CHINO BASIN WATERMASTER

Board Workshop

September 16, 2014

Chino Basin Safe Yield: Past and Future

Agenda Item 1
Legal Framework and Terms for Safe Yield Recalculation and Reset

Key Terms

- Safe Yield
- Overdraft
- Controlled Overdraft
- New Yield
- Developed Yield
- SARUNY

Safe Yield

- Text Book Definition.
- Common Law Definition.
- Judgment Definition. "The long-term average annual quantity of ground water (excluding replenishment or stored water but including return flow to the Basin from use of replenishment or stored water) which can be produced from the Basin under cultural conditions of a particular year without causing an undesirable result." (Restated Judgment, ¶ 4.(x).)

Overdraft

- Overdraft commences when production exceeds Safe Yield.
- Undesirable results are evidence of overdraft.
- Lowering the water table alone may not be adverse or undesirable.
- Undesirable results: e.g., subsidence, water quality degradation, unreasonable increase in pump lifts, continuous decline (chronic).
- Unauthorized production in excess of Safe Yield is enjoined. (Restated Judgment, ¶ 13.)

Controlled Overdraft

- Overdraft of the Basin to effectuate a management purposes.
- 5,000 AFY for a 40 year period
- Hydraulic Control/Basin Reoperation: 400,000 AF over a 20 year period

New Yield

- Proven increases in basin yield during period between Safe Yield Re-sets.
  - "proven increases in yield in quantities greater than historical amounts from sources of supply including, but not limited to, capture of rising water, capture of available storm flow, operation of the Desalters (including the Chino I Desalter), induced Recharge and other management activities implemented and operational after June 1, 2000." (Peace Agreement § 1.1(aa).)
  - New Yield is a mechanism to account for and allocate increased recharge to the Basin in the period between Safe Yield recalculations.
- Initially allocated to offset Desalter Production (Peace Agreement, ¶ 7.5(b).)

Developed Yield

- Not a term defined outside this recalculation process.
- Utilized merely for convenience of the parties.
- Developed Yield: Safe Yield plus SARUNY.

SARUNY

- Santa Ana River underflow New Yield
- New Yield that is attributable to a specific measurable set of actions that were planned to induce recharge from the Santa Ana River.
- Earmarked to make water available to the Desalters to offset the total costs of production.

Safe Yield: Recalculation

- Judgment contemplates recalculation:
  - Definition of Safe Yield contemplates change as cultural conditions change (Restated Judgment, ¶ 8.)
  - Initial Safe Yield could not be changed for period of 10 years (Restated Judgment, ¶ 15(a).)
  - Unproduced Overlying (Ag) Pool right could be reallocated to Appropriative Pool "to compensate for any reduction in the Safe Yield by reason of recalculation thereof" (Restated Judgment, Exhibit "H"), ¶ 10(a)(1).)

Safe Yield: Recalculation

- Agreed that first recalculation would take place in 2010/11:
  - No timeframe in the Judgment itself
  - OBMP Implementation Plan provides for recalculation in year 2010/11 and every 10 years thereafter (OBMP Implementation Plan, pages 44-45)
  - Rules and Regulations provide for recalculation in year 2010/11 based upon data from the ten-year period 2000/01 to 2009/10 (Rules and Regulations, § 6.5.)
  - Initiated in 2010/11 and concluding now using required data and model update

Effects of Recalculation

- SARUNY:
  - SARUNY is allocated to offset Desalter Production. (Peace II Agreement, ¶ 6.2.(a)(iii).)
  - During initial term of Peace Agreement, SARUNY will not be incorporated into Safe Yield. (Peace II Agreement, ¶ 7.1.)
  - While SARUNY may constitute a regular source of Recharge to the Basin, it may not at the same time be allocated as part of the Parties' annual production rights, as doing so would result in double counting of such water.

Effects of Recalculation: New Yield

- Stormwater New Yield:
  - Storm flow recharge determined by Watermaster to be part of New Yield is excepted from Desalter Production offset. (First Amendment to Peace Agreement, ¶ 2.)
  - Quantity credited determined pursuant to the method described in Condition Subsequent 7.
  - While it may be considered part of the gross Safe Yield of the Basin, it is allocated, by agreement, to Appropriators according to percentages of OSY under the Judgment. (First Amendment to Peace Agreement, ¶ 2.)

Effects of Recalculation: New Yield

- Stormwater New Yield:
  - Peace Agreement § 4.5 provides that the Engineering Appendix shall be construed to allow Watermaster to include New Yield as a component of OSY. (Peace Agreement, ¶ 4.5.)
  - First Amendment to Peace Agreement describes intent that Stormwater New Yield remain assigned to Appropriators. (First Amendment to Peace Agreement, Recital D, ¶ 2.)
  - Contrast with Peace II § 7.1, which expressly provides that New Yield attributable to Desalters (SAR Underflow) would not be incorporated into the Safe Yield. (Peace II Agreement, ¶ 7.1.)

Effects of Recalculation: New Yield

- Stormwater New Yield:
  - Research by Watermaster legal counsel has not revealed any documentation describing manner in which Stormwater New Yield should be credited vis-à-vis backfill with Unproduced Ag Water.
  - Proposed treatment would exclude Stormwater New Yield from OSY for purposes of calculating "backfill" obligation and add Stormwater New Yield to Appropriators' production rights (based on % OSY) after Unproduced Ag Water backfill and reallocation.
  - Proposed treatment is intended to respect investments and expectations.

Effects of Recalculation: Ag Reallocation

- To the extent that the Ag Pool's share of Safe Yield is not produced, unproduced Ag Water is available for reallocation to members of the Appropriative Pool, in the following sequence:
  - to supplement water available from Operating Safe Yield to compensate for any reduction in the Safe Yield by reason of recalculation;
  - pursuant to Land Use Conversion and Early Transfer mechanisms; and
  - as a supplement to Operating Safe Yield, without regard to reductions in Safe Yield.

(Restated Judgment, Appendix "H", ¶ 10(a).)

Effects of Recalculation: Ag Reallocation "Backfill"

- Backfill: in the event a Safe Yield recalculation indicates a lower SY, unproduced Ag Pool water is used to compensate for reduction in Safe Yield below 140,000 afy.
- This reduces the volume of Ag Pool water available for Land Use Conversions and Early Transfer

Effects of Recalculation

- Land Use Conversions:
  - Appropriators undertaking permanent water service to lands previously irrigated may be allocated Unproduced Ag Water. (Restated Judgment, Exh. "H", ¶ 10(b).)
  - Quantity of production right allocated has been modified through the years from one-half amount of prior use, to 1.3 AF/acre to 2.0 AF/acre.

Effects of Recalculation

- Early Transfer:
  - Pursuant to Peace Agreement, provides for reallocation of Unproduced Ag Water on an annual basis rather than original five year basis.
  - Watermaster required to annually approve "Early Transfer" to Appropriative Pool of greater of 32,800 AF or 32,800 AF *plus* quantity of Unproduced Ag Water after satisfaction of land use conversions. (Peace Agreement, ¶ 5.3(g).)
  - In order to ensure that Early Transfer did not result in replenishment obligations, it was agreed that reallocation would be proportionally reduced to the amount of water available. (Rules and Regulations, §§ 6.3(c), (d).)

Effects of Recalculation: Land Use Conversion and Early Transfer

- Harmonization of Land Use Conversion and Early Transfer:
  - During process of Peace II Conditions Subsequent compliance, the issue was raised as to ambiguity in re priority of Land Use Conversions vs. Early Transfer
  - As approved through Watermaster process and approved by the Court, in the event unproduced Ag Water is insufficient to satisfy Land Use Conversion claims and Early Transfer, the quantity available for reallocation is allocated proportionally based on Appropriators' total claims for reallocation. (October 8, 2010 Order Approving Watermaster's Compliance with Condition Subsequent Number Eight and Approving Procedures to be Use to Allocate Surplus Agricultural Pool water in the Event of a Decline in Safe Yield.)

Agenda Item 2
Overview of Recalculation Process To Date
[Handout]

CHINO BASIN WATERMASTER

SAFE YIELD RECALCULATION AND RESET

PROCESS TO DATE

April 2011 – February 2013

- WEI tasked with updating the groundwater on April 28, 2011; four-year cumulative expense of $850K
- October 27, 2011: Model workshop/Planning Assumptions
- November 27, 2012: Model Update Scenario 1, Recalibration Workshop
- February 5, 2013: Model Calibration and Scenarios 1 & 2

March – July 2013

- Watermaster staff and consultants analyze Safe Yield Recalculation legal requirements and perform technical work

July 2013

- July 28: 1st Workshop: presentation of legal background; technical results and accounting effects of Safe Yield Recalculation

August 2013

- August 29: 2nd Workshop: Presentation of the model

September – November 2013

- Various meetings with individual parties

December 2013

- December 18: 3rd Workshop: response to questions raised by individuals and Appropriative Pool

January 2014

- January 21: 4th Workshop: continue and conclude response to questions
- January 30: 1st Technical Discussion with AP technical experts, at AP request

March – June 2014

- March 3: 2nd Technical Discussion with AP technical experts
- Watermaster staff and consultants analyze Basin Yield using Prospective Methodology in response to April 2014 request by the Appropriative Pool (reported to the Board during April 24, 2014 meeting)
- April 11: Watermaster files status report with the Court

July 2014

- July 10, 17, 24: Results are presented to Committees and Board

August 2014

- August 7, 21: "Safe Yield Recalculation and Related Matters" series of discussions in response to individual parties and Appropriative Pool request.

September 2014

- September 16: Board Workshop

Agenda Item 3
Yield Estimates

- Peace Agreement and Watermaster Rules and Regulations require the Safe Yield to be recalculated in 2011 using the base period 2001 through 2010
  - Retrospective approach – based on historical hydrology, land use and water management conditions
  - Base period hydrology is not representative of the future long-term hydrology
  - Base period land use and water management conditions are not representative of the present and future conditions

Agenda Item 3
Yield Estimates

- In April 2014, the AP requested that Watermaster staff develop a Safe Yield estimate based on long-term average hydrology and present and future land use and water management conditions.
  - Prospective approach – based on present and future hydrology and water management practices
  - Base period hydrology is representative of the long-term hydrology subject to true up
  - Base period land use and water management are representative of the present and future conditions subject to true up

Agenda Item 3
Yield Estimates

- If a prospective recalculation method is used, a method to "true-up" projections versus actual measurements should be incorporated.
- This way, the implementation of Safe Yield based on a prospective recalculation method can be "corrected" to account for threatened or observed harm in a future Safe Yield determination attributable to the fact the projected Safe Yield was not in fact equal to actual Safe Yield.

Agenda Item 3
Yield Estimates

Safe Yield = Developed Yield – SARUNY

Developed Yield is the net inflow to the basin excluding the direct recharge of Supplemental Water

Developed Yield and SARUNY are estimated from a water budget table that developed from 2013 Groundwater Model input data and model results

Agenda Item 3
Yield Estimates (acre-ft/yr)

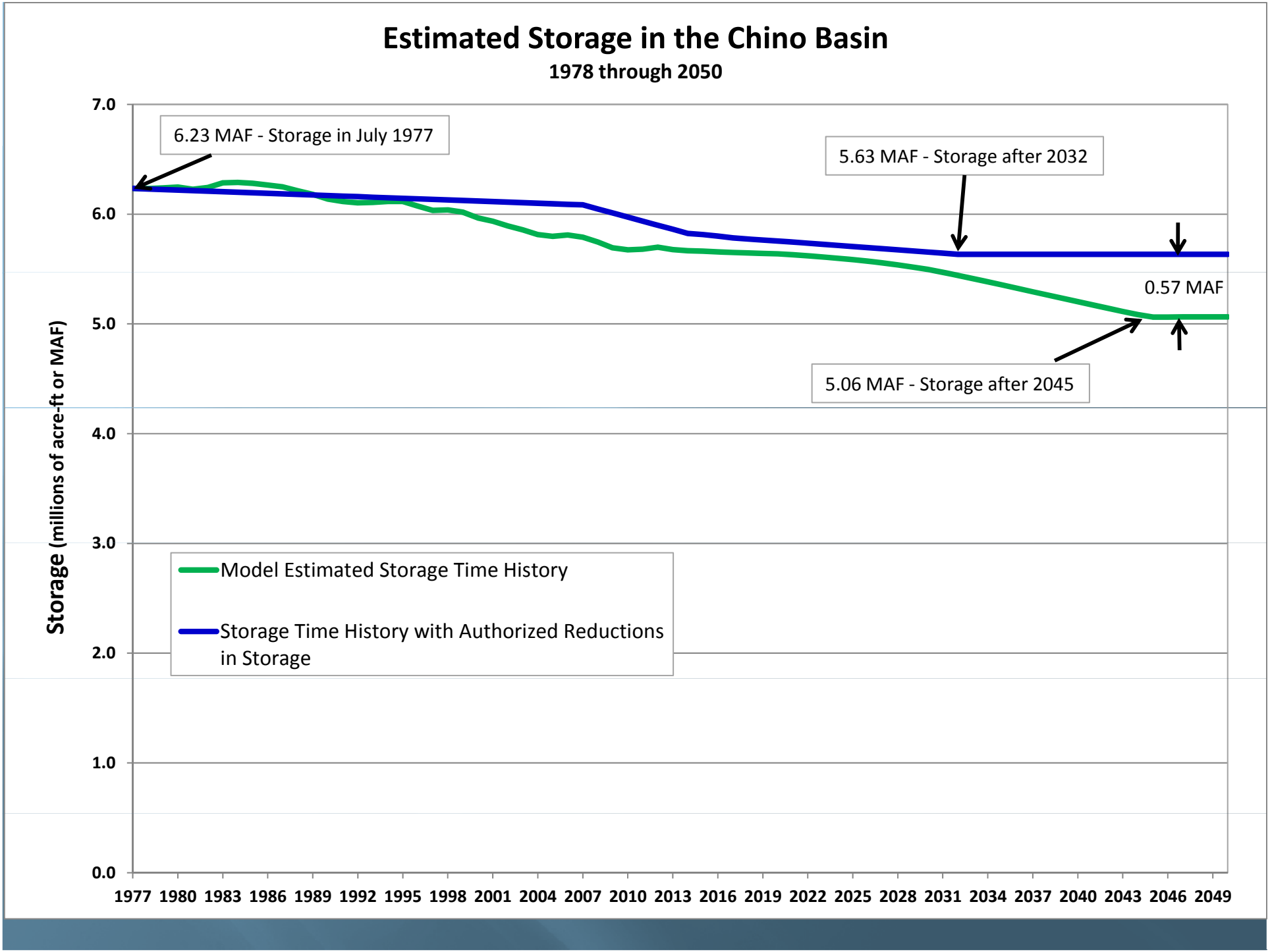
Base Period	Developed Yield	SARUNY	Safe Yield
1965 – 1974	140,000	0	140,000
2001 – 2010	130,000	7,000	123,000

- These are retrospective Safe Yield estimates
- Land use and water management conditions for these base periods are different than 2011 onward
- The first indication that the Safe Yield was less than 140,000 acre-ft/yr occurred in 2007 in the Peace II engineering work.

Agenda Item 3
Yield Estimates (acre-ft/yr)

Base Period	Developed Yield	SARUNY	Safe Yield	Method
1965 – 1974	140,000	0	140,000	Retrospective
2001 – 2010	130,000	7,000	123,000	Retrospective
2011 – 2020	135,000	17,000	118,000	Prospective
2016 – 2025	135,000	19,000	116,000	Prospective

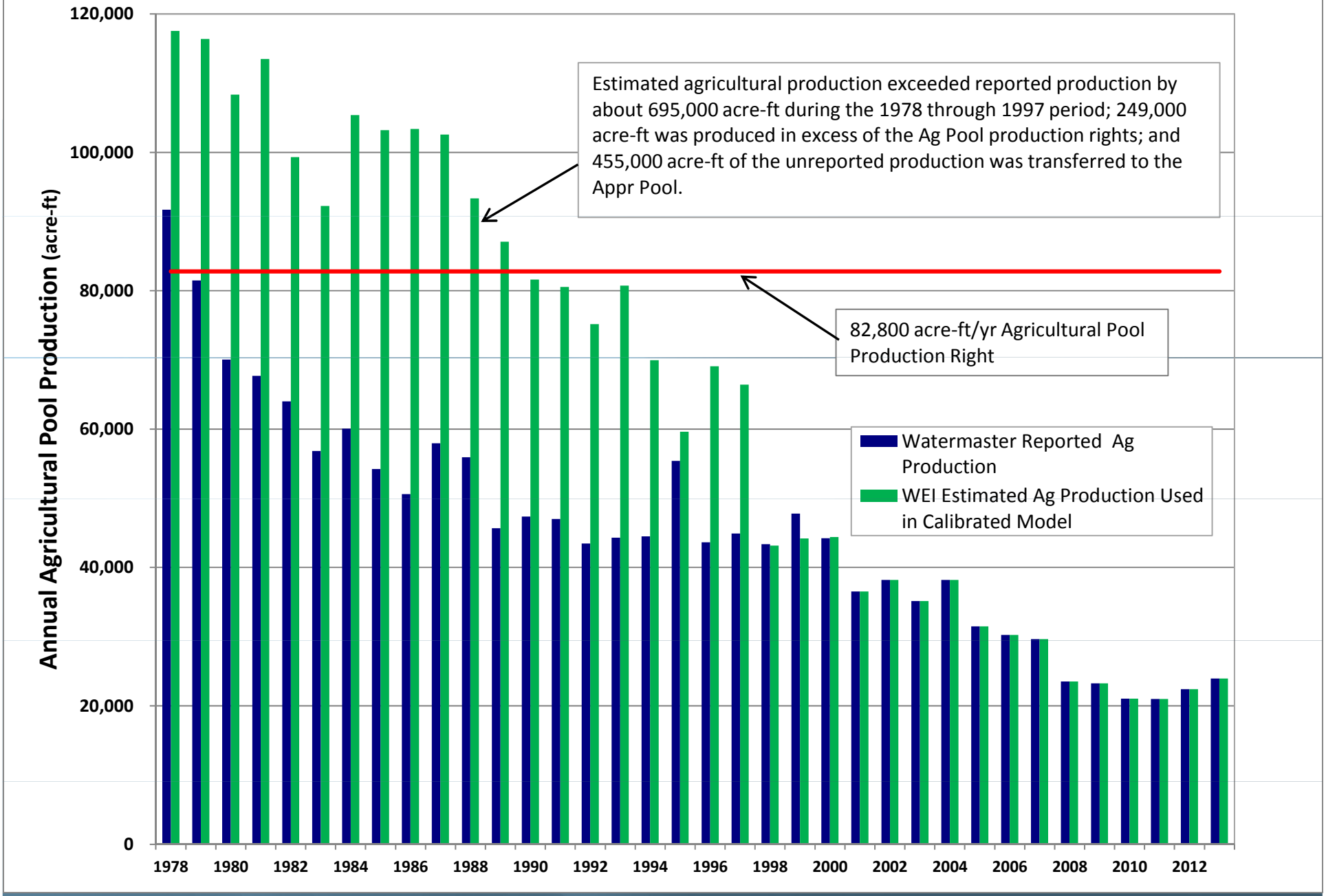
- SARUNY is expected to be 50% of CDA production


Estimated Storage in the Chino Basin
1978 through 2050
6.23 MAF - Storage in July 1977
5.63 MAF - Storage after 2032
0.57 MAF
5.06 MAF - Storage after 2045
Storage (millions of acre-ft or MAF)
Model Estimated Storage Time History
Storage Time History with Authorized Reductions in Storage
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1977 1980 1983 1986 1989 1992 1995 1998 2001 2004 2007 2010 2013 2016 2019 2022 2025 2028 2031 2034 2037 2040 2043 2046 2049

Agenda Item 4
Production Reporting Discrepancies

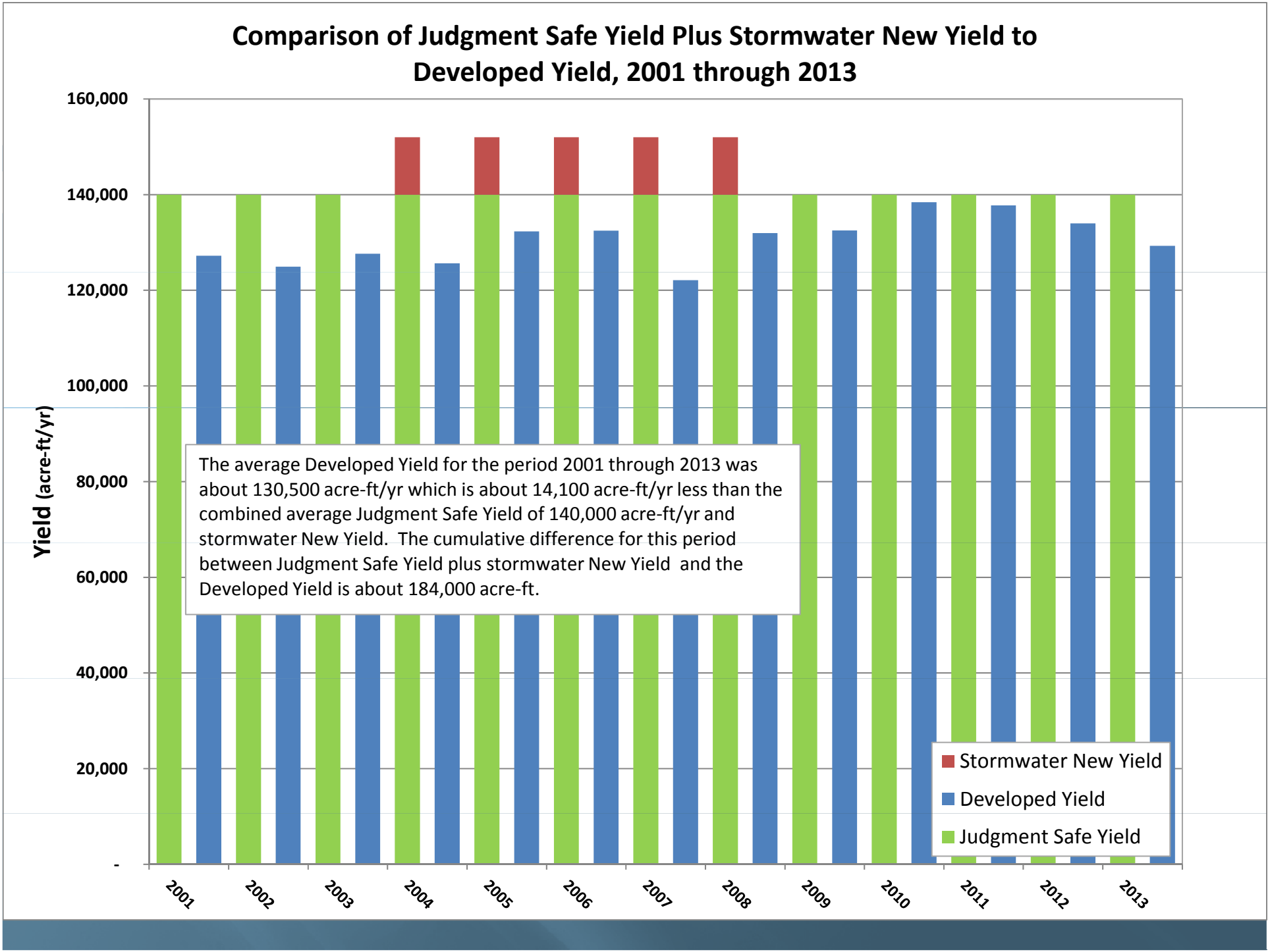
- Agricultural Pool groundwater production has been underestimated in the past
- This was first reported to Watermaster in the early 1990s in the Chino Basin Water Resources Management Plan work
- Watermaster attempted to remedy this in the 1990 to 2000 period
- Mandatory metering and testing program was implemented in 2001 (Peace Agreement requirement).

Discrepancy in Reported Agricultural Production



Agenda Item 5
Comparison of Judgment Safe Yield to Developed Yield 2001 through 2013

Comparison of Judgment Safe Yield Plus Stormwater New Yield to Developed Yield, 2001 through 2013



Assessment Package Appendix

Desalter Replenishment Accounting, Shortfall Deducted from the Pre-Peace II Desalters Re-Operation Account[1]

Per Peace II Agreement, Section 6.2 (PIIA, 6.2)

(Acre-Feet)

Production Year	Desalter Production			Desalter Replenishment									
									Controlled Overdraft / Re-Op, PIIA, 6.2(a)(vi)				
	Pre-Peace II Desalter Production	Peace II Desalter Expansion Production[2]	Total	Desalter (aka Kaiser) Account PIIA, 6.2(a)(i)	Paragraph 31 Settlement Agreements Dedication[3] PIIA, 6.2(a)(ii)	**SAR Underflow New Yield[4] (SARUNY) PIIA, 6.2(a)(iii)**	"Leave Behind" Losses PIIA, 6.2(a)(iv)	Safe Yield Contributed by Parties PIIA, 6.2(a)(v)	Allocation to Pre-Peace II Desalters[5]	Allocation for Peace II Desalter Expansion[6]	Balance	Non-Ag OBMP Assessment (10% Haircut)[7] PIIA, 6.2(b)(i)	Residual Replenishment Obligation[5, 8]
2001	7,989	0	7,989	3,995	0	**0**	0	0	0	0	0	0	3,995
2002	9,458	0	9,458	4,729	0	**0**	0	0	0	0	0	0	4,729
2003	10,439	0	10,439	5,219	0	**0**	0	0	0	0	0	0	5,219
2004	10,605	0	10,605	5,303	0	**0**	0	0	0	0	0	0	5,303
2005	9,854	0	9,854	4,927	0	**0**	0	0	0	0	0	0	4,927
2006	16,476	0	16,476	11,579	0	**0**	0	0	0	0	400,000	0	4,897
2007	26,356	0	26,356	608	4,273	**0**	0	0	21,475	0	378,525	0	0
2008	26,972	0	26,972	0	0	**0**	0	0	26,972	0	351,553	0	0
2009	32,920	0	32,920	0	0	**0**	0	0	61,989	0	289,564	0	-29,069
2010	28,517	0	28,517	0	0	**0**	0	0	28,517	0	261,047	0	0
2011	29,319	0	29,319	0	0	**0**	0	0	29,319	0	231,729	0	0
2012	28,379	0	28,379	0	0	**0**	0	0	28,379	0	203,350	0	0
2013	27,062	0	27,062	0	0	**0**	0	0	27,062	0	176,288	0	0
2014	30,000	0	30,000	0	0	**0**	0	0	1,288	0	175,000	0	28,712
2015	30,000	0	30,000	0	0	**0**	0	0	0	0	175,000	0	30,000
2016	30,000	7,500	37,500	0	0	**0**	0	0	0	7,500	167,500	0	30,000
2017	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	157,500	735	29,265
2018	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	147,500	735	29,265
2019	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	137,500	735	29,265
2020	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	127,500	735	29,265
2021	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	117,500	735	29,265
2022	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	107,500	735	29,265
2023	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	97,500	735	29,265
2024	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	87,500	735	29,265
2025	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	77,500	735	29,265
2026	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	67,500	735	29,265
2027	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	57,500	735	29,265
2028	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	47,500	735	29,265
2029	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	37,500	735	29,265
2030	30,000	10,000	40,000	0	0	**0**	0	0	0	10,000	27,500	735	29,265
Totals	774,345	147,500	921,845	36,360	4,273	**0**	0	0	225,000	147,500		10,290	498,421
									(225,000 available)	(175,000 available)			

1. Table format and content: WEI, Response to Condition Subsequent Number 7, November 2008.

2. Peace II Desalter Expansion expected to increase total desalter production in October 2015.

3. 3,956.877 acre-feet + 316.177 acre-feet added as Non-Ag dedicated stored water per Paragraph 31 Settlement Agreements. Per Agreements, the water is deemed to have been dedicated as of June 30, 2007.

4. The Santa Ana River Underflow New Yield (SARUNY) projection in the table is shown as zero for each year. In the near future, through the modeling work and Safe Yield Recalculation process, Watermaster will determine the SARUNY created by Desalters and Re-Operation, and will produce a new schedule.

5. Six years of Desalter tracking (Production Year 2000/2001 through Production Year 2005/2006) incorrectly assumed that a significant portion of Desalter production was being offset by SAR Underflow New Yield. Condition Subsequent 7 included an adjustment of 29,070 AF against Desalter replenishment in Production Year 2008/2009.

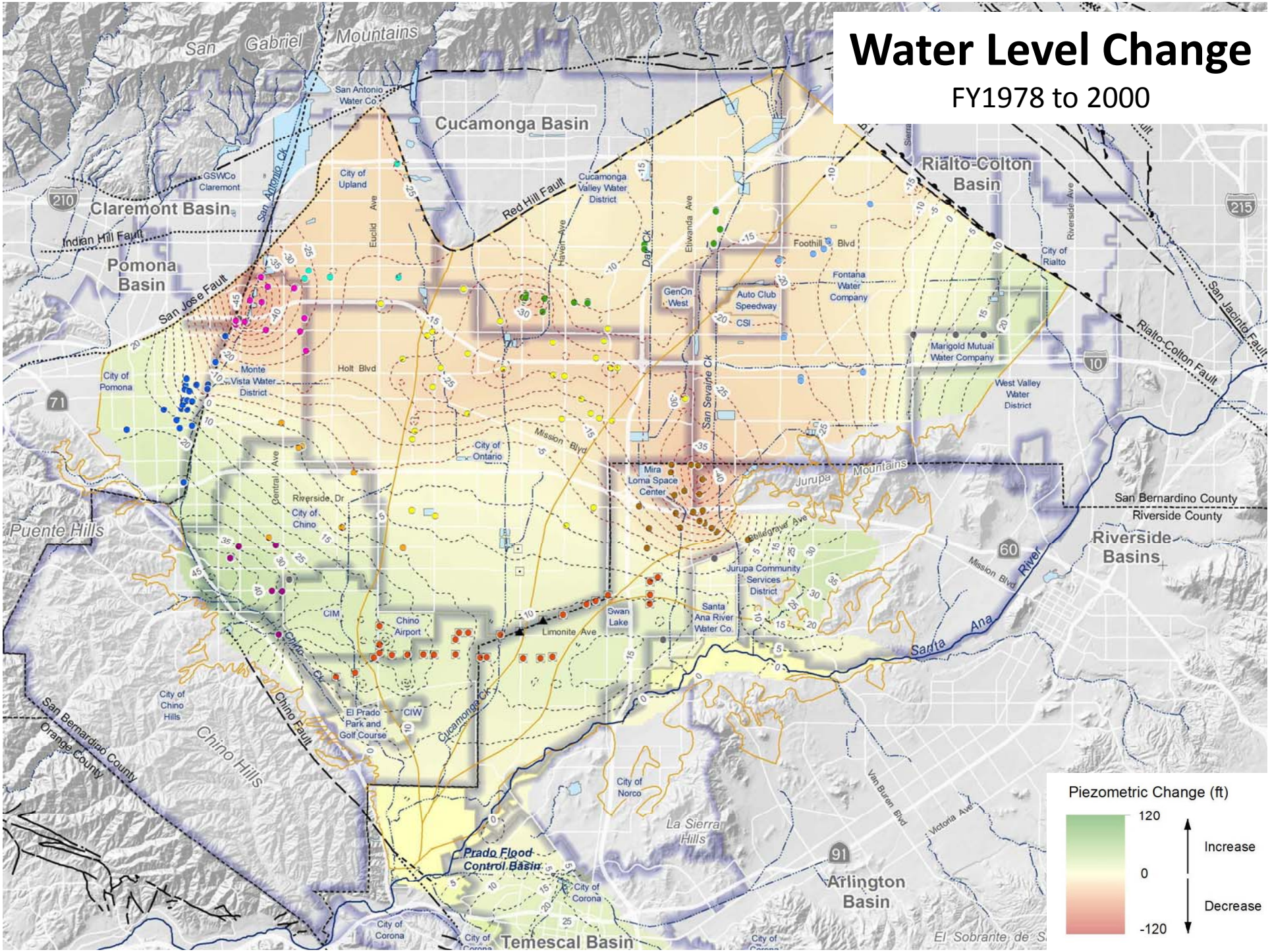
6. The Peace I Agreement terminates in 2030. Per this schedule, the Peace II Desalter expansion has not yet fully utilized its available 175,000 acre-feet.

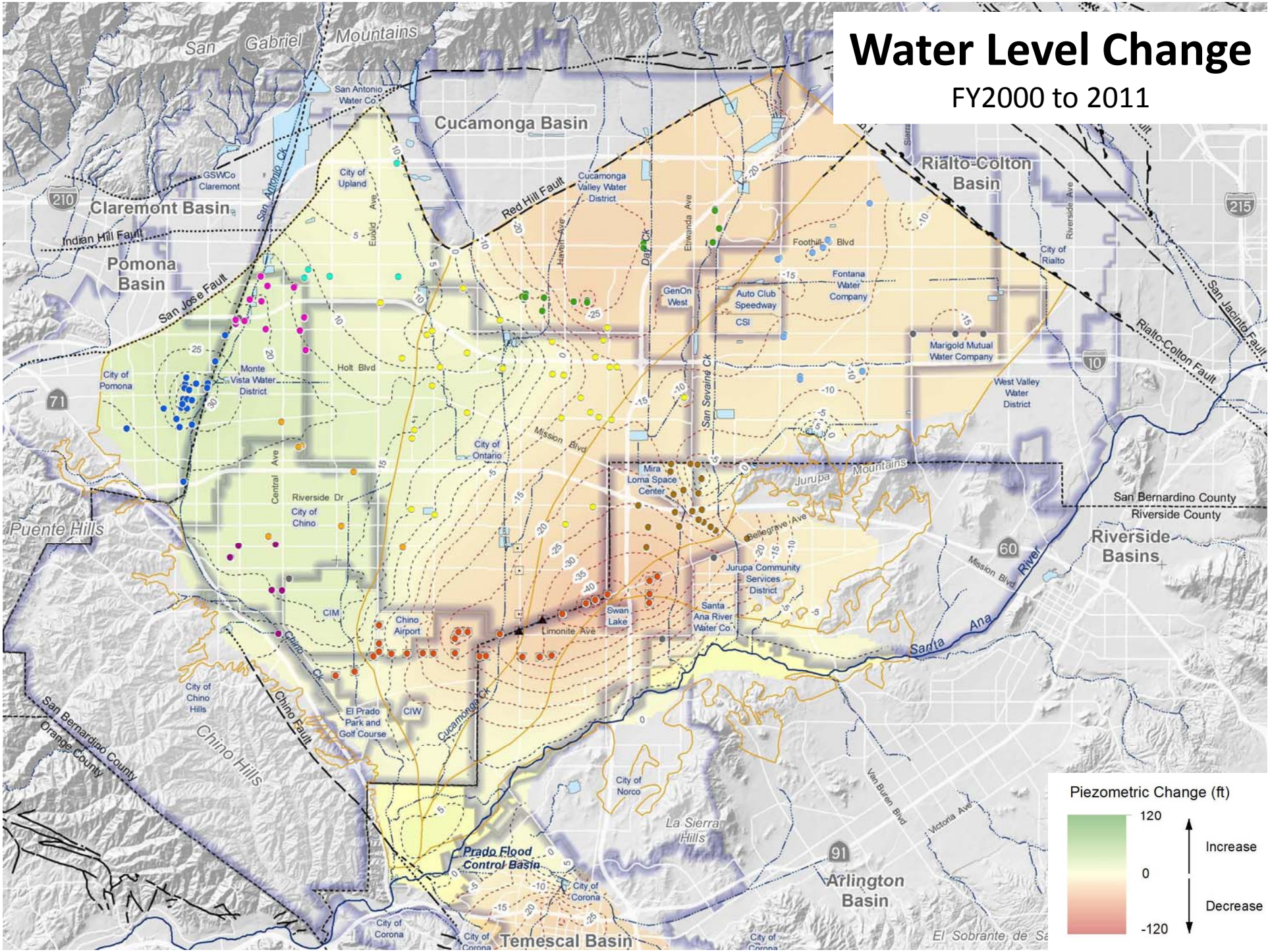
7. For the first 10 years following the Peace II Agreement (2006/2007 through 2015/2016), the Non-Ag "10% Haircut" water is apportioned among the specific seven members of the Appropriative Pool, per PIIA 9.2(a). In the eleventh year and each year thereafter, it is dedicated to Watermaster to further offset desalter replenishment. However, to the extent there is no remaining desalter replenishment obligation in any year after applying the offsets set forth in 6.2(a), it will be distributed pro rata among the members of the Appropriative Pool based upon each Producer's combined total share of OSY and the previous year's actual production.

8. Per the Peace II Agreement, Section 6.2(b)(ii), the residual replenishment assessment is against the Appropriative Pool, pro-rata based on each Producer's combined total share of OSY and the previous year's actual production.

Agenda Item 6
Impact of Management

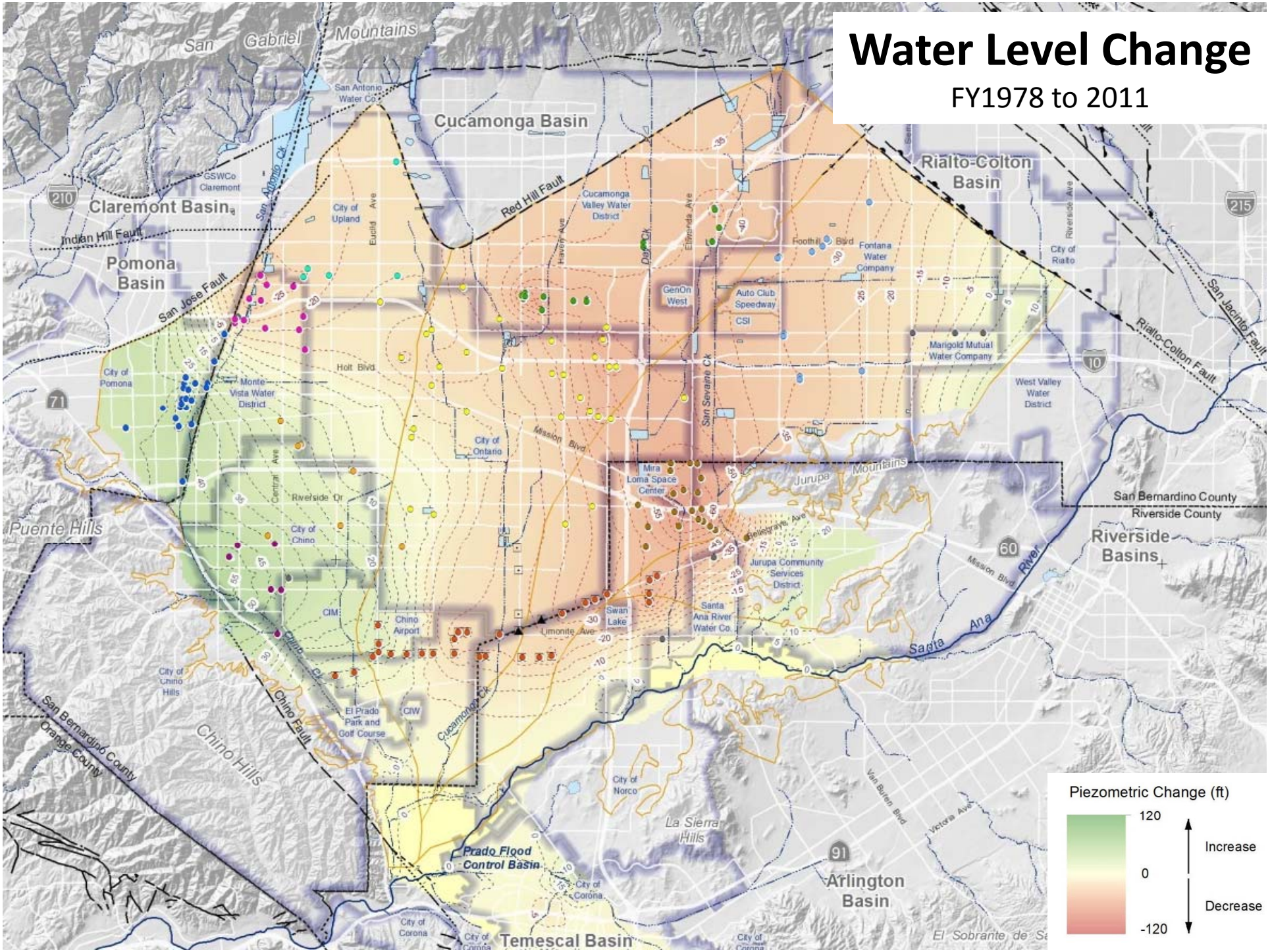
- Groundwater Levels
- Hydraulic Control
- Subsidence
- Yield


Water Level Change
FY1978 to 2000
San Gabriel Mountains
Cucamonga Basin
Rialto-Colton Basin
Claremont Basin
Pomona Basin
Riverside Basins
Arlington Basin
Temescal Basin
Prado Flood Control Basin
Puente Hills
Chino Hills
La Sierra Hills
Jurupa Mountains
Red Hill Fault
Indian Hill Fault
San Jose Fault
Chino Fault
Rialto-Colton Fault
San Jacinto Fault
San Antonio Water Co
GSWCo Claremont
City of Upland
Cucamonga Valley Water District
City of Rialto
Fontana Water Company
GenOn West
Auto Club Speedway
CSI
Marigold Mutual Water Company
West Valley Water District
Monte Vista Water District
City of Pomona
Holt Blvd
City of Ontario
Mission Blvd
Mira Loma Space Center
City of Chino
Riverside Dr
Jurupa Community Services District
Santa Ana River Water Co
Swan Lake
Limonite Ave
Chino Airport
CIM
CIW
El Prado Park and Golf Course
City of Chino Hills
City of Norco
City of Corona
San Bernardino County
Riverside County
Orange County
Santa Ana River
Foothill Blvd
Van Buren Blvd
Victoria Ave
Piezometric Change (ft)
120
0
-120
Increase
Decrease


Water Level Change
FY2000 to 2011
San Gabriel Mountains
Cucamonga Basin
Rialto-Colton Basin
Claremont Basin
Pomona Basin
Arlington Basin
Temescal Basin
Prado Flood Control Basin
Riverside Basins
Puente Hills
Chino Hills
La Sierra Hills
Jurupa Mountains
San Antonio Water Co.
GSWCo Claremont
City of Upland
Cucamonga Valley Water District
Red Hill Fault
Indian Hill Fault
San Jose Fault
Rialto-Colton Fault
San Jacinto Fault
Chino Fault
San Antonio Ck
Day Ck
San Sevaine Ck
Cucamonga Ck
Chino Ck
Santa Ana River
Foothill Blvd
City of Rialto
Fontana Water Company
GenOn West
Auto Club Speedway
CSI
Marigold Mutual Water Company
West Valley Water District
Monte Vista Water District
City of Pomona
Holt Blvd
City of Ontario
Mission Blvd
Riverside Dr
City of Chino
Mira Loma Space Center
Jurupa Community Services District
Santa Ana River Water Co.
Swan Lake
Limonite Ave
Chino Airport
CIM
CIW
El Prado Park and Golf Course
City of Chino Hills
City of Norco
City of Corona
San Bernardino County
Riverside County
Orange County
Piezometric Change (ft)
120
0
-120
Increase
Decrease

Water Level Change

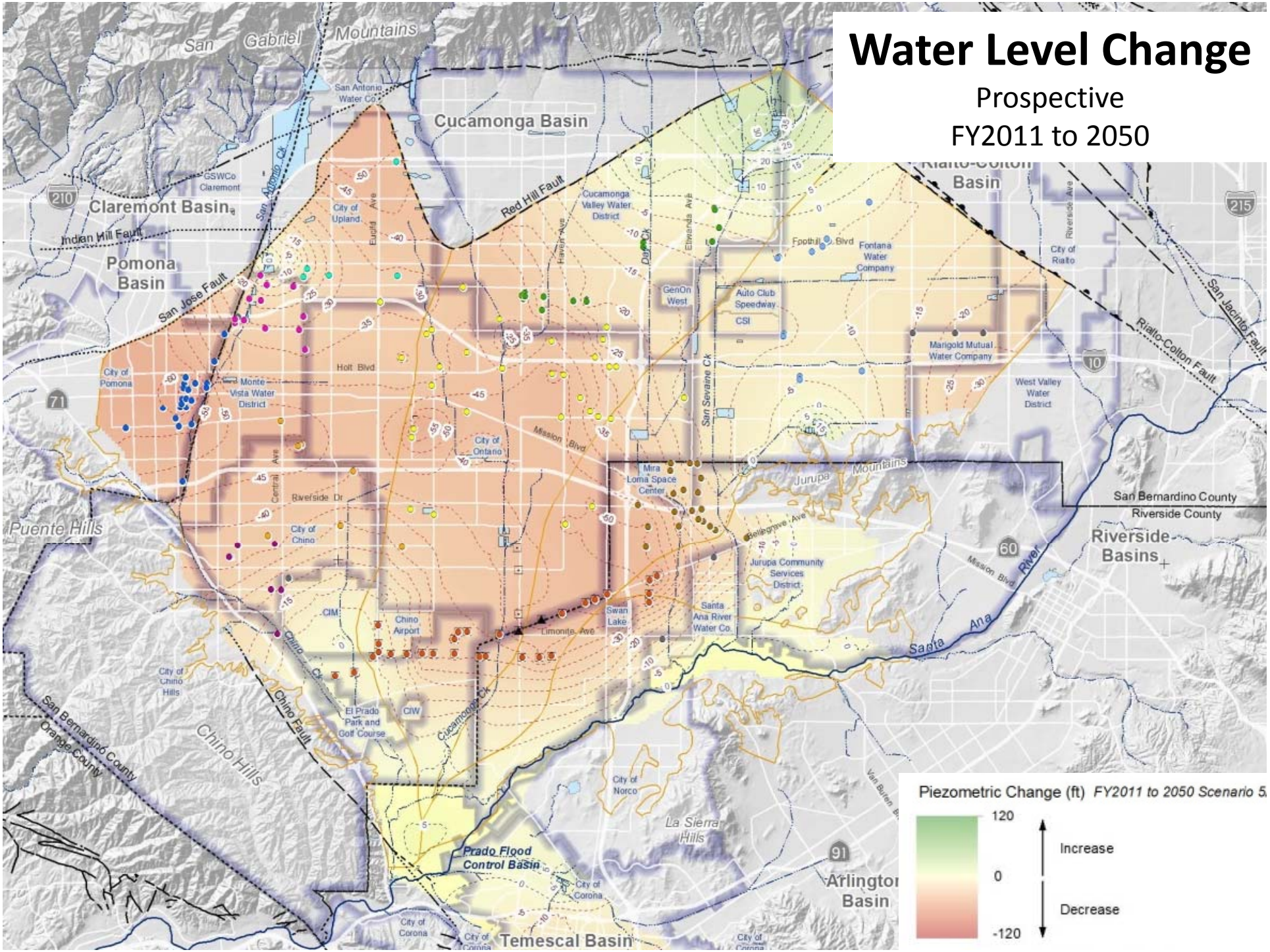
FY1978 to 2011



Water Level Change

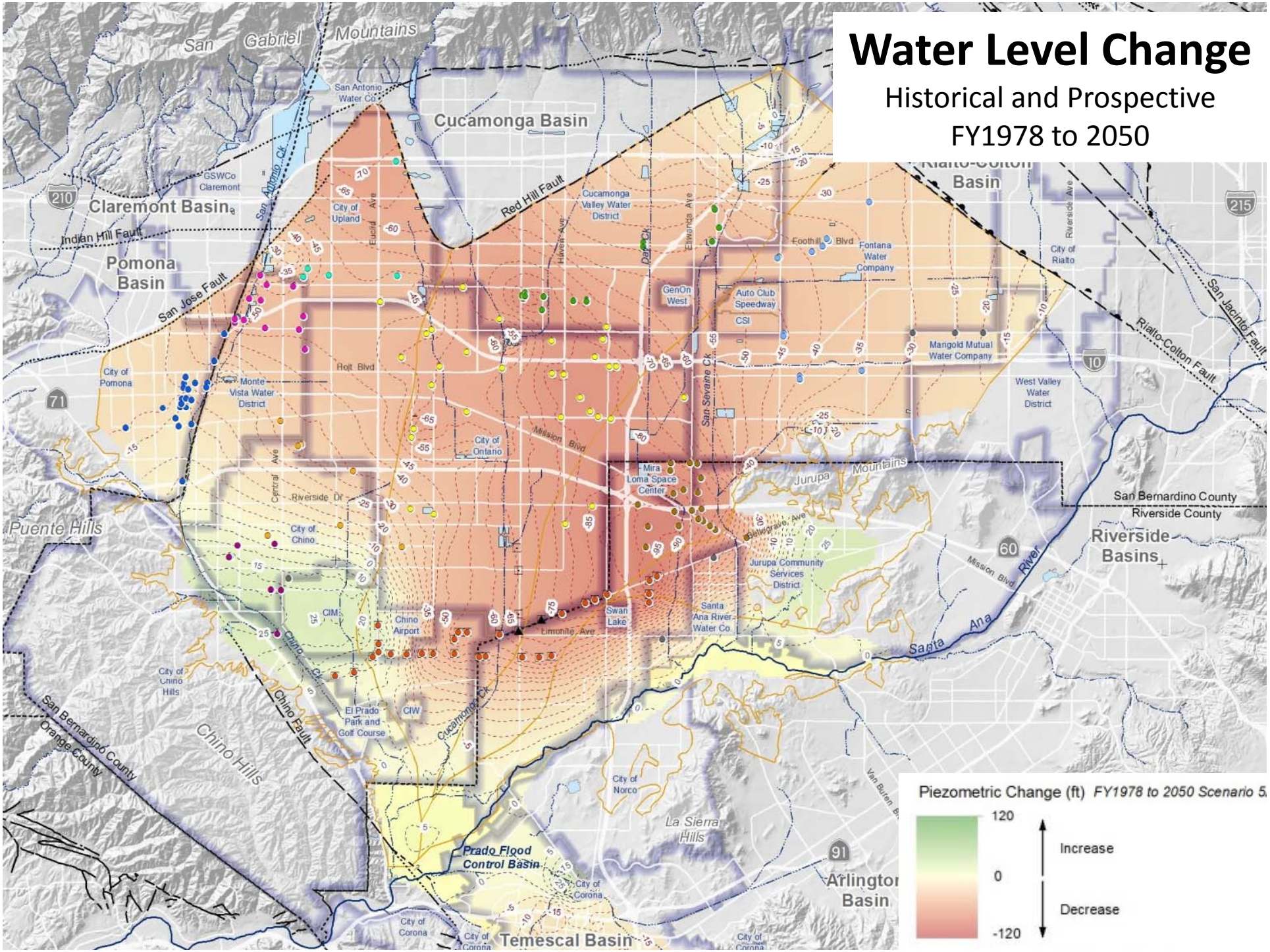
Prospective

FY2011 to 2050



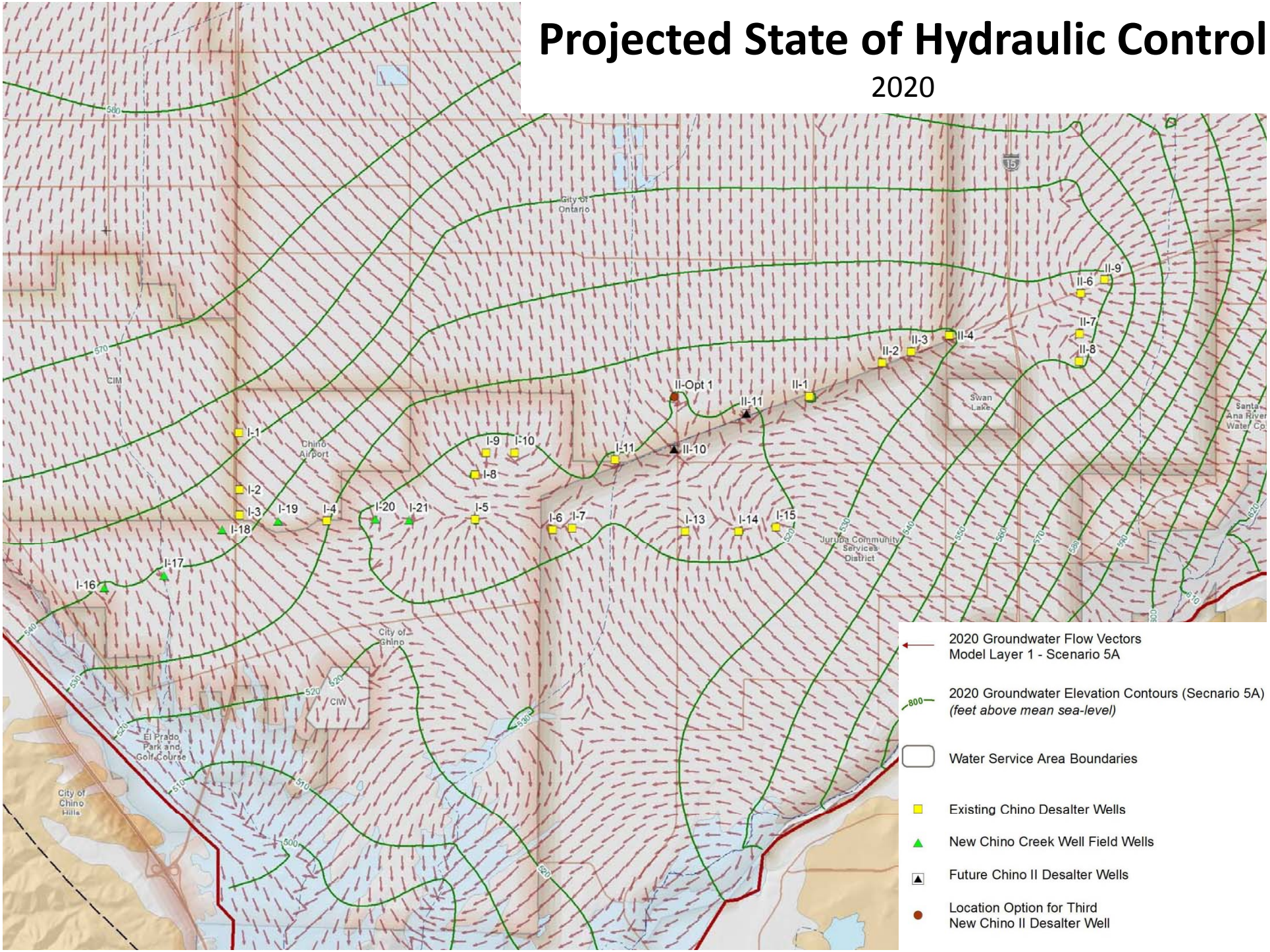
Water Level Change

Historical and Prospective
FY1978 to 2050



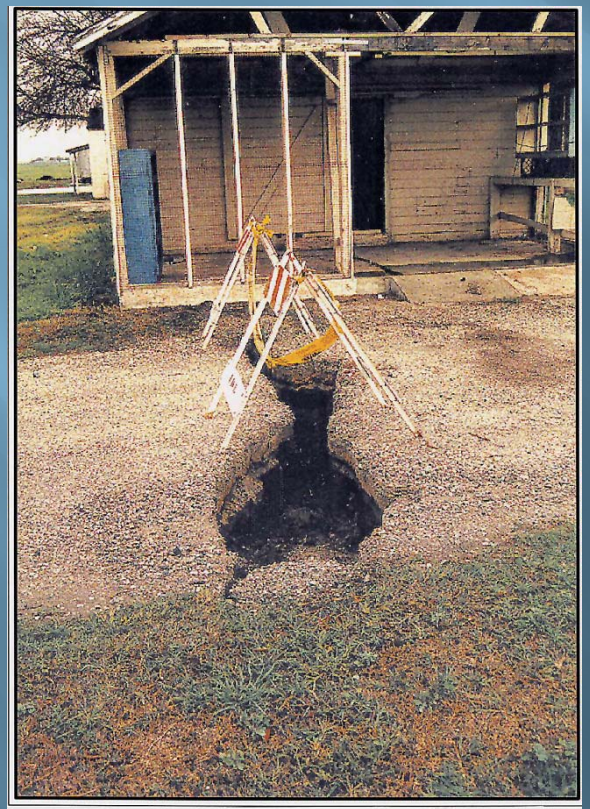
Projected State of Hydraulic Control

2020

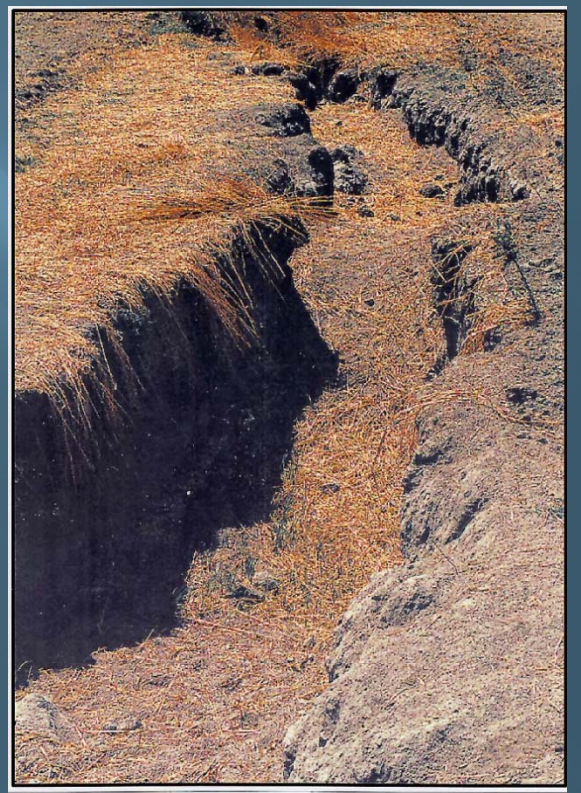


Management of Land Subsidence in Chino Basin

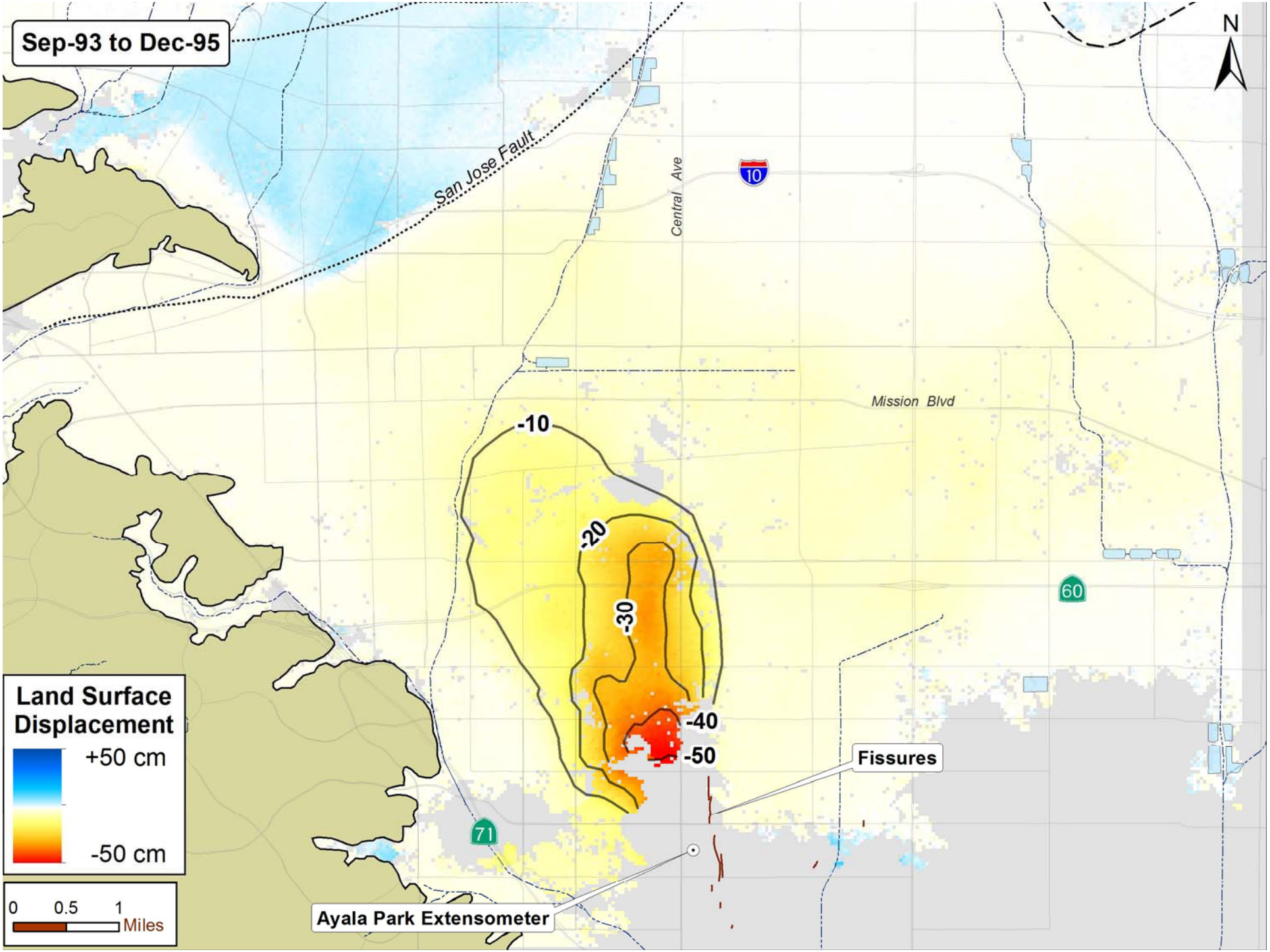
- Subsidence and fissuring occurred in Chino in 1990s, with reports of fissuring in the 1970s

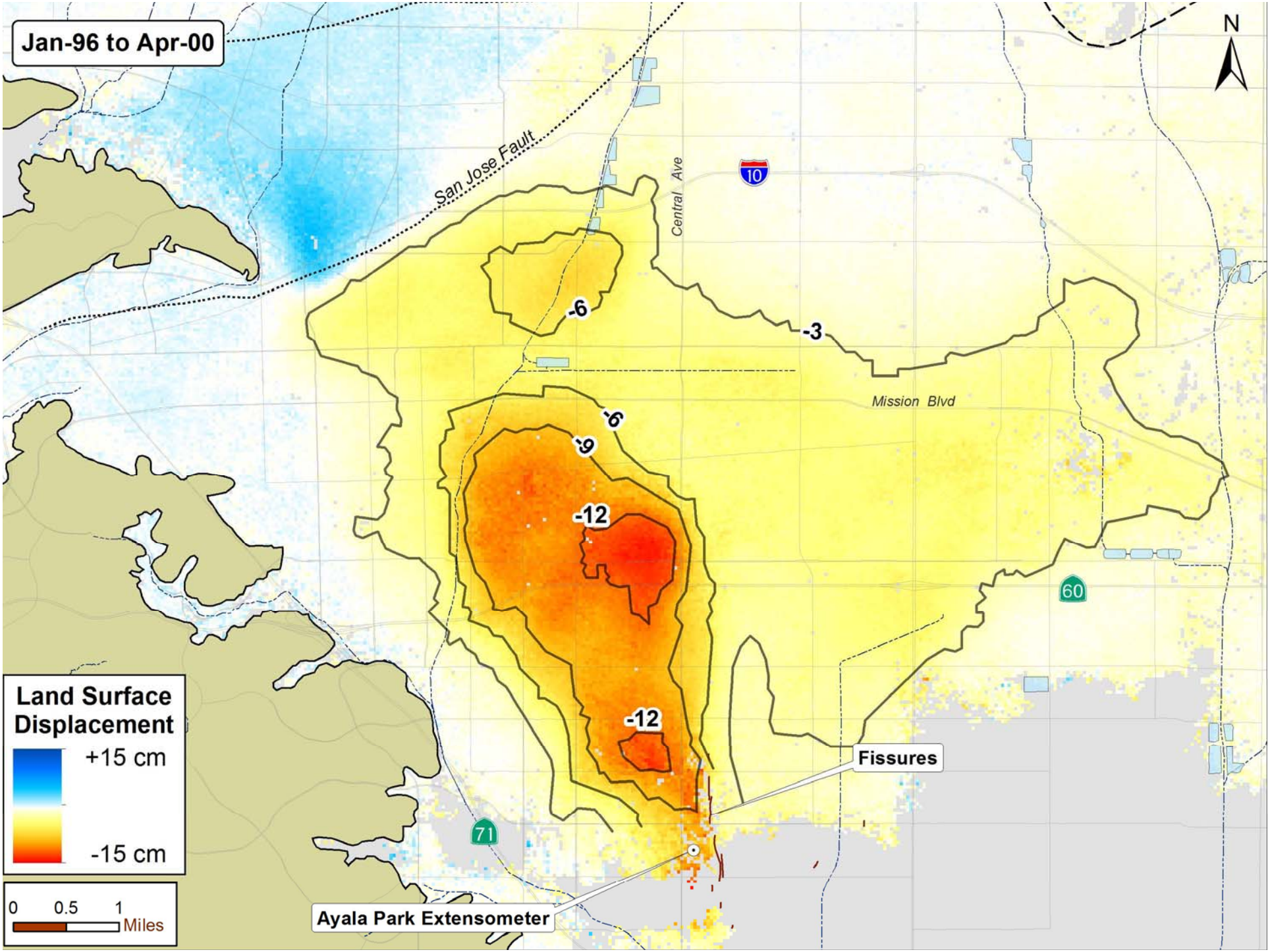


View of a fissure that developed beneath CIM facility in December 1992



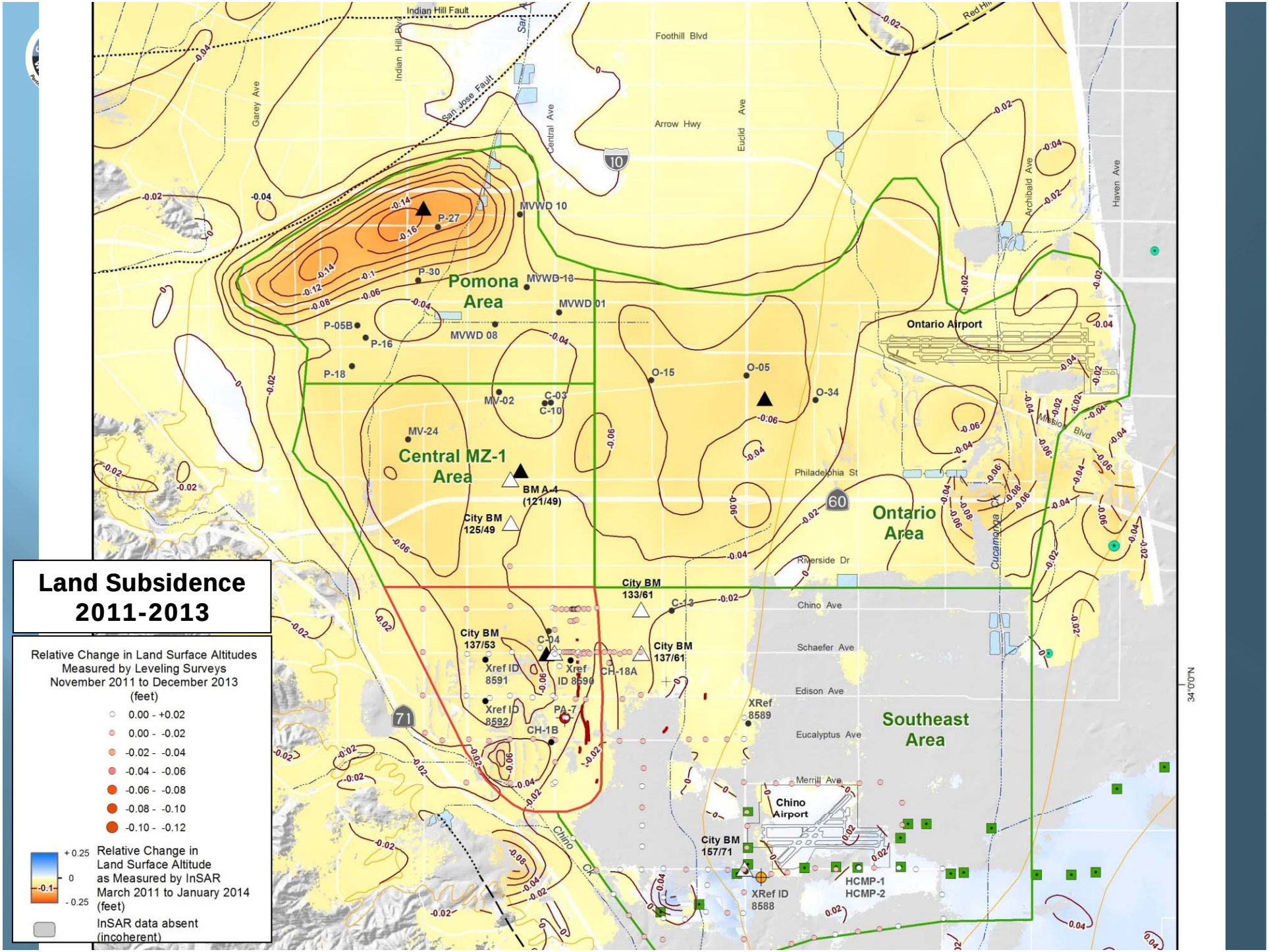
Surface expression of fissure that developed in a field north of CIM in February 1991

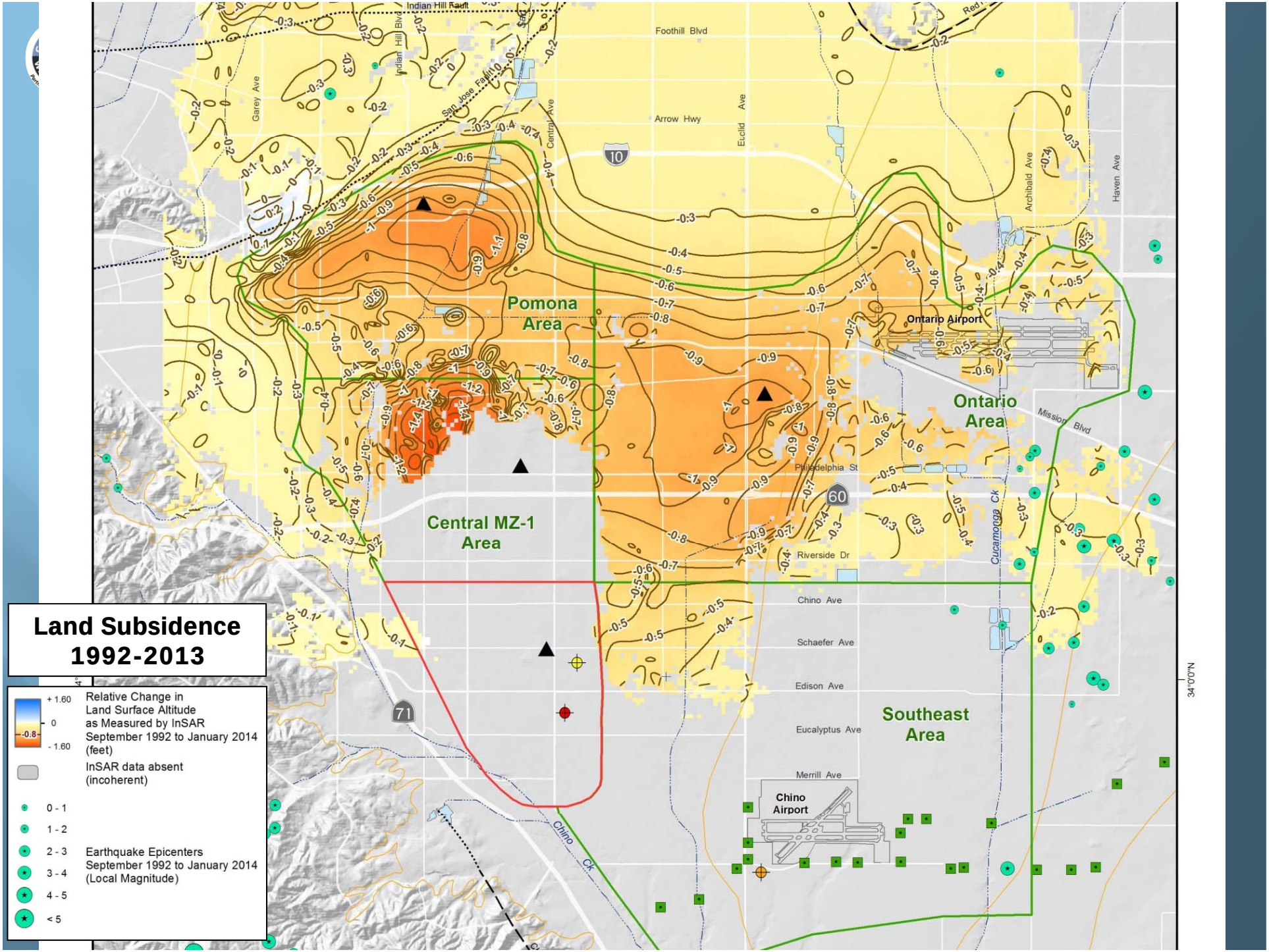

Sep-93 to Dec-95
N
San Jose Fault
Central Ave
10
Mission Blvd
-10
-20
-30
-40
-50
60
71
Fissures
Ayala Park Extensometer
Land Surface Displacement
+50 cm
-50 cm
0 0.5 1
Miles

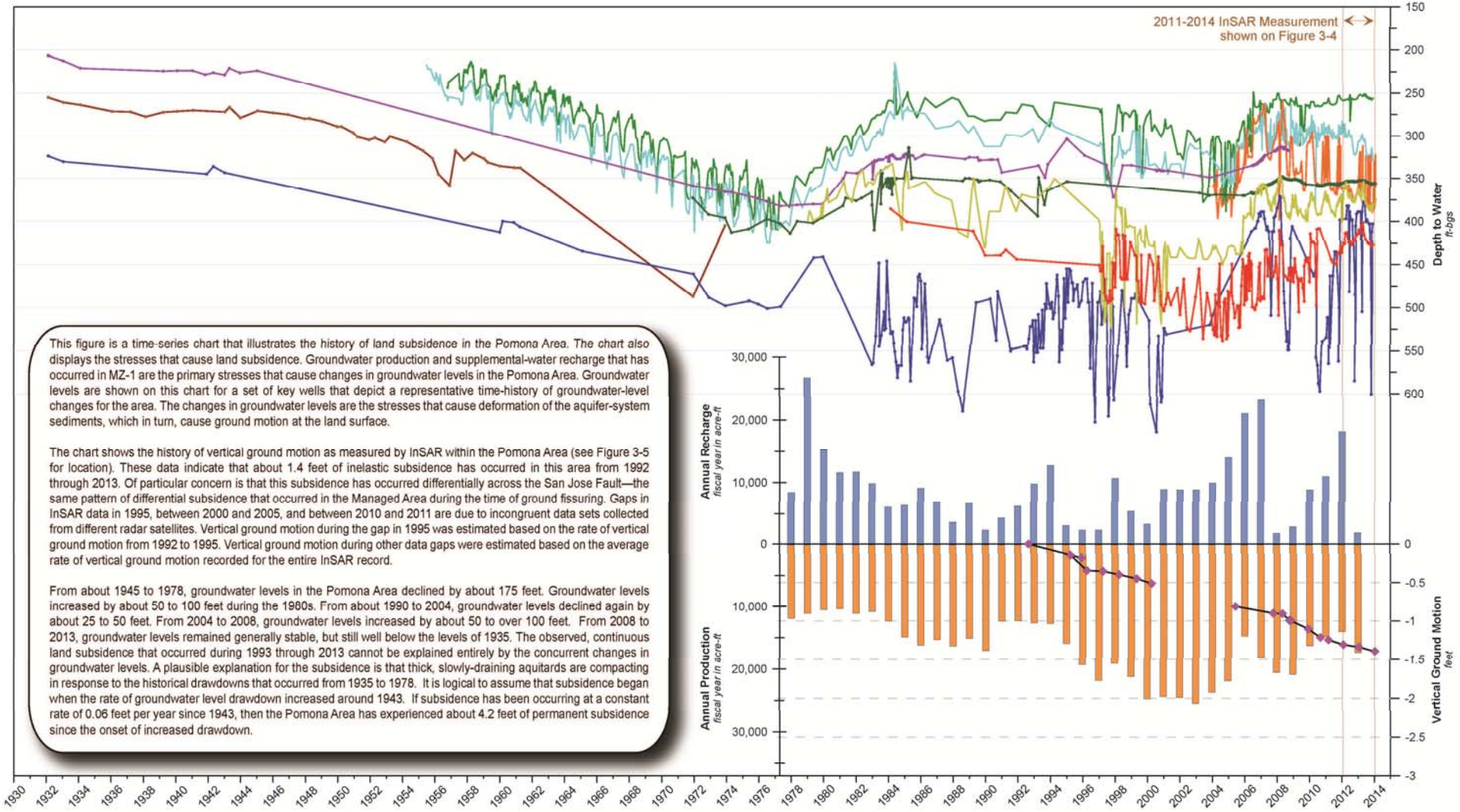

Jan-96 to Apr-00
N
San Jose Fault
Central Ave
10
-6
-3
Mission Blvd
-6
-9
-12
-12
60
71
Fissures
Ayala Park Extensometer
Land Surface Displacement
+15 cm
-15 cm
0
0.5
1
Miles

Subsidence Management in Chino Basin

- OBMP Program Element 4 (2000)
  - Objective: minimize or abate land subsidence and fissuring
  - Developed technical information on cause
  - Developed and implemented an "adaptive management plan"
  - MZ-1 Plan was approved by Court Order in 2007
- Land Subsidence Committee implements MZ-1 Plan
  - Reviews data from monitoring program annually and recommends future efforts
  - Recommends updates to management plan → based on data


Land Subsidence
2011-2013
Relative Change in Land Surface Altitudes
Measured by Leveling Surveys
November 2011 to December 2013
(feet)
0.00 - +0.02
0.00 - -0.02
-0.02 - -0.04
-0.04 - -0.06
-0.06 - -0.08
-0.08 - -0.10
-0.10 - -0.12
+ 0.25
0
- 0.25
Relative Change in
Land Surface Altitude
as Measured by InSAR
March 2011 to January 2014
(feet)
InSAR data absent
(incoherent)
Pomona
Area
Central MZ-1
Area
Ontario
Area
Southeast
Area
Ontario Airport
Chino
Airport
Indian Hill Fault
San Jose Fault
Foothill Blvd
Arrow Hwy
Garey Ave
Indian Hill Blvd
Central Ave
Euclid Ave
Archibald Ave
Haven Ave
Philadelphia St
Riverside Dr
Chino Ave
Schaefer Ave
Edison Ave
Eucalyptus Ave
Merrill Ave
Cucamonga Ck
Chino Ck
MVWD 10
MVWD 13
MVWD 01
MVWD 08
P-27
P-30
P-05B
P-16
P-18
MV-02
MV-24
C-03
C-10
O-15
O-05
O-34
BM A-4
(121/49)
City BM
125/49
City BM
133/61
C-13
City BM
137/53
C-04
City BM
137/61
Xref ID
8591
Xref
ID 8590
CH-18A
Xref ID
8592
PA-7
CH-1B
XRef
8589
City BM
157/71
XRef ID
8588
HCMP-1
HCMP-2
10
60
71
34°0'0"N


Land Subsidence
1992-2013
+ 1.60
0
-0.8
- 1.60
Relative Change in
Land Surface Altitude
as Measured by InSAR
September 1992 to January 2014
(feet)
InSAR data absent
(incoherent)
0 - 1
1 - 2
2 - 3
3 - 4
4 - 5
< 5
Earthquake Epicenters
September 1992 to January 2014
(Local Magnitude)
Pomona
Area
Central MZ-1
Area
Ontario
Area
Southeast
Area
Ontario Airport
Chino
Airport
Foothill Blvd
Arrow Hwy
Indian Hill Fault
San Jose Fault
Garey Ave
Indian Hill Blvd
Central Ave
Euclid Ave
Archibald Ave
Haven Ave
Mission Blvd
Philadelphia St
Riverside Dr
Chino Ave
Schaefer Ave
Edison Ave
Eucalyptus Ave
Merrill Ave
Cucamonga Ck
Chino Ck
10
60
71
34°0'0"N



This figure is a time-series chart that illustrates the history of land subsidence in the Pomona Area. The chart also displays the stresses that cause land subsidence. Groundwater production and supplemental-water recharge that has occurred in MZ-1 are the primary stresses that cause changes in groundwater levels in the Pomona Area. Groundwater levels are shown on this chart for a set of key wells that depict a representative time-history of groundwater-level changes for the area. The changes in groundwater levels are the stresses that cause deformation of the aquifer-system sediments, which in turn, cause ground motion at the land surface.

The chart shows the history of vertical ground motion as measured by InSAR within the Pomona Area (see Figure 3-5 for location). These data indicate that about 1.4 feet of inelastic subsidence has occurred in this area from 1992 through 2013. Of particular concern is that this subsidence has occurred differentially across the San Jose Fault—the same pattern of differential subsidence that occurred in the Managed Area during the time of ground fissuring. Gaps in InSAR data in 1995, between 2000 and 2005, and between 2010 and 2011 are due to incongruent data sets collected from different radar satellites. Vertical ground motion during the gap in 1995 was estimated based on the rate of vertical ground motion from 1992 to 1995. Vertical ground motion during other data gaps were estimated based on the average rate of vertical ground motion recorded for the entire InSAR record.

From about 1945 to 1978, groundwater levels in the Pomona Area declined by about 175 feet. Groundwater levels increased by about 50 to 100 feet during the 1960s. From about 1990 to 2004, groundwater levels declined again by about 25 to 50 feet. From 2004 to 2008, groundwater levels increased by about 50 to over 100 feet. From 2008 to 2013, groundwater levels remained generally stable, but still well below the levels of 1935. The observed, continuous land subsidence that occurred during 1993 through 2013 cannot be explained entirely by the concurrent changes in groundwater levels. A plausible explanation for the subsidence is that thick, slowly-draining aquitards are compacting in response to the historical drawdowns that occurred from 1935 to 1978. It is logical to assume that subsidence began when the rate of groundwater level drawdown increased around 1943. If subsidence has been occurring at a constant rate of 0.06 feet per year since 1943, then the Pomona Area has experienced about 4.2 feet of permanent subsidence since the onset of increased drawdown.

Prepared by:

WEI
Wildermuth Environmental, Inc.
www.wildermuthenvironmental.com

Author: TCR
Date: 20140519
File: Figure_3-10_2013_Pomona.grf

Groundwater Levels at Wells (Top-Bottom Screen Interval)

- MV-01 (245-472 ft-bgs)
- MV-08 (225-447 ft-bgs)
- MV-10 (520-1084 ft-bgs)
- MV-13 (203-475 ft-bgs)
- P-5B (457-615 ft-bgs)
- P-16 (270-328 ft-bgs)
- P-18 (307-660 ft-bgs)
- P-27 (472-849 ft-bgs)
- P-30 (565-875 ft-bgs)

Vertical Ground Motion

- Pomona Area InSAR

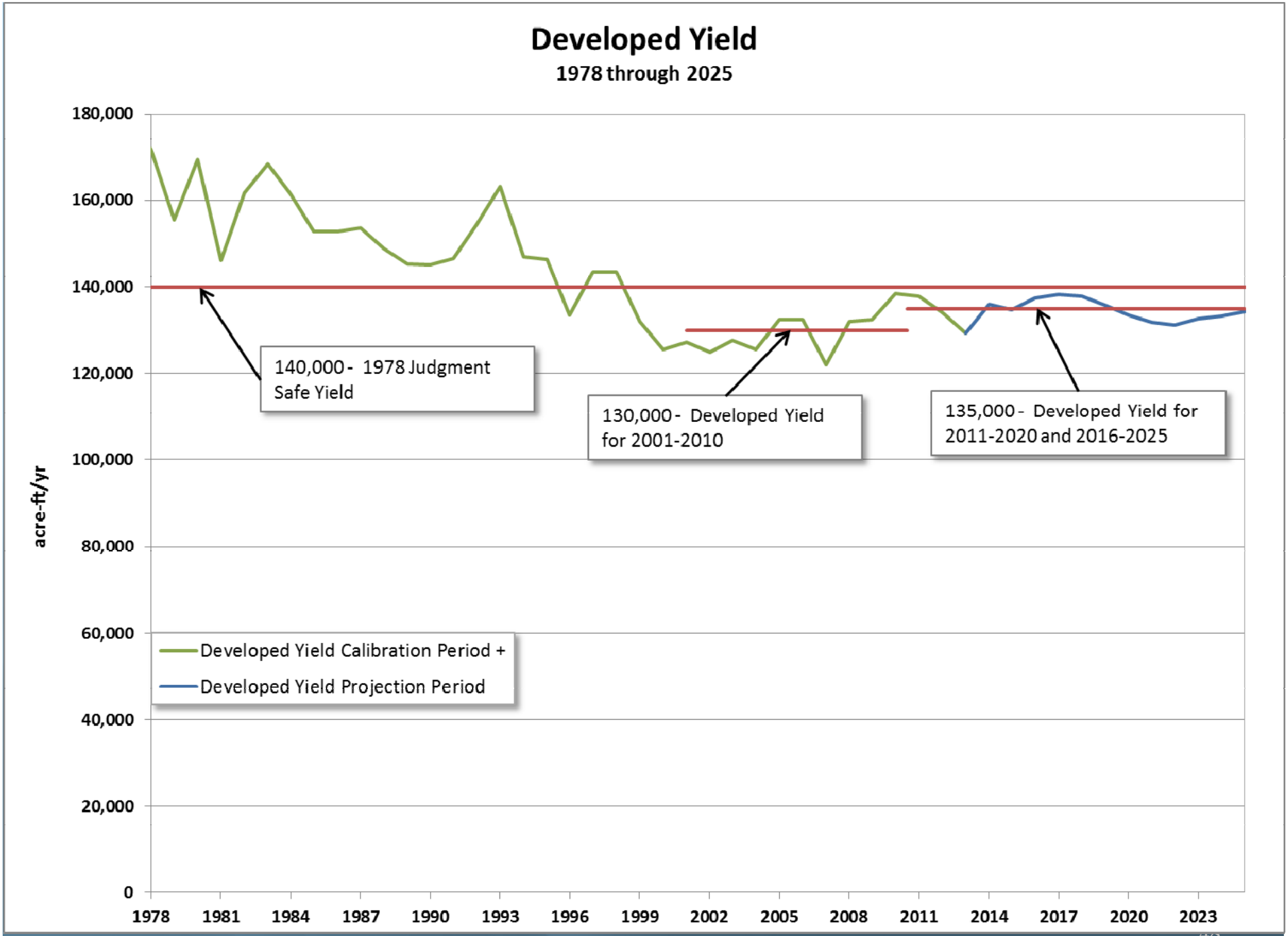
Recharge and Production

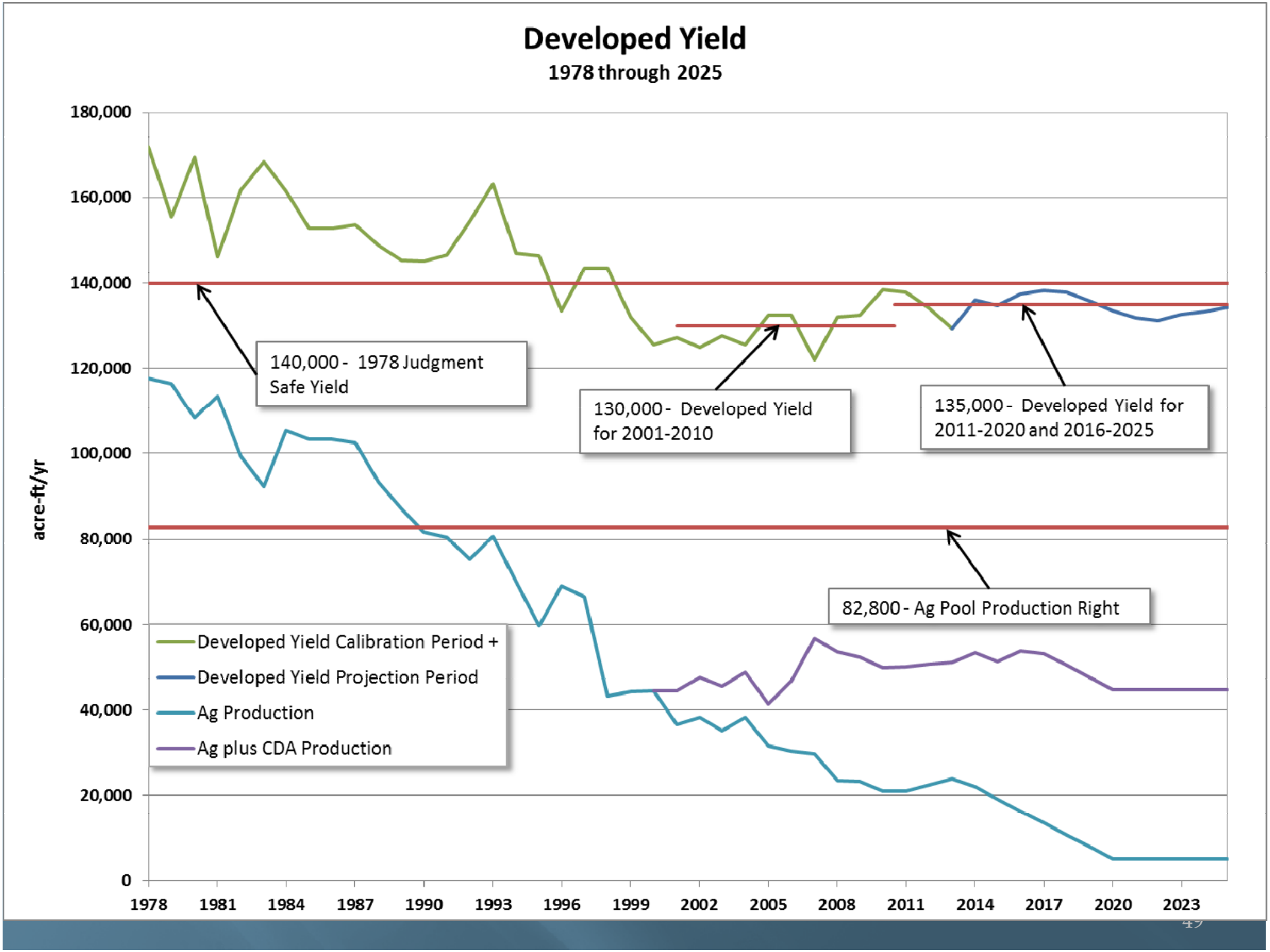
- Recharge of Recycled Water, Storm Water*, and Imported Water at the College Heights, Upland, Montclair, and Brooks Basins; and at MVWD ASR Wells
  *Storm Water is an estimated amount prior to Fiscal Year 04/05
- Groundwater Production from Wells in the Pomona Area

Land Subsidence Committee
2013 Annual Report

The History of Land Subsidence in the Pomona Area

Figure 3-10


Developed Yield
1978 through 2025
acre-ft/yr
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
2023
140,000 - 1978 Judgment Safe Yield
130,000 - Developed Yield for 2001-2010
135,000 - Developed Yield for 2011-2020 and 2016-2025
Developed Yield Calibration Period +
Developed Yield Projection Period


Developed Yield
1978 through 2025
acre-ft/yr
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
2023
140,000 - 1978 Judgment Safe Yield
130,000 - Developed Yield for 2001-2010
135,000 - Developed Yield for 2011-2020 and 2016-2025
82,800 - Ag Pool Production Right
Developed Yield Calibration Period +
Developed Yield Projection Period
Ag Production
Ag plus CDA Production

End

CHINO BASIN WATERMASTER

SAFE YIELD RECALCULATION AND RESET

PROCESS TO COMPLETION

September 2014

- September 11: Pools receive status report
- September 16: Board holds Workshop
- September 18: Advisory receives status report
- September 18: Watermaster staff provides recap of Board Workshop during Open Discussion following Advisory Committee
- September 25: Board receives any further information requested during the 9/16/14 Workshop; offers any further direction

October 2014

- October 2: Open Discussion, topics TBD
- October 9: Pool receive presentation of Recalculated SY and implementation date
- October 16: Advisory Committee receives presentation of Recalculated SY and implementation date
- October 16: Open Discussion following Advisory Committee, topics TBD
- October 23: Board receives presentation of Recalculated SY and implementation date

November 2014

- November 6: Open Discussion
- November 13: Pool consideration
- November 20: Advisory consideration/adoption
- November 20: Board consideration/adoption
- Watermaster files Recalculated SY with the Court