## HEC-RAS

| 🗱 HEC-RAS - River Analysis Sy | /stem       |                               |
|-------------------------------|-------------|-------------------------------|
| File Edit Run View Optic      | ons Help    |                               |
| ☞■¥ <u>╤</u> ŵ£≵⊨             | ᢦᢞ测∠ਝ፟⊾ோ∎෨₨ | Hydrologic Engineering Center |
| Project:                      |             |                               |
| Plan:                         |             |                               |
| Geometry:                     |             |                               |
| Steady Flow:                  |             |                               |
| Unsteady Flow:                |             |                               |
| Project<br>Description :      |             | SI Units                      |

### A Tutorial

(Model Development of a Small Flume)

## HEC-RAS

- Hydraulic Engineering Center:River Analysis System
- 1-D step backwater model
- Utilizes energy equation to compute water surface elevation for a given discharge, geometry, and resistance

## Organizational Structure

- Open project –creates (.prj file)
- Includes:
- 1. Unit system (SI/US customary)
- 2. Geometry (XS, bridges, weirs, etc.) (.g file)
- 3. Flow Data (steady, unsteady) (.f file)
- 4. Plan data(what combination of flow/geometry to use for the analysis) (.p file)

### **Open a new project**

| 🔣 HE  | C-RAS    | - Rive | er Analy | ysis Syste        | m                |   |        |
|-------|----------|--------|----------|-------------------|------------------|---|--------|
| File  | Edıt     | Run    | View     | Options           | Help             |   |        |
| Ne    | w Proje  | ct     |          |                   |                  |   | Ĩ.     |
| Ор    | en Proj  | ect    |          |                   |                  |   |        |
| - 5av | ve Proje | ect    |          |                   |                  |   |        |
| Sav   | ve Proje | ct A   | 5        |                   |                  |   |        |
| Re    | nøme Pr  | oject  | Title .  |                   |                  |   |        |
| De    | lete Pro | oject  |          |                   |                  |   |        |
| Pro   | oject Su | mmar   | γ·       |                   |                  |   |        |
| Imp   | port HE  | C-2 I  | )sts     |                   |                  |   |        |
| Imp   | port HE  | C-RA   | 5 Data   |                   |                  |   |        |
| Ge    | nerste   | Repo   | rt       |                   |                  |   |        |
| Exp   | port GIS | ) Data | a        |                   |                  |   |        |
| Exp   | port to  | HEC-   | D55      |                   |                  |   |        |
| Re    | store B  | ackup  | ) Data   |                   |                  |   | •      |
| Exr   | t        |        |          |                   |                  |   |        |
| C:\   | wris\SA  | N_Jo   | seAdo    | ₽ <i>е</i> \HEC_R | ASVAdo           | be Alternative- model for prof\alternative_7b | vl.prj |
| C:\   | COURS    | E5\C   | E_381    | HEC_RAS           |                  | Viume_1.prj                                   |        |
| C:\   | wris\SA  | N_Jo   | se\do    | be\represe        | entativ <i>e</i> | e_reachesWdobeHiddenVilla.prj                 |        |
| C:\   | wris\re  | dhill∖ | IEC_RA   | SWESTRI           | P.prj            |   |        |
| C:\   | wris\re  | dhill∖ | IEC_RA   | SVRED_NE          | W.prj            |   |        |
| C:\   | HEC Da   | ta\RA  | S\test   | .prj              |                  |   |        |

### Name the project (.prj file)

|                           | New Project   |                  |                        |
|---------------------------|---|------------------|------------------------|
|                           | Title   | File Name        | Directories            |
|                           | flume_study   | flume_study.prj  | C:\HEC Data\RAS        |
| PS USO DA                 | test t  | est.prj          | <u>⊜</u> C:\           |
| Elle Edit                 |   |                  | HEC Data               |
|                           |   |                  |                        |
| FUX                       |   |                  |                        |
| Project:                  |   |                  |                        |
| Plan:                     |   |                  |                        |
| Geometry:                 |   |                  |                        |
| Steady Flow:              |   |                  |                        |
| Unsteady Flow:<br>Project |   |                  |                        |
| Description :             |   |                  |                        |
|                           |   |                  |                        |
|                           | OK Cancel Help  | Create Directory | 🖃 c: [IBM_PRELOAD] 🛛 🔻 |
|                           | Set drive and path, then enter a new project title and file n | ame.             | ,                      |
|                           |   |                  |                        |

After you have entered the above, click O.K. and O.K. again

#### **Select SI units**

| 🗱 HEC-RAS - River Analysis System 🔲 🔲 🔀 |                               |                                  |  |  |
|---|-------------------------------|----------------------------------|--|--|
| File Edit Run View                      | Options Help                  | _                                |  |  |
| R R V - C F                             | Program Setup                 | BS Hydrologic Engineering Center |  |  |
|   | Default Parameters >          | US Army Corps of Engineers       |  |  |
| Project:  flume_study                   | Unit system (US Customary/SI) | me_study.prj                     |  |  |
| Plan:                                   | Convert Project Units         |                                  |  |  |
| Geometry:                               |                               | 1                                |  |  |
| Steady Flow:                            |                               |                                  |  |  |
| Unsteady Flow:                          |                               |                                  |  |  |
| Project<br>Description :                |                               | SI Units                         |  |  |

| HEC-RAS  |  |      |
|--|--|------|
| 9  | Select Units System                    |      |
| <ul> <li>○ US Customary</li> <li>⊙ System Internation</li> <li>☐ Set as default for</li> </ul> | onal (Metric System)<br>r new projects |      |
| ОК   | Cancel                                 | Help |

## Geometry Files (.g)

### • Create a reach- single or dendritic

Click here

|     | 🔣 Geometri               | ic Data – Edit/Enter geometric data |   |     |
|-----|--------------------------|-------------------------------------|---|-----|
|     | File Edit                | Run View Options Help               |   |     |
|     | FR                       | ತು≦₺₽৺≝≝८๕๕ฃฃฃ๛                     | Hydrologic Engineering Center<br>US Army Corps of Engineers | Ini |
| Edi | t/Enter ge               | ometric data                        | i   |     |
|     | Plan:                    |                                     |   |     |
|     | Geometry:                |                                     |   |     |
|     | Steady Flow:             |                                     |   |     |
|     | Unsteady Flow:           |                                     |   |     |
|     | Project<br>Description : | I                                   | SI Units  |     |



#### Draw the reach upstream to downstream

#### Double click to end



#### Name the river and reach



## Geometry

- Cross sections define the channel/flume geometry
- Cross sections are defined by Station(x) and elevation (y) in the plane of the cross section perpendicular to the flow
- River station, downstream reach length and cross section thalweg elevation define the channel slope
- Overbank stations differentiate channel and floodplain characteristics
- Resistance to flow is defined by Manning n coefficients for both the channel and floodplain
- Expansion and contraction coefficients define energy losses associated with velocity head changes between cross sections
- Ineffective flow areas are can store but not convey water downstream
- Obstruction areas block flow completely
- Levee elevations confine flow to channel until the levees are overtopped

## More geometry

- Junctions define where two reaches are connected
- Bridges and culverts
- Inline weirs/gates
- Off channel storage
- Pumping stations
- All can be modeled with a reasonable amount of detail (can be covered at a later date)

### Flume example

- Width- 7.57 cm (0.0757 m)
- Wall height- 12 cm( 0.12 m)
- Flume Length- 182 cm (1.82 m)
- Slope-none, horizontal
- Roughness- Plexiglass (n~0.0085)
- Discharge- 1.5 l/s ( 0.0015 m<sup>3</sup>/s)
- Cross section spacing -10 cm (0.1 m)
- Downstream boundary condition (critical depth at outlet, free overfall)

#### Enter cross section data



#### Add a new cross section



#### Start at downstream river station 0.00 m

#### (HEC RAS ESTABLISHES THE DOWN STREAM END AS ZERO FOR A STARTING DISTANCE AN PROGRESSIVELY WORKS UP STREAM IN CHAINAGE)

|                               | Il Structure I            |                         |                          |
|-------------------------------|---------------------------|-------------------------|--------------------------|
| 😴 Cross Section Data          |                           |                         |                          |
| Exit Edit Options Plot 1      | telp                      |                         |                          |
| River: Flume                  | Apply Data                | Plot Options            | Prev XS Plots Clear Prev |
| Reach: A 🗾 Rive               | r Sta.: 👤 🕇               |                         |                          |
| Description                   |                           |                         |                          |
| Del Row Ins Row               | Downstream Reach Lengths  |                         |                          |
| Cross Section X-Y Coordinates | LOB Channe HEC-RAS        |                         |                          |
| Station Elevation             | Enter a new riv           | ver station for the new |                          |
|                               | Manning's n Val cross sec | ction in reach "A"      |                          |
|                               | LOB Channe                |                         |                          |
| 4                             |                           |                         | HANT BUT WE LOOKAND      |
| 5                             | Main Channel Bar          | No                      | o Data for Plot          |
| 6                             | Left Bank OK              | Cancel                  |                          |
|                               |                           |                         |                          |
| 9                             | Contraction Expansion     |                         |                          |
| 10 -1                         |                           |                         |                          |
|                               | , ,                       |                         |                          |

Enter and apply data assuming an arbitrary datum of 100.00 m, notice the downstream reach length is zero since we are at the furthest downstream extent of the

#### model Cross-sectional data

#### - Entered from left to right looking down stream



Click on "Apply Data" to add the cross-section to the model and to view the section



### **Main Channel Chainage Definition**



Since the geometry is uniform from the upstream to downstream extent, we can make use of the cross section interpolation tool to compute the geometry with the specified cross section spacing

This will take

a few steps....

#### Add a new cross section at the upstream end river station 1.82 m

## (Since we have the same geometry we are going to make use of the copy section function)

|                   |                                  | <u> </u> |                              |                                       |
|-------------------|----------------------------------|----------|------------------------------|---------------------------------------|
| 🤝 Сгоза Бес       | stion Data                       |          |                              |                                       |
| Exit Edit         | Options Plot Help                |          |                              |                                       |
| River: Flume      | Add a new Cross Section          | 🚽 + 📾    | Plot Options                 | 🛅 🎒 🥅 Keep Prev XS Plots 🔤 Clear Prev |
| Reach: A          | Copy Current Cross Section       | - + +    |                              | flume_study Plan:                     |
| Description [     | Rename River Station             | F        |                              | Geom: Flow:<br>Downstream excloritume |
| Description [c    | Delete Cross Section             |          | «                            | .0085                                 |
|                   | Adust Elevations                 | BOB      | 100.14                       | Legend                                |
| Station           | Adjust Stations                  | +        | 100.12                       | Groud                                 |
| 10                | Adjust n or K values             | 2        |                              |                                       |
| 20                | Skew Cross Section               | ROB      | <u>と</u> <sup>100.10</sup> 目 |                                       |
| 3 0.0757          |                                  | - 0085   | 등 100.08                     |                                       |
| 5                 | Ineffective Flow Areas           | ations   | 🗟 100.06                     |                                       |
| 6                 | Levees                           | it Bank  |                              |                                       |
| 7                 | Obstructions                     |          | Ш 100.04                     |                                       |
| 8                 | Add a Lid to XS                  | its 😰    | 100.02                       |                                       |
| 10                | Add Ice Cover                    | ansion   | 100.00                       |                                       |
|                   | Add a Rating Curve               |          | 0.0                          | 0 0.02 0.04 0.06 0.08                 |
|                   | Horizontal Variation in n Values |          |                              |                                       |
| ,                 | Horizontal Variation in K Values |          |                              | Station (m)                           |
| Edit Station Elev | Vertical Variation in n Values   |          | ,                            |                                       |
| Eak oradion 2104  |                                  |          |                              |                                       |

#### Enter the station chainage at the upstream end of the flume (for the flume the upstream end will be located at1.82m) Otherwise, if the geometry was different, you would Click – options / add a new cross section

| 🖵 Cross Section Data   |                 |
|--|-----------------|
| Exit Edit Options Plot Help  |                 |
| River: Flume Apply Data 🕞 + 📾 Plot Options 🖻 🗐 🕞 🗆 Keep Prev XS Plots Clear Prev   |                 |
| Reach:     A     Time_study     Plan:       Description     Downstream end of flume     Image: State of flume  |                 |
| Del Row     Ins Row     Downstream Reach Lengths       Cross Section X-Y Coordinates     LOB     Channel       Station     Elevation   | Legend<br>Groud |
| 1 0     100.12     Manning's n Values     Copy Cross Section       2 0     100     100     100     100   | Baik Sta        |
| 3 0.0757 100<br>4 0.0757 100.12<br>COB Criarinel NOB<br>Select a River and Reach and then enter a new river sta  | ati m.          |
| Main Channel Bank Stations     to     River:     Flume       6     Left Bank     Right Bank     D     Image: State of the st |                 |
| 7 0 0.0757 Ⅲ Reach: A TRiver Sta 1.82  |                 |
| 8 Cont\Exp Coefficients 2 OK Can   | icel            |
|  | 1000101         |
| 0.00 0.02 0.04 0.06  | 0.08            |
| Station (m)  |                 |
|  |                 |





#### Now it's time to interpolate cross sections...In the main geometry menu click on tools/XS interpolation and select between two cross-sections

|  | 🔨 Geometric Data          |   |
|--|---------------------------|---|
|  | File Edit View Tables     | Tools Help  |
| 51 HEC-RAS - River Analysis  | Within 2 Reach            | X5 Interpolation +                                      |
| File Edit Run View Op  | Between 2 X5's            | Channel Modification                                    |
|  | Junct.                    | Graphical Cross Section Edit                            |
|  |                           | Reverse Stationing Data                                 |
| Project: flume_study   | Cross                     | Cross Section Points Filter                             |
| Plan:  | Section                   | Fixed Sediment Elevations                               |
| Geometry:  | Brdg/Culv                 | Pilot Channels  |
| Steady Flow:   |                           | Ineffective Areas - Set to Permanent Mode               |
| Unsteady Flow:   |                           | Ineffective Areas - Fix Overlapping                     |
| River: Project   | Structure                 | Datum Adjustment  |
| Reach: Pescription: Pescription | Lateral                   | GI5 Cut Line Check                                      |
| Description Downstream end of flume  | Structure                 | GIS Coordinates +                                       |
| Del Bow Ins Bow Do   |                           | Plot GIS Profile Reach Bounds                           |
| Cross Section X-Y Coordinates  | Storage<br>Area           | Legend  |
| Station Elevation  |                           | Reach Connectivity Groud                                |
| 1 0 100.12   | Storage<br>Area Conn      | Reach Order for Computations                            |
| 2 0 100 LOE  | <b>b</b> → <b></b>        | Reach Order> Find Loops                                 |
| 4 0 0757 100 0.0085  | Pump                      | Flow Roughness Factors                                  |
| 5  | Station<br>P              | Seasonal Roughness Factors                              |
|  |                           | Design Cross Sections                                   |
|  | Param.                    |   |
| 9  | View                      |   |
| 10 - 0.1   | Picture                   |   |
|  |                           | 0.08  |
|  | Some schematic data outsi | ide default extents (see View/Set Schematic Plot Extent |
|  |                           |   |
|  |                           | 0.0148, 0.6379  |
|  |                           |   |

## Enter 0.1 m as the max distance between XS's, then hit the interpolate button and your geometry is complete

|   | 🗙 Geometric Data                           |       |
|---|--|-------|
|   | File Edit View Tables Tools Help           | 1     |
| Profile Table - View outp<br>File Edit Run View O | Tools River Reach Area Conn. Station Conn. |       |
|   | 5 Interpolation                            |       |
| Project: flume_study River                        | r: Flume 🗨 Upper Riv Sta: 1.82 💌 💵 🕇       |       |
| Plan: Read  | ch: A 🚽 Lower Riv Sta: 🛛                   |       |
| Geometry: Dista                                   | nce Between XS's 10,096 3 Decimal places 💌 |       |
| Steady Flow: Maxi                                 | mum Distance (m) 👻 .1 💦 🔀 Delete Interp [  |       |
| Unsteady Flow:                                    |  |       |
| Project<br>Description :                          | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1      |       |
|   |  | 1     |
|   |  |       |
|   |  |       |
|   |  |       |
|   |  |       |
|   |  |       |
|   |  |       |
|   |  |       |
|   |  |       |
|   |  |       |
|   | Close Help                                 |       |
|   | 10 m/s hatmaan 101 and 11 021              | 10.54 |
| Interp  |  | >0    |

If you continued to have different cross sectional geometry at each cross-section, you would continue to add new crosssections and enter the distances between each section.

#### Your main geometry menu should now look like this



Now is a good time to save your geometry data, remember the .g file? Name and save it in the Ras project directory you are using.



## Let's look at the profile for our model, click on the cross section data menu tab, then plot/profile

| Cross Section Data                              |  |
|---|--|
| Exit Edit Options Plot                          | Help   |
| River: Flume Plot                               | Cross Section (in separate window) 🖻 🙆 🗆 Keep Prev XS Plots Clear Prev       |
| Reach: A  | flume_study Plan:  |
| Description Upstream end of flume               | Geom: Flow:<br>Upsteam end of flume  |
| Del Row Ins Row                                 | Downstream Reach Lengths 100.14  |
| Cross Section X-Y Coordinates Station Elevation | LOB         Channel         ROB           0.096         0.096         100.12 |
| 10<br>20<br>100.12                              | Manning's n Values 12 E 100.10   |
| 3 0.0757 100<br>4 0.0757 100 12                 | 0.0085 0.0085 0.0085 G 100.08  |
| 5   | Main Channel Bank Stations 000.06  |
| 7   | 0 0.0757   |
| 8   | Cont/Exp Coefficients 100.02   |
| 10  |  |
|   |  |
| ]   | Station (m)  |

- If your plot does not look like this:
- go to "options" on the Cross section data window
- go to "scaling"
- change y axis min to 100.0
- change y axis max to 100.14
- change y axis increment to 0.02
- click O.K.
- go to "options / variables"

- click on the first two that are un checked (left main channel bank elevation

& right main channel bank elevation), click O.K.

- click "options /grid" and make sure that "thick border, major and minor tick grids" are all on.

#### Now let's put some water in this flume...



## Flow data (.f files)

- Steady (constant with time)
- Unsteady (varies with time)
- Regimes( supercritical, subcritical, mixed)
- Boundary conditions:
  - 1. Supercritical-upstream
  - 2. Subcritical-downstream
  - 3. Mixed-both

### Flow data continued

- Boundary condition types:
  - 1. Known water surface elevation
  - 2. Critical depth- free overfall or weir
  - 3. Normal depth- downstream energy slope required
  - 4. Rating curve (WSE as a function of discharge)

#### Now open the steady flow data menu



### Let's consider 3 flows 0.5,1.0, and 5 liter/s

#### Enter and apply the data

|                      | 🔆 Steady Flow Data 📃 🗖 🛛   |
|----------------------|--|
| File Edit Run V      | File Options Help  |
| RRYAN                | Enter/Edit Number of Profiles (2000 max): 3 Reach Boundary Conditions Apply Data |
|                      | Locations of Flow Data Changes   |
| Project: flume_study | River: Flume 💌   |
| Plan:                | Reach: A 🗾 👻 River Sta.: 1.82 🚽 Add A Flow Change Location                       |
| Geometry: flume      | Elew Change Legation Profile Names and Elew Pates                                |
| Steady Flow:         | River Reach RS PE 1 RE 2 RE 2  |
| Unsteady Flow:       | 1 Flume A 1.82 0.0005 0.001 0.005  |
| Project              |  |
|                      |  |
|                      |  |
|                      |  |
|                      |  |
|                      |  |
|                      |  |
|                      | Edit Steadu flow data for the profiles (m3/s)                                    |
|                      | je uk oteady now data for the profiles (movs)                                    |

Now we are going to change the profile names (from PF 1, PF2, PF3) -On the "steady flow data window"

- Chose options / edit profile names



Double click each box on the right of the window to what you see in the HEC-RAS box, and then click O.K.



Now we need to specify the boundary condition, let's assume subcritical flow and critical depth at the overfall therefore a downstream boundary condition and a H2 profile

Salaat Daaah

|  | Select Reach                     |
|--|----------------------------------|
| 🔣 HEC-RAS - River A 🌾 Steady Flow Data - flume   | Boundary                         |
| File Edit Run VI File Options Help   | conditions                       |
| Enter/Edit Number of Profiles (2000 max): 3 Reach Boundary Conditions  | from the                         |
| Project: [flume_study] Locations of Flow Data Changes  | steady flow                      |
| Plan: Hume Plane Plane Plane Plane Add A Flow Change Location  | monu                             |
| Steady Flow: flume Flow: Change Location   | menu,                            |
| Unsteady Flow: River Reach RS 0.5 1.0 5.0  | then select                      |
| Description :  | critical depth                   |
| Steady Flow Boundary Conditions  | in the                           |
| Set boundary for all profiles     Set boundary for one profile at a time   | boundary                         |
| Available External Boundary Condition Types  |                                  |
| Known W.S. Critical Bepth Normal Depth Rating Curve Delete   | conditions                       |
| Selected Boundary Condition Locations and Types  | menu                             |
| River         Reach         Profile         Upstream         Downstream           Flume         A         all         Critical Depth | Easy enough now save the         |
|  | data to your directory, this     |
|  | creates a .f file. Since this is |
|  | the first time saving the flow   |
| Steady Flow Reach-Storage Area Optimization DK Cancel Help   | data use the "SAVE FLOW          |
| Enter to accept data changes.  | DATA AS" option                  |
|  | *                                |

Your main HEC-RAS interface should show the following now

MAKE SURE THAT ALL OF YOUR FILES ARE STORED IN THE SAME DIRECTORY (what ever that directory may be) OR, THE SIMULATION WILL NOT WORK

| 🔣 HEC-RAS                | 5 - River Analysis System |             |                    |   |           |
|--------------------------|---------------------------|-------------|--------------------|---|-----------|
| File Edit                | Run View Options Help     |             |                    |   |           |
| FBX                      | ᅸᇳᅸᅸᄜᢦᆧፇᆮᄬ                |             | 🔲 💣 oss            | Hydrologic Engineering Center<br>US Army Corps of Engineers | Ini       |
| Project:                 | flume_study               | C:\HEC Data | RAS\flume_study.pr | i   |           |
| Plan:                    |                           |             |                    |   |           |
| Geometry:                | flume                     | C:\COURSES  | \CE_381\HEC_RAS    | _RUNS\tutorials\flume_s                                     | study.g01 |
| Steady Flow:             | flume_study               | C:\COURSES  | \CE_381\HEC_RAS    | _RUNS\tutorials\flume_s                                     | study.f01 |
| Unsteady Flow:           |                           |             |                    |   |           |
| Project<br>Description : |                           |             |                    | SI Units  |           |

One last step before we run the simulation, we must couple the geometry and flow with the plan (.p file)

#### On the main Hec-Ras interface select Run and steady flow analysis

| 🔣 HEC-RAS                                  | - River Analysis System                         |  |  |  |  |  |  |  |
|--|---|--|--|--|--|--|--|--|
| File Edit                                  | Run View Options Help                           |  |  |  |  |  |  |  |
| FBX  | Steady Flow Analysis<br>Unsteady Flow Analysis  | Hydrologic Engineering Center  |  |  |  |  |  |  |
| Project: [<br>Plan: [                      | Sediment Analysis<br>Hydraulia Design Functions | C:\HEC Data\RAS\flume_study.prj  |  |  |  |  |  |  |
| Geometry:                                  | Run Multiple Plans                              | C:\COURSES\CE_381\HEC_RAS_RUNS\tutorials\flume_study.g01<br>C:\COURSES\CE_381\HEC_RAS_RUNS\tutorials\flume_study.f01 |  |  |  |  |  |  |
| Unsteady Flow:<br>Project<br>Description : |   | SI Units   |  |  |  |  |  |  |

Go ahead and name the plan and save it in the working directory and give a short ID, maybe "flume", use the same name in the station identifier box

| herel             | A Steady Flow Analysis                 |                |                            |
|-------------------|--|----------------|----------------------------|
| 🔝 HEC-RAS -       | File Options Help                      |                | <b>- - ×</b>               |
| File Edit R       | New Plan                               | Short ID flume | 654K 6393                  |
| FRY               | Open Plan                              |                | Engineering Center         |
| Project:          | Save Plan                              | studu 💌        |                            |
| Di fiur           | Save Plan As 🦻                         | _study         | utoriale) flume, studu p01 |
| Plan: Inum        | Rename Plan Title                      | <u>):</u>      | utonais vnume_study.po1    |
| Geometry:  flum   | Delete Plan                            |                | utorials\flume_study.g01   |
| Steady Flow: flum |  |                | utorials\flume_study.f01   |
| Unsteady Flow:    | Exit                                   |                |                            |
| Project 👘         | ······                                 | POMPLITE       | SELInits                   |
| Description :     | L                                      |                |                            |
|                   | Enter to compute water surface profile | IS             |                            |

Now we can go ahead and save a plan with the existing geometry and flow data

Now we are ready to Run our simulation, hit the "compute" button when ready

## When the following screens are visible the simulation has been run

| 👯 HEC-R     | AS Finished Co         | mputations        |               | = = 🛛           | \varkappa Steady Flow Analy          | 515                 |       |          |
|-------------|------------------------|-------------------|---------------|-----------------|--------------------------------------|---------------------|-------|----------|
| Steady Flo  | w Simulation           |                   |               |                 | File Options Help                    | 2                   |       |          |
| River:      | Flume                  | RS:               | 1.82          |                 | Plan : flume                         | Short ID            | flume |          |
| Heach:      | A                      | Node Type:        | Cross Section |                 | Geometru File :                      | 0                   |       |          |
| Profile:    | PF 3                   |                   |               |                 |                                      | Inume               |       |          |
| Simulation  | 3/3                    |                   |               |                 | Steady Flow File :                   | flume_study         |       | <u> </u> |
| Completion. | - 575<br>- 14          |                   |               |                 | Flow Begime                          | )escription :       |       |          |
|             | n Messages             |                   |               |                 | Subcritical                          |                     |       |          |
| Steady Flo  | w Simulation Version 3 | 3.1.2 April 2004  |               |                 | C Supercritical                      |                     |       |          |
| Finished 5  | eauy riow simulation   |                   |               |                 | C Mixed                              |                     |       |          |
| Total Com   | outation Time = 0 min  | 0.41 sec          |               |                 |                                      | COMPLITE            |       |          |
|             |                        |                   |               |                 | 1000                                 |                     |       |          |
|             | HEC-RA                 | 5 - River Analysi | s System      |                 |                                      |                     |       |          |
|             | File Edit              | Run View (        | Options Help  |                 |                                      |                     |       |          |
|             |                        |                   | ₽₽₩₽₽₽        | ☞┗뿓◧◧           | Hydrologic Engine<br>US Army Corps o | eering Center       |       |          |
|             | Project:               | flume_study       |               | C:\HEC Data\RAS | i\flume_study.prj                    |                     |       |          |
|             | Plan:                  | flume             |               | C:\COURSES\CE   | _381\HEC_RAS_RUNS\tutoria            | als\flume_study.p01 |       |          |
|             | Geometry:              | flume             |               | C:\COURSES\CE   | _381\HEC_RAS_RUNS\tutoria            | als\flume_study.g01 |       |          |
|             | Steady Flow:           | flume_study       |               | C:\COURSES\CE   | _381\HEC_RAS_RUNS\tutoria            | als\flume_study.f01 |       |          |
|             | Unsteady Flow          |                   |               |                 |                                      |                     |       |          |
|             | Project                |                   |               | 4.6V            |                                      | Inite               |       |          |
|             | Description :          | 1                 |               |                 |                                      | Drinks              |       |          |

Close the computation screen and congratulations you just ran a HEC-RAS model!

## Let's look at the water surface profile generated for the 5.0 L/s flow, click on the view profiles tab on the main interface



#### A series of variables can be plotted on the profile. Lets add the critical flow depth....

Navigate to options / variables on the Profile Plot Window



Make sure that the following are checked on:

- -Left main channel bank elevations
- Right main channel bank elevations
- Filled in water surface
- Critical depth elevation



#### HEC-RAS Select Variables ✓ Water Surface Energy Grade Elevation Observed Water Surface Ice Cover Reach Labels Left levee Right levee Pilot Channel Sediment Elev Left Side Lateral Structures Right Side Lateral Structures ΰĸ Cancel

#### Click on the tables tab of the main menu interface. Select options/profiles, select all three flows and click the O.K. button. 🐯 HEC-RAS - River Analysis System File Edit Run View Options Help 🛗 💕 DSS Hydrologic Engineering Center ₹.+ (A) Å HD too fill US Army Corps of Engineers flume stud C:\COURSES\CE 381\HEC RAS\RUNS\tutorials\flume study.prj Project: C:\COURSES\CE\_381\HEC\_RAS\_AUNS\tutorials\flume\_study.p01 flume Plan: ES\CE\_381\HEC\_RAS\_RUNS\tutorials\flume\_study.g01 I Profile Output Table - Standard Table 1 ES\CE\_381\HEC\_RAS\_RUN6\tutorials\flume\_study.f01 Options Std. Tables Locations Help File HEC-R Reload Data Plans .... SI Units Profiles .... . Elev Crit W 🔺 Reach ... (m) (m) Reaches .... 100.10 A Select Profiles A Include Interpolated X5's 100.10 Selected (3) Avail Profiles A 100.10 ✓ Include Node Names in Table 1 (0.5) 2 (1.0) 3 (5.0) 1 (0.5) A 100.09 2 (1.0) ✓ Include Profile Name in Table A 100.09 3 (5.0) Table Cross Section Order A 100.09 A Standard Table # Dec Places 100.09 A 100.09 . Units System for Viewing A 100.09 -Δ 100.09 Define Table ... 4 1 Save Table .... Remove Table ... Select All Clear All OK. Cancel

The standard output of HEC RAS lists variables with several different levels of precision, which is dependent upon the particular variable. Since the flume is a very small representation of a "river reach", we need to increase the level of precision on the output to properly capture the scale of the flume.

On the "PROFILE OUTPUT TABLE", click on OPTIONS / STANDARD TABLE & DEC. PLACES.

| File     | Options     | Std. Ta   | bles Lo   | cations    | Help     |           |           |             |           |           |           |              |
|----------|-------------|-----------|-----------|------------|----------|-----------|-----------|-------------|-----------|-----------|-----------|--------------|
|          | Plans       |           |           |            |          | HE        | C-RAS Pla | n:flume Riv | er: flume | Reach: A  |           |              |
| Reach    | Profiles    | •         |           |            | S. Elev  | Crit W.S. | E.G. Elev | E.G. Slope  | Vel Chnl  | Flow Area | Top Width | Froude # Chl |
|          | Reache      | 5         |           |            | (m)      | (m)       | (m)       | (m/m)       | (m/s)     | (m2)      | (m)       |              |
| A        |             |           |           |            | - 100.02 |           | 100.03    | 0.001560    | 0.28      | 0.00      | 0.08      | 0.57         |
| A        | ✓ Include   | Interpol  | ated X5's | 5          | 100.04   |           | 100.04    | 0.001960    | 0.36      | 0.00      | 0.08      | 0.61         |
| <u>A</u> | ✓ Include   | Node Na   | mes in Ta | able       | 100.10   |           | 100.12    | 0.004212    | 0.69      | 0.01      | 0.08      | 0.71         |
| <u> </u> | ✓ Include   | Profile I | Name in T | able       | 100.00   |           | 400.00    | 0.004575    |           |           |           | 0.50         |
| <u>A</u> | Table C     | 2055 Se   | tion Ord  | er         | 100.02   |           | 100.03    | 0.001575    | 0.28      | 0.00      | 0.08      | 0.58         |
| <u>A</u> | Charles Law |           |           |            | 100.04   |           | 100.04    | 0.001970    | 0.35      | 0.00      | 0.08      | 0.51         |
| <u>A</u> | Standar     | ra lapie  | # Dec Fi  | aces       | 100.10   |           | 100.12    | 0.004205    | 0.63      | 0.01      | 0.00      | 0.71         |
| <u> </u> | Units 5     | ystem fo  | r Viewing | 9 <b>)</b> | 100.02   |           | 100.03    | 0.001615    | 0.28      | 0.00      | 0.08      | 0.59         |
| 8        | Define      | Table     |           |            | 100.02   |           | 100.03    | 0.002010    | 0.20      | 0.00      | 0.00      | 0.00         |
| A        | <i>с</i> т  |           |           |            | 100.04   |           | 100.04    | 0.004273    | 0.69      | 0.00      | 0.08      | 0.02         |
| <u> </u> | Dave 12     | IPIE      |           |            |          |           |           |             |           |           |           |              |
| A        | Remove      | : Table   | -         |            | 100.02   |           | 100.03    | 0.001657    | 0.29      | 0.00      | 0.08      | 0.59         |
| A        | 1.53263×    | 1.0       | 0.00      | 100.00     | 100.04   |           | 100.04    | 0.002054    | 0.37      | 0.00      | 0.08      | 0.63         |
| A        | 1.53263*    | 5.0       | 0.01      | 100.00     | 100.09   |           | 100.12    | 0.004344    | 0.70      | 0.01      | 0.08      | 0.73         |
|          |             |           |           |            |          |           |           |             |           |           |           |              |
| A        | 1.43684×    | 0.5       | 0.00      | 100.00     | 100.02   |           | 100.03    | 0.001702    | 0.29      | 0.00      | 0.08      | 0.60         |
| A        | 1.43684*    | 1.0       | 0.00      | 100.00     | 100.04   |           | 100.04    | 0.002099    | 0.37      | 0.00      | 0.08      | 0.64         |
| A        | 1.43684×    | 5.0       | 0.01      | 100.00     | 100.09   |           | 100.12    | 0.004419    | 0.70      | 0.01      | 0.08      | 0.73         |
|          | 1.044.05*   |           | 0.00      | 100.00     | 100.00   |           | 400.00    | 0.004.754   |           |           |           |              |
| <u>A</u> | 1.34105*    | 0.5       | 0.00      | 100.00     | 100.02   |           | 100.03    | 0.001751    | 0.29      | 0.00      | 0.08      | 0.61         |
| A        | 1.34105*    | 1.0       | 0.00      | 100.00     | 100.03   |           | 100.04    | 0.002148    | 0.38      | 0.00      | 0.08      | 0.54         |
| <u> </u> | 1.34105     | 5.0       | 0.01      | 100.00     | 100.03   |           | 100.12    | 0.004437    | 0.71      | 0.01      | 0.00      | 0.74         |
| ~        | 1.24526×    | 0.5       | 0.00      | 100.00     | 100.02   |           | 100.03    | 0.001904    | 0.29      | 0.00      | 0.08      | 0.62         |
| A        | 1.24526*    | 10        | 0.00      | 100.00     | 100.02   |           | 100.03    | 0.001004    | 0.20      | 0.00      | 0.08      | 0.65         |
| A        | 1.24526*    | 5.0       | 0.00      | 100.00     | 100.09   |           | 100.12    | 0.004581    | 0.71      | 0.00      | 0.08      | 0.75         |
|          |             |           |           |            |          |           |           |             |           |           |           |              |
| A        | 1.14947*    | 0.5       | 0.00      | 100.00     | 100.02   |           | 100.03    | 0.001863    | 0.30      | 0.00      | 0.08      | 0.63         |
| A        | 1.14947×    | 1.0       | 0.00      | 100.00     | 100.03   |           | 100.04    | 0.002258    | 0.38      | 0.00      | 0.08      | 0.66         |
| A        | 1.14947*    | 5.0       | 0.01      | 100.00     | 100.09   |           | 100.12    | 0.004669    | 0.72      | 0.01      | 0.08      | 0.76         |
|          |             |           |           |            |          |           |           |             |           |           |           |              |
| A        | 1.05368×    | 0.5       | 0.00      | 100.00     | 100.02   |           | 100.03    | 0.001928    | 0.30      | 0.00      | 0.08      | 0.64         |
| <u>A</u> | 1.05368*    | 1.0       | 0.00      | 100.00     | 100.03   |           | 100.04    | 0.002319    | 0.39      | 0.00      | 0.08      | 0.67         |
| <u>A</u> | 1.05368*    | 5.0       | 0.01      | 100.00     | 100.09   |           | 100.12    | 0.004762    | 0.73      | 0.01      | 0.08      | 0.77         |
| <u>ه</u> | 957894×     | 0.5       | 0.00      | 100.00     | 100.02   |           | 100.03    | 0.001998    | 0.30      | 0.00      | 0.08      | 0.65         |
| A        | .957894×    | 1.0       | 0.00      | 100.00     | 100.02   |           | 100.03    | 0.002384    | 0.39      | 0.00      | 0.00      | 0.03         |
| A        | .957894×    | 5.0       | 0.01      | 100.00     | 100.09   |           | 100.12    | 0.004861    | 0.73      | 0.01      | 0.08      | 0.00         |
|          |             |           | 0.01      |            | .00.00   |           | 100.12    | 5.001001    | 0.10      | 0.01      | 0.00      | 0.10         |

Change any # Dec. values less than 4 to 4 decimal places HEC-RAS Edit the number of decimal places standard tables. Variable #Dec 1 Q Total 4 2 Min Ch EL 4 W.S. Elev 4 Crit W.S. 4 5 E.G. Elev 4 6 E.G. Slope 6 7 Vel Chnl 4 8 Flow Area 4 9 Top Width 4 10 Froude # Chl 4 0K Cancel

Total flow in cross section

#### You can export the data from the Profile Output Table to any application

| E.I        | me Outpu            |          | - Otanidai |          |          |   |           |             |          |           |           |              |
|------------|---------------------|----------|------------|----------|----------|---|-----------|-------------|----------|-----------|-----------|--------------|
| гпе        | Options             | OTA. IS  | apies Lo   | Cations  | пер      |   |           |             |          |           |           |              |
| Сор        | y to Clipt          | poard (D | )ata and I | Heading  | 5)       | HEC-RAS Plan: flume River: flume Reach: A |           |             |          |           |           |              |
| Сор        | y to Clipt          | oard (D  | ata Only)  | )        | ev       | Crit W.S.                                 | E.G. Elev | E.G. Slope  | Vel Chnl | Flow Area | Top Width | Froude # Chl |
| Prin       | t                   |          |            |          |          | (m)                                       | (m)       | (m/m)       | (m/s)    | (m2)      | (m)       |              |
| W/         | e to Text           | File     |            |          | 42       |   | 100.0281  | 0.001560    | 0.2792   | 0.0018    | 0.0756    | 0.5736       |
|            | LC LU ICAL          |          |            |          | 61       |   | 100.0428  | 0.001960    | 0.3637   | 0.0027    | 0.0756    | 0.6113       |
| Exp        | ort HEC5            | Q 53 K   | ecords     | -        | 62       |   | 100.1204  | 0.004212    | 0.6894   | 0.0073    | 0.0756    | 0.7096       |
| Evit       |                     |          |            |          |          |   |           |             |          |           |           |              |
|            | _                   |          |            |          | 40       |   | 100.0280  | 0.001575    | 0.2801   | 0.0018    | 0.0759    | 0.5773       |
| A          | 1.72421*            | 1.0      | 0.0010     | 100.0000 | 100.0359 |   | 100.0426  | 0.001970    | 0.3644   | 0.0027    | 0.0759    | 0.6144       |
| A          | 1.72421*            | 5.0      | 0.0050     | 100.0000 | 100.0958 |   | 100.1200  | 0.004205    | 0.6896   | 0.0073    | 0.0759    | 0.7113       |
|            |                     |          |            |          |          |   |           |             |          |           |           |              |
| <u>A</u>   | 1.62842×            | 0.5      | 0.0005     | 100.0000 | 100.0238 |   | 100.0278  | 0.001615    | 0.2826   | 0.0018    | 0.0759    | 0.5851       |
| <u>A</u>   | 1.62842×            | 1.0      | 0.0010     | 100.0000 | 100.0356 |   | 100.0424  | 0.002010    | 0.3671   | 0.0027    | 0.0759    | 0.6214       |
| A          | 1.62842*            | 5.0      | 0.0050     | 100.0000 | 100.0951 |   | 100.1197  | 0.004273    | 0.6943   | 0.0072    | 0.0759    | 0.7186       |
| <u> </u>   |                     |          |            |          |          |   |           |             |          |           |           |              |
| A          | 1.53263*            | 0.5      | 0.0005     | 100.0000 | 100.0236 |   | 100.0277  | 0.001657    | 0.2852   | 0.0018    | 0.0759    | 0.5931       |
| A          | 1.53263*            | 1.0      | 0.0010     | 100.0000 | 100.0353 |   | 100.0423  | 0.002054    | 0.3700   | 0.0027    | 0.0759    | 0.6287       |
| A          | 1.53263*            | 5.0      | 0.0050     | 100.0000 | 100.0945 |   | 100.1194  | 0.004344    | 0.6991   | 0.0072    | 0.0759    | 0.7261       |
| <u> </u>   | 1 1000 10           |          | 0.0005     | 100.0000 | 100 0000 |   | 100 0070  | 0.001700    |          | 0.0010    | 0.0750    | 0.0010       |
| A          | 1.43684*            | 0.5      | 0.0005     | 100.0000 | 100.0233 |   | 100.0276  | 0.001702    | 0.2879   | 0.0018    | 0.0759    | 0.6016       |
| A          | 1.43684*            | 1.0      | 0.0010     | 100.0000 | 100.0350 |   | 100.0421  | 0.002099    | 0.3731   | 0.0027    | 0.0759    | 0.6365       |
| A          | 1.43684*            | 5.0      | 0.0050     | 100.0000 | 100.0938 |   | 100.1190  | 0.004419    | 0.7041   | 0.0071    | 0.0759    | 0.7339       |
|            | 1.04105*            | 0.5      | 0.0005     | 100.0000 | 100.0001 |   | 100.0074  | 0.001751    | 0 2000   | 0.0010    | 0.0750    | 0.0107       |
| A          | 1.34105*            | 1.0      | 0.0005     | 100.0000 | 100.0231 |   | 100.0274  | 0.001751    | 0.2908   | 0.0018    | 0.0759    | 0.6107       |
| A          | 1.34105*            | 5.0      | 0.0010     | 100.0000 | 100.0347 |   | 100.0419  | 0.002148    | 0.3763   | 0.0026    | 0.0759    | 0.6447       |
| A          | 1.34105"            | 5.0      | 0.0050     | 100.0000 | 100.0931 |   | 100.1187  | 0.004497    | 0.7093   | 0.0071    | 0.0759    | 0.7421       |
|            | 1.24526×            | 0.5      | 0.0005     | 100.0000 | 100 0220 |   | 100 0272  | 0.001004    | 0 2020   | 0.0017    | 0.0759    | 0.6205       |
| A          | 1.24020<br>1.24526× | 1.0      | 0.0000     | 100.0000 | 100.0223 |   | 100.0273  | 0.001604    | 0.2333   | 0.0017    | 0.0759    | 0.6203       |
| A          | 1.24020<br>1.24526× | 5.0      | 0.0010     | 100.0000 | 100.0344 |   | 100.0417  | 0.002200    | 0.3730   | 0.0020    | 0.0753    | 0.0534       |
| <u> </u>   | 1.24020             | 0.0      | 0.0000     | 100.0000 | 100.0324 |   | 100.1104  | 0.004301    | 0.7140   | 0.0070    | 0.0733    | 0.1301       |
| Δ          | 1 14947×            | 0.5      | 0.0005     | 100.0000 | 100.0226 |   | 100 0271  | 0.001863    | 0 2972   | 0.0017    | 0 0759    | 0.6312       |
| A          | 1 14947×            | 1.0      | 0.0000     | 100.0000 | 100.0220 |   | 100.0271  | 0.007258    | 0.2072   | 0.0017    | 0.0759    | 0.6628       |
| A          | 1.14947×            | 5.0      | 0.0050     | 100.0000 | 100.0917 |   | 100.1181  | 0.004669    | 0.7206   | 0.0070    | 0.0759    | 0.7597       |
|            | 1.1101              | 0.0      | 0.0000     |          | .00.0011 |   |           | 0.004000    | 0.1200   | 0.0010    | 0.0100    | 0.1001       |
| A          | 1.05368×            | 0.5      | 0.0005     | 100.0000 | 100 0223 |   | 100 0269  | 0.001928    | 0.3008   | 0.0017    | 0.0759    | 0.6427       |
| 1 <u>1</u> | 1.00000             | 1.0      | 0.0000     | 100.0000 | 100.0220 |   | 100.0200  | 0.000001020 | 0.0000   | 0.0000    | 0.0750    | 0.0427       |

#### And paste the data into excel or any other applicable application

|       | Microso      | oft Exce              | – B          | ook3           |                 |              |               |                  |                       |                  |              |              |              |             |             |           |         |               | 3 🔀 |
|-------|--------------|-----------------------|--------------|----------------|-----------------|--------------|---------------|------------------|-----------------------|------------------|--------------|--------------|--------------|-------------|-------------|-----------|---------|---------------|-----|
| 8     | <u>F</u> ıle | <u>E</u> dıt <u>\</u> | (iew         | <u>I</u> nsert | F <u>o</u> rmat | <u>T</u> ool | s <u>D</u> at | ta <u>W</u> indo | ow <u>H</u> elp       | Ado <u>b</u> e f | PDF          |              |              | Тура        | e a questio | on for he | lp 🔻    | - 6           | ×   |
| D     | 🚔 📘          | 🔒 🐔                   | 8            | 🗟 💖 🎖          | 6 🖻             | 100%         | -             | » Arı            | al                    |                  | <b>-</b> 10  | - B 2        | u≣           | = = =       | \$ %        |           | 🛛 🗕 🕭 🗸 | Α.            | , » |
| *     | ı ta ta      | i 🖉 🖬                 | xa           | 🔊 🖪 🖉          | N W Re          | eziv wit     | h Chai        | 1965 En          | d Review              |                  | <b>1</b>     |              | . <b>.</b> 1 | 3- 23- L-CE | -<br>C &    | 1         | 88 88   | <b>B</b> ()   | D.  |
|       |              |                       | 100000       |                |                 | 1.7          |               | - ,              |                       | • •              |              | •            | ▼ = ∨   □    | r or   *o   |             | ~         |         | <i>n</i> - \. |     |
| i 420 | A1           | · •                   |              | F. HEC D       |                 | o: flumoo    | Divor         | Elumo D          | ocob: A               |                  |              |              |              |             |             |           |         |               |     |
|       |              | · ·                   | 3            |                |                 | 1. liume     | F             | Flume R          | each. A               | н                |              |              | k            |             | м           | N         | 0       |               | _   |
| 1     | HEC-R        | AS Plan               | flum         | ie River F     | Flume F         | Reach: A     | L             | 1                | 0                     |                  | •            | J            | n.           | L           | 191         | IN        |         |               |     |
| 2     | Reach        | River                 | Sta          | Profile        | Q Total         | I Min        | Ch El         | W.S. Elev        | Crit W.S.             | E.G. Elev        | E.G. Slope   | Vel Chnl     | Flow Area    | Top Width   | Froude # 0  | >hl       |         |               | _   |
| 3     |              |                       |              |                | (m3/s)          | (m)          |               | (m)              | (m)                   | (m)              | (m/m)        | (m/s)        | (m2)         | (m)         |             |           |         |               | _   |
| 4     | A            |                       | 1.82         | 0.6            | 5               | 0            | 100           | 100.02           |                       | 100.03           | 0.00156      | 0.28         | 0            | 0.08        | 0.57        |           |         |               |     |
| 5     | A            |                       | 1.82         | 1              | 1               | 0            | 100           | 100.04           |                       | 100.04           | 0.00196      | 0.36         | 0            | 0.08        | 0.61        |           |         |               |     |
| 6     | A            |                       | 1.82         | 6              | 5 0             | .01          | 100           | 100.1            |                       | 100.12           | 0.004212     | 0.69         | 0.01         | 0.08        | 0.71        |           |         |               | _   |
| 17    |              | 4 70                  | 04+          |                | -               |              | 400           | 400.00           |                       | 400.00           | 0.004.575    | 0.00         |              | 0.00        | 0.50        |           |         |               | _   |
| 8     | A            | 1.72                  | 121°<br>101* | 0.5            | 3               | 0            | 100           | 100.02           |                       | 100.03           | 0.001575     | 0.28         | 0            | 0.08        | 0.58        |           |         |               | _   |
| 10    |              | 1.72                  | +21<br>101*  | F              | 5 0             | 01           | 100           | 100.04           |                       | 100.04           | 0.00197      | 06.0<br>Pa 0 | 0.01         | 0.00        | 0.01        |           |         |               | -   |
| 11    | <u> </u>     | 1.72                  | 121          |                | , ,             | .01          | 100           | 100.1            |                       | 100.12           | 0.004200     | 0.00         | 0.01         | 0.00        | 0.71        |           |         |               | -   |
| 12    | A            | 1.628                 | 342*         | 0.6            | 5               | 0            | 100           | 100.02           |                       | 100.03           | 0.001615     | 0.28         | 0            | 0.08        | 0.59        |           |         |               | _   |
| 13    | A            | 1.628                 | 342*         | 1              | 1               | 0            | 100           | 100.04           |                       | 100.04           | 0.00201      | 0.37         | 0            | 0.08        | 0.62        |           |         |               |     |
| 14    | A            | 1.628                 | 342*         | 6              | 5 0             | .01          | 100           | 100.1            |                       | 100.12           | 0.004273     | 0.69         | 0.01         | 0.08        | 0.72        |           |         |               |     |
| 15    |              |                       |              |                |                 |              |               |                  |                       |                  |              |              |              |             |             |           |         |               |     |
| 16    | A            | 1.532                 | 263*         | 0.6            | 5               | 0            | 100           | 100.02           |                       | 100.03           | 0.001657     | 0.29         | 0            | 0.08        | 0.59        |           |         |               | _   |
| 17    | A            | 1.53                  | 263*         | 1              | 1               | 0            | 100           | 100.04           |                       | 100.04           | 0.002054     | 0.37         | 0            | 0.08        | 0.63        |           |         |               | _   |
| 18    | A            | 1.53.                 | 263*         | 5              | 5 U             | .01          | 100           | 100.09           |                       | 100.12           | 0.004344     | U.7          | 0.01         | 0.08        | 0.73        |           |         |               | _   |
| 20    | Δ            | 1 /30                 | 8 <b>/</b> * | 0.4            | 5               | 0            | 100           | 100.02           |                       | 100.03           | 0.001702     | 0.29         | 0            | 0.08        | 0.6         |           |         |               | -   |
| 20    | Â            | 1.430                 | 84*          | 0.0            | 1               | 0            | 100           | 100.02           |                       | 100.03           | 0.001702     | 0.25         | 0            | 0.00        | 0.0         |           |         |               | -   |
| 22    | A            | 1.430                 |              | E              | 5 O             | .01          | 100           | 100.09           |                       | 100.04           | 0.004419     | 0.07         | 0.01         | 0.08        | 0.73        |           |         |               | -   |
| 23    |              |                       |              |                |                 |              |               |                  |                       |                  |              |              |              |             |             |           |         |               | -   |
| 24    | А            | 1.341                 | 05*          | 0.5            | 5               | 0            | 100           | 100.02           |                       | 100.03           | 0.001751     | 0.29         | 0            | 0.08        | 0.61        |           |         |               |     |
| 25    | А            | 1.341                 | 05*          | 1              | 1               | 0            | 100           | 100.03           |                       | 100.04           | 0.002148     | 0.38         | 0            | 0.08        | 0.64        |           |         |               |     |
| 26    | A            | 1.341                 | 05*          | 6              | 5 0             | .01          | 100           | 100.09           |                       | 100.12           | 0.004497     | 0.71         | 0.01         | 0.08        | 0.74        |           |         |               | _   |
| 27    |              |                       |              |                | -               |              | 400           | 400.00           |                       | 400.00           | 0.004004     |              |              |             |             |           |         |               | _   |
| 28    | A            | 1.249                 | 026*<br>Tac* | 0.6            |                 | U            | 100           | 100.02           |                       | 100.03           | 0.001804     | 0.29         | U            | 0.08        | 0.62        |           |         |               | _   |
| 29    | A            | 1.24                  | 026°<br>:06* | E              |                 | 01           | 100           | 100.03           |                       | 100.04           | 0.0022       | 0.38         | 0.01         | 0.08        | 0.55        |           |         |               | -   |
| 31    | <u>^</u>     | 1.24                  | 120          | 5              | 0 0             | .01          | 100           | 100.09           |                       | 100.12           | 0.004001     | 0.71         | 0.01         | 0.00        | 0.75        |           |         |               | -   |
| 32    | A            | 1.149                 | 947*         | 0.5            | 5               | 0            | 100           | 100.02           |                       | 100.03           | 0.001863     | 0.3          | 0            | 0.08        | 0.63        |           | C.      |               | -   |
| H ·   | (            |                       |              |                |                 |              |               |                  |                       |                  |              |              |              |             |             |           |         |               |     |
| Dr    |              | Auto                  | Shape        | 55 - 🔪         |                 | ) 🔮 🔺        | 1 🗘 🛛         | 2 🔜 💩            | - <u>/</u> - <u>A</u> | • =              | = • <i>•</i> | l .          |              |             |             |           |         |               |     |
| Rea   | dv           |                       |              |                |                 | _            |               |                  |                       |                  |              |              |              | Sum=188     | 21.08001    |           |         |               |     |
|       | -/           |                       |              |                |                 |              |               |                  |                       |                  |              |              |              | 200         |             |           |         |               |     |

This table provides water surface elevation, velocity, Froude number, area, width, energy grade line etc. Many more options are available under options/define table

| 🗰 Pro    | ofile Output Table - Standard Table | 1          |           |           |            | . 🗆 🔀    |
|----------|-------------------------------------|------------|-----------|-----------|------------|----------|
| File     | Options Std. Tables Locations       | Help       |           |           |            |          |
|          | Plans                               | Reach      | хA        |           | Reloa      | id Data  |
| Reach    | Profiles                            | S. Elev    | Crit W.S. | E.G. Elev | E.G. Slope | Ve 🔺     |
|          | Reaches                             | <u>(m)</u> | (m)       | (m)       | (m/m)      | <u> </u> |
| <u>A</u> |                                     | - 100.02   |           | 100.03    | 0.001560   |          |
| A        | ✓ Include Interpolated X5's         | 100.04     |           | 100.04    | 0.001960   |          |
| <u>A</u> | 🗸 Include Node Names in Table       | 100.10     |           | 100.12    | 0.004212   |          |
|          | ✓ Include Profile Name in Table     | 100.02     |           | 100.03    | 0.001575   |          |
| A        | Table Cross Section Order           | 100.04     |           | 100.04    | 0.001970   |          |
| A        | Standard Table # Dec Places         | 100.10     |           | 100.12    | 0.004205   |          |
|          | Units System for Viewing 🔰 🕨        |            |           |           |            | ▶        |
|          | Define Table                        |            |           |           |            |          |
|          | Save Table                          |            |           |           |            |          |
|          | Remove Table                        |            |           |           |            |          |

## Double click any parameter (in the Available Variables) to add it to your table.

| HEC-RAS                  | - River Analy:<br>Run View   | ois System<br>Options H   | elp  |  |  |   |   |  |  |  |  |  |  |
|--------------------------|--|---|--|--|--|---|---|--|--|--|--|--|--|
| <b>FB</b>                | <u>** 100 × 5</u>  | но 🖵 🏄  |  | F L L I  | ] 🎹 😰 os   | S Hydrologic En<br>US Army Corp   | gineering Center                                      |  |  |  |  |  |  |
| Project:                 | flume_study  |   |  | C:\HEC Data\   | RAS\flume_stu  | dy.prj  |   |  |  |  |  |  |  |
| Plan:                    | Create a Tabl  | e Heading   |  |  |  |   | ls\flume_study.p01                                    |  |  |  |  |  |  |
| Geometry:                | Select Variables   | Select Variables Additional Options   |  |  |  |   |   |  |  |  |  |  |  |
| Steady Flow:             |  |   | Toble Colum  | un Hoodingo  |  |   | Is\flume_study.f01                                    |  |  |  |  |  |  |
| Unsteady Flow:           | Column   | 1   | 2  | 2 S  | A  | 5   |   |  |  |  |  |  |  |
| Project<br>Description : | Variable   | Q Total   | Min Ch El  | W.S. Elev  | Crit W.S.  | E.G. Elev   | Jnits   |  |  |  |  |  |  |
| Docomption.              | Units  | (m3/s)  | (m)  | (m)  | (m)  | (m)   |   |  |  |  |  |  |  |
| -                        | Decimal Pts  | 2   | 2  | 2  | 2  | 2   |   |  |  |  |  |  |  |
|                          | Delete Col   | umn   | Insert I   | Column   | Clear All T.   | able Headings   |   |  |  |  |  |  |  |
|                          | Delete col   | <u>ann </u>   | Available  | Variables  |  | abie medalings  | and Data 1  |  |  |  |  |  |  |
|                          | Q Perc Chan<br>Q Perc L<br>Q Perc R<br>Q Pump Group<br>Q Pump Station<br>Q Right | Q Total<br>Q US<br>Q Weir<br>R. Freeboard<br>R. Levee Frbrd<br>Rght Sta Eff | ROB Elev<br>SA Area<br>SA Chan<br>SA Left<br>SA Min El<br>SA Right | SA Tot<br>SA Vol<br>Shear<br>Shear<br>Shear<br>Shear | al Spo<br>ume Spo<br>Chan Sta<br>LOB Sta<br>ROB Std<br>Total Top | c Force PR<br>ecif Force<br>W.S. Lft<br>W.S. Rgt<br>IStp Case<br>o W Act Chan | be Ve ▲<br>(r<br>30<br>30<br>2<br>75<br>70<br>05<br>▼ |  |  |  |  |  |  |
|                          |  |   |  |  | <u> </u>   | Cancel  |   |  |  |  |  |  |  |

## Now that we have selected all three flows, we can go back to the main menu and the plot profile tab to compare the three flows.

| HEC-RAS                  | 5 - River Analysis System |  |
|--------------------------|---------------------------|--|
| File Edit                | Run View Options          | ielp   |
| <b>FB</b> X              | 主命上生のマ                    | Hydrologic Engineering Center                            |
| Project:                 | flume_study               | C:\CDURSES\CE_381\HEC_RAS_RUNS\tutorials\flume_study.prj |
| Plan:                    | flume                     | C:\CDURSES\CE_381\HEC_RAS_RUNS\tutorials\flume_study.p01 |
| Geometry:                | flume                     | C:\CDURSES\CE_381\HEC_RAS_RUNS\tutorials\flume_study.g01 |
| Steady Flow:             | flume                     | C:\CDURSES\CE_381\HEC_RAS_RUNS\tutorials\flume_study.f01 |
| Unsteady Flow:           |                           |  |
| Project<br>Description : |                           | SI Units   |



## One last step let's go ahead and save the .prj or project file we have been working on.

| 🔣 HEC-RAS                | ó - River Analysis System |  |
|--------------------------|---------------------------|--|
| File Edit                | Run View Options Help     |  |
| FRX                      | ᅸᇳᅸᅸᄪᢦᄬ灣ᆮᄬ                | F L L II TO DSS Hydrologic Engineering Center            |
| Project:                 | flume_study               | C:\HEC Data\RAS\flume_study.prj                          |
| Plan:                    | flume                     | C:\COURSES\CE_381\HEC_RAS_RUNS\tutorials\flume_study.p01 |
| Geometry:                | flume                     | C:\COURSES\CE_381\HEC_RAS_RUNS\tutorials\flume_study.g01 |
| Steady Flow:             | flume_study               | C:\COURSES\CE_381\HEC_RAS_RUNS\tutorials\flume_study.f01 |
| Unsteady Flow:           |                           |  |
| Project<br>Description : |                           | SI Units   |

# Nice work, you now know how to run HEC-RAS.

When you attempt to calibrate your results to observed data, there are only three things you can vary:

- A. the Manning's n coefficient (within a reasonable range)
- B. flow range (examine the min, max and mean flow ranges that you observed)
- C. the exact location of the critical depth location

