CBRFC
Water Year 2023
Early Season Water Supply Outlook

December 14, 2022

Cody Moser
Hydrologist

2023 Early Season Water Supply Outlook

Observed precipitation over the past several months

Hydrologic model soil moisture conditions entering winter

Current snow conditions

Ensemble Streamflow Prediction (ESP) overview

2023 water supply - early season model guidance

Upcoming weather outlook & ENSO status

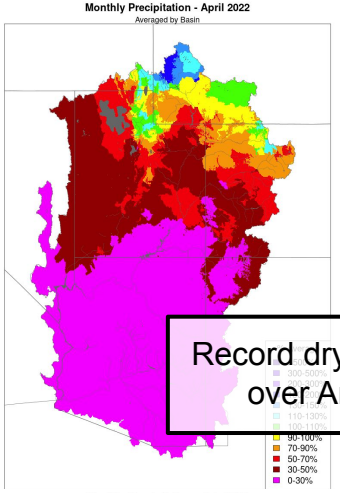
2023 water supply webinar schedule

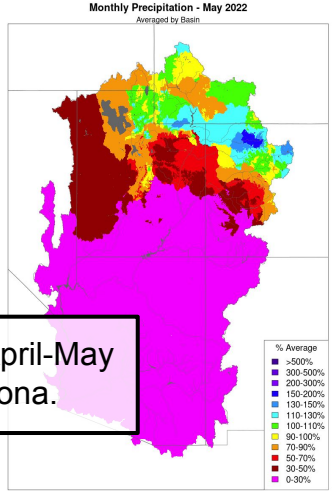
Forecast points of contact

Please mute your phone until the question period.

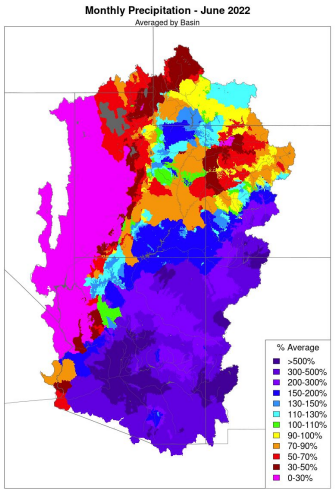
Webinar recording & slides will be made available on CBRFC webpage.

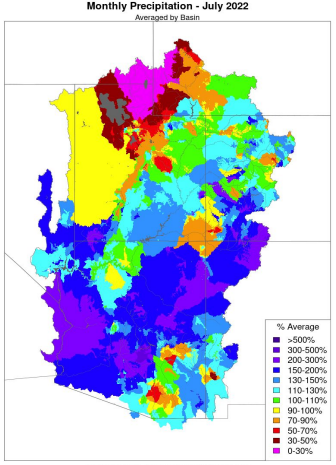
2022: April-September & Water Year Observed Precipitation

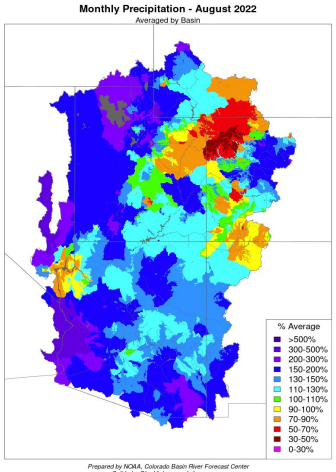


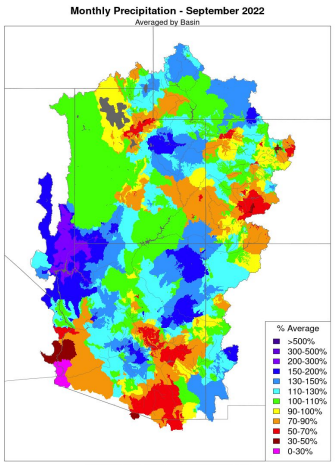


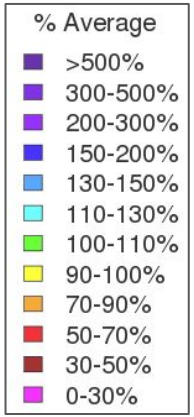
Record dry April-May over Arizona.

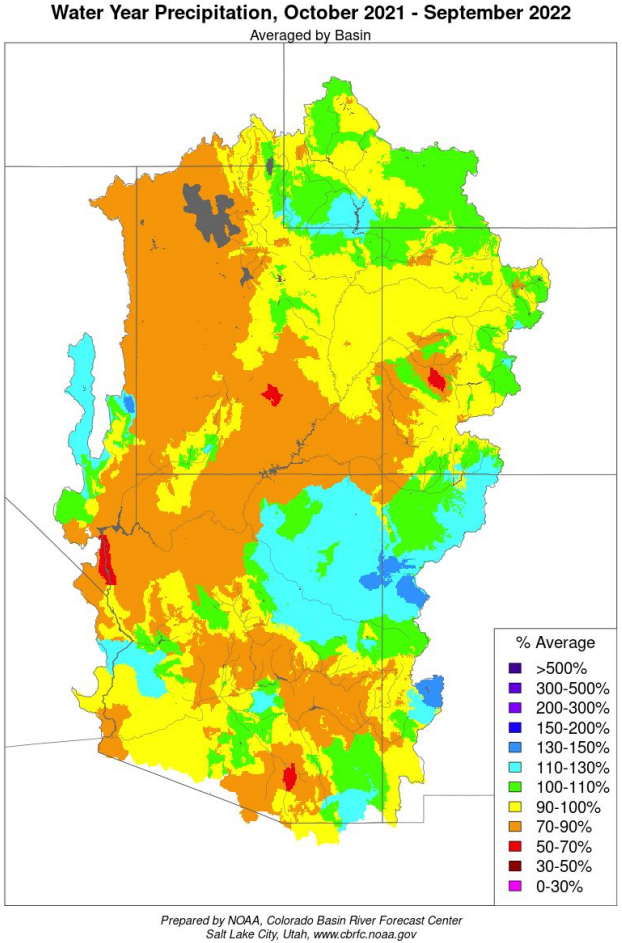








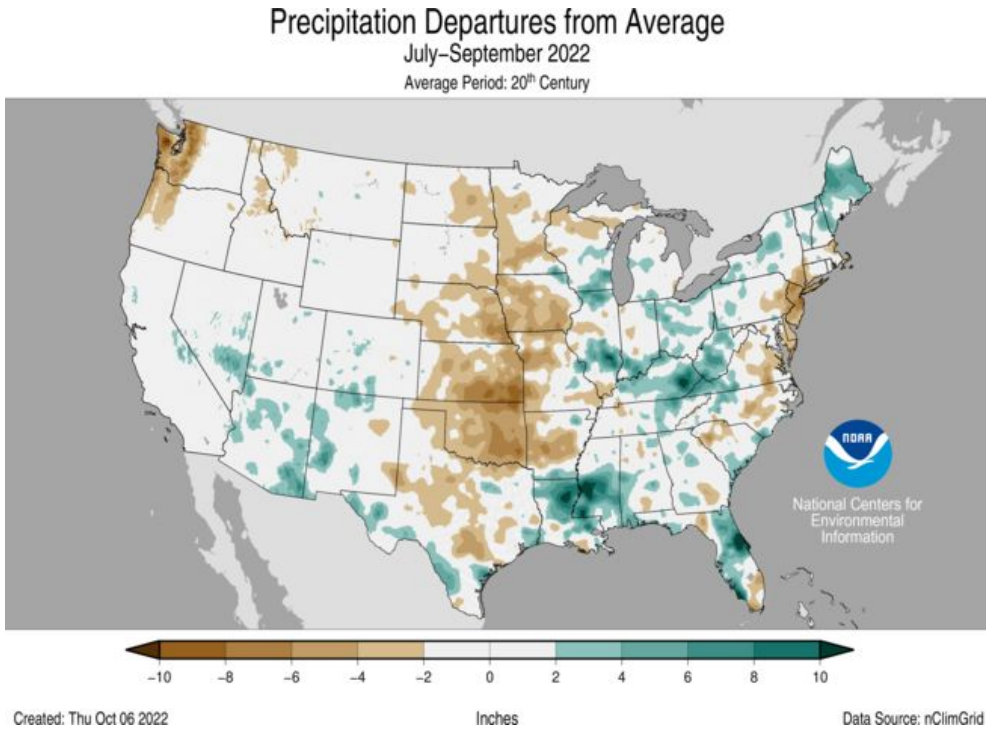




Water Year 2022 Summary

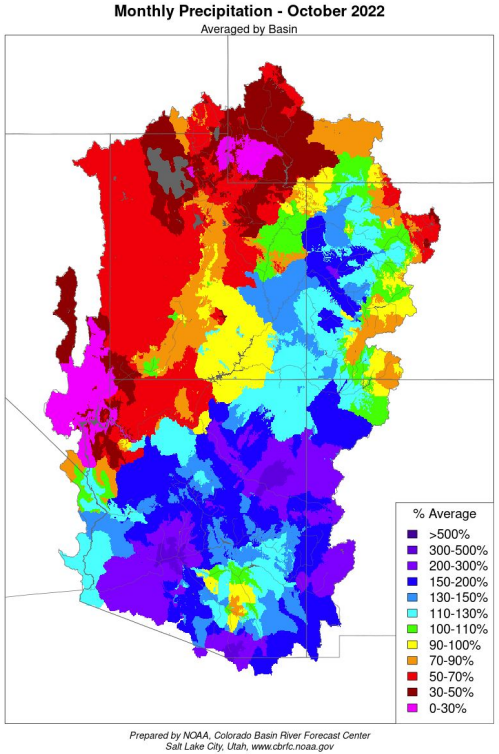
Below normal snowpack and spring runoff was followed by a favorable monsoon season.

2022 April-July Observed Unregulated Streamflow Volumes (%Average) *January-May Period (%Median)		
UPPER COLORADO RIVER BASIN		
	Observed Volume (KAF)	**%Normal (1991-2020)**
Lake Powell	3750	59
Green River Basin		
Fontenelle Reservoir	456	62
Flaming Gorge Reservoir	553	57
Yampa - Deerlodge Park	903	76
White - Watson	174	64
Duchesne - Randlett	159	45
Colorado River Headwaters		
Kremmling	771	89
Eagle	244	73
Roaring Fork	536	82
Cameo	1810	80
Southwest Colorado		
Gunnison - Grand Junction	855	64
Dolores - Cisco	264	52
San Juan - Bluff	750	68
LOWER COLORADO RIVER BASIN		
Virgin - Virgin	22.4	40
*Little Colorado - Chevelon Creek	4.3	31
*Verde - Above Horseshoe Dam	76.8	50
*Salt - Above Roosevelt Lake	115	46
*Upper Gila - San Carlos Reservoir	28.9	40
GREAT BASIN		
Bear - Woodruff Narrows Reservoir	81.4	75
Weber - Gateway	161	59
Six Creeks - Little Cottonwood	28.1	83
Provo - Utah Lake	184	86
Sevier - Hatch	22	46



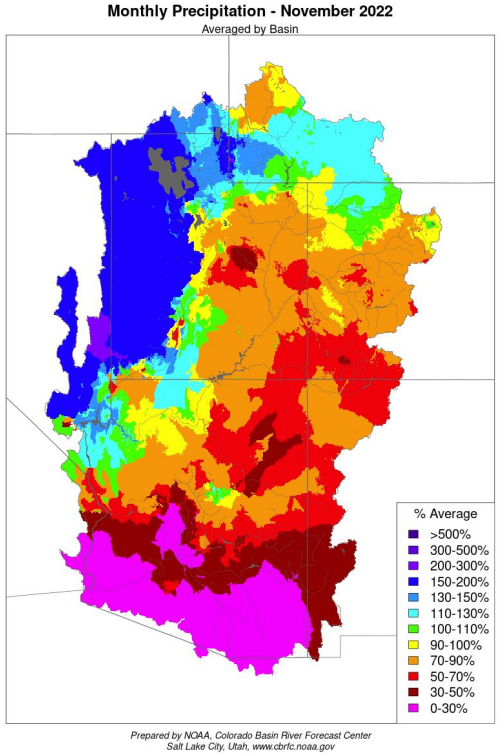
Arizona State Climatologist: "9th wettest June-September on record."

Water Year 2023: October/November Precipitation



Moisture continued over southern/eastern basins during the first half of October.

Snow started accumulating during the last 10 days of October.



A few storm systems moved through the region during November.

Utah received more precipitation than Colorado and Arizona.

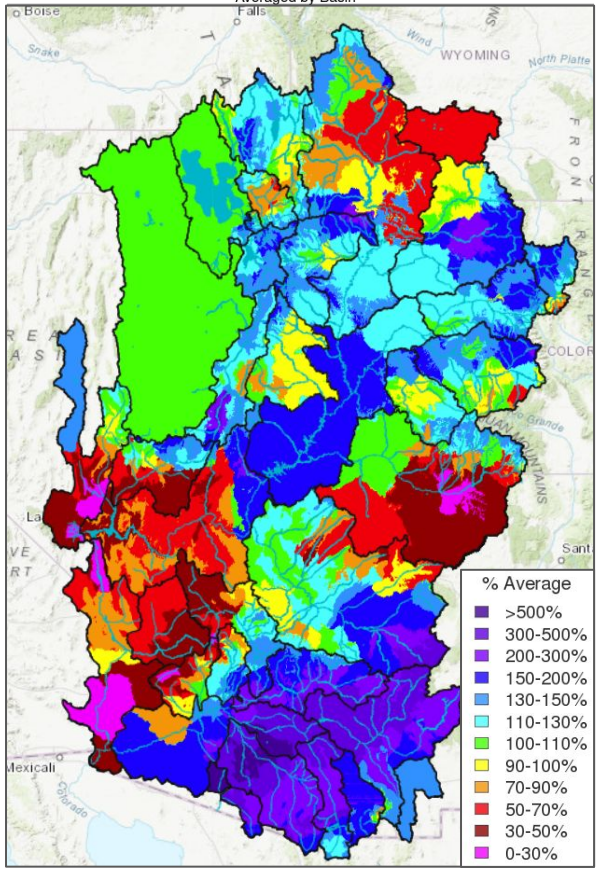
Water Year 2023
Oct-Nov Precip Summary

Basin	Precip (% Avg)
Upper Green	75%
Duchesne	65%
Price/San Rafael	85%
Yampa/White	95%
Upper CO Mainstem	85%
Gunnison	85%
Dolores	85%
San Juan	80%
Lake Powell	85%
Virgin	125%
Little Colorado	120%
Verde	115%
Salt	100%
Upper Gila	130%
Bear	95%
Weber	100%
Six Creeks	105%
Provo/UT Lake	95%
Sevier	95%

Precipitation-To-Date: December & Water Year

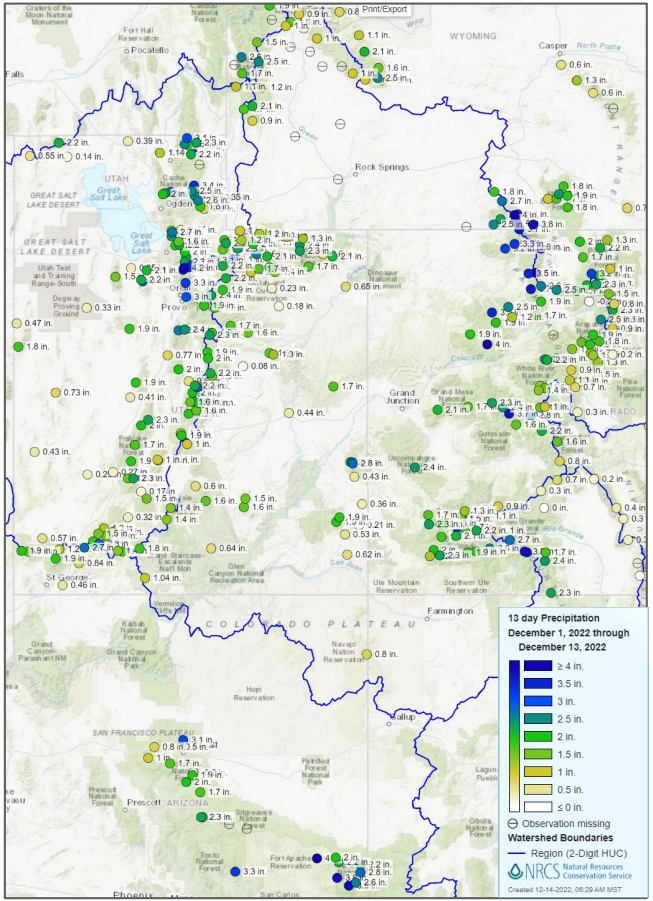
Month to Date Precipitation - December 13 2022

Averaged by Basin



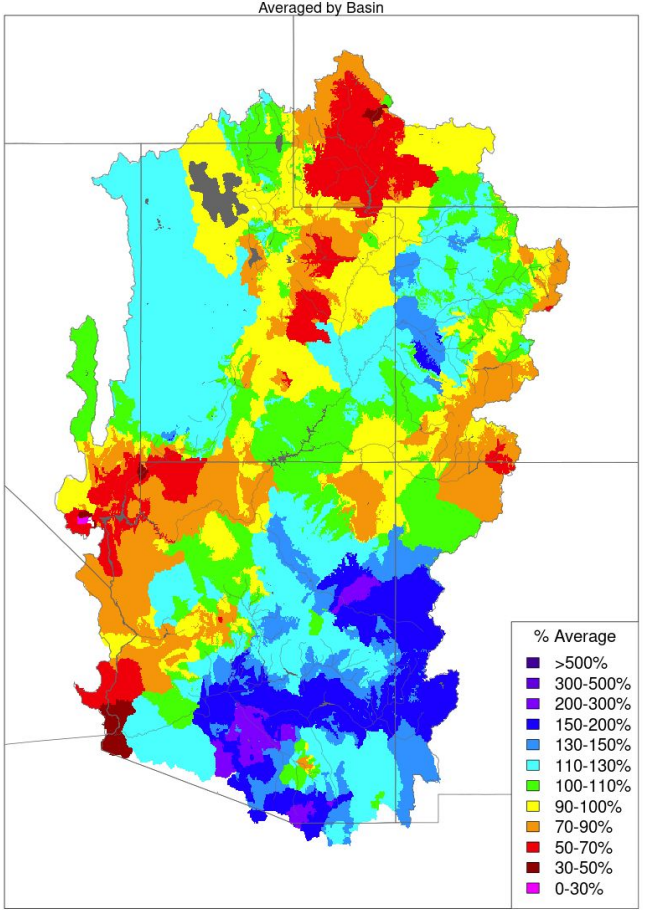
Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

December 1-13 Precipitation Totals at SNOTELs

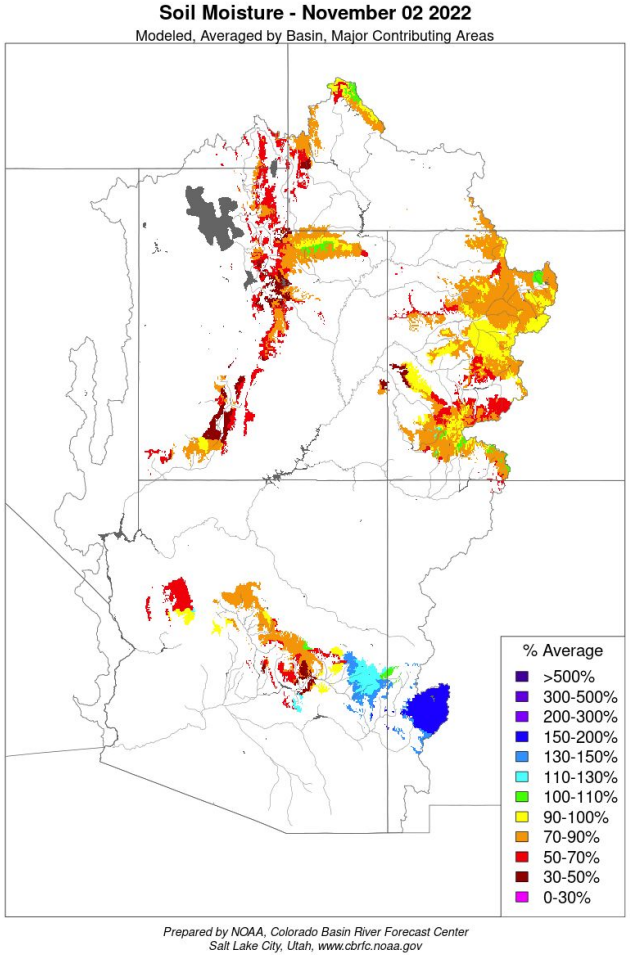


Water Year to Date Precipitation, October 01 - December 13 2022

Averaged by Basin



Fall 2022 Model Soil Moisture Conditions



The map shows the model soil moisture conditions from the lower soil zone in CBRFC's hydrologic model. Modeled lower zone soil water content is a result of past hydrologic conditions including but not limited to:

- -previous year(s) runoff
- -summer/fall precipitation

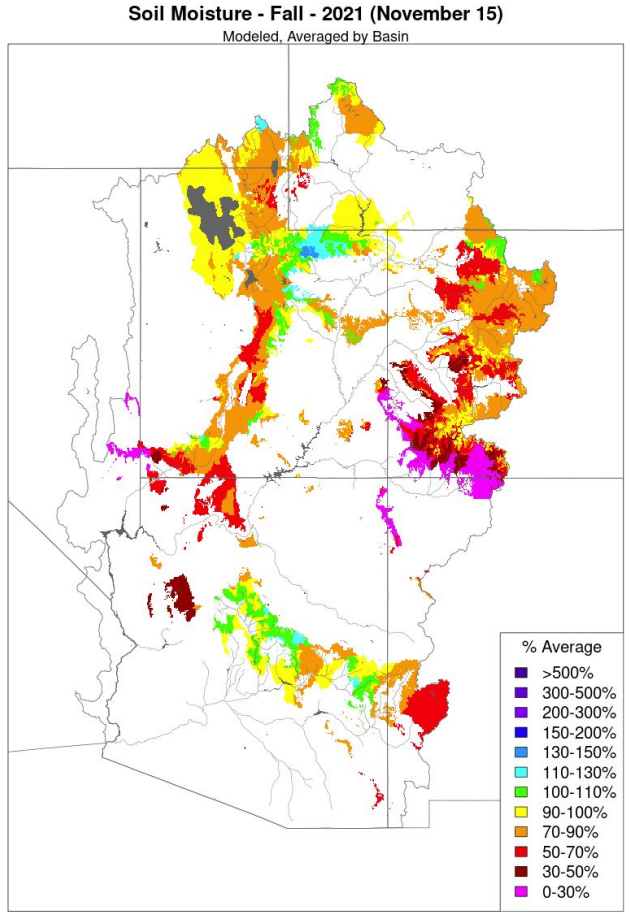
Soil moisture content is adjusted every fall during a dry period after irrigation season has ended and before winter. Forecasters use the following data to make adjustments:

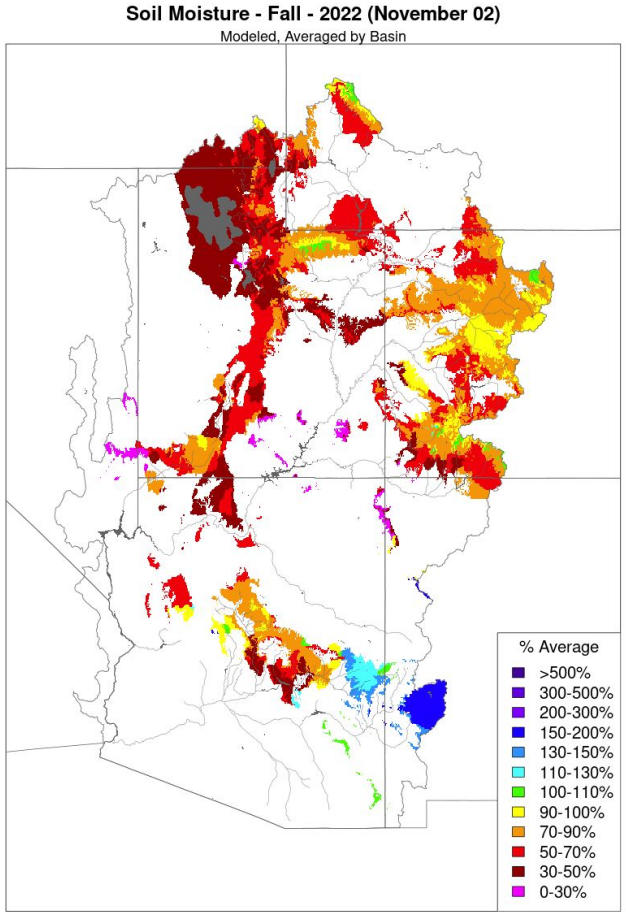
- -Early November streamflow observations (baseflow)
- -Reservoir inflows
- -July-October precipitation
- -Past season(s) runoff conditions

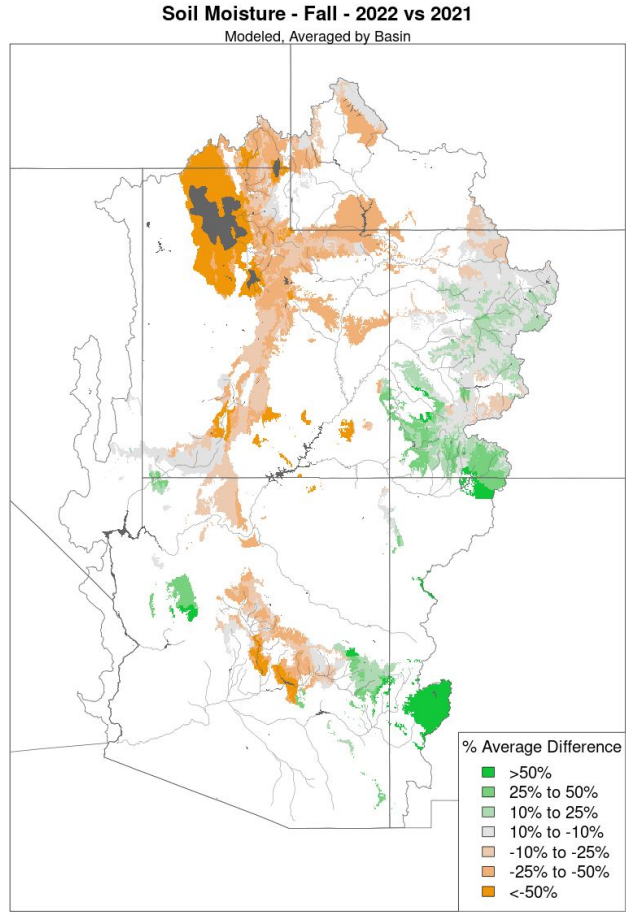
CBRFC model soil moisture conditions are near to below normal across many of the major runoff producing areas.

Generally better conditions in the Colorado River Basin compared to the Great Basin.

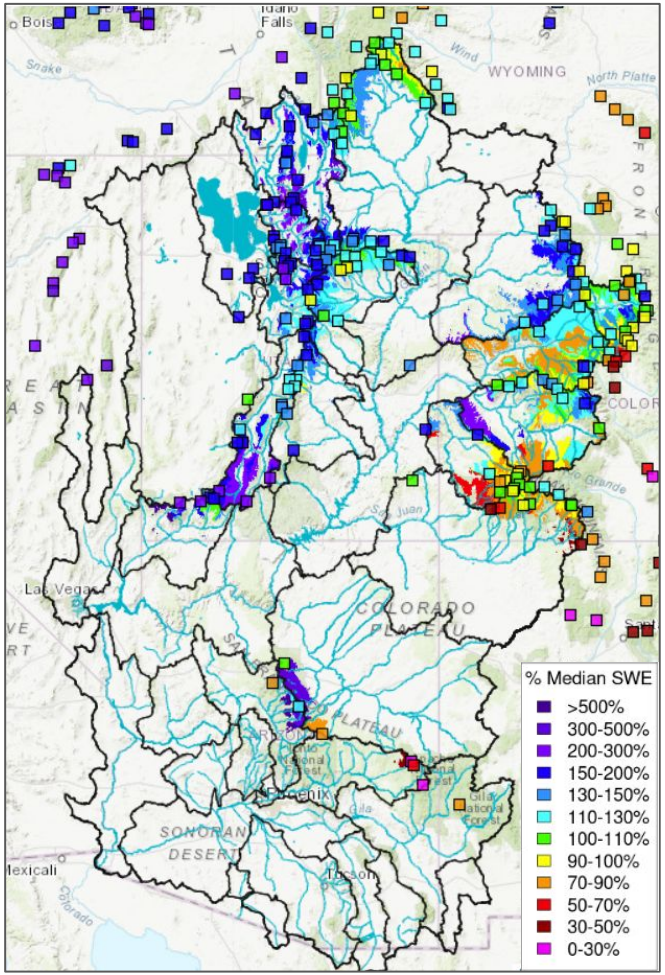
Fall Model Soil Moisture Conditions: 2021 vs. 2022







Mid-December Snow Conditions

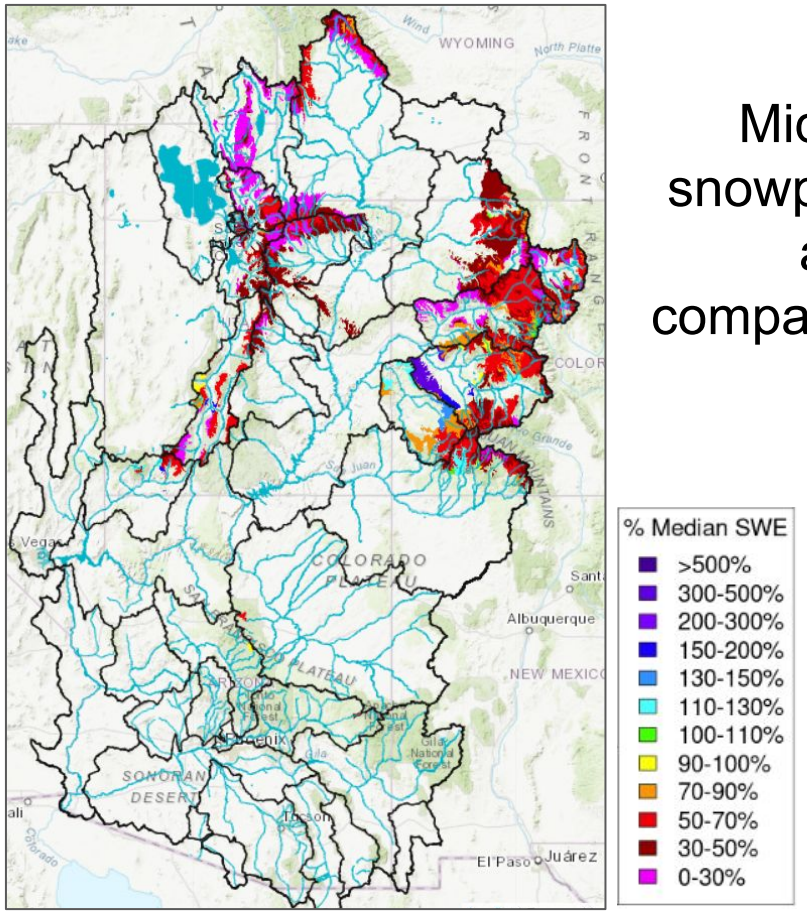


December 13 SWE Summary (SNOTEL)

	Basin	SWE (%Median)
Upper Colorado	Upper Green	115%
	Duchesne	125%
	Price/San Rafael	140%
	Yampa/White	130%
	Upper CO	110%
	Gunnison	115%
	Dolores	100%
	San Juan	100%
	Lake Powell	115%
Lower Colorado	Virgin	210%
	Little Colorado	65%
	Verde	140%
	Salt	45%
	Upper Gila	75%
Great Basin	Bear	155%
	Weber	165%
	Six Creeks	175%
	Provo/UT Lake	155%
	Sevier	160%

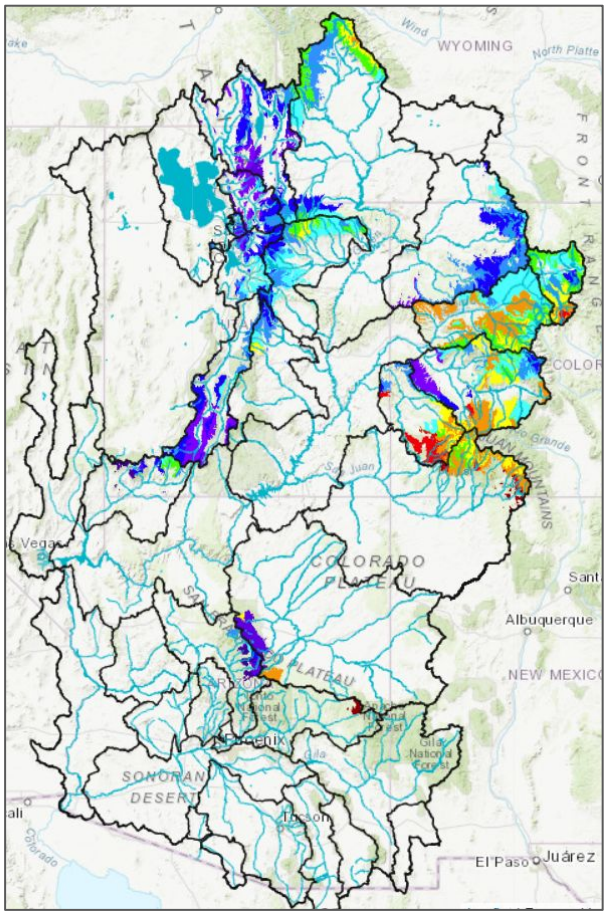
Mid-December CBRFC Model Snow Conditions - 2021 vs. 2022

December 13, 2021



Mid-December snowpack conditions are better compared to last year.

December 13, 2022



Water Supply - Early Season Model Guidance

At this point in time…

- Ideally model soil moisture & snow states are accurate and representative of current conditions.
- ESP model guidance is still heavily influenced by soil moisture.
- Early season forecast errors are generally 20-40% and typically improve through the spring; the primary source of forecast uncertainty is future weather.
- Mid-December snowpack conditions
  - Typically around 30-35% of the seasonal snow has occurred by mid-December
  - Historical median (or normal) snowpack values are still small compared to later in the season
  - ESP more sensitive to SWE earlier in the season
    - A 2” SWE surplus is more impactful now compared to a 2” SWE surplus in April

Ensemble Streamflow Prediction (ESP) Overview

ESP Methodology: current hydrologic model states (soil moisture, snow)
-> future weather (precip/temp) scenarios based on historical (1991-2020) observations
= April-July streamflow volume

Example: Dillon Reservoir (Inflow) **December 13, 2022 ESP Model Run**

2022 current model states + 1991 weather = 143 kaf (thousand acre-feet)
2022 current model states + 1992 weather = 109 kaf
2022 current model states + 1993 weather = 189 kaf
.
.
.
2022 current model states + 2020 weather = 141 kaf

Final result is 30 different possibilities of April-July streamflow volume
-use statistical analysis to determine probabilistic outcomes:
-volume that has 50% chance of being exceeded = 157 kaf
-volume that has 10% chance of being exceeded = 204 kaf
-volume that has 90% chance of being exceeded = 105 kaf

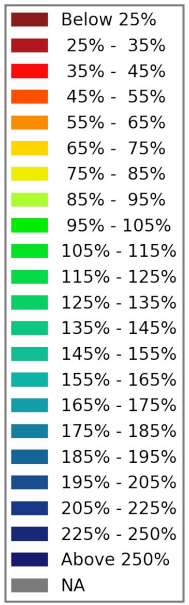
$$\%\text{Average} = \frac{50\%\ \text{Exceedance Volume}}{\text{Average Observed Volume } (1991-2020)}$$

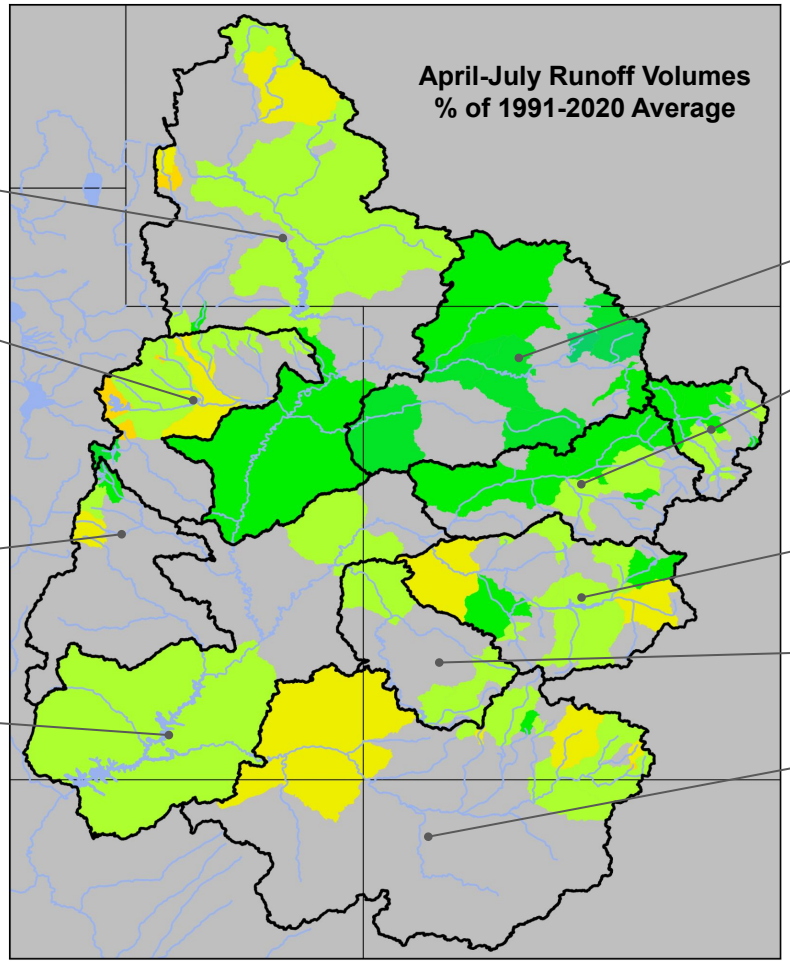
94% of Average = 157/167

**ESP Model Run/Updated Daily*

CBRFC ESP Model Guidance: Upper Colorado

December 13 ESP Model Run





Upper Green: 75-95%

Duchesne/Price: 75-110%

San Rafael/Dirty Devel: 75-110%

Lake Powell: 85%

Lake Powell summarizes the hydrologic conditions throughout the Upper Colorado River Basin.

White/Yampa: 105-115%

Upper CO: 85-100%

Gunnison: 75-100%

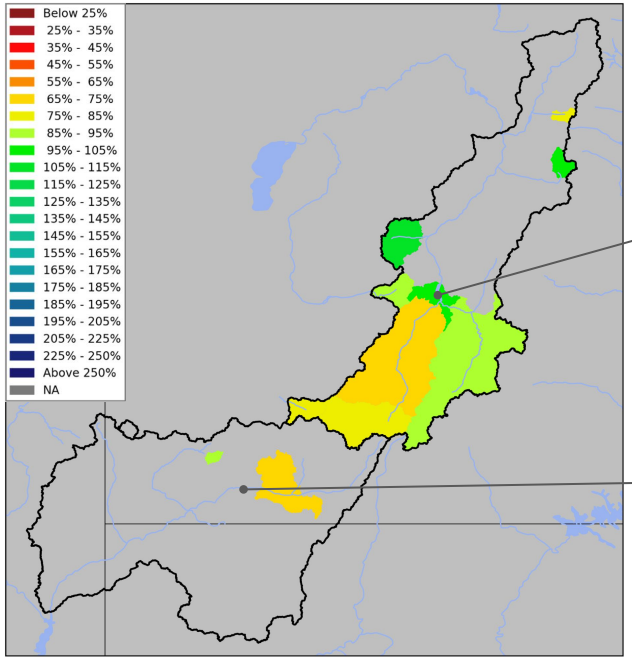
Dolores: 85-95%

San Juan: 75-95%

CBRFC ESP Model Guidance: Sevier, Virgin, Lower Colorado

December 13 ESP Model Run

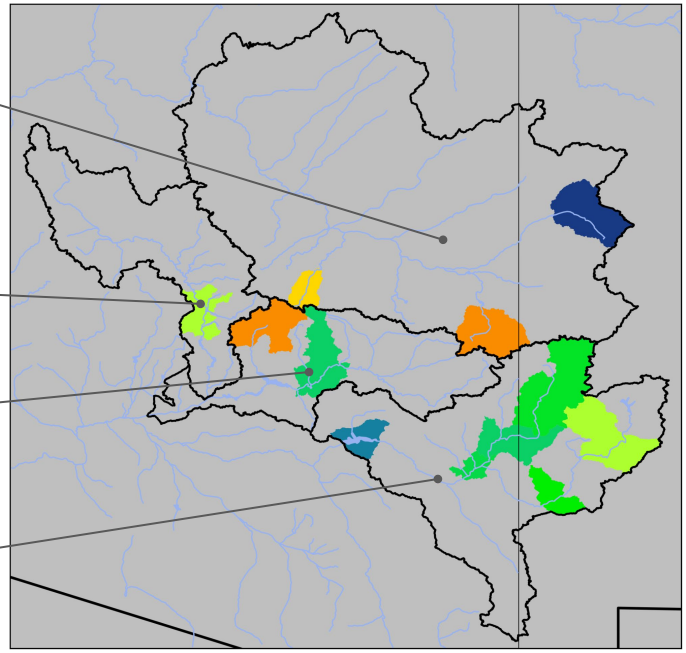
Sevier & Virgin
April-July Runoff Volumes
% of 1991-2020 **Average**



Sevier: 75-110%

Virgin: 65-90%

Lower Colorado
January-May Runoff Volumes
% of 1991-2020 **Median**



Little Colorado: 60-220%

Verde: 90%

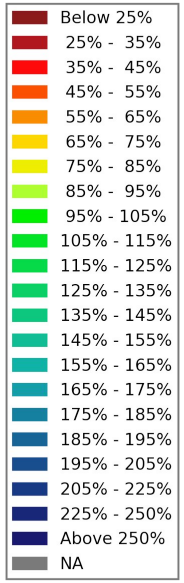
Salt: 55-125%

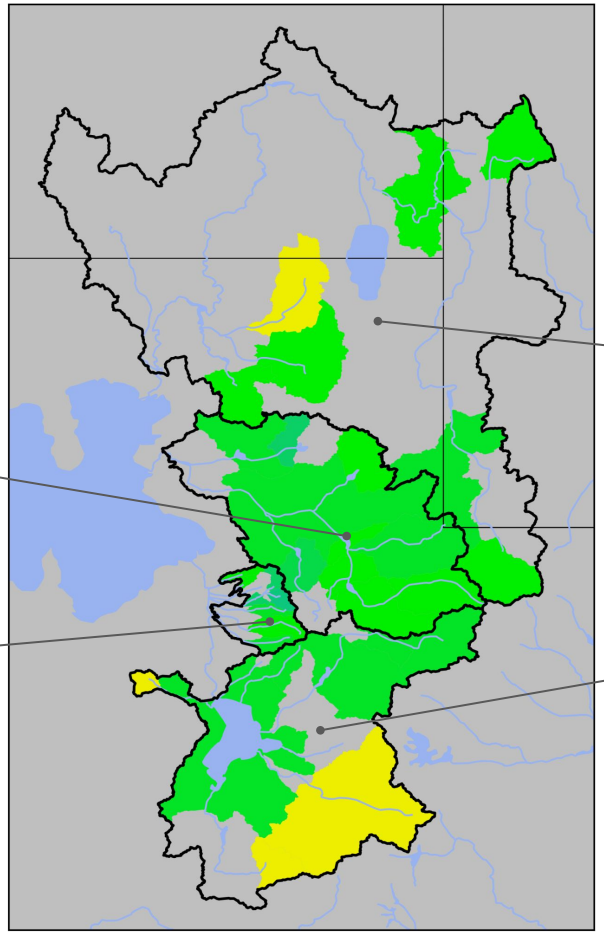
Upper Gila: 90-180%

CBRFC ESP Model Guidance: Great Basin

December 13 ESP Model Run

April-July Runoff Volumes
% of 1991-2020 Average





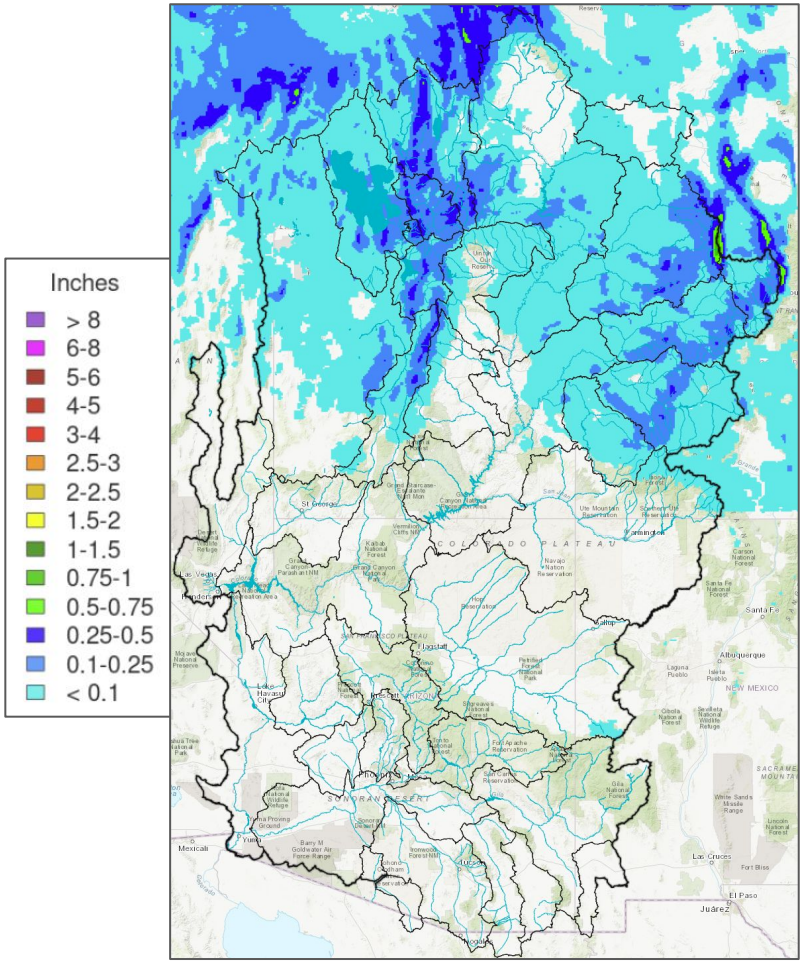
Bear: 80-110%

Weber: 95-135%

Six Creeks: 95-140%

Provo/Utah Lake: 80-115%

Upcoming Weather: 7-Day Precipitation Outlook (December 14-20)

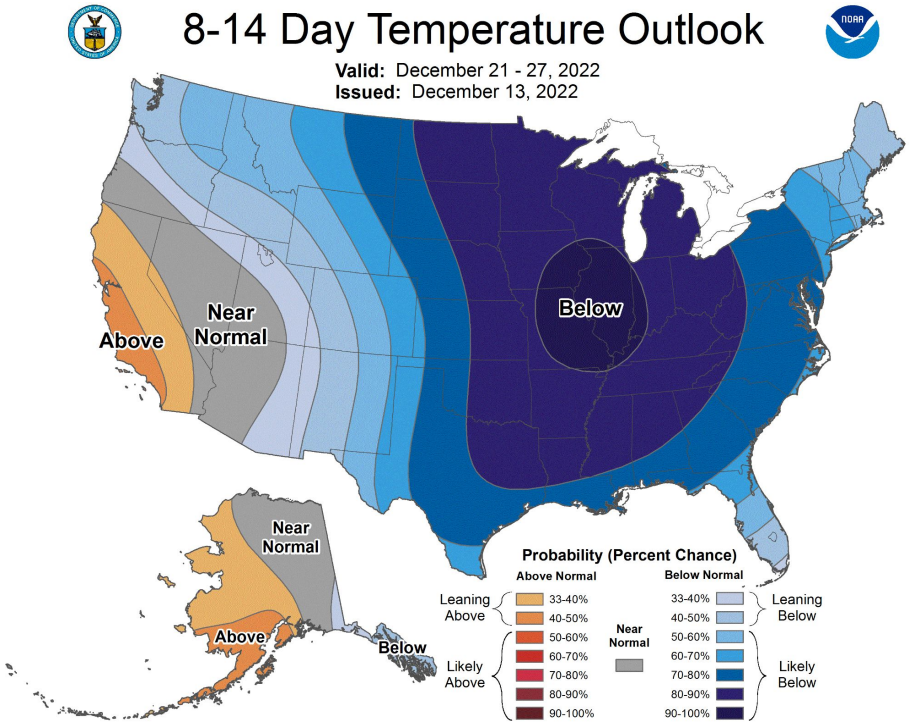


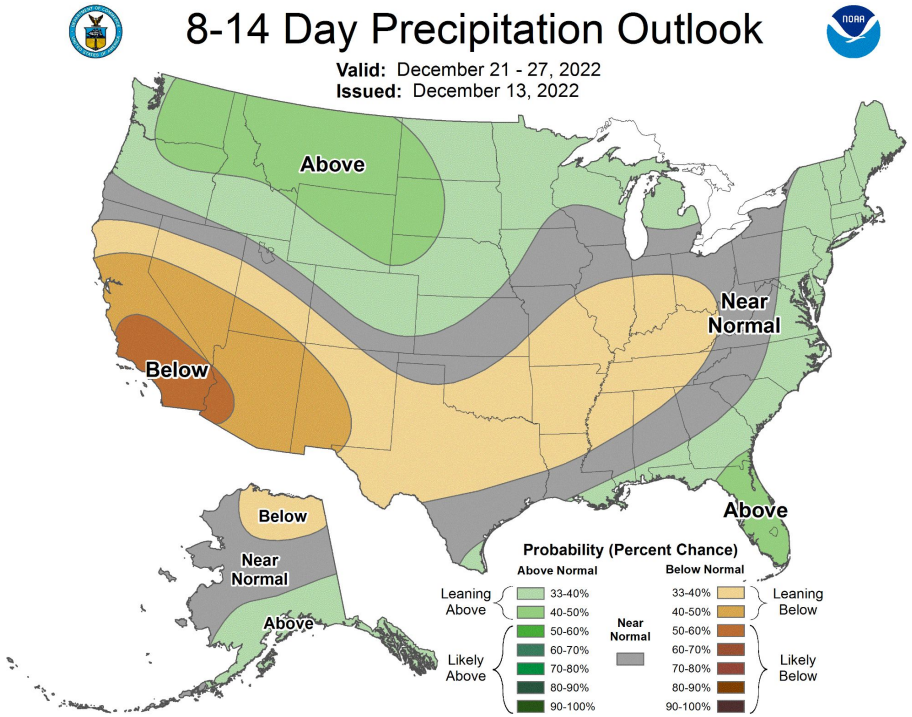
- A short wave trough will bring light precipitation to UT and CO today and tomorrow. Accumulations will generally be less than 0.25".
- Northwest flow and dry air will keep precipitation chances minimal for the remainder of the 7-day period.

Upcoming Weather: 8-14 Day Outlook (December 21-27)

Increased probability of below normal temperatures across northern and eastern basins.

Increased chances of above normal precipitation across northern basins.
Increased chances of below normal precipitation across southern basins.

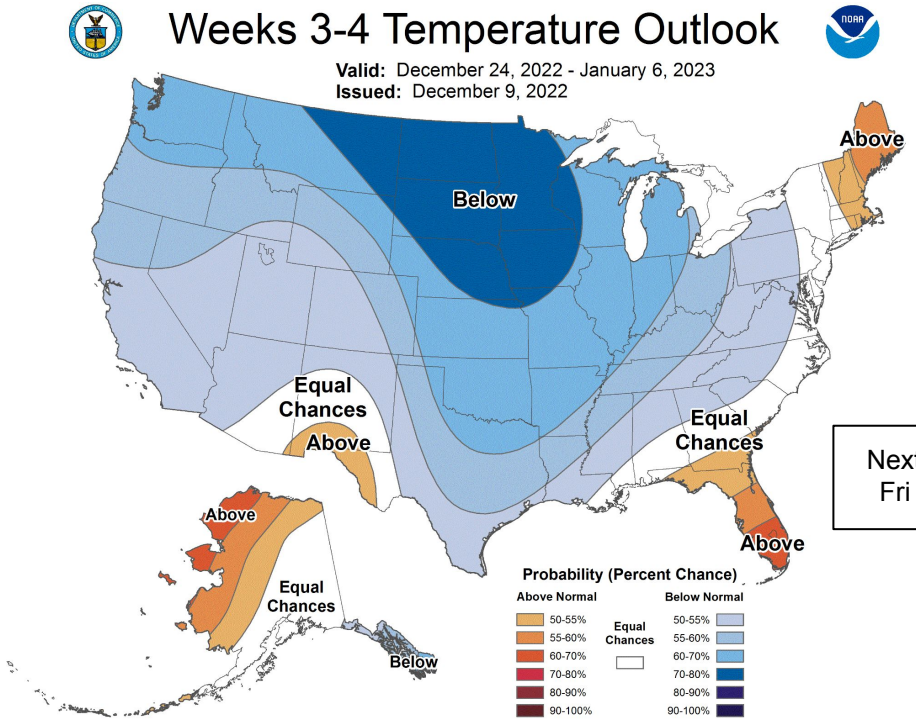




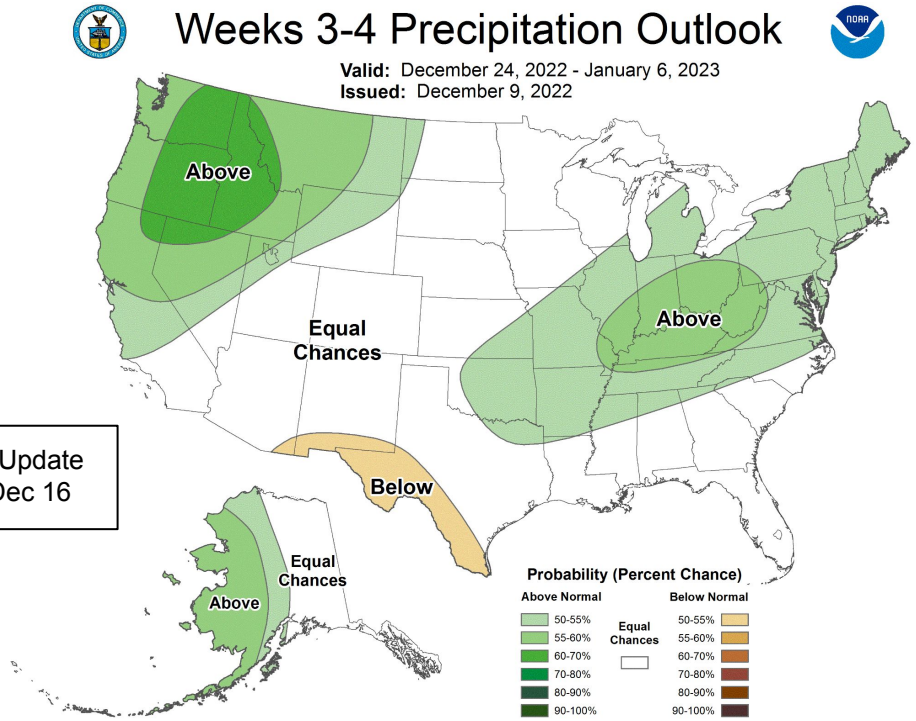
Climate Prediction Center Weeks 3-4 Outlook (December 24 - January 6)

Increased chances of below normal temperatures.

Increased chances of above normal precipitation across northern UT and southwest WY.



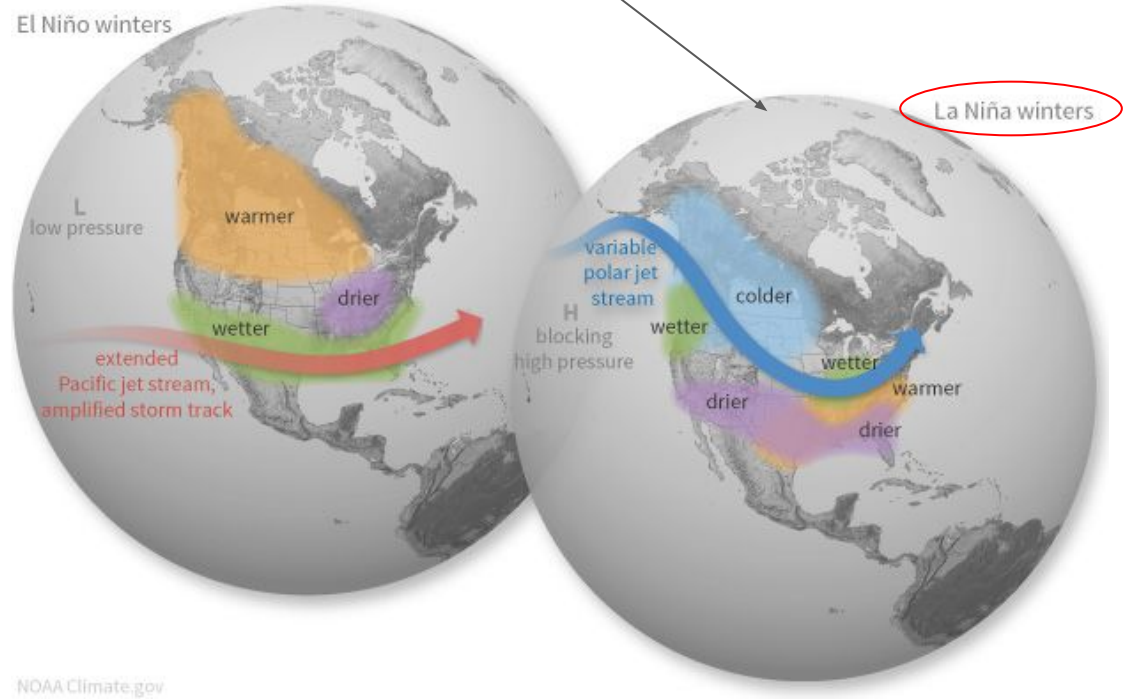
Next Update
Fri Dec 16

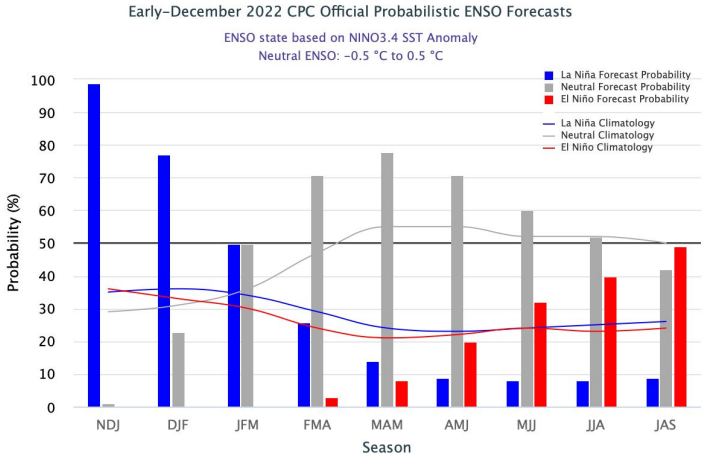


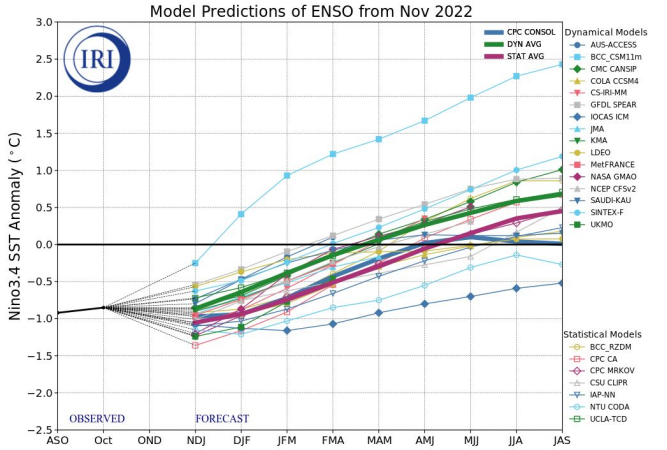
El Niño Southern Oscillation (ENSO) Status

EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION
issued by
CLIMATE PREDICTION CENTER/NCEP/NWS
8 December 2022

- **La Niña** is expected to continue into the winter
  - Increased chances of drier winter weather in Arizona/LCRB
  - Much weaker correlation/winter weather signal elsewhere in basin
  - Equal chances of La Niña and ENSO-neutral during January-March 2023
  - ~70% chance of ENSO-neutral in February-April 2023



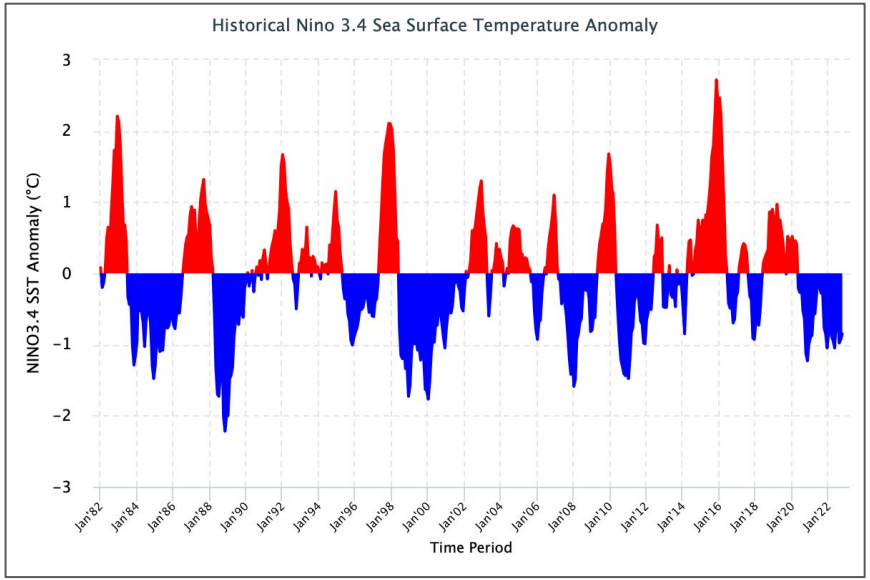




El Niño Southern Oscillation (ENSO) Status

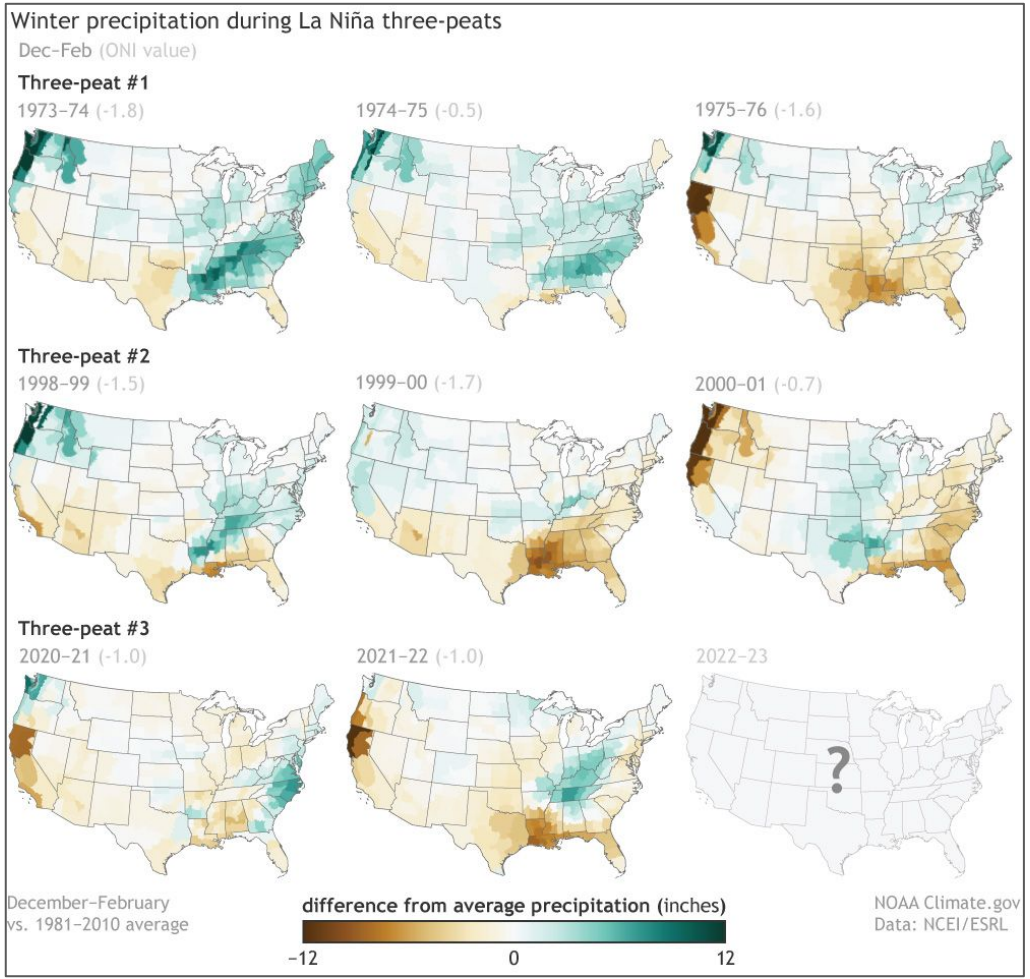
"With a 76% chance of La Niña through this winter, it's likely that we will have **a third La Niña winter in a row**, which would be only the third time since 1950 that this has occurred."

"..there is nothing obviously different about La Niña three-peats relative to all other La Niñas that would lead to markedly different expectations."



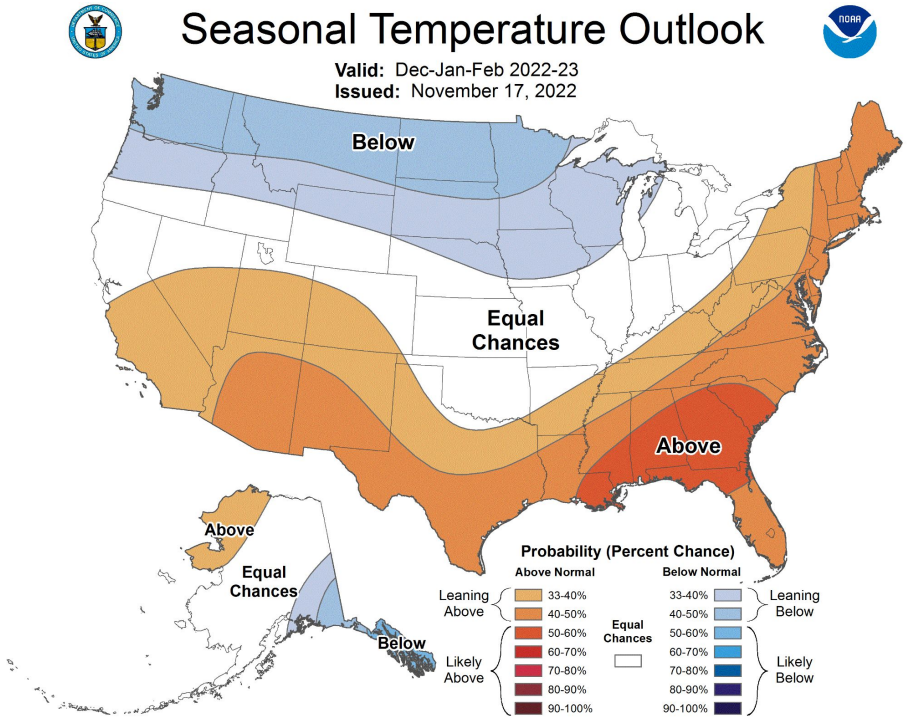
Climate.gov SCIENCE & INFORMATION FOR A CLIMATE-SMART NATION

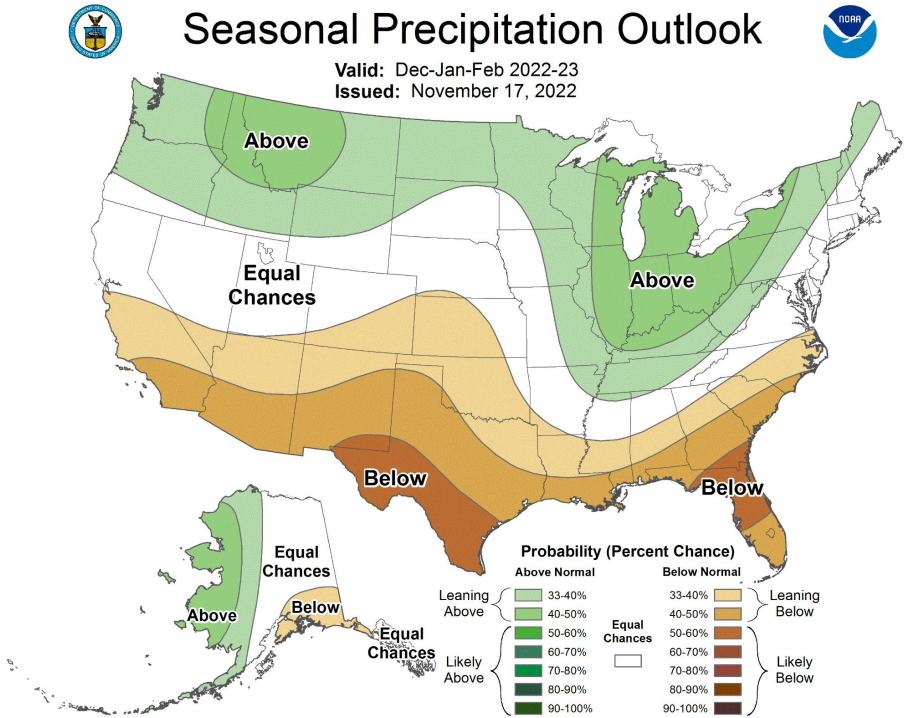
[Data/Source Link]



Climate Prediction Center Seasonal Outlook (Dec-Jan-Feb)

Typical of a La Niña pattern: increased chances of warmer/drier winter weather across AZ/LCRB.





Summary

- Upper Colorado
  - Soil moisture: generally below average
    - compared to last year: Green (worse), NW CO (similar), SW CO (better)
  - Snowpack: near/slightly above normal (100-140%)
  - Water supply guidance: 75-115% of 1991-2020 average; Lake Powell (85%)

- Lower Colorado
  - Soil moisture: generally below average; exceptions are Upper Gila and Upper Salt (above average)
  - Snowpack: variable (45-210% of normal)
  - Water supply guidance: 55-220% of 1991-2020 median

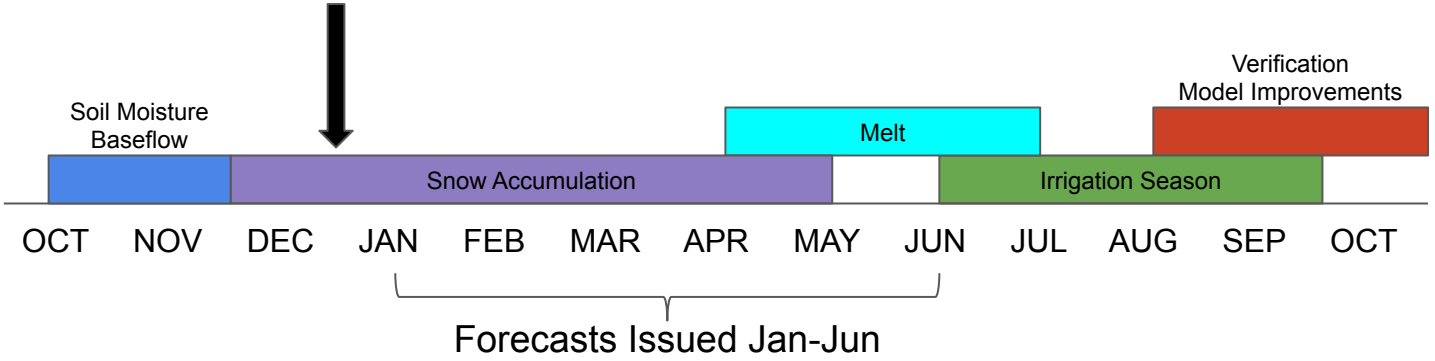
- Great Basin
  - Soil moisture: much below average, worse than last year
  - Snowpack: above normal (155-175%)
  - Water supply guidance: 80-140% of average

- Weather forecast for the next two weeks - below normal temperatures
  - Best chances for precipitation (<0.25”) across northern Great Basin, Upper Green River Basin, NW CO
  - Drier weather likely across southern UT, SW CO, AZ

- Increased chances of drier winter weather in Arizona/LCRB due to La Niña conditions

- Most likely going to need above average snowpack to see near average water supply volumes given the dry conditions. Spring weather is always a factor.

CBRFC Operational Timeline



- ESP model guidance will be available on our website (forecast evolution plots) in the next few days.
  - Water supply forecasts are issued starting early January
  - Water supply discussions/reports issued twice monthly starting early January
  - Peak flow forecasts issued twice monthly starting early March
- Currently, soil moisture states (also represented by baseflow) in the model have a larger influence on hydrologic guidance compared to later in the season.
- As we progress into the winter, snowpack conditions will have a larger impact on forecasts in the Upper Colorado and Great Basins.
- Winter rain events will have largest impacts on Lower Colorado River Basin forecasts.

2023 Water Supply Webinar Schedule

**All Times Mountain Time (MT)*

Colorado River Basin

Monday	Jan 9th	10 am
Tuesday	Feb 7th	10 am
Tuesday	Mar 7th	10 am
Friday	Apr 7th	10 am
Friday	May 5th	10 am

Utah/Great Basin

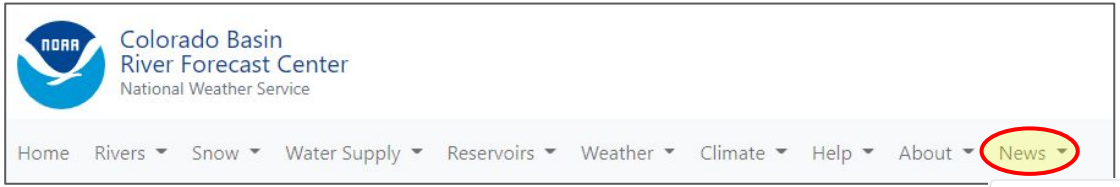
Monday	Jan 9th	11:30 am
Tuesday	Feb 7th	11:30 am
Tuesday	Mar 7th	11:30 am
Friday	Apr 7th	11:30 am
Friday	May 5th	11:30 am

Peak flow forecast webinar Monday, March 20th, 10 am MT

Additional briefings scheduled as needed

Webinar schedule & registration information has been posted to the CBRFC web page

CBRFC Webinar Registration & Email List



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CBRFC Water Supply Forecast Webinar Schedule & Registration - Water Year 2023

The Colorado Basin River Forecast Center (CBRFC) produces water supply forecasts for the Colorado River Basin and the eastern Great Basin.
CBRFC conducts December through May webinars explaining the forecasts and current conditions.

Follow the links below to register for a webinar.

Early Season Water Supply Outlook Webinar
Wednesday December 14 @ 10:00 am MT

Colorado River Basin Water Supply Webinars
Monday January 9 @ 10:00 am MT
Tuesday February 7 @ 10:00 am MT
Tuesday March 7 @ 10:00 am MT
Friday April 7 @ 10:00 am MT
Friday May 5 @ 10:00 am MT

Utah Water Supply Webinars
Monday January 9 @ 11:30 am MT
Tuesday February 7 @ 11:30 am MT
Tuesday March 7 @ 11:30 am MT
Friday April 7 @ 11:30 am MT
Friday May 5 @ 11:30 am MT

Peak Flow Webinar
Monday March 20 @ 10:00 am MT

A notification email will be sent if a date or time change occurs. Additional webinars are scheduled as needed.
The webinar slides will be available on the CBRFC presentations page soon after each briefing.

Email Updates

Available Email Lists

- General Stakeholders
- USBR Water Year and MTOM Forecasts
- Lake Mead Local Forecasts
- Green River Basin Forecasts
- Upper Colorado Mainstem Forecast
- San Juan, Gunnison and Dolores River Basins Forecasts
- Weber Basin PAO
- Special forecasts for the Dolores River Basin
- Special forecasts for the San Juan River Basin
- Special forecasts for CUWCD
- Utah reservoir forecasts
- CRFS
- Eastern Great Basin Water Supply
- Upper Basin Reclamation Reservoirs

Addition Requests

- Request to be on one of our lists by emailing cbrfc.webmasters@noaa.gov

CBRFC Contacts & WY23 Basin Focal Points

Basin Focal Points (Forecasters)

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CBRFC Water Supply Presentations
https://www.cbrfc.noaa.gov/present/present.php