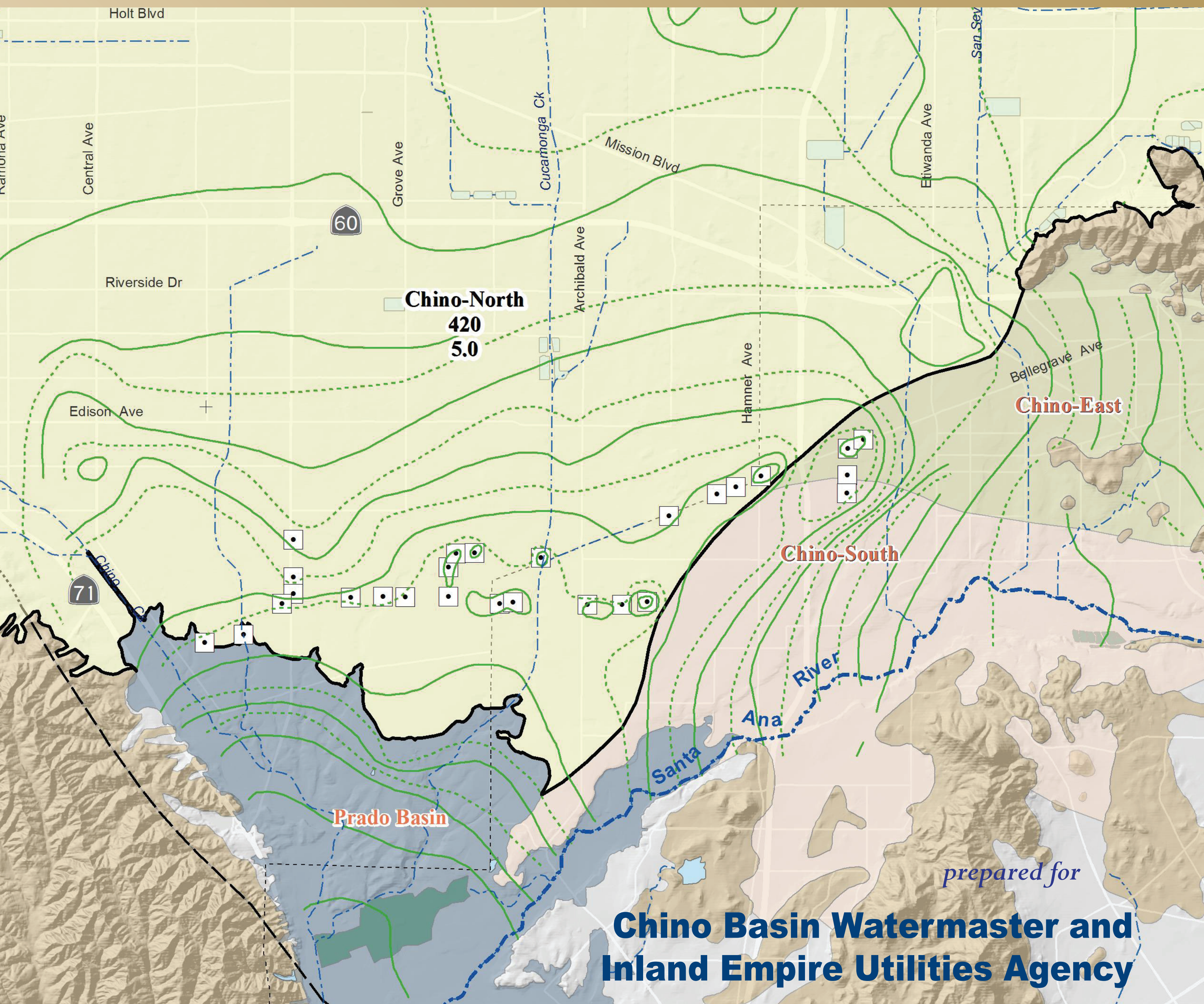
Optimum Basin Management Program

Chino Basin Maximum Benefit Annual Report

2012



prepared for

Chino Basin Watermaster and Inland Empire Utilities Agency

April 2013

WILDERMUTH™ ENVIRONMENTAL INC.

CHINO BASIN WATERMASTER

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PETER KAVOUNAS, P.E.
General Manager

April 15, 2013

Regional Water Quality Control Board, Santa Ana Region
Attention: Mr. Kurt Berchtold
3737 Main Street, Suite 500
Riverside, California 92501-3348

Subject: Transmittal of the Chino Basin 2012 Maximum Benefit Annual Report

Dear Mr. Berchtold,

The Chino Basin Watermaster (Watermaster) hereby submits the Chino Basin Maximum Benefit Annual Report for 2012. This Annual Report is in partial fulfillment of the maximum benefit commitments made by Inland Empire Utility Agency and Watermaster as discussed in Resolution No. R8-2004-0001 and its attachment: Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate an Updated Total Dissolved Solids (TDS) and Nitrogen Management Plan for the Santa Ana Region Including Revised Groundwater Subbasin Boundaries, Revised TDS and Nitrate-Nitrogen Quality Objectives for Groundwater, Revised TDS and Nitrogen Wasteload Allocations, and Revised Reach Designations, TDS and Nitrogen Objectives and Beneficial Uses for Specific Surface Waters. Table 5-8a in the Attachment to the Resolution identifies the projects and requirements that must be implemented to demonstrate that water quality consistent with maximum benefit to the people of the state will be maintained. This Annual Report describes the status of compliance with each commitment and the work performed during 2012.

If you have any questions, please do not hesitate to call.

Sincerely,

Chino Basin Watermaster

P. Kavounas

Peter Kavounas, P.E.

General Manager

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Acronyms, Abbreviations, and Initialisms

µg/L	micrograms per liter
acre-ft/yr	acre-feet per year
Basin Plan	Water Quality Control Plan for the Santa Ana Basin
CCWF	Chino Creek Well Field
CDA	Chino Desalter Authority
Chino-North	Chino-North Management Zone
DTSC	California Department of Toxic Substance Control
ET	evapotranspiration
GWQMP	Groundwater Quality Monitoring Program
HCMP	Hydraulic Control Monitoring Program
IEUA	Inland Empire Utilities Agency
Judgment	OCWD vs. City of Chino et al., Case No. 117628, County of Riverside
mgd	million gallons per day
mg/L	milligrams per liter
MS	Microsoft
NAWQA	National Water Quality Assessment
OBMP	Optimum Basin Management Program
OCWD	Orange County Water District
PBMZ	Prado Basin Management Zone
QA/QC	quality assurance/quality control
Regional Board	Regional Water Quality Control Board, Santa Ana Region
SAR	Santa Ana River
SARWC	Santa Ana River Water Company
SARWM	Santa Ana River Watermaster
SOB	State of the Basin
SWMP	Surface Water Monitoring Program
SWP	State Water Project
Task Force	Nitrogen/TDS Task Force
TDS	total dissolved solids

Acronyms, Abbreviations, and Initialisms

TIN	total inorganic nitrogen
USGS	United States Geological Survey
VOC	volatile organic compound
Watermaster	Chino Basin Watermaster
WEI	Wildermuth Environmental, Inc.
WRCRWA	Western Riverside County Regional Wastewater Authority

This 2012 Maximum Benefit Annual Report was prepared by the Chino Basin Watermaster (Watermaster) and the Inland Empire Utilities Agency (IEUA) pursuant to their maximum-benefit commitments, as described in the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) (California Regional Water Quality Control Board, Santa Ana Region [Regional Board], 2008).

This introductory section provides background on the Chino Basin Optimum Basin Management Program (OBMP); the Regional Board's recognition of the OBMP; the establishment of alternative, maximum-benefit groundwater-quality objectives for the Chino Basin; and the commitments made by Watermaster and IEUA when the Regional Board granted the maximum-benefit groundwater-quality objectives. Several commitments require reporting to the Regional Board. This Annual Report describes the status of compliance with each commitment and the work performed during calendar year 2012.

1.1 Investigations of the Relationship between Groundwater Production and Santa Ana River Discharge

Figure 1-1 is a map of the Chino Basin. Groundwater generally flows from the forebay regions in the north and east towards Prado Basin, where rising groundwater can become surface water in the Santa Ana River and its tributaries. Recent and past studies have provided some insight into the influence of groundwater production in the southern end of the Chino Basin on the safe yield of the Basin and the ability of production in this part of the Basin to control the outflow of rising groundwater. Three studies, discussed below, quantified the impacts of the groundwater desalters in the southern Chino Basin on groundwater discharge to the Prado Basin and the Santa Ana River.

Proposed desalter well fields were first described in *Nitrogen and TDS Studies, Upper Santa Ana Watershed* (James M. Montgomery, Consulting Engineers, Inc., 1991). This study matched desalter production to meet future potable demands in the lower Chino Basin through the year 2015. Well fields were sited to maximize the interception of rising groundwater and to induce streambed percolation in the Santa Ana River. The decrease in rising groundwater and the increase in streambed percolation were projected to range from 45 to 65 percent of total desalter production.

A design study for the Chino Basin Desalter well fields also provided estimates of the volume of rising groundwater intercepted by Desalter production (Wildermuth, 1993). This study used a detailed model of the lower Chino Basin (a rectangular grid with 400-foot by 400-foot cells covering the southern Chino Basin) to evaluate the hydraulic impacts on rising groundwater and groundwater levels at nearby wells. This study showed the relationship of intercepting rising groundwater to well field locations and capacity. The fraction of total desalter well production composed of decreased rising groundwater and increased streambed percolation was estimated to range from 40 to 50 percent.

A subsequent analysis, consistent with the OBMP and the Peace II Agreement, projected the increase in streambed infiltration to be about 20 percent of desalter production due to

Watermaster's reoperation plan alone (Wildermuth Environmental, Inc. [WEI], 2009b). This projection resulted from evaluating the Peace II project description through 2060 with the 2007 groundwater flow model, using existing Chino Desalter wells and the planned Chino Creek Well Field (CCWF). The streambed infiltration resulting from the desalters and reoperation will be estimated in 2013 when the groundwater flow model is next updated.

These studies suggest that the yield of the Chino Basin could be enhanced by increasing groundwater production near the River. These studies also suggest that an expanded desalter program (as shown in Figure 1-1) and a slight permanent decrease in basin storage will (1) capture all groundwater flowing south from the forebay regions of the Chino Basin and (2) reduce the outflow of high-salinity groundwater from the southern Chino Basin to the Santa Ana River, thereby providing greater protection of downstream beneficial uses.

1.2 The OBMP and the 2004 Basin Plan Amendment

The Chino Basin OBMP was developed by Watermaster and the parties to the 1978 Judgment (Chino Basin Municipal Water District *v.* City of Chino, *et al.*). The OBMP maps a strategy that will provide for the enhanced yield of the Chino Basin and seeks to provide reliable water supplies for development that is expected to occur within the Basin. The goals of the OBMP are: to enhance basin water supplies, to protect and enhance water quality, to enhance the management of the Basin, and to equitably finance the OBMP. The OBMP is a comprehensive, long-range water management plan for the Chino Basin and includes the use of recycled water for direct reuse and artificial recharge. It also includes the capture of increased quantities of high quality stormwater runoff, the recharge of imported water when total dissolved solids (TDS) concentrations are low, improving the water supply by desalting poor-quality groundwater, supporting regulatory efforts to improve water quality in the Basin, and the implementation of management activities that will result in reduced outflow of high-TDS/high-nitrate groundwater to the Santa Ana River and the Orange County Basin, thus ensuring the protection of downstream beneficial uses and water quality (WEI, 1999).

For the Chino Basin, the 1995 Basin Plan contained restrictions on the use of recycled water for irrigation and groundwater recharge. In particular, it contained TDS objectives ranging from 220 to 330 milligrams per liter (mg/L) over most of the Basin. The ambient TDS concentrations in the Chino Basin exceeded these objectives, which meant that no assimilative capacity existed for most of the Basin. Therefore, the use of IEUA's recycled water (which has a TDS concentration of about 500 mg/L) for irrigation and groundwater recharge—one of the key elements of the OBMP—would require mitigation even though recycled water reuse would not materially impact future TDS concentrations or impair the beneficial uses of Chino Basin groundwater.

In 1995, in part because of these considerations, the Regional Board initiated a collaborative study with 22 water supply and wastewater agencies, including Watermaster and the IEUA, to devise a new TDS and nitrogen management plan for the Santa Ana Watershed. This study culminated in the Regional Board's adoption of a Basin Plan amendment in January 2004 (Regional Board, 2004). This amendment included revised groundwater subbasin boundaries (termed "management zones"), revised TDS and nitrate-nitrogen objectives for groundwater, revised TDS and nitrogen wasteload allocations, revised reach designations, and revised TDS and nitrogen objectives and beneficial uses for specific surface waters. The technical work supporting the 2004 Basin Plan amendment was directed by the Nitrogen/TDS Task Force (Task Force) and is summarized in *TIN/TDS Phase 2A: Tasks 1 through 5, TIN/TDS Study of the Santa Ana Watershed* (WEI, 2000).

The new TDS and nitrate-nitrogen objectives for the groundwater management zones in the Santa Ana Region were established to ensure that historical quality is maintained pursuant to the State's antidegradation policy (State Board Resolution No. 68-16). These objectives were termed "antidegradation" objectives. Figure 1-1 shows the antidegradation objectives for the Chino Basin management zones. Note that the antidegradation TDS objectives across most of the Chino Basin are still low (250 to 280 mg/L) and would still restrict recycled water reuse and the artificial recharge of imported water.

To address this issue, Watermaster and IEUA proposed, and the Regional Board accepted, alternative and less stringent "maximum-benefit" objectives for a large portion of the Chino Basin, the Chino-North management zone. Figure 1-1 shows the maximum-benefit objectives for Chino-North—specifically the 420 mg/L TDS objective. This maximum-benefit TDS objective is higher than the current ambient TDS concentration (340 mg/L in 2009), thus creating assimilative capacity and allowing for recycled water reuse and recharge without mitigation.

The maximum-benefit objectives were established based on demonstrations by Watermaster and IEUA that antidegradation requirements were satisfied. First, they demonstrated that beneficial uses would continue to be protected. Second, they showed that water quality consistent with maximum benefit to the people of the State of California would be maintained. Other factors—such as economics, the need to use recycled water, and the need to develop housing in the area—were also taken into account in establishing the maximum-benefit objectives.

1.3 Maximum Benefit Implementation Plan for Salt Management: Maximum Benefit Commitments

The application of the maximum-benefit objectives is contingent upon the implementation of specific projects and programs by Watermaster and IEUA. These projects and programs, termed the "Chino Basin maximum-benefit commitments," are described in the Maximum Benefit Implementation Plan for Salt Management in the Basin Plan and are listed therein in Table 5-8a (Regional Board, 2008). These commitments include:

1. The implementation of a surface water monitoring program.
2. The implementation of a groundwater monitoring program.
3. The expansion of the Chino-I Desalter to 10 million gallons per day (mgd) and the construction of the Chino-II Desalter with a design capacity of 10 mgd.
4. The additional expansion of desalter capacity (20 mgd) pursuant to the OBMP and the Peace Agreement (tied to the IEUA's agency-wide effluent concentration).
5. The completion of the recharge facilities included in the Chino Basin Facilities Improvement Program.

6. The management of recycled water quality to ensure that the agency-wide, 12-month running average wastewater effluent quality does not exceed 550 mg/L and 8 mg/L for TDS and total inorganic nitrogen (TIN), respectively.
7. The management of basin-wide, volume-weighted TDS and nitrogen concentrations in artificial recharge to less than or equal to the maximum benefit objectives.
8. The achievement and maintenance of "hydraulic control" of groundwater outflow from the Chino Basin to protect Santa Ana River water quality.
9. The determination of ambient TDS and nitrogen concentrations of Chino Basin groundwater every three years.

If these projects and programs are not implemented to the Regional Board's satisfaction, the antidegradation objectives apply for regulatory purposes. The application of the antidegradation objectives would result in a finding that there is no assimilative capacity for TDS and nitrate-nitrogen in the Chino-1, Chino-2, and Chino-3 management zones. The Regional Board would require mitigation for the TDS and nitrate-nitrogen discharges to these management zones (for both recycled and imported water) that exceeded the antidegradation objectives; this would essentially eliminate the ability to recharge recycled water without mitigation and would restrict the recharge of imported State Water Project (SWP) water when its TDS concentration exceeds the antidegradation objectives. Figure 1-2 shows the percent of the time that the TDS concentration at the Devil Canyon Afterbay has been less than or equal to a specific value based on observed TDS concentrations over the last 30 years. The TDS concentration of SWP water exceeded the antidegradation objective in the Chino-1, -2, and -3 management zones about 30, 45, and 40 percent of the time, respectively. The TDS concentration of SWP water exceeded the Chino-North maximum-benefit objective (420 mg/L) only one percent of the time.

1.4 Purpose and Report Organization

The purpose of this report is to describe the status of compliance by Watermaster and IEUA with the maximum-benefit commitments listed above. The report is organized as follows:

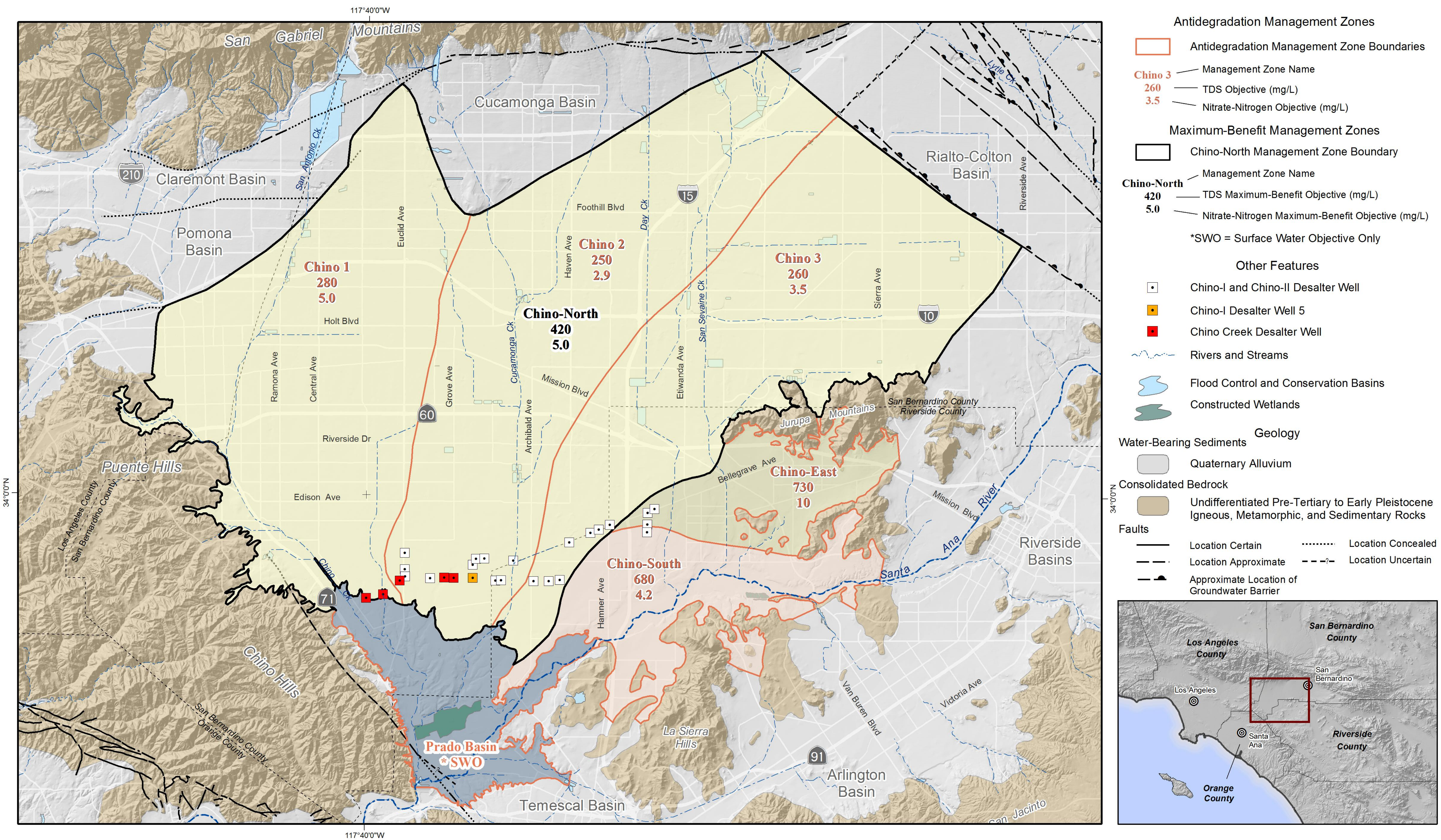
Section 1 – Introduction: This section describes the background that led to the development of the maximum-benefit objectives and the associated maximum-benefit commitments for the Chino Basin.

Section 2 – Maximum-Benefit Commitment Compliance: Section 2 describes the status of compliance with each of the maximum-benefit commitments.

Section 3 – Hydraulic Control Monitoring Program: Data Collected in 2012: Section 3 describes the data collected in 2012 as part of the monitoring program.

Section 4 – The Influence of Rising Groundwater on the Santa Ana River: Section 4 characterizes the influence of rising groundwater on the flow and quality of the Santa Ana River between Riverside Narrows and Prado Dam.

Section 5 – References: Section 5 provides the references consulted in performing the analyses described herein and in writing this report.



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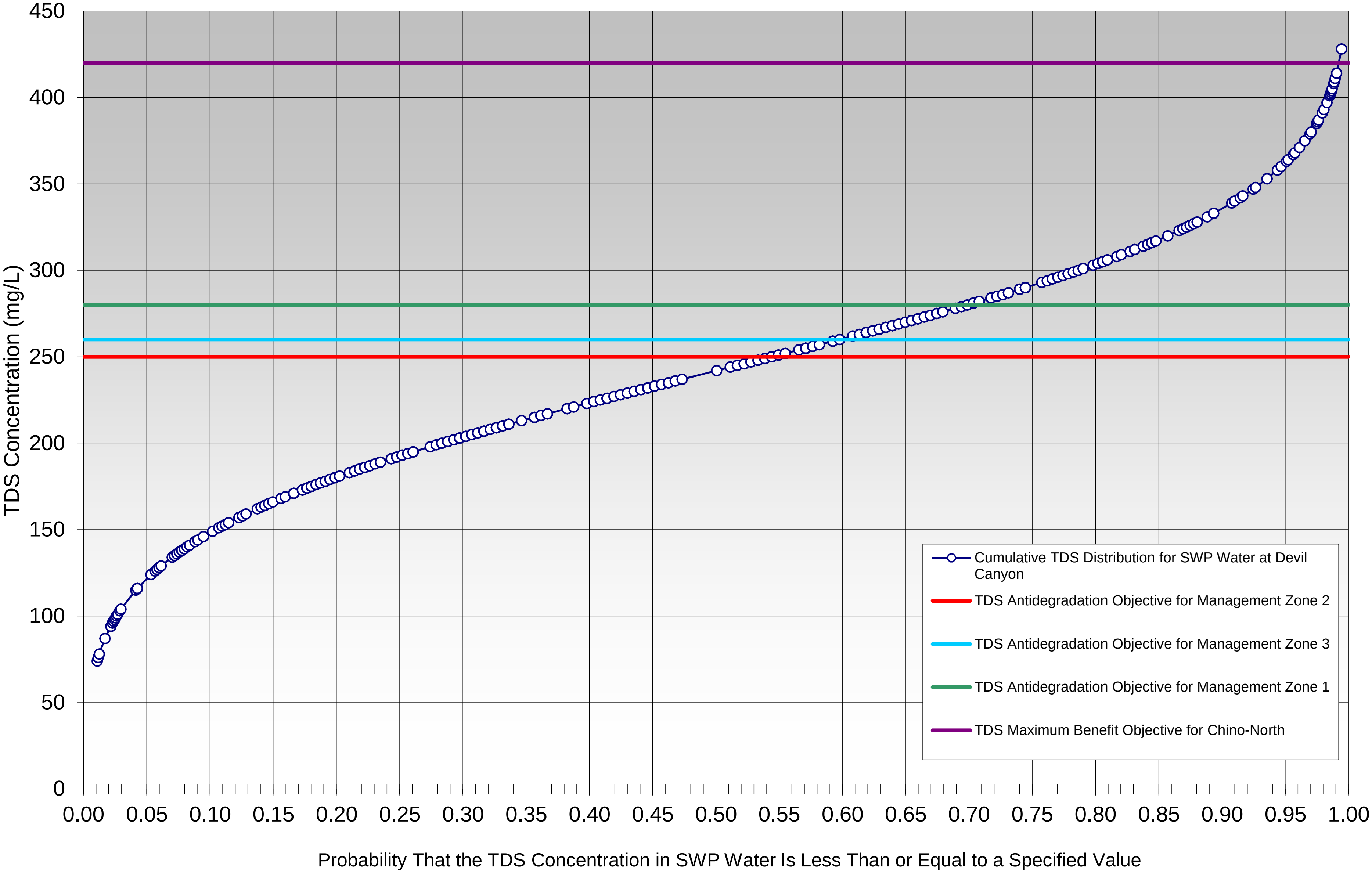
2012 Maximum Benefit Annual Report

Chino Basin Management Zones

Antidegradation & Maximum-Benefit Objectives for TDS and Nitrate-Nitrogen

Figure 1-1

Figure 1- 2
Historical TDS Concentration in State Water Project Water at Devil Canyon



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Section 2 – Maximum-Benefit Commitment Compliance

Table 2-1 lists the status of compliance for each of the nine maximum-benefit commitments outlined in the Maximum Benefit Implementation Plan for Salt Management in the Basin Plan.[1] A discussion of ongoing activities, related to compliance with the commitments, is provided below. For this discussion, the commitments are grouped together by the four main topics they address: hydraulic control, Chino Basin desalters, recycled water use, and ambient groundwater quality.

2.1 Hydraulic Control

The Regional Board requires that Watermaster and IEUA achieve and maintain "hydraulic control" of groundwater outflow from the Chino Basin (Commitment #8). The Basin Plan defines hydraulic control as "[…] eliminating groundwater discharge from the Chino Basin to the Santa Ana River, or controlling the discharge to *de minimis* levels […]." In practice, Watermaster and IEUA use a more measurable definition of hydraulic control: eliminating groundwater discharge from the Chino-North management zone to the Prado Basin management zone (PBMZ) or controlling the discharge to *de minimis* levels. The requisite surface-water and groundwater monitoring programs (Commitments #1 and #2) to collect the data necessary for determining the state of hydraulic control are known collectively as the Hydraulic Control Monitoring Program (HCMP). Section 3 of this Annual Report describes the data collected in 2012 for the HCMP.

2.1.1 Hydraulic Control Monitoring Program

In May 2004, Watermaster and the IEUA submitted a surface-water and groundwater monitoring program work plan to the Regional Board: *Final Hydraulic Control Monitoring Program Work Plan for the Optimum Basin Management Program* (WEI, 2004b). The Regional Board adopted Resolution R8-2005-0064, approving this work plan, and required Watermaster and IEUA to implement the HCMP. The concept of using multiple lines of evidence was included in the initial design of the HCMP because it was not clear at that time whether one line of evidence would clearly demonstrate hydraulic control. These multiple lines of evidence are summarized as follows:

- Collect and analyze groundwater-elevation data to determine the direction of groundwater flow in the southern part of the Basin and whether pumping at the Chino Desalter well fields is completely capturing all groundwater that would otherwise discharge out of the Chino-North management zone and into the PBMZ.

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[1] The commitments related to surface water and groundwater monitoring were revised by a Basin Plan amendment approved by the Regional Board on February 10, 2012. The amendment was approved by the Office of Administrative Law (OAL) on December 6, 2012. Upon final approval by the OAL, the revisions to the monitoring commitments occurred. The evaluation provided herein is a description of compliance with the maximum benefit commitments in calendar year 2012, prior to the final approval of the 2012 amendment by the OAL in December 2012.

- Collect and analyze the chemistry of basin-wide groundwater and the Santa Ana River (a) to track the migration, or lack thereof, of the Archibald South volatile organic compound (VOC) plume beyond the Chino Desalter well fields, and (b) to identify the source of groundwater in the area of the Chino Basin between the Santa Ana River and the Chino Desalter well fields.
- Collect and analyze surface water quality data and surface water discharge measurements to determine if groundwater from the Chino Basin is rising as surface water and contributing to flow in the Santa Ana River or if the River is percolating and recharging the Basin.
- Use Watermaster's numerical groundwater-flow model to corroborate the results and interpretations of the first three lines of evidence.

Watermaster and IEUA executed this monitoring program from 2004 through 2011 and concluded that (i) hydraulic control east of Chino-I Desalter Well 5 has been achieved, (ii) hydraulic control west of Chino-I Desalter Well 5 has not been fully achieved, and (iii) the current impact of rising groundwater outflow from the Chino Basin on the surface-water quality in the Santa Ana River is *de minimis*. (WEI, 2007b; WEI, 2008b; WEI, 2009a; WEI, 2010; WEI, 2011a; WEI, 2012b). The Chino Basin Desalter Authority[2] (CDA) is constructing the CCWF to gain hydraulic control west of Chino-I Desalter Well 5. (See Figure 1-1 and Section 2.3.)

Watermaster and IEUA also concluded that much of the water quality and discharge data collected as part of the surface-water monitoring program were not necessary to determine the state of hydraulic control. The *2009 Maximum Benefit Monitoring Program Annual Report* (WEI, 2010) recommended that:

1. The elimination of groundwater discharge from Chino-North to the PBMZ by the Chino Desalter well fields, or the control of the discharge to *de minimis* levels, is the measureable definition of hydraulic control.
2. Future annual reports should focus on the analysis of groundwater data (piezometric levels and groundwater quality) since these are the main data sets used to show the extent of capture of Chino-North groundwater by the Chino Desalter well fields.
3. Future annual reports should deemphasize the analysis of surface water data (flow and water quality) since these data are not necessary to show the extent of the complete capture of Chino-North groundwater by the Chino Desalter well fields. Future annual reports should continue to report on flow and quality of the Santa Ana River at Below Prado as a check on the conclusion that the influence of rising groundwater in the Prado Basin on the flow and quality of the Santa Ana River is de minimis.
4. If Watermaster and IEUA have satisfied all other Chino Basin maximum-benefit commitments, the Regional Board should reduce the surface-water

[2] http://www.chinodesalter.org/

monitoring commitments in the maximum-benefit commitments as they are currently defined in the Basin Plan.

On February 10, 2012, the Regional Board adopted an amendment to the Basin Plan to implement these recommendations. This amendment removed all references to specific monitoring locations and sampling frequencies for groundwater and surface-water monitoring and, in their place, required that Watermaster and IEUA submit an updated groundwater and surface-water monitoring program. This new work plan, the *2012 HCMP Work Plan* (WEI, 2012a), was adopted by the Regional Board on March 16, 2012 (Regional Board, 2012). The 2012 Basin Plan amendment also requires that Watermaster and IEUA submit an updated groundwater monitoring program by December 2013 that will demonstrate, through either monitoring of groundwater levels or a combination of monitoring and modeling, that hydraulic control is being achieved with the operation of the CCWF.

In a letter from the Regional Board to Watermaster and IEUA, dated October 12, 2011, the Regional Board concluded, based on computer-simulation modeling of groundwater flow provided by the Watermaster, that (i) production rates at 60 to 100 percent of the design rate for the CCWF will achieve hydraulic control and (ii) a production rate at 40 percent of the design rate for the CCWF will result in *de minimis* flow of groundwater from Chino-North to the PBMZ (Regional Board, 2011). At 40 percent of the design production rate for the CCWF, groundwater flow from Chino-North to the PBMZ will be less than 1,000 acre-ft. The letter also contains a commitment that Watermaster and IEUA will recalibrate its model at a minimum frequency of every five years, beginning in 2012, and use the model to assess the state of hydraulic control in the future. A modeling report will be prepared to document the recalibration and future projections of hydraulic control.

2.1.2 Hydraulic Control Monitoring Program Objectives and Methods

Based on the results to date, the ongoing questions to be answered by the HCMP are:

1. Will hydraulic control be maintained east of Chino-I Desalter Well 5?
2. Will the CCWF achieve and maintain hydraulic control west of Chino-I Desalter Well 5?
3. Will the impact of rising groundwater outflow from Chino Basin on the surface-water quality in the Santa Ana River remain *de minimis*?

Watermaster and the IEUA are using the following methods to answer these questions.

Method to Address Question 1. The groundwater monitoring program (groundwater-level and quality) and periodic modeling will continue to be used to define the capture zone created by the Chino Desalter well field east of Chino-I Desalter Well 5 (See Figure 1-1 and Appendix A). An assessment of the state of hydraulic control will be included as part of the Maximum Benefit Annual Reports at a frequency that corresponds with Watermaster's model recalibration schedule (every five years). The preliminary schedule for reporting on the state of hydraulic control to the Regional Board, per the October 12, 2011 letter, is April 15th in 2017[3]

[3] This report will assess the state of hydraulic control achieved after about three full years of CCWF operation.

and 2022.[4] The Regional Board also requested that any additional analyses of hydraulic control published by the Watermaster and IEUA in the interim years be referenced in the Maximum Benefit Annual Report.

Watermaster prepares a State of the Basin (SOB) report every two years (WEI, 2002; 2005; 2007c; 2009c; and 2011c). The SOB report includes a spring groundwater-elevation contour map of the southern portion of Chino Basin showing the state of hydraulic control. During the years when the SOB analysis is complete, the groundwater-elevation contour map of the southern portion of Chino Basin will be included in the Maximum Benefit Annual Report. The spring 2012 groundwater-elevation contour map from the *Draft* 2012 SOB Report (WEI, 2013) is included in Appendix A of this annual report. Additionally, Watermaster is currently recalibrating and updating the Chino Basin groundwater-flow model, which will include an assessment of hydraulic control. The modeling results relevant to the assessment of hydraulic control will be included as an appendix in the 2013 Maximum Benefit Annual Report.

Method to Address Question 2. An expanded groundwater-level monitoring program (due to the Regional Board by December 2013) and periodic modeling will be used to define the capture zone created by the CCWF in the shallow aquifer system west of Chino-I Desalter Well 5 (See Figure 1-1 and Appendix A). The first Maximum Benefit Annual Report to include an assessment of the state of hydraulic control after the startup of the CCWF will be submitted to the Regional Board in 2017[5].

Method to Address Question 3. The HCMP has shown that the current impact of rising groundwater outflow from the Chino Basin on the surface-water quality of the Santa Ana River is *de minimis*. Groundwater modeling suggests that the implementation of the Peace II Agreement (*e.g.*, CCWF pumping and basin re-operation) will further decrease the volume of rising groundwater outflow to the Santa Ana River and thereby further reduce its impact on the River's water quality. Continued monitoring and analysis of the flow and quality of the Santa Ana River will determine the nature of the impact of rising groundwater. The impact of rising groundwater on Reach 2 of the Santa Ana River is described in Section 4 of this report.

2.2 Chino Basin Desalters

The operation of the Chino Desalters is fundamental to achieving hydraulic control, maximizing the yield of the Chino Basin, minimizing the loss of stored water, and protecting the water quality of the Santa Ana River. The first Chino Basin Desalter, Chino-I, began operation in late 2000 and had an original design capacity of 8 mgd. Prior to the recharge of recycled water in the Chino Basin, the Chino-I Desalter was expanded to a capacity of 14 mgd, and a contract was awarded for the construction of the Chino-II Desalter. The Chino-II Desalter went online in June 2006 and has a capacity of 15 mgd. Figure 2-1 shows the total annual production of the Chino Desalters since operation began in 2000. Total production in 2012 was 28,197 acre-ft.

[4] This report will assess the state of hydraulic control achieved after about eight full years of CCWF operation.

[5] This report will assess the state of hydraulic control after about three full years of CCWF operation.

Watermaster's goal—as articulated in the OBMP, the Peace Agreement, and the 2007 court-approved Peace II process—is to expand desalter product water deliveries from the current level of about 25,000 acre-feet per year (acre-ft/yr) to the full capacity of about 35,000 acre-ft/yr. This corresponds to an increase in desalter well production to about 40,000 acre-ft/yr. To accomplish this expansion, the CDA is constructing the CCWF. The construction of five CCWF wells, I-16, I-17, I-18, I-20, and I-21 was completed between September 2011 and May 2012[6]. The CCWF wells are located in the southwestern portion of the Chino Basin (see Figure 1-1). Production at the CCWF wells is anticipated to commence in January 2014.

2.3 Recycled Water Recharge

The recharge of recycled water, imported water, and stormwater is another integral part of the OBMP. The IEUA, Watermaster, Chino Basin Water Conservation District, and San Bernardino County Flood Control District are partners in the implementation of the Chino Basin Recycled Water Groundwater Recharge Program. IEUA manages the recharge program and performs recycled water recharge operations pursuant to Regional Board Orders R8-2007-0039 and R8-2009-0057. As required by these orders, the IEUA submits quarterly and annual reports to the Regional Board on Chino Basin recycled water recharge activities. Figure 2-2 is a map of existing recharge facilities in the Chino Basin, and Table 2-2 summarizes the total annual recharge, by water type, since recycled water recharge activities began in July 2005.

Commitment number 7 requires that the use of recycled water for artificial recharge be limited to the amount that can be blended on a volume-weighted basis with other sources of artificial recharge to achieve a five-year running-average concentration of no more than the maximum-benefit objectives (420 mg/L for TDS and 5 mg/L for nitrate-nitrogen[7]). Table 2-3 summarizes the five-year, volume-weighted TDS and nitrate-nitrogen concentrations of basin-wide artificial recharge.[8] A table of the data used to compute this metric is included with this report in Appendix B.

When the 12-month running-average effluent TDS concentration (measured as an average for all IEUA wastewater treatment facilities) exceeding 545 mg/L for three consecutive months or the agency-wide, 12-month running-average effluent TIN concentration exceeding 8 mg/L in any one month, Commitment number 6 requires IEUA, to submit a plan and time schedule to the Regional Board for the implementation of measures to ensure that the 12-month running-average agency wastewater effluent quality does not exceed 550 mg/L and 8 mg/L for TDS and TIN, respectively. The plan and schedule are to be implemented upon Regional Board approval. This metric is reported by IEUA in the Groundwater Recharge Program Quarterly Monitoring Program. Since 2005, the 12-month running average TDS and TIN

[6] The proposed CCWF well I-19 was not constructed because the projected pumping estimates during borehole testing were too low to warrant the construction of the well.

[7] The 25% nitrogen loss is applied to calculate recycled water nitrogen quality when determining the amount of other recharge water sources required to acheive the 5-year running average.

[8] Recycled water recharge began in July 2005; thus, July 2005 through June 2010 is the first five-year period for which the metric was computed.

concentrations have never reached these triggers and have ranged between 459 and 509 mg/L and 5.2 and 7.3 mg/L, respectively.

2.4 Ambient Groundwater Quality

Commitment number 9 requires that Watermaster and IEUA re-compute ambient TDS and nitrate-nitrogen quality for the Chino Basin and Cucamonga management zones every three years beginning in July 2005. The methods (20-year running averages) must be consistent with the methods used by the Task Force to determine the antidegradation objectives. Watermaster and the IEUA have participated in each of the triennial, region-wide ambient water quality determinations as members of the Basin Monitoring Program Task Force. The most recent recomputation, covering the 20-year period from 1990 to 2009, was completed in August 2011 (WEI, 2011b). Table 2-4 shows the results of the current and all historical ambient TDS and nitrate-nitrogen concentration determinations. The next recomputation, covering the 20-year period from 1993 to 2012, will begin in July 2013 and is due to the Regional Board in 2014.

Table 2-1
Status of Compliance with the Chino Basin Maximum Benefit Commitments[1]

Description of Commitment	Compliance Date – as soon as possible, but no later than	Status of Compliance
1. Surface Water Monitoring Program[1] a. Submit draft monitoring program work plan to Regional Board b. Implement monitoring program c. Quarterly data report submittal d. Annual data report submittal	a. January 23, 2005 b. Within 30 days from the date of Regional Board approval of the monitoring plan c. April 15, July 15, October 15, and January 15 d. February 15th	a. Draft work plan submitted to Regional Board on January 23, 2005. b. Monitoring plan initiated prior to Regional Board approval. c. All quarter data reports have been submitted on time. d. All annual reports submitted by April 15 of each year. (Prior to the submittal of the first annual report in 2006, Regional Board staff agreed to extend the annual report due date to April 15 to allow more time for laboratory analysis of December samples and the subsequent analysis/documentation of results.)
2. Groundwater Monitoring Program a. Submit draft monitoring program work plan to Regional Board b. Implement monitoring program c. Annual data report submittal	a. January 23, 2005 b. Within 30 days from the date of Regional Board approval of the monitoring plan c. February 15th	a. Draft monitoring plan submitted to Regional Board on January 23, 2005. b. Monitoring program initiated prior to Regional Board approval. c. All annual reports submitted by April 15 of each year (see note for item 1d above).

[1] The commitments related to surface water and groundwater monitoring were revised by a Basin Plan amendment approved by the Regional Board on February 10, 2012. The amendment was approved by the Office of Administrative Law (OAL) on December 6, 2012. Upon final approval by the OAL, the revisions to the monitoring commitments occurred. The evaluation provided herein is a description of compliance with the maximum benefit commitments in calendar year 2012, prior to the final approval of the 2012 amendment by the OAL in December 2012.

Table 2-1
Status of Compliance with the Chino Basin Maximum Benefit Commitments[1]

Description of Commitment	Compliance Date – as soon as possible, but no later than	Status of Compliance
3. Chino Desalters a. Chino-I Desalter expansion to 10 mgd b. Chino-II Desalter construction to 10 mgd capacity	a. Prior to the recharge of recycled water b. Recharge of recycled water allowed once award of contract and notice to proceed issued for construction of desalter treatment plant	a. Chino-I Desalter was expanded to about 14 mgd. Expansion completed in April 2005 and operation began in October 2005; recycled water recharge began in July 2005. b. Contract for Chino-II Desalter awarded in early 2005; construction was completed to a capacity of 15 mgd, and the facility went online in June 2006.
4. Submittal of future desalters plan and schedule	October 1, 2005 Implement plan and schedule upon Regional Board approval	The Chino Desalter Expansion activities include expansion of the Chino-I Desalter well field (the Chino Creek Well Field—CCWF) and expansion of the Chino-II Desalter treatment capacity. The CCWF is designed to achieve hydraulic control west of Chino-I Desalter. The construction of five CCWF wells was completed during 2011 and 2012. The project schedule has the Desalter Expansions online in 2014.
5. Recharge facilities (17) built and in operation	June 30, 2005	The subject recharge facilities were completed and in operation by June 30, 2005.
6. Submittal of IEUA wastewater quality improvement plan and schedule	60 days after agency-wide, 12-month running average effluent TDS quality equals or exceeds 545 mg/L for 3 consecutive months, or after agency-wide, 12-month running average TIN equals or exceeds 8 mg/L in any month Implement plan and schedule upon approval by Regional Board	These threshold events have not occurred; therefore, a wastewater quality improvement plan has not been submitted.

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Table 2-1
Status of Compliance with the Chino Basin Maximum Benefit Commitments[1]

Description of Commitment	Compliance Date – as soon as possible, but no later than	Status of Compliance
7. Recycled water will be blended with other recharge sources such that the volume-weighted, 5-year running average TDS and nitrate-nitrogen concentrations of recharge are equal to or less than the maximum benefit water quality objectives. a. Submit a report that documents the location, amount of recharge, and TDS and nitrogen quality of stormwater recharge before the OBMP recharge improvements were constructed and what is projected to occur after the recharge improvements are completed. b. Submit documentation of amount and TDS and nitrogen quality of all sources of recharge and recharge locations. For stormwater recharge used for blending, submit documentation that the recharge is the result of OBMP enhanced recharge facilities.	Compliance must be achieved by the end of the 5th year after initiation of recycled water recharge operations. a. Prior to initiation of recycled water recharge b. Annually, by February 15th, after initiation of construction of basins/other facilities to support enhanced stormwater recharge	a. No documentation of water quality data or quantity for stormwater prior to OBMP initiation exists. Stormwater has been monitored for flow, TDS, and nitrogen since 2005. b. The first report documenting the 5-year, running average TDS and nitrate-nitrogen concentrations of recharge was submitted by the IEUA in June 2011. The volume-weighted, 5-year running average TDS and nitrate-nitrogen concentrations of Chino Basin recharge are less than the maximum benefit water quality objectives.

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Table 2-1
Status of Compliance with the Chino Basin Maximum Benefit Commitments[1]

Description of Commitment	Compliance Date – as soon as possible, but no later than	Status of Compliance
8. Hydraulic Control Failure a. Plan and schedule to correct loss of hydraulic control b. Achievement and maintenance of hydraulic control c. Mitigation plan for temporary failure to achieve/maintain hydraulic control	a. 60 days from Regional Board finding that hydraulic control is not being maintained b. In accordance with plan and schedule approved by the Regional Board. c. By January 23, 2005.	a. Hydraulic control has been achieved to the east of Chino-I Desalter Well 5. The CCWF is designed to achieve hydraulic control west of Chino-I Desalter Well 5. The Regional Board approved the Watermaster and IEUA's plan and schedule for achieving hydraulic control in 2010. b. Hydraulic control to be achieved with the operation of the Chino Creek Well Field. c. Plan submitted to Regional Board on March 3, 2005. No mitigation action has been triggered.
9. Ambient groundwater quality determination	July 1, 2005 and every three years thereafter	Watermaster and the IEUA have participated in the regional ambient water quality determination as requested by SAWPA. Watermaster and the IEUA provided their fair share of funds and substantial groundwater data for this effort.

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Table 2-2

Annual Groundwater Recharge at Chino Basin Facilities since 2005

Year	Imported water	Stormwater	Recycled Water	Total
2005	22,015	16,334	868	39,217
2006	47,426	11,852	2,699	61,977
2007	3,948	6,074	1,622	11,644
2008	0	10,595	2,781	13,376
2009	20	8,217	4,516	12,753
2010	4,980	19,390	8,304	32,674
2011	32,025	10,762	8,078	50,865
2012	0	9,372	7,823	17,195
Total	110,414	92,596	36,691	239,701

Table 2-3

Five-Year, Volume-Weighted, Total Dissolved Solids (TDS) and Nitrate-Nitrogen Concentrations of Recharge to the Chino Basin

Five Year Period	TDS (mg/L)	Nitrate-N (mg/L)
July 2005 - June 2010	203	1.1
July 2006 - June 2011	222	1.3
July 2007 - June 2012	220	1.4

Table 2-4
Water Quality Objectives and Ambient Water Quality Determinations for the Chino Basin and Cucamonga Management Zones

Management Zone	Water Quality Objectives (mg/L)				Ambient Water Quality Determination (mg/L)							
	Antidegradation		Maximum Benefit		1997		2003		2006		2009	
	TDS	NO_3-N	TDS	NO_3-N	TDS	NO_3-N	TDS	NO_3-N	TDS	NO_3-N	TDS	NO_3-N
Chino-North	--	--	420	5	300	7.4	320	8.7	340	9.7	340	9.5
Chino 1	280	5	--	--	310	8.4	330	8.9	340	9.3	340	9.1
Chino 2	250	2.9	--	--	300	7.2	340	9.5	360	10.7	360	10.3
Chino 3	260	3.5	--	--	280	6.3	280	6.8	310	8.2	320	8.4
Cucamonga	210	2.4	380	5	260	4.4	250	4.3	250	4.0	250	4.1

Figure 2-1
Total Calendar Year Groundwater Production by the Chino Desalter Authority
(2000-2012)

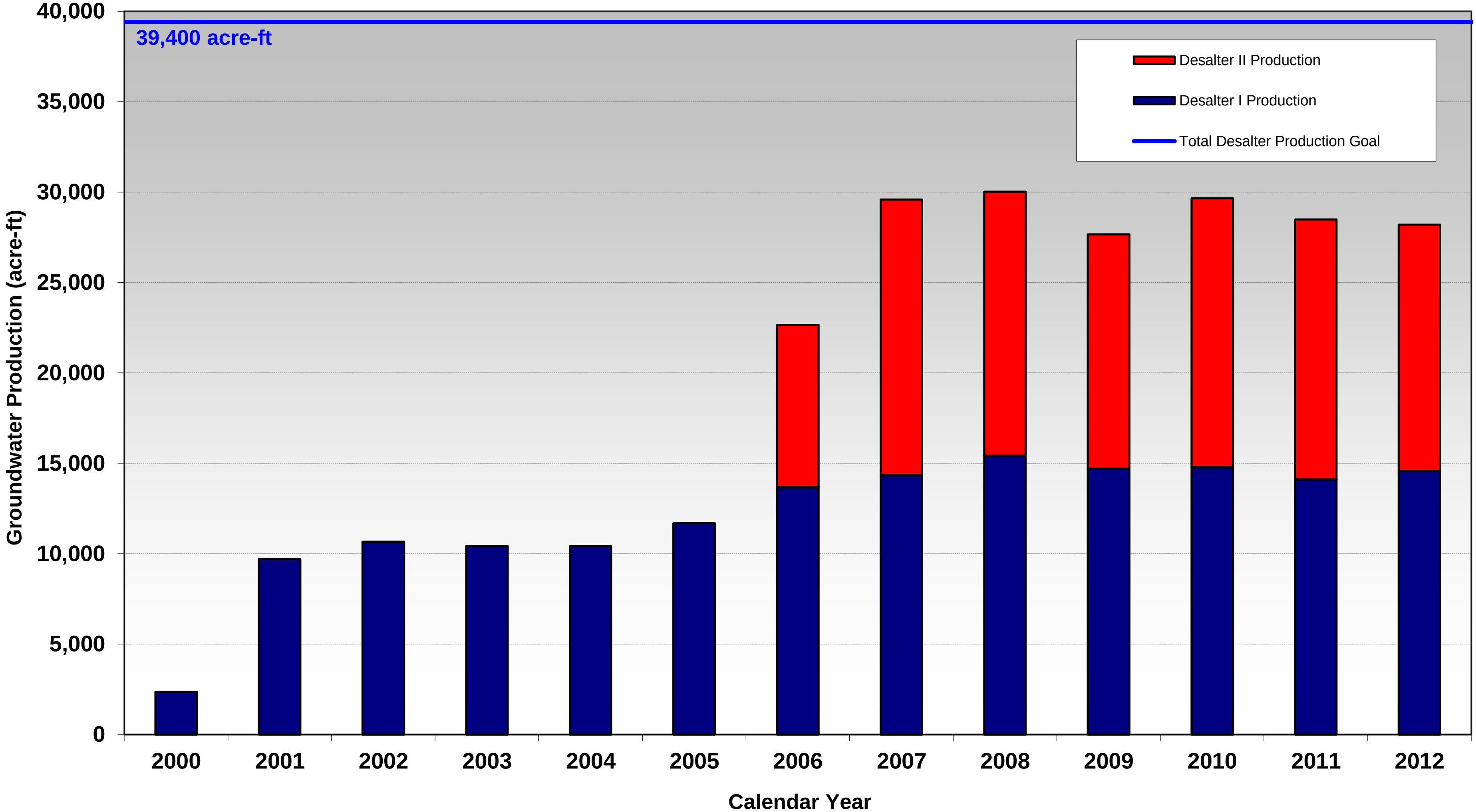

Figure_2-1_Desalter Production.xlsx -- Figure 2-1

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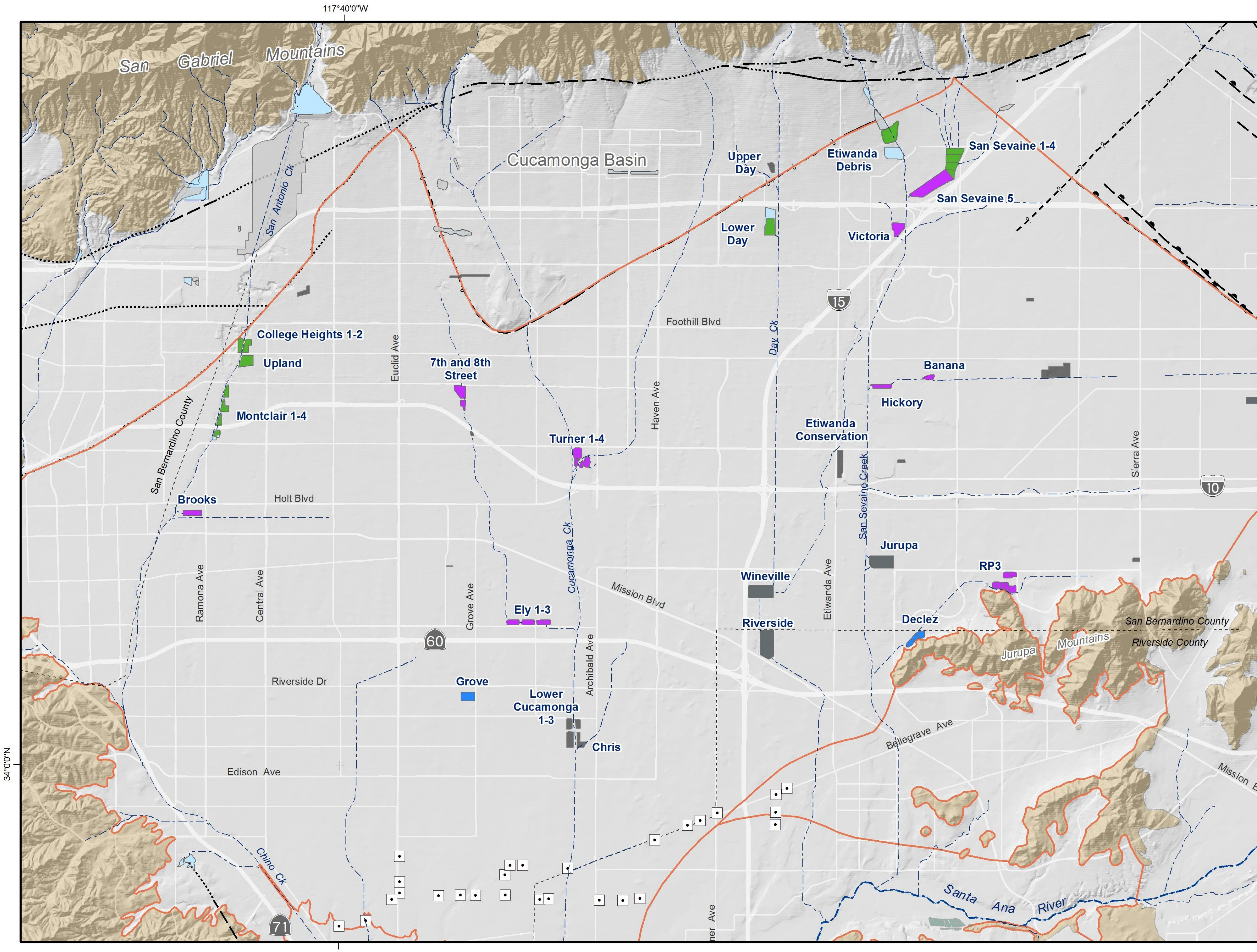

Recharge Basins
(Symbolized by Recharged Water Type)

- Storm, Imported and Recycled Water
- Storm and Imported Water
- Storm Water
- Incidental Stormwater Only
- Recharge Basins and Spreading Grounds Outside of Chino Basin

Other Features

- Chino Basin Maximum-Benefit Management Zone Boundaries
- Chino Desalter Well
- Rivers and Streams

Geology

Water-Bearing Sediments

- Quaternary Alluvium

Consolidated Bedrock

- Undifferentiated Pre-Tertiary to Early Pleistocene Igneous, Metamorphic, and Sedimentary Rocks

Faults

- Location Certain
- Location Approximate
- Approximate Location of Groundwater Barrier
- Location Concealed
- Location Uncertain

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File: Figure 2-2.mxd

0 1 2 3 4 Miles

0 2 4 6 Kilometers

2012 Maximum Benefit Annual Report

Chino Basin Recharge Basins

Existing Facilities by Recharge Type as of 2012

Figure 2-2

Section 3 – Hydraulic Control Monitoring Program: Data Collected in 2012

The data collected in 2012 in compliance with the maximum-benefit commitments include groundwater elevation, groundwater quality, surface-water quality, and surface-water discharge. The data collection efforts are described below.

3.1 Groundwater Monitoring Program

Watermaster's Groundwater Monitoring Program consists of two main components: a groundwater level monitoring program and a groundwater quality monitoring program. These monitoring programs were designed and implemented to support the OBMP program elements and the other regulatory requirements of Watermaster and the IEUA. Watermaster's Groundwater Monitoring Program is summarized below with specific reference to the monitoring requirements of the Watermaster/IEUA maximum-benefit commitments.

3.1.1 Groundwater Level Monitoring Program

Currently, about 1,000 wells comprise Watermaster's groundwater-level monitoring program (see Figure 3-1). The wells in the monitoring program within the southern portion of the Basin were preferentially selected to assist in Watermaster's monitoring programs for hydraulic control and land subsidence, and to aid in the analysis of desalter impacts to private well owners. The density of groundwater-level monitoring near the desalter well fields is greater than in outlying areas because hydraulic gradients are expected to be steeper near the desalter well fields, and these data are needed to assess the state of hydraulic control.

Figure 3-1 shows the wells where groundwater-level data were collected in 2012, symbolized by measurement frequency. At about 800 of these wells, water levels are measured by well owners, including municipal water agencies, the California Department of Toxic Substance Control (DTSC), the County of San Bernardino, and various consulting firms on behalf of their clients. The measurement frequency is typically about once per month. Watermaster collects these water-level data from well owners quarterly. The remaining approximately 200 wells are private wells or dedicated monitoring wells that are mainly located in the southern portion of the Chino Basin. Watermaster staff measures water levels at these wells using manual methods once per month or with pressure transducers that record water levels once every 15 minutes. A quality assurance/quality control (QA/QC) program is conducted prior to uploading data into HydroDaVE™. All water level data collected in 2012 are contained in a Microsoft (MS) Access database, included with this report as Appendix C.

3.1.2 Groundwater Quality Monitoring Program

Watermaster obtains groundwater quality samples and data, in part, to comply with two maximum-benefit commitments: the triennial ambient water quality recomputation and the analysis of hydraulic control. These data are also used for Watermaster's biennial SOB report, to support groundwater modeling, to monitor non-point source groundwater contamination and plumes associated with point-source discharges, and to assess the overall health of the groundwater basin.

Figure 3-2 shows the wells where groundwater-quality data were collected in 2012. At about 300 of these wells, water-quality samples were collected by well owners, including municipal water agencies, the DTSC, the County of San Bernardino, and various private companies and consulting firms. The sampling frequency and constituents sampled vary by well and owner. These water quality data are collected by Watermaster biennially. The remaining wells shown in Figure 3-2 are private agricultural wells or monitoring wells that were sampled by Watermaster.

Watermaster collected 32 samples at four shallow monitoring wells along the Santa Ana River, which consist of two former United States Geological Survey (USGS) National Water Quality Assessment (NAWQA) Program wells (Archibald 1 and Archibald 2) and two Santa Ana River Water Company (SARWC) wells (Wells 9 and 11). The sampling at these wells occurred monthly during January through June 2012, and quarterly thereafter. Additionally, Watermaster collected 21 annual samples at the nine multiport HCMP monitoring wells in the southern portion of Chino Basin.

During 2012, Watermaster collected groundwater quality samples at 33 wells for the Key Well Groundwater Quality Monitoring Program (GWQMP). The Key Well GWQMP consists of a network of about 120 private wells predominantly in the southern portion of the Chino Basin. About twenty of these wells are sampled for water quality every year; the remaining wells are sampled every three years. Watermaster is constantly evaluating and revising the wells in the Key Well GWQMP as private wells are abandoned due to urban development. All groundwater samples collected by Watermaster are tested for the analytes listed in Table 3-1. VOCs are sampled at wells within or adjacent to plumes.

A quality assurance/quality control (QA/QC) program is conducted prior to uploading data into HydroDaVE™. All publically available water quality data collected in 2012 are contained in a MS Access database included with this report as Appendix C. Water quality data collected at private wells in the Basin are excluded from the database in this report for confidentiality reasons.

3.2 Surface Water Monitoring Program

Table 3-2 lists the stations and monitoring frequencies of the Surface Water Monitoring Program (SWMP) pursuant to the Chino Basin maximum-benefit commitments in the 2004 Basin Plan Amendment (Regional Board, 2004), and the 2004 HCMP Work Plan (WEI, 2004b). The locations of these stations are shown in Figure 3-3. These stations were selected, in part, because they have some historical data and were part of existing monitoring programs where the data could be collected from the monitoring agencies, including the Orange County Water District (OCWD), USGS, City of Corona, City of Riverside, IEUA, and Western Riverside County Regional Wastewater Authority (WRCRWA). These surface water stations are monitored bi-weekly for water quality, and at varying frequencies for discharge. Water quality samples are analyzed for general minerals, general physical, and nitrogen components (see Table 3-3). The list of analytes was formalized by the Regional Board October 19, 2005.

As discussed in Section 2.1.1 of this report, a 2012 amendment to the Basin Plan was approved by the Regional Board on February 10, 2012 which eliminated the SWMP shown in Table 3-2. The new 2012 HCMP Work Plan approved by the Regional Board in March 2012 includes a revised SWMP that consist of quarterly water quality sampling at two sites in the Santa Ana River for the characterization of surface water and groundwater interactions along the River. The 2012 Amendment was adopted by the OAL on December 6, 2012, and at that time the 2012 HCMP Work Plan was implemented.

3.2.1 Surface Water Quality Sampling

Bi-weekly surface water quality sampling pursuant to the 2004 Basin Plan Amendment occurred from January through November 2012 at the sites shown in Figure 3-3 and Table 3-2. Three SWMP quarterly reports were submitted to the Regional Board on April 15, July 15, and October 15, 2012 to report and summarize the data collected during Quarters 1, 2, and 3, respectively. During 2012, Watermaster collected 391 bi-weekly grab samples at 14 sites and 3 POTWs along the Santa Ana River and tributaries, and IEUA collected 94 bi-weekly grab samples at their 4 POTWs, resulting in about 10,000 analytical determinations. The surface water quality data collected in 2012 were checked for QA/QC by Watermaster staff and uploaded to HydroDaVE™. All surface water quality data collected in 2012 are contained in a MS Access database, which has been included with this report as Appendix C.

3.2.2 Surface Water Discharge Measurements

Surface water discharge sampling pursuant to the 2004 Basin Plan Amendment occurred from January through November 2012 at the sites shown in Figure 3-3 and Table 3-2. Three SWMP quarterly reports were submitted to the Regional Board on April 15, July 15, and October 15, 2012 to report and summarize the data collected during Quarter 1, 2, and 3, respectively. During 2012, Watermaster measured 110 direct discharge measurements at 6 sites along the Santa Ana River. Daily discharge data were collected for 7 POTWs, and 7 USGS gaging stations along the Santa Ana River and tributaries. The surface water discharge data collected in 2012 were QA/QC-checked by Watermaster staff and uploaded to HydroDaVE™. All surface water discharge data collected in 2012 are contained in a MS Access database, which has been included with this report as Appendix C.

Table 3-1
Analyte List for Groundwater Quality Monitoring

Analyte	Method
Major cations: Ca, Mg, K, Si, Na	EPA 200.7
Major anions: Cl, SO_4, NO_2, NO_3	EPA 300.0
Total Hardness	SM 2340B
Total Alkalinity	SM 2320B
Carbonate, Bicarbonate, Hydroxide	SM 2330B
Ammonia Nitrogen	EPA 350.1
Arsenic	EPA 200.8
Fluoride	SM 4500F-C
Hexavalent Chromium	EPA 218.6
Perchlorate	EPA 314.0
pH	SM2330B/SM 4500-HB
Specific Conductance	SM 2510B
TDS	EPA 160.1/SM 2540C
Total Kjeldahl Nitrogen (TKN)	EPA 351.2
Total Organic Carbon	SM5310C/E415.3
Turbidity	EPA 180.1
VOCs	EPA 524.2
1,2,3 -Trichloropropane (Low Detection)	CASRL 524M-TCP

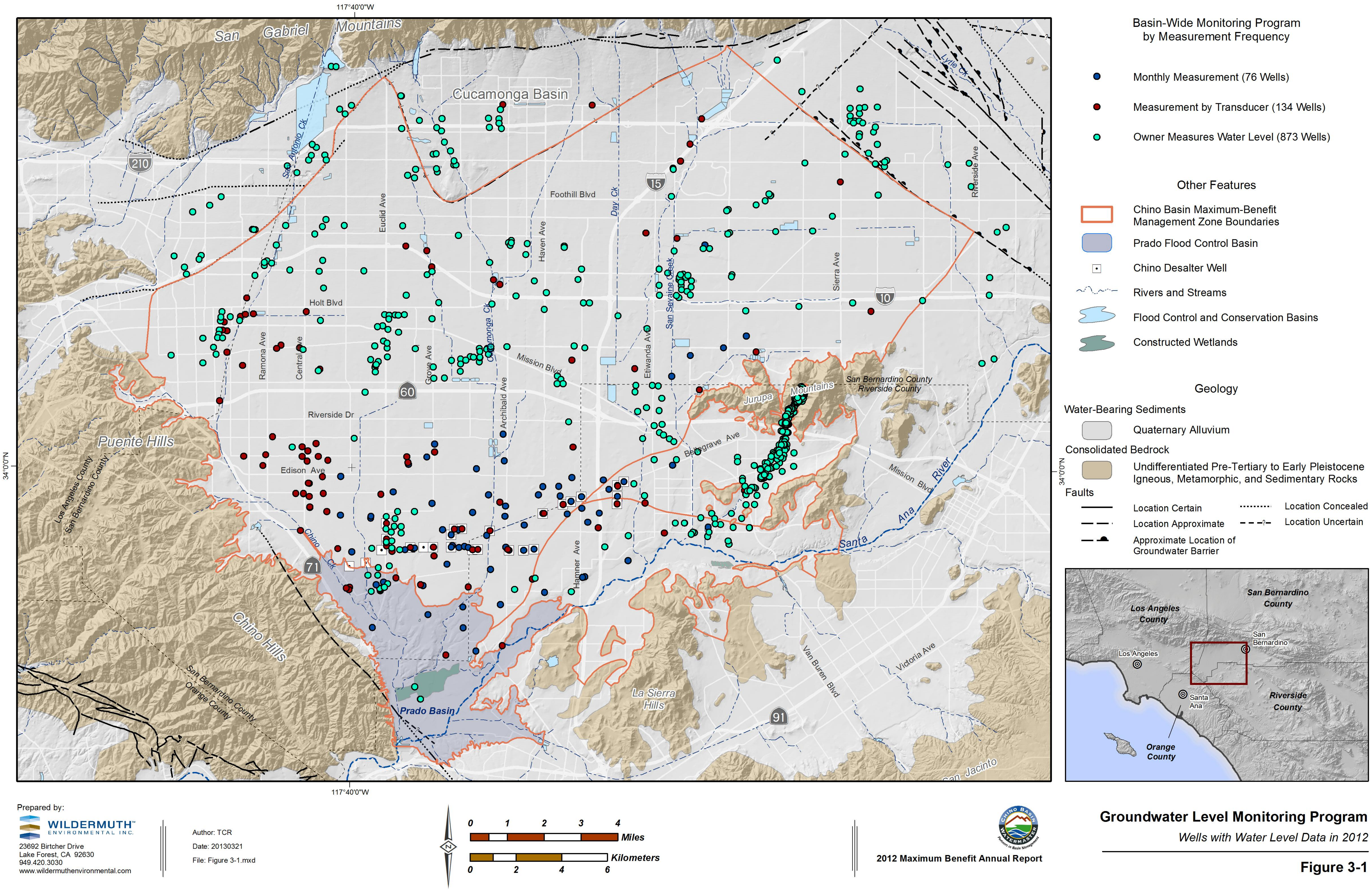
Table 3-2
Surface Water Monitoring Sites

Site Name	Discharge	Type	Discharge Monitoring		Discharge	Water Quality Monitoring			Water Quality
			Frequency	Period	Monitoring Entity	Frequency	Period	Analyses	Monitoring Entity
11066460/SAR at MWD Xing	Santa Ana River	Total Discharge	Daily	Jan - Dec	USGS	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
SAR at Van Buren	Santa Ana River	Total Discharge	Bi-weekly	Jan - Dec	CBWM	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
Hole Lake Outlet	Hole Lake Outlet	Total Discharge	Bi-weekly	Jan - Dec	CBWM	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
RWQCP Direct	Recycled Water	Recycled Water	Daily	Jan - Dec	City of Riverside	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM/Riverside
SAR at Etiwanda	Santa Ana River	Total Discharge	Bi-weekly	Jan - Dec	CBWM	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
RWQCP Hidden Valley (Wetland Diversion)	Recycled Water	Recycled Water	Daily	Jan - Dec	City of Riverside	N/A	Jan - Dec	Gen. Min. & Physical	N/A
SAR at Hamner	Santa Ana River	Total Discharge	Bi-weekly	Jan - Dec	CBWM	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
SAR at River Road	Santa Ana River	Total Discharge	Bi-weekly	Jan - Dec	CBWM	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
WRCRWTP	Recycled Water	Recycled Water	Daily	Jan - Dec	WRCRWA	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM/WRCRWA
11073493/Cucamonga Creek above Ely Basin	Cucamonga Creek	Total Discharge	Daily	Jan - Dec	USGS	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
RP1 Cucamonga	Recycled Water	Recycled Water	Daily	Jan - Dec	IEUA	Bi-weekly	Jan - Dec	Gen. Min. & Physical	IEUA
11073495/Cucamonga Creek near Mira Loma	Cucamonga Creek	Total Discharge	Daily	Jan - Dec	USGS	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
Mill Creek at Chino-Corona[1]	Cucamonga Creek	Total Discharge	N/A	Jan - Dec	CBWM	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
11073300/San Antonio Creek	San Antonio Creek	Total Discharge	Daily	Jan - Dec	USGS	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
11073360/Chino Creek at Schaefer	Chino Creek	Total Discharge	Daily	Jan - Dec	USGS	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
Carbon Canyon	Recycled Water	Recycled Water	Daily	Jan - Dec	IEUA	Bi-weekly	Jan - Dec	Gen. Min. & Physical	IEUA
RP5	Recycled Water	Recycled Water	Daily	Jan - Dec	IEUA	Bi-weekly	Jan - Dec	Gen. Min. & Physical	IEUA
Chino Creek at Pine Ave	Chino Creek	Total Discharge	Bi-weekly	Jan - Dec	CBWM	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
RP1 Prado	Recycled Water	Recycled Water	Daily	Jan - Dec	IEUA	Bi-weekly	Jan - Dec	Gen. Min. & Physical	IEUA
11072100/Temescal Channel above Main at Corona	Temescal Creek	Total Discharge	Daily	Jan - Dec	USGS	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM
Corona RW Plant 1B	Recycled Water	Recycled Water	Daily	Jan - Dec	City of Corona	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM/Corona
11074000/SAR below Prado Dam	Santa Ana River	Total Discharge	Daily	Jan - Dec	USGS	Bi-weekly	Jan - Dec	Gen. Min. & Physical	CBWM/OCWD

[1] No discharge measurements were collected at this station; the flow is comparable to the upstream gage station at Cucamonga Creek near Mira Loma.

Table 3-3
Analyte List for the Surface Water Monitoring Program

Analytes	Method
Major cations: K, Na, Ca, Mg	EPA 200.7
Major anions: Cl, SO_4, NO_2, NO_3	EPA 300.0
Total Alkalinity	SM 2320B
Carbonate, Bicarbonate, Hydroxide	SM 2330B
Ammonia-Nitrogen	EPA 350.1
Perchlorate (Low Detection)	ML/EPA 314
pH	SM 4500-HB
Specific Conductance	SM 2510B
Total Dissolved Solids	E160.1/SM2540C
Total Hardness	SM 2340B
Total Kjeldahl Nitrogen (TKN)	EPA 351.2
Turbidity	EPA 180.1
Total Organic Carbon	SM5310C/E415.3



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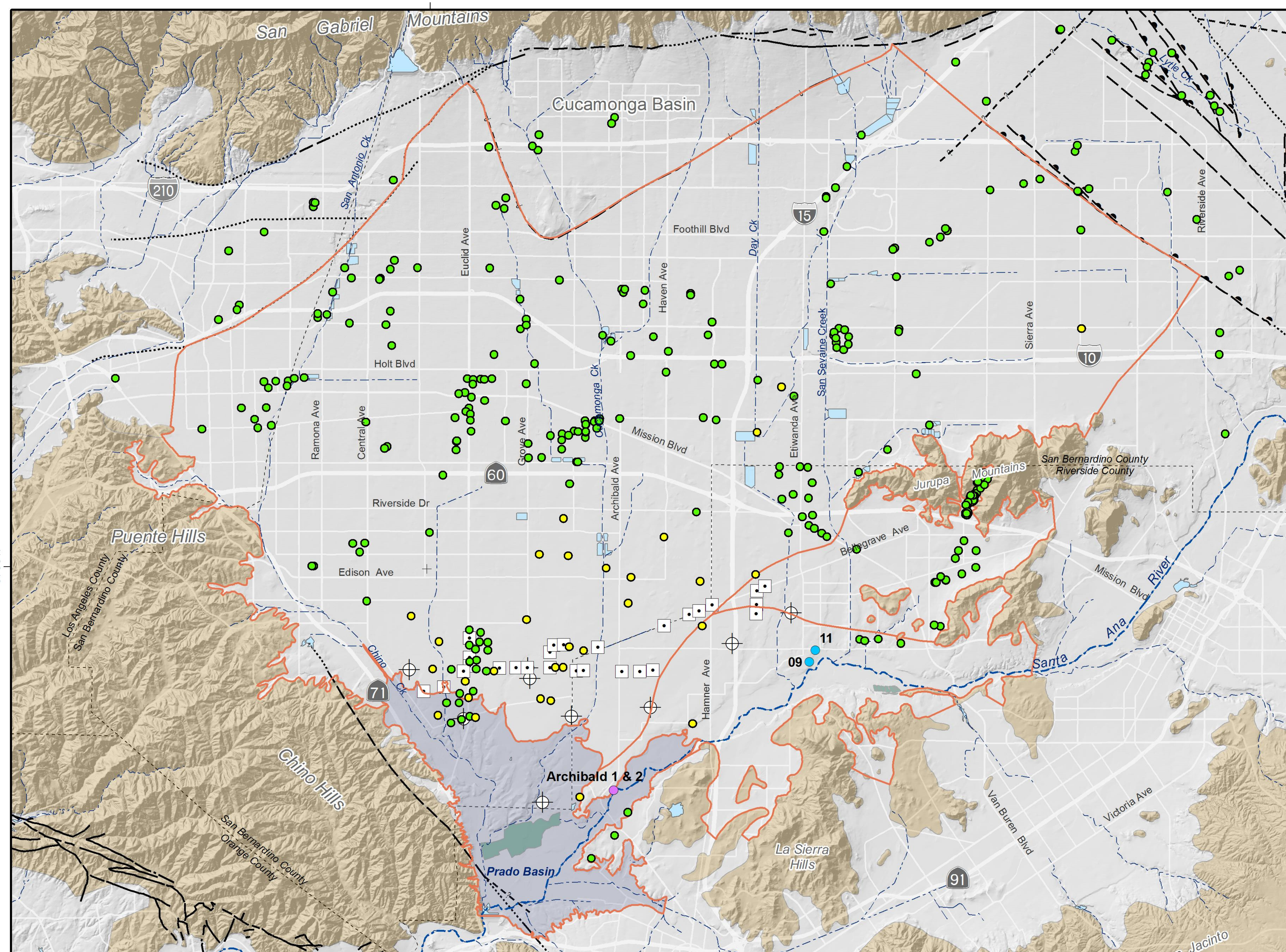
File: Figure 3-1.mxd

2012 Maximum Benefit Annual Report

Groundwater Level Monitoring Program

Wells with Water Level Data in 2012

Figure 3-1



Water Quality Monitoring Wells:

- Owner Samples Water Quality
- Key Wells Sampled in 2012
- Santa Ana River Water Company Wells
- USGS NAWQA Wells
- HCMP Monitoring Wells

Other Features

- Chino Basin Maximum-Benefit Management Zone Boundaries
- Prado Flood Control Basin
- Chino Desalter Well
- Rivers and Streams
- Flood Control and Conservation Basins
- Constructed Wetlands

Geology

Water-Bearing Sediments

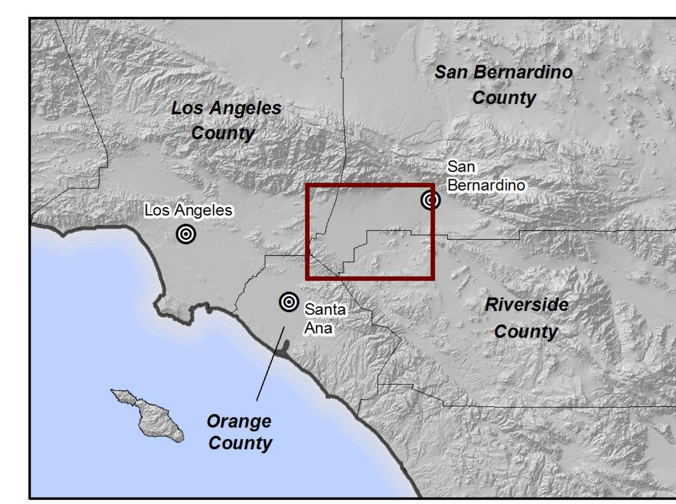
- Quaternary Alluvium

Consolidated Bedrock

- Undifferentiated Pre-Tertiary to Early Pleistocene Igneous, Metamorphic, and Sedimentary Rocks

Faults

- Location Certain
- Location Approximate
- Approximate Location of Groundwater Barrier
- Location Concealed
- Location Uncertain



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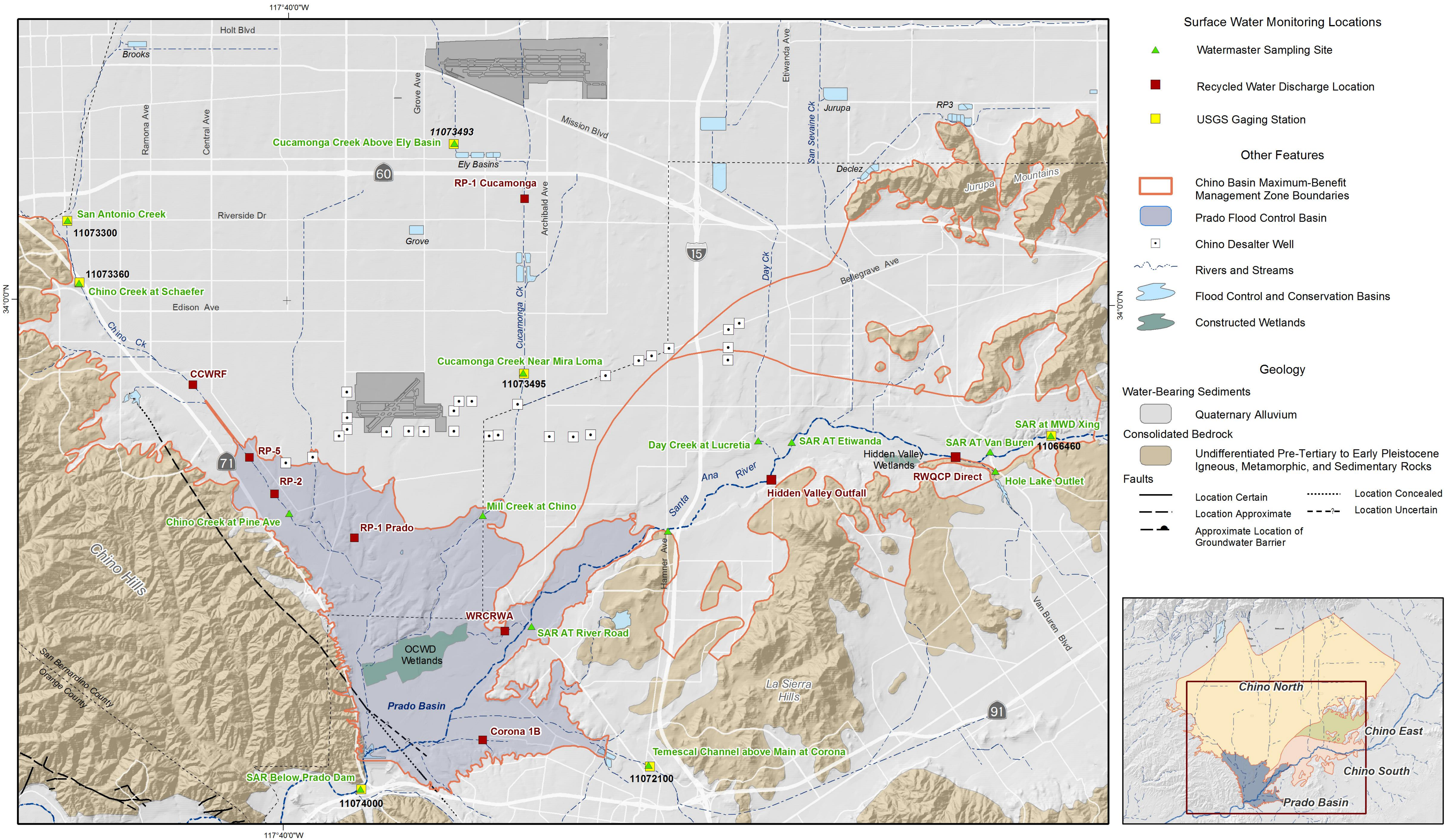
2012 Maximum Benefit Annual Report

Groundwater Quality Monitoring Program

Wells with Water Quality Data in 2012

Figure 3-2



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2012 Maximum Benefit Annual Report

Surface Water Monitoring Program

2004 Basin Plan Amendment

Figure 3-3

Section 4 - The Influence of Rising Groundwater on the Santa Ana River

This section characterizes the influence of rising groundwater on the flow and quality of the Santa Ana River between the Riverside Narrows and Prado Dam. This characterization is based on data that were collected and compiled by the Santa Ana River Watermaster (SARWM).

The Santa Ana River was adjudicated in the 1960s, and a stipulated judgment was filed in 1969 (Judgment) (OCWD *v.* City of Chino *et al.*, Case No. 117628, County of Orange). Since the Judgment was filed, the SARWM has compiled annual reports that contain estimates of significant discharges to the Santa Ana River. The SARWM uses these data to compute the stormwater flow and baseflow of the River each water year as well as the volume-weighted TDS concentration of discharge at Riverside Narrows and at Prado Dam. As defined in the Judgment, baseflow consists of rising groundwater and recycled water discharged in the upper Santa Ana River Watershed.

The available records from the SARWM were investigated to determine the relationship between the Santa Ana River and groundwater in the southern part of the Chino Basin. All available hydrologic studies conducted in support of the Judgment and the subsequent SARWM reports through water year 2011/12 were compiled (i) to estimate the annual net contribution of rising groundwater to the Santa Ana River and (ii) to examine the influence of rising groundwater on the flow and quality of the Santa Ana River.

4.1 Surface Water Discharge Accounting

Data from the SARWM annual reports were used to develop a hydrologic budget for the Santa Ana River between the Riverside Narrows and Prado Dam. The purpose of this analysis is to estimate the magnitude of net rising groundwater in the Santa Ana River. Net rising groundwater is the combined losses and gains in flow due to rising groundwater, infiltration, and evapotranspiration (ET). Achieving hydraulic control should decrease net rising groundwater.

Table 4-1 lists the Santa Ana River storm and baseflow discharges that enter the Basin at Riverside Narrows and leave the Basin at below Prado Dam and the various discharge components in the reach between the San Jacinto Fault and Prado Dam. The SARWM estimates the stormwater component of the hydrograph and subtracts stormwater discharge from the total observed discharge to obtain a trial baseflow. Note that subsurface inflow to the Chino Basin at Riverside Narrows is negligible because Riverside Narrows is a shallow bedrock narrows that forces groundwater in the Riverside Basin to rise and become surface flow. Additionally, there is negligible subsurface outflow from the Chino Basin under the Santa Ana River because Prado Dam was constructed in a similar bedrock narrows and sits on a grout curtain that was constructed to eliminate underflow. Given these subsurface flow assumptions, the net rising groundwater to the Santa Ana River can be calculated from the SARWM tabulations using the following equation:

$$Q_{RW} = Q_{BF\_PD} - Q_{BF\_RN} - \sum Q_{RECi} - \sum Q_{NONTDj}$$

Where Q_{RW} is net rising groundwater to the Santa Ana River between the Riverside Narrows and Prado Dam, Q_{BF_PD} is non-storm discharge at below Prado Dam, Q_{BF_RN} is non-storm discharge at the Riverside Narrows, Q_{RECi} is the i^{th} recycled water discharge to the Santa Ana River in the reach between the Riverside Narrows and Prado Dam, and Q_{NONTDj} is the j^{th} other non-tributary discharge to the Santa Ana River in the reach between the Riverside Narrows and Prado Dam.

Estimates of net rising groundwater in the Santa Ana River between the Riverside Narrows and Prado Dam are shown in Column 15 of Table 4-1 for water years 1970/71 through 2011/12. The time history of net rising groundwater is shown graphically in Figure 4-1. With two exceptions, the net rising groundwater estimate is negative over the last 40 years. Negative values for net rising groundwater indicate that rising groundwater is less than the combined losses from streambed infiltration and ET. Net rising groundwater has decreased since the Chino-I and Chino-II Desalters began pumping groundwater in the southern Chino Basin. These observations are consistent with the conclusion from the monitoring data that the achievement of hydraulic control is progressing.

4.2 Surface Water Quality at Prado Dam

Analysis of HCMP groundwater-elevation data (Section 4.1) indicates that the capture of Chino-North groundwater is incomplete in the southwestern portion of the Chino Basin. Groundwater modeling performed for Watermaster indicates that about 5,000 acre-ft/yr flows through this area into Prado Basin within the shallow aquifer system (WEI, 2009d). The ultimate fate of Chino-North groundwater that flows into Prado Basin is discharge by (i) pumping at wells, (ii) evapotranspiration by riparian vegetation, and/or (iii) rising groundwater. The TDS concentration of rising groundwater would likely be very high compared to the TDS objective for Reach 2 of the Santa Ana River (650 mg/L). Calibration of the Wasteload Allocation Model (1994-2006) determined that rising groundwater in the Prado Basin had an average TDS concentration of about 850 mg/L (WEI, 2009b). If rising groundwater were a significant component of flow in the Santa Ana River, compliance with the Reach 2 TDS objective would be problematic.

To examine the influence of rising groundwater on the flow and quality of the Santa Ana River, the volume-weighted TDS concentrations of the discharge at Prado Dam, as reported by the SARWM, were compiled (SARWM, 2013). Figure 4-2 is a time history of flow and TDS concentrations in the Santa Ana River at Prado Dam, including an estimate of the rising groundwater contribution to total flow. Estimates of the volume of rising groundwater in the Prado Basin were obtained from groundwater-flow modeling of the Chino Basin (WEI, 2007a; 2009d). The time history chart also shows the 5-year moving average of the annual flow-weighted TDS concentration of the Santa Ana River at *Below Prado*, which is the metric the Regional Board uses to determine compliance with the TDS objective for Reach 2 of the Santa Ana River (Reach 2 TDS metric). Note that:

- Since about 1980, rising groundwater in the Prado Basin has been a small percentage of total flow at *Below Prado*—ranging from about 2 percent to 12 percent in any one year.
- Since about 1980, the Reach 2 TDS metric has ranged between 481 and 603 mg/L and has never exceeded the TDS objective of 650 mg/L—even during extended dry periods when stormwater dilution of the Santa Ana River is relatively little (*e.g.,* 1983/84-1991/92 and 1998/99-2003/04).
- In water year 2011/12, the Reach 2 TDS metric is 518 mg/L.

These observations suggest that rising groundwater in the Prado Basin has had a *de minimis* impact on the flow and TDS concentration of the Santa Ana River since about 1980 and, during this time, has never contributed to an exceedance of the TDS objective for Reach 2. Based on the past 32 years of historical data, it appears unlikely that the metric will approach the Reach 2 objective of 650 mg/L unless other conditions that affect the flow and quality of the Santa Ana River change substantially (*e.g.*, wastewater effluent discharge and quality and/or storm flow).

Table 4-1
Estimate of Net Rising Groundwater to the Santa Ana River between San Bernardino and Prado Dam
(acre-ft/yr)

Water Year	Santa Ana River at Riverside Narrows								Santa Ana River below Prado Dam								
	(1) Groundwater Discharge from Bunker Hill	(2) Recycled Water Discharges	(3) Non-Tributary Discharges	(4)=(6)-(5) Q_{BF_RN} Non-Storm Discharge at Riverside Narrows	(5) Storm Discharge at Riverside Narrows	(6) Total Discharge at Riverside Narrows	(7)=(1)+(2)+(3) Groundwater Discharge from Bunker Hill + Recycled Water Discharge + Other Non-Tributary Discharges	(8)=(4)-(7) Net Rising Groundwater Contribution to Surface Discharge	(9) ΣQ_{REC} Recycled Water Discharges	(10) ΣQ_{NONTD} Non-Tributary Discharges	(11)=(13)-(12) Q_{BF_PD} Non-Storm Discharge at Prado Dam	(12) Storm Discharge at Prado Dam	(13) Total Discharge at Prado Dam	(14)=(4)+(9)+(10) Non-Storm Discharge at Riverside Narrows + Recycled Water Discharge + Other Non-Tributary Discharges	(15)=(11)-(14) Q_{RW} Net Rising Groundwater Contribution to Surface Discharge	(16)=(13)-(6) Gain in Total Flow from Riverside Narrows to Prado Dam	(17)=(12)-(5) Gain in Storm Water Discharge between Riverside Narrows and
1970 - 1971	0	22,650	0	35,681	7,051	42,732	22,650	13,031	21,810	0	38,402	13,462	51,864	57,491	(19,089)	9,132	6,411
1971 - 1972	0	20,650	0	35,161	6,096	41,257	20,650	14,511	28,980	0	40,416	11,327	51,743	64,141	(23,725)	10,486	5,231
1972 - 1973	0	23,460	11,617	17,582	15,466	33,048	35,077	(17,495)	32,780	0	49,472	28,485	77,957	50,362	(890)	44,909	13,019
1973 - 1974	0	22,530	0	17,203	8,291	25,494	22,530	(5,327)	36,830	63,035	107,784	19,543	127,327	117,068	(9,284)	101,833	11,252
1974 - 1975	0	21,050	0	16,771	4,199	20,970	21,050	(4,279)	40,600	27,939	81,742	11,655	93,397	85,310	(3,568)	72,427	7,456
1975 - 1976	0	22,030	0	18,350	9,277	27,627	22,030	(3,680)	42,680	60,170	106,797	13,793	120,590	121,200	(14,403)	92,963	4,516
1976 - 1977	0	23,240	0	19,474	5,397	24,871	23,240	(3,766)	41,800	8,350	57,603	14,675	72,278	69,624	(12,021)	47,407	9,278
1977 - 1978	0	24,780	0	23,100	159,400	182,500	24,780	(1,680)	44,220	1,466	60,707	194,349	255,056	68,786	(8,079)	72,556	34,949
1978 - 1979	200	25,940	0	27,208	20,708	47,916	26,140	1,068	46,570	9,897	82,572	62,646	145,218	83,675	(1,103)	97,302	41,938
1979 - 1980	1,000	27,540	0	25,805	228,528	254,333	28,540	(2,735)	48,200	23,820	90,921	445,253	536,174	97,825	(6,904)	281,841	216,725
1980 - 1981	3,000	27,850	0	18,915	15,783	34,698	30,850	(11,935)	52,300	0	91,377	26,923	118,300	71,215	20,162	83,602	11,140
1981 - 1982	6,500	30,590	0	31,715	51,335	83,050	37,090	(5,375)	55,990	0	81,883	61,819	143,702	87,705	(5,822)	60,652	10,484
1982 - 1983	11,000	31,380	0	55,884	224,103	279,987	42,380	13,504	55,960	7,720	120,566	306,519	427,085	119,564	1,002	147,098	82,416
1983 - 1984	14,000	29,610	0	55,403	27,684	83,087	43,610	11,793	57,190	12,550	122,116	55,825	177,941	125,143	(3,027)	94,854	28,141
1984 - 1985	12,000	31,170	0	63,968	15,145	79,113	43,170	20,798	63,440	3,883	125,358	37,889	163,247	131,291	(5,933)	84,134	22,744
1985 - 1986	8,000	33,450	0	64,631	34,969	99,600	41,450	23,181	65,620	1,836	127,550	70,158	197,708	132,087	(4,537)	98,108	35,189
1986 - 1987	5,000	36,330	0	57,965	20,128	78,093	41,330	16,635	68,670	0	120,182	23,343	143,525	126,635	(6,453)	65,432	3,215
1987 - 1988	3,000	39,160	0	53,526	26,521	80,047	42,160	11,366	77,500	5,679	130,117	42,714	172,831	136,705	(6,588)	92,784	16,193
1988 - 1989	1,700	39,470	0	50,330	12,387	62,717	41,170	9,160	85,260	6,582	126,488	33,171	159,659	142,172	(15,684)	96,942	20,784
1989 - 1990	1,000	40,420	0	51,500	7,000	58,500	41,420	10,080	82,840	1,020	120,503	24,314	144,817	135,360	(14,857)	86,317	17,314
1990 - 1991	500	39,530	394	43,710	30,815	74,525	40,424	3,286	84,230	8,052	119,911	75,275	195,186	135,992	(16,081)	120,661	44,460
1991 - 1992	100	37,080	0	38,610	33,158	71,768	37,180	1,430	89,360	8,033	115,551	82,729	198,280	136,003	(20,452)	126,512	49,571
1992 - 1993	0	38,220	0	39,714	227,670	267,384	38,220	1,494	95,570	5,273	133,438	438,563	572,001	140,557	(7,119)	304,617	210,893
1993 - 1994	0	36,170	144	29,639	15,838	45,477	36,314	(6,675)	90,180	5,424	117,075	41,622	158,697	125,243	(8,168)	113,220	25,784
1994 - 1995	0	38,650	2,206	45,632	199,985	245,617	40,856	4,776	95,020	18,945	144,619	284,651	429,270	159,597	(14,978)	183,653	84,666
1995 - 1996	0	43,660	1,470	53,935	29,321	83,256	45,130	8,805	95,270	25,137	158,468	58,692	217,160	174,342	(15,874)	133,904	29,371
1996 - 1997	0	49,960	2,762	63,285	43,995	107,280	52,722	10,563	93,760	48,473	187,911	61,783	249,694	205,518	(17,607)	142,414	17,788
1997 - 1998	0	56,746	1,342	64,147	150,228	214,375	58,088	6,059	104,774	6,665	162,029	300,604	462,633	175,586	(13,557)	248,258	150,376
1998 - 1999	0	54,111	0	70,912	5,382	76,294	54,111	16,801	112,349	2,684	161,321	23,673	184,994	185,945	(24,624)	108,700	18,291
1999 - 2000	0	52,404	0	61,260	14,312	75,572	52,404	8,856	112,380	19,945	168,214	40,269	208,483	193,585	(25,371)	132,911	25,957
2000 - 2001	0	57,753	2,760	62,366	15,725	78,091	60,513	1,853	115,097	10,686	167,305	54,621	221,926	188,149	(20,844)	143,835	38,896
2001 - 2002	0	52,465	9,410	65,845	2,999	68,844	61,875	3,970	110,283	9,053	164,353	10,615	174,968	185,181	(20,828)	106,124	7,616
2002 - 2003	0	53,833	3,664	59,089	33,077	92,166	57,497	1,592	117,208	8,570	158,347	97,810	256,157	184,867	(26,520)	163,991	64,733
2003 - 2004	0	52,808	1,537	53,980	23,356	77,336	54,345	(365)	110,907	10,598	156,785	57,317	214,102	175,485	(18,700)	136,766	33,961
2004 - 2005	0	54,592	0	63,384	292,119	355,503	54,592	8,792	133,684	964	169,017	469,515	638,532	198,032	(29,016)	283,028	177,396
2005 - 2006	0	54,426	727	65,570	46,270	111,840	55,153	10,417	126,192	1,473	161,840	85,734	247,574	193,235	(31,395)	135,734	39,464
2006 - 2007	0	51,668	1,846	55,002	2,866	57,868	53,514	1,488	120,247	2,324	143,246	12,901	156,147	177,573	(34,327)	98,279	10,035
2007 - 2008	0	50,297	4,065	48,537	30,082	78,619	54,362	(5,825)	108,175	5,385	130,798	68,896	199,694	162,097	(31,299)	121,075	38,814
2008 - 2009	0	47,298	1,460	43,080	25,947	69,027	48,758	(5,678)	97,676	1,671	109,039	53,662	162,701	142,427	(33,388)	93,674	27,715
2009 - 2010	0	47,628	0	43,671	68,960	112,631	47,628	(3,957)	92,603	86	107,999	135,775	243,774	136,360	(28,361)	131,143	66,815
2010 - 2011	0	47,335	0	47,516	126,559	174,075	47,335	181	91,195	11,874	119,323	205,568	324,891	150,585	(31,262)	150,816	79,009
2011 - 2012	0	44,745	0	40,447	4,602	45,049	44,745	(4,298)	76,192	0	93,803	27,325	121,128	116,639	(22,836)	76,079	22,723
Total	67,000	1,589,934	45,404	1,859,056	2,318,132	4,177,188	1,702,338	156,718	3,245,400	445,262	4,939,145	4,158,138	9,097,283	5,549,718	(610,573)	4,920,094	1,840,006
Average	1,634	38,779	1,107	45,343	56,540	70,075	41,520	3,822	79,156	10,860	120,467	101,418	221,885	135,359	(14,892)	120,002	44,878
Standard Dev	3,557	11,962	2,428	16,651	76,749	79,568	12,131	8,928	30,530	15,106	37,655	125,694	137,289	43,370	11,485	64,913	53,161
Coef of Var	218%	31%	219%	37%	136%	114%	29%	234%	39%	139%	31%	124%	62%	32%	-77%	54%	118%
Median	0	38,650	0	48,537	25,947	78,091	41,450	1,853	85,260	6,582	120,566	55,825	184,994	136,003	-14,978	106,124	27,715
Max	14,000	57,753	11,617	70,912	292,119	355,503	61,875	23,181	133,684	63,035	187,911	469,515	638,532	205,518	20,162	304,617	216,725
Min	0	20,650	0	16,771	2,866	20,970	20,650	-17,495	21,810	0	38,402	10,615	51,743	50,362	-34,327	9,132	3,215

Source -- All data except historical values for "Groundwater Discharge from Bunker Hill" were obtained from the Annual Reports of the SARWM. "Groundwater Discharge from Bunker Hill" was abstracted from Table 6 of the draft report *Hydrology, Description of Computer Models, and Evaluation of Selected Water-Management Alternatives in the San Bernardino Area, California* (USGS, 1997).

(Red Text) indicates negative values.

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Figure 4-1
Net Annual Rising Groundwater to the Santa Ana River between Riverside Narrows and Prado Dam
Water Years 1970/71 through 2010/12

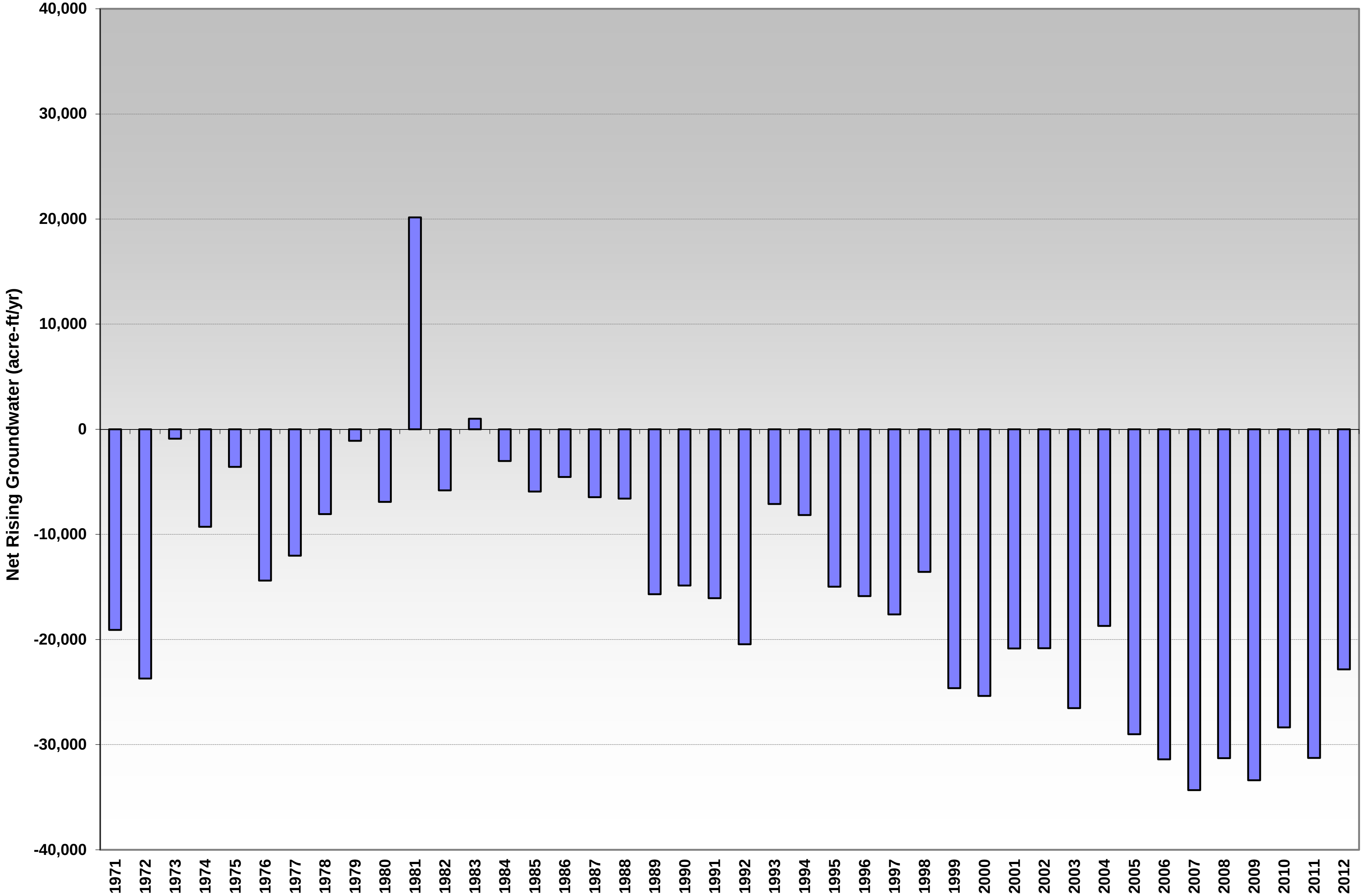

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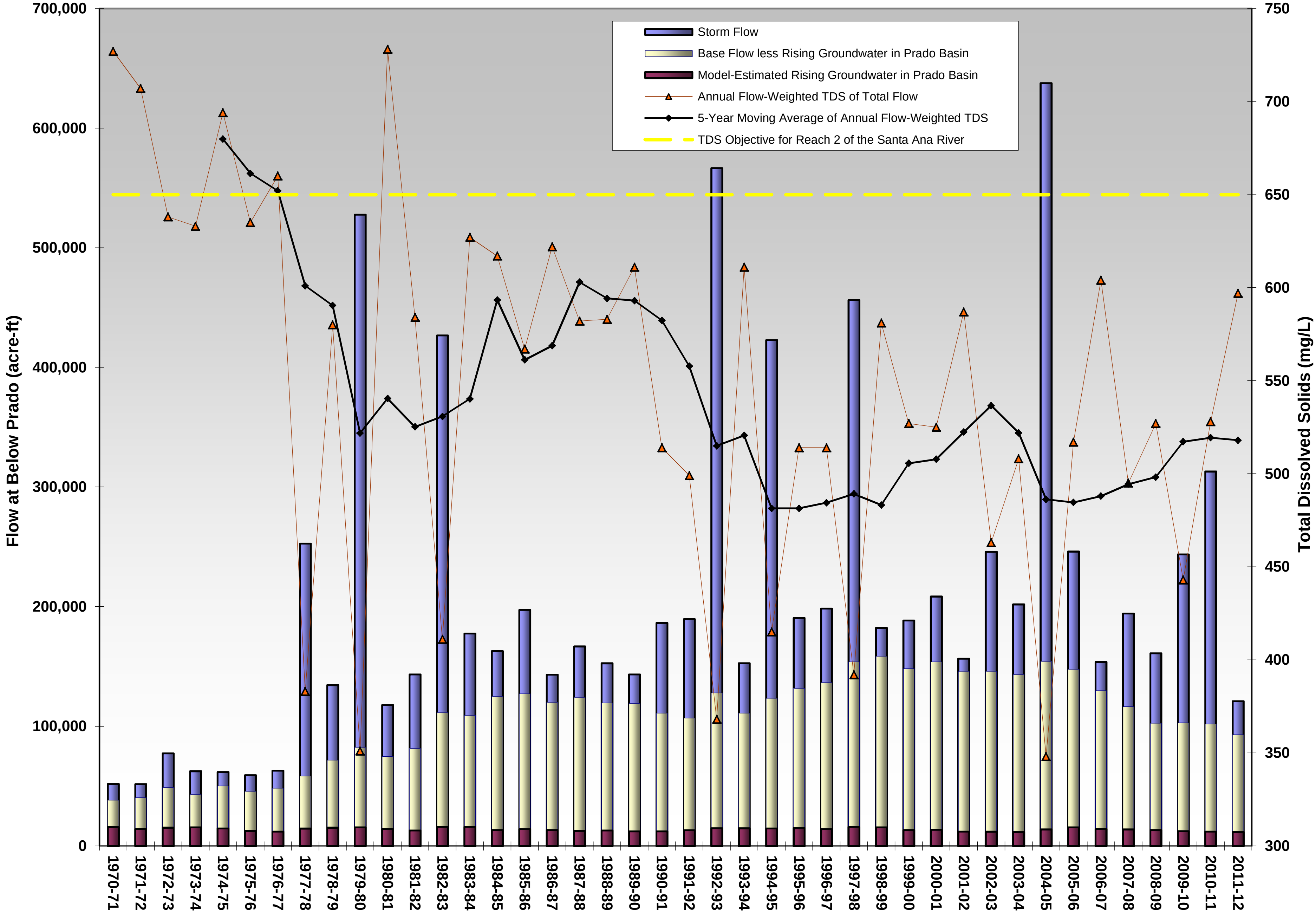
Figure 4-2
TDS and Components of Flow of the Santa Ana River at Below Prado



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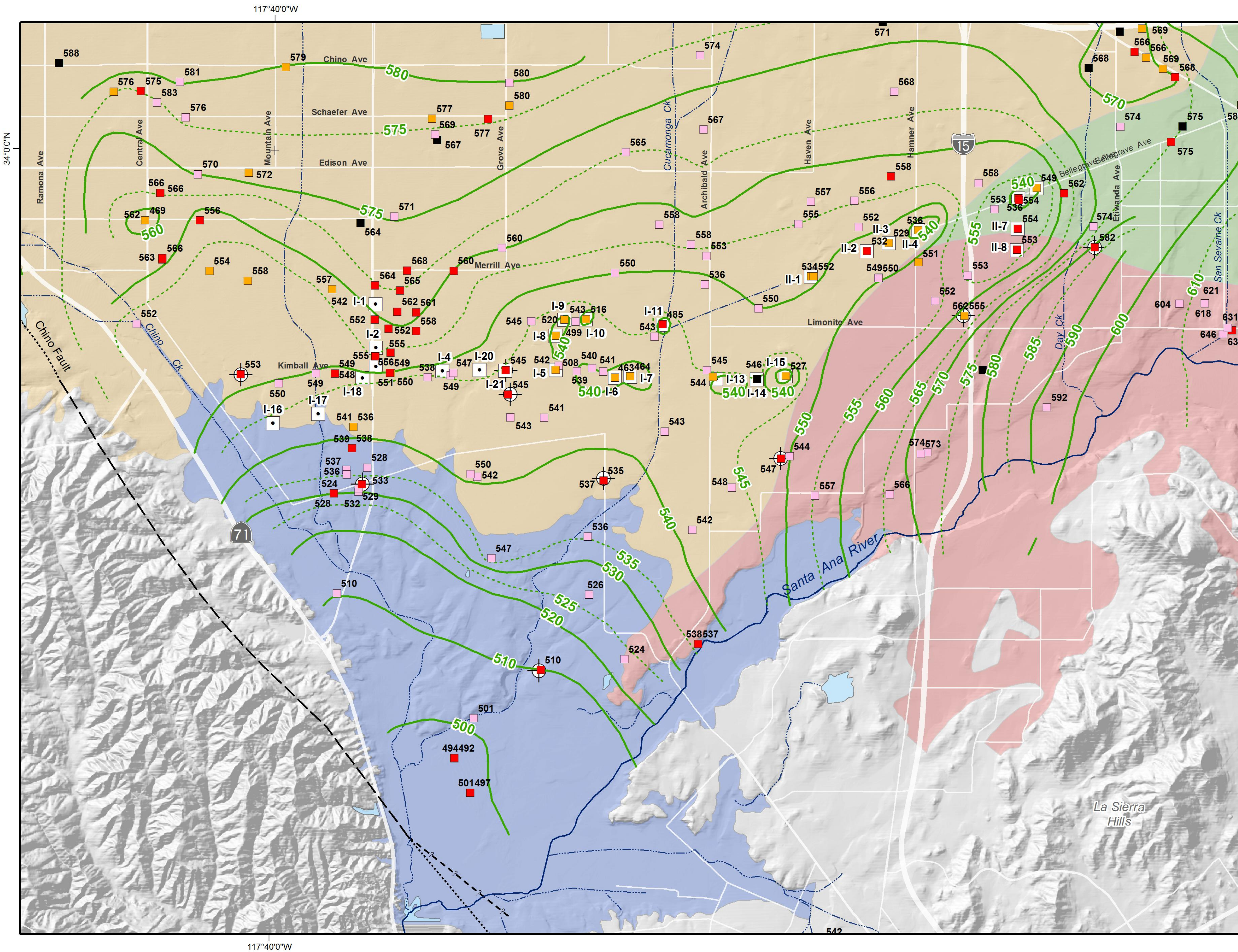
Appendices

Appendix A – State of Hydraulic Control - Spring 2012 - from the 2012 State of the Basin Report

Appendix B – IEUA 5-yr. Volume-Weighted TDS and TIN Computation

Appendix C – HCMP Database



Groundwater Elevation Contours (feet above mean sea-level)

Aquifer Layer Where Well Casing is Perforated Color Code

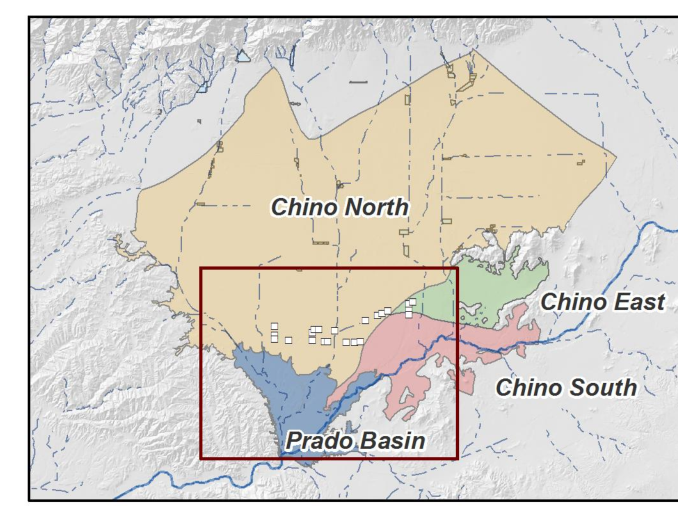
- Layer 1
- Layers 1 & 2
- Layers 1 & 2 & 3
- Unknown Well Construction
- HCMP Monitoring Well
- Chino Desalter Well
- Streams & Flood Control Channels
- Flood Control & Conservation Basins

Maximum Benefit Management Zones

- Chino-North
- Chino-East
- Chino-South
- Prado

Faults

- Location Certain
- Location Approximate
- Approximate Location of Groundwater Barrier
- Location Concealed
- Location Uncertain



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2012 State of the Basin
Groundwater Levels

State of Hydraulic Control in Spring 2012

Shallow Aquifer System

Appendix A

Table No. 1: TDS and NO_3-N Data Table

Month	Volume (acre-feet)				TDS (mg/L)					NO_3-N (mg/L)				
	SW/LR	IW	RW	Total	SW/LR (Mean)	IW	RW	Σ (Vol x TDS)	5-yr Avg	SW/LR (Mean)	IW	RW*	Σ (Vol x TDS)	5-yr Avg
Jul-05	647	1,488	20	2,155	129	189	458	373806		2.9	0.6	2.3	2885	
Aug-05	137	1,545	254	1,936	129	174	447	399909		2.9	0.5	1.6	1564	
Sep-05	299	2,763	268	3,329	129	191	467	691278		2.9	0.4	2.1	2634	
Oct-05	876	2,313	150	3,340	129	205	459	656175		2.9	0.3	1.5	3529	
Nov-05	344	3,567	100	4,010	129	202	455	810393		2.9	0.5	1.8	2800	
Dec-05	669	3,617	77	4,362	129	223	475	929286		2.9	0.6	2.1	4408	
Jan-06	762	3,548	154	4,463	177	276	483	1188208		1.1	0.8	2.8	4015	
Feb-06	1,679	3,467	209	5,355	177	207	451	1109014		1.1	0.8	2.7	5287	
Mar-06	3,177	2,043	0	5,219	95	193	443	697408		0.5	0.8	2.9	3297	
Apr-06	3,337	2,568	0	5,905	115	173	437	827652		0.8	0.6	4.2	4182	
May-06	857	3,190	0	4,046	115	149	442	573690		0.8	0.4	5.4	2025	
Jun-06	216	3,597	73	3,886	115	128	488	520838		0.8	0.3	3.3	1460	
Jul-06	156	956	449	1,561	115	144	455	359551		0.8	0.3	2.3	1459	
Aug-06	182	4,467	619	5,269	115	173	454	1074838		0.8	0.3	2.1	2955	
Sep-06	273	6,749	616	7,638	115	177	427	1488730		0.8	0.4	2.5	4197	
Oct-06	300	6,150	224	6,675	115	170	435	1177526		0.8	0.3	3.6	2969	
Nov-06	296	5,257	93	5,646	115	158	436	905165		0.8	0.5	2.9	2989	
Dec-06	697	5,429	260	6,386	115	271	447	1667416		2.5	0.6	3.4	5918	
Jan-07	543	3,201	160	3,904	115	247	466	927308		2.5	0.8	3.3	4413	
Feb-07	1,140	706	130	1,976	115	301	464	403809		2.5	0.9	4.0	3989	
Mar-07	200	48	117	365	115	295	477	93031		2.5	1.0	3.0	895	
Apr-07	532	4	130	666	115	275	470	123292		2.5	1.0	2.8	1698	
May-07	245	0	182	427	115	244	481	115621		2.5	0.8	4.8	1487	
Jun-07	206	0	10	216	115	249	478	28445		2.5	0.5	3.0	543	
Jul-07	141	0	141	282	329	254	492	115864		0.9	0.5	3.9	683	
Aug-07	197	0	78	275	329	207	475	101948		0.9	0.5	3.3	444	
Sep-07	218	0	143	361	329	220	481	140613		0.9	0.3	3.4	690	
Oct-07	285	0	132	417	366	272	542	175777		0.7	0.4	4.9	865	
Nov-07	915	0	346	1,261	366	278	497	506679		0.7	0.6	3.1	1757	
Dec-07	1,481	0	53	1,534	130	278	506	219871		1.7	0.8	3.8	2667	
Jan-08	4,558	0	1	4,559	86	271	493	392987		0.7	0.9	4.6	3337	
Feb-08	1,427	0	196	1,623	101	248	450	232422		1.5	1.0	3.8	2878	
Mar-08	155	0	360	515	101	275	456	179969		1.5	1.1	3.0	1303	
Apr-08	150	0	260	410	101	281	483	140669		1.5	1.3	3.8	1208	
May-08	588	0	369	957	376	284	481	398503		0.7	0.9	4.8	2190	
Jun-08	128	0	261	389	376	285	490	175914		0.7	0.8	5.8	1612	
Jul-08	142	0	291	433	376	290	489	195594		0.7	0.7	6.0	1854	
Aug-08	111	0	245	356	382	281	465	156409		<0.1	0.7	4.0	982	
Sep-08	99	0	86	185	382	272	467	78001		<0.1	0.4	4.6	402	
Oct-08	161	0	395	556	382	279	487	253867		<0.1	0.5	6.5	2586	
Nov-08	677	0	229	906	432	289	461	398131		0.6	0.6	3.5	1198	
Dec-08	2,363	0	88	2,451	112	289	446	304660		1.1	0.7	4.2	3031	
Jan-09	224	0	356	580	112	287	464	190341		1.1	0.7	3.9	1625	
Feb-09	3,080	0	52	3,132	66	289	413	224746		0.5	0.8	3.3	1698	
Mar-09	299	0	182	481	66	272	434	98661		0.5	0.6	2.6	612	
Apr-09	106	0	311	417	66	273	463	151093		0.5	0.6	2.4	795	
May-09	79	0	156	235	379	284	468	102878		0.5	0.5	2.4	416	
Jun-09	153	0	293	446	379	287	479	198306		0.5	0.5	4.6	1411	
Jul-09	107	0	90	197	379	324	465	82368		0.5	0.6	3.2	344	
Aug-09	113	0	200	313	292	254	446	122229		0.2	0.4	2.9	594	
Sep-09	108	0	296	404	292	235	447	163848		0.2	0.1	2.8	841	
Oct-09	614	17	807	1,438	189	255	455	487420		1.4	0.2	2.9	3205	
Nov-09	489	3	1,210	1,702	189	287	444	629794		1.4	0.5	2.8	4026	
Dec-09	2,851	0	563	3,414	100	255	441	532946		1.0	0.7	2.5	4262	

Appendix B
Five-Year, Volume-Weighted, Total Dissolved Solids (TDS)
and Nitrate as Nitrogen (NO3-N) Concentrations
of Recharge Water Sources in the Chino Basin

Table No. 1: TDS and NO_3-N Data Table

	Volume (acre-feet)				TDS (mg/L)					NO_3-N (mg/L)				
Month	SW/LR	IW	RW	Total	SW/LR (Mean)	IW	RW	Σ (Vol x TDS)	5-yr Avg	SW/LR (Mean)	IW	RW*	Σ (Vol x TDS)	5-yr Avg
Jan-10	4,190	0	473	4,663	68	244	444	496489		0.6	0.7	2.4	3751	
Feb-10	3,715	6	167	3,888	94	235	418	420493		1.3	0.7	3.3	5281	
Mar-10	593	0	612	1,205	94	220	419	311908		1.3	0.8	3.1	2658	
Apr-10	1,156	365	617	2,138	94	220	417	446130		1.3	0.9	2.6	3421	
May-10	179	2,433	1,185	3,797	270	235	423	1121340		0.9	0.8	2.8	5436	
Jun-10	159	2,176	990	3,325	270	232	433	976102	203	0.9	0.6	3.0	4391	1.1
Jul-10	164	0	748	912	270	245	442	374597	205	0.9	0.6	3.2	2544	1.1
Aug-10	183	0	718	901	270	234	434	360817	207	0.9	0.5	3.7	2838	1.1
Sep-10	190	0	836	1,026	309	193	423	411920	208	0.4	0.2	3.6	3088	1.1
Oct-10	670	0	923	1,593	309	244	440	612919	210	0.4	0.1	3.9	3917	1.1
Nov-10	1,156	0	773	1,929	100	267	450	463450	211	1.0	0.4	4.1	4277	1.2
Dec-10	7,036	0	262	7,298	240	248	430	1797782	213	0.7	0.5	3.8	6238	1.1
Jan-11	1,695	0	478	2,173	240	215	430	611254	212	0.7	0.7	4.2	3273	1.2
Feb-11	2,395	0	407	2,802	240	166	422	745176	214	0.7	0.7	4.4	3579	1.2
Mar-11	2,673	0	188	2,861	150	157	413	478632	216	2.2	0.5	4.6	6738	1.2
Apr-11	399	0	751	1,150	150	163	411	368605	221	2.2	0.6	4.6	4313	1.3
May-11	323	3,729	997	5,049	150	143	422	1002210	222	2.2	0.3	3.3	5282	1.3
Jun-11	167	5,736	984	6,887	275	124	422	1172590	222	0.1	0.2	3.4	4521	1.3
Jul-11	244	7,810	706	8,760	275	135	412	1412035	218	0.1	0.5	3.1	5715	1.2
Aug-11	97	7,138	486	7,721	305	129	418	1153623	215	0.8	0.4	2.8	4185	1.2
Sep-11	163	7,529	639	8,331	305	151	413	1450791	213	0.8	0.3	3.8	4772	1.2
Oct-11	888	83	924	1,895	305	136	418	668564	217	0.8	0.2	4.1	4490	1.3
Nov-11	1,174	0	648	1,822	95	135	412	378506	220	1.1	0.3	3.9	3767	1.3
Dec-11	538	0	870	1,408	69	138	411	394455	218	1.1	0.4	4.8	4779	1.4
Jan-12	926	0	826	1,752	73	174	422	416352	218	0.7	0.5	4.8	4600	1.4
Feb-12	1,166	0	664	1,830	73	230	436	374306	218	0.7	0.5	4.3	3698	1.4
Mar-12	2,117	0	381	2,498	73	281	451	325796	216	0.7	0.5	3.4	2825	1.4
Apr-12	1,625	0	367	1,992	73	268	454	285010	215	0.7	0.5	3.9	2598	1.4
May-12	177	0	1,171	1,348	421	282	466	620049	217	1.6	0.7	3.8	4712	1.4
Jun-12	151	0	952	1,103	421	257	454	495353	220	1.6	0.5	3.3	3420	1.4
Jul-12	216	0	547	763	421	249	443	333110	221	1.6	0.5	3.2	2085	1.4
Aug-12	186	0	322	508	371	213	438	209899	221	0.7	0.3	3.3	1173	1.4
Sep-12	154	0	481	635	371	194	439	268173	222	0.7	0.2	3.7	1883	1.4
Oct-12	338	0	615	953	371	223	455	405346	222	0.7	0.1	3.6	2441	1.4
Nov-12	388	0	921	1,309	371	296	456	564333	223	0.7	0.2	4.3	4175	1.4
Dec-12	1928	0	576	2,504	176	270	461	604864	224	4.9	0.3	3.9	11654	1.5

SW/LR (Mean): Stormwater / Local Runoff (Mean) is a monthly average value of all SW/LR data collected during the month. For months without data available, previous month's data is carried down

IW: Imported Water based on monthly Table D data received from the Metropolitan Water District

RW: Recycled Water based on a monthly average of all available RP-1 & RP-4 effluent data and RP-1/RP-4 RW Blend at GenOn Turnout data

* 25% nitrogen loss coefficient has been applied to calculate recycled water nitrate-nitrogen quality per Basin Plan Amendment

Maximum Benefit Water Quality Objectives in Chino North Management Zone for TDS is 420 mg/L and nitrate-nitrogen is 5 mg/L, based on a 5-year running average

Appendix C – HCMP Database