisfactory to the City Manager.

c. LESSEE shall install a drag hose, rainbird-type sprinkler head or approved type of irrigation system of sufficient size to irrigate the acreage devoted to crop production. The main lines shall consist of either agricultural grade transite or City-approved plastic. The hoses and sprinklers shall be adequately sized so as to properly distribute the water over the usable acreage in the required time.

d. Disagreements as to sound agricultural and/or husbandry practices shall be submitted to a mutually acceptable governmental agricultural authority located in the County of San Diego. CITY and LESSEE agree to accept the decisions of such authority as final. In the event that LESSEE fails to cure any unauthorized practice, then this lease shall be treated in accordance with Section 4.4, Defaults and Remedies, hereof. All permanent plantings, as well as all other improvements to the property, shall become the property of CITY at the expiration or sooner termination of this lease agreement.

8.2 Water Quality - Best Management Practices and Storm Water Pollution Prevention Plan. CITY and LESSEE are committed to the implementation of programs to manage activities on the premises in a manner which aids in the protection of the City of San Diego's precious water resources. LESSEE shall comply with the Best Management Practices ("BMP") including the Storm Water Pollution Prevention Plan ("SWPP") approved by CITY's Storm Water Management Program. LESSEE shall submit for review and approval by the City Manager or his designee, within ninety (90) days of the execution of this lease, BMP and SWPP that will control erosion and reduce the amount of pollutants and other sediments discharged from the premises. The BMP and SWPP will be reviewed periodically by CITY. Upon written notice from the City Manager requesting an update of the BMP, LESSEE shall submit updated BMP and SWPP for City Manager review and approval within ninety (90) days of receipt of notice. LESSEE shall implement any necessary changes to the BMP and SWPP as a result of any review by CITY to ensure compliance with any changes in laws or regulations.

When the BMP and SWPP have been developed and implemented by LESSEE, it is crucial that the practices be enforced and maintained. It is LESSEE'S

responsibility to inform employees, contractors, subcontractors, agents and vendors of the BMP and SWPP. LESSEE shall take proper corrective action, to the satisfaction of CITY, to prevent the infestation of noxious weeds, pests, and erosion throughout the entire leased premises.

8.3 Reporting Requirements for Agricultural Practices. LESSEE agrees to provide to the Water Department regular reports about the agricultural activities conducted on the leased property. These reports will detail the usage of water, pesticides, herbicides, fertilizers, and soil amendments; as well as the crops grown. The required reports are specified in Resource Management Plan.

8.4 Noxious Weeds, Pests, and Erosion. LESSEE shall take proper corrective action, to the satisfaction of CITY, to prevent the infestation of noxious weeds, pests, and erosion throughout the entire leased premises.

8.5 No Warranty. CITY does not warrant that the premises are suitable for the purposes for which they are leased as stated herein.

8.6 Cutting of Trees. No growing or mature trees are to be destroyed or removed without prior written consent of the City Manager; trees growing along roadways may be trimmed back as required by the LESSEE. However, trees growing in man-made ditches may be removed by LESSEE. Trees growing in natural drainage channels may not be removed without written consent of the City Manager.

8.7 Hold Harmless, Flood Damage and Other Acts of God. LESSEE understands and agrees that the leasehold area is subject to flood damage and that other damage may result to the leasehold from other circumstances, including weather conditions and such causes as fire and earthquakes. LESSEE agrees that any damages resulting from flooding or such other causes shall not result in any liability on the part of the CITY, and LESSEE specifically agrees to assume the defense of, indemnify, and hold CITY harmless for any such damages. LESSEE further specifically agrees that CITY shall have no obligation whatsoever to construct or maintain channels or to construct, maintain, or operate reservoirs or release water from reservoirs in such a way as to control, alleviate, or minimize potential damages to the leasehold area. LESSEE specifically assumes the risk of all damages resulting from flooding or weather conditions or other natural causes. LESSEE is authorized to minimize potential flood damage through improved drainage and other flood control improvements as agree upon with CITY.

Were it not for LESSEE'S agreement to assume all risk regarding flooding and LESSEE'S further agreement that CITY has absolutely no obligation with regard

9.7 Hazardous/Toxic Waste. Other than approved agricultural chemicals, i.e., insecticides, pesticides, herbicides, and fungicides applied in accordance with all applicable regulations, LESSEE will not allow the installation or release of hazardous substances in, on, under or from the premises. For the purposes of this provision, a release shall include, but not be limited to, any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leeching, dumping, or otherwise disposing of hazardous substance. "Hazardous substances" shall mean those hazardous substances listed by the Environmental Protection Agency in regularly released reports and any other substances incorporated into the State's list of hazardous substances. A copy of the presently effective EPA and the State lists is on file in the City Clerk's office as City Clerk Document 769704-1.

In the event of any release of a hazardous substance, LESSEE shall be responsible for all costs of remediation and removal of such substances in accordance with applicable rules and regulations of governmental authorities.

LESSEE agrees to assume the defense of, indemnify and hold the CITY, its elected officials, officers, agents, representatives and employees, harmless from any and all claims, costs and expenses related to environmental liabilities resulting from LESSEE'S operations on the premises, including, but not limited to, costs of environmental assessments, cost of remediation and removal, any necessary response costs, damage for injury to natural resources or the public, and costs of any health assessment or health effect studies.

If LESSEE knows or has reasonable cause to believe that any hazardous substance has been released on or beneath the premises, LESSEE shall give written notice to the City Manager within ten (10) days of receipt of such knowledge or cause for belief. Provided, however, if LESSEE knows, or has reasonable cause to believe that such substance is an imminent and substantial danger to public health and safety, LESSEE shall notify the City Manager immediately upon receipt of this knowledge or belief and shall take all acts necessary to alleviate such danger. LESSEE will notify the City Manager immediately of any notice of violation received or initiation of environmental action or private suits relative to the premises. In addition, LESSEE and LESSEE'S sublessees shall not utilize or sell any hazardous substance on the property without the prior written consent of the CITY.

Appendix B

Summary Descriptions of Groundwater Management Planning Efforts in the Vicinity of San Diego

Borrego Water District

The Borrego Water District's service area is located approximately 50 miles to the east of the SPGMP area (Error! Reference source not found.). The Borrego Water District Groundwater Management Plan (BWDGMP) was adopted on October 18, 2002. The goal of the BWDGMP is as follows:

> *"The goal of this study is to provide a long-range groundwater management plan for the Borrego Valley that will minimize overdrafting of the aquifer and enhance the recharge capabilities while providing a dependable supply of water for the reasonable growth of the valley. This plan should do so in a manner that is equitable to the current users of the aquifer and economically feasible for future users."*

The components of the BWDGMP are based upon the CDWR Draft Guidelines and include reliability, public input, regional groundwater management, integrated planning, management objectives, data monitoring and evaluation, implementation, and periodic re-evaluation.

The BWDGMP contains the following nine BMOs:

1) Adopt programs and approaches to groundwater management that will incrementally reduce the annual decline in water levels of monitored wells;

2) Evaluate all programs adopted for groundwater management to assess their impact on the long-term water resources of the adjacent land in the state park;

3) Implement programs to improve the measurement of all water uses in the valley;

4) Develop additional programs to measure the water resources of the aquifer;

5) Establish standards for reduction of water use for all categories of land use and develop programs to meet those standards;

6) Maintain water quality throughout the valley at the current standard;

7) Assure that the appropriate agencies, particularly the BWD, evaluate any new land use in terms of its projected impact upon the valley's groundwater resources;

8) Work with public and private entities to acquire agricultural land from willing sellers; and

9) Determine the maximum amount of water that can be obtained from adjacent basins and evaluate programs to acquire land and construct the necessary facilities to make maximum use of these resources.

San Luis Rey Municipal Water District

The San Luis Rey Municipal Water District's service area is located approximately 20 miles to the north of the SPGMP area (Error! Reference source not found.). A groundwater management plan document was completed in 1996. There is no information regarding whether the plan has been implemented.

Sweetwater Authority

The Sweetwater Authority's service area is located approximately 30 miles to the southwest of the SPGMP area (Error! Reference source not found.). An interim GMP was developed for the Sweetwater Authority to commence groundwater management in the area until a subsequent plan is adopted by the Sweetwater Authority Governing Board, pursuant to Water Code Section 10750 et seq. (AB3030).

The Sweetwater Valley basin is described in the State of CDWR Bulletin Number 118 as basin number 9-17 (CDWR, 2003). Implementation of the groundwater management plan involves managing groundwater levels and protecting groundwater quality within the watershed of the Sweetwater River, the Sweetwater Valley basin, and the San Diego Formation within the service area of the Sweetwater Authority.

The groundwater management strategies as described in the interim plan include the following:

- Maintain static groundwater levels
- Protect groundwater from pollution by man-made activities
- Monitor seawater intrusion
- Monitor groundwater quality and quantity
- Sweetwater Authority groundwater projects

- Develop new or expanded groundwater supplies

- Development of relationships with state and local regulation agencies – United States Bureau of Reclamation (USBR) and United States Geological Survey (USGS)

The interim plan states that Sweetwater Authority will maintain a database of groundwater levels and water quality for existing monitoring wells within the Sweetwater Valley basin.

Rainbow Valley Basin Groundwater Management Plan

The Rainbow Valley service area is located approximately 15 miles to the northwest of the SPGMP area, adjacent to Riverside County (Error! Reference source not found.). The Rainbow Valley Basin Groundwater Management Plan (RVBGMP) was prepared in accordance with the Water Code Section 10750 et seq. (AB3030).

The Rainbow Valley basin is located within the Rainbow Valley Watershed, which is a 5,864 acre watershed. The Rainbow Valley basin is surrounded by foothills of granitic rock. The increased storage of water in the aquifer has led to high water tables, failure of septic systems, and perennial flow of Rainbow Creek. The majority of the water imported into the basin is used for irrigation of agricultural land.

The objectives of the RVBGMP are related to the use of only imported water, the high water table, and poor water quality. The following objectives have been identified in the RVBGMP:

- Provide a safe, reliable local water supply,

- Reduce dependence on imported water by developing a new local groundwater supply,

- Lower the groundwater table within the Rainbow Valley east of I-15,

- Improve water quality (both surface and groundwater), and

- Educate the agricultural and residential communities regarding best management practices they can implement.

The RVBGMP was developed as the first comprehensive study of the hydrologic conditions of the Rainbow Valley basin, including compilation and analysis of previously collected data and additional data collection and monitoring to fill data gaps. The recommended future actions include additional data collection and feasibility studies to investigate the potential for groundwater production projects. Additional data will help to develop a better understanding of the basin and ultimately determine the potential for extraction of groundwater from the residual aquifer.

Tia Juana Valley County Water District

The Tia Juana Valley County Water District's service area is located approximately 40 miles to the southwest of the SPGMP area (Error! Reference source not found.). The Tia Juana Valley County Water District was identified as having adopted a GMP in 1995 (CDWR website, 2004). However, no information is readily available about the current management plan.

Appendix C

Summary Descriptions of Other Water Management Efforts Underway in the Region

1. San Pasqual Valley

The following section provides a summary of management efforts that have taken place within the San Pasqual Valley.

1.1. Rancho Bernardo Reclaimed Water Facilities Plan and San Pasqual Valley Groundwater Management Concepts, 1993

The City of San Diego initiated a study in 1990 to investigate the management of wastewater and reclaimed water facilities in the northern limits the City limits which is not served by the Metropolitan Sewage System. The San Pasqual Valley Wastewater Management and Water Reclamation Project included two phases, Phase 1 – Feasibility and Phase 2 – Facilities Plan.

The purpose of the Phase 2 – Facilities Plan was to develop and evaluate alternative facilities to distribute reclaimed water from the Hale Avenue Resource Recovery Facility (HARRF) in Escondido to identified users in San Diego. The scope of the Facilities Plan included the following: (1) Preparation of a reclaimed water marketing analysis of municipal and industrial users in Rancho Bernardo and within the Wild Animal Park in the San Pasqual Valley, (2) development of a reclaimed water distribution system and a computer model to predict the optimal size of pipelines, pump stations and operation storage reservoirs, (3) development of a conceptual Groundwater Management Plan (GMP) to optimize development and utilization of the San Pasqual Valley's water resources, and (4) investigation of alternative funding options available to the San Diego for the Reclaimed Water Distribution System and the Groundwater Management Plan.

The goal of the third scope item was to develop and implement a GMP that would help to improve the existing water quality in the San Pasqual Valley basin and the Hodges basin. The plan proposed that the objective could be met by controlling recharge of poor quality runoff, enhancing recharge of high quality runoff, and by implementing land use controls. Five alternative plans were proposed and analyzed for both economic and non-monetary factors. A preferred alternative was selected,

but additional issues with implementing the GMP were identified and included the following:

price of reclaimed water from Escondido to be used for artificial recharge,

implementation of a management fee for groundwater pumping and other uses in the San Pasqual and Hodges basins, and

future facilities to use Lake Hodges as a raw water source by the City of San Diego.

Additional studies that address these issues were identified and were to be required before implementation of a GMP.

1.2. San Pasqual Water Resources Strategic Plan Draft, 1994

The purpose of the San Pasqual Water Resources Strategic Plan was to develop a comprehensive goal and strategic plan to achieve that goal, for management of water resources in the San Pasqual Valley. A number of goals in the strategic plan for water resources management were identified including the following:

Develop new sources to increase local water supply,

Develop emergency water storage capacity,

Increase groundwater and surface water quality in reservoirs through renovation techniques,

Support agriculture in San Pasqual Valley,

Support environmental conservation programs in San Pasqual Valley,

Develop reclaimed water supplies that have competitive prices with future water costs,

Manage property owed by the water utility in San Pasqual Valley in an environmentally and fiscally sound manner, and

Provide input as the primary landowner within the San Pasqual Valley into the Community Plan Update process.

The plan recommended utilizing the San Pasqual groundwater basin as a storage medium, which led to the inclusion of a basin management plan in the strategic plan. The basin management plan was to do the following:

Renovate groundwater quality,

Provide a place to store water at the lowest cost,

Provide a new supply of water for use locally, for transfers, or to the imported water system, and

Provide a place to store unsold reclaimed water from Aqua III[1] or the HARRF.

Environmental enhancement through wetland restoration and increased revenue through conjunctive use of groundwater were mentioned as two possible benefits of the recommended strategy.

1.3. San Pasqual Valley Water Resources Management Plan, 1997

The San Pasqual Valley Water Resources Management Plan discusses opportunities for the development of alternative water supplies, such as groundwater, reclaimed water, seawater desalination, and water repurification. This plan consists of four distinct projects that aim to maximize the benefits of the primary landowner's (City of San Diego's) assets in the San Pasqual Valley. Each of the four projects was outlined to benefit a specific stakeholder group, which would then be responsible for financing and managing the project. The four projects include the Watershed Management Project, the San Pasqual Valley Groundwater Management Project, the Riparian Corridor Management Project, and the Industrial Brine Export System.

The Groundwater Management Project involved evaluating the current operation of the San Pasqual Reclamation Facility and possible re-engineering of the existing facility. Four scenarios were considered and analyzed for the potential return on investment. Based upon the results of the analysis, multiple cost-effective and technically feasible options were available for the City to pursue. The Plant Expansion Alternative was recommended because the alternative provides the highest return on investment and a positive net cash flow to the City. It was recommended

[1] Aqua III refers to the San Pasqual Water Reclamation Facility.

that the alternative should be further pursued by completing additional studies on means of brine disposal and environmental considerations.

2. City of San Diego

The following section provides a summary of other management efforts that are underway in the City of San Diego.

2.1. General Plan

The City of San Diego's General Plan was first adopted in 1967. An update of the General Plan and Progress Guide was completed in 1979. The next two decades were characterized by growth and an evolving economy within the City. Residential growth extended to the City jurisdictional boundaries. The economic base expanded from tourism and defense to include high technology research and manufacturing, and international trade. Following these two decades, the City Council developed a Strategic Framework Element in 2002 to guide in the comprehensive update of the entire Progress Guide and General Plan from 1979.

The Strategic Framework Element includes an element on Public Facilities, Services, and Safety that includes a subsection on the Water Infrastructure within San Diego. The goal of the Water Infrastructure section is to provide a safe, reliable, and cost-effective source of water to the City of San Diego. Policies have been designated to meet this goal and include the following:

PF-H.1. Optimize the use of imported supplies and improve reliability by increasing alternative water sources to: provide adequate water supplies for present uses, accommodate future growth, attract and support commercial and industrial development, and supply local agriculture.

PF-H.2. Provide and maintain essential water storage, treatment, and supply facilities and infrastructure to serve existing and future development.

PF-H.3. Coordinate land use planning and water infrastructure planning with local, state, and regional agencies to provide for future development and maintain adequate service levels.

The San Pasqual Vision Plan identifies the San Pasqual Valley groundwater basin as a potential site for groundwater storage to efficiently store surplus surface water or imported water, which would contribute to Policy PF-H1b.

In 1995, San Diego adopted the San Pasqual Valley Plan that includes specific goals aimed at the long-term protection and management of the San Pasqual Valley (Valley). The San Pasqual Valley Plan is now included within the City's General Plan. The Valley was also identified as a region for development of potential groundwater resources. The City of San Diego is responsible for following through with directives written in the San Pasqual Valley Plan.

2.2. Integrated Regional Water Management Plan

The Integrated Regional Water Management Plan (IRWMP) for the City of San Diego is being prepared to coordinate water resource management efforts and to enable the San Diego Region to apply for grants tied to IRWM Planning. SDCWA issued a request for proposals (RFP) for an Integrated Regional Water Management (IRWM) Plan Grant Application and a Stakeholder Outreach Phase II Project, on January 29, 2007. The projects selected for inclusion within the final plan must be submitted by April 2007. As this document has not been finalized, projects related to the SPGMP area are currently unknown.

3. Regional Management Efforts

The following section describes management efforts or ordinances within the SPGMP region.

3.1. San Diego County Groundwater Ordinance

Currently, two groundwater ordinances are in place in San Diego County, ordinance numbers 7994 (N.S.) and 9644 (N.S.). The goals of the ordinances are to protect, preserve, and maintain the groundwater resources within the entire San Diego County. Both of the ordinances were written to ensure that agricultural development does not occur in groundwater dependent areas of the County unless there is an adequate groundwater supply for the existing and proposed uses of the land. Agriculture is prevalent within the San Pasqual Valley and is primarily dependent upon groundwater. Agriculture in San Diego County is recognized to provide

sustainable benefits. Therefore, the adoptions of these ordinances are not meant to limit or restrict agricultural activities.

3.2. San Diego County Water Authority

The following section provides information about management efforts taking place through the SDCWA.

3.2.1. Urban Water Management Plan

The SDCWA adopted an UWMP in 2000 and updated it again in 2005. The UWMP was prepared in compliance with the California Urban Water Management Planning Act as well as Water Code sections enacted with the passage of Senate Bills 610 and 221 in 2001. The 2005 UWMP presents and discusses water demands, demand management, SDCWA water supplies, member agency supplies, Metropolitan imported water supplies, water quality, and a shortage contingency analysis. The 2005 UWMP also identifies a number of water resources opportunities, which are expected to be developed over the next 25 years to ensure long-term water supply reliability to the region, including the development of the SDCWA water treatment plant, the emergency storage project (ESP), and the carryover storage project (CSP). As part of the UWMP, water conservation measures have been addressed and several have been established. In addition to these measures, a number of actions towards developing a 50-million gallon per day (mgd) seawater desalination facility have been completed.

As mentioned previously, SDCWA provides water to the City of San Diego; however, within the San Pasqual Valley, water use is primarily from self-supplied groundwater.

In 2006, the total percentage of water delivered to SDCWA from MWD had decreased to 73%. The projections for SDCWA's water supply in 2020 show a more diversified water supply portfolio, the relative percentages shown in **Table C-1** below.

Table C-1 – SDCWA's Current and Projected Water Supply Portfolio

SDCWA Water Supply

2006	
	Percentage (%)
MWD	73
Surface water	11
Conservation	7
Imperial Irrigation District Transfer	5
Recycled water	2
Groundwater	2

2020	
MWD	29
Imperial Irrigation District Transfer	22
Conservation	11
Seawater Desalination	10
Canal Lining Transfers	9
Surface water	7
Recycled water	6
Groundwater	6

3.2.2. SDCWA Groundwater Report (June 1997)

The SDCWA prepared the Groundwater Report in June 1997 to help in developing a Groundwater Implementation Plan, as well as to act as a reference document that will be updated periodically. The Groundwater Report was prepared to serve the following purposes:

Provide an overview of groundwater occurrence and availability within the SDCWA service area;

Identify general opportunities and constraints to groundwater development and conjunctive use;

Identify, summarize, and evaluate existing, planned, and potential groundwater projects within the Authority service area; and

Provide other information that will assist the SDCWA in developing a Groundwater Implementation Plan, and in evaluating and refining the SDCWA's Water Resources Plan groundwater supply projections and Strategic Plan goals.

3.2.3. Regional Facilities Master Plan

The purpose of SDCWA's Regional Water Facilities Master Plan (Master Plan) is to evaluate their ability to continue to provide a safe and reliable water supply to member agencies. The Master Plan serves as an outline for implementing additional facilities and improvements to existing facilities that are needed in order for SDCWA to cost effectively meet their mission through 2030. The Master Plan is made up of three interrelated components including water demands, water supplies, and facilities. Facility planning first involved estimating the water demands of the region and then identifying the facilities that would be needed to treat and transport water supplies. The Master Plan defined three scenarios to model facility alternatives. The different facility alternatives include 18 to 25 potential projects, which will be evaluated for their reliability, cost, and ranking within a set of qualitative criteria. The three Master Plan alternatives include the following:

Alternative 1: Conveyance of Supplies From the North, or Metropolitan with Pipeline 6

Alternative 2: Conveyance of Supplies From the West, or Regional Seawater Desalination (the Proposed Project)

Alternative 3: Conveyance of Supplies from the East, or Regional Colorado River Conveyance Facility

The Master Plan includes the following objectives:

Plan for future treated and untreated water supplies and facilities to meet the projected demands of a growing regional population;

Protect the public's health, safety and welfare by maintaining and enhancing a safe and reliable supply of water;

Plan facilities that are cost-effective; and

Provide an ability to adjust facility plans to meet changes in future demands.

In 1999, the SDCWA Board of Directors authorized the San Diego Formation Groundwater Storage and Recovery Feasibility Study and the Lower San Luis Rey River Valley Groundwater Storage and Recovery Feasibility Study to better quantify future regional water storage requirements. The goal of the Feasibility Studies is to identify the best storage and supply option for the region. By identifying the best combination of imported and local water facilities, SDCWA will be able to meet the region's long term needs for water supply, quality, and reliability.

3.2.4. San Diego Formation Groundwater Storage and Recovery Feasibility Study: Phase 1

A three-phase feasibility study of the San Diego Formation is underway and being conducted by the SDCWA. The purpose of the study is to investigate the feasibility of utilizing the San Diego Formation for the storage of surface water supplies (conjunctive use). The primary goal of the first phase of the San Diego Formation Groundwater Storage and Recovery Feasibility Study was to identify cost-effective and regionally beneficial storage alternatives and to identify potential well sites, all of which will be looked at in a further detailed analysis in Phases 2 and 3.

The results from the first phase of this study indicate that the gross storage potential of the San Diego Formation (Formation) is high, but the "usable" storage capacity is constrained by such things as the potential for inducing land subsidence and saltwater intrusion. The total gross storage potential of the Formation is approximately 2 million acre-feet (MAF) or more of water. However, the practical constraints above and the economic or siting issues associated with accessing the Formation reduce the

estimated usable storage capacity to between 40,000 and 90,000 Acre-feet/year (AF/yr) if all the project concepts discussed in Phase 1 were implemented.

3.2.5. San Luis Rey River Valley Feasibility Study

A three-phase feasibility study is being conducted by the SDCWA within the Lower San Luis Rey River Valley. Phase II of the study was completed in March 2005. The purpose of the study is to investigate the feasibility of utilizing the Mission and Bonsall groundwater basins for storing surface water supplies (conjunctive use).

3.2.6. Facilities Description

Metropolitan delivers imported water to SDCWA from Lake Skinner in Riverside County to a facility approximately six miles south of the Riverside-San Diego County line. The imported water is delivered to SDCWA member agencies through five pipelines, 48 to 108 inches in diameter that traverse the county north to south. The pipelines carry either filtered or raw water and have a combined capacity to carry 900 MGD.

The majority of the pipelines in the aqueduct system deliver water by gravity, but pipeline sections built after 1993 were constructed to withstand pumping pressure. This capability would be used to send water in the opposite direction in case of an emergency.

The pipelines within the system are divided into two alignments, the First Aqueduct and the Second Aqueduct. The First Aqueduct includes Pipelines 1 and 2 and the Second Aqueduct includes Pipelines 3, 4, and 5. The pipeline sections built after 1993 have names that reflect the communities where they are located. Four additional short pipelines run east to west and connect the two aqueducts.

The aqueduct system has additional components to keep water flowing including flow control facilities, pump stations, and other facilities that need to be operated continuously. The facilities are necessary to ensure that the correct amount of water is flowing to meet the needs of member agencies and their customers.

The First Aqueduct (Pipelines 1 and 2) runs through the westernmost portion of the SPGMP area and the City of Escondido. These pipelines carry raw water and are fed by the Crossover Pipeline. The Crossover Pipeline runs from the Second Aqueduct at the Diversion Structure in Twin Oaks Valley (north of San Marcos) and connects to Pipelines 1 and 2 at Hubbard Hill in the northern area of the City of Escondido. From

this point Pipelines 1 and 2 run south through the City of Escondido and across Lake Hodges just east of Interstate 15 continuing southerly to San Vicente Reservoir in the Lakeside area. From the First Aqueduct, the Crossover Pipeline runs northwest from the City of Escondido to meet the Second Aqueduct.

3.3. City of Escondido

Escondido's UWMP was adopted in 2000. An updated, "complete" version of the UWMP was produced in 2005. The UWMP was written in compliance with the California Urban Water Management Planning Act. The City of Escondido is a member agency of the SDCWA and will work in order to ensure water supply reliability for the City. In the event of a water shortage, Escondido will utilize established water conservation plans and action plans outlined in SDCWA's 2005 UWMP, to assist in maintaining adequate water supplies. The urban water management practices of Escondido are of interest to the San Pasqual Valley because surface water supplies could be negatively impacted by urban runoff from Escondido. Cloverdale Creek is a small stream that supplies the San Pasqual Valley basin and that originates within Escondido.

Appendix D

City Council Policy 600-45

CITY OF SAN DIEGO, CALIFORNIA

COUNCIL POLICY

CURRENT

SUBJECT: PROTECTION OF WATER, AGRICULTURAL, BIOLOGICAL AND CULTURAL RESOURCES WITHIN THE SAN PASQUAL VALLEY

POLICY NO.: 600-45

EFFECTIVE DATE: June 27, 2005

BACKGROUND:

For at least 50 years, the San Diego City Council has protected the treasured agricultural preserve of the San Pasqual Valley as well as the public's investment in water resources within the Valley by using land around Lake Hodges and its watershed for agriculture uses which are compatible with the vision to protect water quality, preserve open space and maintain the Valley's rural character.

Beginning in the late 1940's the City of San Diego Water Department began acquiring large parcels of land in the San Pasqual Valley for water-supply purposes. At present time, the City owns most of the land in the Valley, with only a very small portion remaining in private ownership. The Real Estate Assets Department currently manages the land on behalf of the Water Department, leasing the property in a manner which is consistent with the goals of protecting the watershed, rural character and biological resources of the San Pasqual Valley.

The San Pasqual Valley Plan, adopted by the San Diego City Council on June 27th 1995 and amended in March 1996, recognizes the Valley as an important water, agricultural and natural resource, home to San Diego County's most sensitive habitats. The Plan, however, also designates a finite number of sites for limited commercial uses associated with low-impact recreation and agriculture. Today, with the increasing urbanization of surrounding communities, the natural resources of the Valley could be threatened. In the time since the Plan's adoption it has become apparent that some approved land uses are deteriorating the vision for the Valley.

The Multiple Species Conservation Program (MSCP) is a regional conservation plan in which the City of San Diego is a participating member. The City Council, on March 18, 1997, authorized the City's MSCP implementing agreement with the U.S. Fish and Wildlife Agency and the California Fish and Game (R28455), thereby agreeing to implement the City of San Diego MSCP Subarea Plan and other MSCP implementing regulations. Section 1.5.9 of the Subarea Plan sets forth specific management policies and directives for San Pasqual Valley, including biological management measures, land management and planning directives, and access planning guidelines, however these policies do not cover the entire San Pasqual Valley area.

In addition to the adoption of the San Pasqual Valley Plan and the MSCP Subarea Plan, in 2002 the City Council adopted the Strategic Framework Element as part of the City's General Plan Update. The Strategic Framework Element reinforces the preservation of San Pasqual Valley for agricultural use and open space. Further, the General Plan identifies the large City-owned agricultural preserve in the San Pasqual Valley as a unique feature that adds significantly to the overall image and quality of life typical of San Diego.

As an historic step in protecting the San Pasqual Valley's vital water resources, preserving it's rural character and encouraging appropriate agricultural uses, in 2004 the San Pasqual Vision Plan was drafted. The plan recognizes the groundwater resources, natural habitat values, sustainable agricultural opportunities, cultural and historic resources, and outdoor recreational opportunities present in the San Pasqual Valley and the responsibility of the City to manage these lands. One of the goals listed in the plan is the preparation and adoption of this Council Policy to prohibit any further commercialization of the San Pasqual Valley and protect the rural character.

PURPOSE:

It is the desire of the City of San Diego to ensure the long-term protection of the significant water resources within the San Pasqual Valley, as these resources will play an important role in helping to meet the City's future water supply needs. It is also the desire of the City to preserve the Valley's significant agricultural areas, sensitive native habitats and unique scenic qualities. The irreplaceable glimpses of San Diego's natural and cultural heritage that are preserved within this Valley must not be lost. Significant biological and cultural resources will be protected and properly managed; quality of the groundwater basin will be ensured; appropriate agricultural activities will be facilitated; and compatible, passive recreational uses will be pursued. All of these goals are to be accomplished for the enjoyment and appreciation of future generations. This Council Policy will reinforce the goals of both the General Plan and the San Pasqual Valley Community Plan, which identify the San Pasqual Valley as an agricultural preserve with significant open space values.

POLICY:

It shall be the policy of the City to preserve the existing rural character of the San Pasqual Valley by tailoring the Valley's zoning and land use policies prohibiting any further commercialization and further protecting the Valley's vital water resources. The City shall protect the quality and capacity of the San Pasqual/Lake Hodges Surface Water and Groundwater Basin as well as protect, enhance and restore sensitive habitats within the Valley. The City shall educate the public on the importance of the Valley's resources, in order to build a sense of stewardship to sustain the long-term success of the important natural resources of the San Pasqual Valley. The City is directed to preserve, promote and sustain agricultural uses in the Valley. The City shall seek to build consensus with surrounding jurisdictions and other entities in order to ensure a mutual understanding of the need to be sensitive to the vision for the Valley. Implementation of this Policy should ensure that the primary goal of protecting water resources and subsequent goals of natural habitat preservation, retention of agriculture, and passive recreation are achieved in a manner which is complimentary to each other, thus avoiding any condition in which one goal would compete with another. Together these actions, along with any additional protections which the City Manager may identify, are intended to ensure the permanent protection of the San Pasqual Valley's unique water, agricultural, biological and cultural resources.

IMPLEMENTATION:

The protection of water resources, agricultural, biological and cultural resources within the San Pasqual Valley is intended to be implemented through the following actions:

1) The City shall institute an amendment to the Land Development Code to tailor the types of uses allowed in the AG-1-1 zone, as to prohibit uses which are detrimental to the vision for the San Pasqual Valley. The City shall next institute a rezone of all City-owned parcels in the Valley from AR-1-1 to AG-1-1, to ensure that all City-owned parcels are in compliance with the vision. This Council Policy is not intended to restrict the ability of the Wild Animal Park to 1) operate its visitor-serving activities within the current or future Park boundaries or 2) to further its animal conservation and propagation mission, including development of new, and renovation or refurbishment of existing, exhibits and facilities, within the limits of its current boundaries or any future leases or rights of entry. Nor is this Policy intended to prohibit those limited commercial uses that are directly associated with the agricultural activities occurring in the Valley. Additionally, the City shall amend the San Pasqual Valley Plan as to strengthen the language describing the types of land uses envisioned for the Valley. In order to complement the Land Development Code Amendment to the AG-1-1 zone, the San Pasqual Valley Plan shall be amended with language clearly establishing the intention for a strict limitation on development within the Valley. The Community Plan language should provide the framework to further protect the Valley's vital natural resources, reinforcing the goals of previously adopted documents to maintain the Valley as an agricultural preserve.

2) The City, jointly with other stakeholders, is preparing a San Dieguito River Watershed Management Plan. Preparation of a San Pasqual Groundwater Basin Management Plan is included as part of the City evaluation and potential development of the groundwater while protecting the agriculture resource. These plans shall include an evaluation of how best to effectively protect, manage, and utilize the Valley's water resources, while considering agricultural uses, native habitats, cultural resources, and passive recreational opportunities. As the primary landowner in the San Pasqual Valley, the City of San Diego is responsible for ensuring that there is a high quality drinking water supply for City of San Diego residents. Much of the land owned by the City has the potential to influence the quantity and quality of source water that reaches the groundwater and Lake Hodges, one of the City's water supply reservoirs. The Water Department is responsible for managing these watershed lands and the groundwater basin to meet their water supply objectives.

3) In order to provide a comprehensive review of existing and proposed leases in the San Pasqual Valley, the City shall establish a multi-discipline review committee consisting of staff representatives from various City departments. The committee shall prepare an annual report summarizing the status of all leases in the San Pasqual Valley. This report shall also include the status of proposed habitat management actions, as well as the identification of obstacles related to implementation, and a study of leasehold boundaries, including identification of sensitive habitat encroachment. In addition to the report, the City shall establish an encroachment monitoring program to ensure the leaseholders activities are consistent with the terms and conditions of their lease. Finally, the annual report shall provide a summary of ongoing recreation projects in the Valley as well as identify potential areas appropriate for

habitat restoration activities, consistent with the San Dieguito River Watershed Management Plan, which is currently being developed.

4) The City shall work with other public agencies to create a comprehensive interpretive program for the San Pasqual Valley, including the construction of an interpretive center. A major component of any successful habitat preservation project is to educate the citizenry about the importance of the natural features which are contained within that area. In order to ensure the long-term success of the San Pasqual Valley it is important for the residents of San Diego to recognize the Valley's unique natural habitat, its historical role in terms of watershed protection. The Valley is a unique natural and archaeological treasure that is envisioned to become a valuable educational and interpretive resource for the surrounding communities. Interpretive programs often encompass informational exhibits, interpretive stations, interpretive signage, educational resources and materials, as well as interpretive centers. The specific location of trails within the planning area would be proposed by organizations such as the San Dieguito River Park Joint Powers Authority (JPA) and reviewed and approved by the Water, Real Estate Assets and Development Services Deparments. Existing resources, including the San Pasqual Battlefield State Historic Park, the San Diego Wild Animal Park, Sikes Adobe, the Mule Hill/San Pasqual Trail, the Orfilia Vineyards, the San Diego Archaeological Center and the Ruth Merrill Interpretive Trail should all become key components which will serve as hubs along a developed interpretive corridor. City staff shall work closely with public agencies, organizations and community members to provide a variety of interpretive and educational resources throughout the Valley.

5) The City shall establish a San Pasqual Land Use Task Force to devote its focus and attention to current issues which relate to present San Pasqual Valley leaseholds or which affect the integrity and preservation of the Valley. The Task Force shall evaluate the merits of long-term leases, in order to preserve, promote and sustain agricultural uses which are compatible with the protection of water quality. The San Pasqual Land Use Task Force shall be comprised of a total of nine to eleven members from various community groups, City departments and other agencies, including: the San Pasqual/Lake Hodges Community Planning Group, the Rancho Bernardo Community Planning Board, the San Diego Wild Animal Park, the City's Real Estate Assets Department, the City's Water Department, the City's Planning Department, the Farm Bureau, the Natural Resource Conservation District, and a resident selected by the City Councilmember with jurisdiction over the San Pasqual Valley. Members of the Task Force shall be appointed by the Councilmember with jurisdiction over the San Pasqual Valley. Following the completion of their evaluation of the leasehold process, the Task Force shall submit a report of their findings, including recommendations, to the Councilmember.

6) The City shall seek to establish cooperative relationships with the surrounding municipalities, agencies and community planning groups, adjacent to the San Pasqual Valley. Because issues such as water quality, ground water recharge and habitat preservation do not necessarily follow jurisdictional boundaries, governmental bodies and other organizations must work together to protect the beneficial uses of the watershed. In order to ensure that development proposed around the perimeter of the Valley, as well as upstream of the Valley, will not have a negative impact on the qualities and resources of the San Pasqual Valley, the City shall meet

with neighboring entities to convey the importance of addressing onsite urban runoff and storm water issues, including attention to downstream conditions of concern, flooding, erosion and water quality. In addition, the City shall request that these entities institute a practice of regular notification to the City's Real Estate Assets Department, of any land use proposals around the perimeter of the Valley, which may potentially impact the Valley. This coordination should take account of both public and private development projects, including transportation and public utility projects. The entities involved in this collaborative partnership should specifically include the surrounding jurisdictions of Poway, Escondido and the County of San Diego, as well as other agencies and organizations, including the San Pasqual/Lake Hodges Community Planning Group, the Rancho Bernardo Community Planning Board and the San Dieguito River Park JPA.

7) All City Departments shall be required to notify both the San Pasqual/Lake Hodges Community Planning Group and the Rancho Bernardo Community Planning Board of any proposals, public or private, that may affect the lands included within the boundaries of the San Pasqual Valley Plan area. Although the San Pasqual/Lake Hodges Community Planning Group is the City's officially-recognized community planning group for the San Pasqual Valley, per Council Policy 600-24, the Rancho Bernardo Community Planning Board has a long history of participation with land use issues related to the protection of the San Pasqual Valley, therefore will continue this role as well.

8) The City shall identify and review ways to ensure the long-term protection of the Valley's unique water, agricultural, biological and cultural resources. One option the City shall explore is the possibility of an amendment to the City Charter establishing the requirement that a majority vote of the people shall be obtained before any development which is inconsistent with the Council-adopted San Pasqual Valley Plan can be approved within the Valley. Included in this potential City Charter amendment should be the language that a majority vote of the people would also be required prior to the sale of any City-owned property within the San Pasqual Valley for purposes other than agriculture or habitat preservation. The City shall also explore the possible establishment of a conservation easement or appropriate land dedication over the Valley to permanently protect water, agricultural and biological resources. Included in this action, the City Attorney shall provide a legal analysis of the applicability of the Williamson Act to publicly-owned agricultural land. Additionally, the City shall explore the potential to dedicate all of the City-owned parcels within the San Pasqual Valley as parkland. All of the above options should take into account the understanding that they would most likely require that the City reimburse the Water Department for the acquisition of the property, as the property was originally purchased for "water storage" purposes. Finally, the City shall study the potential for further land acquisitions to expand the boundaries of the San Pasqual Valley. By exploring these and other options, the City can develop a feasible solution to permanently protecting the precious resources of the San Pasqual Valley.

PHASING:

The eight steps outlined as the implementation actions in this policy represent a comprehensive strategy for accomplishing the vision for the San Pasqual Valley, to ensure the long-term protection of the Valley's unique water, agricultural, biological and cultural resources.

Initial steps to implement the vision should include:

- A rezone action for all City-owned property in the San Pasqual valley to AG-1-1 (with the exception of the Wild Animal Park).
- A Land Development Code Amendment to the AG-1-1 zone as to forbid a number of non-agricultural uses that are not appropriate in the Valley.
- A Community Plan Amendment to the San Pasqual Valley Plan.
- On a case-by-case basis, consider entering into long-term leases with those uses that are clearly compatible with the vision for the Valley.
- Ensuring that both the San Pasqual/Lake Hodges Community Planning Group and the Rancho Bernardo Community Planning Board are informed of all planning and land use issues that pertain to the San Pasqual Valley Plan Area.
- Exploration of ways to permanently protect the San Pasqual Valley.

Mid-term implementation actions should include:

- Preparation of a San Pasqual/Lake Hodges Surface Water and Groundwater Basin Management Plan.
- Establishment of a San Pasqual Land Use Task Force.
- Creation of a comprehensive interpretive program.

Long-term/ongoing actions include:

- Construction of an interpretive center.
- Preparation of annual status report on leasehold activities.
- Establishment of collaborative partnerships among the adjacent jurisdictions.
- Implementation of the San Dieguito Watershed Management Plan.

HISTORY:

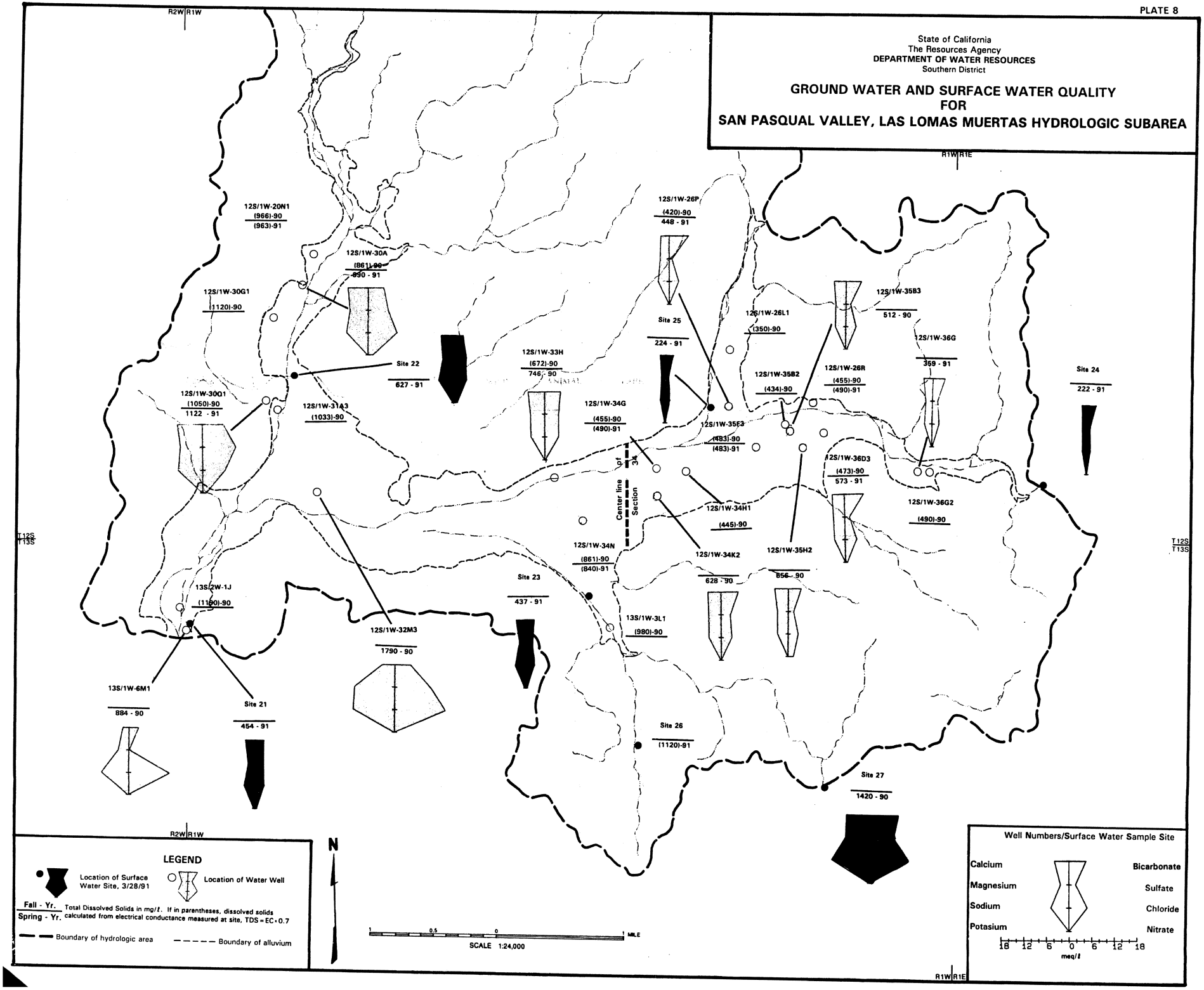
Adopted by Resolution R-300588 06/27/2005

Appendix E

Surface Water Sampling Locations and Summary of Analytical Results – DWR in March of 1991

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
Southern District

GROUND WATER AND SURFACE WATER QUALITY FOR SAN PASQUAL VALLEY, LAS LOMAS MUERTAS HYDROLOGIC SUBAREA



LEGEND

- Location of Surface Water Site, 3/28/91
- Location of Water Well
- Fall - Yr. / Spring - Yr. — Total Dissolved Solids in mg/ℓ. If in parentheses, dissolved solids calculated from electrical conductance measured at site, TDS = EC × 0.7
- Boundary of hydrologic area
- Boundary of alluvium

N

SCALE 1:24,000

Well Numbers/Surface Water Sample Site

Cloverdale Creek (Izbicki, 1983), flows south into the San Dieguito River along the western edge of San Pasqual Valley.

Under natural conditions, stream flow in San Pasqual Valley is intermittent; however, irrigation runoff and waste water discharges cause protracted flow in some streams. For example, much of the flow in Santa Maria Creek comes from the effluent from the Santa Maria Wastewater Treatment Plant (WWTP), which is discharged on spray fields upstream in the Ramona HSA.

On March 28, 1991, surface water samples were collected for mineral analysis at five sites in Las Lomas Muertas HSA. The sampling sites are shown on Plate 8. Site 21 is on the San Dieguito River at the lower end of the subarea, site 22 is on a tributary (Cloverdale Creek) at San Pasqual Road, site 23 is on Santa Maria Creek at Bandy Canyon Road, site 24 is on Santa Ysabel Creek at the upper end of Las Lomas Muertas HSA, and site 25 is on Guejito Creek at San Pasqual Road. Plate 8 also shows site 27 on Santa Maria Creek at the basin divide, where a sample was collected for analysis in March 1990, and site 26 on a small tributary to Santa Maria Creek at Highland Valley Road, where the EC of the water was measured in April 1991. Table 32 shows water temperature, pH and EC, which were measured at each sampling site.

TABLE 32
PARAMETERS MEASURED AT SURFACE WATER SAMPLING SITES IN LAS LOMAS MUERTAS HYDROLOGIC SUBAREA

SAMPLE SITE[1]	DATE SAMPLED	TEMP. (°F)	pH	EC (µS/cm)	CALCULATED TDS[2] (mg/l)
21	3-28-91	56	7.4	590	413
22	3-28-91	56	7.3	875	613
23	3-28-91	51	7.9	600	420
24	3-28-91	49	7.8	320	224
25	3-28-91	54	7.8	360	252
26	4-25-91	58	7.3	1,600	1,120
27	3-13-90	47	8.0	1,760	1,232

1. Refer to Plate 8 for site locations.
2. Calculated TDS = 0.7 x EC.

The surface waters have mixed chemical character, with either sodium-chloride or calcium-bicarbonate as the dominant ions. A detailed ionic characterization for each sample is given in Table 33. Results of the mineral analyses, which are presented in Table 34, show that water quality is generally good and that the concentrations of most constituents are below the water quality objectives and drinking water standards. However, unlike ground water, which typically has fairly consistent quality at a given site, surface water quality can have great seasonal variability. Higher flows can be more diluted. Most of the samples were collected near the end of March 1991, a wet

month in which 9.75 inches of rain were reported at the San Diego Wild Animal Park. No stream flow data are available for the sampling sites, but flow was high enough to wash out some roads in San Pasqual Valley.

TABLE 33
CHARACTERIZATION OF SURFACE WATER QUALITY
IN LAS LOMAS MUERTAS HYDROLOGIC SUBAREA

SAMPLING SITE	DOMINANT CATIONS (in decreasing order of concentration)	DOMINANT ANIONS (in decreasing order of concentration)
21	Na-Ca-Mg	Cl-SO_4-HCO_3
22	Na-Ca-Mg	Cl-SO_4-HCO_3
23	Na-Ca-Mg	HCO_3
24	Ca-Mg-Na	HCO_3
25	Ca-Na-Mg	HCO_3
27	Na-Ca-Mg	Cl-HCO_3-SO_4

Refer to Plate 8 for site locations.
Na = sodium, Ca = calcium, Mg = magnesium
Cl = chloride, SO_4 = sulfate, HCO_3 = bicarbonate

TABLE 34
SURFACE WATER QUALITY IN LAS LOMAS MUERTAS HYDROLOGIC SUBAREA

Ca	Mg	Na	K	HCO_3	SO_4	Cl	NO_3	F	B	TDS	Hardness	pH	EC
Site 21:													
51.3	21.4	63.3	9.6	117.1	107.6	89.1	30.4	<0.1	0.44	454	216	7.6	770
Site 22:													
67.3	35.0	94.7	9.8	134.2	168.6	124.5	60.9	0.3	0.56	627	312	7.6	1,100
Site 23:													
47.3	19.0	63.2	10.7	122.0	91.0	85.6	24.9	<0.1	0.43	437	196	7.8	740
Site 24:													
28.0	14.6	26.4	2.7	122.0	41.8	34.0	2.6	0.1	0.33	222	130	7.9	370
Site 25:													
30.4	12.6	29.8	2.7	100.0	40.8	41.1	5.8	0.2	0.33	224	128	8.0	400
Site 27:													
130	81	238	8.4	463.8	300	369	1.5	0.8	0.6	1,420	658	8.2	2,290

All values are mg/l except EC, which is µS/cm, and pH, which is unitless.
All samples collected on 3-28-91 except Site 27, which was collected on 3-13-90.
Refer to Plate 8 for site locations.

Concentrations of most mineral constituents were lower in samples collected in March 1991 than in samples collected by the USGS in March 1982. This apparent improvement in water quality is probably a result of differences in stream discharge

Appendix F

Map of Invasive Non-Native Riparian Plants in San Dieguito River Watershed

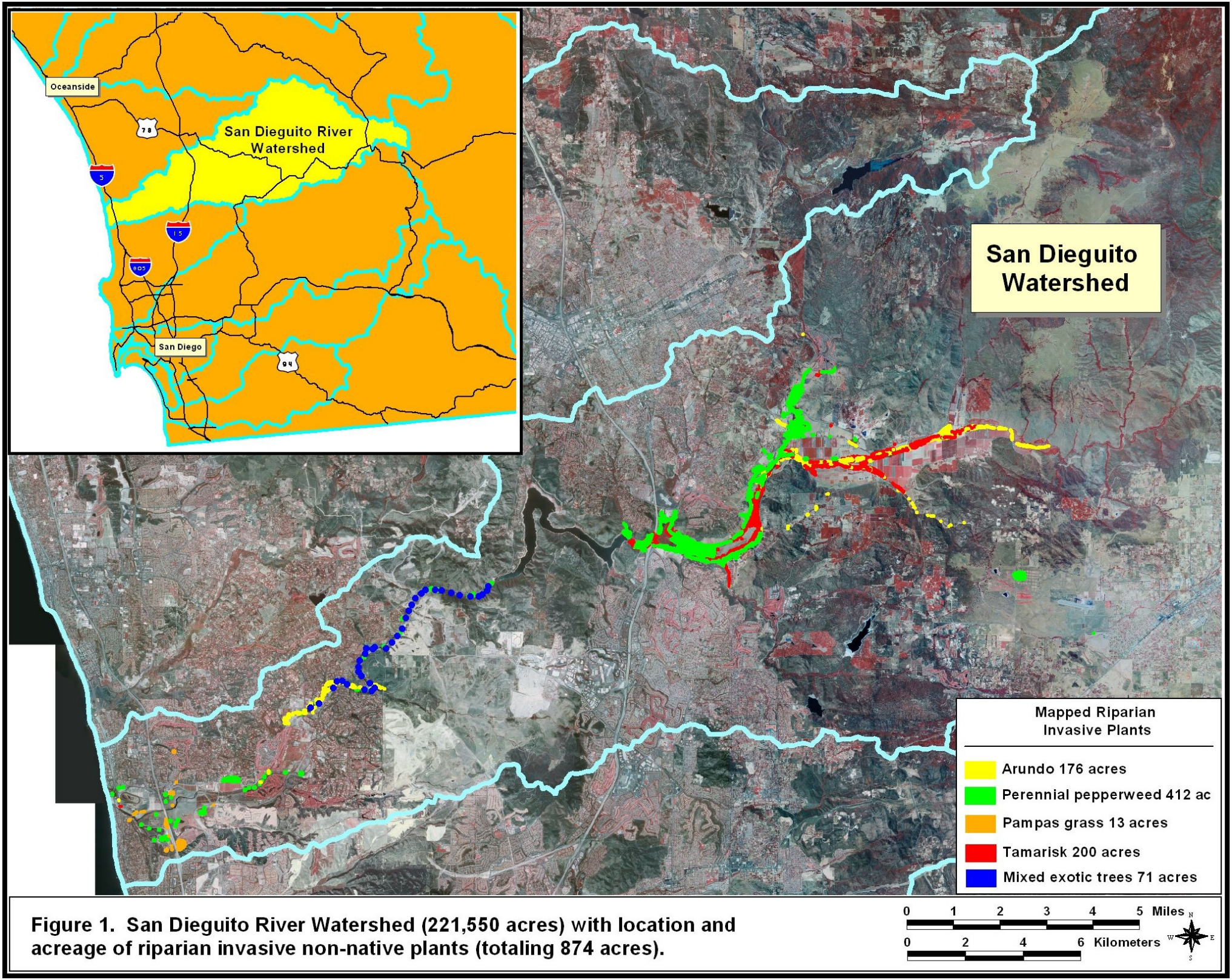


Figure 1. San Dieguito River Watershed (221,550 acres) with location and acreage of riparian invasive non-native plants (totaling 874 acres).

Appendix G

Public Outreach Plan for San Pasqual Groundwater Management Plan

City of San Diego Water Department
San Pasqual Basin Groundwater Management Plan
Public Outreach Plan

Purpose

The City of San Diego Water Department is developing a Groundwater Management Plan for the San Pasqual Valley, an 11,000-acre region southeast of Escondido. Approximately 90 percent of the valley is owned by the Water Department, which purchased the lands in the 1950s for water supply purposes. The GMP represents one of the ways they are ensuring a long-term, sustainable and good quality water supply for San Diego residents. The GMP will also protect the groundwater, agricultural, biological, and cultural resources within the Valley.

Once completed, the GMP will be included the San Pasqual Valley Plan, a land-use document adopted by the San Diego City Council on June 27, 1995 and amended March 1996. On June 27, 2005, the City Council adopted Policy No. 600-45, an eight-step strategy for accomplishing the vision of the San Pasqual Valley Plan. The GMP joins the San Pasqual/Lake Hodges Surface Water Management Plan, establishment of a San Pasqual Land Use Task Force and creation of a comprehensive interpretive program as mid-term policy implementation actions.

The San Pasqual Valley has various stakeholders who have an interest in the future of the groundwater in the basin. It is home to approximately 400 residents, many of whom are connected to the area's two dairies, an ostrich farm, citrus groves and a winery. It is also home to the San Diego Wild Animal Park.

This outreach plan will identify the stakeholders and interested parties, and recommend communication techniques for each specific group, as well as overall information dissemination strategies during the development and implementation of the GMP.

This plan includes the following components:

- Goals
- Objectives
- Approach: Development Phase
  - Required outreach activities
  - Additional outreach opportunities
- Approach: Implementation Phase
- Evaluation

The activities included in the "required outreach activities" section during the development phase are currently in the Katz & Associates scope of work and are mandated by state regulations. All activities included in the "additional outreach opportunities" section, implementation phase and evaluation are recommendations for

implementation by the Water Department but not currently included in the Katz & Associates scope.

Goal

Clearly and accurately convey project information to ensure ample public involvement opportunities for stakeholders and interested parties in the development and implementation of the GMP.

Objectives

- Reaffirm the GMP's purpose and need
- Provide accurate and timely information to stakeholders and interested parties
- Provide mechanisms for two-way dialog
- Determine the issues of concern to be addressed
- Develop trust and credibility with regard to the development and implementation of the GMP
- Show how community input has been incorporated in the GMP
- Avoid misunderstandings

Outreach Approach: Development Phase

Katz & Associates, in conjunction with the Water Department and MWH, will implement the approach outlined in the following section to achieve the overall objective during the **development** of the GMP.

Required Outreach Activities

Public Notices. Public notices need to be drafted and published at several stages before and during the GMP development.

Stakeholder and Interested Party Identification. Defining the stakeholders and interested parties for any project is a necessary first step. Stakeholders are those individuals or groups that have a direct stake in the development, implementation and outcome of the GMP. These individuals and groups will be invited to become participating members of the project advisory committee and invited to all open houses. Interested parties include individuals and groups that have an overall interest in the project based on their organization affiliation or political office. These individuals will be added to the project mailing database, and will be invited to observe the PAC and attend the open houses.

Both groups will be identified through conversations with the District 5 council office and the community planning board, discussions with the city of San Diego's Real Estate Asset Department regarding lessees in the San Pasqual Valley and a review of past groundwater management plans. Once the stakeholders and interested parties are identified, contact information will be

compiled and updated in a master mailing database. This list will grow over the course of the project.

An initial list of stakeholders, stakeholder groups and interested parties include, but is not limited to, the following:

- A & W Ranch
- Am-Sod Inc
- Bordier's Nursery, Inc/Pinery Tree Farm
- California State Parks Department, San Diego Coast District
- Carlsbad Municipal Water District
- City of Del Mar, Public Works
- City of Escondido, Public Works/Maintenance
- City of Escondido, Utilities Division
- City of Oceanside, Water Utilities
- City of Poway Development Services
- City of Poway, Public Services Department
- City of San Diego Water Department
- City of San Diego, District 5
- Cloverdale Stables, Inc.
- County of San Diego District 3
- County of San Diego District 5
- County of San Diego, Department of Planning & Land Use
- County of San Diego, Department of Public Works
- Department of Environmental Services
- Department of Health Services
- Endangered Habitats League
- Environmental Health Coalition
- Escondido Creek Conservancy
- Evergreen Nursery Distributors, Inc.
- Friends of the San Dieguito River Valley
- Fallbrook Public Utility District
- Giumarra Of Escondido
- Helix Water District
- Henry Ranch
- Hodges Golf Improvement Center, Loc
- Lessees of city owned land in the San Pasqual Valley
- Natural Resources Conservation Service
- Olivenhain Municipal Water District
- Orfila Vineyards
- Otay Water District
- Padre Dam Municipal Water District
- Palomar Enterprises Inc/Einer Bros Inc
- Pinery Tree Farms
- Rainbow Municipal Water District
- Rancho Bernardo Community Planning Board
- River Park Joint Powers Authority

- San Diego County Farm Bureau
- San Diego Zoo's Wild Animal Park
- San Dieguito River Park
- San Dieguito River Valley Conservancy
- San Dieguito Watershed Stewardship Initiative Group
- San Pasqual Land Use Task Force
- San Pasqual Valley Planning Group
- San Pasqual Academy High School
- Eagle Crest Golf Course
- Lessees of city owned land in the San Pasqual Valley
- San Diego County Water Authority
- Environmental groups (Sierra Club, Audubon Society)
- Ramona Municipal Water District
- Rincon del Diablo Municipal Water District
- SAD Ostrich, Inc.
- San Diego Archaeological Center
- San Diego Conservation Resources Network
- San Diego County Parks
- San Dieguito Water District
- San Pasqual Battlefield State Historical Park
- San Pasqual Christmas Tree Farm, Inc
- San Pasqual Growers
- San Pasqual High School
- Santa Fe Irrigation District
- SDG&E/09
- Sierra Club, San Diego Chapter
- State Of Ca/Dept Of P&R/3
- State Of Ca/Dept Of Parks & Rec
- Suncoast Botanicals, Inc.
- Sweetwater Authority
- The Hodges Golf Improvement Center
- The Nature Conservancy
- The Nature Conservancy, San Diego Field Office
- Three C Growers
- Time Warner Telecom Of California, L.P.
- T-Mobile Use, Inc.
- Trust for Public Land
- Vallecitos Water District
- Valley Center Municipal Water District
- Verger Dairy Farm
- Vista Irrigation District
- Volcan Mountain Preserve Foundation
- Wildlands, Inc.
- Wilkens Nursery
- Witman Ranch Inc
- Yuima Municipal Water District

Project Advisory Committee. One project advisory committee will be established and will include representatives from various stakeholder groups as well as technical advisors. The advisory committee will provide input and recommendations to the Water Department during the development of the GMP and Basin Management Objectives. The committee will be facilitated by a neutral, third-party facilitator from Katz & Associates and will meet up to six times over the course of nine months. The Water Department staff and consultants will provide presentations during the meetings to ensure the members have the information necessary to make informed recommendations.

The members of the project advisory committee will be asked to share information relating to the PAC and the discussion on the GMP with the groups they represent. This will create a "trickle-down" effect for project information.

Representatives from the following organizations are being asked to participate in the PAC:

- San Dieguito River Valley Conservancy
- County of San Diego
- U.S. Geological Survey
- San Diego County Water Authority
- San Dieguito River Park
- Santa Fe Irrigation District
- Konyn Dairy
- San Diego County Farm Bureau
- San Pasqual Valley Planning Group
- City of San Diego Real Estate Assets Department
- San Diego Zoo's Wild Animal Park
- Department of Water Resources
- Regional Water Quality Board, San Diego Region
- River Park Joint Powers Authority
- Eagle Crest Golf Club
- Rancho Bernardo Community Planning Board
- San Dieguito River Watershed Stewardship Initiative Group
- Witman Ranch

For more information about the committee's mission statement, principles of participation, member list or schedule please see the Mission Statement and Principles of Participation for the project advisory committee attached to this plan.

Community Open Houses. Over the course of the GMP development, two community open houses will be held, one during the initial stages and the second at the completion of the Draft GMP. These open houses will provide an opportunity for stakeholders and interested parties to learn about the GMP, ask questions and provide comments throughout the development phase.

The open houses will include display boards describing the development and implementation process. City staff and consultants will be available to guide members of the public around the room explaining the boards and answering questions.

The first open house will be held **Wednesday, Dec. 4, 2006** and the second will be held **Wednesday, May 2, 2007**.

Additional Outreach Opportunities

Database. To distribute information about the GMP, a mailing list and e-mail database will be needed. Review any existing mailing list databases and expand or enhance them to reflect key stakeholders, elected officials, media and representatives of key interest groups and stakeholders within the Valley. This database should be updated throughout the project by adding names of individuals who attend the PAC meetings, open houses or request information from the Water Department.

Direct Mailings. Project information, open house and advisory committee meetings notices will be distributed to the project database. These mailings will provide information the greater San Pasqual Valley community, environmental organizations, elected officials and public agencies about the project's progress, meetings and milestones.

Planning Group Meetings. The San Pasqual Valley has an active planning group which meets monthly at the Wild Animal Park. It is important this group is well informed throughout the development of the GMP. Project team members will attend these meetings at key milestones in the process to provide up-to-date information about the project status, as well as hear feedback from the planning group members.

Informational Materials. A variety of informational materials must be produced to provide various audiences with information in formats they prefer. Recommended information pieces include a GMP fact sheet and frequently asked questions document written for the layperson. In addition to the basic fact sheet and FAQ, a GMP project newsletter may developed and distributed to external audiences on a semi-annual or quarterly basis. To enhance the opportunities for two-way communication, all information materials should include Water Department contact information.

Presentations. A general presentation, which includes a description of the GMP and planned improvements during the implementation, will be developed by the Water Department. This presentation can be used at community or council meetings, or at presentations to community organizations.

Web Site. Ensure that copies of all informational materials are posted on the Water Department's Web site. Update the Web site to include a specific section about the GMP and invite users to comment and/or request information; include Water Department contact numbers and e-mail addresses. The URL should be prominently included on all informational materials, as well.

Outreach Approach: Implementation Phase

The Water Department will implement the approach outlined in the following section to achieve the overall objective during the **implementation** of the GMP.

Planning Group Meetings. Continuing to update the San Pasqual Valley Planning Group at the group's scheduled meetings is also important during the implementation of the GMP. City staff will periodically attend the San Pasqual Valley Planning Group meetings and provide updates on the implementation.

Database Maintenance. Identifying and creating a database is only half the battle. The other half entails maintaining that database to ensure the most up-to-date information is included and the most appropriate contacts for each organization are listed. As election years come and go, it is important to update the information on the project database with the appropriate staff and newly elected official. Also important, is the updating of new land lessees and executive directors of organizations. Database maintenance is an ongoing task over the life of the project.

Revise Informational Materials. Revise informational materials created during the GMP development phase to reflect the implementation of the GMP.

Revise Presentations. Revise project presentations created during the GMP development phase to reflect the implementation of the GMP.

Direct Mailings. Continue to mail updates (postcard notices, letters, newsletter, etc.) to the mailing database. Keep the lessees, policy makers, environmental groups and other interested parties apprised of the progress and milestones.

Web site Updates. Update and maintain the established project Web page with new and timely information related to the GMP.

Construction Relations. If the construction of new facilities or monitoring sites is identified in the GMP, a small construction relations effort will be necessary to keep interested parties, stakeholders and agencies informed of the construction activities and schedule. Some outreach methods include:

- Construction notices: Similar to the direct mailings recommended above, these notices include construction specific information such as,

work hours, schedule, potential impacts and what the Water Department is doing to address those impacts.

- Project information line: Establish a project information line during construction where stakeholders, impacted parties or agencies can call to have questions answered about the construction activities. This can be a "live" hotline or a voicemail that is checked periodically throughout each day and responded to in a timely manner.

- Tours: Tours allow the stakeholders an opportunity to view the construction site during or after construction, allowing them to see first hand what will be done at the site and how that impacts the basin and water quality/supply. Tours can be given to groups including lessees, the media, and/or elected officials and policy makers.

Trade Articles. One way to highlight a project's successes is to draft and submit articles to trade and industry publications. These articles will describe the efforts made during the development and implementation of the GMP, and any unusual practices that may have been instrumental in the project's success.

Evaluation

Success of the outreach efforts associated with the GMP in the San Pasqual Valley will be measured in several ways. These activities will be conducted by the Water Department to determine the overall success of the program.

Database Size. The stakeholder list will continue to grow and evolve over the course of the project. As this occurs and as the project team learns of new contacts to add to the overall database, the mailing list will be updated. A successful outreach campaign provides the most pertinent and updated information to target audiences.

Questionnaire. Develop and distribute a meeting survey or questionnaire for distribution at the PAC meetings and public open house. Results of the survey can indicate additional outreach needed and effective communication tools. Another option is to distribute the survey electronically to the PAC and open house attendees.

Attendance. Participation in the open houses and advisory committee meetings will be gauged by the use of sign in sheets at every meeting. Attendance at events such as the open house will represent the overall interest in the GMP.

On Schedule. Keeping a project on track and schedule are important indicators of the project's success. Over the development phase there will be up to six advisory committee meetings and two public open houses. It is important that the dates are identified at the onset of the project and the project team makes a commitment to

meet the specified dates. Setting an unrealistic timeline or not meeting identified dates can hinder a project's success.

Appendix H

Public Notices and Resolutions of Intent

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- Employment (2)
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- Announcements (18)
- Business Opportunities (9)
- Business Services (5)
- Coupon Saver (25)
- Garage Sales (50)
- Home Services (30)
- Legals (280)
- Merchandise (168)
- Retail (52)
- Personal Services (27)
- Recreation (3)
- Restaurants (13)
- Tour of Homes (21)

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Location: Ad Market → Legals (280) | Place An Ad

Select a sub-category within Legals

- Legals (280)

Categories: Legals (280)

Keywords: san pasqual

Sort by: Newest ads first

Ads per page: 25

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Found 1 ad for *san pasqual* in Legals

RESOLUTION NUMBER R-301974 A RESOLUTION OF INTENTION TO DRAFT A GROUNDWATER MANAGEMENT PLAN FOR THE SAN PASQUAL BASIN FOR THE PURPOSES OF IMPLEMENTING THE PLAN AND ESTABLISHING A GROUNDWATER MANAGEMENT PROGRAM AND STATEMENT OF PUBLIC PARTICIPATION WHEREAS, the City of San Diego [City] has provided water service since 1901 and currently serves more than 1.3 million people populating more than 200 square miles of developed land; and WHEREAS, in 2002, the City adopted the Long-Range Water Resources Plan [LRWRP] which evaluated different water supply alternatives for meeting the City's current and future water needs; and WHEREAS, the LRWRP identifies the San Pasqual Basin located in the San Pasqual Valley as a potential source of groundwater supply; and WHEREAS, the San Pasqual Basin is located within the City's water service area and the City is the primary landowner in the San Pasqual Valley; and WHEREAS, Council Policy 600-45 directs the City to prepare a Groundwater Management Plan for the San Pasqual Basin which shall include an evaluation of how best to effectively protect,

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manage, and utilize the water resources of the San Pasqual Valley; and WHEREAS, California Water Code sections 10750 through 10755.4 set forth the procedure by which a local agency such as the City may adopt and implement a groundwater management plan; and WHEREAS, after publication of notice pursuant to Government Code section 6066, and prior to adopting this Resolution of Intention, the City held a hearing on whether to adopt this Resolution of Intention to Draft a Groundwater Management Plan for the Purposes of Implementing the Plan and Establishing a Groundwater Management Program and Statement of Public Participation; NOW, THEREFORE, BE IT RESOLVED, by the Council of the City of San Diego, as follows: 1. That the City intends to draft a Groundwater Management Plan for the San Pasqual Basin [Plan] pursuant to California Water Code sections 10750 through 10755.4 for the purposes of implementing the plan and establishing a groundwater management program. 2. That the Plan shall include the following components: a. Basin management objectives; b. Components relating to the monitoring and management of groundwater levels, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping; c. Monitoring protocols designed to detect changes in groundwater levels, groundwater quality, inelastic land surface subsidence if subsidence is identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater pumping. The monitoring protocols shall be designed to generate information that promotes efficient and effective groundwater management; d. A plan to involve other agencies that enables the City to work cooperatively with other public entities whose service area or boundary overlies the San Pasqual Basin; e. A map that details the area of the San Pasqual Basin, as defined in the Department of Water Resources Bulletin No. 118, and the area of the City that will be subject to the Plan, as well as the boundaries of other local agencies that overlie the San Pasqual Basin; and f. Rules related to implementation of the Plan. 3. That the City will provide for public participation in the development of the Plan, which shall include the following: a. The formation of a project advisory committee to guide development of the Plan; b. Preparation and implementation of a public outreach plan, including involving local agencies, water purveyors, land lessees, and well owners/users in the San Pasqual Valley; and c. A public review and comment period prior to the hearing on whether to adopt the Plan. 4. That this activity is a feasibility or planning study that is statutorily exempt from the California Environmental Quality Act (CEQA] pursuant to CEQA Guidelines section 15262. For more information, contact the City of San Diego Water Department at (619) 533-4679. NCT 2012491
12/19/2006

Dec 19, 2006 **Save ad**

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Escondido, CA 92025
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PUBLIC NOTICES

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Advertised public notices, printed in a newspaper of general circulation, are required by California law. Within the individual category, notices are arranged by print publish day in reverse chronological order.

To inquire about getting a ficticious business name or other notice published, please call 619.232.4381 ext. 316 or e-mail: mailto:publicnotice@sddt.com

City of San Diego

PUBLISHED: Friday December 22, 2006

City of San Diego
DEVELOPMENT SERVICES
DEPARTMENT
Date of Notice: 12/22/06
PUBLIC NOTICE OF A
DRAFT NEGATIVE DECLARATION
JO: 42-3456

The City of San Diego Land Development Review Division has prepared a draft Negative Declaration for the following project and is inviting your comments regarding the adequacy of the document. Your comments must be received by January 10, 2007 to be included in the final document considered by the decision-making authorities. Please send your written comments to the following address: James Arnhart, Environmental Planner, City of San Diego Development Services Center, 1222 First Avenue, MS 501, San Diego, CA 92101 or e-mail your comments to JArnhart@sandiego.gov with the Project Number (51161) in the subject line.
General Project Information:
*Project No. 51161, SCH No. N/A
*Community Plan Area: Peninsula
*Council District: 2
Subject: McKinnon Residence: A COASTAL DEVELOPMENT PERMIT, SITE DEVELOPMENT PERMIT, EASEMENT ABANDONMENT and DEVIATION to demolish an existing one-story, single-family residence and construct a two-story, two-bedroom, single-family residence (approximately 11,043 square feet) with basement and attached two-car garage on a previously developed 1.46 acre lot containing Environmentally Sensitive Lands. The project site is located in the RS-1-4 (Residential-Single-Unit) zone within the Coastal Overlay Zone (Appealable), Coastal Height Limitation Overlay Zone and Peninsula Community Plan Area. Legal Description: A portion of Pueblo Lots 105, 106 and 107 of Miscellaneous Map No. 36 (APN 532-410-17). The site is not included on any Government Code Listing of hazardous waste sites.
Applicant: C & SD Construction
Recommended Finding: The City of San Diego has conducted an Initial Study which determined that the proposed project would not have potentially significant environmental effects. As such, neither mitigation nor an Environmental Impact Report is required.
Availability in Alternative Format: To request this Notice, the Negative Declaration, Initial Study, and/or supporting documents in alternative format, call the Development Services Department at 619-446-5460 or (800) 735-2929 (TEXT TELEPHONE).
Additional Information: For environmental review information, contact James

Arnhart at (619) 446-5385. The draft Negative Declaration, Initial Study, and supporting documents may be reviewed, or purchased for the cost of reproduction, at the Fifth floor of the Development Services Center. For information regarding public meetings/hearings on this project, contact Project Manager Cory Wilkinson at (619) 557-7900. This notice was published in the SAN DIEGO DAILY TRANSCRIPT, placed on the City of San Diego web-site (http://clerkdoc.sannet.gov/Website/publicnotice/pubnotceqa.html), and distributed on 12/22/06.
Robert J. Manis, Assistant Deputy Director Development Services Department
Pub. December 22-00017592

City of San Diego
DEVELOPMENT SERVICES
DEPARTMENT
Date of Notice: December 22, 2006
PUBLIC NOTICE OF A
DRAFT MITIGATED NEGATIVE
DECLARATION
JO: 4556

The City of San Diego Land Development Review Division has prepared a draft Mitigated Negative Declaration for the following project and is inviting your comments regarding the adequacy of the document. Your comments must be received by January 22, 2007 to be included in the final document considered by the decision-making authorities. Please send your written comments to the following address: Martha Blake, Senior Planner, City of San Diego Development Services Center, 1222 First Avenue, MS 501, San Diego, CA 92101 or e-mail your comments to DSDEAS@sandiego.gov with Project Number 67993in the subject line.
General Project Information:
*Project No. 67993/SCH No. Pending
*Community Plan Area: Tierrasanta
*Council District: 7
Subject: Tucker Self Storage: PUBLIC RIGHT-OF-WAY VACATION, COMMUNITY PLAN AMENDMENT (CPA), REZONE, PLANNED DEVELOPMENT PERMIT (PDP), AND SITE DEVELOPMENT PERMIT (SDP) to create two parcels from one existing, 3.35-acre site for a 120,183 square-feet of self storage building at 9765 Clairemont Mesa Boulevard. The site is in the RS-1-1, IL-2-1, IH-2-1 and the Airport Environs Overlay Zones, within the Tierrasanta Community Plan area. The project entails a 55-year ground lease of the property pursuant to the Settlement Agreement in the case of TRP LIMITED V. CITY OF SAN DIEGO, ET AL, SCC No. 578191, approved by City Council Resolution No. 274804 on December 4, 1989. Legal Description: Parcel A and B of Lot 2, of Map No. 825. Council District 7. Applicant: Jerry Tucker and Andy Krutzsch. The site is not included on a Government Code Listing of hazardous waste sites.
Applicant: Tucker Self Storage.
Recommended Finding: The recommended finding that the project will not have a significant effect on the environment is based on an Initial Study and project revisions/conditions which now mitigate potentially significant environmental impacts in the following area(s): Biological Resources, Paleontological Resources, and Public Health and Safety.
Availability in Alternative Format: To request this Notice, the Mitigated Negative Declaration, Initial Study, and/or supporting documents in alternative format, call the Development Services Department at (619) 446-5000 or (800) 735-2929 (TEXT TELEPHONE).
Additional Information: For environmental review information, contact Martha Blake at (619) 446-5375. The draft Mitigated Negative Declaration, Initial Study, and supporting documents may be reviewed, or purchased for the cost of reproduction, at the Fifth floor of the Development Services Center. For information regarding public meetings/hearings on this project, contact Project Manager Patricia Grabski at (619) 446-5277. This notice was published in the SAN DIEGO DAILY TRANSCRIPT, placed on the City of San Diego web-site (http://clerkdoc.sannet.gov/Website/publicnotice/pubnotceqa.html), and distributed on December 22, 2006.
Robert J. Manis, Assistant Deputy Director Development Services Department
Pub. Dec 22-00017587

City of San Diego
DEVELOPMENT SERVICES

DEPARTMENT
Date of Notice: December 22, 2006
PUBLIC NOTICE OF A
DRAFT MITIGATED NEGATIVE
DECLARTION
JO: 42-5236

The City of San Diego Land Development Review Division has prepared a draft Mitigated Negative Declaration for the following project and is inviting your comments regarding the adequacy of the document. Your comments must be submitted by January 10, 2007 to be included in the final document considered by the decision-making authorities. Please send your written comments to the following address: Jerry Jakubauskas, Environmental Planner, City of San Diego Development Services Center, 1222 First Avenue, MS 501, San Diego, CA 92101 or e-mail your comments to jjakubauskas@sandiego.gov.

General Project Information:

*Project No. 83705, SCH No. N/A
*Community Plan Area: College Area
*Council District: 7 (Madaffer)

Subject: Aztec Budget Inn Redevelopment. SITE DEVELOPMENT PERMIT / VESTING TENTATIVE MAP / SEWER EASEMENT ABANDONMENT / REZONE to allow for the demolition of an existing vacant one-story 45-unit motel and two-story 10-unit apartment building; construction of a four-story mixed-use structure containing a combined total of 65 one-, two- and three-bedroom units (to include 7 affordable units) and 3,000 square-feet of commercial retail space; a 16-space street-level covered parking garage; a 111-space subterranean parking structure; abandon an existing onsite sewer easement; and rezone a 30,991 square-foot portion of a 0.94 acre site from RM-3-8 to RM-3-9. The project site is located at 6050 El Cajon Boulevard and 4620 Soria Drive, between 60th Street and College Avenue, in the CU-2-4 and RM-3-8 zones of the Central Urbanized Planned District, within the College Area community planning area, and in the Crossroads Redevelopment area (Lots 5, 6, 12, 13 and portions of Lot 7 in Block 7 of El Retiro, Map No. 1996).

Applicant: AMCAL, Multi-Housing, Inc.

Recommended Finding: The recommended finding that the project will not have a significant effect on the environment is based on an Initial Study and project revisions/conditions which now mitigate potentially significant environmental impacts in the following area(s): Air Quality, Noise, Historical Resources (Archeological), Paleontological Resources, and Traffic Circulation.

Availability in Alternative Format: To request this Notice, the Mitigated Negative Declaration, Initial Study, and/or supporting documents in alternative format, call the Development Services Department at (619)446-5460 or (800)735-2929 (TEXT TELEPHONE).

Additional Information: For environmental review information, contact Kenneth Teasley at (619)446-5390. The draft Mitigated Negative Declaration, Initial Study, and supporting documents may be reviewed, or purchased for the cost of reproduction, at the Fifth floor of the Development Services Center. For information regarding public meetings/hearings on this project, contact Project Manager Dan Stricker at (619)446-5251. This notice was published in the SAN DIEGO DAILY TRANSCRIPT, placed on the City of San Diego web-site (http://clerkdoc.sannet.gov/Website/publicnotice/publicnoticeqa.html), and distributed on December 22, 2006. Robert Manis, Assistant Deputy Director Development Services Department

Pub. December 22-00017589

City of San Diego
DEVELOPMENT SERVICES
DEPARTMENT
Date of Notice: December 22, 2006
PUBLIC NOTICE OF A
DRAFT MITIGATED NEGATIVE
DECLARATION
Job Order: 426280

The City of San Diego Land Development Review Division has prepared a draft Mitigated Negative Declaration for the following project and is inviting your comments regarding the adequacy of the document. Your comments must be submitted by January 12, 2007 to be included in the final document considered by the decision-making authorities. Please send your written comments to the following

address: Kristen Forburger, Environmental Planner, City of San Diego Development Services Center, 1222 First Avenue, MS 501, San Diego, CA 92101 or e-mail your comments to DSDEAS@sandiego.gov with the Project Number in the subject line.
General Project Information:
*Project No 99730 SCH No. N/A
*Community Plan Area: College Area Community Plan
*Council District: 7
Subject: Grant Residence: NEIGHBORHOOD DEVELOPMENT PERMIT (NDP) to allow for slope repair which would include the construction of a tied-back retaining wall on Environmentally Sensitive Lands (ESL) with an existing single family residence. The 0.2-acre project site is located at 6852 Julie Street within the College Area Community Plan area. (Lot 7, Dennstedt Point Unit Number Three, Map Number: 2930)
Applicant: Applicant: Richard J. Grant
Recommended Finding: The recommended finding that the project will not have a significant effect on the environment is based on an Initial Study and project revisions/conditions which now mitigate potentially significant environmental impacts in the following area(s): Land Use (MHPA Land Use Adjacency)
Availability in Alternative Format: To request this Notice, the Mitigated Negative Declaration, Initial Study, and/or supporting documents in alternative format, call the Development Services Department at 619-446-5000 or (800) 735-2929 (TEXT TELEPHONE).
Additional Information: For environmental review information, contact Kristen Forburger at (619) 446-5344. The draft Mitigated Negative Declaration, Initial Study, and supporting documents may be reviewed, or purchased for the cost of reproduction, at the Fifth floor of the Development Services Center. For information regarding public meetings/hearings on this project, contact Project Manager Jeff Rhobles at (619) 446-5225. This notice was published in the SAN DIEGO DAILY TRANSCRIPT, placed on the City of San Diego web-site (http://clerkdoc.sannet.gov/Website/publicnotice/publicnoticeqa.html), and distributed on December 22, 2006
Robert J. Manis, Assistant Deputy Director Development Services Department
Pub. December 22-00017593

The City of San Diego
RELOUTION NUMBER R-301974

A RESOLUTION OF INTENTION TO DRAFT A GROUNDWATER MANAGEMENT PLAN FOR THE SAN PASQUAL BASIN FOR THE PURPOSES OF IMPLEMENTING THE PLAN AND ESTABLISHING A GROUNDWATER MANAGEMENT PROGRAM AND STATEMENT OF PUBLIC PARTICIPATION

WHEREAS, the City of San Diego [City] has provided water service since 1901 and currently serves more than 1.3 million people populating more than 200 square miles of developed land; and
WHEREAS, in 2002, the City adopted the Long-Range Water Resources Plan [LRWRP] which evaluated different water supply alternatives for meeting the City's current and future water needs; and
WHEREAS, the LRWRP identifies the San Pasqual Basin located in the San Pasqual Valley as a potential source of groundwater supply; and
WHEREAS, the San Pasqual Basin is located within the City's water service area and the City is the primary landowner in the San Pasqual Valley; and
WHEREAS, Council Policy 600-45 directs the City to prepare a Groundwater Management Plan for the San Pasqual Basin which shall include an evaluation of how best to effectively protect, manage, and utilize the water resources of the San Pasqual Valley; and
WHEREAS, California Water Code sections 10750 through 10755.4 set forth the procedure by which a local agency such as the City may adopt and implement a groundwater management plan; and
WHEREAS, after publication of notice pursuant to Government Code section 6066, and prior to adopting this Resolution of Intention, the City held a hearing on whether to adopt this Resolution of Intention to Draft a Groundwater Management Plan for the Purposes of Implementing the Plan and Establishing a Groundwater Management Program and Statement of Public Participation;
NOW, THEREFORE, BE IT RESOLVED, by the Council of the City of San Diego, as follows:
1. That the City intends to draft a Groundwater Management Plan for the San Pasqual Basin [Plan] pursuant to California Water Code sections 10750 through 10755.4 for the purposes of implementing the plan and establishing a groundwater

management program.
2. That the Plan shall include the following components:
a. Basin management objectives;
b. Components relating to the monitoring and management of groundwater levels, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping;
c. Monitoring protocols designed to detect changes in groundwater levels, groundwater quality, inelastic land surface subsidence if subsidence is identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater pumping. The monitoring protocols shall be designed to generate information that promotes efficient and effective groundwater management;
d. A plan to involve other agencies that enables the City to work cooperatively with other public entities whose service area or boundary overlies the San Pasqual Basin;
e. A map that details the area of the San Pasqual Basin, as defined in the Department of Water Resources Bulletin No. 118, and the area of the City that will be subject to the Plan, as well as the boundaries of other local agencies that overlie the San Pasqual Basin; and
f. Rules related to implementation of the Plan.
3. That the City will provide for public participation in the development of the Plan, which shall include the following:
a. The formation of a project advisory committee to guide development of the Plan;
b. Preparation and implementation of a public outreach plan, including involving local agencies, water purveyors, land lessees, and well owners/ users in the San Pasqual Valley; and
c. A public review and comment period prior to the hearing on whether to adopt the Plan.
4. That this activity is a feasibility or planning study that is statutorily exempt from the California Environmental Quality Act (CEQA] pursuant to CEQA Guidelines section 15262.
For more information, contact the City of San Diego Water Department at (619) 533-4679.
Pub. Dec. 22-00017590

City of San Diego

PUBLISHED: Friday December 22, 2006

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2007 Public Notices

2006 Public Notices

2005 Public Notices

2004 Public Notices

2003 Public Notices

2002 Public Notices

2001 Public Notices

2000 Public Notices

1999 Public Notices

Appendix I

Standard Operating Procedures for Collecting Field Data

STANDARD OPERATING PROCEDURE

FOR WATER SAMPLING AND FIELD MEASUREMENTS

TABLE OF CONTENTS

1.0 INTRODUCTION

This guideline is a general reference for the proper equipment and techniques for groundwater sampling. The purpose of these procedures is to enable the user to collect representative and defensible groundwater samples and to facilitate planning of the field sampling effort. These techniques should be followed whenever applicable, although site-specific conditions or project-specific plans may require adjustments in methodology.

To be valid, a groundwater sample must be representative of the particular zone of the water being sampled. The physical, chemical, and bacteriological integrity of the sample must be maintained from the time of collection to the time of analysis in order to minimize changes in water quality parameters. Acceptable equipment for withdrawing samples from completed wells include bailers and various types of pumps. The primary considerations in obtaining a representative sample of the groundwater are to avoid collecting stagnant (standing) water in the well, to avoid physically or chemically altering the water due to improper sampling techniques, sample handling, or transport, and to document that proper sampling procedures have been followed.

This guideline describes suggested well evacuation methods, sample collection and handling, field measurement, decontamination, and documentation procedures. Examples of sampling and chain-of-custody (COC) forms are attached.

2.0 DEFINITIONS

Annular Space: The space between casing or well screen and the wall of the drilled hole, or between drill pipe and casing, or between two separate strings of casing. Also called annulus.

Aquifer: A geologic formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring.

Bailer: A long narrow tubular device with an open top and a check valve at the bottom that is used to remove water from a well during purging or sampling. Bailers may be made of Teflon, polyvinyl chloride (PVC), or stainless steel. Disposable bailers are available and are made of polycarbonate.

Bladder Pump: A pump consisting of flexible bladder usually made of Teflon contained within a rigid cylindrical body (commonly made of PVC). The lower end of the bladder is connected through a check valve to the intake port, while the upper end is connected to a sampling line that leads to the ground surface. A second line, the gas line, leads from the ground surface to the annular space between the bladder and the outer body of the pump. After filling, under hydrostatic pressure, application of gas pressure causes the bladder to collapse, closing the check valve and forcing the sample to ground surface through the sample line. Gas pressure is often provided by a compressed air tank, and commercial models generally include a control box that automatically switches the gas pressure off and on at appropriate intervals.

Centrifugal Pump: A pump that moves a liquid by accelerating it radially outward in an impeller to a surrounding spiral-shaped casing.

Chain of Custody: Method for documenting the history and possession of a sample from the time of its collection through its analysis and data reporting to its final disposition.

Check Valve: Ball and spring valves on core barrels, bailers, and sampling devices that are used to allow water to flow in one direction only.

Conductivity (electrical): A measure of the quantity of electricity transferred across a unit area, per unit potential gradient, per unit time. It is the reciprocal of resistivity.

Datum: An arbitrary surface (or plane) used in the measurement of heads (i.e., National Geodetic Vertical Datum [NGVD], commonly referred to as mean sea level [msl]).

Decontamination: A variety of processes used to clean equipment that contacted formation material or groundwater that is known to be or suspected of being contaminated.

Downgradient: In the direction of decreasing hydrostatic head.

Drawdown: The lowering of the potentiometric or piezometric surface in a well and aquifer due to the discharge of water from the well.

Electric Submersible Pump: A pump that consists of a rotor contained within a chamber and driven by an electric motor. The entire device is lowered into the well with the electrical cable

and discharge tubing attached. A portable power source and control box remain at the surface. Electrical submersible pumps used for groundwater sampling are constructed of inert materials such as stainless steel, and are well sealed to prevent sample contamination by lubricants.

Filter Pack: Sand or gravel that is generally uniform, clean, and well rounded that is placed in the annulus of the well between the borehole wall and the well screen to prevent formation material from entering through the well screen and to stabilize the adjacent formation.

Headspace: The empty volume in a sample container between the water level and the cap.

HydroPunch: An in situ groundwater sampling system in which a hollow steel rod is driven into the saturated zone and a groundwater sample is collected.

In Situ: In the natural or original position; in place.

Monitoring Well: A well that is constructed by one of a variety of techniques for the purpose of extracting groundwater for physical, chemical, or biological testing, or for measuring water levels.

Packer: A transient or dedicated device placed in a well or borehole that isolates or seals a portion of the well, well annulus, or borehole at a specific level.

Peristaltic Pump: A low-volume suction pump. The compression of a flexible tube by a rotor results in the development of suction.

pH: A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. (Original designation for potential of hydrogen.)

Piezometer: An instrument used to measure head at a point in the subsurface; a nonpumping well, generally of small diameter, that is used to measure the elevation of the water table or potentiometric surface.

Preservative: An additive (usually an acid or a base) used to protect a sample against decay or spoilage, or to extend the holding time for a sample.

Static Water Level: The elevation of the top of a column of water in a monitoring well or piezometer that is not influenced by pumping or conditions related to well installation, hydrologic testing, or nearby pumpage.

Turbidity: Cloudiness in water due to suspended and colloidal organic and inorganic material.
Upgradient: In the direction of increasing static head.

3.0 RESPONSIBILITIES

Project Manager: Selects site-specific water sampling methods, locations for monitoring well installations, monitoring wells to be sampled and analytes to be analyzed with input from the field team leader (FTL) and project geologist. Responsible for project quality control and field audits.

Field Team Leader: Implements water sampling program. Supervises project geologist/hydrogeologist and sampling technician. Insures that proper chain-of-custody procedures are observed and that samples are sampled, transported, packaged, and shipped in a correct and timely manner.

Project Geologist/Hydrogeologist: Insures proper collection, documentation, and storage of groundwater samples prior to shipment to the laboratory. Assists in packaging and shipment of samples.

Field Sampling Technician: Assists the project geologist/hydrogeologist in the completion of tasks and is responsible for the proper use, decontamination, and maintenance of groundwater sampling equipment.

4.0 WATER SAMPLING GUIDELINES

4.1 WELL EVACUATION AND SAMPLING EQUIPMENT

There are many methods available for well purging. A variety of issues must be considered when choosing evacuation and sample collection equipment including: the depth and diameter of the well, the recharge capacity of the well, and the analytical parameters that will be tested. Few sampling devices are suitable for the complete range of groundwater parameters. For example,

an open bailer is acceptable for collecting major ion and trace metal samples, but it may lead to erroneous analytical results if used for the collection of samples that are analyzed for volatile organics, dissolved gases, or even pH. Generally, the best pumps to use are positive displacement pumps, such as bladder and helical rotor pumps that minimize the aeration of the groundwater as it is sampled, and therefore yield the most representative groundwater samples. Although it is possible to use different equipment to evacuate the well and to sample the well, this is not recommended because of the increased decontamination requirements and possibilities for cross contamination. It is recommended that a flow rate as close to the actual groundwater flow rate should be employed to avoid further development, well damage, or the disturbance of accumulated corrosion or reaction products in the well (Puls and Barcelona, 1989).

Positive displacement pumps, such as bladder pumps, are generally recommended for both well evacuation and sample collection. Other types of sample collection, such as bailing or the use of gas lift pumps, should be avoided, especially when analyzing for sensitive parameters because of the geochemical changes that can occur due to the aeration of the water within the well. Also, the use of these sample devices may entrain suspended materials, such as fine clays and colloids which are not representative of mobile chemical constituents in the formation of interest (Puls and Barcelona, 1989).

Specific instructions for the use of several of the sampling devices are discussed in the next sections. All purging and sampling equipment should be decontaminated before beginning work and between wells in accordance with Section 4.4.

Bailers. Bailers represent the simplest and least expensive method of collecting the sample from a well. However, they may not be suitable for all analyses. For most applications, the bailer should be constructed of Teflon or stainless steel. Disposable bailers constructed of polyethylene may also be acceptable for some applications (e.g., sampling for petroleum hydrocarbons), and they represent a simple method of avoiding cross-contamination between samples without the time-consuming need for decontamination. The following issues should be considered when using bailers for sampling:

- Bailers should be decontaminated per Section 4.4 of these guidelines and then isolated from any type of contamination prior to use for purging or sampling. The bailer should be decontaminated prior to the first well and between each subsequent well.

- Stainless steel or Teflon-coated stainless steel wire is recommended for lowering and retrieving the bailer from the well. At no time should the bailer or the line touch the ground during the sampling process. This can be done by coiling the line in a bucket or on a sheet of polyethylene. Polypropylene line may be substituted for the stainless steel wire, but should be discarded after each use.

- When lowering the bailer into the well, care should be taken to minimize agitation in the well, such as when the bailer contacts the water-table surface.

Peristaltic/Centrifugal Pumps. Peristaltic and centrifugal pumps are widely used for purging of wells with water levels close to the surface (less than 30 feet). They are reasonably portable, light, and easily adaptable to ground-level monitoring of field parameters by attaching a flow-through cell. These pumps require minimal downhole equipment, and they can easily be cleaned in the field, or the entire tubing assembly can be changed for each well. The following procedures should be considered when using these pumps:

- Prior to use, the exterior and interior of all intake tubing for use with the peristaltic/centrifugal pump should be thoroughly flushed with tap water and then double rinsed with distilled water. New tubing should be used at each well and then discarded. If a gas-powered generator is used, it should be downwind of the well.

- The intake of the suction tubing should be lowered to the midpoint of the well screen. Alternatives to this procedure may be necessary if the drawdown from the purging operations causes the water level to fall and begin to pump air. The suction line should be lowered slowly into the well until it pumps water continuously but not lower than 1 foot above the bottom of the well.

- If parameters are to be monitored continuously, connect the instrumentation header to the pump discharge and begin flushing the well. Continuously monitor the parameters (pH, Eh, temperature, and specific conductivity) and measure the volume of groundwater being pumped. Alternately, parameters may be monitored in a beaker filled from the pump discharge.

- After purging, remove the intake tubing from the well while the pump is still pumping to prevent backwash of water into the well. Stop the pump and disconnect the tubing from the pump for cleaning or disposal.

- If tubing is to be reused (not recommended), clean the interior of the tubing by flushing thoroughly with tap water. Double rinse the tubing with distilled water. Using Alconox and water, wash the exterior of the tubing, and then rinse with tap water and distilled water.

Gas-Lift Pumps. A pressure displacement system consists of a chamber equipped with a gas inlet line, a water discharge line and two check valves. When the chamber is lowered into the casing, water floods it from the bottom through the check valve. Once full, a gas (e.g., nitrogen or air) is forced into the top of the chamber in sufficient amounts to displace the water out the discharge tube. The check valve in the bottom prevents water from being forced back into the casing, and the upper check valve prevents water from flowing back into the chamber when the gas pressure is released. This cycle can be repeated as necessary until purging is complete. The pressure lift system is particularly useful when the well depth is beyond the capability of a peristaltic or centrifugal pump. The water is displaced up the discharge tube by the increased gas pressure above the water level. The potential for increased gas diffusion into the water makes this system unsuitable for sampling volatile organic or most pH critical parameters. The entire pump assembly and tubing should be decontaminated before beginning purging and between wells as described in Section 4.4. The following procedures should be considered when using these pumps:

- Determine depth to midpoint of screen or depth to well section open to the aquifer (consult driller's or well completion log).
- Lower displacement chamber until top is just below water level.
- Attach gas supply line to pressure adjustment valve on cap.
- Gradually increase gas pressure to maintain discharge flow rate.
- Measure rate of discharge frequently. A bucket and stopwatch are usually sufficient.
- Purge a minimum of five casing volumes or until discharge characteristics stabilize (see discussion on well purging).

Submersible Pumps. Submersible pumps take in water and push the sample up a sample tube to the surface. The power sources for these pumps may be compressed gas or electricity. The operation principles vary, and the displacement of the sample can be by an inflatable bladder, sliding piston, gas bubble, or impeller. Bladder or helical rotor pumps are recommended for sampling for sensitive parameters. Pumps are available for 2-inch-diameter wells and larger, and these pumps can lift water up to several hundred feet. The entire pump assembly and tubing should be decontaminated before beginning purging and between wells as described in Section 4.4.

Limitations of this class of pumps include:

- They may have low delivery rates.
- Many models of these pumps are expensive.
- Compressed gas or electricity is needed.
- Sediment in water may cause clogging of the valves or eroding the impellers with some of these pumps.
- Decontamination of internal components of some types is difficult and time consuming.

Advantages of this class of pumps include:

- Delivery of low turbidity samples.
- Adjustable to very low flow rates.

- Some types (e.g., bladder pumps) are relatively inexpensive and easy to install as dedicated systems.

- Some types (e.g., bladder pumps) can be easily disassembled for decontamination.

HydroPunch® Groundwater Sampling System. The HydroPunch® provides in situ groundwater samples by using a specially designed sample tool to provide a hydraulic connection with the adjacent water table. Both groundwater and floating layer hydrocarbons may be sampled using the HydroPunch®. These are two types of HydroPunch® available for use today: HydroPunch I and HydroPunch II. The main difference between the original system (HydroPunch I) and the HydroPunch II is in the amount of groundwater that can be extracted from the formation using each of the methods. The HydroPunch I allows for only one sample of very low volume to be collected while the HydroPunch II allows for the withdrawal of as much groundwater as is required for the analyses being conducted.

In the HydroPunch I Groundwater Sampling System, the sample tool is pushed to the proper zone (at least 5 feet of submergence for groundwater sampling) and then withdrawn to expose an inlet screen. The interior of the sample tool fills with water. When the HydroPunch is recovered, check valves keep the sample from draining. Discharge to sample containers is accomplished through a stopcock.

The HydroPunch II utilizes the same type of system to collect groundwater samples except this sampler is lowered and pushed into the groundwater on hollow push rods. A 1-inch-diameter stainless steel bailer is then lowered down the hollow push rods and into the exposed screened interval of the HydroPunch II. The bailer can be lowered to the water table as many times as are required to obtain a sufficient volume of water for analyses.

Both systems may be pushed through as much as 60 feet of soft sediments to collect groundwater samples. In coarse sand, gravel, consolidated rock, or at depths greater than 60 feet, a pilot hole must be drilled prior to driving the HydroPunch® into the saturated zone.

Advantages of this system include low cost, the ability to collect a relatively undisturbed in situ groundwater sample, and the relative speed with which a sample can be collected when compared to drilling, installing, developing, purging, and sampling a monitoring well. Disadvantages are that an accurate water level can not be obtained using the HydroPunch®,

sampling cannot be repeated if problems occur with the samples after they are collected, and it does not allow for long-term groundwater monitoring.

The HydroPunch® is ideal for screening for contaminants or defining a contaminant plume when resources are not available to install a large number of monitoring wells.

4.2 WELL EVACUATION METHODS

4.2.1 Purging Requirements

To obtain a representative groundwater sample it must be understood that the composition of the water within the well casing and in close proximity to the well is probably not representative of the overall groundwater quality in the target aquifer. This is due to the possible presence of drilling materials near the well and because important environmental conditions such as the oxidation-reduction (redox) potential may differ drastically near the well from the conditions in the surrounding water-bearing materials. For these reasons it is necessary to pump or bail the well until it is thoroughly flushed of standing water and contains fresh water from the aquifer. The recommended amount of purging before sampling is dependent on many factors including the characteristics of the well, the hydrogeological nature of the aquifer, the type of sampling equipment being used, and the parameters that are to be analyzed.

The number of casing volumes that should be removed prior to sample collection has been a matter of debate in the groundwater community for some time. The consensus seems to be that rather than relying on the removal of a specific volume of water (such as five casing volumes) prior to sample collection, physical parameters such as pH, specific conductivity, temperature, and possibly redox potential should be used to evaluate when enough water has been removed from the well to obtain a representative groundwater sample. However, it is recommended that where possible, a minimum of five casing volumes should be purged prior to sampling. The sensitivity of the above parameters to changes as a result of exposure of groundwater to surface level conditions (i.e., changes in the partial pressure of dissolved gases or the conditions of the purging system) make in situ monitoring desirable. An alternative to this would be to conduct these measurements in a closed cell attached to the discharge side of the pump system. Puls and Barcelona (1989) suggest that an initial estimate for the time of pumping necessary to collect representative water from a formation is around two times the time required to get plateau values for the above parameters. For example, the parameters may be considered stable when several

consecutive measurements (collected at least one-half a casing volume apart) do not change by more than the following:

- Conductivity ±10 percent
- pH ±0.4 units
- Temperature ±2˚C

When evacuating low yield wells (wells that are incapable of yielding at least five casing volumes), the well should be evacuated to dryness once (USEPA, 1986). As soon as the well recovers sufficiently, the samples should be collected and containerized in the order of the parameter volatilization sensitivity. The samples should be retested for field parameters after sampling as a check on the stability of the water samples over time. Whenever full recovery exceeds 2 hours, the sample should be collected as soon as sufficient volume is available for a sample for each parameter. However, allowing a well to recover overnight is not acceptable. At no time should the well be pumped to dryness if the recharge rate causes the formation water to vigorously cascade down the sides of the screen and cause an accelerated loss of volatiles. In this case, samples should be collected at a rate slow enough to maintain the water level at or above the top of the screen to prevent cascading.

Other factors that will influence the amount of purging required before sampling include the pumping rate and the placement of the pumping equipment within the column of water in the well. For example, recent studies have shown that if a pump is lowered immediately to the bottom of a well before pumping, it may take some time for the column of water above it to be exchanged if the transmissivity of the aquifer is high and the well screen is at the bottom of the casing. In these cases, the pump will be drawing water primarily from the aquifer. Purging from higher in the well or just below the water surface provides a more complete removal of the casing water.

4.2.2 Calculation of Casing Volume

To insure that an adequate volume of water has been removed from the well prior to sampling, it is first necessary to determine the volume of standing water in the well and the volume of water in the filter pack below the well seal. The volume can be easily calculated by the following method (calculations should be entered in the field logbook):

1. Obtain all available information on well construction (e.g., location, casing, screen, depth).

2. Determine well or casing diameter.

3. Measure and record static water level (depth below ground level or top of casing reference point) using one of the methods described in Section 2.3.1.

4. Determine depth of well by sounding using a clean, decontaminated weighted tape measure or an electronic water-level probe.

5. Calculate the volume of water in the casing using the following formula:

$$V = 7.481 (\_r^2 h)$$

Where: V = Casing Volume (gal)
r = Well radius (ft) = well diameter (ft)/2
h = Linear feet of water in well = total well depth (ft) - static water depth (ft)

Alternatively, the casing volume can be calculated by multiplying the linear feet of water in the well by the volume per linear feet taken from Attachment 1 or other similar tables. Always be sure that the units in your calculation are consistent. In the equation above, 7.481 is the conversion factor from cubic feet to gallons.

4.2.3 Calculation of Annulus Volume

Some groundwater sampling protocol require the evacuation of casing and annulus volumes prior to sampling. In these cases the volume of water contained in the annular space between the casing and the borehole wall is calculated by the following formula:

$$V^c = (C_b - C_c) \times (h) \times (0.30)$$

Where:
C_b = Borehole Capacity (Volume in Gal./ft)
C_c = Casing Capacity (Volume in Gal./ft)
h = Amount of standing water in the well
0.30 = Average porosity of typical sand pack

The annulus volume is added to the casing volume prior to multiplying by the number of volumes to be excavated.

4.2.4 Purge Water Handling and Disposal

Because of the potential for spreading environmental contamination, planning for purge water disposal is a necessary part of well monitoring. Alternatives range from releasing it on the ground (not back down the well) to full containment, treatment, and disposal. If the well is believed to be contaminated, the best practice is to contain the purge water and store it in drums labeled "purge water" or in aboveground portable storage tanks (i.e., "Baker Tanks") until the water samples have been analyzed. Once the contaminants are identified, appropriate treatment or disposal requirements can be determined.

4.3 SAMPLE COLLECTION METHODS

All groundwater samples should be collected using a clean, dry decontaminated bailer made of either stainless steel or Teflon unless a HydroPunch® groundwater system is being used.

4.3.1 Sample Containers

A complete set of sample containers should be prepared by the laboratory prior to going into the field. The laboratory should provide the proper containers with the required preservatives. The laboratory's QA manual should provide a complete description of the procedures used to clean and prepare the containers. The containers should be labeled in the field with the date, well designation, project name, collectors' name, time of collection, and parameters to be analyzed. The sample containers should be kept in a cooler (at 4˚C) until they are needed (i.e., not left in the sun during purging). One cooler should be used to store the unfilled bottles and another to store the samples.

The sample bottles will be filled in order of the volatility of the analytes so that the containers for volatile organics will be filled first, and samples that are not pH-sensitive or subject to loss through volatilization will be collected last. A preferred collection order (as listed in USEPA, 1986) is as follows:

- Volatile organics (VOCs)
- Total petroleum hydrocarbons (TPH)
- Total organic halogens (TOX)
- Total organic carbon (TOC)
- Extractable organics (e.g., BNAs, pesticides, herbicides)
- Total metals
- Dissolved metals
- Phenols
- Cyanide

- Sulfate and chloride
- Turbidity
- Nitrate and ammonia
- Radionuclides

Temperature, pH, and specific conductance should be measured and recorded in the field before and after sample collection to check on the stability of the water samples over time.

4.3.2 Field Filtration for Dissolved Metals

Filtering groundwater samples has been a subject of considerable debate in recent years. In many cases, samples passing a 0.45 micron (_m) filter were used to provide an indication of dissolved metals concentrations in groundwater. Puls and Barcelona (1989) report that the use of a 0.45 micron filter was not useful, appropriate, or reproducible in providing information on metals mobility in groundwater systems, nor was it appropriate for determination of truly "dissolved" constituents in groundwater. A dual sampling approach is recommended to collect both filtered and unfiltered samples.

Any filtration for estimates of dissolved species loads should be performed in the field with no air contact and immediate preservation and storage. In-line pressure filtration is best with as small a filter pore size as practically possible (e.g., 0.45, 0.10 micron). Disposable, in-line filters are recommended for convenience and avoiding cross-contamination. The filters should be pre-rinsed with distilled water; work by Jay (1985) showed that virtually all filters require pre-washing to avoid sample contamination.

In the absence of filters, sample turbidity can generally be reduced by using bladder pumps. USEPA (1986) recommends that the turbidity should be less than 5 nephelometric turbidity units (NTUs).

4.3.3 Sampling From Nonmonitoring Wells and Springs/Seeps

Municipal/Private Wells. Domestic water supply wells should be sampled in a similar manner to monitoring wells, although allowances must be made for the type of pumping equipment already installed in the well. The sampling point should be determined at the time of sampling, and it should be the cold-water tap as close to the pump as practical. Domestic supply samples should not be taken from taps delivering chlorinated, aerated, softened, or filtered water. Faucet aerators should be removed if possible before sampling. The water tap should be turned on and run for at least 30 minutes unless the water tap is directly adjacent to the well head, and then the water should be allowed to run for no less than 10 minutes before the samples are collected to flush stagnant water from the system. Prior to collecting the sample, reduce the flow rate to approximately 50 milliliters per minute (ml/min). All sample containers should be filled with water directly from the tap and the samples processed as described for monitoring well samples. Components of the plumbing system should be noted to assist in data interpretation.

Groundwater should be collected from water supply wells in a manner as consistent with the monitoring well sampling procedure as the circumstances permit. In most cases, this will involve sampling directly from the tap on each well and before the water has gone through any chlorination or treatment system.

Spring and Seep Sampling. Samples from springs or seeps should be collected directly into the sample bottles without using any special sampling equipment. The sample will be collected as close as possible to where the spring emanates from the soil or rock. The sampler should always stand downstream of the spring or seep to avoid disturbing sediment or clouding the water.

4.4 FIELD MEASUREMENTS

A variety of field measurements are commonly made during the sampling of groundwater including: water level, pH, conductivity, and temperature. The accuracy, precision, and usefulness of these measurements is dependent on the proper use and care of the field instruments. Valid and useful data can only be collected if consistent practices (in accordance with recommended manufacturers instructions) are followed. The instruments should be handled carefully at the well site and during transportation to the field and between sampling sites.

4.4.1 Water Level

Water levels can be measured by several techniques, but the same steps should be followed in each case. The proper sequence is as follows:

1. Check operation of measurement equipment aboveground. Prior to opening the well, don personal protective equipment as required.

2. Record all information specified below on a sampling form or in the field notebook if a form is not available.

3. Record well number, top of casing elevation, and surface elevation if available.

4. Measure and record static water level and total depth to the nearest 0.01 foot (0.3 cm) from the surveyed reference mark on the top edge of the inner well casing. If no reference mark is present, record in the log book where the measurement was taken from (i.e., from the north side of the inner casing).

5. Record the time and day of the measurement.

6. Some water-level measuring devices have marked metal or plastic bands clamped at intervals along the measuring line used for reference points to obtain depth measurements. The spacing and accuracy of these bands should be checked before each round of measurements because they may loosen and slide up or down the line, resulting in inaccurate reference points.

Electric Water Level Indicators. These devices consist of a spool of small-diameter cable or tape and a weighted probe attached to the end. When the probe comes in contact with the water, an electrical circuit is closed and a meter, light, and/or buzzer attached to the spool will signal the contact. This is the recommended method for obtaining accurate water-level measurements.

There are a number of commercial electric sounders available, none of which is entirely reliable under all conditions likely to occur in a contaminated monitoring well. In conditions where there is oil on the water, groundwater with high specific conductance, water cascading into the well, or a turbulent water surface in the well, measuring with an electric sounder may be difficult.

For accurate readings, the probe should be lowered slowly into the well. The electric tape is marked at the measuring point where contact with the water surface was indicated. The distance from the mark to the nearest tape bank is measured using a ruler or steel tape and added to the band reading to obtain the depth to water. Band spacing should be checked periodically as described above.

Chalked Steel Tape. Water level is measured by chalking a weighted steel tape and lowering it a known distance (to any convenient whole-foot mark) into the well or borehole. The water level is determined by subtracting the wetted chalked mark from the total length lowered into the hole.

The tape should be withdrawn quickly from the well because water has a tendency to rise up the chalk due to capillary action. A paste called "National Water Finder" may be used in place of chalk. The paste is spread on the tape the same way as the chalk but the part that gets wet turns red. This paste is manufactured by the Metal Hose and Tubing Company, Dover, New Jersey.

Disadvantages to this method include: depths are limited by the inconvenience of using heavier weights to properly tension longer tape lengths (typically, 100 foot tapes require a 10- to 12-pound weight to tension adequately); it is ineffective if borehole/well wall is wet or inflow is occurring above the static water level; chalking the tape is time consuming; and it is difficult to use in the rain. The water chemistry may also be modified somewhat by the addition of chalk or paste.

4.4.2 pH

The pH meters should be calibrated against two standard pH solutions, either 4 and 7 or 7 and 10, depending on whether previous pH measurements have been less than or greater than 7, respectively. The meter readings will be adjusted, and the probe should then be rinsed thoroughly with distilled water. The probe should then be immersed in the water sample, and the pH and temperature recorded in the field log or on the sampling form. The manufacturer's directions for calibration, maintenance, and use should be read and closely followed. Any problems with the functioning of the meter should be noted in the field log and reported to the office equipment manager.

4.4.3 Conductivity

Specific conductivity meters should be standardized by immersing a decontaminated specific conductivity probe into a standard solution of conductivity buffer. The conductivity of the standard solution should be within the same order of magnitude as anticipated for the water sample. The meter reading will be adjusted to the buffer solution value, and the probe will then by thoroughly rinsed with distilled water. The probe should then be immersed in the well water sample, and the conductivity value recorded. The manufacturer's directions for calibration, maintenance, and use should be read and closely followed. Calibrant solutions should be dated and discarded on their expiration date. Any problems with the functioning of the meter should be noted in the field log and reported to the office equipment manager.

4.4.4 Temperature

Temperature measurements should be made with either a mercury or electronic thermometer capable of accurately reading to 0.1˚C. The temperature reading should be recorded in the field log or on the sampling form.

4.5 DECONTAMINATION

The general decontamination procedure for all non-dedicated groundwater sampling equipment (bailers, pumps, water-level probes) consists of the following steps:

1. Scrub and wash with laboratory-grade detergent (such as Alconox) and tap water;

2. Rinse with reagent-grade isopropanol alcohol or methanol and allow to air dry; and

3. Triple rinse with deionized water.

If available, a steam cleaner can also be used for decontaminating sampling equipment. Steam cleaning is the desired method since it does not introduce any additional chemicals into the system. If a steam cleaner is available it should be used instead of any other type of decontamination procedure. As with other procedures documented in this SOP, decontamination procedures may be determined by the client or regulatory agency involved in the project.

4.6 RECORDS AND DOCUMENTATION

4.6.1 Sample Designation

One suggested approach is to use the site name or an abbreviation or acronym of the site name to be the lead designator in the sample identification. For example, a sample from Hill Air Force Base Operable Unit 1 could be designated HAFB-OU1-2, with the final 2 designating the monitoring well number. Similarly, a spring sample may be designated with the site name HAFB-OU1-ZC, with the initials or name of the owner of the spring or name of the spring. Blind duplicate samples should be labeled with the number of a non-existent well. Equipment and trip blanks, collected when non-dedicated equipment is used, should also be labeled with a fictitious well name in a similar manner to the blind duplicate samples.

4.6.2 Sample Label

Sample containers should be labeled using water proof ink before a sample is obtained. A sample label should be affixed to all sample containers. This label identifies the sample by documenting the sample type, sampler(s) initials, sample location, time, date, analyses requested, and preservation method. A unique sample designation as discussed above is assigned to each sample collected. This sample ID is also noted on the sample label.

4.6.3 Field Notebooks and Sampling Forms

A field notebook should be prepared prior to beginning sampling activities and should be maintained throughout the sample round. The notebook should contain pertinent information

about the monitoring wells, such as depth of casing and water levels. During sampling, all the activities should be recorded on a groundwater sampling log (see Attachment 2) and in the field notebook. All forms used during sampling should be referenced in the field notebook. A brief description of weather conditions should also be noted as weather can sometimes affect samples. Any deviation from the sampling procedure described in the project work plan or SOP should be outlined in detail and justified in the field notebook. Specialized sampling forms can also be used to record the field measurements and other conditions observed.

4.6.4 Chain-of-Custody

The chain-of-custody form (Attachment 3) should be used to record the number of samples collected and the corresponding laboratory analyses. Information included on this form consists of time and date sampled, sample number, type of sample, sampler's name, preservatives used, and any special instructions. A complete and separate COC form should be completed for each cooler. A copy of the COC form should be retained by the sampler prior to shipment (forms with multiple carbon copies are recommended). The original COC form should accompany the sample to the laboratory and provide a "paper trail" to track the sample. When transferring the possession of samples, the individuals relinquishing and receiving the samples should sign, date, and note the time on the chain-of-custody form.

4.7 SAMPLE HANDLING AND SHIPPING

4.7.1 Sample Handling

The samples will be kept cool during collection and shipment with regular ice contained in a plastic bag or with frozen "blue ice." It is suggested that the blue ice be changed immediately before shipment to help assure the samples remain cool. The samples should be stored in an appropriately sized, durable ice chest. Over a 3-inch layer of packing materials, such as vermiculite or bubble packaging, the samples should be placed and kept separated, with the intervening voids filled with the packing material more than halfway to the top of the bottles or containers. Bottles should be placed upright. The ice should be placed above and about the top of the containers. The chain-of-custody record should be sealed in a "Ziplock" plastic bag and affixed to the inside of the top lid of the cooler. The remaining space should be filled with packing material. The cooler should be secured by completely wrapping with strapping tape

around both ends. If there is a drain on the cooler, it should be taped shut. Chain-of-custody seals should be affixed across the seal between the lid and body of the cooler.

4.7.2 Shipping Instructions

All samples should be shipped overnight delivery through a reliable commercial carrier, such as Federal Express, Emery, Purolator, or equivalent. If shipment requires more than a 24-hour period, sample holding times can be exceeded, or the samples may get warm compromising the integrity of the sample analysis. The sampler should call the laboratory to alert them when the samples will arrive on the following day.

5.0 REFERENCES

Jay, P.C., 1985. Anion Contamination of Environmental Water Samples Introduced by Filter Media. Analytical Chemistry 57(3): 780-782.

Nielson, D.M., 1991. Practical Handbook of Groundwater Monitoring, Lewis Publishers, Inc., Chelsea, MI.

Puls, R.W. and M.S. Barcelona, 1989. Ground Water Sampling for Metals Analyses, Superfund Ground Water Issue, EPA/540/4-89/001, March 1989.

U.S. Environmental Protection Agency (USEPA), 1986. RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, OSWER-9950.1, September 1986.

6.0 ATTACHMENTS

1 - Volume of Schedule 40 PVC Pipe

2 - Groundwater Field Sampling Date Record

3 - Chain-of-Custody Record

STANDARD OPERATING PROCEDURES

SAMPLE MANAGEMENT/PRESERVATION

STANDARD OPERATING PROCEDURES

FOR SAMPLE MANAGEMENT/PRESERVATION

TABLE OF CONTENTS

1.0 INTRODUCTION

This guideline for sample management describes the requirements for sample identification, chain of custody (COC), sample handling, storage and shipping. The purpose of this SOP is to define sample management activities as performed from the time of sample collection to the time they are received by the laboratory.

2.0 DEFINITIONS

Sample: Physical evidence collected for environmental measuring and monitoring. For the purposes of this SOP, sample is restricted to solid, aqueous, air, or waste matrices. This SOP does not cover samples collected for lithologic description nor does it include remote sensing imagery or photographs. (Refer to SOPs for Field Documentation and Sample Management/ Preservation.)

Field Team Leader: The individual responsible for the supervision of field work at the site during a given phase of investigation or monitoring.

Sampler: The individual who collects environmental samples during field work.

3.0 RESPONSIBILITIES

The following is a general description of responsibilities related to sample management; specific responsibilities are described in project work plans.

Program QC Coordinator: The program QC coordinator (QCC) is responsible for ensuring that client sample management requirements can be accommodated within Montgomery Watson quality requirements.

Project Manager: The project manager is responsible for ensuring that the requirements for sample management are included in the appropriate project plans. The project manager is responsible for fully communicating the sample management requirements to the Field Team Leader (FTL) by providing a copy of project plans or issuing written notice that the SOP is to be used exclusively.

Project QC Coordinator: The project QC coordinator is responsible for reviewing documentation developed from sample management to determine compliance with this SOP and project plan requirements.

Field Team Leader: The FTL is responsible for conducting the procedures described herein and, if applicable, the requirement of the project plan. Any variance from these procedures is considered a nonconformance, and written documentation is required, at a minimum, as described in the SOP for Corrective Action.

4.0 PROCEDURES

4.1 APPLICABILITY

These procedures apply to all work conducted for Montgomery Watson clients, by Montgomery Watson, or under the direction of Montgomery Watson. The information in this SOP may be incorporated into project-specific plans. Deviations or modifications to procedures not addressed in the project plans must be handled as a corrective action (see SOP for Corrective Action).

4.2 SAMPLE MANAGEMENT

4.2.1 Sample Containers

The sample containers to be used will be dependent on the sample matrix and analyses desired. Unless specified otherwise by the project plan, the containers to be used for various analyses are provided in Attachment 1 (EPA SW-846). Sample containers are to be filled (approximately 90 percent), with adequate headspace for safe handling upon opening, except containers for volatile organic compound (VOC) analyses, which are to be filled completely with no headspace. This applies to soil samples as well as water samples.

Once opened, the containers are to be used immediately. If the container has been received unsealed or is not used upon opening, it is to be recycled. If the container is used for any reason in the field (i.e., screening) and not sent to the laboratory for analysis, it should be discarded. The contents of the used container and the container itself may require disposal as a hazardous material. When storing before and after sampling, the containers must remain separate from

solvents. Sample containers with preservatives added by the laboratory should not be used if held for an extended period on the job site or exposed to extreme heat conditions.

4.2.2 Numbering and Labeling

Sample Label: A sample label, as shown in Attachment 2, will be affixed to all sample containers. Labels provided by the laboratory may be used if an example is included in the project plan. The sample label will be completed with the following information:

- Client name, project title, or project location (sufficiently specific for data management; e.g., Bayou Chemical Corp., East Suburbs Interceptor, Sawatch AFB)
- Sample location
- Sample identification number
- Date and time of sample collection
- Type of sample (grab or composite)
- Initials of sampler
- Preservative used
- Analyte(s) of interest
- Label number

If a sample is split with another party, identical labels will be attached to each sample container. After labeling, each sample will be refrigerated or placed in a cooler containing ice or "blue ice" to maintain the sample temperature of 4 degrees Celsius (˚C).

Custody Seals: Custody seals, as shown in Attachment 3, will be used on each sample and/or shipping container to ensure custody. Custody seals used during the course of the project will consist of security tape with the date and initials of the sampler. As a minimum, one custody seal will be placed on the front of the cooler overlapping the strapping tape and one on the side of the cooler. If required by the client, a seal will be placed on each sample container so that it must be broken to gain access to the contents. Since VOC samples may be subject to contamination by the tape, VOC sample containers will first be secured in a "zip-lock" plastic bag. The plastic bag

will be sealed with a completed custody seal. If the seals are serially numbered, these numbers will be cross-referenced on both the field logbook and the COC form.

4.2.3 Chain of Custody

COC procedures require a written record of the possession of individual samples from the time of collection through laboratory analyses. A sample is considered to be in custody if it is:

- In a person's possession.
- In view after being in physical possession.
- In a secured condition after having been in physical custody.
- In a designated secure area, restricted to authorized personnel.

The COC record, as shown in Attachment 4, shall be used to document the samples taken and the analyses requested. A different COC record may be used if an example is included in the approved project plan. Information recorded by field personnel on the COC record includes the following:

- Client name
- Project name
- Project location
- Sampling location
- Signature of sampler(s)
- Sample identification number
- Date and time of collection
- Sample designation (grab or composite)
- Sample matrix
- Signature of individuals involved in custody transfer (including date and time of transfer)
- Airbill number (if appropriate)
- Number and type of bottles collected for each analysis
- Type of analysis and laboratory method number
- Any comments regarding individual samples (e.g., HNU readings, special instructions)

COC records will be placed in a plastic bag, secured to the lid of the cooler, and transported with the samples. When the sample(s) are transferred, the record is signed by both the receiving and relinquishing individuals. Signed airbills will serve as evidence of custody transfer between the field sampler and courier as well as courier and laboratory. If a carrier service is used to ship the samples (e.g., Federal Express), custody will remain with the sampler until it is relinquished to the laboratory. Copies of the COC record and airbill will be retained by the sampler. If the COC records are sequentially numbered, the record number and airbill number will be cross-referenced in both the field logbook and the sample register. If the COC record is not previously numbered, a tracking number of four digits or more should be added to the top of the form and recorded as above.

4.2.4 Sample Register/Sample Tracking

The sample register is a bound logbook with sequentially numbered pages used to document which samples were collected on a particular day. The sample register is also used as the key to correlate field samples with duplicate samples. Information that should be recorded in the sample register includes the following:

- Client name
- Project name and location
- Job number
- Date and time of collection
- Sample identification number
- Sample designation (grab or composite)
- Sample matrix
- Number and type of bottles
- Type of analysis
- Sample destination
- Sampler's initials

A sample tracking database, which includes the above information, may be substituted for a handwritten sample register. However, a hardcopy of each day's sampling activities should be maintained in the field files.

4.2.5 Sample Preservation/Storage

The requirements for sample preservation are dependent on the analyses desired and the sample matrix. Unless otherwise specified by the project plan, sample preservation requirements are provided in Attachment 1.

(Note: An important step in the sample management process is recording activities performed at each sampling location in the field logbook. This topic is discussed in the SOP for Field Documentation.)

4.2.6 Shipping

Procedures for packaging and transporting samples to the laboratory will be based on an estimation of contaminant concentrations in the samples to be shipped. Samples will be identified as either environmental, high concentration, geotechnical, or other samples. Environmental samples are defined as soil or water samples that are not saturated or mixed with product material. Those samples that are saturated in product or are free product samples are defined as high concentration samples.

4.2.6.1 Environmental Samples. Environmental samples will be shipped in the following manner:

- Each sample will be placed in a separate plastic or "bubble-wrap" bag. As much air as possible is squeezed from the bag before sealing. Bags may be sealed with evidence tape for additional security. If brass or stainless steel tubes are used, bubble wrap is not required.

- An ice chest (sturdy construction) is typically used as the shipping container. In preparation for shipping samples, the drain plug is taped shut from the outside and a large plastic bag is used as a liner for the cooler. Approximately 1 inch of packing material, such as vermiculite or bubble wrap, is placed in the bottom of the liner. Sufficient packing material should be used to prevent sample containers from making contact during shipment.

- The bottles are placed in the lined ice chest. Cardboard or foam separators may be placed between the bottles at the discretion of the shipper.

- Water samples for organic analysis and inorganic analysis will be cooled to 4˚C with ice or "blue ice" during shipment. If ice is used, it will be contained such that the water will not fill the cooler as the ice melts. Dry ice should not be used as it has a tendency to freeze samples.

- As described previously, the COC record will be placed inside a plastic bag, sealed, and taped to the inside of the cooler lid if a carrier (e.g., Federal Express or UPS) is used. If a carrier is used, the COC record should be placed in a pouch or plastic bag attached to the top of the cooler. The airbill will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the shipper suspects that the sample contains any substance for which the laboratory personnel should take safety precautions.

- The cooler is closed and taped shut with strapping tape (filament type) around both ends.

- Two signed custody seals will be placed on the cooler, one on the front and one on the side overlapping strapping tape if possible. Additional seals may be used if the sampler and shipper think more seals are necessary. Wide clear tape will be placed over the seals to ensure against accidental breakage.

- The cooler is handed over to the overnight carrier, typically a cargo-only air service. A standard airbill is necessary for shipping environmental samples.

4.2.6.2 High Concentration Samples. High concentration samples will be shipped as follows:

- Each sample bottle is placed in a plastic bag, and the bag is sealed. Each VOC vial is wrapped in a paper towel, and the two vials are placed in one bag. As much air as possible is squeezed from the bag before sealing. Bags may be sealed with evidence tape for additional security.

- Each bottle is placed in a separate paint can, the paint can is filled with vermiculite, and the lid is fixed to the can. The lid must be sealed with metal clips, filament, or evidence tape. If clips are used, the manufacturer typically recommends six clips. Arrows are placed on the can to indicate the upright position.

- The outside of each can contains the proper Department of Transportation (DOT) shipping name and identification number for the sample. The information may be placed on stickers or printed legibly. A liquid sample of an uncertain nature will be shipped as a flammable liquid with the shipping name "FLAMMABLE Liquid N.O.S." and the identification number "UN1993." If the nature of the sample is known, Title 49, Code of Federal Regulations, Parts 171 to 177 (49 CFR 171-177) will be consulted to determine the proper labeling and packaging requirements. Typically carrier services are able to provide the above information.

- The cans will be placed upright in a cooler that has had the drain plug taped shut inside and outside, and the cooler is lined with a large plastic bag. Approximately 1 inch of packing material, such as vermiculite, is placed in the bottom of the liner. Three sizes of paint cans are used: pint, half-gallon, and gallon. The pint or half-gallon paint cans can be stored on top of each other; however, the gallon cans are too high to stack. The cooler will be filled with packing material, and the liner will be taped shut.

- As mentioned, the COC record going to the laboratory via carrier will be sealed inside a plastic bag and taped to the inside of the cooler lid or attached to the top of the cooler if a courier is used. The sampler retains one copy of the COC record. The laboratory will be notified if the sample is suspected of containing any substance for which the laboratory personnel should take safety precautions.

- The cooler is shut and sealed with strapping tape (filament type) around both ends. Two signed custody seals will be placed on the cooler, one on the front and one on the back. Additional seals may be used if the sampler and shipper thinks

more seals are necessary. Wide clear tape will be placed over the seals to ensure against accidental breakage.

- The following markings are placed on the top of the cooler:

  - Proper Shipping Name (49 CFR 172.301)

  - DOT identification number (49 CFR 172.301)

  - Shipper's or consignee's name and address (49 CFR 172.306)

  - "This End Up" legibly written if the shipment contains liquid hazardous materials (49 CFR 172.312)

- The following labels will be placed on the top of the cooler (49 CFR 172.406e):

  - Appropriate hazard class label (placed next to the proper shipping name).
  - "Cargo Aircraft Only" (if applicable as identified in 49 CFR 172.101).

- An arrow symbol(s) indicating "This End Up" will be placed on the cooler in addition to the markings and labels described above.

- Restricted article airbills will be used for shipment. The "Shipper Certification for Restricted Articles" section will be filled out as follows for a flammable solid or a flammable liquid:

  - Number of packages or number of coolers

  - Proper shipping name; if unknown use
    - Flammable solid, N.O.S., or
    - Flammable liquid, N.O.S.

  - Identification number; if unknown use
    - UN1325 (for flammable solids) or
    - UN1993 (for flammable liquids).

  - Net quantity per package or amount of substance in each cooler.

  - Radioactive materials section (leave blank).

  - Passenger or Cargo Aircraft. (Cross off the nonapplicable items. Up to 25 pounds of flammable solid per cooler can be shipped on a passenger aircraft. Up to 1 quart of flammable liquid per cooler can be shipped on a passenger aircraft, and up to 10 gallons of flammable liquid can be shipped on a cargo aircraft.)

  - Name and title of shipper (printed).

- An emergency telephone number where the shipper can be reached within the following 24 to 48 hours.

- Shipper's signature.

· No samples shall be held on site for more than 24 hours, except during weekend field activities. Samples collected on the weekend will be stored under refrigeration and shipped the following Monday. Sampling activities for analytes with extremely short holding times, such as 24 hours, will not be scheduled for weekend collection. All DOT regulations will be followed for packaging and shipping.

· Occasionally, multiple coolers will be sent in one shipment to the laboratory. One cooler will have the original COC record and the other coolers will have copies. The plastic bag in which the COC Records are placed will be marked appropriately "ORIGINAL" or "COPY." In addition, the outside of the coolers will be marked to indicate how many coolers are in the shipment.

4.2.6.3 Geotechnical Samples. Geotechnical samples will be collected in tubes as undisturbed samples or in plastic bags as bulk samples. Proper labeling procedures are described in Section 4.2.2. Holding times do not apply; however, samples should be shipped as soon as possible and kept cool to prevent drying and mold growth. Undisturbed samples should be sealed in resealable plastic bags to maintain sample moisture content.

Geotechnical samples may be shipped in a sturdy box or other container. No ice is necessary. Enough packing material should be added so that samples remain undisturbed. COC procedures are necessary to generate defensible data. Hazardous nature of the samples, including any HNU readings, name of the suspected contaminants present, and the approximate range of concentrations, if known, should be noted on the COC record.

4.2.6.4 Other Samples. Samples other than environmental or high concentration samples must be shipped according to the requirements of 49 CFR 173.24 and other applicable state and local regulations. Prior to the collection and shipment of these samples, shipment requirements shall be researched; a written description of shipment procedures shall be prepared; and the description reviewed and approved by a Montgomery Watson certified industrial hygienist prior to samples. These shipment procedures will be included in the project plan (if applicable). Examples of such samples include potential asbestos containing material land transformer fluids.

4.2.6.5 Prohibited Samples. Montgomery Watson prohibits the collection of the following types of samples:

- Compressed gas cylinders
- Radioactive substances
- Biological hazards
- Chemical warfare agents
- Drugs (controlled substances)
- Explosive ordnance
- Explosives (as per DOT)
- Shock-sensitive materials

This prohibition can only be lifted by the provision for and approval of Montgomery Watson corporate counsel and the Montgomery Watson Industrial/Hazardous Waste (I/HW) group health and safety manager.

4.2.7 Holding Times

The holding times for samples will depend on the analysis and the sample matrix. Unless otherwise specified by the contract, holding times are as given in Table 1.

5.0 REFERENCES

Enforcement Considerations for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors, Draft, Appendix D, April 1980.

6.0 ATTACHMENTS

1 - Recommended Preservation for Water Samples by Analysis
2 - Sample Label
3 - Custody Seal
4 - Chain-of-Custody Record

STANDARD OPERATING PROCEDURES

SURFACE WATER AND SEDIMENT SAMPLING

STANDARD OPERATING PROCEDURES

FOR SURFACE WATER AND SEDIMENT SAMPLING

TABLE OF CONTENTS

1.0 INTRODUCTION

This guideline describes methods and equipment commonly used for collecting environmental samples of surface water and aquatic sediment for either on-site examination and chemical testing or for laboratory analysis.

The information presented in this guideline is generally applicable to all environmental sampling of surface waters and aquatic sediments except where the analyte(s) may interact with the sampling equipment. The collection of concentrated sludges or hazardous waste samples from disposal or process lagoons often requires methods, precautions and equipment different from those described herein.

Specific sampling problems may require the adaptation of existing equipment or design of new equipment. Such innovations should be clearly described in the sampling plan (or addendum to the sampling plan if the RI is ongoing) and brought to the attention of the PM.

2.0 DEFINITIONS

Environmental Sample: low concentration sample typically collected off site and not requiring Department of Transportation (DOT) hazardous waste labeling or Contract Laboratory Program (CLP) handling as a high hazard sample.

Hazardous Waste Sample: medium-to-high concentration sample (e.g., source material, sludge, leachate) requiring DOT labeling and CLP handling as a high hazard sample.

3.0 RESPONSIBILITIES

Field Team Leader (FTL): has overall responsibility for the correct implementation of surface water and sediment sampling activities, including review of the sampling plan with, and any necessary training of, the sampling technician(s). The actual collection, packaging, documentation (sample label and log sheet, chain-of-custody record, etc.) and initial custody of samples will be the responsibility of the sampling technician(s).

4.0 PROCEDURES

4.1 BACKGROUND

Collecting a representative sample from surface water or sediments is often difficult because of water movement, stratification, or patchiness. To collect representative samples, one must standardize sampling bias related to site selection; sampling frequency; sample collection; sampling devices; and sample handling, preservation, and identification.

Representativeness is a qualitative description of the degree to which an individual sample accurately reflects population characteristics or parameter variations at a sampling point. It is therefore an important quality not only for assessment and quantification of environmental threats posed by the site, but also for providing information for engineering design and construction. Proper sample location selection and proper sample collection methods are important to ensure that a truly representative sample has been taken. Regardless of scrutiny and quality control applied during laboratory analyses, reported data are no better than the confidence that can be placed in the representativeness of the samples.

4.2 DEFINING THE SAMPLING PROGRAM

Factors that must be considered in developing a sampling program for surface water or sediments including study objectives are: accessibility; site topography; flow, mixing, and other physical characteristics of the water body; point and diffuse sources of contamination; and personnel and equipment available to conduct the study. For waterborne constituents, dispersion depends on the vertical and lateral mixing within the body of water. For sediments, dispersion depends on bottom current or flow characteristics, sediment characteristics (density, size) and geochemical properties (which affect adsorption/desorption). The hydrologist developing the sampling plan must therefore know not only the mixing characteristics of streams and lakes, but also must understand the role of fluvial-sediment transport, deposition, and chemical sorption.

4.2.1 Sampling Program Objectives

The objective of surface water sampling is to determine the surface water quality entering, leaving, or remaining within the site. The scope of the sampling program must consider the sources and potential pathways for transport of contamination to or in a surface water body.

Sources may include point sources (leaky tanks, outfalls, etc.) or nonpoint sources (e.g., spills). The major pathways for surface water contamination (not including airborne deposition) are: a) overland runoff; b) leachate influx to the waterbody; c) direct waste disposal (solid or liquid) into the water body; and groundwater flow influx from upgradient. The relative importance of these pathways, and therefore the design of the sampling program, is controlled by the physiographic and hydrologic features of the site, the drainage basin(s) that encompass the site, and the history of site activities.

Physiographic and hydrologic features to be considered include slopes and runoff direction; areas of temporary flooding or pooling; tidal effects; artificial surface runoff controls such as berms or drainage ditches (and when they were constructed relative to site operation); and locations of springs, seeps, marshes, etc. In addition, the obvious considerations such as the location of man-made discharge points to the nearest stream (intermittent or flowing), pond, lake, estuary, etc., should not be overlooked.

A more subtle consideration in designing the sampling program is the potential for dispersion of dissolved or sediment-associated contaminants away from the source. The dispersion could lead to a more homogeneous distribution of contamination at low or possibly non-detectable concentrations. Such dispersion does not, however, always readily occur. For example, obtaining a representative sample of contamination from a main stream immediately below an outfall or a tributary is difficult because the inflow frequently follows a stream bank with little lateral mixing for some distance. Sampling alternatives to overcome this situation are: 1) move the site far enough downstream to allow for adequate mixing, or 2) collect integrated samples in a cross section. Also, nonhomogeneous distribution is a particular problem with regard to sediment-associated contaminants, which may accumulate in low-energy environments (coves, river bends, deep spots, or even behind boulders) near or distant from the source while higher energy areas (main stream channels) near the source may show no contaminant accumulation.

The distribution of particulates within a sample is an important consideration. Many organic compounds are only slightly water soluble and tend to be adsorbed by particulate matter. Nitrogen, phosphorus, and heavy metals may also be transported by particulates. Samples must be collected with a representative amount of suspended material; transfer from the sampling device should include transferring a proportionate amount of the suspended material.

The first steps in selecting sampling locations, therefore, are: 1) to review site history; 2) to define the hydrologic boundaries and features of the site; and 3) to identify the sources, pathways and potential distribution of contamination. Based on these considerations the numbers, types and general locations of required samples upgradient (for background measurement) on site and downgradient can be identified.

4.2.2 Location of Sampling Stations

Accessibility is the primary factor affecting sampling costs. The desirability and utility of a sample for analysis and description of site conditions must be balanced against the costs of collection as controlled by accessibility. Bridges or piers are the first choice for locating a sampling station on a stream because bridges provide ready access and also permit the sampling technician to sample any point across the stream. A boat or pontoon (with an associated increase in cost) may be needed to sample locations on lakes and reservoirs, as well as those locations on larger rivers. Frequently, however, a boat will take longer to cross a water body and will hinder manipulation of the sampling equipment. Wading for samples is not recommended unless it is known that contaminant levels are low enough that skin contact will not produce adverse health effects. This provides a built-in margin of safety in the event that wading boots or other protective equipment should fail to function properly. If it is necessary to wade into the water body to obtain a sample, the sampler should be careful to minimize disturbance of bottom sediments and must enter the water body downstream of the sampling location. If necessary, the sampling technician should wait for the sediments to settle before taking a sample.

Sampling in marshes or tidal areas may require the use of an all-terrain-vehicle (ATV). The same precautions mentioned above with regard to sediment disturbance will apply.

Under ideal and uniform contaminant dispersion conditions in a flowing stream, the same concentrations of each would occur at all points along the cross section. This situation is most likely downstream of areas of high turbulence. Careful site selection is needed in order to ensure, as closely as possible, that samples are taken where uniform flow or deposition and good mixing conditions exist.

The availability of streamflow and sediment discharge records can be an important consideration in choosing sampling sites in streams. Streamflow data in association with contaminant concentration data are essential for estimating the total contaminant loads carried by the stream.

If a gaging station is not conveniently located on a selected stream, the project hydrologist should explore the possibility of obtaining streamflow data by direct or indirect methods.

4.2.3 Frequency of Sampling

The sampling frequency and the objectives of the sampling event will be defined by the work plan. For single-event site- or area-characterization sampling, both bottom material and overlying water samples should be collected at the specified sampling stations. If valid data are available on the distribution of the contaminant between the solid and aqueous phases, it may be appropriate to sample only one phase, although this is not often recommended. If samples are collected primarily for monitoring purposes, consisting of repetitive, continuing measurements to define variations and trends at a given location, water samples should be collected at a pre-established and constant interval as specified in the work plan (often monthly or quarterly) and during droughts and floods. Samples of bottom material should be collected from fresh deposits at least yearly, and preferably during both spring and fall seasons.

The variability in available water-quality data should be evaluated before deciding on the number and collection frequency of samples required to maintain an effective monitoring program.

4.3 SURFACE WATER SAMPLE COLLECTION

4.3.1 Streams, Rivers, Outfalls, and Drainage Features (Ditches, Culverts)

Methods for sampling streams, rivers, outfalls, and drainage features at a single point vary from the simplest of hand-sampling procedures to the more sophisticated multipoint sampling techniques known as the equal-width-increment (EWI) method or the equal-discharge-increment (EDI) methods (defined below).

Samples from different depths or cross-sectional locations in the water course taken during the same sampling episode should be composited. However, samples collected along the length of the watercourse or collected at different times may reflect differing inputs or dilutions and therefore should not be composited. Generally, the number and type of samples to be taken depend upon the river's width, depth, discharge, and the suspended sediment the river transports. The greater number of individual points that are sampled, the more likely that the composite sample truly will represent the overall characteristics of the water.

In small streams less than about 20 feet wide, a sampling site can generally be found where the water is well mixed. In such cases, a single grab sample taken at mid-depth in the center of the channel is adequate to represent the entire cross section.

For larger streams, at least one vertical composite should be taken with one sample each from just below the surface, at mid-depth, and just above the bottom. The measurement of DO, pH, temperature, conductivity, etc., shall be made on each aliquot of the vertical composite and on the composite itself. For rivers several vertical composites should be collected.

4.3.2 Lakes, Ponds, and Reservoirs

Lakes, ponds, and reservoirs have a much greater tendency to stratify than rivers and streams do. The relative lack of mixing requires that a high number of samples be obtained.

The number of water sampling sites on a lake, pond, or impoundment will vary with the size and shape of the basin. In ponds and small lakes, a single vertical composite at the deepest point may be sufficient. Similarly, the measurement of DO, pH, temperature, etc., is to be conducted on each aliquot of the vertical composite. In naturally formed ponds, the deepest point may have to be determined empirically; in impoundments, the deepest point is usually near the dam.

In lakes and larger reservoirs, several vertical composites should be composited to form a single sample. These verticals are often taken along a transect or grid. In some cases, it may be of interest to form separate composites of epilimnetic and hypolimnetic zones. In a stratified lake, the epilimnion is the upper, warmer, and less dense layer of lake water (above the thermocline) that is exposed to the atmosphere. The hypolimnion is the lower, "confined" layer that is only mixed with the epilimnion and vented to the atmosphere during seasonal "overturn" (when density stratification disappears). These two zones thus may have very different concentrations of contaminants if input is only to one zone, if the contaminants are volatile (and therefore vented from the epiliminion but not the hypolimnion), or if the epilimnion only is involved in short-term flushing (i.e., inflow from or outflow to shallow streams). Normally, however, a composite consists of several verticals with samples collected at various depths.

In lakes with irregular shape and with bays and coves that are protected from the wind, separate composite samples may be needed to adequately represent water quality since it is likely that only poor mixing will occur. Similarly, additional samples should be taken where discharges,

tributaries, land-use characteristics, and other such factors are suspected of influencing water quality.

Many lake measurements are now made in-situ using sensors and automatic readout or recording devices. Single and multiparameter instruments are available for measuring temperature, depth, pH, oxidation-reduction potential (ORP), specific conductance, dissolved oxygen, some cations and anions, and light penetration.

4.3.3 Estuaries

Estuarine areas are by definition zones where inland freshwaters (both surface and ground) mix with oceanic saline waters. Estuaries are generally categorized into three types dependent upon freshwater inflow and mixing properties. Knowledge of the estuary type is necessary to determine sampling locations:

- Mixed estuary - characterized by the absence of a vertical halocline (gradual or no marked increase in salinity in the water column) and a gradual increase in salinity seaward. Typically this type of estuary is shallow and is found in major freshwater sheetflow areas. Since they are well mixed, the sampling locations are not critical in this type of estuary.

- Salt wedge estuary - characterized by a sharp vertical increase in salinity and stratified freshwater flow along the surface. In these estuaries the vertical mixing forces cannot override the density differential between fresh and saline waters. In effect, a salt wedge tapering inland moves horizontally, back and forth, with the tidal phase. If contamination is being introduced into the estuary from upstream, water sampling from the salt wedge may miss it entirely.

- Oceanic estuary - characterized by salinities approaching full-strength oceanic waters. Seasonally, freshwater inflow is small, with the preponderance of the fresh-saline water mixing occurring near, or at, the shore line.

Sampling in estuarine areas is normally based upon the tidal phases, with samples collected on successive slack tides (i.e., when the tide turns). Estuarine sampling programs should include vertical salinity measurements at 1- to 5-foot increments coupled with vertical dissolved oxygen and temperature profiles. A variety of water sampling devices is used, but in general the Van Dorn (or similar type) horizontal sampler is employed.

4.3.4 Sampling Equipment and Techniques

The selection of sampling equipment depends on the site conditions and sample type required. The most frequently used samplers are:

- Open tube
- Dip sampler
- Weighted bottle sampler
- Hand pump
- Kemmerer or Van Dorn Sampler
- Depth-Integrating Sampler

The dip sampler and the weighted bottle sampler are used most often.

The criteria for selecting a sampler include:

- Disposable and/or easily decontaminated.
- Inexpensive (if the item is to be disposed of).
- Ease of operation, particularly if personnel protection required is above Level D.
- Nonreactive/noncontaminating - Teflon-coated, glass, stainless steel, or PVC sample chambers are preferred (in that order).

Each sample (grab or each aliquot collected for compositing) should be measured for:

- Specific conductance
- Temperature
- pH (optional)
- Dissolved oxygen (optional)

These items should be measured for as soon as the sample is recovered. These analyses will provide information on water mixing/stratification and potential contamination.

Dip Sampling

Water is often sampled by filling a container either attached to a pole or held directly, from just beneath the surface of the water (a dip or grab sample). Constituents measured in grab samples are only indicative of conditions near the surface of the water and may not be a true representation of the total concentration that is distributed throughout the water column and in the cross section. Therefore, whenever possible dip samples should be augmented with samples

that represent both dissolved and suspended constituents and both vertical and horizontal distributions.

Weighted Bottle Sampling

A grab sample can also be taken using a weighted holder that allows a sample to be lowered to any desired depth, opened for filling, closed, and returned to the surface. This allows discrete sampling with depth. Several of these samples can be combined to provide a vertical composite. Alternatively, an open bottle can be lowered to the bottom and raised to the surface at a uniform rate so that the bottle collects sample throughout the total depth and is just filled on reaching the surface. The resulting sample using either method will roughly approach what is known as a depth-integrated sample.

A closed, weighted bottle sampler consists of a stoppered glass or plastic bottle, a weight and/or holding device, and lines to open the stopper and lower or raise the bottle. The procedure for sampling is:

1. Gently lower the sampler to the desired depth so as not to remove the stopper prematurely (watch for bubbles).

2. Pull out the stopper with a sharp jerk of the sampler line.

3. Allow the bottle to fill completely, as evidenced by the cessation of air bubbles.

4. Raise the sampler and cap the bottle

5. Decontaminate the outside of the bottle. The bottle can be used as the sample container (as long as original bottle is an approved container).

Hand Pumps

Hand pumps may operate by peristaltic, bellows, diaphragm, or siphon action. Hand pumps that operate by bellow, diaphragm, or siphon action should not be used to collect samples that will be analyzed for volatile organics because the slight vacuum applied may cause loss of these contaminants. To avoid contamination of the pump, a liquid trap consisting of a vacuum flask or other vessel to collect the sample should be inserted between the sample inlet hose and the pump.

Tubing used for the inlet hose should be nonreactive (preferably Teflon). The tubing and liquid trap must be thoroughly decontaminated between uses (or disposed of after one use).

When sampling, the tubing is weighted and lowered to the desired depth. The sample is then obtained by operation of the pump, and subsequently transferred from the trap to the sample container.

Kemmerer/Van Dorn Samplers

If samples are desired at a specific depth, and the parameters to be measured do not require a Teflon-coated sampler, a standard Kemmerer or Van Dorn sampler may be used. The Kemmerer sampler is a brass cylinder with rubber stoppers that leave the ends open while being lowered in a vertical position to allow free passage of water through the cylinder. The Van Dorn sampler is plastic and is lowered in a horizontal position. In each case a "messenger" is sent down the line when the sampler is at the designated depth, to cause the stoppers to close the cylinder, which is then raised. Water is removed through a valve to fill sample bottles.

Depth-Integrated Sampling

Depth integration is used to collect a water and suspended material sample, in direct proportion to relative velocity at each increment of depth. This means that the volume of water and suspended material must enter the sample bottle at a rate proportional to the velocity of the flow passing the intake of the sampler. If a depth-integrating sampler is lowered from the surface to the bed and back at the same rate, and presuming that the sampler is not overfilled during the course of the sampling operation, each increment of flow in that vertical is sampled proportionately to the velocity.

One method of collecting depth-integrated samples is the EWI technique. Samples are taken at several equally spaced verticals across the stream, with the transit rate of the sampler (that is, the velocity at which the sampler is passed through the water column) the same in all verticals. The samples collected in each vertical are then composited into a single sample representative of the entire flow in the cross section. Since the volume collected in each vertical sample will be directly in proportion to depth and velocity at the vertical location, the composite sample of the water-sediment mixture flowing in the cross section will be discharge-weighted.

In the equal-discharge-increment (EDI) technique, the positions of sampling verticals across the stream are based on incremental discharges rather than width (i.e., deeper or higher velocity areas of the stream cross section are sampled at a closer spacing). This method provides the most accurate measure of total discharge of the contaminant for streams that are not well mixed; however, it requires knowledge of the cross-sectional stream flow distribution.

The EDI method has these advantages: variable transit rates may be used because samples can be composited in proportion to known stream flow distribution, fewer verticals need to be sampled, and cross-section discharge information is obtained. The primary disadvantage of the method is that the streamflow distribution in the cross section must be known or measured each time before sampling.

The EWI method has these advantages: discharge measurements are not needed, the technique is learned easily, and the technique is applicable where cross-sectional stream flow distribution varies because of shifting beds or other causes. The main disadvantages are that the procedure is time consuming for large streams and does not provide quantitative information on cross-sectional discharge since this parameter does not need to be measured for the EWI method. Furthermore, the EWI method requires sampling at equally spaced verticals and use of identical transit rates within each vertical.

Because these multi-point sampling techniques can become very time consuming and expensive, an alternate method often used involves sampling at the quarter points or other equal intervals across the width of the stream. Composites of individual samples collected at the quarter points can be fairly representative, providing the stream cross section is properly located.

Several depth-integrating samplers specifically designed and suitable for collecting representative samples are available. In shallow streams and wetlands that can be waded, the US DH-48 suspended-sediment sampler can be used. The US DH-59 suspended-sediment sampler was designed to be suspended by a hand-held rope in streams too deep to be waded. The US D-49 suspended-sediment sampler also has been used for many years to collect depth-integrated samples in large streams and rivers. It accommodates a 473-ml bottle and has a choice of nozzles (3.2-mm, 4.8-mm, and 6.4-mm in diameter) to control the rate of inflow of the water-sediment mixture. The D-49 sampler, which weighs about 27 kg, is suspended on a cable and operated with a reel attached to a boom. The US D-74 sampler is a modified D-49 sampler that accommodates either a 473-ml or 946-ml bottle. The US D-74 AL sampler is also a modified D-

49 sampler, but is cast from aluminum and weighs approximately 13.6 kg. This sampler can be used with a handline in slower moving streams. The US DH-76 sampler is a modified DH-59 sampler that accommodates a 946-ml bottle and is available in the regular or trace-metal series. A new sampler, designated DH-80, accommodates either a 473-ml or 946-ml Mason jar. The intake nozzle with air exhaust ports is a single-piece head molded from polypropylene. Contaminated heads can be replaced quickly and easily.

Because of the number and diversity of analyses that may be performed on collected surface water or water-sediment mixtures, a sample splitter will often be required. A churn splitter is a practical means for splitting composited samples into representative subsamples.

4.4 SEDIMENT SAMPLING

4.4.1 General

Sediment samples are usually collected at the same verticals at which water samples were collected. If only one sediment sample is to be collected, the site should be approximately at the center of the water body. This is particularly true for reservoirs that are formed by the impoundment of rivers or streams. Generally, the coarser grained sediments are deposited near the headwaters of the reservoir. Bed sediments near the center will be composed of fine-grained materials that may, because of their lower porosity and greater surface area available for adsorption, contain greater concentrations of contaminants. The shape, flow pattern, bathymetry (depth distribution), and water circulation patterns must all be considered when selecting sediment sampling sites. In streams, areas likely to have sediment accumulation (bends; behind islands or boulders; quiet, shallow areas; or very deep, low-velocity areas) should be sampled while areas likely to show net erosion (high velocity, turbulent areas) and suspension of fine solid materials should be avoided.

Chemical constituents associated with bottom material may reflect an integration of chemical and biological processes. Bottom samples reflect the historical input to streams, lakes, and estuaries with respect to time, application of chemicals, and land use. Bottom sediments (especially fine-grained materials) may act as a sink or reservoir for adsorbed heavy metals and organic contaminants (even if water column concentrations are below detection limits). It is therefore important to minimize the loss of low-density "fines" during any sampling process.

4.4.2 Sampling Equipment and Techniques

A bottom-material sample may consist of a single scoop or core or may be a composite of several individual samples in the cross section. Sediment samples may be obtained using on-shore or off-shore techniques.

When boats are used for sampling, life preservers must be provided and two individuals must undertake the sampling. An additional person should remain on shore in visual contact at all times.

The following samplers may be used to collect bottom materials:

- Scoop sampler
- Core samplers

- Hand-operated gravity corers
- Dredge samplers

Scoop Sampler

A scoop sampler consists of a pole to which a jar or scoop is attached. The pole may be made of bamboo, wood, or aluminum and be either telescoping or of fixed length. The scoop or jar at the end of the pole is usually attached using a clamp.

If the water body can be sampled from the shore or if it can be waded, the easiest and "cleanest" way to collect a sediment sample is to use a scoop sampler. This reduces the potential for cross-contamination. This method is accomplished by reaching over or wading into the water body and, while facing upstream (into the current), scooping the sample along the bottom in the upstream direction. It is very difficult not to disturb fine-grained materials of the sediment-water interface when using this method.

Core Samplers

Core samplers are used to sample vertical columns of sediment. They are useful when a historical record of sediment deposition is desired, for they preserve the sequential layering of the deposit. Coring devices are particularly useful for sediments because the "shock wave" created by descent is minimal, thus the fines of the sediment-water interface are not disturbed. Also, the sample is withdrawn intact, permitting the removal of only those layers of interest and core liners manufactured of glass or Teflon can be purchased, thus reducing the possible sample contamination. In addition, samples are easily delivered to the lab for analysis in the tube in which they are collected. The disadvantage of coring devices is that a relatively small surface area and sample size is obtained, necessitating repetitive sampling to obtain large amounts of sample needed for some analyses.

Many types of coring devices have been developed to address varying depths of water from which the sample is to be obtained, the nature of the bottom material, and the length of the core to be collected. In shallow wadeable waters, the direct use of a glass or Teflon core liner or tube is recommended. Teflon is preferred to avoid glass breakage and possible sample loss. The use of the tube by itself eliminates any possible metal contamination from core barrels, cutting heads, and retainers.

Core sampler tubes or liners should be approximately 12 inches long since only recently deposited sediments (8 inches or less) are to be sampled. Soft or semi-consolidated sediments such as mud and clays have a greater adherence to the inside of the tube and thus can be sampled with large-diameter tubes. However, because coarse or unconsolidated sediments such as sand and gravel will tend to fall out of the tube, a small diameter is required. A tube about 2 inches in diameter is usually sufficient. The wall thickness of the tube should be about 1/3 inch for either Teflon or glass. The end of the tube may be tapered by filing it down to facilitate entry of the liner into the substrate.

Hand-Operated Gravity Corers

Hand corers are generally constructed of an outer rigid metal tube into which a 2-inch ID, plastic or Teflon core sleeve fits with minimal clearance. The cutting edge of the corer has a recessed lip on which the core sleeve rests and which accommodates a plastic core catcher. The core catcher is composed of intermeshing "fingers" that point upward into the core sleeve so that when the sampler is pressed into the sediment, the core is free to move past the catcher, but the core cannot fall through the catcher upon removal of the sampler from the sediment.

Use of hand corers or liners involves pushing the device into the substrate until only 4 inches or less is above the sediment-water interface. When sampling hard or coarse substrates, a gentle rotation of the corer while it is pushed will facilitate greater penetration and cut down on core compaction. The liner is then capped with a Teflon plug or a sheet of Teflon held in place by a rubber stopper or cork. After capping, the corer is slowly extracted, the negative pressure and core catcher (if used) keeping the sample in the liner. As the bottom part of the liner comes out of the water, it too is capped. If the top or bottom of the liner contains water or air, the caps should be removed, the water carefully decanted (to avoid removal of surface sediments) and the ends packed with clean silica sand. The caps are then replaced and secured with friction tape. The orientation of the core should be marked on the sleeve.

Gravity corers are used to obtain sediment samples in water bodies deeper than 3 to 5 feet. These types of samplers can be used for collecting 1- to 2-foot cores (with a 2-inch ID), of surface sediments at depths of up to several hundred feet beneath the water surface. Because of their small diameter, gravity corers are not suitable for obtaining coarse-grained samples, but they are excellent for obtaining fine-grained materials.

The gravity core sampler operates in a manner similar to the hand-operated core. A plastic or Teflon liner (2-inch ID) fits within a metal core housing fitted with a cutting edge. Core-catchers are used to retain the core within the liner. An opening exists above the liner to allow free flow of water through the corer as it moves vertically through the water and into the sediment. The sampler has a messenger-activated valve assembly that seals the opening above the liner following sediment penetration, which creates a partial vacuum to assist in sample retention during retrieval.

Samples are obtained by allowing the sampler, which is attached to sufficient length of stainless steel cable, to drop to the bottom. The weight of the sampler drives the core into the sediment to vary depths depending on the characteristics of the sediments. The messenger is then dropped and the sampler carefully retrieved. Upon retrieval, treatment is similar to that described above for hand corers.

Dredges

Dredges are generally used to sample sediments that cannot easily be obtained using coring devices (i.e., coarse-grained or partially cemented materials) or when large quantities of materials are required. Dredges generally consist of a clam shell arrangement of two buckets. The buckets may either close upon impact or be activated by use of a messenger. Most dredges are heavy (up to several hundred pounds) and require use of a winch and crane assembly for sample retrieval. There are three major types of dredges: Peterson, Eckman, and Ponar dredges.

The Peterson dredge is used when the bottom is rocky, in very deep water, or when the flow velocity is high. The dredge should be lowered very slowly as it approaches bottom, because it can force out and miss lighter materials if allowed to drop freely.

The Eckman dredge has only limited usefulness. It performs well where bottom material is unusually soft, as when covered with organic sludge or light mud. It is unsuitable, however, for sandy, rocky, and hard bottoms and is too light for use in streams with high flow velocities.

The Ponar dredge is a Peterson dredge modified by the addition of side plates and a screen on the top of the sample compartment. The screen over the sample compartment permits water to pass through the sampler as it descends, thus reducing the "shock wave" and permitting direct access to the secured sample without opening the closed jaws. The Ponar dredge is easily operated by

one person in the same fashion as that of the Peterson dredge. The Ponar dredge is one of the most effective samplers for general use on all types of substrates. Access to the secured sample through the covering screens permits subsampling of the secured material with coring tubes or Teflon scoops, thus minimizing the change of metal contamination from the frame of the device.

5.0 REFERENCES

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6.0 ATTACHMENTS

None.

STANDARD OPERATING PROCEDURES

FIELD DOCUMENTATION

STANDARD OPERATING PROCEDURES

FOR FIELD DOCUMENTATION

TABLE OF CONTENTS

1.0 INTRODUCTION

This guideline is a general reference for the required documentation to be completed by company personnel during field investigations. Documentation in the form of field logbooks, reports, and forms should be completed for every activity in the field. Records should be maintained on a daily basis as the work progresses. All field documentation should be accurate and legible because it is part of the client's product and may potentially serve as a legal document.

Sample field documentation forms are attached.

2.0 DEFINITIONS

None.

3.0 RESPONSIBILITIES

All field team members are responsible for recording daily activities. A general breakdown of responsibilities should occur as follows. An in-depth description of the documentation mentioned below is given in later sections.

Sample field documentation forms are attached.

Field Team Leader (FTL): The FTL is responsible for completing the FTL logbook; Daily Quality Control Reports (DQCRs); documentation concerning supervision of team members; duplication and distribution of applicable records.

Rig Geologist/Sampling Team: The Rig Geologist/Sampling Team is responsible for completing the drilling logbook; lithologic logs; well construction diagrams; sampling documentation such as sample labels, sample register, and chain-of-custody (COC) forms.

Water Sampling/Development Team: The Water Sampling/Development Team is responsible for completing the water sampling/development logbook; groundwater sampling/development logs, sampling documentation such as sample labels, sample register, and chain-of-custody (COC) forms.

Aquifer Data Collection Team: The Aquifer Data Collection Team is responsible for completing the aquifer logs (e.g., slug tests, step-drawdown tests, pump tests), water level records, data organization/tracking (e.g., downloading of data from data loggers).

4.0 FIELD DOCUMENTATION GUIDELINES

Field documentation serves as the primary foundation for all field data collected that will be used to evaluate the project site. All field documentation should be accurate, legible and written in indelible ink. Absolutely no pencils or erasures are to be used. Mistakes written in the field books, logs, or on forms that need to be deleted should be crossed out with one line, initialed, and dated. Skipped pages or blank sections at the end of a page should be crossed out with an "X" covering the entire page or blank section; "No Further Entries," initials, and date should be written by the person making the correction. The responsible field team member should write his/her signature, date, and time after the day's last entry. To further assist in the organization of the field books, logs, or forms, it is important to write the date on top of each page and the significant activity description (e.g., boring or well number). Each project job number should have its own field book. In addition, all original field documentation should be submitted to the project files.

The descriptions of field data/documentation given below serve as an outline; individual projects will vary in documentation needs.

4.1 FIELD LOGBOOKS

The field logbook is a bound, weatherproof book with numbered pages that serves primarily as a daily log of the activities carried out during the investigation. All entries should be made in indelible ink. A field logbook should be completed for each operation undertaken during the investigation, such as field team leader notes, drilling, groundwater sampling/development, and site visitors. The logbook should serve as a diary of the events of the day.

Field activities will vary from project to project; however, the concept and general information that should be recorded will remain similar. A detailed description of three basic logbooks in which field activities should be documented is given below. These field logbooks include the FTL logbook, rig geologist/sampling team logbook, and groundwater sampling/development

logbook. The following sections describe the minimum information that should be recorded in each of these logbooks.

FTL Logbook

The field team leader's responsibilities include the general supervision, support, assistance, and coordination of the various field investigation activities. As a result, a large portion of the FTL's day is spent rotating between operations in a supervisory mode. Records of the FTL's activities as well as a summary of the field team's activities should be maintained in a logbook. The FTL's logbook will be used to fill out daily quality control reports (DQCRs), and as such should contain all information required in these reports (refer to Section 3.3). Items to be documented include:

- Record of tailgate meetings
- Personnel and subcontractors on job site and time spent on the site
- Field operations and personnel assigned to these activities
- Site visitors
- Log of FTL's activities: time spent supervising each operation and summary of daily operations as provided by field team members
- Problems encountered and related corrective actions
- Deviations from the sampling plan
- Records of communications: discussions of job-related activities with the client, subcontractor, field team members, and project manager
- Information on addresses and contacts
- Record of invoices signed and other billing information
- Field observations

Rig Geologist/Sampling Team Logbook

The rig geologist or sampling team leader is responsible for recording the following information:

- Health and Safety Activities
    - Calibration records for health and safety equipment (type of PID, calibration gas used and associated readings, noise dosimeters, etc.)

- Personnel contamination prevention and decontamination procedures
- Record of daily tailgate safety meetings

· Weather

• Calibration of field equipment

• Equipment decontamination procedures

• Personnel and subcontractors on job site and time spent on the site

• Site name and well or soil boring number

• Drilling activities

- Sample location (sketch)
- Drilling method and equipment used
- Borehole diameter
- Drill cuttings disposal/containerization (number of drums, roll off-bins, etc.)
- Type and amount of drilling fluids used (mud, water, etc.)
- Depth and time at which first groundwater was encountered, depth to water at completion of drilling, and the stabilized depth to water. The absence of water in the boring should also be noted.
- Total drilling depth of well or soil boring
- Type and amount of materials used for well installation
- Well construction details [depth of grout (mixture, weight), bentonite seal, filter pack, etc. [include type and amount used, calculate estimated amount that should be used]
- Type and amount of material used to backfill soil borings
- Time and date of drilling, completion, and backfilling
- Name of drilling company, driller, and helpers

- Sampling
    - Date and time of sample collection
    - Sample interval
    - Number of samples collected
    - Analyses to be performed on collected samples
- Disposal of contaminated wastes (PPE, paper towels, visqueen, etc.)
- Field observations
- Problems encountered and corrective action taken
- Deviations from the sampling plan
- Site visitors

Groundwater Sampling/Development Logbook

The groundwater sampling and development team members are responsible for recording the following information.

- Health and Safety Activities
    - Calibration records for health and safety equipment (i.e. type of PID, calibration gas used and readings, noise dosimeters etc.)
    - Personnel contamination prevention and decontamination procedures
    - Record of daily tailgate safety meetings
- Weather
- Calibration of field equipment
- Equipment decontamination procedures
- Personnel and subcontractors on job site and time spent on the site

- Equipment decontamination procedures
- Disposal of contaminated wastes (PPE, paper towels, visqueen, etc.)
- Site name, well number
- Water levels and product levels [time and datum that water levels are measured (i.e. top of casing)]. Purging of the well (include calculations, well volumes) with the following information:
  - Measured field parameters (temperature, pH, conductivity, odor, color, cloudiness, etc.)
  - Amount of water purged
  - Purge method: indicate bailer/pump, diameter and length of bailer, material that the bailer is composed of, type of pump, new nylon rope, etc.
- Purge water disposal/containment (Baker tank/ drums, number used, identification, etc.)
- PID readings from inside of well, purged water, and breathing zone
- Background PID readings
- Well sampling
  - Number of samples collected and type of containers used
  - Date and time of sample collection
  - Type of analyses
  - QA/QC samples collected; names given to blind samples
- Field observations
- Problems encountered and corrective actions taken
- Deviations from the sampling plan
- Site visitors

4.2 TAILGATE SAFETY MEETINGS

Tailgate safety meetings are held at the beginning of each day before the initiation of work. All personnel, subcontractors, and others who will be on the job site are required to attend. The meetings are usually conducted by the FTL, on-site safety officer, or other qualified team member. The topics discussed at the meeting should include the following:

- Protective clothing and equipment
- Chemical hazards
- Physical hazards
- Special equipment
- Emergency procedures
- Emergency phone numbers
- Directions to the hospital

All site personnel are required to sign the tailgate safety meeting form. The original form should be kept on site, and a copy should be sent to the home office.

4.3 DAILY QUALITY CONTROL REPORTS

The preparation of DQCRs is the responsibility of the field team leader. DQCRs are completed on a daily basis and should summarize the events of the day and supplement the information that is already recorded in the field logbook. DQCRs should be completed regardless of the duration of the field effort. Depending on the client, copies of the report should be distributed to the Montgomery Watson Project Manager, Montgomery Watson Project Geologist, Client Project Manager (depending on the project), field office file, and home office file. Information recorded in this report should include the following.

- Date and Weather Information. date, daily temperatures, wind speed and direction, humidity.
- Montgomery Watson Personnel and Time Spent on Site
- Subcontractors and Time Spent on Site
- Special Equipment on Site. PID, Smeal Water Sampling Rig, Hollow-Stem Auger Rig, pH meter, conductivity meter, etc.
- Work and Sampling Performed. Personnel performing specific site activities, a summary of samples collected, and a thorough explanation of the work completed.

- Quality Control Activities. Activities such as decontamination procedures, QA/QC samples taken, calibration of field equipment, etc.

- Health and Safety Levels and Activities. Field parameter measurements, including calibration of equipment. Includes daily tailgate safety meetings, level of protection used, etc.

- Problems Encountered/Corrective Actions Taken. Any technical difficulties, for example problems encountered during drilling or equipment breakdowns. Any problems that could potentially affect the quality of the samples should be included.

- Special Notes. Any information that does not fit under the categories listed above, but is important to record. Information that would be useful for future sampling such as base contacts made, visitors on site, etc.

- Next Day's Expectations

- Signature of Individual Completing the Report.

4.4 BORING LOGS

The preparation of drill logs is the responsibility of the field team members assigned to the drill rig. A detailed description of well logging is provided in the SOP for that subject. Several examples of drilling logs are given in the attachments. The exact format is dependent upon the job and the client; however, the following basic information should be recorded on the log regardless of the format.

- Project and site name

- Name of driller and drilling company

- Well/soil boring ID and location (sketch)

- Drilling and backfilling dates and times

- Reference elevation for all depth measurements

- Total depth of completed soil boring/well

- Depth of grouting, sealing, and grout mixes

- Signature of the logger.

- Description of unconsolidated materials

  - Geologic lithology description
  - Descriptive Unified Soil Classifications System (USCS) classification
  - USCS symbol

- Color (use appropriate soil color chart)

  - Penetration resistance (consistency or density)
  - Moisture content
  - Grain size information
  - Miscellaneous information (odor, fractures, visible contamination, etc.)

- Description of consolidated materials

  - Geologic rock description
  - Rock type
  - Relative hardness
  - Density
  - Texture
  - Color (use appropriate rock color charts)
  - Weathering
  - Bedding
  - Structures (fractures, joints, bedding, etc.)
  - Miscellaneous information (presence of odor, visible contamination, etc.)

- Stratigraphic/lithologic changes; depths at which changes occur

- Depth intervals at which sampling was attempted and amount of sample recovered

- Blow counts

- Depth intervals from which samples are retained

- Analyses to be performed on collected samples

- Depth at which first groundwater was encountered, depth to water at completion of drilling, and the stabilized depth to water. The absence of water in the boring should also be noted.

- Loss and depth of drilling fluids, rate of loss, and total volume of loss

- Use of drilling fluids
- Drilling and sampling problems
- PID readings

4.5 WELL CONSTRUCTION DIAGRAMS

The preparation of well construction diagrams are also the responsibility of field team members assigned to the drilling operations. This topic is further discussed in the SOP for Well Installation. The exact format of the diagram is dependent on the job and the client; however, the following basic information should be recorded and/or illustrated on the diagram regardless of the format.

- Project and site name
- Well identification number
- Name of driller and drilling company
- Depth and type of well casing
- Description of well screen and blank
- Borehole diameter
- Any sealing off of water-bearing strata
- Static water level upon completion of the well and after development
- Drilling and installation dates
- Type and amount of annulus materials used; depth measurements of annulus materials
- Other construction details (filter pack type and interval, location of centralizers, etc.)
- Surface elevation and reference elevation of all depth measurements

4.6 GROUNDWATER SAMPLING/DEVELOPMENT LOGS

The groundwater sampling/development log should be used any time that a well is developed or sampled. The following information should be recorded on the log.

- Project name and site
- Well identification number
- The date and time of sampling/development
- The water level and reference elevation
- Volume of water to be purged
- Pertinent well construction information (total depth, well diameter, etc.)
- Measurement of field parameters such as pH, turbidity, conductivity, and temperature, as well as the times at which the readings were taken.
- Type of purging and sampling equipment used
- Type of samples collected
- Sampler's initials

4.7 AQUIFER TESTING LOGS

The aquifer testing team is responsible for setting up, collecting, tracking, and organizing data. The information listed below is a partial listing of required information. Refer to the Aquifer Testing SOP for more details and the various book references as related to your project site.

- Well number/identification (data logger identification)
- Data logger information/parameter setup
- Water level (include date, time, and measurement reference (such as top of casing)
- Type of aquifer test (slug, step-drawdown, pump test, etc.)
- Slug test (include length and diameter of slug for volume calculations)

- Start time of test
- Duration of test
- Pump tests (include disposal/containment of water information)
- Field observations and problems
- Tester's name

4.8 DOCUMENTATION OF SAMPLING ACTIVITIES

Documentation to be made during sampling activities includes sample labels, sample seals, Chain-of-Custody Records, and sample register.

4.8.1 Sample Labels

A sample label should be affixed to all soil and water sample containers, and completed with the following information written in indelible ink. Required information on sample labels may vary from job to job; however, the following should be included at a minimum.

- Sample number
- Type of sample (grab or composite)
- Type of preservative, if applicable
- Date and time of collection
- Project location
- Analyte(s)
- Initials of sampling personnel

4.8.2 Custody Seals

Custody seals consist of security tape with the initials of the sampler and the date placed over the lid of each cooler containing samples. The tape should be placed such that the seal must be broken to gain access to the contents. Custody seals should not be placed directly onto the volatile organic compound (VOC) sample bottles. Custody seals should be placed on coolers prior to the sampling team's release to a second or third party (e.g., shipment to the laboratory).

4.8.3 Chain-of-Custody Records

Chain-of-custody procedures allow for the tracing of possession and handling of individual samples from the time of field collection through to laboratory analysis. Documentation of custody is accomplished through a chain-of-custody record that lists each sample and the individuals responsible for sample collection, shipment, and receipt. A sample is considered in custody if it is:

- In a person's possession.
- In view after being in physical possession.
- Locked or sealed so that no one can tamper with it after it has been in an individual's physical custody.
- In a secured area, restricted to authorized personnel.

A COC record is used to record the samples taken and the analyses requested. Information recorded includes time and date of sample collection, sample number, and the type of sample, the sampler's signature, the required analysis, and the type of containers and preservatives used. A copy of the COC record should be retained by the sampler prior to release to a second or third party. Shipping receipts should be signed and filed as evidence of custody transfer between field sampler(s), courier, and laboratory.

The COC Record will be properly signed and the date of collection and shipment recorded, along with the sample site identifications and requested analyses for each sample.

4.8.4 Sample Register

The sample register is a field record book with prenumbered pages. A full description of each sample is recorded in the book. The information included in the sample register should include the following:

- Sample number (identification)
- Duplicate and split sample numbers (identification)
- Location of sample
- Client
- Project number
- Collection method
- Number and size of bottles for each analysis
- Destination of the sample

- Type of analysis
- Date and time of collection
- Name of sampler

Other observations may be included as the situation dictates for a thorough record that could be used to reconstruct the events concerning that sample. All information should be recorded in indelible ink.

5.0 REFERENCES

None.

6.0 ATTACHMENTS

1 - Tailgate Safety Forms and Health and Safety Documentation
2 - Daily Quality Control Reports
3 - Lithologic Logs
4 - Well Construction Logs
5 - Groundwater Sampling and Well Development Forms
6 - Aquifer Testing Forms
7 - Sampling Documentation and Tracking Forms