Introducing Iowa StreamStats Version 4, a Redesign of the USGS Application for Estimating Streamflow Stats

Presented for Iowa County Engineer's Association

Ames, IA

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by David Eash

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What is StreamStats?

- A map-based Web application that provides information that can be used by engineers, managers, and planners to make informed decisions on water-related activities
- Primary products are basin delineations, basin-characteristic measurements, and estimates of streamflow statistics
- Version 3 released July 2015
- Beta Version 4: released March 2016

StreamStats Beta Version 4

- Redesigned single user interface for all states
- Streamlined core functionality
- Map interaction that is more intuitive for users
- Improved communication with users
- All functionality will be available as web services
- Batch processing will be available for multiple sites
- V.4 functionality not yet fully implemented for Iowa
- Users encouraged to provide feedback – Help button

How is StreamStats Information Used?

- Engineering Design—Bridges, culverts, roads, levees, dams, and other structures along streams; flood-plain mapping
- Water and Land Management—Water rights adjudication, in-stream flows, fish passage/habitat studies
- Water Quality Regulation—Low flows, perennial vs. intermittent streams (TMDL’s, NPDES Permits)

StreamStats Site Capabilities

- Provides published streamflow statistics and basin characteristics for USGS streamgages
- For user-selected ungaged sites:
  - Delineates drainage basin boundaries
  - Computes basin characteristics
  - Provides estimates of streamflow statistics based on regression equations
  - Allows for download of basin boundary shapefiles

StreamStats Implementation for Iowa

- 90 regression equations from 4 USGS streamflow-estimation reports will be implemented in StreamStats
- StreamStats allows users to click on any ungaged or gaged stream site in Iowa and obtain estimates of 30 streamflow statistics
- 7 low-flow statistics that include 4 annual and 2 seasonal low-flow probabilities and the harmonic mean
- 15 flow-duration statistics that include 1% - 99% exceedance probabilities

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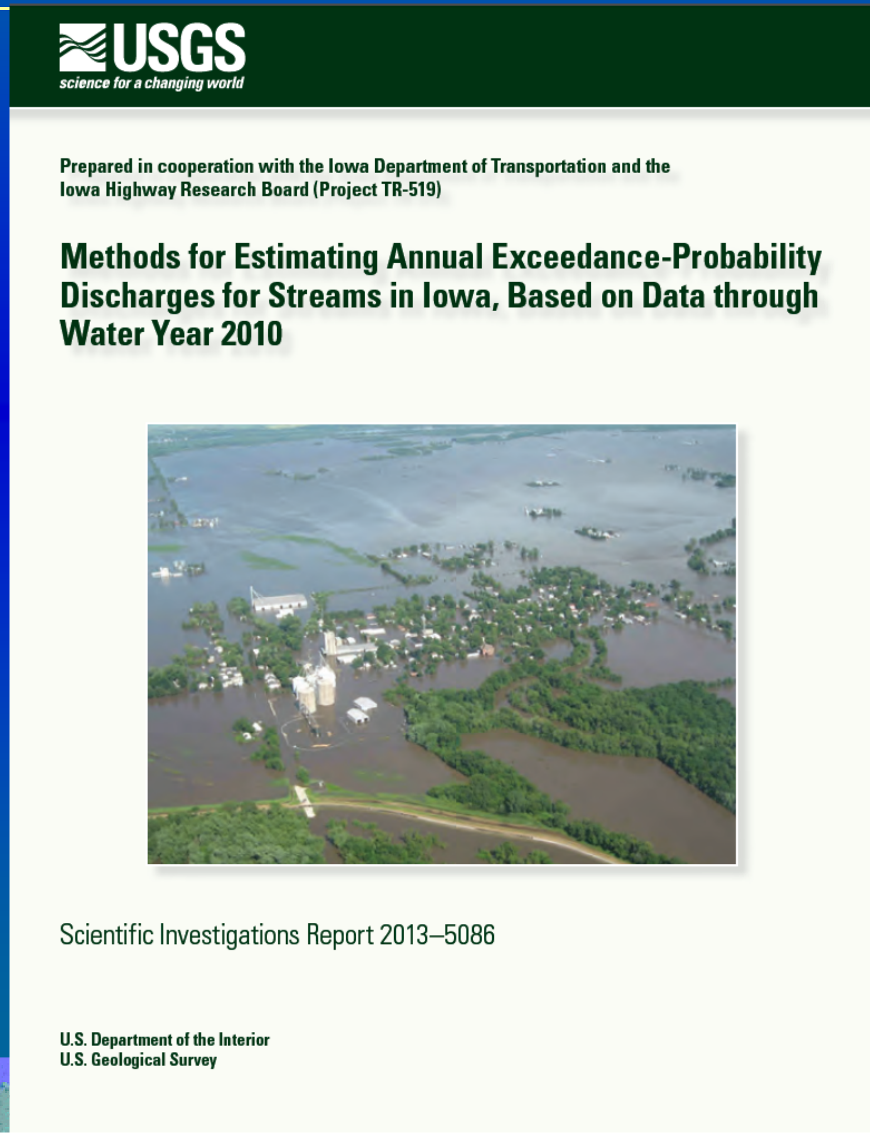
StreamStats Implementation for Iowa

- 8 peak-flow statistics that include 2- to 500-year recurrence-interval floods
- 90-percent prediction intervals are computed for an ungaged site for the peak-flow & low-flow regression estimates
- Peak-flow equations were implemented in June 2013
- Low-flow and flow duration equations were implemented in July 2015

IA StreamStats app uses peak-flow regional-regression equations published in SIR 2013-5086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Prepared in cooperation with the Iowa Department of Transportation and the Iowa Highway Research Board (Project TR-519)

Methods for Estimating Annual Exceedance-Probability Discharges for Streams in Iowa, Based on Data through Water Year 2010

Scientific Investigations Report 2013–5086

U.S. Department of the Interior
U.S. Geological Survey

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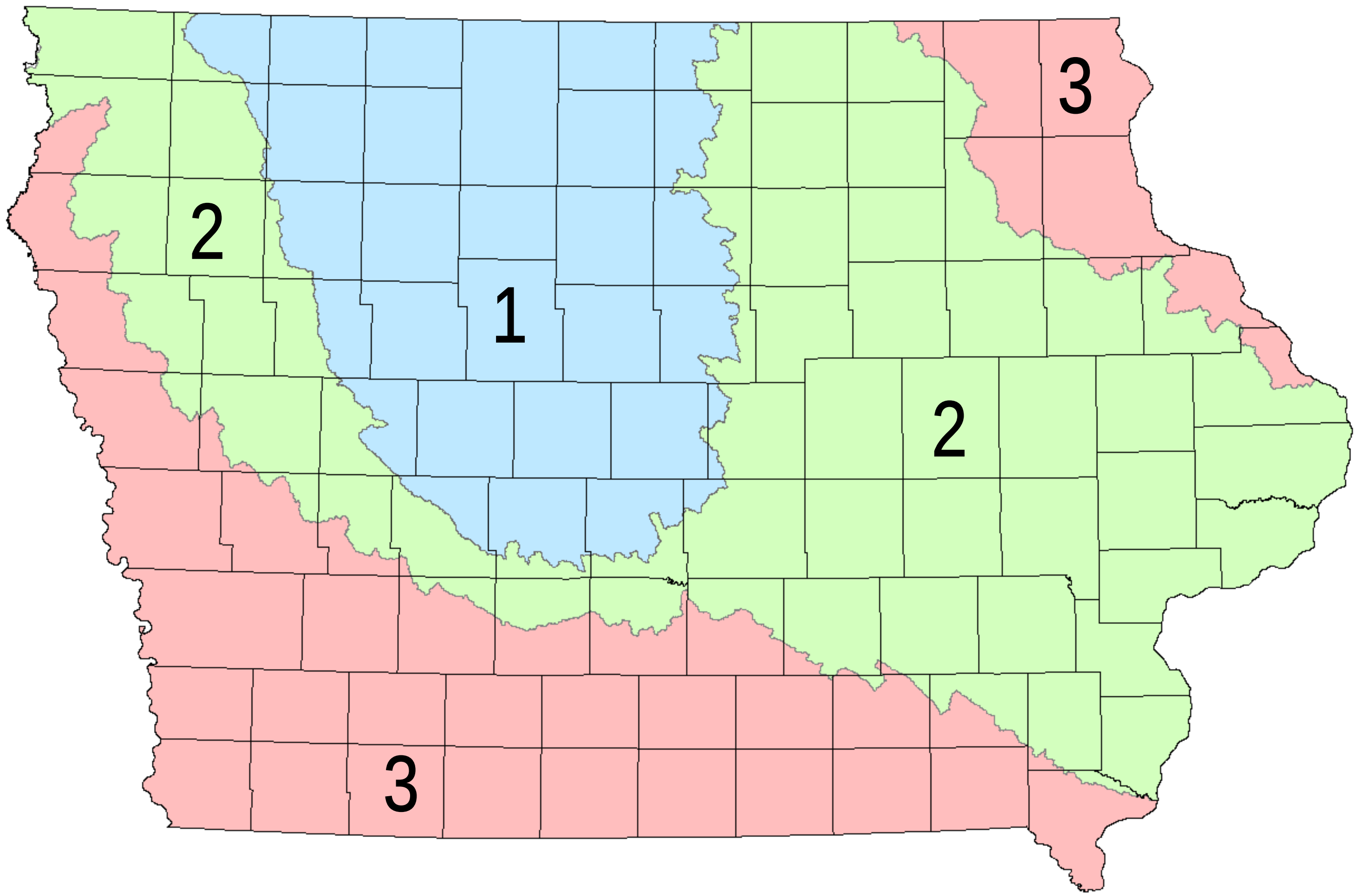
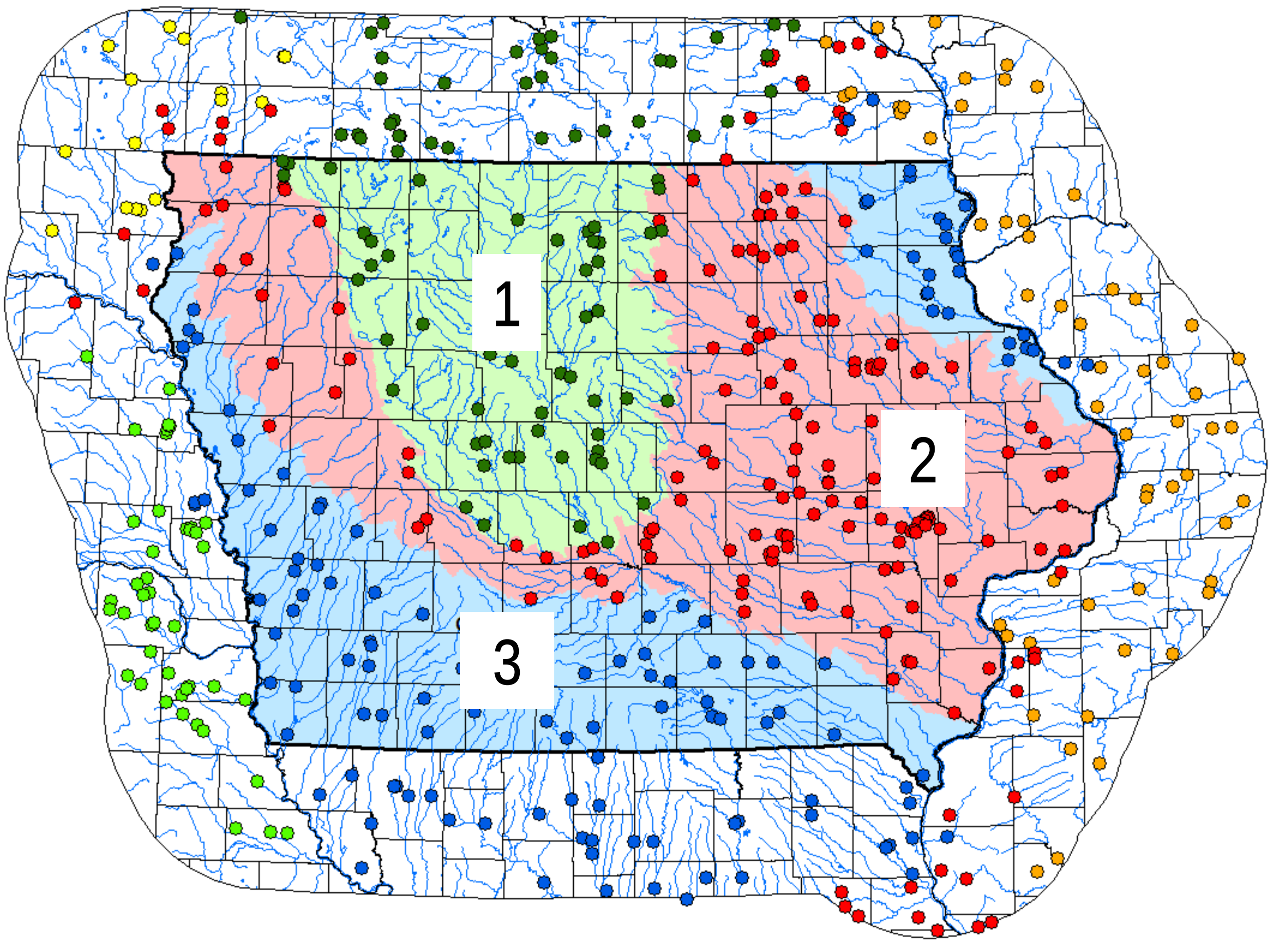
Iowa 2013 Flood Regions



518 streamgages used for defining six flood regions



New Statistical Methodologies included in the Iowa Peak-Flow Estimation Study

- Flood-probability analyses include results of new statewide regional skew analysis (Bayesian GLS/WLS regression analysis – constant value -0.4)
- New flood-probability analysis method used - EMA (expected moments algorithm) with new MGB (multiple Grubbs-Beck) test for detecting low-outliers
- New optimization test used for selecting best transformation for drainage area for the regression analyses - either a log 10 or a power transformation

2013 Flood Region 1 Regression Equation

- **Regression equations take the form:**

$$Q_{1\%}=DRNAREA^{0.566}10^{(0.917+0.567\ I24H10Y-0.742\ CCM^{\wedge}0.55)}$$

- **where:** (91 streamgages used to develop equations)

DRNAREA is drainage area, in square miles

I24H10Y is maximum 24-hour precipitation that occurs on average once in 10 years, in inches

CCM is constant of channel maintenance (DRNAREA/ total length of all streams in basin), in mi^2/mi

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2013 Flood Region 2 Regression Equation

- **Regression equations take the form:**

$$Q_{1\%} = 10^{(11.1 - 7.92 \times DRNAREA^{-0.031} - 0.002 \times DESMOIN - 0.025 \times BSHAPE)}$$

- **where:** (176 streamgages used to develop equations)

DRNAREA is drainage area, in square miles

DESMOIN is percent area of basin within Des Moines Lobe landform region (percent area)

BSHAPE is a shape factor measure of basin shape computed as $BASLEN^2/DRNAREA$

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2013 Flood Region 3 Regression Equation

- **Regression equations take the form:**

$$Q_{1\%} = 10^{(6.41 - 3.06 \times DRNAREA^{-0.097} - 0.009 \times KSATSSUR - 0.035 \times BSHAPE)}$$

- **where:** (127 streamgages used to develop equations)

DRNAREA is drainage area, in square miles

KSATSSUR is the average saturated hydraulic conductivity of soil (micrometers per second)

BSHAPE is a shape factor measure of basin shape computed as $BASLEN^2/DRNAREA$

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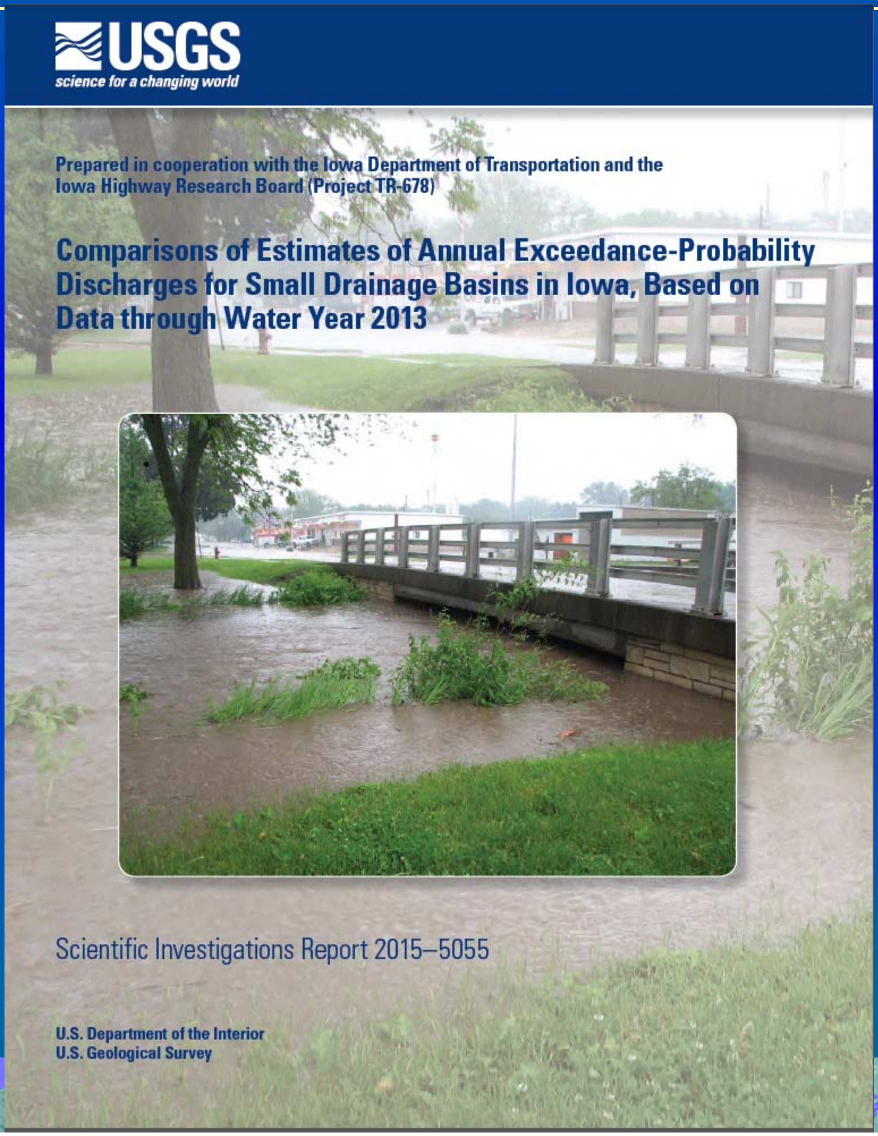
IA StreamStats app will use peak-flow regional-regression equations published in SIR 2015-5055



Iowa Landform Regions

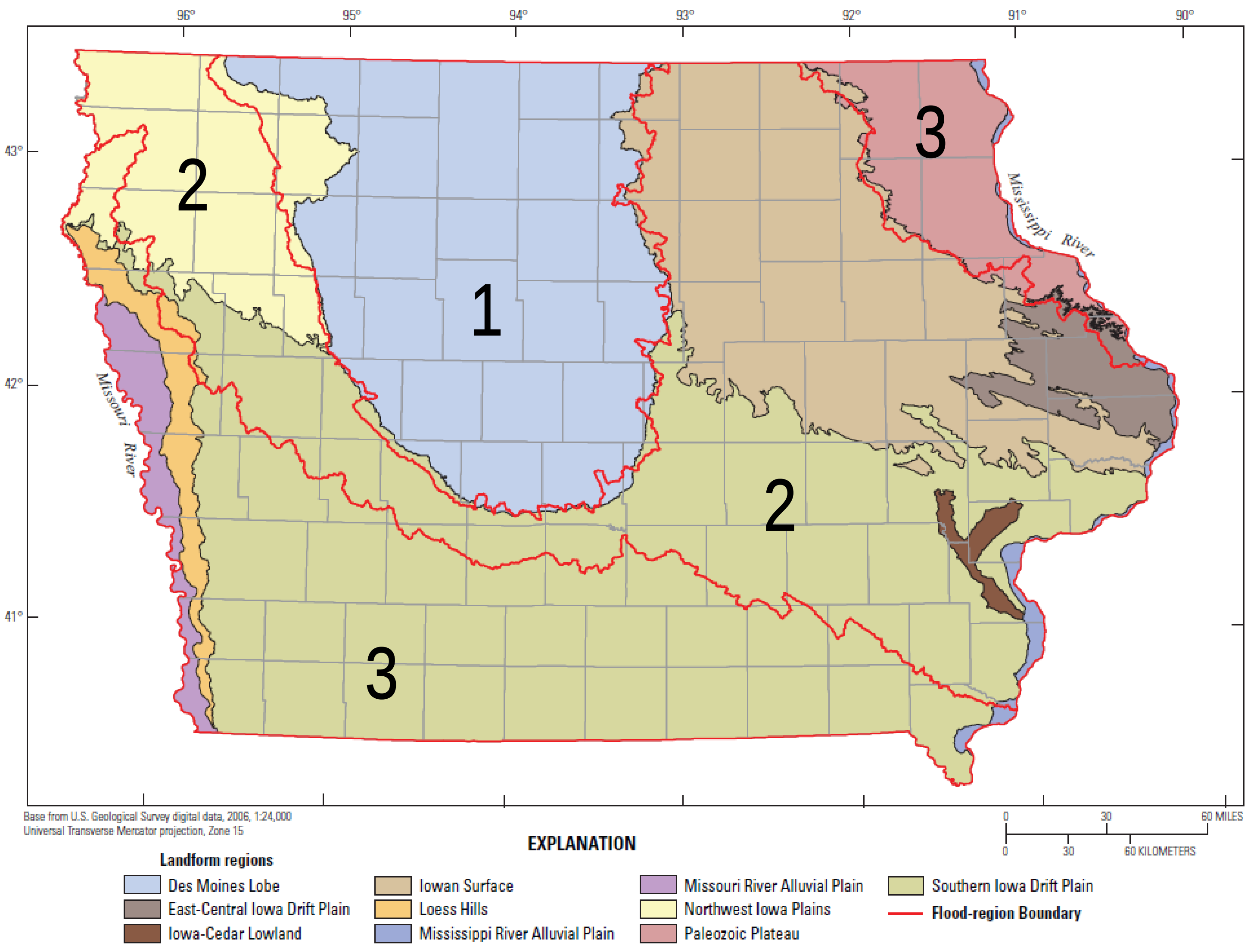


Figure 3. Landform regions in Iowa.

Summary of flood-frequency-estimation comparison results from SIR 2015-5055

- For DA < 2 mi^2, use of the TR-55 method for flood regions 1 and 3 and the 1987 RREs for flood region 2 may provide the best overall results
- For DA from 2-20 mi^2, use of the 1987 RREs for the Southern Iowa Drift Plain landform region and for flood region 3, the 2013 multi-var RREs for the Iowan Surface landform region, the 2013 or 1987 single-var RREs for flood region 2, and the 2013 single-var RREs elsewhere may provide the best overall results

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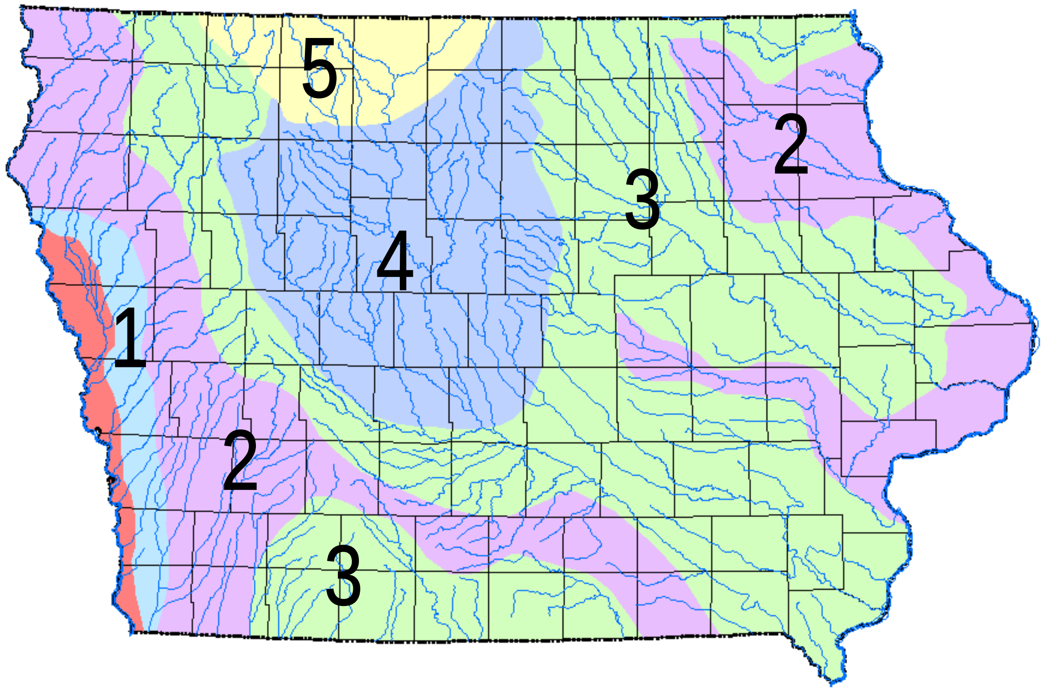
Iowa 1987 Hydrologic Regions



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1987 Regional Regression Equations

Table 2.--Regional flood-frequency equations

Hydrologic region 1
(19 stations)

Equation for indicated recurrence interval	Standard error (percent)
$Q_2 = 211A^{0.62}$	61
$Q_5 = 502A^{0.60}$	37
$Q_{10} = 757A^{0.60}$	28
$Q_{25} = 1,140A^{0.57}$	24
$Q_{50} = 1,500A^{0.60}$	21
$Q_{100} = 1,880A^{0.60}$	24

Hydrologic region 2
(81 stations)

Equation for indicated recurrence interval	Standard error (percent)
$Q_2 = 196A^{0.57}$	55
$Q_5 = 402A^{0.55}$	39
$Q_{10} = 570A^{0.55}$	34
$Q_{25} = 821A^{0.54}$	32
$Q_{50} = 1,020A^{0.53}$	33
$Q_{100} = 1,230A^{0.53}$	36

Hydrologic region 3
(119 stations)

Equation for indicated recurrence interval	Standard error (percent)
$Q_2 = 129A^{0.62}$	44
$Q_5 = 265A^{0.59}$	36
$Q_{10} = 381A^{0.57}$	35
$Q_{25} = 555A^{0.55}$	37
$Q_{50} = 695A^{0.54}$	39
$Q_{100} = 851A^{0.53}$	41

Hydrologic region 4
(24 stations)

Equation for indicated recurrence interval	Standard error (percent)
$Q_2 = 31A^{0.77}$	40
$Q_5 = 67A^{0.72}$	33
$Q_{10} = 98A^{0.70}$	31
$Q_{25} = 145A^{0.68}$	29
$Q_{50} = 180A^{0.66}$	30
$Q_{100} = 227A^{0.65}$	30

Hydrologic region 5
(8 stations)

Equation for indicated recurrence interval	Standard error (percent)
$Q_2 = 30A^{0.66}$	27
$Q_5 = 37A^{0.71}$	21
$Q_{10} = 41A^{0.74}$	20
$Q_{25} = 45A^{0.77}$	24
$Q_{50} = 47A^{0.79}$	24
$Q_{100} = 50A^{0.80}$	26

2013 Flood Region 1 Drainage-Area Only Regression Equation

- **Regression equations take the form:**

  $$Q_{1\%} = 462\ DRNAREA^{0.524}$$

- **where:**

  DRNAREA **is drainage area, in square miles**

IA StreamStats app uses low-flow regional-regression equations published in SIR 2012-5171

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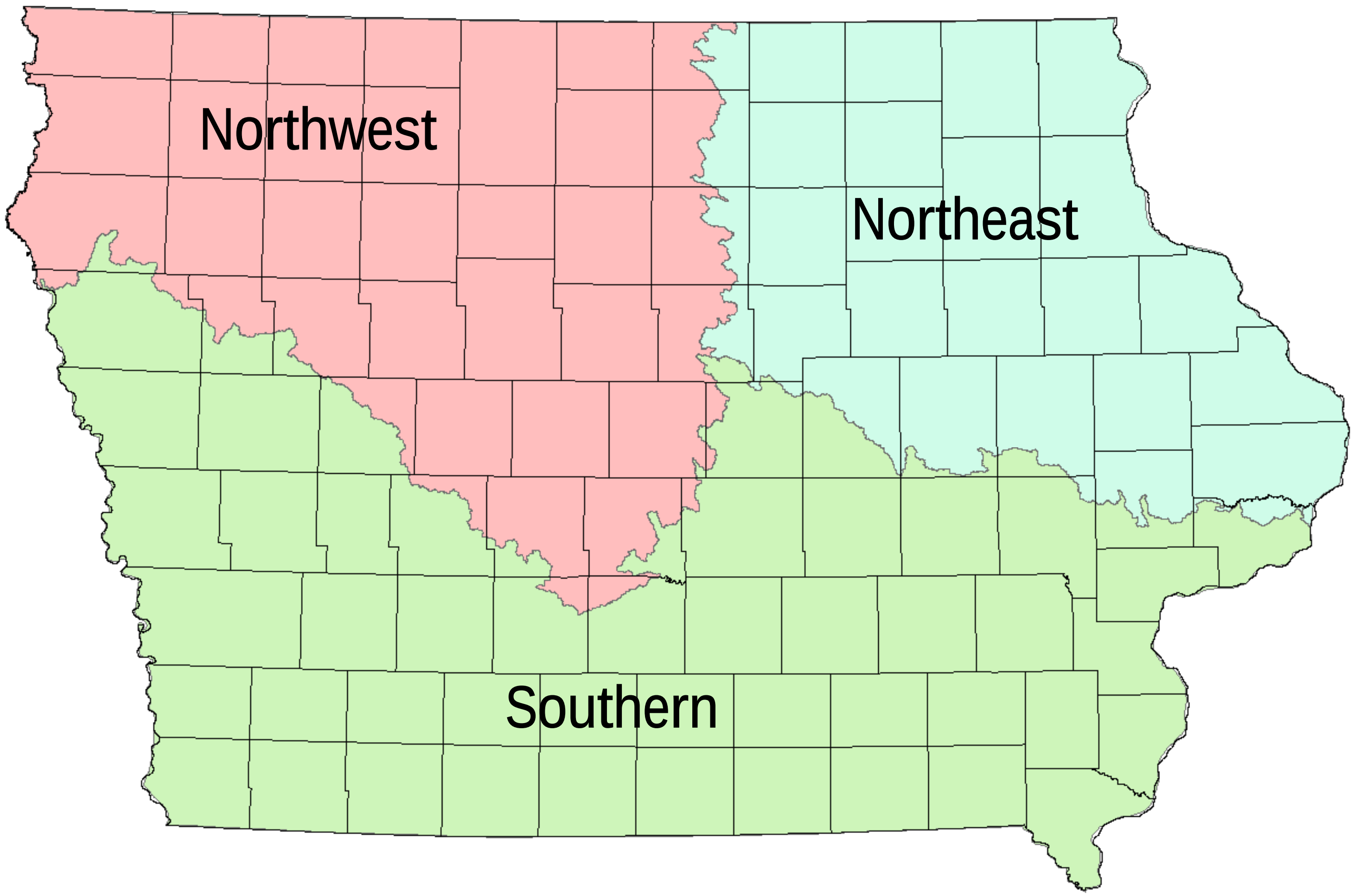
Prepared in cooperation with the Iowa Department of Natural Resources

Methods for Estimating Selected Low-Flow Frequency Statistics and Harmonic Mean Flows for Streams in Iowa

Scientific Investigations Report 2012–5171

U.S. Department of the Interior
U.S. Geological Survey

Iowa Low-Flow Regions



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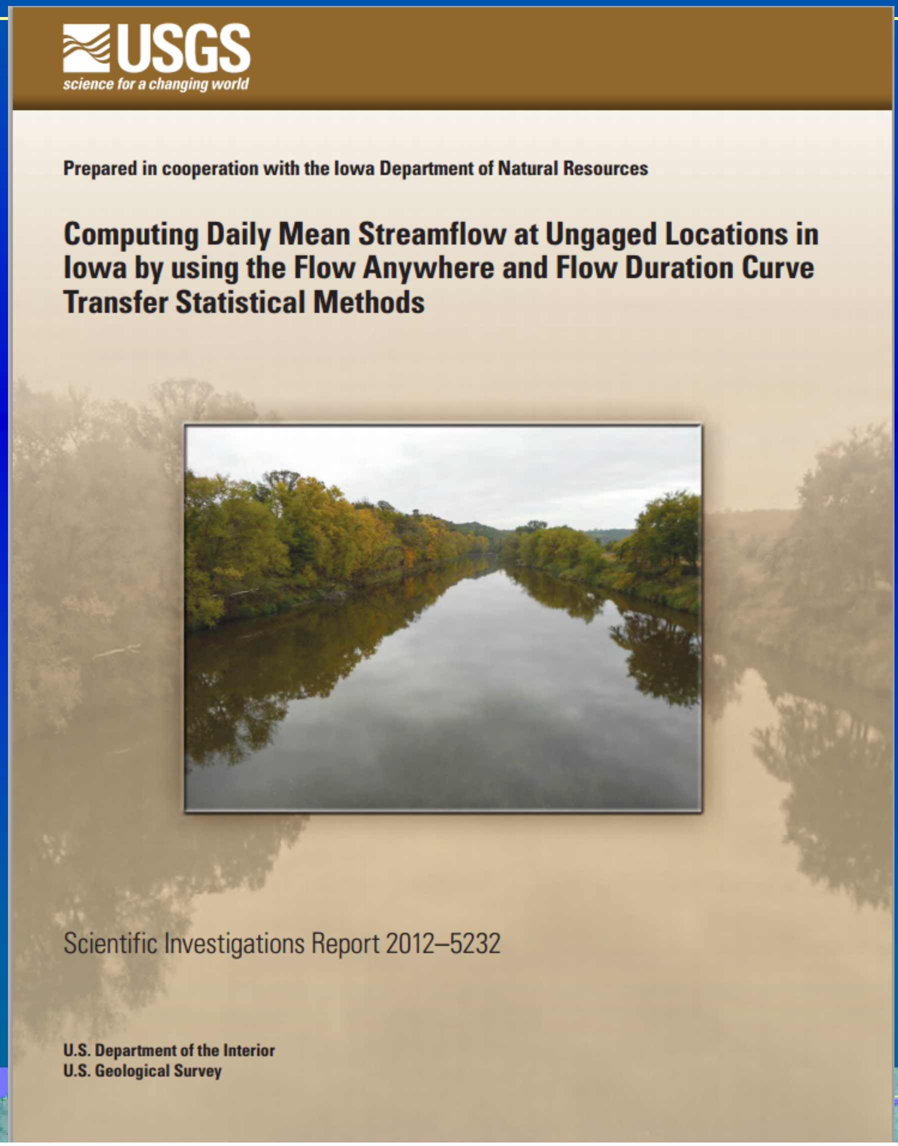
IA StreamStats app uses statewide flow-duration equations published in SIR 2012-5232



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Prepared in cooperation with the Iowa Department of Natural Resources

Computing Daily Mean Streamflow at Ungaged Locations in Iowa by using the Flow Anywhere and Flow Duration Curve Transfer Statistical Methods

Scientific Investigations Report 2012–5232

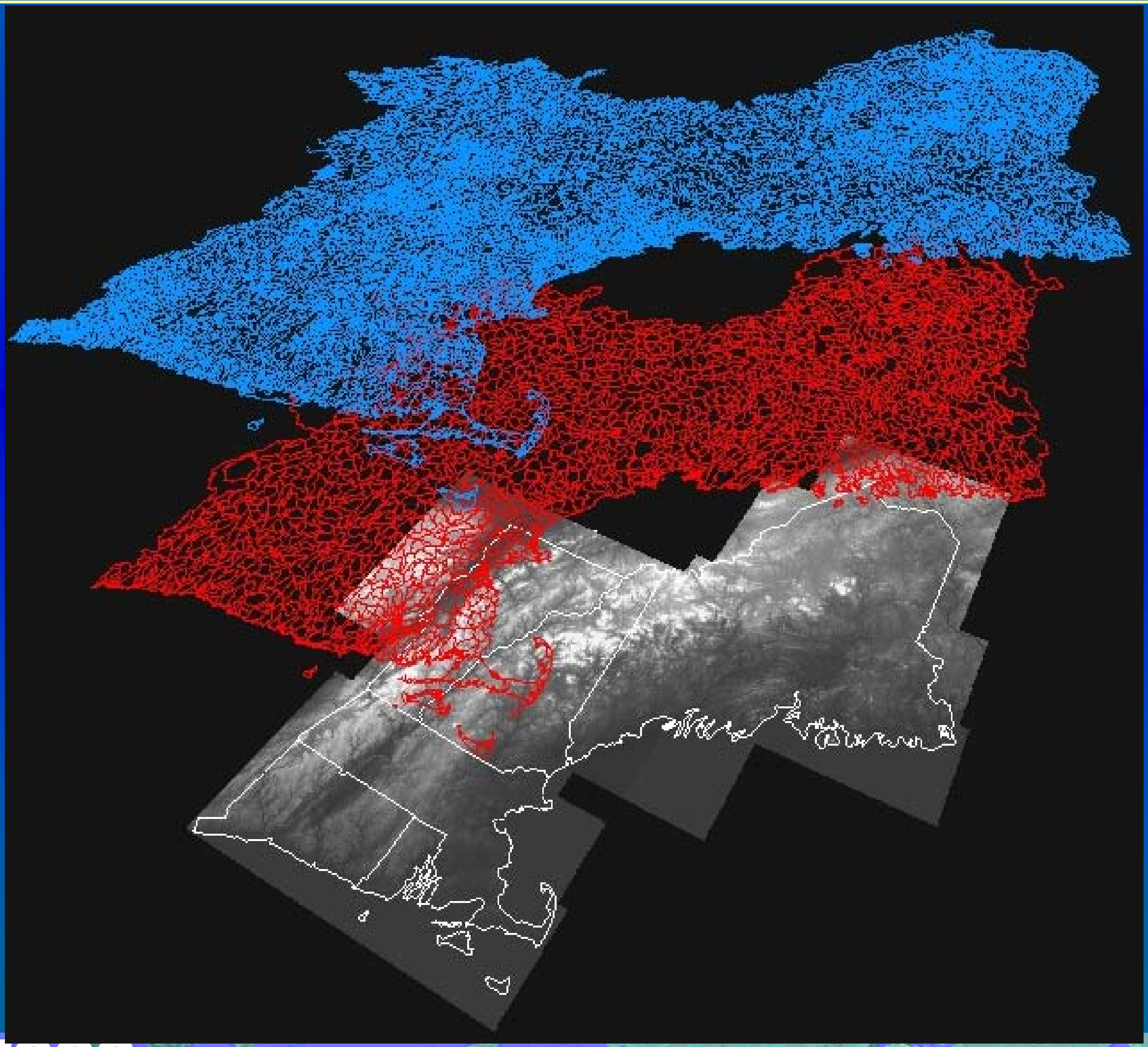
U.S. Department of the Interior
U.S. Geological Survey

StreamStats Version 4 App

Watershed Delineation from a Point

1. User selects point on stream
2. Point is transferred to a cell in a flow-direction grid derived from a DEM
3. GIS determines boundary from flow-direction grid up to points at which the boundary for the new site intersects boundaries in boundary map layer
4. GIS accumulates all upstream areas and dissolves internal boundaries

StreamStats Integrates NHD Streams, WBD Boundaries and NED Elevation in ArcHydro

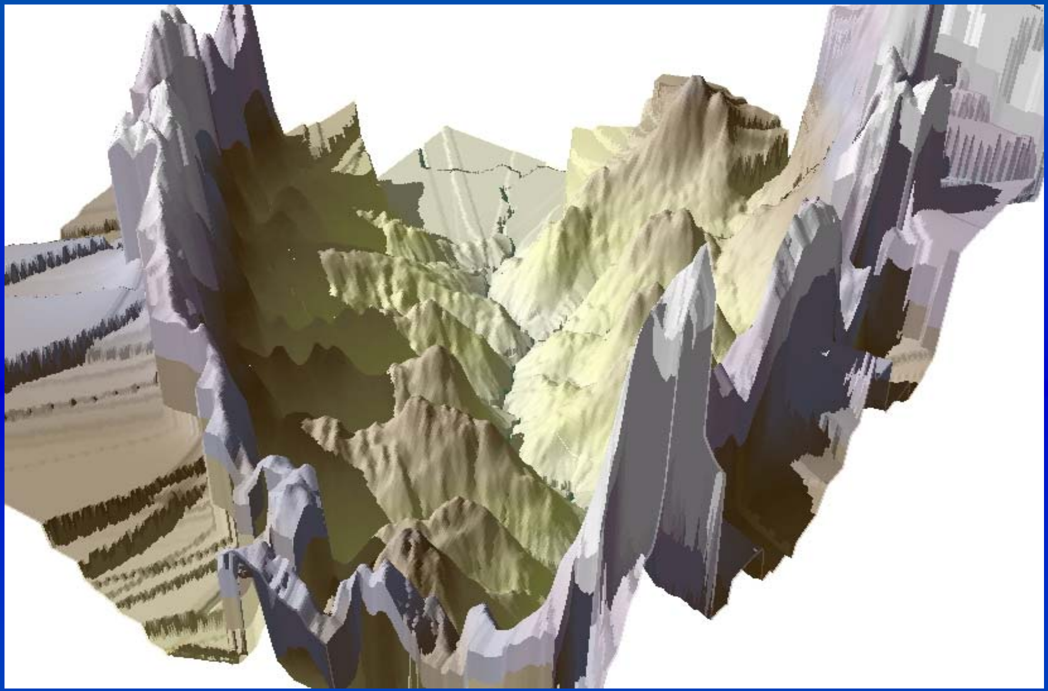


National Hydrography Dataset (NHD)

Watershed Boundary Dataset (WBD)

National Elevation Dataset (NED)

Burning and Walling of DEM



Forces DEM to agree with stream network and WBD or locally digitized drainage boundaries

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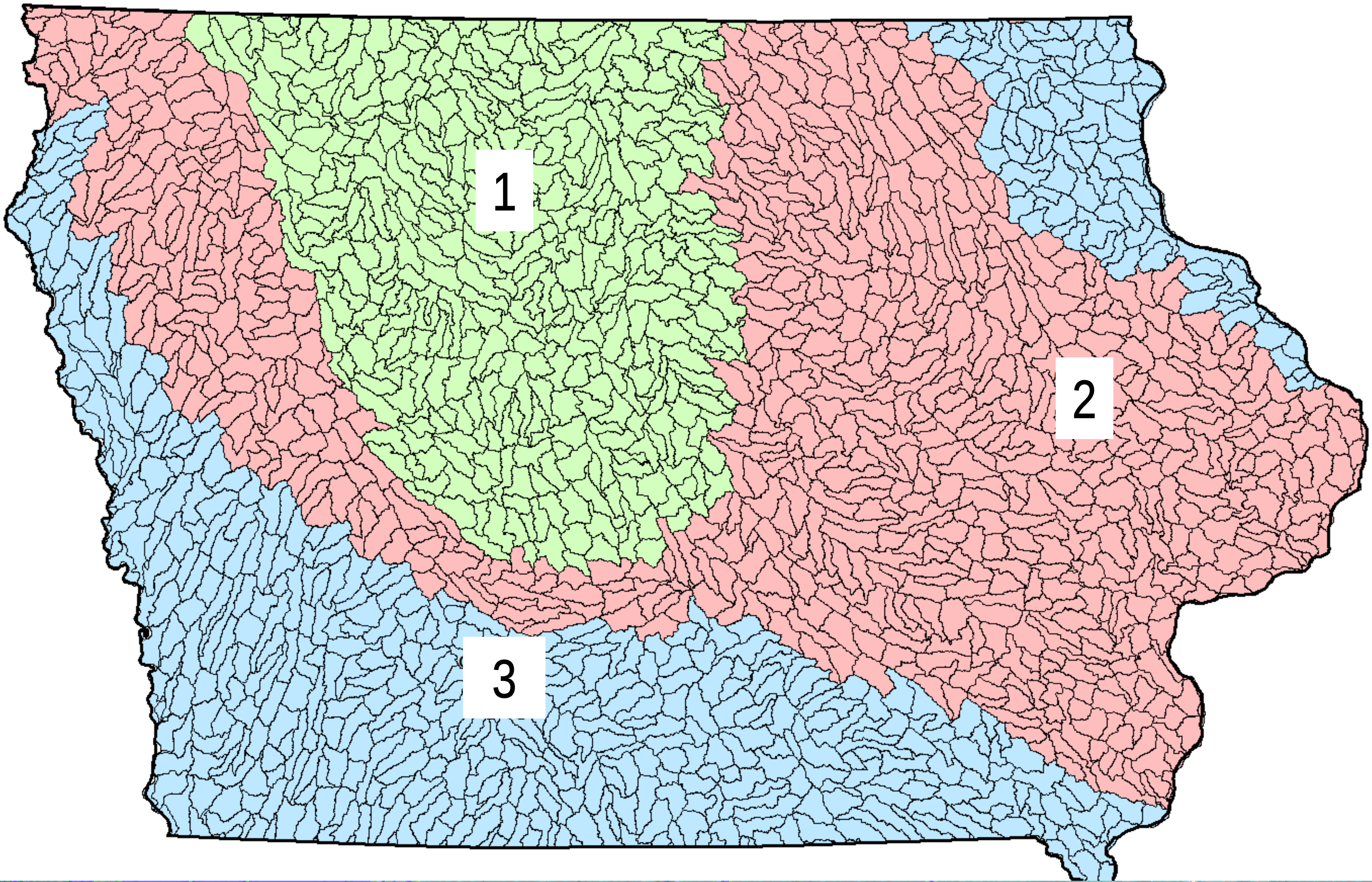
12-digit HUCs Watershed Boundary Dataset



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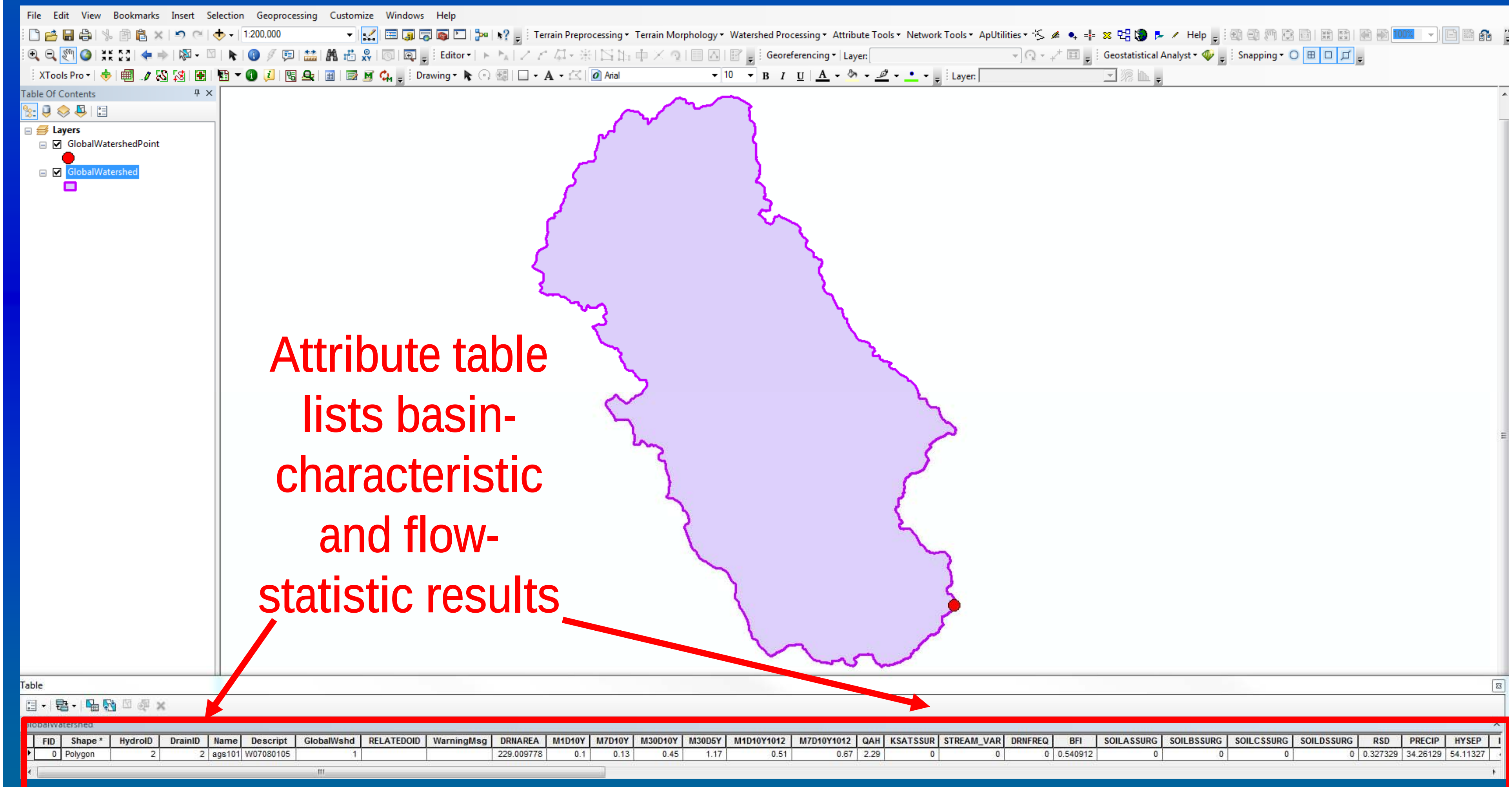
StreamStats Version 4 App

ArcMap showing downloaded Shapefiles



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QUESTIONS

StreamStats Home Page
water.usgs.gov/osw/streamstats

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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 ungaged streams and do the following:

- obtain the drainage-basin boundary (version 3 and beta version 4),
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- 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),
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- print the map (beta version 4 only),
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Several tools, mostly related to stream-network navigation, were lost from StreamStats when version 2 was retired and version 3 was introduced on July 14, 2015, before all tools from version 2 were redeveloped for version 3. These tools allowed users to search upstream or downstream along the stream network from user-selected sites to identify stream reaches and water-related activities along the streams, such as dams and point discharges, and obtain information about those activities. In addition, users could (1) estimate flow statistics at ungaged sites based on the statistics at upstream or downstream streamgages, (2) trace the path of a drop of water that falls on any point on the land surface downstream through the stream network, and (3) obtain elevation profiles along stream channels and between points on the land surface. Version 2 was retired because it was operated on computers that used an older operating system that was considered a security risk for use on U.S. government servers. Beta version 4 restores some of the tools that were lost from version 2. Also, the outputs that list the basin characteristics and estimated streamflow statistics for user-selected ungaged sites now include maps of the site locations. All other functionality that was available in Version 2, including all tools that rely on stream-network navigation, is still in development, with a goal of having completing development by late spring of 2016. Version 3 will remain available and should be used for official purposes until version 4 is more thoroughly tested.

State Applications

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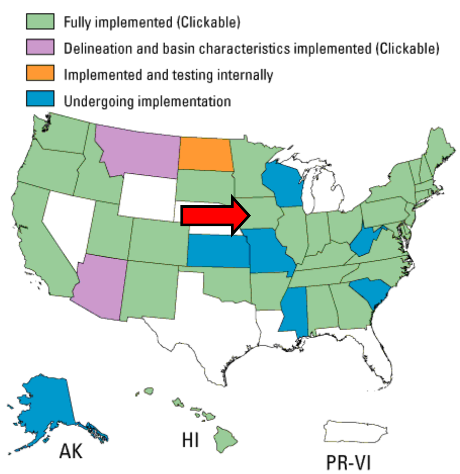
State Applications

StreamStats Application Status

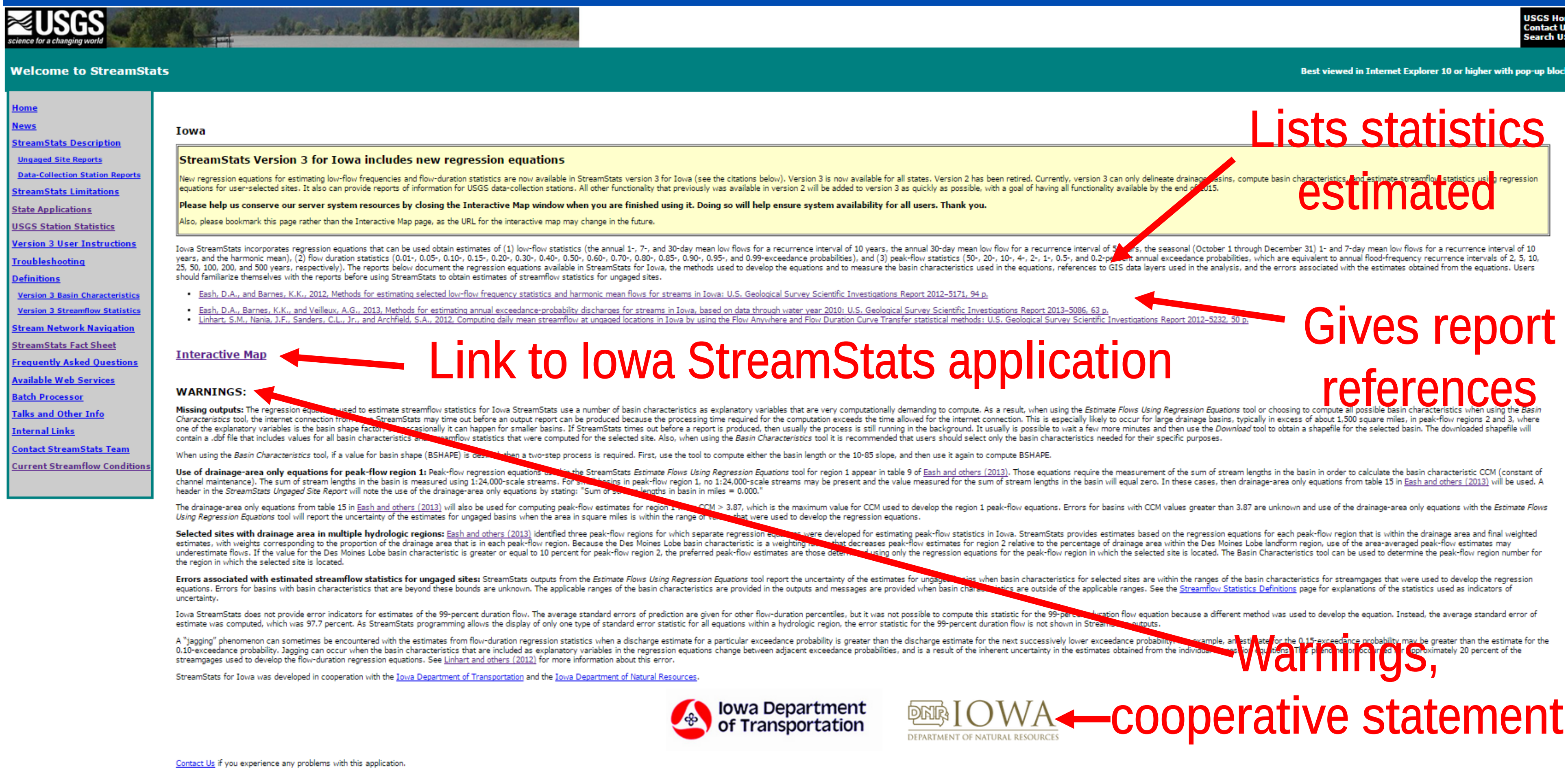
Choose a State ▾ OR Choose a River Basin ▾

Efforts are underway to make StreamStats operational for many states, with a long-term goal of national coverage. Work needed to implement StreamStats is generally done by the USGS in cooperation with various state and local agencies. The map below indicates states where StreamStats has been implemented, and where work on implementation is currently underway. Green states have fully implemented StreamStats applications, orange states have been completed and are in testing internally, and blue states are undergoing implementation. Users may access the implemented state applications by selecting the state of interest on the map below, or by selecting the name of the state from the list above.



For the states that are not yet fully implemented, StreamStats provides a separate application that allows users to obtain information for USGS data-collection stations, including descriptive information, and previously published streamflow statistics and physical and climatic characteristics of the drainage basins for the stations. All of the information provided by this national application is also available from the separate state applications. If your state is not highlighted in the above map and you are interested in making StreamStats operational there, contact the USGS Water Science Center Director for your state. The application continues to be improved and expanded. Please continue to come back to this page to see future enhancements.

Iowa StreamStats Introductory Page



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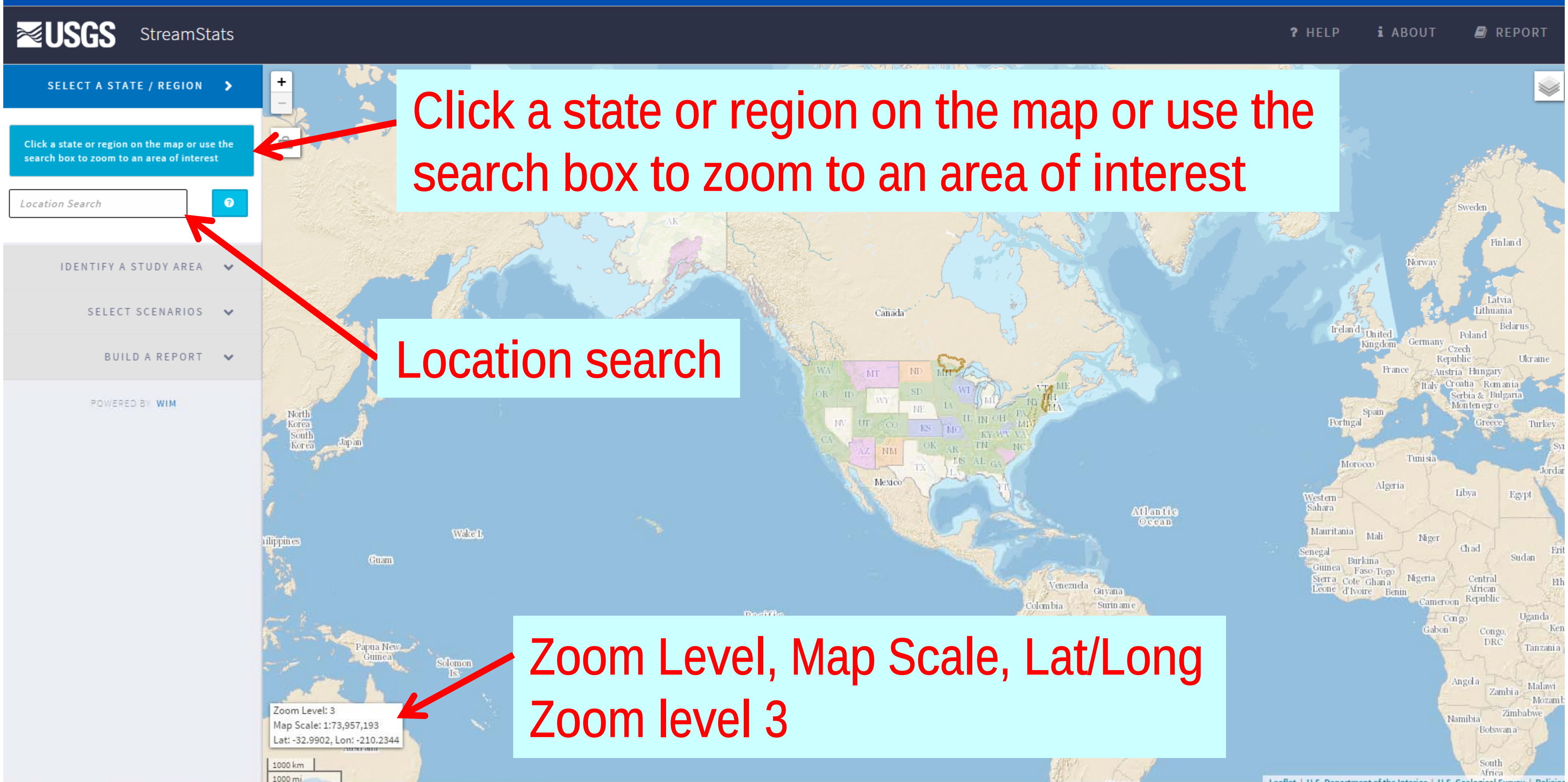
Version 4 User Interface



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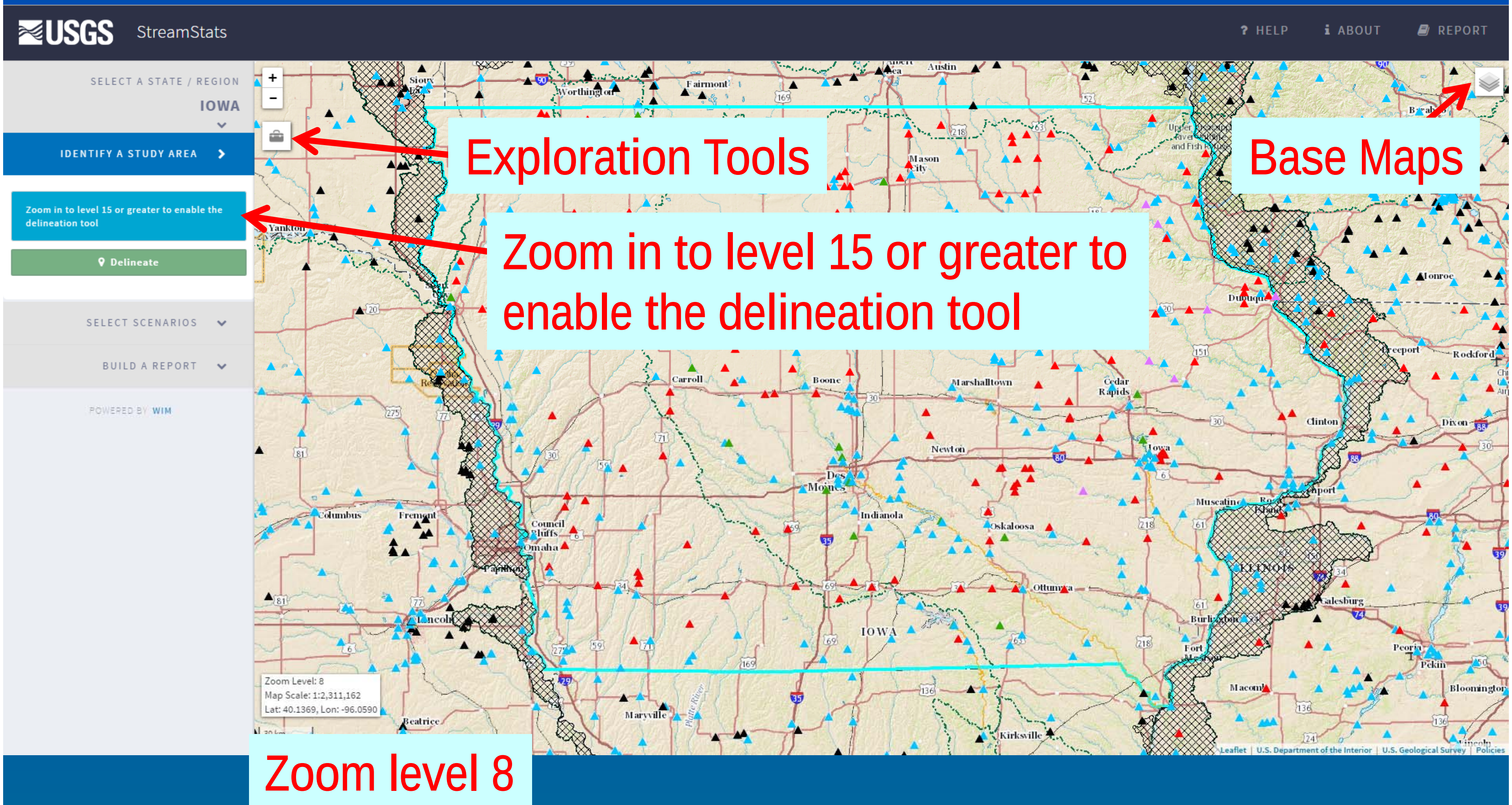
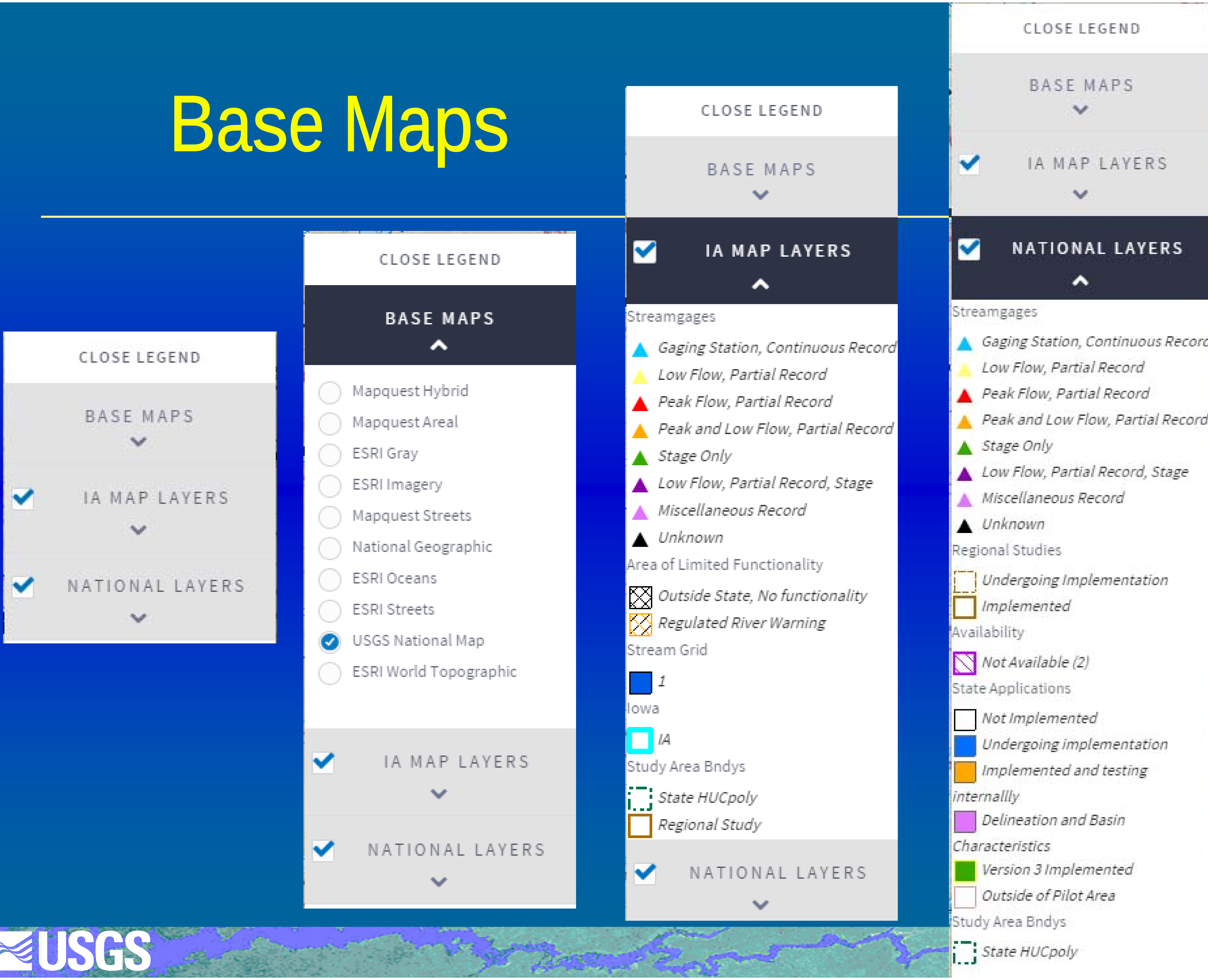
Version 4: Iowa User Interface



Base Maps



CLOSE LEGEND
BASE MAPS
IA MAP LAYERS
NATIONAL LAYERS
CLOSE LEGEND
BASE MAPS
Mapquest Hybrid
Mapquest Areal
ESRI Gray
ESRI Imagery
Mapquest Streets
National Geographic
ESRI Oceans
ESRI Streets
USGS National Map
ESRI World Topographic
IA MAP LAYERS
NATIONAL LAYERS
CLOSE LEGEND
BASE MAPS
IA MAP LAYERS
Streamgages
Gaging Station, Continuous Record
Low Flow, Partial Record
Peak Flow, Partial Record
Peak and Low Flow, Partial Record
Stage Only
Low Flow, Partial Record, Stage
Miscellaneous Record
Unknown
Area of Limited Functionality
Outside State, No functionality
Regulated River Warning
Stream Grid
1
Iowa
IA
Study Area Bndys
State HUCpoly
Regional Study
NATIONAL LAYERS
CLOSE LEGEND
BASE MAPS
IA MAP LAYERS
NATIONAL LAYERS
Streamgages
Gaging Station, Continuous Record
Low Flow, Partial Record
Peak Flow, Partial Record
Peak and Low Flow, Partial Record
Stage Only
Low Flow, Partial Record, Stage
Miscellaneous Record
Unknown
Regional Studies
Undergoing Implementation
Implemented
Availability
Not Available (2)
State Applications
Not Implemented
Undergoing implementation
Implemented and testing internallly
Delineation and Basin Characteristics
Version 3 Implemented
Outside of Pilot Area
Study Area Bndys
State HUCpoly

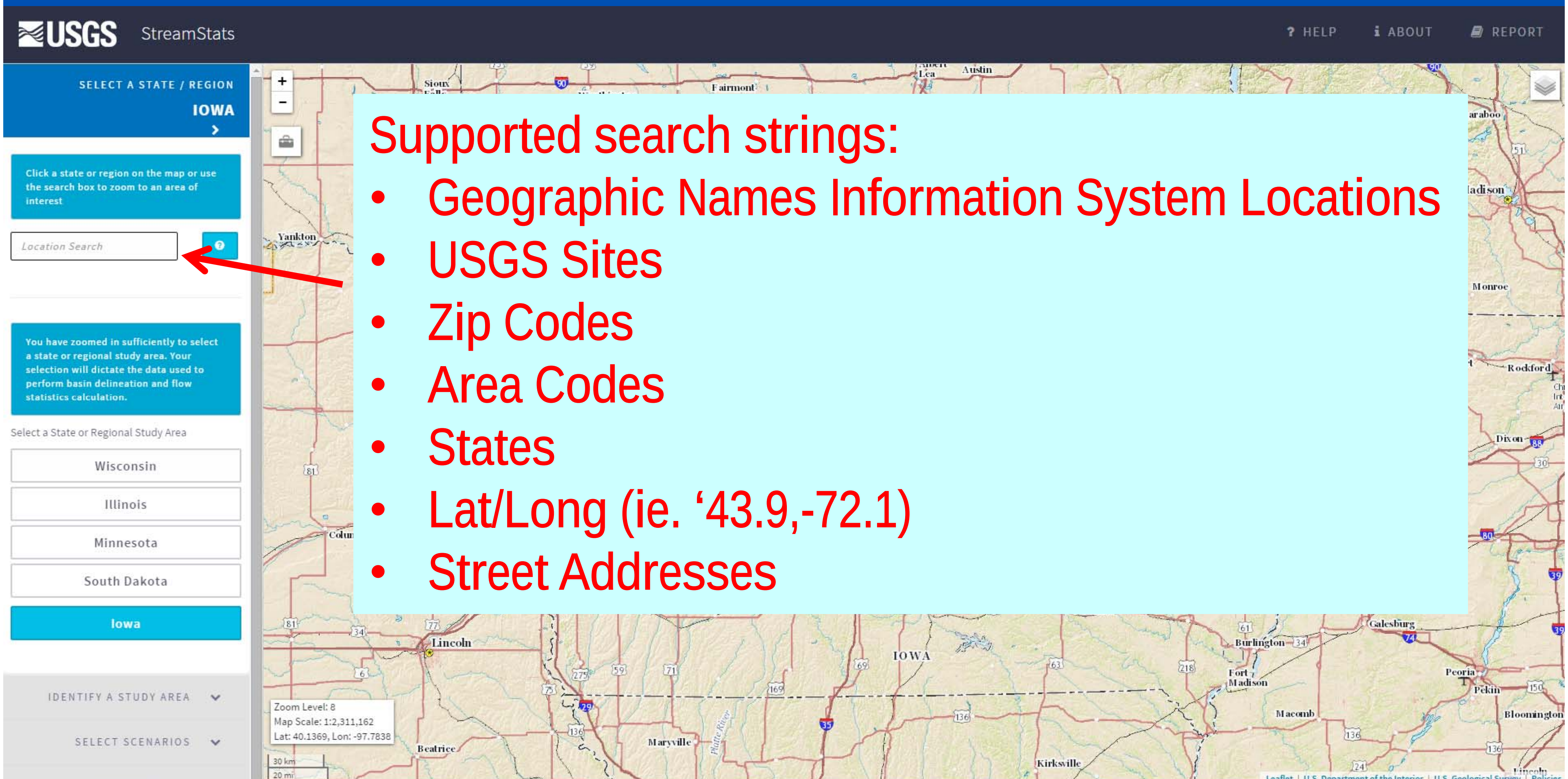
Iowa User Interface without Streamgages

Can zoom in and out with zoom tool or by scrolling, and can drag map in any direction

Search box reappears by clicking on 'Select A State / Region'

Zoom level 8

Location Search

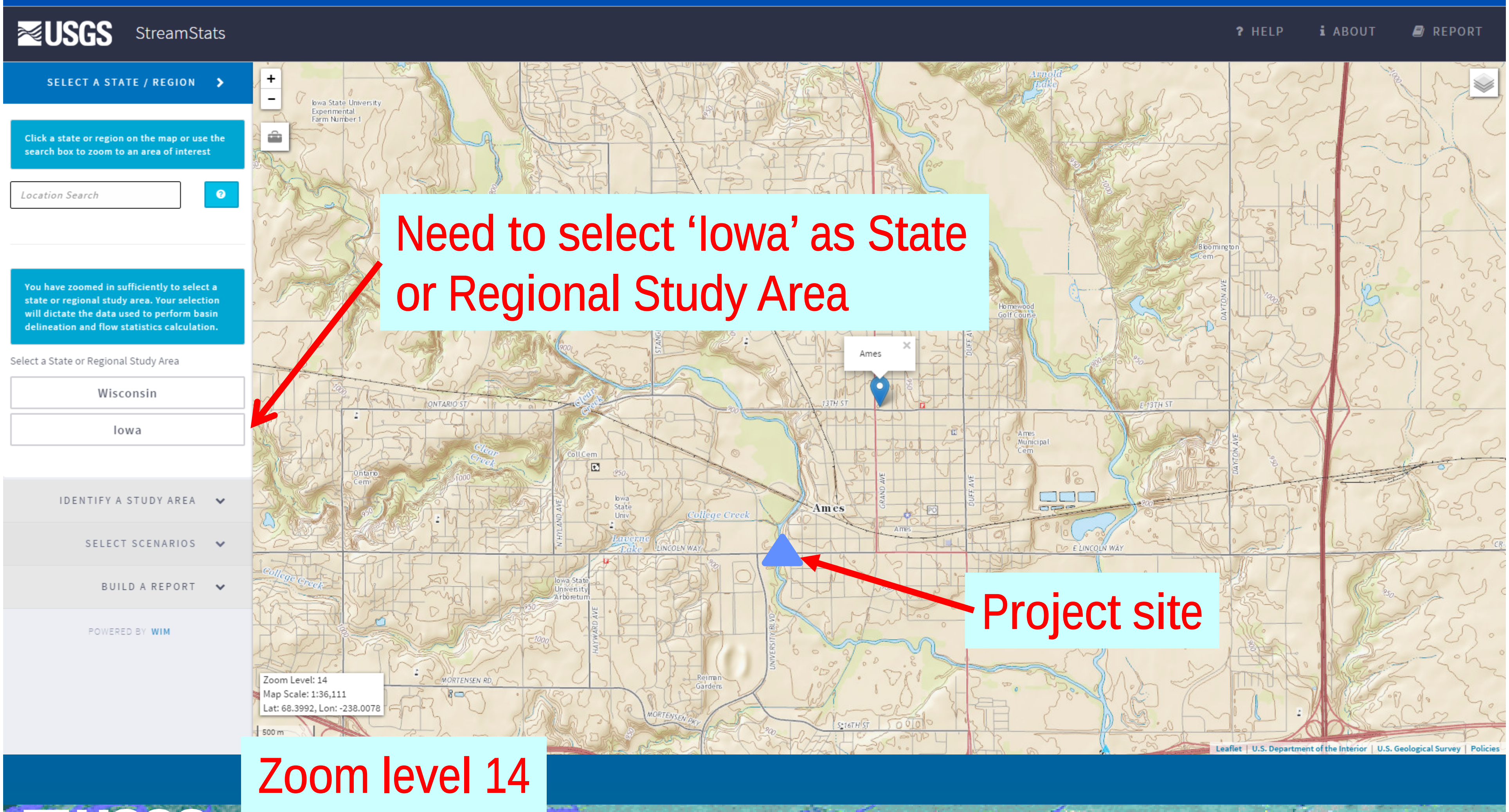


Supported search strings:

- Geographic Names Information System Locations
- USGS Sites
- Zip Codes
- Area Codes
- States
- Lat/Long (ie. '43.9,-72.1)
- Street Addresses

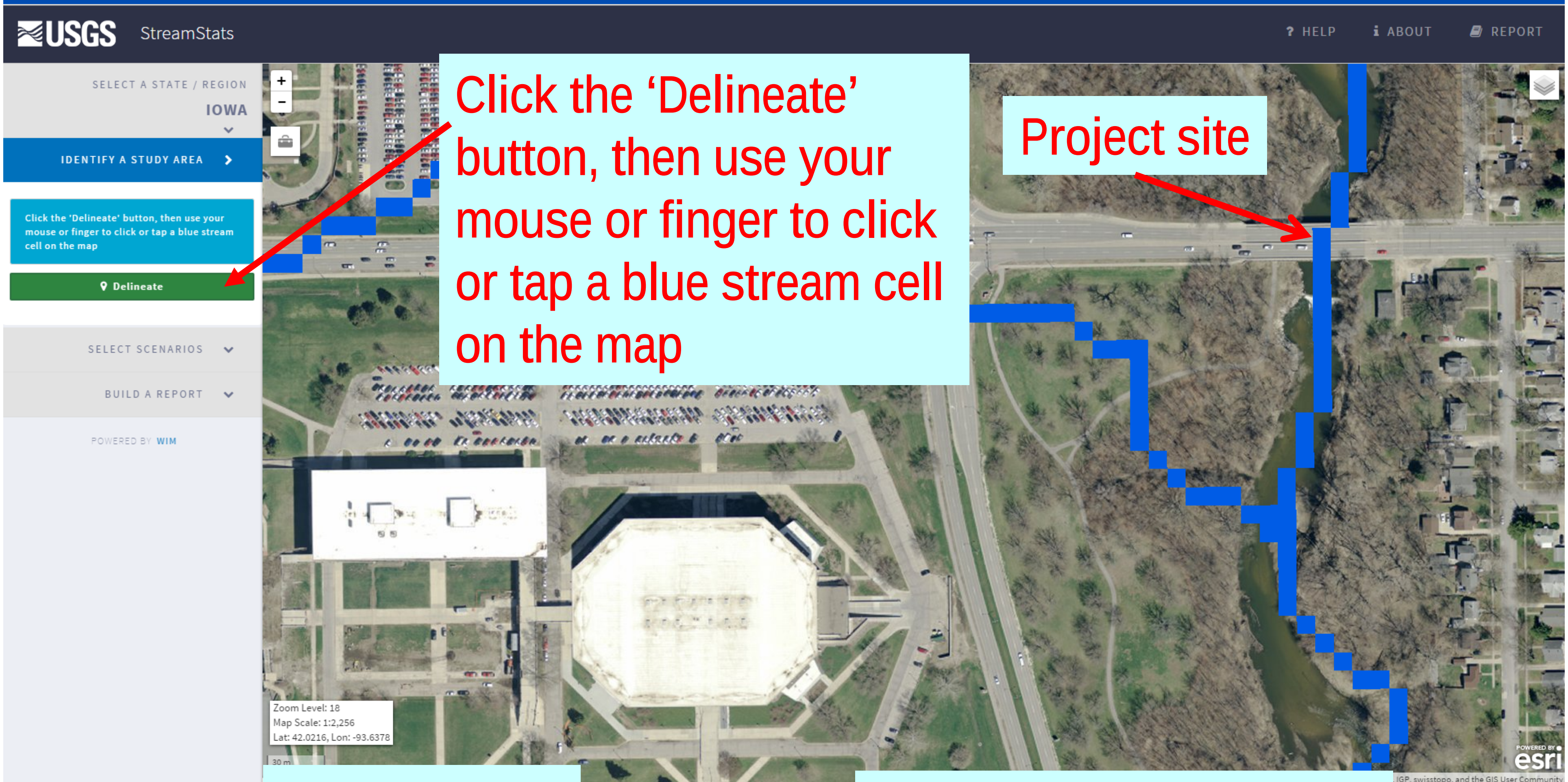
Zoom level 8

Location Search: Ames, IA: then click on Ames Story County, IA



USGS

How to Perform a Basin Delineation



Click the 'Delineate' button, then use your mouse or finger to click or tap a blue stream cell on the map

Project site

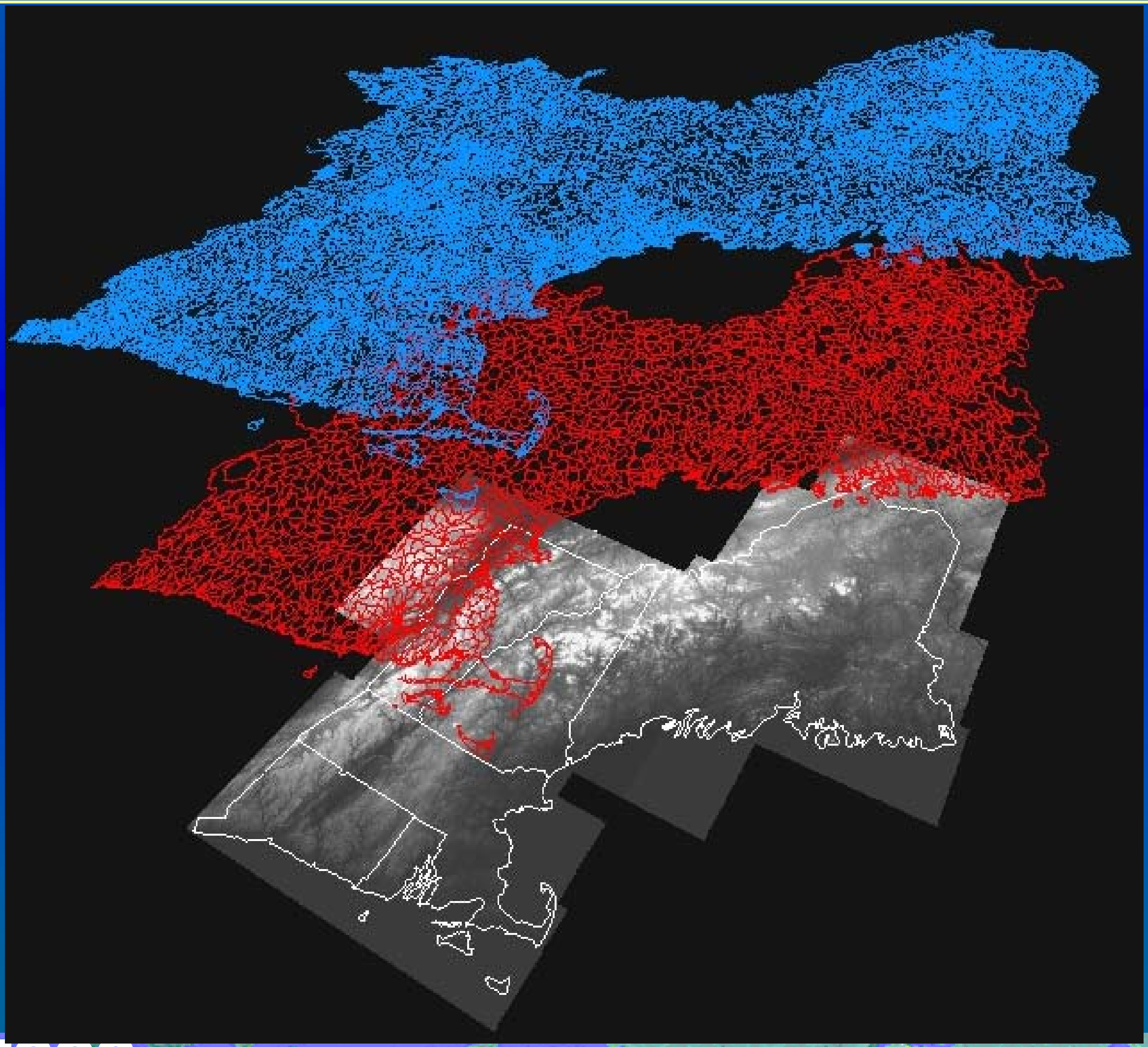
Zoom level 18

Base Map: ESRI Imagery

Watershed Delineation from a Point

1. User selects point on stream
2. Point is transferred to a cell in a flow-direction grid derived from a DEM
3. GIS determines boundary from flow-direction grid up to points at which the boundary for the new site intersects boundaries in boundary map layer
4. GIS accumulates all upstream areas and dissolves internal boundaries

StreamStats Integrates NHD Streams, WBD Boundaries and NED Elevation in ArcHydro

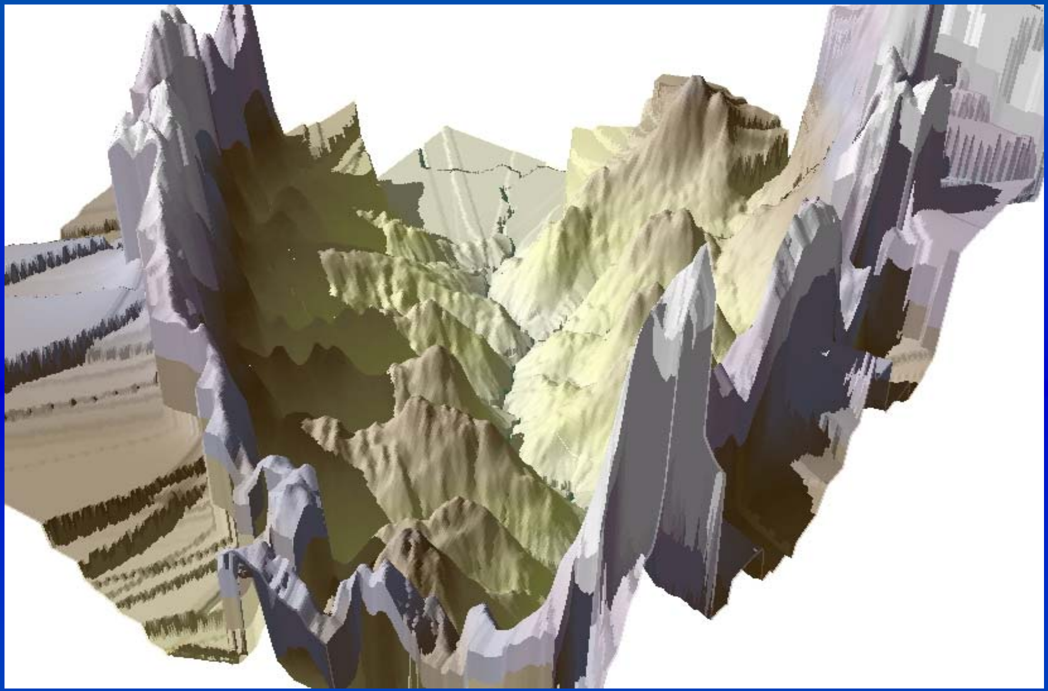


National Hydrography Dataset (NHD)

Watershed Boundary Dataset (WBD)

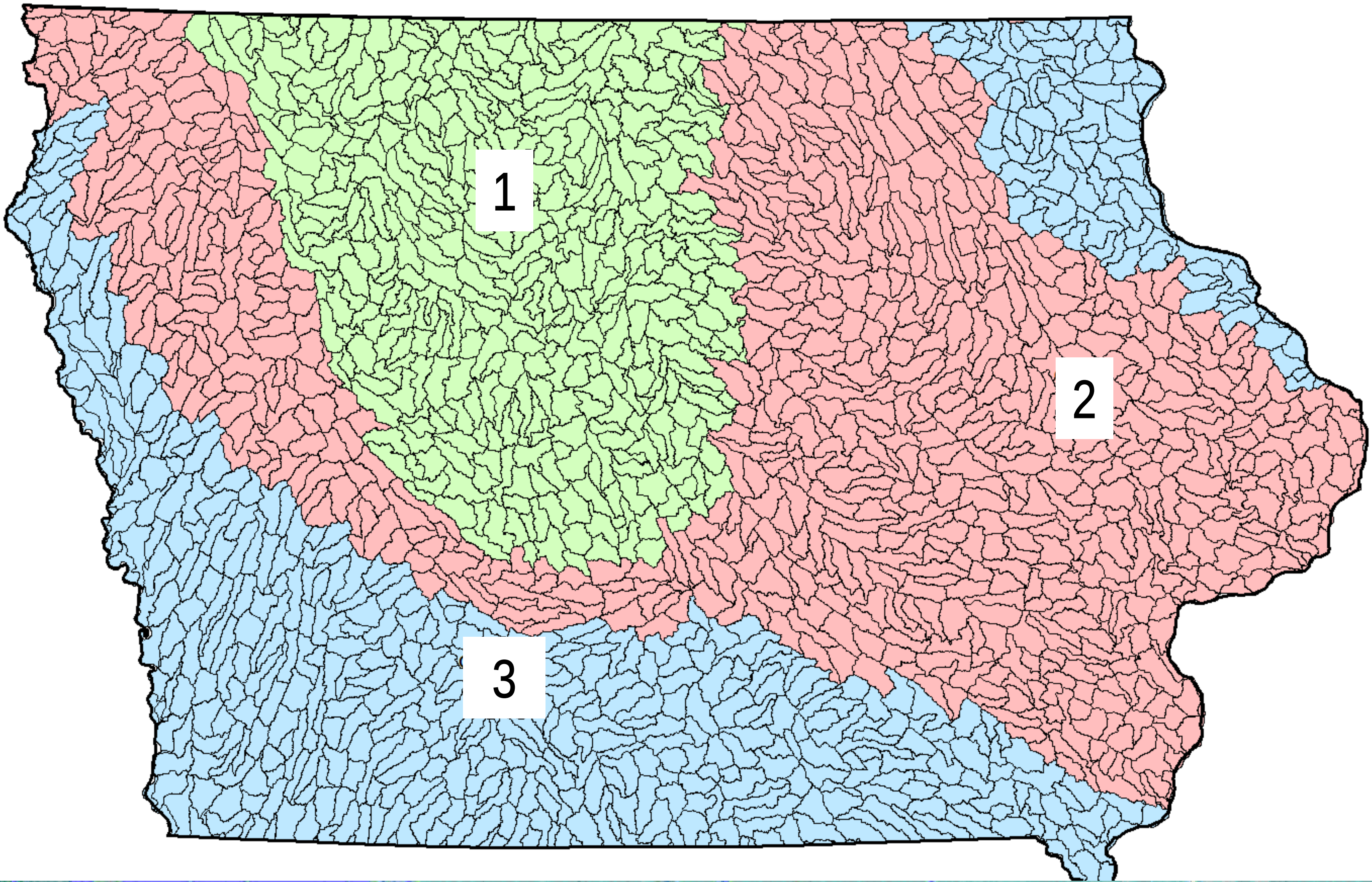
National Elevation Dataset (NED)

Burning and Walling of DEM



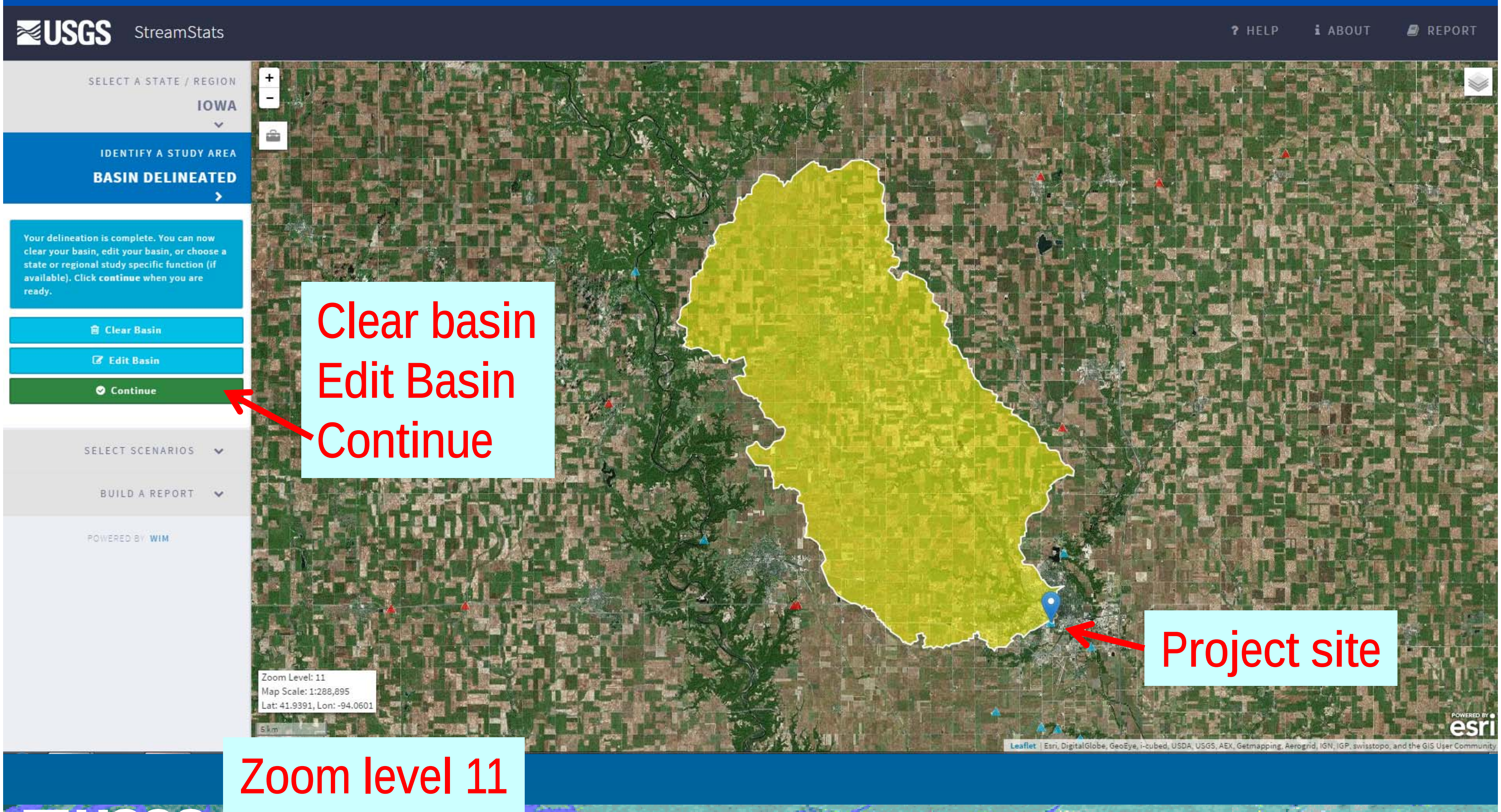
Forces DEM to agree with stream network and WBD or locally digitized drainage boundaries

12-digit HUCs Watershed Boundary Dataset



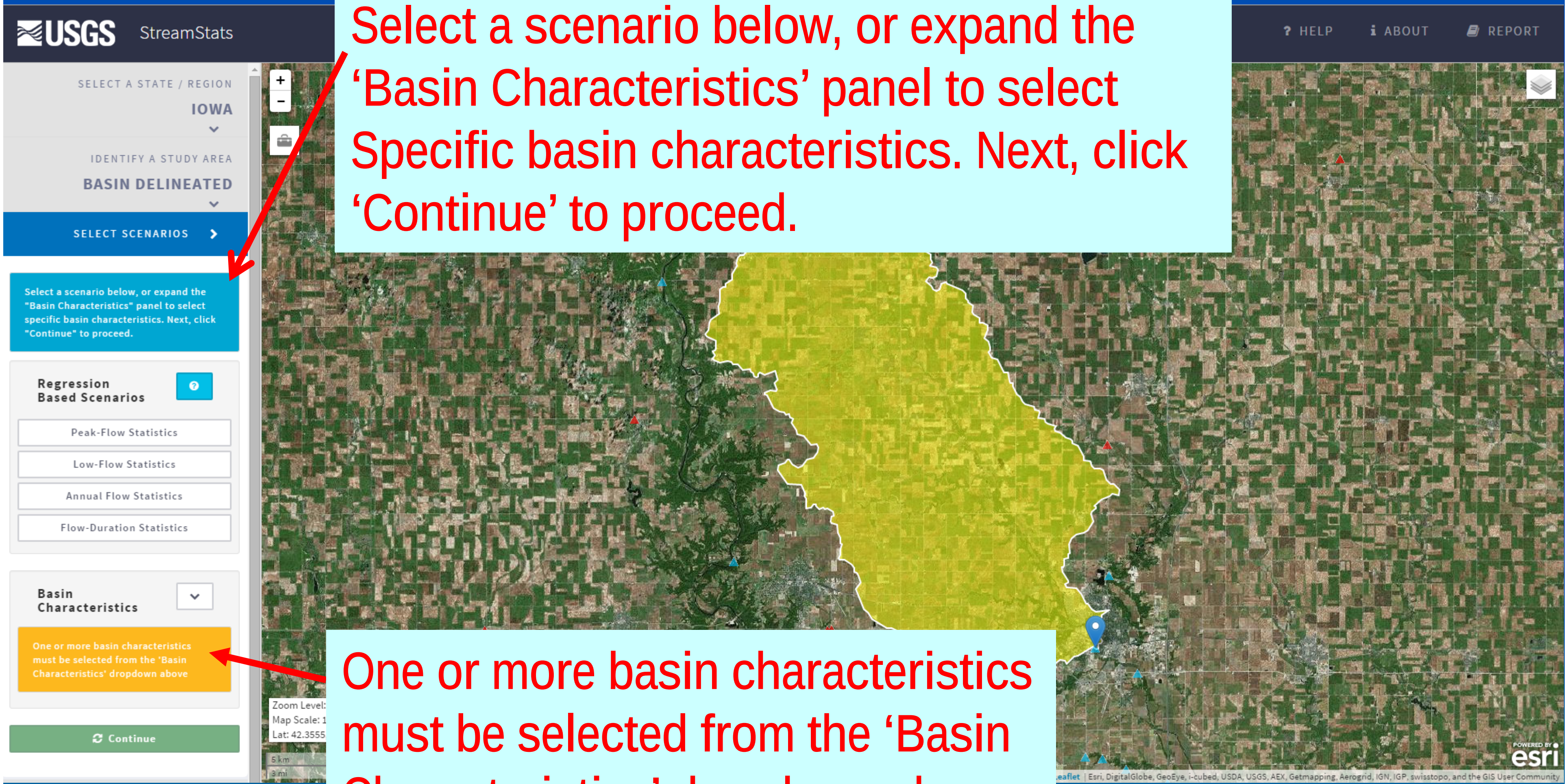
USGS

Basin Delineation



Select Scenarios

Select a scenario below, or expand the 'Basin Characteristics' panel to select Specific basin characteristics. Next, click 'Continue' to proceed.



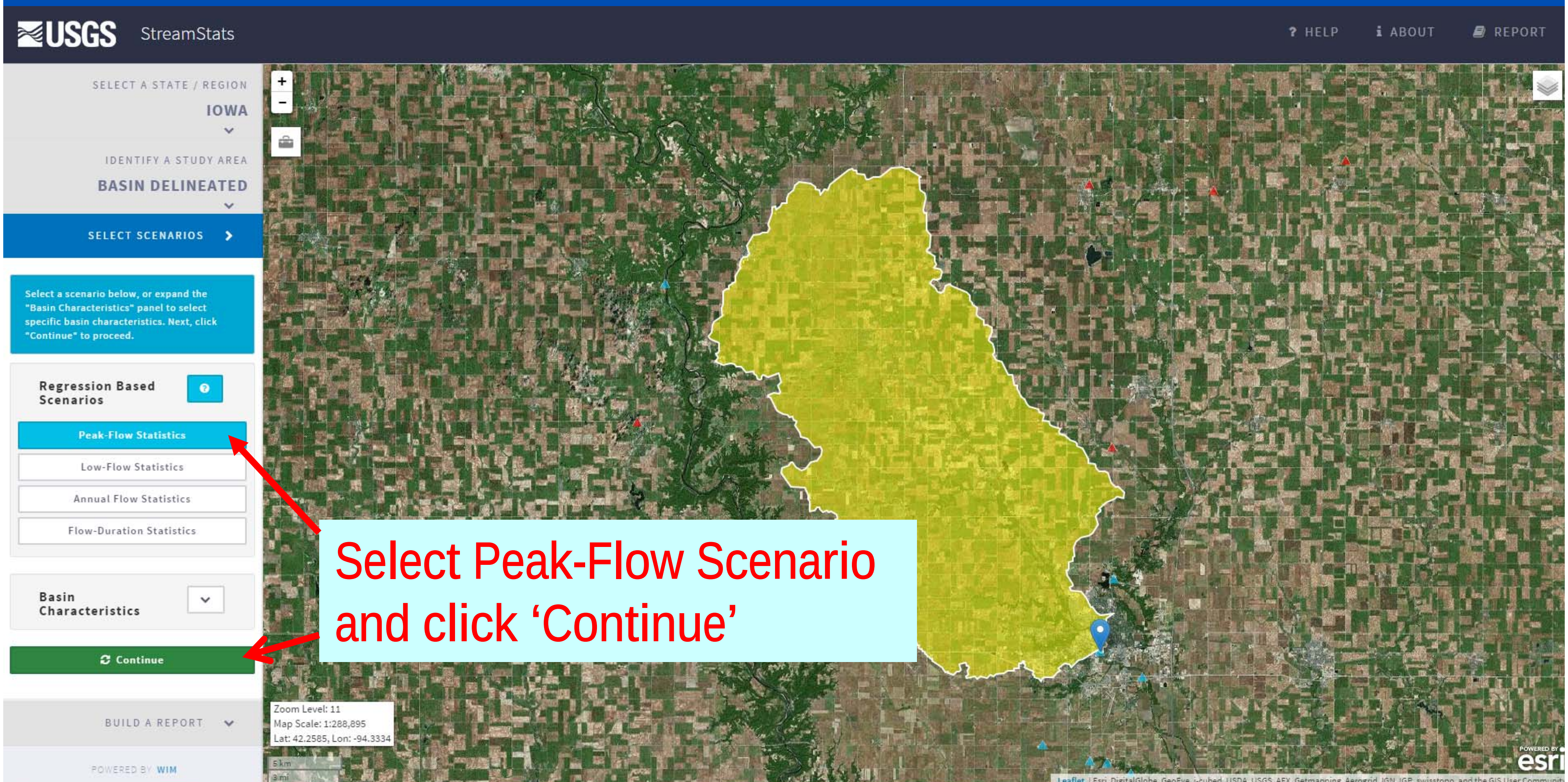
One or more basin characteristics must be selected from the 'Basin Characteristics' dropdown above

Regression Based Scenarios

- Peak-Flow Statistics (8 flood-frequency statistics that include 2- to 500-year recurrence-interval floods)
- Low-Flow Statistics (4 annual and 2 seasonal low-flow probabilities)
- Annual-Flow Statistics (Harmonic mean)
- Flow-Duration Statistics (15 statistics that include 1% - 99% exceedance probabilities)

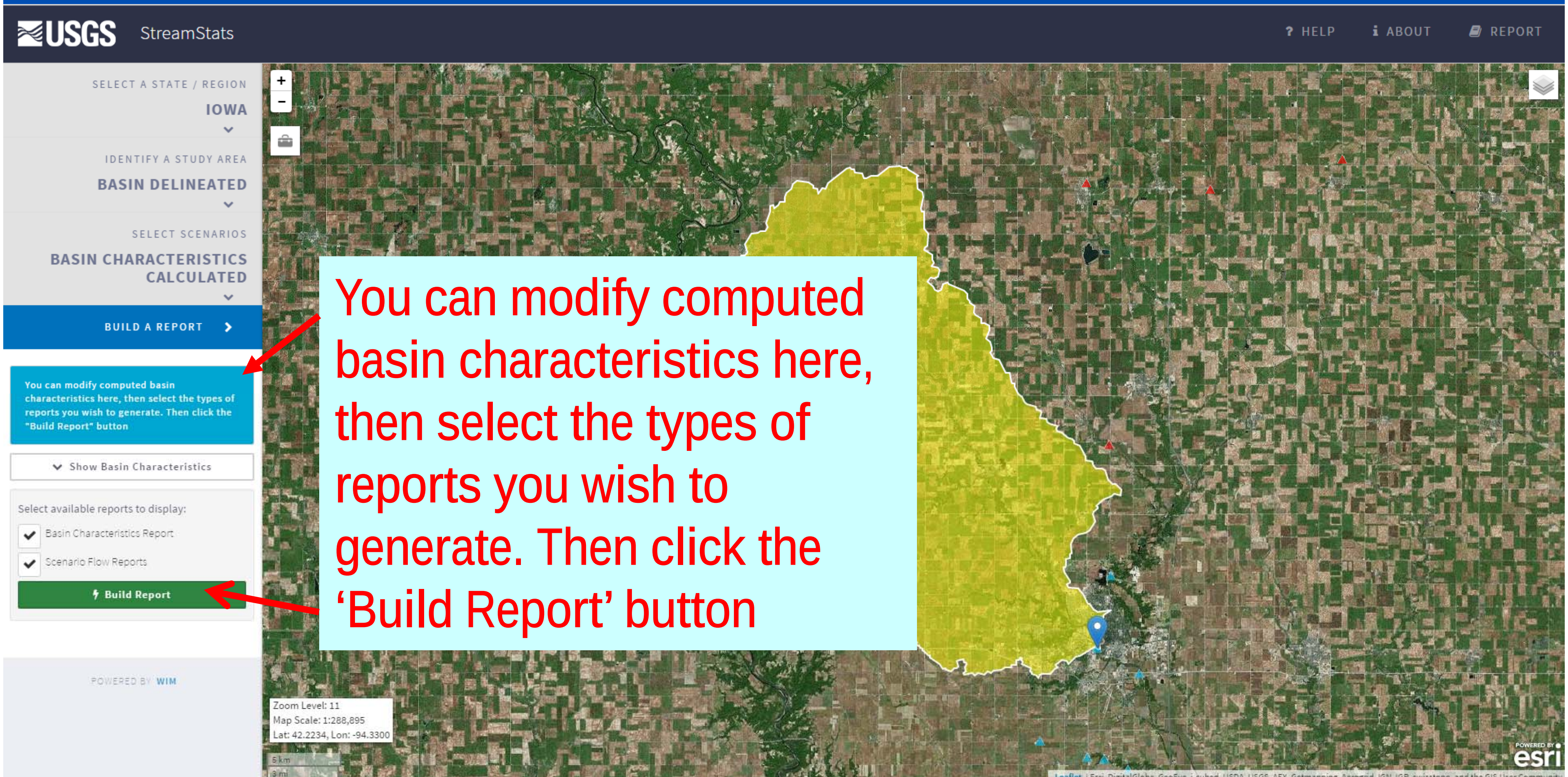
USGS

Peak-Flow Scenario



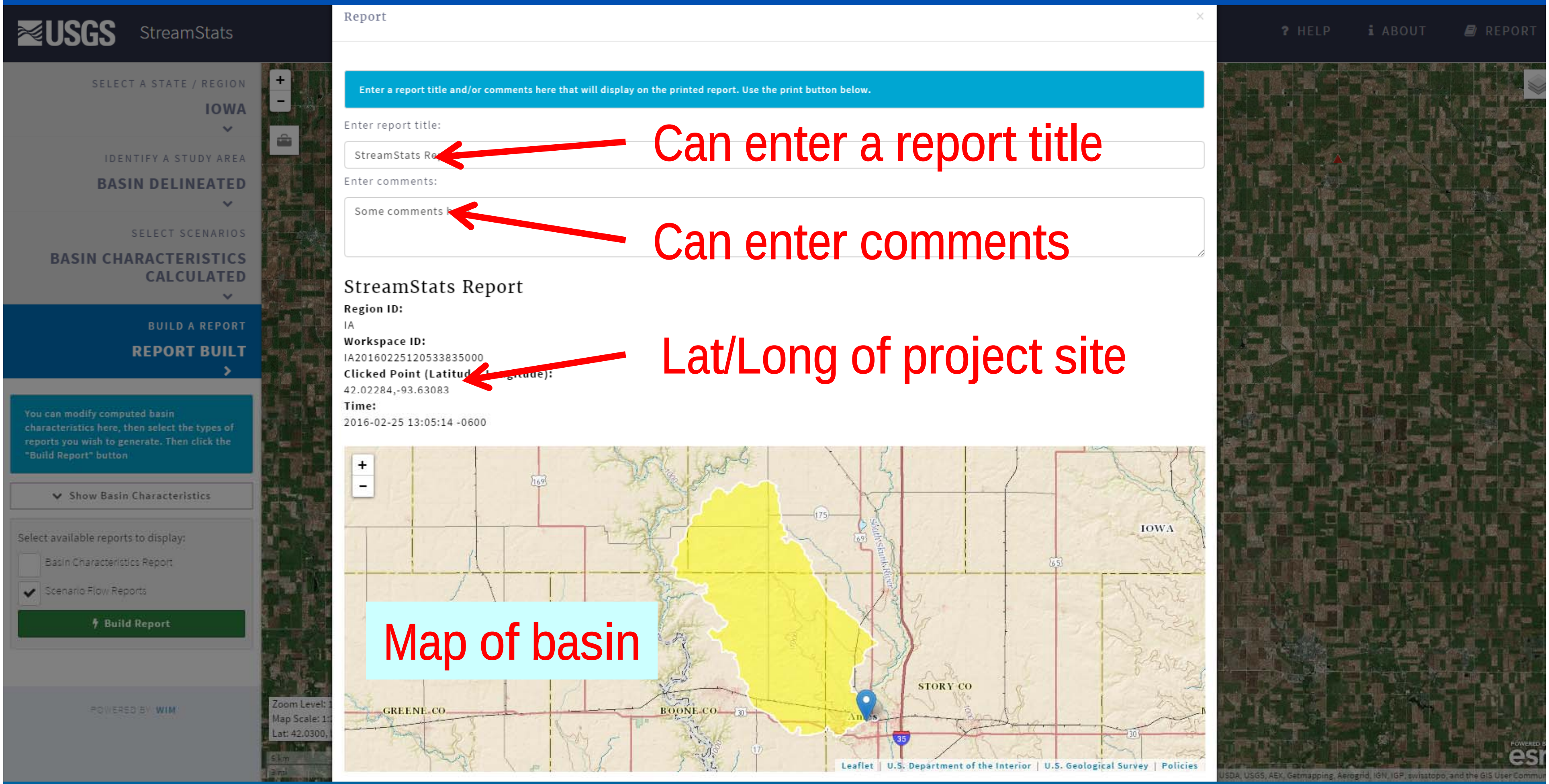
Select Peak-Flow Scenario and click 'Continue'

Build A Report



You can modify computed basin characteristics here, then select the types of reports you wish to generate. Then click the 'Build Report' button

Peak-Flow Report: top half



Peak-Flow Report: bottom half

Peak-Flow Statistics Parameters 100 Percent Peak Region 1 2013 5086

100 Percent Peak Region 1

Parameter	Value	Min Limit	Max Limit
Drainage Area	210	0.06	5464.00
24 Hour 10 Year Precipitation	4.46	3.58	4.50
Constant of Channel Maintenance	0.79	0.11	3.87

Basin-characteristic values

Peak-Flow Statistics Flow Report

Statistic	Value	Unit	Prediction Error
2 Year Peak Flood [100 Percent Peak Region 1 2013 5086]	2346	ft^3/s	41.6
5 Year Peak Flood [100 Percent Peak Region 1 2013 5086]	4592	ft^3/s	32.6
10 Year Peak Flood [100 Percent Peak Region 1 2013 5086]	6404	ft^3/s	31.8
25 Year Peak Flood [100 Percent Peak Region 1 2013 5086]	8880	ft^3/s	33.2
50 Year Peak Flood [100 Percent Peak Region 1 2013 5086]	10767	ft^3/s	35.6
100 Year Peak Flood [100 Percent Peak Region 1 2013 5086]	12836	ft^3/s	38
200 Year Peak Flood [100 Percent Peak Region 1 2013 5086]	15082	ft^3/s	41
500 Year Peak Flood [100 Percent Peak Region 1 2013 5086]	17678	ft^3/s	45.2

Peak-Flow Estimates

Peak-Flow Statistics Citations

Eash, D.A., Barnes, K.K., and Veilleux, A.G., 2013, Methods for estimating annual exceedance-probability discharges for streams in Iowa, based on data through water year 2010: U.S. Geological Survey Scientific Investigations Report 2013-5086, 63 p. with a

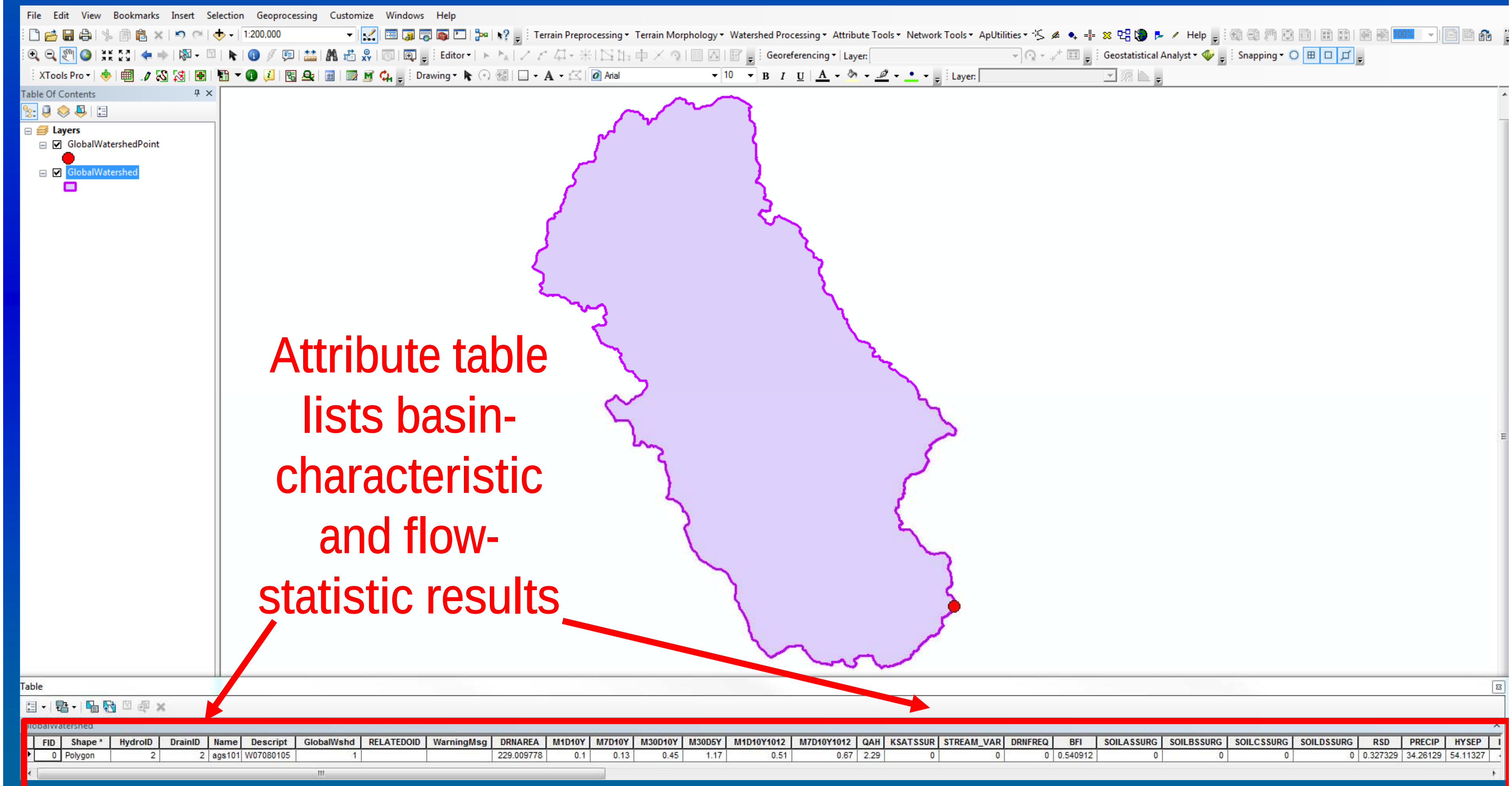
Download Basin | Download CSV

Download Basin or CSV or Print

Close | Print

USGS

ArcMap showing downloaded Shapefiles



FID	Shape *	HydroID	DrainID	Name	Descript	GlobalWshd	RELATEDOID	WarningMsg	DRNAREA	M1D10Y	M7D10Y	M30D10Y	M30D5Y	M1D10Y1012	M7D10Y1012	QAH	KSATSSUR	STREAM_VAR	DRNFREQ	BFI	SOILASSURG	SOILBSSURG	SOILCSSURG	SOILDSSURG	RSD	PRECIP	HYSEP
0	Polygon	2	2	ags101	W07080105	1			229.009778	0.1	0.13	0.45	1.17	0.51	0.67	2.29	0	0	0	0.540912	0	0	0	0	0.327329	34.26129	54.11327

Attribute table lists basin-characteristic and flow-statistic results

USGS

CSV Download

StreamStats Output Report			
State/Region ID	IA		
Workspace ID	IA20160225120533835000		
Latitude	42.02284		
Longitude	-93.63083		
Time	2/25/2016	1:05:14 PM	
Parameters			
Name	Value	Unit	
DRNAREA	210	square miles	
I24H10Y	4.46	inches	
CCM	0.79	square mile per mile	
DRNAREA	210	square miles	
I24H10Y	4.46	inches	
CCM	0.79	square mile per mile	
Peak-Flow Statistics Parameters 100 Percent Peak Region 1 2013 5086			
Name	Value	Min Limit	Max Limit
Drainage Area	210	0.06	5464
24 Hour 10 Year Precipitation	4.46	3.58	4.5
Constant of Channel Maintenance	0.79	0.11	3.87
Peak-Flow Statistics Flow Report			
Name	Value	Unit	Prediction Error
2 Year Peak Flood	2346	ft^3/s	
5 Year Peak Flood	4592	ft^3/s	
10 Year Peak Flood	6404	ft^3/s	
25 Year Peak Flood	8880	ft^3/s	
50 Year Peak Flood	10767	ft^3/s	
100 Year Peak Flood	12836	ft^3/s	
200 Year Peak Flood	15082	ft^3/s	
500 Year Peak Flood	17678	ft^3/s	

Low-Flow Report: bottom half

100 Percent Low Flow Northwest Region

Low-Flow Statistics Parameters 100 Percent Low Flow Northwest Region 2012 5171

Basin-characteristic values

Parameter	Value	Min Limit	Max Limit
Drainage Area	210	23.40	5464.00
Base Flow Index	0.540759	0.36	0.62
SSURGO Percent Hydrologic Soil Type A	1.49	0.00	7.87

Low-Flow Statistics Flow Report

Low-Flow Estimates

Statistic	Value	Unit	Prediction Error
1 Day 10 Year Low Flow [100 Percent Low Flow Northwest Region 2012 5171]	0	ft^3/s	104.8
7 Day 10 Year Low Flow [100 Percent Low Flow Northwest Region 2012 5171]	0	ft^3/s	111.8
30 Day 10 Year Low Flow [100 Percent Low Flow Northwest Region 2012 5171]	0	ft^3/s	109.7
30 Day 5 Year Low Flow [100 Percent Low Flow Northwest Region 2012 5171]	1	ft^3/s	87.2
1 Day 10 Year lowflow Oct to Dec [100 Percent Low Flow Northwest Region 2012 5171]	0	ft^3/s	85.8
7 Day 10 Year lowflow Oct to Dec [100 Percent Low Flow Northwest Region 2012 5171]	1	ft^3/s	88.4

Low-Flow Statistics Citations

Eash, D.A., and Barnes, K.K., 2012, Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa: U.S. Geological Survey Scientific Investigations Report 2012-5171, 99 p.

Annual-Flow Report: bottom half

100 Percent Low Flow Northwest Region

Annual Flow Statistics Parameters [100.00 Percent Low Flow Northwest Region 2012 5171]

Basin-characteristic values

Parameter	Value	Min Limit	Max Limit
Drainage Area	210	23.4	5464
Tau Annual from Grid	21.96	21.2	35.8
Relative Stream Density	0.34	0.189	0.511

Annual Flow Statistics Flow Report [100.00 Percent Low Flow Northwest Region 2012 5171]

Harmonic Mean Streamflow Estimate

Statistic	Value	Unit	Prediction Error
Harmonic Mean Streamflow	2.159	ft^3/s	71.6

Annual Flow Statistics Citations

Eash, D.A., and Barnes, K.K., 2012, Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa: U.S. Geological Survey Scientific Investigations Report 2012-5171, 99 p.

Flow-Duration Report: bottom half

Flow-Duration Statistics Parameters 100 Percent Statewide Flow Duration 2012 5232

Parameter	Value	Min Limit	Max Limit
Drainage Area	210	15.50	7782.00
Mean Annual Precipitation	34.24	27.70	38.00
SSURGO Percent Hydrologic Soil Type C	4.43	0.09	83.50
Relative Stream Density	0.34	0.22	0.49
Hydrograph separation percent	54.13	20.30	78.00
Streamflow Variability Index from Grid	0.63	0.21	0.76
SSURGO Percent Hydrologic Soil Type B	94.1	5.70	99.40
SSURGO Percent Hydrologic Soil Type D	0	0.00	57.00

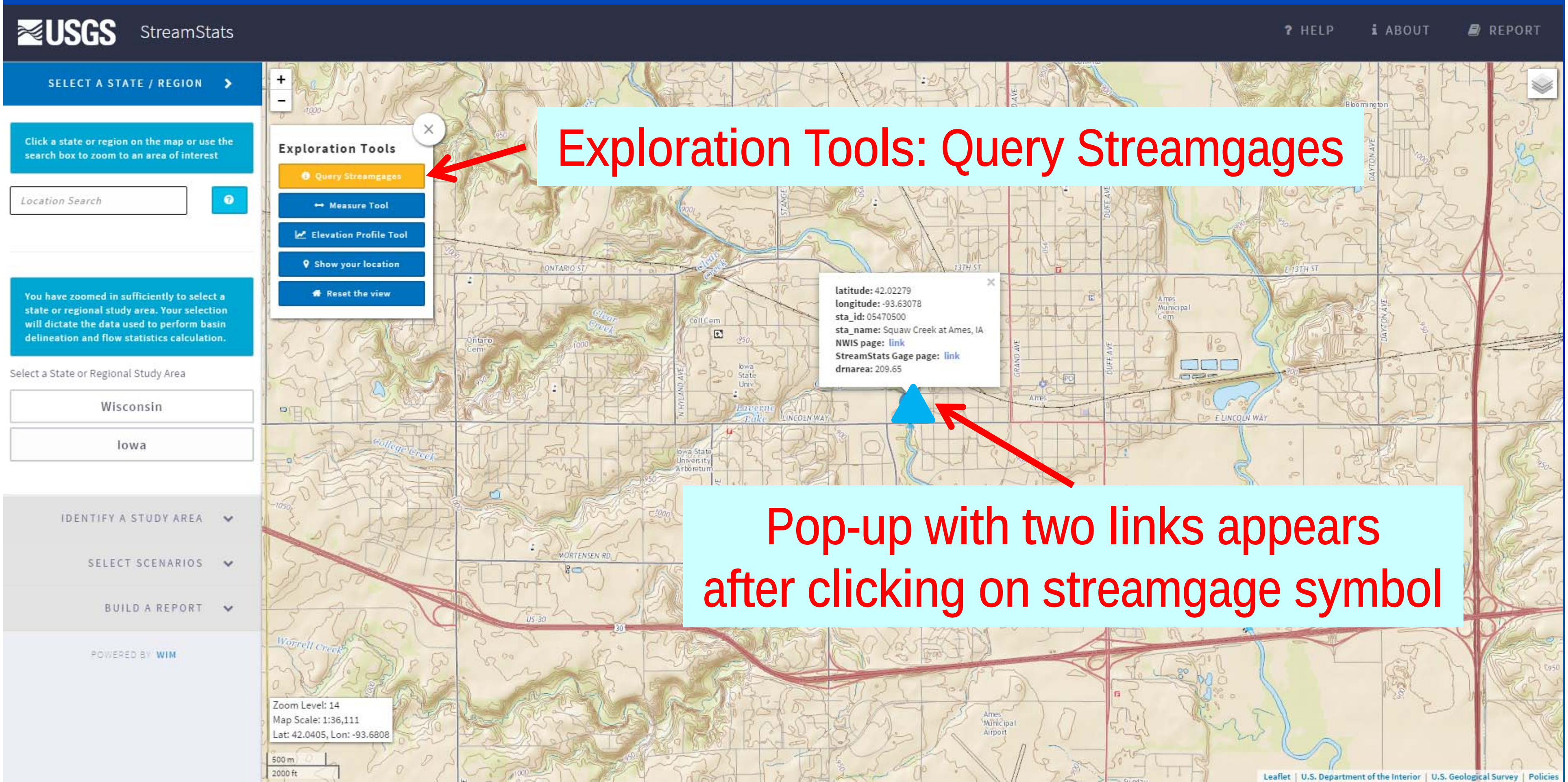
Basin-characteristic values

Flow-Duration Statistics Flow Report

Statistic	Value	Unit	Prediction Error
1 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	1256	ft^3/s	23.5
5 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	471	ft^3/s	23.6
10 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	262	ft^3/s	24.2
15 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	225	ft^3/s	24.6
20 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	175	ft^3/s	22.1
30 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	124	ft^3/s	17.1
40 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	87	ft^3/s	14.9
50 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	66	ft^3/s	16.4
60 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	48	ft^3/s	22.1
70 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	31	ft^3/s	32.4
80 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	13	ft^3/s	40.1
85 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	10	ft^3/s	42.5
90 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	7	ft^3/s	51
95 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	4	ft^3/s	74.9
99 Percent Duration [100 Percent Statewide Flow Duration 2012 5232]	1	ft^3/s	97.7

Flow-Duration Estimates

StreamStats Streamgage Information



StreamStats Streamgage Information

latitude: 42.02279

longitude: -93.63078

sta_id: 05470500

sta_name: Squaw Creek at Ames, IA

NWIS page: link NWIS Link

StreamStats Gage page: link

drnarea: 209.65 StreamStats Link

StreamStats Streamgage Information

USGS
science for a changing world

StreamStats Data-Collection Station Report

USGS Station Number **05470500**
Station Name **Squaw Creek at Ames, IA**

Click here to link to available data on NWIS-Web for this site.

Descriptive Information

Descriptive information

Station Type	Streamgage, continuous record
Location	
Gage	
Regulation and Diversions	
Regulated?	False
Period of Record	
Remarks	
Latitude (degrees NAD83)	42.02304157
Longitude (degrees NAD83)	-93.63049623
Hydrologic unit code	07080105
County	169-Story
HCDN2009	No

Basin Characteristics

Physical Characteristics

Characteristic Name	Value	Units	Citation Number
Descriptive Information			
Datum_of_Latitude_Longitude	NAD83	dimensionless	30
District_Code	19	dimensionless	30
Begin_date_of_record	5/24/1919	days	41
End_date_of_record	9/30/2003	days	41
Number_of_days_of_record	17061	days	41

USGS

StreamStats Streamgage Information

Basin Characteristics

Physical Characteristics

Characteristic Name	Value	Units	Citation Number
Descriptive Information			
Datum_of_Latitude_Longitude	NAD83	dimensionless	30
District_Code	19	dimensionless	30
Begin_date_of_record	5/24/1919	days	41
End_date_of_record	9/30/2003	days	41
Number_of_days_of_record	17061	days	41
Number_of_days_GT_0	16685	days	41
Precipitation Statistics			
24_Hour_2_Year_Precipitation	3.2000	inches	31
24_Hour_10_Year_Precipitation	4.461	inches	244
Mean_Annual_Precipitation	30.900	inches	31
Climate Characteristics			
Mean_Annual_Snowfall	32.000	inches	31
Temperature Statistics			
Mean_Min_January_Temperature	10.500	degrees F	31
Mean_Max_July_Temperature	87.000	degrees F	31
Topographical Characteristics			
Mean_Basin_Elevation	1060.00	feet	31
Geological Characteristics			
Des_Moines_Lobe	100	percent	244
Loess_Depth	0.1000	feet	31
Land Cover Characteristics			
Percent_Forest	2.2000	percent	31
Soil Properties			
Soil_Infiltration	3.2000	inches	31
SSURGO_Percent_Hydrologic_Soil_Type_A	1.487	percent	243
SSURGO_Percent_Hydrologic_Soil_Type_B	93.732	percent	243
SSURGO_Percent_Hydrologic_Soil_Type_C	4.358	percent	243
SSURGO_Saturated_Hydraulic_Conductivity	11.726	micrometers per second	243
Stream Channel Properties			
Drainage_Frequency	0.534	per square mile	243

USGS

StreamStats Streamgage Information

Streamflow Statistics

Statistic Name	Value	Units	Citation Number	Preferred?	Years of Record	Standard Error, percent	Variance log-10	Lower 95% Confidence Interval	Upper 95% Confidence Interval	Start Date	End Date	Remarks
Peak-Flow Statistics												
2_Year_Peak_Flood	2680	cubic feet per second	244	Y	93	9.6	0.00173	2200	3220	6/4/1918	8/11/2010	EMA/MGB
5_Year_Peak_Flood	4960	cubic feet per second	244	Y	93	9.82	0.00181	4080	6040	6/4/1918	8/11/2010	EMA/MGB
10_Year_Peak_Flood	6860	cubic feet per second	244	Y	93	11.1	0.0023	5580	8740	6/4/1918	8/11/2010	EMA/MGB
25_Year_Peak_Flood	9730	cubic feet per second	244	Y	93	13.9	0.0036	7690	13700	6/4/1918	8/11/2010	EMA/MGB
50_Year_Peak_Flood	12200	cubic feet per second	244	Y	93	16.6	0.00512	9350	18900	6/4/1918	8/11/2010	EMA/MGB
100_Year_Peak_Flood	15000	cubic feet per second	244	Y	93	19.6	0.00714	11100	25600	6/4/1918	8/11/2010	EMA/MGB
200_Year_Peak_Flood	18100	cubic feet per second	244	Y	93	23	0.00969	12800	34400	6/4/1918	8/11/2010	EMA/MGB
500_Year_Peak_Flood	22800	cubic feet per second	244	Y	93	27.6	0.01388	15200	49900	6/4/1918	8/11/2010	EMA/MGB
Regression_2_Year_Peak_Flood	2350	cubic feet per second	244	Y								RRE
Regression_5_Year_Peak_Flood	4590	cubic feet per second	244	Y								RRE
Regression_10_Year_Peak_Flood	6400	cubic feet per second	244	Y								RRE
Regression_25_Year_Peak_Flood	8880	cubic feet per second	244	Y								RRE
Regression_50_Year_Peak_Flood	10800	cubic feet per second	244	Y								RRE
Regression_100_Year_Peak_Flood	12800	cubic feet per second	244	Y								RRE
Regression_200_Year_Peak_Flood	15100	cubic feet per second	244	Y								RRE
Regression_500_Year_Peak_Flood	17700	cubic feet per second	244	Y								RRE
Weighted_5_Year_Peak_Flood	4930	cubic feet per second	244	Y		8.6	0.0014	4170	5830			WIE
Weighted_10_Year_Peak_Flood	6810	cubic feet per second	244	Y		10.1	0.0019	5600	8280			WIE
Weighted_25_Year_Peak_Flood	9600	cubic feet per second	244	Y		12.4	0.0029	7520	12300			WIE
Weighted_50_Year_Peak_Flood	11900	cubic feet per second	244	Y		14.8	0.0041	8960	15900			WIE
Weighted_100_Year_Peak_Flood	14500	cubic feet per second	244	Y		17	0.0054	10400	20200			WIE
Weighted_200_Year_Peak_Flood	17300	cubic feet per second	244	Y		19.6	0.0071	11900	25300			WIE
Weighted_500_Year_Peak_Flood	21300	cubic feet per second	244	Y		22.9	0.0096	13700	33100			WIE
Systematic_peak_years	20.000	years	31	Y								
Peak_years_with_historic_adjustment	0.0000	years	31	Y								
Weighted_2_Year_Peak_Flood	2670	cubic feet per second	244	Y		7.6	0.0011	2290	3110			WIE
Flood-Volume Statistics												
3_Day_2_Year_Maximum	1354.00	cubic feet per second	31	Y								
3_Day_10_Year_Maximum	2015.00	cubic feet per second	31	Y								
3_Day_50_Year_Maximum	2160.00	cubic feet per second	31	Y								

Peak-flow statistics

Citation number to report with published statistic

StreamStats Streamgage Information

Low-Flow Statistics							
1_Day_10_Year_Low_Flow	0	cubic feet per second	243	Y	40	4/1/1966	3/31/2005
7_Day_10_Year_Low_Flow	0	cubic feet per second	243	Y	40	4/1/1966	3/31/2005
30_Day_5_Year_Low_Flow	0.66	cubic feet per second	243	Y	40	4/1/1966	3/31/2005
30_Day_10_Year_Low_Flow	0.15	cubic feet per second	243	Y	40	4/1/1966	3/31/2005
Low_flow_years	20.000	years	31	Y			
1_Day_10_Year_lowflow_Oct_to_Dec	0	cubic feet per second	243	Y	40	10/1/1966	12/31/2005
7_Day_10_Year_lowflow_Oct_to_Dec	0	cubic feet per second	243	Y	40	10/1/1966	12/31/2005
Flow-Duration Statistics							
1_Percent_Duration	1400	cubic feet per second	41	Y	47		
5_Percent_Duration	571.45	cubic feet per second	41	Y	47		
10_Percent_Duration	339	cubic feet per second	41	Y	47		
20_Percent_Duration	174	cubic feet per second	41	Y	47		
25_Percent_Duration	134	cubic feet per second	41	Y	47		
30_Percent_Duration	104	cubic feet per second	41	Y	47		
40_Percent_Duration	68	cubic feet per second	41	Y	47		
50_Percent_Duration	43	cubic feet per second	41	Y	47		
60_Percent_Duration	27	cubic feet per second	41	Y	47		
70_Percent_Duration	15	cubic feet per second	41	Y	47		
75_Percent_Duration	10	cubic feet per second	41	Y	47		
80_Percent_Duration	6.4	cubic feet per second	41	Y	47		
90_Percent_Duration	1.6	cubic feet per second	41	Y	47		
95_Percent_Duration	0.44	cubic feet per second	41	Y	47		
99_Percent_Duration	0	cubic feet per second	41	Y	47		
Annual Flow Statistics							
Mean_Annual_Flow	90.390	cubic feet per second	31	Y			
Daily_flow_years	20.000	years	31	Y			
Stand_Dev_of_Mean_Annual_Flow	37.980	cubic feet per second	31	Y			
Harmonic_Mean_Streamflow	2.36	cubic feet per second	243	Y	40	4/1/1966	9/30/2006
Tau_Annual	22.174	days	243	Y			
Monthly Flow Statistics							
January_Mean_Flow	28.000	cubic feet per second	31	Y			
January_STD	24.940	cubic feet per second	31	Y			
February_Mean_Flow	68.570	cubic feet per second	31	Y			
February_STD	48.720	cubic feet per second	31	Y			
March_Mean_Flow	145.400	cubic feet per second	31	Y			
March_STD	100.400	cubic feet per second	31	Y			
April_Mean_Flow	126.600	cubic feet per second	31	Y			

Low-flow and flow-duration statistics

USGS

StreamStats Streamgage Information

August_STD	72.480	cubic feet per second	31	Y	
September_Mean_Flow	148.400	cubic feet per second	31	Y	
September_STD	197.000	cubic feet per second	31	Y	
October_Mean_Flow	97.490	cubic feet per second	31	Y	
October_STD	80.220	cubic feet per second	31	Y	
November_Mean_Flow	80.760	cubic feet per second	31	Y	
November_STD	74.470	cubic feet per second	31	Y	
December_Mean_Flow	39.630	cubic feet per second	31	Y	
December_STD	24.780	cubic feet per second	31	Y	
General Flow Statistics					
Minimum_daily_flow	0	cubic feet per second	41	Y	47
Maximum_daily_flow	12200	cubic feet per second	41	Y	47
Std_Dev_of_daily_flows	316.869	cubic feet per second	41	Y	47
Average_daily_streamflow	137.433	cubic feet per second	41	Y	47
Streamflow_Variability_Index_At_Site	0.629	dimensionless	243	Y	
Base Flow Statistics					
Number_of_years_to_compute_BFI	46	years	42	Y	47
Average_BFI_value	0.365	dimensionless	42	Y	47
Std_dev_of_annual_BFI_values	0.098	dimensionless	42	Y	47
Base_Flow_Index	0.535	dimensionless	243	Y	

Citations

Citation Number	*Citation Name and URL*
30	Imported from NWIS file
31	Imported from Basin Characteristics file
41	Wolock, D.M., 2003, Flow characteristics at U.S. Geological Survey streamgages in the conterminous United States: U.S. Geological Survey Open-File Report 03-146, digital data set
42	Wolock, D.M., 2003, Base-flow index grid for the conterminous United States: U.S. Geological Survey Open-File Report 03-263, digital data set
243	Eash, D.A., and Barnes, K.K., 2012, Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa: U.S. Geological Survey Scientific Investigations Report 2012-5171, 99 p.
244	Eash, D.A., Barnes, K.K., and Veilleux, A.G., 2013, Methods for estimating annual exceedance-probability discharges for streams in Iowa, based on data through water year 2010: U.S. Geological Survey Scientific Investigations Report 2013-5086, 63 p. with a

Cited reports which include published streamflow statistics

NWIS Streamgage Information

USGS 05470500 Squaw Creek at Ames, IA

Available data for this site SUMMARY OF ALL AV

Stream Site

Summary of all available data

DESCRIPTION:

Latitude 42°01'23",   Longitude 93°37'49"   NAD27
Story County, Iowa, Hydrologic Unit 07080105
Drainage area: 204 square miles
Datum of gage: 881.00 feet above   NGVD29.

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Current / Historical Observations (availability statement)	2007-10-01	2015-09-21	
Daily Data			
Discharge, cubic feet per second	1919-05-24	2015-09-20	21434
Daily Statistics			
Discharge, cubic feet per second	1919-05-24	2015-04-27	21288
Monthly Statistics			
Discharge, cubic feet per second	1919-05	2015-04	
Annual Statistics			
Discharge, cubic feet per second	1919	2015	
Peak streamflow	1918-06-04	2014-07-01	59
Field measurements	1918-06-04	2015-09-01	674
Field/Lab water-quality samples	1969-11-06	2009-09-21	183
Water-Year Summary	2006	2014	9
Additional Data Sources	**Begin Date**	**End Date**	**Count**
Instantaneous-Data Archive **offsite**	1990-10-01	2007-09-30	506900

OPERATION:

Record for this site is maintained by the USGS Iowa Water Science Center
Email questions about this site to Iowa Water Science Center Water-Data Inquiries

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QUESTIONS
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