

Building Better Models Through Collaboration:

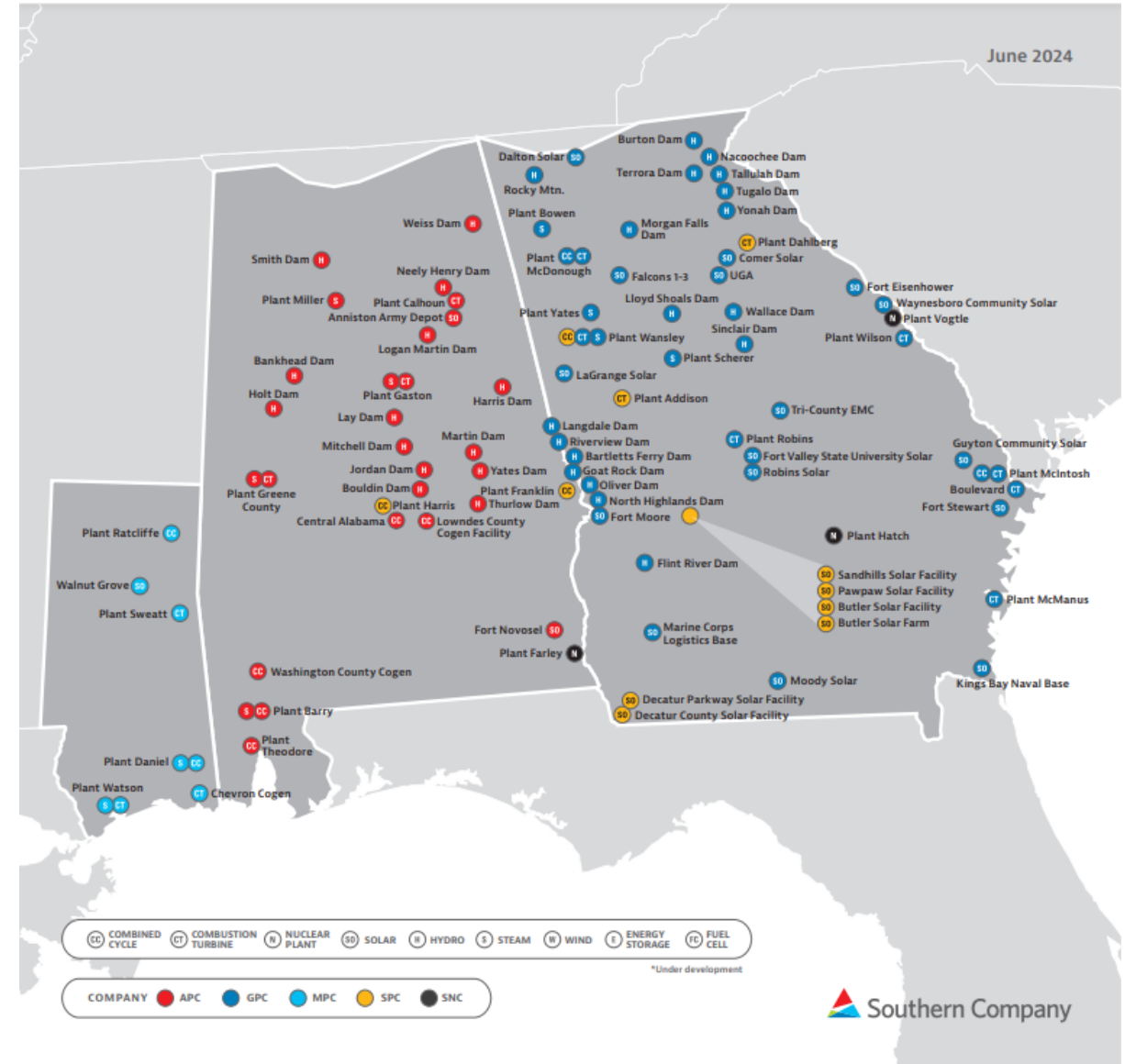
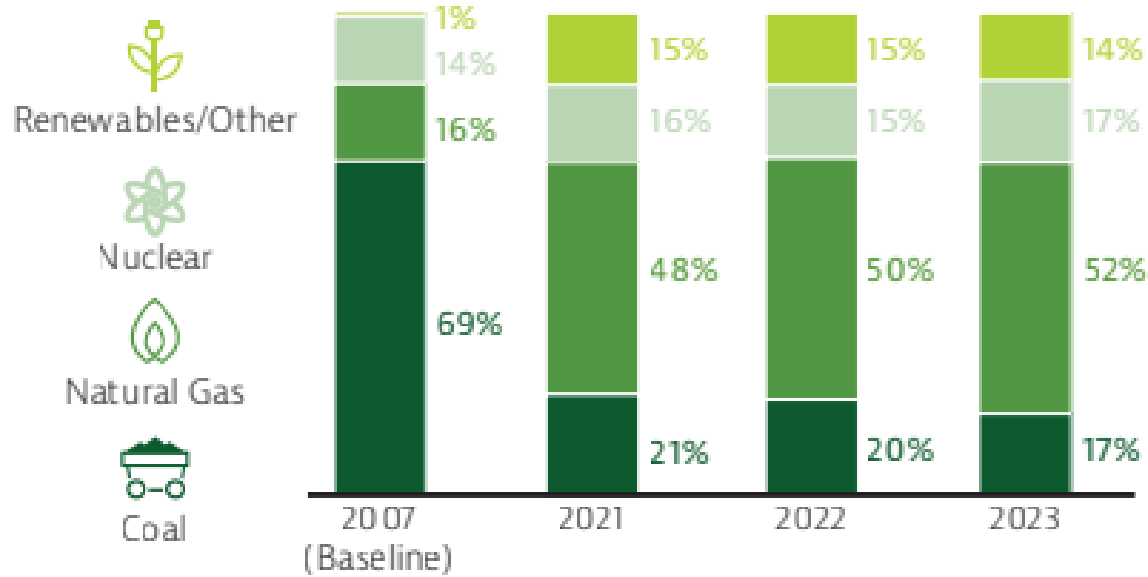
Lessons from Alabama Power Company's RiverWare Development

Josh Free | Southern Company
Abby Watson | RTI International

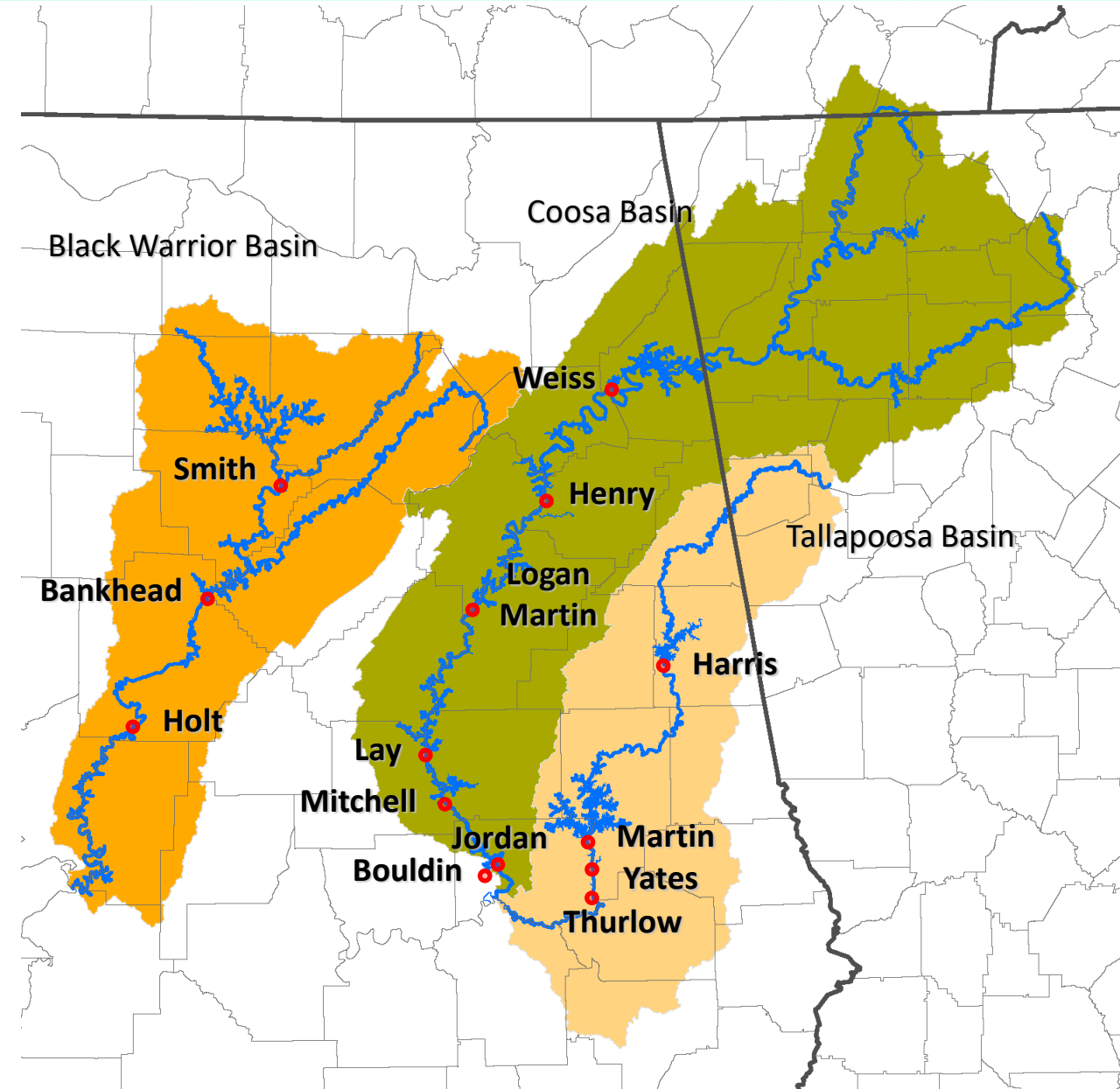


Southern Company

Annual Energy Mix



Hydroelectric Generation



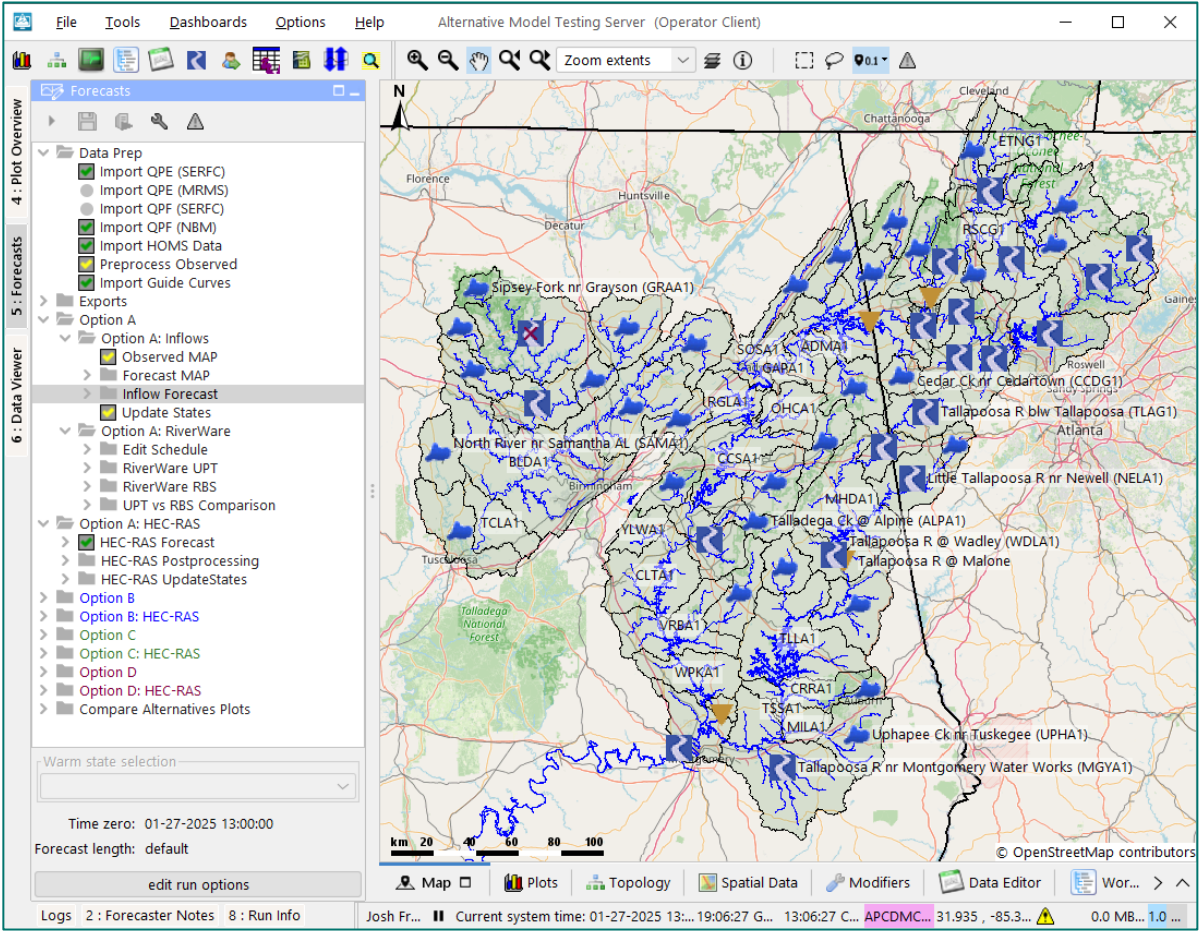
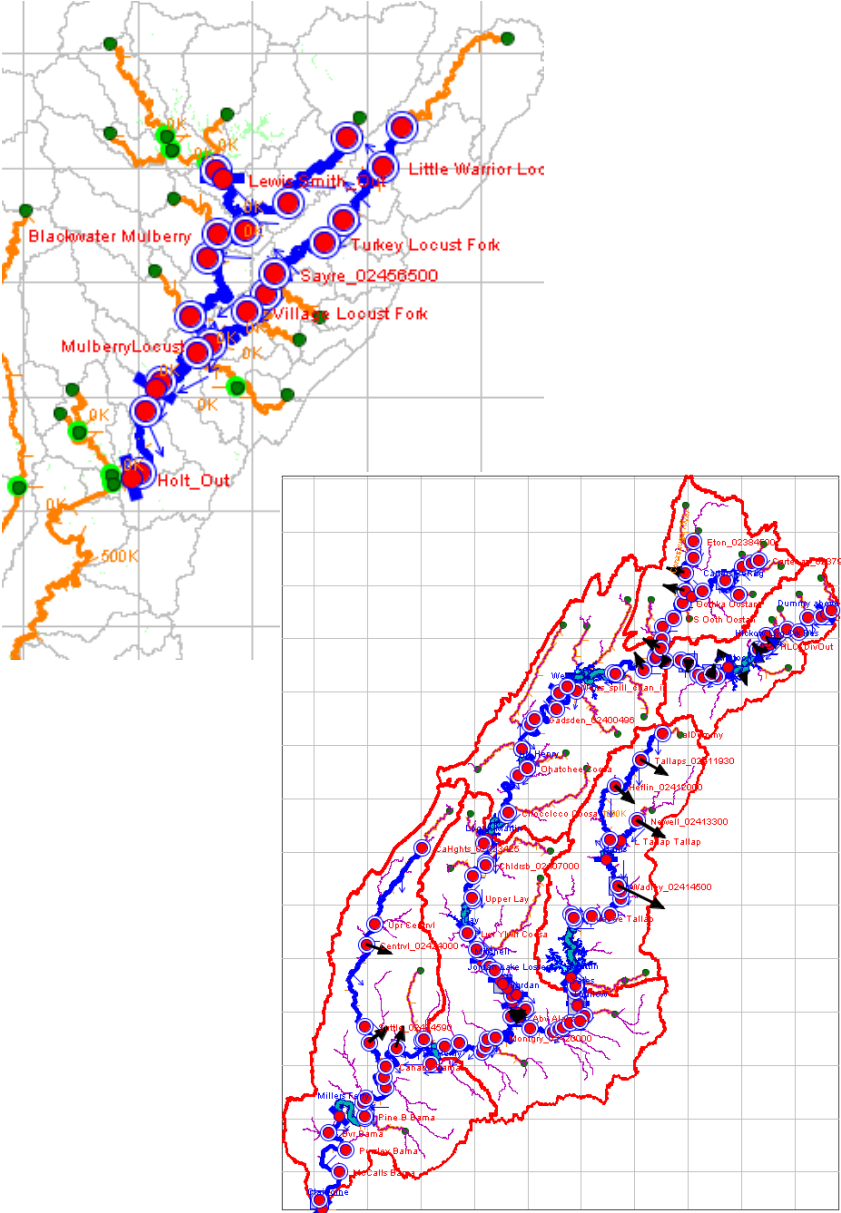
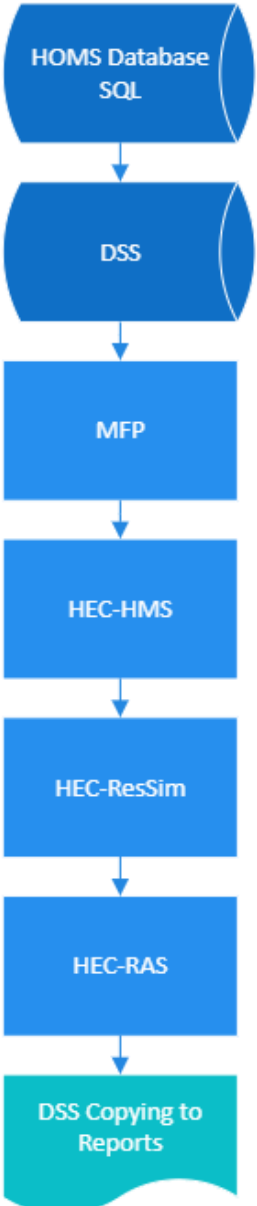
- **Alabama Power**
 - 14 Powerhouses
 - 41 Units
 - ~ 1700 megawatts of capacity
 - 11 Reservoirs
 - ~157,000 acres of pool area
 - ~3,500 miles of shoreline
 - Located in the Black Warrior, Coosa and Tallapoosa Basins

Reservoir Management

- **Reservoir Management**
 - 3 operators, 2 forecasters
 - On-call rotations
 - Daily schedule and flood control
 - Maintain gaging network
- **Operational Guidelines**
 - Maintain full lakes
 - Hydropower generation
 - Dissolved oxygen levels and environmental flows
 - Flood and drought management



Deltares-FEWS Forecast System



A Brief History of RiverWare Development

Simulation Model Development (Unit Power Table Method)

Power user input model developed

Flow user inputs & Model segments

2020

2021

2022

2023

2024

Rulebased Model Development (Rulebased Model)

RiverWare model based on ResSim

Collaborative model development

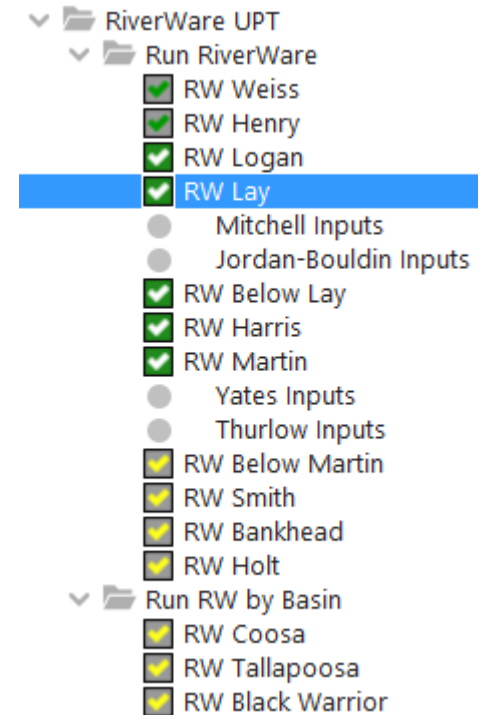
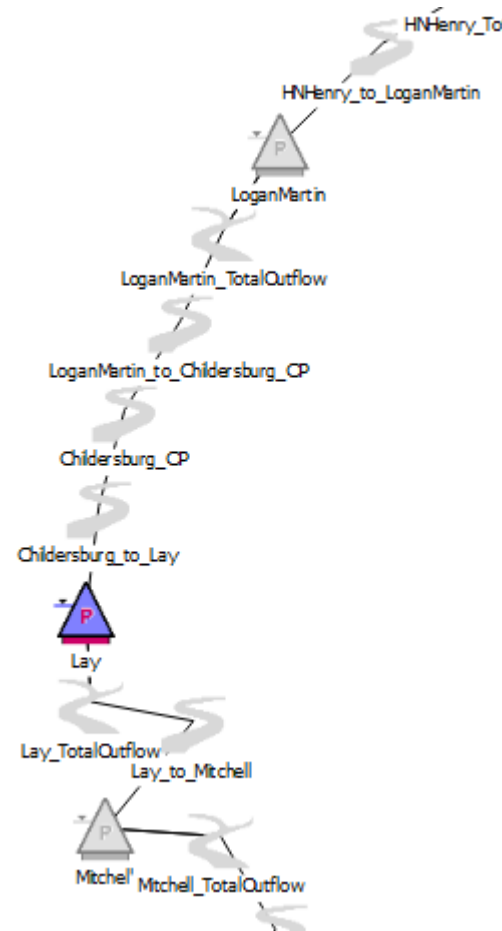
Lesson #1

It's best to prioritize reliability.



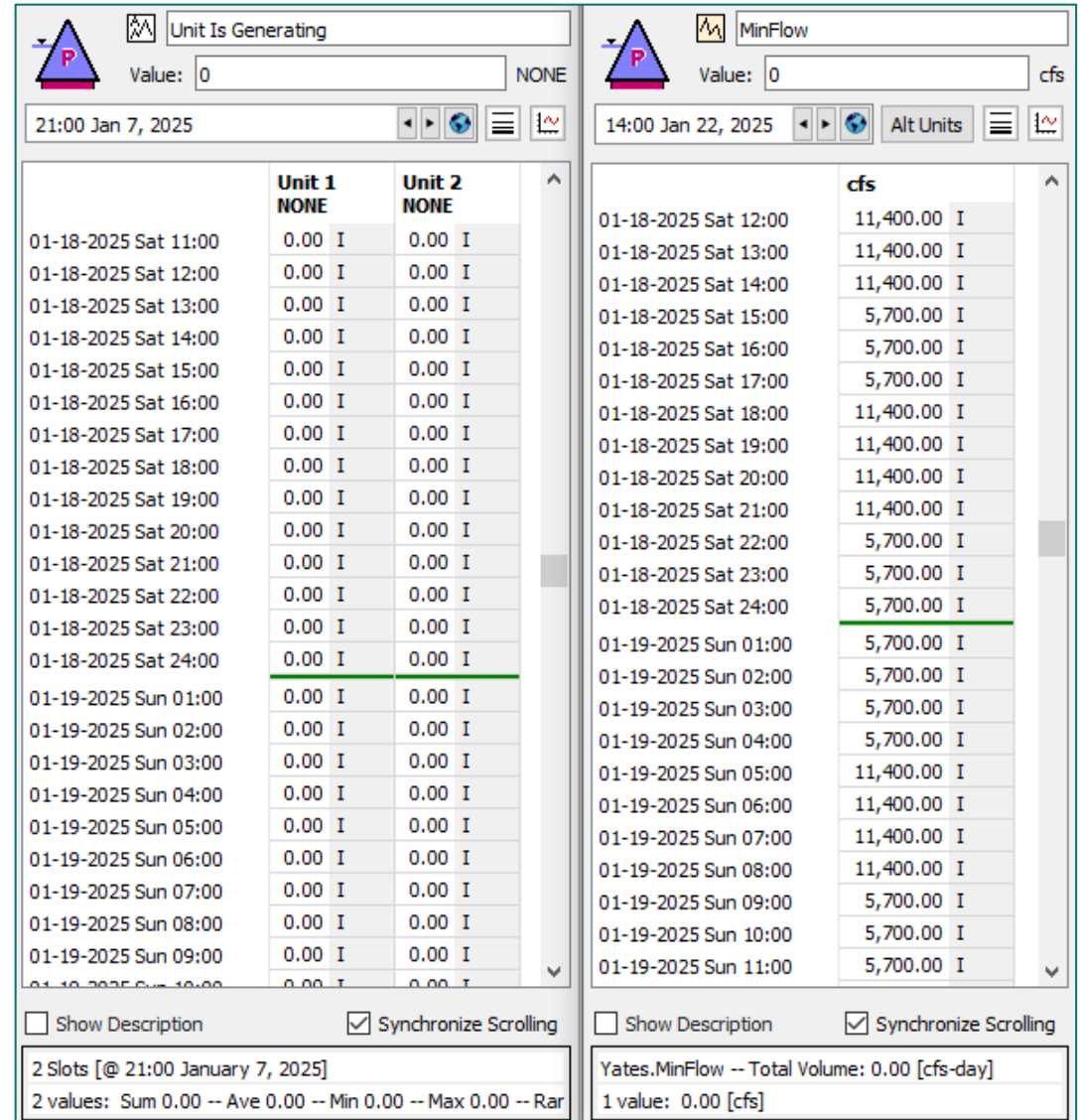
Simulation Segments

- River basins segmented into individual plants or small groups of plants
 - Mirrored previous methods
 - Decreased number of simulation failures
 - Eased debugging
- All flow routing handled outside of RiverWare
 - Enable routing to match the inflow model
 - Variable Lag/k vs. Modified Puls
- RiverWare scripts and DMIs used to enable/disable objects



Change in Simulation Philosophy

- From Unit MWs to Unit Flows
- Underlying curves are deficient
 - No internal program for continuous testing of power curves
 - Power curves require updates for dissolved oxygen operations and unit upgrades
 - Tailwater curves can be unreliable for projects in backwater
- MinFlow slot hacked to be used for flow inputs



Lesson #2

It's important to learn from each other.



Collaborative Learning

- From APCO

- Daily operational thought process
- Expected end product definition
- Model Development Priorities
- Individual rules interpretation
- Rule logic blueprinting

- From RTI

- RiverWare model building philosophy
- NWS model calibration and setup
- FEWS configurations and versions
- FEWS data and server requirements
- Model and FEWS troubleshooting

RBS Ruleset Editor - "Baseline Realtime"

Path: C:\fews_StandAlone_Boneyard\fews_bw\Models\RiverWare\ALPowerUnitPower\ModelParar

Name	Priority	On	Type
> Jordan-Bouldin	1-3	✓	Policy Group
> Mitchell	4-6	✓	Policy Group
> Lay	7-9	✓	Policy Group
> Logan	10-17	✓	Policy Group
> Henry	18-22	✓	Policy Group
> Weiss	23-34	✓	Policy Group
> Thurlow	35-37	✓	Policy Group
> Yates	38-41	✓	Policy Group
> Martin	42-48	✓	Policy Group
> Harris	49-58	✓	Policy Group
> Drought Level Response and Navigation Policy	59-68	✓	Policy Group
> Bankhead and Holt - Follow GC	69-70	✓	Policy Group
> Smith	71-77	✓	Policy Group
> Check Inputs	78-78	✓	Policy Group
> Misc Functions		✓	Utility Group
> Power Functions		✓	Utility Group
> Pool Elevation, Storage Functions		✓	Utility Group
> Reservoir Specific Functions		✓	Utility Group
> Operating Zone Functions		✓	Utility Group
> Date, Time, and Season Functions		✓	Utility Group

Show: Set Description Selected Description Set Notes Adv. Properties

RBS Ruleset Editor - "APC Ops 2"

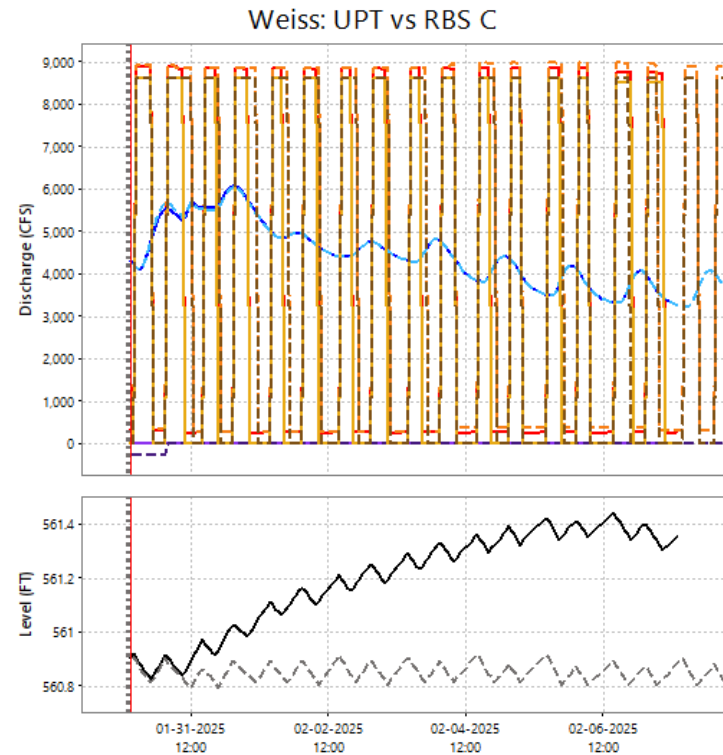
Path: C:\RIVERWARE\SmithRBSDev\Working Copy_23\FEWS Copy\Testing\20250118_OptionA_

Name	Priority	On	Type
> QC	1-2	✗	Policy Group
> Holt	3-8	✓	Policy Group
> Bankhead	9-14	✓	Policy Group
> Smith	15-26	✓	Policy Group
> Thurlow	27-33	✓	Policy Group
> Yates	34-39	✓	Policy Group
> Martin	40-48	✓	Policy Group
> Harris	49-59	✓	Policy Group
> Set Tallapoosa Target Elevations	60-63	✓	Policy Group
> Jordan	64-72	✓	Policy Group
> Mitchell	73-79	✓	Policy Group
> Lay	80-87	✓	Policy Group
> Logan	88-100	✓	Policy Group
> Henry	101-109	✓	Policy Group
> Weiss	110-118	✓	Policy Group
> Coosa Balancing	119-120	✓	Policy Group
> Tallapoosa Balancing	121-121	✓	Policy Group
> Max Daily Elevation Calculations	122-128	✓	Policy Group
> Drought Level Response and Navigation Policy	129-139	✗	Policy Group
> BONEYARD Warrior	140-180	✗	Policy Group
> BONEYARD Coosa	181-194	✗	Policy Group
> BONEYARD Tallapoosa	195-225	✗	Policy Group
> Check Inputs	226-226	✗	Policy Group
> Misc Functions		✓	Utility Group
> Power Functions		✓	Utility Group
> Pool Elevation, Storage Functions		✓	Utility Group
> Reservoir Specific Functions		✓	Utility Group
> Operating Zone Functions		✓	Utility Group
> Date, Time, and Season Functions		✓	Utility Group
> Rule Development Project - New Functions		✓	Utility Group
> BONEYARD Functions		✗	Utility Group

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Resetting the Vision

- **Include tight standards**
 - Close to Rule Curve
 - Changing daily targets
- **Real life scheduling**
 - Unit flows/outages
 - Summer/Winter peaks
 - Spread generation
 - Reflect local uniqueness
- **Flood Control Changes**
 - Gate configuration/scheduling
 - Smooth transitions between normal and flood operations
- **Balancing**
 - Bridge the gap between normal and drought operations



Forecasts

Data Prep

- Import QPE (SERFC)
- Import QPE (MRMS)
- Import QPF (SERFC)
- Import QPF (NBM)
- Import HOMS Data
- Preprocess Observed
- Import Guide Curves

Exports

- Option A
 - Option A: Inflows
 - Option A: RiverWare
 - Option A: HEC-RAS
- Option B
 - Option B: Inflows
 - Option B: RiverWare
 - Option B: HEC-RAS
- Option C
 - Option C: Inflows
 - Option C: RiverWare
 - Option C: HEC-RAS
- Option D
 - Option D: Inflows
 - Option D: RiverWare
 - Option D: HEC-RAS
- Compare Alternatives Plots

Warm state selection

Time zero: 01-30-2025 15:0...

Forecast length: default

Questions?

