StreamStats: The Past, Present, Future, Nuts and Bolts

Part 1 - StreamStats History, Status and Plans

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What is StreamStats?

• A web-service-based application that provides information used by engineers, hydrologists, managers, planners, and others to make informed decisions on water-related activities

• Primary products are basin delineations, basin characteristics, and estimates of streamflow statistics

• Provides information for gaged and user-selected ungauged sites on streams
Beta version 4 has arrived!

Beta version 4 is now available for most states on a trial basis, and version 3 remains available. Beta version 4 provides a single user interface (at http://streamstats.usgs.gov/streamstats/) for all states that are implemented, rather than separate applications for each state, as in versions 2 and 3, and the user interface is more user friendly than previous versions. Information for user-selected ungaged sites currently cannot be obtained using beta version 4 for the States of Arkansas, Arizona, Georgia, Iowa, Indiana, Maryland, North Carolina, Oregon, South Carolina, and Tennessee because of unique functionality for those states that is not yet implemented. Users are encouraged to provide comments and report bugs by use of the Help button on the interface, which also provides access to limited beta version 4 documentation. See below for additional information about versions both 3 and 4.

Please contact the StreamStats by email at support@streamstats.freshdesk.com if you have any questions.

The StreamStats Program

StreamStats is a Web application that incorporates a Geographic Information System (GIS) to provide users with access to an assortment of analytical tools that are useful for a variety of water-resources planning and management purposes, and for engineering and design purposes. In version 3 as well as beta version 4, StreamStats users can select USGS data-collection station locations shown on a map and obtain previously published information for the stations, including descriptive information, and previously published basin characteristics and streamflow statistics. Currently, StreamStats provides additional tools that allow users to select sites on an ungaged stream where:

- obtain the drainage-basin boundary (version 3 and beta version 4),
- compute selected basin characteristics (version 3 and beta version 4),
- estimate selected streamflow statistics using regression equations (version 3 and beta version 4),
- download a shapefile of the drainage-basin boundary, as well as any computed basin characteristics and flow statistics (version 3 and beta version 4),
- edit the delineated basin boundary (beta version 4 only),
- modify the basin characteristics that are used as explanatory variables in the regression equations and get new estimates of streamflow statistics (beta version 4 only),
- print the map (beta version 4 only),
- measure distances between user-selected points on the map (beta version 4 only),
- obtain plots of the elevation profile between user-selected points on the map (beta version 4 only).

The streamflow statistics that StreamStats can provide for data-collection stations and for user-selected ungaged sites vary among the states that are implemented in StreamStats and among data-collection stations within states. Unless otherwise noted on a state's introductory page, estimates obtained for ungaged sites assume natural flow conditions at the site.

StreamStats generally is implemented separately for each state, with the needed data preparation work accomplished through cooperative agreements with states or other agencies. When states have not been implemented, it is generally because no state or other agency has been willing to enter into a cooperative agreement with the USGS to assist with funding the needed work.

StreamStats applications for individual states are accessed separately in version 3, whereas beta version 4 provides a single national user interface for all state applications. Use the State Applications link at the left to access a web page that shows where StreamStats version 3 is available and where it is being implemented. Users can select an individual state application from the map or the pull-

http://streamstats.usgs.gov
Development Team

• John Guthrie, CO, IT support/programmer
• Tana Haluska, OR, GIS specialist
• Katharine Kolb, NC, GIS specialist
• Jeremy Newson, WiM-ID, programmer
• Kernell Ries, Ofc. of Surface Water-MD, coordinator
• Martyn Smith, WiM-NY, programmer
• Peter Steeves, MA, GIS specialist
• Ryan Thompson, SD, GIS specialist
• Contractors
  ■ ESRI (GIS programming) and Respec (database programming)
Ancient History

- Desktop automated process (ONEBASIN) developed in Massachusetts in early 1990’s
- Development of web app began in 1997, released in 2001
- Used custom Java* applet, ArcView, ArcViewIMS
- Addressed the problems of:
  - Making readily available information from numerous old, out of print reports
  - Avoiding large labor costs for manually obtaining basin characteristics needed as input to regression equations for estimating streamflow statistics

* Mention of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government
Original Mass. User Interface
National Effort

• USGS Office of Surface Water began national effort in 2001 with $200K budget
• Mass. application not scalable for use nationally
• Initial national development done through CRADA between USGS and ESRI
StreamStats Version 1

- Based on ArcMap and ArcIMS
- Highly integrated with ArcHydro model and tools
- Could be configured for any state
- Added abilities to edit basin boundaries and download boundaries, basin characteristics, and flow estimates in shapefiles
- Idaho became first State available to public in Jan. 2005
Version 1 User Interface
Version 1 Design Principles

• Separate applications for each state using map projections preferred by the states
• Flexibility in scales of base data (elevation, streams, watershed boundaries) used for delineations
• States could add custom tools
• Statistics provided for streamgages must be published previously and reports must be posted online
Funding Model

• The national development team is funded by the National Streamflow Information Program, now GW and SW Information Program

• Water Science Centers are assessed annually to cover IT costs for each implemented state
  - FY16 assessment was $6,400/state

• Water Science Centers enter into cooperative agreements with other entities (usually state agencies), who provide at least half of the funding needed to implement the states
  - Average cost per state is about $300,000
StreamStats Version 2

- Based on ArcGIS Server 9.2
- New user interface with additional zoom functions
- New functionality, including stream network navigation, drainage-area ratio estimates for ungauged sites, and editing of computed basin characteristics to obtain revised regression-equation-based flow estimates
- Batch process, some web services
- Released for MA and UT during Oct. 2008
Version 2 User Interface
StreamStats Version 3

- Originally to be based on ArcGIS Server 9.3
- Began development in 2012, but restarted after release of ArcGIS Server 10.1
- Released July 2015 with additional zoom functions but without network-navigation tools from version 2
- All functionality developed as web services, which are de-coupled from user interface
- Reduced need to keep up with new ESRI releases
Version 3 User Interface
StreamStats Beta Version 4

- Began development in 2015, released in beta during March 2016
- Much different, more intuitive, single national user interface
- Restores abilities to edit and download basins, and get elevation profiles
- All functionality initially uses same web services as in version 3
- Ungaged site outputs now include maps
- Improved support utility
Beta Version 4 User Interface
StreamStats Status - July 2016

- 33 states fully implemented
- 6 states basin characteristics only
- 1 new state in testing
- 3 states in process
- Regional Studies
  - Connecticut River Basin and Delaware River Basins fully implemented
  - Rainy River Basin - basin characteristics only
Done So Far in FY16

- Released beta version 4 on March 26
- Released basin-characteristics-only applications for AK, MS, SC, WI, Delaware River Basin (water use)
- Updates of equations and/or data for GA, ME, OH (water use), OR
Plans Remaining for FY16

• Release ND and KS
• Major updates of equations and/or data to AK, AR, AZ, IA, IL, MT, NM, OK, WA
• Get network navigation working
• Start implementing StreamStats in the cloud
• Begin serving ~100 non-interpretive flow stats for ~18,500 streamgages, to be updated annually
Plans for FY17

• Improve version 4 to the point where version 3 can be retired
• Continue updating states with new regression equations and data
• Implement remaining states using NHDPlus version 2 to allow delineations and computation of limited basin characteristics
• Update published statistics for streamgages
Future Vision

• Use high-resolution NHDPlus datasets currently in development to power delineations nationally
• Compute a standard set of basin characteristics nationally, and custom BCs where needed
• Regression equations based on large basins (such as HUC4s)
• Incorporate estimation methods that consider effects of urbanization and climate change
• Work with others on new functionality, such as estimation methods for small basins and travel time