



The
Freshwater
Trust®

SB88 Monitoring Method and Alternative Compliance Plan:

A field-level approach to remotely sensed water use
estimation in the Sacramento-San Joaquin Delta

Nick Osman, The Freshwater Trust
Conservation Project Manager

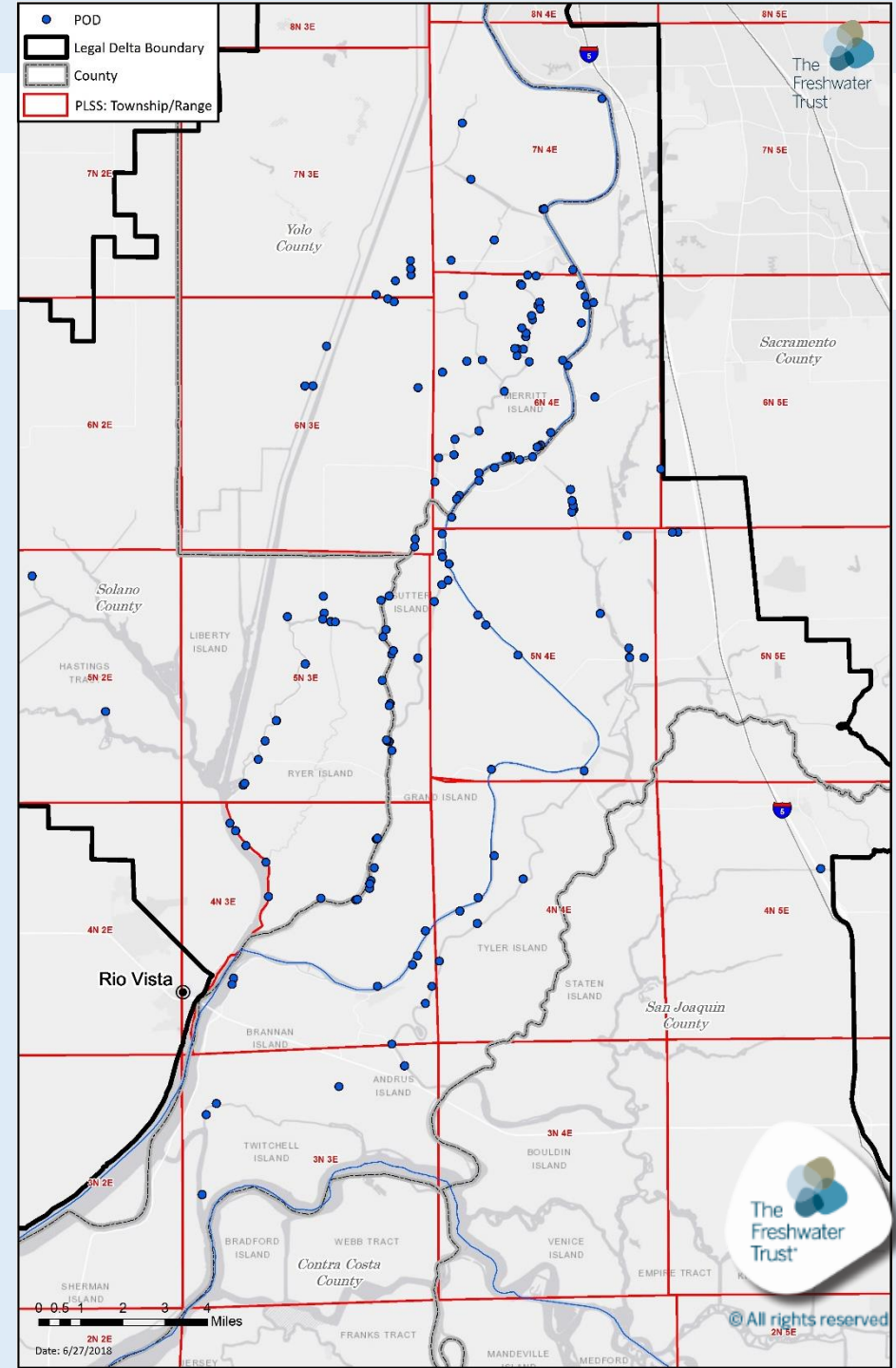
SB-88 Alternative Compliance Plan

- Five-year plan to develop and validate a new measurement method for determining water diversion in the Delta
- Technologic and hydrologic barriers to the application of conventional measuring devices, data collection equipment, and telemetry
- Goals are two-fold:
 1. fulfill reporting requirements for participants
 2. advance the science of consumptive use estimations through automation, refinement, and comparison of existing methodologies



ACP Participants

- Recruitment of participants is on-going
- Currently:
 - 65 water right holders
 - 162 licenses and statements
 - 183 diversions



Data Collection

- Crops – acreages and rotations (including cover cropping)
- Irrigation methods and schedules per field
- Points of use for each point of diversion
- Sources:
 - Participant-supplied
 - Publicly available
 - Remotely sensed

The Freshwater Trust

WHO WE ARE WHAT WE DO OUR IMPACT THE LATEST NEWS GET INVOLVED CONTACT US

SB 88 Alternative Compliance Plan

California Water Code § 1840 – Senate Bill 88
Alternative Measurement Method and Alternative Compliance Plan
Landowner Participation Agreement

THIS AGREEMENT ("Agreement") is made this _____ day of _____, 2018, between
("Landowner") and The Freshwater Trust ("TFT"), a non-profit corporation.

I. Measurement Method & Alternative Compliance Plan.
Landowner is the owner of real property with a place of water diversion(s) at the following location.
Landowner wishes to participate in the development of TFT's Measurement Method and Alternative
Compliance Plan ("Plan"), attached as Exhibit A, in lieu of Landowner's obligation to measure annual
individual water rights water use that meets or exceeds 10 acre-feet per year. Each covered diversion will
be reflected in a statement and or license number provided below.

Statement Number 1: _____
Associated Point of Use _____
Assessor Parcel Number(s): _____
Password/Reporting Identifier: _____

Statement Number 2: _____
Associated Point of Use _____
Assessor Parcel Number(s): _____
Password/Reporting Identifier: _____

For additional statement numbers, please include attachments at the end of this Agreement.
License Number (if applicable): _____

II. Term and Termination.
2.1. This Agreement is effective as of the date last signed by the parties ("Effective Date"), and unless
mutually earlier terminated by the parties in writing, shall expire on December 31, 2021.
2.2. This Agreement may be terminated by either party without cause upon thirty (30) days' prior written
notice to the other party. In the event of termination by Landowner, Landowner will pay TFT for the
portion of the Annual Per-Diversion Fee (as defined in Section 3) earned up and until the date of
termination.

III. Annual Per-Diversion Fee.
3.1. Landowner agrees to pay TFT an annual payment of \$775.00 per diversion ("Annual Per-Diversion
Fee"). In exchange for this Annual Per-Diversion Fee, TFT will provide the Landowner's required annual
surface water diversion reporting to the State Water Resources Control Board as required by California
Water Code § 1840.
3.2. Landowner will pay the Annual Per-Diversion Fee to TFT within thirty (30) days of execution of this
Agreement via online payment or check. Pay online at <https://www.thefreshwaterttrust.org/get-involved/process-payment-sb88/>. Check shall be sent to: The Freshwater Trust, Attn: Heather Jones,

by email or physically via _____
divided below:

ter Trust:
Alternative Compliance Plan
or St., Ste. 200
97205

diverting more than 10
and report the timing,
California State Water
Landowners' compliance
circumstances of the
water Trust is developing
Alternative Compliance

sign on to an Alternative
just's opt-in form (below)
you are now part of an

ust, an Oregon non-profit
Alternative Compliance Plan or

and Alternative Compliance
23, section 935 Alternative
Measurement Method

as on previously submitted
E:

Contact Last Name *

Mailing Street Address *

City *

State *

Zip Code *

Email Address *

Phone Number *

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Field-Level Water Use Modeling

Summary of Input Data

Plant Year:	2014
Select an Input Data File:	Other/Weather
Select a path for ET _o :	Daily
Choose a Crop Type:	Deciduous
Choose a Crop:	Peach
Crop Number is:	3.09
Crop is:	Peach
Enter Starting Date:	
Default Starting Date:	1-Apr-14
Enter End Date:	
Default Ending Date:	15-Oct-14
AWH Capacity (mm/mm):	0.11
Max. Soil Depth (mm):	1500
Max. Root Depth (mm):	1500
Allow. Depl. (%):	50

Enter 1st Cover Crop (mon/day)

Start Date (mon/day):	
End Date (mon/day):	

Enter 2nd Cover Crop (mon/day)

Start Date (mon/day):	
End Date (mon/day):	

Enter Ground Cover in Percentage (%)

C	
D	

CALIFORNIA DEPARTMENT OF
WATER RESOURCES

CUP-Plus

Consumptive Use Program Plus

Metric Version 6.9

Calculated ET_o, ET_c, and ET_{aw} (mm/month) and weighted mean K_c values

Month:	Apr	May	Jun	Jul	Aug	Sep	Oct	
K _c ():	0.73	0.82	0.93	1.04	1.05	1.04	0.78	
ET _o (mm):	112.23	164.25	198.38	225.02	193.27	146.17	56.97	
ET _c (mm):	79.46	130.73	184.58	234.60	202.44	151.70	44.58	
ET _{aw} (mm):	47.03	92.90	183.77	234.80	202.64	132.77		
Seasonal ET _o (mm):	1,096.29			Seasonal ET _c (mm):				1,028.09
Annual Re and Espg (mm):	117.98			Seasonal ET _{aw} (mm):				910.11

Monthly Total Values of ET_o, ET_c, and ET_{aw} (mm mon-1) for Peach

Month	ET _o	ET _c	ET _{aw}
Apr	112.23	79.46	47.03
May	164.25	130.73	92.90
Jun	198.38	184.58	183.77
Jul	225.02	234.60	234.80
Aug	193.27	202.44	202.64
Sep	146.17	151.70	132.77
Oct	56.97	44.58	

DAILY SOIL WATER BALANCE APPLICATION PROGRAM

Overview

CUP Plus "Consumptive Use Program Plus" was developed to determine reference evapotranspiration (ET_o), crop coefficient (K_c) values, crop evapotranspiration (ET_c), and evapotranspiration of applied water (ET_{aw}), which provides an estimate of the net irrigation water diversion needed to produce a crop. The application can also be used to study the impact of climate change on evapotranspiration and irrigation water needs. The application outputs a wide range of tables and charts that are useful for irrigation planning.

CALIFORNIA DEPARTMENT OF
WATER RESOURCES

Developed by California Department of Water Resources

And

University of California, Davis

Morteza N. Orang, Richard L. Snyder

UC DAVIS
UNIVERSITY OF CALIFORNIA

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Reporting

- Batch reporting to SWRCB anticipated in future years
- 2017 reporting reflects automated CUP+ output
- Field-level results aggregated to water rights

SUPPLEMENTAL STATEMENT OF WATER DIVERSION AND USE FOR 2017

Primary Owner: _____
Statement Number: S0
Date Submitted: 06/25/2018

1. Water is used under _____
2. Year diversion commenced _____
Riparian Claim
Pre-1914 Claim
1899

3. Purpose of Use
Irrigation _____
Multiple Crops _____
Irrigated Crops _____
Area Irrigated (Acres) 460
Primary Irrigation Method Sprinkler

4. Changes in Method of Diversion _____
Special Use Categories _____
C1. Are you using any water diverted under this right for the cultivation of cannabis? No

5-6. Maximum Rate of Diversion for each Month and Amount of Water Diverted and Used

Month	Rate of diversion	Amount directly diverted (Acre-Feet)	Amount diverted or collected to storage (Acre-Feet)	Amount beneficially used (Acre-Feet)
January		0	0	0
February		0	0	0
March		0	0	0
April		0	0	0
May		224.52	0	0
June		405	0	0
July		438.09	0	144.85
August		512.36	0	261.29
September		449.82	0	282.64
October		338.52	0	330.55
November		233.86	0	290.21
December		69.87	0	218.4
Total		0	0	150.88
Type of Diversion	Direct Diversion Only	2672.04	0	45.08
Comments				1723.9

6d. Water transferred _____
6e. Quantity transferred (Acre-Feet) _____
6f. Dates which transfer occurred _____
No
/ to /

(1) Irrigation End Date _____
YYYY-MM-DD or N/A

(2) Crop 2 _____
Other: _____

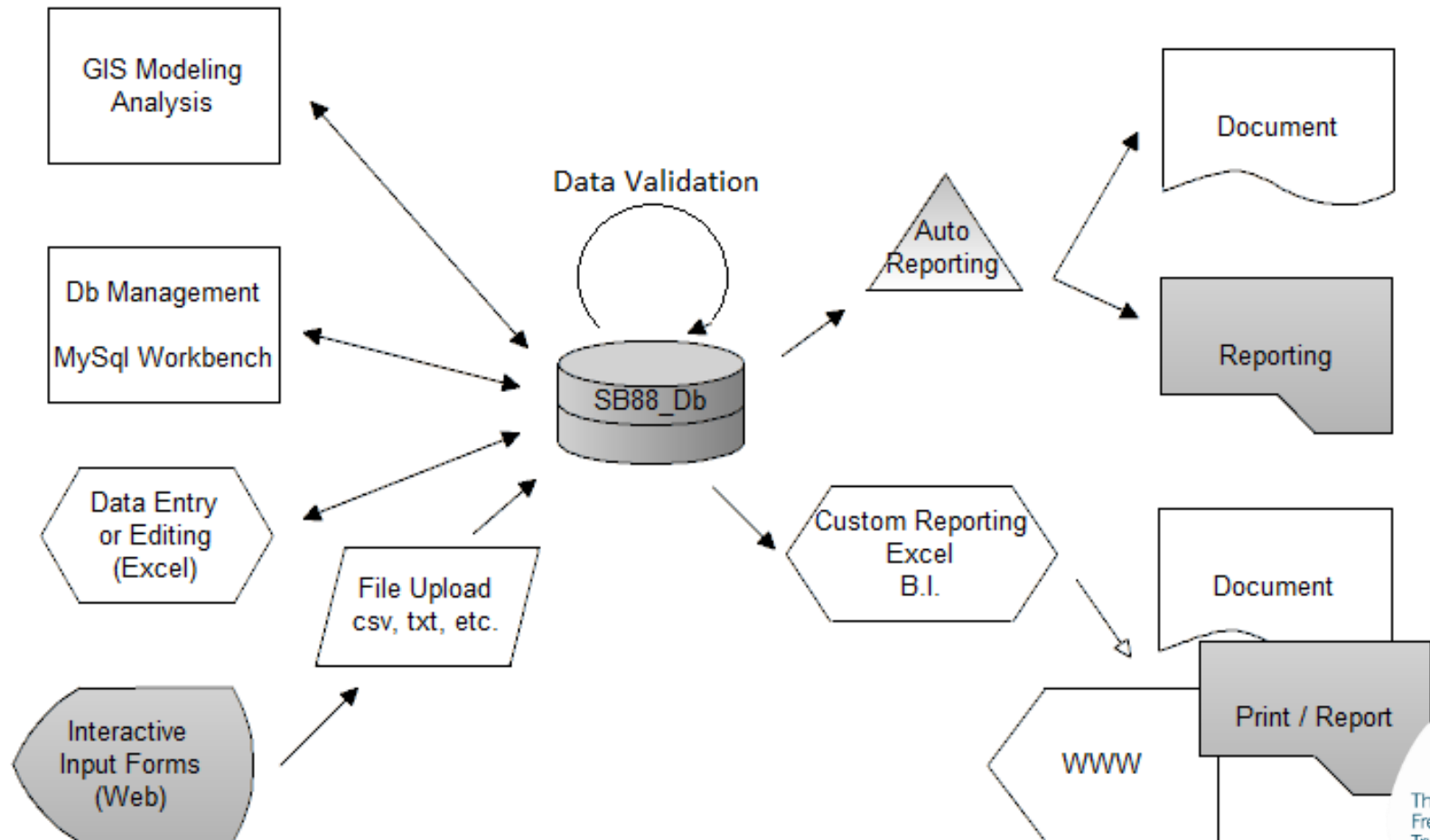
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Research Questions

- How do results of field-level, management-based ET models compare to one another? (CUP vs SIMETAW)
- How do ET model results compare to results of other measurement methods, such as meters?
- How can estimated water diversion be refined to account for factors beyond consumptive use, such as conveyance, irrigation efficiencies, etc.?
- Can remotely sensed crop, irrigation, and management data be used for model inputs?
- What is the best workflow to accommodate data collection, water use estimation, and reporting?



Jan 2017 – June 2018



Data Flow Diagram (Draft)

Workflow Overview

- Delineate agricultural fields in GIS using satellite imagery
- Store additional data in DB associated with each field (remotely sensed sources, participant-supplied data, etc.)
- Pull daily reference ET and precipitation data into database from CIMIS
- Associate fields with water rights and diversions in DB for reporting
- Run model for all fields in R to get results and data validation report



Database



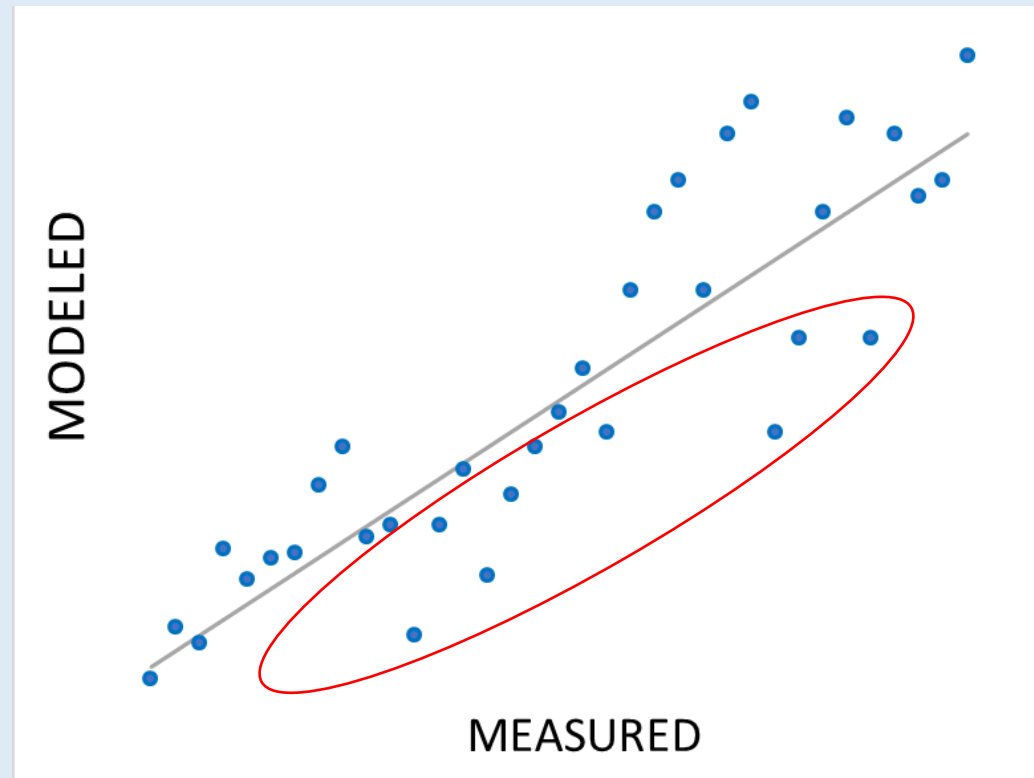
Next Steps: ET Model Comparison

- Compare ET model results
- Field-level models that take into account management practices
- CUP+, ITRC Metric, and CALSIMETAW



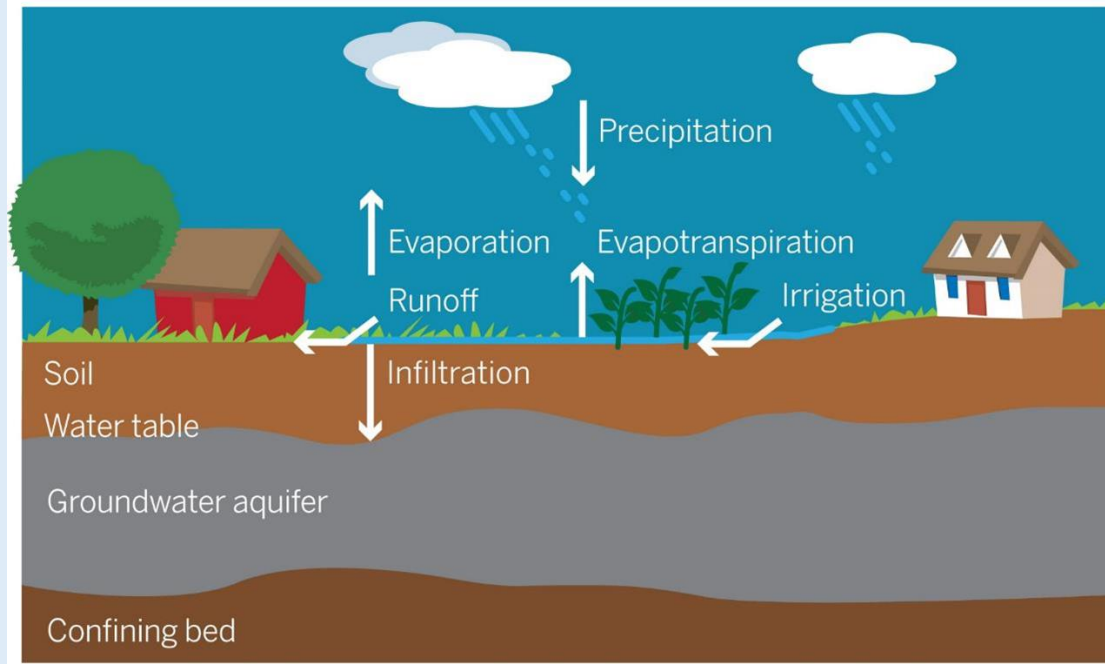
Next Steps: Methods Comparison

- Metered pumps and siphons
- The Nature Conservancy
- Accuracy issues
- Relate trends to crop and management practices for additional model parameters



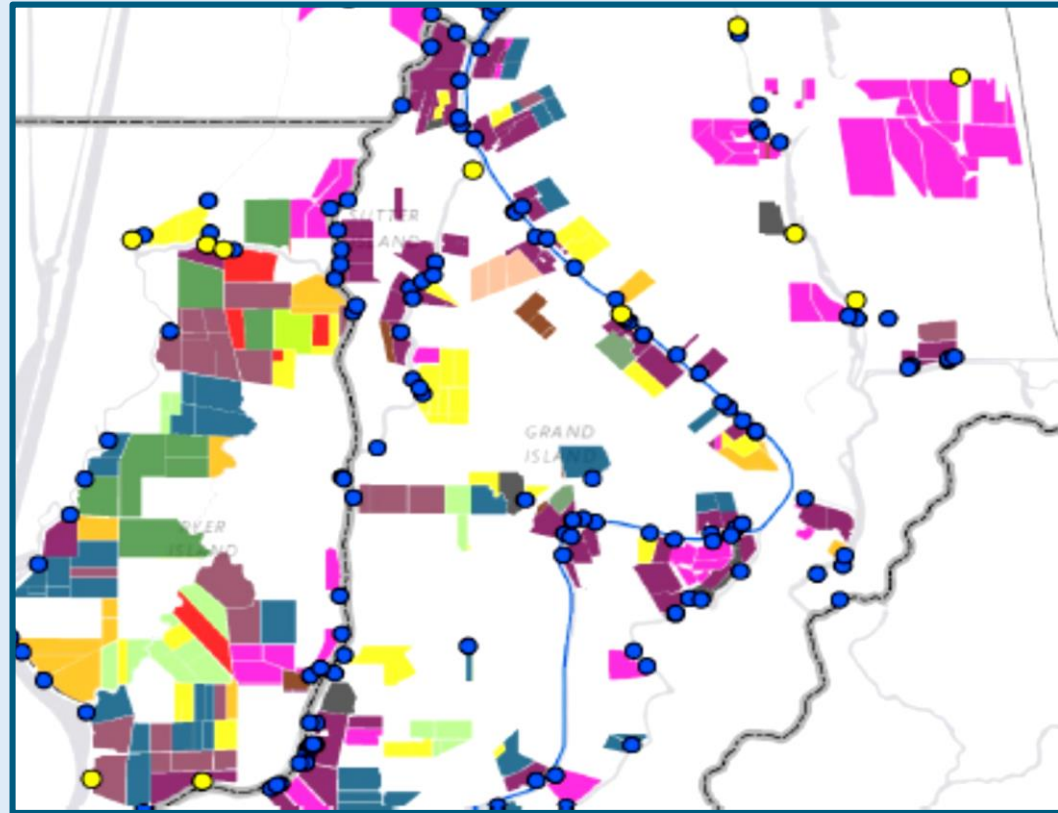
Next Steps: Water Budgets

- Whole island data, including return flows back to river
- Help to understand water diverted rather than ET
- Seepage, runoff, conveyance loss, infiltration, etc.



Next Steps – Remotely-sensed data

- Use of machine learning and neural networks:
 - Irrigation type & intensity
 - Crop rotation, orchard age
 - Cover crop use & intensity
 - Conveyance/Drainage network
- POD, POU, and water right association through eWRIMS database and tax-lot records



TFT and the Delta

- TFT is creating a decision-support tool to show how agricultural management practices can contribute to meeting surface water and groundwater goals
- Optimal distribution of agricultural management practices, while maintaining or improving production and flexibility for farmers
- Understand how management practices on a single field contribute to meeting these targets
- Watershed assessment that involves spatially explicit cost-benefit analysis, modeling, and land use optimization
- Maintain and restore health of Delta surface- and groundwater-dependent ecosystems



StreamBank[®]

Analysis & prioritization



BasinScout[™]

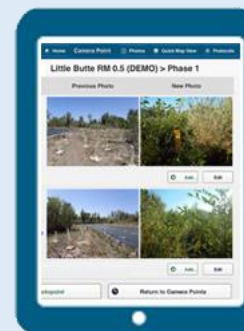
Implementation



DIET

Dynamic Implementation
Environment Tool

Tracking



**Monitoring
App**



**Tracking
Tool**



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Questions & Discussion

