An Approach for Real-Time Evaluation of Savannah Harbor Deepening Mitigation Effectiveness for the Protection of Freshwater Tidal Marshes

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Presentation Outline

- Savannah River Water Issues
  - Harbor Deeping
- Salinity Intrusion Primer
- Savannah Harbor Deeping
  - Salinity Intrusion Mitigation
- Approach to Real-time Mitigation Evaluation
- Real Data Reality

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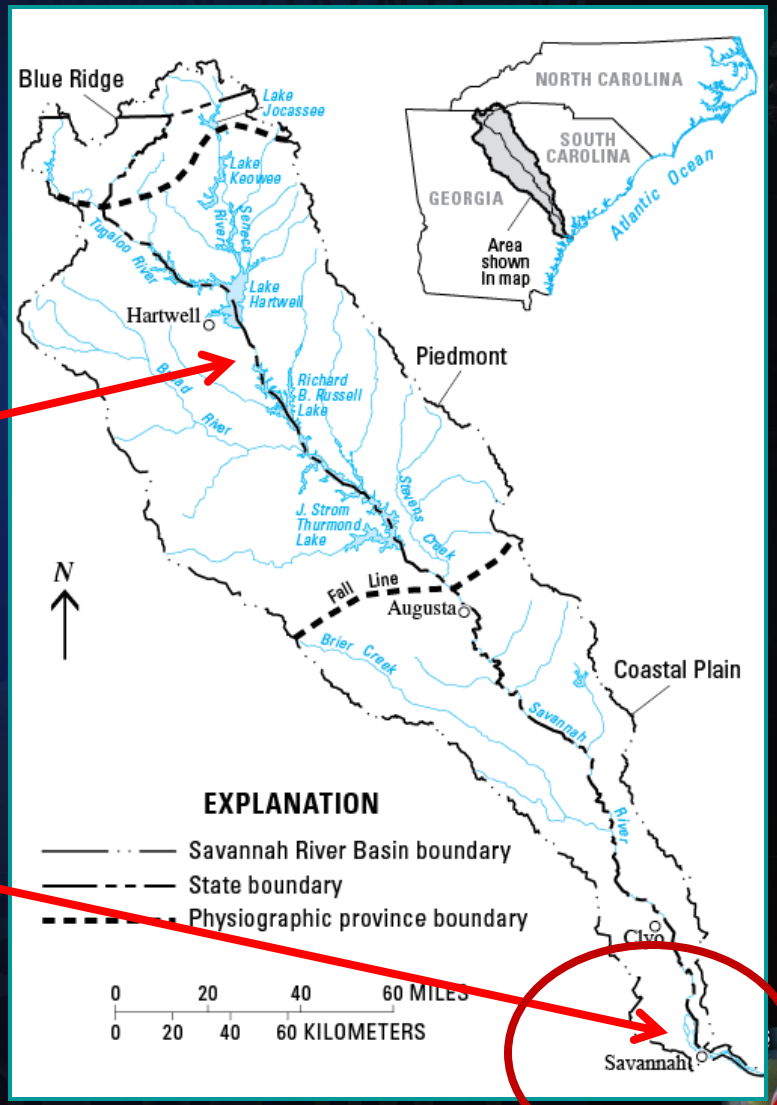
Savannah River Basin

- Collision of issues
  - Power production vs. Water supply
  - Lake levels vs. Drought response
- Savannah Lake
  - DO standard
  - DO TMDL
  - Deepening of Savannah Harbor
- Savannah Harbor
  - Salinity intrusion



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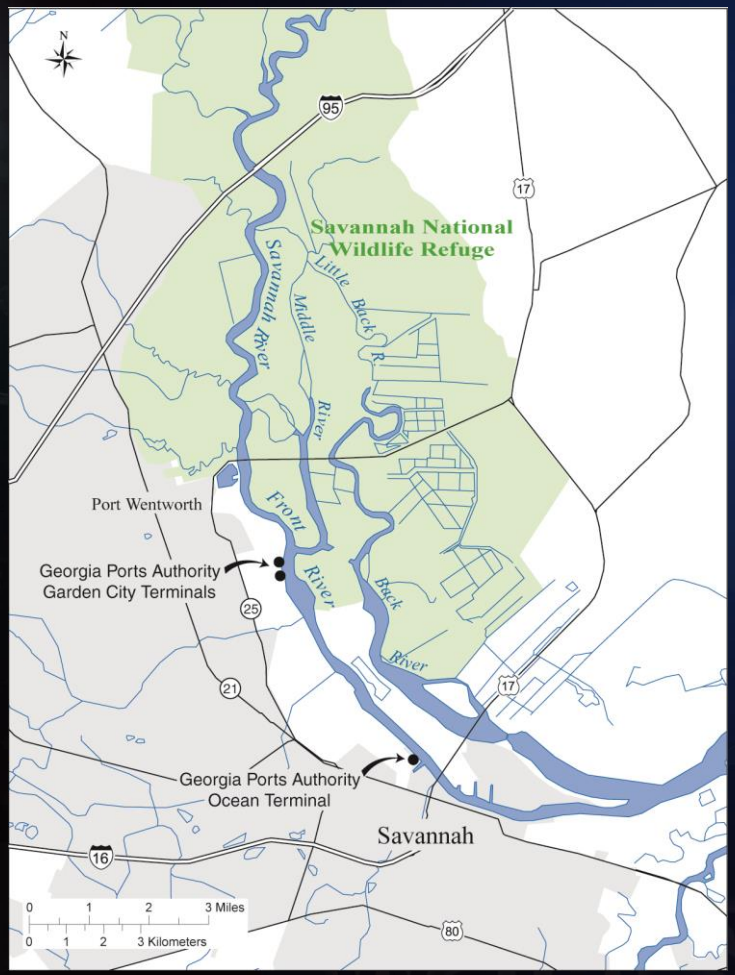
Savannah Harbor Expansion Project (SHEP)



Mitigation plan to minimize salinity impacts to freshwater tidal marshes

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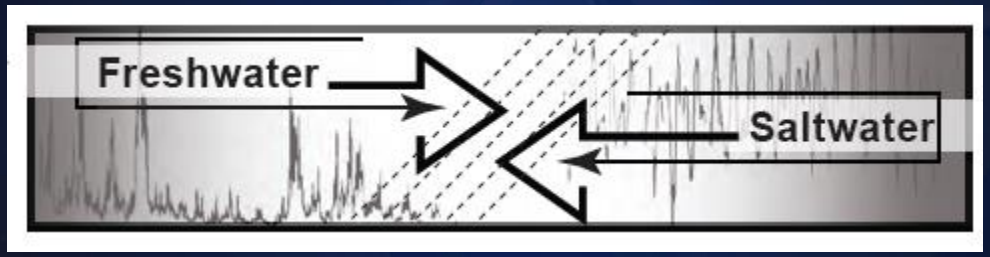
Salinity Dynamics Primer

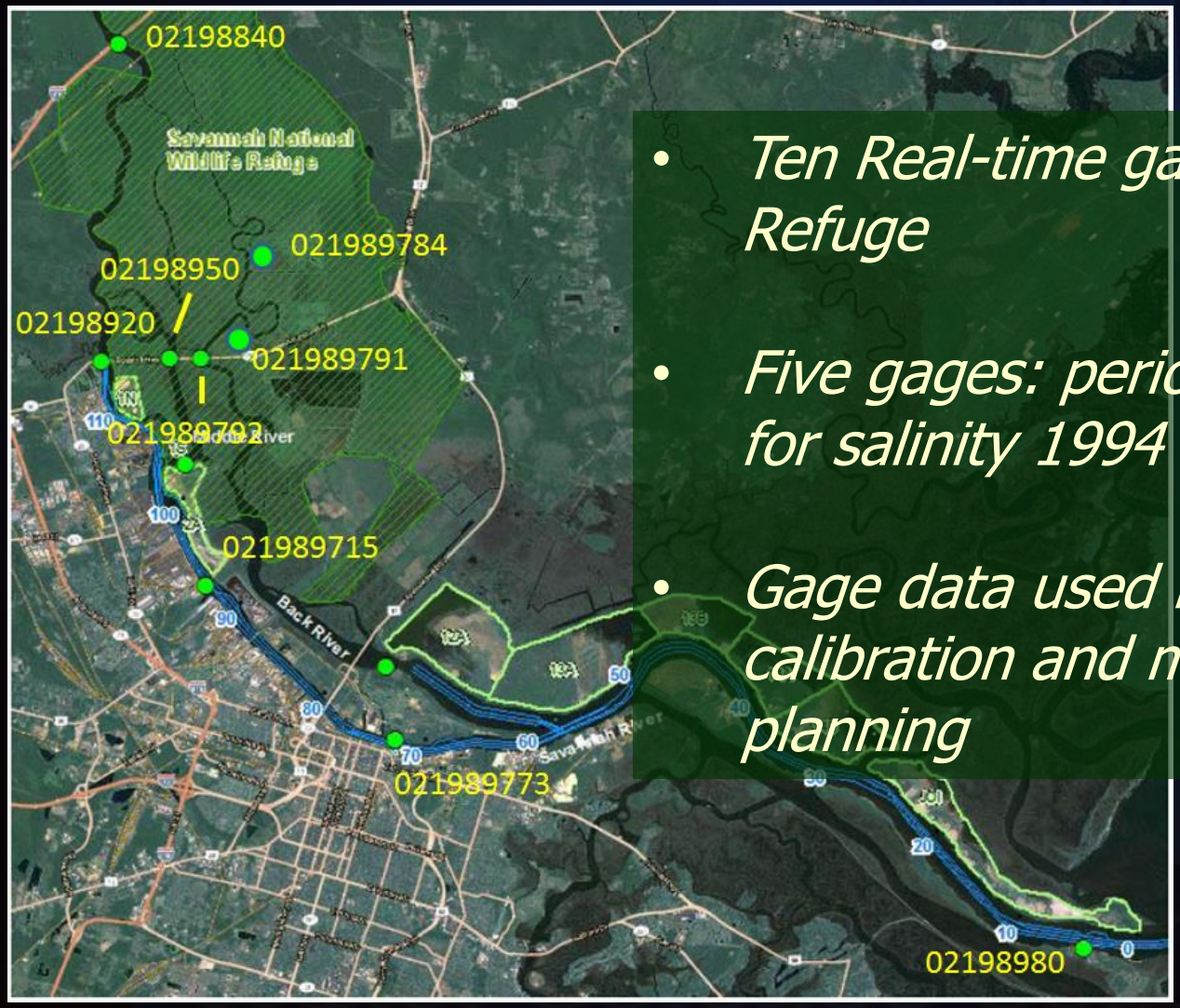
Savannah River Flow



Savannah Harbor Water-Level

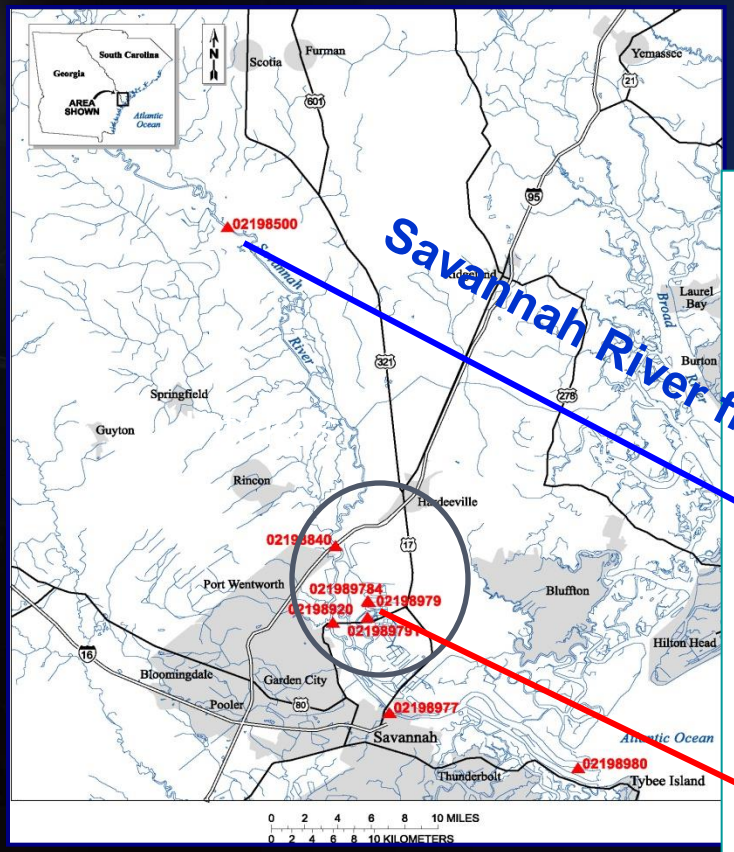
Salinity response due to interaction of riverine and tidal forcing

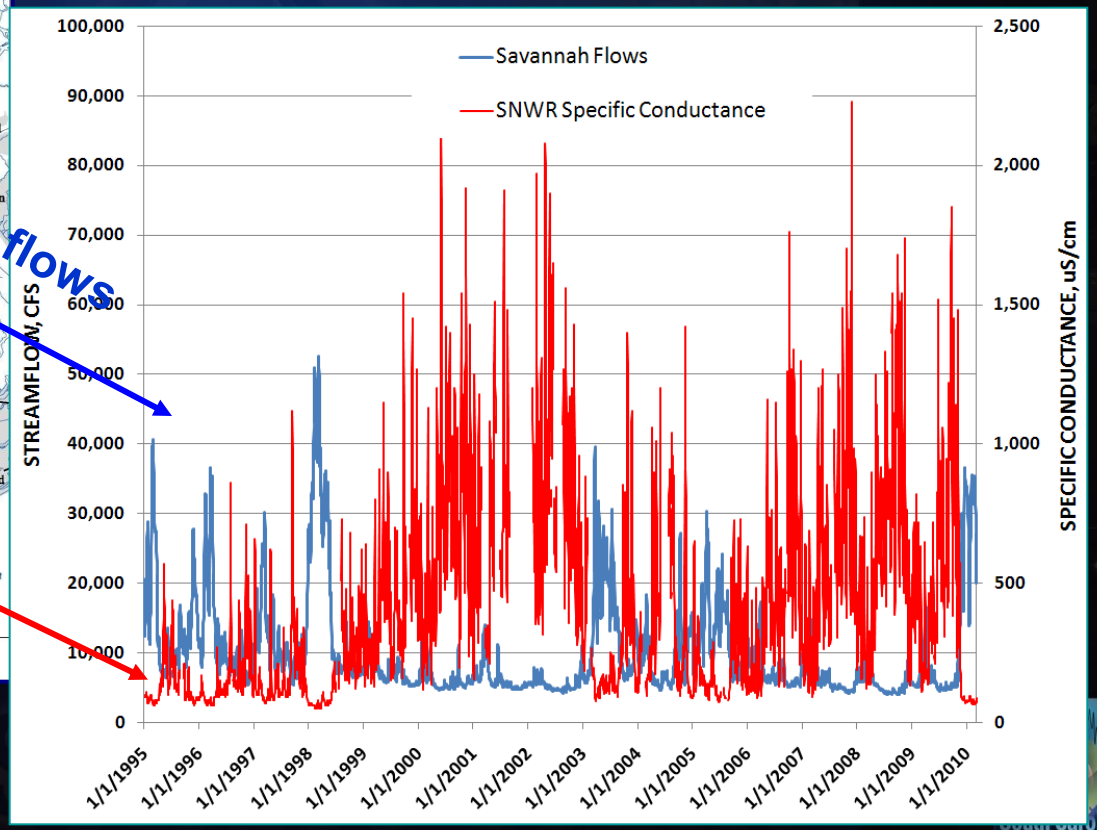
USGS Real-Time Network



- *Ten Real-time gage in the Refuge*
- *Five gages: period of record for salinity 1994 to present*
- *Gage data used for model calibration and mitigation planning*

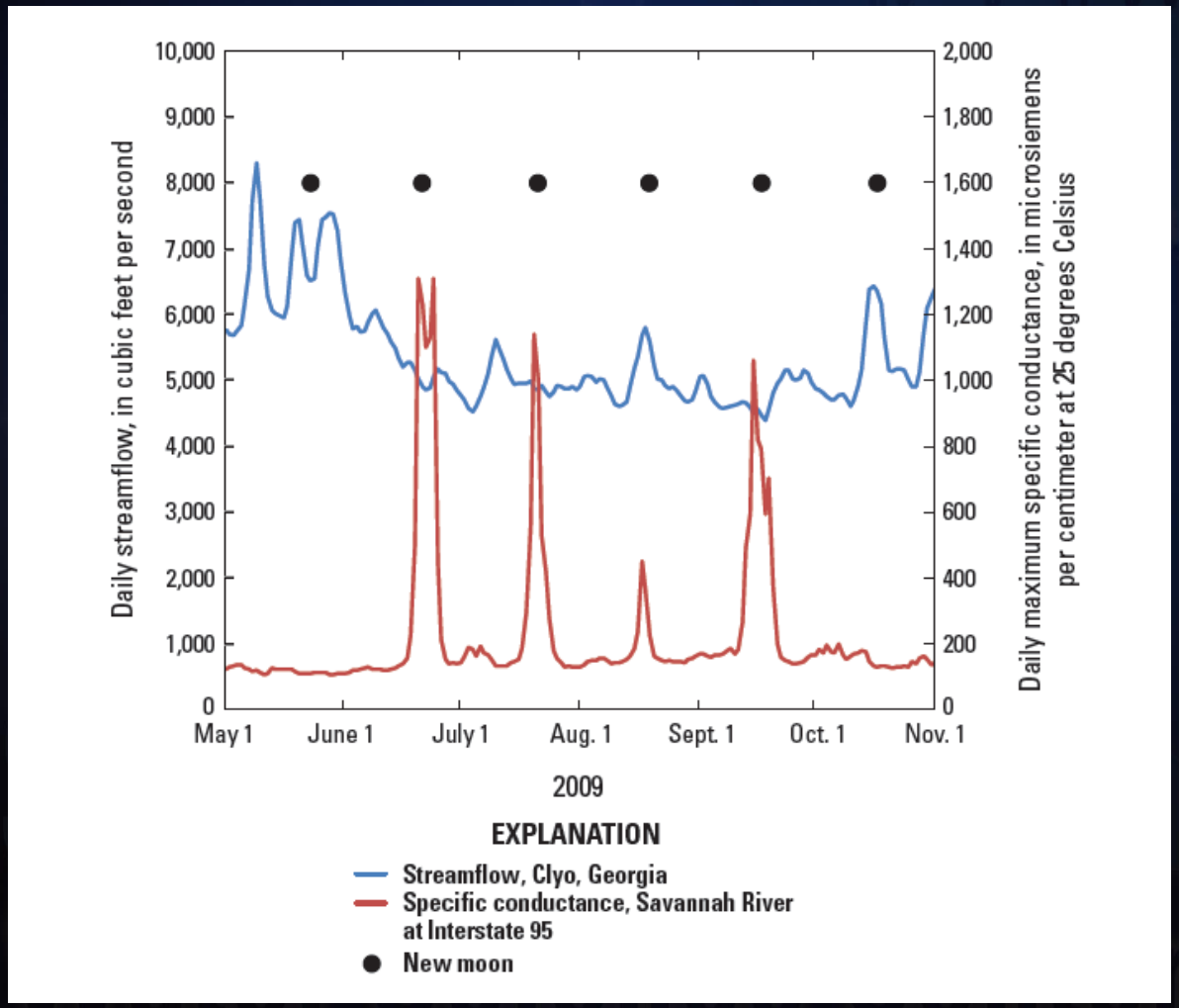
Flow and Specific Conductance Savannah River





Salinity Intrusion

Convergence of Conditions



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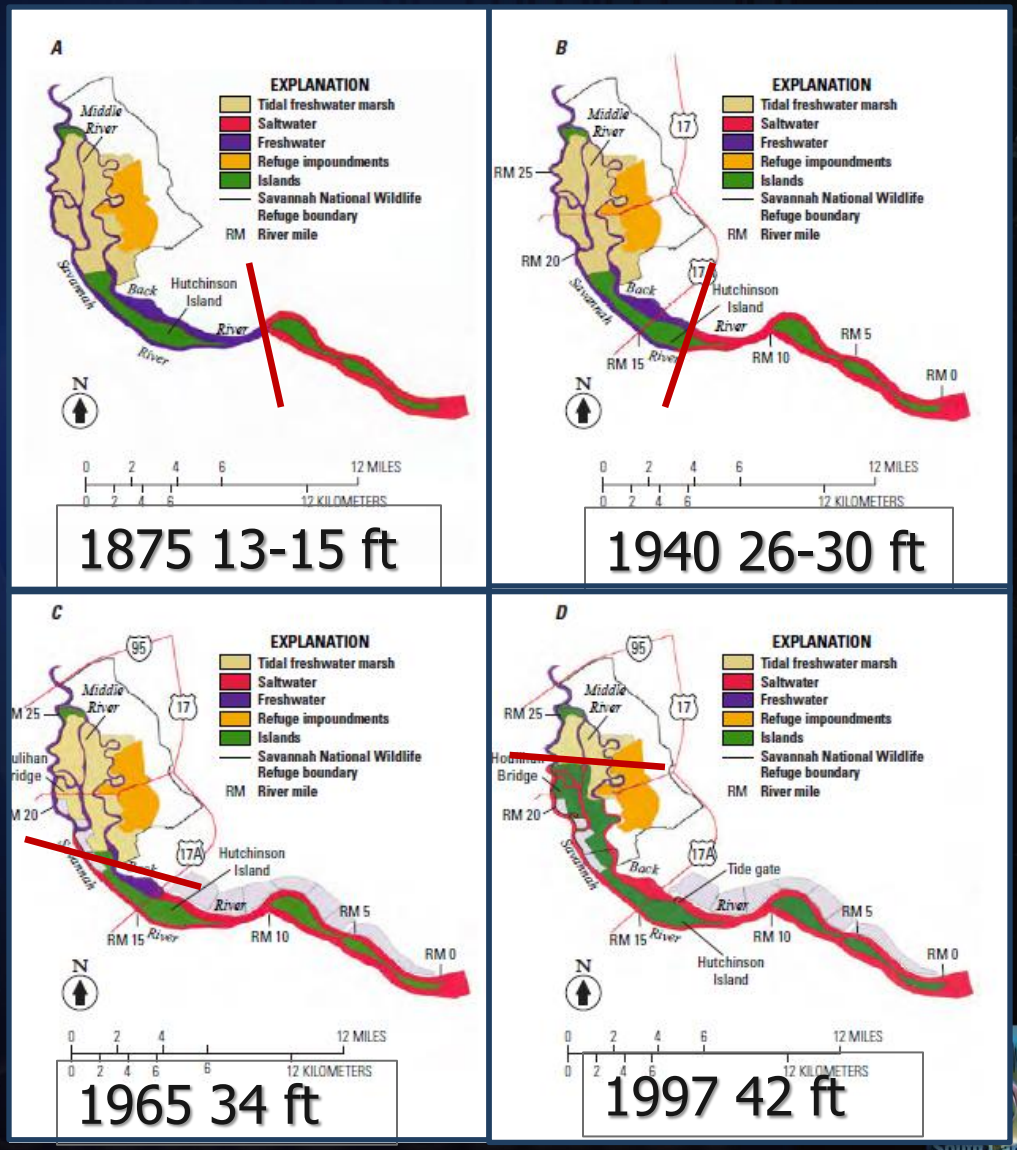
History of Harbor Deepening & Salinity Intrusion

Salinity = *f*(flow, tidal condition, channel depth)



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SHEP Mitigation Plan

Plan developed using 3D hydrodynamic and water-quality model (EFDC/WASP)

- Deepen to 47 feet
- Divert freshwater to Little Back River
- Close connections to Middle and Savannah Rivers

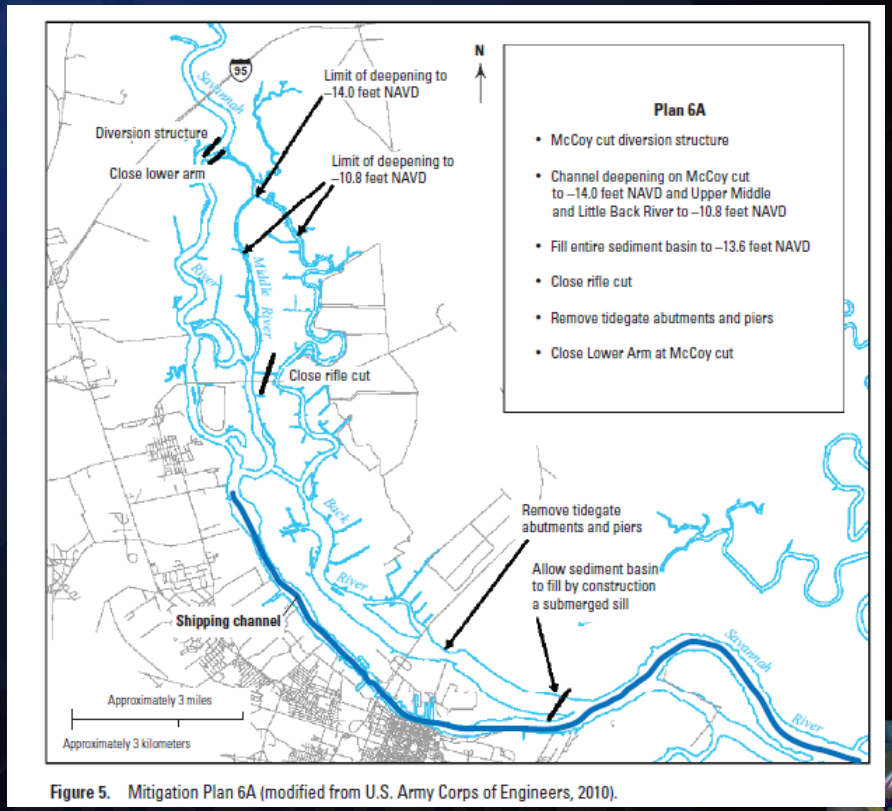

Figure 5. Mitigation Plan 6A (modified from U.S. Army Corps of Engineers, 2010).

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Real-Time Mitigation Evaluation Approach

Salinity = *f*(flow, tidal condition, channel depth)

Simplify:

1. Tidal condition is the new moon (spring tides)
2. Channel depth – simulated with the 3D model (with and without project)

Salinity = *f*(flow)

Real-Time Mitigation Evaluation Approach (continued)

$$\text{Salinity} = f(\text{flow})$$

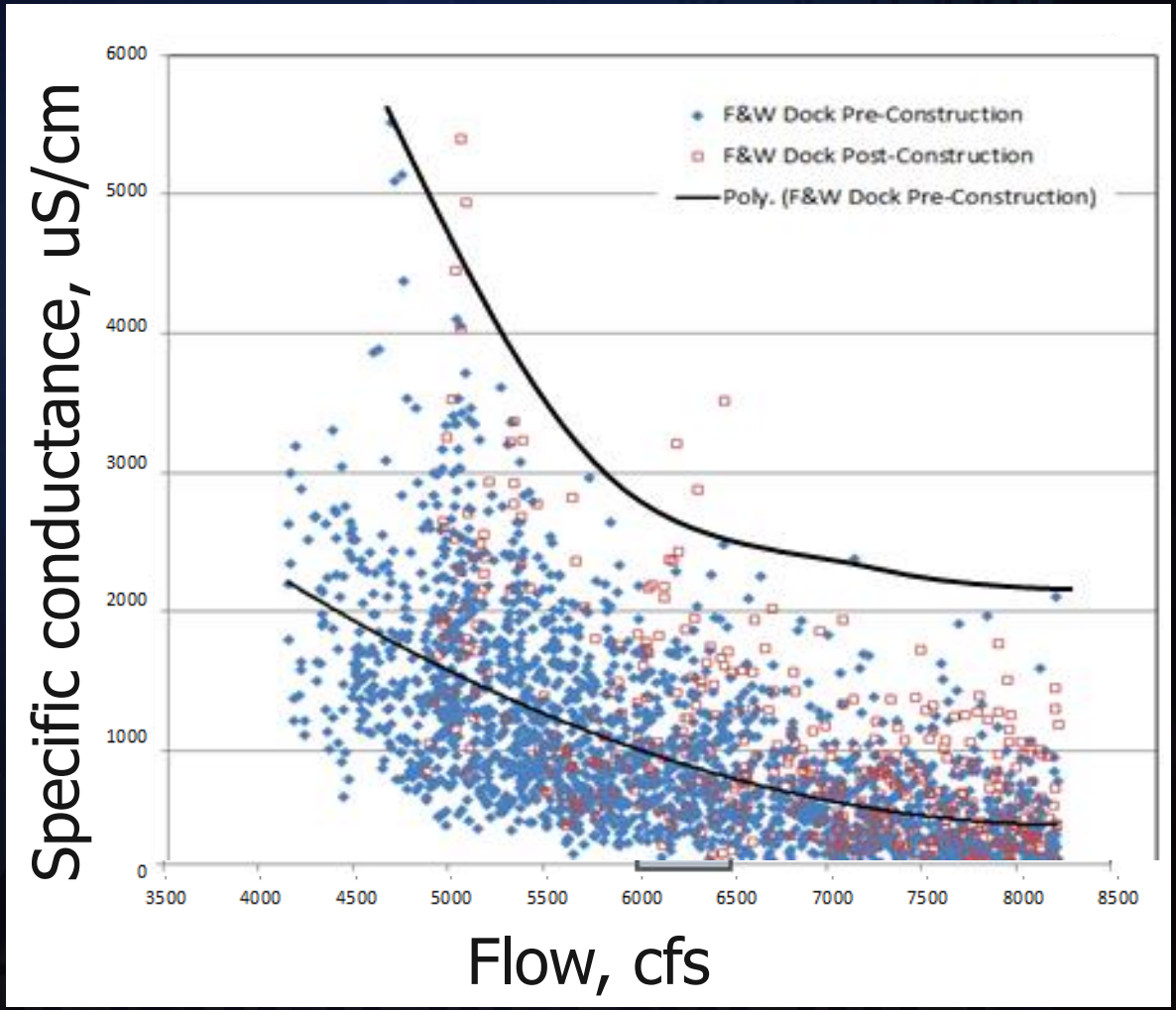
- Scatter plots
  - Historical manifestation of process physics
  - Use plots to establish upper threshold for performance measure
  - Use plots to compare
    - Historical conditions, model calibration, mitigation scenarios, and post-deepening conditions

Example: Little Back River

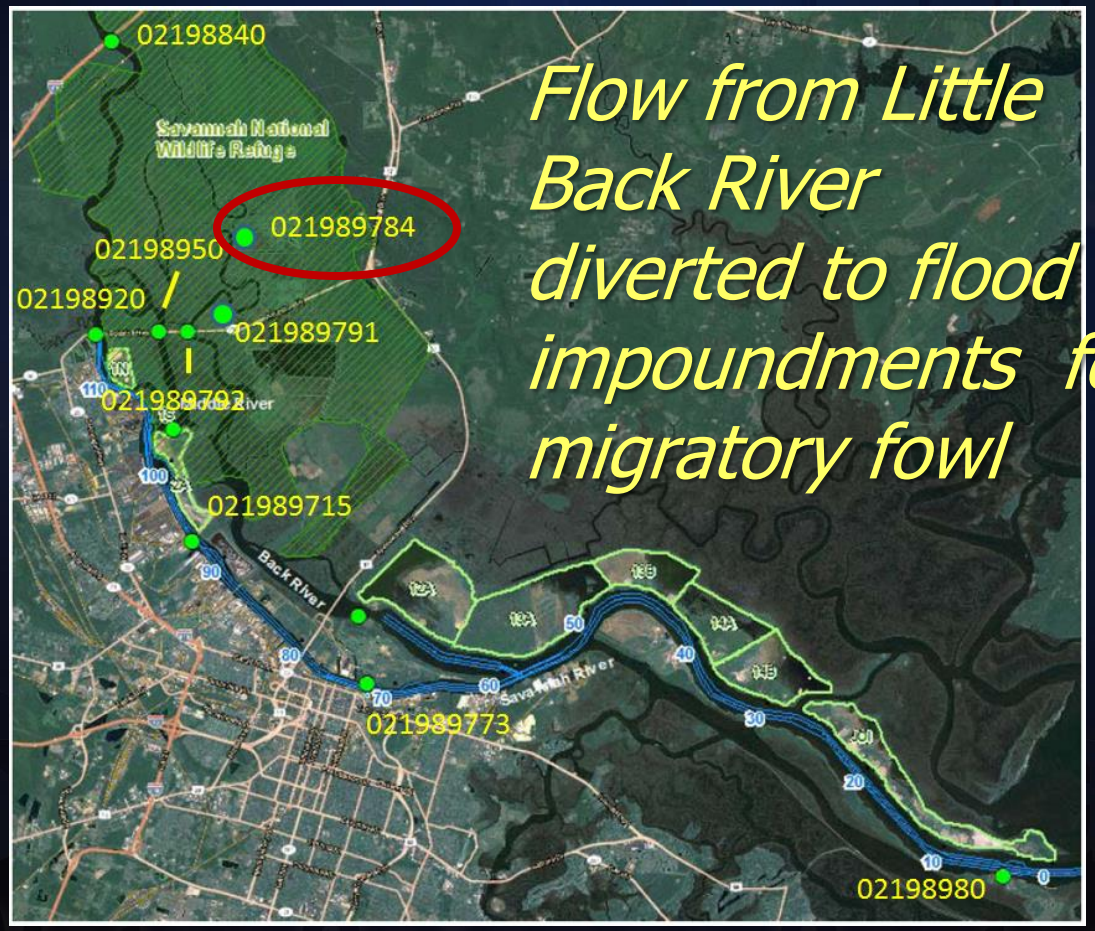
Range of salinity for flow range is due to tidal conditions

Envelop curve to set upper threshold

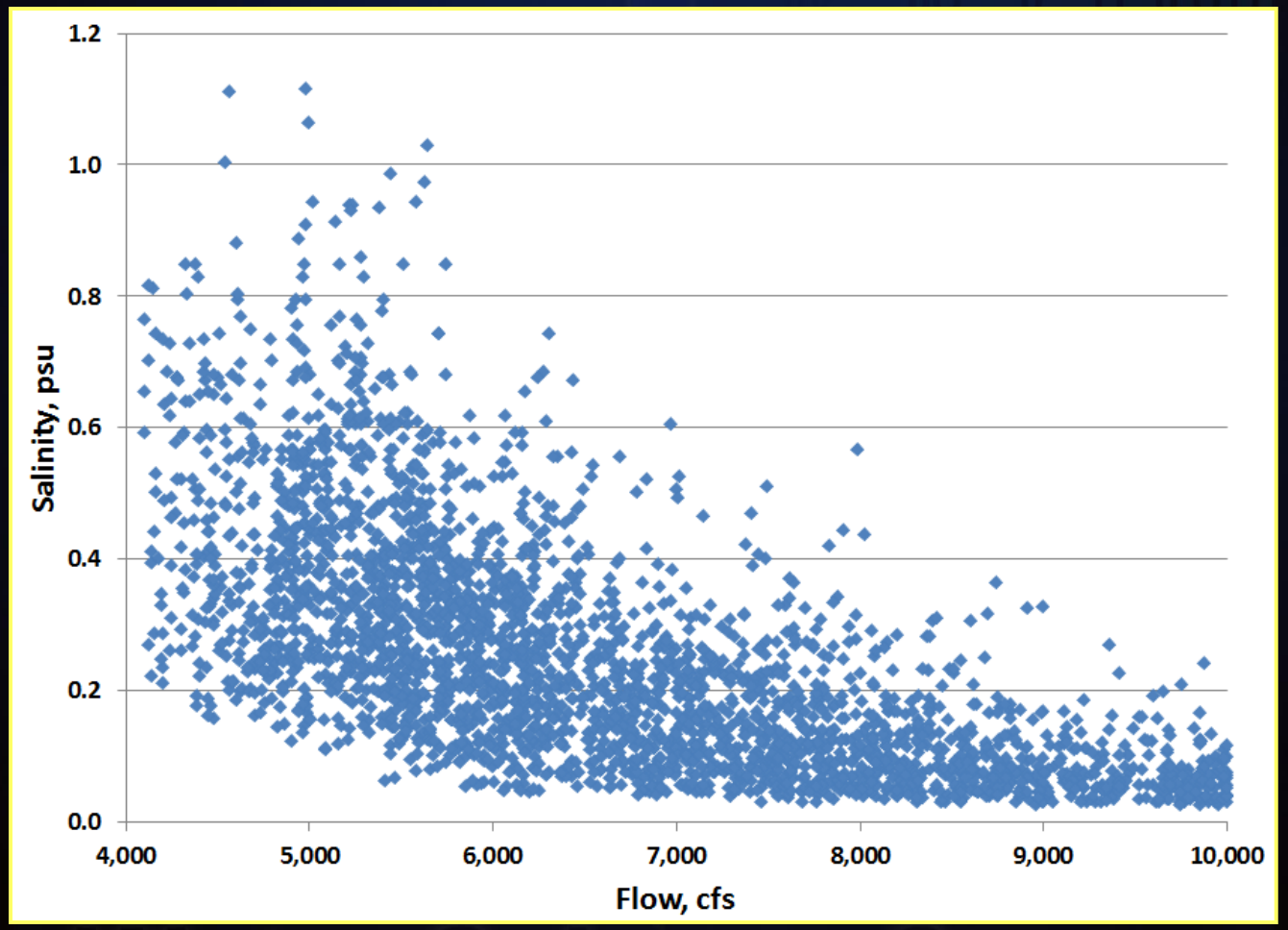
Use curve to compare with model data or real-time data



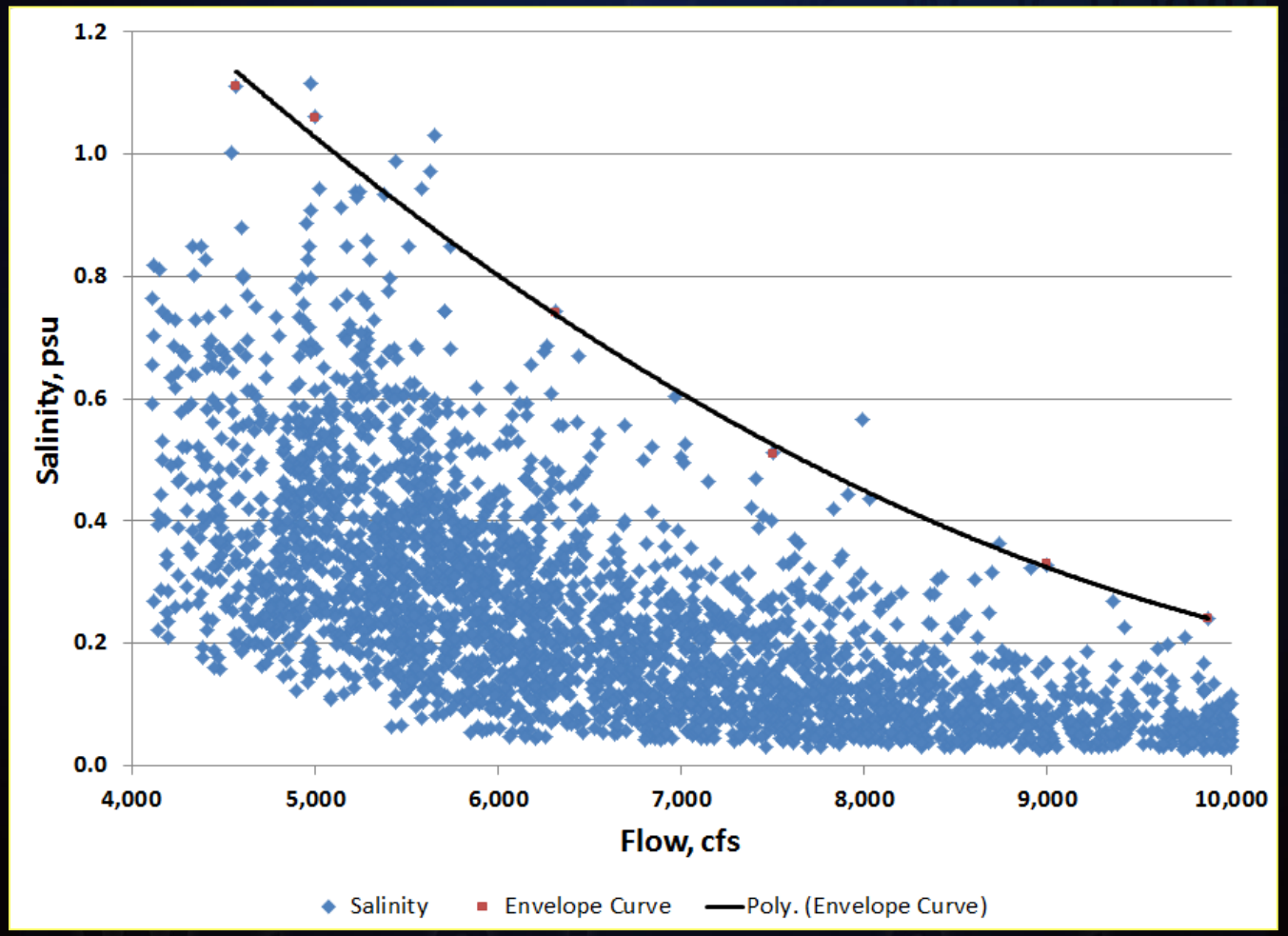
Real Life: Little Back River at Lucknow Canal



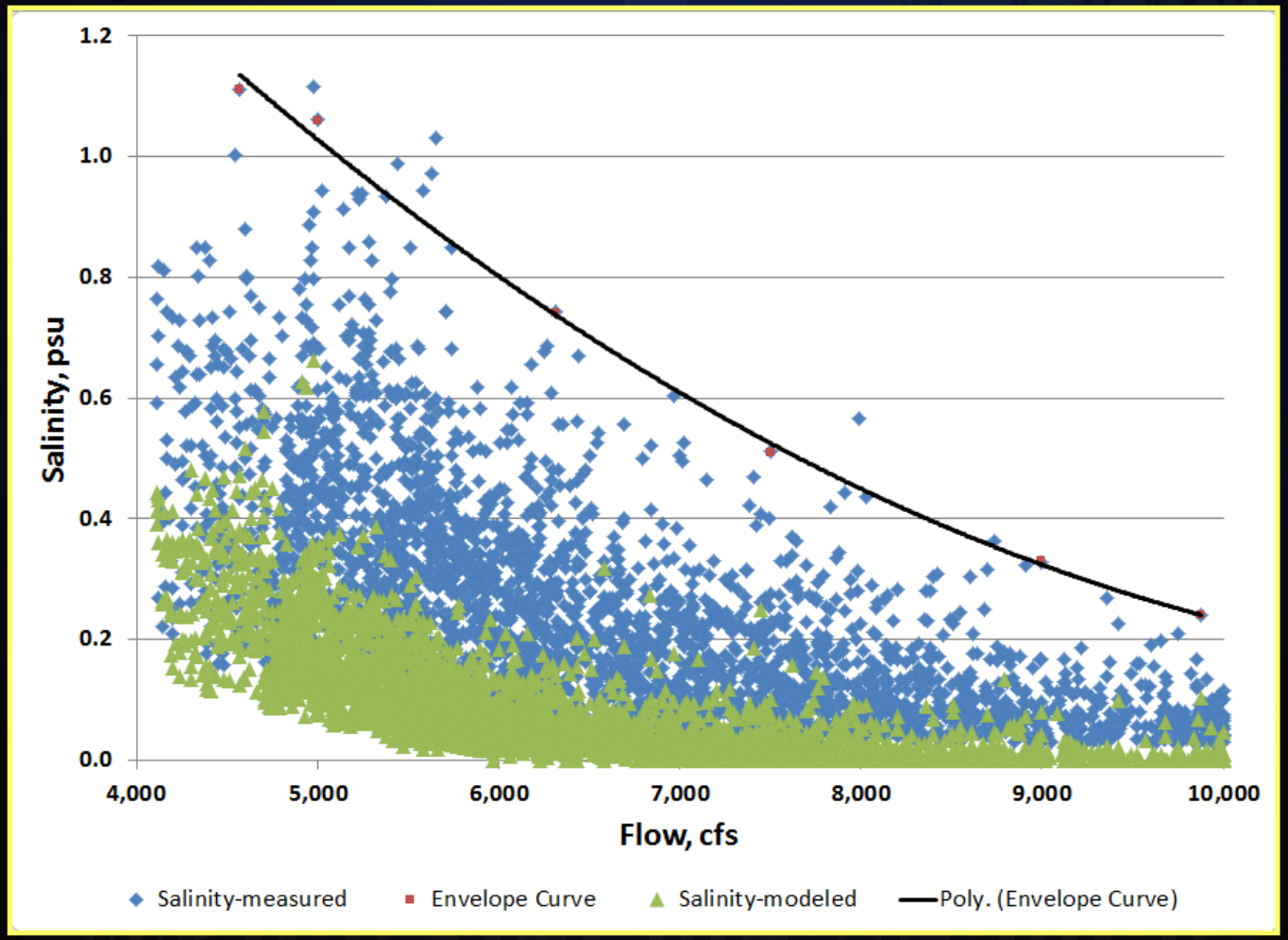
Measured Salinity: Lucknow Canal



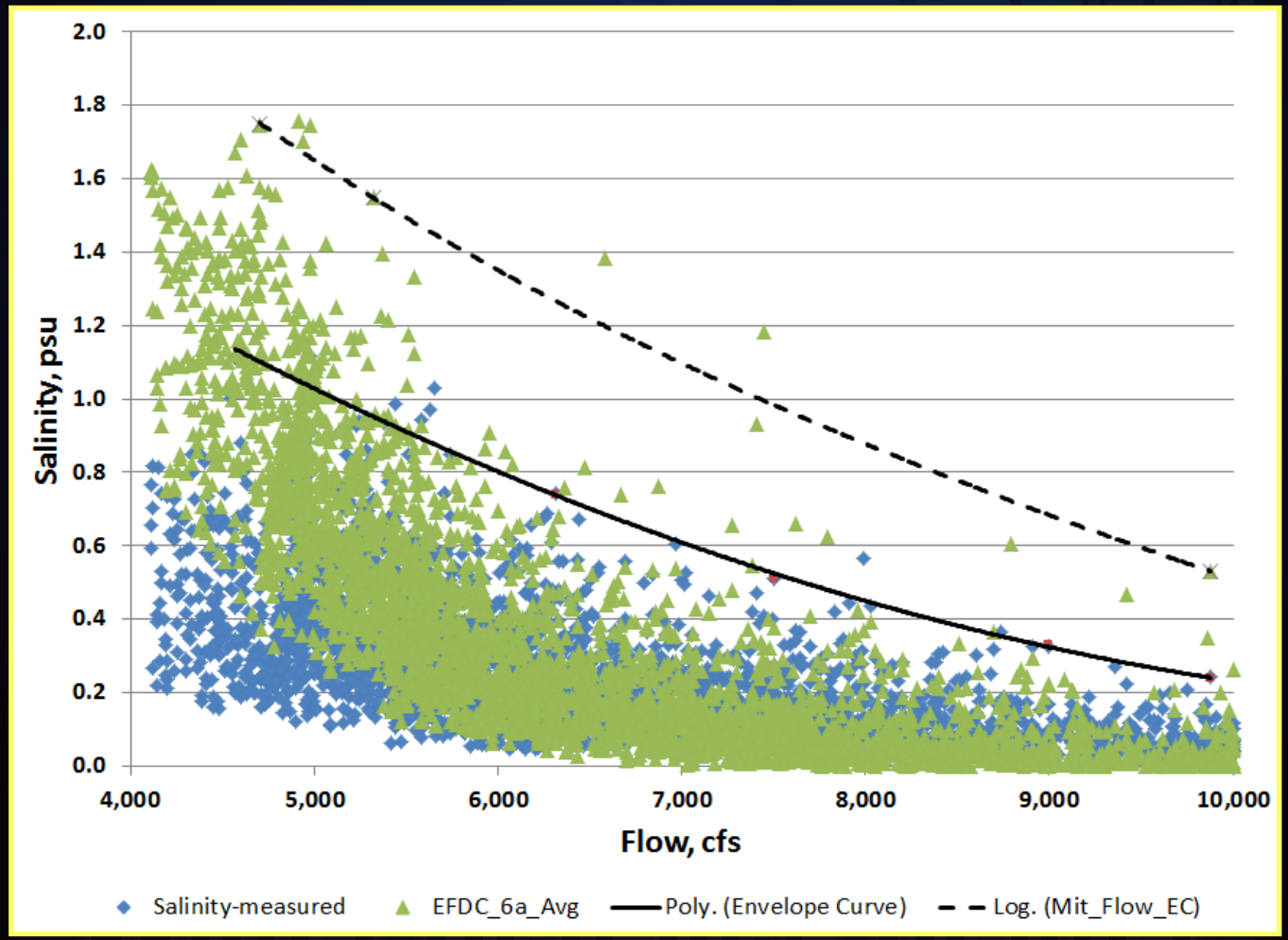
Measured Salinity & Envelope Curve



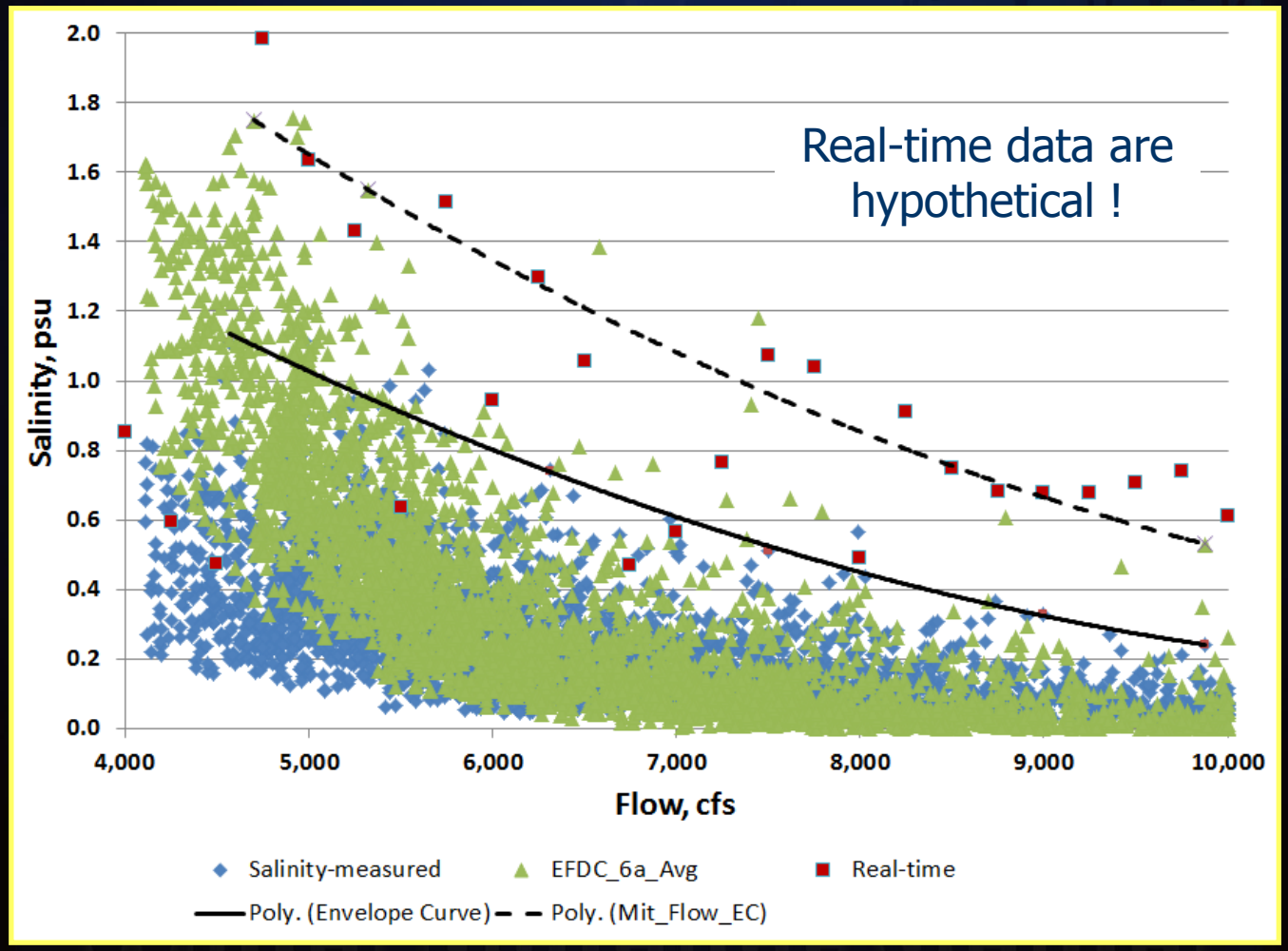
Measured & Modeled Salinity & Envelope Curve



Measured & Mitigation Salinity & Envelope Curves



Measured & Mitigation Salinity & Envelope Curves & Real-time Data



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Summary

- Continuous data used to calibrate models and develop mitigation plans
- Understand system dynamics to correlate critical parameters
- Correlation (scatter plots) can be used to evaluate planning tools and decisions
- Correlation can be used for real-time evaluation of mitigation plan

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Questions

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