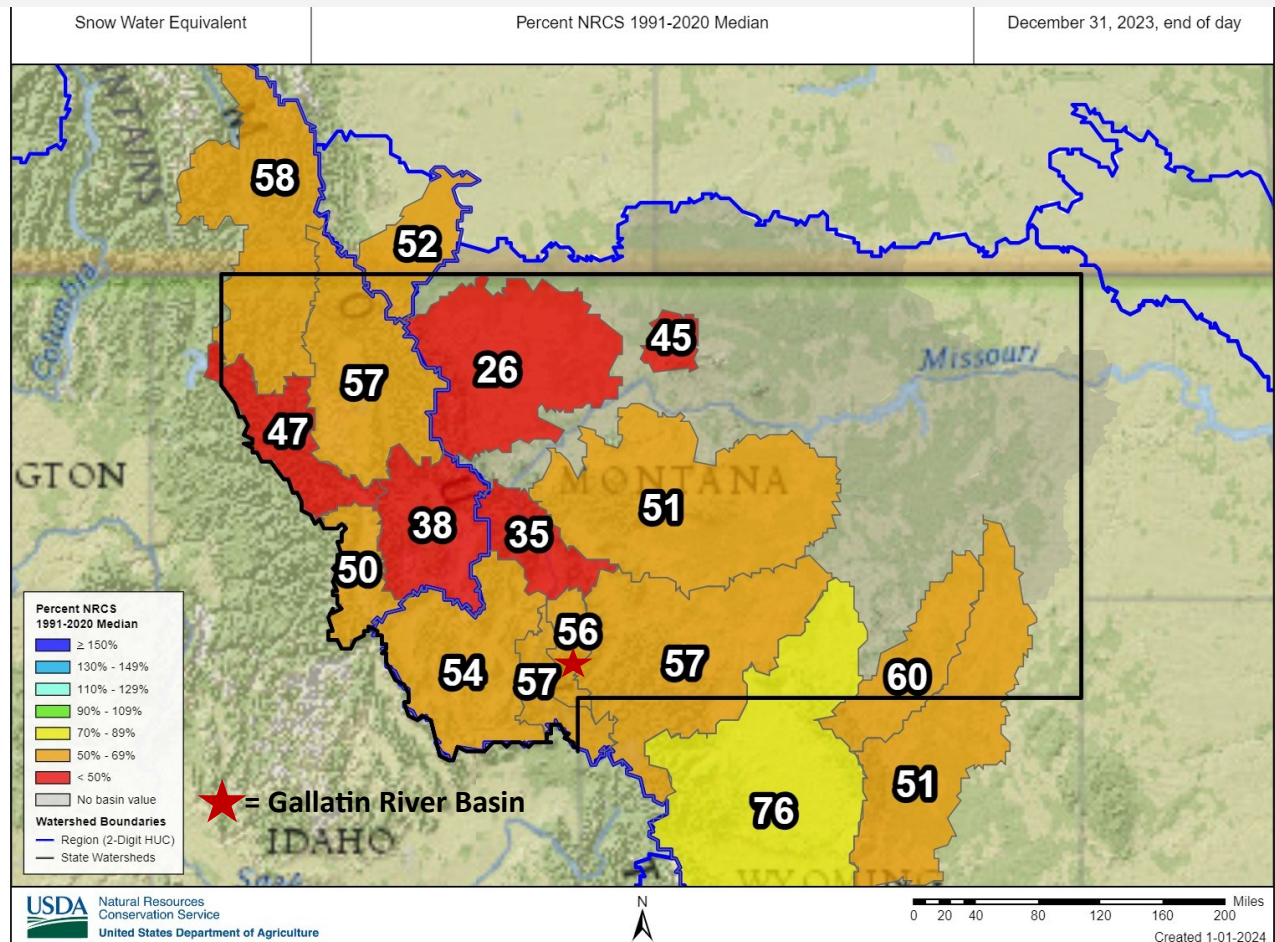
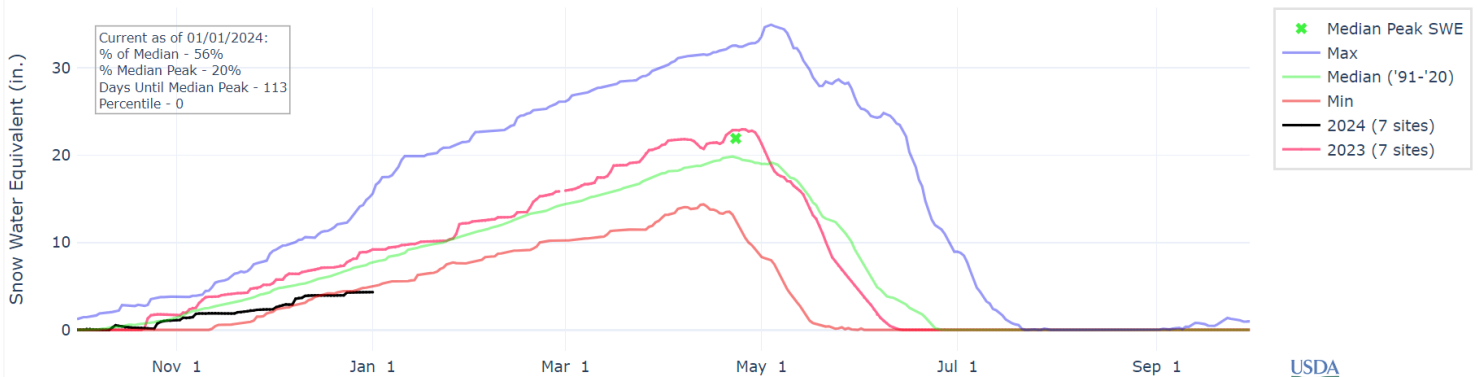


Gallatin County Water Supply

December 2023



SNOW WATER EQUIVALENT IN GALLATIN



SNOWPACK SUMMARY (Water Year (WY) = October 1st—September 30)

*Data current as of January 1st

We are currently in Water Year 2024 (black line). The Snow Water Equivalent (SWE) was below normal (median) and below the minimum within the Gallatin River Basin on December 31st, 2023 at 4.3 inches (a 1.9 increase since last month). The SWE on December 31st, 2022 (central red line) was 9.0 inches. Detailed end-of-month SNOTEL site information follows.

Snowpack Data

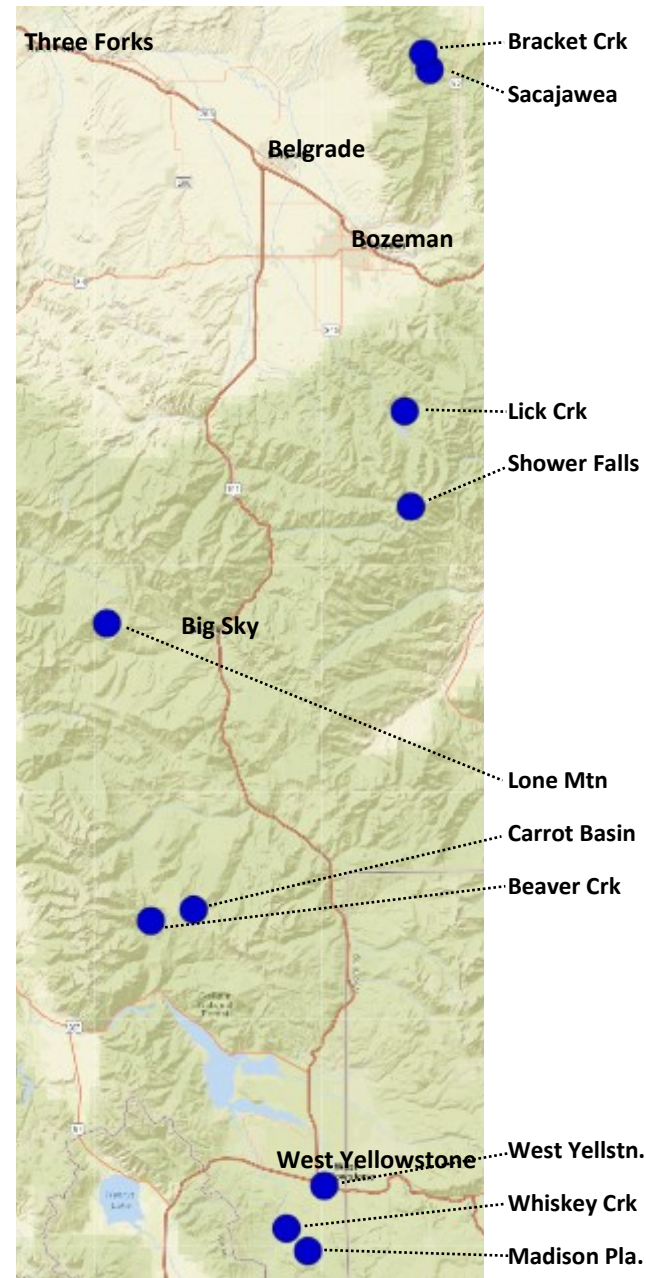
Gallatin River Basin—December 2023

Gallatin Valley Region (Bozeman-Belgrade-Four Corners)					
Station Name	Date	Snow Depth (in)	SWE (in)	SWE % Normal	Normal SWE 1971-2000 (in)
Brackett Creek	Dec. 2022	32	7.6	85	8.9
	Dec. 2023	18	4.3	48	
Sacajawea	Dec. 2022	22	5.4	106	5.1
	Dec. 2023	7	2.1	41	

Hyalite Region (Gallatin Gateway)					
Station Name	Date	Snow Depth (in)	SWE (in)	SWE % Normal	Normal SWE 1971-2000 (in)
Lick Creek	Dec. 2022	22	5.6	106	5.3
	Dec. 2023	6	2.2	42	
Shower Falls	Dec. 2022	41	9.5	94	10.1
	Dec. 2023	22	5.4	53	

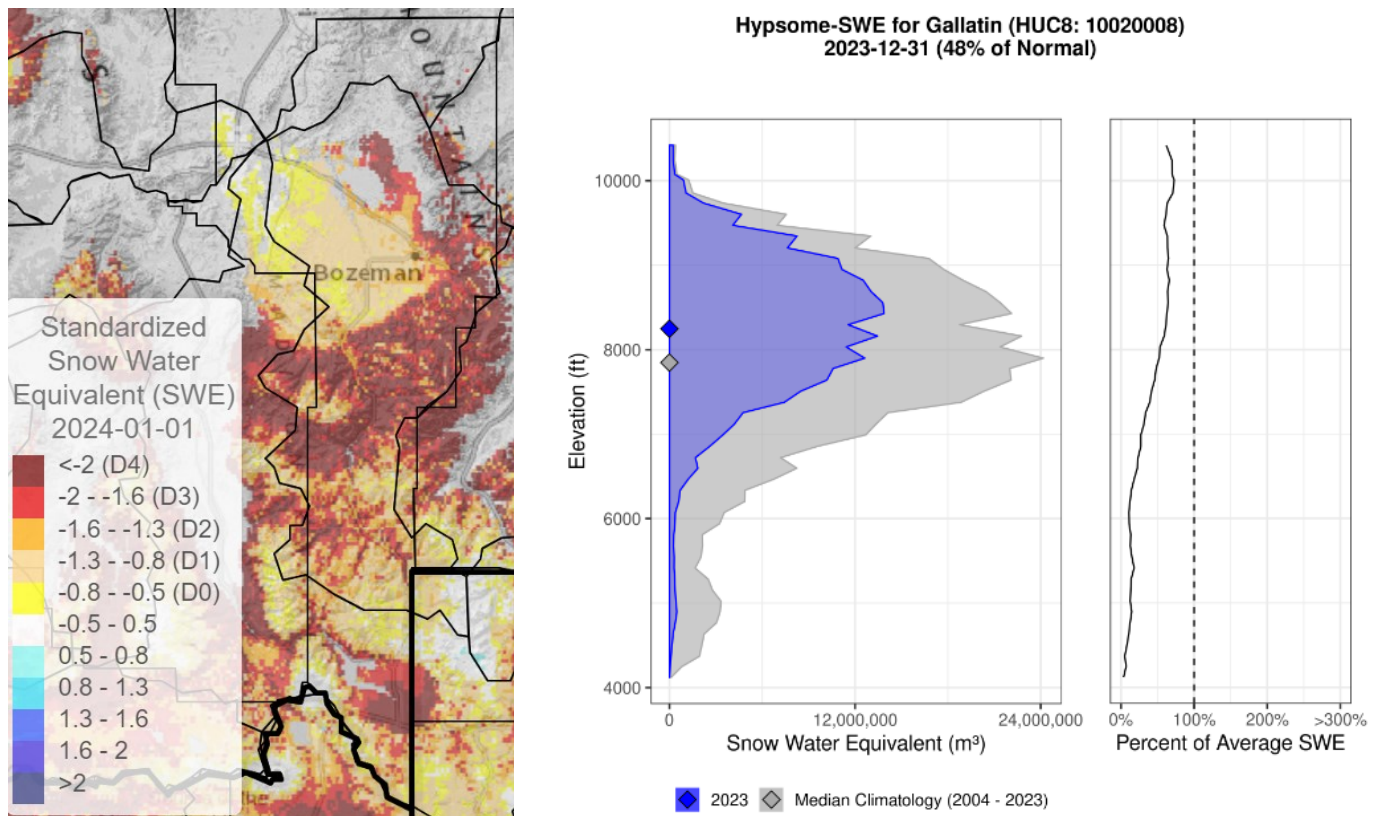
Lee Metcalf Wilderness Region (Big Sky)					
Station Name	Date	Snow Depth (in)	SWE (in)	SWE % Normal	Normal SWE 1971-2000 (in)
Beaver Creek	Dec. 2022	43	10.0	127	7.9
	Dec. 2023	20	4.9	62	
Carrot Basin	Dec. 2022	55	15.5	119	13.0
	Dec. 2023	31	7.4	57	
Lone Mountain	Dec. 2022	42	10.9	138	7.9
	Dec. 2023	17	3.9	49	

West Yellowstone Region					
Station Name	Date	Snow Depth (in)	SWE (in)	SWE % Normal	Normal SWE 1971-2000 (in)
Madison Plateau	Dec. 2022	56	14.6	130	11.2
	Dec. 2023	25	6.0	54	
West Yellowstone	Dec. 2022	34	8.1	137	5.9
	Dec. 2023	6	1.6	27	
Whiskey Creek	Dec. 2022	44	10.1	135	7.5
	Dec. 2023	14	3.3	44	



Standardized SWE from SNODAS & Hypsome-SWE

Gallatin River Watershed—December 2023



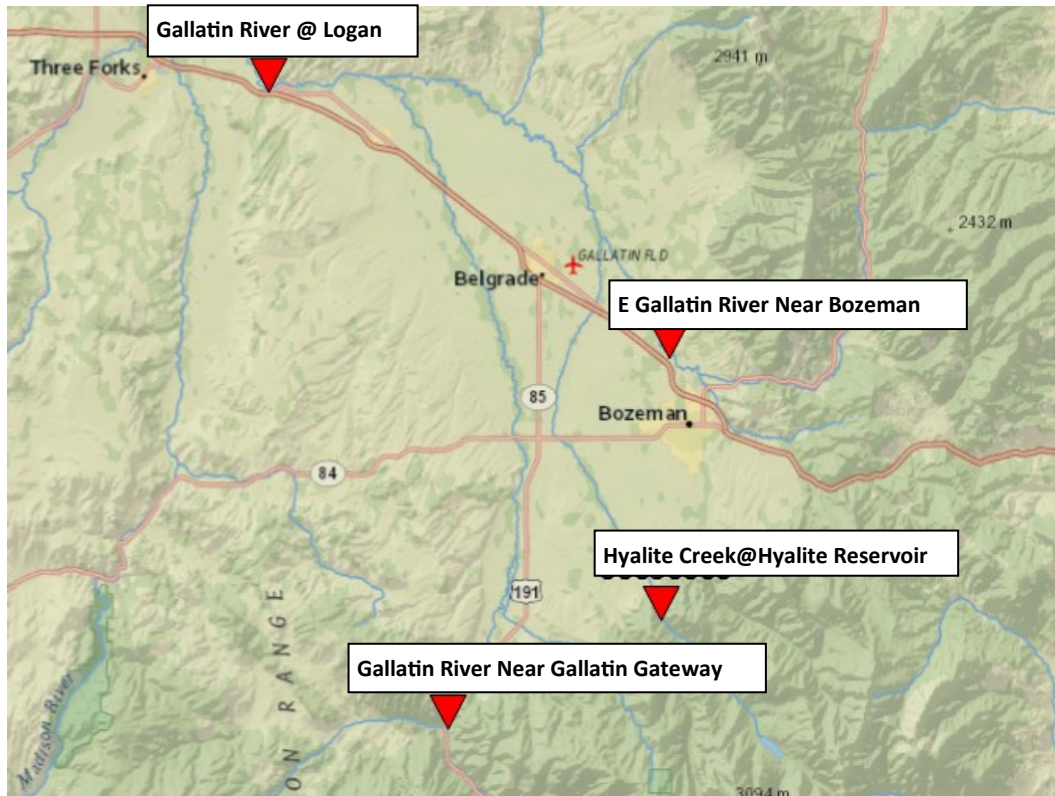
OVERVIEW *Data current as of January 1st, 2024 & December 31st, 2023

Left Map: This data set contains estimates of standardized snow pack anomalies based on the depth of snow water equivalent (SWE), from the NOAA National Weather Service's National Operational Hydrologic Remote Sensing Center SNOw Data Assimilation System (SNODAS). SNODAS is a modeling and data assimilation system created to provide the best possible estimates of snow cover and associated parameters to support hydrologic modeling and analysis. Negative (red) values represent lesser than average SWE while positive (blue) values represent greater than average SWE. Standardization is based on data from 2004-present and computed daily.

Right Graph: Hypsome-SWE represents a method to evaluate the distribution of SWE across watersheds. Hypsome-SWE is loosely based on the concept of hypsometry, the area-elevation relationship of a basin. Instead of evaluating the area-elevation relationship, here they evaluate the cumulative SWE (m³)-elevation relationship. More specifically, in this module, they compare the median hypsome-SWE curve for December using the SNODAS period of record (2004-present) to the December, 2023 SWE distribution. This allows for a rapid assessment of the distribution of SWE within a basin with respect to elevation and allows for easy comparison to the expected distribution given the SNODAS period of record.

Streamflow Data

Gallatin River Basin—December 2023



December 1st Gallatin Watershed Streamflow					
Station Name	2023 Discharge (cfs)	% Normal	Normal Discharge (cfs)	2022 Discharge (cfs)	Period Of Record (Yrs)
Gallatin at Logan	994	144	690	632	107
E Gallatin near Bozeman	ICE	-	40	39.3	9
Hyalite Creek at Hyalite Reservoir	ICE	-	18	18.5	69
Gallatin near Gallatin Gateway	325	108	302	334	93

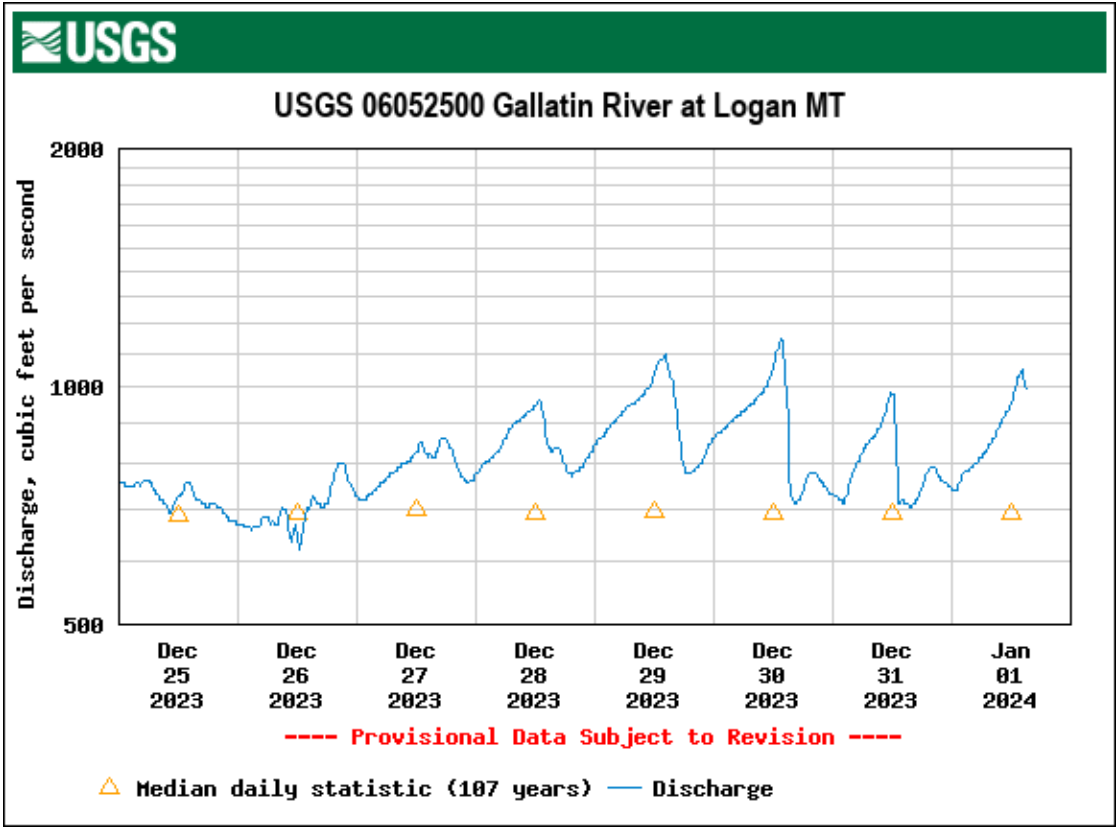
STREAMFLOW SUMMARY *Data current as of January 1st

The Gallatin at Logan and the Gallatin near Gallatin Gateway sites were above normal for this time of year. The Gallatin at Logan site was above what it was at this time last year and the Gallatin Gateway site is just below what it was at this time last year.

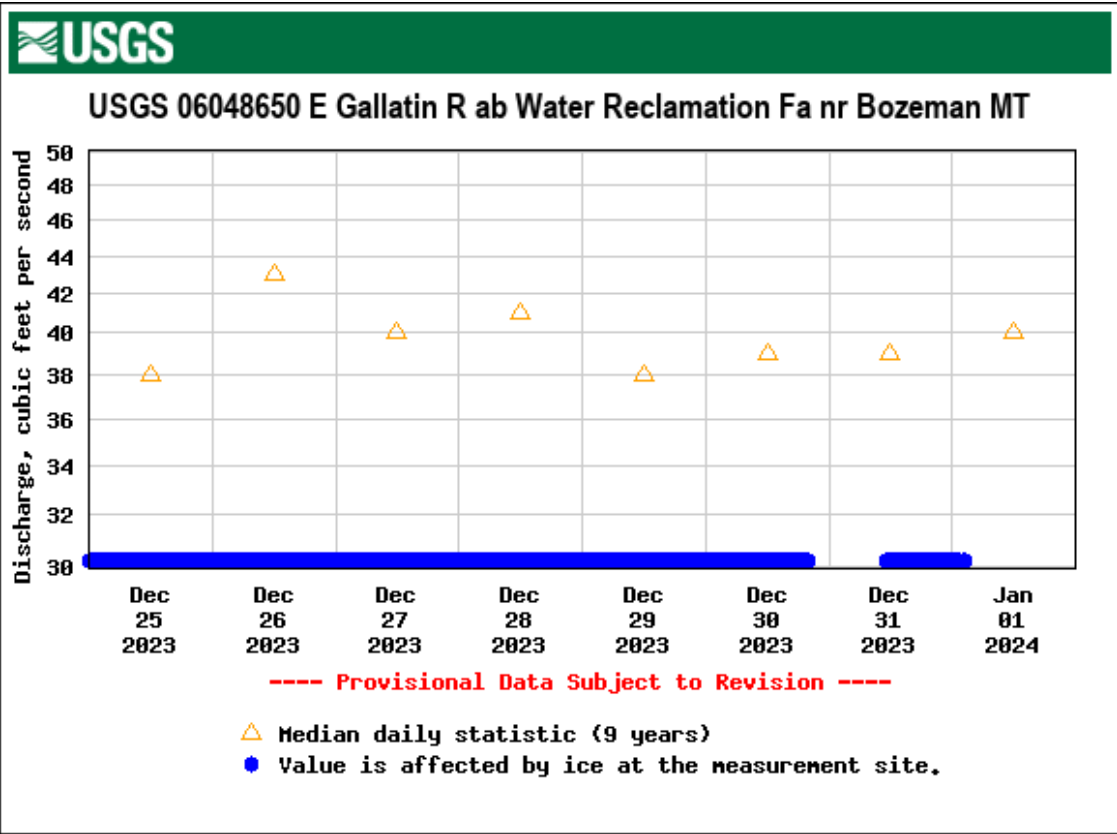
Discharge values at the E Gallatin Near Bozeman and Hyalite Creek sites are ice affected.

Streamflow Data

Gallatin River Basin—December 2023



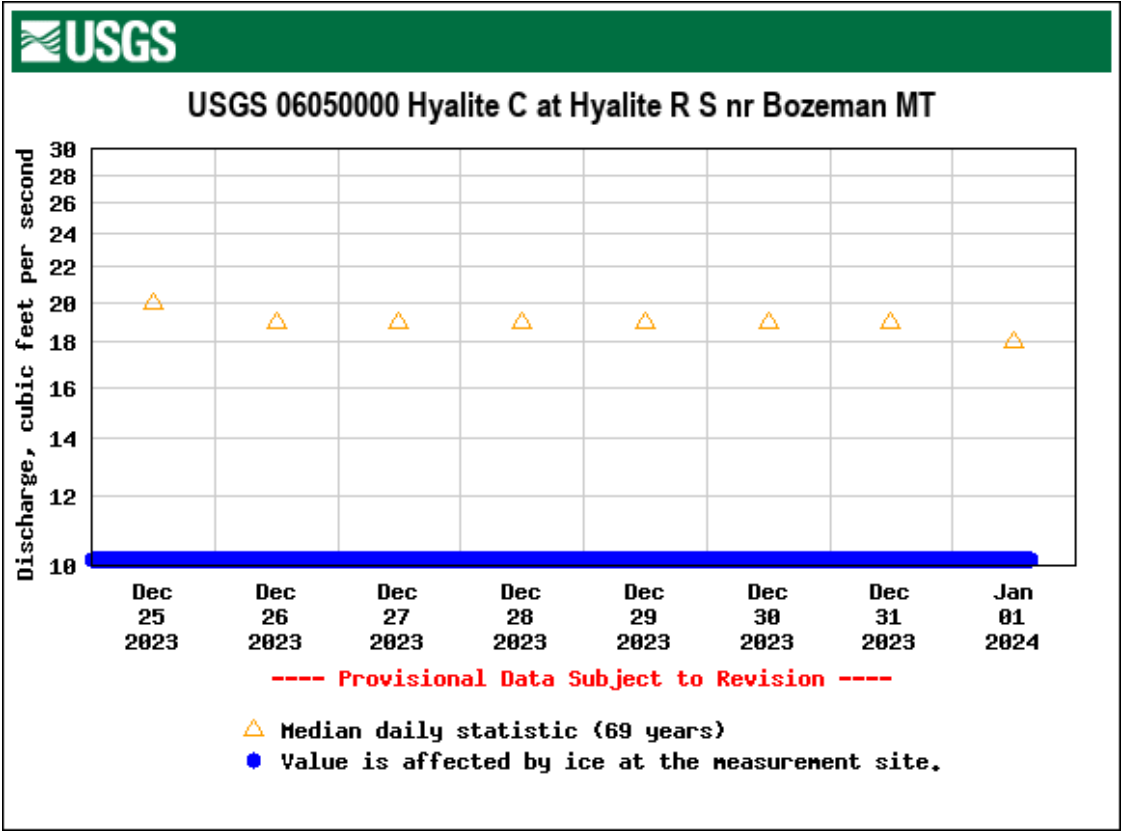
January 1st 2024 15:00:00— Discharge is above normal.



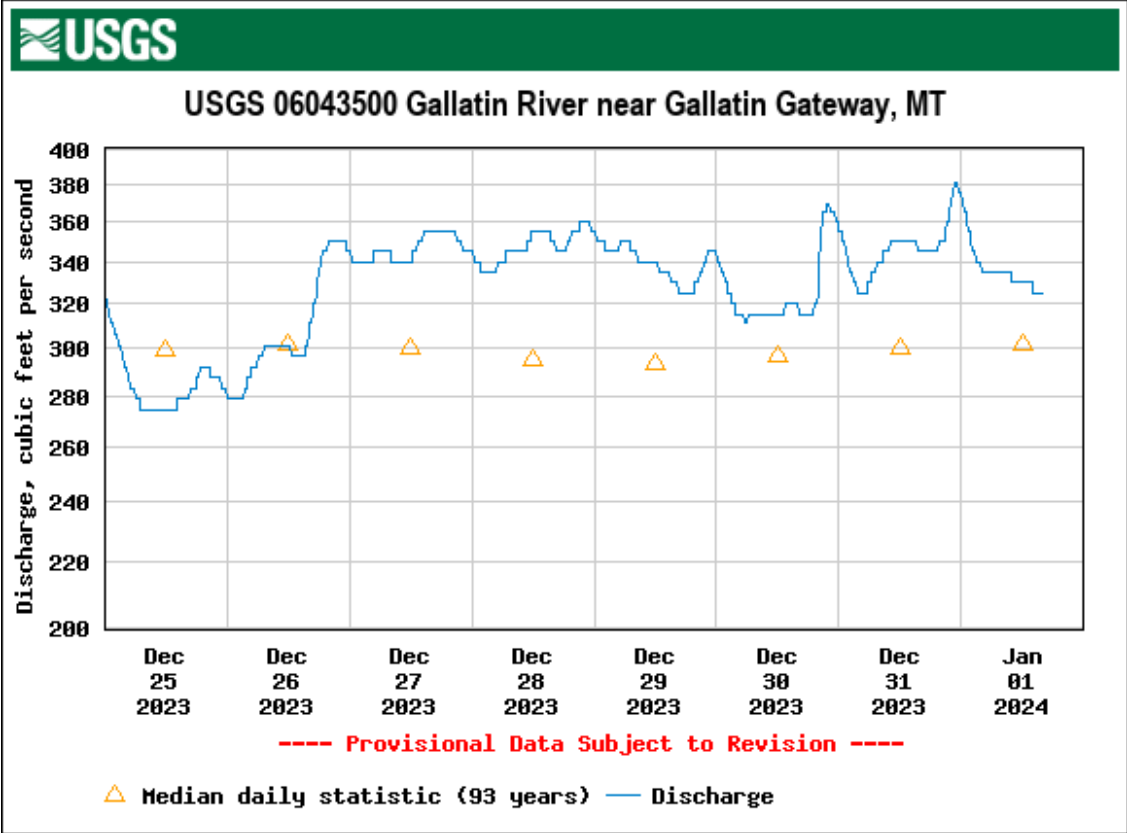
January 1st 2024 14:30:00— Discharge data is unavailable.

Streamflow Data

Gallatin River Basin—December 2023



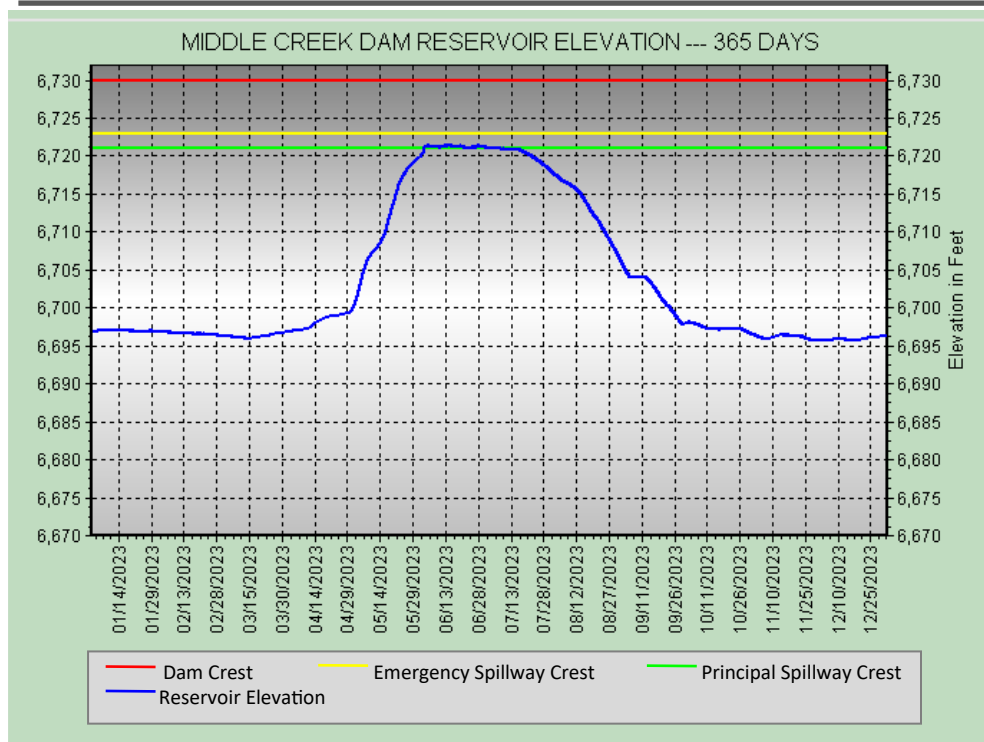
January 1st 2024 15:30:00— Discharge data is unavailable.



January 1st 2024 16:00:00— Discharge is above normal.

Water Storage Data

Middle Creek Dam, Hyalite Reservoir—December 2023



TIME OF LAST READING 1/1/2024 3:00 PM

RESERVOIR ELEVATION 6,696.4 FT

RESERVOIR VOLUME 5,366 AF

REFERENCE INFORMATION	FT (MSL)	AC-FT
DAM CREST	6730	12,790
EMERGENCY SPILLWAY CREST	6723	10,707
PRINCIPAL SPILLWAY CREST	6721	10,184
LOWEST USEABLE ELEVATION	6637	0



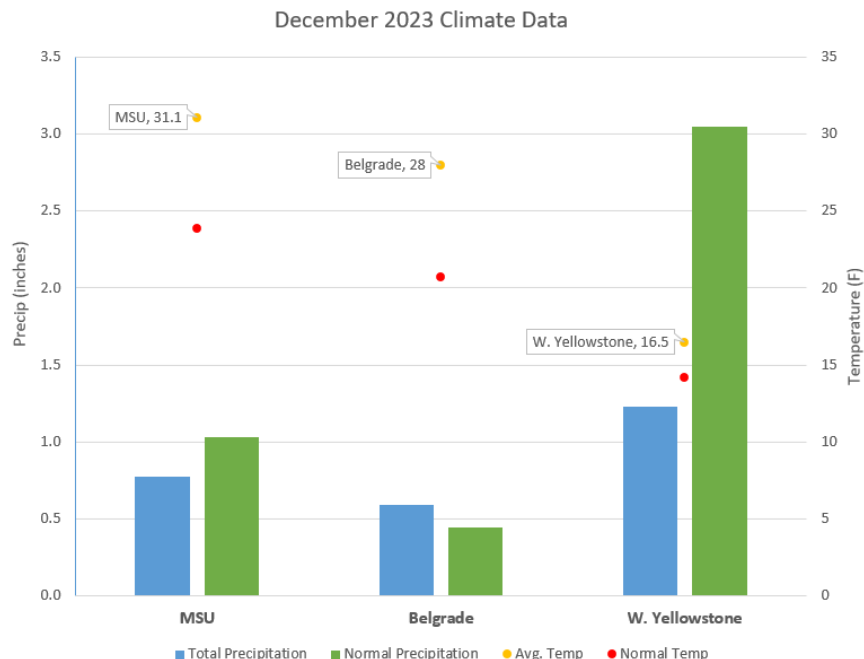
*** PROVISIONAL DATA SUBJECT TO REVISION ***

RESERVOIR SUMMARY *Data current as of January 1st

Middle Creek Dam Reservoir elevation is 6,696.4 ft which is 24.6 ft below the principal spillway crest (6,721 ft). The reservoir elevation has increased by .7 ft since December 1st, 2023 (date of last relevant WSO report). Reservoir volume is 5,366 acre-ft; which is 103 acre-ft less than December 1st, 2023.

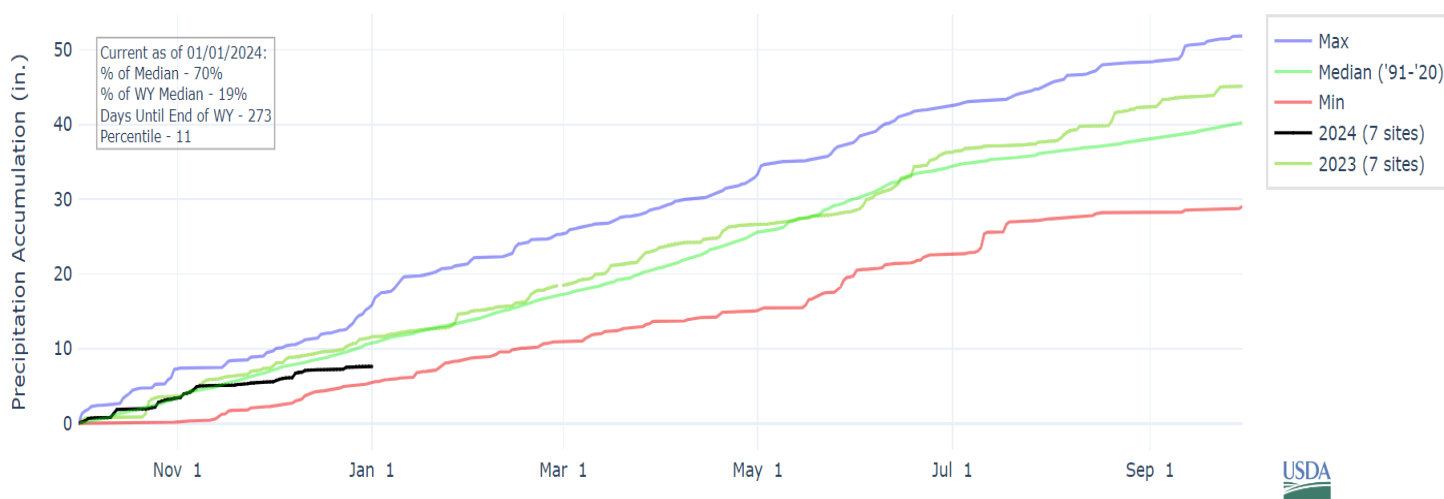
Climate Data

Gallatin County—December 2023



Above graph depicting ACIS climate data representing the entire month of December.

PRECIPITATION ACCUMULATION IN GALLATIN



TEMP & PRECIP SUMMARY (Water Year (WY) = October 1st—September 30)

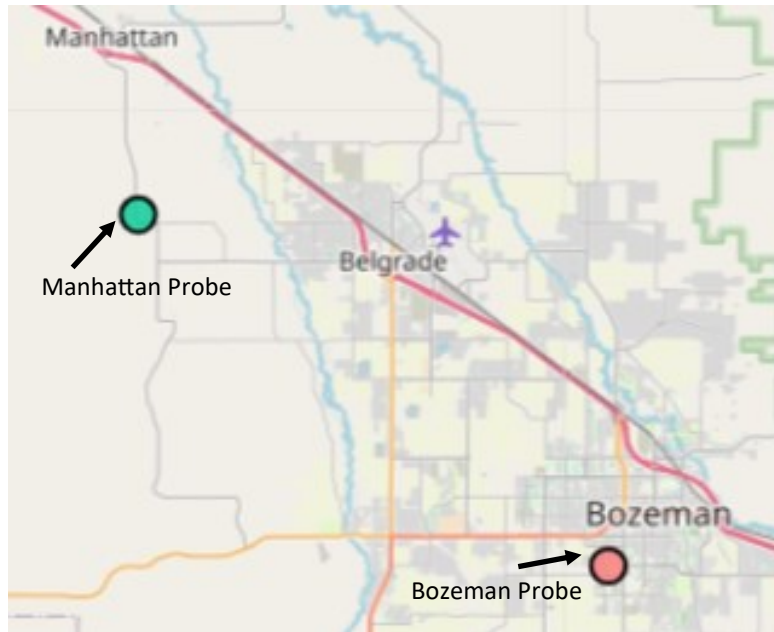
*Data is current as of January 1st

Average temperatures have decreased at the MSU, Belgrade, and West Yellowstone sites since November 2023 (ACIS graph). Average temperatures at the MSU, Belgrade, and West Yellowstone sites are all above normal for this time of year. MSU and West Yellowstone sites had below normal precipitation in December 2023 while the Belgrade site reported above normal precipitation.

We are currently in Water Year 2024 (black line). The total accrued precipitation for the Gallatin River Basin as of December 31st, 2023 is below the average (median) at 7.6 inches (USDA graph). The total accrued precipitation for WY 2023 December 31st, 2022 was 11.4 inches (green line).

Soil Moisture Data

Mesonet Stations—December 2023



Manhattan Soil Probe Depth (in)	Soil Temp (°F)	Soil Water Content (%)
8" - Surface	30.92	22.5%
20" - Shallow rooting	34.88	11.3%
36" - Deep Rooting	38.48	32.4%

Bozeman Soil Probe Depth (in)	Soil Temp (°F)	Soil Water Content (%)
4" - Surface	27.14	16.8%
8" - Shallow rooting	28.58	12.3%
20" - Deep Rooting	32.9	15.7%

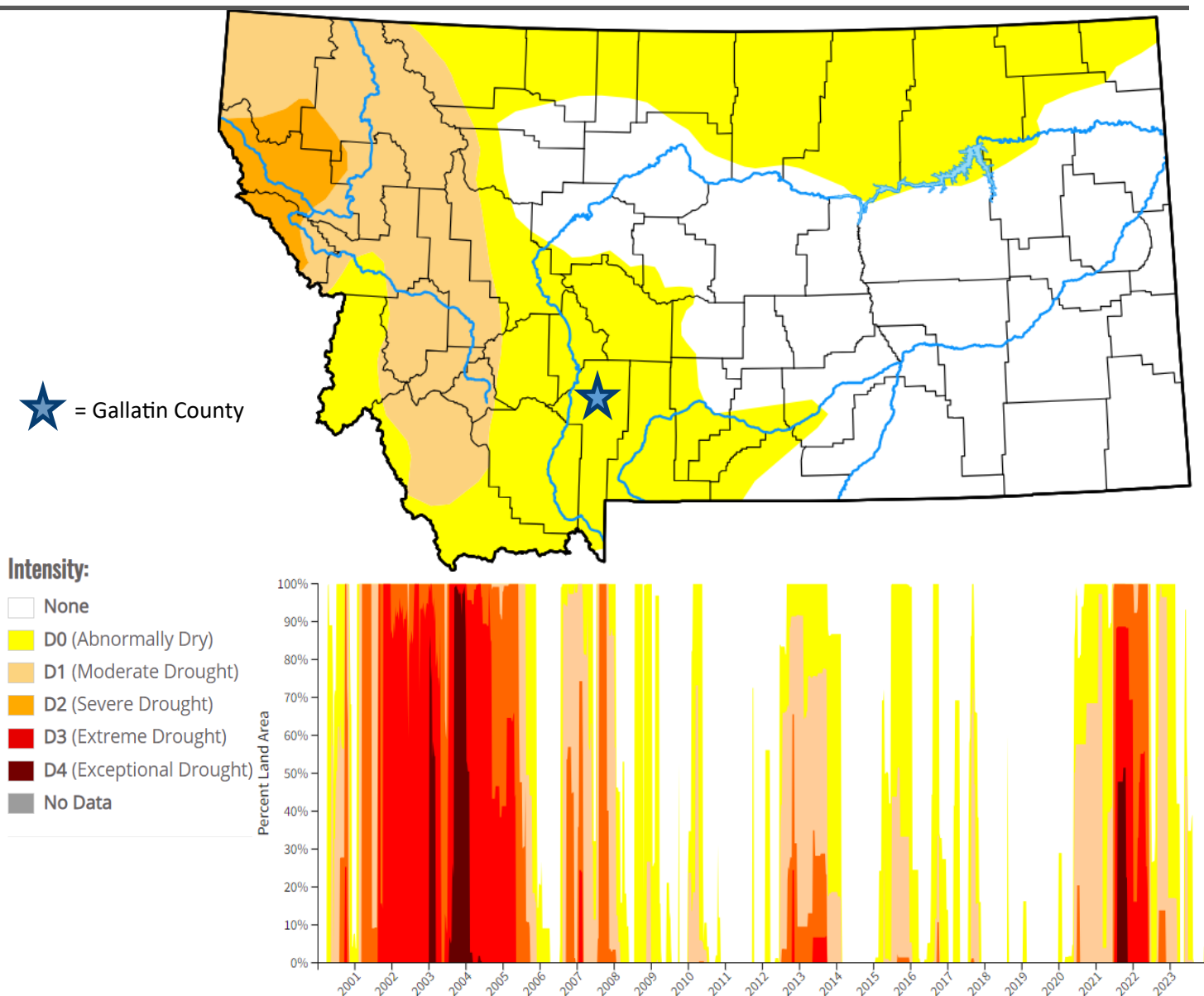
SOIL MOISTURE SUMMARY *Data current as of January 1st

At the Manhattan station, temperature has decreased at all depths but soil water content has decreased at 8", increased at 20", and remained the same at 36" since November 2023.

At the Bozeman station, temperature has increased at 4", while decreasing at 8" and 20". Soil water content has remained just about the same at all depths since November 2023.

Drought Index Data

Gallatin County—December 2023

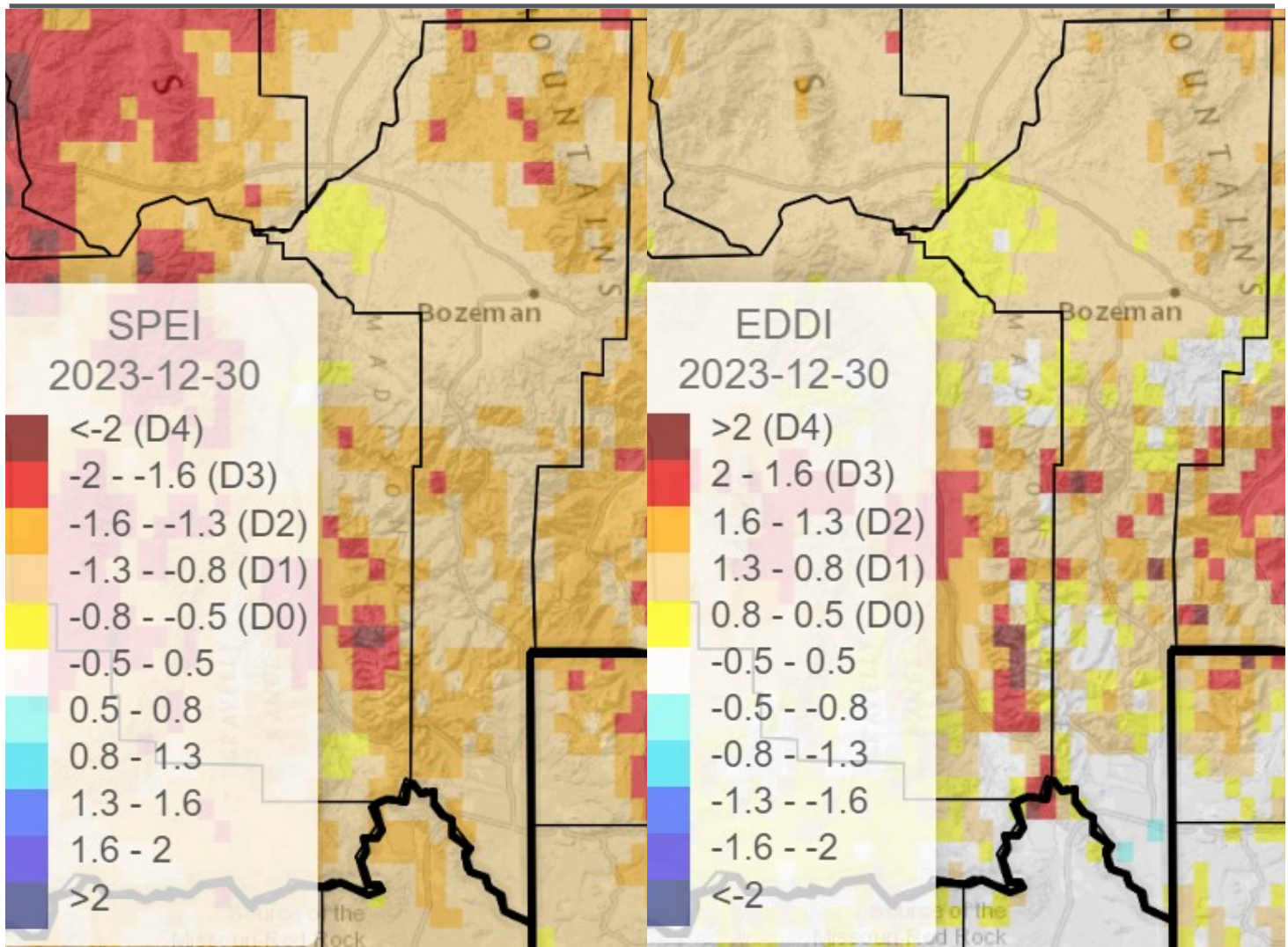


DROUGHT INDEX SUMMARY *Data is current as of December 28th

98.86% of Gallatin County is experiencing Abnormally dry drought conditions. Impacts include low soil moisture contributing to poor crop germination and dry pastures, increased fire danger, and low streamflow with impacts to recreational fishing.

Standardized Precipitation Evapotranspiration Index

Evaporative Demand Drought Index



SPEI & EDDI Overview *Data is current as of December 30th

The maps above show the current Standardized Precipitation Evapotranspiration Index (SPEI, Left) and Evaporative Demand Drought Index (EDDI, Right) for the month of December 2023.

SPEI takes into account both precipitation and potential evapotranspiration to describe the wetness (positive blue values) or dryness (negative red values) of a time period. SPEI has been calculated for the month of December 2023 to represent drought impacts on hydrological conditions for the past 30 days. SPEI incorporates the important effect of atmospheric demand on drought.

EDDI has examined how deviated from normal the atmospheric evaporative demand is for Gallatin County for the month of December 2023. EDDI is an experimental drought monitoring and early warning guidance tool. EDDI can offer early warning of agricultural drought, hydrologic drought, and fire-weather risk. Positive (red) values represent dryness categories while negative (blue) values represent wetness categories.

Gallatin County Water Supply Outlook

Source Information & Helpful Links

Gallatin Conservation District:

- [Archive of Water Supply Outlook Reports](#)
- [Living by the Water](#)
- [310 Permit Forms & Info](#)

Snowpack:

- [USDA / NRCS Interactive Map](#)
- [Montana Snow Survey Homepage](#)
- [NRCS / NWCC National Water & Climate Center](#)
- [Standardized Snow Water Equivalent \(SWE from SNODAS & Hypsometric –SWE](#)

Streamflow:

- [USGS Real Time Streamflow](#)
- [State of Montana Gaging Stations](#)
- [DNRC Water Right Query System](#)

Water Storage:

- [DNRC Water Projects—Middle Creek Real Time Data](#)
- [Middle Creek Early Warning System](#)
- [BOR—Montana Lakes and Reservoirs](#)

Climate:

- [ACIS Database](#)
- [NRCS Montana Current Conditions](#)
- [Montana Snow Survey Homepage](#)
- [US Climate Data](#)

Soil Moisture:

- [Montana Mesonet](#)
- [DNRC Drought Status by County](#)

Drought:

- [US Drought Portal](#)
- [US Drought Monitor](#)

SPEI & EDDI:

[Standardized Precipitation Evapotranspiration Index](#)
[Evaporative Demand Drought Index](#)

Helpful Partner Websites:

- [Department of Natural Resources & Conservation](#)
- [Gallatin County MSU Extension Office](#)
- [Gallatin Local Water Quality District](#)
- [Gallatin River Task Force](#)
- [Gallatin Watershed Council](#)
- [Montana Fish, Wildlife, & Parks](#)
- [Natural Resource Conservation Services](#)
- [One Montana](#)
- [Association of Gallatin Agricultural Irrigators](#)