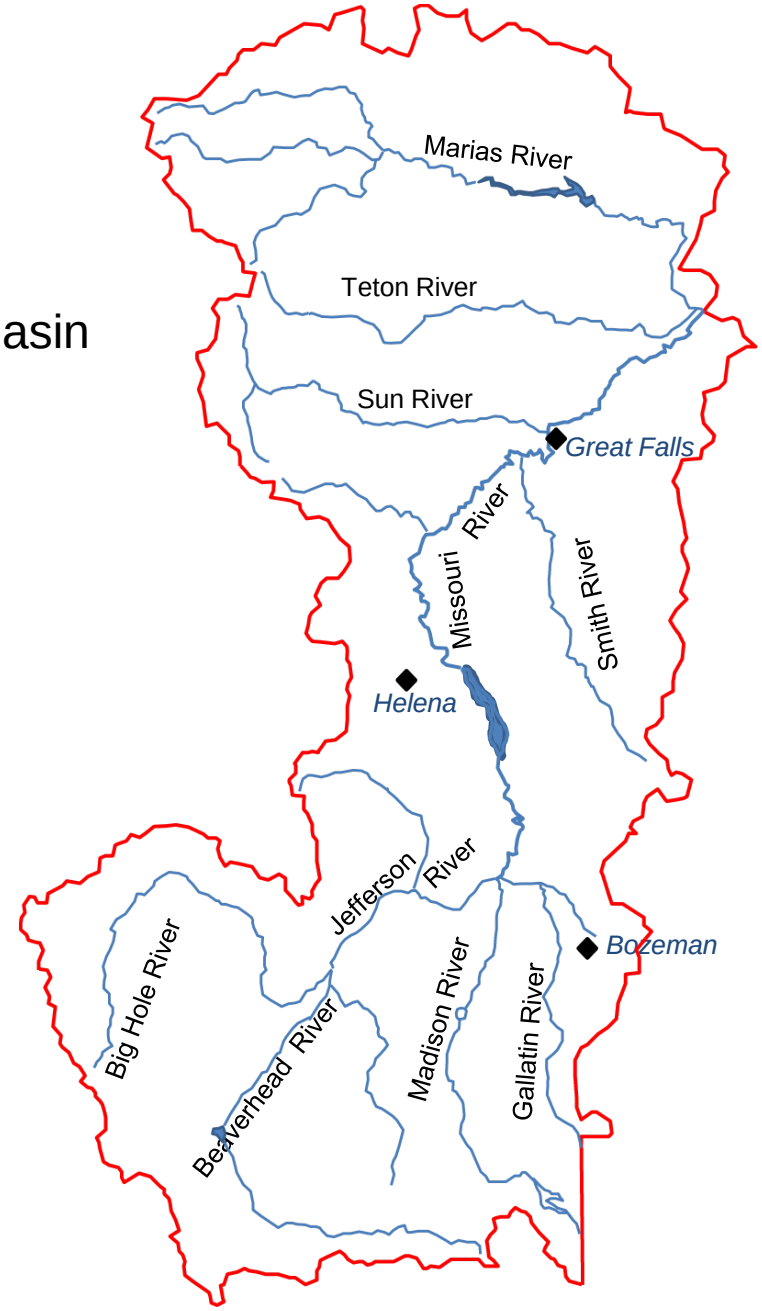
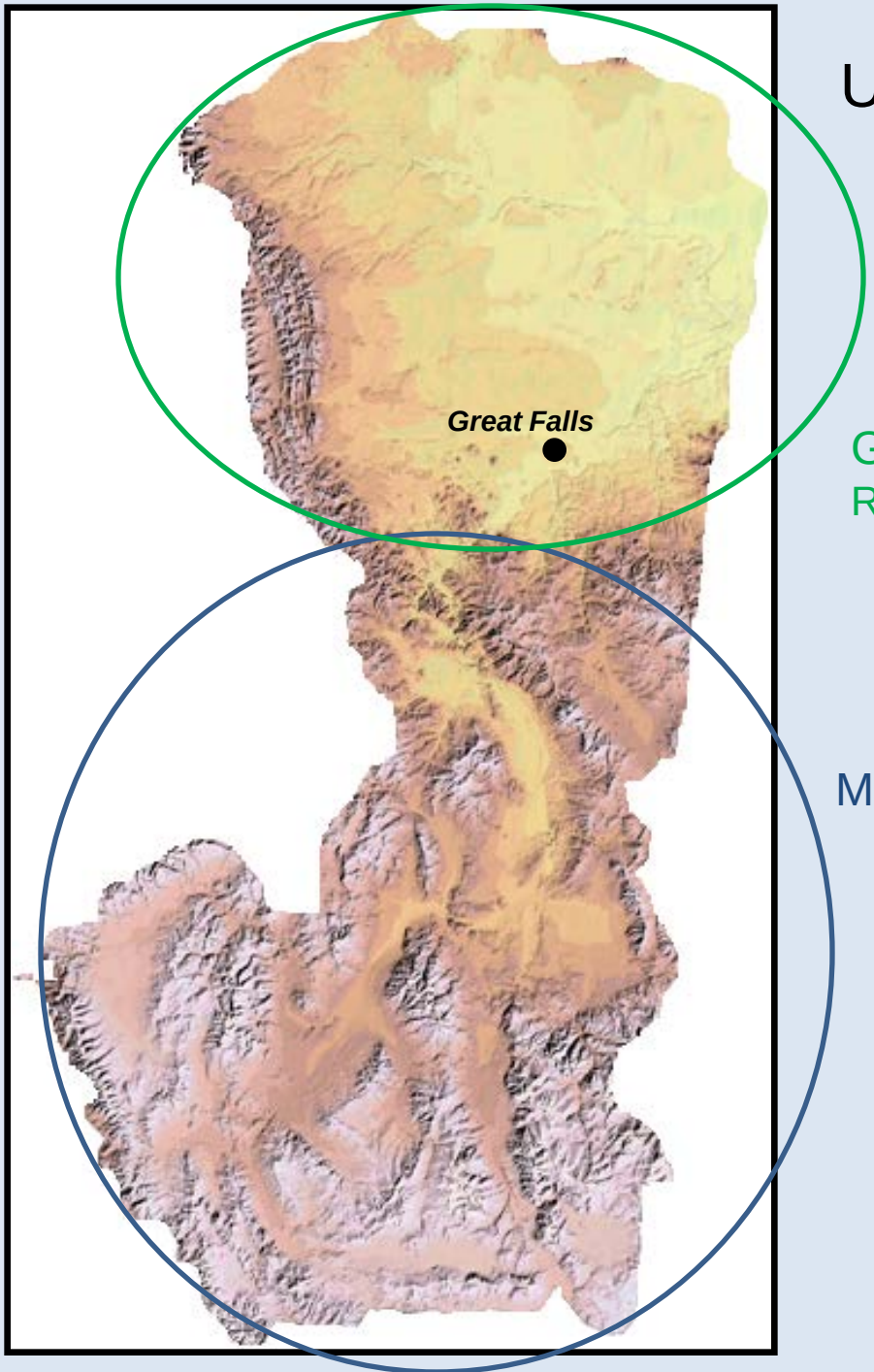
Water Resources of the Upper Missouri River Basin

An Overview

Upper Missouri River Basin
Major Streams



Upper Missouri Basin Landscapes



Great Plains:
Runoff from Rocky Mountain Front

Mountains and Valleys

Big Hole River

Mike Roberts

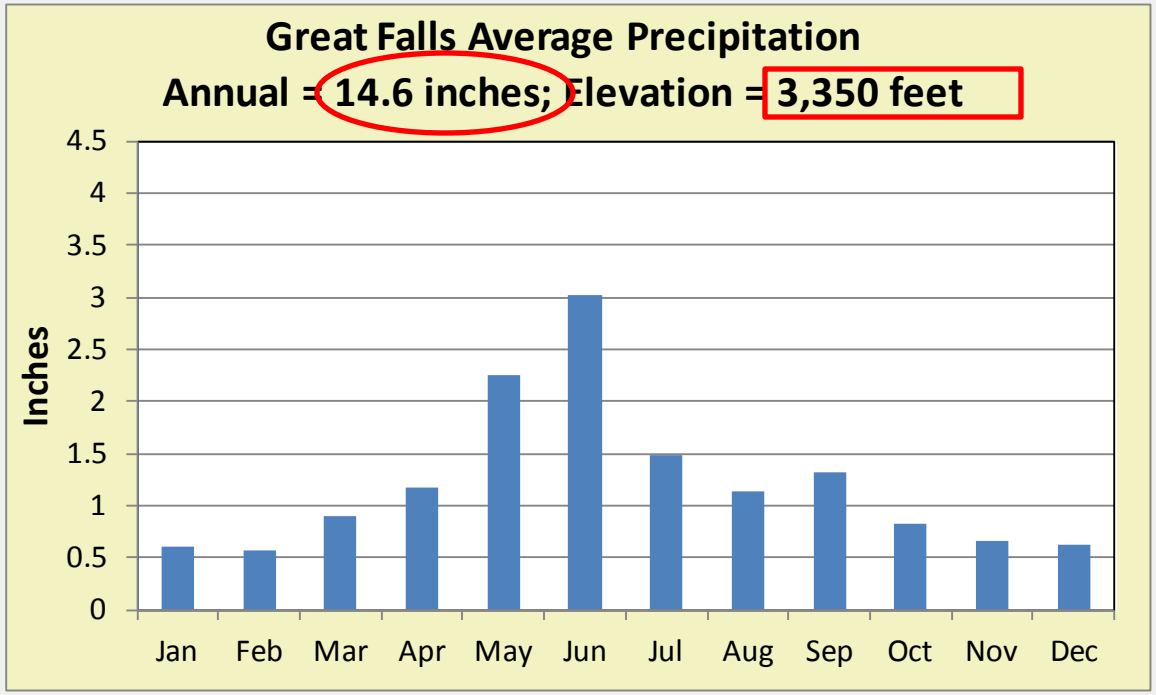
Sun River

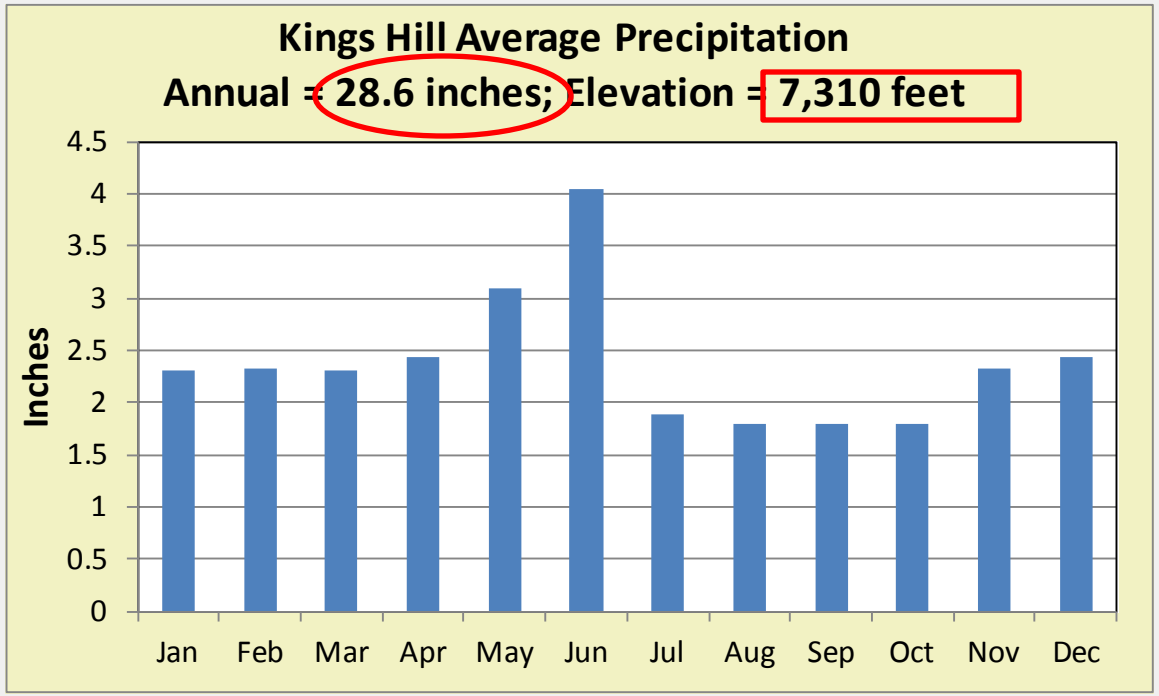
Precipitation

Upper Missouri Basin Average Annual Precipitation (1971-2000)

Average Annual Precipitation, Inches

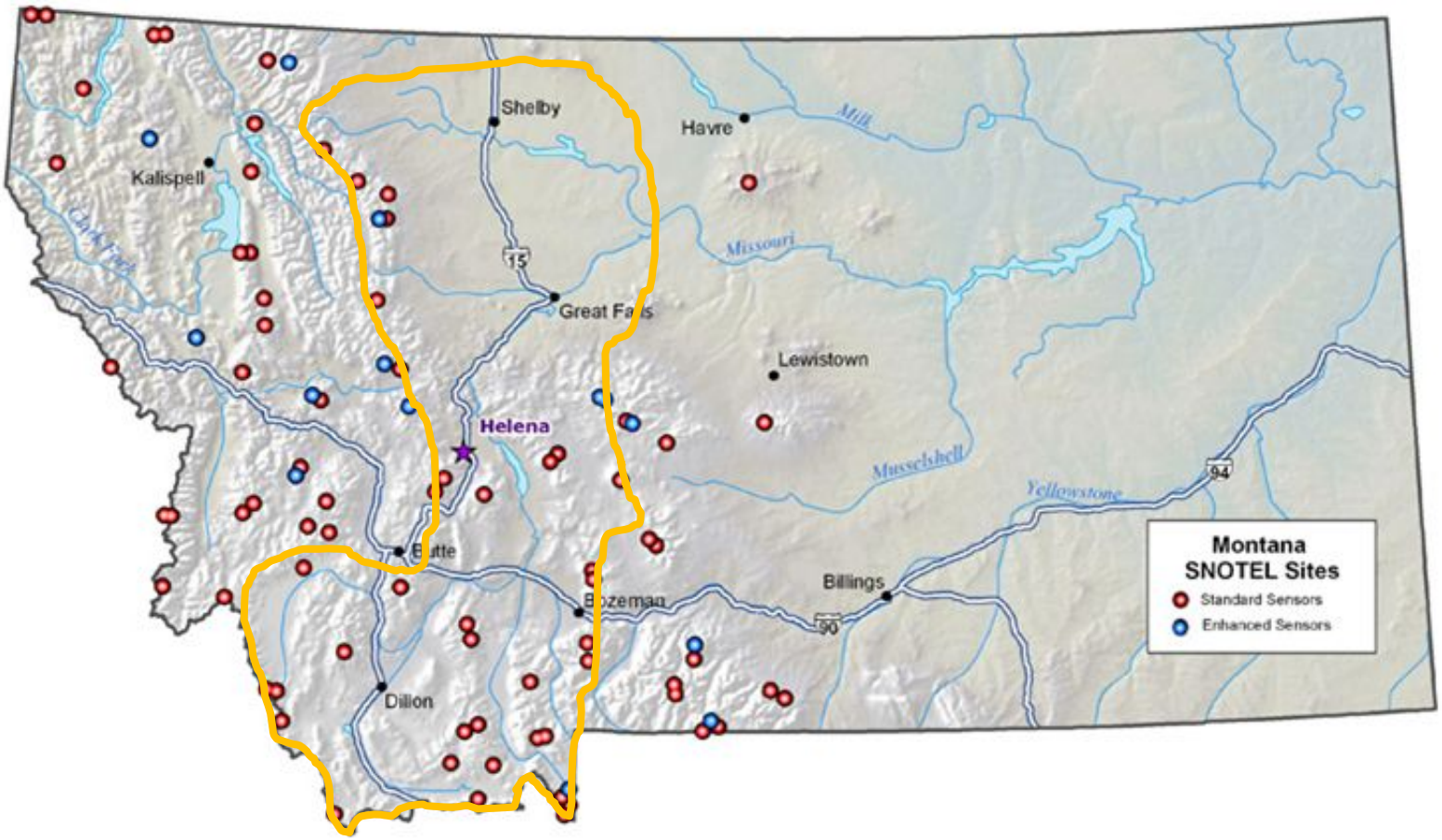
- 6-12
- 12-14
- 14-16
- 16-22
- 22-34
- 34-60
- 60-85
- Over 85


Great Falls Average Precipitation
Annual = 14.6 inches; Elevation = 3,350 feet
Inches
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

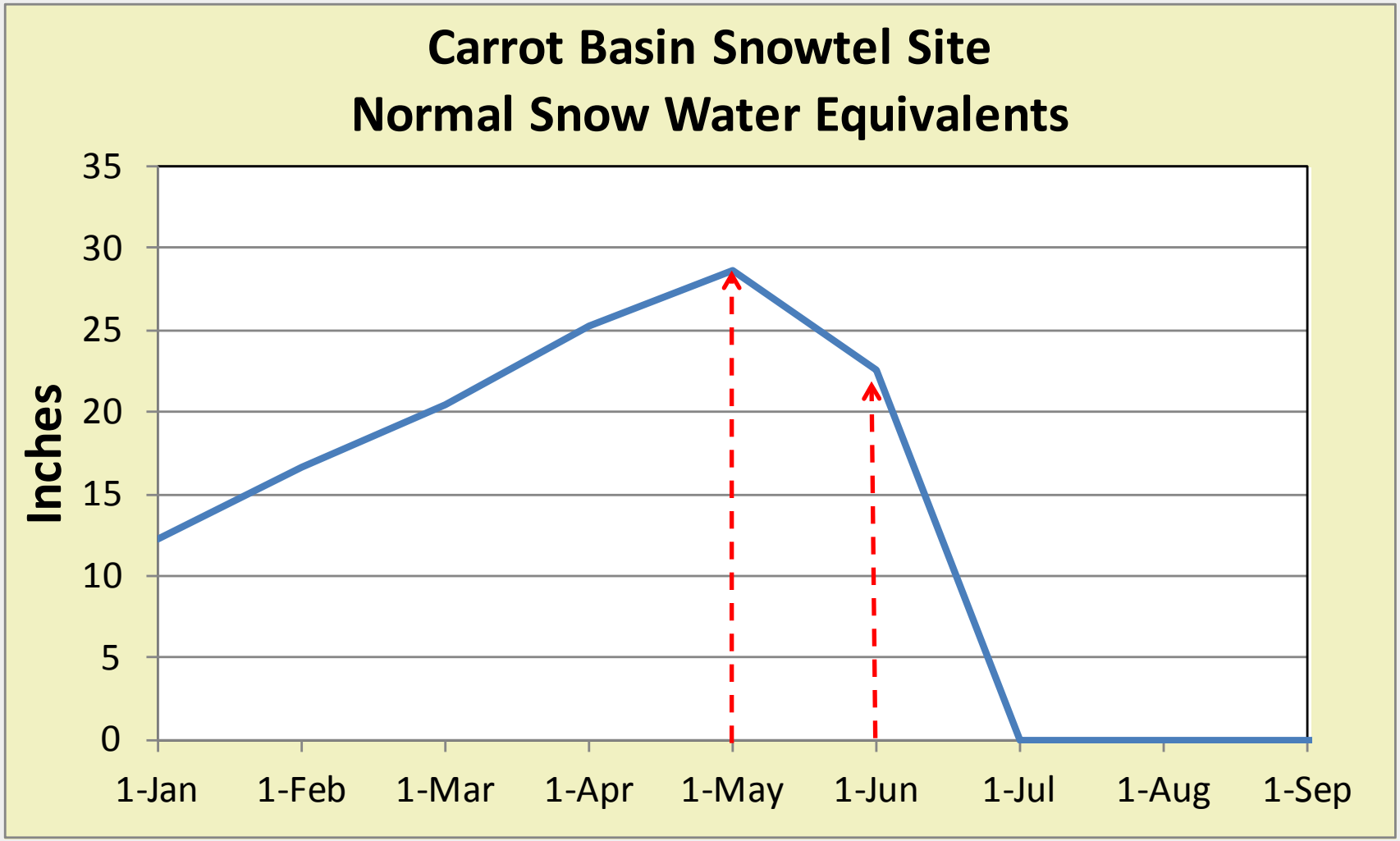

Kings Hill Average Precipitation
Annual = 28.6 inches; Elevation = 7,310 feet
Inches
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Snow

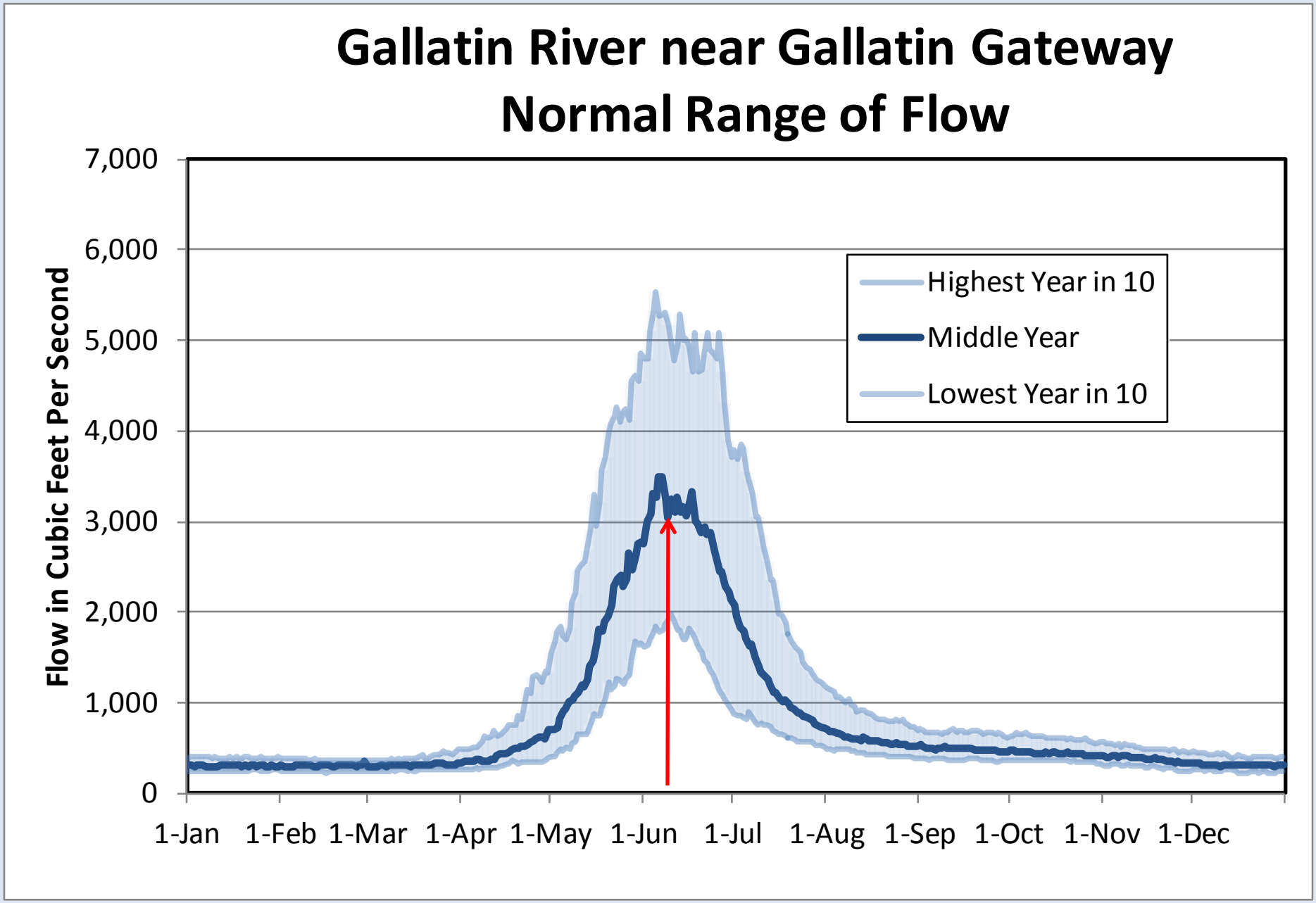
This map depicts the location of NRCS SNOTEL sites in Montana.

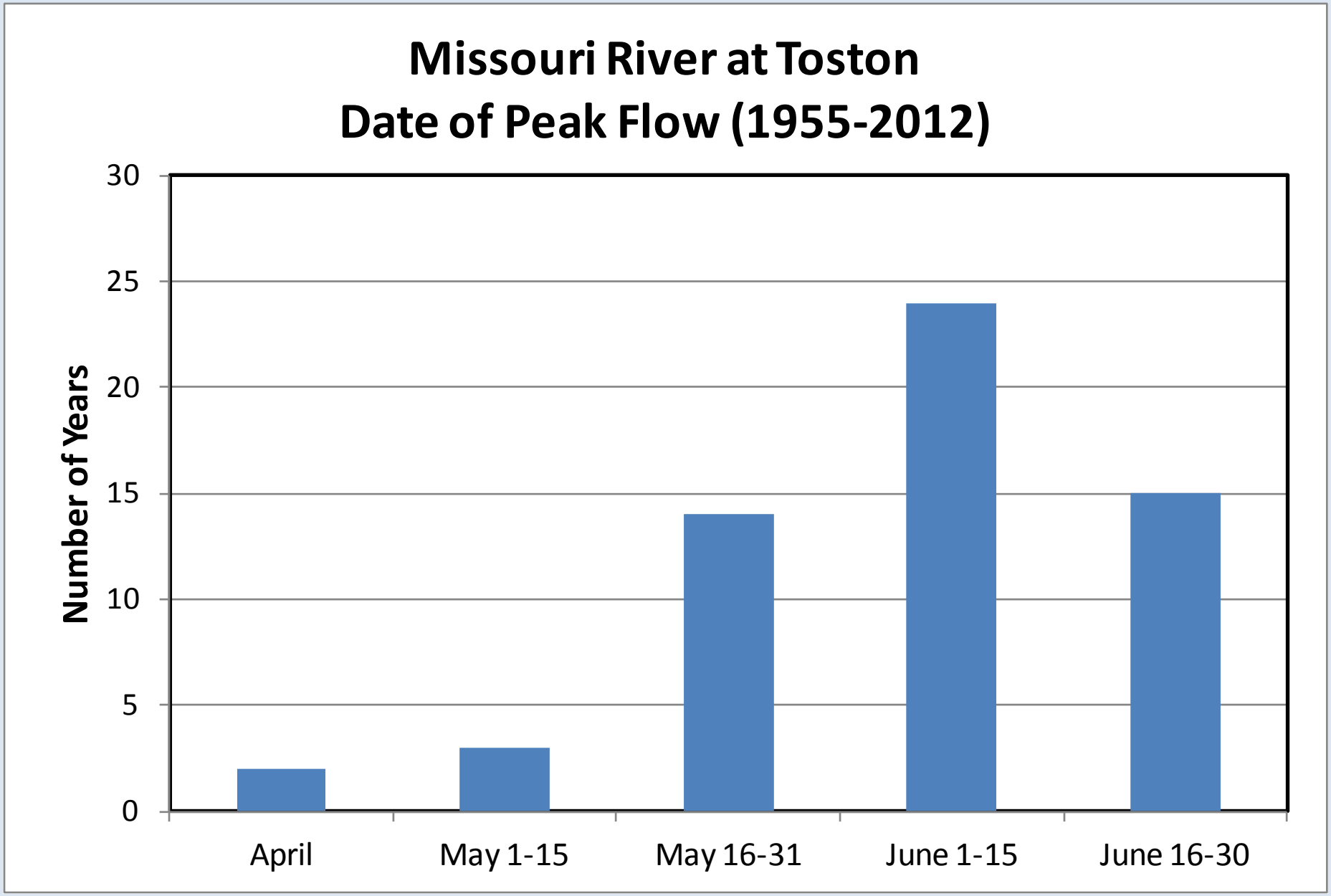


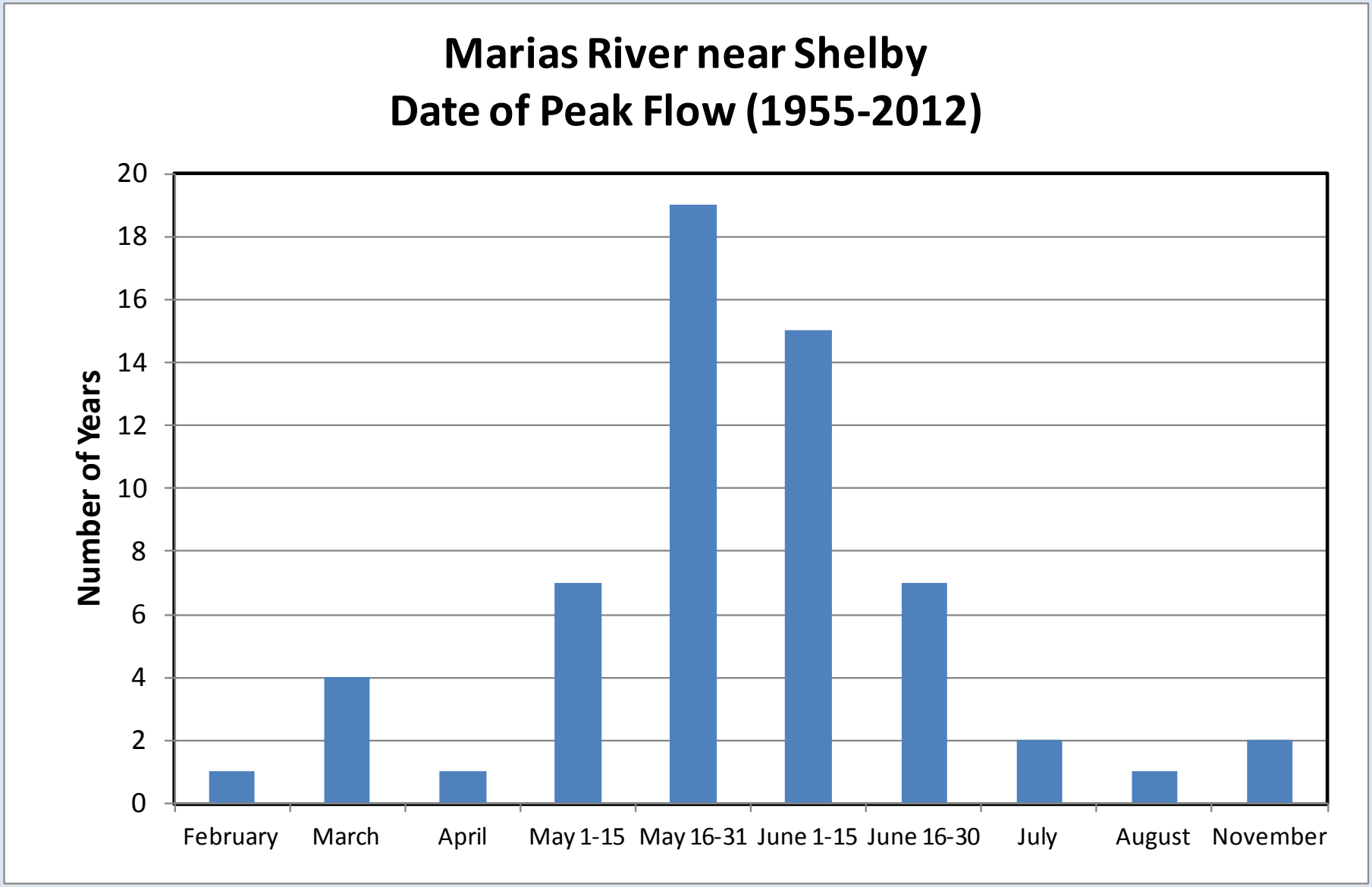
Normal 1st of Month Snow Water Equivalents for Carrot Basin Snowtel Site
Madison Range; Elevation of 9,000 feet
Average Annual Precipitation = 43 inches

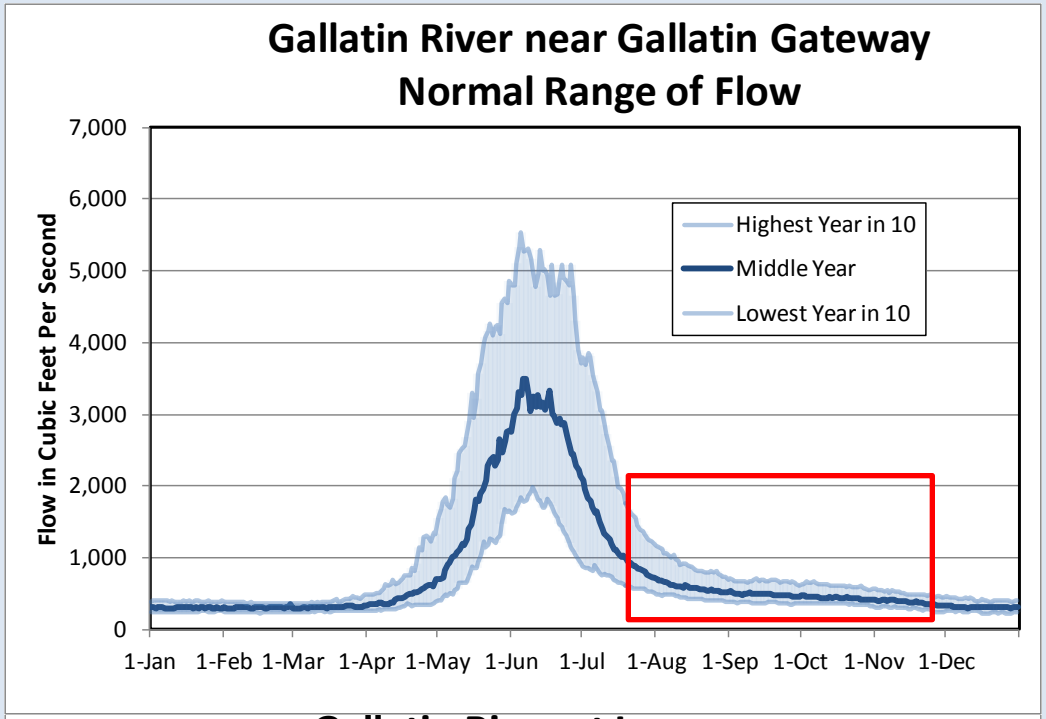


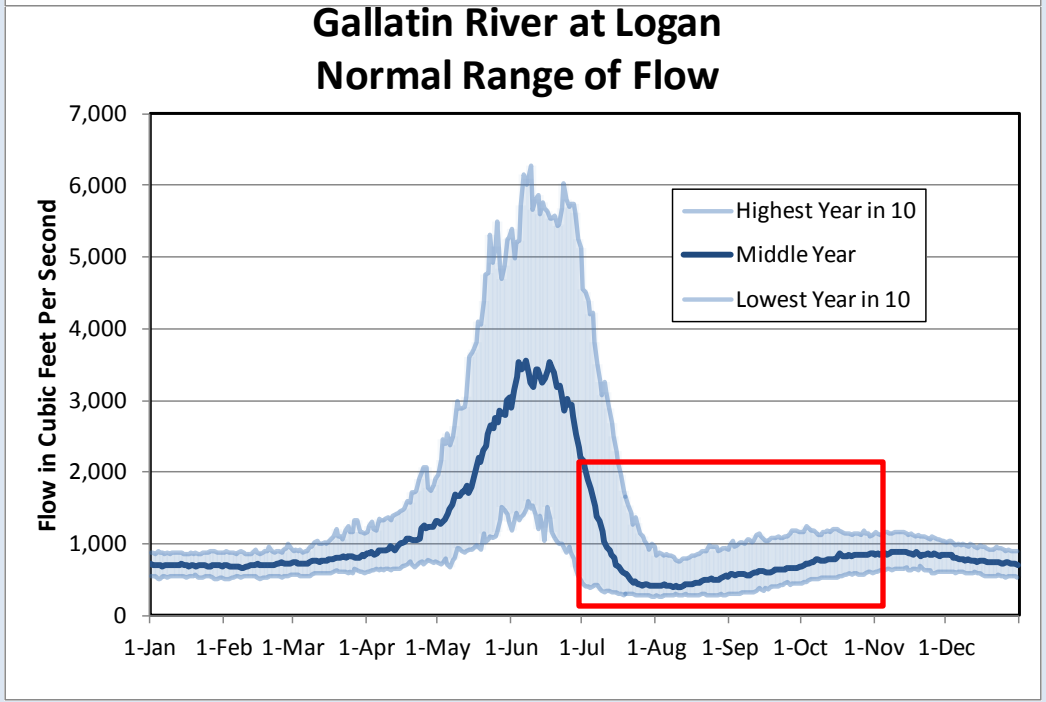
Streamflow


Gallatin River near Gallatin Gateway
Normal Range of Flow
Flow in Cubic Feet Per Second
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Highest Year in 10
Middle Year
Lowest Year in 10


Missouri River at Toston
Date of Peak Flow (1955-2012)
Number of Years
30
25
20
15
10
5
0
April
May 1-15
May 16-31
June 1-15
June 16-30


Marias River near Shelby
Date of Peak Flow (1955-2012)
Number of Years
20
18
16
14
12
10
8
6
4
2
0
February
March
April
May 1-15
May 16-31
June 1-15
June 16-30
July
August
November

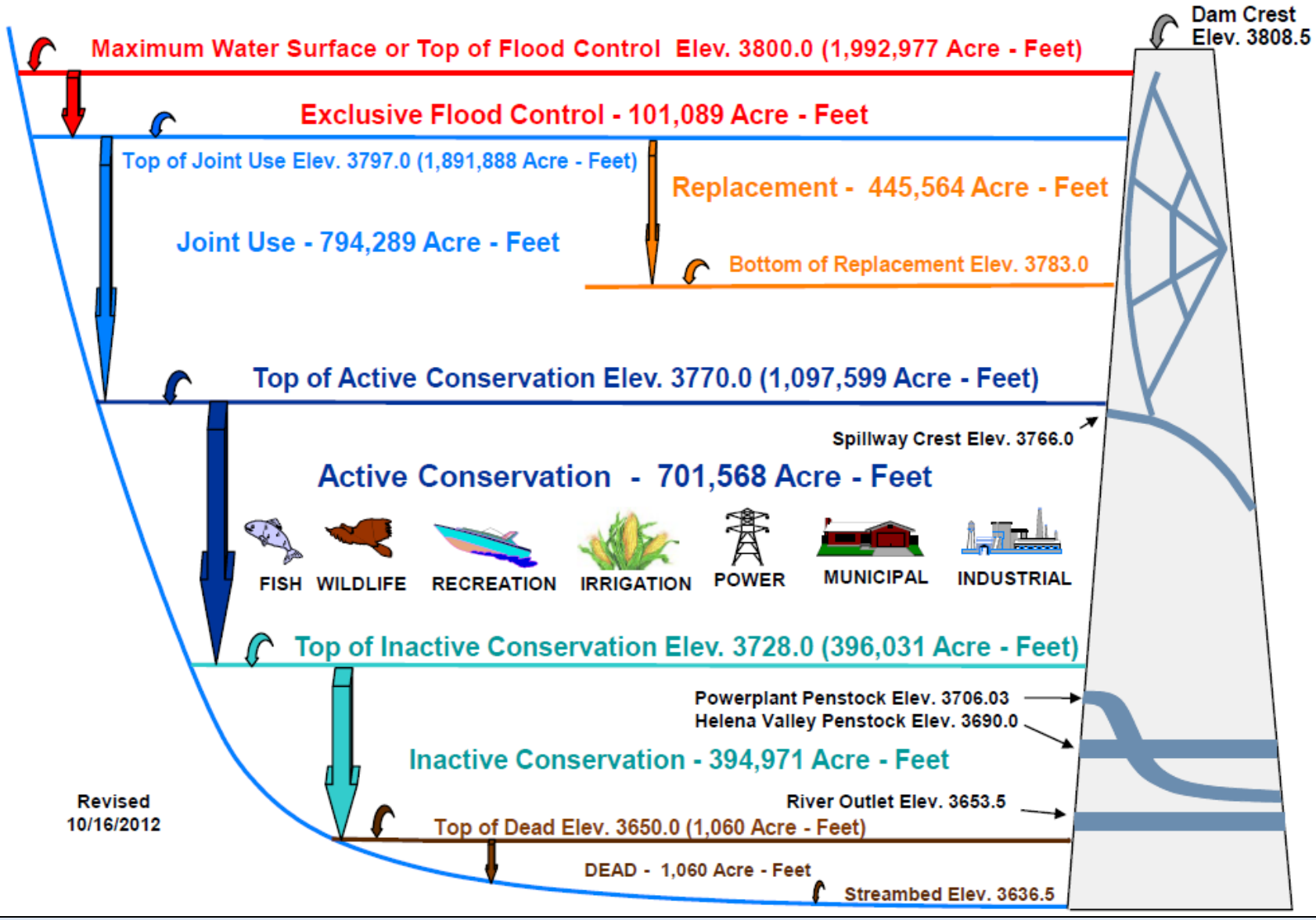

Gallatin River near Gallatin Gateway
Normal Range of Flow
Flow in Cubic Feet Per Second
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Highest Year in 10
Middle Year
Lowest Year in 10

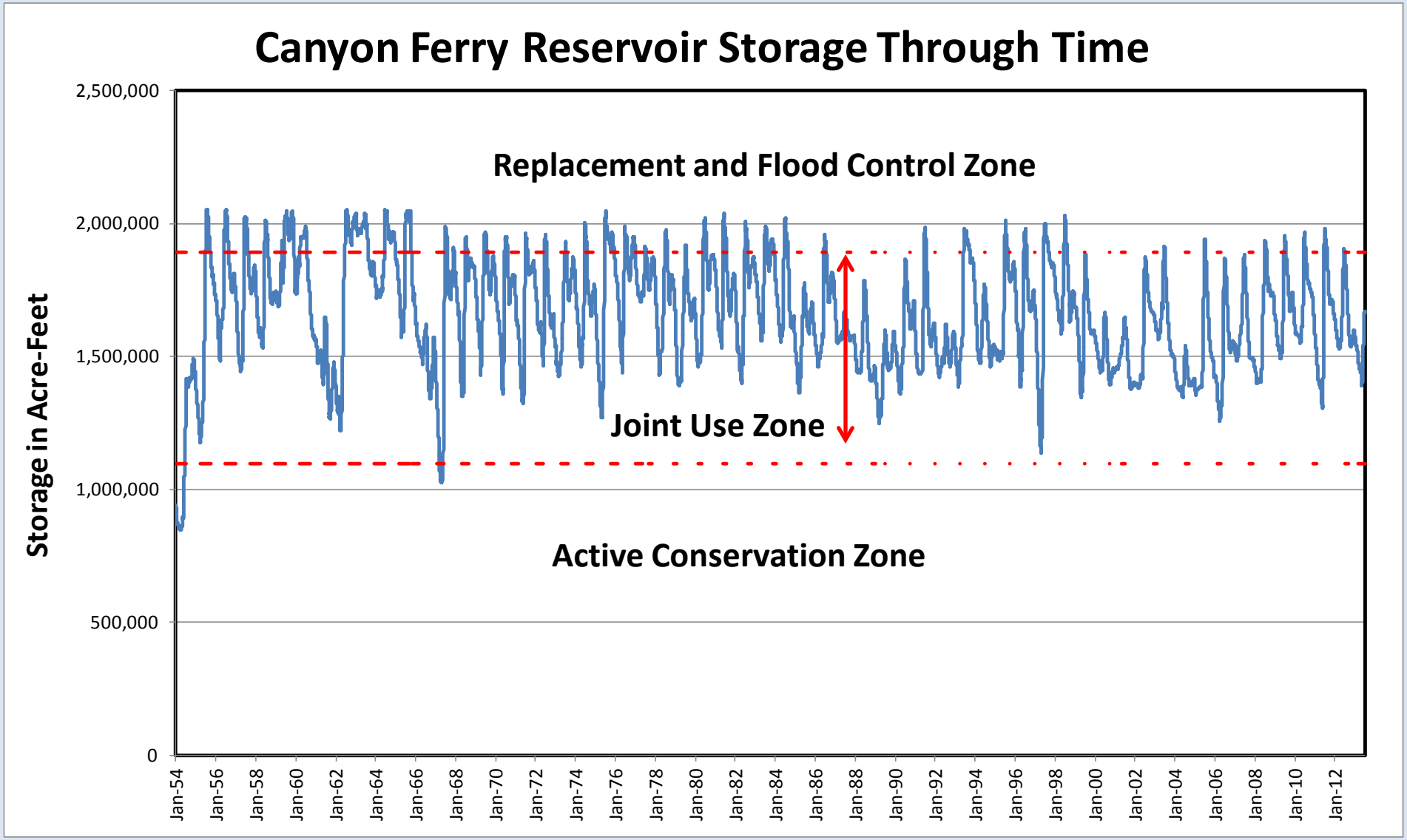

Gallatin River at Logan
Normal Range of Flow
Flow in Cubic Feet Per Second
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Highest Year in 10
Middle Year
Lowest Year in 10

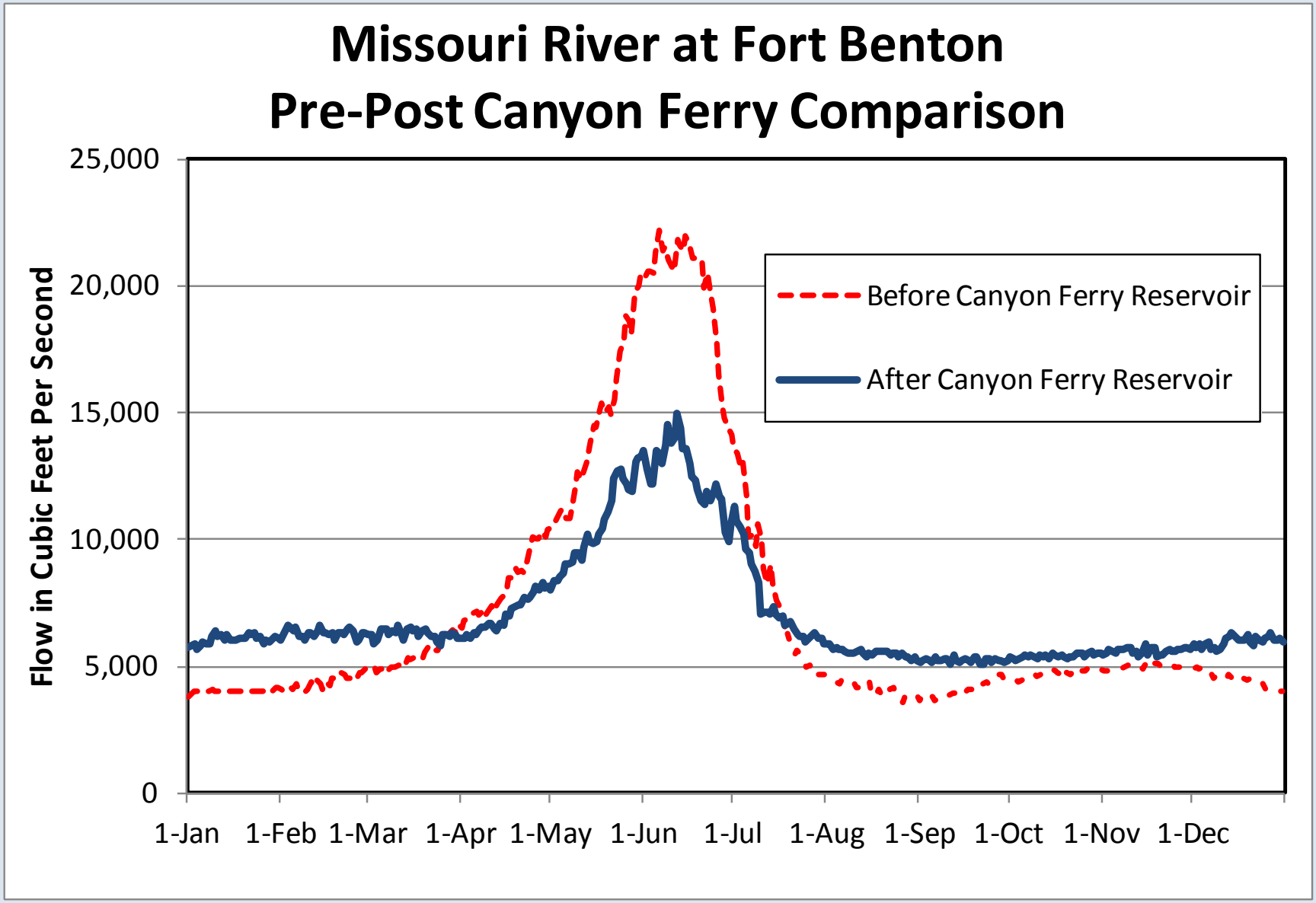
Canyon Ferry Reservoirs

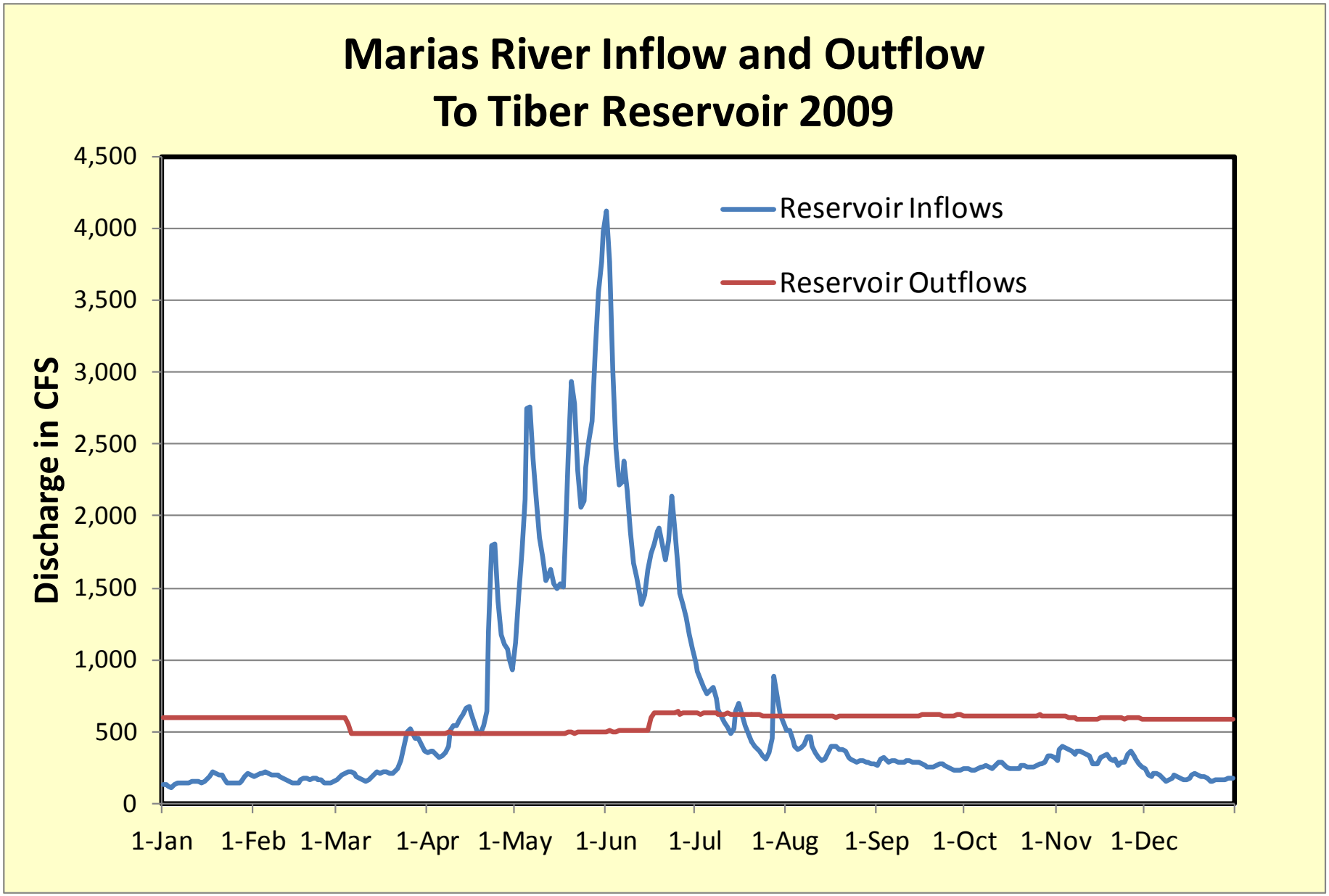
Photos from
U.S. Bureau of Reclamation

CANYON FERRY RESERVOIR ALLOCATIONS



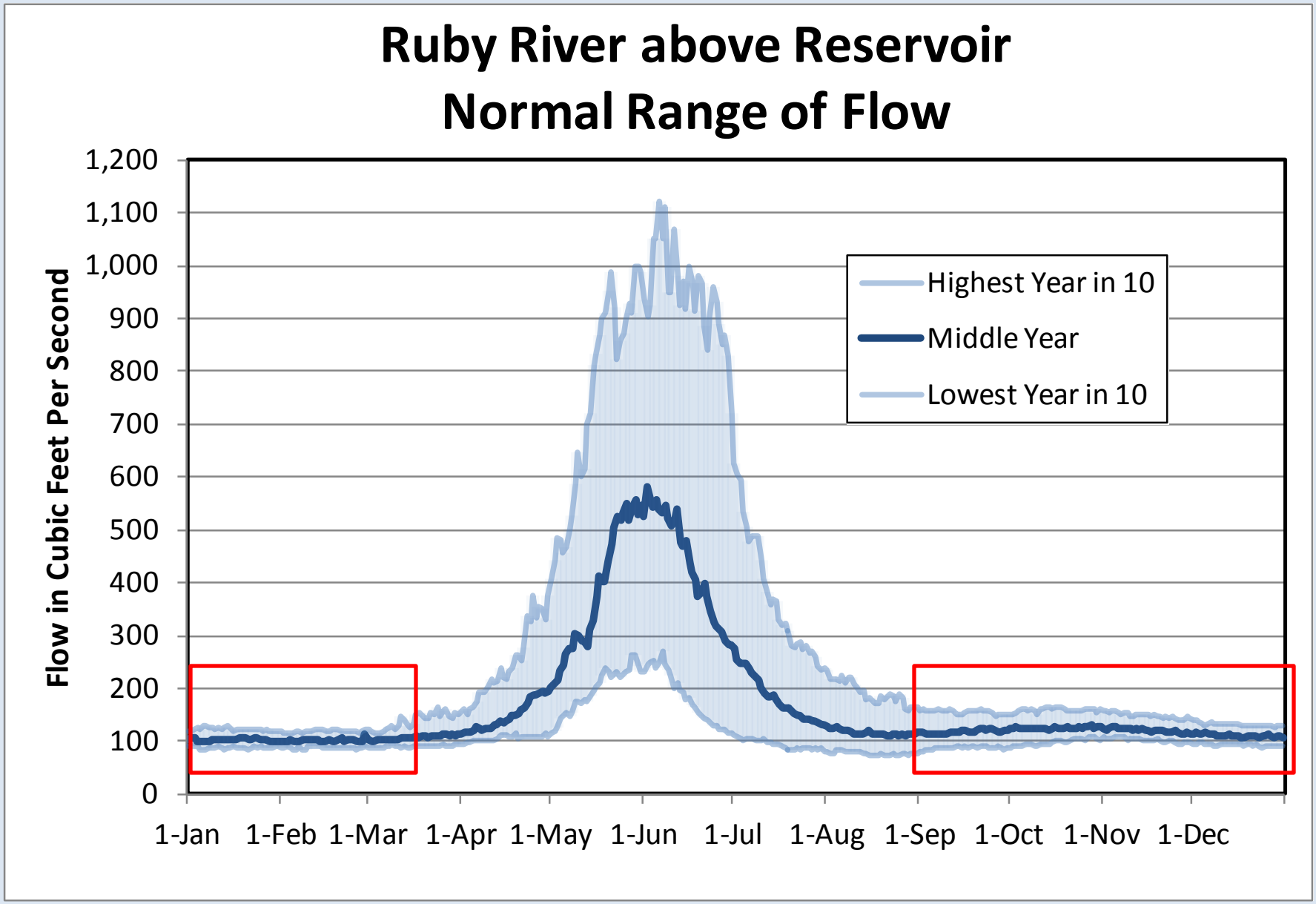

Canyon Ferry Reservoir Storage Through Time
Storage in Acre-Feet
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Replacement and Flood Control Zone
Joint Use Zone
Active Conservation Zone
Jan-54
Jan-56
Jan-58
Jan-60
Jan-62
Jan-64
Jan-66
Jan-68
Jan-70
Jan-72
Jan-74
Jan-76
Jan-78
Jan-80
Jan-82
Jan-84
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
Jan-06
Jan-08
Jan-10
Jan-12

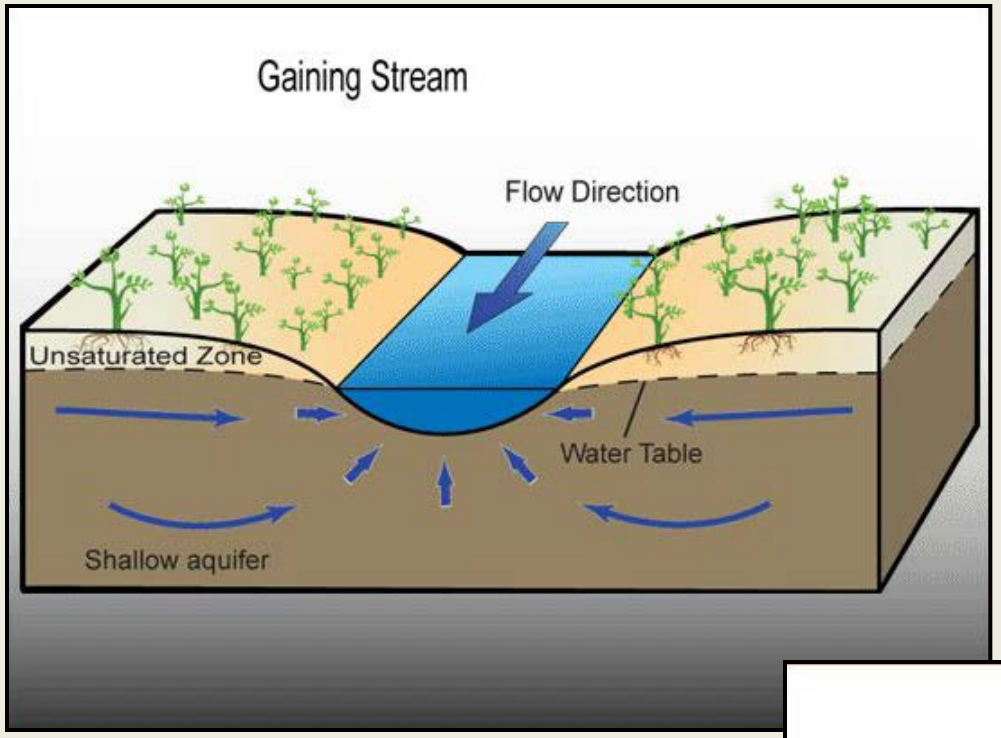

Missouri River at Fort Benton
Pre-Post Canyon Ferry Comparison
Flow in Cubic Feet Per Second
25,000
20,000
15,000
10,000
5,000
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Before Canyon Ferry Reservoir
After Canyon Ferry Reservoir

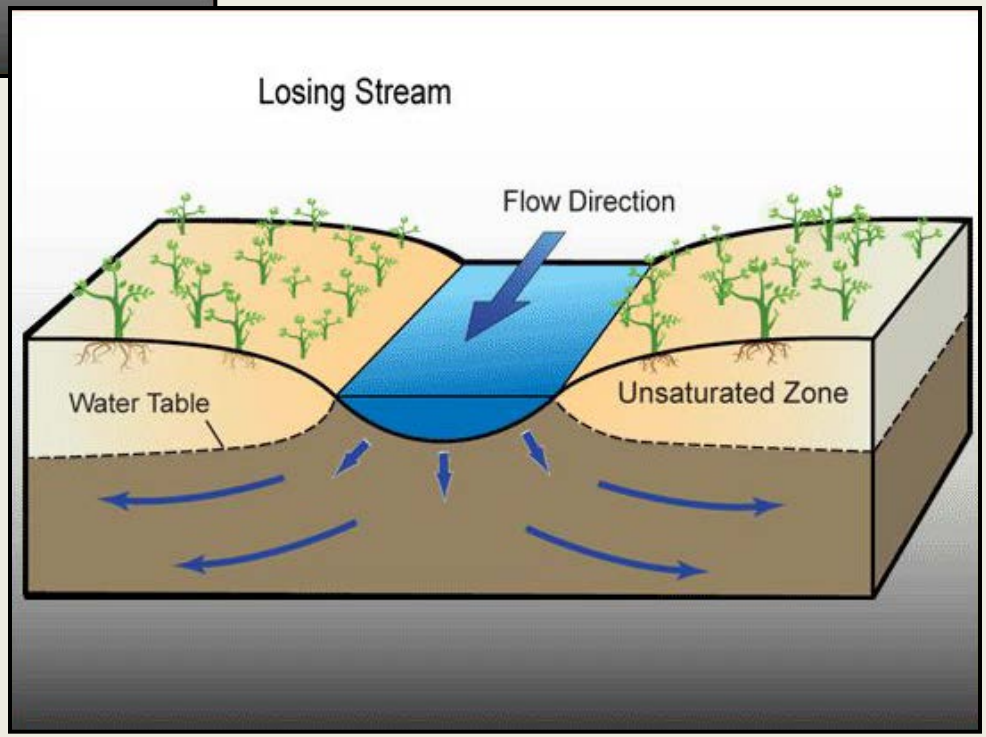

Marias River Inflow and Outflow
To Tiber Reservoir 2009
Discharge in CFS
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Reservoir Inflows
Reservoir Outflows
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec

Surface Water-Ground Water

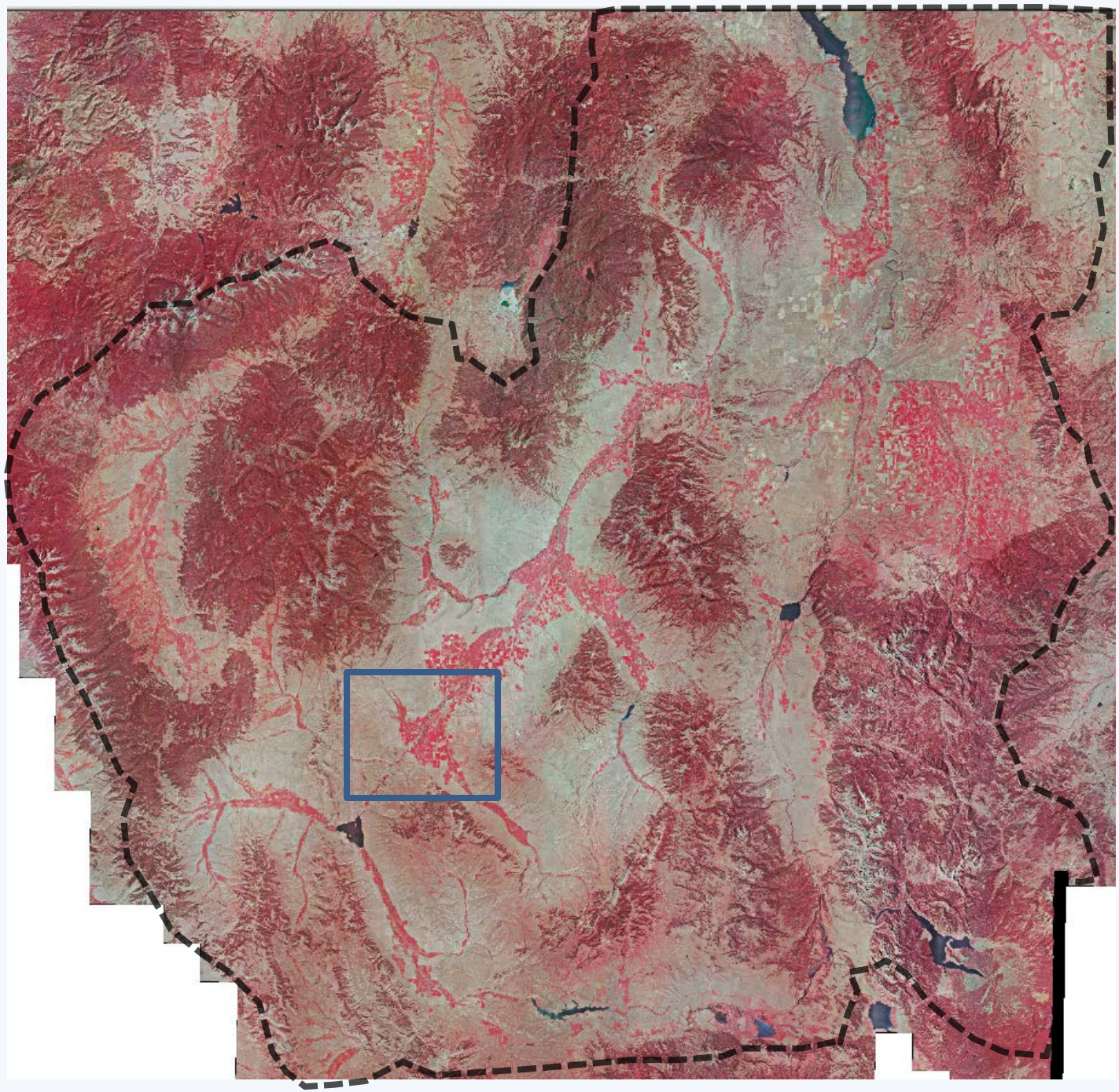
Base Flow


Ruby River above Reservoir
Normal Range of Flow
Flow in Cubic Feet Per Second
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Highest Year in 10
Middle Year
Lowest Year in 10

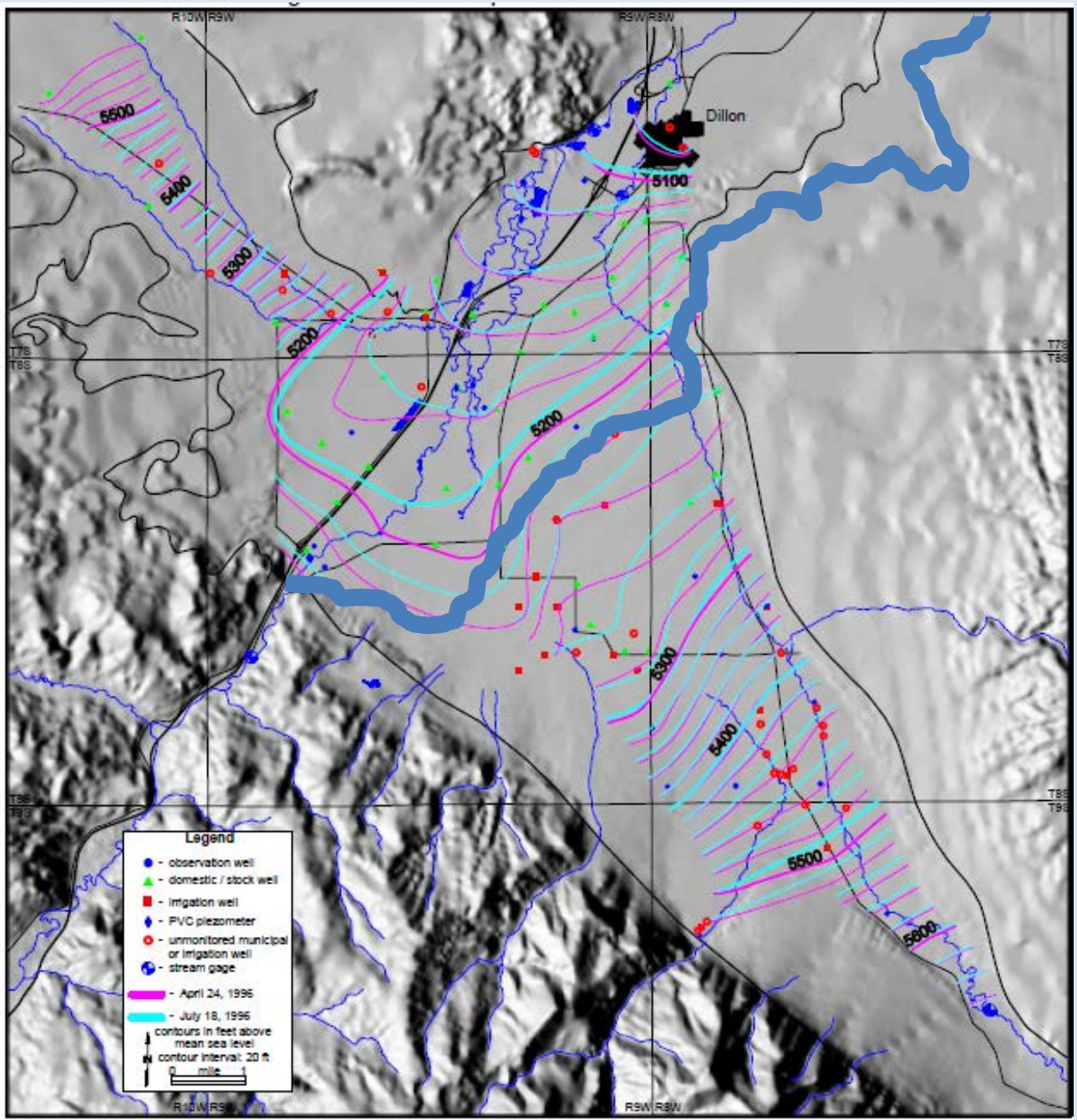




Source: US Geological Survey

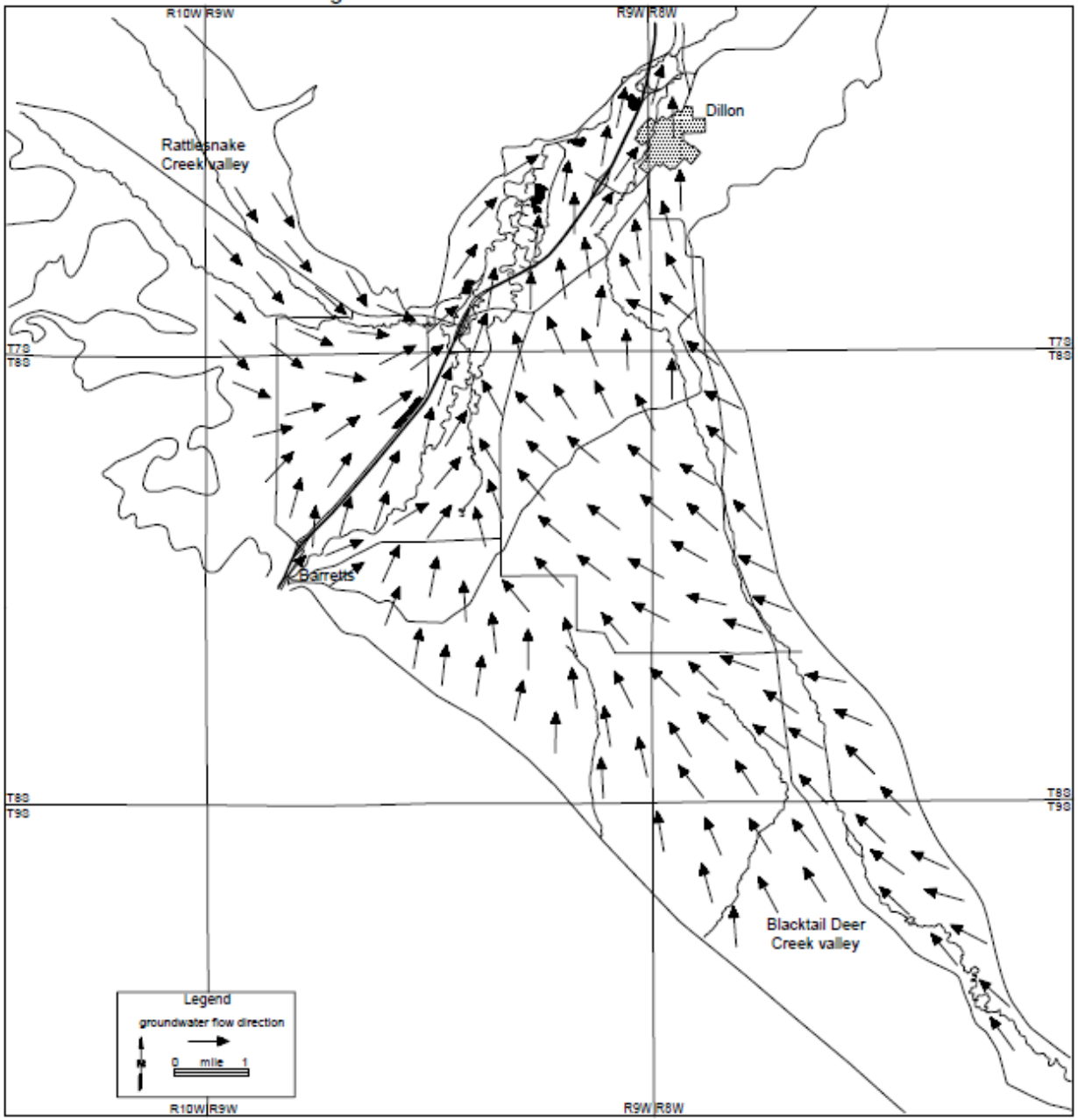


Beaverhead Valley Groundwater Elevations 1996



Beaverhead Valley General Groundwater Flow Directions

Figure 11. General Groundwater Flow Direction



Questions?