The exhibits in this section show the physical state of the Chino Basin with respect to groundwater levels and change in storage. The groundwater-level data used to generate these exhibits were collected and compiled as part of Watermaster's groundwater-level monitoring program.

Prior to OBMP implementation, there was no formal groundwater-level monitoring program in the Chino Basin. Problems with historical groundwater-level monitoring included an inadequate areal distribution of wells that were monitored, short time histories, questionable data quality, and insufficient resources to develop and conduct a comprehensive program. The OBMP defined a new, comprehensive, basin-wide groundwater-level monitoring program pursuant to *OBMP Program Element 1 – Develop and Implement a Comprehensive Monitoring Program.* The monitoring program has been refined over time to satisfy the evolving needs of the Watermaster and IEUA, such as new regulatory requirements, and to increase efficiency.

The groundwater-level monitoring program supports many Watermaster functions, such as the periodic reassessment of Safe Yield, the monitoring and management of land subsidence, and the assessment of Hydraulic Control. The data are also used to update and re-calibrate Watermaster's computer-simulation groundwater-flow model, to understand directions of groundwater flow, to compute storage changes, to interpret water quality data, and to identify areas of the basin where recharge and discharge are not in balance.

Exhibit 15 shows the locations and measurement frequencies of all wells currently in Watermaster's groundwater-level monitoring program. Water levels are measured at private wells and dedicated monitoring wells by Watermaster staff using manual methods once per month or with pressure transducers that record water levels once every 15 minutes. Water levels are also measured by well owners, including municipal water agencies, private water companies, the California Department of Toxic Substance Control (DTSC), the County of San Bernardino, and various private consulting firms. Typically, water levels are measured by well owners monthly, and Watermaster staff collects these data from the well owners quarterly. All water-level data are checked by Watermaster staff and uploaded to a centralized database management system that can be accessed online through HydroDaVE^{SM}.

The groundwater-level data were used to create groundwater-elevation contour maps for the shallow aquifer system in the Chino Basin for spring 2000 (Exhibit 16), spring 2010 (Exhibit 17), and spring 2012 (Exhibit 18). Groundwater elevations from spring 2010 and spring 2012 were subtracted to generate a map of water-level change over the two-year period since the last State of the Basin analysis (Exhibit 19). Groundwater elevations from spring 2000 and spring 2012 were subtracted to generate a map of water-level change over the twelve-year period since the OBMP and Peace Agreement implementation (Exhibit 20).

Achieving "Hydraulic Control" in the southern portion of Chino Basin is an important objective of Watermaster, IEUA, and the Santa Ana Regional Water Quality Control Board (RWQCB). Hydraulic Control is achieved when groundwater discharge from the Chino-North management zone to Prado Basin is eliminated or reduced to de minimis levels. The RWQCB made Hydraulic Control a commitment for the Watermaster and IEUA in the 2004 Basin Plan Amendment in exchange for relaxed groundwater-quality objectives in Chino-North. These objectives, called "maximum-benefit" objectives allow for the implementation of recycled-water reuse in Chino Basin for both direct use and recharge while simultaneously assuring the protection of beneficial uses of the Santa Ana River. Achieving Hydraulic Control also enhances the yield of the Chino Basin by controlling water levels in the southern portion of the Chino Basin, which has the effect of reducing outflow as rising groundwater and increasing streambed recharge in the Santa Ana River.

Groundwater-level data are used to assess the state of Hydraulic Control. Data are collected from a selected set of "key wells" and are mapped and analyzed annually. Exhibit 21 shows groundwater-elevation contours and data for the shallow aquifer system within the southern portion of the Chino Basin in spring 2000—prior to any significant pumping by the Chino-I Desalter wells. Exhibit 22 shows groundwater-elevation contours and data for the shallow aquifer system in spring 2012—approximately twelve years after the commencement of Chino-I Desalter pumping and six years after the commencement of Chino-II Desalter pumping. These exhibits include a brief interpretation of the state of Hydraulic Control. For an in-depth discussion of Hydraulic Control, see *Chino Basin Maximum Benefit Monitoring Program 2010 Annual Report* (WEI, 2012).

Exhibit 23 shows the location of selected wells across the Chino Basin that have long time-histories of water-levels. The time-histories describe the long-term trends in groundwater levels in the different management zones of the Chino Basin. The wells were selected based on geographic location within the management zone, well-screen intervals, and the length, density, and quality of water-level records. Exhibits 24 through 28 show water-level time-series charts for these wells by management zone for the period of 1978 to 2012. On these exhibits, the behavior of water levels at these wells is compared to climate, groundwater production, and recharge to reveal the cause-and-effect relationships. To show the relationship between groundwater levels and climate, a cumulative departure from mean precipitation (CDFM) plot is shown. Positive sloping lines on the CDFM plot indicate wet years or wet periods. Negatively sloping lines indicate dry years or dry periods. For example, 1978 to 1983 was an extremely wet period, and it is represented by a positively sloping line. Bar charts of annual pumping and artificial recharge by management zone are shown to shown to demonstrate the relationships between groundwater levels and pumping and/or artificial recharge.

The volume of groundwater in storage within an aquifer is a function of the volume of the aquifer materials and the volume of pore space within the aquifer material that will readily yield water under the force of gravity. The change in storage over a particular time period is determined by multiplying the water-level change by the specific yield of the aquifer materials over which the water-level change occurred. Watermaster developed a GIS-based model to estimate groundwater storage changes in two time periods: spring 2000 to spring 2012 (total change in storage since the OBMP and Peace Agreement Implementation), and spring 2010 to spring 2012 (total change in storage since the 2010 SOB Report).

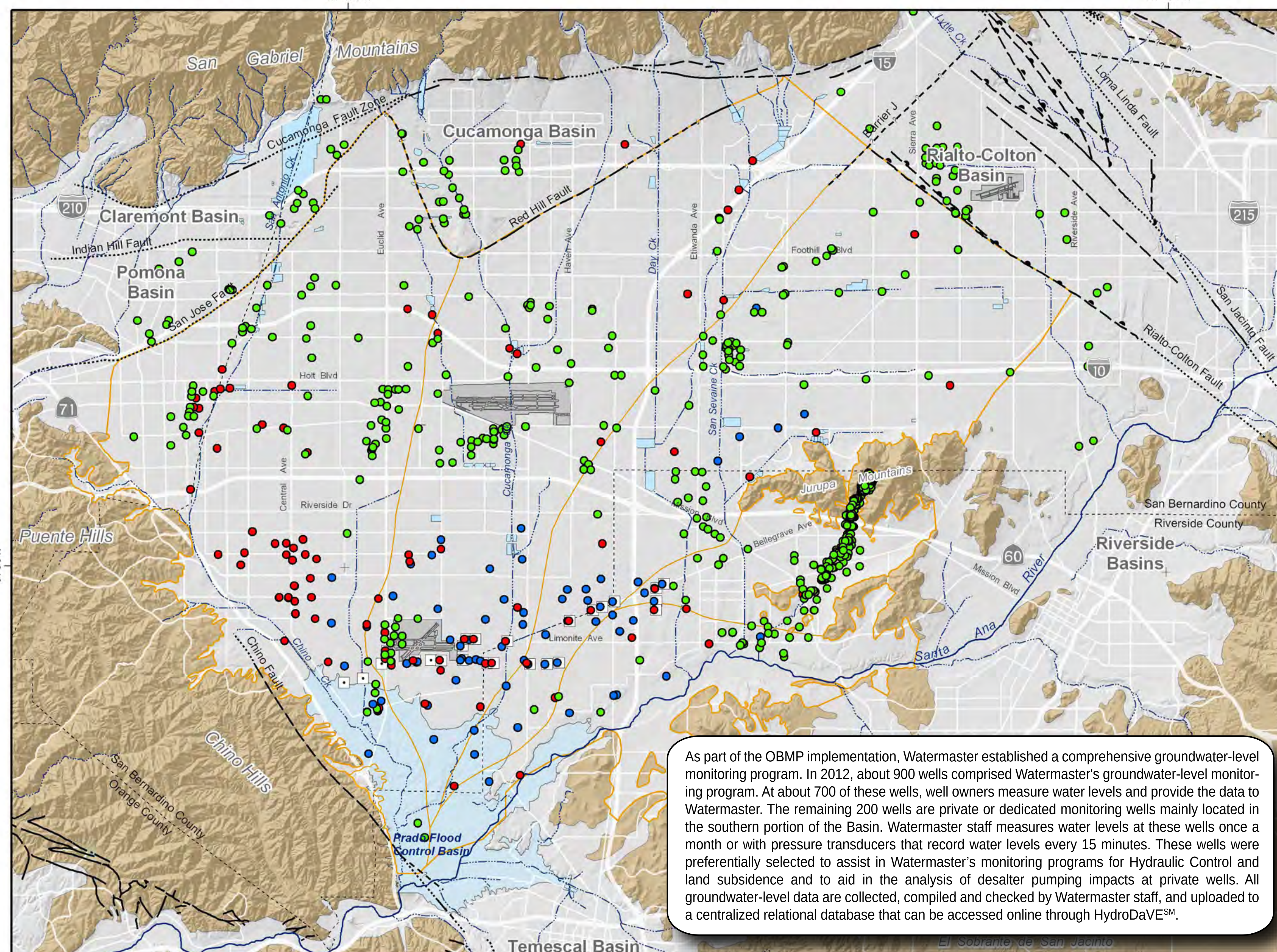
The storage change (ΔS, in acre-feet) for a period is calculated as follows:

$$\text{Change in Storage } (\Delta S) = \Delta WL * SY_{avg} * A$$

Where ΔWL is the change in groundwater elevation for a specific period (feet), SY_{avg} is the thickness-weighted average specific yield of the sediments where the groundwater elevation change occurred, and A is the area (acres) where storage and groundwater elevation have changed.

Exhibit 29 illustrates the change in storage for the period of 2010 to 2012, which was about +23,000 acre-ft. Exhibit 30 illustrates the change in storage for the period of 2000 to 2012, which was about -161,000 acre-ft or about -13,400 acre-ft/yr.

Defined in the OBMP Implementation Plan, the Operational Storage Requirement is the groundwater storage in the Chino Basin that is necessary to maintain Safe Yield, and the Safe Storage is the maximum storage in the Basin that will not cause significant water quality and high-groundwater related problems. The Safe Storage Capacity is the difference between the Operational Storage Requirement and the Safe Storage. Watermaster was required to evaluate the Operational Storage Requirement, Safe Storage, and Safe Storage Capacity of the Chino Basin in FY 2002/2003, and determined that the Operational Storage Requirement is 5,980,000 acre-ft which corresponds to the year 2000 estimate of groundwater in storage— the Safe Storage is 6,480,000 acre-ft., and the Safe Storage Capacity is 500,000 acre-ft (WEI, 2003b). These storage parameters of the Chino Basin have not been evaluated since FY 2002/2003.



As part of the OBMP implementation, Watermaster established a comprehensive groundwater-level monitoring program. In 2012, about 900 wells comprised Watermaster's groundwater-level monitoring program. At about 700 of these wells, well owners measure water levels and provide the data to Watermaster. The remaining 200 wells are private or dedicated monitoring wells mainly located in the southern portion of the Basin. Watermaster staff measures water levels at these wells once a month or with pressure transducers that record water levels every 15 minutes. These wells were preferentially selected to assist in Watermaster's monitoring programs for Hydraulic Control and land subsidence and to aid in the analysis of desalter pumping impacts at private wells. All groundwater-level data are collected, compiled and checked by Watermaster staff, and uploaded to a centralized relational database that can be accessed online through HydroDaVE[SM].

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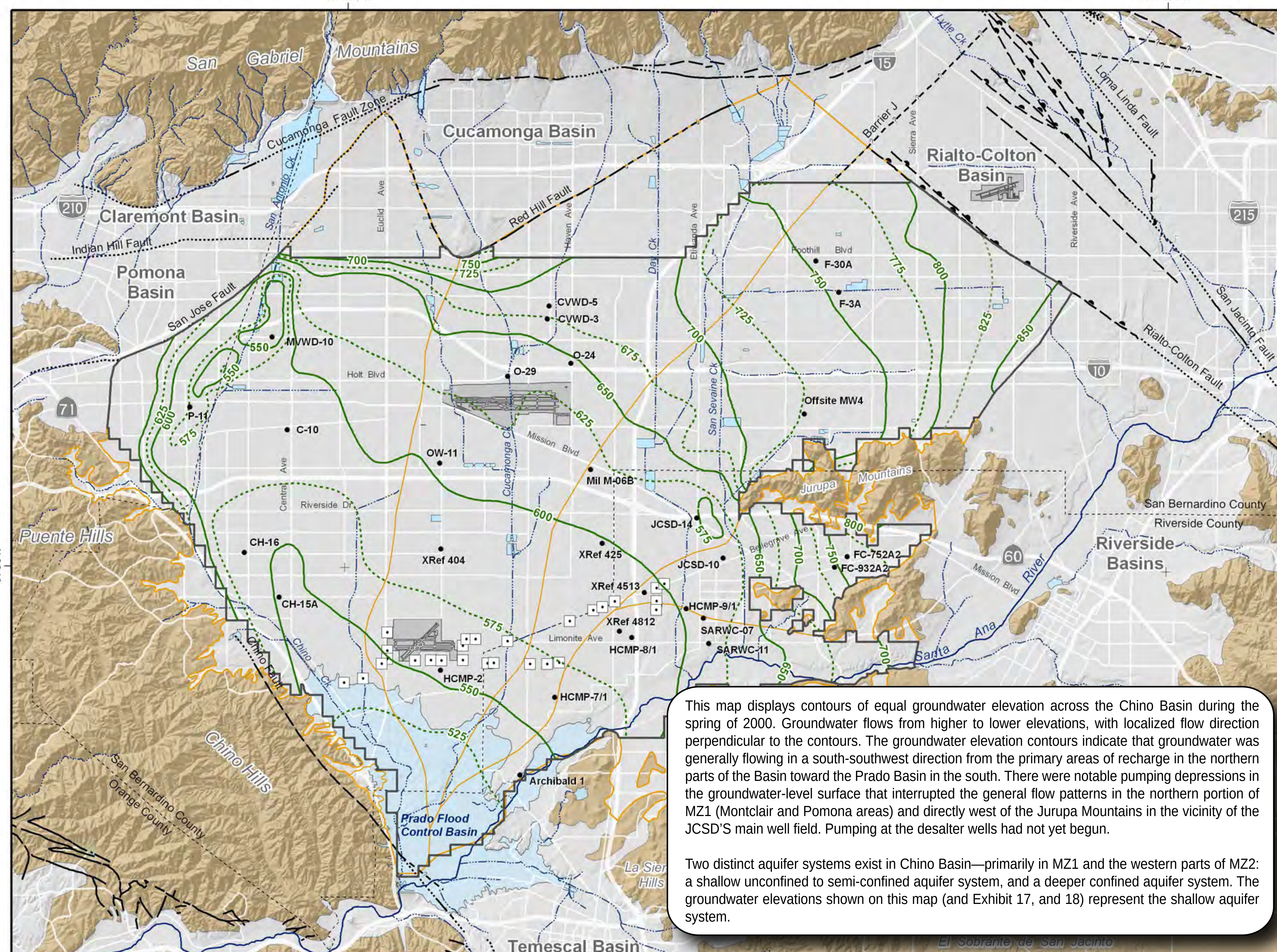
0 1 2 3 4 5 Miles
0 2 4 6 8 KM

2012 State of the Basin
Groundwater Levels

Groundwater Level Monitoring Network

Well Location and Measurement Frequency as of 2012

Exhibit 15



This map displays contours of equal groundwater elevation across the Chino Basin during the spring of 2000. Groundwater flows from higher to lower elevations, with localized flow direction perpendicular to the contours. The groundwater elevation contours indicate that groundwater was generally flowing in a south-southwest direction from the primary areas of recharge in the northern parts of the Basin toward the Prado Basin in the south. There were notable pumping depressions in the groundwater-level surface that interrupted the general flow patterns in the northern portion of MZ1 (Montclair and Pomona areas) and directly west of the Jurupa Mountains in the vicinity of the JCSD'S main well field. Pumping at the desalter wells had not yet begun.

Two distinct aquifer systems exist in Chino Basin—primarily in MZ1 and the western parts of MZ2: a shallow unconfined to semi-confined aquifer system, and a deeper confined aquifer system. The groundwater elevations shown on this map (and Exhibit 17, and 18) represent the shallow aquifer system.

Groundwater Elevation Contours (feet above mean sea-level)

Boundry of Contoured Area (contours are not shown outside of this boundary due to lack of water level data)

Well With a Water-Level Time History Plotted on Exhibits 24 through 28.

OBMP Management Zones

Chino Desalter Wells

Streams & Flood Control Channels

Flood Control & Conservation Basins

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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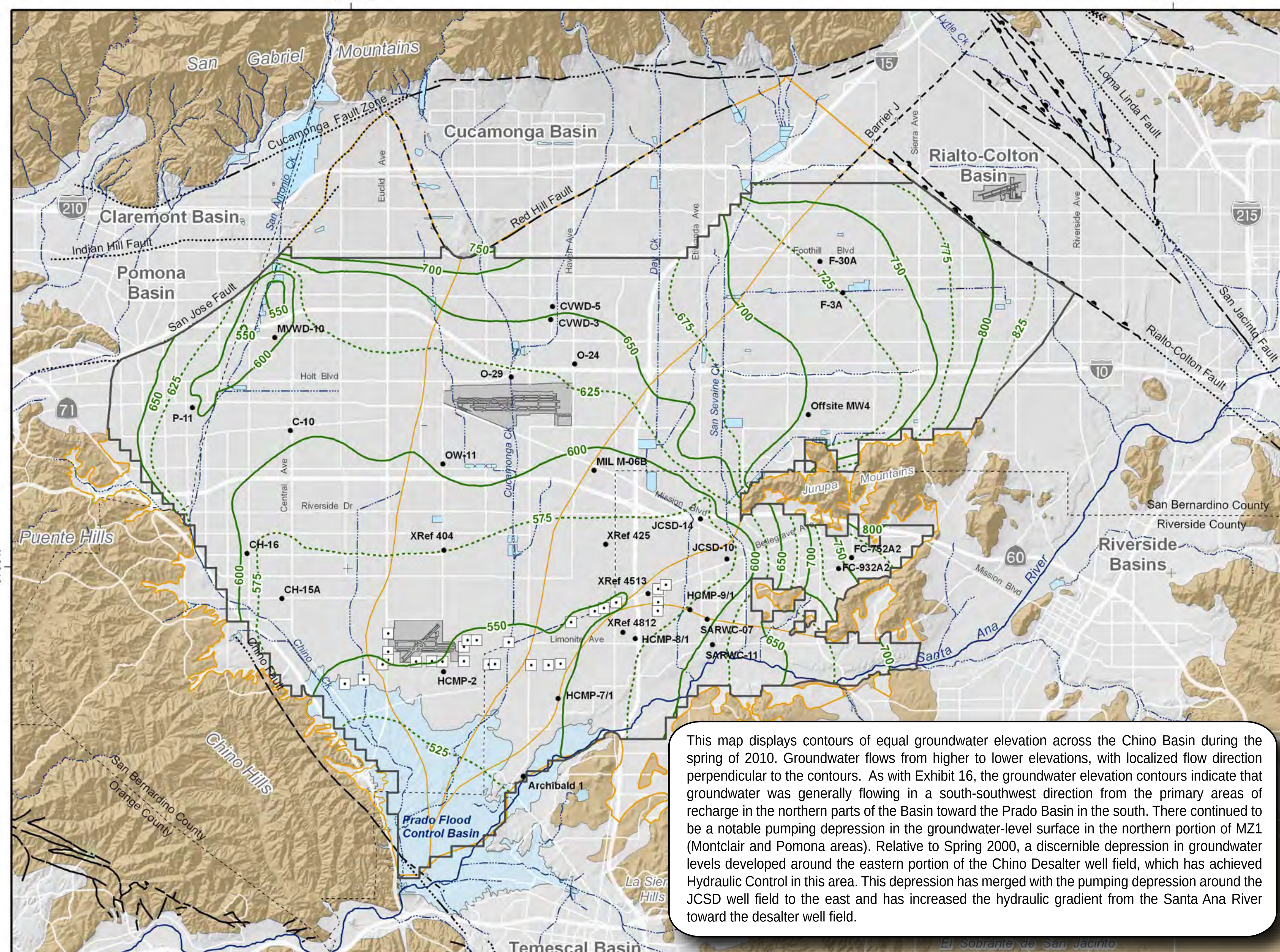
0 1 2 3 4 5 Miles
0 2 4 6 8 KM

2012 State of the Basin
Groundwater Levels

Groundwater Elevation Contours in Spring 2000

Shallow Aquifer System

Exhibit 16



This map displays contours of equal groundwater elevation across the Chino Basin during the spring of 2010. Groundwater flows from higher to lower elevations, with localized flow direction perpendicular to the contours. As with Exhibit 16, the groundwater elevation contours indicate that groundwater was generally flowing in a south-southwest direction from the primary areas of recharge in the northern parts of the Basin toward the Prado Basin in the south. There continued to be a notable pumping depression in the groundwater-level surface in the northern portion of MZ1 (Montclair and Pomona areas). Relative to Spring 2000, a discernible depression in groundwater levels developed around the eastern portion of the Chino Desalter well field, which has achieved Hydraulic Control in this area. This depression has merged with the pumping depression around the JCSD well field to the east and has increased the hydraulic gradient from the Santa Ana River toward the desalter well field.

Groundwater Elevation Contours (feet above mean sea-level)

Boundry of Contoured Area (contours are not shown outside of this boundary due to lack of water level data)

Well With a Water-Level Time History Plotted on Exhibits 24 through 28.

OBMP Management Zones

Chino Desalter Wells

Streams & Flood Control Channels

Flood Control & Conservation Basins

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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0 1 2 3 4 5 Miles

0 2 4 6 8 KM

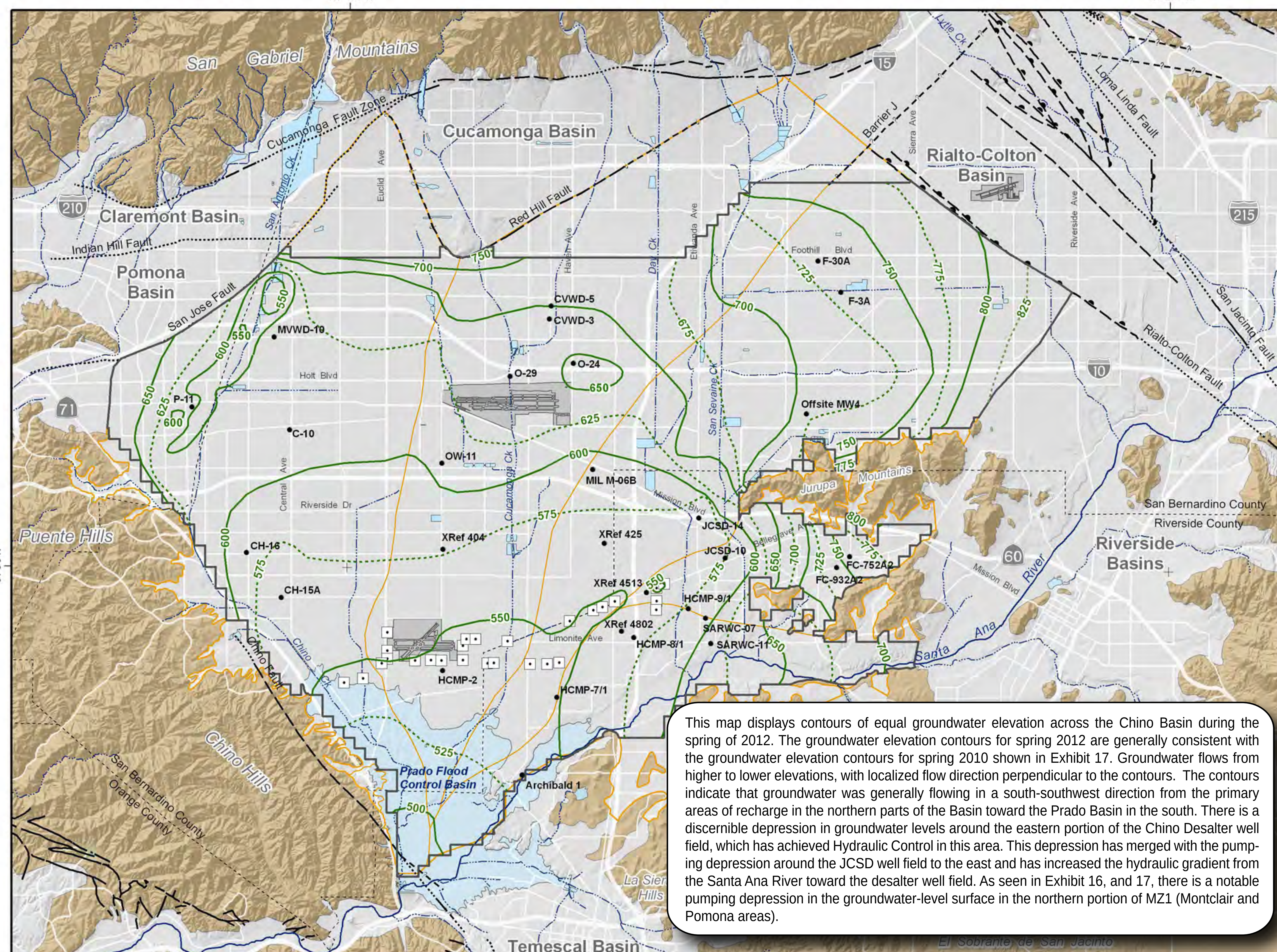
2012 State of the Basin

Groundwater Levels

Groundwater Elevation Contours in Spring 2010

Shallow Aquifer System

Exhibit 17



This map displays contours of equal groundwater elevation across the Chino Basin during the spring of 2012. The groundwater elevation contours for spring 2012 are generally consistent with the groundwater elevation contours for spring 2010 shown in Exhibit 17. Groundwater flows from higher to lower elevations, with localized flow direction perpendicular to the contours. The contours indicate that groundwater was generally flowing in a south-southwest direction from the primary areas of recharge in the northern parts of the Basin toward the Prado Basin in the south. There is a discernible depression in groundwater levels around the eastern portion of the Chino Desalter well field, which has achieved Hydraulic Control in this area. This depression has merged with the pumping depression around the JCSD well field to the east and has increased the hydraulic gradient from the Santa Ana River toward the desalter well field. As seen in Exhibit 16, and 17, there is a notable pumping depression in the groundwater-level surface in the northern portion of MZ1 (Montclair and Pomona areas).

Groundwater Elevation Contours (feet above mean sea-level)

Boundry of Contoured Area (contours are not shown outside of this boundary due to lack of water level data)

Well With a Water-Level Time History Plotted on Exhibits 24 through 28.

OBMP Management Zones

Chino Desalter Wells

Streams & Flood Control Channels

Flood Control & Conservation Basins

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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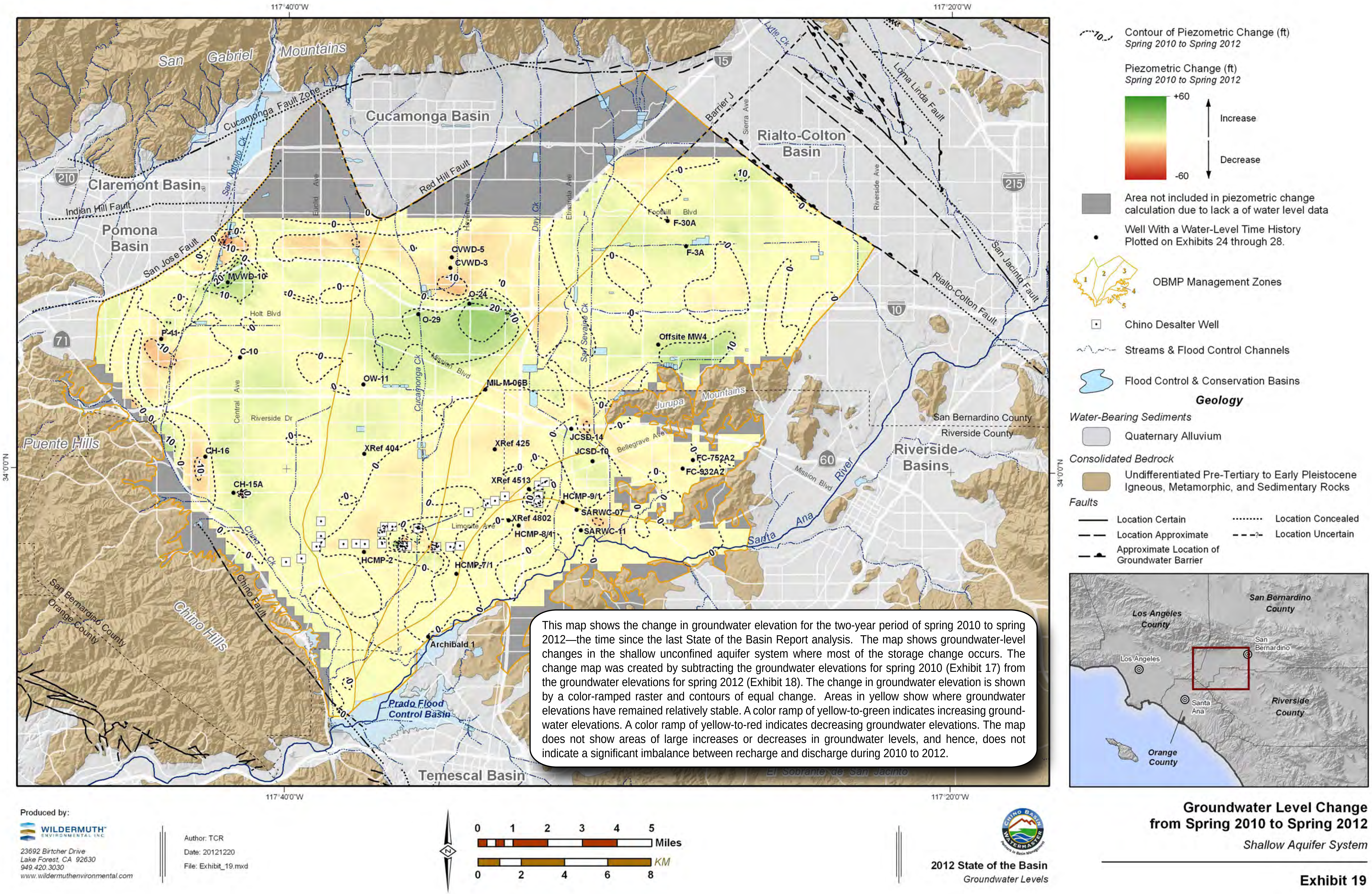
0 1 2 3 4 5 Miles
0 2 4 6 8 KM

2012 State of the Basin
Groundwater Levels

Groundwater Elevation Contours in Spring 2012

Shallow Aquifer System

Exhibit 18



This map shows the change in groundwater elevation for the two-year period of spring 2010 to spring 2012—the time since the last State of the Basin Report analysis. The map shows groundwater-level changes in the shallow unconfined aquifer system where most of the storage change occurs. The change map was created by subtracting the groundwater elevations for spring 2010 (Exhibit 17) from the groundwater elevations for spring 2012 (Exhibit 18). The change in groundwater elevation is shown by a color-ramped raster and contours of equal change. Areas in yellow show where groundwater elevations have remained relatively stable. A color ramp of yellow-to-green indicates increasing groundwater elevations. A color ramp of yellow-to-red indicates decreasing groundwater elevations. The map does not show areas of large increases or decreases in groundwater levels, and hence, does not indicate a significant imbalance between recharge and discharge during 2010 to 2012.

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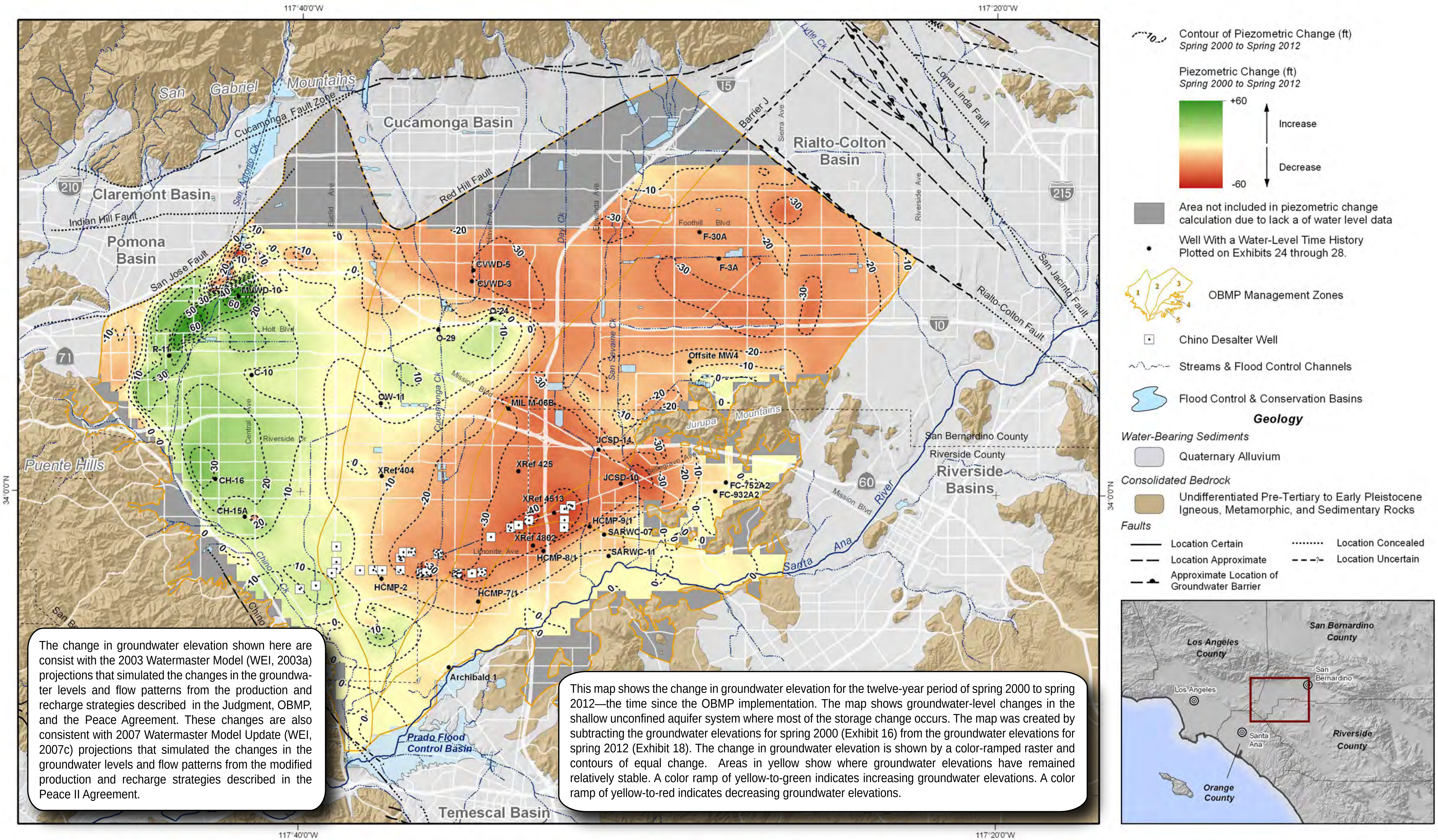
2012 State of the Basin
Groundwater Levels

Groundwater Level Change from Spring 2010 to Spring 2012

Shallow Aquifer System

Exhibit 19



The change in groundwater elevation shown here are consist with the 2003 Watermaster Model (WEI, 2003a) projections that simulated the changes in the groundwater levels and flow patterns from the production and recharge strategies described in the Judgment, OBMP, and the Peace Agreement. These changes are also consistent with 2007 Watermaster Model Update (WEI, 2007c) projections that simulated the changes in the groundwater levels and flow patterns from the modified production and recharge strategies described in the Peace II Agreement.

This map shows the change in groundwater elevation for the twelve-year period of spring 2000 to spring 2012—the time since the OBMP implementation. The map shows groundwater-level changes in the shallow unconfined aquifer system where most of the storage change occurs. The map was created by subtracting the groundwater elevations for spring 2000 (Exhibit 16) from the groundwater elevations for spring 2012 (Exhibit 18). The change in groundwater elevation is shown by a color-ramped raster and contours of equal change. Areas in yellow show where groundwater elevations have remained relatively stable. A color ramp of yellow-to-green indicates increasing groundwater elevations. A color ramp of yellow-to-red indicates decreasing groundwater elevations.

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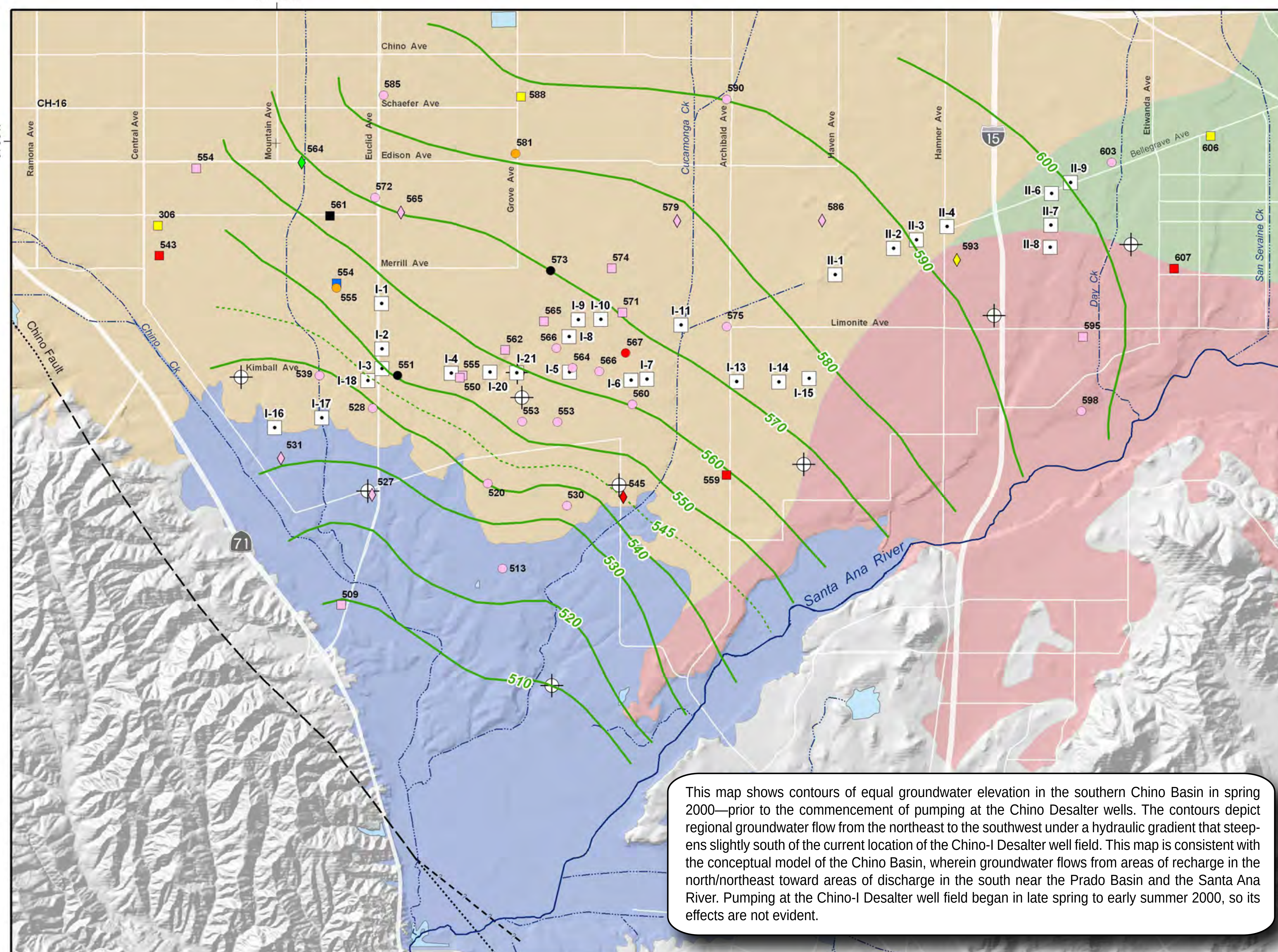
2012 State of the Basin
Groundwater Levels

Groundwater Level Change

Spring 2000 to Spring 2012

Exhibit 20



This map shows contours of equal groundwater elevation in the southern Chino Basin in spring 2000—prior to the commencement of pumping at the Chino Desalter wells. The contours depict regional groundwater flow from the northeast to the southwest under a hydraulic gradient that steepens slightly south of the current location of the Chino-I Desalter well field. This is consistent with the conceptual model of the Chino Basin, wherein groundwater flows from areas of recharge in the north/northeast toward areas of discharge in the south near the Prado Basin and the Santa Ana River. Pumping at the Chino-I Desalter well field began in late spring to early summer 2000, so its effects are not evident.

Groundwater Elevation Contours (feet above mean sea-level)

Water-Level Qualification Symbol Code (Showing Groundwater Elevation)

- Static
- Recovering
- Estimated Static
- Dynamic

Aquifer Layer Where Well Casing is Perforated

- Layer 1
- Layers 1 & 2
- Layer 2
- Layers 2 & 3
- Layer 3
- Layers 1 & 2 & 3
- Unknown Well Construction

- HCMP Monitoring Well (Installed During 2004 and 2005)
- Chino Desalter Well

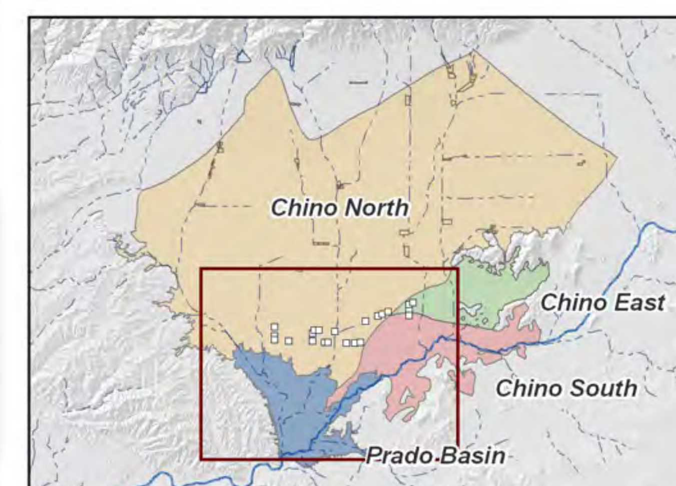
- Streams & Flood Control Channels
- Flood Control & Conservation Basins

Maximum Benefit Management Zones

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

Faults

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



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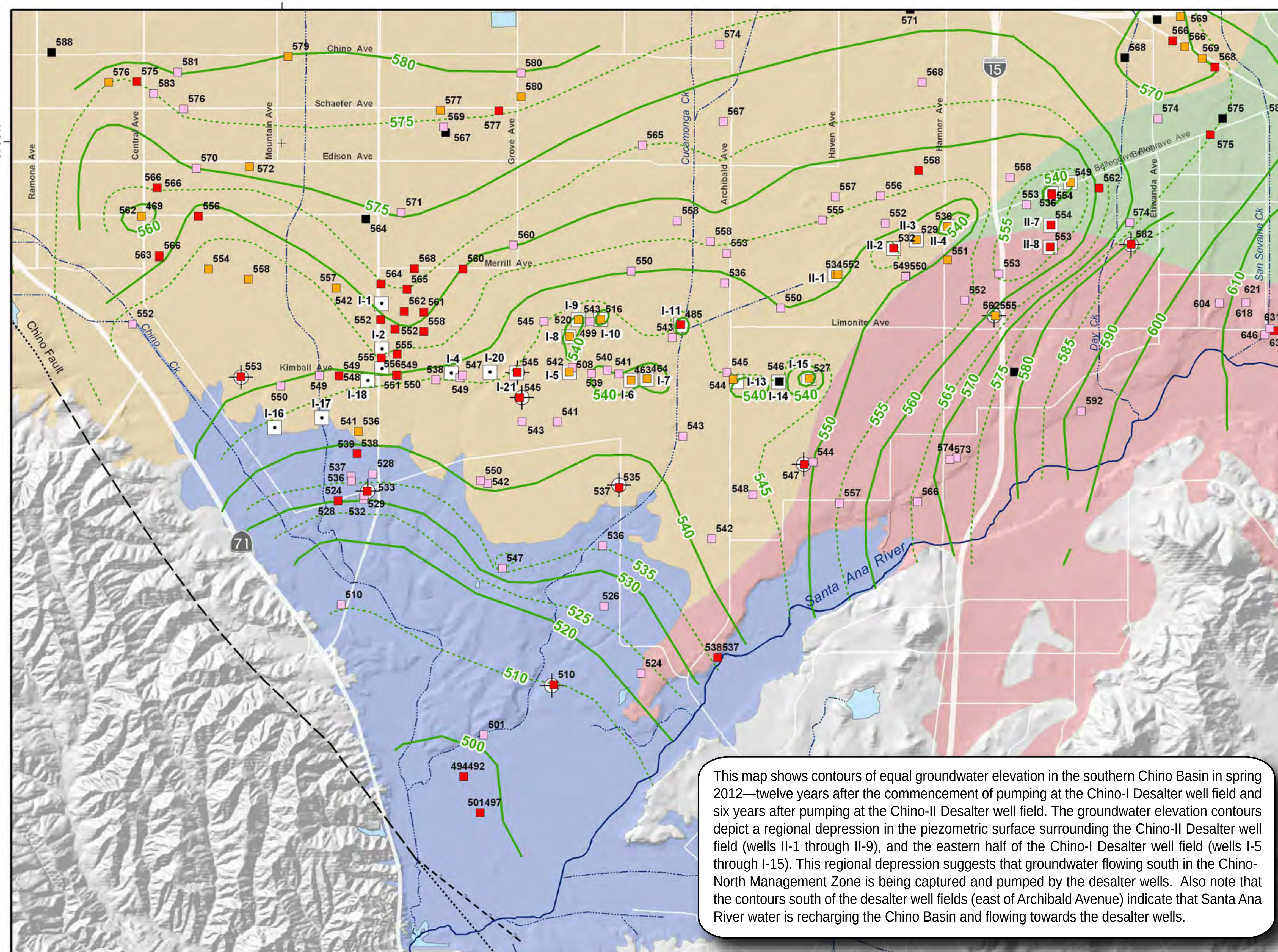
0 1 2 Miles
0 1 2 3 KM

2012 State of the Basin
Groundwater Levels

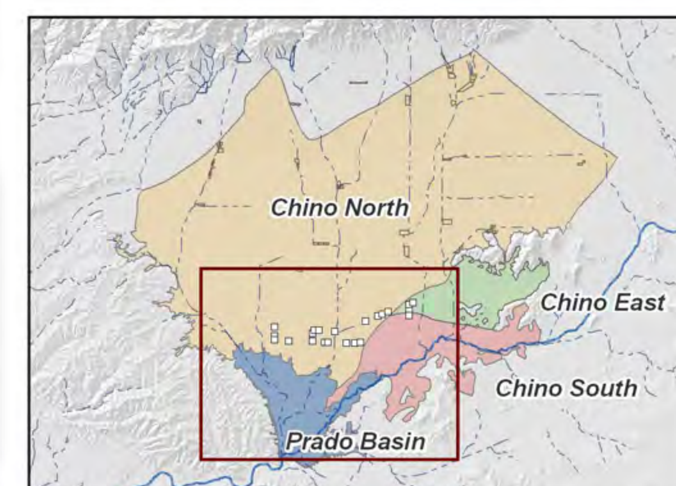
State of Hydraulic Control in Spring 2000

Shallow Aquifer System

Exhibit 21



This map shows contours of equal groundwater elevation in the southern Chino Basin in spring 2012—twelve years after the commencement of pumping at the Chino-I Desalter well field and six years after pumping at the Chino-II Desalter well field. The groundwater elevation contours depict a regional depression in the piezometric surface surrounding the Chino-II Desalter well field (wells II-1 through II-9), and the eastern half of the Chino-I Desalter well field (wells I-5 through I-15). This regional depression suggests that groundwater flowing south in the Chino-North Management Zone is being captured and pumped by the desalter wells. Also note that the contours south of the desalter well fields (east of Archibald Avenue) indicate that Santa Ana River water is recharging the Chino Basin and flowing towards the desalter wells.



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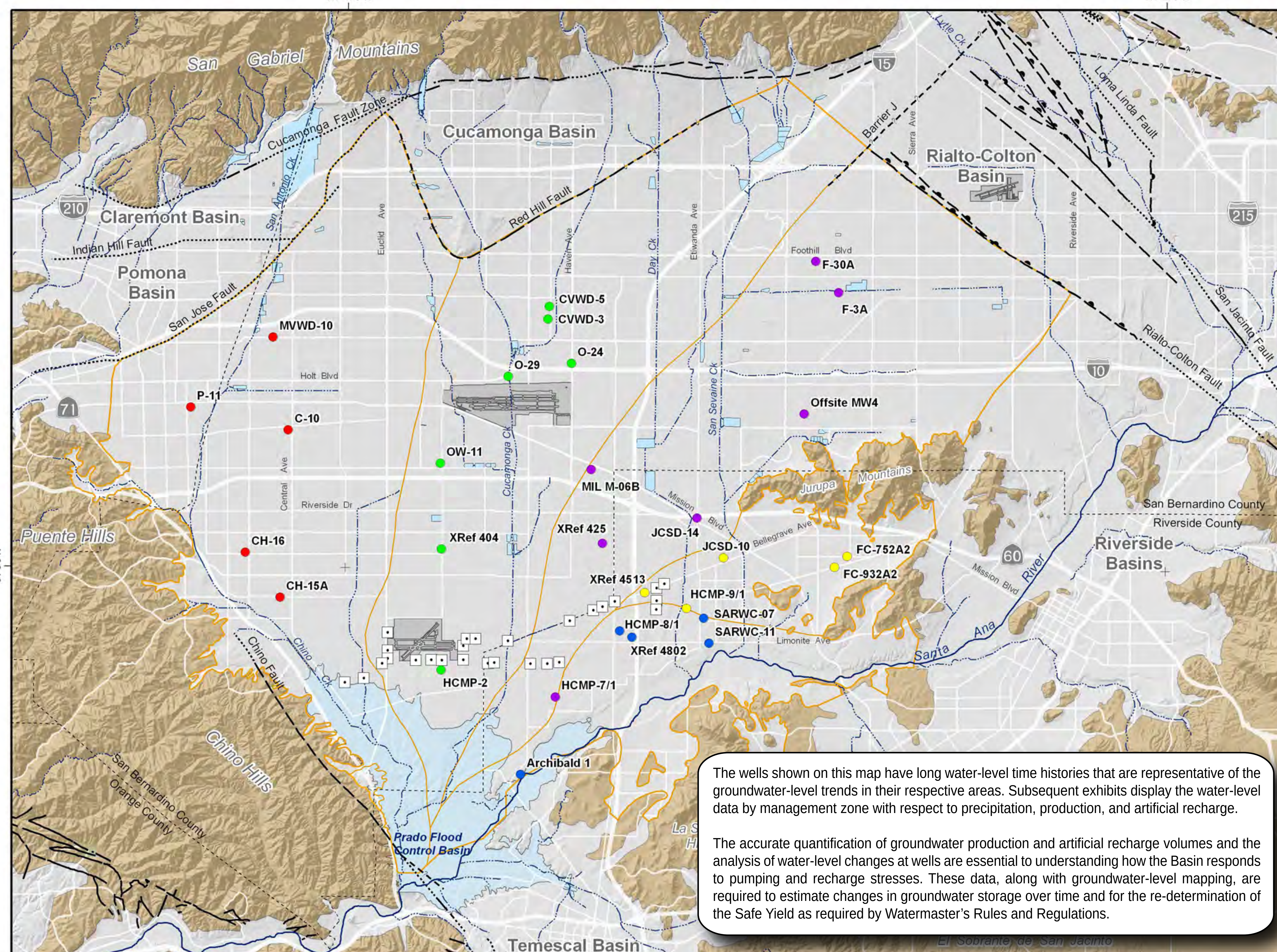
0 1 2 Miles
0 1 2 3 KM

2012 State of the Basin
Groundwater Levels

State of Hydraulic Control in Spring 2012

Shallow Aquifer System

Exhibit 22



The wells shown on this map have long water-level time histories that are representative of the groundwater-level trends in their respective areas. Subsequent exhibits display the water-level data by management zone with respect to precipitation, production, and artificial recharge.

The accurate quantification of groundwater production and artificial recharge volumes and the analysis of water-level changes at wells are essential to understanding how the Basin responds to pumping and recharge stresses. These data, along with groundwater-level mapping, are required to estimate changes in groundwater storage over time and for the re-determination of the Safe Yield as required by Watermaster's Rules and Regulations.

Wells With a Water-Level Time History Plotted on Exhibit 25 through Exhibit 29.

- Wells in MZ1
- Wells in MZ2
- Wells in MZ3
- Wells in MZ4
- Wells in MZ5

OBMP Management Zones

Chino Desalter Well

Streams & Flood Control Channels

Flood Control & Conservation Basins

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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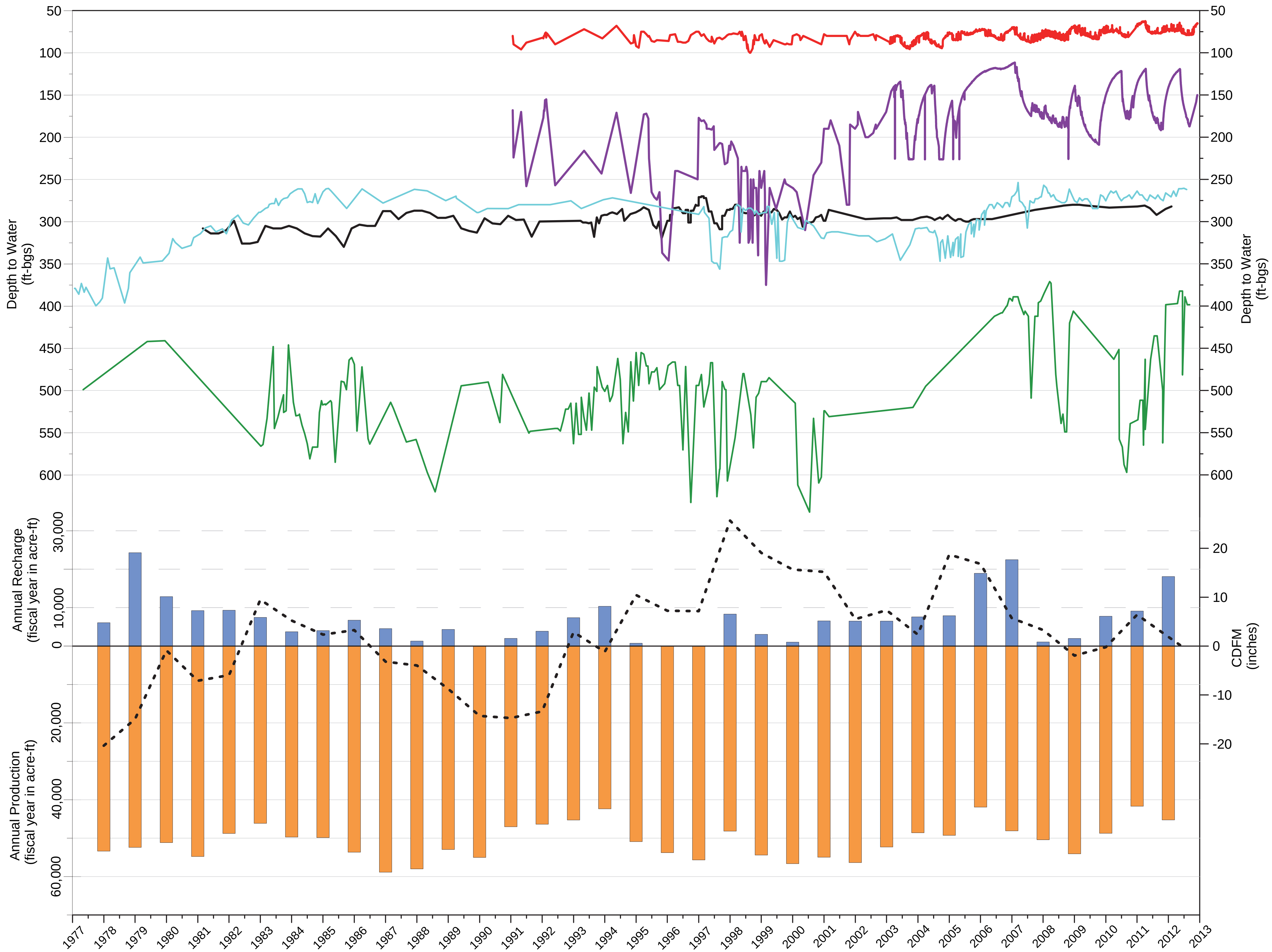
0 1 2 3 4 5 Miles
0 2 4 6 8 KM

2012 State of the Basin
Groundwater Levels

Wells Used to Characterize Long-Term Trends in Groundwater Levels Versus Climate, Production, and Recharge

Exhibit 23



This exhibit is a time-series chart that displays groundwater levels at wells, annual production, and annual artificial recharge to basins, in MZ1, for the time period since the Judgment to FY 2011/2012. Climate is displayed as CDFM precipitation plot using the PRISM data from 1895 to 2012. Upward sloping lines on the CDFM curve indicate wet years or wet periods. Downward sloping lines indicate dry years or dry periods.

Water levels at wells MVWD-10, P-11, and C-10 are representative of groundwater-level trends in the central and northern portions of MZ1. From about 1995 to 2003, water levels generally declined in these areas due to increased production and relatively small volumes of wet water recharge in MZ1. From about 2003 to 2012 water levels increased in this area due to a decrease in production and an increase in artificial recharge to basins in the northern portion of MZ1. The changes in water levels in the central and northern portion of MZ1 since 2003 also coincide with a dry period, and the "put and take" cycle associated with Metropolitan Water District of Southern California's Dry Year Yield storage program in Chino Basin.

Water levels at well CH-16 are representative of groundwater-level trends in the deep, confined aquifer system in the southern portion of MZ1. Water levels at this well are influenced by pumping from nearby wells that are also screened within the deep aquifer system. During the 1990s, water levels at this well declined by up to 200 feet due to increased pumping from the deep aquifer system in this area. From 2000 to 2007, water levels at this well increased primarily due to decreased pumping from the deep aquifer system associated with the implementation of the MZ1 Subsidence Management Plan (WEI, 2007b), and have remained stable since.

Water levels at well CH-15A are representative of groundwater-level trends in the shallow, unconfined aquifer system in the southern portion of MZ1. Historically, water levels in CH-15A have been stable, from 80 to 90 ft-bgs, and showed only small fluctuations in response to nearby pumping. Since 2000, water levels have risen by about 15 feet, which is primarily due to a decrease in local pumping.

Since 2000, generally in MZ1 groundwater levels have increased, annual production has decreased, and annual artificial recharge to basins has increased. The time from 2000 to 2012 was a relatively dry period— as indicated by the CDFM precipitation plot.

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Date: 06/04/2013
File: Exhibit_24.grf

Groundwater Levels at Wells (Perforated Interval Depth)

- MVWD 10 (540-1,084 ft-bgs)
- P-11 (168-550 ft-bgs)
- C-10 (350-1,090 ft-bgs)
- CH-16 (430-940 ft-bgs)
- CH-15A (190-310 ft-bgs)

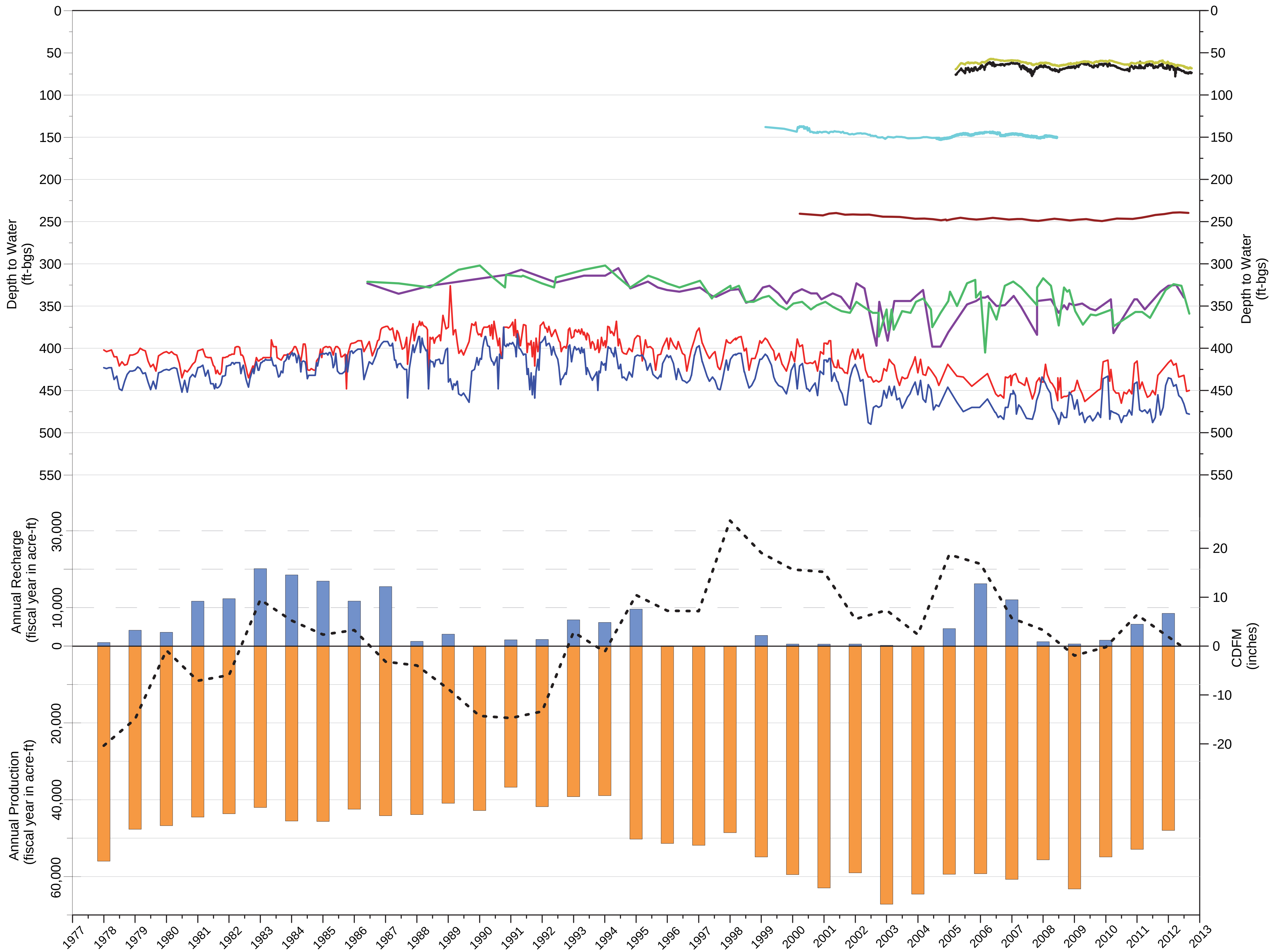
Production, Recharge, and Precipitation

- Recharge of Imported Water and Recycled Water at Basins in MZ1
- Groundwater Production from Wells in the MZ1
- CDFM Precipitation Plot - Data from PRISM 4-km grid for 1895-2012; Spatial Average for Chino Basin

2012 State of the Basin
Groundwater Levels

Time-Series Chart of Groundwater Levels, Production, Recharge, and Climate – MZ1
1978 to 2012

Exhibit 24



This exhibit is a time-series chart that displays groundwater levels at wells, annual production, and annual artificial recharge to basins, in MZ2, for the time period since the Judgment to FY 2011/2012. Climate is displayed as CDFM precipitation plot using the PRISM data from 1895 to 2012. Upward sloping lines on the CDFM curve indicate wet years or wet periods. Downward sloping lines indicate dry years or dry periods.

Water levels at wells CVWD-3 and CVWD-5 are representative of groundwater-level trends in the northern portions of MZ2. Water levels increased from 1978 to about 1990— likely due to a combination of the 1978 to 1983 wet period, decreased production following the execution of the Judgment, and the initiation of artificial recharge of imported water in the San Sevaine and Etiwanda Basins. From 1990 to 2010, water levels in this portion on MZ2 have progressively declined by about 50 feet due to increased production in this region. From 2010 to 2012, water levels have remained relatively stable, likely due to a decreased production and increased recharge at the San Sevaine, and Victoria basins.

Water levels at wells O-29 and O-24 are representative of groundwater-level trends in the upper-central portion of MZ2. The water levels at O-29 and O-24 follow a similar pattern of decrease beginning in 1990 as the seen in wells in the northern portion of MZ2, however since 2010 water levels have increased 10 to 20 feet. This water level increase is prominent in Exhibit 19, which shows the change in groundwater elevation from spring 2010 to spring 2012. This increase is likely due to a decrease in production, and an increase in recharge at the Turner, San Sevaine, and Victoria basins.

Water level data at wells OW-11 and XRef 404 (private well) located in the lower-central portion of MZ2 are representative of trends in this region, which is south of the recharge basins, and north of the pumping influence of the Chino-I Desalter wells. From 2000 to 2012, water levels have remained stable, which indicates a relative balance of recharge and discharge in this area of Chino Basin.

Water levels at wells HCMP-2/1 (shallow aquifer) and HCMP-2/2 (deep aquifer) are representative of groundwater-level trends at the southern portion of MZ2, just south of the Chino-I Desalter wells. One of the objectives of the desalter well field is to draw down water levels in the southern portion of Chino Basin to achieve Hydraulic Control. Chino-I Desalter well field began pumping in late 2000 and steadily increased in production till 2008. The water levels at HCMP-2/1 and HCMP-2/2 have remained relatively stable since the wells were constructed in 2005, which suggests that Hydraulic Control is not yet being achieved in this portion of the desalter well field.

Since 2000, generally in MZ2 groundwater levels have decreased or remained stable, annual production has decreased, and annual recharge to basins has increased. The time from 2000 to 2012 was a relatively dry period— as indicated by the CDFM precipitation plot.

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Groundwater Levels at Wells (Perforated Interval Depth)

- CVWD-5 (538-1,238 ft-bgs)
- CVWD-3 (341-810 ft-bgs)
- O-29 (400-1,095 ft-bgs)
- O-24 (484-952 ft-bgs)
- OW-11 (323-333 ft-bgs)
- X Ref 404 (274-354 ft-bgs)
- HCMP-2/2 (296-316 ft-bgs)
- HCMP-2/1 (124-164 ft-bgs)

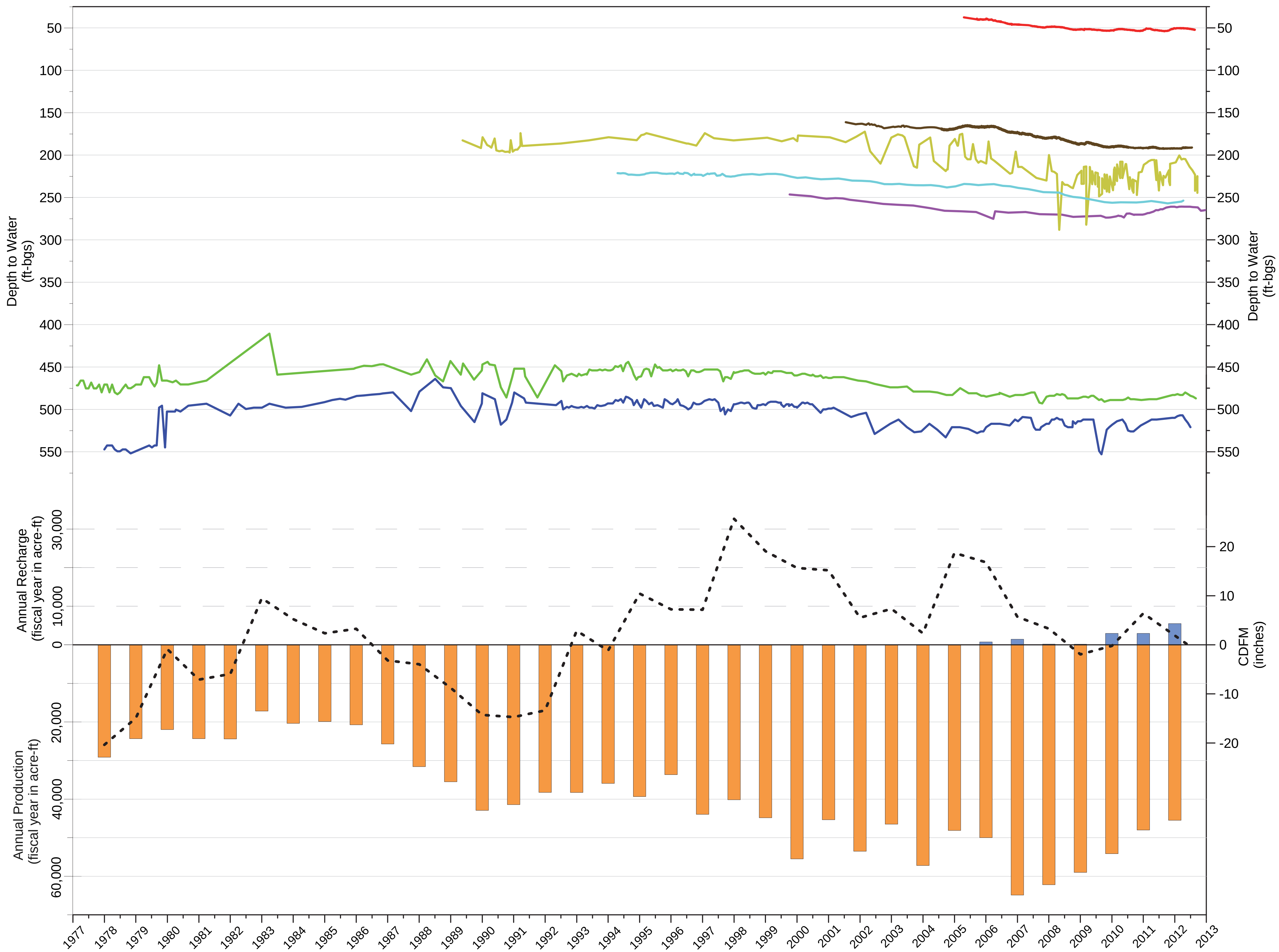
Production, Recharge, and Precipitation

- Recharge of Imported Water and Recycled Water at Basins in MZ2
- Groundwater Production from Wells in the MZ2
- CDFM Precipitation Plot - Data from PRISM 4-km grid for 1895-2012; Spatial Average for Chino Basin

2012 State of the Basin
Groundwater Levels

Time-Series Chart of Groundwater Levels, Production, Recharge, and Climate – MZ2
1978 to 2012

Exhibit 25



This exhibit is a time-series chart that displays groundwater levels at wells, annual production, and annual artificial recharge to basins, in MZ3, for the time period since the Judgment to FY 2011/2012. Climate is displayed as CDFM precipitation plot using the PRISM data from 1895 to 2012. Upward sloping lines on the CDFM curve indicate wet years or wet periods. Downward sloping lines indicate dry years or dry periods.

Water levels at wells F-30A and F-3A are representative of groundwater-level trends in the northeastern portions of MZ3. Water levels were relatively stable from 1978 to about 1995. From 1995 to 2007, water levels declined by approximately 25-30 feet due to a dry climatic period and increased pumping in MZ3. Since 2010, water levels have remained relatively stable.

Water levels at wells Offsite MW4, Mill M-06B, JCSD-14, and XRef 425 (private well) are representative of groundwater-level trends in the central portion of MZ3. From about 1998 to 2010, water levels at these wells progressively declined by about 30 feet due to a dry climatic period and increased pumping in MZ3. From 2010 to 2012 water levels at Mill M-06B, JCSD-14, and XRef 425 have remained relatively stable, and water levels at Offsite MW4 have increased by about 10 feet from 2010 to 2012. The water level increase seen at Offsite MW4 is likely due to improvements to, and the increase of, the recharge of storm water and recycled water at the RP3 recharge basins.

Water levels at well HCMP-7/1 are representative of groundwater-level trends in the southernmost portion of MZ3—just south of the Chino-II Desalter well field and just north of the Santa Ana River. From 2006 to 2012, water levels at this well progressively declined by about 12 feet. This drawdown is mainly due to pumping at the Chino-II Desalter and is necessary for Hydraulic Control to be achieved in this portion of the Chino Basin; and to enhance recharge of the Santa Ana River. See Exhibits 21 and 22 for further explanation of Hydraulic Control.

Since 2000, generally in MZ3 groundwater levels have decreased, annual production has increased, and annual recharge has increased. The time from 2000 to 2012 was a relatively dry period— as indicated by the CDFM precipitation plot.

Groundwater Levels at Wells (Perforated Interval Depth)

- F-30A (507-864 ft-bgs)
- F-3A (380-854 ft-bgs)
- Offsite MW4 (222-282 ft-bgs)
- M-06B (255-275 ft-bgs)
- JCSD-14 (210-370 ft-bgs)
- XRef 425 (no perf data)
- HCMP-7/1 (70-110 ft-bgs)

Production, Recharge, and Precipitation

- Recharge of Imported Water and Recycled Water at Basins in MZ3
- Groundwater Production from Wells in the MZ3
- CDFM Precipitation Plot - Data from PRISM 4-km grid 1895-2012; Spatial Average for Chino Basin

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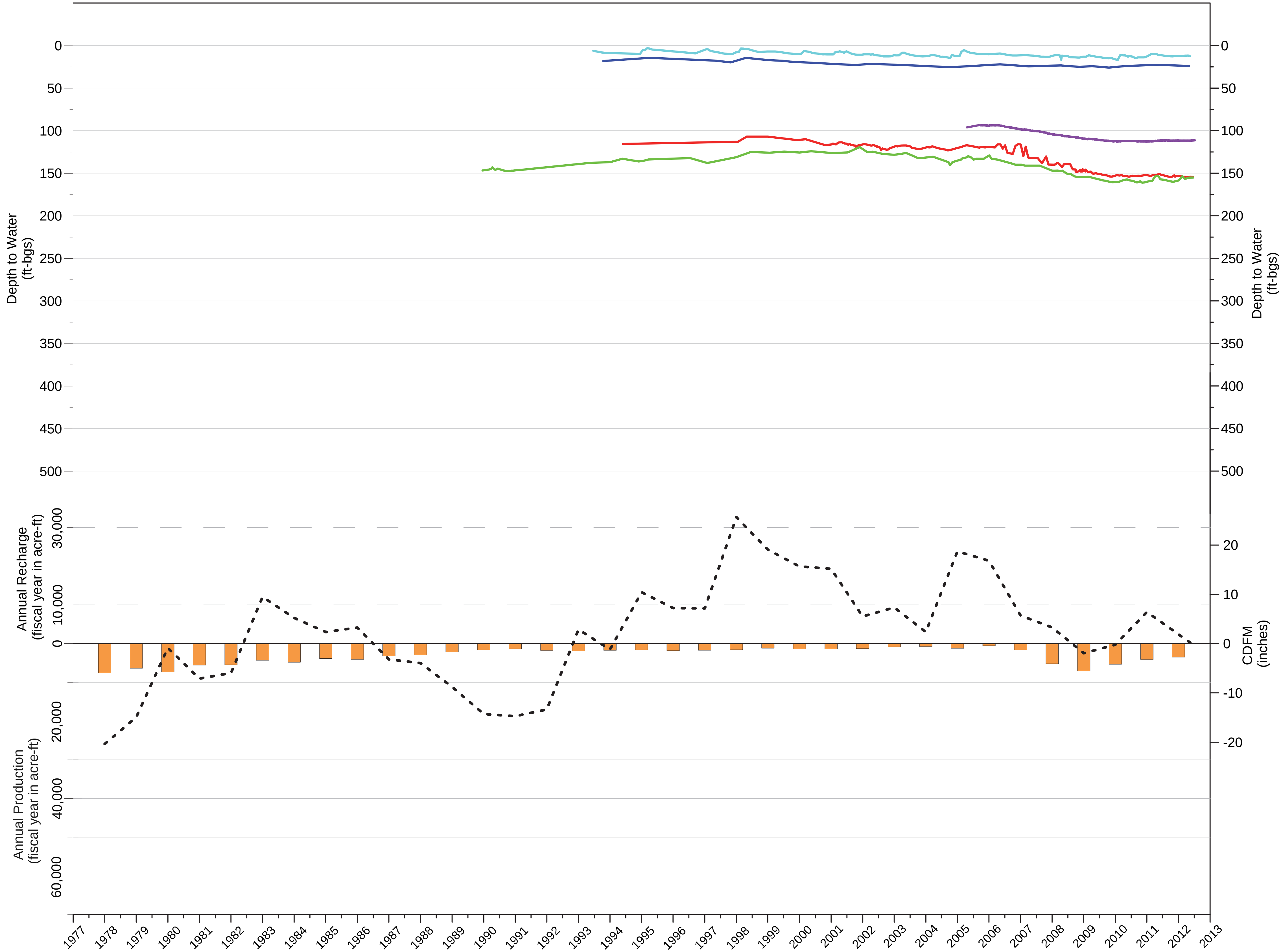
2012 State of the Basin
Groundwater Levels

Time-Series Chart of Groundwater Levels, Production, Recharge, and Climate – MZ3
1978 to 2012

Exhibit 26



This exhibit is a time-series chart that displays groundwater levels at wells, annual production, and annual artificial recharge to basins, in MZ4, for the time period since the Judgment to FY 2011/2012. Climate is displayed as CDFM precipitation plot using the PRISM data from 1895 to 2012. Upward sloping lines on the CDFM curve indicate wet years or wet periods, and downward sloping lines indicate dry years or dry periods.

Water levels at wells JCSD-10, XRef 4513 (private well), and HCMP-9/1 are representative of groundwater-level trends in the western portion of MZ4—in the vicinity of the major well fields of the Jurupa Community Services District (JCSD) and the Chino-II Desalter. Water levels at JCSD-10 and XRef 4513 began to decrease around 2000, and show a notable acceleration in drawdown around 2006 when pumping at Chino-II Desalter wells commenced. A similar decrease is seen in HCMP-9/1, where water levels decreased by about 18 feet since the wells construction in 2005. Overall in this portion of MZ4, water levels have decreased by about 35 feet since 2000, due to a dry climatic period and increased pumping. The drawdown seen at the wells in the eastern portion of MZ4, is necessary for Hydraulic Control to be achieved in this portion of the Chino Basin. See Exhibits 21 and 22 for further explanation of Hydraulic Control. The drawdown in this area is also a concern of JCSD with regard to the production sustainability at their wells.

Water levels at wells FC-752A2 and FC-932A2 are representative of groundwater-level trends in the eastern portion of MZ4. From 2000 to 2012 the water levels at these wells have remained relatively stable.

Since 2000, generally in MZ4 groundwater levels have decreased, and annual production has increased. The time from 2000 to 2012 was a relatively dry period— as indicated by the CDFM precipitation plot.

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Groundwater Levels at Wells (Perforated Interval Depth)

- JCSD-10 (no perf data)
- XRef 4513 (no perf data)
- HCMP-9/1 (110-150 ft-bgs)
- FC-752A2 (no perf data)
- FC-932A2 (no perf data)

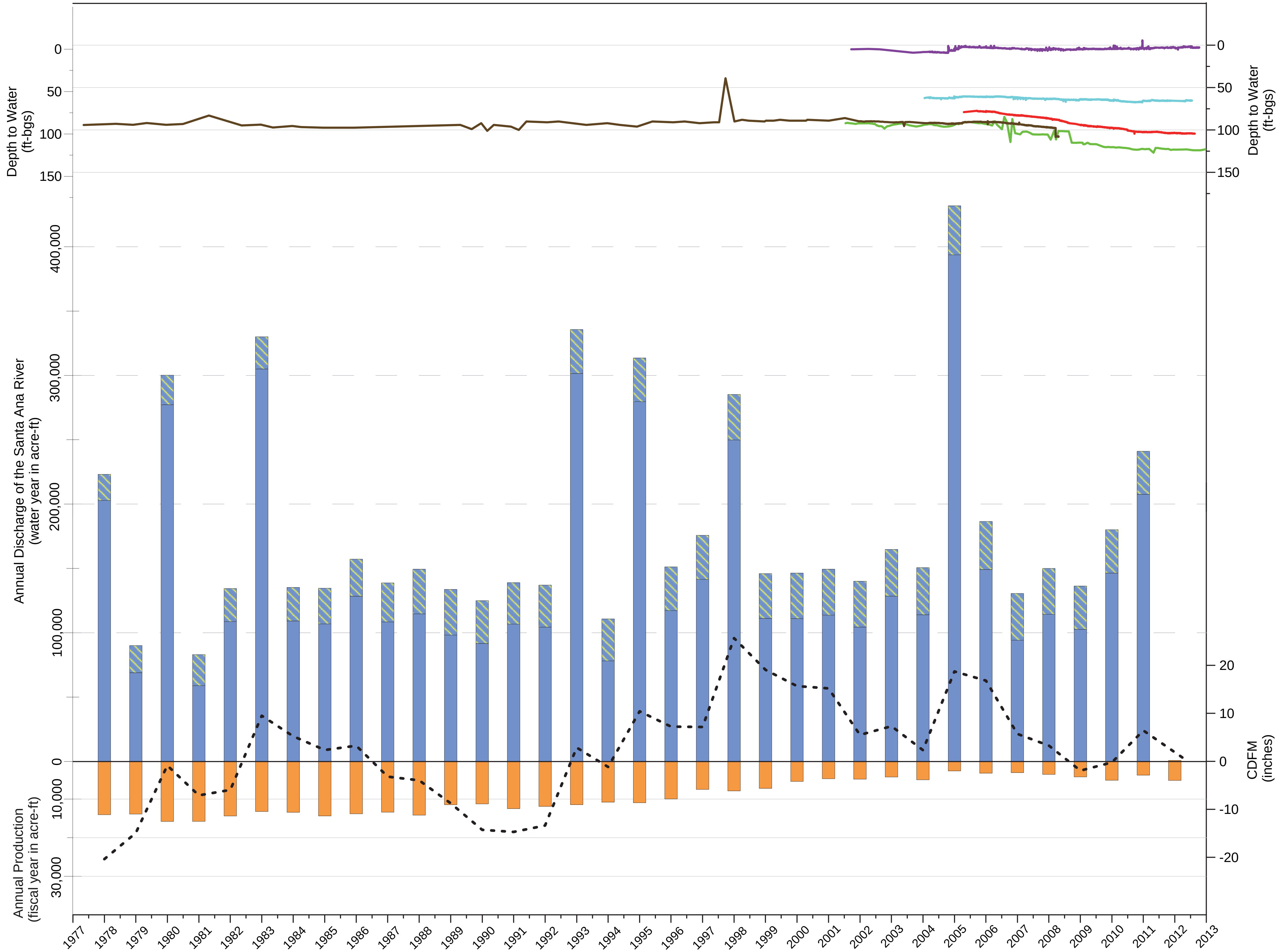
Production, Recharge, and Precipitation

- Recharge of Imported Water and Recycled Water at Basins in MZ4
- Groundwater Production from Wells in the MZ4
- CDFM Precipitation Plot - Data from PRISM 4-km grid for 1895-2012; Spatial Average for Chino Basin

2012 State of the Basin
Groundwater Levels

Time-Series Chart of Groundwater Levels, Production, Recharge, and Climate – MZ4
1978 to 2012

Exhibit 27



This exhibit is a time-series chart that displays groundwater levels and annual production at wells in MZ5, and annual discharge of the Santa Ana River through MZ5, for the time period since the Judgment to FY 2011/2012. Total discharge of the Santa Ana River through the MZ5 area is represented by the total flow measured by the USGS at the *SAR at MWD Xing* station, and the total effluent discharged to the Santa Ana River from the City of Riverside's WWTP. MZ5 is a groundwater flow system that parallels the Santa Ana River. The discharge of the Santa Ana River shown in this chart represents the total potential volume of Santa Ana River water that can recharge the Chino Basin in MZ5. Climate is displayed as CDFM precipitation plot using the PRISM data from 1895 to 2012. Upward sloping lines on the CDFM curve indicate wet years or wet periods. Downward sloping lines indicate dry years or dry periods.

Water levels at wells XRef 4802 (private well), SARWC-07, SARWC-11, and HCMP-8/1 are representative of groundwater levels in the eastern portion of MZ5 where the Santa Ana River is recharging the Chino Basin. From 2005 to 2012, water levels at these wells have progressively declined by about five to 25 feet. This drawdown is consistent with increased pumping at the desalter wells and is a necessary occurrence to achieve Hydraulic Control in this portion of the Chino Basin. This drawdown also indicates that recharge of the Santa Ana River is being enhanced in this vicinity. See Exhibits 21 and 22 for further explanation of Hydraulic Control.

Water levels at the Archibald 1 well are representative of groundwater levels in the southwestern portion of MZ5, where groundwater is very near the ground surface and could be rising to become flow in the Santa Ana River. Water levels at this near-river well have remained relatively stable since monitoring began in 2000.

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Groundwater Levels at Wells (Perforated Interval Depth)

- XRef 4802 (no perf data)
- SARWC-07 (100-172 ft-bgs)
- HCMP-8/1 (75-115 ft-bgs)
- SARWC-11 (75-230 ft-bgs)
- Archibald 1(75-85 ft-bgs)

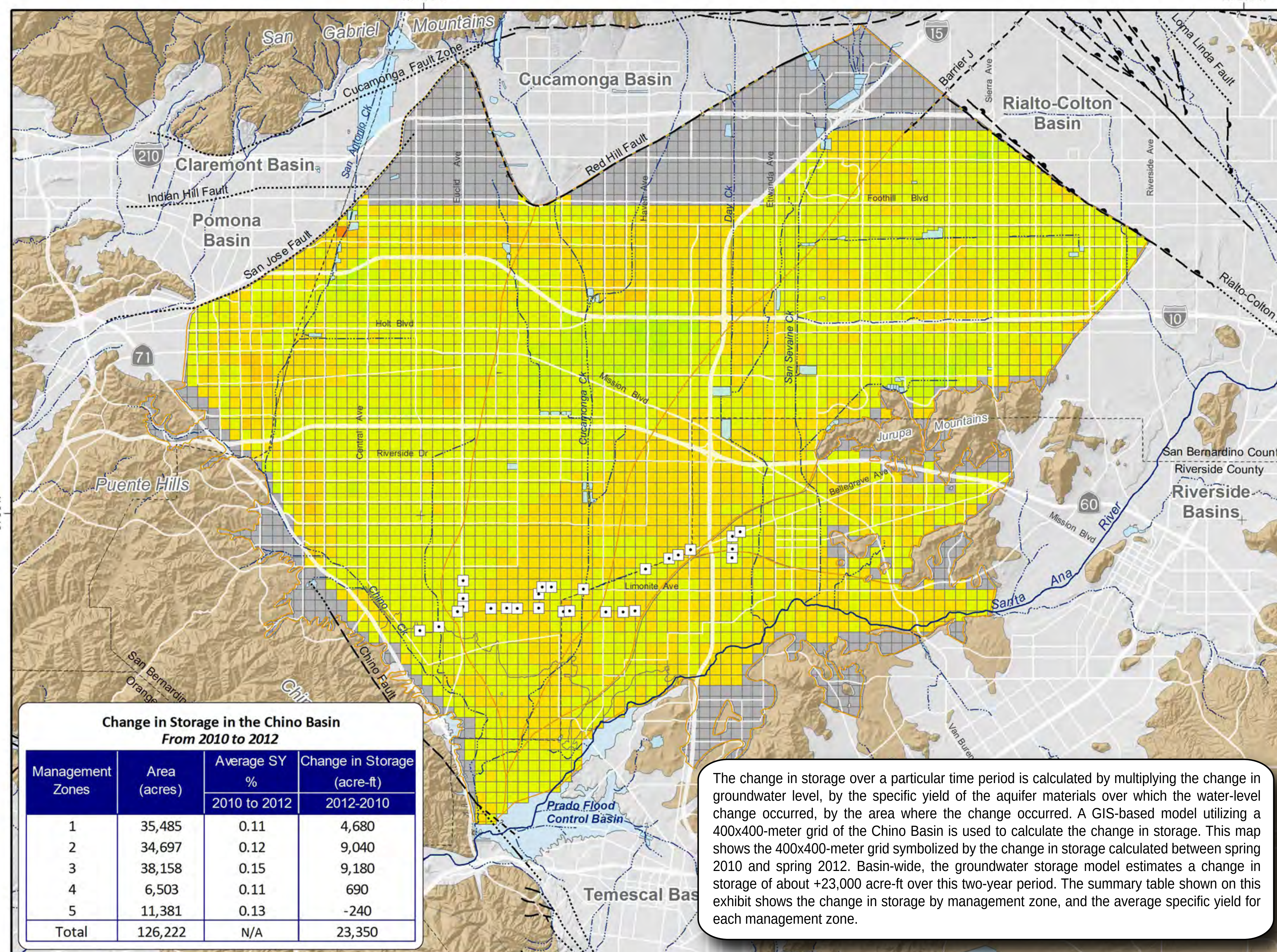
Production, Recharge, and Precipitation

- Flow of the Santa Ana River at MWD *Xing*
- Discharge from the City of Riverside WWTP
- Groundwater Production from Wells in the MZ5
- CDFM Precipitation Plot - Data from PRISM 4-km grid for 1895-2012; Spatial Average for Chino Basin

2012 State of the Basin
Groundwater Levels

Time-Series Chart of Groundwater Levels, Production, Recharge, and Climate – MZ5
1978 to 2012

Exhibit 28



Change in Storage in the Chino Basin
From 2010 to 2012

Management Zones	Area (acres)	Average SY % 2010 to 2012	Change in Storage (acre-ft) 2012-2010
1	35,485	0.11	4,680
2	34,697	0.12	9,040
3	38,158	0.15	9,180
4	6,503	0.11	690
5	11,381	0.13	-240
Total	126,222	N/A	23,350

The change in storage over a particular time period is calculated by multiplying the change in groundwater level, by the specific yield of the aquifer materials over which the water-level change occurred, by the area where the change occurred. A GIS-based model utilizing a 400x400-meter grid of the Chino Basin is used to calculate the change in storage. This map shows the 400x400-meter grid symbolized by the change in storage calculated between spring 2010 and spring 2012. Basin-wide, the groundwater storage model estimates a change in storage of about +23,000 acre-ft over this two-year period. The summary table shown on this exhibit shows the change in storage by management zone, and the average specific yield for each management zone.

Change in Groundwater Storage Grid (acre-ft)

Storage Decrease	*Storage Increase*
> -450	1 - 50
-449 - -400	51 - 100
-399 - -350	101 - 150
-349 - -300	151 - 200
-299 - -250	201 - 250
-249 - -200	251 - 300
-199 - -150	301 - 350
-149 - -100	351 - 400
-99 - -50	401 - 450
-49 - 0	> 450

Cell not included in storage calculation due to lack of water level data in area

OBMP Management Zones

Chino Desalter Well

Streams & Flood Control Channels

Flood Control & Conservation Basins

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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0 1 2 3 4 5 Miles

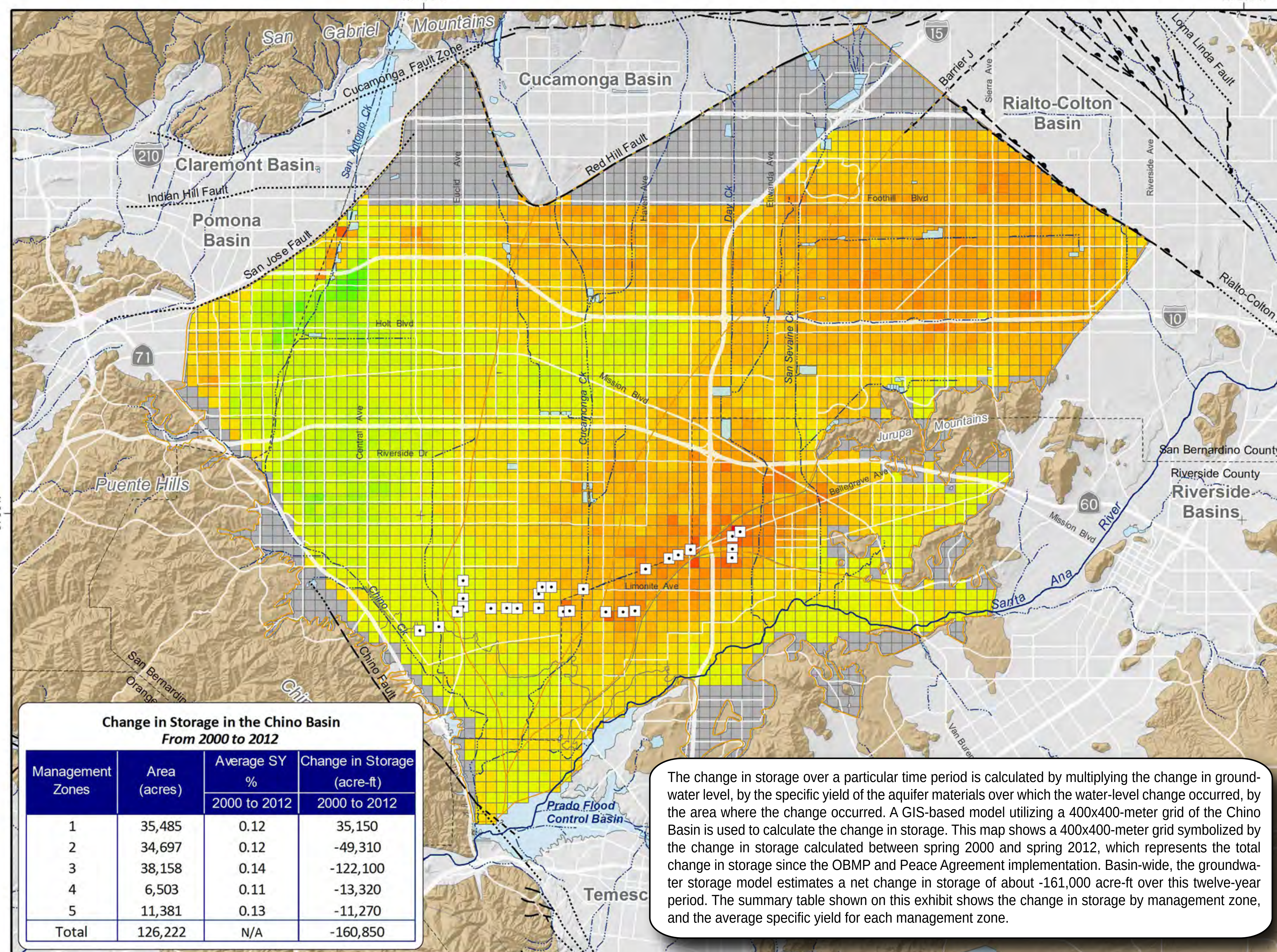
0 2 4 6 8 KM

2012 State of the Basin
Groundwater Levels

Change in Groundwater Storage

Spring 2010 to Spring 2012

Exhibit 29



Change in Storage in the Chino Basin
From 2000 to 2012

Management Zones	Area (acres)	Average SY % 2000 to 2012	Change in Storage (acre-ft) 2000 to 2012
1	35,485	0.12	35,150
2	34,697	0.12	-49,310
3	38,158	0.14	-122,100
4	6,503	0.11	-13,320
5	11,381	0.13	-11,270
Total	126,222	N/A	-160,850

The change in storage over a particular time period is calculated by multiplying the change in groundwater level, by the specific yield of the aquifer materials over which the water-level change occurred, by the area where the change occurred. A GIS-based model utilizing a 400x400-meter grid of the Chino Basin is used to calculate the change in storage. This map shows a 400x400-meter grid symbolized by the change in storage calculated between spring 2000 and spring 2012, which represents the total change in storage since the OBMP and Peace Agreement implementation. Basin-wide, the groundwater storage model estimates a net change in storage of about -161,000 acre-ft over this twelve-year period. The summary table shown on this exhibit shows the change in storage by management zone, and the average specific yield for each management zone.

Change in Groundwater Storage Grid (acre-ft)

Storage Decrease	*Storage Increase*
> -450	1 - 50
-449 - -400	51 - 100
-399 - -350	101 - 150
-349 - -300	151 - 200
-299 - -250	201 - 250
-249 - -200	251 - 300
-199 - -150	301 - 350
-149 - -100	351 - 400
-99 - -50	401 - 450
-49 - 0	> 450

Cell not included in storage calculation due to lack of water level data in area

OBMP Management Zones

Chino Desalter Well

Streams & Flood Control Channels

Flood Control & Conservation Basins

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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0 1 2 3 4 5 Miles
0 2 4 6 8 KM

2012 State of the Basin
Groundwater Levels

Change in Groundwater Storage

Spring 2000 to Spring 2012

Exhibit 30