



Montana StreamStats

An overview of Montana StreamStats and methods for obtaining streamflow characteristics at gaged and ungaged locations in Montana

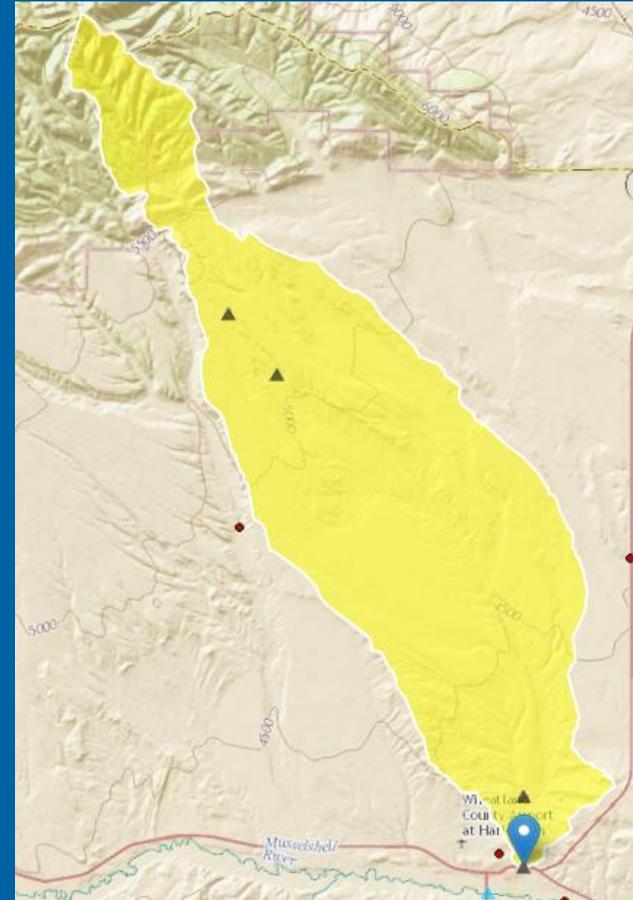
**In cooperation with
Montana Department of Natural Resources and Conservation,
Montana Department of Transportation,
and Montana Department of Environmental Quality**

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

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What is StreamStats?

- Web-based GIS system for retrieving basin and streamflow characteristics
- Delineates basins
- Computes basin characteristics
- Retrieves streamflow characteristics
- Solves regression equations for estimating streamflow characteristics



Who developed StreamStats?

- StreamStats platform developed by USGS StreamStats Team
- Data developed locally in cooperation with
 - Montana Department of Natural Resources and Conservation
 - Montana Department of Transportation
 - Montana Department of Environmental Quality



StreamStats Hydrography

- **NHDPlus Version 2: Application ready* geospatial datasets**

http://www.horizon-systems.com/nhdplus/NHDPlusV2_home.php

- **National Hydrography Dataset (NHD) 1:100K scale**
 - Stream network represented by flowlines
 - Attributes of flow direction, length, name, and many others
- **Watershed Boundary Dataset (WBD)**
 - Seamless national framework of drainage boundaries
- **30-meter Digital Elevation Model (DEM)**
 - Developed from the National Elevation Dataset (NED)
 - Raster (grid) data for elevations used to create flow accumulation and flow direction grids (for delineating basins)

StreamStats Hydrography

- **NHDPlus Version 2 also includes**
 - **USGS gaging stations**
 - **Dams from the National Inventory of Dams**
 - **Transboundary data harmonization between Canada and United States**



Montana Basin Characteristics

- **CONTDA-Contributing drainage area**
- **ELEV-Mean basin elevation**
- **TEMP-Mean annual temperature**
- **ELEVMAX-Maximum basin elevation**
- **MINBELEV-Minimum basin elevation**
- **Relief-Maximum minus minimum elevation**
- **EL5000, EL6000-Percent of basin above listed elevation**
- **IRRIGAT_MT-Percent of basin that is irrigated**
- **LAKESNHDH-Percent of basin in lakes, ponds, and reservoirs**
- **LC01CRPHAY-Percent of basin with cultivated crops**
- **LC01DEV-Percent of basin with urban land**
- **LC01WTLND-Percent of basin with wetlands**

Montana Basin Characteristics

- BSLDEM30M-Mean basin slope
- SLOP30_30M-Percent of basin with slopes greater than 30%
- NFSL30_30M-Percent of basin with north-facing slopes >30%
- SLOP50_30M-Percent of basin with slopes greater than 50%
- PRECIP-Mean annual precipitation for basin (PRISM & Natural Resources Canada; 1971-2000)
- LC01Forest-Percent of basin with forest cover
- ET0306MOD-Mean monthly evapotranspiration for March-June
- ET0710MOD-Mean monthly evapotranspiration for July-October

Due to server processing capabilities and speeds we are limited to 20 basin characteristics

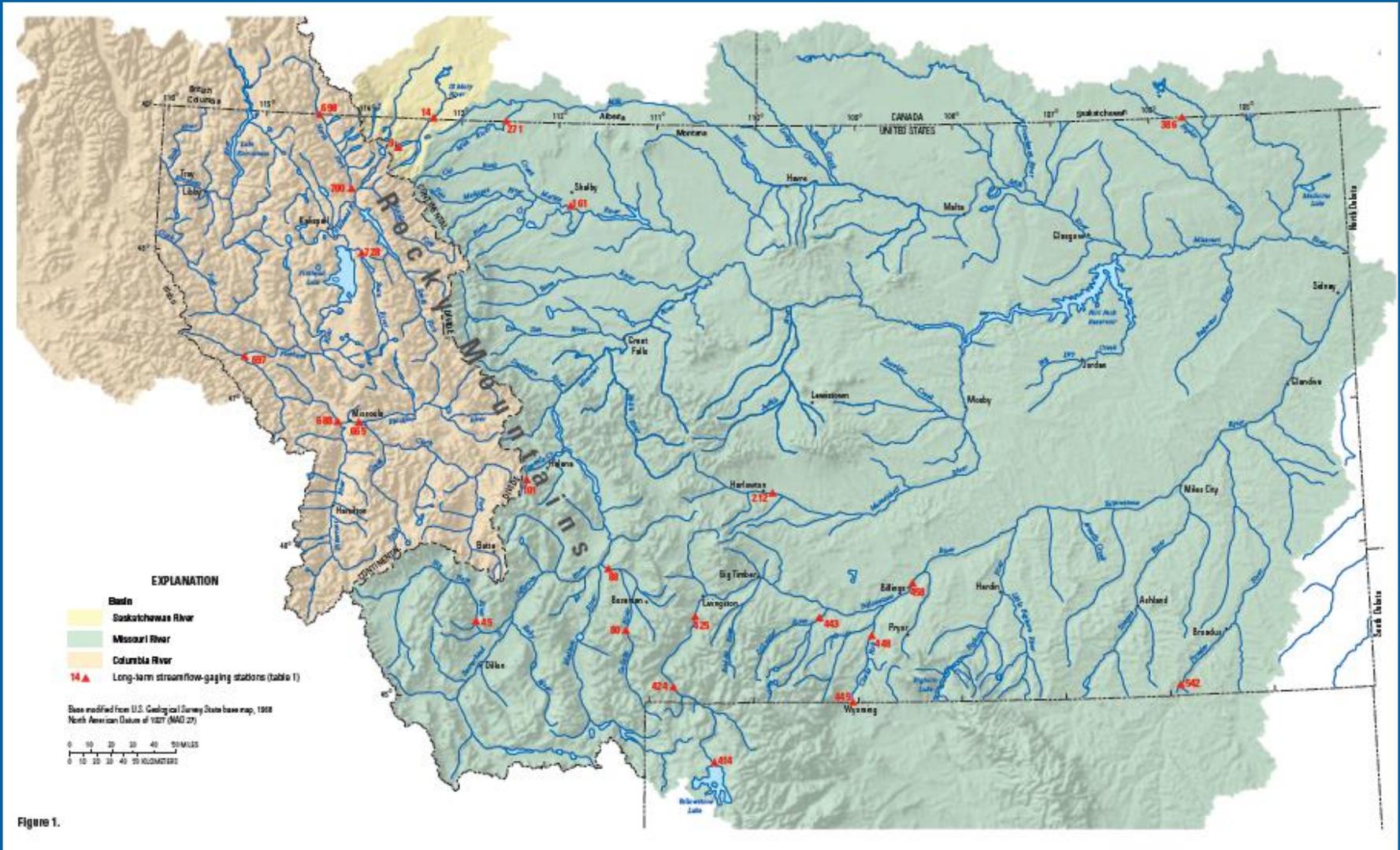
Montana Streamflow Characteristics

- **One Scientific Investigations Report (SIR) with multiple chapters**
 - **Chapter A: Montana StreamStats introduction**
 - **Streamflow characteristics for USGS gages**
 - **Chapter B: Peak flow trends and stationarity**
 - **Chapter C: Peak-flow analyses**
 - **Chapter D: Methods for improving peak flow analyses**
 - **Chapter E: Streamflow characteristics (i.e. low flow, duration)**
 - **Streamflow characteristics for ungaged sites**
 - **Chapter F: Peak-flow regional regression equations**
 - **Chapter G: Streamflow statistics regional regression equations**

Chapter A: StreamStats

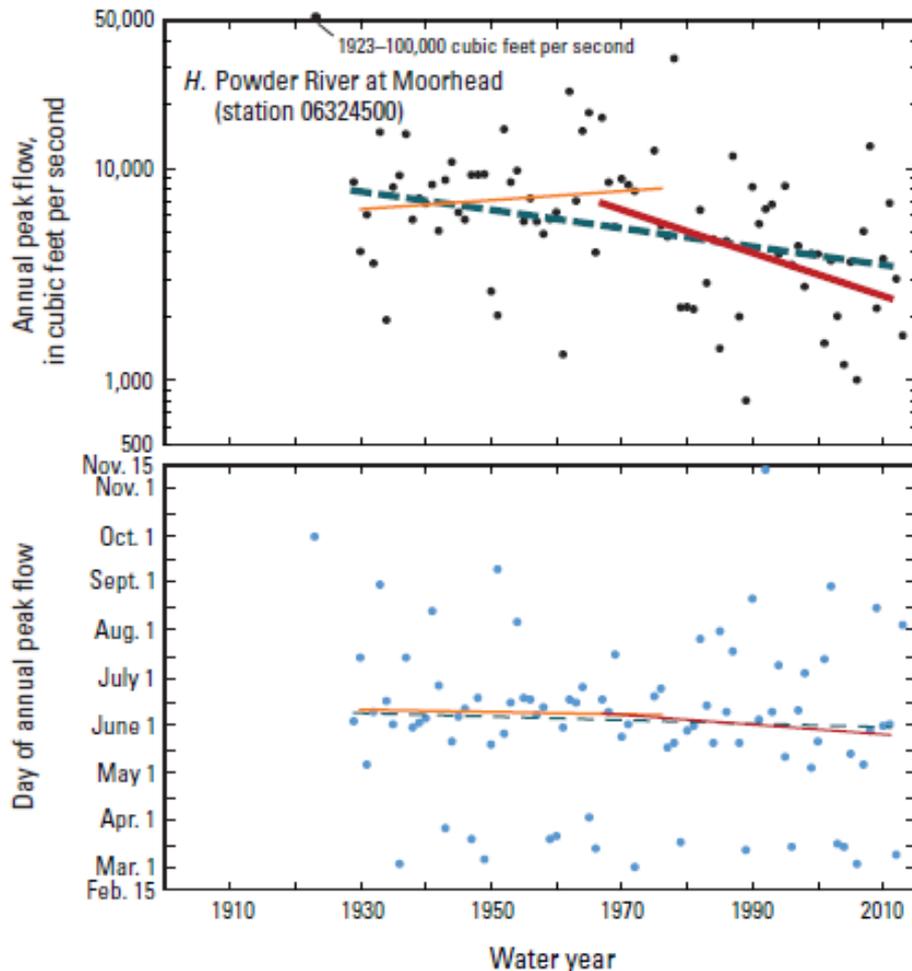
- **Description of hydrography and data used to develop StreamStats**
- **Regulation classification**
 - **Regulated:** If the conjoined drainage area of all dams is greater than or equal to 20% of the basin
 - **Major regulation:** The drainage area of a single dam exceeds 20%
 - **Minor regulation:** The drainage area of no single dam exceeds 20%, however the conjoined drainage area exceeds 20%.

Chapter B: Peak flow trends

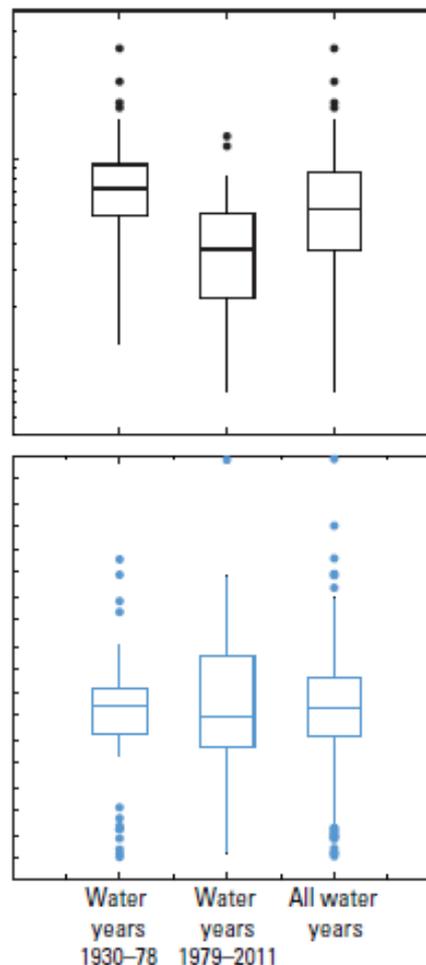


Chapter B: Peak flow trends

Annual peak flows, days of annual peak flows, and fitted trend lines



Statistical distributions for indicated periods



EXPLANATION

[Water year is defined as the 12-month period from October 1 through September 30 and is designated by the year in which it ends]

Annual peak flows and days of annual peak flows

- Annual peak flow
- Day of annual peak flow

Fitted trend lines

- Start of systematic data collection through 1940
- 1930 through 1976
- 1967 through 2011
- - - Start of systematic data collection through 2011

Bold lines indicate statistical significance (p -value less than 0.05)

Boxplots

- Data value greater than 1.5 times the interquartile range outside the quartile

Data value less than or equal to 1.5 times the interquartile range outside the quartile



Chapter B: Peak flow trends

06324500-Powder River at Moorhead

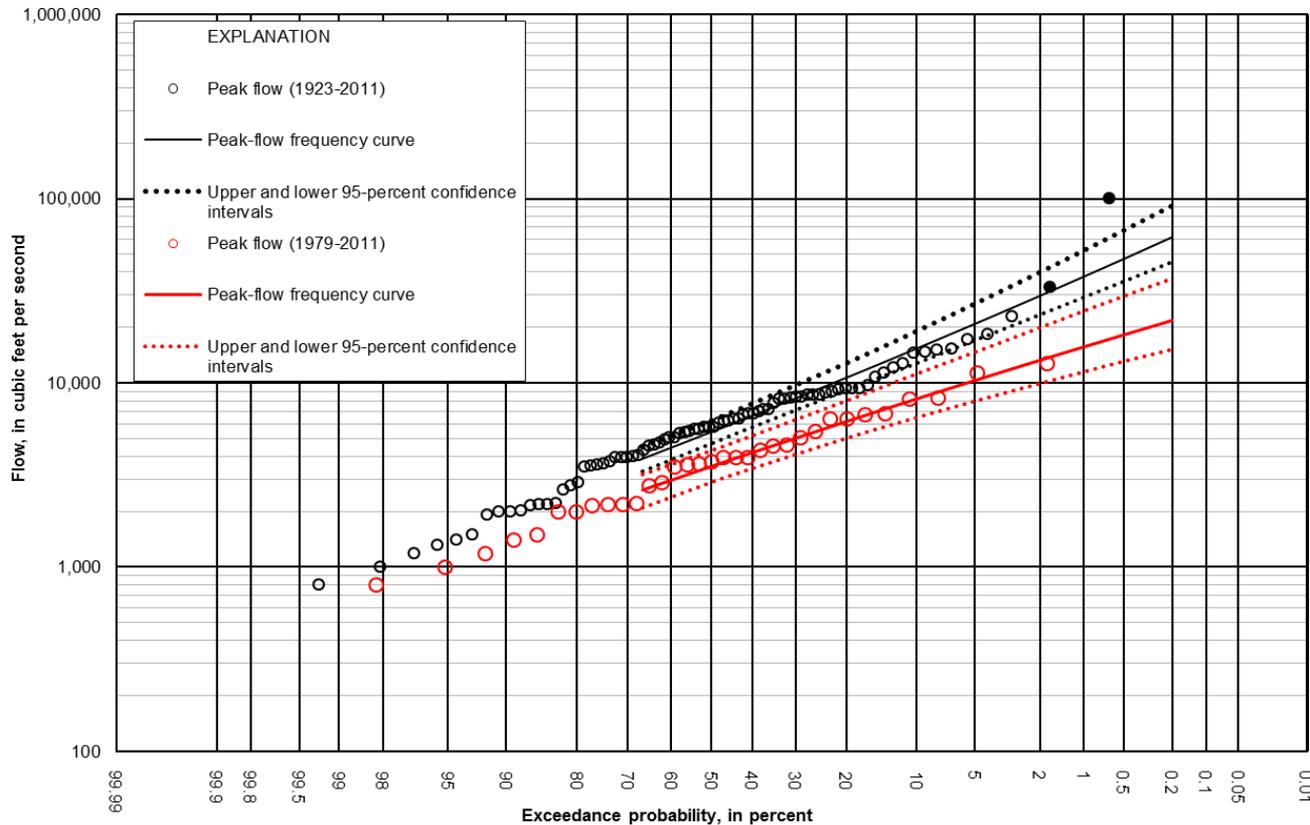
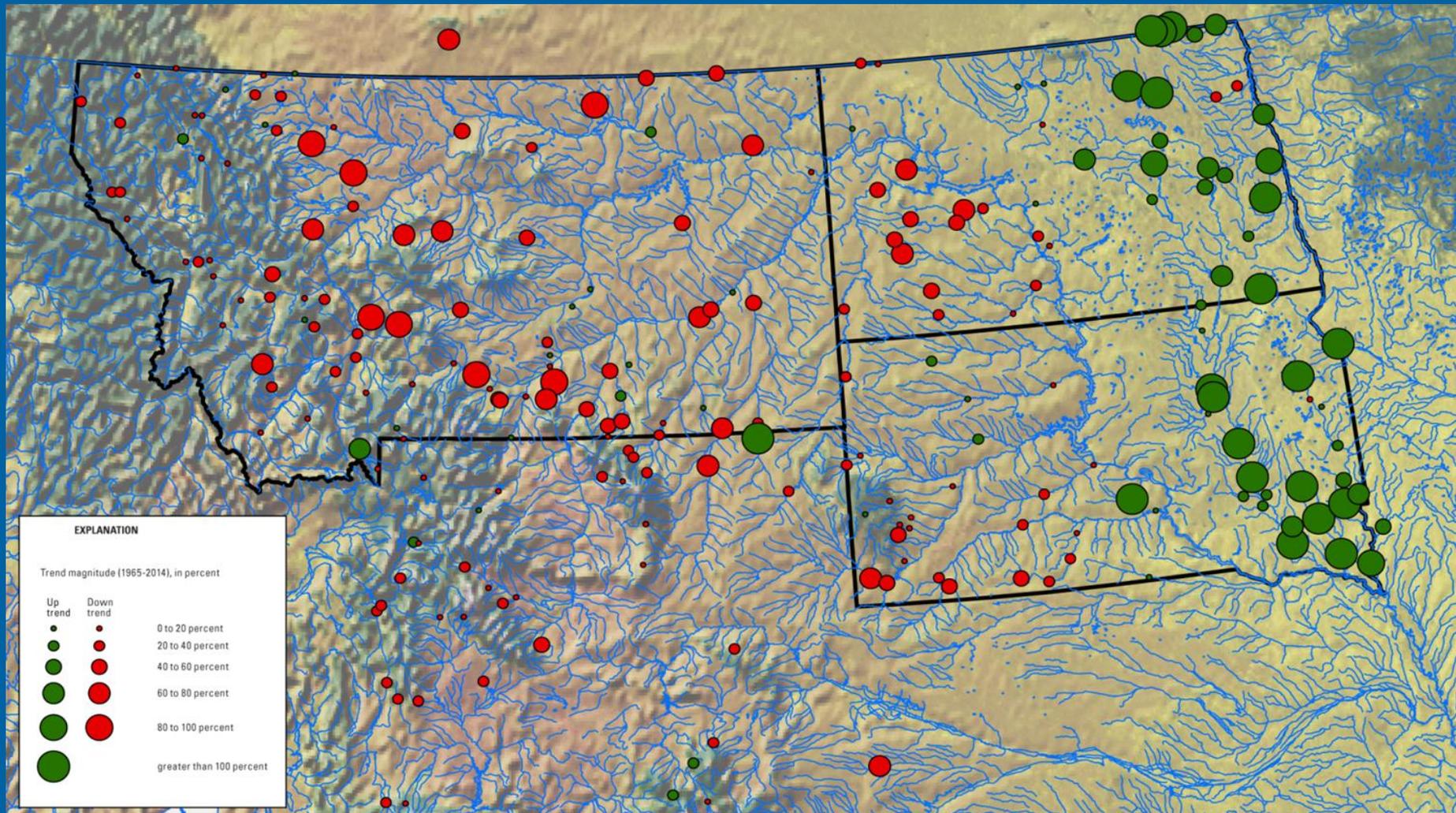


Figure 1. Annual peak flows (plotting positions determined using the Cunnane formulation; Helsel and Hirsch, 2002) and peak-flow frequency curve

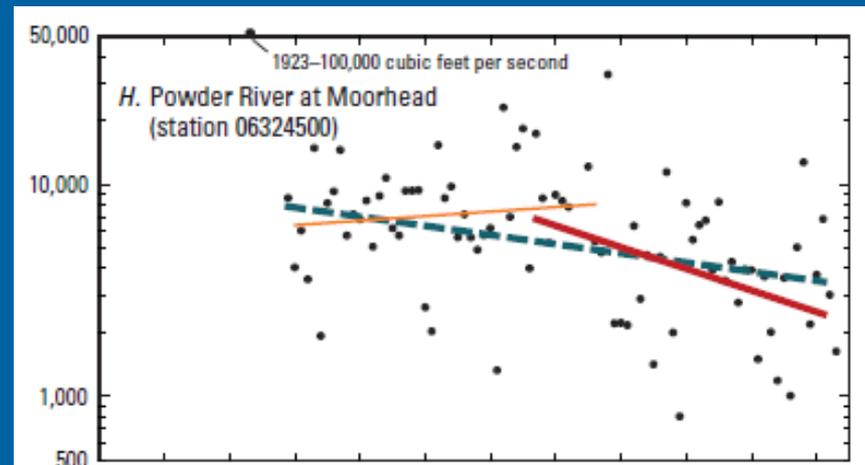
	Peak flow, in cubic feet per second, for indicated annual exceedance probability, in percent									
Period	66.7	50	42.9	20	10	4	2	1.0	0.5	0.2
1923-2011	3,879	5,424	6,238	10,680	15,390	22,920	29,780	37,820	47,190	61,930
1979-2011	2,625	3,526	3,981	6,172	8,198	11,020	13,300	15,710	18,250	21,850
Percent difference in flood frequency estimates for 1923-2011 versus 1979-2011										
	-32	-35	-36	-42	-47	-52	-55	-58	-61	-65

Chapter B: Peak flow trends



Chapter B: Peak flow trends

- More research and analyses are needed to better understand downward trends of peak flow magnitudes and timing in Eastern Montana
 - Effects of smaller dams and land use practices
 - Effects of climate changes
- Be conservative!



Chapter C: Peak flow analyses

- Performed analyses using Bulletin 17B
- 725 streamflow gaging stations in and near Montana
 - 579 unregulated streamflow stations
 - 146 regulated streamflow stations
 - 100 analyzed for post-regulation period only
 - 17 analyzed for pre-regulation period only
 - 29 analyzed for both pre- and post-regulation
 - Pre-regulation analyses used for regression equations

Chapter C: Peak flow analyses

- Analyses in downloadable file
- Tables 1-1 through 1-6 provide analyses info
- Tables provide **NECESSARY** background information

05011000 Belly River near Mountain View, Alberta													05011000 Belly River near Mountain View, Alberta												
Analysis period of record, water year: 1912-78													Analysis period of record, water year: 1912-78												
Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6													Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6												
Reference for the 12-month period from October 1 through September 30 and is designated by the year in which it ends.													Reference for the 12-month period from October 1 through September 30 and is designated by the year in which it ends.												
Peak-flow data ^a													Ranked (largest to smaller) peak-flow data ^a												
Water year	Date	Peak flow, in cubic feet per second	Gage height, in feet	Water year	Date	Peak flow, in cubic feet per second	Gage height, in feet	Water year	Date	Peak flow, in cubic feet per second	Gage height, in feet	Water year	Date	Peak flow, in cubic feet per second	Gage height, in feet										
1912	5/17/1912	1,510	2.45	1964	6/19/1964	16,400	11.40	1913	5/24/1913	2,070	4.49	1965	6/17/1965	14,700	12.13										
1914	6/13/1914	1,370	3.09	1966	6/14/1966	4,500	6.64	1915	6/13/1915	1,732	3.92	1967	6/13/1967	4,150	6.22										
1916	6/23/1916	2,730	5.22	1968	6/13/1968	2,640	4.79	1916	6/21/1916	2,100	4.52	1969	6/17/1969	3,220	5.68										
1917	6/10/1917	2,100	4.52	1970	6/13/1970	2,640	4.79	1917	6/10/1917	1,443	4.27	1971	6/10/1971	2,100	4.52										
1918	6/12/1918	1,443	4.27	1972	6/12/1972	2,710	5.28	1918	5/29/1918	1,954	4.39	1973	6/19/1973	1,590	3.26										
1919	5/29/1919	1,954	4.39	1974	6/12/1974	2,510	3.99	1919	6/19/1919	1,954	4.39	1975	6/20/1975	16,700	12.13										
1920	6/16/1920	1,930	4.37	1976	6/19/1976	1,730	5.28	1920	6/16/1920	2,030	4.40	1977	6/19/1977	643	4.15										
1921	6/18/1921	1,730	4.23	1977	6/19/1977	643	4.15	1922	6/16/1922	2,040	4.50	1978	6/19/1978	643	4.15										
1922	6/16/1922	2,040	4.50	1979	6/19/1979	643	4.15	1923	6/12/1923	2,230	4.69	1980	6/19/1980	643	4.15										
1923	6/12/1923	2,230	4.69	1981	6/19/1981	643	4.15	1924	6/16/1924	1,500	3.93	1982	6/19/1982	643	4.15										
1924	6/16/1924	1,500	3.93	1983	6/19/1983	643	4.15	1925	5/23/1925	2,030	4.40	1984	6/19/1984	643	4.15										
1925	5/23/1925	2,030	4.40	1985	6/19/1985	643	4.15	1926	6/15/1926	1,444	4.25	1986	6/19/1986	643	4.15										
1926	6/15/1926	1,444	4.25	1987	6/19/1987	643	4.15	1927	6/11/1927	2,670	5.13	1988	6/19/1988	643	4.15										
1927	6/11/1927	2,670	5.13	1989	6/19/1989	643	4.15	1928	5/25/1928	2,040	4.49	1990	6/19/1990	643	4.15										
1928	5/25/1928	2,040	4.49	1991	6/19/1991	643	4.15	1929	6/23/1929	1,800	3.82	1992	6/19/1992	643	4.15										
1929	6/23/1929	1,800	3.82	1993	6/19/1993	643	4.15	1930	5/22/1930	3,240	3.81	1994	6/19/1994	643	4.15										
1930	5/22/1930	3,240	3.81	1995	6/19/1995	643	4.15	1931	5/16/1931	1,300	3.75	1996	6/19/1996	643	4.15										
1931	5/16/1931	1,300	3.75	1997	6/19/1997	643	4.15	1932	5/22/1932	1,800	4.16	1998	6/19/1998	643	4.15										
1932	5/22/1932	1,800	4.16	1999	6/19/1999	643	4.15	1933	6/17/1933	1,420	4.27	2000	6/19/2000	643	4.15										
1933	6/17/1933	1,420	4.27	2001	6/19/2001	643	4.15	1934	6/17/1934	1,400	5.30	2002	6/19/2002	643	4.15										
1934	6/17/1934	1,400	5.30	2003	6/19/2003	643	4.15	1935	5/24/1935	2,640	4.03	2004	6/19/2004	643	4.15										
1935	5/24/1935	2,640	4.03	2005	6/19/2005	643	4.15	1936	5/15/1936	1,300	3.76	2006	6/19/2006	643	4.15										
1936	5/15/1936	1,300	3.76	2007	6/19/2007	643	4.15	1937	6/13/1937	1,850	6.32	2008	6/19/2008	643	4.15										
1937	6/13/1937	1,850	6.32	2009	6/19/2009	643	4.15	1938	5/26/1938	2,070	4.53	2010	6/19/2010	643	4.15										
1938	5/26/1938	2,070	4.53	2011	6/19/2011	643	4.15	1939	5/18/1939	1,008	3.44	2012	6/19/2012	643	4.15										
1939	5/18/1939	1,008	3.44	2013	6/19/2013	643	4.15	1940	5/12/1940	1,050	3.56	2014	6/19/2014	643	4.15										
1940	5/12/1940	1,050	3.56	2015	6/19/2015	643	4.15	1941	6/29/1941	936	3.32	2016	6/19/2016	643	4.15										
1941	6/29/1941	936	3.32	2017	6/19/2017	643	4.15	1942	6/16/1942	2,510	5.03	2018	6/19/2018	643	4.15										
1942	6/16/1942	2,510	5.03	2019	6/19/2019	643	4.15	1943	6/18/1943	1,910	4.40	2020	6/19/2020	643	4.15										
1943	6/18/1943	1,910	4.40	2021	6/19/2021	643	4.15	1944	6/27/1944	1,050	4.43	2022	6/19/2022	643	4.15										
1944	6/27/1944	1,050	4.43	2023	6/19/2023	643	4.15	1945	6/18/1945	1,610	4.10	2024	6/19/2024	643	4.15										
1945	6/18/1945	1,610	4.10	2025	6/19/2025	643	4.15	1946	5/23/1946	1,540	4.02	2026	6/19/2026	643	4.15										
1946	5/23/1946	1,540	4.02	2027	6/19/2027	643	4.15	1947	5/23/1947	1,420	3.99	2028	6/19/2028	643	4.15										
1947	5/23/1947	1,420	3.99	2029	6/19/2029	643	4.15	1948	6/17/1948	3,220	5.68	2030	6/19/2030	643	4.15										
1948	6/17/1948	3,220	5.68	2031	6/19/2031	643	4.15	1949	5/23/1949	1,330	3.81	2032	6/19/2032	643	4.15										
1949	5/23/1949	1,330	3.81	2033	6/19/2033	643	4.15	1950	6/22/1950	2,210	4.67	2034	6/19/2034	643	4.15										
1950	6/22/1950	2,210	4.67	2035	6/19/2035	643	4.15	1951	6/24/1951	2,020	5.33	2036	6/19/2036	643	4.15										
1951	6/24/1951	2,020	5.33	2037	6/19/2037	643	4.15	1952	6/12/1952	1,020	3.46	2038	6/19/2038	643	4.15										
1952	6/12/1952	1,020	3.46	2039	6/19/2039	643	4.15	1953	6/12/1953	4,500	6.64	2040	6/19/2040	643	4.15										
1953	6/12/1953	4,500	6.64	2041	6/19/2041	643	4.15	1954	5/20/1954	2,470	4.82	2042	6/19/2042	643	4.15										
1954	5/20/1954	2,470	4.82	2043	6/19/2043	643	4.15	1955	6/25/1955	2,140	4.53	2044	6/19/2044	643	4.15										
1955	6/25/1955	2,140	4.53	2045	6/19/2045	643	4.15	1956	5/22/1956	2,180	4.58	2046	6/19/2046	643	4.15										
1956	5/22/1956	2,180	4.58	2047	6/19/2047	643	4.15	1957	6/14/1957	2,000	4.39	2048	6/19/2048	643	4.15										
1957	6/14/1957	2,000	4.39	2049	6/19/2049	643	4.15	1958	6/16/1958	1,960	4.44	2050	6/19/2050	643	4.15										
1958	6/16/1958	1,960	4.44	2051	6/19/2051	643	4.15	1959	6/16/1959	1,960	4.44	2052	6/19/2052	643	4.15										
1959	6/16/1959	1,960	4.44	2053	6/19/2053	643	4.15	1960	6/16/1960	1,960	4.44	2054	6/19/2054	643	4.15										
1960	6/16/1960	1,960	4.44	2055	6/19/2055	643	4.15	1961	6/16/1961	1,960	4.44	2056	6/19/2056	643	4.15										
1961	6/16/1961	1,960	4.44	2057	6/19/2057	643	4.15	1962	6/16/1962	1,960	4.44	2058	6/19/2058	643	4.15										
1962	6/16/1962	1,960	4.44	2059	6/19/2059	643	4.15	1963	6/16/1963	1,960	4.44	2060	6/19/2060	643	4.15										
1963	6/16/1963	1,960	4.44	2061	6/19/2061	643	4.15	1964	6/16/1964	1,960	4.44	2062	6/19/2062	643	4.15										
1964	6/16/1964	1,960	4.44	2063	6/19/2063	643	4.15	1965	6/16/1965	1,960	4.44	2064	6/19/2064	643	4.15										
1965	6/16/1965	1,960	4.44	2065	6/19/2065	643	4.15	1966	6/16/1966	1,960	4.44	2066	6/19/2066	643	4.15										
1966	6/16/1966	1,960	4.44	2067	6/19/2067	643	4.15	1967	6/16/1967	1,960	4.44	2068	6/19/2068	643	4.15										
1967	6/16/1967	1,960	4.44	2069	6/19/2069	643	4.15	1968	6/16/1968	1,960	4.44	2070	6/19/2070	643	4.15										
1968	6/16/1968	1,960	4.44	2071	6/19/2071	643	4.15	1969	6/16/1969	1,960	4.44	2072	6/19/2072	643	4.15										
1969	6/16/1969	1,960	4.44	2073	6/19/2073	643	4.15	1970	6/16/1970	1,960	4.44	2074	6/19/2074	643	4.15										
1970	6/16/1970	1,960	4.44	2075	6/19/2075	643	4.15	1971	5/23/1971	1,910	3.52	2076	6/19/2076	643	4.15										
1971	5/23/1971	1,910	3.52	2077	6/19/2077	643	4.15	1972	6/12/1972	2,710	5.28	2078	6/19/2078	643	4.15										
1972	6/12/1972	2,710	5.28	2079	6/19/2079	643	4.15	1973	6/19/1973	1,590	3.26	2080	6/19/2080	643	4.15										
1973	6/19/1973	1,590	3.26	2081	6/19/2081	643	4.15	1974	6/19/1974	2,510	3.99	2082	6/19/2082	643	4.15										
1974	6/19/1974	2,510	3.99	2083	6/19/2083	643	4.15	1975	6/20/1975	16,700	12.13	2084	6/19/2084	643	4.15										
1975	6/20/1975	16,700	12.13	2085	6/19/2085	643	4.15	1976	6/19/1976	1,730	5.28	2086	6/19/2086	643	4.15										
1976	6/19/1976	1,730	5.28	2087	6/19/2087	643	4.15	1977	6/19/1977	643	4.15	2088	6/19/2088	643	4.15										
1977	6/19/1977	643	4.15	2089	6/19/2089	643	4.15	1978	6/19/1978	643	4.15	2090	6/19/2090	643	4.15										
1978	6/19/1978	643	4.15	2091	6/19/2091	643	4.15	1979	6/19/1979	643	4.15	2092	6/19/2092	643	4.15										
1979	6/19/1979	643	4.15	2093	6/19/2093	643	4.15	1980	6/19/1980	643	4.15	2094	6/19/2094	643	4.15										
1980	6/19/1980	643	4.15	2095	6/19/2095	643	4.15	1981	6/19/1981	643	4.15	2096	6/19/2096	643	4.15										
1981	6/19/1981	643	4.15	2097	6/19/2097	643	4.15	1982	6/19/1982	643	4.15	2098	6/19/2098	643	4.15										
1982	6/19/1982	643	4.15	2099	6/19/2099	643	4.15	1983	6/19/1983	643	4.15	2100	6/19/2100	643	4.15										
1983	6/19/1983	643	4.1																						

Chapter D: Improving peak flow analyses

- Why do peak flow analyses need to be improved?
 - Period of record (dry or wet period)
 - Length of record (short period of record)
 - Multiple stations along same stream with different periods of record and results
- How are peak flow analyses improved?
 - MOVE.1 Record extension methods (66 gaging stations)
 - Weighting station analyses with regression equations (438 gaging stations)

Chapter E: Streamflow Characteristics

- Streamflow characteristics using daily mean streamflow
 - Annual and seasonal low flows
 - Annual based on climatic year (March 1-February 28)
 - March-June
 - July-October
 - November-February
 - Annual high flows
 - Mean annual and monthly streamflows
 - Annual and monthly durations

09/07/2015

Chapter E: Streamflow Characteristics

- Performed analyses using SWSTAT
- 408 streamflow gaging stations in and near Montana
 - 281 unregulated streamflow stations
 - 127 regulated streamflow stations
 - 89 analyzed for post-regulation period only
 - 15 analyzed for pre-regulation period only
 - 23 analyzed for both pre- and post-regulation
 - Pre-regulation analyses used for regression equations

09/07/2015

Chapter E: Streamflow Characteristics

- Analyses served in downloadable file
- Table_1 provides station information
- Excel tab for each station

B1 05011000 Belly River near Mountain View, Alberta

05011000 Belly River near Mountain View, Alberta
Site number 2
Period of record 1912-1978

[UCI, upper 95-percent confidence interval; LCI, lower 95-percent confidence interval; R3%, cubic feet per second; %, percent; -, length of record is not sufficient to estimate value for given recurrence interval]

Flow and 35-percent confidence intervals (UCI, LCI), in ft^3/s , for indicated non-exceedance probability, and recurrence interval, in years

Period of concurrent use days	50%		20%		10%		5%		2%		1%	
	Flow	UCI										
1	30.7	28.2	21.0	19.0	16.8	14.7	13.7	11.7	10.7	8.81	5.95	7.20
3	32.6	30.2	23.2	21.2	18.9	20.9	17.7	17.7	10.7	10.9	12.8	14.6
7	35.3	37.9	24.2	28.3	22.2	24.2	19.2	21.2	16.2	14.3	16.2	18.2
14	39.9	42.3	31.0	32.9	24.8	23.7	23.6	25.5	20.2	22.2	16.2	20.2
20	43.2	41.0	34.1	32.0	29.6	31.6	24.9	23.6	22.3	19.8	20.0	19.7
30	47.1	44.8	37.5	35.2	32.6	30.1	28.8	24.1	24.6	21.0	22.1	19.2
60	59.5	63.0	46.9	49.7	40.6	43.5	35.7	38.7	30.6	32.6	24.7	20.8
90	69.3	73.9	52.5	56.3	45.1	48.9	39.7	43.6	34.3	38.2	31.1	24.9
120	81.4	78.9	61.3	56.2	52.8	47.6	46.7	41.5	40.6	35.4	37.0	31.8
193	110	102	82.5	75.5	71.6	64.5	63.9	56.7	56.4	49.3	52.0	44.9

Magnitude of annual high flow for March-June based on 67 years of record

Period of concurrent use days	50%	20%	10%	5%	2%	1%
1	43.4	40.4	31.2	28.6	25.4	22.7
3	44.0	41.0	32.7	30.1	27.1	24.4
7	47.3	50.6	35.1	37.7	29.5	32.0
14	50.1	53.8	37.6	40.7	32.7	35.7
20	52.1	49.2	39.9	42.2	35.9	32.7
30	59.2	54.8	44.7	40.4	39.4	35.3

Magnitude of annual high flow for July-October based on 64 years of record

Period of concurrent use days	50%	20%	10%	5%	2%	1%
1	85.2	78.6	59.2	48.2	34.7	26.8
3	87.8	73.5	54.2	47.1	41.2	34.8
7	92.9	82.6	59.5	52.1	39.8	37.8
14	99.7	90.4	67.1	59.5	54.7	47.4
20	105	95.8	73.4	61.1	61.6	52.9
30	115	102	81.1	68.5	68.8	60.6

Magnitude of annual high flow for November-February based on 67 years of record

Period of concurrent use days	50%	20%	10%	5%	2%	1%
1	35.9	33.0	24.2	21.8	19.0	16.7
3	38.1	41.4	26.5	28.9	21.3	23.8
7	40.5	43.6	29.6	31.8	24.7	26.9
14	44.7	47.6	34.2	36.4	29.4	31.9
20	47.6	50.5	36.9	39.3	32.1	34.5
30	51.6	48.7	40.7	42.7	34.8	37.5

Flow and 35-percent confidence intervals (UCI, LCI), in ft^3/s , for indicated exceedance probability, and recurrence interval, in years

Period of concurrent use days	50%		20%		10%		5%		2%		1%	
	Flow	UCI										
1	1,720	1,560	2,710	2,440	3,430	3,210	5,200	4,440	6,730	5,600	6,650	11,400
3	1,670	1,520	2,490	2,790	3,180	2,850	4,220	5,040	5,140	4,320	6,200	7,140
7	1,540	1,370	2,160	2,390	2,590	2,990	3,100	3,600	3,520	4,140	2,930	4,700
14	1,420	1,250	1,970	1,970	2,140	2,400	2,430	2,770	2,610	3,490	2,790	3,230
20	1,330	1,240	1,740	1,930	1,980	2,210	2,210	2,500	2,340	2,990	2,480	2,980
30	1,240	1,340	1,600	1,740	1,780	1,980	1,960	2,200	2,070	2,340	2,160	2,450
60	1,050	1,120	1,300	1,420	1,420	1,560	1,530	1,700	1,600	1,780	1,540	1,840
90	865	915	1,070	1,150	1,150	1,240	1,240	1,370	1,290	1,420	1,320	1,470

Magnitude of annual high flow based on 65 years of record

Period of concurrent use days	50%	20%	10%	5%	2%	1%
1	1,720	1,560	2,440	2,440	3,430	3,210
3	1,670	1,520	2,490	2,540	3,180	2,850
7	1,540	1,370	2,160	2,290	2,590	2,990
14	1,420	1,250	1,970	2,000	2,140	2,400
20	1,330	1,240	1,740	1,820	1,980	2,210
30	1,240	1,340	1,600	1,740	1,780	1,980

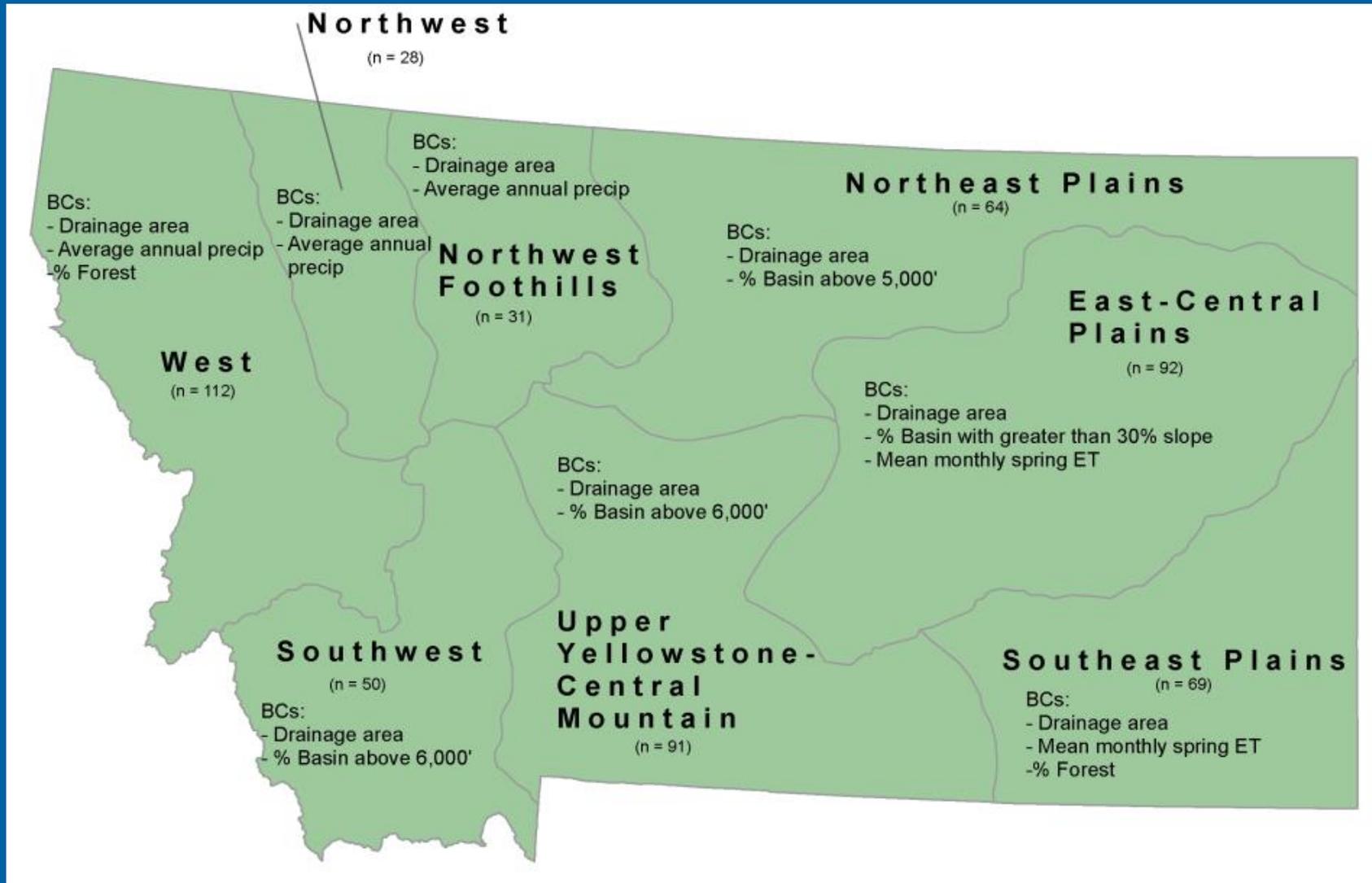
Standard Deviation of computed flow for indicated in-day period is greater than 3.0; therefore, the frequency curve cannot be computed.

Table 1 05010000 All 05011000 All 05011500 All 05012500 All 05013700 All 05013900 All

Chapter F: Peak-Flow Regional Regression Equations

- Regional Regression Equations for unregulated annual exceedance probabilities
 - 8 hydrologic regions
 - 537 gaging stations
 - Drainage area less than ~2,500 sq. mi.
 - Systematic record unaffected by major regulation
 - No redundancy with nearby stations
 - Representation of peak-flow characteristics in MT
 - 28 candidate basin characteristics
 - A, EL_{5000} , EL_{6000} , ET_{SPR} , F, P, SLP_{30}

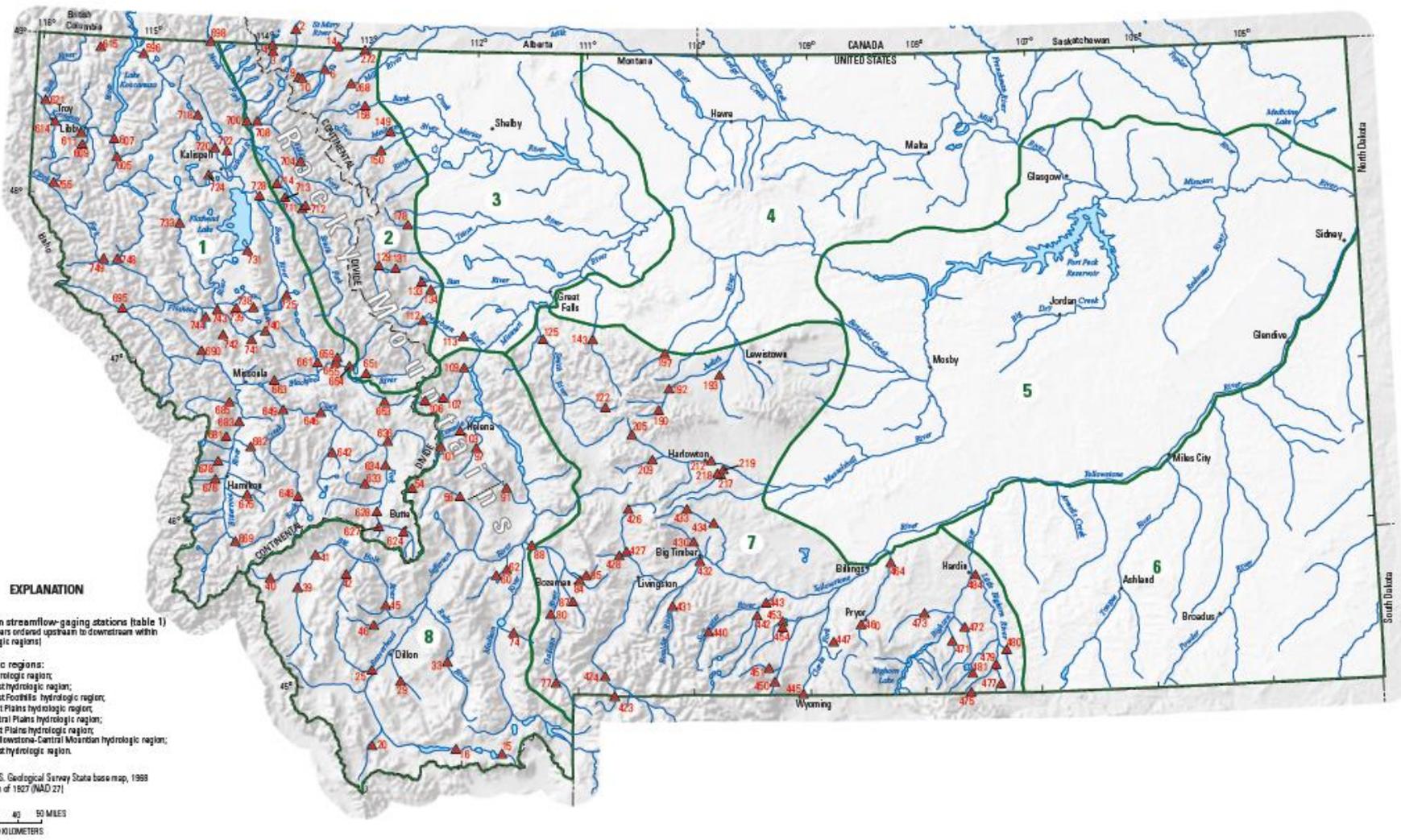
Chapter F: Peak-Flow Regional Regression Equations



Chapter G: Regional Regression Equations for Streamflow Characteristics

- Annual and seasonal low-flow
 - 7Q10
 - 14Q5
- Annual and monthly
 - Mean
 - Duration values for
 - Q20%
 - Q50%
 - Q80%
- Explanatory Variables
 - Drainage area
 - Mean annual precip.
 - Percent of basin with slopes greater than 50 percent.

Chapter G: Regional Regression Equations for Streamflow Characteristics



StreamStats Application

<http://water.usgs.gov/osw/streamstats/>



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Welcome to StreamStats

Best viewed in Internet Explorer 10 or higher with pop-up blocker disabled

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[News](#)

[StreamStats Description](#)

[Un-gaged Site Reports](#)

[Data-Collection Station Reports](#)

[StreamStats Limitations](#)

[State Applications](#)

[USGS Station Statistics](#)

[Version 3 User Instructions](#)

[Troubleshooting](#)

[Definitions](#)

[Version 3 Basin Characteristics](#)

[Version 3 Streamflow Statistics](#)



Version 3 is still under construction but available for all states

StreamStats version 3 is now available for all states. StreamStats Version 2 was retired on July 14. The version 2 retirement was required because it was operated on computers that used an older operating system, which was considered a security risk for use on U.S. government servers.

Currently, users can get information for USGS data-collection stations throughout the U.S. Users also can get basin delineations, basin characteristics, and estimates of streamflow statistics from regression equations for user-selected un-gaged sites in states that are implemented, as well as download shapefiles of the delineations that include whatever basin characteristics and streamflow statistics that have been calculated. All other functionality that was available in Version 2, including all tools that rely on stream-network navigation, will not be available until they can be redeveloped. It is planned to release the redeveloped tools as they become available, with a goal of having all functionality available by the end of 2015.

This notice will be revised as needed when changes are made to StreamStats. Please contact the StreamStats by email at GS-W_StreamStats@usgs.gov if you have any questions.



StreamStats Application



StreamStats

? HELP

i ABOUT

REPORT

SELECT A STATE / REGION >

Click a state or region on the map or use the search box to zoom to an area of interest

Location Search

IDENTIFY A STUDY AREA ▾

SELECT SCENARIOS ▾

BUILD A REPORT ▾

POWERED BY WIM

- StreamStats v4
 - Publically available in “next couple of days”
 - Beta version
 - Slowly incorporate tools once available in v2.
 - Chrome or Firefox for now (web standards compliancy issue)

Zoom Level: 3
Map Scale: 1:73,957,193
Lat: -25.6454, Lon: -4.5703

1000 km
1000 mi

StreamStats v4

StreamStats v4



StreamStats

? HELP

i ABOUT

REPORT

SELECT A STATE / REGION >

Click a state or region on the map or use the search box to zoom to an area of interest

Location Search



IDENTIFY A STUDY AREA >

SELECT SCENARIOS >

BUILD A REPORT >

POWERED BY WIM



StreamStats v4

The image displays three sequential screenshots of the StreamStats v4 web application interface, illustrating the workflow for selecting a study area and delineating a stream.

Screenshot 1 (Left): The interface shows the "SELECT A STATE / REGION" dropdown menu with "MONTANA" selected. Below the dropdown is a "Location Search" input field. A teal instruction box reads: "Click a state or region on the map or use the search box to zoom to an area of interest." Below the search field, another teal box states: "You have zoomed in sufficiently to select a state or regional study area. Your selection will dictate the data used to perform basin delineation and flow statistics calculation." The "IDENTIFY A STUDY AREA" button is highlighted in blue.

Screenshot 2 (Middle): The "IDENTIFY A STUDY AREA" button is now greyed out. A teal instruction box reads: "Zoom in to level 15 or greater to enable the delineation tool." Below this, a green "Delineate" button is visible. The "SELECT SCENARIOS" and "BUILD A REPORT" buttons are also visible.

Screenshot 3 (Right): The "Delineate" button is now greyed out. A teal instruction box reads: "Click the 'Delineate' button, then use your mouse or finger to click or tap a blue stream cell on the map." The map shows a blue stream cell selected. The "Delineate" button is now green and active.



StreamStats v4

The image shows the StreamStats v4 web application interface. On the left is a sidebar with the following elements:

- A dropdown menu labeled "SELECT A STATE / REGION" with "MONTANA" selected.
- A blue button labeled "IDENTIFY A STUDY AREA" with a right-pointing arrow.
- A teal instruction box: "Click the 'Delineate' button, then use your mouse or finger to click or tap a blue stream cell on the map".
- A green button labeled "Delineate" with a location pin icon.
- A dropdown menu labeled "SELECT SCENARIOS".
- A dropdown menu labeled "BUILD A REPORT".
- Text at the bottom: "POWERED BY WIM".

The main area is a topographic map of Harlowton, Montana, showing a network of blue stream cells overlaid on the terrain. The map includes street names such as 1st St NE, 2nd St NW, 3rd St NE, 4th St NE, 5th St NW, 6th St NW, 7th St NE, 8th St NE, 9th St NE, 10th St NE, 11th St NE, 12th St NE, 13th St NE, 14th St NE, 15th St NE, 16th St NE, 17th St NE, 18th St NE, 19th St NE, 20th St NE, 21st St NE, 22nd St NE, 23rd St NE, 24th St NE, 25th St NE, 26th St NE, 27th St NE, 28th St NE, 29th St NE, 30th St NE, 31st St NE, 32nd St NE, 33rd St NE, 34th St NE, 35th St NE, 36th St NE, 37th St NE, 38th St NE, 39th St NE, 40th St NE, 41st St NE, 42nd St NE, 43rd St NE, 44th St NE, 45th St NE, 46th St NE, 47th St NE, 48th St NE, 49th St NE, 50th St NE, 51st St NE, 52nd St NE, 53rd St NE, 54th St NE, 55th St NE, 56th St NE, 57th St NE, 58th St NE, 59th St NE, 60th St NE, 61st St NE, 62nd St NE, 63rd St NE, 64th St NE, 65th St NE, 66th St NE, 67th St NE, 68th St NE, 69th St NE, 70th St NE, 71st St NE, 72nd St NE, 73rd St NE, 74th St NE, 75th St NE, 76th St NE, 77th St NE, 78th St NE, 79th St NE, 80th St NE, 81st St NE, 82nd St NE, 83rd St NE, 84th St NE, 85th St NE, 86th St NE, 87th St NE, 88th St NE, 89th St NE, 90th St NE, 91st St NE, 92nd St NE, 93rd St NE, 94th St NE, 95th St NE, 96th St NE, 97th St NE, 98th St NE, 99th St NE, 100th St NE. The map also shows contour lines and a red line representing a road or boundary.

StreamStats v4

SELECT A STATE / REGION
MONTANA

IDENTIFY A STUDY AREA >

Zoom in to level 15 or greater to enable the delineation tool

Delineating Basin

SELECT SCENARIOS v

BUILD A REPORT v

POWERED BY WIM

Zoom Level: 15
Map Scale: 1:18,055
Lat: 46.4334, Lon: -109.8447

Your clicked point
Latitude: 46.43863
Longitude: -109.82251

Delineating Basin
Please wait...

Your clicked point is valid
Delineating your basin now...

Information
Validating your clicked point...

Delineate
Click on a blue stream cell to start delineation

StreamStats v4

SELECT A STATE / REGION

MONTANA

IDENTIFY A STUDY AREA

BASIN DELINEATED

Your delineation is complete. You can now clear your basin, edit your basin, or choose a state or regional study specific function (if available). Click continue when you are ready.

Clear Basin

Edit Basin

Continue

State/Region Specific Functions

The following additional functions are available for Montana.

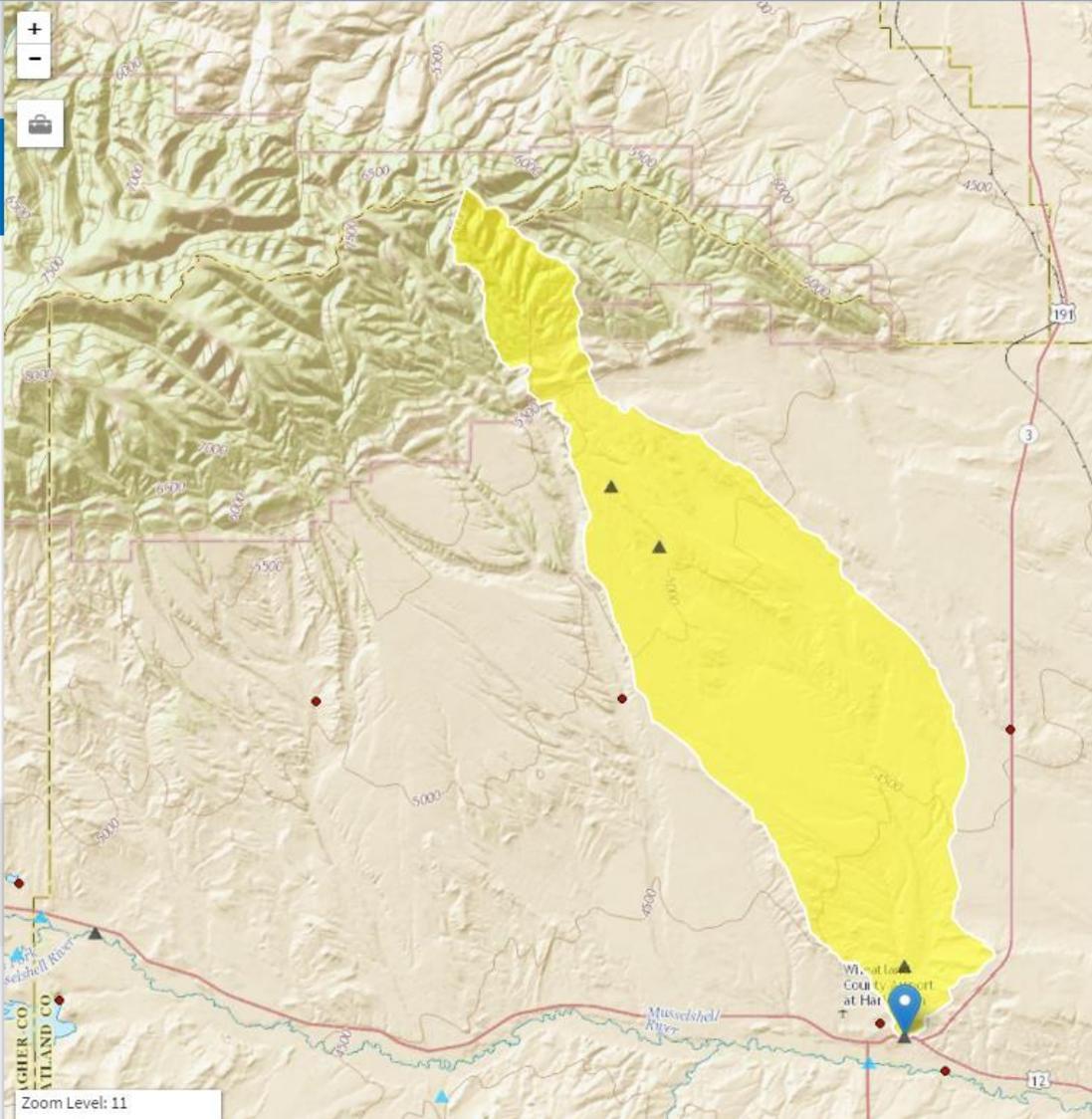
Check for upstream regulation

SELECT SCENARIOS

BUILD A REPORT

POWERED BY WIM

Zoom Level: 11



SELECT A STATE / REGION

MONTANA

IDENTIFY A STUDY AREA

BASIN DELINEATED

Your delineation is complete. You can now clear your basin, edit your basin, or choose a state or regional study specific function (if available). Click continue when you are ready.

Clear Basin

Edit Basin

Continue

State/Region Specific Functions

The following additional functions are available for Montana.

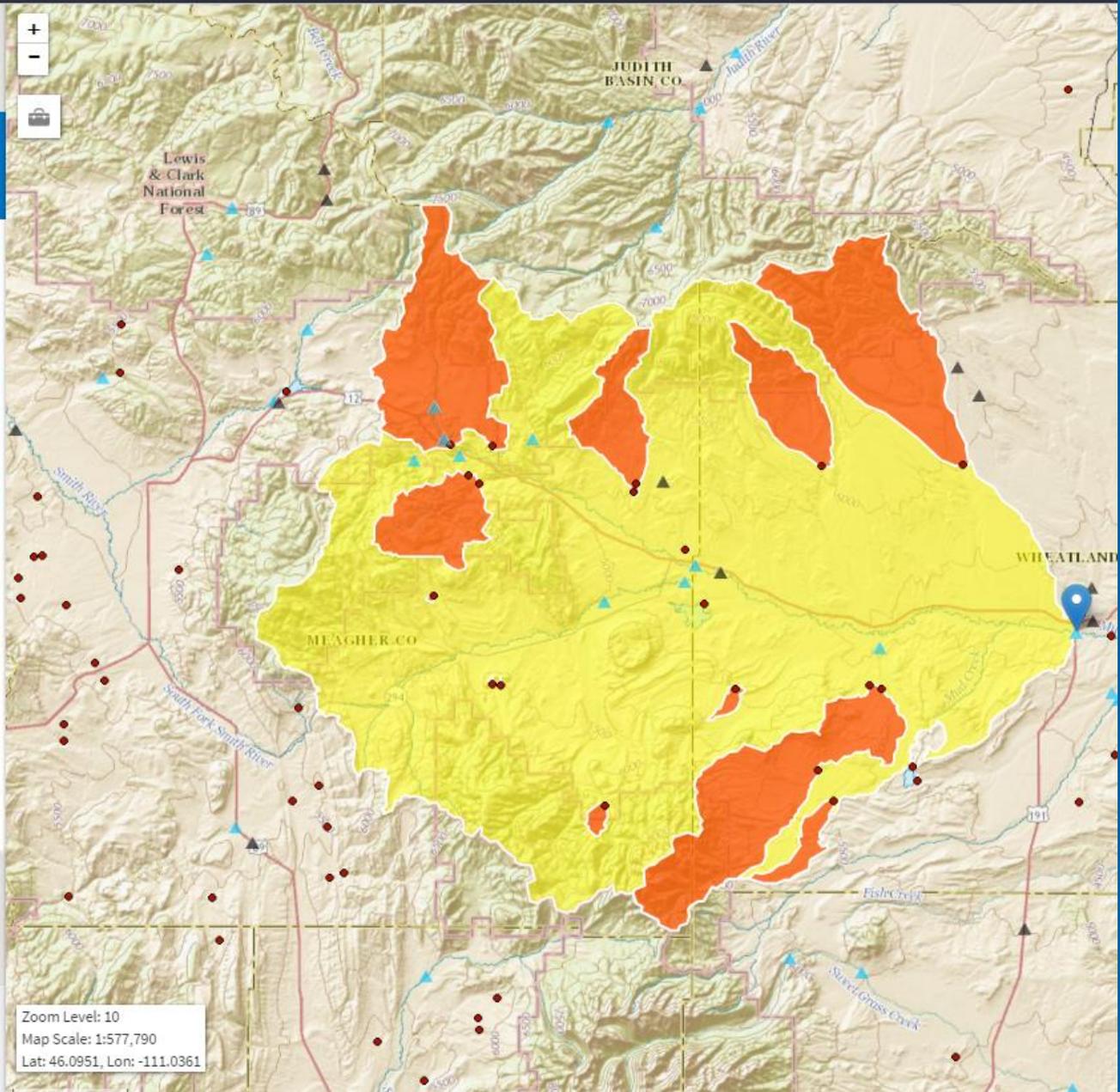
Check for upstream regulation

Upstream Regulation check has been completed. There is **23.67 percent** regulation in this watershed.

SELECT SCENARIOS

BUILD A REPORT

POWERED BY WIM



Zoom Level: 10
Map Scale: 1:577,790
Lat: 46.0951, Lon: -111.0361

StreamStats Report

Region ID:

MT

Workspace ID:

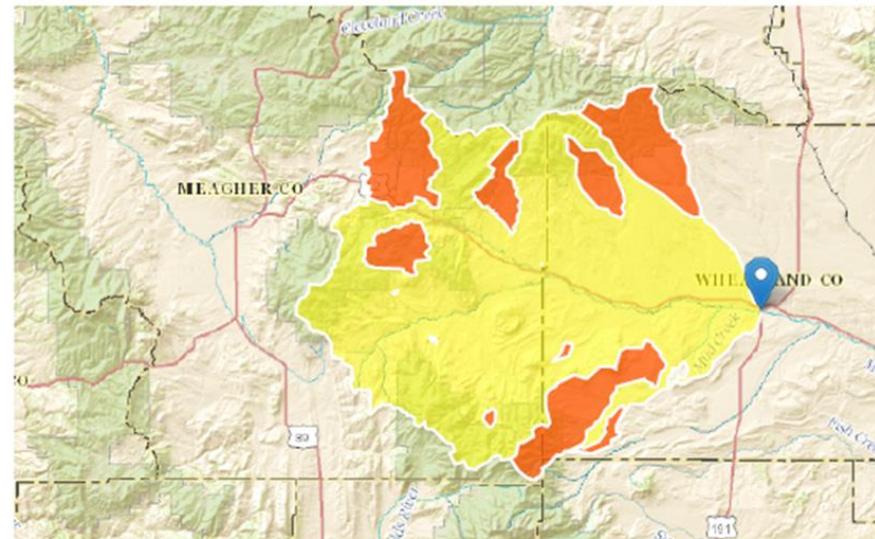
MT20160314161050037000

Clicked Point (Latitude, Longitude):

46.42898,-109.84151

Time:

2016-03-14 16:10:59 -0600



Basin Characteristics

Parameter Code	Parameter Description	Value	Unregulated Value	Regulated Value	Unit
CONDA	Area that contributes flow to a point on a stream (total drainage area minus non-contributing areas within basin)	1108.2			square miles

SELECT A STATE / REGION

MONTANA

IDENTIFY A STUDY AREA

BASIN DELINEATED

SELECT SCENARIOS

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

Regression Based Scenarios



Failed to load scenarios or no scenarios available

Basin Characteristics



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

Continue

BUILD A REPORT

When?

- **National StreamStats Version 4**
 - Internally testing
 - Expected public release soon (days to weeks)
- **Montana StreamStats Application**
 - Currently able to compute basin characteristics
 - Fully Implemented (~6 weeks)

StreamStats Developments

- National development of NHDPlus High Res.
 - 2-3 years out
 - Will include value attributes for high resolution hydrography (1:24K NHD, 10-meter DEM)
- Updated basin and streamflow characteristics
 - Regulation (better methods, more inclusive)
 - Trends (land use/climate, etc)
- Spinoff applications
 - Time of travel
 - Real-time streamflow estimation for ungaged sites
- USGS WY-MT WSC – Wyoming StreamStats



StreamStats Training

- Sign up for training notifications at <http://wy-mt.water.usgs.gov/mtwy-notices.html>
- Association of Montana Floodplain Managers meeting-March 15-17, 2016
- AWRA
- Others?

Data qualifications, and limitations of a StreamStats determined discharge...

Peak-flow data

Peak flow trends

Peak flow analyses

Adj. peak flow analyses

Low flow data

Low flow frequency

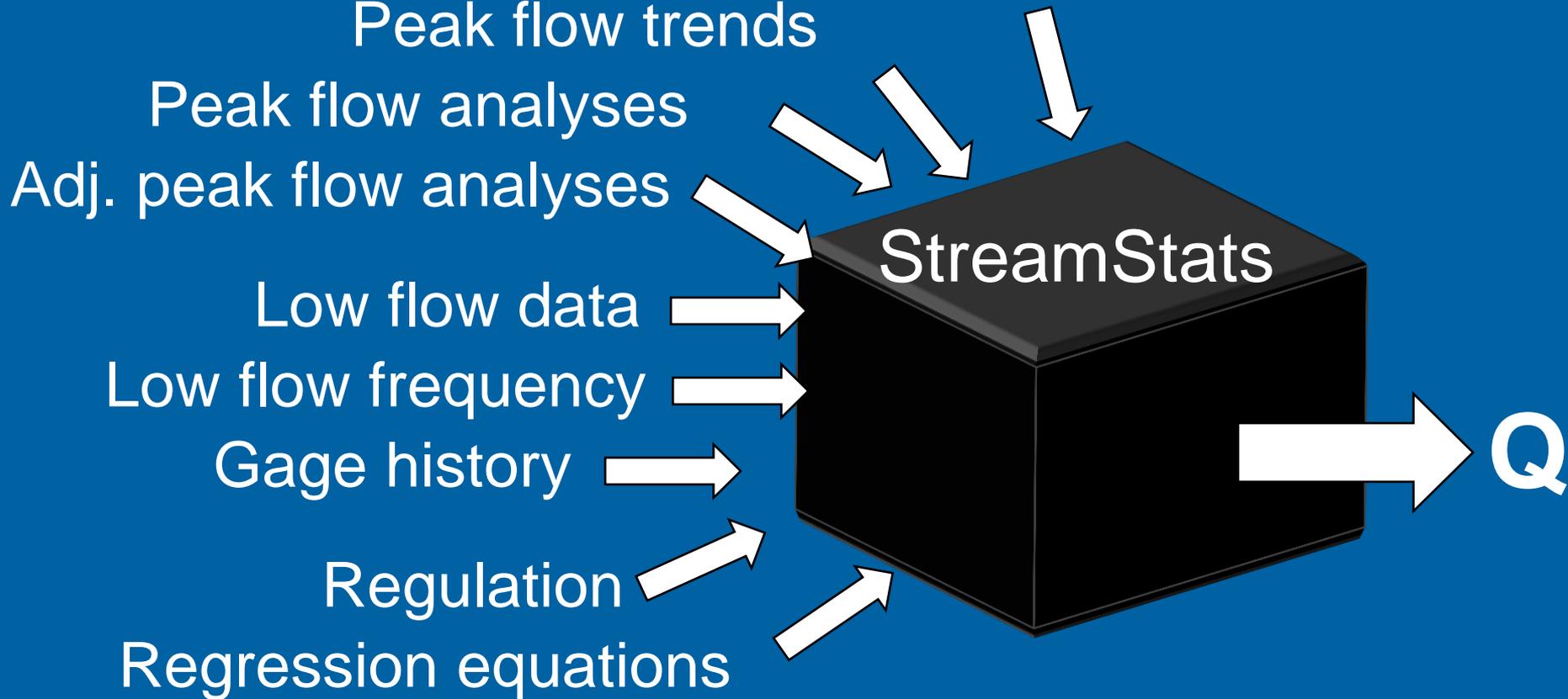
Gage history

Regulation

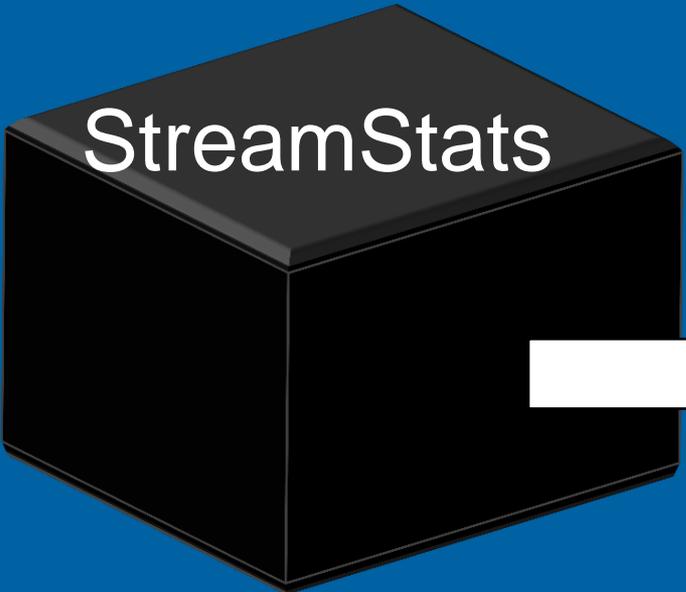
Regression equations

StreamStats

Q



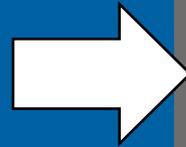
....are described in USGS Reports



StreamStats



Q



SIR20155019A

SIR20155019B

SIR20155019C

SIR20155019D

SIR20155019E

SIR20155019F

SIR20155019G

Questions?



Clark Fork River at Milltown Dam, June 1908
<http://www.floodsafety.noaa.gov/states/mt-flood.shtml>

$Q_{\text{peak}}=48,000\text{cfs}$