# Upper Missouri River Basin
# July 2016 Calendar Year Runoff Forecast
**July 7, 2016**

**U.S. Army Corps of Engineers, Northwestern Division**
**Missouri River Basin Water Management**
**Omaha, NE**

## Calendar Year Runoff Forecast

### Explanation and Purpose of Forecast

The long-range runoff forecast is presented as the Calendar Year Runoff Forecast. This forecast is developed shortly after the beginning of each calendar year and is updated at the beginning of each month to show the actual runoff for historic months of that year and the updated forecast for the remaining months of the year. This forecast presents monthly inflows in million acre-feet (MAF) from five incremental drainage areas, as defined by the individual System projects, plus the incremental drainage area between Gavins Point Dam and Sioux City. Due to their close proximity, the Big Bend and Fort Randall drainage areas are combined. Summations are provided for the total Missouri River reach above Gavins Point Dam and for the total Missouri River reach above Sioux City. The Calendar Year Runoff Forecast is used in the Monthly Study simulation model to plan future system regulation in order to meet the authorized project purposes throughout the calendar year.

### June 2016 Runoff

June 2016 Missouri River Basin above Sioux City, IA (upper Basin) runoff was 4.1 MAF (74% of average). June runoff was 57% of average in the Fort Peck reach, 82% of average in the Garrison reach, 45% of average in the Oahe reach, 18% of average in the Fort Randall reach, 91% of average in the Gavins Point reach, and 156% of average in the Sioux City reach. Early mountain snowmelt in the northern Rocky Mountains coupled with significantly below-normal precipitation and above-normal temperatures led to the below-normal runoff in the Fort Peck and Garrison reaches, while significantly below normal rainfall led to the well below-normal runoff in the Oahe and Fort Randall reaches. Runoff in the Gavins Point and Sioux City reaches was largely due to wet antecedent soil moisture conditions, as rainfall was below normal in much of these two reaches as well.

### 2016 Calendar Year Forecast Synopsis

The July 1 forecast for 2016 upper Basin runoff is **23.0 MAF (91% of average)**. Runoff for the basin above Gavins Point Dam is forecast to be **19.5 MAF (85% of average)**. Due to the amount of variability in precipitation and other hydrologic factors that can occur over the next 6 months, the range of expected inflow is quite large and ranges from the 25.3 MAF upper basic

forecast to the 20.9 MAF lower basic forecast. The upper and lower basic forecasts are used in long-term regulation planning models to "bracket" the range of expected runoff given much wetter or drier conditions, respectively. Given that 6 months are being forecasted for this July 1 forecast (6 months observed/6 months forecast), the range of wetter than normal (upper basic) and drier than normal (lower basic) conditions is attributed to all 6 reaches for 6 months. The result is a range or "bracket" for each reach, and thus, for the total runoff forecast. As the year progresses, the range will further lessen as the number of observed months increases and number of forecast months decreases.

## Current Conditions

### Drought Analysis

The latest National Drought Mitigation Center's drought monitor for June 28, 2016 (**Figure 1**), when compared to the drought monitor for May 31, 2016 (**Figure 2**), shows an increase in severity and areal extent of drought conditions in the upper Basin. There has been some worsening and increase in areal extent of drought conditions in western North Dakota and northeastern Wyoming, and southern Iowa, southeastern Nebraska, eastern Kansas and northern Missouri. The U.S. Seasonal Drought Outlook in **Figure 3** indicates that drought is expected to persist in portions of Montana, Wyoming and North Dakota with some drought development expected to develop in western Montana.

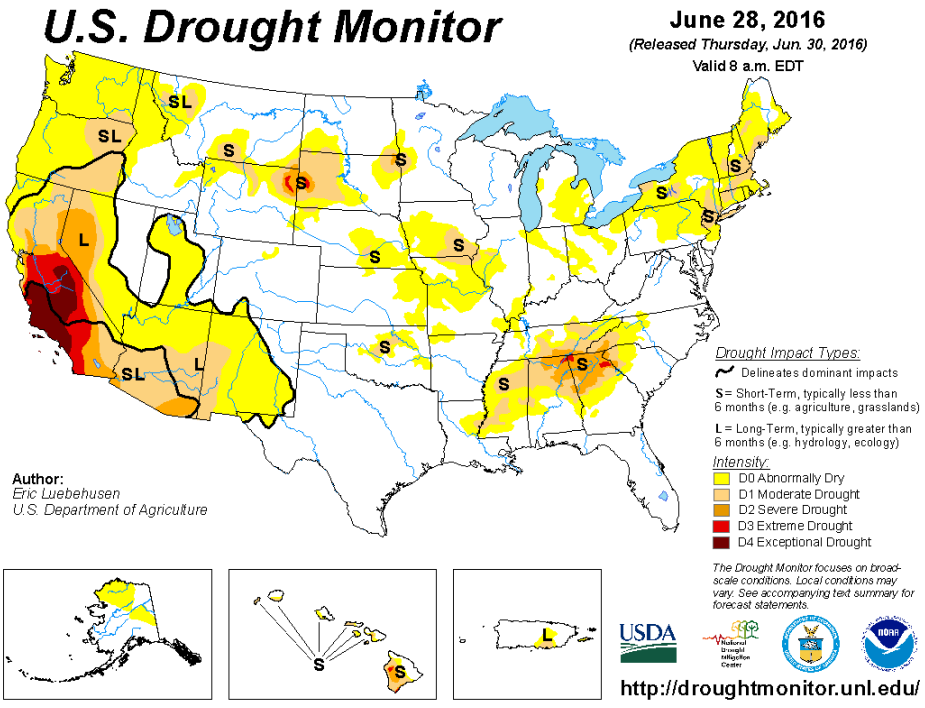



**Figure 1 National Drought Mitigation Center U.S. Drought Monitor for June 28, 2016**

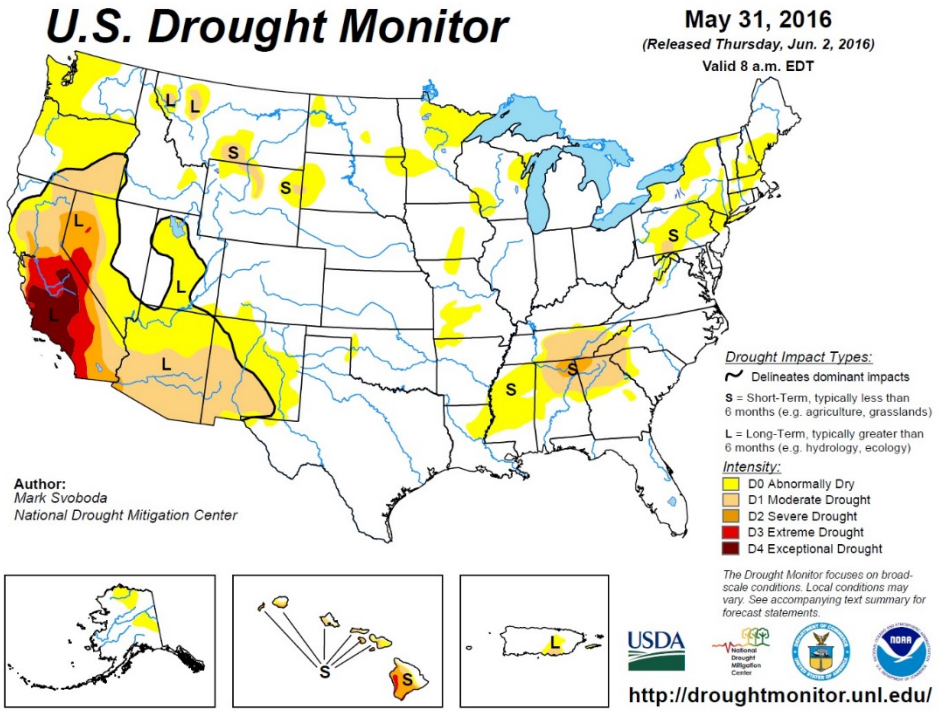



**Figure 2. National Drought Mitigation Center U.S. Drought Monitor for May 31, 2016.**

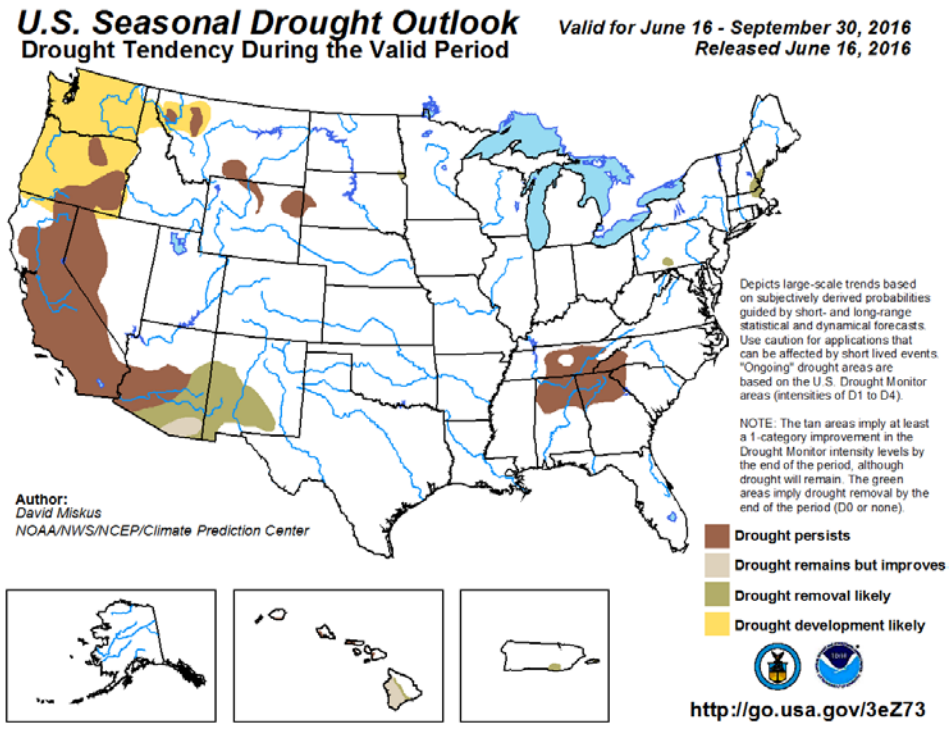



**Figure 3. National Drought Mitigation Center U.S. Drought Seasonal Drought Outlook.**

## Precipitation

June precipitation accumulations are shown in **Figure 4** as both inches of precipitation (left) and percent of normal monthly precipitation (right). June precipitation was much below average in most of the Basin. The only areas of above-normal precipitation were in northeastern Montana and a few isolated pockets extending from southern North Dakota into north-central Nebraska and into northeastern Colorado. Large areas of Montana, Wyoming, western North Dakota, South Dakota, eastern Nebraska and Kansas, and western Iowa and Missouri received less than 50% of average precipitation in June.

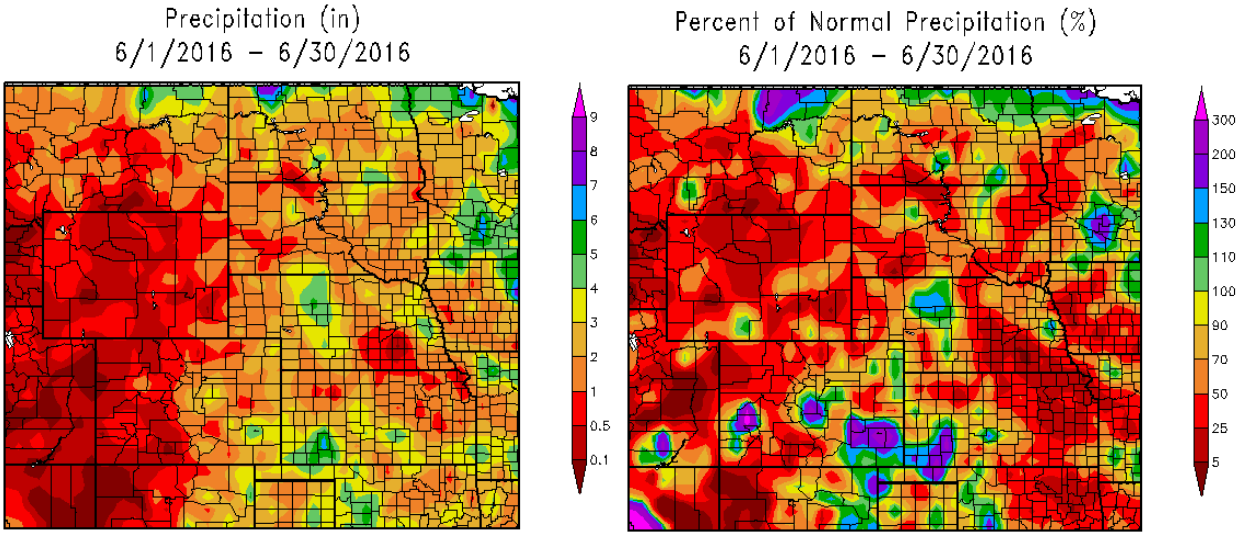



**Figure 4. July 2016 Precipitation (inches) and Percent of Normal Precipitation. Source: High Plains Regional Climate Center, http://www.hprcc.unl.edu/.**

**Table 1** contains notable June precipitation and departures in many locations in the Missouri Basin. Precipitation departures were variable across the basin ranging from large above-average departures in Glasgow, MT and Billings, MT to large below-average departures in Grand Island, NE and Billings, MT. Notable departures in the upper Basin include: 2.32 inches below normal in Lewistown, MT, 2.29 inches below normal in Aberdeen, SD, 1.89 inches below normal in Billings, MT, and 1.21 inches above normal in Bismarck, ND. Notable departures in the lower Basin include: 4.37 inches below normal in Lawrence, KS, 4.25 inches below normal in Grand Island, NE and Kansas City, MO, 3.77 inches below normal in Lincoln, NE, and 3.24 inches below normal in Omaha, NE.

**Table 1. June 2016 precipitation and precipitation departures.**

| City, State | Precipitation inches | Precipitation Departure inches | Percent of Normal |
|---|---|---|---|
| Bozeman, MT | 1.17 | -1.23 | 49% |
| Lewistown, MT | 0.76 | -2.32 | 25% |
| Livingston, MT | 0.73 | -1.66 | 31% |
| Great Falls, MT | 0.96 | -1.57 | 38% |
| Havre, MT | 1.93 | -0.26 | 88% |

| City, State | Precipitation inches | Precipitation Departure inches | Percent of Normal |
|---|---|---|---|
| Miles City, MT | 0.69 | -1.82 | 27% |
| Billings, MT | 0.23 | -1.89 | 11% |
| Glasgow, MT | 3.51 | 1.18 | 151% |
| Wolf Point, MT | 3.20 | 0.49 | 118% |
| Lander, WY | 0.57 | -0.70 | 45% |
| Lake Yellowstone, WY | 0.95 | -1.05 | 48% |
| Sheridan, WY | 0.39 | -1.73 | 18% |
| Gillette, WY | 0.44 | -1.77 | 20% |
| Jamestown, ND | 2.45 | -0.74 | 77% |
| Bismarck, ND | 4.38 | 1.21 | 138% |
| Williston, ND | 1.84 | -0.68 | 73% |
| Huron, SD | 1.91 | -2.02 | 49% |
| Rapid City Arpt, SD | 1.22 | -1.31 | 48% |
| Aberdeen, SD | 1.41 | -2.29 | 38% |
| Watertown, SD | 1.53 | -2.05 | 43% |
| Pierre, SD | 1.83 | -1.74 | 51% |
| Mobridge, SD | 2.41 | -0.75 | 76% |
| Sioux Falls, SD | 1.72 | -2.20 | 44% |
| Sioux City, IA | 1.38 | -2.51 | 35% |
| Valentine, NE | 4.16 | 0.60 | 117% |
| North Platte, NE | 3.26 | -0.16 | 95% |
| Grand Island, NE | 0.05 | -4.25 | 1% |
| Norfolk, NE | 3.21 | -1.05 | 75% |
| Kearney, NE | 0.46 | -3.47 | 12% |
| Lincoln, NE | 0.58 | -3.77 | 13% |
| Omaha, NE | 0.94 | -3.24 | 22% |
| Manhattan, KS | 1.25 | -3.84 | 25% |
| Topeka, KS | 2.39 | -3.01 | 44% |
| Lawrence, KS | 1.09 | -4.37 | 20% |
| Kansas City Intl Arpt, KS | 0.98 | -4.25 | 19% |
| St. Joseph, MO | 0.71 | -3.47 | 17% |
| Columbia, MO | 1.46 | -3.01 | 33% |
| Jefferson City, MO | 1.53 | -3.03 | 34% |

April-May-June 2016 precipitation accumulations and percent of normal (average) precipitation are shown in **Figure 5**. The precipitation pattern since April 1 shows above-average precipitation (right image) in much of Nebraska, Kansas, and Colorado, southern Wyoming, northeastern Montana and portions of North and South Dakota into northwestern Iowa. A below-average precipitation pattern has been prevalent in southern Montana, southwest North Dakota, northeast Wyoming and western South Dakota. Additionally, the lower Basin in southern Iowa and Missouri has received below-average precipitation since April 1. The areas with the driest conditions over the past three months closely correspond with areas noted as being in drought conditions above.

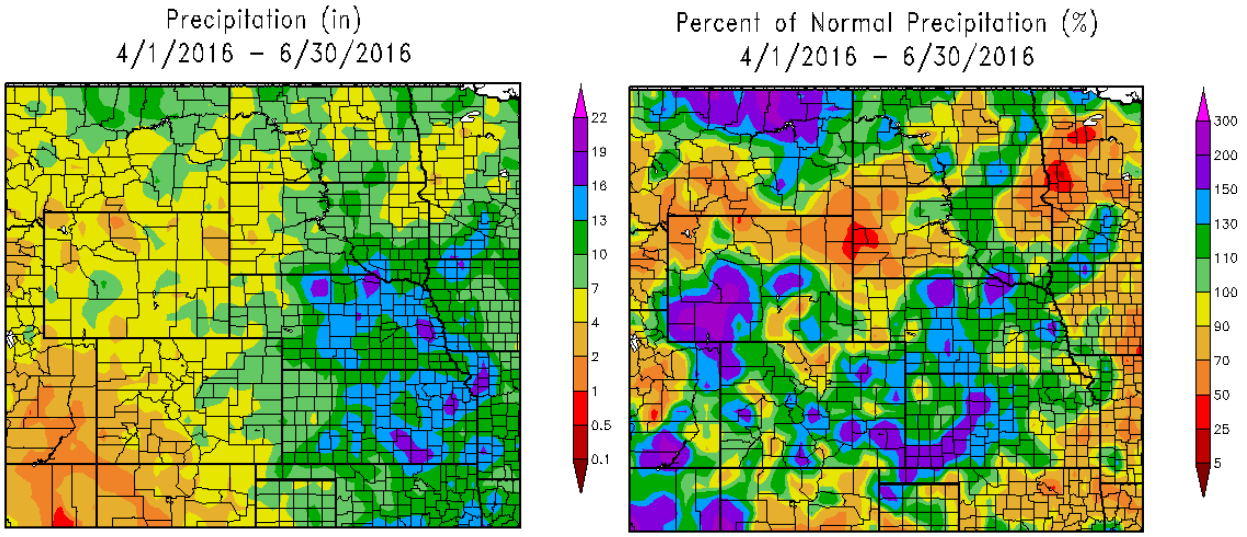



**Figure 5. April-May-June 2016 Precipitation (inches) and Percent of Normal Precipitation. Source: High Plains Regional Climate Center, http://www.hprcc.unl.edu/.**

## Temperature

June temperature departures from normal are shown in the left image of **Figure 6** in degrees Fahrenheit (deg F). April-May-June 2016 temperature departures are also shown in the right image of **Figure 6**. Temperatures during June (left image) have been above normal the entire Basin, with the exception of a few isolated pockets along the Canada-Montana border. The wsarmer temperatures are a reflection of dry June conditions. During the April-May-June period, an overall warmer-than-normal temperature pattern has prevailed throughout the entire Missouri Basin with the exception of isolated areas across northern Montana, North and South Dakota, Wyoming, Nebraska, Colorado and Kansas. Warmer temperatures in March through May led to earlier-than-normal peak mountain snow accumulations and earlier-than-normal snowmelt in the Northern Rockies. Temperatures in the Central Rockies have been closer to normal, resulting in normal to slightly above normal peak mountain snow accumulations and snowmelt in the Platte River basin.

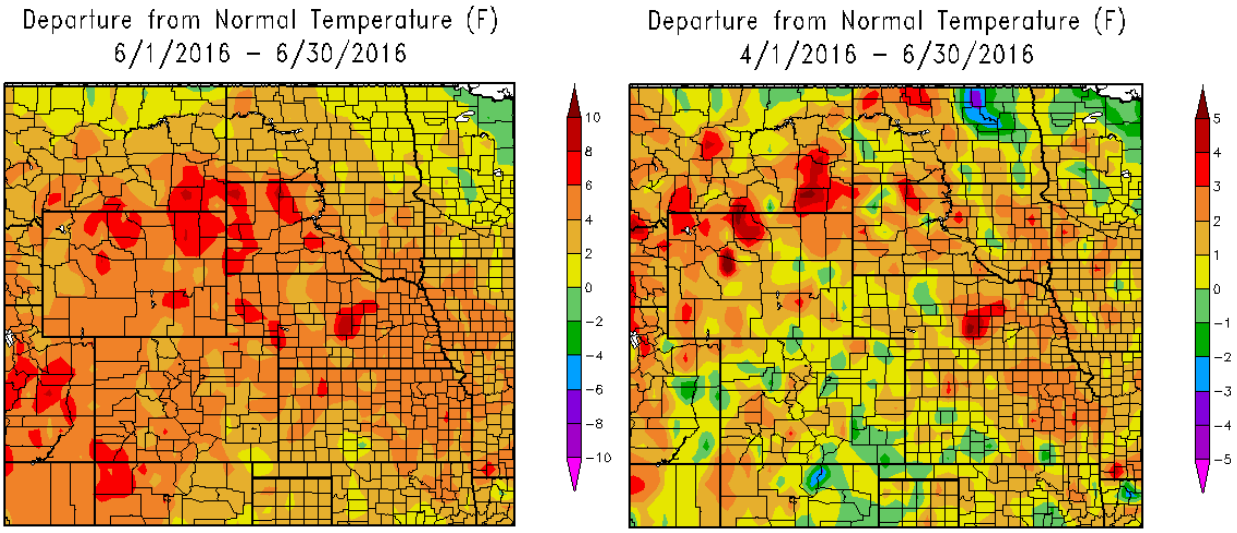



**Figure 6. June 2016 and April-May-June 2016 Departure from Normal Temperature (deg F). Source: High Plains Regional Climate Center, http://www.hprcc.unl.edu/.**

## Soil Moisture

Soil moisture is factored into the forecast as an indicator of wet or dry hydrologic basin conditions. Typically when soil moisture conditions are wet or greater than normal, rainfall and snowmelt runoff is greater than when soil moisture is dry or less than normal. Not only is soil moisture a physical parameter that influences runoff, it can be used as an indicator of future runoff.

**Figure 7** shows the NOAA NLDAS ensemble top 1-meter soil moisture anomaly on June 26, 2016. The NLDAS soil moisture depiction is an average value for the soil moisture column. **Figure 7** indicates above-normal soil moisture anomalies in northeastern Montana, most of southern Wyoming, western Nebraska and Kansas, and eastern Colorado. Below-normal soil moisture anomalies are present across southern Montana and northern Wyoming, most of North and South Dakota, eastern Kansas, and most of Iowa and Missouri.

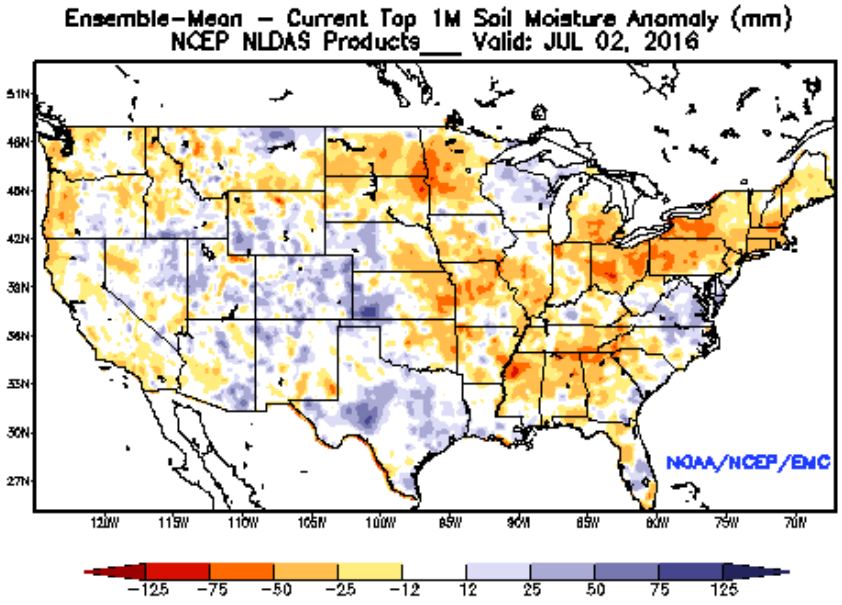



**Figure 7. Top 1-Meter Soil Moisture Anomaly on July 2, 2016. Source: NOAA NLDAS Drought Monitor Soil Moisture. http://www.emc.ncep.noaa.gov/mmb/nldas/drought/**

## Streamflow Conditions

Missouri Basin streamflow conditions are shown in **Figure 8**. These conditions are based on the ranking of the July 1, 2016 daily streamflow versus the historical record of streamflow for that date. Streamflow conditions are generally "Normal" (25$^{th}$-75$^{th}$ percentile) and "Below Normal) (10$^{th}$ to 24$^{th}$ percentile) in Montana and Wyoming, though there are a number of tributaries that have fallen into the "Much Below Normal" (below 10$^{th}$ percentile) class as a result of early low elevation mountain snowmelt and below-average precipitation across areas of western and southern Montana. Streamflow has also been "Normal" to "Below Normal" in North Dakota and South Dakota, with some tributary headwaters locations in both states in the "Much Below Normal" class. Streamflow in the North Platte Basin in southeast Wyoming is "Normal" to "Above Normal" (76$^{th}$ – 90$^{th}$ percentile). The Missouri River and its tributaries from Sioux City to Kansas City range from "Normal" to "Much Above Normal" (above 90$^{th}$ percentile) due to precipitation in late June, with a few locations falling into "Below Normal" scattered throughout the area, depending on the location of late-month rainfall.

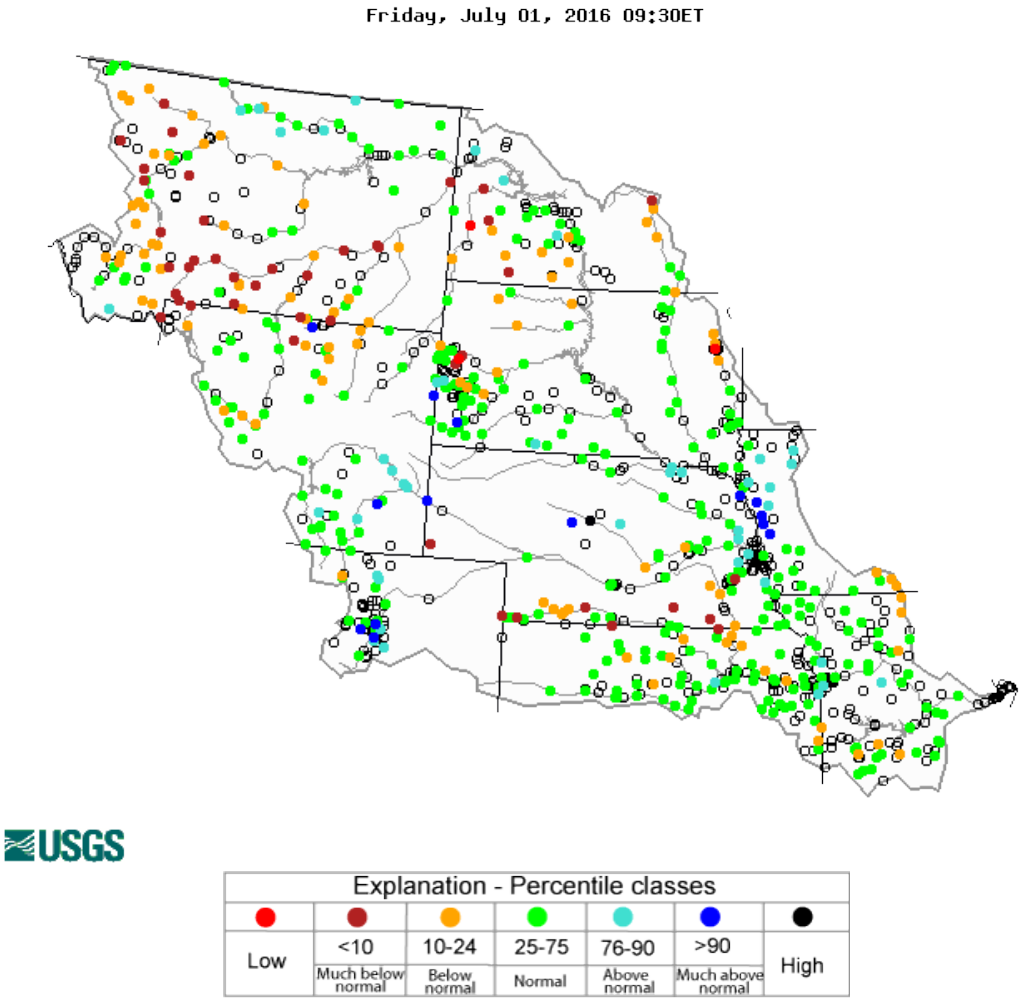



**Figure 8. USGS Streamflow Conditions as a Percentile of Normal in the Missouri River Basin as of July 1, 2016. Source: USGS. http://waterwatch.usgs.gov/index.php**

## Mountain Snowpack

Mountain snowpack is the primary factor used to predict June-July runoff volumes in the Fort Peck and Fort Peck to Garrison mainstem reaches. During the 3-month May-June-July runoff period, about 50% of the annual runoff enters the mainstem system as a result of mountain snowmelt and rainfall runoff. Greater-than-average mountain snow accumulations are usually associated with greater-than-average June-July runoff volumes, especially when mountain soil moisture conditions have been wetter than normal as in the past three years. For example, we would expect to see below-average runoff from a below-average mountain snowpack this year due to soil moisture conditions ranging from drier than normal to wetter than normal.

**Figure 9** includes time series plots of the average mountain snow water equivalent (SWE) beginning on October 1, 2015 based on the NRCS SNOTEL gages for the basin above Fort Peck and the incremental basin from Fort Peck to Garrison. The current average SWE values (shaded blue area) are plotted against the 1981-2010 basin average SWE (bold red line), 2001 (green

line), and two historic high SWE years occurring in 1997 (purple) and 2011 (dark blue). On average, mountain SWE normally peaks around April 15, and about 39% of the peak SWE accumulation remains by June 1.

The Fort Peck reach peaked at 15.0 inches of SWE on April 1, while Fort Peck to Garrison peaked at 12.2 inches of SWE on April 2, or 95% and 89% of average annual peak SWE, respectively. The mountain SWE has decreased rapidly over the past month as low to mid-level mountain snowpack melted due to warmer-than-normal temperatures in the Northern Rockies. On May 31, mountain SWE was 4.6 inches (74% of average) above Fort Peck and 4.5 inches (72% of average) from Fort Peck to Garrison. As of July 1, the mountain snowpack in both the Fort Peck and the Fort Peck to Garrison reaches had melted. No further snowmelt is anticipated in July.

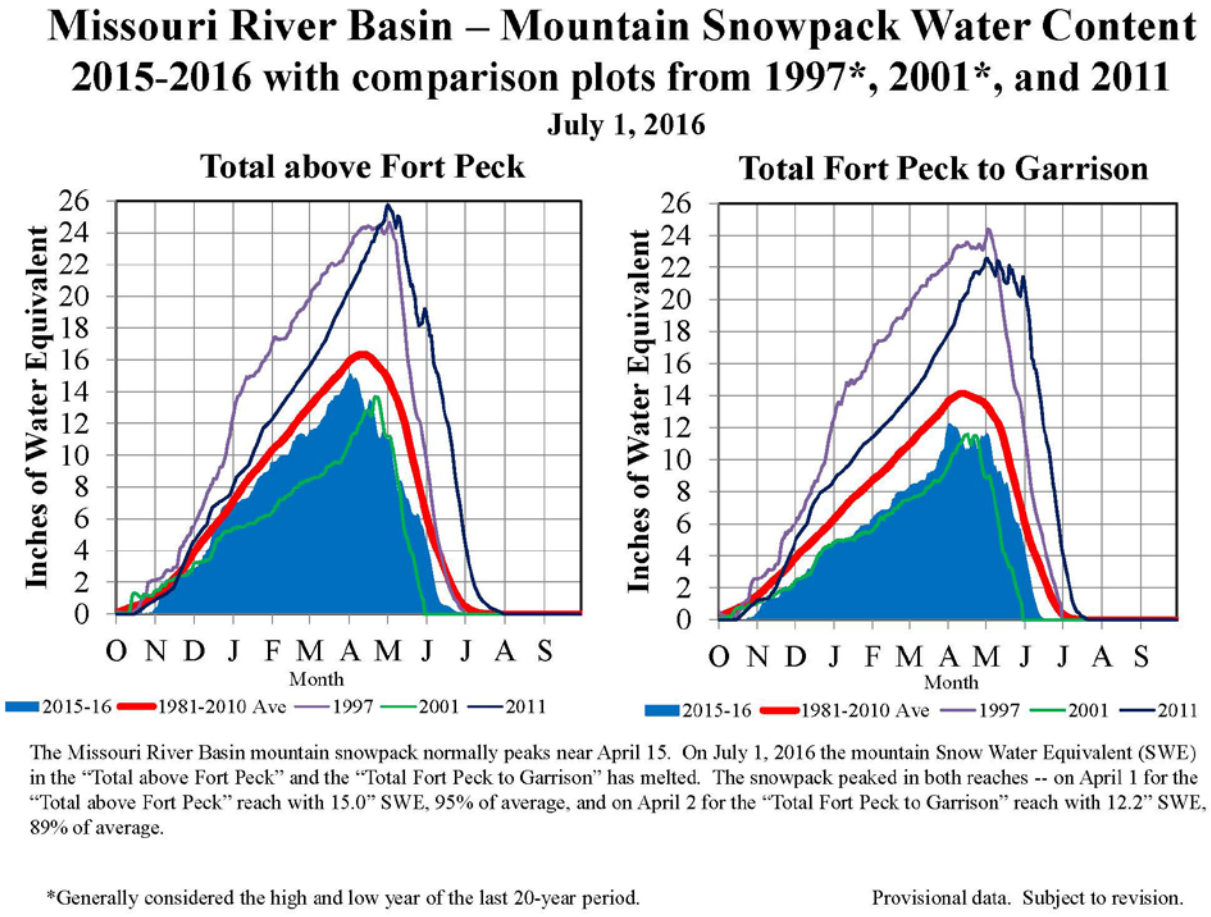



**Figure 9. Mountain snowpack water content on July 1, 2016 compared to normal and historic conditions. Corps of Engineers - Missouri River Basin Water Management.**

## Climate Outlook

### ENSO (El Niño Southern Oscillation)

According to the CPC's latest monthly updated[1] on July 5, 2016, "***ENSO-neutral conditions are present. La Niña is favored to develop during the Northern Hemisphere summer 2016, with about a 75% chance of La Niña during the fall and winter 2016-2017."***

MRBWMD participates in the monthly North Central U.S. Climate/Drought Outlook Webinar coordinated through NOAA, the regional climate centers, and the American Association of State Climatologists (AASC). These webinars provide updates on near-term climate outlooks and impacts including the La Niña climate pattern and its implications on winter temperature and precipitation patterns in the Missouri River Basin. During La Niña winters, the probability for a colder-than-normal and slightly wetter-than-normal weather pattern in the Northern Rockies and Northern Plains is higher. The possible impacts of La Niña have been factored into the CPC climate outlooks described below.

### Temperature and Precipitation Outlooks

The NOAA Climate Prediction Center climate outlook for July 2016 (**Figure 10)** indicates there are increased probabilities for above-normal temperatures throughout the entire Basin. With regard to precipitation, there are equal chances for above-normal, normal and below-normal precipitation in the Missouri Basin with the exception of western Montana, which has an increased probability for below-normal precipitation. However, the mid-term outlooks through mid-July indicate that Montana and Wyoming will be cooler-than-normal, while northern Montana, North Dakota, eastern South Dakota, western Iowa, eastern Nebraska, eastern Kansas and Missouri will be wetter than normal.

[1] http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf

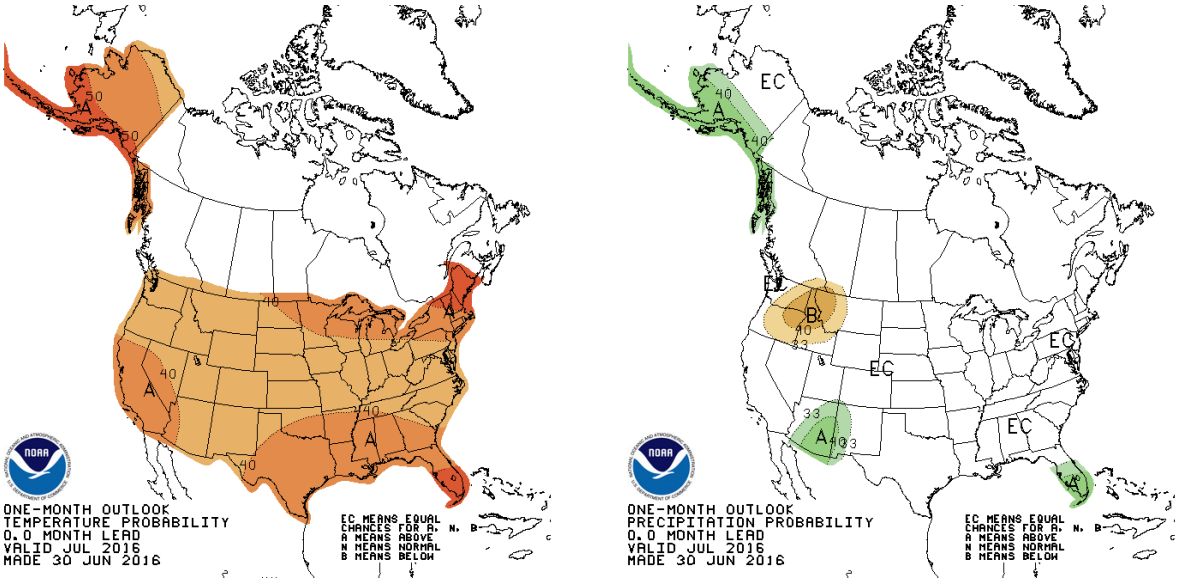



**Figure 10. CPC July 2016 temperature and precipitation outlooks.**

The July-August-September 2016 temperature outlook (**Figure 11**) indicates there are increased chances for above-normal temperatures throughout the entire Missouri Basin. With regard to precipitation, the July-August-September outlook indicates that is an increased probability of below-normal precipitation in western Montana, an increased probability of above-normal precipitation in nearly all of South Dakota, and equal chances for above-normal, normal or below-normal precipitation over the remainder of the Basin.

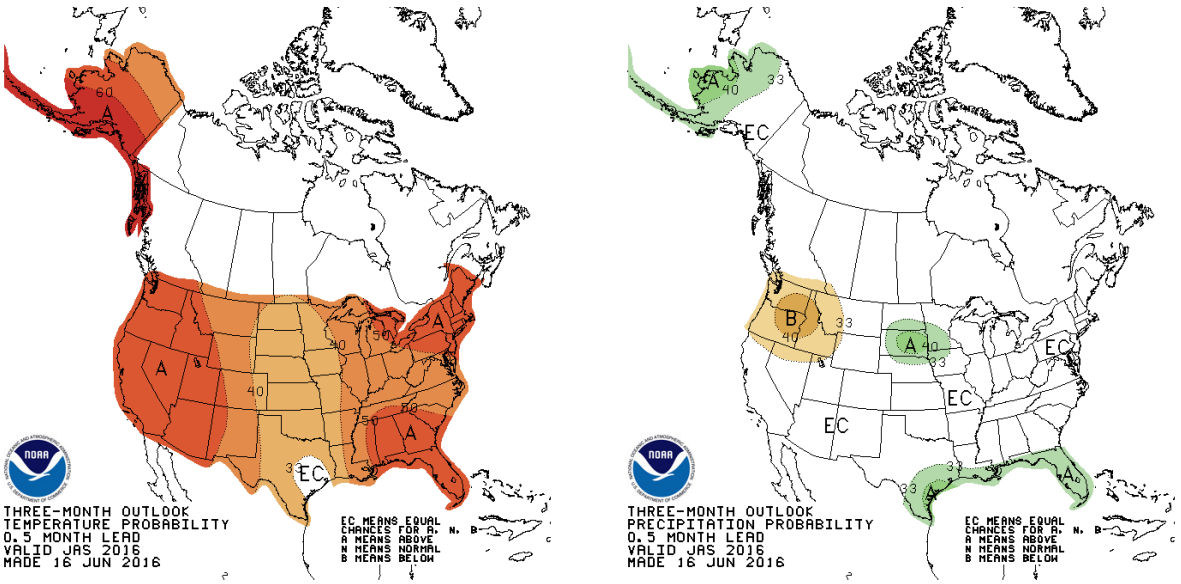



**Figure 11. CPC July-August-September 2016 temperature and precipitation outlooks.**

The October-November-December 2016 CPC temperature outlook (**Figure 12**) indicates there are equal chances for above-normal, normal or below-normal temperatures across nearly all of Montana and North Dakota and increased chances for above-normal temperatures across the

remainder of the Missouri Basin. In terms of precipitation, there are increased chances for above-normal precipitation across western Montana, increased chances for below-normal precipitation across nearly all of Colorado and equal chances for above-normal, normal and below-normal precipitation across the rest of the Missouri Basin.

During the January-February-March 2017 period (**Figure 13**) CPC outlooks indicate increased chances (33% to greater than 40%) for below-normal temperatures in the Northern Rockies and Northern Plains based on the 75% chance that La Niña will develop in the fall and winter. The CPC outlook indicates increased chances (33% to greater than 40%) that precipitation will be above normal in Montana. There are equal chances for precipitation in most other areas of the Missouri Basin through March 2017, with the exception of Colorado, Nebraska and Kansas, which have an increased probability of below-normal precipitation.

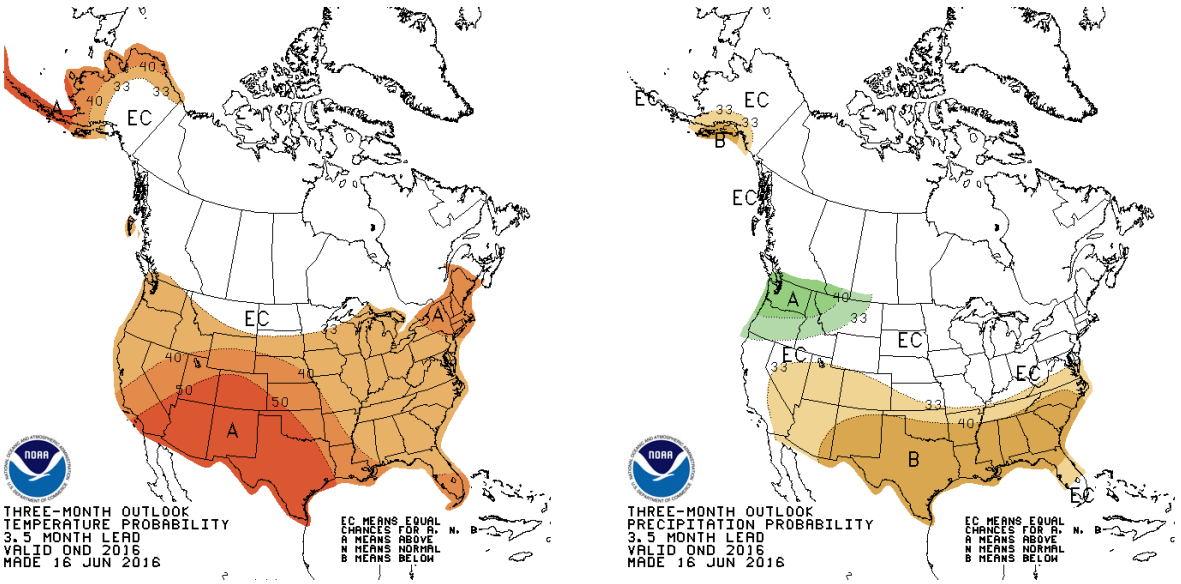



**Figure 12. CPC October-November-December 2016 temperature and precipitation outlooks.**

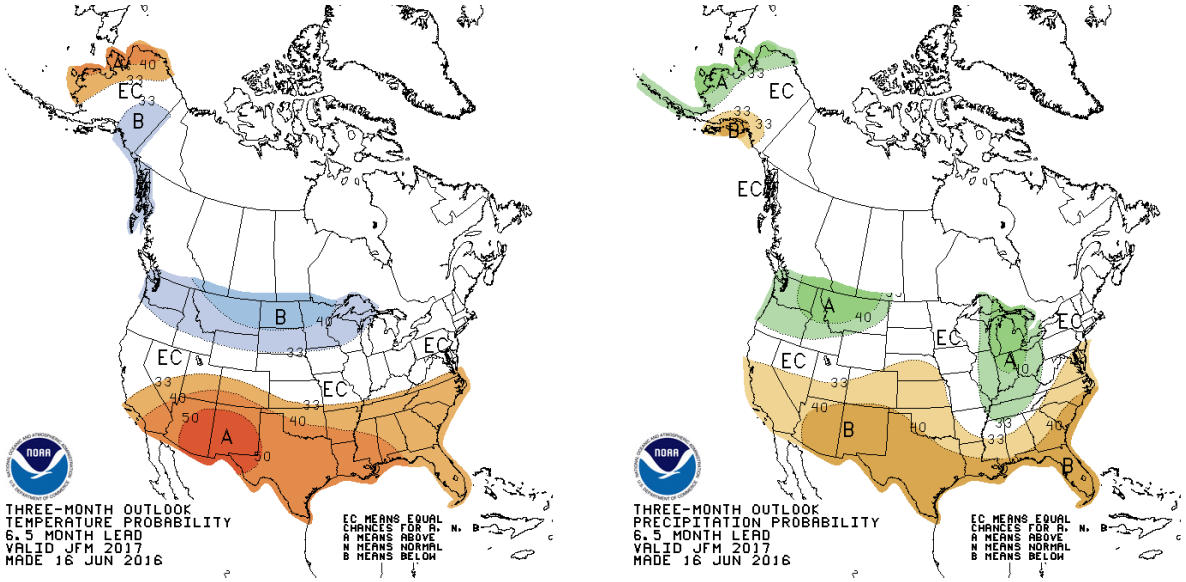
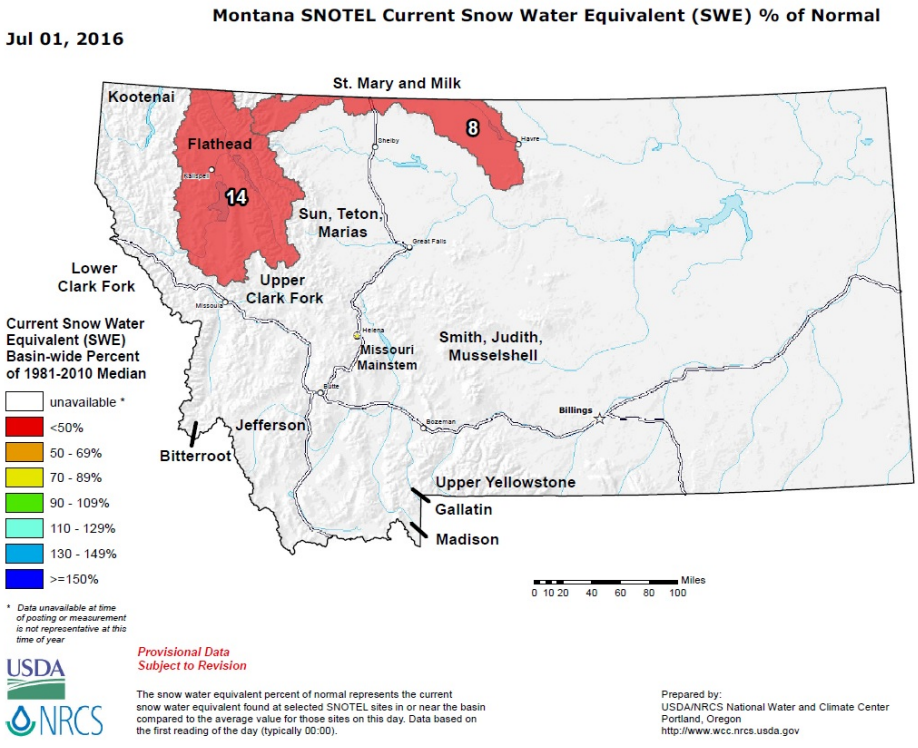


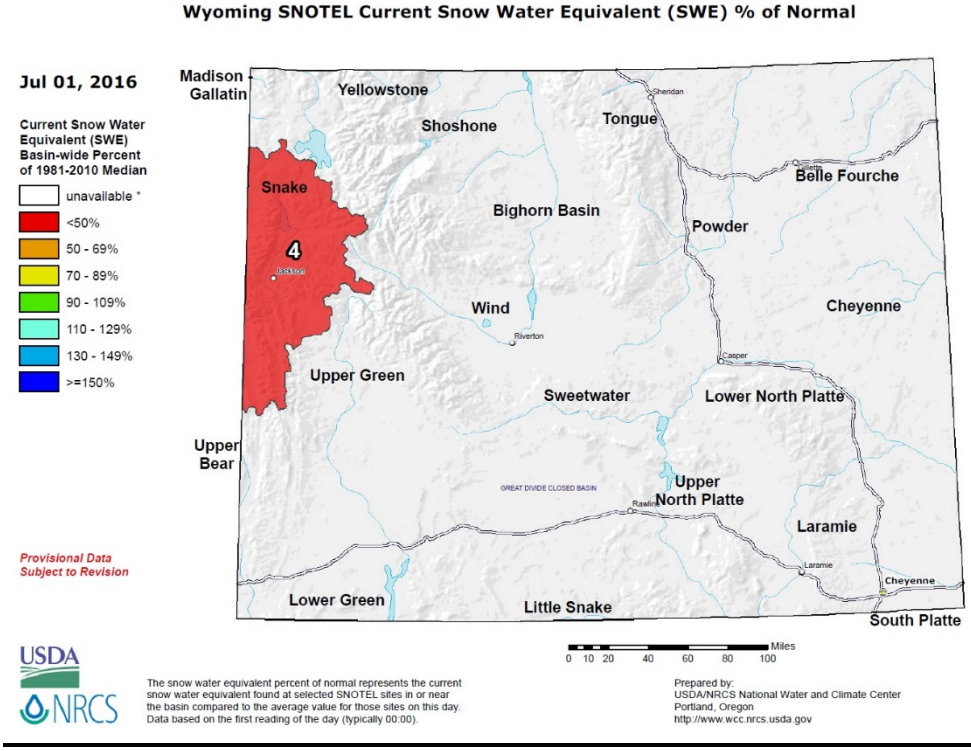

**Figure 13. CPC January-February-March 2017 temperature and precipitation outlooks.**

## June 2016 Calendar Year Runoff Forecast

In summary, the 2016 calendar year runoff forecast is **23.0 MAF**, **91% of average**. Runoff for the basin above Gavins Point Dam, excluding the contributing area between Gavins Point Dam and Sioux City, IA, is forecast to be **19.5 MAF (85% of average)**. June runoff was 74% of average. The below-normal runoff was due to an earlier-than-normal mountain snowmelt and below-average observed precipitation in the upper Basin coupled with above-average temperatures. We will continue to monitor Missouri Basin conditions and make forecast adjustments as conditions change.

# Additional Figures



USDA NRCS National Water & Climate Center
 * - DATA CURRENT AS OF: June 06, 2016 01:28:36 PM
   - Based on June 01, 2016 forecast values

PRELIMINARY MISSOURI RIVER BASIN FORECASTS

| Forecast Point | period | 50% (KAF) | % of avg | max (KAF) | 30% (KAF) | 70% (KAF) | min (KAF) | 30-yr avg |
|---|---|---|---|---|---|---|---|---|
| Lake Sherburne Inflow | JUN-JUL | 47 | 84 | 60 | 52 | 42 | 34 | 56 |
| | JUN-SEP | 61 | 86 | 76 | 67 | 55 | 46 | 71 |
| St. Mary R at Int'l Boundary (2) | JUN-JUL | 220 | 80 | 290 | 245 | 191 | 149 | 275 |
| | JUN-SEP | 280 | 81 | 355 | 310 | 250 | 200 | 345 |
| Lima Reservoir Inflow (2) | JUN-JUL | 20 | 65 | 34 | 26 | 14.5 | 6.3 | 31 |
| | JUN-SEP | 25 | 64 | 43 | 32 | 17.9 | 7.4 | 39 |
| Clark Canyon Reservoir Inflow (2) | JUN-JUL | 21 | 60 | 65 | 39 | 3.1 | -23 | 35 |
| | JUN-SEP | 34 | 62 | 84 | 54 | 13.6 | -16.4 | 55 |
| Jefferson R nr Three Forks (2) | JUN-JUL | 290 | 82 | 480 | 365 | 210 | 96 | 355 |
| | JUN-SEP | 345 | 83 | 575 | 440 | 250 | 109 | 415 |
| Hebgen Reservoir Inflow (2) | JUN-JUL | 126 | 71 | 169 | 143 | 109 | 83 | 178 |
| | JUN-SEP | 210 | 75 | 260 | 230 | 189 | 158 | 280 |
| Ennis Reservoir Inflow (2) | JUN-JUL | 260 | 79 | 325 | 285 | 235 | 193 | 330 |
| | JUN-SEP | 395 | 81 | 480 | 430 | 360 | 310 | 485 |
| Missouri R at Toston (2) | JUN-JUL | 725 | 77 | 1090 | 875 | 575 | 360 | 940 |
| | JUN-SEP | 970 | 80 | 1480 | 1180 | 765 | 465 | 1220 |
| Smith R bl Eagle Ck (2) | JUN-JUL | 55 | 102 | 89 | 69 | 41 | 21 | 54 |
| | JUN-SEP | 67 | 103 | 112 | 85 | 48 | 21 | 65 |
| Gibson Reservoir Inflow (2) | JUN-JUL | 115 | 55 | 169 | 137 | 93 | 61 | 210 |
| | JUN-SEP | 150 | 60 | 210 | 173 | 127 | 92 | 250 |
| Marias R nr Shelby (2) | JUN-JUL | 65 | 45 | 175 | 109 | 21 | -15.0 | 143 |
| | JUN-SEP | 76 | 48 | 200 | 127 | 25 | -15.0 | 158 |

PRELIMINARY YELLOWSTONE RIVER BASIN FORECASTS

| Forecast Point | period | 50% (KAF) | % of avg | max (KAF) | 30% (KAF) | 70% (KAF) | min (KAF) | 30-yr avg |
|---|---|---|---|---|---|---|---|---|
| West Rosebud Ck nr Roscoe (2) | JUN-JUL | 40 | 85 | 48 | 43 | 37 | 32 | 47 |
| | JUN-SEP | 53 | 84 | 64 | 57 | 49 | 42 | 63 |
| Wind R ab Bull Lake Ck (2) | JUN-JUL | 360 | 109 | 455 | 400 | 320 | 265 | 330 |
| | JUN-SEP | 395 | 108 | 505 | 440 | 350 | 285 | 365 |
| Bull Lake Ck nr Lenore (2) | JUN-JUL | 137 | 127 | 161 | 147 | 128 | 114 | 108 |
| | JUN-SEP | 172 | 124 | 205 | 185 | 159 | 140 | 139 |
| Boysen Reservoir Inflow (2) | JUN-JUL | 635 | 149 | 820 | 710 | 560 | 450 | 425 |
| | JUN-SEP | 705 | 145 | 935 | 800 | 610 | 475 | 485 |
| Greybull R nr Meeteetse | JUN-JUL | 113 | 118 | 138 | 123 | 103 | 88 | 96 |
| | JUN-SEP | 164 | 115 | 197 | 177 | 151 | 131 | 142 |
| Shell Ck nr Shell | JUN-JUL | 21 | 60 | 31 | 25 | 17.1 | 11.5 | 35 |
| | JUN-SEP | 30 | 65 | 41 | 35 | 25 | 18.6 | 46 |
| Bighorn R at Kane (2) | JUN-JUL | 765 | 134 | 1010 | 860 | 670 | 525 | 570 |
| | JUN-SEP | 860 | 137 | 1160 | 980 | 740 | 560 | 630 |
| NF Shoshone R at Wapiti | JUN-JUL | 275 | 90 | 330 | 295 | 250 | 215 | 305 |
| | JUN-SEP | 325 | 90 | 395 | 355 | 295 | 250 | 360 |
| SF Shoshone R nr Valley | JUN-JUL | 155 | 99 | 181 | 165 | 145 | 129 | 157 |
| | JUN-SEP | 187 | 99 | 220 | 200 | 173 | 153 | 189 |
| Buffalo Bill Reservoir Inflow (2) | JUN-JUL | 440 | 95 | 545 | 480 | 400 | 335 | 465 |
| | JUN-SEP | 510 | 95 | 640 | 565 | 460 | 380 | 535 |
| Bighorn R nr St. Xavier (2) | JUN-JUL | 1090 | 118 | 1400 | 1220 | 970 | 785 | 920 |
| | JUN-SEP | 1220 | 121 | 1620 | 1380 | 1050 | 815 | 1010 |
| Little Bighorn R nr Hardin | JUN-JUL | 32 | 60 | 61 | 44 | 20 | 3.3 | 53 |
| | JUN-SEP | 42 | 64 | 76 | 56 | 28 | 8.0 | 66 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Tongue R nr Dayton (2) | JUN-JUL | 30 | 61 | 46 | 36 | 24 | 14.0 | 49 |
| | JUN-SEP | 41 | 66 | 60 | 49 | 33 | 22 | 62 |
| Tongue River Reservoir Inflow (2) | JUN-JUL | 63 | 57 | 107 | 81 | 45 | 18.0 | 110 |
| | JUN-SEP | 81 | 60 | 137 | 104 | 59 | 25 | 134 |
| NF Powder R nr Hazelton | JUN-JUL | 2.7 | 60 | 4.9 | 3.6 | 1.84 | 0.56 | 4.5 |
| | JUN-SEP | 3.4 | 65 | 5.8 | 4.3 | 2.4 | 0.97 | 5.2 |
| Powder R at Moorhead | JUN-JUL | 67 | 73 | 121 | 89 | 45 | 12.2 | 92 |
| | JUN-SEP | 87 | 79 | 153 | 114 | 60 | 21 | 110 |
| Powder R nr Locate | JUN-JUL | 74 | 73 | 146 | 103 | 45 | 2.3 | 101 |
| | JUN-SEP | 95 | 78 | 186 | 132 | 58 | 4.3 | 122 |

Max (10%), 30%, 50%, 70% and Min (90%) chance that actual volume will exceed forecast.
Averages are for the 1981-2010 period.
All volumes are in thousands of acre-feet.

footnotes:
1) Max and Min are 5% and 95% chance that actual volume will exceed forecast
2) streamflow is adjusted for upstream storage
3) median value used in place of average