

**Salton Sea Ecosystem  
Restoration Plan  
Inflows/Modeling Working  
Group**



**October 28, 2005  
San Diego, CA**

# **Agenda**

- ◆ **Recap of previous meeting**
- ◆ **Update on annual inflows**
- ◆ **Spatial distribution of inflows**
- ◆ **Monthly inflow patterns**
- ◆ **Recent refinements to hydrologic model**
- ◆ **Historical model calibration and validation**
- ◆ **Hydrologic model schematics for major alternatives**
- ◆ **Deterministic model application**
- ◆ **Stochastic model development and application**
- ◆ **Discussion**

# **Recap of Previous Meeting**

- ◆ **Overview of hydrologic modeling objectives**
- ◆ **Summary of model capabilities and limitations**
- ◆ **Generalized CALSIM software overview**
- ◆ **Enhancements incorporated for Salton Sea model**
- ◆ **Salton Sea model formulation**
- ◆ **Model demonstration and usage**
- ◆ **Deterministic vs stochastic applications**
- ◆ **Future model development tasks**

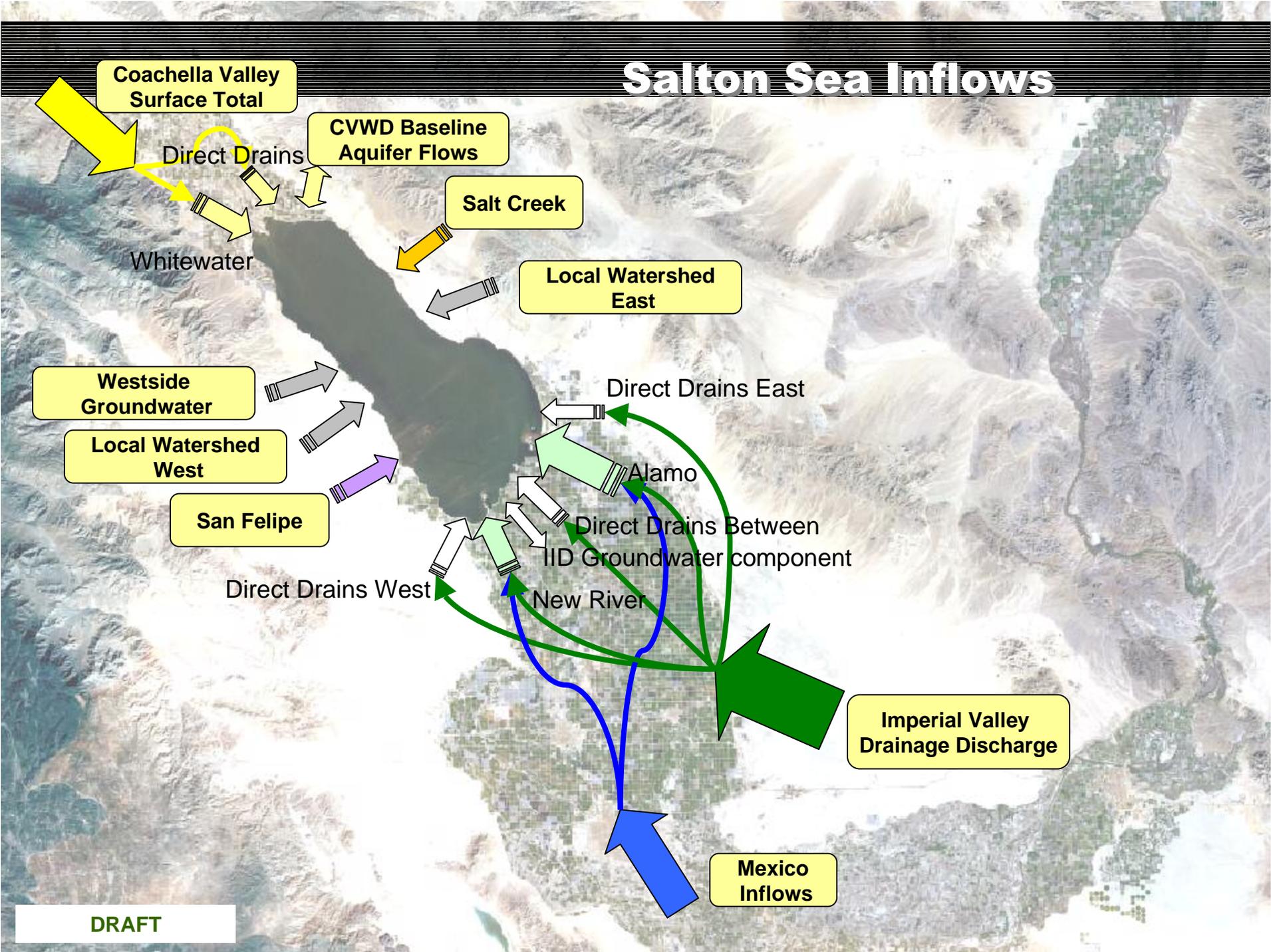
# **Update on Inflows Development**

- ◆ **Hydrology report being developed; will be released within the next several weeks**
- ◆ **Minor changes to future inflow projections for subsequent re-use**
- ◆ **Refined climate projections requested from Scripps Institute for better spatial coverage**

# **Spatial Distribution of Inflows**

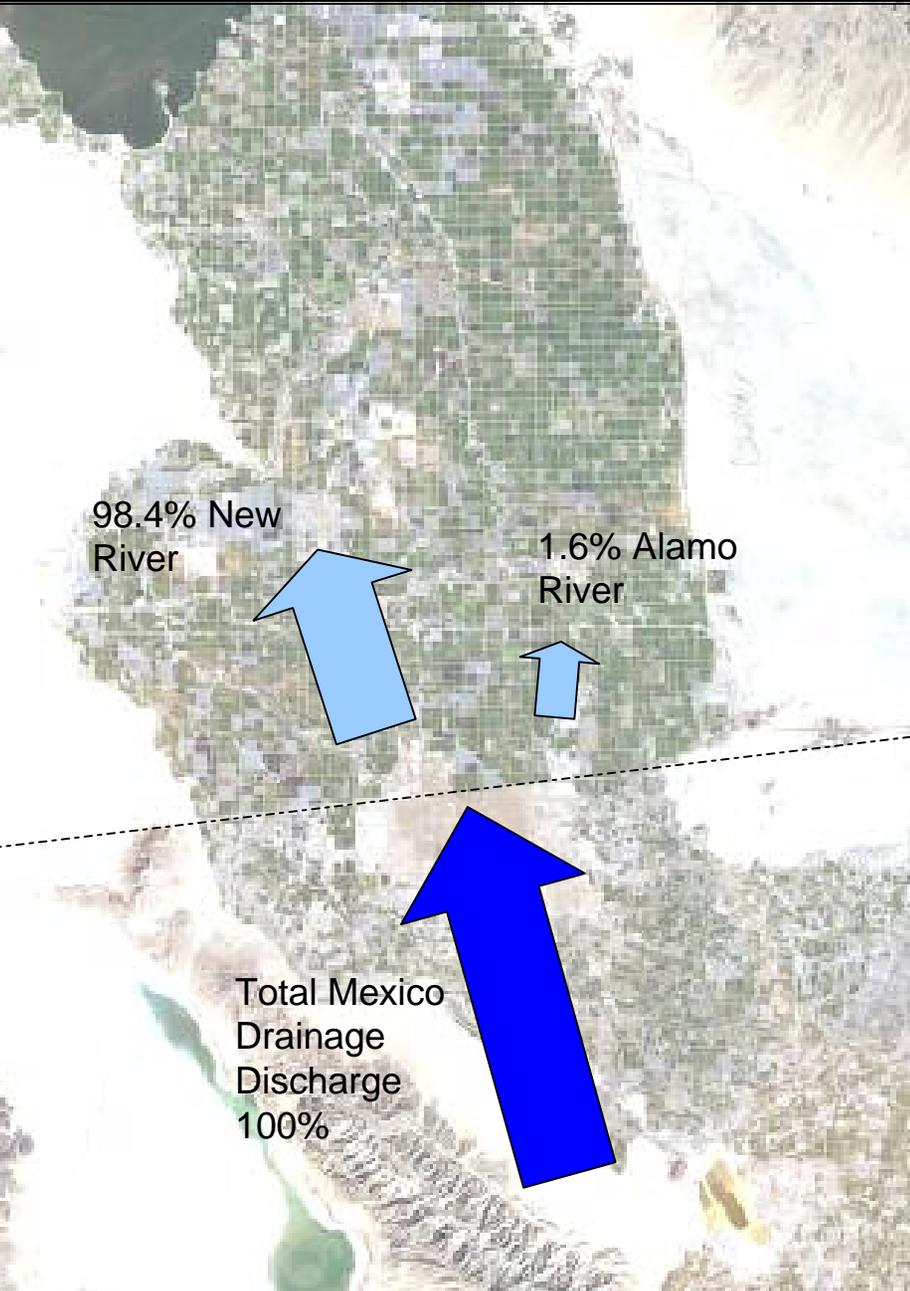
- ◆ **Several sources of information provide aggregated inflows**
  - **Imperial Valley contributions**
  - **Coachella Valley surface water**
  - **Mexico contributions**
- ◆ **Spatial disaggregation required to analyze alternatives**
- ◆ **Distributions based on historical data**

# Salton Sea Inflows

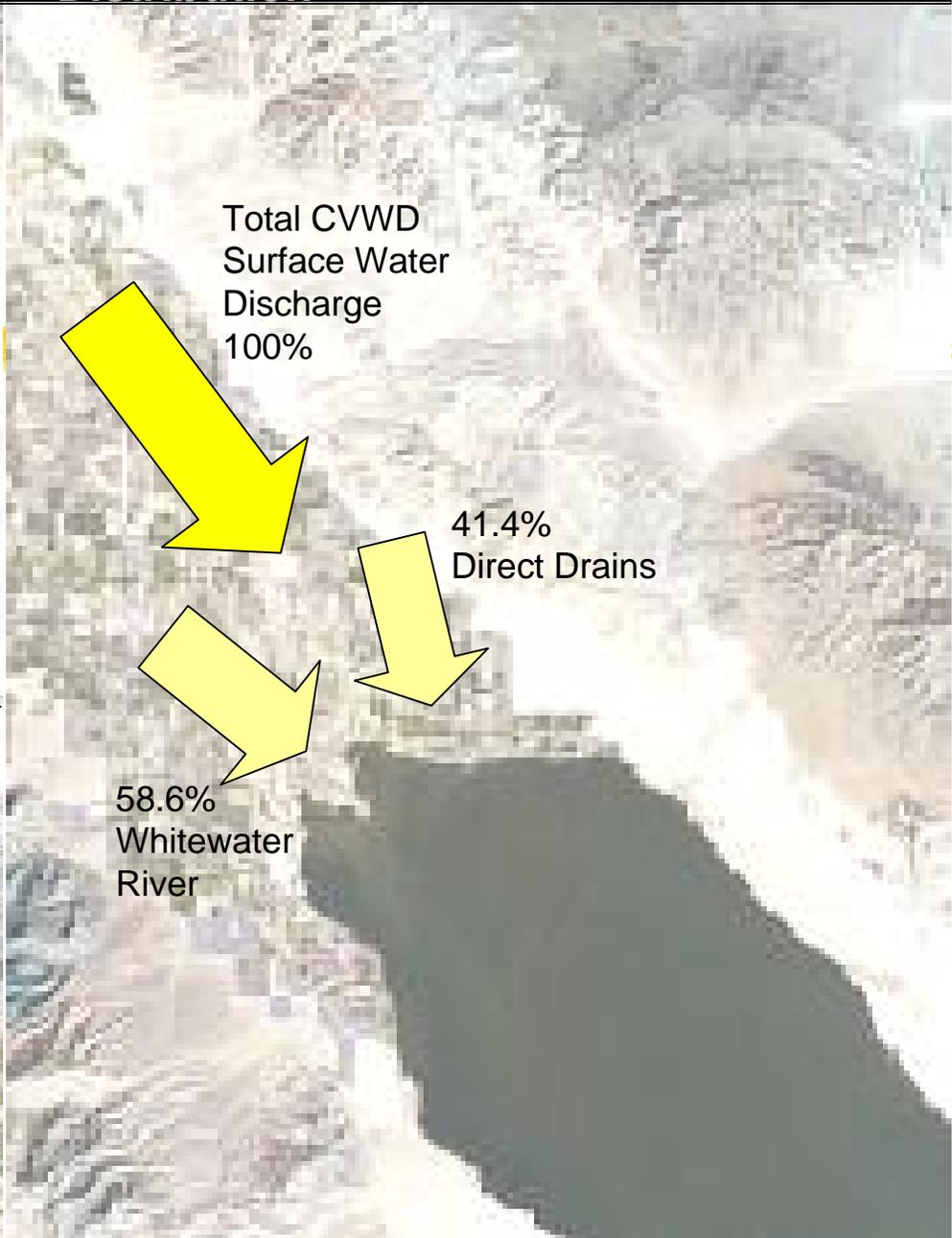


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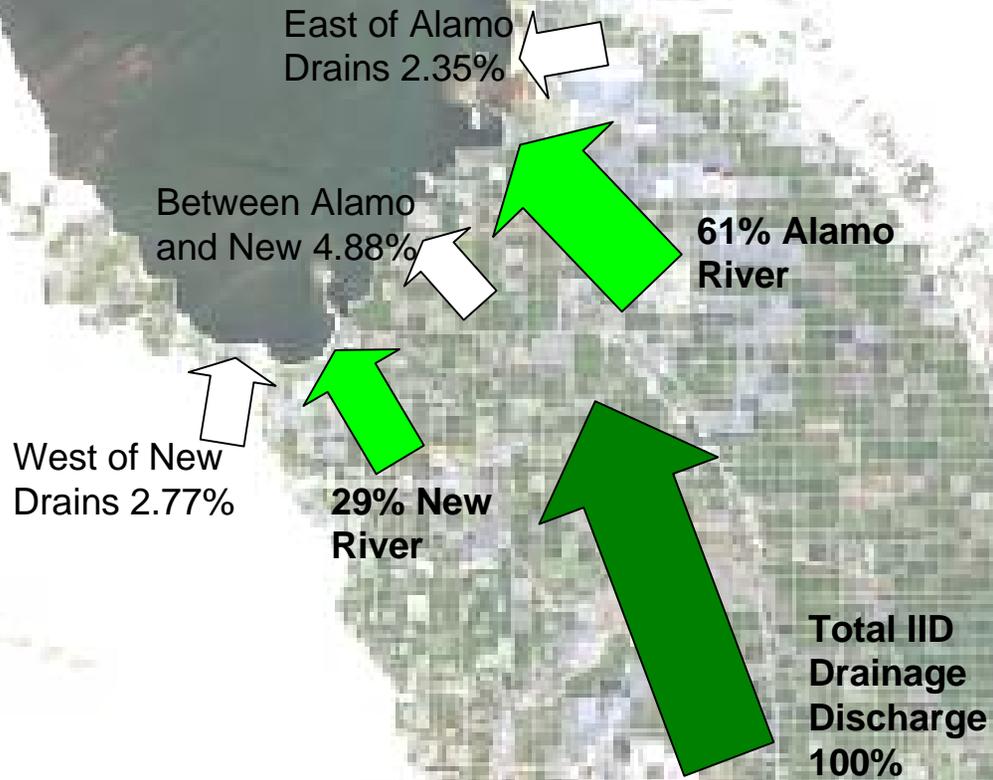
# Total Mexico Inflow Distribution



# Total CVWD Surface Water Inflow Distribution



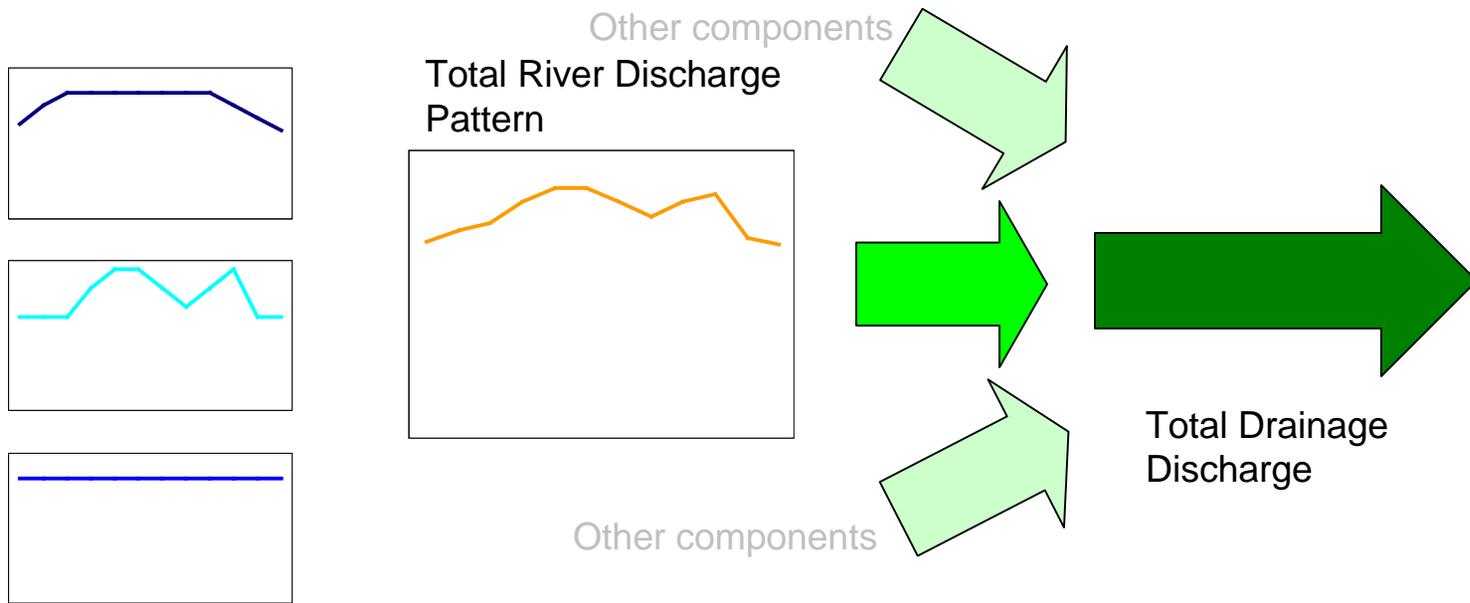
# Total IID Drainage Inflow Distribution



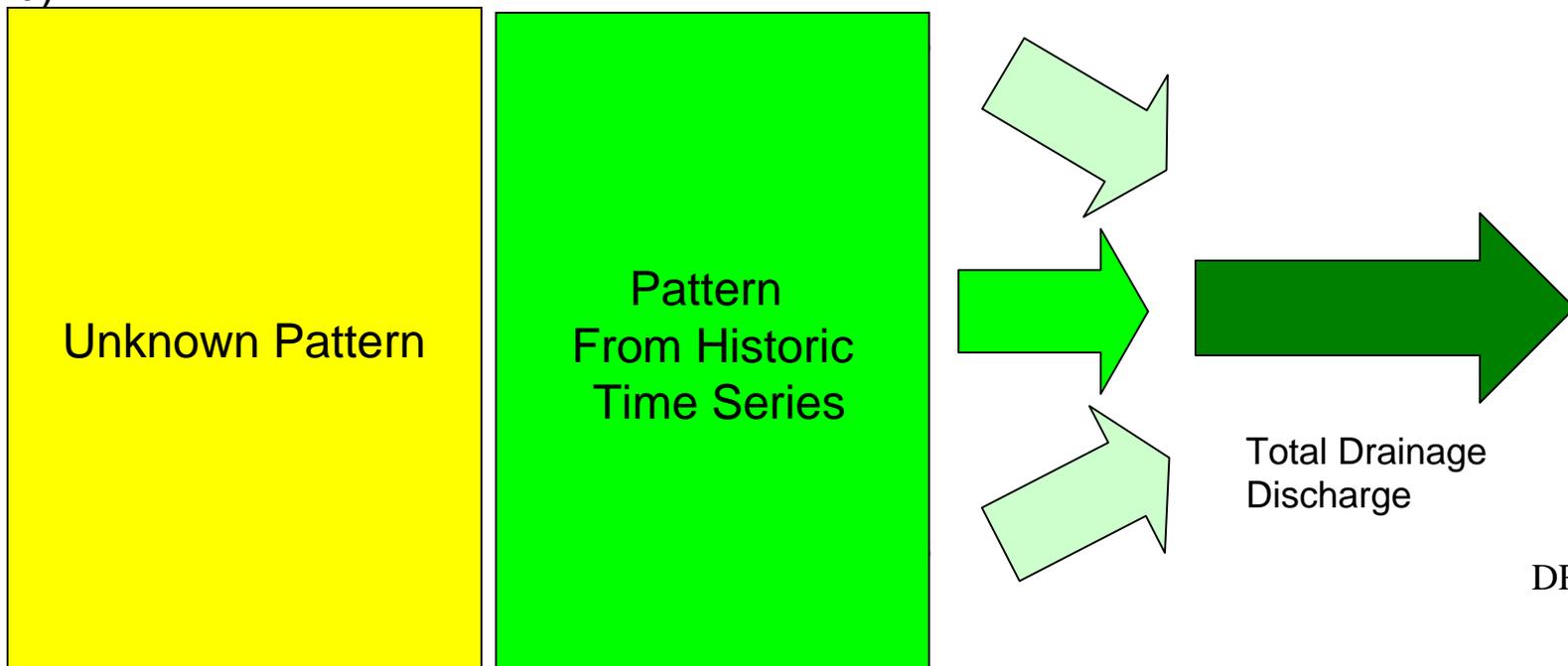
# **Monthly Inflow Patterns**

- ◆ **Hydrology developed on annual basis**
- ◆ **Down-scaling of hydrology to monthly time step is desired for greater temporal detail**
- ◆ **Historical flows ranked into 5 bins (lowest to highest)**
- ◆ **Monthly patterns, expressed as percent of annual volume, developed for flows in each bin**
- ◆ **Reshaping of patterns may be considered**

a)

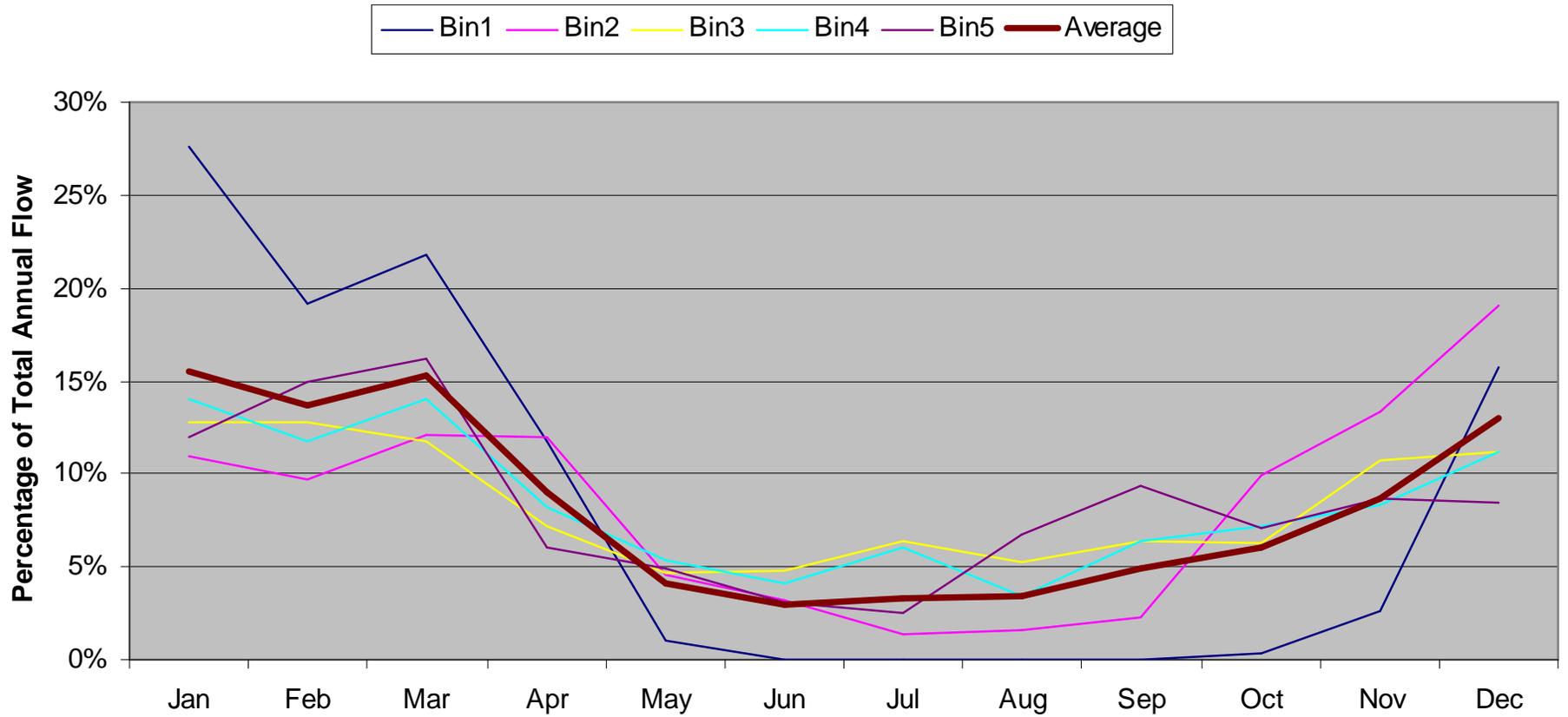


b)



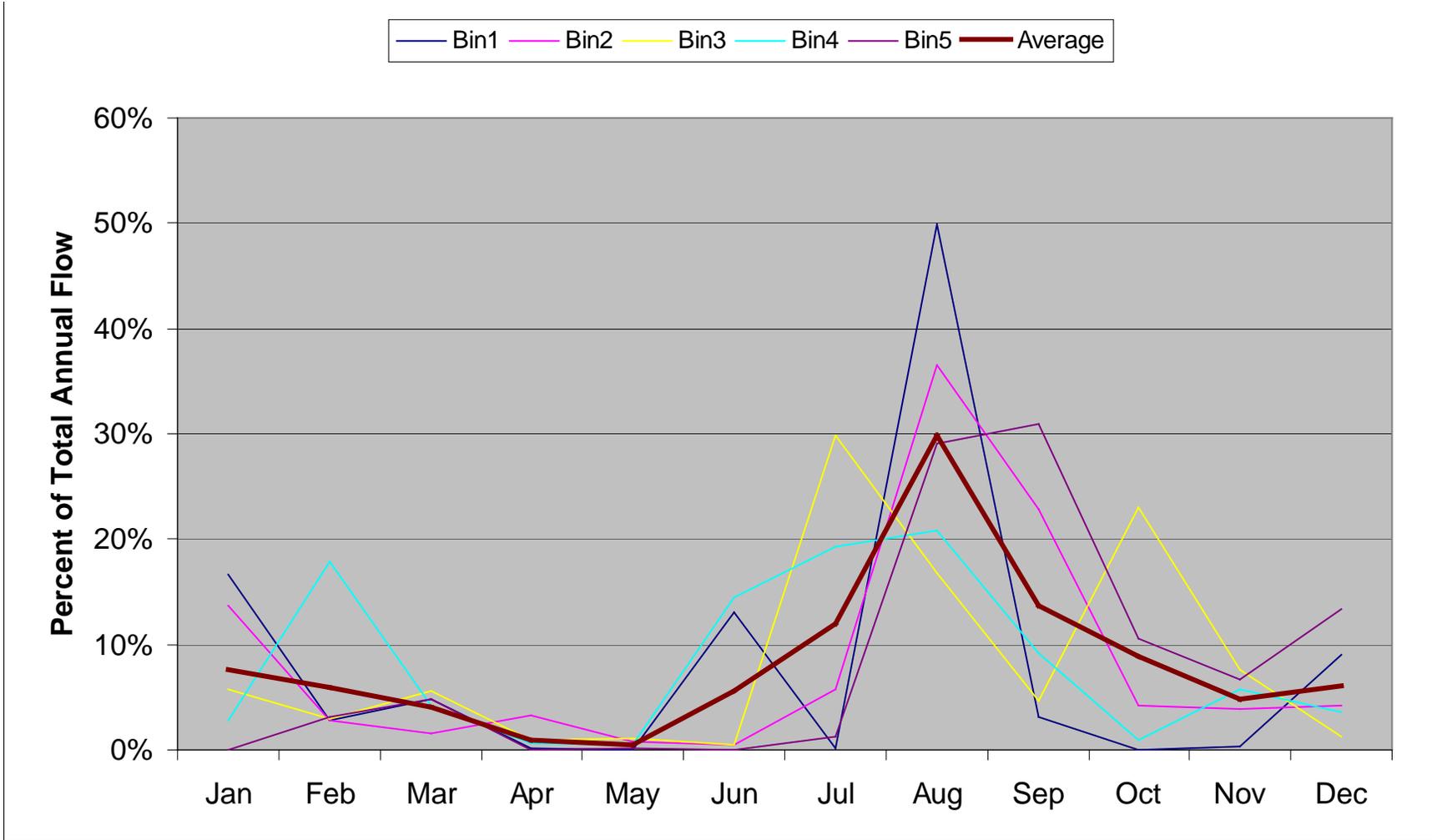
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# Salt Creek – Monthly Patterns



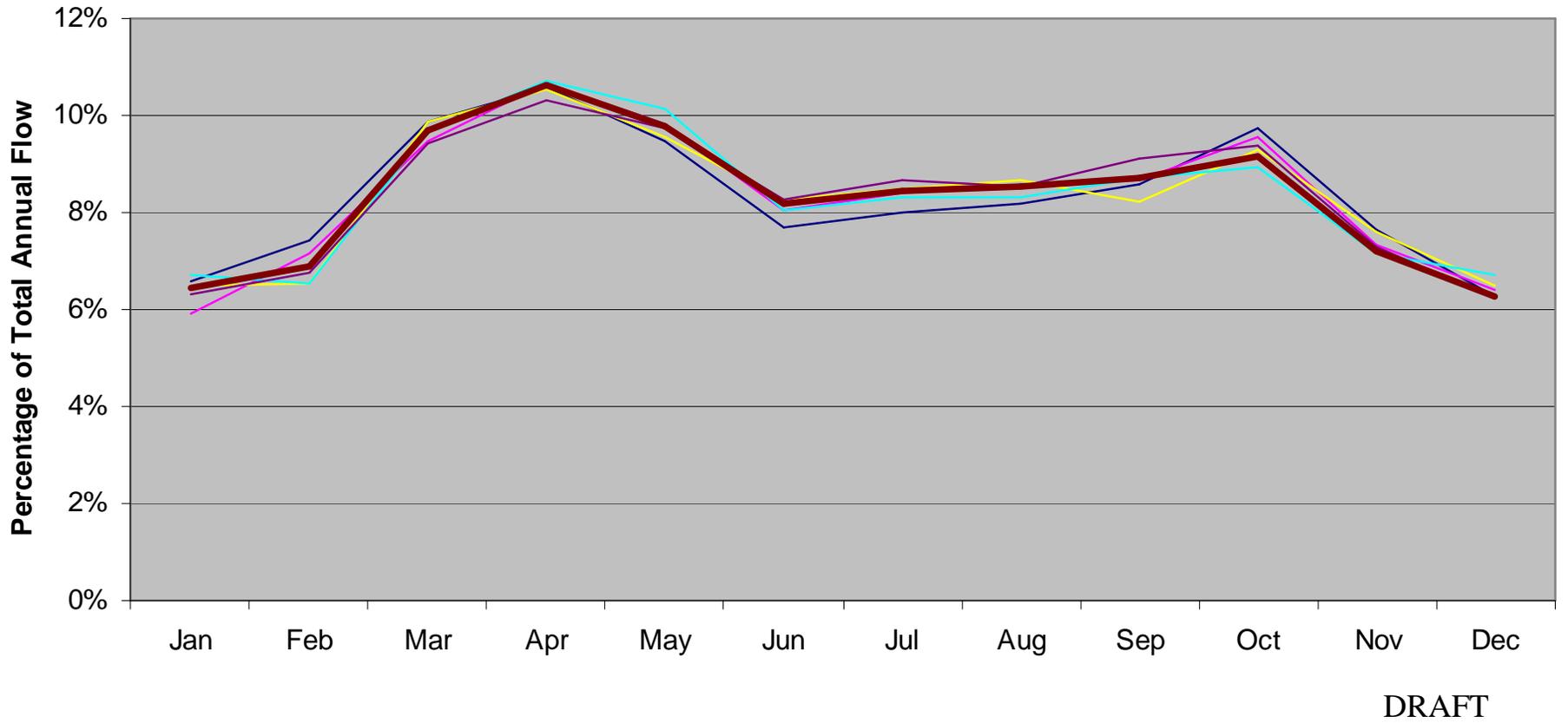
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# San Felipe Creek – Monthly Patterns

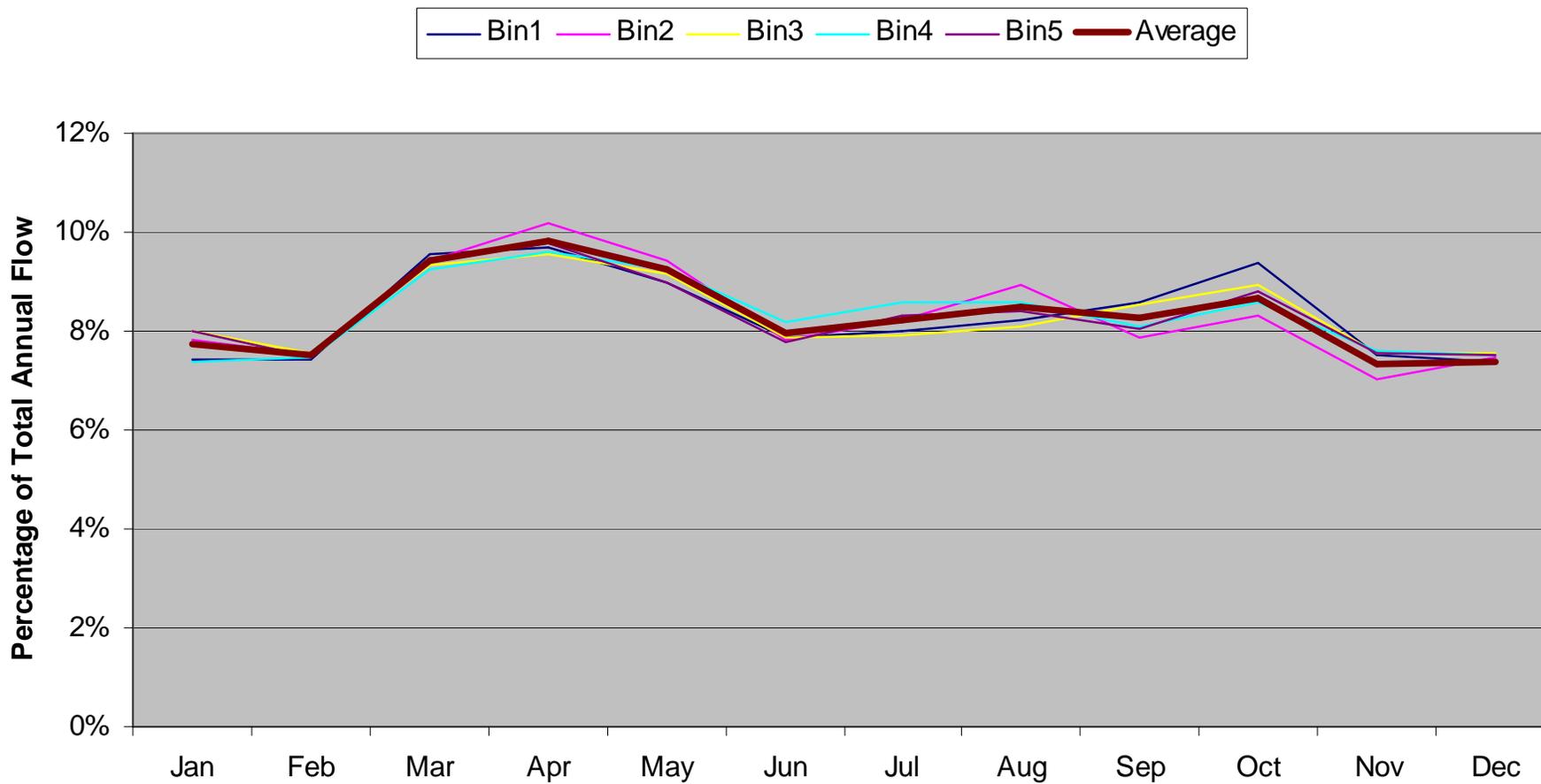


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# Alamo River – Monthly Patterns

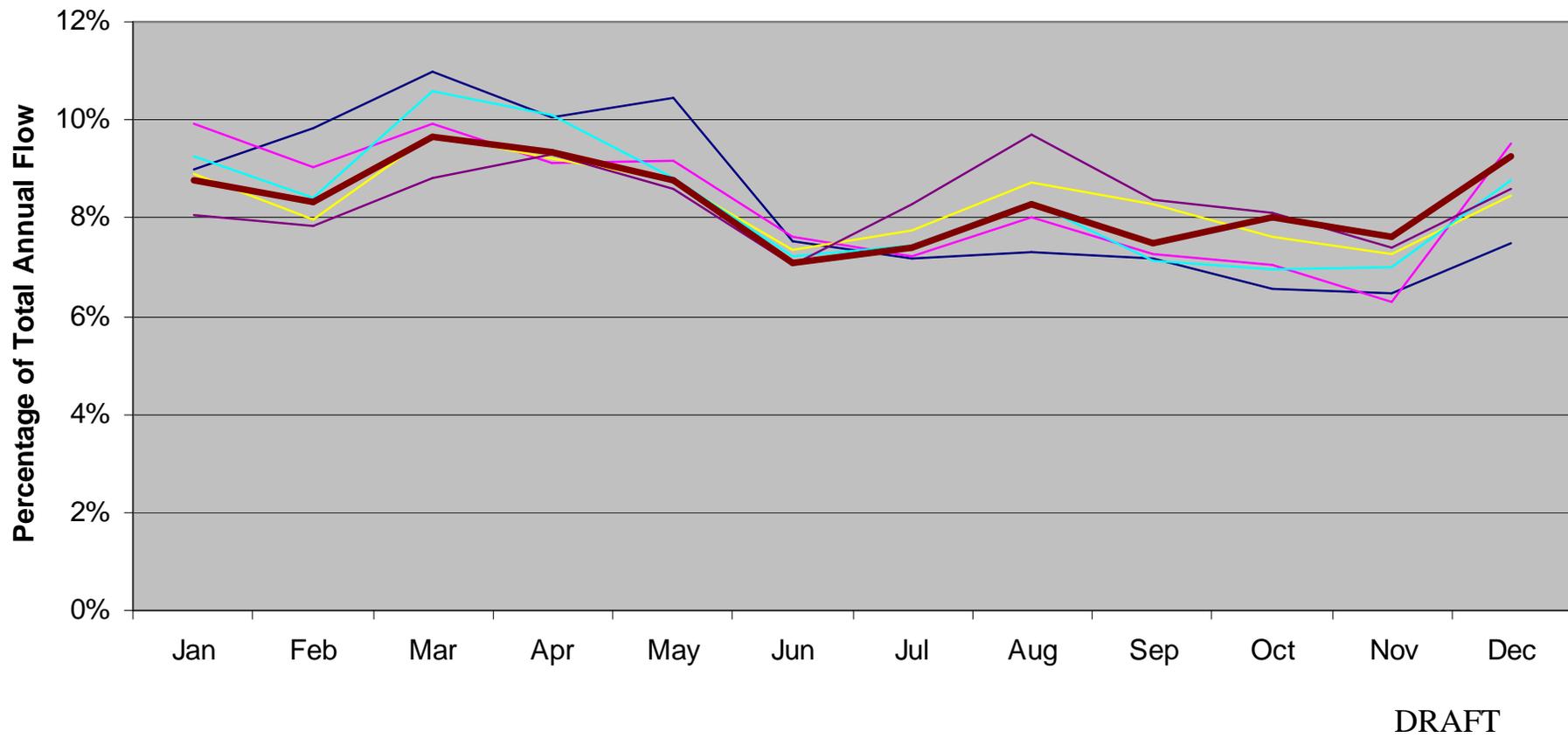


# New River – Monthly Patterns

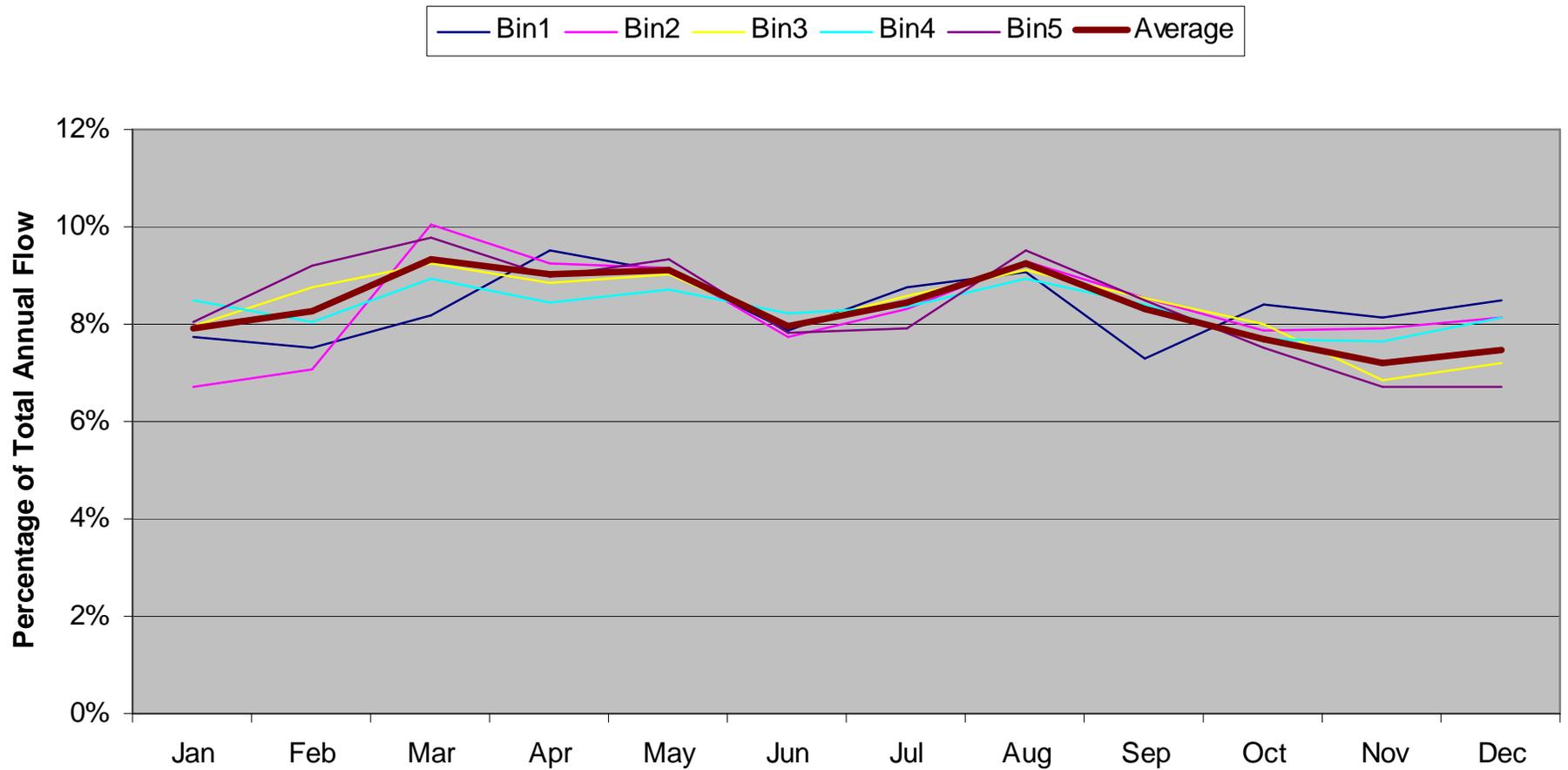


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# New River at IB – Monthly Patterns



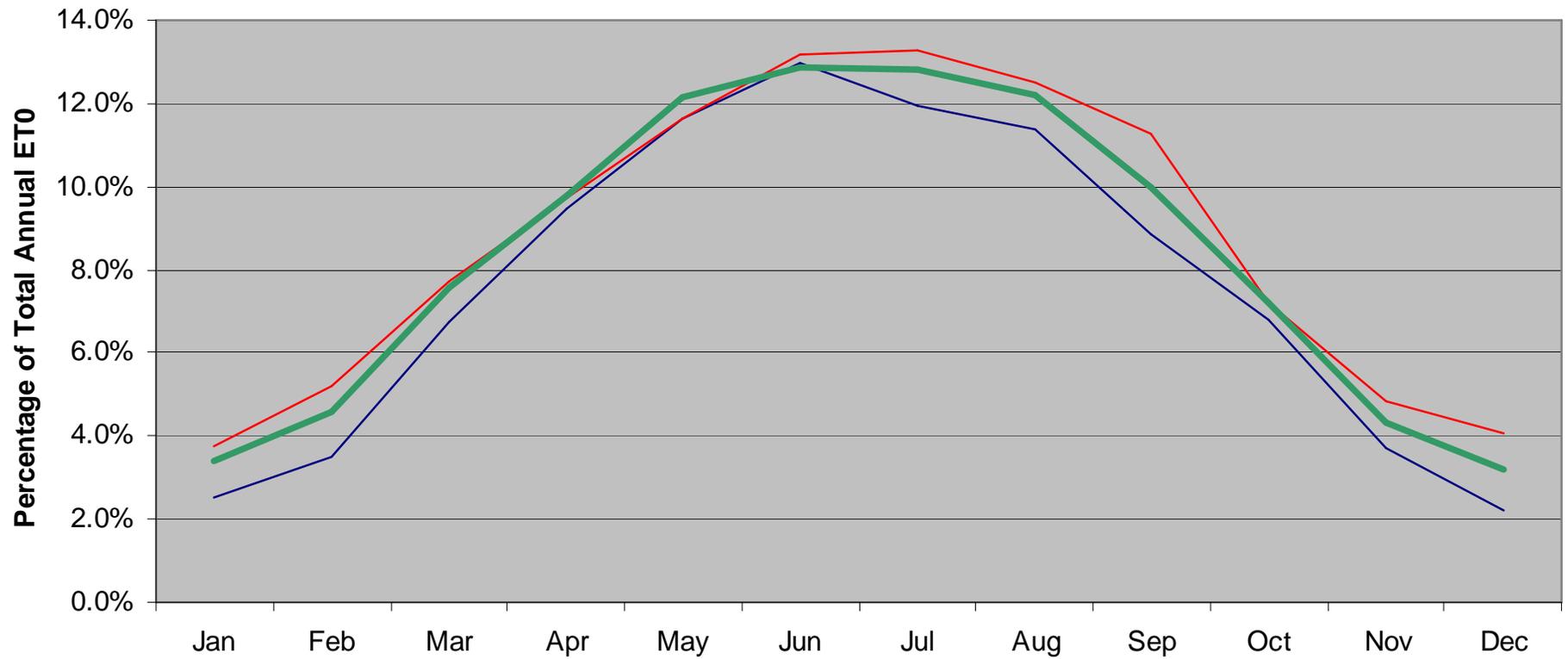
# Whitewater River – Monthly Patterns



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# Reference ET – Monthly Patterns

— Min — Max — Mean



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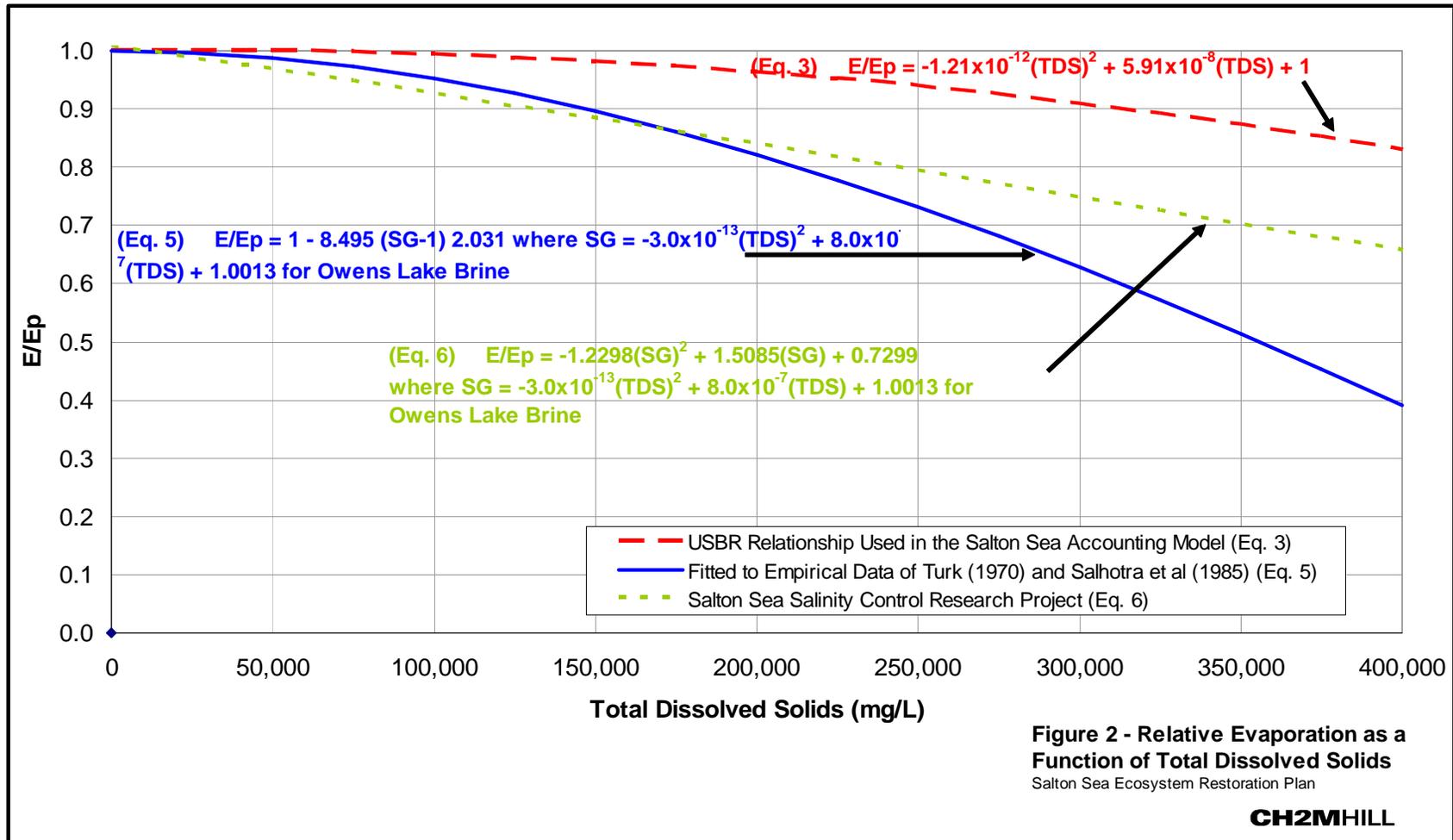
# **Monthly Inflow Patterns Summary**

- ◆ **Only San Felipe Cr and, to a lesser extent, Salt Cr display a widely-varying monthly pattern**
- ◆ **Agricultural drainage inflows display a nearly constant monthly pattern**
- ◆ **Separation of tailwater from other components would be desirable for future inflows**
- ◆ **Average patterns are considered reasonable at this time**

# **Refinements to Hydrologic Model**

- ◆ **Internal QA/QC performed**
- ◆ **Model refined in three areas**
  - **computation of exposed area**
  - **computation of mass balance error**
  - **additional cycles (iterations) added**
- ◆ **Evaporation suppression with increasing salinity to be revised**

# Relative Evaporation as Function of TDS

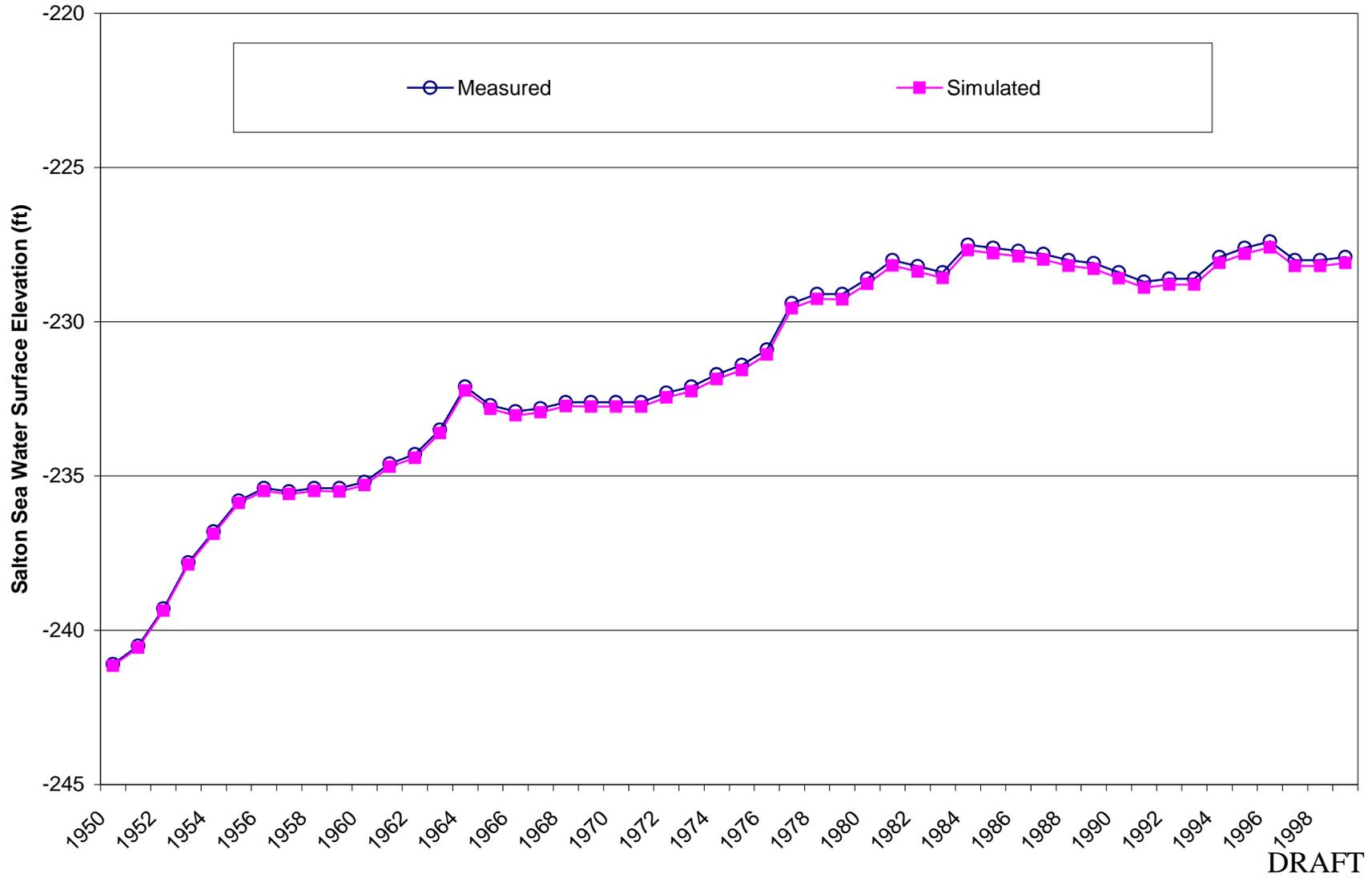


# **Hydrologic Model Calibration**

- ◆ **Historical period 1950-99 selected**
- ◆ **Estimated historical inflows and salt loads**
- ◆ **Measured elevation and salinity**
- ◆ **1995 USBR bathymetry**
- ◆ **Calibration performed in two steps**
  - **Model (algorithms/software) verification**
  - **Adjustments to water/salt budget terms, if required**
- ◆ **Evaporation computed from water budget terms**

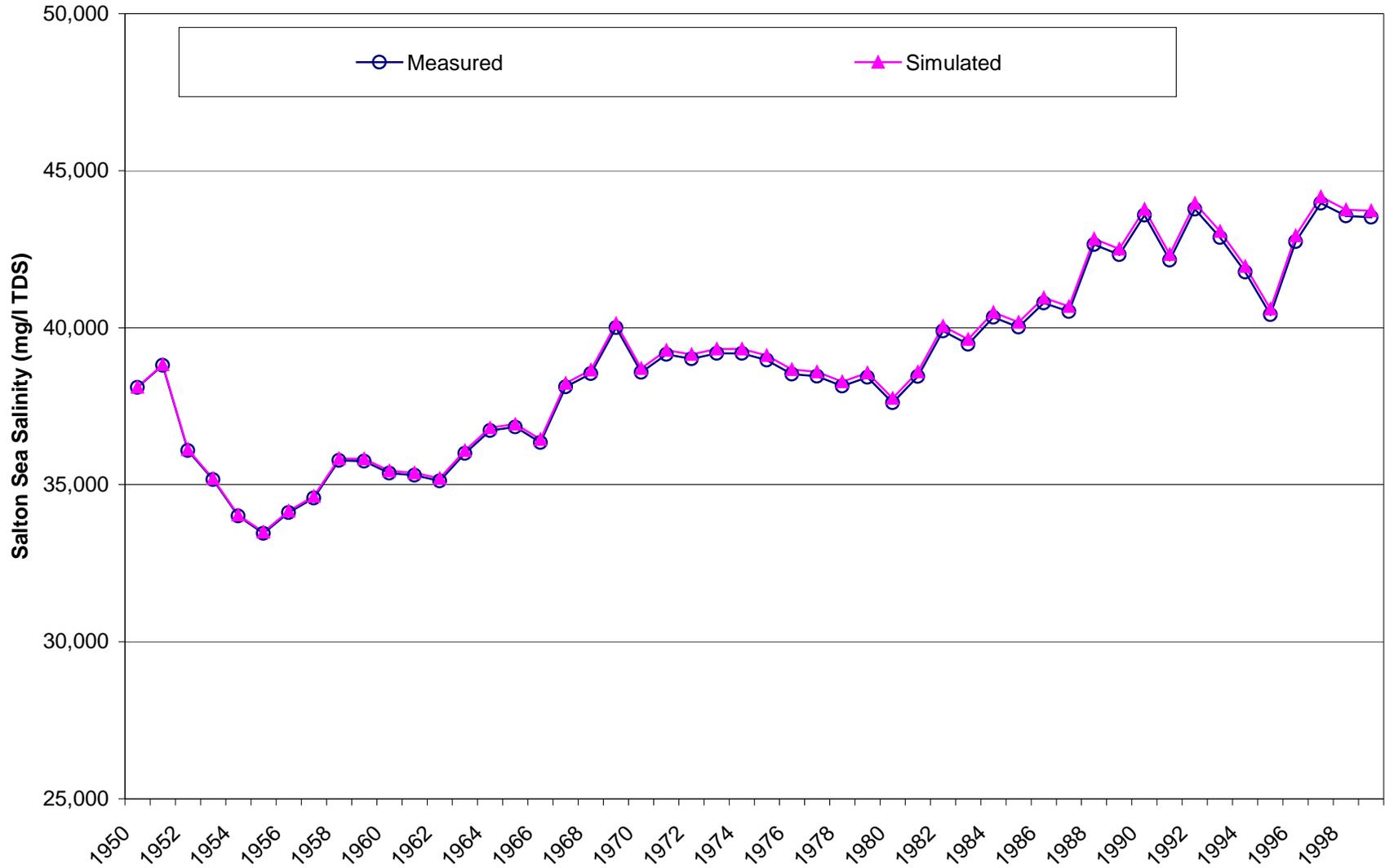
# Elevation Calibration

Model Calibration - Elevation  
(model mass balance check)



# Salinity Calibration

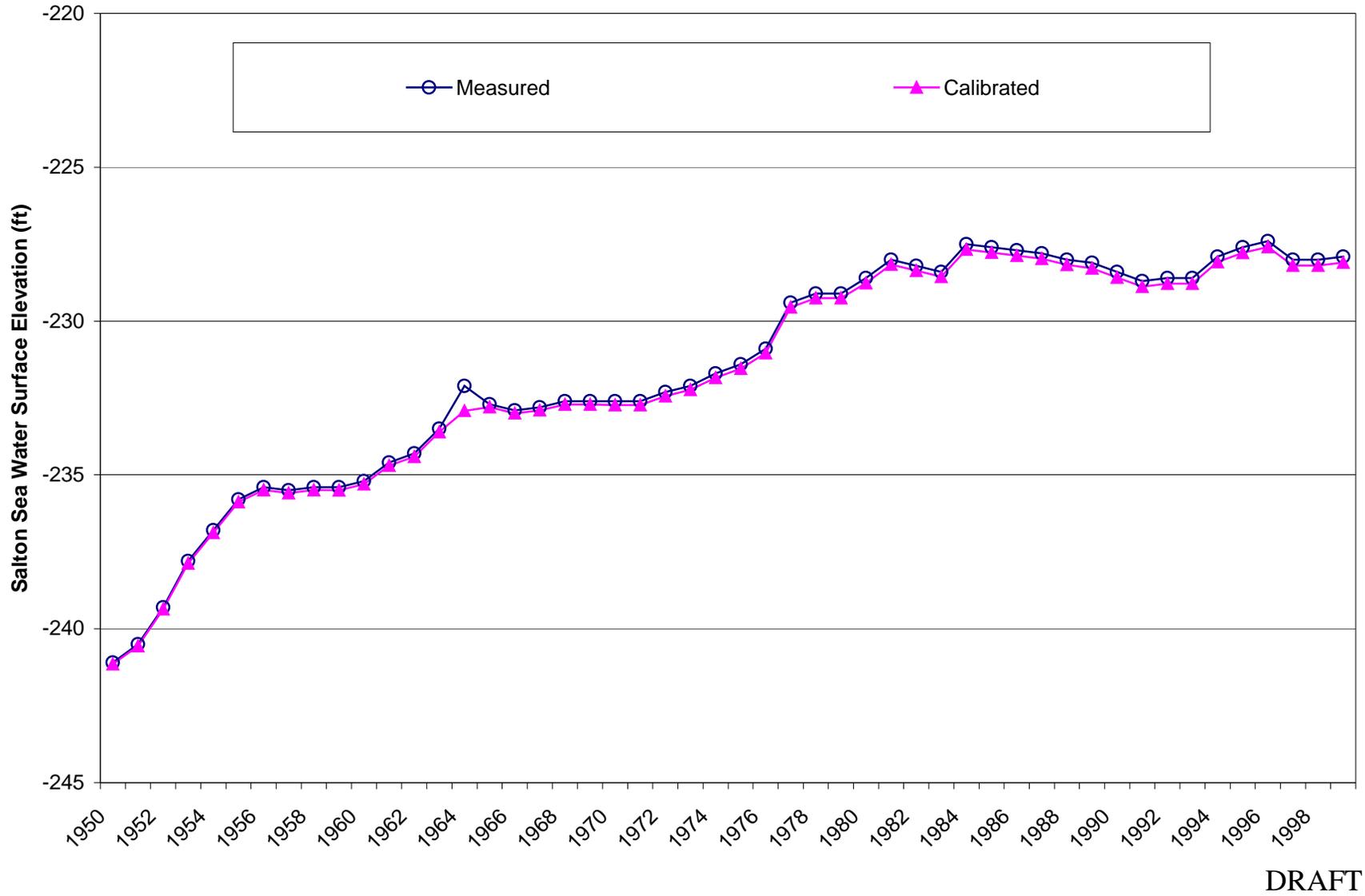
Model Calibration - Salinity  
(model mass balance check)



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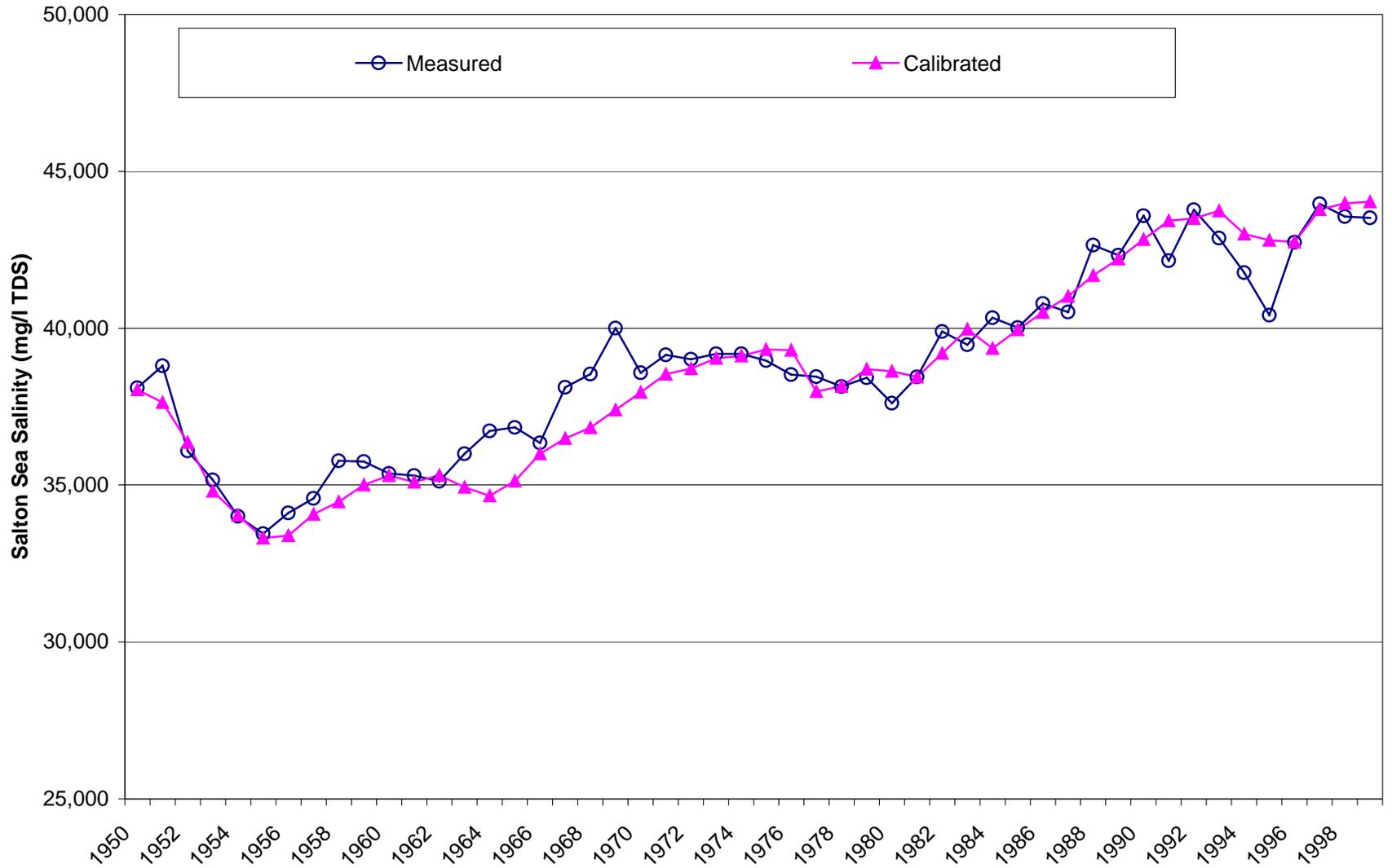
# Elevation Calibration

Model Calibration - Elevation



# Salinity Calibration

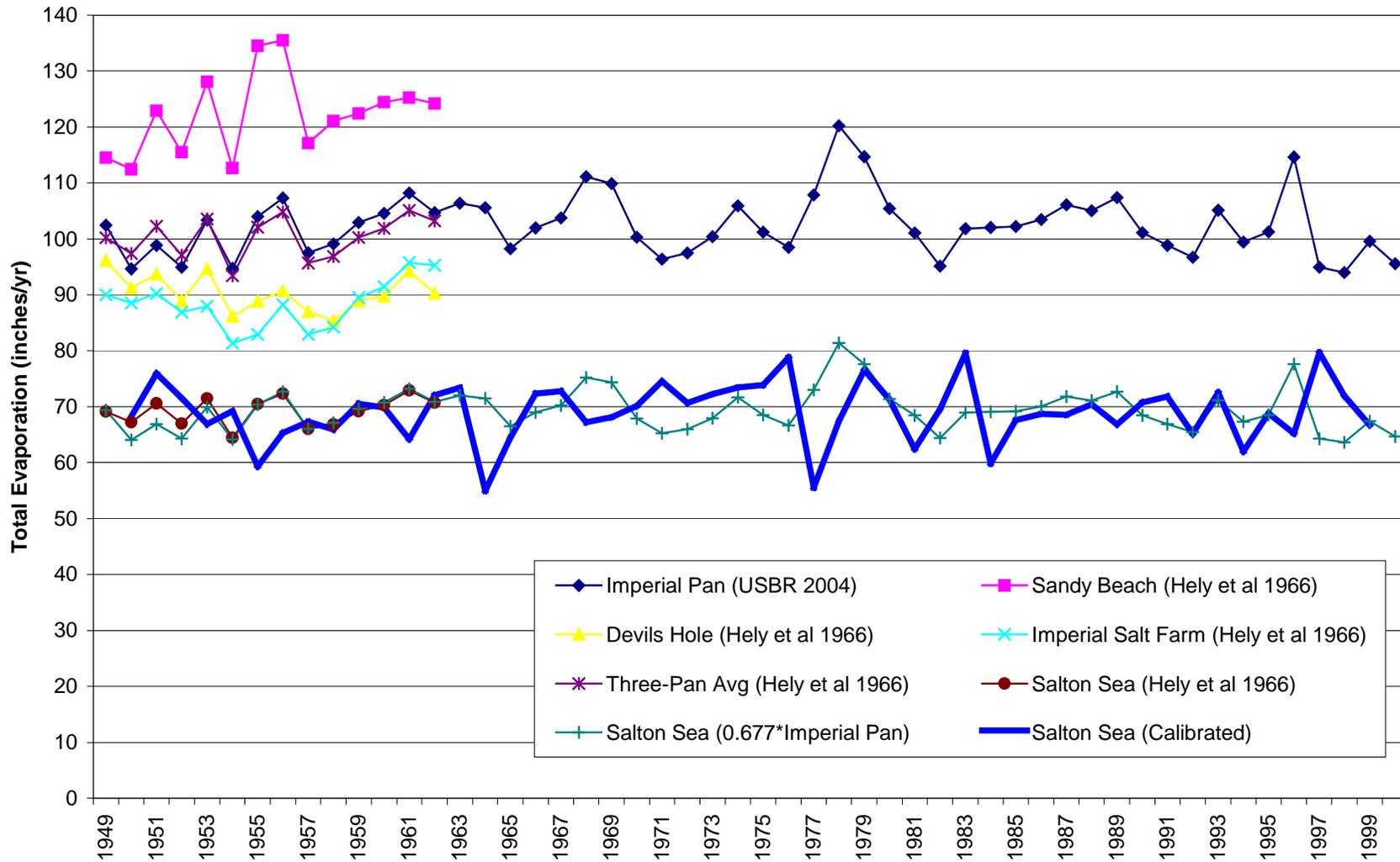
Model Calibration - Salinity



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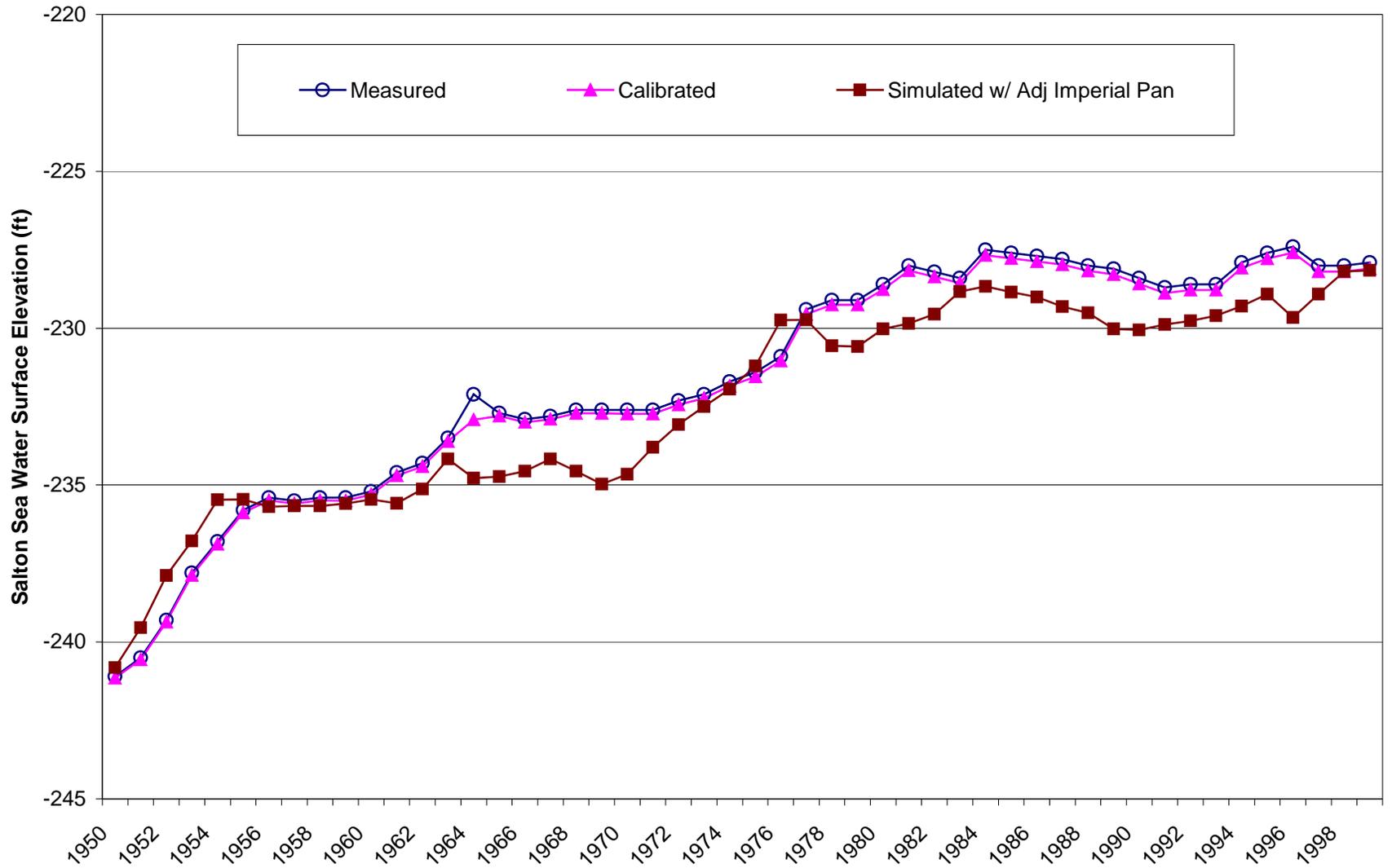
# Evaporation Calibration Results

Comparison of Total Evaporation Data and Calibrated Results



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# Simulation with Independently-developed Evaporation Rate



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# **Conclusions from Calibration**

- ◆ **Calibrated evaporation rate, 69 inches as total evaporation, compares well to published and adjusted pan values**
- ◆ **Inter-annual variability does not show a strong correlation to adjusted pan values**
- ◆ **Cause of poor inter-annual correlation are probably due to errors in other budget terms or elevation measurements**
- ◆ **Salinity calibration above ~42,000 mg/l was not possible without including significant salt precipitation within the Sea**

# **Model Schematics**

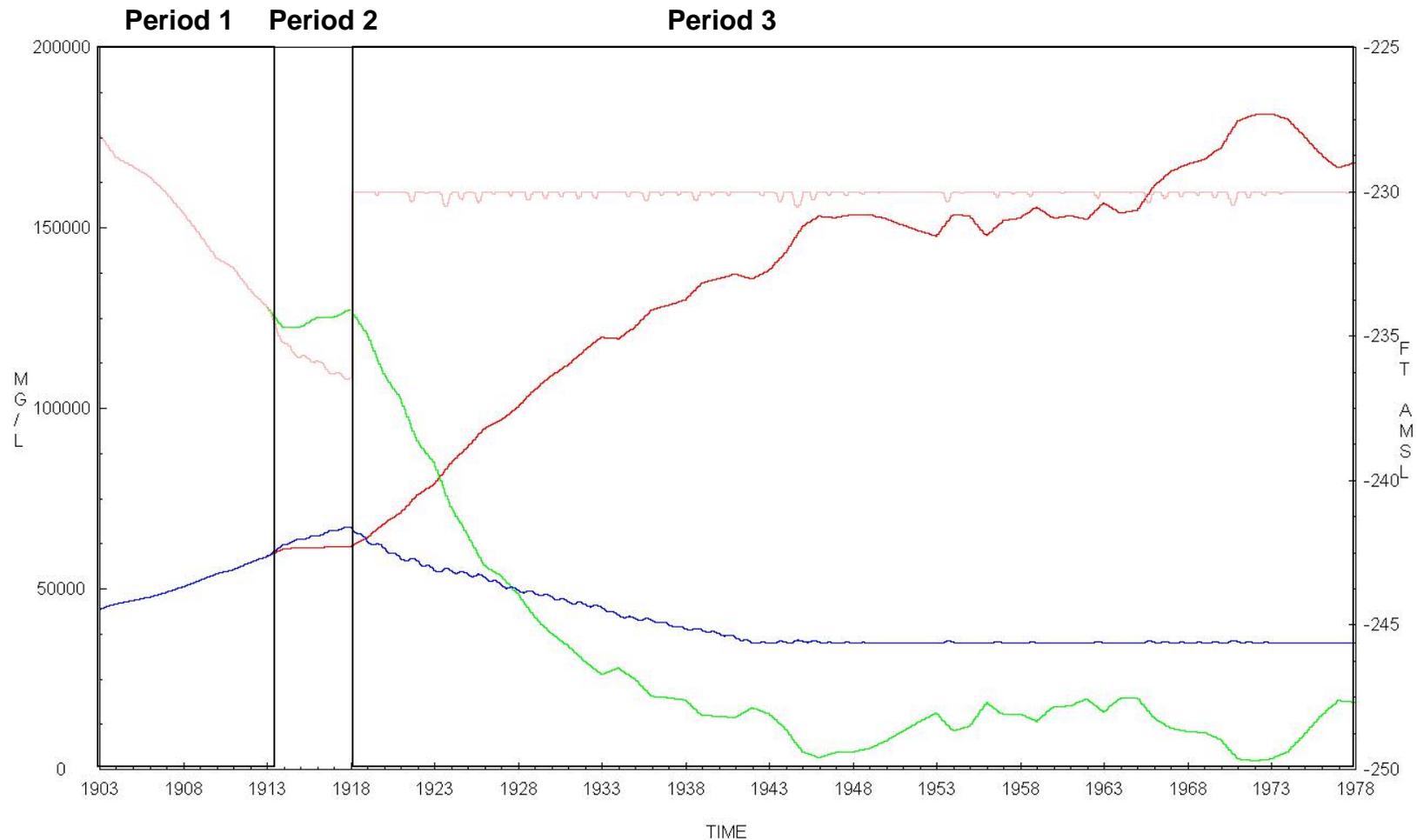
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# **Deterministic Model Application**

- ◆ **Example of incorporating phasing in model simulations**
- ◆ **Two possible approaches**
  - **Embed timing of phases in model code**
  - **Perform sequential partial simulations**

# Phasing Example

## (Model Illustration Purposes Only)



- CONCENTRATION at CNS100 (TEST1)
- ELEVATION at ELEVS100DV (TEST1)
- CONCENTRATION at CNS100 (TEST1)
- ELEVATION at ELEVS100DV (TEST1)

# **Stochastic Application**

- ◆ **Modification to model for stochastic version continues**
  - **multiple hydrologic traces considering variability and uncertainty**
  - **results in many (hundreds/thousands) traces of simulation results**
  - **allows statistical analysis of results**
- ◆ **Testing two procedures**
  - **embedded calls to model as part of Excel/@Risk**
  - **stand-alone wrapper program in Java or Fortran**

# Next Steps