

143SRPP

Stream Revitalization: Principles & Practices

SEMINAR 2

Gradually-Varied Flow HEC-RAS Modeling

Winter 2019 Semester

7 October 2019



CTU in Prague - Faculty of Civil Engineering
The Department of Landscape Water Conservation

Introduction: HEC-RAS Model

US Army Corps of Engineers:

Hydrological Engineering Center – River Analysis System

HEC-RAS developed from the HEC-2 water surface profile program based on one-dimensional steady flow, utilizing the gradually-varied flow equation.

River Analysis System Components:

1. Steady Flow Water Surface Profiles
2. Unsteady Flow Simulations
3. Sediment Transport / Mobile Boundary Computations
4. Water Quality Analysis

HEC-RAS has a graphical user interface (GUI) for pre- and post-processing; and several features the HEC-2 model did not have such as flood encroachment analysis optimization, stable channel design, and accounting ice cover resistance.

Introduction: HEC-RAS Model

HEC-RAS Model

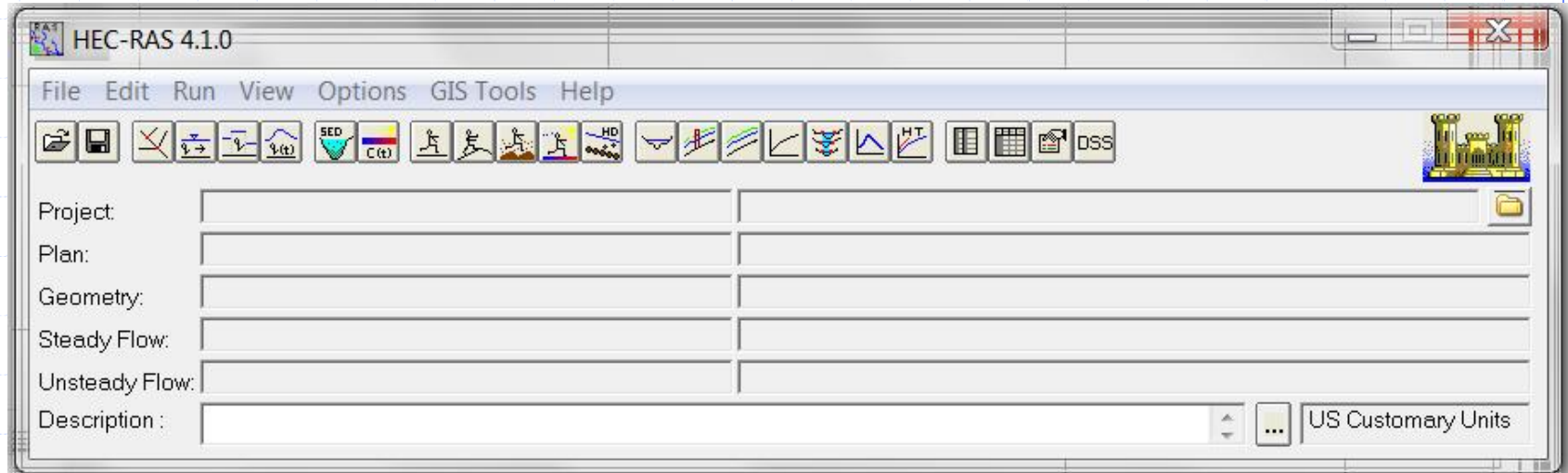
Steady Flow Module based on one-dimensional energy equation, gradually-varied flow derivation. Energy losses are evaluated by friction (Manning Equation, S_e) and contraction/ expansion estimation by loss coefficients (K_L) multiplied by the change in velocity head.

Model capable of modeling subcritical flow, supercritical flow, and mixed flow regimes. Selection of boundary conditions for different reaches are important, and dependent on flow regime.

Momentum equation is utilized where the water surface profile is rapidly-varied (mixed flow regime calculations), or for any shift from subcritical to supercritical flow, or visa versa.

HEC-RAS Model 4.1

Main Window / Menu Bar



File / Edit / Run / View / Options / GIS Tools / Help

Note: User Manual for vers. 4.1, uses illustration figures from vers. 4.0
Most current version is 5.0.3.

HEC-RAS Model 4.0

Main Window / Menu Bar

button bar for
quick access

The image shows the HEC-RAS 4.0.0 main window with a blue title bar and a menu bar (File, Edit, Run, View, Options, Help). Below the menu bar is a button bar with 20 icons. The main area contains a project information table and a units dropdown menu.

Project:	Single Bridge - Example 2	C:\HEC Data\HEC-RAS\Steady Examples\BEAVCPREK.prj
Plan:	Press/Wer Method	C:\HEC Data\HEC-RAS\Steady Example\BEAVCPREK.p01
Geometry:	Beaver Cr. + Bridge - P/W	C:\HEC Data\HEC-RAS\Steady Example\BEAVCPREK.g01
Steady Flow:	Beaver Cr. - 3 Flows	C:\HEC Data\HEC-RAS\Steady Example\BEAVCPREK.f01
Unsteady Flow:		
Description:		

Units: US Customary Units

Annotations and their corresponding functions:

- Open Project:** Open an existing project
- Save Project:** Save an existing project
- Geometric Data:** Edit and/or enter geometric Data
- Steady Flow Data:** Edit and/or enter steady flow data
- Water Quality Data:** Enter and edit water quality data
- Sediment Data:** Enter/edit sediment data
- Water Quality Analysis:** Perform a steady flow simulation
- Steady Flow Analysis:** Perform a steady flow simulation
- Cross Sections:** View cross section plots
- Sediment Analysis:** Perform Sediment Transport Analysis
- Hydraulic Design Functions:** Perform hydraulic design computations
- General Profile Plot:** View computed variables along the channel
- Rating Curve:** View computed rating curves
- Profile Plot:** View water surface profile plots
- XYZ Perspective Plot:** View 3D multiple cross section plot
- Hydraulic Properties:** Plots and tables of hydraulic properties
- Hydraulic Design Functions:** Perform hydraulic design computations
- Profile Summary Table:** View summary output at multiple locations by profile
- Sum Errs, Warn, Notes:** Summary of Errors, Warnings, and Notes
- View DSS:** View Data stored in DSS
- Detailed Output Table:** View detailed output at cross-sections, bridges, culverts, etc...
- Stage and Flow Hydrographs:** Plot stage and flow hydrographs

HEC-RAS Model: Modelling Steps

HEC-RAS Modeling: Five Main Steps for Steady Flow

1. Starting a new project
2. Entering geometric data
3. Entering flow data and boundary conditions
4. Performing the hydraulic calculations
5. Viewing and printing results

HEC-RAS Model

Manual Example

Ch. 4

