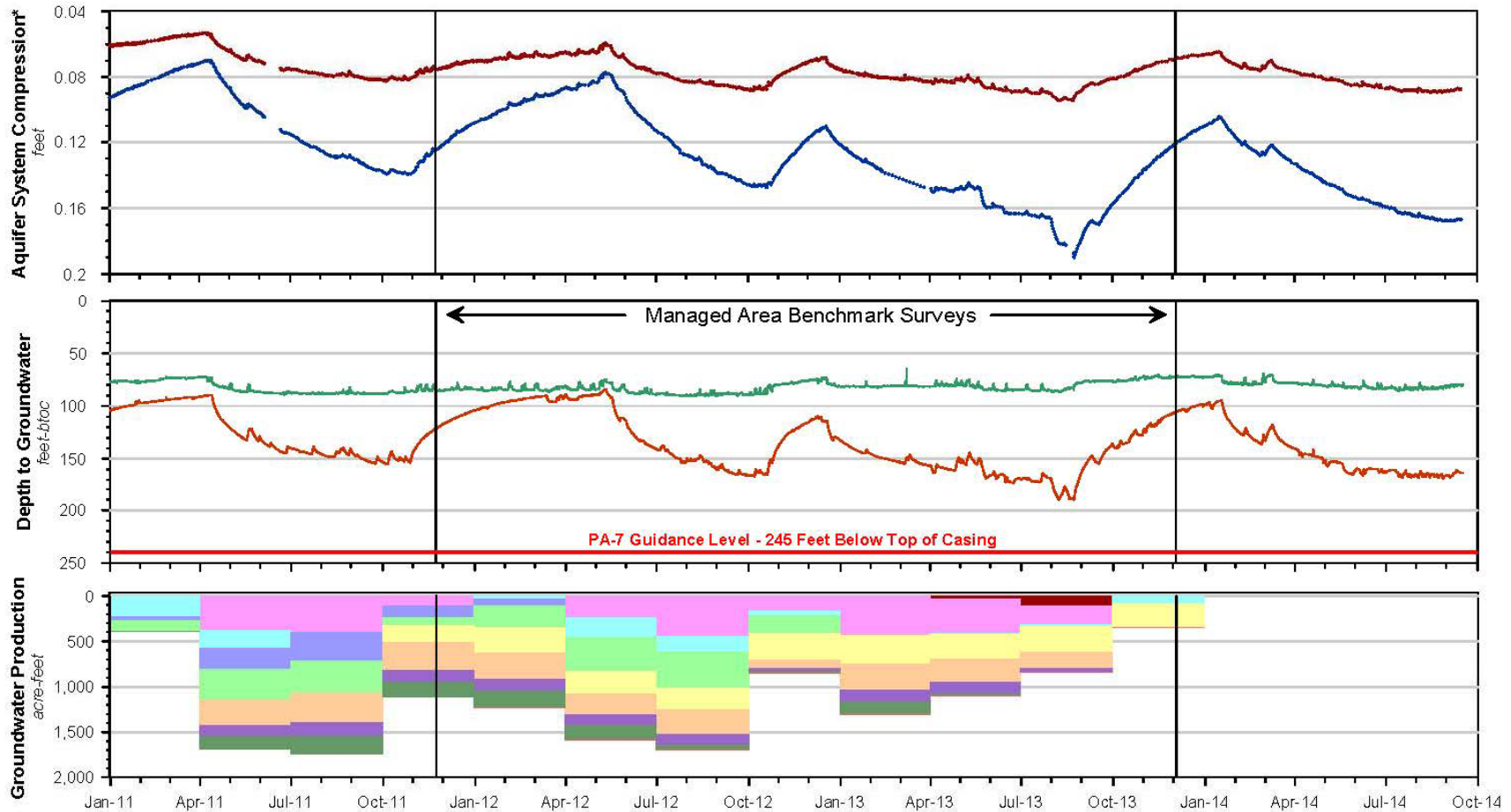


# Land Subsidence Monitoring Program

*FY 2014-15*

- Long-Term Pumping Test – Test the Guidance Level
- Chino Hills ASR Test – Rehabilitate and Retrofit CH-16
- Routine monitoring: production, piezometric levels, and extensometers
- InSAR – Five interferograms during FY 2014-15
- Ground-level Surveys
  - Managed Area – vertical survey and EDMs at maximum drawdown (below Guidance Level) and maximum recovery
  - Southeast Area – vertical survey, fall 2014
  - Pomona Area – vertical survey and EDMs at San Jose Array, fall 2014



**Shallow Aquifer System**

- Aquifer System Deformation (Extensometer Depth Interval)
  - Shallow Extensometer (30-550 ft-bgs)
- Depth to Groundwater (Perforated Depth Interval)
  - PA-10 Piezometer (213-233 ft-bgs)
- Groundwater Production (Top-Bottom Screen Interval)
  - C-4 (160-275 ft-bgs)
  - C-6 (200-375 ft-bgs)
  - CIM-1 (118-357 ft-bgs)
  - CH-1A (166-317 ft-bgs)
  - CH-7A (135-290 ft-bgs)
  - CH-7B (120-360 ft-bgs)
  - XRef 8730 (unknown)

**Deep Aquifer System**

- Aquifer System Deformation (Extensometer Depth Interval)
  - Deep Extensometer (30-1,400 ft-bgs)
- Depth to Groundwater (Perforated Depth Interval)
  - PA-7 Piezometer (438-448 ft-bgs)
- Groundwater Production (Top-Bottom Screen Interval)
  - CH-15B (360-900 ft-bgs)
  - CH-17 (300-980 ft-bgs)
  - CIM-11A (174-465\*\* ft-bgs)



Prepared by:  
 Author: TCR  
 Date: 20140919  
 Filename: Figure\_3-2.grf



**Land Subsidence Committee**  
 2014 Annual Report

**Stress and Strain within the Managed Area**

**Figure 3-2**

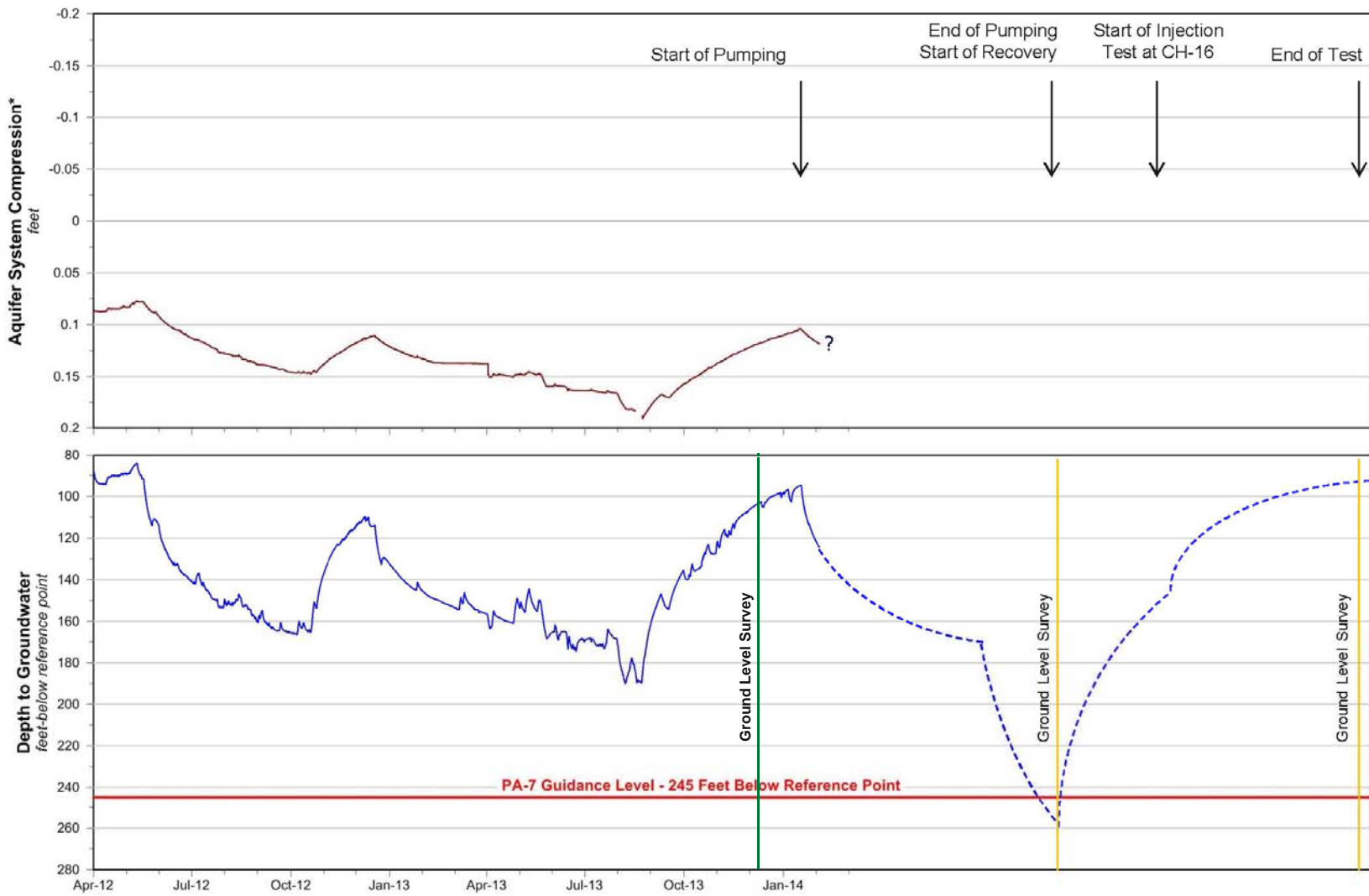
\*Positive compression values represent compression of soils, negative compression values represent expansion of soils

\*\*The original casing was perforated from 135-148, 174-187, 240-283, 405-465, 484-512, 518-540 ft-bgs. This casing collapsed below 470 ft-bgs in 2011. A liner was installed to 470.5 ft-bgs with screen interval from 155 to 470 ft-bgs.

# Long-Term Pumping Test

*FY 2014-15*

- Pumping at CH-15 has not commenced, and there is no time table for start up. It is unlikely that the Guidance Level will be tested this fiscal year.
- Should the Watermaster conduct the surveys in the Managed area in fall 2014 if drawdown at PA-7 does not fall below the Guidance Level?
  - Managed Area Fall surveys: 2001, 2003, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2013
  - Fall 2014 survey = \$34,770 (if conducted with SE Area survey)
  - Spring 2015 survey = \$36,600



Prepared by:



- Aquifer System Compression (Aquifer System Depth Interval)
  - Ayala Park Deep Extensometer (30-1,400 feet-bgs)
- Groundwater Levels at Wells (Perforated Depth Interval)
  - PA-7 (438-448 feet-bgs)
  - - - Predicted Record for PA-7 During Test

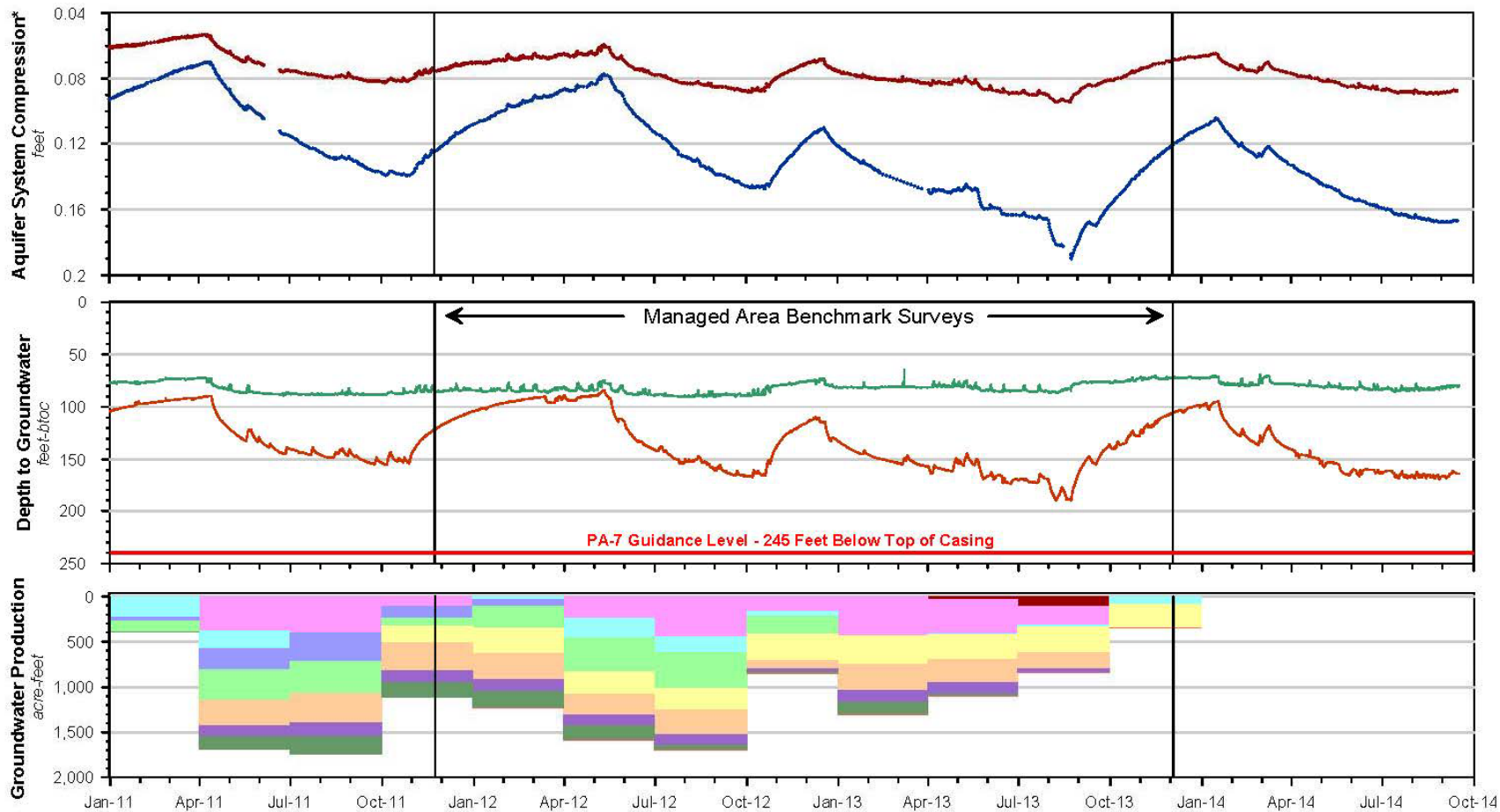
\*Positive compression values represent compression of soils, negative compression values represent expansion of soils.



Land Subsidence Committee  
2013 Annual Report

Long-Term Pumping Test  
Managed Area

Figure 4-2



**Shallow Aquifer System**

- Aquifer System Deformation (Extensometer Depth Interval)
  - Shallow Extensometer (30-550 ft-bgs)
- Depth to Groundwater (Perforated Depth Interval)
  - PA-10 Piezometer (213-233 ft-bgs)
- Groundwater Production (Top-Bottom Screen Interval)
  - C-4 (160-275 ft-bgs)
  - C-6 (200-375 ft-bgs)
  - CIM-1 (118-357 ft-bgs)
  - CH-1A (166-317 ft-bgs)
  - CH-7A (135-290 ft-bgs)
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- Aquifer System Deformation (Extensometer Depth Interval)
  - Deep Extensometer (30-1,400 ft-bgs)
- Depth to Groundwater (Perforated Depth Interval)
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  - CH-15B (360-900 ft-bgs)
  - CH-17 (300-980 ft-bgs)
  - CIM-11A (174-465\*\* ft-bgs)



Prepared by:  
 Author: TCR  
 Date: 20140919  
 Filename: Figure\_3-2.grf



**Land Subsidence Committee**  
 2014 Annual Report

**Stress and Strain within the Managed Area**

**Figure 3-2**

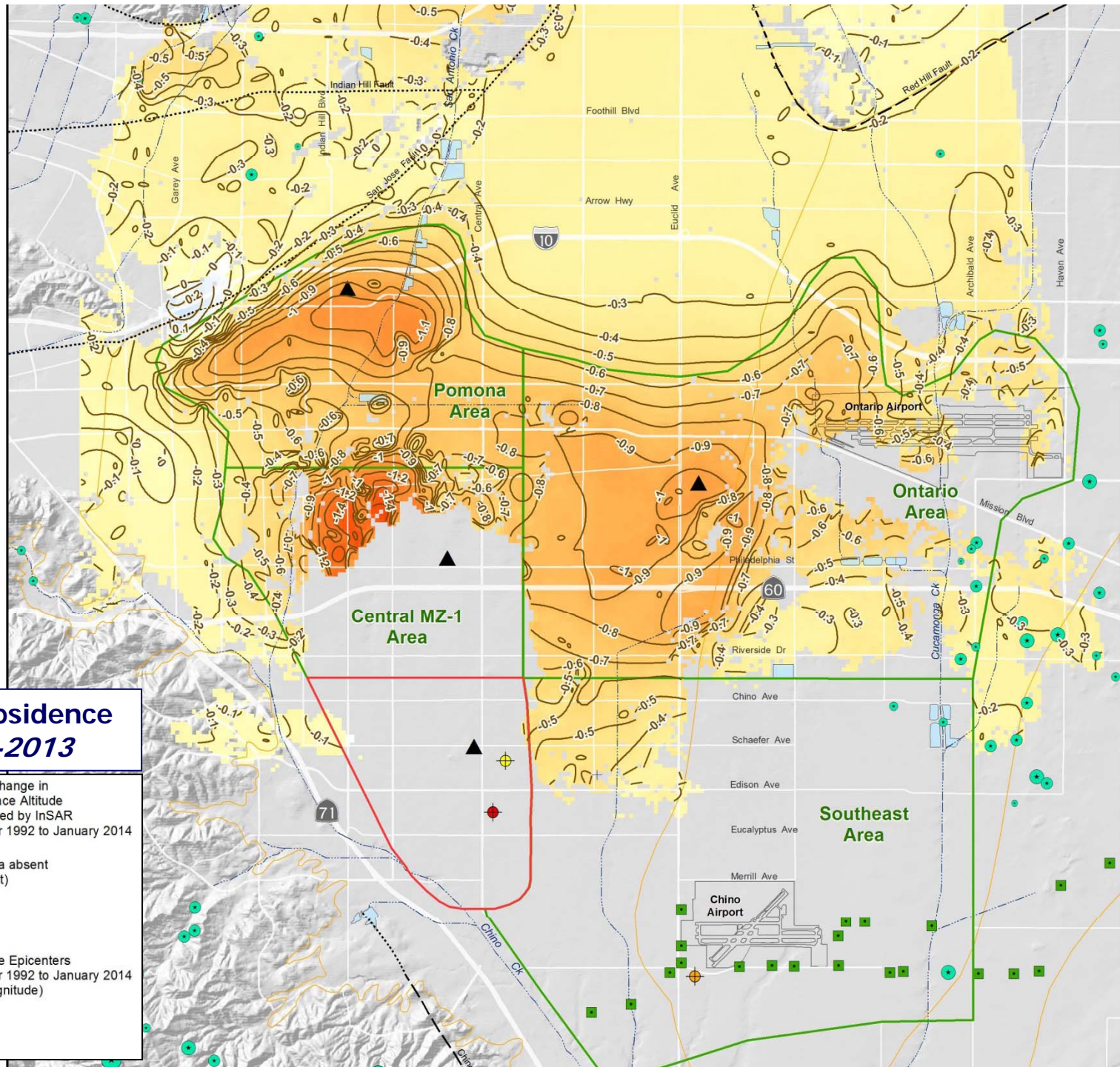
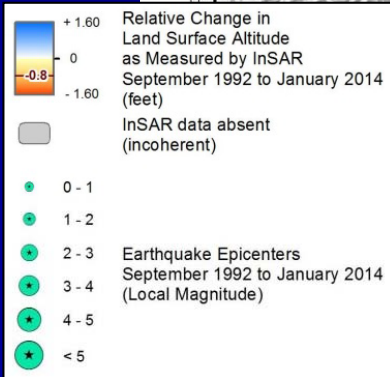
\*Positive compression values represent compression of soils, negative compression values represent expansion of soils  
 \*\*The original casing was perforated from 135-148, 174-187, 240-283, 405-465, 484-512, 518-540 ft-bgs. This casing collapsed below 470 ft-bgs in 2011. A liner was installed to 470.5 ft-bgs with screen interval from 155 to 470 ft-bgs.

# Update of the Subsidence Management Plan

- Update to include:
  - Watermaster's current and future efforts with regard to the monitoring and management of land subsidence
  - Watermaster's commitment to develop the Pomona Management Plan
    - A description of the Pomona Subsidence Investigation to help develop the subsidence management plan for the Pomona Area (w/ costs and schedule)



## Land Subsidence 1992-2013



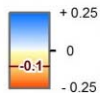


## Land Subsidence 2011-2013

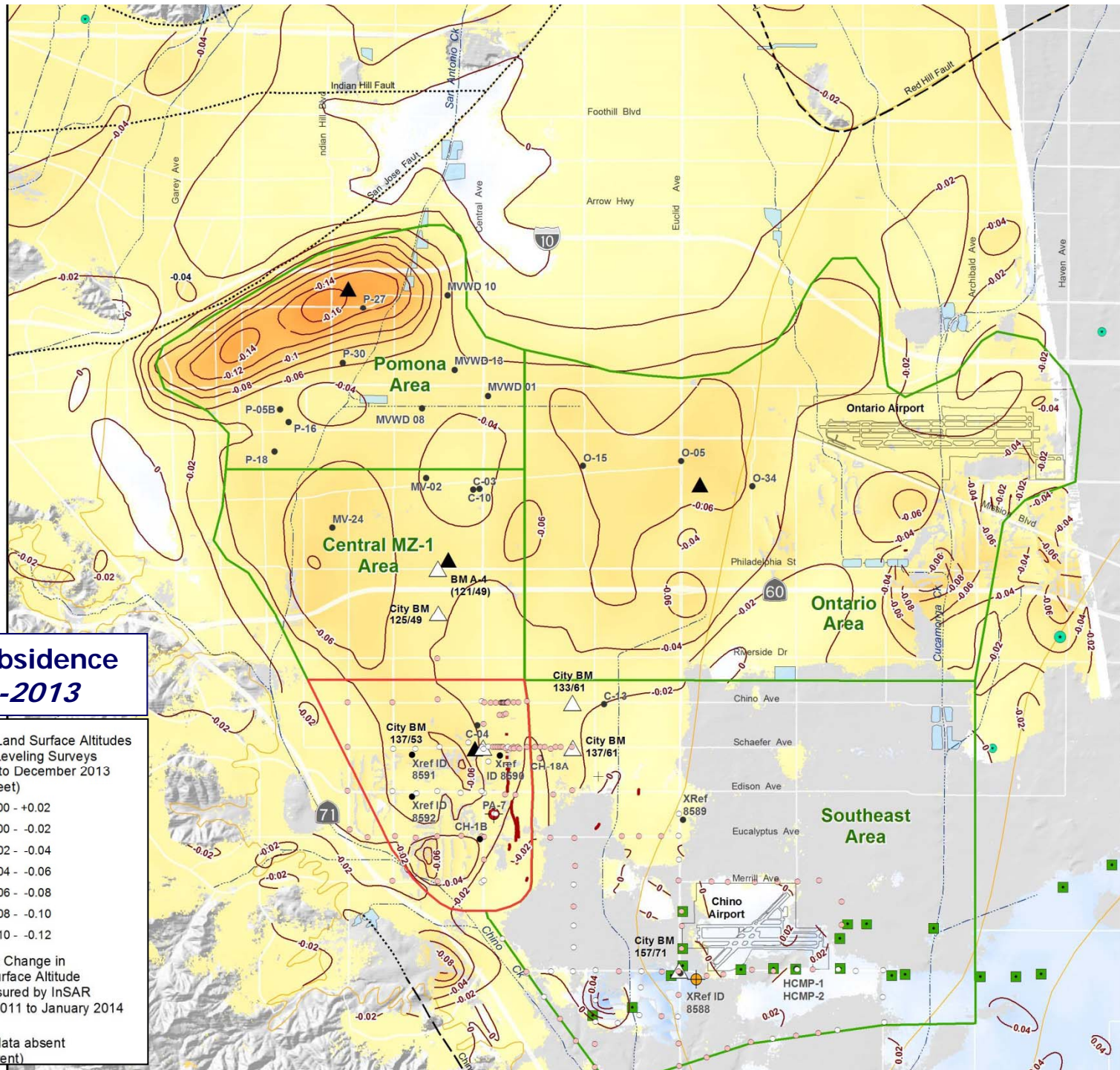
Relative Change in Land Surface Altitudes  
Measured by Leveling Surveys  
November 2011 to December 2013  
(feet)

- 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

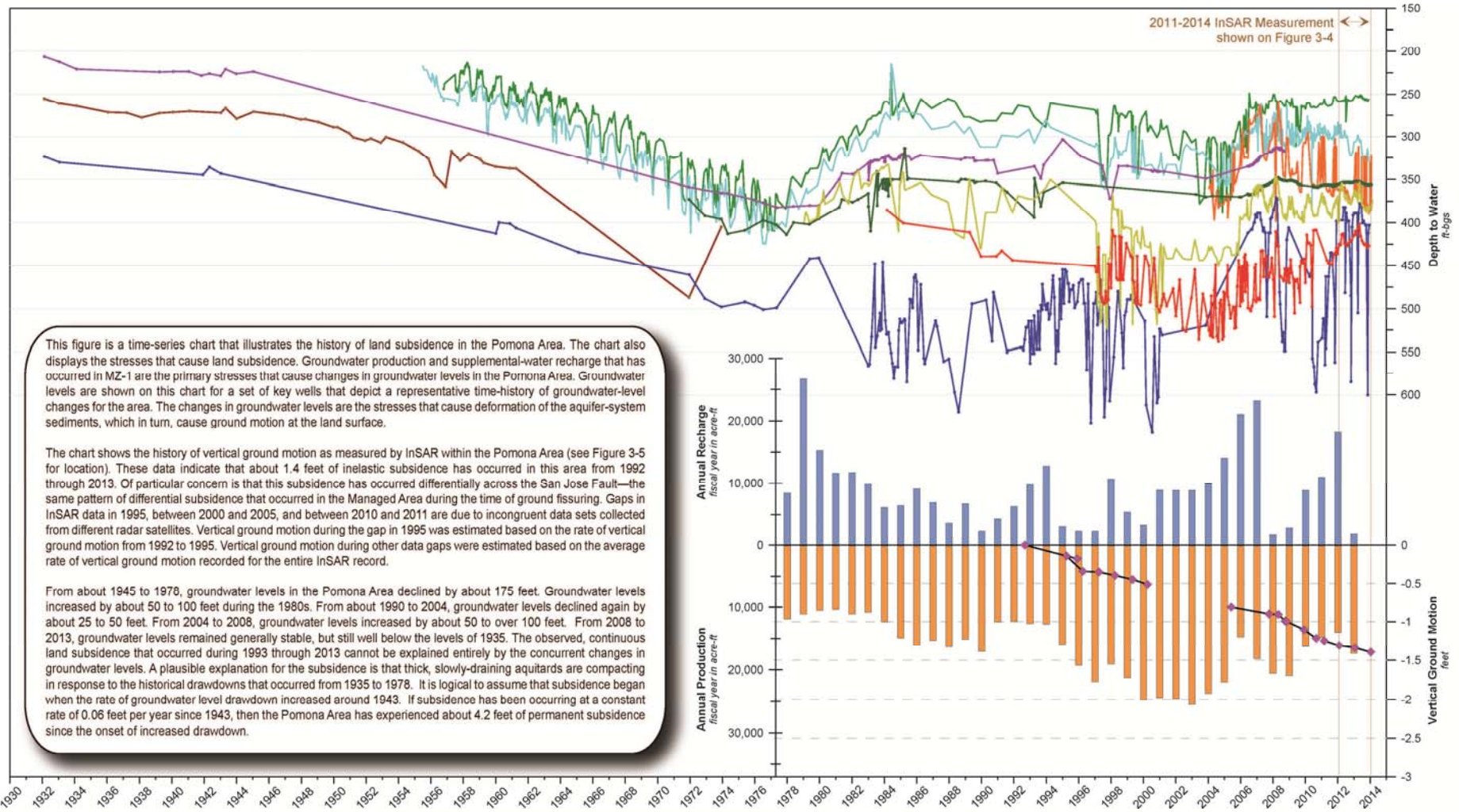
Relative Change in Land Surface Altitude  
as Measured by InSAR  
March 2011 to January 2014  
(feet)



InSAR data absent  
(incoherent)







Prepared by:  
 WEI  
 WILDERMITH ENVIRONMENTAL, INC.  
 www.wildermitheenvironmental.com  
 Author: TCR  
 Date: 20140519  
 File: Figure\_3-10\_2013\_Pomona.grf

- Groundwater Levels at Wells (Perforated Depth 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

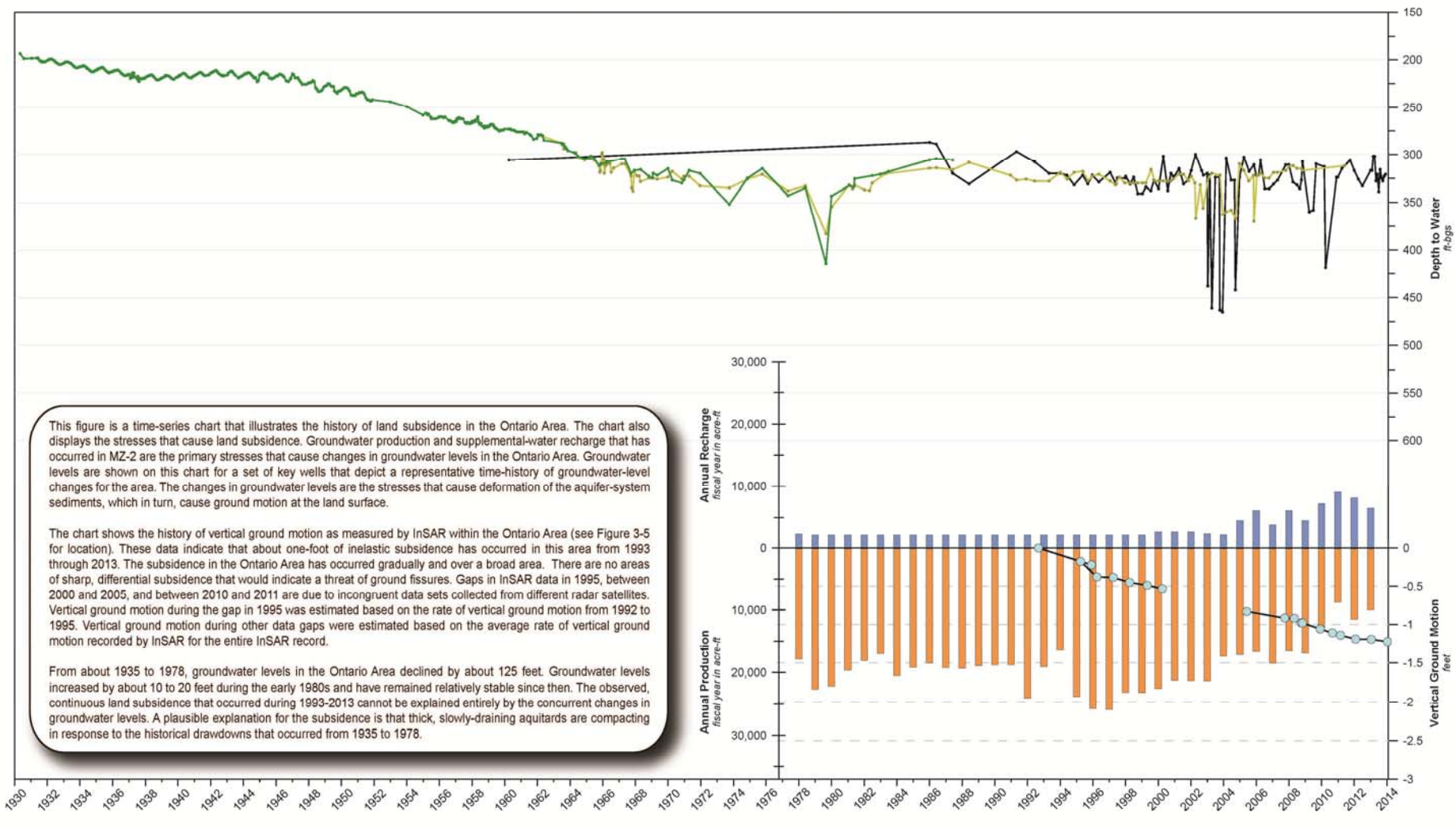
- Recharge and Production**
- Recharge of Recycled Water, Storm Water\*, and Imported Water at the College Heights, Upland, Montclair, and Brooks Basins, and at MWD ASR Wells
  - \*Storm Water is an estimated amount prior to Fiscal Year 04/05
  - Groundwater Production from Wells in the Pomona Area



**The History of Land Subsidence in the Pomona Area**

**Land Subsidence Committee**  
 2013 Annual Report

**Figure 3-10**



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 WILSON & ENVIRONMENTAL, INC.  
 www.wildermuthenvironmental.com  
 Author: TCR  
 Date: 20140519  
 File: Figure\_3-11\_2013\_Ontario.grf

Groundwater Levels at Wells  
 (Top-Bottom Screen Interval)

- O-05 (360-470 ft.-bgs)
- O-15 (474-966 ft.-bgs)
- O-34 (522-1092 ft.-bgs)

Vertical Ground Motion

- Ontario Area InSAR

Recharge and Production

- Recharge of Recycled, Storm Water\*, and Imported Water at the Ely, Grove, Turner, 7th Street, 8th Street, and 15th Street Basins \*Storm Water is an estimated amount prior to Fiscal Year 04/05
- Groundwater Production from Wells in the Ontario Area



**The History of Land Subsidence in the Ontario Area**

Land Subsidence Committee  
 2013 Annual Report

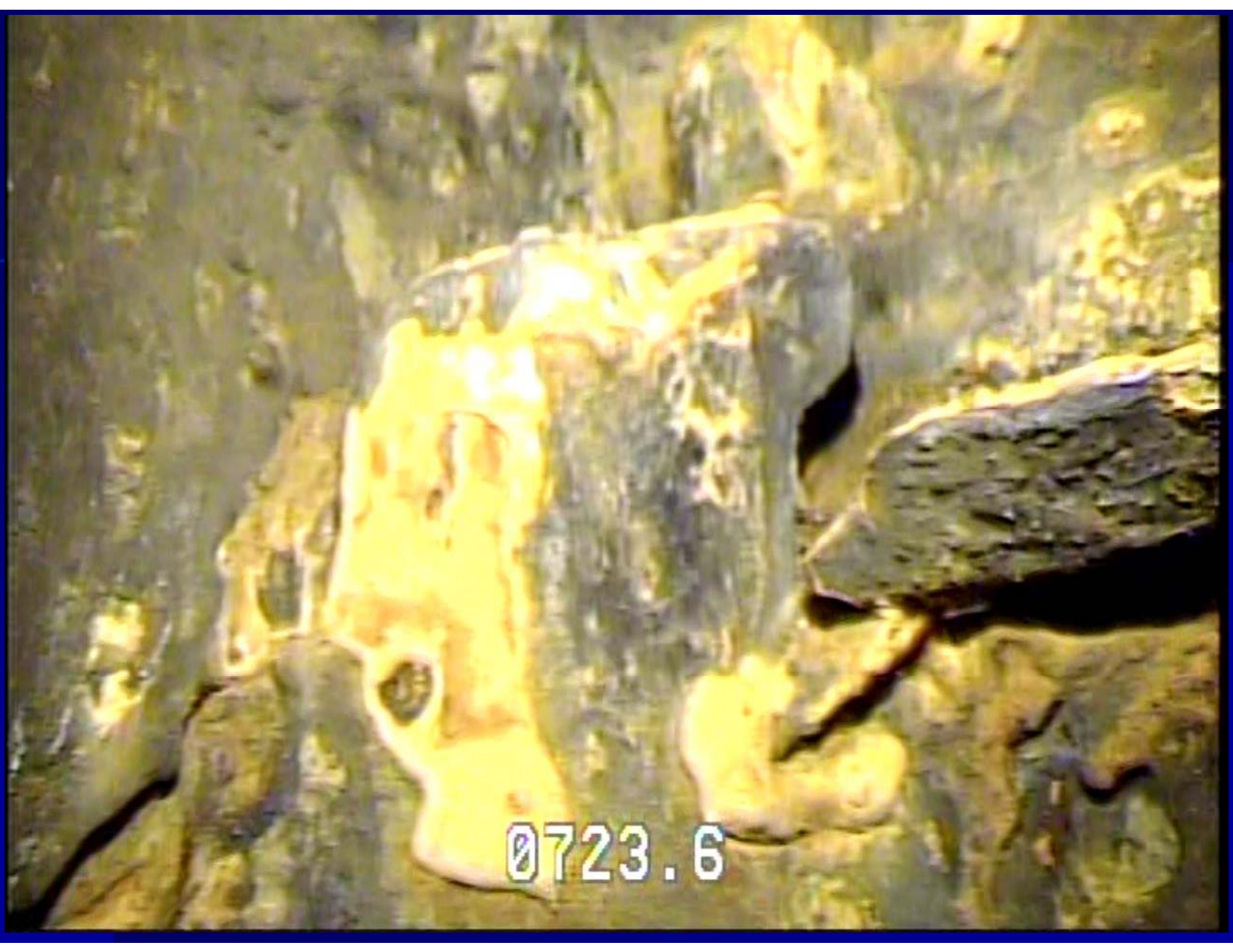
Figure 3-11






0719.8





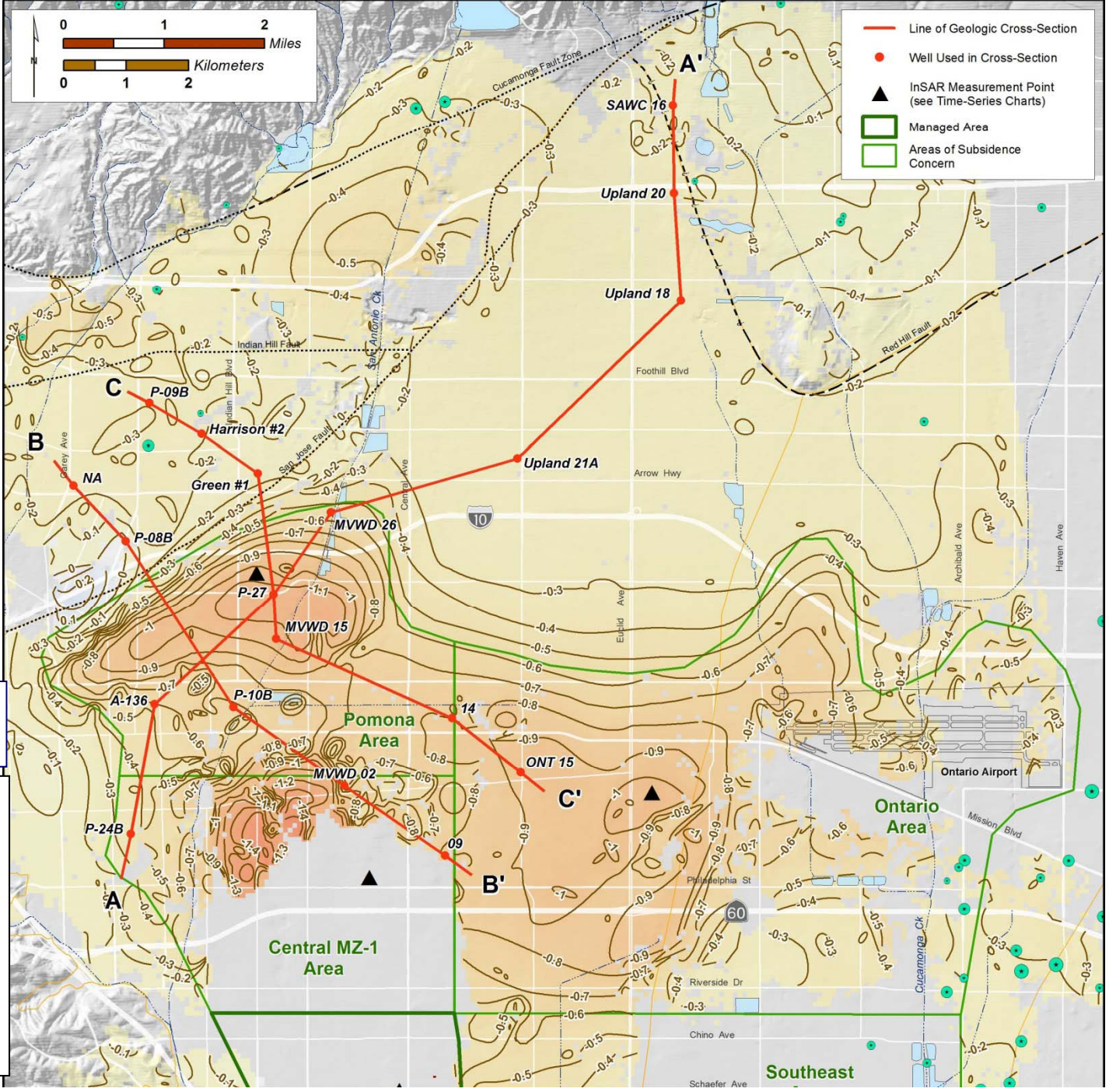
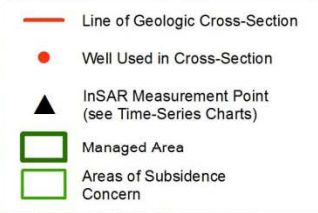
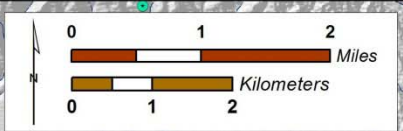
0723.6



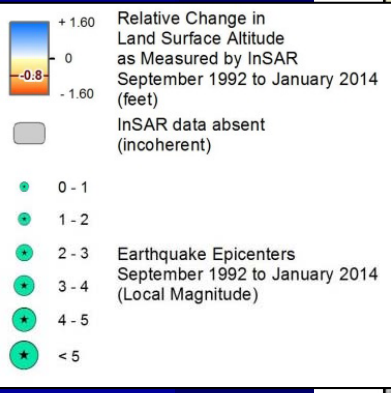


0723.7





### Geologic Cross-Sections



Central MZ-1 Area

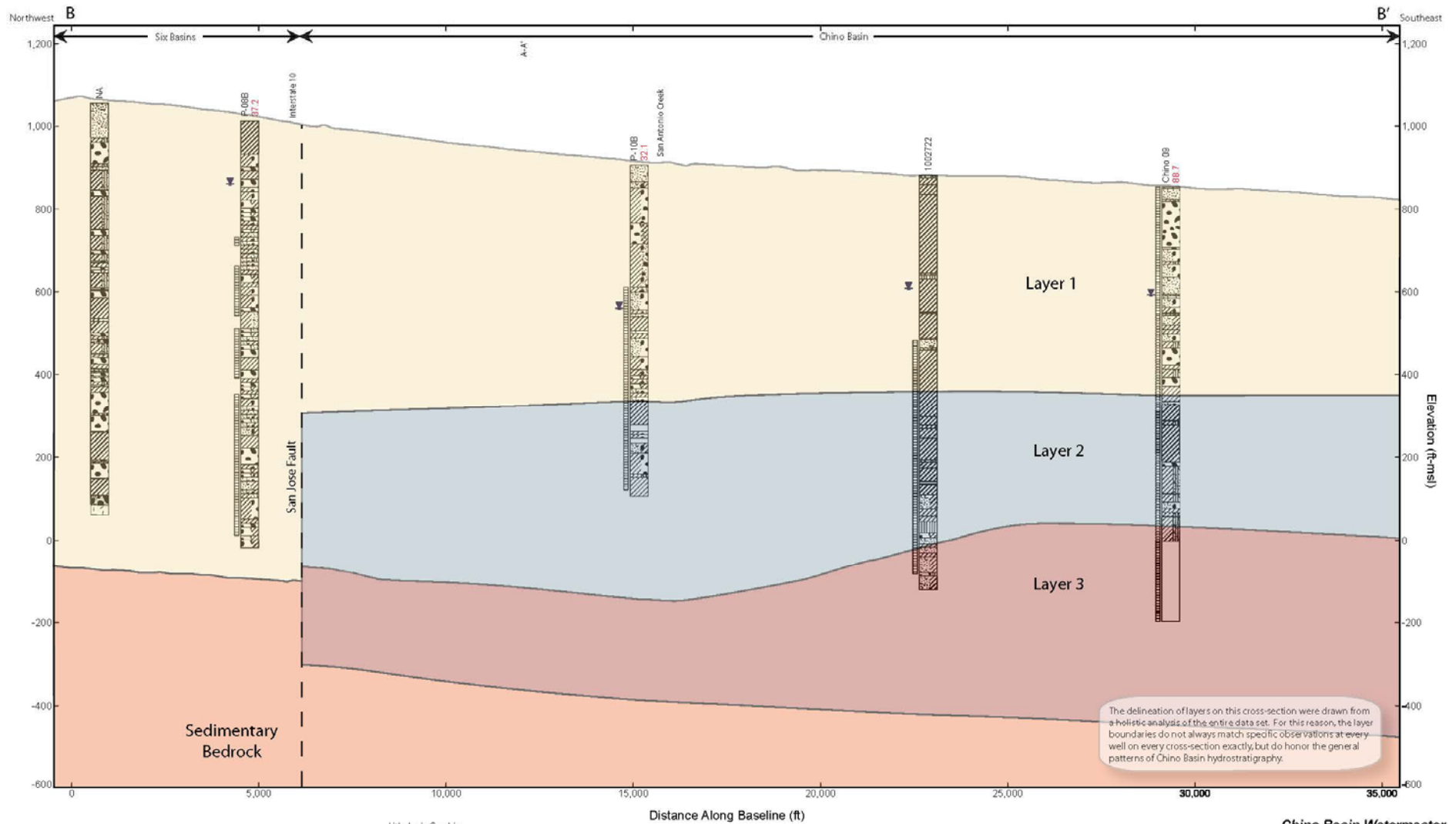
Pomona Area

Ontario Area

Southeast







Prepared by:  
 WEI  
 Water & Environmental Inc.

- Lithologic Graphics
- Gravel
  - Sand
  - Silt
  - Clay
  - Granite
  - Decomposed Granite
  - Topsoil
  - Interbedded Sandstone/Siltstone

Chino Basin Watermaster

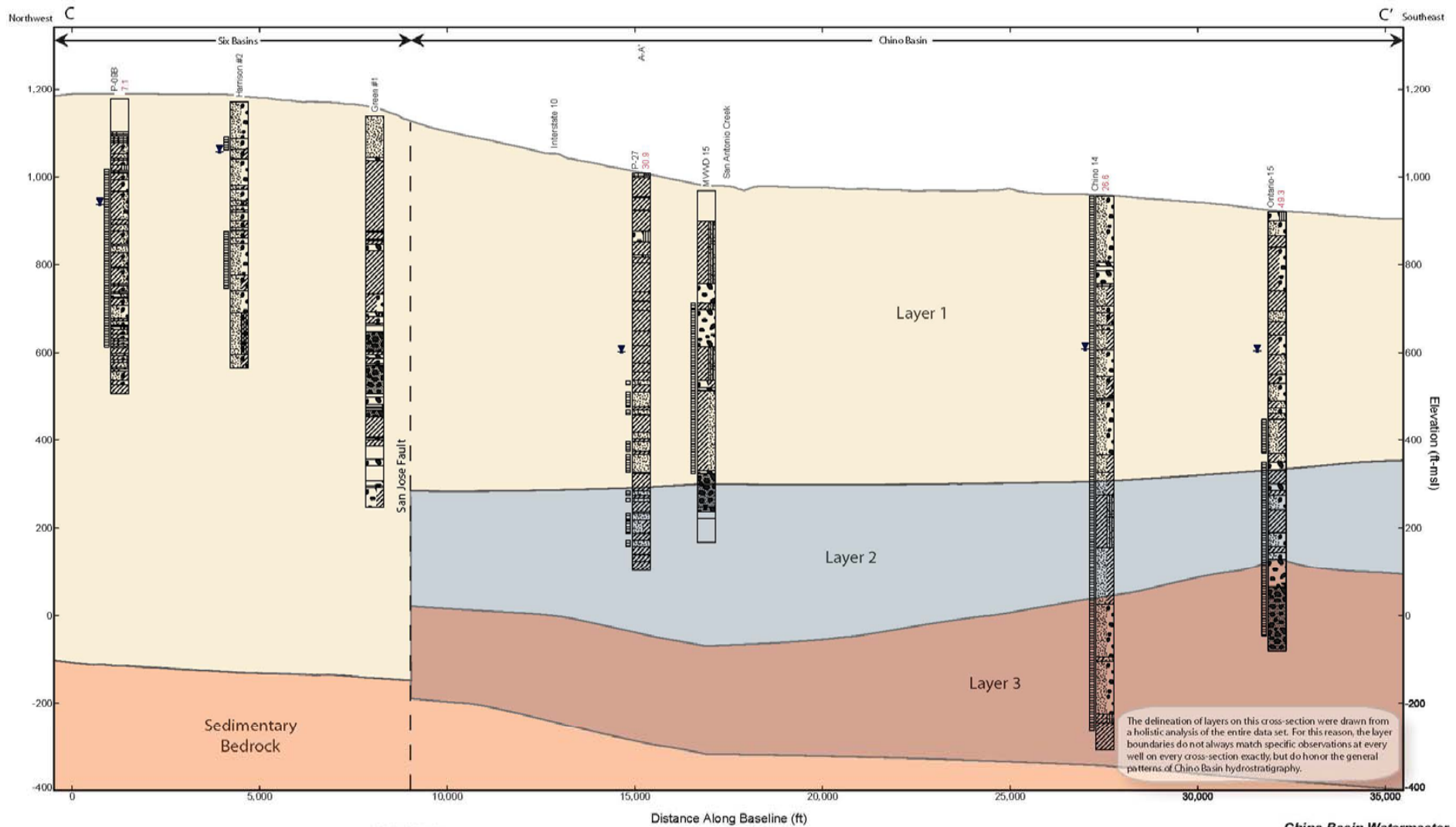
2015 Update to the Subsidence Management Plan



Cross-Section B-B'

Figure 2

# Cross-Section B-B'



Prepared by:  
WEI

- Lithologic Graphics**
- Gravel
  - Sand
  - Silt
  - Clay
  - Granite
  - Decomposed Granite
  - Topsoil
  - Interbedded Sandstone/Siltstone

Where the lithologic graphic column is split, the primary component is on the left side of the column; secondary component(s) are on the right.

- Well Screen Interval
- Water Level (Spring 2013)
- 16" Short Normal Geophysical Log
- Groundwater Model Layer Boundaries
- Inferred Fault
- 25.2 Specific Capacity

Chino Basin Watermaster

2015 Update to the Subsidence Management Plan



Cross-Section C-C'

Figure 3

Cross-Section  
C-C'



# Schedule to Develop the Pomona Subsidence Investigation

- Watermaster develops a “straw-man” investigation (October 2014)
- LSC meetings to refine the investigation (October - December 2014)
- Watermaster prepares a written description of investigation including scope, schedule and budget (January 2015)
- LSC reviews/approves the investigation for incorporation into the draft Subsidence Management Plan (February 2015)

# Outline of the Subsidence Management Plan

## 1. Background and Objectives

- Historical Land Subsidence and Ground Fissuring
- Chino Basin Judgment, OBMP, and Peace Agreement
- Interim Monitoring Program and the Initial MZ-1 Plan
- Land-Subsidence Monitoring Program (2008-2014)
- 2015 Update to the Chino Basin Subsidence Management Plan

# Outline of the Subsidence Management Plan

## 2. Subsidence-Management Program

### Areas of Subsidence Concern

- Managed Area

  - Management Criteria

    - Managed Area

    - Managed Wells

    - Guidance Level

  - On-going Monitoring and Testing Program

  - Future Efforts

- Pomona Area

  - On-going Monitoring and Testing Program

  - Future Efforts



# Outline of the Subsidence Management Plan

- Southeast Area

  - On-going Monitoring and Testing Program
  - Future Efforts

- Ontario Area

  - On-going Monitoring and Testing Program
  - Future Efforts

- Central MZ-1 Area

  - On-going Monitoring and Testing Program
  - Future Efforts

Data Exchange between Watermaster Parties

# Outline of the Subsidence Management Plan

## 3. Annual Reporting

Annual Report of the Land Subsidence Committee

Scoping and Budgeting for Future Fiscal Years

## 4. Process to Update the Subsidence Management Plan

## 5. Glossary of Terms

## 6. References

# Schedule to Update the Subsidence Management Plan

- LSC to review a proposed outline (today)
- Watermaster staff and LSC develop a recommended Pomona Subsidence Investigation (December 2014)
- Watermaster staff prepares a draft Subsidence Management Plan for LSC review. The plan includes the Pomona Subsidence Investigation (January 2015)
- Draft plan approved by LSC (February/March 2015)
- Final plan is reviewed/approved by Watermaster Pools/AC/Board (March/April 2015)

**End**