Workshop: Groundwater Accounting Options and Fees

East Turlock Subbasin Groundwater Sustainability Agency
Technical Advisory Committee

October 18, 2022

TURLOCK GROUNDWATER

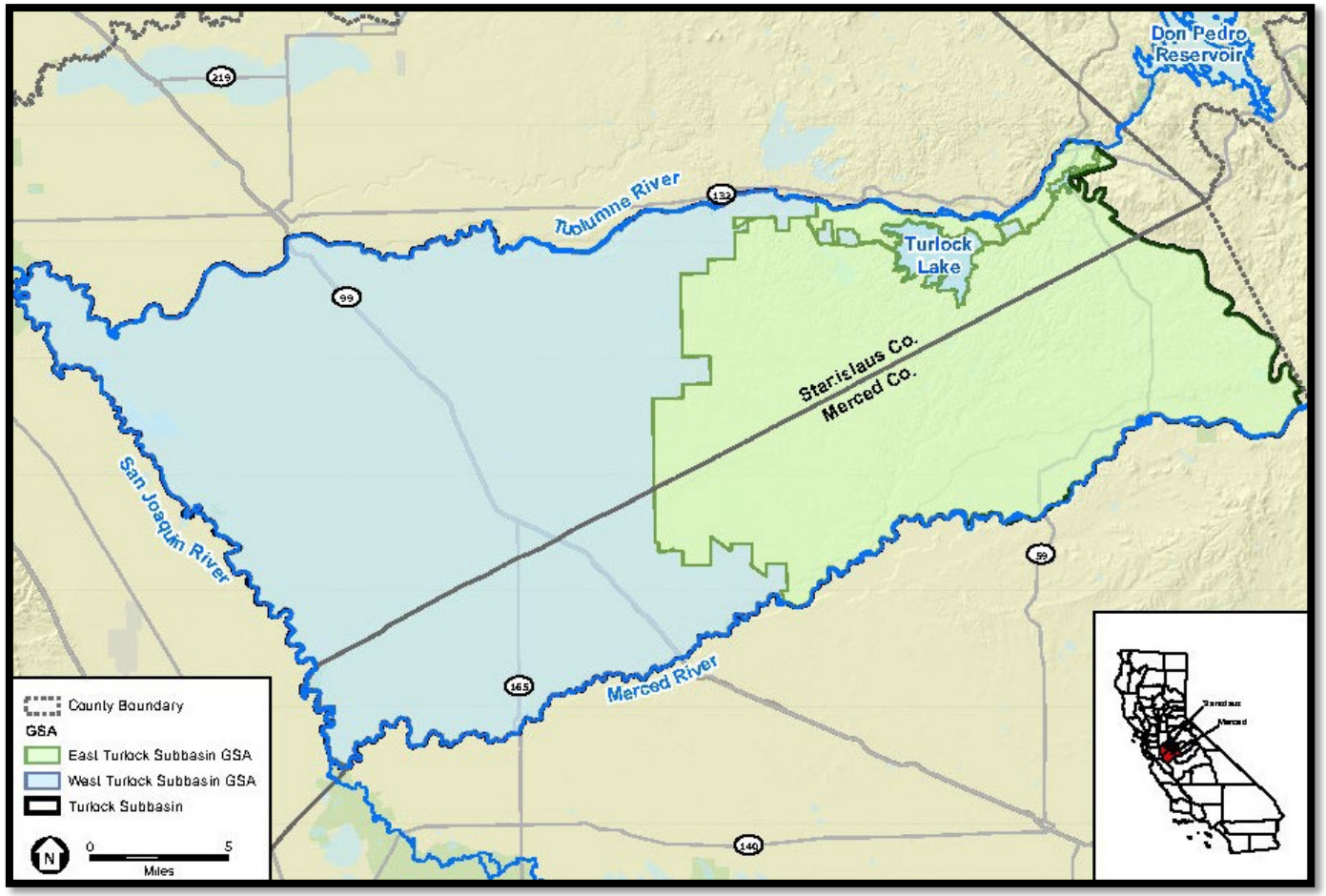
Workshop Topics

- Introduction and Background
- Evapotranspiration (ET) Analysis for Baseline Development
- Options for Extraction Monitoring
- Options for Pumping Allocations and Extraction Fees

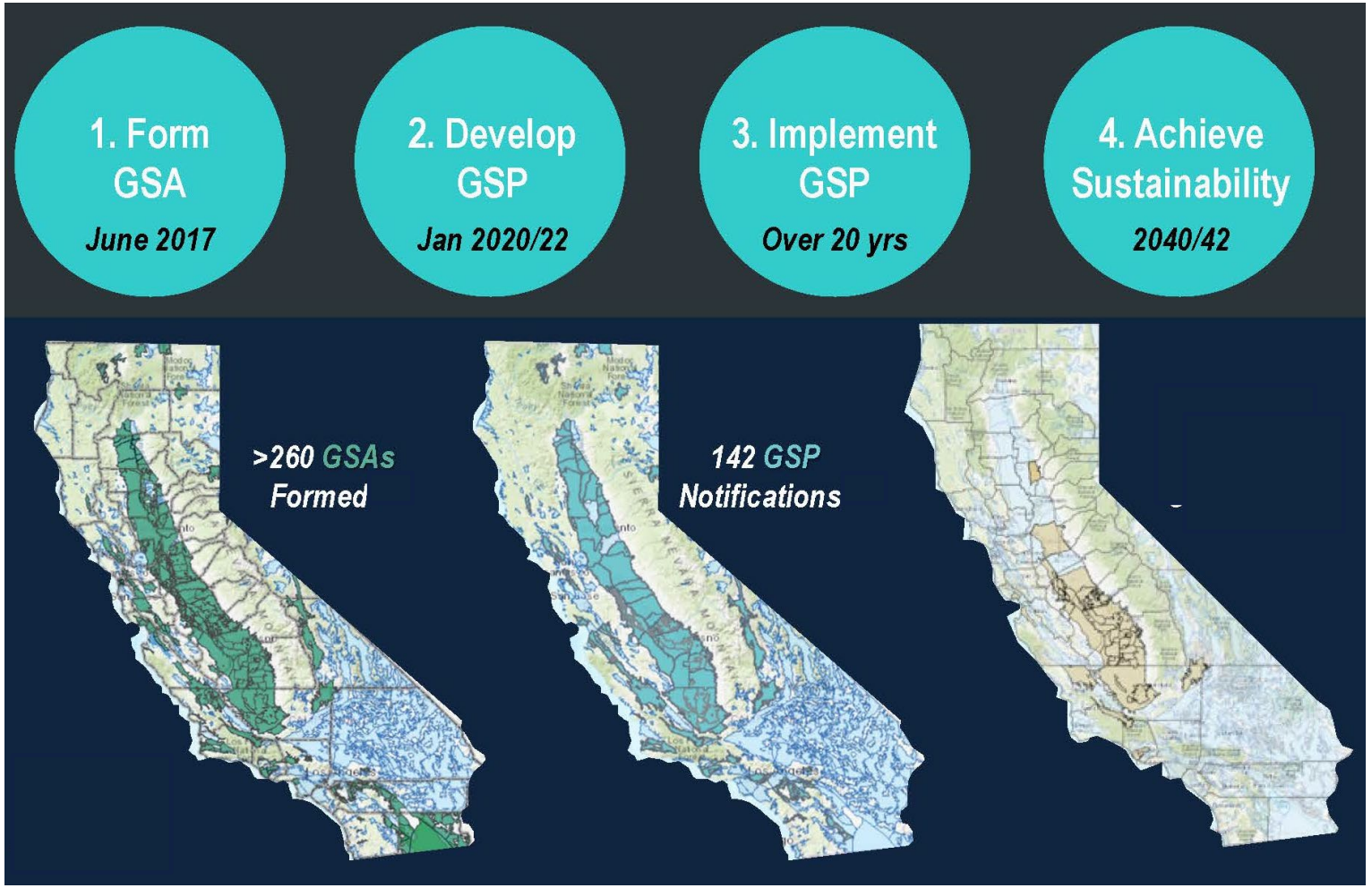
INTRODUCTION AND BACKGROUND

TURLOCK GROUNDWATER SUBBASIN

- About 350,000 acres
- About 85,000 acres of irrigated land in eastern subbasin
- Western subbasin served by TID; Groundwater a supplemental water source
- Eastern subbasin has limited surface water supplies; GW is the primary water source



SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)

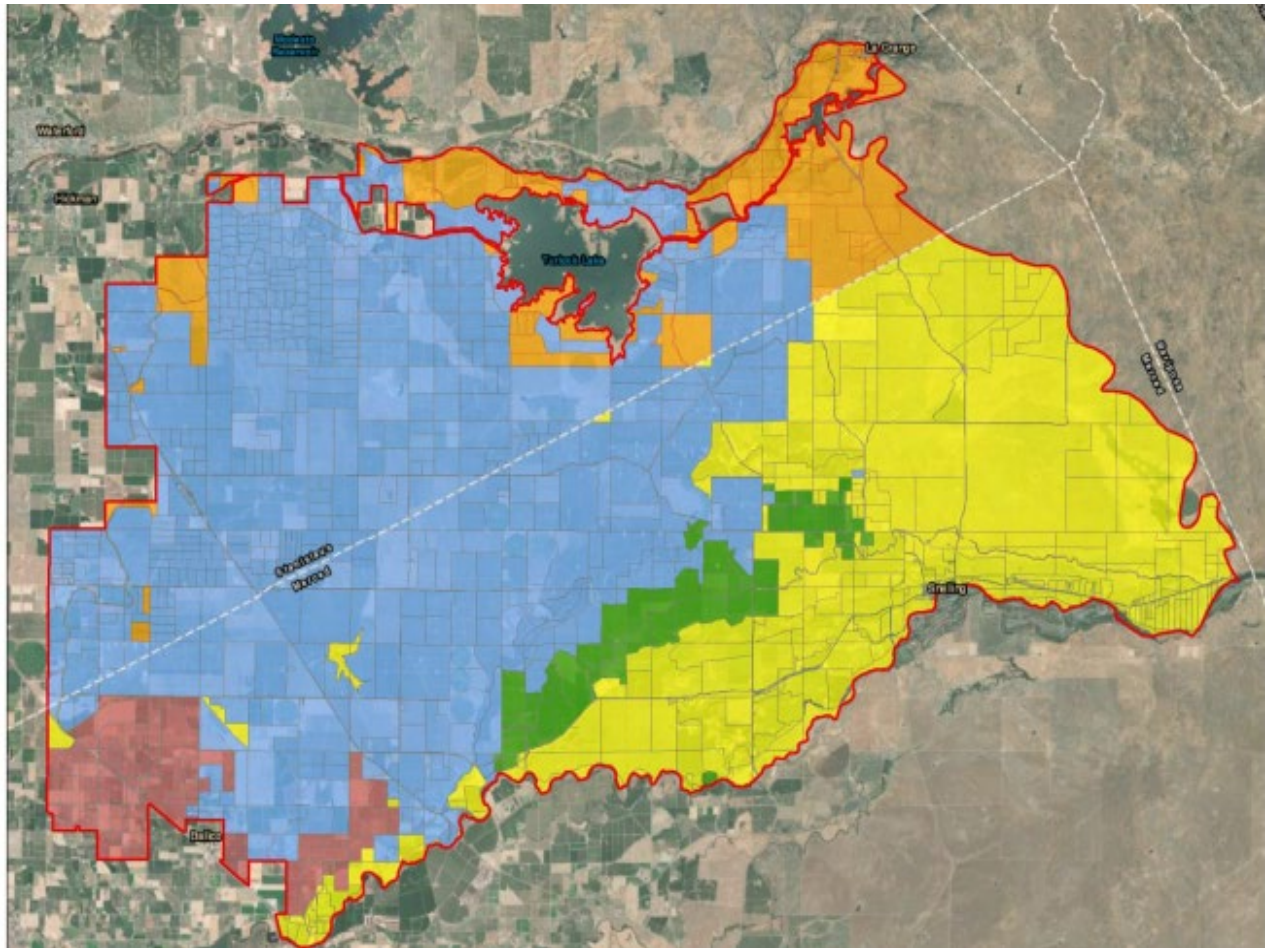


- Achieve groundwater sustainability in medium and high priority GW basins.
- Implement monitoring, projects and management actions to achieve sustainability within 20 years.
- Local control, backstopped by State intervention.

Our Goal: Sustainable Groundwater Management Under Local Control by 2042

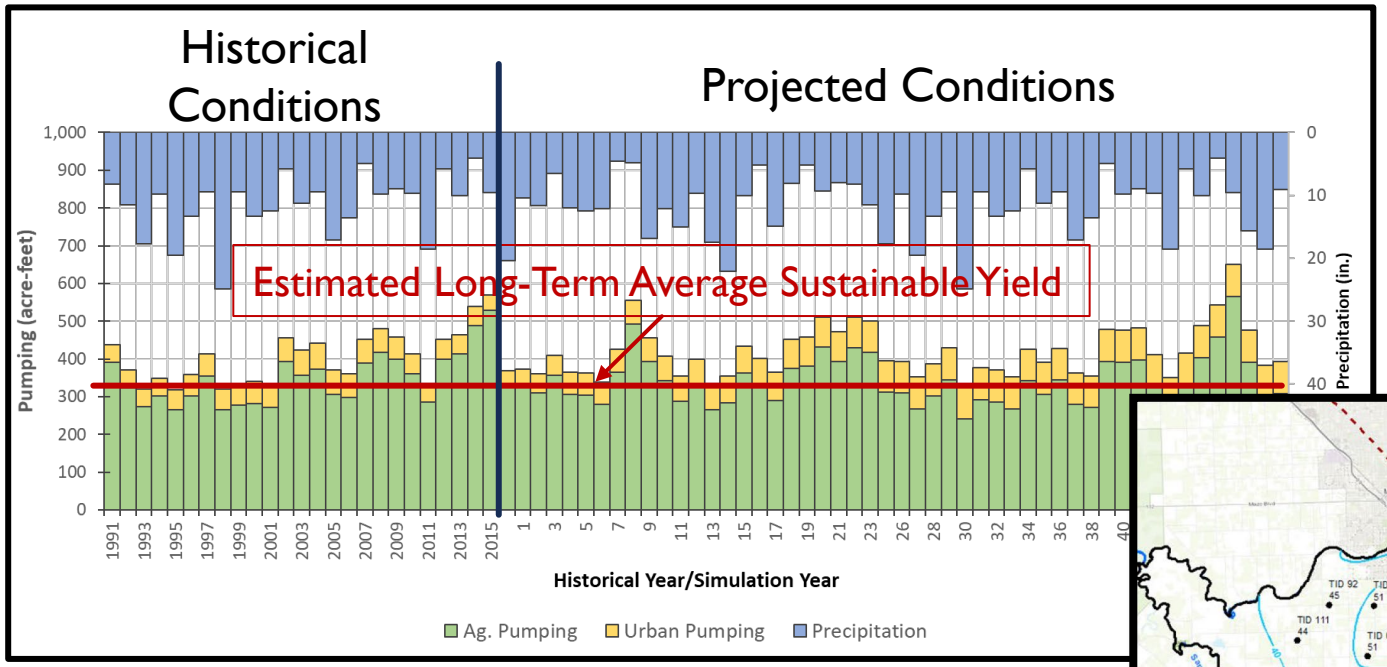
Sustainable Yield Definition: *"The maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result."* (California Water Code §10721(w))

WHAT WE HAVE DONE TO COMPLY W/ SGMA

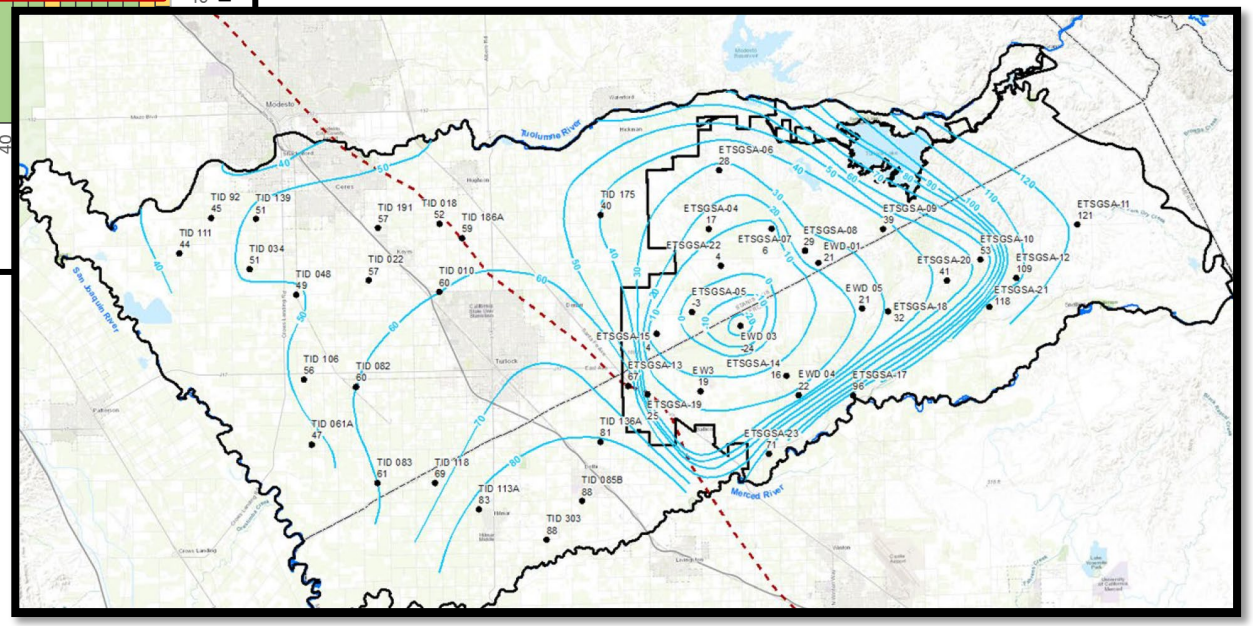


- ✓ Formed East Turlock Subbasin GSA
  - Eastside Water District, Ballico-Cortez Water District, Merced Irrigation District, Merced County, Stanislaus County
- ✓ Adopted a GSP jointly with WTSGSA
- ✓ Planning for initial projects and management actions
- ✓ Actions to address data gaps
- ✓ Joint compliance reporting
- ✓ Joint grant pursuits

Groundwater Pumping and Sustainable Yield



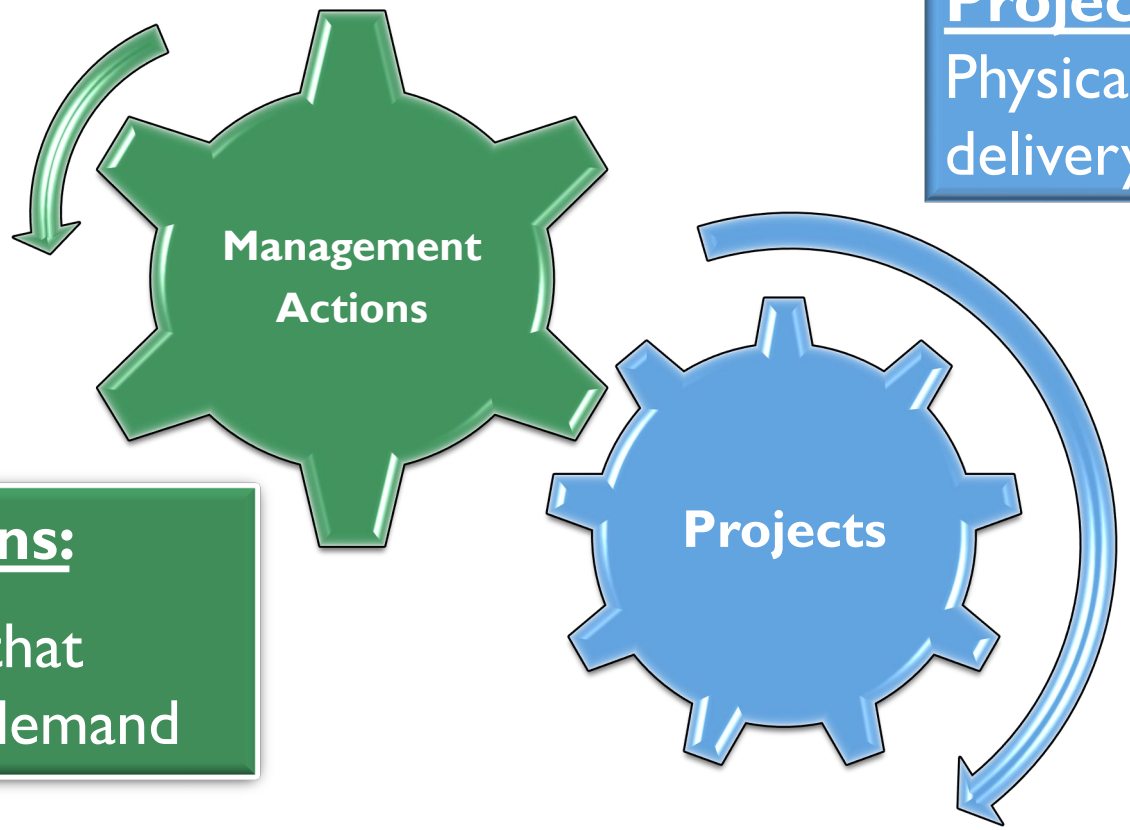
- Long-term average sustainable yield is exceeded under current and projected demand conditions.



- Long-term groundwater extraction has created a cone of depression in the eastern subbasin

How will we Meet Subbasin Sustainability Goals?

Projects:
Physically constructed water delivery and recharge projects



Management Actions:

Programs or policies that reduce groundwater demand

Potential Actions Needed to Reach Sustainability

- Sustainable Yield can't be precisely quantified yet
- Modeling indicates the initial projects will have significant benefits, but more projects and demand reduction will be needed
- Preliminary estimate: About 25% reduction in net groundwater demand is needed, met by a combination of projects and demand reduction
- Aim is to maximize our best opportunities for recharge and in lieu surface water supply and decrease the amount of pumping reduction needed
- Pumping reduction will be necessary, but we can get significant recharge benefits from projects we develop and operate

Planned Projects

Planned Now

- Replenishment water deliveries from Highline Canal
- Mustang Creek Flood Control Recharge Project
- Turlock Lake Rehabilitation

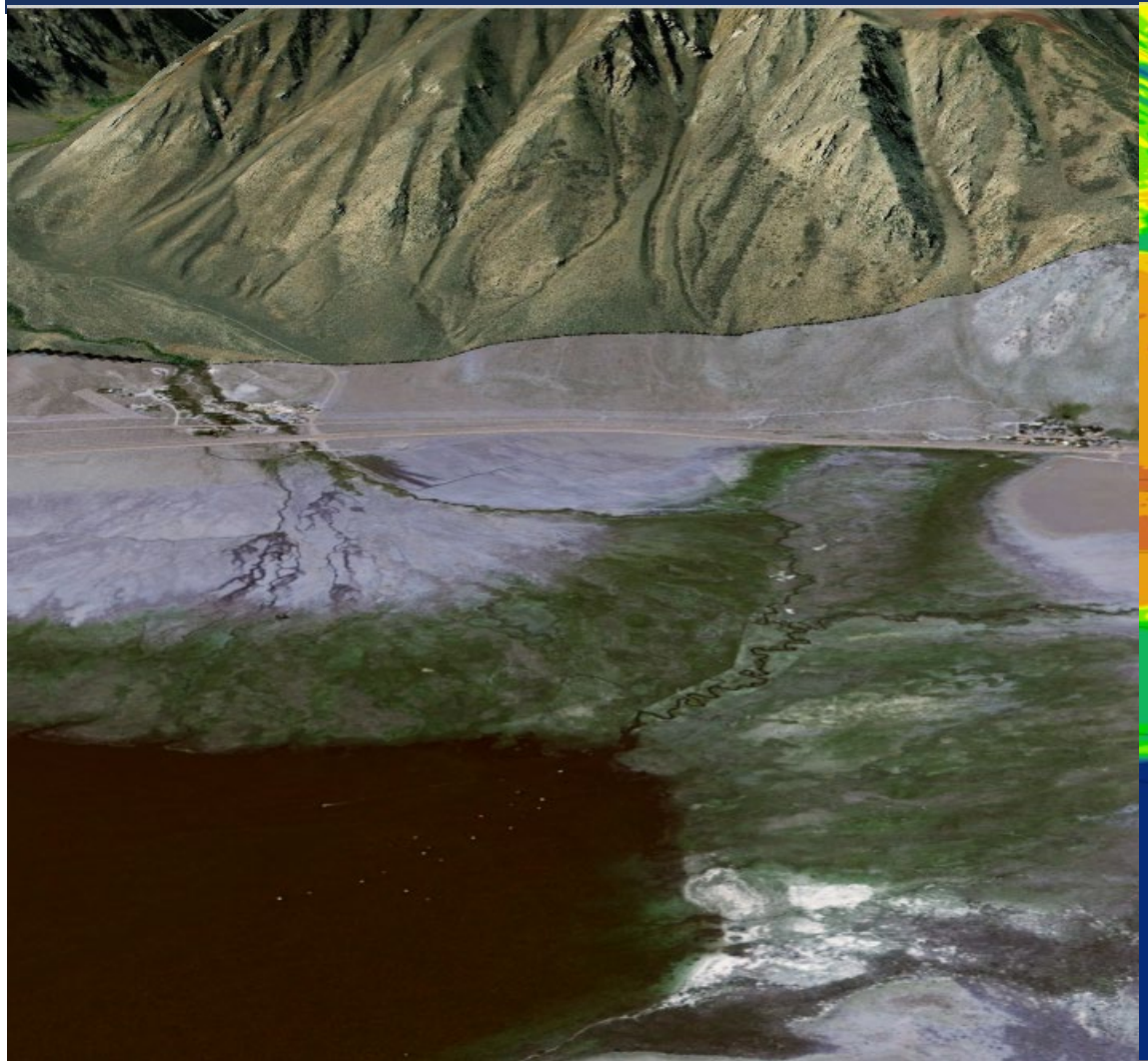
Coming Soon

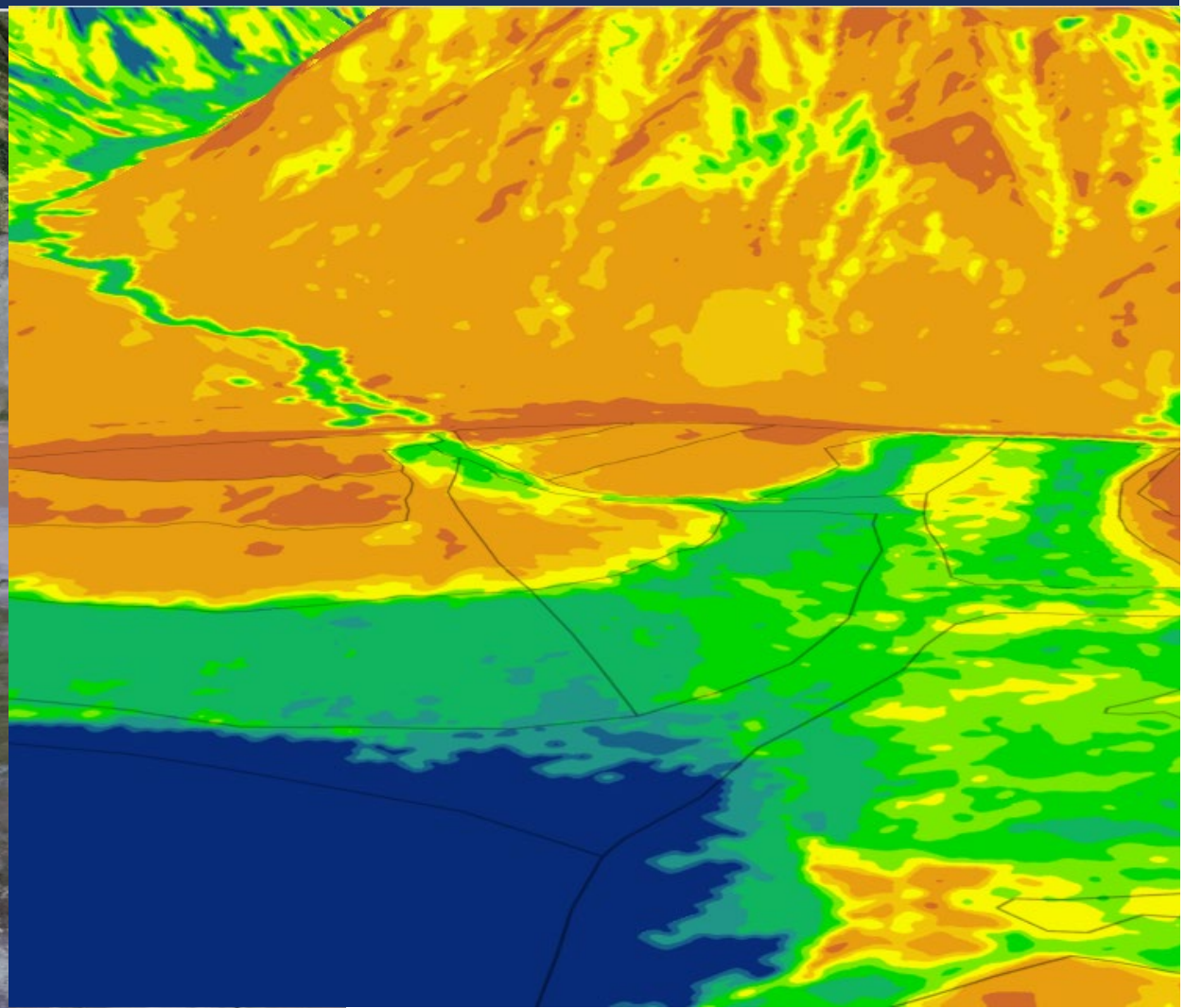
- Recharge Master Plan
- Expand replenishment water deliveries
- Off-season stormwater delivery for direct recharge
- Additional Dry Well Projects
- Canal water recharge

Planned Management Actions

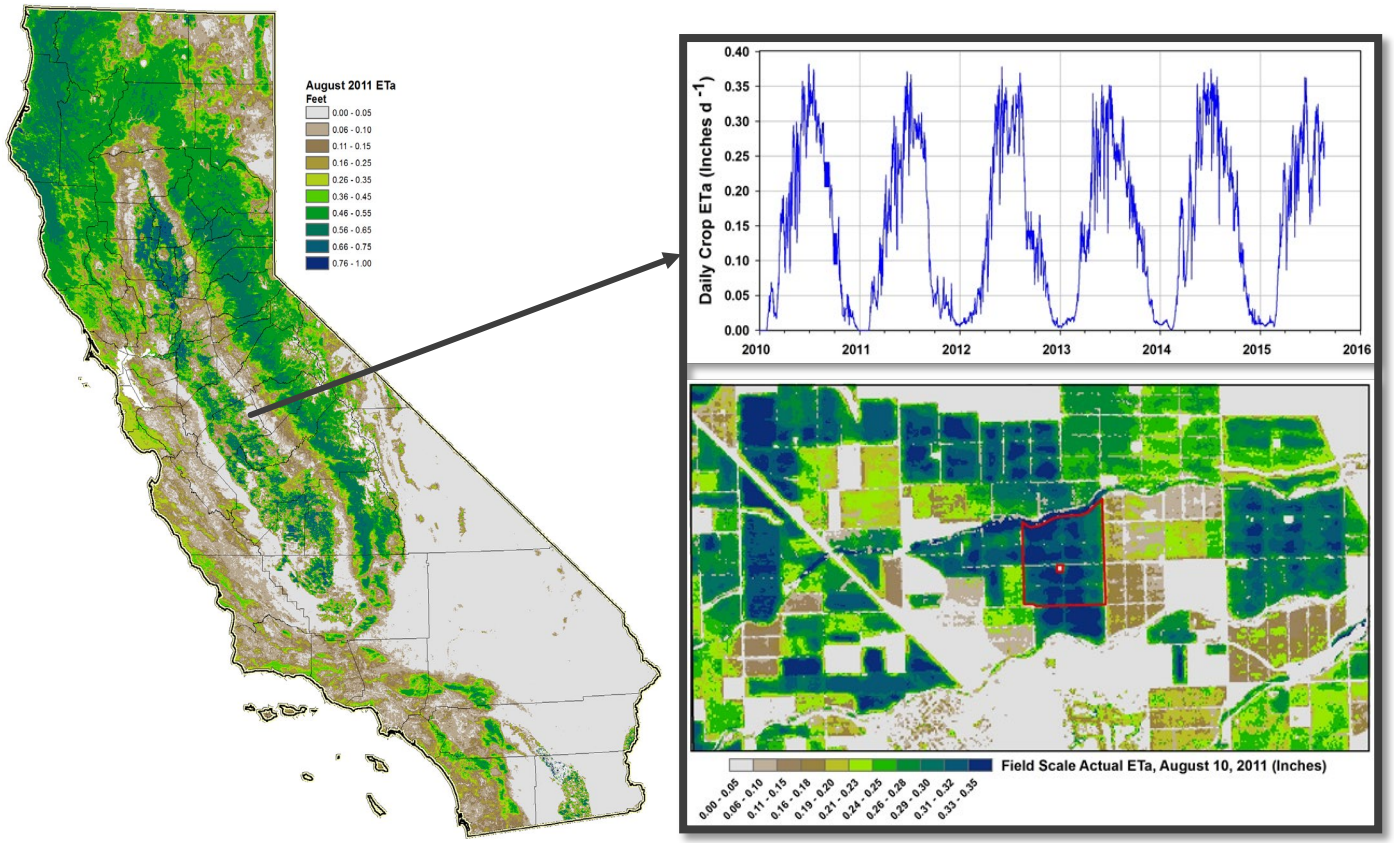
- Implement Extraction Measurement Program
- Establish Groundwater Extraction Baseline (for comparison)
- Assign Sustainable Pumping Allocation (subtract from baseline)
- Implement a Fee Program (Fund Projects)
- Establish a Pumping Management and Credit Framework
- Adapt implementation periodically to respond to new data and project effectiveness
- Get stakeholder input throughout the process

ET ANALYSIS FOR BASELINE DEVELOPMENT





HOW ARE WE USING ET DATA?



- We need to establish baseline of groundwater use to measure against
- Satellite-based ET is our best way to estimate historical consumptive use
- CalETa is a readily available dataset developed for DWR that maps daily actual ET from 2003 – 2021 at the field scale

HOW ET IS MEASURED?

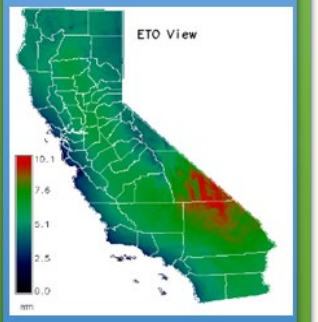
Image Processing

- Automated Imagery Download (Landsat & MODIS)
- Automated Cloud Screen
- Conversion to Surface Reflectance
- Derive Physical & Biophysical Variables

Climate / Weather

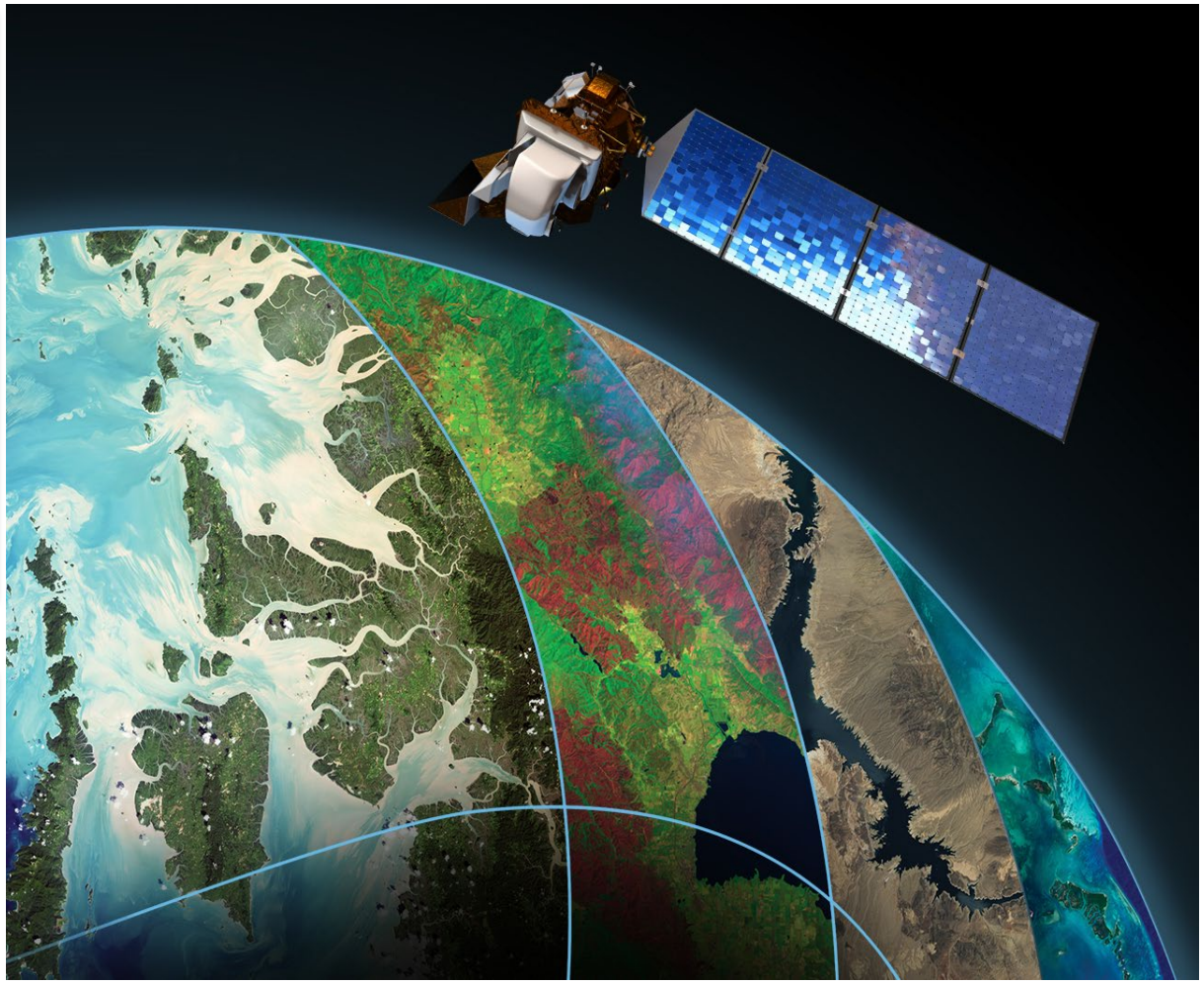
- Conditions at Satellite Overpass
  - Solar Radiation
  - Air Temperature
  - Relative Humidity
  - Wind Speed
  - Reference ET

- Spatial CIMIS: Daily Reference ET

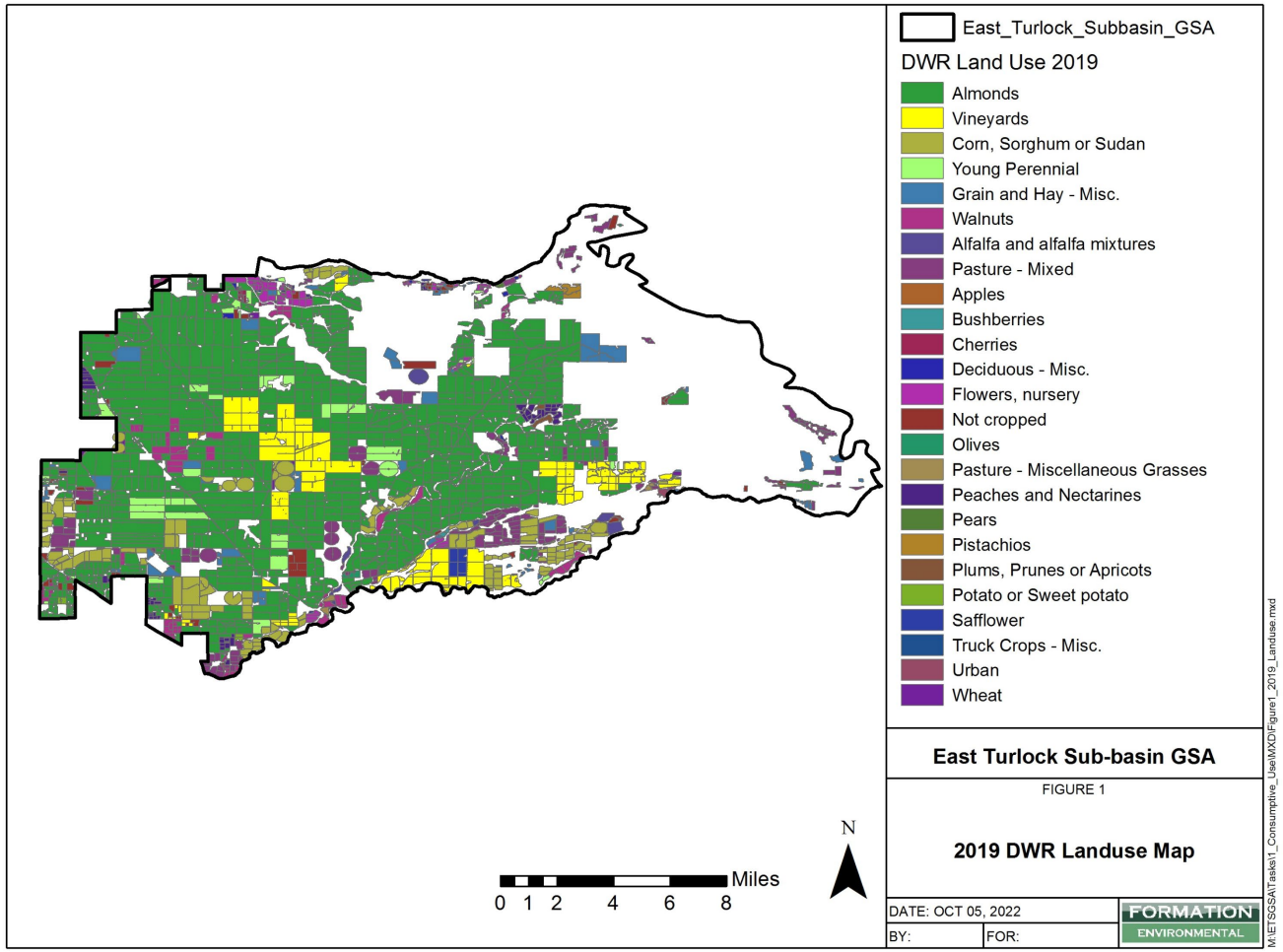


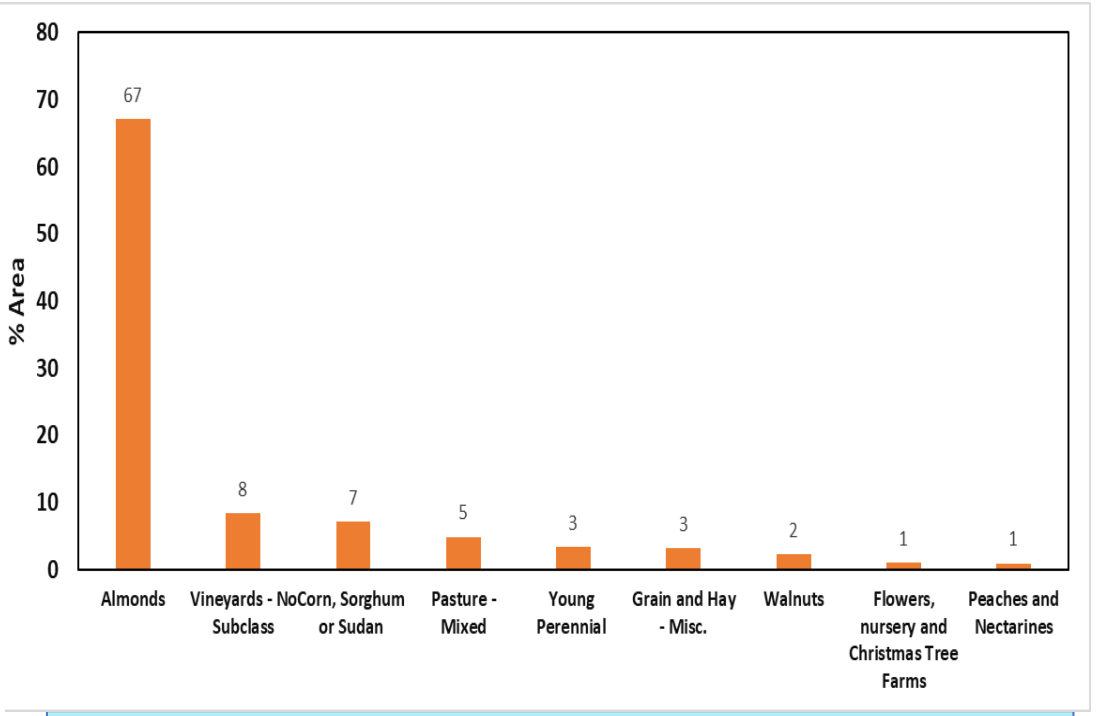
Surface Energy Balance Equation

Daily ETa (Statewide; 30 meter resolution)



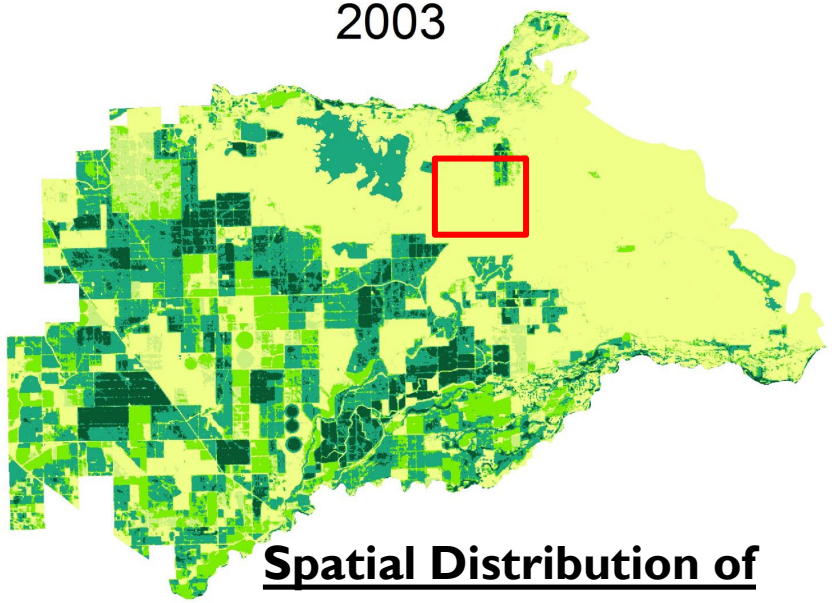
Baseline Land Use and Cropping Data (2019)





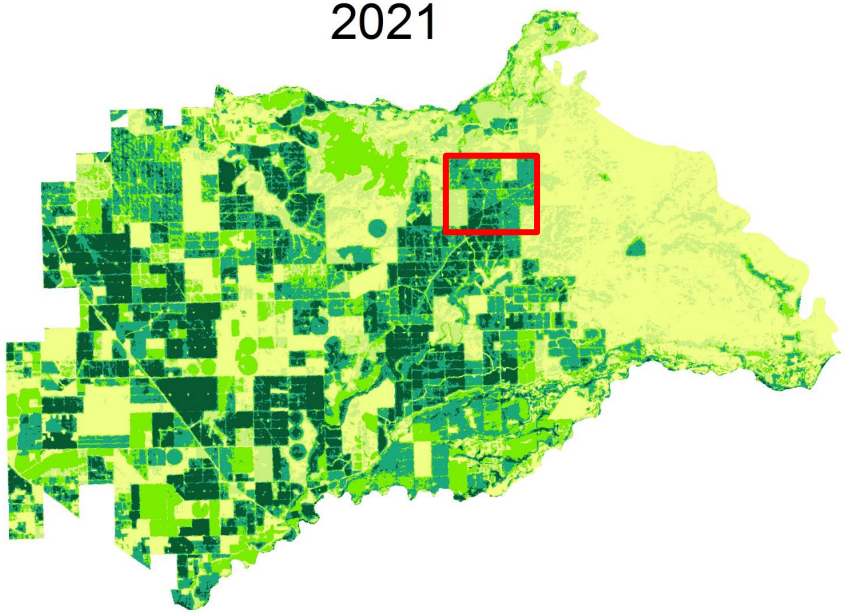
Total Irrigated Land: ~ 85,000 acres
Top Nine Crops: ~ 83,000 acres (98%)
Perennial Crops: ~ 72,000 acres (84%)
Almonds: ~ 57,000 acres (67%)

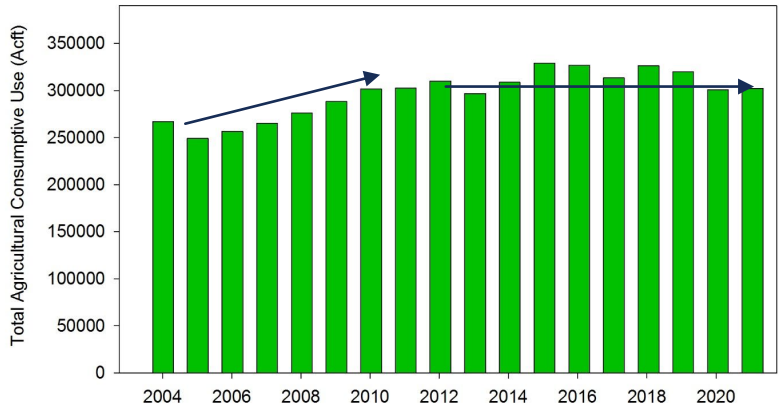
2003



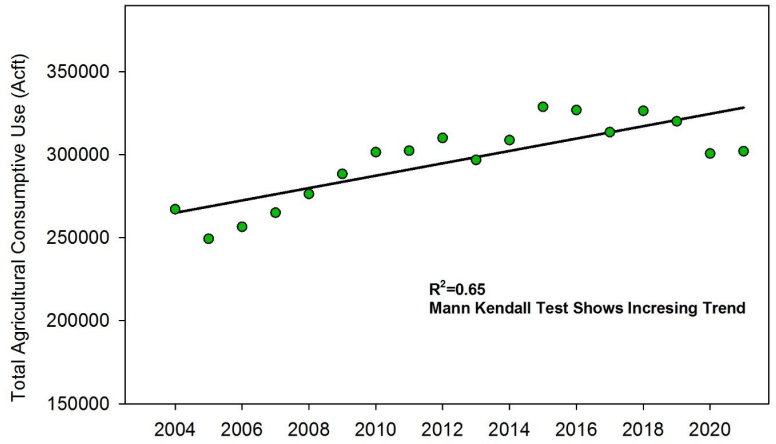
Spatial Distribution of Consumptive Use Over Time

2021





Changes in Average Consumptive Use Over Time



Annual ET

Inches

- 0 - 20
- 21 - 26
- 27 - 42
- 43 - 51
- > 52

East Turlock Sub-basin GSA

FIGURE 2

Long Term Comsumptive Use

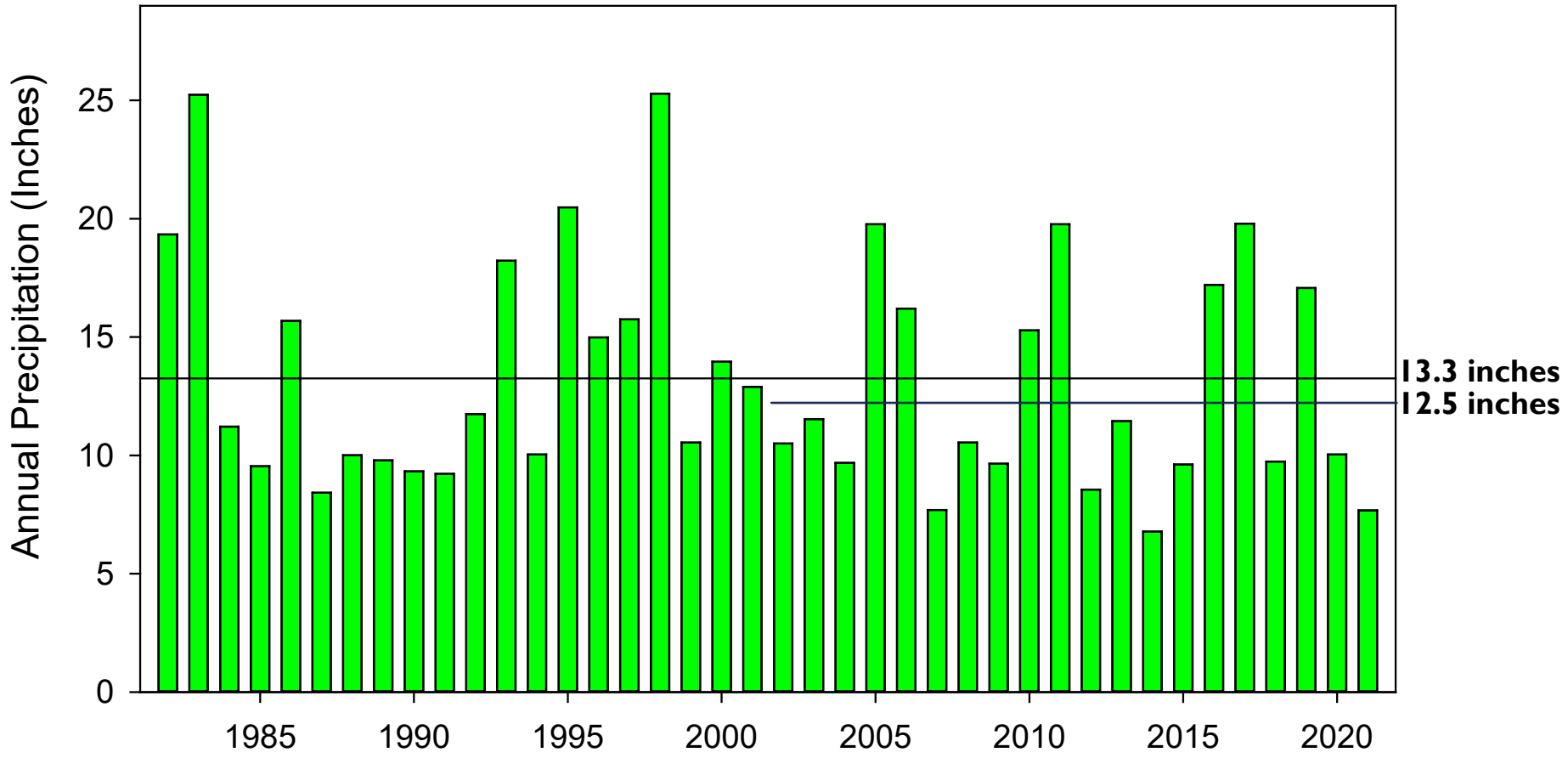
DATE: OCT 06, 2022

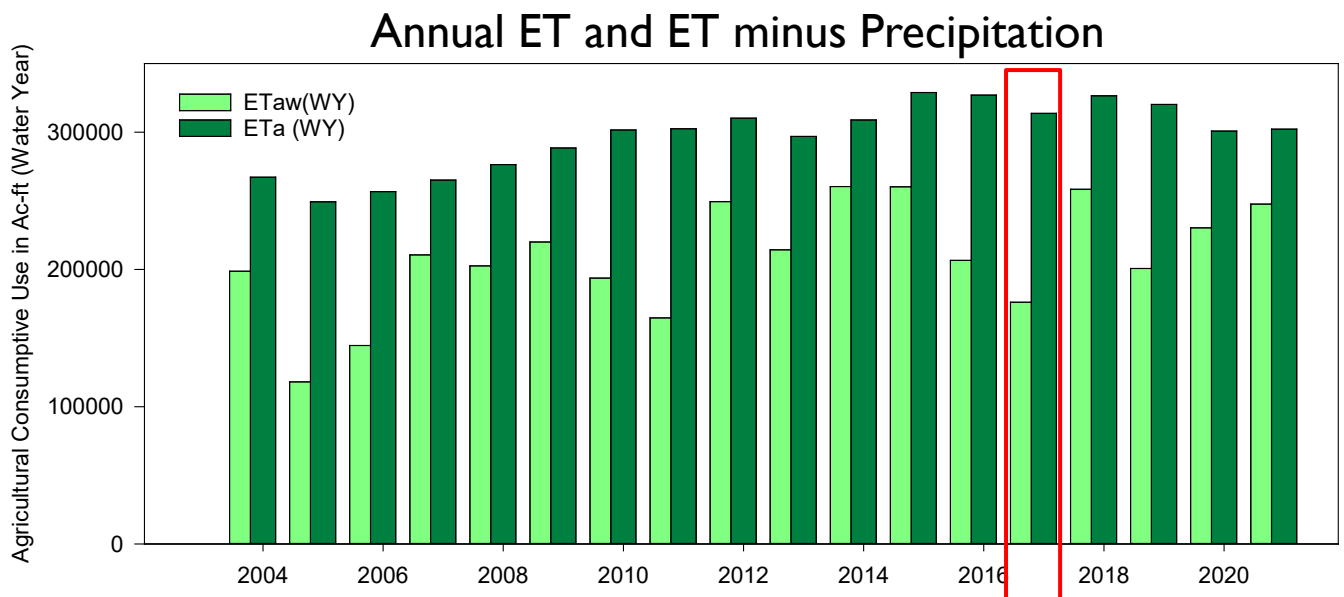
BY:

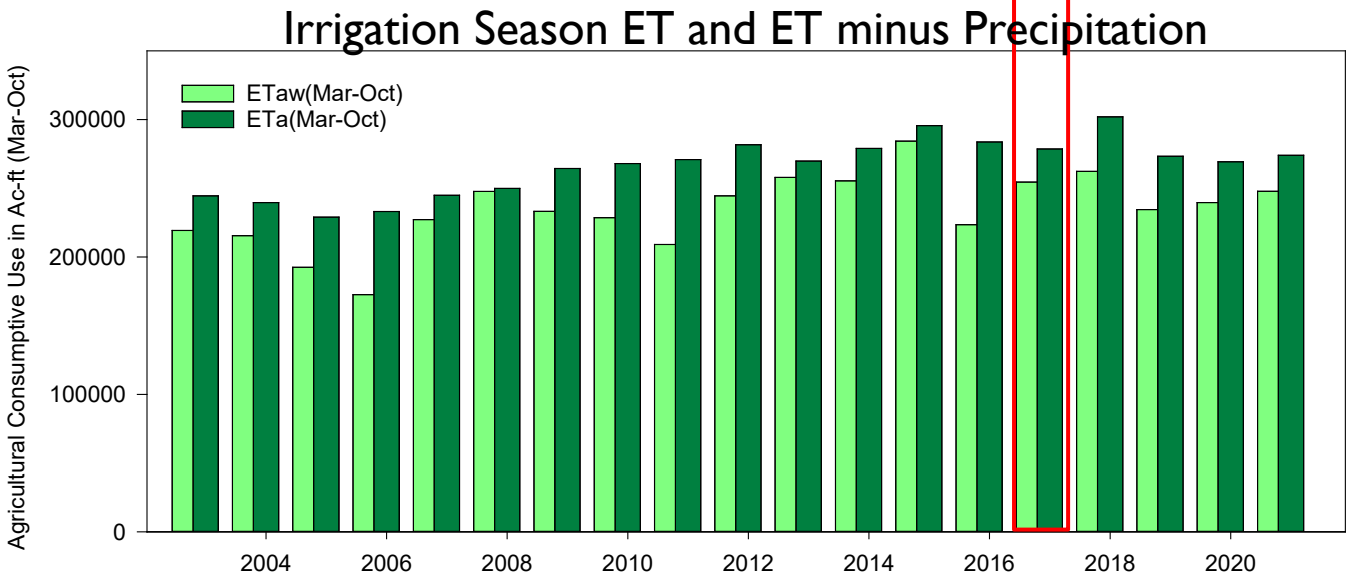
FOR:

FORMATION ENVIRONMENTAL

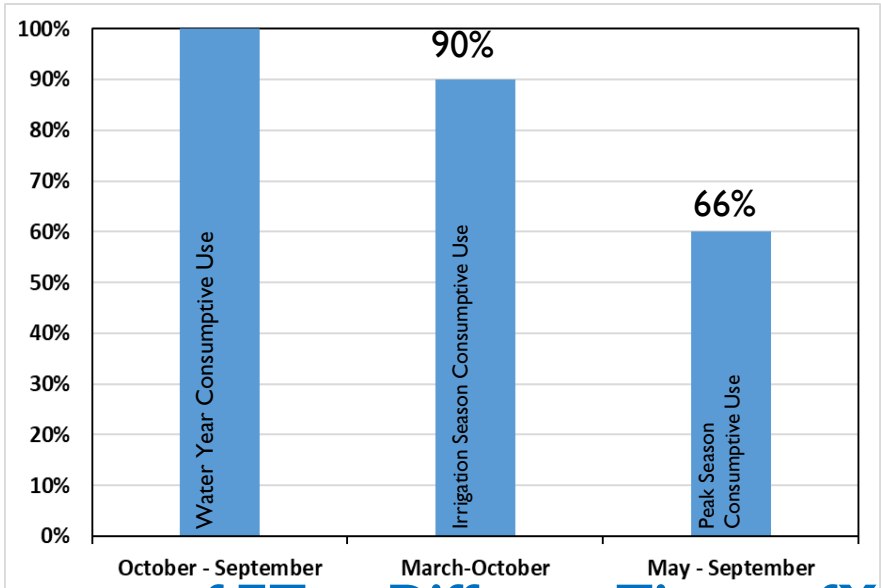
Long Term Precipitation Trends



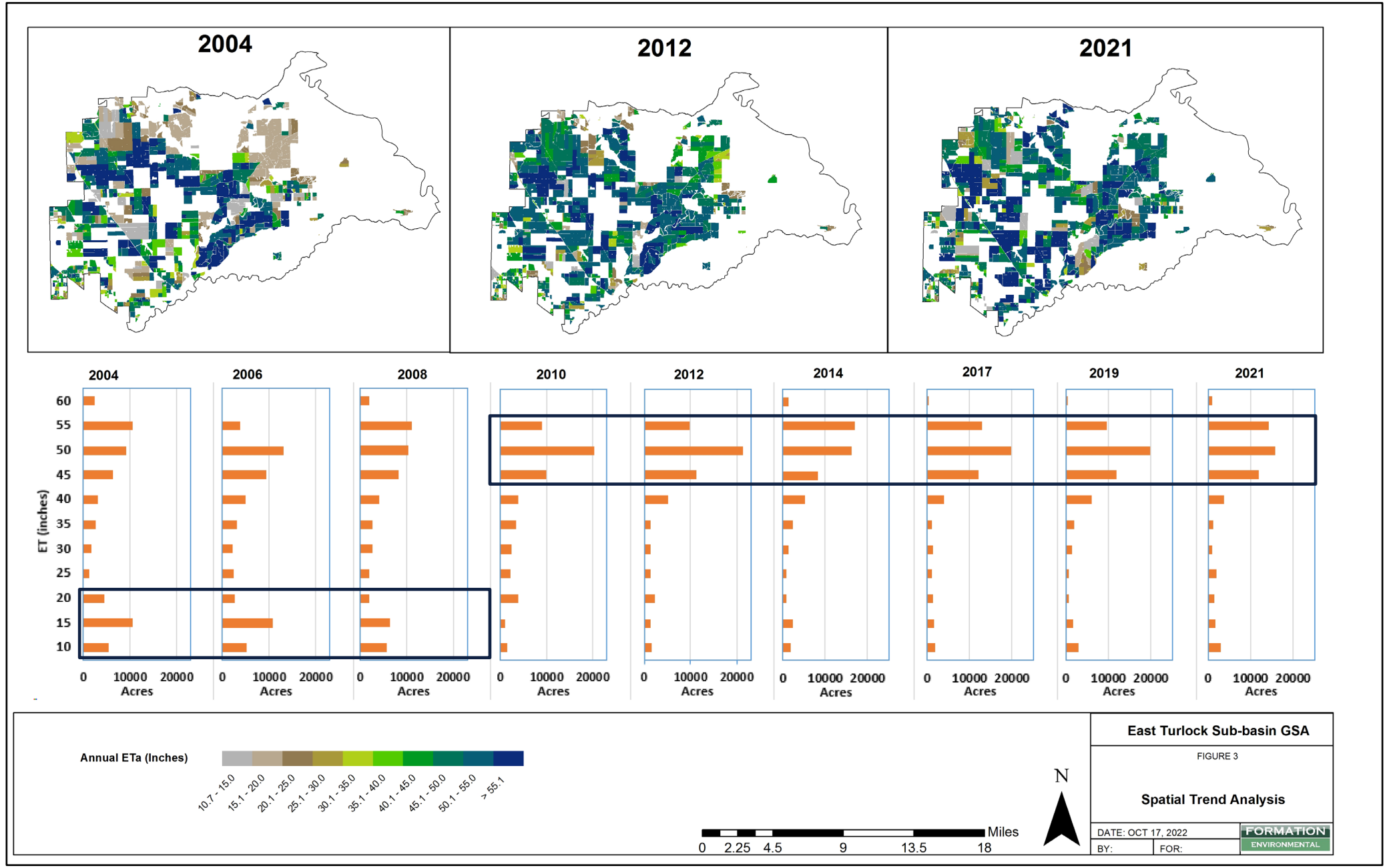




- ET includes water from irrigation and precipitation
- Annual ET includes precipitation, runon and runoff
- We want to use ET as a tool to estimate GW pumping, so our focus is the irrigation season



Percent of ET at Different Times of Year


2004
2012
2021
2004
2006
2008
2010
2012
2014
2017
2019
2021
ET (inches)
60
55
50
45
40
35
30
25
20
15
10
0
10000
20000
Acres
Annual ETa (Inches)
10.7 - 15.0
15.1 - 20.0
20.1 - 25.0
25.1 - 30.0
30.1 - 35.0
35.1 - 40.0
40.1 - 45.0
45.1 - 50.0
50.1 - 55.0
> 55.1
N
Miles
0
2.25
4.5
9
13.5
18
East Turlock Sub-basin GSA
FIGURE 3
Spatial Trend Analysis
DATE: OCT 17, 2022
BY:
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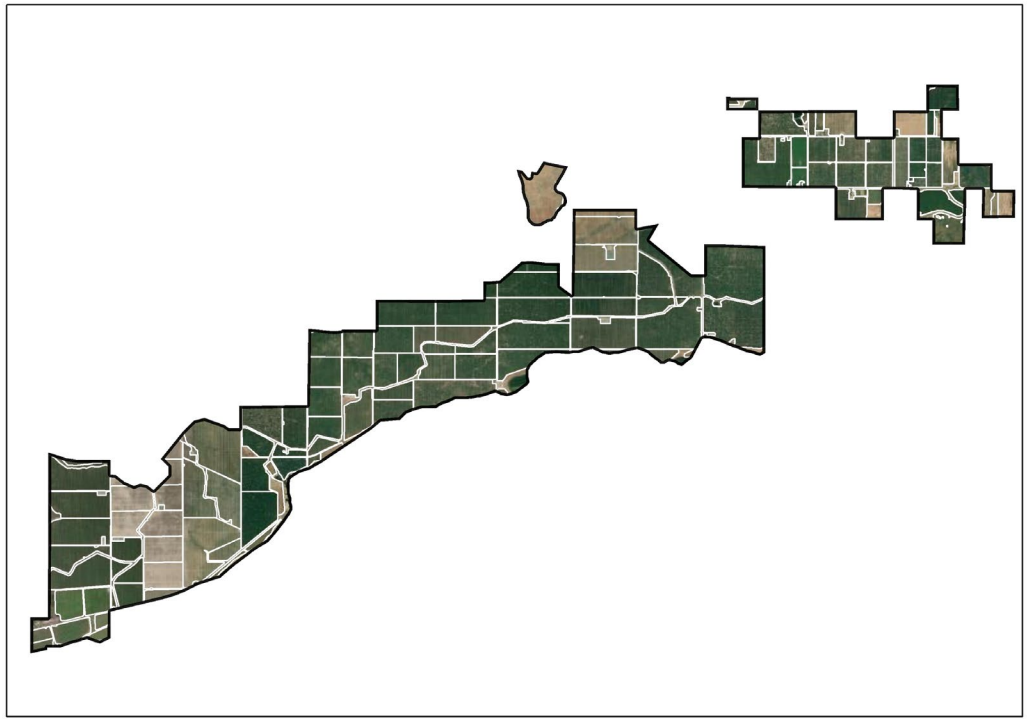
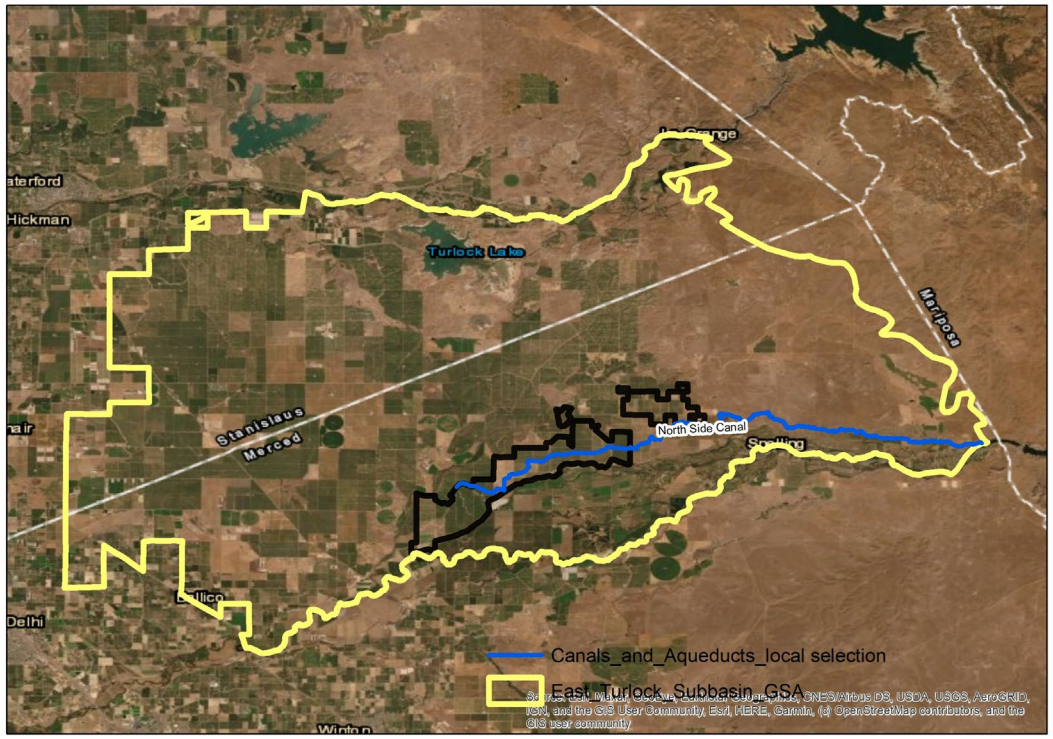
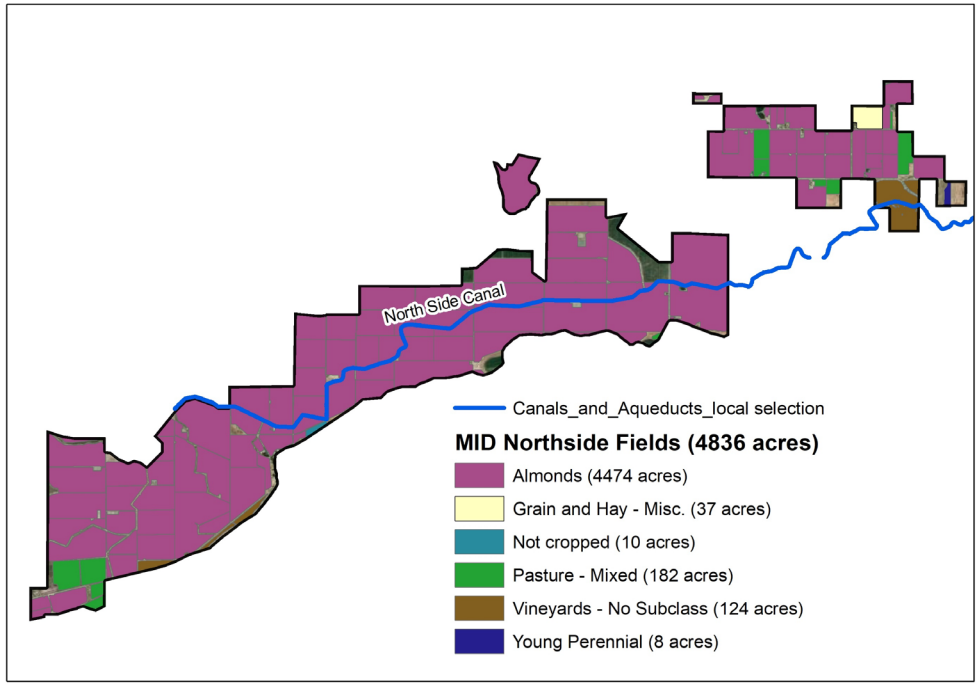
Comparison of ET and Surface Water Delivery Data
Merced ID Northside Canal Area





- The dominant crop is almonds
- Irrigation season ET is in the expected range of 3 to 3.5 feet
- MID deliveries are lower, consistent with surface water delivery supplemented by groundwater



Year	MID Records (AF, Mar-Oct)	MID Records (FT, Mar-Oct)	CalETa (AF, Mar-Oct)	CalETa (FT, Mar-Oct)
2008	11,347	2.3	15,605	3.2
2009	12,008	2.5	16,912	3.5
2010	10,320	2.1	15,374	3.2
2011	11,145	2.3	15,890	3.3
2012	12,639	2.6	16,936	3.5
2013	12,594	2.6	16,040	3.3
2014	6,698	1.4	14,549	3.0
2016	9,948	2.1	14,274	3.0
2017	12,125	2.5	17,131	3.5
2018	11,398	2.4	18,194	3.8
2019	11,406	2.4	16,522	3.4
2020	8,367	1.7	15,272	3.2
2021	11,140	2.3	16,001	3.3

Ranch	Year Planted	Pump Rating & Power Usage Based		CalETa (Remote Sensing Based)	
		2020 (inches)	2021 (inches)	2020 (inches)	2021 (inches)
Ranch 1 AG5B	2004	27	23	48	46
Ranch 2 AG5B	2021-22	19	18	43	30
Ranch 3 AG5B	1996	28	25	45	43
Ranch 4 (AG4B)	2000	26	23	48	45
Ranch 5 AGVB	2013	23	22	42	42
Ranch 6 AG5B	1999	22	20	44	43
Average		**24**	**22**	**45**	**42**

- Evaluation is ongoing
- Compared to Almond Board data, ET seems high and Pump Power Usage data seems low
- Calculations using ITRC reference values also fall between the two values
- More data are needed to validate both ET and Pump Power Usage approaches
- Validation using metered pumping is needed

Comparison of ET and Groundwater Extraction Calculated from Pump Electrical Data, Sperry Farms 2020-2021

GROUNDWATER USE MEASUREMENT OPTIONS

Groundwater Extraction Measurement Options

OPTION	ADVANTAGES	DISADVANTAGES
Meters	• Site specific measurement of actual extraction • Data loggers and remote telemetry options available	• Requires GSA-wide installation, reporting and maintenance • Takes several years to establish baseline
Satellite-Based ET	• Historical data can be used to establish a baseline • Reasonably accurate if calibrated; • Relatively inexpensive	• Accuracy requires calibration through meter comparisons, ET measurement and cropping confirmation • Some data variability is inherent
Electrical Consumption	• Readily available for many wells • Meters already installed	• Requires site-specific calibration • Historical data may not be available

Recommendations

- Propose using satellite-based ET as tool for the first five years
  - Compare to 2012-2021 baseline
  - Option to use meter or electrical data if available and appropriately installed and calibrated
- Propose using meter data after the first five years
  - Implement GSA-wide metering program
  - GSA would seek grant funding for meters.
  - Installation must be by approved meter installers
  - Use for performance measurement after baseline can be established
- Implement virtual program for first year and real time thereafter
  - Use Grower-accessible internet portal to track data
  - Maintain confidentiality

GROUNDWATER ALLOCATION AND FEE OPTIONS

Establish Pumping Allocations

- Actual pumping reductions needed for sustainability are not yet known
  - Refined assessment possible as more data are available
  - Need for pumping reductions may change due to project implementation
- Recommended Approach
  - Explore an initial reduction of 10% to 20% below baseline?
  - Use one GSA-wide pumping allocation for parcels on a per-acre basis
  - Refine and update approach every five years as needed
- Operational Considerations
  - Credits, trading and carry over (wet to dry years)
  - Fees to fund projects

Extraction Fee Choices

Flat Fee

- Based on groundwater extraction volumes
- Same for every pumper per unit volume pumped

Excess Pumping Fee Surcharge

- Based on pumping in excess of sustainable pumping allocation
- Varies by pumper depending on volume pumped

Tiered Fee

- Based on combination of the above
- Base rate plus one or more escalating tiers

Theoretical Pumping Allocation and Fee Examples

100-acre parcel planted with 100 acres of vines (Assumed Allocation 2.5 AF/A)

- *Gross Demand: 210 AFY*
- *Extraction Density: 2.1 AF/A*
- *Allocation: 250 AFY*
- *Base Fee: 210 AF*
- *Surcharge Fee: Credit 40 AF*

100-acre parcel planted with 100 acres of almonds (Assumed Allocation 2.5 AF/A)

- *Gross Demand: 330 AFY*
- *Extraction Density: 3.3 AF/A*
- *Allocation: 250 AFY*
- *Base Fee: 330 AF*
- *Surcharge Fee: 80 AF*

100-acre parcel planted with 50 acres of vines (Assumed Allocation 2.5 AF/A)

- *Gross Demand: 105 AFY*
- *Extraction Density: 1.05 AF/A*
- *Allocation: 250 AFY*
- *Base Fee: 105 AF*
- *Surcharge Fee: Credit 145 AF*

100-acre parcel planted with 50 acres of almonds (Assumed Allocation 2.5 AF/A)

- *Gross Demand: 165 AFY*
- *Extraction Density: 1.65 AF/A*
- *Allocation: 250 AFY*
- *Base Fee: 165 AF*
- *Surcharge Fee: Credit 85 AF*