US Army Corps of Engineers
Pittsburgh District

Mahoning River, Ohio
Environmental Dredging Project
Feasibility Study

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HEC – RAS Model

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Objectives

- Introduction to HEC-RAS
- Existing Conditions Model
  - Geometry
  - Flows
  - Model Verification
  - Model Uses
- Possible Additional Models
  - Sedimentation Study
  - WES Model
  - CRREL Studies

HEC – RAS Overview

- RAS = River Analysis System
  - Product of the Corps' Civil Works Hydrologic Engineering Research and Development Program
  - Located at the Hydrologic Engineering Center (HEC)
  - Performs hydraulics computations

What goes into the model?

- Geometry
  - Cross sections
  - Bridges
  - Dams
- Flows
- Hydraulic coefficients

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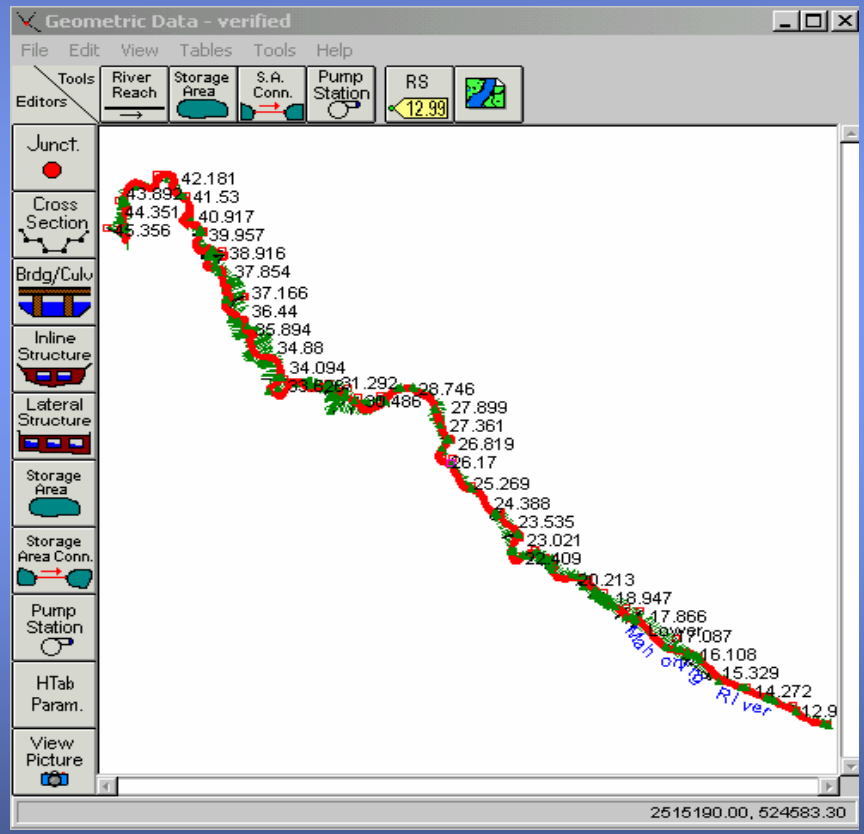
Existing Geometry

- Developed using digital mapping provided by Trumbull and Mahoning counties
- Surveys performed by a contractor for the Corps
- Sections extend to contain the 1% chance exceedence flood



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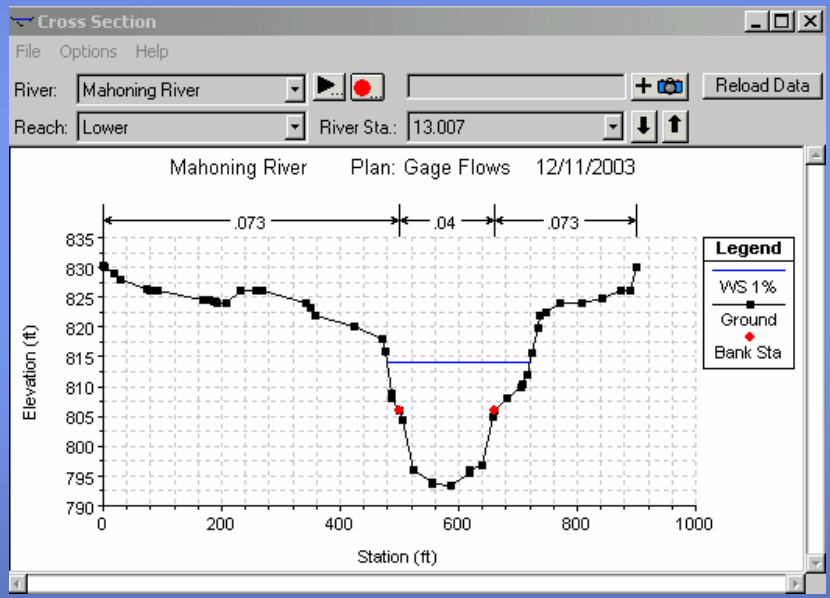

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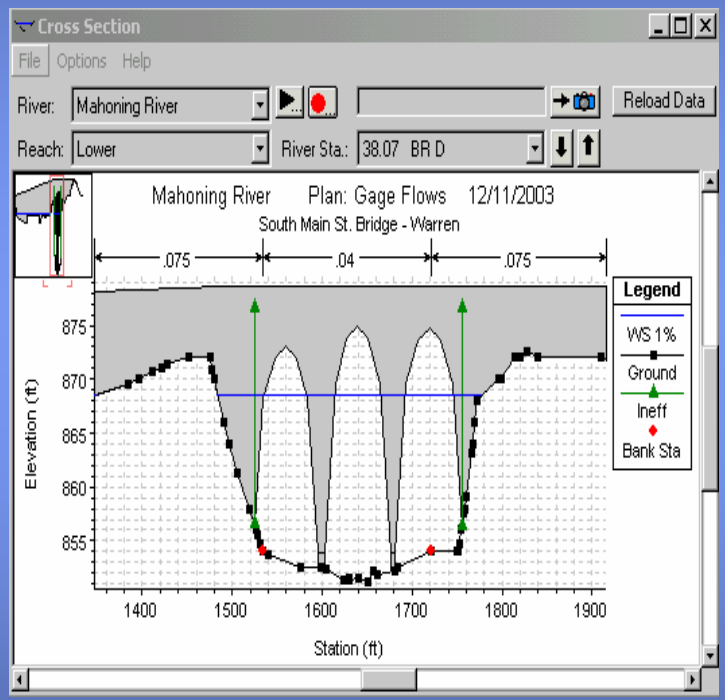

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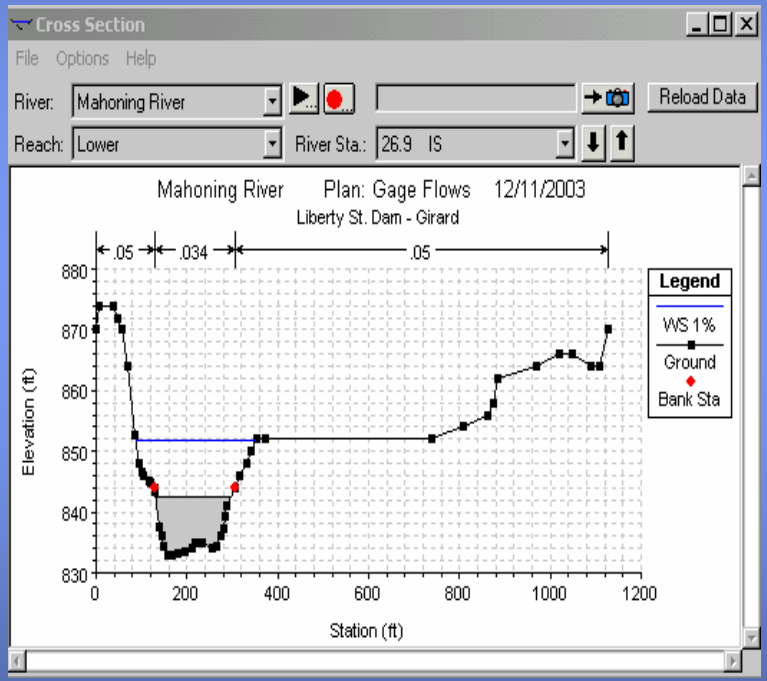

Model Verification

- Hydraulic coefficients were verified to match existing profiles.
  - Flood Insurance Study
  - Gage Rating Curves
  - Field Measurements
    - Low flow taken April 2003
    - High flow taken July 2003

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Model Uses

- Verify Ordinary High Water Elevations
- Calculate velocities
- Develop water surface profiles
- Effects of dam removals
- Scour
- Comparison of Existing and Future Conditions

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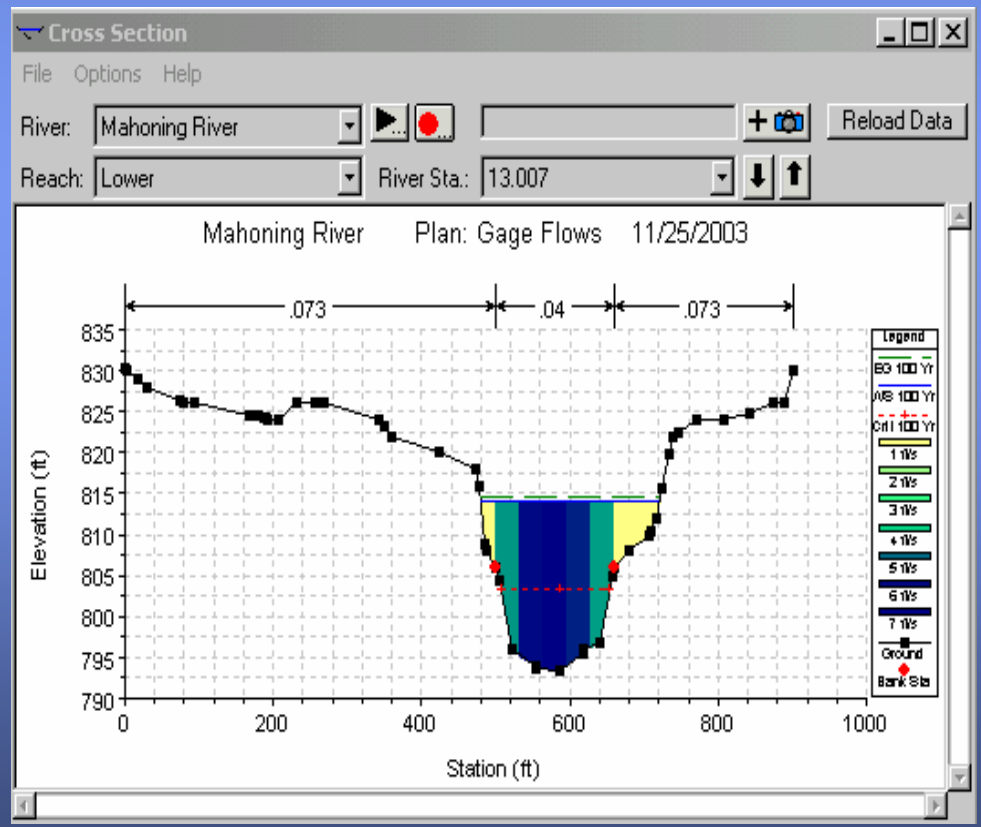
Ordinary High Water

- Defines the lateral extent of Federal jurisdiction over navigable waters
- Study conducted by USACE biologist

Calculate Velocities

- Used to locate possible problem areas for scour
- Design bank stabilization if necessary



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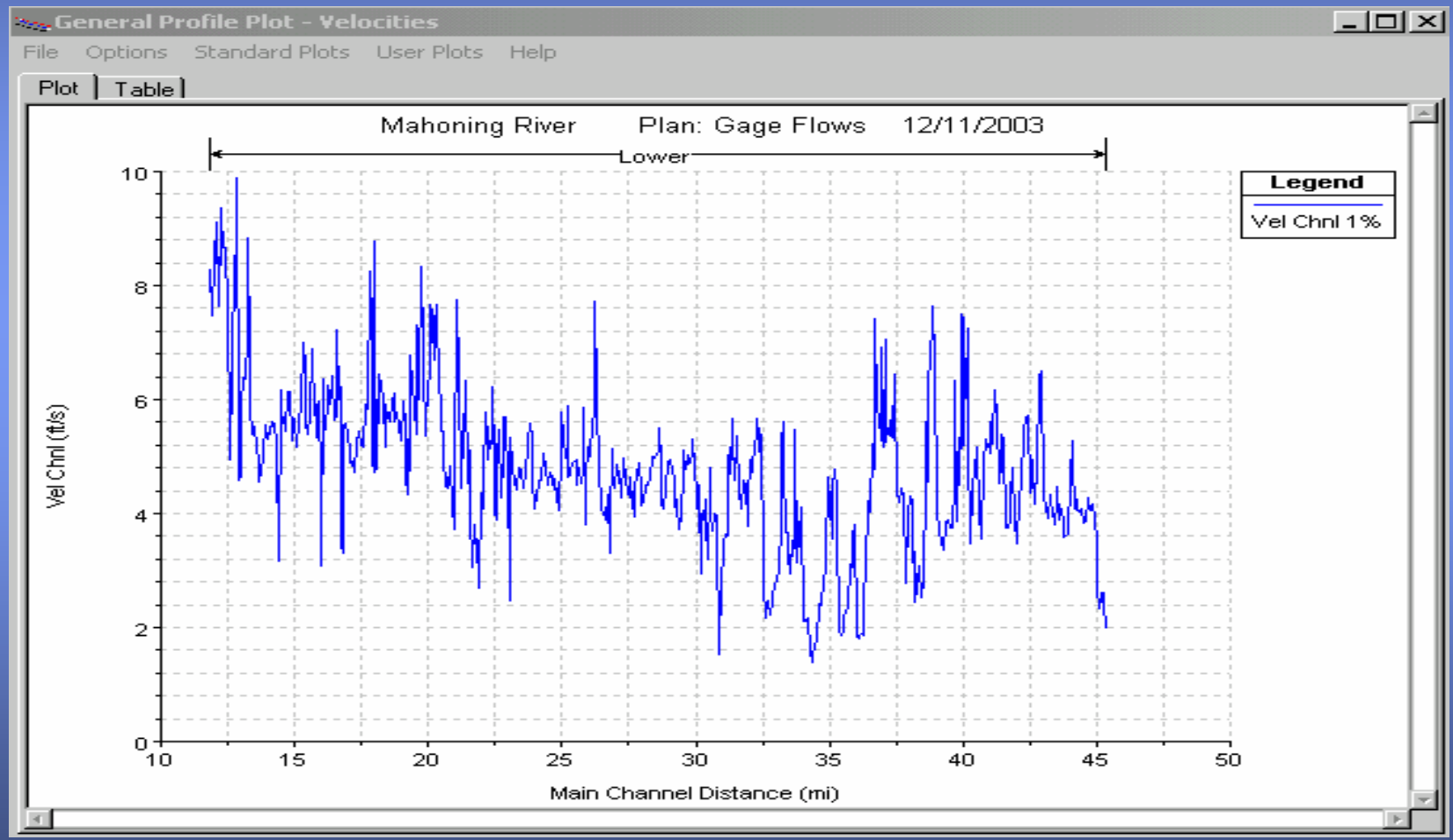

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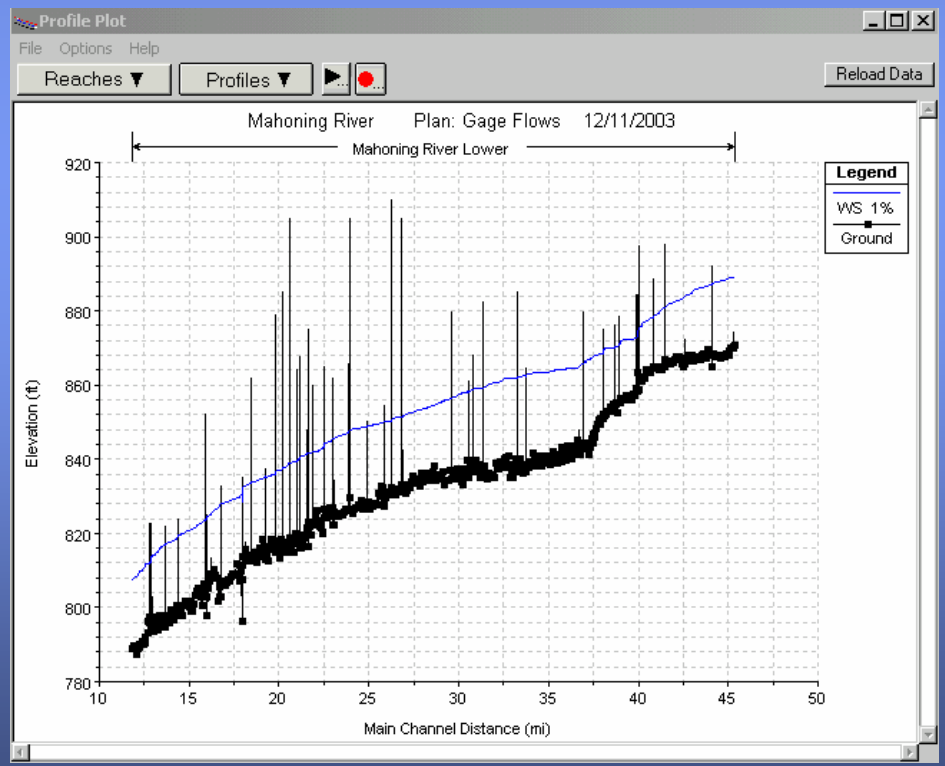
Develop Water Surface Profiles

- Calculates water surface elevations for various flows at each cross section
- Use to compare existing conditions to proposed project conditions



Effects of Dam Removal

- Change geometry file to remove dams
- Check changes in
  - Water surface elevation
  - Velocity
  - Sedimentation / Scour
  - Lateral flooding

Scour

- Velocities may require stream bank protection against scour
- Ice jams and scour due to ice needs investigated

Additional Models

- Sedimentation
- WES
- CRREL

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Sedimentation

- A sedimentation analysis is necessary to determine the effects of:
  - Dredging
  - Ice
  - Dam removal

WES Model

- WES = Waterways Experiment Station
  - US Army Corps of Engineers facility
- Physical model of river
- Uses
  - Sedimentation / Scour
  - Bank Protection
  - Dam Removal

CRREL Model

- CRREL = Cold Regions Research and Engineering Laboratory
  - US Army Corps of Engineers facility
- Physical model of river
- Studied Considerations for Dam Removal in Ice-Affected Rivers
  - Published in Ice Engineering bulletin January 2001

CRREL Model

- **Uses**
  - Sedimentation / Scour
    - Sedimentation from upstream carried by ice
    - Scour along banks and channel bottom by ice
  - Possibility of future ice formation / jams

Conclusion

- Brief overview of HEC-RAS
- What makes up the model
- Validity of model
- Uses of completed model
- Possible additional sources of information

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