

# LCRA Planning Model Monthly vs. Daily Model

Kevin Wheeler

AMEC Earth and Environmental

(Formerly Hydrosphere Resource Consultants)



# Choosing a Time Step

## Monthly Model

### Advantages

- Faster Run Times
- Longer Time Horizons
- Simplified Inputs
  - Average Monthly Inputs

### Disadvantages

- Preprocessing of Inputs
- Course Results
  - Average Monthly Volumes
  - Supply and Demand Estimates

## Daily Model

### Disadvantages

- Slower Run Times
- Shorter Time Horizons
- More Complex Inputs
  - Average Daily Values

### Advantages

- Easier preprocessing of Inputs
- Better Reflects Reality
  - Capture individual precipitation events
  - Capture demand distributions
  - Capture travel times

# Analysis Sequence

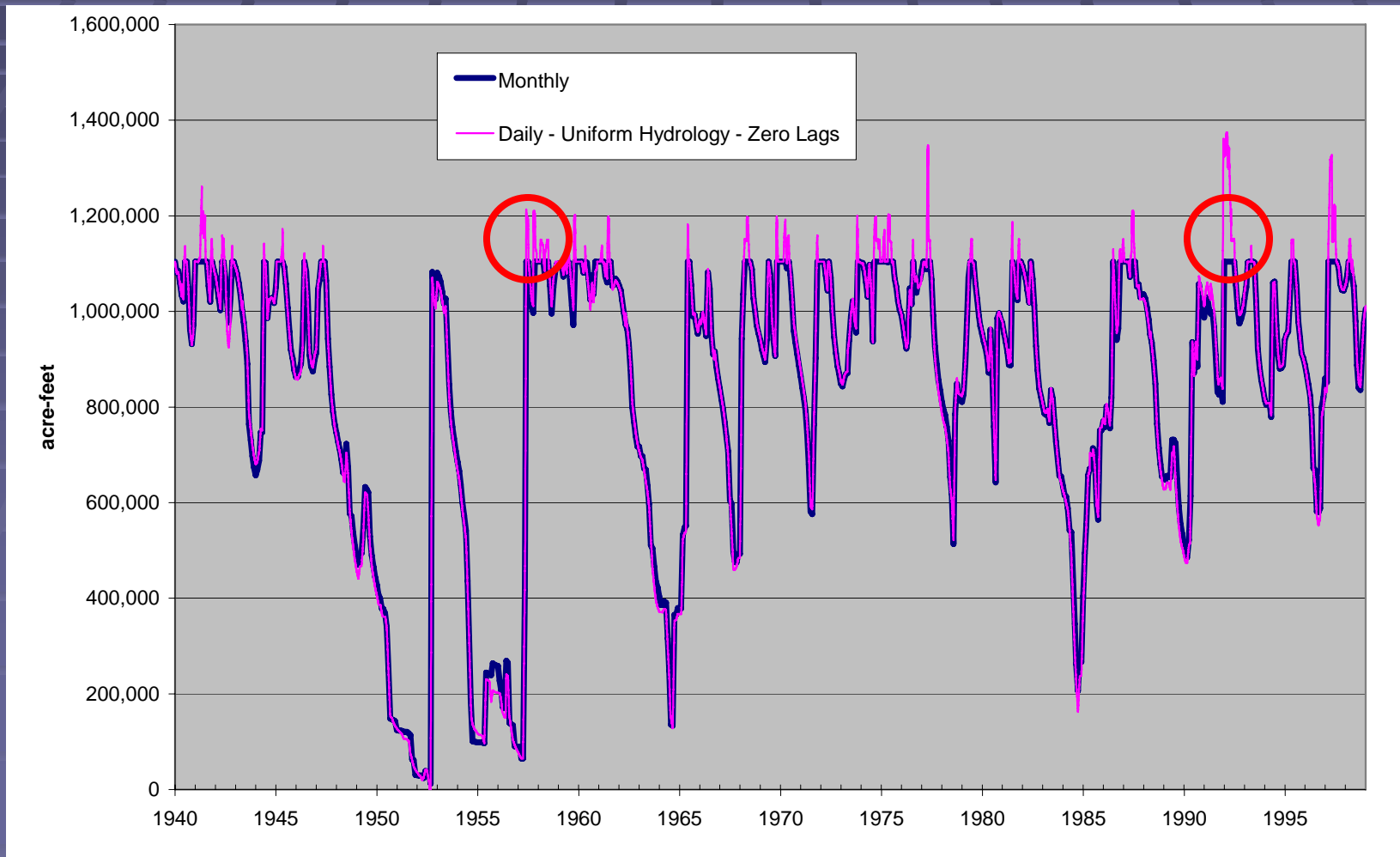
Start with the Monthly “rule-based” Allocation Model

1. Convert Monthly model to a Simple Daily Model
  - Uniform Monthly Hydrology
  - Uniform Monthly Demands
  - Zero Mainstem Lags
  - One Day Return Flow Lag
2. Introduce Daily Variable Hydrology
3. Introduce Travel Time - (Mainstem Lags)
4. Introduce Daily Variable Demands

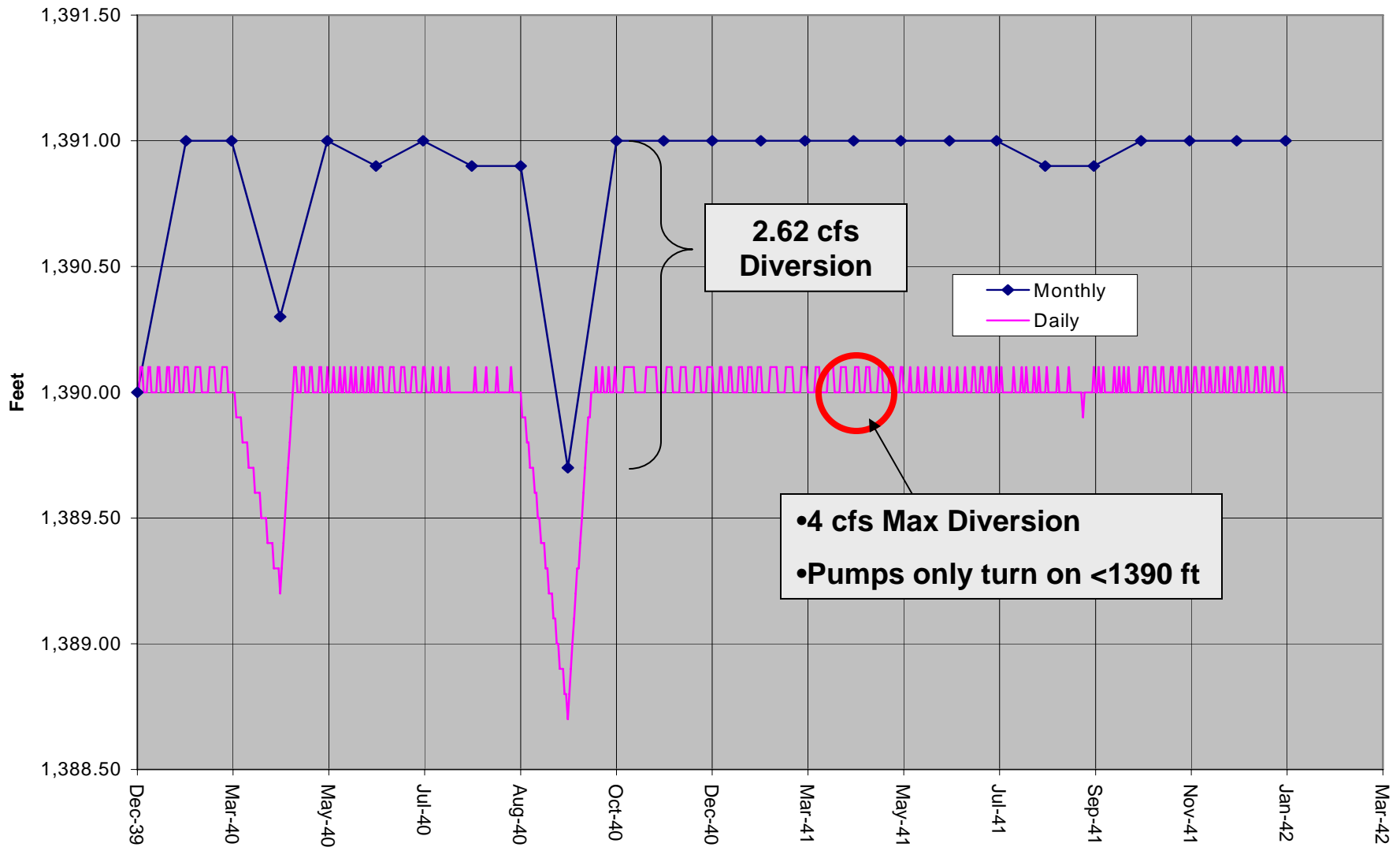
# Step #1: (Re)Creating the Daily Model

- Checklist to Switch from Monthly to Daily
- Updating the HEC-DSS Interaction
- Modification to the Model and Rule Set

# Lake Travis Storage – Monthly Model vs. Uniform Daily Model



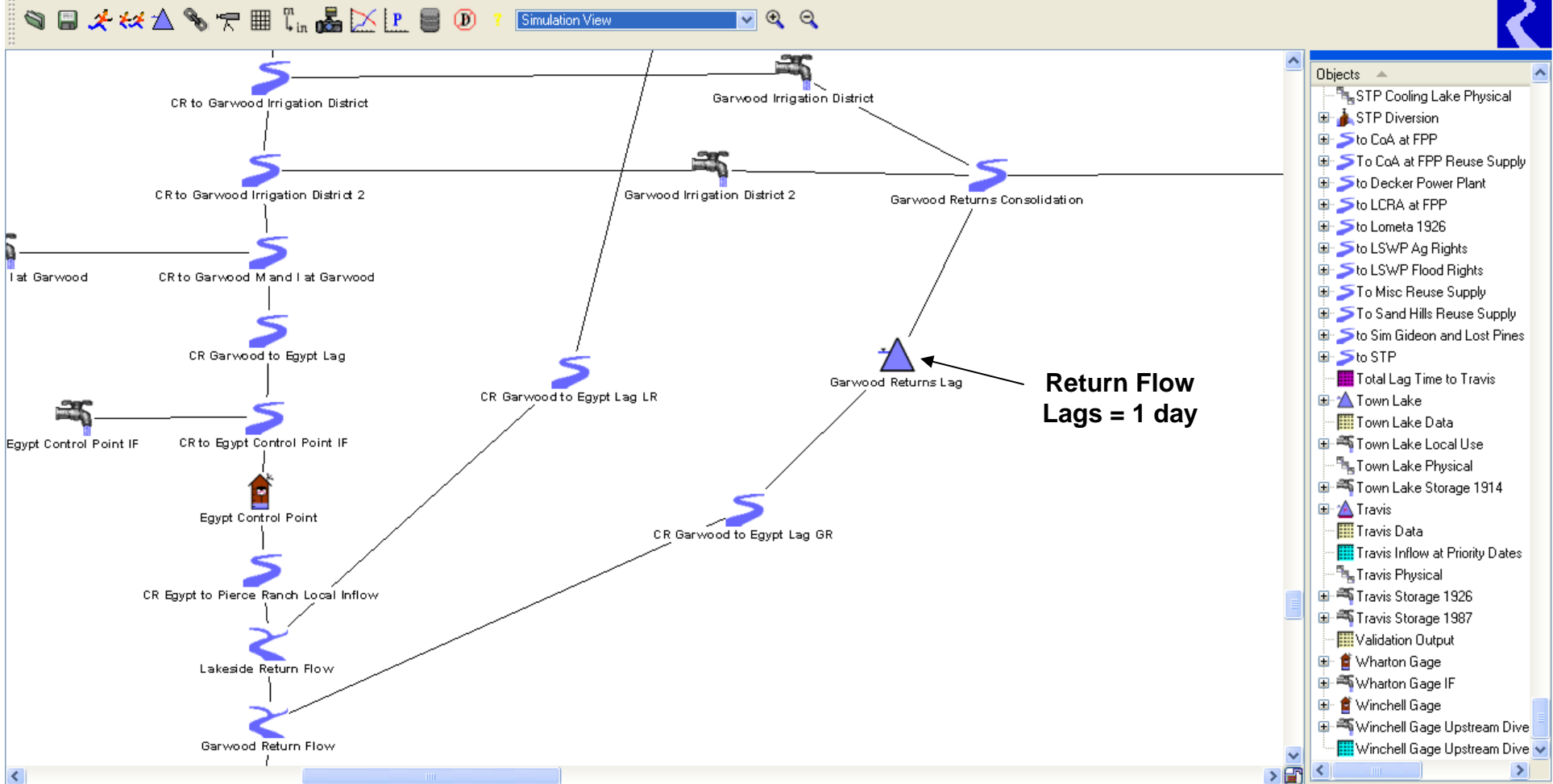
# Lake Lometa Storage – Monthly Model vs. Uniform Daily Model



# Other Issues

RiverWare 4.8.6 - LCRA\_Monthly\_Model\_Zero\_Lags.mdl.gz

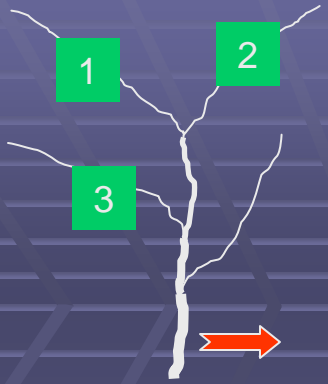
File Control Workspace Policy DMI Accounting Utilities Help



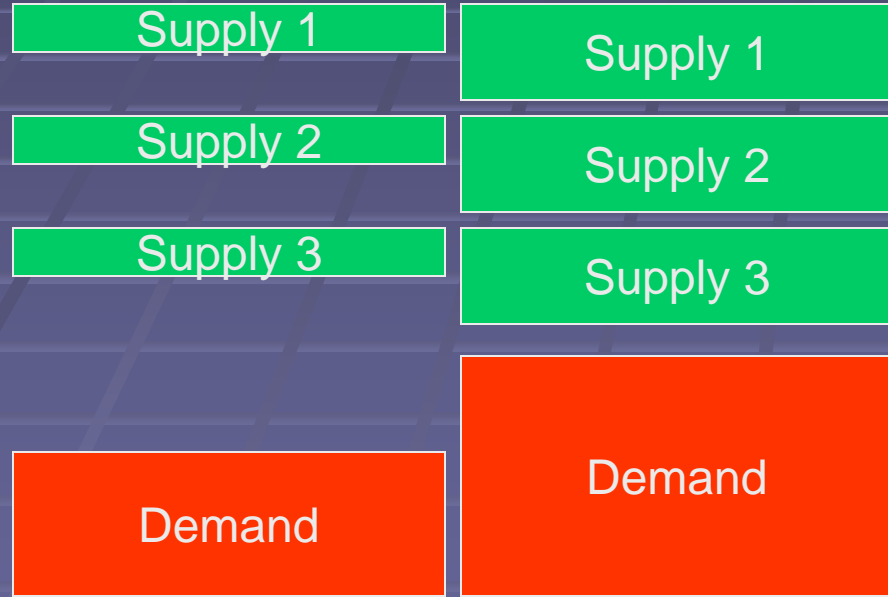
Riverware

start | Q:\Project... | 17 river... | Book1 | Sent for k... | Microsoft ... | Daily-Mon... | 6 java | Day-Timer... | 3:24 PM

# Return Flow Lags



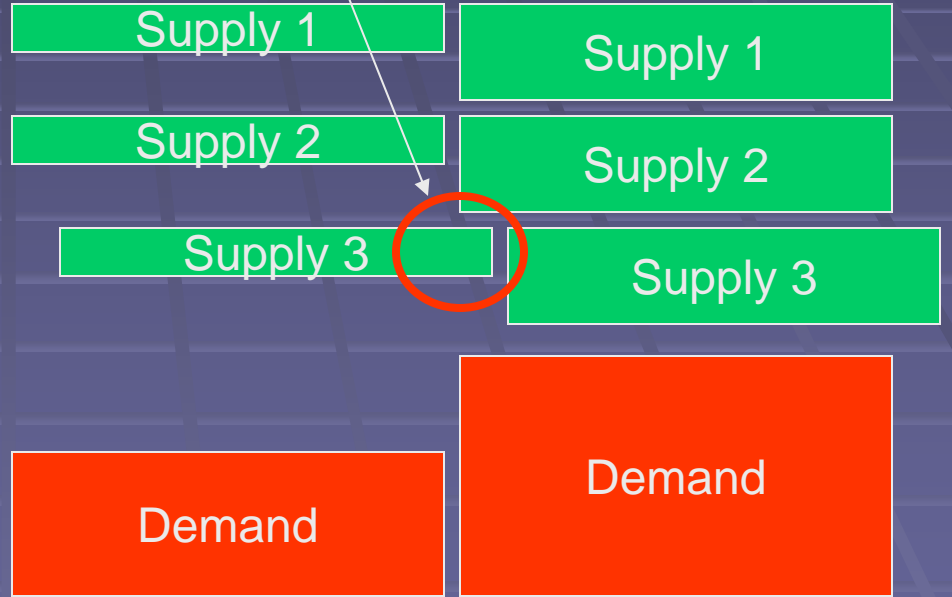
1 Day Return Flow Lag



100%

100%

Monthly



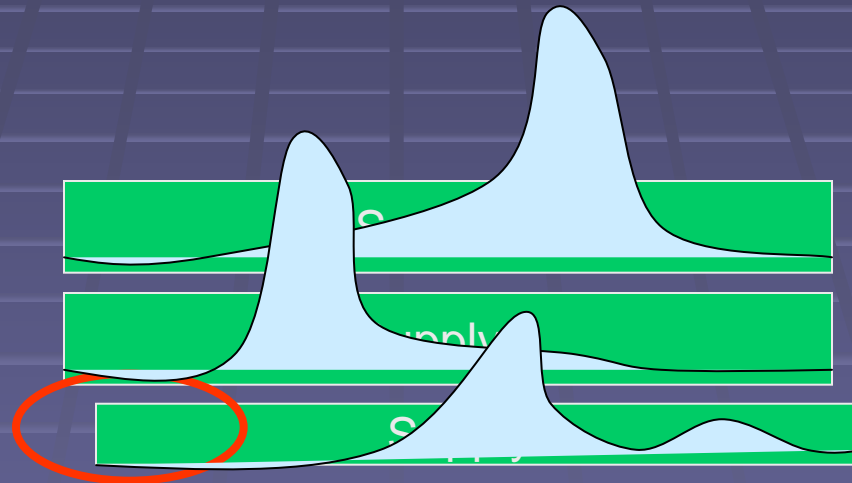
100%

96%

Basic Daily



# Step #2: Introducing Variable Daily Hydrology

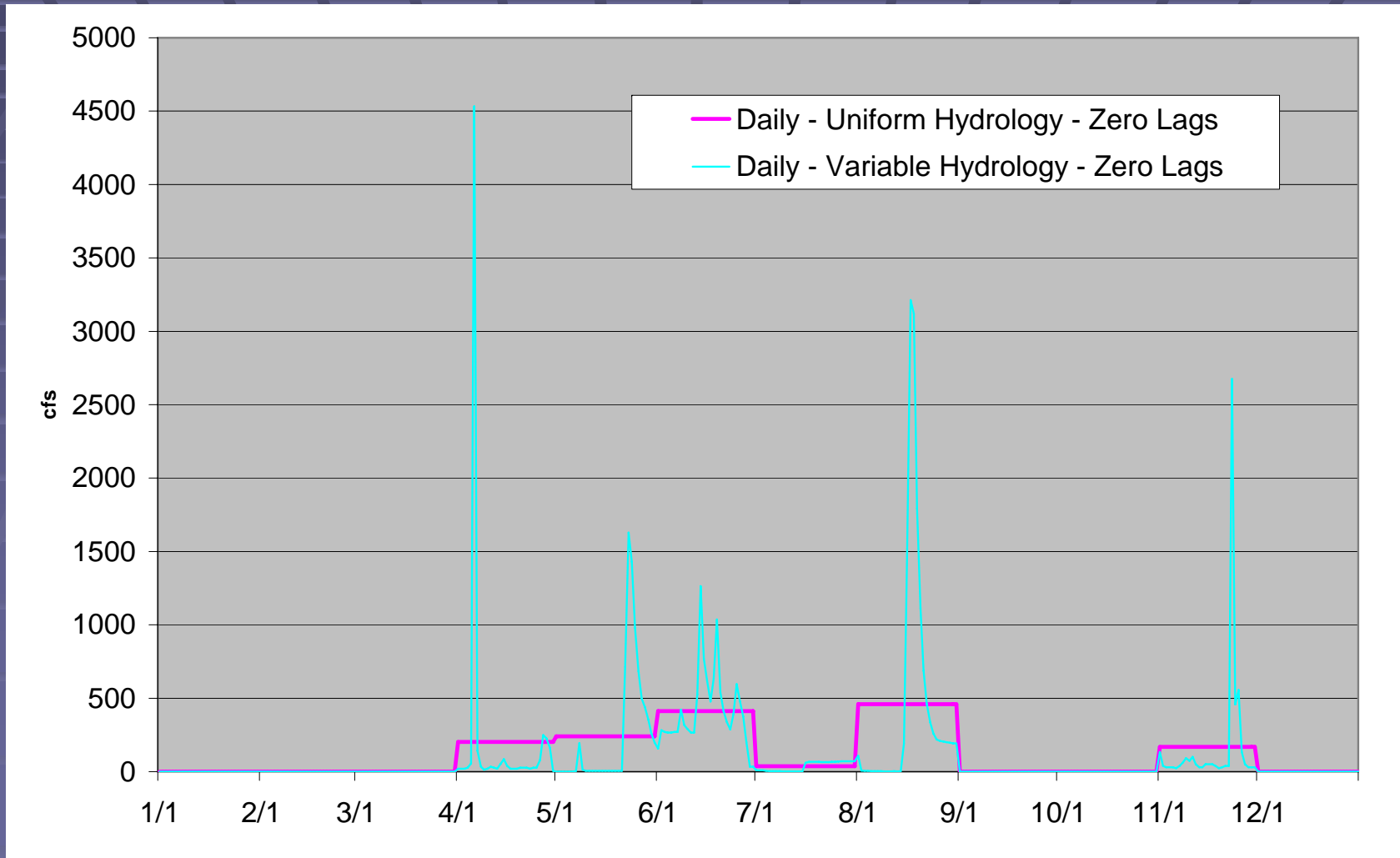


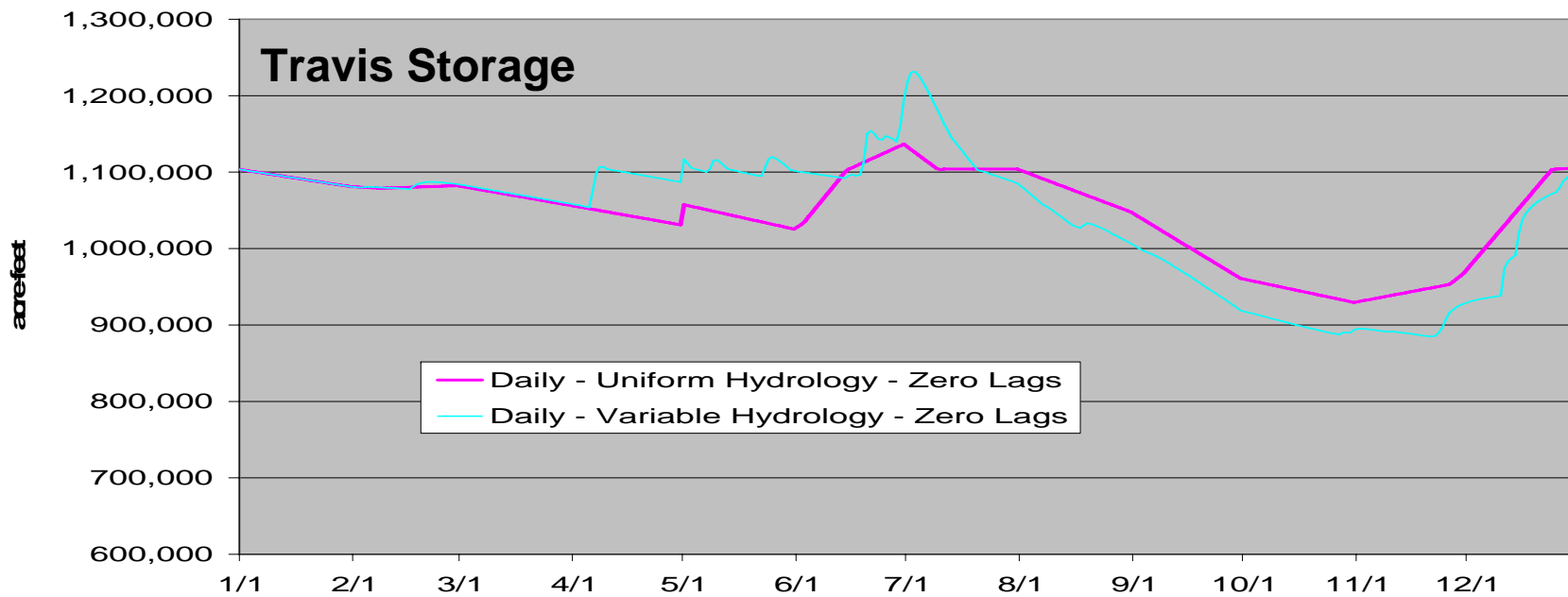
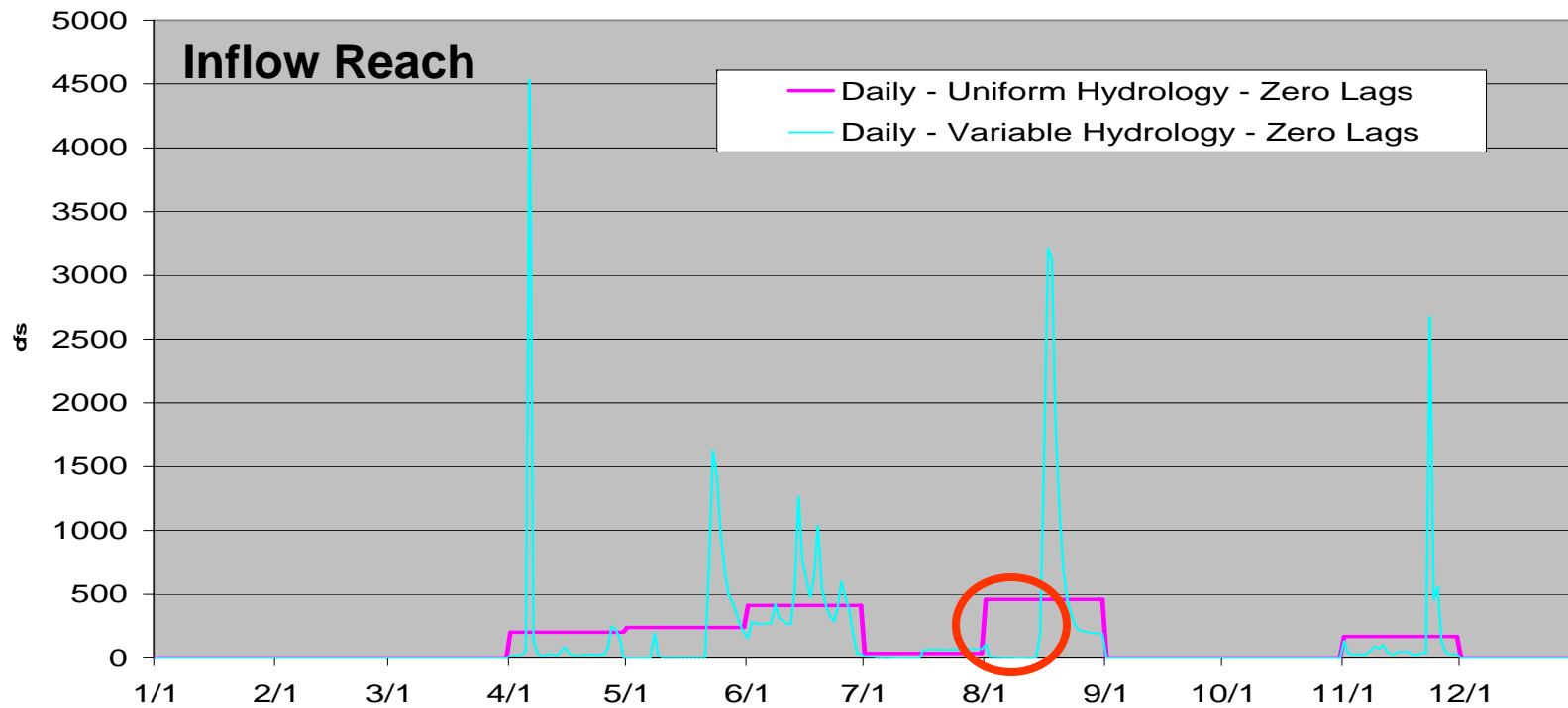
Demand

# Step #1: Introducing Variable Daily Hydrology

- Redistribute Monthly Inflows
- Base Redistribution on Near-by USGS Gages
- Maintain Zero Mainstem Lags
- 1 Day Return Flow Lags
- Uniform Monthly Demands

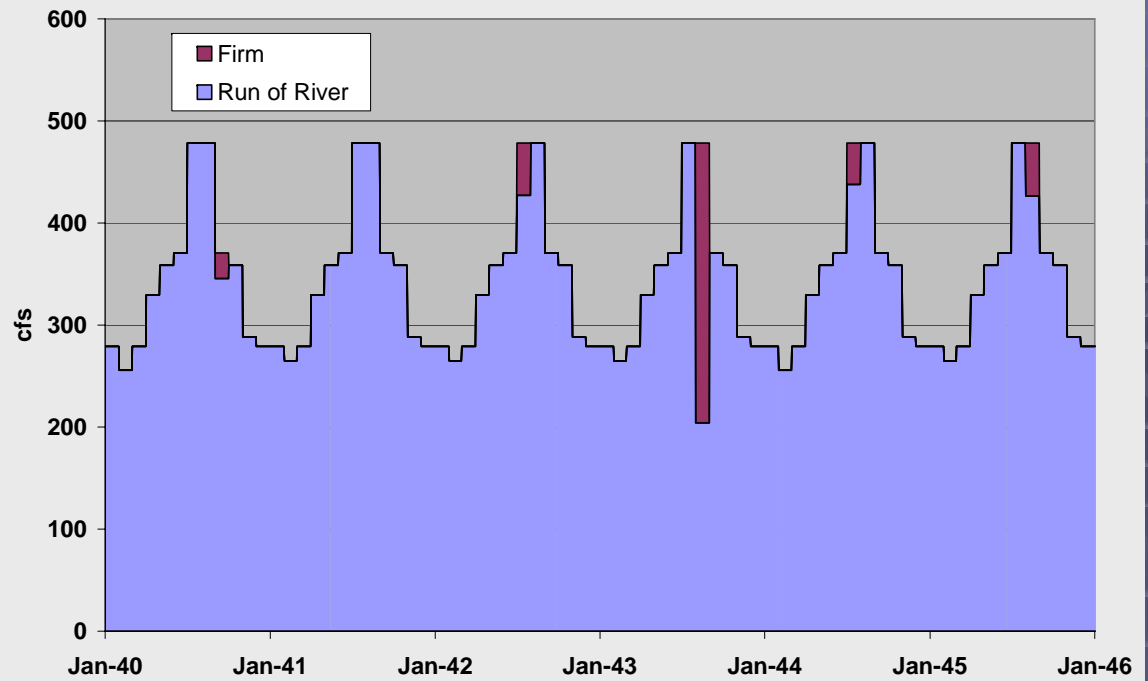
# Pecan Bayou Above Lake Brownwood, 1940 – Monthly Uniform vs. Daily Variable Hydrology



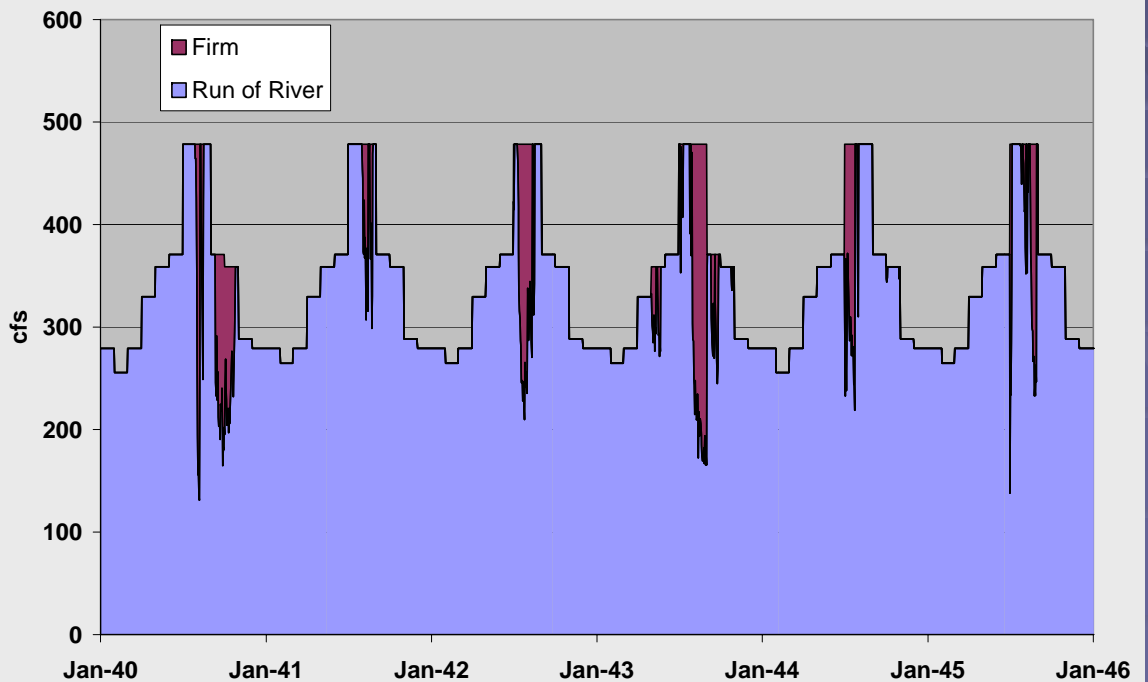


# Diversion for City of Austin 1913 Municipal, 1940-1945

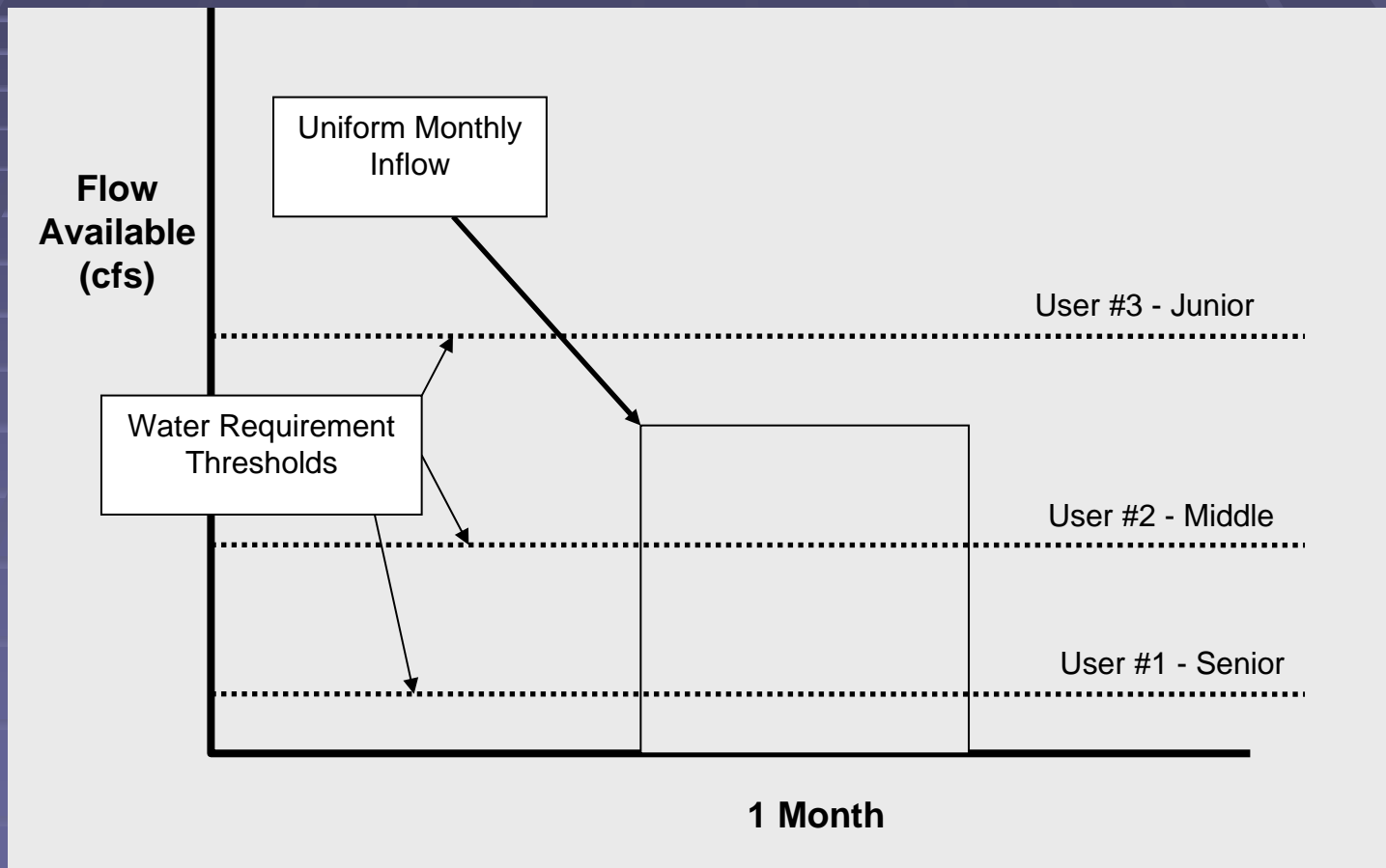
## Monthly Uniform Hydrology



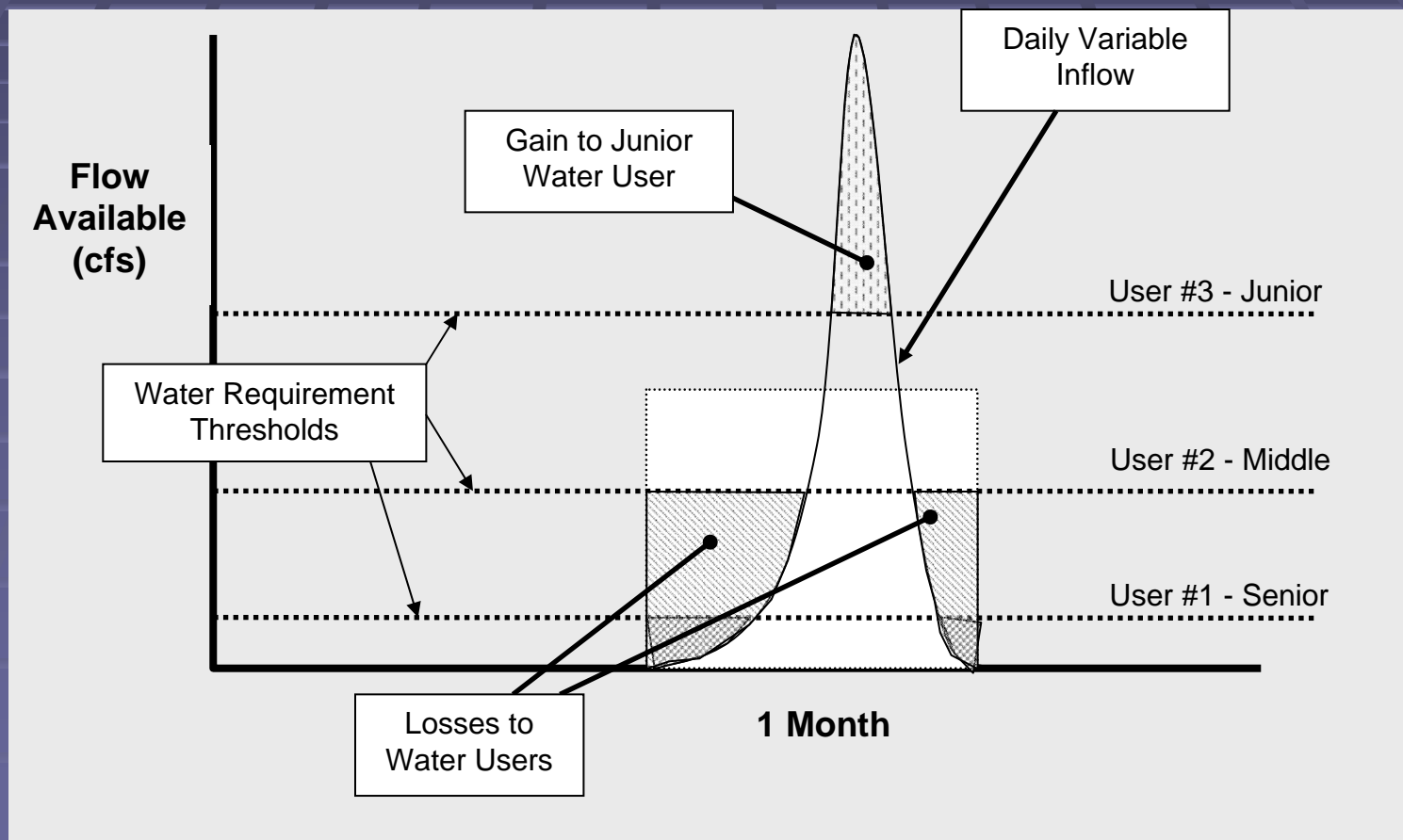
## Daily Variable Hydrology



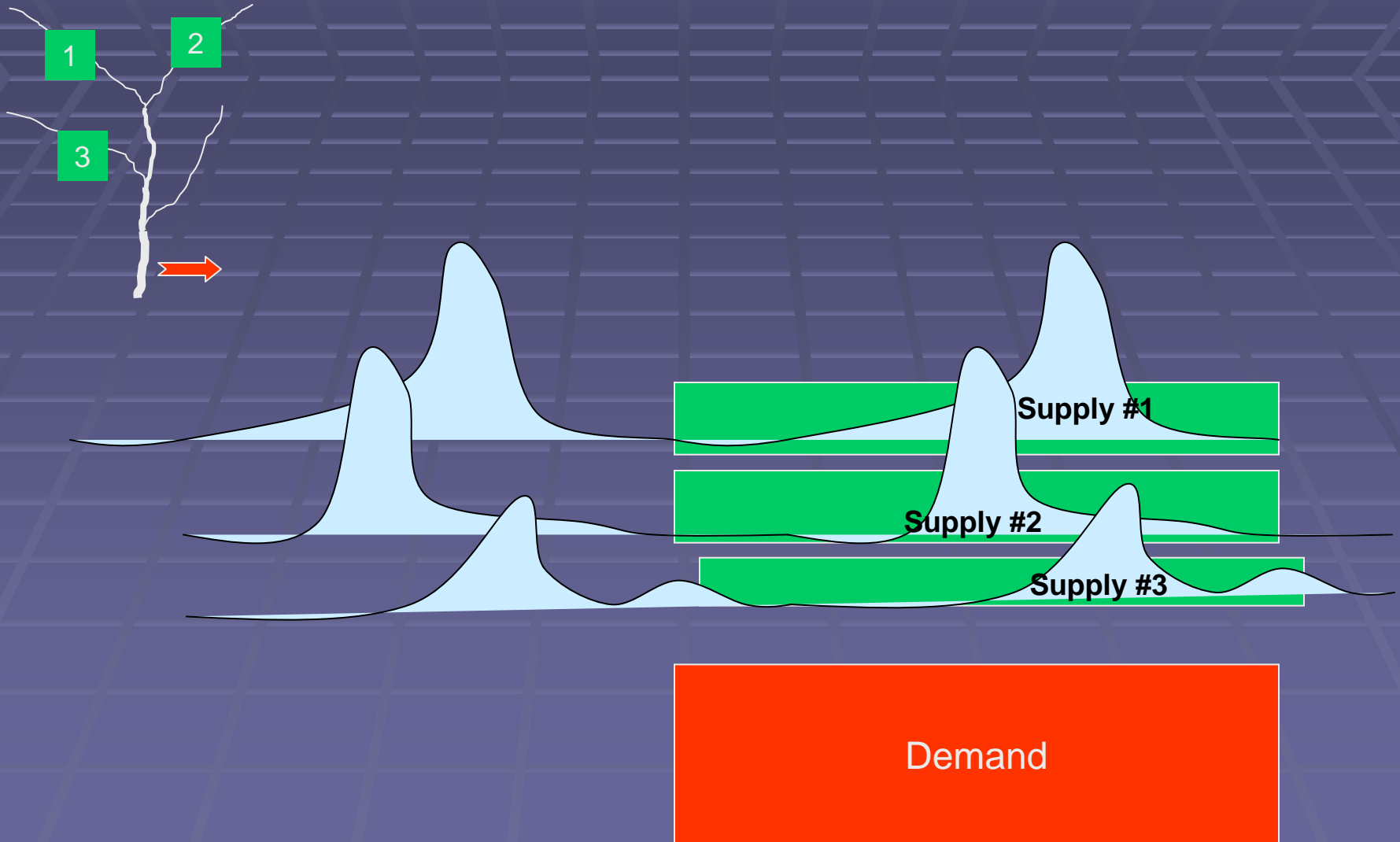
# Conceptual Model of Water Available to Prioritized Water Users with Uniform Monthly Hydrology



# Conceptual Model of Water Available to Prioritized Water Users with Daily Variable Hydrology



# Step #3: Introducing Mainstem Lags

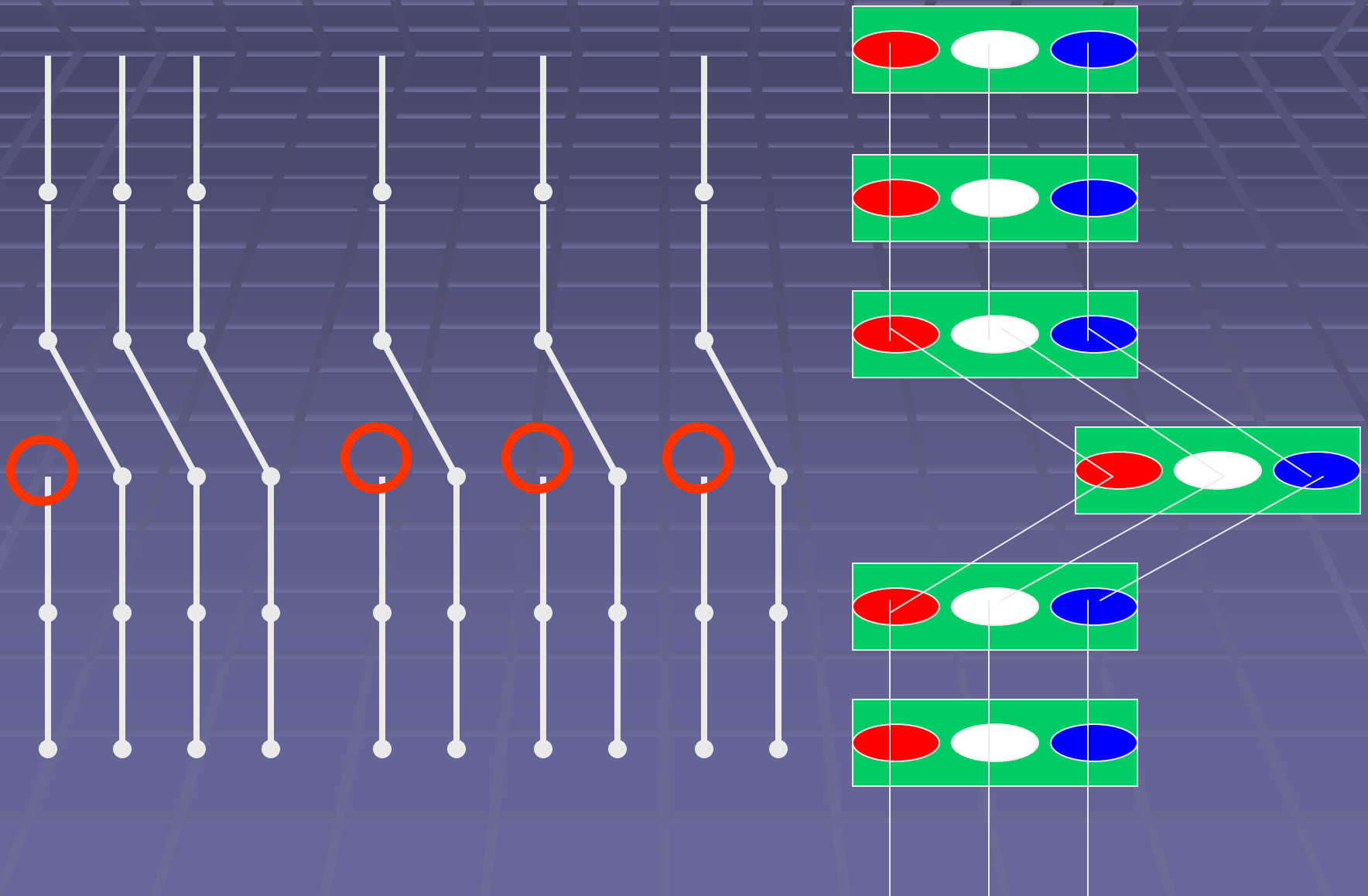


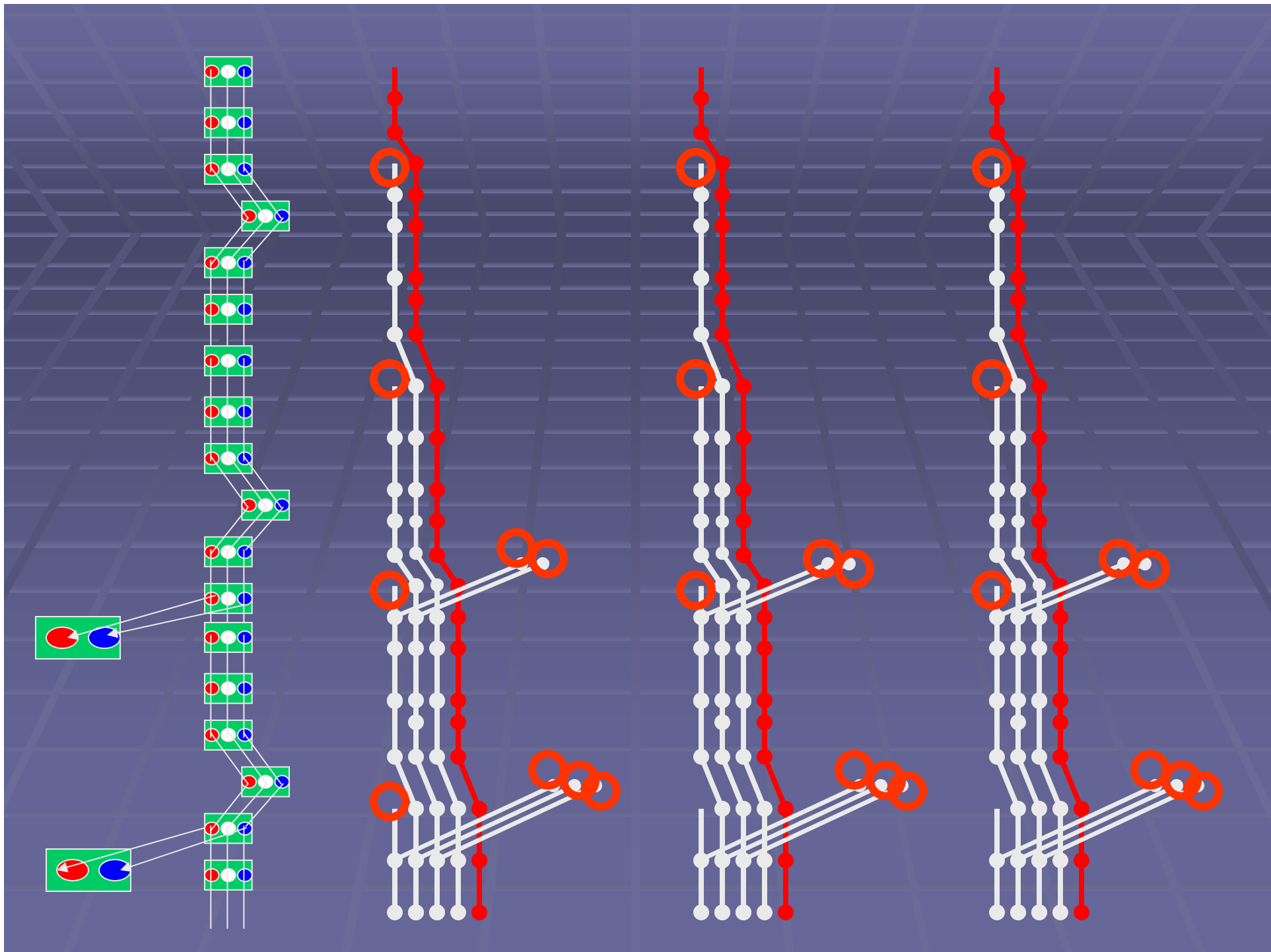


## Step #3: Introducing Mainstem Lags

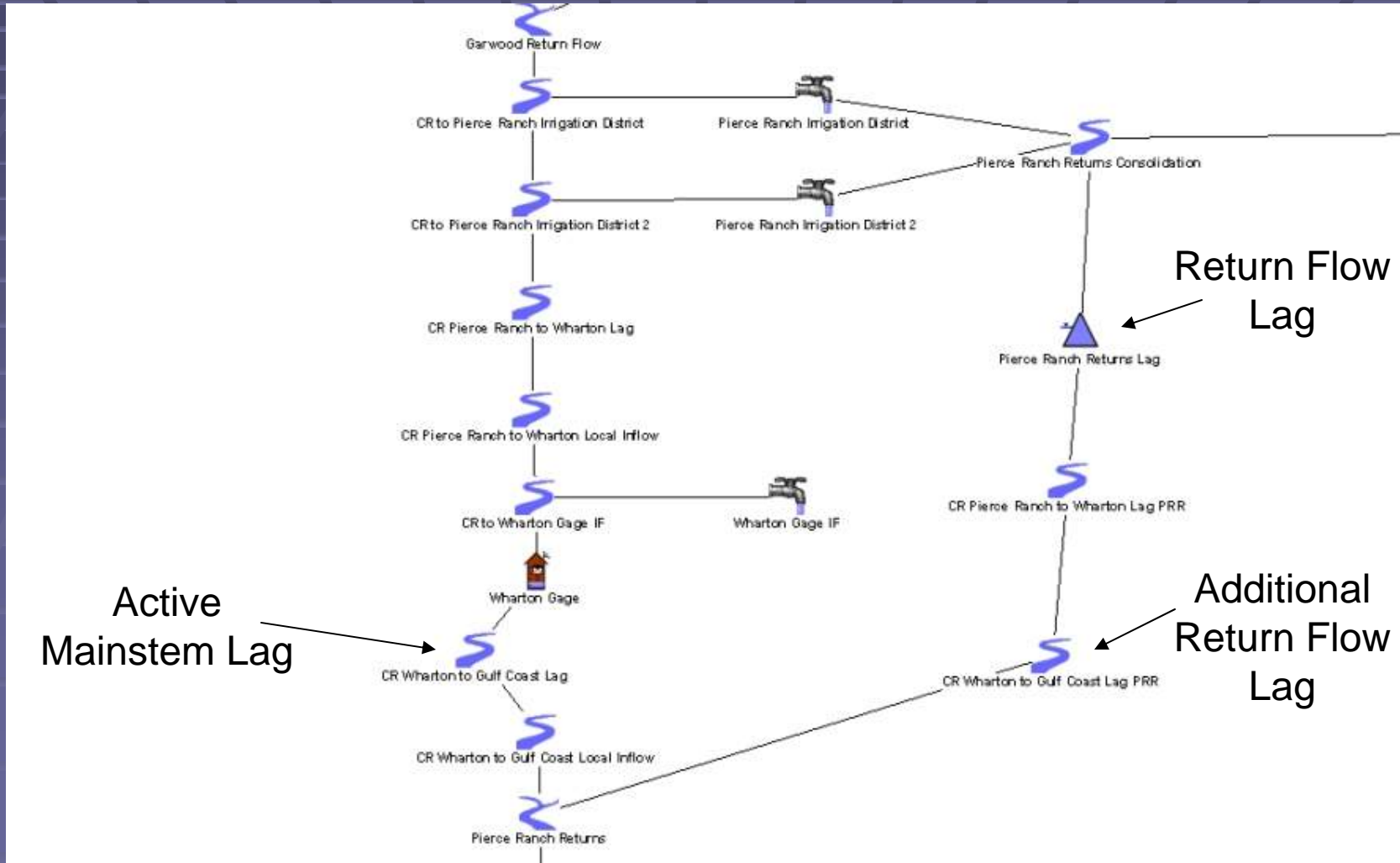
- 7 Day Travel Time Lag from Lake Travis to Matagorda Bay
- Run Controller is on “Travis Time”
- Rules set slots 0 to 6 days into the future
- MANY slots to populate during initial period
  - Individual DMI's
  - Don't Leave Gaps!
  - Primarily Due to 5 Year Segmented Runs

# Initializing For Lags

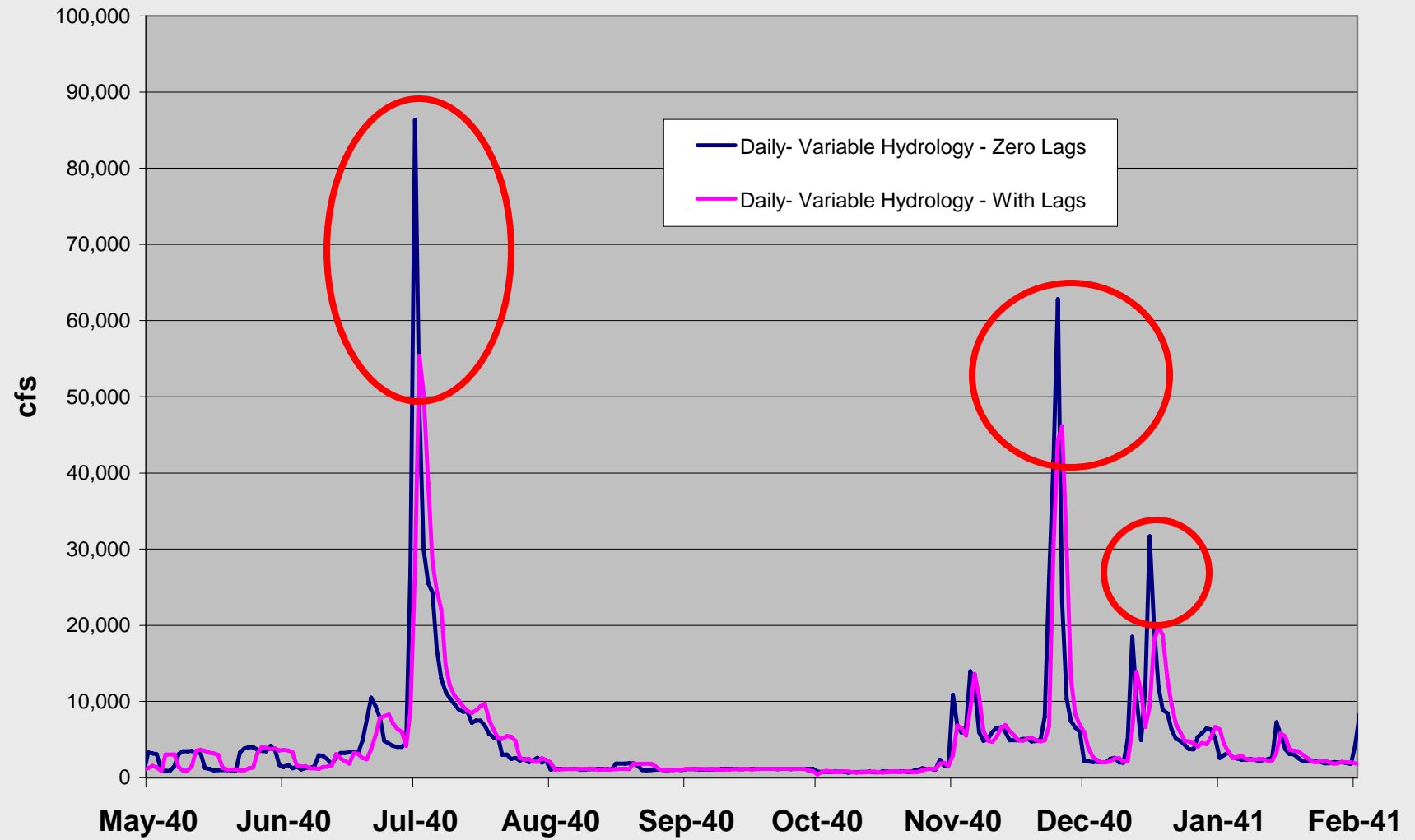




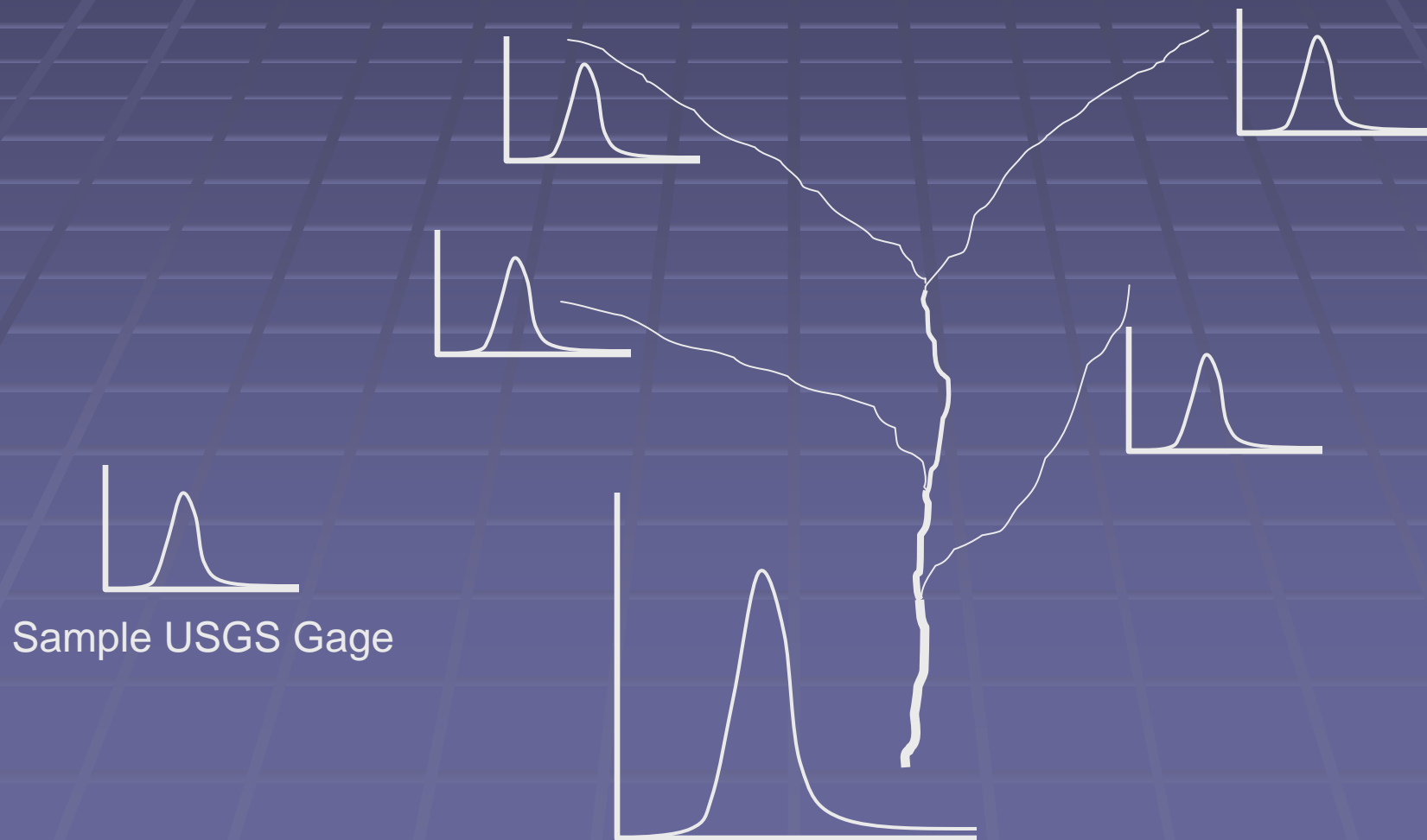
# Lag Locations



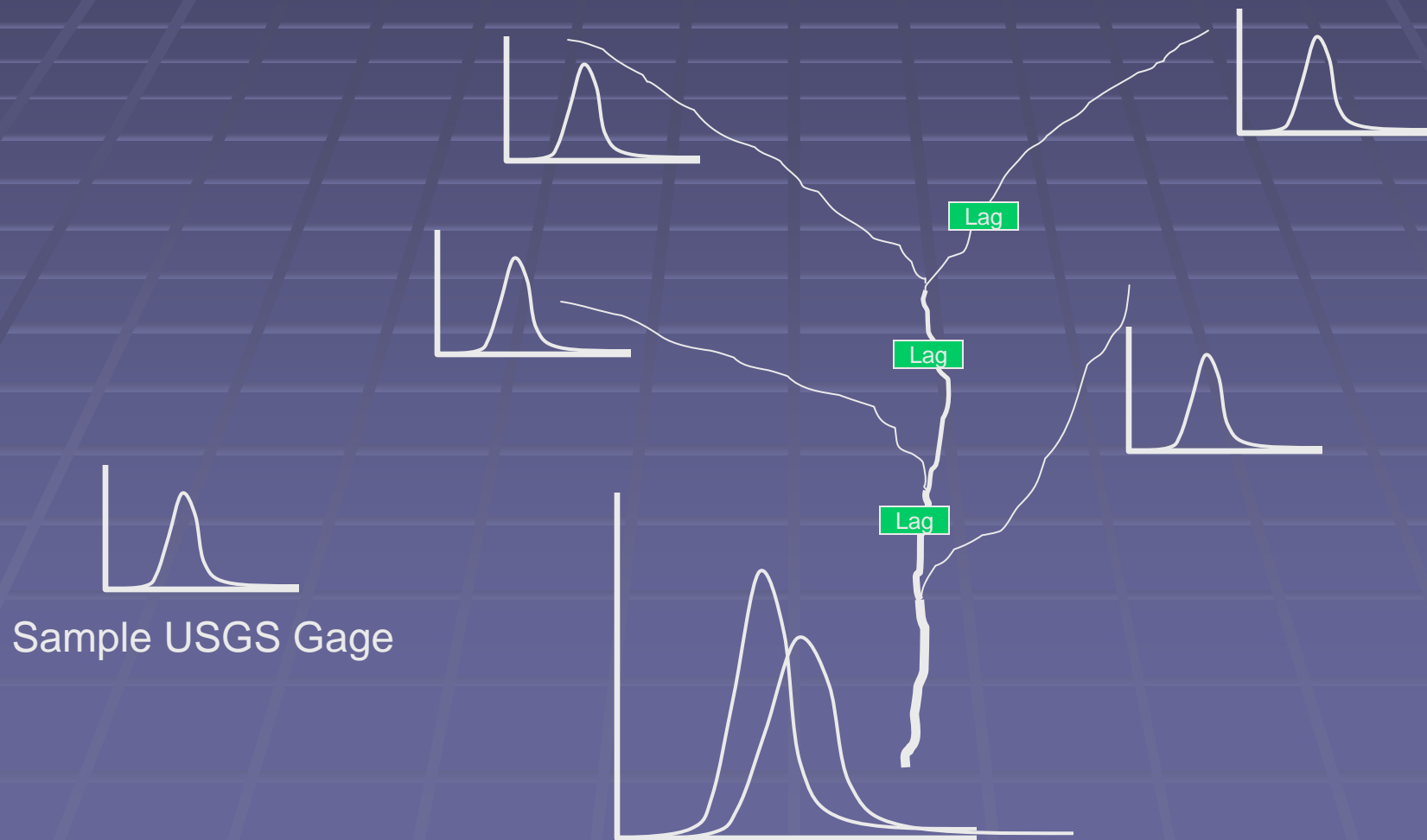
# Flows at Columbus Gage, 1940-1941 – Zero Mainstem Lags vs. With Mainstem Lags



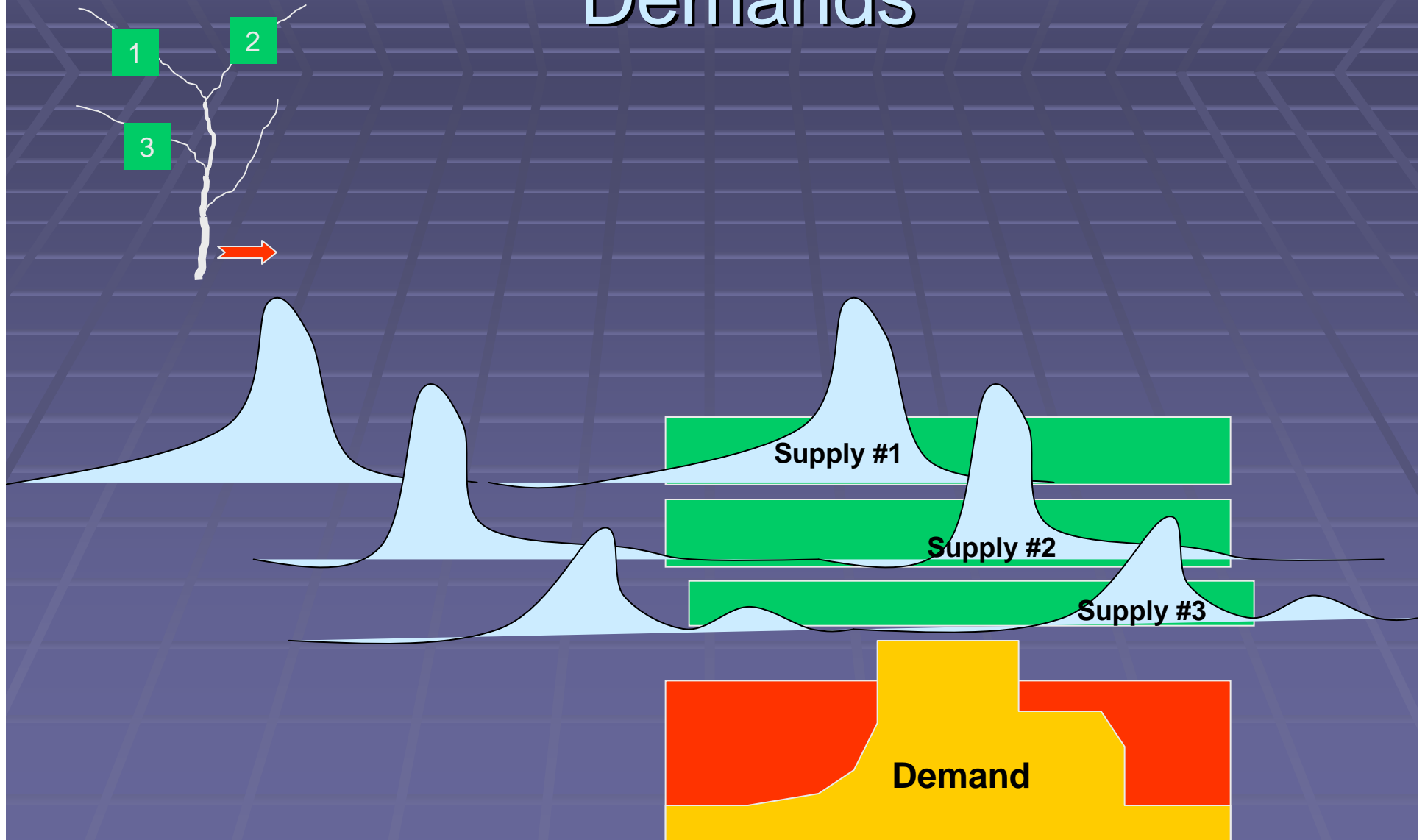
# Daily Hydrologic Inflows Using the Same Pattern Gage



# Daily Hydrologic Inflows Using the Same Pattern Gage With Lags



# Step #4: Introducing Daily Variable Demands



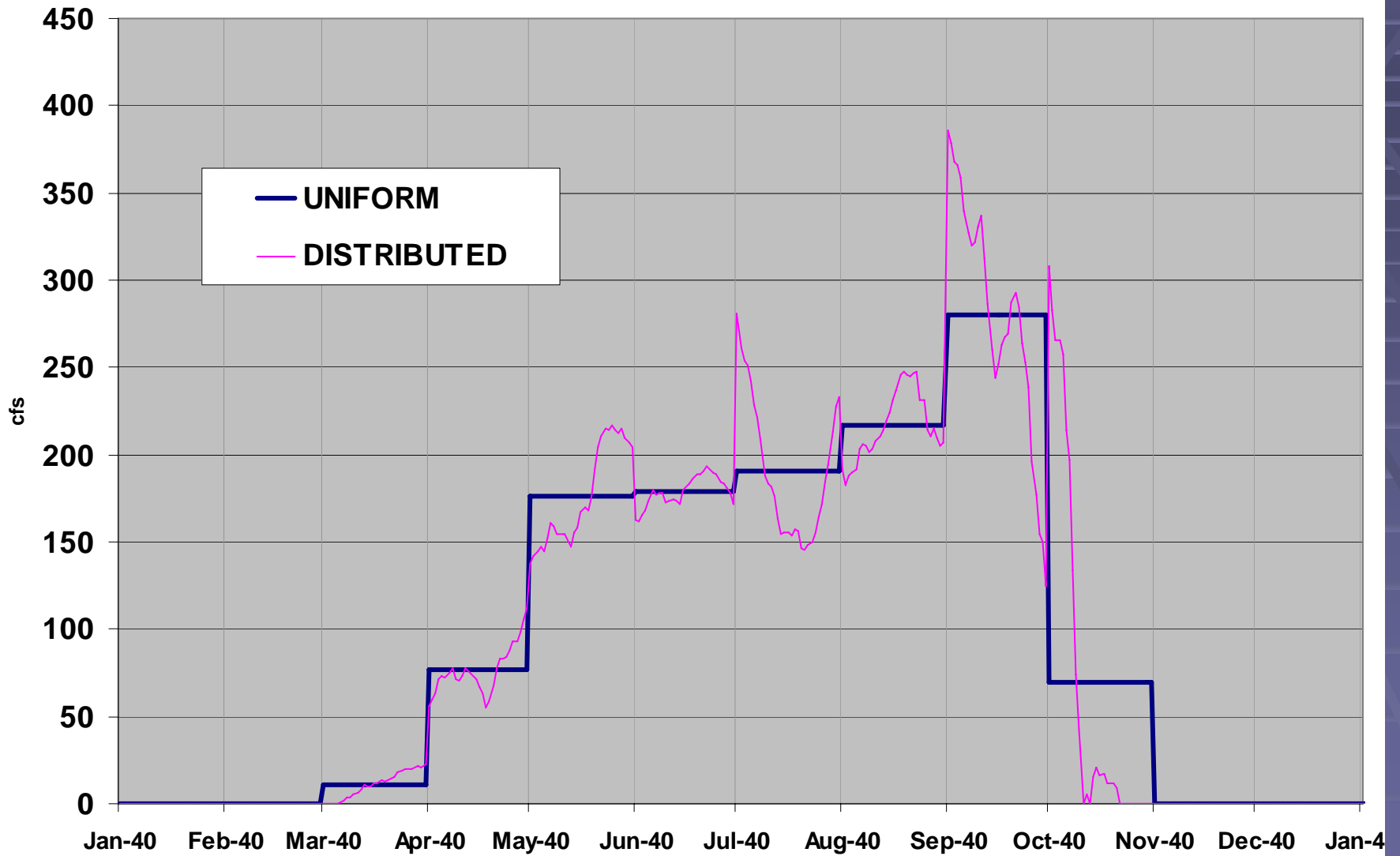


# Step #4: Introducing Daily Variable Demands

Daily Demand Distributions developed by:

1. Various water user types from LCRA's RESPONSE Model
  - Municipal Demands
  - Industrial Uses
  - Uniform/Power Uses
  - Irrigation (Fixed, Variable – 1<sup>st</sup> and 2<sup>nd</sup> crops)
2. Distributions applied to actual Monthly Irrigation and Return Flows
  - Distributions Provided by LCRA

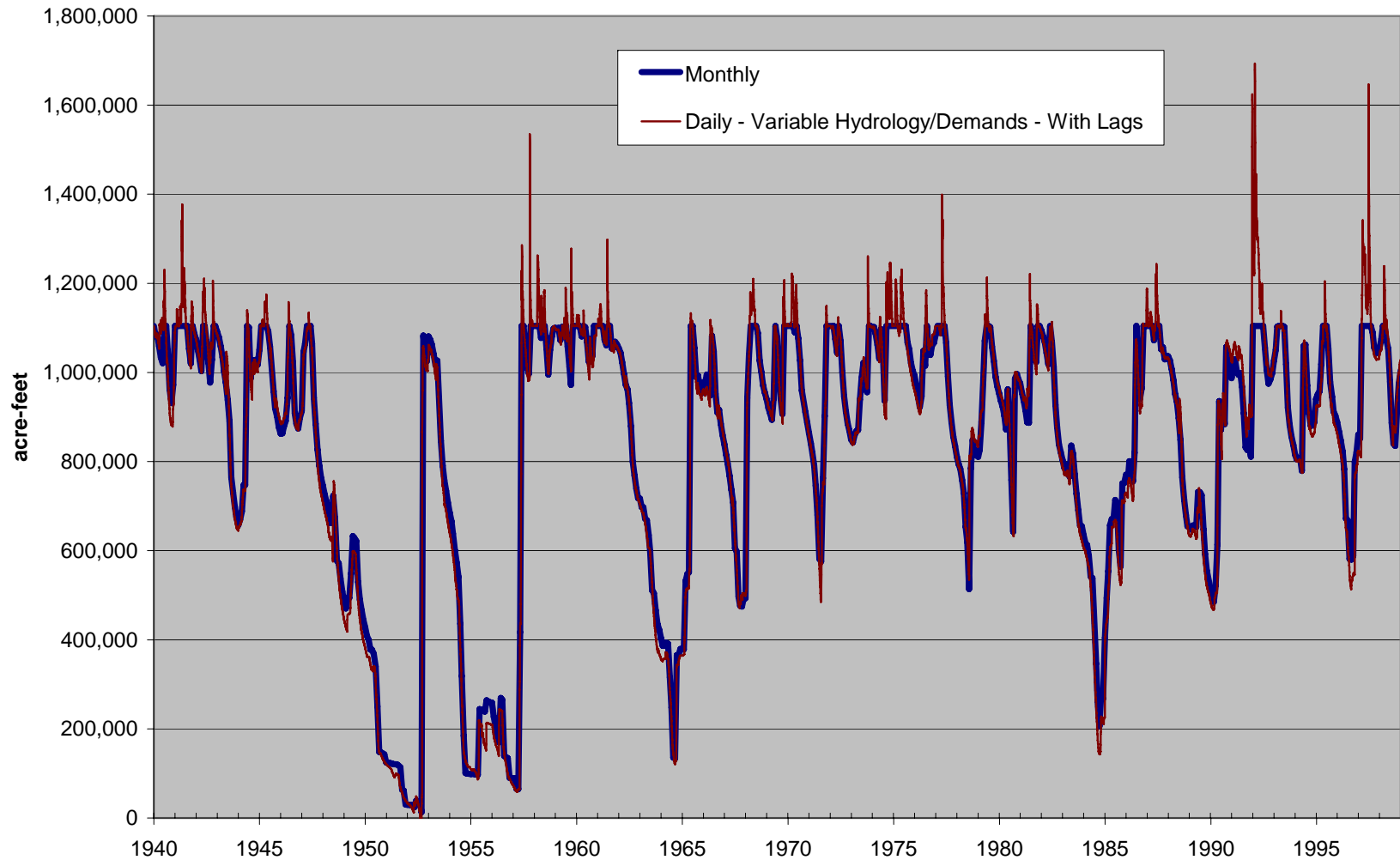
## Garwood Irrigation Demand



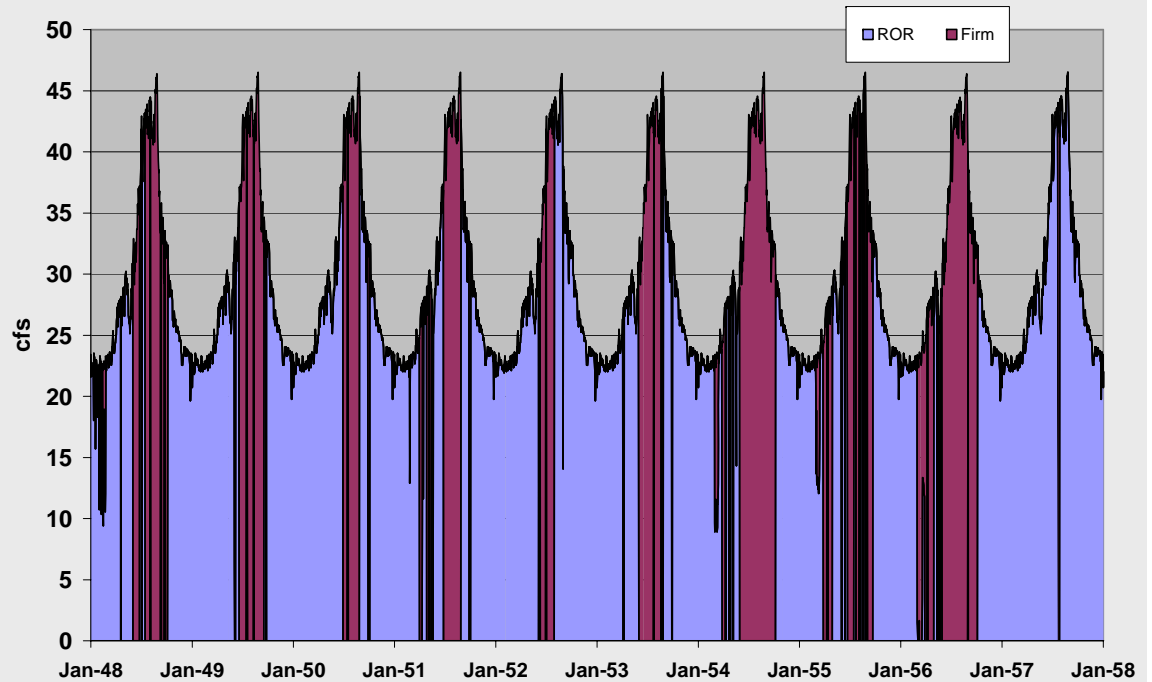
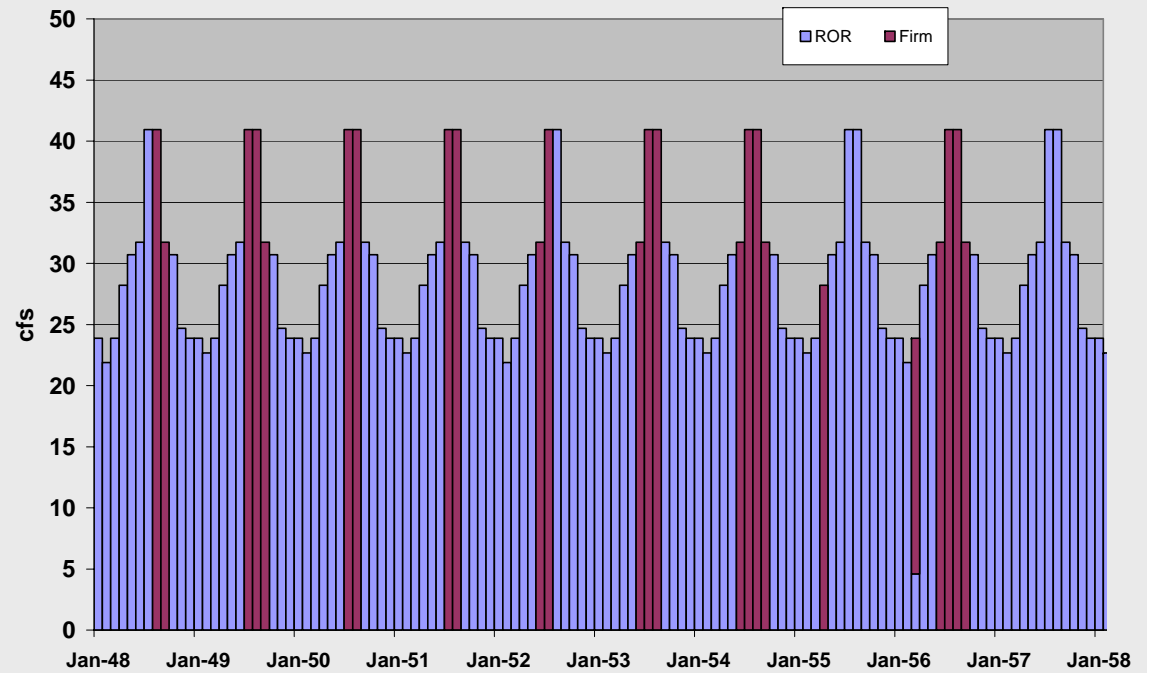
# Step #5: Comparing Monthly vs. Complete Daily Models

- The Big Picture
- No More Surprises
- Justification of the Daily Model
  - How Necessary is it?
- What are the Most Sensitive Parameters?

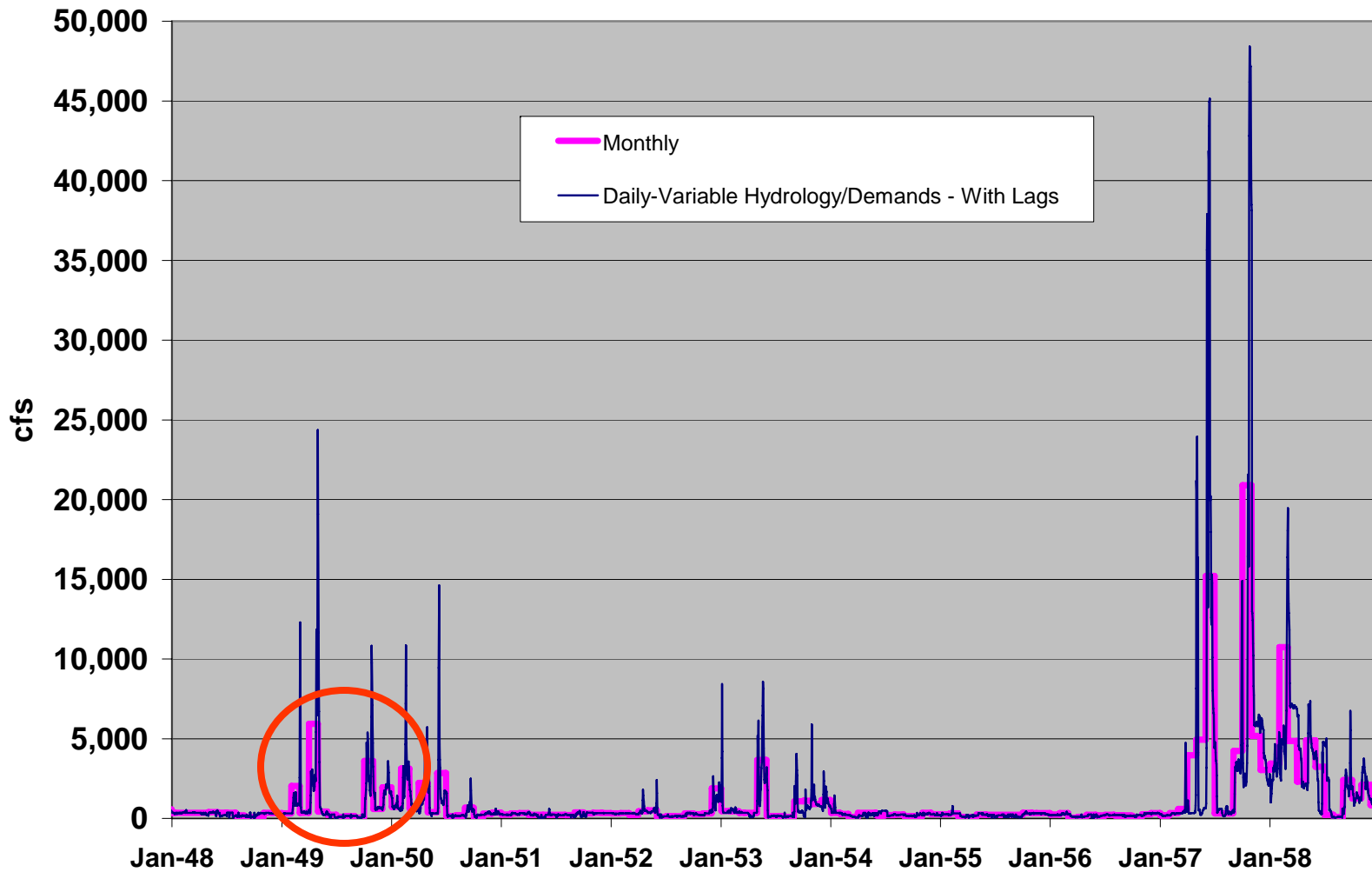
# Lake Travis Storage, Period of Record - Monthly Model vs. Complete Daily Model



# Diversion for City of Austin 1914 Municipal Drought of Record

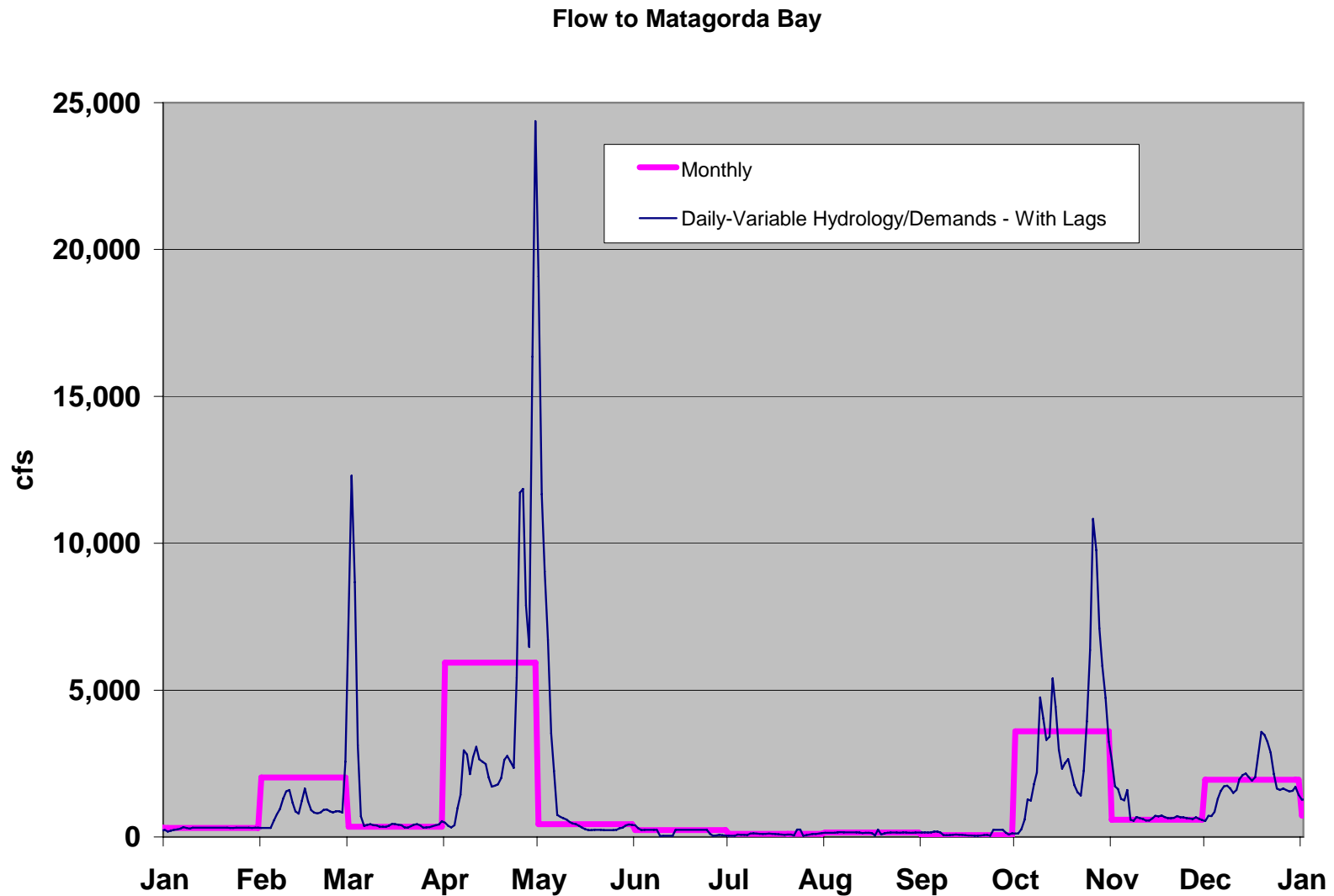


# Flow to Matagorda Bay, Drought of Record Monthly Model vs. Complete Daily Model



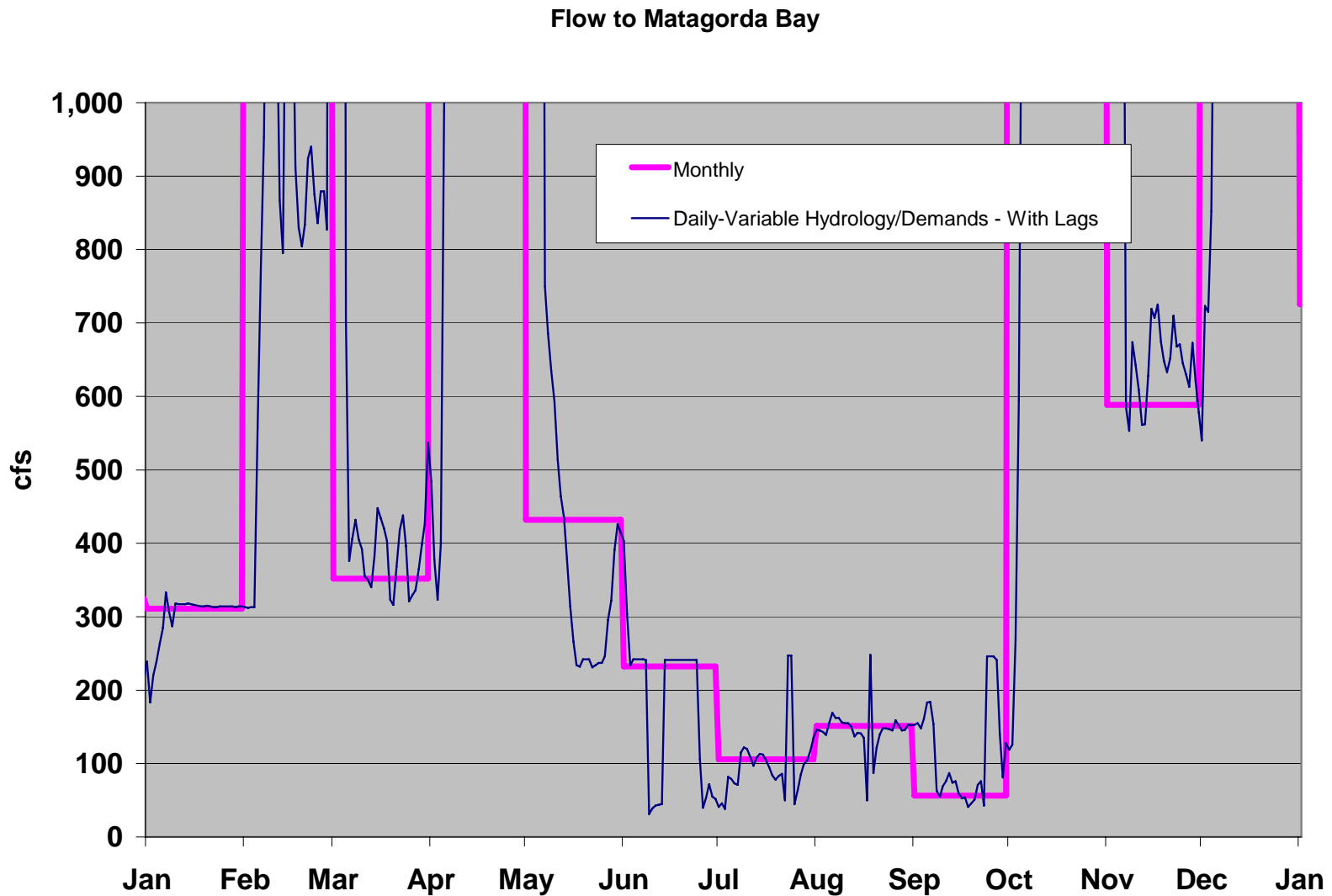
# Flow to Matagorda Bay, 1949

## Monthly Model vs. Complete Daily Model



# Flow to Matagorda Bay, 1949

## Monthly Model vs. Complete Daily Model





# Conclusions

- Successful Implementation of a Dual Monthly and Daily Model
- Identification of Fundamental Logic Differences
- Provide a Substantially more Realistic View of Water Rights and Contract Water Allocation
- Detail vs. Run Time