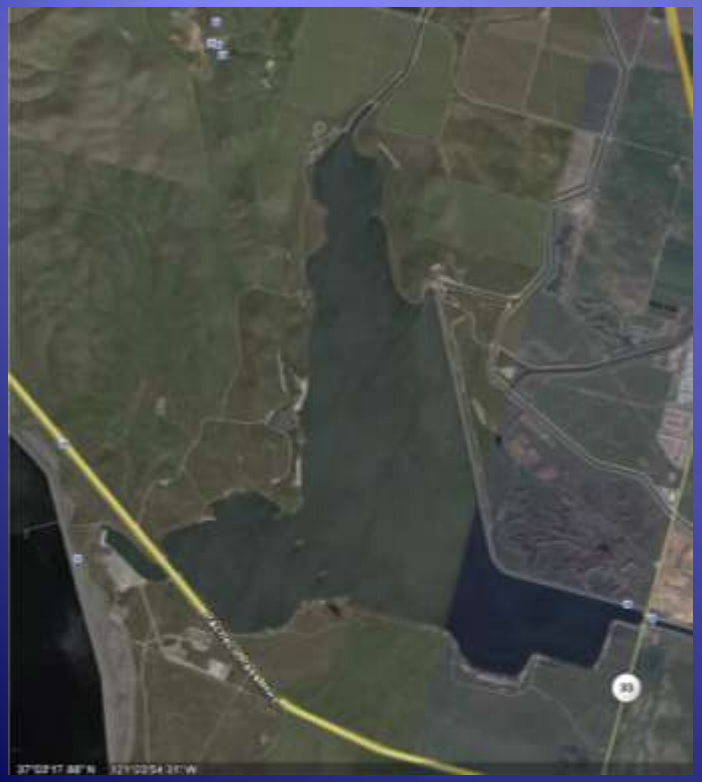
The California State Water Project

FLOW, MIXING, DISPERSION & TRAVEL TIME

State Water Project Studies

O'Neill Forebay EC Patterns



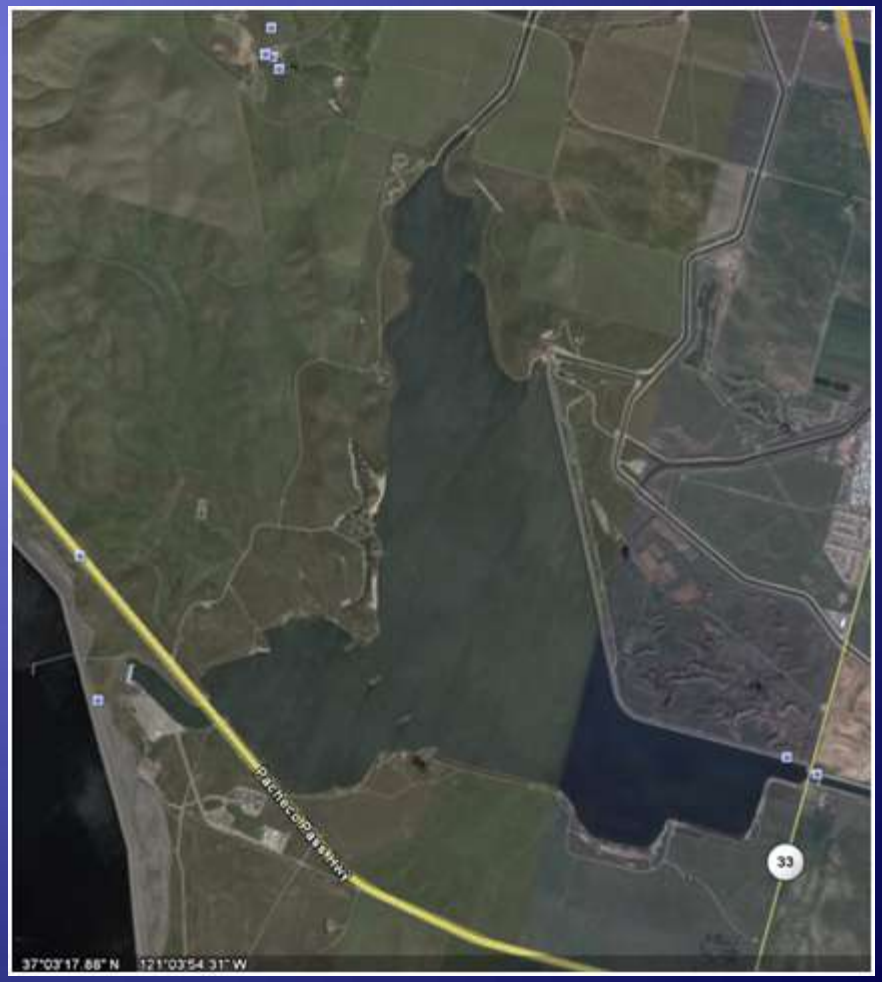
Smart Oranges

O'Neill Forebay EC Patterns

- San Luis Reservoir stores water for both the CA State Water Project (SWP) and the Federal Central Valley Project (CVP).
- O'Neill Forebay is used for transferring water back and forth between San Luis Reservoir and the CVP
- Question: When water is being transferred between the CVP and San Luis Reservoir how is water quality in the SWP affected?

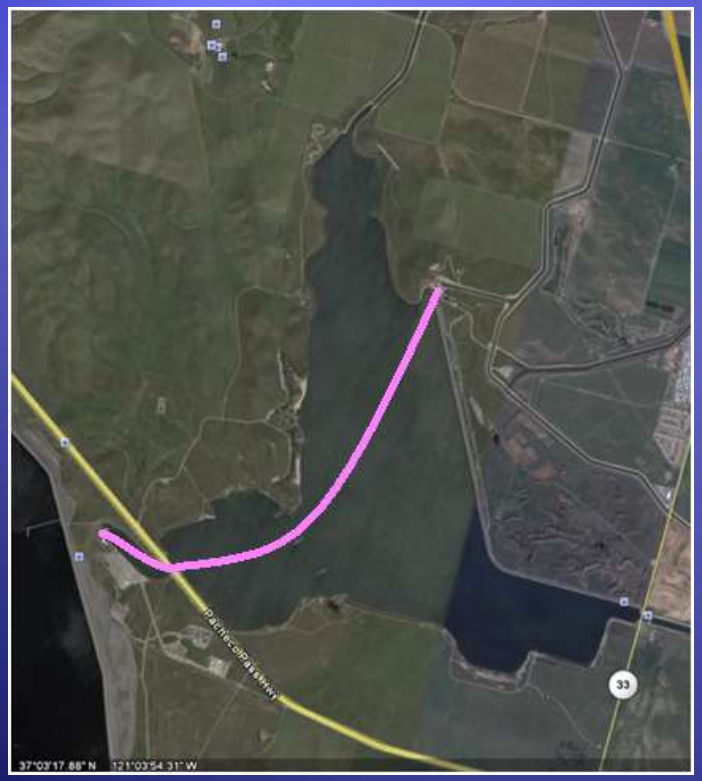
Complicated Hydrology and Limited Data.

- Water can enter O'Neill Forebay at three locations
- Water can exit O'Neill Forebay at three locations
- Historical water quality data exists for only two of the four input/outputs.



How does water behave in the Forebay?

Does it move across the Forebay into San Luis Reservoir?



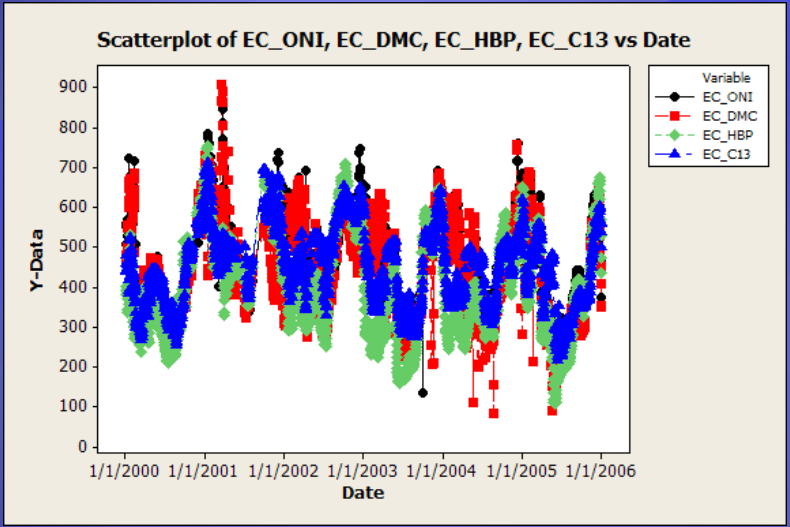
Does it 'Short Circuit' directly to the SWP?

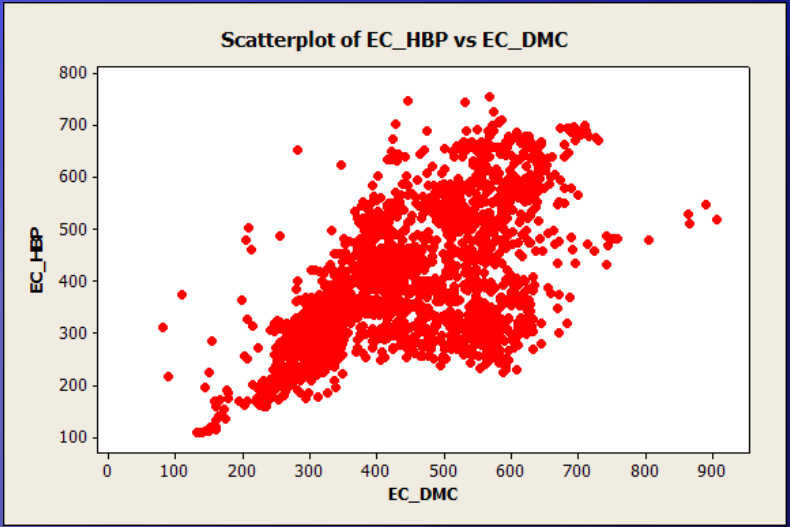
Or does it do something in between?

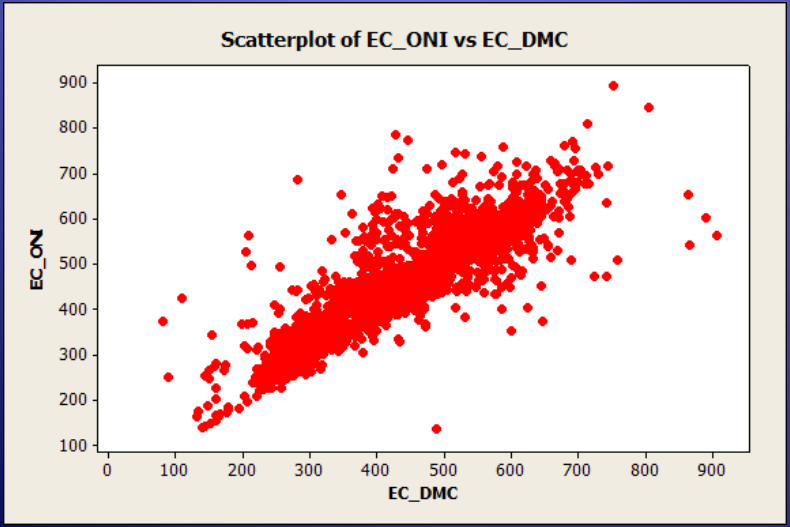
How will we investigate this?

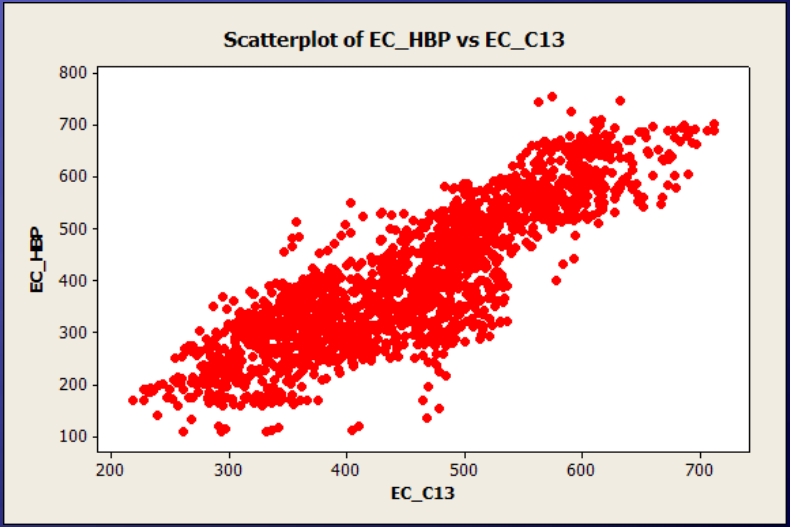
- First, the limited electrical conductance (EC) data available will be used to determine if a pattern of 'Short Circuiting' of CVP water into the SWP is detectable.
- If it is possible to detect sources of EC from the historical data, a year-long comprehensive monitoring study of EC patterns will begin when the four stations that detect EC concentrations at the inflows/outflows of O'Neill Forebay are operating.
- Following or concurrent to the comprehensive study of EC in O'Neill Forebay a proposed third study component may give more detailed information about water transport inside the forebay.

Initial Data



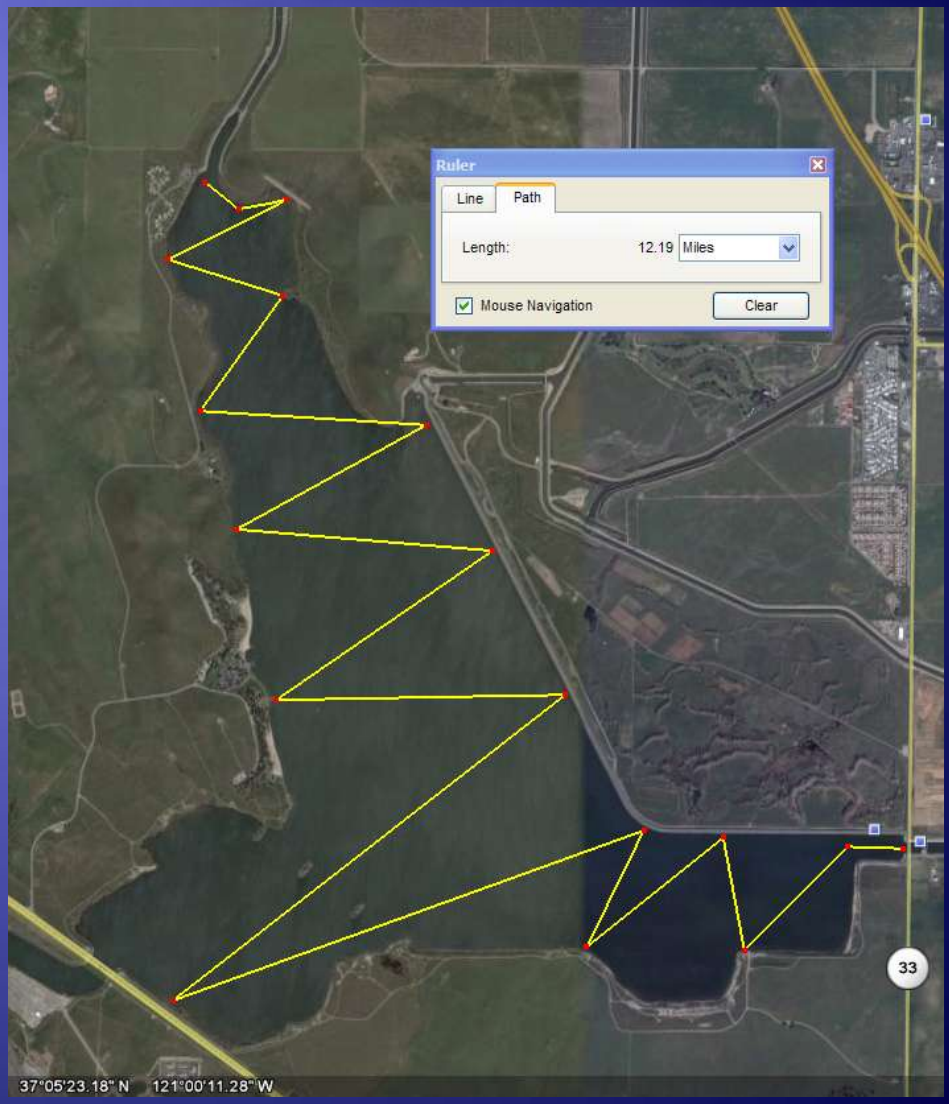






Possible Third Component

- Transects of the Forebay will be taken using gear similar to that used in the South Delta Salinity Study.
- Gradients of EC can be overlaid onto maps using GIS software.
- Multi-colored gradients will show where EC changes and where short-circuiting may be occurring under different operating scenarios.



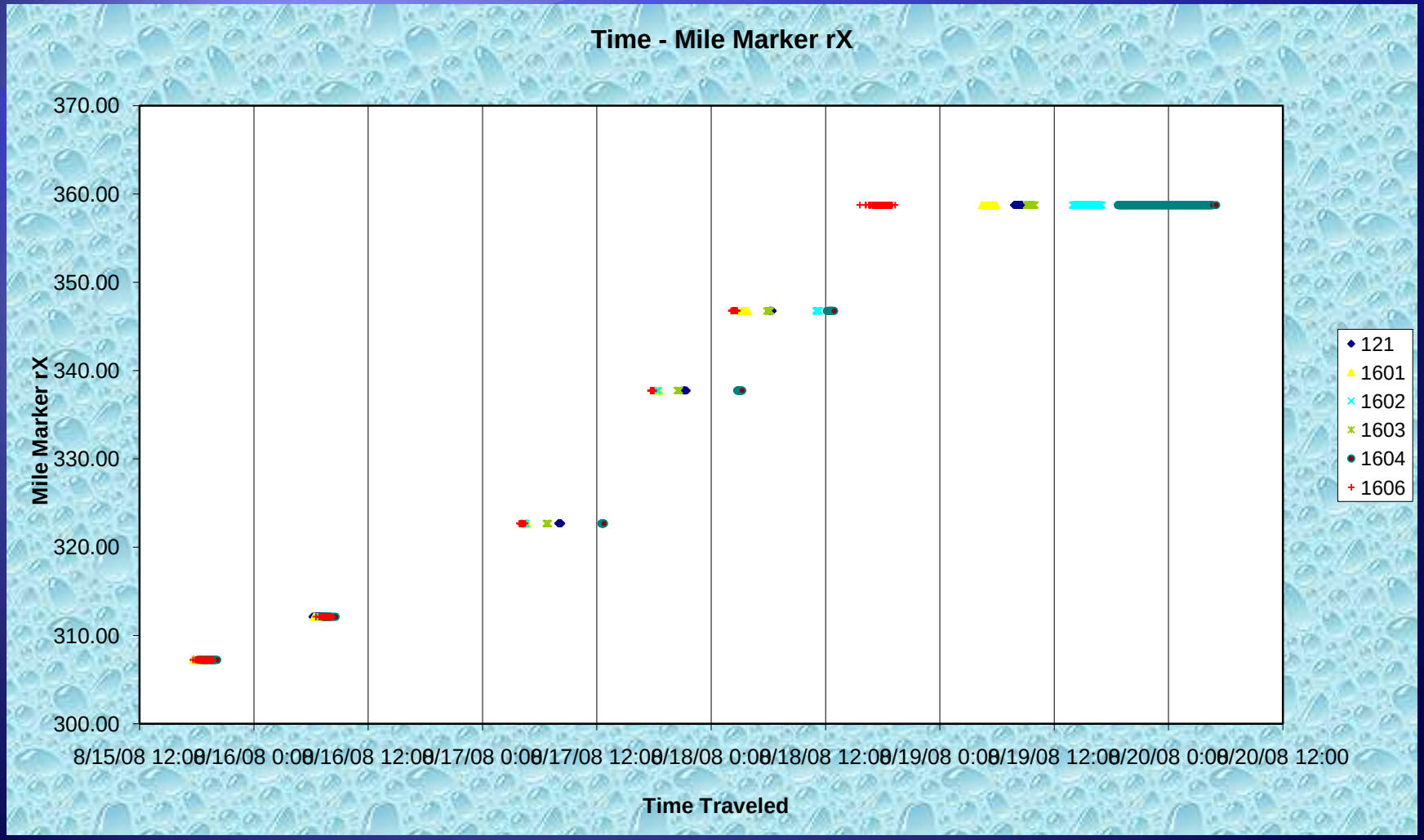
Smart Oranges and Dye Study

Smart Oranges Study

Purpose:

- To gather data on dispersion rates and travel times in the California Aqueduct that will help modelers develop more accurate models.
- Test a new method of particle tracking, where tracer dyes can not be used, using neutrally buoyant 'Smart Oranges' that send data to receivers placed in the aqueduct.

Dispersion of 6 of ten oranges over time



First Smart Orange Deployment

In the Summer of 2008 the first set of ten 'oranges' was deployed in the east branch of the SWP in the Antelope Valley

Much was learned in this first deployment.

- During a battle of 'Orange' vs. pumping plant you should always bet on the pumping plant
- Oranges can get detained while in transit
- When not detained, 'oranges' apparently disperse in the SWP at rates similar to dispersion rates of particles in typical river systems

However new questions arose:

- Were the observed dispersion rates due to hydrology or short term detentions of the oranges in transit?

The next deployment(s)

- Will be during the summer of 2009 when pumping is more regular.
- Will use more compact oranges that will (hopefully) be less likely to become detained.
- Will be accompanied by a Tracer Dye Study using Rhodamine WT (R-WT) and sensors that detect R-WT

Facts about Rhodamine-WT

- Rhodamine WT photo-decomposes.
- Rhodamine WT does not adhere to sediments, (It won't permanently dye the aqueduct red)
- Out of the bottle the dye comes as a 20% solution and is at 200 million ppb.
- The 'safe' level for human consumption is <370 ppb
- The dye is visible in a clear glass of water at >30 ppb
- The dye is visible in a clear reservoir at >10 ppb.
- EPA suggests that the dye concentrations be <10 ppb at the intake of a WTP
- The sondes, when configured properly detect the dye at concentrations >0.05 ppb
- 20 liters of dye will be enough to treat the entire volume of the pool just south of Dos Amigos at about 10 ppb.

Rhodamine-WT

Mixed with deionized water

Mixed with Sacramento River water

Why use both methods simultaneously?

- Tracer Dye Studies are well documented and common methods of determining dispersion rates and travel times of particles in aquatic systems
- To evaluate the effectiveness of the Smart Oranges method.
- To validate the initial dispersion rates calculated and travel times observed from the first Smart Oranges deployment.

Questions?