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

Groundwater-level monitoring was inadequate prior to OBMP implementation. Problems with historical groundwater-level monitoring included an inadequate areal distribution of wells in monitoring programs, short time histories, questionable data quality, and insufficient resources to develop and conduct a comprehensive program. In 2000, 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 fulfill the Watermaster's objectives and to increase efficiency.

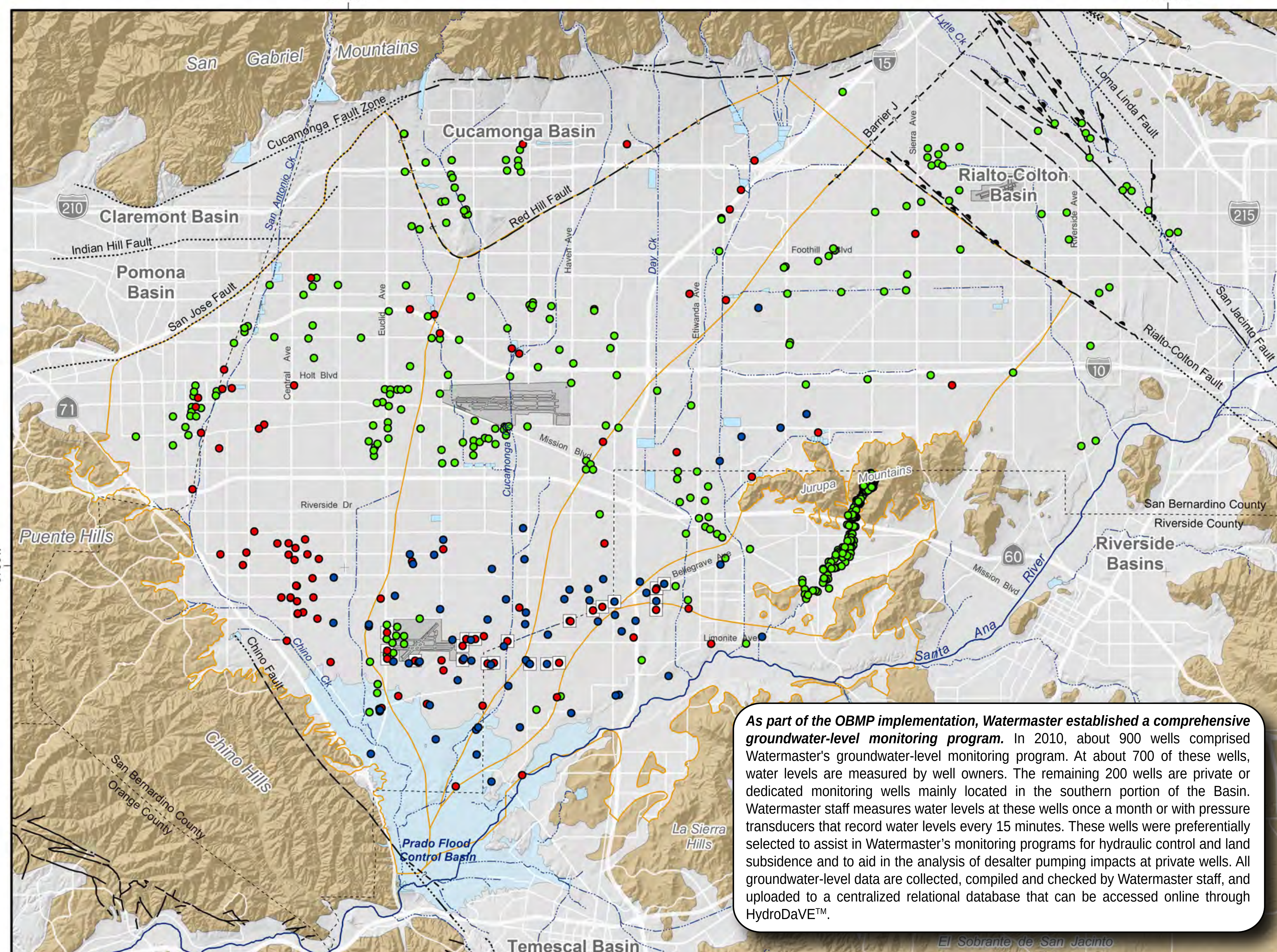
The groundwater-level monitoring program supports many Watermaster functions, such as the periodic reassessment of safe yield, the monitoring and management of land subsidence, and the assessment of hydraulic control. These data are also used to update and recalibrate Watermaster's computer-simulation groundwater-flow model, to understand directions of groundwater flow, to compute storage changes, and to identify areas of the basin where recharge and discharge are not in balance.

Exhibit 14 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, 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 quarterly. All water-level data are checked by Watermaster staff and uploaded to a centralized database that can be accessed online through HydroDaVE™.

Exhibit 15 shows the location of selected wells distributed across the Chino Basin that have long time-histories of water-level data. The wells were selected based on geographic location within the major groundwater flow systems of the Chino Basin, well-screen intervals, and the length, density, and quality of water-level records. Exhibits 16 through 20 show water-level time-series charts for these wells by management zone for the period of 1978 to 2010. 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) curve is shown. Positive sloping lines on the CDFM curve 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. To show the relationships between groundwater levels and pumping and/or artificial recharge, bar charts of pumping and recharge by management zone are shown and described.

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 21) and spring 2010 (Exhibit 22). These contour maps were subtracted to generate a map of water-level change over this ten-year period (Exhibit 23). These exhibits include brief characterizations of groundwater elevation, groundwater flow, and groundwater storage changes during 2000 to 2010.

In the southern portion of the basin, the water-level data is used to assess the state of hydraulic control. Hydraulic control is defined as eliminating groundwater discharge from the Chino-North Management Zone or controlling the discharge to de minimis levels. One of the intended purposes of the Chino Desalter well fields is to intercept (capture) groundwater originating in Chino-North before it discharges to the Prado Basin or the Santa Ana River as surface water. Water-level data is collected from a selected set of "key wells" and analyzed to determine the state of hydraulic control annually. Exhibit 24 shows groundwater-elevation contours and data for the shallow aquifer system within the hydraulic control monitoring area in spring 2000—prior to any significant pumping by the Chino-I Desalter wells. Exhibit 25 shows groundwater-elevation contours and data for the shallow aquifer system in spring 2010—approximately ten years after the commencement of Chino-I Desalter pumping and four years after the commencement of Chino-II Desalter pumping. These exhibits include a brief interpretation of the state of hydraulic control. For a further discussion of hydraulic control, see *Chino Basin Maximum Benefit Monitoring Program 2010 Annual Report* (WEI, 2011a).



As part of the OBMP implementation, Watermaster established a comprehensive groundwater-level monitoring program. In 2010, about 900 wells comprised Watermaster's groundwater-level monitoring program. At about 700 of these wells, water levels are measured by well owners. 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™.

Basin-Wide Groundwater Level Monitoring Program Wells by Measurement Frequency

- Monthly Measurement (68 Wells)
- Measurement by Transducer (130 Wells)
- Owner Measures Water Level (699 Wells)
- 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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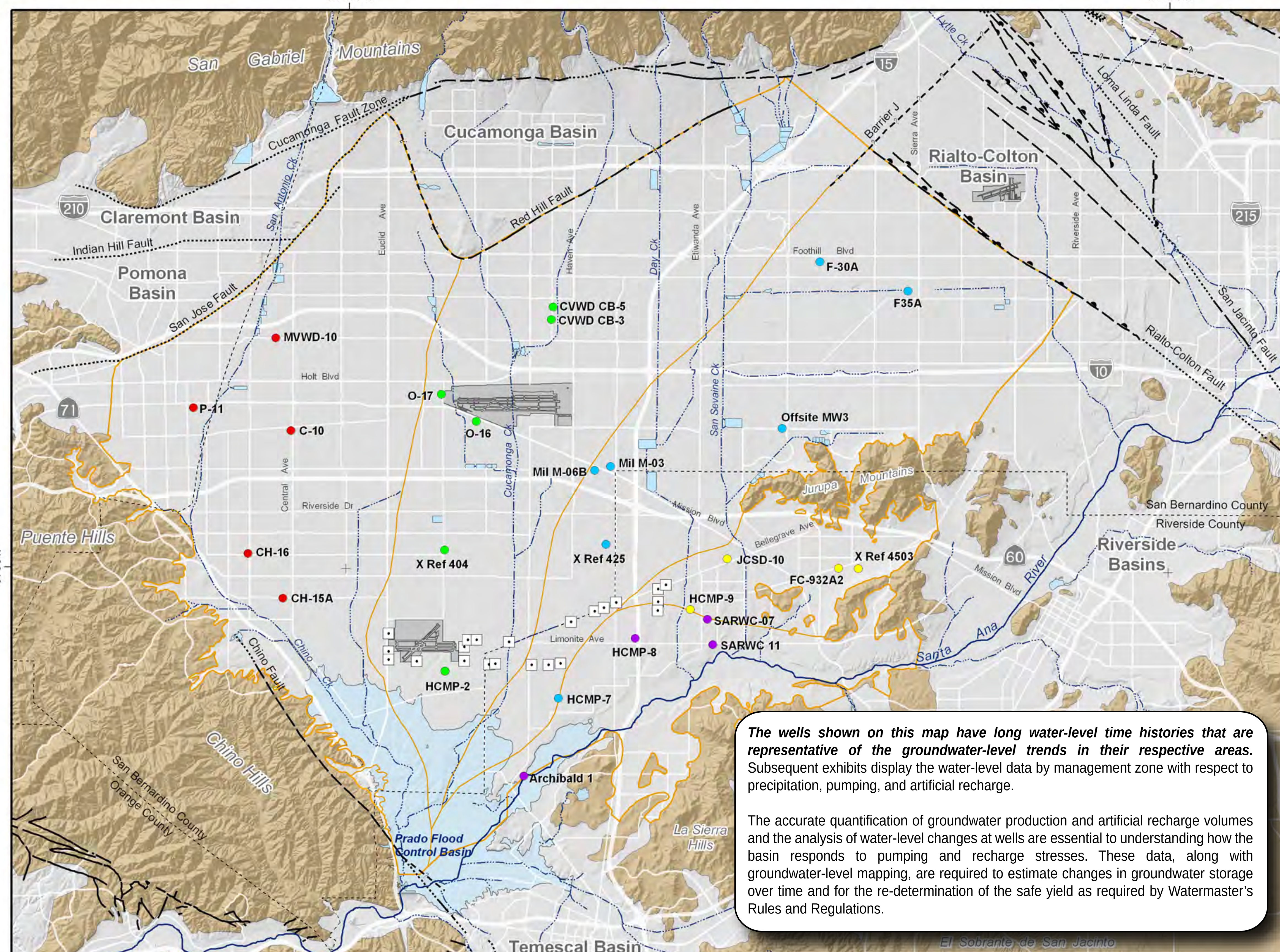
0 1 2 3 4 5 Miles
0 2 4 6 8 KM

2010 State of the Basin
Groundwater Levels

Groundwater Level Monitoring Network

Well Location and Measurement Frequency as of 2010

Exhibit 14



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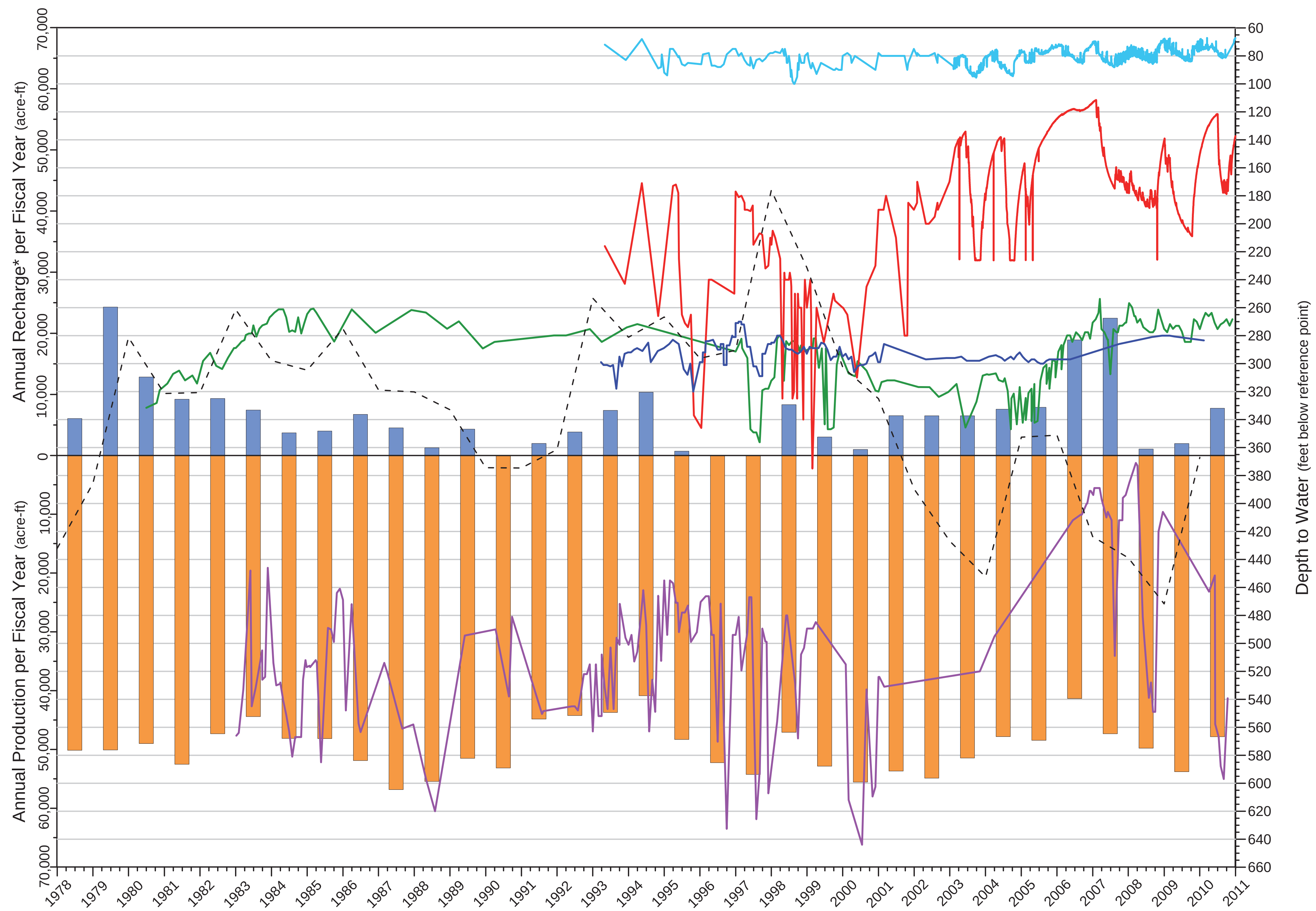
0 1 2 3 4 5 Miles
0 2 4 6 8 KM

2010 State of the Basin
Groundwater Levels

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

Exhibit 15



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 pumping and relatively small volumes of wet water recharge in MZ1. From about 2003 to 2007, water levels increased in these areas; from 2007 to 2010, water levels generally decreased in these areas. The changes in water levels since 2003 coincide with and are likely due to above average precipitation in 2005 and a "put and take" cycle associated with Metropolitan Water District of Southern California's Dry Year Yield 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 2010, 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).

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 10 feet, which is primarily due to a decrease in nearby pumping.

* Recharge includes imported water and recycled water delivered to recharge basins, and does not include in-lieu replenishment water.

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MZ1 Water Levels (top-bottom of well screen)
- 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)

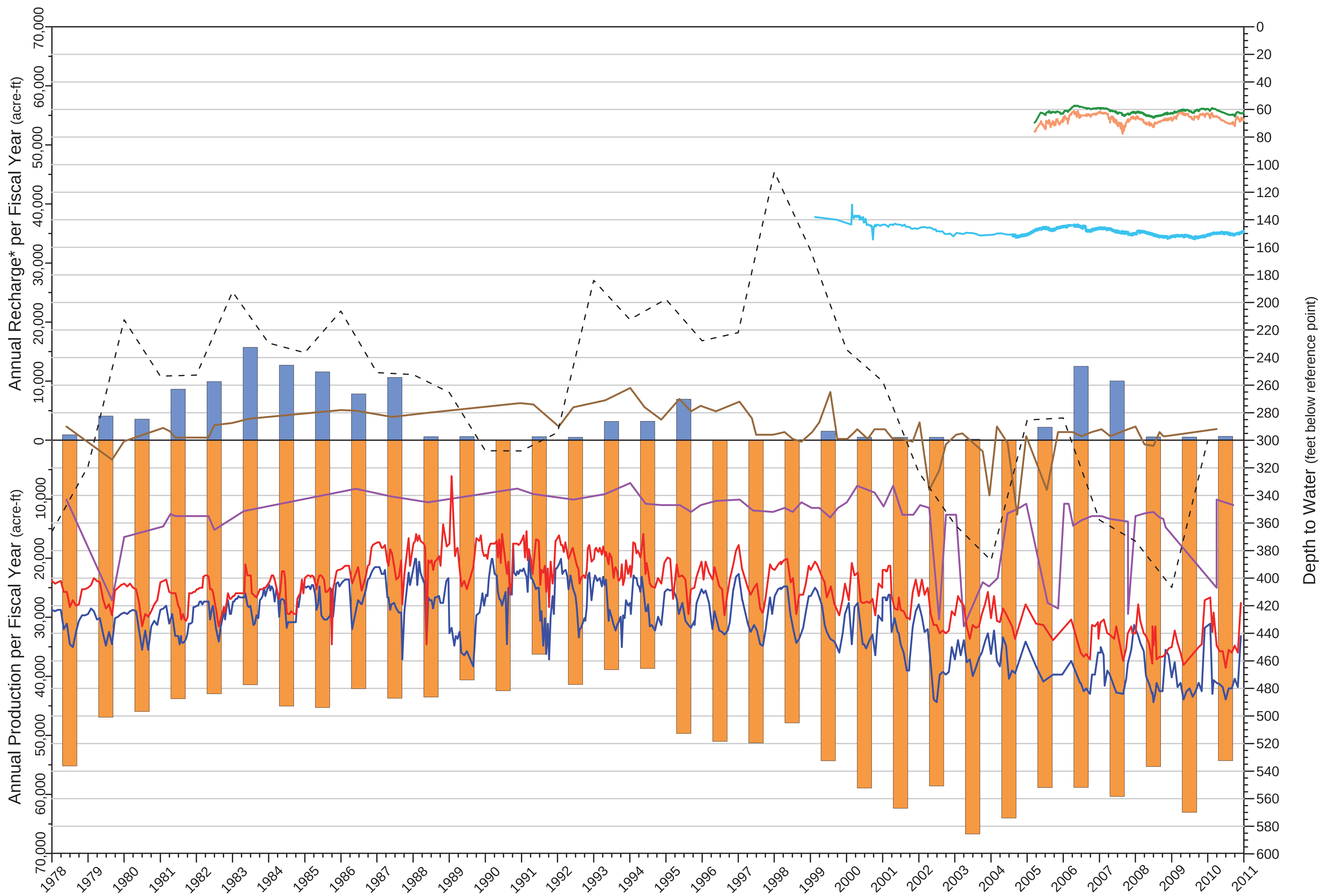
MZ1 Production and Recharge
- Recharge*
- Groundwater Production
- Cumulative Departure from Mean Precipitation

2010 State of the Basin
Groundwater Levels

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *MZ1*

1978 to 2010

Exhibit 16



Water levels at wells CB-3 and CB-5 are representative of groundwater-level trends in the northern portions of MZ2. Water levels at these wells increased from 1978 to about 1990—likely due to a combination of the 1978 to 1983 wet period, decreased pumping 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 at these wells have progressively declined by about 40 feet due to increased pumping in MZ2.

Water levels at wells O-16, O-17, and XRef 404 (private well) are representative of groundwater-level trends in the central portions of MZ2, north of the Chino-I Desalter well field. Water levels at these wells followed a similar pattern of increase from 1978 to 1990, and decrease from 1990 to 2000. From 2000 to 2010, water levels in these wells have remained relatively 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 end of MZ2, just south of the Chino-I Desalter well field. 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. Water levels at these wells have remained relatively stable since they were constructed in 2005, which suggests that hydraulic control is not yet being achieved in this portion of the desalter well field. See Exhibits 24 and 25 for further explanation of hydraulic control.

* Recharge includes imported water and recycled water delivered to recharge basins, and does not include in-lieu replenishment water.

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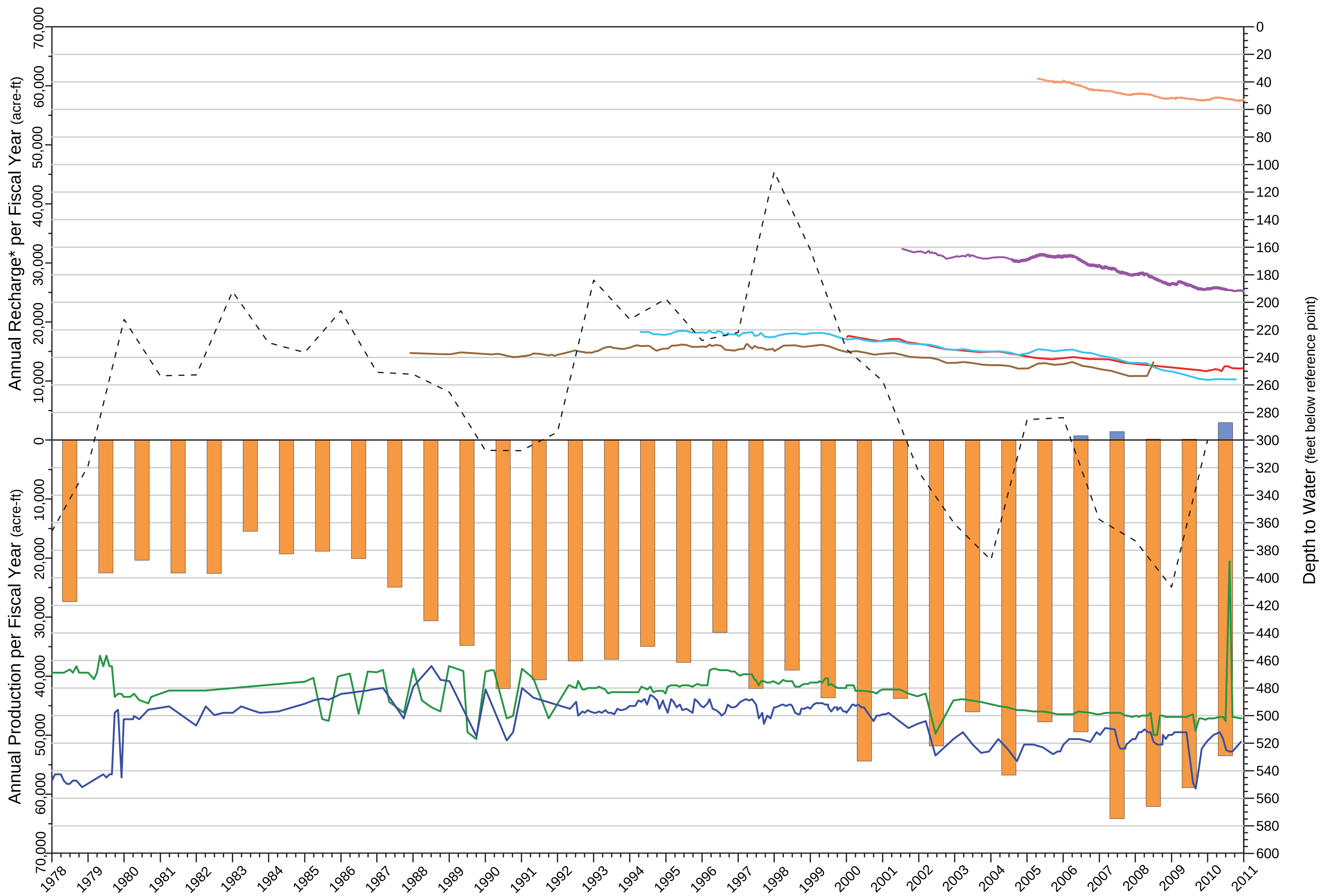
MZ2 Water Levels (top-bottom of well screen)
- CVWD CB-5 (538-1,238 ft-bgs)
- CVWD CB-3 (341-810 ft-bgs)
- O-17 (415-1,007 ft-bgs)
- O-16 (366-630 ft-bgs)
- X Ref 404 (274-354 ft-bgs)
- HCMP-2/2 (296-316 ft-bgs)
- HCMP-2/1 (124-164 ft-bgs)

MZ2 Production and Recharge
- Recharge*
- Groundwater Production
- Cumulative Departure from Mean Precipitation

2010 State of the Basin
Groundwater Levels

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *MZ2*
1978 to 2010

Exhibit 17



Water levels at wells F30A and F35A 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 2006, water levels declined by approximately 25-30 feet due to a dry climatic period and increased pumping in MZ3. Since 2006, water levels at these wells have remained relatively stable.

Water levels at wells Mill M-03, Mill M-06B, Offsite MW3, 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. However, at Offsite MW3, water levels have increased by about 5 feet from 2009 to 2010. This water level increase is likely due to improvements to and increased artificial 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 2005 to 2010, water levels at this well progressively declined by about 20 feet. This drawdown is mainly due to pumping at the Chino Desalter well fields and suggests that hydraulic control is being achieved in this portion of the Chino Basin, and that recharge of the Santa Ana River is being enhanced by desalter pumping. See Exhibits 24 and 25 for further explanation of hydraulic control.

* Recharge includes imported water and recycled water delivered to recharge basins, and does not include in-lieu replenishment water.

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MZ3 Water Levels (top-bottom of well screen)

- F-30A (507-864 ft-bgs)
- F-35A (700-852 ft-bgs)
- Mil M-03 (244-262 ft-bgs)
- Mil M-06B (255-275 ft-bgs)
- Offsite MW3
- XRef 425 (no perf data)
- HCMP-7/1 (70-110 ft-bgs)

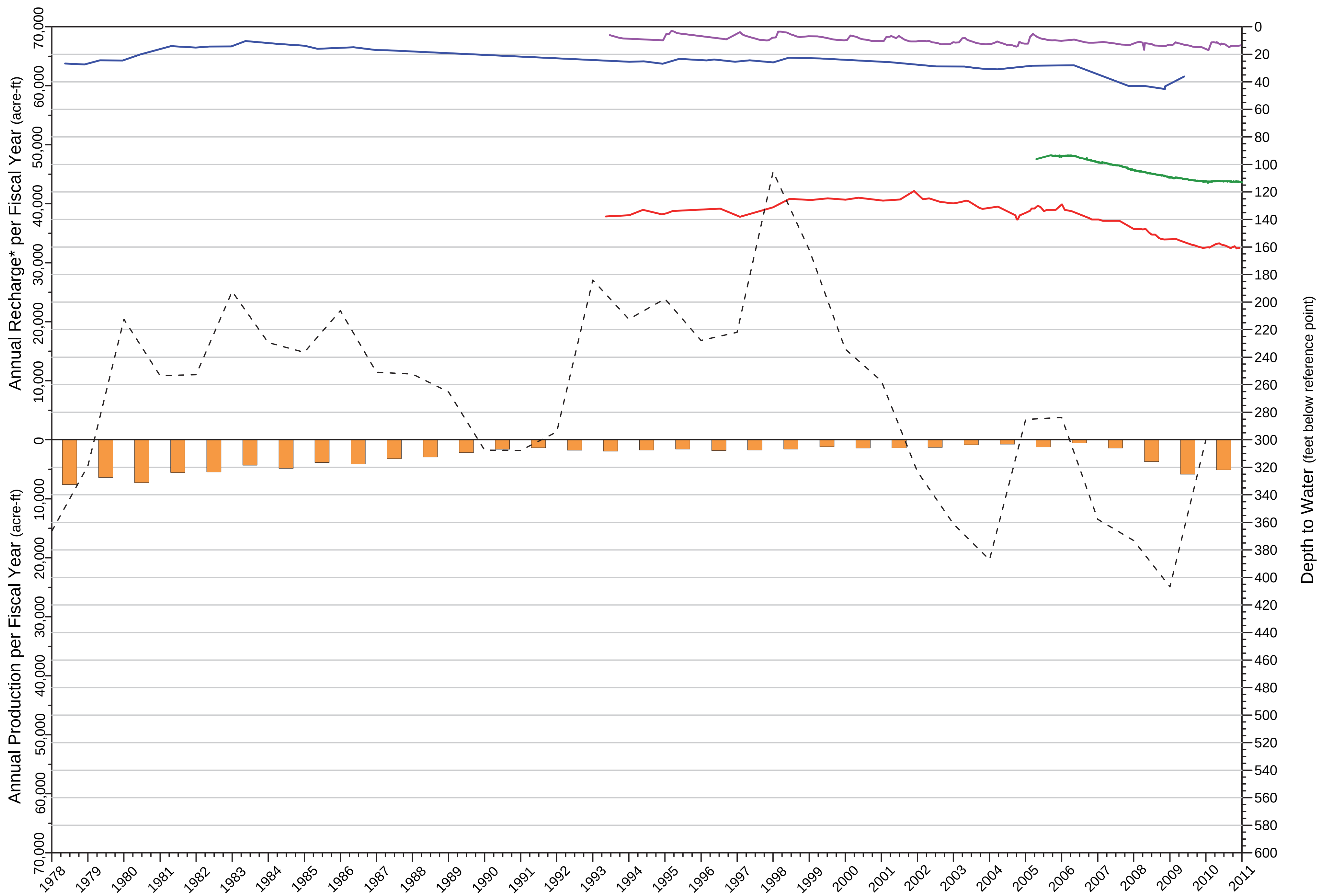
MZ3 Production and Recharge

- Recharge*
- Groundwater Production
- Cumulative Departure from Mean Precipitation

2010 State of the Basin
Groundwater Levels

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *MZ3*
1978 to 2010

Exhibit 18



Water levels at wells JCSD-10 and HCMP-9/1 are representative of groundwater-level trends near the western boundary of MZ4—in the vicinity of the major well fields of the Jurupa Community Services District (JCSD) and the Chino-II Desalter. From 2000 to 2010, water levels at these wells have decreased by up to 30 feet. This drawdown suggests that hydraulic control is being achieved in this portion of the Chino Basin. See Exhibits 24 and 25 for further explanation of hydraulic control. The drawdown in this area is also a concern of JCSD with regard to the production capacity at their well field.

Water levels at wells XRef 4503 (private well) and FC-932A2 are representative of groundwater-level trends in the eastern and central parts of MZ4. From 1980 to 2010 the water levels at these wells have declined by over 10-20 feet.

* Recharge includes imported water and recycled water delivered to recharge basins, and does not include in-lieu replenishment water. There is no imported water or recycled water delivered to basins within MZ4.

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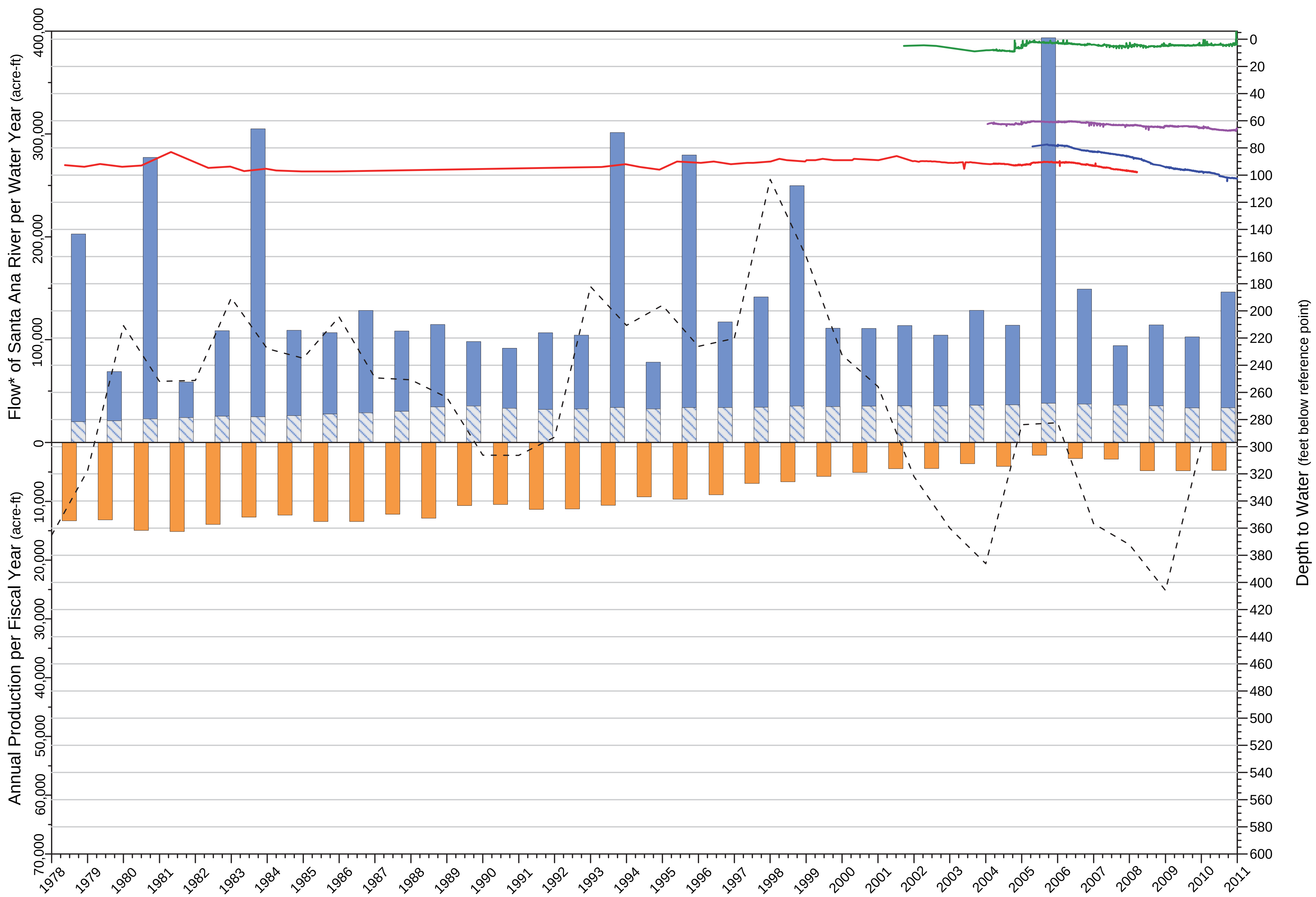
MZ4 Water Levels (top-bottom of well screen)
- JCSD-10 (no perf data)
- HCMP-9/1 (110-150 ft-bgs)
- X Ref 4503 (no perf data)
- FC-932A2 (no perf data)

MZ4 Production and Recharge
- Groundwater Production
- Cumulative Departure from Mean Precipitation

2010 State of the Basin
Groundwater Levels

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *MZ4*
1978 to 2010

Exhibit 19



MZ5 is a groundwater flow system that parallels the Santa Ana River. ***Water levels at wells SARWC-7, 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 2010, water levels at these wells have progressively declined by about 5 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 24 and 25 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 is likely 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.

* Flow of the Santa Ana River through Management Zone 5 includes the flow measured at the USGS gauging station at Riverside Narrows plus effluent discharge from City of Riverside Wastewater Treatment Plant.

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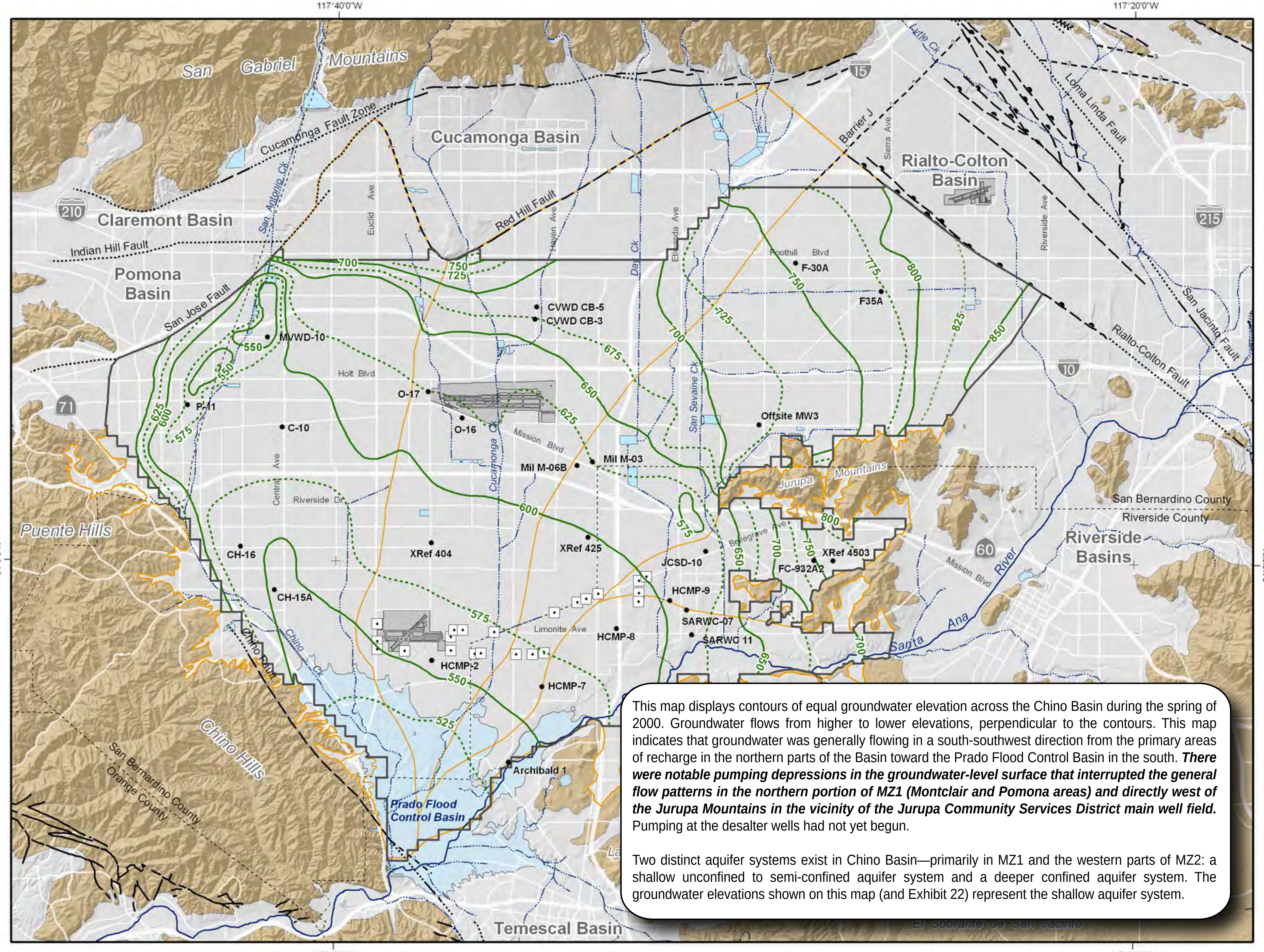
MZ5 Water Levels (top-bottom or well screen)
- SARWC-07 (100-172 ft-bgs)
- HCMP-8/1 (75-115 ft-bgs)
- SARWC-11 (75-230 ft-bgs)
- Archibald-1 (75-85 ft-bgs)

MZ5 Production and Recharge
- City of Riverside WWTP
- Santa Ana River at Riverside Narrows
- Groundwater Production
- Cumulative Departure from Mean Precipitation

2010 State of the Basin
Groundwater Levels

Long-Term Trends in Groundwater Levels versus Climate, Production, and Recharge - *MZ5*
1978 to 2010

Exhibit 20



This map displays contours of equal groundwater elevation across the Chino Basin during the spring of 2000. Groundwater flows from higher to lower elevations, perpendicular to the contours. This map indicates 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 Flood Control 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 Jurupa Community Services District 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 22) represent the shallow aquifer system.

800 / 775 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 used for Time History Analysis (Exhibits 16 through 20)

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

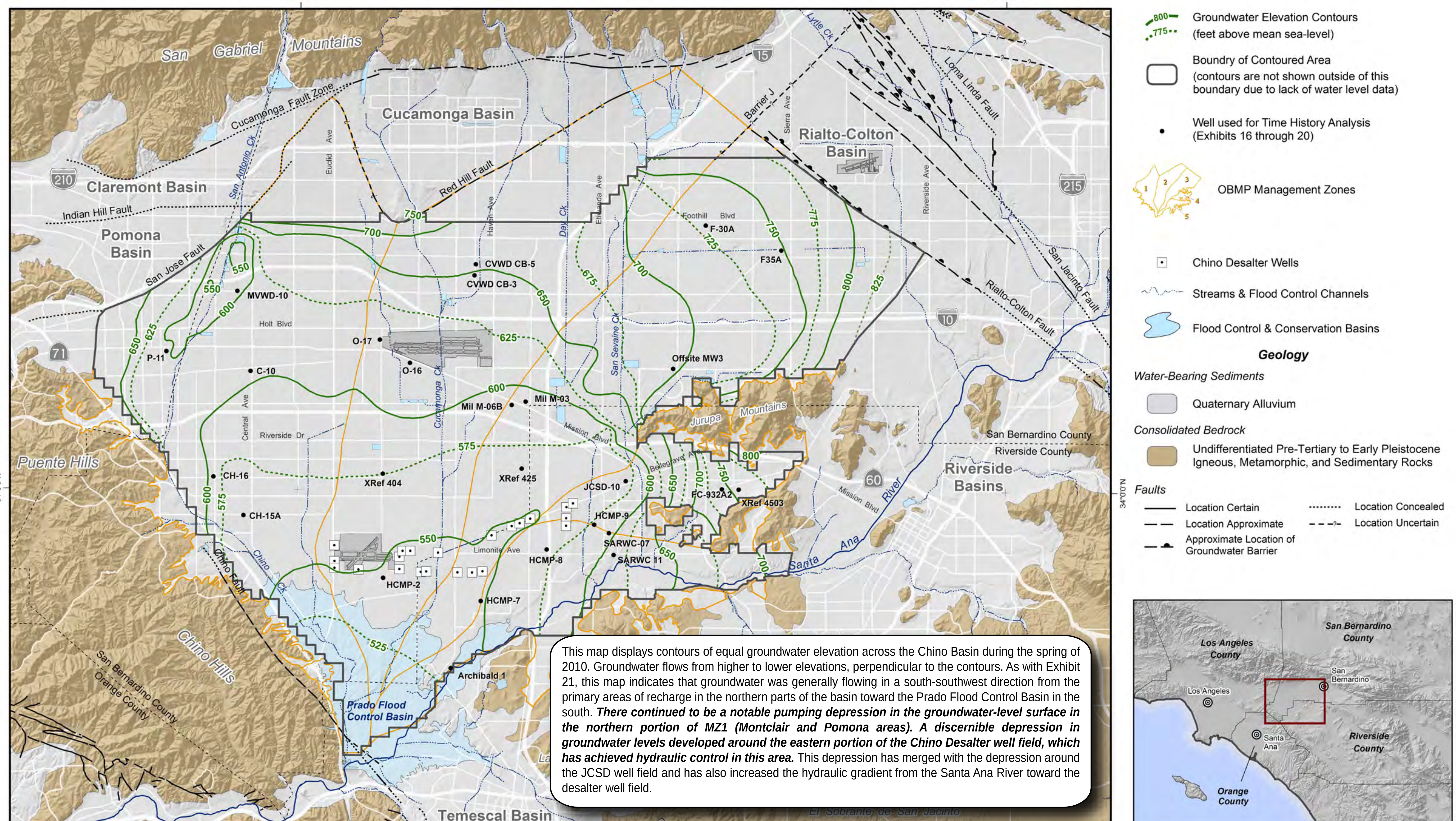
2010 State of the Basin

Groundwater Levels

Groundwater Elevation Contours

Spring 2000

Exhibit 21



This map displays contours of equal groundwater elevation across the Chino Basin during the spring of 2010. Groundwater flows from higher to lower elevations, perpendicular to the contours. As with Exhibit 21, this map indicates 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 Flood Control 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). 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 depression around the JCSD well field and has also increased the hydraulic gradient from the Santa Ana River toward the desalter well field.

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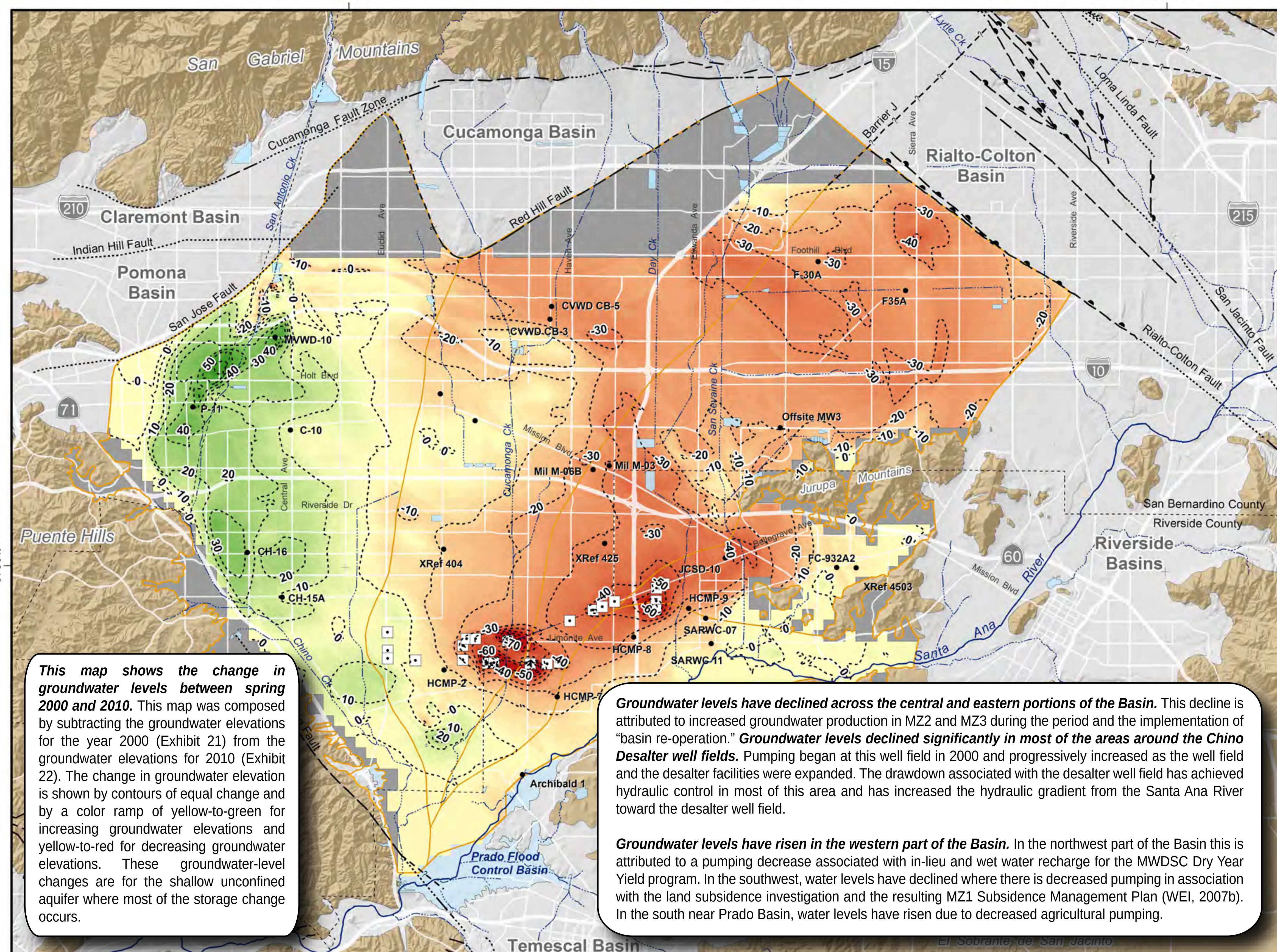
0 1 2 3 4 5 Miles
0 2 4 6 8 KM

2010 State of the Basin
Groundwater Levels

Groundwater Elevation Contours
Spring 2010

Exhibit 22



This map shows the change in groundwater levels between spring 2000 and 2010. This map was composed by subtracting the groundwater elevations for the year 2000 (Exhibit 21) from the groundwater elevations for 2010 (Exhibit 22). The change in groundwater elevation is shown by contours of equal change and by a color ramp of yellow-to-green for increasing groundwater elevations and yellow-to-red for decreasing groundwater elevations. These groundwater-level changes are for the shallow unconfined aquifer where most of the storage change occurs.

Groundwater levels have declined across the central and eastern portions of the Basin. This decline is attributed to increased groundwater production in MZ2 and MZ3 during the period and the implementation of "basin re-operation." ***Groundwater levels declined significantly in most of the areas around the Chino Desalter well fields.*** Pumping began at this well field in 2000 and progressively increased as the well field and the desalter facilities were expanded. The drawdown associated with the desalter well field has achieved hydraulic control in most of this area and has increased the hydraulic gradient from the Santa Ana River toward the desalter well field.

Groundwater levels have risen in the western part of the Basin. In the northwest part of the Basin this is attributed to a pumping decrease associated with in-lieu and wet water recharge for the MWDSC Dry Year Yield program. In the southwest, water levels have declined where there is decreased pumping in association with the land subsidence investigation and the resulting MZ1 Subsidence Management Plan (WEI, 2007b). In the south near Prado Basin, water levels have risen due to decreased agricultural pumping.

Contour of Piezometric Change (ft)
Spring 2000 to Spring 2010

Piezometric Change (ft)
Spring 2000 to Spring 2010
+60 Increase
-60 Decrease

Area not included in piezometric change calculation due to lack a of water level data

Well used for Time History Analysis (Exhibits 16 through 20)

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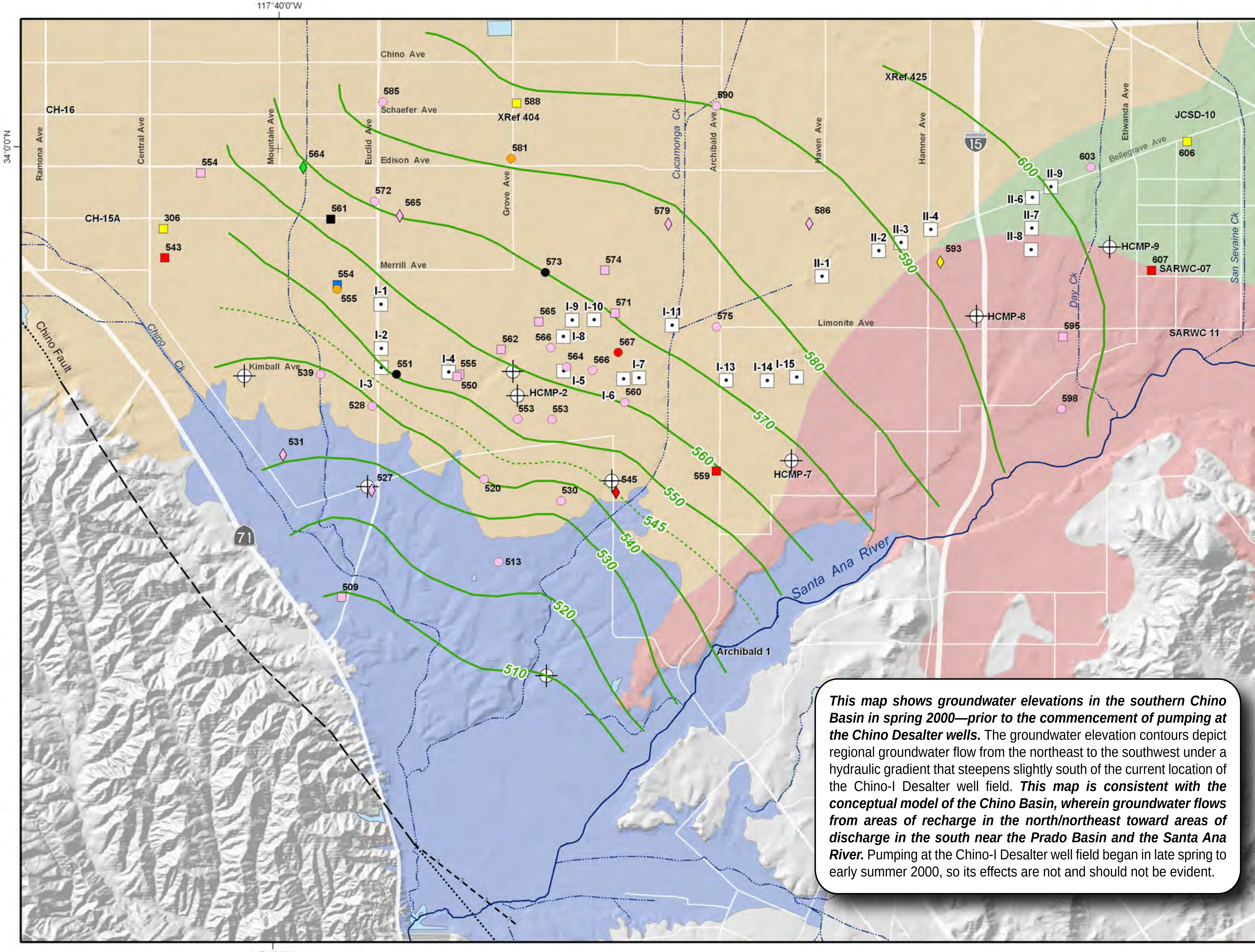
0 1 2 3 4 5 Miles
0 2 4 6 8 KM

2010 State of the Basin
Groundwater Levels

Groundwater Level Change
Spring 2000 to Spring 2010

Exhibit 23



This map shows groundwater elevations in the southern Chino Basin in spring 2000—prior to the commencement of pumping at the Chino Desalter wells. The groundwater elevation 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 map 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 and should not be evident.

800 / 775 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

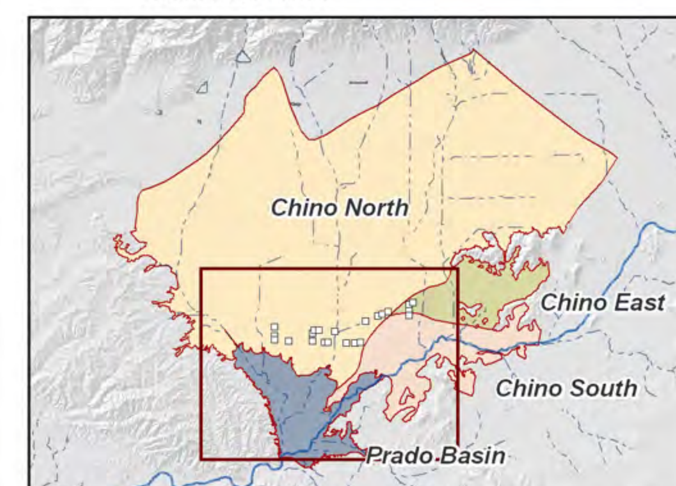
- HCMP Monitoring Well (Installed During 2004 and 2005)
- Chino Desalter Well
- Well Used for Time History Analysis (Exhibits 16 through 20)
- Streams & Flood Control Channels
- Flood Control & Conservation Basins

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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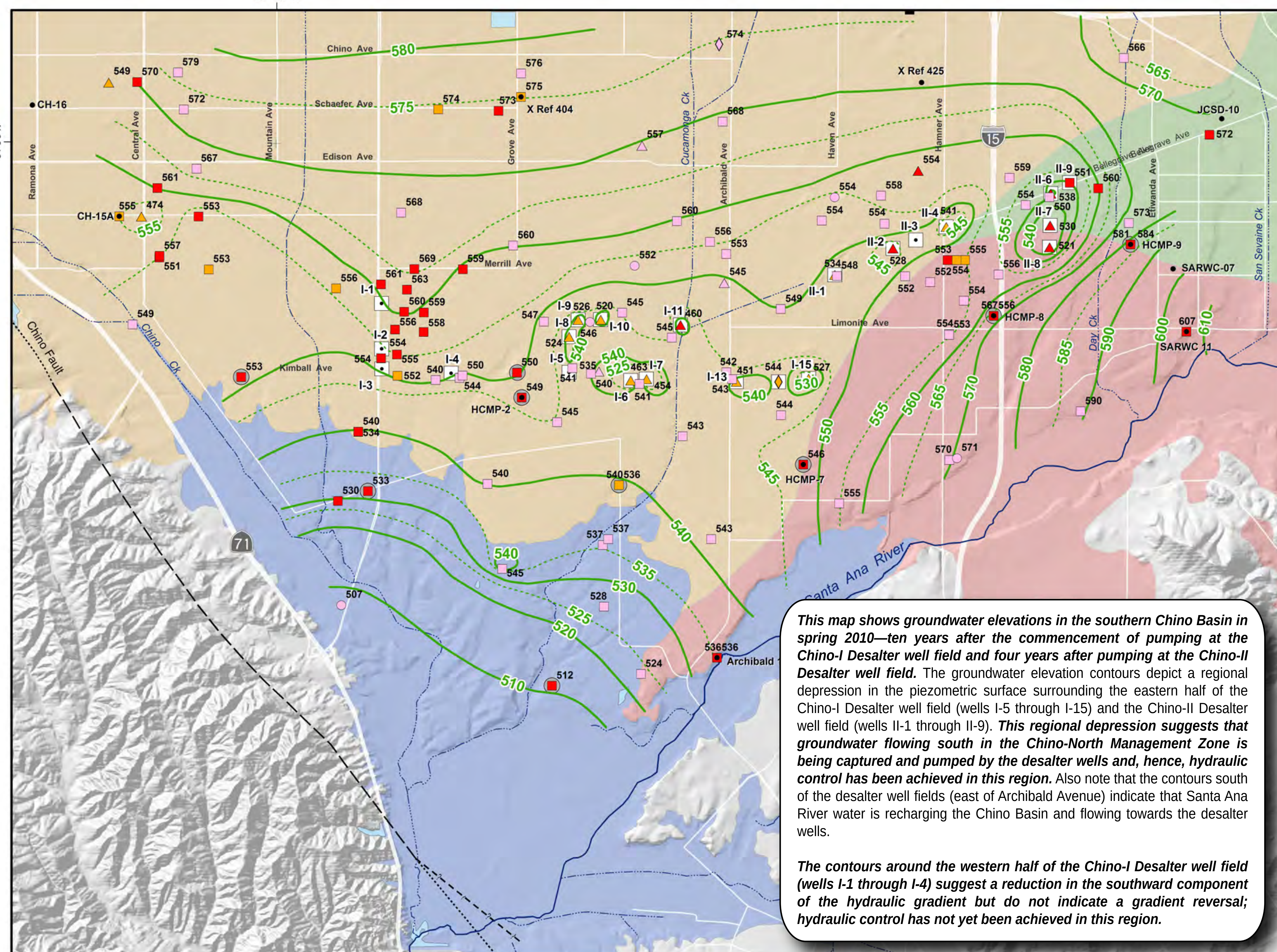
0 1 2 Miles
0 1 2 3 KM

2010 State of the Basin
Groundwater Levels

State of Hydraulic Control in Spring 2000

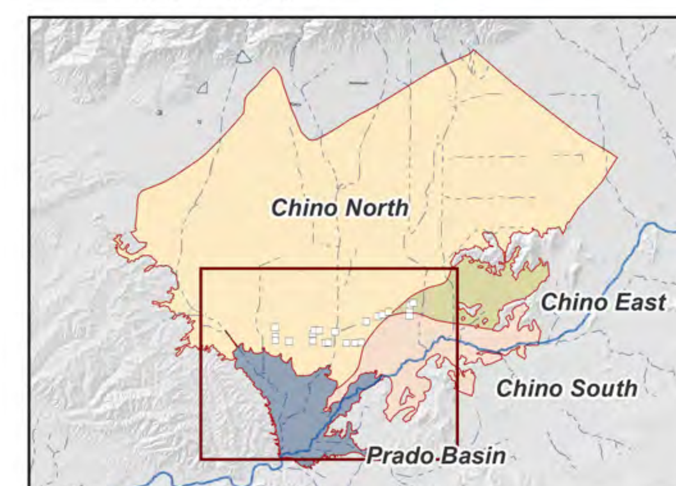
Shallow Aquifer System

Exhibit 24



This map shows groundwater elevations in the southern Chino Basin in spring 2010—ten years after the commencement of pumping at the Chino-I Desalter well field and four years after pumping at the Chino-II Desalter well field. The groundwater elevation contours depict a regional depression in the piezometric surface surrounding the eastern half of the Chino-I Desalter well field (wells I-5 through I-15) and the Chino-II Desalter well field (wells II-1 through II-9). ***This regional depression suggests that groundwater flowing south in the Chino-North Management Zone is being captured and pumped by the desalter wells and, hence, hydraulic control has been achieved in this region.*** 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.

The contours around the western half of the Chino-I Desalter well field (wells I-1 through I-4) suggest a reduction in the southward component of the hydraulic gradient but do not indicate a gradient reversal; hydraulic control has not yet been achieved in this region.



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0 1 2 Miles
0 1 2 3 KM

2010 State of the Basin
Groundwater Levels

State of Hydraulic Control in Spring 2010

Shallow Aquifer System

Exhibit 25