TRWD Excess Flow Optimization Study

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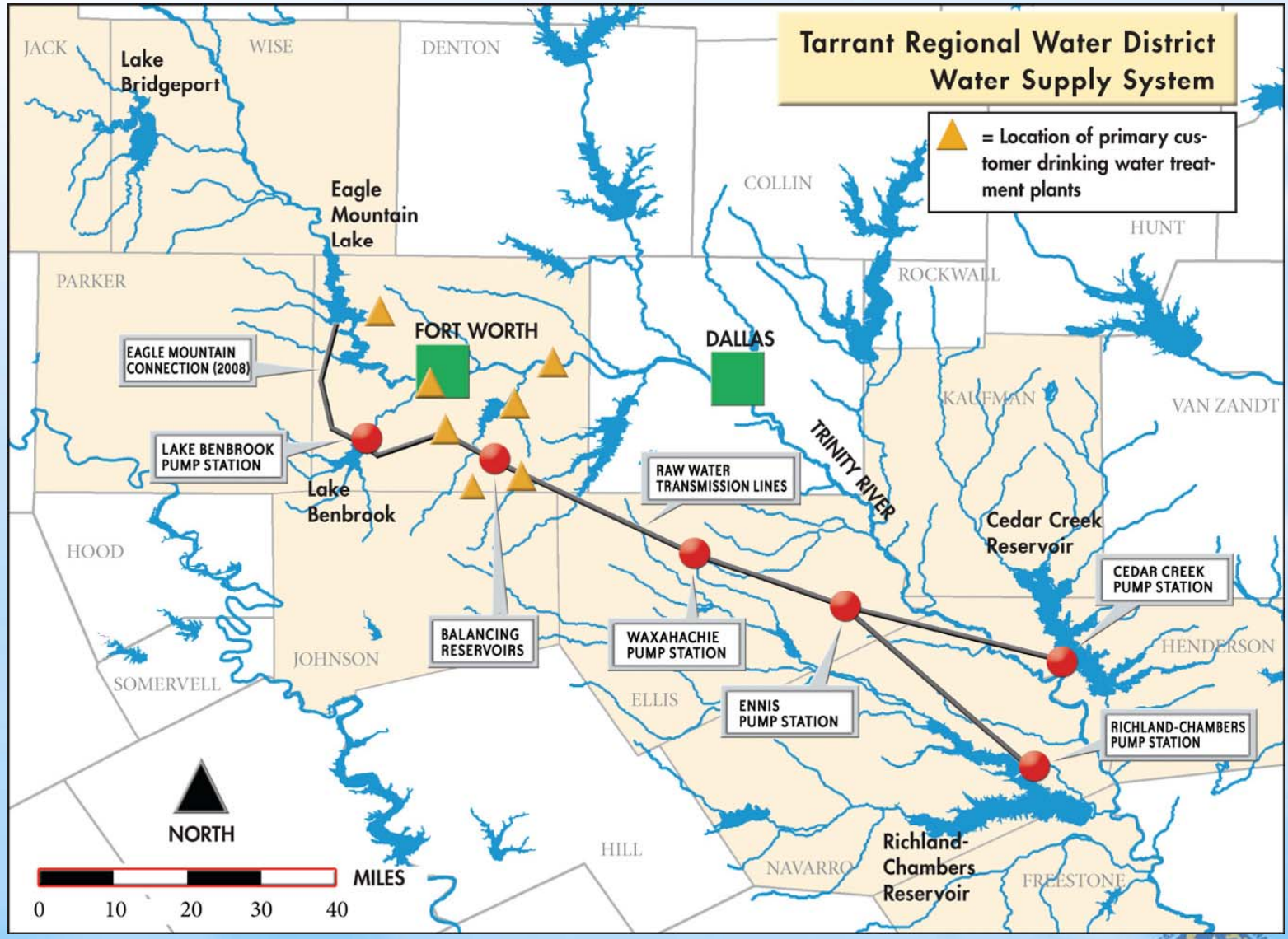
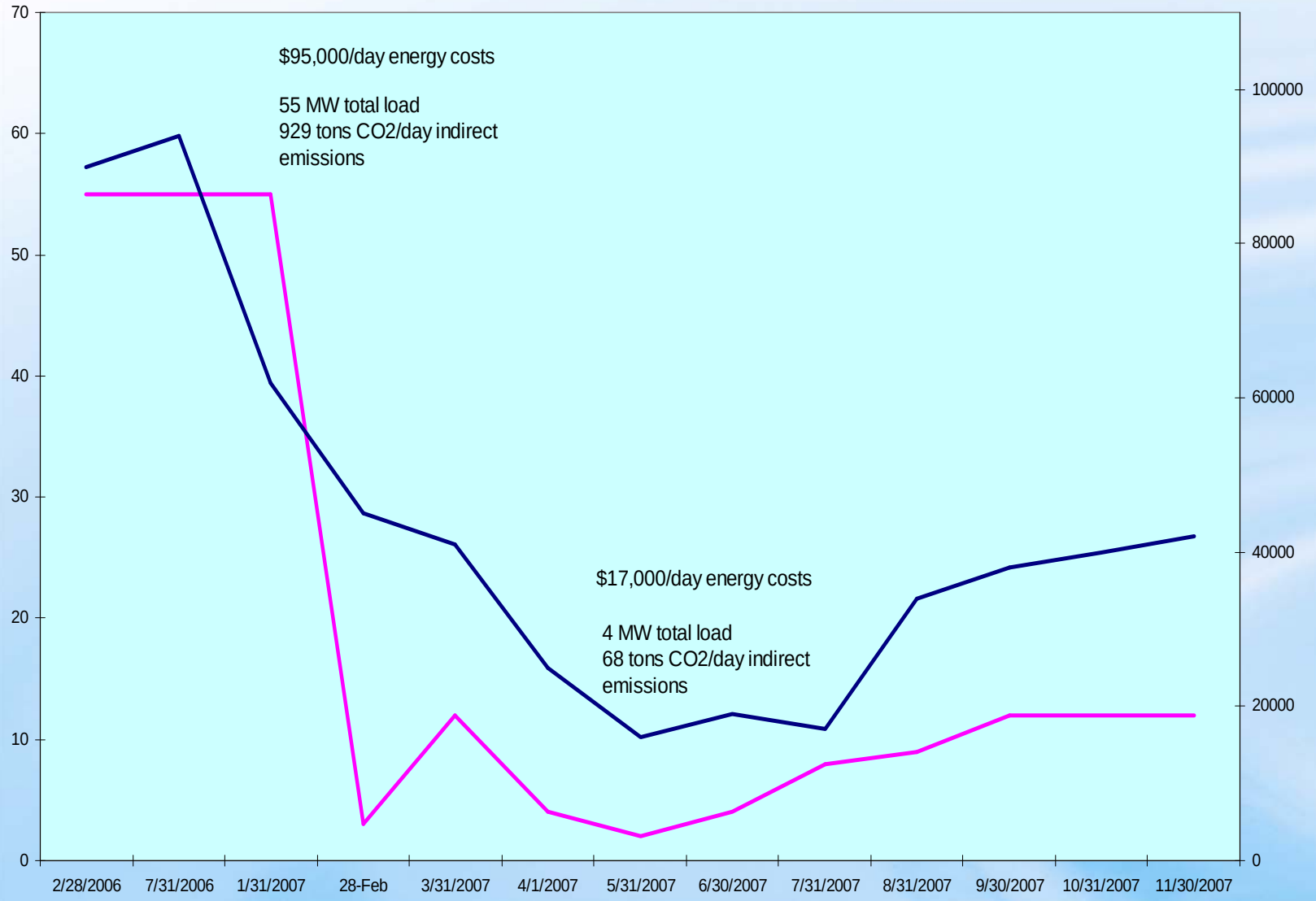
TRWD Pipeline System



Normal Operations

- 80% of Supply from East Texas Lakes
- Benbrook is a COE Flood Control Reservoir
- Eagle Mountain has substantial flood flows
- Use of Flood Water Saves Energy/Time/Money/Carbon etc…
- Permit Limitations

Observed Example



Preliminary Analysis over the POR showed that Optimizing Use of Flood Water Can Save TRWD's customers about $33,000 a day in electrical costs for pumping, during flood conditions, as well as reduce carbon emissions by over 330 tons per day, on an annual average basis.

EXFLOP Daily Model Development

- From Monthly Timestep to Daily Timestep
- Rigid Operating Rules, Defined with Monthly Constraints
- Violations of Operating Rules, When Conditions Warrant, Occur on a Daily Basis

ExFlop and TRWD Daily Model

- Existing Monthly Model is a 67 year POR
- Existing Daily Model is a 3 year Operations Forecasting Tool
- Needed a Longer Historic Daily POR
- Span Observed Extreme Conditions



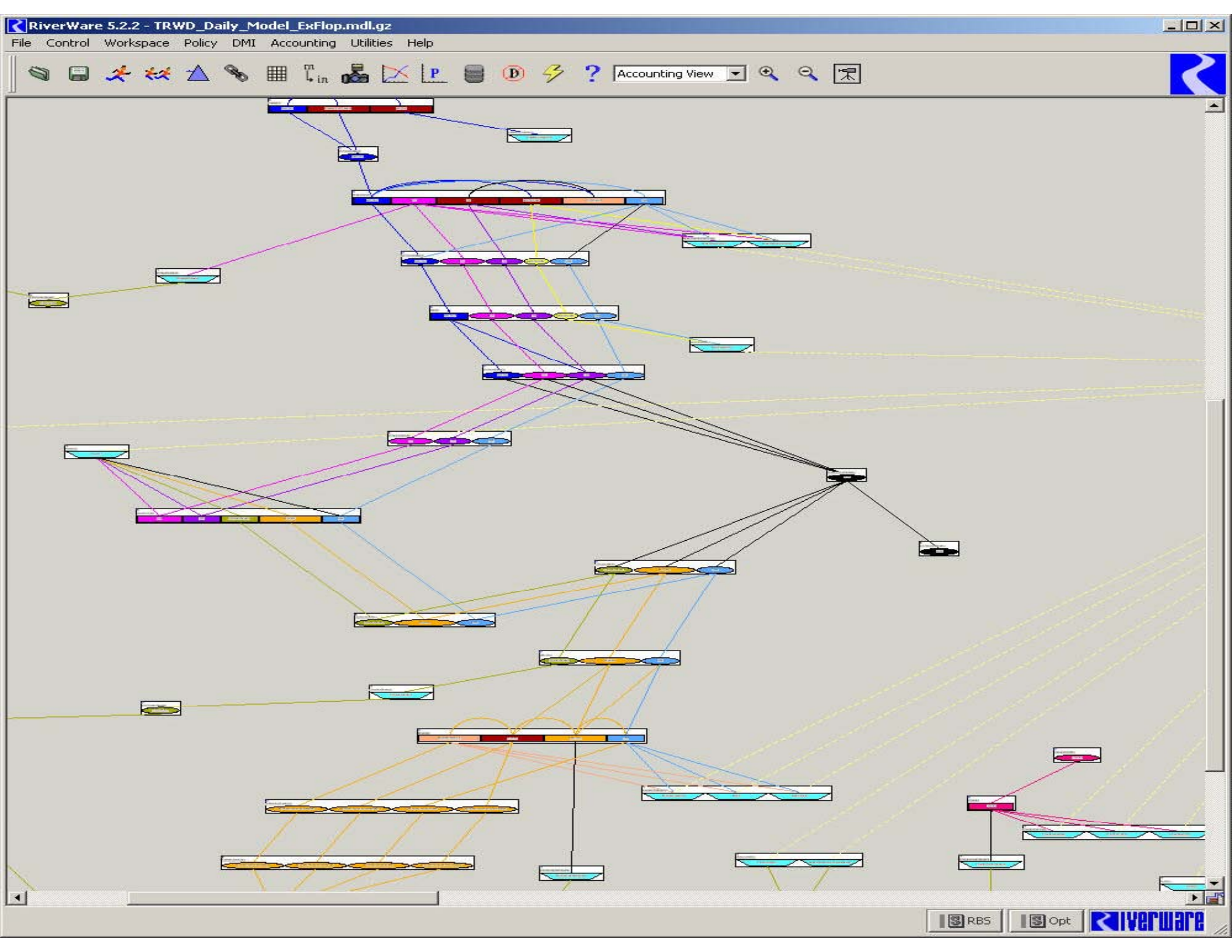

ExFlop Model Challenges

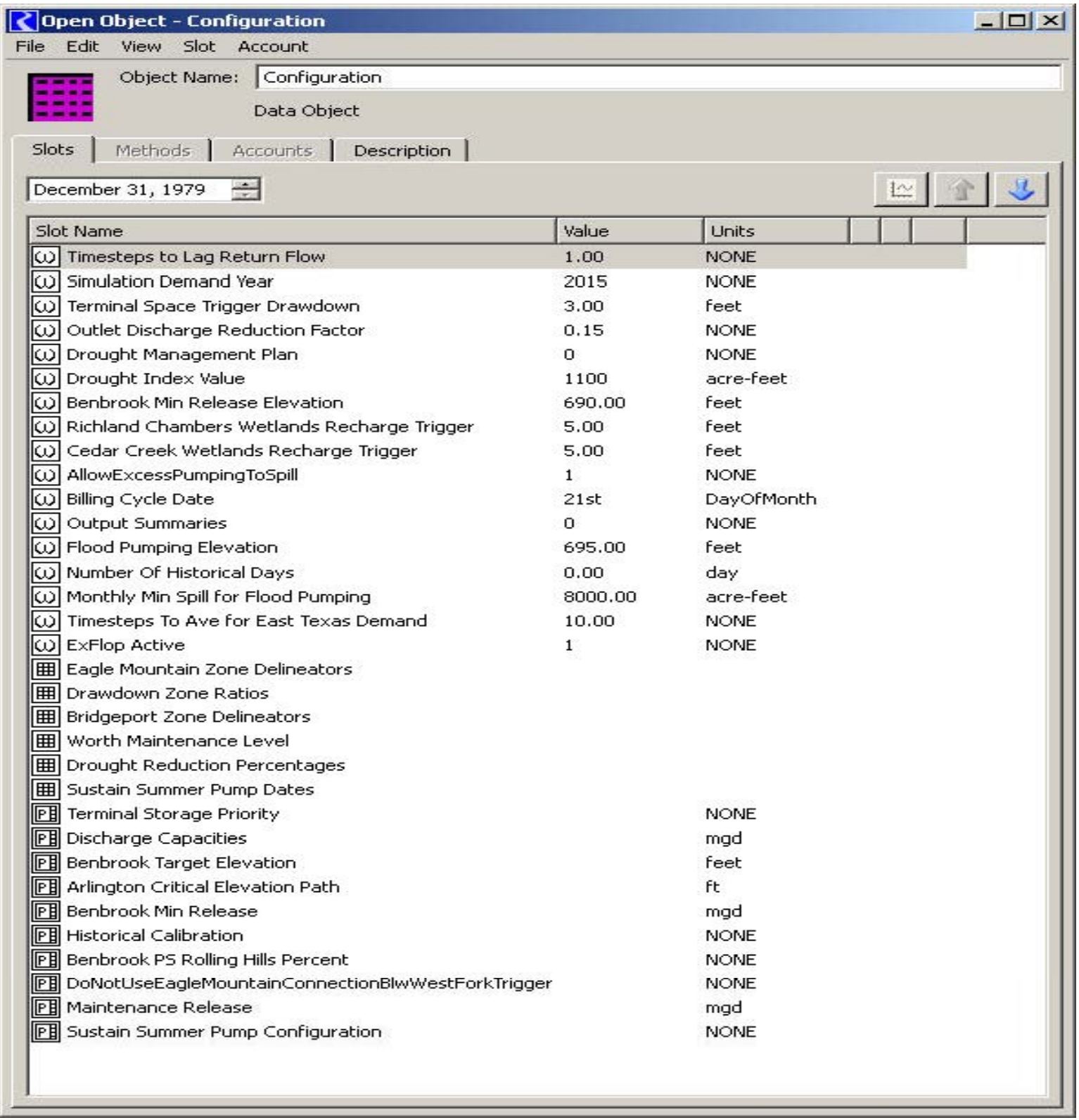
- Keep existing daily model structure intact (3 year model with one year of initialization)
- One ruleset for all configurations
- Variable “initialization timesteps”
- Facilitate quick and easy changes between the four major configurations
- The existing model had not been fully tested (this was part of the test)

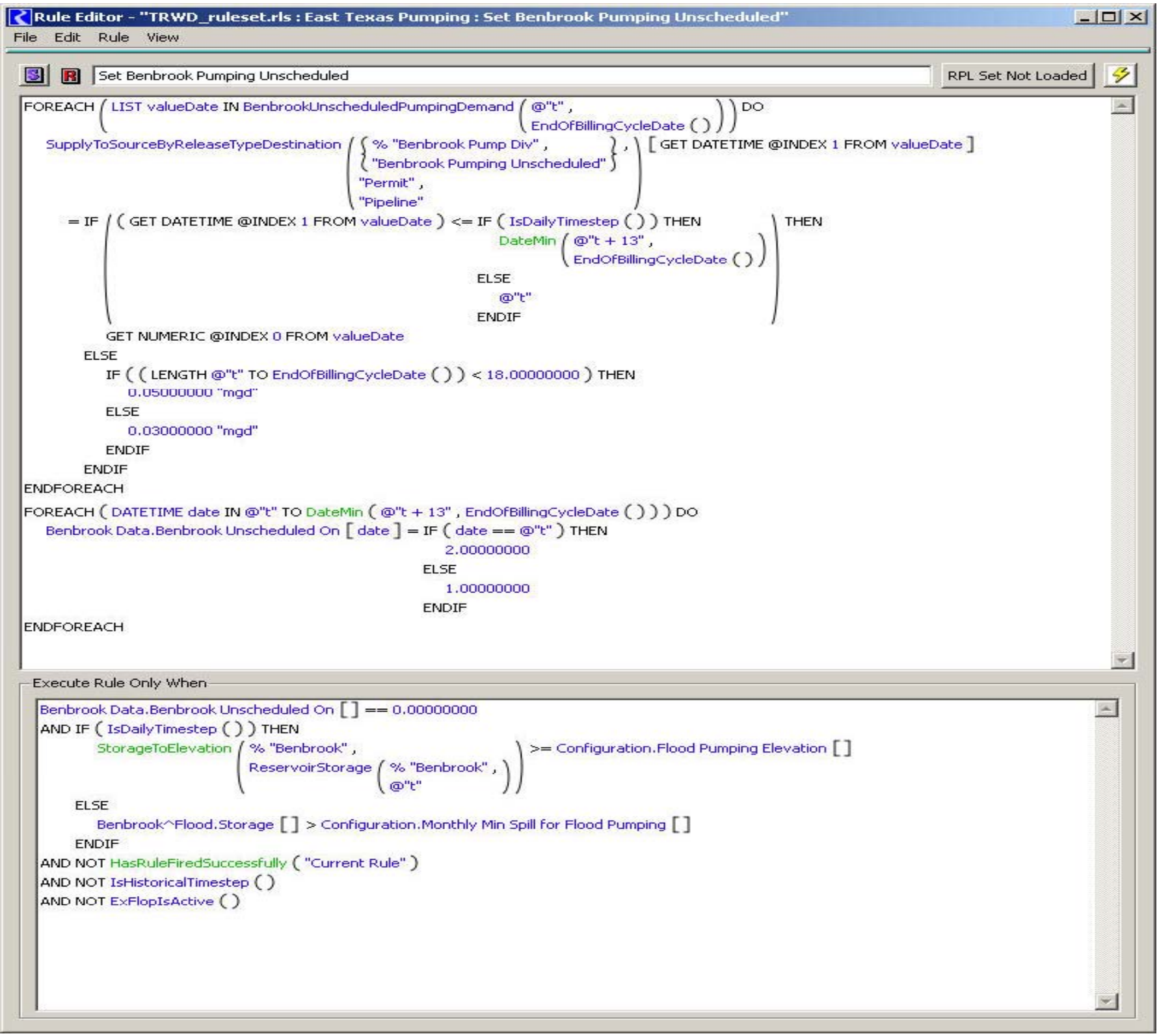



The Solution

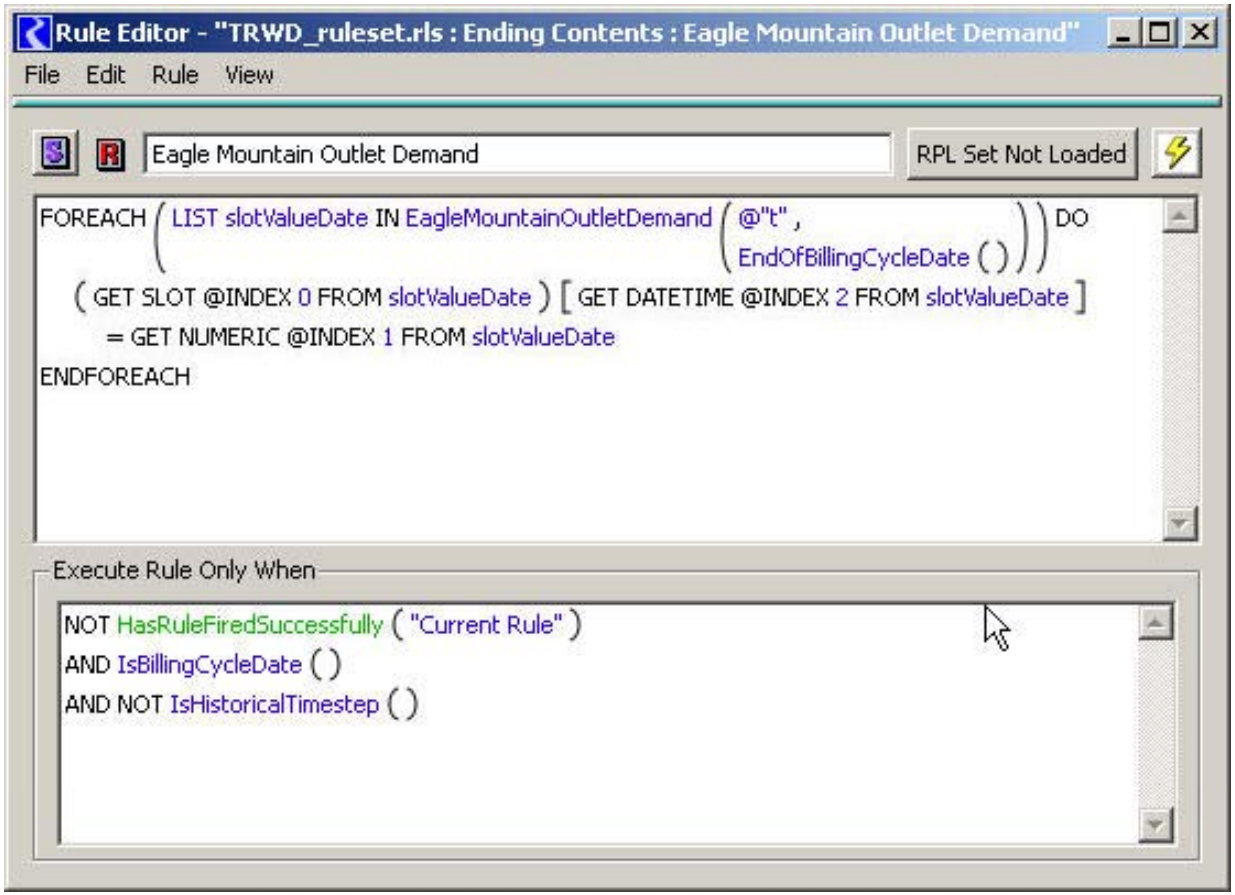
- The model solves via accounting
- Add additional accounts
- Add control in model (Via data object)
- Modify ruleset
- Modify DMI's

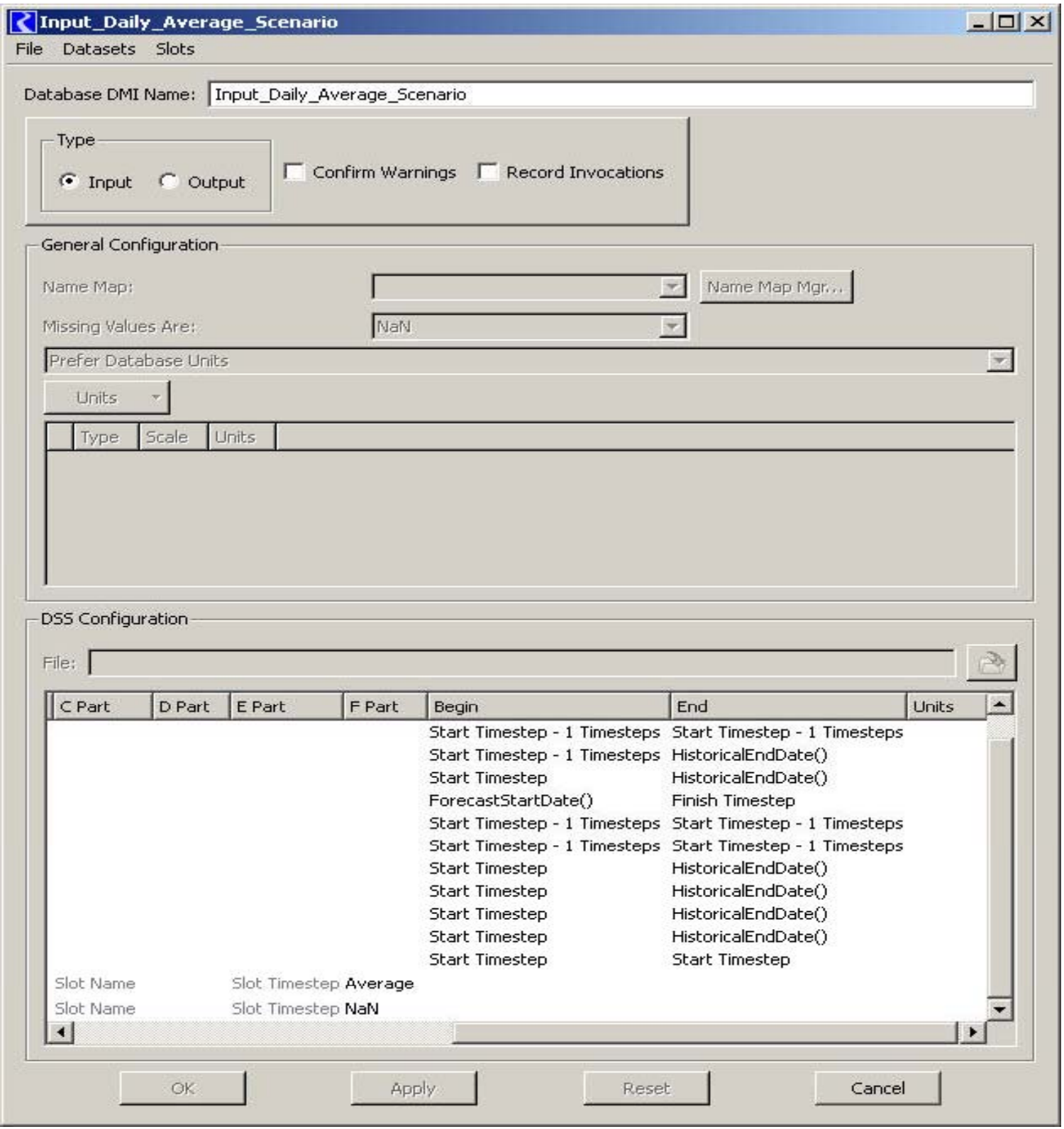

RiverWare 5.2.2 - TRWD_Daily_Model_ExFlop.mdl.gz
File Control Workspace Policy DMI Accounting Utilities Help
Accounting View
RBS
Opt
RiverWare


Open Object - Configuration
File Edit View Slot Account
Object Name: Configuration
Data Object
Slots Methods Accounts Description
December 31, 1979
Slot Name | Value | Units
Timesteps to Lag Return Flow | 1.00 | NONE
Simulation Demand Year | 2015 | NONE
Terminal Space Trigger Drawdown | 3.00 | feet
Outlet Discharge Reduction Factor | 0.15 | NONE
Drought Management Plan | 0 | NONE
Drought Index Value | 1100 | acre-feet
Benbrook Min Release Elevation | 690.00 | feet
Richland Chambers Wetlands Recharge Trigger | 5.00 | feet
Cedar Creek Wetlands Recharge Trigger | 5.00 | feet
AllowExcessPumpingToSpill | 1 | NONE
Billing Cycle Date | 21st | DayOfMonth
Output Summaries | 0 | NONE
Flood Pumping Elevation | 695.00 | feet
Number Of Historical Days | 0.00 | day
Monthly Min Spill for Flood Pumping | 8000.00 | acre-feet
Timesteps To Ave for East Texas Demand | 10.00 | NONE
ExFlop Active | 1 | NONE
Eagle Mountain Zone Delineators
Drawdown Zone Ratios
Bridgeport Zone Delineators
Worth Maintenance Level
Drought Reduction Percentages
Sustain Summer Pump Dates
Terminal Storage Priority | NONE
Discharge Capacities | mgd
Benbrook Target Elevation | feet
Arlington Critical Elevation Path | ft
Benbrook Min Release | mgd
Historical Calibration | NONE
Benbrook PS Rolling Hills Percent | NONE
DoNotUseEagleMountainConnectionBlwWestForkTrigger | NONE
Maintenance Release | mgd
Sustain Summer Pump Configuration | NONE

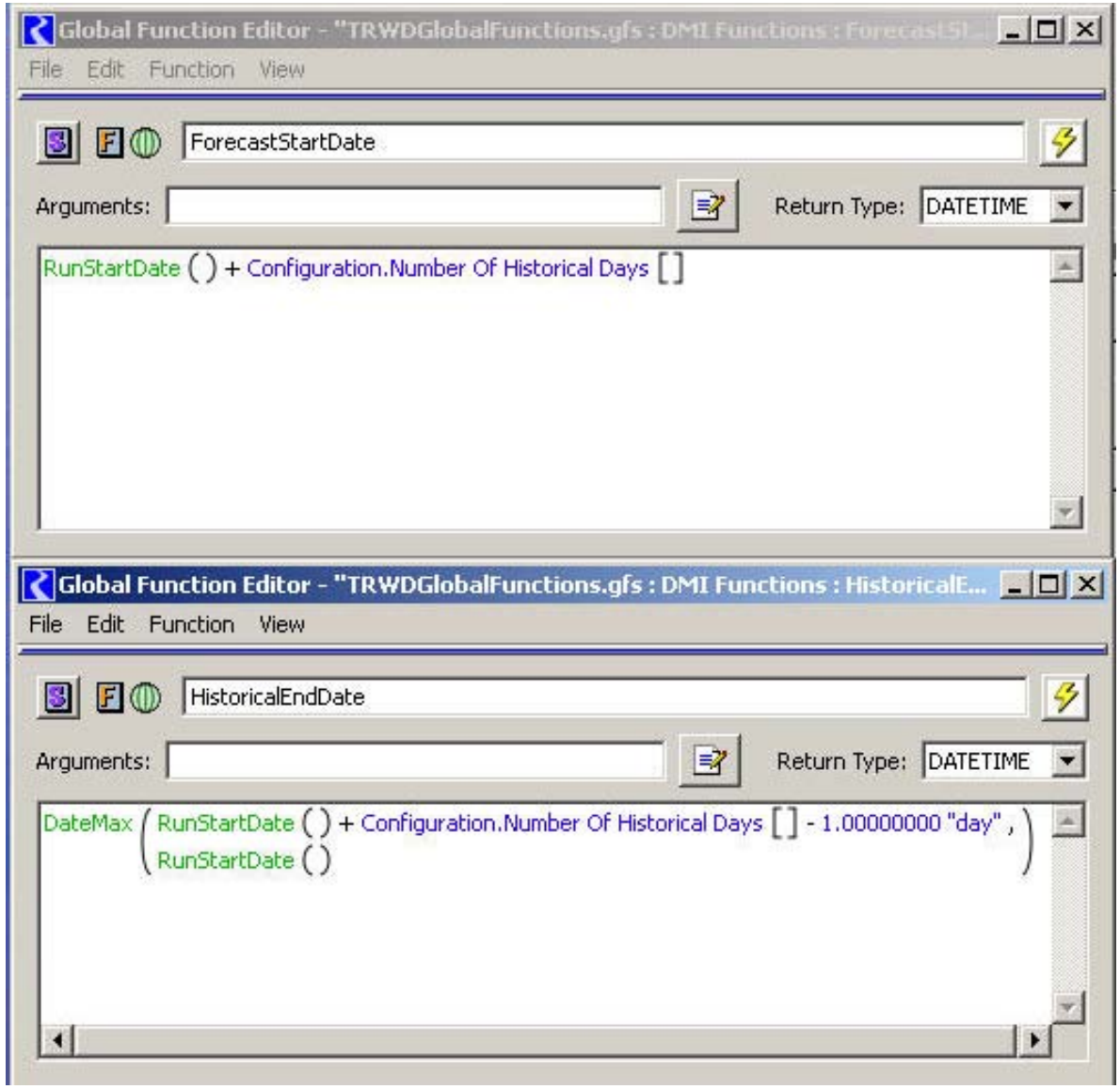

Rule Editor - "TRWD_ruleset.rls : East Texas Pumping : Set Benbrook Pumping Unscheduled"
File Edit Rule View
Set Benbrook Pumping Unscheduled
RPL Set Not Loaded
FOREACH (LIST valueDate IN BenbrookUnscheduledPumpingDemand (@"t" , EndOfBillingCycleDate ( ))) DO
SupplyToSourceByReleaseTypeDestination ({ % "Benbrook Pump Div" , "Benbrook Pumping Unscheduled" } , "Permit" , "Pipeline") [GET DATETIME @INDEX 1 FROM valueDate]
= IF ((GET DATETIME @INDEX 1 FROM valueDate) <= IF (IsDailyTimestep ( )) THEN DateMin (@"t + 13" , EndOfBillingCycleDate ( )) ELSE @"t" ENDIF) THEN
GET NUMERIC @INDEX 0 FROM valueDate
ELSE
IF ((LENGTH @"t" TO EndOfBillingCycleDate ( )) < 18.00000000) THEN
0.05000000 "mgd"
ELSE
0.03000000 "mgd"
ENDIF
ENDIF
ENDFOREACH
FOREACH (DATETIME date IN @"t" TO DateMin (@"t + 13" , EndOfBillingCycleDate ( ))) DO
Benbrook Data.Benbrook Unscheduled On [date] = IF (date == @"t") THEN
2.00000000
ELSE
1.00000000
ENDIF
ENDFOREACH
Execute Rule Only When
Benbrook Data.Benbrook Unscheduled On [ ] == 0.00000000
AND IF (IsDailyTimestep ( )) THEN
StorageToElevation (% "Benbrook" , ReservoirStorage (% "Benbrook" , @"t")) >= Configuration.Flood Pumping Elevation [ ]
ELSE
Benbrook^Flood.Storage [ ] > Configuration.Monthly Min Spill for Flood Pumping [ ]
ENDIF
AND NOT HasRuleFiredSuccessfully ("Current Rule")
AND NOT IsHistoricalTimestep ( )
AND NOT ExFlopIsActive ( )

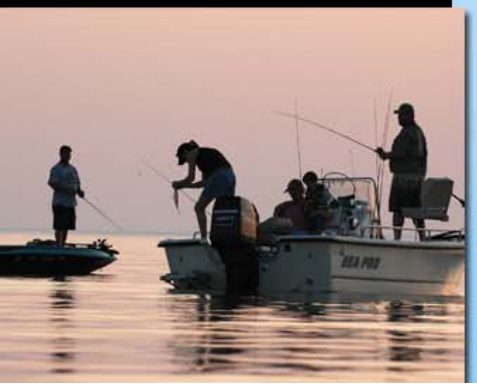
Other Rule Example




Input_Daily_Average_Scenario
File Datasets Slots
Database DMI Name: Input_Daily_Average_Scenario
Type
Input Output
Confirm Warnings Record Invocations
General Configuration
Name Map:
Name Map Mgr...
Missing Values Are:
NaN
Prefer Database Units
Units
Type Scale Units
DSS Configuration
File:
C Part D Part E Part F Part Begin End Units
Start Timestep - 1 Timesteps Start Timestep - 1 Timesteps
Start Timestep - 1 Timesteps HistoricalEndDate()
Start Timestep HistoricalEndDate()
ForecastStartDate() Finish Timestep
Start Timestep - 1 Timesteps Start Timestep - 1 Timesteps
Start Timestep - 1 Timesteps Start Timestep - 1 Timesteps
Start Timestep HistoricalEndDate()
Start Timestep HistoricalEndDate()
Start Timestep HistoricalEndDate()
Start Timestep HistoricalEndDate()
Start Timestep Start Timestep
Slot Name Slot Timestep Average
Slot Name Slot Timestep NaN
OK
Apply
Reset
Cancel

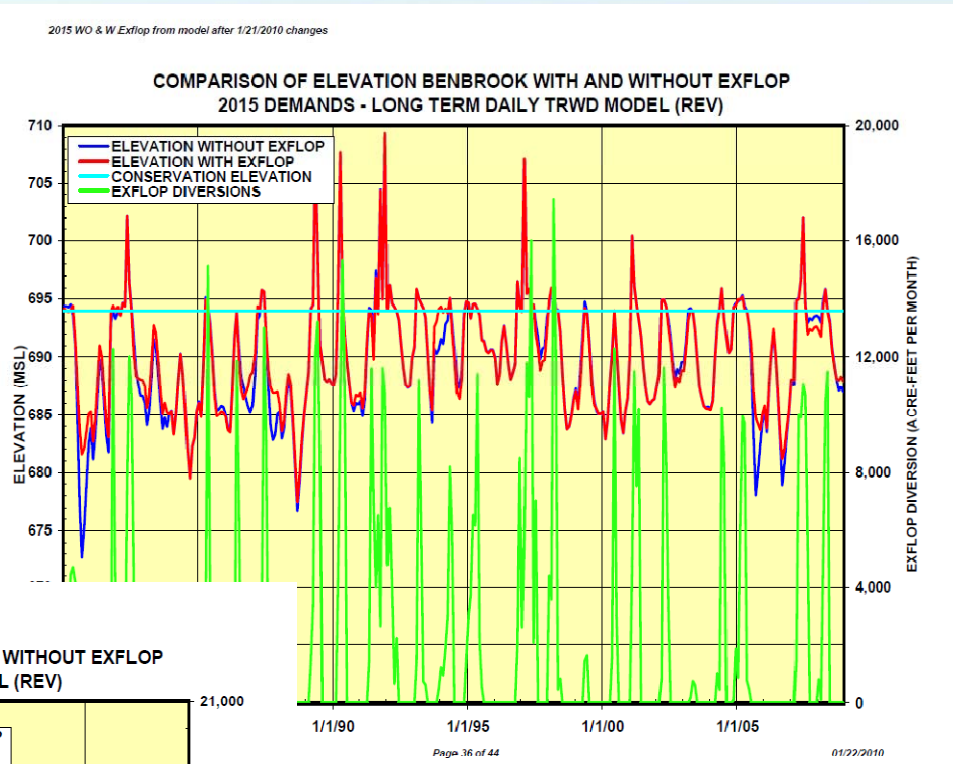
Example DMI Functions

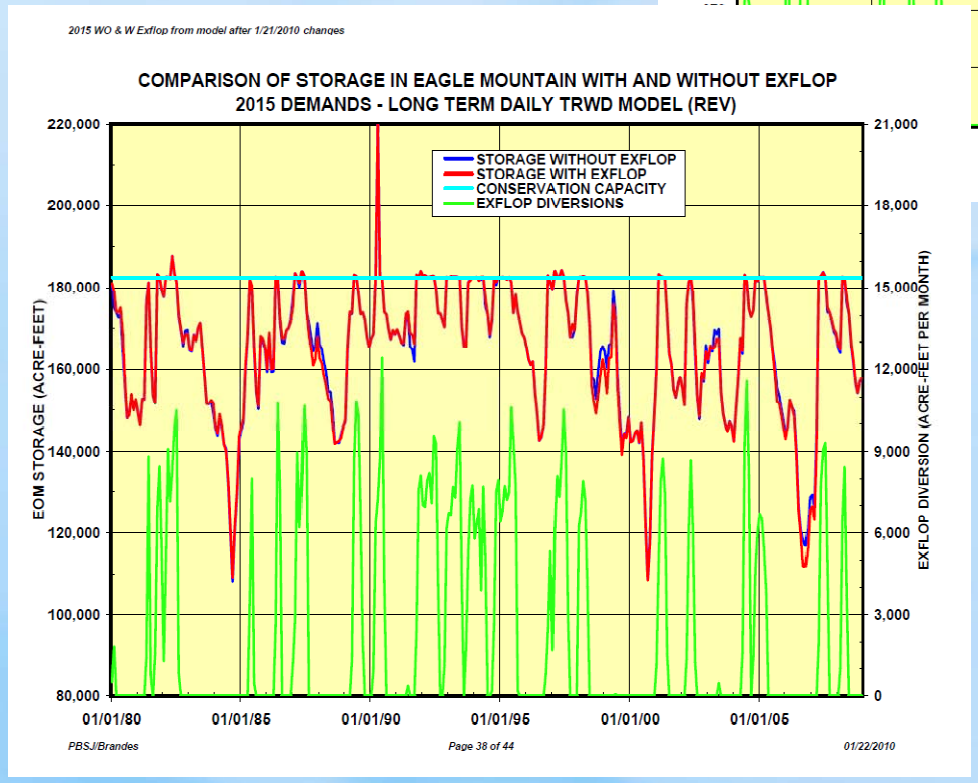




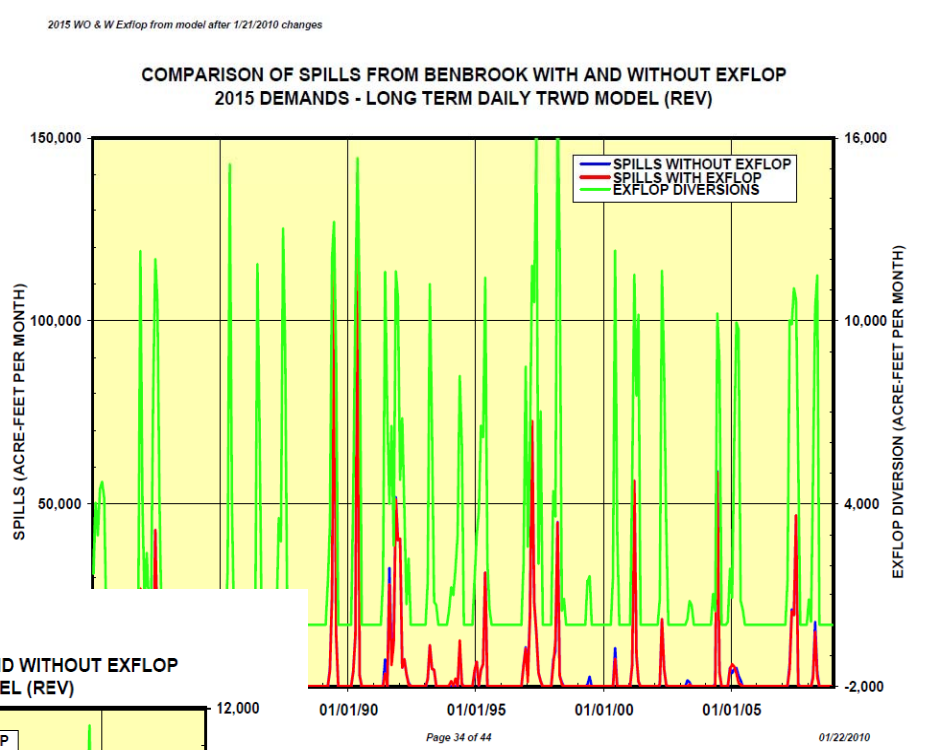
ExFlop Summary Results

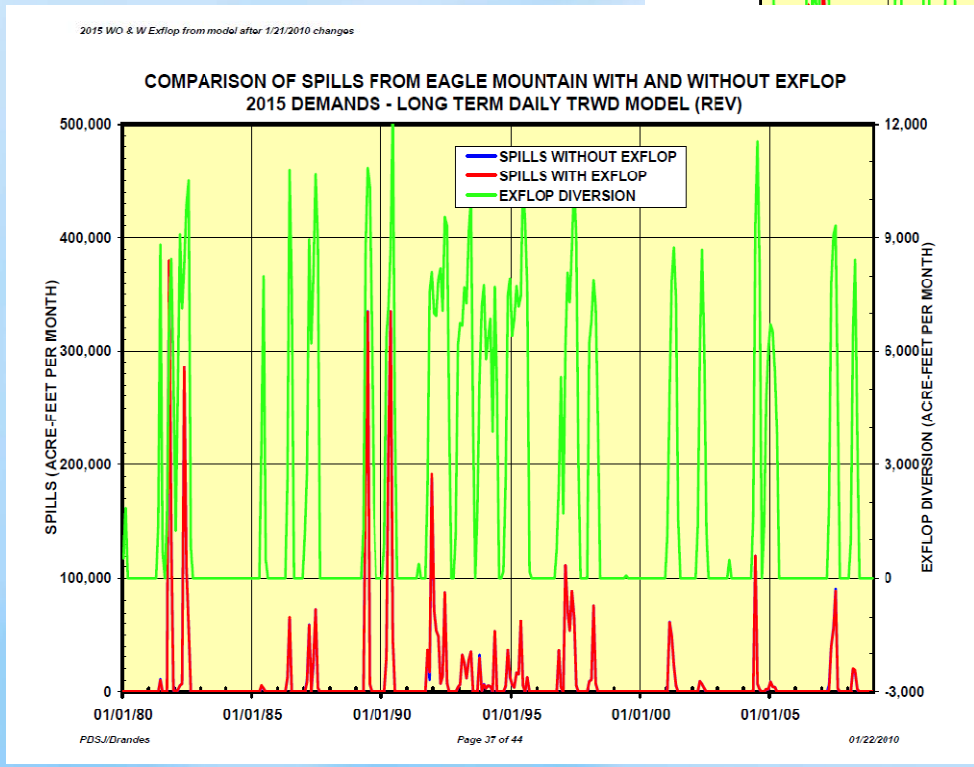
Summer Peaking for Holly WTP Swapped From One Lake to Another



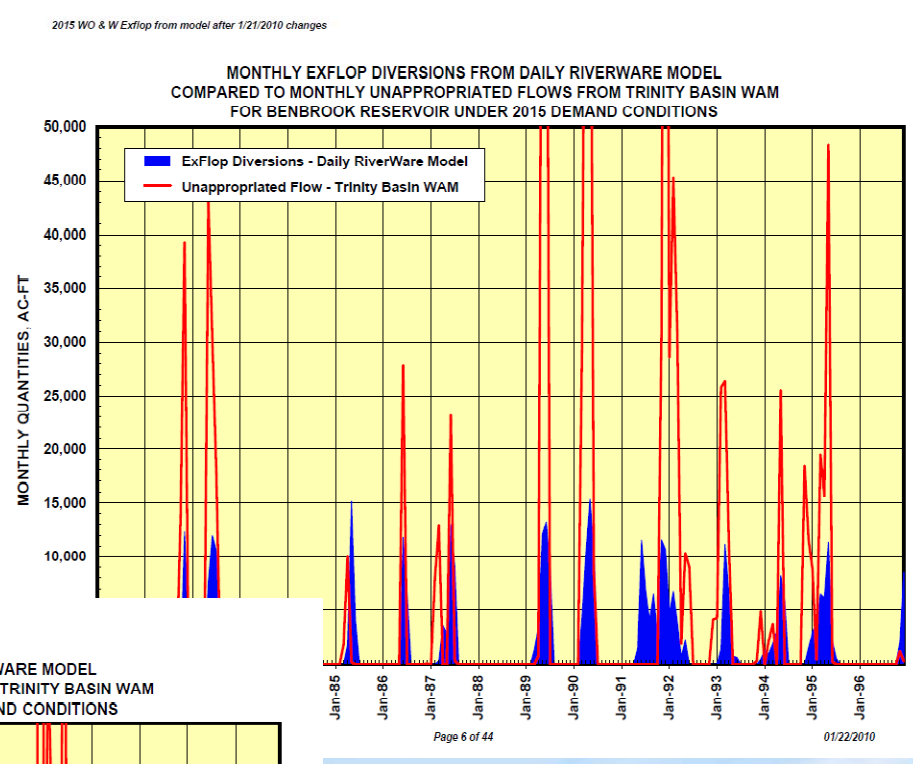


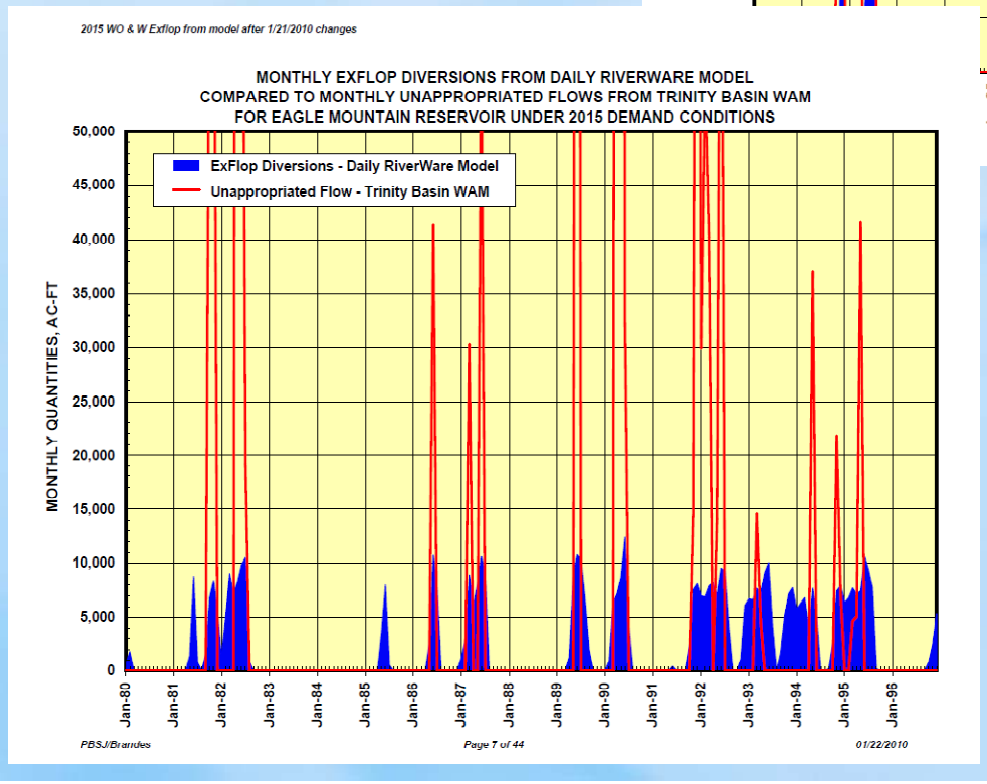
ExFlop Summary Results

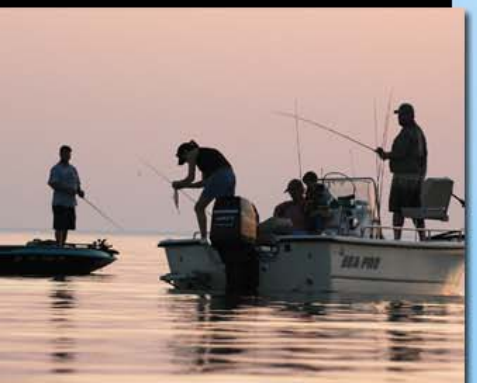




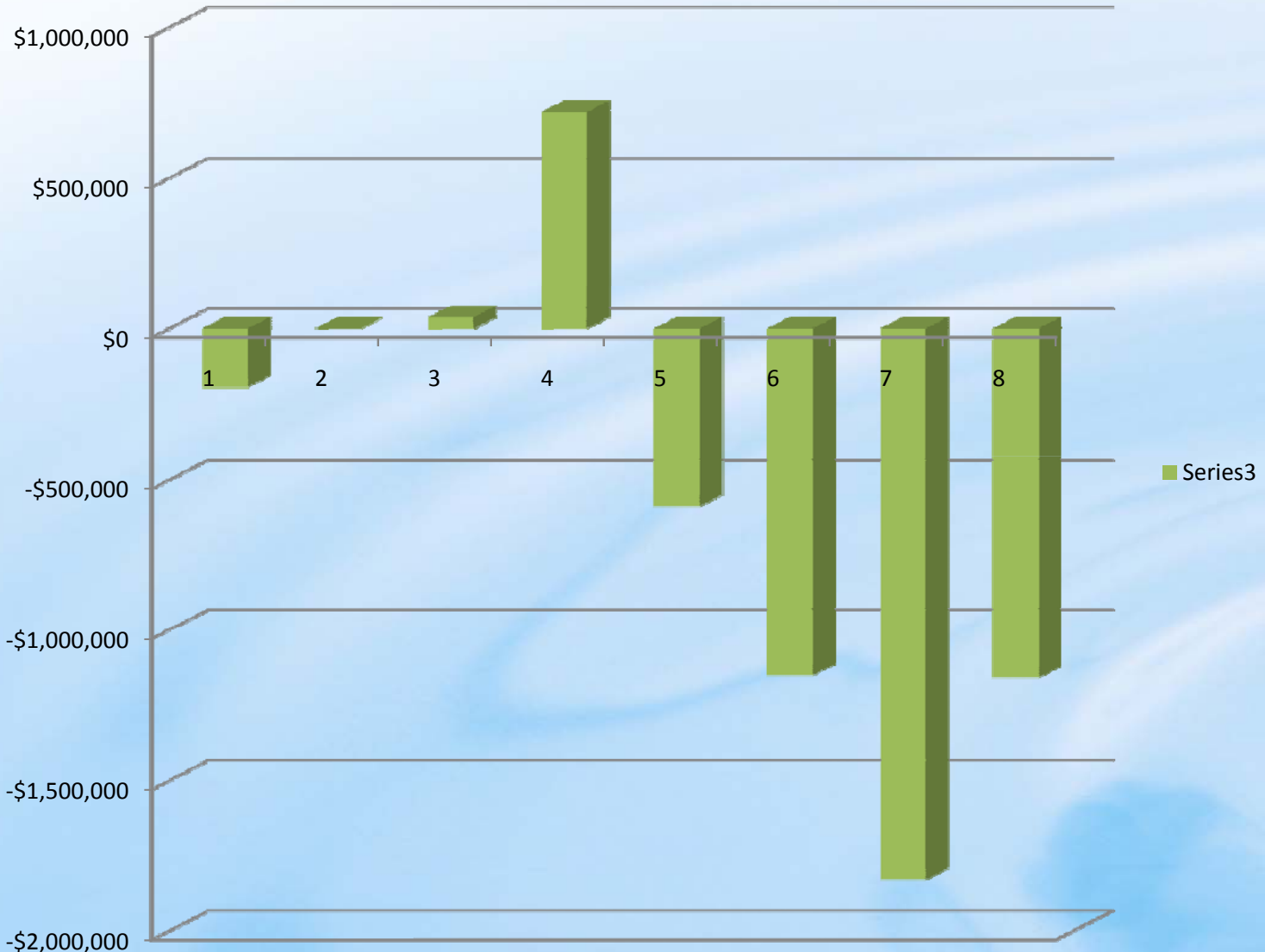
ExFlop Summary Results







ExFlop and Cost Savings






Much Ado About ExFlop

- Some Additional Analysis

Application Process to TCEQ

- Public Meetings, etc




Questions?

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