RED RIVER PERIOD OF RECORD UPDATE THRU 2017 FOR USACE-SWD

Sarah Harris

Corps of Engineers, Tulsa District

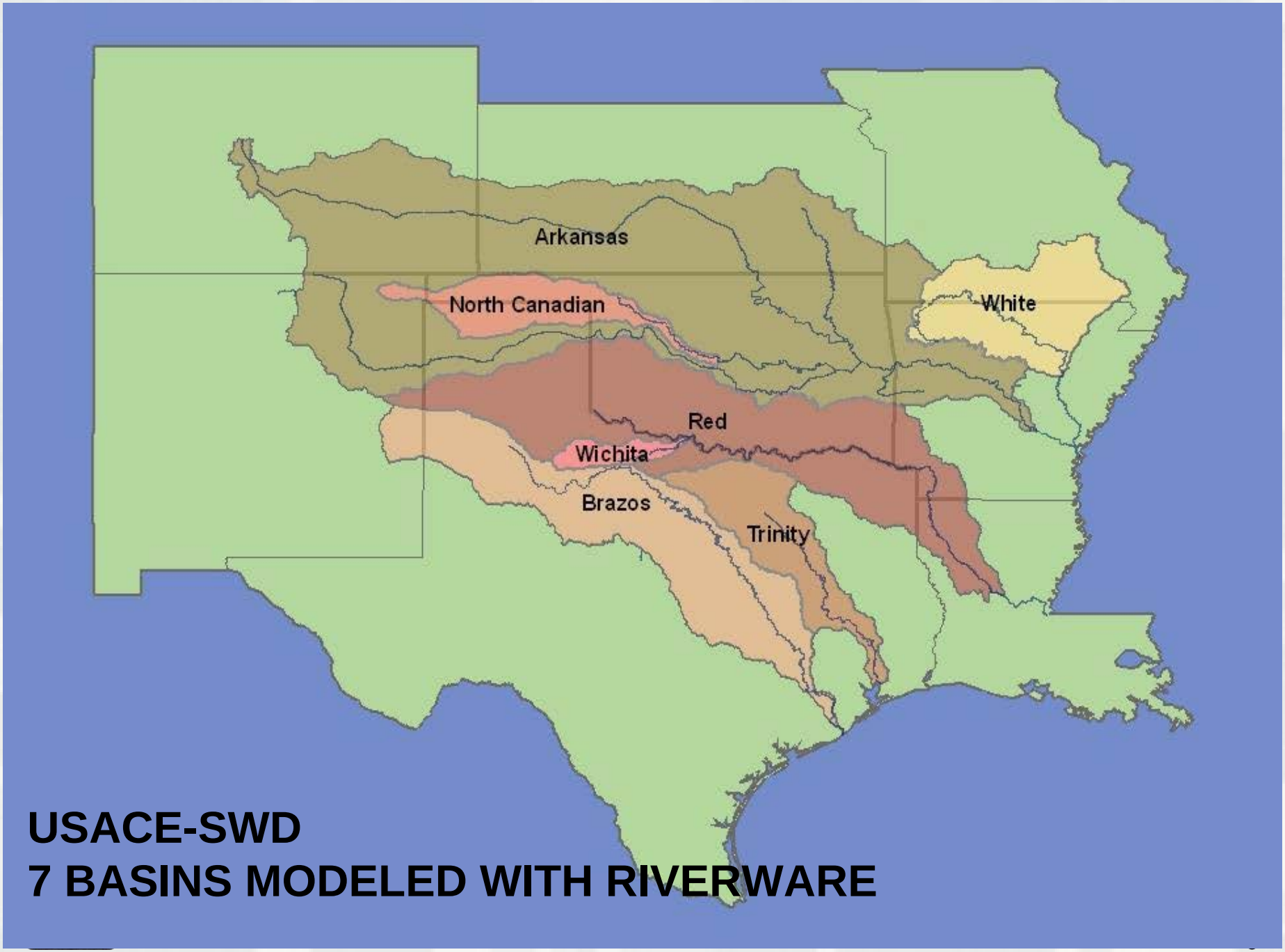
2018 RW Users Meeting

Contributors:

Mary Ann Duke, USACE-Tulsa District

US Army Corps of Engineers

BUILDING STRONG®



USACE-SWD
7 BASINS MODELED WITH RIVERWARE

Tulsa's RiverWare Period of Record Models:

- **Arkansas River Basin to Little Rock:**
  - **21 Reservoirs**
  - **Jan 1940 thru Dec 2008 (soon to be thru CY17)**

- **Red River Basin to Shreveport:**
  - **15 Reservoirs**
  - **Jan 1938 thru Dec 2007 (soon to be thru CY17)**

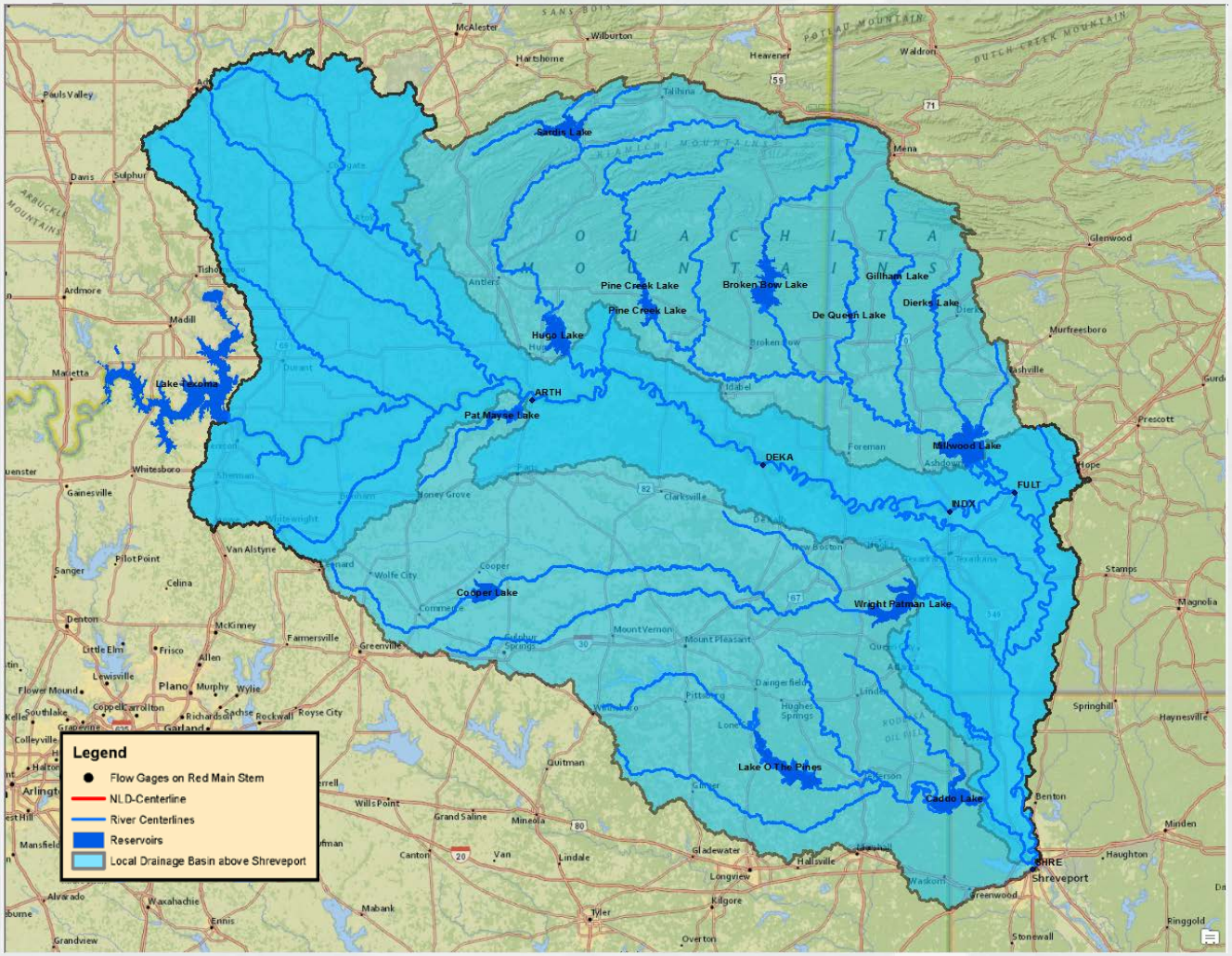
- **Upper North Canadian River Basin to Oklahoma City:**
  - **5 Reservoirs**
  - **Jan 1940 thru Dec 2016**

- **Wichita River Basin:**
  - **1 Reservoir**
  - **Jan 1924 thru Dec 2002**

PURPOSE OF PERIOD OF RECORD MODELS

- Data for Flood Frequency Analysis
  - Unregulated Data for 17.b
    - Ark Navigation Flow Frequency Study
    - Shreveport Flow Frequency Study
- Planning Studies
- Water Supply Studies

Red River POR Extents



Steps to Extend POR:

1. Gather observed data.
2. Update EAC tables and related curves and tables.
3. Calculate locals. (model had to be created)
4. Load POR model with observed data and locals.
5. Update Computational Sub-basin data.
6. Get model to run.
7. Send to Southwestern Power Administration for power loads.
8. Input new power loads into model and re-run.

Determine what data is needed

1. Gather Necessary Observed data

- Data converted from hourly to daily average.
- Red River Model Reservoirs
  - 15 Reservoirs
    - 11 Headwater & 4 Tandem
      - Observed Inflows & Outflows (monthly charts, other districts)
      - Storage values for reservoirs at first time step (model)
      - Seepage (model)
      - Evaporation Rates (monthly charts)
      - Water User data (model)
      - Low flow Requirements (model)
- Red River Model Control Points
  - 41 Control points
    - 26 that require observed data
      - Observed flow data (USGS, database, other districts)

Gather Observed Data

1. Gather Necessary Observed data

- **This model spans 4 districts, so we had to get data from SWL, SWF, MVK, and of course our data in SWT.**
  - **SWT Data – Update through 2015 had already been started so all of the required data from SWT through most of 2015. Just had to pull through 2017. Got this data straight from our database and monthly charts.**
  - **SWL Data – Observed data sent in a dss file.**
  - **SWF Data - Data sent in SWF locals model, so used a DMI to extract all of the data needed for larger Red River model.**
  - **MVK – Shreveport observed data was sent for the years 1979-2017 in a dss file.**

2. Updating EAC and Curve Data Updates

- Update any Elevation Area Tables and Elevation Volume Tables where new data exists at reservoirs.
- Update Operating Level Table where we had new EAC data.
  - The flood control routine calls on the operating level table to set outflows.
- Rating Curves and Max Release table should be updated as well.

Background Information

3. Calculating Locals

- Previous historic POR model used legacy external routines to calculate cumulative locals.

- SWD districts decided to switch to incremental locals for updates, as this is a simpler method of calculation.
  - This method is currently used in SWT benefits calculations.

Creating Local Model

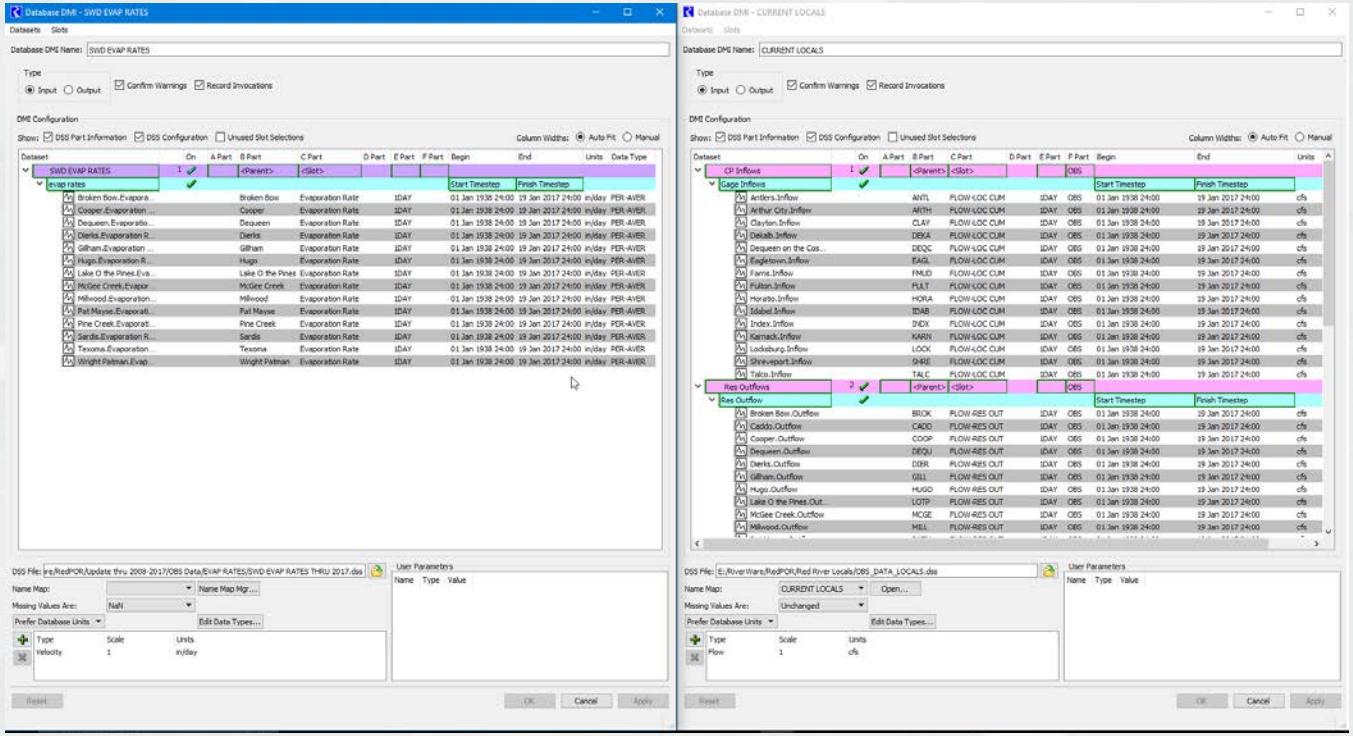
3. Calculating Locals

- **Built a separate model in RiverWare to calculate the incremental locals.**
  - **First step, took POR model and ‘saved as’ to duplicate.**
  - **Second step, changed from a Rules-based run to a Simulation run.**

Local Model DMI's

3. Calculating Locals, cont'd

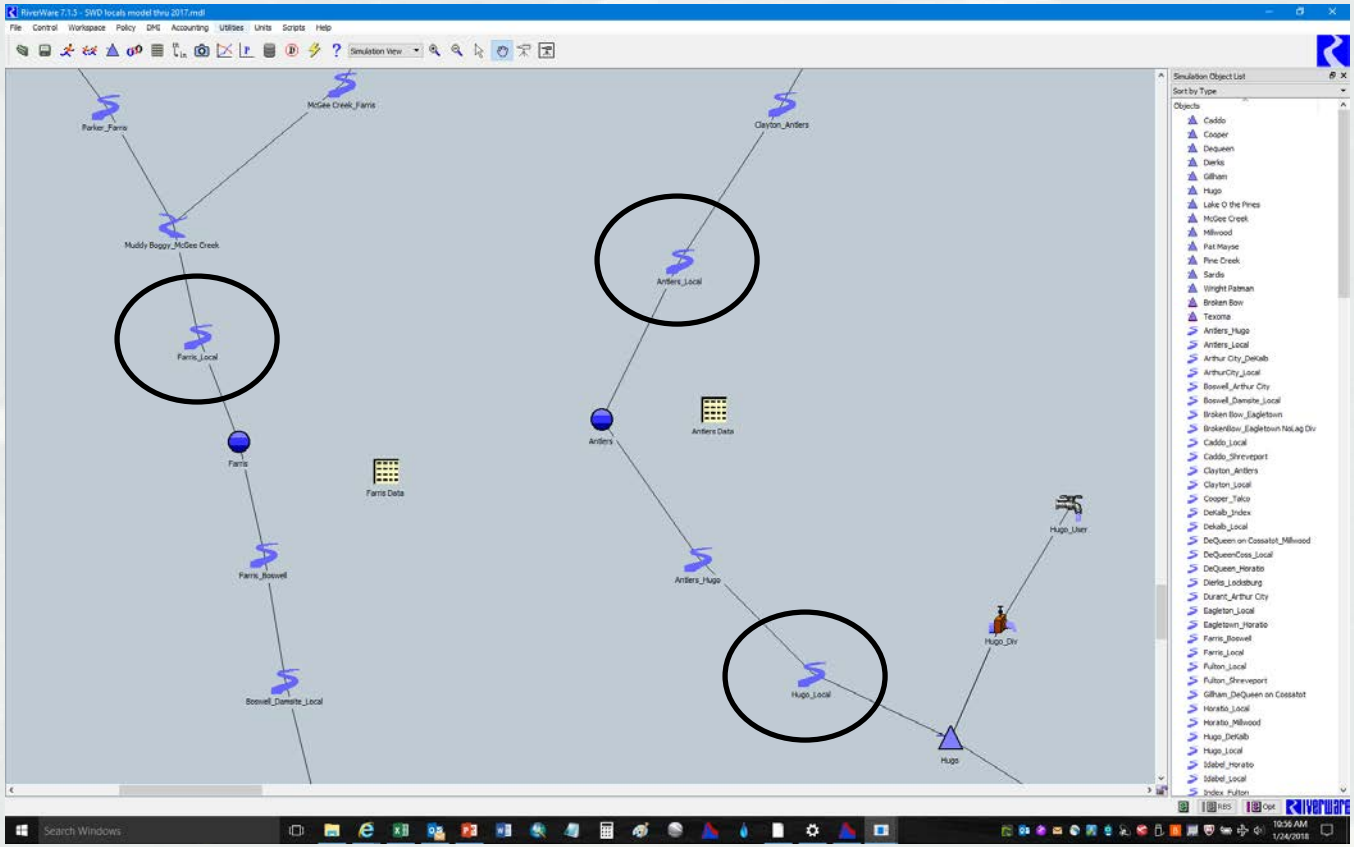
- **Third step was to pull in the observed data necessary to run the model.**
  - **Used DMI's to pull in this data.**



Dummy Routing Reaches for Locals

3. Calculating Locals, cont'd

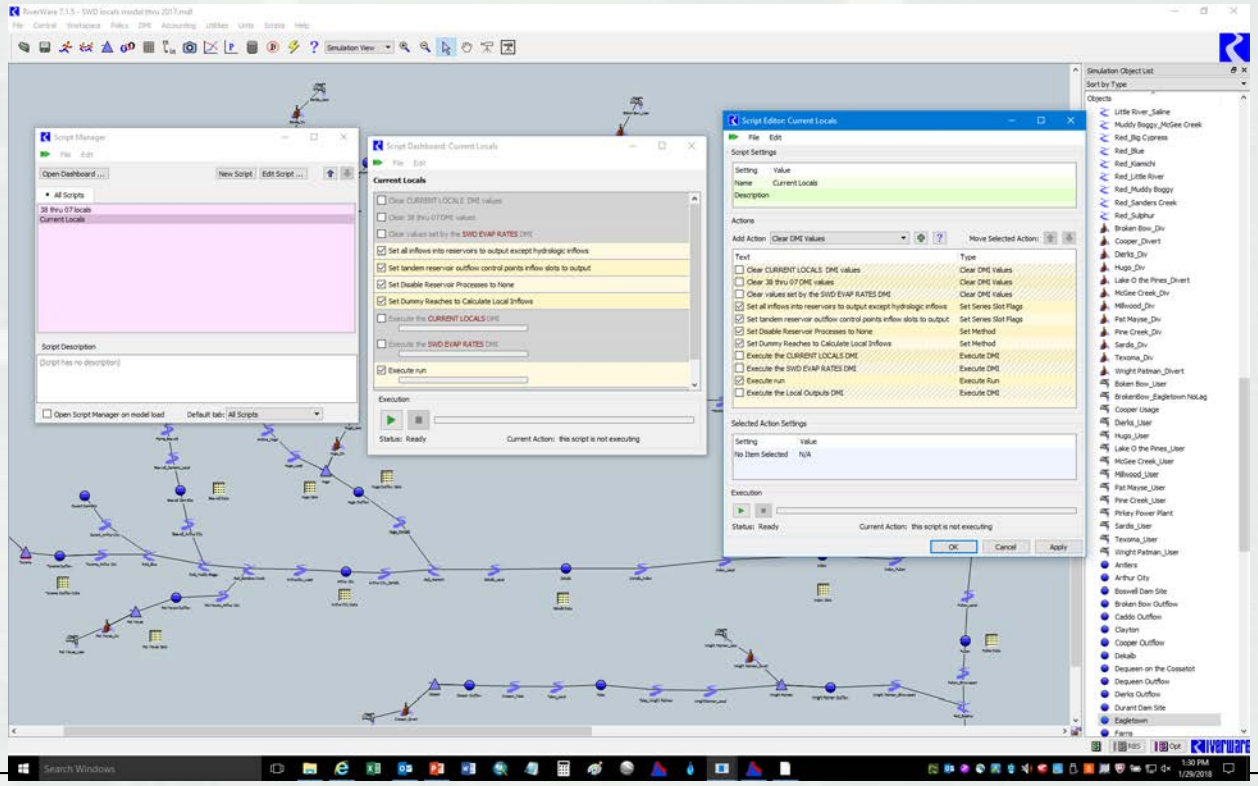
- **Fourth step, added dummy reaches above every control point and tandem reservoir that needed a local calculated.**



Object Method Change

3. Calculating Locals, cont'd

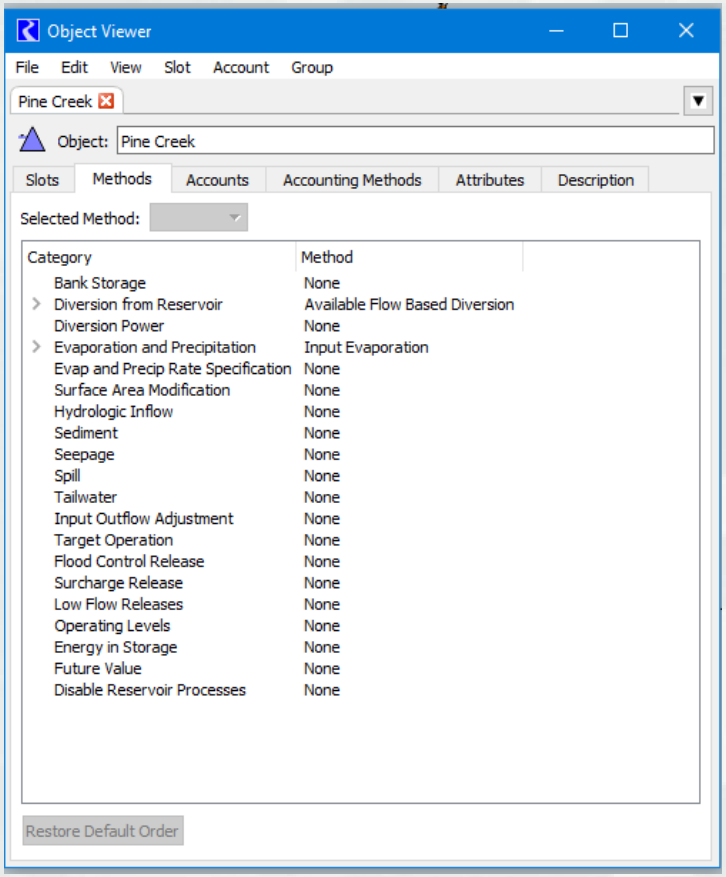
- **Fifth step, changed the methods on Reservoir Objects, Dummy Reaches, and Control Point objects to accomplish the locals calculation.**
  - **Used scripts to accomplish this.**



Reservoirs Method Change

3. Calculating Locals, cont'd

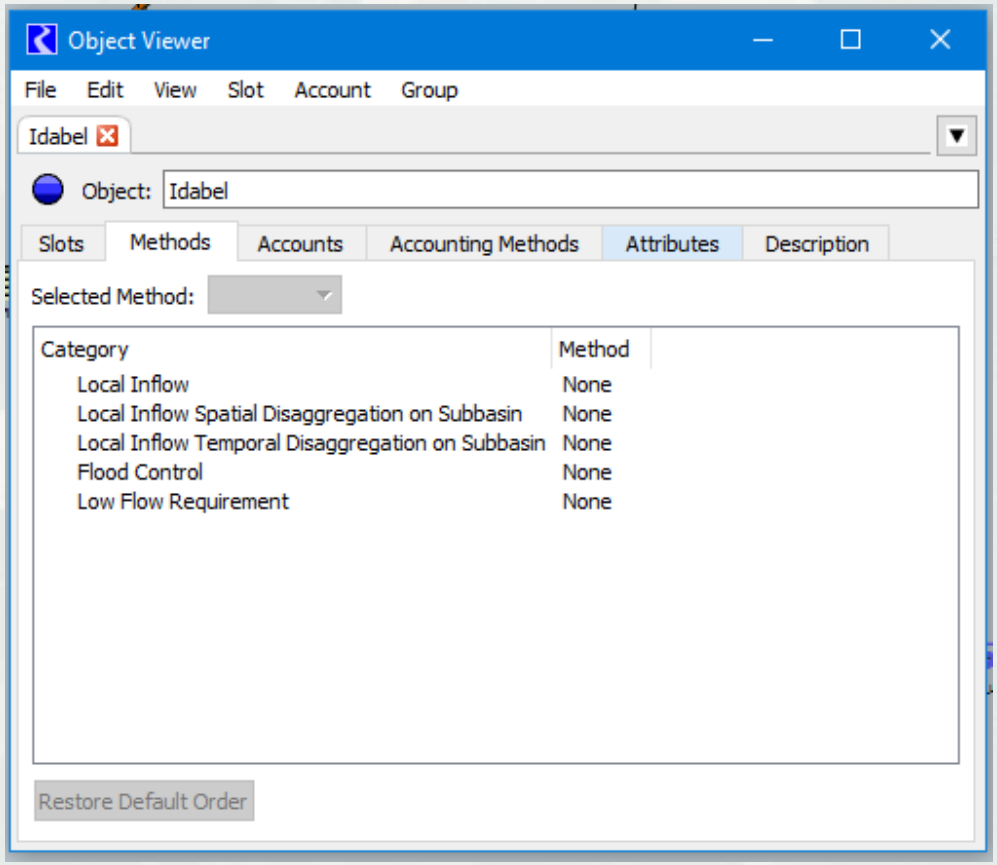
- **Reservoirs**
  - **Only Diversions and Evaporation.**



Control Points Method Change

3. Calculating Locals, cont'd

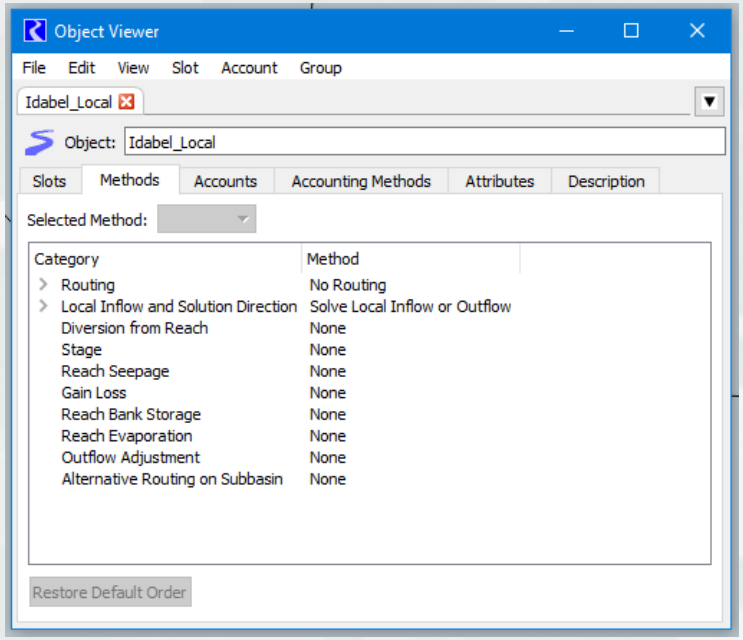
- **Control Points**
  - **Turned off all methods**



Dummy Reaches Method Change

3. Calculating Locals, cont'd

- Set Methods on Dummy Reaches
  - Routing Method
    - No routing
  - Local Inflow and Solution Direction Method
    - Solve Local Inflow or Outflow



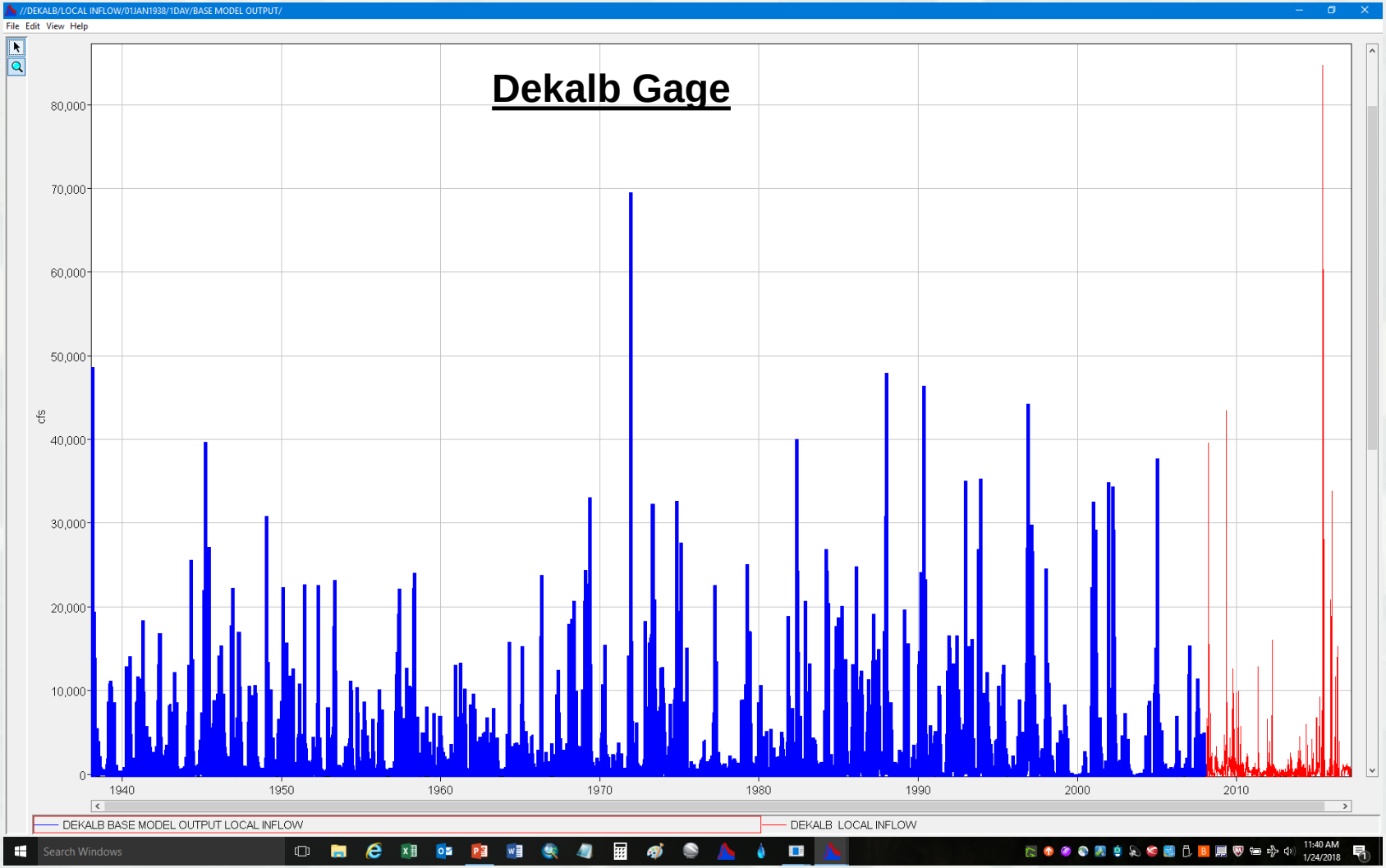
Locals verification

3. Calculating Locals, cont'd

- **Sixth step was to verify that the locals it calculated, duplicated the locals in the historical period of record.**
  - **RW calculated incremental locals in our POR model, so we had a direct method of comparison.**

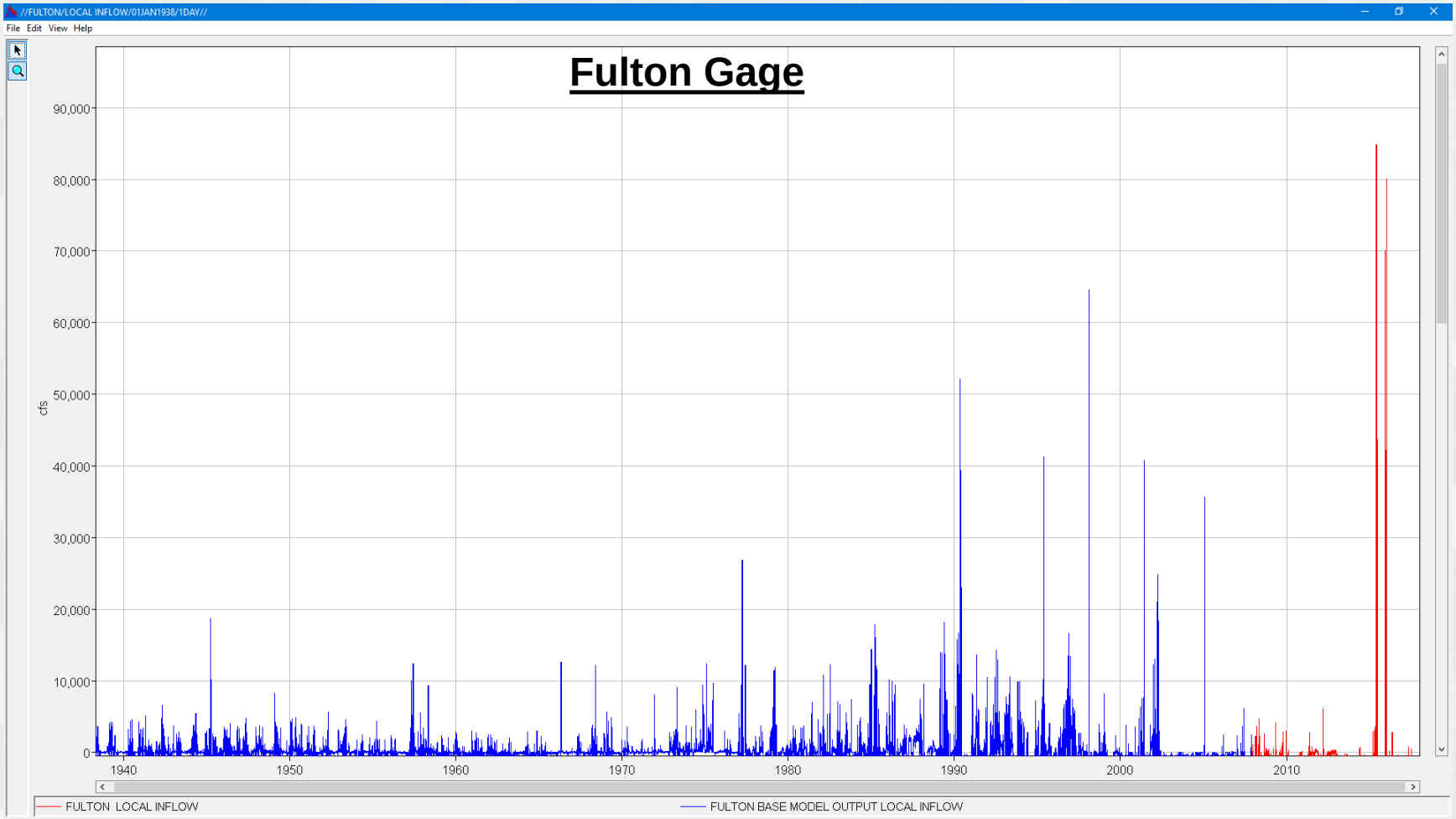
Locals verification

3. Calculating Locals, cont'd



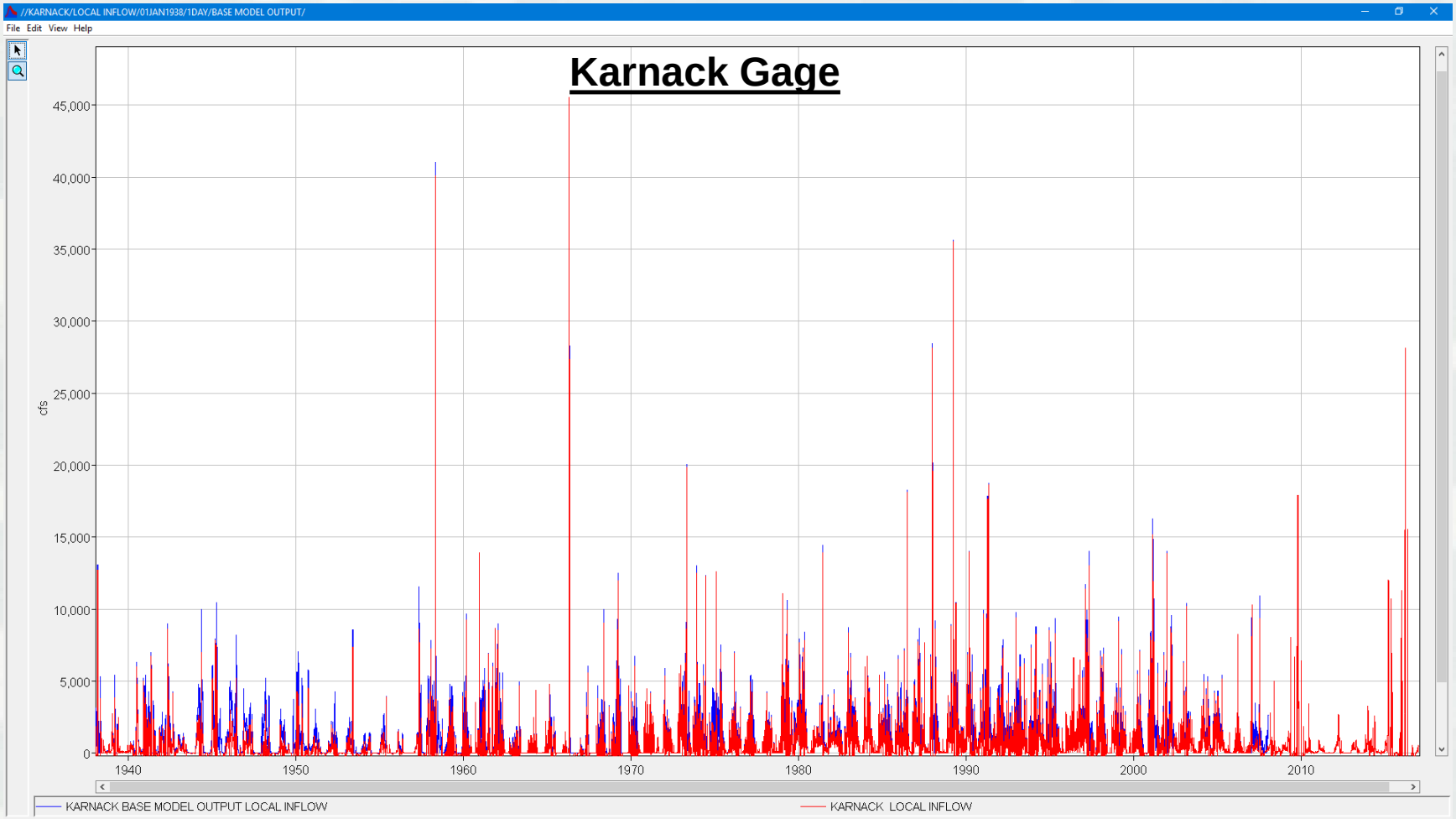
Locals verification

3. Calculating Locals, cont'd

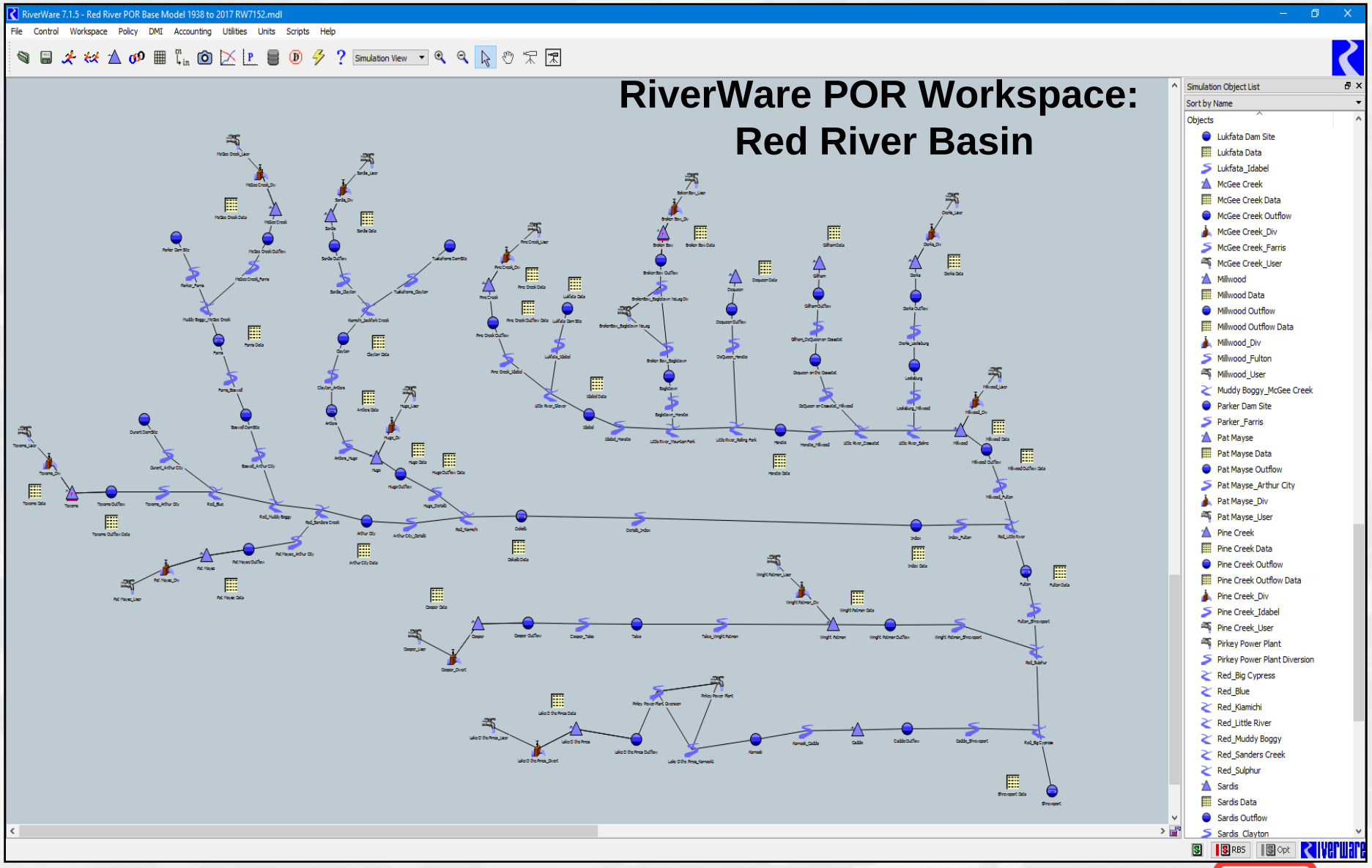


Locals verification

3. Calculating Locals, cont'd



Now that we have confidence in our locals model, we are ready to update POR Model



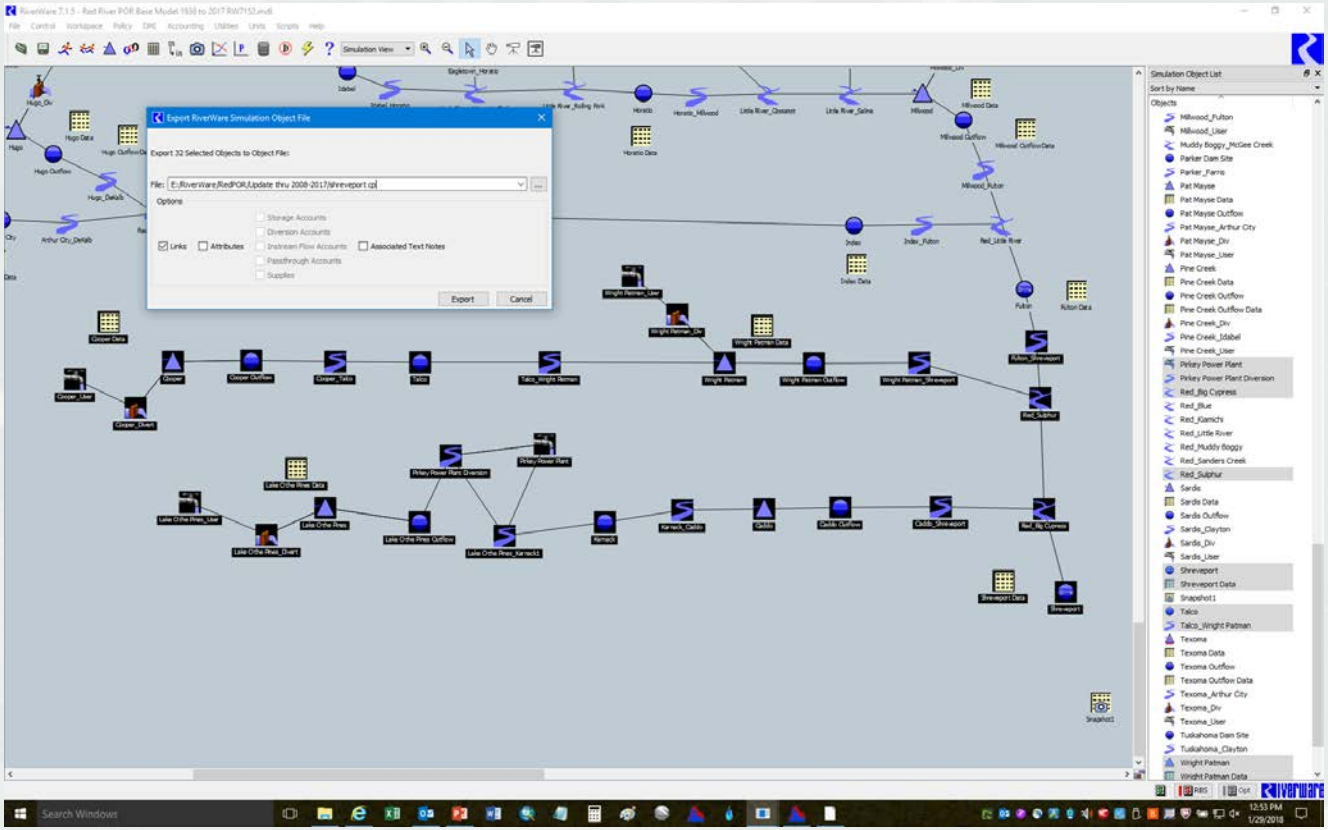
U.S.ARMY

BUILDING STRONG®

Update SWF Objects

4. Update to POR Model

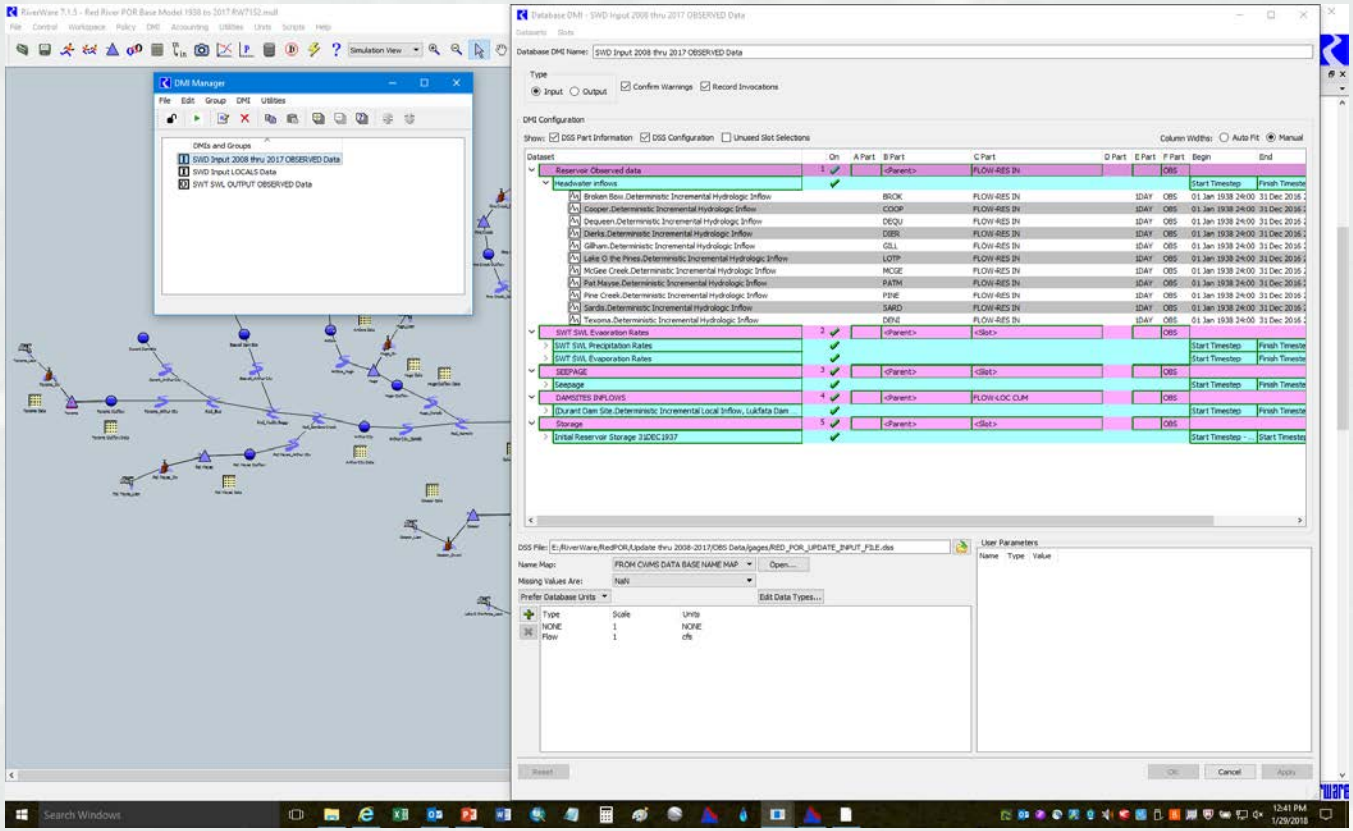
- **First step was to pull in the objects from SWF model that had changes.**
  - **Used object export and import to accomplish easily.**



Add Observed Data for Extension

4. Update to POR Model, cont'd

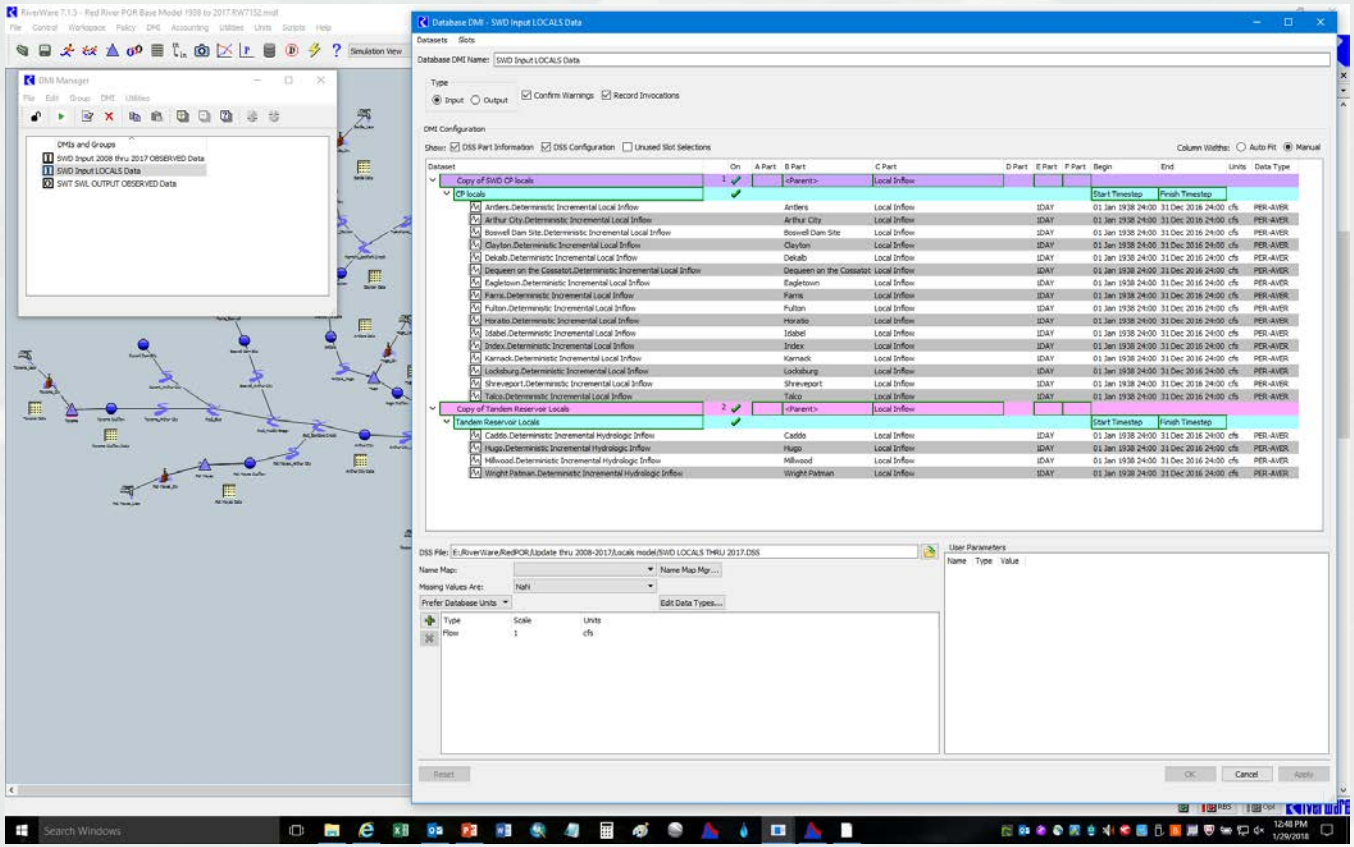
- **Second step was to pull in the observed data necessary to run the model.**
  - **Used DMI's to pull in this data.**



Add Local Flows for Extension

4. Update to POR Model, cont'd

- **Third step was to pull in the calculated locals data.**
  - **Used DMI's to pull in this data.**



Update data and Run Model

4. Update to POR Model, cont'd

- **Fourth step, updated our EAC table and associated tables, we have already completed.**
- **Fifth step, update Computational Subbasin data where necessary.**
- **Sixth step, and where I am currently, work through errors as you try to run it……**

Steps to Extend POR:

1. ~~Update necessary observed data.~~
2. ~~Update EAC tables and related curves and tables where needed.~~
3. ~~Calculate locals (model had to be created)~~
4. ~~Load POR model with observed data and locals and run.~~
5. ~~Update Computational Sub basin data where necessary.~~
6. *Get model to run.*
7. Send to Southwestern Power Administration to run in conjunction with other models in their jurisdiction so power loads can be calculated.
8. Input new power loads into model and re-run.


THANK YOU!
05/11/2011 09:35