

Montana

Water Supply Outlook Report

May 1st, 2019



Photo Credit: Ian Bardwell (USFS – RMRD)

Measuring snow (or no snow at the Cabin Creek snowcourse in the Bob Marshall Wilderness) isn't easy. Snow Surveyors, who go out monthly to collect valuable snowpack data at snowcourses in Montana, don't always have the luxury of using a machine to get to where they measure. Collaborators from multiple federal agencies, tribes, and non-profits assist in collecting this data throughout the winter, and for many of them, the May 1st survey is the last of the year. Without their help, we would not be able to provide snowpack data and water supply information that water users across the state have come to rely on. Thanks to all of you, and happy trails this summer!

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Montana Water Supply Outlook Report as of May 1st, 2019

How Forecasts Are Made

Most of the annual streamflow in the Western United States originates as snowfall that has accumulated high in the mountains during winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Predictions are based on careful measurements of snow water equivalent at selected index points. Precipitation, temperature, soil moisture and antecedent streamflow data are combined with snowpack data to prepare runoff forecasts. Streamflow forecasts are coordinated by Natural Resources Conservation Service and National Weather Service hydrologists. This report presents a comprehensive picture of water supply conditions for areas dependent upon surface runoff. It includes selected streamflow forecasts, summarized snowpack and precipitation data, reservoir storage data, and narratives describing current conditions.

Snowpack data are obtained by using a combination of manual and automated SNOTEL measurement methods. Manual readings of snow depth and water equivalent are taken at locations called snow courses on a monthly or semi-monthly schedule during the winter. In addition, snow water equivalent, precipitation and temperature are monitored on a daily basis and transmitted via meteor burst telemetry to central data collection facilities. Both monthly and daily data are used to project snowmelt runoff.

Forecast uncertainty originates from two sources: (1) uncertainty of future hydrologic and climatic conditions, and (2) error in the forecasting procedure. To express the uncertainty in the most probable forecast, four additional forecasts are provided. The actual streamflow can be expected to exceed the most probable forecast 50% of the time. Similarly, the actual streamflow volume can be expected to exceed the 90% forecast volume 90% of the time. The same is true for the 70%, 30%, and 10% forecasts. Generally, the 90% and 70% forecasts reflect drier than normal hydrologic and climatic conditions; the 30% and 10% forecasts reflect wetter than normal conditions. As the forecast season progresses, a greater portion of the future hydrologic and climatic uncertainty will become known and the additional forecasts will move closer to the most probable forecast.

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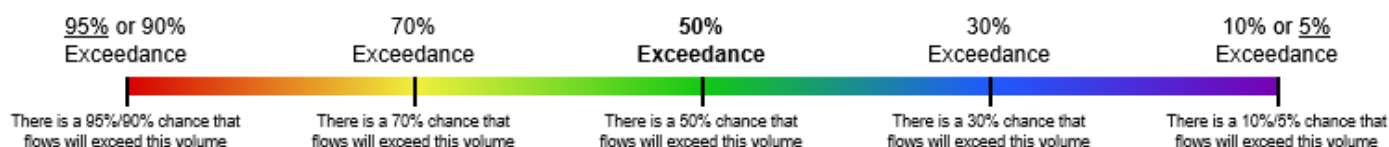
What's New?

Official forecasts are being released by the NRCS Montana Snow Survey and Water Supply Forecasting Program for this coming spring runoff season, and the forecasts are being released in a new graphical format. If you are uncomfortable with this new format, the old format can still be found [here](#).

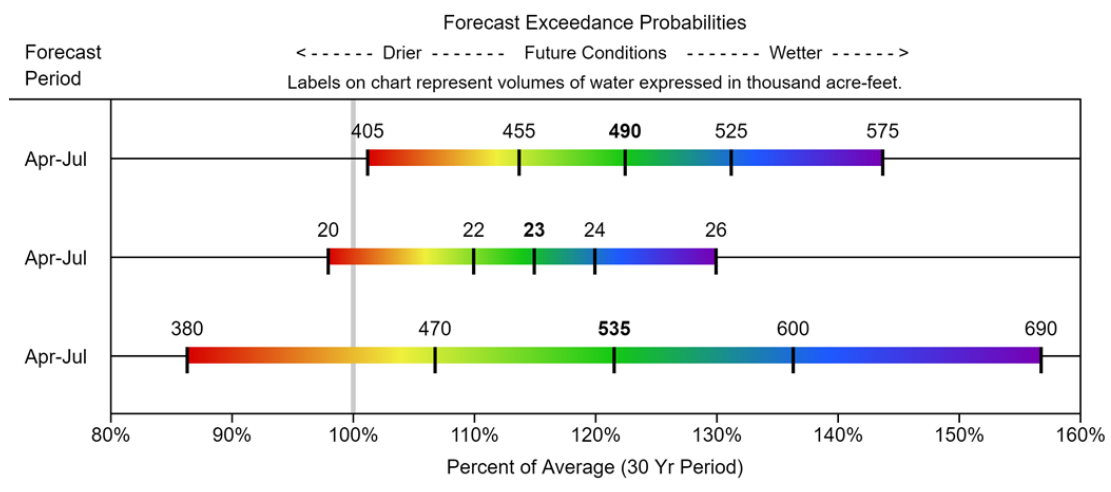
Typically, the NRCS has presented streamflow forecasts as a table format showing the five exceedance probabilities compared to the 30-year average as follows:

Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast							
Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
APR-JUL	315	375	420	187%	460	525	225

The Forecast Chart provides a visual alternative to the table. The forecast range is represented by a colored bar. Vertical lines on the bar signify the five forecast exceedances.



Below is an example. The numbers above the forecast bars are the five exceedance probability volumes in thousand acre-feet (KAF). Each exceedance forecast's percent of average can be estimated by looking at the horizontal axis. The gray line centered above 100% on the horizontal axis represents the 1981-2010 historical average streamflow for the forecast period.



In this example, almost all the forecast bars in the basin are shifted right of the gray vertical line indicating forecasts of above average streamflow. The 50% exceedance is represented by the black line in the green portion of the colored bar. For the top most line, this represents a forecast volume of 490KAF, which is ~123% of average. If drier than normal future conditions occur the 70% exceedance forecast may be more likely (455KAF or ~114% of average). If future conditions turn wetter than normal, the 30% exceedance forecast may be more likely (525KAF or ~132% of average). Water users are encouraged to consider the range of forecast exceedances instead of relying solely only on the 50% forecast.

Snowpack – Overview

Another month is in the books, and this chapter was full of surprises much like the rest of this winter. The first week of the month started out slowly, but a potent series of storms impacted the state during the second and third weeks of the month adding to the mountain snow water equivalent in many mid and high elevations. Towards the end of this storm cycle at the end of the third week in April temperatures took a turn towards the warm side for an 8 to 10-day period, before another round of storms impacted the state, ending the month with cooler temperatures during the last week helping to moderate snowmelt at low and mid elevations.

So where does that put us for runoff and melt ending April? Most of the low-elevation snowpack across the state began to melt in mid to late March, which when combined with abundant valley snowpack melt, lead to the early increases in river volumes. Mid-elevations accumulated snowpack through the month, until abundant sunshine and warm temperatures during the latter half of the month resulted in a discharging snowpack. High elevations across the state continued to gain snow water equivalent through most of the month, but the persistently sunny and warm weather finally caused the snowpack to go isothermal (one temperature throughout, and capable of melt) at the end of the month.

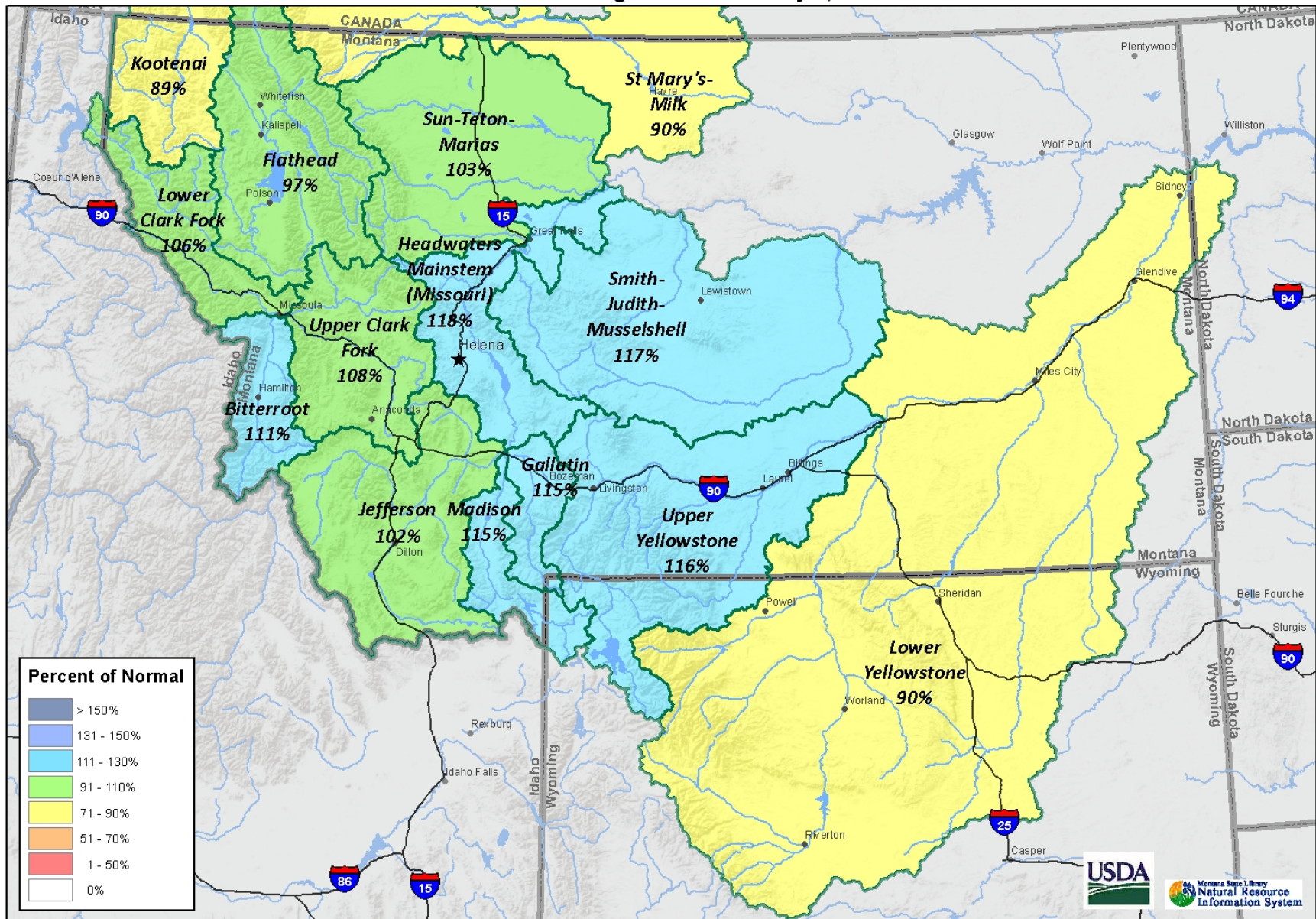
On May 1st snowpack has peaked for the year at all but the highest elevations in southwest and south-central Montana, so the amount of water available from the snowmelt component of runoff is known. In general, snowpack in many basins of the state peaked at near to slightly above normal levels this year, except in some northwest river basins where peak snowpack was below normal. Please consult the individual basins narratives to find out more information on snowpack peaks and levels for this date in individual basins of interest.

The main point is this; The stage is set. The snowpack is primed for melt on May 1st at all but the highest elevations, and only some regions look to experience below normal snowmelt runoff. What's unknown at this time is how the future weather will impact the timing of runoff in the coming months.

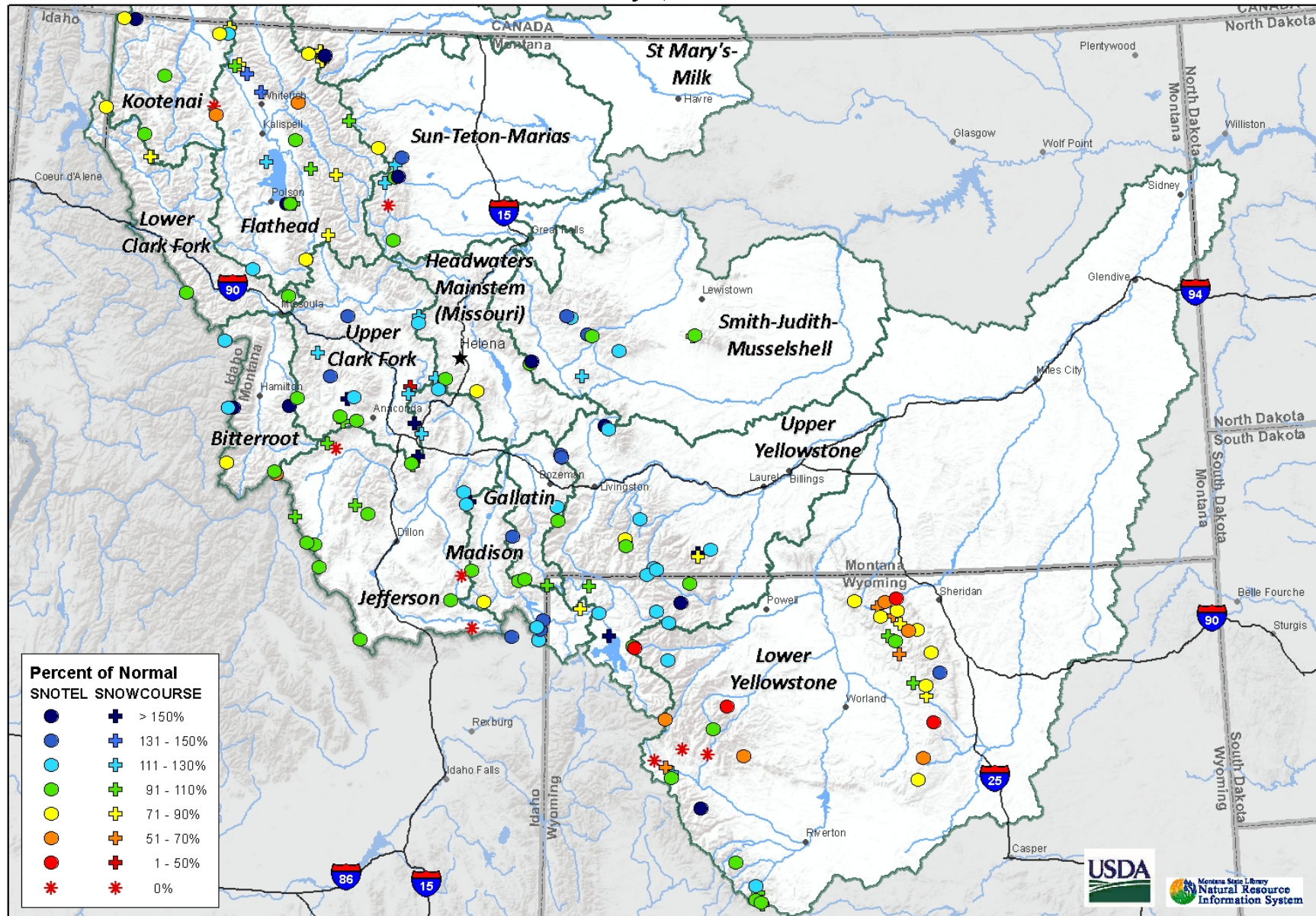
Snow Water Equivalent

5/1/2019	% Normal	% Last Year
Columbia River Basin	101	61
Kootnenai in Montana	89	60
Flathead in Montana	97	55
Upper Clark Fork	108	62
Bitterroot	111	67
Lower Clark Fork	106	70
Missouri River Basin	110	75
Jefferson	102	74
Madison	115	90
Gallatin	115	78
Headwaters Mainstem	118	65
Smith-Judith-Musselshell	117	84
Sun-Teton-Marias	103	53
St. Mary-Milk	90	60
Yellowstone River Basin	102	69
Upper Yellowstone	116	68
Lower Yellowstone	90	72
West of Divide	101	61
East of Divide	104	71
Montana State-Wide	106	67

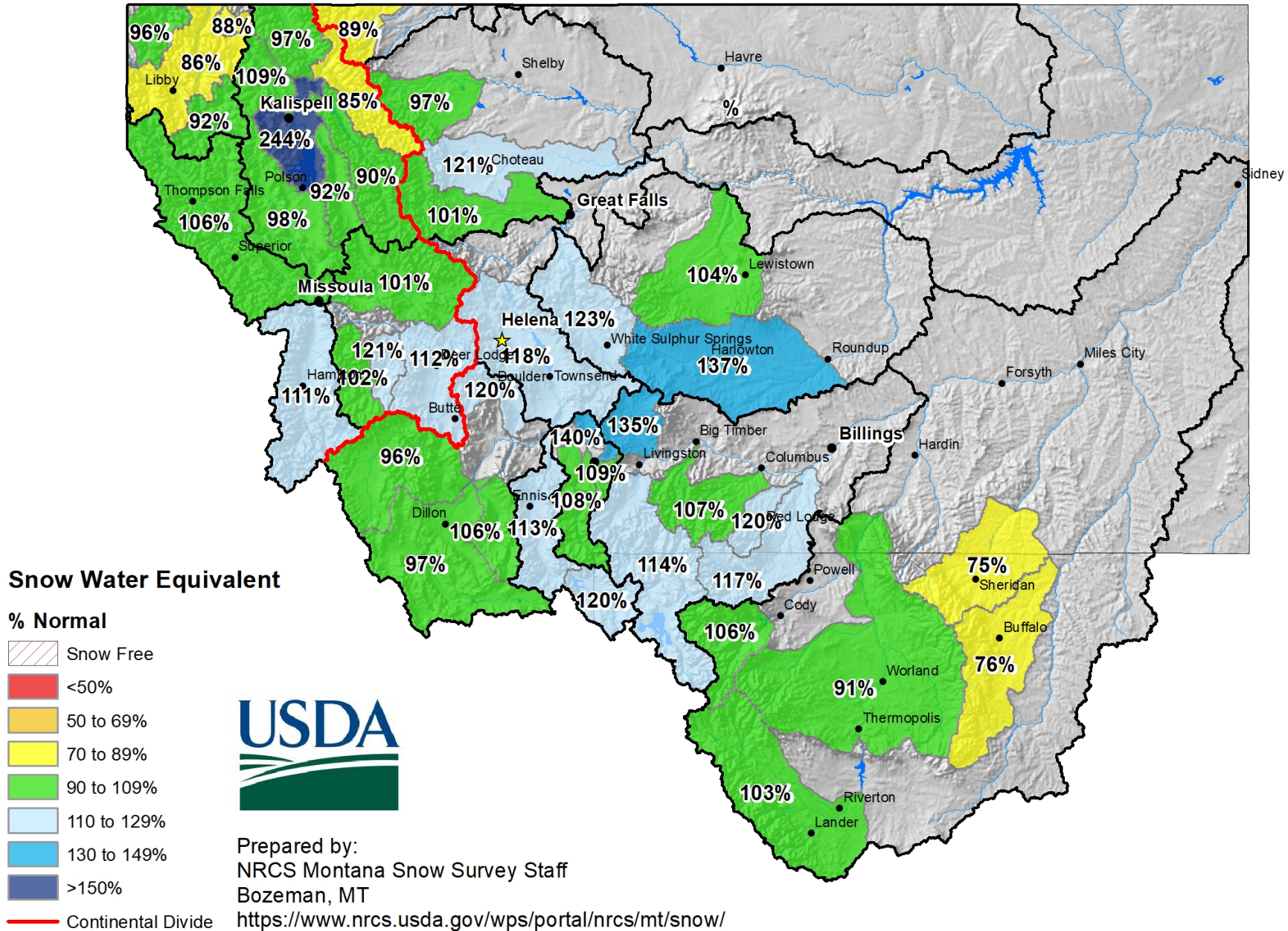
Montana Data Collection Office
Current Snow Water Equivalent
Basin Percentage of Normal - May 1, 2019



Montana Data Collection Office
Current Snow Water Equivalent
May 1, 2019



Montana Data Collection Office
Sub-Basin Snow Water Equivalent - May 1st, 2019



Precipitation - Overview

In yet another flip in weather patterns, which seems to be the pattern this winter; one month of dry weather followed by a month of wet weather, April delivered above average precipitation to many areas of the Treasure State. Coming off a record-dry month of March this was certainly a welcome change. Most of this precipitation fell during a two-week period during the middle of the month, when storms consistently passed through the state and added to the mountain snowpack at all but the lowest elevations where rain on snow amplified snowmelt.

Water Year precipitation, which begins on October 1st shows the areas in the state where early season precipitation and snowfall deficits still linger. Although both February and April yielded above average precipitation along the northern Canadian border, water year precipitation totals in the Sun-Teton-Marias, St. Mary, northern Flathead and Kootenai River basins remain below average for May 1st due to the lack of early season precipitation. Elsewhere in the state precipitation totals for May 1st improve from north to south in the state with totals for this date near average to above average in central and southern river basins.

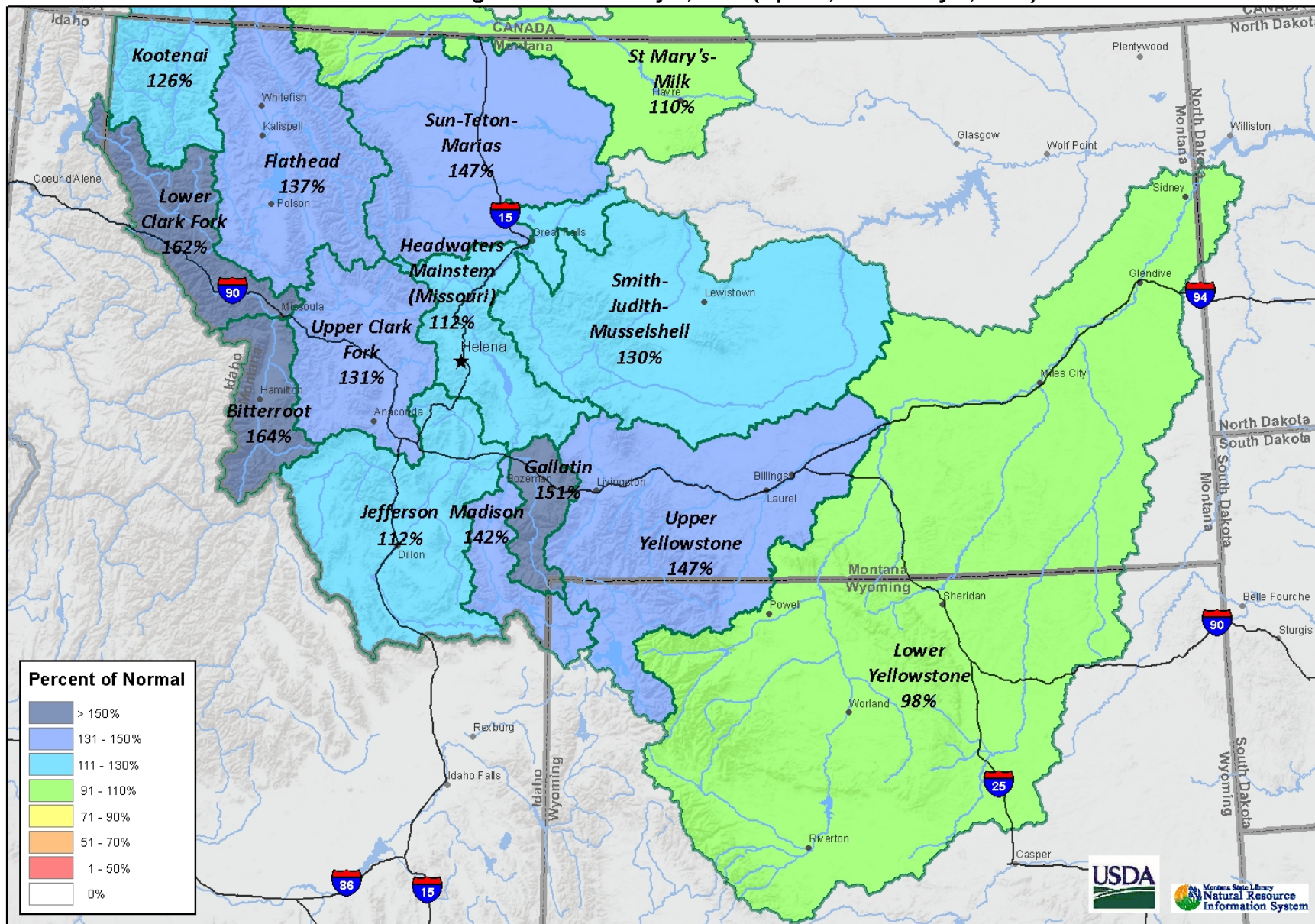
But what do water-year precipitation totals really mean with regards to mountain snowpack runoff? The Montana Snow Survey forecasts total volumes of water during a certain time periods, so on May 1st the forecasts are for the total amount of water that passes through a river during the May 1st – July 31st period. What is known on this date is the snowpack component and where it peaked for the year. What is unknown is how much spring precipitation we will receive to supplement this snowmelt water in the rivers and streams. If we look at averages for water-precipitation totals on July 31st, which is when one of the forecast periods ends, we get a better idea of why May 1st – July 31st precipitation is critical to our summer streamflows. West of the Divide, precipitation is frontloaded during the Oct – March period, but May 1st – July 31st precipitation still accounts for 19% to 23% of the water year total on July 31st. East of the Divide, where spring and early summer precipitation plays a critical role in seasonal runoff, May 1st – July 31st precipitation accounts for 28% to 36% of the water year total on July 31st. What this means is 1/5 to 1/3 of the precipitation that helps to drive streamflow is yet to come. Snow is only one component to the runoff, and an important one, but a close eye will be kept what happens in the next two months as they will fill in the details of what spring and summer precipitation contributes to our runoff.

Precipitation

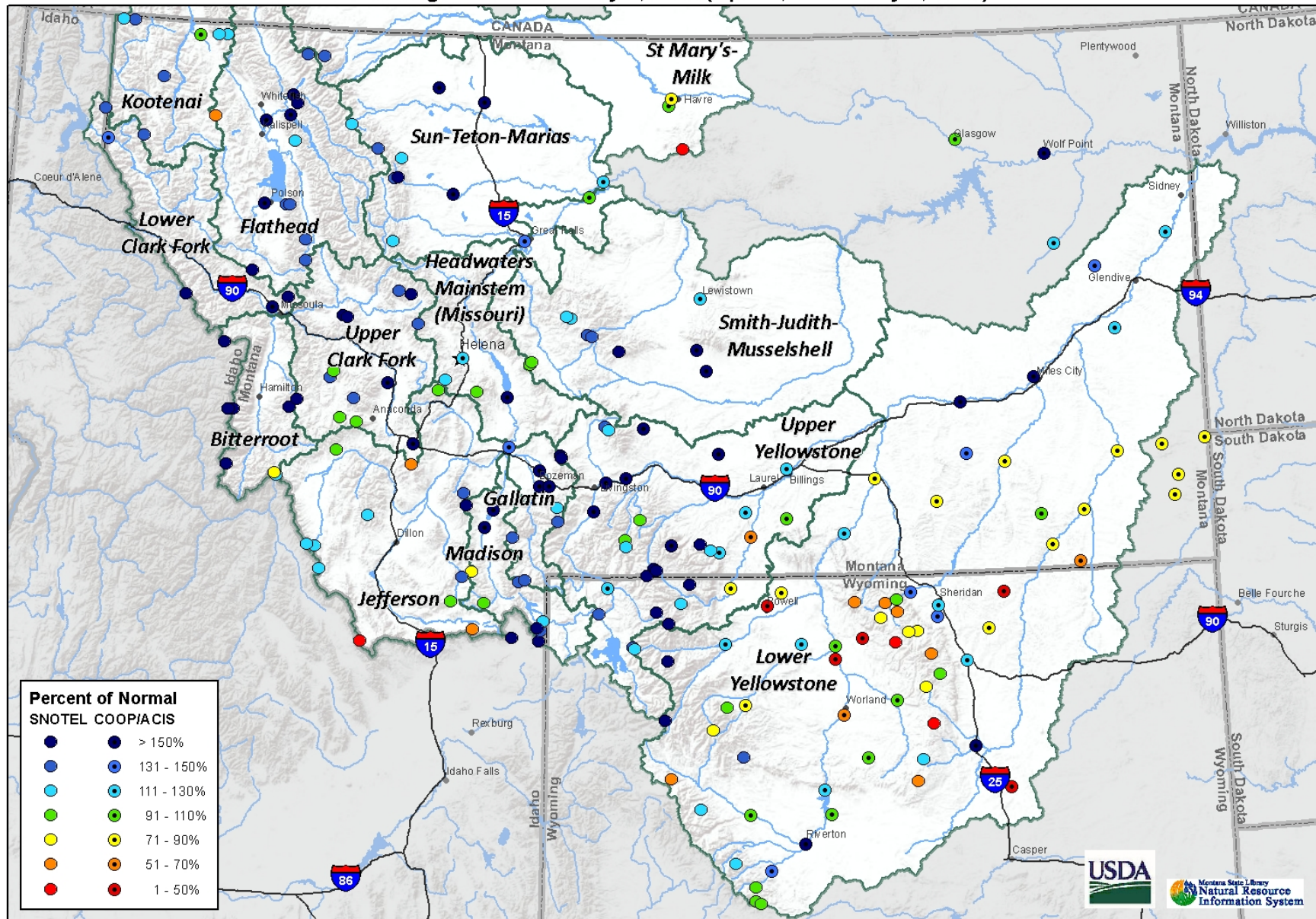
5/1/2019	Monthly % Avg	Water Year % Avg	WY % Last Year
Columbia River Basin	140	93	74
Kootenai in Montana	126	80	68
Flathead in Montana	137	91	70
Upper Clark Fork	131	100	76
Bitterroot	164	103	84
Lower Clark Fork	162	93	79
Missouri River Basin	130	111	93
Jefferson	112	104	91
Madison	142	115	99
Gallatin	151	121	93
Headwaters Mainstem	112	112	84
Smith-Judith-Musselshell	130	108	93
Sun-Teton-Marias	147	94	71
St. Mary-Milk	110	89	71
Yellowstone River Basin	117	102	84
Upper Yellowstone	147	113	81
Lower Yellowstone	98	93	85

West of Divide	140	93	74
East of Divide	123	104	86
Montana State-Wide	136	103	82

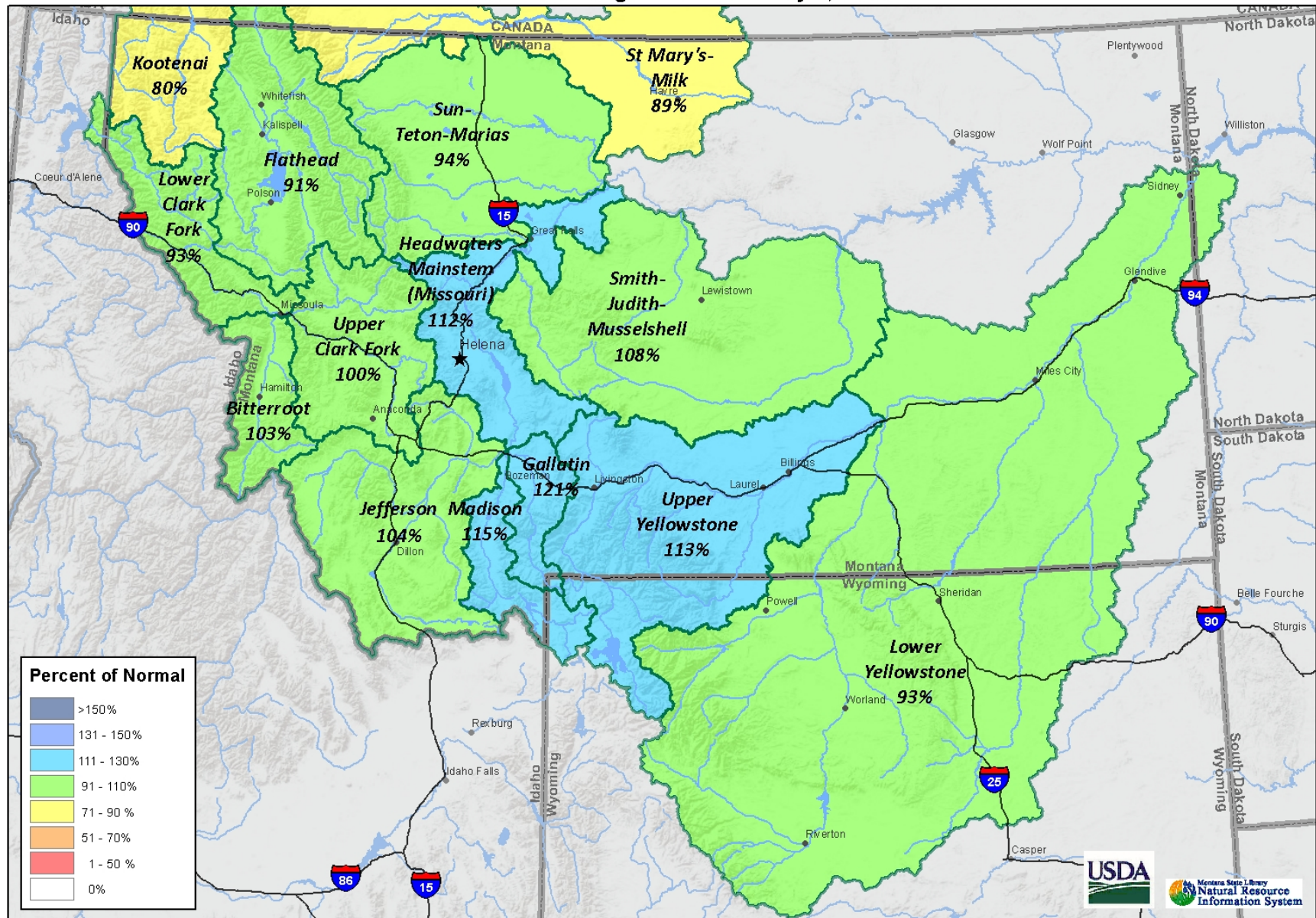
Montana Data Collection Office
Monthly Precipitation
Basin Percentage of Normal - May 1, 2019 (April 1, 2019 - May 1, 2019)



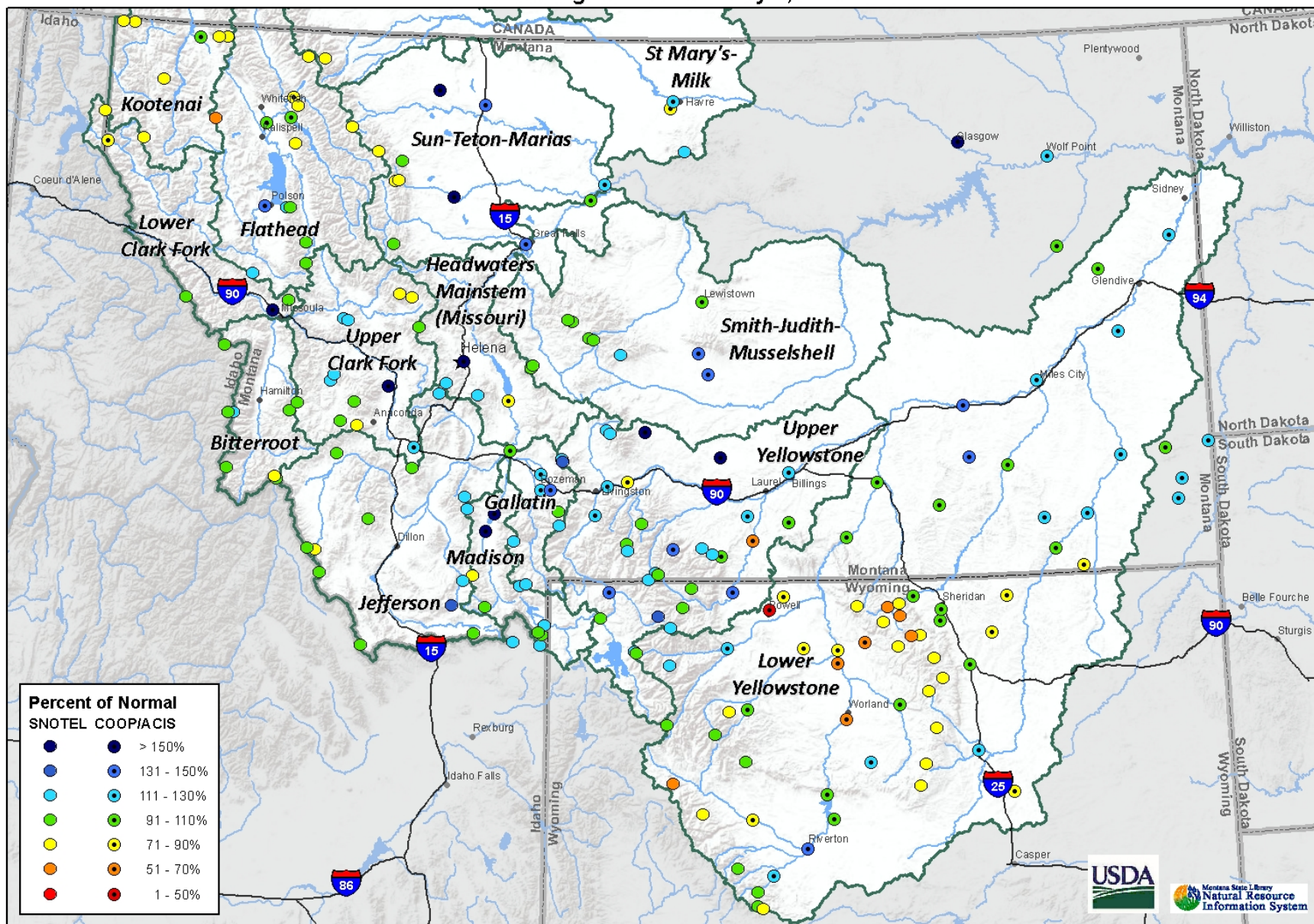
Montana Data Collection Office
 Monthly Precipitation
 Percentage of Normal - May 1, 2019 (April 1, 2019 - May 1, 2019)



Montana Data Collection Office
Water Year to Date Precipitation
Basin Percentage of Normal - May 1, 2019



Montana Data Collection Office
Water Year to Date Precipitation
Percentage of Normal - May 1, 2019



Reservoirs - Overview

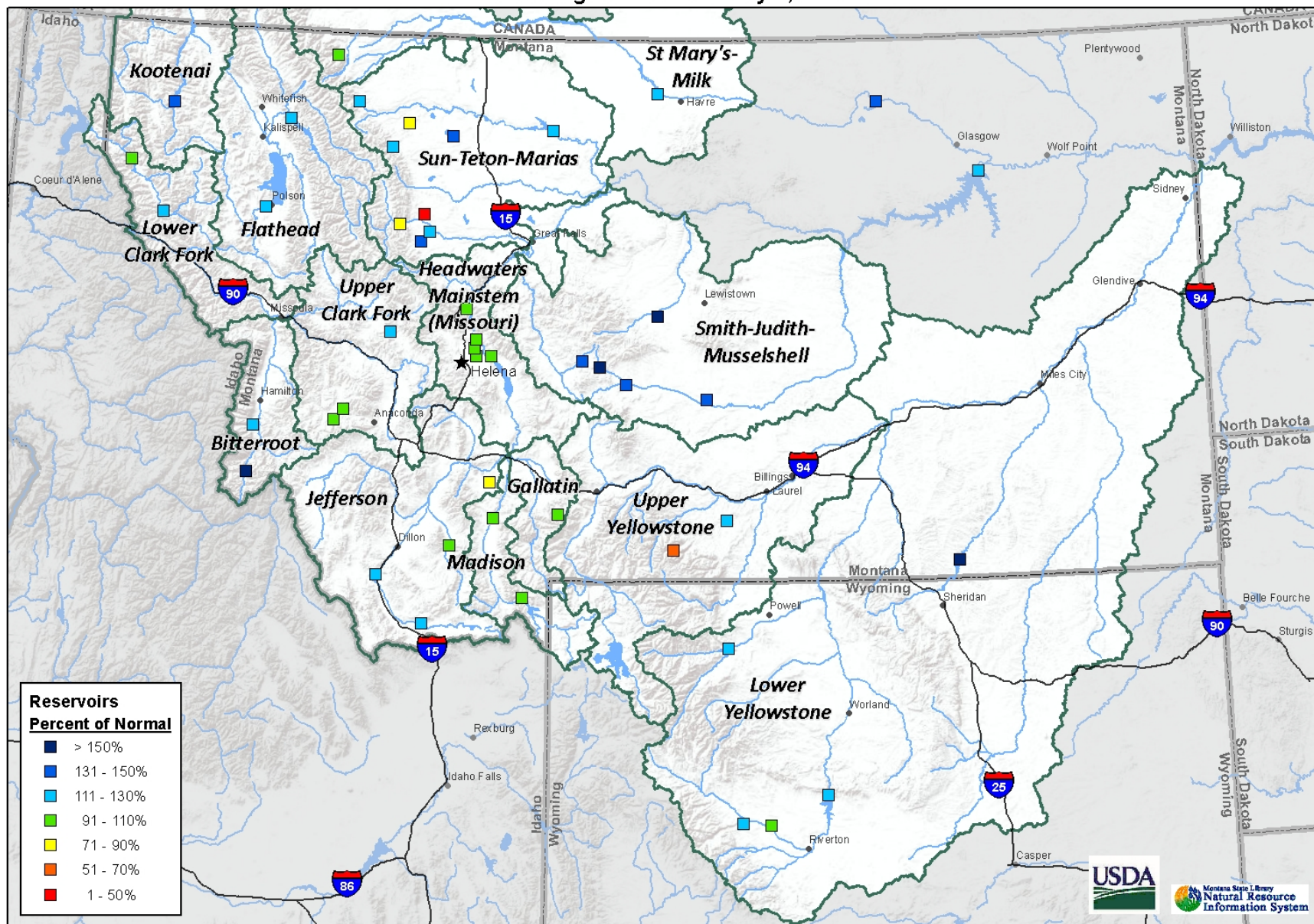
It's been mentioned throughout this winter that carryover storage in many reservoirs has been above average in many locations due to last year's abundant runoff from the well above normal to record-setting snowpack. As such, carryover storage will help to insulate basins where snowpack totals are below normal for this date and most reservoirs in the state look to fill this summer from the amount of snowpack that we have at this time. What remains to be seen is the timing of when that water will enter and fill the reservoirs. The magic ingredients of sunshine, overnight temperatures above freezing at mountain locations, increasing daily average temperatures, and future rain events will soon be added to the mix and will drive fill-rates in the reservoirs this summer.

Reservoir Storage

5/1/2019	% Average	% Capacity	% Last Year
Columbia River Basin	130	70	141
Kootenai in Montana	141	64	158
Flathead in Montana	125	75	133
Upper Clark Fork	105	84	101
Bitterroot	134	82	133
Lower Clark Fork	97	89	90
Missouri River Basin	121	84	102
Jefferson	120	74	98
Madison	102	75	102
Gallatin	104	63	108
Headwaters Mainstem	125	87	101
Smith-Judith-Musselshell	142	93	108
Sun-Teton-Marias	110	61	102
St. Mary-Milk	118	62	97
Yellowstone River Basin	105	59	108
Upper Yellowstone	113	53	108
Lower Yellowstone	105	59	108

West of Divide	130	70	141
East of Divide	121	82	103
<i>Montana State-Wide</i>	123	78	111

Montana Data Collection Office
Reservoir Levels
Percentage of Normal - May 1, 2019



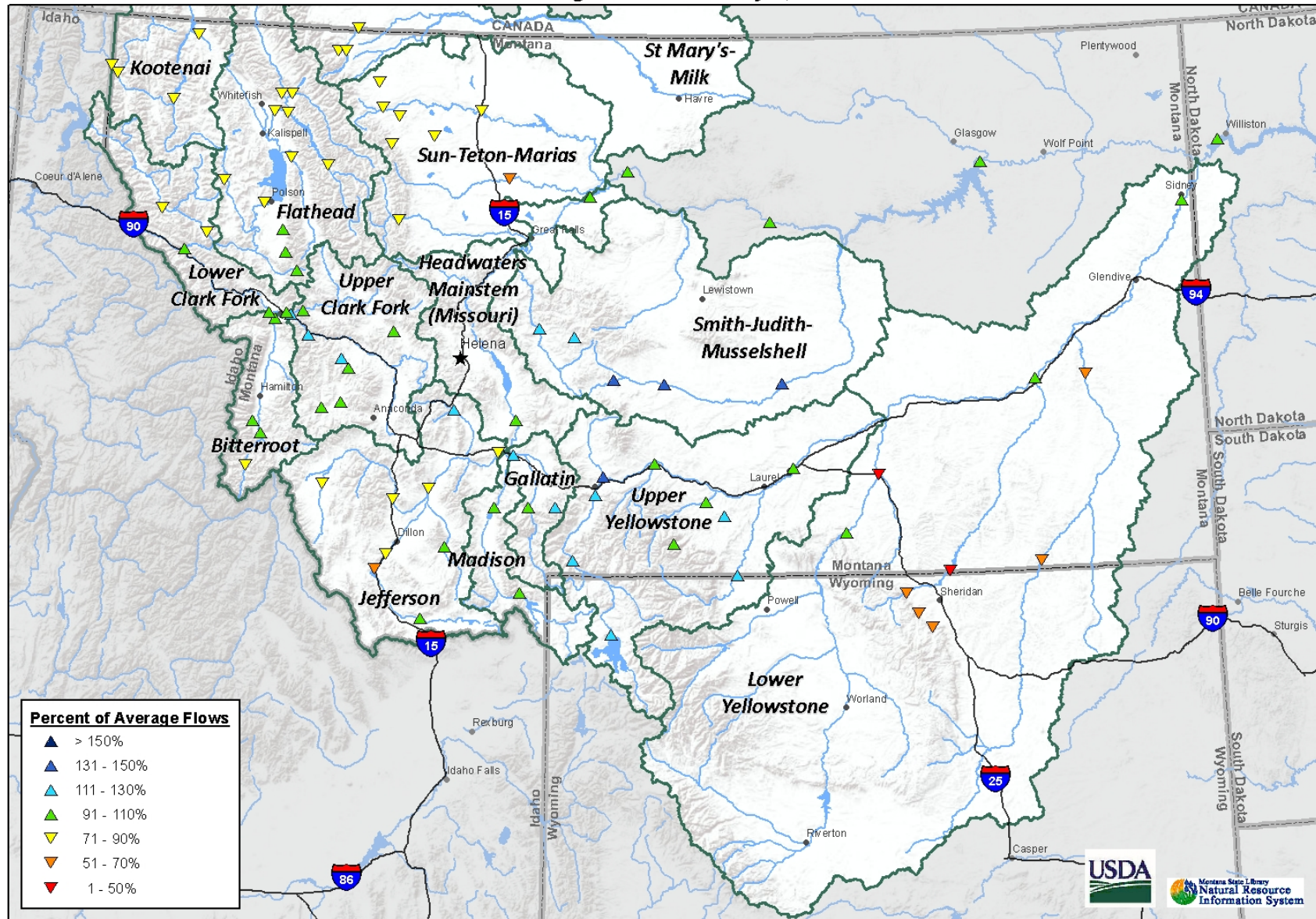
Streamflow Forecasts - Overview

As the snowpack in the valleys and plains across the state began to melt during the latter half of March, streamflows began their seasonal rise from snowmelt runoff. The timing of the valley melt out also coincided with the transition of the low elevations in the mountains to melt, which was then followed by discharge from mid-elevation snowpack during the middle of the month. Many rivers and streams were running well above average throughout April, with some rivers reaching minor flood stages. The mountain snowpack wasn't anomalously high in many regions, but the valley and low elevation snowpack remaining from the bitterly cold February and March was. This was the culprit for the high early season flows this year.

All but the highest elevations are primed for discharge on May 1st, so the seasonal runoff of the snowpack is lined up and ready to go. Streamflow forecasts issued on May 1st vary widely across the state, and within the river basins themselves. Forecasts in the Kootenai and Flathead River basins are the lowest in the state, and seasonal river volumes are anticipated to be below average during the spring and summer. The northern basins have made some improvement over the last month, but fall and winter precipitation deficits lingered before runoff began. Elsewhere in the state, forecasts are near to above average for the May 1st – July 31st period. Great news on May 1st for many water users in the state. Due to the variability this year, water users are encouraged to consult the individual river basin narratives for more detailed information on your area of interest and forecasts for specific rivers and streams.

Seasonal runoff in Montana has many components, and snowpack is only one of them. Our mountain snowpack "reservoir" typically provides a slow release of the water contained within it to the soils, groundwater, and streams in the state. Another important component to our runoff is spring and summer precipitation, which in some basins accounts for a significant amount of water that is added to the hydrologic system. The snowpack component of runoff is relatively known, but uncertainty around future weather and just how much precipitation we will receive is why forecasts are issued for a range of probabilities. Above average temperatures and abundant sunshine weather could move the water more quickly through the system, and cold and wet weather could prolong melt and add more water before snowmelt runoff is done. When looking at forecasts, consider that there are multiple outcomes from this point in time and that future weather will dictate the total amount of water in the rivers this year.

Montana Data Collection Office
Streamflow Forecast
Percentage of Normal - May 1, 2019



Kootenai River Basin



Peak Snow Water Equivalent (SWE), or maximum amount of water contained in the snowpack this year was well below normal at many SNOTEL sites within the Kootenai River basin. High-elevation sites within the basin were the most disappointing this year and experienced seasonal peaks which were well below normal, while two mid-elevation sites were able to come close to their normal peak. The lack of precipitation (both rain and snow) during critical months early in the water year has resulted in basin-wide water year-to-date precipitation totals which are well below average for May 1st. Because of the below normal snowpack and below average water year precipitation in the mountains within Montana that feed tributaries of the Kootenai, forecasts on smaller rivers and streams indicate below average streamflows during the May 1st – July 31st period. Well below normal snowpack and precipitation in the mountains of British Columbia this year have also resulted in mainstem Kootenai forecasts that are well below average.

Kootenai River Basin Data Summary

Snowpack

	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
KOOTENAY in CANADA	72%	136%
KOOTENAI MAINSTEM	86%	136%
TOBACCO	88%	161%
FISHER	92%	149%
YAAK	96%	159%
KOOTENAI RIVER BASIN in MONTANA	86%	136%
KOOTENAI ab BONNERS FERRY	89%	152%
Basin-Wide Snowpack	89%	148%

Precipitation

	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	127%	80%	118%
Valley Precipitation	101%	102%	151%
Basin-Wide Precipitation	126%	80%	118%

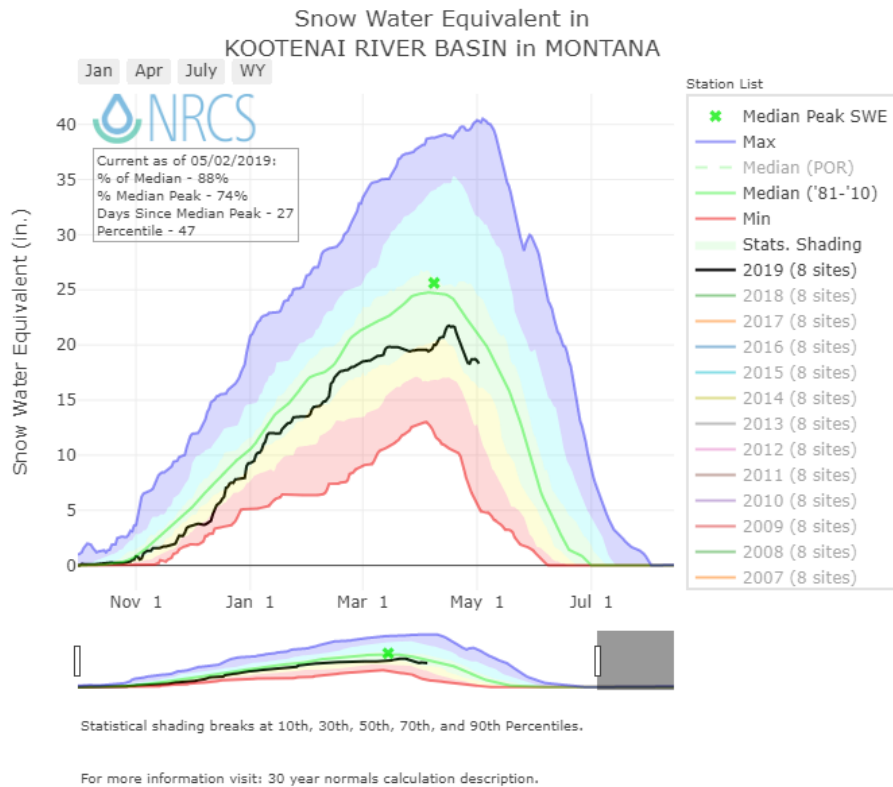
*WYTD Precipitation is October 1st- Current

Reservoir Storage

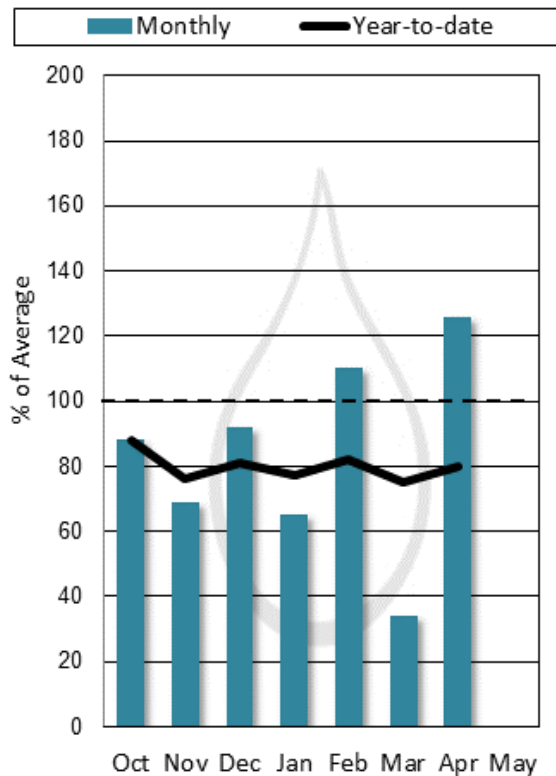
	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Reservoir Storage	141%	64%	89%

*See Reservoir Storage Table for storage in individual reservoirs

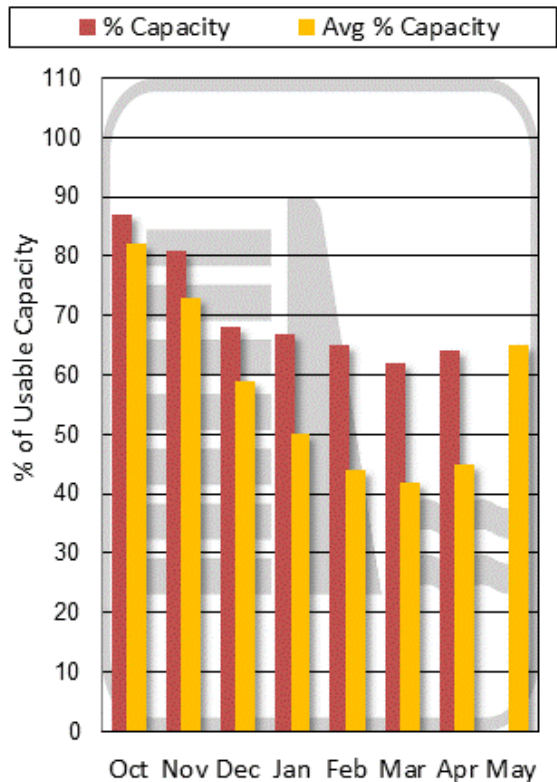
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Mountain and Valley Precipitation



End of Month Reservoir Storage

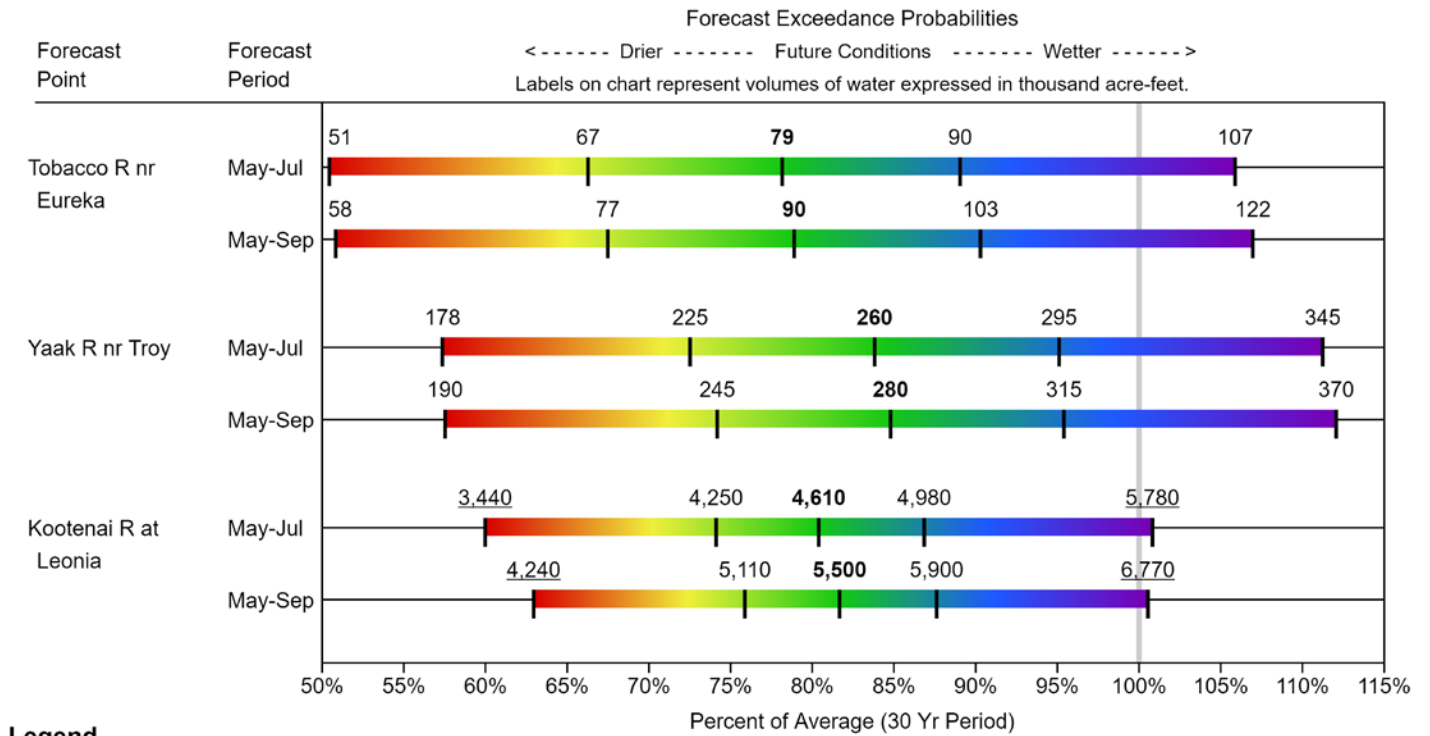


Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

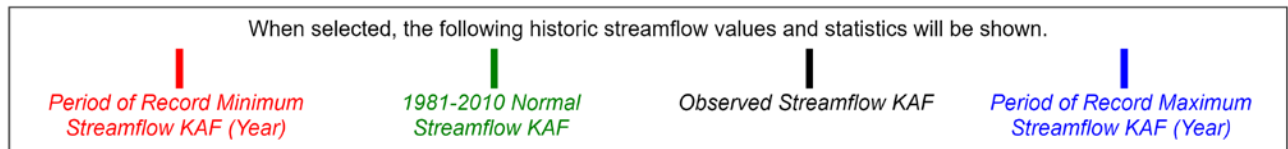
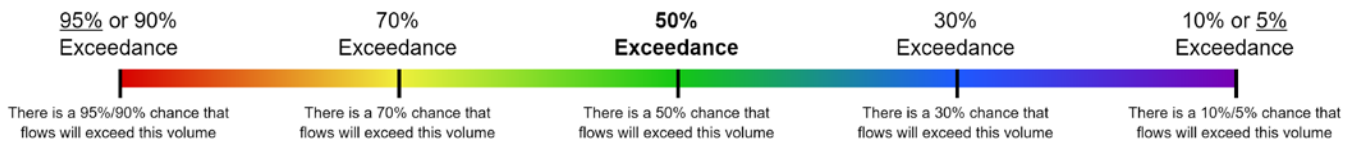
KOOTENAI RIVER BASIN in MONTANA

Water Supply Forecasts

May 1, 2019

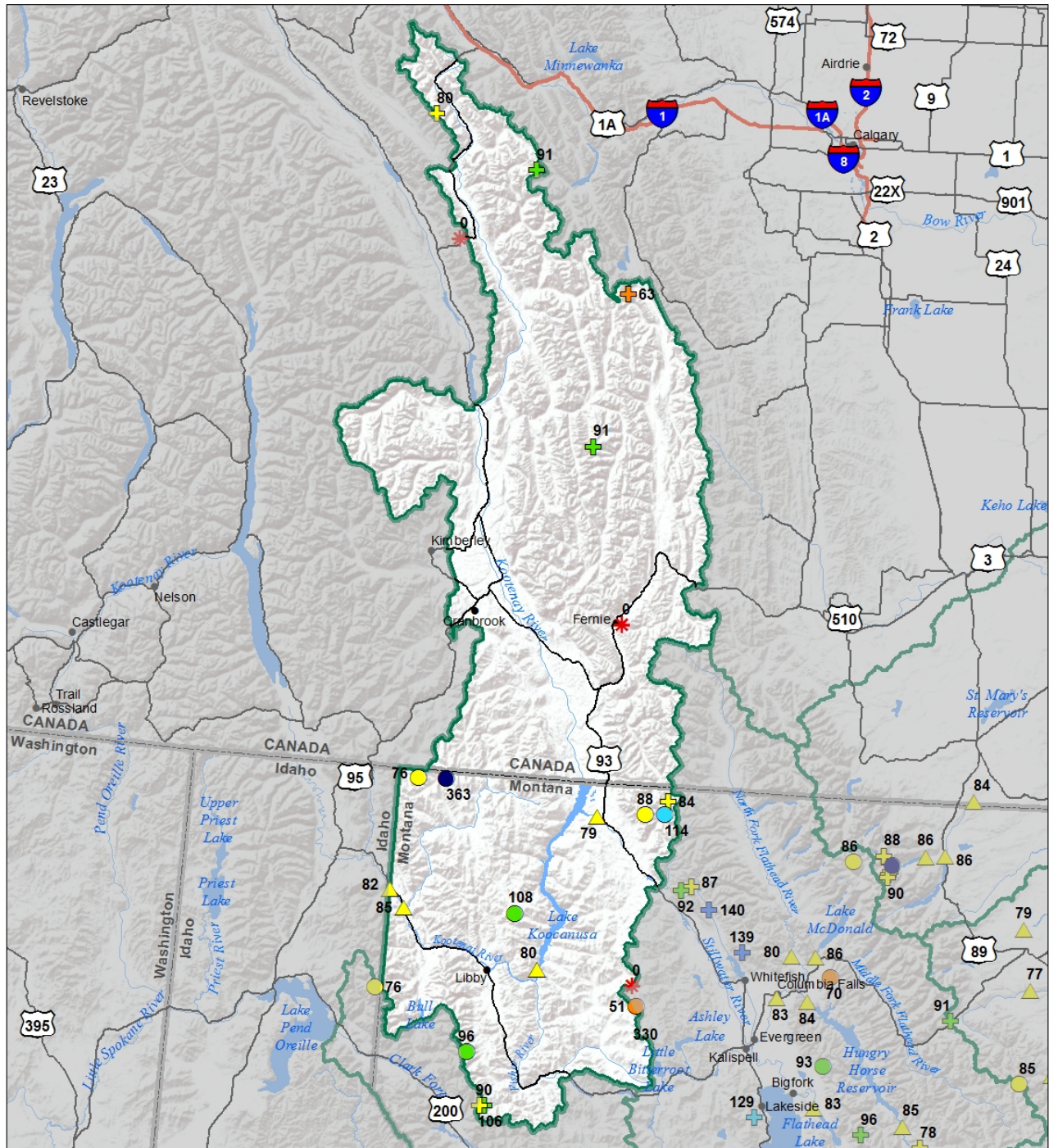


Legend



Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

Kootenai River Basin Streamflow Forecast, Snow Water Equivalent Percentage of Normal May 1, 2019



Snow Water Equivalent Percent of Normal

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%
- 0%

Snowcourse

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%
- 0%

Streamflow Forecast Percent of Average Flows

- ▲ > 150%
- ▲ 131 - 150%
- ▲ 111 - 130%
- ▲ 91 - 110%
- ▲ 71 - 90%
- ▲ 51 - 70%
- ▲ 1 - 50%

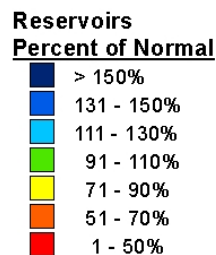
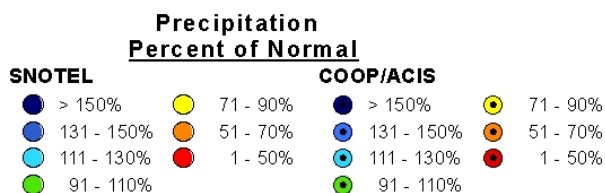
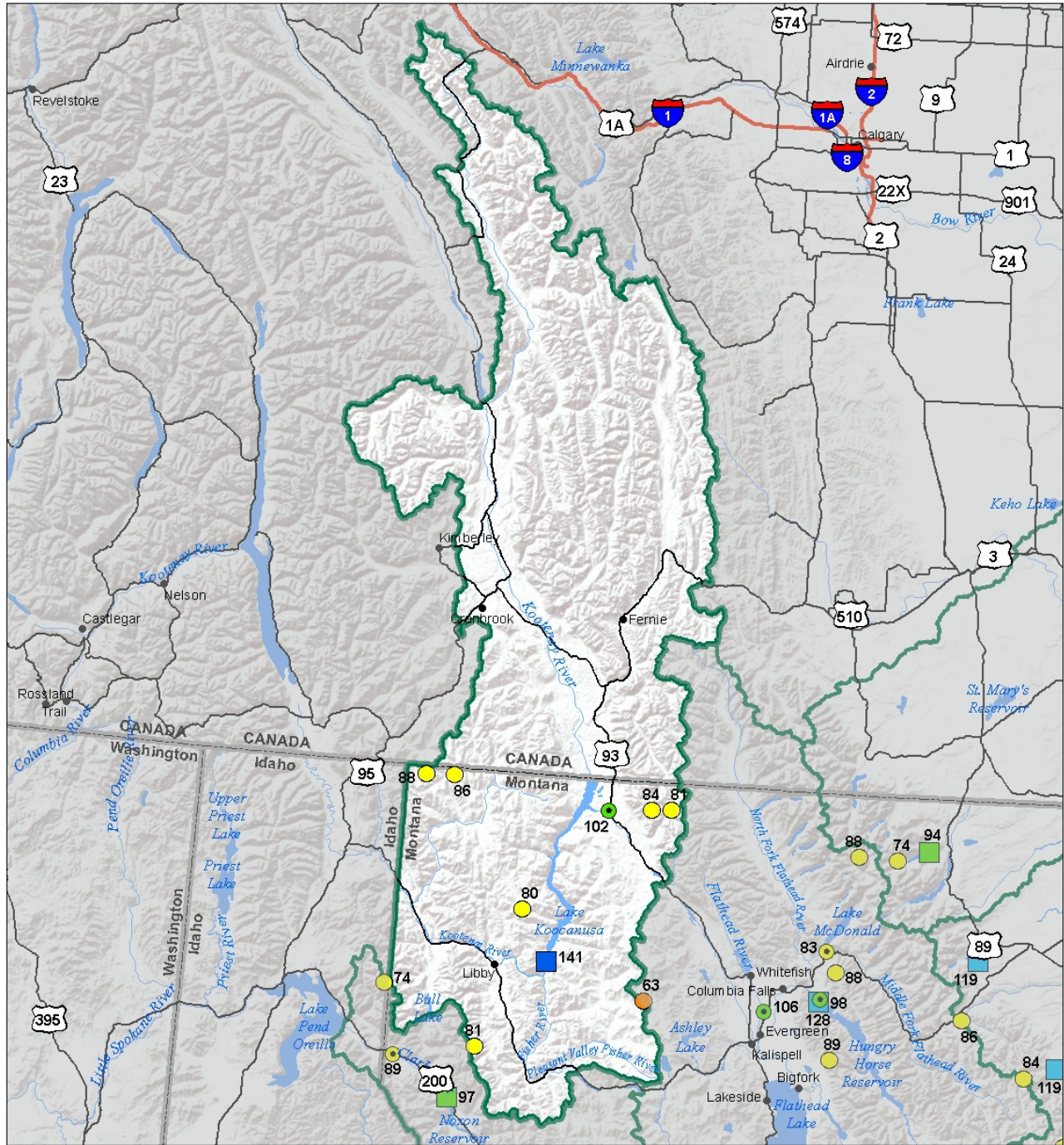


Kootenai River Basin

Water Year to Date Precipitation and Reservoir Levels

Percentage of Normal

May 1, 2019

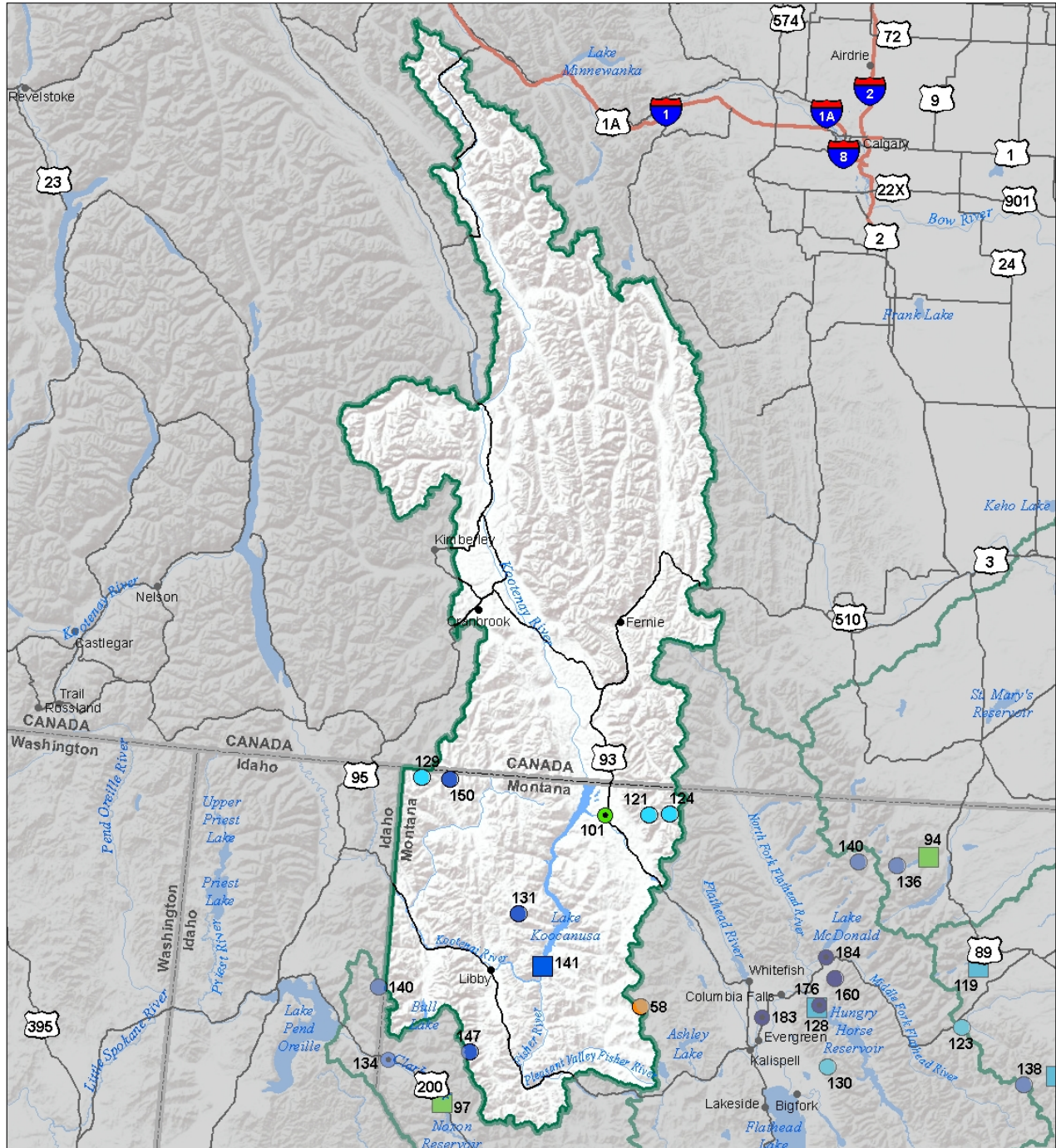


Kootenai River Basin

Monthly Precipitation and Reservoir Levels

Percentage of Normal

May 1, 2019 (April 1, 2019 - May 1, 2019)



Precipitation Percent of Normal

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

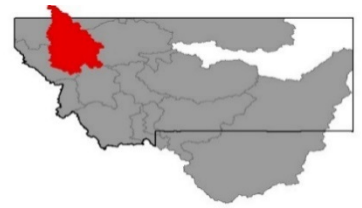
COOP/ACIS

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

Reservoirs Percent of Normal

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%





Flathead River Basin

Let's start with the good news. April was an excellent month for precipitation within the Flathead River basin with all mountain locations reporting above average to well above average precipitation for the month. This helped to put a dent in the early season deficits, but unfortunately, it wasn't enough to help snowpack climb back to normal before this year's annual snowpack peak. Now here's the bad news. As of May 1st, there is a strong gradient north to south gradient within the Flathead River basin for snowpack totals, a pattern which has defined this winter season. Mountain ranges to the north experienced snowpack peaks which were below normal this year, but snowpack conditions, fortunately, improve as you move south in the basin (aside from a few areas in the Jocko Valley). This trend also plays out in the water year precipitation within the basin, with northern regions reporting 88-90% of the average precipitation for May 1st, while southern regions are reporting 95-120% of average precipitation.

Streamflows forecasts issued for May 1st vary widely within the basin, but in general, are indicating below average volumes for the May 1st – July 31st period. The outlook isn't dire within the basin, while forecasts are below average they are far from a record low. However, water users within the basin should anticipate below average streamflows this year unless spring and summer wind up being anomalously wet.

Flathead River Basin Data Summary

Snowpack	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
NF FLATHEAD in CANADA	%	%
NF FLATHEAD in MONTANA	97%	157%
MIDDLE FORK FLATHEAD	85%	156%
SOUTH FORK FLATHEAD	90%	178%
STILLWATER-WHITEFISH	109%	199%
SWAN	92%	161%
MISSION VALLEY	109%	158%
LITTLE BITTERROOT-ASHLEY	244%	414%
JOCKO	98%	159%
FLATHEAD in MONTANA	97%	175%
Basin-Wide Snowpack	97%	175%

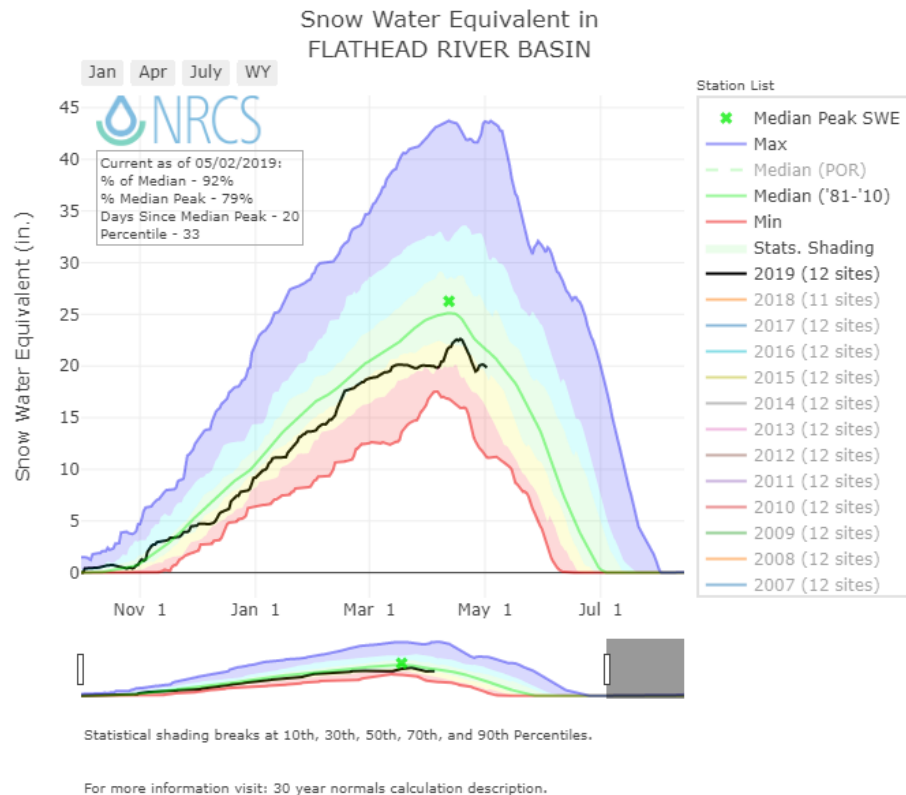
Precipitation	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	136%	91%	130%
Valley Precipitation	183%	106%	120%
Basin-Wide Precipitation	137%	91%	130%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

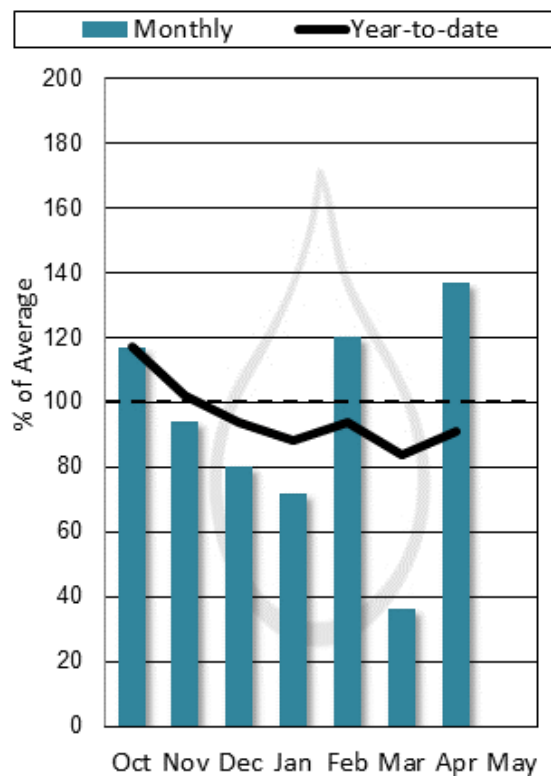
Reservoir Storage	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Reservoir Storage	125%	75%	94%

*See Reservoir Storage Table for storage in individual reservoirs

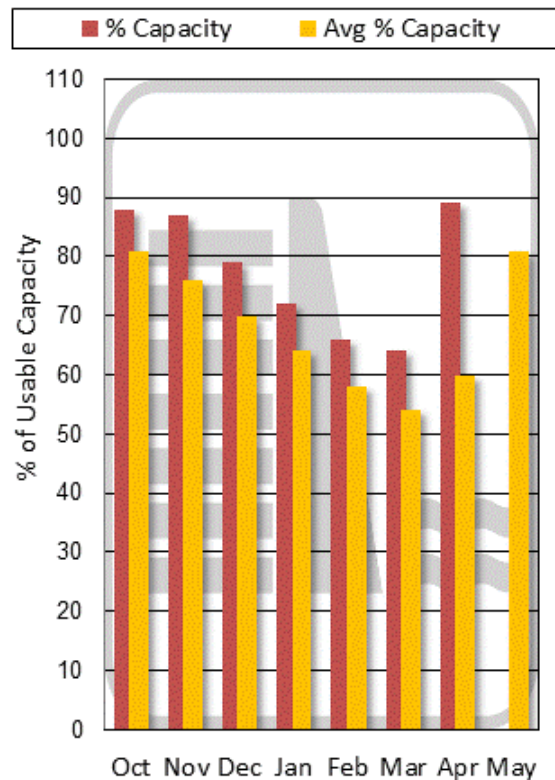
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation

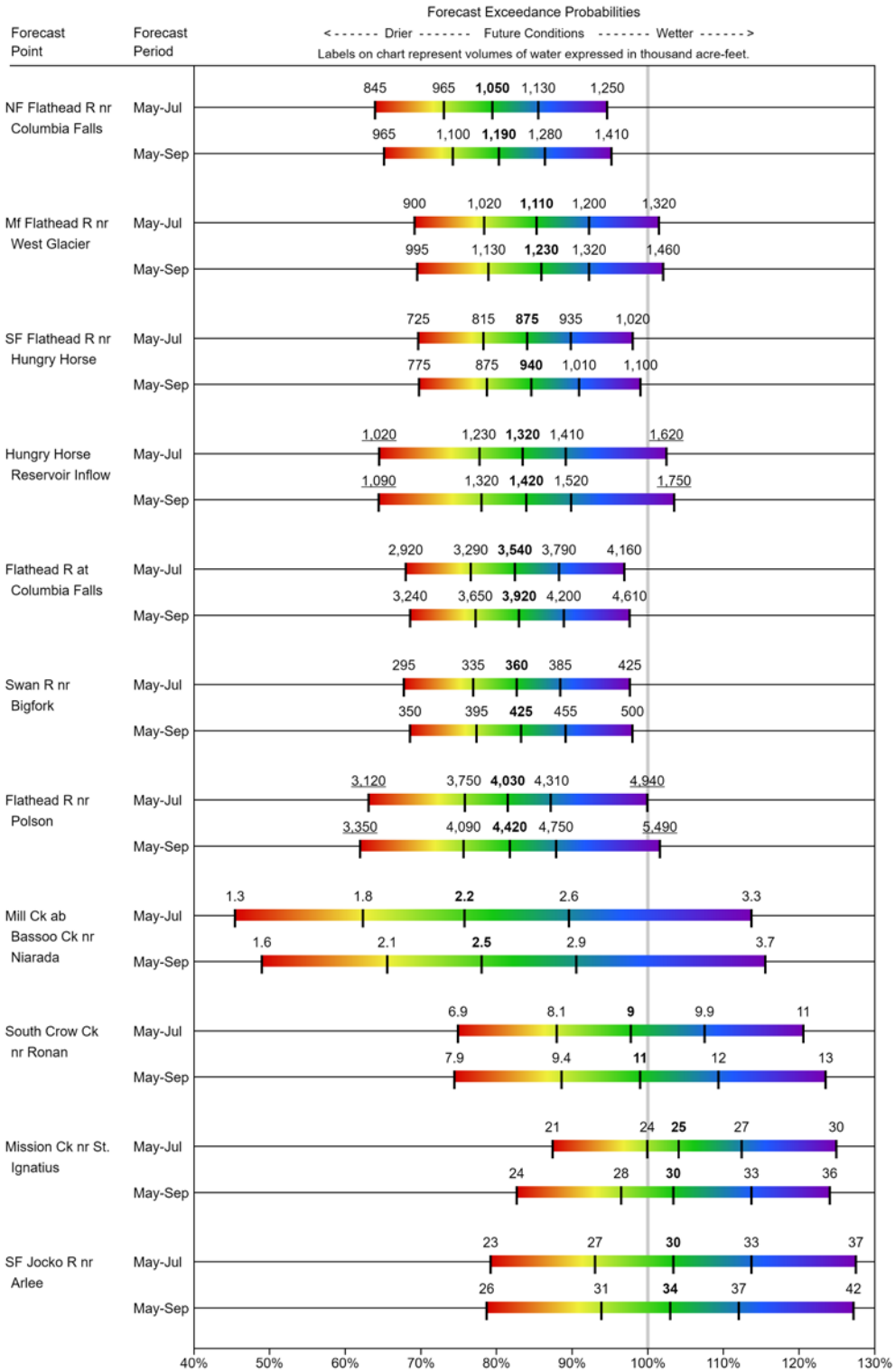


End of Month Reservoir Storage

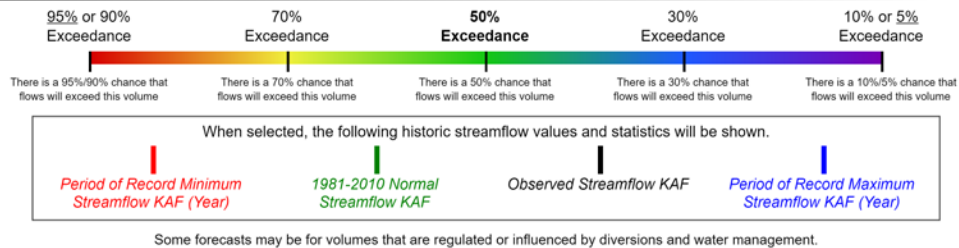


Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

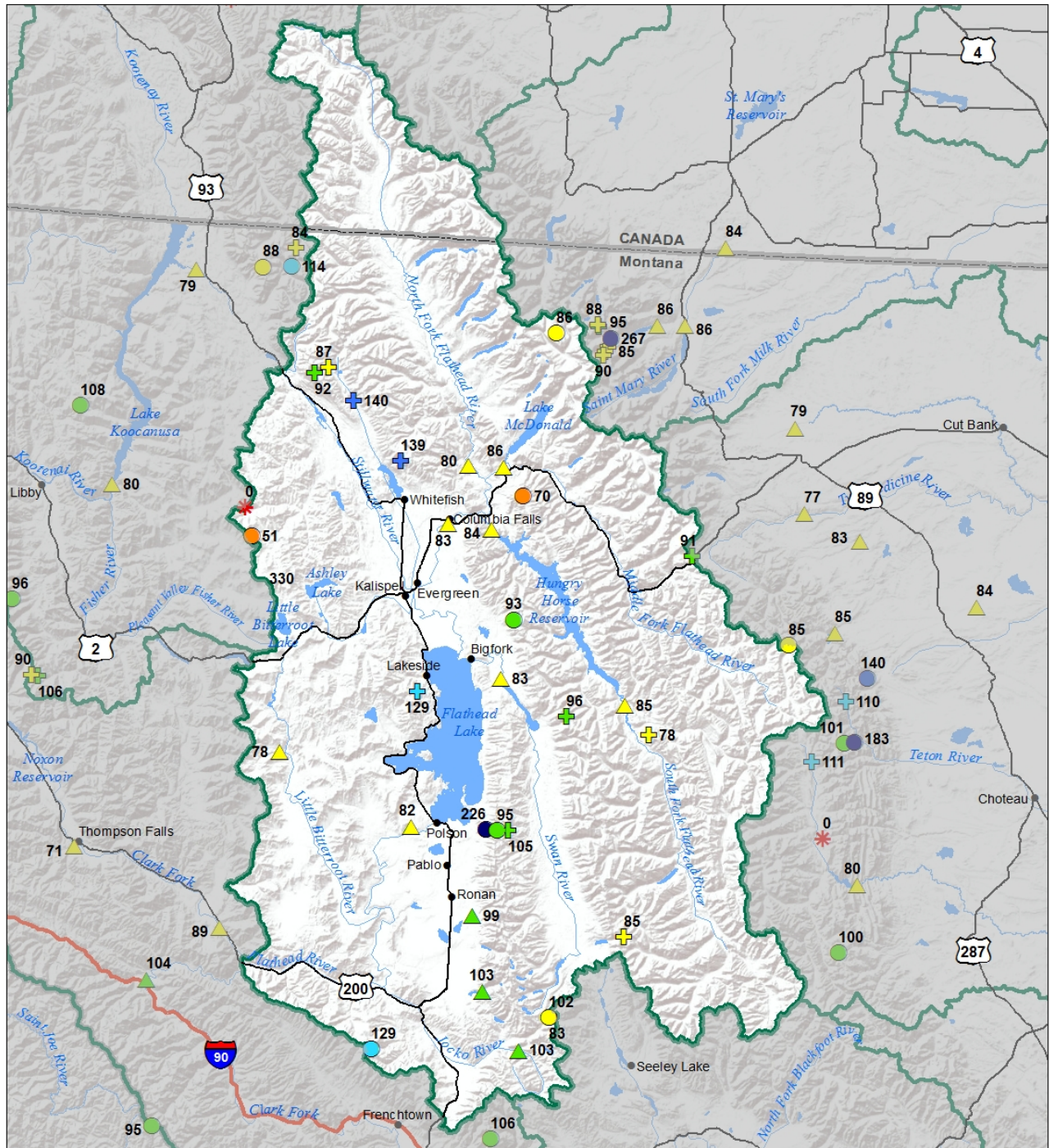
FLATHEAD RIVER BASIN
Water Supply Forecasts
May 1, 2019



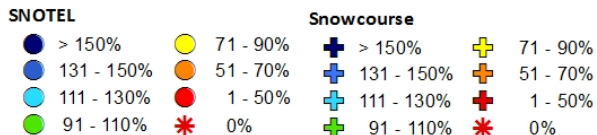
Legend



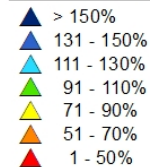
Flathead River Basin Streamflow Forecast, Snow Water Equivalent Percentage of Normal May 1, 2019



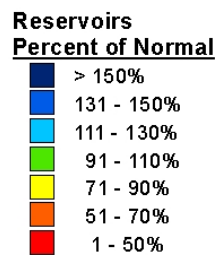
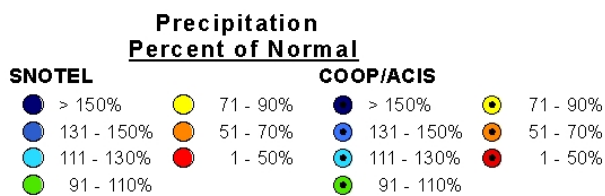
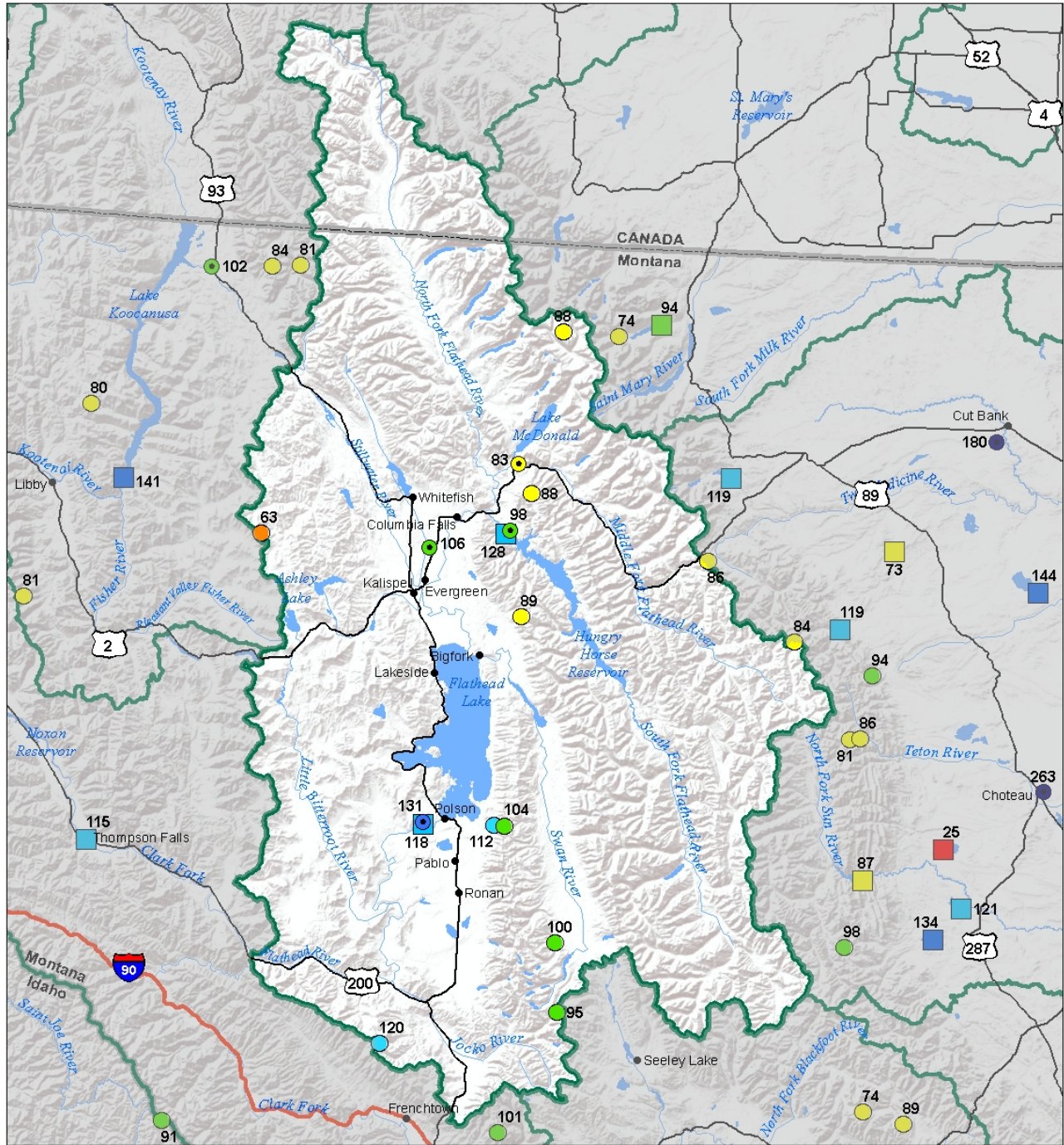
Snow Water Equivalent Percent of Normal



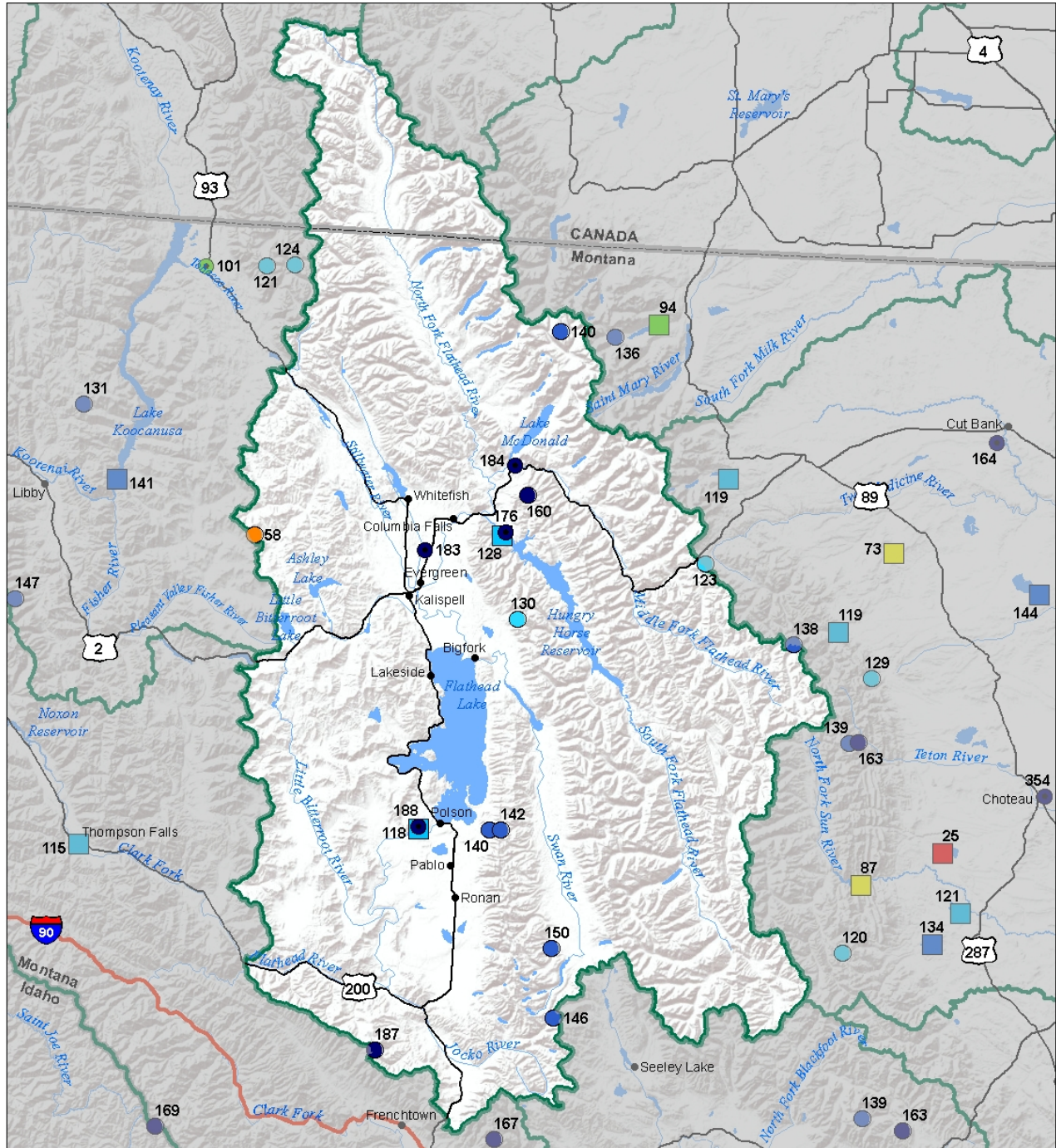
Streamflow Forecast Percent of Average Flows



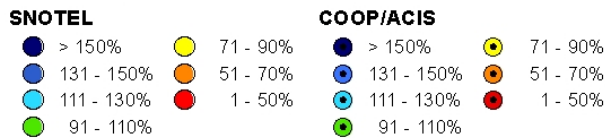
Flathead River Basin
Water Year to Date Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019



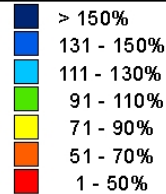
Flathead River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



Precipitation
Percent of Normal



Reservoirs
Percent of Normal



Upper Clark Fork River Basin



After typing the word record over and over last year when describing snowpack, precipitation, and streamflow prospects for the Upper Clark Fork River basin, it feels great to use this word to describe this year's peak snowpack. Normal. While some areas within the lower Flint Creek drainage peaked well above average, most areas experienced seasonal peaks that were near normal or only slightly above normal. April brought a significant change from the dry March weather patterns, and this was a benefit to some areas of the basin where snowpack was lacking on April 1st. SNOTEL sites within the Blackfoot River basin that were below normal at the beginning of the month experienced an improvement due to the abundant precipitation which improved snowpack totals to near normal peak before the latter half of the month.

Streamflows forecasts within the basin for the May 1st – July 31st period vary widely but range from near average to slightly above average. Water users are encouraged to look at the forecast graphic for individual points of interest. Low elevations have been actively melting since mid to late March, and mid-elevations made the transition in mid to late April. The warm weather at the end of April primed upper elevations for melt once weather patterns change and temperatures moderate in May. The spring runoff is upon us.

Upper Clark Fork River Basin Data Summary

Snowpack	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
CLARK FORK ab FLINT CREEK	111%	172%
FLINT CREEK	121%	171%
ROCK CREEK	102%	154%
CLARK FORK ab BLACKFOOT	112%	168%
BLACKFOOT	101%	187%
Basin-Wide Snowpack	108%	173%

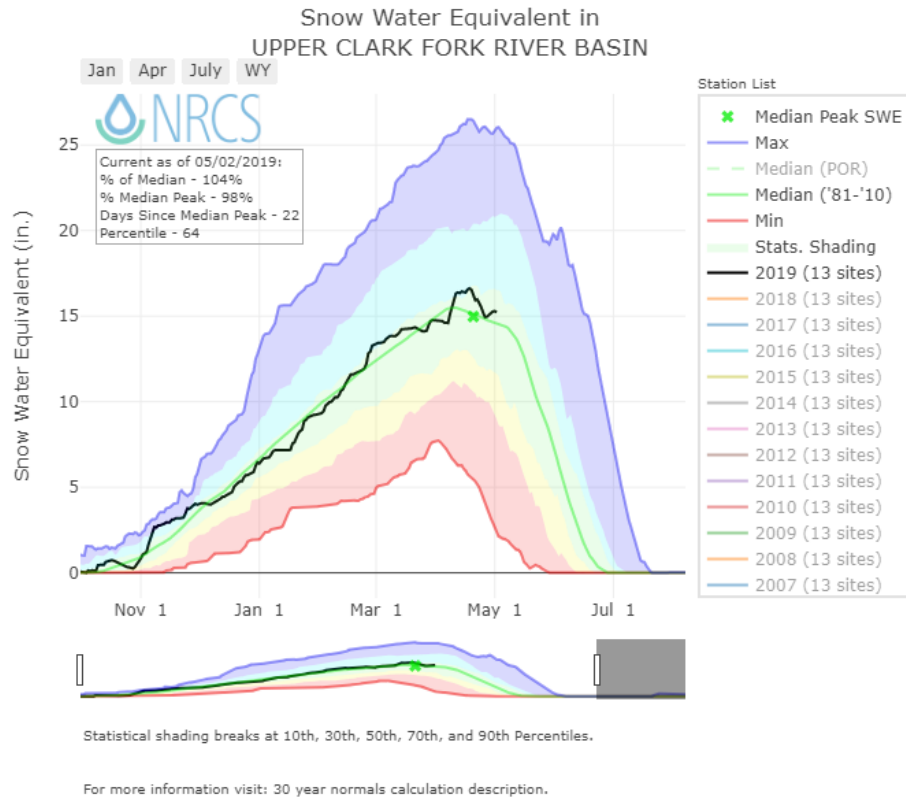
Precipitation	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	130%	100%	131%
Valley Precipitation	155%	113%	106%
Basin-Wide Precipitation	131%	100%	131%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

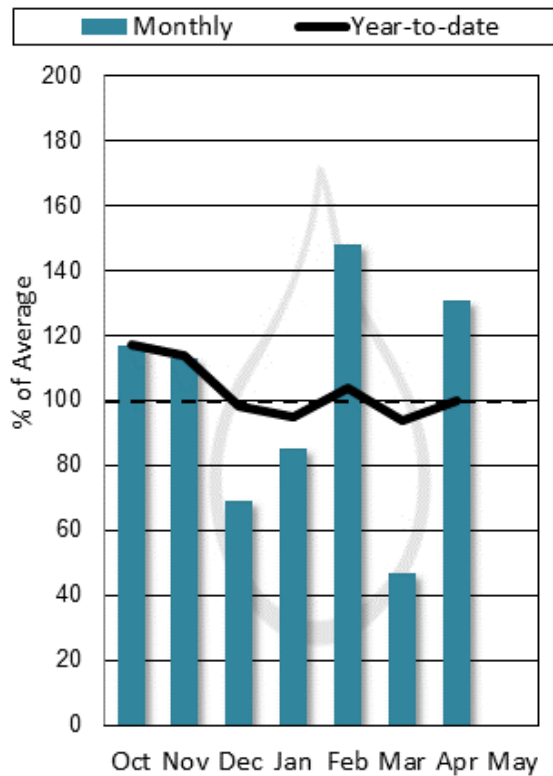
Reservoir Storage	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	105%	84%	104%

*See Reservoir Storage Table for storage in individual reservoirs

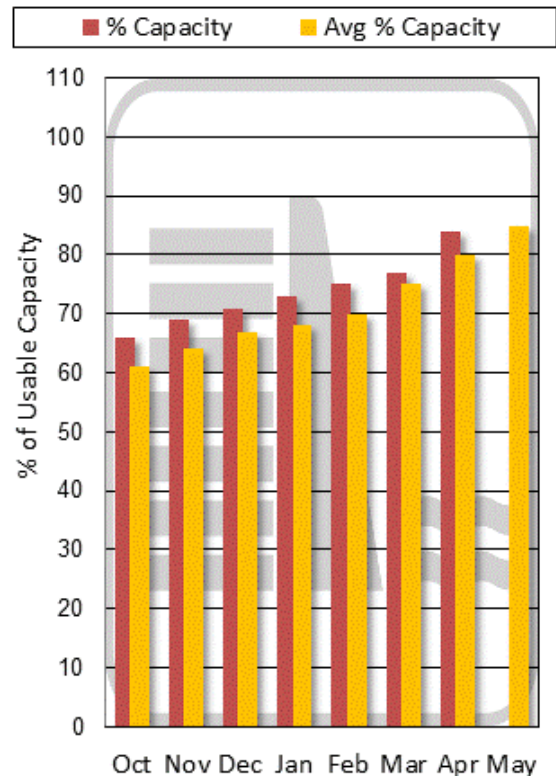
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation



End of Month Reservoir Storage

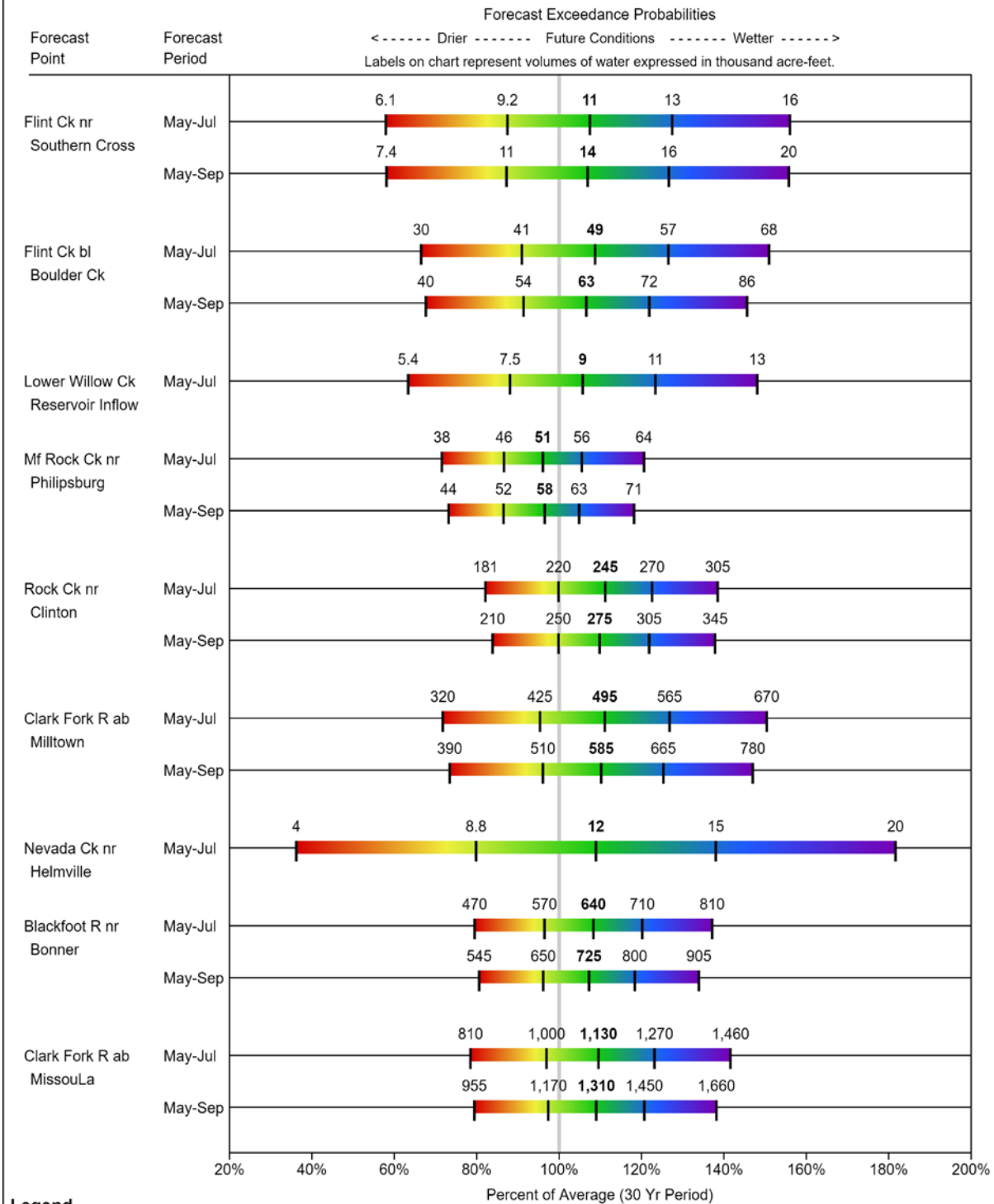


Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

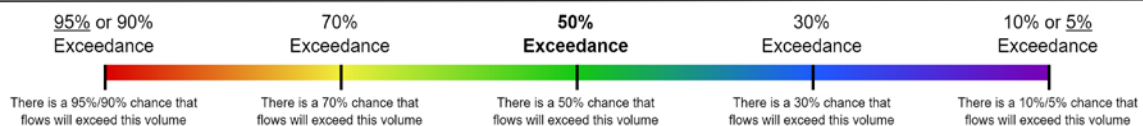
UPPER CLARK FORK RIVER BASIN

Water Supply Forecasts

May 1, 2019



Legend



When selected, the following historic streamflow values and statistics will be shown.

Period of Record Minimum Streamflow KAF (Year)

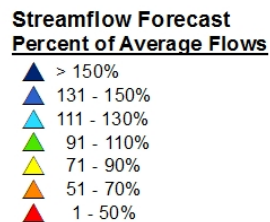
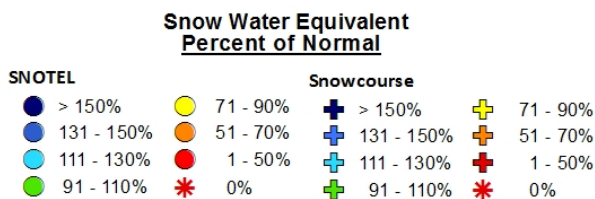
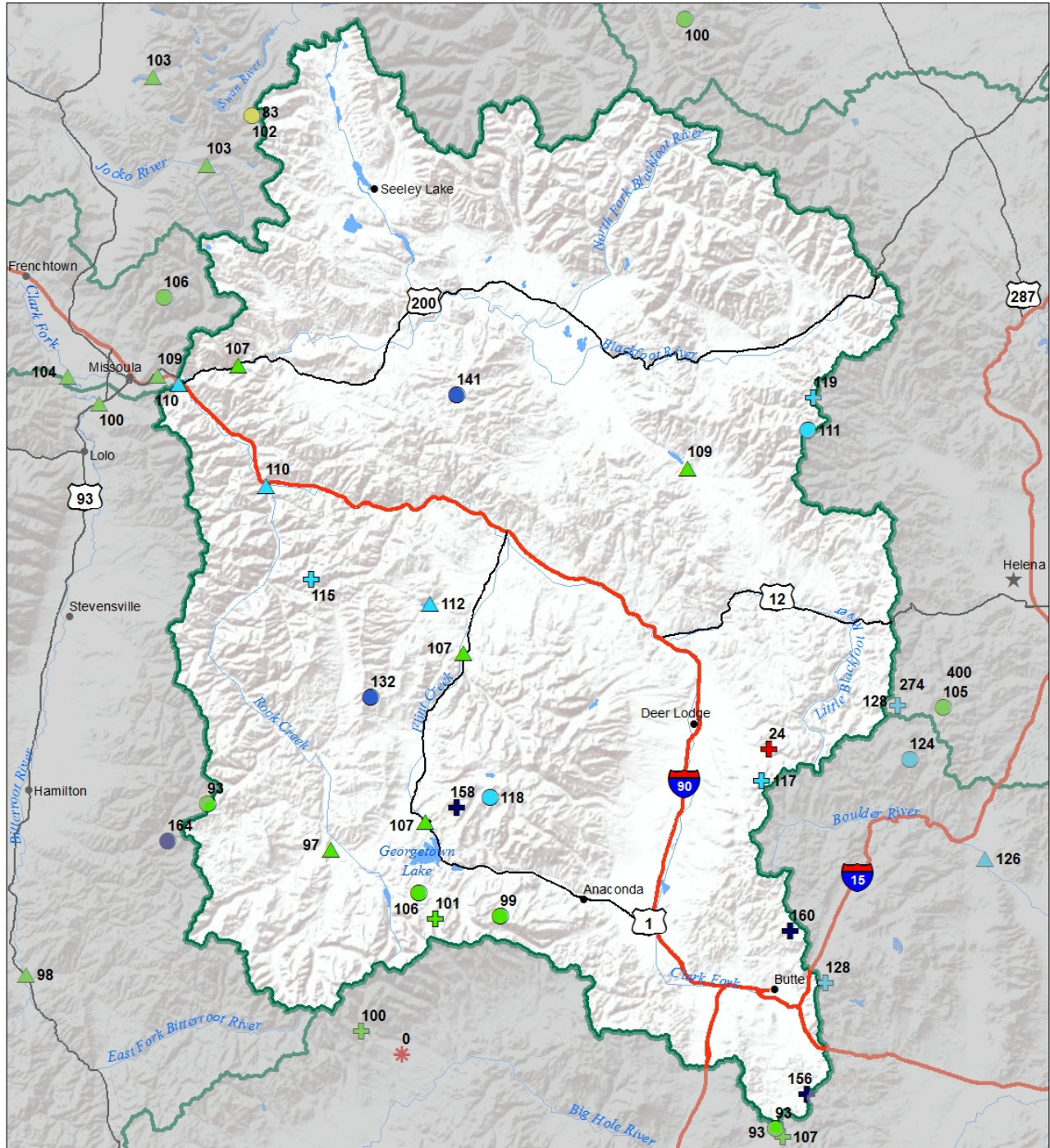
1981-2010 Normal Streamflow KAF

Observed Streamflow KAF

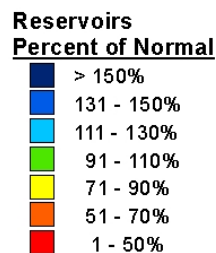
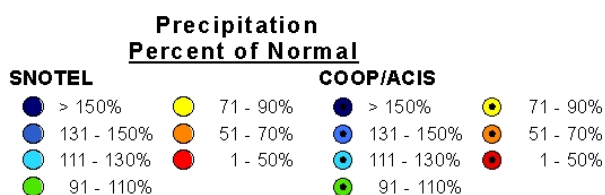
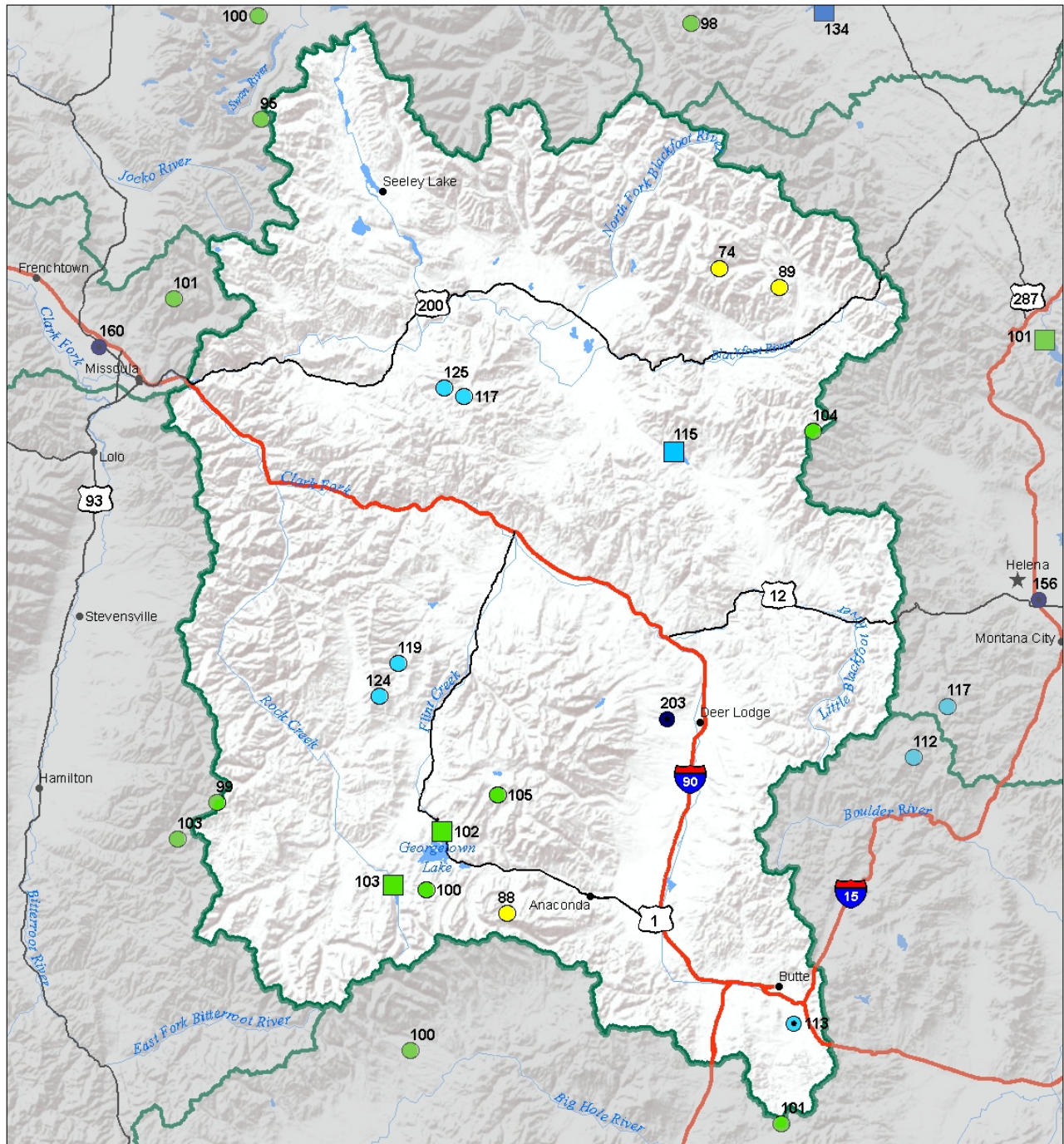
Period of Record Maximum Streamflow KAF (Year)

Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

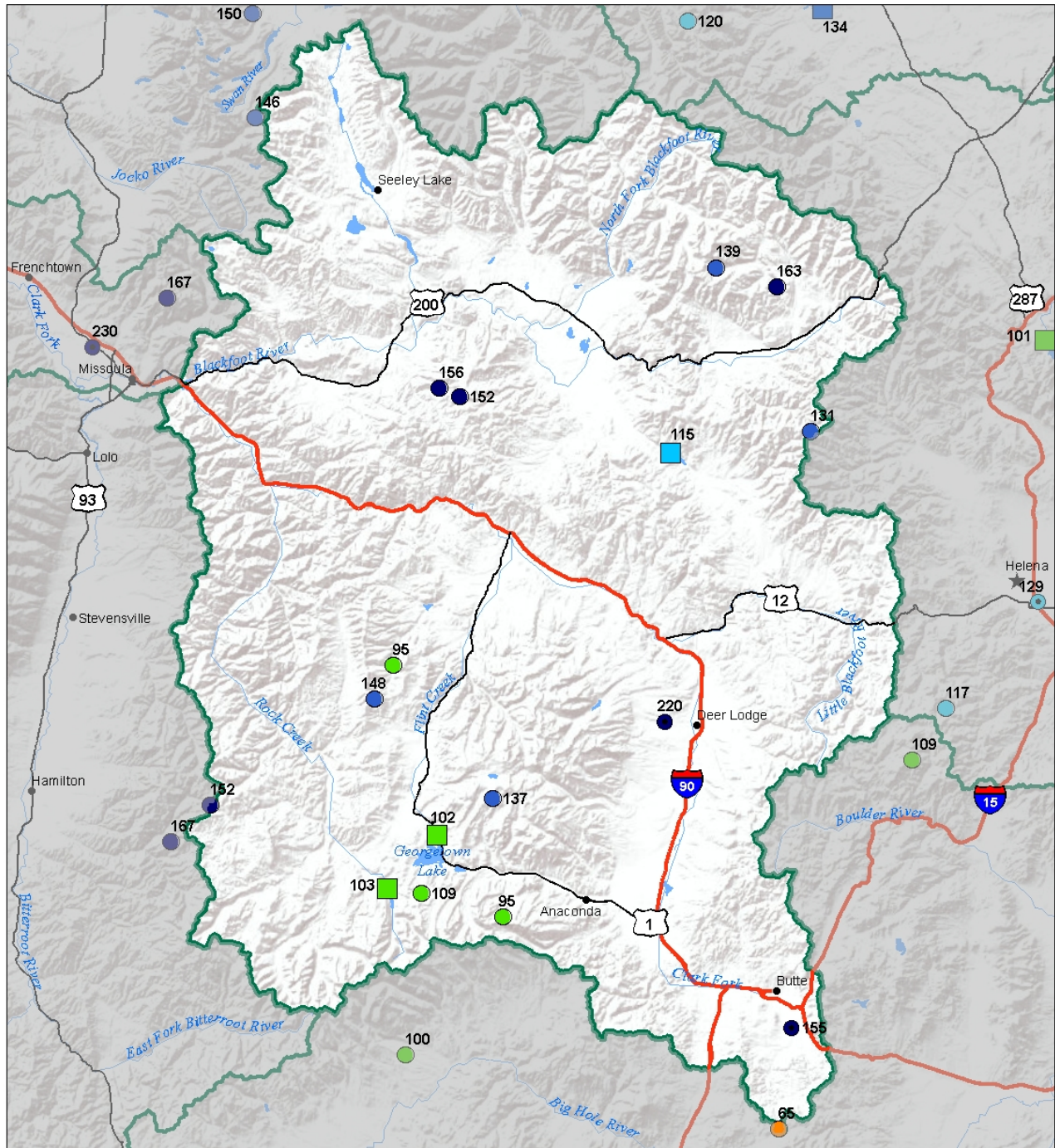
**Upper Clark Fork River Basin
Streamflow Forecast, Snow Water Equivalent
Percentage of Normal
May 1, 2019**



Upper Clark Fork River Basin Water Year to Date Precipitation and Reservoir Levels Percentage of Normal May 1, 2019



Upper Clark Fork River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



**Precipitation
Percent of Normal**

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

COOP/ACIS

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

**Reservoirs
Percent of Normal**

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%



Bitterroot River Basin



After a March that looked like a flatline on a heart-rate monitor, April brought change to the mountains feeding water to the Bitterroot Valley. So, what happened this month? Monthly precipitation in the area was well above average for the month, helping to push water year to totals slightly above average for this date. The second and third weeks experienced active weather patterns which added water to the mountain snowpack at higher elevations before the weather warmed up and sunshine returned to the region. In some areas, the precipitation fell as rain on a melting snowpack at lower elevations. Snowpack in the mountains peaked during the first or second week of April at low and mid-elevation monitoring sites, and the end of the third week at high-elevation sites. Seasonal snowpack peaks were near to slightly above normal in the Sapphire Range and the West Bitterroot, but slightly below normal in the southern ranges feeding the headwaters of the East Fork and West Fork of the Bitterroot.

The combination of peak Snow Water Equivalent (SWE) and near average water-year precipitation has led to streamflow forecasts that indicate near to slightly below average streamflows in the Bitterroot River for the May 1st – July 31st period. Late spring and early summer precipitation play a critical role in these flows, so even though it's good news, don't rest on your laurels just knowing the snowpack peaked near normal. The next month or two will tell us a lot about our water resources later in the summer. For now, we're on the right track.

Bitterroot River Basin Data Summary

Snowpack

	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
WEST FORK BITTERROOT	98%	148%
EAST SIDE BITTERROOT	103%	157%
WEST SIDE BITTERROOT	123%	182%
Basin-Wide Snowpack	111%	166%

Precipitation

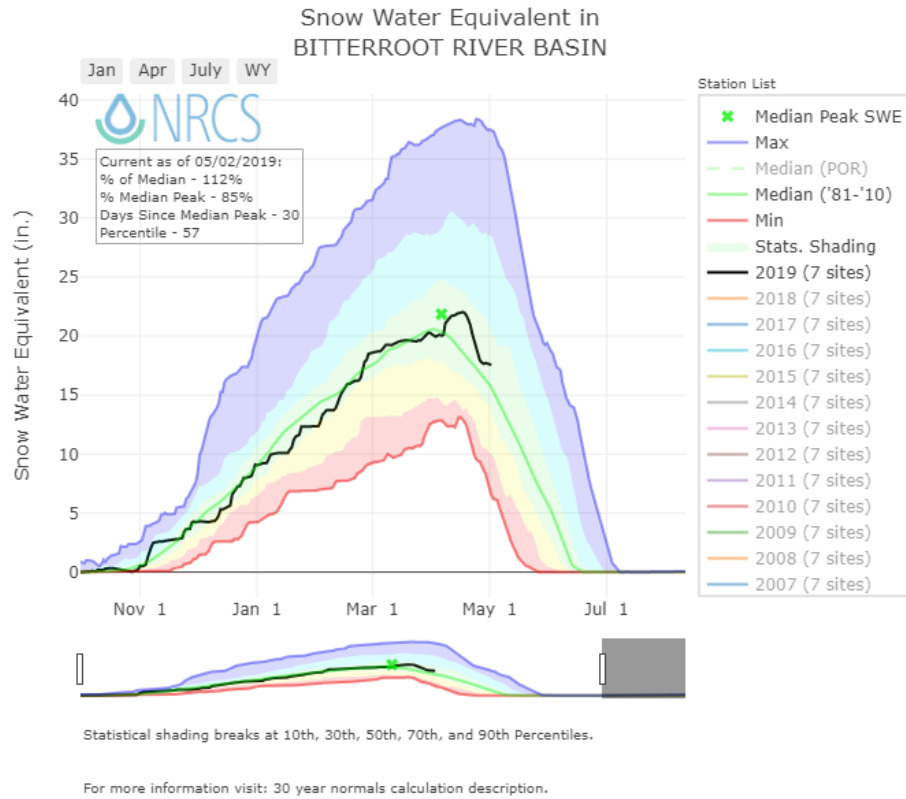
	Monthly Percentage of Average	WYTD Percentage of 1981- 2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	164%	103%	122%
Valley Precipitation	%	%	%
Basin-Wide Precipitation	164%	103%	122%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

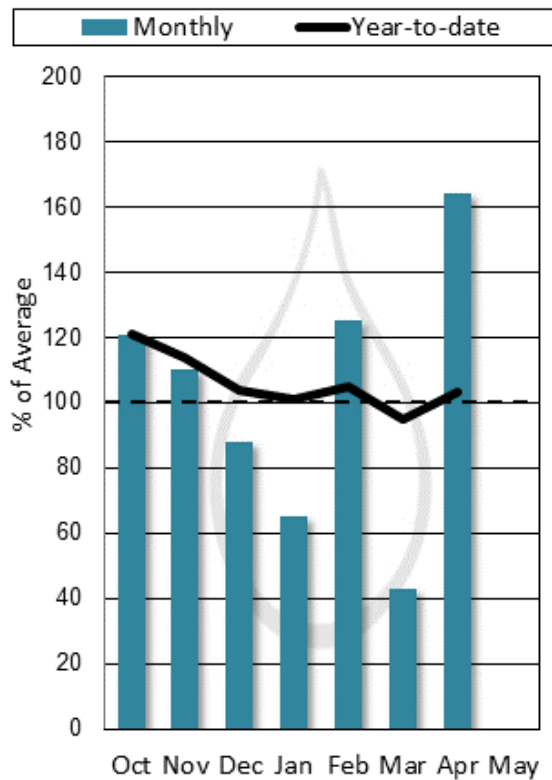
	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	134%	82%	101%

*See Reservoir Storage Table for storage in individual reservoirs

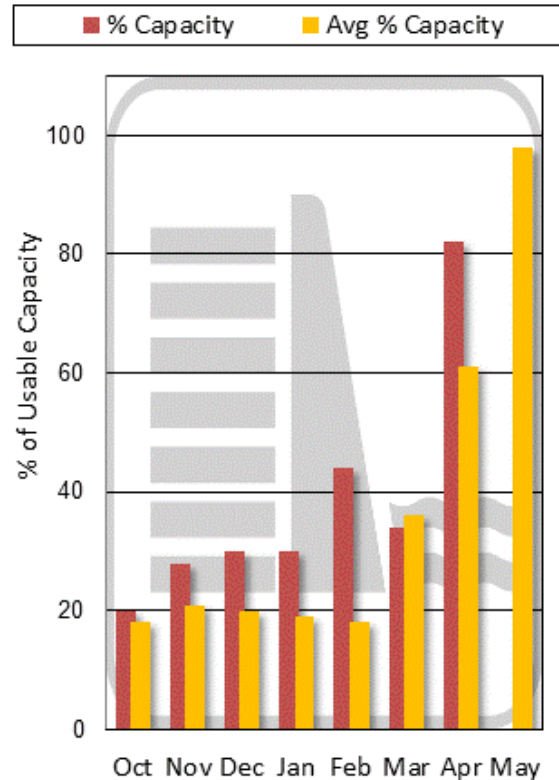
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation



End of Month Reservoir Storage



Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

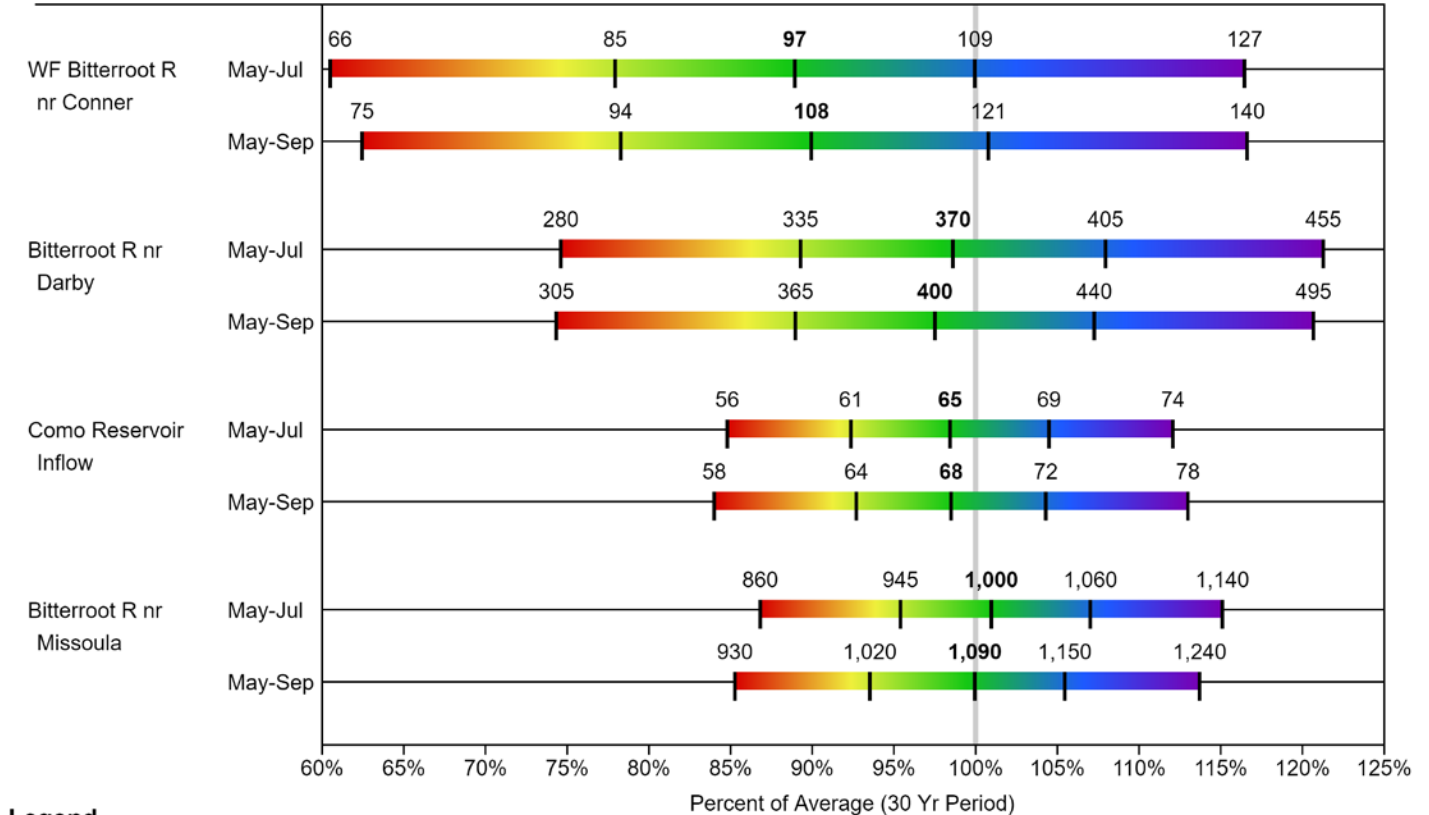
BITTERROOT RIVER BASIN

Water Supply Forecasts

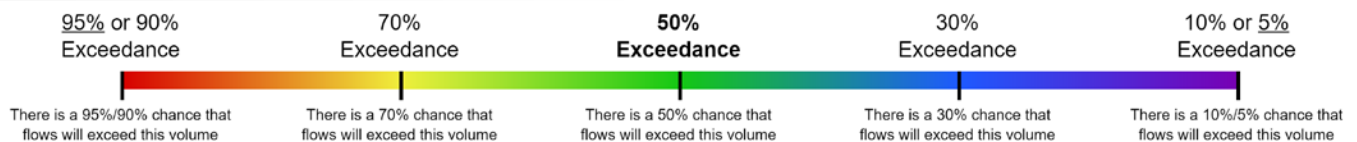
May 1, 2019

Forecast Exceedance Probabilities

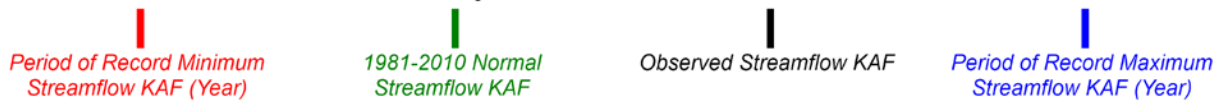
<----- Drier ----- Future Conditions ----- Wetter ----->
Labels on chart represent volumes of water expressed in thousand acre-feet.



Legend



When selected, the following historic streamflow values and statistics will be shown.



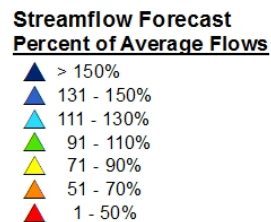
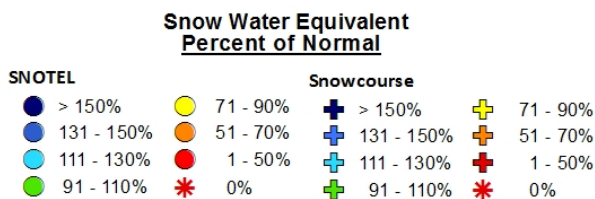
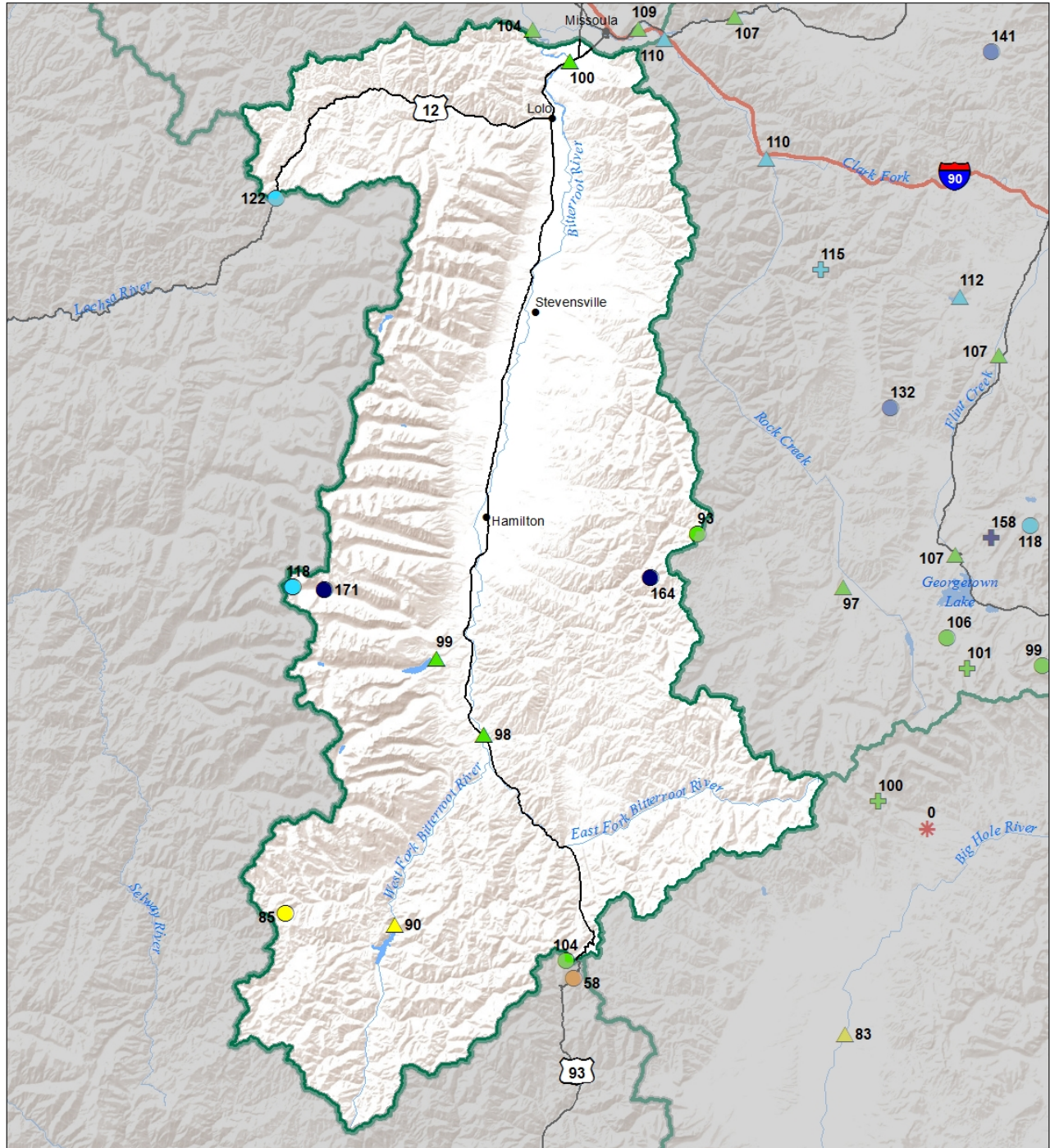
Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

Bitterroot River Basin

Streamflow Forecast, Snow Water Equivalent

Percentage of Normal

May 1, 2019

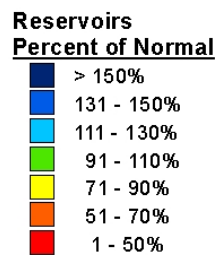
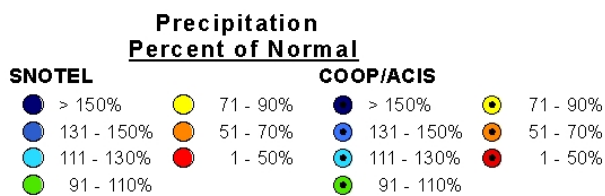
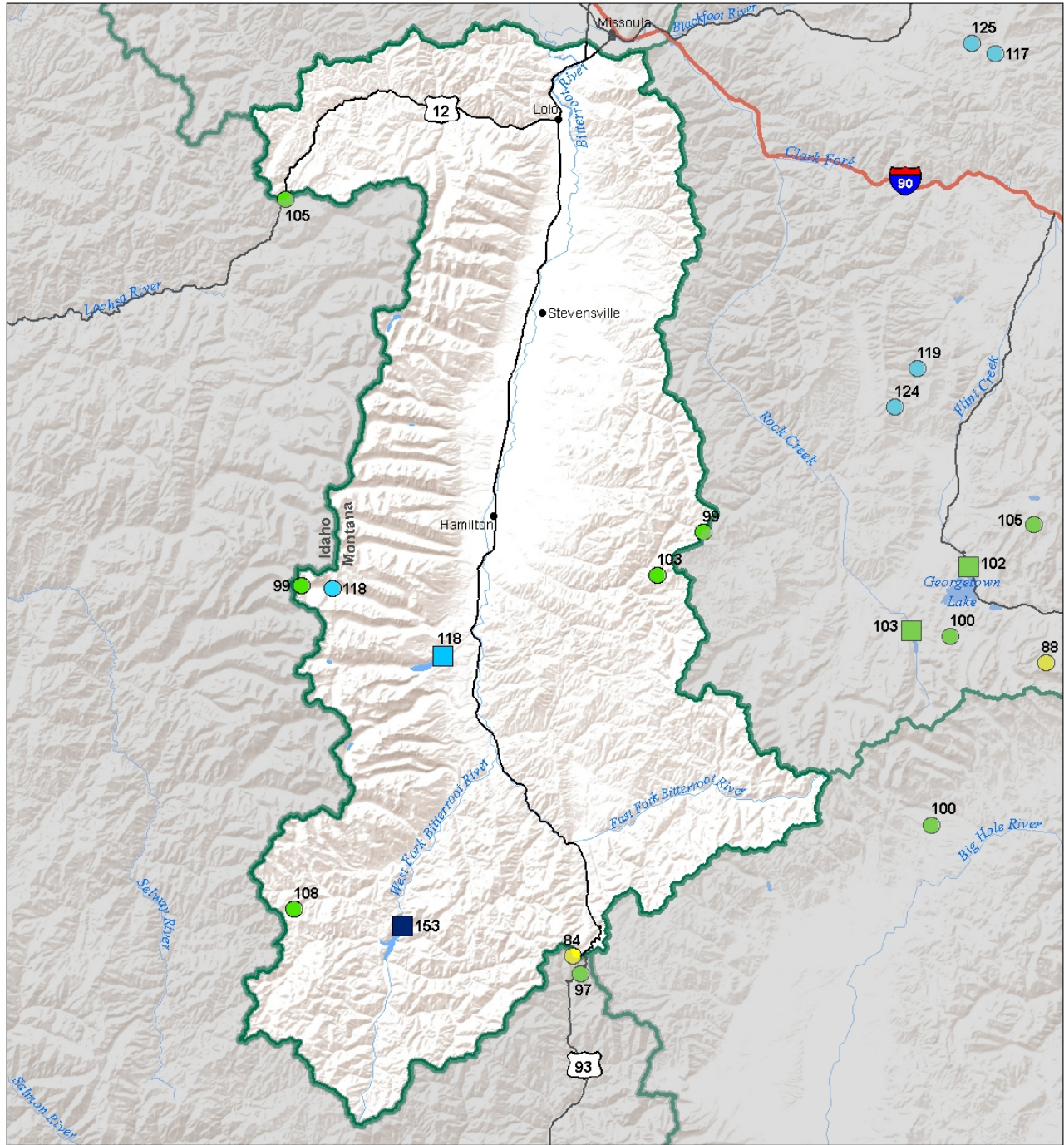


Bitterroot River Basin

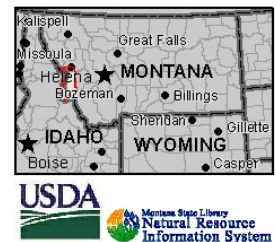
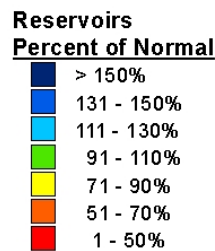
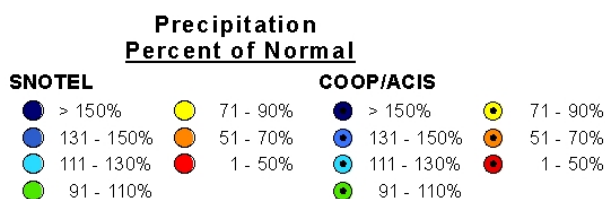
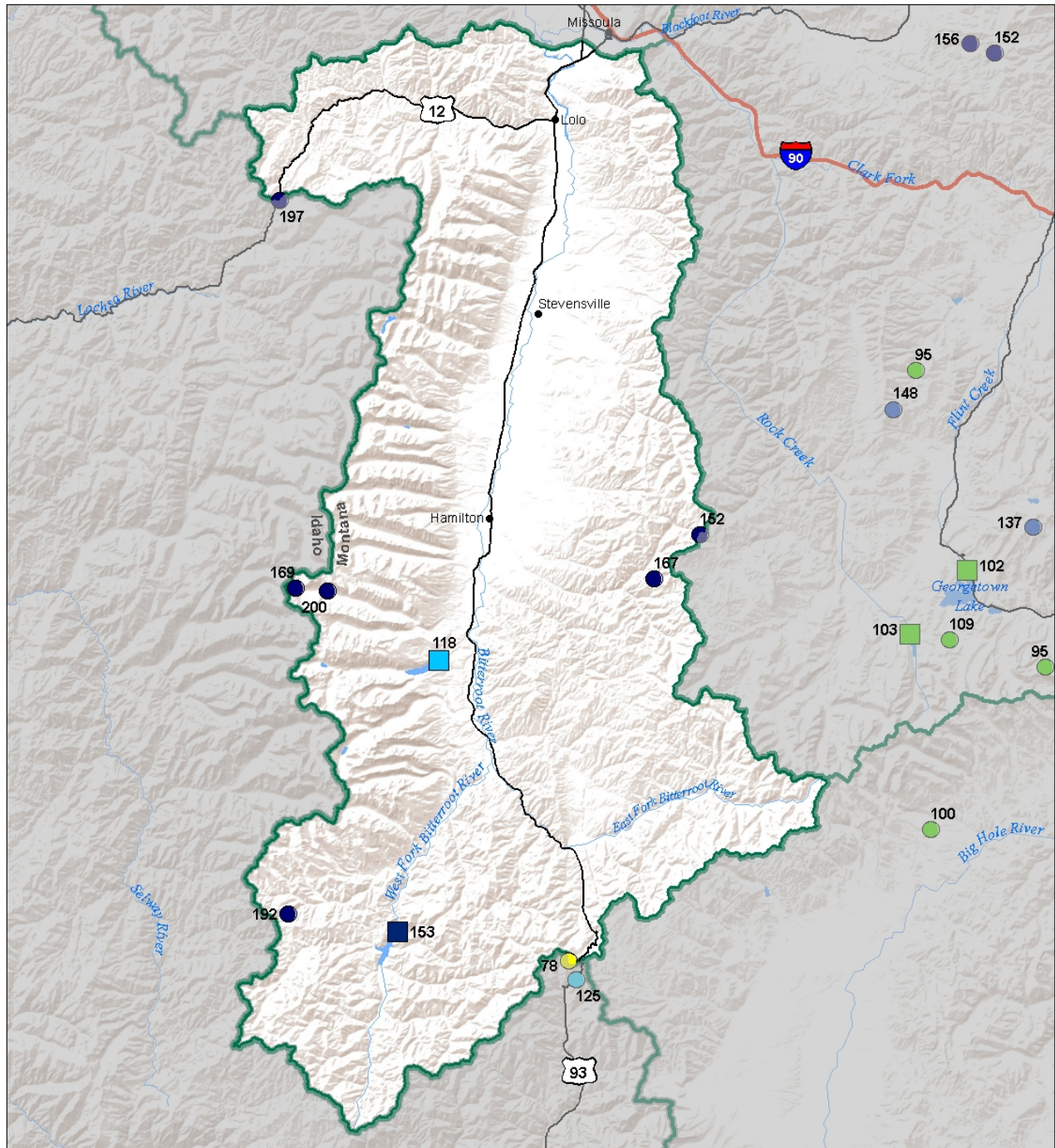
Water Year to Date Precipitation and Reservoir Levels

Percentage of Normal

May 1, 2019



Bitterroot River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



Lower Clark Fork River Basin



After a dry March, the Lower Clark Fork River basin got a boost in snowpack and water-year precipitation totals during April. All mountain SNOTEL sites within the Lower Clark Fork below Missoula received above average precipitation for the month. Snowpack in the basin reached its seasonal peak shortly after this active storm pattern pushed through during the third weekend in April, peaking near to slightly above normal in the southern and eastern regions of the basin. One area experienced seasonal peaks which were below normal this year, snowpack in the Cabinet Range reached seasonal peaks which were 80-90% of normal this year. Even though April brought much-needed precipitation to the basin, the early winter months we're on the dry side, which has resulted in water year precipitation totals which are below normal in the southern and western halves of the basin. Elsewhere, to the east water year precipitation remains closer to normal for May 1st.

Streamflow forecasts issued on May 1st indicate near average flows in the mainstem of the Clark Fork above the confluence with the Flathead. Smaller tributaries may experience slightly below average seasonal volumes this spring and summer. Spring and summer precipitation will fill in the blanks and are important to the hydrograph, so some uncertainty remains in these forecasts.

Lower Clark For River Basin Data Summary

<i>Snowpack</i>	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
LOWER CLARK FORK RIVER BASIN	106%	151%
Basin-Wide	106%	151%

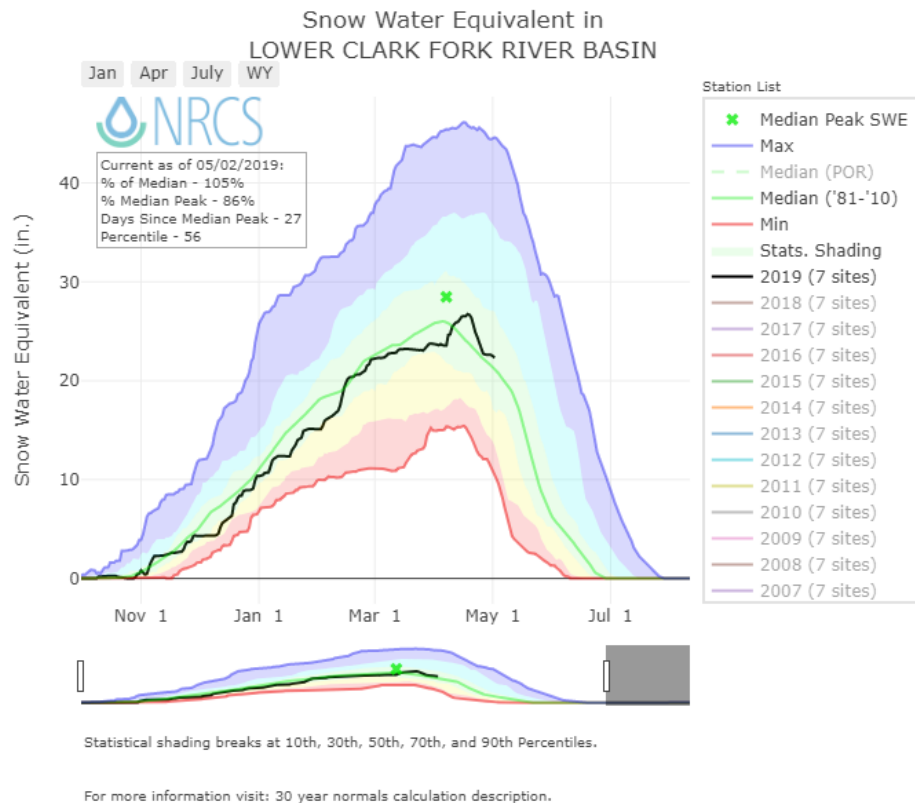
<i>Precipitation</i>	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	159%	91%	117%
Valley Precipitation	230%	160%	139%
Basin-Wide Precipitation	162%	93%	118%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

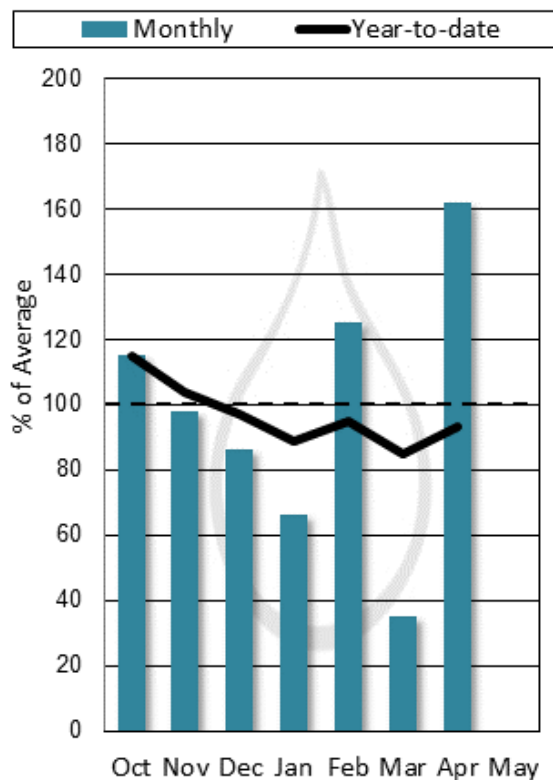
<i>Reservoir Storage</i>	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	97%	89%	108%

*See Reservoir Storage Table for storage in individual reservoirs

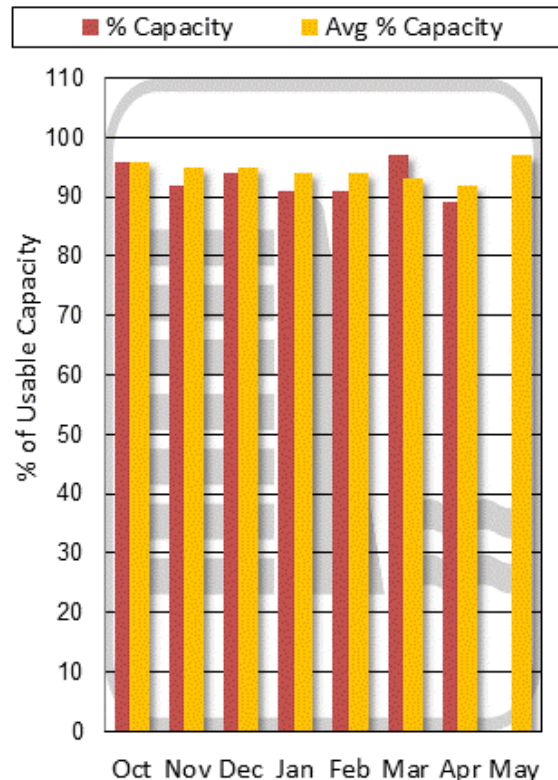
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation

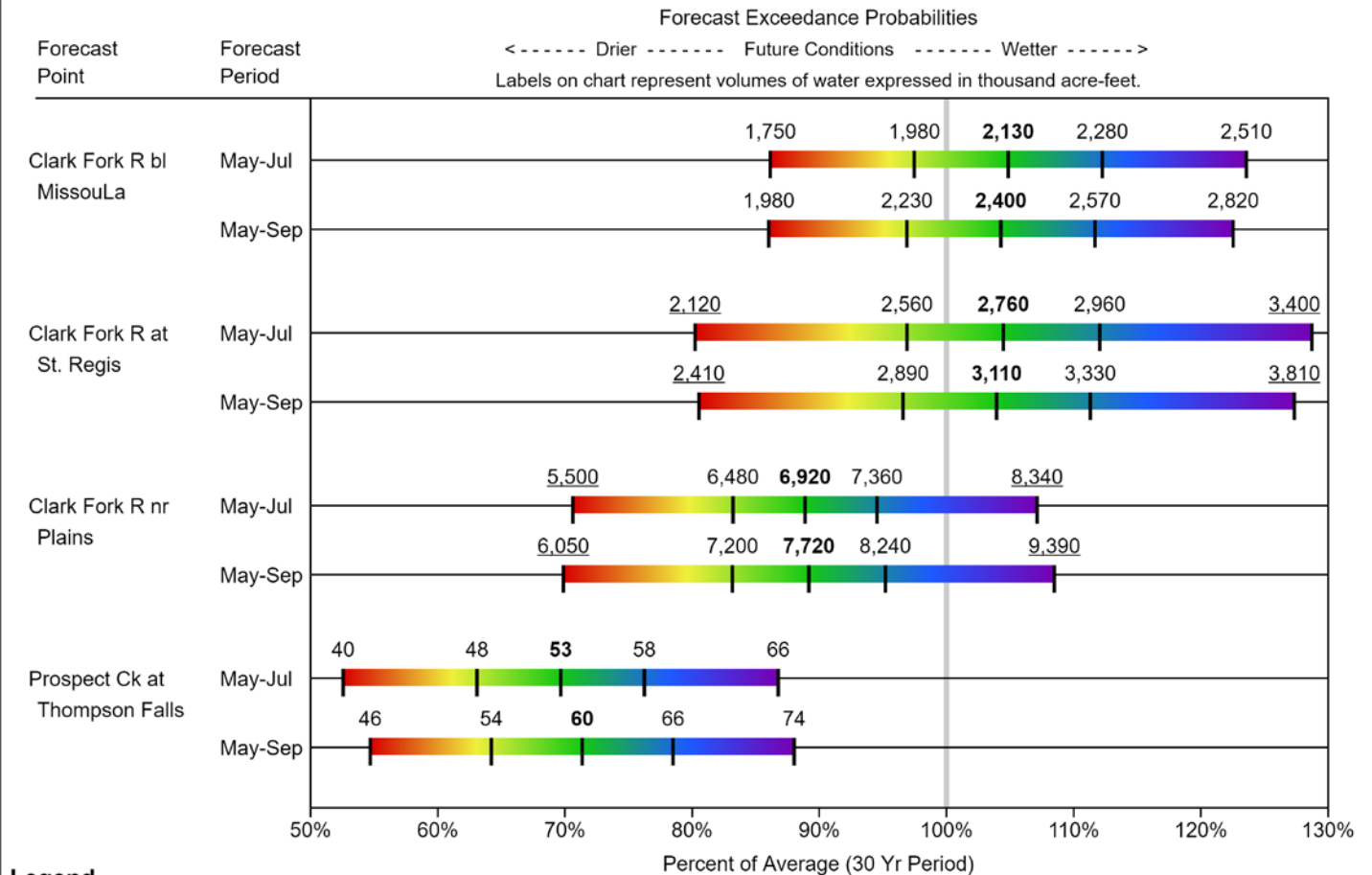


End of Month Reservoir Storage

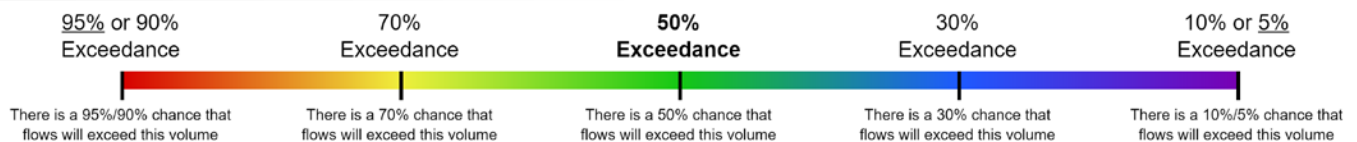


Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

LOWER CLARK FORK RIVER BASIN **Water Supply Forecasts** **May 1, 2019**



Legend



When selected, the following historic streamflow values and statistics will be shown.

Period of Record Minimum Streamflow KAF (Year)

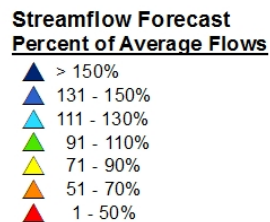
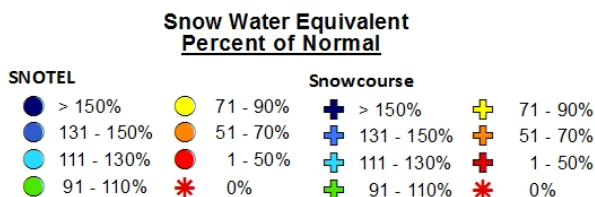
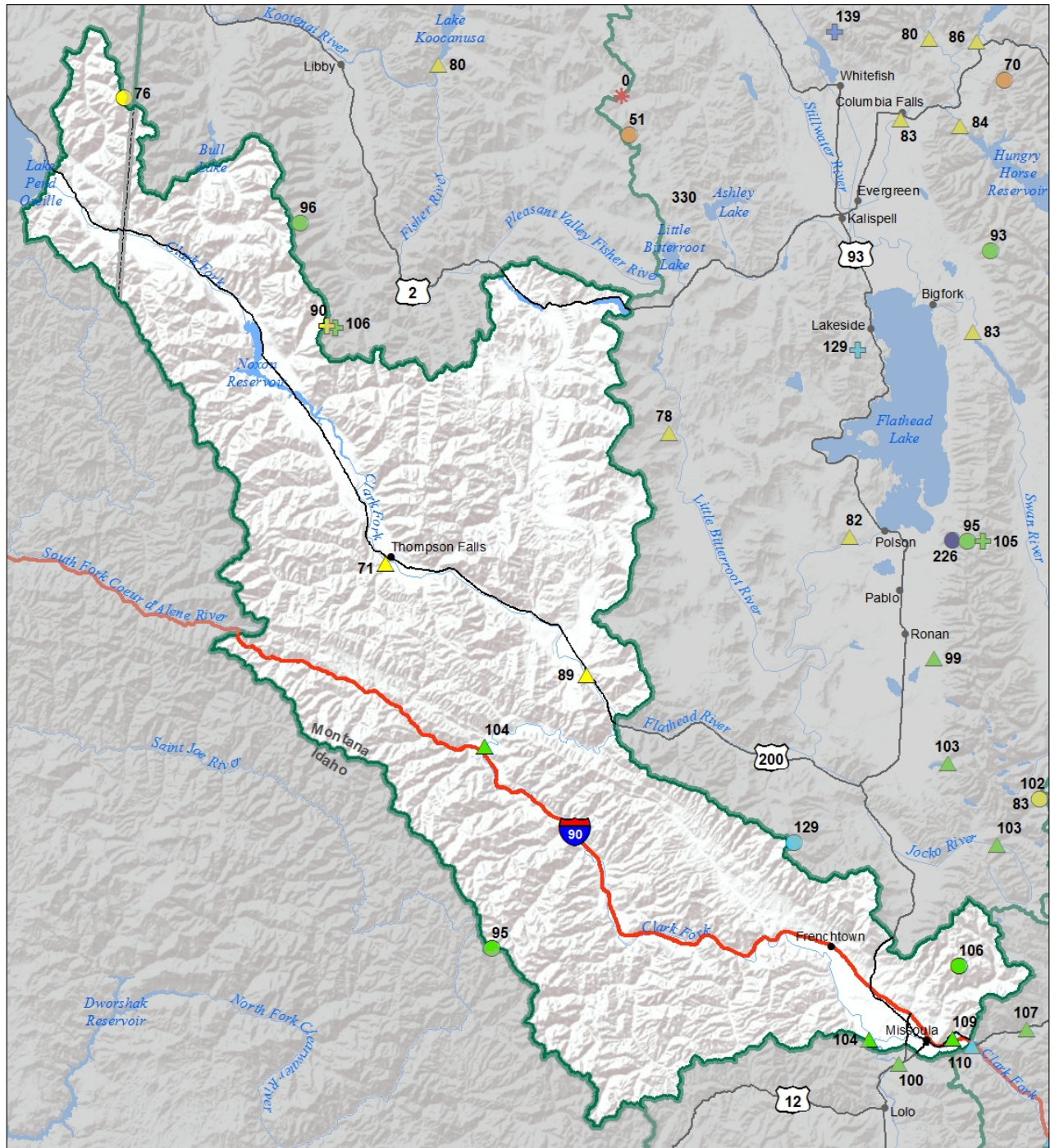
1981-2010 Normal Streamflow KAF

Observed Streamflow KAF

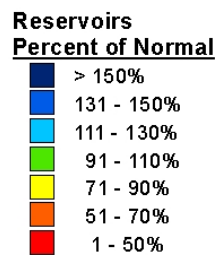
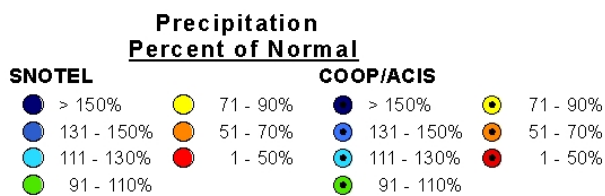
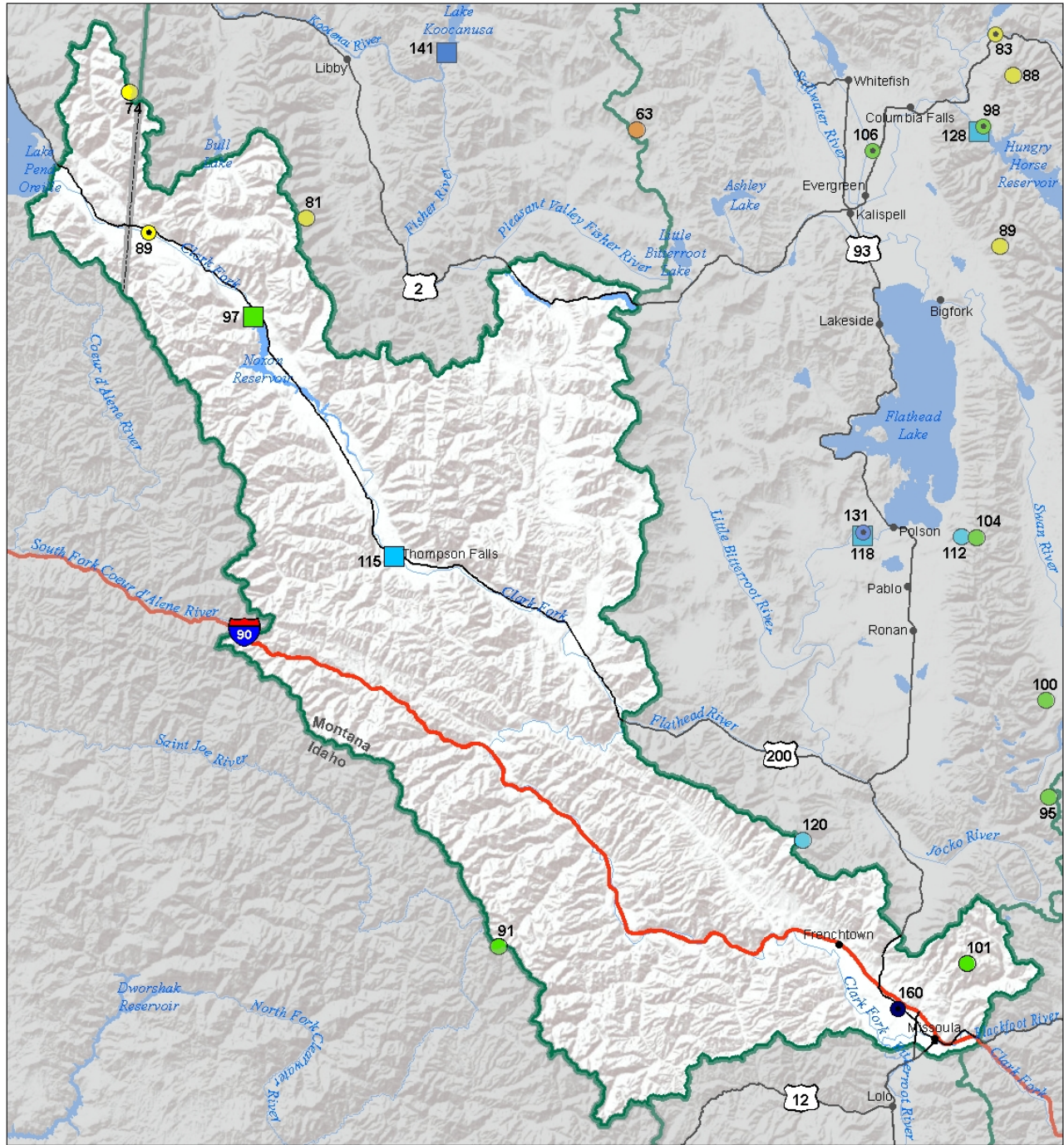
Period of Record Maximum Streamflow KAF (Year)

Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

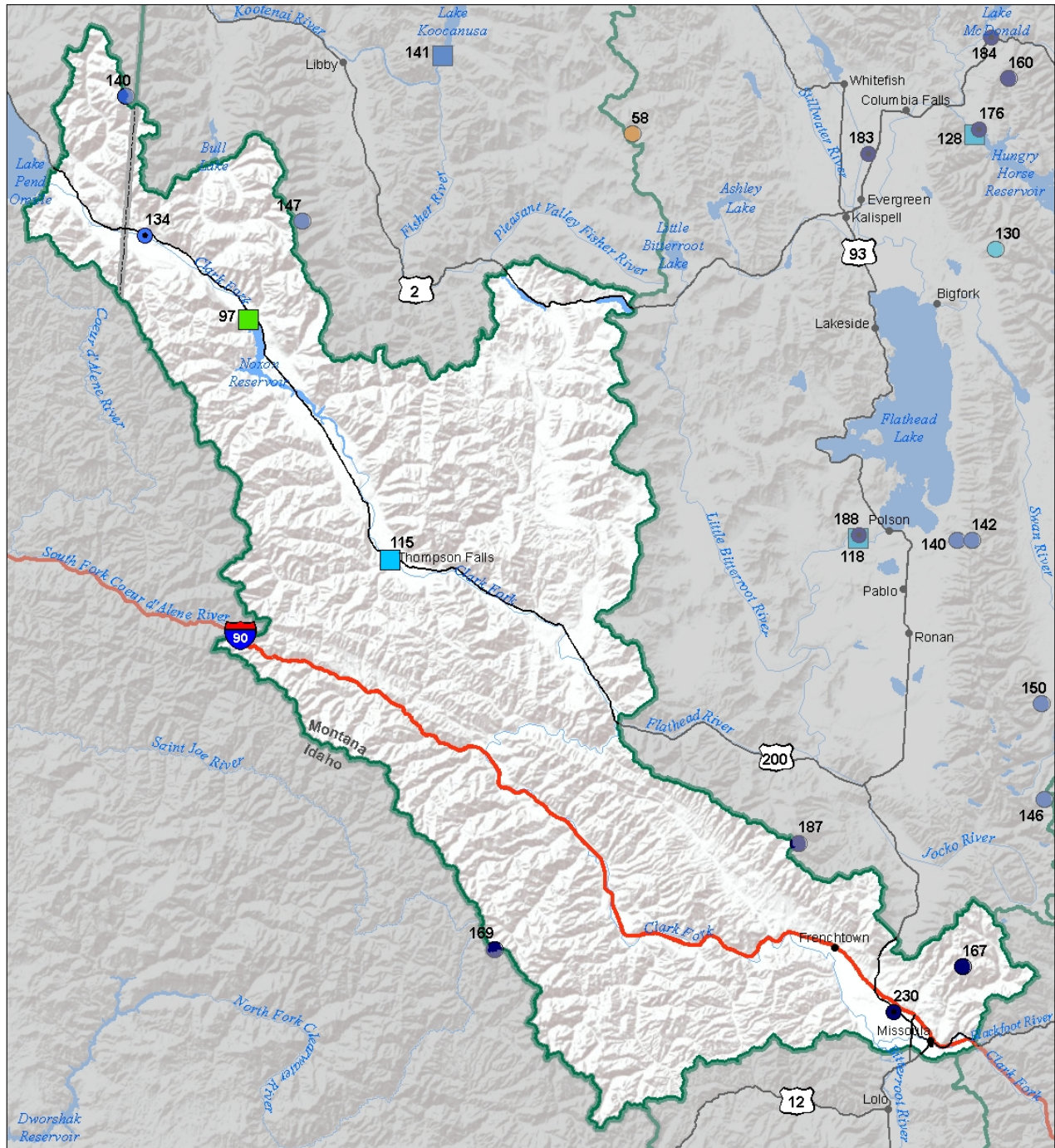
**Lower Clark Fork River Basin
Streamflow Forecast, Snow Water Equivalent
Percentage of Normal
May 1, 2019**



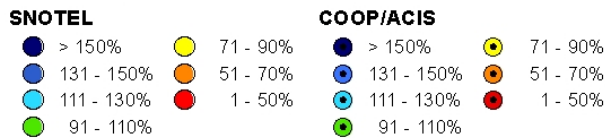
Lower Clark Fork River Basin
Water Year to Date Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019



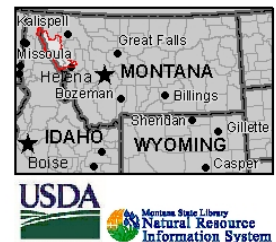
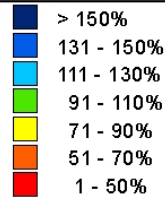
Lower Clark Fork River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



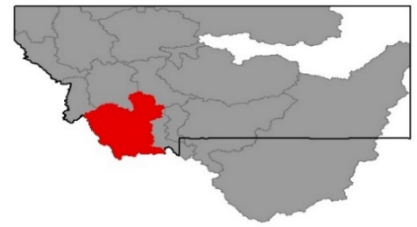
**Precipitation
Percent of Normal**



**Reservoirs
Percent of Normal**



Jefferson River Basin



April wasn't quite as kind to the Jefferson River basin as it was to the basins surrounding it. Storms during the middle two weeks of the month favored the northern half of the river basin, helping to increase only the high elevation snowpack in the basin. Low and sites made the transition to melt this year in late March, and mid-elevations were able to hold on until the anomalously warm weather during the third week in April. Many high elevation sites still haven't made the transition to melt but will once the weather returns to more seasonal patterns. Snowpack at peak accumulation at most sites was near to slightly below normal this year, but new peaks may yet be set at high elevations. Overall basin-wide snowpack for this date remains slightly below normal for May 1st, due in large part to the early low elevation melt. The good news is that as of May 1st, both Clark Canyon and Ruby reservoirs are both full, but summer demand and the rate of inflow from the higher elevations will dictate how much water is available later in the summer months.

Streamflow forecasts for the May 1st – July 31st period range from below average in the Red Rock/Upper Beaverhead basin to near to slightly below average in the Big Hole and Lower Jefferson River basins.

Jefferson River Basin Data Summary

Snowpack	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
BEAVERHEAD	97%	124%
RUBY	106%	124%
BIGHOLE	96%	144%
BOULDER	120%	162%
Basin-Wide Snowpack	137%	102%

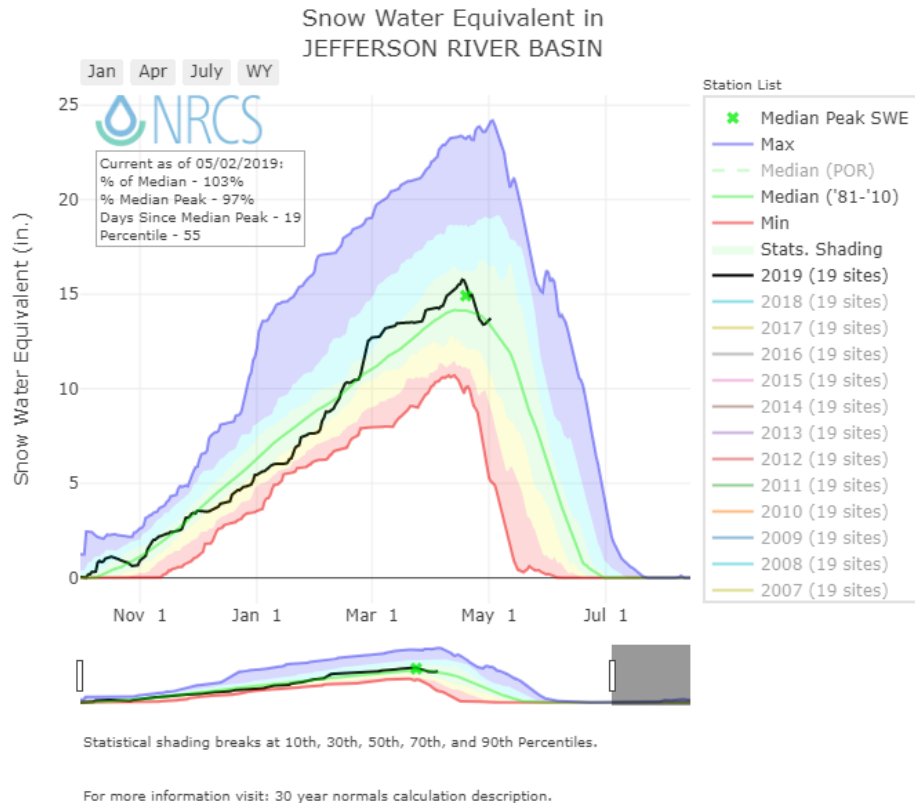
Precipitation	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	112%	104%	114%
Valley Precipitation	%	%	%
Basin-Wide Precipitation	112%	104%	114%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

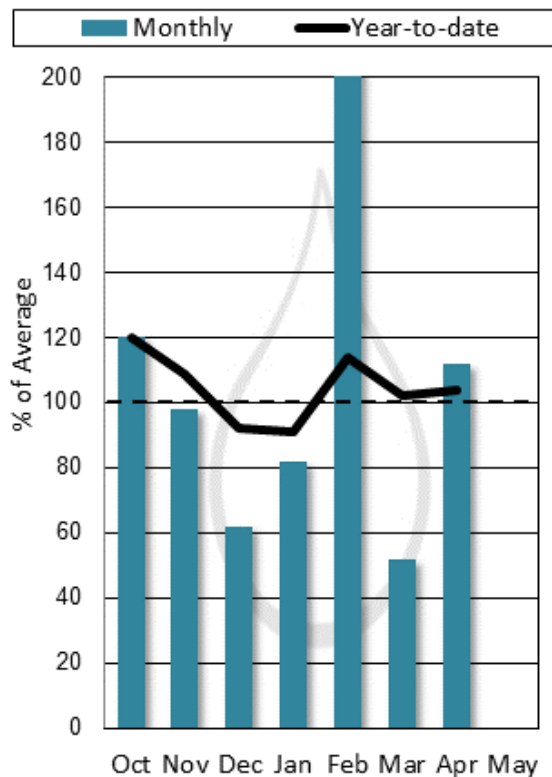
Reservoir Storage	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	120%	74%	123%

*See Reservoir Storage Table for storage in individual reservoirs

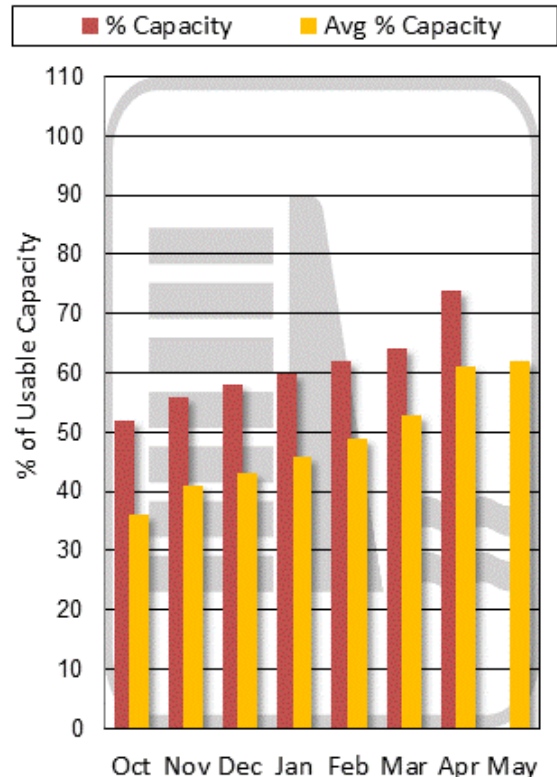
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation



End of Month Reservoir Storage

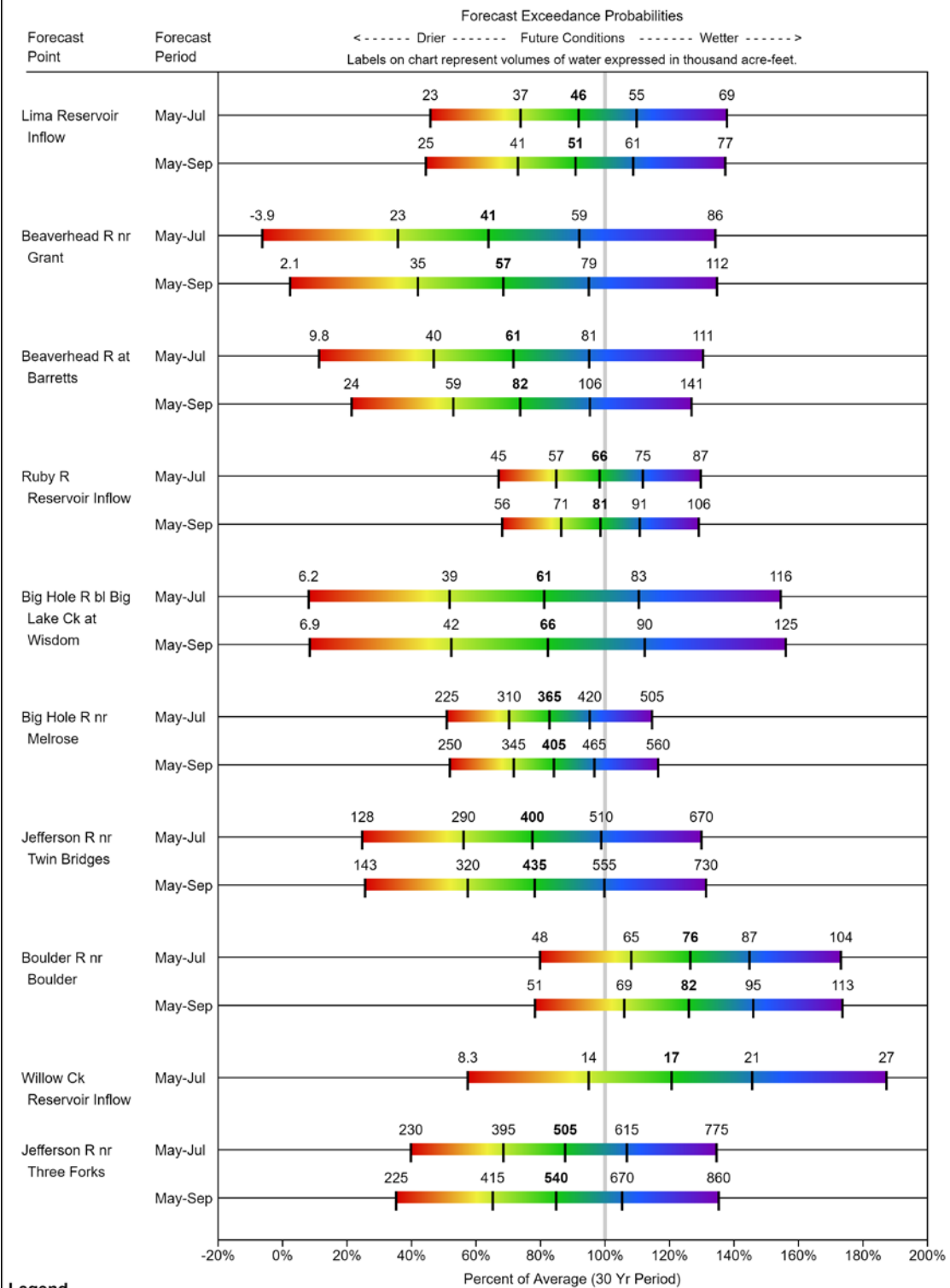


Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

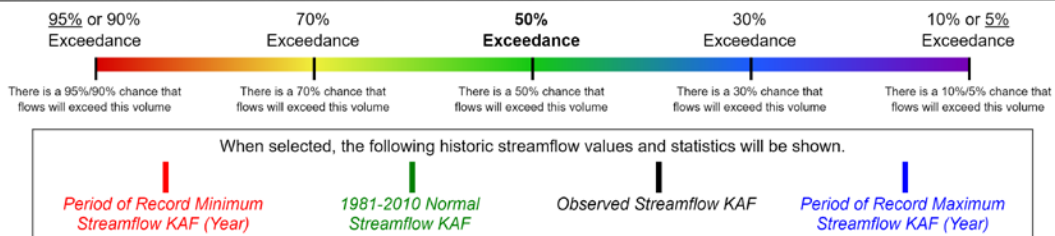
JEFFERSON RIVER BASIN

Water Supply Forecasts

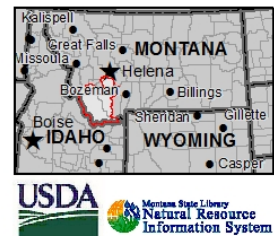
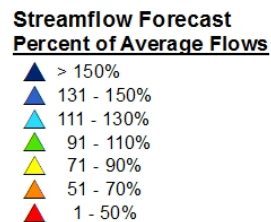
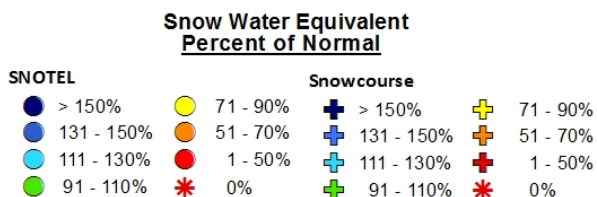
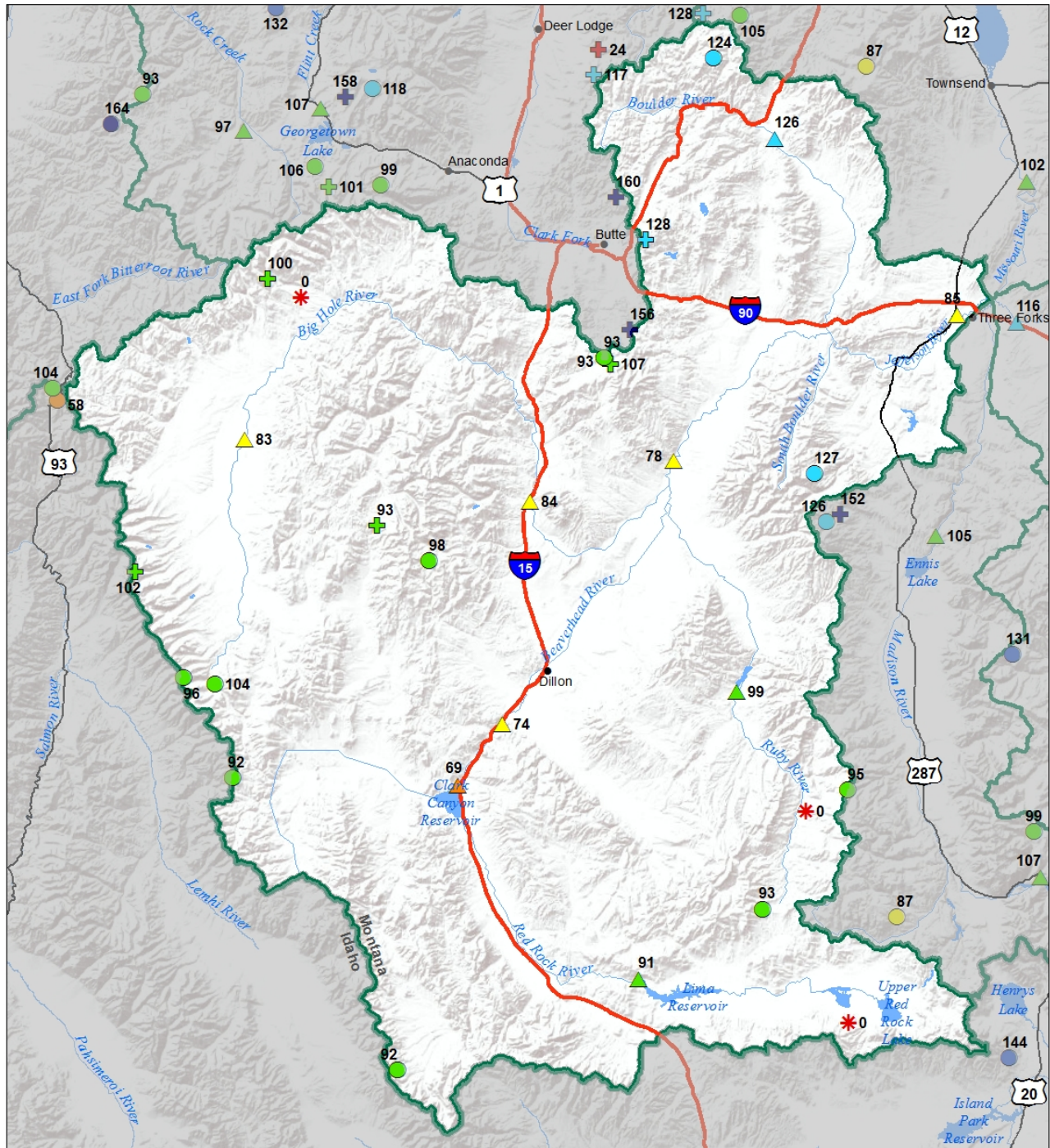
May 1, 2019



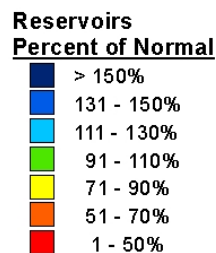
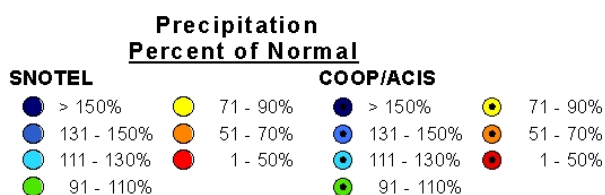
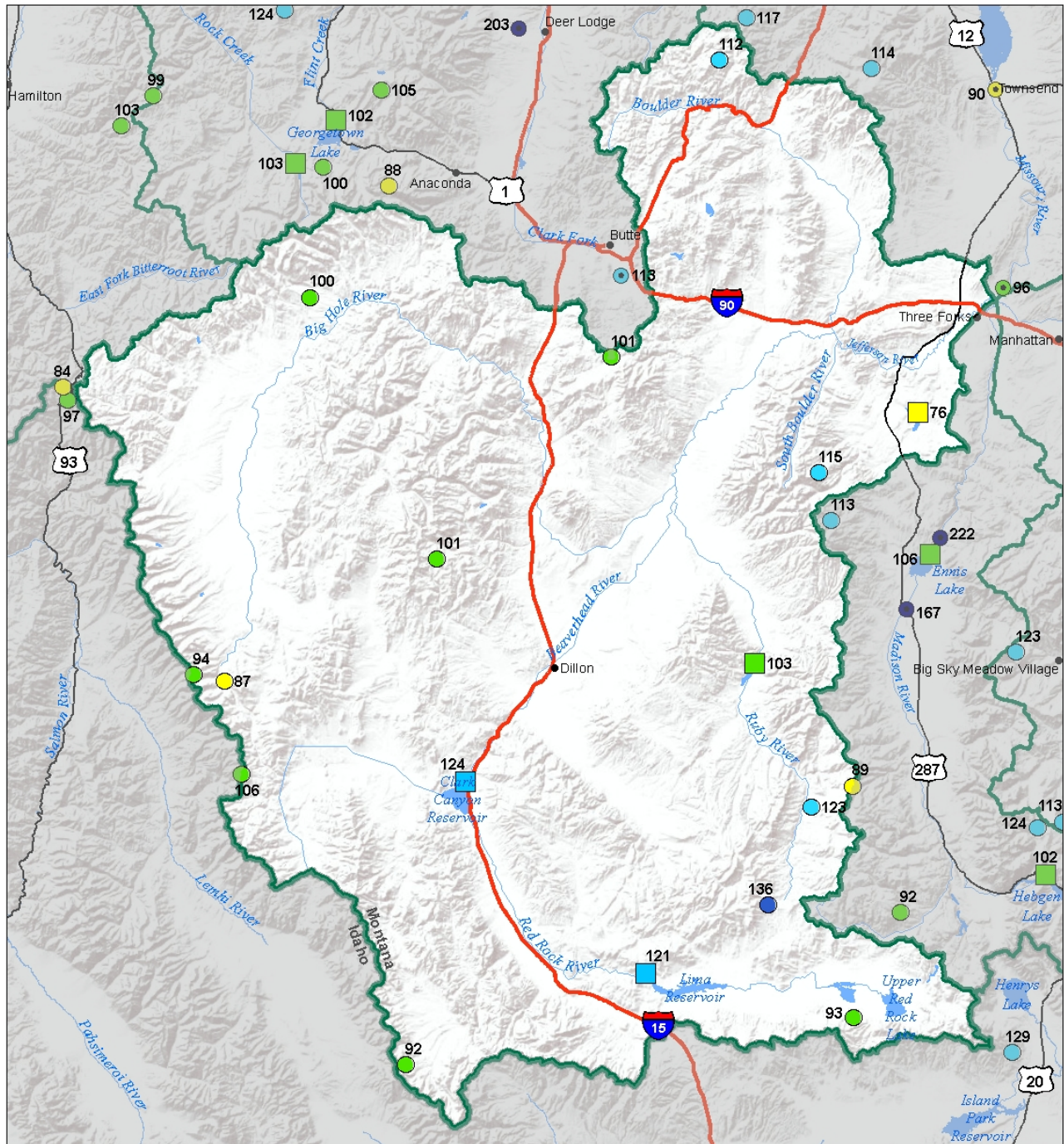
Legend



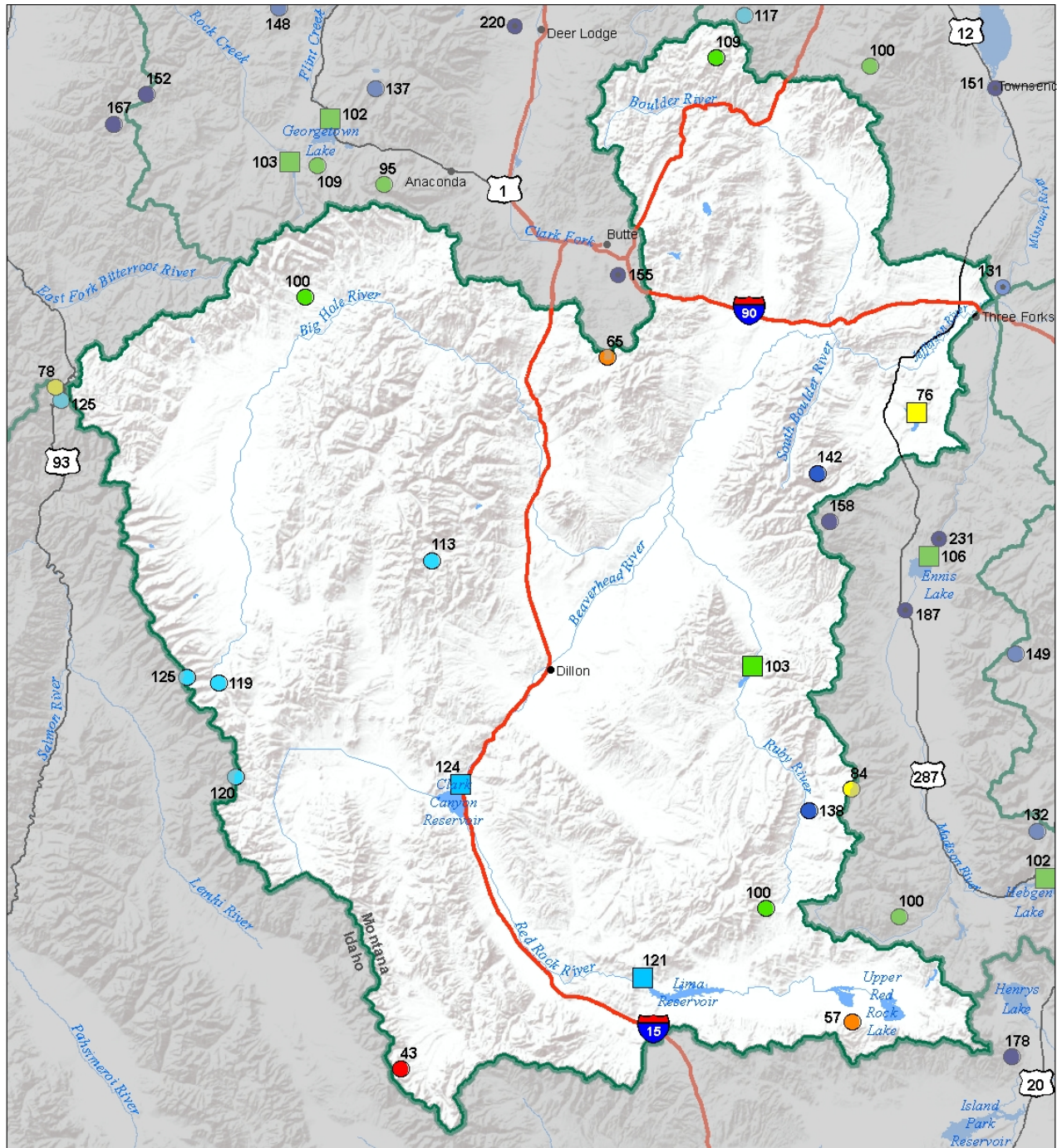
Jefferson River Basin Streamflow Forecast, Snow Water Equivalent Percentage of Normal May 1, 2019



Jefferson River Basin Water Year to Date Precipitation and Reservoir Levels Percentage of Normal May 1, 2019



Jefferson River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



**Precipitation
Percent of Normal**

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%

COOP/ACIS

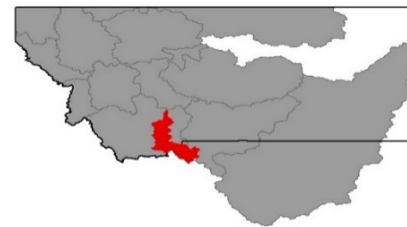
- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%

**Reservoirs
Percent of Normal**

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%



Madison River Basin



It's official, with regards to snowmelt runoff this year, February saved the winter. After a dry March, there was much uncertainty of what this erratic winter would bring, and true to form things changed. April yielded above-average precipitation in almost all locations except for a few SNOTEL sites in the Gravelly Range. Seasonal snowpack peaks have occurred at most low and mid-elevation sites, and active melt is occurring. Some high elevation sites made the transition to melt during the unseasonably warm period at the end of the third weekend of the month, while other high elevation sites in the Madison Range continue to gain snow water. The basin-wide snowpack is above normal for May 1st, which combined with near to above normal seasonal peaks should ensure adequate water supply this spring and summer.

Volumetric streamflow forecasts for the May 1st – July 31st period reflect this and are near average for the spring and summer months. The icing on the cake is that storage is above average for this date in both Ennis and Hebgen Reservoirs, which could help to sustain flows if the spring and early summer months end up making another major weather pattern switch and end up below average for precipitation.

Madison River Basin Data Summary

Snowpack	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
MADISON abv HEBGEN LAKE	120%	129%
MADISON blw HEBGEN LAKE	113%	128%
Basin-Wide Snowpack	115%	128%

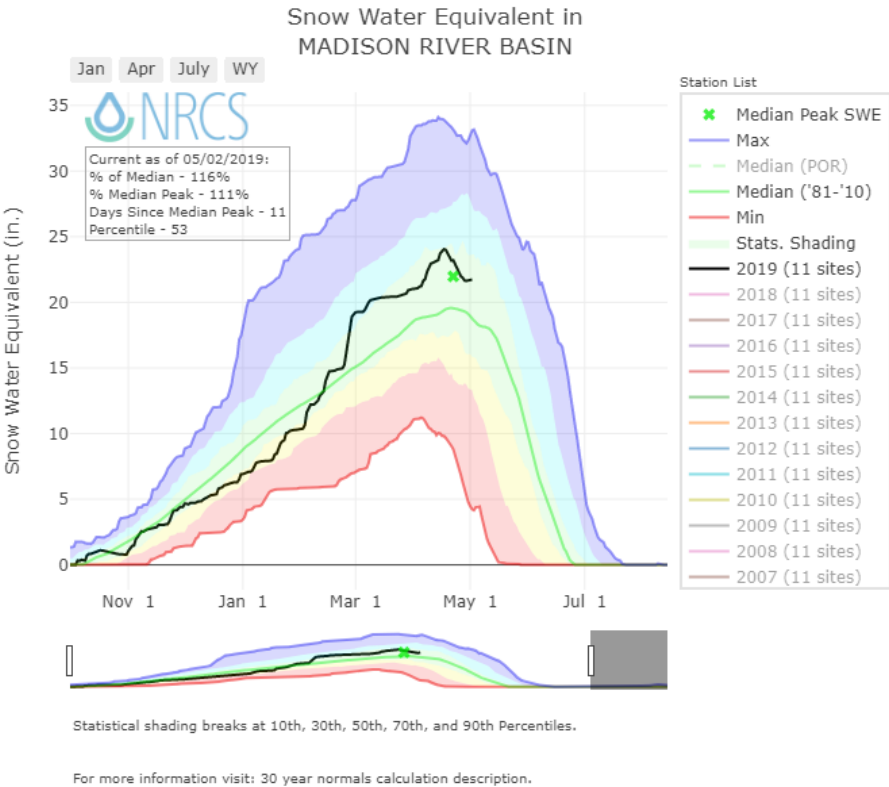
Precipitation	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	137%	112%	113%
Valley Precipitation	212%	197%	187%
Basin-Wide Precipitation	142%	115%	116%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

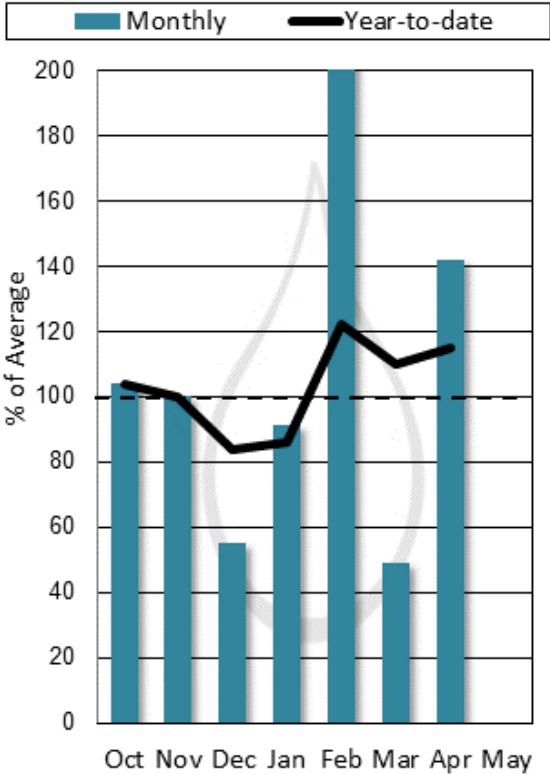
Reservoir Storage	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	102%	75%	100%

*See Reservoir Storage Table for storage in individual reservoirs

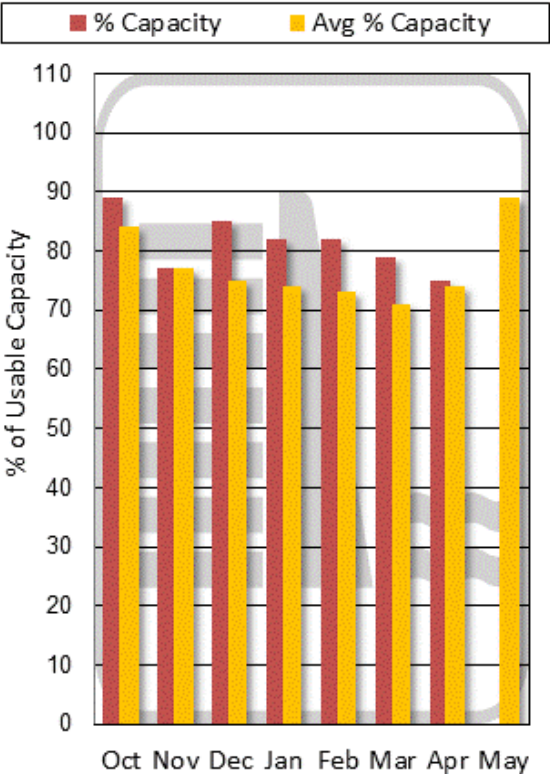
(click on chart below to navigate to [online version](#) with additional features)



**Mountain and Valley
Precipitation**



**End of Month Reservoir
Storage**

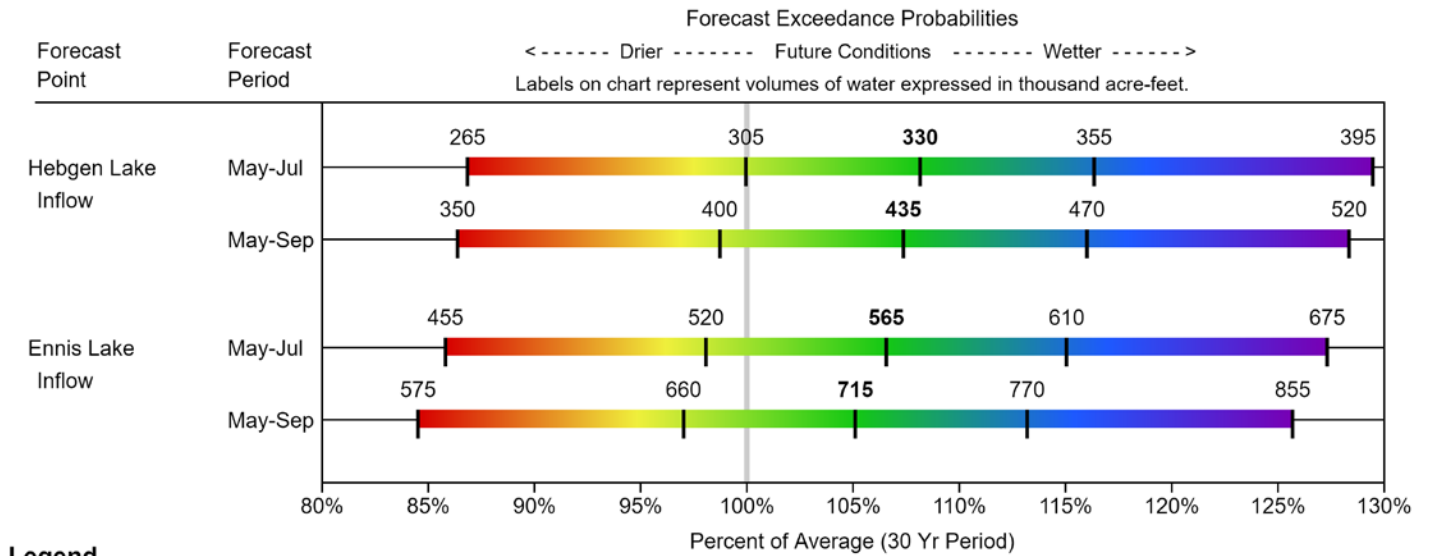


Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

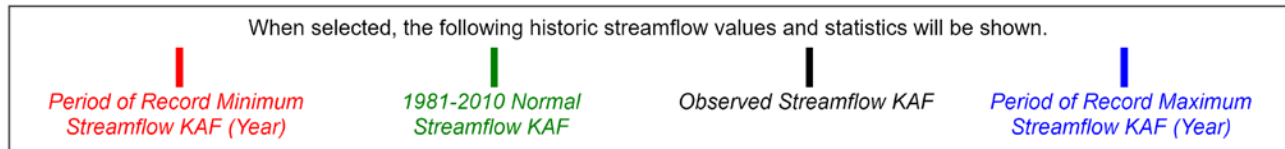
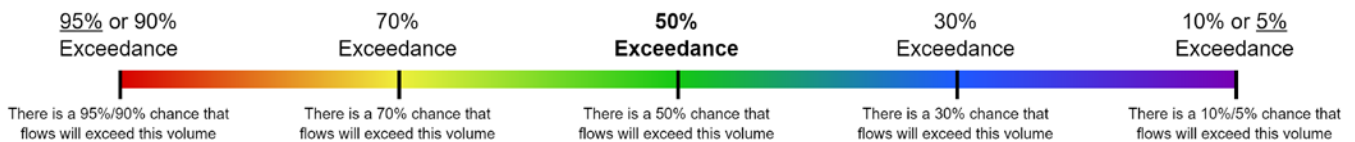
MADISON RIVER BASIN

Water Supply Forecasts

May 1, 2019

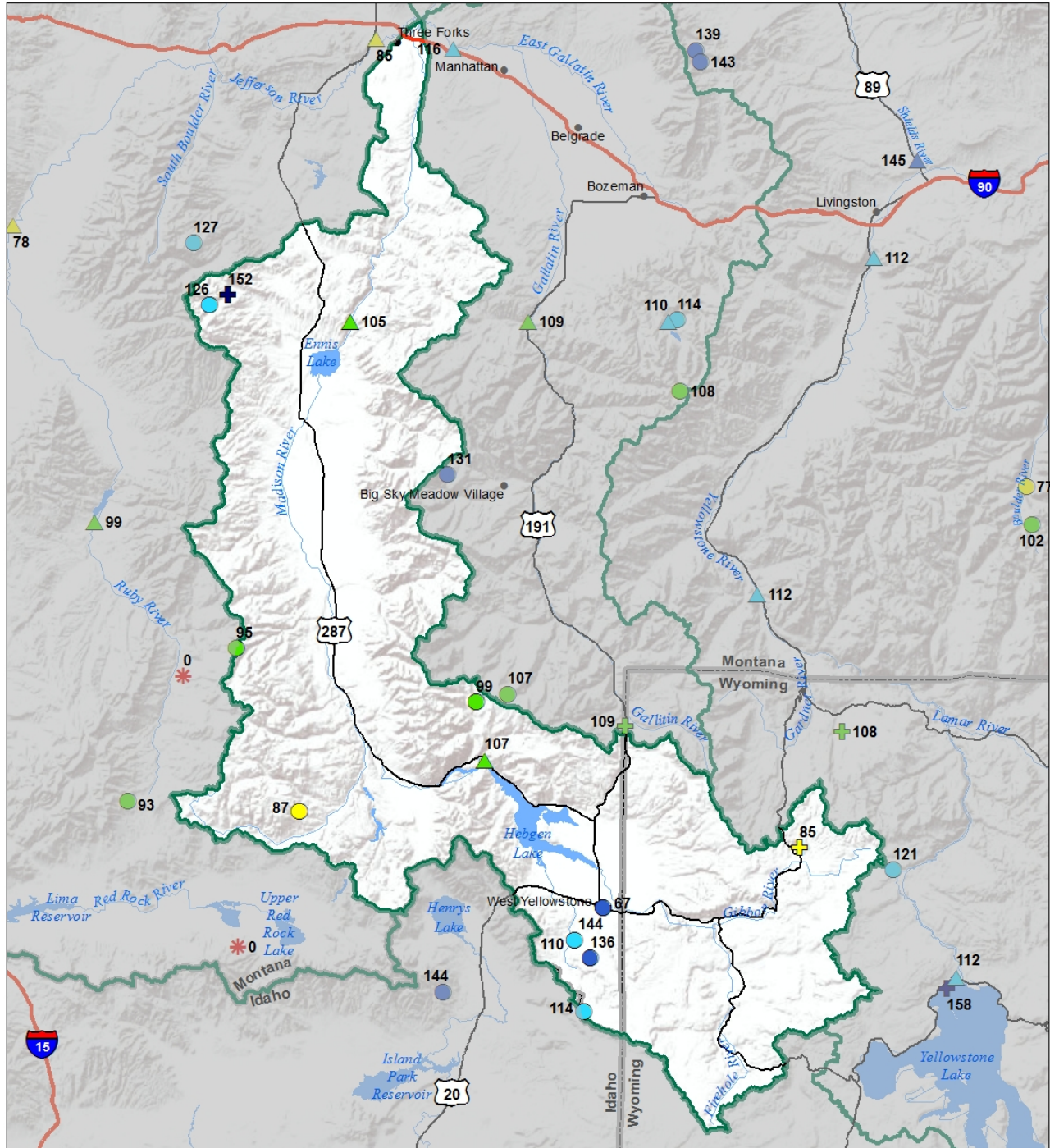


Legend

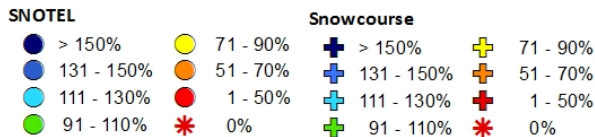


Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

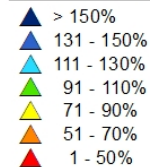
Madison River Basin Streamflow Forecast, Snow Water Equivalent Percentage of Normal May 1, 2019



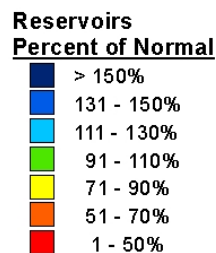
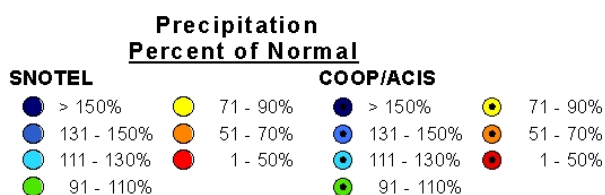
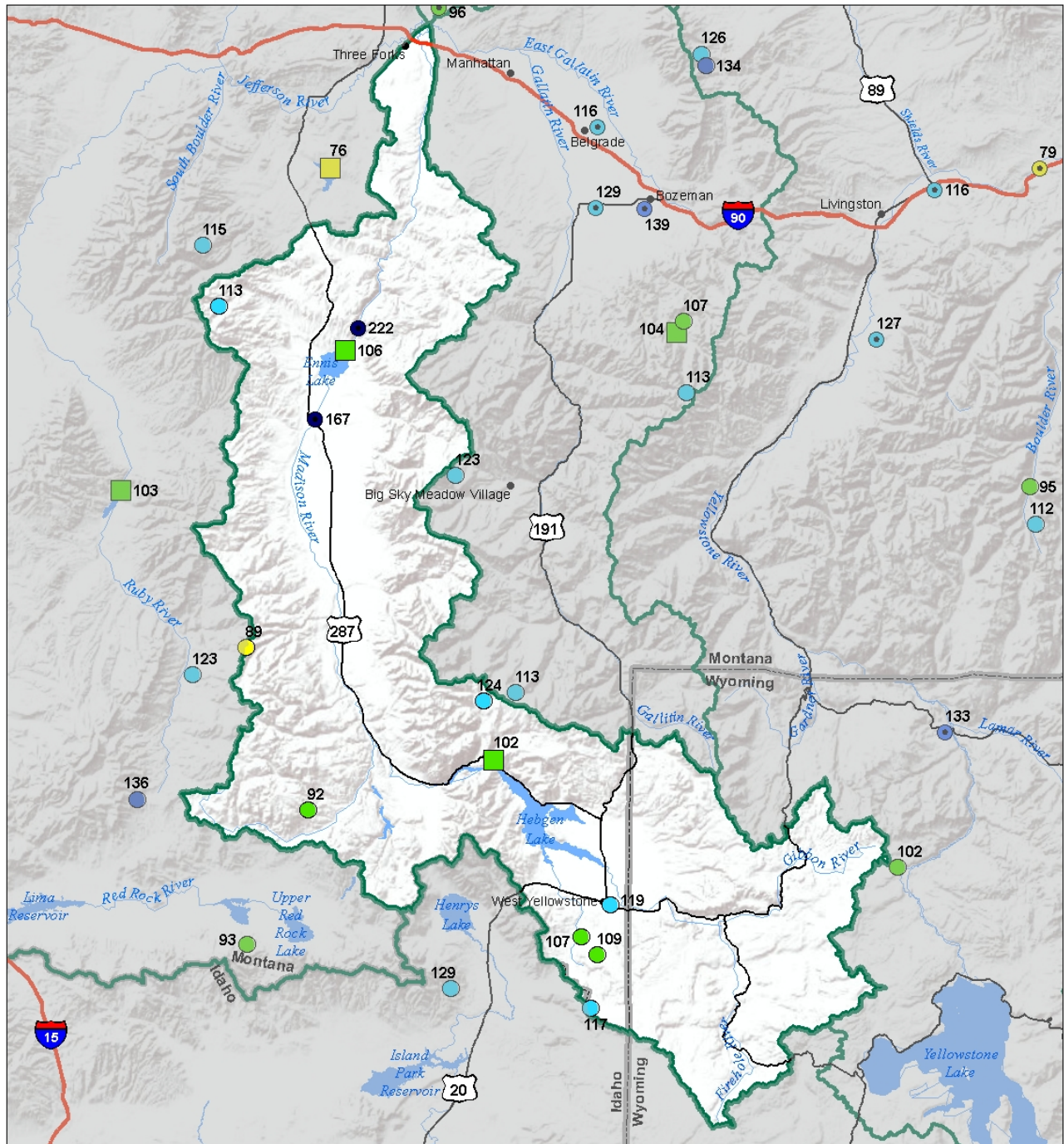
Snow Water Equivalent Percent of Normal



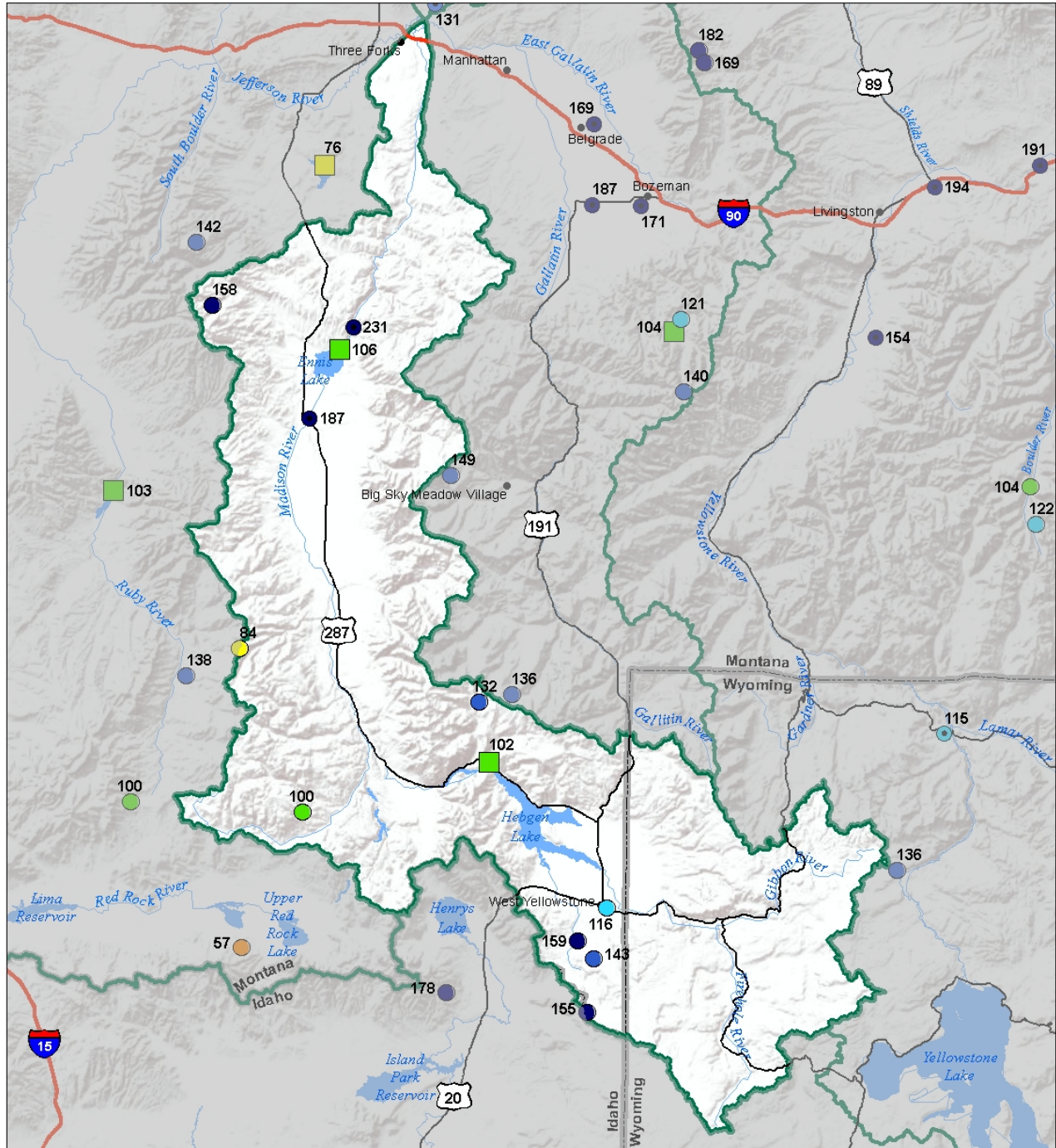
Streamflow Forecast Percent of Average Flows



Madison River Basin Water Year to Date Precipitation and Reservoir Levels Percentage of Normal May 1, 2019



Madison River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



Precipitation
Percent of Normal

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

COOP/ACIS

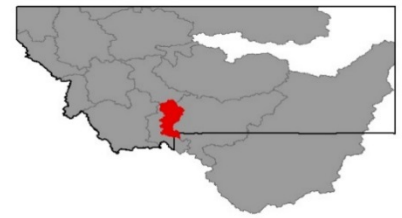
- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

Reservoirs
Percent of Normal

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%



Gallatin River Basin



Back and forth. March was extremely dry, April was extremely wet. Mountain SNOTEL sites reported 134% to 180% of average precipitation for the month, boosting water year precipitation totals to well above average on May 1st. The Gallatin Valley was unusually wet. Valley weather stations reported 2.7" to 4.0" of precipitation for the month, which was 170% to 190% of normal, and [the MSU Experimental Farm west of Bozeman experienced it's "wettest" April in 53 years of record](#). So, what does the snowpack look like in the mountains? The seasonal melt has begun at low and mid elevations, but deeper higher elevation snowpack monitoring sites in the Gallatin and Madison Ranges have not turned the corner yet and continued to gain snow water through the end of the month. This is not uncommon at these sites as normal seasonal peaks occur at these sites during the first week of May. Before beginning to melt, this year's seasonal peaks at SNOTEL sites were above normal at low and mid-elevation sites. High elevation sites have not peaked yet, and the forecasted cool and wet weather may cause future peaks in May. Which all leads to this, snowpack for this date is above normal at all monitoring sites within the basin for May 1st.

As you might expect, streamflow forecasts issued for the May 1st – July 31st period indicate near to slightly above average flows this spring and summer. However, that comes with the always present spring caveat. May and June precipitation are two of the biggest months with regards to annual precipitation in the Gallatin River basin, and should that fall-through, volumetric streamflows would be expected to be below forecasted levels. A few months of "normal" to finish runoff season off isn't too much to ask for, is it?

Gallatin River Basin Data Summary

Snowpack	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
UPPER GALLATIN	108%	136%
HYALITE	109%	148%
BRIDGER	140%	187%
Basin-Wide Snowpack	115%	148%

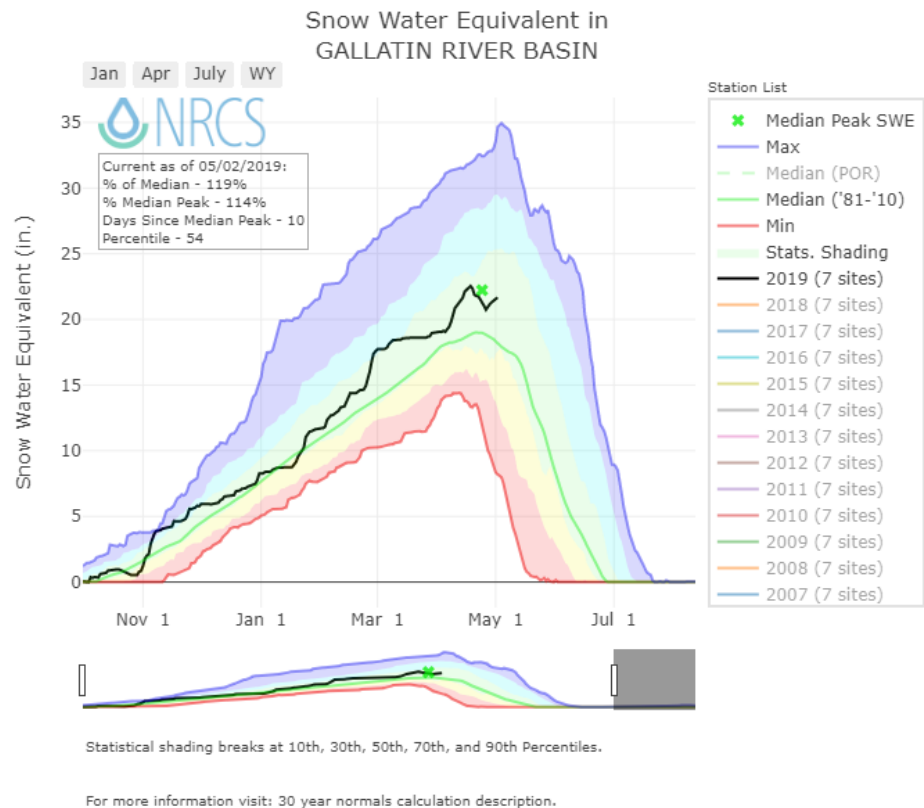
Precipitation	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	149%	120%	129%
Valley Precipitation	170%	130%	143%
Basin-Wide Precipitation	151%	121%	130%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

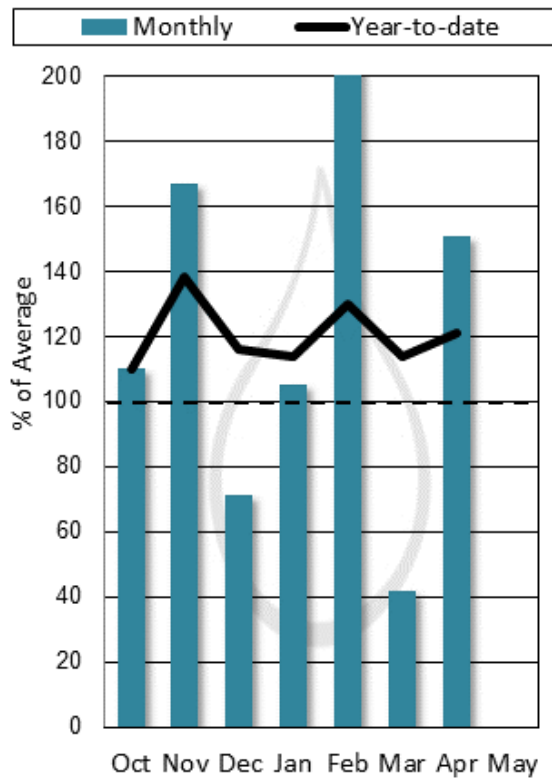
Reservoir Storage	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	104%	63%	107%

*See Reservoir Storage Table for storage in individual reservoirs

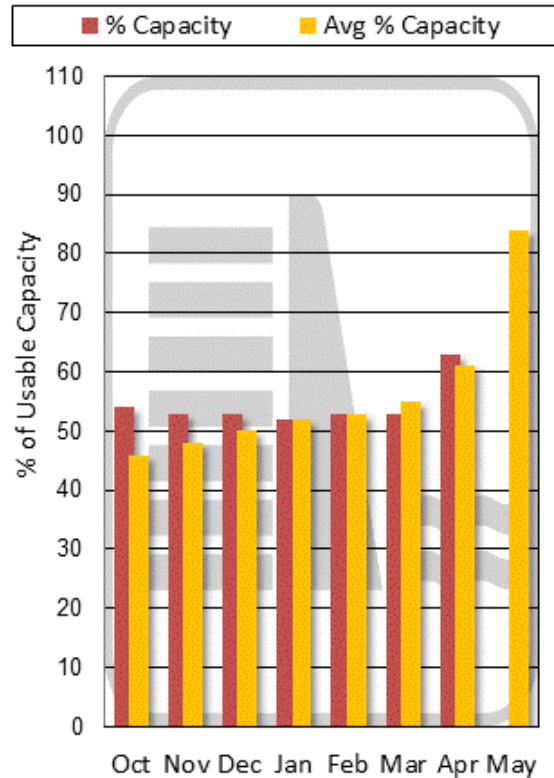
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation



End of Month Reservoir Storage



Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

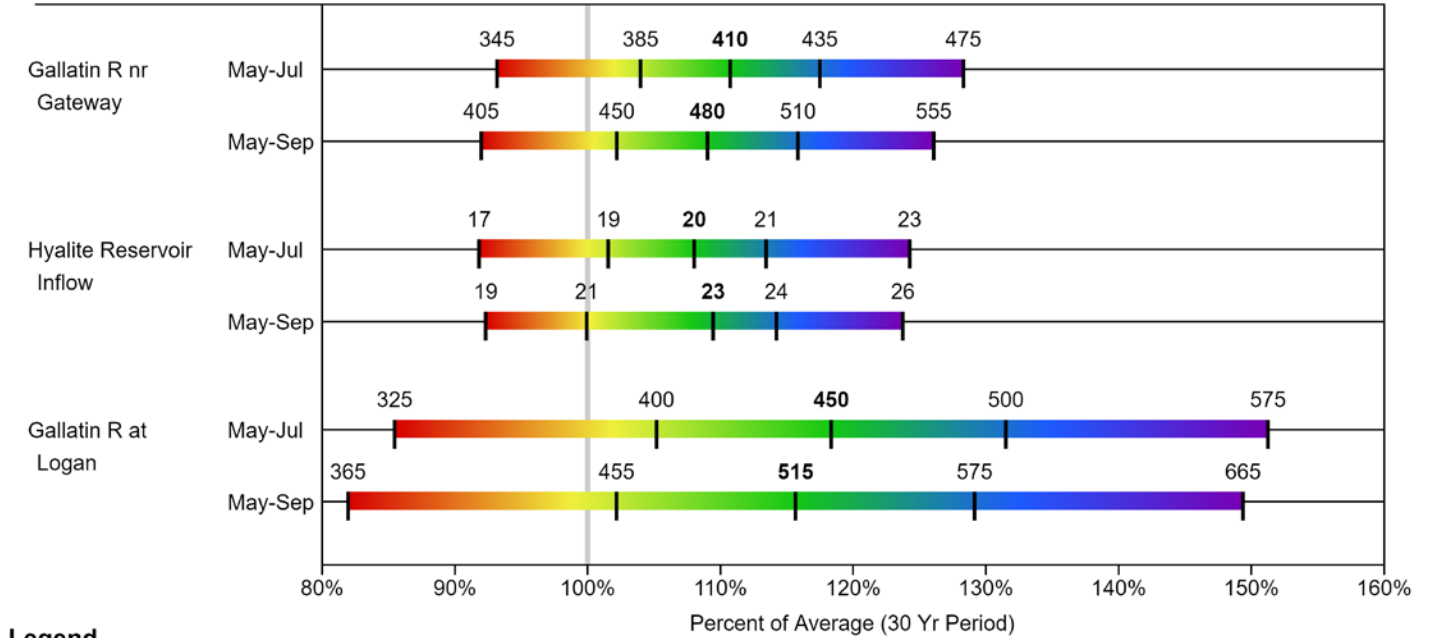
GALLATIN RIVER BASIN

Water Supply Forecasts

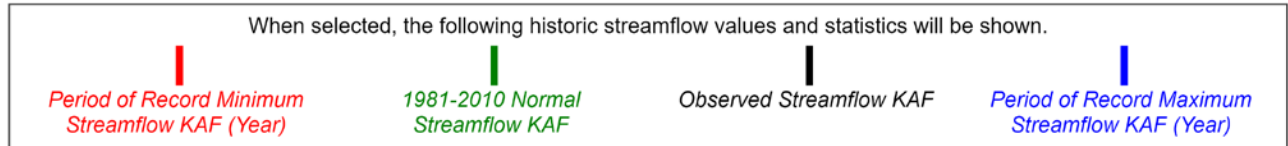
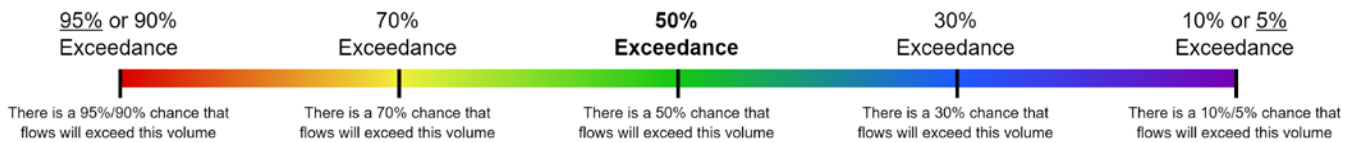
May 1, 2019

Forecast Exceedance Probabilities

<----- Drier ----- Future Conditions ----- Wetter ----->
 Labels on chart represent volumes of water expressed in thousand acre-feet.

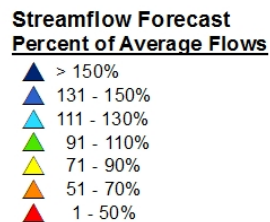
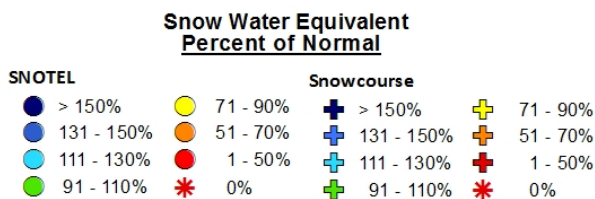
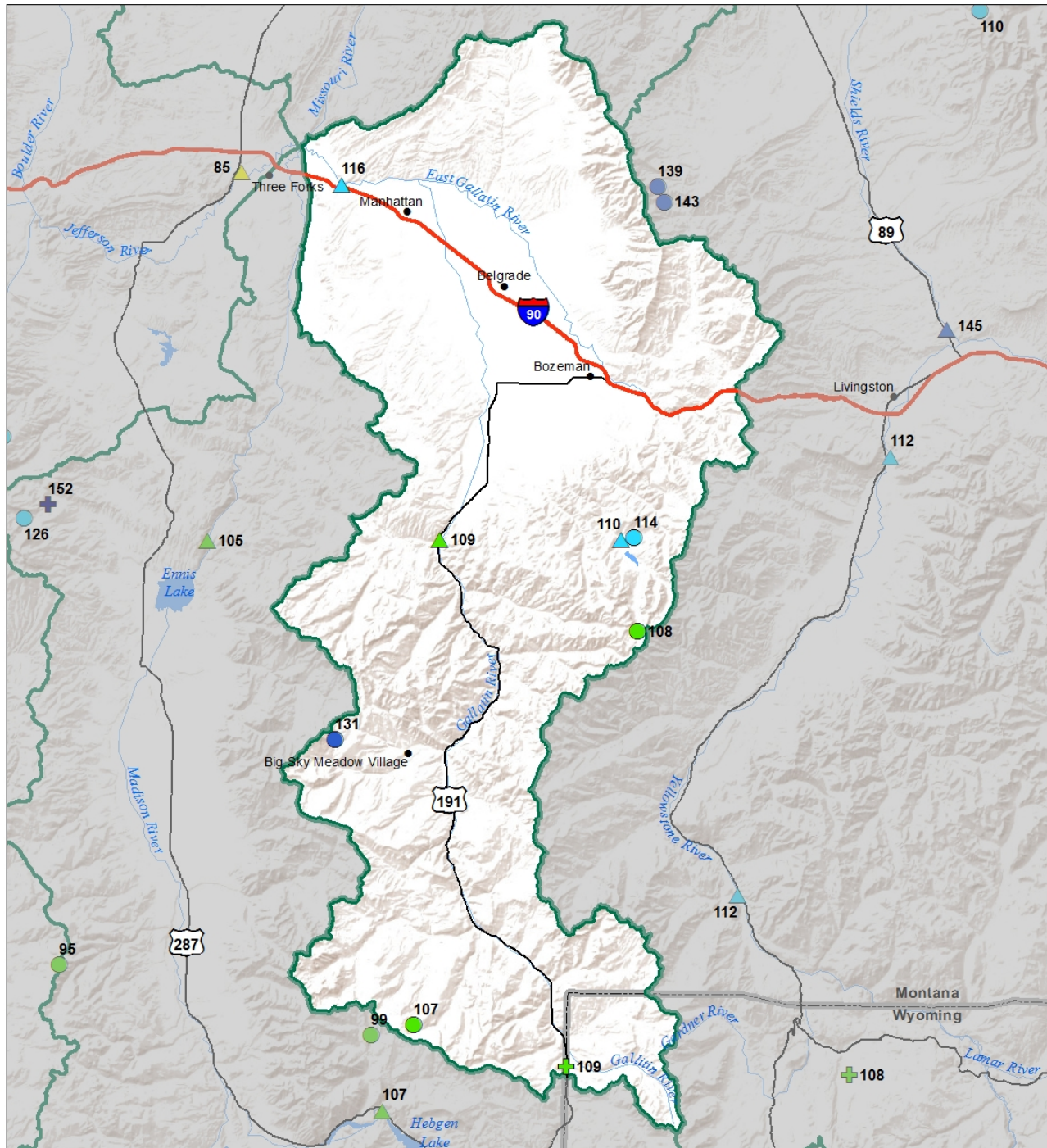


Legend

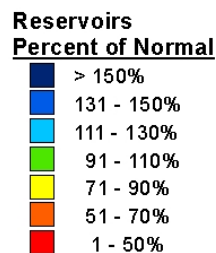
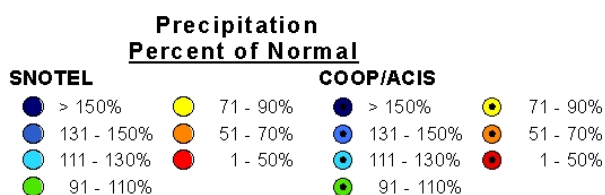
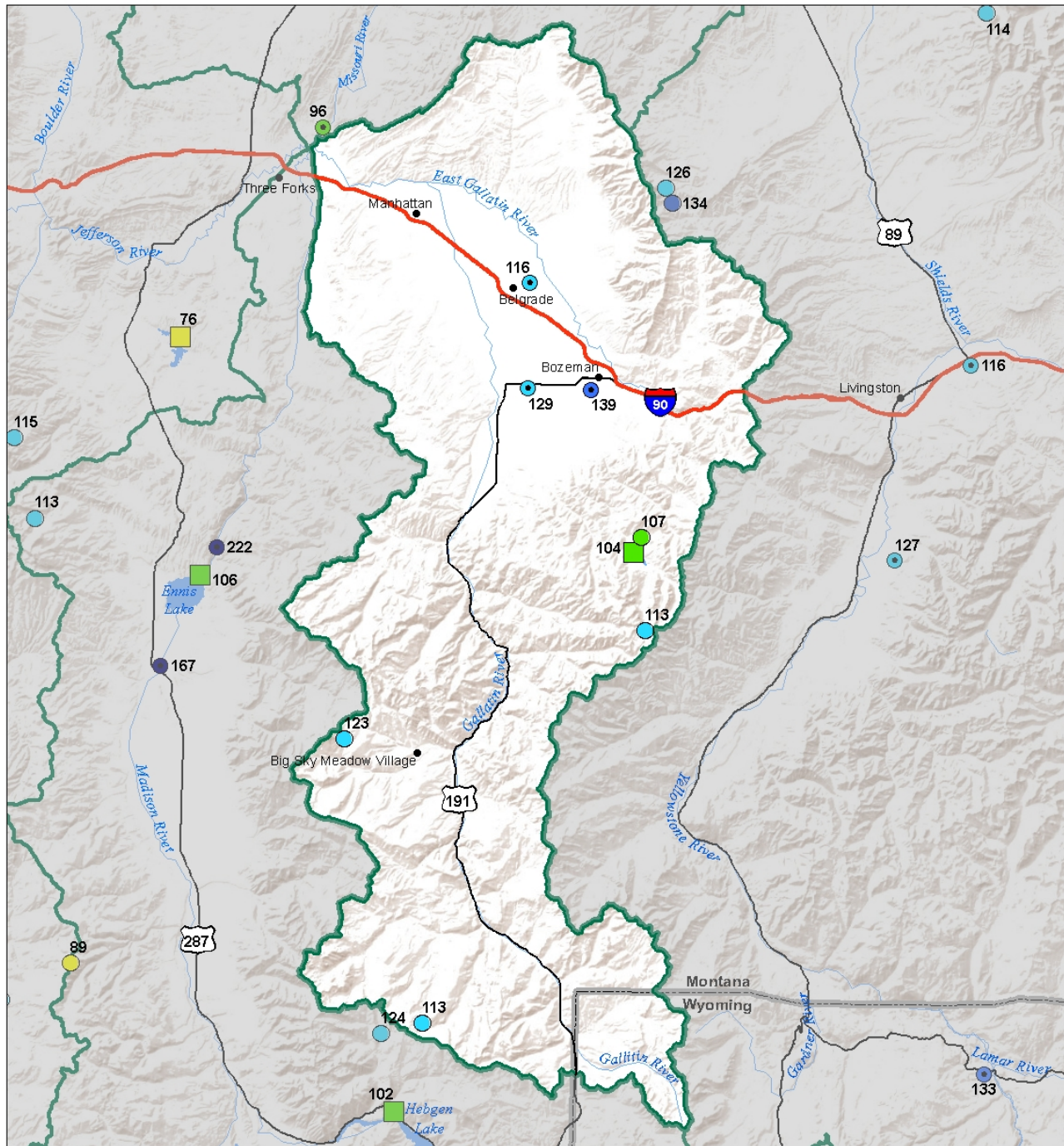


Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

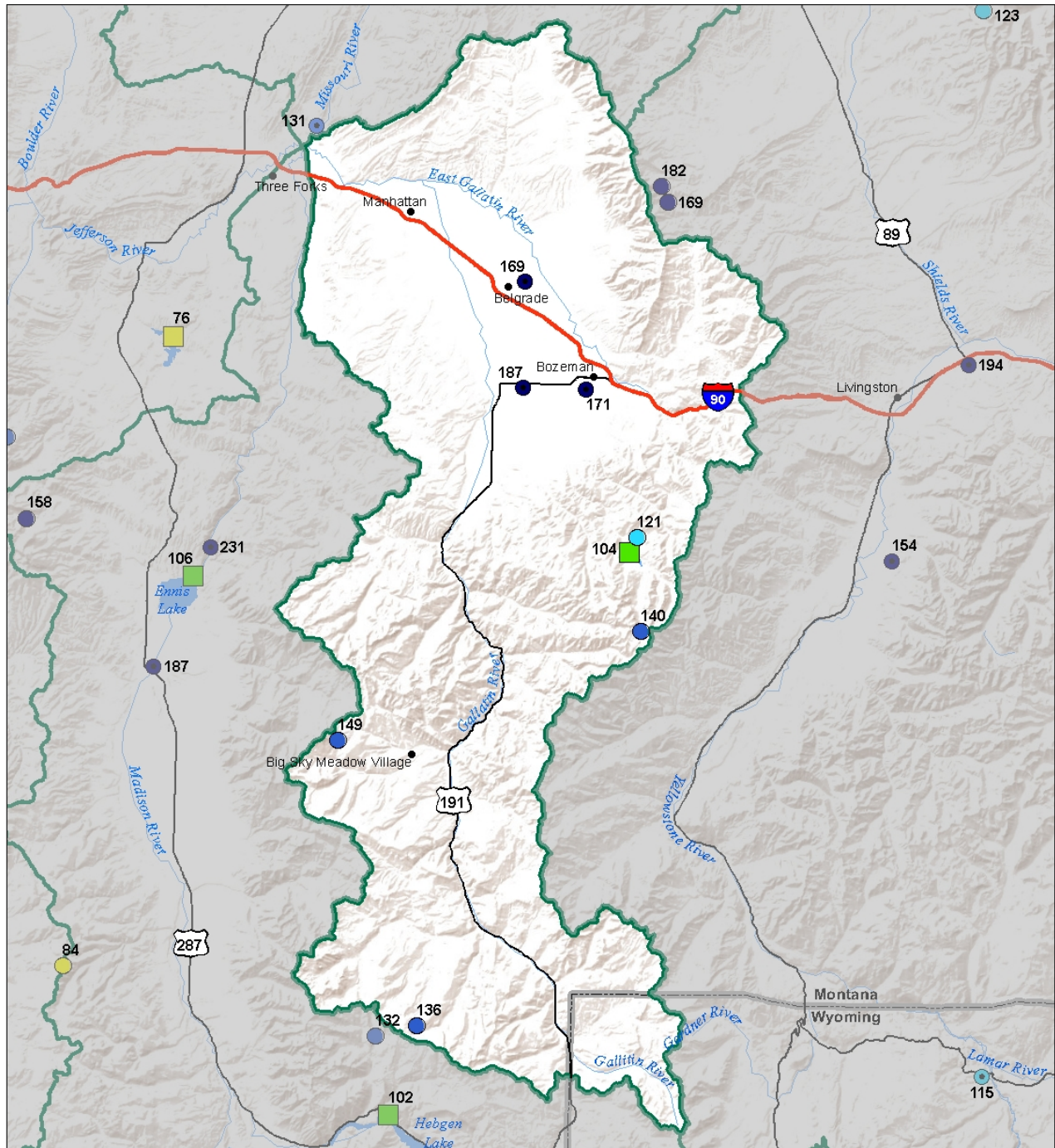
**Gallatin River Basin
Streamflow Forecast, Snow Water Equivalent
Percentage of Normal
May 1, 2019**



Gallatin River Basin
Water Year to Date Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019



Gallatin River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



Precipitation
Percent of Normal

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

COOP/ACIS

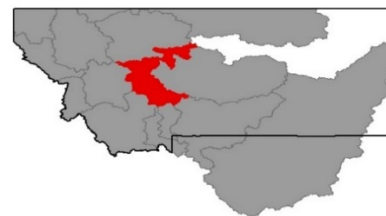
- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

- 71 - 90%
- 51 - 70%
- 1 - 50%

Reservoirs
Percent of Normal

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%





Headwaters Mainstem (Missouri) River Basin

A wise water manager once said, “There’s no such thing as an average year. There is a lot of variability, a year falls on one side or the other, but it is never average”. It’s an especially relevant saying for this winter and spring. It should come as no surprise at this point, after an extremely dry March, April ended up being well above average for monthly precipitation at valley monitoring sites. Valley precipitation ranged from 131% to 151% of average for the month, while mountain locations received average to slightly above average precipitation. The bulk of this water fell during a two-week period in the middle of the month when an active weather pattern delivered storms to the state. Mountain locations gained snow water through the middle of the month at mid-elevation SNOTEL sites, while high elevation sites continued to gain through the end of the month. Low and mid-elevations experienced water year peaks during late March to mid-April, peaking above normal for the year. High elevations continue to hold water and may experience future peaks. Snowpack for May 1st is above normal at all monitoring sites except the Tizer Basin SNOTEL site, which is only slightly below.

Streamflow forecasts for the May 1st – July 31st period indicate near to above average flows in most rivers and streams in the region. Spring precipitation contributes a significant amount of water, so the next month or two dictate overall runoff volumes and timing.

Headwaters Missouri Mainstem River Basin Data Summary

Snowpack	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
HEADWATERS MAINSTEM	118%	182%
Basin-Wide Snowpack	% Median%	Last Year % Median%

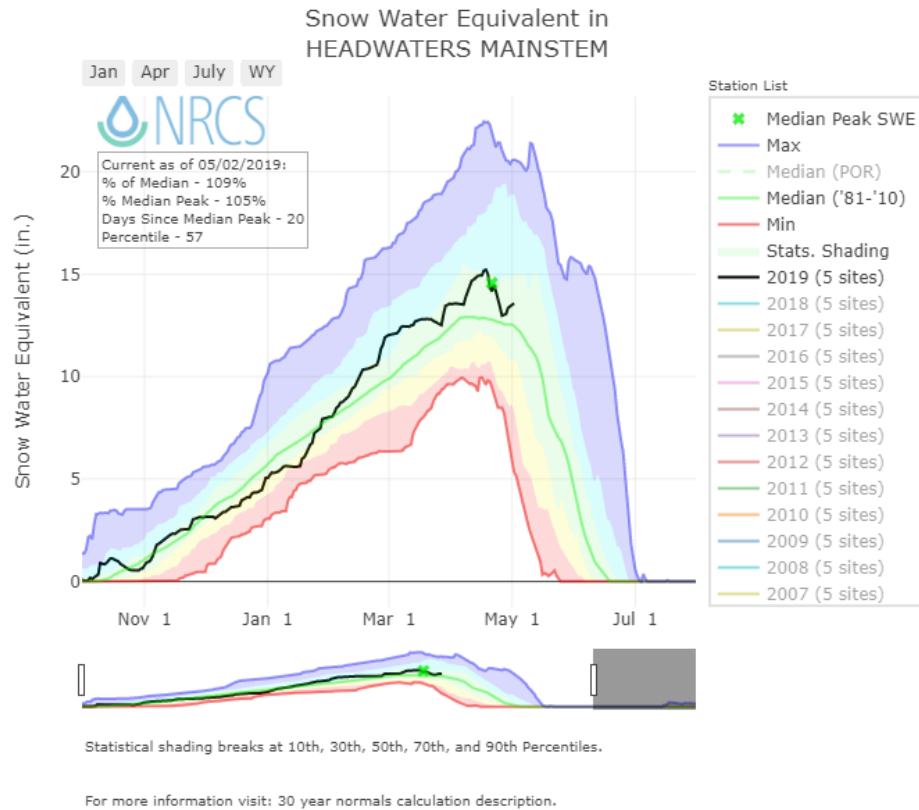
Precipitation	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	111%	110%	131%
Valley Precipitation	129%	156%	199%
Basin-Wide Precipitation	112%	112%	134%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

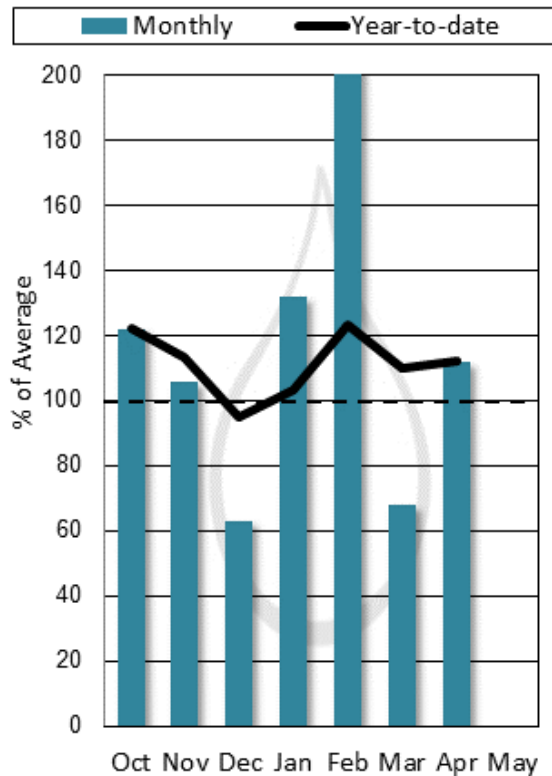
Reservoir Storage	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	122%	86%	120%

*See Reservoir Storage Table for storage in individual reservoirs

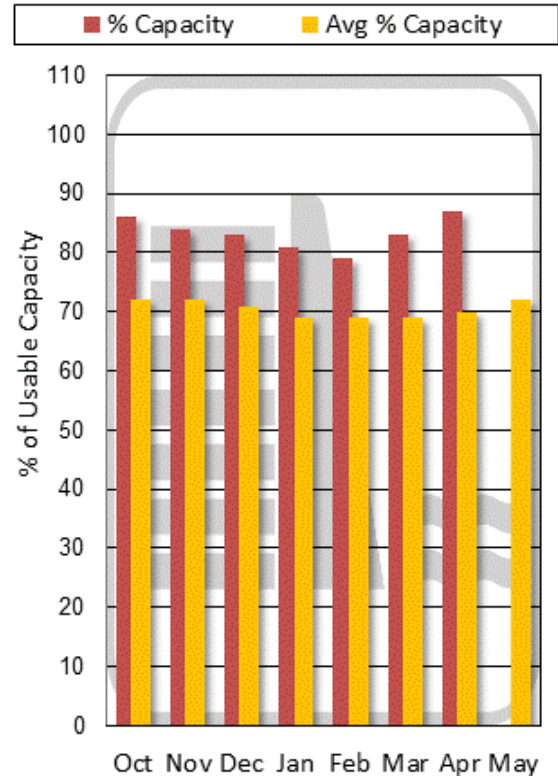
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation



End of Month Reservoir Storage



Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

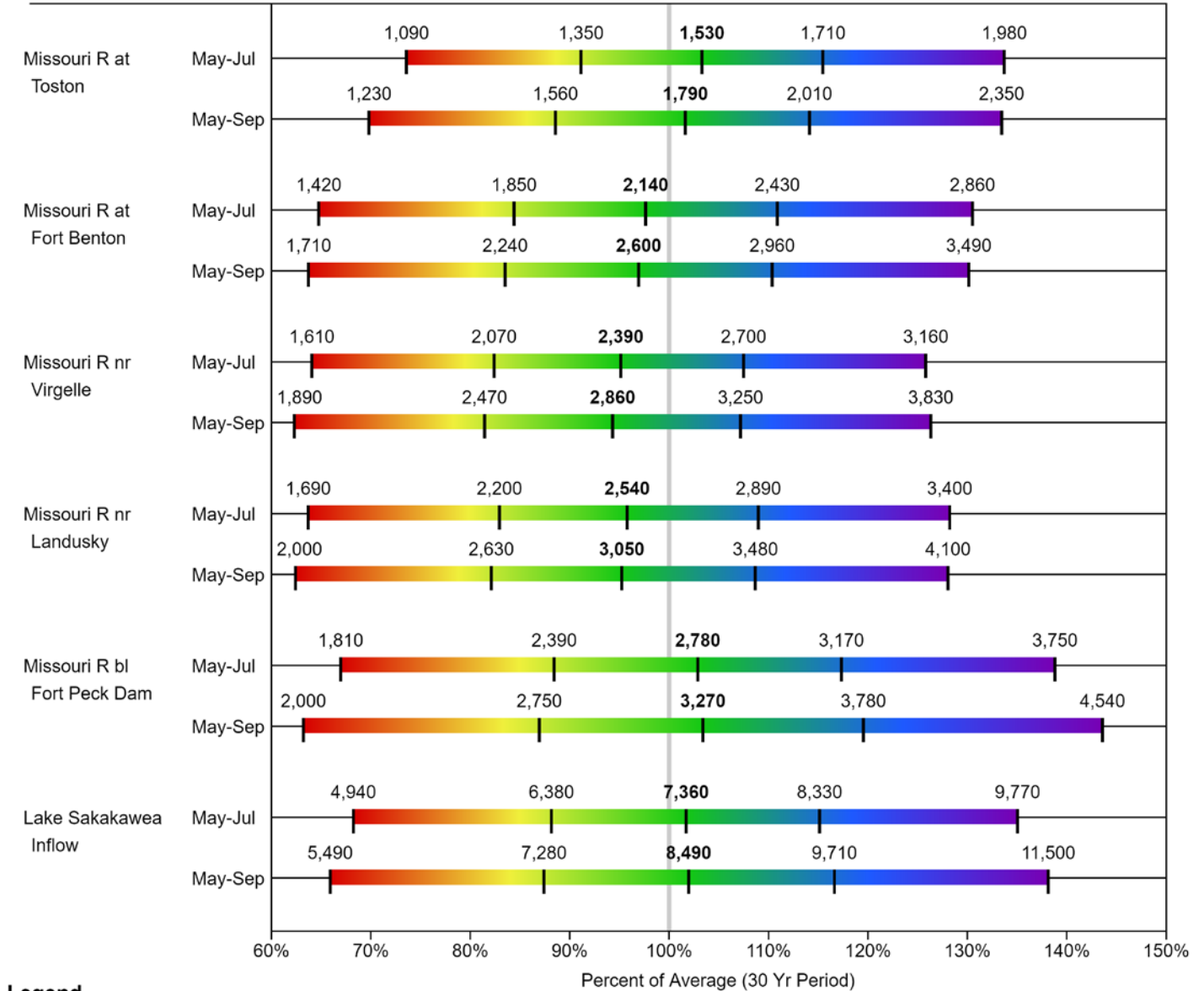
MISSOURI MAINSTEM BASIN

Water Supply Forecasts

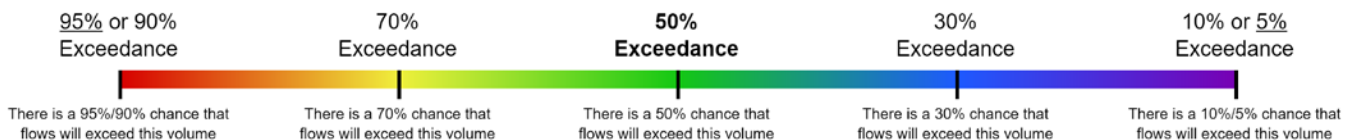
May 1, 2019

Forecast Exceedance Probabilities

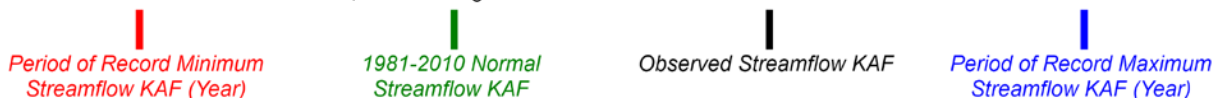
<----- Drier ----- Future Conditions ----- Wetter ----->
Labels on chart represent volumes of water expressed in thousand acre-feet.



Legend

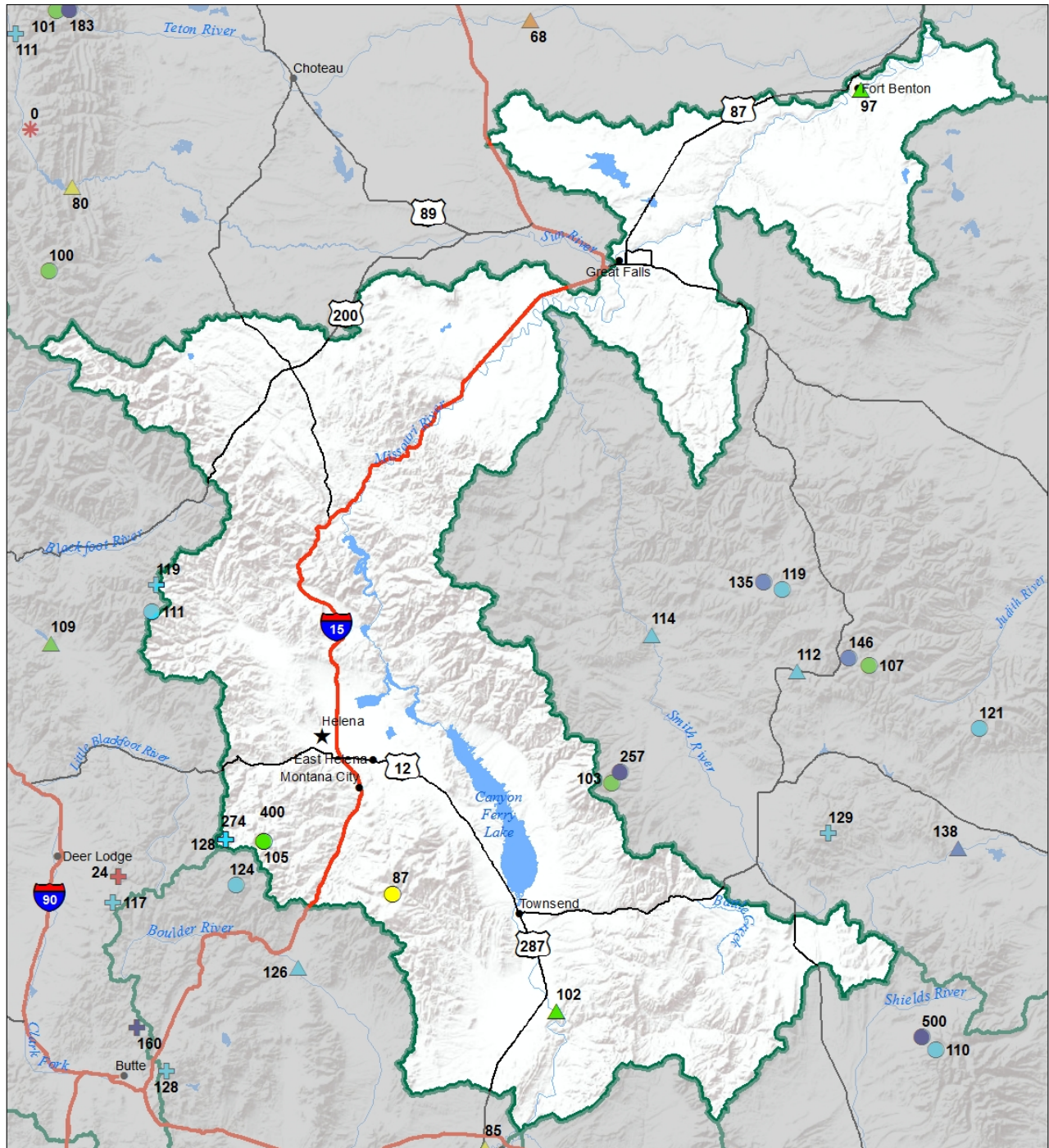


When selected, the following historic streamflow values and statistics will be shown.



Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

Headwaters Mainstem (Missouri) River Basin Streamflow Forecast, Snow Water Equivalent Percentage of Normal May 1, 2019

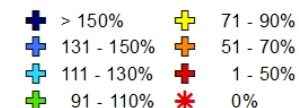


Snow Water Equivalent Percent of Normal

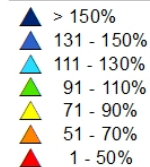
SNOTEL



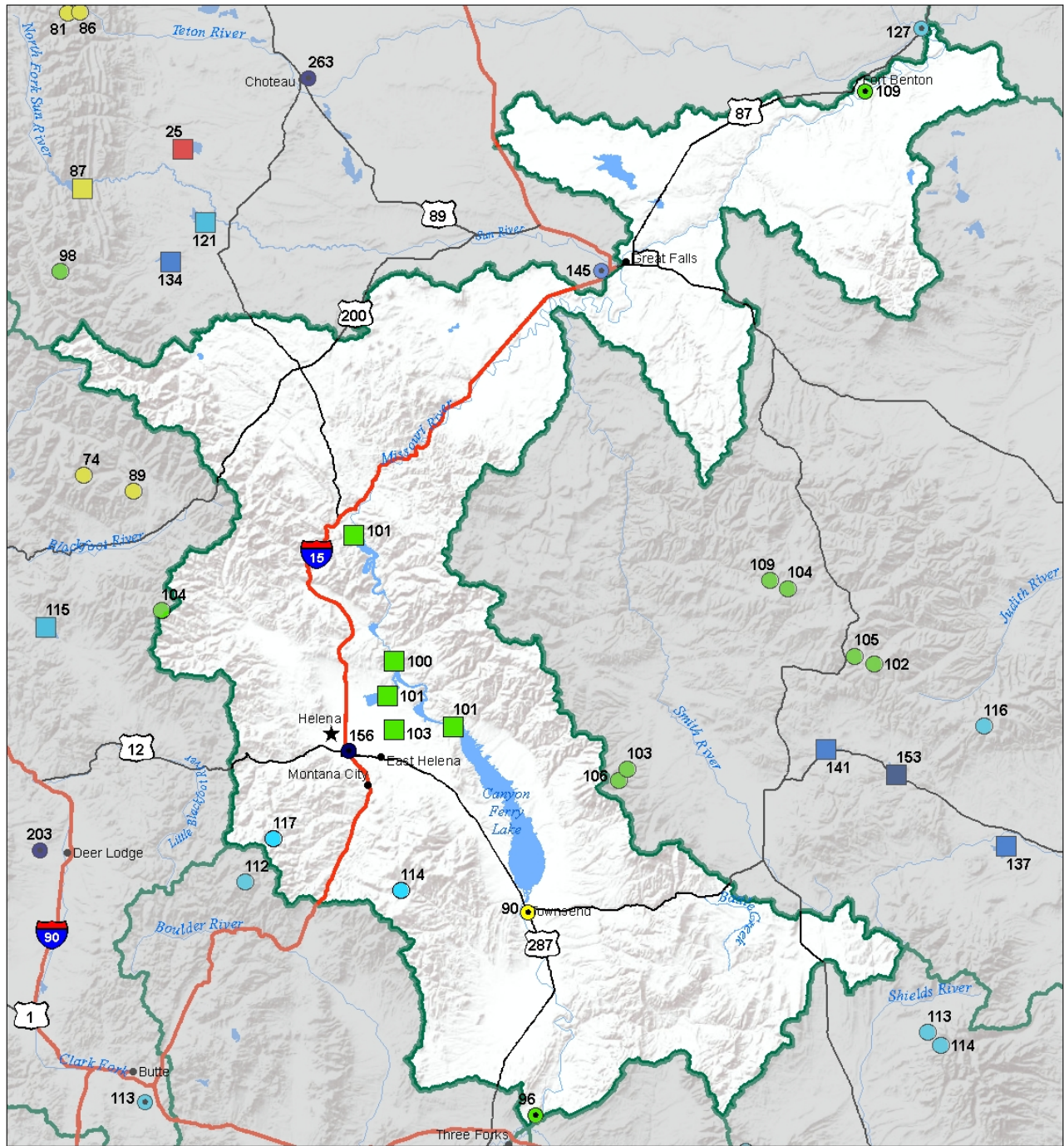
Snowcourse



Streamflow Forecast Percent of Average Flows



Headwaters Mainstem (Missouri) River Basin Water Year to Date Precipitation and Reservoir Levels Percentage of Normal May 1, 2019



Precipitation Percent of Normal

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

- 71 - 90%
- 51 - 70%
- 1 - 50%

COOP/ACIS

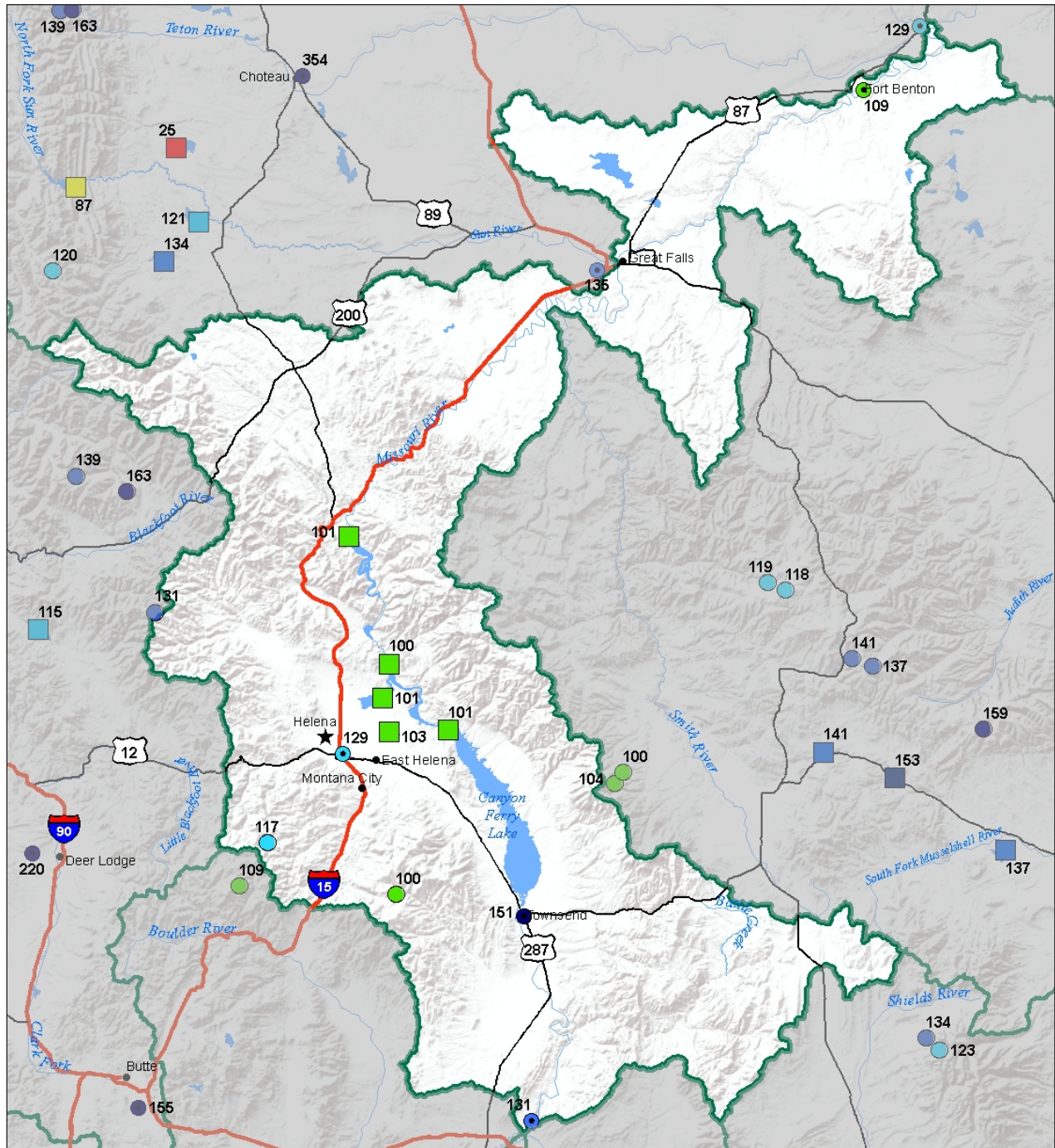
- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%

Reservoirs Percent of Normal

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%



Headwaters Mainstem (Missouri) River Basin Monthly Precipitation and Reservoir Levels Percentage of Normal May 1, 2019 (April 1, 2019 - May 1, 2019)



Precipitation Percent of Normal

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

COOP/ACIS

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

Reservoirs Percent of Normal

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%



Smith-Judith-Musselshell River Basin



Above average snowpack still resides in the Big and Little Belts, Castles, Crazy's and Big Snowy Mountains, with lower elevation sites holding on to deep snowpacks later than usual. Last weekend's storm blanketed the region and was especially beneficial to the Big Snowy's, bringing over a foot of snow to the range, bumping snow totals from 84% of normal to near average. Basin-wide reservoir storage is also above average, which sets the stage for a favorable runoff season as long as a consistent weather pattern persists: a slow warm up allowing mountain snowpack to melt gradually along with average precipitation in the upcoming months. Last year, the month of May brought unseasonably warm temperatures eating away at what would otherwise be a big snow water year, but instead turned into an average runoff year, after the flooding subsided. Fingers crossed for the exact opposite- slow and steady melt off.

Streamflow forecasts issued for the May 1st – July 31st period are well average across the basin. However, spring and early precipitation play a large role in the summer flows in this region, so uncertainty remains on just how much will be received. For now, with reservoir storage well above average and streamflow forecasts indicating above adequate flows, water users are in good shape on May 1st.

Smith Judith Musselshell River Basin Data Summary

Snowpack	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
SMITH	123%	138%
HIGHWOOD	%	%
JUDITH	104%	131%
MUSSELSHELL	137%	180%
Basin-Wide Snowpack	117%	140%

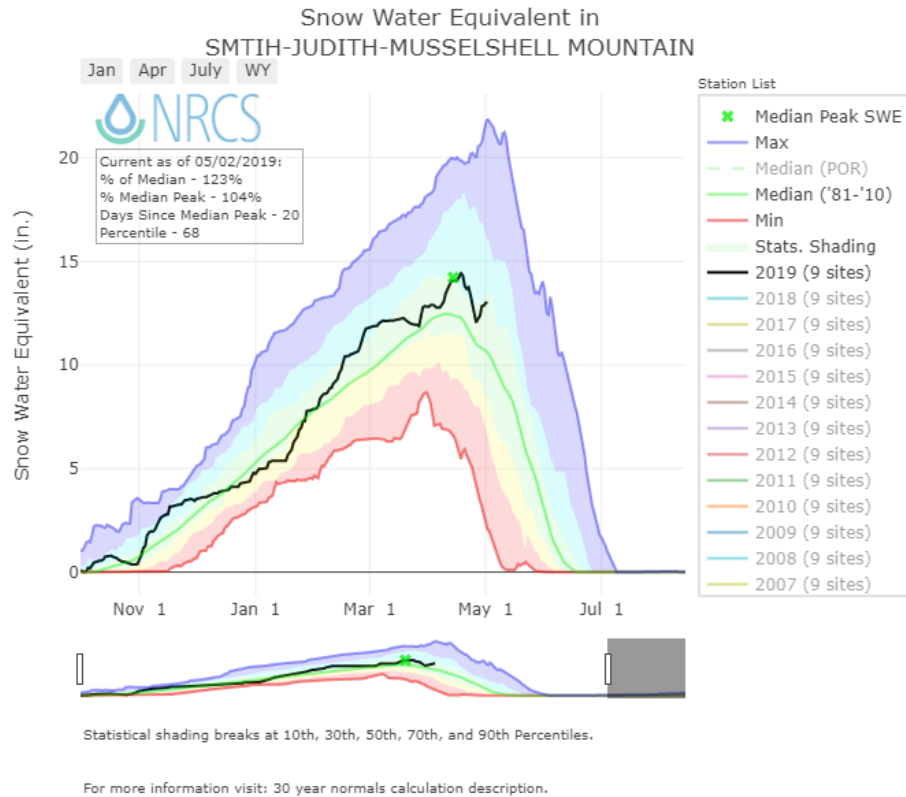
Precipitation	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	125%	107%	114%
Valley Precipitation	161%	122%	135%
Basin-Wide Precipitation	130%	108%	116%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

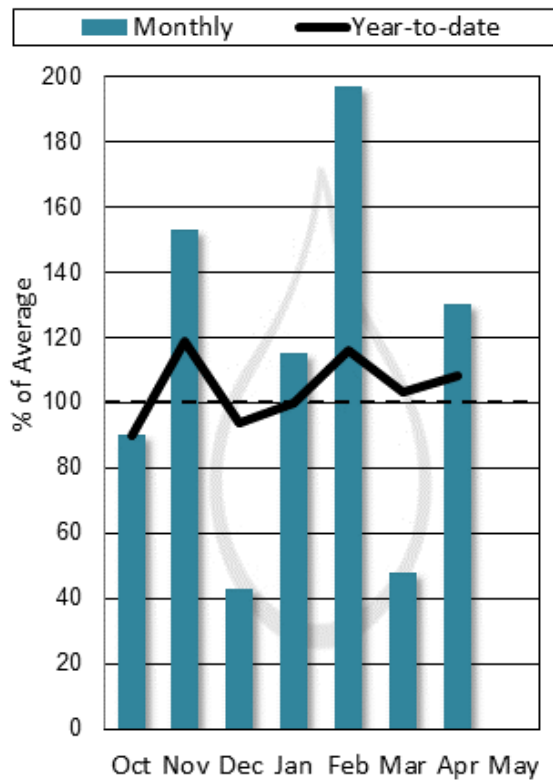
Reservoir Storage	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	142%	93%	131%

*See Reservoir Storage Table for storage in individual reservoirs

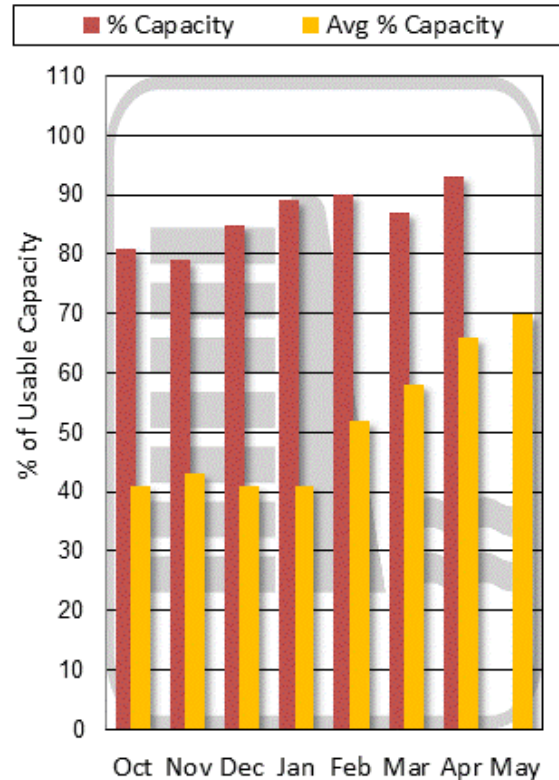
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation



End of Month Reservoir Storage



Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

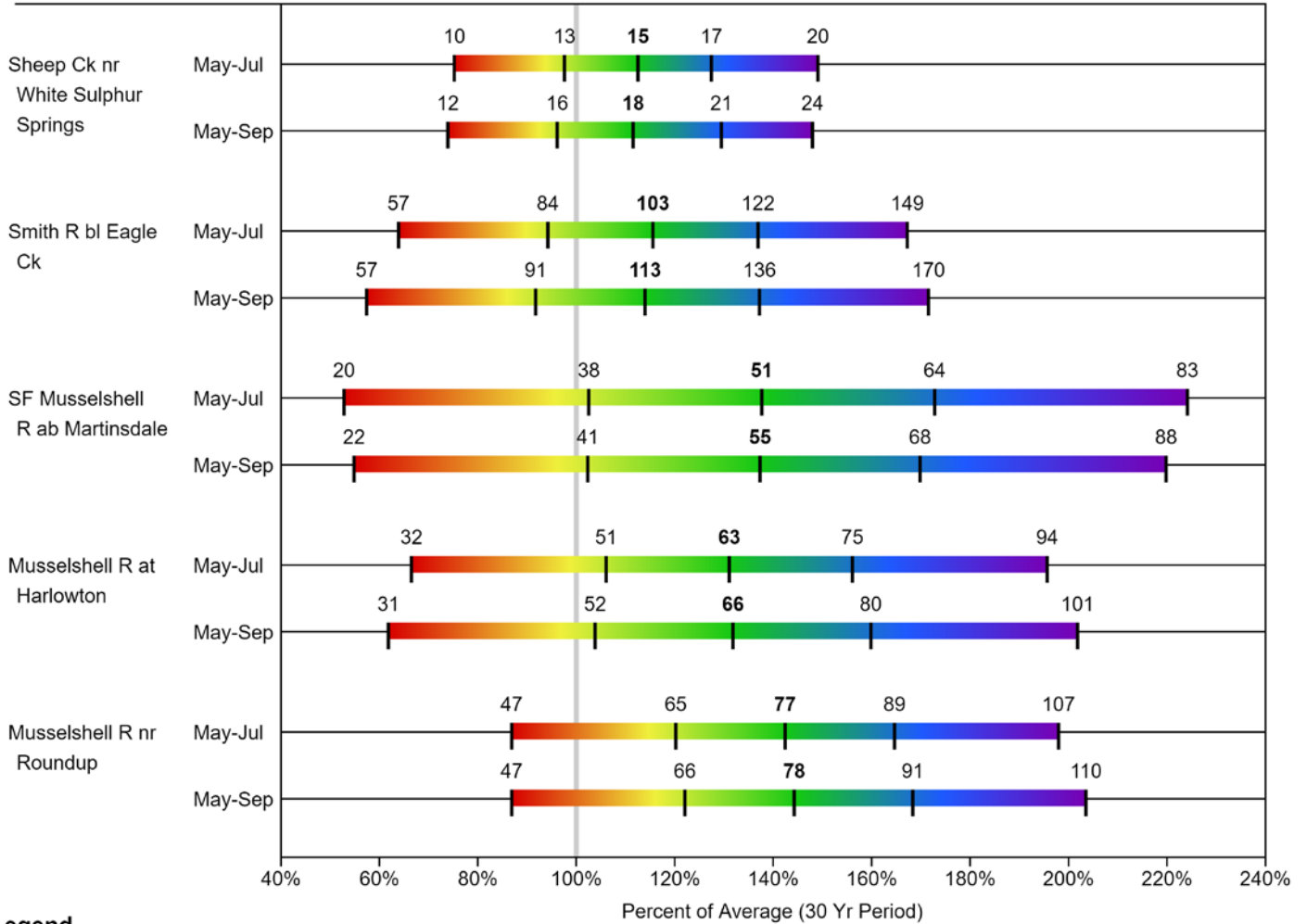
SMITH-JUDITH-MUSSELSHELL

Water Supply Forecasts

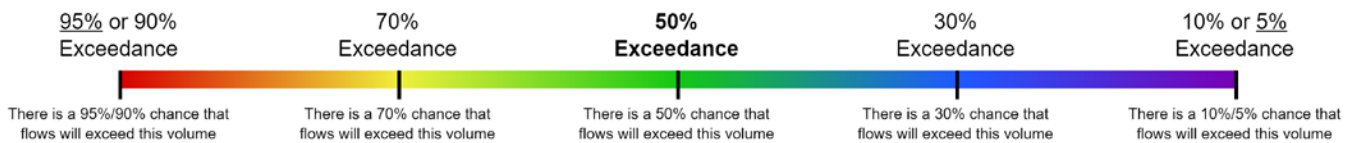
May 1, 2019

Forecast Exceedance Probabilities

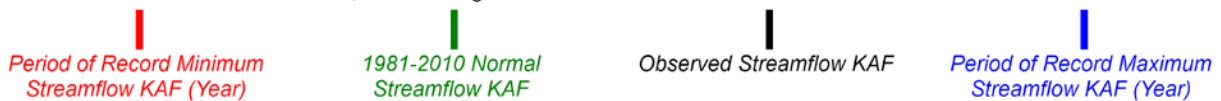
<----- Drier ----- Future Conditions ----- Wetter ----->
Labels on chart represent volumes of water expressed in thousand acre-feet.



Legend

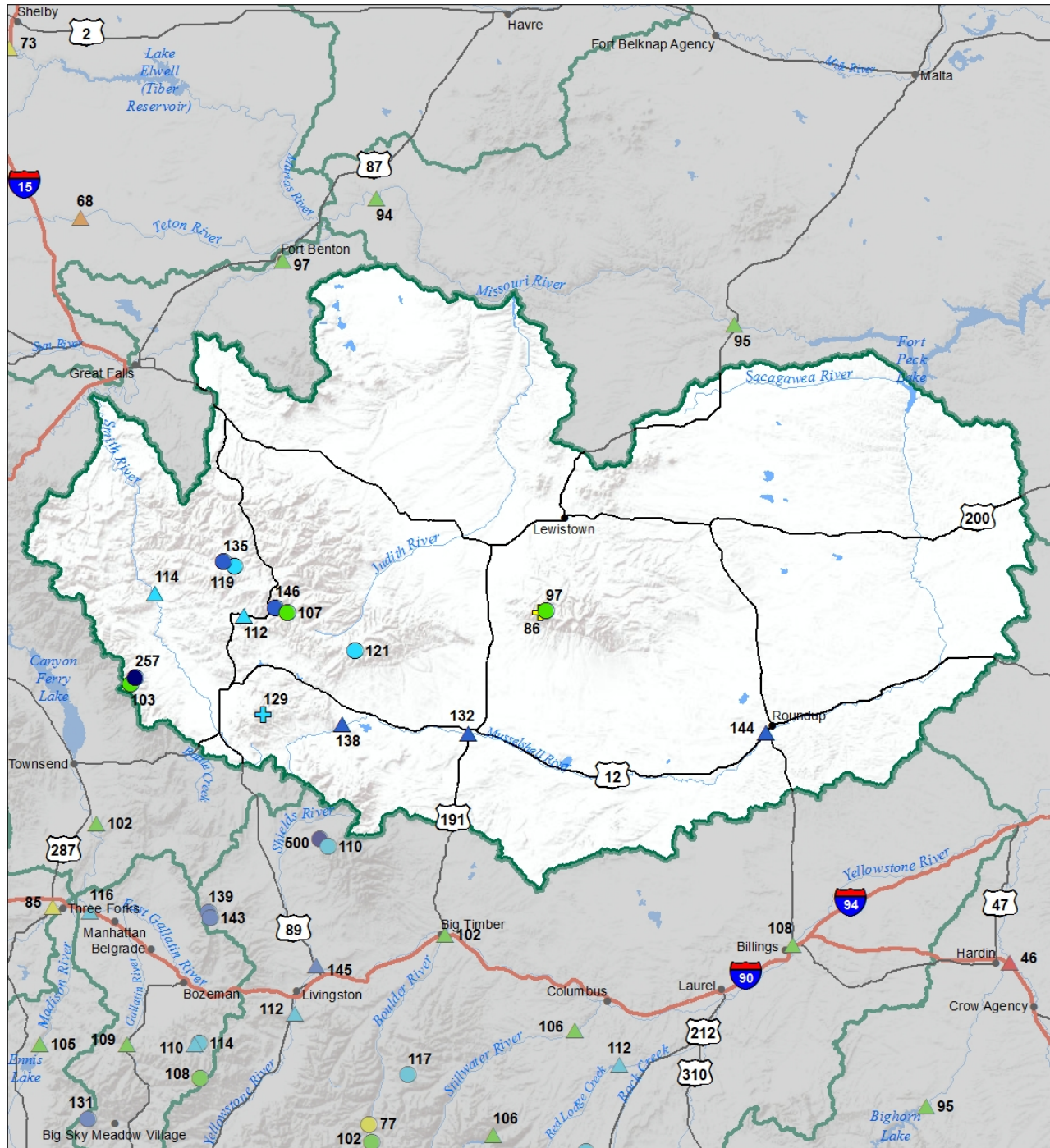


When selected, the following historic streamflow values and statistics will be shown.

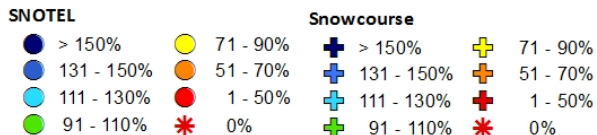


Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

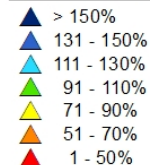
Smith-Judith-Musselshell River Basin Streamflow Forecast, Snow Water Equivalent Percentage of Normal May 1, 2019



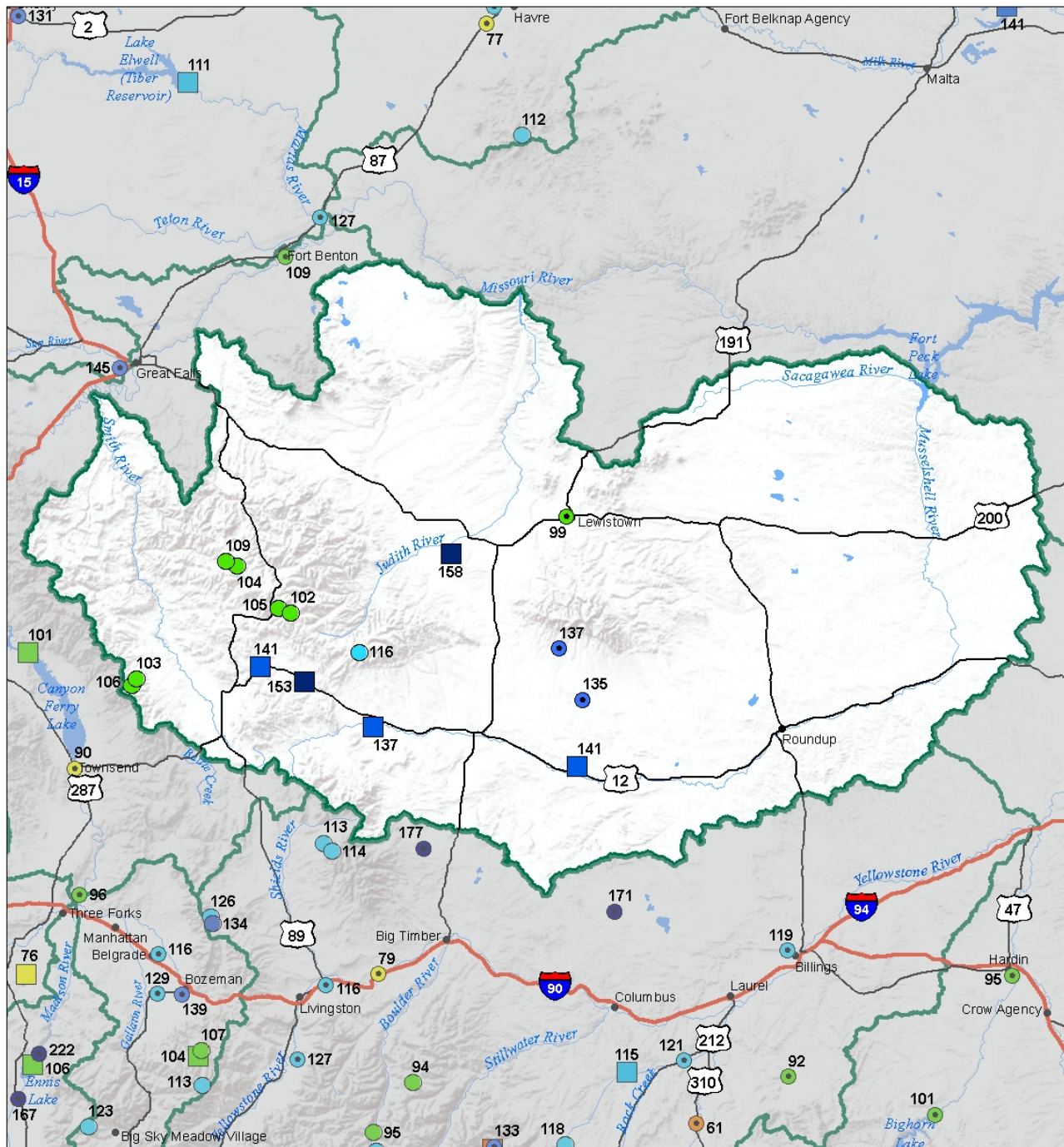
Snow Water Equivalent Percent of Normal



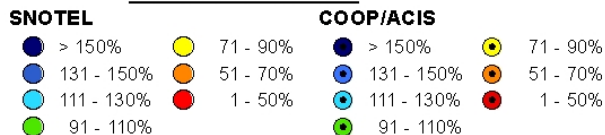
Streamflow Forecast Percent of Average Flows



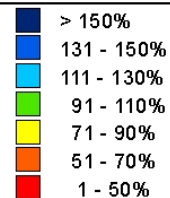
Smith-Judith-Musselshell River Basin
Water Year to Date Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019



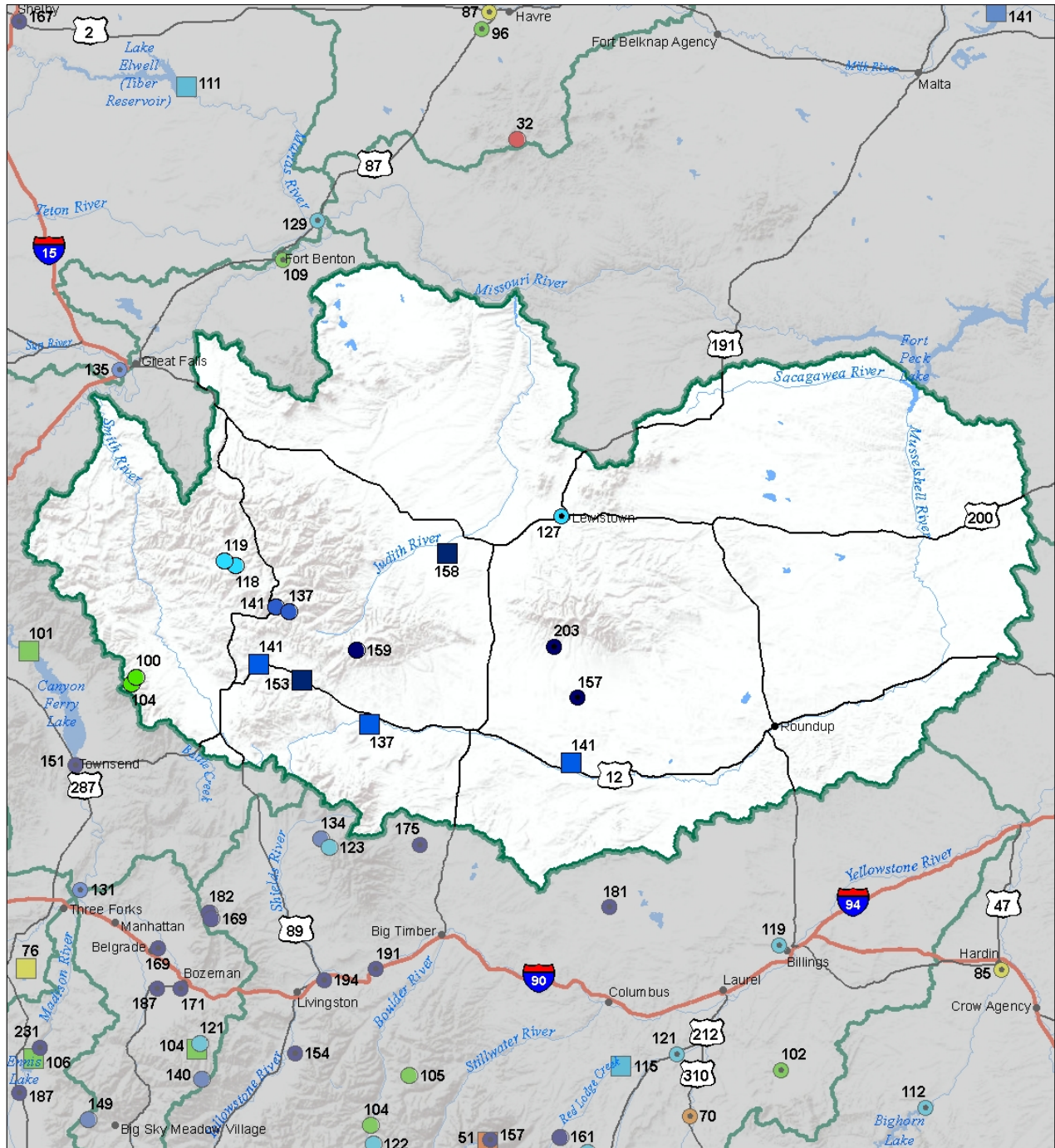
Precipitation
Percent of Normal



Reservoirs
Percent of Normal



Smith-Judith-Musselshell River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



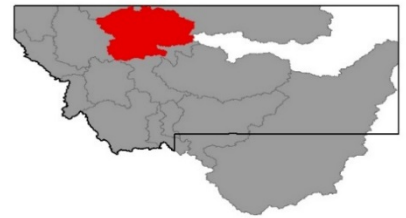
**Precipitation
Percent of Normal**

SNOTEL		COOP/ACIS	
●	> 150%	●	> 150%
●	131 - 150%	●	131 - 150%
●	111 - 130%	●	111 - 130%
●	91 - 110%	●	91 - 110%
●	71 - 90%	●	71 - 90%
●	51 - 70%	●	51 - 70%
●	1 - 50%	●	1 - 50%

**Reservoirs
Percent of Normal**

	> 150%
	131 - 150%
	111 - 130%
	91 - 110%
	71 - 90%
	51 - 70%
	1 - 50%





Sun-Teton-Marias River Basin

The front range snowpack is near normal to above normal in the Sun, Teton and Marias basins. After a record-setting dry March at some sites, April brought abundant valley precipitation accompanied by above normal mountain snowfall. Low elevation snowpack continues to dominate the story in the Teton River basin, as snowpack monitoring sites throughout the region are boasting upwards of ~140-180% of normal snowpack in comparison to higher elevation sites that are near normal. This low elevation snowpack will play a vital role in this spring's runoff season. Too warm too quick, and it will blow past water users before they have a chance to utilize it, thus leaving us reliant on higher elevation snowpack storage. On the other hand, a slow and steady melt off with average temperatures and precipitation would allow reservoir managers to hold back the bulk of low elevation snow runoff, sustaining flows until the higher elevation snow begins to contribute to the system. It's an icing on the cake scenario as reservoir storage is already slightly above average, but May and June will spell out how all this unfolds.

Streamflow forecasts issued for the May 1st – July 31st period may seem somewhat disconnected from snowpack totals and are below average for most location in the basin. This is due in large part to the well below average water year precipitation at mountain locations. Spring and early precipitation is the dominant driver of flows in this region, so uncertainty remains on just how much will be received.

Sun-Teton-Marias River Basin Data Summary

Snowpack	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
SUN	101%	233%
TETON	121%	178%
MARIAS	97%	165%
Basin-Wide Snowpack	103%	193%

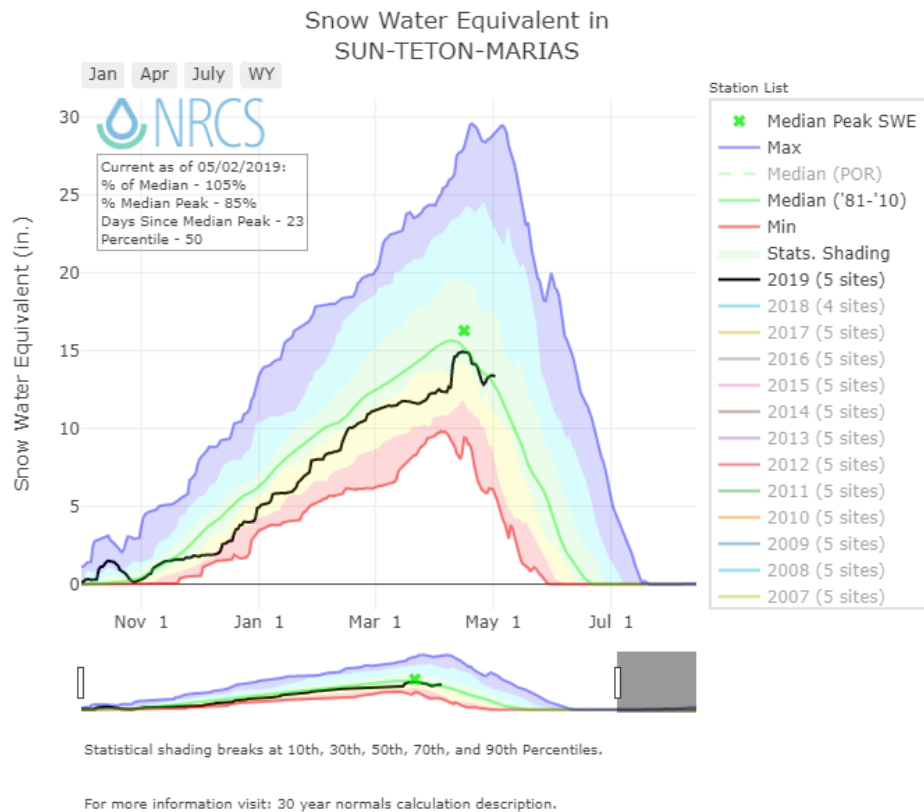
Precipitation	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	134%	88%	128%
Valley Precipitation	266%	222%	221%
Basin-Wide Precipitation	147%	94%	133%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

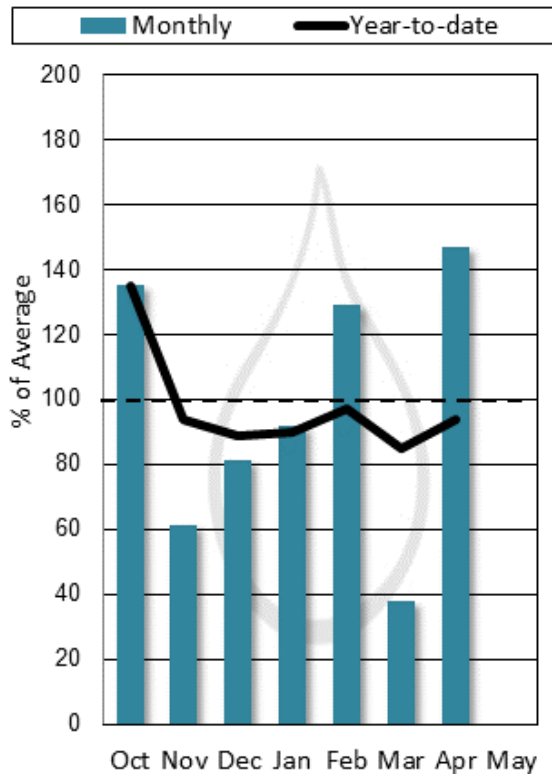
Reservoir Storage	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	110%	61%	108%

*See Reservoir Storage Table for storage in individual reservoirs

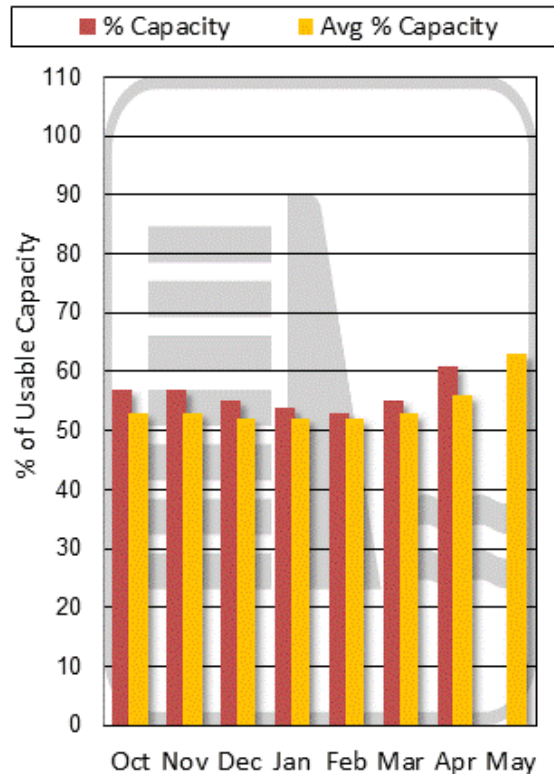
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation

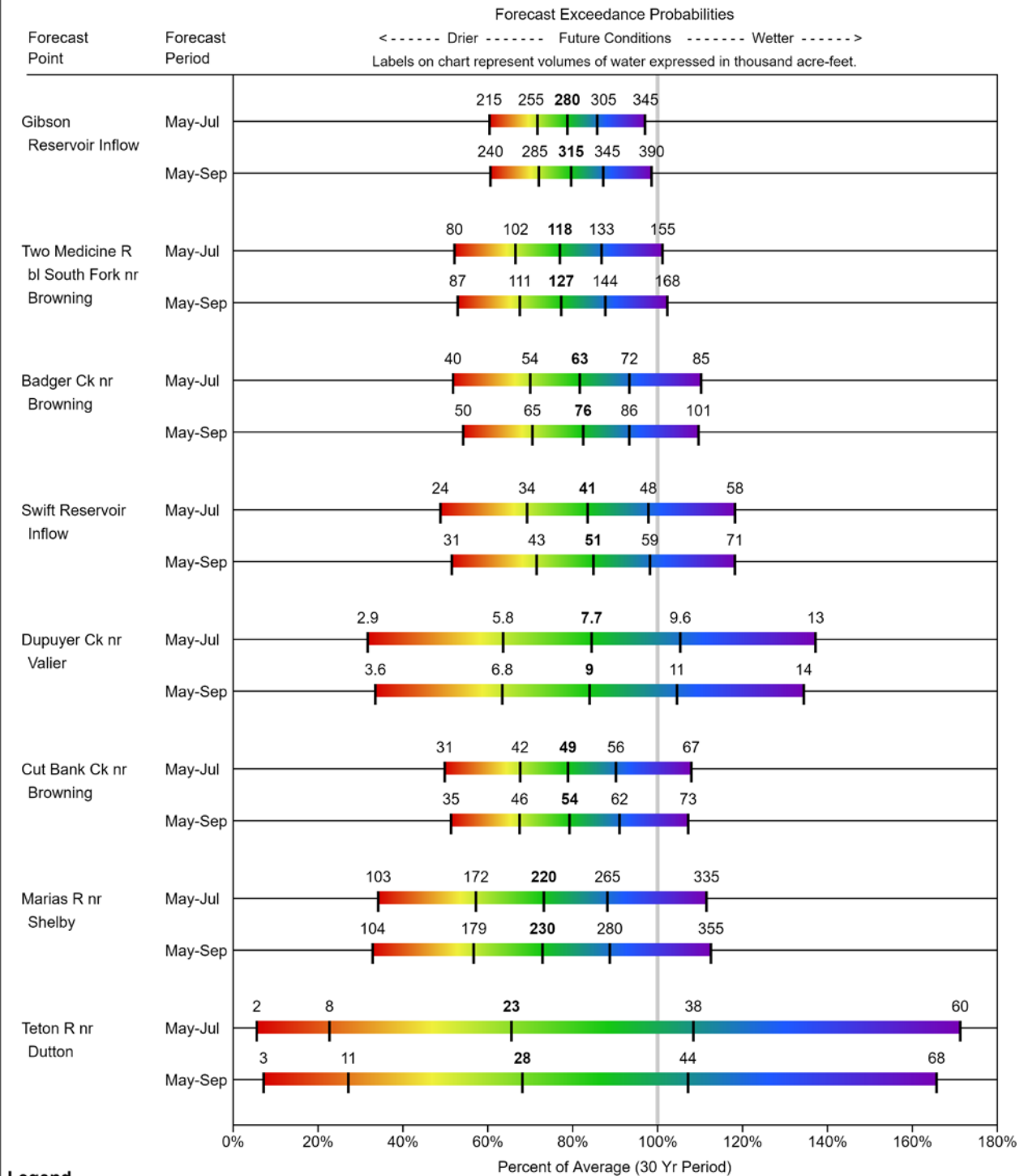


End of Month Reservoir Storage

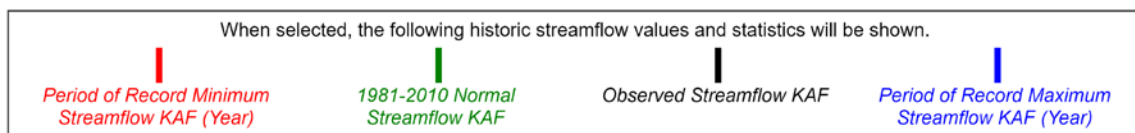
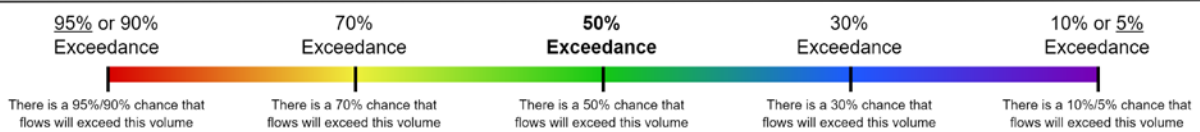


Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

SUN-TETON-MARIAS
Water Supply Forecasts
May 1, 2019

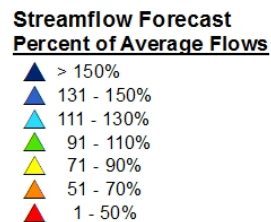
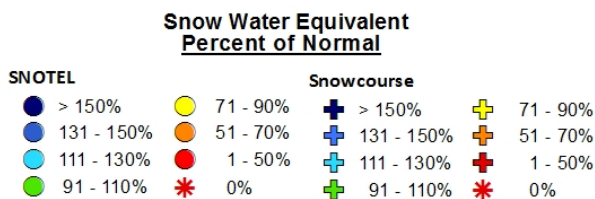
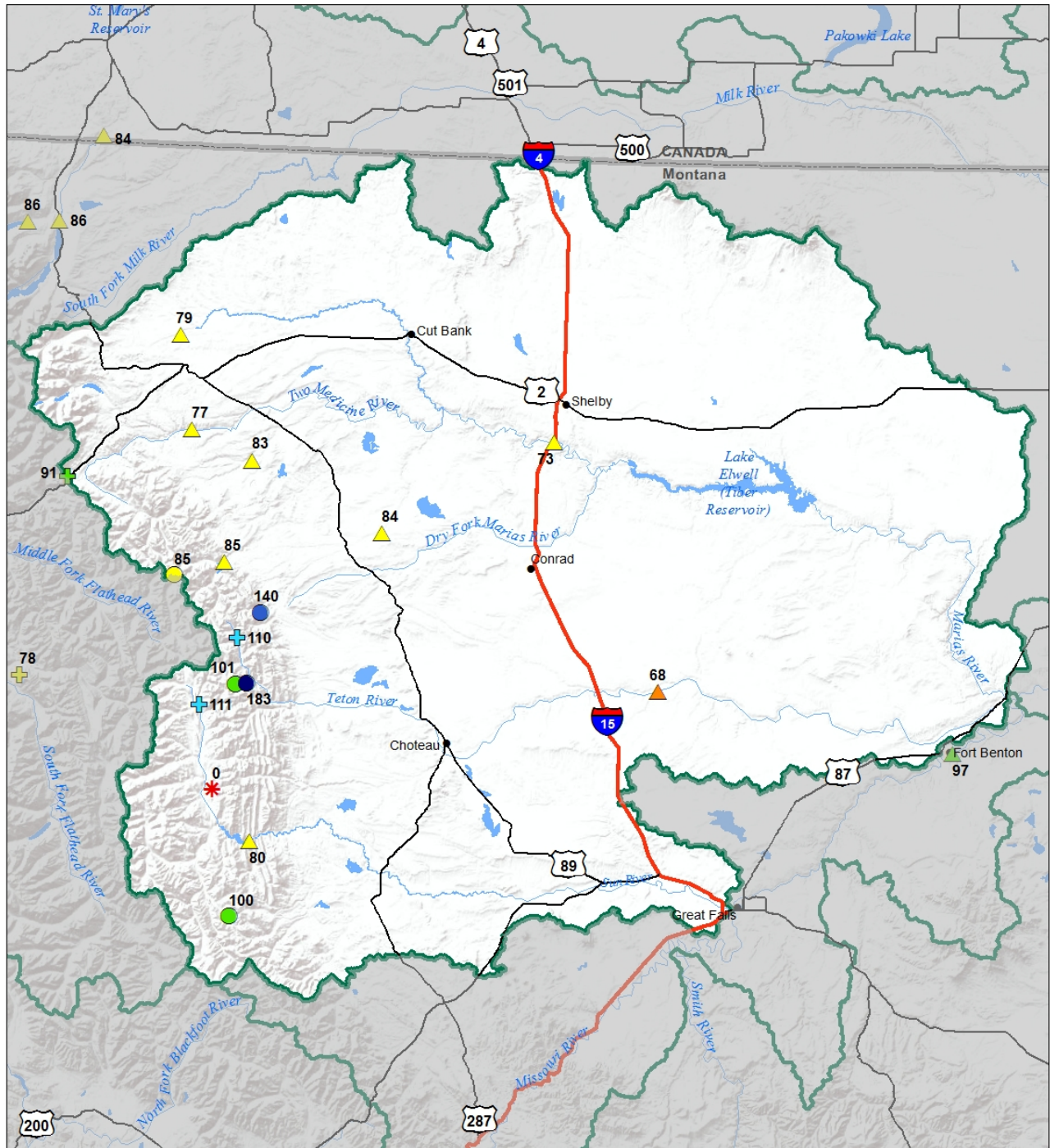


Legend

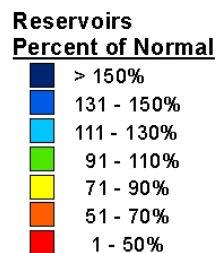
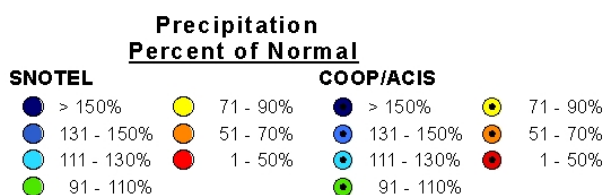
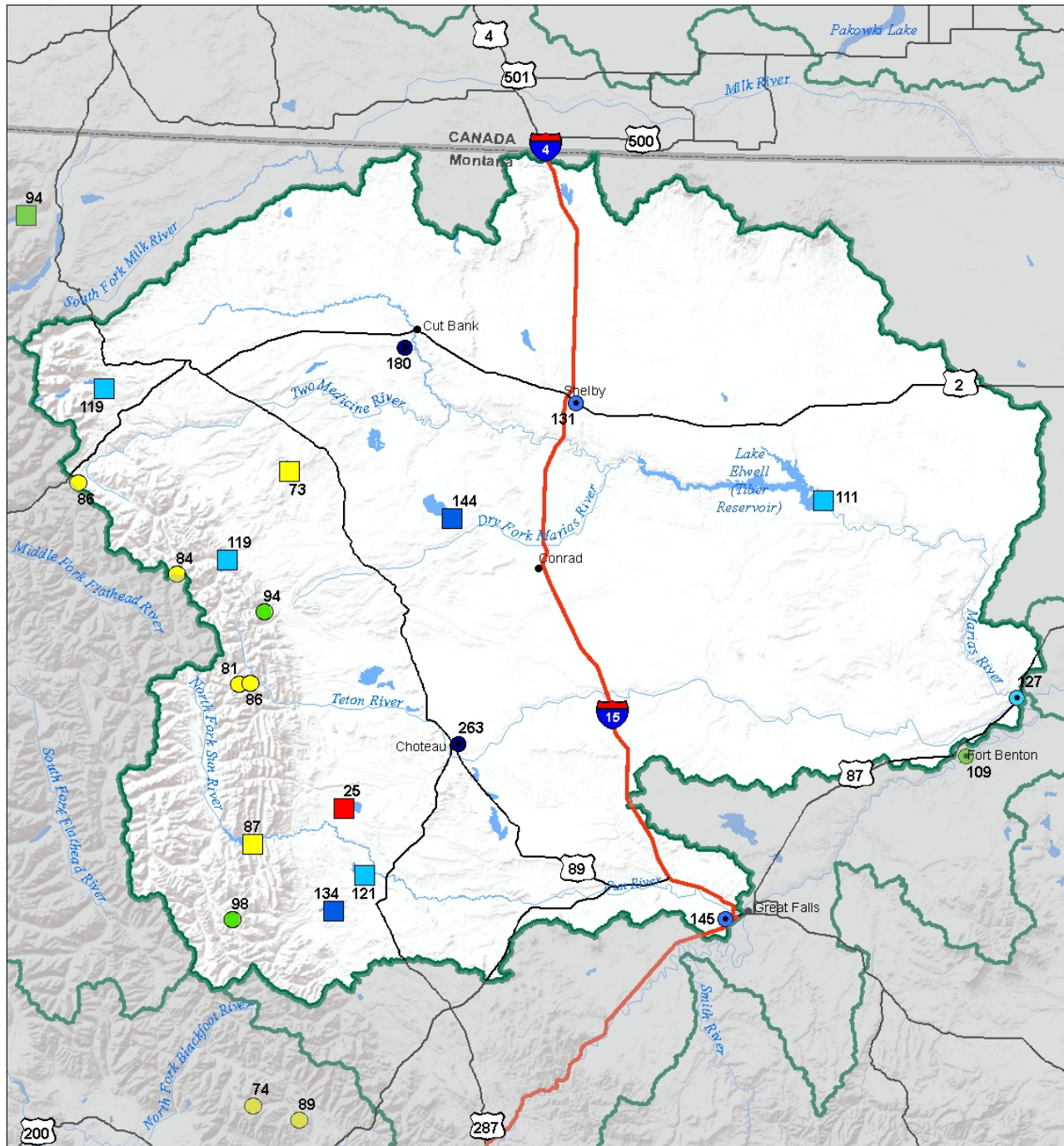


Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

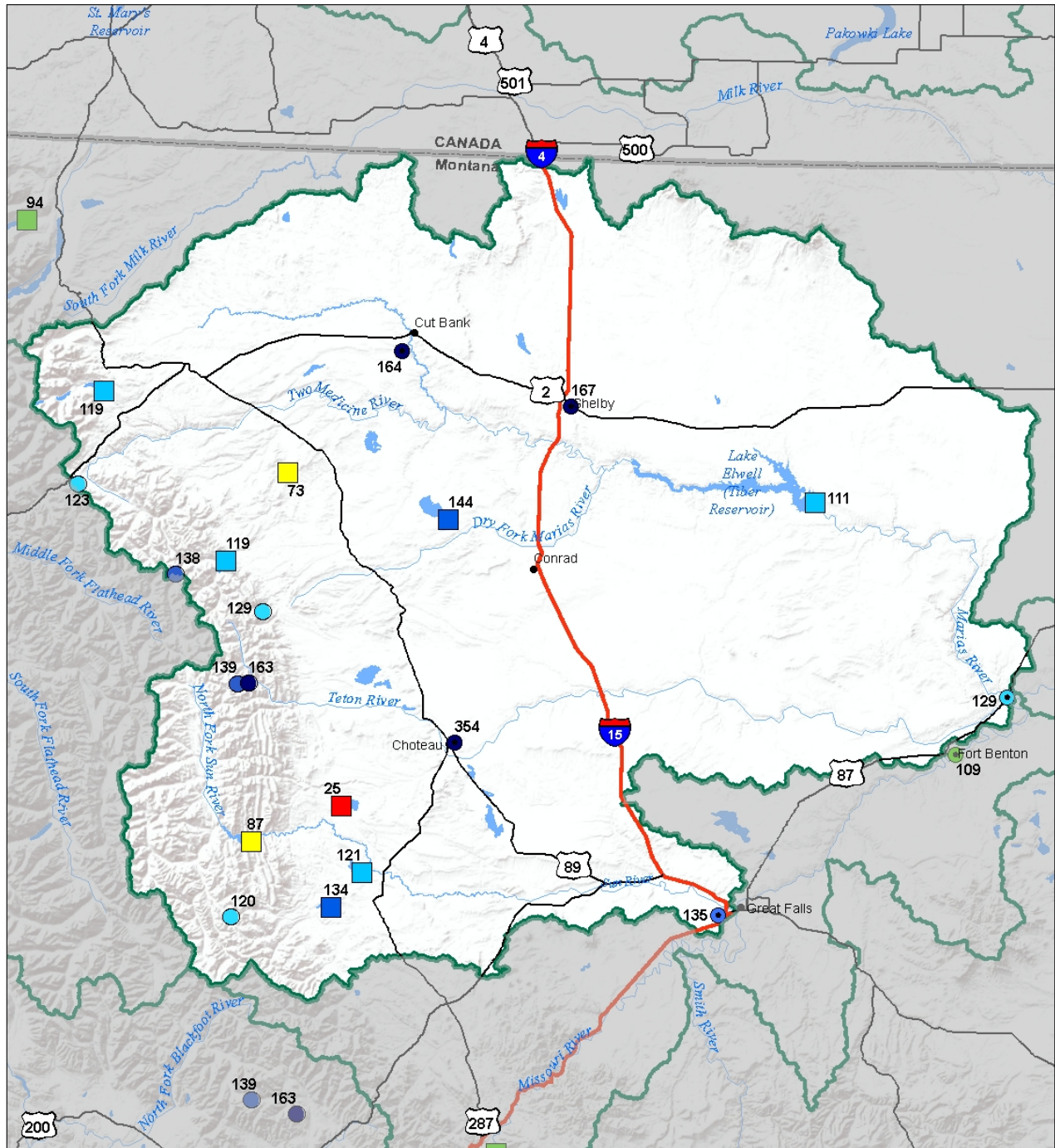
**Sun-Teton-Marias River Basin
Streamflow Forecast, Snow Water Equivalent
Percentage of Normal
May 1, 2019**



Sun-Teton-Marias River Basin
Water Year to Date Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019



Sun-Teton-Marias River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



Precipitation
Percent of Normal

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

COOP/ACIS

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

Reservoirs
Percent of Normal

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%



St. Mary-Milk River Basin



Coming off a record-breaking dry March, a wet April was badly needed, thankfully it delivered. Snowpack percentages in the St. Mary recovered from 77% of normal last month to 91% of normal as of May 1st. Snowfall was concentrated in the upper reaches of the basin, while mountain precipitation was 138% of average and prairie precipitation was near normal. Reservoir storage remains above average which paints the picture for a slight recovery in the streamflow forecasts reflected below.

The [Milk River crested at a flood stage of 31 ft near Glasgow](#) at the end of March as the prairie snow melted off, and flows have subsided since. Precipitation during April was below average across much of the Sweet Grass Hills and Bear Paw Mountains, but one late April storm brought a foot of snow to the Bear Paws which is quickly melting. As always, the Milk is heavily dependent on late spring and summer precipitation to keep flows adequate for irrigation, fingers crossed mother nature delivers.

St. Mary-Milk River Basin Data Summary

Snowpack

	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
ST. MARY	89%	150%
BEARPAW MOUNTAINS	%	%
MILK RIVER BASIN	%	%
Basin-Wide	%	%

Precipitation

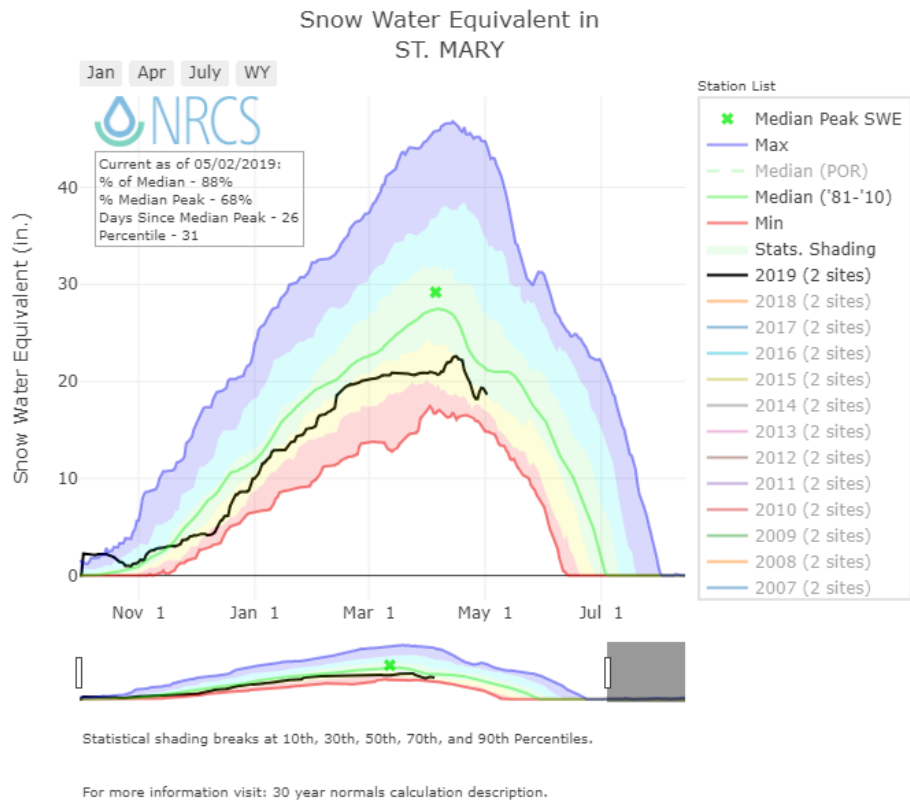
	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation (St. Mary)	138%	82%	121%
Mountain Precipitation (Bearpaw Mtns)	32%	112%	130%
Valley Precipitation	95%	113%	155%
Basin-Wide Precipitation	110%	89%	125%

*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

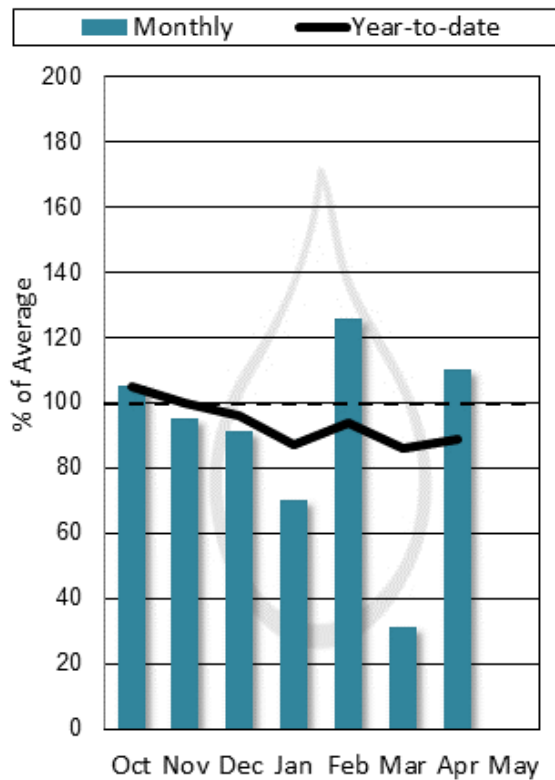
Reservoir Storage

	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	118%	62%	122%

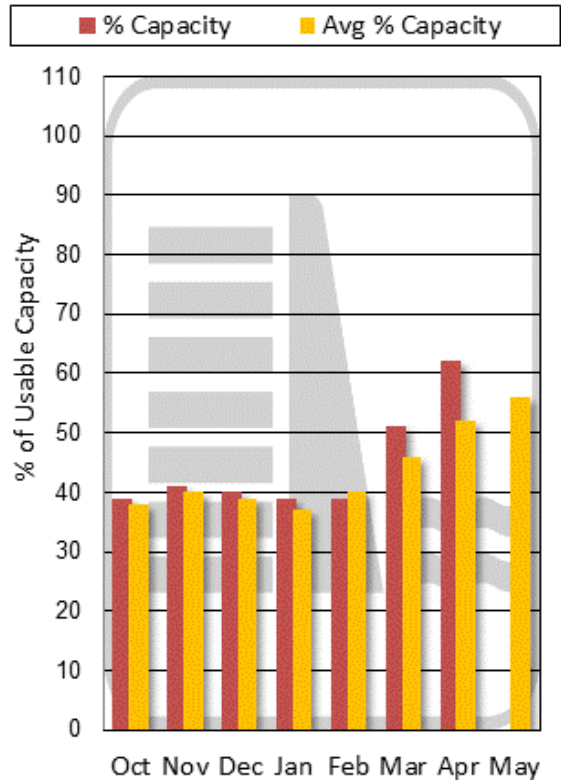
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation



End of Month Reservoir Storage



Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

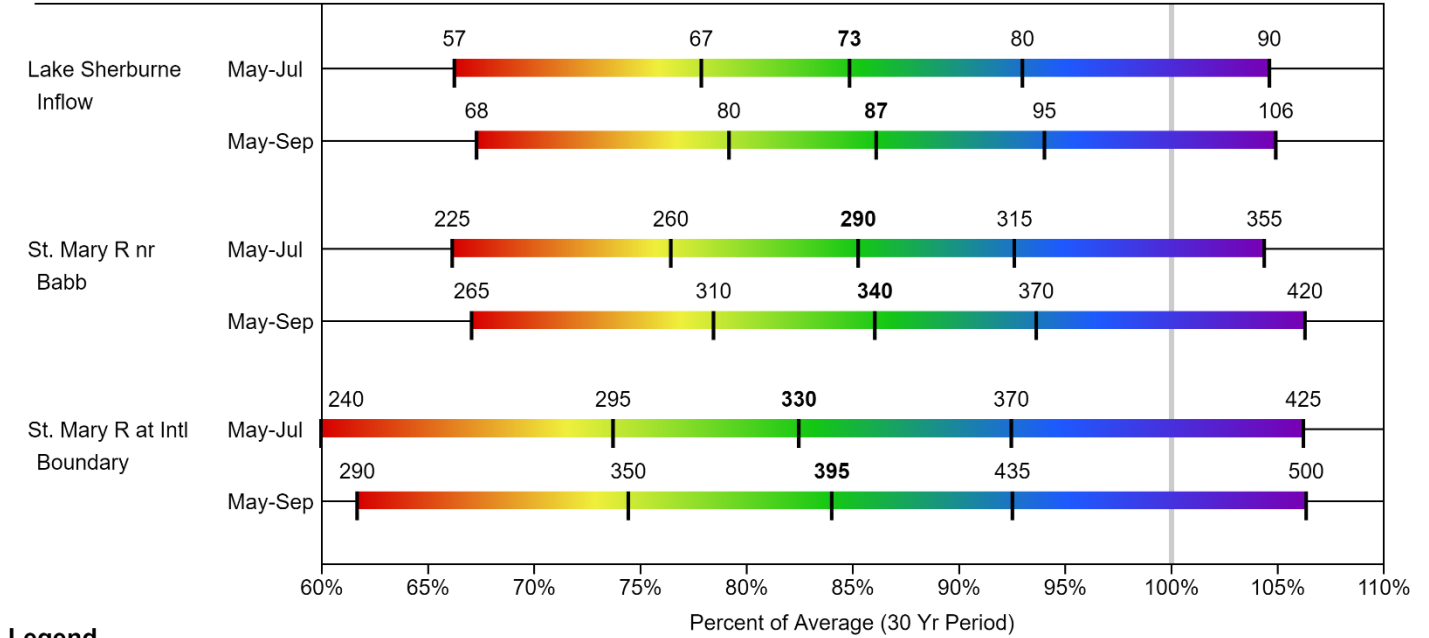
ST. MARY & MILK BASINS

Water Supply Forecasts

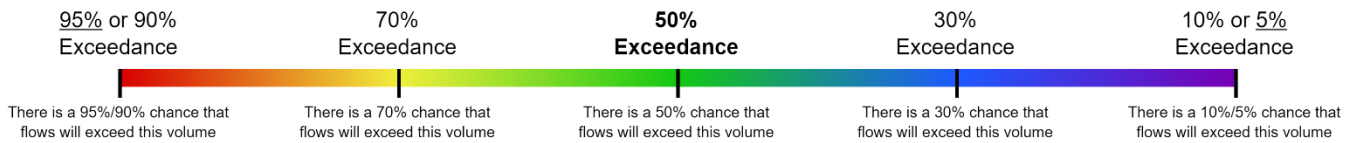
May 1, 2019

Forecast Exceedance Probabilities

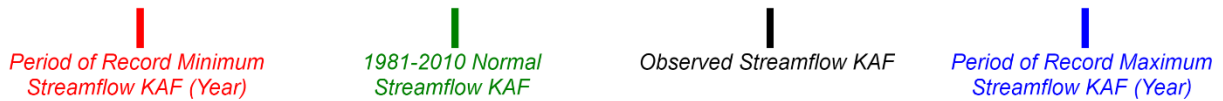
<----- Drier ----- Future Conditions ----- Wetter ----->
Labels on chart represent volumes of water expressed in thousand acre-feet.



Legend

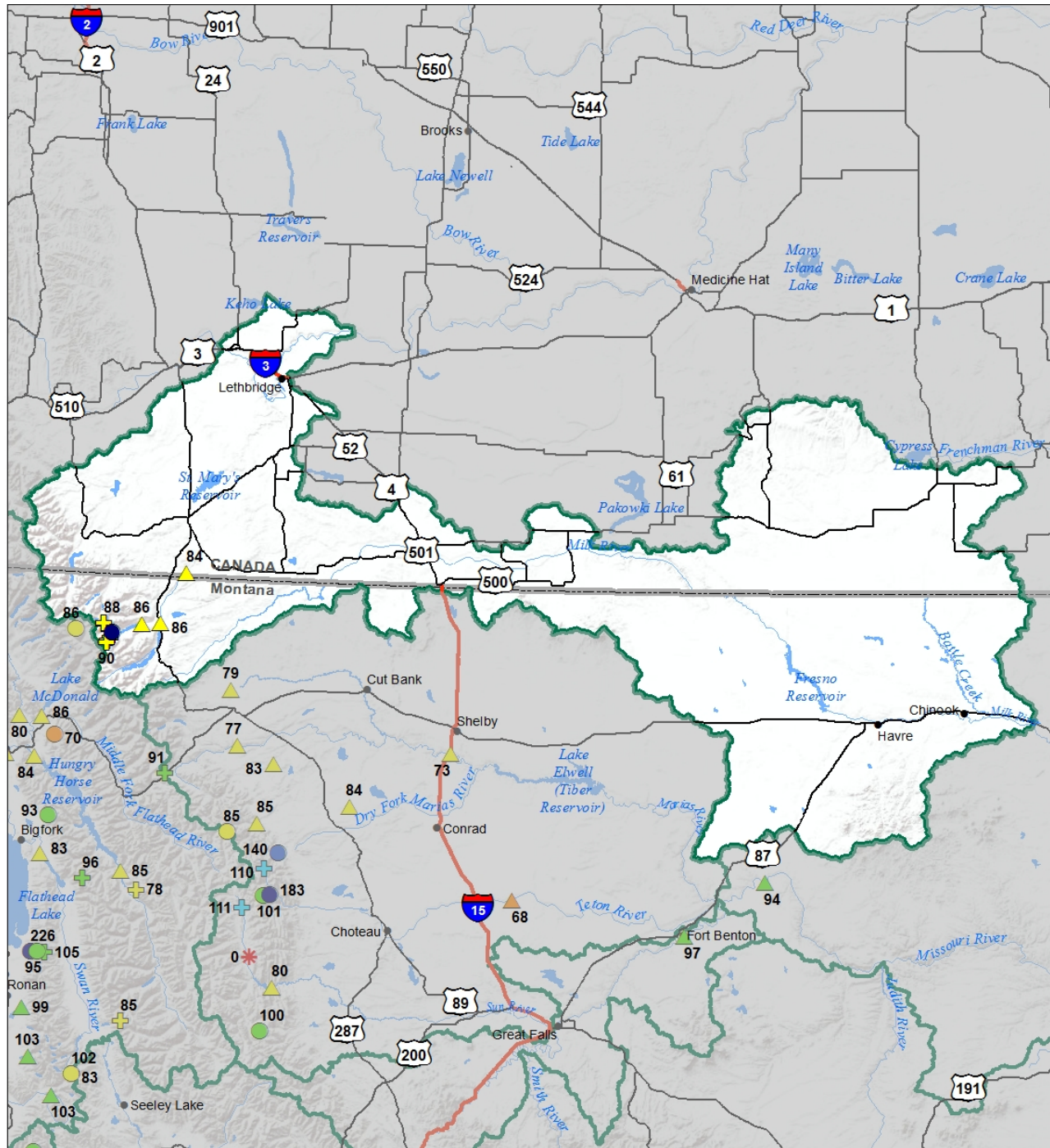


When selected, the following historic streamflow values and statistics will be shown.



Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

**St Mary's-Milk River Basin
Streamflow Forecast, Snow Water Equivalent
Percentage of Normal
May 1, 2019**



**Snow Water Equivalent
Percent of Normal**

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

Snowcourse

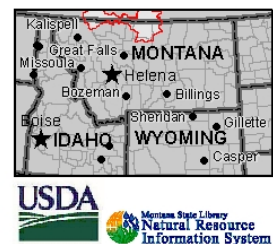
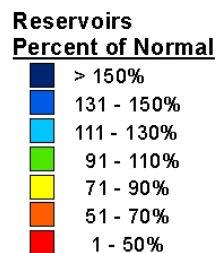
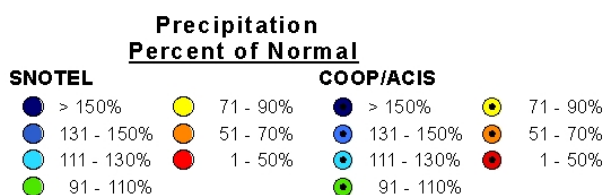
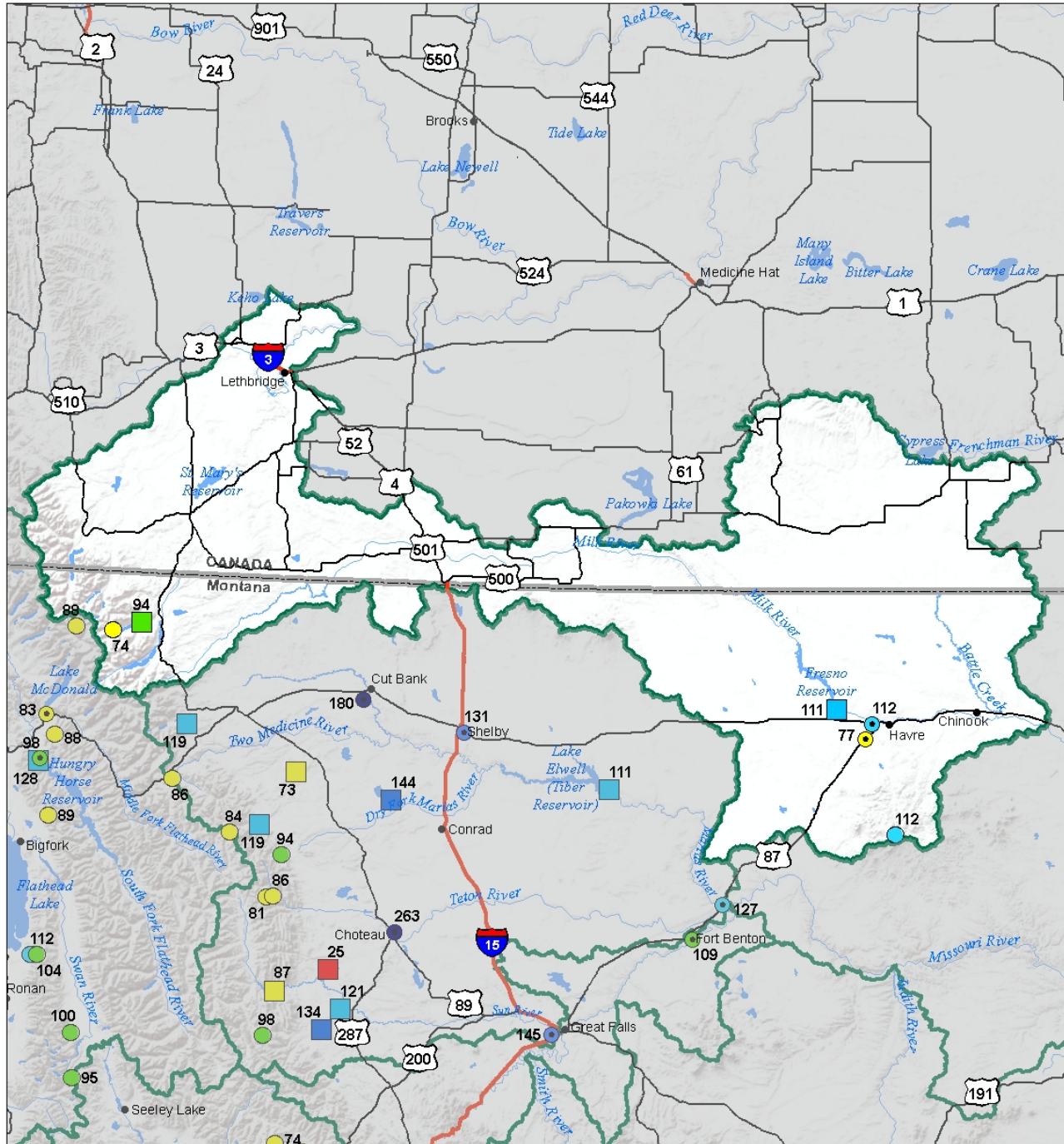
- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%
- 0%

**Streamflow Forecast
Percent of Average Flows**

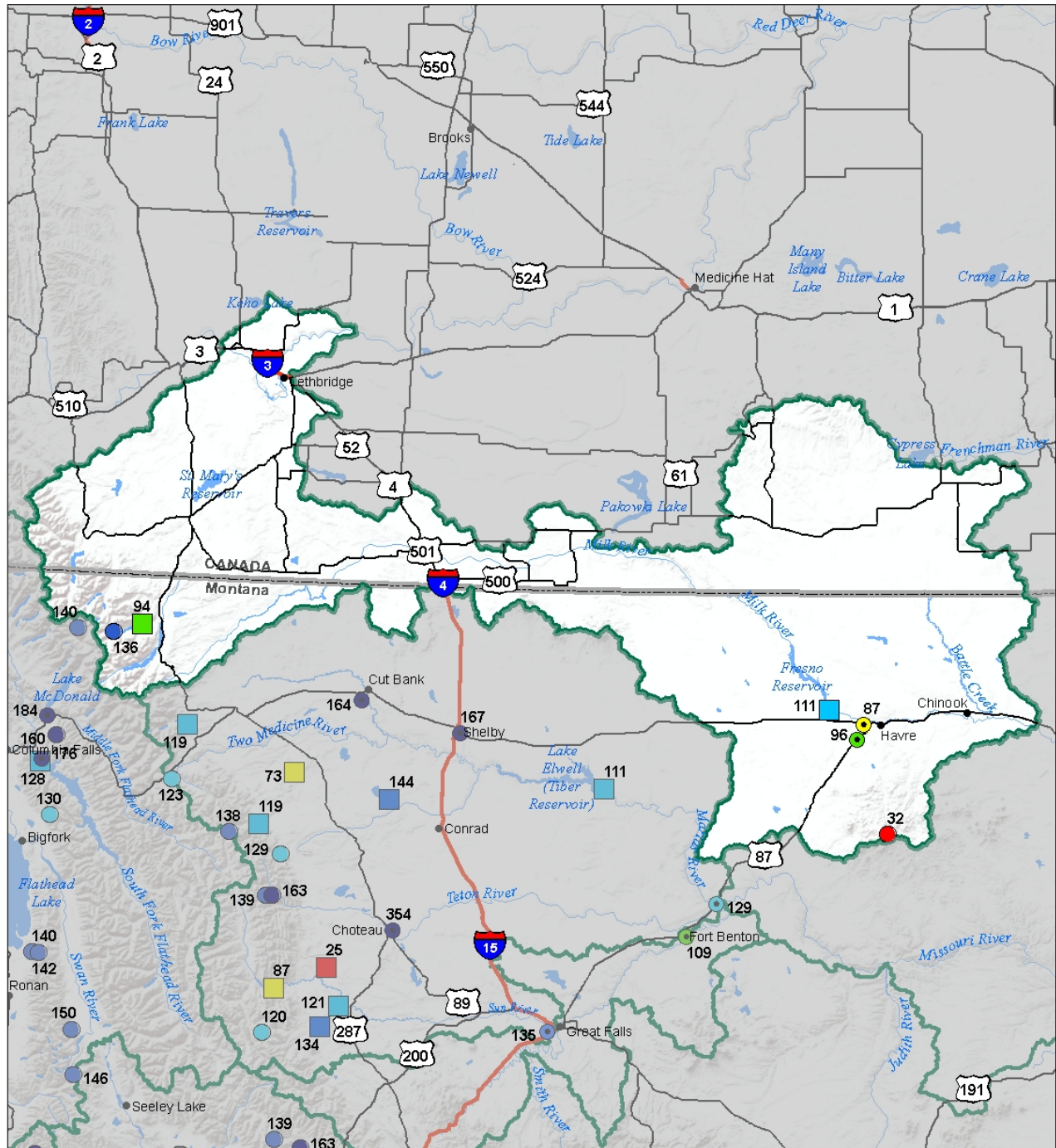
- ▲ > 150%
- ▲ 131 - 150%
- ▲ 111 - 130%
- ▲ 91 - 110%
- ▲ 71 - 90%
- ▲ 51 - 70%
- ▲ 1 - 50%



St Mary's-Milk River Basin
Water Year to Date Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019



St Mary's-Milk River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



**Precipitation
Percent of Normal**

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

COOP/ACIS

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%

**Reservoirs
Percent of Normal**

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%





Upper Yellowstone River Basin

Three big months, that's all that the Upper Yellowstone needed to build an above normal snowpack on May 1st. Looking back at this winter, it was the months of November, February, and April that got the basin to where it is in right now. The rest of the fall and winter months were a disappointment, but it doesn't matter when you get it, so long as you get it. April was a big month in the Upper Yellowstone River basin, and it helped to build the snowpack through the middle of the month at mid-elevations, and snowpack continued to gain through the end of the month at high elevations. Seasonal peak snow water equivalent (SWE) was reached at most low and mid elevations during the month and was near to above normal. High elevations, which have yet to begun significant melt will likely experience their peaks during the coming week or two. As good as this may sound the runoff story is not over. May and June are typically the most significant months of the year in the region with regards to precipitation, and given this winter's wild vacillations in weather patterns, there is much uncertainty on what they will yield.

Streamflow forecasts issued for the May 1st – July 31st period indicate near to above average seasonal volumes this spring and summer, but it will depend on spring weather. The good news is that the snowmelt component of runoff is right where it needs to be for this time of year. Another month should tell us a lot about what to expect later in the summer months.

Upper Yellowstone River Basin Data Summary

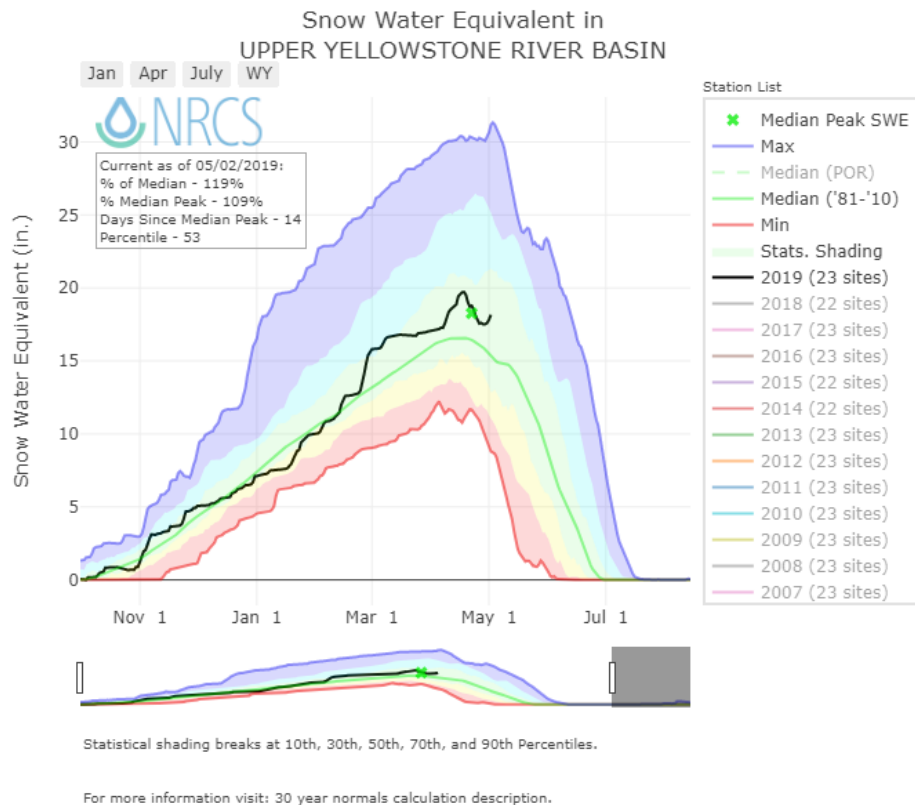
Snowpack	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
<i>YELLOWSTONE ab LIVINGSTON</i>	114%	167%
<i>SHIELDS</i>	135%	190%
<i>BOULDER-STILLWATER</i>	107%	168%
<i>RED LODGE-ROCK CREEK</i>	120%	144%
<i>CLARK'S FORK</i>	117%	192%
Basin-Wide Snowpack	116%	171%

Precipitation	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	145%	111%	138%
Valley Precipitation	156%	124%	151%
Basin-Wide Precipitation	147%	113%	139%

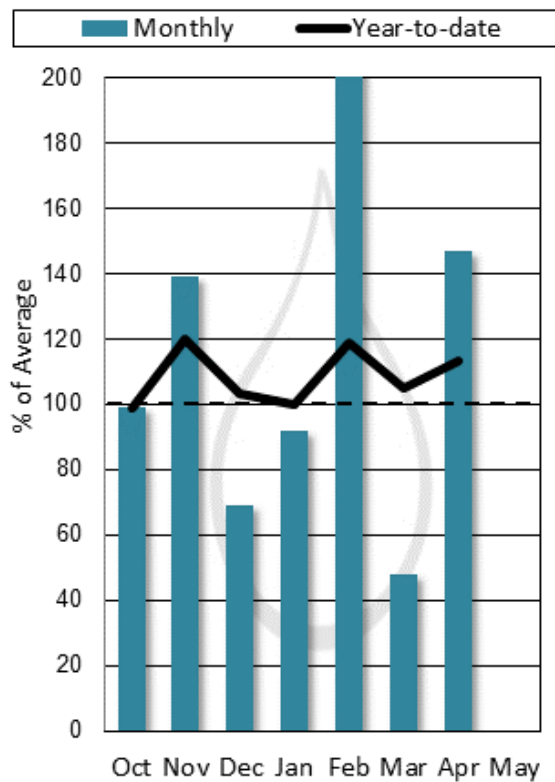
*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

Reservoir Storage	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	113%	53%	105%

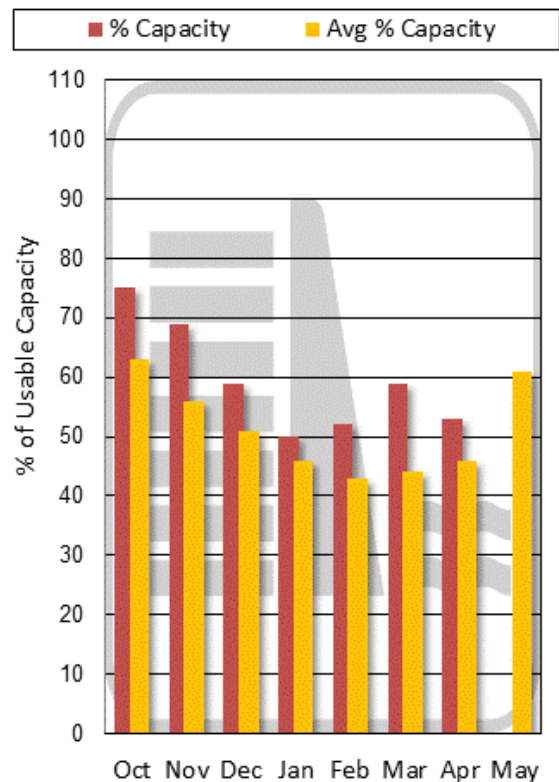
(click on chart below to navigate to [online version](#) with additional features)



Mountain and Valley Precipitation



End of Month Reservoir Storage

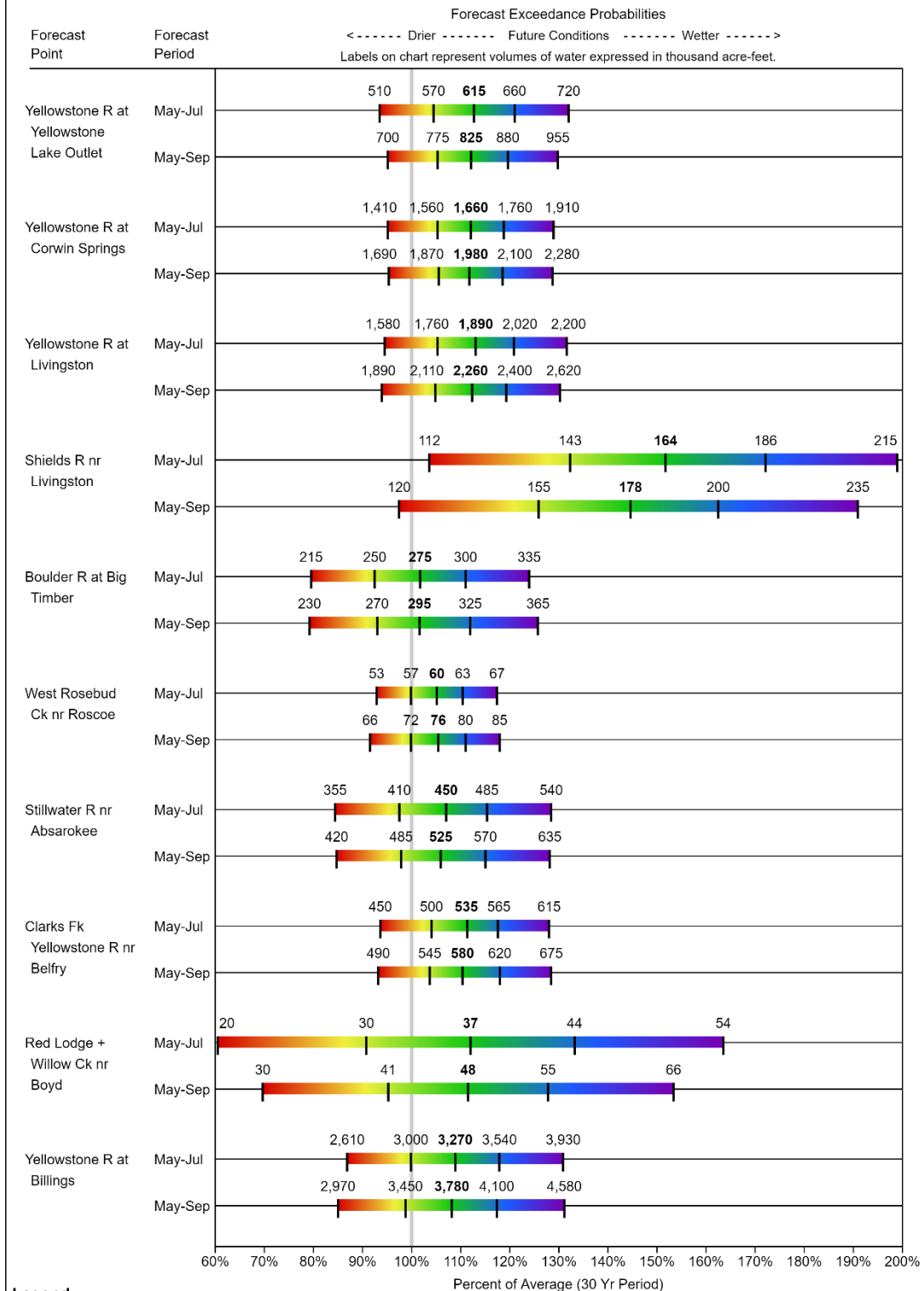


Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

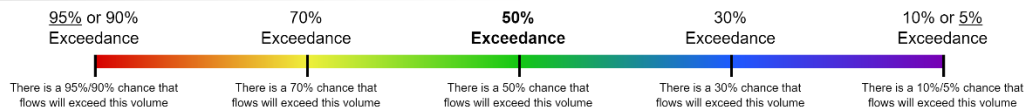
UPPER YELLOWSTONE RIVER BASIN

Water Supply Forecasts

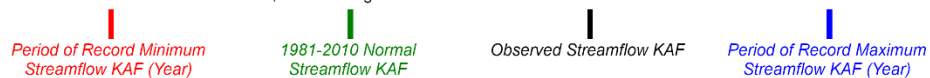
May 1, 2019



Legend

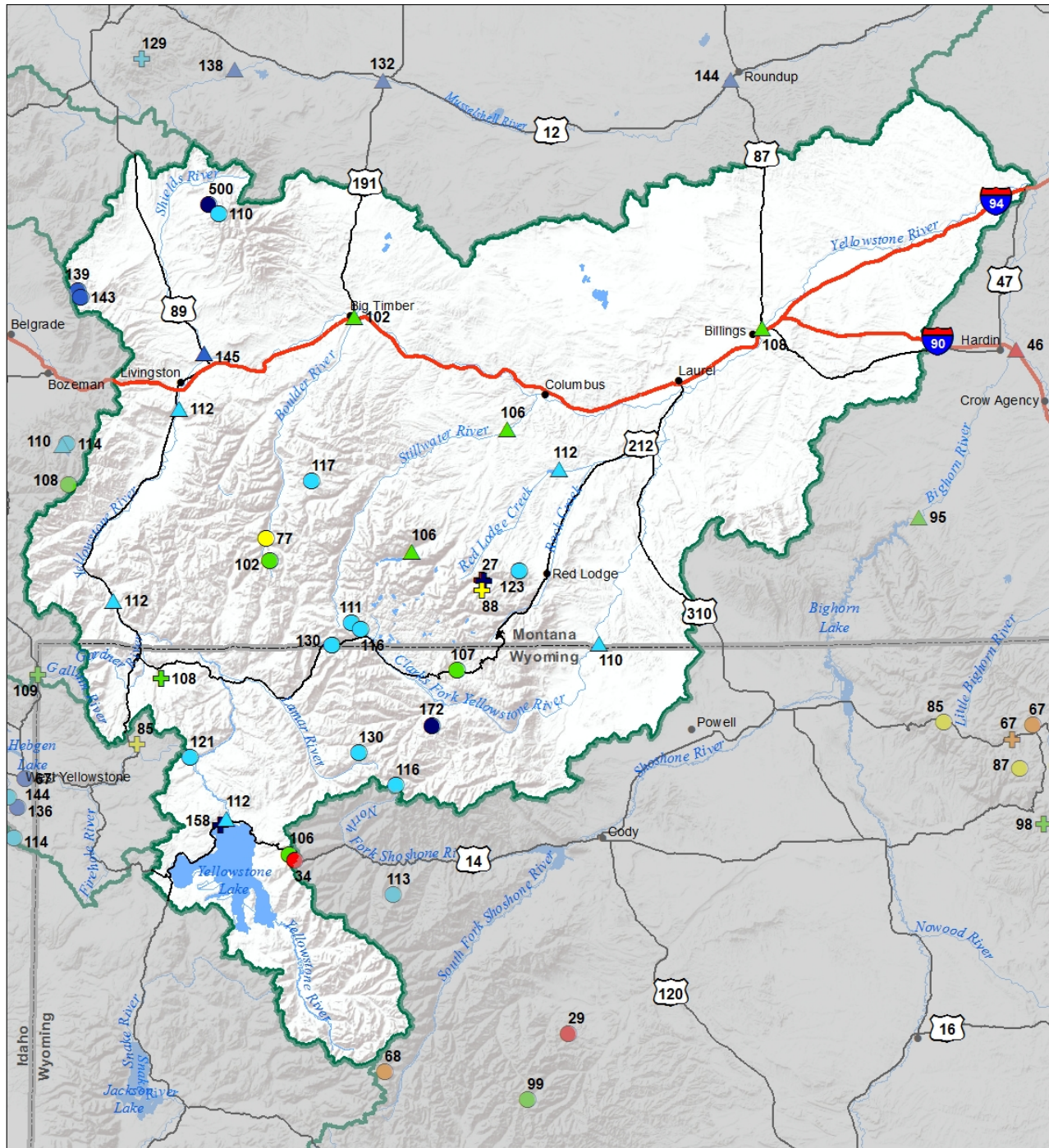


When selected, the following historic streamflow values and statistics will be shown.



Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

**Upper Yellowstone River Basin
Streamflow Forecast, Snow Water Equivalent
Percentage of Normal
May 1, 2019**



**Snow Water Equivalent
Percent of Normal**

SNOTEL

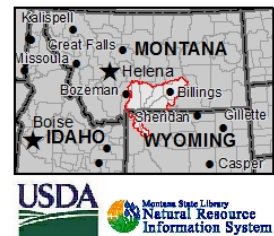
- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%
- *

Snowcourse

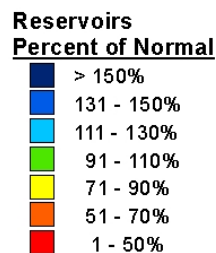
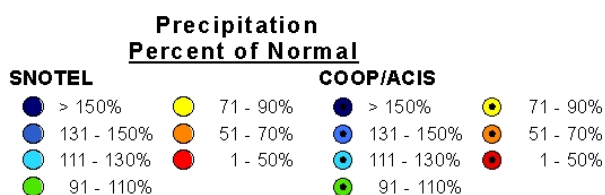
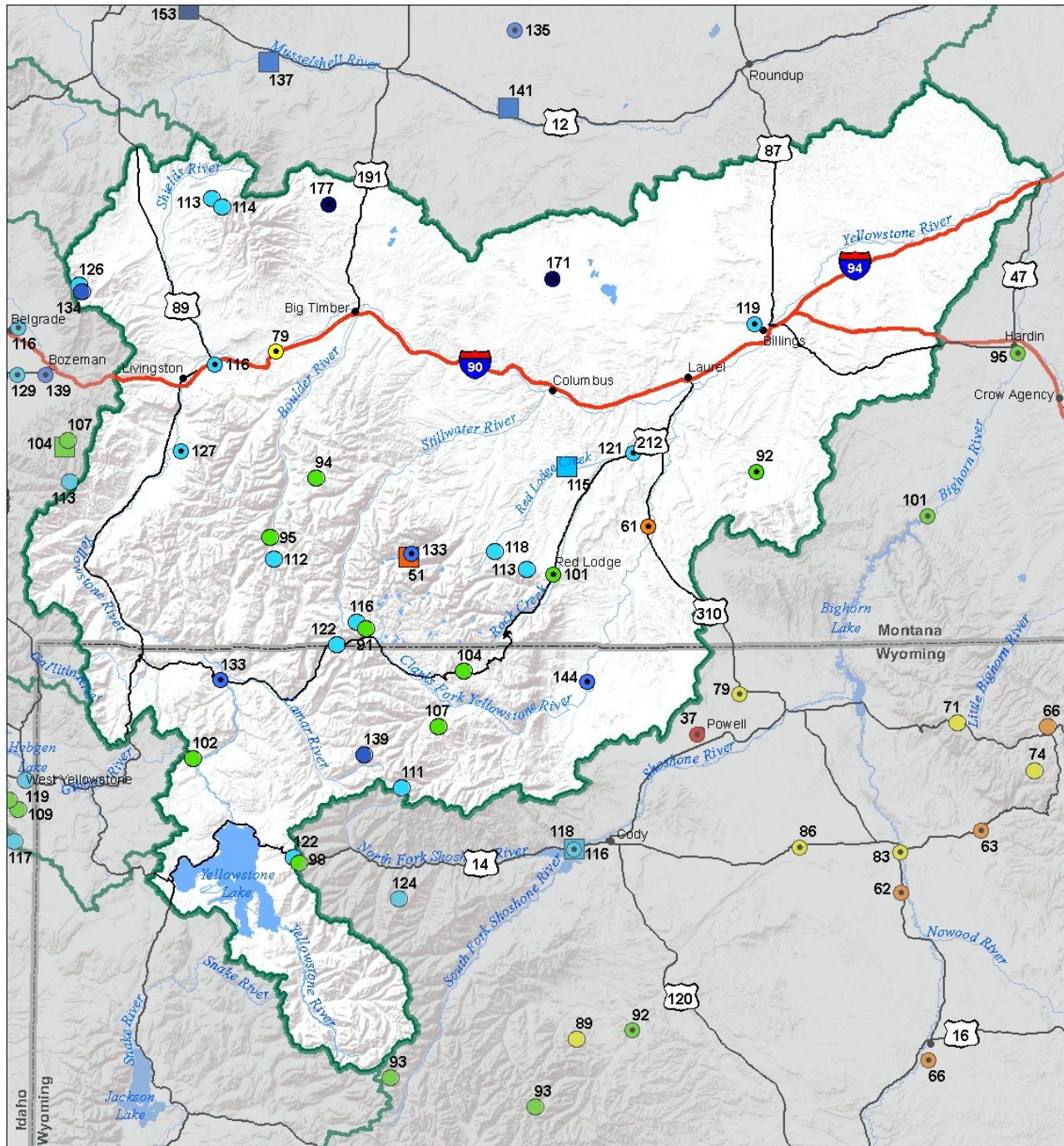
- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%
- *

**Streamflow Forecast
Percent of Average Flows**

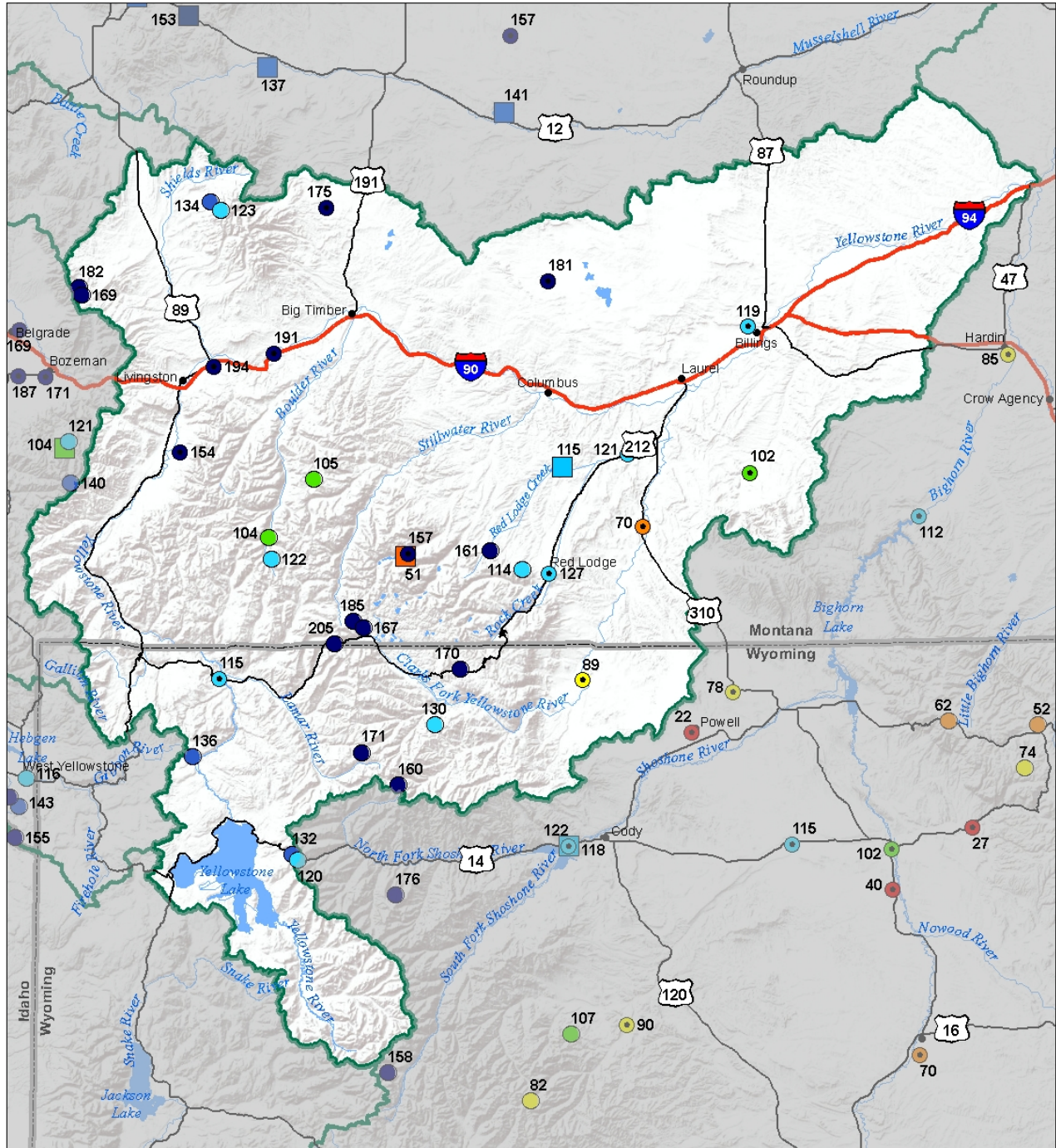
- ▲ > 150%
- ▲ 131 - 150%
- ▲ 111 - 130%
- ▲ 91 - 110%
- ▲ 71 - 90%
- ▲ 51 - 70%
- ▲ 1 - 50%



Upper Yellowstone River Basin Water Year to Date Precipitation and Reservoir Levels Percentage of Normal May 1, 2019



Upper Yellowstone River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)



**Precipitation
Percent of Normal**

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

COOP/ACIS

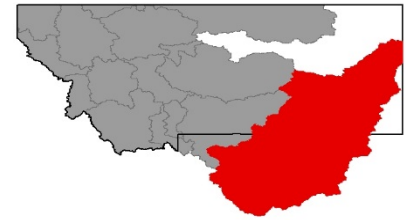
- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%

**Reservoirs
Percent of Normal**

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%



Lower Yellowstone River Basin



As is often the case in the greater Lower Yellowstone basin, there are two sides to the snowpack and melt story this month; the east side and the west side. For the remainder of the snow accumulation season, the east side of the Big Horn mountains which feeds the Tongue and Powder Rivers did not receive any significant snowfall while the western (Absaroka) and southern (Wind River) mountains that feed the Bighorn River continued to accumulate snow until mid-month. [Mountain precipitation measured at SNOTEL sites from April 1 to April 15 shows this discrepancy.](#) In the Big Horn mountains, the dry weather patterns that plagued March continued into April, and by mid-April, the below normal snowpack had begun to melt in earnest. The Shoshone and Wind River basins benefited from multiple storm systems in early April which boosted snowpack percentages from last month and delayed the onset of melt. At this point water users in the Bighorn, Wind & Shoshone basins can expect normal to above normal streamflows this spring while water users and managers should prepare for below normal streamflows in the Tongue and Powder Rivers. These expectations can change in an instant with anomalous weather conditions; it is recommended that water users pay close attention to weather patterns over the next month and utilize the range of forecasts provided in this report.

Lower Yellowstone River Basin Data Summary

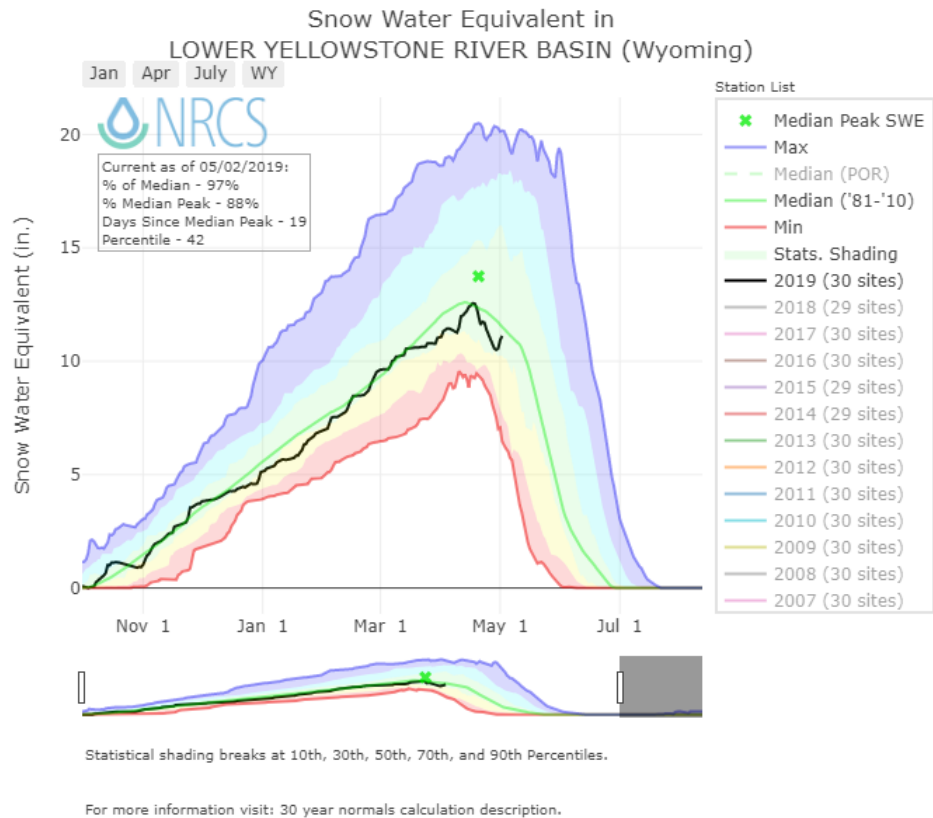
Snowpack	Percent of 1981-2010 Normal (Median)	Last Year Percentage of Normal (Median)
WIND RIVER BASIN	103%	121%
SHOSHONE RIVER BASIN	106%	149%
BIGHORN RIVER BASIN	91%	144%
LITTLE BIGHORN BASIN	76%	107%
TONGUE RIVER BASIN	75%	114%
POWDER RIVER BASIN	76%	125%
Basin-Wide Snowpack	90%	125%

Precipitation	Monthly Percentage of Average	WYTD Percentage of 1981-2010 Average*	WYTD Last Year Percentage of Average
Mountain Precipitation	94%	88%	104%
Valley Precipitation	105%	106%	122%
Basin-Wide Precipitation	98%	93%	109%

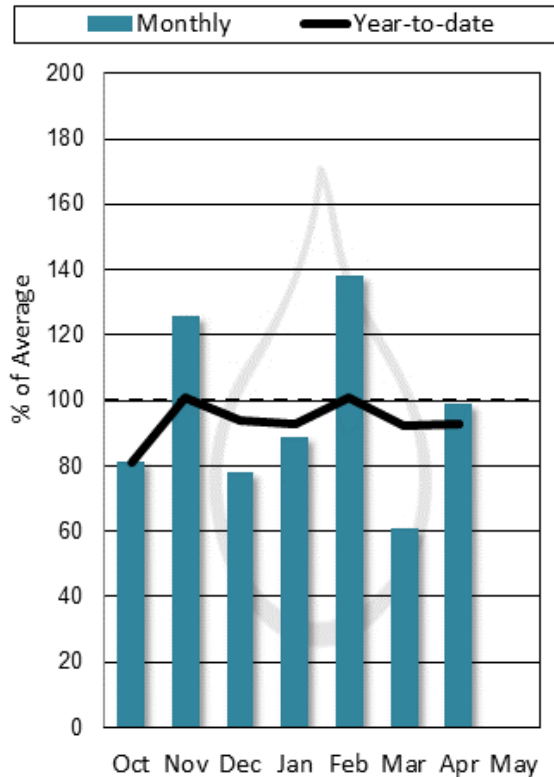
*Water Year-to-Date (WYTD) Precipitation is October 1st - Current

Reservoir Storage	Percentage of Average	Percentage of Capacity (Total)	Last Year Percentage of Average
Basin-Wide Storage	105%	59%	97%

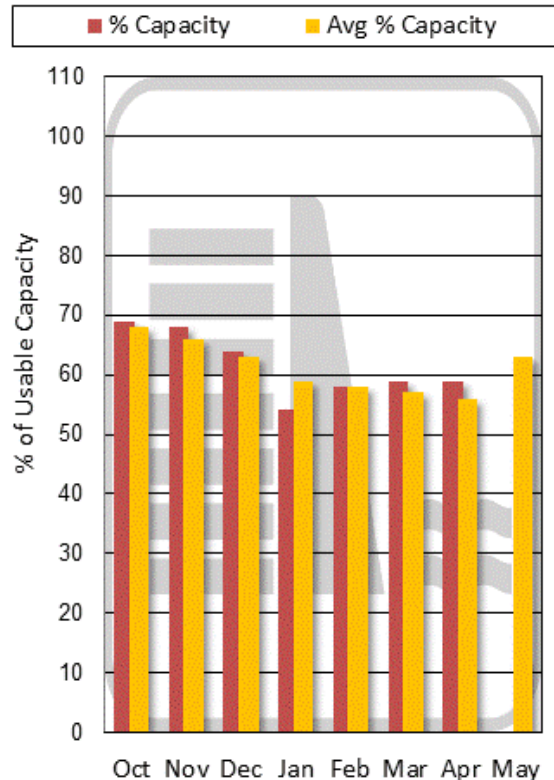
(click on chart below to navigate to online version with additional features)



Mountain and Valley Precipitation



End of Month Reservoir Storage

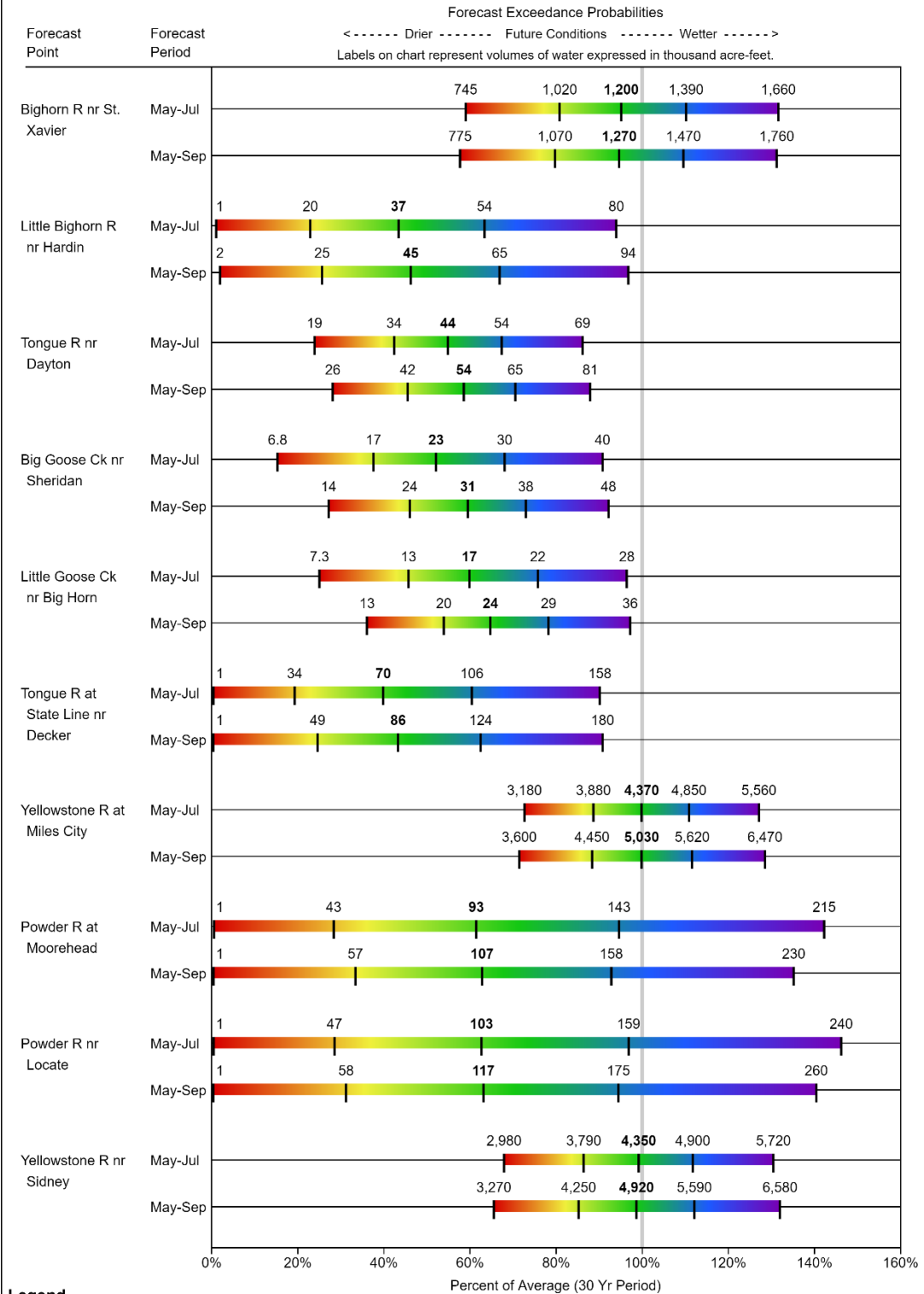


Storage above is averaged for all reservoirs in the basin. For individual reservoirs see table below.

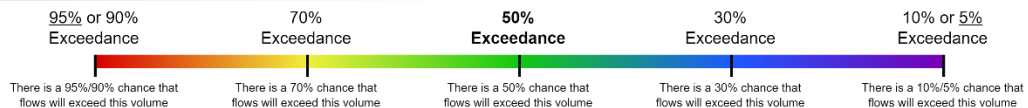
LOWER YELLOWSTONE RIVER BASIN (Wyoming)

Water Supply Forecasts

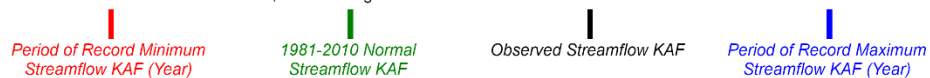
May 1, 2019



Legend

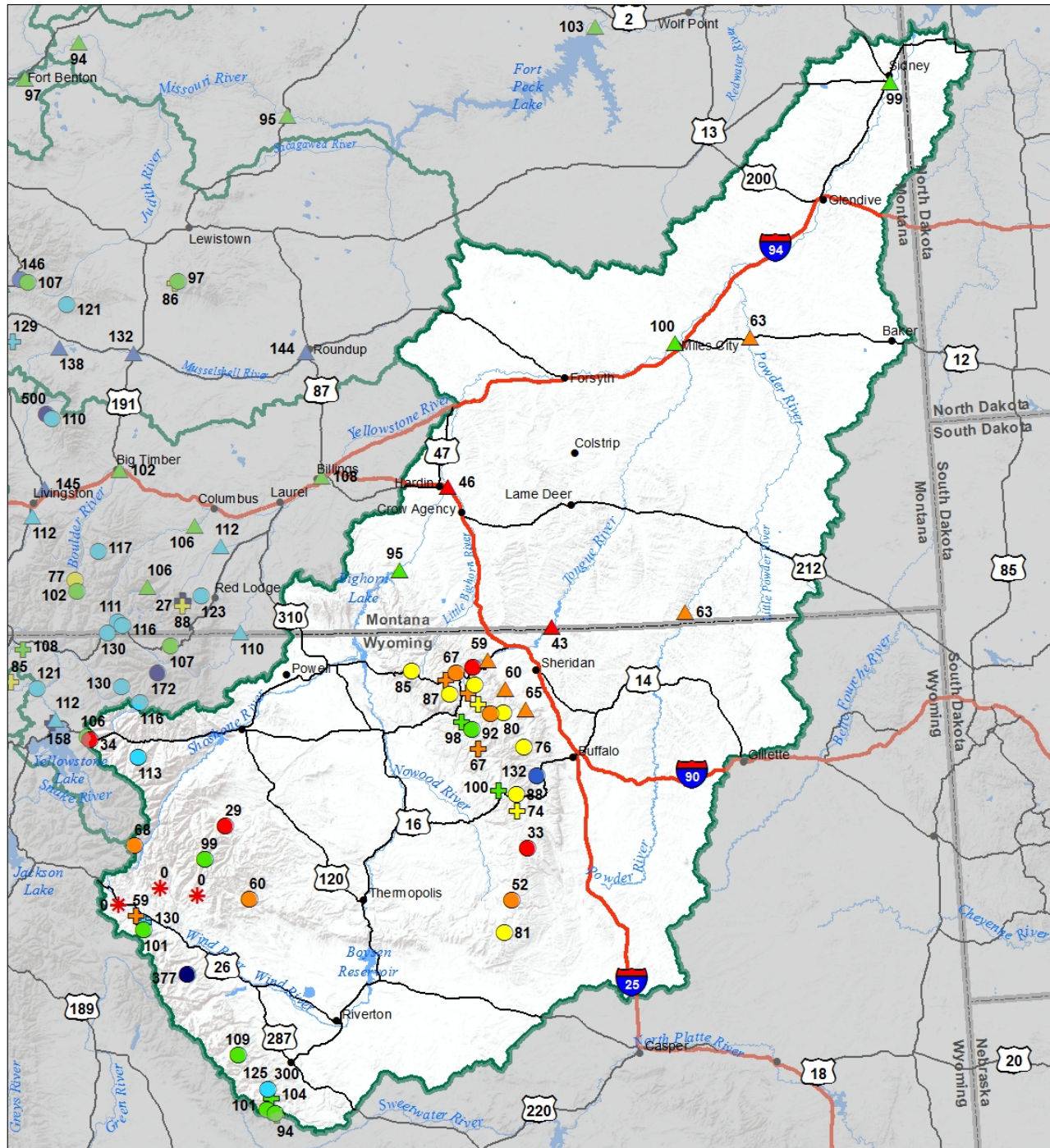


When selected, the following historic streamflow values and statistics will be shown.



Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

**Lower Yellowstone River Basin
Streamflow Forecast, Snow Water Equivalent
Percentage of Normal
May 1, 2019**



**Snow Water Equivalent
Percent of Normal**

SNOTEL

- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%

Snowcourse

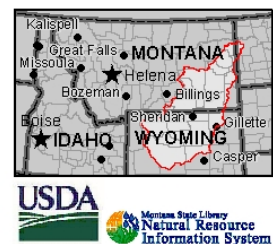
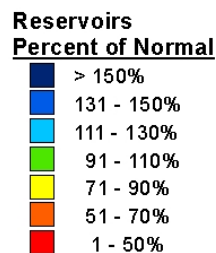
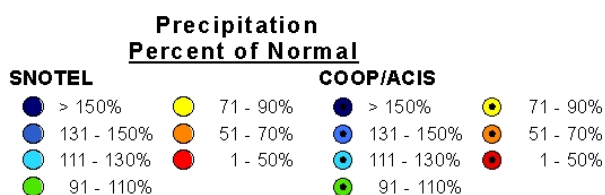
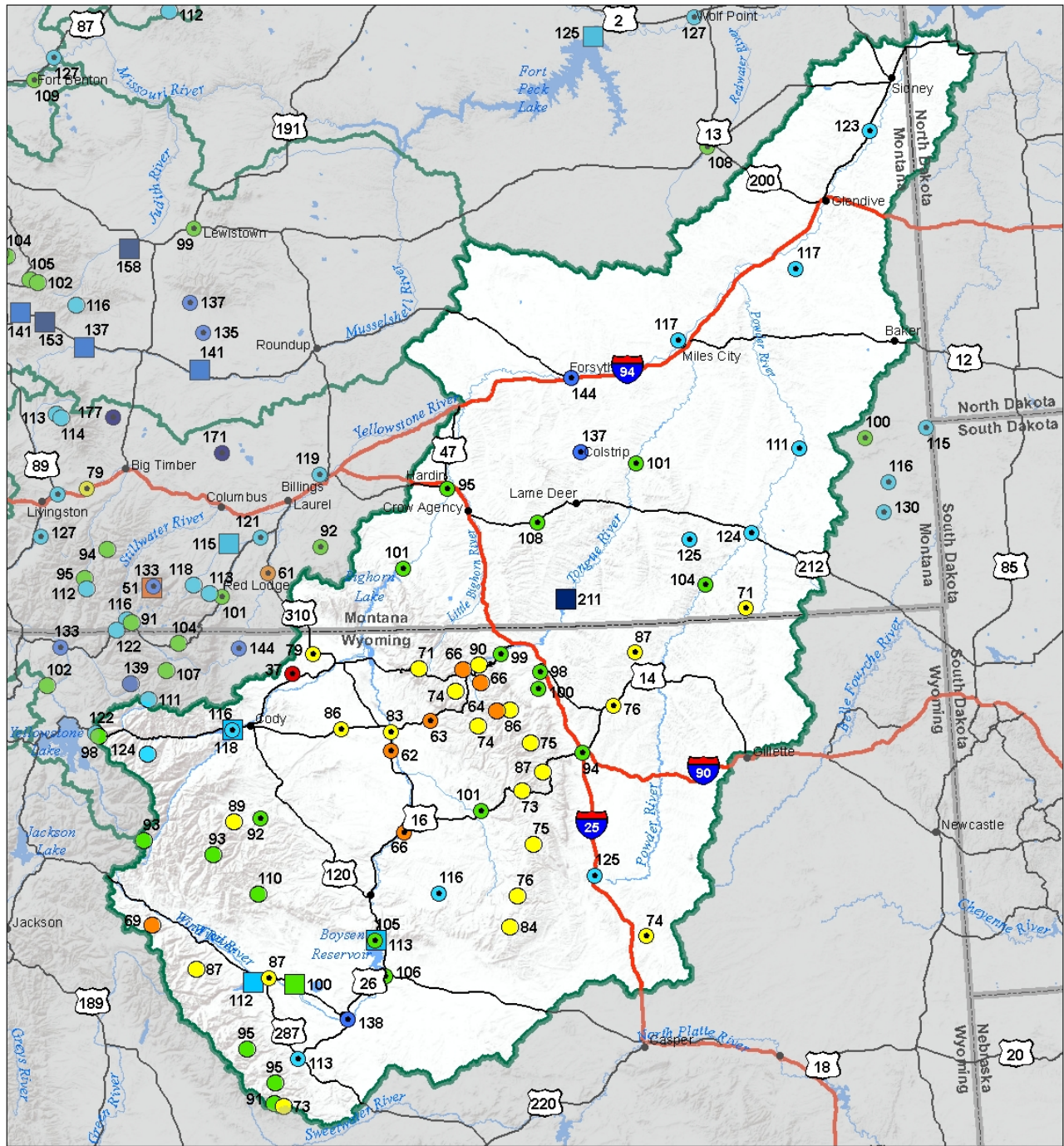
- > 150%
- 131 - 150%
- 111 - 130%
- 91 - 110%
- 71 - 90%
- 51 - 70%
- 1 - 50%
- 0%

**Streamflow Forecast
Percent of Average Flows**

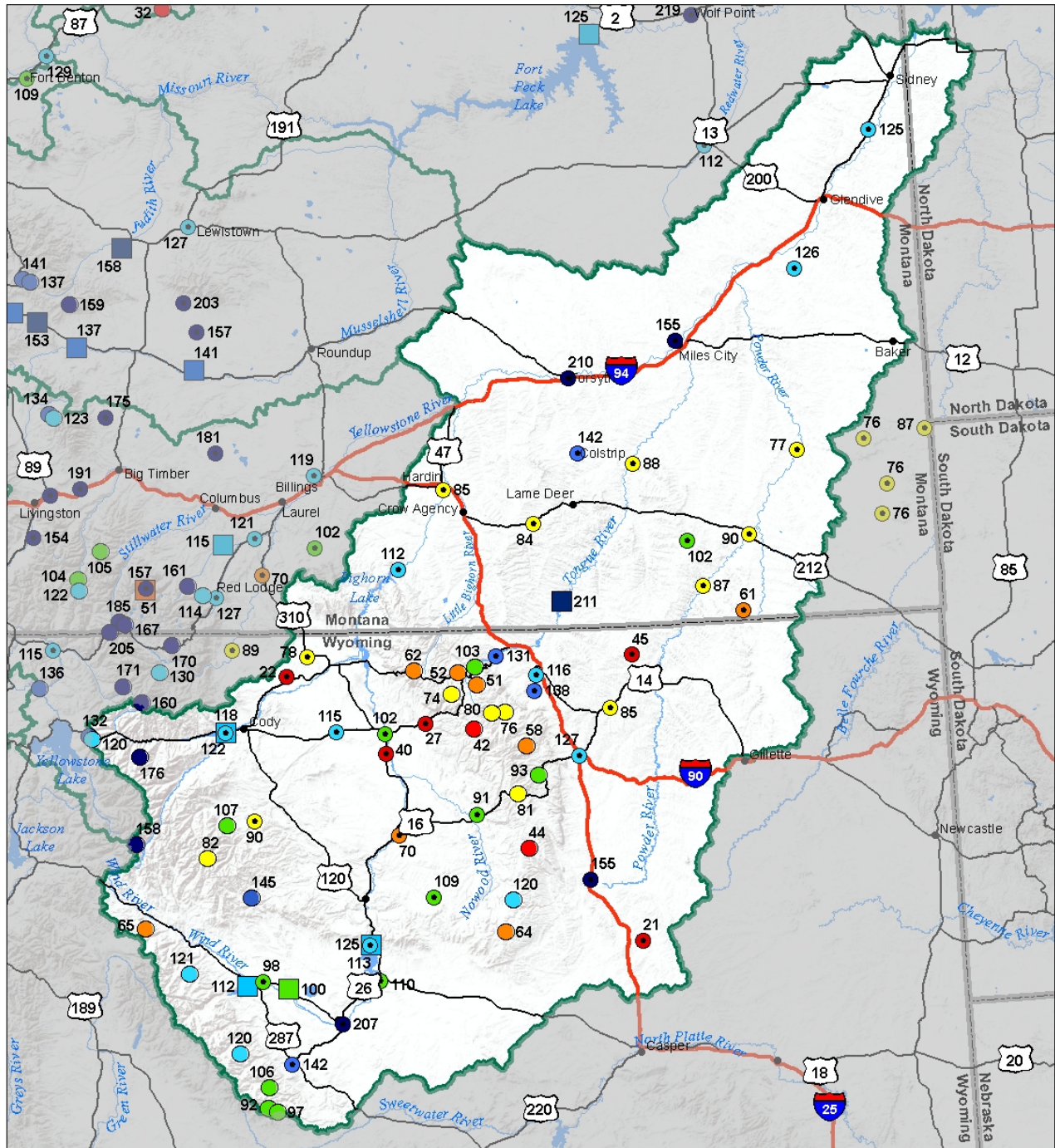
- ▲ > 150%
- ▲ 131 - 150%
- ▲ 111 - 130%
- ▲ 91 - 110%
- ▲ 71 - 90%
- ▲ 51 - 70%
- ▲ 1 - 50%



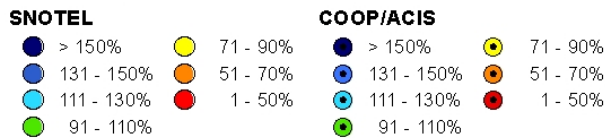
Lower Yellowstone River Basin
Water Year to Date Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019



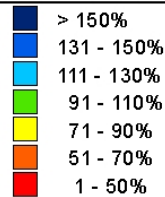
**Lower Yellowstone River Basin
Monthly Precipitation and Reservoir Levels
Percentage of Normal
May 1, 2019 (April 1, 2019 - May 1, 2019)**



**Precipitation
Percent of Normal**



**Reservoirs
Percent of Normal**



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Montana Water Supply Outlook Report

Natural Resources Conservation Service

