

# Colorado River Flow, Stage, and Sediment Graphical User Interface (CRFSSGUI)

Computer Application Developed for  
GCMRC by:

Ecometric Research

Steve Wiele, USGS

Tim Randle, BOR

# CRFSSGUI Components

- **Unsteady Flow Model** – Steve Wiele, USGS
  - Reach-averaged one-dimensional wave propagation model
  - Calculates hydrographs at points along the Colorado River in Grand Canyon in support of field studies
  - Also predicts water velocity that can be used to predict travel time and distance (for boating and various science applications)

# CRFSSGUI Components (cont'd)

- **STARS** – Randle and Pemberton, BOR
  - One-dimensional steady flow model designed to predicts stage and average water velocity at many cross-sections as a function of discharge
  - STARS simulates both stage and sediment movement, only the stage component of the model has been integrated within this application
  - Stage-discharge relations have many applications (e.g., computation of inundation frequency)

# What Do You Do With It?

- Discharge at GCD began increasing above 5 kcfs at 9:00 am. What time will I begin to see an increase in discharge at RM 30, 60, etc? – *wave travel time*
- The Paria discharged considerable sediment into the CR on at 9:00 am. When will the sediment plume show up at the LCR confluence? – *water travel time*

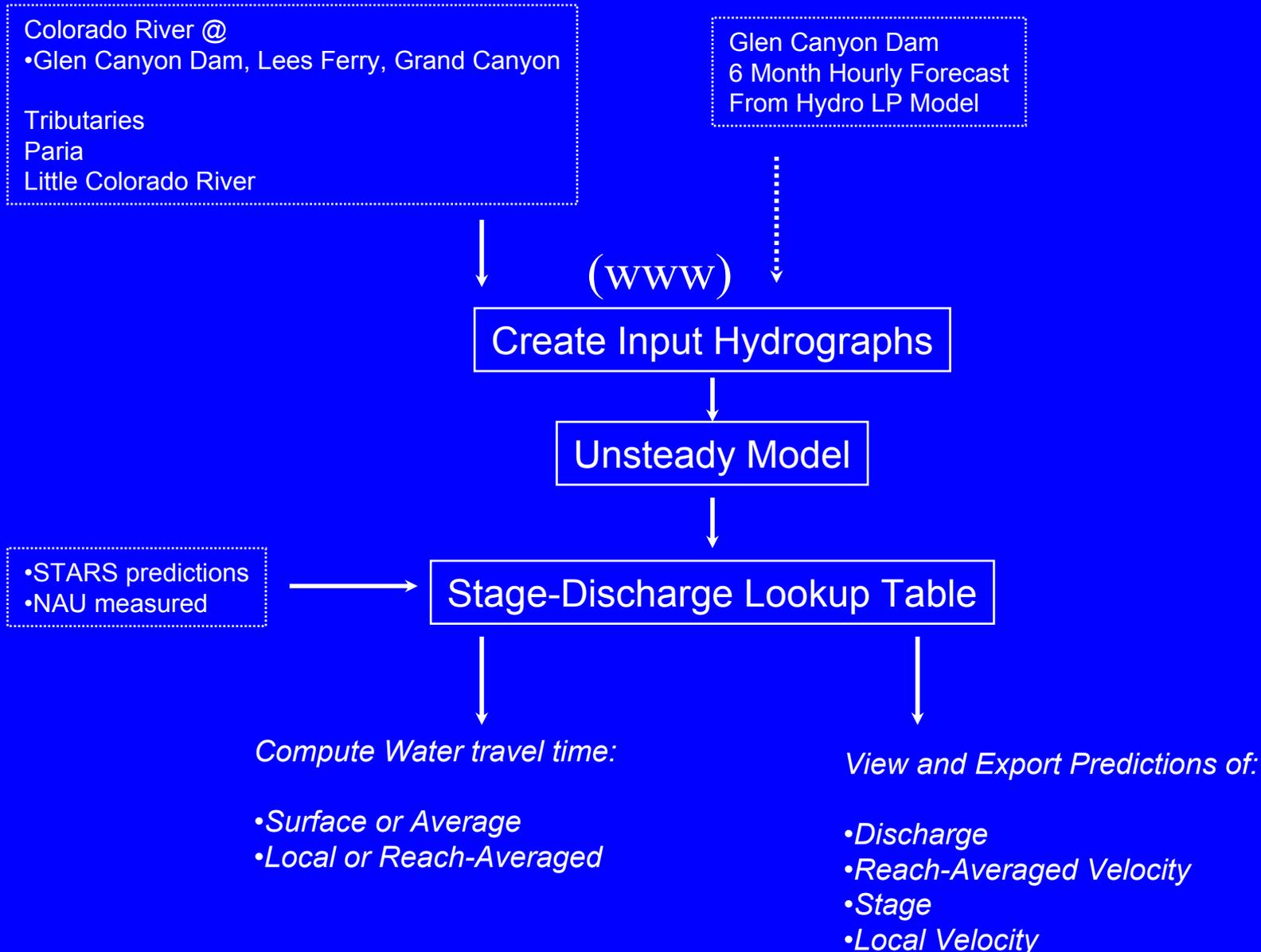
# What Do You Do With It (cont'd)?

- Discharge at RM 30 is predicted to increase from 5 to 20 kcfs. What is the associated stage change?  
– *stage-discharge prediction*
- If I implement an abrupt 2 hr. minimum flow of 2 kcfs at GCD, what will the resulting minimum flow be at RM 60?

# Characteristics of Discharge Waves Generated by Power Load-Following

- The wave form moves downstream faster than the speed at which the water flows.
- As it progresses downstream, the rising limb of the wave steepens and the declining limb flattens.
- This occurs because the wave speed is a function of the change in discharge. The higher-gradient component overtakes the lower-gradient component, which attenuates the wave.
- Attenuation results in a small reduction in the peak flow, and a more substantial increase in the minimum flow as the wave propagates downstream. The duration of minimum and maximum flows are also reduced.

# How CRESSGUI Works



# Coming Soon...

- Predictions of sand and silt/clay inputs from Paria and LCR based on real-time water discharge (2003)
- Retention and residence time estimates of sediment based on Wiele's 1.5d sediment routing model (2003-2005)