

## HYDROLOGIC AND HYDRAULIC MODELING

**Hydrologic**      Precipitation & Basin Parameters,  
Flood Frequency Analysis

**Hydraulic**      Energy & Momentum Relationships

## HYDROLOGIC MODELING

|                              |              |   |                      |
|------------------------------|--------------|---|----------------------|
| <b>Water Budget Analysis</b> | Droughts     | } | Reservoir Operations |
|                              | Water Supply |   |                      |
|                              | Rule Curve   |   |                      |

|                            |                                                                  |
|----------------------------|------------------------------------------------------------------|
| <b>Hydrologic Routings</b> | Overland Flow<br><i>(Rational Formula: <math>Q = CIA</math>)</i> |
|                            | River Channel<br><i>(Muskingum, Straddle Stagger, etc.)</i>      |

|                          |                                                                          |
|--------------------------|--------------------------------------------------------------------------|
| <b>Flood Frequencies</b> | e.g., 50 & 100 Year Floods<br><i>(log Pearson Type III distribution)</i> |
|--------------------------|--------------------------------------------------------------------------|

# HYDRAULIC MODELING

## Steady State

Step Backwater Computations  
(*FEMA FIRM Flood Studies*)

## Unsteady State

Dam Breach Analyses,  
Detail Flood Studies,  
Dynamic Riverine Conditions

# HYDRAULIC MODELING HISTORY

## Pre 1970

### Paper Spreadsheets

### Physical Models

*Logan Martin at Univ of AL  
Farley Nuclear Plant at Auburn Univ  
US Army Corps of Engineers  
Waterways Experiment Station (WES)  
at Vicksburg, MS*

## Post 1970

### Fortran 66

*US Army Corps of Engineers  
Hydrologic Engineering Center (HEC)  
at Davis, CA*

*HEC-1 (Basin Overland Flow)*

*HEC-2 (Steady State River Routings)*

*HEC-5 (Reservoir Operations)*

*HEC-6 (Sediment Transport)*

**HEC HMS**

**HEC RAS** (*Also Unsteady State*)

**RES SIM**

**NEXGEN**

**EXCEL Spreadsheets**

## HYDRAULIC MODELING HISTORY *(Continued)*

### Post 1977

1976 Teton Dam                      Idaho                      14 Killed



1977 Laurel Run Dam              Pennsylvania              40 Killed



1977 Toccoa Falls Dam            Georgia                    39 Killed



## HYDRAULIC MODELING HISTORY *(Continued)*

### Post 1977

**DAMBRK**

*Dr. Danny Fread  
National Weather Service (NWS)  
Silver Springs, MD*

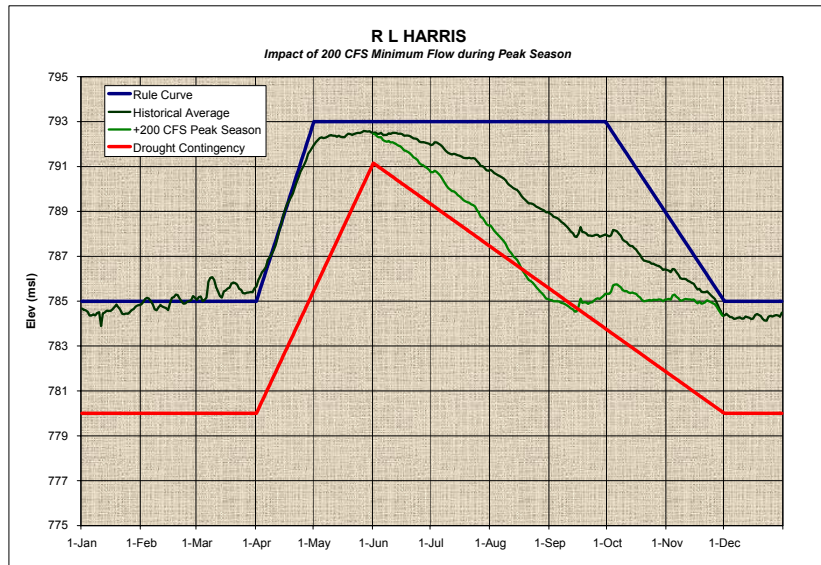
**UNET**

*Dr. Robert Barkau  
at Colorado State*

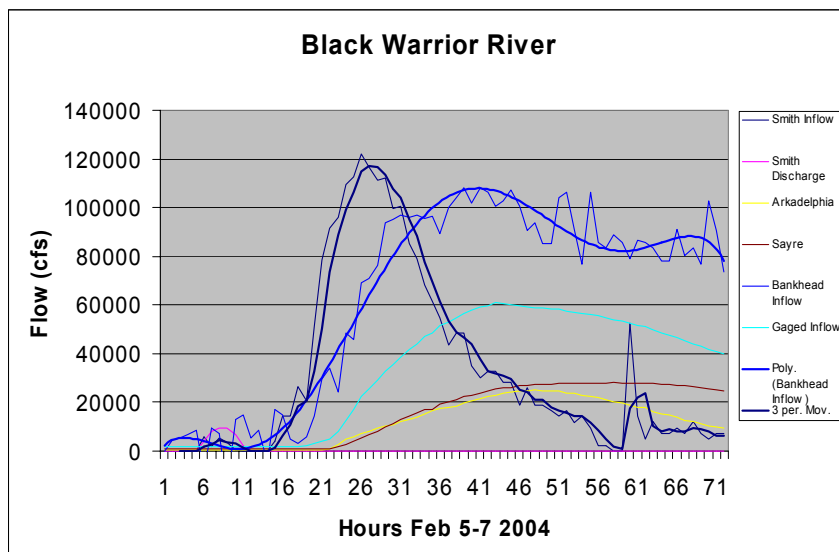
**DWOPER  
BRANCH  
FLDWAV**

**HEC RAS**

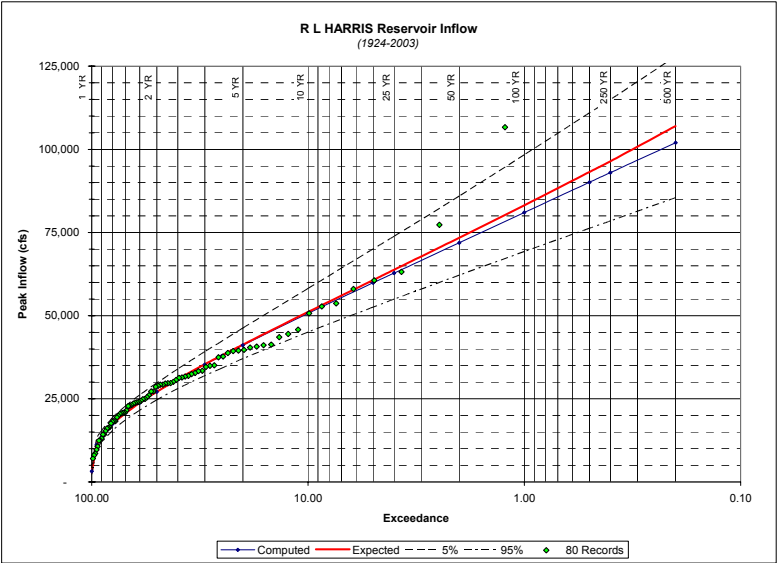
## HYDROLOGIC MODELING EXAMPLE – (Water Budget)



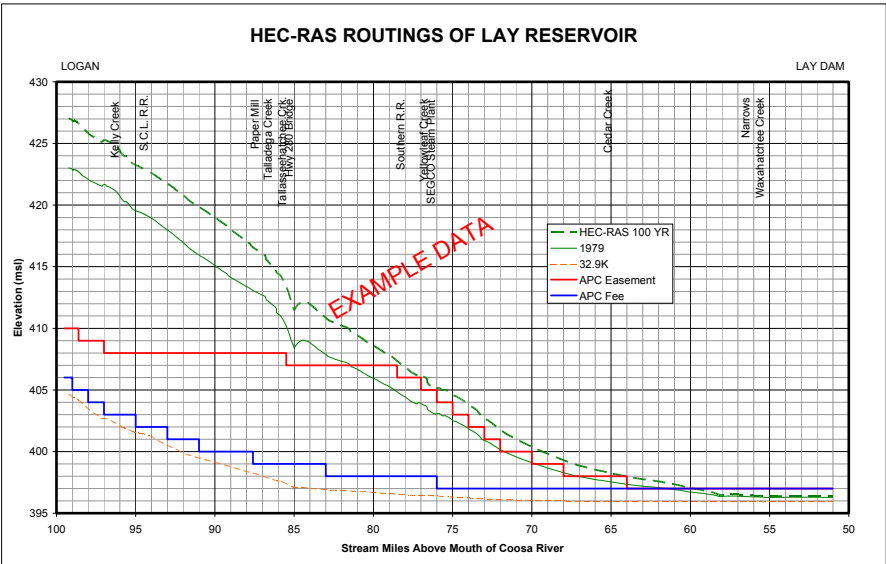
## HYDROLOGIC MODELING EXAMPLE – (Routings)



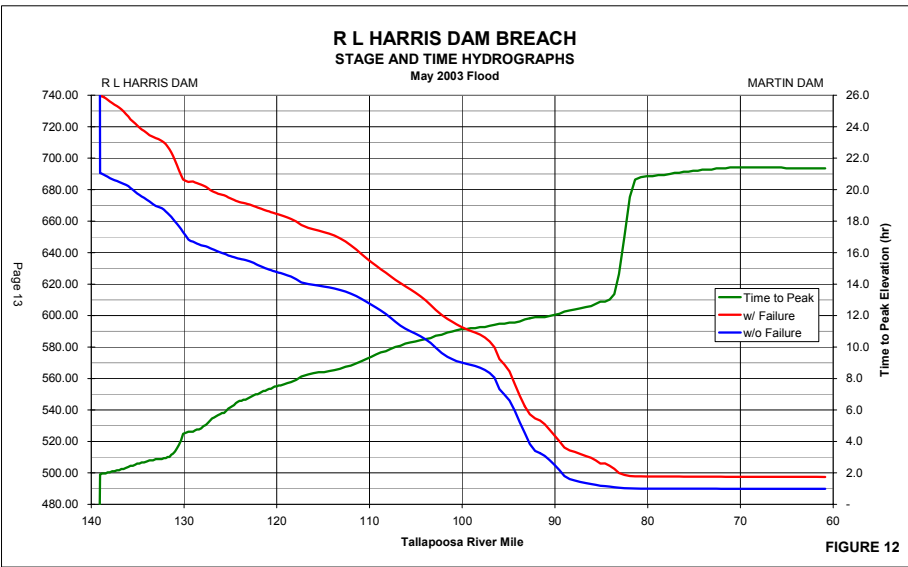
HYDROLOGIC MODELING EXAMPLE – (Flood Frequency Analysis)



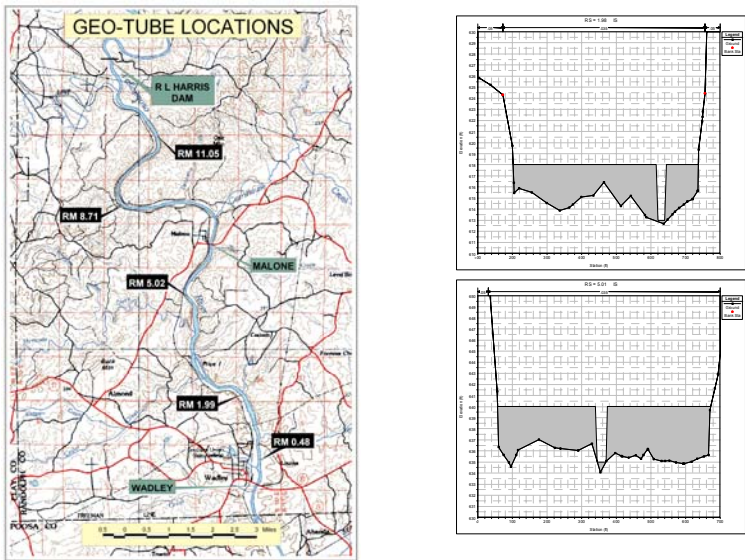
HYDRAULIC MODELING EXAMPLE - (HEC-RAS Steady State)



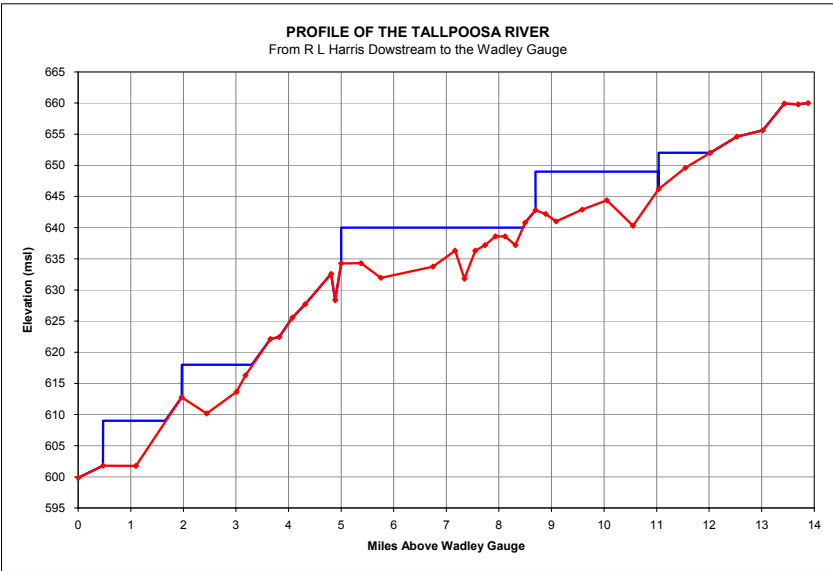
HYDRAULIC MODELING EXAMPLE - (DAMBRK)



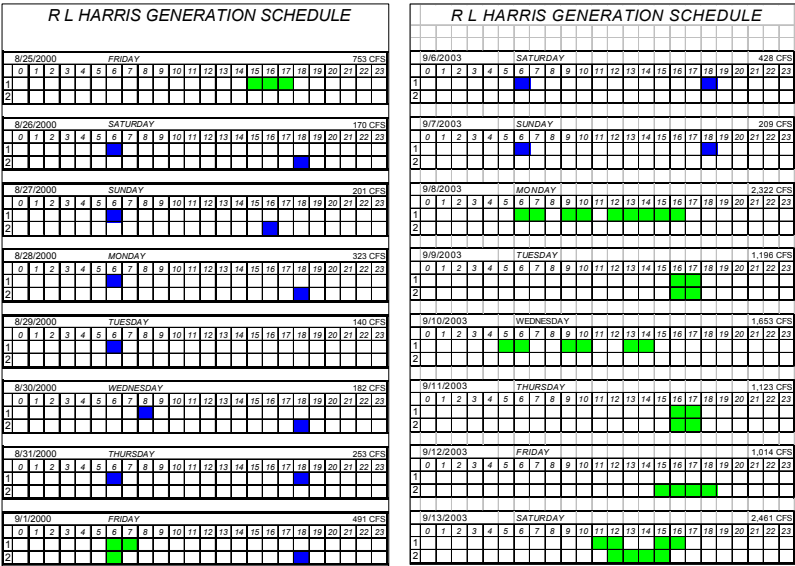
HYDRAULIC MODELING EXAMPLE - (HEC-RAS Unsteady State)



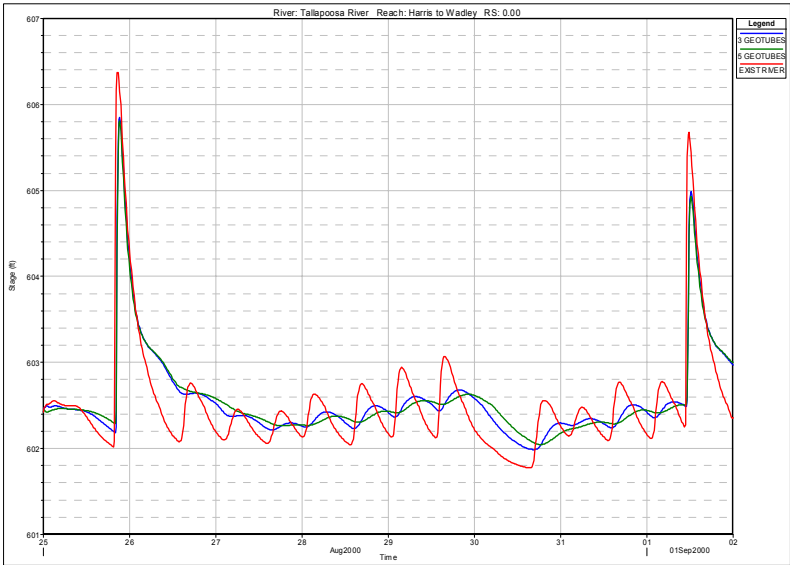
HYDRAULIC MODELING EXAMPLE - (HEC-RAS Unsteady State)



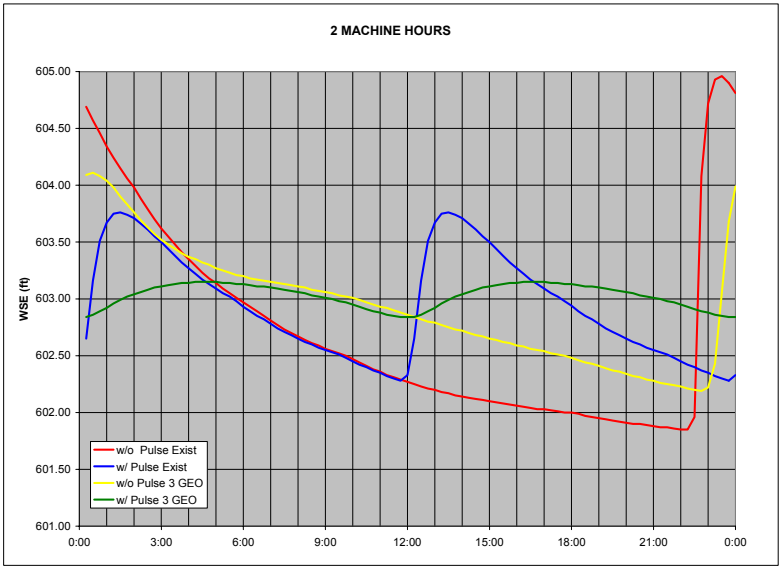
HYDRAULIC MODELING EXAMPLE - (HEC-RAS Unsteady State)



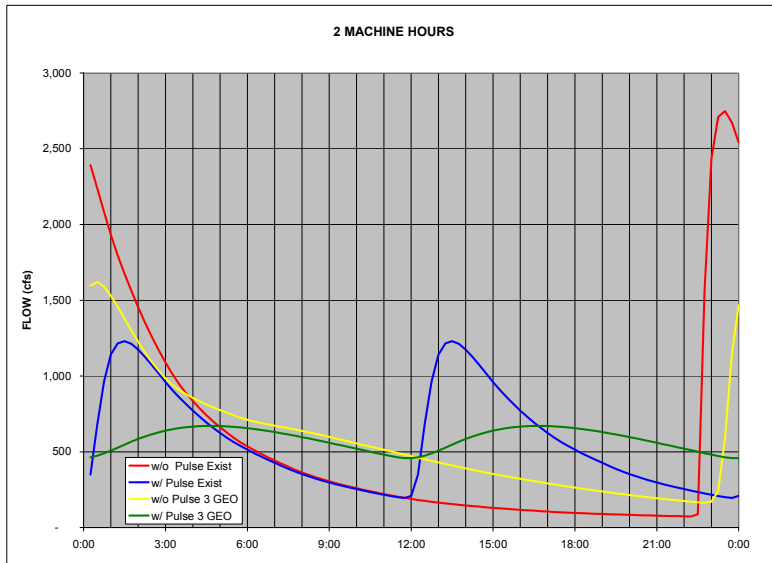
HYDRAULIC MODELING EXAMPLE - (HEC-RAS Unsteady State)



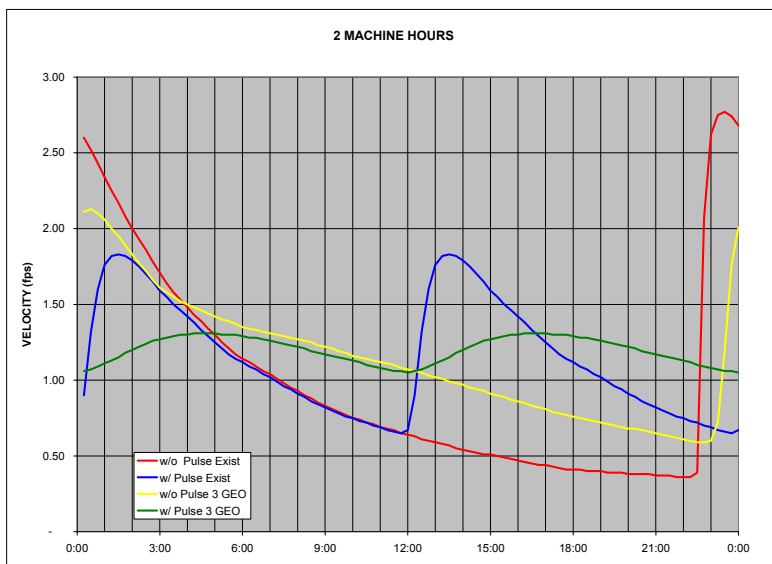
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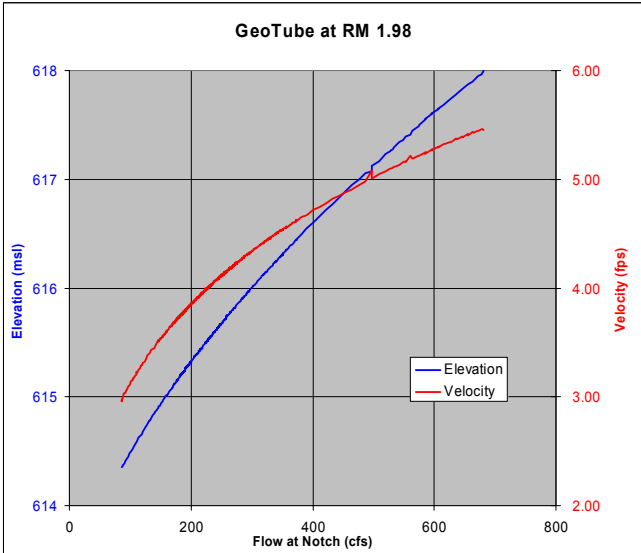
## HYDRAULIC MODELING EXAMPLE - (HEC-RAS Unsteady State)



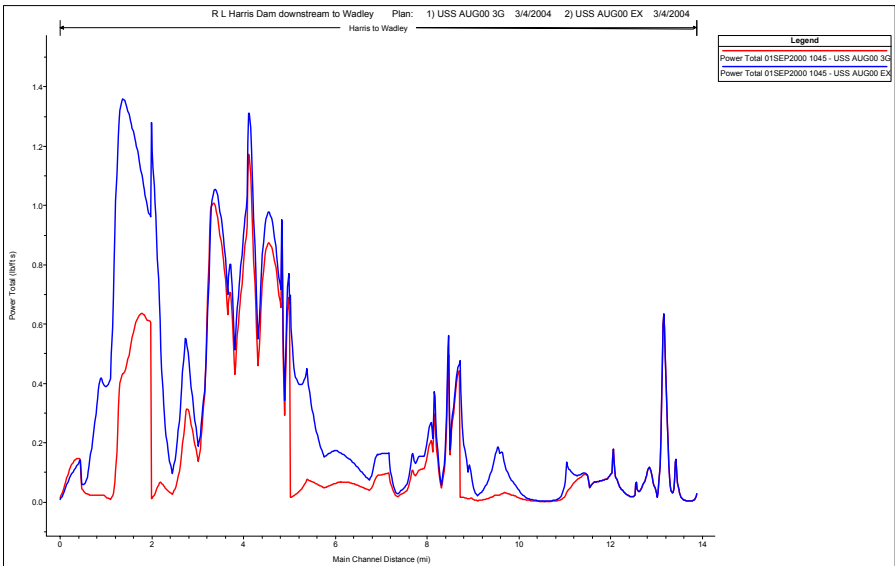
## HYDRAULIC MODELING EXAMPLE - (HEC-RAS Unsteady State)



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