



StreamStats:

A Web Site for Stream Information

By Kernell Ries

U.S. Department of the Interior
U.S. Geological Survey
MD-DE-DC District
410-238-4317
kries@usgs.gov

Outline

- Description of need for streamflow statistics and problems with providing them
- Description of StreamStats
- Status
- Implementation Process
- Regional StreamStats activities

Examples of Streamflow Statistics

- 100-year flood
- Average annual streamflow
- Average streamflow for August
- 7-day, 10-year low flow
- 90-percent duration flow

Uses of Streamflow Statistics

- Design of structures such as roads, bridges, culverts, dams, locks, and levees
- Water resources planning and management
- Flood-plain mapping for zoning and insurance rate setting
- Instream flow determinations for pollution control and habitat protection
- Design and permitting of facilities such as wastewater-treatment plants, hydropower plants, and water-supply reservoirs

Statistics for Gaged Sites

- Computed from streamflow records using standard methods
- Problems:
 - ☞ Statistics in old reports are sometimes difficult to obtain
 - ☞ USGS labor cost for information requests is high
 - ☞ Not possible to operate gaging stations everywhere streamflow statistics are needed

Estimates for Ungaged Sites

- Streamflow Statistics are estimated from regression equations that relate flows to basin characteristics.
- Examples of basin characteristics: Basin area, slope, shape, climate, vegetation cover, degree of urbanization, geology, . . .
- Usually developed on a State-by-State basis through the cooperative program

Example Regression Equation

- Regression equations take the form:

$$Q_{100} = 0.471A^{0.715}E^{0.827}SH^{0.472}$$

- where:

Q_{100} is the 100-year flood flow, cubic feet
per second

A is drainage area, in square miles

E is mean basin elevation, in feet

SH is a shape factor, dimensionless

Problems with Regression Approach

- Reports with equations can be difficult to identify and obtain
- Delineating basin boundaries and computing basin characteristics:
 - ☞ Is difficult,
 - ☞ Demands high-level skills,
 - ☞ Is very time consuming
 - ☞ Is error-prone
- Manual method can take several hours or more
- GIS methods require substantial investments of time, money, and data development
- Equations are often not used because of large efforts needed to determine basin characteristics

StreamStats Web Application

- Provides estimates of streamflow statistics, basin and climatic characteristics, and other information for user-selected points on ungaged streams
- Automatically measures basin and climatic characteristics for ungaged sites using GIS
- Provides published streamflow statistics, basin and climatic characteristics, and other information for data-collection stations

StreamStats Web Page

■ <http://streamstats.usgs.gov>

☞ Under construction

☞ Description of application

☞ Links to state applications

☞ Links to documentation

Welcome to StreamStats - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media Print Mail

Address <http://streamstats.usgs.gov/html/index.html> Go

USGS
science for a changing world

USGS Home
Contact USGS
Search USGS

Welcome to StreamStats

Home

- [StreamStats Description](#)
- [StreamStats Limitations](#)
- [State Applications](#)
- [User Instructions](#)
- [Definitions](#)
- [StreamStats Fact Sheet](#)
- [Frequently Asked Questions](#)
- [Contact StreamStats Team](#)

StreamStats is a Web-based tool that allows users to obtain streamflow statistics, drainage-basin characteristics, and other information for user-selected sites on streams. StreamStats users can choose locations of interest from an interactive map and obtain information for these locations. If a user selects the location of a U.S. Geological Survey (USGS) data-collection station, the user will get previously published information for the station from a database. If a user selects a location where no data are available (an unengaged site), a Geographic Information System (GIS) program will estimate information for the site. The GIS program determines the boundary of the drainage basin above the site, measures the physical characteristics of the drainage basin, and solves the appropriate regression equations to estimate streamflow statistics for the site. The results are presented in a table and a map showing the basin outline. The estimates assume natural flow conditions at the site. In the past, it could take an experienced person more than a day to estimate this information for an unengaged site. StreamStats reduces the effort to only a few minutes.

Some StreamStats options will not work in Netscape. The application continues to be improved and expanded. Please continue to come back to this page to see future enhancements. [Contact us](#) if you have any questions.

Users should familiarize themselves with StreamStats Description, Instructions, and Limitations (using the links on the left) before utilizing the application.

The StreamStats Web application provides access to automated procedures and very large, complex data sets. These data sets are known to contain occasional errors. Users are hereby advised to carefully check all results for accuracy and to exercise their own professional judgment in evaluating the appropriateness of the results for their application. Basin delineations in particular frequently have been found to be erroneous. The Web site provides tools and base maps useful for verifying the accuracy of the basin delineations.

The U.S. Geological Survey expressly disclaims responsibility for damages or liability that may arise from use of these data.

Accessibility FOIA Privacy Policies and Notices
U.S. Department of the Interior | U.S. Geological Survey
URL: www.streamstats.usgs.gov
Page Contact Information: GS-W_Streamstats@usgs.gov
Page Last Modified: 5/4/05

FIRST GOV
TAKE PRIDE IN AMERICA

User Interface at Startup

USGS StreamStats - Microsoft Internet Explorer

USGS

Idaho StreamStats

ZoomIn ZoomOut Pan GetInfo FullExtent LastExtent Basin Delimited EditBasin FlowStats BasinChar ClearBasin Download NWIS Print Help

Scale

Zoom To: water GO

Enter Water Resource

Map Layers Locator Map

BASE LAYERS

- Shaded_Relief
- 24K QUAD Boundaries
- Major Highways
 - Interstate
 - State Highway
 - US Highway

WATER

- Water Bodies
- Rivers
- HUCs

USGS Scale 1:6524373

U.S. Department of the Interior, U.S. Geological Survey
Contact: [Jacque Coles](#)
[Accessibility](#) | [Disclaimer](#) | [Privacy](#)

Metadata
[Return to Home Page](#)

Ungaged Site Process

1. User selects point on stream network
2. Point is transferred to a cell in a flow-direction grid derived from a DEM
 - ☛ DEM usually is preprocessed to conform to mapped streams and previously determined drainage boundaries
3. GIS determines drainage boundary and presents it for review in map frame
4. Boundary can be edited if errors are found
5. GIS computes drainage area and other basin characteristics
6. Basin characteristics are inserted into regression equations to compute flow estimates
7. Flow estimates appear in pop-up window with error estimates

Ungaged Site Selection

USGS StreamStats - Microsoft Internet Explorer

USGS

Idaho StreamStats

ZoomIn ZoomOut Pan GetInfo FullExtent LastExtent BasinDelineation EditBasin FlowStats BasinChar ClearBasin Download NWIS Print Help

Scale

Zoom To: water GO

Enter Water Resource

Map Layers Locator Map

- BASE LAYERS
 - Gray_Relief
 - 24K_DRG
 - 24K QUAD Boundaries
 - Roads
 - Interstates
 - Highways
 - Secondary Roads
 - Highways
- WATER
 - HUCs
 - Unavailable Area

Refresh Map Reset Layers

Orofino (BM 1020)

Radio Tower (KLER)

Reservoir

Mile 45

Gaging Station

Scale 1:10957

USGS

U.S. Department of the Interior, U.S. Geological Survey
Contact: [Jacque Coles](#)
[Accessibility](#) | [Disclaimer](#) | [Privacy](#)

Metadata
[Return to Home Page](#)

Basinwide View of Boundary

The screenshot displays the USGS StreamStats web application interface. At the top, the browser title is "USGS StreamStats - Microsoft Internet Explorer". The application header includes the USGS logo and the text "Idaho StreamStats". A toolbar contains various navigation and analysis tools: ZoomIn, ZoomOut, Pan, GetInfo, FullExtent, LastExtent, Basin Delineation, EditBasin, FlowStats, BasinChar, ClearBasin, Download, NWIS, Print, and Help. The main map area shows a topographic view of a river basin with a green-shaded boundary. The basin is labeled "CLEARWATER". Surrounding areas are labeled "LEWIS" and "IDAHO". A scale bar indicates a scale of 1:295028. On the right side, there is a "Map Layers" panel with two tabs: "Map Layers" and "Locator Map". Under "Map Layers", there are two sections: "BASE LAYERS" and "WATER". The "BASE LAYERS" section includes checkboxes for Gray_Relief, Shaded_Relief, NLCD, 24K QUAD Boundaries, and Highways. The "WATER" section includes checkboxes for HUCs and Unavailable Area. Below the map, there are buttons for "Refresh Map" and "Reset Layers". At the bottom of the page, there is a footer with the text "U.S. Department of the Interior, U.S. Geological Survey", "Contact: [Jacque Coles](#)", "Accessibility | [Disclaimer](#) | [Privacy](#)", "Metadata", and "Return to Home Page".



Zoom In to Check Boundary

USGS StreamStats - Microsoft Internet Explorer

USGS

Idaho StreamStats

ZoomIn ZoomOut Pan GetInfo FullExtent LastExtent Basin Delimitation EditBasin FlowStats BasinChar ClearBasin Download NWIS Print Help

Scale

Zoom To: water GO

Enter Water Resource

Map Layers Locator Map

BASE LAYERS

- Gray_Relief
- 100K_DRG
- 24K QUAD Boundaries
- Highways
 - Interstates
 - Highways
 - Secondary Roads

WATER

- HUCs
- Unavailable Area
- Undefined Area

USGS Scale 1:52133

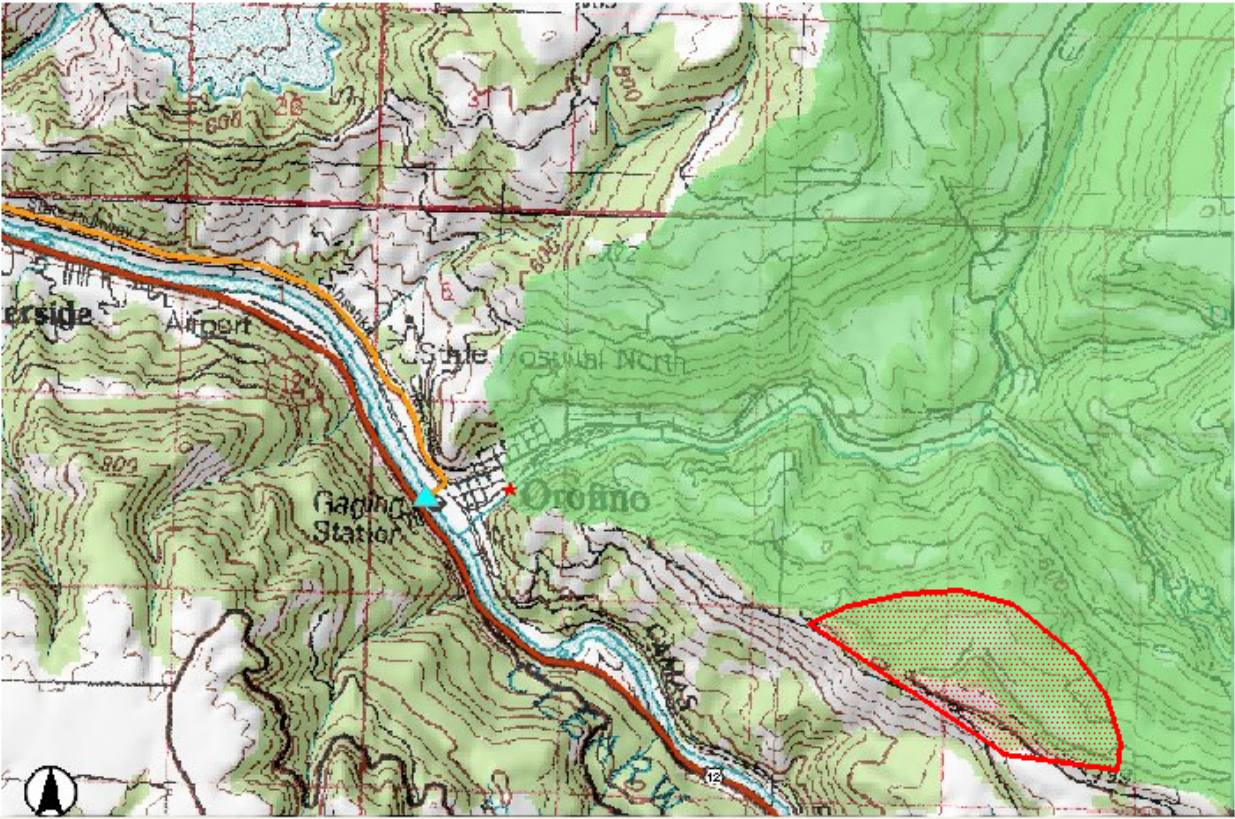
U.S. Department of the Interior, U.S. Geological Survey
Contact: [Jacque Coles](#)
[Accessibility](#) | [Disclaimer](#) | [Privacy](#)

Metadata
[Return to Home Page](#)

Edit Boundary

USGS StreamStats - Microsoft Internet Explorer

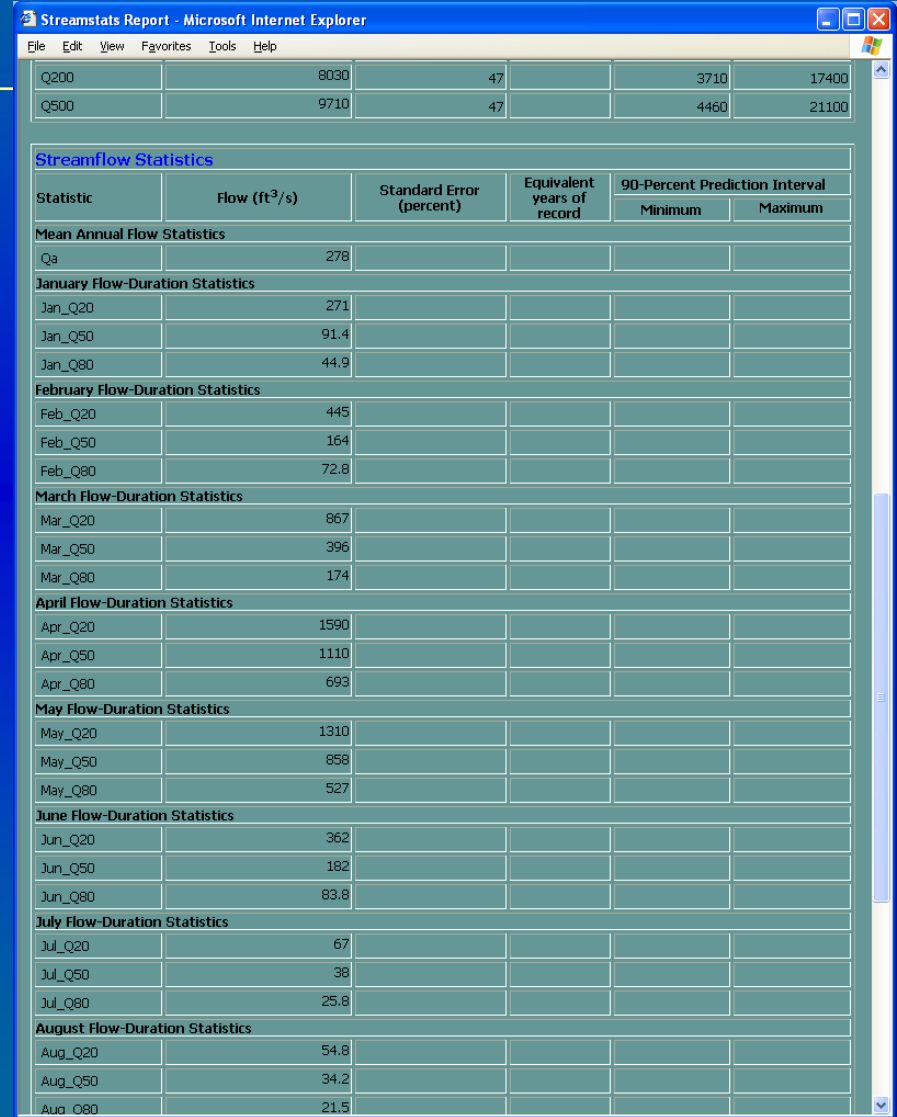
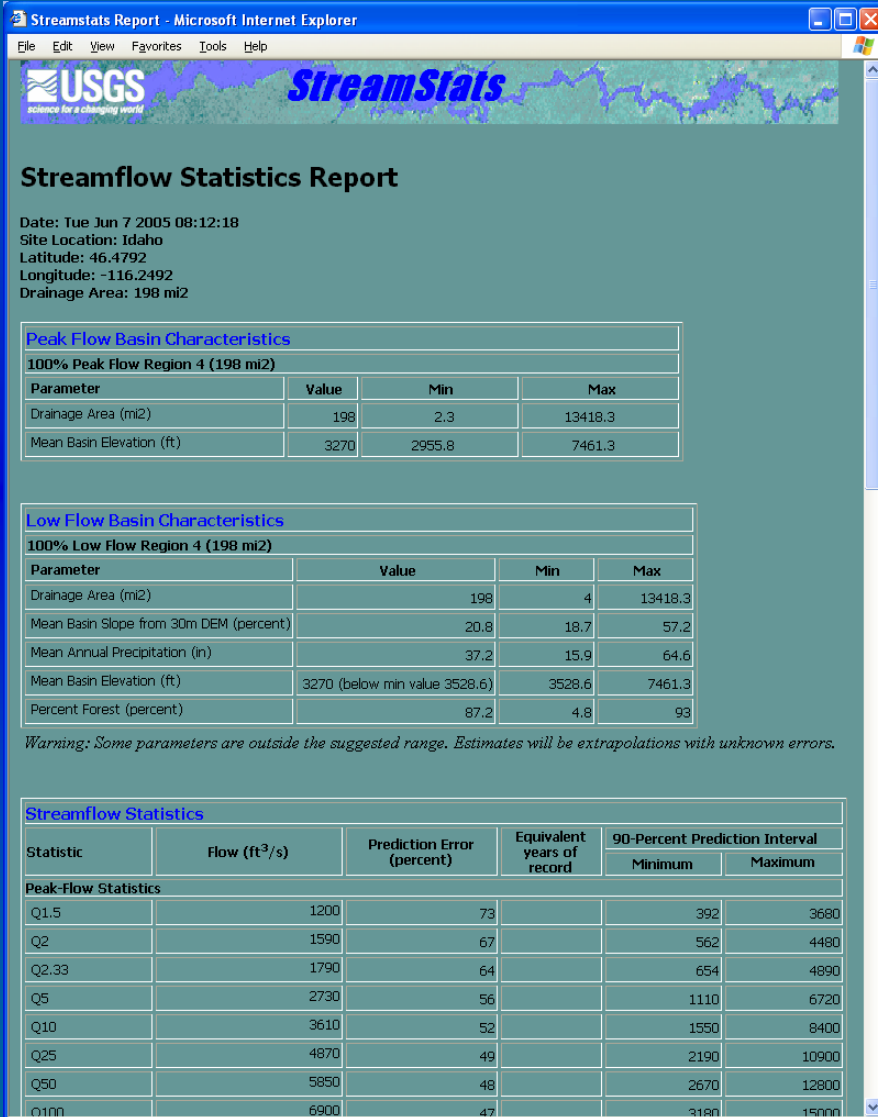
Blue for Outline Add Remove Measure



The map displays a topographic view of a stream network. A red boundary outlines a specific area on the right side of the map. A blue arrow points to a station labeled 'Gaging Station' on the stream. Other features include 'Airport', 'School', and 'Orofino'. The map includes contour lines and a north arrow.

X:333292 Y:603570 (feet) [696,30] Internet

Example Output for Ungaged Site



Data-Collection Station Process

1. USGS data-collection stations are displayed in a map frame in user's web browser
2. User zooms in and selects a station of interest
3. Previously published information for the station is retrieved from StreamStatsDB
4. Pop-up window appears showing the information and references
5. User may also link to NWIS-Web


(Implementation expected by June 2005)

Mock-up Data-Collection Site Output

USGS StreamStats - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <Z:\OSW\Streamstats\SampleGagedOutput.htm>



Streamflow Statistics Report

USGS Station Number 01094500
Station Name NORTH NASHUA RIVER NEAR LEOMINSTER, MA

[Click here to link to available data on NWIS-Web for this site.](#)

Descriptive Information

Station Type	Gaging Station, continuous record
Regulated?	True
Period of Record	1935-present
Remarks	Regulated at low flow by mills. Flow includes diversion to basin for municipal supplies.
Latitude, degrees	42.50176
Longitude, degrees	-71.72257
Hydrologic unit code	01070004
Local Basin	11-Nashua
County	027-Worcester
MCD	35075-Leominster city
Directions to station	1.3 miles upstream from Wekepeke Brook

Physical Characteristics

Characteristic Name	Value	Units	Citation Number
Area_of_Lakes_and_Ponds	3.3	square miles	12
Drainage_Area	110	square miles	12
Mean_Basin_Elevation	870	inches per hour	12
Mean_Basin_Slope_ft_per_mi	40.7	feet per mile	12
Total_Stream_Length	22.7	miles	12

USGS StreamStats - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <Z:\OSW\Streamstats\SampleGagedOutput.htm>

Mean_Basin_Slope_ft_per_mi	40.7	feet per mile	12
Total_Stream_Length	22.7	miles	12

Streamflow Statistics

Statistic Name	Discharge, in cubic feet per second	Citation Number
Peak-Flow Statistics		
Mean_Annual_Flood	683	12
10-Year_Peak_Flood	4,760	12
25-Year_Peak_Flood	6,560	12
50-Year_Peak_Flood	8,160	12
100-Year_Peak_Flood	9,990	12
500-Year_Peak_Flood	15,400	12
Low-Flow Statistics		
7-Day_2-Year_Low_Flow	45.4	22
7-Day_10-Year_Low_Flow	35.3	22
Flow-Duration Statistics		
10-Percent_Duration	418	16
25-Percent_Duration	229	22
50-Percent_Duration	126	16
70-Percent_Duration	74.2	22
75-Percent_Duration	67.3	22
90-Percent_Duration	49	16
95-Percent_Duration	43.8	22
99-Percent_Duration	34	22

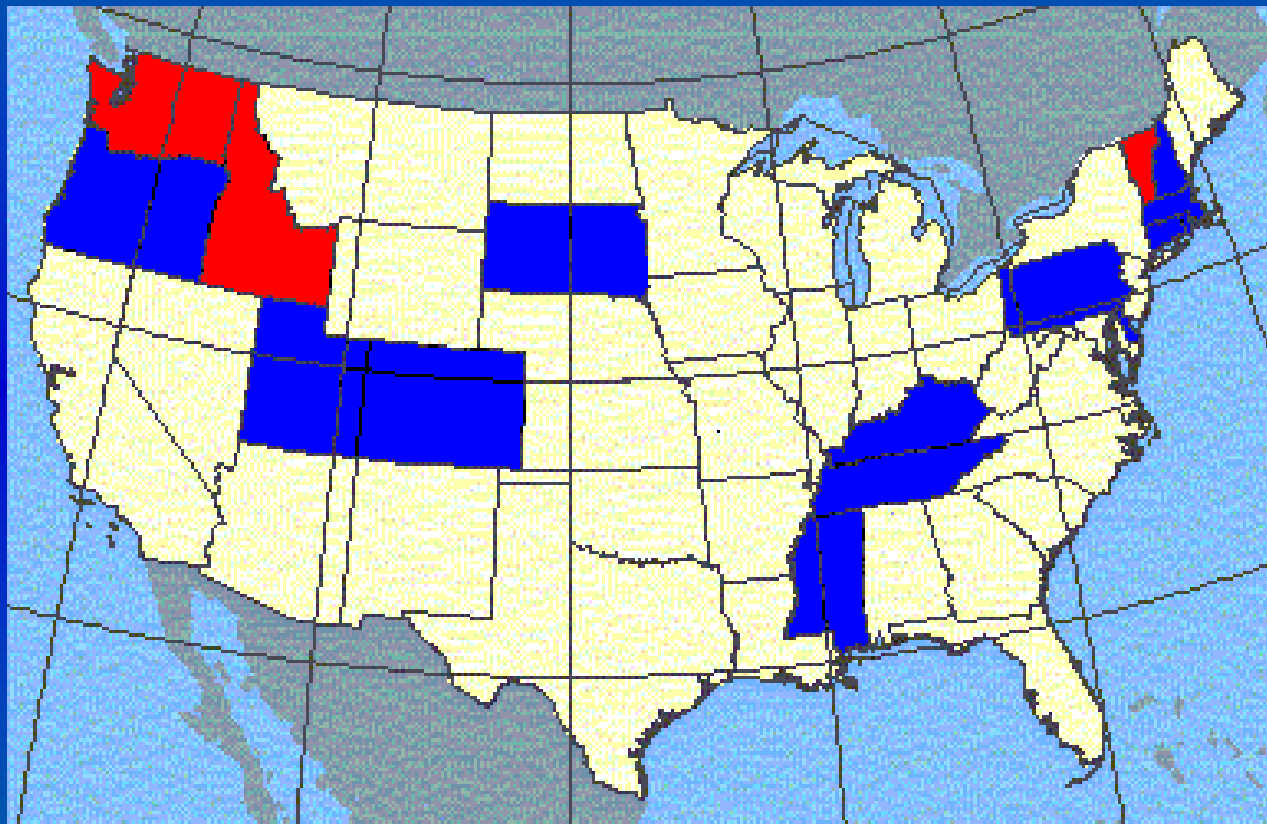
Citations

Citation Number	Citation Name
12	Murphy, P.J., 2001, Evaluation of mixed-population flood-frequency analysis: American Society of Civil Engineers, Journal of Hydrologic Engineering, v. 6, no. 1, p. 62-70
22	Wandle, S.W., Jr., and Fontaine, R.A., 1984, Gazetteer of Hydrologic Characteristics of Streams in Massachusetts--Merrimack River Basin: U.S. Geological Survey Water-Resources Investigations Report 84-4284.
16	Socolow, R.S., Leighton, C.R., Zanca, J.L., and Ramsbey, L.R., Water Resources Data Massachusetts and Rhode Island Water Year 1997: U.S. Geological Survey Water-Data Report MA-RI-97-1.

StreamStats Benefits

- Cost — Time to delineate drainage boundaries and compute basin characteristics is reduced from hours to minutes
- Accuracy — Measurement errors not introduced; some measurements much better; others about the same as manual methods
- Consistency — Important for statistical validity
- Accessibility — Special equipment and/or expertise not needed to obtain estimates

Status



-  Available to Public
-  Work in progress

State Implementation Process

- Usually done through cooperative agreements between Water Science Centers and local agencies
- Populate and quality assure StreamStatsDB
- Generate and format GIS datasets
- Test and report on accuracy of basin and climatic characteristics and equation results
- Potentially develop new equations, using GIS data to measure basin characteristics
- Possibly fund any required customization
- USGS HQ and WSC concurrence to put on Web
- Full national implementation will take several years

Mid-Atlantic Activities

■ Pennsylvania

- ☞ Peak-flow equations implemented by Sept. '05
- ☞ Will also include low-flow equations when ready

■ Delaware

- ☞ Peak-flow equations implemented by March '06

■ GIS datasets prepared

- ☞ All of Chesapeake Bay drainage

Want StreamStats in Your State?

- Contact your local USGS Water Science Center Chief
- Find names and contact information at http://water.usgs.gov/district_chief.html