CHAPTER 15

Stable Channel Design Functions

The channel design functions within HEC-RAS are based upon the methods available in the SAM Hydraulic Design Package for Channels (USACE, 1998), developed by the U.S. Army Corps of Engineers Waterways Experiment Station. This chapter presents the data input required for computing uniform flow parameters, stable channel dimensions, and sediment transport capacity for a given cross section.

For information on the Channel Design Functions equations and theory, please see Chapter 15 of the HEC-RAS Hydraulic Reference Manual.

Contents

General Modeling Guidelines

The Stable Channel Design Functions within HEC-RAS are meant to be used as an aid in the design of stable channels. The purpose of this application is to provide the qualitative, easy-to-use methodology of the SAM software package within the HEC-RAS framework. Specifically, the Stable Channel Design Functions will allow the user to easily compute the hydraulic parameters of a given cross section, use that information to design a stable channel with regard to its size and armoring, and determine the sediment transport capacity of that cross section.

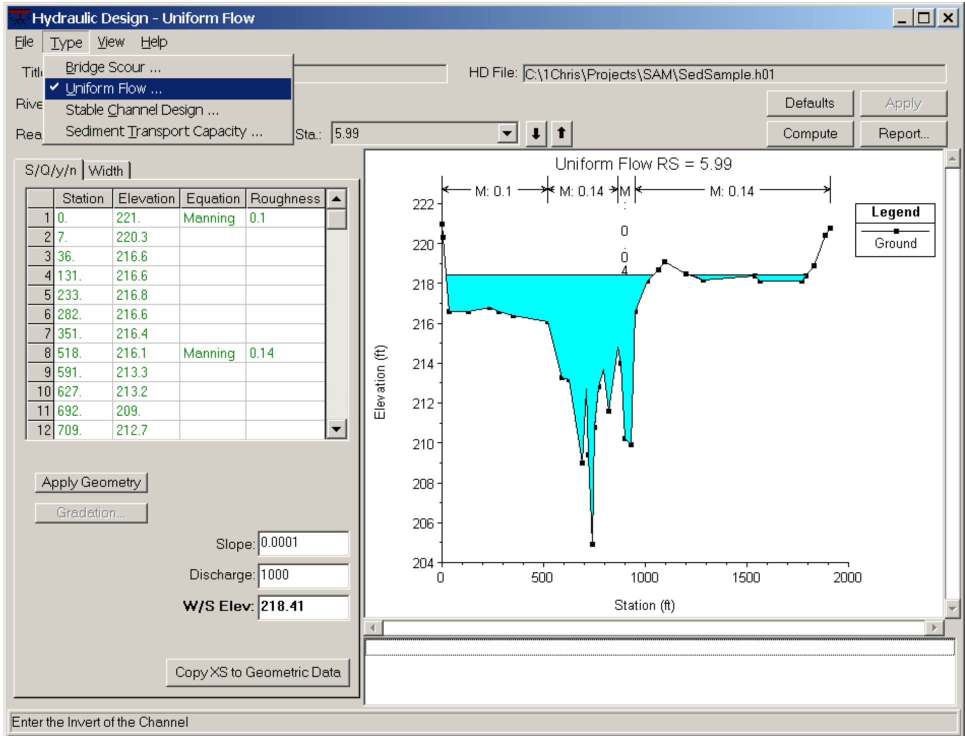
General Command Buttons

The general command buttons can be seen in the top right-hand corner of the window shown in figure 15.1. The **Defaults** button restores the current hydraulic design function's fields to the default values. The **Apply** button will store the entries on the current window into memory. These values will remain in memory until a new hydraulic design file is opened or the user exits HEC-RAS. The **Compute** button initiates the computations for whatever hydraulic design function is currently active. The **Report** button displays a printable report providing detailed hydraulic design information. Output will be displayed in the report window if the computations have been run.

Uniform Flow Computations

The uniform flow computations are performed by opening the **Hydraulic Design Functions** window and selecting the **Uniform Flow** from the **Type** menu item.. Once this option is selected the program will automatically go to the geometry file and plot a cross section with the station and elevation data entered into the table. The user can select any cross section from the available rivers and reaches. The Hydraulic Design window for uniform flow will appear as shown in Figure 15.1.

As shown in Figure 15.1, the Uniform Flow window contains the input data, a graphic, and a window for summary results. Input data tabs included are the S/Q/y/n tab and the Width tab. The S/Q/y/n tab is used for calculating the normal slope, discharge, depth, or roughness for the current cross section. The Width tab is used to calculate the bottom width for a uniform flow solution of a user-entered compound channel (with up to 3 trapezoidal templates). The station, elevation, and roughness values for both the current cross section and the user-defined cross section can easily be manipulated in the table and applied to the current geometry file. The user is required to enter only a minimal amount of input and the computations can be performed.



	Station	Elevation	Equation	Roughness
1	0.	221.	Manning	0.1
2	7.	220.3		
3	36.	216.6		
4	131.	216.6		
5	233.	216.8		
6	282.	216.6		
7	351.	216.4		
8	518.	216.1	Manning	0.14
9	591.	213.3		
10	627.	213.2		
11	692.	209.		
12	709.	212.7		

Figure 15.1 Hydraulic Design Window For Uniform Flow

Solving for Slope, Discharge, or W/S Elevation

When the S/Q/y/n tab has been selected, to calculate a slope that satisfies the uniform flow equations for the current cross section, simply enter values into the Discharge and a W/S Elev fields and press the Compute button. A value for the slope is then automatically entered into the Slope field. Likewise, for solving for discharge or water surface elevation, enter values for the other two parameters.

The roughness values are automatically taken from the geometry file, but these can be changed to better represent the bed characteristics of the cross section. In addition to changing the value of the roughness factor (in the default case, Manning's n), the function for defining roughness can be changed. To do this, click on any cell in the equation column of the table and select a function from the dropdown list. The available functions to choose from are Manning's, Keulegan, Strickler, Limerinos, Brownlie, and five grass-lined channel methods. Each of these functions is discussed in detail in Chapter 15 of the Hydraulic Reference Manual.

For the Limerinos and Brownlie functions, gradation distribution is necessary and can be entered by pressing the Gradation button. Only one gradation distribution can be used for a given cross section and should be applied only to the main channel, as these functions were developed for bed material. The Gradation window is shown in Figure 15.2. The following gradation variables are defined as the following:

d84: The sediment particle size for which 84% of the sediment mixture is finer (mm).

d50: The sediment particle size for which 50% of the sediment mixture is finer (mm).

d16: The sediment particle size for which 16% of the sediment mixture is finer (mm).

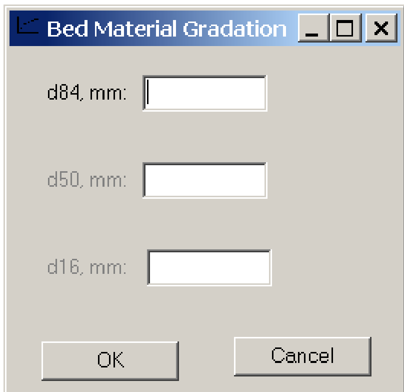


Figure 15.2 Gradation Window

The Brownlie function requires a sediment specific gravity to be entered and the Keulegan function requires a temperature to be entered. The Compute button only becomes active once all required input is entered.

To solve for a roughness value, click on and delete only one of the roughness values in the table. Only one roughness section can be solved for at a time. Make sure Slope, Discharge, and W/S Elev are specified and all other required input are entered. RAS then computes a Manning's n value to satisfy the uniform flow equation for the portion of the cross section that is desired. Then, the roughness value is back-calculated to match the selected roughness function. Only Manning, Keulegan, and Strickler functions can be used to solve for roughness, since the other functions do not have a representative roughness value to solve for.

Once one computation has been made, the value that was solved for will be shown in bold font. For subsequent computations, any of the four uniform flow parameters that is emboldened will be what is solved for to avoid having to delete out the value every time. Once a new parameter is deleted out, it will then be solved for and emboldened.

Solving for Bottom Width

Bottom width can be solved for the uniform flow equation only with a compound channel that is defined by the user. The compound channel may contain up to three trapezoidal templates, a low flow channel, the main channel, and the overbank channel. The bottom width of either the main channel or the overbank may be solved for. The addition or subtraction of width may be applied to right of centerline, left of centerline or equally to both sides.

When the bottom width tab is selected, the window shown in Figure 15.3 is displayed. To define the compound channel, enter the appropriate values into the compound channel table, which is located below the station elevation table. Data for the Overbank, Main, and Low Flow channels can be entered, however data for the low flow channel can only be applied if a main channel is also defined. The following variables are defined as follows:

SSL: The side slope of the left side of the channel. Entering a value of “0” provides a vertical slope (1Vertical : __Horizontal).

SSR: The side slope of the right side of the channel. Entering a value of “0” provides a vertical slope (1Vertical : __Horizontal).

WL: The bottom width of the left side of the channel from the centerline of the channel to the toe of the side slope (ft or m).

WR: The bottom width of the left side of the channel from the centerline of the channel to the toe of the side slope (ft or m).

Height: The height of the respective channel from its invert to the top of its side slope (ft or m).

Invert: The invert of the respective channel (ft or m).

Once the channel template data is entered, the user may plot the data by selecting Apply Geometry. When this button is selected, the channel design is shown in the plot window and entered in the station elevation table with the default roughness information. A Manning’s n value of 0.03 will be applied to each of the channel templates defined. The user may then adjust the roughness values, change the roughness functions, or add more roughness change locations within the cross section on the station elevation table. Any changes made can be reapplied to the plot by pressing Apply Geometry. See Figure 15.4. If either the Brownlie or Limerinos functions are chosen, gradation data will have to be entered.

A value for the energy slope, discharge, and water surface elevation must be entered in the appropriate fields. The user can then select how to solve for the bottom width by using the dropdown boxes in the “Compute Widths” section. Either the main channel or the overbank channel can be solved for and the width can be applied to the left side of the channel (Left of CL only), the right side of the channel (Right of CL only), or equally to both (Total).

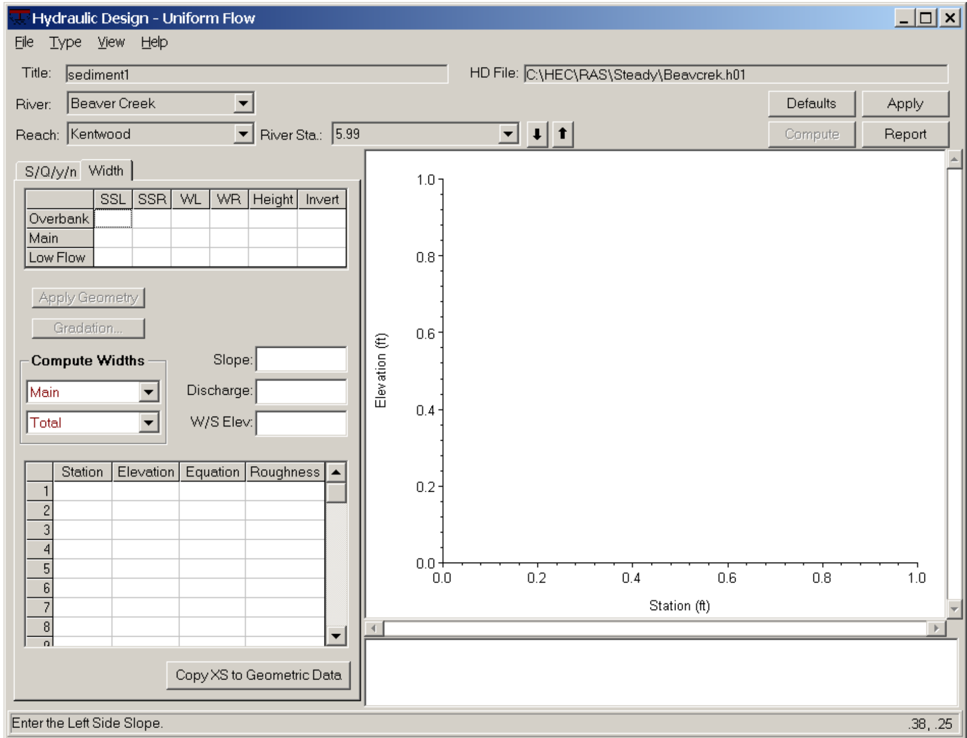


Figure 15.3 Bottom Width Calculation

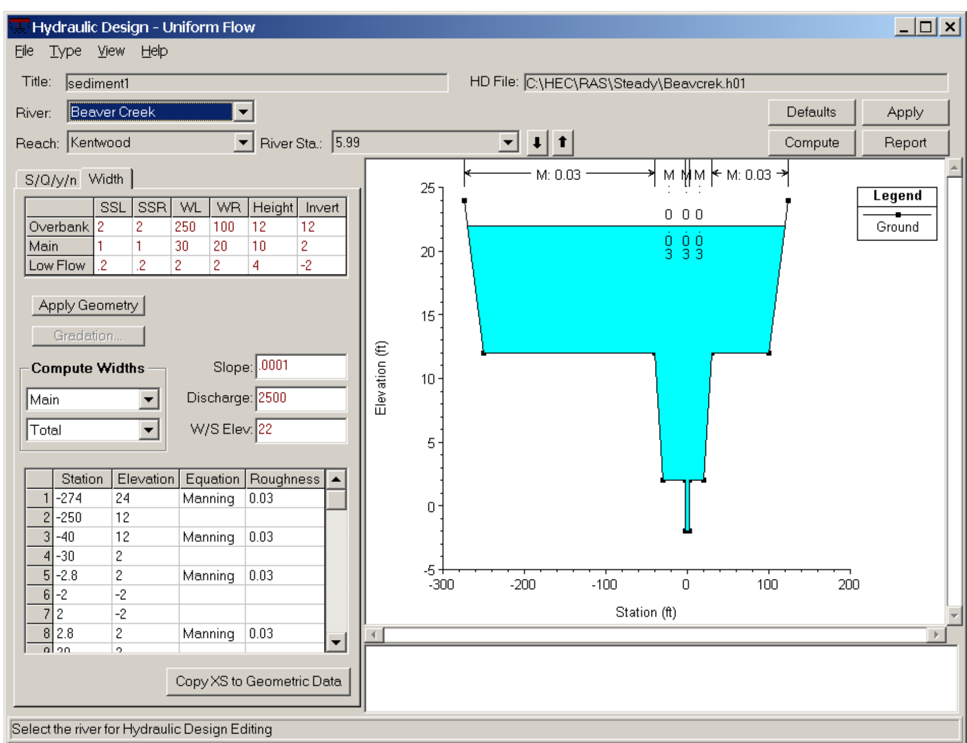


Figure 15.4 Example Bottom Width Data Entry

When all required data is entered, the Compute button will become active. The computations are constrained from creating unrealistic geometries. One example is the overbank bottom width cannot become less than the top width of the main channel. Likewise, the main channel bottom width cannot become less than the low flow channel top width. If this situation occurs within the computations, the user is notified and a course of action is suggested. However, if the top width of a lower channel becomes greater than the bottom width of the channel above it within the calculations, the program automatically increases the upper channel's bottom width to compensate.

When a solution is obtained, the new widths are updated in the compound channel table, the station elevation table and the plot.

Applying Uniform Flow Data to the Geometry File

The resulting cross section, displayed in the plot window can be added to the existing geometry data by clicking on the "Copy XS to Geometric Data" command button. The following window will appear:

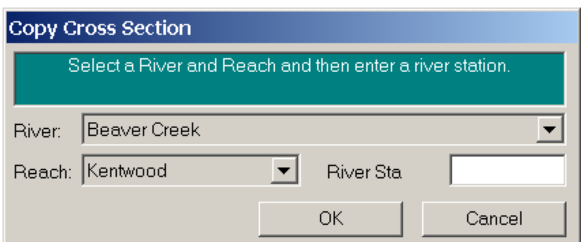


Figure 15.5 Copy Cross Section Window

Enter in the river station you want this cross section to be applied to. If the selected river station already contains a cross section, RAS will ask if you want to copy over it. If there is no cross section at the entered river station, RAS will automatically adjust the distances between the new cross section and its adjacent ones. Make sure that once the new cross section has been copied to the geometry, appropriate values for the bed elevations are reentered. This can easily be done by selecting "Adjust Elevations…" in the Option menu of the Cross Section Data window.

Saving Uniform Flow Data

To save the uniform flow data, click on File…save. This will add all pertinent data from all the HD Functions to an ascii file with the extension *.h##. The content of this file can easily be read within any word processing program.

Stable Channel Design

Stable channels can be computed using three different methods:

- Copeland
- Regime
- Tractive Force

To access the stable channel design window, click on Type…Stable Channel Design in the Hydraulic Design Window. The following window will become active:

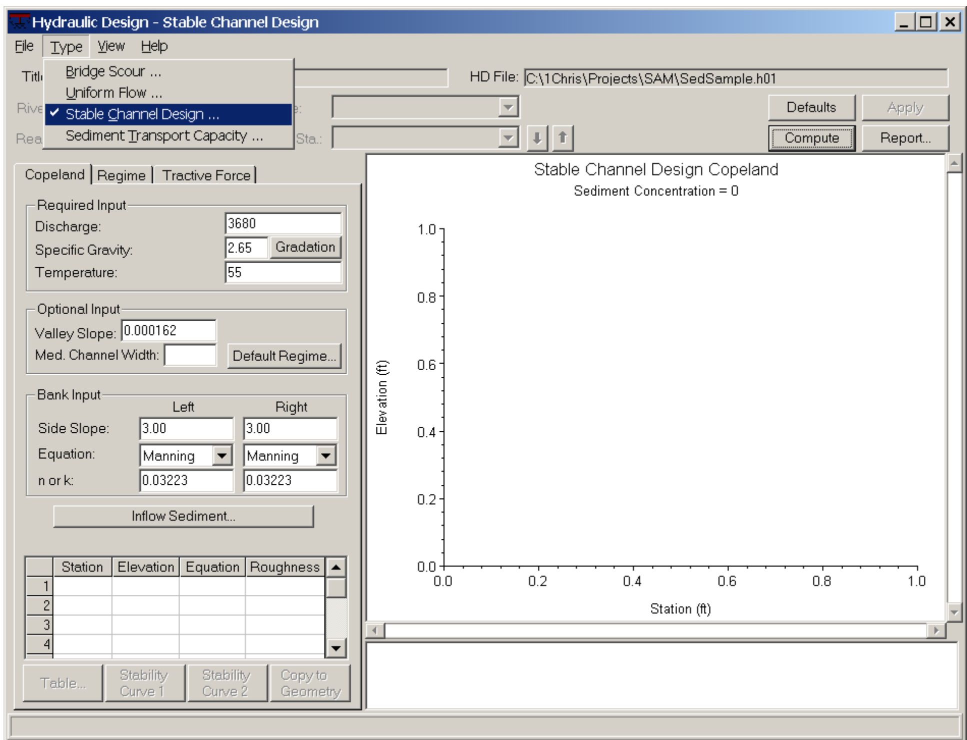


Figure 15.6 Stable Channel Design Window

Copeland Method

To use the Copeland Method, select the tab named "Copeland." There are a number of required and optional fields to enter data into for both the design section and the upstream section. To enter in data for the design section, simply add data to the fields shown.

Discharge: The design discharge. Can be the 2-year, 10-year, bankfull, etc. Must represent the channel forming discharge (cfs or m^3/s).

Specific Gravity: Self-explanatory. Default is 2.65.

Temperature: A representative temperature of the water. Default is 55 degrees F or 10 degrees C.

Valley Slope: (Optional) The maximum possible slope for the channel invert (i.e. no channel sinuosity). If the slope returned is greater than the valley slope, HEC-RAS will indicate that this is a "sediment trap."

Med. Channel Width: (Optional) Median channel width. The median width of the array of 20 bottom widths that are solved for. There will be 9 widths less than and 10 widths greater than the median channel width all at an increment of 0.1 X Med. Channel Width (ft or m). If this is left blank, the median width assigned will be equal to the regime width by the following equation: $B = 2Q^{0.5}$

Side Slope: Slope of the left and right side slopes. (1Vertical : __Horizontal).

Equation: Can choose from Mannings or Strickler to solve for the side slope roughness.

n or k: If Mannings is selected, enter a Mannings "n" value. If Strickler is selected, enter a "k" value (ft or m for k values).

Gradation of the sediment is required for Copeland method and can be entered by clicking on the Gradation command button. Values for d_{84}, d_{50}, and d_{16} must be entered.

The user has the ability to designate the default regime for the computations. The HEC-RAS default is lower regime, but this can be changed by clicking on the "Default Regime…" button and selecting "Upper Regime". Any time the computations result in a solution that is in the transitional regime, the default regime will be used and the user will be notified in the output table that this occurred. See chapter 12 of the Hydraulic Design Manual for more information.

Once all required data for the design section has been entered, click on the "Inflow Sediment…" command button to input information about the upstream section for sediment concentration computations. The window shown in figure 15.7 becomes active. The user can either enter in a value for the inflowing sediment concentration or let HEC-RAS calculate it. If HEC-RAS is to calculate the inflow sediment concentration, then the following information about the upstream section must be entered:

Supply Reach Bottom Width: Width of the bed of the supply reach (ft or m).

Supply Reach Bank Height: A representative value of the bank elevation minus the channel invert elevation of the supply section. This is only used in the computations to target a depth and does not limit the solution to this height (ft or m).

Supply Energy Slope: A representative energy slope at the supply section.

Water surface slope is typically used.

Side Slope: Slope of the left and right side slopes of the supply section. (1Vertical : __Horizontal).

Equation: Can choose from Mannings or Strickler to solve for the side slope roughness of the supply section.

n or k: If Mannings is selected, enter a Mannings "n" value. If Strickler is selected, enter a "k" value for the supply section (ft or m for k values).

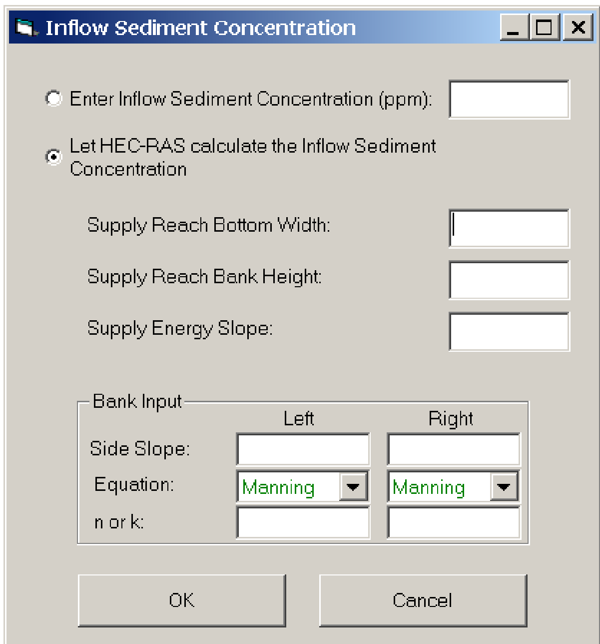
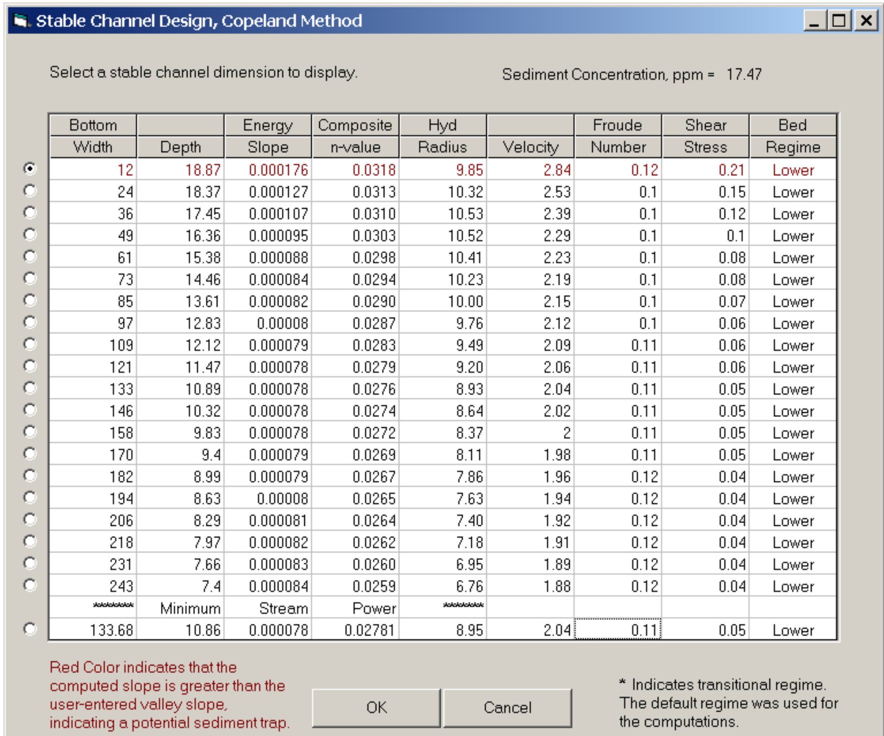


Figure 15.7 Inflow Sediment Concentration Window

Click OK to apply the input and return to the main HD Functions window. Once all of the required input has been entered, the Compute button will be activated. Click the Compute button to run the computations. When the computations are complete, the output table will be shown. The output table lists all of the channel widths solved for along with the corresponding depth, slope, composite n value, hydraulic radius, velocity, Froude number, shear stress and bed transport regime. An example is shown in figure 15.8. There will be twenty different stable channel geometries plus one for the minimum stream power. The user can select one of these geometries for display on the plot window. Once the desired section is selected, click OK and the HD Functions window will become active with the selected section plotted in the plot window.

When the computations have been run, the Table button, the two Stability Curve buttons and the Copy to Geometry button become active. The Table button simply allows the user to pull up the output table again, and select a different stable section, if desired. Clicking on the Stability Curve 1 button will bring up a plot of the stability curve showing slope versus width, indicating for what slope/width combination aggradation or degradation can be expected. Figure 15.9 shows an example.


Stable Channel Design, Copeland Method

Select a stable channel dimension to display.

Sediment Concentration, ppm = 17.47

Bottom Width	Depth	Energy Slope	Composite n-value	Hyd Radius	Velocity	Froude Number	Shear Stress	Bed Regime
12	18.87	0.000176	0.0318	9.85	2.84	0.12	0.21	Lower
24	18.37	0.000127	0.0313	10.32	2.53	0.1	0.15	Lower
36	17.45	0.000107	0.0310	10.53	2.39	0.1	0.12	Lower
49	16.36	0.000095	0.0303	10.52	2.29	0.1	0.1	Lower
61	15.38	0.000088	0.0298	10.41	2.23	0.1	0.08	Lower
73	14.46	0.000084	0.0294	10.23	2.19	0.1	0.08	Lower
85	13.61	0.000082	0.0290	10.00	2.15	0.1	0.07	Lower
97	12.83	0.00008	0.0287	9.76	2.12	0.1	0.06	Lower
109	12.12	0.000079	0.0283	9.49	2.09	0.11	0.06	Lower
121	11.47	0.000078	0.0279	9.20	2.06	0.11	0.06	Lower
133	10.89	0.000078	0.0276	8.93	2.04	0.11	0.05	Lower
146	10.32	0.000078	0.0274	8.64	2.02	0.11	0.05	Lower
158	9.83	0.000078	0.0272	8.37	2	0.11	0.05	Lower
170	9.4	0.000079	0.0269	8.11	1.98	0.11	0.05	Lower
182	8.99	0.000079	0.0267	7.86	1.96	0.12	0.04	Lower
194	8.63	0.00008	0.0265	7.63	1.94	0.12	0.04	Lower
206	8.29	0.000081	0.0264	7.40	1.92	0.12	0.04	Lower
218	7.97	0.000082	0.0262	7.18	1.91	0.12	0.04	Lower
231	7.66	0.000083	0.0260	6.95	1.89	0.12	0.04	Lower
243	7.4	0.000084	0.0259	6.76	1.88	0.12	0.04	Lower
*******	Minimum	Stream	Power	*******				
133.68	10.86	0.000078	0.02781	8.95	2.04	0.11	0.05	Lower

Red Color indicates that the computed slope is greater than the user-entered valley slope, indicating a potential sediment trap.

OK Cancel

* Indicates transitional regime. The default regime was used for the computations.

Figure 15.8 Copeland Method Output Table

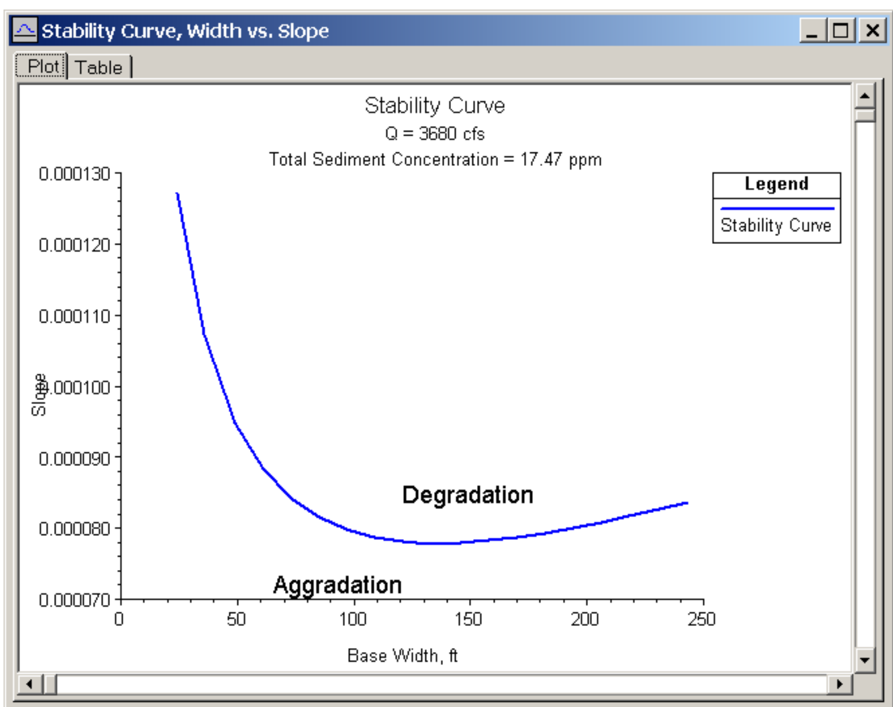


Figure 15.9 Stability Curve

Stability Curve 2 brings up a similar plot, only with slope compared to *depth*. In addition to viewing the plots, the table tab can be clicked to view the stability curves in tabular form.

As with the uniform flow computations, the section that has been plotted from the Copeland Method can be applied to the current geometry file by clicking on the Copy to Geometry button.

Regime Method

To use the Regime Method, select the tab named "Regime." The window shown in figure 15.10 becomes active.

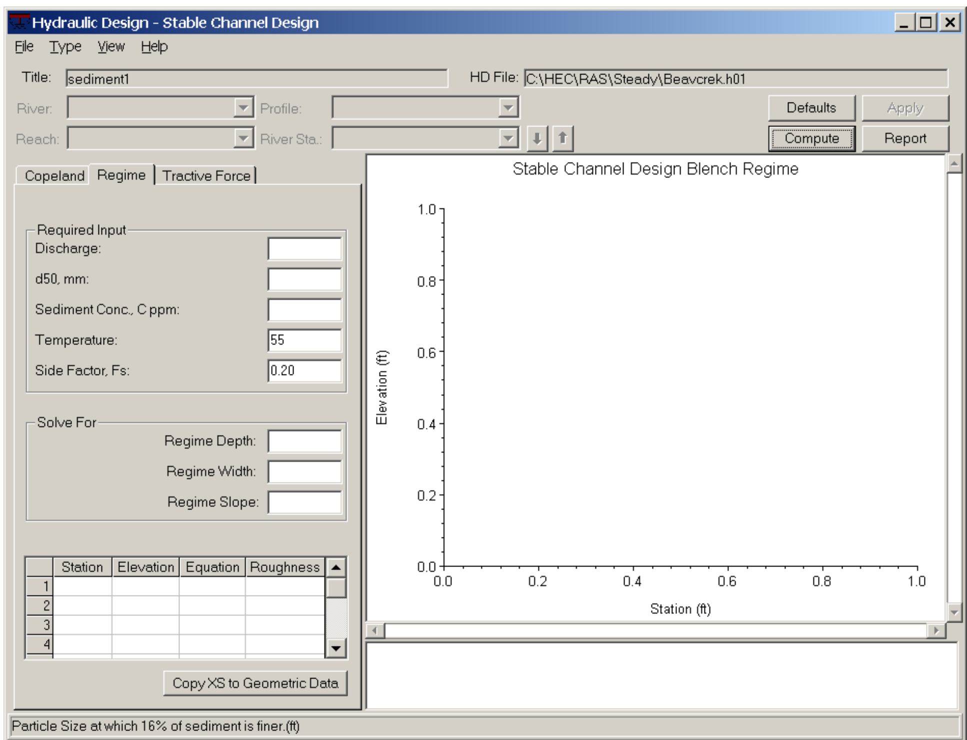


Figure 15.10 Regime Method

Enter in all required input which are:

Discharge: Channel forming discharge (cfs or m^3/s).

d50: Median particle size (mm).

Sediment Conc, C ppm: The bed material sediment concentration, in ppm.

Temperature: A representative temperature of the water. Default is 55 degrees F or 10 degrees C.

Side Factor, Fs: The side factor as defined by Blench. Blench suggests 0.1 for friable banks, 0.2 for silty, clayey, or loamy banks, or 0.3 for tough clay banks. Default value is 0.2.

Once these values are entered, the compute button becomes activated and the stable channel regime values for depth, width, and slope will be solved for and entered into the appropriate fields. In addition, the plot window will display the resulting cross section.

The displayed cross section can be added to the existing geometry file by clicking on “Copy XS to Geometric Data.”

Tractive Force Method

To use the Tractive Force Method, select the tab named “Tractive Force.” The window shown in figure 15.11 becomes active.

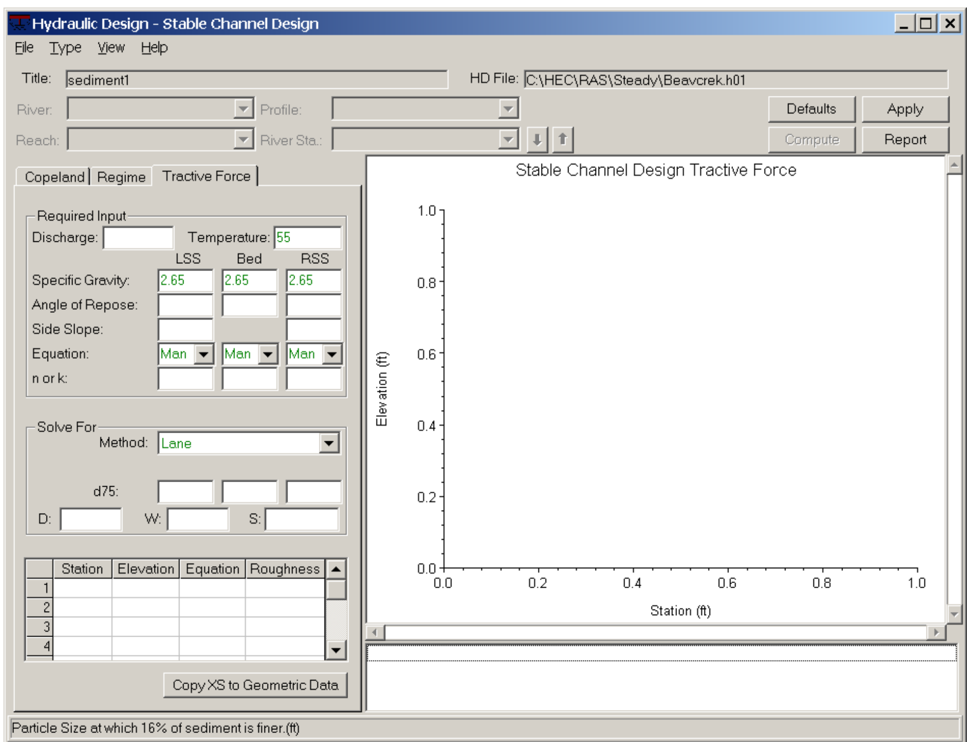


Figure 15.11 Tractive Force Method

Enter in all required input which are:

Discharge: Design discharge (cfs or m^3/s).

Temperature: Temperature of the water. Default is 55 degrees F or 10 degrees C.

Specific Gravity: Specific gravity of the sediments for the left side slope, bed, and right side slope.

Angle of Repose: The angle of repose of the sediment for the left side slope, bed, and right side slope. See figure 12-9 in the HEC-RAS Hydraulic Reference Manual for suggested values.

Side Slope: Left side slope and right side slope (1Vertical : __Horizontal).

Equation: the roughness equation for the left side slope, bed, and right side slope. Mannings and Strickler are available for use.

n or k: If Mannings is selected, enter a Mannings "n" value. If Strickler is selected, enter a "k" value for the left side slope, bed, and right side slope (ft or m for k values).

Method: Solve for critical shear using either Lane, Shields, or by entering in your own critical mobility parameter.

The remaining values are the dependant variables. Only two can be solved for at a time. The other two must be entered by the user. The three fields for particle diameter (left side slope, bed, right side slope) are considered one variable such that any one of the remaining variables plus any or all of the particle diameters can be solved for.

d50/d75: The particle diameter in which 50%/75% of the sediment is smaller, by weight. d_{50} is used for Shields and user-entered. d_{75} is used for Lane (mm).

D: The depth of the stable cross section (ft or m).

B: The bottom width of the stable cross section (ft or m).

S: The slope of the energy grade line at the stable cross section.

Once the required values plus two of the dependent variables are entered, the compute button becomes activated and the stable channel values for the remaining dependent variables will be solved for and entered into the appropriate fields. In addition, the plot window will display the resulting cross section.

The displayed cross section can be added to the existing geometry file by clicking on "Copy XS to Geometric Data."

Sediment Transport Capacity

The sediment transport capacity computations can only be run once steady or unsteady flow computations have been run. Sediment Transport Capacity for any cross section can be computed using any of the following sediment transport functions:

- Ackers-White
- Engelund-Hansen
- Laursen
- Meyer-Peter Müller
- Toffaleti
- Yang

To access the sediment transport capacity window, click on Type…Sediment Transport Capacity in the Hydraulic Design Window. The following window will become active:

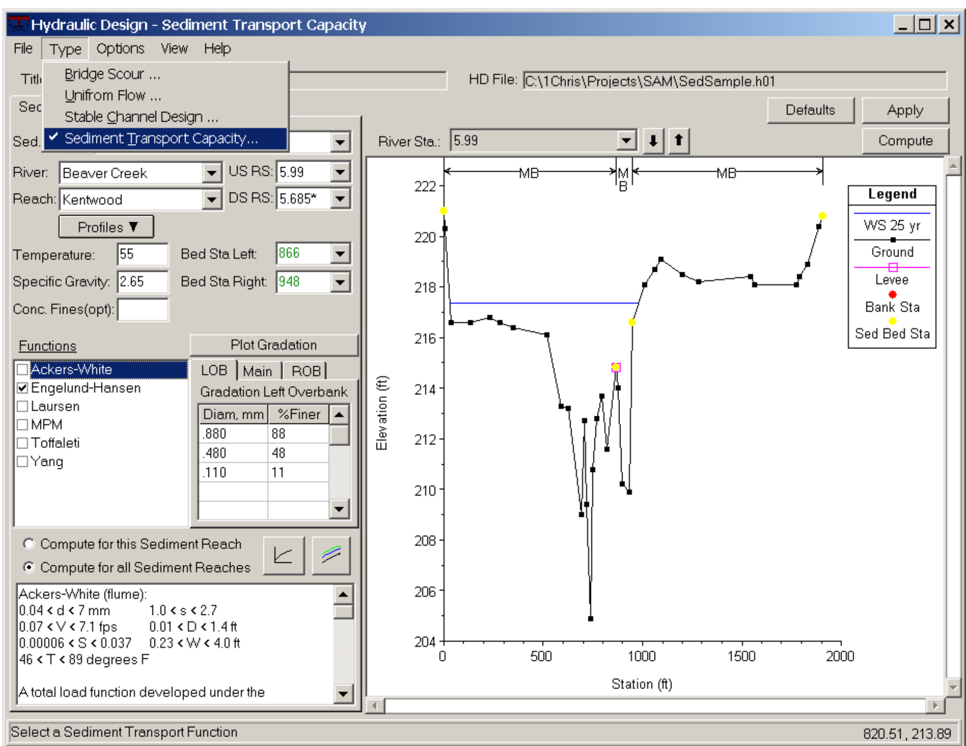


Figure 15.12 Sediment Transport Capacity Window

To perform sediment transport capacity computations, the user must define one or more sediment reaches. A sediment reach indicates for which cross sections transport rates will be computed and contains information necessary to fulfill the computations. Sediment reaches can vary spatially within the geometry, can have different input parameters such as temperature, specific gravity, and gradation, or can simply use different sediment transport functions. A sediment reach cannot span more then one river reach, however there can be multiple sediment reaches within one river reach. **Sediment reaches cannot have overlapping cross sections.**

When the sediment transport capacity window is opened, if there are not any previously defined sediment reaches defined for the current hd file, the user will be automatically prompted to name a new sediment reach. To create a new reach otherwise, click on File…New Sediment Reach. The user also has the option of copying, deleting, and renaming existing sediment reaches under the File menu option. The name selected for the new sediment reach will appear in the Sed. Reach dropdown box along with all other existing sediment reaches for the particular hydraulic design file.

Once a new sediment reach has been named, the user must define its spatial constraints by selecting the river, reach, and the bounding upstream and downstream river stations. Next, one of the existing profiles must be selected.

Sed.Reach: Indicates which sediment reach is active. This dropdown box lists all existing sediment reaches for the current hydraulic design file.

River: The river where the current sediment reach is located.

Reach: The reach where the current sediment reach is located.

US RS: The upstream bounding river station of the current sediment reach.

DS RS: The downstream bounding river station of the current sediment reach.

Profiles: The profile to be used in the sediment transport computations for the current sediment reach.

River Sta: The river station currently displayed on the plot.

Temperature: Temperature of the water. Default is 55 degrees F or 10 degrees C.

Specific Gravity: Specific gravity of the moveable sediments. Default is 2.65.

Bed Sta Left/Right: The cross section stations that separate the left overbank from the main channel from the right overbank for sediment transport capacity computations. Defaults are the main bank stations. These values can be changed for every cross section within the sediment reach. The selected stations appear on the cross section plot as yellow nodes, and are bracketed by "MB" (mobile bed) location arrows on the top of the plot.
Conc. of Fines (opt),: The concentration of fine sediments (wash load) in the current sediment reach. This is an optional value and is used to adjust the transport rate based on Colby's (Colby, 1964) findings regarding the effects

of fine sediment and temperature on kinematic viscosity, and consequently particle fall velocity. Values are given in parts sediment per one million parts water, by weight.

Functions: The user can select one or more sediment transport functions from this list box. By clicking the checkbox, a check will appear and RAS will compute for that function. When clicking on the name of the function, a brief description of the function and its applicability will appear in the text box below.

Gradation: This is entered for the left overbank (LOB), main channel (Main) and right overbank (ROB) as defined by the left and right bed stations. The user can enter nothing or up to 50 particle size/percent finer relationships. By right-clicking on one of the tabs, the grid can be expanded for easier viewing. Right-click again to return the grid to its compact display. Typically 5 to 10 gradation points are enough to represent a typical gradation curve. The particle diameter is entered in mm under the column header Diam, mm, and the percent of the representative sediment that is finer than that particle diameter is entered under the column header %Finer. RAS then takes this gradation input to determine the fraction of the sediment that is in each standard grade size class. If a zero percent value and/or a 100% value are not entered by the user, the program will assign zero percent to the next lowest grade class and 100% to the next highest grade class. See the hydraulic reference manual for more detail.

Plot Gradation: This button gives the user a graphical representation of the sediment gradation.

The user has the option to compute sediment transport capacity rates for the currently selected sediment reach (**Compute for this Sediment Reach**) or for all existing sediment reaches (**Compute for all Sediment Reaches**) within the currently opened hydraulic design file.

A text box is provided for brief descriptions of selected transport functions. In addition to a summary of the selected function, the range of input parameters, from both field and laboratory measurements, used in the development of the respective function is also provided. Where available, these ranges are taken from those found in the SAM package user's manual (Waterways Experiment Station, 1998) and are based on the developer's stated ranges when presented in their original papers. The ranges provided for Engelund and Hansen are taken from the database (Guy, et al, 1966) primarily used in that function's development.

The following variables are used in the summaries:

- d, overall particle diameter
- dm, median particle diameter
- s, sediment specific gravity
- V, average channel velocity
- D, channel depth

- S, energy gradient
- W, channel width
- T, water temperature

Defaults: The Defaults button will restore all input boxes for the currently selected sediment reach to the default values.

Apply: The Apply button will be enabled any time new input has been added which has not been stored into memory. By clicking on the Apply button, all input for the current sediment reach will be stored to memory.

Compute: The compute button will be enabled once all required input is entered. Pressing the compute button initiates the computations for sediment transport capacity.

Options Menu: The Options Menu drop down list is on the top of the Sediment Transport Capacity form and includes:

Fall Velocity: This option allows the user to select the method of fall velocity computation. If "Default" is selected, the method used in the research and development of the respective function is chosen. Otherwise, any functions used in the computations will use the selected fall velocity method. The three fall velocity methods available are: Toffaleti, Van Rijn, and Rubey.

Depth/Width: This allows the user to select which depth and width parameters to use in the solution of the transport functions. If "Default" is selected, the program will use the depth/width combination used in the research of the selected functions(s). If any of the other depth/width combinations is used, all selected functions will be solved using those specific parameters.

Eff. Depth/Eff. Width: Used in HEC 6, this is the effective depth and effective width. Effective Depth is a weighted average depth and the effective width is calculated from the effective depth to preserve $aD^{2/3}$ for the cross section:

$$EFD = \frac{\sum_{i=1}^{n} D_{avg} a_i D_{avg}^{\frac{2}{3}}}{\sum_{i=1}^{n} a_i D_{avg}^{\frac{2}{3}}} \qquad EFW = \frac{\sum_{i=1}^{n} a_i D_{avg}^{\frac{2}{3}}}{EFD^{\frac{5}{3}}}$$

Hyd. Depth/Top Width: The hydraulic depth is the area of the cross section divided by the top width.

Hyd. Radius/Top Width: The hydraulic radius is the Area divided by the wetted perimeter. Is equivalent to hydraulic depth for relatively wide, shallow streams.

Hiding Factor for Ackers-White: An optional "hiding factor" adjustment is available for the Ackers-White function only. The user can choose whether or not to use this feature. The default is "No."

Compute for Small Grains Outside Applicable Range: By default, RAS will perform calculations for grain sizes which are smaller than the applicable range of a given transport function. By selecting "No", the user can override this and have RAS compute for only the grain sizes within the applicability range of each sediment transport function, as defined in Table 12.7 in the Reference Manual.

Sediment Rating Curve Plot/Table: This button displays a plot of the sediment transport capacity rates for a selected cross section within a sediment reach. It is only enabled once computations for that reach have been performed. Display options can be selected from the dropdown buttons. Figure 15.13 shows a sediment rating curve plot. In addition to viewing the plots, the table tab can be clicked to view in tabular form.

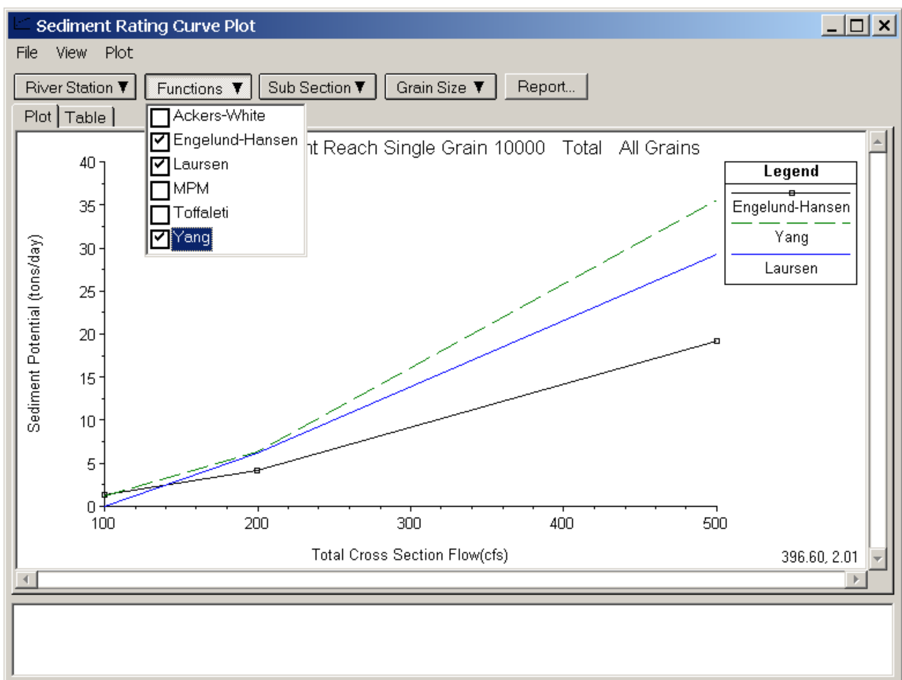


Figure 15.13 Sediment Transport Capacity Rating Curve

Sediment Transport Profile Plot/Table: This button displays a plot of the sediment transport capacity rates along a selected sediment reach. It is only enabled once computations for that reach have been performed. Display options can be selected from the dropdown buttons. Figure 15.14 shows the sediment transport profile plot. In addition to viewing the plots, the table tab can be clicked to view in tabular form.

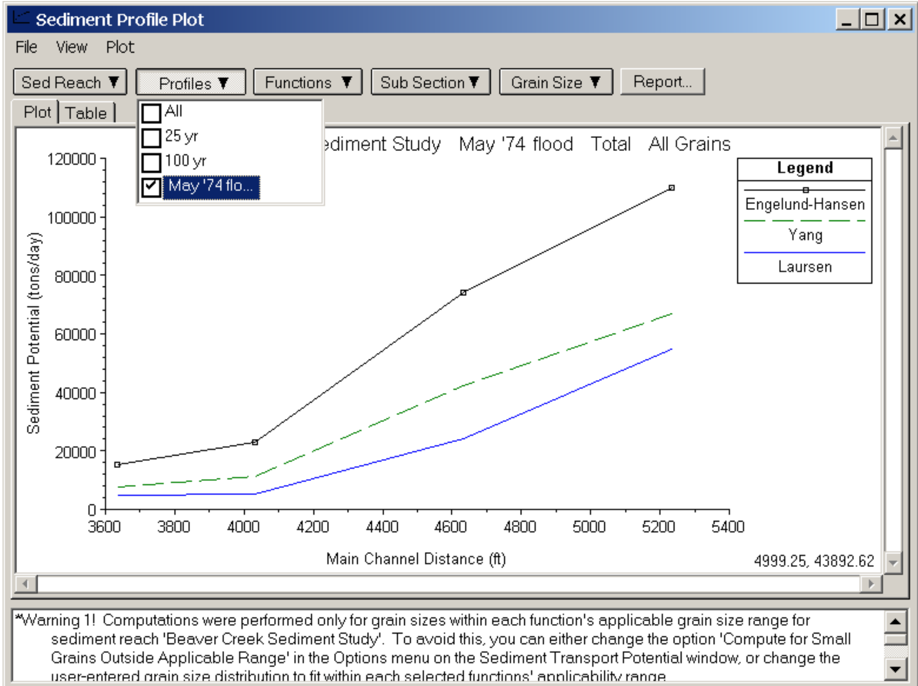


Figure 15.14 Sediment Transport Capacity Plot

Both plot windows have a list box at the bottom with warning messages. These warnings are meant to make the user aware of how sediment transport rates are being computed. If the user selects the option to compute sediment transport rates for all grade sizes within the user-specified range, a warning stating this will be shown. If the user selects the option to compute sediment transport rates for only those grade sizes within the respective function's applicability range, then a warning a different warning message will appear.

The "Compute for Small Grains Outside Applicability Range" option is located in the menu item "Options" on the Hydraulic Design window for sediment transport capacity.

Report: The Report button is located in the plot window and generates a report summarizing the input and output data. The output data is displayed as per the selections made in the dropdown buttons. Because the amount of output has the potential for being quite large, the report that is generated can likewise be very large. Figure 15.15 shows an example of the sediment transport capacity report. As with other report windows found in HEC-RAS, the user has the ability to send this report to the clipboard, print it, or save it as a text file.

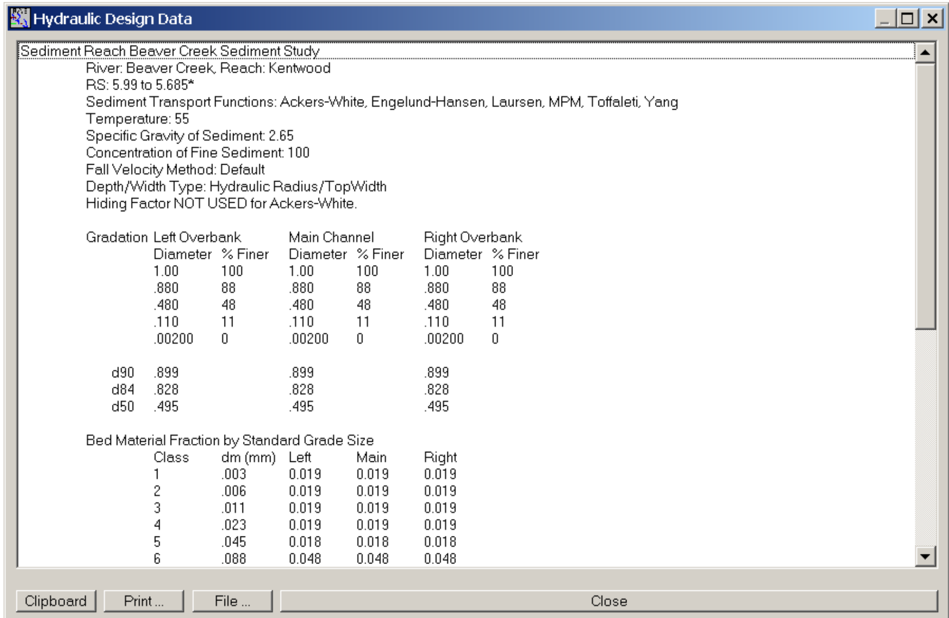


Figure 15.15 Sediment Transport Capacity Report