

# **Developing a Water Supply Planning Model for EBMUD**

**2016 RiverWare User Group Meeting**

**August 23<sup>rd</sup>**

# Acknowledgment



- Hydros Consulting Inc.
  - **Steve Setzer**
  - John Carron
  - Jennifer Thomasson

# Why a New Planning Model?

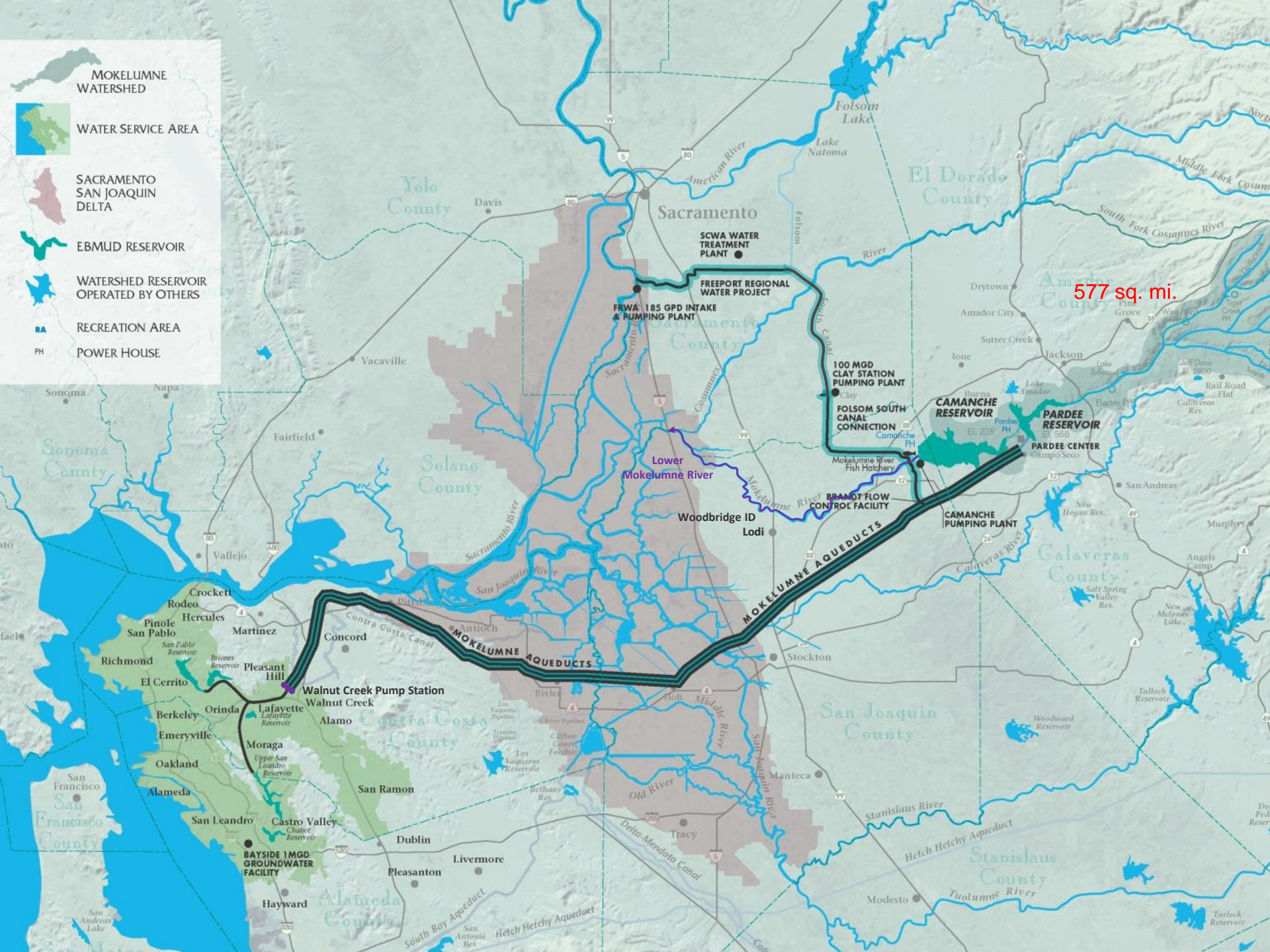


- Previous model built in FORTRAN
  - Many years of edits, changes and manipulation
  - Loosing experts that can manage the model
  - Difficult to make code changes and integrate new components
- Update to modern software (*RiverWare*)
  - Improved system and temporal resolution
  - Improved capabilities and flexibility
  - Improved transparency

# Fixed Demand Planning Model



- Demands defined by User
  - LOD: 2015, 2020, 2030, 2040
  - EBMUD customers, river diversions
- Historical hydrology (1921 to 2012)
  - Mokelumne River watershed runoff
  - Local watersheds
- Daily time step



MOKELUMNE WATERSHED

WATER SERVICE AREA

SACRAMENTO SAN JOAQUIN DELTA

EBMUD RESERVOIR

WATERSHED RESERVOIR OPERATED BY OTHERS

RECREATION AREA

POWER HOUSE

577 sq. mi.

FRWA 185 GPD INTAKE & PUMPING PLANT

SCWA WATER TREATMENT PLANT

FREERPORT REGIONAL WATER PROJECT

100 MGD CLAY STATION PUMPING PLANT

FOLSOM SOUTH CANAL CONNECTION

CAMANCHE RESERVOIR

PARDEE RESERVOIR

PARDEE CENTER

Lower Mokelumne River

Mokelumne River Fish Hatchery

BRANDT FLOW CONTROL FACILITY

Woodbridge ID

Lodi

CAMANCHE PUMPING PLANT

WOKELUMNE AQUEDUCTS

MOKELUMNE AQUEDUCTS

Walnut Creek Pump Station

Walnut Creek

Pleasant Hill

Lafayette Reservoir

Moraga

Castro Valley

BAYSIDE 1MGD GROUNDWATER FACILITY

Hayward

Dublin

Pleasanton

Livermore

Hayward

Antioch

Bixler

Hob

Alamo

San Ramon

Dublin

Pleasanton

Livermore

Hayward

Stockton

Manteca

Tracy

Modesto

Hayward

Dublin

Pleasanton

Livermore

Hayward

Hayward

Hayward

Stockton

Manteca

Tracy

Modesto

Hayward

Dublin

Pleasanton

Livermore

Hayward

Hayward

Hayward

Stockton

Manteca

Tracy

Modesto

Hayward

Dublin

Pleasanton

Livermore

Hayward

Hayward

Hayward

Stockton

Manteca

Tracy

Modesto

Hayward

Dublin

Pleasanton

Livermore

Hayward

Hayward

Hayward

Stockton

Manteca

Tracy

Modesto

Hayward

Dublin

Pleasanton

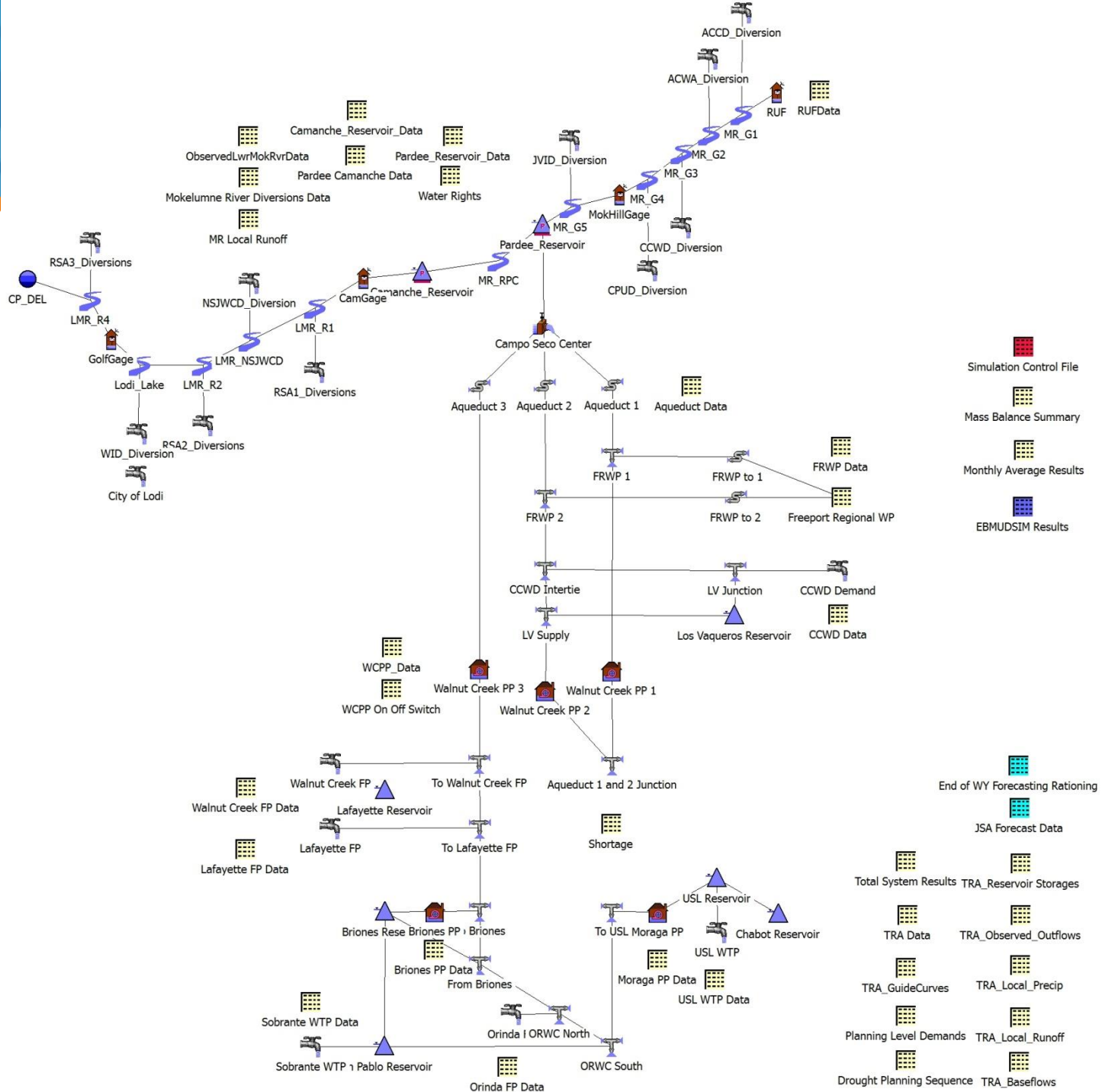
Livermore

Hayward

Hayward

Hayward

# RiverWare Workspace

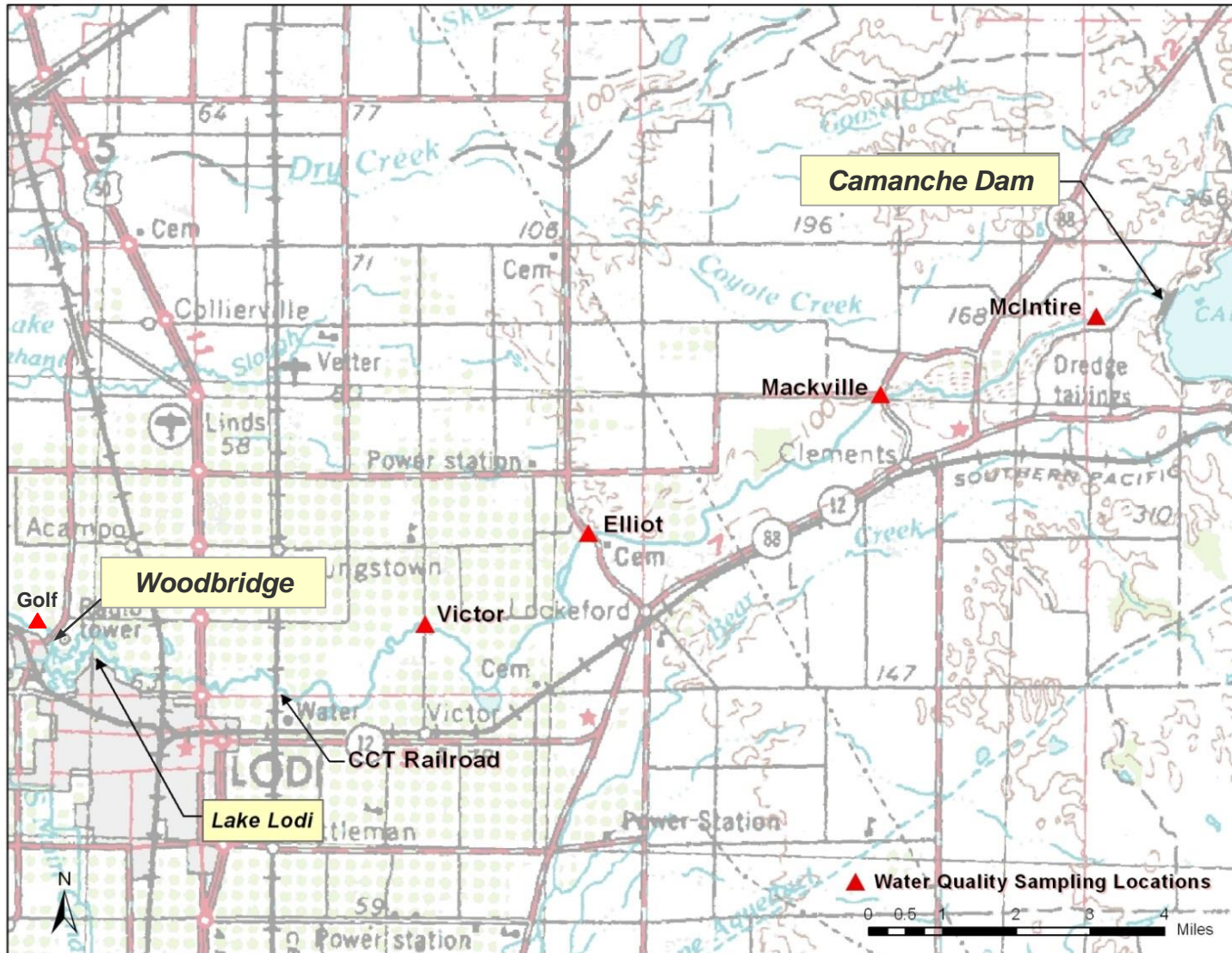


# Operational Priorities



- Meet obligations for water right holders
- Comply with environmental requirements
  - Flows and temperature
- Meet USACE flood reserve requirements
- Meet EBMUD customer demands
  - Implement drought management plan

# Environmental Flow Requirements



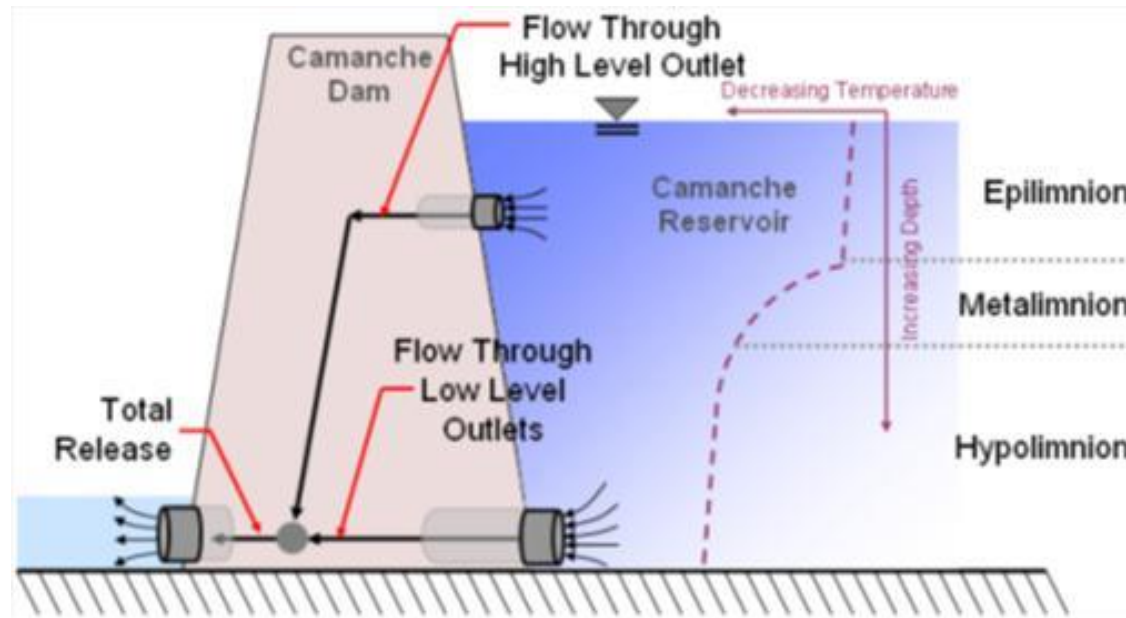
Year Type	
AN	Above Normal
N	Normal
BN	Below Normal
D	Dry
CD	Critically Dry



# Temperature Requirements

Goal: Maintain water temperatures in the Lower Mokelumne River for fisheries

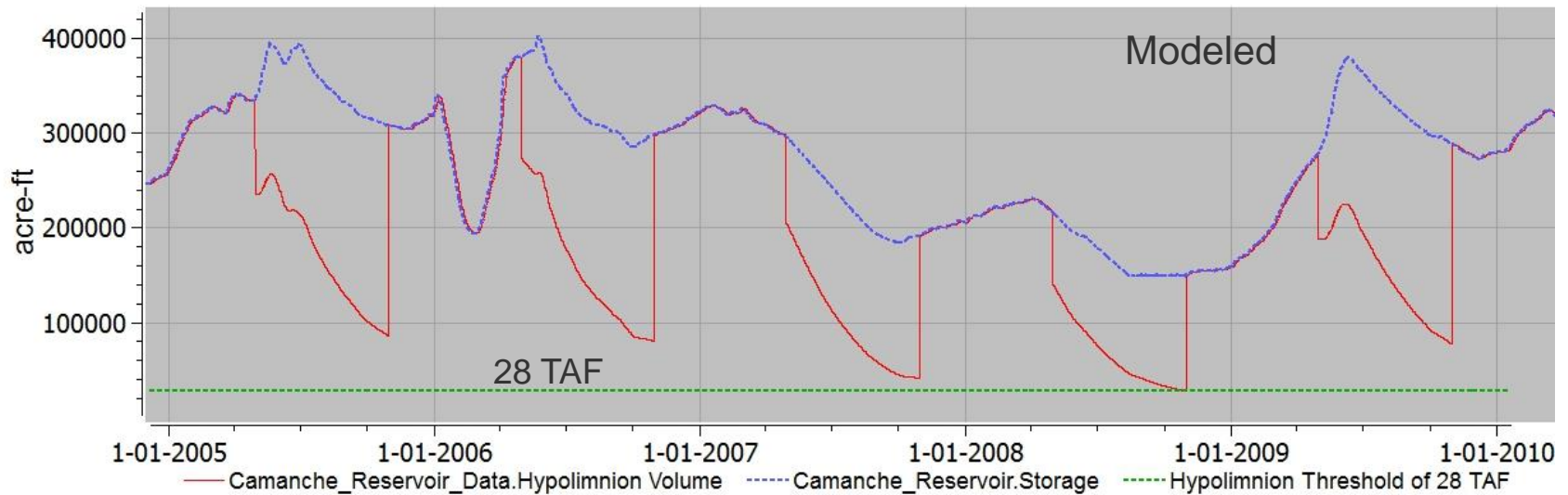
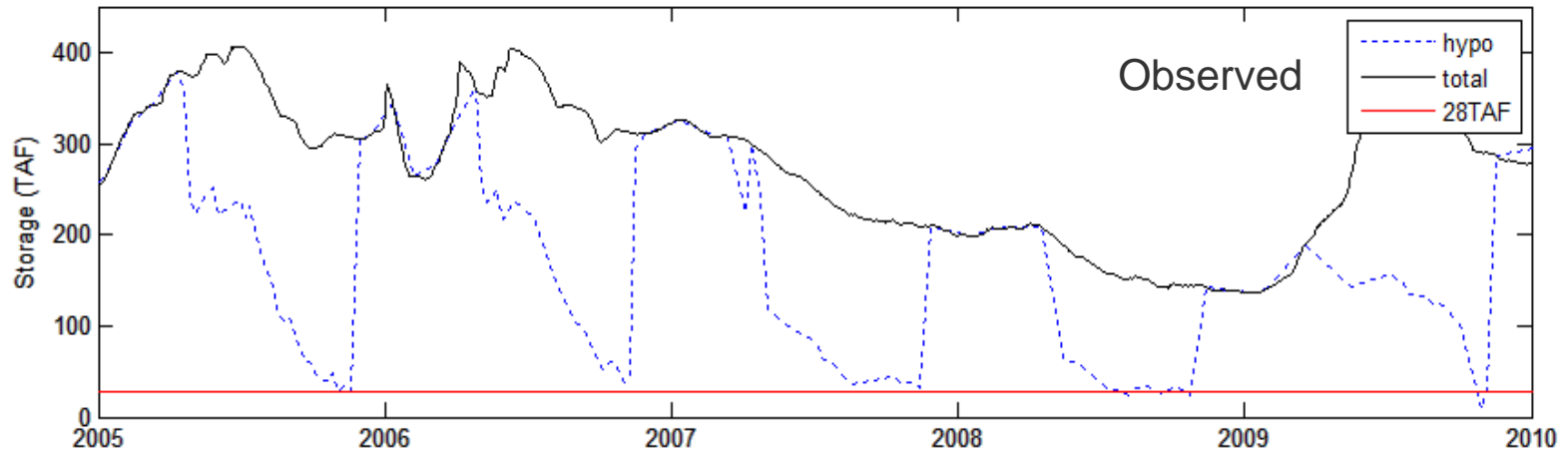
- Maintain Camanche hypolimnetic volume ( $Temp \leq 16.4^{\circ}C$ ) at or above 28 TAF thru October.



# Camanche Hypolimnion



Camanche Hypolimnion Volume < 16.4°C



# Drought Management Plan

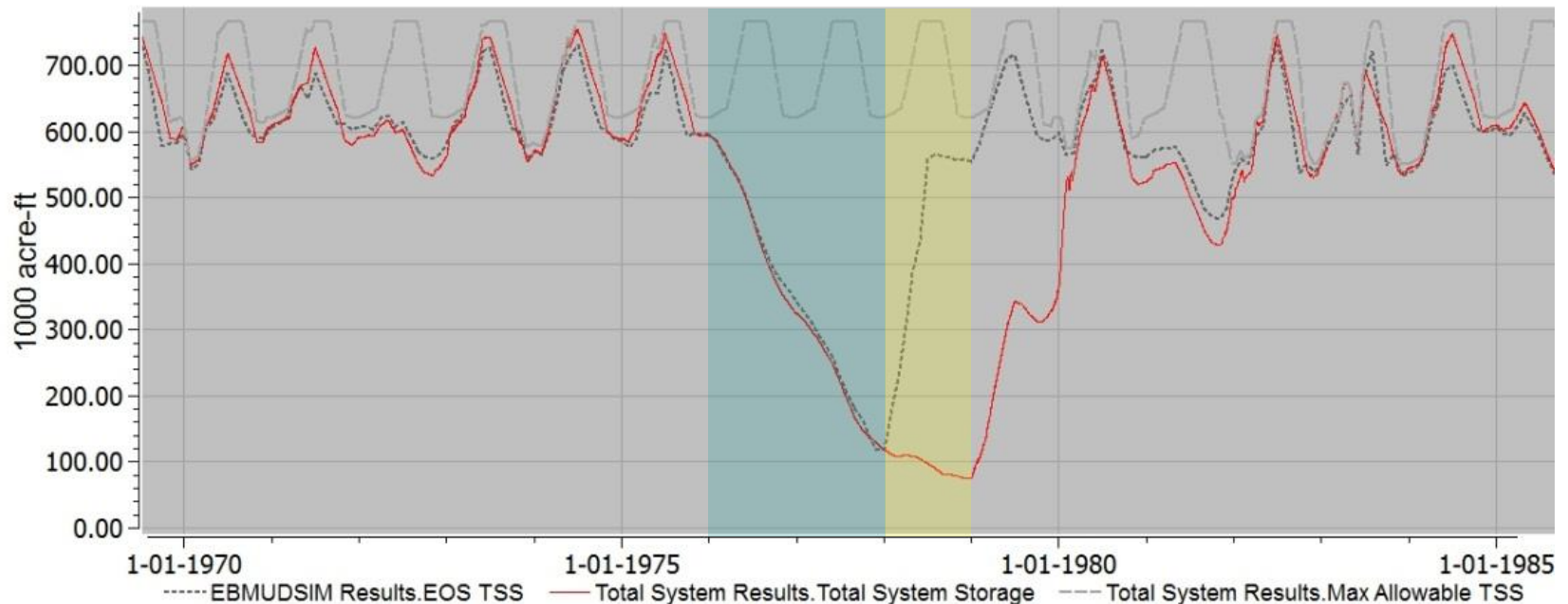


- Drought Planning Sequence
- Customer Demand Rationing
- Supplemental Supplies
  - Freeport Regional Water Project
- Need for Water
  - Transfers

# Drought Planning Sequence



- 1976, 1977 and modified 1978



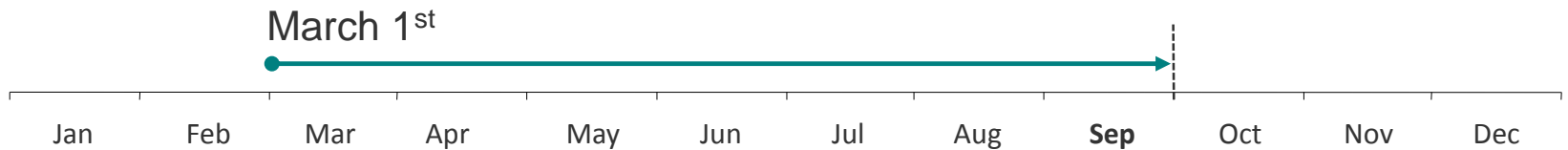
# Forecasting Future Storage



*End-of-Sept Total-System-Storage*

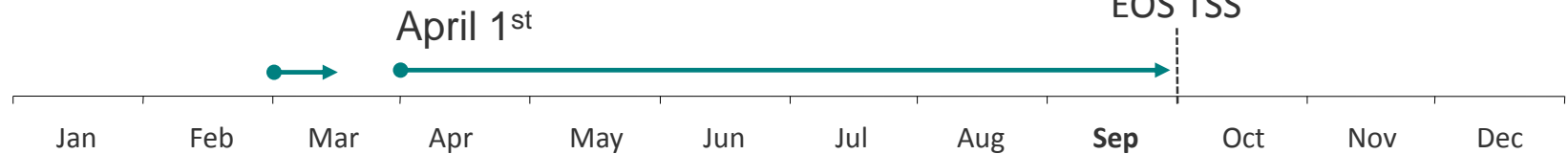
Drought supply

EOS TSS < 500 TAF



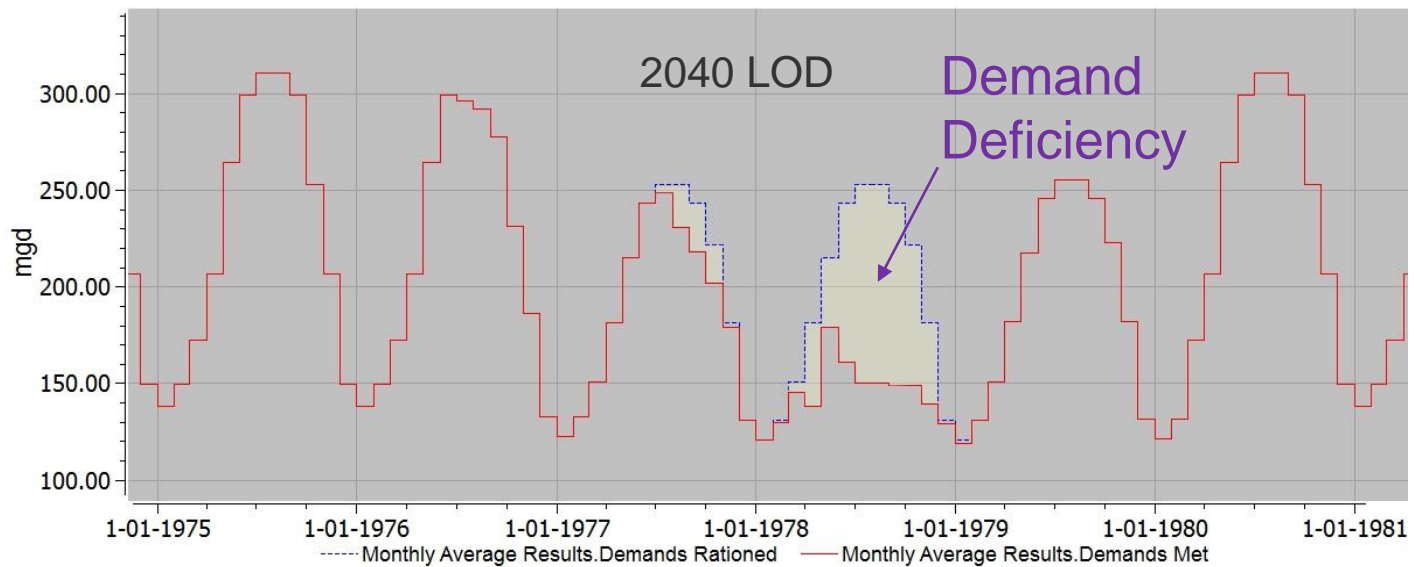
Rationing

EOS TSS



Drought Stage	EOS-TSS (TAF)	Rationing Goal
Normal	500 TAF or more	None
Moderate	500 – 425	0 to 10%
Significant	425 – 390	10% to 15%
Severe	390 – 325	15% to 20%
Critical	Less than 325	20% Max

# Need for Water



Drought Planning Sequence

# Rules Organization



RBS Ruleset Editor - "RBS Ruleset (from model file)"

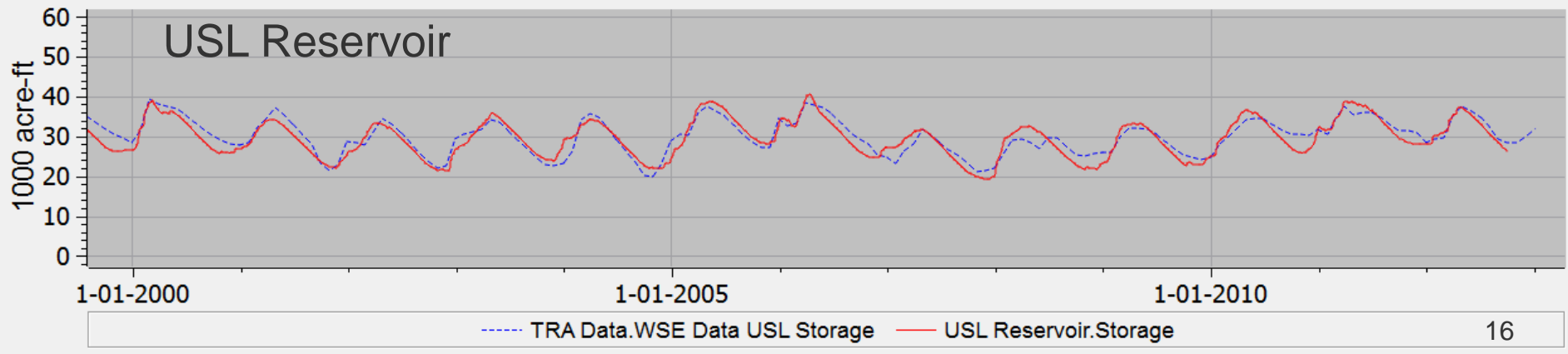
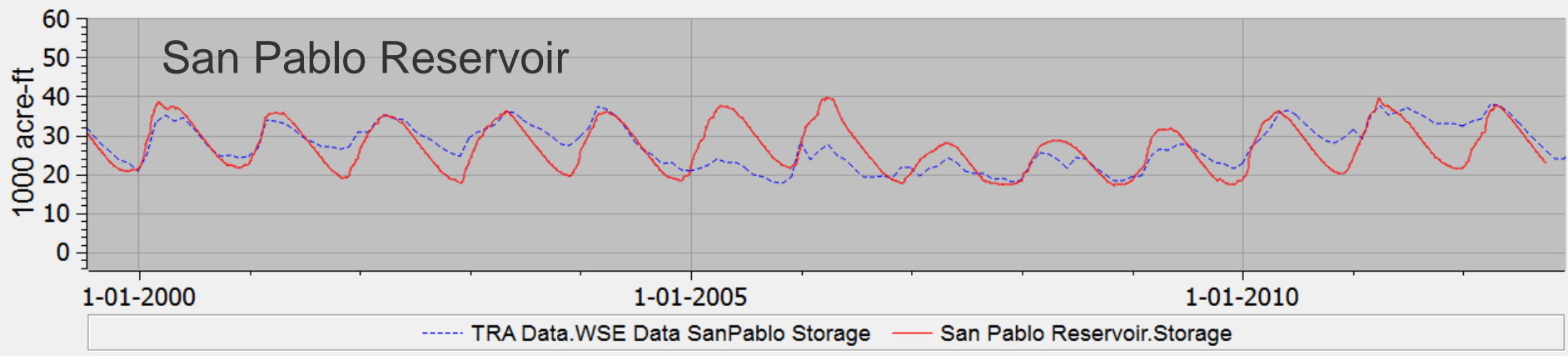
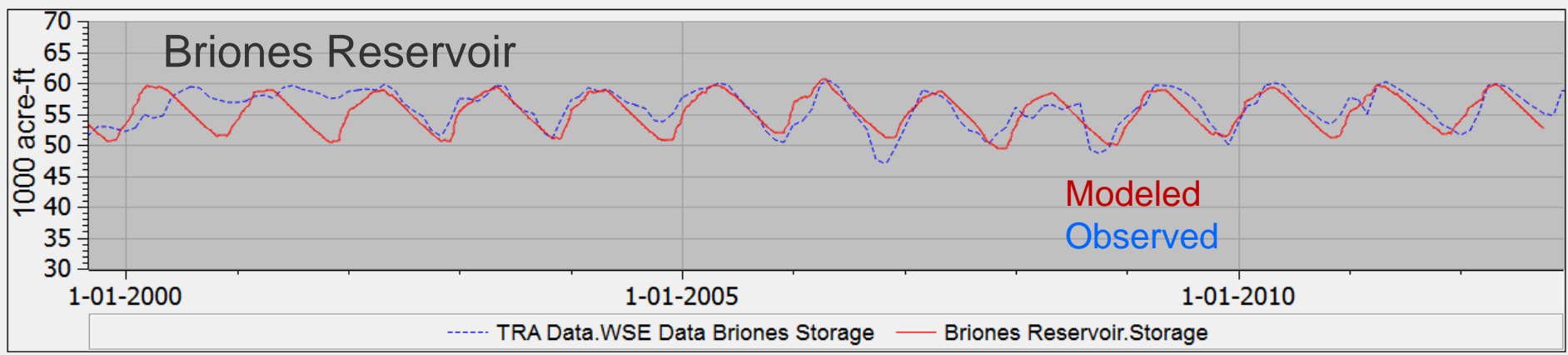
File Edit Set View

RBS Ruleset (from model file) RPL Set Loaded

Policy & Utility Groups Report Groups

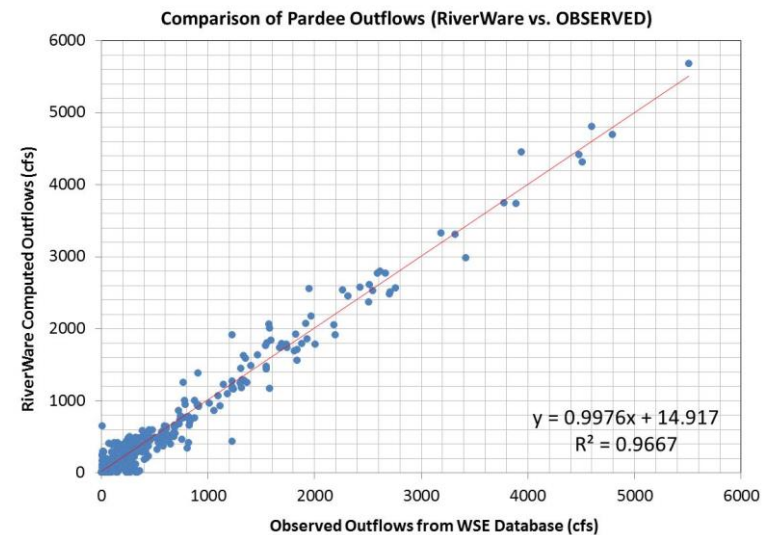
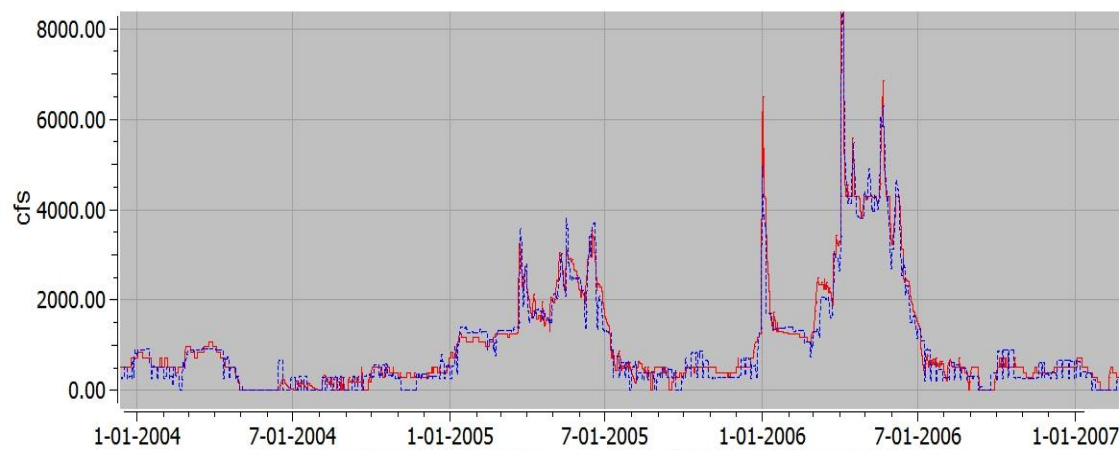
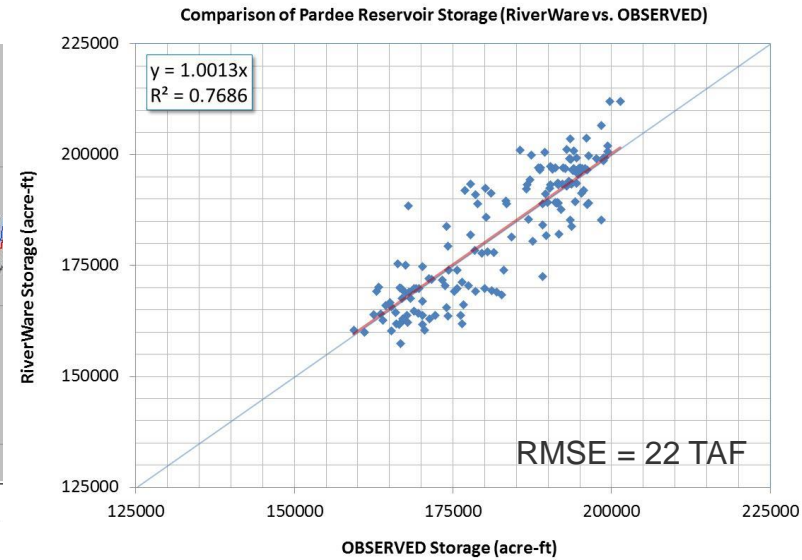
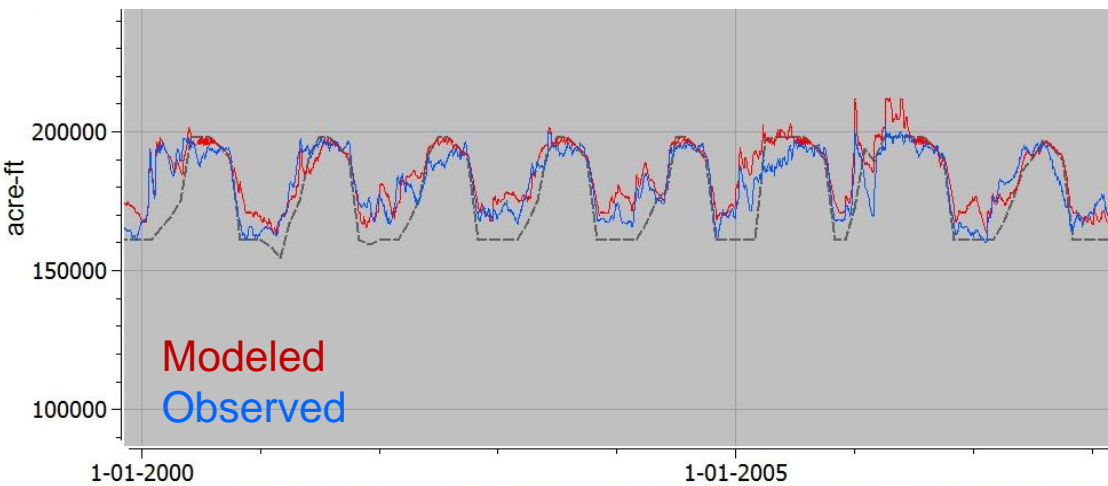
Name	Priority	On	Type	
Summary Rules	1-13	✓	Policy Group	Mokelumne River System
Camanche Reservoir Operations	14-27	✓	Policy Group	
Pardee Reservoir Operations	28-41	✓	Policy Group	
Complete TRA Solution	42-44	✓	Policy Group	
Balance TRA Network	45-80	✓	Policy Group	TRA System
Compute Aqueduct Capacities	81-82	✓	Policy Group	
Chabot Operations	83-87	✓	Policy Group	
USL Operations	88-95	✓	Policy Group	
San Pablo Operations	96-102	✓	Policy Group	
Briones Operations	103-110	✓	Policy Group	Forecasting, JSA, Rationing, FRWP
Lafayette Operations	111-113	✓	Policy Group	
Manage CCWD and LV	114-118	✓	Policy Group	
Rationing with FRWP	119-128	✓	Policy Group	
FRWP Scheduling	129-144	✓	Policy Group	Initialize Demands
Rationing	145-155	✓	Policy Group	
Nov 5th Forecasting and JSA Year Type	156-162	✓	Policy Group	River Diversions, Year Type
Initialize Demands	163-166	✓	Policy Group	
WID Diversions and Year Type	167-169	✓	Policy Group	
UMR Diversions	170-170	✓	Policy Group	
LMR Diversions and Year Type	171-173	✓	Policy Group	Initialization
Aqueduct Conditions	174-174	✓	Policy Group	
Initialize Flood Reserve	175-186	✓	Policy Group	
Initialize DPS	187-187	✓	Policy Group	
Apply Climate Change	188-189	✓	Policy Group	
Basic Functions		✓	Utility Group	
Forecasting Functions		✓	Utility Group	

Show:  Set Description  Selected Description  Adv. Properties

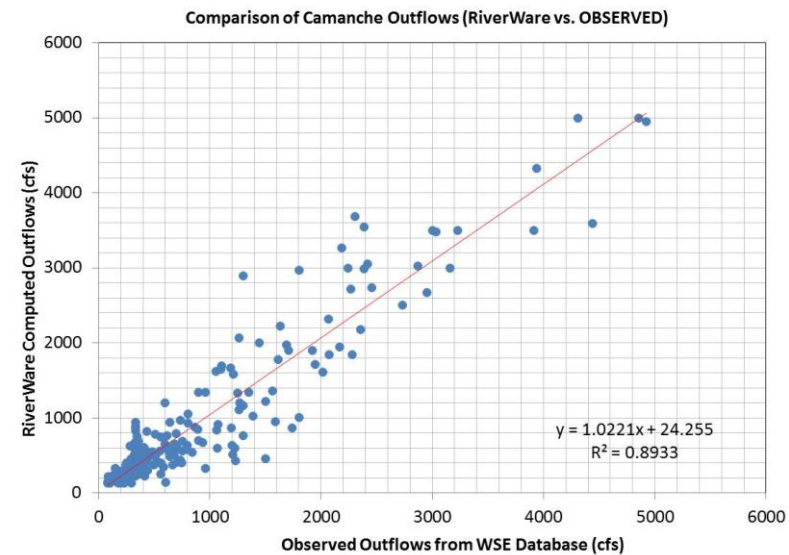
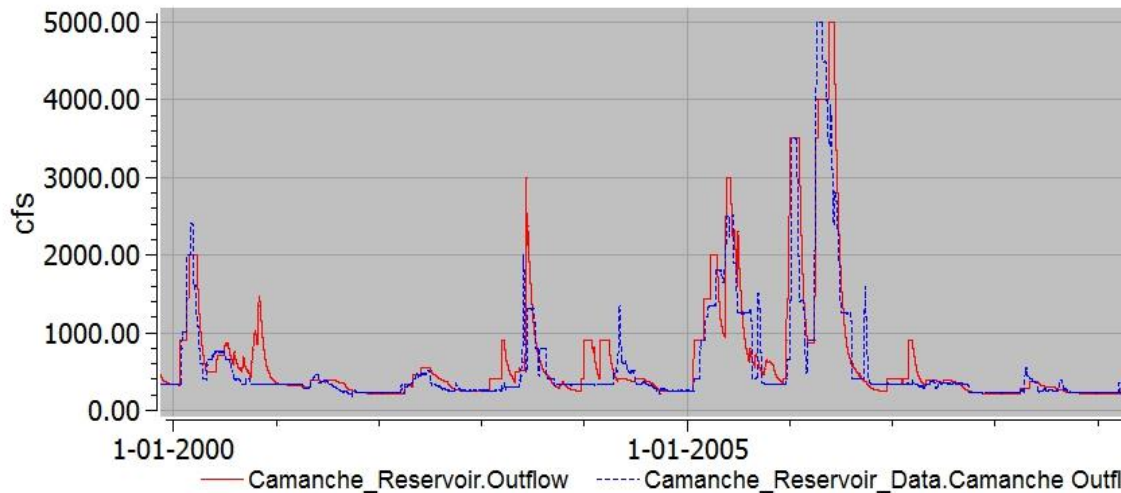
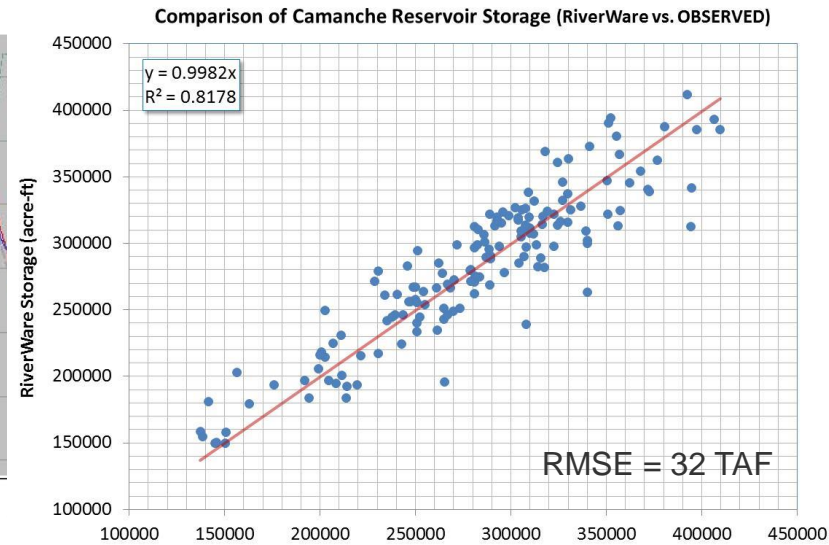
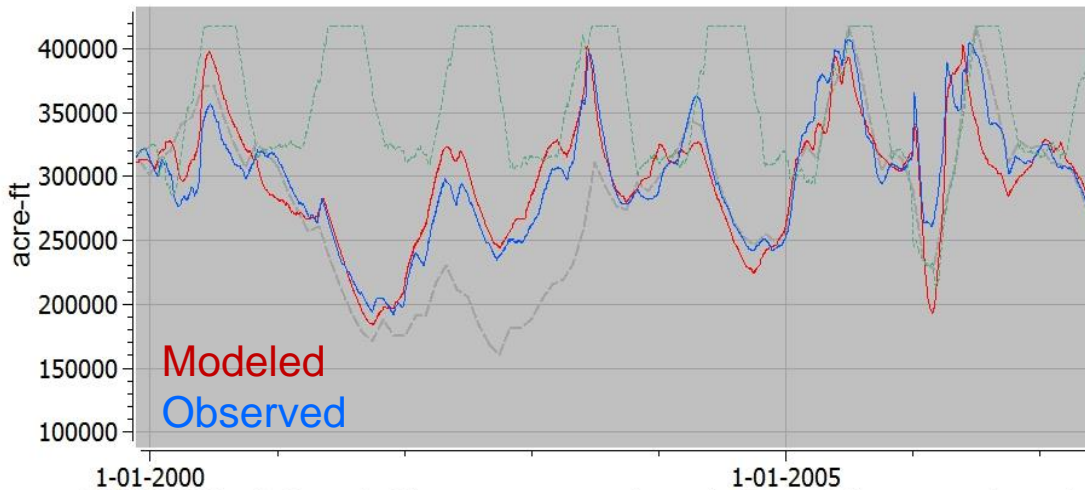


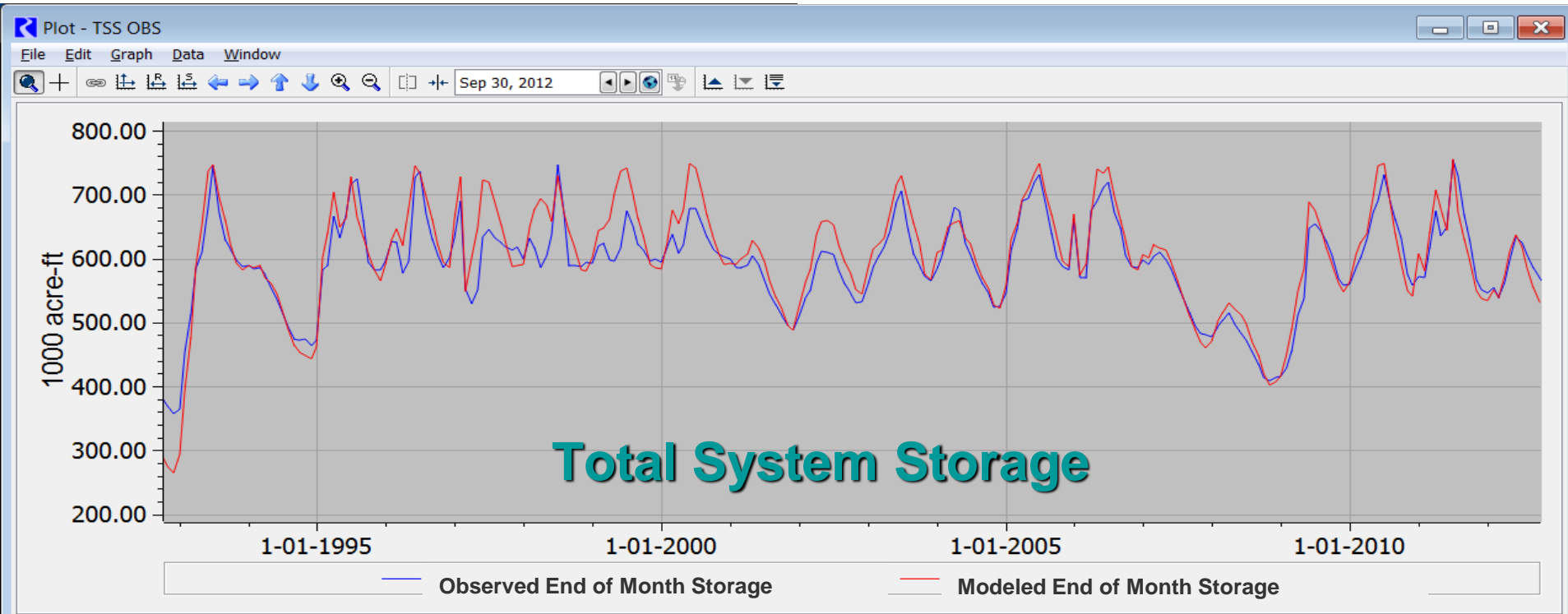
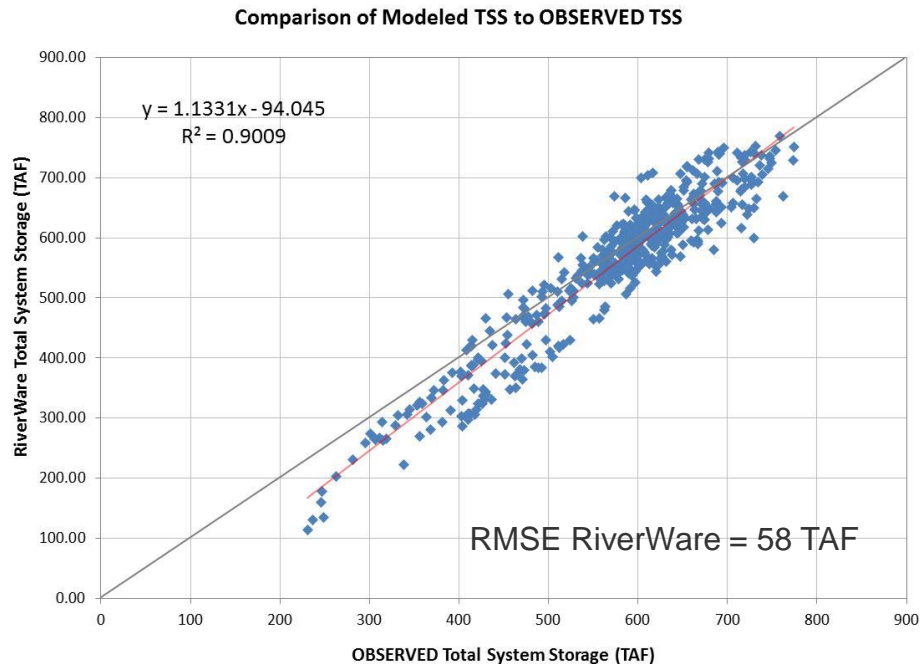
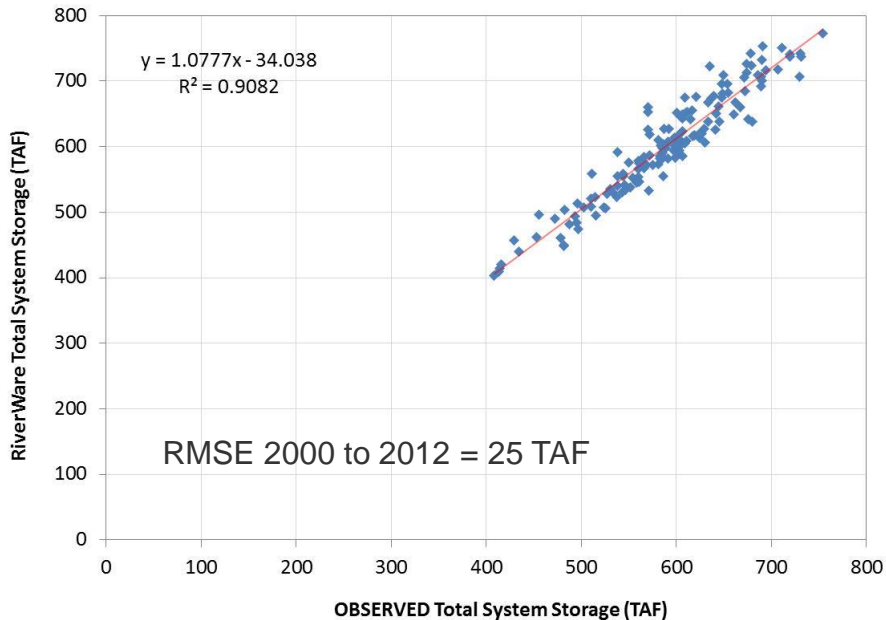


# Pardee Reservoir



# Camanche Reservoir





# Next Steps



- Phase out FORTRAN model
- Adopted by Operations Dept
- Accounting



**EAST BAY MUNICIPAL UTILITY DISTRICT**

# Questions?

*[gpalhegy@ebmud.com](mailto:gpalhegy@ebmud.com)*

*510-287-2068*

*[bbray@ebmud.com](mailto:bbray@ebmud.com)*

*510-287-0206*