San Pasqual Groundwater Management

State of the Basin Report Update

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City of San Diego

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San Pasqual Groundwater Management State of the Basin Report Update

Prepared for

City of San Diego

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September 2015

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Acronyms and Abbreviations

Basin	San Pasqual Valley Groundwater Basin
bgs	below ground surface
BMP	best management practices
CASGEM	California Statewide Groundwater Elevation Monitoring
CIMIS	California Irrigation Management Information System
City	City of San Diego
DWR	California Department of Water Resources
lb/yr	pounds per year
MCL	maximum contaminant level
mg/L	milligrams per liter
msl	mean sea level
NO_3	nitrate
NRCS	Natural Resources Conservation Service
NTS	natural treatment system
Report	*San Pasqual Groundwater Management State of the Basin Report Update*
RWQCB	San Diego Regional Water Quality Control Board
SNMP	*San Pasqual Valley Groundwater Basin Salt and Nutrient Management Plan*
SPGMP	*San Pasqual Groundwater Management Plan*
TDS	total dissolved solids
TN	total nitrogen
USGS	U.S. Geological Survey
Valley	San Pasqual Valley
WQO	water quality objective

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SECTION 1

Introduction

This *San Pasqual Groundwater Management State of the Basin Report Update* (Report) documents groundwater management activities performed by the City of San Diego (City) from July 2010 through 2014. This Report is designed to document hydrologic conditions as well as activities undertaken to manage the long-term sustainability of the Basin's groundwater resources. This Report also documents the ongoing implementation of the *San Pasqual Groundwater Management Plan* (SPGMP) (City, 2007) and planned groundwater management implementation activities, and it presents recommendations from the recent *San Pasqual Valley Groundwater Basin Salt and Nutrient Management Plan* (SNMP) (CH2M HILL, 2014).

1.1 San Pasqual Valley Background

The San Pasqual Valley Groundwater Basin (Basin) is an alluvial aquifer that underlies the San Pasqual Valley (Valley) and portions of Cloverdale Canyon, Rockwell Canyon, and Bandy Canyon in northern San Diego County. As shown on Figure 1-1, the Basin is near the southern coast of California, approximately 25 miles north of downtown San Diego, and approximately 5 miles southwest of the city of Escondido (figures are located at the end of their respective sections).

The Basin is in the South Coast Hydrologic Region within the San Dieguito Drainage Basin, which is the fourth largest drainage basin in San Diego County. The San Dieguito Drainage Basin starts in the Laguna Mountains, flows west-southwest, and ultimately terminates at the Pacific Ocean (see Figure 1-1). The Basin is bounded by Lake Hodges to the southwest and by non-water-bearing rocks of the Peninsular Ranges to the northeast. The City owns the land and water rights to 7.1 square miles of the Basin. The City leases much of this land for agricultural and residential uses, for which groundwater from the Basin serves as the primary source of water supply (see Figure 1-2).

The California Department of Water Resources (DWR) originally defined the Basin as underlying the Valley and Cloverdale, Rockwood, and Bandy canyons in central San Diego County. The City and DWR have reevaluated this boundary based on hydrologic and geologic conditions in the Basin. Recently, DWR re-assessed the areal extent of the alluvial aquifer and revised the alluvial aquifer boundary. DWR found that much of the previous Basin boundary included areas of bedrock outcrops and very thin alluvial "fingers," and that wells in those areas likely would not be drawing water from the alluvium.

1.2 San Pasqual Groundwater Management

The primary existing plan that establishes current and planned groundwater management strategies in the Basin is the SPGMP (City, 2007). Progress toward achieving the Basin management objectives established in the SPGMP is reported in State of the Basin updates, the last of which was the *2010 Groundwater Management State of the Basin Report* (MWH Americas, 2011).

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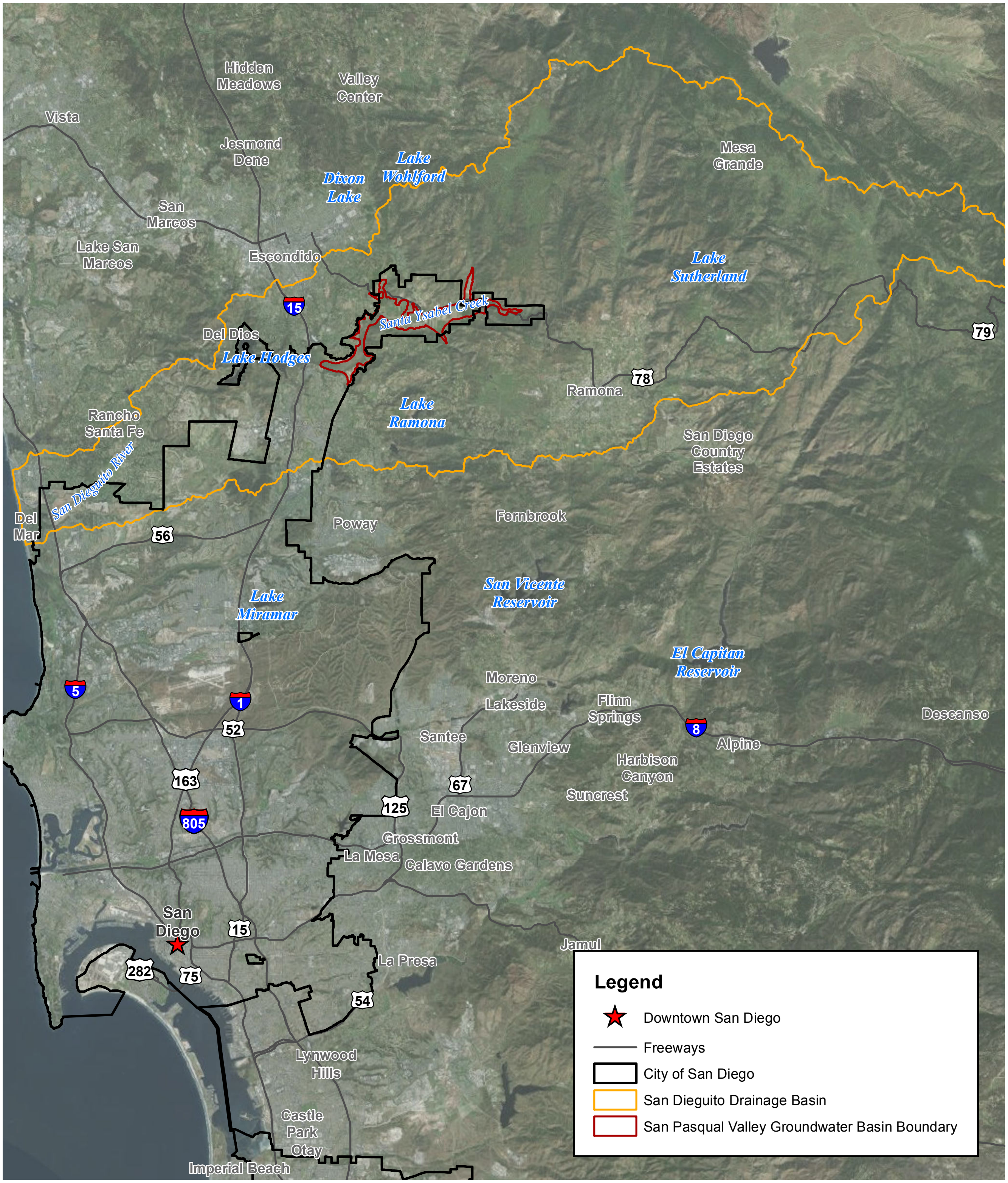

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

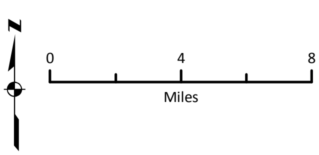

FIGURE 1-1
San Pasqual Valley Location
San Pasqual Groundwater Management
State of the Basin Report

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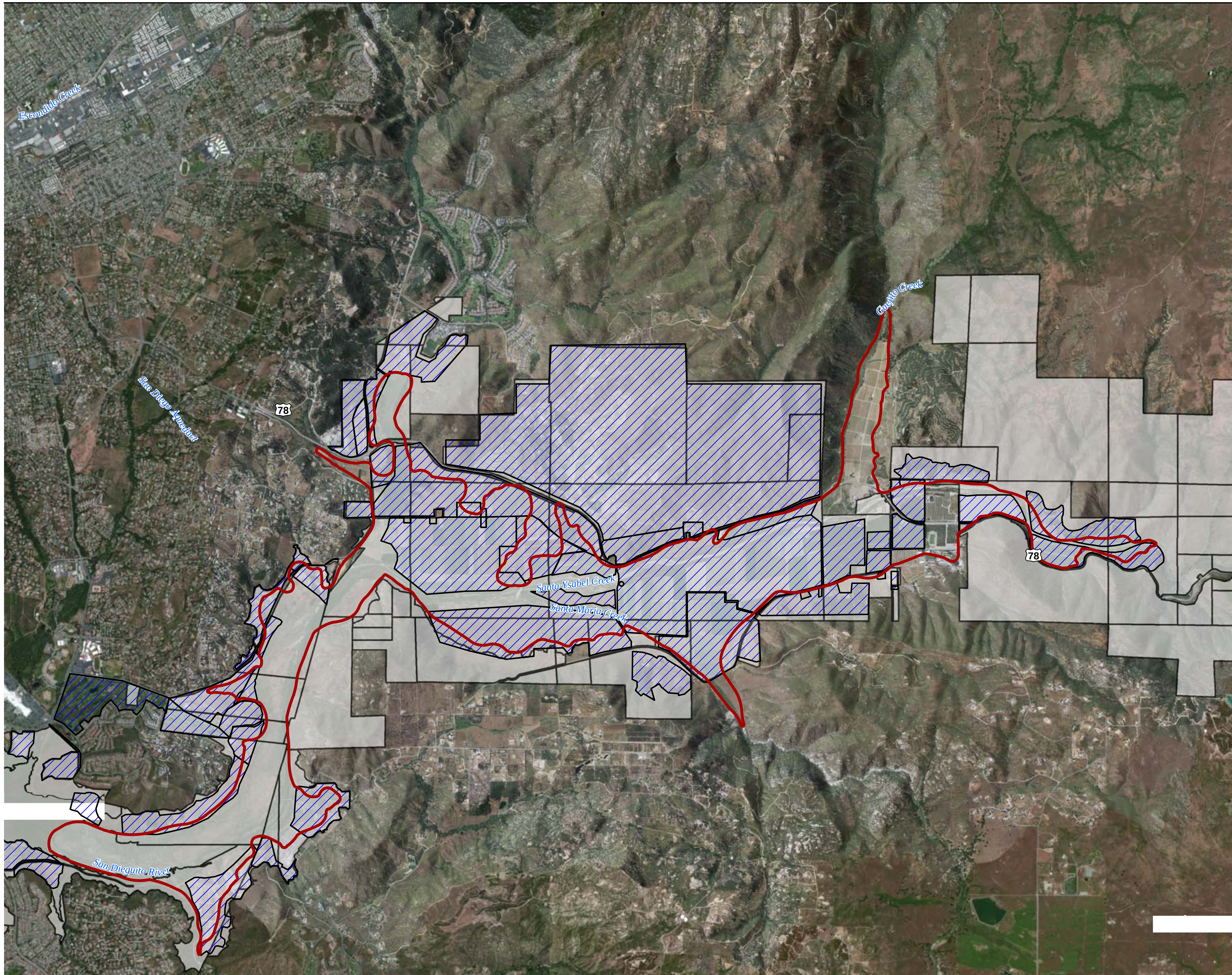
Figure 1-1 back



LEGEND

- San Pasqual Valley Groundwater Basin Boundary
- City of San Diego Lease Properties
- City of San Diego Owned Parcels

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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FIGURE 1-2
City-Owned Leases and Parcels
San Pasqual Groundwater Management
State of the Basin Report

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Figure 1-2 back

SECTION 2
Basin Conditions

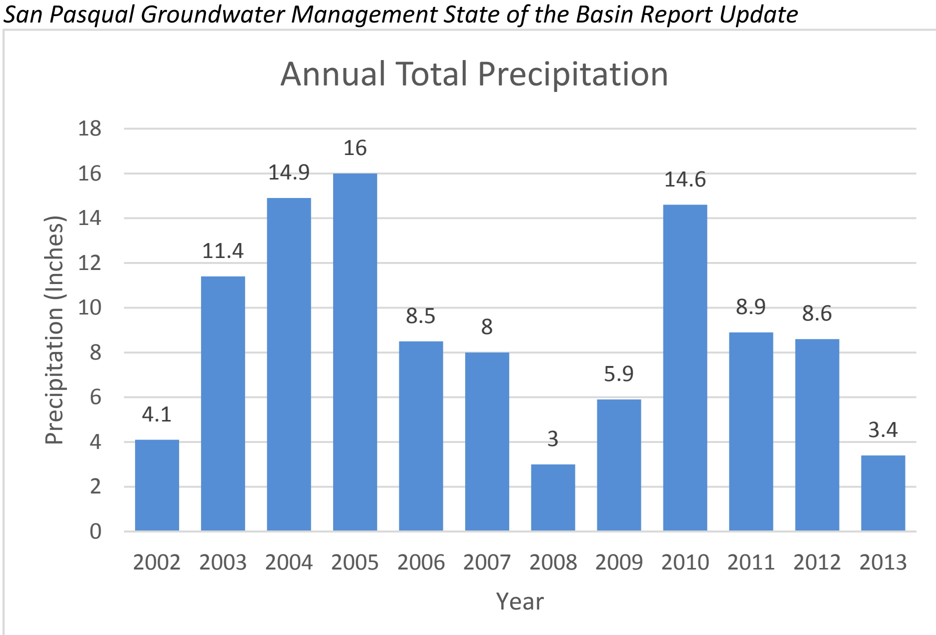
This section describes the hydrologic conditions in the Basin for the July 2010 through 2014 reporting period. Climate, depth to groundwater, groundwater elevations, groundwater and surface water quality, and land use are summarized in the following subsections.

2.1 Climate

The climate of the Basin is characteristic of a Mediterranean climate. The average precipitation from 2002 to 2013 was 8.94 inches per year. While some years experienced more rainfall than others, due to periods of drought or other weather variations, there does not appear to be a notable trend in historic precipitation data. Precipitation data are collected at the weather station shown on Figure 2-1, identified as ESCONDIDO_SPV, located on the Valley floor at 390 feet mean sea level (msl). The ESCONDIDO_SPV weather station is DWR's California Irrigation Management Information System (CIMIS) station.

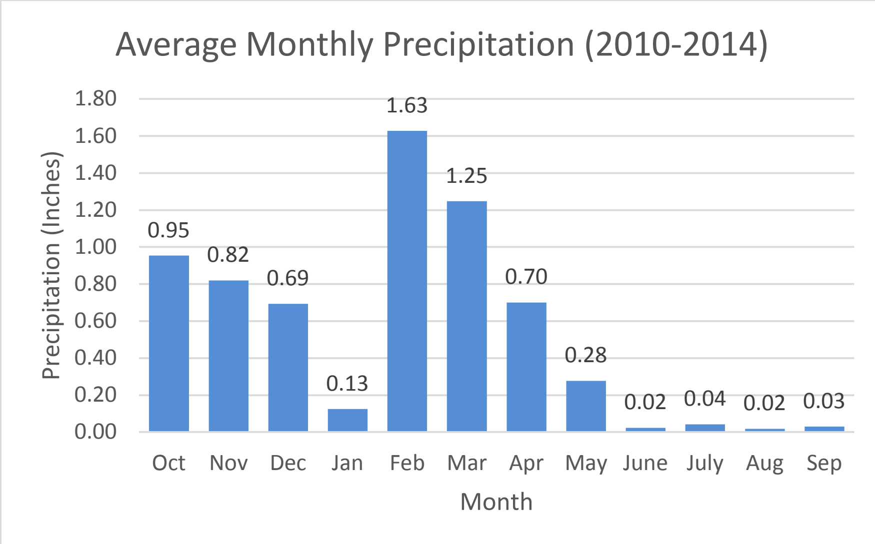
Figure 2-2 displays the annual precipitation totals from 2002 to 2013. During the 11-year reporting period, the wettest year was 2005 (16 inches of rain); the driest year was 2008 (3 inches of rain), which coincides with the peak of the last recent drought during 2007-2009. Figure 2-3 shows the average monthly rainfall totals during this reporting period of 2010 through 2014. The wettest month is February when, on average, more than 1.6 inches of rainfall are typically measured in the Basin. The driest month on average in the Basin is typically August, with approximately 0.02 inch of rainfall. These average monthly precipitation trends are typical for the region.

FIGURE 2-2
Total Annual Precipitation in San Pasqual Basin
San Pasqual Groundwater Management State of the Basin Report Update



Note: Measured at ESCONDIDO_SPV weather station.

FIGURE 2-3
Average Monthly Precipitation in San Pasqual Basin
San Pasqual Groundwater Management State of the Basin Report Update



Note: Measured at ESCONDIDO_SPV weather station.

2.2 Groundwater Levels

Measuring groundwater levels provides a direct indicator of groundwater supply. Consistent monitoring of groundwater levels provides meaningful data for evaluating the quantity and quality of the groundwater, as well as the influence of the Basin hydrology on the groundwater levels. Groundwater levels can be variable and monitoring data helps inform and improve groundwater resource planning efforts. Depth to groundwater data are useful for well design and pump selection. Groundwater elevation data are useful for evaluating groundwater flow direction and velocity within the Basin. The City monitors groundwater levels in the Basin monthly by using a network of 13 monitoring wells. Other groundwater monitoring wells include the U.S. Geological Survey (USGS) groundwater level monitoring wells, and the City water quality monitoring wells. The USGS wells are monitored every 15 minutes at three depths.

2.2.1 Depth to Groundwater

USGS monitors groundwater levels at three wells in the Valley (see Figure 2-1): SDSY (Santa Ysabel), SDLH (Lake Hodges), and SDCD (Cloverdale). USGS constructed the Santa Ysabel well in 2010, the Lake Hodges well in 2012 and the Cloverdale well in 2013 as part of the San Diego Hydrogeology Project (http://ca.water.usgs.gov/projects/sandiego/index.html). Water levels at SDSY have been measured at 15-minute intervals since April 29, 2011; the total depth of SDSY is 355 feet. Water levels for SDLH have been measured at 15-minute intervals since February 15, 2013; the total depth of SDLH is 280 feet. The water level at SDCD has been measured at 15-minute intervals since September 26, 2013; the total depth of SDCD is 287 feet.

The City is a monitoring entity in accordance with the California Statewide Groundwater Elevation Monitoring (CASGEM) Program Guidelines under Scenario A – One Monitoring Entity, submitting data for the region. In December 2010, a monitoring entity notification was submitted to DWR stating the City’s intent to monitor groundwater levels in the Basin to track seasonal and long-term trends in groundwater elevations. Six wells identified for CASGEM include wells from the City’s groundwater elevations monitoring effort (with assistance from DWR), and USGS multi-level well sites, as well as two private lease wells. The City performs semi-annual monitoring and reporting and measures water levels in the fall during the month of November, before the winter wet period, and in the spring during the month of May, right after the wet season.

LEGEND

- San Pasqual Valley Groundwater Basin Boundary
- City of San Diego Water Level Monitoring Site
- City of San Diego Water Quality Monitoring Site
- USGS Groundwater Monitoring Wells
- Surface Water Monitoring Site
- CASGEM Monitoring Site

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Miles

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FIGURE 2-1
San Pasqual Monitoring Locations
San Pasqual Groundwater Management
State of the Basin Report

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Figure 2-1 back

Figure 2-4
CASGEM Depth to Groundwater Levels
San Pasqual Groundwater Management State of the Basin Report Update

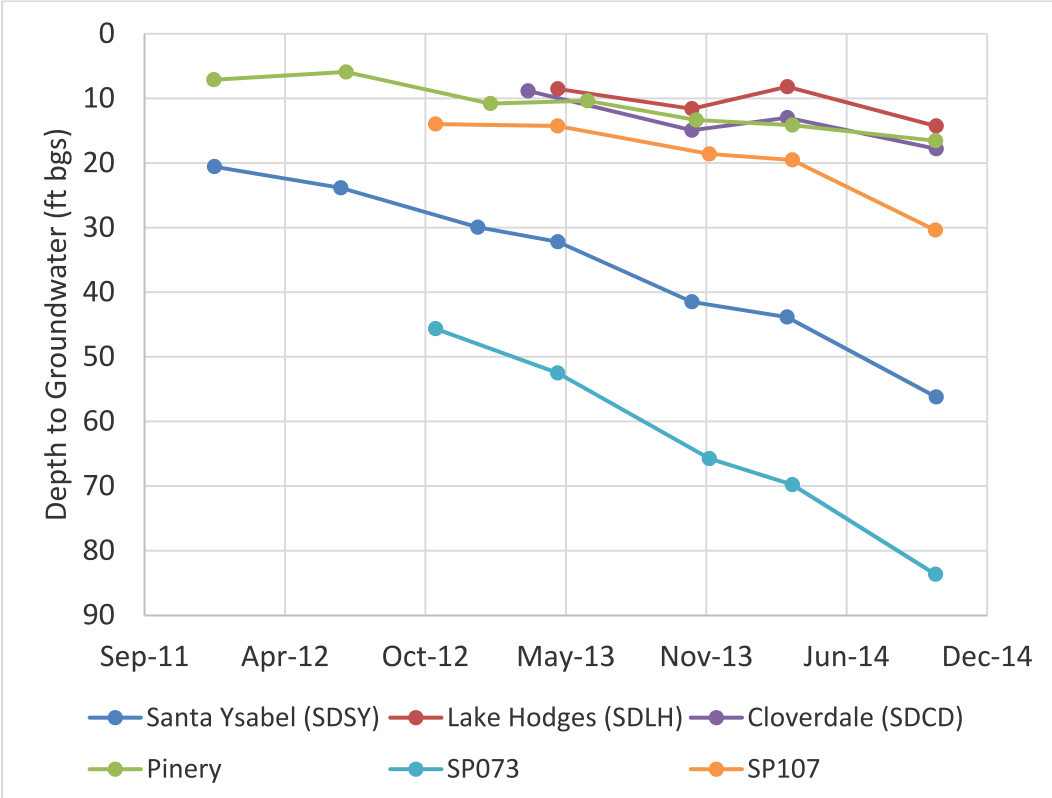


Figure 2-4 shows the depth-to-water measurements of the monitoring wells included in the CASGEM Program. The deepest groundwater is in the eastern part of the Basin, east of the confluence of Guejito Creek. Groundwater in this area is as deep as 83 feet below ground surface (bgs) (at SP073). The shallowest groundwater measured was adjacent to Lake Hodges (14 feet bgs at SDLH).

2.2.2 Groundwater Elevations

Figure 2-5 shows groundwater elevations for the City monitoring network measured between 2010 and 2014. Groundwater generally flows from the east to the west through the Basin. The highest groundwater elevation was measured to be 440 feet msl, at SP093. The lowest groundwater elevation was measured at 318 feet msl, at SP106.

2.3 Water Quality

The City has measured and monitored groundwater quality in the Basin for decades, including as part of the SPGMP. Groundwater monitoring is ongoing at several locations, because total dissolved solids (TDS) and nitrogen (as nitrate [NO_3]) concentrations have been of particular concern.

2.3.1 Groundwater Quality

Water quality objectives (WQO) for the Basin were established by the San Diego Regional Water Quality Control Board (RWQCB) as part of the Water Quality Control Plan for the San Diego Basin (RWQCB, 1994), which is available online (http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/). Groundwater quality in some areas of the Basin does not meet the objective and include chloride, nitrate (as NO_3), sulfate, TDS, iron, and manganese, as noted in Table 2-1. The groundwater WQOs are protective of beneficial uses that are consistent with the Basin management objectives and Basin utilization goals of the City.

The City attempts to collect and analyze groundwater samples quarterly; however, often only one or two sampling events occur in a year. The samples are analyzed for a variety of inorganics, organics, and metals. Because TDS and NO_3 have been evaluated as the constituents of interest, the most recent concentrations in groundwater have been graphed (see Figures 2-6 and 2-7). The overall trend shows that nitrate increases from east to west, and TDS is highest toward the middle of the Basin, which can be attributed to the variety of land uses in the Basin and general movement of groundwater through the aquifer. However, the westernmost sampling location, SP010, has much lower concentrations than the other western groundwater sites. Table 2-1 presents a summary of groundwater quality in the Basin.

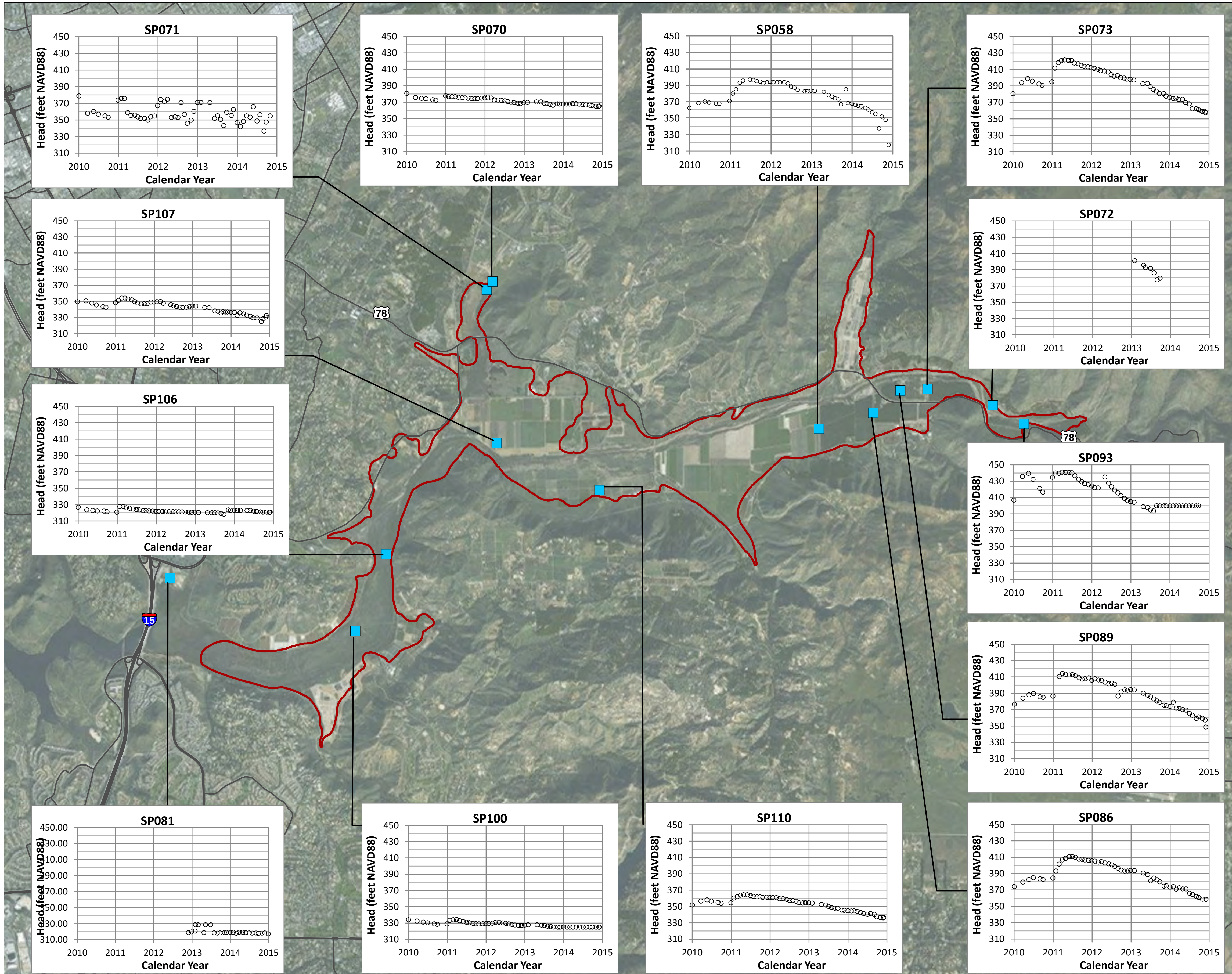
2.3.1.1 Total Dissolved Solids

TDS concentrations is one way to quantify groundwater salinity within the Basin. More salts are currently entering the aquifer than are being removed, which has resulted in an overall increase in groundwater concentrations of TDS over time. Evapoconcentration of groundwater salts from irrigation pumping and passive use by riparian vegetation is a significant factor contributing to elevated TDS concentrations in groundwater. In addition, with more than 90 percent of the total nitrogen (TN) contributions to the Basin coming from fertilizer and manure use, and given the historical elevated nitrate concentrations in groundwater, effective nutrient management across agricultural and urban landscapes has been identified as an important component of Basin water quality management.

TDS concentrations in the westernmost well (SP010) range from 604 to 1,050 milligrams per liter (mg/L), which indicates that groundwater is leaving the Basin with TDS concentrations that exceed the recommended secondary maximum contaminant level (MCL) of 500 mg/L and in some instances exceed the WQO of 1,000 mg/L. An analysis of existing historical data indicates that TDS concentrations in the western portion of the Basin have generally increased since 1950; however, constituent concentration trends seem to have become more constant in the western portion of the Basin over approximately the last decade.

2.3.1.2 Nitrates

Although the most recent nitrate concentrations in well SP010 are relatively low, average NO_3 concentrations in the western Basin are 40 mg/L, with a maximum concentration of 174 mg/L; thus, the primary MCL for nitrate (as NO_3) of 45 mg/L as well as the WQO of 10 mg/L is exceeded in some areas. Historical data show that the general trend for nitrate concentrations has increased, with the exception of wells SP089 and SP061, which have decreased.



MAP LEGEND

San Pasqual Valley Groundwater Basin Boundary

City of San Diego Water Level Monitoring Site

PLOT LEGEND

Measured Groundwater Elevation (feet NAVD88)

NOTE:

NAVD88 = North American Vertical Datum of 1988.

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FIGURE 2-5
Groundwater Elevation Trends
San Pasqual Groundwater Management
State of the Basin Report

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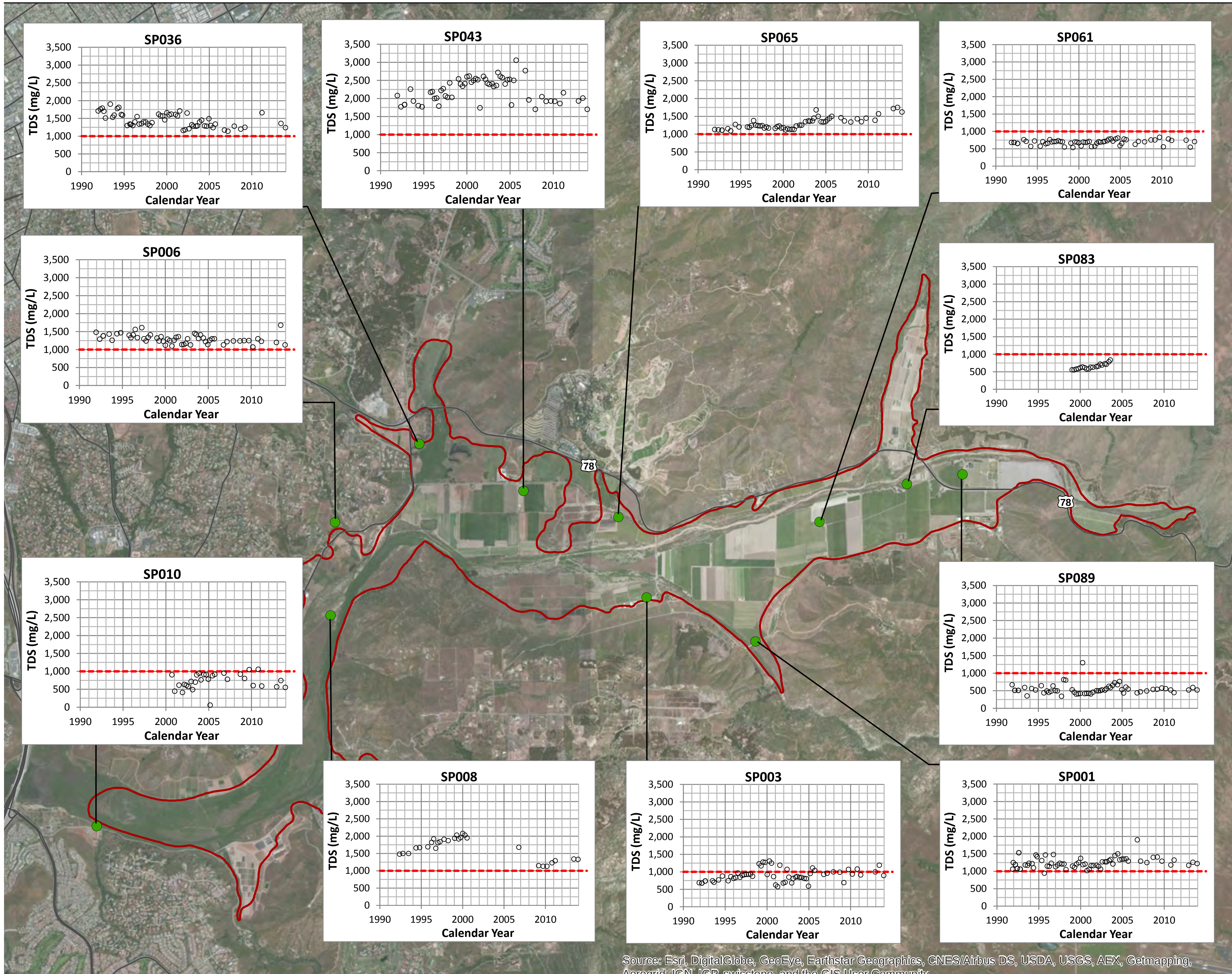
Figure 2-5 back



MAP LEGEND

San Pasqual Valley Groundwater Basin Boundary

City of San Diego Water Quality Monitoring Site

PLOT LEGEND

Measured TDS Concentration (mg/L)

TDS Groundwater Water Quality Objective (1,000 mg/L)

NOTES:

mg/L = Milligrams per liter.

TDS = Total Dissolved Solids.

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FIGURE 2-6
Groundwater Total Dissolved Solids
San Pasqual Groundwater Management
State of the Basin Report

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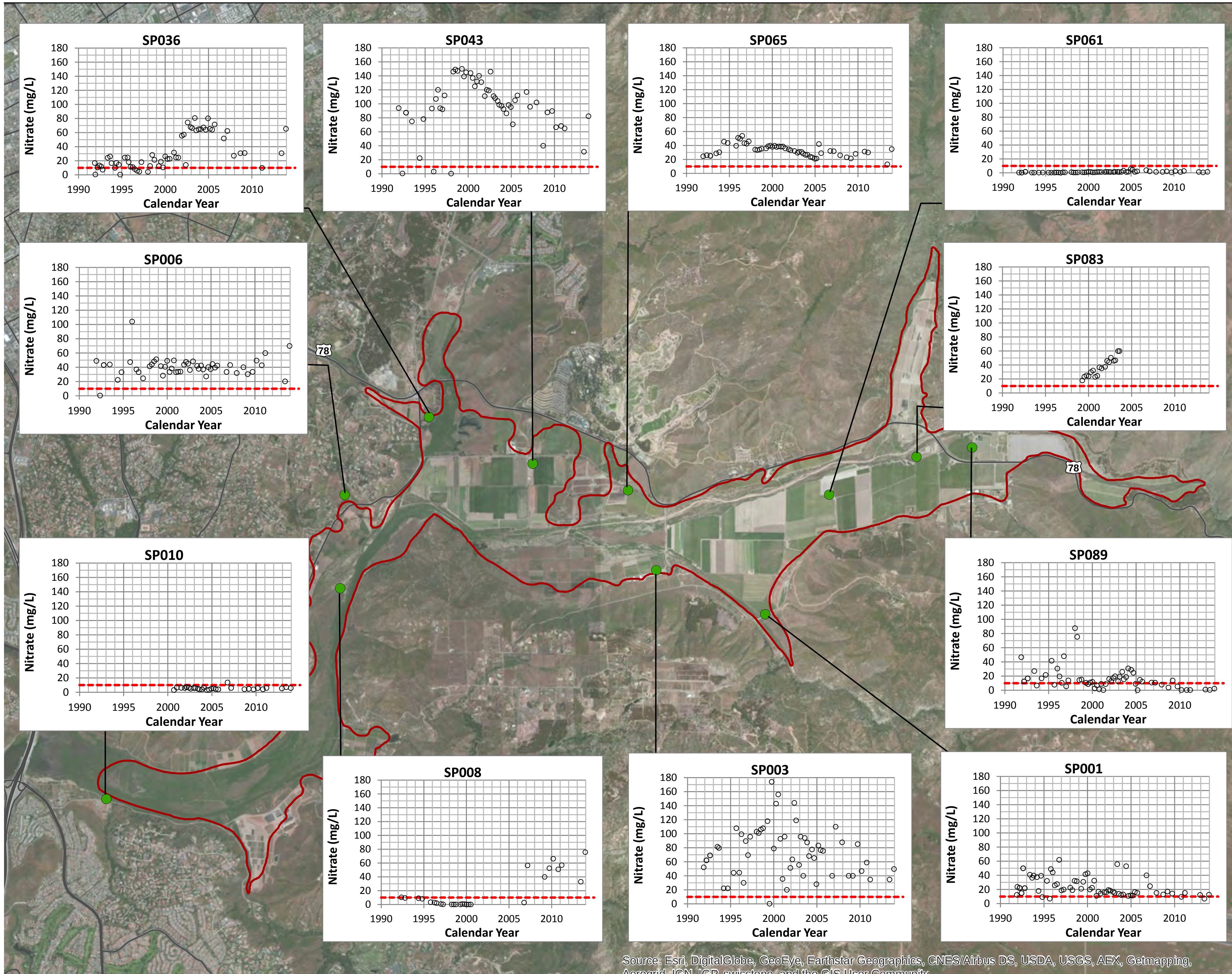
Figure 2-6 back



MAP LEGEND

San Pasqual Valley Groundwater Basin Boundary

City of San Diego Water Quality Monitoring Site

PLOT LEGEND

Measured Nitrate Concentration (mg/L)

Nitrate Groundwater Water Quality Objective (10 mg/L)

NOTES:

Nitrate concentrations are expressed as NO_3.

mg/L = Milligrams per liter.

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FIGURE 2-7

Groundwater Nitrate Concentrations

San Pasqual Groundwater Management

State of the Basin Report

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Figure 2-7 back

TABLE 2-1
Groundwater Quality Summary, 2010 through 2014
San Pasqual Groundwater Management State of the Basin Report Update

Constituent	Primary MCL[a]	Secondary MCL[a]	RWQCB Groundwater WQO[b]	Units	Groundwater Results			Exceeds Primary or Secondary MCL[d]	Exceeds RWQCB Groundwater WQO[d]
					Minimum	Average[c]	Maximum		
General Mineral									
Calcium	--	--	--	mg/L	59	112	184	NA[e]	NA[e]
Chloride	--	250/500/600 [f]	400 [g]	mg/L	104	234	558	Yes	Yes
Fluoride	2	--	1.0 [g]	mg/L	0.19	0.34	0.66	No	No
Hardness (as $CaCO_3$)	--	--	--	mg/L	207	529	989	NA[e]	NA[e]
Magnesium	--	--	--	mg/L	25	61	127	NA[e]	NA[e]
Nitrate (as NO_3)	45	--	10 [g]	mg/L	0.5	31	87	Yes	Yes
Potassium	--	--	--	mg/L	0.8	3.2	6.8	NA[e]	NA[e]
Sodium	--	--	--	mg/L	53	162	539	NA[e]	NA[e]
Sulfate	--	250/500/600 [f]	500 [g]	mg/L	68	288	596	Yes	Yes
Alkalinity (total)	--	--	--	mg/L	106	229	372	NA[e]	NA[e]
General Physical									
Total Dissolved Solids	--	500/1000/1500 [f]	1000 [g]	mg/L	447	1,144	2,160	Yes	Yes
Inorganics									
Aluminum	1	0.2	--	mg/L	0.01	0.55	2.83	Yes	NA[e]
Antimony	0.006	--	--	mg/L	<0.0001	<0.0001	<0.0001	No	NA[e]
Arsenic	0.01	--	--	mg/L	0.002	0.003	0.004	No	NA[e]
Barium	2	--	--	mg/L	0.01	0.08	0.19	No	NA[e]
Beryllium	0.004	--	--	mg/L	<0.0002	<0.0002	<0.0002	No	NA[e]
Boron	--	--	0.75 [g]	mg/L	0.03	0.10	0.20	NA[e]	No
Cadmium	0.005	--	--	mg/L	<0.0001	<0.0001	<0.0001	No	NA[e]
Chromium	0.05	--	--	mg/L	0.001	0.002	0.004	No	NA[e]
Copper	--	1	--	mg/L	0.005	0.018	0.092	No	NA[e]
Iron	--	0.3	0.3 [g]	mg/L	0.06	0.22	1.14	Yes	Yes
Lead	0.015	--	--	mg/L	0.002	0.006	0.009	No	NA[e]
Manganese	--	0.05	0.05 [g]	mg/L	0.002	0.15	1.88	Yes	Yes
Mercury	0.002	--	--	mg/L	<0.00002	<0.00002	<0.00002	No	NA[e]

TABLE 2-1
Groundwater Quality Summary, 2010 through 2014
San Pasqual Groundwater Management State of the Basin Report Update

Constituent	Primary MCL[a]	Secondary MCL[a]	RWQCB Groundwater WQO[b]	Units	Groundwater Results			Exceeds Primary or Secondary MCL[d]	Exceeds RWQCB Groundwater WQO[d]
					Minimum	Average[c]	Maximum		
Nickel	0.1	--	--	mg/L	0.002	0.004	0.011	No	NA[e]
Perchlorate	--	--	--	mg/L	<0.0004	<0.0004	<0.0004	NA[e]	NA[e]
Selenium	0.05	--	--	mg/L	0.003	0.004	0.006	No	NA[e]
Silver	--	0.1	--	mg/L	<0.0003	<0.0003	<0.0003	No	NA[e]
Thallium	0.002	--	--	mg/L	<0.0002	<0.0002	<0.0002	No	NA[e]
Vanadium	--	--	--	mg/L	0.003	0.012	0.025	NA[e]	NA[e]
Zinc	--	5	--	mg/L	0.02	0.34	3.95	No	NA[e]
Organics									
Volatile Organic Compounds (drinking water)	--[h]	--[h]	--[h]	mg/L	--[h]	--[h]	--[h]	--[h]	NA[e]

Source: City of San Diego Water Quality Laboratory reports, San Pasqual Wells 2010-2014

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

[b]These values represent the RWQCB groundwater WQOs for the Basin.

[c]Average was calculated by using detections above the reporting limit; therefore, nondetect or less than the detection limit values are not factored into the average calculation.

[d]Indicates that at least one or more reported concentration exceeds the primary or secondary MCL or RWQCB groundwater WQO.

[e]To date, MCLs and groundwater WQOs have not been identified for this constituent.

[f]Secondary MCL limits presented in order of Recommended/Upper/Short Term.

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

[h]Because multiple constituents are represented as volatile organic compounds, MCLs and average concentrations are not provided.

Notes:

$CaCO_3$	= calcium carbonate	NA	= Not available
--	= Not applicable	RWQCB	= San Diego Regional Water Quality Control Board

2.3.2 Surface Water Quality

The City's goal is to monitor surface water quality monthly when streams in the Valley are flowing. The basic water quality data are measured in the field by using a Hydrolab sonde; water quality data include temperature, dissolved oxygen, pH, electrical conductivity, and oxidation-reduction potential. Nutrient data are collected as grab samples that are analyzed in the City's water quality laboratory. The laboratory is certified through the Environmental Laboratory Approval Program. Fieldwork and laboratory work described herein are completed in accordance with quality assurance/quality control protocols by using the standard operating procedures established by the water quality laboratory. A handheld flowmeter and tape measure are used to measure the width, depth, and velocity of streams of interest. Table 2-2 presents the surface water sampling locations and average TDS and nitrate concentrations. The City analyzes water quality at Kit Carson Creek (KCC3) and Sycamore Creek (SCY2), but stream flow data is not available through USGS.

TABLE 2-2
Surface Water Quality Flow-weighted Average Concentrations
San Pasqual Groundwater Management State of the Basin Report Update

Sampling Location [a]	Average Annual Discharge (acre-feet per year)[b]	Flow-weighted Nitrate Concentration[c] (mg/L)	Flow-weighted TDS Concentration[c] (mg/L)
YSA 8, Santa Ysabel Creek on the east side of the Basin	5,262	0.5	218
GJC4, Guejito Creek, immediately upstream from the confluence with Santa Ysabel Creek	1,509	0.93	256
SMC4, Santa Maria Creek, immediately upstream from the confluence with Santa Ysabel Creek	2,615	10.2	562
CDC4, Cloverdale Creek, immediately upstream from the confluence with San Dieguito River	1,162	7.2	1,290
Total	**10,548**		

Notes:

[a]Stream flow data for KCC3 and SCY2 not available through USGS for flow-weighted concentrations.

[b]Average flows reported from USGS gages for 2010 through 2014 for all stations except Cloverdale Creek. Cloverdale Creek flows are estimated from Cloverdale Canyon return flows (CH2M HILL, 2001).

[c]Processed from surface water samples collected by the City from 2010 through 2014, which were analyzed in the City's water quality laboratory.

The cumulative streambed infiltration across the entire subcatchment is estimated to contribute 20,000 pounds per year (lb/yr) of TN and 12,561,000 lb/yr of TDS to the groundwater system. These amounts represent approximately 2 percent of the Basin nitrogen load and 29 percent of the Basin salt load.

The City monitors the seven major streams in and around the Basin for a variety of organic, inorganic, and metal constituents. TDS and nitrate concentrations in surface water are shown on Figures 2-8 and 2-9. The primary MCLs, as defined by the California drinking water quality standards and the RWQCB Groundwater Quality Objectives, were issued for groundwater concentrations. MCLs are included on Figures 2-8 and 2-9 for reference of target values. Surface water quality data for Kit Carson Creek suggest impacts from urban development, but this has no effective impact on the quality of Basin groundwater because Kit Carson Creek discharges into Lake Hodges.

In general, Surface water quality appears better on the east (upstream) side of the Basin compared to the west (downstream) side of the Basin.

Santa Ysabel Creek (YSA8) shows low concentrations of nitrate and TDS, with both below their respective primary and secondary MCLs. Guejito Creek (GJC4) also has low concentrations of nitrate and TDS below the primary and secondary MCLs. Santa Maria Creek (SMC4) has lower concentrations of nitrate but elevated TDS concentrations that exceed the RWQCB groundwater WQO of 1,000 mg/L. Cloverdale Creek has a significant variation in measured nitrate concentrations (2.4 to 55 mg/L).

Cloverdale, Kit Carson, and Sycamore creeks have TDS levels that exceed the RWQCB WQOs, likely due to increased human activity and urban stormwater runoff. These areas are surrounded by agricultural and residential land uses, which may be contributors to the high TDS concentrations. However, nitrate concentrations in all three streams are generally consistently below the primary MCLs, with the exception of one sampling site (SMC4).

2.4 Land Use

The City owns most of the land in and around the Basin, and much of this property is leased for various agricultural and commercial land uses (see Figure 2-10). Many of the leases are long-term (e.g., greater than 10 years), which helps promote viable production agriculture and effective land and water resource management practices. Because the City owns a significant portion of land in the Basin, it has the responsibility to promote sustainable resource management practices with a focus on maintaining and improving groundwater quality.

As shown in Table 2-3, open space with native shrub land cover represents the largest land use within the subcatchment; agriculture is the second most predominant land use. The total land in agricultural production (for avocado, citrus, cut flowers, feedlot, grapevines, greenhouse, nursery, summer forage, truck crops, sod, and winter forage) within the subcatchment was estimated to be 5,545 acres. The largest single crop area was attributed to avocados, which are grown on hillsides surrounding the Basin. Riparian areas cover 1,533 acres, landscaping (including residential development) covers 2,395 acres, golf courses cover 171 acres, and open-water ponds (including natural, groundwater-fed ponds and irrigation storage ponds) cover 38 acres. The riparian areas identified in this analysis were only delineated in the Basin area.

TABLE 2-3
Summary of Land Use and Irrigated Area
San Pasqual Groundwater Management State of the Basin Report Update

Primary Land Use	Total Area (acres)
Avocado	2,422
Citrus	645
Cut Flowers	222
Feedlot	372
Golf Course	171
Grapevines	185
Greenhouse	8
Landscape	2,385
Native Shrub (open space)	17,282
Nursery – Container	100
Nursery – Field	248
Open Water – Irrigation	15
Open Water – Groundwater	23
Riparian	1,533
Summer Forage	157
Truck Crops	224
Sod Farms	633
Winter Forage	329
TOTAL	**26,955**

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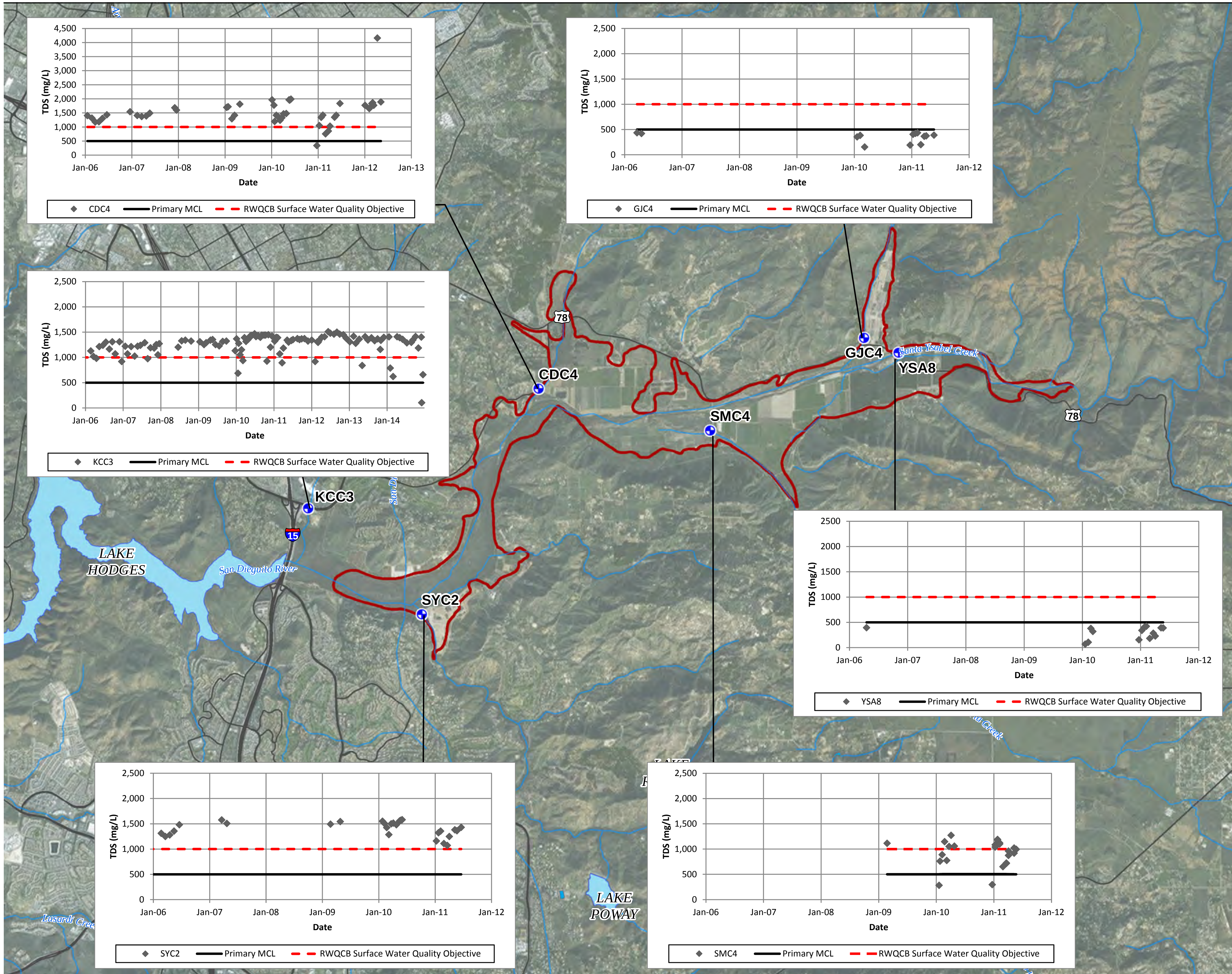

MAP LEGEND

San Pasqual Valley Groundwater Basin Boundary

City of San Diego Surface Water Sampling Locations

GRAPH LEGEND

TDS Concentration in Surface Water (mg/L)

TDS Water Quality Objective (1,000 mg/L)

TDS USEPA Maximum Contaminant Level (500 mg/L)

NOTES:

mg/L = Milligrams per liter.

TDS = Total dissolved solids.

Ground Water Boundary Source:
San Pasqual Valley Groundwater Basin Boundary (DWR Bulletin 118 Draft).

Notes:
Grab samples were collected by the City and analyzed in by the San Diego Water Quality Laboratory.

0 1 2
Miles

FIGURE 2-8
Surface Water Total Dissolved Solids
San Pasqual Valley Groundwater Management
State of the Basin Report

CH2MHILL

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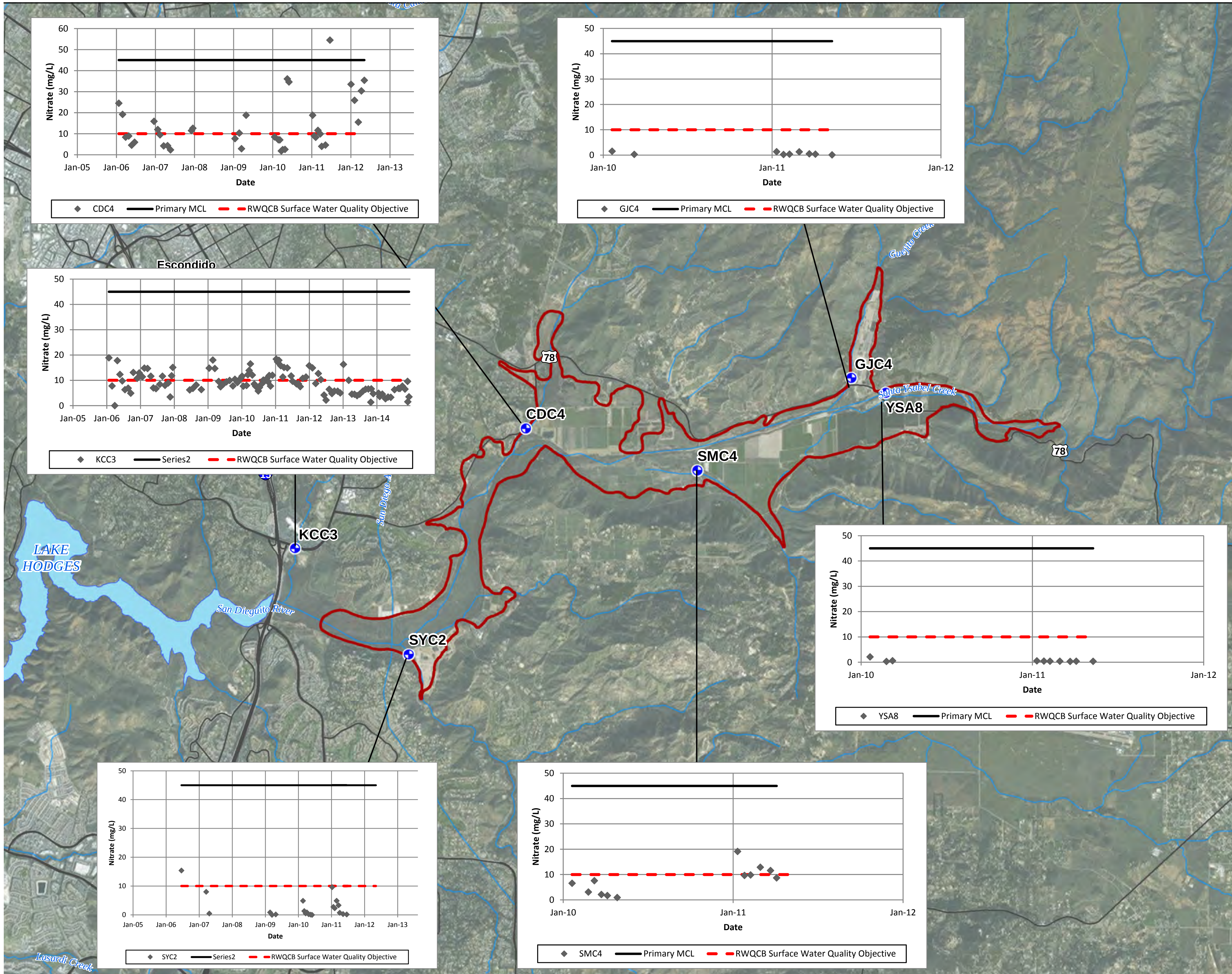

MAP LEGEND

San Pasqual Valley Groundwater Basin Boundary

City of San Diego Surface Water Sampling Locations

GRAPH LEGEND

Nitrate Concentration in Surface Water (mg/L)

Nitrate Water Quality Objective (10 mg/L)

Nitrate USEPA Maximum Contaminant Level (45 mg/L)

NOTES:

Nitrate concentrations are expressed as NO_3.

mg/L = Milligrams per liter.

0 1 2

Miles

N

FIGURE 2-9

Surface Water Nitrate

San Pasqual Groundwater Management

State of the Basin Report

\\ODIN\PROJ\SANDIEGOCITYOF\437947\SANPASQUALGROUNDWATER\GIS\FIGURES\SOTB\FIG2-9_SW_NITRATE.MXD 2/23/2015 11:07:50 AM LHAMMOND

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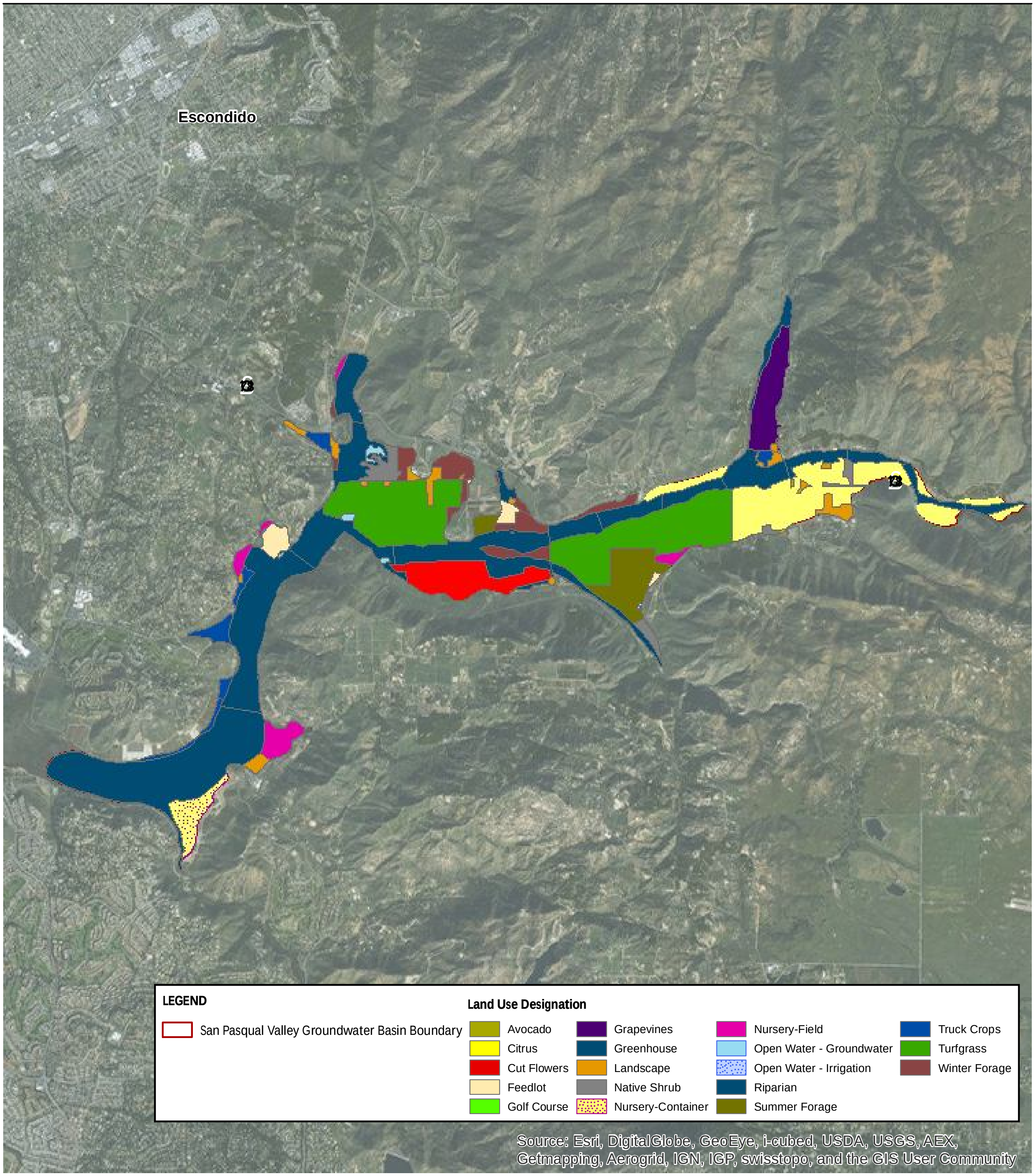
Figure 2-9 back



NOTE:
Land use designations based on SNMP analysis.

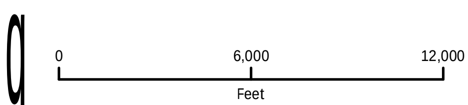


FIGURE 2-10
Land Use
San Pasqual Groundwater Management
State of the Basin Report Update

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Figure 2-10 back

SECTION 3

Basin Management Activities

This section describes management activities in the Basin from 2010 to 2014 in three general categories:

1. Overall implementation of the San Pasqual Groundwater Management Plan (City, 2007)
2. Results and recommendations from the Salt and Nutrient management Plan (CH2M HILL, 2014)
3. Other management activities conducted by the City.

3.1 Groundwater Management Plan

The SPGMP is an adaptive management plan for understanding how to best manage groundwater the Basin. The SPGMP includes a preliminary summary of proposed management actions for Basin groundwater management, as established in 2007.

3.1.1 San Pasqual Hydrogeologic Evaluation

The San Pasqual Hydrogeologic Evaluation (DWR, 2012) provided an evaluation of Basin storage capacity and safe yield, identified wells to receive installation of monitoring transducers, and established an updated Basin boundary. In November 2011, DWR recommended six wells for the installation of transducers: SP070, SP073, SP100, SP110, SP093, and SP107. Two more wells, SP081 and SP106, were added to the monitoring network at the City's request. DWR installed transducers in all eight wells on June 13 and 14, 2012.

Eight transducers record pressure and temperature, and five of these eight wells include transducers that also record conductivity. The transducers record measurements twice a day at 12am and noon, from mid-June to present. Additional data from the transducers are available up to November 2014. The pressure sensors detected falling and rising water levels. The water level changes were likely caused by pumping and cessation of pumping and possibly by replenishment after rainfall in early October 2012. No instrument-related anomalies were apparent in the pressure measurements.

The transducers record gradual increases in water temperatures in most wells, but some unexplained patterns were observed in the measurements for wells SP093 and SP107. Gradual changes in specific conductivity occurred in three wells, but some unexplained patterns are observed in wells SP081 and SP110. The transducer for SP081 is removed twice a year to sample the groundwater for an open Corrective Action Plan that URS is developing, which may explain the patterns in SP081.

As the City develops plans and goals for the Basin, the monitoring network may need to be modified to improve the effectiveness of the network. These modifications might include adding monitoring wells, as previously discussed, and replacing some of the shallower wells with deeper wells. Additional transducers may be needed if more wells are added to the network. Changes in land use in the Valley may require moving the pressure–temperature–conductivity transducers to other wells. The frequency of measurements for some transducers may need to be increased to collect more data in various parts of the Basin.

3.1.2 California Statewide Groundwater Elevation Monitoring Program

The City qualifies as a monitoring entity in accordance with the CASGEM Guidelines under Scenario A – One Monitoring Entity, submitting data for the region. The City submitted a monitoring entity notification to DWR in 2010 stating the City’s intent to monitor groundwater levels in the Basin. As a local agency and water supplier, the City has managed the Basin and collected groundwater elevation data there. The monitoring notification under the CASGEM Program is the City’s effort to continue to manage and collect groundwater level data in the Basin. The City is qualified in basin management activities, and operations personnel are experienced in groundwater data collection.

The groundwater elevation monitoring plan for the Basin was prepared to fulfill the requirements of the CASGEM Program, in compliance with Senate Bill X7-6.

The selection of wells for the CASGEM Program was based on an assessment of the existing well locations and well selection criteria identified in the CASGEM Guidelines:

- Wells that can provide static water levels for seasonal and long-term trends
- Wells readily available and assumed to be accessible
- Wells with known well screen data and that are compatible with the primary water bearing zone(s)
- Wells with known ownership
- Well locations that can provide representative water level data within the Basin
- Relatively new wells

The City identified six wells for the CASGEM program: County of San Diego owned well SP073, two private lessee wells (Pinery and SP107), and three USGS monitored wells (Cloverdale, Lake Hodges, and Santa Ysabel). The City monitors groundwater elevation in these wells and submits data to DWR semi-annually. Groundwater elevation data for the USGS wells is available online at http://ca.water.usgs.gov/projects/sandiego/wells/summary.html

3.1.3 USGS Monitoring Wells

USGS tracks groundwater levels at three wells in the Valley—SDSY (Santa Ysabel), SDLH (Lake Hodges), and

SDCD (Cloverdale). USGS completed construction of the Santa Ysabel well on October 23, 2010; the Lake Hodges well on October 5, 2012; and the Cloverdale well on February 1, 2013. Water levels for SDSY have been recorded at 15-minute intervals since April 29, 2011; the total depth of SDSY is 355 feet. Water levels for SDLH have been recorded at 15-minute intervals since February 15, 2013; the total depth of SDLH is 280 feet. Water levels for SDCD have been recorded at 15-minute intervals since September 26, 2013; the total depth of SDCD is 287 feet.

3.1.4 City Groundwater Monitoring Program

Three sets of monitoring wells are in the Basin—USGS groundwater level monitoring wells, City of San Diego groundwater level monitoring wells, and City of San Diego water quality monitoring wells. The City measures groundwater levels in the Basin each month. The City also collects and analyzes groundwater samples twice a year throughout the Basin. The City analyzes samples for a broad suite of organic and inorganic compounds.

3.2 Salt and Nutrient Management Plan

The State of California Recycled Water Policy was established in February 2009 with the State Water Resources Control Board (State Board) adoption of Resolution No. 2009-011. The Recycled Water Policy required that Salt and Nutrient Management Plans (SNMPs) be prepared for each California groundwater basin or subbasin by May 2014 and the Regional Board determined that SNMPs were required for groundwater basins, as published in California's Groundwater Bulletin 118 (DWR, 2003).

In May 2012, in conjunction with and on behalf of the City, CH2M prepared a SNMP for the Basin that was submitted to the City in March 2014. The purpose of the SNMP was to work with stakeholders in the Basin to identify water quality constituents of interest, identify land and water use practices required to sustain beneficial uses, identify and evaluate salt and nutrient management strategies for water quality protection and enhancement, and develop a plan for implementing potential salt and nutrient management strategies aimed at achieving compliance with Basin Plan groundwater WQOs.

3.2.1 Key Findings from the Salt and Nutrient Management Plan

The SNMP concluded that groundwater quality associated with salinity and nutrients is expected to degrade unless management strategies are implemented. Therefore, the SNMP identified and evaluated salt and nutrient management strategies for water quality protection and enhancement in the Basin. It is unlikely that implementation of any single management strategy will effectively mitigate elevated TDS and nitrate concentrations at all locations within the Basin. Effective resource management will likely require implementing a combination of management strategies, including additional monitoring and reporting, refining and expanding upon existing studies, and, potentially, implementing focused nutrient and salinity management projects. The potential management strategies are discussed further in the 2014 SNMP.

3.2.2 Nutrient Management Program

The vast majority of the nutrient contributions to the Basin are either not regulated or are regulated under conditional waivers. Consequently, the nutrient management strategies presented in this section focus on cooperative efforts that can be implemented by the Basin stakeholders outside of or in parallel with other regulatory activities. Other minor nutrient contributions are also discussed to address sources that can be controlled effectively by Basin stakeholders.

The SNMP presents four primary nutrient management strategies:

1. **Nutrient management on the City's leased lands** – Because the majority of the agricultural operations that directly overlay the groundwater Basin are located on leased properties owned by the City, the City plans to work with leaseholders to implement nutrient and irrigation water management planning and reporting on these properties. The nutrient management planning and reporting requirements for property leased by the City is expected to follow Natural Resources Conservation Service (NRCS) guidelines (2008). The City plans to review data reported by the lessees in annual reports so that management practices comply with the site-specific and comprehensive nutrient management plans and the irrigation water management plan, which are all included in the NRCS guidelines.
2. **Nutrient management outreach for private lands** – The most significant agricultural operations on private lands within the subcatchment are avocado orchards on hillsides surrounding the Basin and the irrigated lands along the Guejito Creek drainage. To address the contributions, an educational and technical assistance outreach program is recommended to support landowners willing to participate in nutrient management programs. This program would be developed in cooperation with the water districts serving the respective areas and with the local NRCS office.
3. **Stormwater management** – Current City leases require lessees to prepare and comply with a stormwater pollution protection plan. A preliminary review of the documents referenced in current lease agreements suggests that the stormwater guidance provided may be targeted at urban controls more than agricultural controls. This guidance should be reviewed further to evaluate whether the controls are appropriate to address the potential release of sediment and nutrients through stormwater runoff from agricultural lands.
4. **Septic system management** – Most facilities and residences in the Valley have septic systems. Septic systems are a relatively minor contribution to Basin salt and nutrient loads. However, those contributions should be managed and best management practices (BMP) implemented so that those contributions are minimized. Evaluation of City lease operations procedures relative to septic system management is recommended.

3.3 Other Groundwater Management Activities

3.3.1 San Pasqual Brackish Groundwater Desalination Demonstration Project

The City contracted with RBF Consulting in March 2007 to perform the work encompassing the Phase III Temporary Desalination Demonstration Facility (TDDF) project. The project was executed by the RBF team and City staff over a period spanning approximately three (3) years. The San Pasqual Brackish Groundwater TDDF project was originally envisioned as the third phase of a multi-phased effort to develop groundwater as a resource within the San Pasqual Basin. Phase I comprised the performance of a pre-feasibility study that identified the San Pasqual Basin as a suitable candidate for groundwater development. Phase II resulted in the performance of an approximate one-year pilot study to assess the initial characteristics of the groundwater and evaluate various reverse osmosis components during pilot-scale treatment operation. This TDDF project, funded jointly by the City of San Diego with matching Proposition 50 funding from the

Department of Water Resources (DWR), represents Phase III of the development effort and addresses the technical and financial feasibility of treating the groundwater to meet state and federal drinking water standards.

Based on the finalized DWR Agreement 3, the primary objective of this demonstration project was to "develop and operate a 500 AFY TDDF which will desalinate groundwater from the San Pasqual Groundwater Basin." Based on the results of the TDDF operation, a conceptual design evaluation was performed to develop and present recommended design criteria and parameters for a 5.0 million gallon/day (MGD) full-scale brackish groundwater treatment facility.

3.3.2 San Pasqual Conjunctive Use Study

Previous studies have examined potential conjunctive use in the Basin; however, further evaluation of the Basin was necessary to understand the storage potential of a conjunctive use project and the Basin's response to increased management practices. CDM Smith, Inc. (formerly Camp Dresser & McKee, Inc.) conducted a feasibility study that considered potential environmental effects, economic feasibility, and operating parameters of implementing a conjunctive use project in the Basin. The Conjunctive Use Study (CDM Smith, Inc., 2010) presented findings of predesign facility plans, cost estimates, and economic analyses for four conjunctive use alternatives. The study presented Alternative 4b, which is the alternative that offered the greatest potential for integration with a proposed desalination facility, while increasing local water supply from the Basin. Alternative 4b proposed a new 30-inch-diameter pipeline from First Aqueduct; a new 4,989-kilowatt hydropower facility; 11,610 feet of distribution pipelines; 3 recharge basins; 10 new extraction wells; a new 24-inch-diameter direct delivery pipeline from the extraction wells to the Rancho Bernardo distribution system; and a new sodium hypochlorite treatment system. Alternative 4b would provide 5,600 acre-feet of new storage within 6 months.

3.3.3 Sustainable Water Supply Alternatives for the Basin

Building on the conclusions of the Conjunctive Use Study (CDM Smith, Inc., 2010), Sustainable Water Supply Alternatives (H2O Futures, 2012) investigated environmentally sustainable methods to increase the quantity of water available for the Basin and the quality of the groundwater within the Basin. The investigative and water budgeting processes confirmed that opportunities for site-specific capture of existing water sources need to be evaluated further and that previous investigations to capture and treat existing water might not have taken full advantage of local resources.

Focusing on economies of scale, energy, water, and money, Sustainable Water Supply Alternatives presented three water management methodologies that could be employed in different places within the Basin. The assessment evaluated hypothetical scalable scenarios, estimating the anticipated costs of implementing and operating them based on best available data for similar methodologies and a 30-year life cycle. To maximize the Basin's potential as a water resource, the report presented recommendations that would further inform the City's pursuit of sustainable water reclamation, bio-treatment, and reuse in the Basin. Recommendations included identifying additional potential recycled water users in the Basin, funding water reclamation pilot programs at the City PS 77 or a percolation pilot project, and continuing to cultivate a thriving agricultural community.

3.3.4 Evaluation of Water Use Alternatives in San Pasqual Valley

In 2012, the City retained CDM Smith Inc., to define, develop, and evaluate a wide range of groundwater management alternatives in the Basin that largely focus on using recycled water and local runoff to yield new local water sources. The evaluation resulted in recommendations that the City could consider in their current long-range planning efforts. The City could also use the information to decide whether to include one or more alternatives for developing Basin water resources as part of the *2012 Long Range Water Resources Plan* (City, 2012).

The evaluation recommended that the City adopt Alternative 1 as the preferred alternative and bring that alternative forward for comparison with other water supply projects being considered under the City's long-range water supply planning efforts. Under Alternative 1, the City would deliver recycled water to agricultural users in the Valley to replace most of the existing agricultural groundwater production, which would increase groundwater yield for municipal uses in the Rancho Bernardo service area. Primary facilities required include a secondary and tertiary wastewater treatment plant to treat wastewater diverted from PS 77, distribution pipelines, extraction wells, and a groundwater treatment plant with reverse osmosis processes. These primary facilities would be at the site of the City's former San Pasqual Water Reclamation Plant. This alternative would require an extensive distribution system to switch agricultural irrigation from groundwater to recycled water and a possible alternative water supply source for a few lessees. Alternative 1 is anticipated to provide a new yield of 3,119 acre-feet per year of locally developed water.

In addition, the evaluation recommended that the City continue discussions with the City of Escondido in the near future regarding a possible joint project that would bring tertiary effluent into the San Pasqual Valley as a possible alternative to implementing Alternative 1, if it can be shown to be more cost effective. The evaluation recommended that the City closely follow the further development and adoption of the revised California Department of Public Health regulations regarding groundwater recharge and possibly reconsider one of the groundwater recharge options if there are additional changes that would further enhance the viability of one of the recharge alternatives.

3.3.5 Lake Hodges Natural Treatment System Options

Dudek (2013) conducted a preliminary analysis of nutrient loading to Lake Hodges and presented two conceptual-level options for the natural treatment system (NTS) for Lake Hodges. The two conceptual-level options for the NTS included the type and location of BMPs selected in accordance with the quantity and distribution of nutrient loading (total phosphorus and TN) to Lake Hodges and the location of public (i.e., City) lands.

The first NTS option consists of a large wetland upstream from Lake Hodges and a series of detention basins along the main stem of Santa Ysabel Creek. The wetland would be designed to capture and treat discharge from Santa Ysabel Creek before it enters Lake Hodges and would be sustained year round by water pumped from Lake Hodges. Farther upstream, the detention basins would be located in agricultural fields near the confluence of Santa Maria Creek and Santa Ysabel Creek. These detention basins would be designed to capture and treat discharge and would also result in a reduction of the peak flow in Santa Ysabel Creek. Sizing of the wetland and detention basins will depend on the water quality volume selected for this option.

The second NTS option consists of a series of smaller wetlands and detention basins at the confluences of the three tributaries that drain the urban watersheds directly into Lake Hodges. The urban watersheds are Kit Carson, Green Valley, and Felicita. This NTS option would be designed to capture and treat the urban base flow and smaller storm events discharging from those urban watersheds.

3.3.6 Groundwater Well Flow Metering Implementation

At the time of this report, approximately 59 of the 64 active groundwater production wells in the Valley did not have flowmeters. Historically, Valley groundwater pumping rates and volumes were estimated by using land use information and assumptions for typical irrigation water management practices. Precision flow metering is needed for more effective water resource management in the future, as identified in the SPGMP and supported by the SNMP. The City is currently evaluating the need for and benefits of implementing a groundwater well flow metering program in the San Pasqual Valley.

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SECTION 4

Summary of Objectives and Recommendations

Throughout the 2010 to 2014 reporting period, the City made significant strides toward developing a reliable groundwater basin for future generations and advancing successful implementation of the Vision Plan for San Pasqual (City, 1995). The SPGMP (City, 2007) presented management actions within five main components developed with input from the groundwater stakeholders in the Basin. This section summarizes the City's progress on these management objectives and the objectives resulting from the SNMP.

4.1 Groundwater Management Plan Objectives

The SPGMP includes Basin management objectives under five primary components; the City has made significant progress in each of these objectives:

- Component No. 1 – Stakeholder Involvement

  Work on the 2014 SNMP implemented stakeholder outreach recommendations from the SNMP Guidelines (Welch, 2010) and Recycled Water Policy (California State Water Resources Control Board, 2009) into each of the SNMP Work Plan elements. The SNMP stakeholder outreach program for the Basin SNMP is modeled after a comprehensive stakeholder outreach program conducted by the City in the Basin in 2007 as part of development of the SPGMP. The SPGMP is recognized by the State of California as being in compliance with standards established by Assembly Bill 3030. Since completing the SPGMP in 2007, the City has periodically reviewed and updated the list of stakeholders that might have an interest in Basin groundwater.

  A presentation was given to stakeholders in November 2013, and stakeholders were invited to comment on a preliminary work-in-progress draft SNMP completed in October 2013. A presentation of the draft final SNMP findings and selected management was subsequently delivered on April 3, 2014, during a San Pasqual Land Use Task Force meeting.

- Component No. 2 – Monitoring Program and Basin Understanding

  Significant progress has been made by the City with respect to monitoring Basin groundwater elevations and hydrogeology through completion of the groundwater well flow metering, groundwater modeling efforts, installation of USGS monitoring wells, installation of monitoring well transducers as part of DWR's hydrogologic evaluation, and implementation of CASGEM participation, as described in Section 3.

  The City is currently evaluating the need for and benefits of implementing a groundwater well flow metering program in the San Pasqual Valley and has concluded that installing flow meters on groundwater production wells will be beneficial to groundwater management in the Basin. Groundwater flow metering is consistent with the objectives of previous planning studies and reports including the SNMP and the SPGMP.

- Component No. 3 – Groundwater Resource Protection

  The City has made progress implementing groundwater resource protection programs with the completion of (1) Evaluation of Water Use Alternatives (CDM Smith Inc., 2012) and (2) the SNMP (CH2M HILL, 2014), which evaluated salt and nutrient management strategies for water quality protection and enhancement within the Basin. The Evaluation of Water Use Alternatives provided recommendations for groundwater management alternatives focusing on the use of local runoff and recycled water for the City's consideration in the *2012 Long Range Water Resources Plan* (City, 2012).

- Component No. 4 – Groundwater Sustainability

  The City has made progress on achieving groundwater sustainability after conducting an evaluation of NTS alternatives for Lake Hodges, completing the Conjunctive Use Study (CDM Smith, Inc., 2010), and evaluating sustainable water supply alternatives for the Basin with the report from H2O Futures.

  On September 16, 2014, Governor Jerry Brown signed into law the Sustainable Groundwater Management Act of 2014 (SGMA). The SGMA is a comprehensive three-bill package that provides a framework for sustainable management of groundwater supplies. The act requires the formation of local groundwater sustainability agencies (GSAs) that must assess conditions in their local water basins and adopt locally-based management plans. GSAs responsible for high- and medium-priority basins must adopt groundwater sustainability plans within five to seven years, depending on whether the basin is in critical overdraft. The San Pasqual Basin is considered a medium-priority groundwater basin and the City is anticipating the preparation of a groundwater sustainability plan as part of their long range planning efforts.

- Component No. 5 – Planning Integration

  The findings and recommendations of the SNMP (CH2M HILL, 2014), the Sustainable Water Supply Alternatives study, (H2O Futures, 2012), and the Conjunctive Use Study (CDM Smith, Inc., 2010), particularly recommendations and alternatives for sustainable water supply options, can be incorporated into the City's long-range planning efforts. The evaluation of water supply alternatives and availability may also be addressed as part of the City's urban water management plan updates and other water reliability efforts.

4.2 Salt and Nutrient Management Plan Recommendations

The Basin has been studied extensively, and sufficient data were available to support the development of the SNMP. In areas where monitoring data were not available, enough information was available to make reasonable estimates of salt and nutrient loads and Basin processes to support the development of potential management strategies. The SNMP recommended additional monitoring to support implementation of the management strategies, which are summarized in Table 4-1.

TABLE 4-1
San Pasqual Valley Supplemental Monitoring Recommendations
San Pasqual Groundwater Management State of the Basin Report Update

Monitoring Item	Description	Target Schedule
Groundwater Level and Quality Monitoring	Continue groundwater monitoring and data collection/archiving	Groundwater monitoring is ongoing.
Groundwater Well Metering	Phased implementation of installing flowmeters on production wells on agricultural leases	Initiate first phase by 2017.
Surface Water Flow and Quality Monitoring	Ongoing surface water monitoring plus a revised monitoring plan, which might include additional gaging stations	Surface water monitoring is ongoing. Update surface water monitoring plan by 2017.

The SNMP concluded that groundwater quality associated with salinity and nutrients is expected to degrade unless management strategies are implemented. Therefore, the SNMP identified and evaluated salt and nutrient management strategies for water quality protection and enhancement in the Basin. It is unlikely that implementation of any single management strategy will effectively mitigate elevated TDS and nitrate concentrations at all locations within the Basin. Effective resource management will likely require implementing a combination of management strategies, including additional monitoring and reporting, refining and expanding upon existing studies, and potentially implementing focused nutrient and salinity management projects.

The 2014 SNMP listed several potential management strategies, some of which require further analysis or stakeholder input. As the City intends to evaluate management strategy effectiveness approximately every 2 years in conjunction with the San Pasqual State of the Basin updates, management strategy effectiveness reviews will include determining whether amending or adding management strategies should be evaluated further. SNMP audits will be conducted by the City in coordination with other Basin stakeholders every 10 years to determine whether comprehensive updates to the SNMP are needed.

4.3 Summary of Additional Recommendations

The following recommendations build on the management actions developed in the San Pasqual GMP and subsequent Basin studies and help in the achieving the basin management objectives.

Recommendation 1: Stakeholders List – Annual review and update of the stakeholders in the basin should precede all planned outreach efforts and will aid in the coordination/communication efforts described in the SPGMP.

Recommendation 2: Continue bi-annual reporting – The updates in the 2010 Groundwater Management Status Report and the 2014 SNMP were concerted efforts to enhance the long-term sustainability of groundwater within the basin. The City continues to coordinate with stakeholders to protect this resource for beneficial uses including water supply, agriculture, and the environment. Continued bi-annual reporting provides transparency to the community, demonstrates accountability, and verifies the City’s commitment to the SPGMP objectives.

Recommendation 3: Additional Well Monitoring - Information on well construction, well condition, hydrogeologic conditions, and the influence of active pumping wells is unknown for most of the proposed monitoring wells. Prior to the selection and installation of additional transducers in wells for the City’s groundwater monitoring network, the City may consider investigating other wells in the Basin both to expand the network and to replace the wells currently monitored with more suitable wells. Additional wells might be located in the tributary canyons of Santa Ysabel Creek.

Recommendation 4: Evaluation of Water Use Alternatives – The City should continue to closely follow the further development and adoption of the revised CDPH regulations on groundwater recharge and possibly reconsider one of the groundwater recharge options if there are additional changes that would further enhance the viability of a recharge alternative. As a part of this effort, the City should continue to maintain positive relationships with the lessees in the Valley and keep them informed of future Basin planning decisions. The City has committed to maintaining agriculture in the Valley, so the lessees will be important stakeholders in any potential future project and should also be recognized as valuable resources for data on water demand, groundwater supplies, and quality and general understanding of the Basin’s dynamics.

Recommendation 5: Sustainable Water Supply –The City has taken steps to evaluate sustainable water supply alternatives as a way to increase the quantity and quality of water within the Basin. To maximize the Basin’s potential as a water resource requires strategic next steps in order to further inform the City’s pursuit of sustainable water reclamation, bio-treatment and reuse in the Basin. The City should consider opening a dialogue with leaseholders in the Basin regarding water management and opportunities for recycled water use. Following this, the City could implement a pilot project to demonstrate the performance and appeal of sustainable water reclamation and potentially attract funding from sources (such as agriculture-related funding) that may not yet have been tapped.

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SECTION 5

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