

# Support for Advancing SRP Work



**US Army Corps  
of Engineers**

**John Hickey and Chris Dunn  
Water Resource Systems Division  
IWR-HEC**

# HEC's Involvement in SRP

- Training Courses
- Interagency Personnel Agreement
- Modeling Tools and Support
- New Modeling Capabilities
- New Software Tools
- Corps' Research Programs?

# Corps/TNC Training Courses at HEC

## ***Water and the Watershed***

*...understanding of the physical nature of water in the watershed and the conceptual, technical, and institutional tools available for planning and management.*

## ***Hydrologic Analysis for Ecosystem Restoration***

*...understanding of the issues, policies, and analytical methods in restoration studies and insights into the applicability of a range of tools for the various hydrologic analyses necessary in restoration planning and design.*

# Interagency Personnel Agreement between HEC and TNC



# Interagency Personnel Agreement

- Started February 9<sup>th</sup>, 2004

*Through this IPA, John Hickey is to become an ambassador for the Sustainable Rivers Project. Work with the Corps and TNC to advance and increase the visibility of the SRP.*

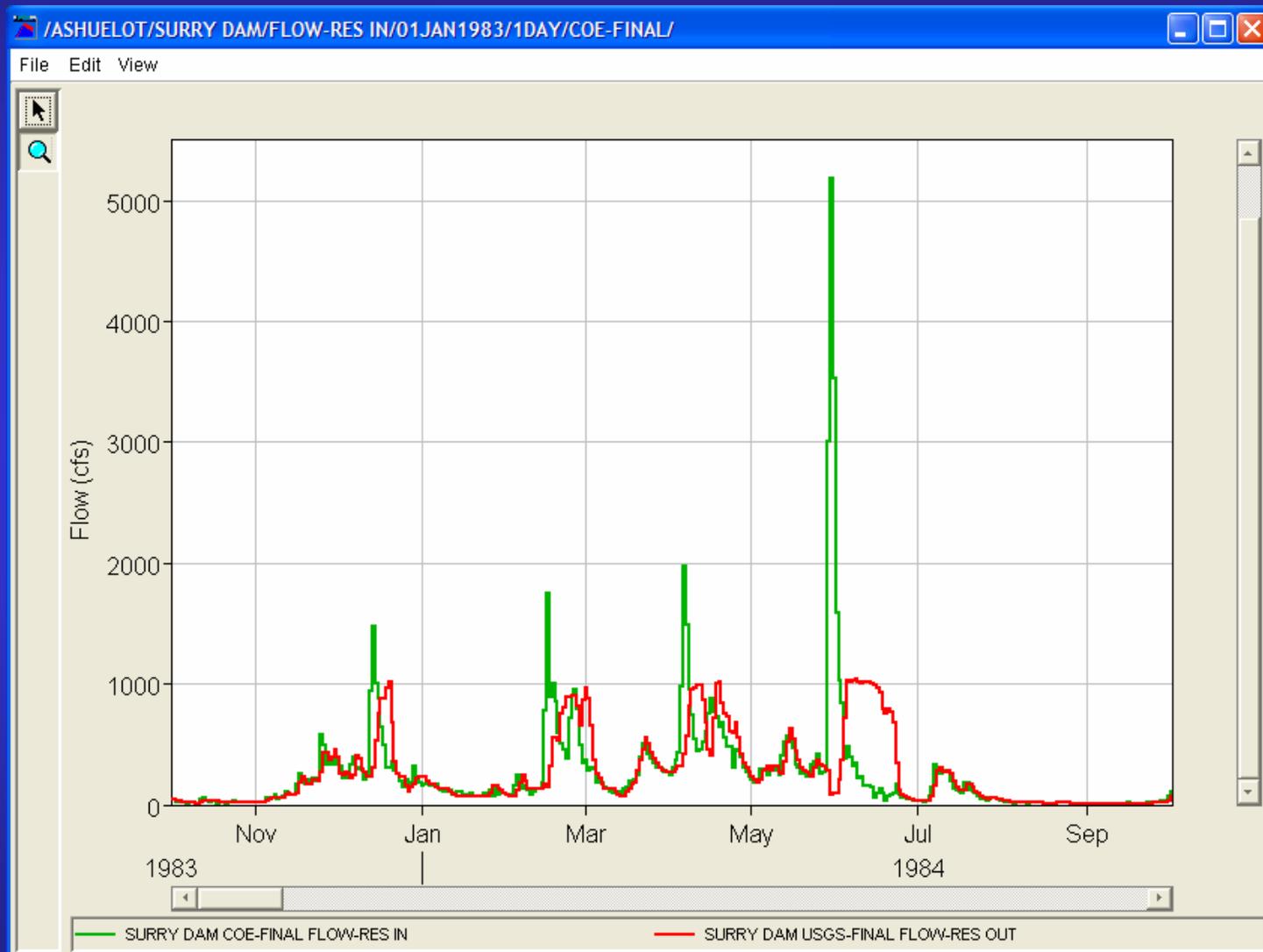
- Enhanced understanding of the SRP within the Corps
  - Direct technical support to SRP sites
  - Improved Corps and TNC software
  - Improved training through HEC related to eco-restoration
  - Expanded communications and technology transfer
  - Promotion of Corps and TNC resources and capabilities
- 
- 1-yr agreement. Savannah, New England...

# West and Ashuelot Rivers

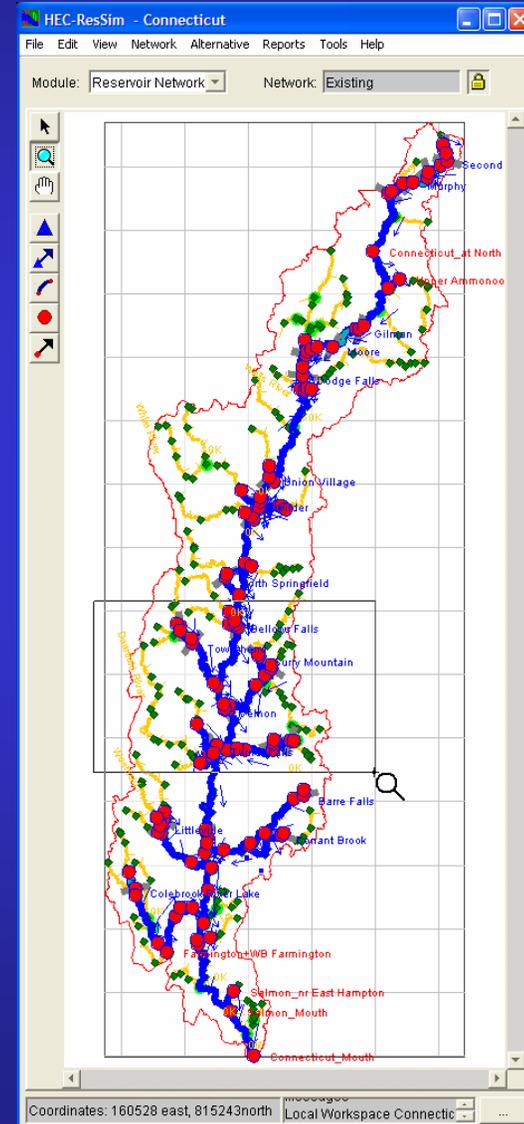
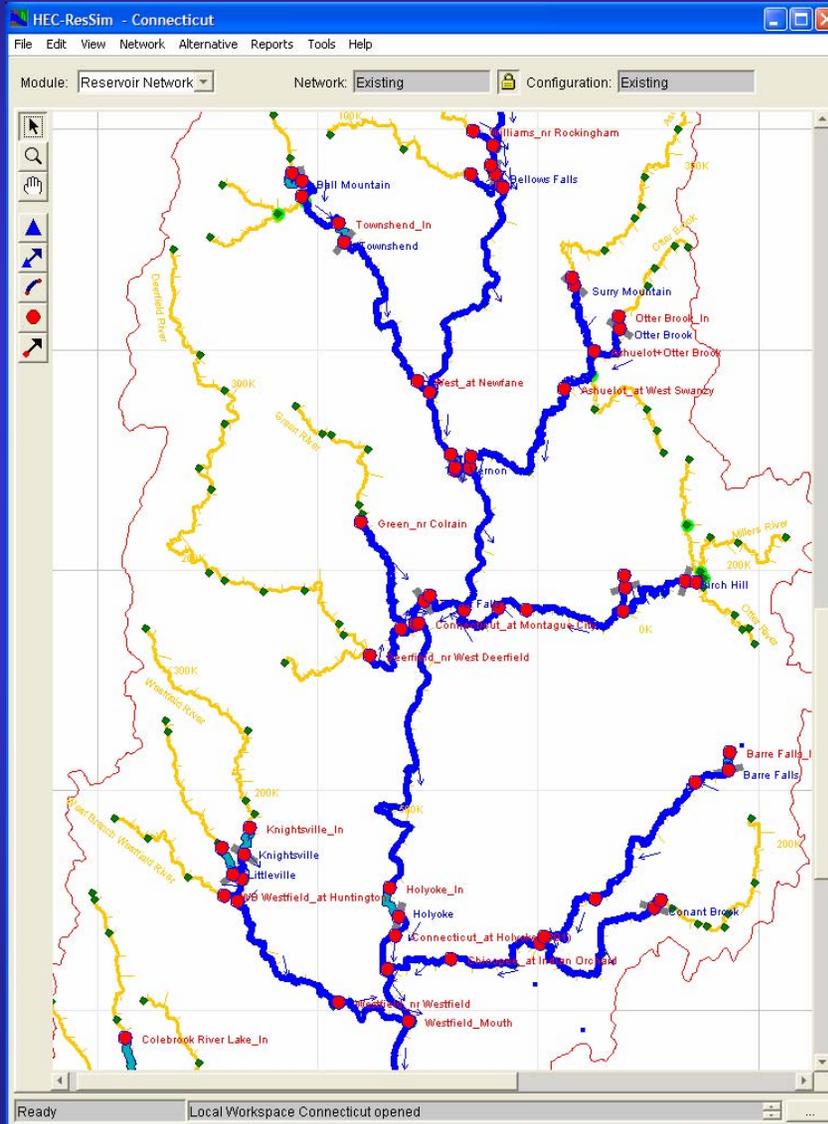
- Surry and Otter Brook Reservoirs on the Ashuelot
- Ball Mountain and Townshend on the West
- Issues
  - Hydrology
  - Endangered Species
  - Fish Passage
  - Water Quality/Temperature
- Dwarf Wedge Mussel populations below Surry Dam



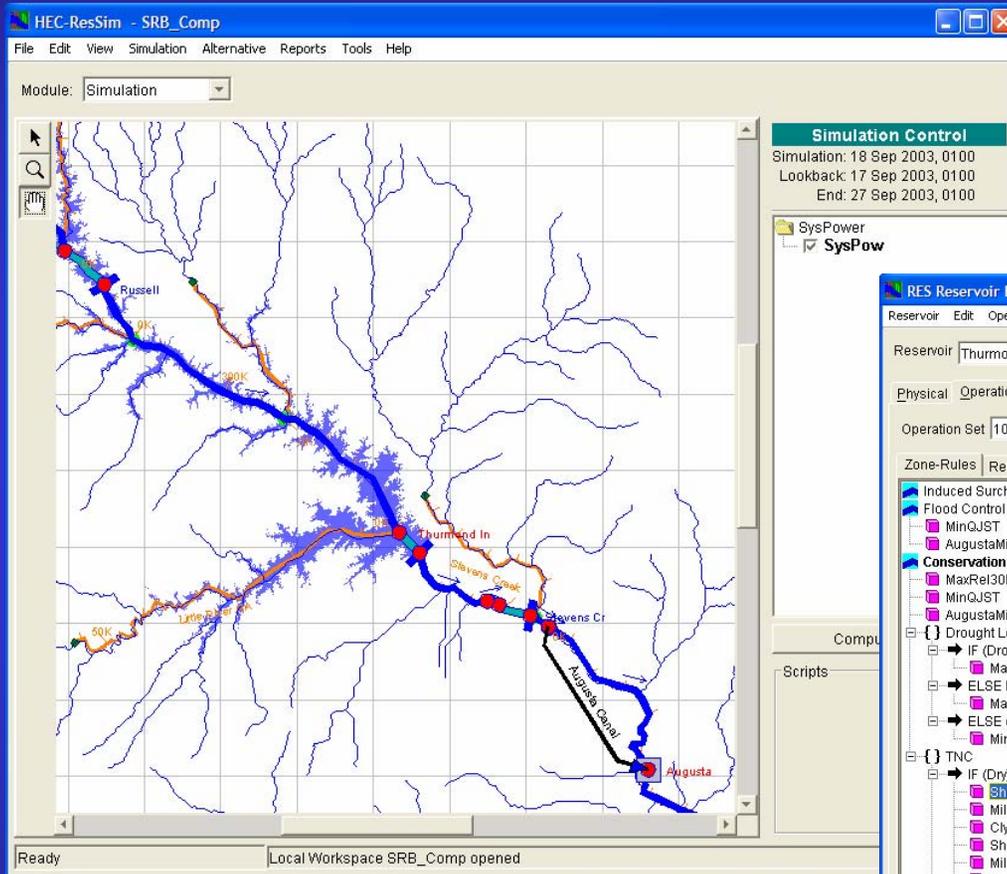
# Ashuelot River Flows at Surry Dam



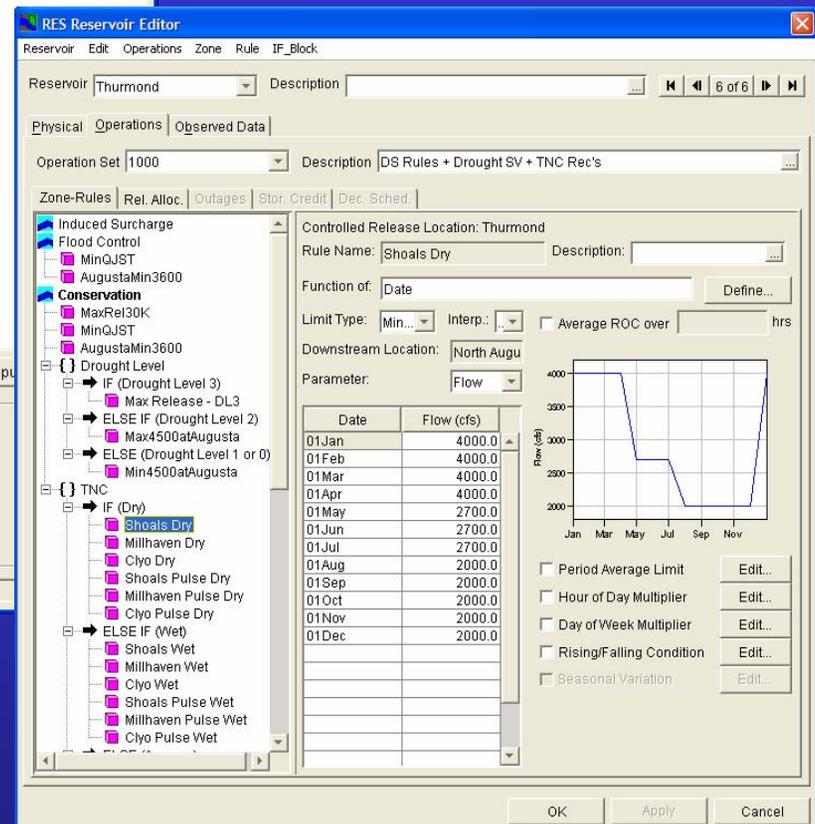
# West and Ashuelot Rivers - ResSim



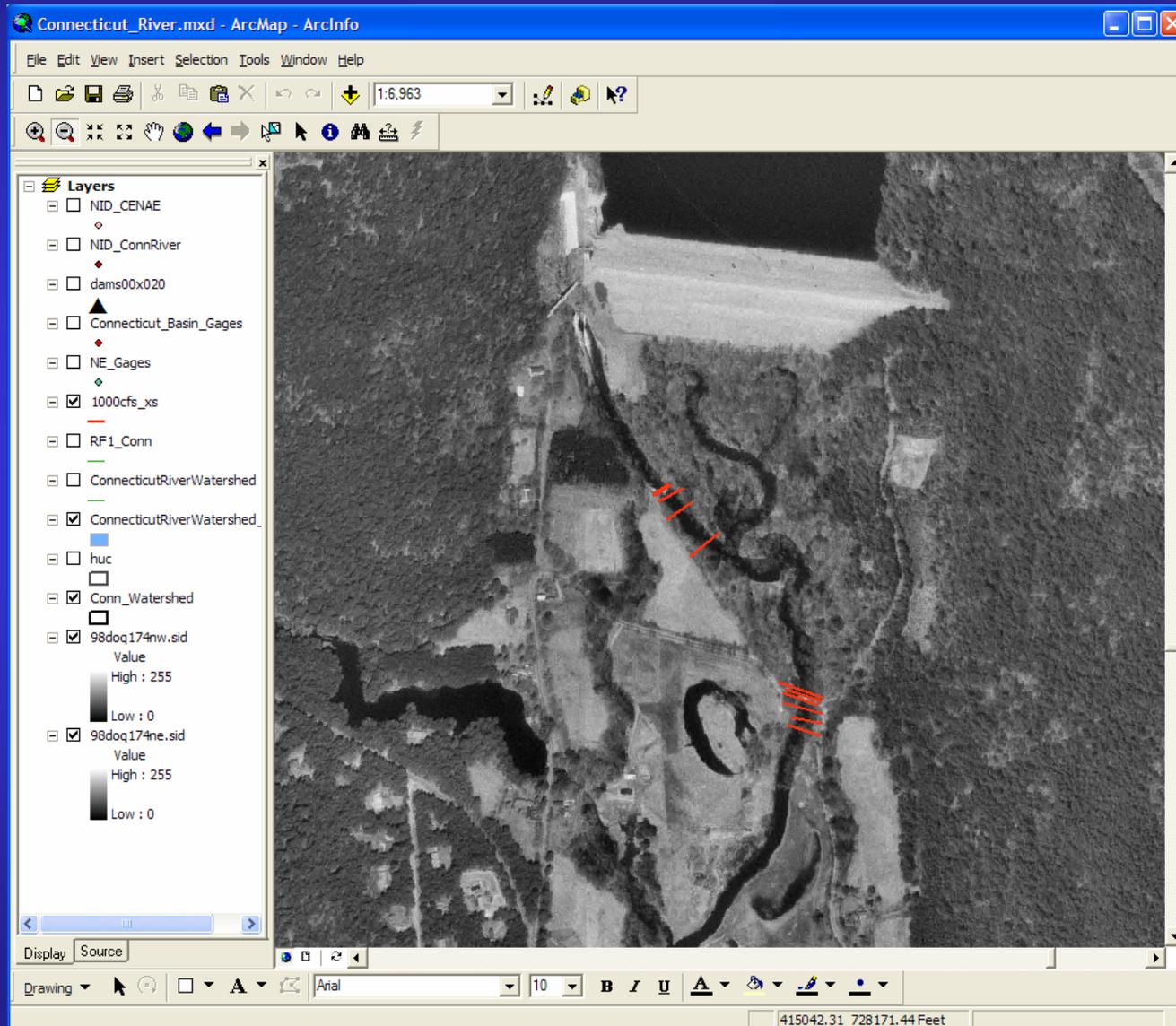
# More on HEC-ResSim...



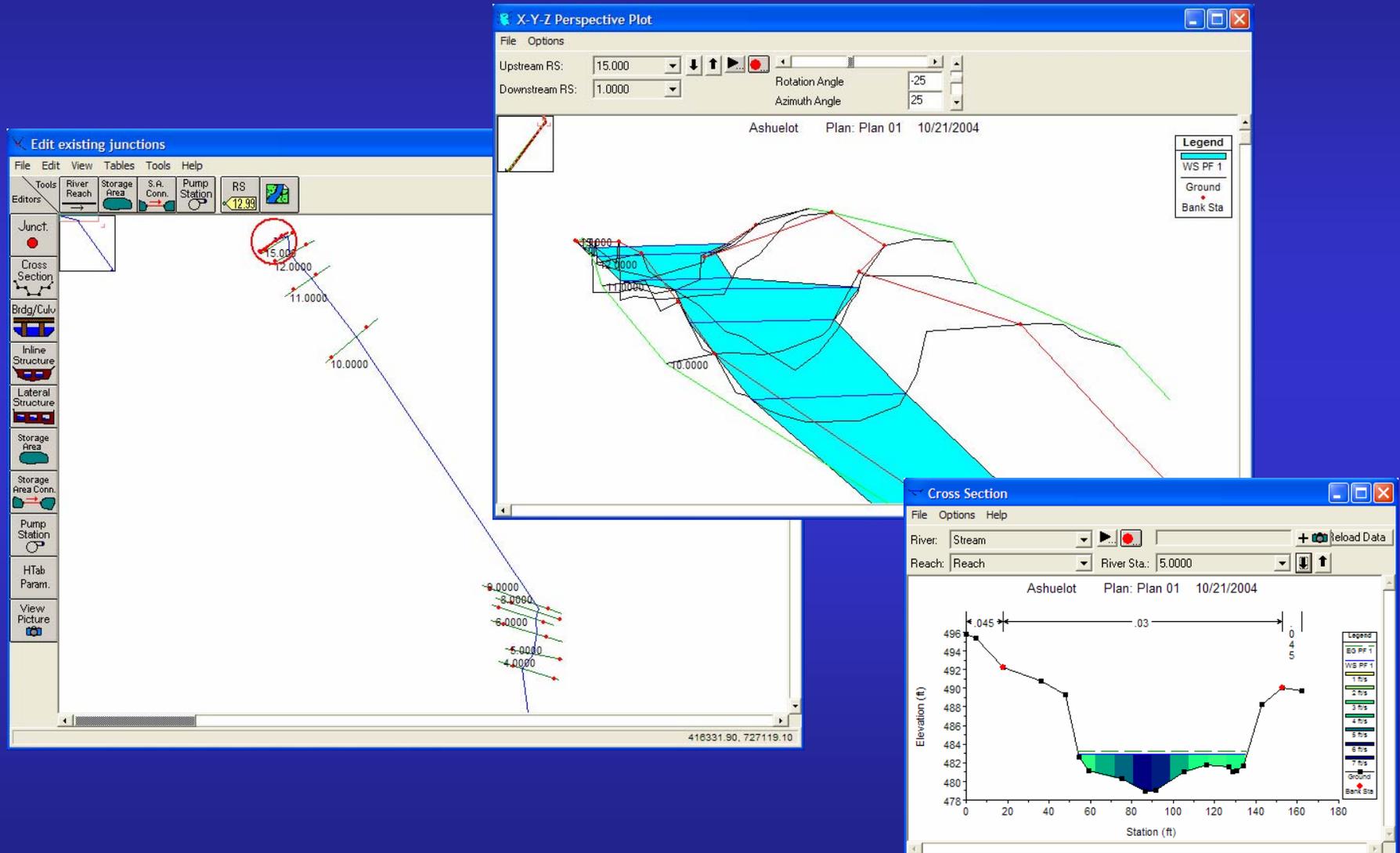
ResSim – Reservoir modeling to analyze water management alternatives



# Ashuelot Monitoring Efforts



# HEC-RAS – River Hydraulics



# HEC-EFM – Ecosystem Model

Ashuelot\_DWM.efm - HEC-EFM

File Edit Help

Model information

Title: Ashuelot River Basin Application

Author: COE/TNC

Description: EFM application for the Ashuelot with a focus on Surry and Otter Brook Reservoirs. Relationships developed in support of ongoing Dwarf Wedge

File locations

EFM model pathname: C:\Hickey\Sustainable R

Working folder: C:\Hickey\Sustainable R

Time series record files

Ref	Active	Identifier	Filename
1	<input checked="" type="checkbox"/>	Surry Inflow	Ashuelot_Natu...
2	<input checked="" type="checkbox"/>	Surry Outflc	Ashuelot_Natu...
3	<input type="checkbox"/>	Otter Inflow	Ashuelot_Natu...
4	<input type="checkbox"/>	Otter Outflc	Ashuelot_Natu...
5	<input type="checkbox"/>	Hinsdale Na	Ashuelot_Natu...
6	<input type="checkbox"/>	Hinsdale Ga	Ashuelot_Natu...

Properties Relationships Tables

Completed

Ashuelot\_DWM.efm - HEC-EFM

File Edit Help

Relationship name: DWM Spawning

Description: Spawning occurs in August. Glochidia are held overwinter and released in the Spring. Page 25, Biological Assessment DWM, USACE, 2002.

Options

Write computation arrays

Hypothesis tracking - increased flow will

+  -  Curve eco-health

Confidence tracking: ☆☆☆☆☆

Index  A  B  C  D  E

Statistical queries

Season

From: 08/01 (m/d)

To: 08/02 (m/d)

Duration of 30 days

Sustained high  Average high

Sustained low  Average low

Rate of change:  Stage  Flow

feet per  days

Rising  Falling  Absolute

Time series specifications

50 % exceedance (2.00-yr)

Flow frequency  Flow duration

to  Water year range

Individual water year

Relationship-defined water year

Geographical queries

Velocity

From  to  ft/sec

Map layers

HEC-RAS and GeoRAS information:

Inundated area shapefile:

Ashuelot\_DWM.efm - HEC-EFM

File Edit Help

Evaluated at: 11/14/2004 20:54

**Summary**

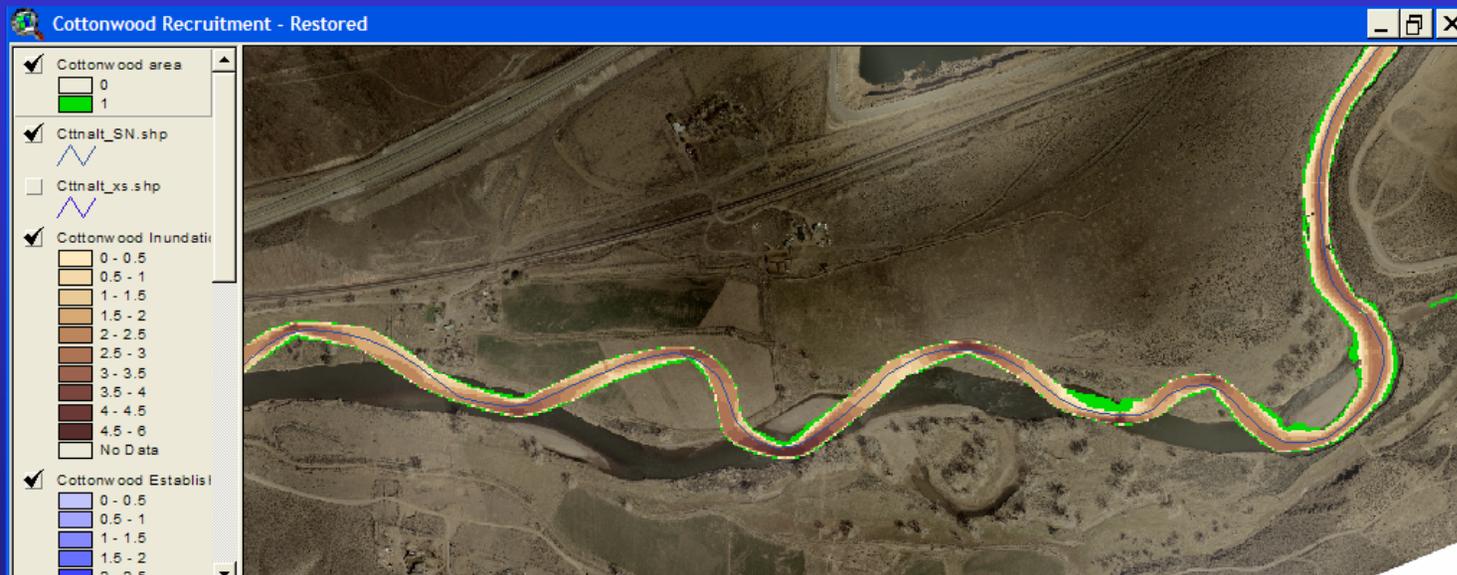
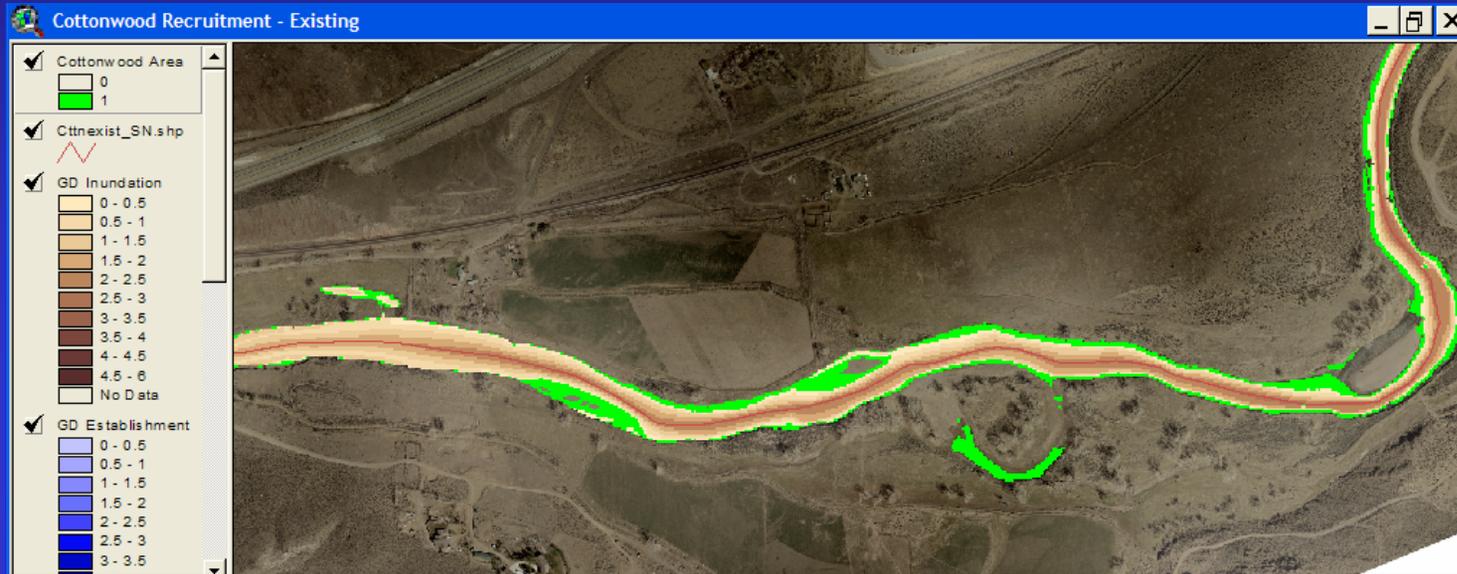
Relationship	Conf.	Surry Inflow		Chg.	Surry Outflow	
		Stage, ft	Flow, cfs		Stage, ft	Flow, cfs
DWM Spawning	n/a	4.8	28	n/a	4.8	26
DWM Glochidia Release (low flow query)	n/a	5.0	36	n/a	5.0	38
DWM Glochidia Release (high flow query)	n/a	8.5	1,036	n/a	8.1	868

Properties Relationships Tables

Completed

Recalc

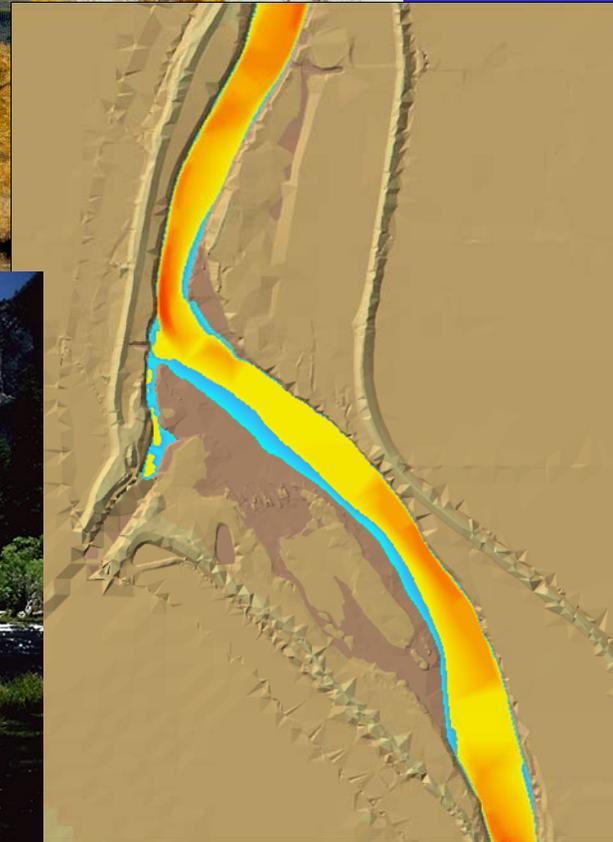
# EFM and RAS – McCarran Ranch



# Things to Consider in Modeling

- Triggers for Water Management
  - Thermal stratification/destratification
  - Fish surveys
- Outlet Retrofitting
- Eco-concerns Spanning Multiple Years
- Creation and Assessment of Ecosystem Flow Recommendations

# Emerging Research



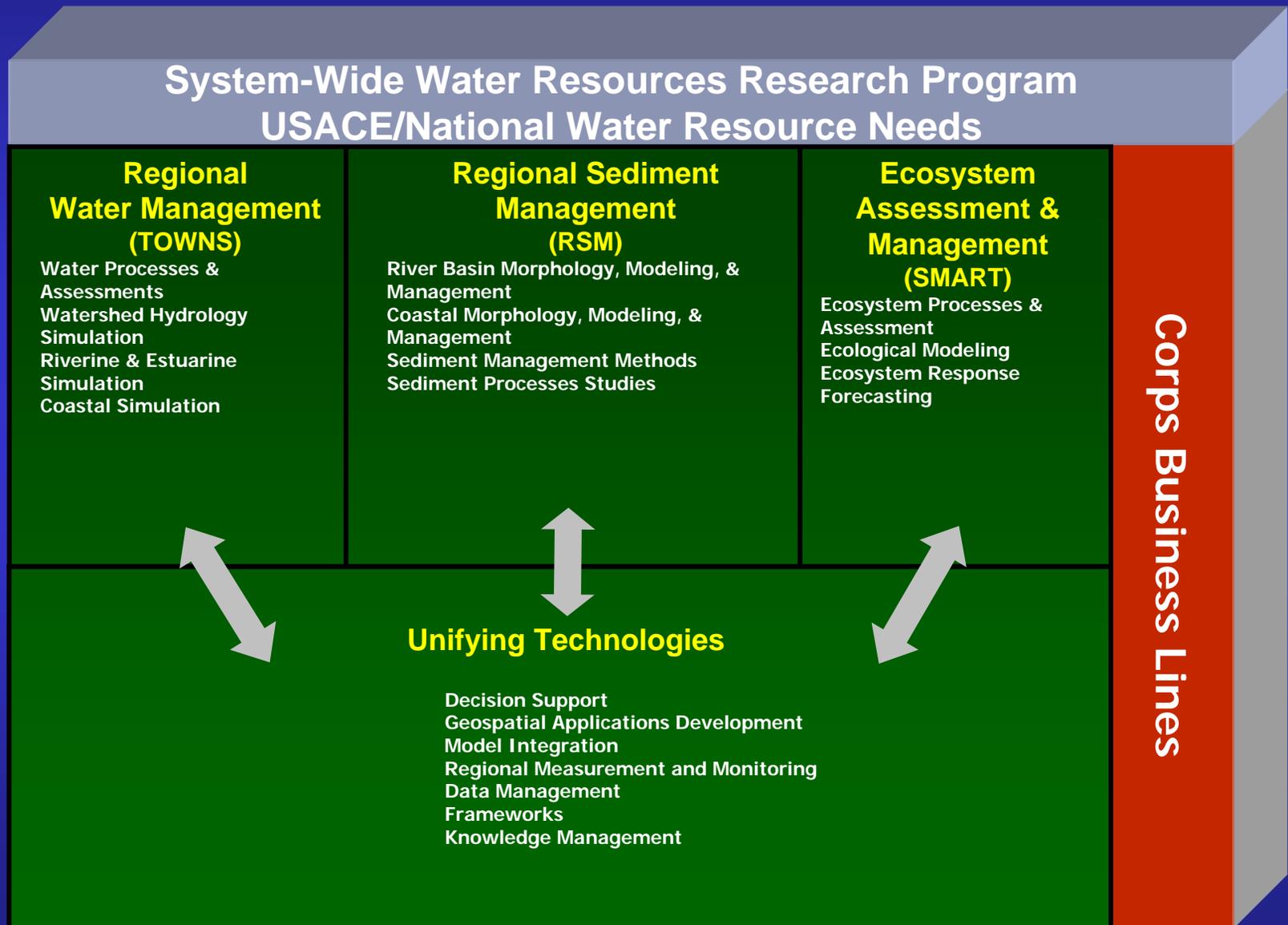
# Where were we?

- SMART - System-wide Modeling, Assessment, and Restoration Technologies Program
- RSM – Regional Sediment Management
- TOWNS - Technologies and Operational Innovations for Urban Watershed Networks
- Environmental – Including the EMRRP - Ecosystem Management & Restoration Research Program
- Flood and Coastal
- Navigation
- Geospatial

# Where are we?

- Navigation
- Environmental
- Flood and Coastal
- System-Wide Water Resources Program

# Where are we?



# Water Quality Enhancements

## HEC-HMS

(software that uses advanced methodologies and numerical models for simulation of complex hydrologic processes)

### Objectives:

- Sediment Washoff (lumped subarea washoff)
- Sediment Washoff (gridded washoff)
- Water quality simulation
  - Surface Washoff
  - Total Nitrogen
  - Total Phosphorous
  - Fecal Coliform

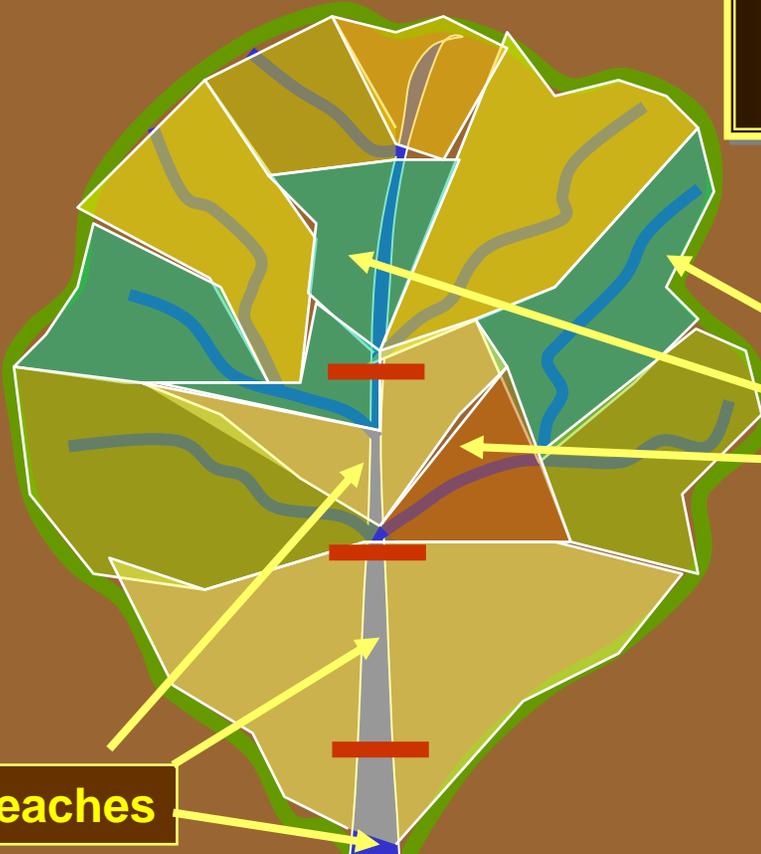
# Sediment Transport for River Analysis

## HEC-RAS

(software that uses a set of algorithms and guidance to analyze steady and unsteady flow and sediment transport)

- Through RSM
- This work will produce a new analysis algorithm for 1D sediment transport (movable bed calculations through scour and deposition).
- This algorithm will be included in HEC-RAS in order to provide a uniform set of tools within a single river analysis environment.

# Sediment Impact Assessment Model



Sub basins

Being tested on multiple watersheds

River Reaches

**Goal: Balance sediment system when sub-basin loadings change & predict resulting instabilities in downstream channel reaches.**

# Temperature & WQ

## HEC-RAS

- Purpose: To add water temperature modeling to the HEC-RAS program
- Future Objective: To begin the process of adding water quality constituents to the HEC-RAS analysis process by incorporating the water quality computations of QUAL-RIV1 into HEC-RAS
  - Temperature
  - CBOD
  - ORG-N, NH3-N, NO3-N
  - ORG-P, ORTHO-P
  - Dissolved MN
  - Dissolved FE
  - DO
  - Coliform
  - Algae

# Ecosystem Restoration Planning

## HEC-EFM

(developed to perform system-wide ecosystem restoration planning)

SWWRP Pillar: Ecosystem Assessment & Management

Focus Area: Ecosystem Response and Forecasting

Focus Area Goal: To develop innovative approaches for watershed assessments that can be implemented in the field and used for management decisions

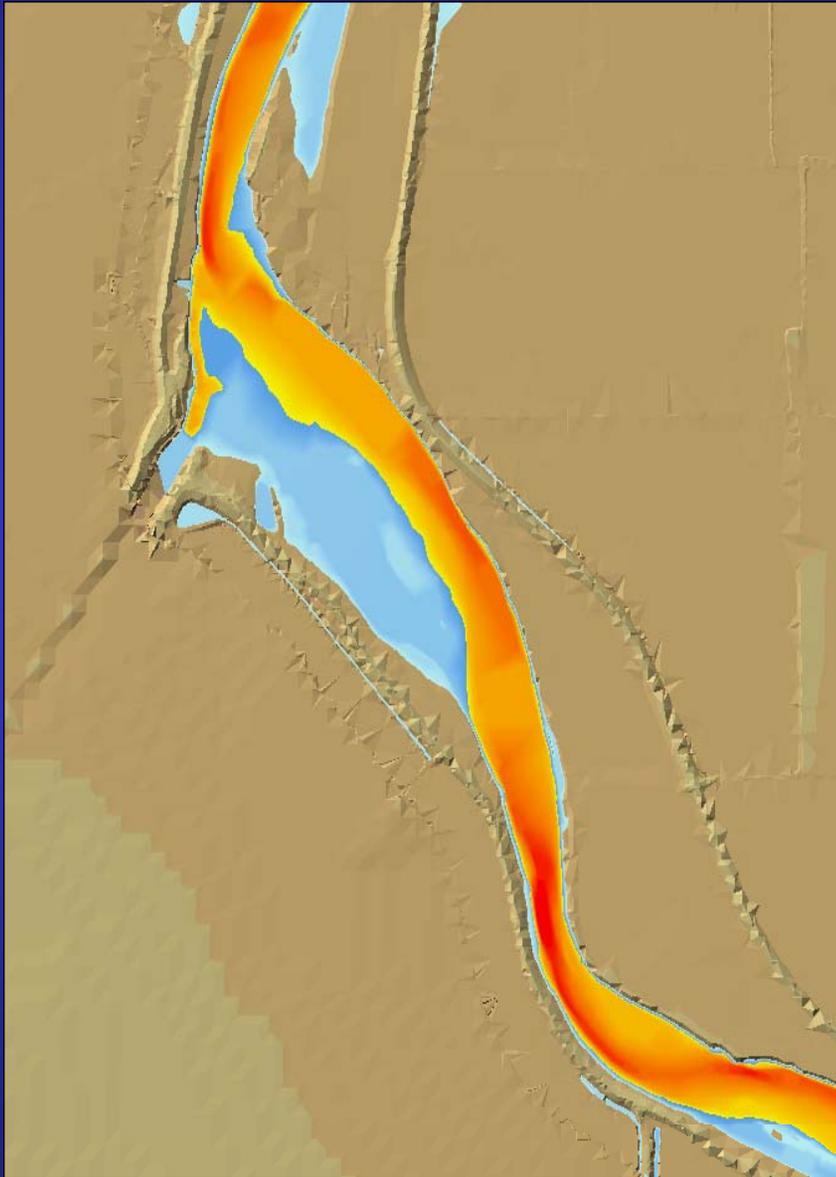
HEC Contributions:

Application last year – Truckee River, McCarran Ranch Reach

Application this year – Mill Creek, TN

# System-Wide Integration

## Ecosystem Assessment & Management Pillar



### EFM Development

#### Landscape and Habitat Assessment Focus Area

- ✓ revise User's Manual
- ✓ improve indicator approach
- ✓ enhance GIS coordination
- ✓ Coordinate with ERDC's models
- ✓ Initiate P-O-R approach

# Reservoir Water Quality Enhancements

## HEC-ResSim & CE-QUAL-W2

- ResSim a multi-objective reservoir simulation tool used for real-time operations & planning studies
- CE-QUAL-W2 a reservoir tool used for water quality and temperature studies
- Demand for water quality and temperature modeling for real-time and planning analyses
- Effort being considered in the Ecosystem Assessment & Management Pillar
- Looking to link both models rather than fund a major development effort
- Will provide in and downstream of the reservoir
  - Temperatures
  - Dissolved Oxygen
  - Other conservative constituents
  - Variable gate settings

# Flow Prescription Tool

## Reservoir Operations – Pulsinator

(software to improve interaction while defining ecosystem flow regimes)

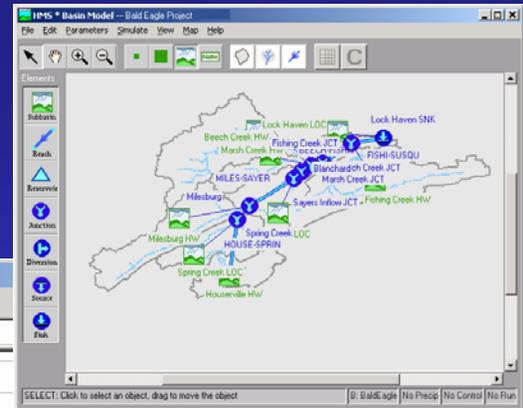
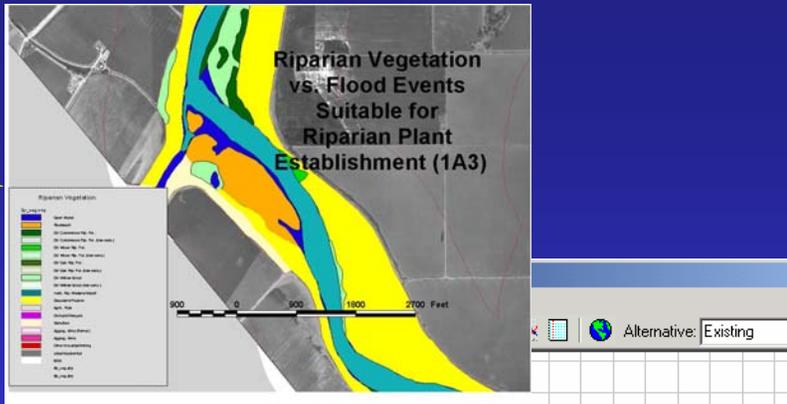
- Need identified as a direct result of the Corps and TNC's partnership on the Sustainable Rivers Project – Savannah River Comprehensive Study
- First piece of software jointly developed and financed through the SRP
- Will allow parties to:
  - Define wet, dry, or average flow years
  - script flow regimes to include flood, pulse, and base flows
  - Use with the EFM and ResSim to help make planning and operational decisions
  - Eventually could be used within ResSIM to make real-time operational decisions

# Integration of HEC Software for Watershed Studies

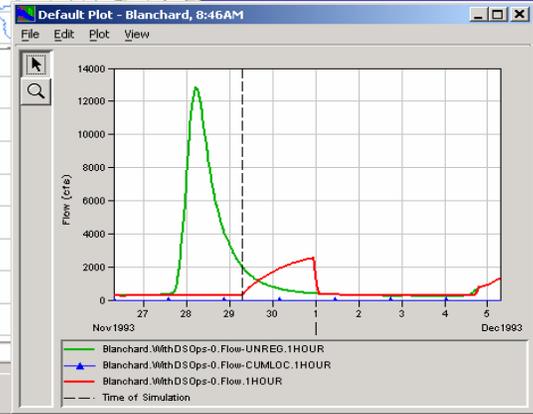
## Watershed Analysis Tool - WAT

- Help districts perform watershed/system-wide studies
- By developing the capabilities needed to integrate the tools that are used by the districts during the analytical process
- It will improve coordination and communication across Project Delivery Teams
- Share data across models
- Involve modelers early in the study process
- Encourage a team approach

# Environmental



# Hydrology



# Reservoir

Damage by Analysis Year

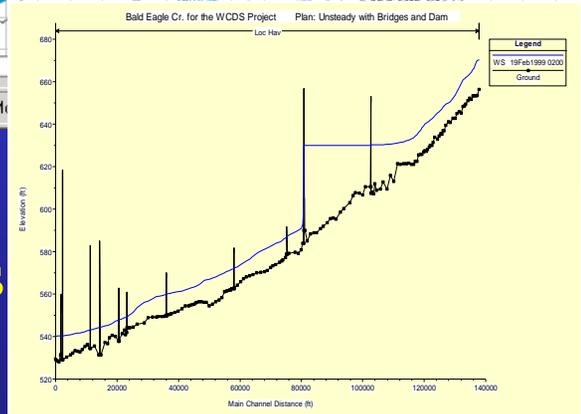
Modesto  
Expected Annual Damage Reduced and Distributed  
for the Levee R2-3 200Yr  
and for Analysis Year 2000  
(Damage in \$)  
Plan was calculated with Uncertainty

Stream Name	Stream Description	Damag. Name	Damage R. Description	Expected Annual Damage			Probability Damage Reduced Exceedance Indicated Value		
				Total Without Project	Total With Project	Damage Reduced	75	50	25
Tuolumne	Stream 5 description	+T1R		268.11	268.11	0.00	0.00	0.00	0.00
		+T1L		4053.86	4053.86	0.00	0.00	0.00	0.00
		+T2R		153.16	122.31	30.84	23.18	41.17	32.21
		+T2L		277.87	155.34	122.63	169.37	137.63	128.89
		+T3R		127.87	118.59	9.27	3.69	13.30	11.27
		+T3L		1345.00	141.63	1203.45	1175.49	1230.87	1232.61
		+T4R		6.04	6.04	0.00	0.00	0.00	0.00
		+T4L		62.25	62.25	0.00	0.00	0.00	0.00
Total for stream Tuom.				42794.14	48927.94	1365.20	1311.72	1423.29	1405.99
Dry Creek	Stream 5 description	+DC 1		3460.43	3460.43	0.00	0.00	0.00	0.00
				3460.43	3460.43	0.00	0.00	0.00	0.00

\*\*\*\* - Computations have not been completed.  
- - Something has changed and computations need to be redone.

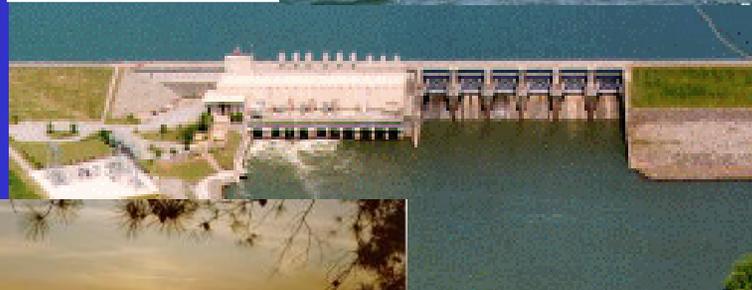
# Flood Damage

# Hydraulics



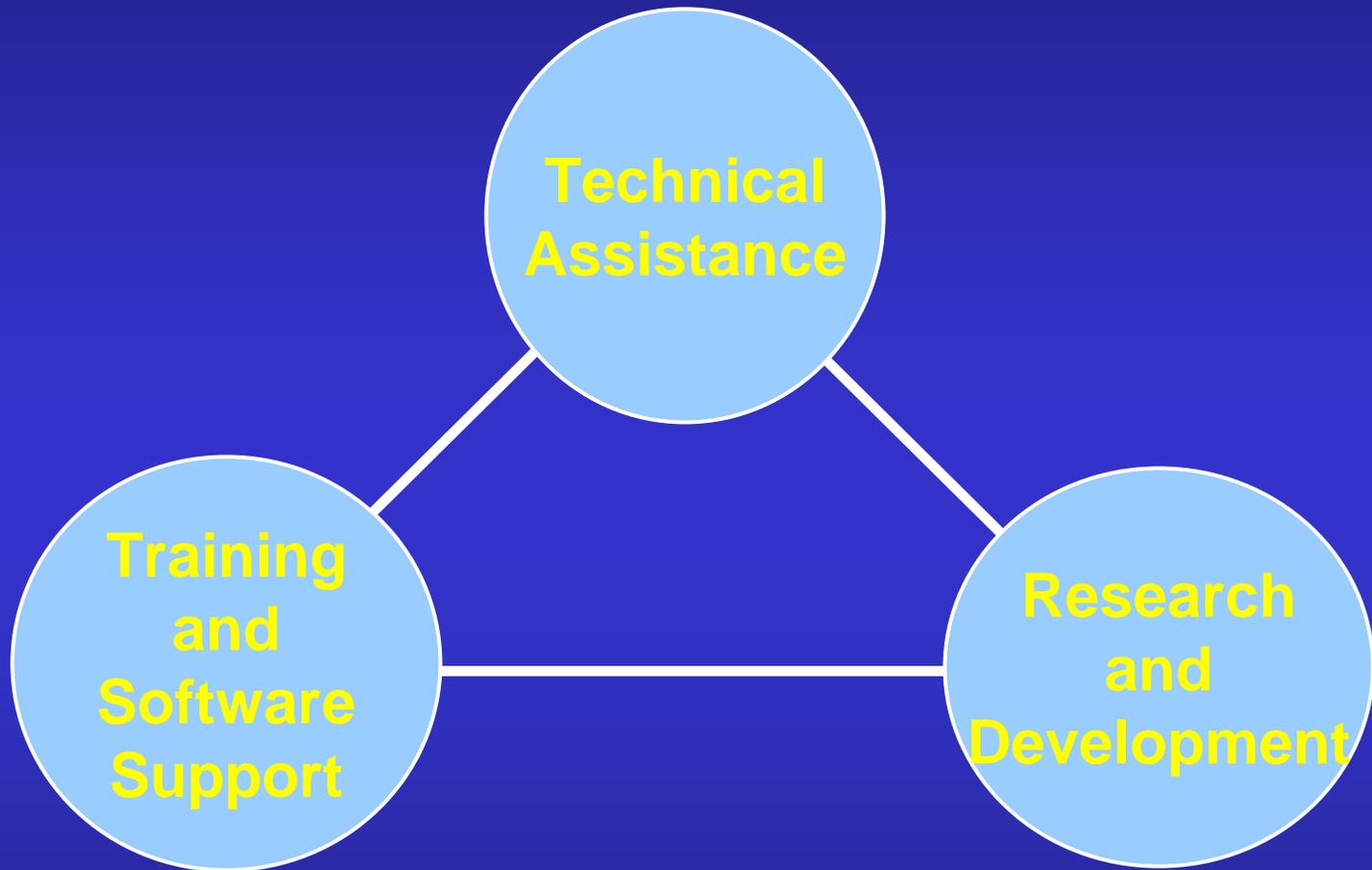
# Water Operations Technical Support Program (WOTS)

Provide rapid direct technical assistance to CE projects in applying technology to solve water quality and other environmental problems  
Assistance is provided at no cost to the user  
Limited to 5 man-days, including travel



Web site – <http://www.wes.army.mil/el/wots/wots.html>

# HEC's Continuing Roles



Center of expertise in hydrologic engineering and planning analysis executing a balanced program of technical assistance, special studies, training and research.