## March 1, 2023 Water Supply Forecast Discussion

The Colorado Basin River Forecast Center (CBRFC) geographic forecast area includes the Upper Colorado River Basin (UCRB), Lower Colorado River Basin (LCRB), and Eastern Great Basin (GB).

**Water Supply Forecast Summary**

Following above average December and January precipitation, February started out unusually dry, with most basins receiving less than 30% of normal precipitation during the first half of the month. The weather pattern became more active around the middle of February, with a series of wet storms impacting most areas across the CRB and GB. Most basins ended February with near to slightly above normal precipitation as a result of moisture during the last half of the month. The active weather pattern during the last half of February brought colder than normal temperatures to the region with most of the precipitation falling as snow, even across much of the LCRB.

Early March snow water equivalent (SWE) conditions are near to much above normal across the CRB and GB. Near to slightly above average February precipitation in most basins led to modest changes in percent of normal SWE conditions over the past month. March 1 CBRFC model SWE conditions are 100-185% of normal across the UCRB. Early March CBRFC model SWE conditions across the LCRB are much above normal and exceeding expectations as La Niña conditions usually result in drier than average winter precipitation across the southwest US. March 1 SWE conditions across the GB range from 150-190% of normal, and generally reflect better conditions when compared to the UCRB.

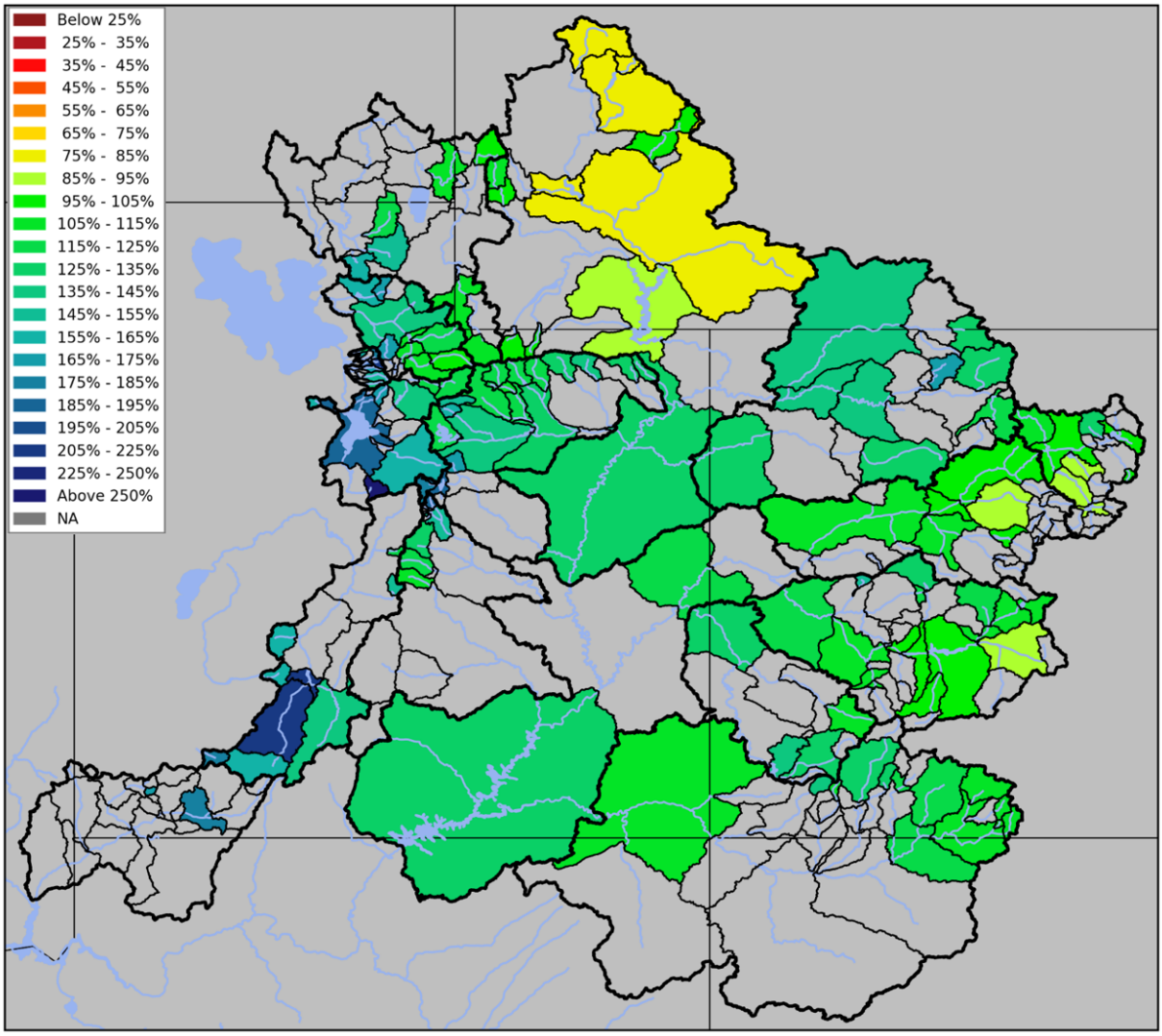
April-July unregulated inflow forecasts for some of the major reservoirs in the UCRB include Fontenelle 620 KAF (84% average), Flaming Gorge 880 KAF (91%), Green Mountain 255 KAF (91%), Blue Mesa 665 KAF (105%), McPhee 345 KAF (135%), and Navajo 735 KAF (117%). The Lake Powell inflow forecast is 8.0 MAF (125% of average), which is a 500 KAF increase from February.

An active weather pattern will bring cool, wet weather to the area through next week. Northern UT, southwest WY, and northwest CO will see the most precipitation, with 0.75-1.0” inches of precipitation expected across higher elevations through Tuesday. Beyond Tuesday, there is disagreement between weather models, but it’s likely the southern half of the area will not see any significant precipitation next week. The weather pattern is expected to remain active through mid-March with increased chances of above normal precipitation and below normal temperatures forecast across the area.

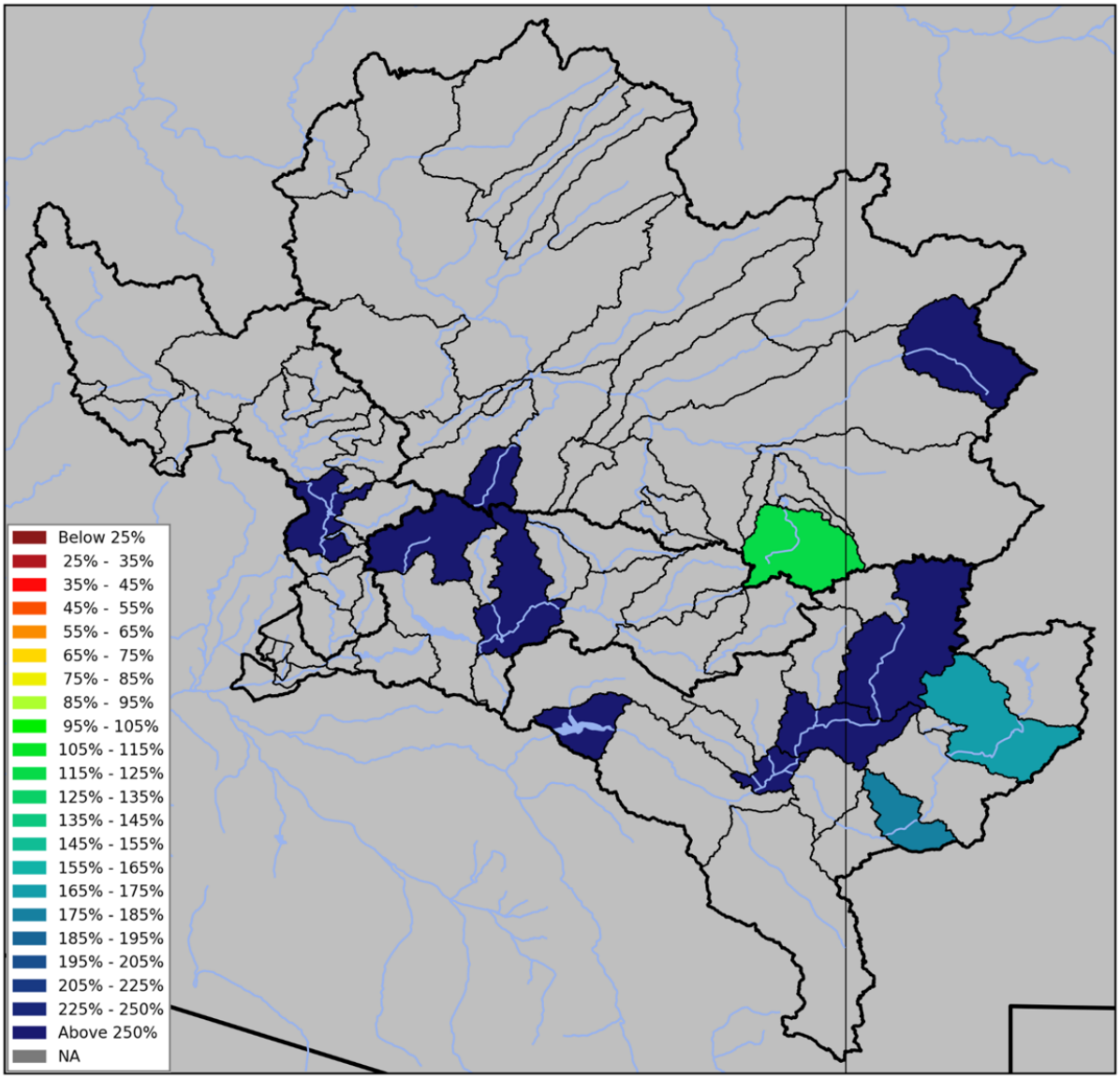
**Seasonal Water Supply Forecasts**

March 1 water supply forecast ranges (percent of normal) by basin:

| **April-July Water Supply Forecast Ranges (%Average)**<br>**January-May Forecast Period (%Median)* | |
|---|---|
| **UPPER COLORADO RIVER BASIN** | |
| **Basin** | **Forecast Range** |
| Lake Powell | 125 |
| **Green River Basin** | |
| Upper Green | 80-105 |
| Duchesne | 115-160 |
| Yampa/White | 120-170 |
| Price/San Rafael/Dirty Devil | 115-190 |
| **Colorado River Headwaters** | |
| Above Kremmling | 85-130 |
| Kremmling to Cameo | 95-105 |
| **Southwest Colorado** | |
| Gunnison | 85-150 |
| Dolores | 110-135 |
| San Juan | 105-140 |
| **LOWER COLORADO RIVER BASIN** | |
| Virgin | 170-180 |
| **Little Colorado* | 125-300 |
| **Verde* | 270 |
| **Salt* | 255-395 |
| **Upper Gila* | 175-390 |
| **GREAT BASIN** | |
| Bear | 105-155 |
| Weber | 105-175 |
| Six Creeks | 130-210 |
| Provo/Utah Lake | 125-190 |
| Sevier | 120-225 |




Upper Colorado, Great Basin, and Virgin River Basins
2023 April-July forecast volumes as a percent of 1991-2020 average
(50% exceedance probability forecast).



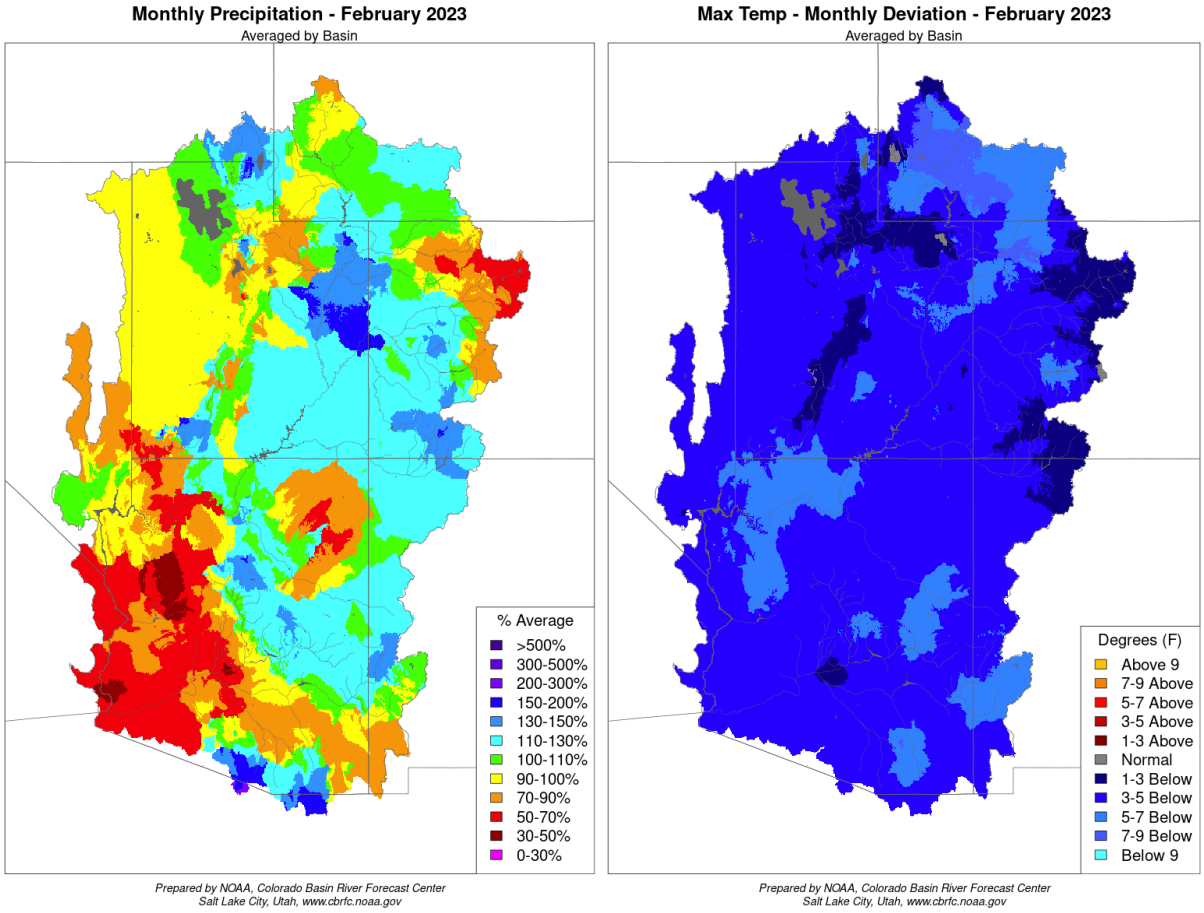

Lower Colorado River Basin (AZ/NM)
2023 January-May forecast volumes as a percent of 1991-2020 median
(50% exceedance probability forecast).

For specific site water supply forecasts click here.

## Water Supply Discussion

**February Weather/Precipitation**

Following above average December and January precipitation, February started out unusually dry, with most basins receiving less than 30% of normal precipitation during the first half of the month. The weather pattern became more active around the middle of February, with a series of wet storms impacting most areas across the CRB and GB during the last half of the month. Largest precipitation amounts occurred across central AZ, southwest CO/Four Corners region, as well as southwest and north central UT. Despite the dry first half of February, most basins ended February with near to slightly above normal precipitation as a result of moisture during the last half of the month. The exception was northwest CO, where February precipitation was around 65-85% of normal. The active weather pattern during the last half of February brought colder than normal temperatures to the region with most of the precipitation falling as snow, even across much of the LCRB.

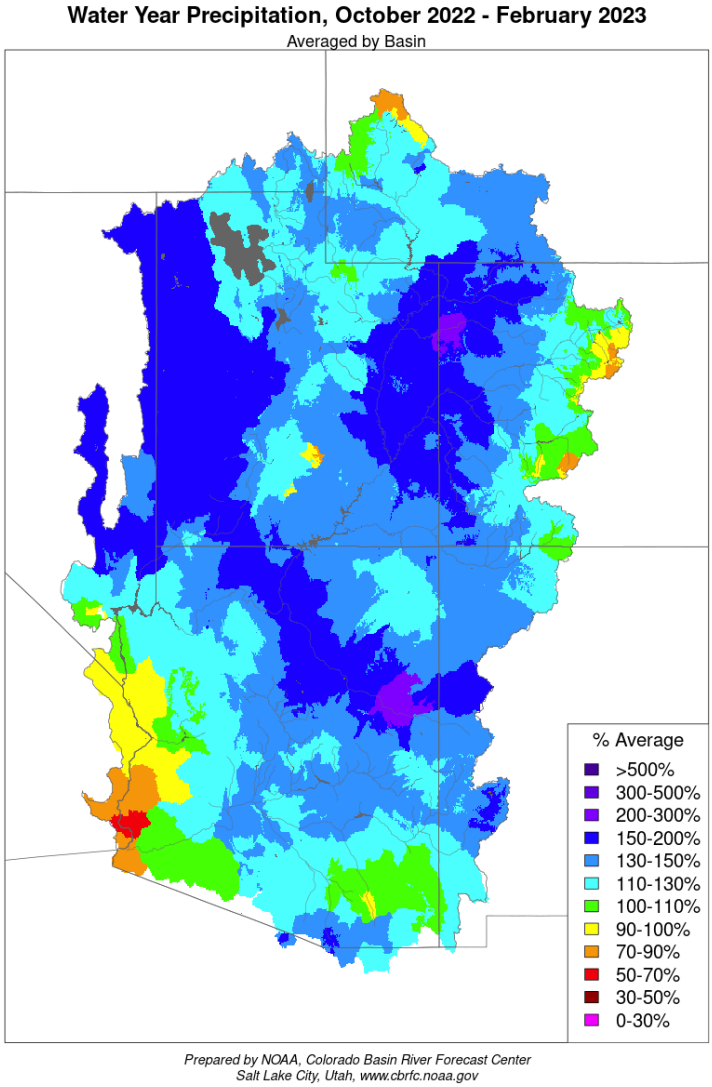



February 2023 percent of normal precipitation (left) and maximum temperature departure (right). (Averaged by basins defined in the CBRFC hydrologic model)

For CBRFC monthly precipitation maps click here.

**Water Year Precipitation**

October precipitation was above average across much of AZ as well as lower elevation areas along the UT/CO border, while the majority of the GB and Upper Green River Basin received below normal precipitation during the month. A few storm systems moved through the region during November, with precipitation primarily targeting western UT, southwest WY, and northwest CO. December and January precipitation was well above average across the region, with near/record wet precipitation across central UT and northwest WY. February precipitation was much below normal during the first half of the month and generally much above normal during the last of the month, with most basins ending the month with near to slightly above normal precipitation. Water year precipitation-to-date (October-February) is near to above average across most of the region, and is summarized in the figure and table below.




Water Year 2023 percent of normal precipitation.
(Averaged by basins defined in the CBRFC hydrologic model)

For CBRFC seasonal precipitation maps click here.

| Water Year 2023<br>CBRFC Precipitation (Significant Runoff Areas)<br>Percent of 1991-2020 Average | | |
|---|---|---|
| **UPPER COLORADO RIVER BASIN** | | |
| | **Feb** | **Oct-Feb** |
| Above Lake Powell | 102 | 118 |
| **Green River Basin** | | |
| Above Fontenelle | 91 | 96 |
| Above Flaming Gorge | 95 | 107 |
| Yampa/White | 86 | 129 |
| Duchesne | 95 | 124 |
| Price/San Rafael/Dirty Devil | 100 | 133 |
| **Colorado River Headwaters** | | |
| Above Kremmling | 66 | 99 |
| Eagle | 74 | 103 |
| Roaring Fork | 103 | 113 |
| Above Cameo | 86 | 108 |
| **Southwest Colorado** | | |
| Gunnison | 112 | 117 |
| Dolores | 127 | 131 |
| San Juan | 127 | 120 |
| **LOWER COLORADO RIVER BASIN** | | |
| Virgin | 129 | 157 |
| Little Colorado | 127 | 141 |
| Verde | 116 | 144 |
| Salt | 114 | 129 |
| Upper Gila | 104 | 132 |
| **GREAT BASIN** | | |
| Bear | 128 | 124 |
| Weber | 108 | 130 |
| Six Creeks | 128 | 140 |
| Provo/Utah Lake | 107 | 140 |
| Sevier | 108 | 137 |

**Snowpack**

Early March snow water equivalent (SWE) conditions are near to much above normal across the CRB and GB. Near to slightly above average February precipitation in most basins led to modest changes in percent of normal snow water equivalent (SWE) conditions over the past month.

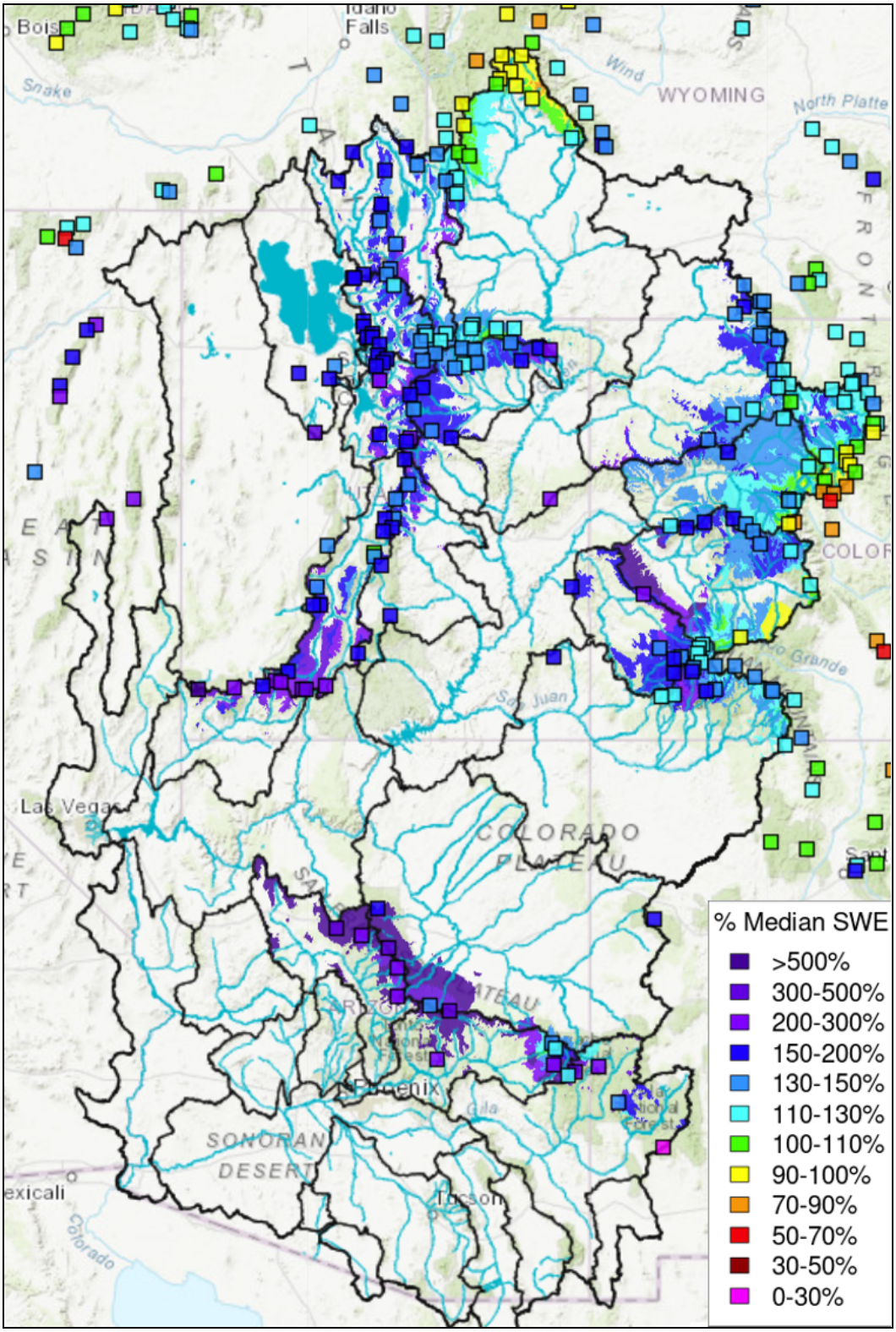
March 1 CBRFC model SWE conditions are 100-185% of normal across the UCRB. SWE conditions along Colorado's Western Slope are more favorable in the northern (White/Yampa) and southern (Gunnison, Dolores, San Juan) basins compared to Colorado River headwater basins in west-central CO. Many SNOTEL stations in the White/Yampa River Basin are reporting early March SWE values that rank in the top three of the station's record and above the 90$^{th}$ percentile. Southwest CO generally had smaller declines in SWE conditions during February, with snow conditions as a percent of normal slightly improving in the San Juan River Basin. March 1 snowpack conditions are least favorable in the far northern Upper Green River Basin above Fontenelle Reservoir, although SWE conditions are still near normal in this area.

Across the LCRB, percent of normal SWE can be highly variable due to percentages being computed using smaller values, and precipitation type (rain vs. snow) having a large impact on percent of normal conditions. This year is a good example as winter temperatures across the LCRB have been below normal with more snow than normal observed at lower elevations leading to large percent of normal snowpack conditions. With that said, early March CBRFC model SWE conditions across the LCRB are much above normal and exceeding expectations because La Niña conditions usually result in drier than average winter weather across the southwest US. March 1 SWE values at most SNOTEL stations in central AZ rank in wettest five on record and are above the 90$^{th}$ percentile.

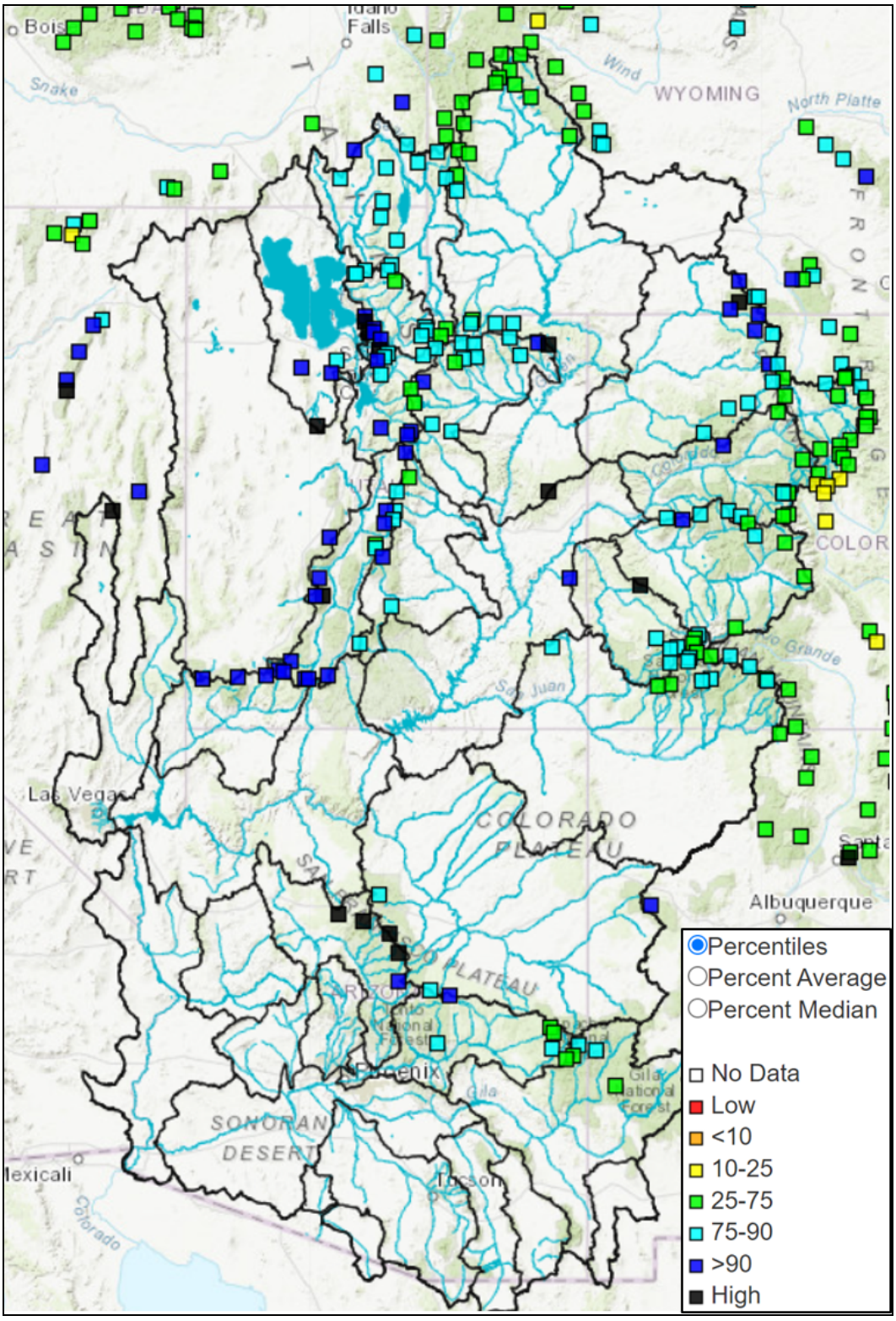
More storms and precipitation events have targeted UT this winter compared to southwest WY, and western CO, and SWE conditions in the GB generally reflect better conditions when compared to the UCRB. March 1 SWE conditions across the GB range from 150% of normal in the Bear River Basin to 190% of normal in the Provo/Utah Lake Basin. Around 10 SNOTEL stations in UT are reporting record early March SWE values, with the majority of UT SNOTEL stations reporting early March SWE values that rank in the top five of the station's record and above the 85$^{th}$ percentile.

SWE conditions are summarized in the table and figures below.

| Water Year 2023<br>CBRFC Model SWE (Significant Runoff Areas)<br>Percent of 1991-2020 Median | | | |
|---|---|---|---|
| **UPPER COLORADO RIVER BASIN** | | | |
| | **Feb1** | **Mar1** | **Change** |
| Above Lake Powell | 144 | 135 | -9 |
| **Green River Basin** | | | |
| Above Fontenelle | 106 | 99 | -7 |
| Above Flaming Gorge | 126 | 116 | -10 |
| Yampa/White | 163 | 148 | -15 |
| Duchesne | 174 | 157 | -17 |
| Price/San Rafael/Dirty Devil | 193 | 183 | -10 |
| **Colorado River Headwaters** | | | |
| Above Kremmling | 126 | 111 | -15 |
| Eagle | 120 | 109 | -11 |
| Roaring Fork | 126 | 119 | -7 |
| Above Cameo | 129 | 117 | -12 |
| **Southwest Colorado** | | | |
| Gunnison | 137 | 133 | -4 |
| Dolores | 165 | 157 | -8 |
| San Juan | 124 | 129 | 5 |
| **LOWER COLORADO RIVER BASIN** | | | |
| Virgin | 263 | 239 | -24 |
| Little Colorado | 269 | 342 | 73 |
| Verde | 541 | 486 | -55 |
| Salt | 168 | 175 | 7 |
| Upper Gila | 215 | 206 | -9 |
| **GREAT BASIN** | | | |
| Bear | 156 | 149 | -7 |
| Weber | 169 | 165 | -4 |
| Six Creeks | 175 | 168 | -7 |
| Provo/Utah Lake | 191 | 191 | 0 |
| Sevier | 183 | 184 | 1 |




March 1, 2023 percent median SWE.
NRCS SNOTEL observed (squares) and CBRFC hydrologic model significant runoff areas.



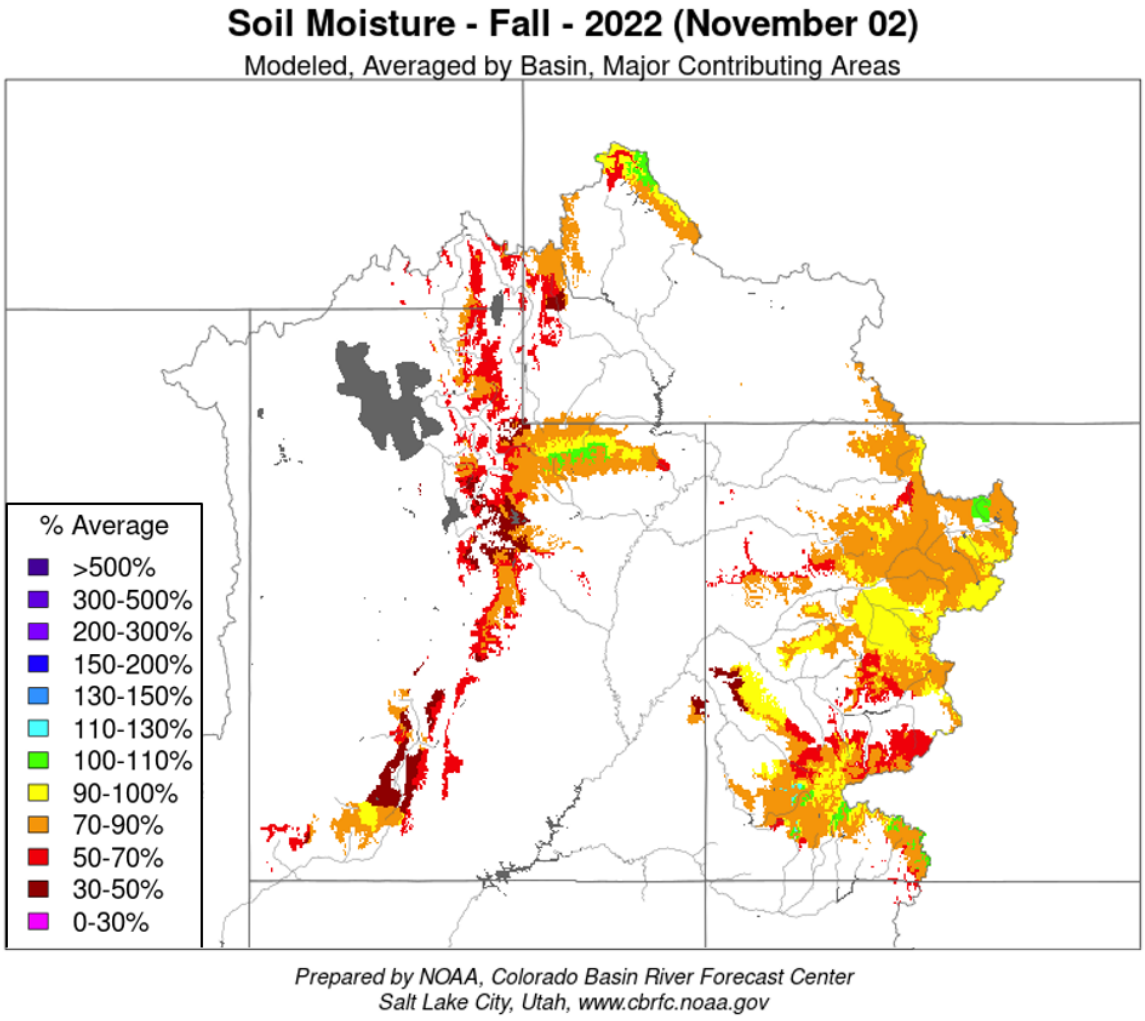

March 3, 2023 SWE percentiles at SNOTEL stations.

For updated SNOTEL information click here.
For CBRFC hydrologic model snow click here.

**Soil Moisture**

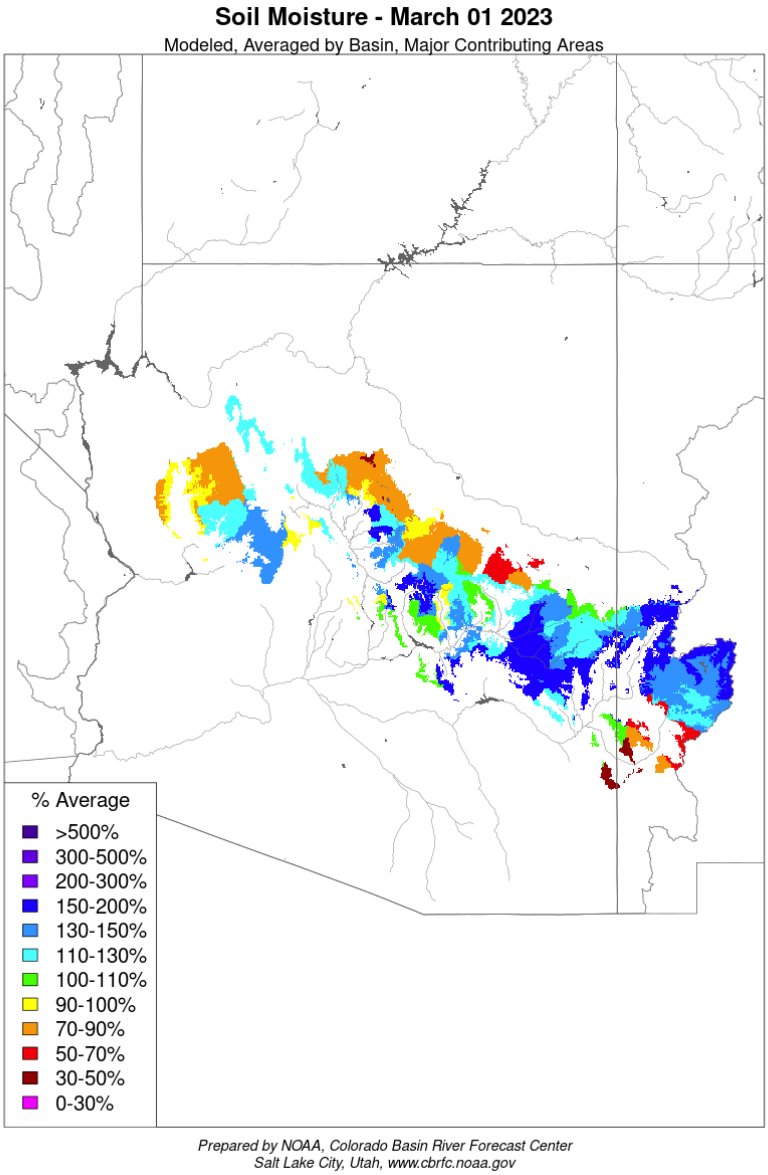
CBRFC model soil moisture conditions impact water supply forecasts and the efficiency of spring runoff. Above average Fall (antecedent) soil moisture conditions have a positive impact (increased runoff efficiency) on water supply forecasts while below average conditions have a negative impact (decreased runoff efficiency). The timing and magnitude of spring runoff is ultimately a result of SWE conditions, spring weather, and antecedent soil moisture conditions.

A favorable monsoon season helped to improve soil moisture conditions, especially across southwest CO (San Juan, Dolores basins) and the southeast LCRB (Salt, Upper Gila basins). However, Fall soil moisture conditions remain below average across many of the major runoff producing areas. UCRB model soil moisture conditions are generally better (near to below average) when compared to GB soil moisture conditions (below to much below average).




November 2022 CBRFC hydrologic model soil moisture conditions.

Soil moisture conditions tend to fluctuate more in the LCRB of AZ and NM in the winter due to the frequency of rain events and melting snow. Soil conditions in the fall are less informative than they are in the northern basins that remain under snowpack throughout the winter season. Basins with above average soil moisture conditions can be expected to experience more efficient runoff from rainfall or snowmelt while basins with below average soil moisture conditions can be expected to have lower runoff efficiency until soil moisture deficits are fulfilled. LCRB model soil moisture conditions (image below) improved during February as a result of rainfall runoff and snowmelt occurring, and early February model soil moisture is above average in most basins.



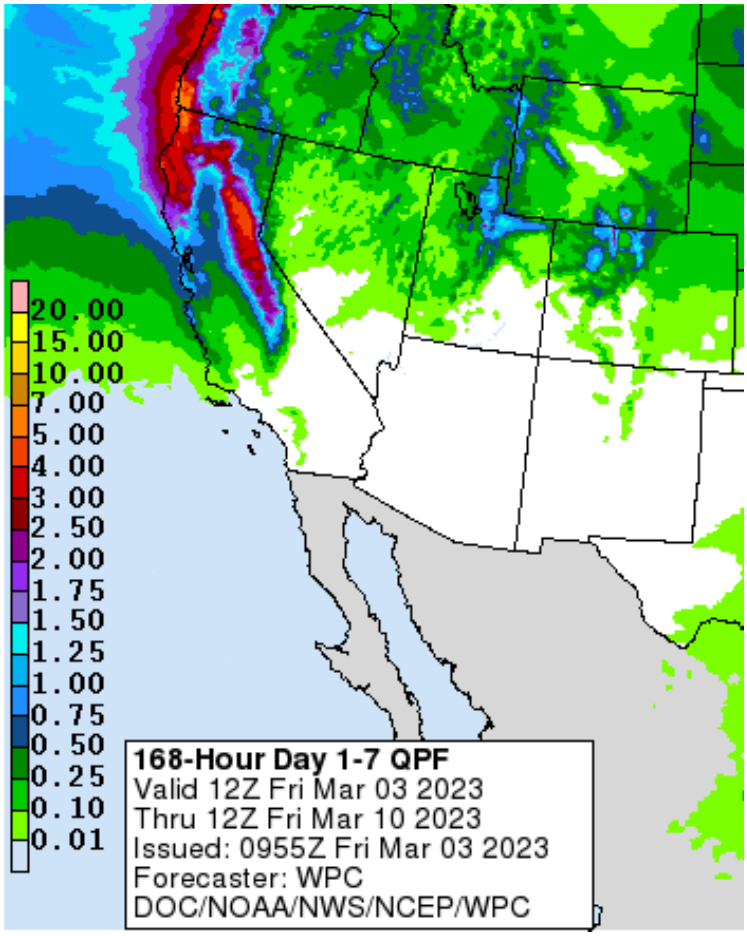

Lower Colorado River Basin (AZ/NM) model soil moisture - March 1, 2023.

For CBRFC hydrologic model soil moisture conditions click here.

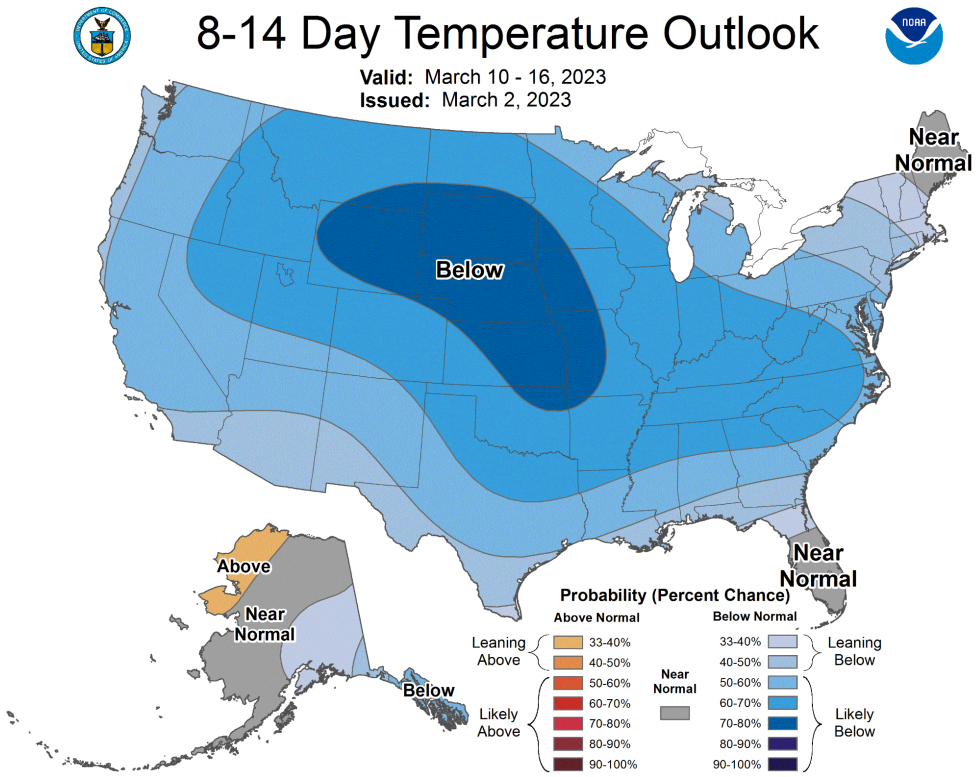
**Upcoming Weather**

A broad upper low will develop over the Pacific Northwest this weekend and will set up an active weather pattern that will bring cool, wet weather to the area through next week. The northern portion of the area will see the most precipitation. The higher elevations will be favored to receive the most precipitation and will see between 0.75-1.0” of precipitation by Tuesday, with a 20% chance that precipitation totals will exceed 1.25” across higher terrain.

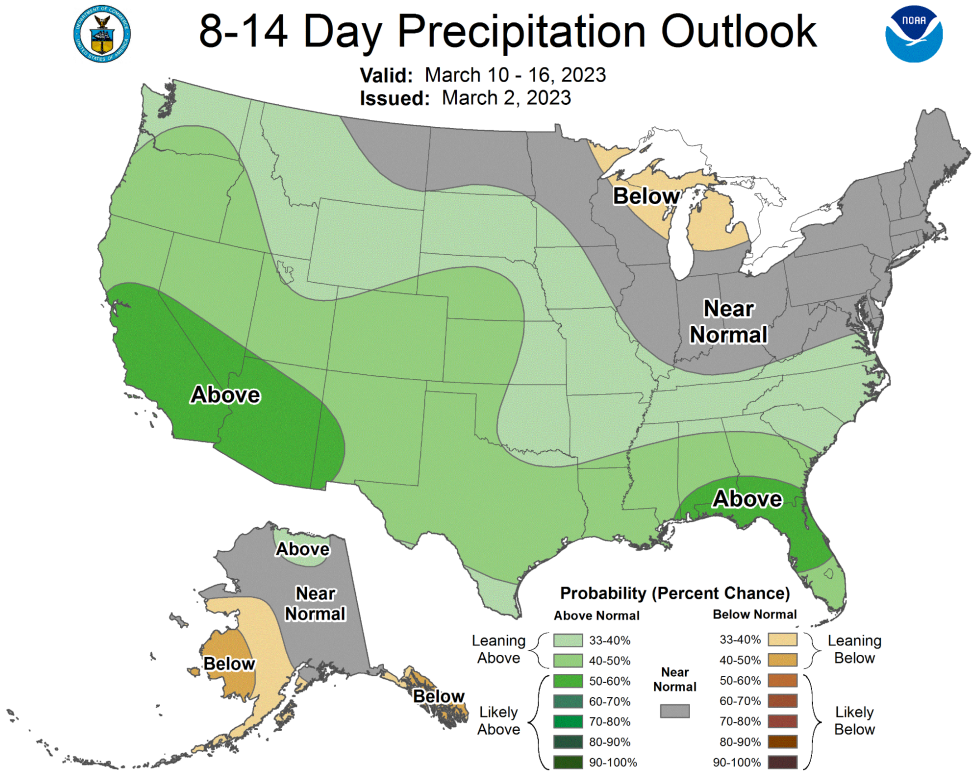
After Tuesday, there is quite a bit of disagreement between weather models regarding the track and speed of the upper low as it begins to exit the Pacific Northwest. The track of this low will greatly influence temperature and precipitation across the area. Currently, about 60% of the ensemble members are favoring a faster exit of the upper low which would allow for temperatures to rebound across the central and southern portion of the area around the middle of next week. About 40% of the members favor a slower storm track which would result in below normal temperatures across the area through the end of next week. Despite the disagreement between ensemble members, it’s likely the southern half of the area will not see any significant precipitation next week. The weather pattern is expected to remain active through mid-March with increased chances of above normal precipitation and below normal temperatures forecast across the area.




Weather Prediction Center precipitation forecast for March 3-10, 2023.




NWS Climate Prediction Center temperature probability forecast for March 10 - March 16, 2023.




NWS Climate Prediction Center precipitation probability forecast for March 10 - March 16, 2023

For CBRFC's beginning of the month online publication that contains basin conditions, summary graphics, and end of month reservoir content tables, refer to the following links.

**Basin Conditions and Summary Graphics**

- Green River Basin
- Upper Colorado River Basin
- San Juan River Basin
- Great Salt Lake Basin
- Sevier River Basin
- Virgin River Basin

**End Of Month Reservoir Content Tables**

- Green River Basin
- Upper Colorado River Basin
- San Juan River Basin
- Great Salt Lake Basin
- Sevier Basin

**Acronyms & Abbreviations**

CBRFC - Colorado Basin River Forecast Center
CPC - Climate Prediction Center
CRB - Colorado River Basin
ENSO - El Niño/Southern Oscillation
ESP - Ensemble Streamflow Prediction
GB - Great Basin
KAF - Thousand Acre-Feet
LCRB - Lower Colorado River Basin
MAF - Million Acre-Feet
NWS - National Weather Service
QPF - Quantitative Precipitation Forecast
SNOTEL - Snow Telemetry
SWE - Snow Water Equivalent
UCRB - Upper Colorado River Basin
WPC - Weather Prediction Center