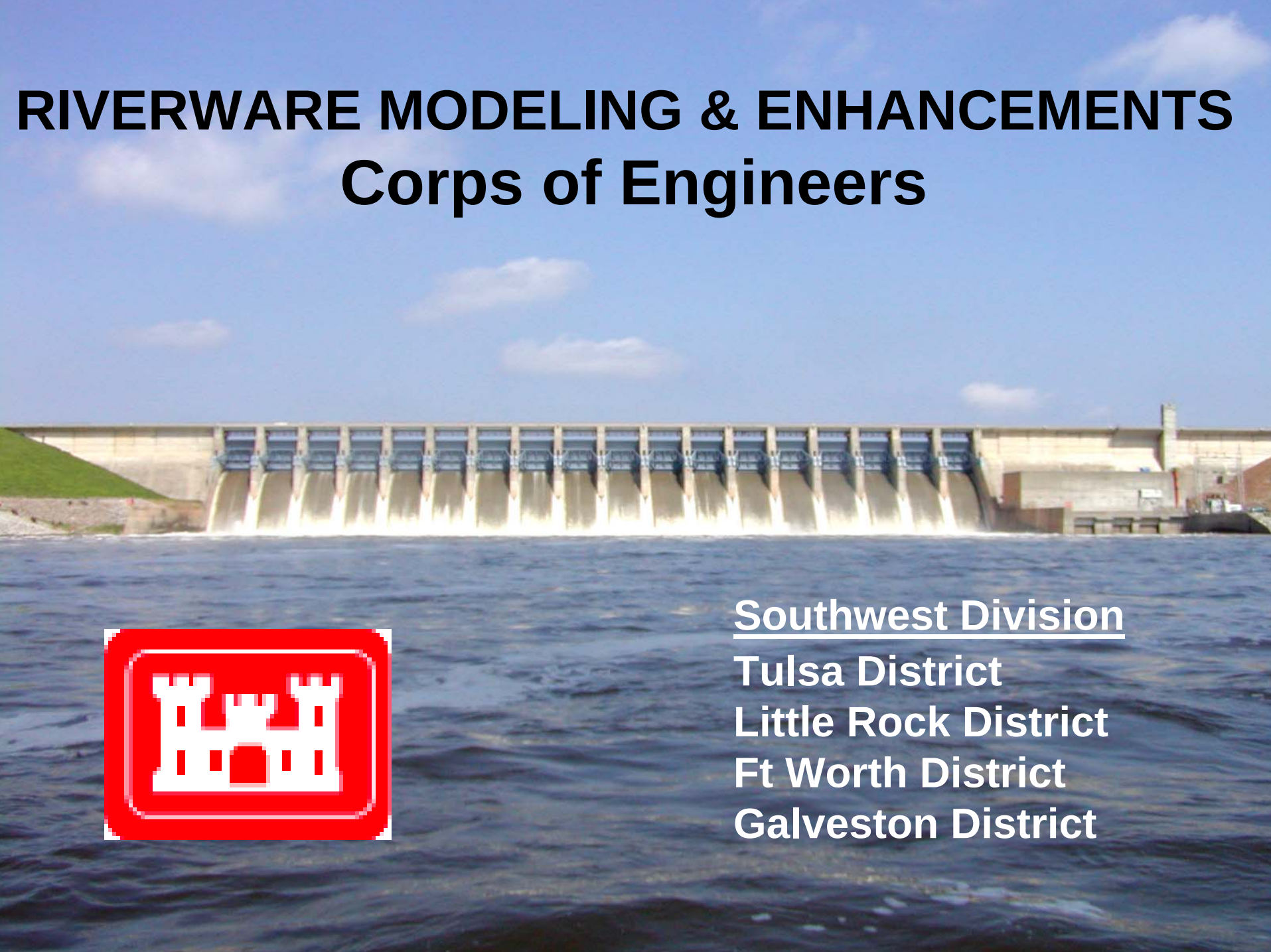
RIVERWARE MODELING & ENHANCEMENTS
Corps of Engineers



Southwest Division

Tulsa District
Little Rock District
Ft Worth District
Galveston District

Today's Discussion:

Brief History: SUPER into RiverWare

Recent Effort

Ongoing Effort

Applied Modeling with RiverWare

Need for POR Basin Simulation:

- Evaluate Proposed Changes with System Operation
- Flood Control, HP, Navigation, M&I, WQ
- Proposed Reservoirs
- Frequency Analysis

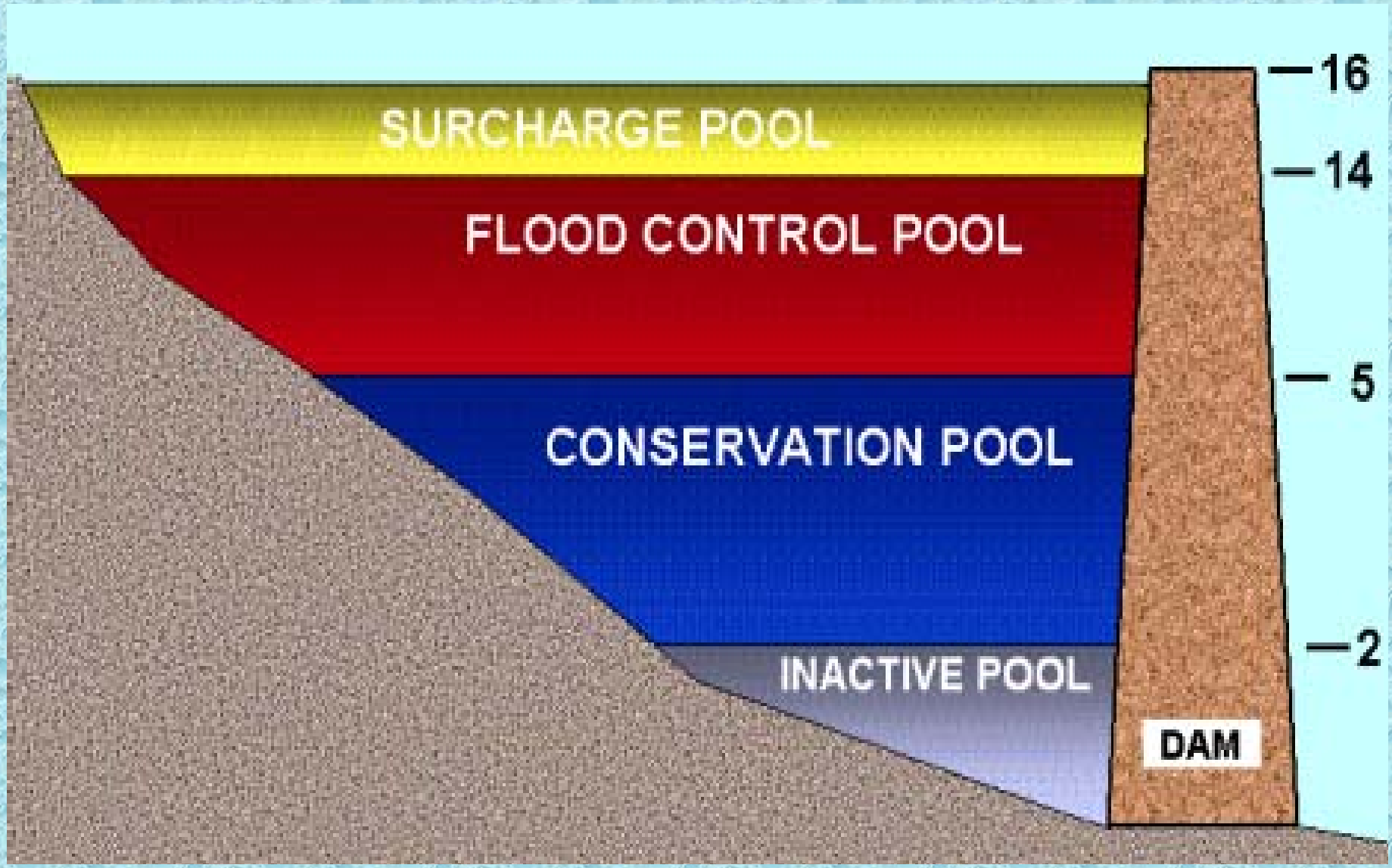
Modeling Approach:

Flood Control:

Evacuate Flood Storage As Soon As Possible Given DS Constraints to Achieve "*System Balance*"

Conservation Pool:

Balance Approach for Common Purposes



USACE storage divisions and balance levels

16 BALANCE LEVELS

1 Zero storage

2 Bottom conservation

3 Bottom power pool

4 50% conservation

5 100% conservation pool

6-8 Typically not used

9 10% Flood control

10 30% Flood control

11 50% Flood control

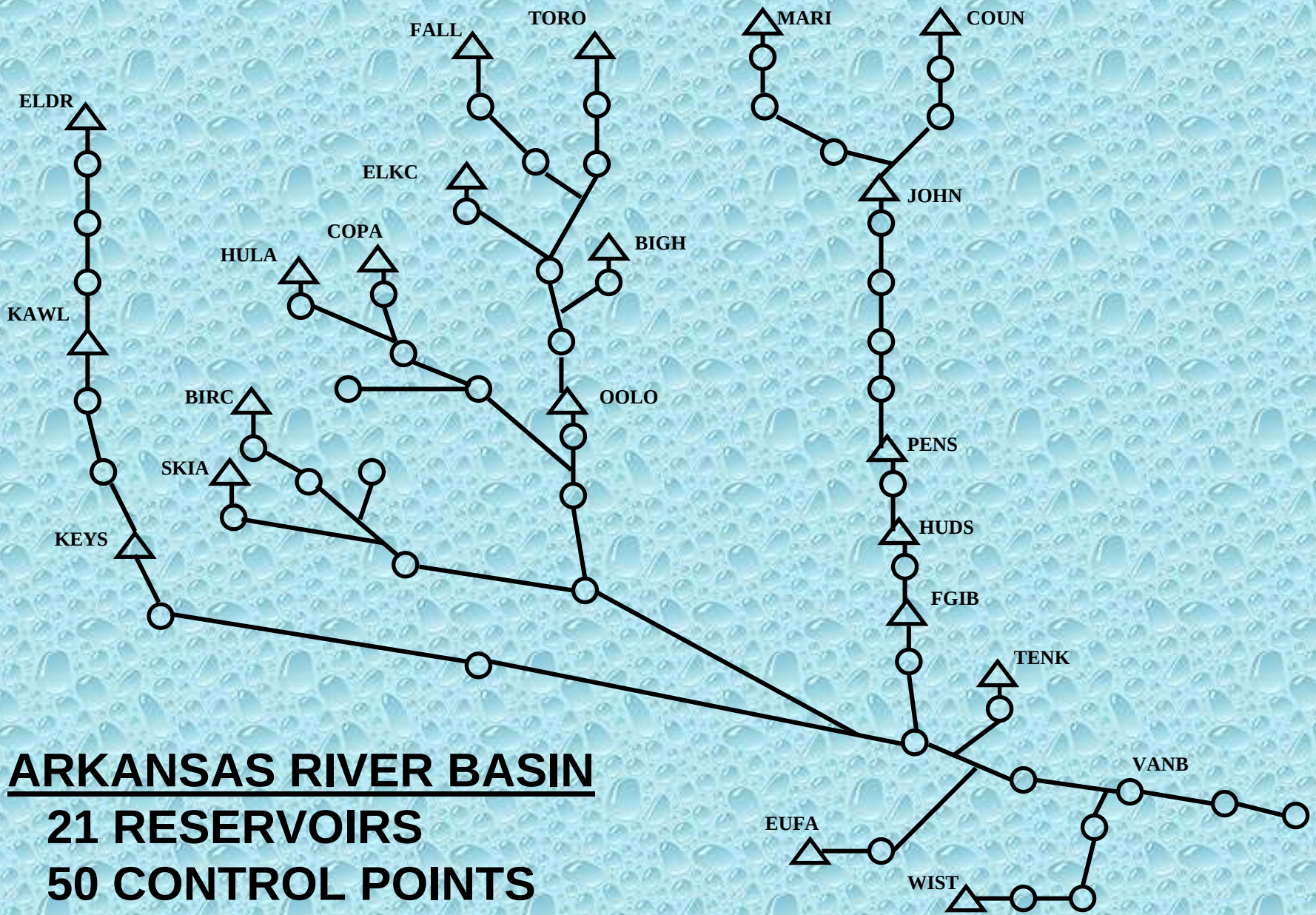
12 70% Flood control

13 90% Flood control

14 100% Flood control

15 Top surcharge

16 Top of dam



ARKANSAS RIVER BASIN

21 RESERVOIRS

50 CONTROL POINTS

History/Background:

- SWD-COE Legacy Program: SUPER
- Used for 30+ Years
- Author/Expert Retired: Ron Hula

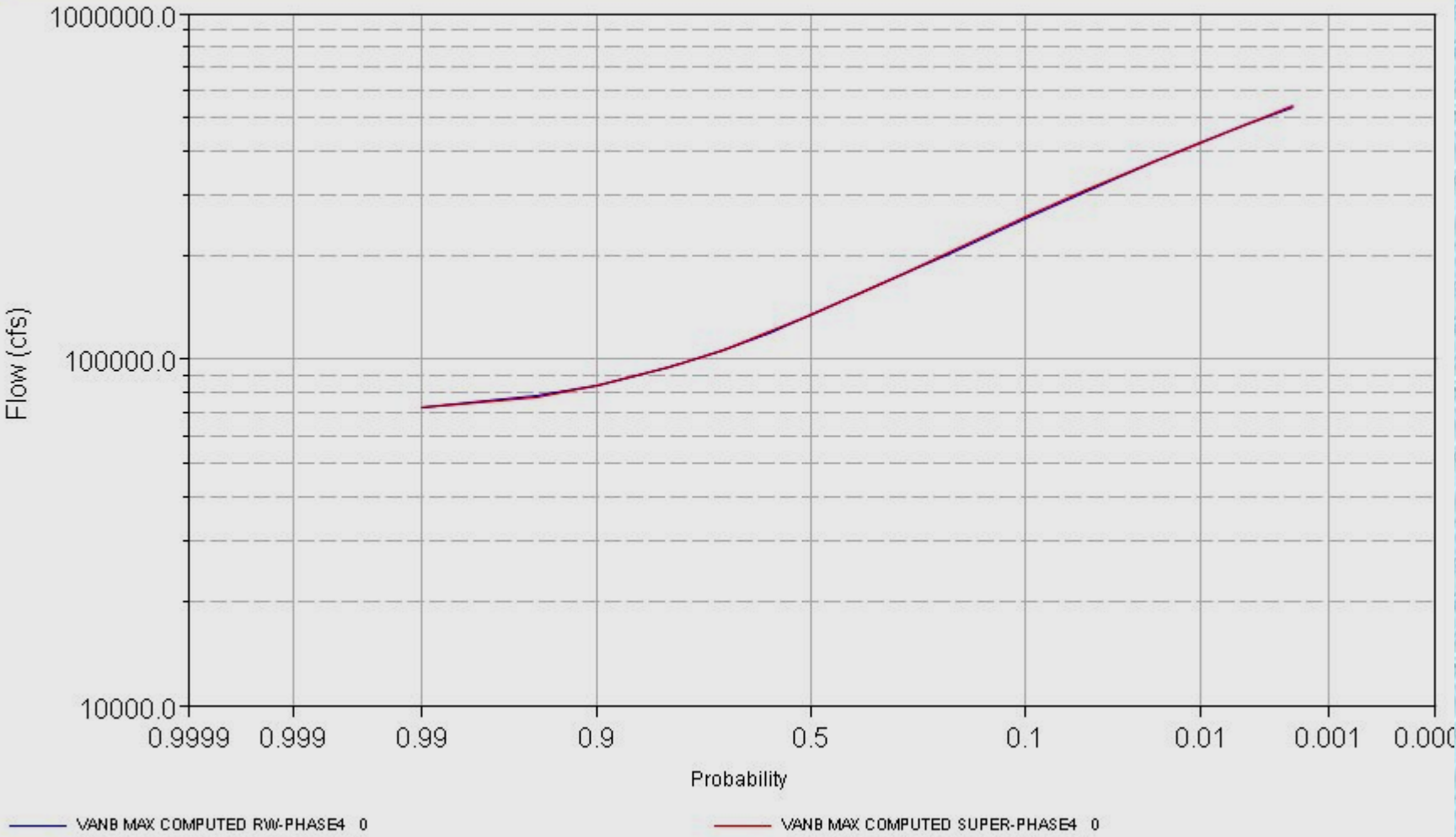
History/Background:

- **Operational Program: RiverWare**
- **RiverWare Selected by SWD-COE Team in 2000 for SUPER Replacement**
- **Lead to New Methods/Features in RiverWare**

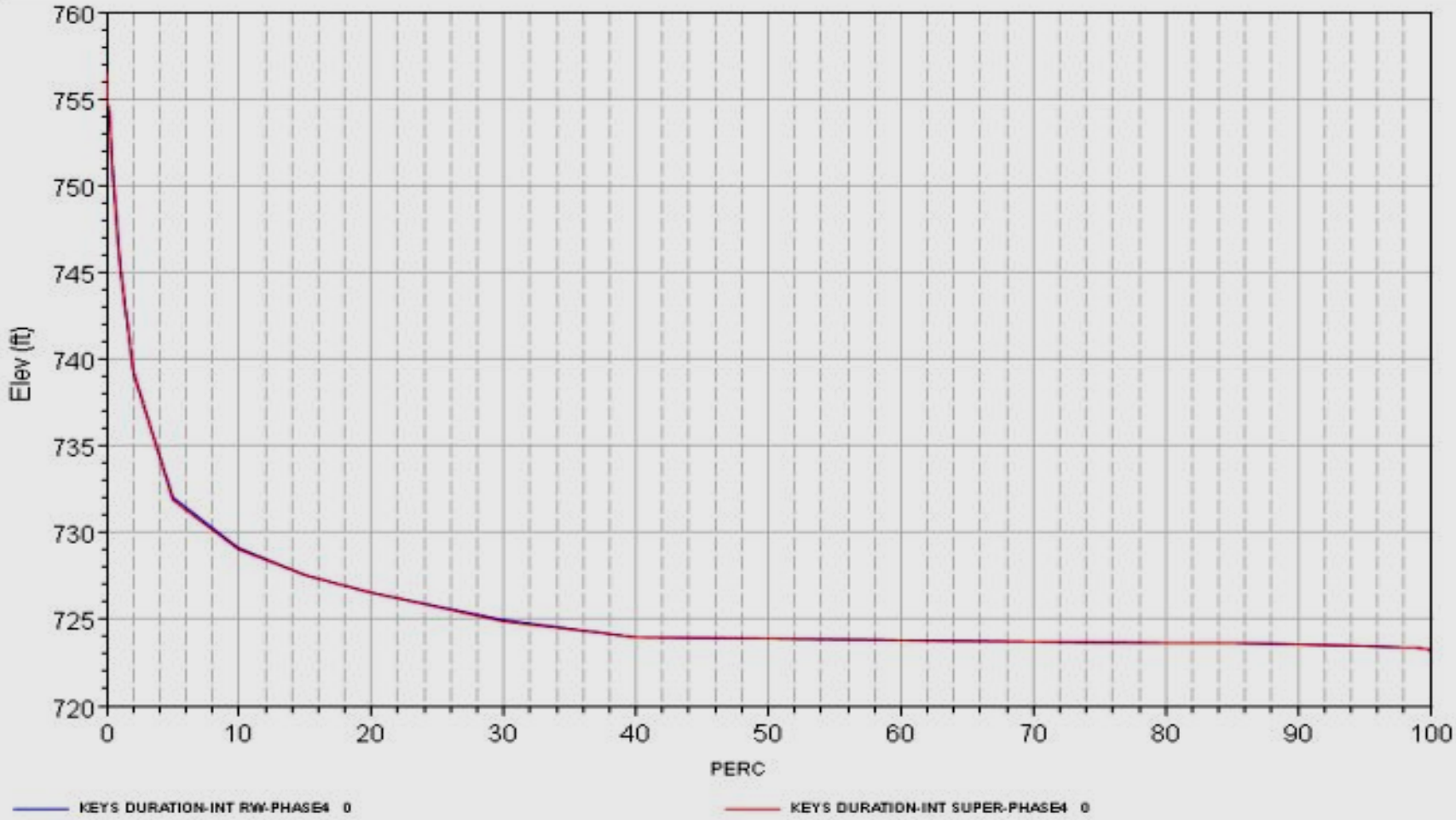
History/Background:

- **Fall 2004 – Completed SUPER's Flood Control Logic into RiverWare**
- **2005 & 2006 – Conservation Pool**

RiverWare & Super Results
Phase 4 CADSWES Contr.
HEC-STATS & DSSVUE PROGRAMS
29 March 2005



RIVERWARE & SUPER OUTPUT
CADSWES PHASE 4 CONTRACT - FALL 2004
SUPER ELEV'S VIA RULE FROM SUPER STORAGES
HEC-STATS ELEV-DURATION
INTERPOLATED DURATION CURVES w/ 1-FT CLASS INCR.
31 March 2005



CADSWES Effort for SWD COE:

2005 ?

Hydropower Analysis:

- POR Load Requirements from SWPA
- New Hydropower Methods for COE-SWD
- Demands/Thermal Purchase/Dump Energy
- Minimum Sustained Release/Accounting (Partial Power vs Daily TS)

COE Flood Control Performance Study & Improvements by CADSWES

Arkansas R. Model, 61 Years Daily TS

21 Reservoirs & 50 CP's

91 Minutes to 66 Minutes

(Windows/Intel/4GB RAM)

- **Reach: stepResponseRouting**
- **Control Point: maxLevelForecast**

RiverWare 4.7 - ARKCOE3_HP.MDL

Open Object - Van Buren Data

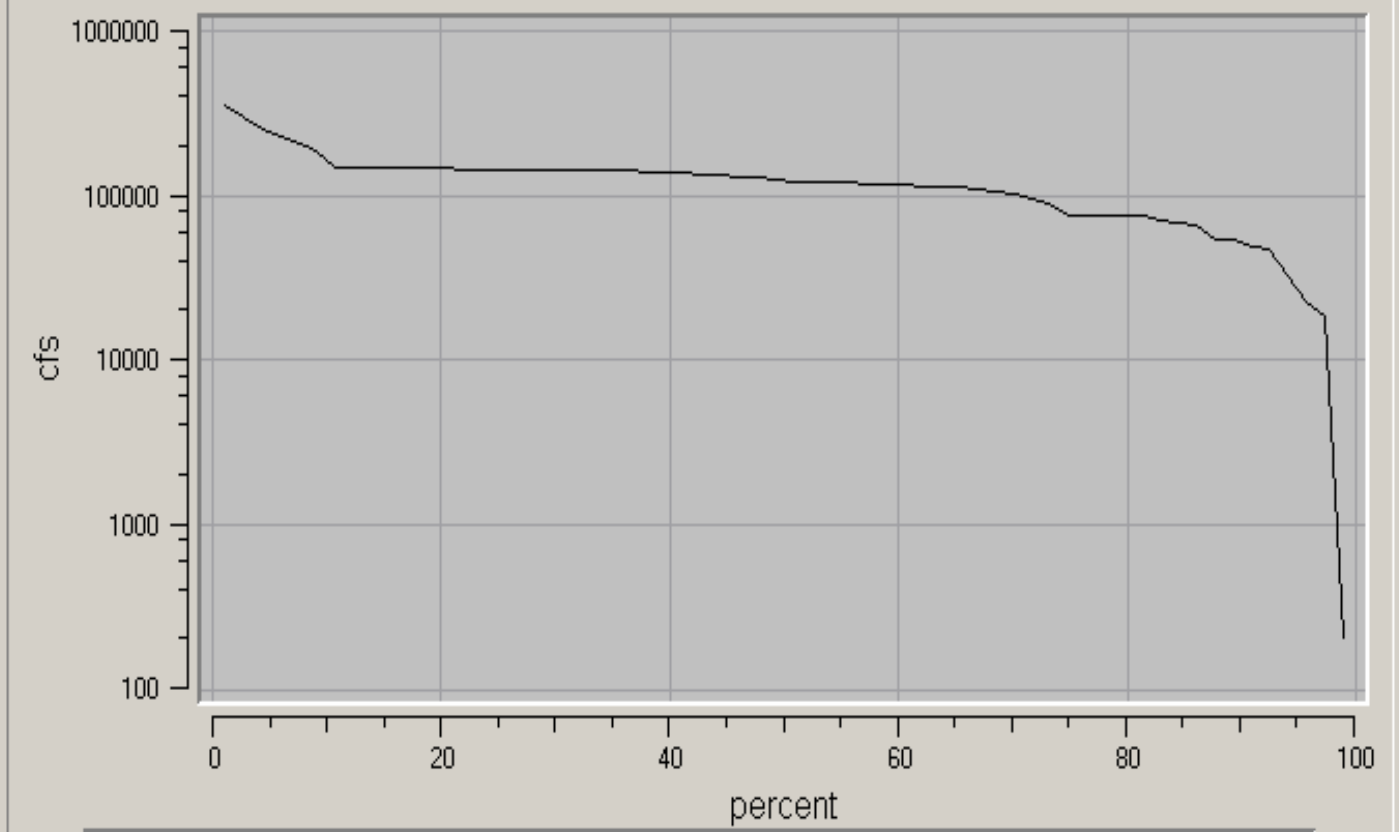
Select Reference Slot for Statistical Table Slot: Statistical Table00000 (Single)

Van Buren Data.Statistical Table00000

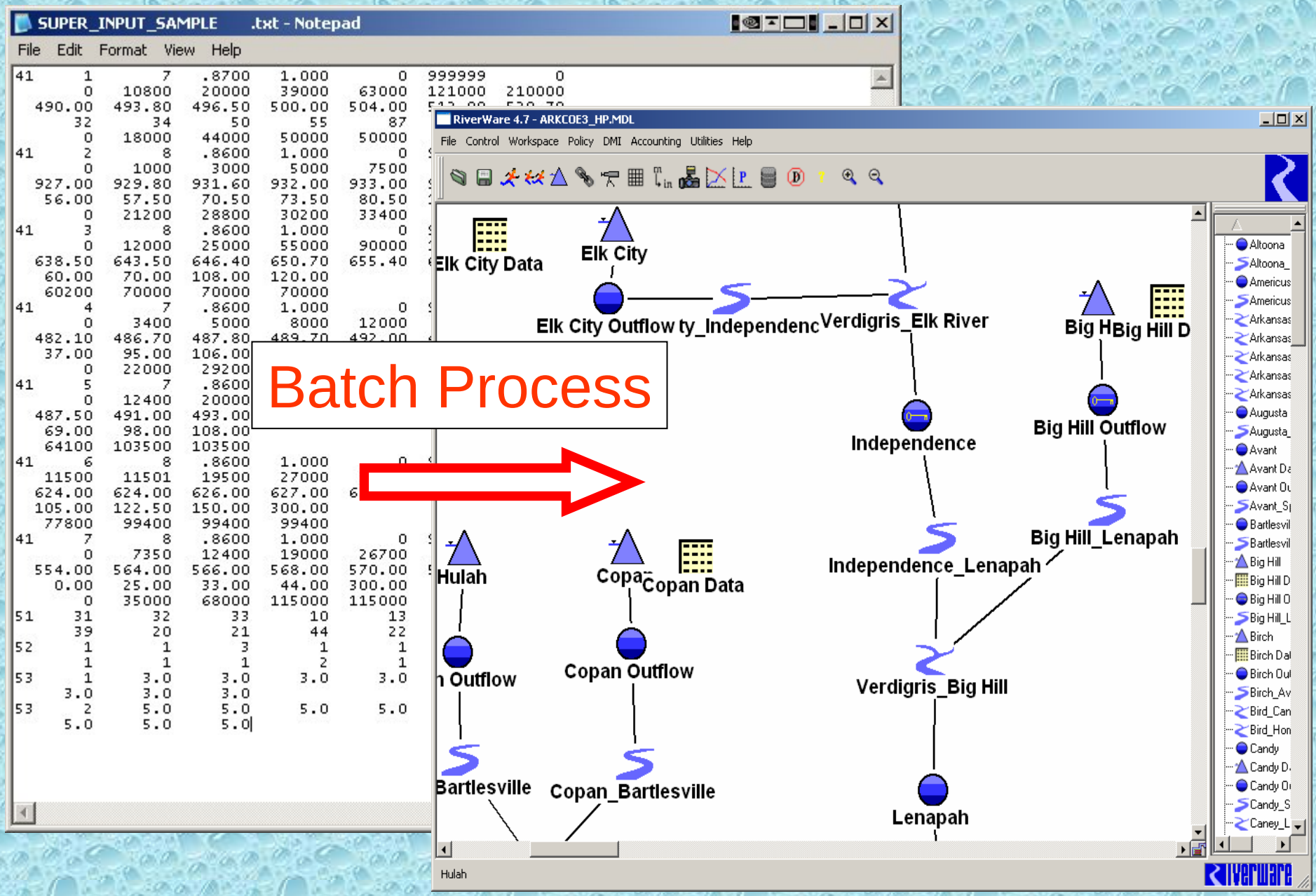
Plot

File Edit Graph Data Window

December 31, 1939



X, Y = (67.9348, 967063)

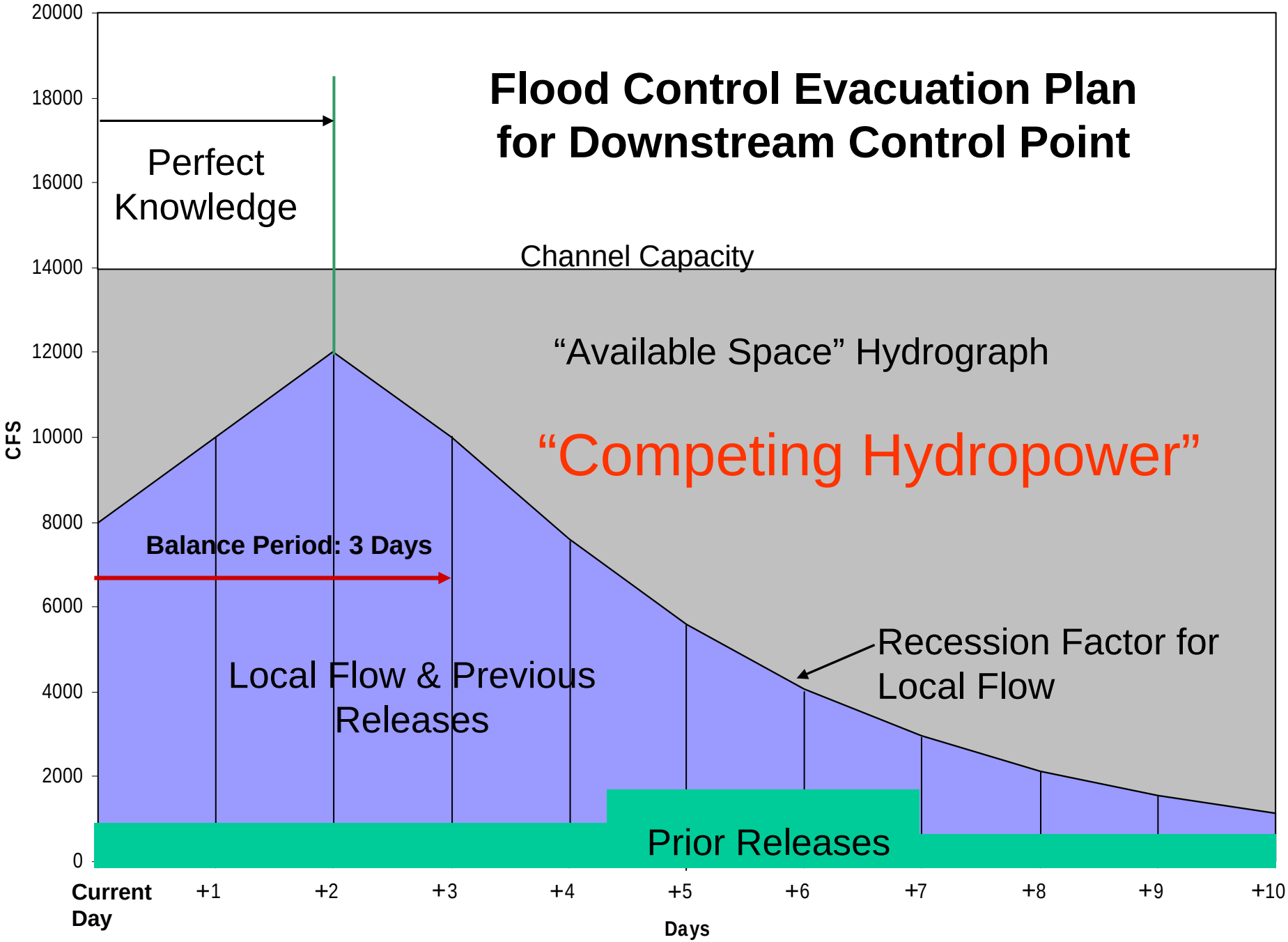

SUPER_INPUT_SAMPLE .txt - Notepad
File Edit Format View Help
41 1 7 .8700 1.000 0 999999 0
0 10800 20000 39000 63000 121000 210000
490.00 493.80 496.50 500.00 504.00
32 34 50 55 87
0 18000 44000 50000 50000
41 2 8 .8600 1.000 0
0 1000 3000 5000 7500
927.00 929.80 931.60 932.00 933.00
56.00 57.50 70.50 73.50 80.50
0 21200 28800 30200 33400
41 3 8 .8600 1.000 0
0 12000 25000 55000 90000
638.50 643.50 646.40 650.70 655.40
60.00 70.00 108.00 120.00
60200 70000 70000 70000
41 4 7 .8600 1.000 0
0 3400 5000 8000 12000
482.10 486.70 487.80
37.00 95.00 106.00
0 22000 29200
41 5 7 .8600
0 12400 20000
487.50 491.00 493.00
69.00 98.00 108.00
64100 103500 103500
41 6 8 .8600 1.000
11500 11501 19500 27000
624.00 624.00 626.00 627.00
105.00 122.50 150.00 300.00
77800 99400 99400 99400
41 7 8 .8600 1.000 0
0 7350 12400 19000 26700
554.00 564.00 566.00 568.00 570.00
0.00 25.00 33.00 44.00 300.00
0 35000 68000 115000 115000
51 31 32 33 10 13
39 20 21 44 22
52 1 1 3 1 1
1 1 1 2 1
53 1 3.0 3.0 3.0 3.0
3.0 3.0 3.0
53 2 5.0 5.0 5.0 5.0
5.0 5.0 5.0
Batch Process
RiverWare 4.7 - ARKCOE3_HP.MDL
File Control Workspace Policy DMI Accounting Utilities Help
Elk City Data
Elk City
Elk City Outflow
ty_Independenc
Verdigris_Elk River
Big H
Big Hill D
Big Hill Outflow
Independence
Big Hill_Lenapah
Independence_Lenapah
Hulah
Copa
Copan Data
Copan Outflow
n Outflow
Verdigris_Big Hill
Bartlesville
Copan_Bartlesville
Lenapah
Altoona
Americus
Arkansas
Augusta
Avant
Bartlesvil
Big Hill
Birch
Bird_Can
Bird_Hon
Candy
Hulah
Riverware

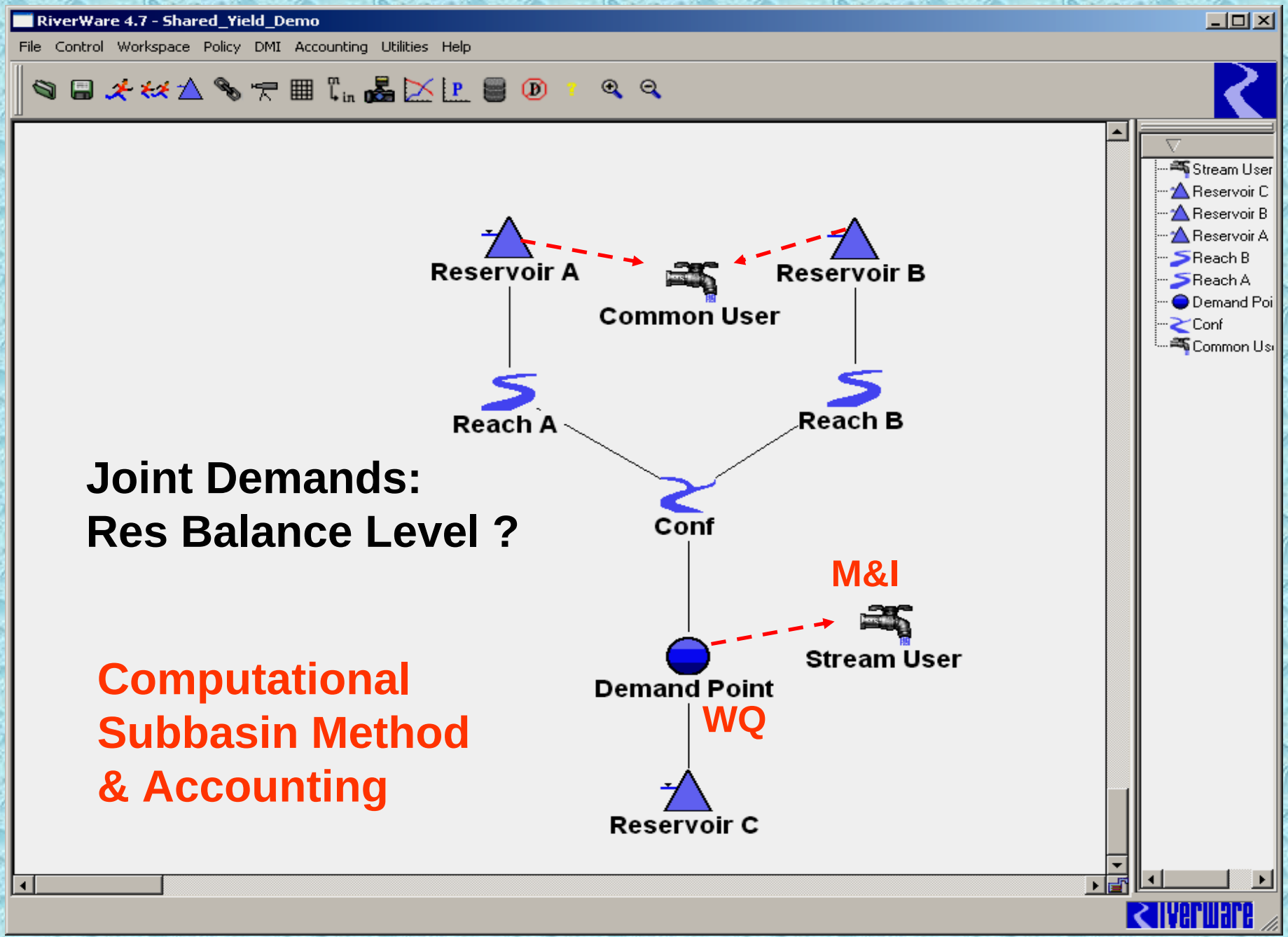
Other CADSWES Effort for 2005:

- Imbedded DSS DMI GUI
- High Level Design of RiverWare CWMS Integration
- Reservoir Releases for Common DS Demands: Design Only

CADSWES Effort for SWD COE:

2006 ?


Flood Control Evacuation Plan
for Downstream Control Point
Perfect
Knowledge
Channel Capacity
"Available Space" Hydrograph
"Competing Hydropower"
Balance Period: 3 Days
Local Flow & Previous
Releases
Recession Factor for
Local Flow
Prior Releases
CFS
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Current
Day
+1
+2
+3
+4
+5
+6
+7
+8
+9
+10
Days


RiverWare 4.7 - Shared_Yield_Demo
File Control Workspace Policy DMI Accounting Utilities Help
Reservoir A
Reservoir B
Common User
Reach A
Reach B
Conf
Demand Point
Reservoir C
Stream User
M&I
WQ
Joint Demands:
Res Balance Level ?
Computational
Subbasin Method
& Accounting
Stream User
Reservoir C
Reservoir B
Reservoir A
Reach B
Reach A
Demand Poi
Conf
Common Us
RiverWare

Additional Statistics:

- Probability Scale
- Partial Duration
- Sorting by Month, etc
- Expand Output Format
- Snapshots for Comparing Runs

Enhanced Routing:

- Alternative Routing Coefficients for Large Flows
- Effects Flood Control Iteration Over Forecast Period
- This Year: Design only

Other CADSWES 2006 Efforts:

- Completion of Imbedded DSS DMI
- Additional Improvements with Runtime Performance
- RiverWare & COE-CWMS Integration

SUPER to RiverWare Transition:

Tulsa District COE: Arkansas River
Red River
North Canadian River
Wichita River

Ft Worth District COE: Trinity River
Brazos River
Other?

Little Rock District COE: White River

Upcoming COE App's with RiverWare:

- Tulsa's TAPER Program
- Bartlesville, OK M&I Study ?
- Red River Basin Master Manual Update
- Little Rock & Ft Worth Districts?

End Reliance on SUPER: Fall 2006!

QUESTIONS?