2018 Annual Report of the Prado Basin Habitat Sustainability Committee

Prado Basin Habitat Sustainability Committee Meeting

May 14, 2019

Chino Basin Watermaster – Partners in Basin Management

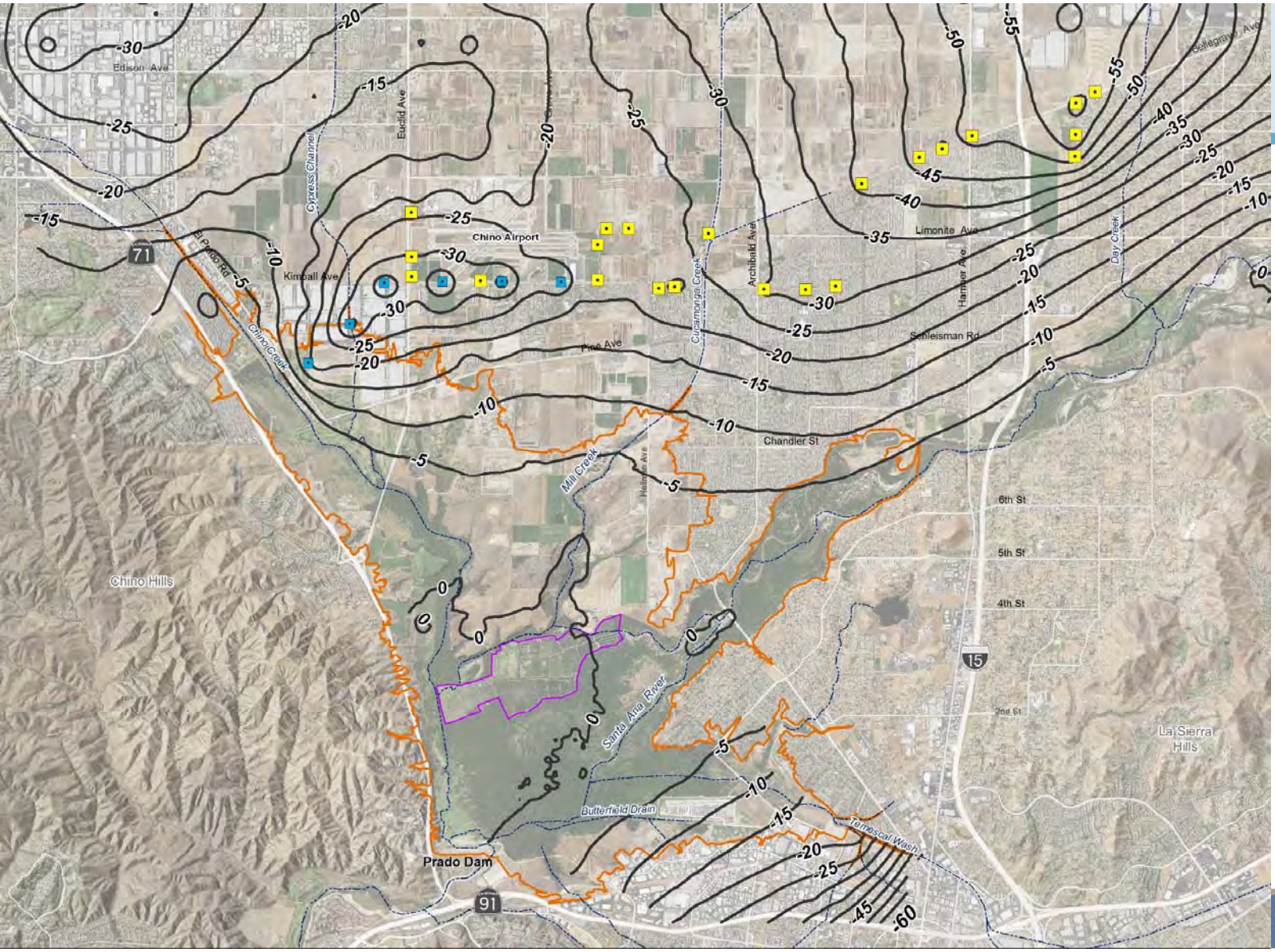
Inland Empire Utilities Agency *

WEI – Wildermuth Environmental, Inc.

AGENDA

1. Background
2. Review of the draft 2018 Annual Report for the PBHSC
3. Next steps

Peace II CEQA



-10 Change in Groundwater Levels
FY2005 to 2030, feet

Prado Flood Control Basin

Chino Basin Desalter Authority Well

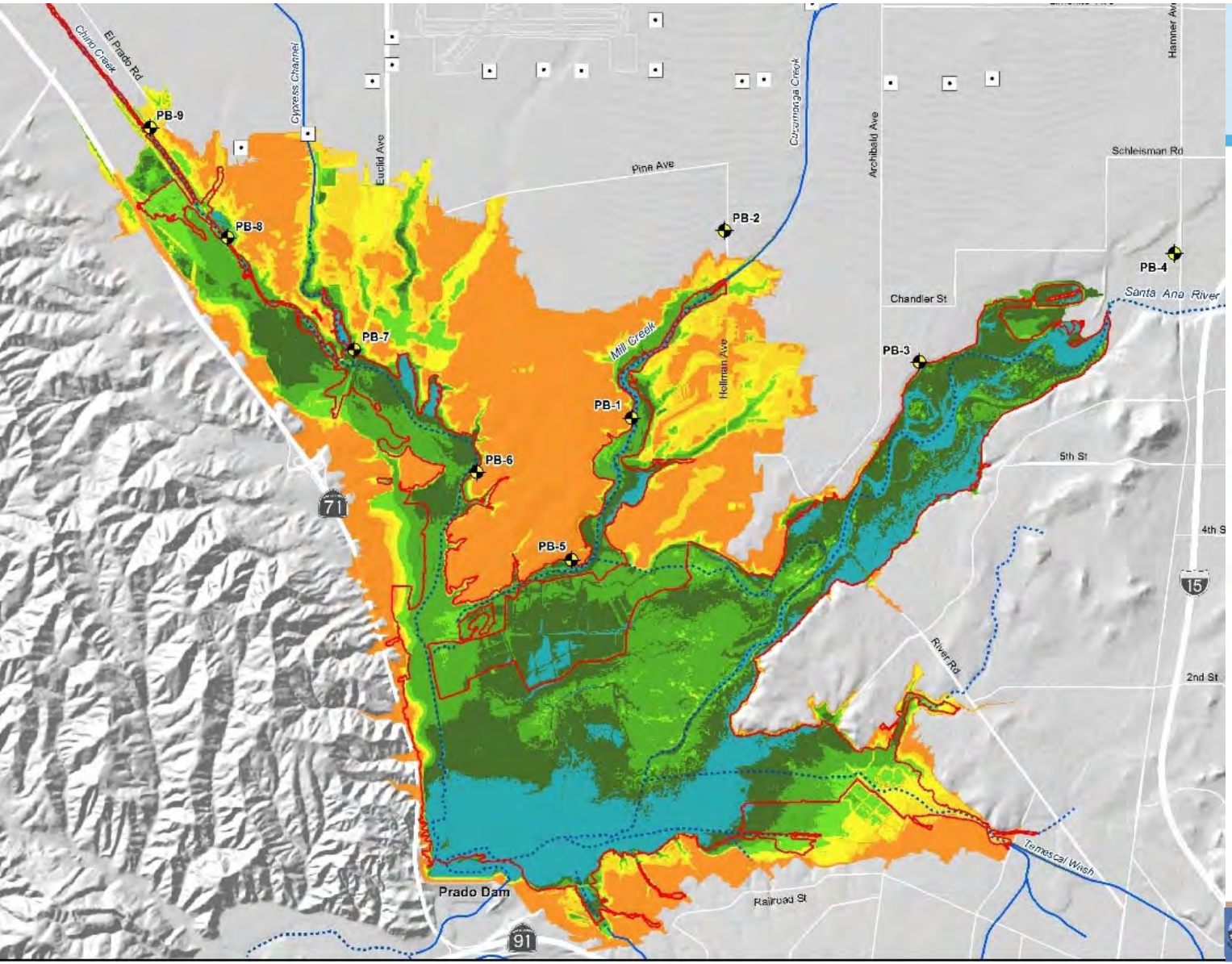
Chino Creek Well Field
(as modeled for the Peace II SEIR)

OCWD Prado Wetlands

Rivers and Streams

Projected Change in Groundwater Levels
FY2005 to 2030 - Peace II Alternative

Depth to Groundwater
September 2018



Depth to Groundwater (feet below ground surface)

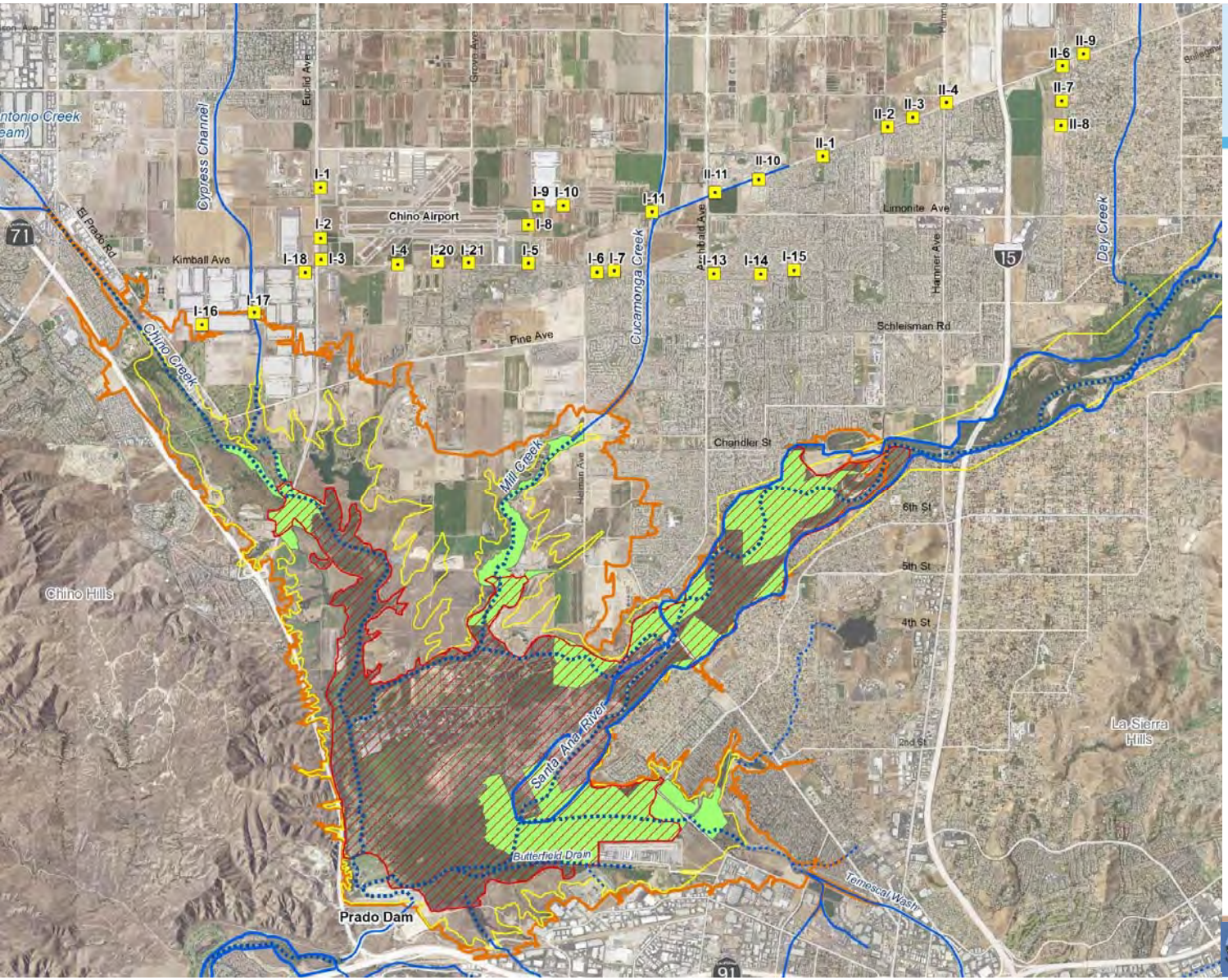
- Area of Groundwater at the Ground Surface
- > 0 and ≤ 5
- > 5 and ≤ 10
- > 10 and ≤ 15
- > 15 and ≤ 20
- > 20 and ≤ 25
- > 25

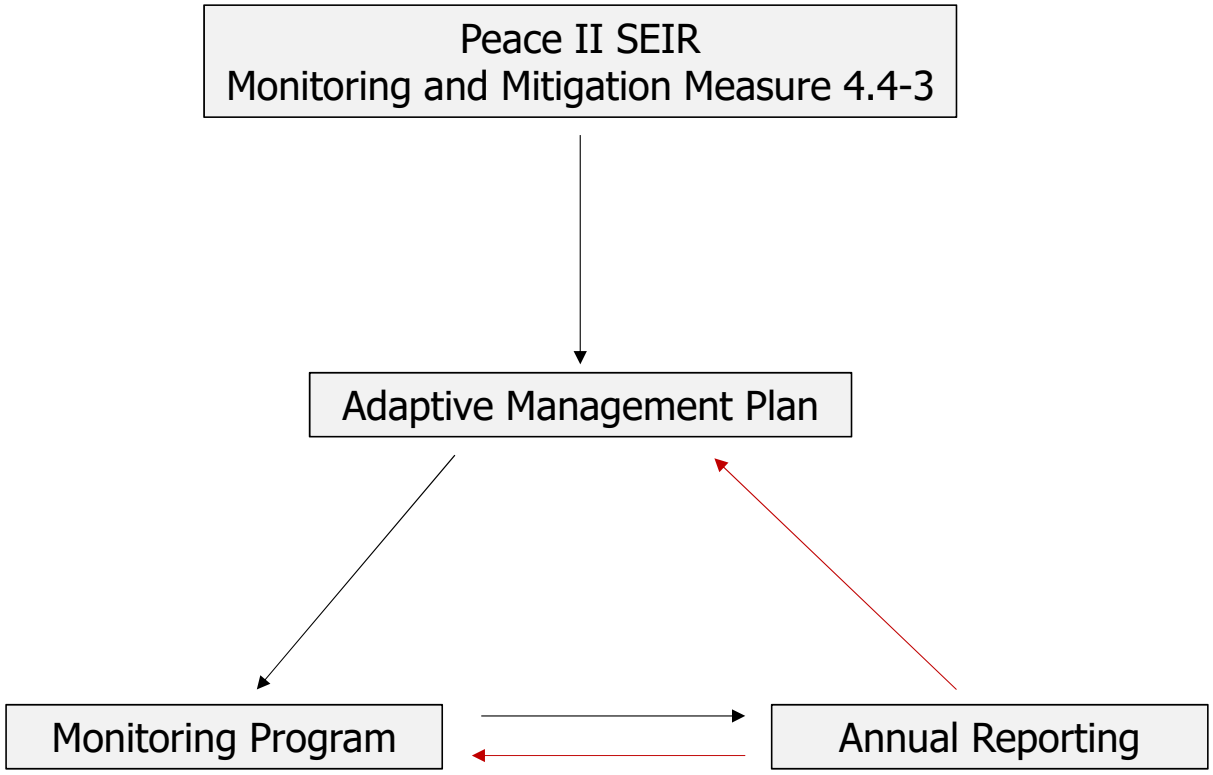
2018 Extent of the Riparian Vegetation in Prado Basin

Chino Basin Desalter Authority Well

PBHSP Monitoring Well

Designated Critical Habitat in the Prado Basin




Peace II SEIR
Monitoring and Mitigation Measure 4.4-3
Adaptive Management Plan
Monitoring Program
Annual Reporting

Annual Report – Table of Contents

Potential Stressors

Riparian Habitat Monitoring Program

- Objective: Monitor the extent and quality of the riparian habitat
  - Pre- and post-Peace II implementation
  - Ongoing

- Two Types of Assessment:
  - Regional Assessment
    - Interpretations of air photos
    - Remote sensing data → NDVI derived from Landsat satellite imagery
  - Site Specific Assessment → "Ground-truth" of regional assessment
    - Vegetation Surveys (USBR)

Regional Monitoring of Riparian Habitat

High Resolution Air Photo
July 2, 2018

Normalized Difference Vegetation Index (NDVI)

$$NDVI = \frac{NIR - VIS}{NIR + VIS}$$

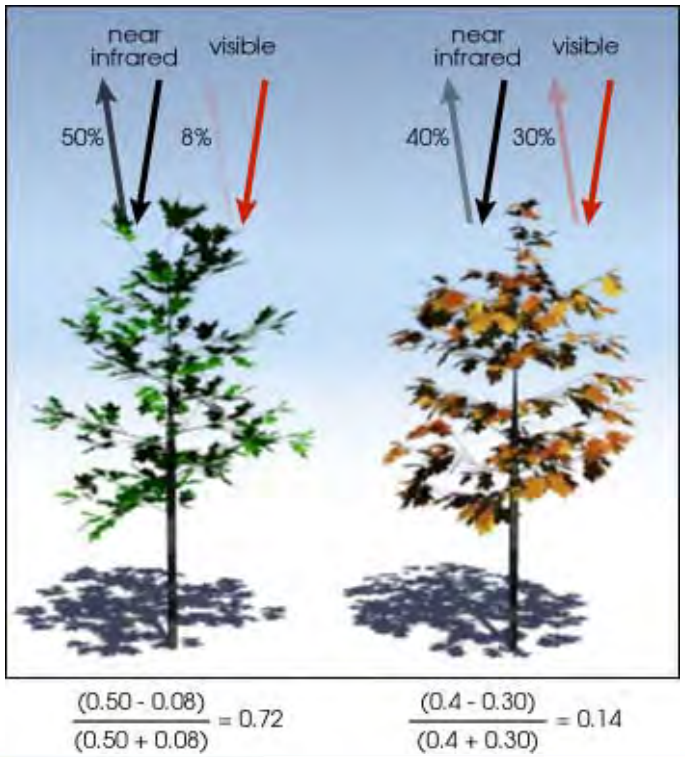


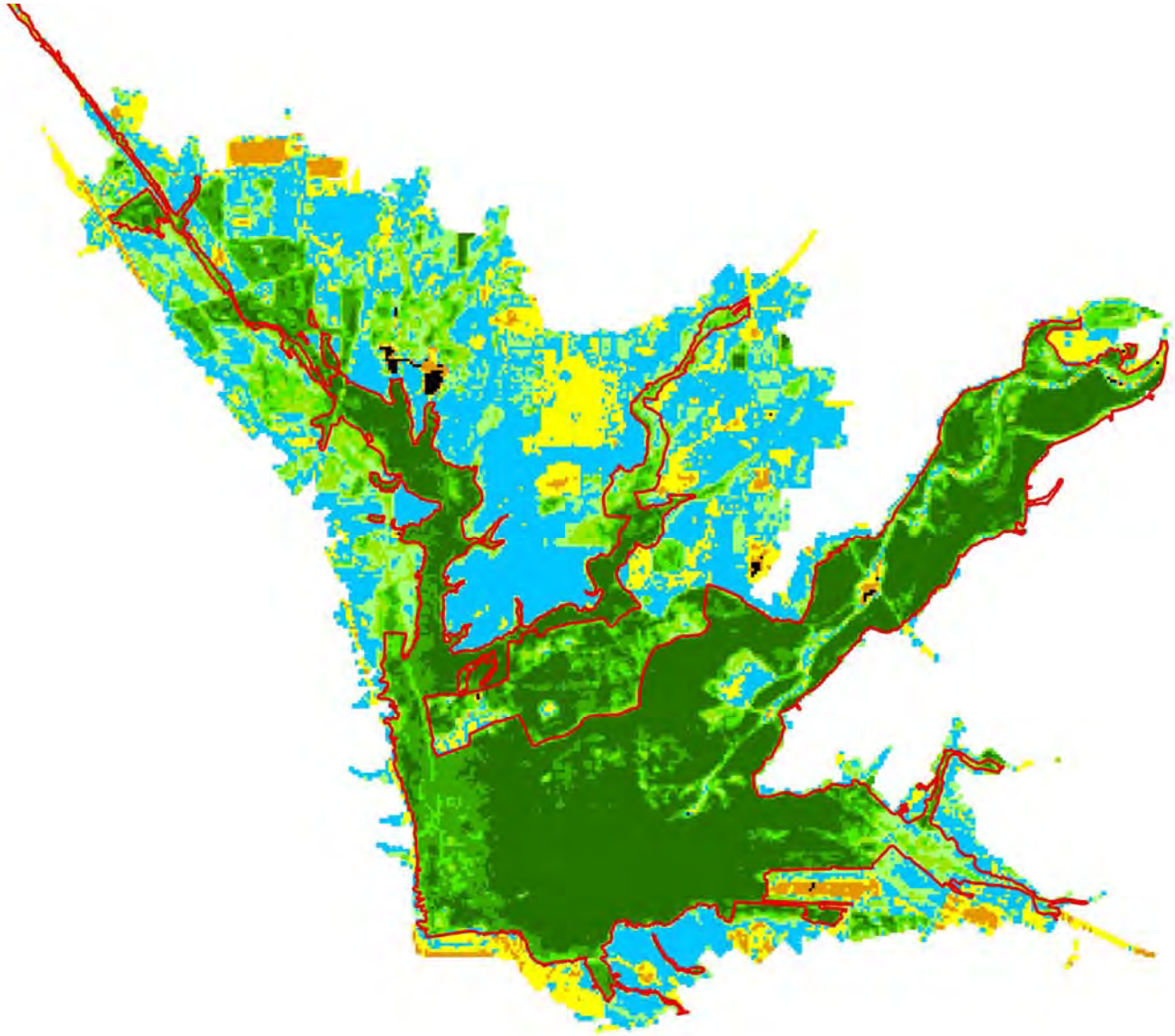
Image source: http://earthobservatory.nasa.gov/Features/MeasuringVegetation/measuring_vegetation_2.php

Collection and review of NDVI determined from remote sensing measurements from Landsat satellites

NDVI - numerical index – ratio of visible light and near infrared light reflected by the vegetation. Indication of plant health - greenness correlated with Photosynthesis

Available since 1980s - Can be used to assess the temporal and spatial changes in vegetation for the entire Prado Basin

Regional Monitoring of Riparian Habitat

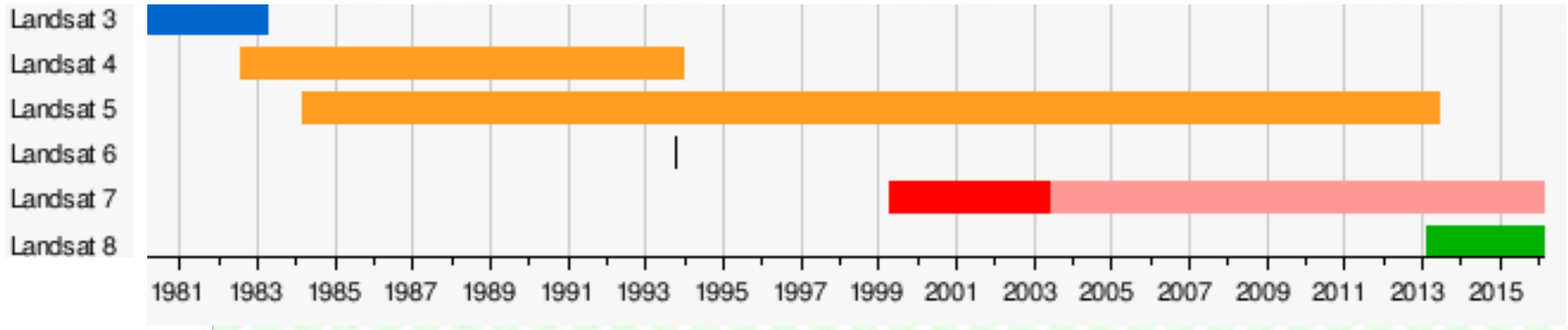


NDVI

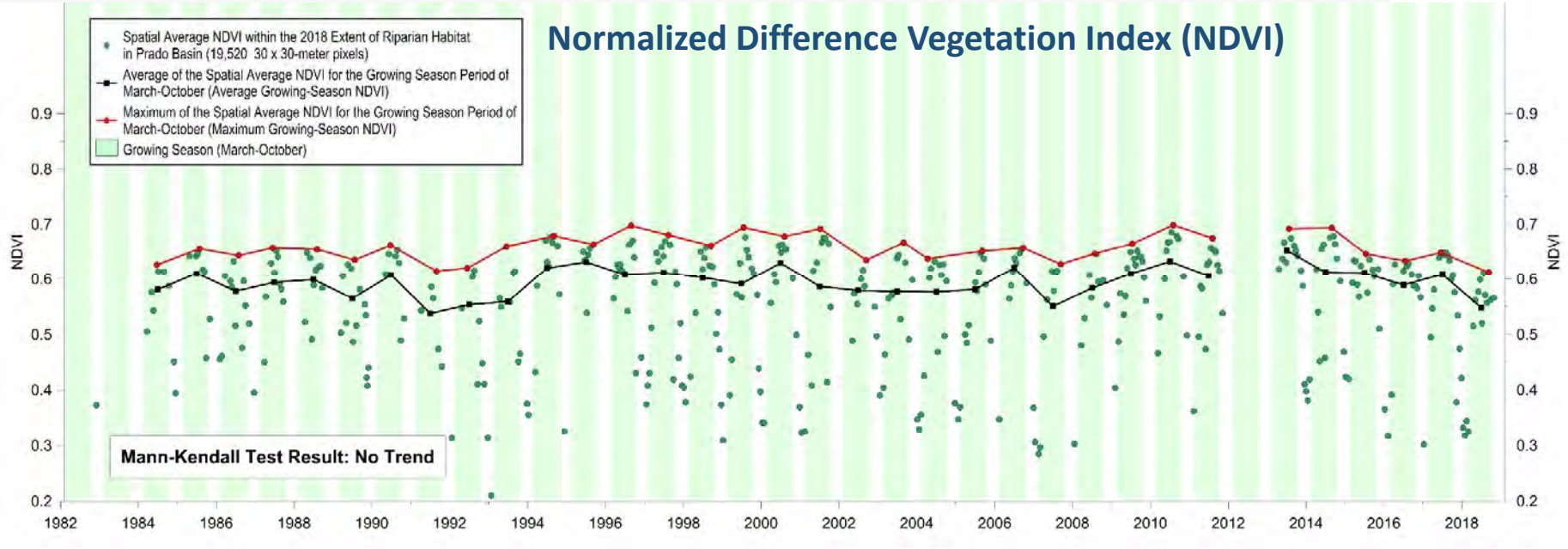
- > -1 and ≤ 0
- > 0 and ≤ 0.1
- > 0.1 and ≤ 0.2
- > 0.2 and ≤ 0.3
- > 0.3 and ≤ 0.4
- > 0.4 and ≤ 0.5
- > 0.5 and ≤ 0.6
- > 0.6 and ≤ 0.7
- > 0.7 and ≤ 1

Extent of the Riparian Vegetation in Prado Basin

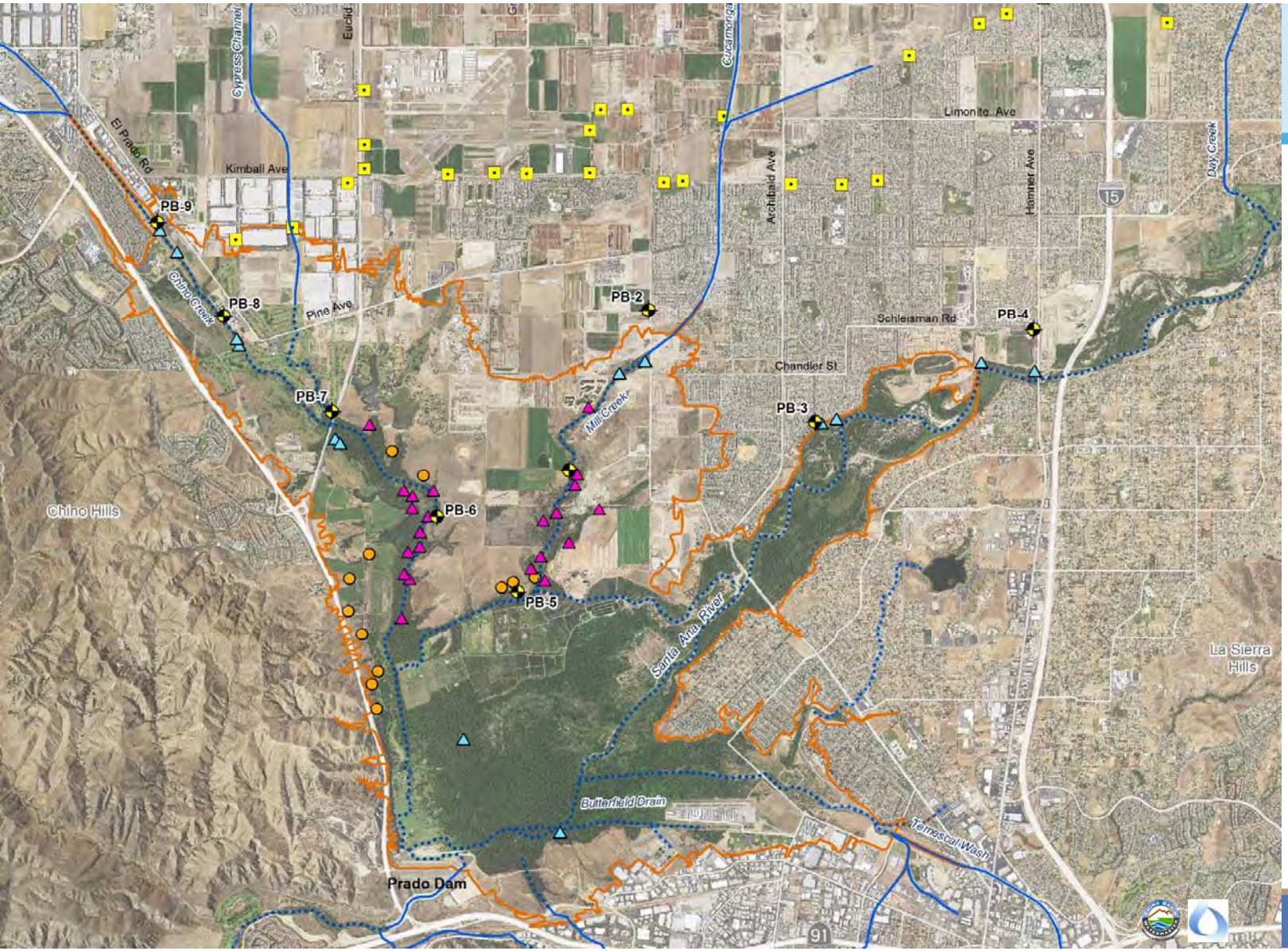
Landsat Program – Remote Sensing Measurements



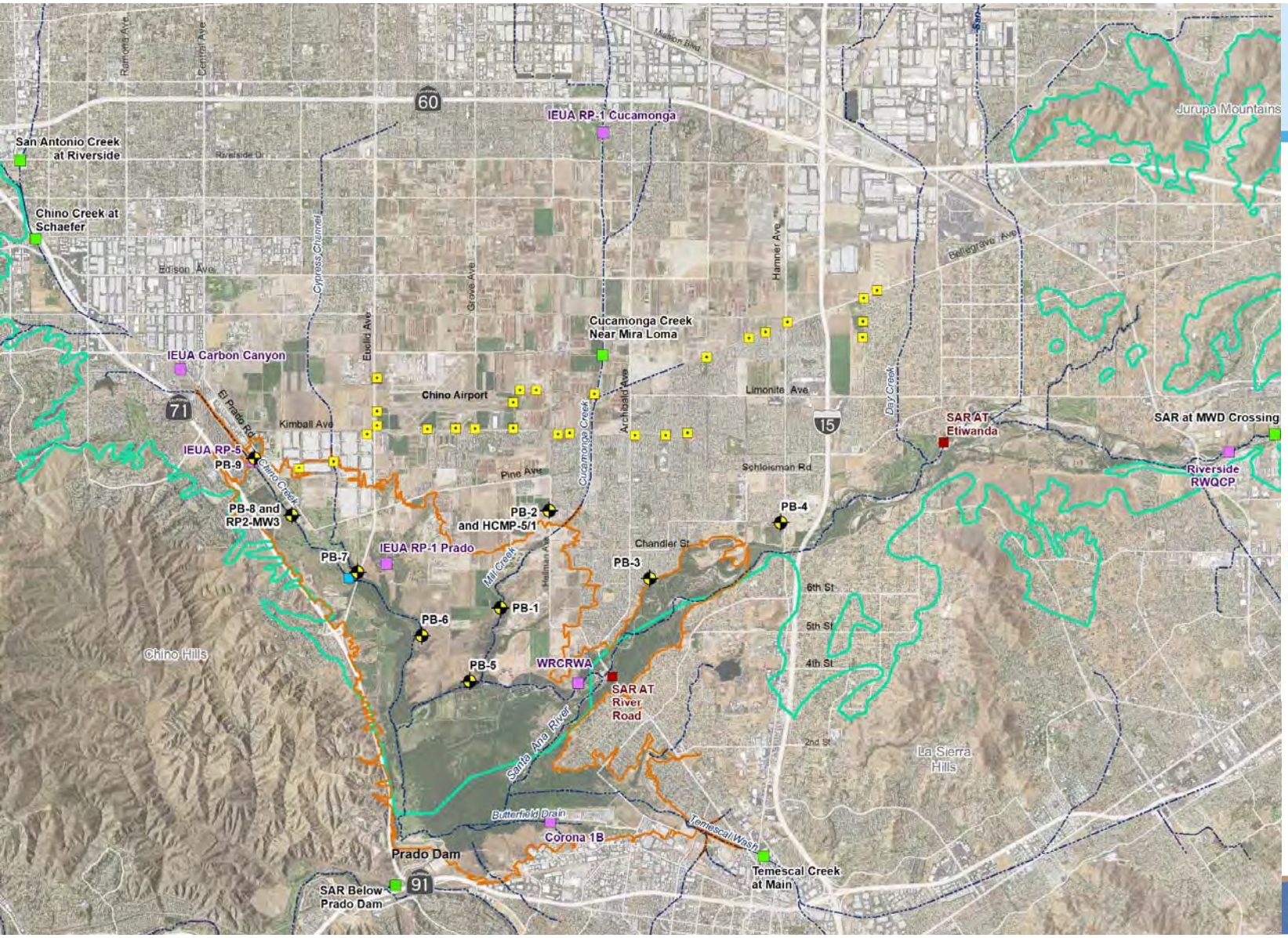
Normalized Difference Vegetation Index (NDVI)



Site-Specific Monitoring of Riparian Habitat



- USBR Vegetation Surveys 2007, 2013, and 2016
- USBR Vegetation Surveys 2016
- OCWD Photo Stations (2010 - 2016)



Groundwater, Surface Water, and Climate

Groundwater and Surface Water Monitoring Sites

- PBHSP Well Site (Groundwater Levels and Quality)
- POTW Discharge Outfall (Discharge and Surface Water Quality)
- USGS Stream Gage Station (Discharge)
- Watermaster Santa Ana River Sites - Maximum Benefit Monitoring (Surface Water Quality)
- PBHSP Surface Water Site

Climate Monitoring Program

- Chino Basin - Area to Extract Grided Data from PRISM and NEXRAD Data Sets (Precipitation)
- Prado Basin - Area to Extract Grided Data from PRISM and NEXRAD Data Sets (Temperature)

- Chino Basin Desalter Authority Well

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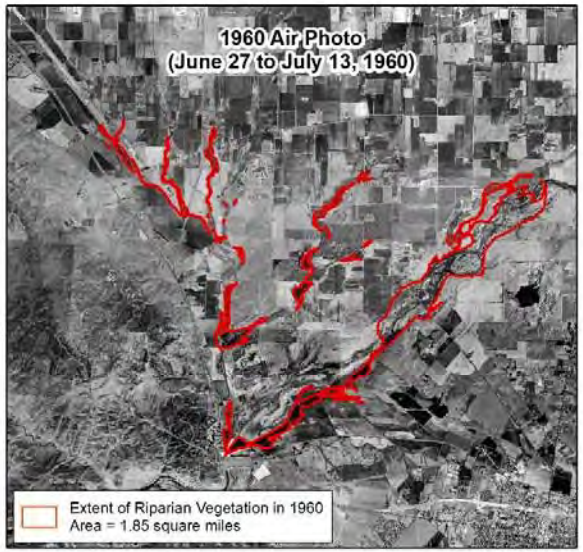
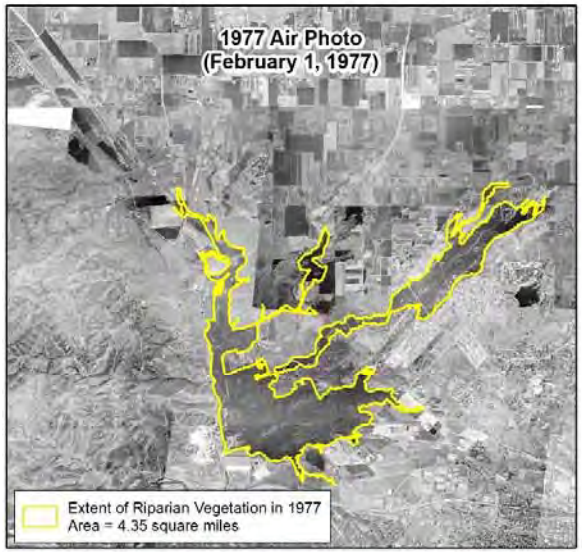
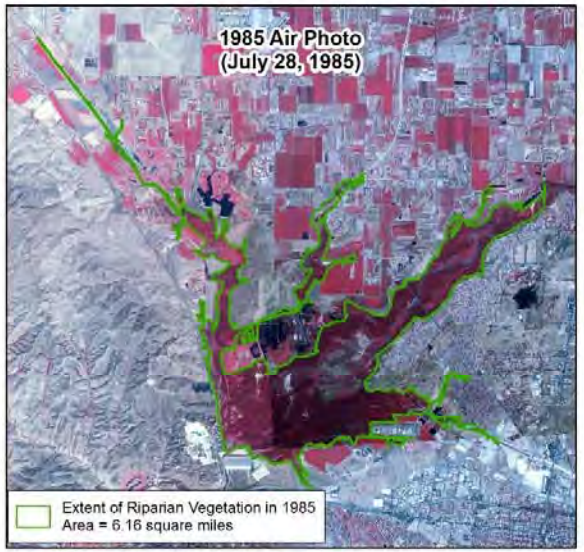
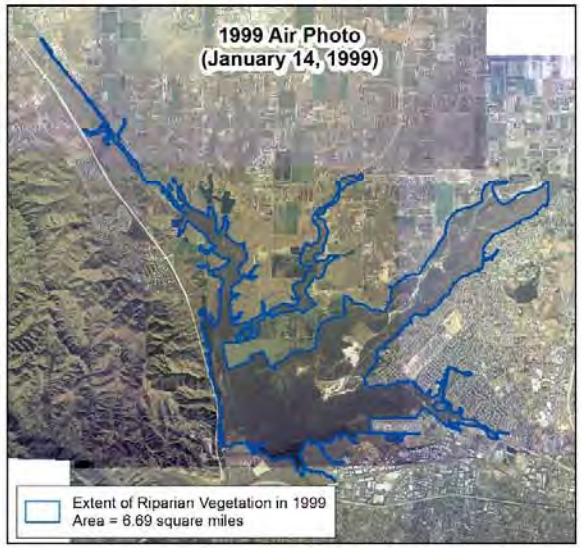
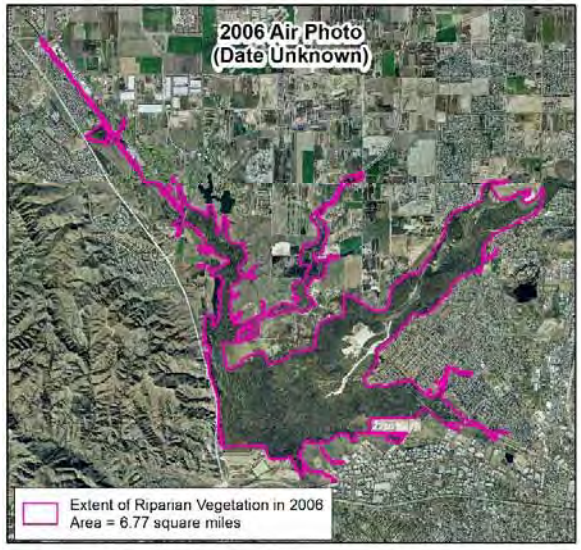
Potential Stressors

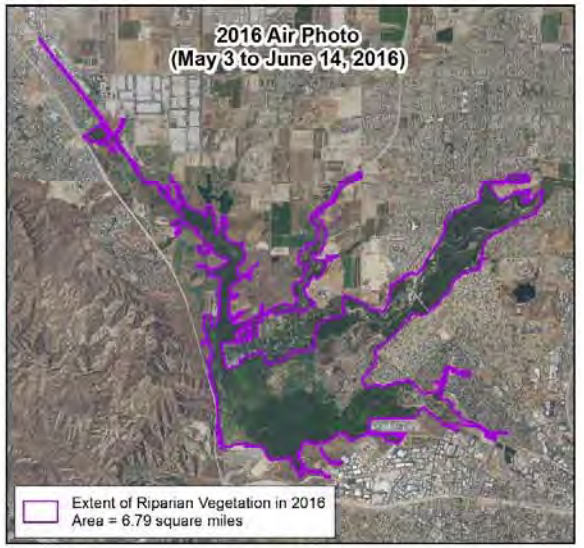

1960 Air Photo
(June 27 to July 13, 1960)
Extent of Riparian Vegetation in 1960
Area = 1.85 square miles

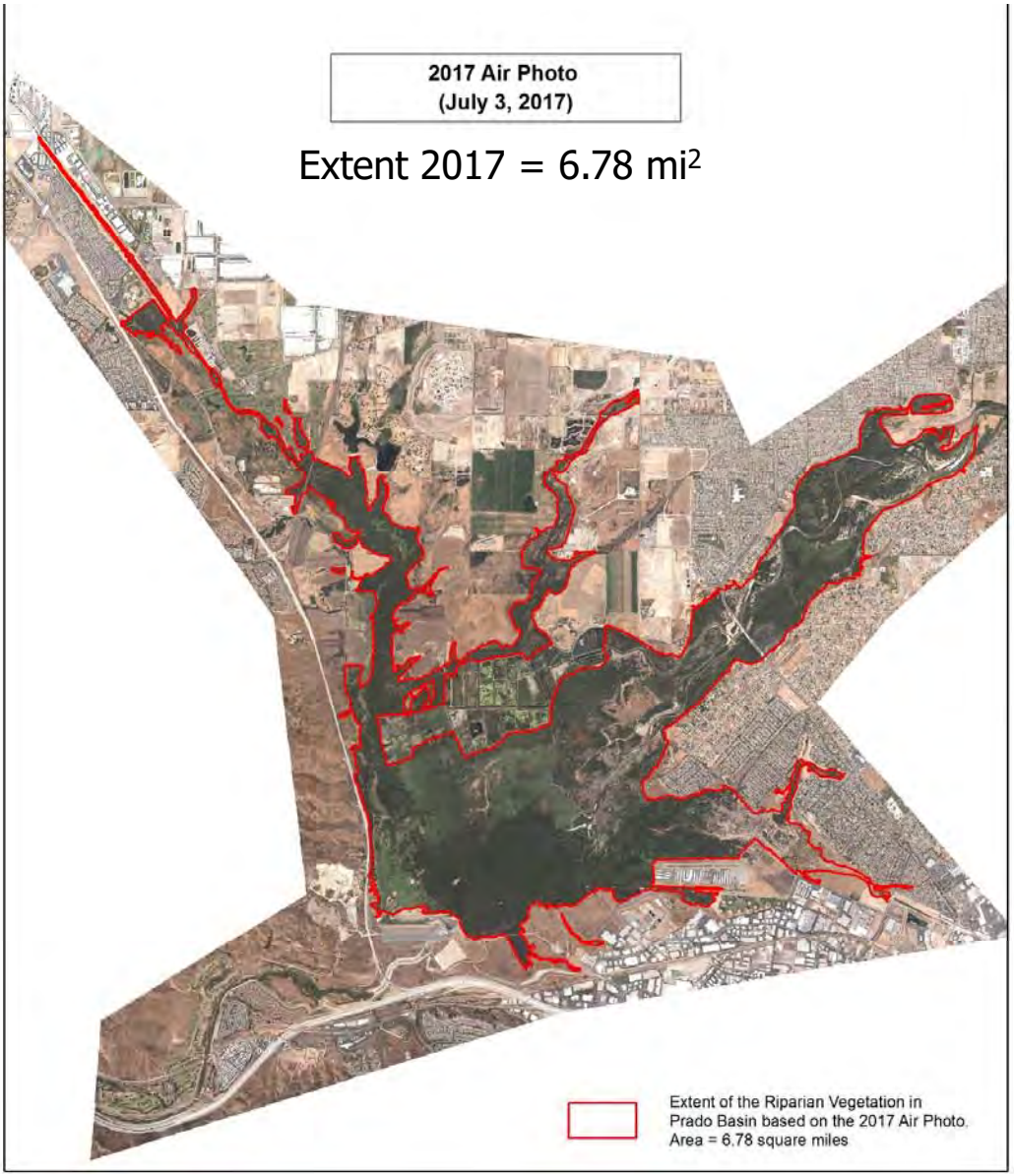

1977 Air Photo
(February 1, 1977)
Extent of Riparian Vegetation in 1977
Area = 4.35 square miles

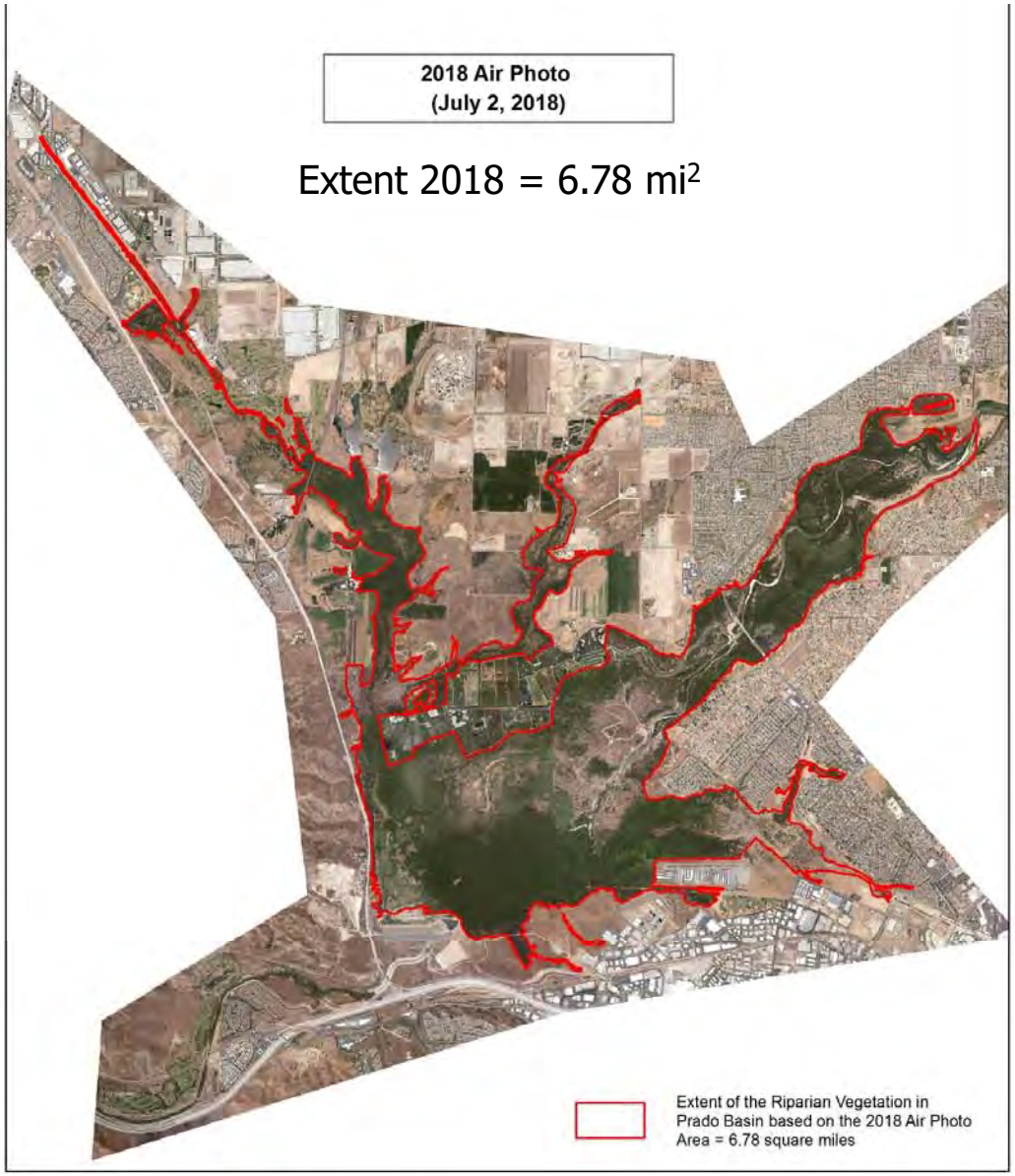

1985 Air Photo
(July 28, 1985)
Extent of Riparian Vegetation in 1985
Area = 6.16 square miles

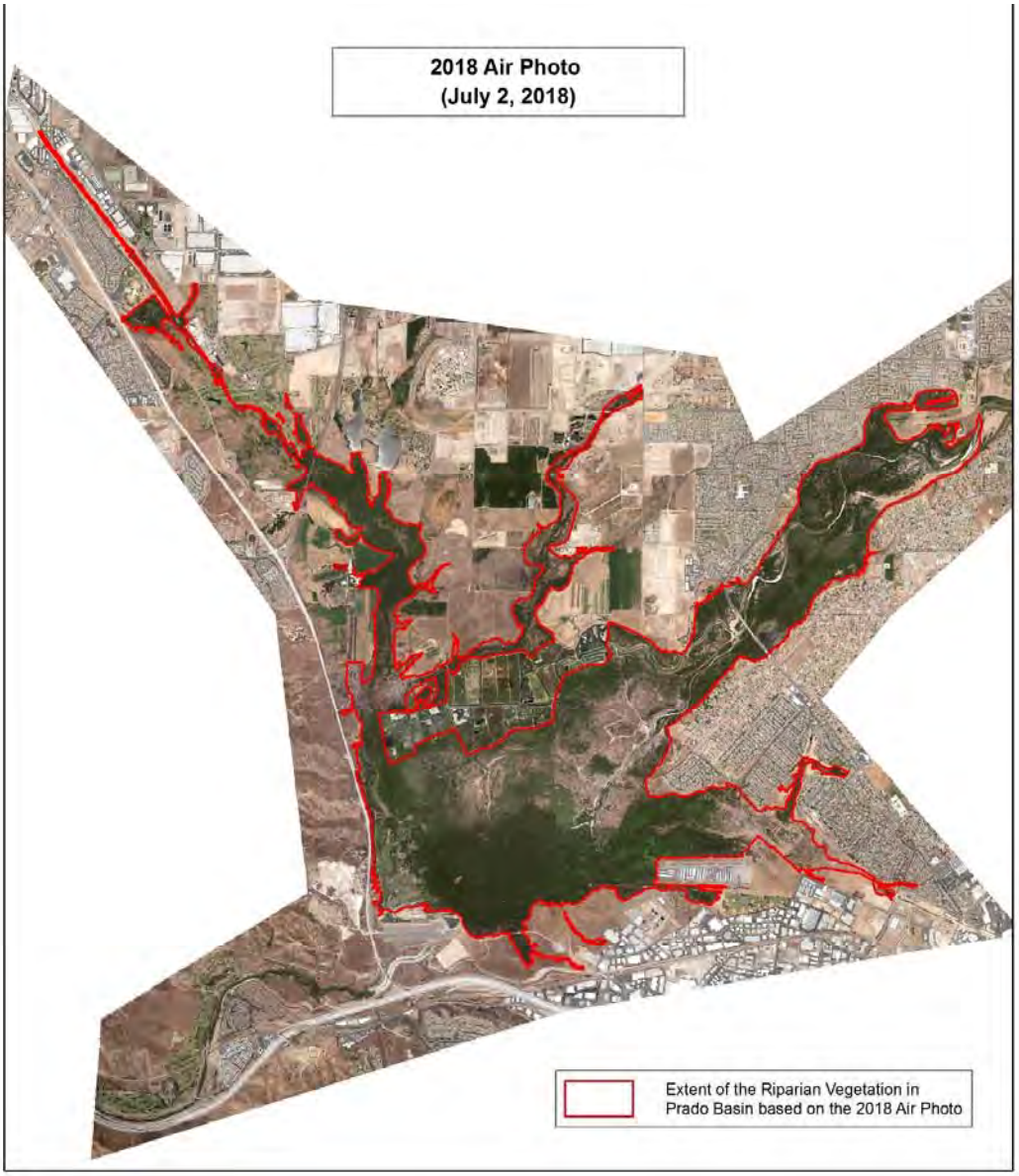

1999 Air Photo
(January 14, 1999)
Extent of Riparian Vegetation in 1999
Area = 6.69 square miles

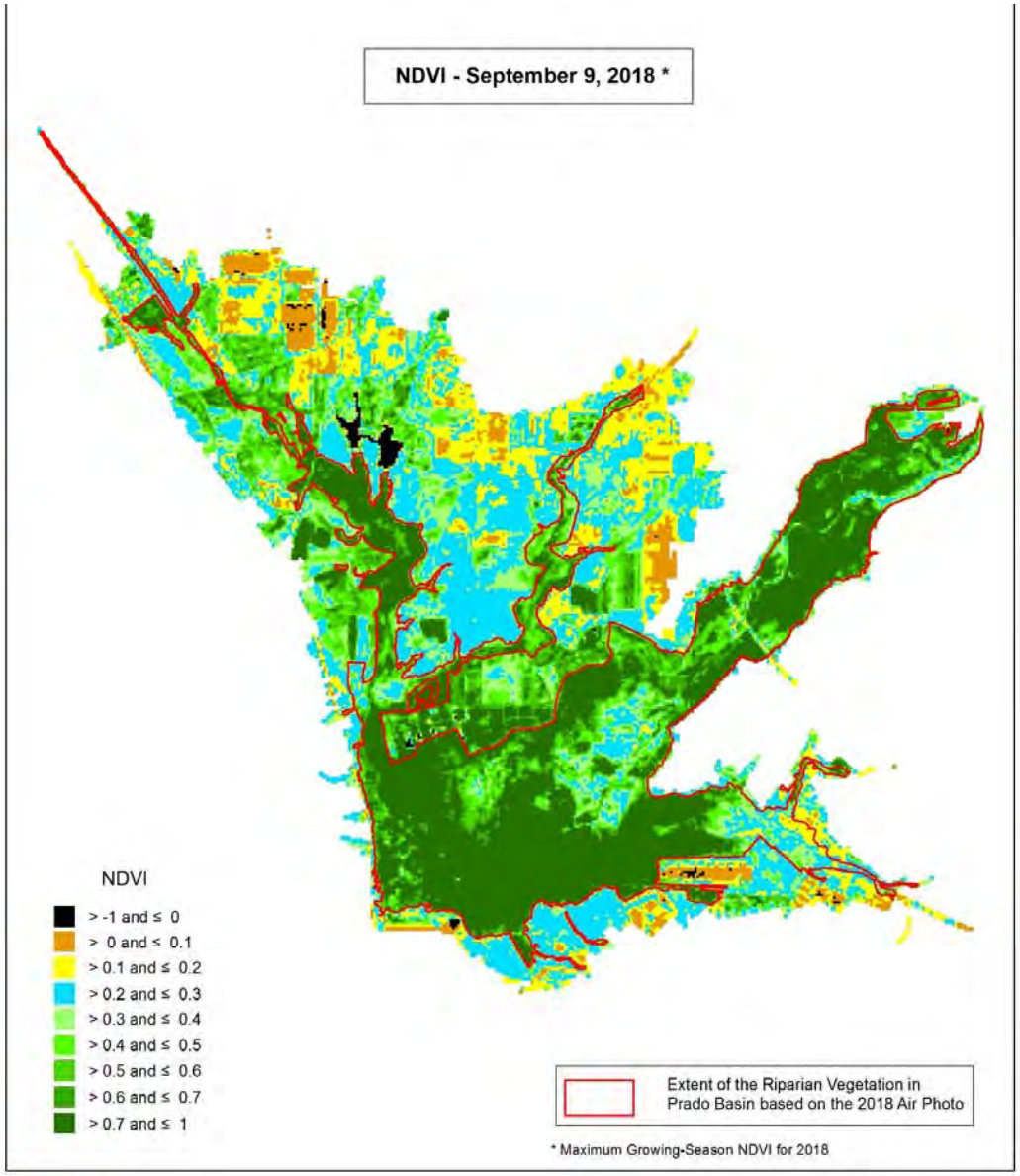

2006 Air Photo
(Date Unknown)
Extent of Riparian Vegetation in 2006
Area = 6.77 square miles

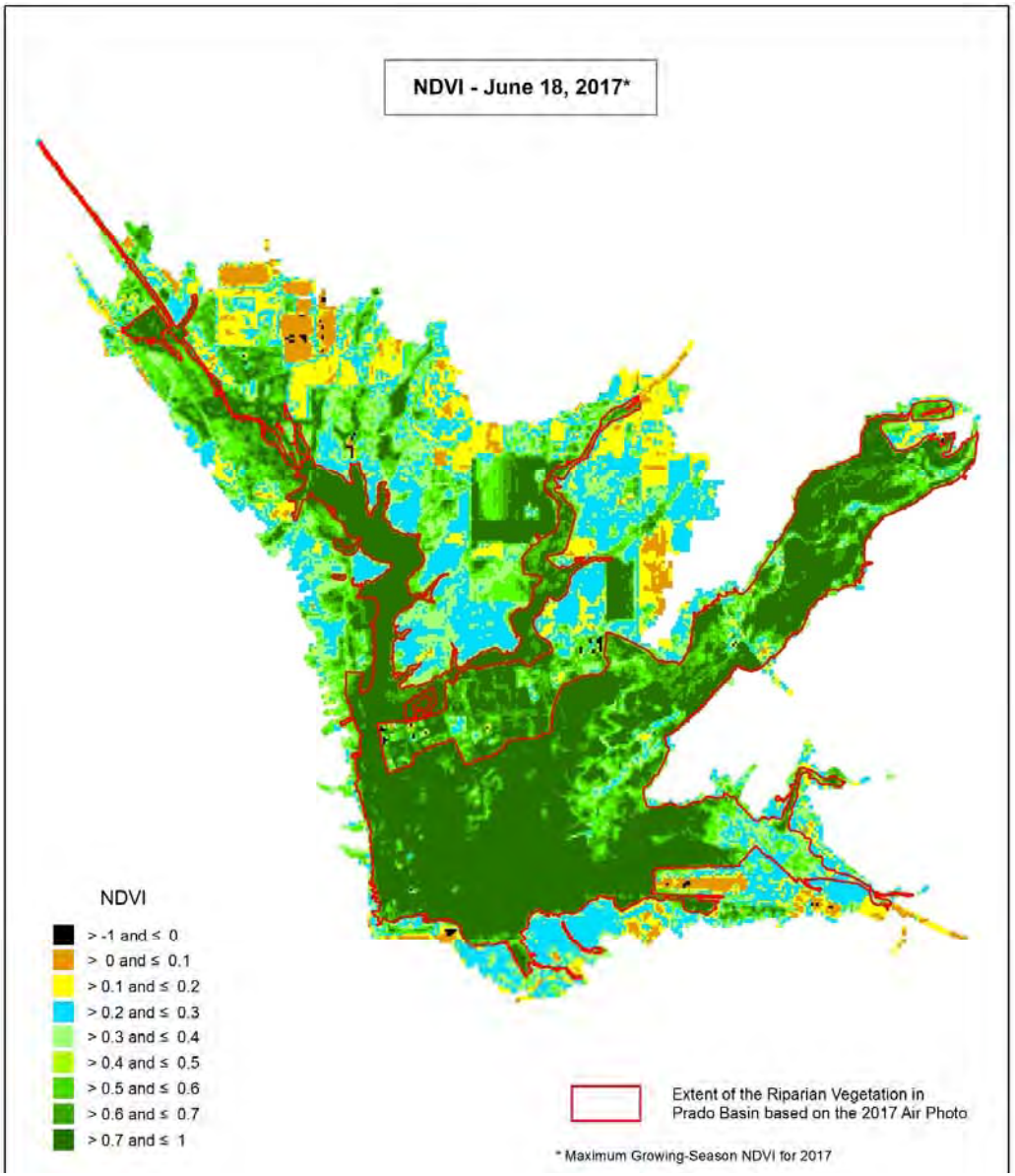

2016 Air Photo
(May 3 to June 14, 2016)
Extent of Riparian Vegetation in 2016
Area = 6.79 square miles

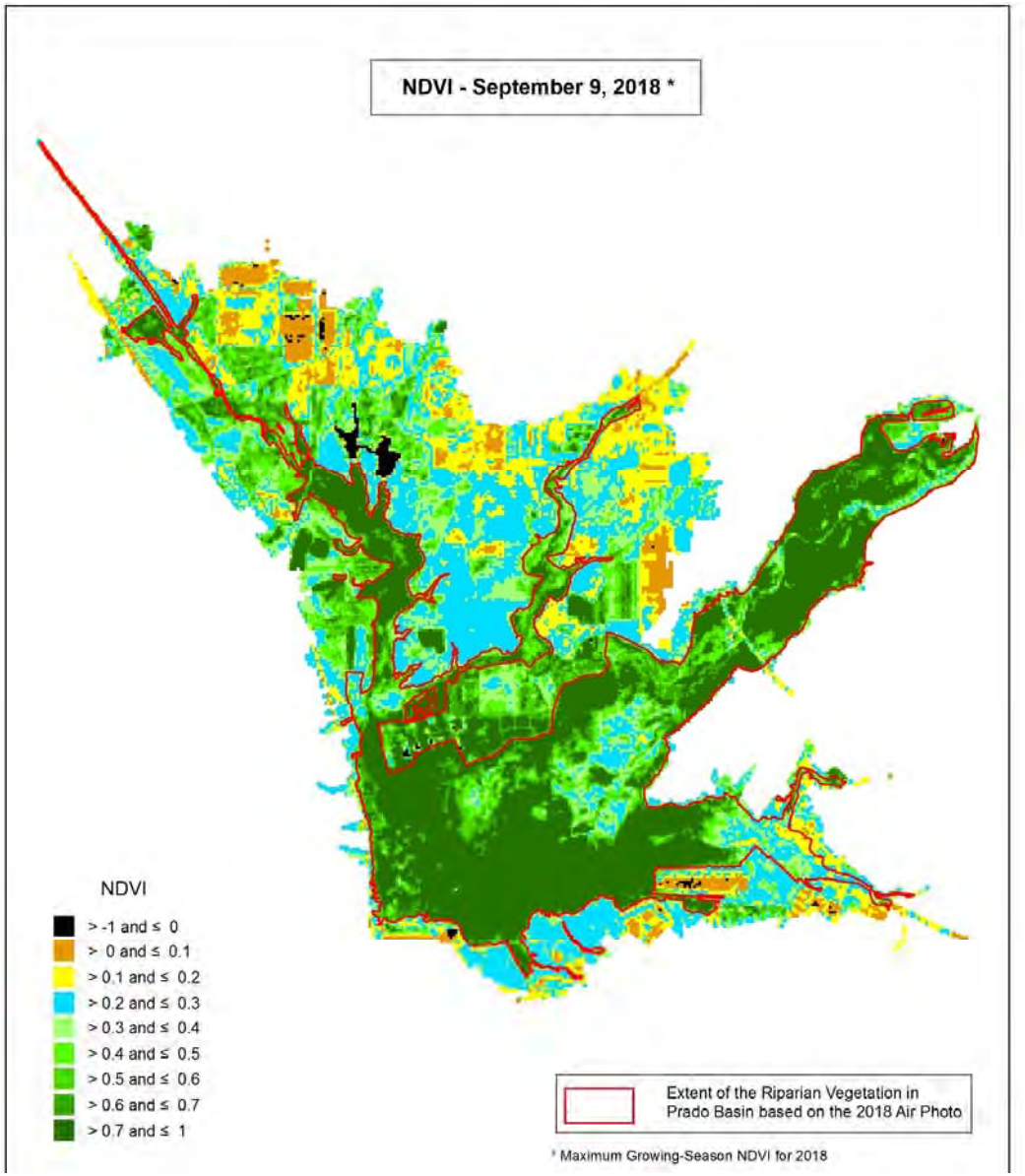

2017 Air Photo
(July 3, 2017)
Extent 2017 = 6.78 mi2
Extent of the Riparian Vegetation in
Prado Basin based on the 2017 Air Photo.
Area = 6.78 square miles


2018 Air Photo
(July 2, 2018)
Extent 2018 = 6.78 mi2
Extent of the Riparian Vegetation in
Prado Basin based on the 2018 Air Photo
Area = 6.78 square miles


2018 Air Photo
(July 2, 2018)
Extent of the Riparian Vegetation in
Prado Basin based on the 2018 Air Photo


NDVI - September 9, 2018 *
NDVI
> -1 and ≤ 0
> 0 and < 0.1
> 0.1 and ≤ 0.2
> 0.2 and ≤ 0.3
> 0.3 and ≤ 0.4
> 0.4 and ≤ 0.5
> 0.5 and ≤ 0.6
> 0.6 and ≤ 0.7
> 0.7 and ≤ 1
Extent of the Riparian Vegetation in
Prado Basin based on the 2018 Air Photo
* Maximum Growing-Season NDVI for 2018


NDVI - June 18, 2017*
NDVI
> -1 and ≤ 0
> 0 and ≤ 0.1
> 0.1 and ≤ 0.2
> 0.2 and ≤ 0.3
> 0.3 and ≤ 0.4
> 0.4 and ≤ 0.5
> 0.5 and ≤ 0.6
> 0.6 and ≤ 0.7
> 0.7 and ≤ 1
Extent of the Riparian Vegetation in Prado Basin based on the 2017 Air Photo
* Maximum Growing-Season NDVI for 2017


NDVI - September 9, 2018 *
NDVI
> -1 and ≤ 0
> 0 and ≤ 0.1
> 0.1 and ≤ 0.2
> 0.2 and ≤ 0.3
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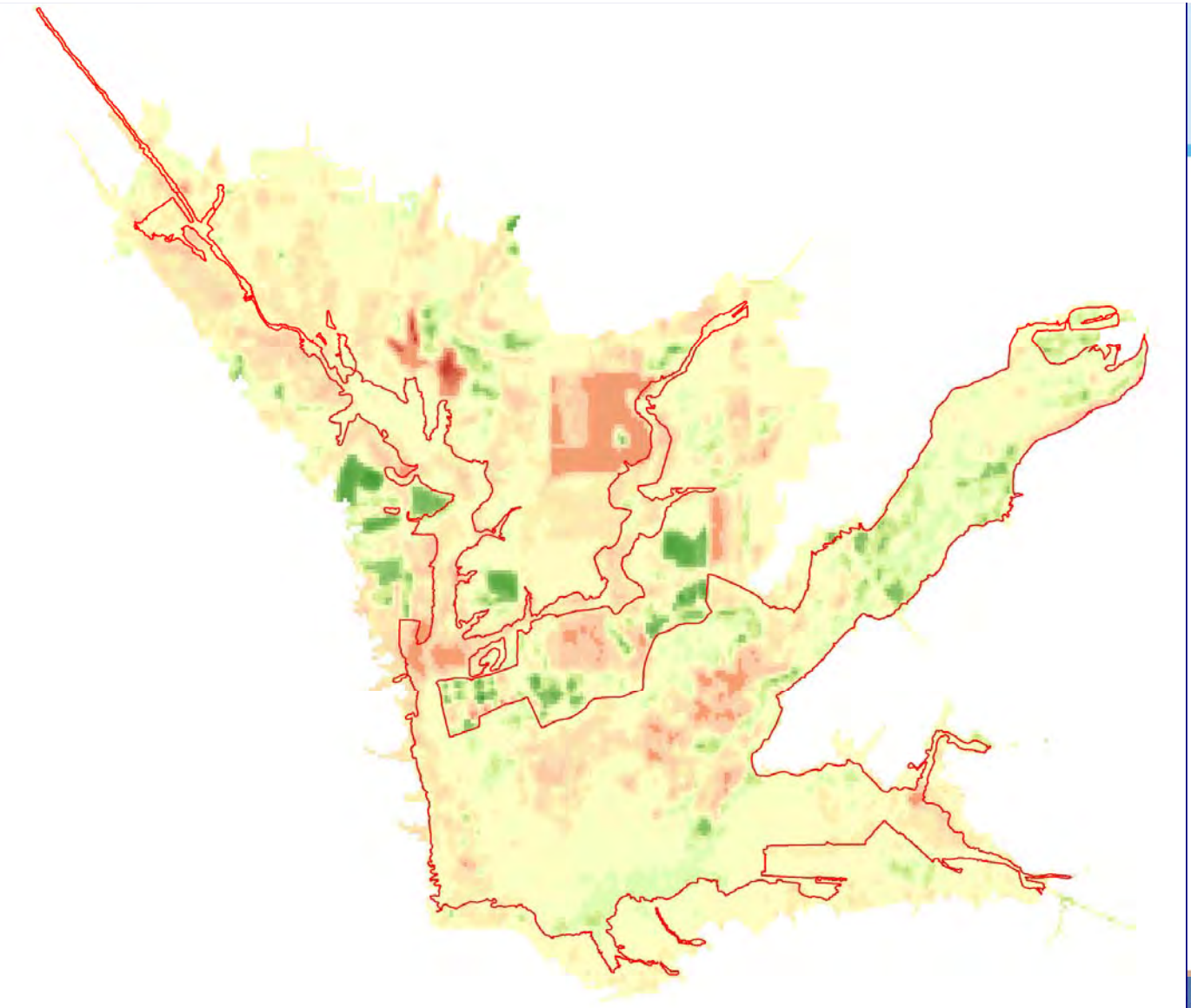
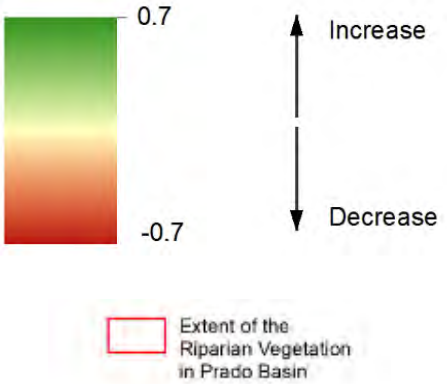
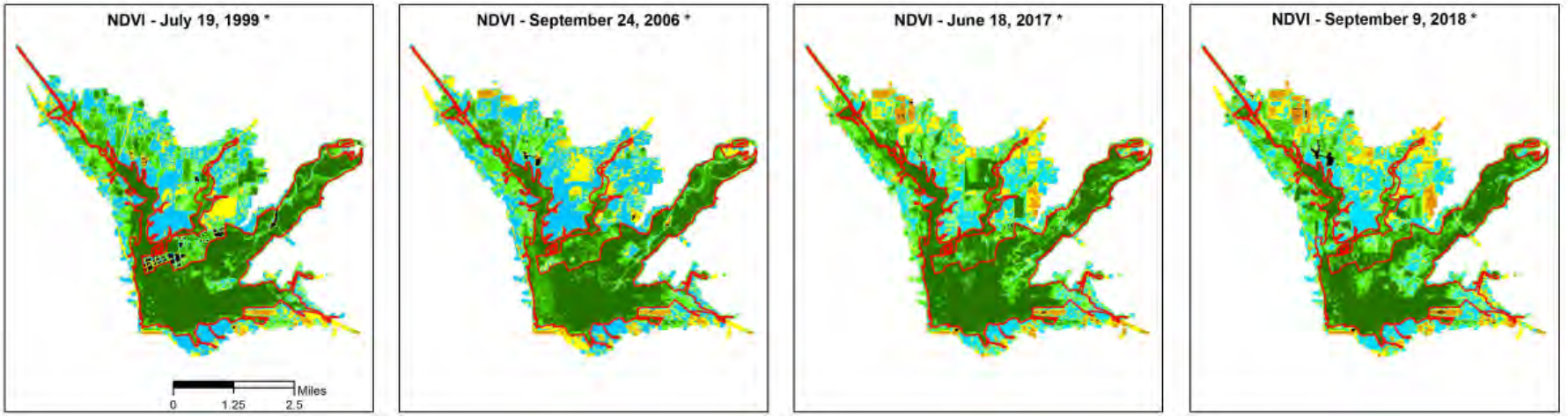
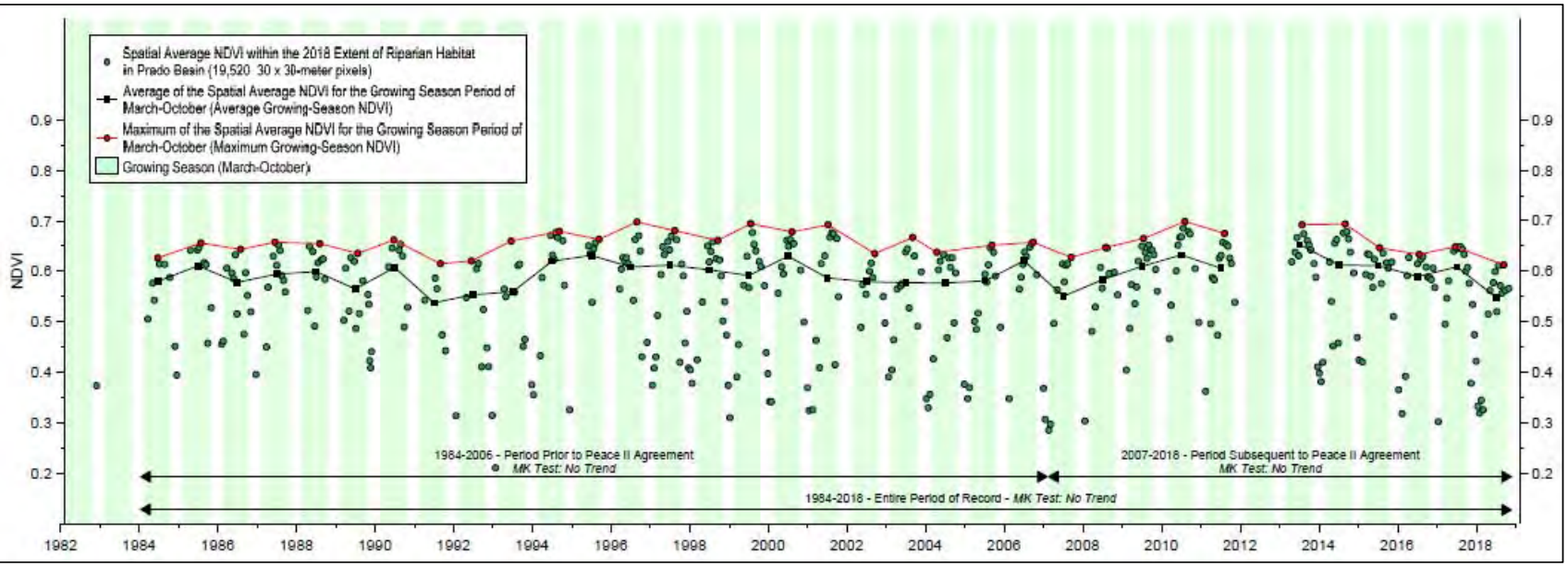
> 0.6 and ≤ 0.7
> 0.7 and ≤ 1
Extent of the Riparian Vegetation in Prado Basin based on the 2018 Air Photo
* Maximum Growing-Season NDVI for 2018

Spatial Change in NDVI for the Prado Basin, 2017-2018





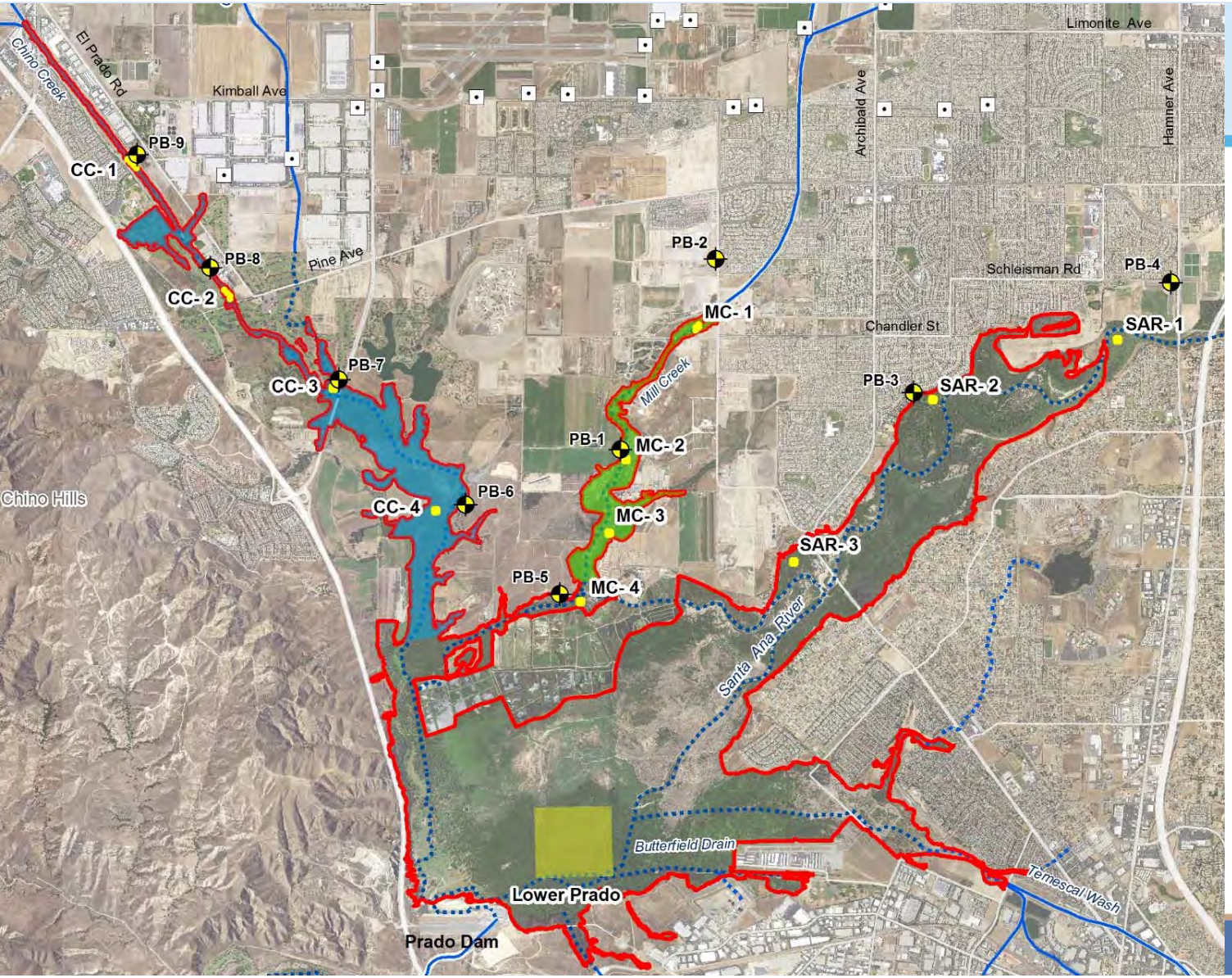




Spatial Average NDVI

Maximum Growing-Season NDVI

Average Growing-Season NDVI



NDVI Temporal Analysis Areas in Prado Basin

Defined Areas Analyzed for NDVI Temporally in Time-Series Charts

- 6.8 square-mile area (19,520 pixels) - 2018 Riparian Vegetation Extent (Figure 3-5)
- 0.74 square-mile area (2,134 NDVI pixels) in Chino Creek (Figure 3-6)
- 0.26 square-mile area (759 NDVI pixels) in Mill Creek (Figure 3-7)
- 0.23 square-mile area (677 NDVI pixels) in Lower Prado (Figure 3-8)
- 3,600 square-meter area (four NDVI pixels) (Figures 3-9a through 3-9k)
- PBHSP Monitoring Well Site

4 large areas

11 small areas

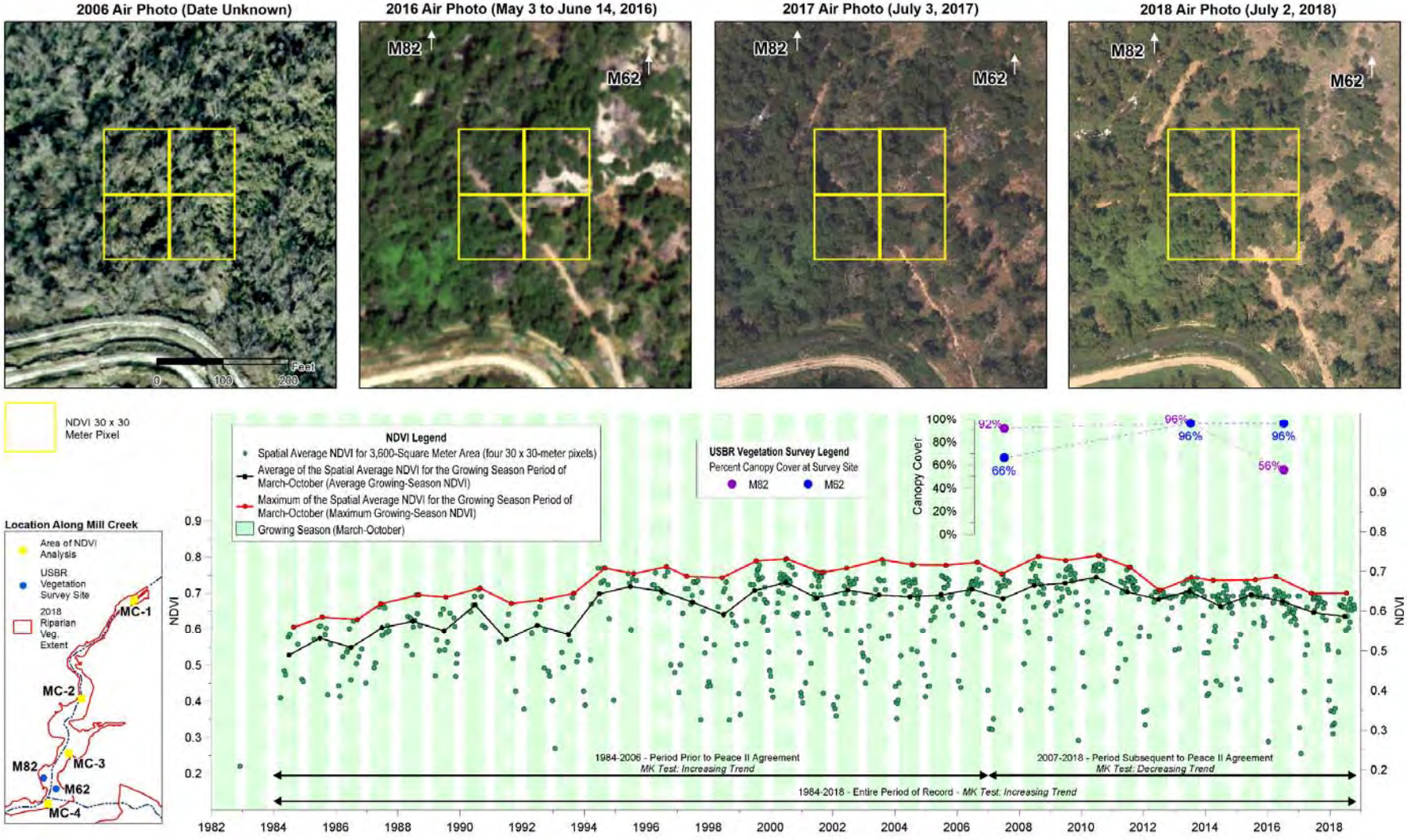
Summary of Mann-Kendal Statistical Trend Test on the Average-Growing Season NDVI

Defined Area	Figure Number	Mann Kendal Test Result[1]		
		Period of Record 1984 - 2018	Prior to Peace II 1984 - 2006	Post Peace II 2007 - 2018
2018 Rip Veg Extent	3-5	No Trend	No Trend	No Trend
Chino Creek Area	3-6	Increasing	Increasing	No Trend
Mill Creek Area	3-7	No Trend	Decreasing	No Trend
Lower Prado	3-8	Increasing	No Trend	Increasing
CC-1	3-9a	Increasing	Increasing	No Trend
CC-2	3-9b	Increasing	Increasing	Increasing
CC-3	3-9c	Increasing	No Trend	No Trend
CC-4	3-9d	Increasing	No Trend	No Trend
MC-1	3-9e	Increasing	No Trend	No Trend
MC-2	3-9f	No Trend	Decreasing	No Trend
MC-3	3-9g	No Trend	No Trend	No Trend
MC-4	3-9h	Increasing	Increasing	Decreasing
SAR-1	3-9i	Increasing	Increasing	Decreasing
SAR-2	3-9j	Increasing	Increasing	No Trend
SAR-3	3-9k	Increasing	No Trend	Increasing

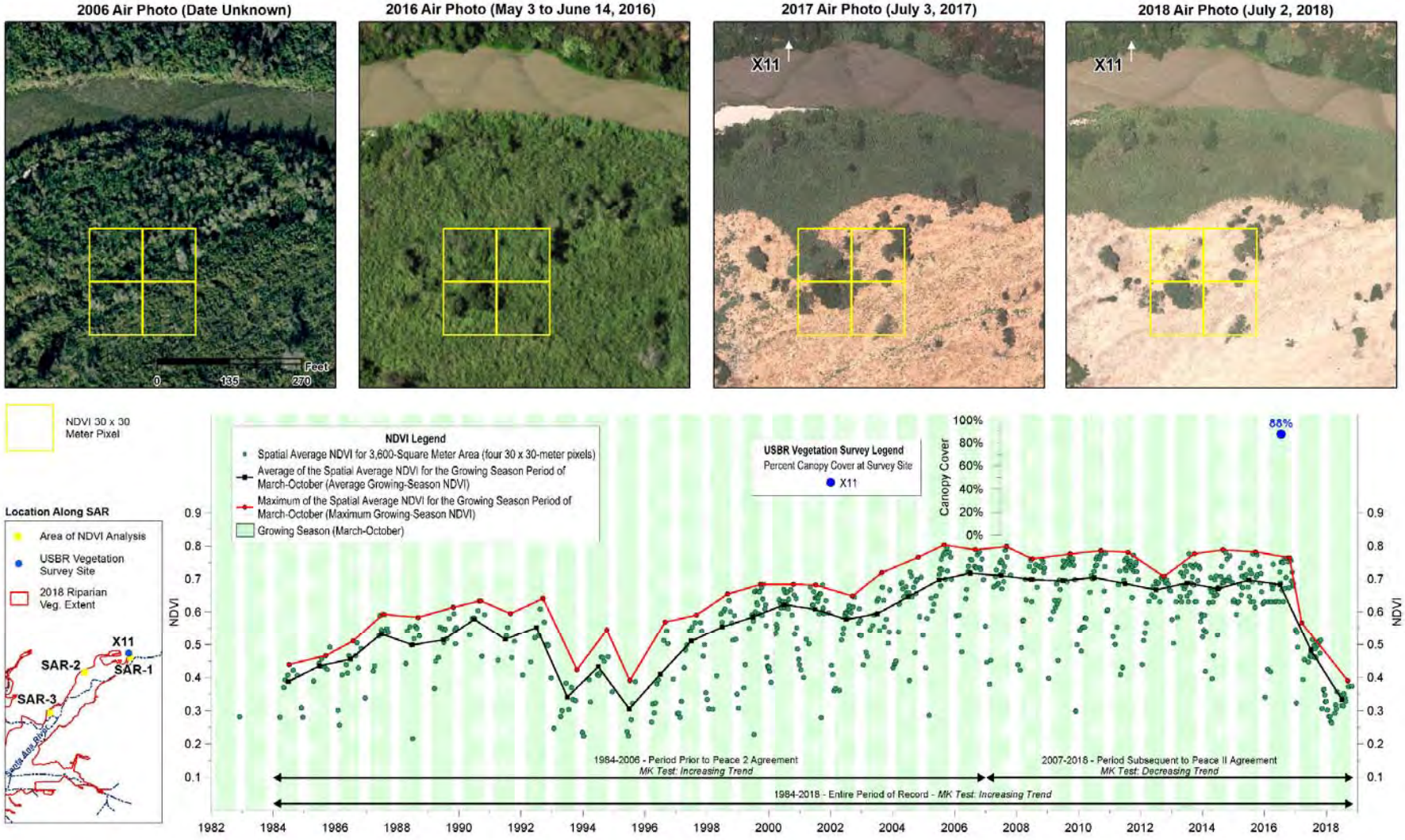
Statistically characterize the long-term trends in NDVI:

- **1984 to 2018**: the entire period of record.
- **1984 to 2006**: period prior to Peace II Agreement implementation
- **2007 to 2018**: period subsequent to Peace II Agreement implementation

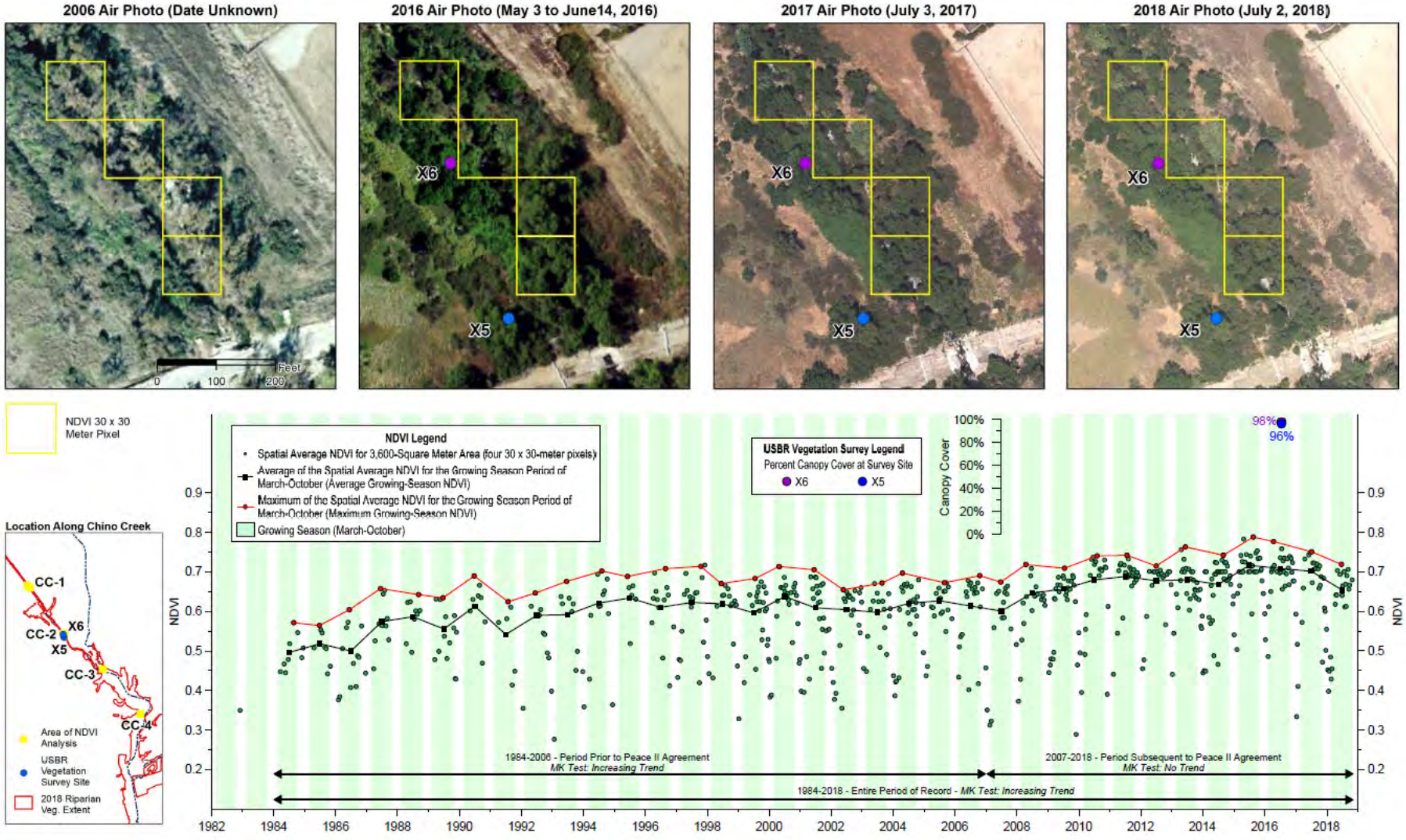
NDVI Analysis – MC-4



NDVI Analysis – SAR-1



NDVI Analysis – CC-2



Characterization of Historical and Recent Short Term Changes in Growing-Season NDVI

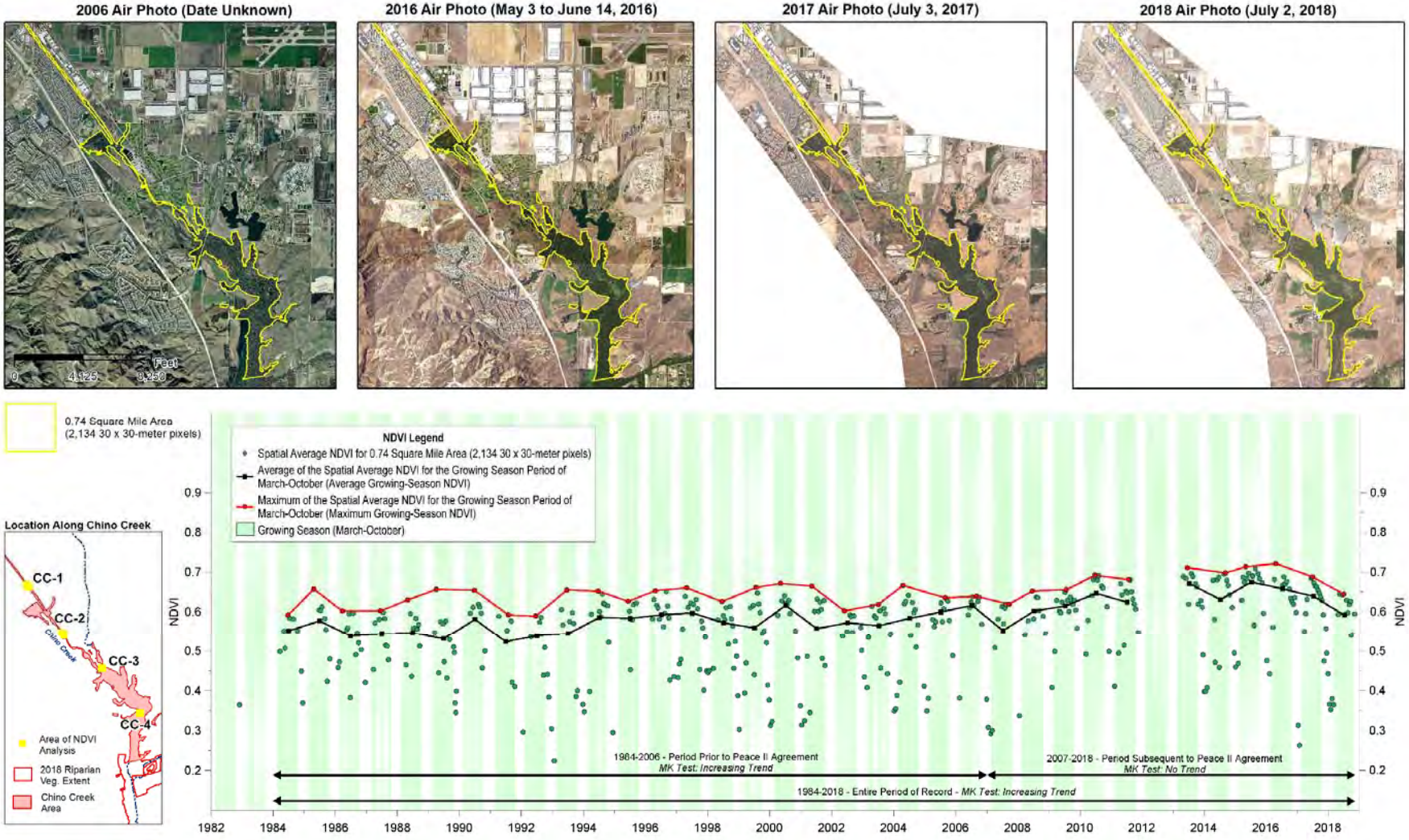
Defined Area	Figure Number	Historical Short-Term Changes in NDVI 1984 - 2015			Recent Changes in NDVI	
		Average Annual Change in NDVI (Absolute Value)	Maximum One-Year Change in NDVI (Absolute Value)	Maximum Three Year Change in NDVI (Absolute Value)	One Year Change in NDVI 2017 - 2018 [1]	Three-Year Change in NDVI 2015 - 2018 [2]
2018 Rip Veg Extent	3-5	0.02	0.07	0.08	-0.06	-0.06
Chino Creek Area	3-6	0.03	0.06	0.09	-0.05	**-0.09**
Mill Creek Area	3-7	0.04	0.10	0.15	**-0.11**	-0.12
Lower Prado	3-8	0.03	0.10	0.13	-0.01	-0.02
CC-1	3-9a	0.03	0.09	0.10	-0.03	-0.08
CC-2	3-9b	0.02	0.07	0.08	-0.05	-0.06
CC-3	3-9c	0.03	0.14	0.10	0.01	-0.02
CC-4	3-9d	0.04	0.12	0.13	0.01	-0.03
MC-1	3-9e	0.03	0.10	0.13	-0.03	-0.10
MC-2	3-9f	0.04	0.18	0.17	-0.07	-0.13
MC-3	3-9g	0.04	0.12	0.14	-0.07	-0.04
MC-4	3-9h	0.03	0.11	0.13	-0.08	-0.09
SAR-1	3-9i	0.05	0.21	0.25	-0.01	**-0.36**
SAR-2	3-9j	0.03	0.11	0.13	-0.02	0.07
SAR-3	3-9k	0.03	0.11	0.12	-0.04	-0.05

Characterize the meaningfulness of recent changes in NDVI (2017-18) and (2015-18)

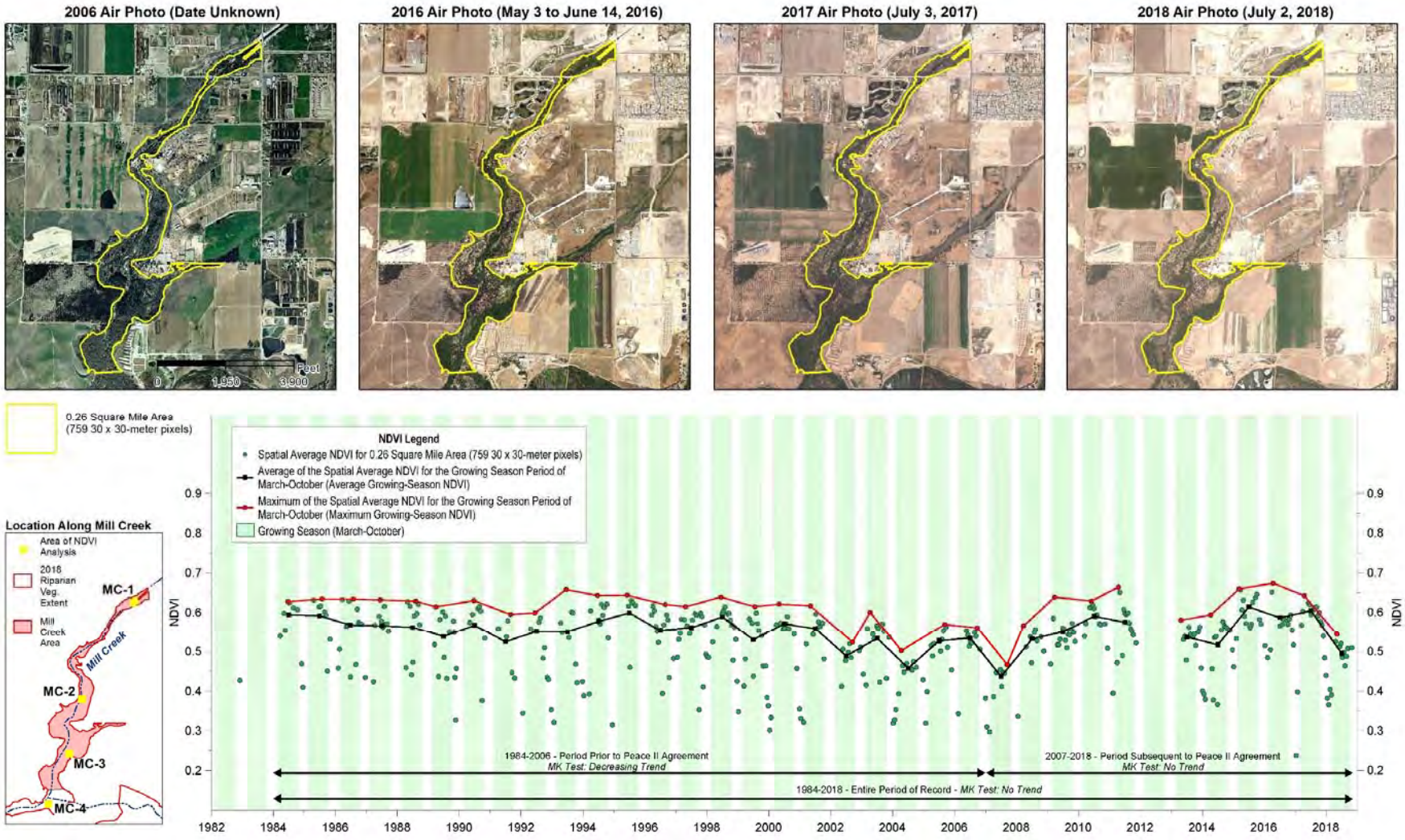
Look at recent one-year and three-year changes in the Average Growing Season NDVI

Compare to one-year and three-year changes in over the longer term historical period.

NDVI Analysis – Along Chino Creek



NDVI Analysis – Along Mill Creek



Conclusions

Riparian Habitat Monitoring Program

- The quality of riparian habitat characterized through the analysis of air photos, and maps and time-series charts of NDVI for areas, indicate notable declines in the greenness over the past one or three years at the following areas:
  - Along Chino Creek, particularly along its southern reach, north of the OCWD wetlands
  - Along most of the reach of Mill Creek north of the OCWD wetlands
  - A large area southeast of the OCWD wetlands
  - The most upstream reach of the SAR in Prado Basin

- Remainder of Section 3 describes the factors that can affect the riparian habitat, how these factors have changed over time, and how the changes may explain the observed changes in the riparian habitat

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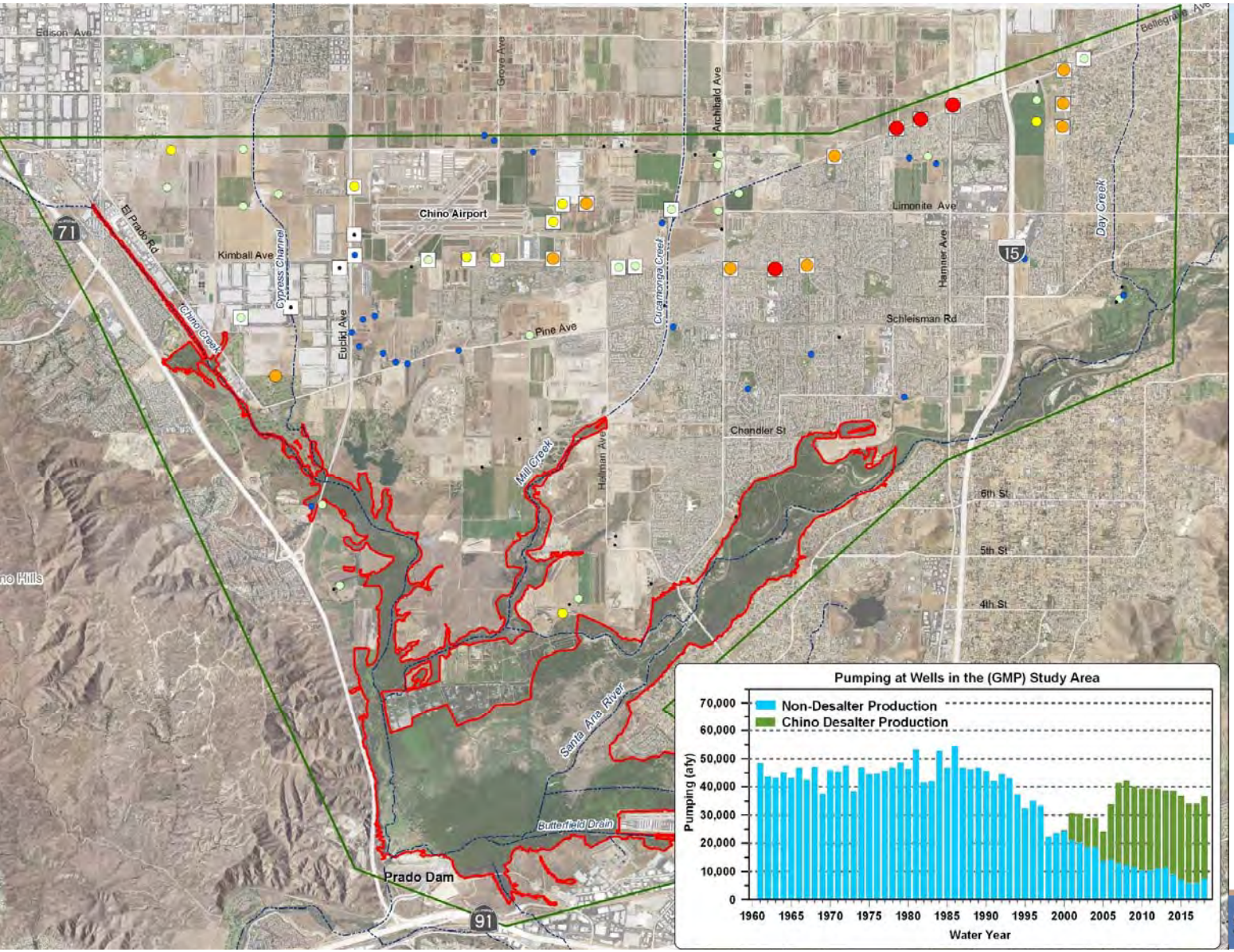
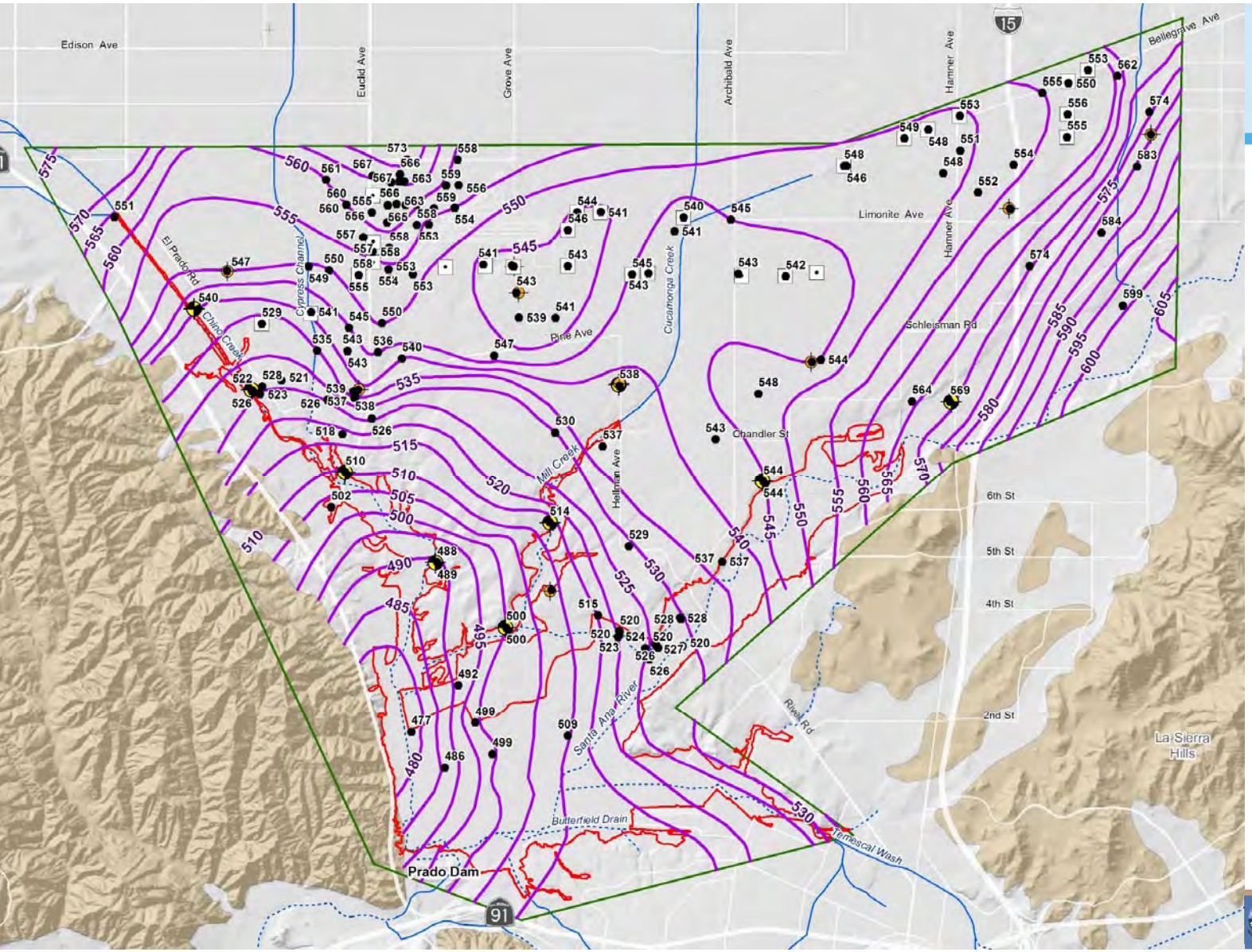
Potential Stressors

Groundwater Production
WY 2018



Groundwater Pumping
Water Year 2018 (AF)

- < 10
- 10 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 2,500
- 2,500 - 5,000
- > 5,000



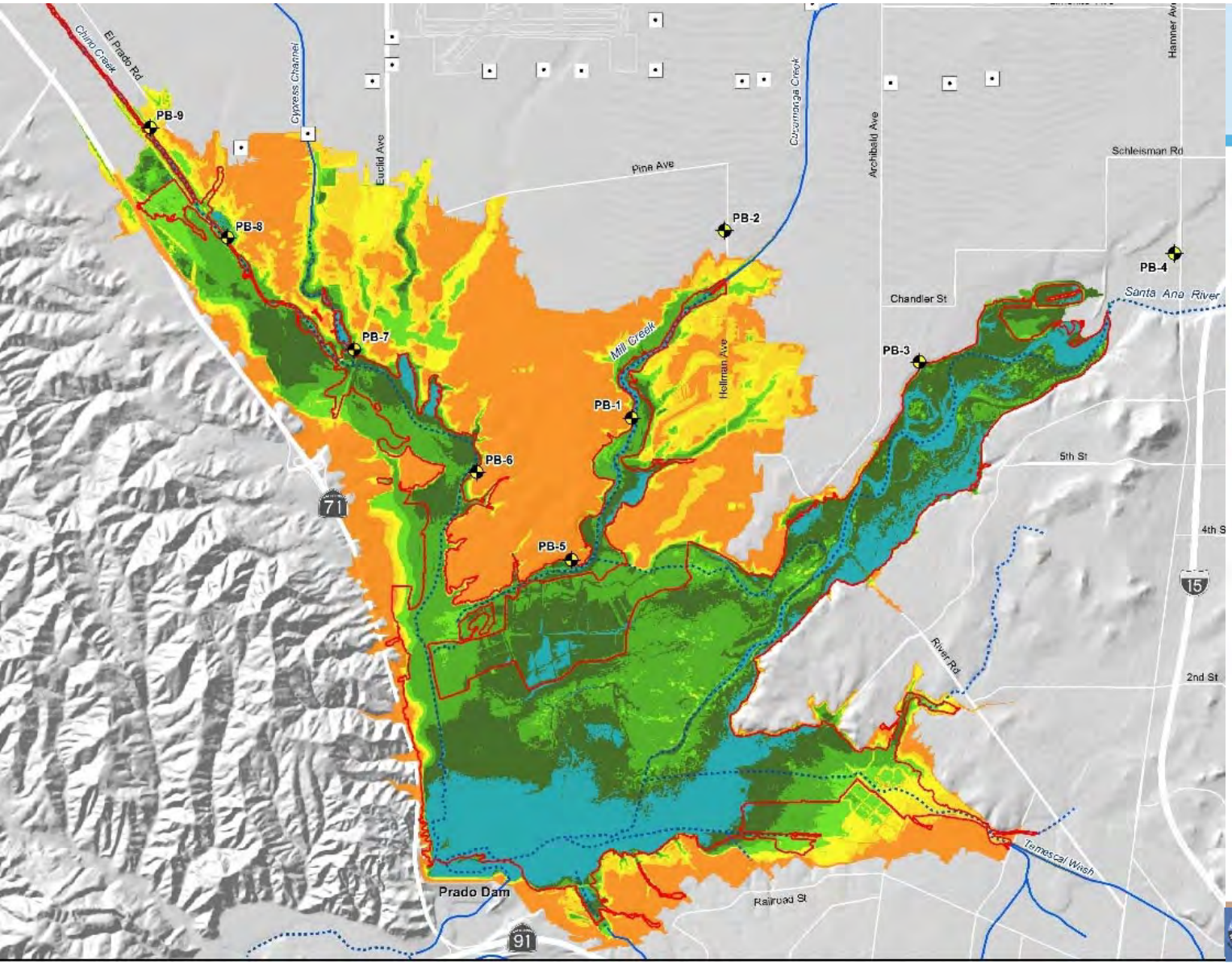
Groundwater Elevation in Shallow Aquifer System

September 2018

- Equal Elevation Contour of Groundwater Elevation (feet above mean sea level)
- Measured Groundwater Elevation in September 2018 used to draw contours (feet above mean sea level)
- Chino Basin Desalter Authority Well
- PBHSP Monitoring Well
- HCMP Monitoring Well
- Other Well
- Groundwater Monitoring Program (GMP) Study Area
- 2018 Extent of the Riparian Vegetation in Prado Basin

Depth to Groundwater

September 2018



Depth to Groundwater (feet below ground surface)

- Area of Groundwater at the Ground Surface
- > 0 and ≤ 5
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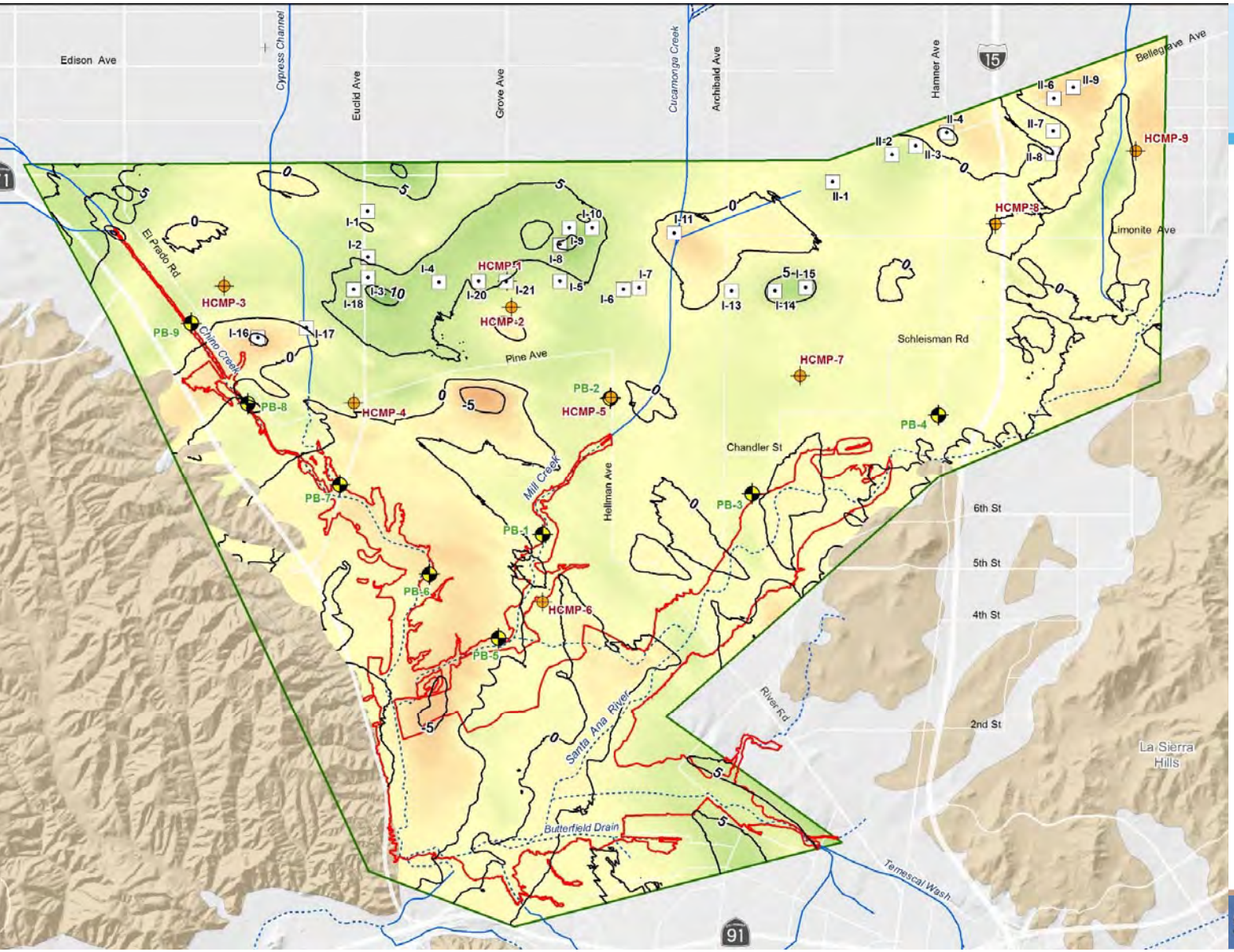
2018 Extent of the Riparian Vegetation in Prado Basin

Chino Basin Desalter Authority Well

PBHSP Monitoring Well



Change in Groundwater Elevation
2016 - 2018

+ 25
0
- 25

Change in Groundwater Elevation from September 2016 to September 2018

Contour of Change in Groundwater Elevation from September 2016 to September 2018 (feet)

Chino Basin Desalter Well

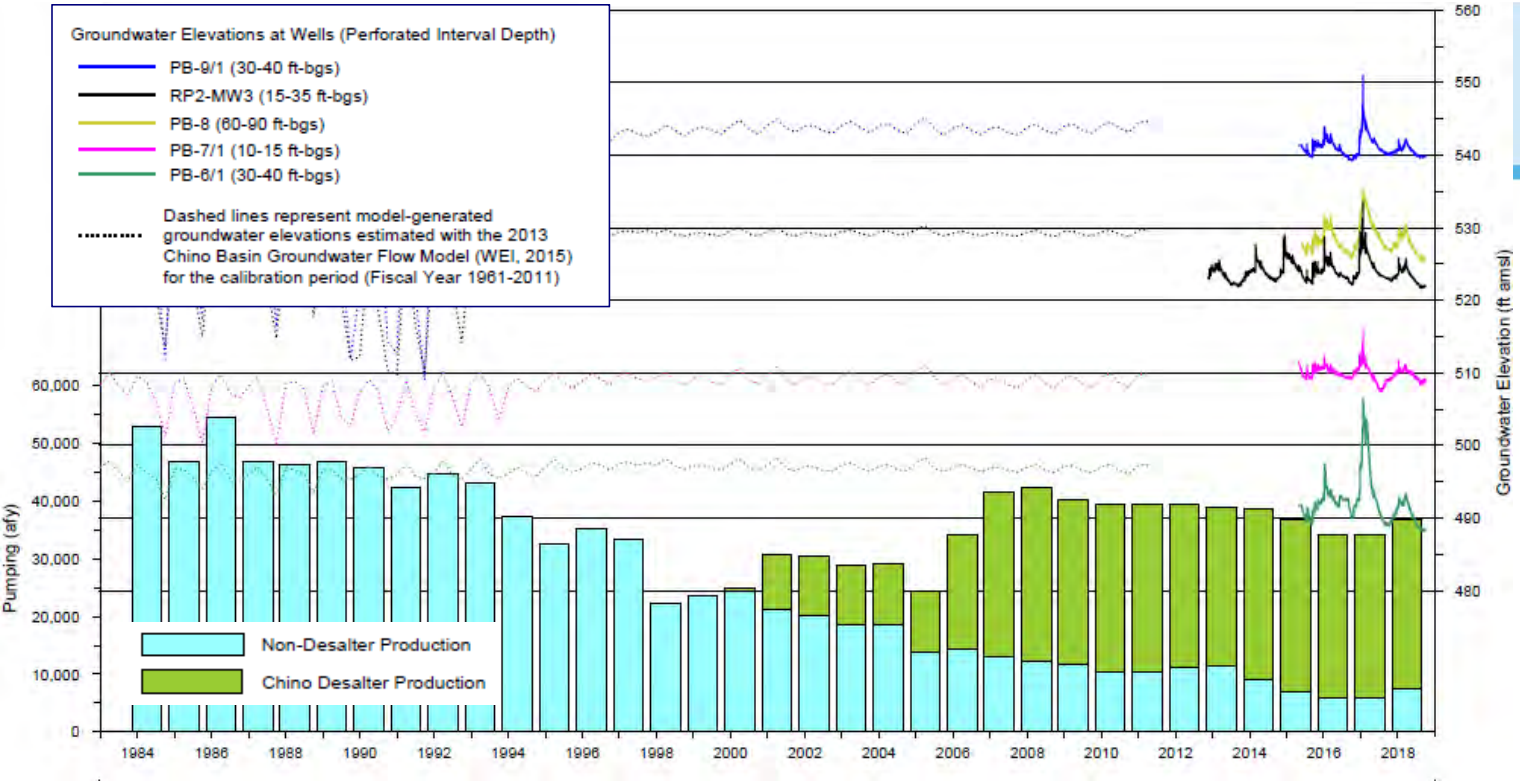
HCMP Monitoring Well

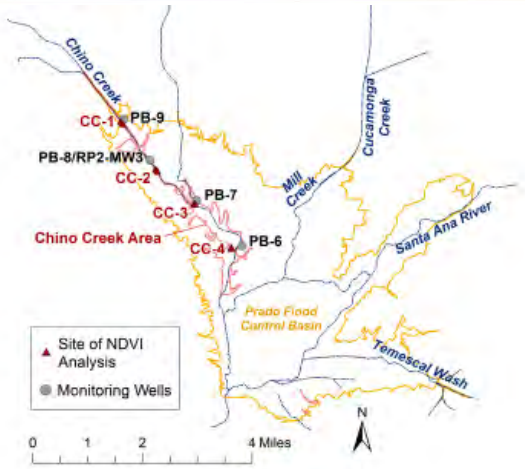
PBHSP Monitoring Well

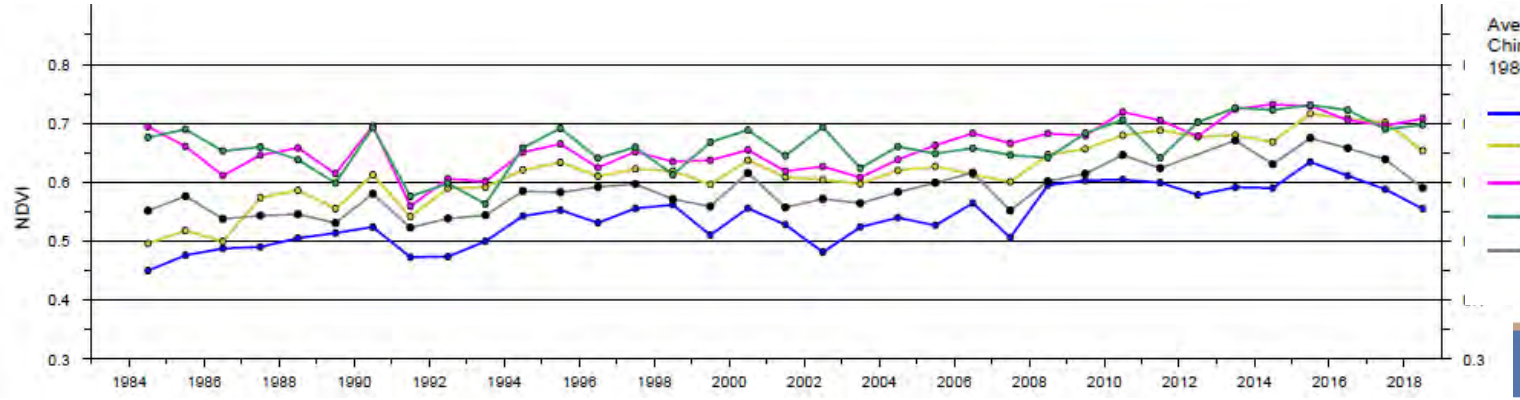
Groundwater Monitoring Program (GMP) Study Area

2018 Extent of the Riparian Vegetation in Prado Basin

Production, Groundwater Levels, NDVI – Chino Creek



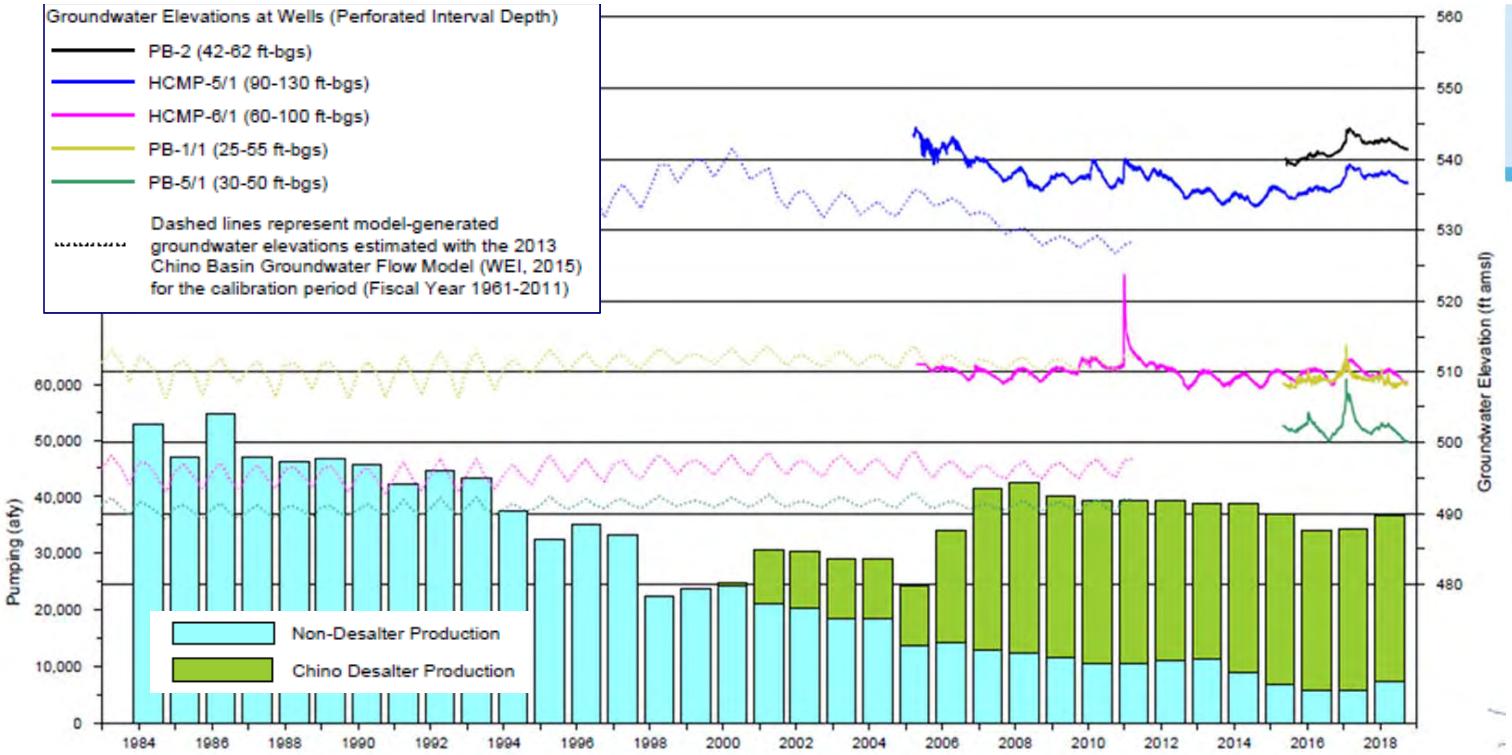


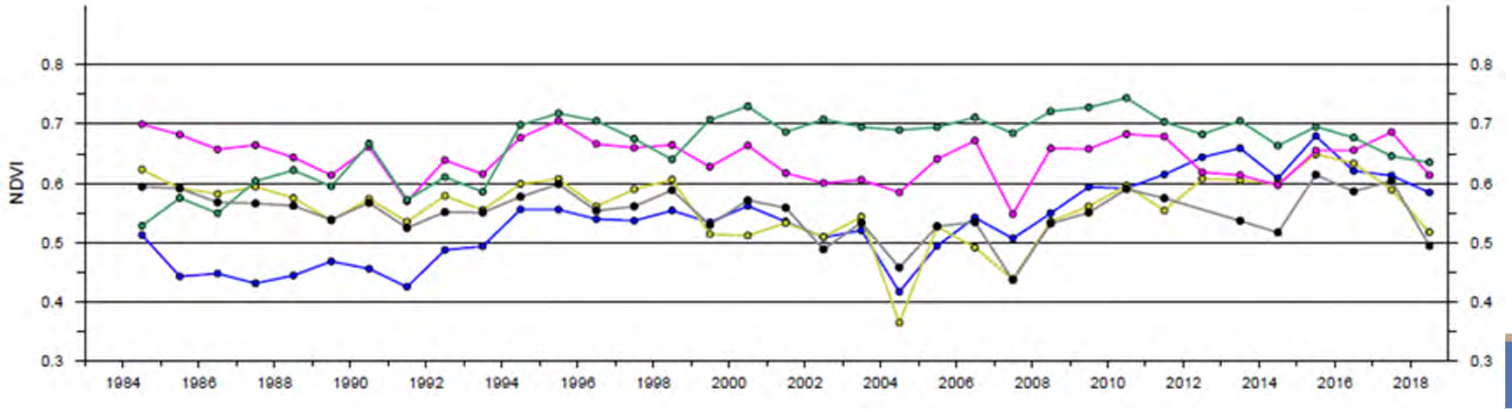


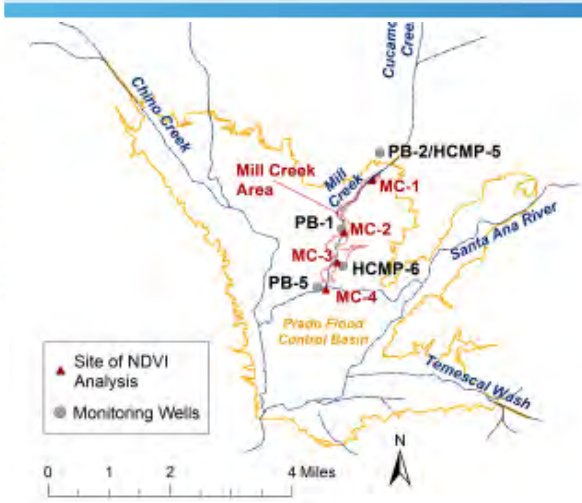
Average Growing Season NDVI for Areas Along Chino Creek - (Mann-Kendall Result for 1984-2018; 1984-2006; 2007-2018)

- CC-1 (*Increasing Trend; Increasing Trend; No Trend*)
- CC-2 (*Increasing Trend; Increasing Trend; No Trend*)
- CC-3 (*Increasing Trend; No Trend; No Trend*)
- CC-4 (*Increasing Trend; No Trend; No Trend*)
- Chino Creek Area (*Increasing Trend; Increasing Trend; No Trend*)

Production, Groundwater Levels, NDVI – Mill Creek



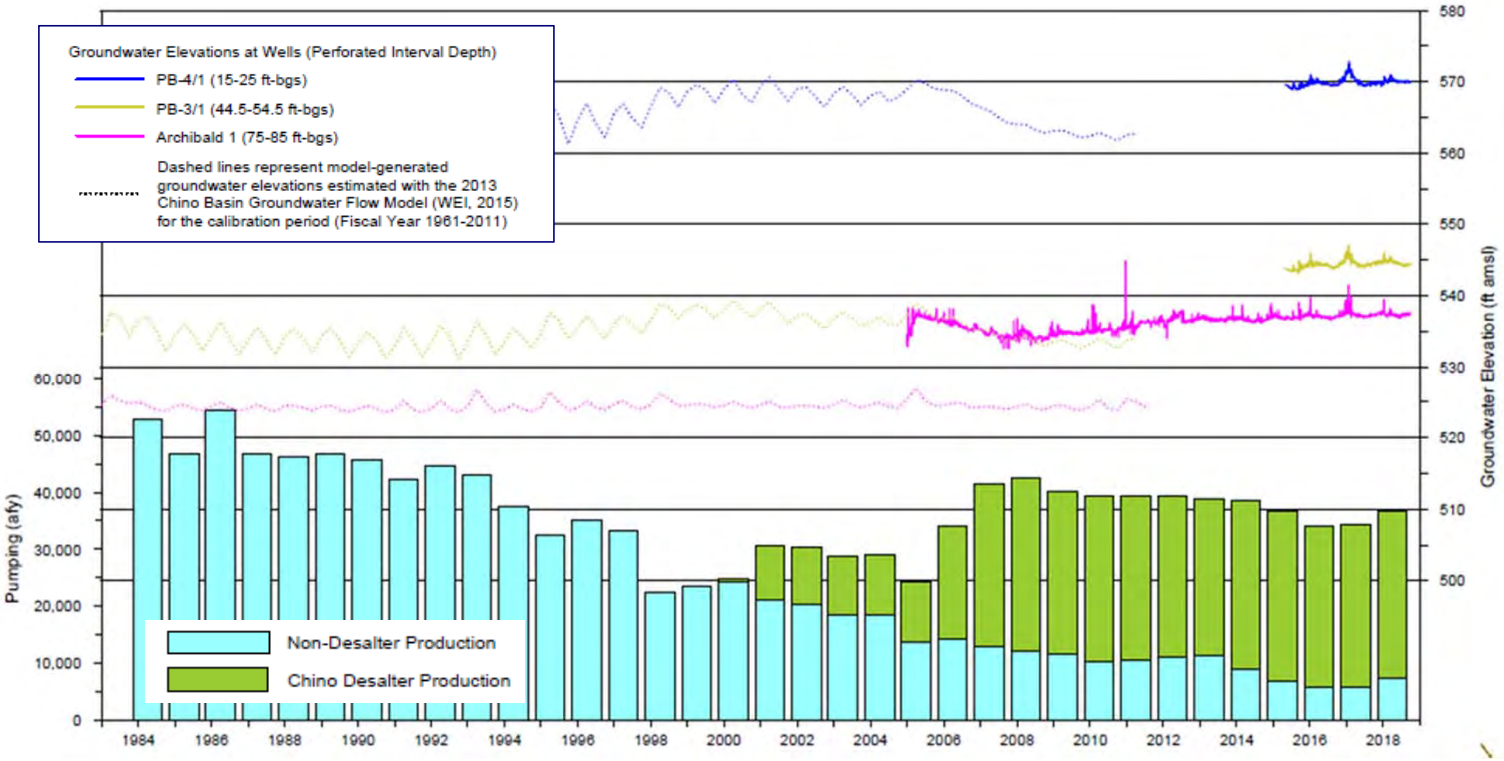


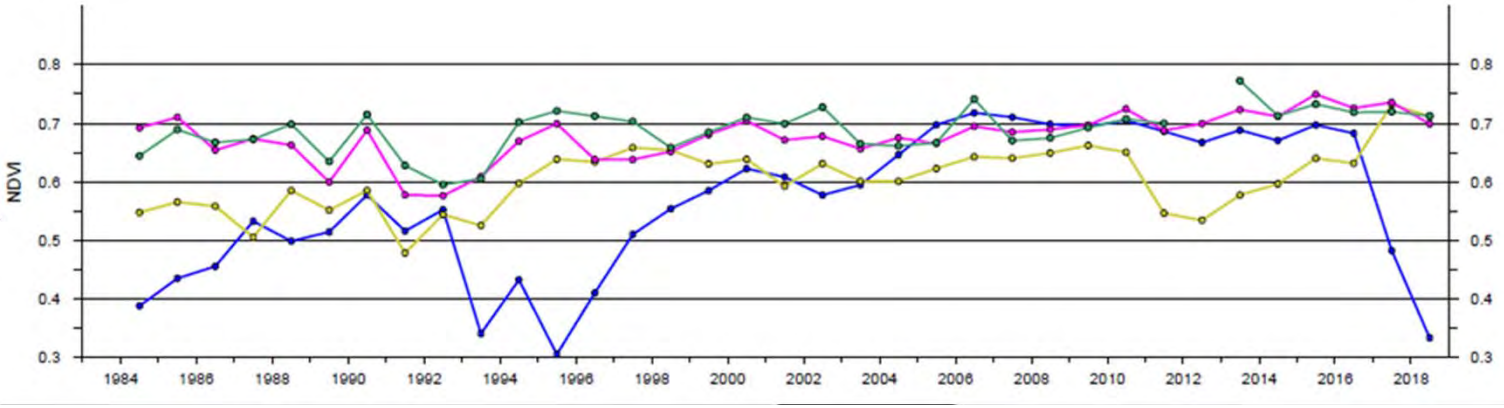


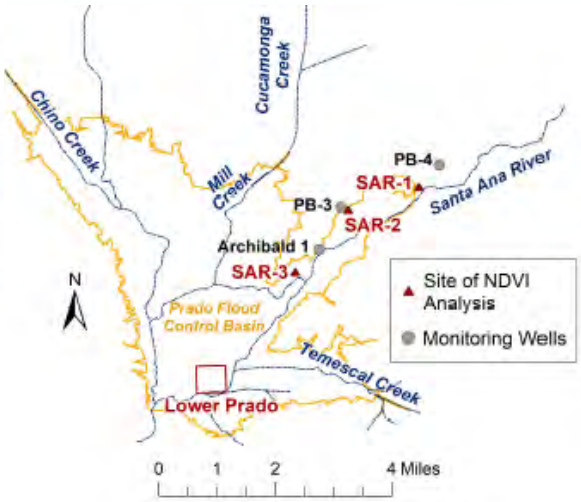
Average Growing Season NDVI for Areas Along Mill Creek - (Mann-Kendall Result for 1984-2018; 1984-2006; 2007-2018)

- MC-1 (*Increasing Trend; No Trend; No Trend*)
- MC-2 (*No Trend; Decreasing Trend; No Trend*)
- MC-3 (*No Trend; No Trend; No Trend*)
- MC-4 (*Increasing Trend; Increasing Trend; Decreasing Trend*)
- Mill Creek Area (*No Trend; Decreasing Trend; No Trend*)

Production, Groundwater Levels, NDVI – Santa Ana River







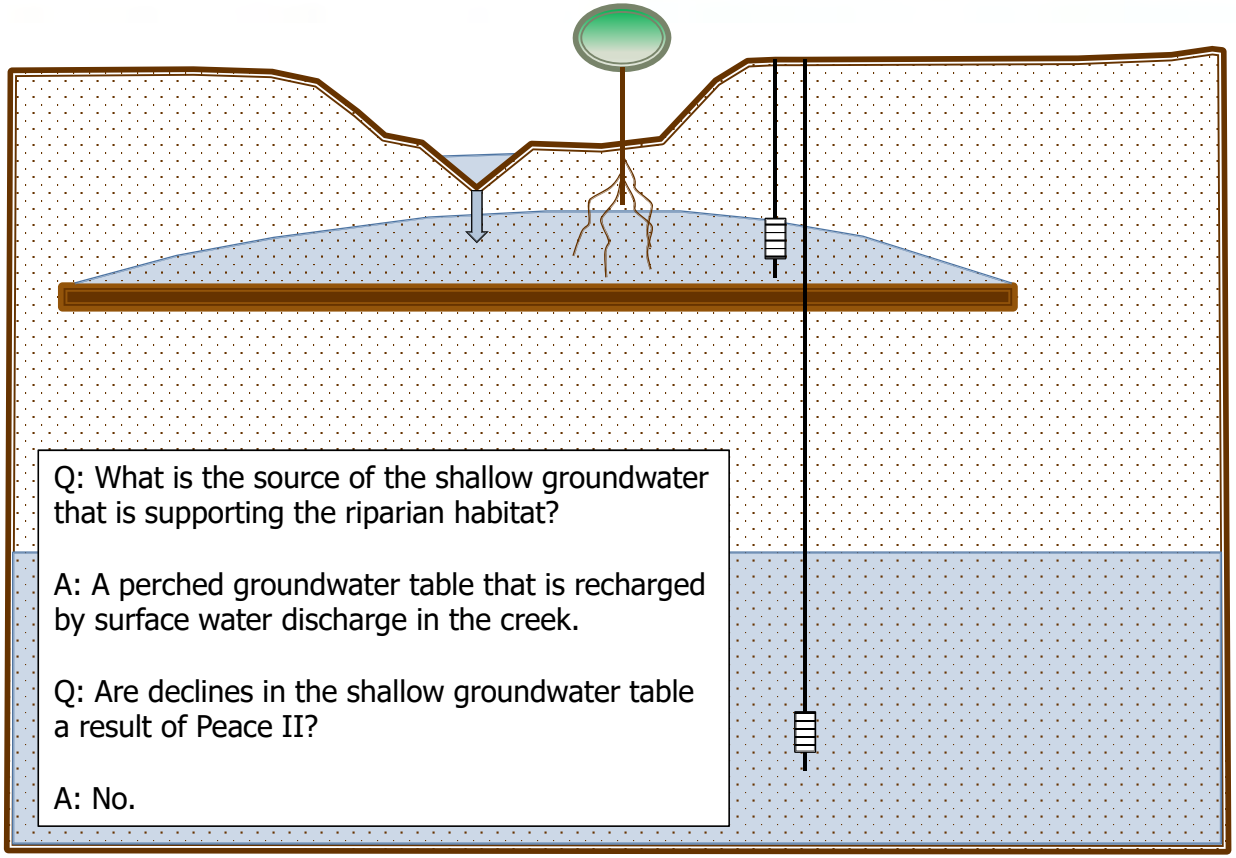
Average Growing Season NDVI for Areas Along Santa Ana River and Lower Prado (Mann-Kendall Result for 1984-2018;1984-2006; 2007-2018)

- SAR-1 (*Increasing Trend; Increasing Trend; Decreasing Trend*)
- SAR-2 (*Increasing Trend; Increasing Trend; No Trend*)
- SAR-3 (*Increasing Trend; No Trend; Increasing Trend*)
- Lower Prado (*Increasing Trend; No Trend; Increasing Trend*)

Conclusions

Groundwater vs. Riparian Habitat

- Declining groundwater levels are not likely the cause of the recent declines in the greenness of the riparian vegetation, because groundwater levels across the study area were relatively stable during 2015-2018.

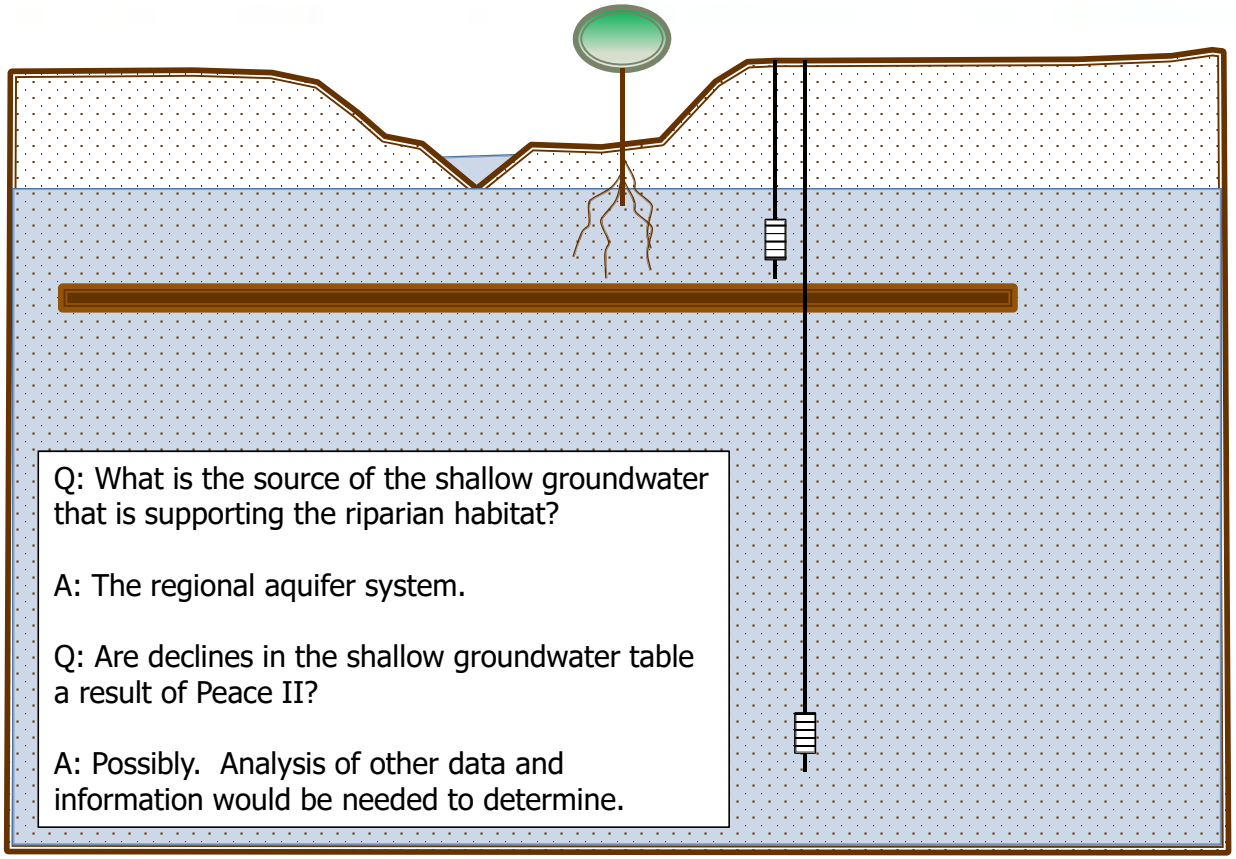


Q: What is the source of the shallow groundwater that is supporting the riparian habitat?

A: A perched groundwater table that is recharged by surface water discharge in the creek.

Q: Are declines in the shallow groundwater table a result of Peace II?

A: No.

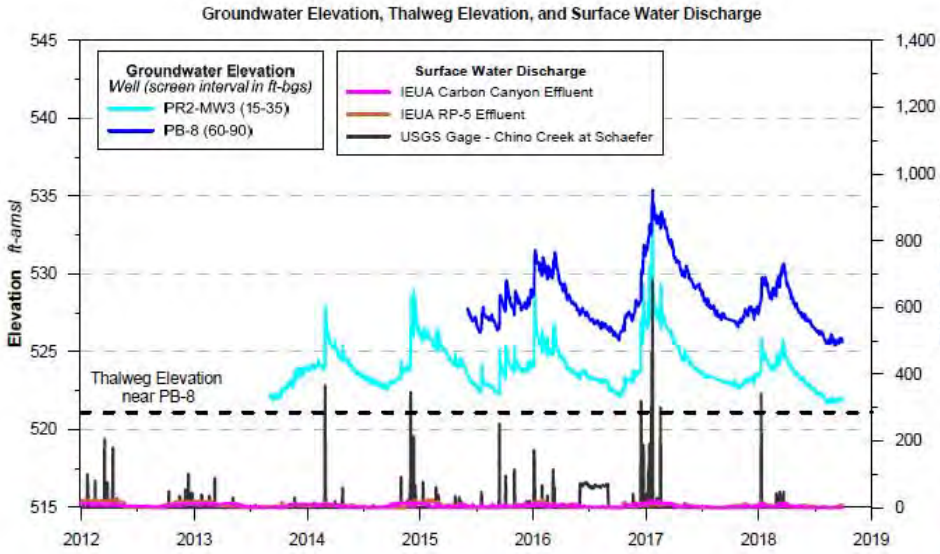


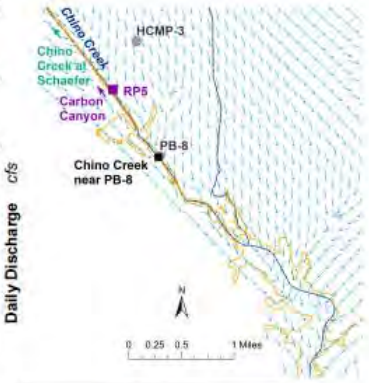
Q: What is the source of the shallow groundwater that is supporting the riparian habitat?

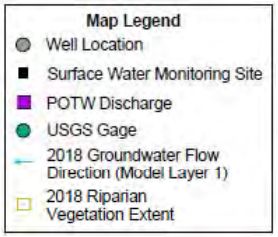
A: The regional aquifer system.

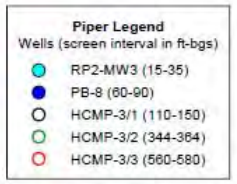
Q: Are declines in the shallow groundwater table a result of Peace II?

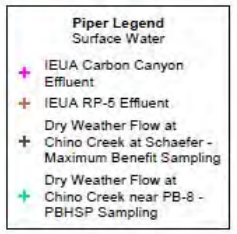
A: Possibly. Analysis of other data and information would be needed to determine.

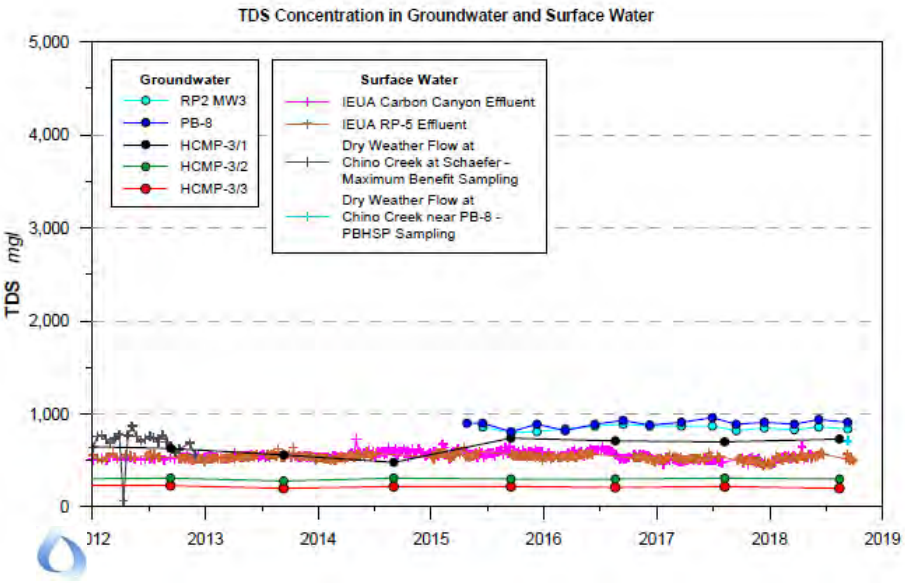






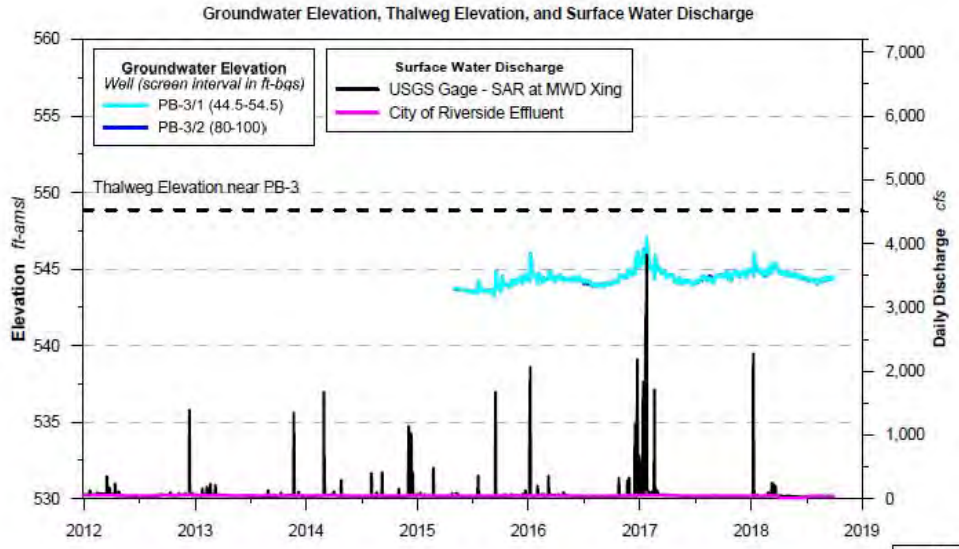


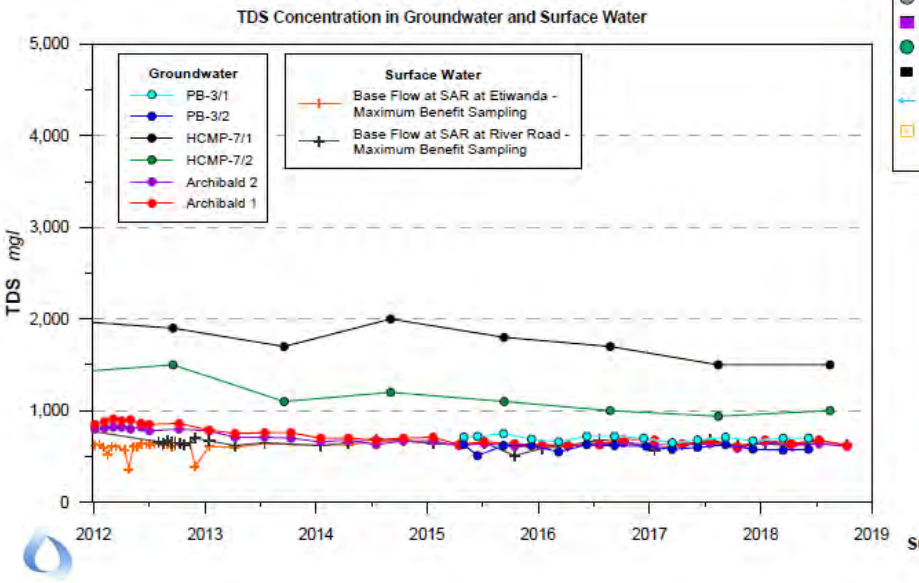


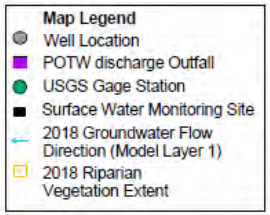


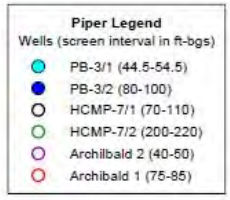
Prado Basin Habitat Sustainability Committee
2018 Annual Report

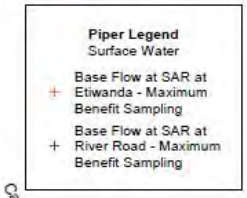
Groundwater Surface Water Interaction
PB-8 along Chino Creek







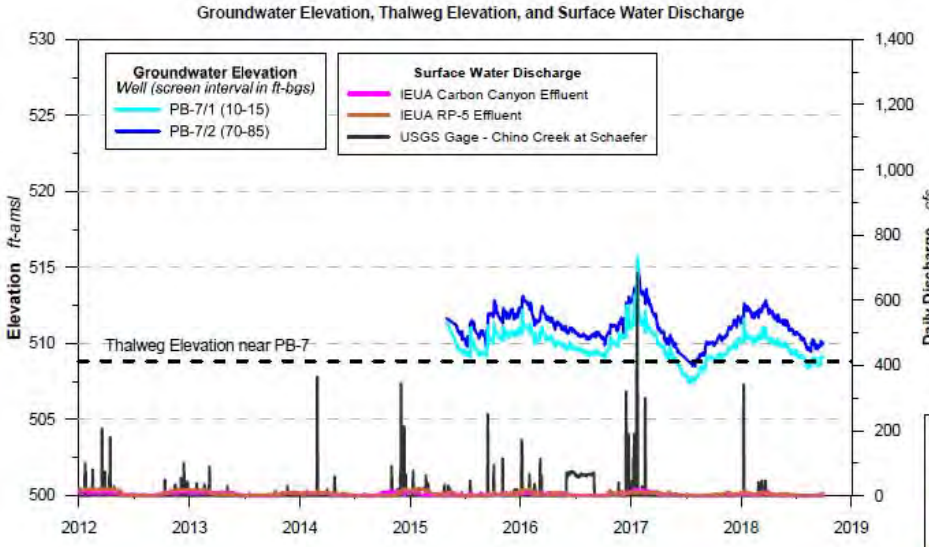


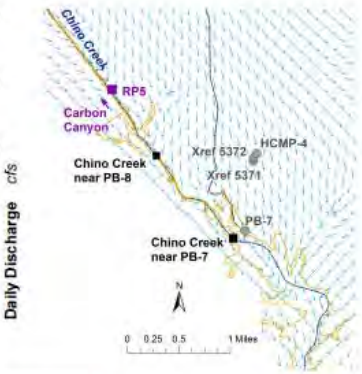


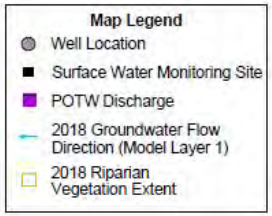
Prado Basin Habitat Sustainability Committee
2018 Annual Report

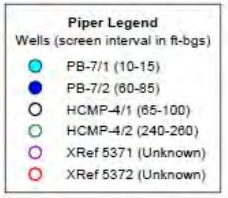
Groundwater Surface Water Interaction

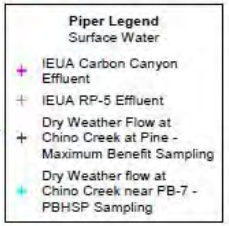
PB-3 along Santa Ana River

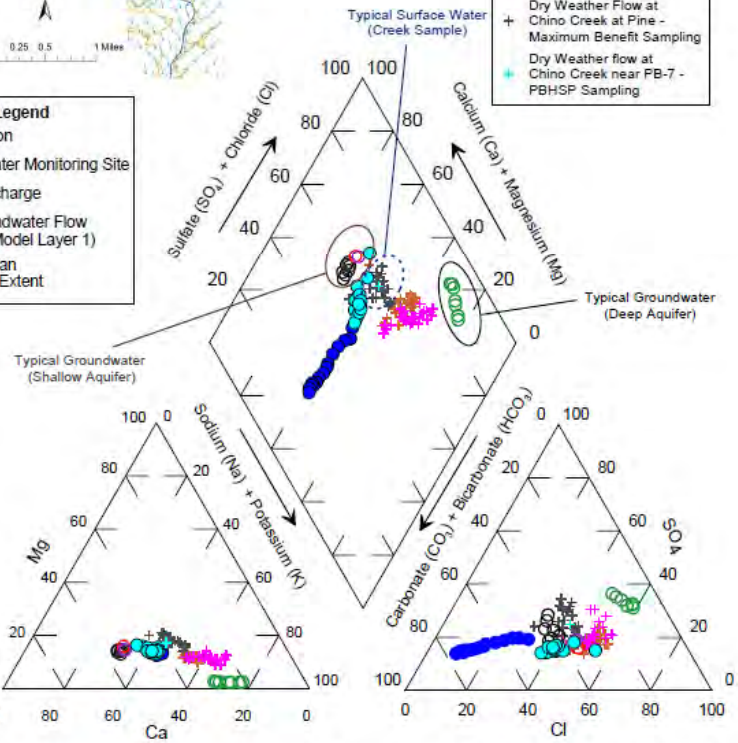


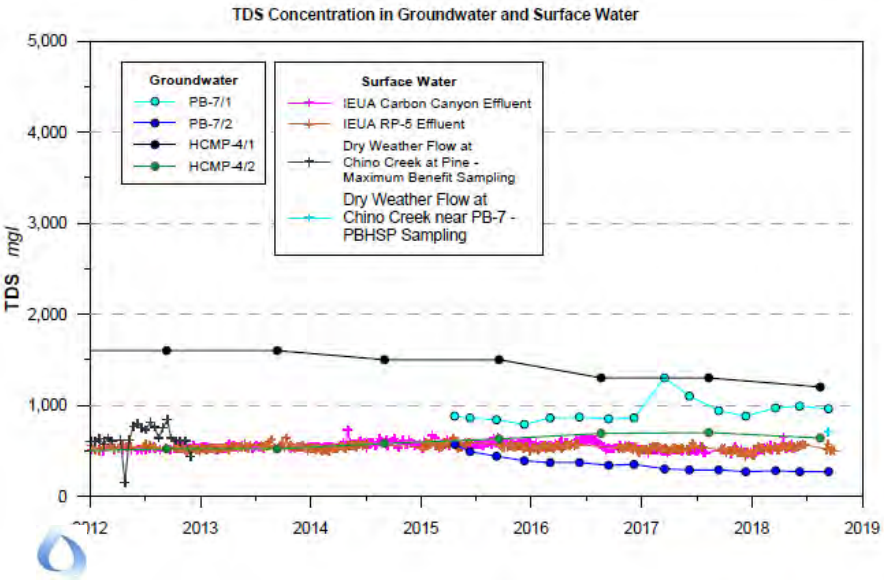












Groundwater Surface Water Interaction

PB-7 along Chino Creek

Conclusions

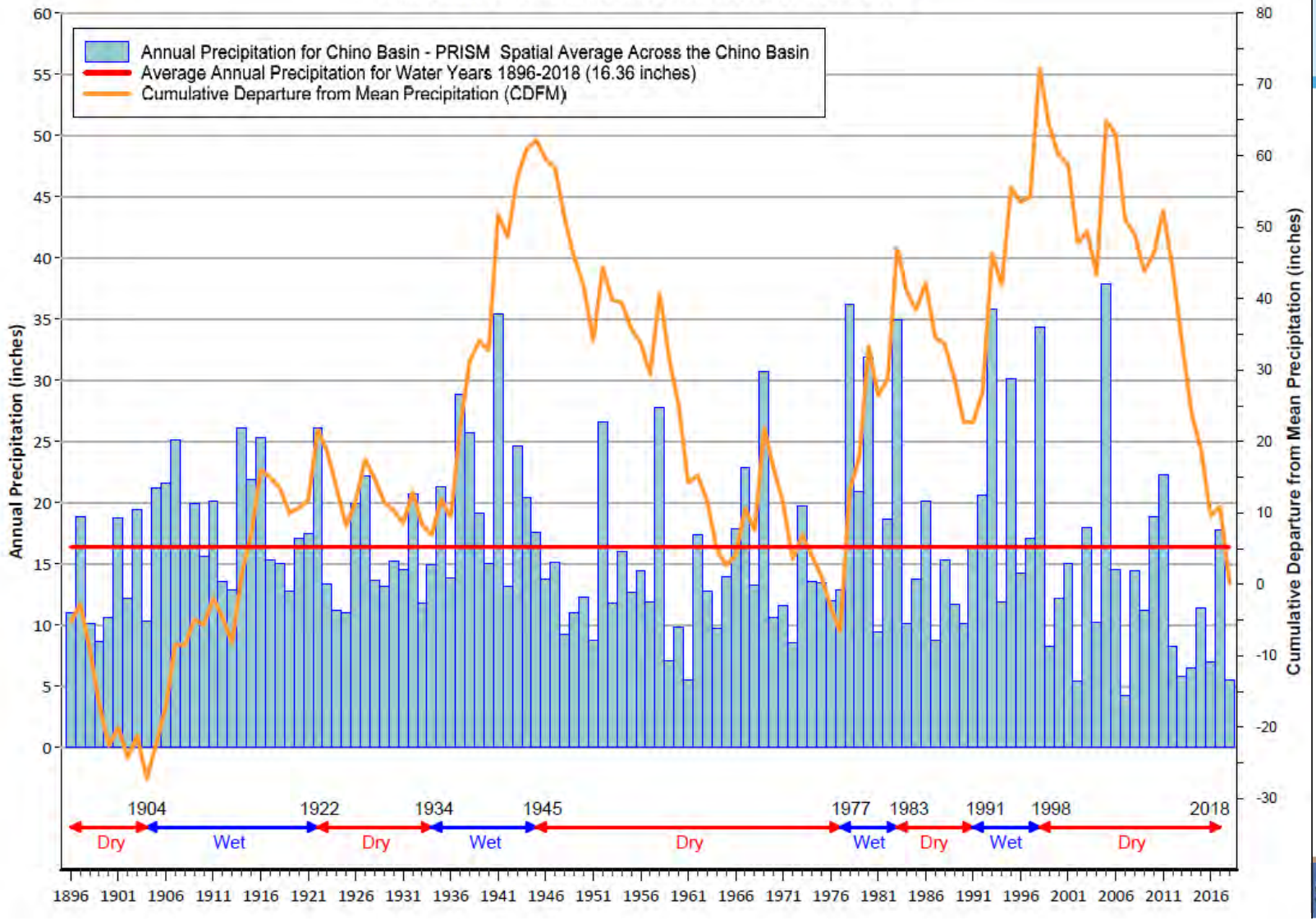
Groundwater and Surface Water Interaction

- Analysis of groundwater/surface water interactions in the Prado Basin indicates that the northern reaches of Mill Creek and the SAR are “losing reaches” characterized by streambed recharge.
- Most other areas along Chino Creek and Mill Creek are “gaining reaches” characterized by groundwater discharge.
- At many other locations in Prado Basin, groundwater/surface-water interactions are complex and there appears to be multiple transient source waters that feed the shallow groundwater.
- Additional monitoring is needed to better characterize the source waters and the groundwater/surface-water interactions in these locations. This additional monitoring began in WY 2018 as a pilot program that included the installation of probes to measure Temperature and EC in selected PBHSP monitoring wells and in the adjacent surface water.

Annual Report – Table of Contents

Potential Stressors

Figure 3-16
Annual Precipitation in the Chino Basin - Water Years 1896-2018



Precipitation in Prado Basin

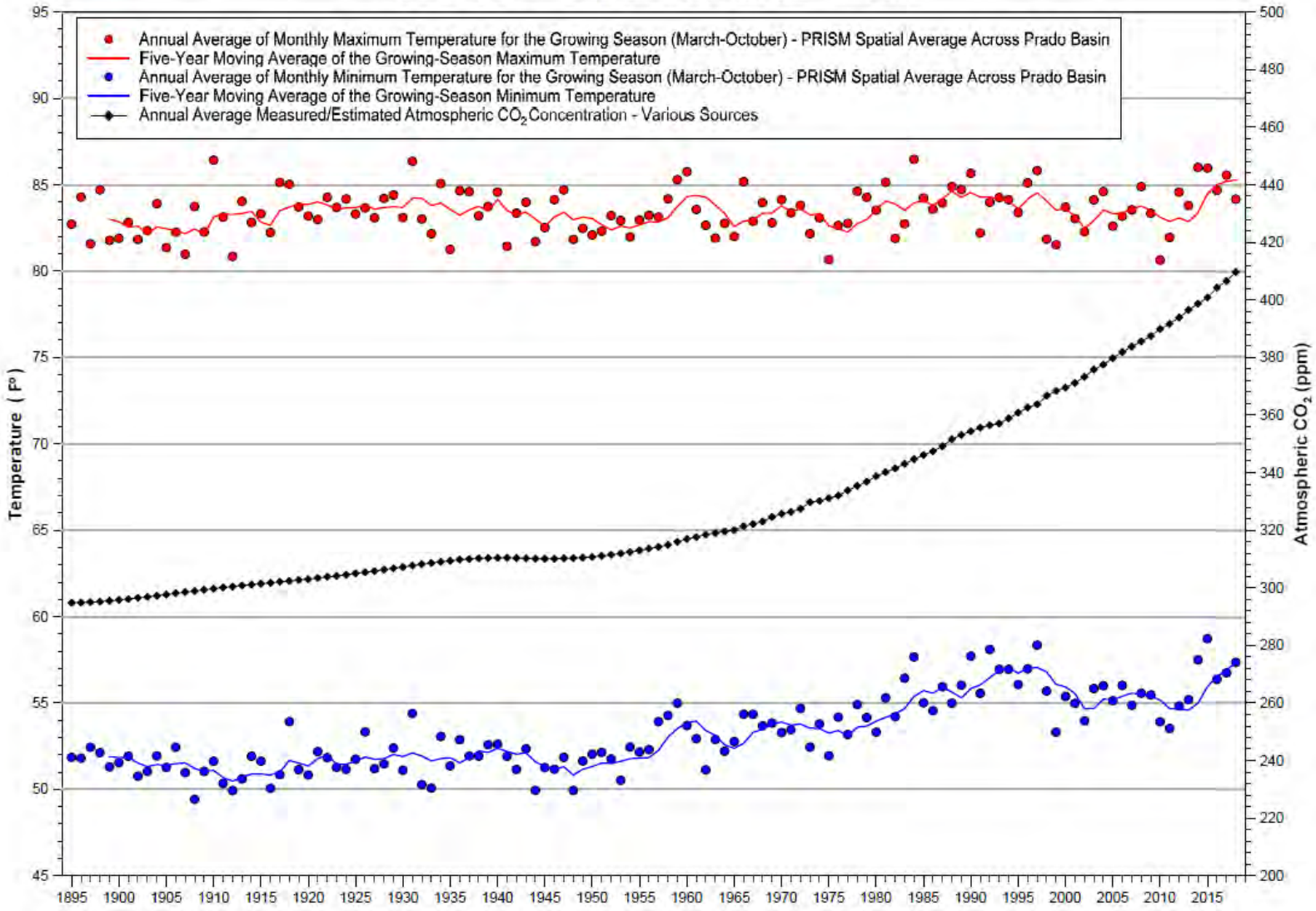
- Several wet and dry Periods; dry periods typically longer

- The Peace/Peace II periods has been over a dry period of 19 years (WY 1999-2018)

- Last five years (2014-2018) average precipitation 9.62 in/yr— 40 % less

- In 2018 – 5.5 in/yr - 3rd lowest

Figure 3-17
Maximum and Minimum Temperature in Prado Basin - 1895-2018



Temperature in Prado Basin

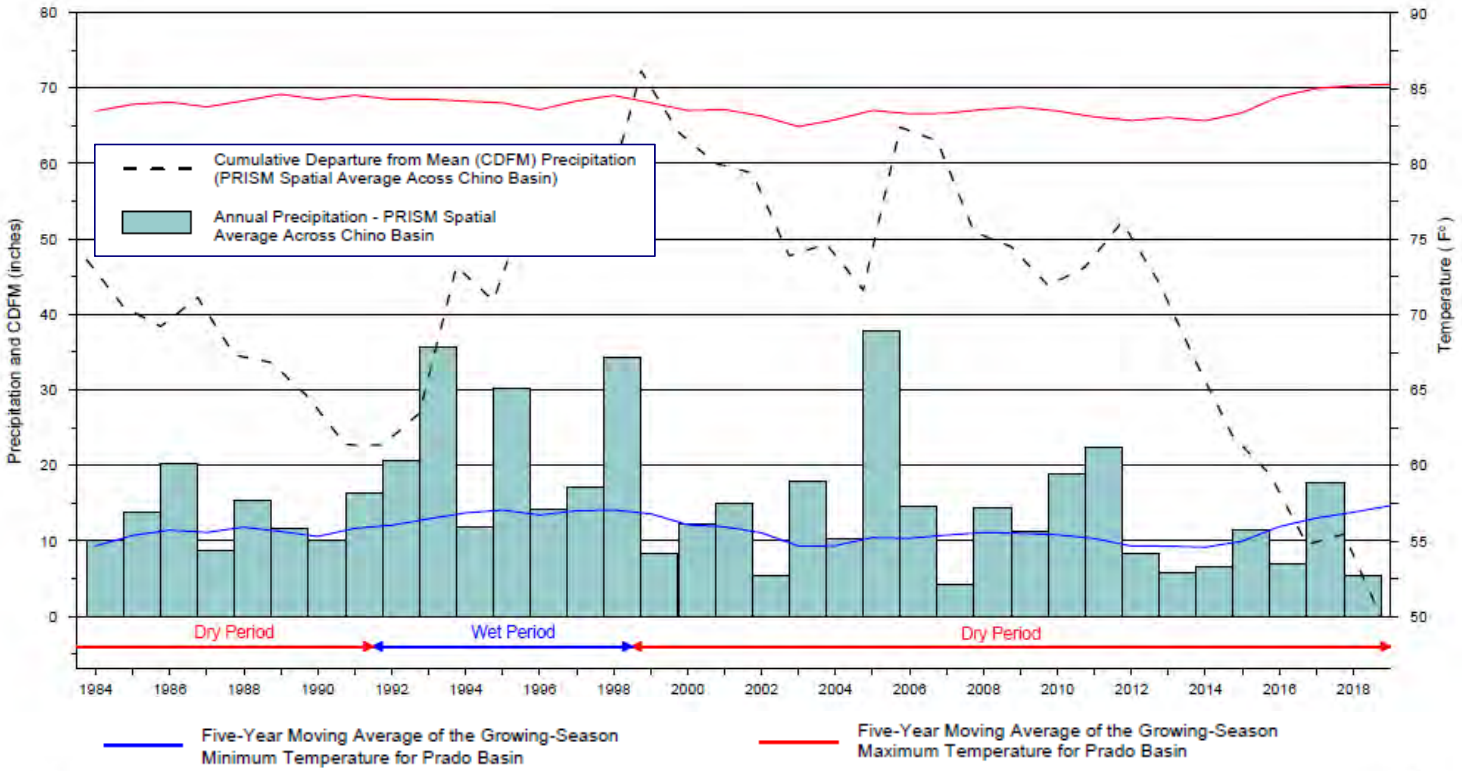
Growing-Season Maximum Temperature:

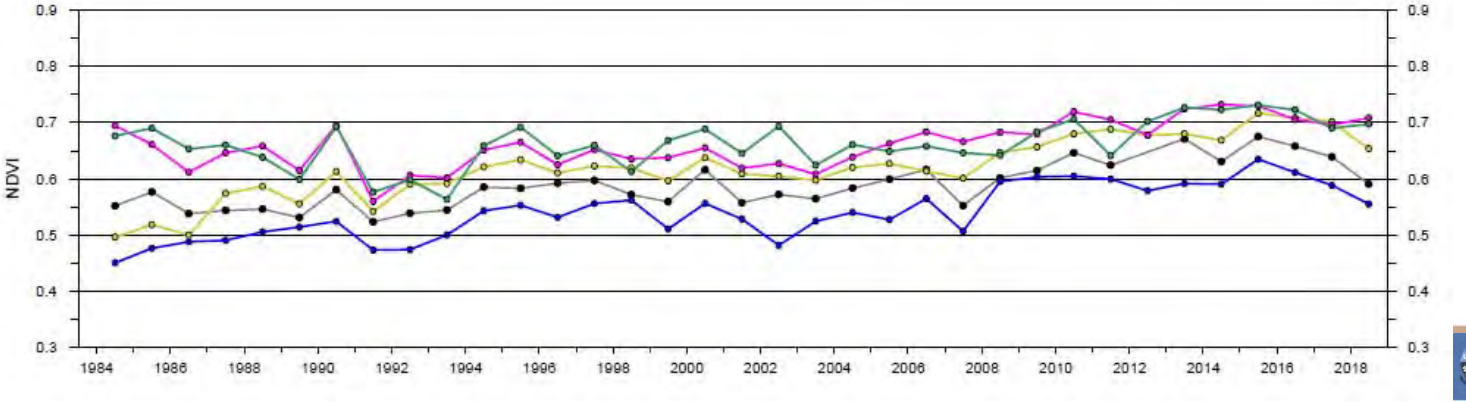
- 80° F to 86° F
- No apparent long-term increasing or decreasing trend until the recent six years
- 5-year moving average increased to highest value

Growing-Season Minimum Temperature:

- 49° F to 59° F
- No apparent long-term increasing or decreasing trend until 1950
- 5-year moving average increased to highest value

Climate versus NDVI
Chino Creek

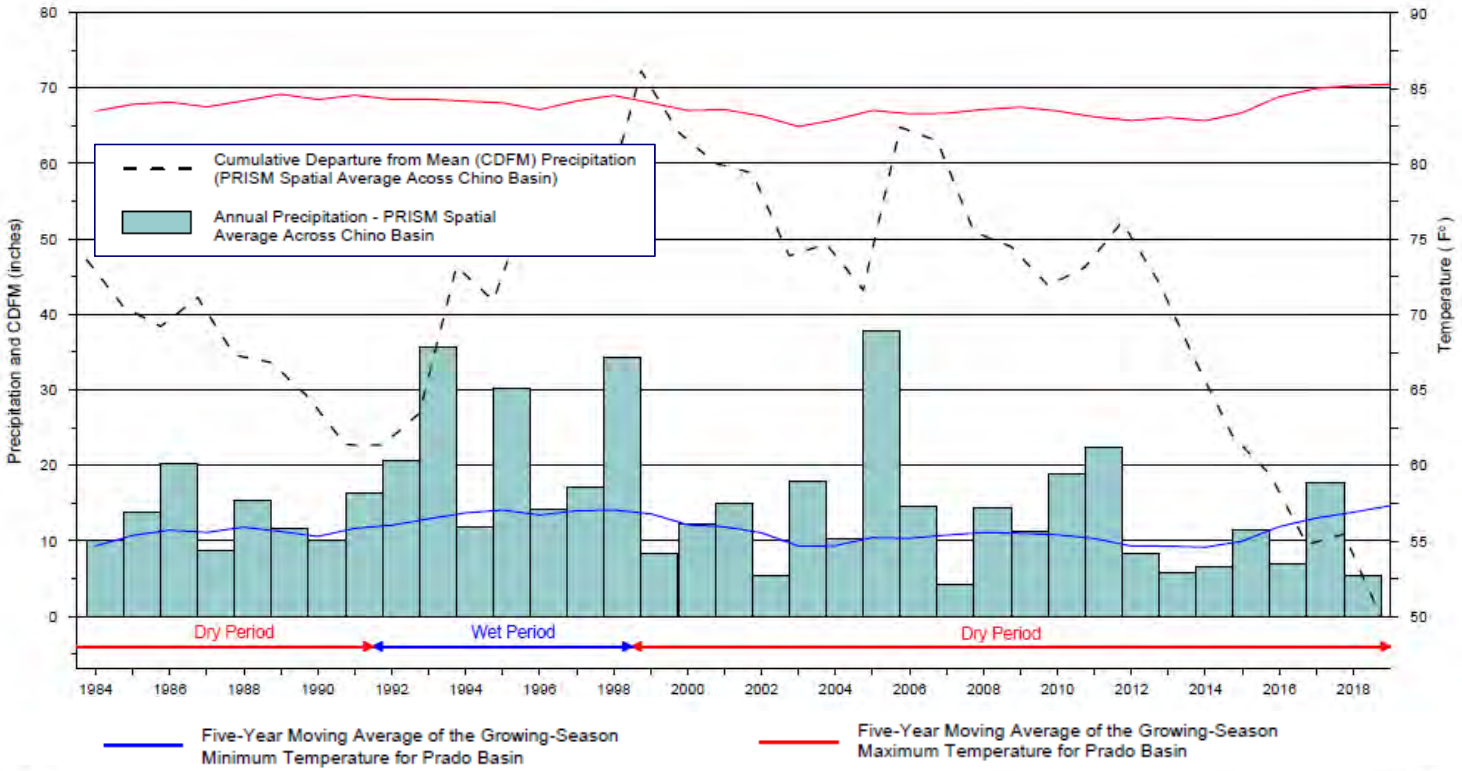


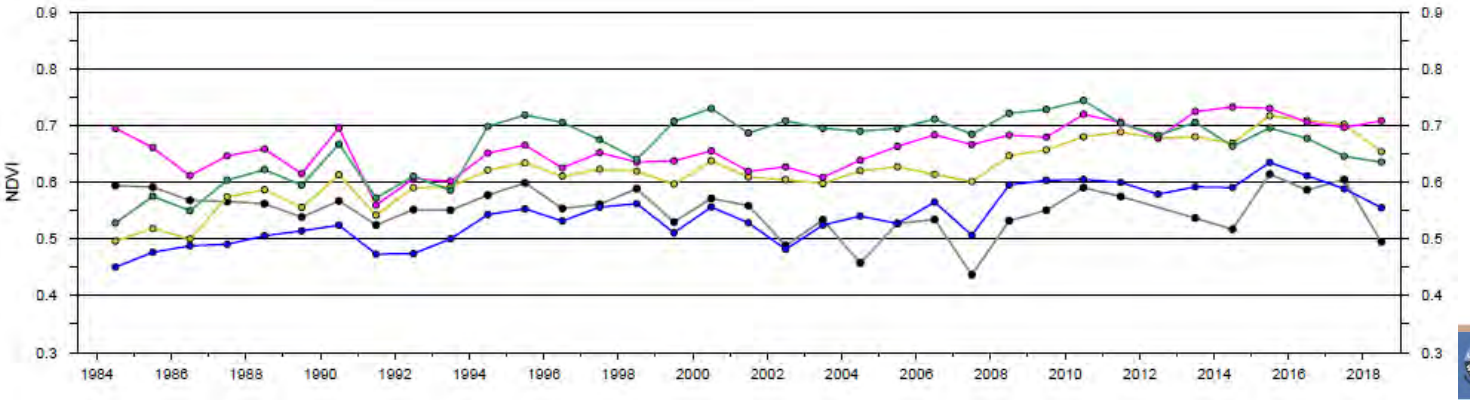


Average Growing Season NDVI for Areas Along Chino Creek - (Mann-Kendall Result for 1984-2018; 1984-2006; 2007-2018)

- CC-1 (*Increasing Trend; Increasing Trend; No Trend*)
- CC-2 (*Increasing Trend; Increasing Trend; No Trend*)
- CC-3 (*Increasing Trend; No Trend; No Trend*)
- CC-4 (*Increasing Trend; No Trend; No Trend*)
- Chino Creek Area (*Increasing Trend; Increasing Trend; No Trend*)

Climate versus NDVI
Mill Creek

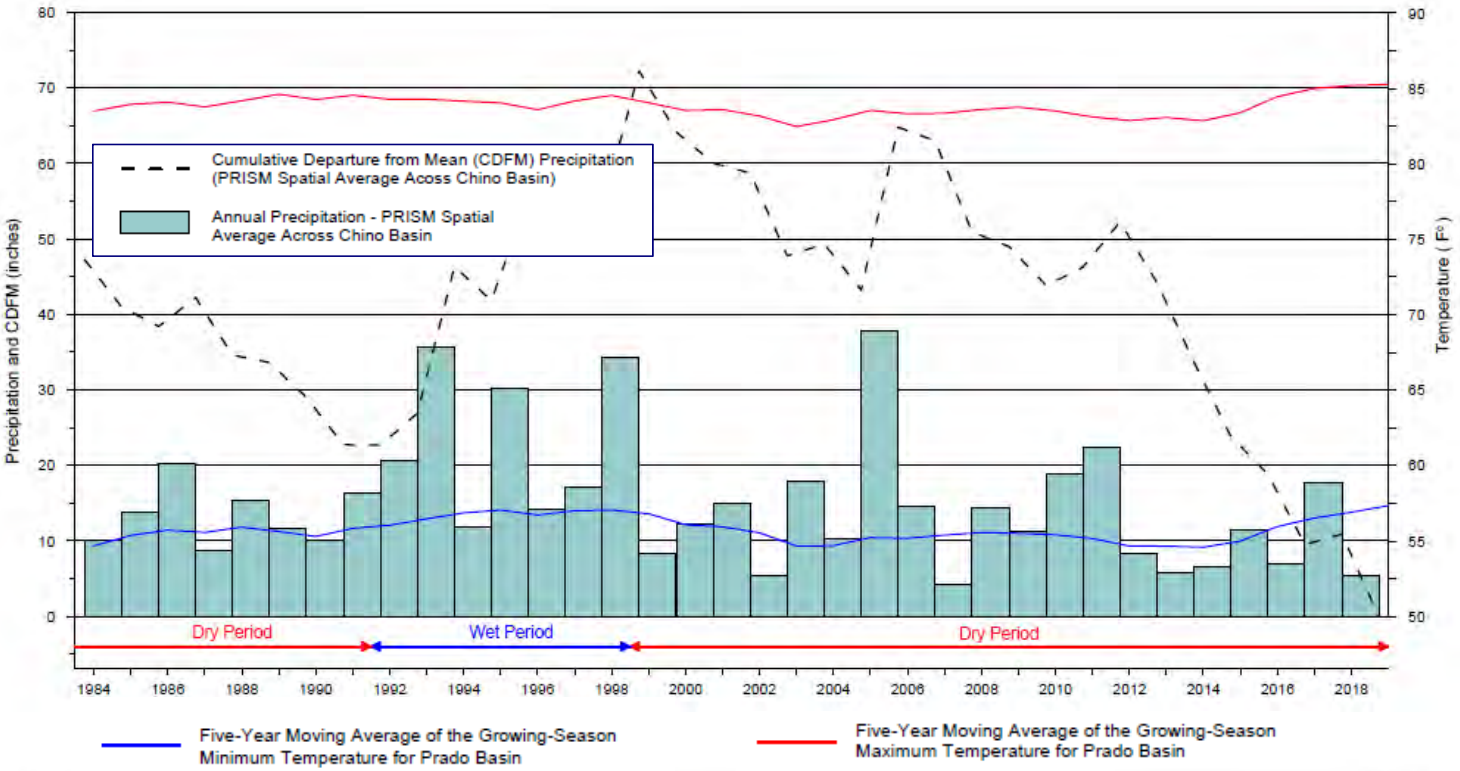


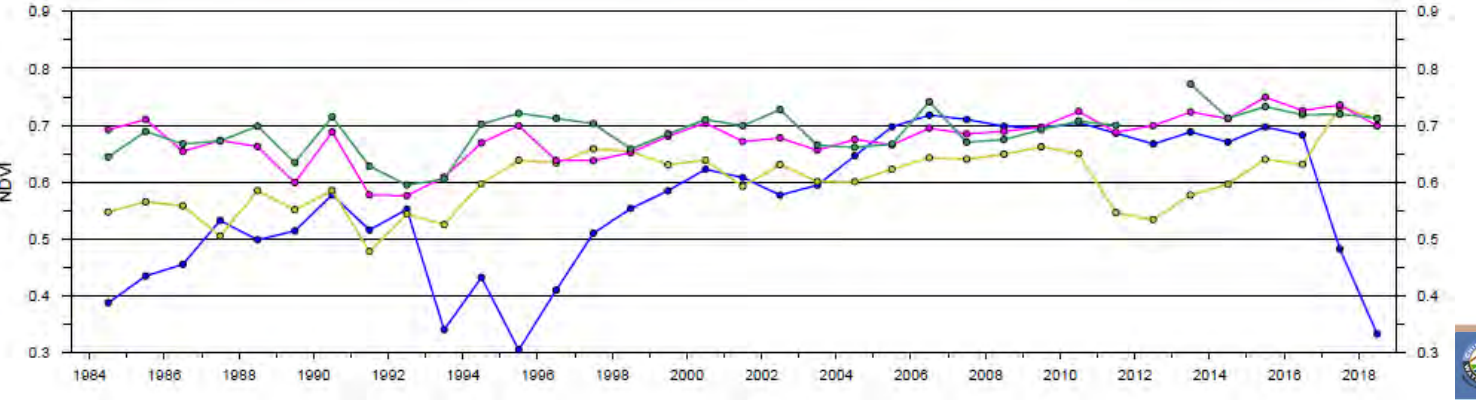


Average Growing Season NDVI for Areas Along Mill Creek - (Mann-Kendall Result for 1984-2018; 1984-2006; 2007-2018)

- MC-1 (*Increasing Trend; No Trend; No Trend*)
- MC-2 (*No Trend; Decreasing Trend; No Trend*)
- MC-3 (*No Trend; No Trend; No Trend*)
- MC-4 (*Increasing Trend; Increasing Trend; Decreasing Trend*)
- Mill Creek Area (*No Trend; Decreasing Trend; No Trend*)

Climate versus NDVI
Santa Ana River





Average Growing Season NDVI for Areas Along Santa Ana River and Lower Prado (Mann-Kendall Result for 1984-2018;1984-2006; 2007-2018)

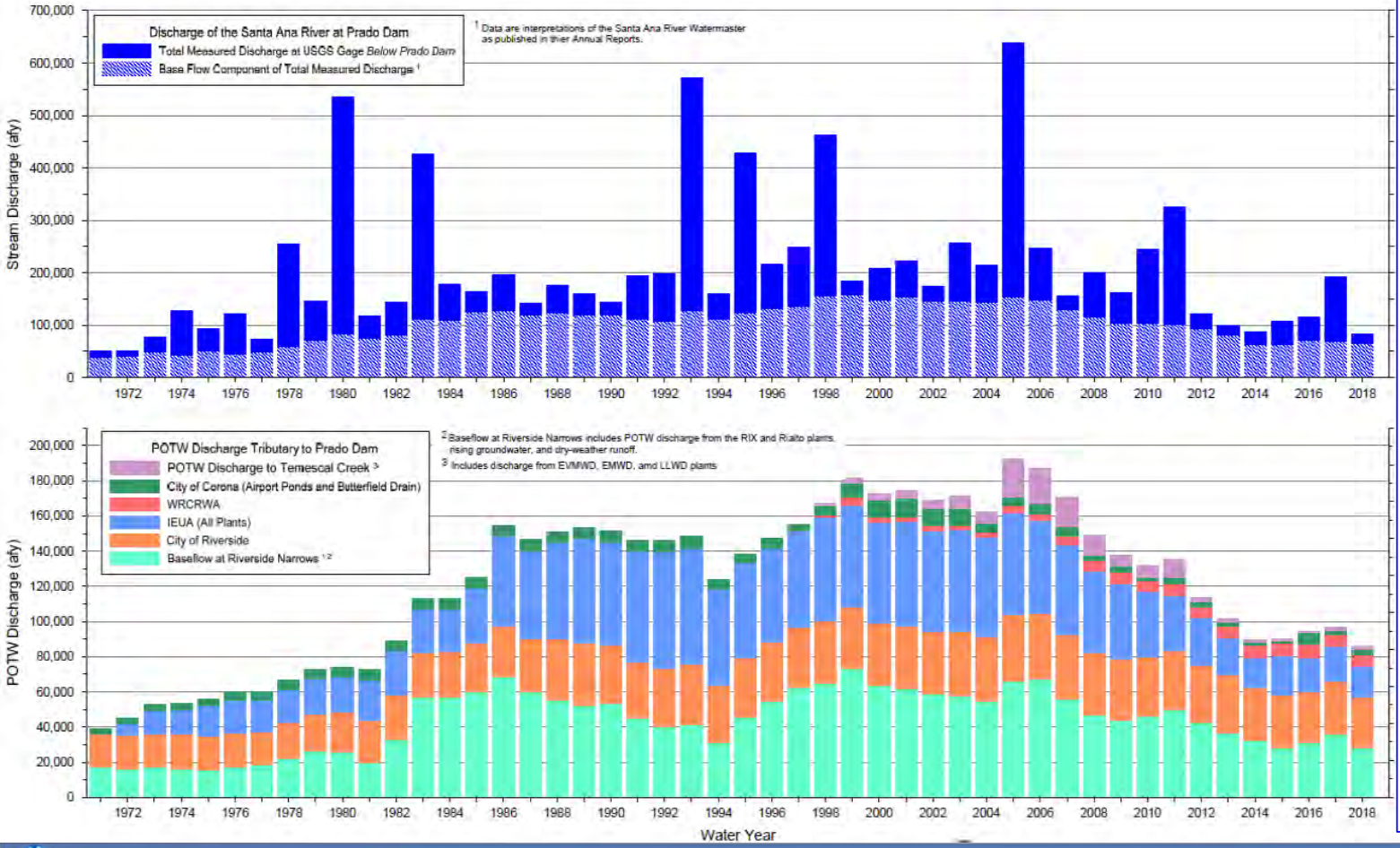
- SAR-1 (*Increasing Trend; Increasing Trend; Decreasing Trend*)
- SAR-2 (*Increasing Trend; Increasing Trend; No Trend*)
- SAR-3 (*Increasing Trend; No Trend; Increasing Trend*)
- Lower Prado (*Increasing Trend; No Trend; Increasing Trend*)

Conclusions

Climate vs. Riparian Habitat

- The Prado Basin has experienced a prolonged dry period over the last 19 years with the most recent water year being the third driest over the 123-year record.
- The Prado Basin has experienced a recent warming trend, particularly over the last six years.
- The dry conditions and warming temperatures may be a contributing cause of recent declines in the greenness of the riparian vegetation during 2015-2018.

Trends in Surface Water Tributary to Prado Dam
WY 1970 - 2018



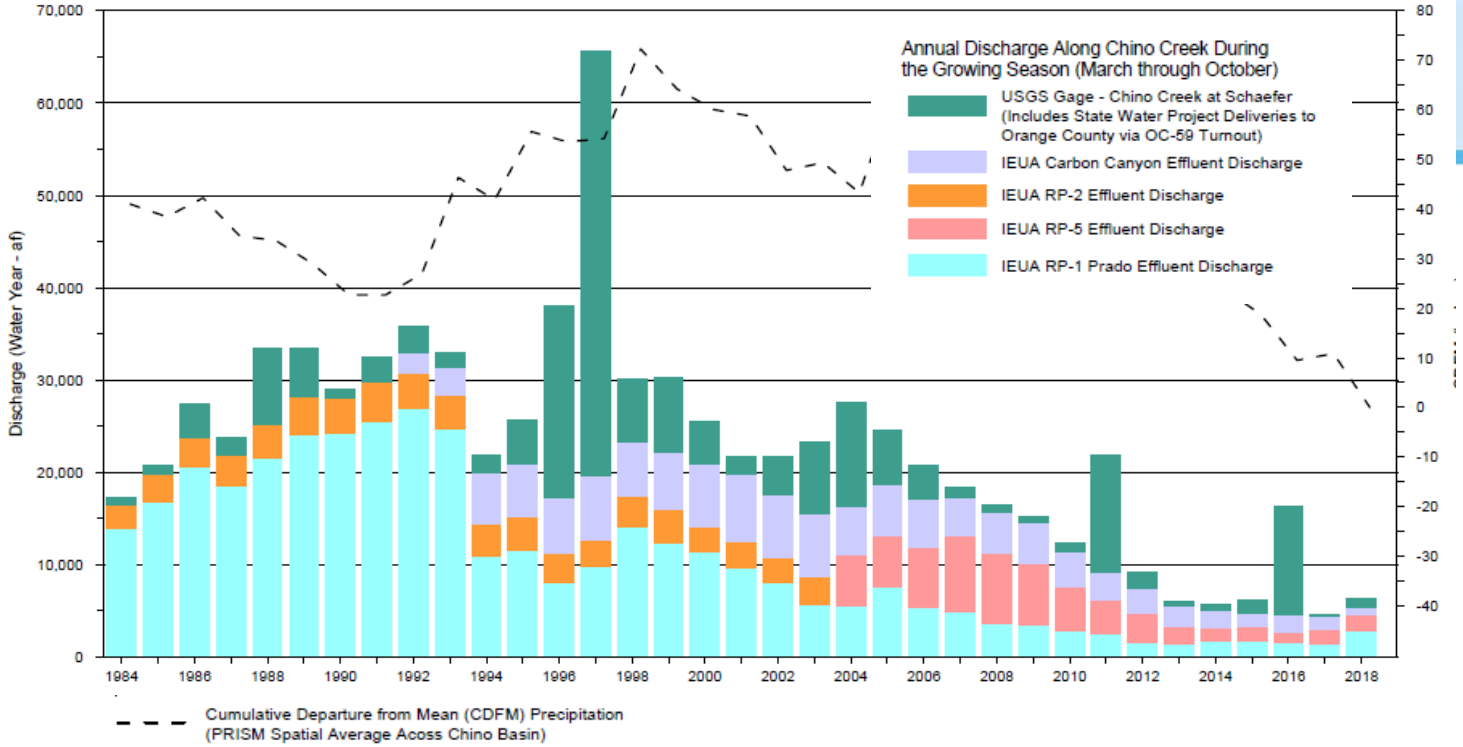
- Baseflow declined from 154,000 afy in 2005 to 65,000 afy for the last five years (2014-2018)

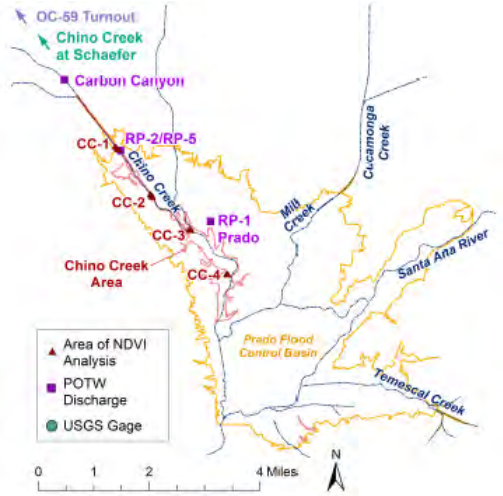
- Decline is primarily related to declines in POTW effluent discharge

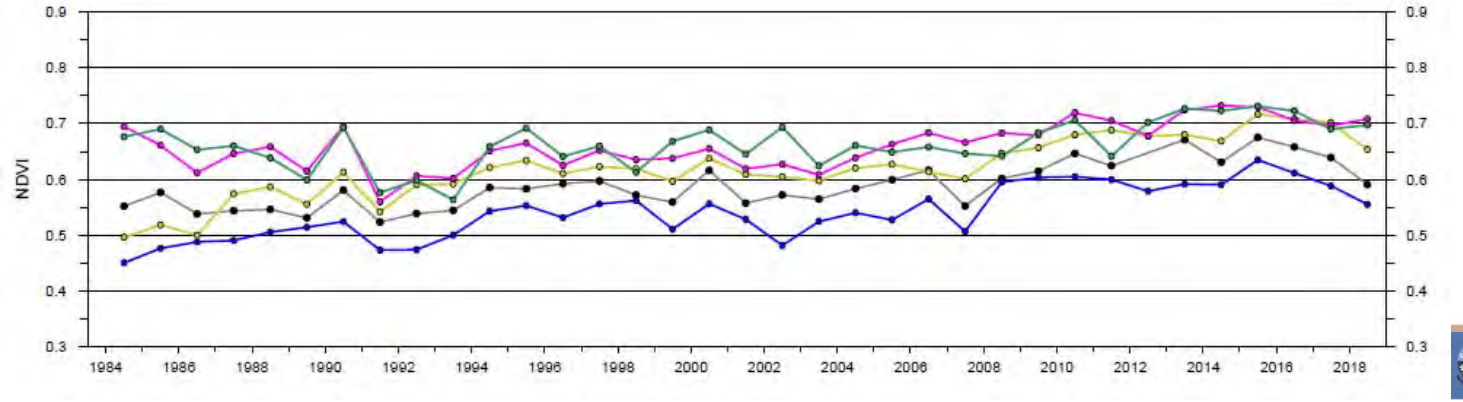
- POTW discharges declined from 192,000 afy in 2005 to 90,000 afy for the past five years (2014-2018)

- Post-2005 decrease in POTW discharge, caused by increase in recycled water reuse, decrease in water use due to economic recession and state drought mandates

Surface Water versus NDVI - *Chino Creek*



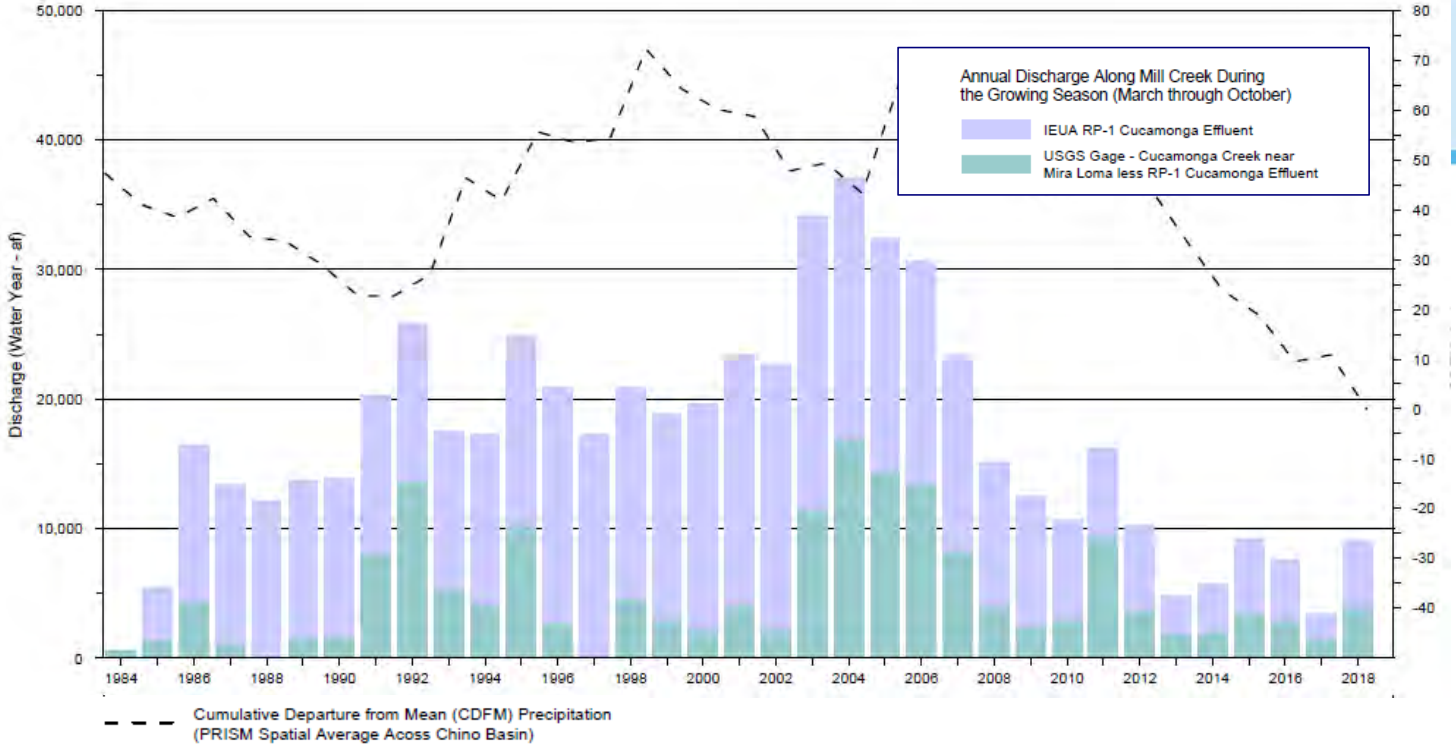


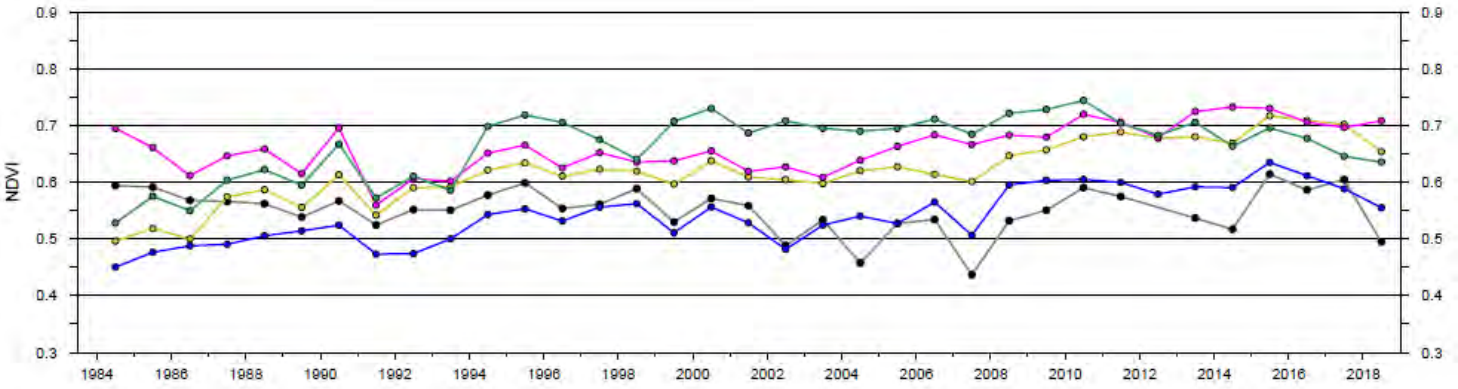


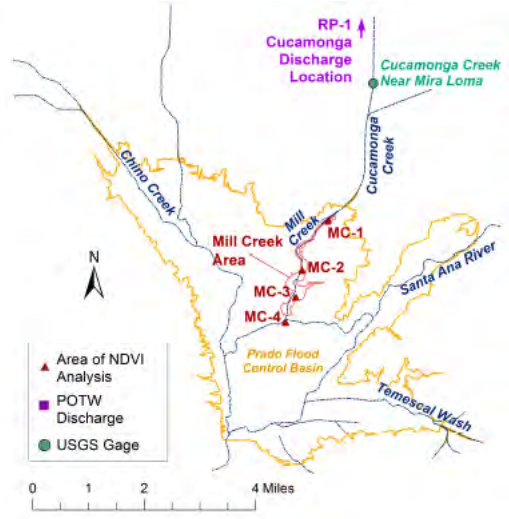
Average Growing Season NDVI for Areas Along Chino Creek - (Mann-Kendall Result for 1984-2018; 1984-2006; 2007-2018)

- CC-1 (*Increasing Trend; Increasing Trend; No Trend*)
- CC-2 (*Increasing Trend; Increasing Trend; No Trend*)
- CC-3 (*Increasing Trend; No Trend; No Trend*)
- CC-4 (*Increasing Trend; No Trend; No Trend*)
- Chino Creek Area (*Increasing Trend; Increasing Trend; No Trend*)

Surface Water versus NDVI - *Mill Creek*



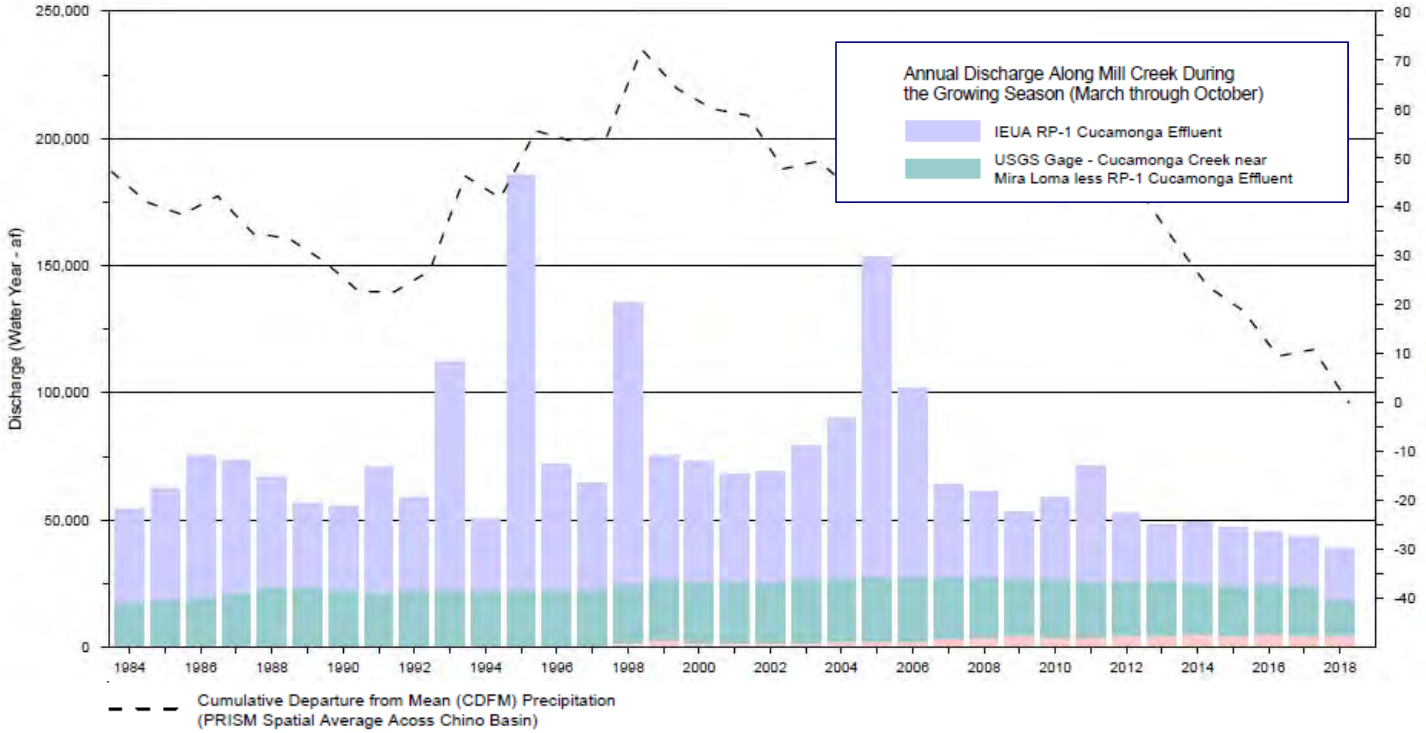


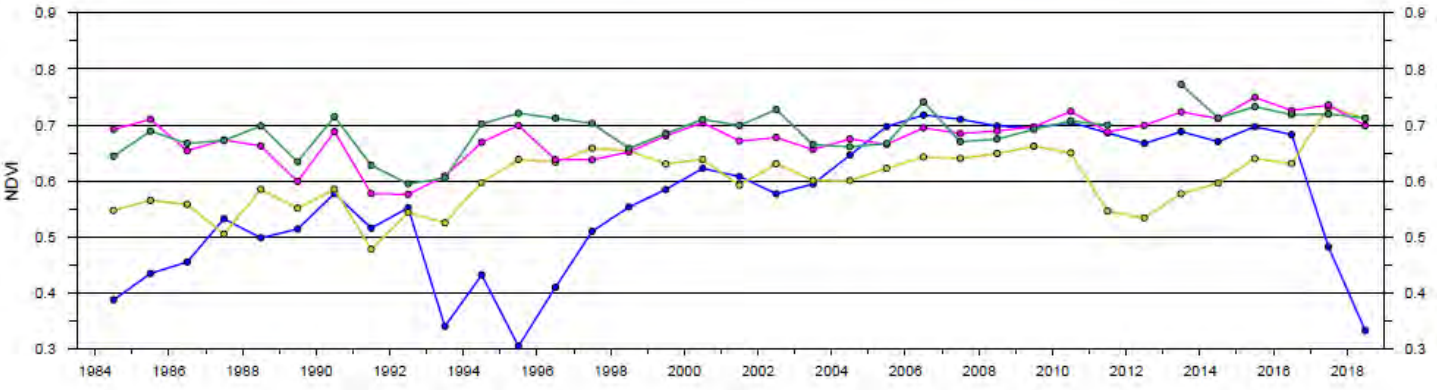


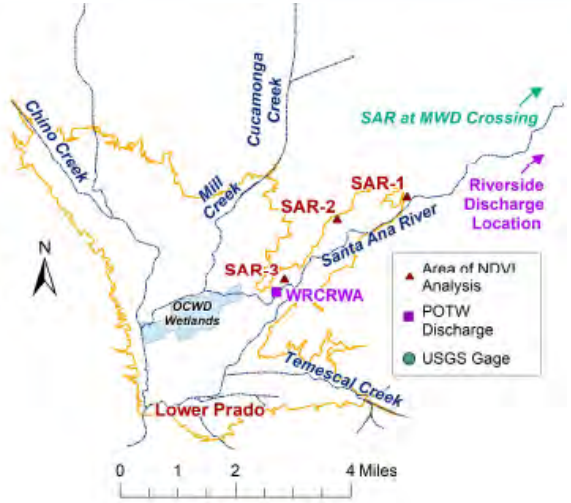
Average Growing Season NDVI for Areas Along Mill Creek - (Mann-Kendall Result for 1984-2018; 1984-2006; 2007-2018)

- MC-1 (*Increasing Trend; No Trend; No Trend*)
- MC-2 (*No Trend; Decreasing Trend; No Trend*)
- MC-3 (*No Trend; No Trend; No Trend*)
- MC-4 (*Increasing Trend; Increasing Trend; Decreasing Trend*)
- Mill Creek Area (*No Trend; Decreasing Trend; No Trend*)

Surface Water versus NDVI -*SAR*







Average Growing Season NDVI for Areas Along Santa Ana River and Lower Prado (Mann-Kendall Result for 1984-2018;1984-2006; 2007-2018)

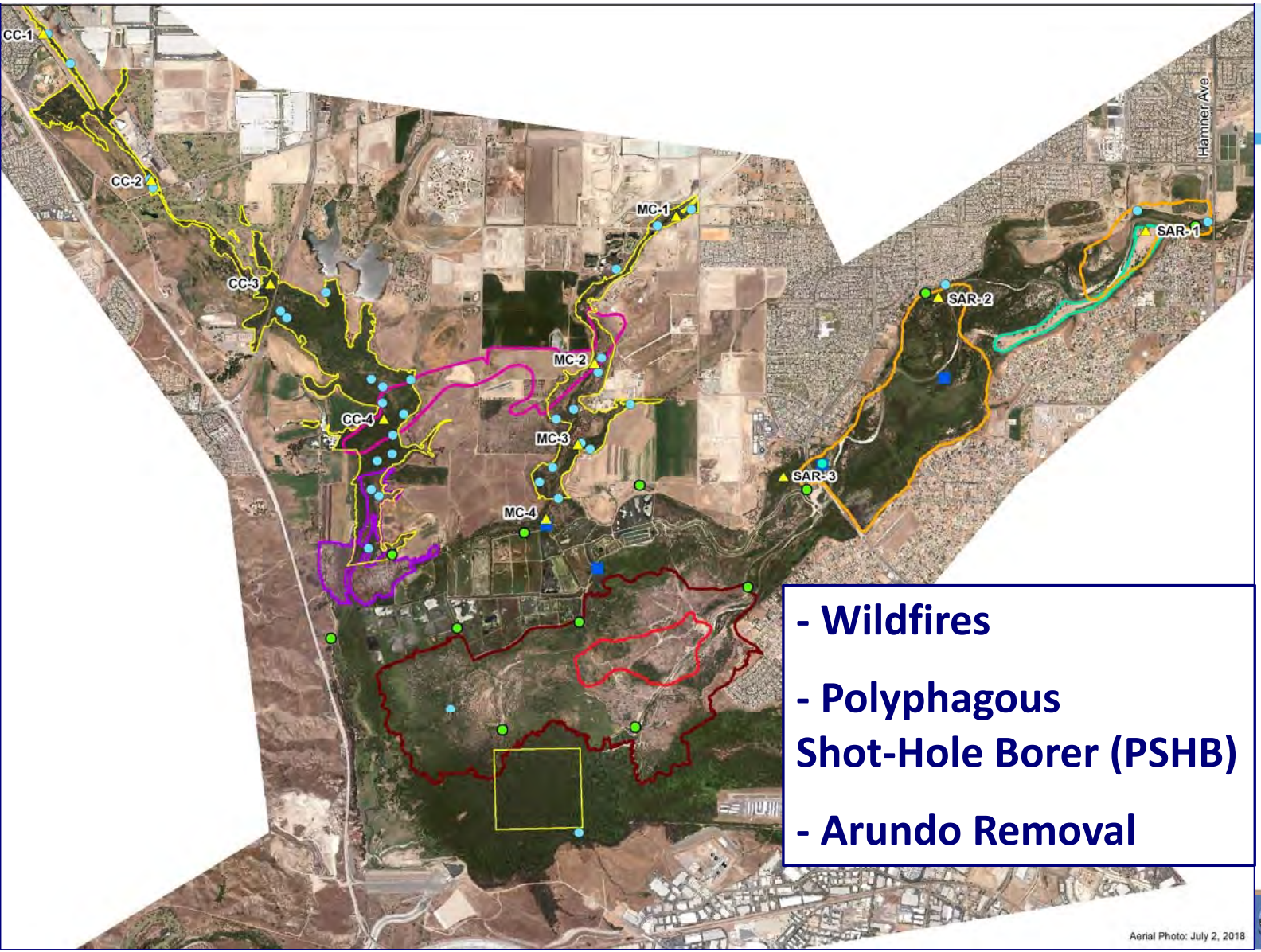
- SAR-1 (*Increasing Trend; Increasing Trend; Decreasing Trend*)
- SAR-2 (*Increasing Trend; Increasing Trend; No Trend*)
- SAR-3 (*Increasing Trend; No Trend; Increasing Trend*)
- Lower Prado (*Increasing Trend; No Trend; Increasing Trend*)

Conclusions

Surface Water vs. Riparian Habitat

- Stream discharge during the growing season in Chino Creek, Mill Creek, and the SAR has decreased over time, and over the last six years, stream discharge volumes have been the lowest recorded over the period of 1984-2018.
- These declines in stream discharge during the growing season may be a contributing cause of the recent declines in the greenness of the riparian vegetation during 2015-2018.

Other Factors Affecting Riparian Habitat



- Wildfires
- Polyphagous Shot-Hole Borer (PSHB)
- Arundo Removal

Documented Locations of Polyphagous Shot-Hole Borer (PSHB)

- Identified by in USBR during the 2016 Site-Specific Vegetation Surveys
- Documented by University of California Division of Agriculture and Natural Resources According to PSHB/FD Distribution Map
- Location of PHSB Traps Deployed by OCWD and SAWA from August 2016 to April 2017

Extents of Wildfire Occurrences in Prado Basin

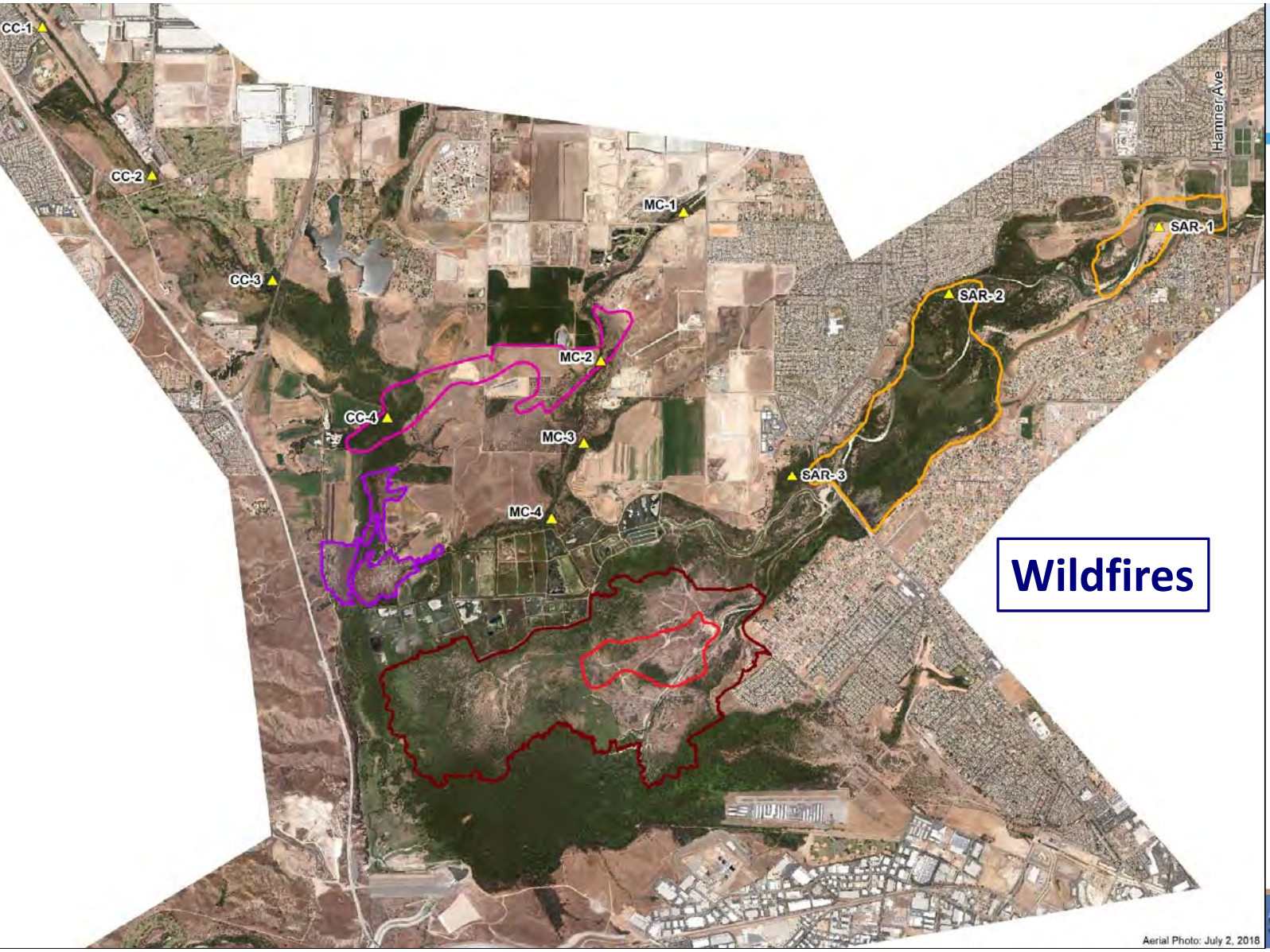
- 1985
- 1989
- 2007
- 2015
- 2018

Areas of Recent Arundo Management

- Area along the Santa Ana River where arundo was removed between 2016-2018
- Area of the 2015 Wildfire where arundo regrowth is being controlled

Defined Areas Analyzed for NDVI

- Chino Creek and Mill Creek Areas (0.74 and 0.26 square miles)
- Lower Prado Area (0.23 square miles)
- Smaller NDVI Areas (3,600 square meters)



Other Factors – Wildfires

Extents of Wildfire Occurrences in Prado Basin

1985
1989
2007
2015
2018

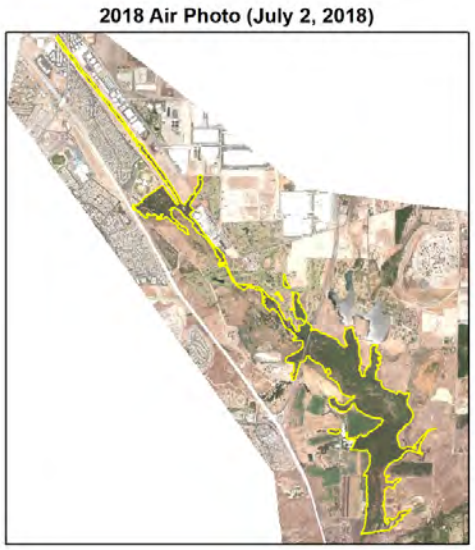
- Data collected from FRAP (1985-2017)

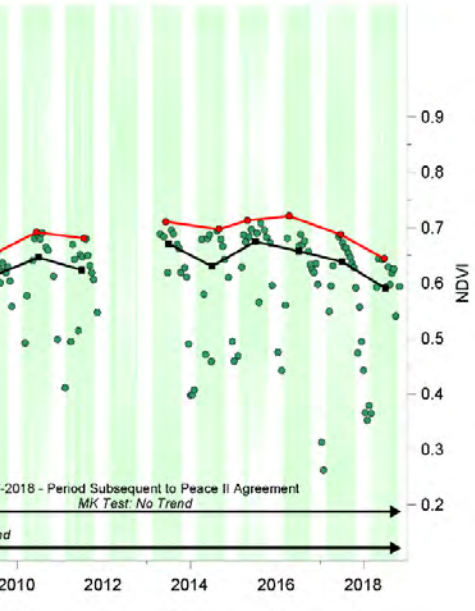
- 2018 fire digitized

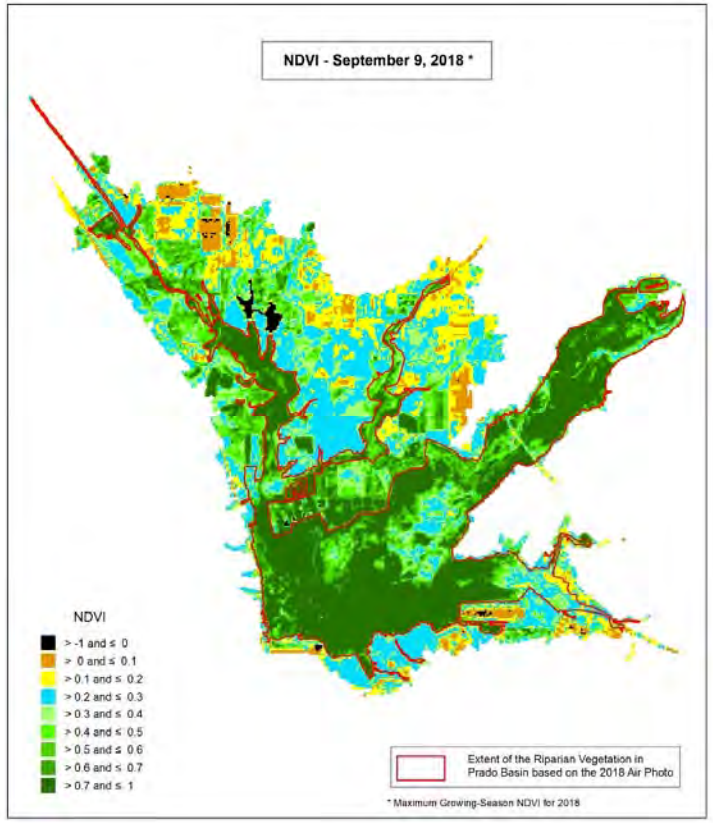
- June 12, 2018 fire identifiable by brownish vegetation

- Portions of the 2015 wildfire extent are still identifiable.

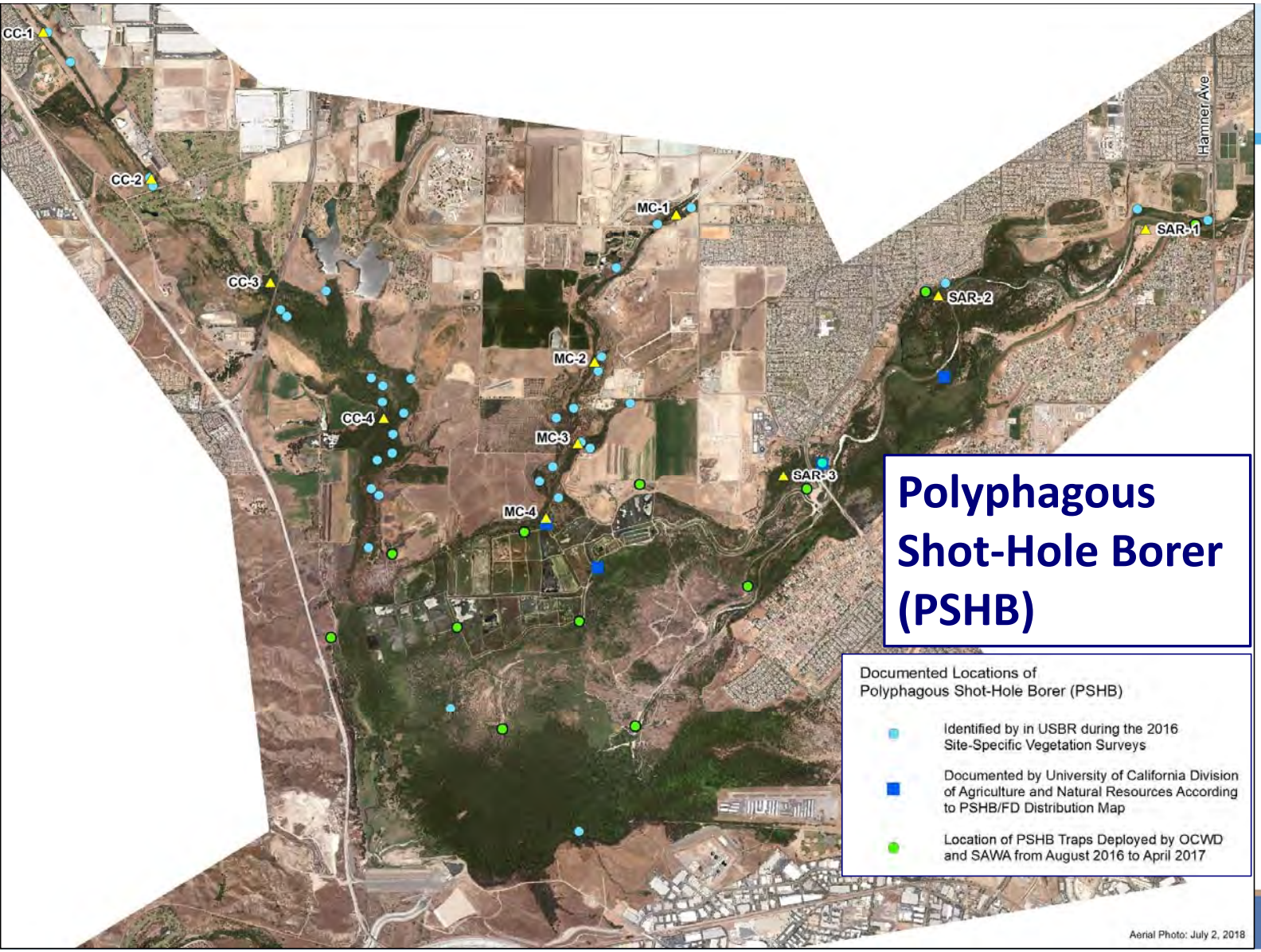
Other Factors – Wildfires







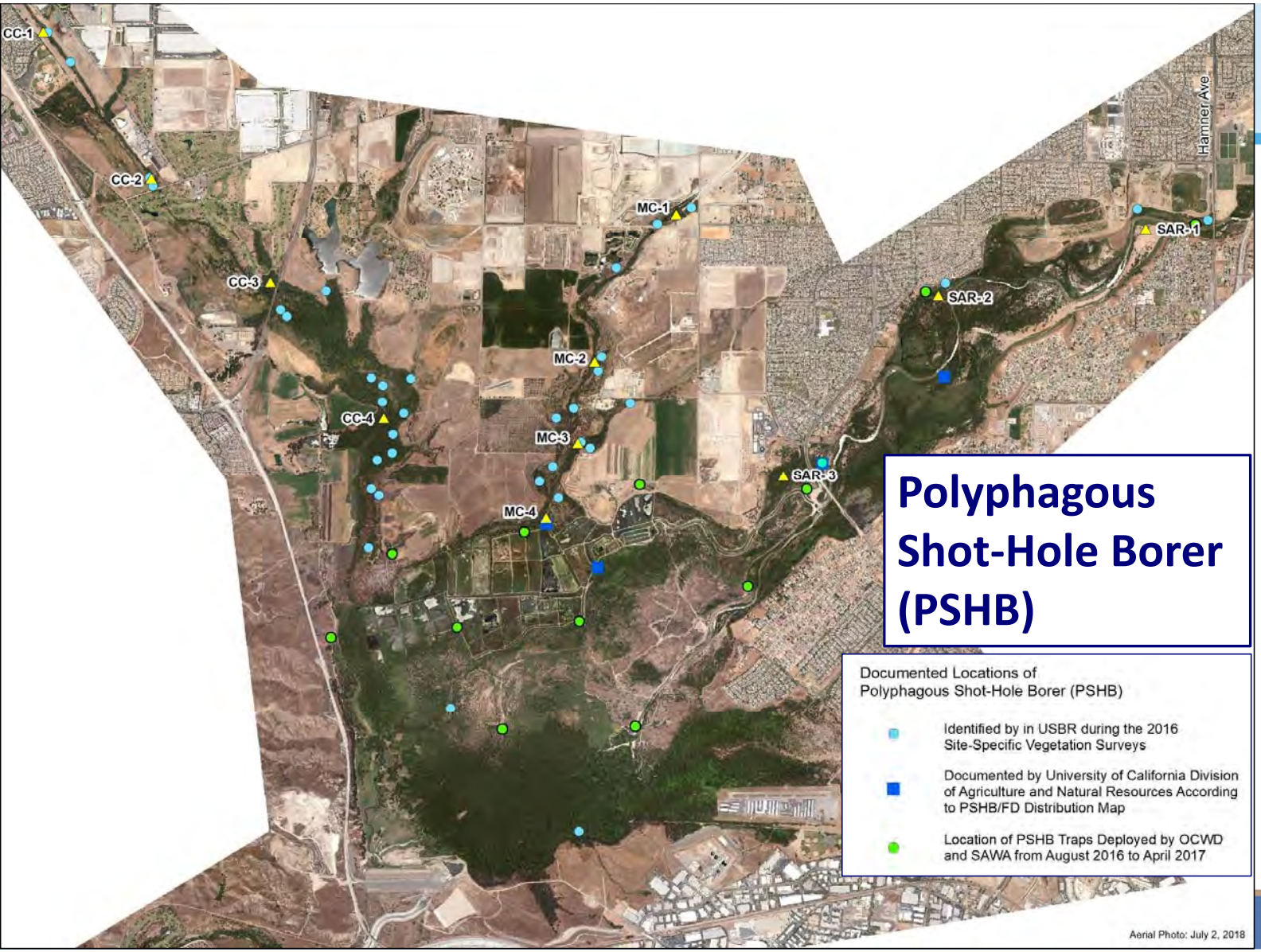
- June 12, 2018 wildfire burned the southern portion of Chino Creek. The Chino Creek area, which includes the northern portion of the 2018 wildfire, shows a decrease in the Average Growing-Season NDVI of about 0.05
- In the area of the 2015 wildfire there are still notable low NDVI values within the perimeter of the fire.



Other Factors – PSHB

In the spring of 2016, OCWD biologists observed die off of riparian vegetation trees in patches throughout the Prado Basin.

Since 2016 OCWD biologists have noted that the presence of PSHB is widespread through the Prado Basin and has significantly reduced tree canopy cover throughout the region, but tree mortality has remained confined to small local patches.



Other Factors – PSHB

UC ANR PSHB Distribution Map online

USBR 2016 Site-Specific Vegetation Surveys

- 29 of the 37 sites.
- All trees stressed one dead

OCWD/SAWA/Others Traps 2016-2017

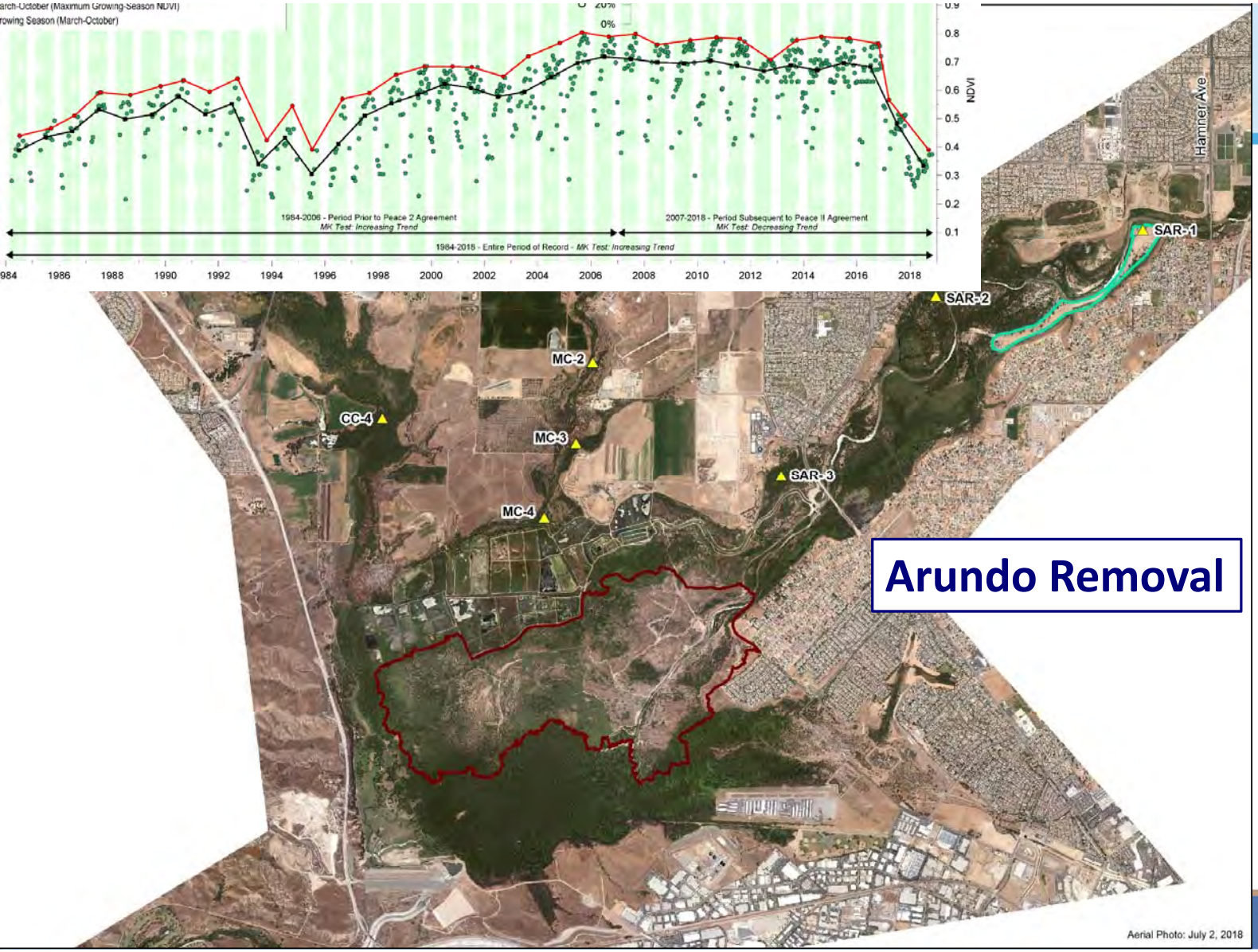
- 12 locations
- Trapped - 7 to 2,092
- Too many trees to effectively protect entire forest

Other Factors – Arundo Removal

OCWD/SAWA are the main entities that implement habitat restoration programs

Areas of habitat restoration occurred recently in Prado Basin were there are notable impacts:

- Along SAR west of Hamner
- Area within the 2015 wildfire perimeter.



Areas of Recent Arundo Management

- Area along the Santa Ana River where arundo was removed between 2016-2018
- Area of the 2015 Wildfire where arundo regrowth is being controlled

Conclusions

Other Factors vs. Riparian Habitat

- **Wildfires** in the Prado Basin burned areas of riparian habitat southeast of the OCWD Wetlands in 2015 and along Chino Creek in 2018, which contributed to recent declines in the greenness of the riparian vegetation during 2015-2018.

- The vegetation field surveys performed by the USBR in 2016 noted the presence of the **PSHB** at about 80 percent of the sites surveyed along Chino Creek, Mill Creek, and the SAR. The PSHB can affect tree health and result in reduced canopy cover or tree mortality. The PSHB may be a contributing cause of recent declines in the greenness of the riparian vegetation during 2015-2018.

- There are numerous habitat restoration projects implemented by OCWD, SAWA, and others throughout the Prado Basin, including the **removal of arundo**, a non-native invasive plant. The removal of arundo helps to restore native vegetation and reduce the consumptive use of water but can also cause declines in the greenness of the riparian vegetation. This was observed in the upper reach of the SAR near SAR-1 from 2016-2018, and the area southeast of the OCWD Wetlands where the regrowth of arundo is being treated within the 2015 wildfire burn area.

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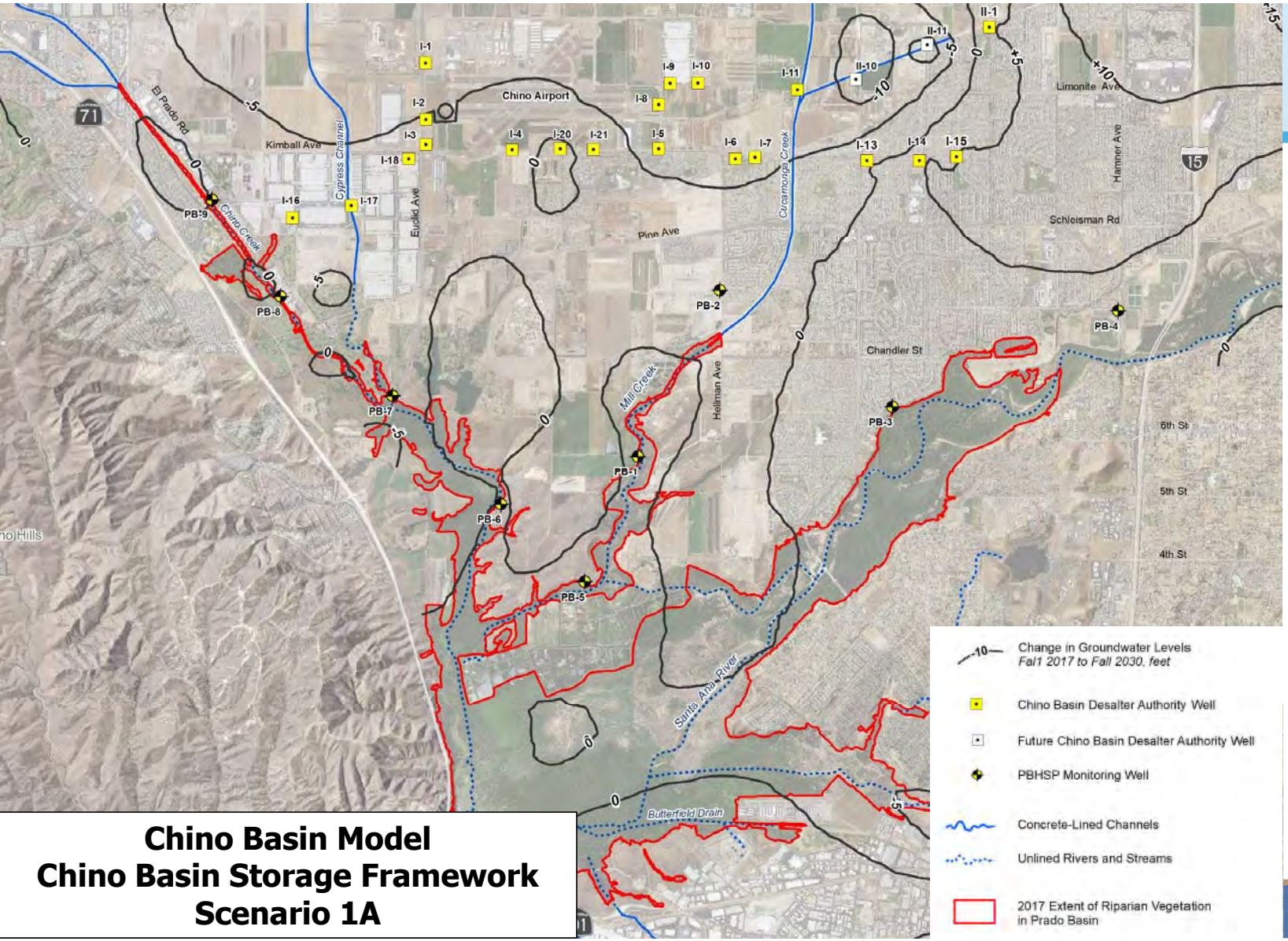
Potential Stressors



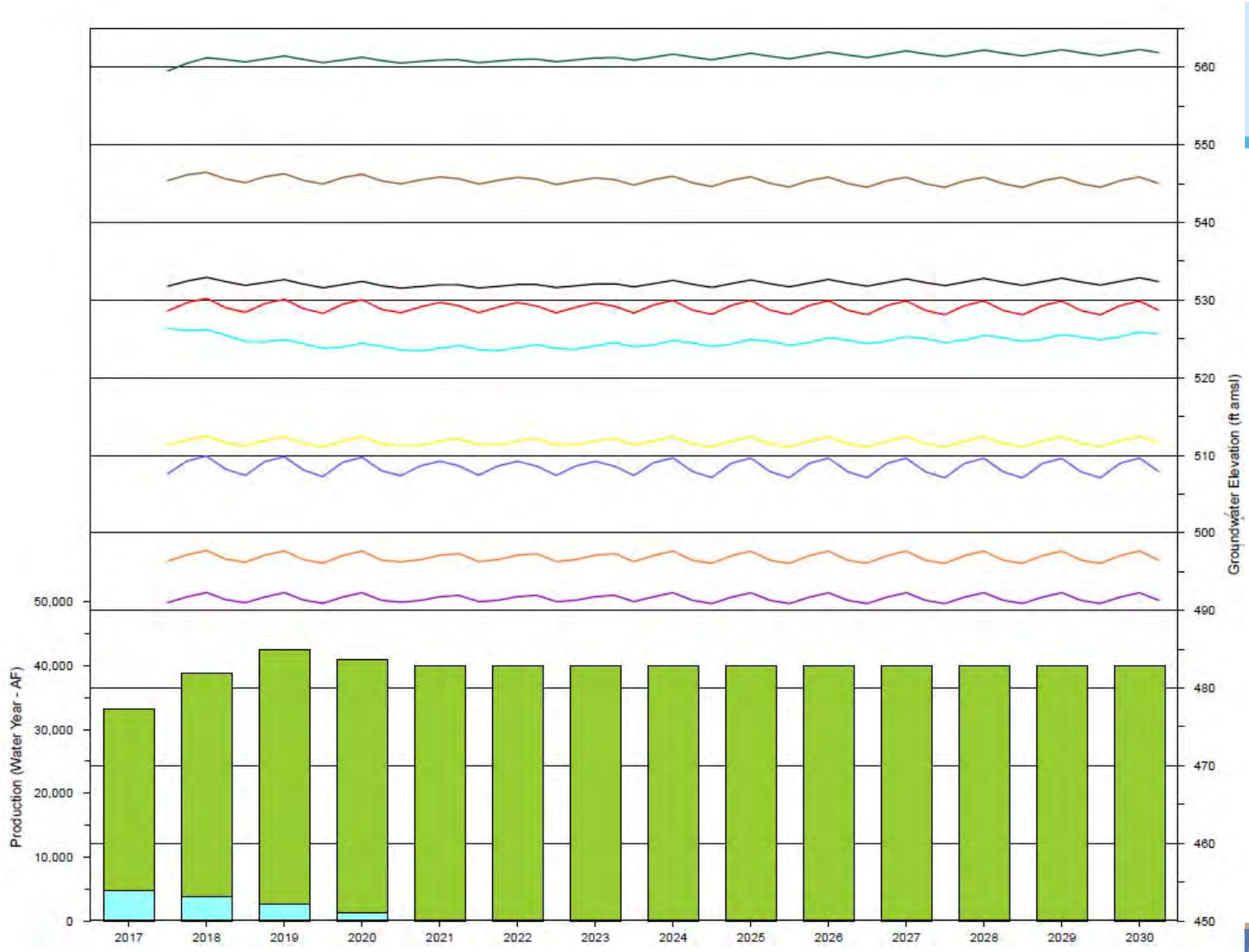
Chino Basin Model
Chino Basin Storage Framework
Scenario 1A

Projected Change in Groundwater Levels 2017-2030

Pursuant to the SEIR mitigation measure and the AMP, perspective loss or future loss of riparian habitat is analyzed

Watermaster's most recent groundwater-model can be used to projects how groundwater levels will change and if there are any declines in groundwater levels that may negatively impact riparian habitat in the Prado Basin

Projected Change in Groundwater Production and Levels



Model Simulated Groundwater Elevations*

- PB-4
- PB-9
- PB-3
- PB-8
- PB-2
- Archibald 1
- PB-1
- PB-7
- PB-6
- PB-5

Projected Groundwater Production at Wells in the Groundwater Monitoring Program Study Area*

- Non-Desalter Production
- Chino Desalter Production

Simulated Groundwater Levels for 2017-2030

Conclusions

Prospective Loss of Riparian Habitat

- Projected changes is groundwater levels are predicted to remain steady across most of the Prado Basin area through 2030: There are minor changes (up to -2 feet) predicted to occur along the very north portions of Mill Creek and Chino Creek.

- There are no areas for prospective loss of riparian habitat

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Potential Stressors

Recommendations of the 2018 Annual Report

- The monitoring and analyses of the riparian habitat, groundwater levels, precipitation, temperature, and surface-water discharge should continue with no change in scope.
- The monitoring and analysis of other factors—such as wildfires, the PSHB, arundo removal, and additional factors as needed—should also continue.
- Continued monitoring and analysis is required to identify the relationships between recent trends in the riparian habitat with recent trends in the factors that can influence it.
- The PBHSP in 2019/20 includes periodic vegetation field surveys of the riparian vegetation at 37 sites throughout the Prado Basin. The vegetation field surveys will be used to quantitatively characterize the current state of the riparian vegetation at these 40 sites, to ground-truth the interpretations derived from the regional monitoring of the riparian habitat, and to note the occurrence and effects of PSHB.

Recommendations of the 2018 Annual Report

- Monitoring of surface-water and groundwater quality to characterize groundwater/surface water interactions should continue with no change in scope. This includes continuing the pilot monitoring program initiated in fiscal year 2018/19 at four PBHSP monitoring wells.

- This annual report documented no trend in the degradation of the extent or quality of the riparian habitat along Chino Creek, Mill Creek, or the SAR that is contemporaneous with decreasing groundwater levels caused by the implementation of the Peace II Agreement. **As such, no mitigation measures are proposed at this time.**

- The Recommended PBHSP for Fiscal Year 2019/20 is included with the report.

Next Steps

- May 2019 - The FY 2019/20 Recommended Scope and Budget for the PBHSP is being considered for approval by Watermaster/IEUA.
- May 28, 2019 – PBHSC members submit comments and suggested revisions on the Draft 2018 Annual Report.
- June 6, 2019 – Final 2018 Annual Report completed
- July 1, 2019 – Next fiscal year monitoring program begins

Questions ?