

# User manual for the Connecticut River UnImpacted Streamflow Estimation (CRUISE) tool – version 1.3

by Stacey A. Archfield and Peter A. Steeves

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# User manual for the Connecticut River UnImpacted Streamflow Estimation (CRUISE) tool – version 1.3

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## Using the Connecticut River UnImpacted Streamflow Estimation (CRUISE) tool

The Connecticut River UnImpacted Streamflow Estimation (CRUISE) tool is a spreadsheet template that computes the daily unimpacted streamflow for a user-selected stream location. CRUISE relies on a web-based tool named StreamStats to locate and delineate the contributing basin area to the stream location of interest. StreamStats will also compute the basin characteristics of the contributing area that are used as inputs for CRUISE and will allow downloading of the basin characteristics to a Microsoft Excel spreadsheet. Once the basin characteristics have been obtained, the CRUISE tool is used to estimate the daily flows for the selected location.

## Software requirements and files needed

CRUISE requires the use of Internet Explorer (version 8 or higher) and Microsoft Excel version 2003 or higher. Macros must be enabled to run on Microsoft Excel. The two files that are needed to run CRUISE have been included in a compressed file, which can be downloaded at

[http://webdmamrl.er.usgs.gov/s1/sarch/ctrtool/cruise\\_version1.3.zip](http://webdmamrl.er.usgs.gov/s1/sarch/ctrtool/cruise_version1.3.zip). There two files are:

- *CTRiver\_ReferenceGageInformation.xls*: This file contains information related to the reference-streamflow gages.
- *ConnecticutRiverUnimpactedFlows\_v1.2.xls*: This is the spreadsheet that is used to compute daily streamflow for a selected location.

The compressed file should be placed in any directory where the user has read and write privileges, and

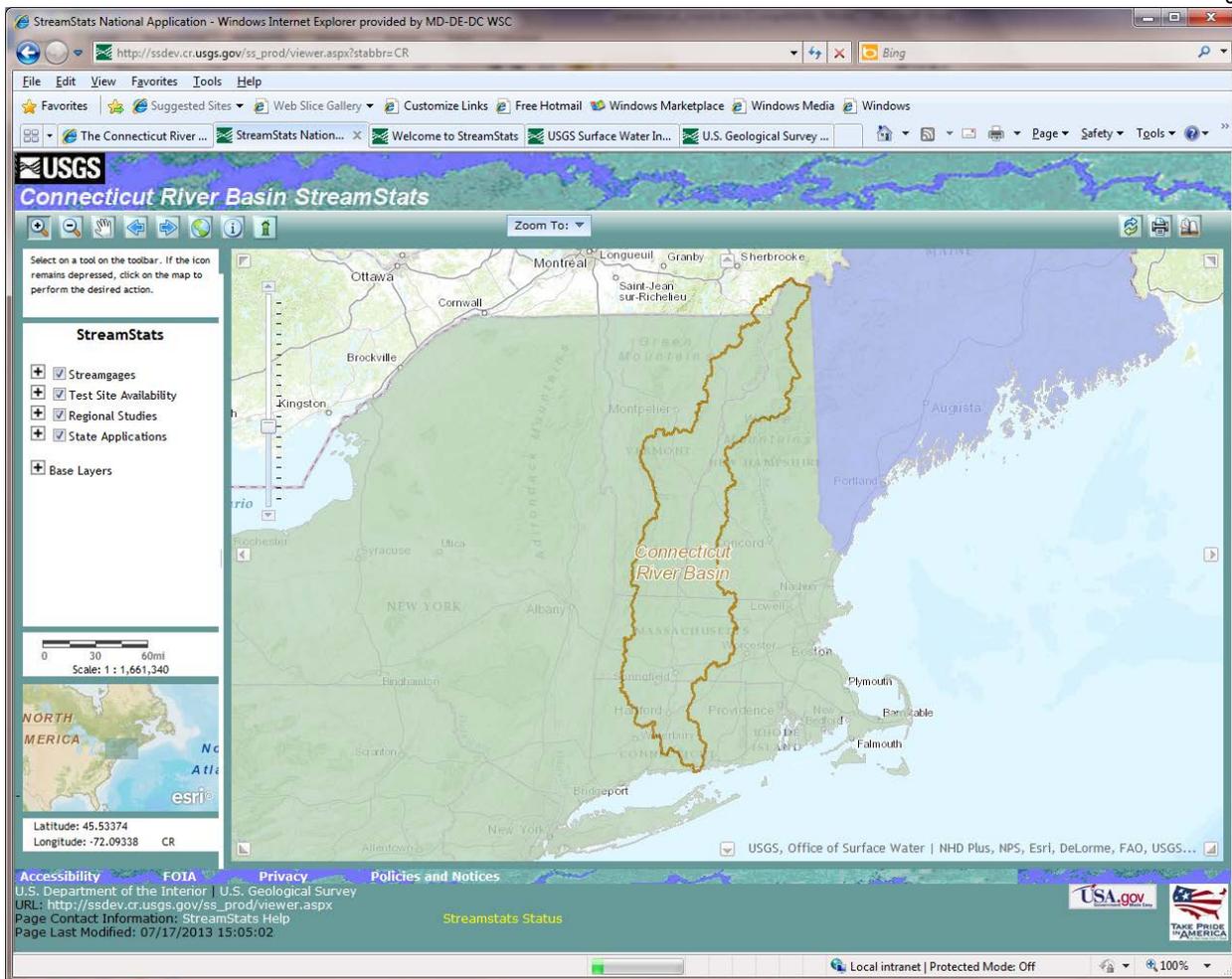
then it should be uncompressed to allow access to the files mentioned above. User access to the CTRiver\_ReferenceGageInformation.xls is not needed; however, the CRUISE program will prompt the user to specify the location of this file.

## Computing daily streamflow for an ungauged location

There is a two-step process to estimate daily streamflow for an ungauged location in the Connecticut River Basin: 1) Use of StreamStats to delineate the contributing drainage area and compute basin characteristics for the stream location of interest, and 2) Use of CRUISE to estimate daily streamflow.

### Delineating a basin and computing basin characteristics

An introductory web page for the StreamStats application for the Connecticut River Basin is at [http://water.usgs.gov/osw/streamstats/connecticut\\_rb.html](http://water.usgs.gov/osw/streamstats/connecticut_rb.html), which users should bookmark for future use. This web page briefly describes the application and it provides a link to the StreamStats user interface. Also on the introductory page are numerous links that allow access to program documentation, user instructions, and separate StreamStats applications for most states. Selecting the Interactive Map link on the introductory page will cause the user interface to appear in a separate web browser window, with the Connecticut River Basin outlined in brown (figure 1).

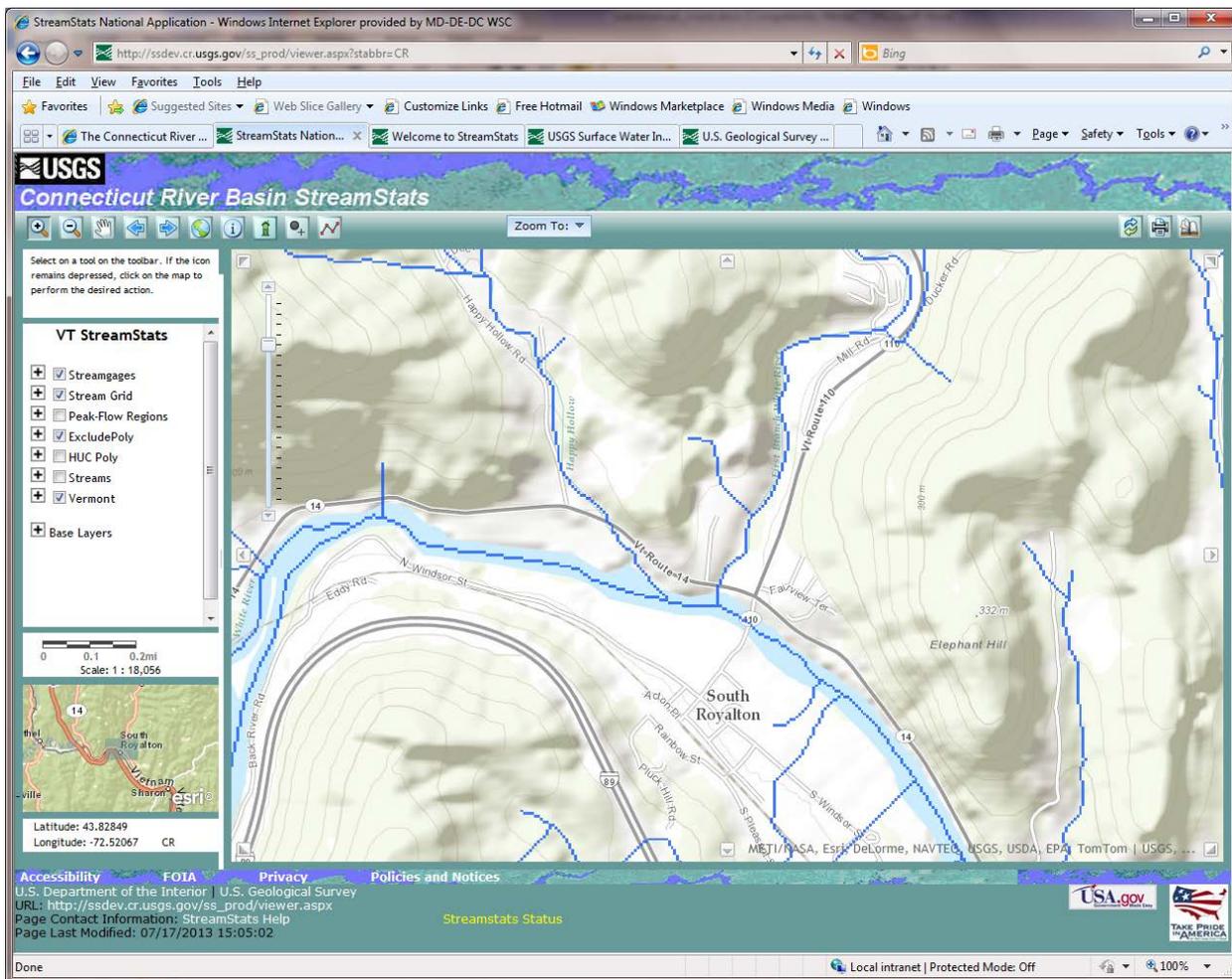


**Figure 1.** The Connecticut River Basin StreamStats application at initiation.

The process to be followed to obtain the information that is needed as input to CRUISE is as follows:

1. Use the navigation tools shown on the left side of the toolbar above the map to navigate to the stream location of interest. Placing the mouse on top of each icon without selecting it will provide more information about the functionality of each tool. Use of these tools is more fully described in the StreamStats user instructions, which can be accessed at <http://streamstats.usgs.gov/UserInstructions-20120427.pdf>. The map scale, which is indicated in the panel to the left of the map, must be at a scale of at least 1:24,000 before delineations can be obtained. At this and greater scales, the *Watershed Delineation from a Point* tool (filled circle with

a '+' sign) will appear in the toolbar above the map and a dark blue gridded representation of the streams will appear on the map (figure 2). Also, the left panel will display a list of the map layers that can be displayed on the map. Above the list will be title consisting of the 2-letter postal code for the state in which the center of the map is located (CT for Connecticut, MA for Massachusetts, NH for New Hampshire, or VT for Vermont) and 'StreamStats', as web services for the StreamStats application for that state will provide the functionality for the tools in the CRB user interface.



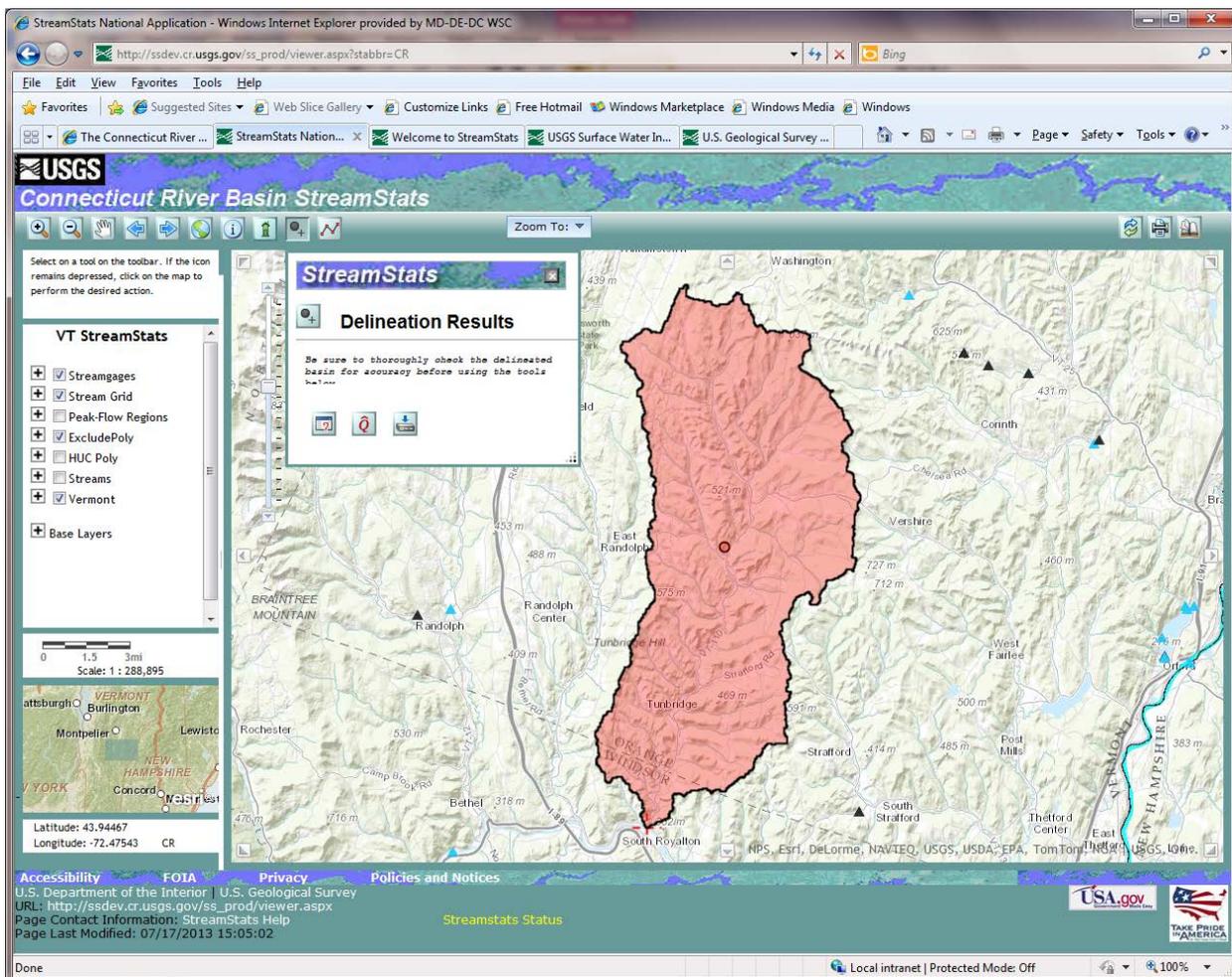
**Figure 2.** The user interface as it appears at a scale of greater than 1:24,000 (actually 1:18,056), with the *Watershed Delineation from a Point* tool shown in the toolbar and the stream grid shown on the map.

2. Select the *Watershed Delineation from a Point* tool. Immediately after selecting the tool, a small dialog box will appear over the top left of the map, entitled *Delineation Results*. Initially, the dialog

box will contain instructions to click on the map at the desired location on the stream grid to

delineate a watershed. Follow those instructions. A status bar will then appear on the screen with the work “Loading.” The basin is now being delineated for the selected stream location, which should take anywhere from 30 seconds to a minute.

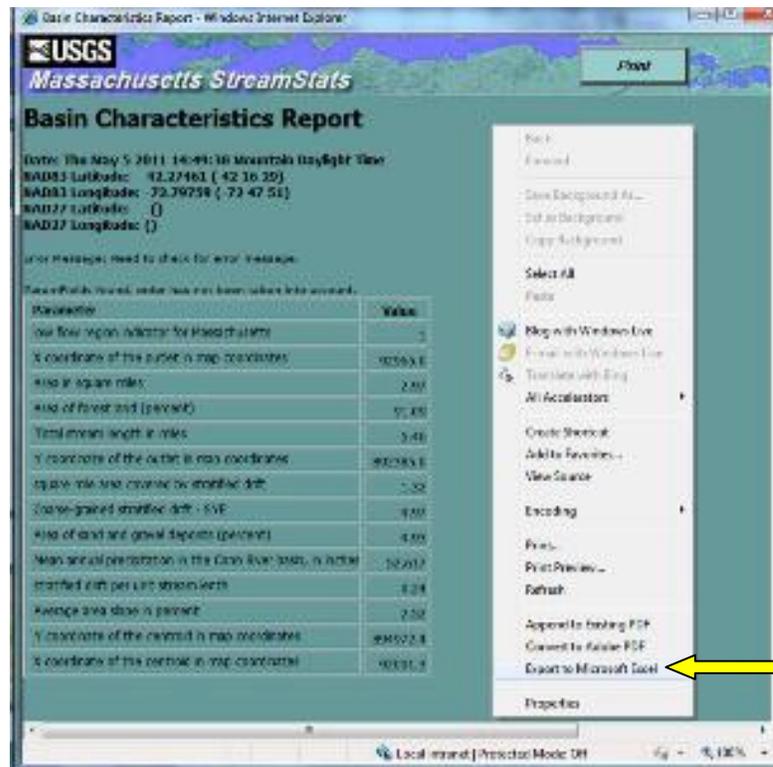
3. Once the basin has been delineated, the contributing area for the selected site will be shown as orange with a black boundary on the map, and a new set of tools will appear in the Delineation Results dialog box (figure 3). These tools can be used to compute basin characteristics, estimate flows using regression equations, and download the basin boundary and other results. Note that the Estimate Flows Using Regression Equations tool uses regression equations that have been developed separately for each state to provide estimates of specific streamflow statistics – it does not provide estimates of daily flows.



**Figure 3.** The StreamStats user interface as it appears after a watershed delineation is completed, with the Basin Characteristics, Estimate Streamflows Based on Regression Equations, and Download tool buttons appearing in the Delineation Results dialog box.

Using these new tools, you can edit the basin boundary and export the shapefile to be used in other maps you might have created for this basin.

4. Click on the Basin Characteristics tool button, which is the left button in the Delineation Results dialog box. Within about a minute, a window entitled “Basin Characteristics Report” will appear, with a summary of the basin characteristics:
5. Right-click on the Basin Characteristics Report window and select the option to ‘Export to Microsoft Excel’ (figure 4). When the next dialog box opens, select “Import” and then on the Import Data dialog box, click “OK.” You will see your characteristics now displayed in a Microsoft Excel spreadsheet. You can save this worksheet and move on to delineate more watersheds or take the next step to estimate daily streamflow for this location



**Figure 4.** An example Basin Characteristics Report window showing a list of options that appears when a user clicks in the window on the right mouse button, with 'Export to Microsoft Excel' selected.

### Estimating daily streamflow

Once the basin characteristics have been computed for the stream location of interest, daily streamflow estimation can be done using the *ConnecticutRiverUnimpactedFlows\_v1.2.xls* spreadsheet. Instructions are located on the MainMenu worksheet of the spreadsheet.

1. Open the project folder *ConnecticutRiverUnimpactedFlows\_v1.2.xls*.
2. Before beginning work with the spreadsheet, save the spreadsheet as another name so that the original version is preserved as *ConnecticutRiverUnimpactedFlows\_v1.2.xls*.
3. Specify the location of the file *CTRiver\_ReferenceGageInformation.xls* by typing the path or by using the set path button, located in cell E4 on the MainMenu worksheet.
4. Open the spreadsheet containing the saved basin characteristics from your stream location of interest.
5. Go to the worksheet titled "BasinCharacteristics" and enter the characteristics for your basin into

the sheet. The basin characteristics are in the same order as the exported web worksheet. Please note that the basin characteristics used for this tool are always the first 8 characteristics listed in the exported web worksheet.

6. When finished, click on the button 'Compute Unregulated Streamflow.' The program will compute the flow-duration curve and daily streamflow time series for the stream location of interest as well as for the reference streamgage. Streamflow is reported in units of cubic feet per second and cubic feet per second per square mile.
7. The analysis may be re-run using a new reference streamgage by going to the 'ReferenceGageSelection' worksheet, selecting another reference gage from the pull-down list, and clicking on the 'Update' button. Note that the top five most-correlated reference streamgages are shown at the bottom of the 'ReferenceGageSelection.' Estimated daily streamflows for the ungaged location and the reference streamgage are shown in the 'ContinuousDailyFlow' worksheet.