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USACE – SWF
Initiatives and Model Results

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Modeling Requirements

- Reallocation studies
- Changes in operation to accommodate:
  - Flooding issues
  - Recreation interests
  - Users with conflicting needs
  - Environmental needs
- Risk assessments
- Evaluate litigant claims
- What if scenarios
  - Flooding
  - Drought

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Reservoir System Simulation Considerations

- System of reservoirs
- Period of record simulations (historical data)
- Simulations using modified operating parameters
- Simulations in which:
  - Controlled and balanced evacuation of flood water
  - Maximize flow at control points
  - Accommodate mandatory releases
  - Accommodate low flow requirements
  - Accommodate conservation operations requirements
  - Accommodate hydropower requirements
- Operational models

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System Simulation Components

- Pre-processing of model inputs
- Flood control operation analysis
- Conservation operations analysis
- Hydropower operations analysis
- Hydrologic forecasting
- Post-processing
  - Statistical analysis
  - Economic analysis

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Scope of Work
(Starting FY2001)

- Flood control
  - Develop control point objects & workspace flood control configuration
  - Add operating level data to reservoirs
  - Add mandatory release methods to reservoirs
  - Add forecasted hydrology methods to reservoirs, reaches & control points
  - Develop regulation discharge & space hydrograph methods on control point objects
  - Developed flood release dispatch method slots
  - Computational sub-basin object
  - Flood control algorithm testing & documentation

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Scope of Work

- Conservation operations
  - Multi-year periodic slot
  - Algorithm to calculate reservoir releases for downstream demands
  - Critical dependable yield (controlled multiple runs)
    - Joint with USBR
  - Transit losses (SWD technique)

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Scope of Work

- Miscellaneous enhancements
  - Hydropower methods
  - Integration into CWMS
    - Joint with HEC
  - Integrated DSS DMI
    - Joint with USBR
  - Conditional probabilities
  - Post-processing statistical methods
  - Usability features
  - Performance tuning
    - Joint with USBR
  - Integration testing & documentation

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Scope of Work

- Joint SPA/USBR Enhancements
  - Groundwater/surface water interaction
  - Dynamic interface between MODFLOW & RiverWare
  - URGWOM modeling

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Scope of Work

- In progress enhancements
  - Runtime performance enhancements
  - Additional statistical methods
  - Probability scale for plotting
  - Hydropower enhancements
  - RPL enhancements
  - DMI enhancements
  - Saved exportable/importable plot configurations
  - Integration into CWMS with CWMS 2.0 release
    - Joint with HEC
    - Operational model integration similar to RESIM

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Future Enhancements

- Water accounting capabilities (WAM)
- Training class for SWD methods/enhancements
- GIS capabilities
- Further performance tuning (decrease run times)

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Partnership with Corps of Engineers

- In June 08 COE accepted as a RiverWare partner based on total contributions
- Like USBR & TVA, cost-free licenses
- Should result in increased usage across the COE

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SWF - Rules and Methods

- Rules
  - Mandatory Surcharge Release
  - Regulation Discharge
  - Flood Control
  - Low Flow Releases
  - Diversions
  - Hydropower
- Methods
  - Flat Top Surcharge
  - Operating Level Balance
  - Operating Level-Based
  - Key Control Point Balance Levels
  - Meet Hydropower Load
  - Seasonal Load and Seasonal Load Time

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SWF - Rules and Methods

- Surcharge Release
  - The rule sets a (S) flag on the Outflow slot
  - Based off of storage and inflows
  - Finds a minimum mandatory release from induced surcharge curves
  - Finds a maximum mandatory release from free-flow curves
  - Min and Max releases are then used to bracket the surcharge release
  - The surcharge release is computed to "flat top" the incoming flood

- Regulation Discharge
  - The rule set a (G) flag on the Reg Discharge Calculation slot.
  - Calculates the maximum flow that is allowed in the channel at a control point
  - These values a fundamental to determining flood control releases
  - Channel Regulation, Res Current or Future Level Regulation, or Reservoir System Percent Full Regulation

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SWF -
Rules and Methods

- Flood Control
  - The rule coupled with the method Operating Level Balancing attempts to balance a system of reservoirs by reducing their flood storage from fullest to least full reservoir.
  - It cannot cause flooding at a downstream control point
  - Water is not released from Conservation Pool
  - Priority is given to reservoirs based on operating levels
  - Flood pools are drained as soon as possible and within a forecasted period
  - Reservoir are given a smooth release schedule

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SWF - Rules and Methods

- Meet Low Flow Requirements
  - Uses the predefined function MeetLowFlowRequirement.
  - This function computes the necessary Low Flow Release from contributing reservoirs to meet the low flow requirement as a control point
  - This is executed after the Flood Control Rule so as to add any additional release that may be needed
- Diversions
  - Uses the predefined function ComputeReservoirDiversion
  - Used to meet multiple water user demands using multiple reservoirs

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SWF - Rules and Methods

- Hydropower
  - Uses the predefined function HyrdopowerRelease
  - This is used to determine the maximum proposes power release.
  - This rule executes the Meet Hydropower Load method
  - This method then determines the additional outflow need to meet the required load, or

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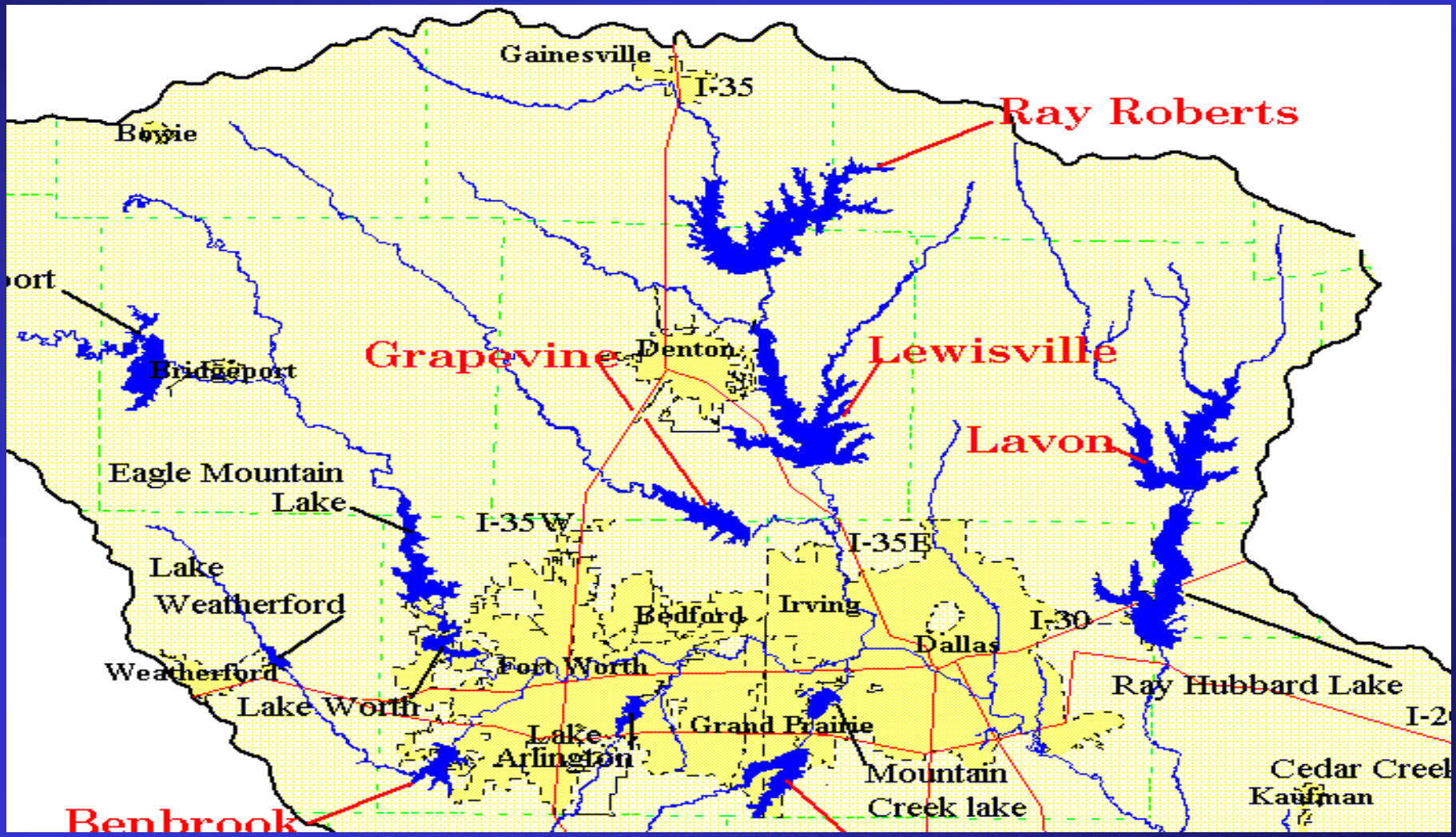
Trinity River Basin



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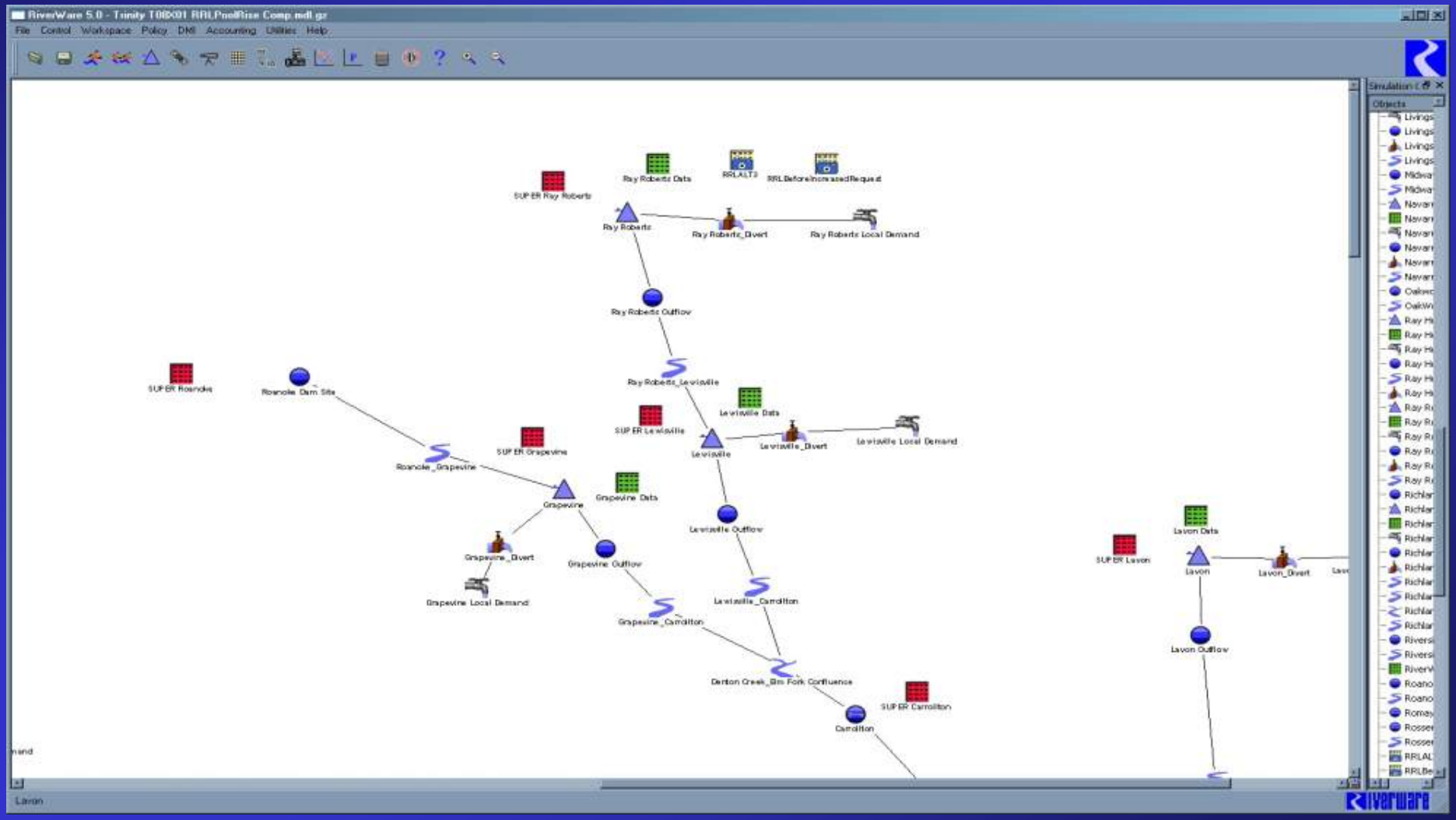
Ray Robert's Pool Rise



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Ray Robert's Pool Rise

- Changes in Water Supply Request

RRLBeforeIncreasedRequest.R...

File Edit Row Column View Adjust

Ray Roberts Outflow_Low Flow R

Value: 12 cfs

	Low Flow Requirement cfs
0:00 January 1	12.00
0:00 February 1	18.00
0:00 March 1	30.00
0:00 April 1	25.00
0:00 May 1	39.00
0:00 June 1	22.00
0:00 July 1	6.00
0:00 August 1	3.00
0:00 September 1	5.00
0:00 October 1	6.00
0:00 November 1	7.00
0:00 December 1	7.00

Interpolate Lookup

Annual Period, Irregular Interval

Ray Roberts Outflow.Level Vs Low Flow Requirement

File Edit Row Column View Adjust

Level Vs Low Flow Requirement

Value: 186 cfs

	1.00 NONE cfs	3.98 NONE cfs	3.98 NONE cfs	4.30 NONE cfs	4.30 NONE cfs	4.65 NONE cfs	4.65 NONE cfs	4.82 NONE cfs	5.00 NONE cfs	16.00 NONE cfs
0:00 January 1	186.00	186.00	124.00	124.00	62.00	62.00	23.00	23.00	23.00	23.00

Interpolate Lookup

Annual Period, Irregular Interval

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Ray Robert's Pool Rise

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Ray Robert's Pool Rise

- Reallocated Flood Pool
  - 15% of Flood Pool or 50,000 acre-ft
  - Or a Requested elevation increased
- Requested for this Study
  - Marina Owners asked for a 5 ft increase

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Ray Robert's Pool Rise

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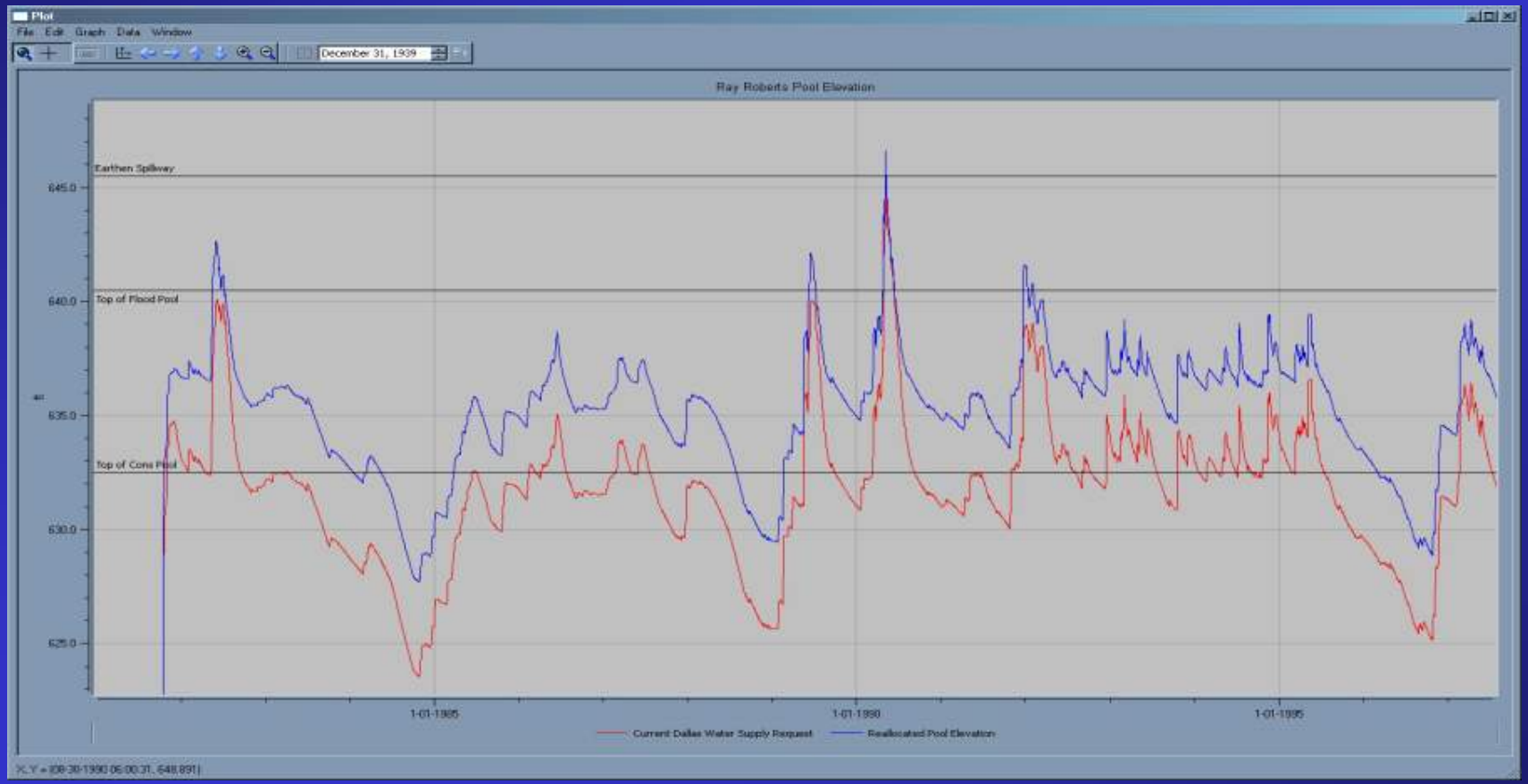
Ray Robert's Pool Rise



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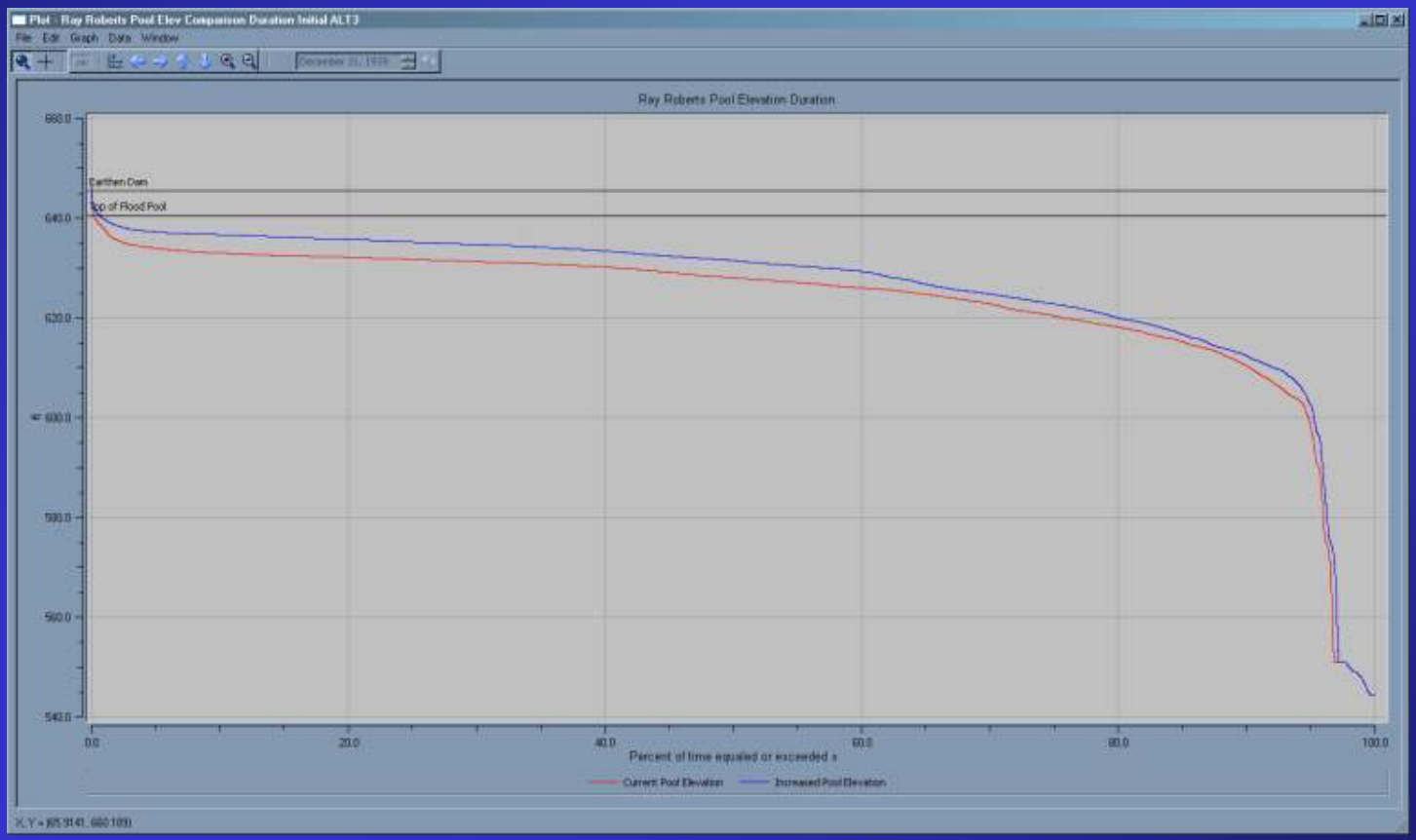
Ray Robert's Pool Rise



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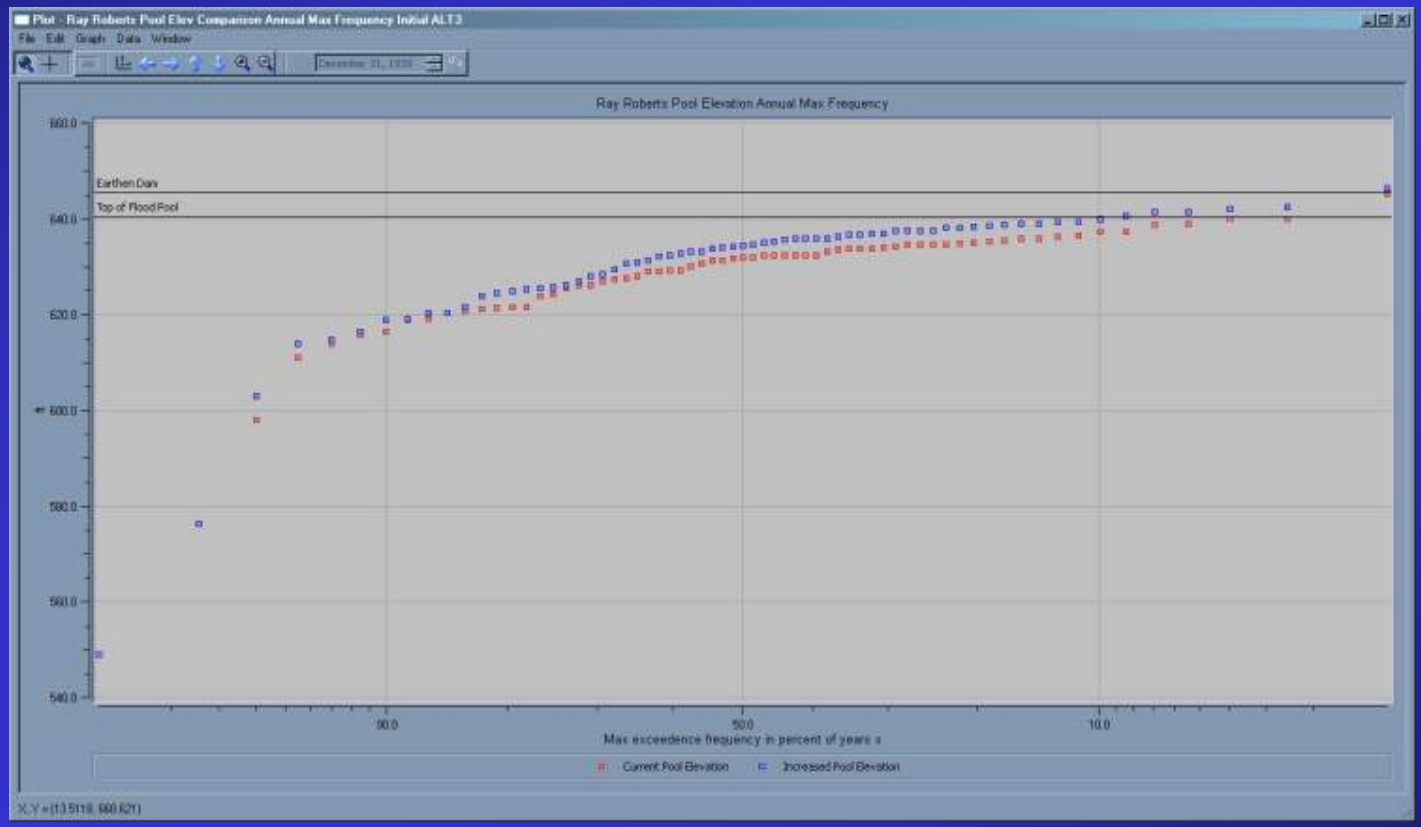
Ray Robert's Pool Rise



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Brazos River Basin

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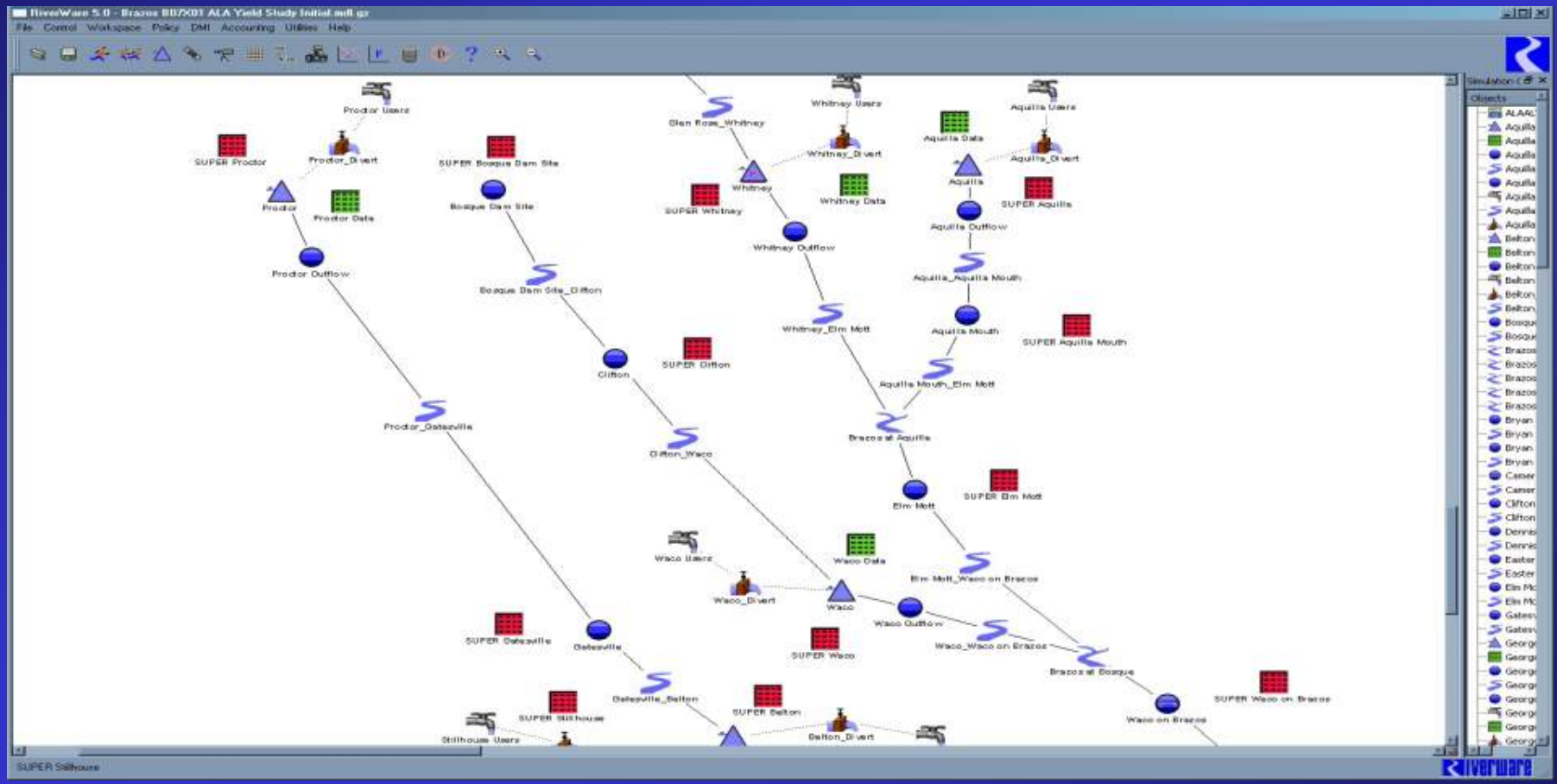
Aquilla Yield Study



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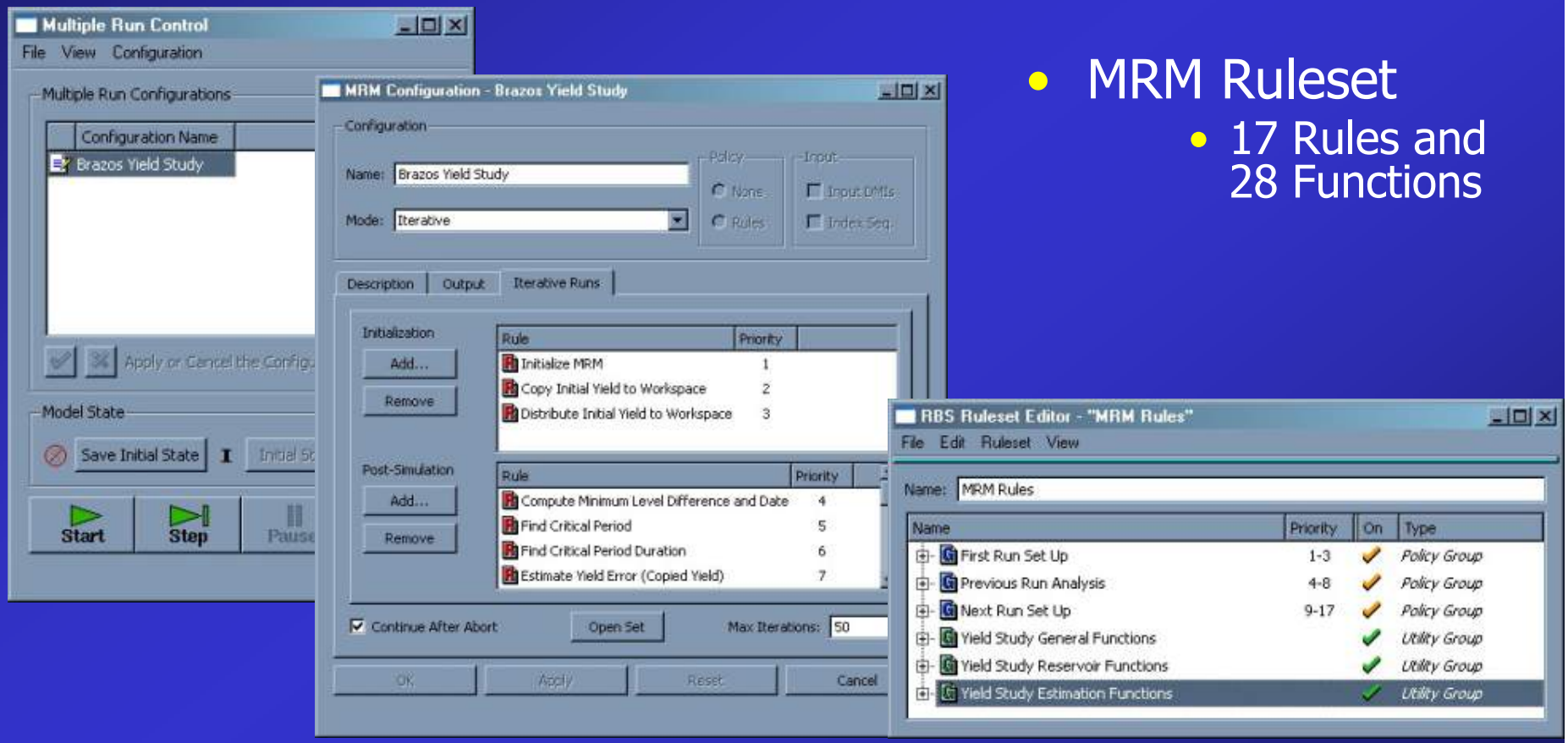
Aquilla Yield Study



- MRM Ruleset
  - 17 Rules and 28 Functions

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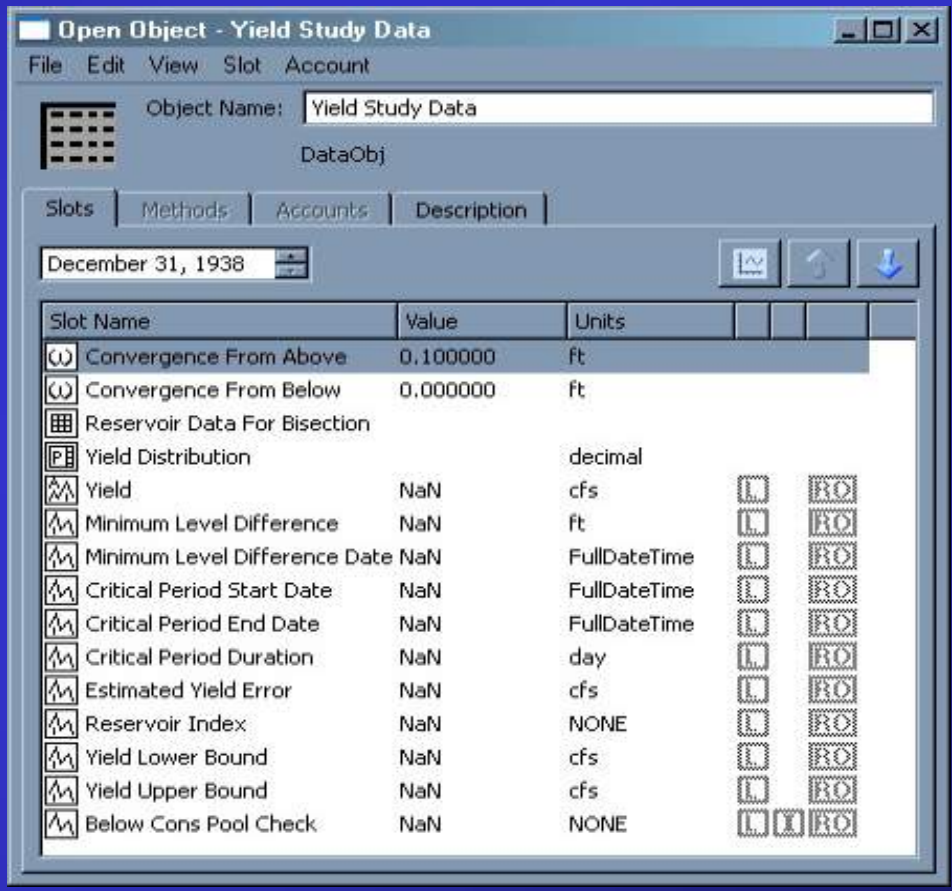
Aquilla Yield Study

- Yield Study Data Object



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Aquilla Yield Study

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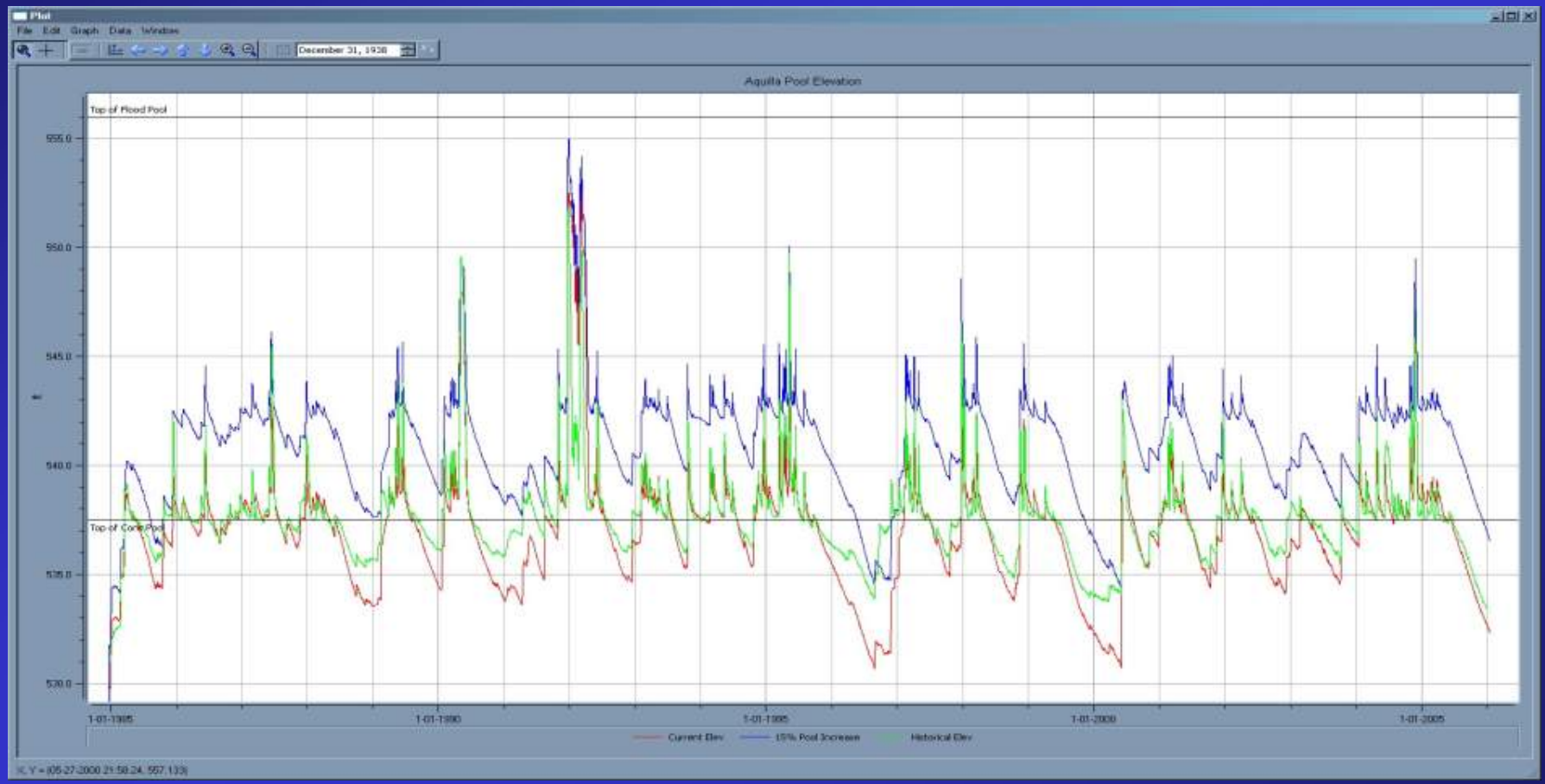
Aquilla Yield Study



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Aquilla Yield Study

- Yield Study SCTs
- Initial Conditions

Integer Indexed SCT: AquillaYieldStudy.sct.gz (Brazos B07X01 Yield Study.mdl.gz)

File Edit Slots Aggregation View Config DMI Run Diagnostics Go To

NaN

Series Slots | Scalar Slots | Other Slots

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3	0	51.125285	-2.479713	24:00 October 10, 1949	DT NaN	DT NaN	NaN
4	0	25.562642	-1.548324	24:00 March 11, 1956	DT NaN	DT NaN	NaN
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6	0	23.867282	-1.397259	24:00 April 26, 1956	DT NaN	DT NaN	NaN
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8	0	19.908485	0.268219	24:00 March 31, 1957	24:00 June 20, 1953	24:00 April 25, 1957	1404
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12	NaN	NaN	NaN	DT NaN	DT NaN	DT NaN	NaN

7 Slots
[multiple unit types]

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Aquilla Yield Study

- Yield Study SCTs
- Reallocated Flood Pool

Integer Indexed SCT: AquillaYieldStudy.sct.gz (Brazos B07X01 ALA Yield Study ALT1.mdl.gz)

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Series Slots | Scalar Slots | Other Slots

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4	0	25.562642	-1.227592	24:00 January 21, 1957	DT NaN	DT NaN	NaN
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6	0	23.859967	0.562601	24:00 March 31, 1957	24:00 June 14, 1953	24:00 April 30, 1957	1415
7	0	23.982474	-1.000000	24:00 April 10, 1957	DT NaN	DT NaN	NaN
8	0	23.921221	0.275518	24:00 March 31, 1957	24:00 June 14, 1953	24:00 April 30, 1957	1415
9	0	23.951847	0.129446	24:00 March 31, 1957	24:00 June 14, 1953	24:00 April 30, 1957	1415
10	0	23.967161	0.056480	24:00 March 31, 1957	24:00 June 14, 1953	24:00 April 30, 1957	1415
11	NaN	NaN	NaN	DT NaN	DT NaN	DT NaN	NaN
12	NaN	NaN	NaN	DT NaN	DT NaN	DT NaN	NaN
13	NaN	NaN	NaN	DT NaN	DT NaN	DT NaN	NaN
14	NaN	NaN	NaN	DT NaN	DT NaN	DT NaN	NaN
15	NaN	NaN	NaN	DT NaN	DT NaN	DT NaN	NaN
16	NaN	NaN	NaN	DT NaN	DT NaN	DT NaN	NaN
17	NaN	NaN	NaN	DT NaN	DT NaN	DT NaN	NaN
18	NaN	NaN	NaN	DT NaN	DT NaN	DT NaN	NaN

7 Slots
[multiple unit types]

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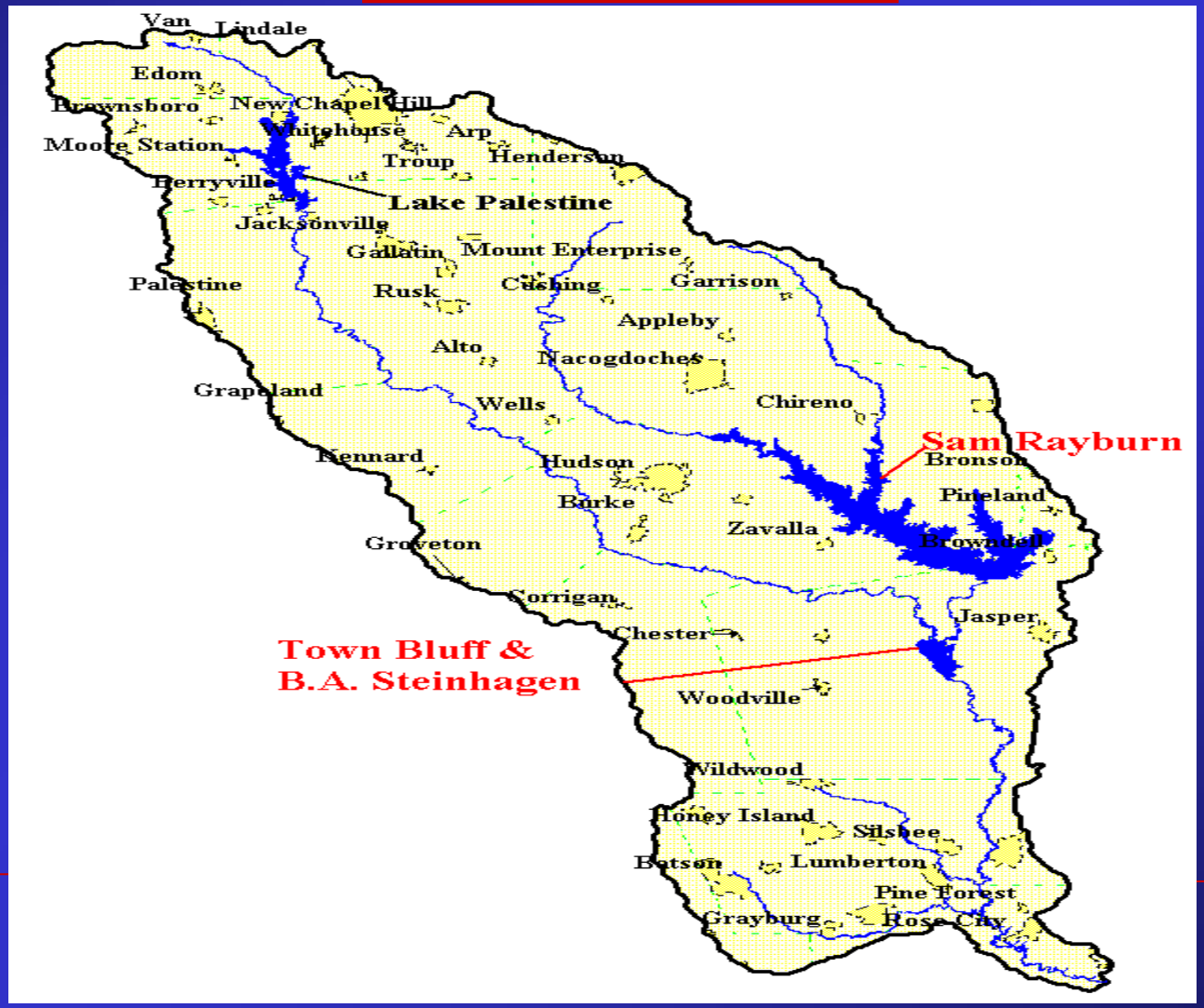
Neches River Basin



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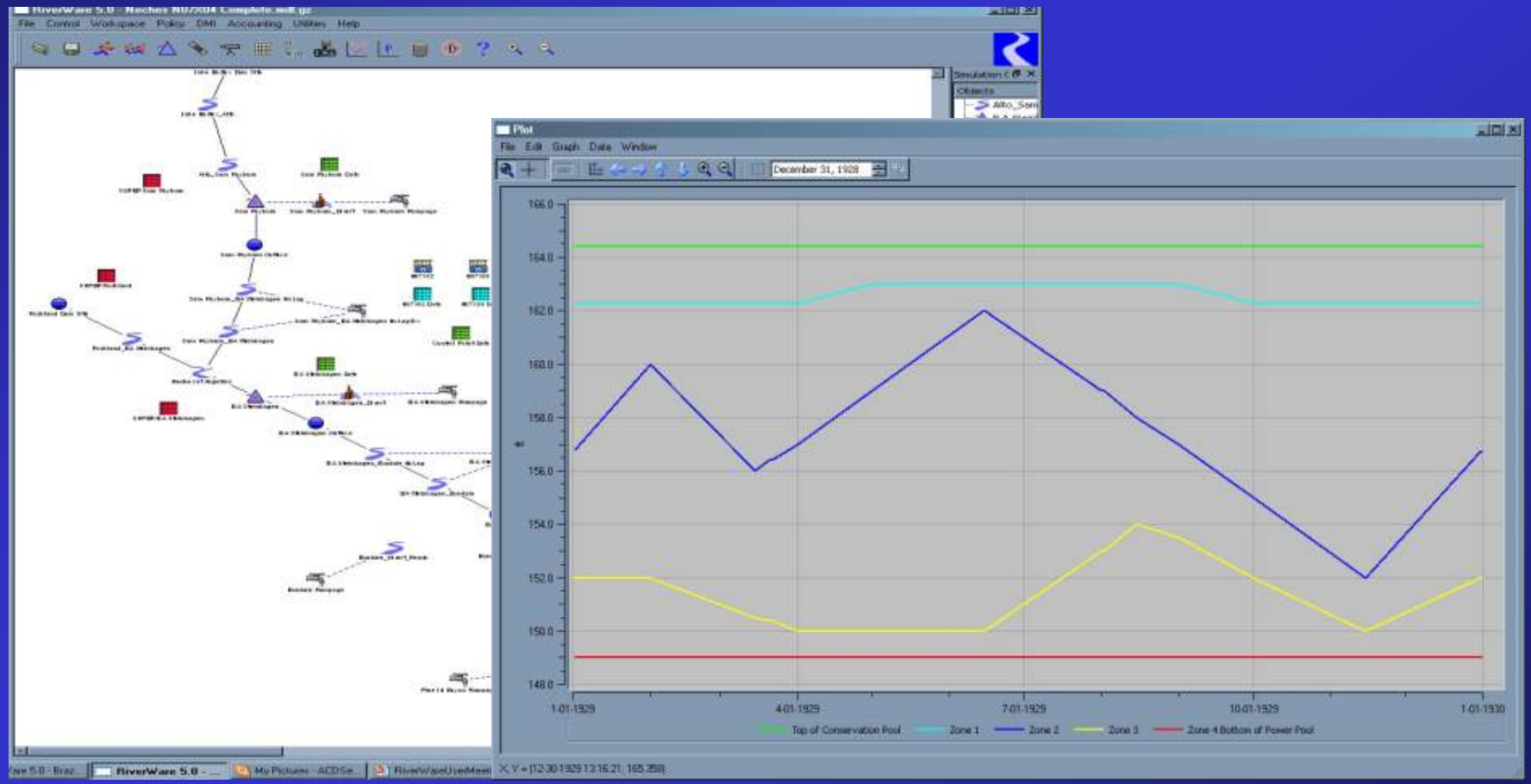
Neches River Basin



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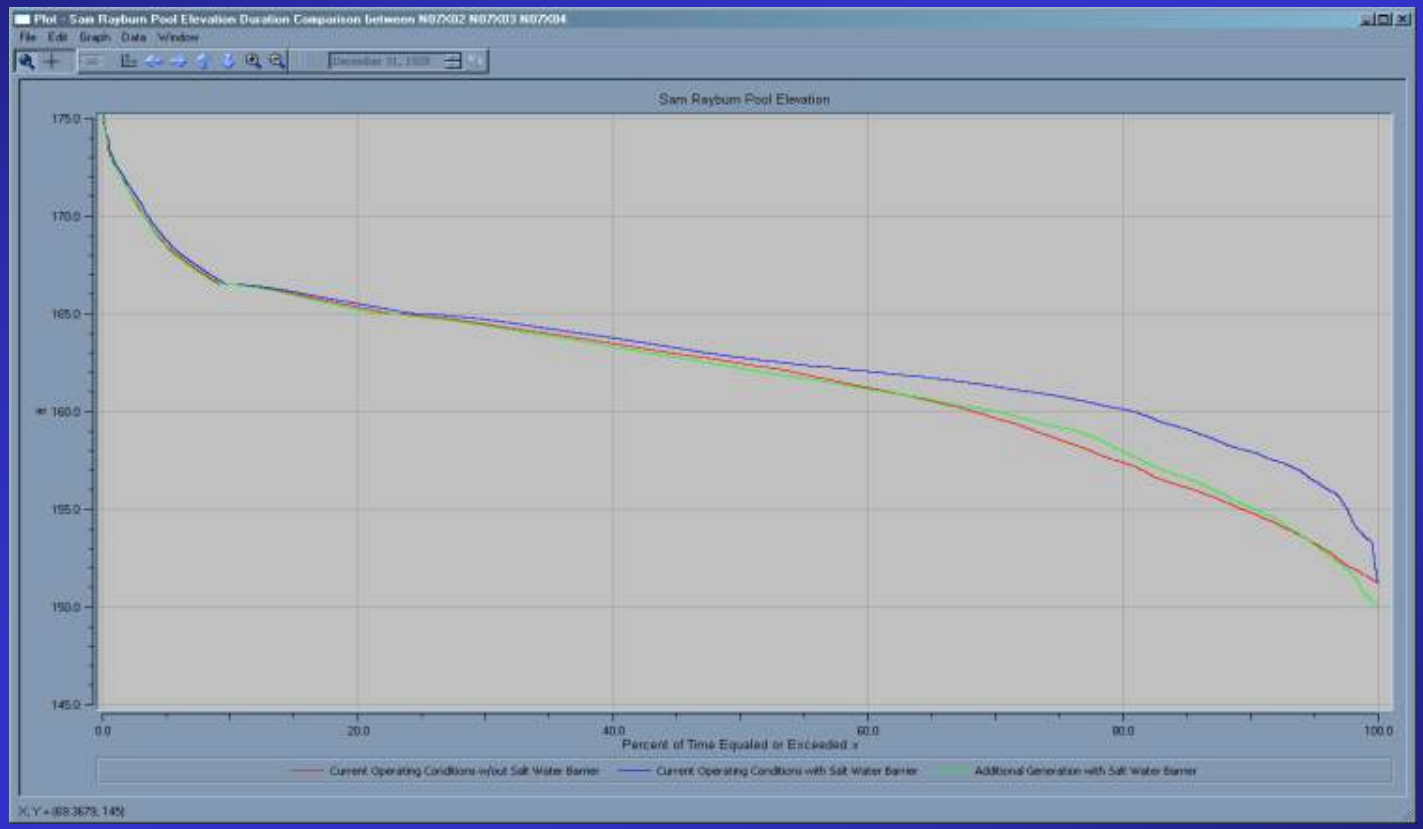
Neches River Basin



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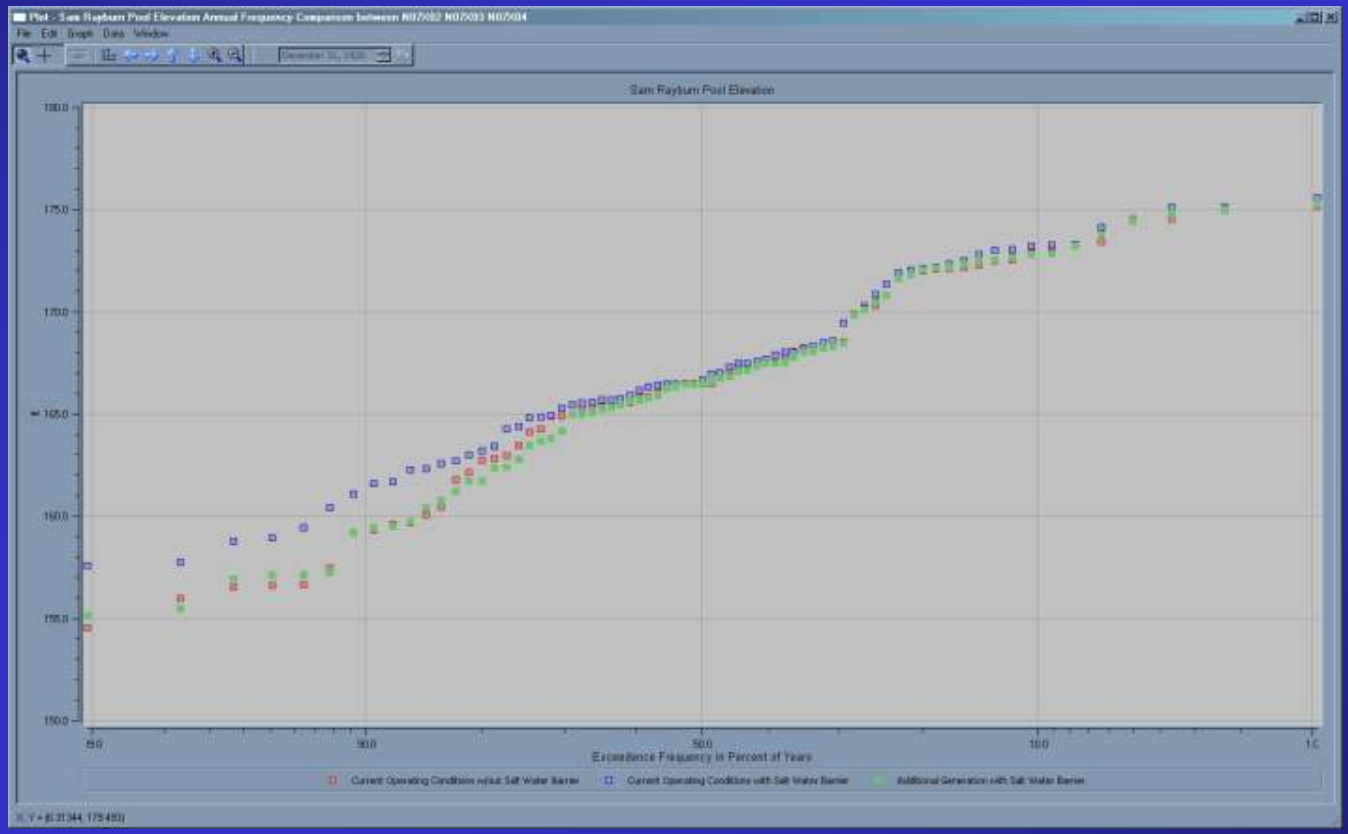
Neches River Basin



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Questions?