Teton County Watersheds Hydrologic Analysis: Deep Creek, Muddy Creek, Teton River, and Sun River

Teton County, MT

August 2021

Michael Baker INTERNATIONAL

Document History

Document Location

Location

Revision History

Version Number	Version Date	Summary of Changes	Team/Author
01	06/11/2021	Initial Submittal	R. Anderson
02	08/20/2021	Response to review comments	R. Anderson

Client Distribution

Name	Title/Organization	Location

Cover Photo: Sun River Diversion Dam below Gibson Reservoir. Great Falls Tribune. Accessed at https://www.greatfallstribune.com/story/news/2018/05/03/gibson-dam-operator-keeps-watch-water-flood-concerns-rise/568782002/ on May 21, 2021.

Table of Contents

1. Executive Summary

Hydrologic analyses have been performed on gaged and ungaged portions of flooding sources in Teton County, MT. These hydrologic analyses will support future hydraulic analyses that will lead to updated floodplain mapping and development of other flood risk products to revise flood risk information to the communities within Teton County. The hydrologic analyses were performed to establish peak discharges for the 10%, 4%, 2%, 1% and 0.2% Annual Exceedance Probability flood events. Additionally, peak discharges were determined for a standard error of prediction above the 1% Annual Exceedance Probability event to demonstrate a level of uncertainty in the computed discharge values, and, ultimately, the calculated flood elevations. For FEMA-based flood risk products, this discharge value above the 1% Annual Exceedance Probability is known as the 1% Plus discharge. Peak discharges were determined on 81 flooding sources covering about 430 miles within the county. Intermediate flow change locations were identified on the flooding sources based on watershed characteristics to account for the features within the watershed that result in the changes in flow as the river flows downstream through the watershed. The flow nodes were located at significant tributaries and other substantial increases in drainage area which can account for flow increases along the river. These additional flow change locations (flow nodes) within the tributaries resulted in approximately 231 pour points along the flooding sources within the watershed.

Flood-frequency peak flow analyses were performed by USGS on 20 stream gages within or near Teton County (Siefken, et al., 2021). The flood-frequency peak flow analyses were performed using Bulletin 17C “Guidelines for Determining Flood Flow Frequency” (England et al., 2017) methodologies. For flooding sources without stream gages, the USGS water resources web application, StreamStats, was utilized to determine the peak discharge values based on regional regression equations for the 75 non-gaged flooding sources included in the analysis. StreamStats applies regional regression equations for a location of interest based on the Hydrologic Region and basin characteristics of the location. Flooding sources included in this hydrologic analysis are located within the Northwest or Northwest Foothills regions. The flow locations of interest were input to StreamStats via the batch process tool within StreamStats. A quality check was performed on the StreamStats output using basin characteristics derived from Digital Elevation Models developed from recently collected high-resolution LiDAR data. Discrepancies between StreamStats and LiDAR derived output were manually reviewed and the StreamStats results were adjusted as required to correct any StreamStats processed discrepancies.

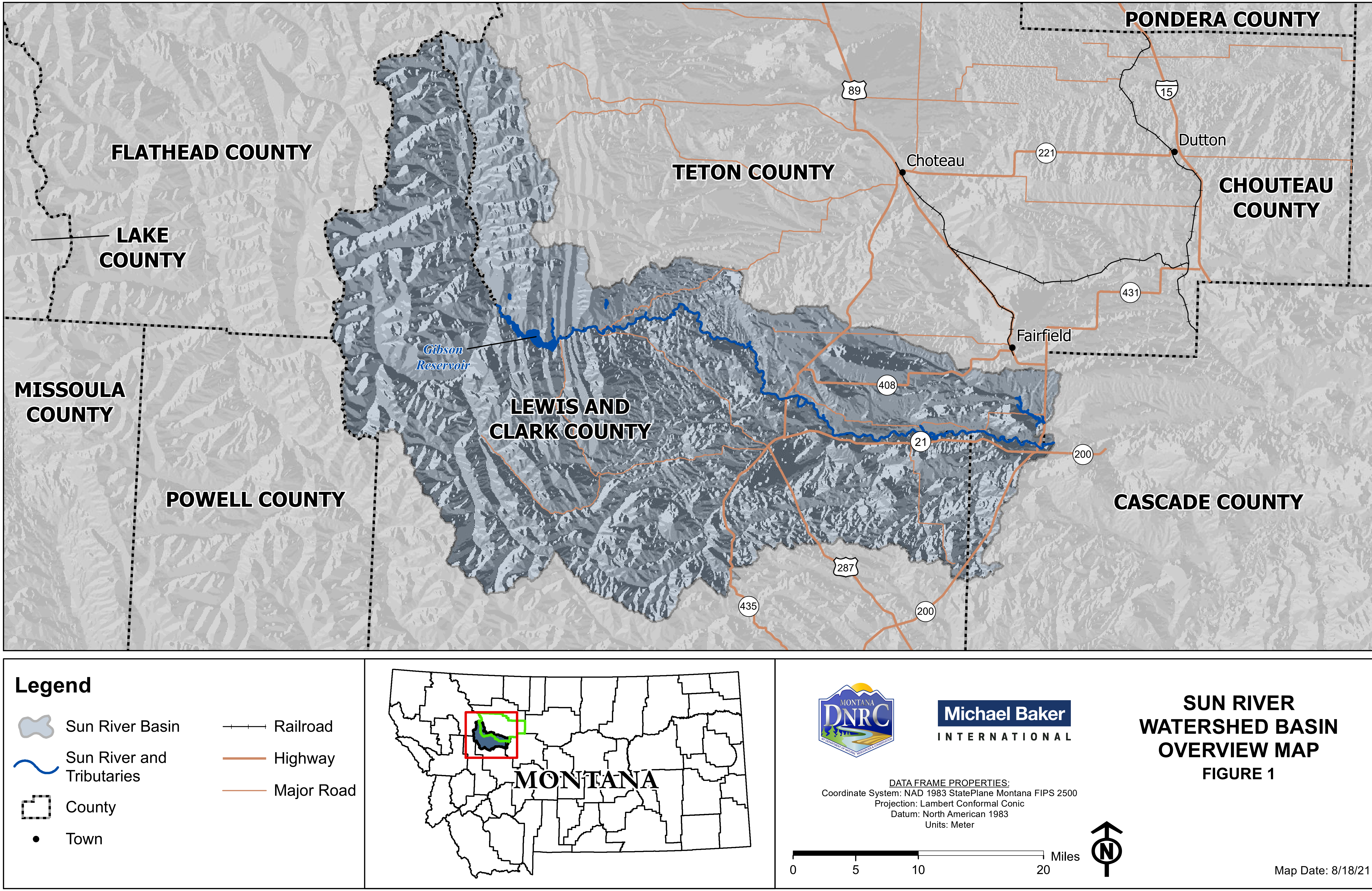
The flow values were determined using methods that meet FEMA guidance and standards and are considered to be reliable for use in future flood risk products.

2. Introduction

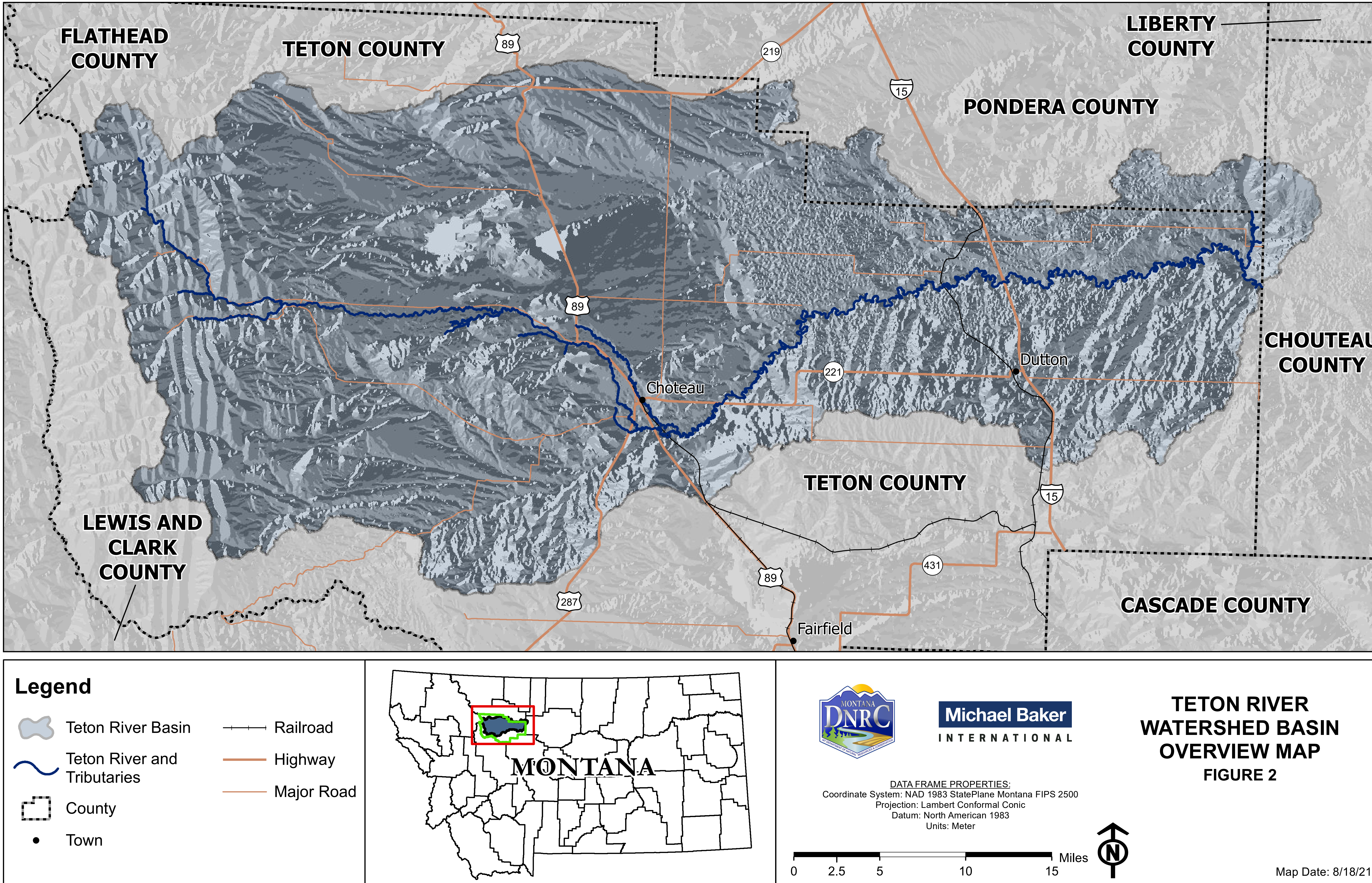
Under contract to the State of Montana's Department of Natural Resources and Conservation (DNRC), Michael Baker International (Baker) has been tasked with preparing hydrologic data and documentation for floodplain studies within Teton County, MT, which includes portions of the Sun River, Teton River, Deep Creek, and Muddy Creek within Teton County and select tributaries (**Figure 1 through Figure 4**). The purpose of the hydrologic analyses is to provide new and updated hydrologic information that will be subsequently used in floodplain mapping activities within Teton County. The State of Montana is a Cooperating Technical Partner (CTP) with the US Department of Homeland Security (DHS) Federal Emergency Management Agency (FEMA), and this work is performed under Mapping Activity Statement (MAS) Number 2020-01, Teton Countywide Modernization Risk MAP Study.

This hydrologic analysis for the flooding sources within Teton County provides the results of peak-flow frequency analyses performed on stream gages within Teton County, as well as regression analyses for ungaged flooding sources within the county. **Table 1** lists information about the primary flooding sources included in this study.

The analysis also includes an evaluation of two instream impoundments (Gibson Reservoir and Sun River Diversion) and an investigation into two isolated areas appearing to be mapped as off-channel ponds (Unnamed Ponds 1 and 2). These reservoirs are reliant on peak-flow frequency analyses reported herein to describe the appropriate hydrologic input parameters for the future hydraulic analyses and floodplain mapping. As such, the results of hydrologic analyses for the impoundments and ponds are included in this report.

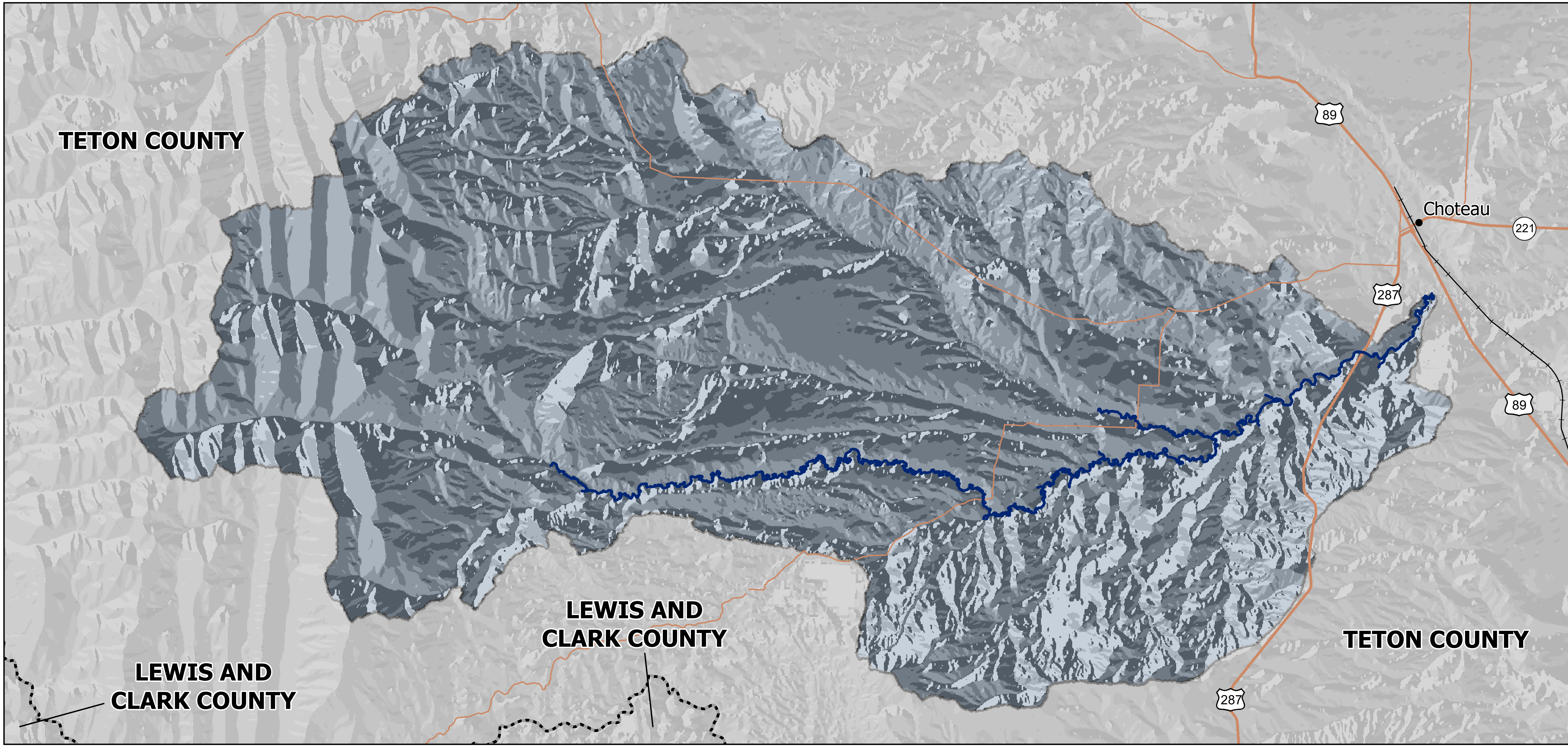


PONDERA COUNTY
FLATHEAD COUNTY
TETON COUNTY
CHOUTEAU COUNTY
LAKE COUNTY
MISSOULA COUNTY
LEWIS AND CLARK COUNTY
POWELL COUNTY
CASCADE COUNTY
Gibson Reservoir
Choteau
Dutton
Fairfield
89
15
221
431
408
21
200
287
435
Legend
Sun River Basin
Sun River and Tributaries
County
Town
Railroad
Highway
Major Road
MONTANA
Michael Baker INTERNATIONAL
DATA FRAME PROPERTIES:
Coordinate System: NAD 1983 StatePlane Montana FIPS 2500
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter
0 5 10 20 Miles
N
SUN RIVER WATERSHED BASIN OVERVIEW MAP
FIGURE 1
Map Date: 8/18/21



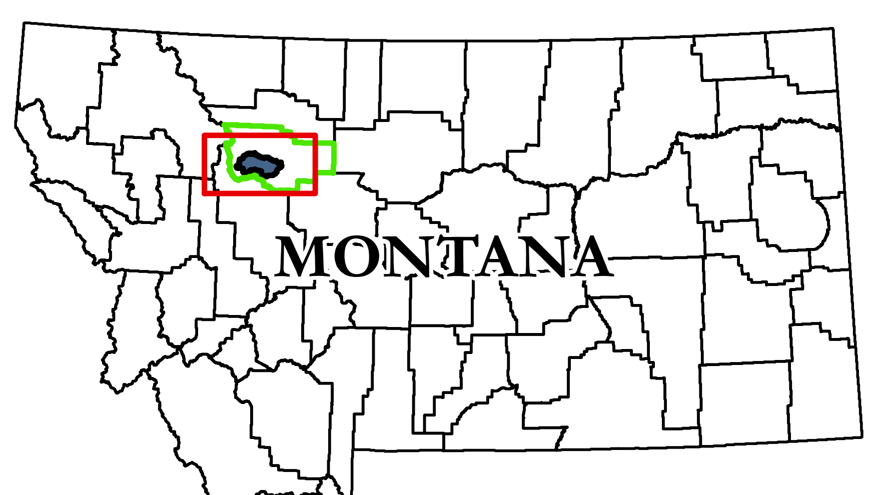
TETON RIVER WATERSHED BASIN OVERVIEW MAP

FIGURE 2



Legend

- Deep Creek Basin
- Deep Creek and Tributaries
- County
- Town
- Railroad
- Highway
- Major Road



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DEEP CREEK WATERSHED BASIN OVERVIEW MAP

FIGURE 3

DATA FRAME PROPERTIES:
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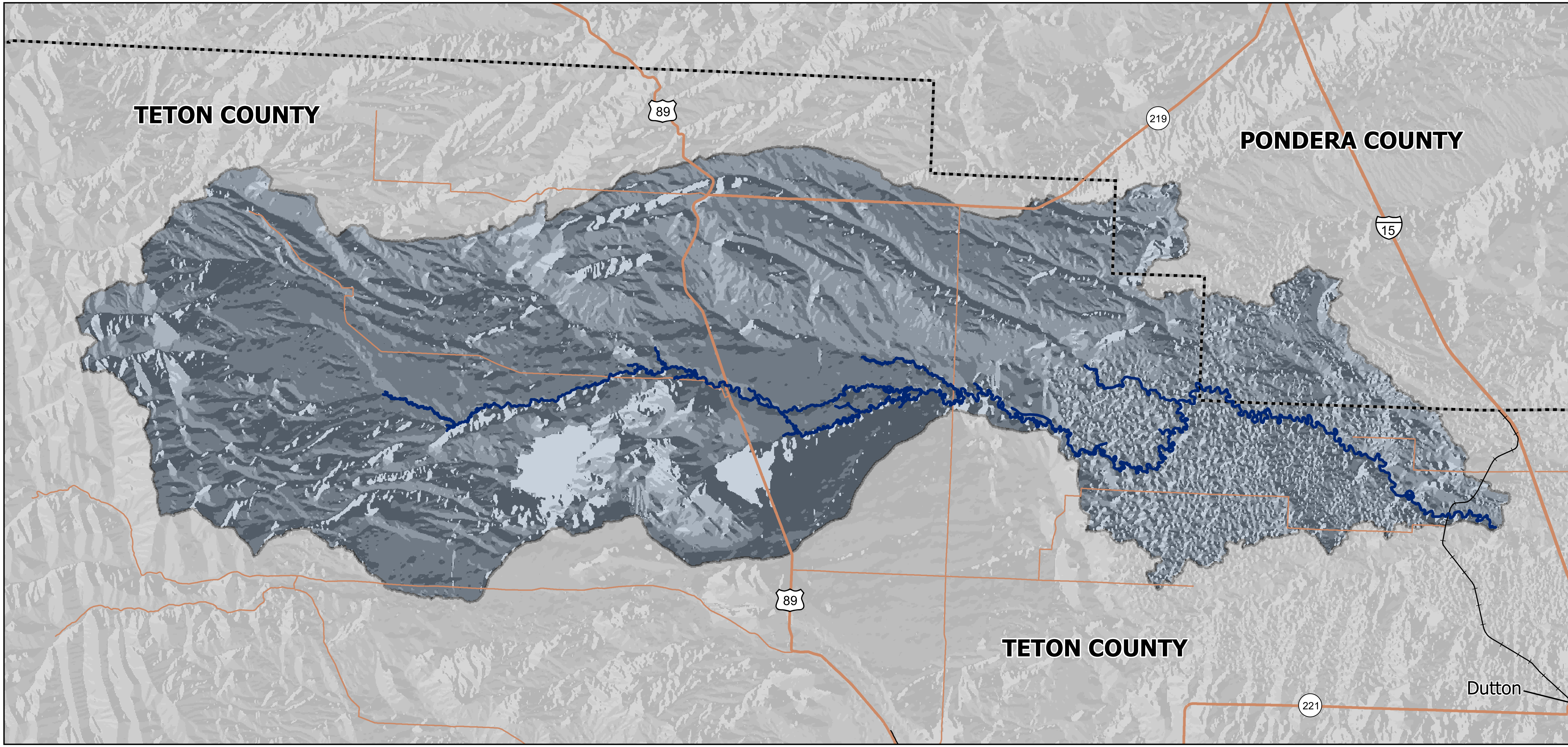
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter

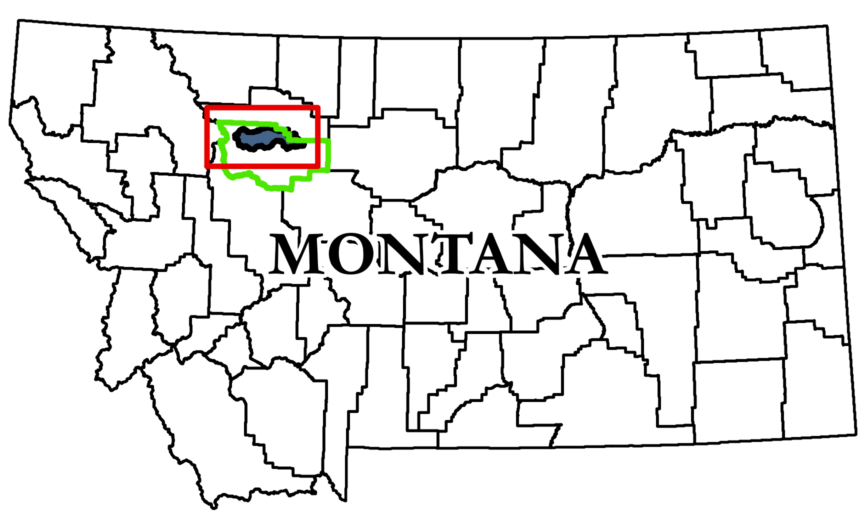
0 1.5 3 6 Miles

Map Date: 8/18/21



Legend

- Muddy Creek Basin
- Muddy Creek and Tributaries
- County
- Town
- Railroad
- Highway
- Major Road



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DATA FRAME PROPERTIES:
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Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter

0 2.5 5 10 Miles

N

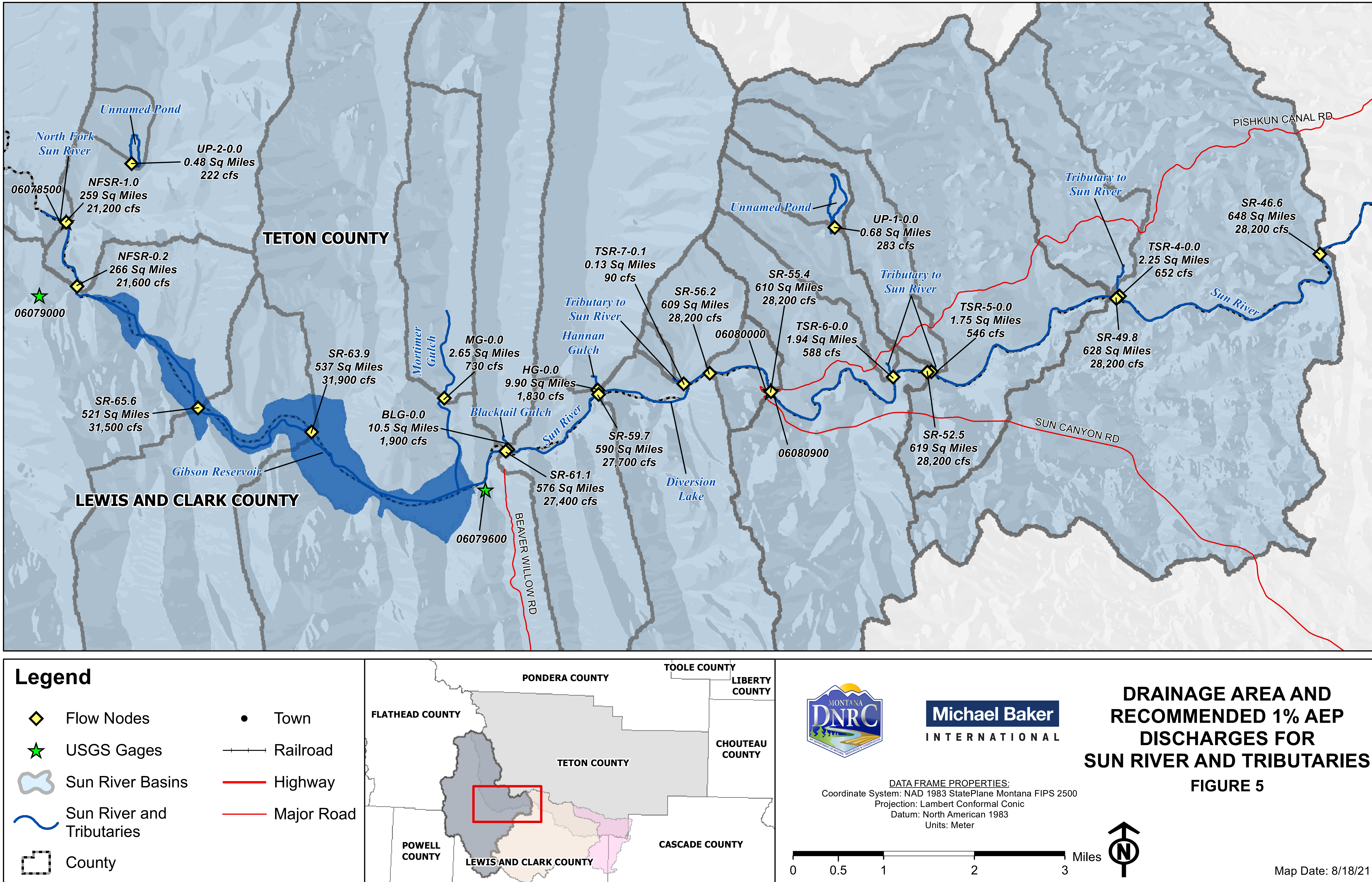
MUDDY CREEK WATERSHED BASIN OVERVIEW MAP
FIGURE 4

Map Date: 8/18/21

Table 1. List of primary flooding sources included in the study area.

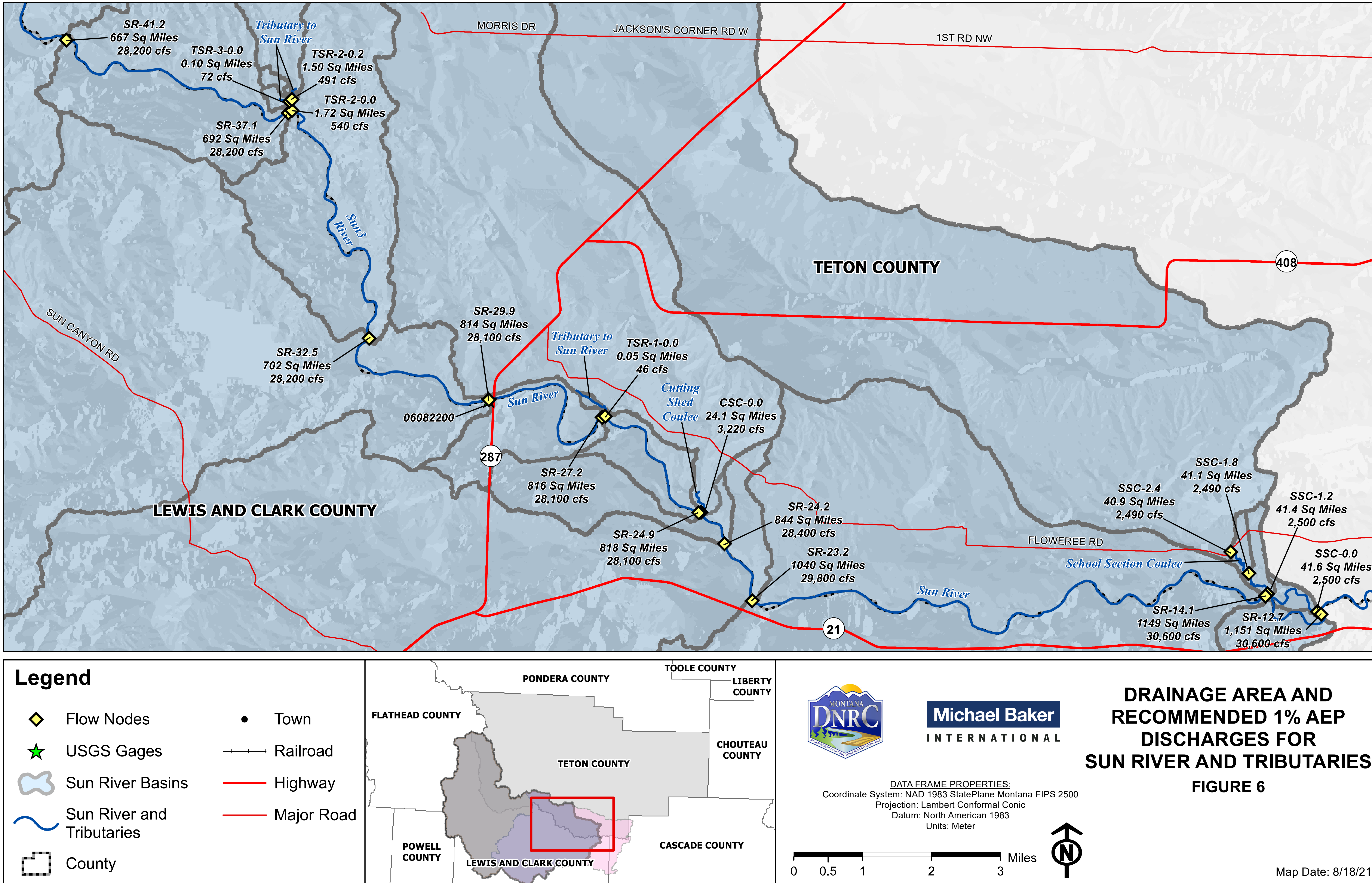
Type of Study	Miles of Hydraulic Analysis
Sun River and Tribs	
Enhanced	72.1
Enhanced (with floodway)	3.1
Teton River and Tribs	
Enhanced	235.8
Enhanced (with floodway)	7.5
Muddy Creek and Tribs	
Enhanced	107.7
Enhanced (with floodway)	3.1

Figures 5 – 16 identify the location and indicate the extents of the sub-watersheds that are included in this hydrologic analysis.



DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR SUN RIVER AND TRIBUTARIES

FIGURE 5


SR-41.2
667 Sq Miles
28,200 cfs
Tributary to
Sun River
TSR-3-0.0
0.10 Sq Miles
72 cfs
TSR-2-0.2
1.50 Sq Miles
491 cfs
TSR-2-0.0
1.72 Sq Miles
540 cfs
SR-37.1
692 Sq Miles
28,200 cfs
MORRIS DR
JACKSON'S CORNER RD W
1ST RD NW
Sun River
TETON COUNTY
408
SUN CANYON RD
SR-32.5
702 Sq Miles
28,200 cfs
SR-29.9
814 Sq Miles
28,100 cfs
Tributary to
Sun River
TSR-1-0.0
0.05 Sq Miles
46 cfs
Cutting
Shed
Coulee
CSC-0.0
24.1 Sq Miles
3,220 cfs
Sun River
06082200
287
SR-27.2
816 Sq Miles
28,100 cfs
LEWIS AND CLARK COUNTY
SR-24.2
844 Sq Miles
28,400 cfs
SR-24.9
818 Sq Miles
28,100 cfs
SR-23.2
1040 Sq Miles
29,800 cfs
21
Sun River
FLOWEREE RD
School Section Coulee
SSC-1.8
41.1 Sq Miles
2,490 cfs
SSC-2.4
40.9 Sq Miles
2,490 cfs
SSC-1.2
41.4 Sq Miles
2,500 cfs
SSC-0.0
41.6 Sq Miles
2,500 cfs
SR-14.1
1149 Sq Miles
30,600 cfs
SR-12.7
1,151 Sq Miles
30,600 cfs
Legend
Flow Nodes
USGS Gages
Sun River Basins
Sun River and Tributaries
County
Town
Railroad
Highway
Major Road
PONDERA COUNTY
TOOLE COUNTY
LIBERTY COUNTY
FLATHEAD COUNTY
TETON COUNTY
CHOUTEAU COUNTY
POWELL COUNTY
LEWIS AND CLARK COUNTY
CASCADE COUNTY
MONTANA DNRC
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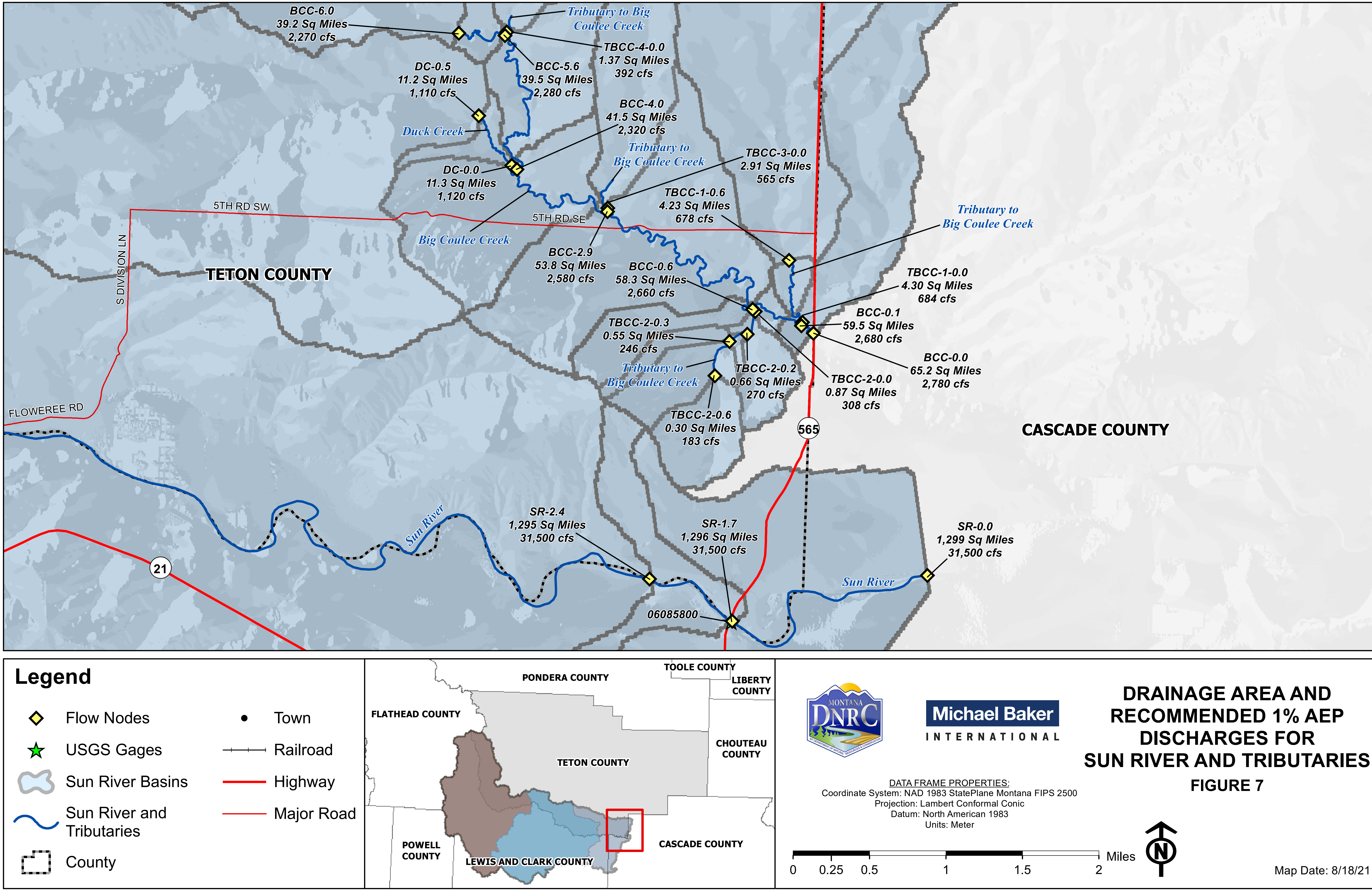
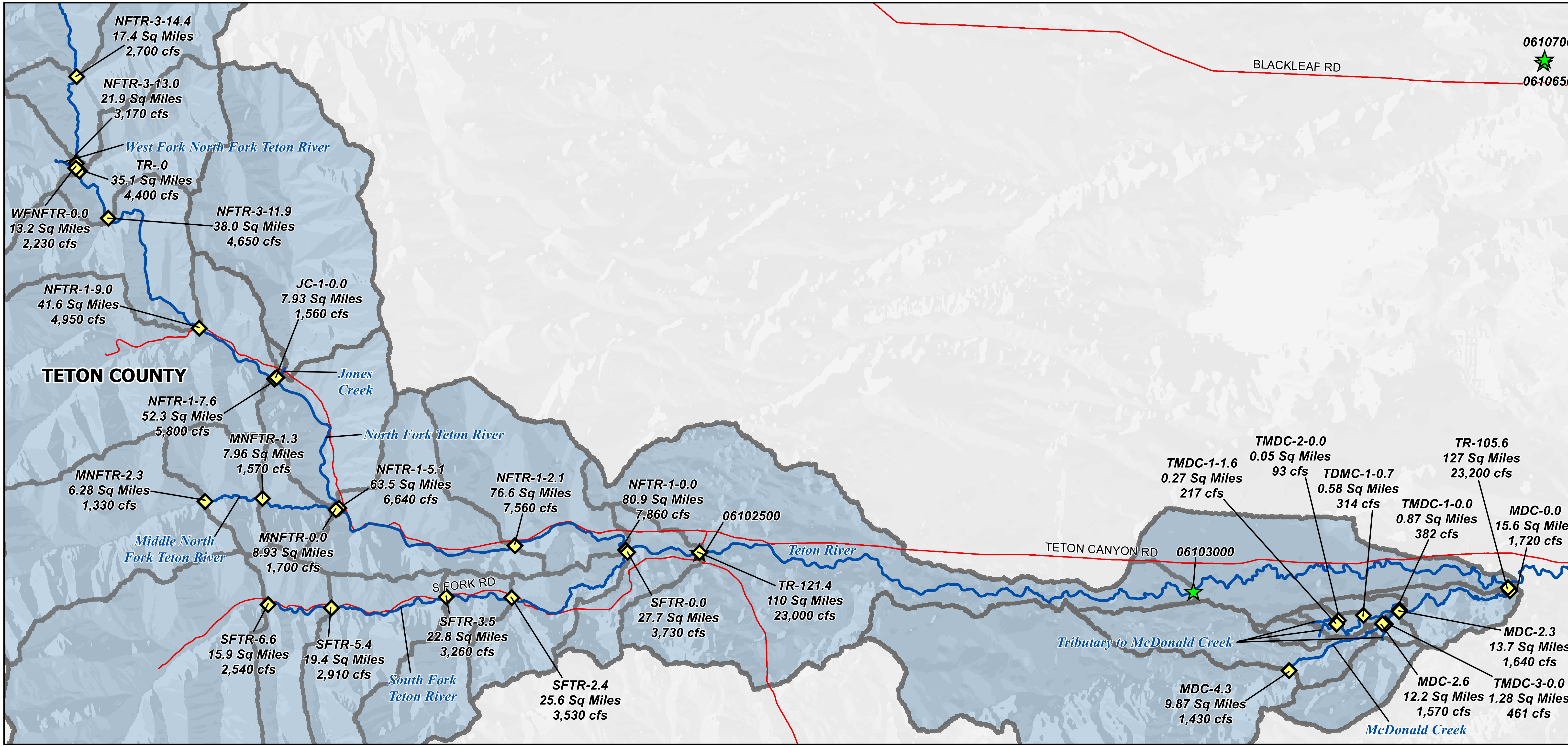
DATA FRAME PROPERTIES:
Coordinate System: NAD 1983 StatePlane Montana FIPS 2500
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter
0 0.5 1 2 3 Miles
N
DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR SUN RIVER AND TRIBUTARIES
FIGURE 6
Map Date: 8/18/21



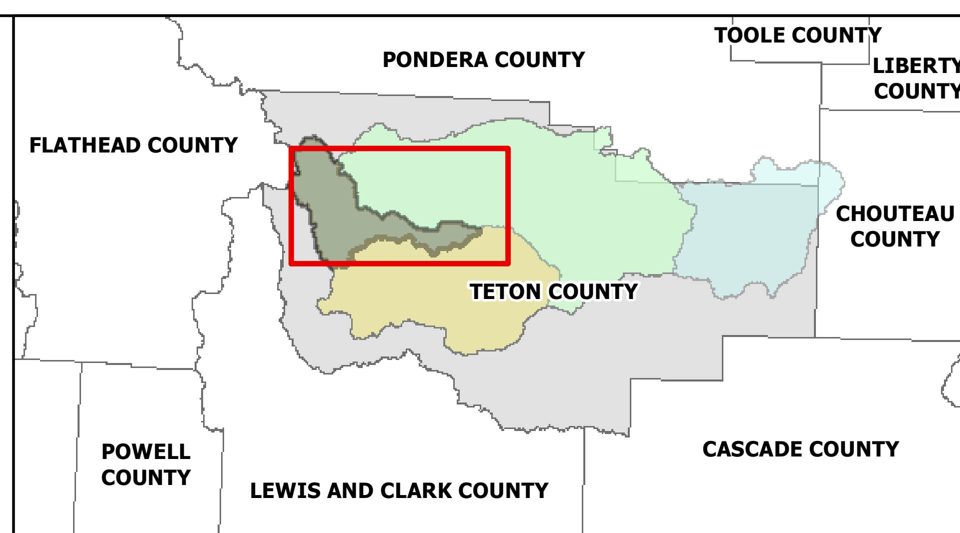
DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR SUN RIVER AND TRIBUTARIES

FIGURE 7



Legend

- Flow Nodes
- USGS Gages
- Teton River Basins
- Teton River and Tributaries
- County
- Town
- Railroad
- Highway
- Major Road



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DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR TETON RIVER AND TRIBUTARIES

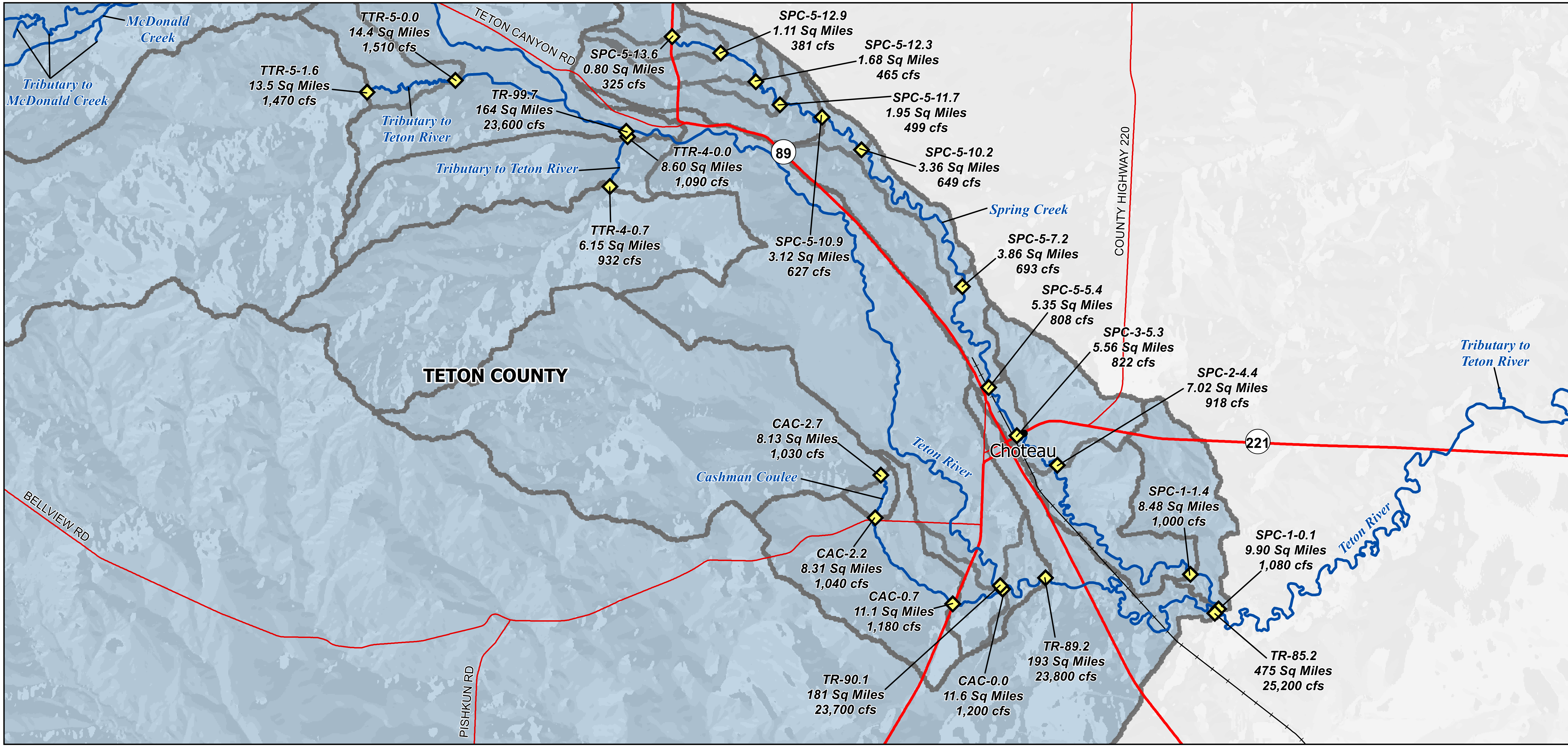
FIGURE 8

DATA FRAME PROPERTIES:
Coordinate System: NAD 1983 StatePlane Montana FIPS 2500
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter

0 0.5 1 2 3 4 Miles

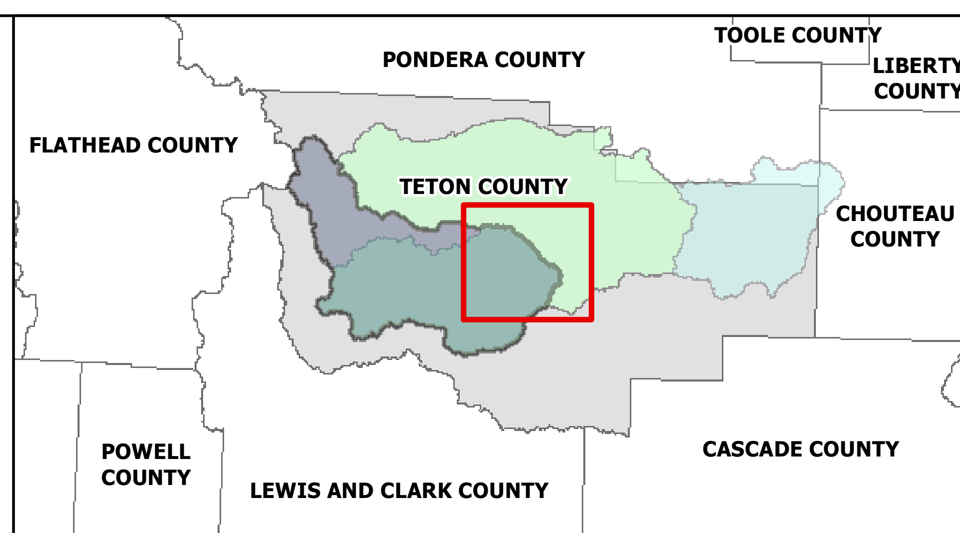
N

Map Date: 8/18/21



Legend

- Flow Nodes
- USGS Gages
- Teton River Basins
- Teton River and Tributaries
- County
- Town
- Railroad
- Highway
- Major Road



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DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR TETON RIVER AND TRIBUTARIES

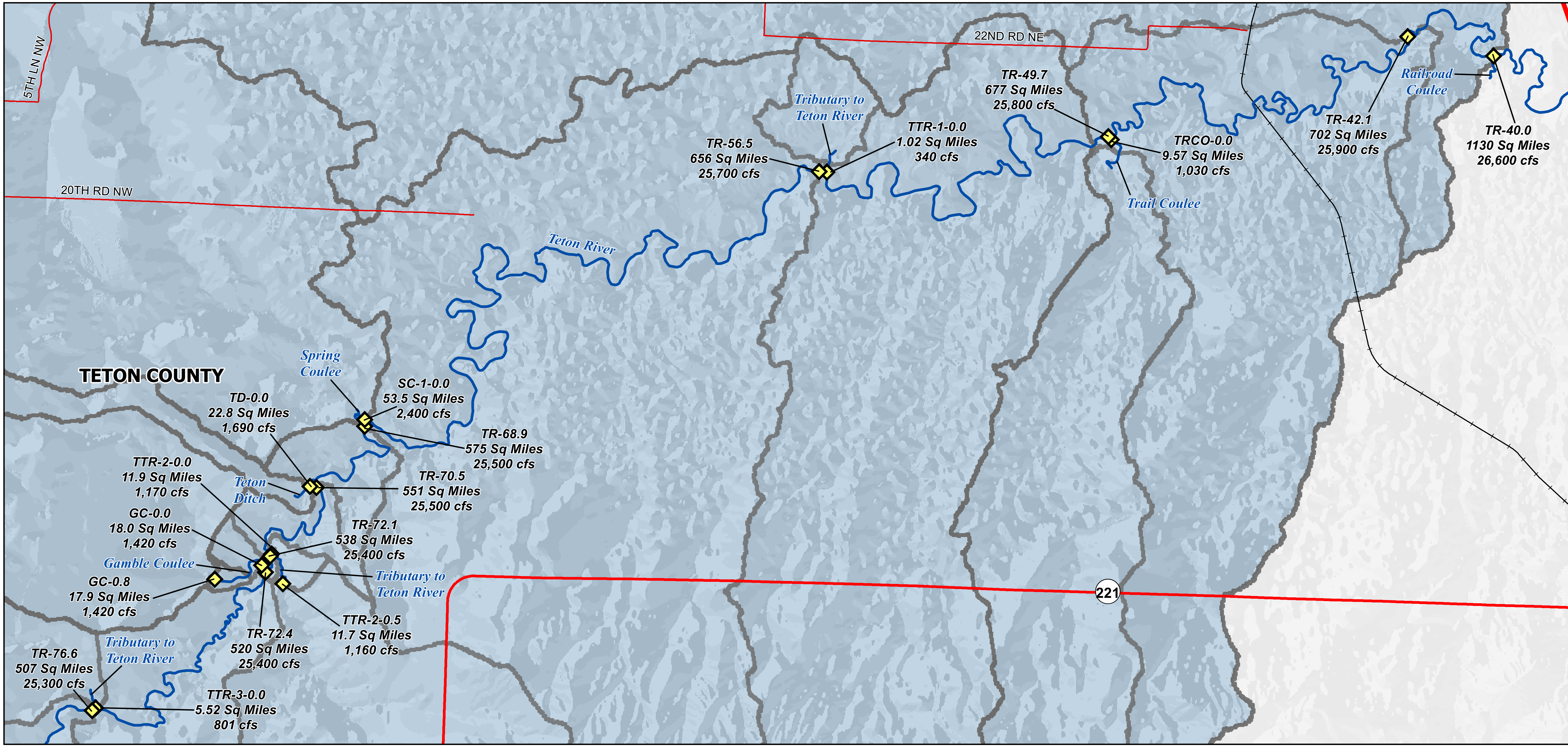
FIGURE 9

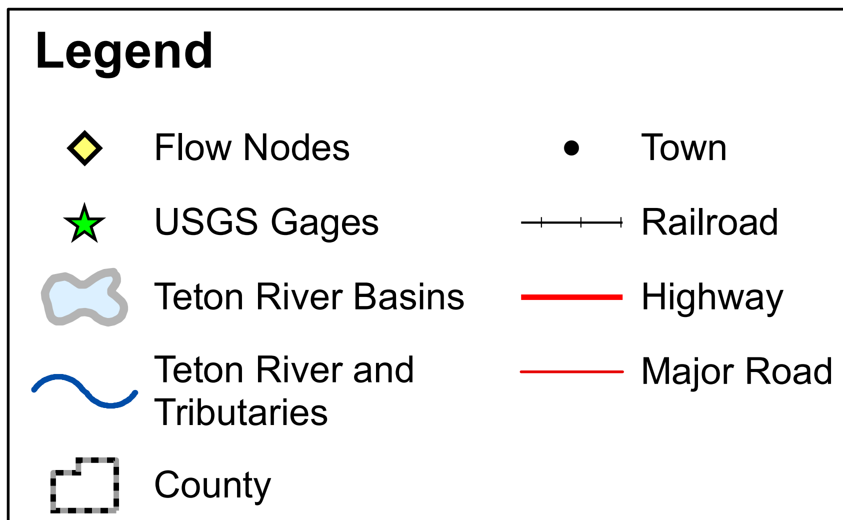
DATA FRAME PROPERTIES:
Coordinate System: NAD 1983 StatePlane Montana FIPS 2500
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter

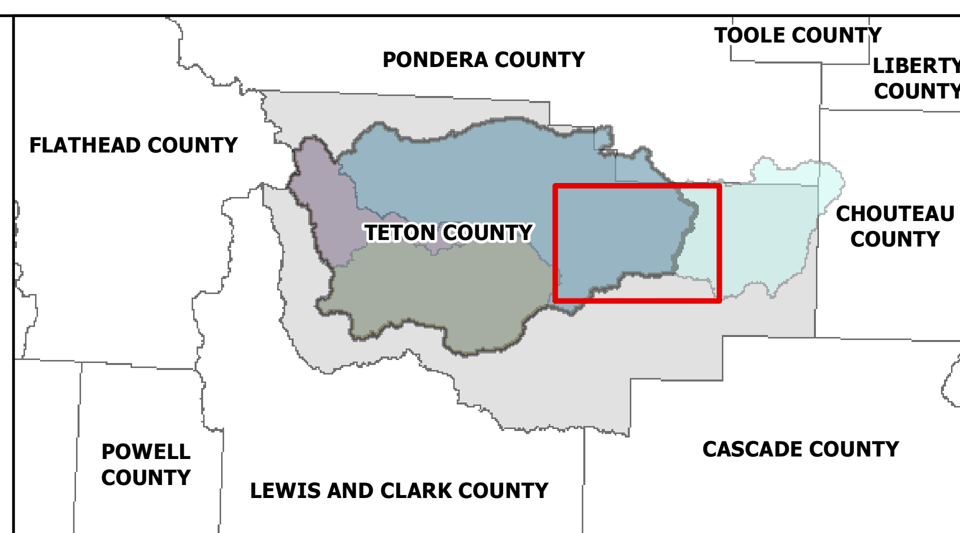
0 0.5 1 2 3 4 Miles

N

Map Date: 8/18/21







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DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR TETON RIVER AND TRIBUTARIES

FIGURE 10

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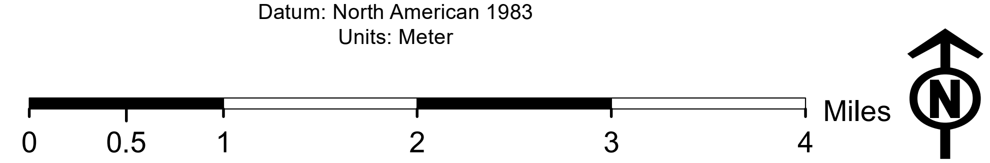
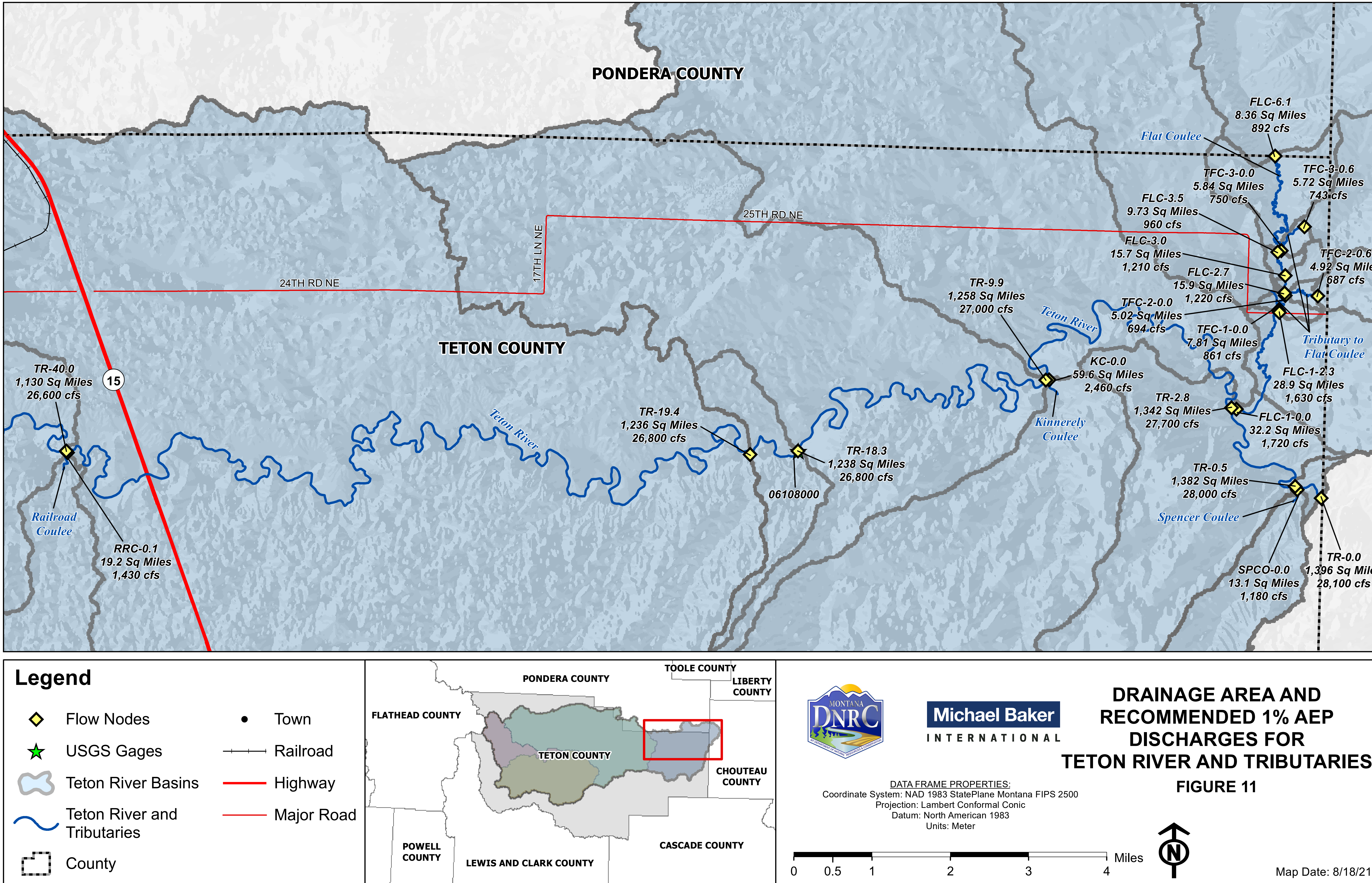
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter

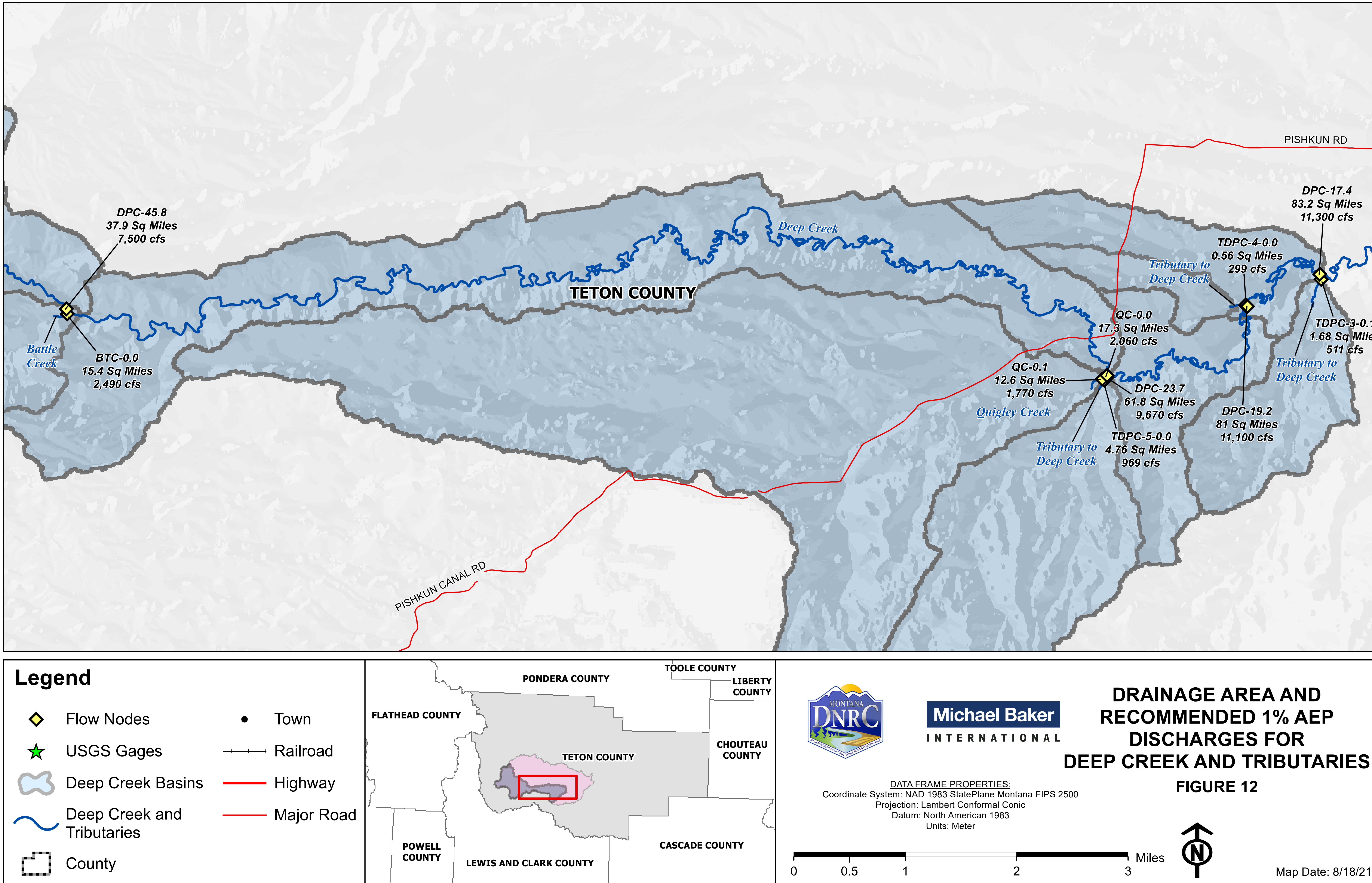


Map Date: 8/18/21



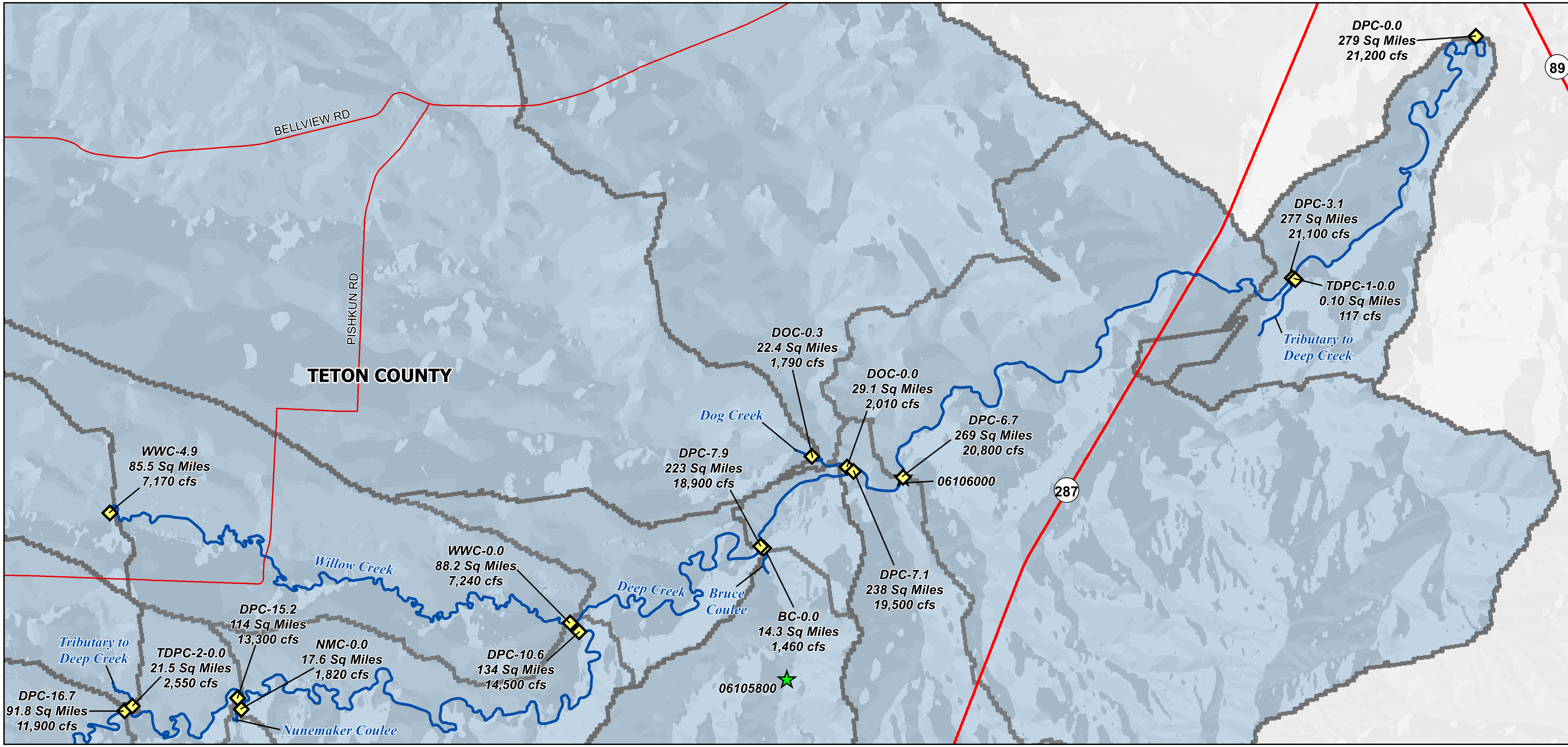
DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR TETON RIVER AND TRIBUTARIES

FIGURE 11



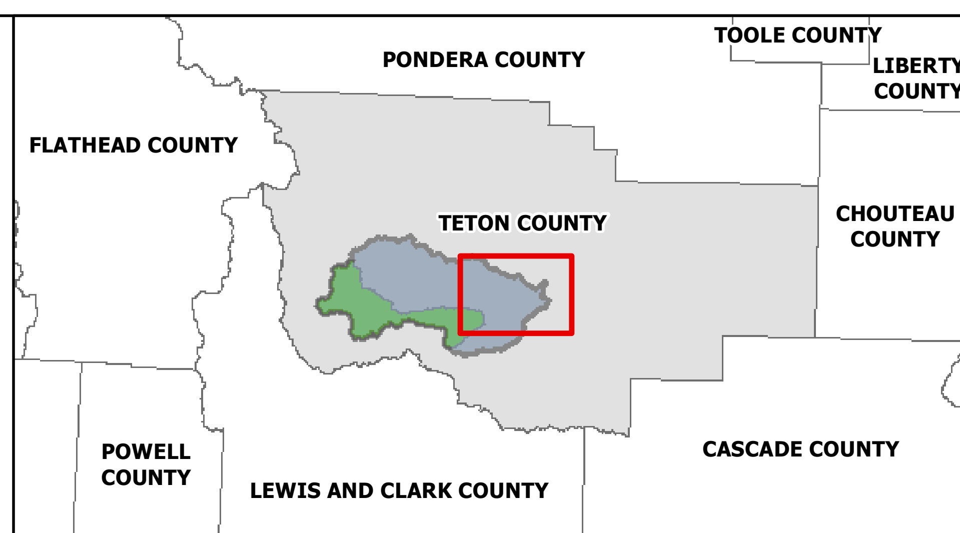
DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR DEEP CREEK AND TRIBUTARIES

FIGURE 12



Legend

- Flow Nodes
- USGS Gages
- Deep Creek Basins
- Deep Creek and Tributaries
- County
- Town
- Railroad
- Highway
- Major Road



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DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR DEEP CREEK AND TRIBUTARIES

FIGURE 13

DATA FRAME PROPERTIES:
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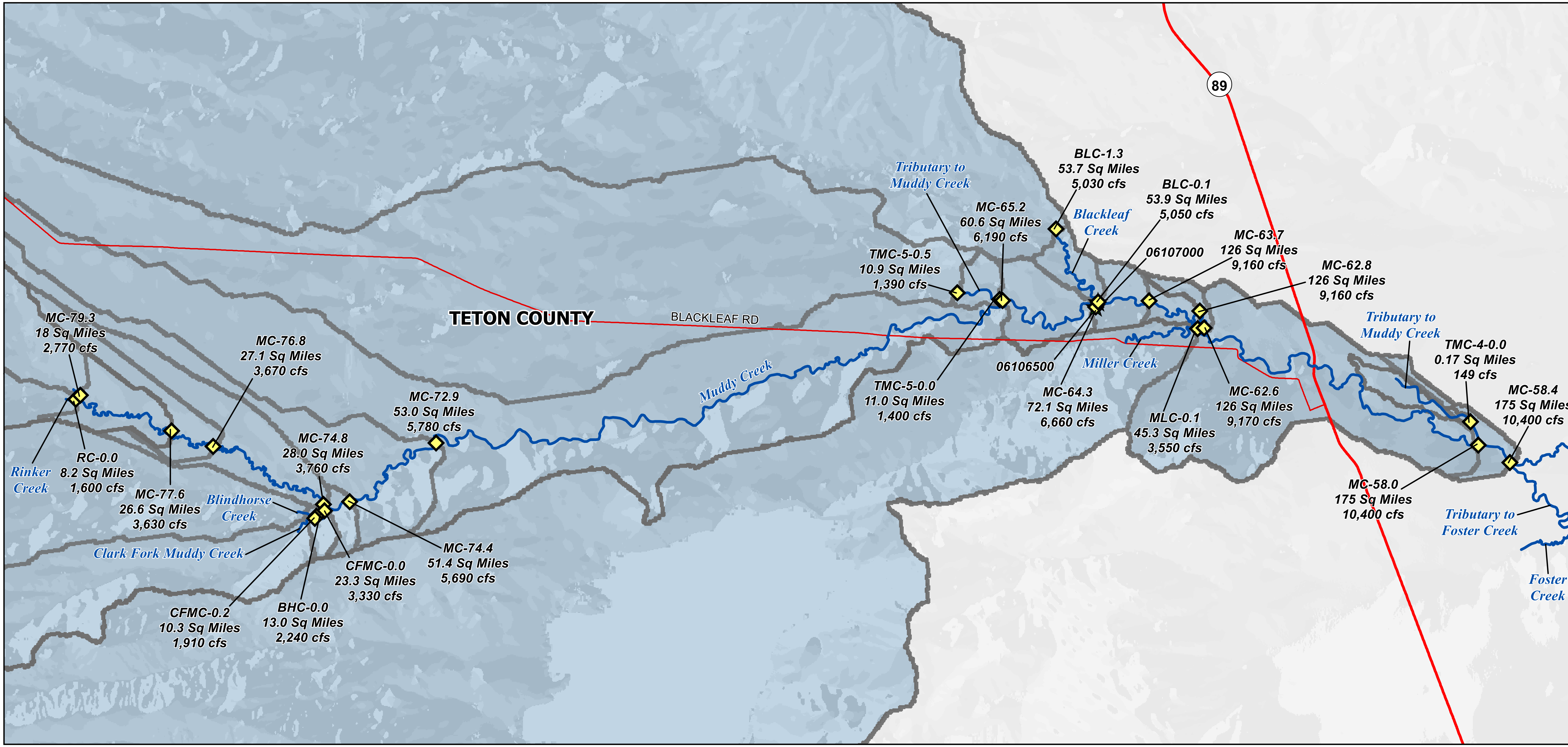
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter

0 0.5 1 2 Miles

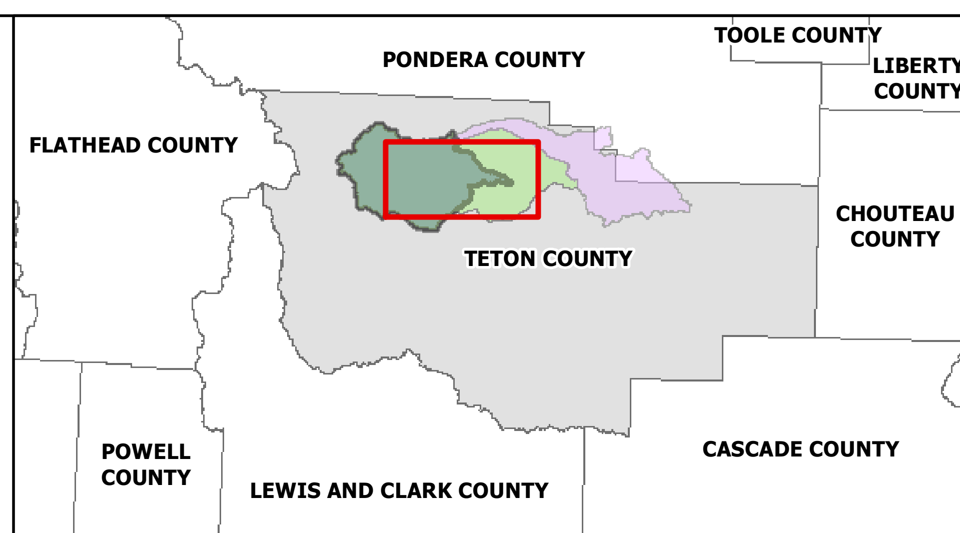
N

Map Date: 8/18/21



Legend

- Flow Nodes
- USGS Gages
- Muddy Creek Basins
- Muddy Creek and Tributaries
- County
- Town
- Railroad
- Highway
- Major Road



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DATA FRAME PROPERTIES:
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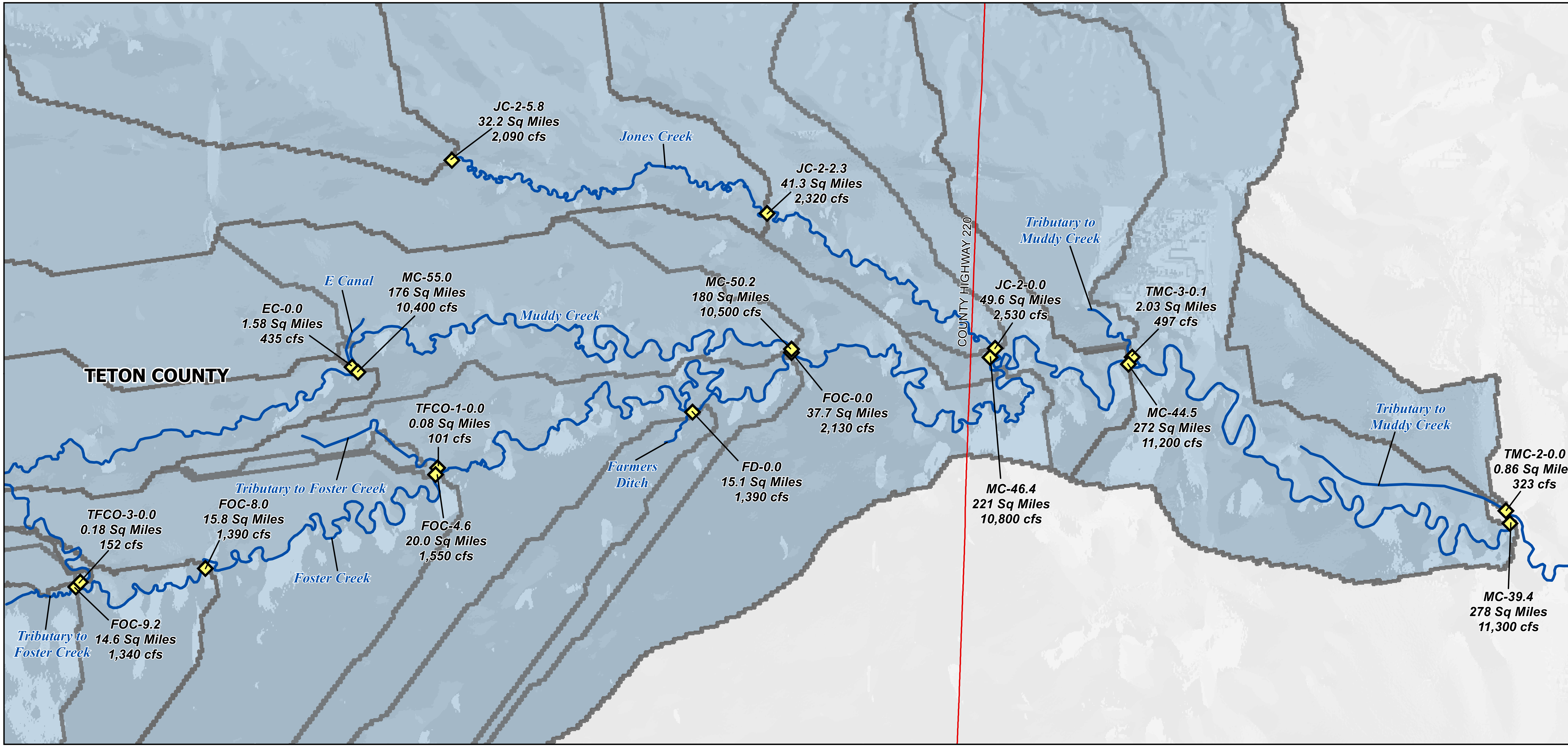
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter

0 0.5 1 2 3 Miles

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR MUDDY CREEK AND TRIBUTARIES

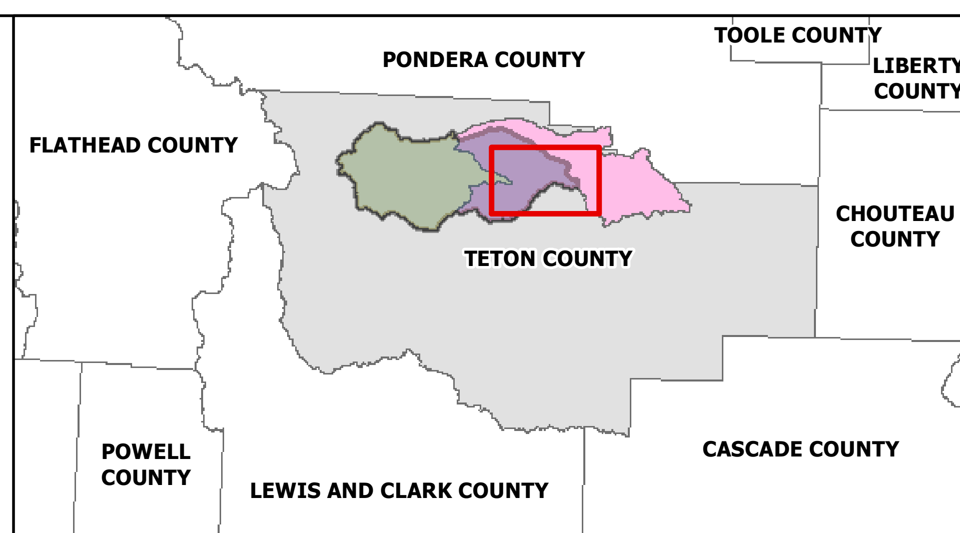
FIGURE 14

Map Date: 8/18/21



Legend

- Flow Nodes
- USGS Gages
- Muddy Creek Basins
- Muddy Creek and Tributaries
- County
- Town
- Railroad
- Highway
- Major Road



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DATA FRAME PROPERTIES:
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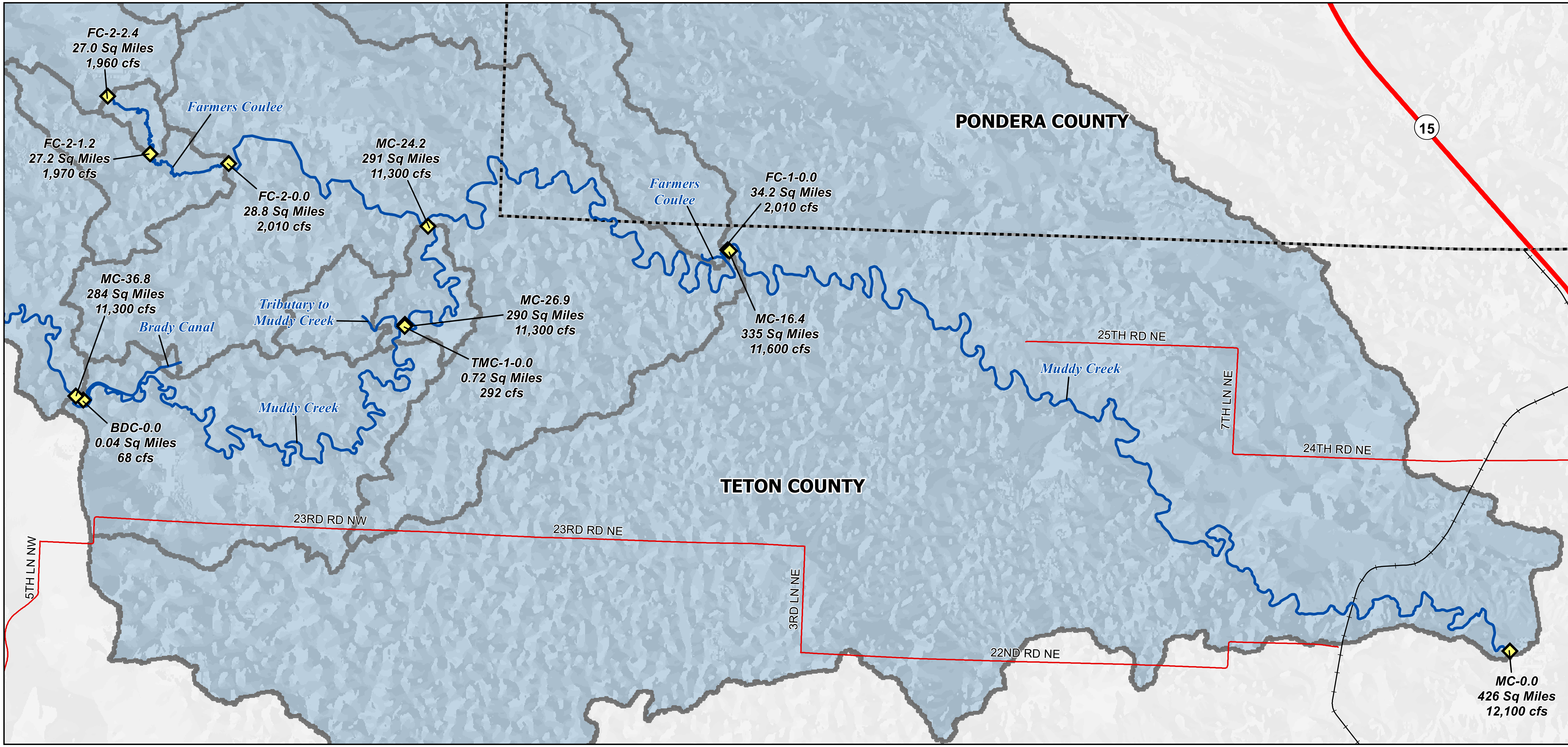
Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter

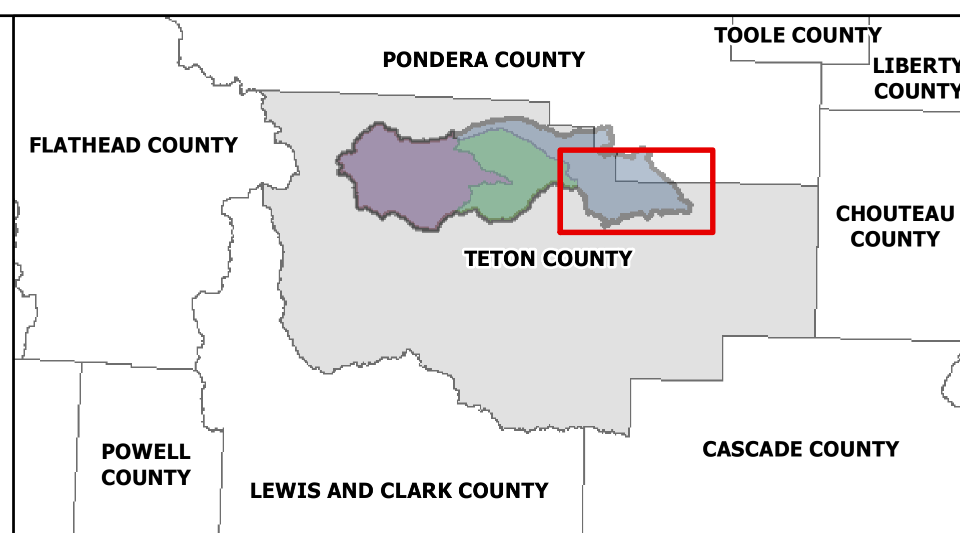
0 0.5 1 2 Miles

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR MUDDY CREEK AND TRIBUTARIES

FIGURE 15

Map Date: 8/18/21





MONTANA DNRC

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DATA FRAME PROPERTIES:
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Projection: Lambert Conformal Conic
Datum: North American 1983
Units: Meter

0 0.5 1 2 3 Miles

N

DRAINAGE AREA AND RECOMMENDED 1% AEP DISCHARGES FOR MUDDY CREEK AND TRIBUTARIES

FIGURE 16

Map Date: 8/18/21

2.1. Background Information and Existing Flood Hazards

As a participant in FEMA's CTP program, The State of Montana works in collaboration with FEMA to identify flood hazards and communicate flood risk to communities throughout the state, and to assist with administration of the National Flood Insurance Program (NFIP). In this role, the State also engages with communities to provide technical and community outreach resources related to implementation of the NFIP, the Montana Floodplain and Floodway Management Act (1971), and the Montana Code Annotated. Annually, the State identifies and prioritizes specific study and mapping projects and applies to FEMA for funding to implement these projects and other related program activities. The hydrologic evaluation of the flooding sources in Teton County is one element of a project identified and prioritized for the Teton Countywide Modernization Risk MAP Study. The ultimate goal of the study is to provide new and updated flood hazard risk information to the communities within Teton County.

Existing flood hazard information within Teton County is dated and quite limited given the broad extent and considerable flood risk posed by the numerous flooding sources. Flood hazard information has been published by FEMA on Flood Insurance Rate Maps (FIRMs) for Teton County. With the exception of a short reach of the Teton River and Spring Creek in Choteau, the flooding sources within the Teton County study area are currently mapped as Zone A on the FIRMs.

2.2. Community Description

Teton County is located along Montana's Rocky Mountain Front on the East side of the Continental Divide where the plains transition to the Sawtooth Range of the Rocky Mountain Front. Teton County lies Southeast of Glacier National Park and is Northwest of Helena, MT. The four principal flooding sources in Teton County are Sun River, Teton River, Muddy Creek, and Deep Creek. These flooding sources originate in the higher mountains on the Western boundary of Teton County and flow east into the Foothills area where they ultimately flow into the Missouri River East of Teton County. Deep Creek and Muddy Creek flow into the Teton River before the Teton River flows out of Teton County. Other flooding sources in Teton County originate in smaller foothill watersheds and flow into one of the four principal flooding sources described above.

Irrigated agriculture is a major land use within Teton County and several significant impoundments are located in the county to provide storage for irrigation water delivery. The largest impoundment is Gibson Reservoir, an approximately 99,000 acre-ft reservoir on the Sun River immediately below the confluence of the North and South Fork Sun River in Lewis and Clark National Forest. Other significant impoundments include Pishkun, Bynum, Farmers, and Eureka Reservoirs.

Much of the soils in Teton County formed in glacial till or glacial outwash material. The soils are quite variable, from alluvium in and around stream channels and floodplains, to sand and silts, clays, shales, and loams (with and without high rock content), depending on the parent material. Poorly consolidated lake and streambed sediments overlay thick deposits of sedimentary rock from the Cambrian and Cretaceous age. Glaciation played a role in the distribution and patterns of erosion and deposition of glacial material. Given the range in topography, various formations have been exposed in the Sawtooth Range, and eroded material have been deposited in the flatter foothills and plains areas.

Mean Annual Precipitation within Teton County varies considerably based on elevation. Mean Annual Precipitation for the City of Choteau is just over 10 inches per year, while the mountains near the continental divide in western Teton County can receive up to 60 inches of precipitation a year. The western (mountainous) portion of Teton County is located in the Northwest hydrologic region with the rest of the county in the Northwest Foothills hydrologic region. The flood characteristics of the Northwest hydrologic region is described as “Largest floods caused by runoff from rain associated with moist air masses from the Gulf of Mexico. Most annual peak flows are from snowmelt or snowmelt mixed with rain.” The flood characteristics of the Northwest Foothills hydrologic regions are “Floods caused by snowmelt, large amounts of rain, or thunderstorms. Annual peak flows are more variable than those from similar-sized streams in the mountainous regions.” (USGS 2018a).

Approximately 20 stream gages exist within or near Teton County that have peak flow records on flooding sources of interest. Effective flood hazard mapping data exists in paper formats within the county, with nearly all of the Special Flood Hazard Areas (SFHA) mapped using approximate methods (Zone A). A short reach the Teton River and Spring Creek within the City of Choteau are mapped as Zone AE with a Floodway. As a separate task to DNRC, Baker has digitized the effective flood hazard maps. The City of Choteau is the largest community in Teton County and is the county seat. Choteau is located along the Teton River and Spring Creek flows through Choteau prior to joining the Teton River. Fairfield, Power, Dutton, Bynum and Pendroy are other small communities within Teton County.

2.3. Flood History

2.3.1. Teton County

Historical accounts of flooding in Teton County, Montana date back to the early 1900s. They cover the upstream portions of the Missouri River watershed, which include but are not limited to the Muddy Creek, Teton River, Spring Creek, Deep Creek, and Sun River basins. Most recorded flood events in Teton County were reported to be the result of delayed, but increased snowmelt with additional peak flows resulting from heavy late season rainfall most often in May and June. Ice jams created by unusually cold winters added to the flooding extents in several, but not most cases.

Floods are often described with reference to a peak discharge or flow rate. The highest rate of flow to occur during a flood event is only one metric of the overall impact of a flood event. The duration of flooding, the volume of total runoff during the event, the height to which the water rises and the extents the runoff reaches in the floodplain are also factors that can vary with each flood. For example, a rainfall driven flood with a peak discharge of 10,000 cfs that lasts three days in summer could have drastically different impacts on the river and floodplain than a slow spring melt flood with the same peak discharge that takes place over three weeks, and is subjected to ice jams and reduced floodplain conveyance from snow and frozen soils. Thus, the anecdotal history provided below may not always include estimates of peak discharge, however, other observations lend important insight into the extent of damage, duration, and communities affected by these events.

2.3.1.1 Anecdotal Information

There are a few anecdotal accounts of flooding, many of which are available in historic newspaper articles. The largest known flood in Teton County occurred in 1964, and is reflected in the volume of published articles and reports covering the flooding. This flooding event had severe consequences in Teton County as well as numerous counties adjacent to and downstream of the county. Additional information is summarized in county and state documents.

The following accounts pertaining to the Teton County flooding sources have been summarized from the existing Teton County, Montana Unincorporated Areas (FEMA, 1983a) and the City of Choteau, Montana Teton County Flood Insurance Studies (FEMA, 1983b).

1948: The first significant flood of note was a result of what has turned out to be common annual symptoms along the Continental Divide in Montana. Cool spring temperatures delayed snowmelt in the mountains and above average rainfall in April and May along with the warmer temperatures in late May resulted in inordinately high stream flows. Heavy rain in mid-June throughout Teton County, among others, was the highest on record at the time and tipped the scales for streams already at bankfull. Some monthly rainfall totals included 11.13 inches at the Gibson Dam and 8.61 inches at Choteau. While no loss of life was reported, and despite the low population density throughout the rural counties, total losses were estimated above $1 million – a substantial monetary loss for that time period.

1953: While damage in the Missouri River basin exceeded $8.5 million, flood-control devices and irrigation efforts reduced peak flow rates enough to avoid any loss of life as a result of the substantial flooding during 1953. Delayed snowmelt and late season rainfall both contributed to the flood flows throughout Teton County and downstream regions as well. The Teton River was noted as relatively high compared to other nearby flooding sources and resulted in most damage being confined to the town of Choteau. The USGS reported that a peak rainfall in Choteau reached 1.29 in one day, and 0.86 inches in one hour. While the monetary losses increased from the last severe flooding event, advances in flood protection measures were directly responsible for avoiding the loss of life.

1964: In a sequence of events similar to those preceding the floods of 1948 and 1953, a combination of cool spring temperatures delaying snow melt until June and unusually heavy rainfall in the same month resulted in the most severe flooding event Teton County and Montana at large has seen to date. The USGS estimated that the flood had an annual exceedance probability of 0.5%, which classified it as a 200-year storm. The Sun River reported peak flow rates at 55,000 cfs where the previous record had been 32,300 cfs. Further, multiple dam failures resulted in the loss of 32 lives while the overall property losses across the affected areas were estimated above $62 million. According to the effective FIS for Teton County, the Teton River registered a flow of 54,600 cfs, Deep Creek a flow of 41,800 cfs, and the inflow at Gibson Dam on the Sun River reached 60,000 cfs. The dam’s crest reportedly overtopped by over 3 ft during this flooding event.

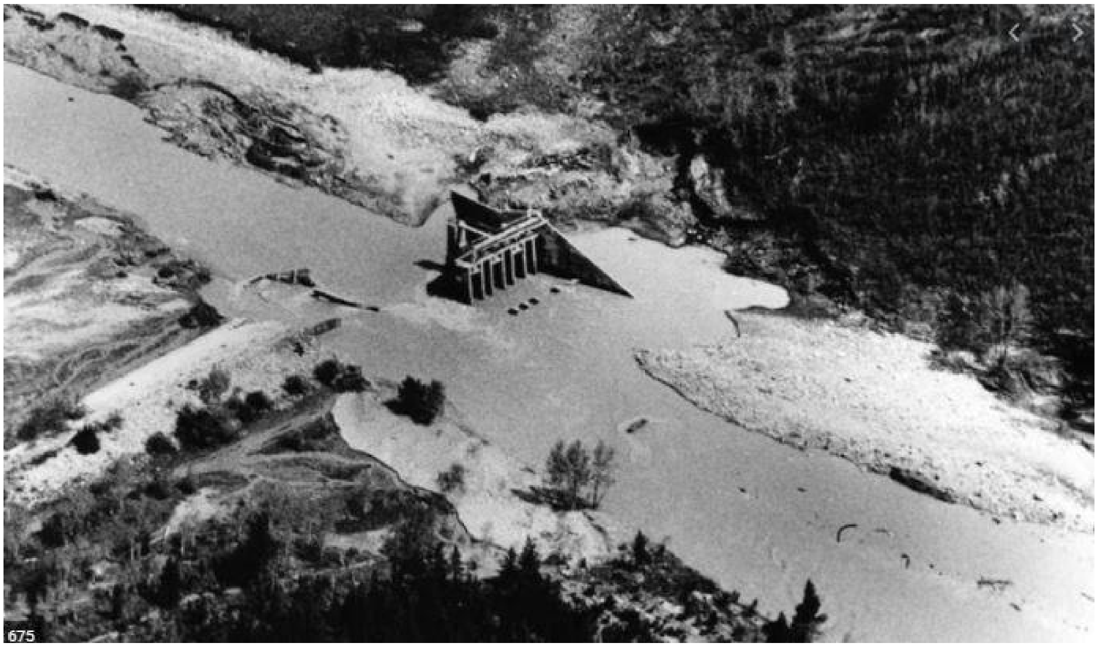


Photo 1. Two Medicine Dam on the Two Medicine River, 1964 (Great Falls Tribune, 2018)

1975: Again, the most frequent and consistent cause of flooding throughout Montana, a combination of above average snowpack with a delayed melt and late season rainfall resulted in an unusually large flooding event near the Continental Divide. According to the USGS report on the flooding, estimates of flood damage were about $53 million. While flood damage was substantially less than that as a result of the 1964 flooding, the dollar amount for the damage in 1975 was comparatively similar. This indicates both an increase in property value in the affected areas as well as the influx of inhabitants.

2011: Unusually cold weather in the winter leading up to the spring of 2011 resulted in the buildup of river ice across most of the state. Beginning with persistent and widespread ice jamming issues, continued cold weather brought significant snow to the plains, which melted at the same time as the river ice, leading to substantial and widespread flooding issues. Rain in late May brought additional late season snow to the mountains, directly resulting in prolonged inundation for streams already strained by the original snowmelt and recent rain. Once again, a frequent victim of flood damage, the town of Sun River was inundated. The need for water releases from filled reservoirs to accommodate incoming runoff passed the flooding issue downstream, extending the period of flooding for many towns across the plains. This flooding through 2011 damaged numerous bank stabilization structures in the Deep Creek watershed, which as a tributary to the Missouri River exacerbated the flooding downstream as well.

Photo 2. Corey Low-Water Crossing Near Choteau, June 9, 2011 (Choteau Acantha, 2011)

2.3.2. Recorded Flow Data

The USGS currently operates (and has historically operated) numerous gaging stations within Teton County. Under an agreement with DNRC, USGS performed flood frequency analyses of select gages within (and adjacent to) Teton County with the intent of using the revised flood frequency results in hydraulic analyses and subsequent revisions to floodplain mapping within the County. The results of these analyses are presented in the following sections. The largest recorded discharge events for 20 of the stream gages representing the four primary flooding sources (Sun River, Teton River, Muddy Creek, and Deep Creek) and tributaries are presented in **Table 2**. **Figures 17 through 36** indicate peak flow events used in the peak-flow frequency analyses, and include peak flows directly measured at those gages and those used in record extension (MOVE.3) methodologies.

Table 2. Peak flow data for select gages in Teton County

Station Name	Sun River near Augusta		Sun River below diversion dam, near Augusta		Sun River below Willow Creek near Augusta	
Station Number	06080000		06080900		06082200	
Period of Peak Flow Data	1890 – 1964		1964 – 2019		1964 – 2019	
Number of Peak Flow Records	27		18		16	
Largest Recorded Events	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
	6/9/1964	59,700.	6/9/1964	59,700.	6/9/1964	46,700.
	6/21/1916	32,300.	6/19/1975	32,000.	6/19/1975	34,000.
	6/7/1908	20,000.	6/19/2018	10,500.	6/19/2018	13,300.
	5/25/1917	18,700.	6/2/1972	8,910.	6/2/1972	10,000.
	6/10/1918	11,900.	5/14/1976	8,470.	5/28/1971	7,650.
Station Name	Sun River at Simms		Sun River at Fort Shaw		Sun River near Vaughn	
Station Number	06085800		06086000		06078500	
Period of Peak Flow Data	1964 – 2019		1913-1928		1934-2019	
Number of Peak Flow Records	38		16		86	
Largest Recorded Events	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
	6/9/1964	50,000.	6/7/1908	27,200.	6/9/1964	53,500.
	6/20/1975	37,900.	6/21/1916	20,000.	6/20/1975	32,600.
	6/19/2018	18,100.	5/26/1917	16,400.	6/21/2018	18,200.
	6/8/2011	13,900.	6/9/1909	12,000.	6/4/1953	17,900.
	5/27/2019	11,900.	6/24/1907	10,900.	6/10/2011	14,800.

Station Name	South Fork Sun River near Augusta		North Fork Sun River near Augusta		Muddy Creek tributary near Power	
Station Number	06079000		06078500		06087900	
Period of Peak Flow Data	1911 - 2019		1911 – 2019		1963 - 1986	
Number of Peak Flow Records	11		38		17	
Largest Recorded Events	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
	6/8/1964	28,800.	6/8/1964	51,100.	7/2/1966	620.
	6/19/2018	6,330.	5/19/1991	6,620.	10/15/1975	420.
	5/19/2008	4,370.	6/3/1948	4,840.	6/20/1975	350.
	6/1/2009	3,550.	5/20/1954	4,580.	3/17/1978	350.
	5/24/2014	3,380.	6/2/1956	4,170.	5/3/1964	284.
Station Name	Muddy Creek near Bynum		Bruce Coulee tributary near Choteau		Beaver Creek at Gibson Dam, near Augusta	
Station Number	06106500		06105800		06079600	
Period of Peak Flow Data	1913 - 1924		1963-2002		1959 – 1973	
Number of Peak Flow Records	10		40		15	
Largest Recorded Events	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
	6/21/1916	976.	6/9/1972	390.	6/8/1964	4,360.
	5/26/1917	720.	9/18/1986	284.	5/26/1962	496.
	4/14/1920	519.	7/2/1966	247.	5/12/1960	458.
	6/27/1913	320.	6/10/1967	155.	5/30/1967	300.
	12/31/1917	152.	6/8/1964	148.	5/11/1970	215.

Station Name	Teton River below South Fork, near Choteau		Teton River at Strabane		Teton River near Dutton	
Station Number	06102500		06103000		06108000	
Period of Peak Flow Data	1948 - 2019		1908-1925		1955-2019	
Number of Peak Flow Records	30		18		65	
Largest Recorded Events	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
	6/8/1964	54,600.	6/21/1916	3,810.	6/9/1964	71,300.
	6/19/2018	11,100.	5/26/1917	2,460.	6/20/1975	16,000.
	5/27/2019	3,560.	6/10/1908	2,300.	7/2/1966	8,580.
	5/26/2008	3,200.	6/2/1913	1,410.	5/28/2019	7,380.
	6/3/1948	2,780.	7/27/1909	1,080.	2/26/1986	7,290.

Station Name	Teton River at Loma		Deep Creek near Choteau		Kinley Coulee near Dutton	
Station Number	06108800		06106000		06108200	
Period of Peak Flow Data	1998 - 2019		1911 – 1964		1963-1978	
Number of Peak Flow Records	22		15		16	
Largest Recorded Events	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
	5/30/2019	6,520.	6/8/1964	41,800.	7/2/1966	465.
	8/22/1932	5,660.	6/21/1916	3,700.	5/7/1975	153.
	6/12/2011	3,910.	5/26/1917	2,150.	3/21/1969	125.
	6/24/2018	3,210.	5/21/1912	1,460.	3/18/1978	122.
	6/13/2002	2,000.	4/13/1920	1,420.	6/8/1964	76.

Station Name	Kinley Coulee tributary near Dutton		North Fork Muddy Creek near Bynum			
Station Number	06108300		06107000			
Period of Peak Flow Data	1963-1978		1913 - 1924			
Number of Peak Flow Records	16		11			
Largest Recorded Events	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)		
	7/2/1966	465.	6/21/1916	600.		
	5/7/1975	153.	6/1/1917	352.		
	3/21/1969	125.	5/12/1920	212.		
	3/18/1978	122.	8/1/1915	118.		
	6/8/1964	76.	4/29/1922	102.		

Figure 17. USGS 06080000 Sun River near Augusta

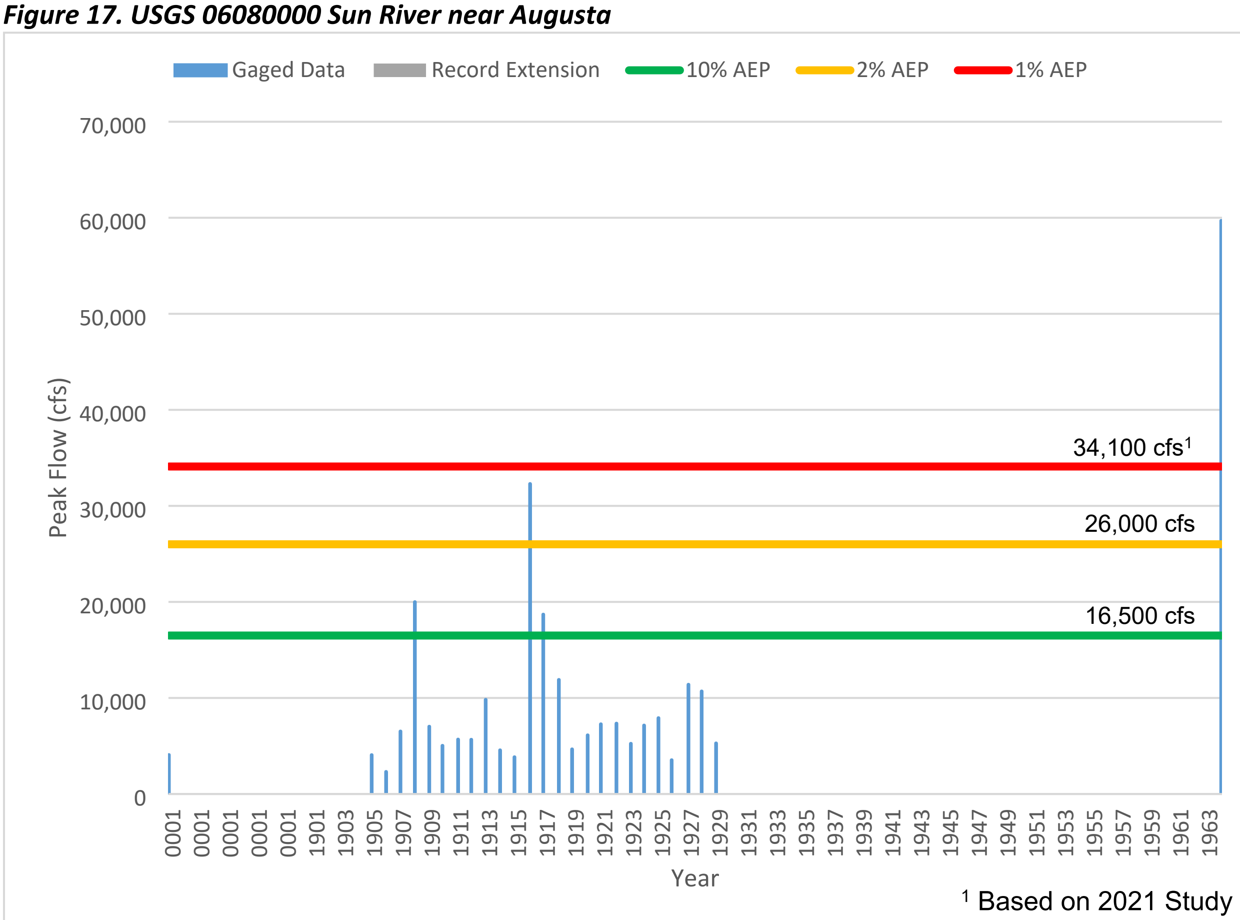


Figure 18. USGS 06080900 Sun River below Diversion

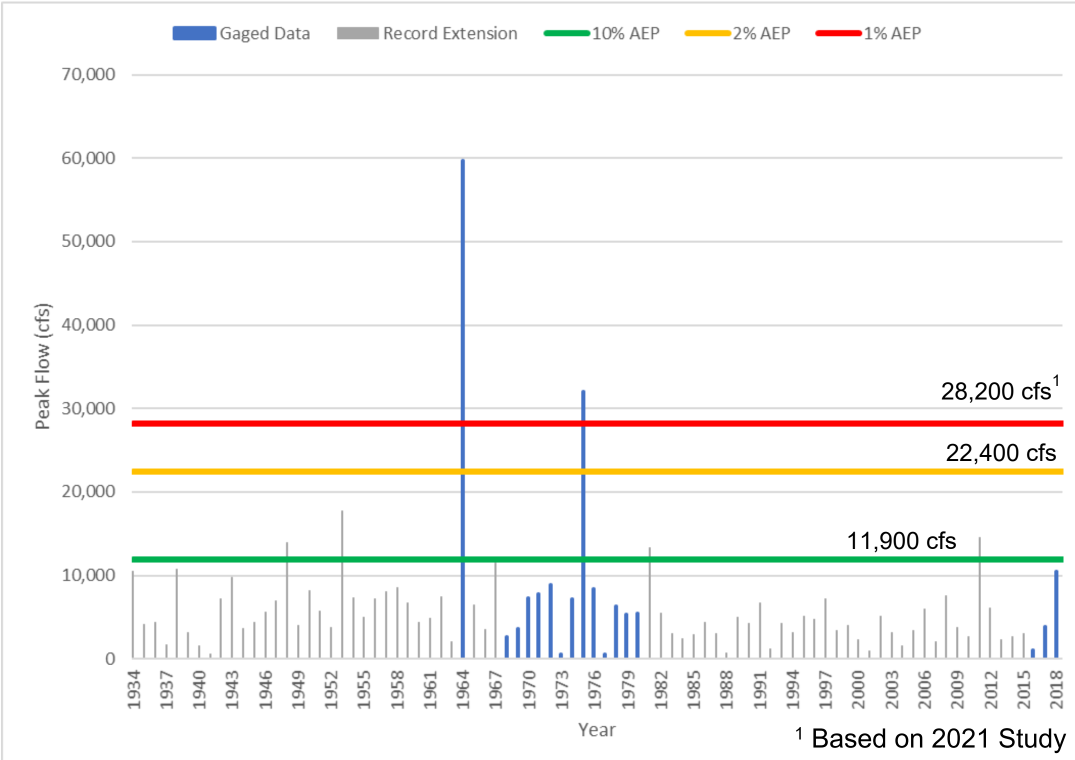


Figure 19. USGS 06082200 Sun River below Willow Creek near Augusta

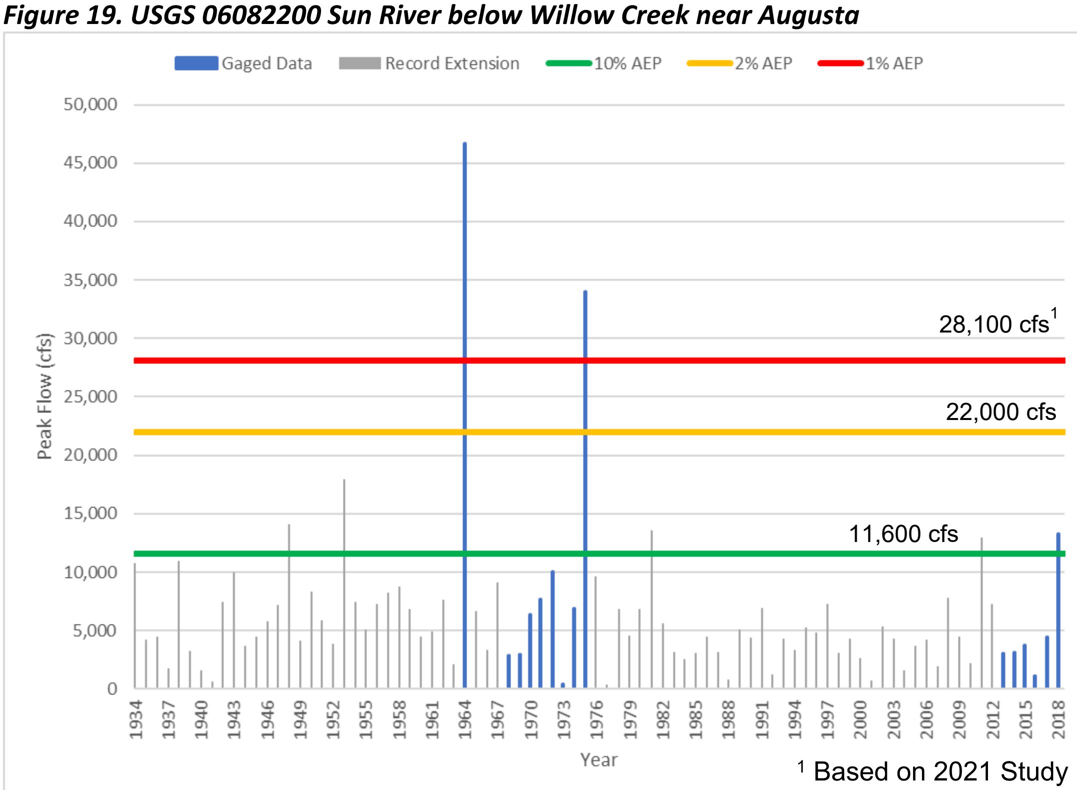


Figure 20. USGS 06085800 Sun River at Simms

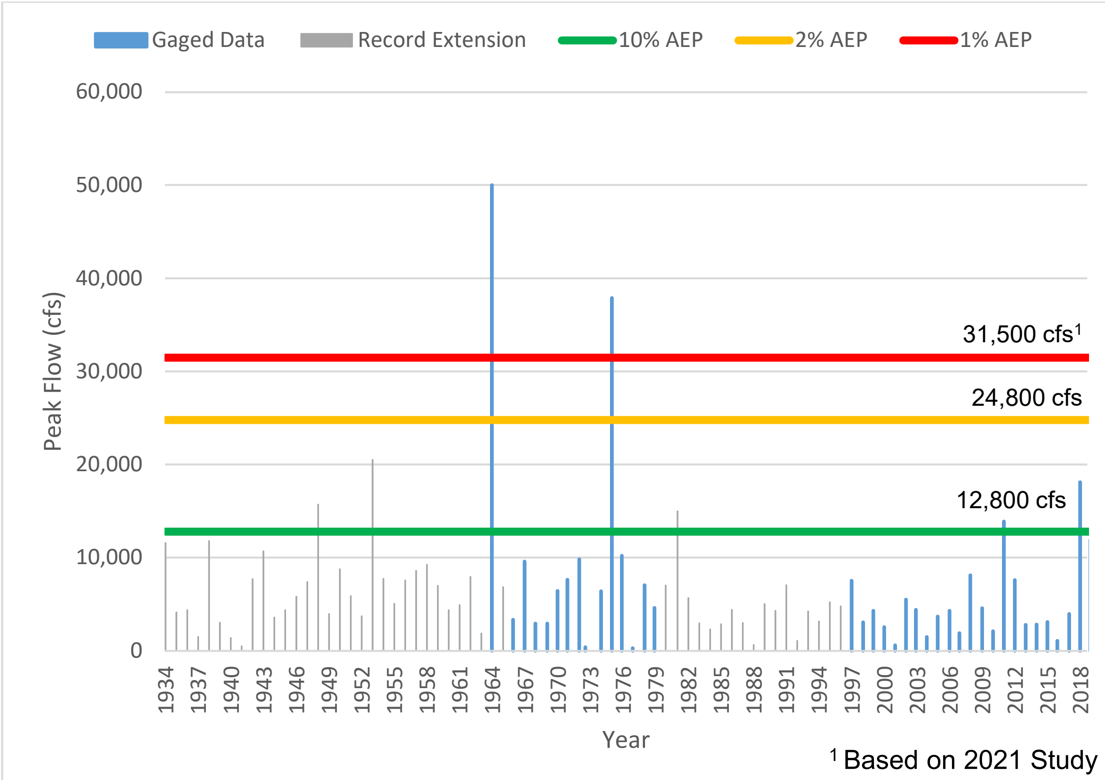


Figure 21. USGS 06086000 Sun River at Fort Shaw

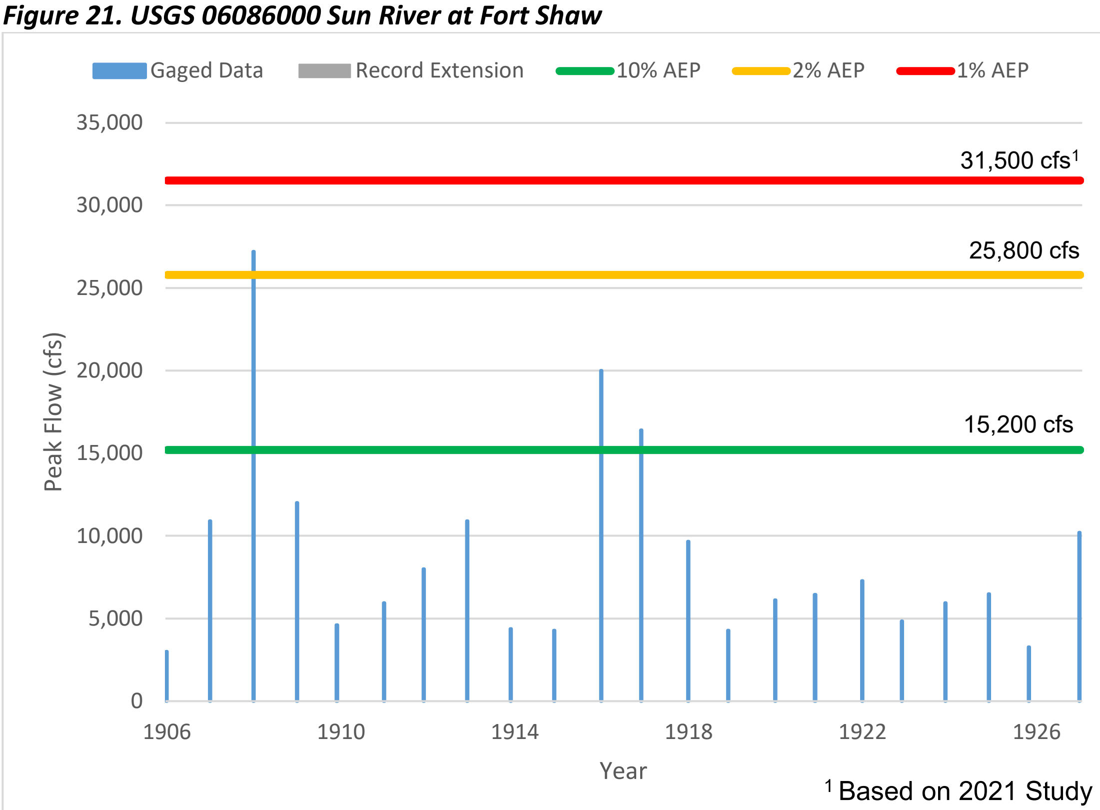


Figure 22. USGS 06089000 Sun River near Vaughn

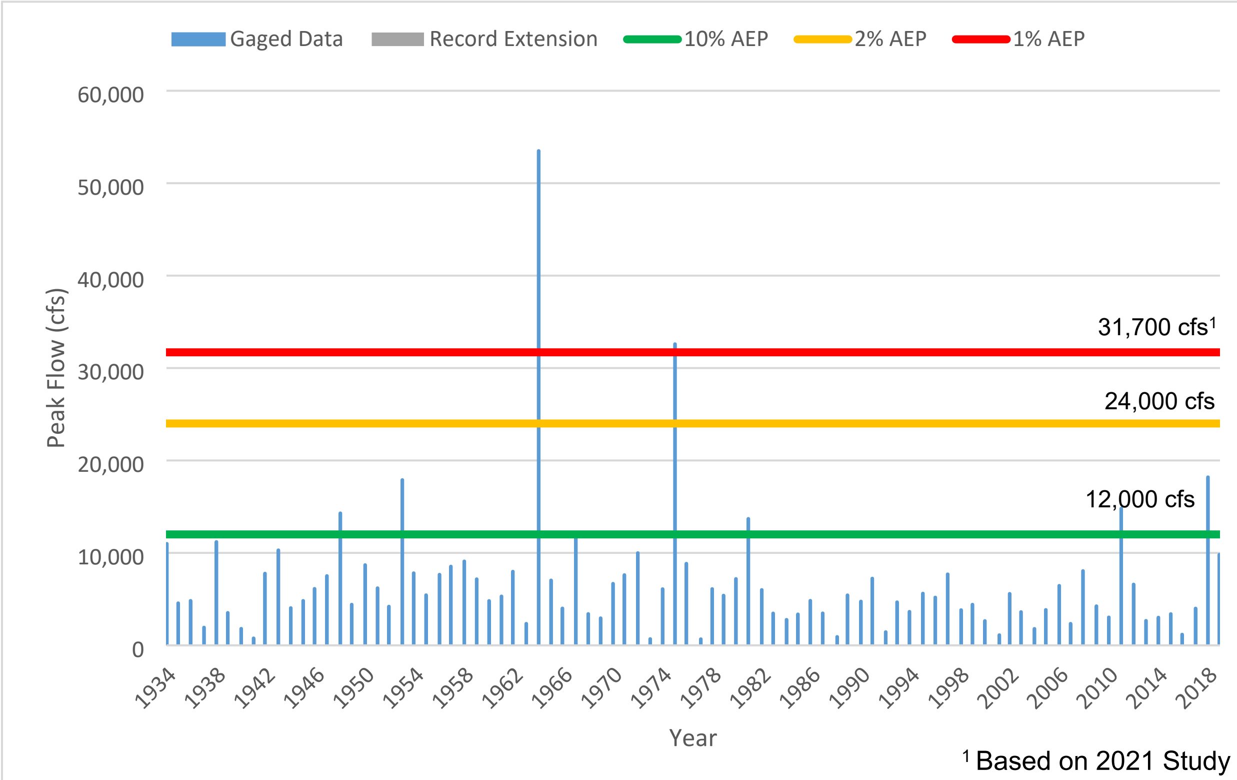


Figure 23. USGS 06079000 South Fork Sun River near Augusta

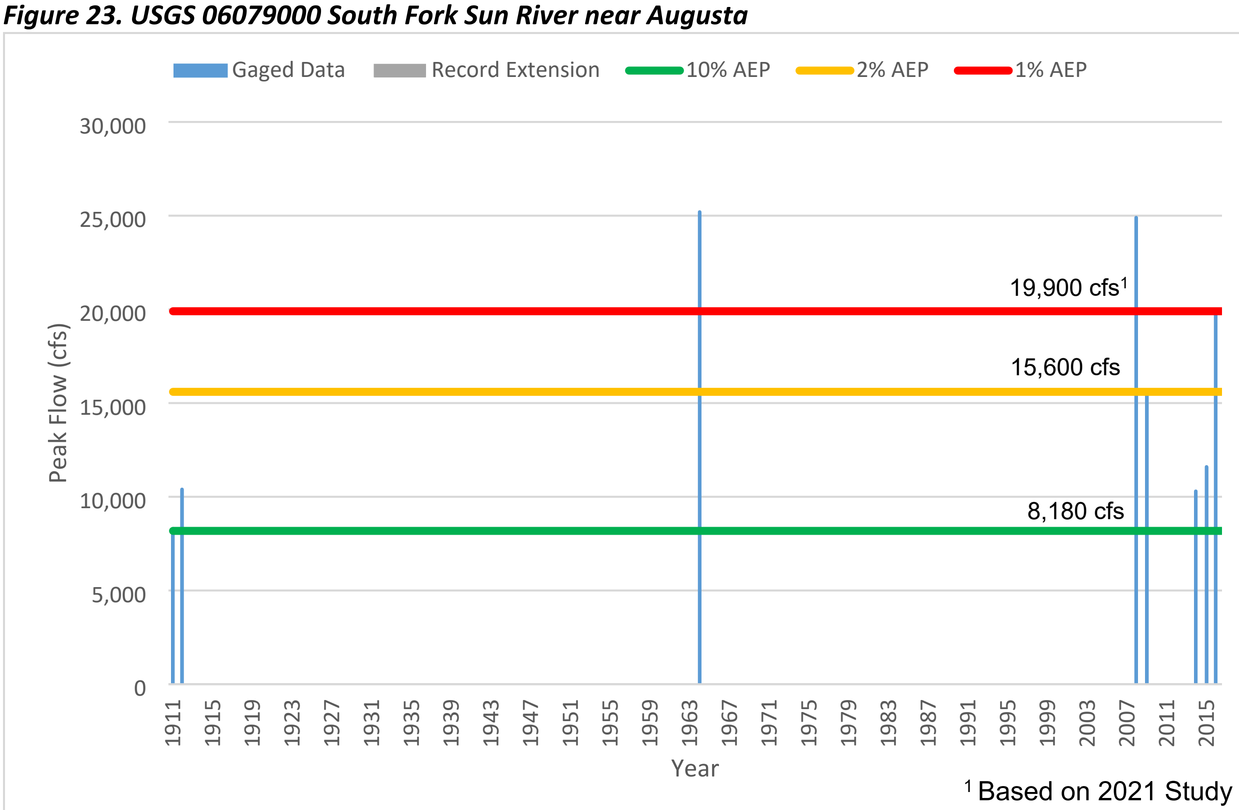


Figure 24. USGS 06078500 North Fork Sun River near Augusta

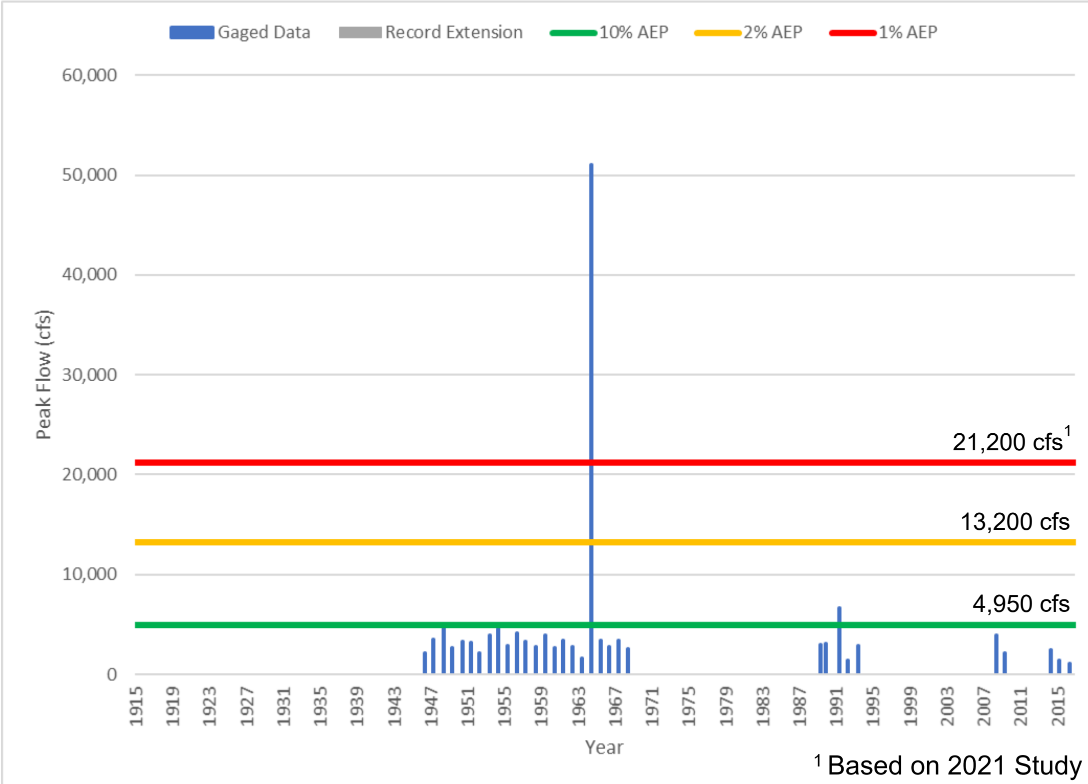


Figure 25. USGS 06087900 Muddy Creek Tributary near Power

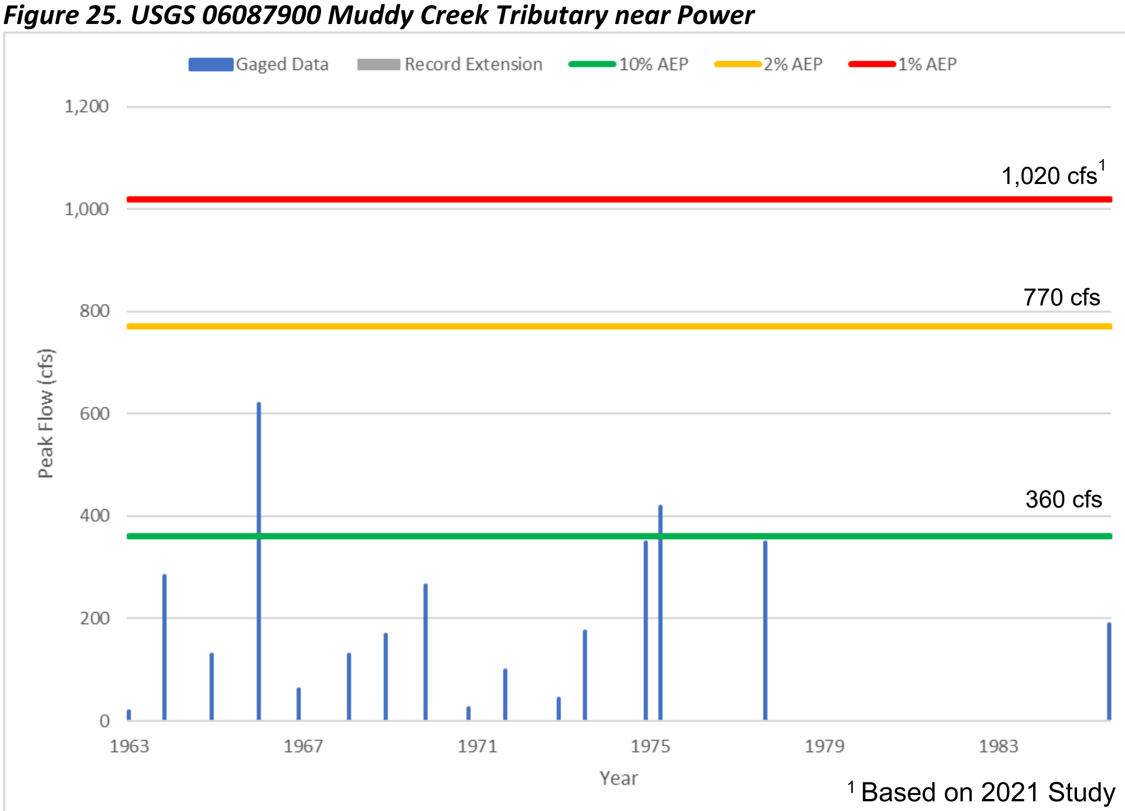


Figure 26. USGS 06106500 Muddy Creek near Bynum

Figure 27. USGS 06105800 Bruce Coulee tributary near Choteau, Montana

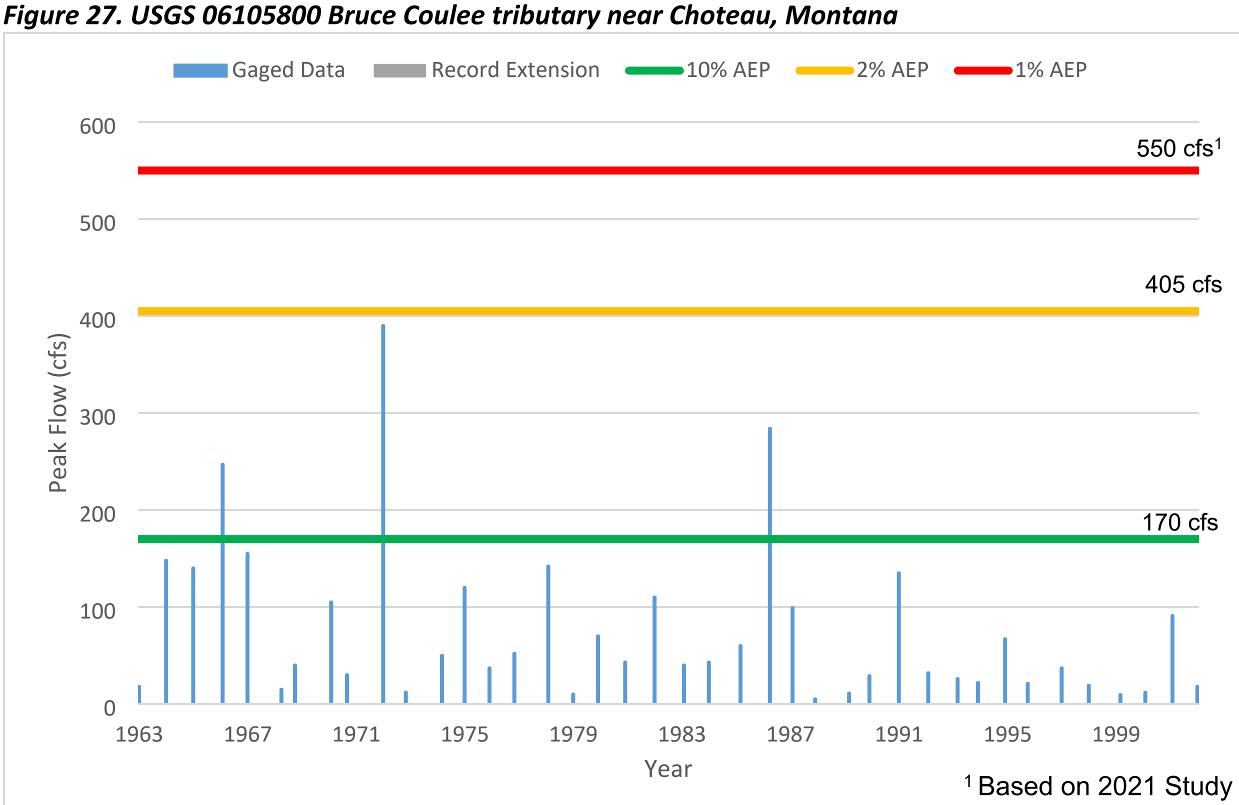


Figure 28. USGS 06079600 Beaver Creek at Gibson Dam near Augusta

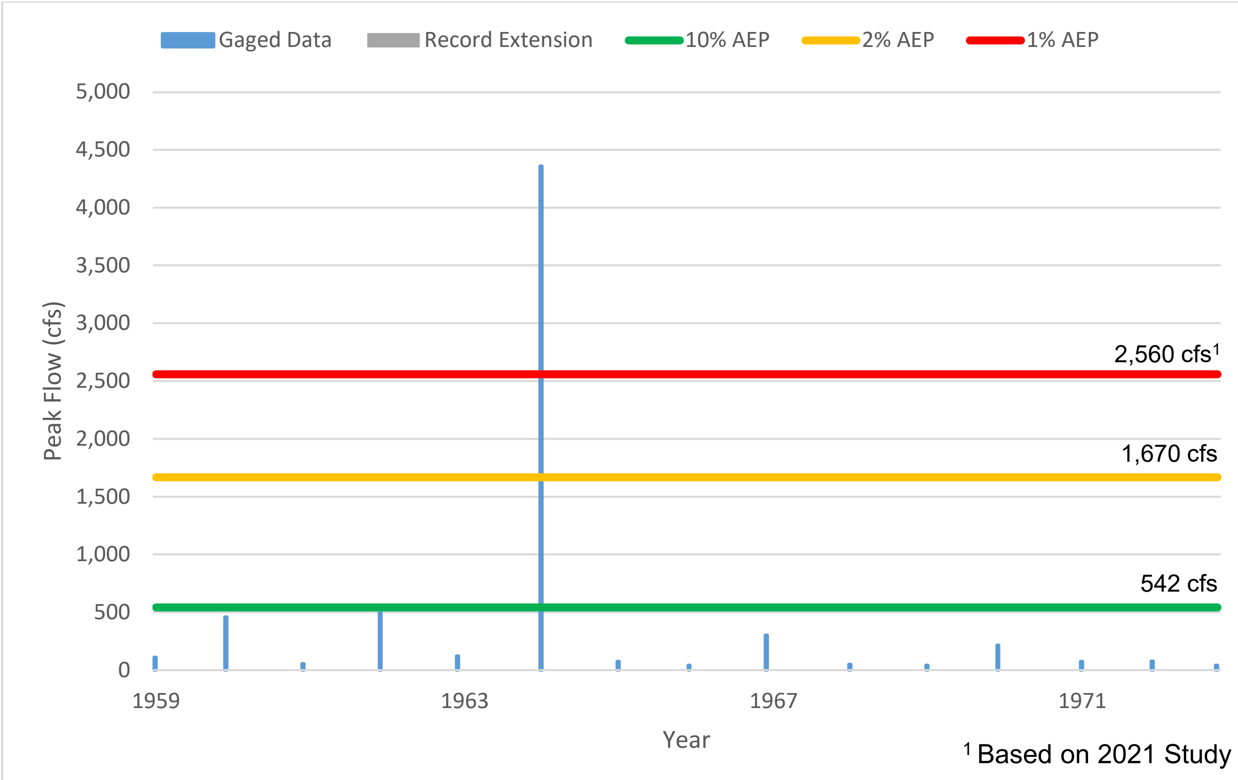


Figure 29. USGS 06102500 Teton River below South Fork, near Choteau

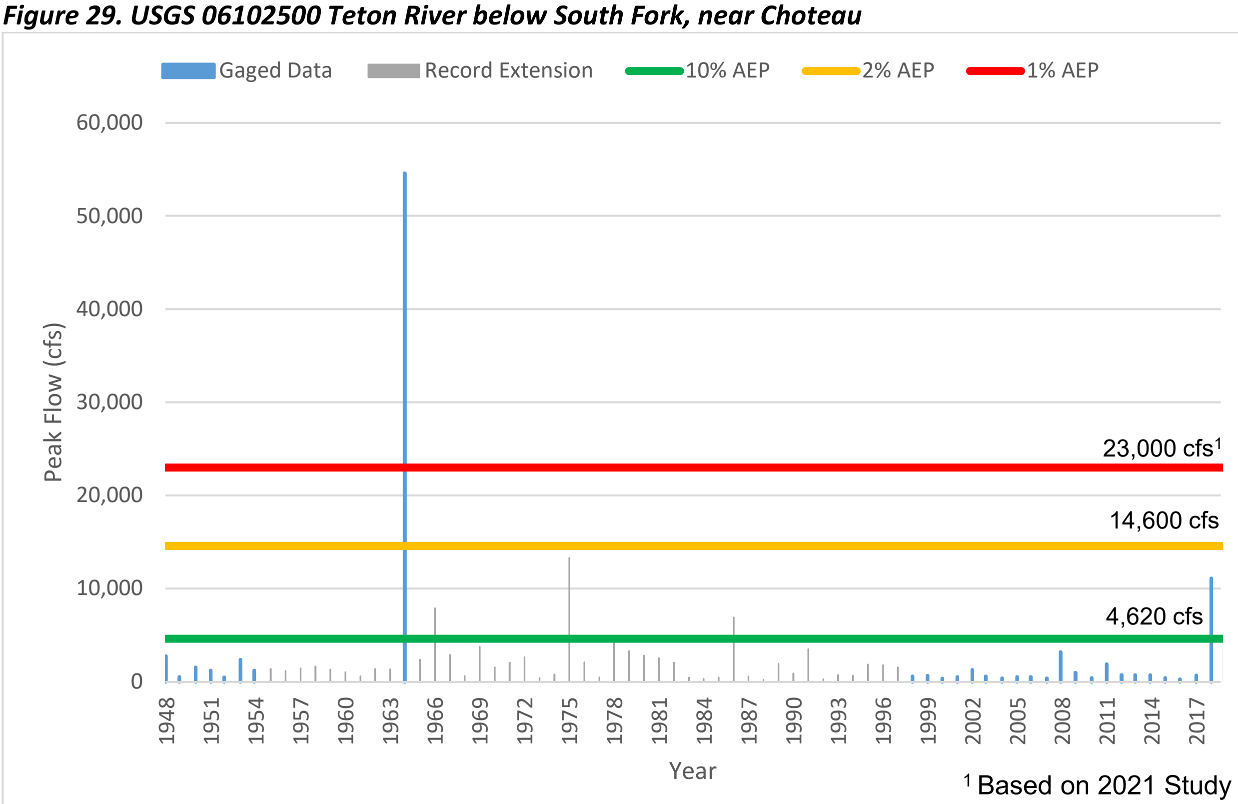


Figure 30. USGS 06103000 Teton River at Strabane

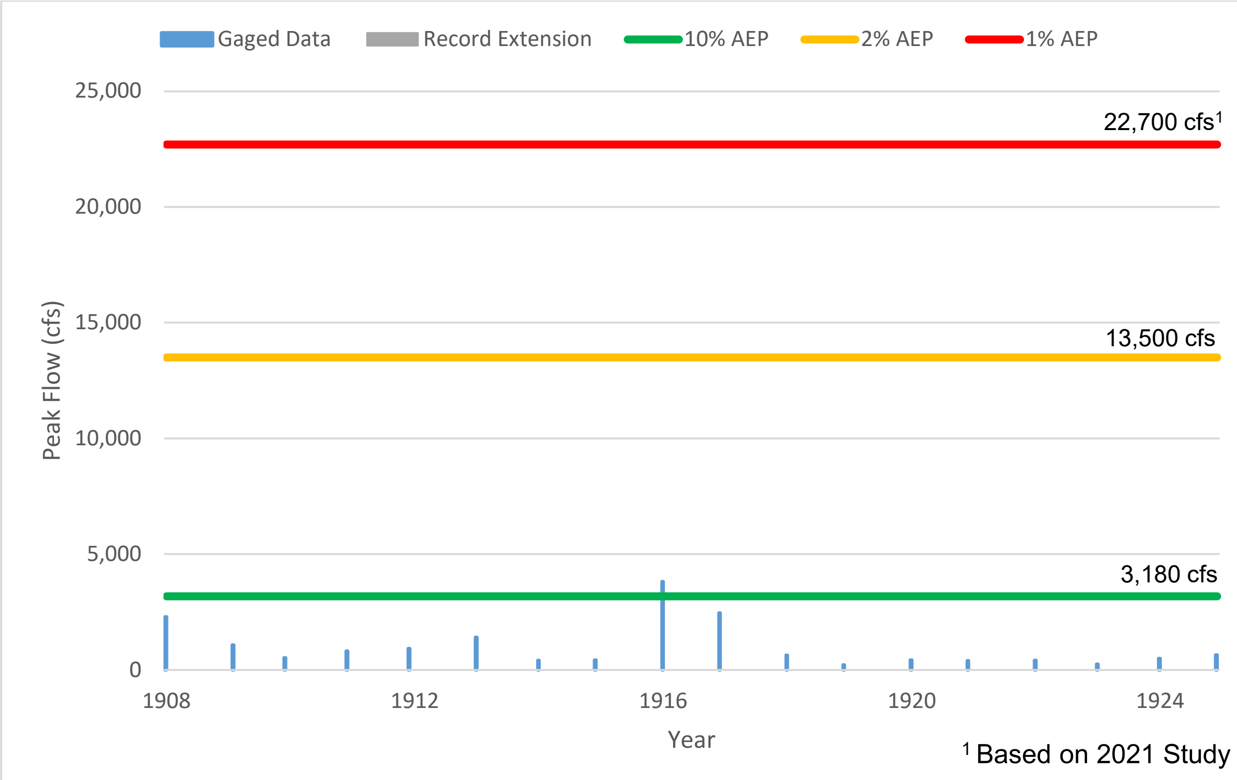


Figure 31. USGS 06108000 Teton River near Dutton

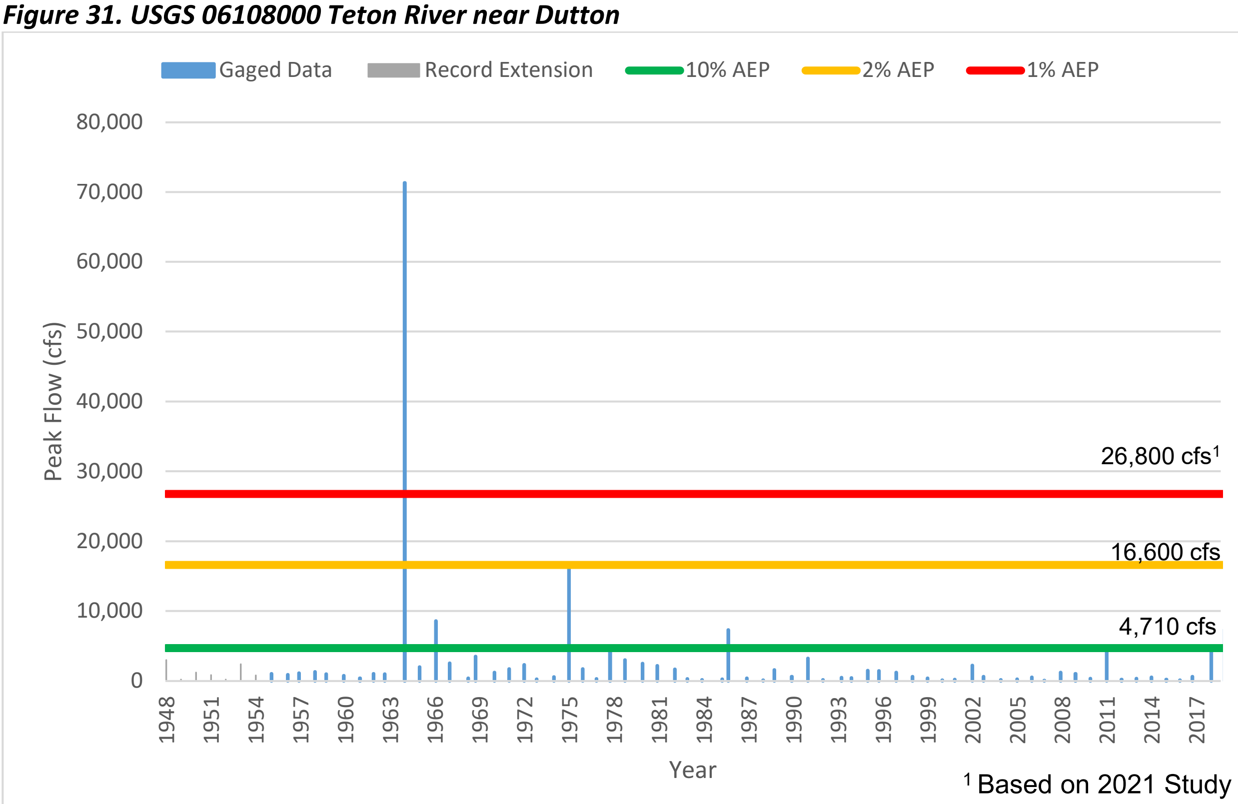


Figure 32. USGS 06108800 Teton River at Loma

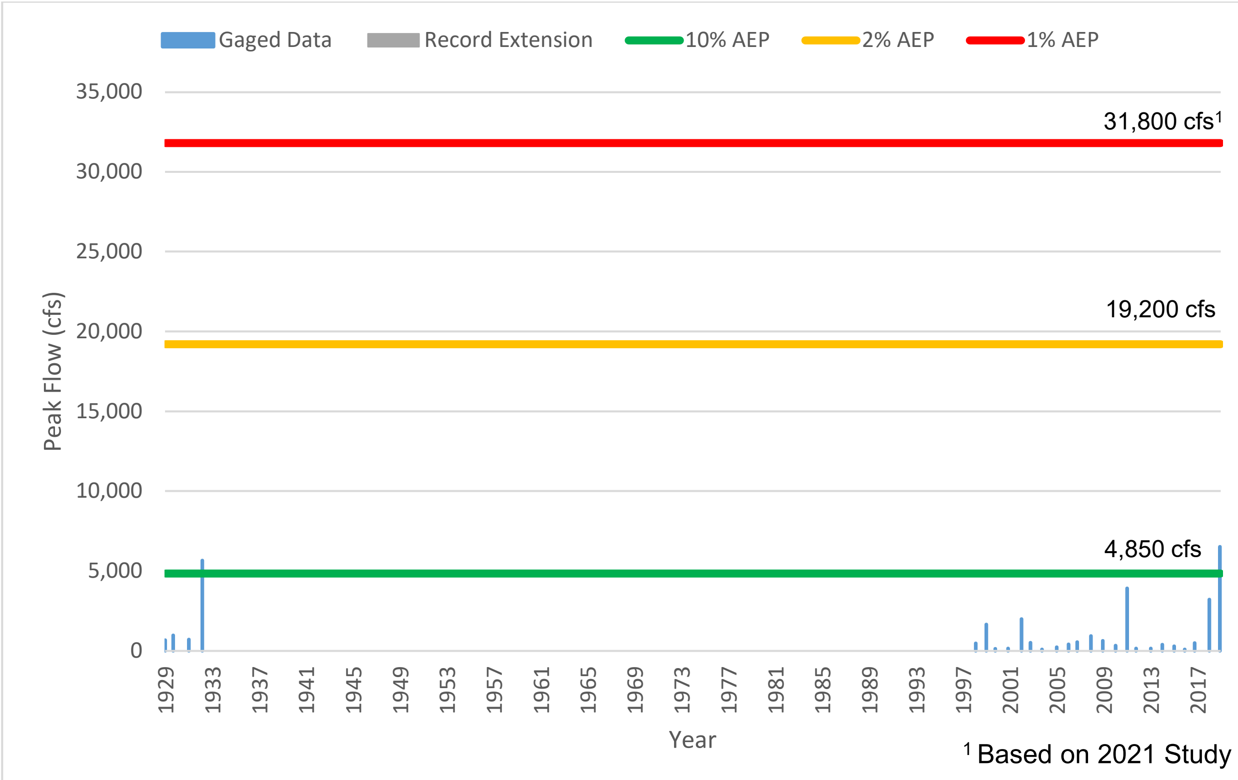


Figure 33. USGS 06106000 Deep Creek near Choteau

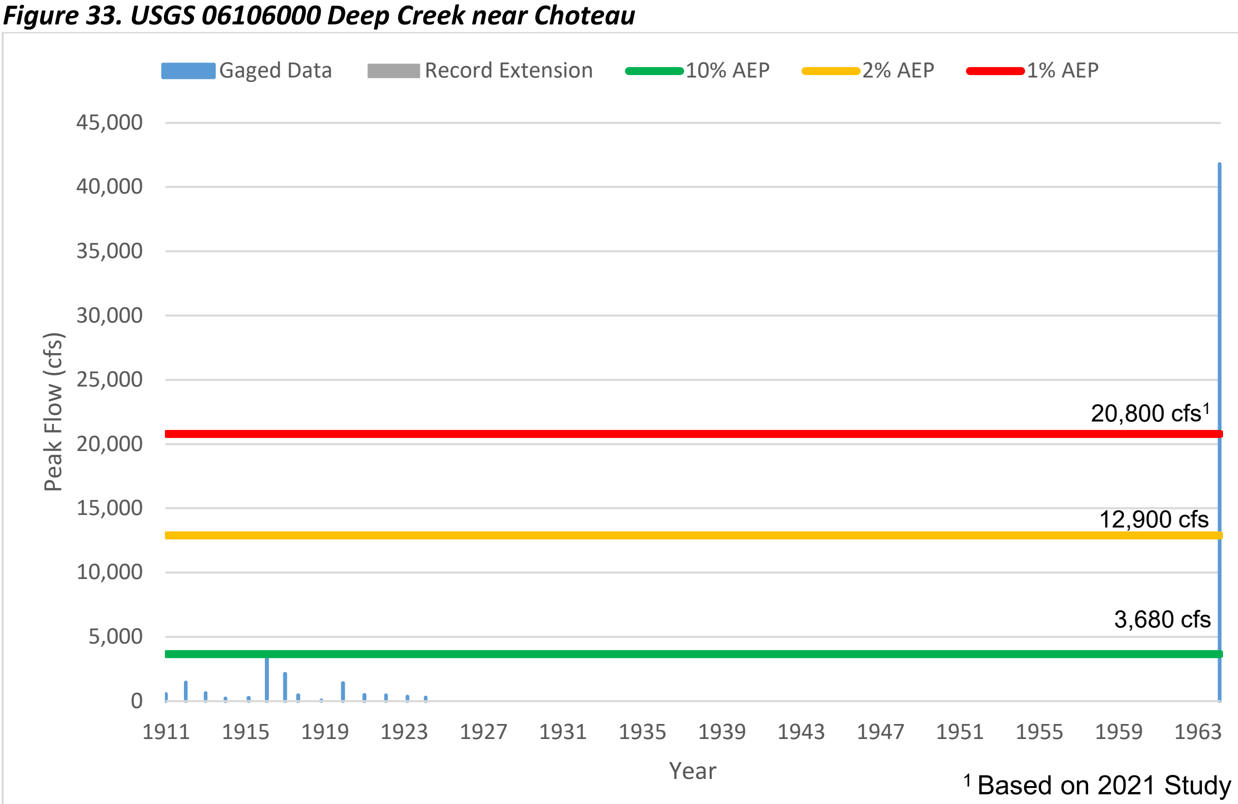


Figure 34. USGS 06108200 Kinley Coulee near Dutton

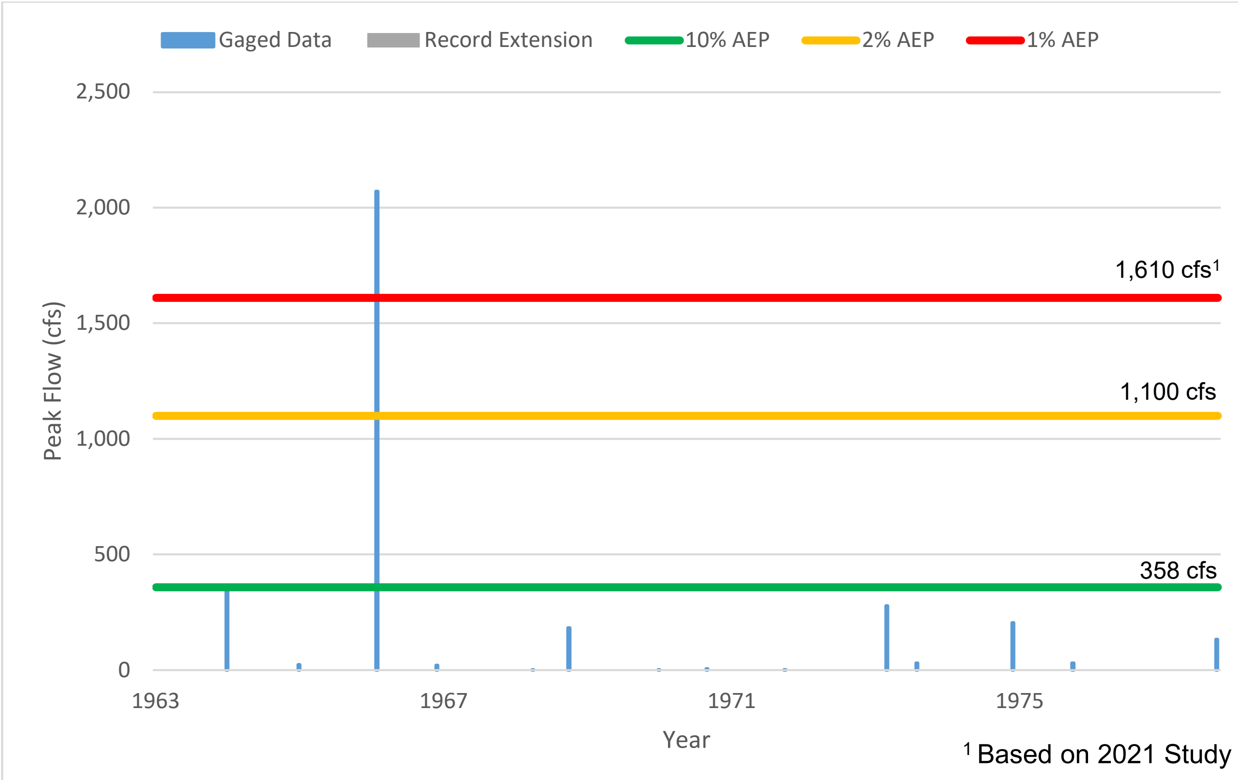


Figure 35. 06108300 Kinley Coulee tributary near Dutton

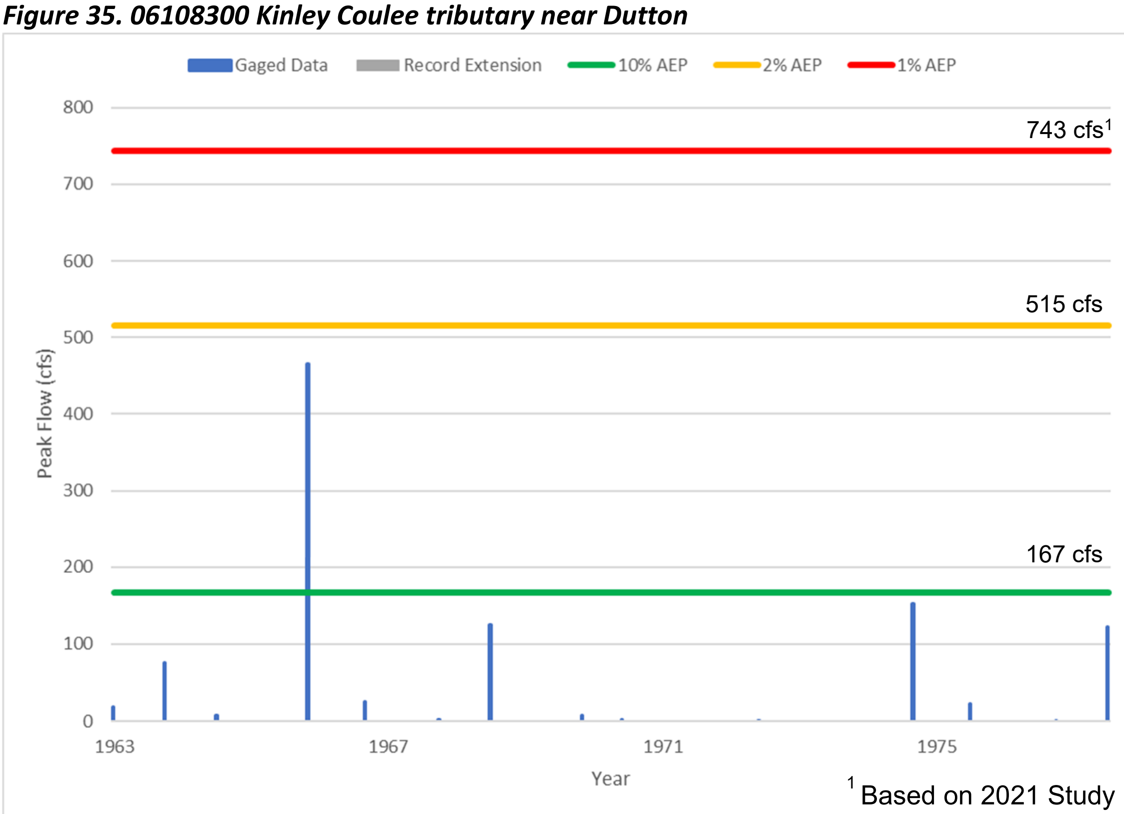
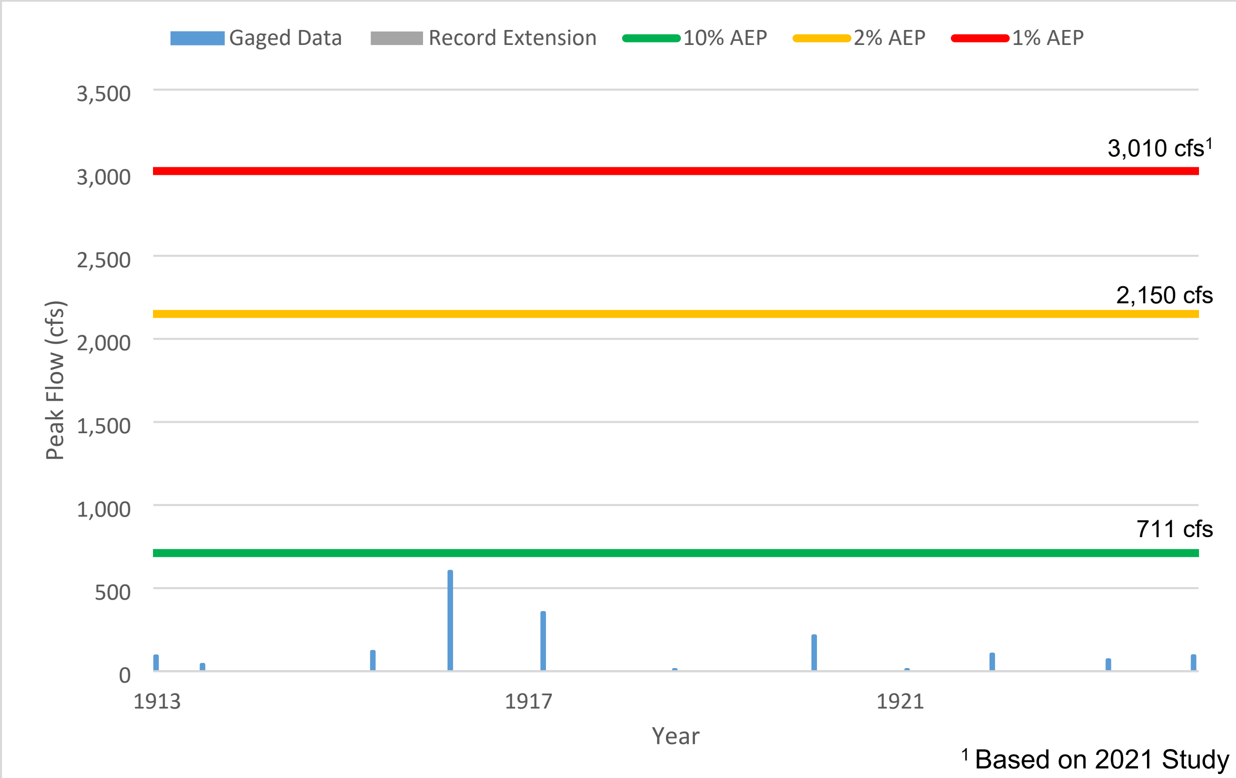


Figure 36. 06107000 North Fork Muddy Creek near Bynum



2.3.3. Teton County Flooding Sources

The flooding sources analyzed in this study include Sun River, Teton River, Muddy Creek, Deep Creek, and associated tributaries to those larger flooding sources. Although these flooding sources share many similarities, there is some variability in size, orientation, soil composition, land use and elevation as the tributaries flow out of the Mountainous Rocky Mountain Front and into the Foothills and Plains of Central Montana. While the predominant flood drivers for the contributing basins may not be strictly coincidental with those on the four larger flooding sources (Sun River, Teton River, Muddy Creek, and Deep Creek), a review of gaging data indicates that peak flows for all gage sites tend to occur in the May to June window, principally a function of snowmelt or rain-on-snow events. There is very little flow data available for the smaller tributaries that drain foothill regions in the county, but the limited data and anecdotal information suggest that these smaller foothills watersheds may be more susceptible to peak flow events that occur from more intense rainfall events arising from summertime thunderstorm events. The tributaries located further west (higher up in the watershed) in the system are more prone to flooding due to spring snowmelt, while the tributaries in the eastern portion of the system can experience floods due to thunderstorm bursts and heavy summer rains.

For example, the Bruce Coulee near Choteau (a foothills tributary to Deep Creek), has 20 of its 40 peak flow events occur outside the May-June window, with 15 of the flow events outside the May-June window occur in July, August, and September. Similarly, a foothills tributary to Muddy Creek near Power has 16 peak flow records for the gaged site and 8 of the 16 peak flow events occur outside the May – June window. In contrast with these two tributaries, only 4 of the 86 peak flow records for the Sun River near Vaughn occur outside the May – June window (the remaining 4 peaks occurred in July).

3. Previous Studies

Hydrologic analyses for the flooding sources in Teton County are limited and primarily focused on USGS gage data on the larger rivers and creeks within the county.

The various sources of information are tied to previous FEMA flood insurance studies and data compiled by the USGS for stream gages within the watershed. A summary of the existing studies and documents are provided in the following sections.

3.1. Flood Insurance Studies

3.1.1. Teton County

An original Flood Insurance Study (FIS) for Teton County, Montana (Unincorporated Areas) was published effective by FEMA on January 18, 1983 (FEMA 1983a).

The 1983 FIS was based on existing and new hydrologic and hydraulic analyses performed on the Teton River and Spring Creek at Choteau to provide results using detailed study methods at Choteau. Information for the Sun River was derived from the Cascade County FIS and was produced using limited detailed study methods. Other mapped areas within the county were performed using approximate methods.

Summaries of discharge are reported at three locations on the Teton River (above Choteau, MT, at US Highway 287, and downstream of Deep Creek), Spring Creek (at Choteau), and on the Sun River (at Simms, MT). Flows for the Teton River in the Choteau area were determined by performing a regional analysis of 10 gaging stations within the area and drainage area vs. discharge plots were developed to provide a relationship that was used to determine the flood frequency values for the Teton River around Choteau.

Spring Creek at Choteau is complicated in that there are no stream gages on Spring Creek, and that during higher flows, the Teton River spills into Spring Creek. Two separate analyses were performed for the FIS at Spring Creek at Choteau. The first method applied a modified regional analysis similar to the Teton River used multipliers representing variability from the mean value for each recurrence interval flood. The second method utilized rainfall-runoff analysis of the Spring Creek basin. The results of the two analyses compared favorably and the modified regional analysis results were utilized in the FIS.

Flow information for the Sun River was taken from the Cascade County FIS, where discharges at Simms were determined using Log Pearson type III analyses of gage data at Augusta, MT (below Gibson Dam).

3.1.2. City of Choteau

Original Flood Insurance Studies (FIS's) for City of Choteau, Montana (Teton County) was published effective by FEMA on October 3, 1983 (FEMA 1983b). Summaries of discharge are reported at two locations on the Teton River near Choteau (above Choteau, MT, and at US Highway 287. The US Highway 287 site represents a reduction in Teton River flows due to flows spilling into Spring Creek. Summaries of discharge report one location on Spring Creek (at Choteau). The description of hydrologic methods provided in the City of Choteau FIS is exactly the same as reported in the Teton County (Unincorporated Areas) FIS as described in **Section 3.1.1** above.

4. Hydrologic Analyses and Results

Hydrologic analyses were performed to identify the peak flow discharge estimates for flood events corresponding to the 10%, 4%, 2%, 1%, 0.2%, and 1% 'plus' annual exceedance probability (AEP) at specific locations on gaged and ungaged flooding sources in Teton County, MT. The select tributaries are those that will be studied as part of the Teton Countywide Modernization Risk MAP Study. Peak flow discharge estimates were performed by USGS for select stream gages within Teton County watersheds using Bulletin 17C methodology. For ungaged sites, the peak flow discharge estimates were determined using regional regression equations published by USGS (Sando, et al., 2018b). The locations for these calculations establish or define flow change locations along the studied flooding sources and generally correspond to the junction of significant drainages or where intermediate flow changes are required due to significant changes in contributing drainage area between confluences. The analyses conducted to identify hydrologic characteristics at these locations were performed using a regional regression equation approach to determine peak flows or applying gaged data to an ungaged location - either a drainage-area ratio adjustment or logarithmic interpolation between gages (USGS SIR 2015-5109-F (Sando, et al., 2018a)).

As previously described, the primary flooding sources included in this study are within the Teton River and Sun River watersheds in Teton County, MT. This study, provides peak flow hydrologic characteristics for approximately 430 miles of flooding sources in Teton County. Bulletin 17C peak flow discharge analyses were performed on select gaged sites as described in **Section 4.1**. Peak flow hydrologic characteristics for ungaged enhanced study reaches were analyzed using regional regression analysis, described in **Section 4.2.1**, and study reaches with gage data applied the gaged data to ungaged locations as described in **Sections 4.2.2 and 4.2.3**.

Bulletin 17C flood-frequency peak discharge analyses were deemed to be the most appropriate analyses for gaged sites, as they utilized actual flow data for that reach and for many sites record extension methodologies (MOVE.3) were able to be used to extend gage locations with relatively shorter periods of gage data to improve the representation of peak flows at the gage site. When possible, the Bulletin 17C flood frequency results were further improved by weighting the flood-frequency analyses with regional regression data. Weighting was generally applied if the gage site was unregulated and assessments of the gaged peak flow data were in agreement with the peak flow data used to generate the regional regression equations.

For gaged streams containing one or more stream gages, the USGS Bulletin 17C flood-frequency analyses were coupled with methodologies to extrapolate or interpolate the gaged data to ungaged locations within the study reach using methodologies based on drainage-area ratios.

Regional regression analysis was selected as the best methodology to determine peak flows for flooding sources without stream gages due to the relative accuracy and practical feasibility for the ungaged tributaries within the County.

All the methods described above rely on a delineation of the upstream contributing drainage area to each flow change node. Basin delineation, characteristics, and peak flow estimation are all available through the StreamStats web application (McCarthy, et al. 2016). Given the reliance of the equations on these delineations and the low resolution of the StreamStats elevation source (30-meters), the delineation results were checked and corrected using manual delineation based on engineering judgement and use of a high-resolution digital elevation model (DEM), derived from LiDAR collected at a 3ft resolution. If the StreamStats delineations were inconsistent with the more accurate high-resolution elevation data the StreamStats delineation was replaced by the revised sub-basin. Approximately 231 flow node locations were identified that required revisions to the StreamStats results.

4.1. USGS Stream Gage Analyses

Under an agreement with Montana DNRC, the USGS performed a peak-flow frequency analysis for select gages in or near Teton County, MT. This analysis included gages throughout the watershed and has been published as a USGS data release (Siefken, et al. 2021). The gage analyses performed by USGS utilized methods described in a methods document prepared by USGS (Sando and McCarthy, 2018a), and included at-station methodologies described in Bulletin 17C, the mixed-station record extension methodology Mixed-Station Maintenance of Variance Type 3 (MOVE.3), and regional regression equation weighting of at-station flood frequency analysis results. In general, gage stations were analyzed using the mixed-station record extension methodology Mixed-Station Maintenance of Variance Type 3 (MOVE.3) (those with short records, affected by flow regulation, or with large drainage areas (typically larger than 2,750 mi^2)). Details of how USGS applied the MOVE.3 analysis to synthesize peak flow data are provided in detail in Chapter D of Montana StreamStats (Sando, et al. 2018a) and summarized below. The MOVE.3 methodology is based on correlation of concurrent peak-flow records for the target station (station with incomplete flow records) with one or more index stations (stations with peak flow records for one or more of the missing years of the target station). The procedure evaluates the strength of the relationship between peak discharges at target and index stations for the same year and adjusts the peaks for the index stations to fit the characteristics of the target station for the missing year data. Documentation regarding the application of the mixed-station MOVE.3 procedure is provided in the USGS data release (McCarthy, et al. 2016). For gaging stations where the MOVE.3 record extension was not appropriate, the sites were evaluated to determine if weighting the at-station results with regional regression equations developed by USGS would be appropriate to better represent the peak-flow flood frequency results at those sites. **Appendix A** provides the results of the USGS flood frequency analyses and indicates those sites that had MOVE.3 record extension included in the analyses and those sites where the at-station results had regional regression weighting applied. **Figures 37 and 38** indicate how flows change along the Sun River and Teton River based on drainage area within those watersheds.

Figure 37. Annual Exceedance Probabilities for Sun River flow gages evaluated by this study

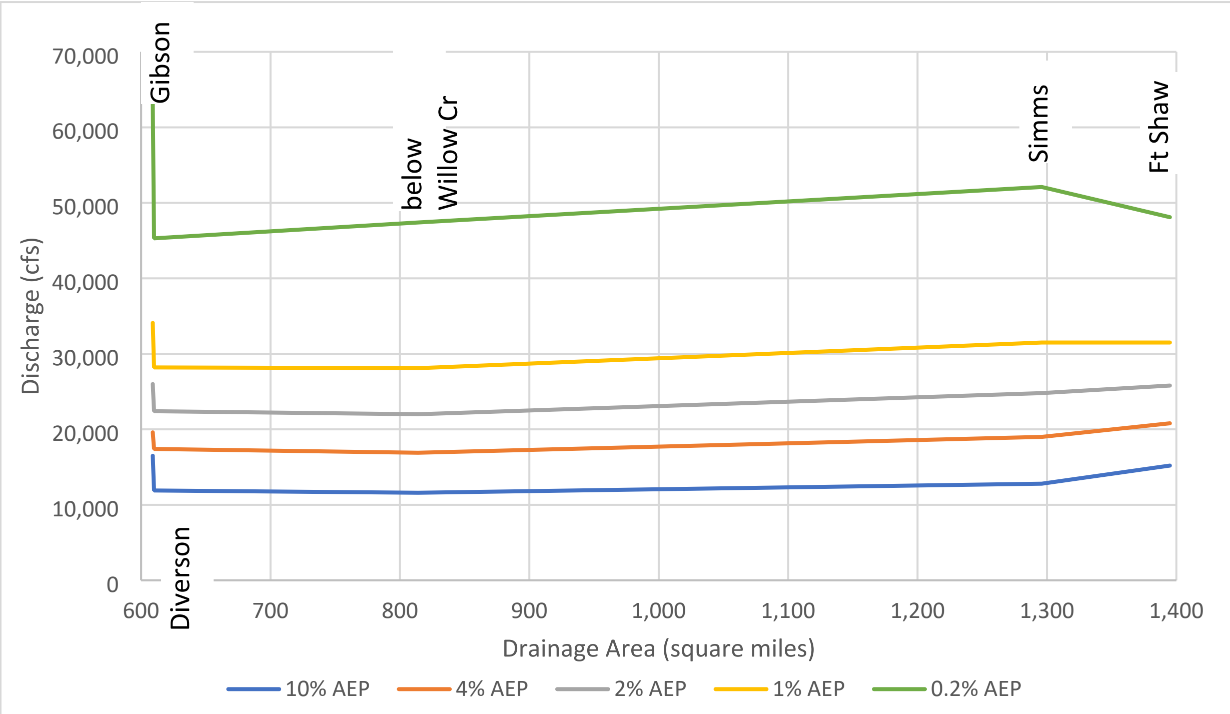
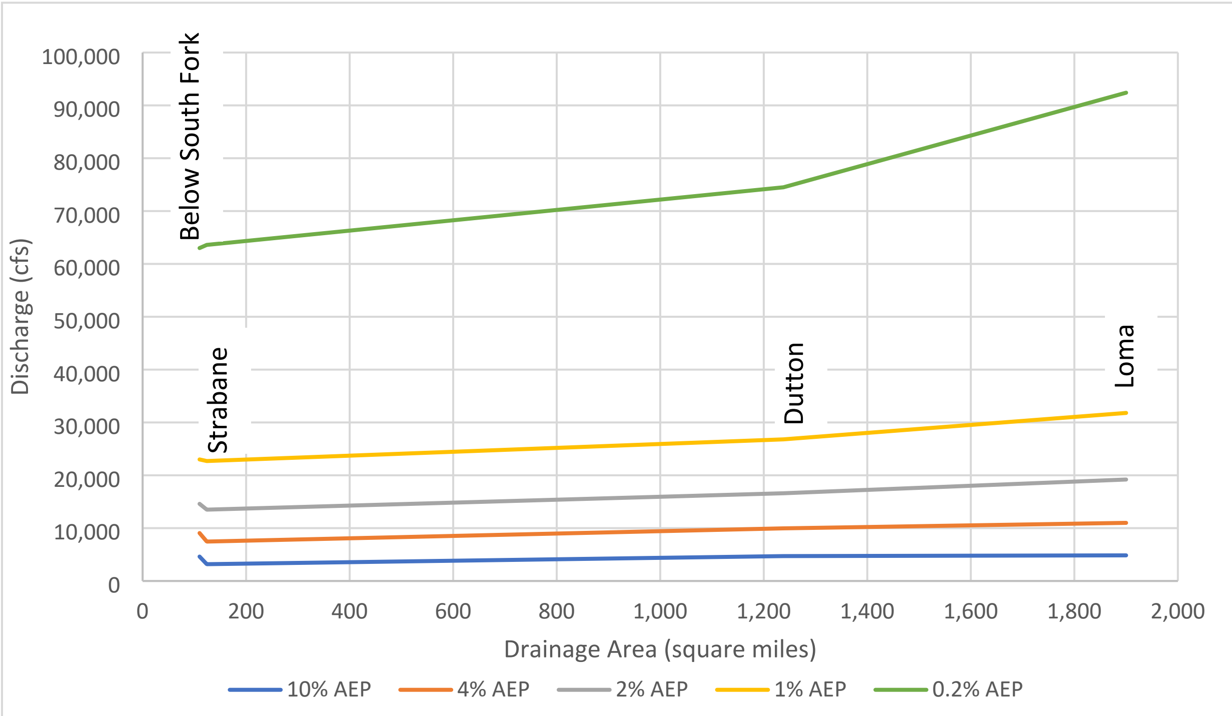


Figure 38. Annual Exceedance Probabilities for Teton River flow gages evaluated by this study



4.1.1. 1%+ Peak Flow Estimates - Gaged Peak-Flow Frequency Analyses

FEMA flood risk products employ a method for determining peak discharge estimates for a standard error of prediction above the 1% AEP, known as the 1% Plus discharge. The purpose of the 1% plus analysis is to represent uncertainty within the hydrologic evaluation and potential underestimations in the resulting modeled flood elevations by using the upper confidence limits (84%) of the 1% AEP flood to compute higher flood discharge (FEMA 2012). Baker staff reviewed supplemental information provided by USGS (Siefken, et al., 2021) and incorporated the 1% plus results for the stream gages included in the USGS peak-flow flood frequency analyses.

4.1.2. Flow Change Node Locations

Flow change nodes typically fall into three types of placements throughout the study area. They were placed at the upstream extent of the enhanced study reach and at the downstream confluence of the study reach. In between the upper and lower extents, they occur when a significant tributary enters the study reach and created a significant increase in contributing drainage area or otherwise influenced contributing watershed conditions such that a relatively large change in flows could be expected. HUC-12 watershed boundaries were utilized as a tool to evaluate potential locations where a flow change location might be warranted, but not all flow changes occurred at HUC-12 boundaries and not all HUC-12 boundaries resulted in a flow change location. The flow change nodes were spaced such that each node provides a smooth flow transition from the adjacent upstream node.

4.2. Flood Frequency Estimates at Ungaged Sites

As previously described, a review of available peak-flow discharge data from gaging stations within Teton County and tributaries determined that refinement of hydrologic conditions along the study reach is required to properly represent changes in contributing drainage area and watershed characteristics along the study reach. For ungaged reaches, regional regression analyses were applied to the study reaches, and in many instances, multiple flow nodes were established along the study reach to better represent the changes in contributing drainage area and watershed conditions along the study reaches, so unreasonably large peak-flow values were not improperly applied to portions of the study reaches with significantly less contributing drainage areas. **Section 4.2.1** describes how regional regression equations were applied to ungaged study reaches.

There are 20 stream gages within the Teton County study area that the USGS performed peak-flow flood-frequency analyses on to determine the peak flow characteristics at those gage locations. However, these represent a relatively low density of the 430 mile study area, where a number of significant tributaries and large changes in contributing drainage area occur between the gage sites. As a result, an assessment was performed of the gaged peak-flow discharge results at the gaged locations, and intermediate flow change locations were identified where more gradual changes in peak-flow discharge values can be reasonably expected to occur between gage sites. Generally, these flow change locations were placed to corresponded to junctions of significant tributaries that were known or expected to result in significant changes to flow values. HUC-12 watersheds were used as a tool to screen these locations, but not every HUC-12 watershed necessitated a flow change location, nor was every flow change location located at a HUC-12 boundary. In many instances, flow change locations where located in the immediate vicinity (upstream, downstream, or both) of a community along the flooding source to best represent flow conditions through the community. A total of 231 flow change locations were placed within study area. When a flow change location was located between two stream gages, the two-site logarithmic interpolation method (**Section 4.2.2**) was utilized to determine the peak-flow discharge conditions at the ungaged site.

On gaged flooding sources with only one USGS stream gage or other locations above the uppermost stream gage or below the lowermost stream gage, the peak-flow discharge characteristics at ungaged flow node locations were determined by translating the gaged data to ungaged locations using drainage-area ratio adjustment (extrapolation). Six flow change locations on three gaged sites were identified and studied using this method.

4.2.1. Regional Regression Equations

The regional regression equation approach, developed by the U.S. Geological Survey (USGS) in cooperation with the Montana Department of Natural Resources and Conservation, was applied to the node locations to estimate peak-flow magnitudes associated with the 10, 4, 2, 1, and 0.2 percent annual exceedance probabilities. The methodology in this study relied on 537 gaging stations throughout the state of Montana that had a period of at least 10 years of systematic record, drainage area under 2,750 mi^2 and were unaffected by major regulation. Screening criteria also limited gages to those that were representative of peak-flow frequencies and included a redundant gaging-station analysis to account for spatial autocorrelation. An ordinary least squares regression was used in the study to adjust the boundaries between eight predetermined hydrologic regions. Final regression equations were developed for each hydrologic region using either generalized least squares regression or weighted least squares regression. The detailed methodology of regional regression analysis is described in Chapter F of Montana StreamStats (Sando, et al. 2018a).

The watersheds studied in Teton County span two of the eight hydrologic regions in Montana (**Figure 39**), Northwest and Northwest Foothills regions. The mean standard error of prediction (SEP) for the 1% AEP discharges calculated by this method ranges from 13.6 percent in the Northwest region, to 65.8 percent in the Northwest Foothills region. For the nodes where the basin delineation in StreamStats was accepted, peak flow estimates are retrieved directly from the web application. Calculating flows for the nodes that were replaced required obtaining the explanatory variables using the high-resolution spatial delineations. Contributing drainage area to each node is the one common explanatory variable in flow calculation across all regions with the other basin characteristics varying by region. The process of calculating other explanatory variables is outlined in **Section 4.1.2**.

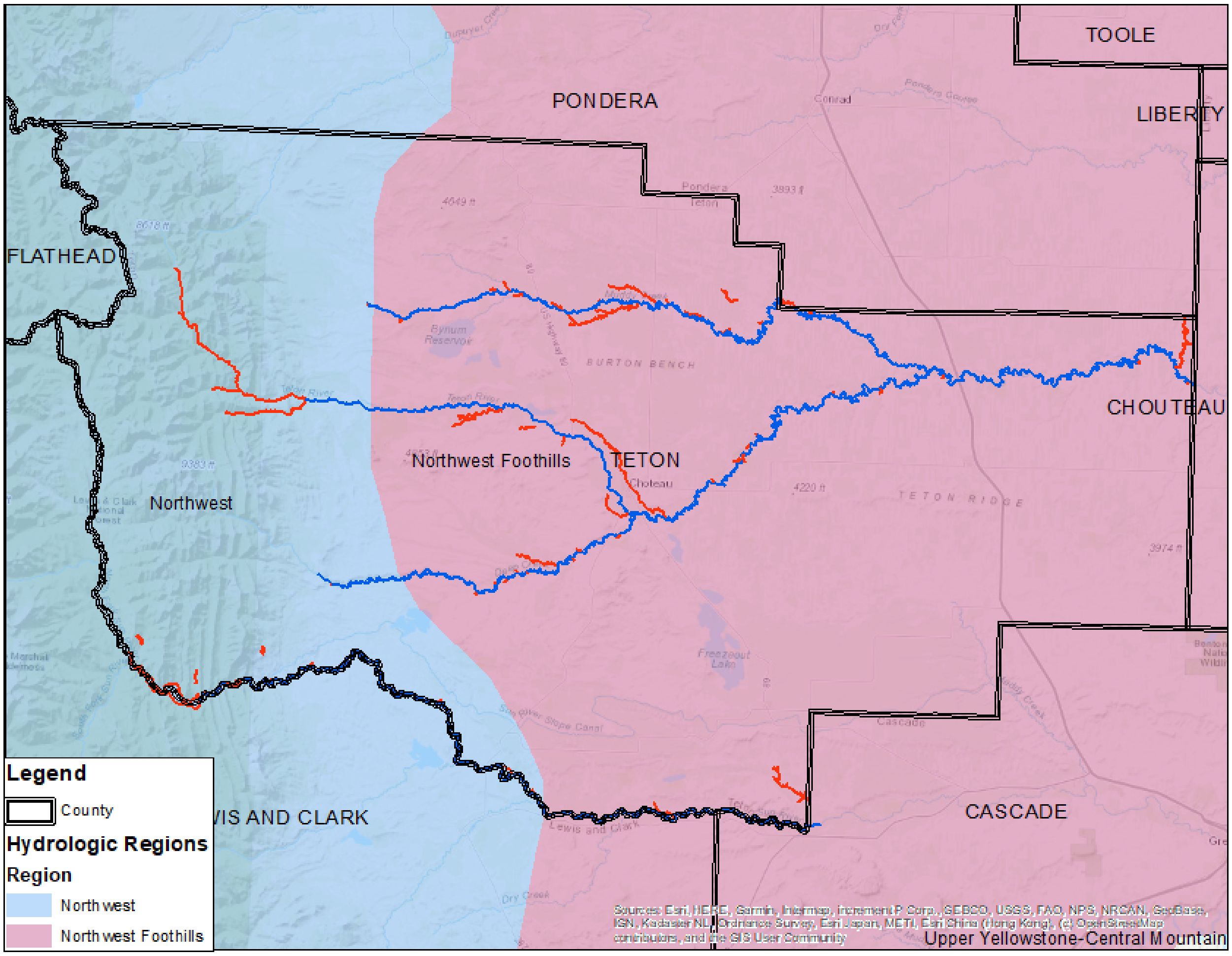


Figure 39: Montana Hydrologic Regions

In addition to the contributing drainage area, calculated as a feature of the basin polygons, the Northwest Foothills hydrologic region utilizes mean annual precipitation (P (in inches)) for flow calculations in the study area. These variable values were taken from corresponding StreamStats basin results.

When the contributing drainage area included two hydrologic regions, an area weighted percentage was applied based on the percentage of the watershed that is located in each watershed.

The regression equations vary for each of the five estimated recurrence intervals, with a consistent set of explanatory variables maintained within each hydrologic region outlined in **Table 3** (Sando, et al. 2018b). These equations were used to calculate the peak flow for all AEPs at all flow nodes on ungaged study reaches.

Table 3: Regression equations for estimating peak-flow at ungaged sites

REGRESSION EQUATIONS FOR ESTIMATING PEAK-FLOW AT UNGAGED SITES						
Regression equation for indicated Q_{AEP}	Number of streamflow-gaging stations $(n)^1$	σ_δ^2 (log units)	*MVP* (log units)	*SEP* (%)	*SEM* (%)	Pseudo or adjusted R^2 (%)
Northwest hydrologic region[2]						
$Q_{10} = 69.8\ A^{0.808}$	32	0.019	0.021	34.4	32.5	88.4
$Q_4 = 132\ A^{0.771}$	32	0.000	0.002	9.11	0.00	89.4
$Q_2 = 223\ A^{0.732}$	32	0.000	0.002	11.3	0.00	88.0
$Q_1 = 371\ A^{0.695}$	32	0.000	0.004	13.6	0.00	84.4
$Q_{0.2} = 1{,}171\ A^{0.614}$	32	0.000	0.007	19.3	0.00	67.0
Northwest Foothills hydrologic region[2]						
$Q_{10} = 0.916\ A^{0.433}\ P^{1.83}$	31	0.042	0.052	56.4	50.2	88.5
$Q_4 = 3.24\ A^{0.451}\ P^{1.57}$	31	0.039	0.050	55.2	48.1	88.7
$Q_2 = 7.60\ A^{0.469}\ P^{1.38}$	31	0.044	0.056	59.1	51.0	87.5
$Q_1 = 16.3\ A^{0.487}\ P^{1.20}$	31	0.053	0.068	65.8	56.7	85.4
$Q_{0.2} = 76.6\ A^{0.530} P^{0.844}$	31	0.088	0.111	89.5	76.9	78.5

[Q_{AEP}, peak-flow magnitude, in cubic feet per second, for annual exceedance probability (AEP) in percent; n, number of streamflow-gaging stations used in developing regression equations for indicated hydrologic region; σ_δ^2, model error variance; MVP, mean variance of prediction; SEP, mean standard error of prediction; SEM, mean standard error of model; Pseudo R^2, pseudo coefficient of determination presented for generalized least squares regression analysis; Adjusted R^2, adjusted coefficient of determination presented for weighted least squares regression analysis; A, contributing drainage area, in square miles; P, mean annual precipitation, in inches; E_{5000}, percentage of basin above 5,000 feet elevation; SLP_{30}, percentage of basin with slope greater than 30 percent; ET_{SPR}, Mean spring (March–June) evapotranspiration, in inches per month]

[1]The number of streamflow-gaging stations used in the $Q_{66.7}$ regression equation for a region might differ from the number of streamflow-gaging stations used in all other regression equations in that region because of streamflow-gaging stations with unreported $Q_{66.7}$ values (table 1–2; Sando et al. 2018b), which is discussed further in Sando et al., 2018b.

[2]Regression equations were developed using generalized least squares regression analyses.

4.2.1.1 1%+ Peak Flow Estimates - Regional Regression Equations

In addition to the recurrence intervals described in **Section 4.2.1**, FEMA flood risk products employ a method for determining peak discharge estimates for a standard error of prediction above the 1% AEP, known as the 1% plus discharge. This 1% plus discharge was calculated by adding the associated mean Standard Error of Prediction (SEP) to the 1% discharge. This calculation was made for regional regression equations at nodes delineated by both methods, as the 1% plus discharge is not returned by the StreamStats web application (Sando et al., 2018c).

4.2.2. Two-site Logarithmic Interpolation

At ungaged sites located between two gaging stations on the same river, Chapter F of USGS Scientific Investigations Report 2015-5019 (Sando, et al. 2018b) provides a methodology to estimate peak-flow frequencies using linear interpolation of the logarithms of peak-flow frequencies at the two gages using the logarithm of the drainage areas as the basis for the interpolation. The flow change locations between two gaging stations on the Sun River and Teton River utilize this methodology. The SIR cautions that this method may produce unreliable results if the two gaging stations have different peak flow characteristics caused by substantially different periods of records. The MOVE.3 analysis performed by USGS (Sando et al., 2018c) minimizes the potential for this cause of unreliability given the record extension methodology. Results are presented in **Appendix A.**

Equation 1:

$$logQ_{AEP,U} = logQ_{AEP,G1} + \left[\frac{(logQ_{AEP,G2} - logQ_{AEP,G1})}{(logDA_{G2} - logDA_{G1})}\right](logDA_U - logDA_{G1})$$

where:

$Q_{AEP,U}$	is the AEP-percent peak flow at ungaged site *U*, in cubic feet per second;
$Q_{AEP,G1}$	is the AEP-percent peak flow for the upstream gaging station *G1*, in cubic feet per second;
$Q_{AEP,G2}$	is the AEP-percent peak flow at the downstream gaging station *G2*, in cubic feet per second;
DA_{G2}	is the drainage area at the downstream gaging *G2*, in square miles;
DA_{G1}	is the drainage area at the upstream gaging station *G1*, in square miles; and
D_{AU}	is the drainage area at ungaged site *U*, in square miles.

4.2.3. Estimating Peak-Flow Frequencies at an Ungaged Site on a Gaged Stream

USGS SIR 20155019 Chapter F (Sando et al. 2018b) provides the methodology for estimating the peak-flow frequency when an ungaged site is close to a gaging station on the same river. The drainage-area ratio adjustment methodology is provided in Chapter F and is provided below. This method was utilized to estimate the peak-flow frequencies on gaged flooding sources in the study area. As noted in SIR 20155019, this method is appropriate for ungaged sites on large streams where regression equations are not applicable (e.g. drainage area out of the range of applicability), and results may not be reliable if the ratio of drainage areas (DA_U/DA_G) is outside the range of 0.5 to 1.5. Except as noted in **Section 4.4**, all applications of this methodology on the ungaged sites on flooding sources with stream gages meet these criteria. Results are summarized in **Appendix A**.

Equation 2:

$$Q_{AEP,U} = Q_{AEP,G}\left(\frac{DA_U}{DA_G}\right)^{exp_{AEP}}$$

Where:

$Q_{AEP,U}$	is the AEP-percent peak flow for ungaged site *U*, in cubic feet per second;
$Q_{AEP,G}$	is the AEP-percent peak flow for gaging station *G*, in cubic feet per second;
DA_U	is the drainage area at ungaged site *U*, in square miles;
DA_G	is the drainage area at gaging station *G*, in square miles;
exp_{AEP}	is the regression coefficient for an OLS regression relating the log of the AEP-percent peak flow to the log of the drainage area within each location (SIR 20155019 Chapter F, Table 5).

4.3. Ponds, Closed Basins, and other Water Bodies

Scoping information and effective floodplain maps indicate two small disconnected and unnamed ponds are mapped as Zone A (Approximate) in the upper reaches of the Sun River watershed. This study intended to apply a 2019 Michael Baker guidance document (*Recommendations for the Treatment of Reservoirs and Closed Basin Lakes for Flood Studies in Montana*; MBI 2019) to the hydrology at these locations. A detailed assessment was made of these two locations using terrain data derived from hi-resolution Light Detection and Ranging (LiDAR) data and visual inspection of aerial photo-imagery to determine stage-storage characteristics at these locations. The results of these assessments indicate that neither location mapped as disconnected pond provides any significant storage beyond potential shallow flooding under sheet flow conditions. Thus, the methodology described in the 2019 Michael Baker guidance document is not appropriate to describe the hydrology at these sites, and the contributing drainage area to these locations was delineated and regional regression equations were applied to determine peak flow flood events through these locations should a riverine hydraulic analysis be performed at the locations.

Two significant instream impoundments are located on the Sun River: Gibson Reservoir (99,100 acre-ft total storage) located near the upper extent of the Sun River study area and Sun River Diversion (minimal storage) located approximately 2.5 miles below Gibson Dam. In accordance with FEMA guidance as summarized in the 2019 Baker guidance document, these impoundments are located within riverine systems with sufficient gage data to perform hydrologic analyses that reflect the impoundment's effects on flows within the system. Also, these impoundments are controlled systems with a record of consistent operation that supports use of the gage data to define the impoundment hydrology.

4.4. Gaged/Ungaged Sites with Special Circumstances

In most cases, AEP flow values at ungaged locations of gaged streams can be determine using **Equation 2**. USGS recommendations suggest results may be unreliable if **Equation 2** is applied at ungaged sites where the ratio of ungaged to gaged drainage areas outside the range of 0.5 to 1.5. Analyses of flow data for the upper reaches of Deep Creek above Choteau (at Nunemaker Coulee and upstream) indicate that it is most appropriate to apply **Equation 2** outside the range of 0.5 to 1.5 drainage area ratios. The justification for this determination is because the stream gage used to determine the upstream flow values (USGS 06106000 Deep Creek near Choteau, MT) incorporates recorded peak flow information within Deep Creek and includes an estimate of the June 1964 flood in the peak-flow frequency analysis and is more conservative than regression equations.

The Muddy Creek flooding source contains one stream gage within the study area (USGS 06106500 Muddy Creek near Bynum, MT). There are only 10 years of peak flow data for this gage, and the period of record is 1913 to 1924 and does not include any of the significant flood events that occurred in 1953, 1964, and 1975. Thus, it is determined that regional regression equations are more appropriate to describe peak-flow flood conditions along the entire Muddy Creek study reach than the USGS stream gage. North Fork Muddy Creek near Bynum, MT (USGS 06107000) also only has data for the same period of record as the Muddy Creek gage and does not include peak flow values from significant flood events. Thus, values from regional regression equations will be applied to North Fork Muddy Creek.

The USGS reports peak-flow flood frequency results for two gages on the Sun River that have flow data at approximately the same location along the Sun River. USGS gage 06080000 (Sun River near Augusta, MT) has a period of record of 1890 to 1929 which includes 27 peak flow records. This period of record occurs before closure of Gibson Dam, but does include an estimate of the 1964 flood event in the peak-flow frequency analysis. Thus, USGS gage 06080000 represents unregulated flow conditions on the Sun River and can be applied to unregulated flow conditions upstream of Gibson Dam. USGS gage 06089000 (Sun River below diversion dam, near Augusta, MT) records flow at approximately the same location as 06080000 and has a period of record from 1968 to 2019 with 18 peak flow records and includes an estimate of the 1964 flood event. Thus, 06089000 represents post- closure of Gibson Dam and regulated flow conditions downstream of the dam. Additionally, MOVE.3 record extension methods were utilized by USGS in peak-flow frequency analyses for this site which increases the number of peak flows utilized in the analysis to 86 peak flow records. Thus, as indicated by the sharp drop in **Figure 37**, the apparent discontinuity in flow conditions at the beginning of the plot illustrates the effect of flow regulation on Sun River peak flows by Gibson Dam.

5. Summary/Discussion

5.1. Peak Flow Frequency Analysis

This peak flow frequency analysis was performed for approximately 430 miles of flooding sources within Teton County, MT. The peak flow frequency analyses were performed for the flows that correspond to the 10%, 4%, 2%, 1%, and 0.2% AEPs. In addition to these AEPs, the 1% plus discharge value was determined at each flow node, which incorporates a standard error of prediction into the 1% AEP calculations. These peak flows were calculated using the State of Montana regression equations. The standard error of prediction for the peak flow rates for the 1% annual-exceedance-probability event ranges from 13.6% in the Northwest hydrologic region to 65.8% in the Northwest Foothills hydrologic region. The peak flows for approximately 231 flow nodes are provided in **Appendix A. Figures 5 through 16** indicate the flow change locations and recommended 1% AEP flow values for use in hydraulic modeling and subsequent floodplain mapping. It is anticipated that hydraulic modeling for floodplain study purposes would conservatively apply flow values from a flow node to the immediate upstream reach until the next upstream flow node. For many of the tributary watersheds, a flow node was placed at the upstream extents of the reach. While this uppermost flow node is not expected to be applied directly to floodplain study hydraulic analyses (because it would generally be applied to the reach upstream of the node), it does provide an indication of the relative magnitude of flow in reaches above the study and is useful for comparison purposes.

Comparisons have been made between USGS regression equation results (StreamStats) and peak-flow frequency results at the gage sites in the study area. The results are presented in **Table 4**. There is considerable variability exists between the regression equation and gage analysis results, and a discussion about the variability follows.

The regression equation results for the Muddy Creek gages (Muddy Creek and North Fork Muddy Creek near Bynum) yield high results for the 1% AEP flood than gage analyses. The reason for the difference is the relatively short period of record at the gage sites, the fact that the gage sites do not include the 1964 flood event (nor other significant flood events of 1953 and 1975), and the observed data do not fit the Pearson Type III distribution very well. Thus, regression equation results are applied to Muddy Creek and North Fork Muddy Creek study reaches.

The Teton River gage data tend to provide larger 1% AEP estimates than regression equation results. The peak-flow frequency analyses for Teton River gaged data include estimates of the 1964 flood and incorporate that historic flood in the 1% AEP estimates. Thus, the gage analyses are considered a better representation of peak flow characteristics on the Teton River through the study reach.

For the Sun River gage sites, the gage data for locations below Gibson Dam tend to provide results that are lower than regional regression equation results. Baker provided comments to DNRC and USGS noting that MOVE3 analyses for Sun River gaged sites appear reasonable but on the low side of estimates given the departure from plotting positions and identified that the MOVE3 results have two flood events exceeding the 1% AEP discharge and the 1964 flood exceeding 0.2% AEP discharge. During follow up discussions (Siefken email 5/25/2021) USGS provided additional justification for use of MOVE3 results and the peak-flow flood frequency results as published by USGS are incorporated into this study. Additional discussion may be considered based on future results of hydraulics analyses along the Sun River.

Flow nodes with contributing drainage areas less than or equal to one square mile are identified by italics in the table in **Appendix A**. Flooding sources from drainages less than or equal to one square mile are not recommended for further study unless it is determined on a case-by-case basis that these drainages should receive additional consideration.

Table 4: Comparison of peak-flow flood frequency results at gaged sites and regression equation results (StreamStats).

Main Drainage	Source	Drainage Area	10-percent AEP flood	4-percent AEP flood	2-percent AEP flood	1-percent AEP flood	0.2-percent AEP flood
Muddy Creek	StreamStats	72.1	2,030	3,330	4,760	6,660	14,400
	USGS wymt_ffa_2019	72.1	1,300	2,560	3,840	5,390	11,200
Muddy Creek	StreamStats	53.9	1,480	2,480	3,590	5,050	10,900
	USGS wymt_ffa_2019	55.8	711	1,420	2,150	3,010	6,040
Teton River	StreamStats	110.3	3,120	4,960	6,970	9,750	21,000
	USGS wymt_ffa_2019	110	4,620	9,070	14,600	23,000	63,000
Teton River	StreamStats	122.5	3,420	5,400	7,550	10,500	22,400
	USGS wymt_ffa_2019	124	3,180	7,460	13,500	22,700	63,600
Teton River	StreamStats	1238	8,930	14,200	19,600	26,500	53,100
	USGS wymt_ffa_2019	1238	4,710	9,960	16,600	26,800	74,500
Deep Creek	StreamStats	269	4,470	7,200	10,000	13,600	27,500
	USGS wymt_ffa_2019	269	3,680	7,770	12,900	20,800	57,100
Sun River	StreamStats	259	6,210	9,570	13,000	17,600	35,500
	USGS wymt_ffa_2019	259	4,950	8,390	13,200	21,200	69,400
Sun River	StreamStats	609	12,400	18,500	24,400	32,000	60,100
	USGS wymt_ffa_2019	609	16,500	19,600	26,000	34,100	63,300
Sun River	StreamStats	610	12,400	18,500	24,400	32,000	60,100
	USGS wymt_ffa_2019	610	11,900	17,400	22,400	28,200	45,300
Sun River	StreamStats	814	15,700	23,200	30,100	39,100	71,700
	USGS wymt_ffa_2019	814	11,600	16,900	22,000	28,100	47,400
Sun River	StreamStats	1296	20,300	29,900	38,500	49,400	88,400
	USGS wymt_ffa_2019	1296	12,800	19,000	24,800	31,500	52,100
Sun River	StreamStats	20.8	812	1,370	2,060	3,060	7,550
	USGS wymt_ffa_2019	20.8	542	1,060	1,670	2,560	6,410

5.2. Study Comparison with Effective FIS

There are five locations in this study that have corresponding peak flow values reported in the effective FIS. **Table 5** provides a comparison between the effective FIS flows and those revised by this study. A discussion of the flow differences is included in the text following the table. Note that the locations provided in the table and discussion below are drawn from the effective FIS Summary of Discharge tables for Teton County, Unincorporated Areas (equivalent values are reported for the Teton River and Spring Creek in the City of Choteau FIS). Some general notes relevant to the comparisons:

- Where the FIS Summary of Discharge table reports the results at a USGS gage site, the revised peak flow frequency results from this study are compared against the FIS results and differences in results are noted and discussed below. Note that minor differences in contributing drainage area at gage locations are documented and reflect minor differences between the contributing drainage area published in USGS stream gage data and the drainage area calculation methods produced in this study using high resolution terrain data and detailed delineation methods.

- In general, differences in reported peak flow values at gage sites between the FIS and this study are a function of analyses of longer period of record (this study utilizes peak flow values up through 2019). Differences can also be attributed to differences in peak flow frequency methods and how they are applied between Bulletin 17A (previous studies) and Bulletin 17C (this study). Differences between the two methods include application of record extension methods (e.g. MOVE3), implementing specific historic flood peaks as perception thresholds over discontinuous flow records, or weighting the at-site peak flow frequency analysis with regional regression equations.
- Two additional study methods are reported in the effective FIS to determine peak flow flood frequency values. These include developing drainage area – discharge curves from 10 nearby stream gages and utilizing rainfall runoff methodology.
- This study primarily draws on updated peak flow frequency analyses for gages in the watershed with data through 2019; and for ungaged sites, utilizes the most recent USGS regional regression equations published as Montana StreamStats in 2016.
- Note that flow change locations (pour points) in this study were established based on criteria described in **Section 4.1.2**. In many instances, these flow change locations do not line up exactly with the locations identified in the FIS. The primary reasons for this are described in criteria for establishing flow change locations and are also a result of the locations and extents of new enhanced studies within Teton County that in most cases do not directly correspond to studies documented in the effective FIS. However, there is generally a flow change location established in this study that is relatively close to the location reported in the effective FIS Summary of Discharges table to allow a comparison between the results and discussion of differences. These sites are indicated by a Baker code that has an abbreviation for the flooding source followed by river station number (e.g. TR-90.1 represents the Teton River at River Station 90.1 miles which is 90.1 miles from the Teton County – Choteau County line (at US 287 near Choteau)).
- The comparison discussions focus on changes to the 1% AEP flow values. In many cases only limited data are available in the effective FIS's regarding flows of other recurrence intervals. **Table 5** denotes the flow values that are not reported in the associated FIS with a "(1)" in the flow field to indicate the data were not reported. Additionally, **Table 5** does not include the 1%-plus flow value generated in this study, as no previous study produced a 1%-plus flow value. **Appendix A** provides a complete list of all flow values produced in this study for all AEP's, including the 1%-plus.

Table 5. Comparison of peak flow values from effective FIS to results from this study.

Baker Node (or USGS Station ID if gaged site)	Location Description	Peak Flood Frequency Source	Drainage Area (mi^2)	Peak Flow (cfs) 10% Annual Chance 10-year	4% Annual Chance 25-year	2% Annual Chance 50-year	1% Annual Chance 100-year	0.2% Annual Chance 500-year	Methodology
TR-99.7	Teton River above Choteau	USGS 2021 Peak Flow Analysis	164	3,342	7,737	13,857	23,181	64,884	Linear interpolation between Dutton and Strabane gages
		Teton County Effective FIS (Effective 1983)	221	3,400	(1)	10,000	16,000	45,800	Regression Analyses performed on 10 gages in the general area.
TR-90.1	Teton River at US 287	USGS 2021 Peak Flow Analysis	181	3,397	7,831	13,977	23,342	65,312	Linear interpolation between Dutton and Strabane gages
		Teton County Effective FIS (Effective 1983)	221	3,400	(1)	9,540	15,200	38,100	Regression Analyses performed on 10 gages in the general area. Reduction in flow due to overflow into Spring Creek drainage
TR-85.2	Teton River downstream of Deep Creek	USGS 2021 Peak Flow Analysis	475	4,003	8,837	15,238	25,019	69,777	Linear interpolation between Dutton and Strabane gages
		Teton County Effective FIS (Effective 1983)	447	5,000	(1)	14,040	21,200	62,500	Regression Analyses performed on 10 gages in the general area. Reduction in flow due to overflow into Spring Creek drainage
USGS 06085800	Sun River at Simms	USGS 2021 Peak Flow Analysis	1,296	12,800	19,000	24,800	31,500	52,100	MOVE3 record extension. From 38 peak flow events at-site to 86 events.
		Teton County Effective FIS (Effective 1983)	1,224	12,000	(1)	24,500	38,000	100,000	LPIII Analysis (Bulletin 17A) from 26 yrs of record.
SPC-3-5.3	Spring Creek at Choteau	Regression Analyses	5.6	213	398	591	822	1,670	StreamStates regression equations.
		Teton County Effective FIS (Effective 1983)	5.6	375	(1)	1,100	1,700	8,075	Rainfall-runoff methods. Cross checked against regional runoff methods, found to be close enough to appropriately represent flood risk from Spring Cr. May require incorporation of Teton River overflows into Spring Creek.

Notes: (1) data not provided

5.3. Future Studies

Many flooding sources within Teton County have a high degree of interaction with other flooding sources within the study area. These interactions may include distinct flow splits from one flooding source to another or have flow exchanges within shared floodplains that result in flows entering or leaving an adjacent flooding source in overbank flows. Another complicating factor is much of the land use within the study area is irrigated agriculture with a complex network if irrigation ditches, canals, diversion structures, and storage facilities. The results of this study report the contribution of each flooding source's drainage basin to flow nodes within the study area. Future studies under the Hydraulic Data Capture task will apply the contributing basin flows provided in this report and define the locations and magnitude of flow exchanges through the study area based on channel and floodplain topography and conveyance characteristics, hydraulic structures, and other factors that influence the distribution of flows through the study area. As a result, the flow values due to these interactions between flooding sources may result in the calculated flows at flow nodes listed in this analyses that vary from those determined from the Hydraulic Data Capture task. This is not uncommon for studies under similar conditions.

5.4. FEMA Guidance and Standards

All flow values were determined using methods that meet FEMA guidance and standards. The results of this study will be used to produce revised flood hazard mapping in Teton County.

6. References

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Appendix A.

Table of Discharges

HYDROLOGY NODE DISCHARGE TABLE										
					Peak Discharge (cfs) for Annual Exceedance Probability Flows					
Stream	Latitude	Longitude	Node ID	Drainage Area (mi²)	10%	4%	2%	1%	1% plus	0.20%
Muddy Creek										
Farmers Coulee (RRE)[1]	47.9814	-111.9376	FC-1-0.0	34.2	472	911	1,390	2,010	3,330	4,380
Tributary to Muddy Creek 1 (RRE)[1]	*47.9697*	*-112.0030*	*TMC-1-0.0*	*0.72*	*83*	*151*	*217*	*292*	*484*	*548*
Farmers Coulee 2 (RRE)[1]	47.9910	-112.0400	FC-2-0.0	28.8	500	944	1,420	2,010	3,330	4,250
	47.9920	-112.0562	FC-2-1.2	27.2	493	928	1,400	1,970	3,270	4,150
	47.9997	-112.0652	FC-2-2.4	27.0	492	926	1,390	1,960	3,250	4,130
Brady Canal (RRE)[1,2]	*47.9579*	*-112.0681*	*BDC-0.0*	*0.04*	*23*	*39*	*54*	*68*	*113*	*113*
Tributary to Muddy Creek 2 (RRE)[1,2]	*47.9738*	*-112.0899*	*TMC-2-0.0*	*0.86*	*91*	*166*	*239*	*323*	*536*	*608*
Tributary to Muddy Creek 3 (RRE)[1]	47.9856	-112.1366	TMC-3-0.1	2.03	135	248	362	497	824	967
Jones Creek 2 (RRE)[1]	47.9859	-112.1536	JC-2-0.0	49.6	600	1,150	1,760	2,530	4,200	5,540
	47.9964	-112.1823	JC-2-2.3	41.3	555	1,060	1,620	2,320	3,850	5,030
	47.9999	-112.2214	JC-2-5.8	32.2	512	971	1,470	2,090	3,470	4,460
Foster Creek (RRE)[1]	47.9850	-112.1787	FOC-0.0	37.7	502	967	1,480	2,130	3,530	4,660
	47.9739	-112.2221	FOC-4.6	20.0	375	716	1,090	1,550	2,570	3,300
	47.9654	-112.2501	FOC-8.0	15.8	343	650	981	1,390	2,310	2,930
	47.9635	-112.2660	FOC-9.2	14.6	333	630	949	1,340	2,220	2,820
Tributary to Foster Creek 1 (RRE)[1,2]	*47.9744*	*-112.2218*	*TFCO-1-0.0*	*0.08*	*32*	*57*	*78*	*101*	*167*	*172*
Tributary to Foster Creek 2 (RRE)[1,2]	*47.9639*	*-112.2654*	*TFCO-3-0.0*	*0.18*	*47*	*82*	*115*	*152*	*252*	*267*
Farmers Ditch (RRE)[1]	47.9798	-112.1907	FD-0.0	15.1	350	659	990	1,390	2,310	2,910
East Canal (RRE)[1]	47.9825	-112.2328	EC-0.0	1.6	119	218	318	435	721	840
Tributary to Muddy Creek 4 (RRE)[1,2]	*47.9781*	*-112.2851*	*TMC-4-0.0*	*0.17*	*46*	*81*	*113*	*149*	*247*	*260*
Miller Creek (RRE)[1]	47.9889	-112.3381	MLC-0.1	45.3	971	1,710	2,520	3,550	5,400	7,660
North Fork Muddy Creek (RRE)[1,3]	**47.9919**	**-112.3574**	**BLC-0.1**	**53.9**	**1,480**	**2,480**	**3,590**	**5,050**	**6,900**	**10,900**
	48.0010	-112.3661	BLC-1.3	53.7	1,480	2,480	3,580	5,030	6,870	10,900
Tributary to Muddy Creek 5 (RRE)[1]	47.9917	-112.3764	TMC-5-0.0	11.0	368	668	993	1,400	2,210	3,000
	47.9924	-112.3846	TMC-5-0.5	10.9	365	665	988	1,390	2,200	2,970
Clark Fork Muddy Creek (RRE)[1]	47.9612	-112.5045	CFMC-0.0	23.3	919	1,540	2,280	3,330	3,920	7,940
	47.9602	-112.5063	CFMC-0.2	10.3	491	844	1,280	1,910	2,260	4,790
Blindhorse Creek (RRE)[1]	47.9604	-112.5060	BHC-0.0	13.0	587	1,000	1,510	2,240	2,630	5,570
Rinker Creek (RRE)[1]	47.9743	-112.5531	RC-0.0	8.2	382	669	1,040	1,600	1,820	4,260

HYDROLOGY NODE DISCHARGE TABLE

Stream	Latitude	Longitude	Node ID	Drainage Area (mi²)	Peak Discharge (cfs) for Annual Exceedance Probability Flows 10%	4%	2%	1%	1% plus	0.20%
Muddy Creek (RRE)[1 3]	47.9296	-111.7756	MC-0.0	426	3,550	6,010	8,640	12,100	18,700	25,700
	47.9812	-111.9372	MC-16.4	335	3,520	5,880	8,380	11,600	17,500	24,400
	47.9833	-111.9989	MC-24.2	291	3,470	5,770	8,200	11,300	16,800	23,600
	47.9695	-112.0030	MC-26.9	290	3,460	5,730	8,160	11,300	16,800	23,600
	47.9584	-112.0697	MC-36.8	284	3,470	5,760	8,170	11,300	16,800	23,600
	47.9728	-112.0894	MC-39.4	278	3,480	5,760	8,180	11,300	16,700	23,600
	47.9850	-112.1371	MC-44.5	272	3,440	5,710	8,100	11,200	16,600	23,300
	47.9851	-112.1542	MC-46.4	221	3,380	5,560	7,850	10,800	15,500	22,400
	47.9853	-112.1787	MC-50.2	180	3,320	5,410	7,620	10,500	14,600	21,700
	47.9821	-112.2321	MC-55.0	176	3,310	5,390	7,590	10,400	14,400	21,600
	47.9730	-112.2773	MC-58.0	175	3,300	5,370	7,560	10,400	14,400	21,500
	47.9751	-112.2835	MC-58.4	175	3,300	5,360	7,560	10,400	14,400	21,500
	47.9890	-112.3369	MC-62.6	126	2,900	4,710	6,640	9,170	12,100	19,200
	47.9911	-112.3378	MC-62.8	126	2,900	4,710	6,630	9,160	12,100	19,200
	47.9922	-112.3477	MC-63.7	126	2,900	4,700	6,630	9,160	12,100	19,200
	47.9911	**-112.3575**	**MC-64.3**	**72.1**	**2,030**	**3,330**	**4,760**	**6,660**	**8,570**	**14,400**
	47.9916	-112.3758	MC-65.2	60.6	1,870	3,070	4,390	6,190	7,610	13,700
	47.9705	-112.4836	MC-72.9	53.0	1,720	2,820	4,070	5,780	6,840	13,000
	47.9625	-112.4998	MC-74.4	51.4	1,680	2,760	3,990	5,690	6,670	12,900
	47.9620	-112.5048	MC-74.8	28.0	1,040	1,740	2,570	3,760	4,370	8,920
	47.9689	-112.5264	MC-76.8	27.1	1,010	1,690	2,500	3,670	4,210	8,820
	47.9707	-112.5345	MC-77.6	26.6	992	1,660	2,460	3,630	4,140	8,760
	47.9748	-112.5523	MC-79.3	18.0	721	1,230	1,850	2,770	3,150	6,910
Teton River										
Spenser Coulee (RRE)[1]	47.9256	-111.4155	SPCO-0.0	13.1	284	545	828	1,180	2,520	1,960
Flat Coulee (RRE)[1]	47.9402	-111.4327	FLC-1-0.0	32.2	379	751	1,170	1,720	3,890	2,850
	47.9583	-111.4216	FLC-1-2.3	28.9	363	717	1,120	1,630	3,670	2,700
	47.9619	-111.4203	FLC-2.7	15.9	281	548	845	1,220	2,680	2,020
	47.9651	-111.4202	FLC-3.0	15.7	279	545	840	1,210	2,660	2,010
	47.9694	-111.4224	FLC-3.5	9.73	226	439	670	960	2,060	1,590
	47.9872	-111.4238	FLC-6.1	8.36	212	410	625	892	1,900	1,480
Tributary to Flat Coulee 1 (RRE)[1]	47.9587	-111.4218	TFC-1-0.0	7.81	205	396	603	861	1,830	1,430
Tributary to Flat Coulee 2 (RRE)[1]	47.9614	-111.4201	TFC-2-0.0	5.02	169	325	490	694	1,450	1,150
	47.9615	-111.4111	TFC-2-0.6	4.92	168	322	486	687	1,430	1,140
Tributary to Flat Coulee 3 (RRE)[1]	47.9697	-111.4215	TFC-3-0.0	5.84	182	350	529	750	1,580	1,240
	47.9742	-111.4153	TFC-3-0.6	5.72	181	347	524	743	1,560	1,230

HYDROLOGY NODE DISCHARGE TABLE

Stream	Latitude	Longitude	Node ID	Drainage Area (mi^2)	Peak Discharge (cfs) for Annual Exceedance Probability Flows					
					10%	4%	2%	1%	1% plus	0.20%
Kinnerely Coulee (RRE)[1]	47.9448	-111.4845	KC-0.0	59.6	543	1,070	1,680	2,460	5,620	4,080
Railroad Coulee (RRE)[1]	47.9264	-111.7542	RRC-0.1	19.2	339	655	1,000	1,430	3,110	2,370
Trail Coulee (RRE)[1]	47.9122	-111.8407	TRCO-0.0	9.57	253	483	728	1,030	2,160	1,710
Tributary to Teton River 1 (RRE)[1]	47.9059	-111.9049	TTR-1-0.0	1.02	94	172	250	340	652	564
Spring Coulee (RRE)[1]	47.8659	-112.0080	SC-1-0.0	53.5	542	1,060	1,650	2,400	5,410	3,980
Teton Ditch (RRE)[1]	47.8555	-112.0199	TD-0.0	22.8	414	788	1,190	1,690	3,610	2,800
Tributary to Teton River 2 (RRE)[1]	47.8450	-112.0281	TTR-2-0.0	11.9	287	547	825	1,170	2,460	1,940
	47.8405	-112.0253	TTR-2-0.5	11.7	285	543	819	1,160	2,440	1,920
Gamble Coulee (RRE)[1]	47.8432	-112.0303	GC-0.0	18.0	341	655	996	1,420	3,050	2,350
	47.8409	-112.0408	GC-0.8	17.9	341	654	994	1,420	3,040	2,350
Tributary to Teton River 3 (RRE)[1]	47.8206	-112.0668	TTR-3-0.0	5.52	205	385	573	801	1,630	1,330
Cashman Coulee (RRE)[1]	47.7889	-112.1832	CAC-0.0	11.6	303	571	855	1,200	2,500	1,990
	47.7863	-112.1948	CAC-0.7	11.1	299	562	841	1,180	2,450	1,960
	47.7995	-112.2137	CAC-2.2	8.31	268	501	744	1,040	2,120	1,720
	47.8063	-112.2128	CAC-2.7	8.13	266	496	737	1,030	2,090	1,710
Spring Creek (RRE)[1,2]	47.7869	-112.1323	SPC-1-0.1	9.90	270	511	767	1,080	2,250	1,790
	47.7922	-112.1392	SPC-1-1.4	8.48	253	477	715	1,000	2,070	1,660
	47.8088	-112.1714	SPC-2-4.4	7.02	234	440	656	918	1,880	1,520
	47.8133	-112.1811	SPC-3-5.3	5.56	213	398	591	822	1,670	1,360
	47.8207	-112.1881	SPC-5-5.4	5.35	210	392	581	808	1,630	1,340
	47.8366	-112.1951	SPC-5-7.2	3.86	183	340	501	693	1,380	1,150
	47.8577	-112.2200	SPC-5-10.2	3.36	173	321	471	649	1,280	1,080
	47.8626	-112.2295	SPC-5-10.9	3.12	168	311	455	627	1,230	1,040
	47.8644	-112.2395	SPC-5-11.7	1.95	137	252	366	499	963	827
	47.8679	-112.2454	SPC-5-12.3	1.68	129	236	342	465	891	771
	47.8722	-112.2539	SPC-5-12.9	1.11	108	196	282	381	716	632
	47.8746	*-112.2655*	*SPC-5-13.6*	*0.80*	*94*	*169*	*242*	*325*	*602*	*539*
Tributary to Teton River 4 (RRE)[1]	47.8584	-112.2751	TTR-4-0.0	8.60	287	532	787	1,090	2,210	1,810
	47.8504	-112.2788	TTR-4-0.7	6.15	250	460	676	932	1,850	1,550
Tributary to Teton River 5 (RRE)[1]	47.8664	-112.3161	TTR-5-0.0	14.4	399	736	1,090	1,510	3,050	2,500
	47.8640	-112.3368	TTR-5-1.6	13.5	392	721	1,060	1,470	2,960	2,440
McDonald Creek (RRE)[1]	47.8815	-112.3622	MDC-0.0	15.6	470	852	1,250	1,720	3,500	2,810
	47.8765	-112.3960	MDC-2.3	13.7	452	814	1,190	1,640	3,310	2,670
	47.8738	-112.4010	MDC-2.6	12.2	437	783	1,140	1,570	3,150	2,550
	47.8633	-112.4292	MDC-4.3	9.87	404	721	1,040	1,430	2,870	2,310
Tributary to McDonald Creek 1 (RRE)[1,2]	*47.8768*	*-112.3959*	*TMDC-1-0.0*	*0.87*	*117*	*206*	*290*	*382*	*687*	*633*

HYDROLOGY NODE DISCHARGE TABLE

Stream	Latitude	Longitude	Node ID	Drainage Area (mi^2)	Peak Discharge (cfs) for Annual Exceedance Probability Flows					
					10%	4%	2%	1%	1% plus	0.20%
	47.8753	*-112.4069*	*TDMC-1-0.7*	*0.58*	*99*	*172*	*240*	*314*	*553*	*521*
	47.8734	*-112.4151*	*TMDC-1-1.6*	*0.27*	*72*	*123*	*168*	*217*	*369*	*360*
Tributary to McDonald Creek 2 (RRE)[1,2]	*47.8741*	*-112.4146*	*TMDC-2-0.0*	*0.05*	*34*	*56*	*75*	*93*	*147*	*155*
Tributary to McDonald Creek 3 (RRE)[1]	47.8737	-112.4001	TMDC-3-0.0	1.28	139	245	347	461	843	764
South Fork Teton River (RRE)[1]	47.8825	-112.6340	SFTR-0.0	27.7	1,020	1,710	2,540	3,730	9,000	4,240
	47.8722	-112.6691	SFTR-2.4	25.6	958	1,610	2,390	3,530	8,570	4,010
	47.8718	-112.6893	SFTR-3.5	22.8	872	1,470	2,200	3,260	7,980	3,700
	47.8686	-112.7244	SFTR-5.4	19.4	765	1,300	1,950	2,910	7,220	3,310
	47.8687	-112.7439	SFTR-6.6	15.9	652	1,110	1,690	2,540	6,400	2,890
Middle North Fork Teton River (RRE)[1]	47.8888	-112.7242	MNFTR-0.0	8.93	409	714	1,110	1,700	4,490	1,930
	47.8906	-112.7470	MNFTR-1.3	7.96	373	653	1,020	1,570	4,180	1,780
	47.8895	-112.7646	MNFTR-2.3	6.28	308	544	856	1,330	3,620	1,510
Jones Creek (RRE)[1]	47.9157	-112.7442	JC-1-0.0	7.93	372	651	1,010	1,560	4,170	1,770
West Fork North Fork Teton River (RRE)[1]	47.9574	-112.8087	WFNFTR-0.0	13.2	561	964	1,470	2,230	5,700	2,530
North Fork Teton River (RRE)[1]	47.8830	-112.6347	NFTR-1-0.0	80.9	2,430	3,900	5,560	7,860	17,400	8,930
	47.8830	-112.6688	NFTR-1-2.1	76.6	2,320	3,740	5,340	7,560	16,800	8,590
	47.8893	-112.7233	NFTR-1-5.1	63.5	2,000	3,240	4,650	6,640	15,000	7,540
	47.9155	-112.7448	NFTR-1-7.6	52.3	1,710	2,790	4,040	5,800	13,300	6,590
	47.9253	-112.7687	NFTR-1-9.0	41.6	1,420	2,340	3,420	4,950	11,600	5,620
	47.9473	-112.7981	NFTR-3-11.9	38.0	1,320	2,180	3,200	4,650	10,900	5,280
	47.9567	-112.8076	NFTR-3-12.9	35.1	1,240	2,050	3,020	4,400	10,400	5,000
	47.9584	-112.8086	NFTR-3-13.0	21.9	845	1,430	2,140	3,170	7,790	3,600
	47.9763	-112.8097	NFTR-3-14.4	17.4	702	1,200	1,810	2,700	6,770	3,070
Teton River Dutton to Loma (GI)[1]	47.9241	-111.4088	TR-0.0	1,396	4,750	10,200	17,300	28,100	79,100	51,800
	47.9262	-111.4161	TR-0.5	1,382	4,750	10,200	17,200	28,000	78,700	51,600
	47.9404	-111.4341	TR-2.8	1,342	4,740	10,100	17,100	27,700	77,600	50,800
	47.9447	-111.4854	TR-9.9	1,258	4,720	10,000	16,700	27,000	75,100	49,200
Teton River Choteau to Dutton (GI)[1,3]	**47.9303**	**-111.5529**	**TR-18.3**	**1,238**	**4,710**	**9,960**	**16,600**	**26,800**	**74,500**	**48,800**
	47.9295	-111.5663	TR-19.4	1,236	4,710	9,960	16,600	26,800	74,500	48,800
	47.9267	-111.7544	TR-40.0	1,130	4,710	9,930	16,500	26,600	74,000	48,900
	47.9292	-111.7741	TR-42.1	702	4,690	9,740	16,100	25,900	71,600	49,200
	47.9126	-111.8414	TR-49.7	677	4,690	9,730	16,100	25,800	71,400	49,200
	47.9059	-111.9067	TR-56.5	656	4,690	9,720	16,000	25,700	71,300	49,200
	47.8649	-112.0080	TR-68.9	575	4,680	9,670	15,900	25,500	70,600	49,300
	47.8553	-112.0184	TR-70.5	551	4,680	9,650	15,900	25,500	70,400	49,300
	47.8446	-112.0284	TR-72.1	538	4,680	9,640	15,900	25,400	70,300	49,300

HYDROLOGY NODE DISCHARGE TABLE

Stream	Latitude	Longitude	Node ID	Drainage Area (mi²)	Peak Discharge (cfs) for Annual Exceedance Probability Flows: 10%	4%	2%	1%	1% plus	0.20%
	47.8422	-112.0293	TR-72.4	520	4,680	9,630	15,900	25,400	70,200	49,400
	47.8202	-112.0676	TR-76.6	507	4,680	9,620	15,800	25,300	70,000	49,400
	47.7862	-112.1331	TR-85.2	475	4,670	9,600	15,800	25,200	69,700	49,400
	47.7909	-112.1732	TR-89.2	193	4,640	9,270	15,000	23,800	65,500	50,000
	47.7894	-112.1838	TR-90.1	181	4,640	9,250	15,000	23,700	65,200	50,100
	47.8593	-112.2755	TR-99.7	164	4,630	9,210	14,900	23,600	64,800	50,100
	47.8822	-112.3628	TR-105.6	127	4,630	9,120	14,700	23,200	63,600	50,300
	47.8831	**-112.6120**	**TR-121.4**	**110**	**4,620**	**9,070**	**14,600**	**23,000**	**63,000**	**50,400**
Deep Creek										
Tributary to Deep Creek 1 (RRE)[1,2]	*47.7694*	*-112.1928*	*TDPC-1-0.0*	*0.10*	*38*	*65*	*90*	*117*	*194*	*199*
Dog Creek (RRE)[1]	47.7528	-112.2464	DOC-0.0	29.1	498	941	1,420	2,010	3,330	4,260
	47.7536	-112.2507	DOC-0.3	22.4	454	851	1,280	1,790	2,970	3,740
Bruce Coulee (RRE)[1]	47.7459	-112.2562	BC-0.0	14.3	382	709	1,050	1,460	2,420	2,980
Willow Creek (RRE)[1]	47.7392	-112.2793	WWC-0.0	88.2	2,230	3,660	5,190	7,240	9,660	15,300
	47.7469	-112.3356	WWC-4.9	85.5	2,210	3,620	5,150	7,170	9,490	15,300
Nunemaker Coulee (RRE)[1]	47.7312	-112.3188	NMC-0.0	17.6	488	887	1,300	1,820	2,960	3,730
Tributary to Deep Creek 2 (RRE)[1]	47.7311	-112.3320	TDPC-2-0.0	21.5	688	1,200	1,780	2,550	3,630	5,720
Tributary to Deep Creek 3 (RRE)[1]	47.7243	-112.3472	TDPC-3-0.1	1.68	149	267	381	511	847	952
Tributary to Deep Creek 4 (RRE)[1,2]	*47.7206*	*-112.3616*	*TDPC-4-0.0*	*0.56*	*93*	*163*	*228*	*299*	*496*	*531*
Tributary to Deep Creek 5 (RRE)[1]	47.7102	-112.3882	TDPC-5-0.0	4.76	275	488	707	969	1,550	1,940
Quigley Creek (RRE)[1]	47.7106	-112.3877	QC-0.0	17.3	552	979	1,450	2,060	3,080	4,540
	47.7103	-112.3887	QC-0.1	12.6	468	828	1,230	1,770	2,570	3,980
Battle Creek (RRE)[1]	47.7136	-112.5883	BTC-0.0	15.4	637	1,090	1,650	2,490	2,830	6,290
Deep Creek Below Choteau (GI)[1,3]	47.7898	-112.1719	DPC-0.0	279	3,750	7,920	13,100	21,200	39,400	58,200
	47.7695	-112.1932	DPC-3.1	277	3,740	7,890	13,100	21,100	39,300	58,000
	47.7520	**-112.2395**	**DPC-6.7**	**269**	**3,680**	**7,770**	**12,900**	**20,800**	**38,700**	**57,100**
Deep Creek Above Choteau (GI)[1]	47.7524	-112.2456	DPC-7.1	238	3,450	7,290	12,100	19,500	36,300	53,400
	47.7460	-112.2565	DPC-7.9	223	3,340	7,060	11,700	18,900	35,100	51,700
	47.7385	-112.2782	DPC-10.6	134	2,560	5,420	9,000	14,500	26,900	39,300
	47.7321	-112.3193	DPC-15.2	114	2,350	4,990	8,270	13,300	24,700	36,000
	47.7307	-112.3329	DPC-16.7	91.8	2,100	4,460	7,400	11,900	22,100	32,100
	47.7250	-112.3475	DPC-17.4	83.2	1,990	4,240	7,030	11,300	21,000	30,400
	47.7205	-112.3612	DPC-19.2	81.0	1,970	4,180	6,940	11,100	20,700	30,000
	47.7108	-112.3878	DPC-23.7	61.8	1,710	3,640	6,030	9,670	18,000	26,000
	47.7143	-112.5885	DPC-45.8	37.9	1,320	2,830	4,690	7,500	13,900	20,000

HYDROLOGY NODE DISCHARGE TABLE

Stream	Latitude	Longitude	Node ID	Drainage Area (mi^2)	Peak Discharge (cfs) for Annual Exceedance Probability Flows					
					10%	4%	2%	1%	1% plus	0.20%
Sun River										
Big Coulee Creek (RRE)[1]	47.5296	-111.9223	BCC-0.0	65.2	637	1,240	1,920	2,780	4,610	6,230
	47.5302	-111.9241	BCC-0.1	59.5	619	1,200	1,850	2,680	4,440	5,960
	47.5317	-111.9310	BCC-0.6	58.3	616	1,190	1,840	2,660	4,410	5,910
	47.5405	-111.9517	BCC-2.9	53.8	602	1,160	1,790	2,580	4,280	5,690
	47.5442	-111.9645	BCC-4.0	41.5	556	1,060	1,620	2,320	3,850	5,040
	47.5569	-111.9668	BCC-5.6	39.5	549	1,050	1,600	2,280	3,780	4,930
	47.5569	-111.9732	BCC-6.0	39.2	548	1,050	1,590	2,270	3,760	4,910
Tributary to Big Coulee Creek 1 (RRE)[1]	47.5306	-111.9240	TBCC-1-0.0	4.30	174	328	489	684	1,130	1,390
	47.5364	-111.9261	TBCC-1-0.6	4.23	173	325	485	678	1,120	1,380
Tributary to Big Coulee Creek 2 (RRE)[1,2]	*47.5315*	*-111.9306*	*TBCC-2-0.0*	*0.87*	*85*	*155*	*226*	*308*	*511*	*590*
	47.5293	*-111.9316*	*TBCC-2-0.2*	*0.66*	*75*	*138*	*199*	*270*	*448*	*510*
	47.5285	*-111.9341*	*TBCC-2-0.3*	*0.55*	*69*	*126*	*182*	*246*	*408*	*461*
	47.5253	*-111.9359*	*TBCC-2-0.6*	*0.30*	*53*	*96*	*137*	*183*	*303*	*335*
Tributary to Big Coulee Creek 3 (RRE)[1]	47.5408	-111.9517	TBCC-3-0.0	2.91	147	275	407	565	937	1,130
Duck Creek (RRE)[1]	47.5446	-111.9653	DC-0.0	11.3	273	522	789	1,120	1,860	2,370
	47.5492	-111.9701	DC-0.5	11.2	272	519	786	1,110	1,840	2,350
Tributary to Big Coulee Creek 4 (RRE)[1]	47.5572	-111.9665	TBCC-4-0.0	1.37	106	196	286	392	650	760
School Section Coulee (RRE)[1]	47.5092	-112.1071	SSC-0.0	41.6	624	1,170	1,770	2,500	4,130	5,350
	47.5126	-112.1227	SSC-1.2	41.4	623	1,170	1,770	2,500	4,130	5,330
	47.5168	-112.1288	SSC-1.8	41.1	622	1,170	1,770	2,490	4,120	5,320
	47.5211	-112.1345	SSC-2.4	40.9	621	1,170	1,760	2,490	4,120	5,300
Cutting Shed Coulee (RRE)[1]	47.5257	-112.2995	CSC-0.0	24.1	866	1,470	2,180	3,220	3,860	7,760
Tributary to Sun River 1 (RRE)[1,2]	*47.5451*	*-112.3303*	*TSR-1-0.0*	*0.05*	*6.1*	*13*	*25*	*46*	*52*	*184*
Tributary to Sun River 2 (RRE)[1]	47.6069	-112.4312	TSR-2-0.0	1.72	73	200	331	540	613	1,630
	47.6093	-112.4312	TSR-2-0.2	1.50	97	180	299	491	558	1,500
Tributary to Sun River 3 (RRE)[1,2]	*47.6088*	*-112.4320*	*TSR-3-0.0*	*0.10*	*10*	*22*	*40*	*72*	*82*	*276*
Tributary to Sun River 4 (RRE)[1]	47.6359	-112.6107	TSR-4-0.0	2.25	134	247	404	652	741	1,930
Tributary to Sun River 5 (RRE)[1]	47.6226	-112.6544	TSR-5-0.0	1.75	109	203	335	546	620	1,650
Tributary to Sun River 6 (RRE)[1]	47.6216	-112.6633	TSR-6-0.0	1.94	119	220	362	588	668	1,760
Tributary to Sun River 7 (RRE)[1,2]	*47.6191*	*-112.7127*	*TSR-7-0.1*	*0.13*	*14*	*28*	*50*	*90*	*103*	*336*
Hannan Gulch (RRE)[1]	47.6175	-112.7330	HG-0.0	9.90	445	773	1,190	1,830	2,080	4,790
Blacktail Gulch (RRE)[1]	47.6075	-112.7536	BLG-0.0	10.5	465	806	1,240	1,900	2,160	4,950
Mortimer Gulch (RRE)[1]	47.6152	-112.7691	MG-0.0	2.65	153	280	455	730	829	2,130
Unnamed Pond 1 (RRE)[1,2]	*47.6450*	*-112.6785*	*UP-1-0.0*	*0.68*	*51*	*98*	*168*	*283*	*321*	*923*
Unnamed Pond 2 (RRE)[1,2]	*47.6506*	*-112.8453*	*UP-2-0.0*	*0.48*	*38*	*75*	*130*	*222*	*254*	*742*

HYDROLOGY NODE DISCHARGE TABLE

Stream	Latitude	Longitude	Node ID	Drainage Area (mi^2)	Peak Discharge (cfs) for Annual Exceedance Probability Flows 10%	4%	2%	1%	1% plus	0.20%
Sun River Below Simms (GI)[1 3]	47.5070	-111.9054	SR-0.0	1,299	12,800	19,000	24,800	31,500	41,500	52,200
	47.5016	**-111.9319**	**SR-1.7**	**1,296**	**12,800**	**19,000**	**24,800**	**31,500**	**41,500**	**52,100**
Sun River Below Willow Creek to Simms (GI)[1 3]	47.5058	-111.9442	SR-2.4	1,295	12,800	19,000	24,800	31,500	41,500	52,100
	47.5087	-112.1059	SR-12.7	1,151	12,500	18,400	24,100	30,600	40,700	50,900
	47.5121	-112.1234	SR-14.1	1,149	12,500	18,400	24,000	30,600	40,700	50,800
	47.5074	-112.2826	SR-23.2	1,040	12,200	18,000	23,400	29,800	40,000	49,800
	47.5192	-112.2919	SR-24.2	844	11,700	17,100	22,200	28,400	38,700	47,800
	47.5255	-112.3002	SR-24.9	818	11,600	16,900	22,000	28,100	38,500	47,400
	47.5448	-112.3312	SR-27.2	816	11,600	16,900	22,000	28,100	38,500	47,400
	47.5471	**-112.3674**	**SR-29.9**	**814**	**11,600**	**16,900**	**22,000**	**28,100**	**38,500**	**47,400**
Sun River Diversion to Below Willow (GI)[1 3]	47.5597	-112.4045	SR-32.5	702	11,800	17,200	22,200	28,200	38,800	46,300
	47.6064	-112.4322	SR-37.1	692	11,800	17,200	22,200	28,200	38,800	46,200
	47.6200	-112.5021	SR-41.2	667	11,800	17,200	22,300	28,200	38,800	45,900
	47.6439	-112.5637	SR-46.6	648	11,800	17,300	22,300	28,200	38,900	45,700
	47.6355	-112.6113	SR-49.8	628	11,900	17,300	22,400	28,200	38,900	45,500
	47.6225	-112.6553	SR-52.5	619	11,900	17,400	22,400	28,200	39,000	45,400
	47.6185	**-112.6921**	**SR-55.4**	**610**	**11,900**	**17,400**	**22,400**	**28,200**	**39,000**	**45,300**
Sun River Gibson to Diversion (GI)[1 3]	47.6210	-112.7067	SR-56.2	609	11,900	17,400	22,400	28,200	39,000	45,300
	47.6168	-112.7327	SR-59.7	590	11,700	17,100	22,000	27,700	38,300	44,500
	47.6072	-112.7541	SR-61.1	576	11,500	16,900	21,700	27,400	37,800	43,900
Sun River Above Gibson (GI)[1]	47.6090	-112.8001	SR-63.9	537	15,400	18,400	24,400	31,900	36,100	59,200
	47.6120	-112.8271	SR-65.6	521	15,200	18,100	24,000	31,500	35,600	58,200
North Fork Sun River (GI)[1 3]	47.6306	-112.8570	NFSR-0.2	266	5,050	8,550	13,400	21,600	36,200	70,500
	47.6399	**-112.8593**	**NFSR-1.0**	**259**	**4,950**	**8,390**	**13,200**	**21,200**	**35,600**	**69,400**

1. Method of analysis is indicated as RRE: Regional regression equation GI: Gage Interpolation
2. *Italicized* values indicate subbasins with a drainage area of less than or equal to 1 square mile
3. Values in **bold** indicate values reported at the gaging station

Appendix B.

USGS Peak-flow Frequency Results

Table 1–1. Information on streamgages for which peak-flow frequency analyses are reported.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. NAD 83, North American Datum of 1983; --, not applicable; U, unregulated; ND, not determined; R, regulated]

Streamgage identification number	Streamgage name	Latitude, in decimal degrees (NAD 83)	Longitude, in decimal degrees (NAD 83)	Type of streamgage[1]	Contributing drainage area, in square miles	Data combination[2]	Data correction[3]	Regulation status[4] as of 2014	Number of recorded peak flows	Water years of recorded peak flows	Number of unregulated peak-flow records	Water years of unregulated peak-flow records	Number of regulated peak-flow records	Water years of regulated peak-flow records	Percentage of drainage basin regulated by dams (2014)	Regulation status for reported at-site peak-flow frequency analyses
06078500	North Fork Sun River near Augusta, Montana	47.6399	-112.8593	CONT	259	--	--	U	38	1911-1912, 1946-1968, 1989-1993, 2008-2009, 2014-2019	38	1911-1912, 1946-1968, 1989-1993, 2008-2009, 2014-2019	0	--	0	U
06079000	South Fork Sun River near Augusta, Montana	47.6286	-112.8658	CONT	251	--	--	U	11	1911-1912, 1964, 2008-2009, 2014-2019	11	1911-1912, 1964, 2008-2009, 2014-2019	0	--	0	U
06079600	Beaver Creek at Gibson Dam, near Augusta, Montana	47.6023	-112.7575	CSG	20.8	--	--	U	15	1959-1973	15	1959-1973	0	--	0	U
06080000	Sun River near Augusta, Montana	47.6209	-112.7070	CONT	609	--	YES	R (MAJ–dam)	27	1890, 1905-1929, 1964	24	1890, 1905-1927	3	1928-1929, 1964	91	R
06080900	Sun River below diversion dam, near Augusta, Montana	47.6185	-112.6921	CONT	610	--	--	R (MAJ–dam)	18	1964, 1968-1980, 2016-2019	0	--	18	1964, 1968-1980, 2016-2019	91	R
06082200	Sun River below Willow Creek near Augusta, Montana	47.5471	-112.3674	CONT	814	--	--	R (MAJ–dam)	16	1964, 1968-1975, 2013-2019	0	--	16	1964, 1968-1975, 2013-2019	80	R
06085800	Sun River at Simms, Montana	47.5016	-111.9319	CONT	1,296	--	--	R (MAJ–dam)	38	1964, 1966-1979, 1997-2019	0	--	38	1964, 1966-1979, 1997-2019	55	R
06086000	Sun River at Fort Shaw, Montana	47.5134	-111.8155	CONT	1,395	YES	--	R (MAJ–dam)	16	1913-1928	15	1913-1927	1	1928	52	R
06087900	Muddy Creek tributary near Power, Montana	47.7557	-111.7296	CSG	3.81	--	YES	U	17	1963-1978, 1986	17	1963-1978, 1986	0	--	0	U
06089000	Sun River near Vaughn, Montana	47.5258	-111.5110	CONT	1,774	--	--	R (MAJ–dam)	87	1934-2019	0	--	87	1934-2019	42	R
06102500	Teton River below South Fork, near Choteau, Montana	47.8831	-112.6120	CONT	110	--	--	U	30	1948-1954, 1964, 1998-2019	30	1948-1954, 1964, 1998-2019	0	--	0	U
06103000	Teton River at Strabane, Montana	47.8788	-112.4595	CONT	124	--	YES	U	18	1908-1925	18	1908-1925	0	--	1	U
06105800	Bruce Coulee tributary near Choteau, Montana	47.7351	-112.2527	CSG	1.84	--	--	U	40	1963-2002	40	1963-2002	0	--	0	U
06106000	Deep Creek near Choteau, Montana	47.7520	-112.2395	CONT	269	--	--	U	15	1911-1924, 1964	15	1911-1924, 1964	0	--	2	U
06106500	Muddy Creek near Bynum, Montana	47.9911	-112.3575	CONT	72.1	--	--	U	10	1913-1918, 1920, 1922-1924	10	1913-1918, 1920, 1922-1924	0	--	1	U
06107000	North Fork Muddy Creek near Bynum, Montana	47.9919	-112.3574	CONT	55.8	--	--	U	11	1913-1917, 1919-1924	11	1913-1917, 1919-1924	0	--	2	U
06108000	Teton River near Dutton, Montana	47.9303	-111.5529	CONT	1,238	--	--	U	65	1955-2019	65	1955-2019	0	--	2	U
06108200	Kinley Coulee near Dutton, Montana	47.8428	-111.5917	CSG	14.4	--	--	U	16	1963-1978	16	1963-1978	0	--	0	U
06108300	Kinley Coulee tributary near Dutton, Montana	47.8428	-111.5521	CSG	2.96	--	--	U	16	1963-1978	16	1963-1978	0	--	0	U
06108800	Teton River at Loma, Montana	47.9327	-110.5144	CONT	1,900	YES	YES	U	22	1998-2019	22	1998-2019	0	--	7	U

[1]Abbreviations for type of streamgage are defined as follows:
CONT: continuous streamflow operations.
CSG: crest-stage gage operations.
In cases where both CONT and CSG are indicated for an individual streamgage, the historic operations of the streamgage have included periods of continuous streamflow operations and periods of crest-stage gage operations.
[2]Data combination refers to combining peak-flow records of two or more closely located streamgages on the same channel. Information on combining records of multiple streamgages is presented in table 1–2.
[3]Data correction refers to manual adjustment of specific peak-flow records to provide reliable frequency analyses. Information on manual correction of peak-flow records is presented in table 1–3.

[4]Abbreviations for regulation status are defined as follows:
U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.
R (MAJ–dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
R (MAJ–canal): major diversion canal regulation, where a large diversion canal is known to be located on the channel upstream from the streamgage.
R (MIN–dams): minor dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage, but no single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
Total: the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation, . The "Total" peak-flow frequency analysis is provided in cases where major regulation affects less than 50 percent of the drainage area of the streamgage and there is uncertainty in the effects of regulation on specific peak-flow characteristics. Also, the "Total" peak-flow frequency analysis is the only peak-flow frequency analysis provided in cases of minor dam regulation.

Table 1–2. Information on analyses combining peak-flow records for two or more closely located streamgages on the same channel

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

Primary streamgage					Secondary streamgage(s) combined with primary streamgage					Combined characteristics	
Streamgage identification number	Streamgage name	Contributing drainage area, in square miles	Number of recorded peak flows	Water years of recorded peak flows	Streamgage identification number	Streamgage name	Drainage area, in square miles	Number of recorded peak flows	Water years of recorded peak flows	Combined number of recorded peak flows	Water years of combined peak-flow records
06086000	Sun River at Fort Shaw, Montana	1,395	16	1913-1928	06087500	Sun River at Sun River, Montana	1,428	7	1906-1912	23	1906-1928
06108800	Teton River at Loma, Montana	1,900	22	1998-2019	06108500	Teton River near Fort Benton, Montana	1,879	4	1929-1932	26	1929-1932, 1998-2019

Table 1–3. Information on data correction and flow interval representation of specific peak-flow records.

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

Streamgage identification number	Streamgage name	Water year	Recorded peak flow, in cubic feet per second	Type of flow interval	Lower interval value, in cubic feet per second	Upper interval value, in cubic feet per second	Comments
06080000	Sun River near Augusta, Montana	1964	59,700	PEAK > STATED VALUE	59,700	INF	Lower interval from measurement of 1964 peak (included attenuation from Gibson Reservoir)
06087900	Muddy Creek tributary near Power, Montana	1986	190	EXCLUSION (OPPORTUNISTIC)	0	INF	Correction of opportunistic peak after the end of systematic record
06103000	Teton River at Strabane, Montana	1964	--	PEAK > STATED VALUE	54,600	INF	Lower interval value from upstream measurement of 1964 peak
06108800	Teton River at Loma, Montana	1964	--	PEAK > STATED VALUE	81,300	INF	Lower interval value from upstream measurement of 1964 peak

Table 1–4. Documentation regarding analytical procedures for peak-flow frequency analyses.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF, potentially influential low flow; U, unregulated; --, not applicable; R, regulated; MGBT, multiple Grubbs-Beck test; MOVE3, Maintenance of Variance Extension Type III record extension; RRE wtd, regional regression equation weighted; log, logarithm base 10]

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Primary reason for deviation from standard Bulletin 17C procedures[4]	Mean (log units)	Standard deviation (log units)	Skew type used in analysis	Station skew of the peak-flow data (log units)	Generalized skew (log units)	Source of generalized skew used in weighted skew determinations	Analysis skew used for the frequency analysis (log units)	PILF threshold, cubic feet per second	Type of PILF threshold	Number of systematic peak flows equal to zero	Number of non-zero systematic peak flows less than PILF threshold	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)
06078500.00	North Fork Sun River near Augusta, Montana	259	U	At-site	38	1911-1912, 1946-1968, 1989-1993, 2008-2009, 2014-2019	upper tail	3.526	0.180	Station	4.331	--	--	4.331	2,720	FIXED	0	14	YES
06078500.03	North Fork Sun River near Augusta, Montana	259	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06079000.00	South Fork Sun River near Augusta, Montana	251	U	At-site	11	1911-1912, 1964, 2008-2009, 2014-2019	--	3.532	0.288	Weighted	1.735	0.430	Bulletin 17B[5]	0.468	--	MGBT	0	0	YES
06079000.03	South Fork Sun River near Augusta, Montana	251	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06079600.00	Beaver Creek at Gibson Dam, near Augusta, Montana	20.8	U	At-site	15	1959-1973	--	2.080	0.494	Weighted	1.111	0.410	Bulletin 17B[5]	0.505	--	MGBT	0	0	YES
06079600.03	Beaver Creek at Gibson Dam, near Augusta, Montana	20.8	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06080000.00	Sun River near Augusta, Montana	609	U	At-site	27	1890, 1905-1929, 1964	--	3.863	0.294	Weighted	1.215	0.412	Bulletin 17B[5]	0.544	--	MGBT	0	0	YES
06080000.03	Sun River near Augusta, Montana	609	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06080900.10	Sun River below diversion dam, near Augusta, Montana	610	R (MAJ–dam)	At-site	18	1964, 1968-1980, 2016-2019	reg	3.724	0.266	Station	1.218	NA	--	1.217	2,620	FIXED	0	3	YES
06080900.11	Sun River below diversion dam, near Augusta, Montana	610	R (MAJ–dam)	MOVE3	86	1934-2019	reg	3.663	0.318	Station	0.198	NA	--	0.198	1510	MGBT	0	7	YES
06082200.10	Sun River below Willow Creek near Augusta, Montana	814	R (MAJ–dam)	At-site	16	1964, 1968-1975, 2013-2019	--	3.640	0.376	Weighted	0.090	0.362	Bulletin 17B[5]	0.202	1,080	MGBT	0	1	YES
06082200.11	Sun River below Willow Creek near Augusta, Montana	814	R (MAJ–dam)	MOVE3	86	1934-2019	--	3.694	0.278	Weighted	0.607	0.362	Bulletin 17B[5]	0.535	2480	MGBT	0	13	YES
06085800.10	Sun River at Simms, Montana	1,296	R (MAJ–dam)	At-site	38	1964, 1966-1979, 1997-2019	--	3.648	0.366	Weighted	0.211	0.323	Bulletin 17B[5]	0.246	1,480	MGBT	0	4	YES
06085800.11	Sun River at Simms, Montana	1,296	R (MAJ–dam)	MOVE3	86	1934-2019	--	3.685	0.324	Weighted	0.226	0.323	Bulletin 17B[5]	0.248	1,880	MGBT	0	10	YES
06086000.00	Sun River at Fort Shaw, Montana	1,395	U	At-site	22	1906-1927	--	3.861	0.243	Weighted	0.506	0.311	Bulletin 17B[5]	0.418	--	MGBT	0	0	YES
06086000.03	Sun River at Fort Shaw, Montana	1,395	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06087900.00	Muddy Creek tributary near Power, Montana	3.81	U	At-site	16	1963-1978, 1986	--	2.078	0.516	Weighted	-0.838	0.316	Bulletin 17B[5]	-0.178	19	MGBT	1	0	--
06087900.03	Muddy Creek tributary near Power, Montana	3.81	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06089000.10	Sun River near Vaughn, Montana	1,774	R (MAJ–dam)	At-site	86	1934-2019	upper tail	3.740	0.252	Station	0.998	--	--	0.998	3,370	FIXED	0	18	YES
06102500.00	Teton River below South Fork, near Choteau, Montana	110	U	At-site	30	1948-1954, 1964, 1998-2019	upper tail	2.983	0.428	Station	1.491	--	--	1.491	--	MGBT	0	0	YES
06102500.01	Teton River below South Fork, near Choteau, Montana	110	U	MOVE3	72	1948-2019	upper tail	3.088	0.430	Station	0.906	--	--	0.906	--	MGBT	0	0	YES
06103000.00	Teton River at Strabane, Montana	124	U	At-site	18	1908-1925	upper tail	2.878	0.438	Station	2.548	--	--	2.548	--	MGBT	0	0	YES
06103000.03	Teton River at Strabane, Montana	124	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06105800.00	Bruce Coulee tributary near Choteau, Montana	1.84	U	At-site	40	1963-2002	--	1.654	0.453	Weighted	0.056	0.388	Bulletin 17B[5]	0.137	--	MGBT	0	0	--
06105800.03	Bruce Coulee tributary near Choteau, Montana	1.84	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06106000.00	Deep Creek near Choteau, Montana	269	U	At-site	15	1911-1924, 1964	--	2.827	0.560	Weighted	0.949	0.389	Bulletin 17B[5]	0.469	--	MGBT	0	0	YES
06106000.03	Deep Creek near Choteau, Montana	269	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06106500.00	Muddy Creek near Bynum, Montana	72.1	U	At-site	10	1913-1918, 1920, 1922-1924	--	1.993	0.745	Weighted	-0.320	0.457	Bulletin 17B[5]	0.111	--	MGBT	0	0	YES
06106500.03	Muddy Creek near Bynum, Montana	72.1	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06107000.00	North Fork Muddy Creek near Bynum, Montana	55.8	U	At-site	11	1913-1917, 1919-1924	--	1.902	0.569	Weighted	-0.506	0.457	Bulletin 17B[5]	0.013	--	MGBT	0	0	YES
06107000.03	North Fork Muddy Creek near Bynum, Montana	55.8	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06108000.00	Teton River near Dutton, Montana	1,238	U	At-site	65	1955-2019	upper tail	2.943	0.563	Station	0.511	--	--	0.511	--	MGBT	0	0	YES
06108000.01	Teton River near Dutton, Montana	1,238	U	MOVE3	72	1948-2019	upper tail	2.941	0.553	Station	0.503	--	--	0.503	--	MGBT	0	0	YES
06108200.00	Kinley Coulee near Dutton, Montana	14.4	U	At-site	16	1963-1978	upper tail	1.320	1.170	Weighted	-0.415	0.300	Bulletin 17B[5]	-0.022	5	FIXED	2	3	--
06108200.03	Kinley Coulee near Dutton, Montana	14.4	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06108300.00	Kinley Coulee tributary near Dutton, Montana	2.96	U	At-site	16	1963-1978	--	1.014	1.013	Weighted	-0.106	0.293	Bulletin 17B[5]	0.109	1	MGBT	2	0	--
06108300.03	Kinley Coulee tributary near Dutton, Montana	2.96	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06108800.00	Teton River at Loma, Montana	1,900	U	At-site	26	1929-1932, 1998-2019	--	2.818	0.663	Weighted	1.249	0.119	Bulletin 17B[5]	0.297	--	MGBT	0	0	YES
06108800.03	Teton River at Loma, Montana	1,900	U	RRE wtd	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

[1]The streamgage identification number and analysis designation is defined by XXXXXXXX.AB,
where,
XXXXXXXX is the streamgage identification number;
A is the regulation status for the analysis period; and
B is the type of peak-flow frequency analysis.

Values of A (regulation status) are defined as:
A = 0, unregulated;
A = 1, regulated by major regulation; and
A = 2, total; that is, the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation (see footnote 2).

Values of B (type of peak-flow frequency analysis) are defined as:
B = 0, at-site peak-flow frequency analysis conducted on recorded data;
B = 1, peak-flow frequency analysis conducted on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
B = 2, peak-flow frequency analysis determined from regional regression equations (RREs); RRE frequency results not presented in this report; and
B = 3, at-site peak-flow frequency analysis weighted with results from RREs; distributional parameters not available for RRE weighted frequency analyses.

[2]Abbreviations for regulation status are defined as follows:
U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.
R (MAJ–dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
R (MAJ–canal): major diversion canal regulation, where a large diversion canal is known to be located on the channel upstream from the streamgage.
R (MIN–dams): minor dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage, but no single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
Total: the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation, . The "Total" peak-flow frequency analysis is provided in cases where major regulation affects less than 50 percent of the drainage area of the streamgage and there is uncertainty in the effects of regulation on specific peak-flow characteristics. Also, the "Total" peak-flow frequency analysis is the only peak-flow frequency analysis provided in cases of minor dam regulation.

[3]Abbreviations for type of frequency analysis are defined as follows:
At-site: peak-flow frequency analysis on recorded data.
RRE wtd: the at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
MOVE.3: peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure.

[4]Standard Bulletin 17C (England and others, 2019) procedures are considered to be the use of the weighted skew and the use of the multiple Grubbs-Beck low-outlier test (MGBT) for identifying PILFs. In cases where either the station skew or a manual (analyst-selected) PILF threshold was used, the peak-flow frequency analysis was considered to deviate from standard Bulletin 17C procedures. The abbreviations for the reasons for deviation from standard Bulletin 17C procedures are defined as follows:
reg: the peak-flow records are affected by major dam or canal regulation;
upper tail: the probability plots of the peak-flow records deviate from typical patterns in the upper tail of the frequency curve, generally because of mixed population characteristics; and
lower tail: the probability plots of the peak-flow records deviate from typical patterns in the lower tail of the frequency curve at high annual exceedance probabilities (greater than about 50.0 percent).

[5]U.S. Interagency Advisory Council on Water Data, 1982, Guidelines for determining flood flow frequency: Hydrology Subcommittee, Bulletin 17B, appendixes 1–14, 28 p.

Table 1–5. Documentation of user-defined perception thresholds for peaks represented as flow intervals (excluding missing data periods) in applicable peak-flow frequency analyses.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. U, unregulated; --, not applicable]

Streamgage identification number and analysis designation[1]	Streamgage name	Regulation status for analysis[2]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Perception threshold period, in water years	Lower bound of perceptible range, in cubic feet per second	Upper bound of perceptible range, in cubic feet per second	Water year of peak flow used for historical perception threshold	Peak flow used for historical perception threshold, in cubic feet per second	Comments
06078500.00	North Fork Sun River near Augusta, Montana	U	38	1911-1912, 1946-1968, 1989-1993, 2008-2009, 2014-2019	1905-1910	51,100	INF	1964	51,100	1964 HISTORICAL PERIOD
06078500.00	North Fork Sun River near Augusta, Montana	U	38	1911-1912, 1946-1968, 1989-1993, 2008-2009, 2014-2019	1913-1945	51,100	INF	1964	51,100	1964 HISTORICAL PERIOD
06078500.00	North Fork Sun River near Augusta, Montana	U	38	1911-1912, 1946-1968, 1989-1993, 2008-2009, 2014-2019	1969-1988	51,100	INF	1964	51,100	1964 HISTORICAL PERIOD
06078500.00	North Fork Sun River near Augusta, Montana	U	38	1911-1912, 1946-1968, 1989-1993, 2008-2009, 2014-2019	1994-2007	51,100	INF	1964	51,100	1964 HISTORICAL PERIOD
06078500.00	North Fork Sun River near Augusta, Montana	U	38	1911-1912, 1946-1968, 1989-1993, 2008-2009, 2014-2019	2010-2013	51,100	INF	1964	51,100	1964 HISTORICAL PERIOD
06079000.00	South Fork Sun River near Augusta, Montana	U	11	1911-1912, 1964, 2008-2009, 2014-2019	1905-1910	28,800	INF	1964	28,800	1964 HISTORICAL PERIOD
06079000.00	South Fork Sun River near Augusta, Montana	U	11	1911-1912, 1964, 2008-2009, 2014-2019	1913-2007	28,800	INF	1964	28,800	1964 HISTORICAL PERIOD
06079000.00	South Fork Sun River near Augusta, Montana	U	11	1911-1912, 1964, 2008-2009, 2014-2019	2010-2013	28,800	INF	1964	28,800	1964 HISTORICAL PERIOD
06079600.00	Beaver Creek at Gibson Dam, near Augusta, Montana	U	15	1959-1973	1917-1958	4,360	INF	1964	4,360	1964 HISTORICAL PERIOD
06079600.00	Beaver Creek at Gibson Dam, near Augusta, Montana	U	15	1959-1973	1974-2019	4,360	INF	1964	4,360	1964 HISTORICAL PERIOD
06080000.00	Sun River near Augusta, Montana	U	27	1890, 1905-1929, 1964	1895-1904	59,700	INF	1964	59,700	1964 HISTORICAL PERIOD
06080000.00	Sun River near Augusta, Montana	U	27	1890, 1905-1929, 1964	1930-2019	59,700	INF	1964	59,700	1964 HISTORICAL PERIOD
06080900.10	Sun River below diversion dam, near Augusta, Montana	R (MAJ–dam)	18	1964, 1968-1980, 2016-2019	1895-1929	32,300	INF	1916	32,300	1916 HISTORICAL PERIOD
06080900.10	Sun River below diversion dam, near Augusta, Montana	R (MAJ–dam)	18	1964, 1968-1980, 2016-2019	1930-1967	32,000	INF	1975	32,000	1975 HISTORICAL PERIOD
06080900.10	Sun River below diversion dam, near Augusta, Montana	R (MAJ–dam)	18	1964, 1968-1980, 2016-2019	1981-2015	32,000	INF	1975	32,000	1975 HISTORICAL PERIOD
06080900.11	Sun River below diversion dam, near Augusta, Montana	R (MAJ–dam)	86	1934-2019	1895-1929	32,300	INF	1916	32,300	1916 HISTORICAL PERIOD
06080900.11	Sun River below diversion dam, near Augusta, Montana	R (MAJ–dam)	86	1934-2019	1930-1933	32,000	INF	1975	32,000	1975 HISTORICAL PERIOD
06082200.10	Sun River below Willow Creek near Augusta, Montana	R (MAJ–dam)	16	1964, 1968-1975, 2013-2019	1895-1967	34,000	INF	1975	34,000	1975 HISTORICAL PERIOD
06082200.10	Sun River below Willow Creek near Augusta, Montana	R (MAJ–dam)	16	1964, 1968-1975, 2013-2019	1976-2012	34,000	INF	1975	34,000	1975 HISTORICAL PERIOD
06082200.11	Sun River below Willow Creek near Augusta, Montana	R (MAJ–dam)	86	1934-2019	1895-1933	34,000	INF	1975	34,000	1975 HISTORICAL PERIOD
06085800.10	Sun River at Simms, Montana	R (MAJ–dam)	38	1964, 1966-1979, 1997-2019	1895-1965	37,900	INF	1975	37,900	1975 HISTORICAL PERIOD
06085800.10	Sun River at Simms, Montana	R (MAJ–dam)	38	1964, 1966-1979, 1997-2019	1980-1996	37,900	INF	1975	37,900	1975 HISTORICAL PERIOD
06085800.11	Sun River at Simms, Montana	R (MAJ–dam)	86	1934-2019	1895-1933	37,900	INF	1975	37,900	1975 HISTORICAL PERIOD
06086000.00	Sun River at Fort Shaw, Montana	U	22	1906-1927	1895-1905	27,200	INF	1908	27,200	1908 HISTORICAL PERIOD
06089000.10	Sun River near Vaughn, Montana	R (MAJ–dam)	86	1934-2019	1895-1908	53,500	INF	1964	53,500	1964 HISTORICAL PERIOD
06089000.10	Sun River near Vaughn, Montana	R (MAJ–dam)	86	1934-2019	1909-1933	32,600	INF	1975	32,600	1975 HISTORICAL PERIOD
06102500.00	Teton River below South Fork, near Choteau, Montana	U	30	1948-1954, 1964, 1998-2019	1895-1947	54,600	INF	1964	54,600	1964 HISTORICAL PERIOD
06102500.00	Teton River below South Fork, near Choteau, Montana	U	30	1948-1954, 1964, 1998-2019	1955-1997	54,600	INF	1964	54,600	1964 HISTORICAL PERIOD
06102500.01	Teton River below South Fork, near Choteau, Montana	U	72	1948-2019	1895-1947	54,600	INF	1964	54,600	1964 HISTORICAL PERIOD
06103000.00	Teton River at Strabane, Montana	U	18	1908-1925	1895-1907	54,600	INF	1964	54,600	1964 HISTORICAL PERIOD
06103000.00	Teton River at Strabane, Montana	U	18	1908-1925	1926-2019	54,600	INF	1964	54,600	1964 HISTORICAL PERIOD
06106000.00	Deep Creek near Choteau, Montana	U	15	1911-1924, 1964	1895-1910	41,800	INF	1964	41,800	1964 HISTORICAL PERIOD
06106000.00	Deep Creek near Choteau, Montana	U	15	1911-1924, 1964	1925-2019	41,800	INF	1964	41,800	1964 HISTORICAL PERIOD
06106500.00	Muddy Creek near Bynum, Montana	U	10	1913-1918, 1920, 1922-1924	1919	976	INF	1916	976	1916 HISTORICAL PERIOD
06106500.00	Muddy Creek near Bynum, Montana	U	10	1913-1918, 1920, 1922-1924	1921	976	INF	1916	976	1916 HISTORICAL PERIOD
06107000.00	North Fork Muddy Creek near Bynum, Montana	U	11	1913-1917, 1919-1924	1918	600	INF	1916	600	1916 HISTORICAL PERIOD
06108000.00	Teton River near Dutton, Montana	U	65	1955-2019	1895-1954	71,300	INF	1964	71,300	1964 HISTORICAL PERIOD
06108000.01	Teton River near Dutton, Montana	U	72	1948-2019	1895-1947	71,300	INF	1964	71,300	1964 HISTORICAL PERIOD
06108800.00	Teton River at Loma, Montana	U	26	1929-1932, 1998-2019	1895-1928	81,300	INF	1964	81,300	1964 HISTORICAL PERIOD
06108800.00	Teton River at Loma, Montana	U	26	1929-1932, 1998-2019	1933-1997	81,300	INF	1964	81,300	1964 HISTORICAL PERIOD

Streamgage identification number and analysis designation[1]	Streamgage name	Regulation status for analysis[2]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Perception threshold period, in water years	Lower bound of perceptible range, in cubic feet per second	Upper bound of perceptible range, in cubic feet per second	Water year of peak flow used for historical perception threshold	Peak flow used for historical perception threshold, in cubic feet per second	Comments

[1]The streamgage identification number and analysis designation is defined by XXXXXXXX.AB,
where,
XXXXXXXX is the streamgage identification number;
A is the regulation status for the analysis period; and
B is the type of peak-flow frequency analysis.

Values of A (regulation status) are defined as:
A = 0, unregulated;
A = 1, regulated by major regulation; and
A = 2, total; that is, the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation (see footnote 2).

Values of B (type of peak-flow frequency analysis) are defined as:
B = 0, at-site peak-flow frequency analysis conducted on recorded data;
B = 1, peak-flow frequency analysis conducted on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
B = 2, peak-flow frequency analysis determined from regional regression equations (RREs); RRE frequency results not presented in this report; and
B = 3, at-site peak-flow frequency analysis weighted with results from RREs; distributional parameters not available for RRE weighted frequency analyses.

[2]Abbreviations for regulation status are defined as follows:
U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.
R (MAJ–dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
R (MAJ–canal): major diversion canal regulation, where a large diversion canal is known to be located on the channel upstream from the streamgage.
R (MIN–dams): minor dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage, but no single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
Total: the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation, . The "Total" peak-flow frequency analysis is provided in cases where major regulation affects less than 50 percent of the drainage area of the streamgage and there is uncertainty in the effects of regulation on specific peak-flow characteristics. Also, the "Total" peak-flow frequency analysis is the only peak-flow frequency analysis provided in cases of minor dam regulation.

Table 1–6. Documentation regarding the Maintenance of Variance Type III (MOVE.3) record extension procedure for selected streamgages.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. SEP, standard error of prediction, in percent; --, not applicable]

								Index streamgage(s) used for synthesis of peak streamflows								
Streamgage identification number	Streamgage Name	Contributing drainage area, in square miles	Number of recorded peak flows	Water years of recorded peak flows	Number of years requiring synthesis of peak flows	Water years requiring synthesis of peak flows	Percentage of record synthesized	Streamgage identification number	Streamgage Name	Contributing drainage area, in square miles	Number of peak flows synthesized based on this streamgage	Number of concurrent recorded peak flows for target and index streamgages	Pearson correlation coefficient for concurrent data for target and index streamgage	Weighted average Pearson correlation coefficient[1]	Estimated standard error of MOVE.3 analysis, in percent[2]	Effective record length for the synthesized peak flows
06080900	Sun River below Diversion Dam near Augusta, Montana	610	18	1964, 1968-1980, 2016-2019	68	1934-1963, 1965-1967, 1981-2015	79.1	06089000	Sun River near Vaughn, Montana	1,774	68	18	0.98	0.98	24.8	46.4
06082200	Sun River below Willow Creek near Augusta, Montana	814	16	1964, 1968-1975, 2013-2019	70	1934-1963, 1965-1967, 1976-2012	81.4	06085800	Sun River at Simms, Montana	1,296	22	16	0.99	0.99	20.7	19.1
								06089000	Sun River near Vaughn, Montana	1,774	48	16	0.98	0.99	20.7	36.3
06085800	Sun River at Simms, Montana	1,296	38	1964, 1966-1979, 1997-2019	48	1934-1963, 1965, 1980-1996	55.8	06089000	Sun River near Vaughn, Montana	1,774	48	38	0.99	0.99	18.6	41.7
06102500	Teton River below South Fork, near Choteau, Montana	110	30	1948-1954, 1964, 1998-2019	42	1955-1963, 1965-1997	58.3	06108000	Teton River near Dutton, Montana	1,238	42	23	0.92	0.92	56.1	18.8
06108000	Teton River near Dutton, Montana	1,238	65	1955-2019	7	1948-1954	9.7	06102500	Teton River below South Fork, near Choteau, Montana	110	7	23	0.92	0.92	89.8	4.5

[1]The weighted average Pearson correlation coefficient was determined by multiplying the number of peak flows synthesized based on an index streamgage times the Pearson correlation coefficient for the index streamgage for each index streamgage. The resultant products then were summed and divided by the total number of synthesized peak flows.

[2]A standard error was calculated based on an ordinary least squares (OLS) formulation of the analysis. That OLS standard error was adjusted to an estimated MOVE.3 formulation by multiplying times the following adjustment factor (Wilbert O. Thomas, Michael Baker International, written commun., November 2016):

$AF = 2/(1+\rho)$,

where,

AF is the adjustment factor; and

ρ is the weighted average Pearson correlation coefficient.

Table 1–7. Peak-flow frequency results.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. U, unregulated; R, regulated; --, not applicable; MOVE3, Maintenance of Variance Extension Type III record extension; RRE wtd, regional regression equation weighted]

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)	Annual peak flow, in cubic feet per second, for indicated annual exceedance probability, in percent										84 percent confidence level for the 1 percent annual exceedance probability peak flow	Analyses considered by U.S. Geological Survey to be most appropriate for flood-plain mapping purposes [4]
								66.7	50	42.9	20	10	4	2	1	0.5	0.2		
06078500.00	North Fork Sun River near Augusta, Montana	259	U	At-site	38	1911-1912, 1946-1968, 1989-1993, 2008-2009, 2014-2019	YES	--	2,840	2,900	3,600	4,950	8,390	13,200	21,200	35,000	69,400	35,600	YES
06078500.03	North Fork Sun River near Augusta, Montana	259	U	RRE wtd	--	--	--	--	2,840	2,900	3,610	5,090	9,470	13,000	17,800	24,400	36,700	19,800	--
06079000.00	South Fork Sun River near Augusta, Montana	251	U	At-site	11	1911-1912, 1964, 2008-2009, 2014-2019	YES	2,460	3,240	3,640	5,830	8,180	12,000	15,600	19,900	25,100	33,500	28,200	YES
06079000.03	South Fork Sun River near Augusta, Montana	251	U	RRE wtd	--	--	--	2,460	3,210	3,590	5,530	7,310	9,480	12,900	17,500	23,500	34,700	19,300	--
06079600.00	Beaver Creek at Gibson Dam, near Augusta, Montana	20.8	U	At-site	15	1959-1973	YES	68	109	134	301	542	1,060	1,670	2,560	3,850	6,410	4,590	YES
06079600.03	Beaver Creek at Gibson Dam, near Augusta, Montana	20.8	U	RRE wtd	--	--	--	77	126	156	365	678	1,350	2,030	3,020	4,480	7,460	3,490	--
06080000.00	Sun River near Augusta, Montana	609	U	At-site	27	1890, 1905-1929, 1964	YES	5,200	6,860	7,740	12,600	17,900	26,800	35,400	45,900	58,700	80,200	62,300	--
06080000.03	Sun River near Augusta, Montana	609	U	RRE wtd	--	--	--	5,200	6,840	7,700	12,200	16,500	19,600	26,000	34,100	44,600	63,300	38,600	--
06080900.10	Sun River below diversion dam, near Augusta, Montana	610	R (MAJ–dam)	At-site	18	1964, 1968-1980, 2016-2019	YES	3,760	4,700	5,220	8,300	12,100	19,100	26,600	36,800	50,500	76,000	53,000	--
06080900.11	Sun River below diversion dam, near Augusta, Montana	610	R (MAJ–dam)	MOVE3	86	1934-2019	YES	3,290	4,490	5,120	8,460	11,900	17,400	22,400	28,200	34,800	45,300	39,000	YES
06082200.10	Sun River below Willow Creek near Augusta, Montana	814	R (MAJ–dam)	At-site	16	1964, 1968-1975, 2013-2019	YES	2,940	4,240	4,960	8,960	13,500	21,100	28,300	37,100	47,800	65,200	49,300	--
06082200.11	Sun River below Willow Creek near Augusta, Montana	814	R (MAJ–dam)	MOVE3	86	1934-2019	YES	3,600	4,670	5,240	8,280	11,600	16,900	22,000	28,100	35,400	47,400	38,500	YES
06085800.10	Sun River at Simms, Montana	1,296	R (MAJ–dam)	At-site	38	1964, 1966-1979, 1997-2019	YES	3,010	4,300	5,000	8,940	13,400	20,800	28,000	36,800	47,400	64,800	49,400	--
06085800.11	Sun River at Simms, Montana	1,296	R (MAJ–dam)	MOVE3	86	1934-2019	YES	3,430	4,700	5,370	8,980	12,800	19,000	24,800	31,500	39,400	52,100	41,500	YES
06086000.00	Sun River at Fort Shaw, Montana	1,395	U	At-site	22	1906-1927	YES	5,540	6,980	7,710	11,400	15,200	20,800	25,800	31,500	38,000	48,100	46,000	--
06086000.03	Sun River at Fort Shaw, Montana	1,395	U	RRE wtd	--	--	--	5,430	6,790	7,490	10,900	14,300	19,700	24,700	30,600	37,800	49,300	42,500	--
06087900.00	Muddy Creek tributary near Power, Montana	3.81	U	At-site	16	1963-1978, 1986	--	74	124	153	328	536	890	1,220	1,620	2,100	2,830	3,490	--
06087900.03	Muddy Creek tributary near Power, Montana	3.81	U	RRE wtd	--	--	--	61	100	122	241	360	562	770	1,020	1,360	1,900	1,620	YES
06089000.10	Sun River near Vaughn, Montana	1,774	R (MAJ–dam)	At-site	86	1934-2019	YES	4,010	5,000	5,530	8,530	12,000	18,000	24,000	31,700	41,600	58,900	45,200	YES
06102500.00	Teton River below South Fork, near Choteau, Montana	110	U	At-site	30	1948-1954, 1964, 1998-2019	YES	544	760	895	1,900	3,580	7,950	14,300	25,400	45,000	94,500	52,000	--
06102500.01	Teton River below South Fork, near Choteau, Montana	110	U	MOVE3	72	1948-2019	YES	722	1,060	1,260	2,620	4,620	9,070	14,600	23,000	35,800	63,000	50,400	YES
06103000.00	Teton River at Strabane, Montana	124	U	At-site	18	1908-1925	YES	418	523	598	1,260	2,650	7,400	16,500	37,200	84,800	255,000	79,400	--
06103000.03	Teton River at Strabane, Montana	124	U	RRE wtd	--	--	--	424	556	655	1,560	3,180	7,460	13,500	22,700	36,600	63,600	39,800	YES
06105800.00	Bruce Coulee tributary near Choteau, Montana	1.84	U	At-site	40	1963-2002	--	28	44	53	108	174	293	413	565	755	1,080	954	--
06105800.03	Bruce Coulee tributary near Choteau, Montana	1.84	U	RRE wtd	--	--	--	27	43	52	105	170	287	405	550	736	1,040	813	YES
06106000.00	Deep Creek near Choteau, Montana	269	U	At-site	15	1911-1924, 1964	YES	357	607	764	1,910	3,680	7,770	12,900	20,800	32,500	57,100	38,700	YES
06106000.03	Deep Creek near Choteau, Montana	269	U	RRE wtd	--	--	--	356	600	751	1,780	3,200	6,070	9,350	13,800	20,100	32,000	21,100	--
06106500.00	Muddy Creek near Bynum, Montana	72.1	U	At-site	10	1913-1918, 1920, 1922-1924	YES	46	95	130	413	904	2,110	3,690	6,110	9,750	17,300	27,200	--
06106500.03	Muddy Creek near Bynum, Montana	72.1	U	RRE wtd	--	--	--	66	144	197	634	1,300	2,560	3,840	5,390	7,510	11,200	9,450	YES
06107000.00	North Fork Muddy Creek near Bynum, Montana	55.8	U	At-site	11	1913-1917, 1919-1924	YES	45	80	101	240	429	797	1,190	1,710	2,380	3,550	5,000	--
06107000.03	North Fork Muddy Creek near Bynum, Montana	55.8	U	RRE wtd	--	--	--	54	101	130	358	711	1,420	2,150	3,010	4,160	6,040	5,010	YES
06108000.00	Teton River near Dutton, Montana	1,238	U	At-site	65	1955-2019	YES	462	785	990	2,500	4,870	10,500	17,600	28,800	45,800	82,000	52,700	--
06108000.01	Teton River near Dutton, Montana	1,238	U	MOVE3	72	1948-2019	YES	466	785	986	2,440	4,710	9,960	16,600	26,800	42,100	74,500	48,800	YES
06108200.00	Kinley Coulee near Dutton, Montana	14.4	U	At-site	16	1963-1978	--	--	21	34	202	655	2,280	5,100	10,500	20,300	45,100	89,700	--
06108200.03	Kinley Coulee near Dutton, Montana	14.4	U	RRE wtd	--	--	--	--	31	46	176	358	708	1,100	1,610	2,340	3,700	2,810	YES
06108300.00	Kinley Coulee tributary near Dutton, Montana	2.96	U	At-site	16	1963-1978	--	3.7	9.9	15	72	210	667	1,420	2,820	5,320	11,600	16,600	--
06108300.03	Kinley Coulee tributary near Dutton, Montana	2.96	U	RRE wtd	--	--	--	5.4	14	20	79	167	335	515	743	1,060	1,630	1,290	YES
06108800.00	Teton River at Loma, Montana	1,900	U	At-site	26	1929-1932, 1998-2019	YES	321	610	801	2,310	4,850	11,000	19,200	31,800	51,200	92,400	60,400	YES
06108800.03	Teton River at Loma, Montana	1,900	U	RRE wtd	--	--	--	332	626	818	2,270	4,480	9,420	15,500	24,200	37,200	63,100	38,000	--

[1]The streamgage identification number and analysis designation is defined by XXXXXXXX.AB,
where,
XXXXXXXX is the streamgage identification number;
A is the regulation status for the analysis period; and
B is the type of peak-flow frequency analysis.

Values of A (regulation status) are defined as:
A = 0, unregulated;
A = 1, regulated by major regulation; and
A = 2, total; that is, the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation (see footnote 2).

Values of B (type of peak-flow frequency analysis) are defined as:
B = 0, at-site peak-flow frequency analysis conducted on recorded data;
B = 1, peak-flow frequency analysis conducted on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
B = 2, peak-flow frequency analysis determined from regional regression equations (RREs); RRE frequency results not presented in this report; and
B = 3, at-site peak-flow frequency analysis weighted with results from RREs; distributional parameters not available for RRE weighted frequency analyses.

[2]Abbreviations for regulation status are defined as follows:
U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.
R (MAJ–dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
R (MAJ–canal): major diversion canal regulation, where a large diversion canal is known to be located on the channel upstream from the streamgage.
R (MIN–dams): minor dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage, but no single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
Total: the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation, . The "Total" peak-flow frequency analysis is provided in cases where major regulation affects less than 50 percent of the drainage area of the streamgage and there is uncertainty in the effects of regulation on specific peak-flow characteristics. Also, the "Total" peak-flow frequency analysis is the only peak-flow frequency analysis provided in cases of minor dam regulation.

[3]Abbreviations for type of frequency analysis are defined as follows:
At-site: peak-flow frequency analysis on recorded data.
RRE wtd: the at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
MOVE.3: peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure.
[4] For a given streamgage, the "most appropriate analysis" was selected based on the professional judgements of two or more U. S. Geological Survey analysts. Efforts were made to maintain consistency in the selection process among different streamgages. Major factors considered in the selection process include: (1) the characteristics of the streamgage peak-flow dataset and hydroclimatic regime; and (2) the adequacy of representation of the streamgage peak-flow characteristics and hydroclimatic regime in the development of the regional regression equations (RREs). If a streamgage is affected by major dam regulation and the streamgage peak-flow dataset includes pre- and post-regulation data, the confidence in the determination of regulation effects on the peak flows also was considered in the selection process. If a Maintenance of Variance Extension Type III (MOVE.3) record extension analysis is presented for a streamgage, that analysis is considered "most appropriate." If only one analysis is presented for a streamgage, that analysis is considered "most appropriate."

Table 1–8. Variance of peak-flow frequency estimates.

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. U, unregulated; R, regulated; --, not applicable; MOVE3, Maintenance of Variance Extension Type III record extension; RRE wtd, regional regression equation weighted]

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)	Variance, in base 10 logarithm, for indicated annual exceedance probability, in percent: 66.7	50	42.9	20	10	4	2	1	0.5	0.2
06078500.00	North Fork Sun River near Augusta, Montana	259	U	At-site	38	1911-1912, 1946-1968, 1989-1993, 2008-2009, 2014-2019	YES	--	0.0027	0.0019	0.0007	0.0030	0.0099	0.0186	0.0313	0.0487	0.0800
06078500.03	North Fork Sun River near Augusta, Montana	259	U	RRE wtd	--	--	--	--	0.0026	0.0019	0.0007	0.0026	0.0009	0.0013	0.0019	0.0026	0.0038
06079000.00	South Fork Sun River near Augusta, Montana	251	U	At-site	11	1911-1912, 1964, 2008-2009, 2014-2019	YES	0.0082	0.0088	0.0092	0.0107	0.0123	0.0152	0.0183	0.0225	0.0278	0.0368
06079000.03	South Fork Sun River near Augusta, Montana	251	U	RRE wtd	--	--	--	0.0078	0.0081	0.0084	0.0087	0.0077	0.0009	0.0013	0.0018	0.0025	0.0036
06079600.00	Beaver Creek at Gibson Dam, near Augusta, Montana	20.8	U	At-site	15	1959-1973	YES	0.0161	0.0176	0.0184	0.0222	0.0264	0.0351	0.0450	0.0583	0.0753	0.1039
06079600.03	Beaver Creek at Gibson Dam, near Augusta, Montana	20.8	U	RRE wtd	--	--	--	0.0146	0.0152	0.0154	0.0150	0.0118	0.0018	0.0027	0.0038	0.0052	0.0075
06080000.00	Sun River near Augusta, Montana	609	U	At-site	27	1890, 1905-1929, 1964	YES	0.0033	0.0037	0.0039	0.0048	0.0059	0.0084	0.0114	0.0155	0.0208	0.0298
06080000.03	Sun River near Augusta, Montana	609	U	RRE wtd	--	--	--	0.0032	0.0036	0.0037	0.0044	0.0046	0.0013	0.0019	0.0028	0.0038	0.0056
06080900.10	Sun River below diversion dam, near Augusta, Montana	610	R (MAJ–dam)	At-site	18	1964, 1968-1980, 2016-2019	YES	0.0033	0.0056	0.0067	0.0091	0.0090	0.0098	0.0129	0.0196	0.0306	0.0527
06080900.11	Sun River below diversion dam, near Augusta, Montana	610	R (MAJ–dam)	MOVE3	86	1934-2019	YES	0.0013	0.0014	0.0014	0.0017	0.0023	0.0039	0.0060	0.0087	0.0123	0.0183
06082200.10	Sun River below Willow Creek near Augusta, Montana	814	R (MAJ–dam)	At-site	16	1964, 1968-1975, 2013-2019	YES	0.0102	0.0099	0.0099	0.0097	0.0095	0.0100	0.0114	0.0140	0.0180	0.0256
06082200.11	Sun River below Willow Creek near Augusta, Montana	814	R (MAJ–dam)	MOVE3	86	1934-2019	YES	0.0009	0.0010	0.0011	0.0016	0.0023	0.0041	0.0064	0.0097	0.0139	0.0212
06085800.10	Sun River at Simms, Montana	1,296	R (MAJ–dam)	At-site	38	1964, 1966-1979, 1997-2019	YES	0.0040	0.0041	0.0042	0.0048	0.0055	0.0074	0.0098	0.0133	0.0181	0.0264
06085800.11	Sun River at Simms, Montana	1,296	R (MAJ–dam)	MOVE3	86	1934-2019	YES	0.0014	0.0014	0.0015	0.0019	0.0025	0.0042	0.0063	0.0092	0.0128	0.0191
06086000.00	Sun River at Fort Shaw, Montana	1,395	U	At-site	22	1906-1927	YES	0.0027	0.0029	0.0030	0.0040	0.0055	0.0088	0.0124	0.0170	0.0228	0.0321
06086000.03	Sun River at Fort Shaw, Montana	1,395	U	RRE wtd	--	--	--	0.0027	0.0028	0.0029	0.0038	0.0050	0.0076	0.0104	0.0140	0.0185	0.0258
06087900.00	Muddy Creek tributary near Power, Montana	3.81	U	At-site	16	1963-1978, 1986	--	0.0205	0.0179	0.0176	0.0201	0.0258	0.0377	0.0501	0.0656	0.0840	0.1131
06087900.03	Muddy Creek tributary near Power, Montana	3.81	U	RRE wtd	--	--	--	0.0182	0.0154	0.0149	0.0152	0.0169	0.0208	0.0257	0.0322	0.0401	0.0538
06089000.10	Sun River near Vaughn, Montana	1,774	R (MAJ–dam)	At-site	86	1934-2019	YES	0.0006	0.0009	0.0011	0.0017	0.0025	0.0052	0.0092	0.0153	0.0238	0.0390
06102500.00	Teton River below South Fork, near Choteau, Montana	110	U	At-site	30	1948-1954, 1964, 1998-2019	YES	0.0050	0.0097	0.0118	0.0173	0.0206	0.0323	0.0514	0.0821	0.1263	0.2080
06102500.01	Teton River below South Fork, near Choteau, Montana	110	U	MOVE3	72	1948-2019	YES	0.0026	0.0034	0.0037	0.0052	0.0082	0.0169	0.0281	0.0437	0.0641	0.0991
06103000.00	Teton River at Strabane, Montana	124	U	At-site	18	1908-1925	YES	0.0060	0.0117	0.0154	0.0304	0.0384	0.0513	0.0707	0.1037	0.1538	0.2509
06103000.03	Teton River at Strabane, Montana	124	U	RRE wtd	--	--	--	0.0059	0.0110	0.0141	0.0237	0.0270	0.0332	0.0428	0.0580	0.0786	0.1147
06105800.00	Bruce Coulee tributary near Choteau, Montana	1.84	U	At-site	40	1963-2002	--	0.0057	0.0057	0.0058	0.0074	0.0104	0.0171	0.0243	0.0335	0.0448	0.0630
06105800.03	Bruce Coulee tributary near Choteau, Montana	1.84	U	RRE wtd	--	--	--	0.0055	0.0054	0.0055	0.0066	0.0086	0.0126	0.0167	0.0220	0.0285	0.0394
06106000.00	Deep Creek near Choteau, Montana	269	U	At-site	15	1911-1924, 1964	YES	0.0223	0.0242	0.0252	0.0298	0.0346	0.0444	0.0554	0.0703	0.0893	0.1215
06106000.03	Deep Creek near Choteau, Montana	269	U	RRE wtd	--	--	--	0.0197	0.0200	0.0202	0.0203	0.0205	0.0231	0.0276	0.0341	0.0424	0.0573
06106500.00	Muddy Creek near Bynum, Montana	72.1	U	At-site	10	1913-1918, 1920, 1922-1924	YES	0.0588	0.0560	0.0565	0.0689	0.0906	0.1337	0.1776	0.2315	0.2956	0.3964
06106500.03	Muddy Creek near Bynum, Montana	72.1	U	RRE wtd	--	--	--	0.0442	0.0382	0.0368	0.0338	0.0334	0.0368	0.0437	0.0536	0.0662	0.0887
06107000.00	North Fork Muddy Creek near Bynum, Montana	55.8	U	At-site	11	1913-1917, 1919-1924	YES	0.0323	0.0308	0.0312	0.0384	0.0505	0.0743	0.0984	0.1279	0.1629	0.2177
06107000.03	North Fork Muddy Creek near Bynum, Montana	55.8	U	RRE wtd	--	--	--	0.0271	0.0242	0.0238	0.0237	0.0248	0.0286	0.0344	0.0425	0.0526	0.0706
06108000.00	Teton River near Dutton, Montana	1,238	U	At-site	65	1955-2019	YES	0.0052	0.0059	0.0062	0.0081	0.0119	0.0215	0.0331	0.0488	0.0688	0.1022
06108000.01	Teton River near Dutton, Montana	1,238	U	MOVE3	72	1948-2019	YES	0.0046	0.0051	0.0054	0.0071	0.0106	0.0196	0.0304	0.0448	0.0632	0.0938
06108200.00	Kinley Coulee near Dutton, Montana	14.4	U	At-site	16	1963-1978	--	--	0.1048	0.0959	0.1116	0.1645	0.2658	0.3620	0.4743	0.6024	0.7964
06108200.03	Kinley Coulee near Dutton, Montana	14.4	U	RRE wtd	--	--	--	--	0.0540	0.0484	0.0397	0.0376	0.0398	0.0463	0.0561	0.0688	0.0917
06108300.00	Kinley Coulee tributary near Dutton, Montana	2.96	U	At-site	16	1963-1978	--	0.0769	0.0681	0.0687	0.0905	0.1259	0.1930	0.2601	0.3424	0.4406	0.5958
06108300.03	Kinley Coulee tributary near Dutton, Montana	2.96	U	RRE wtd	--	--	--	0.0526	0.0424	0.0405	0.0368	0.0353	0.0377	0.0440	0.0536	0.0658	0.0880
06108800.00	Teton River at Loma, Montana	1,900	U	At-site	26	1929-1932, 1998-2019	YES	0.0180	0.0187	0.0193	0.0229	0.0282	0.0398	0.0528	0.0700	0.0916	0.1274
06108800.03	Teton River at Loma, Montana	1,900	U	RRE wtd	--	--	--	0.0164	0.0162	0.0164	0.0172	0.0188	0.0232	0.0289	0.0367	0.0465	0.0634

Streamgage identification number and analysis designation[1]	Streamgage name	Contributing drainage area, in square miles	Regulation status for analysis[2]	Type of peak-flow frequency analysis[3]	Number of peak flows used in the analysis	Water years of peak flows used in the analysis	Frequency analysis incorporates historical information? (if Yes, see Table 1-5 for additional information)	Variance, in base 10 logarithm, for indicated annual exceedance probability, in percent									
								66.7	50	42.9	20	10	4	2	1	0.5	0.2

[1]The streamgage identification number and analysis designation is defined by XXXXXXXX.AB,
where,
XXXXXXXX is the streamgage identification number;
A is the regulation status for the analysis period; and
B is the type of peak-flow frequency analysis.

Values of A (regulation status) are defined as:
A = 0, unregulated;
A = 1, regulated by major regulation; and
A = 2, total; that is, the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation (see footnote 2).

Values of B (type of peak-flow frequency analysis) are defined as:
B = 0, at-site peak-flow frequency analysis conducted on recorded data;
B = 1, peak-flow frequency analysis conducted on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
B = 2, peak-flow frequency analysis determined from regional regression equations (RREs); RRE frequency results not presented in this report; and
B = 3, at-site peak-flow frequency analysis weighted with results from RREs; distributional parameters not available for RRE weighted frequency analyses.

[2]Abbreviations for regulation status are defined as follows:
U, unregulated, where the cumulative drainage area upstream from all dams is less than 20 percent of the drainage area of the streamgage.
R (MAJ–dam): major dam regulation, where a single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
R (MAJ–canal): major diversion canal regulation, where a large diversion canal is known to be located on the channel upstream from the streamgage.
R (MIN–dams): minor dam regulation, where the cumulative drainage area of all upstream dams exceeds 20 percent of the drainage area of the streamgage, but no single upstream dam has a drainage area that exceeds 20 percent of the drainage area of the streamgage.
Total: the combined unregulated and regulated peak-flow records for streamgages with peak-flow records before and after the start of regulation, . The "Total" peak-flow frequency analysis is provided in cases where major regulation affects less than 50 percent of the drainage area of the streamgage and there is uncertainty in the effects of regulation on specific peak-flow characteristics. Also, the "Total" peak-flow frequency analysis is the only peak-flow frequency analysis provided in cases of minor dam regulation.

[3]Abbreviations for type of frequency analysis are defined as follows:
At-site: peak-flow frequency analysis on recorded data.
RRE wtd: the at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
MOVE.3: peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure.

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06078500 North Fork Sun River near Augusta, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1905 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
259	38	Station	FIXED	2,720			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
--[3]	2,840	2,900	3,600	4,950	8,390	13,200	21,200	35,000	69,400
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
--[3]	3,190	3,220	4,610	7,160	16,300	31,600	61,200	120,000	302,000
--[3]	1,810	1,930	3,350	4,260	6,330	8,780	12,300	17,300	27,400

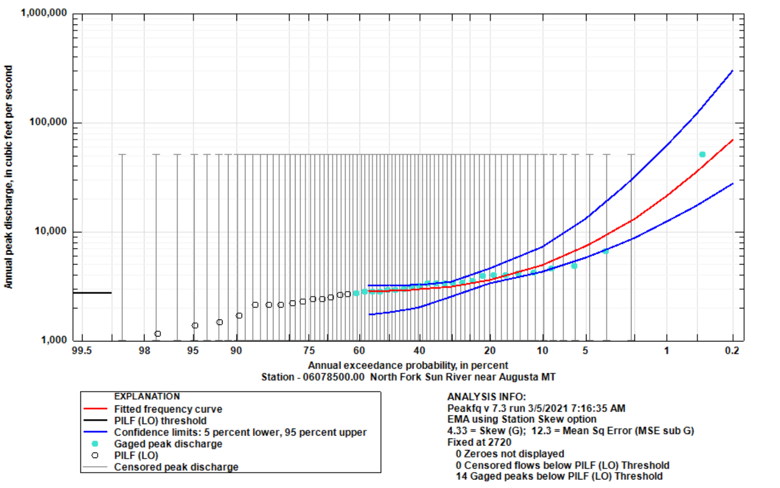

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

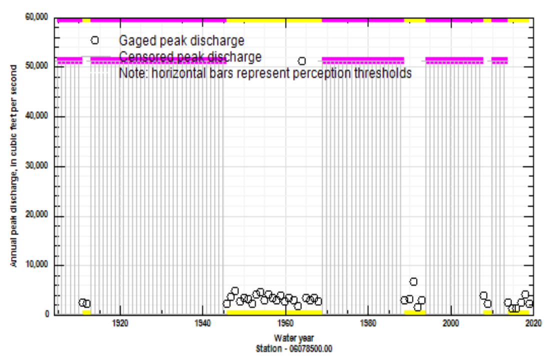

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:

England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.

Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06078500 North Fork Sun River near Augusta, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1905 - 2019
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1911	6/3/1911	2,390	--	--	PILF	1964	6/8/1964	51,100	--	15.82	
1912	5/20/1912	2,280	--	--	PILF	1991	5/19/1991	6,620	--	8.71	
1946	5/28/1946	2,190	--	--	PILF	1948	6/3/1948	4,840	--	7.03	
1947	5/9/1947	3,520	--	6.28		1954	5/20/1954	4,580	--	6.77	
1948	6/3/1948	4,840	--	7.03		1956	6/2/1956	4,170	--	6.73	
1949	5/15/1949	2,720	--	5.33		2018	5/8/2018	4,120	--	8.24	
1950	6/5/1950	3,340	--	6.00		1953	6/3/1953	3,990	--	6.44	
1951	6/16/1951	3,170	--	5.88		1959	6/15/1959	3,960	--	6.48	
1952	5/15/1952	2,140	--	5.11	PILF	2008	5/23/2008	3,920	--	6.49	
1953	6/3/1953	3,990	--	6.44		1947	5/9/1947	3,520	--	6.28	
1954	5/20/1954	4,580	--	6.77		1961	5/27/1961	3,400	--	6.07	
1955	5/21/1955	2,900	--	5.58		1965	6/11/1965	3,370	--	5.90	
1956	6/2/1956	4,170	--	6.73		1967	5/31/1967	3,370	--	6.31	
1957	5/21/1957	3,330	--	5.92		1950	6/5/1950	3,340	--	6.00	
1958	6/10/1958	2,830	--	5.61		1957	5/21/1957	3,330	--	5.92	
1959	6/15/1959	3,960	--	6.48		1951	6/16/1951	3,170	--	5.88	
1960	6/4/1960	2,660	--	5.63	PILF	1990	11/11/1989	3,100	--	5.64	
1961	5/27/1961	3,400	--	6.07		1989	5/11/1989	2,950	--	5.48	
1962	5/25/1962	2,830	--	5.71		1993	5/15/1993	2,920	--	5.13	
1963	6/5/1963	1,680	--	4.56	PILF	1955	5/21/1955	2,900	--	5.58	
1964	6/8/1964	51,100	--	15.82		1958	6/10/1958	2,830	--	5.61	
1965	6/11/1965	3,370	--	5.90		1962	5/25/1962	2,830	--	5.71	
1966	5/29/1966	2,810	--	5.50		1966	5/29/1966	2,810	--	5.50	
1967	5/31/1967	3,370	--	6.31		1949	5/15/1949	2,720	--	5.33	
1968	6/3/1968	2,600	--	5.17	PILF	1960	6/4/1960	2,660	--	5.63	PILF
1989	5/11/1989	2,950	--	5.48		1968	6/3/1968	2,600	--	5.17	PILF
1990	11/11/1989	3,100	--	5.64		2014	5/24/2014	2,470	--	4.97	PILF
1991	5/19/1991	6,620	--	8.71		1911	6/3/1911	2,390	--	--	PILF
1992	4/30/1992	1,470	--	3.57	PILF	2017	5/6/2017	2,380	--	7.18	PILF
1993	5/15/1993	2,920	--	5.13		1912	5/20/1912	2,280	--	--	PILF
2008	5/23/2008	3,920	--	6.49		1946	5/28/1946	2,190	--	--	PILF
2009	5/31/2009	2,110	--	4.57	PILF	1952	5/15/1952	2,140	--	5.11	PILF
2014	5/24/2014	2,470	--	4.97	PILF	2019	5/26/2019	2,140	--	6.72	PILF
2015	3/16/2015	1,380	--	6.15	PILF	2009	5/31/2009	2,110	--	4.57	PILF
2016	5/9/2016	1,160	--	5.86	PILF	1963	6/5/1963	1,680	--	4.56	PILF
2017	5/6/2017	2,380	--	7.18	PILF	1992	4/30/1992	1,470	--	3.57	PILF
2018	5/8/2018	4,120	--	8.24		2015	3/16/2015	1,380	--	6.15	PILF
2019	5/26/2019	2,140	--	6.72	PILF	2016	5/9/2016	1,160	--	5.86	PILF

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06078500 North Fork Sun River near Augusta, Montana

Analysis for unregulated period of record

Analysis period of record, water years: 1905 - 2019

At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
259			FIXED	2,720			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
--[3]	2,840	2,900	3,610	5,090	9,470	13,000	17,800	24,400	36,700
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
--[3]	3,190	3,220	4,580	6,910	10,600	15,000	21,100	29,600	46,500
--[3]	1,860	1,980	3,360	4,410	8,500	11,400	15,200	20,100	29,100

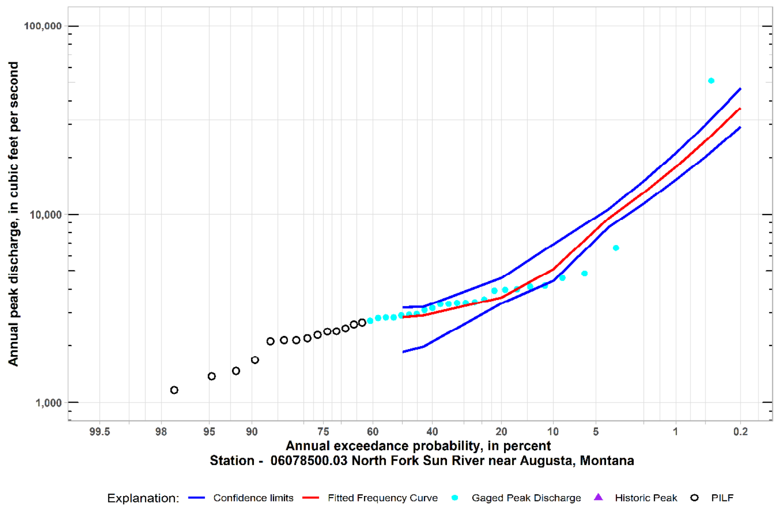

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06078500 North Fork Sun River near Augusta, Montana

Analysis for unregulated period of record

Analysis period of record, water years: 1905 - 2019

At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1911	6/3/1911	2,390	--	--	PILF	1964	6/8/1964	51,100	--	15.82	
1912	5/20/1912	2,280	--	--	PILF	1991	5/19/1991	6,620	--	8.71	
1946	5/28/1946	2,190	--	--	PILF	1948	6/3/1948	4,840	--	7.03	
1947	5/9/1947	3,520	--	6.28		1954	5/20/1954	4,580	--	6.77	
1948	6/3/1948	4,840	--	7.03		1956	6/2/1956	4,170	--	6.73	
1949	5/15/1949	2,720	--	5.33		2018	5/8/2018	4,120	--	8.24	
1950	6/5/1950	3,340	--	6.00		1953	6/3/1953	3,990	--	6.44	
1951	6/16/1951	3,170	--	5.88		1959	6/15/1959	3,960	--	6.48	
1952	5/15/1952	2,140	--	5.11	PILF	2008	5/23/2008	3,920	--	6.49	
1953	6/3/1953	3,990	--	6.44		1947	5/9/1947	3,520	--	6.28	
1954	5/20/1954	4,580	--	6.77		1961	5/27/1961	3,400	--	6.07	
1955	5/21/1955	2,900	--	5.58		1965	6/11/1965	3,370	--	5.90	
1956	6/2/1956	4,170	--	6.73		1967	5/31/1967	3,370	--	6.31	
1957	5/21/1957	3,330	--	5.92		1950	6/5/1950	3,340	--	6.00	
1958	6/10/1958	2,830	--	5.61		1957	5/21/1957	3,330	--	5.92	
1959	6/15/1959	3,960	--	6.48		1951	6/16/1951	3,170	--	5.88	
1960	6/4/1960	2,660	--	5.63	PILF	1990	11/11/1989	3,100	--	5.64	
1961	5/27/1961	3,400	--	6.07		1989	5/11/1989	2,950	--	5.48	
1962	5/25/1962	2,830	--	5.71		1993	5/15/1993	2,920	--	5.13	
1963	6/5/1963	1,680	--	4.56	PILF	1955	5/21/1955	2,900	--	5.58	
1964	6/8/1964	51,100	--	15.82		1958	6/10/1958	2,830	--	5.61	
1965	6/11/1965	3,370	--	5.90		1962	5/25/1962	2,830	--	5.71	
1966	5/29/1966	2,810	--	5.50		1966	5/29/1966	2,810	--	5.50	
1967	5/31/1967	3,370	--	6.31		1949	5/15/1949	2,720	--	5.33	
1968	6/3/1968	2,600	--	5.17	PILF	1960	6/4/1960	2,660	--	5.63	PILF
1989	5/11/1989	2,950	--	5.48		1968	6/3/1968	2,600	--	5.17	PILF
1990	11/11/1989	3,100	--	5.64		2014	5/24/2014	2,470	--	4.97	PILF
1991	5/19/1991	6,620	--	8.71		1911	6/3/1911	2,390	--	--	PILF
1992	4/30/1992	1,470	--	3.57	PILF	2017	5/6/2017	2,380	--	7.18	PILF
1993	5/15/1993	2,920	--	5.13		1912	5/20/1912	2,280	--	--	PILF
2008	5/23/2008	3,920	--	6.49		1946	5/28/1946	2,190	--	--	PILF
2009	5/31/2009	2,110	--	4.57	PILF	1952	5/15/1952	2,140	--	5.11	PILF
2014	5/24/2014	2,470	--	4.97	PILF	2019	5/26/2019	2,140	--	6.72	PILF
2015	3/16/2015	1,380	--	6.15	PILF	2009	5/31/2009	2,110	--	4.57	PILF
2016	5/9/2016	1,160	--	5.86	PILF	1963	6/5/1963	1,680	--	4.56	PILF
2017	5/6/2017	2,380	--	7.18	PILF	1992	4/30/1992	1,470	--	3.57	PILF
2018	5/8/2018	4,120	--	8.24		2015	3/16/2015	1,380	--	6.15	PILF
2019	5/26/2019	2,140	--	6.72	PILF	2016	5/9/2016	1,160	--	5.86	PILF

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:

England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

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06079000 South Fork Sun River near Augusta, Montana

Analysis for unregulated period of record

Analysis period of record, water years: 1905 - 2019

At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
251	11	Weighted	MGBT	--			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
2,460	3,240	3,640	5,830	8,180	12,000	15,600	19,900	25,100	33,500
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
3,600	4,770	5,390	8,740	12,400	19,000	26,000	35,900	49,900	78,100
1,720	2,260	2,540	3,920	5,280	7,310	9,070	11,100	13,300	16,800

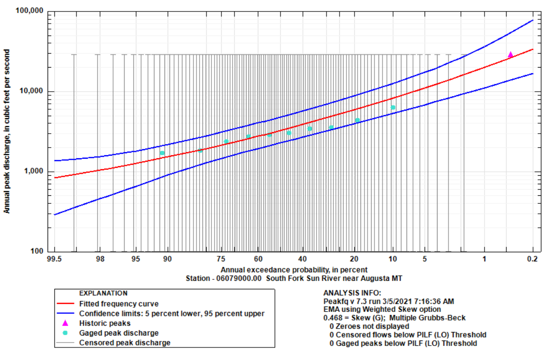

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

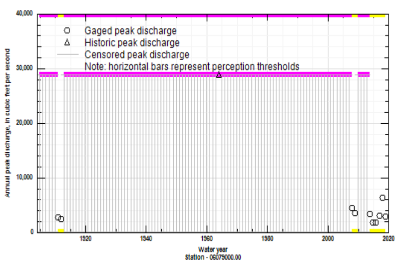

Figure 2. Annual peak flows and perception thresholds.

06079000 South Fork Sun River near Augusta, Montana

Analysis for unregulated period of record

Analysis period of record, water years: 1905 - 2019

At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1911	6/3/1911	2,740	1	--		1964	6/8/1964	28,800	7	--	Historic
1912	5/20/1912	2,350	1	--		2018	6/19/2018	6,330	--	7.34	
1964	6/8/1964	28,800	7	--	Historic	2008	5/19/2008	4,370	--	6.35	
2008	5/19/2008	4,370	--	6.35		2009	6/1/2009	3,550	--	5.81	
2009	6/1/2009	3,550	--	5.81		2014	5/24/2014	3,380	--	5.69	
2014	5/24/2014	3,380	--	5.69		2017	6/2/2017	3,000	--	5.36	
2015	6/2/2015	1,810	--	4.36		2019	5/27/2019	2,870	--	5.26	
2016	5/9/2016	1,710	--	4.25		1911	6/3/1911	2,740	1	--	
2017	6/2/2017	3,000	--	5.36		1912	5/20/1912	2,350	1	--	
2018	6/19/2018	6,330	--	7.34		2015	6/2/2015	1,810	--	4.36	
2019	5/27/2019	2,870	--	5.26		2016	5/9/2016	1,710	--	4.25	

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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
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PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

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England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.

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06079000 South Fork Sun River near Augusta, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1905 - 2019
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
251			MGBT	--			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
2,460	3,210	3,590	5,530	7,310	9,480	12,900	17,500	23,500	34,700
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
3,550	4,640	5,190	7,930	10,200	10,600	14,800	20,500	28,400	43,600
1,730	2,270	2,540	3,870	5,200	8,480	11,300	14,800	19,500	27,700

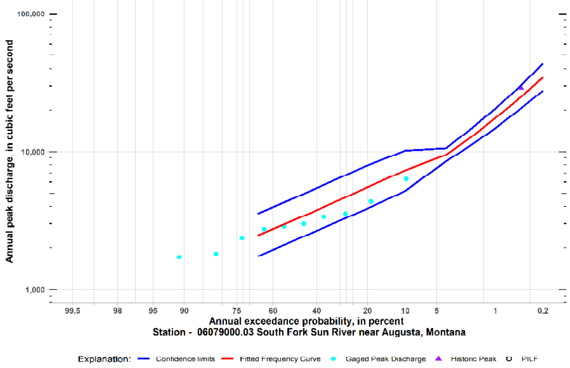

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06079000 South Fork Sun River near Augusta, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1905 - 2019
At-site peak flow frequency analysis weighted with regional regression equations

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1912	5/20/1912	2,350	1	--		2018	6/19/2018	6,330	--	7.34	
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2008	5/19/2008	4,370	--	6.35		2009	6/1/2009	3,550	--	5.81	
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2014	5/24/2014	3,380	--	5.69		2017	6/2/2017	3,000	--	5.36	
2015	6/2/2015	1,810	--	4.36		2019	5/27/2019	2,870	--	5.26	
2016	5/9/2016	1,710	--	4.25		1911	6/3/1911	2,740	1	--	
2017	6/2/2017	3,000	--	5.36		1912	5/20/1912	2,350	1	--	
2018	6/19/2018	6,330	--	7.34		2015	6/2/2015	1,810	--	4.36	
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06079600 Beaver Creek at Gibson Dam, near Augusta, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1917 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

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Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
20.8	15	Weighted	MGBT	--			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
68	109	134	301	542	1,060	1,670	2,560	3,850	6,410
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
115	188	232	542	1,020	2,180	3,880	6,970	12,700	28,400
42	66	80	171	290	513	745	1,050	1,440	2,130

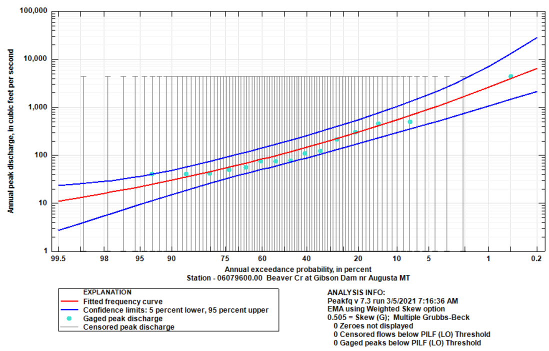

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

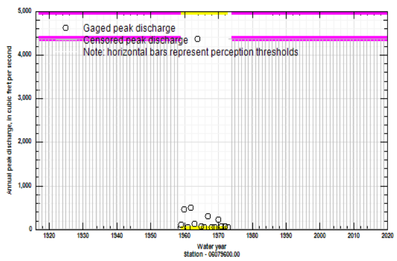

Figure 2. Annual peak flows and perception thresholds.

06079600 Beaver Creek at Gibson Dam, near Augusta, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1917 - 2019
At-site peak-flow frequency analysis conducted on recorded data

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Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1959	6/6/1959	110	--	0.78		1964	6/8/1964	4,360	--	--	
1960	5/12/1960	458	--	2.28		1962	5/26/1962	496	--	2.45	
1961	5/7/1961	55	--	0.37		1960	5/12/1960	458	--	2.28	
1962	5/26/1962	496	--	2.45		1967	5/30/1967	300	--	1.16	
1963	5/25/1963	122	--	0.85		1970	5/11/1970	215	--	0.93	
1964	6/8/1964	4,360	--	--		1963	5/25/1963	122	--	0.85	
1965	6/11/1965	75	--	0.71		1959	6/6/1959	110	--	0.78	
1966	5/29/1966	40	--	0.41		1972	5/15/1972	76	--	0.48	
1967	5/30/1967	300	--	1.16		1965	6/11/1965	75	--	0.71	
1968	--	50	2,Bd	1.16		1971	6/3/1971	75	--	0.51	
1969	--	42	Bd	0.42		1961	5/7/1961	55	--	0.37	
1970	5/11/1970	215	--	0.93		1968	--	50	2,Bd	1.16	
1971	6/3/1971	75	--	0.51		1969	--	42	Bd	0.42	
1972	5/15/1972	76	--	0.48		1966	5/29/1966	40	--	0.41	
1973	3/17/1973	40	--	0.78		1973	3/17/1973	40	--	0.78	

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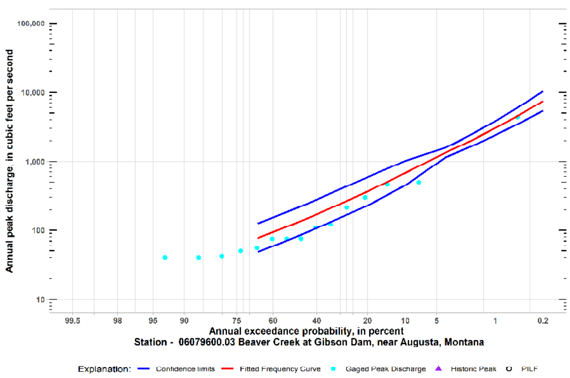
Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
20.8			MGBT	--			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
77	126	156	365	678	1,350	2,030	3,020	4,480	7,460
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
126	206	255	588	1,020	1,590	2,470	3,820	5,900	10,400
48	79	98	230	448	1,150	1,670	2,390	3,410	5,390



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1960	5/12/1960	458	--	2.28		1962	5/26/1962	496	--	2.45	
1961	5/7/1961	55	--	0.37		1960	5/12/1960	458	--	2.28	
1962	5/26/1962	496	--	2.45		1967	5/30/1967	300	--	1.16	
1963	5/25/1963	122	--	0.85		1970	5/11/1970	215	--	0.93	
1964	6/8/1964	4,360	--	--		1963	5/25/1963	122	--	0.85	
1965	6/11/1965	75	--	0.71		1959	6/6/1959	110	--	0.78	
1966	5/29/1966	40	--	0.41		1972	5/15/1972	76	--	0.48	
1967	5/30/1967	300	--	1.16		1965	6/11/1965	75	--	0.71	
1968	--	50	2,Bd	1.16		1971	6/3/1971	75	--	0.51	
1969	--	42	Bd	0.42		1961	5/7/1961	55	--	0.37	
1970	5/11/1970	215	--	0.93		1968	--	50	2,Bd	1.16	
1971	6/3/1971	75	--	0.51		1969	--	42	Bd	0.42	
1972	5/15/1972	76	--	0.48		1966	5/29/1966	40	--	0.41	
1973	3/17/1973	40	--	0.78		1973	3/17/1973	40	--	0.78	

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PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

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06080000 Sun River near Augusta, Montana

Analysis for unregulated period of record

Analysis period of record, water years: 1890 - 2019

At-site peak-flow frequency analysis conducted on recorded data

Table 1-1   Table 1-2   Table 1-3   Table 1-4   Table 1-5   Table 1-6   Table 1-7   Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
609	27	Weighted	MGBT	--			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
5,200	6,860	7,740	12,600	17,900	26,800	35,400	45,900	58,700	80,200
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
6,560	8,740	9,910	16,500	24,200	38,600	54,900	78,400	112,000	182,000
4,180	5,450	6,110	9,680	13,400	19,000	23,900	29,500	35,800	45,400

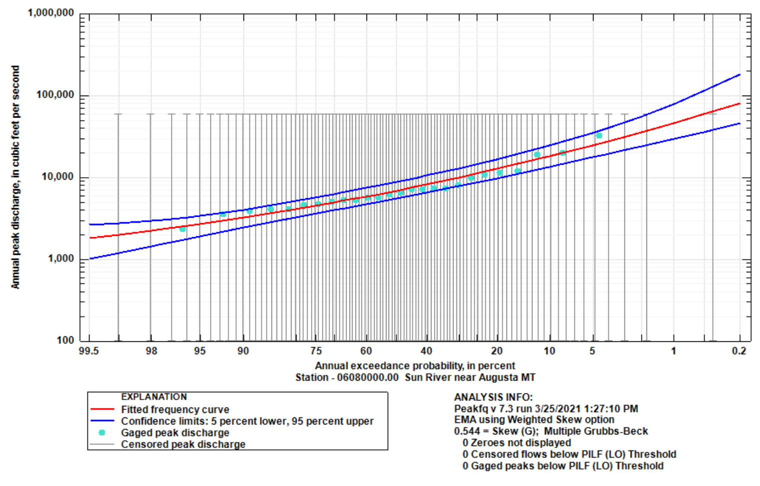

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

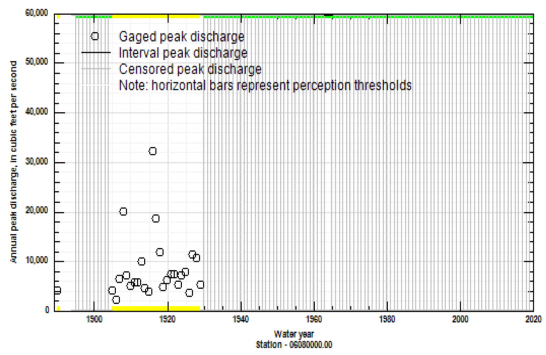

Figure 2. Annual peak flows and perception thresholds.

06080000 Sun River near Augusta, Montana

Analysis for unregulated period of record

Analysis period of record, water years: 1890 - 2019

At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1890	5/9/1890	4,080	--	--		1964	6/9/1964	59,700	7	15.70	Historic
1905	6/6/1905	4,070	--	--		1916	6/21/1916	32,300	--	11.40	
1906	6/5/1906	2,320	--	--		1908	6/7/1908	20,000	--	--	
1907	6/2/1907	6,530	--	--		1917	5/25/1917	18,700	--	8.20	
1908	6/7/1908	20,000	--	--		1918	6/10/1918	11,900	--	6.02	
1909	6/3/1909	7,030	--	--		1927	6/9/1927	11,400	--	5.95	
1910	5/8/1910	5,040	--	--		1928	5/23/1928	10,700	--	5.60	
1911	6/15/1911	5,690	--	--		1913	5/24/1913	9,830	--	--	
1912	5/21/1912	5,670	--	--		1925	5/20/1925	7,920	--	4.60	
1913	5/24/1913	9,830	--	--		1922	6/5/1922	7,350	--	4.40	
1914	5/17/1914	4,570	--	--		1921	5/26/1921	7,280	--	4.40	
1915	5/1/1915	3,850	--	--		1924	5/15/1924	7,150	--	4.40	
1916	6/21/1916	32,300	--	11.40		1909	6/3/1909	7,030	--	--	
1917	5/25/1917	18,700	--	8.20		1907	6/2/1907	6,530	--	--	
1918	6/10/1918	11,900	--	6.02		1920	6/15/1920	6,130	--	3.90	
1919	5/28/1919	4,670	--	3.40		1911	6/15/1911	5,690	--	--	
1920	6/15/1920	6,130	--	3.90		1912	5/21/1912	5,670	--	--	
1921	5/26/1921	7,280	--	4.40		1929	5/24/1929	5,290	--	3.60	
1922	6/5/1922	7,350	--	4.40		1923	6/12/1923	5,250	--	3.60	
1923	6/12/1923	5,250	--	3.60		1910	5/8/1910	5,040	--	--	
1924	5/15/1924	7,150	--	4.40		1919	5/28/1919	4,670	--	3.40	
1925	5/20/1925	7,920	--	4.60		1914	5/17/1914	4,570	--	--	
1926	4/30/1926	3,540	--	2.80		1890	5/9/1890	4,080	--	--	
1927	6/9/1927	11,400	--	5.95		1905	6/6/1905	4,070	--	--	
1928	5/23/1928	10,700	--	5.60		1915	5/1/1915	3,850	--	--	
1929	5/24/1929	5,290	--	3.60		1926	4/30/1926	3,540	--	2.80	
1964	6/9/1964	59,700	7	15.70	Historic	1906	6/5/1906	2,320	--	--	

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.

[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).

[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.

[4]Peak-flow data with a value of zero are not plotted in figures.

[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.

[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help

[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Combined: The peak flow was recorded at a closely located streamgage on the same channel. Information on combining records of multiple streamgages is presented in table 1–2;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

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06080000 Sun River near Augusta, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1890 - 2019
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
609			MGBT	--			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
5,200	6,840	7,700	12,200	16,500	19,600	26,000	34,100	44,600	63,300
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
6,540	8,680	9,810	15,800	21,500	22,600	30,700	41,900	56,700	84,800
4,190	5,460	6,110	9,530	12,800	17,100	22,000	28,000	35,500	48,200

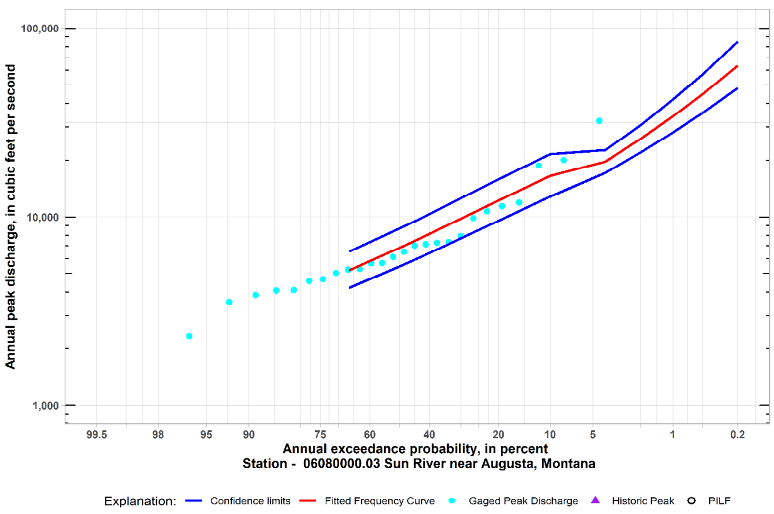

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06080000 Sun River near Augusta, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1890 - 2019
At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1890	5/9/1890	4,080	--	--		1964	6/9/1964	59,700	7	15.70	Historic
1905	6/6/1905	4,070	--	--		1916	6/21/1916	32,300	--	11.40	
1906	6/5/1906	2,320	--	--		1908	6/7/1908	20,000	--	--	
1907	6/2/1907	6,530	--	--		1917	5/25/1917	18,700	--	8.20	
1908	6/7/1908	20,000	--	--		1918	6/10/1918	11,900	--	6.02	
1909	6/3/1909	7,030	--	--		1927	6/9/1927	11,400	--	5.95	
1910	5/8/1910	5,040	--	--		1928	5/23/1928	10,700	--	5.60	
1911	6/15/1911	5,690	--	--		1913	5/24/1913	9,830	--	--	
1912	5/21/1912	5,670	--	--		1925	5/20/1925	7,920	--	4.60	
1913	5/24/1913	9,830	--	--		1922	6/5/1922	7,350	--	4.40	
1914	5/17/1914	4,570	--	--		1921	5/26/1921	7,280	--	4.40	
1915	5/1/1915	3,850	--	--		1924	5/15/1924	7,150	--	4.40	
1916	6/21/1916	32,300	--	11.40		1909	6/3/1909	7,030	--	--	
1917	5/25/1917	18,700	--	8.20		1907	6/2/1907	6,530	--	--	
1918	6/10/1918	11,900	--	6.02		1920	6/15/1920	6,130	--	3.90	
1919	5/28/1919	4,670	--	3.40		1911	6/15/1911	5,690	--	--	
1920	6/15/1920	6,130	--	3.90		1912	5/21/1912	5,670	--	--	
1921	5/26/1921	7,280	--	4.40		1929	5/24/1929	5,290	--	3.60	
1922	6/5/1922	7,350	--	4.40		1923	6/12/1923	5,250	--	3.60	
1923	6/12/1923	5,250	--	3.60		1910	5/8/1910	5,040	--	--	
1924	5/15/1924	7,150	--	4.40		1919	5/28/1919	4,670	--	3.40	
1925	5/20/1925	7,920	--	4.60		1914	5/17/1914	4,570	--	--	
1926	4/30/1926	3,540	--	2.80		1890	5/9/1890	4,080	--	--	
1927	6/9/1927	11,400	--	5.95		1905	6/6/1905	4,070	--	--	
1928	5/23/1928	10,700	--	5.60		1915	5/1/1915	3,850	--	--	
1929	5/24/1929	5,290	--	3.60		1926	4/30/1926	3,540	--	2.80	
1964	6/9/1964	59,700	7	15.70	Historic	1906	6/5/1906	2,320	--	--	

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).

[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.

[4]Peak-flow data with a value of zero are not plotted in figures.

[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.

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06080900 Sun River below diversion dam, near Augusta, Montana
Analysis for regulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
610	18	Station	FIXED	2,620			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
3,760	4,700	5,220	8,300	12,100	19,100	26,600	36,800	50,500	76,000
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
5,260	6,660	7,420	11,800	17,000	28,000	43,300	71,800	126,000	279,000
3,060	3,670	3,940	5,650	8,090	12,900	17,700	23,200	29,500	38,800

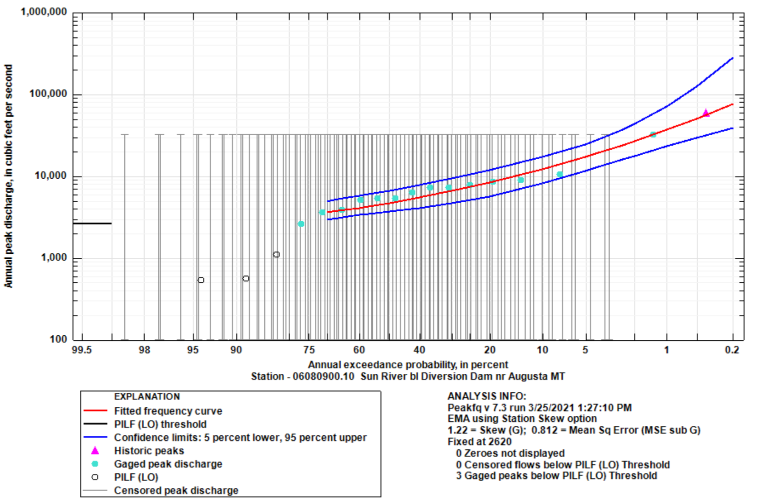

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

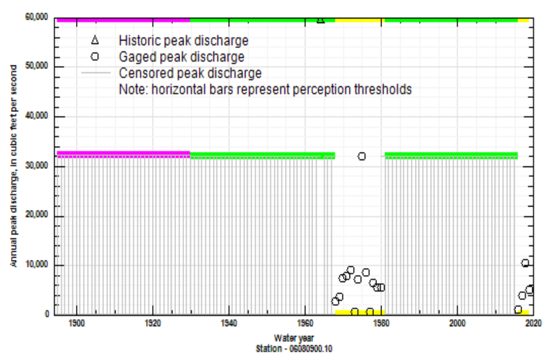

Figure 2. Annual peak flows and perception thresholds.

06080900 Sun River below diversion dam, near Augusta, Montana
Analysis for regulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1964	6/9/1964	59,700	5,7	--	Historic	1964	6/9/1964	59,700	5,7	--	Historic
1968	6/10/1968	2,620	5	7.59		1975	6/19/1975	32,000	5	19.00	
1969	6/6/1969	3,630	5	8.04		2018	6/19/2018	10,500	5	11.96	
1970	6/5/1970	7,350	5	10.01		1972	6/2/1972	8,910	2,5	11.35	
1971	5/29/1971	7,820	5	10.78		1976	5/14/1976	8,470	5	11.11	
1972	6/2/1972	8,910	2,5	11.35		1971	5/29/1971	7,820	5	10.78	
1973	5/30/1973	562	5	5.14	PILF	1970	6/5/1970	7,350	5	10.01	
1974	6/17/1974	7,210	5	10.08		1974	6/17/1974	7,210	5	10.08	
1975	6/19/1975	32,000	5	19.00		1978	6/7/1978	6,330	5	9.96	
1976	5/14/1976	8,470	5	11.11		1980	5/26/1980	5,430	5	9.36	
1977	5/12/1977	536	5	4.92	PILF	1979	5/27/1979	5,380	5	9.38	
1978	6/7/1978	6,330	5	9.96		2019	5/27/2019	5,070	5	9.06	
1979	5/27/1979	5,380	5	9.38		2017	6/2/2017	3,840	5	8.30	
1980	5/26/1980	5,430	5	9.36		1969	6/6/1969	3,630	5	8.04	
2016	5/28/2016	1,110	5	5.74	PILF	1968	6/10/1968	2,620	5	7.59	
2017	6/2/2017	3,840	5	8.30		2016	5/28/2016	1,110	5	5.74	PILF
2018	6/19/2018	10,500	5	11.96		1973	5/30/1973	562	5	5.14	PILF
2019	5/27/2019	5,070	5	9.06		1977	5/12/1977	536	5	4.92	PILF

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.

[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).

[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.

[4]Peak-flow data with a value of zero are not plotted in figures.

[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.

[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
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[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Combined: The peak flow was recorded at a closely located streamgage on the same channel. Information on combining records of multiple streamgages is presented in table 1–2;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

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06080900 Sun River below diversion dam, near Augusta, Montana

Analysis for regulated period of record

Analysis period of record, water years: 1895 - 2019

Peak-flow frequency analysis conducted on recorded and synthesized data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second	Type of peak-flow frequency analysis[2]				
610	86	Station	MGBT	1,510	MOVE3				
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
3,290	4,490	5,120	8,460	11,900	17,400	22,400	28,200	34,800	45,300
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
3,950	5,420	6,200	10,500	15,500	25,200	36,200	51,400	72,400	113,000
2,710	3,690	4,200	6,850	9,420	13,000	15,800	18,700	21,600	25,400

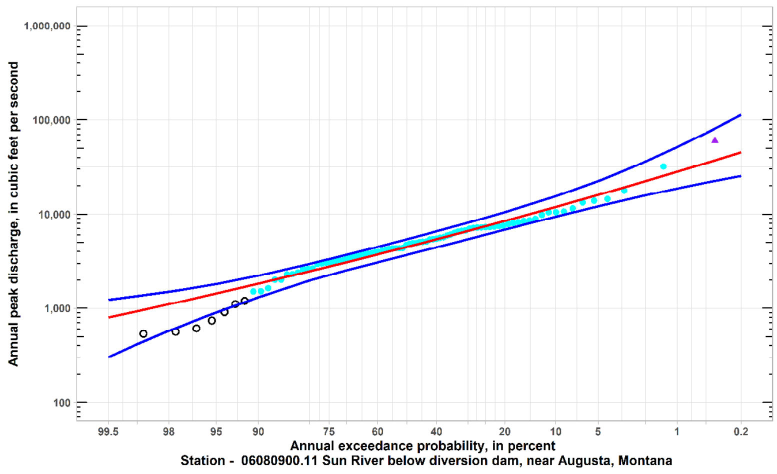

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

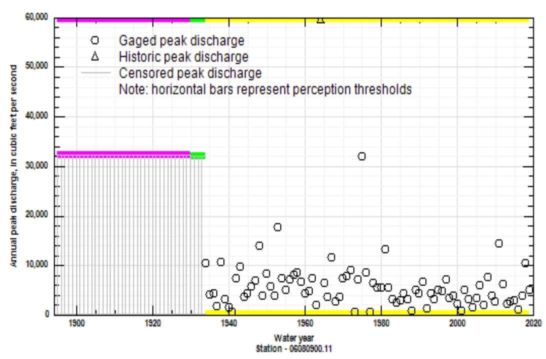

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.

[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).

[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.

[4]Peak-flow data with a value of zero are not plotted in figures.

[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.

[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help

[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Combined: The peak flow was recorded at a closely located streamgage on the same channel. Information on combining records of multiple streamgages is presented in table 1–2;
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Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06080900 Sun River below diversion dam, near Augusta, Montana

Analysis for regulated period of record

Analysis period of record, water years: 1895 - 2019

Peak-flow frequency analysis conducted on recorded and synthesized data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1934	--	10,500	--	--	Synthesized	1964	6/9/1964	59,700	5,7	--	Historic
1935	--	4,100	--	--	Synthesized	1975	6/19/1975	32,000	5	19.00	
1936	--	4,350	--	--	Synthesized	1953	--	17,700	--	--	Synthesized
1937	--	1,640	--	--	Synthesized	2011	--	14,500	--	--	Synthesized
1938	--	10,700	--	--	Synthesized	1948	--	13,900	--	--	Synthesized
1939	--	3,110	--	--	Synthesized	1981	--	13,300	--	--	Synthesized
1940	--	1,520	--	--	Synthesized	1967	--	11,500	--	--	Synthesized
1941	--	612	--	--	PILF, Synthesized	1938	--	10,700	--	--	Synthesized
1942	--	7,260	--	--	Synthesized	1934	--	10,500	--	--	Synthesized
1943	--	9,800	--	--	Synthesized	2018	6/19/2018	10,500	5	11.96	
1944	--	3,600	--	--	Synthesized	1943	--	9,800	--	--	Synthesized
1945	--	4,350	--	--	Synthesized	1972	6/2/1972	8,910	2,5	11.35	
1946	--	5,620	--	--	Synthesized	1958	--	8,580	--	--	Synthesized
1947	--	7,000	--	--	Synthesized	1976	5/14/1976	8,470	5	11.11	
1948	--	13,900	--	--	Synthesized	1950	--	8,180	--	--	Synthesized
1949	--	3,960	--	--	Synthesized	1957	--	8,020	--	--	Synthesized
1950	--	8,180	--	--	Synthesized	1971	5/29/1971	7,820	5	10.78	
1951	--	5,690	--	--	Synthesized	2008	--	7,540	--	--	Synthesized
1952	--	3,760	--	--	Synthesized	1962	--	7,470	--	--	Synthesized
1953	--	17,700	--	--	Synthesized	1970	6/5/1970	7,350	5	10.01	
1954	--	7,300	--	--	Synthesized	1954	--	7,300	--	--	Synthesized
1955	--	4,940	--	--	Synthesized	1942	--	7,260	--	--	Synthesized
1956	--	7,140	--	--	Synthesized	1974	6/17/1974	7,210	5	10.08	
1957	--	8,020	--	--	Synthesized	1997	--	7,180	--	--	Synthesized
1958	--	8,580	--	--	Synthesized	1956	--	7,140	--	--	Synthesized
1959	--	6,650	--	--	Synthesized	1947	--	7,000	--	--	Synthesized
1960	--	4,340	--	--	Synthesized	1991	--	6,720	--	--	Synthesized
1961	--	4,820	--	--	Synthesized	1959	--	6,650	--	--	Synthesized
1962	--	7,470	--	--	Synthesized	1965	--	6,520	--	--	Synthesized
1963	--	2,010	--	--	Synthesized	1978	6/7/1978	6,330	5	9.96	
1964	6/9/1964	59,700	5,7	--	Historic	2012	--	6,080	--	--	Synthesized
1965	--	6,520	--	--	Synthesized	2006	--	5,940	--	--	Synthesized
1966	--	3,570	--	--	Synthesized	1951	--	5,690	--	--	Synthesized
1967	--	11,500	--	--	Synthesized	1946	--	5,620	--	--	Synthesized
1968	6/10/1968	2,620	5	7.59		1982	--	5,500	--	--	Synthesized
1969	6/6/1969	3,630	5	8.04		1980	5/26/1980	5,430	5	9.36	
1970	6/5/1970	7,350	5	10.01		1979	5/27/1979	5,380	5	9.38	
1971	5/29/1971	7,820	5	10.78		1995	--	5,120	--	--	Synthesized
1972	6/2/1972	8,910	2,5	11.35		2002	--	5,090	--	--	Synthesized
1973	5/30/1973	562	5	5.14	PILF	2019	5/27/2019	5,070	5	9.06	
1974	6/17/1974	7,210	5	10.08		1955	--	4,940	--	--	Synthesized
1975	6/19/1975	32,000	5	19.00		1989	--	4,940	--	--	Synthesized
1976	5/14/1976	8,470	5	11.11		1961	--	4,820	--	--	Synthesized
1977	5/12/1977	536	5	4.92	PILF	1996	--	4,700	--	--	Synthesized
1978	6/7/1978	6,330	5	9.96		1986	--	4,360	--	--	Synthesized
1979	5/27/1979	5,380	5	9.38		1936	--	4,350	--	--	Synthesized
1980	5/26/1980	5,430	5	9.36		1945	--	4,350	--	--	Synthesized
1981	--	13,300	--	--	Synthesized	1960	--	4,340	--	--	Synthesized
1982	--	5,500	--	--	Synthesized	1990	--	4,290	--	--	Synthesized
1983	--	3,050	--	--	Synthesized	1993	--	4,210	--	--	Synthesized
1984	--	2,410	--	--	Synthesized	1935	--	4,100	--	--	Synthesized
1985	--	2,960	--	--	Synthesized	1949	--	3,960	--	--	Synthesized
1986	--	4,360	--	--	Synthesized	1999	--	3,960	--	--	Synthesized
1987	--	3,060	--	--	Synthesized	2017	6/2/2017	3,840	5	8.30	
1988	--	742	--	--	PILF, Synthesized	2009	--	3,800	--	--	Synthesized
1989	--	4,940	--	--	Synthesized	1952	--	3,760	--	--	Synthesized
1990	--	4,290	--	--	Synthesized	1969	6/6/1969	3,630	5	8.04	
1991	--	6,720	--	--	Synthesized	1944	--	3,600	--	--	Synthesized
1992	--	1,200	--	--	PILF, Synthesized	1966	--	3,570	--	--	Synthesized
1993	--	4,210	--	--	Synthesized	2005	--	3,410	--	--	Synthesized
1994	--	3,220	--	--	Synthesized	1998	--	3,390	--	--	Synthesized
1995	--	5,120	--	--	Synthesized	1994	--	3,220	--	--	Synthesized
1996	--	4,700	--	--	Synthesized	2003	--	3,200	--	--	Synthesized
1997	--	7,180	--	--	Synthesized	1939	--	3,110	--	--	Synthesized
1998	--	3,390	--	--	Synthesized	1987	--	3,060	--	--	Synthesized
1999	--	3,960	--	--	Synthesized	1983	--	3,050	--	--	Synthesized
2000	--	2,290	--	--	Synthesized	2015	--	2,990	--	--	Synthesized
2001	--	909	--	--	PILF, Synthesized	1985	--	2,960	--	--	Synthesized
2002	--	5,090	--	--	Synthesized	2010	--	2,650	--	--	Synthesized
2003	--	3,200	--	--	Synthesized	2014	--	2,630	--	--	Synthesized
2004	--	1,510	--	--	Synthesized	1968	6/10/1968	2,620	5	7.59	
2005	--	3,410	--	--	Synthesized	1984	--	2,410	--	--	Synthesized
2006	--	5,940	--	--	Synthesized	2013	--	2,310	--	--	Synthesized
2007	--	2,010	--	--	Synthesized	2000	--	2,290	--	--	Synthesized
2008	--	7,540	--	--	Synthesized	1963	--	2,010	--	--	Synthesized
2009	--	3,800	--	--	Synthesized	2007	--	2,010	--	--	Synthesized
2010	--	2,650	--	--	Synthesized	1937	--	1,640	--	--	Synthesized
2011	--	14,500	--	--	Synthesized	1940	--	1,520	--	--	Synthesized
2012	--	6,080	--	--	Synthesized	2004	--	1,510	--	--	Synthesized
2013	--	2,310	--	--	Synthesized	1992	--	1,200	--	--	PILF, Synthesiz
2014	--	2,630	--	--	Synthesized	2016	5/28/2016	1,110	5	5.74	PILF
2015	--	2,990	--	--	Synthesized	2001	--	909	--	--	PILF, Synthesiz
2016	5/28/2016	1,110	5	5.74	PILF	1988	--	742	--	--	PILF, Synthesiz
2017	6/2/2017	3,840	5	8.30		1941	--	612	--	--	PILF, Synthesiz
2018	6/19/2018	10,500	5	11.96		1973	5/30/1973	562	5	5.14	PILF
2019	5/27/2019	5,070	5	9.06		1977	5/12/1977	536	5	4.92	PILF

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06082200 Sun River below Willow Creek near Augusta, Montana
Analysis for regulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
814	16	Weighted	MGBT	1,080			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
2,940	4,240	4,960	8,960	13,500	21,100	28,300	37,100	47,800	65,200
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
4,350	6,190	7,180	12,700	18,900	30,000	42,300	60,400	87,900	148,000
1,910	2,840	3,320	5,910	8,850	13,700	18,300	23,600	29,800	38,900

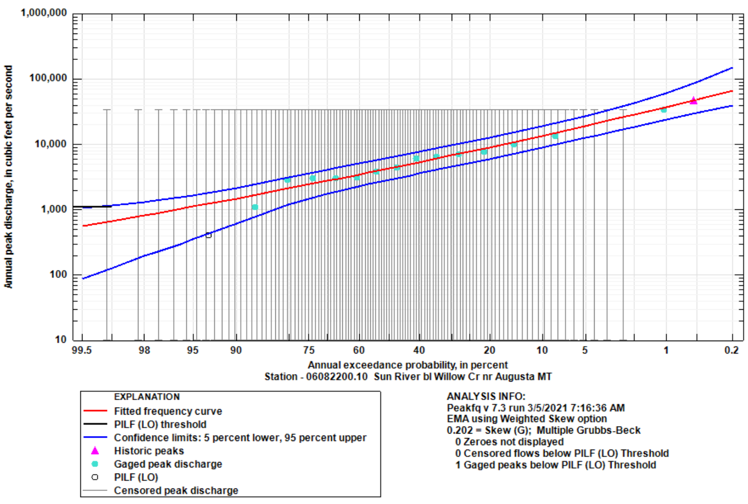

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

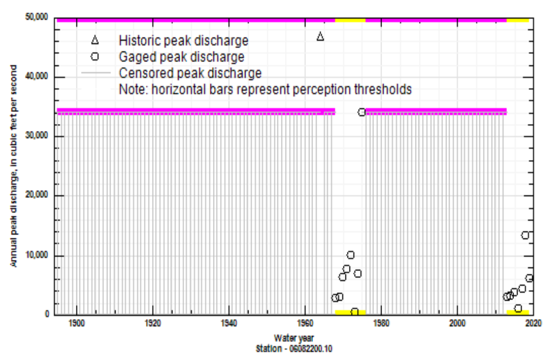

Figure 2. Annual peak flows and perception thresholds.

06082200 Sun River below Willow Creek near Augusta, Montana
Analysis for regulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1964	6/9/1964	46,700	5,7	16.16	Historic	1964	6/9/1964	46,700	5,7	16.16	Historic
1968	6/10/1968	2,840	5	4.46		1975	6/19/1975	34,000	5	11.50	
1969	6/7/1969	3,000	5	4.40		2018	6/19/2018	13,300	5	7.82	
1970	6/6/1970	6,380	5	6.06		1972	6/2/1972	10,000	5	7.33	
1971	5/28/1971	7,650	5	6.69		1971	5/28/1971	7,650	5	6.69	
1972	6/2/1972	10,000	5	7.33		1974	6/16/1974	6,910	5	6.18	
1973	5/26/1973	409	5	2.39	PILF	1970	6/6/1970	6,380	5	6.06	
1974	6/16/1974	6,910	5	6.18		2019	5/27/2019	6,090	5	5.75	
1975	6/19/1975	34,000	5	11.50		2017	6/2/2017	4,450	5	5.03	
2013	6/9/2013	3,010	5	4.22		2015	6/3/2015	3,770	5	4.49	
2014	6/25/2014	3,140	5	4.27		2014	6/25/2014	3,140	5	4.27	
2015	6/3/2015	3,770	5	4.49		2013	6/9/2013	3,010	5	4.22	
2016	5/28/2016	1,080	5	3.22		1969	6/7/1969	3,000	5	4.40	
2017	6/2/2017	4,450	5	5.03		1968	6/10/1968	2,840	5	4.46	
2018	6/19/2018	13,300	5	7.82		2016	5/28/2016	1,080	5	3.22	
2019	5/27/2019	6,090	5	5.75		1973	5/26/1973	409	5	2.39	PILF

[1]Definitions of types of PILF thresholds include:
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[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
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06082200 Sun River below Willow Creek near Augusta, Montana

Analysis for regulated period of record

Analysis period of record, water years: 1895 - 2019

Peak-flow frequency analysis conducted on recorded and synthesized data

Table 1-1   Table 1-2   Table 1-3   Table 1-4   Table 1-5   Table 1-6   Table 1-7   Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second	Type of peak-flow frequency analysis[2]				
814	86	Weighted	MGBT	2,480	MOVE3				
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
3,600	4,670	5,240	8,280	11,600	16,900	22,000	28,100	35,400	47,400
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
4,140	5,440	6,140	10,000	14,700	24,000	34,900	50,800	73,800	121,000
3,120	4,040	4,500	6,930	9,400	13,000	16,000	19,300	22,800	27,700

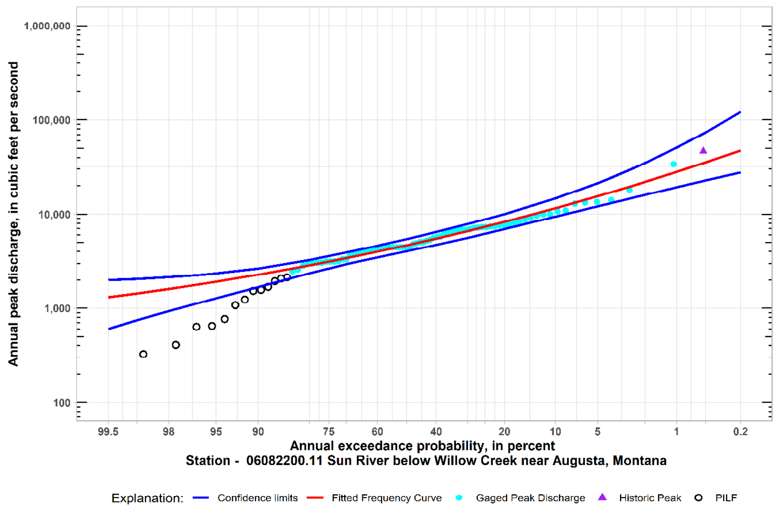

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

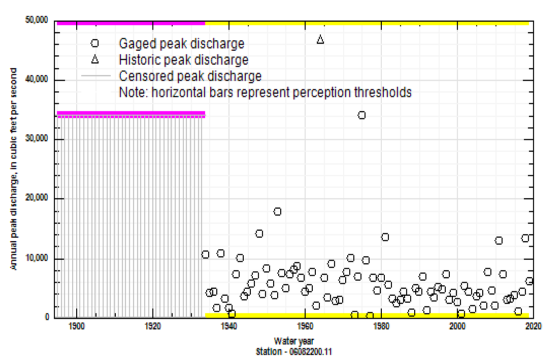

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06082200 Sun River below Willow Creek near Augusta, Montana

Analysis for regulated period of record

Analysis period of record, water years: 1895 - 2019

Peak-flow frequency analysis conducted on recorded and synthesized data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Water year	Peak-flow data[4] Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Ranked (largest to smallest) peak-flow data[4] Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1934	--	10,700	--	--	Synthesized	1964	6/9/1964	46,700	5,7	16.16	Historic
1935	--	4,200	--	--	Synthesized	1975	6/19/1975	34,000	5	11.50	
1936	--	4,450	--	--	Synthesized	1953	--	17,900	--	--	Synthesized
1937	--	1,690	--	--	PILF, Synthesized	1948	--	14,100	--	--	Synthesized
1938	--	10,900	--	--	Synthesized	1981	--	13,500	--	--	Synthesized
1939	--	3,190	--	--	Synthesized	2018	6/19/2018	13,300	5	7.82	
1940	--	1,570	--	--	PILF, Synthesized	2011	--	12,900	--	--	Synthesized
1941	--	636	--	--	PILF, Synthesized	1938	--	10,900	--	--	Synthesized
1942	--	7,390	--	--	Synthesized	1934	--	10,700	--	--	Synthesized
1943	--	9,960	--	--	Synthesized	1972	6/2/1972	10,000	5	7.33	
1944	--	3,690	--	--	Synthesized	1943	--	9,960	--	--	Synthesized
1945	--	4,450	--	--	Synthesized	1976	--	9,630	--	--	Synthesized
1946	--	5,740	--	--	Synthesized	1967	--	9,100	--	--	Synthesized
1947	--	7,130	--	--	Synthesized	1958	--	8,730	--	--	Synthesized
1948	--	14,100	--	--	Synthesized	1950	--	8,320	--	--	Synthesized
1949	--	4,050	--	--	Synthesized	1957	--	8,160	--	--	Synthesized
1950	--	8,320	--	--	Synthesized	2008	--	7,750	--	--	Synthesized
1951	--	5,810	--	--	Synthesized	1971	5/28/1971	7,650	5	6.69	
1952	--	3,850	--	--	Synthesized	1962	--	7,600	--	--	Synthesized
1953	--	17,900	--	--	Synthesized	1954	--	7,430	--	--	Synthesized
1954	--	7,430	--	--	Synthesized	1942	--	7,390	--	--	Synthesized
1955	--	5,050	--	--	Synthesized	1956	--	7,270	--	--	Synthesized
1956	--	7,270	--	--	Synthesized	2012	--	7,270	--	--	Synthesized
1957	--	8,160	--	--	Synthesized	1997	--	7,210	--	--	Synthesized
1958	--	8,730	--	--	Synthesized	1947	--	7,130	--	--	Synthesized
1959	--	6,780	--	--	Synthesized	1974	6/16/1974	6,910	5	6.18	
1960	--	4,440	--	--	Synthesized	1991	--	6,850	--	--	Synthesized
1961	--	4,920	--	--	Synthesized	1980	--	6,810	--	--	Synthesized
1962	--	7,600	--	--	Synthesized	1959	--	6,780	--	--	Synthesized
1963	--	2,070	--	--	PILF, Synthesized	1978	--	6,780	--	--	Synthesized
1964	6/9/1964	46,700	5,7	16.16	Historic	1965	--	6,650	--	--	Synthesized
1965	--	6,650	--	--	Synthesized	1970	6/6/1970	6,380	5	6.06	
1966	--	3,330	--	--	Synthesized	2019	5/27/2019	6,090	5	5.75	
1967	--	9,100	--	--	Synthesized	1951	--	5,810	--	--	Synthesized
1968	6/10/1968	2,840	5	4.46		1946	--	5,740	--	--	Synthesized
1969	6/7/1969	3,000	5	4.40		1982	--	5,620	--	--	Synthesized
1970	6/6/1970	6,380	5	6.06		2002	--	5,350	--	--	Synthesized
1971	5/28/1971	7,650	5	6.69		1995	--	5,230	--	--	Synthesized
1972	6/2/1972	10,000	5	7.33		1955	--	5,050	--	--	Synthesized
1973	5/26/1973	409	5	2.39	PILF	1989	--	5,040	--	--	Synthesized
1974	6/16/1974	6,910	5	6.18		1961	--	4,920	--	--	Synthesized
1975	6/19/1975	34,000	5	11.50		1996	--	4,810	--	--	Synthesized
1976	--	9,630	--	--	Synthesized	1979	--	4,500	--	--	Synthesized
1977	--	326	--	--	PILF, Synthesized	2009	--	4,480	--	--	Synthesized
1978	--	6,780	--	--	Synthesized	1986	--	4,460	--	--	Synthesized
1979	--	4,500	--	--	Synthesized	1936	--	4,450	--	--	Synthesized
1980	--	6,810	--	--	Synthesized	1945	--	4,450	--	--	Synthesized
1981	--	13,500	--	--	Synthesized	2017	6/2/2017	4,450	5	5.03	
1982	--	5,620	--	--	Synthesized	1960	--	4,440	--	--	Synthesized
1983	--	3,130	--	--	Synthesized	1990	--	4,380	--	--	Synthesized
1984	--	2,480	--	--	Synthesized	1993	--	4,310	--	--	Synthesized
1985	--	3,040	--	--	Synthesized	2003	--	4,310	--	--	Synthesized
1986	--	4,460	--	--	Synthesized	1999	--	4,230	--	--	Synthesized
1987	--	3,140	--	--	Synthesized	2006	--	4,210	--	--	Synthesized
1988	--	770	--	--	PILF, Synthesized	1935	--	4,200	--	--	Synthesized
1989	--	5,040	--	--	Synthesized	1949	--	4,050	--	--	Synthesized
1990	--	4,380	--	--	Synthesized	1952	--	3,850	--	--	Synthesized
1991	--	6,850	--	--	Synthesized	2015	6/3/2015	3,770	5	4.49	
1992	--	1,240	--	--	PILF, Synthesized	1944	--	3,690	--	--	Synthesized
1993	--	4,310	--	--	Synthesized	2005	--	3,660	--	--	Synthesized
1994	--	3,310	--	--	Synthesized	1966	--	3,330	--	--	Synthesized
1995	--	5,230	--	--	Synthesized	1994	--	3,310	--	--	Synthesized
1996	--	4,810	--	--	Synthesized	1939	--	3,190	--	--	Synthesized
1997	--	7,210	--	--	Synthesized	1987	--	3,140	--	--	Synthesized
1998	--	3,060	--	--	Synthesized	2014	6/25/2014	3,140	5	4.27	
1999	--	4,230	--	--	Synthesized	1983	--	3,130	--	--	Synthesized
2000	--	2,580	--	--	Synthesized	1998	--	3,060	--	--	Synthesized
2001	--	650	--	--	PILF, Synthesized	1985	--	3,040	--	--	Synthesized
2002	--	5,350	--	--	Synthesized	2013	6/9/2013	3,010	5	4.22	
2003	--	4,310	--	--	Synthesized	1969	6/7/1969	3,000	5	4.40	
2004	--	1,530	--	--	PILF, Synthesized	1968	6/10/1968	2,840	5	4.46	
2005	--	3,660	--	--	Synthesized	2000	--	2,580	--	--	Synthesized
2006	--	4,210	--	--	Synthesized	1984	--	2,480	--	--	Synthesized
2007	--	1,940	--	--	PILF, Synthesized	2010	--	2,130	--	--	PILF, Synthesiz
2008	--	7,750	--	--	Synthesized	1963	--	2,070	--	--	PILF, Synthesiz
2009	--	4,480	--	--	Synthesized	2007	--	1,940	--	--	PILF, Synthesiz
2010	--	2,130	--	--	PILF, Synthesized	1937	--	1,690	--	--	PILF, Synthesiz
2011	--	12,900	--	--	Synthesized	1940	--	1,570	--	--	PILF, Synthesiz
2012	--	7,270	--	--	Synthesized	2004	--	1,530	--	--	PILF, Synthesiz
2013	6/9/2013	3,010	5	4.22		1992	--	1,240	--	--	PILF, Synthesiz
2014	6/25/2014	3,140	5	4.27		2016	5/28/2016	1,080	5	3.22	PILF
2015	6/3/2015	3,770	5	4.49		1988	--	770	--	--	PILF, Synthesiz
2016	5/28/2016	1,080	5	3.22	PILF	2001	--	650	--	--	PILF, Synthesiz
2017	6/2/2017	4,450	5	5.03		1941	--	636	--	--	PILF, Synthesiz
2018	6/19/2018	13,300	5	7.82		1973	5/26/1973	409	5	2.39	PILF
2019	5/27/2019	6,090	5	5.75		1977	--	326	--	--	PILF, Synthesiz

Note: Not all footnotes are applicable for each frequency analysis. Even if a footnote is not applicable for a given frequency analysis, it is retained in the worksheet for convenience and to maintain consistency among the various similarly structured frequency-analysis worksheets. Also, not all table columns are applicable for each frequency analysis. Even if a table column is not applicable for a given frequency analysis, it is retained in the worksheet for convenience and to maintain consistency among the various similarly structured frequency-analysis worksheets.

06085800 Sun River at Simms, Montana
Analysis for regulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
1,296	38	Weighted	MGBT	1,480			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
3,010	4,300	5,000	8,940	13,400	20,800	28,000	36,800	47,400	64,800
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
3,840	5,520	6,430	11,700	17,800	29,400	42,700	62,500	92,000	154,000
2,330	3,370	3,900	6,860	10,100	15,100	19,600	24,700	30,500	39,100

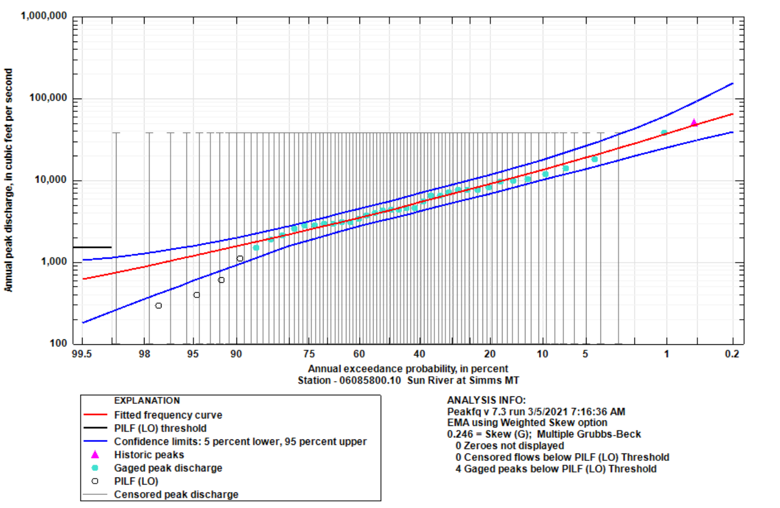

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

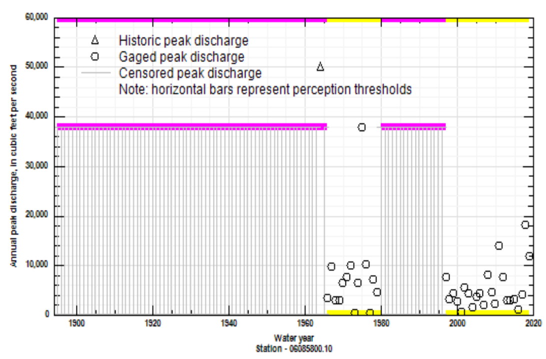

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
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Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06085800 Sun River at Simms, Montana
Analysis for regulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1964	6/9/1964	50,000	7	13.70	Historic	1964	6/9/1964	50,000	7	13.70	Historic
1966	5/30/1966	3,350	--	5.37		1975	6/20/1975	37,900	--	12.48	
1967	6/1/1967	9,610	--	7.79		2018	6/19/2018	18,100	--	10.96	
1968	6/11/1968	2,940	--	4.93		2011	6/8/2011	13,900	--	9.87	
1969	7/1/1969	2,940	--	6.68		2019	5/27/2019	11,900	--	9.27	
1970	6/6/1970	6,420	--	6.51		1976	5/15/1976	10,200	--	7.88	
1971	5/29/1971	7,630	--	7.15		1972	6/2/1972	9,840	--	8.04	
1972	6/2/1972	9,840	--	8.04		1967	6/1/1967	9,610	--	7.79	
1973	1/15/1973	400	2	3.30	PILF	2008	5/26/2008	8,130	--	8.08	
1974	6/17/1974	6,400	--	7.14		1971	5/29/1971	7,630	--	7.15	
1975	6/20/1975	37,900	--	12.48		2012	6/7/2012	7,600	--	7.87	
1976	5/15/1976	10,200	--	7.88		1997	6/13/1997	7,530	--	7.36	
1977	5/11/1977	294	--	2.73	PILF	1978	6/7/1978	7,060	--	6.77	
1978	6/7/1978	7,060	--	6.77		1970	6/6/1970	6,420	--	6.51	
1979	5/27/1979	4,600	--	6.06		1974	6/17/1974	6,400	--	7.14	
1997	6/13/1997	7,530	--	7.36		2002	6/24/2002	5,510	--	6.46	
1998	7/4/1998	3,070	--	5.27		1979	5/27/1979	4,600	--	6.06	
1999	6/5/1999	4,310	--	6.00		2009	6/1/2009	4,580	--	6.21	
2000	6/10/2000	2,570	--	4.80		2003	5/27/2003	4,400	--	5.88	
2001	6/14/2001	606	--	2.57	PILF	1999	6/5/1999	4,310	--	6.00	
2002	6/24/2002	5,510	--	6.46		2006	6/12/2006	4,290	--	5.97	
2003	5/27/2003	4,400	--	5.88		2017	6/2/2017	3,980	--	5.99	
2004	5/11/2004	1,480	--	3.73		2005	5/18/2005	3,700	--	5.72	
2005	5/18/2005	3,700	--	5.72		1966	5/30/1966	3,350	--	5.37	
2006	6/12/2006	4,290	--	5.97		2015	6/4/2015	3,100	--	5.35	
2007	5/20/2007	1,900	--	4.16		1998	7/4/1998	3,070	--	5.27	
2008	5/26/2008	8,130	--	8.08		1968	6/11/1968	2,940	--	4.93	
2009	6/1/2009	4,580	--	6.21		1969	7/1/1969	2,940	--	6.68	
2010	6/6/2010	2,100	--	4.33		2014	6/25/2014	2,830	--	5.00	
2011	6/8/2011	13,900	--	9.87		2013	6/9/2013	2,800	--	4.98	
2012	6/7/2012	7,600	--	7.87		2000	6/10/2000	2,570	--	4.80	
2013	6/9/2013	2,800	--	4.98		2010	6/6/2010	2,100	--	4.33	
2014	6/25/2014	2,830	--	5.00		2007	5/20/2007	1,900	--	4.16	
2015	6/4/2015	3,100	--	5.35		2004	5/11/2004	1,480	--	3.73	
2016	5/28/2016	1,090	--	3.60	PILF	2016	5/28/2016	1,090	--	3.60	PILF
2017	6/2/2017	3,980	--	5.99		2001	6/14/2001	606	--	2.57	PILF
2018	6/19/2018	18,100	--	10.96		1973	1/15/1973	400	2	3.30	PILF
2019	5/27/2019	11,900	--	9.27		1977	5/11/1977	294	--	2.73	PILF

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06085800 Sun River at Simms, Montana
Analysis for regulated period of record
Analysis period of record, water years: 1895 - 2019
Peak-flow frequency analysis conducted on recorded and synthesized data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
1,296	86	Weighted	MGBT	1,880			MOVE3		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
3,430	4,700	5,370	8,980	12,800	19,000	24,800	31,500	39,400	52,100
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
3,980	5,490	6,300	10,800	16,100	26,200	37,300	52,600	73,800	114,000
2,930	4,030	4,590	7,570	10,600	15,000	18,700	22,700	27,000	33,200

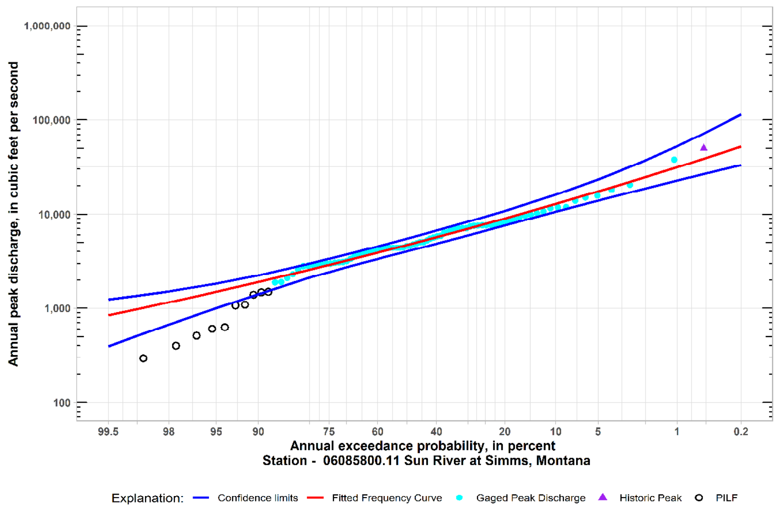

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

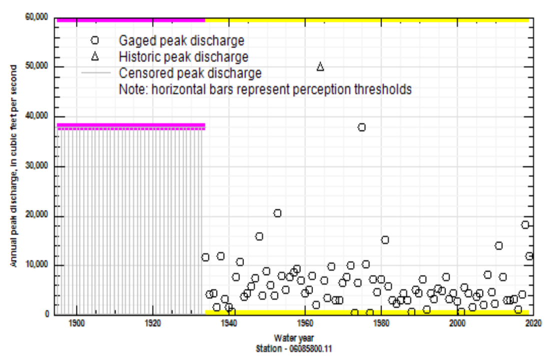

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:

England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.

Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06085800 Sun River at Simms, Montana
Analysis for regulated period of record
Analysis period of record, water years: 1895 - 2019
Peak-flow frequency analysis conducted on recorded and synthesized data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1934	--	11,600	--	--	Synthesized	1964	6/9/1964	50,000	7	13.70	Historic
1935	--	4,120	--	--	Synthesized	1975	6/20/1975	37,900	--	12.48	
1936	--	4,390	--	--	Synthesized	1953	--	20,500	--	--	Synthesized
1937	--	1,500	--	--	PILF, Synthesized	2018	6/19/2018	18,100	--	10.96	
1938	--	11,800	--	--	Synthesized	1948	--	15,700	--	--	Synthesized
1939	--	3,040	--	--	Synthesized	1981	--	15,000	--	--	Synthesized
1940	--	1,390	--	--	PILF, Synthesized	2011	6/8/2011	13,900	--	9.87	
1941	--	511	--	--	PILF, Synthesized	2019	5/27/2019	11,900	--	9.27	
1942	--	7,700	--	--	Synthesized	1938	--	11,800	--	--	Synthesized
1943	--	10,700	--	--	Synthesized	1934	--	11,600	--	--	Synthesized
1944	--	3,570	--	--	Synthesized	1943	--	10,700	--	--	Synthesized
1945	--	4,390	--	--	Synthesized	1976	5/15/1976	10,200	--	7.88	
1946	--	5,820	--	--	Synthesized	1972	6/2/1972	9,840	--	8.04	
1947	--	7,400	--	--	Synthesized	1967	6/1/1967	9,610	--	7.79	
1948	--	15,700	--	--	Synthesized	1958	--	9,250	--	--	Synthesized
1949	--	3,960	--	--	Synthesized	1950	--	8,780	--	--	Synthesized
1950	--	8,780	--	--	Synthesized	1957	--	8,590	--	--	Synthesized
1951	--	5,890	--	--	Synthesized	2008	5/26/2008	8,130	--	8.08	
1952	--	3,740	--	--	Synthesized	1962	--	7,940	--	--	Synthesized
1953	--	20,500	--	--	Synthesized	1954	--	7,740	--	--	Synthesized
1954	--	7,740	--	--	Synthesized	1942	--	7,700	--	--	Synthesized
1955	--	5,050	--	--	Synthesized	1971	5/29/1971	7,630	--	7.15	
1956	--	7,560	--	--	Synthesized	2012	6/7/2012	7,600	--	7.87	
1957	--	8,590	--	--	Synthesized	1956	--	7,560	--	--	Synthesized
1958	--	9,250	--	--	Synthesized	1997	6/13/1997	7,530	--	7.36	
1959	--	6,990	--	--	Synthesized	1947	--	7,400	--	--	Synthesized
1960	--	4,380	--	--	Synthesized	1991	--	7,070	--	--	Synthesized
1961	--	4,910	--	--	Synthesized	1978	6/7/1978	7,060	--	6.77	
1962	--	7,940	--	--	Synthesized	1980	--	7,030	--	--	Synthesized
1963	--	1,880	--	--	Synthesized	1959	--	6,990	--	--	Synthesized
1964	6/9/1964	50,000	7	13.70	Historic	1965	--	6,840	--	--	Synthesized
1965	--	6,840	--	--	Synthesized	1970	6/6/1970	6,420	--	6.51	
1966	5/30/1966	3,350	--	5.37		1974	6/17/1974	6,400	--	7.14	
1967	6/1/1967	9,610	--	7.79		1951	--	5,890	--	--	Synthesized
1968	6/11/1968	2,940	--	4.93		1946	--	5,820	--	--	Synthesized
1969	7/1/1969	2,940	--	6.68		1982	--	5,680	--	--	Synthesized
1970	6/6/1970	6,420	--	6.51		2002	6/24/2002	5,510	--	6.46	
1971	5/29/1971	7,630	--	7.15		1995	--	5,250	--	--	Synthesized
1972	6/2/1972	9,840	--	8.04		1955	--	5,050	--	--	Synthesized
1973	1/15/1973	400	2	3.30	PILF	1989	--	5,040	--	--	Synthesized
1974	6/17/1974	6,400	--	7.14		1961	--	4,910	--	--	Synthesized
1975	6/20/1975	37,900	--	12.48		1996	--	4,780	--	--	Synthesized
1976	5/15/1976	10,200	--	7.88		1979	5/27/1979	4,600	--	6.06	
1977	5/11/1977	294	--	2.73	PILF	2009	6/1/2009	4,580	--	6.21	
1978	6/7/1978	7,060	--	6.77		1986	--	4,410	--	--	Synthesized
1979	5/27/1979	4,600	--	6.06		2003	5/27/2003	4,400	--	5.88	
1980	--	7,030	--	--	Synthesized	1936	--	4,390	--	--	Synthesized
1981	--	15,000	--	--	Synthesized	1945	--	4,390	--	--	Synthesized
1982	--	5,680	--	--	Synthesized	1960	--	4,380	--	--	Synthesized
1983	--	2,980	--	--	Synthesized	1990	--	4,320	--	--	Synthesized
1984	--	2,300	--	--	Synthesized	1999	6/5/1999	4,310	--	6.00	
1985	--	2,880	--	--	Synthesized	2006	6/12/2006	4,290	--	5.97	
1986	--	4,410	--	--	Synthesized	1993	--	4,230	--	--	Synthesized
1987	--	2,990	--	--	Synthesized	1935	--	4,120	--	--	Synthesized
1988	--	631	--	--	PILF, Synthesized	2017	6/2/2017	3,980	--	5.99	
1989	--	5,040	--	--	Synthesized	1949	--	3,960	--	--	Synthesized
1990	--	4,320	--	--	Synthesized	1952	--	3,740	--	--	Synthesized
1991	--	7,070	--	--	Synthesized	2005	5/18/2005	3,700	--	5.72	
1992	--	1,070	--	--	PILF, Synthesized	1944	--	3,570	--	--	Synthesized
1993	--	4,230	--	--	Synthesized	1966	5/30/1966	3,350	--	5.37	
1994	--	3,160	--	--	Synthesized	1994	--	3,160	--	--	Synthesized
1995	--	5,250	--	--	Synthesized	2015	6/4/2015	3,100	--	5.35	
1996	--	4,780	--	--	Synthesized	1998	7/4/1998	3,070	--	5.27	
1997	6/13/1997	7,530	--	7.36		1939	--	3,040	--	--	Synthesized
1998	7/4/1998	3,070	--	5.27		1987	--	2,990	--	--	Synthesized
1999	6/5/1999	4,310	--	6.00		1983	--	2,980	--	--	Synthesized
2000	6/10/2000	2,570	--	4.80		1968	6/11/1968	2,940	--	4.93	
2001	6/14/2001	606	--	2.57	PILF	1969	7/1/1969	2,940	--	6.68	
2002	6/24/2002	5,510	--	6.46		1985	--	2,880	--	--	Synthesized
2003	5/27/2003	4,400	--	5.88		2014	6/25/2014	2,830	--	5.00	
2004	5/11/2004	1,480	--	3.73	PILF	2013	6/9/2013	2,800	--	4.98	
2005	5/18/2005	3,700	--	5.72		2000	6/10/2000	2,570	--	4.80	
2006	6/12/2006	4,290	--	5.97		1984	--	2,300	--	--	Synthesized
2007	5/20/2007	1,900	--	4.16		2010	6/6/2010	2,100	--	4.33	
2008	5/26/2008	8,130	--	8.08		2007	5/20/2007	1,900	--	4.16	
2009	6/1/2009	4,580	--	6.21		1963	--	1,880	--	--	Synthesized
2010	6/6/2010	2,100	--	4.33		1937	--	1,500	--	--	PILF, Synthesiz
2011	6/8/2011	13,900	--	9.87		2004	5/11/2004	1,480	--	3.73	PILF
2012	6/7/2012	7,600	--	7.87		1940	--	1,390	--	--	PILF, Synthesiz
2013	6/9/2013	2,800	--	4.98		2016	5/28/2016	1,090	--	3.60	PILF
2014	6/25/2014	2,830	--	5.00		1992	--	1,070	--	--	PILF, Synthesiz
2015	6/4/2015	3,100	--	5.35		1988	--	631	--	--	PILF, Synthesiz
2016	5/28/2016	1,090	--	3.60	PILF	2001	6/14/2001	606	--	2.57	PILF
2017	6/2/2017	3,980	--	5.99		1941	--	511	--	--	PILF, Synthesiz
2018	6/19/2018	18,100	--	10.96		1973	1/15/1973	400	2	3.30	PILF
2019	5/27/2019	11,900	--	9.27		1977	5/11/1977	294	--	2.73	PILF

Note: Not all footnotes are applicable for each frequency analysis. Even if a footnote is not applicable for a given frequency analysis, it is retained in the worksheet for convenience and to maintain consistency among the various similarly structured frequency-analysis worksheets. Also, not all table columns are applicable for each frequency analysis. Even if a table column is not applicable for a given frequency analysis, it is retained in the worksheet for convenience and to maintain consistency among the various similarly structured frequency-analysis worksheets.

06086000 Sun River at Fort Shaw, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 1927
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
1,395	22	Weighted	MGBT	--			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
5,540	6,980	7,710	11,400	15,200	20,800	25,800	31,500	38,000	48,100
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
6,800	8,660	9,630	15,000	21,400	33,700	47,700	67,600	96,000	152,000
4,510	5,680	6,260	9,100	11,700	15,400	18,400	21,400	24,700	29,300

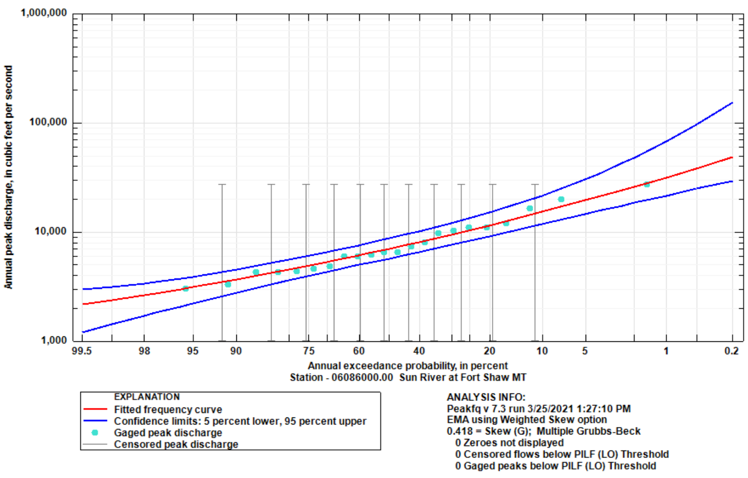

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

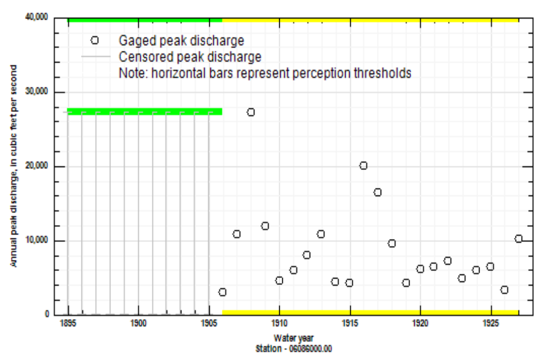

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.

[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).

[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.

[4]Peak-flow data with a value of zero are not plotted in figures.

[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.

[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help

[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Combined: The peak flow was recorded at a closely located streamgage on the same channel. Information on combining records of multiple streamgages is presented in table 1–2;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06086000 Sun River at Fort Shaw, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 1927
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1906	6/5/1906	3,000	--	5.80	Combined	1908	6/7/1908	27,200	--	13.40	Combined
1907	6/24/1907	10,900	--	9.60	Combined	1916	6/21/1916	20,000	--	--	
1908	6/7/1908	27,200	--	13.40	Combined	1917	5/26/1917	16,400	--	--	
1909	6/9/1909	12,000	--	10.20	Combined	1909	6/9/1909	12,000	--	10.20	Combined
1910	5/11/1910	4,600	--	7.10	Combined	1907	6/24/1907	10,900	--	9.60	Combined
1911	6/11/1911	5,940	--	7.80	Combined	1913	5/29/1913	10,900	--	--	
1912	5/22/1912	8,000	--	8.60	Combined	1927	6/9/1927	10,200	--	10.32	
1913	5/29/1913	10,900	--	--		1918	6/11/1918	9,660	--	--	
1914	5/17/1914	4,380	--	--		1912	5/22/1912	8,000	--	8.60	Combined
1915	5/2/1915	4,280	--	--		1922	6/5/1922	7,280	--	--	
1916	6/21/1916	20,000	--	--		1925	5/20/1925	6,490	--	8.82	
1917	5/26/1917	16,400	--	--		1921	5/26/1921	6,440	--	--	
1918	6/11/1918	9,660	--	--		1920	6/16/1920	6,120	--	--	
1919	5/23/1919	4,280	--	--		1924	5/17/1924	5,950	--	--	
1920	6/16/1920	6,120	--	--		1911	6/11/1911	5,940	--	7.80	Combined
1921	5/26/1921	6,440	--	--		1923	5/26/1923	4,830	--	--	
1922	6/5/1922	7,280	--	--		1910	5/11/1910	4,600	--	7.10	Combined
1923	5/26/1923	4,830	--	--		1914	5/17/1914	4,380	--	--	
1924	5/17/1924	5,950	--	--		1915	5/2/1915	4,280	--	--	
1925	5/20/1925	6,490	--	8.82		1919	5/23/1919	4,280	--	--	
1926	4/30/1926	3,280	--	6.90		1926	4/30/1926	3,280	--	6.90	
1927	6/9/1927	10,200	--	10.32		1906	6/5/1906	3,000	--	5.80	Combined

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06086000 Sun River at Fort Shaw, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 1927
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
1,395			MGBT	--			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
5,430	6,790	7,490	10,900	14,300	19,700	24,700	30,600	37,800	49,300
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
6,660	8,400	9,320	14,200	19,800	30,200	41,600	57,000	78,400	119,000
4,430	5,540	6,090	8,750	11,200	14,800	17,900	21,300	25,300	30,900

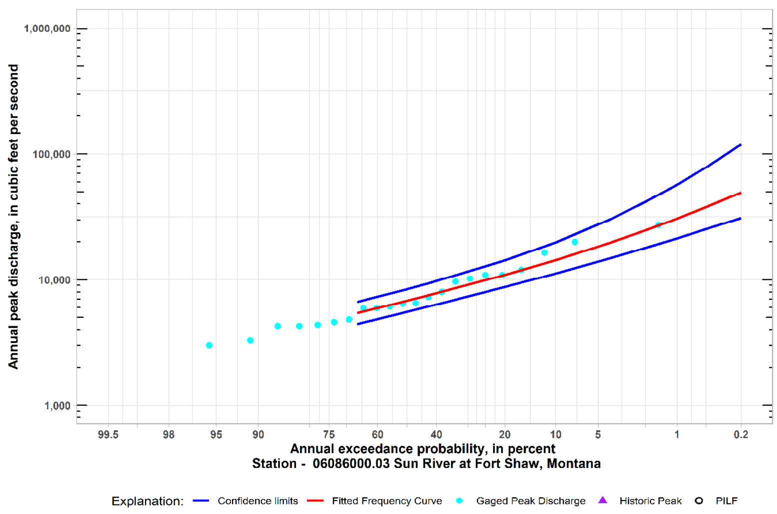

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06086000 Sun River at Fort Shaw, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 1927
At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1906	6/5/1906	3,000	--	5.80	Combined	1908	6/7/1908	27,200	--	13.40	Combined
1907	6/24/1907	10,900	--	9.60	Combined	1916	6/21/1916	20,000	--	--	
1908	6/7/1908	27,200	--	13.40	Combined	1917	5/26/1917	16,400	--	--	
1909	6/9/1909	12,000	--	10.20	Combined	1909	6/9/1909	12,000	--	10.20	Combined
1910	5/11/1910	4,600	--	7.10	Combined	1907	6/24/1907	10,900	--	9.60	Combined
1911	6/11/1911	5,940	--	7.80	Combined	1913	5/29/1913	10,900	--	--	
1912	5/22/1912	8,000	--	8.60	Combined	1927	6/9/1927	10,200	--	10.32	
1913	5/29/1913	10,900	--	--		1918	6/11/1918	9,660	--	--	
1914	5/17/1914	4,380	--	--		1912	5/22/1912	8,000	--	8.60	Combined
1915	5/2/1915	4,280	--	--		1922	6/5/1922	7,280	--	--	
1916	6/21/1916	20,000	--	--		1925	5/20/1925	6,490	--	8.82	
1917	5/26/1917	16,400	--	--		1921	5/26/1921	6,440	--	--	
1918	6/11/1918	9,660	--	--		1920	6/16/1920	6,120	--	--	
1919	5/23/1919	4,280	--	--		1924	5/17/1924	5,950	--	--	
1920	6/16/1920	6,120	--	--		1911	6/11/1911	5,940	--	7.80	Combined
1921	5/26/1921	6,440	--	--		1923	5/26/1923	4,830	--	--	
1922	6/5/1922	7,280	--	--		1910	5/11/1910	4,600	--	7.10	Combined
1923	5/26/1923	4,830	--	--		1914	5/17/1914	4,380	--	--	
1924	5/17/1924	5,950	--	--		1915	5/2/1915	4,280	--	--	
1925	5/20/1925	6,490	--	8.82		1919	5/23/1919	4,280	--	--	
1926	4/30/1926	3,280	--	6.90		1926	4/30/1926	3,280	--	6.90	
1927	6/9/1927	10,200	--	10.32		1906	6/5/1906	3,000	--	5.80	Combined

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).

[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.

[4]Peak-flow data with a value of zero are not plotted in figures.

[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.

[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
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[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Combined: The peak flow was recorded at a closely located streamgage on the same channel. Information on combining records of multiple streamgages is presented in table 1–2;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

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06087900 Muddy Creek tributary near Power, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
3.81	16	Weighted	MGBT	19.0			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
74	124	153	328	536	890	1,220	1,620	2,100	2,830
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
124	210	261	628	1,220	2,700	4,700	7,920	13,100	25,000
37	71	90	196	312	488	632	780	929	1,120

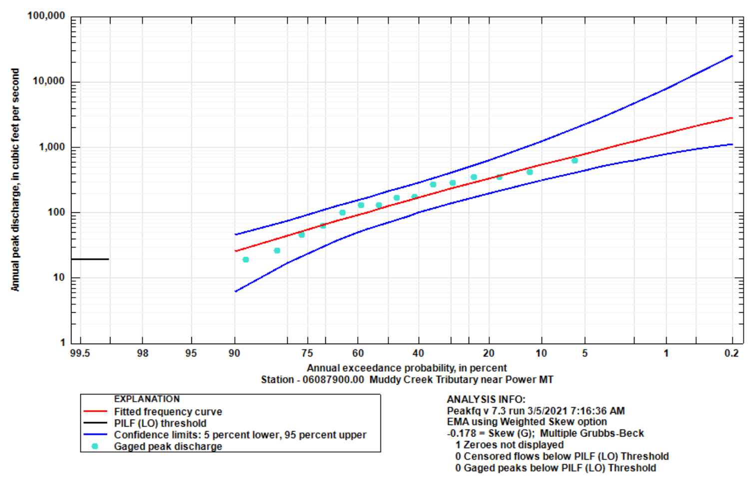

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

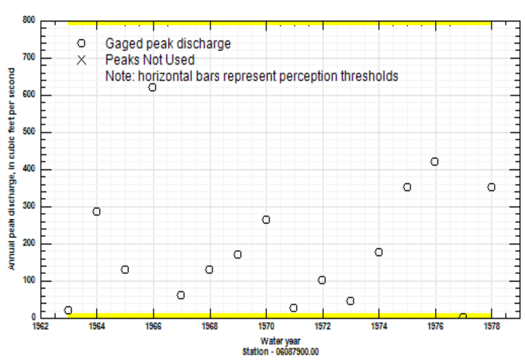

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06087900 Muddy Creek tributary near Power, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1963	7/10/1963	19	--	1.15		1966	7/2/1966	620	--	5.41	
1964	5/3/1964	284	--	2.26		1976	10/15/1975	420	--	2.52	
1965	6/17/1965	130	--	2.27		1975	6/20/1975	350	--	2.39	
1966	7/2/1966	620	--	5.41		1978	3/17/1978	350	--	2.49	
1967	6/10/1967	62	--	1.73		1964	5/3/1964	284	--	2.26	
1968	8/15/1968	130	--	1.94		1970	5/11/1970	265	--	2.24	
1969	6/28/1969	170	--	2.04		1986	2/25/1986	190	O	4.16	Opportunistic
1970	5/11/1970	265	--	2.24		1974	1/15/1974	175	--	2.06	
1971	5/20/1971	26	--	1.24		1969	6/28/1969	170	--	2.04	
1972	3/13/1972	100	2	2.80		1965	6/17/1965	130	--	2.27	
1973	6/15/1973	45	--	1.64		1968	8/15/1968	130	--	1.94	
1974	1/15/1974	175	--	2.06		1972	3/13/1972	100	2	2.80	
1975	6/20/1975	350	--	2.39		1967	6/10/1967	62	--	1.73	
1976	10/15/1975	420	--	2.52		1973	6/15/1973	45	--	1.64	
1977	--	0	Bm	--	PILF	1971	5/20/1971	26	--	1.24	
1978	3/17/1978	350	--	2.49		1963	7/10/1963	19	--	1.15	
1986	2/25/1986	190	O	4.16	Opportunistic	1977	--	0	Bm	--	PILF

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06087900 Muddy Creek tributary near Power, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
3.81			MGBT	19.0			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
61	100	122	241	360	562	770	1,020	1,360	1,900
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
100	163	199	411	647	1,080	1,590	2,310	3,370	5,480
33	60	75	153	229	347	455	573	713	913

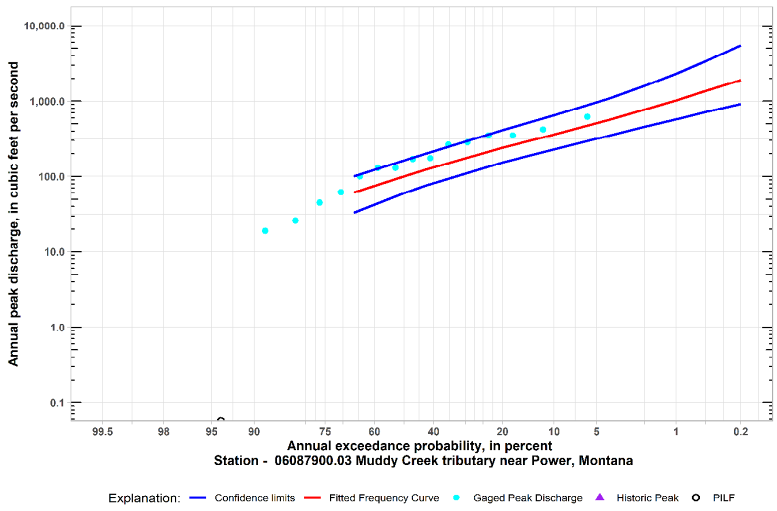

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06087900 Muddy Creek tributary near Power, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1963	7/10/1963	19	--	1.15		1966	7/2/1966	620	--	5.41	
1964	5/3/1964	284	--	2.26		1976	10/15/1975	420	--	2.52	
1965	6/17/1965	130	--	2.27		1975	6/20/1975	350	--	2.39	
1966	7/2/1966	620	--	5.41		1978	3/17/1978	350	--	2.49	
1967	6/10/1967	62	--	1.73		1964	5/3/1964	284	--	2.26	
1968	8/15/1968	130	--	1.94		1970	5/11/1970	265	--	2.24	
1969	6/28/1969	170	--	2.04		1986	2/25/1986	190	O	4.16	Opportunistic
1970	5/11/1970	265	--	2.24		1974	1/15/1974	175	--	2.06	
1971	5/20/1971	26	--	1.24		1969	6/28/1969	170	--	2.04	
1972	3/13/1972	100	2	2.80		1965	6/17/1965	130	--	2.27	
1973	6/15/1973	45	--	1.64		1968	8/15/1968	130	--	1.94	
1974	1/15/1974	175	--	2.06		1972	3/13/1972	100	2	2.80	
1975	6/20/1975	350	--	2.39		1967	6/10/1967	62	--	1.73	
1976	10/15/1975	420	--	2.52		1973	6/15/1973	45	--	1.64	
1977	--	0	Bm	--	PILF	1971	5/20/1971	26	--	1.24	
1978	3/17/1978	350	--	2.49		1963	7/10/1963	19	--	1.15	
1986	2/25/1986	190	O	4.16	Opportunistic	1977	--	0	Bm	--	PILF

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
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[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
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06089000 Sun River near Vaughn, Montana
Analysis for regulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
1,774	86	Station	FIXED	3,370			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
4,010	5,000	5,530	8,530	12,000	18,000	24,000	31,700	41,600	58,900
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
4,420	5,660	6,310	10,100	14,900	25,500	39,900	64,100	105,000	207,000
3,610	4,500	4,900	7,320	10,100	14,200	17,900	22,000	26,800	34,100

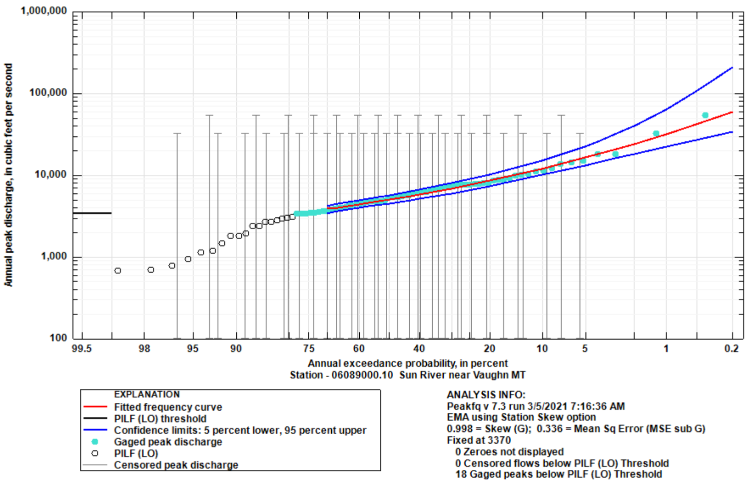

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

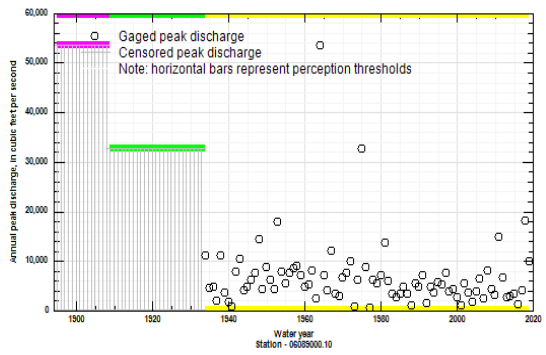

Figure 2. Annual peak flows and perception thresholds.

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[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
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[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
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Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06089000 Sun River near Vaughn, Montana
Analysis for regulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1934	6/8/1934	11,000	--	9.50		1964	6/9/1964	53,500	--	23.40	
1935	5/25/1935	4,570	--	4.85		1975	6/20/1975	32,600	--	22.28	
1936	5/16/1936	4,830	--	5.02		2018	6/21/2018	18,200	--	9.64	
1937	6/19/1937	1,940	--	2.74	PILF	1953	6/4/1953	17,900	--	16.38	
1938	6/24/1938	11,200	--	9.56		2011	6/10/2011	14,800	--	8.29	
1939	5/19/1939	3,530	--	4.05		1948	6/6/1948	14,300	--	13.48	
1940	6/1/1940	1,810	--	2.63	PILF	1981	5/24/1981	13,700	--	15.45	
1941	6/30/1941	774	--	--	PILF	1967	6/19/1967	12,000	--	11.80	
1942	5/28/1942	7,780	--	7.18		1938	6/24/1938	11,200	--	9.56	
1943	6/16/1943	10,300	--	10.48		1934	6/8/1934	11,000	--	9.50	
1944	6/19/1944	4,050	--	4.60		1943	6/16/1943	10,300	--	10.48	
1945	6/7/1945	4,830	--	5.00		1972	6/3/1972	10,000	--	--	
1946	5/30/1946	6,130	--	6.05		2019	5/28/2019	9,820	--	6.66	
1947	5/11/1947	7,520	--	--		1958	6/13/1958	9,100	--	10.92	
1948	6/6/1948	14,300	--	13.48		1976	5/15/1976	8,850	--	11.41	
1949	5/30/1949	4,420	--	5.75		1950	6/18/1950	8,700	--	9.50	
1950	6/18/1950	8,700	--	9.50		1957	5/22/1957	8,540	--	10.33	
1951	6/17/1951	6,200	--	--		2008	5/27/2008	8,060	--	5.81	
1952	5/17/1952	4,210	--	5.23		1962	5/27/1962	7,990	--	9.99	
1953	6/4/1953	17,900	--	16.38		1954	5/22/1954	7,820	--	9.15	
1954	5/22/1954	7,820	--	9.15		1942	5/28/1942	7,780	--	7.18	
1955	5/23/1955	5,440	--	6.74		1997	6/13/1997	7,700	--	11.45	
1956	6/4/1956	7,660	--	8.96		1956	6/4/1956	7,660	--	8.96	
1957	5/22/1957	8,540	--	10.33		1971	5/30/1971	7,620	--	9.01	
1958	6/13/1958	9,100	--	10.92		1947	5/11/1947	7,520	--	--	
1959	6/16/1959	7,170	--	8.77		1991	5/22/1991	7,240	--	10.55	
1960	6/5/1960	4,820	--	--		1980	5/27/1980	7,200	--	10.14	
1961	6/1/1961	5,310	--	6.30		1959	6/16/1959	7,170	--	8.77	
1962	5/27/1962	7,990	--	9.99		1965	6/17/1965	7,040	--	8.81	
1963	6/7/1963	2,350	--	3.52	PILF	1970	6/7/1970	6,680	--	7.82	
1964	6/9/1964	53,500	--	23.40		2012	6/7/2012	6,600	--	5.43	
1965	6/17/1965	7,040	--	8.81		2006	6/11/2006	6,460	2,R	5.35	
1966	5/31/1966	4,010	--	5.31		1951	6/17/1951	6,200	--	--	
1967	6/19/1967	12,000	--	11.80		1946	5/30/1946	6,130	--	6.05	
1968	6/10/1968	3,410	--	5.48		1978	6/8/1978	6,110	--	8.83	
1969	6/29/1969	2,950	--	--	PILF	1974	6/18/1974	6,100	--	8.83	
1970	6/7/1970	6,680	--	7.82		1982	6/18/1982	6,010	--	9.07	
1971	5/30/1971	7,620	--	9.01		1995	6/7/1995	5,620	--	9.05	
1972	6/3/1972	10,000	--	--		2002	6/11/2002	5,590	--	8.64	
1973	6/20/1973	698	--	1.86	PILF	1955	5/23/1955	5,440	--	6.74	
1974	6/18/1974	6,100	--	8.83		1989	5/12/1989	5,430	--	8.22	
1975	6/20/1975	32,600	--	22.28		1979	5/28/1979	5,400	--	7.68	
1976	5/15/1976	8,850	--	11.41		1961	6/1/1961	5,310	--	6.30	
1977	7/25/1977	681	--	1.93	PILF	1996	6/6/1996	5,190	--	8.27	
1978	6/8/1978	6,110	--	8.83		1986	5/31/1986	4,840	--	7.61	
1979	5/28/1979	5,400	--	7.68		1936	5/16/1936	4,830	--	5.02	
1980	5/27/1980	7,200	--	10.14		1945	6/7/1945	4,830	--	5.00	
1981	5/24/1981	13,700	--	15.45		1960	6/5/1960	4,820	--	--	
1982	6/18/1982	6,010	--	9.07		1990	6/1/1990	4,760	--	7.29	
1983	5/28/1983	3,470	--	5.50		1993	5/18/1993	4,680	--	7.62	
1984	6/22/1984	2,780	--	4.40	PILF	1935	5/25/1935	4,570	--	4.85	
1985	5/26/1985	3,370	--	5.23		1949	5/30/1949	4,420	--	5.75	
1986	5/31/1986	4,840	--	7.61		1999	6/6/1999	4,420	--	7.08	
1987	5/2/1987	3,480	--	5.57		2009	6/2/2009	4,250	--	4.58	
1988	7/6/1988	927	--	2.05	PILF	1952	5/17/1952	4,210	--	5.23	
1989	5/12/1989	5,430	--	8.22		1944	6/19/1944	4,050	--	4.60	
1990	6/1/1990	4,760	--	7.29		1966	5/31/1966	4,010	--	5.31	
1991	5/22/1991	7,240	--	10.55		2017	6/15/2017	4,000	--	4.39	
1992	6/17/1992	1,450	--	2.57	PILF	2005	5/18/2005	3,850	--	4.33	
1993	5/18/1993	4,680	--	7.62		1998	7/4/1998	3,830	--	6.13	
1994	5/14/1994	3,650	--	5.54		1994	5/14/1994	3,650	--	5.54	
1995	6/7/1995	5,620	--	9.05		2003	5/27/2003	3,620	--	4.21	
1996	6/6/1996	5,190	--	8.27		1939	5/19/1939	3,530	--	4.05	
1997	6/13/1997	7,700	--	11.45		1987	5/2/1987	3,480	--	5.57	
1998	7/4/1998	3,830	--	6.13		1983	5/28/1983	3,470	--	5.50	
1999	6/6/1999	4,420	--	7.08		1968	6/10/1968	3,410	--	5.48	
2000	6/10/2000	2,650	--	4.33	PILF	2015	6/3/2015	3,400	--	4.11	
2001	8/1/2001	1,120	--	2.71	PILF	1985	5/26/1985	3,370	--	5.23	
2002	6/11/2002	5,590	--	8.64		2010	6/18/2010	3,040	--	3.95	PILF
2003	5/27/2003	3,620	--	4.21		2014	6/25/2014	3,020	--	4.03	PILF
2004	6/8/2004	1,800	--	3.29	PILF	1969	6/29/1969	2,950	--	--	PILF
2005	5/18/2005	3,850	--	4.33		1984	6/22/1984	2,780	--	4.40	PILF
2006	6/11/2006	6,460	2,R	5.35		2013	6/9/2013	2,670	--	3.79	PILF
2007	5/21/2007	2,350	--	3.61	PILF	2000	6/10/2000	2,650	--	4.33	PILF
2008	5/27/2008	8,060	--	5.81		1963	6/7/1963	2,350	--	3.52	PILF
2009	6/2/2009	4,250	--	4.58		2007	5/21/2007	2,350	--	3.61	PILF
2010	6/18/2010	3,040	--	3.95	PILF	1937	6/19/1937	1,940	--	2.74	PILF
2011	6/10/2011	14,800	--	8.29		1940	6/1/1940	1,810	--	2.63	PILF
2012	6/7/2012	6,600	--	5.43		2004	6/8/2004	1,800	--	3.29	PILF
2013	6/9/2013	2,670	--	3.79	PILF	1992	6/17/1992	1,450	--	2.57	PILF
2014	6/25/2014	3,020	--	4.03	PILF	2016	5/29/2016	1,180	--	2.91	PILF
2015	6/3/2015	3,400	--	4.11		2001	8/1/2001	1,120	--	2.71	PILF
2016	5/29/2016	1,180	--	2.91	PILF	1988	7/6/1988	927	--	2.05	PILF
2017	6/15/2017	4,000	--	4.39		1941	6/30/1941	774	--	--	PILF
2018	6/21/2018	18,200	--	9.64		1973	6/20/1973	698	--	1.86	PILF
2019	5/28/2019	9,820	--	6.66		1977	7/25/1977	681	--	1.93	PILF

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06102500 Teton River below South Fork, near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
110	30	Station	MGBT	--			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
544	760	895	1,900	3,580	7,950	14,300	25,400	45,000	94,500
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
770	1,170	1,420	3,300	6,590	16,800	37,200	89,600	231,000	874,000
427	535	600	1,160	2,130	4,180	6,420	9,510	13,800	22,000

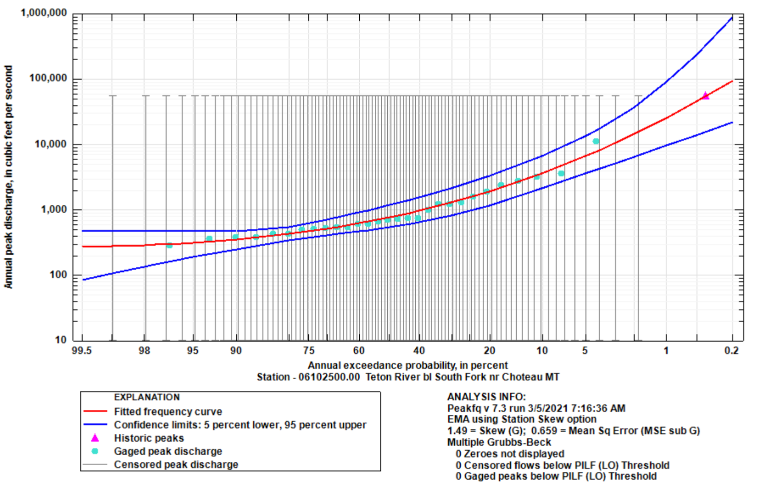

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

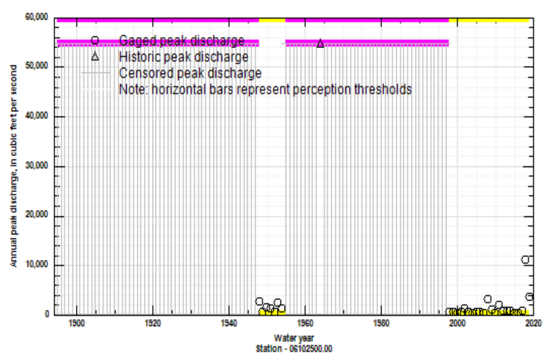

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06102500 Teton River below South Fork, near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1948	6/3/1948	2,780	--	5.32		1964	6/8/1964	54,600	7	--	Historic
1949	5/30/1949	515	--	4.92		2018	6/19/2018	11,100	--	9.01	
1950	6/21/1950	1,570	--	6.02		2019	5/27/2019	3,560	--	7.29	
1951	6/15/1951	1,230	--	5.72		2008	5/26/2008	3,200	--	7.11	
1952	5/20/1952	493	--	4.73		1948	6/3/1948	2,780	--	5.32	
1953	6/3/1953	2,400	--	6.87		1953	6/3/1953	2,400	--	6.87	
1954	5/20/1954	1,210	--	5.31		2011	6/7/2011	1,900	--	7.23	
1964	6/8/1964	54,600	7	--	Historic	1950	6/21/1950	1,570	--	6.02	
1998	6/18/1998	608	--	5.21		2002	6/17/2002	1,280	--	5.78	
1999	6/5/1999	657	--	5.35		1951	6/15/1951	1,230	--	5.72	
2000	6/9/2000	357	--	4.97		1954	5/20/1954	1,210	--	5.31	
2001	6/4/2001	525	--	5.22		2009	5/31/2009	988	--	5.77	
2002	6/17/2002	1,280	--	5.78		2012	6/6/2012	748	--	5.86	
2003	5/30/2003	608	--	5.21		2014	5/24/2014	736	--	5.71	
2004	6/6/2004	379	--	4.87		2013	5/14/2013	724	--	5.68	
2005	6/4/2005	547	--	5.13		2017	6/1/2017	706	--	5.65	
2006	5/20/2006	533	--	5.11		1999	6/5/1999	657	--	5.35	
2007	6/5/2007	385	--	4.89		1998	6/18/1998	608	--	5.21	
2008	5/26/2008	3,200	--	7.11		2003	5/30/2003	608	--	5.21	
2009	5/31/2009	988	--	5.77		2005	6/4/2005	547	--	5.13	
2010	6/21/2010	431	--	5.30		2006	5/20/2006	533	--	5.11	
2011	6/7/2011	1,900	--	7.23		2001	6/4/2001	525	--	5.22	
2012	6/6/2012	748	--	5.86		1949	5/30/1949	515	--	4.92	
2013	5/14/2013	724	--	5.68		1952	5/20/1952	493	--	4.73	
2014	5/24/2014	736	--	5.71		2015	5/29/2015	433	--	5.09	
2015	5/29/2015	433	--	5.09		2010	6/21/2010	431	--	5.30	
2016	5/9/2016	281	--	4.74		2007	6/5/2007	385	--	4.89	
2017	6/1/2017	706	--	5.65		2004	6/6/2004	379	--	4.87	
2018	6/19/2018	11,100	--	9.01		2000	6/9/2000	357	--	4.97	
2019	5/27/2019	3,560	--	7.29		2016	5/9/2016	281	--	4.74	

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06102500 Teton River below South Fork, near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
Peak-flow frequency analysis conducted on recorded and synthesized data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second	Type of peak-flow frequency analysis[2]				
110	72	Station	MGBT	--	MOVE3				
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
722	1,060	1,260	2,620	4,620	9,070	14,600	23,000	35,800	63,000
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
960	1,450	1,750	4,010	8,030	20,800	44,400	97,000	215,000	623,000
540	734	853	1,720	2,800	4,470	5,880	7,260	8,360	8,470

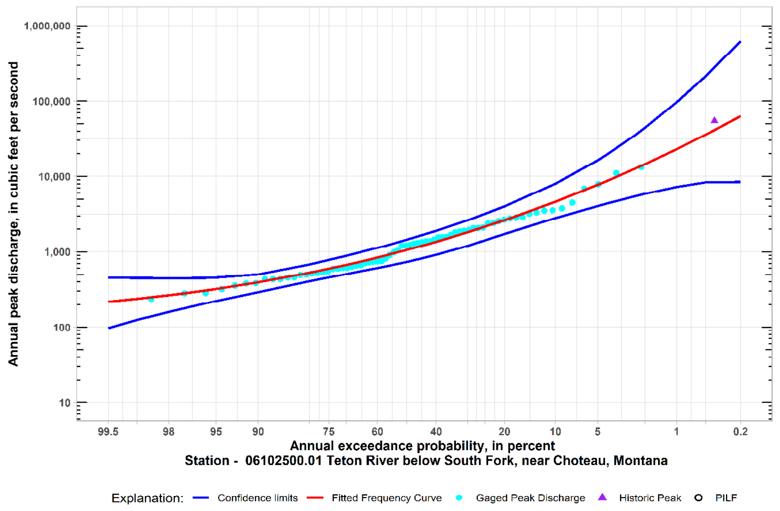

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

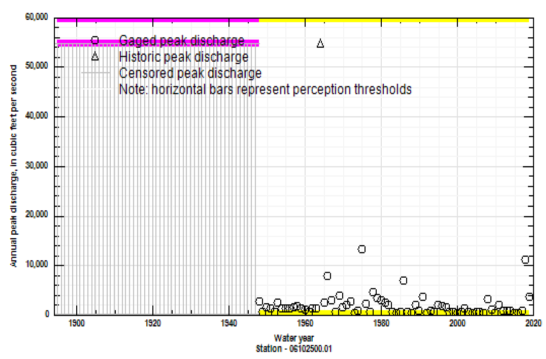

Figure 2. Annual peak flows and perception thresholds.

06102500 Teton River below South Fork, near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
Peak-flow frequency analysis conducted on recorded and synthesized data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1948	6/3/1948	2,780	--	5.32		1964	6/8/1964	54,600	7	--	Historic
1949	5/30/1949	515	--	4.92		1975	--	13,300	--	--	Synthesized
1950	6/21/1950	1,570	--	6.02		2018	6/19/2018	11,100	--	9.01	
1951	6/15/1951	1,230	--	5.72		1966	--	7,920	--	--	Synthesized
1952	5/20/1952	493	--	4.73		1986	--	6,920	--	--	Synthesized
1953	6/3/1953	2,400	--	6.87		1978	--	4,500	--	--	Synthesized
1954	5/20/1954	1,210	--	5.31		1969	--	3,770	--	--	Synthesized
1955	--	1,380	--	--	Synthesized	2019	5/27/2019	3,560	--	7.29	
1956	--	1,200	--	--	Synthesized	1991	--	3,530	--	--	Synthesized
1957	--	1,450	--	--	Synthesized	1979	--	3,320	--	--	Synthesized
1958	--	1,670	--	--	Synthesized	2008	5/26/2008	3,200	--	7.11	
1959	--	1,310	--	--	Synthesized	1967	--	2,890	--	--	Synthesized
1960	--	1,050	--	--	Synthesized	1980	--	2,840	--	--	Synthesized
1961	--	594	--	--	Synthesized	1948	6/3/1948	2,780	--	5.32	
1962	--	1,380	--	--	Synthesized	1972	--	2,660	--	--	Synthesized
1963	--	1,340	--	--	Synthesized	1981	--	2,550	--	--	Synthesized
1964	6/8/1964	54,600	7	--	Historic	1953	6/3/1953	2,400	--	6.87	
1965	--	2,370	--	--	Synthesized	1965	--	2,370	--	--	Synthesized
1966	--	7,920	--	--	Synthesized	1976	--	2,100	--	--	Synthesized
1967	--	2,890	--	--	Synthesized	1971	--	2,070	--	--	Synthesized
1968	--	638	--	--	Synthesized	1982	--	2,060	--	--	Synthesized
1969	--	3,770	--	--	Synthesized	1989	--	1,940	--	--	Synthesized
1970	--	1,550	--	--	Synthesized	2011	6/7/2011	1,900	--	7.23	
1971	--	2,070	--	--	Synthesized	1995	--	1,860	--	--	Synthesized
1972	--	2,660	--	--	Synthesized	1996	--	1,810	--	--	Synthesized
1973	--	435	--	--	Synthesized	1958	--	1,670	--	--	Synthesized
1974	--	817	--	--	Synthesized	1950	6/21/1950	1,570	--	6.02	
1975	--	13,300	--	--	Synthesized	1997	--	1,560	--	--	Synthesized
1976	--	2,100	--	--	Synthesized	1970	--	1,550	--	--	Synthesized
1977	--	498	--	--	Synthesized	1957	--	1,450	--	--	Synthesized
1978	--	4,500	--	--	Synthesized	1955	--	1,380	--	--	Synthesized
1979	--	3,320	--	--	Synthesized	1962	--	1,380	--	--	Synthesized
1980	--	2,840	--	--	Synthesized	1963	--	1,340	--	--	Synthesized
1981	--	2,550	--	--	Synthesized	1959	--	1,310	--	--	Synthesized
1982	--	2,060	--	--	Synthesized	2002	6/17/2002	1,280	--	5.78	
1983	--	460	--	--	Synthesized	1951	6/15/1951	1,230	--	5.72	
1984	--	320	--	--	Synthesized	1954	5/20/1954	1,210	--	5.31	
1985	--	455	--	--	Synthesized	1956	--	1,200	--	--	Synthesized
1986	--	6,920	--	--	Synthesized	1960	--	1,050	--	--	Synthesized
1987	--	598	--	--	Synthesized	2009	5/31/2009	988	--	5.77	
1988	--	237	--	--	Synthesized	1990	--	903	--	--	Synthesized
1989	--	1,940	--	--	Synthesized	1974	--	817	--	--	Synthesized
1990	--	903	--	--	Synthesized	1993	--	754	--	--	Synthesized
1991	--	3,530	--	--	Synthesized	2012	6/6/2012	748	--	5.86	
1992	--	284	--	--	Synthesized	2014	5/24/2014	736	--	5.71	
1993	--	754	--	--	Synthesized	2013	5/14/2013	724	--	5.68	
1994	--	663	--	--	Synthesized	2017	6/1/2017	706	--	5.65	
1995	--	1,860	--	--	Synthesized	1994	--	663	--	--	Synthesized
1996	--	1,810	--	--	Synthesized	1999	6/5/1999	657	--	5.35	
1997	--	1,560	--	--	Synthesized	1968	--	638	--	--	Synthesized
1998	6/18/1998	608	--	5.21		1998	6/18/1998	608	--	5.21	
1999	6/5/1999	657	--	5.35		2003	5/30/2003	608	--	5.21	
2000	6/9/2000	357	--	4.97		1987	--	598	--	--	Synthesized
2001	6/4/2001	525	--	5.22		1961	--	594	--	--	Synthesized
2002	6/17/2002	1,280	--	5.78		2005	6/4/2005	547	--	5.13	
2003	5/30/2003	608	--	5.21		2006	5/20/2006	533	--	5.11	
2004	6/6/2004	379	--	4.87		2001	6/4/2001	525	--	5.22	
2005	6/4/2005	547	--	5.13		1949	5/30/1949	515	--	4.92	
2006	5/20/2006	533	--	5.11		1977	--	498	--	--	Synthesized
2007	6/5/2007	385	--	4.89		1952	5/20/1952	493	--	4.73	
2008	5/26/2008	3,200	--	7.11		1983	--	460	--	--	Synthesized
2009	5/31/2009	988	--	5.77		1985	--	455	--	--	Synthesized
2010	6/21/2010	431	--	5.30		1973	--	435	--	--	Synthesized
2011	6/7/2011	1,900	--	7.23		2015	5/29/2015	433	--	5.09	
2012	6/6/2012	748	--	5.86		2010	6/21/2010	431	--	5.30	
2013	5/14/2013	724	--	5.68		2007	6/5/2007	385	--	4.89	
2014	5/24/2014	736	--	5.71		2004	6/6/2004	379	--	4.87	
2015	5/29/2015	433	--	5.09		2000	6/9/2000	357	--	4.97	
2016	5/9/2016	281	--	4.74		1984	--	320	--	--	Synthesized
2017	6/1/2017	706	--	5.65		1992	--	284	--	--	Synthesized
2018	6/19/2018	11,100	--	9.01		2016	5/9/2016	281	--	4.74	
2019	5/27/2019	3,560	--	7.29		1988	--	237	--	--	Synthesized

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[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
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References:
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Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

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06103000 Teton River at Strabane, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
124	18	Station	MGBT	--			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
418	523	598	1,260	2,650	7,400	16,500	37,200	84,800	255,000
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
616	966	1,180	2,880	6,300	18,900	47,700	134,000	412,000	2,030,000
315	372	405	701	1,340	3,280	6,200	11,300	20,300	43,000

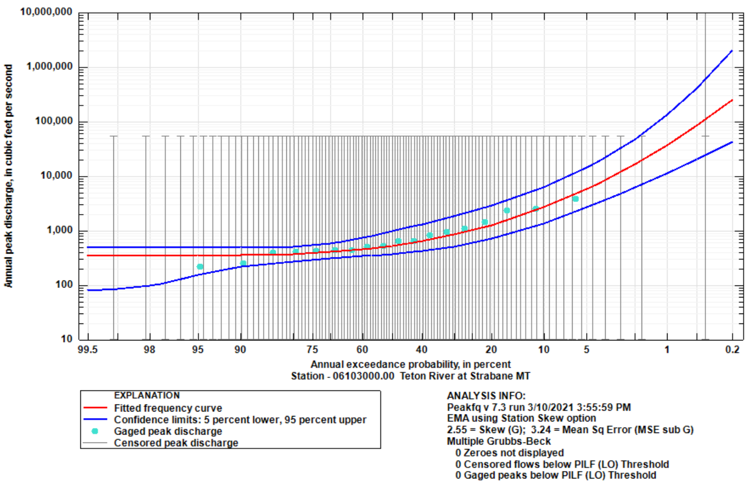
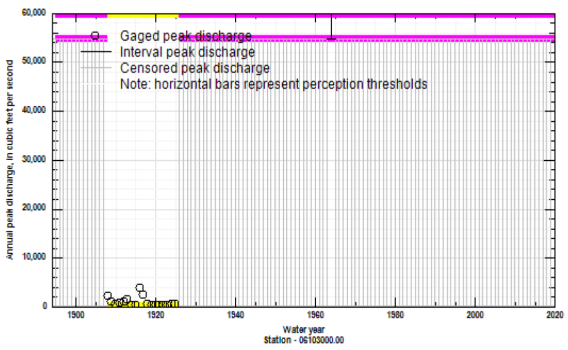


Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.



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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
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Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:

England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.

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06103000 Teton River at Strabane, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1908	6/10/1908	2,300	--	--		1916	6/21/1916	3,810	--	7.80	
1909	7/27/1909	1,080	--	--		1917	5/26/1917	2,460	--	6.45	
1910	5/4/1910	525	--	--		1908	6/10/1908	2,300	--	--	
1911	5/16/1911	820	--	5.10		1913	6/2/1913	1,410	--	5.80	
1912	5/22/1912	925	--	5.40		1909	7/27/1909	1,080	--	--	
1913	6/2/1913	1,410	--	5.80		1912	5/22/1912	925	--	5.40	
1914	6/4/1914	415	--	4.76		1911	5/16/1911	820	--	5.10	
1915	5/9/1915	430	--	4.75		1925	5/21/1925	642	--	4.06	
1916	6/21/1916	3,810	--	7.80		1918	6/10/1918	636	--	4.25	
1917	5/26/1917	2,460	--	6.45		1910	5/4/1910	525	--	--	
1918	6/10/1918	636	--	4.25		1924	6/16/1924	502	--	4.06	
1919	5/23/1919	217	--	2.82		1920	6/15/1920	432	--	3.70	
1920	6/15/1920	432	--	3.70		1915	5/9/1915	430	--	4.75	
1921	5/20/1921	396	--	3.59		1914	6/4/1914	415	--	4.76	
1922	6/5/1922	412	--	3.74		1922	6/5/1922	412	--	3.74	
1923	6/16/1923	252	--	3.24		1921	5/20/1921	396	--	3.59	
1924	6/16/1924	502	--	4.06		1923	6/16/1923	252	--	3.24	
1925	5/21/1925	642	--	4.06		1919	5/23/1919	217	--	2.82	

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06103000 Teton River at Strabane, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
124			MGBT	--			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
424	556	655	1,560	3,180	7,460	13,500	22,700	36,600	63,600
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
622	987	1,220	3,090	6,350	15,400	30,200	57,800	109,000	241,000
321	398	449	915	1,770	3,830	6,230	9,250	13,000	18,400

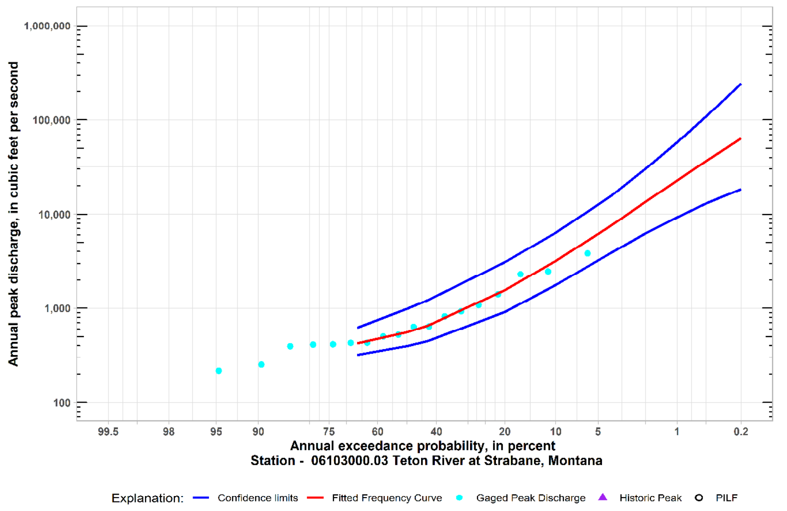

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06103000 Teton River at Strabane, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1908	6/10/1908	2,300	--	--		1916	6/21/1916	3,810	--	7.80	
1909	7/27/1909	1,080	--	--		1917	5/26/1917	2,460	--	6.45	
1910	5/4/1910	525	--	--		1908	6/10/1908	2,300	--	--	
1911	5/16/1911	820	--	5.10		1913	6/2/1913	1,410	--	5.80	
1912	5/22/1912	925	--	5.40		1909	7/27/1909	1,080	--	--	
1913	6/2/1913	1,410	--	5.80		1912	5/22/1912	925	--	5.40	
1914	6/4/1914	415	--	4.76		1911	5/16/1911	820	--	5.10	
1915	5/9/1915	430	--	4.75		1925	5/21/1925	642	--	4.06	
1916	6/21/1916	3,810	--	7.80		1918	6/10/1918	636	--	4.25	
1917	5/26/1917	2,460	--	6.45		1910	5/4/1910	525	--	--	
1918	6/10/1918	636	--	4.25		1924	6/16/1924	502	--	4.06	
1919	5/23/1919	217	--	2.82		1920	6/15/1920	432	--	3.70	
1920	6/15/1920	432	--	3.70		1915	5/9/1915	430	--	4.75	
1921	5/20/1921	396	--	3.59		1914	6/4/1914	415	--	4.76	
1922	6/5/1922	412	--	3.74		1922	6/5/1922	412	--	3.74	
1923	6/16/1923	252	--	3.24		1921	5/20/1921	396	--	3.59	
1924	6/16/1924	502	--	4.06		1923	6/16/1923	252	--	3.24	
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06105800 Bruce Coulee tributary near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 2002
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second	Type of peak-flow frequency analysis[2]				
1.84	40	Weighted	MGBT	--	At-site				
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
28	44	53	108	174	293	413	565	755	1,080
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
38	59	72	156	282	580	973	1,600	2,590	4,810
21	33	40	79	123	195	258	330	411	530

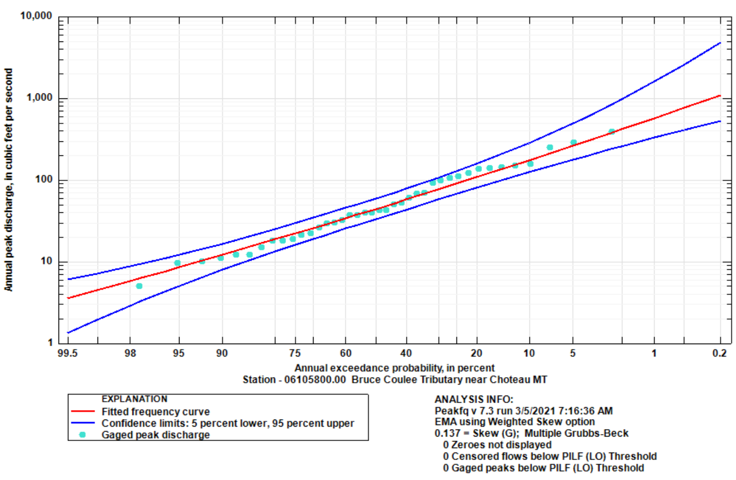

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

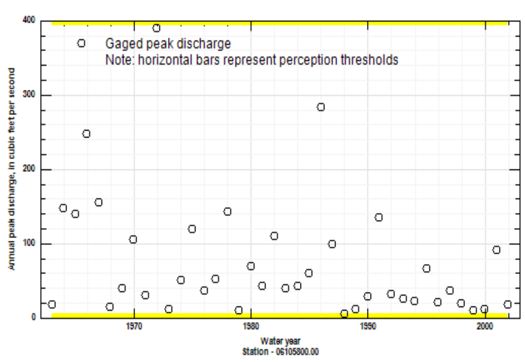

Figure 2. Annual peak flows and perception thresholds.

06105800 Bruce Coulee tributary near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 2002
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1963	6/28/1963	18	2	0.65		1972	6/9/1972	390	--	5.06	
1964	6/8/1964	148	--	1.76		1986	9/18/1986	284	--	2.73	
1965	6/16/1965	140	--	1.90		1966	7/2/1966	247	--	3.50	
1966	7/2/1966	247	--	3.50		1967	6/10/1967	155	--	2.44	
1967	6/10/1967	155	--	2.44		1964	6/8/1964	148	--	1.76	
1968	9/21/1968	15	--	0.54		1978	7/2/1978	142	--	2.37	
1969	3/26/1969	40	--	0.92		1965	6/16/1965	140	--	1.90	
1970	7/13/1970	105	--	1.84		1991	6/21/1991	135	--	10.00	
1971	2/13/1971	30	--	0.83		1975	6/19/1975	120	--	2.00	
1972	6/9/1972	390	--	5.06		1982	6/30/1982	110	--	2.22	
1973	4/25/1973	12	--	0.49		1970	7/13/1970	105	--	1.84	
1974	8/13/1974	50	--	1.08		1987	7/18/1987	99	--	2.17	
1975	6/19/1975	120	--	2.00		2001	7/31/2001	91	--	6.75	
1976	5/4/1976	37	--	0.93		1980	5/25/1980	70	--	2.06	
1977	4/5/1977	52	--	1.15		1995	5/12/1995	67	--	5.28	
1978	7/2/1978	142	--	2.37		1985	8/16/1985	60	--	2.02	
1979	6/18/1979	10	--	1.34		1977	4/5/1977	52	--	1.15	
1980	5/25/1980	70	--	2.06		1974	8/13/1974	50	--	1.08	
1981	5/24/1981	43	--	1.84		1981	5/24/1981	43	--	1.84	
1982	6/30/1982	110	--	2.22		1984	6/21/1984	43	--	1.58	
1983	7/10/1983	40	--	1.85		1969	3/26/1969	40	--	0.92	
1984	6/21/1984	43	--	1.58		1983	7/10/1983	40	--	1.85	
1985	8/16/1985	60	--	2.02		1976	5/4/1976	37	--	0.93	
1986	9/18/1986	284	--	2.73		1997	6/11/1997	37	--	3.60	
1987	7/18/1987	99	--	2.17		1992	7/21/1992	32	--	3.39	
1988	5/30/1988	5	--	2.04		1971	2/13/1971	30	--	0.83	
1989	8/26/1989	11	--	2.50		1990	5/25/1990	29	--	3.25	
1990	5/25/1990	29	--	3.25		1993	8/21/1993	26	--	3.08	
1991	6/21/1991	135	--	10.00		1994	5/19/1994	22	--	2.94	
1992	7/21/1992	32	--	3.39		1996	3/10/1996	21	--	2.90	
1993	8/21/1993	26	--	3.08		1998	6/17/1998	19	--	2.85	
1994	5/19/1994	22	--	2.94		1963	6/28/1963	18	2	0.65	
1995	5/12/1995	67	--	5.28		2002	6/10/2002	18	--	2.80	
1996	3/10/1996	21	--	2.90		1968	9/21/1968	15	--	0.54	
1997	6/11/1997	37	--	3.60		1973	4/25/1973	12	--	0.49	
1998	6/17/1998	19	--	2.85		2000	7/8/2000	12	--	2.52	
1999	8/11/1999	9.6	--	2.41		1989	8/26/1989	11	--	2.50	
2000	7/8/2000	12	--	2.52		1979	6/18/1979	10	--	1.34	
2001	7/31/2001	91	--	6.75		1999	8/11/1999	9.6	--	2.41	
2002	6/10/2002	18	--	2.80		1988	5/30/1988	5	--	2.04	

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
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Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
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References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
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06105800 Bruce Coulee tributary near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 2002
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
1.84			MGBT	--			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
27	43	52	105	170	287	405	550	736	1,040
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
37	57	69	148	258	485	747	1,110	1,640	2,680
20	32	39	78	123	199	268	345	434	564

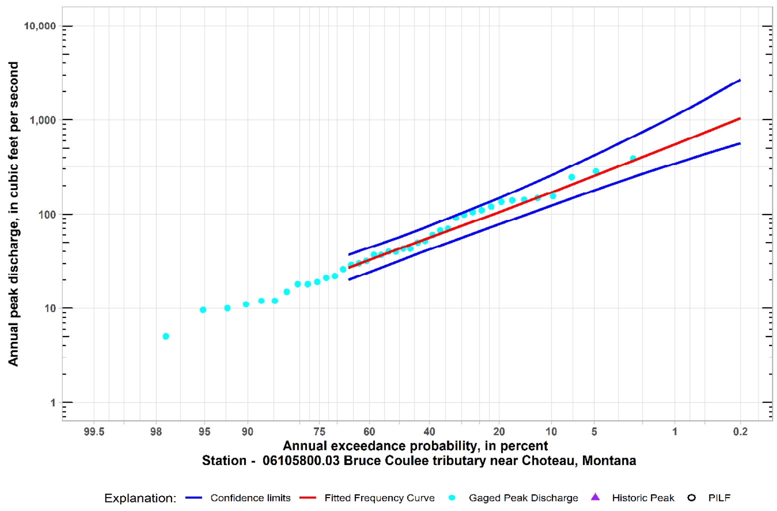

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06105800 Bruce Coulee tributary near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 2002
At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1963	6/28/1963	18	2	0.65		1972	6/9/1972	390	--	5.06	
1964	6/8/1964	148	--	1.76		1986	9/18/1986	284	--	2.73	
1965	6/16/1965	140	--	1.90		1966	7/2/1966	247	--	3.50	
1966	7/2/1966	247	--	3.50		1967	6/10/1967	155	--	2.44	
1967	6/10/1967	155	--	2.44		1964	6/8/1964	148	--	1.76	
1968	9/21/1968	15	--	0.54		1978	7/2/1978	142	--	2.37	
1969	3/26/1969	40	--	0.92		1965	6/16/1965	140	--	1.90	
1970	7/13/1970	105	--	1.84		1991	6/21/1991	135	--	10.00	
1971	2/13/1971	30	--	0.83		1975	6/19/1975	120	--	2.00	
1972	6/9/1972	390	--	5.06		1982	6/30/1982	110	--	2.22	
1973	4/25/1973	12	--	0.49		1970	7/13/1970	105	--	1.84	
1974	8/13/1974	50	--	1.08		1987	7/18/1987	99	--	2.17	
1975	6/19/1975	120	--	2.00		2001	7/31/2001	91	--	6.75	
1976	5/4/1976	37	--	0.93		1980	5/25/1980	70	--	2.06	
1977	4/5/1977	52	--	1.15		1995	5/12/1995	67	--	5.28	
1978	7/2/1978	142	--	2.37		1985	8/16/1985	60	--	2.02	
1979	6/18/1979	10	--	1.34		1977	4/5/1977	52	--	1.15	
1980	5/25/1980	70	--	2.06		1974	8/13/1974	50	--	1.08	
1981	5/24/1981	43	--	1.84		1981	5/24/1981	43	--	1.84	
1982	6/30/1982	110	--	2.22		1984	6/21/1984	43	--	1.58	
1983	7/10/1983	40	--	1.85		1969	3/26/1969	40	--	0.92	
1984	6/21/1984	43	--	1.58		1983	7/10/1983	40	--	1.85	
1985	8/16/1985	60	--	2.02		1976	5/4/1976	37	--	0.93	
1986	9/18/1986	284	--	2.73		1997	6/11/1997	37	--	3.60	
1987	7/18/1987	99	--	2.17		1992	7/21/1992	32	--	3.39	
1988	5/30/1988	5	--	2.04		1971	2/13/1971	30	--	0.83	
1989	8/26/1989	11	--	2.50		1990	5/25/1990	29	--	3.25	
1990	5/25/1990	29	--	3.25		1993	8/21/1993	26	--	3.08	
1991	6/21/1991	135	--	10.00		1994	5/19/1994	22	--	2.94	
1992	7/21/1992	32	--	3.39		1996	3/10/1996	21	--	2.90	
1993	8/21/1993	26	--	3.08		1998	6/17/1998	19	--	2.85	
1994	5/19/1994	22	--	2.94		1963	6/28/1963	18	2	0.65	
1995	5/12/1995	67	--	5.28		2002	6/10/2002	18	--	2.80	
1996	3/10/1996	21	--	2.90		1968	9/21/1968	15	--	0.54	
1997	6/11/1997	37	--	3.60		1973	4/25/1973	12	--	0.49	
1998	6/17/1998	19	--	2.85		2000	7/8/2000	12	--	2.52	
1999	8/11/1999	9.6	--	2.41		1989	8/26/1989	11	--	2.50	
2000	7/8/2000	12	--	2.52		1979	6/18/1979	10	--	1.34	
2001	7/31/2001	91	--	6.75		1999	8/11/1999	9.6	--	2.41	
2002	6/10/2002	18	--	2.80		1988	5/30/1988	5	--	2.04	

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
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References:

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06106000 Deep Creek near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
269	15	Weighted	MGBT	--			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
357	607	764	1,910	3,680	7,770	12,900	20,800	32,500	57,100
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
659	1,140	1,450	3,750	7,480	17,200	31,900	59,600	113,000	269,000
199	337	420	988	1,790	3,380	5,130	7,510	10,700	16,600

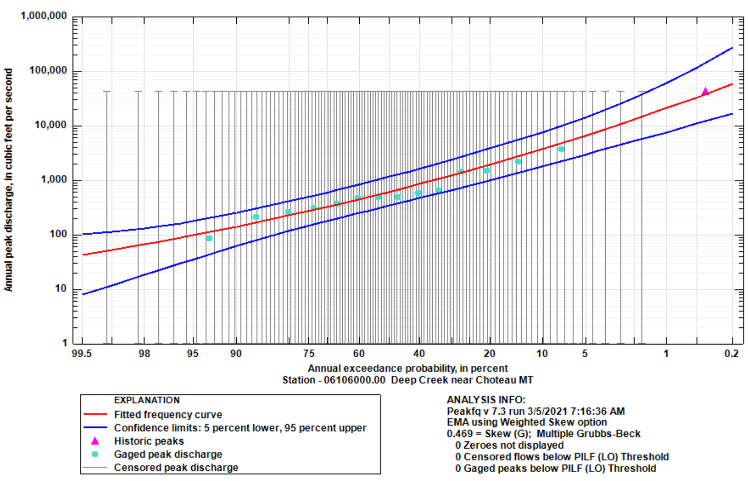

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

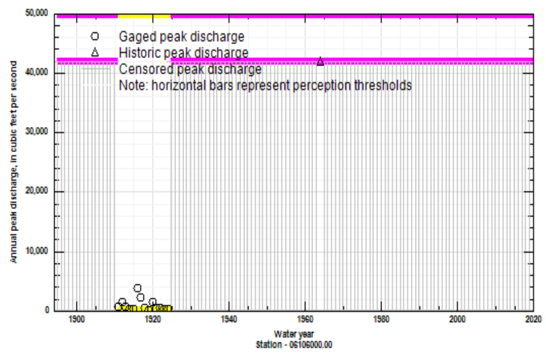

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
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[2]Definitions of type of peak-flow frequency analysis include:
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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
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06106000 Deep Creek near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1911	5/16/1911	582	--	7.30		1964	6/8/1964	41,800	7	--	Historic
1912	5/21/1912	1,460	--	8.40		1916	6/21/1916	3,700	--	10.50	
1913	5/30/1913	644	--	7.45		1917	5/26/1917	2,150	--	9.10	
1914	5/25/1914	212	--	6.50		1912	5/21/1912	1,460	--	8.40	
1915	7/26/1915	260	--	6.60		1920	4/13/1920	1,420	--	8.35	
1916	6/21/1916	3,700	--	10.50		1913	5/30/1913	644	--	7.45	
1917	5/26/1917	2,150	--	9.10		1911	5/16/1911	582	--	7.30	
1918	1/1/1918	477	--	7.10		1921	5/19/1921	490	--	7.15	
1919	3/23/1919	84	--	5.93		1918	1/1/1918	477	--	7.10	
1920	4/13/1920	1,420	--	8.35		1922	6/10/1922	465	--	7.10	
1921	5/19/1921	490	--	7.15		1923	7/8/1923	361	--	6.85	
1922	6/10/1922	465	--	7.10		1924	6/9/1924	304	--	6.70	
1923	7/8/1923	361	--	6.85		1915	7/26/1915	260	--	6.60	
1924	6/9/1924	304	--	6.70		1914	5/25/1914	212	--	6.50	
1964	6/8/1964	41,800	7	--	Historic	1919	3/23/1919	84	--	5.93	

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Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

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Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
269			MGBT	--			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
356	600	751	1,780	3,200	6,070	9,350	13,800	20,100	32,000
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
630	1,060	1,320	3,100	5,510	10,800	17,600	28,100	45,200	84,400
205	351	439	1,040	1,850	3,380	4,940	6,820	9,270	13,300

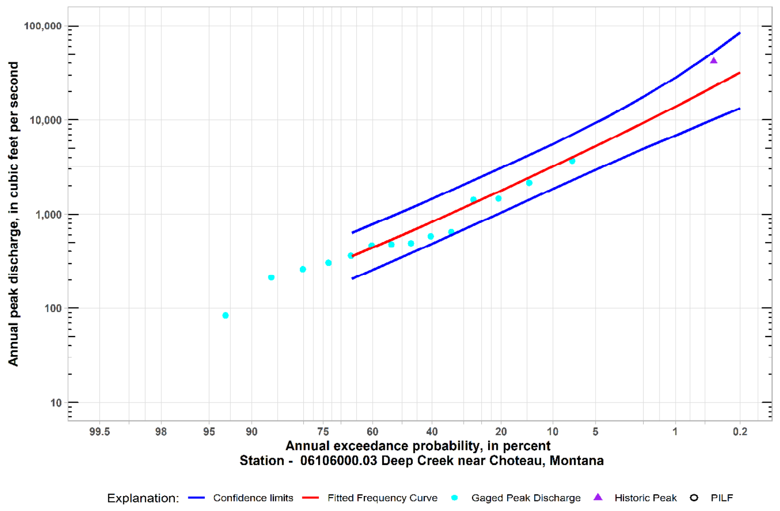

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06106000 Deep Creek near Choteau, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1911	5/16/1911	582	--	7.30		1964	6/8/1964	41,800	7	--	Historic
1912	5/21/1912	1,460	--	8.40		1916	6/21/1916	3,700	--	10.50	
1913	5/30/1913	644	--	7.45		1917	5/26/1917	2,150	--	9.10	
1914	5/25/1914	212	--	6.50		1912	5/21/1912	1,460	--	8.40	
1915	7/26/1915	260	--	6.60		1920	4/13/1920	1,420	--	8.35	
1916	6/21/1916	3,700	--	10.50		1913	5/30/1913	644	--	7.45	
1917	5/26/1917	2,150	--	9.10		1911	5/16/1911	582	--	7.30	
1918	1/1/1918	477	--	7.10		1921	5/19/1921	490	--	7.15	
1919	3/23/1919	84	--	5.93		1918	1/1/1918	477	--	7.10	
1920	4/13/1920	1,420	--	8.35		1922	6/10/1922	465	--	7.10	
1921	5/19/1921	490	--	7.15		1923	7/8/1923	361	--	6.85	
1922	6/10/1922	465	--	7.10		1924	6/9/1924	304	--	6.70	
1923	7/8/1923	361	--	6.85		1915	7/26/1915	260	--	6.60	
1924	6/9/1924	304	--	6.70		1914	5/25/1914	212	--	6.50	
1964	6/8/1964	41,800	7	--	Historic	1919	3/23/1919	84	--	5.93	

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
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PILF: The peak flow was identified as a potentially influential low flow;
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06106500 Muddy Creek near Bynum, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1913 - 1924
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
72.1	10	Weighted	MGBT	--			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
46	95	130	413	904	2,110	3,690	6,110	9,750	17,300
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
115	246	344	1,420	4,520	19,300	55,600	156,000	426,000	1,570,000
16	36	50	158	329	693	1,090	1,590	2,220	3,240

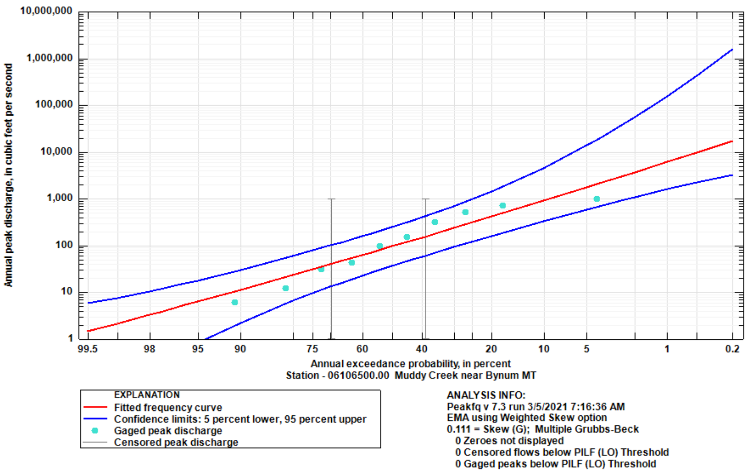

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

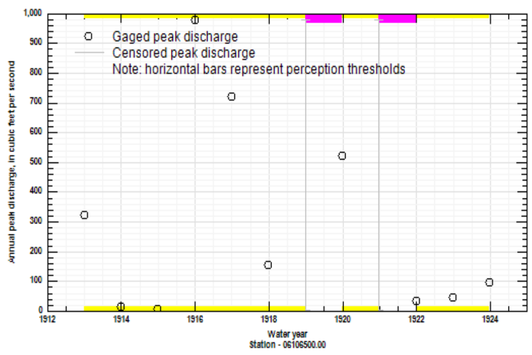

Figure 2. Annual peak flows and perception thresholds.

06106500 Muddy Creek near Bynum, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1913 - 1924
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1913	6/27/1913	320	--	--		1916	6/21/1916	976	--	--	
1914	6/14/1914	12	--	--		1917	5/26/1917	720	--	--	
1915	8/2/1915	6	--	--		1920	4/14/1920	519	--	--	
1916	6/21/1916	976	--	--		1913	6/27/1913	320	--	--	
1917	5/26/1917	720	--	--		1918	12/31/1917	152	--	--	
1918	12/31/1917	152	--	--		1924	6/9/1924	96	--	3.60	
1920	4/14/1920	519	--	--		1923	7/8/1923	43	--	2.76	
1922	6/11/1922	31	--	2.47		1922	6/11/1922	31	--	2.47	
1923	7/8/1923	43	--	2.76		1914	6/14/1914	12	--	--	
1924	6/9/1924	96	--	3.60		1915	8/2/1915	6	--	--	

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
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PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

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06106500 Muddy Creek near Bynum, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1913 - 1924
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
72.1			MGBT	--			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
66	144	197	634	1,300	2,560	3,840	5,390	7,510	11,200
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
148	311	423	1,360	2,780	5,660	9,090	14,000	21,700	38,100
27	66	93	320	671	1,300	1,850	2,420	3,100	4,040

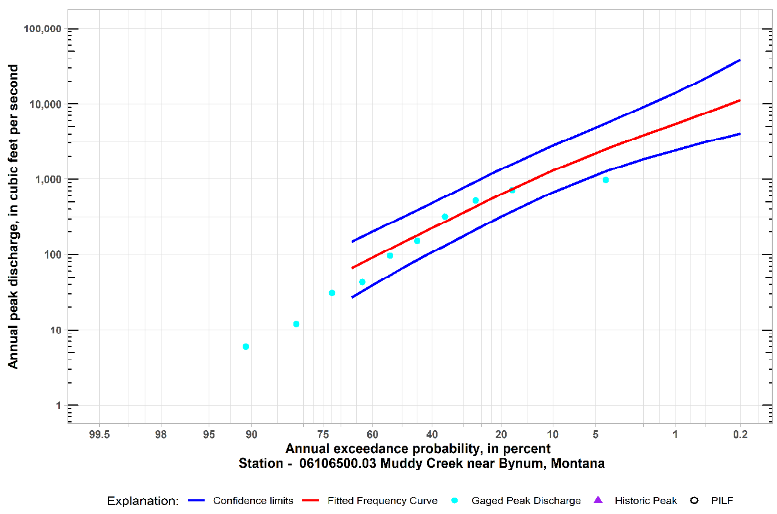

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06106500 Muddy Creek near Bynum, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1913 - 1924
At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1913	6/27/1913	320	--	--		1916	6/21/1916	976	--	--	
1914	6/14/1914	12	--	--		1917	5/26/1917	720	--	--	
1915	8/2/1915	6	--	--		1920	4/14/1920	519	--	--	
1916	6/21/1916	976	--	--		1913	6/27/1913	320	--	--	
1917	5/26/1917	720	--	--		1918	12/31/1917	152	--	--	
1918	12/31/1917	152	--	--		1924	6/9/1924	96	--	3.60	
1920	4/14/1920	519	--	--		1923	7/8/1923	43	--	2.76	
1922	6/11/1922	31	--	2.47		1922	6/11/1922	31	--	2.47	
1923	7/8/1923	43	--	2.76		1914	6/14/1914	12	--	--	
1924	6/9/1924	96	--	3.60		1915	8/2/1915	6	--	--	

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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
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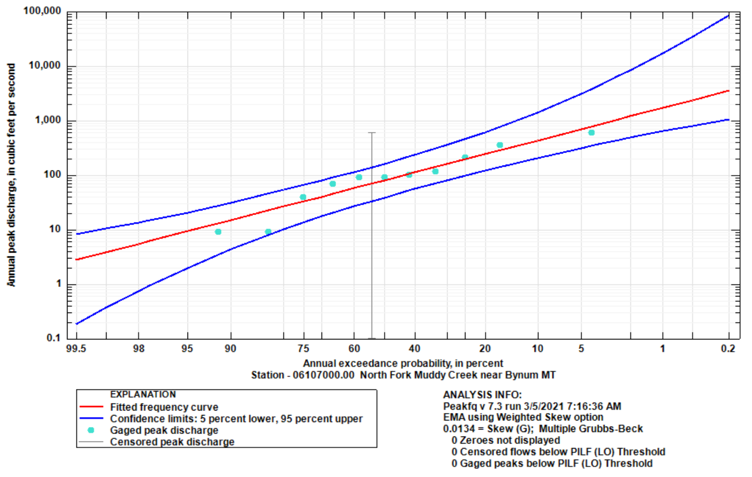
06107000 North Fork Muddy Creek near Bynum, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1913 - 1924
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
55.8	11	Weighted	MGBT	--			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
45	80	101	240	429	797	1,190	1,710	2,380	3,550
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
90	161	208	601	1,400	3,970	8,360	17,200	34,400	84,500
20	39	50	119	205	353	488	639	805	1,040



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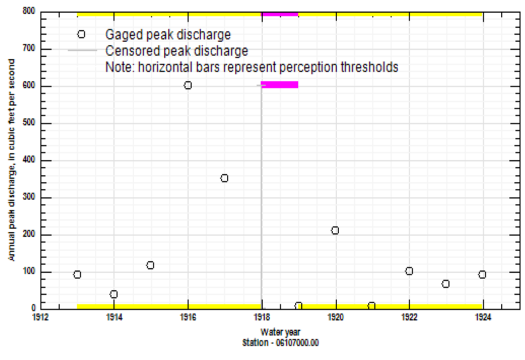

Figure 2. Annual peak flows and perception thresholds.

06107000 North Fork Muddy Creek near Bynum, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1913 - 1924
At-site peak-flow frequency analysis conducted on recorded data

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Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1913	4/7/1913	91	--	3.30		1916	6/21/1916	600	--	5.85	
1914	10/13/1913	40	--	2.70		1917	6/1/1917	352	--	5.03	
1915	8/1/1915	118	--	3.35		1920	5/12/1920	212	--	4.26	
1916	6/21/1916	600	--	5.85		1915	8/1/1915	118	--	3.35	
1917	6/1/1917	352	--	5.03		1922	4/29/1922	102	--	3.70	
1919	11/13/1918	9	--	3.12		1924	6/8/1924	92	--	3.55	
1920	5/12/1920	212	--	4.26		1913	4/7/1913	91	--	3.30	
1921	5/7/1921	9	--	2.88		1923	7/9/1923	68	--	3.50	
1922	4/29/1922	102	--	3.70		1914	10/13/1913	40	--	2.70	
1923	7/9/1923	68	--	3.50		1919	11/13/1918	9	--	3.12	
1924	6/8/1924	92	--	3.55		1921	5/7/1921	9	--	2.88	

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06107000 North Fork Muddy Creek near Bynum, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1913 - 1924
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
55.8			MGBT	--			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
54	101	130	358	711	1,420	2,150	3,010	4,160	6,040
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
101	186	242	690	1,410	2,940	4,740	7,260	11,100	18,900
27	54	71	204	409	800	1,150	1,520	1,960	2,550

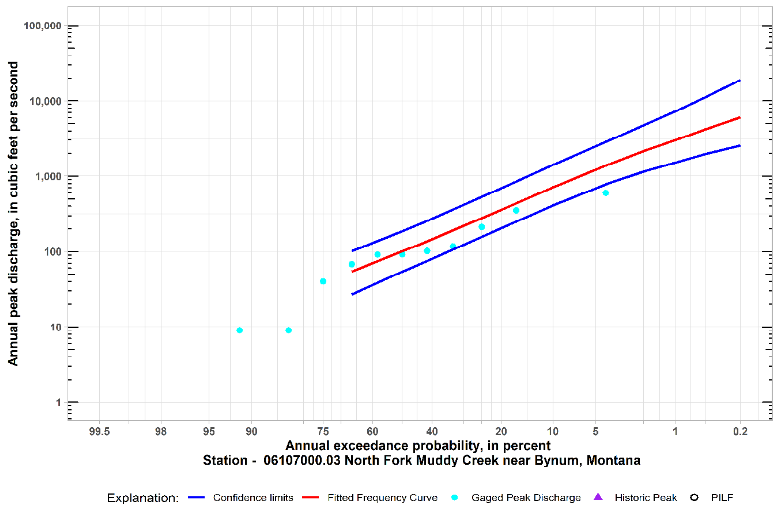

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06107000 North Fork Muddy Creek near Bynum, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1913 - 1924
At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1913	4/7/1913	91	--	3.30		1916	6/21/1916	600	--	5.85	
1914	10/13/1913	40	--	2.70		1917	6/1/1917	352	--	5.03	
1915	8/1/1915	118	--	3.35		1920	5/12/1920	212	--	4.26	
1916	6/21/1916	600	--	5.85		1915	8/1/1915	118	--	3.35	
1917	6/1/1917	352	--	5.03		1922	4/29/1922	102	--	3.70	
1919	11/13/1918	9	--	3.12		1924	6/8/1924	92	--	3.55	
1920	5/12/1920	212	--	4.26		1913	4/7/1913	91	--	3.30	
1921	5/7/1921	9	--	2.88		1923	7/9/1923	68	--	3.50	
1922	4/29/1922	102	--	3.70		1914	10/13/1913	40	--	2.70	
1923	7/9/1923	68	--	3.50		1919	11/13/1918	9	--	3.12	
1924	6/8/1924	92	--	3.55		1921	5/7/1921	9	--	2.88	

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

Note: Not all footnotes are applicable for each frequency analysis. Even if a footnote is not applicable for a given frequency analysis, it is retained in the worksheet for convenience and to maintain consistency among the various similarly structured frequency-analysis worksheets. Also, not all table columns are applicable for each frequency analysis. Even if a table column is not applicable for a given frequency analysis, it is retained in the worksheet for convenience and to maintain consistency among the various similarly structured frequency-analysis worksheets.

06108000 Teton River near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
1,238	65	Station	MGBT	--			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
462	785	990	2,500	4,870	10,500	17,600	28,800	45,800	82,000
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
610	1,050	1,340	3,620	7,780	20,600	43,300	91,000	192,000	515,000
350	583	730	1,800	3,330	6,420	9,860	14,600	20,800	32,300

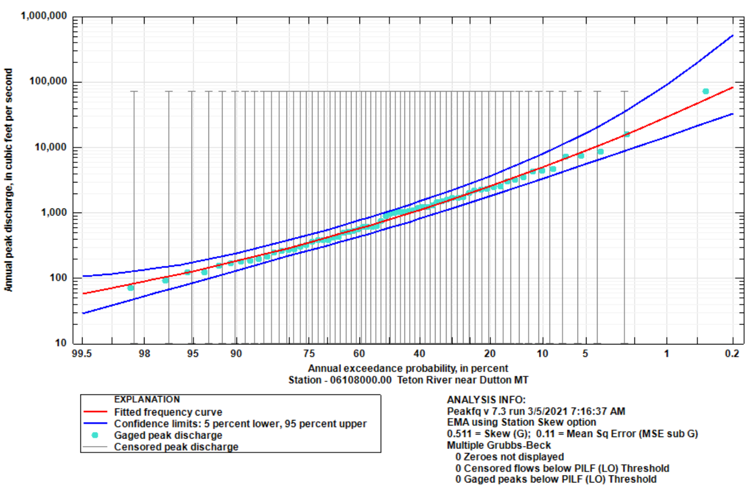

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

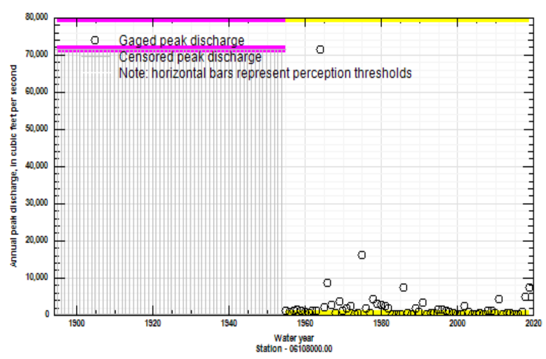

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
MOVE3: Peak-flow frequency analysis on combined recorded and synthesized data; synthesized data from Maintenance of Variance Extension Type III (MOVE.3) record extension procedure;
RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06108000 Teton River near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1955	7/17/1955	1,040	--	--		1964	6/9/1964	71,300	--	20.48	
1956	8/4/1956	875	--	--		1975	6/20/1975	16,000	--	14.80	
1957	5/23/1957	1,100	--	--		1966	7/2/1966	8,580	--	12.00	
1958	6/21/1958	1,310	--	5.96		2019	5/28/2019	7,380	--	12.15	
1959	3/19/1959	975	--	--		1986	2/26/1986	7,290	--	11.52	
1960	5/4/1960	744	--	--		2018	6/21/2018	4,720	--	9.83	
1961	6/1/1961	376	--	--		1978	3/20/1978	4,340	--	8.30	
1962	5/28/1962	1,040	--	--		2011	6/10/2011	4,240	--	9.23	
1963	2/7/1963	1,000	--	7.06		1969	3/19/1969	3,500	1,2	--	
1964	6/9/1964	71,300	--	20.48		1991	6/22/1991	3,230	--	7.77	
1965	6/17/1965	2,000	--	6.50		1979	3/7/1979	3,000	1,2	--	
1966	7/2/1966	8,580	--	12.00		1967	6/14/1967	2,540	--	6.22	
1967	6/14/1967	2,540	--	6.22		1980	5/26/1980	2,490	--	6.39	
1968	9/24/1968	410	--	3.09		1972	6/10/1972	2,300	--	11.60	
1969	3/19/1969	3,500	1,2	--		2002	6/11/2002	2,240	--	7.07	
1970	6/15/1970	1,200	2	5.96		1981	5/24/1981	2,180	--	6.01	
1971	6/2/1971	1,700	2	7.62		1965	6/17/1965	2,000	--	6.50	
1972	6/10/1972	2,300	--	11.60		1976	5/6/1976	1,730	--	5.47	
1973	4/17/1973	258	--	3.89		1971	6/2/1971	1,700	2	7.62	
1974	6/24/1974	552	--	4.88		1982	7/1/1982	1,690	--	5.35	
1975	6/20/1975	16,000	--	14.80		1989	3/24/1989	1,570	--	5.04	
1976	5/6/1976	1,730	--	5.47		1995	6/8/1995	1,490	--	5.62	
1977	4/7/1977	304	--	2.65		1996	3/13/1996	1,440	--	5.40	
1978	3/20/1978	4,340	--	8.30		1958	6/21/1958	1,310	--	5.96	
1979	3/7/1979	3,000	1,2	--		2008	5/27/2008	1,220	--	5.21	
1980	5/26/1980	2,490	--	6.39		1997	5/27/1997	1,210	--	5.20	
1981	5/24/1981	2,180	--	6.01		1970	6/15/1970	1,200	2	5.96	
1982	7/1/1982	1,690	--	5.35		1957	5/23/1957	1,100	--	--	
1983	5/13/1983	276	--	2.57		2009	5/5/2009	1,050	--	4.87	
1984	5/15/1984	178	--	2.20		1955	7/17/1955	1,040	--	--	
1985	9/19/1985	272	--	2.64		1962	5/28/1962	1,040	--	--	
1986	2/26/1986	7,290	--	11.52		1963	2/7/1963	1,000	--	7.06	
1987	5/30/1987	379	--	3.02		1959	3/19/1959	975	--	--	
1988	6/30/1988	124	--	2.10		1956	8/4/1956	875	--	--	
1989	3/24/1989	1,570	--	5.04		1960	5/4/1960	744	--	--	
1990	5/31/1990	623	--	3.69		1990	5/31/1990	623	--	3.69	
1991	6/22/1991	3,230	--	7.77		1998	6/18/1998	611	--	3.79	
1992	6/17/1992	154	--	2.27		2003	3/16/2003	607	--	3.82	
1993	9/7/1993	501	--	3.50		2017	3/16/2017	601	--	4.07	
1994	5/21/1994	429	--	3.22		1974	6/24/1974	552	--	4.88	
1995	6/8/1995	1,490	--	5.62		2014	6/21/2014	529	--	3.88	
1996	3/13/1996	1,440	--	5.40		2006	6/11/2006	508	--	3.66	
1997	5/27/1997	1,210	--	5.20		1993	9/7/1993	501	--	3.50	
1998	6/18/1998	611	--	3.79		1994	5/21/1994	429	--	3.22	
1999	6/5/1999	384	--	3.08		1968	9/24/1968	410	--	3.09	
2000	6/3/2000	124	--	1.98		1999	6/5/1999	384	--	3.08	
2001	4/10/2001	211	--	2.42		1987	5/30/1987	379	--	3.02	
2002	6/11/2002	2,240	--	7.07		1961	6/1/1961	376	--	--	
2003	3/16/2003	607	--	3.82		2010	5/30/2010	360	--	3.19	
2004	5/25/2004	168	--	2.22		2013	6/21/2013	322	--	3.25	
2005	6/6/2005	247	--	2.66		1977	4/7/1977	304	--	2.65	
2006	6/11/2006	508	--	3.66		1983	5/13/1983	276	--	2.57	
2007	4/21/2007	70	1,2	--		1985	9/19/1985	272	--	2.64	
2008	5/27/2008	1,220	--	5.21		1973	4/17/1973	258	--	3.89	
2009	5/5/2009	1,050	--	4.87		2005	6/6/2005	247	--	2.66	
2010	5/30/2010	360	--	3.19		2001	4/10/2001	211	--	2.42	
2011	6/10/2011	4,240	--	9.23		2015	6/7/2015	196	--	2.76	
2012	6/8/2012	185	--	2.71		2012	6/8/2012	185	--	2.71	
2013	6/21/2013	322	--	3.25		1984	5/15/1984	178	--	2.20	
2014	6/21/2014	529	--	3.88		2004	5/25/2004	168	--	2.22	
2015	6/7/2015	196	--	2.76		1992	6/17/1992	154	--	2.27	
2016	5/25/2016	92	--	2.18		1988	6/30/1988	124	--	2.10	
2017	3/16/2017	601	--	4.07		2000	6/3/2000	124	--	1.98	
2018	6/21/2018	4,720	--	9.83		2016	5/25/2016	92	--	2.18	
2019	5/28/2019	7,380	--	12.15		2007	4/21/2007	70	1,2	--	

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06108000 Teton River near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
Peak-flow frequency analysis conducted on recorded and synthesized data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
1,238	72	Station	MGBT	--			MOVE3		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
466	785	986	2,440	4,710	9,960	16,600	26,800	42,100	74,500
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
609	1,040	1,320	3,500	7,470	19,600	40,500	83,900	173,000	451,000
356	588	734	1,780	3,240	6,150	9,320	13,600	19,200	29,100

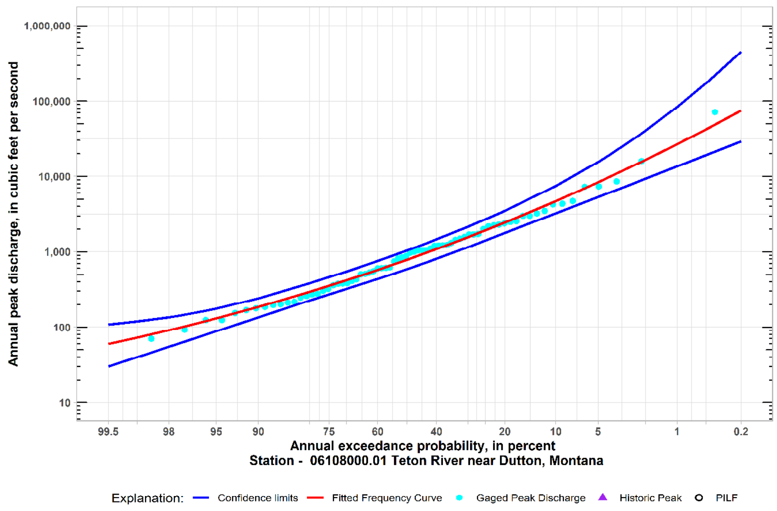

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

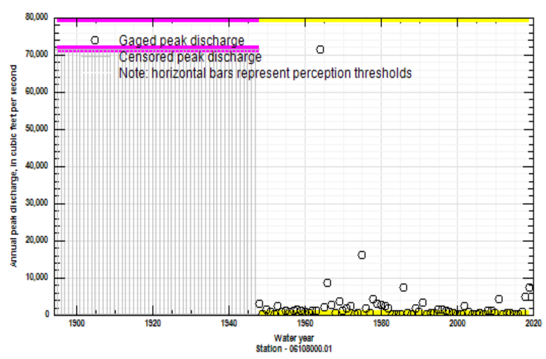

Figure 2. Annual peak flows and perception thresholds.

06108000 Teton River near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
Peak-flow frequency analysis conducted on recorded and synthesized data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1948	--	2,990	--	--	Synthesized	1964	6/9/1964	71,300	--	20.48	
1949	--	216	--	--	Synthesized	1975	6/20/1975	16,000	--	14.80	
1950	--	1,230	--	--	Synthesized	1966	7/2/1966	8,580	--	12.00	
1951	--	839	--	--	Synthesized	2019	5/28/2019	7,380	--	12.15	
1952	--	202	--	--	Synthesized	1986	2/26/1986	7,290	--	11.52	
1953	--	2,380	--	--	Synthesized	2018	6/21/2018	4,720	--	9.83	
1954	--	817	--	--	Synthesized	1978	3/20/1978	4,340	--	8.30	
1955	7/17/1955	1,040	--	--		2011	6/10/2011	4,240	--	9.23	
1956	8/4/1956	875	--	--		1969	3/19/1969	3,500	1,2	--	
1957	5/23/1957	1,100	--	--		1991	6/22/1991	3,230	--	7.77	
1958	6/21/1958	1,310	--	5.96		1979	3/7/1979	3,000	1,2	--	
1959	3/19/1959	975	--	--		1948	--	2,990	--	--	Synthesized
1960	5/4/1960	744	--	--		1967	6/14/1967	2,540	--	6.22	
1961	6/1/1961	376	--	--		1980	5/26/1980	2,490	--	6.39	
1962	5/28/1962	1,040	--	--		1953	--	2,380	--	--	Synthesized
1963	2/7/1963	1,000	--	7.06		1972	6/10/1972	2,300	--	11.60	
1964	6/9/1964	71,300	--	20.48		2002	6/11/2002	2,240	--	7.07	
1965	6/17/1965	2,000	--	6.50		1981	5/24/1981	2,180	--	6.01	
1966	7/2/1966	8,580	--	12.00		1965	6/17/1965	2,000	--	6.50	
1967	6/14/1967	2,540	--	6.22		1976	5/6/1976	1,730	--	5.47	
1968	9/24/1968	410	--	3.09		1971	6/2/1971	1,700	2	7.62	
1969	3/19/1969	3,500	1,2	--		1982	7/1/1982	1,690	--	5.35	
1970	6/15/1970	1,200	2	5.96		1989	3/24/1989	1,570	--	5.04	
1971	6/2/1971	1,700	2	7.62		1995	6/8/1995	1,490	--	5.62	
1972	6/10/1972	2,300	--	11.60		1996	3/13/1996	1,440	--	5.40	
1973	4/17/1973	258	--	3.89		1958	6/21/1958	1,310	--	5.96	
1974	6/24/1974	552	--	4.88		1950	--	1,230	--	--	Synthesized
1975	6/20/1975	16,000	--	14.80		2008	5/27/2008	1,220	--	5.21	
1976	5/6/1976	1,730	--	5.47		1997	5/27/1997	1,210	--	5.20	
1977	4/7/1977	304	--	2.65		1970	6/15/1970	1,200	2	5.96	
1978	3/20/1978	4,340	--	8.30		1957	5/23/1957	1,100	--	--	
1979	3/7/1979	3,000	1,2	--		2009	5/5/2009	1,050	--	4.87	
1980	5/26/1980	2,490	--	6.39		1955	7/17/1955	1,040	--	--	
1981	5/24/1981	2,180	--	6.01		1962	5/28/1962	1,040	--	--	
1982	7/1/1982	1,690	--	5.35		1963	2/7/1963	1,000	--	7.06	
1983	5/13/1983	276	--	2.57		1959	3/19/1959	975	--	--	
1984	5/15/1984	178	--	2.20		1956	8/4/1956	875	--	--	
1985	9/19/1985	272	--	2.64		1951	--	839	--	--	Synthesized
1986	2/26/1986	7,290	--	11.52		1954	--	817	--	--	Synthesized
1987	5/30/1987	379	--	3.02		1960	5/4/1960	744	--	--	
1988	6/30/1988	124	--	2.10		1990	5/31/1990	623	--	3.69	
1989	3/24/1989	1,570	--	5.04		1998	6/18/1998	611	--	3.79	
1990	5/31/1990	623	--	3.69		2003	3/16/2003	607	--	3.82	
1991	6/22/1991	3,230	--	7.77		2017	3/16/2017	601	--	4.07	
1992	6/17/1992	154	--	2.27		1974	6/24/1974	552	--	4.88	
1993	9/7/1993	501	--	3.50		2014	6/21/2014	529	--	3.88	
1994	5/21/1994	429	--	3.22		2006	6/11/2006	508	--	3.66	
1995	6/8/1995	1,490	--	5.62		1993	9/7/1993	501	--	3.50	
1996	3/13/1996	1,440	--	5.40		1994	5/21/1994	429	--	3.22	
1997	5/27/1997	1,210	--	5.20		1968	9/24/1968	410	--	3.09	
1998	6/18/1998	611	--	3.79		1999	6/5/1999	384	--	3.08	
1999	6/5/1999	384	--	3.08		1987	5/30/1987	379	--	3.02	
2000	6/3/2000	124	--	1.98		1961	6/1/1961	376	--	--	
2001	4/10/2001	211	--	2.42		2010	5/30/2010	360	--	3.19	
2002	6/11/2002	2,240	--	7.07		2013	6/21/2013	322	--	3.25	
2003	3/16/2003	607	--	3.82		1977	4/7/1977	304	--	2.65	
2004	5/25/2004	168	--	2.22		1983	5/13/1983	276	--	2.57	
2005	6/6/2005	247	--	2.66		1985	9/19/1985	272	--	2.64	
2006	6/11/2006	508	--	3.66		1973	4/17/1973	258	--	3.89	
2007	4/21/2007	70	1,2	--		2005	6/6/2005	247	--	2.66	
2008	5/27/2008	1,220	--	5.21		1949	--	216	--	--	Synthesized
2009	5/5/2009	1,050	--	4.87		2001	4/10/2001	211	--	2.42	
2010	5/30/2010	360	--	3.19		1952	--	202	--	--	Synthesized
2011	6/10/2011	4,240	--	9.23		2015	6/7/2015	196	--	2.76	
2012	6/8/2012	185	--	2.71		2012	6/8/2012	185	--	2.71	
2013	6/21/2013	322	--	3.25		1984	5/15/1984	178	--	2.20	
2014	6/21/2014	529	--	3.88		2004	5/25/2004	168	--	2.22	
2015	6/7/2015	196	--	2.76		1992	6/17/1992	154	--	2.27	
2016	5/25/2016	92	--	2.18		1988	6/30/1988	124	--	2.10	
2017	3/16/2017	601	--	4.07		2000	6/3/2000	124	--	1.98	
2018	6/21/2018	4,720	--	9.83		2016	5/25/2016	92	--	2.18	
2019	5/28/2019	7,380	--	12.15		2007	4/21/2007	70	1,2	--	

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[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
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[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
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PILF: The peak flow was identified as a potentially influential low flow;
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References:

England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.

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06108200 Kinley Coulee near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
14.4	16	Weighted	FIXED	5.00			At-site		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
--[3]	21	34	202	655	2,280	5,100	10,500	20,300	45,100
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
--[3]	56	100	1,090	5,940	53,400	276,000	1,380,000	6,610,000	44,700,000
--[3]	1.0	3.7	63	189	522	966	1,640	2,600	4,420

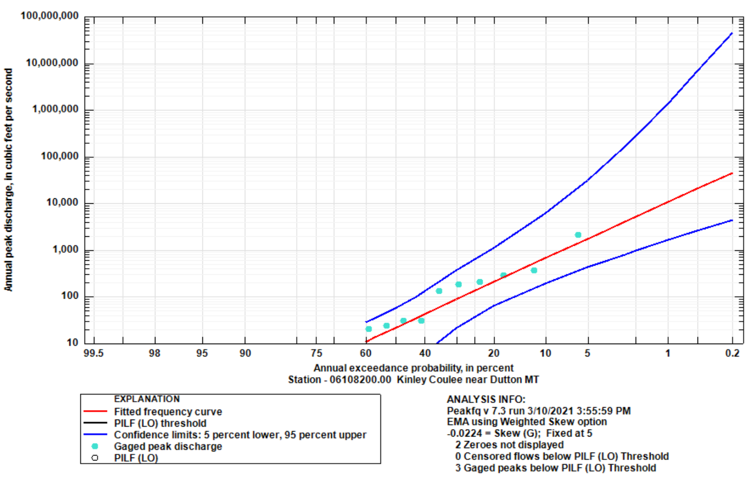
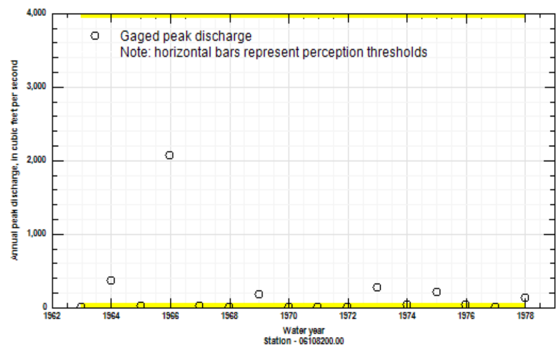


Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.



06108200 Kinley Coulee near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1963	--	0	Bm	--	PILF	1966	7/2/1966	2,070	--	10.72	
1964	6/21/1964	364	--	8.00		1964	6/21/1964	364	--	8.00	
1965	6/16/1965	24	--	1.39		1973	8/24/1973	278	--	6.34	
1966	7/2/1966	2,070	--	10.72		1975	5/7/1975	205	--	4.96	
1967	5/7/1967	20	--	1.31		1969	3/20/1969	182	--	4.45	
1968	9/21/1968	1	--	0.58	PILF	1978	3/18/1978	133	--	3.49	
1969	3/20/1969	182	--	4.45		1974	1/16/1974	30	--	1.54	
1970	6/13/1970	1	--	0.63	PILF	1976	3/19/1976	30	--	1.52	
1971	2/13/1971	5	2	2.01		1965	6/16/1965	24	--	1.39	
1972	3/18/1972	1	--	0.37	PILF	1967	5/7/1967	20	--	1.31	
1973	8/24/1973	278	--	6.34		1971	2/13/1971	5	2	2.01	
1974	1/16/1974	30	--	1.54		1968	9/21/1968	1	--	0.58	PILF
1975	5/7/1975	205	--	4.96		1970	6/13/1970	1	--	0.63	PILF
1976	3/19/1976	30	--	1.52		1972	3/18/1972	1	--	0.37	PILF
1977	--	0	Bm	--	PILF	1963	--	0	Bm	--	PILF
1978	3/18/1978	133	--	3.49		1977	--	0	Bm	--	PILF

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
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At-site: Peak-flow frequency analysis on recorded data;
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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
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06108200 Kinley Coulee near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
14.4			FIXED	5.00			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
	31	46	176	358	708	1,100	1,610	2,340	3,700
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
#NUM!	68	101	399	782	1,560	2,570	4,090	6,600	12,200
#NUM!	10	16	85	179	346	507	688	919	1,260

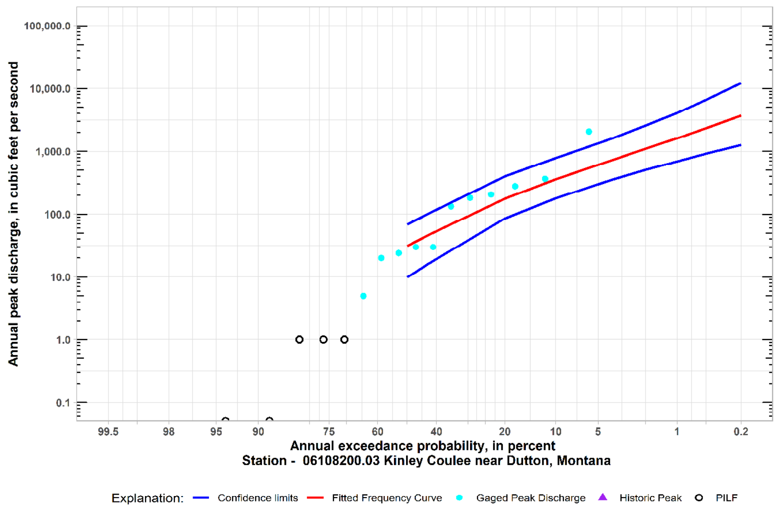

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06108200 Kinley Coulee near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1963	--	0	Bm	--	PILF	1966	7/2/1966	2,070	--	10.72	
1964	6/21/1964	364	--	8.00		1964	6/21/1964	364	--	8.00	
1965	6/16/1965	24	--	1.39		1973	8/24/1973	278	--	6.34	
1966	7/2/1966	2,070	--	10.72		1975	5/7/1975	205	--	4.96	
1967	5/7/1967	20	--	1.31		1969	3/20/1969	182	--	4.45	
1968	9/21/1968	1	--	0.58	PILF	1978	3/18/1978	133	--	3.49	
1969	3/20/1969	182	--	4.45		1974	1/16/1974	30	--	1.54	
1970	6/13/1970	1	--	0.63	PILF	1976	3/19/1976	30	--	1.52	
1971	2/13/1971	5	2	2.01		1965	6/16/1965	24	--	1.39	
1972	3/18/1972	1	--	0.37	PILF	1967	5/7/1967	20	--	1.31	
1973	8/24/1973	278	--	6.34		1971	2/13/1971	5	2	2.01	
1974	1/16/1974	30	--	1.54		1968	9/21/1968	1	--	0.58	PILF
1975	5/7/1975	205	--	4.96		1970	6/13/1970	1	--	0.63	PILF
1976	3/19/1976	30	--	1.52		1972	3/18/1972	1	--	0.37	PILF
1977	--	0	Bm	--	PILF	1963	--	0	Bm	--	PILF
1978	3/18/1978	133	--	3.49		1977	--	0	Bm	--	PILF

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
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[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
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06108300 Kinley Coulee tributary near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second		Type of peak-flow frequency analysis[2]			
2.96	16	Weighted	MGBT	1.00		At-site			
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
4	10	15	72	210	667	1,420	2,820	5,320	11,600
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
10	29	46	309	1,380	8,740	33,000	118,000	414,000	2,110,000
1	3	5	26	67	178	324	542	852	1,440

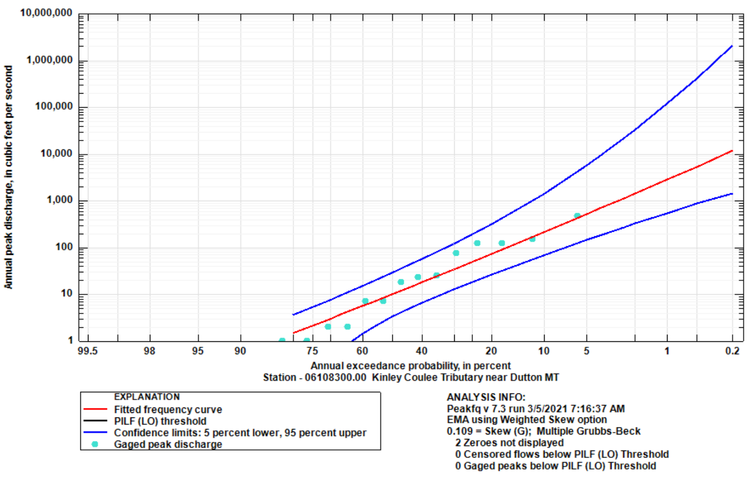

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

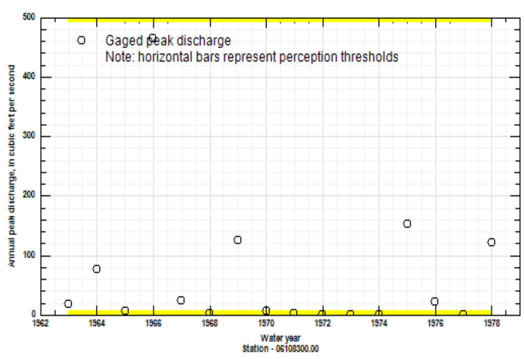

Figure 2. Annual peak flows and perception thresholds.

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Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
Sando, Roy, Sando, S.K., McCarthy, P.M., and Dutton, D.M., 2018, Methods for estimating peak-flow frequencies at ungaged sites in Montana based on data through water year 2011 (ver. 1.1, February 2018) : U.S. Geological Survey Scientific Investigations Report 2015–5019–F, 30 p., https://doi.org/10.3133/sir20155019F.

06108300 Kinley Coulee tributary near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak-flow frequency analysis conducted on recorded data

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1963	9/16/1963	18	--	1.28		1966	7/2/1966	465	--	14.77	
1964	6/8/1964	76	--	2.98		1975	5/7/1975	153	--	4.83	
1965	3/31/1965	7	--	1.43		1969	3/21/1969	125	--	3.97	
1966	7/2/1966	465	--	14.77		1978	3/18/1978	122	--	3.86	
1967	5/7/1967	25	--	1.59		1964	6/8/1964	76	--	2.98	
1968	6/9/1968	2	--	0.61		1967	5/7/1967	25	--	1.59	
1969	3/21/1969	125	--	3.97		1976	3/19/1976	23	--	1.53	
1970	7/13/1970	7	--	0.88		1963	9/16/1963	18	--	1.28	
1971	2/13/1971	2	2	1.96		1965	3/31/1965	7	--	1.43	
1972	--	0	Bm	--	PILF	1970	7/13/1970	7	--	0.88	
1973	2/22/1973	1	--	--		1968	6/9/1968	2	--	0.61	
1974	--	0	Bm	--	PILF	1971	2/13/1971	2	2	1.96	
1975	5/7/1975	153	--	4.83		1973	2/22/1973	1	--	--	
1976	3/19/1976	23	--	1.53		1977	6/10/1977	1	--	0.64	
1977	6/10/1977	1	--	0.64		1972	--	0	Bm	--	PILF
1978	3/18/1978	122	--	3.86		1974	--	0	Bm	--	PILF

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06108300 Kinley Coulee tributary near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak flow frequency analysis weighted with regional regression equations

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second			Type of peak-flow frequency analysis[2]		
2.96			MGBT	1.00			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
5	14	20	79	167	335	515	743	1,060	1,630
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
12	31	46	173	358	730	1,190	1,870	2,950	5,300
2	6	9	39	85	167	243	326	427	570

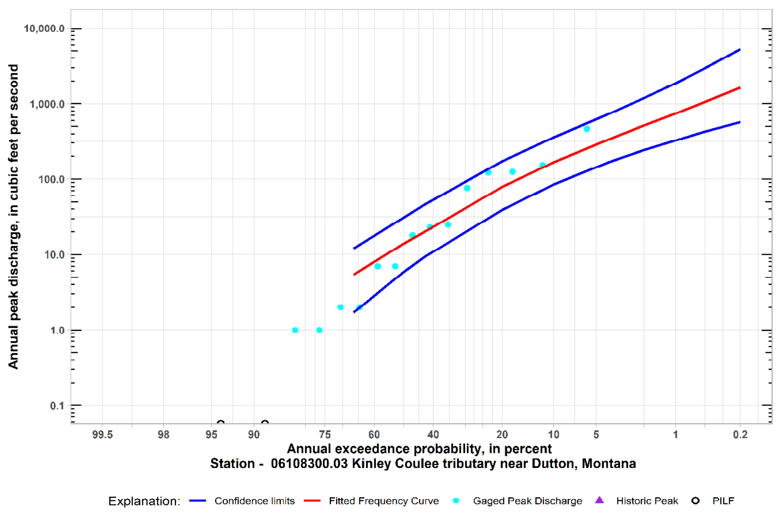

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

06108300 Kinley Coulee tributary near Dutton, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1963 - 1978
At-site peak flow frequency analysis weighted with regional regression equations

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends; --, not applicable or not available.]

Peak-flow data[4]						Ranked (largest to smallest) peak-flow data[4]					
Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1963	9/16/1963	18	--	1.28		1966	7/2/1966	465	--	14.77	
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1966	7/2/1966	465	--	14.77		1978	3/18/1978	122	--	3.86	
1967	5/7/1967	25	--	1.59		1964	6/8/1964	76	--	2.98	
1968	6/9/1968	2	--	0.61		1967	5/7/1967	25	--	1.59	
1969	3/21/1969	125	--	3.97		1976	3/19/1976	23	--	1.53	
1970	7/13/1970	7	--	0.88		1963	9/16/1963	18	--	1.28	
1971	2/13/1971	2	2	1.96		1965	3/31/1965	7	--	1.43	
1972	--	0	Bm	--	PILF	1970	7/13/1970	7	--	0.88	
1973	2/22/1973	1	--	--		1968	6/9/1968	2	--	0.61	
1974	--	0	Bm	--	PILF	1971	2/13/1971	2	2	1.96	
1975	5/7/1975	153	--	4.83		1973	2/22/1973	1	--	--	
1976	3/19/1976	23	--	1.53		1977	6/10/1977	1	--	0.64	
1977	6/10/1977	1	--	0.64		1972	--	0	Bm	--	PILF
1978	3/18/1978	122	--	3.86		1974	--	0	Bm	--	PILF

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.
[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).
[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.
[4]Peak-flow data with a value of zero are not plotted in figures.
[5]In cases where the month, day, or both are not present in the date of a peak flow, the month, day, or both are unknown.
[6]Qualification codes indicate special conditions that may affect how the peak streamflow value is interpreted. A list of codes and definitions is available at the NWIS website:
https://nwis.waterdata.usgs.gov/nwis/peak?help
[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:

England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
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06108800 Teton River at Loma, Montana
Analysis for unregulated period of record
Analysis period of record, water years: 1895 - 2019
At-site peak-flow frequency analysis conducted on recorded data

Table 1-1 Table 1-2 Table 1-3 Table 1-4 Table 1-5 Table 1-6 Table 1-7 Table 1-8

[Water year is the 12-month period from October 1 through September 30 and is designated by the year in which it ends. PILF; potentially influential low flow; MGBT, multiple Grubbs-Beck test; -- not applicable or not available]

Contributing drainage area, in square miles	Number of recorded peak flows used in the analysis	Skew type used in analysis	Type of PILF threshold[1]	PILF threshold, in cubic feet per second		Type of peak-flow frequency analysis[2]			
1,900	26	Weighted	MGBT	--		At-site			
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
321	610	801	2,310	4,850	11,000	19,200	31,800	51,200	92,400
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
542	1,050	1,390	4,220	9,390	24,200	48,300	95,800	189,000	466,000
189	361	473	1,320	2,590	5,220	8,180	12,200	17,600	27,400

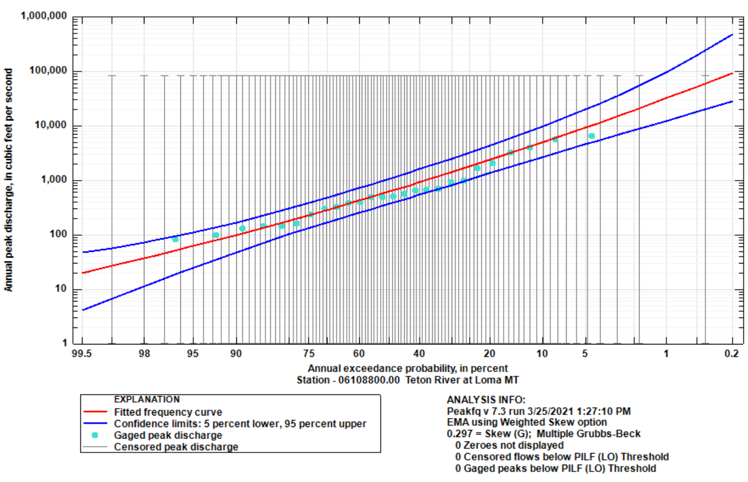

Figure 1. Annual peak flows (probability plotting positions) and peak-flow frequency curve. EMA, Expected Moments Algorithm; Skew(G), analysis skew; PILF(LO), Potentially Influential Low Flow (low outlier). For regional regression weighted analyses, only annual exceedance probabilities of 66.7 percent or less are shown.

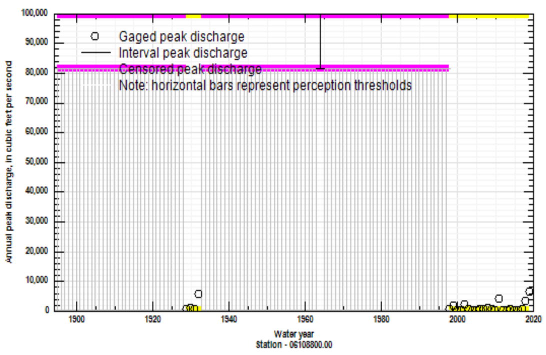

Figure 2. Annual peak flows and perception thresholds.

[1]Definitions of types of PILF thresholds include:
MGBT: PILF threshold calculated by using the multiple Grubbs-Beck Test as specified in Bulletin 17C (England and others, 2019);
FIXED: PILF threshold based on a systematic peak flow selected by the peak-flow frequency analyst.

[2]Definitions of type of peak-flow frequency analysis include:
At-site: Peak-flow frequency analysis on recorded data;
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RRE wtd: The at-site peak-flow frequency analysis was weighted with results from regional regression equations (RREs) from Sando and others (2018).

[3]Flood-frequency results not reported because of too many values less than the PILF threshold used in the at-site analysis.

[4]Peak-flow data with a value of zero are not plotted in figures.

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[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Combined: The peak flow was recorded at a closely located streamgage on the same channel. Information on combining records of multiple streamgages is presented in table 1–2;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
England, J.F., Jr., Cohn, T.A., Faber, B.A., Stedinger, J.R., Thomas, W.O., Jr., Veilleux, A.G., Kiang, J.E., and Mason, R.R., Jr., 2019, Guidelines for determining flood flow frequency—Bulletin 17C (ver. 1.1, May 2019): U.S. Geological Survey Techniques and Methods, book 4, chap. B5, 148 p., https://doi.org/10.3133/tm4B5.
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06108800 Teton River at Loma, Montana
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Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]	Water year	Date[5]	Peak flow, in cubic feet per second	Peak flow qualification codes[6]	Gage height, in feet	Peak-flow designation in analysis[7]
1929	6/10/1929	668	--	--	Combined	2019	5/30/2019	6,520	--	8.95	
1930	2/19/1930	970	1	--	Combined	1932	8/22/1932	5,660	2	--	Combined
1931	6/30/1931	700	--	--	Combined	2011	6/12/2011	3,910	--	8.52	
1932	8/22/1932	5,660	2	--	Combined	2018	6/24/2018	3,210	--	7.51	
1998	7/4/1998	477	--	3.65		2002	6/13/2002	2,000	--	5.87	
1999	6/3/1999	1,650	--	5.59		1999	6/3/1999	1,650	--	5.59	
2000	3/12/2000	127	--	2.70		1930	2/19/1930	970	1	--	Combined
2001	4/12/2001	158	--	2.79		2008	5/29/2008	924	--	4.28	
2002	6/13/2002	2,000	--	5.87		1931	6/30/1931	700	--	--	Combined
2003	3/16/2003	500	2	6.98		1929	6/10/1929	668	--	--	Combined
2004	3/14/2004	98	--	2.28		2009	5/7/2009	639	--	3.72	
2005	6/9/2005	236	--	2.77		2007	3/6/2007	559	--	3.59	
2006	6/14/2006	399	--	3.31		2003	3/16/2003	500	2	6.98	
2007	3/6/2007	559	--	3.59		2017	3/18/2017	488	--	3.70	
2008	5/29/2008	924	--	4.28		1998	7/4/1998	477	--	3.65	
2009	5/7/2009	639	--	3.72		2006	6/14/2006	399	--	3.31	
2010	6/1/2010	319	--	2.89		2014	6/23/2014	379	--	3.41	
2011	6/12/2011	3,910	--	8.52		2010	6/1/2010	319	--	2.89	
2012	3/13/2012	145	--	2.58		2015	6/2/2015	295	--	3.17	
2013	6/23/2013	145	--	2.52		2005	6/9/2005	236	--	2.77	
2014	6/23/2014	379	--	3.41		2001	4/12/2001	158	--	2.79	
2015	6/2/2015	295	--	3.17		2012	3/13/2012	145	--	2.58	
2016	5/27/2016	81	--	2.26		2013	6/23/2013	145	--	2.52	
2017	3/18/2017	488	--	3.70		2000	3/12/2000	127	--	2.70	
2018	6/24/2018	3,210	--	7.51		2004	3/14/2004	98	--	2.28	
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At-site peak flow frequency analysis weighted with regional regression equations

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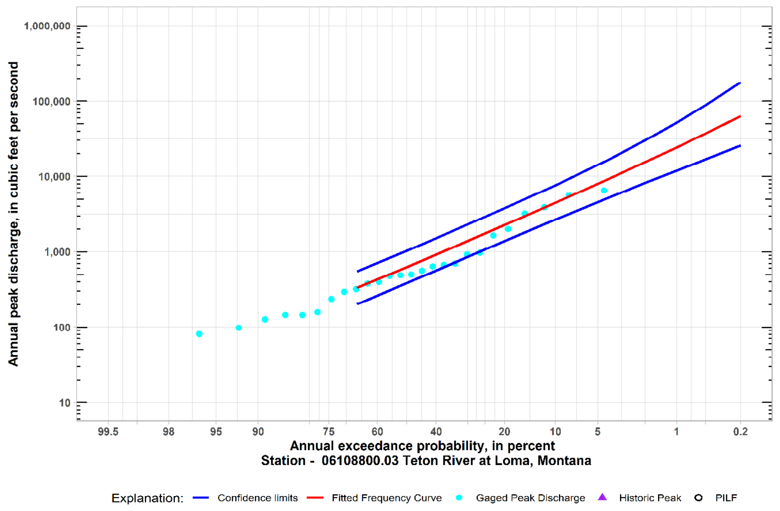
1,900			MGBT	--			RRE wtd		
Peak flow, in cubic feet per second, for indicated annual exceedance probability (bold values), in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
332	626	818	2,270	4,480	9,420	15,500	24,200	37,200	63,100
Upper and lower 90-percent confidence intervals, in cubic feet per second, for indicated annual exceedance probability, in percent									
66.7	**50**	**42.9**	**20**	**10**	**4**	**2**	**1.0**	**0.5**	**0.2**
547	1,030	1,350	3,790	7,620	17,000	30,100	51,700	88,500	177,000
201	384	504	1,390	2,680	5,310	8,200	11,900	16,900	25,700



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[7]Definitions of peak-flow designations used in analysis include:
Historic: The peak flow was collected outside of the systematic record and is included in the analysis;
Opportunistic: The peak flow was excluded from the analysis because it is outside of the systematic record and was of insufficient magnitude to determine nonexceedance during an ungaged period;
PILF: The peak flow was identified as a potentially influential low flow;
Combined: The peak flow was recorded at a closely located streamgage on the same channel. Information on combining records of multiple streamgages is presented in table 1–2;
Synthesized: The peak flow was synthesized using Maintenance of Variance Extension Type III record extension.

References:
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