

# College of Applied Sciences-Nepal

Tribhuvan University

## Bishwa Prakash Puri

Hydrological Modelling using HEC-HMS and HEC-RAS

[work.bishwapuri@gmail.com](mailto:work.bishwapuri@gmail.com)

9843314630

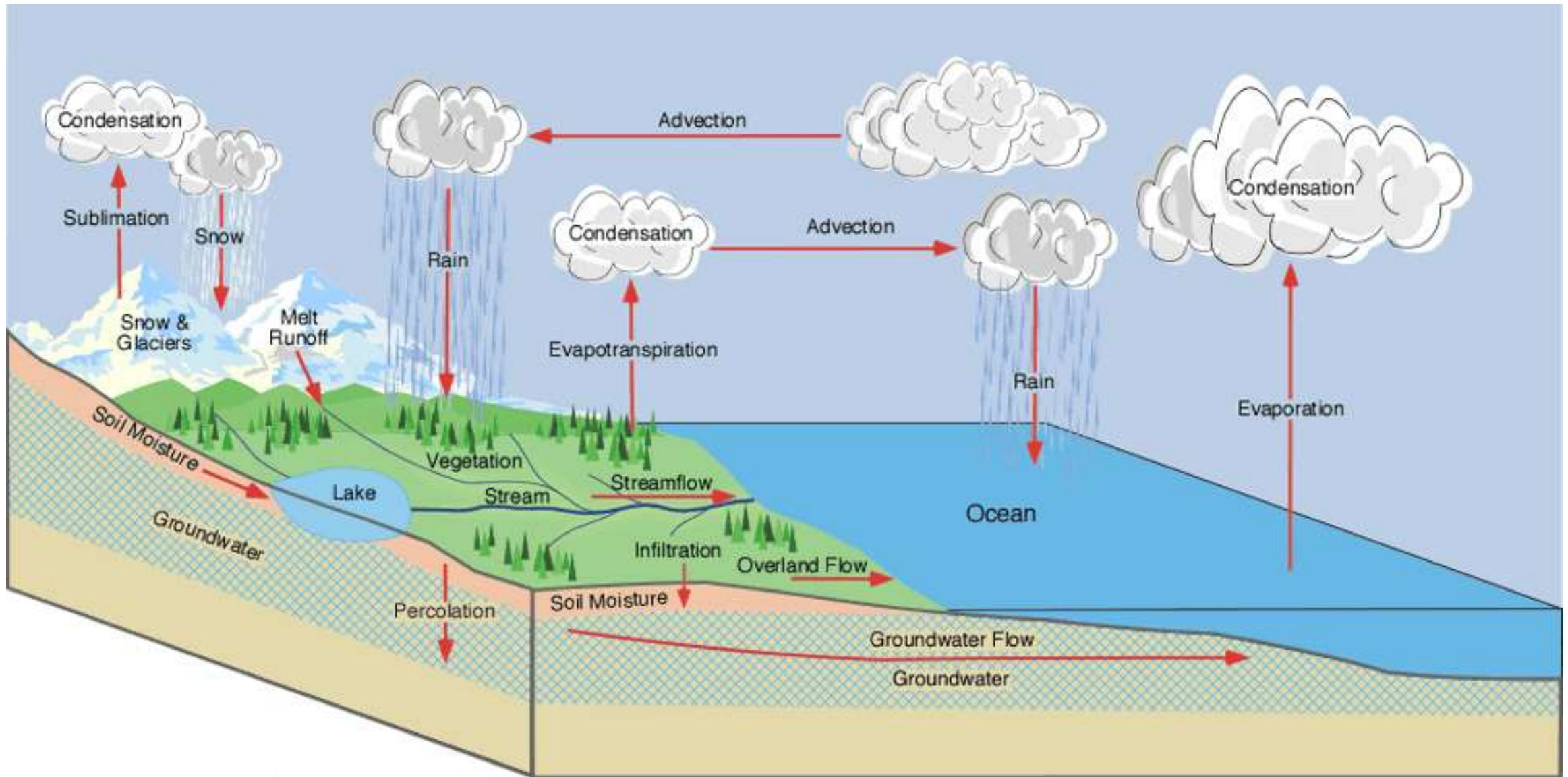
# What will we cover?

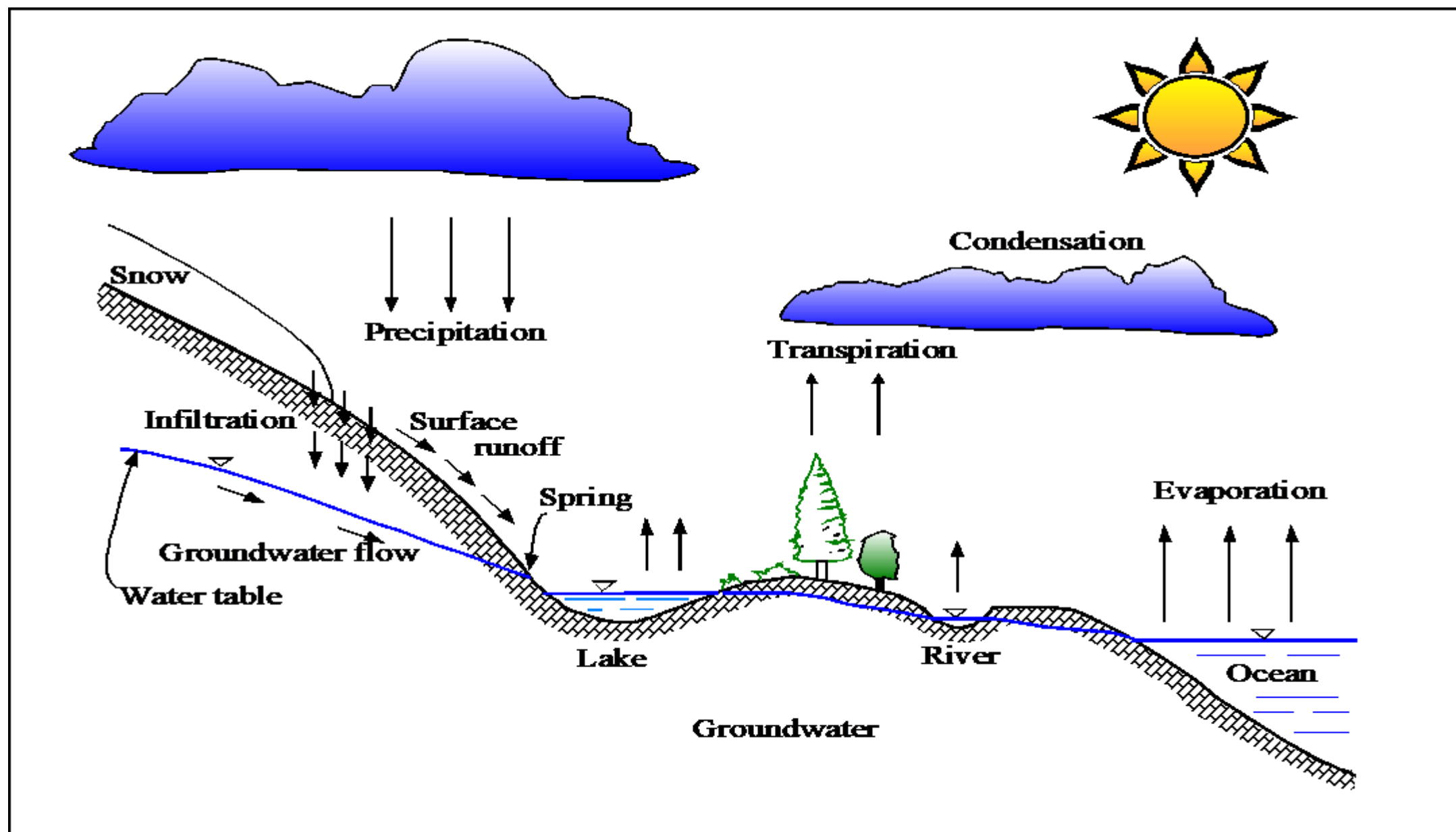
- Hydrological modelling (~~snowmelt model~~, rainfall-runoff model, ~~SWAT~~)

# Objectives

- To determine the flood frequency analysis and flood plain analysis by using Gumbel's Distribution Method
- To determine flood return period of 2, 100, 500 years of Balkhu River Basin.
- To create river channel geometry of Balkhu River Basin using HEC-RAS.
- To study and determine land-use change analysis

# Complexity of Hydrology





# Hydrology and Hydraulics

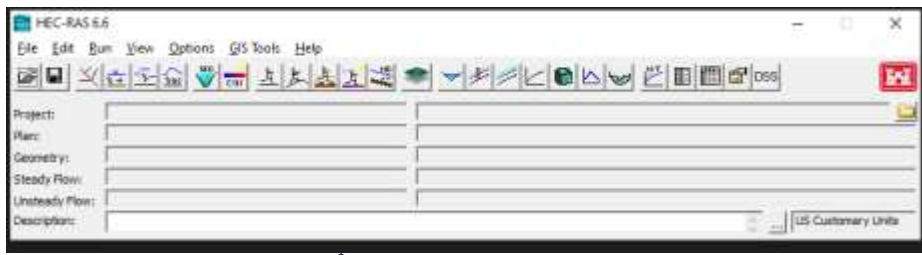
## ➤ What is hydrology?

- Hydrology is the study of the circulation of water and its constituents through the hydrologic cycle or the quantification of flows that are ultimately produced by precipitation. It deals with precipitation (rain, snow, sleet, hail, etc.), evaporation, infiltration, groundwater flow, surface runoff, streamflow, and the transport of substances dissolved or suspended in flowing water. Hydrology typically refers to the rate of precipitation, the quantity of water, the rate of surface runoff, and the timing of its arrival at a point of interest.

- 

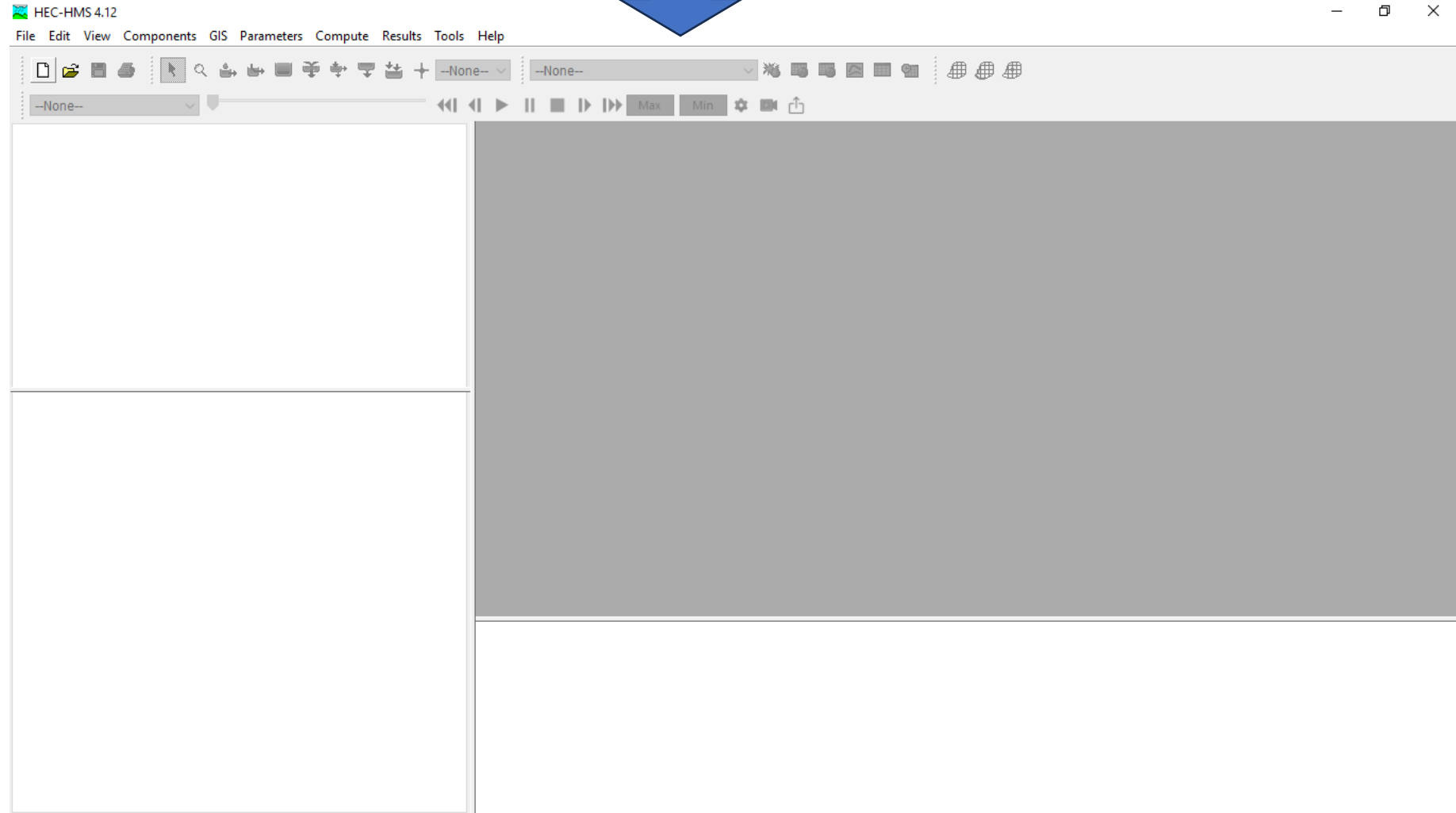
## • What is hydraulics?

- Hydrologic is defined as the study of the mechanical behavior (movement/flow) of water in physical systems. Hydraulics analyzes how surface and/or subsurface flows move from one point to the next. A hydraulic analysis is used to evaluate flow in rivers, streams, storm drain networks, water aqueducts, water lines, sewers, etc.

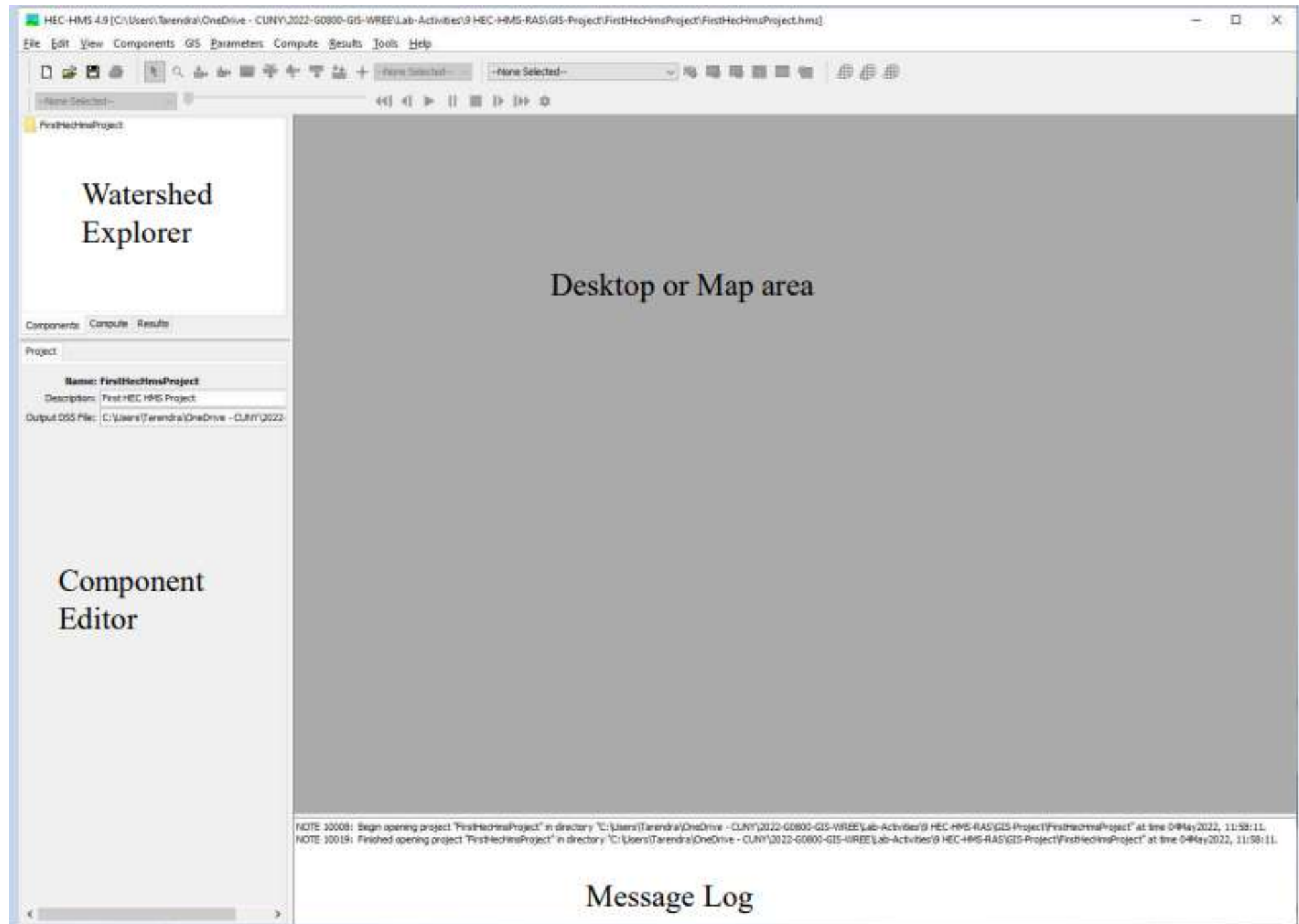


- **HEC-RAS** excels at channel and floodplain hydraulic analysis, providing detailed insights into how water flows within and beyond rivers.

**HEC-HMS** is best suited for watershed-scale hydrological analysis, focusing on how rainfall translates into runoff and streamflow.

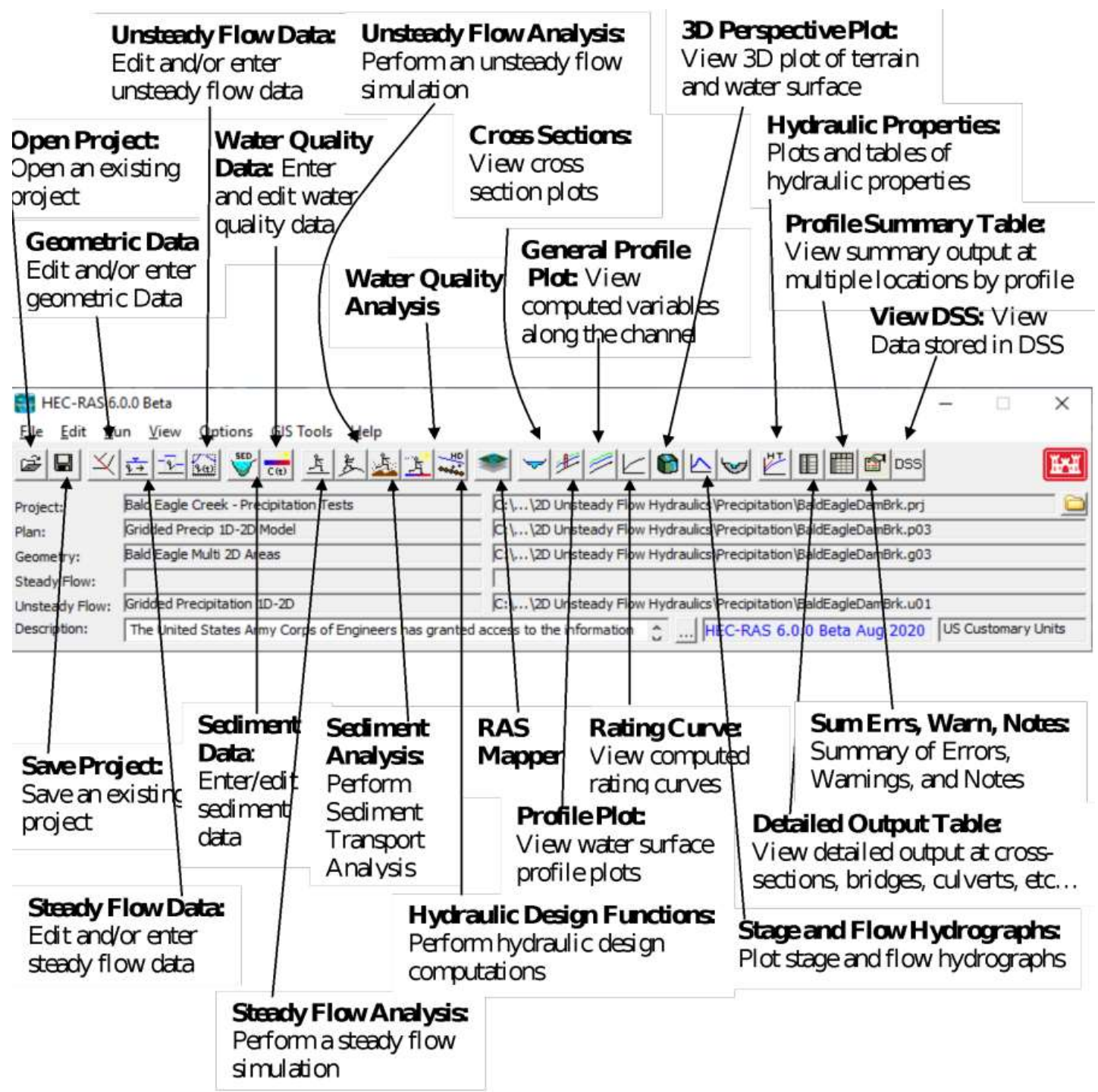


HEC-HMS,  
how it  
looks  
like!!!





How about  
**HEC-RAS**, how  
it looks like!!!



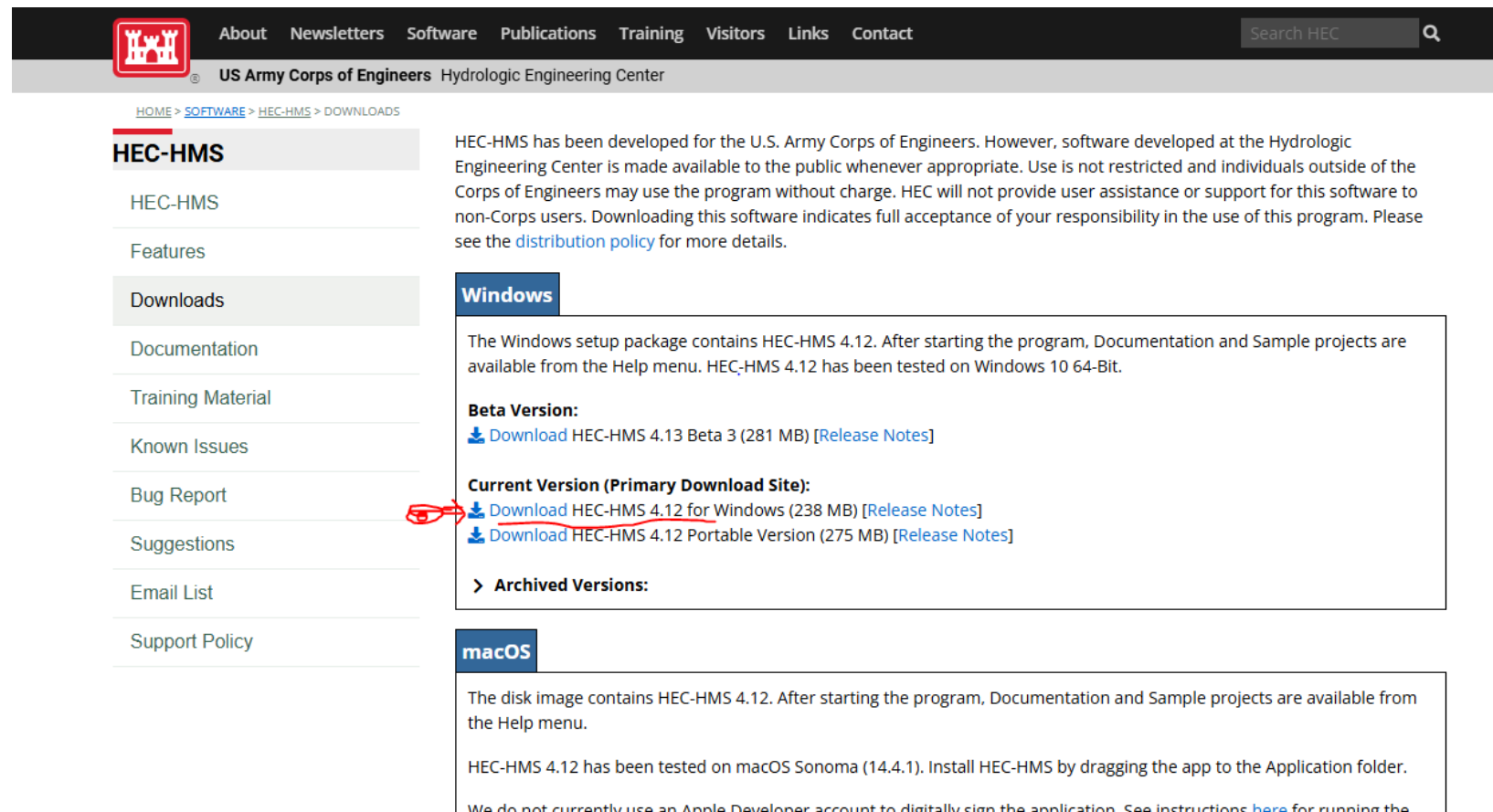
# Differences



	HEC-RAS	HEC-HMS
Primary Purpose	Hydraulic modeling of water flow in rivers and channels.	Hydrologic modeling of precipitation-runoff processes in watersheds.
Key Functions	<ul style="list-style-type: none"><li>- Simulates steady and unsteady flow, sediment transport, and water quality.</li><li>- Models floodplain mapping and water surface profiles.</li></ul>	<ul style="list-style-type: none"><li>- Simulates rainfall-runoff processes, streamflow, and reservoir operations.</li><li>- Estimates peak flows, hydrographs, and watershed responses.</li></ul>
Input Requirements	<ul style="list-style-type: none"><li>- Geometric data (cross-sections, channel properties).</li><li>- Boundary conditions (flow and stage data).</li></ul>	<ul style="list-style-type: none"><li>- Precipitation data, land-use data, and watershed characteristics.</li><li>- Soil properties and meteorological inputs.</li></ul>
Output	<ul style="list-style-type: none"><li>- Water surface elevations, flow rates, velocity profiles, and flood extents.</li></ul>	<ul style="list-style-type: none"><li>- Hydrographs, runoff volumes, infiltration, and streamflow simulations.</li></ul>
Primary Applications	<ul style="list-style-type: none"><li>- Floodplain mapping, levee breach analysis, dam break studies.</li></ul>	<ul style="list-style-type: none"><li>- Rainfall-runoff modeling, watershed management, reservoir optimization.</li></ul>
Spatial Scale	<ul style="list-style-type: none"><li>- Focuses on localized, detailed hydraulic modeling (channels and floodplains).</li></ul>	<ul style="list-style-type: none"><li>- Basin-wide or watershed-level hydrological modeling.</li></ul>

# Links for download

HEC-HMS: <https://www.hec.usace.army.mil/software/hec-hms/downloads.aspx>



The screenshot shows the HEC-HMS Downloads page. The top navigation bar includes links for About, Newsletters, Software, Publications, Training, Visitors, Links, and Contact, along with a search bar. The left sidebar contains a list of links: HEC-HMS, Features, Downloads (highlighted), Documentation, Training Material, Known Issues, Bug Report, Suggestions, Email List, and Support Policy. The main content area is titled 'HEC-HMS' and contains a paragraph about the software's availability. Below this, there are two sections: 'Windows' and 'macOS'. The 'Windows' section includes a description of the setup package, a 'Beta Version' link, and a 'Current Version (Primary Download Site)' section with two download links. A red circle and arrow highlight the 'Download HEC-HMS 4.12 for Windows (238 MB)' link. The 'macOS' section includes a description of the disk image and a note about the Apple Developer account.

**HEC-HMS**

HEC-HMS has been developed for the U.S. Army Corps of Engineers. However, software developed at the Hydrologic Engineering Center is made available to the public whenever appropriate. Use is not restricted and individuals outside of the Corps of Engineers may use the program without charge. HEC will not provide user assistance or support for this software to non-Corps users. Downloading this software indicates full acceptance of your responsibility in the use of this program. Please see the [distribution policy](#) for more details.

**Windows**

The Windows setup package contains HEC-HMS 4.12. After starting the program, Documentation and Sample projects are available from the Help menu. HEC-HMS 4.12 has been tested on Windows 10 64-Bit.

**Beta Version:**

[Download](#) HEC-HMS 4.13 Beta 3 (281 MB) [\[Release Notes\]](#)

**Current Version (Primary Download Site):**

[Download](#) HEC-HMS 4.12 for Windows (238 MB) [\[Release Notes\]](#)

[Download](#) HEC-HMS 4.12 Portable Version (275 MB) [\[Release Notes\]](#)

**> Archived Versions:**


**macOS**


The disk image contains HEC-HMS 4.12. After starting the program, Documentation and Sample projects are available from the Help menu.

HEC-HMS 4.12 has been tested on macOS Sonoma (14.4.1). Install HEC-HMS by dragging the app to the Application folder.

We do not currently use an Apple Developer account to digitally sign the application. See instructions [here](#) for running the

HEC-RAS: <https://www.hec.usace.army.mil/software/hec-ras/download.aspx>

[About](#) [Newsletters](#) [Software](#) [Publications](#) [Training](#) [Visitors](#) [Links](#) [Contact](#)

Search HEC 

US Army Corps of Engineers Hydrologic Engineering Center

[HOME](#) > [SOFTWARE](#) > [HEC-RAS](#) > [DOWNLOAD](#)

## HEC-RAS

- HEC-RAS 6.6
- HEC-RAS 2025 Alpha
- Features
- Downloads**
- Documentation
- Training
- Known Issues
- Bug Report
- Suggestions
- Collaborators
- Support Policy

HEC-RAS has been developed for the U.S. Army Corps of Engineers (USACE). However, software developed at the Hydrologic Engineering Center is made available to the public whenever appropriate. Use is not restricted and individuals outside of USACE may use the program without charge. HEC will not provide user assistance or support for this software to non-USACE users. Downloading this software indicates full acceptance of your responsibility in the use of this program. Please see the [distribution policy](#) for more details.

### HEC-RAS 6.6 Windows:

The setup package includes HEC-RAS 6.6.

**Primary Download Site:**  
[Download](#) HEC-RAS 6.6 Setup Package (209 MB) [\[Release Notes\]](#)

**Alternate Download Site:**  
[Download](#) HEC-RAS 6.6 Setup Package (209 MB) [\[Release Notes\]](#)

**Supported Operating Systems:**  
Windows 10/11 64-bit

> **Archived Versions:**

### HEC-RAS 6.6 Example Projects:

This file contains all of the HEC-RAS example projects.

[Download](#) HEC-RAS 6.6 Example Projects (422 MB)

## HEC-DSSVue

:<https://www.hec.usace.army.mil/software/hec-dssvue/downloads.aspx>

