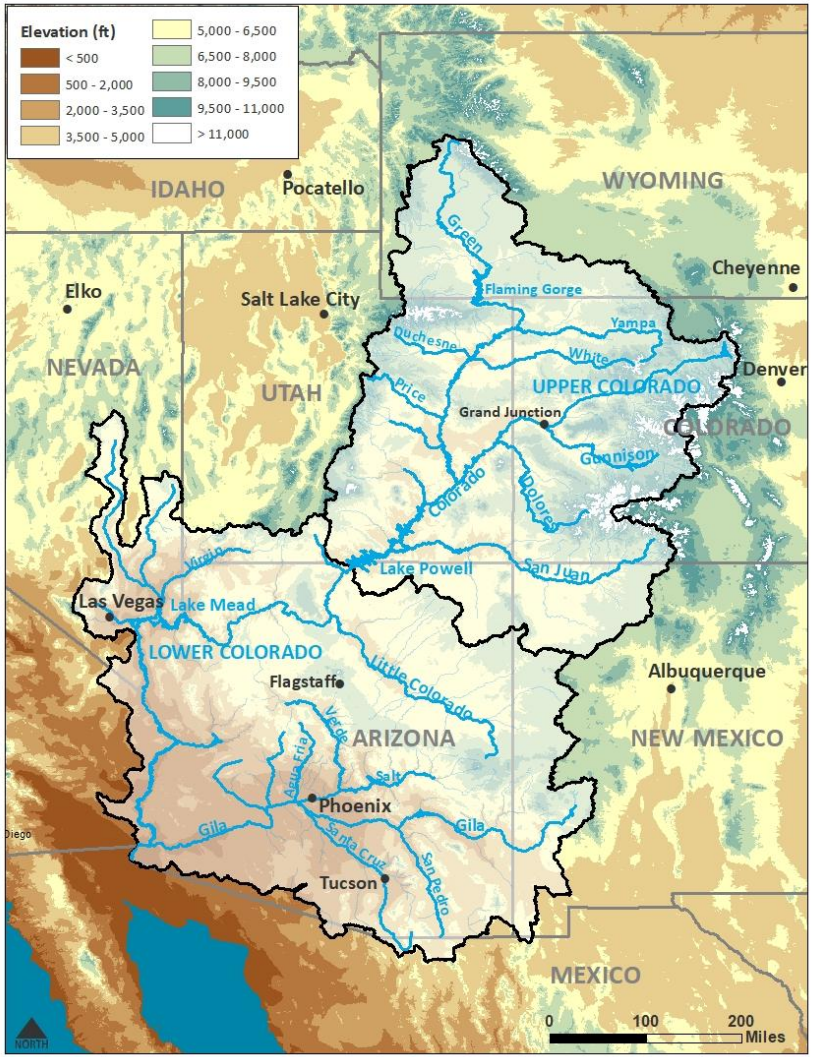
Colorado River Basin Water Supply Briefing

February 7, 2023

Cody Moser - Hydrologist

Colorado Basin
River Forecast Center
National Weather Service



Presentation Overview

Precipitation Review

Soil Moisture Conditions

Current Snowpack Conditions

2023 Water Supply Forecasts

February Water Supply Forecast Error

Recent/Upcoming Weather

Contacts & Questions

CBRFC Web Page Demo

Webinar recording & slides will be made available on CBRFC webpage

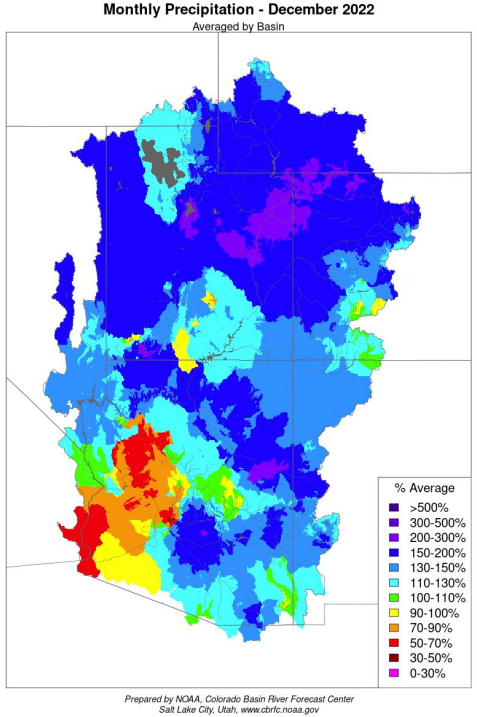
CBRFC staff monitoring chat/questions during webinar

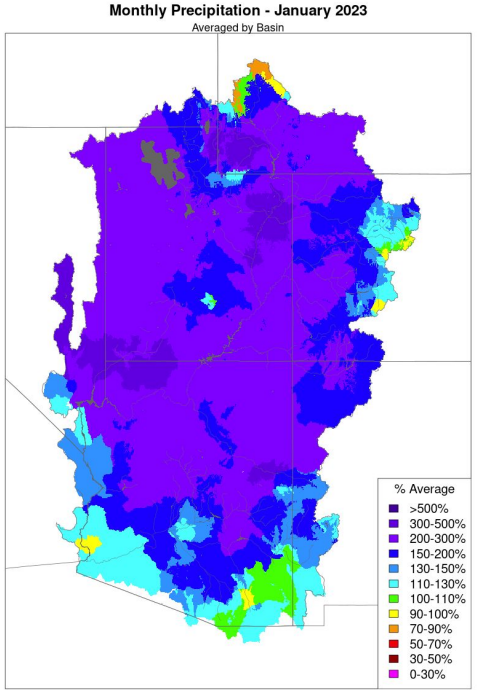
December & January Precipitation Summary

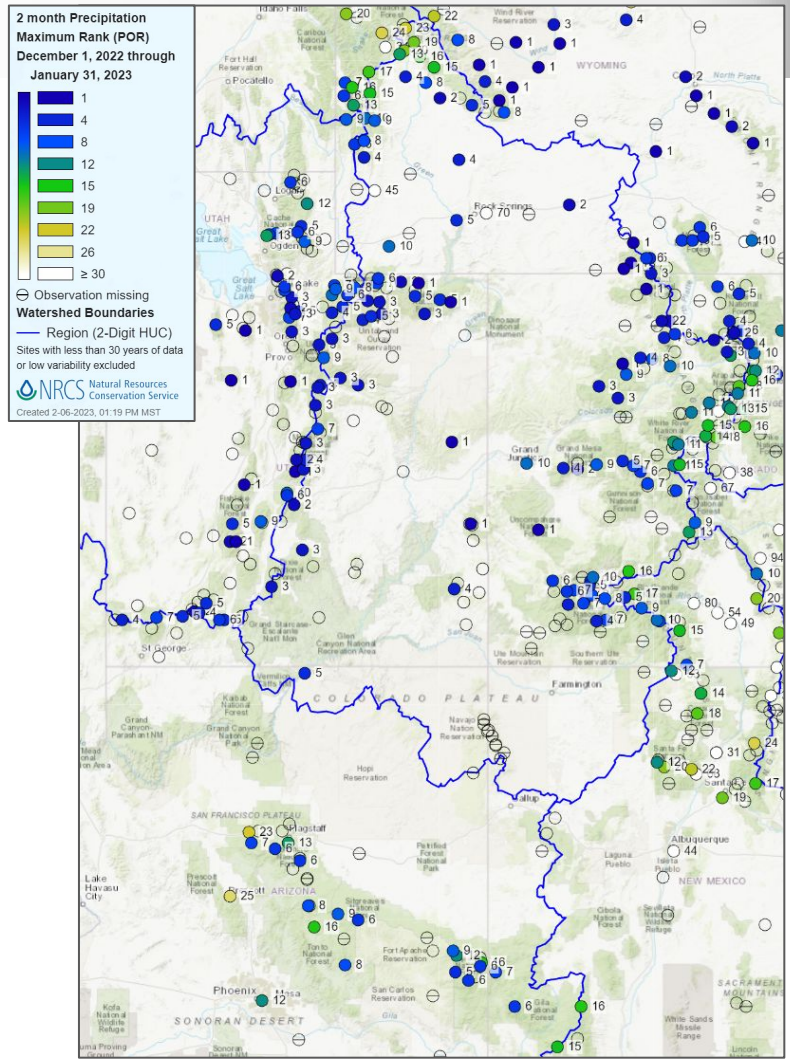
Well above average December and January precipitation across the region.

UT and AZ have generally received more precipitation than WY and CO.

Near/record wet December-January period across central UT and northwest WY.

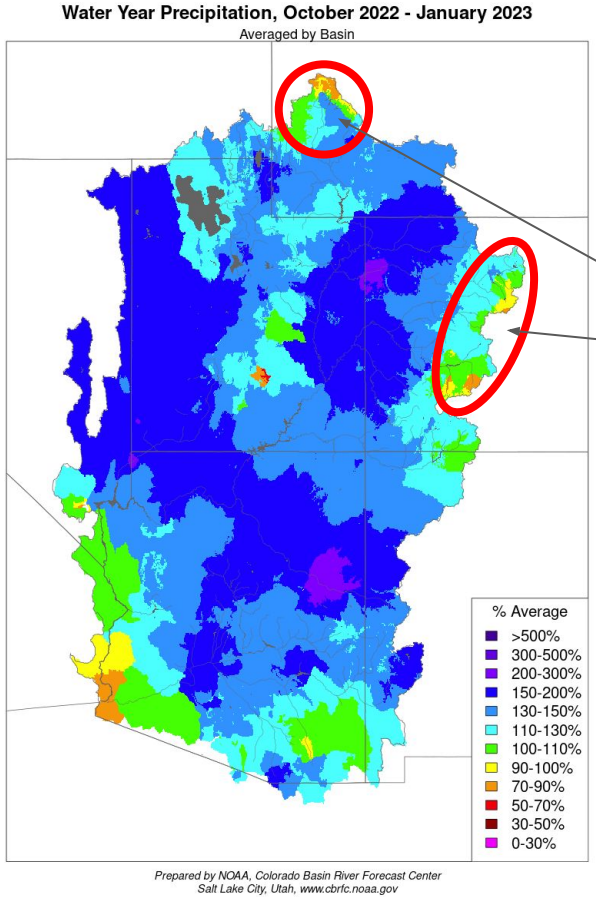






Water Year 2023 (October - January) Precipitation

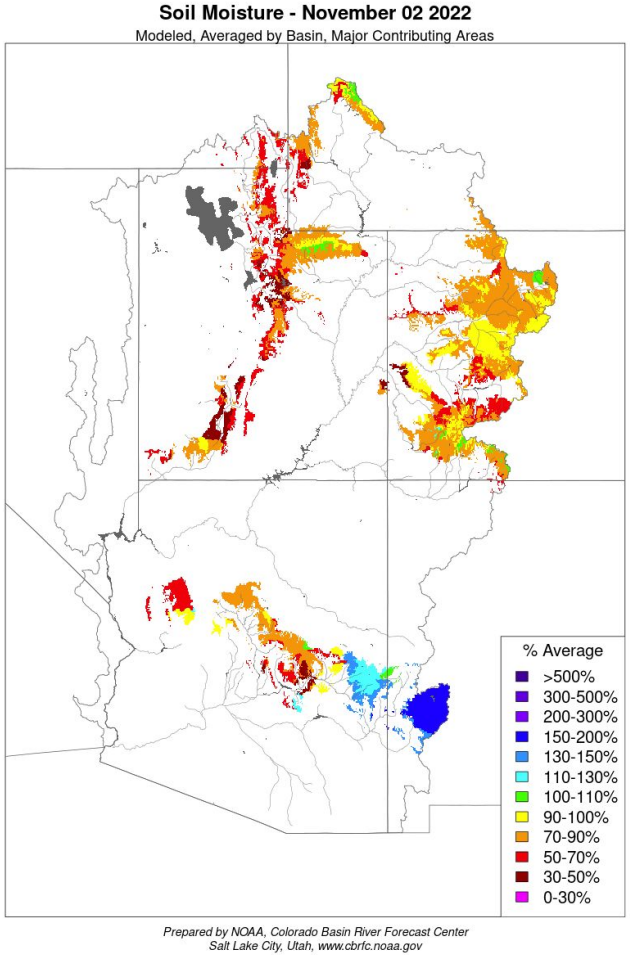
Water Year 2023 CBRFC Precipitation (Significant Runoff Areas) Percent of 1991-2020 Average			
UPPER COLORADO RIVER BASIN			
	Dec	**Jan**	**Oct-Jan**
Above Lake Powell	152	170	123
Green River Basin			
Above Fontenelle	140	92	97
Above Flaming Gorge	156	120	110
Yampa/White	179	180	140
Duchesne	178	219	132
Price/San Rafael/Dirty Devil	181	206	141
Colorado River Headwaters			
Above Kremmling	150	124	106
Eagle	146	109	110
Roaring Fork	142	143	117
Above Cameo	148	135	114
Southwest Colorado			
Gunnison	136	169	119
Dolores	152	198	132
San Juan	119	192	119
LOWER COLORADO RIVER BASIN			
Virgin	113	291	167
Little Colorado	121	218	148
Verde	114	235	153
Salt	126	188	137
Upper Gila	140	151	138



Water year precipitation can be used as a good indicator of early season water supply conditions, and is near to above average across most of the region.

The northern Upper Green River Basin above Fontenelle Reservoir and areas along the Continental Divide have received less precipitation compared to surrounding basins.

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.

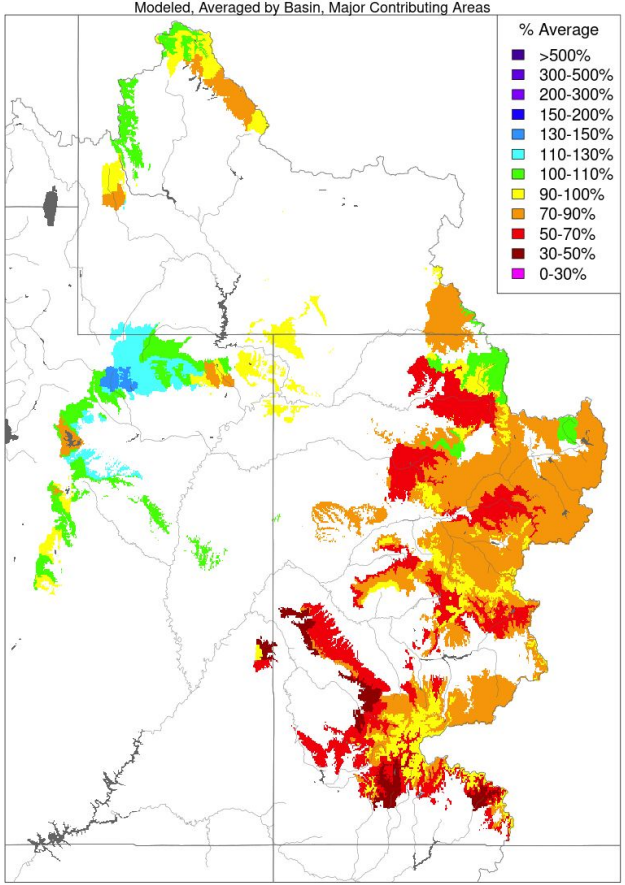
Generally better conditions in the Colorado River Basin compared to the Great Basin.

The timing and magnitude of spring runoff is ultimately a result of SWE conditions, spring weather, and antecedent soil moisture conditions.

UCRB Fall Model Soil Moisture Conditions: 2021 vs. 2022

Soil Moisture - Fall - 2021 (November 15)

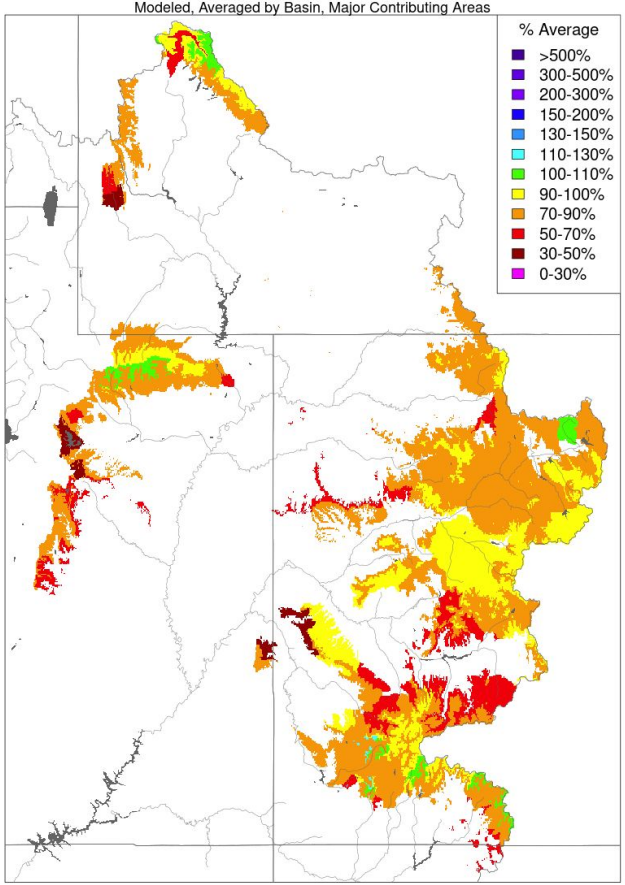
Modeled, Averaged by Basin, Major Contributing Areas



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

Soil Moisture - Fall - 2022 (November 02)

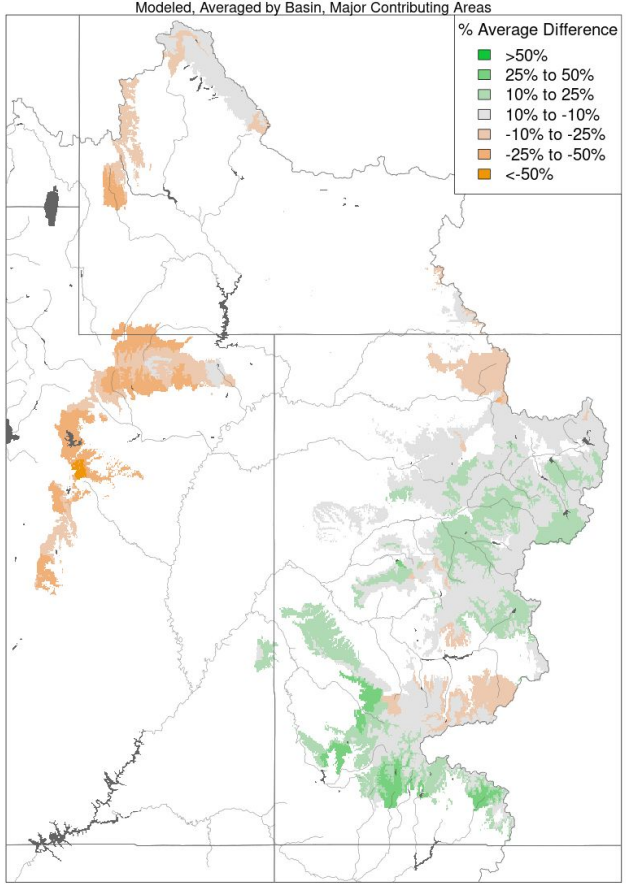
Modeled, Averaged by Basin, Major Contributing Areas



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

Soil Moisture - Fall - 2022 vs 2021

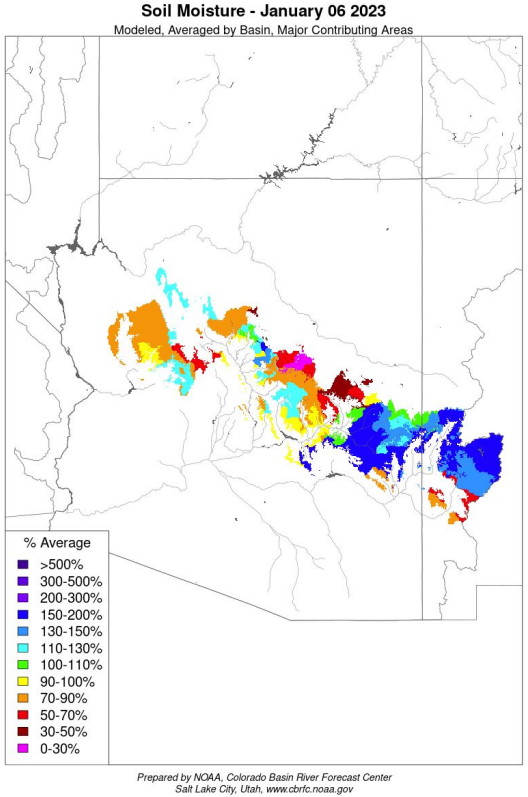
Modeled, Averaged by Basin, Major Contributing Areas

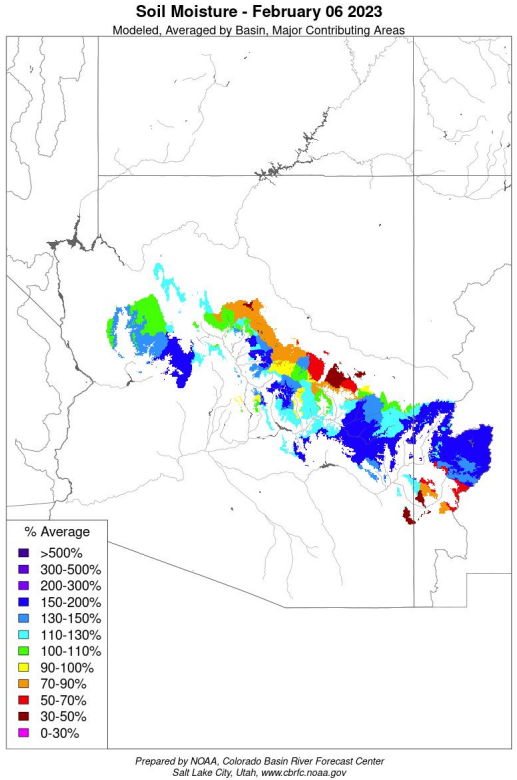


Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

Lower Colorado River Basin Soil Moisture Conditions

LCRB model soil moisture conditions improved during January as a result of above average precipitation, and early February model soil moisture is above average in most basins.

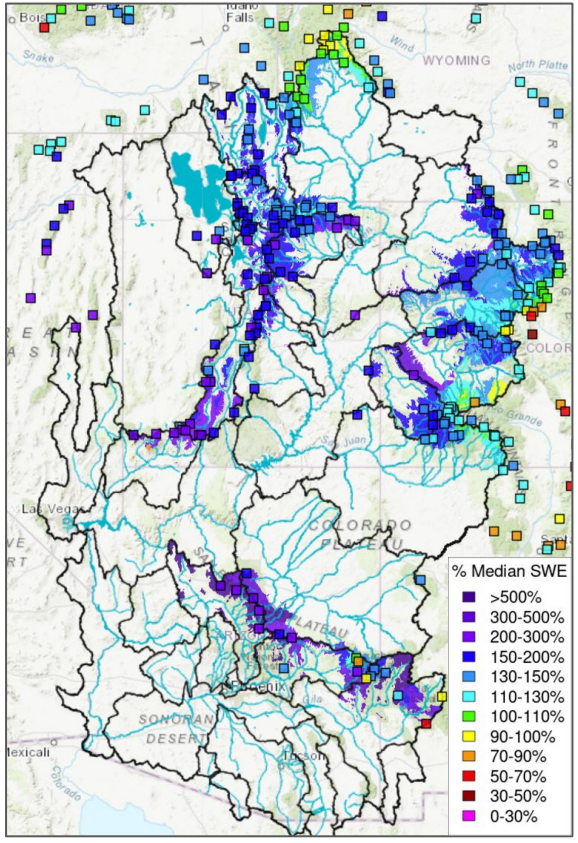




Water Year 2023 Snowpack Conditions

February 1 SWE Conditions

NRCS SNOTEL Observed (Squares)
CBRFC Model (Significant Areas)



SWE = Snow Water Equivalent
The amount water in snow.

Water Year 2023 CBRFC Model SWE (Significant Runoff Areas) Percent of 1991-2020 Median			
UPPER COLORADO RIVER BASIN			
	Jan1	Feb1	Change
Above Lake Powell	126	144	18
Green River Basin			
Above Fontenelle	112	106	-6
Above Flaming Gorge	127	126	-1
Yampa/White	160	163	3
Duchesne	146	174	28
Price/San Rafael/Dirty Devil	164	193	29
Colorado River Headwaters			
Above Kremmling	122	126	4
Eagle	118	120	2
Roaring Fork	114	126	12
Above Cameo	122	129	7
Southwest Colorado			
Gunnison	117	137	20
Dolores	122	165	43
San Juan	87	124	37
LOWER COLORADO RIVER BASIN			
Virgin	121	263	142
Little Colorado	49	269	220
Verde	108	541	433
Salt	52	168	116
Upper Gila	28	215	187

Early February SWE conditions are above normal across the Colorado River Basin.

Less Dec/Jan precip across far northern basins.

More precipitation across UT in January.

Similar Jan1/Feb1 percent of normal SWE conditions.

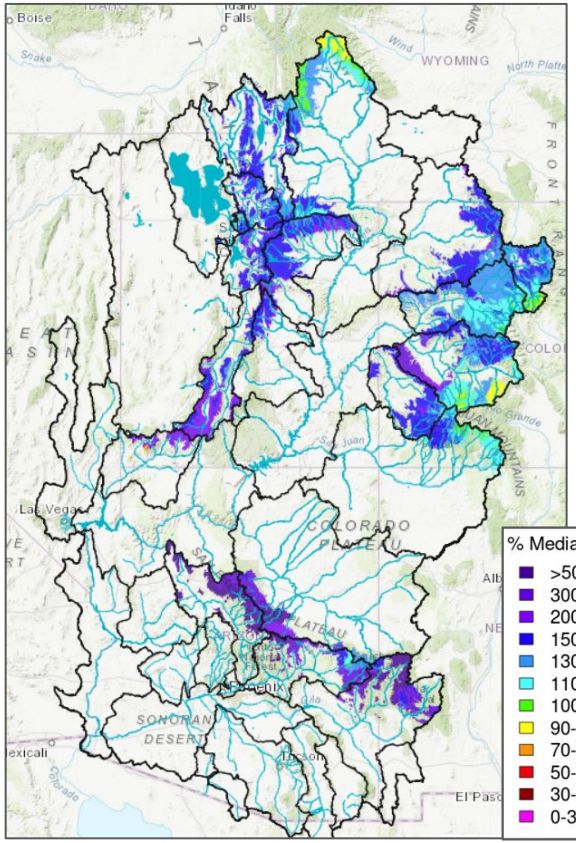
SWE conditions improved during January.

More variable - percentages computed using smaller values.

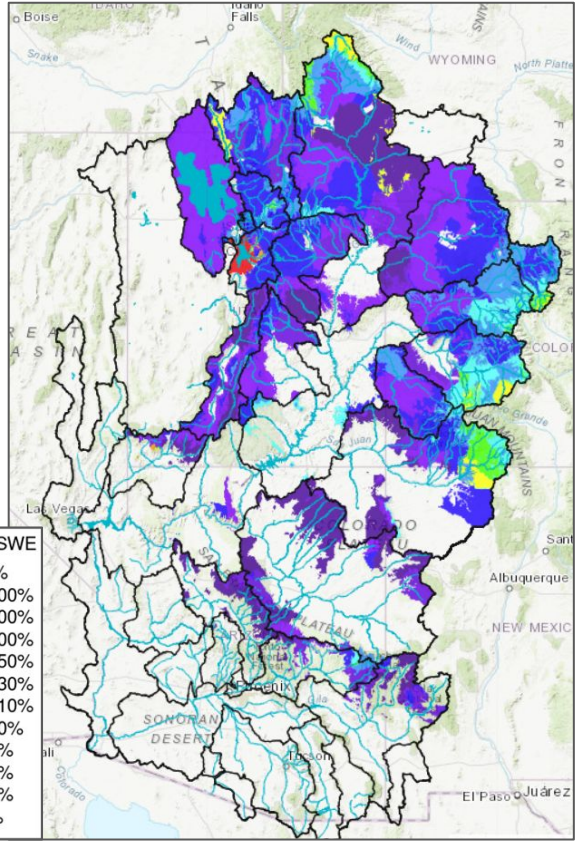
Exceeding expectations because La Niña conditions usually result in drier than average winter weather across the SW US.

Feb 1 CBRFC Model SWE Conditions - Snow Distribution (High Elevation vs. Low Elevation)

Significant Runoff Areas



All Runoff Areas



Snow Distribution Implications

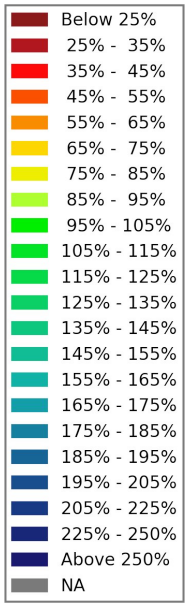
-melt timing

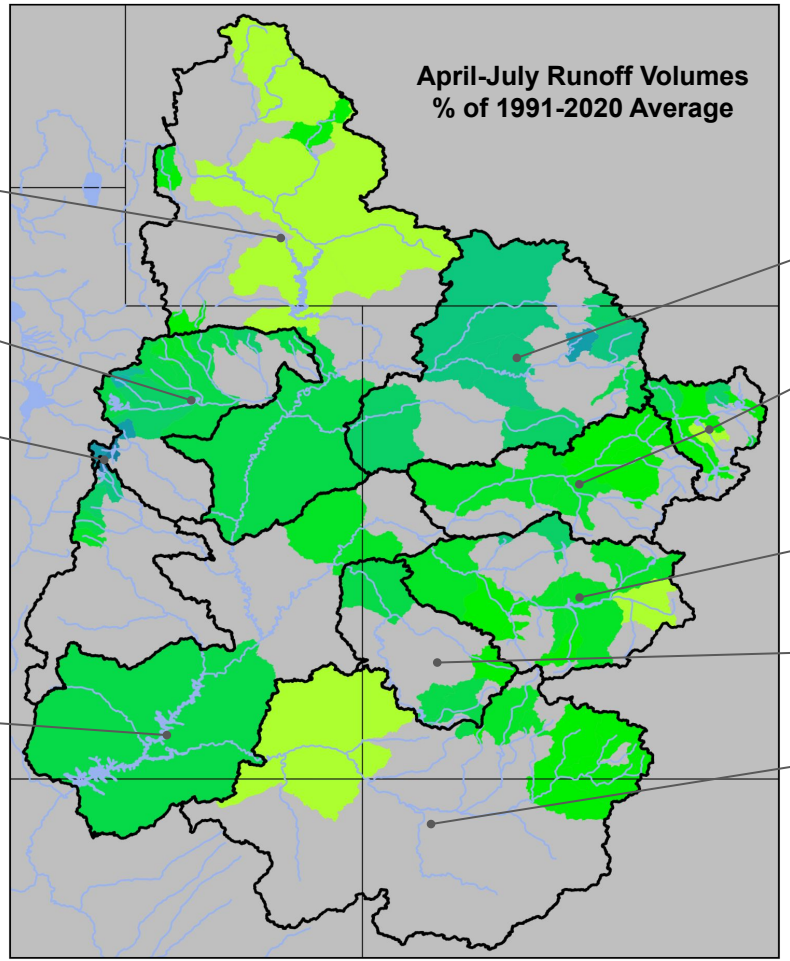
-high elevation reservoir inflows

-peak flows

-impact on AMJJ runoff volumes

Feb 1st Water Supply Forecasts: Upper Colorado





Upper Green: 85-105%

Duchesne: 110-160%

San Rafael/Dirty Devil: 115-175%

Lake Powell: 117%

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

White/Yampa: 125-170%

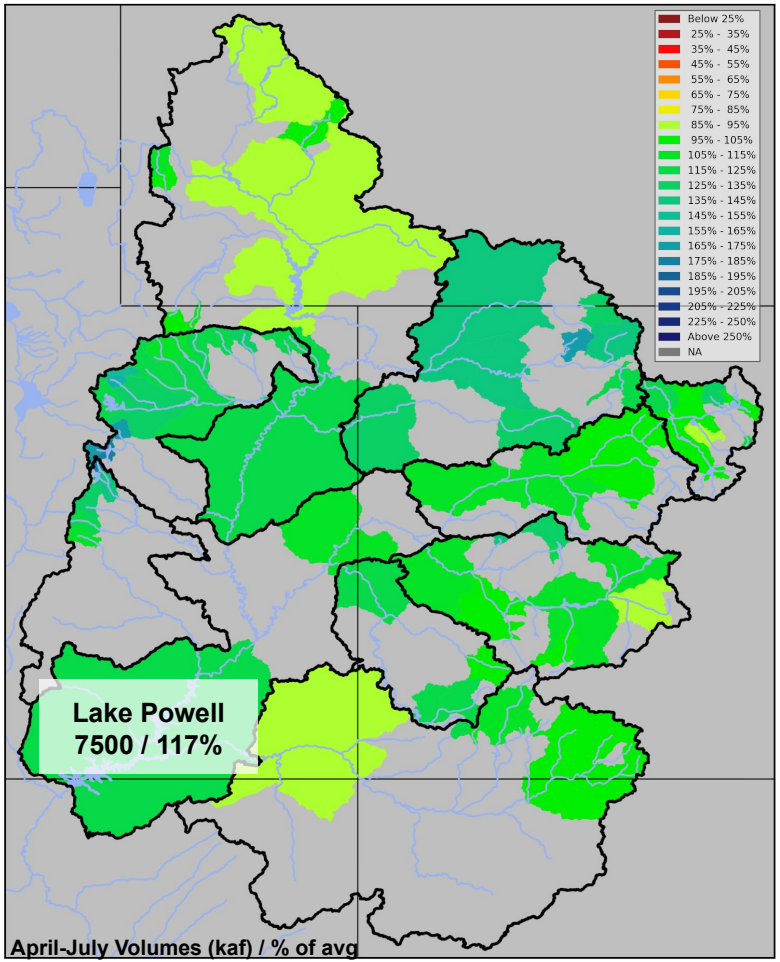
Upper CO: 95-130%

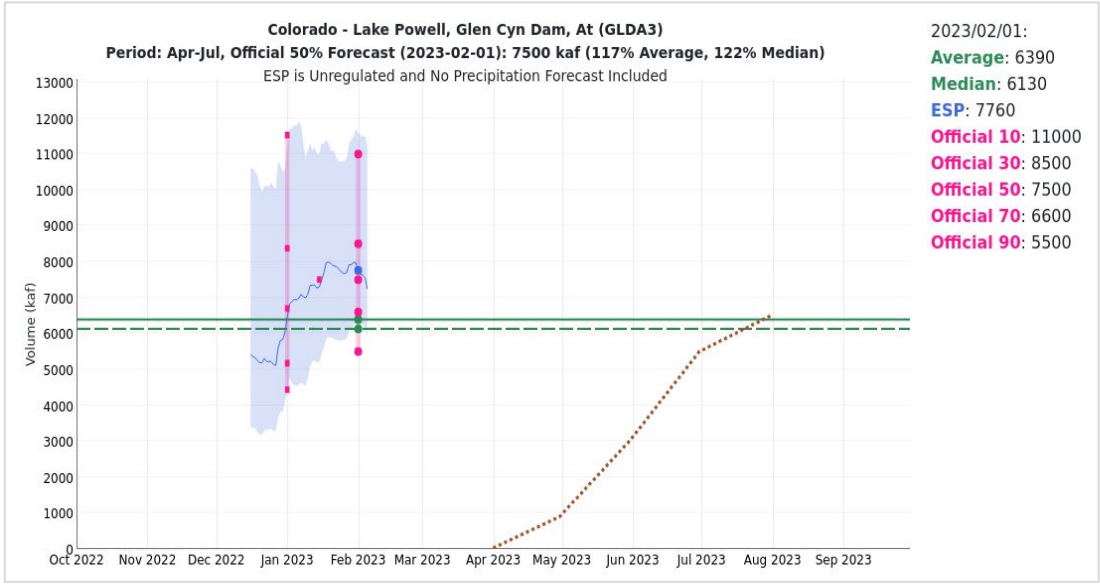
Gunnison: 90-145%

Dolores: 105-125%

San Juan: 95-120%

Feb 1st Water Supply Forecasts: Upper Colorado (Lake Powell)





Official 10: 11000 → 10% chance of exceeding 11000 KAF / 172% avg

Official 30: 8500

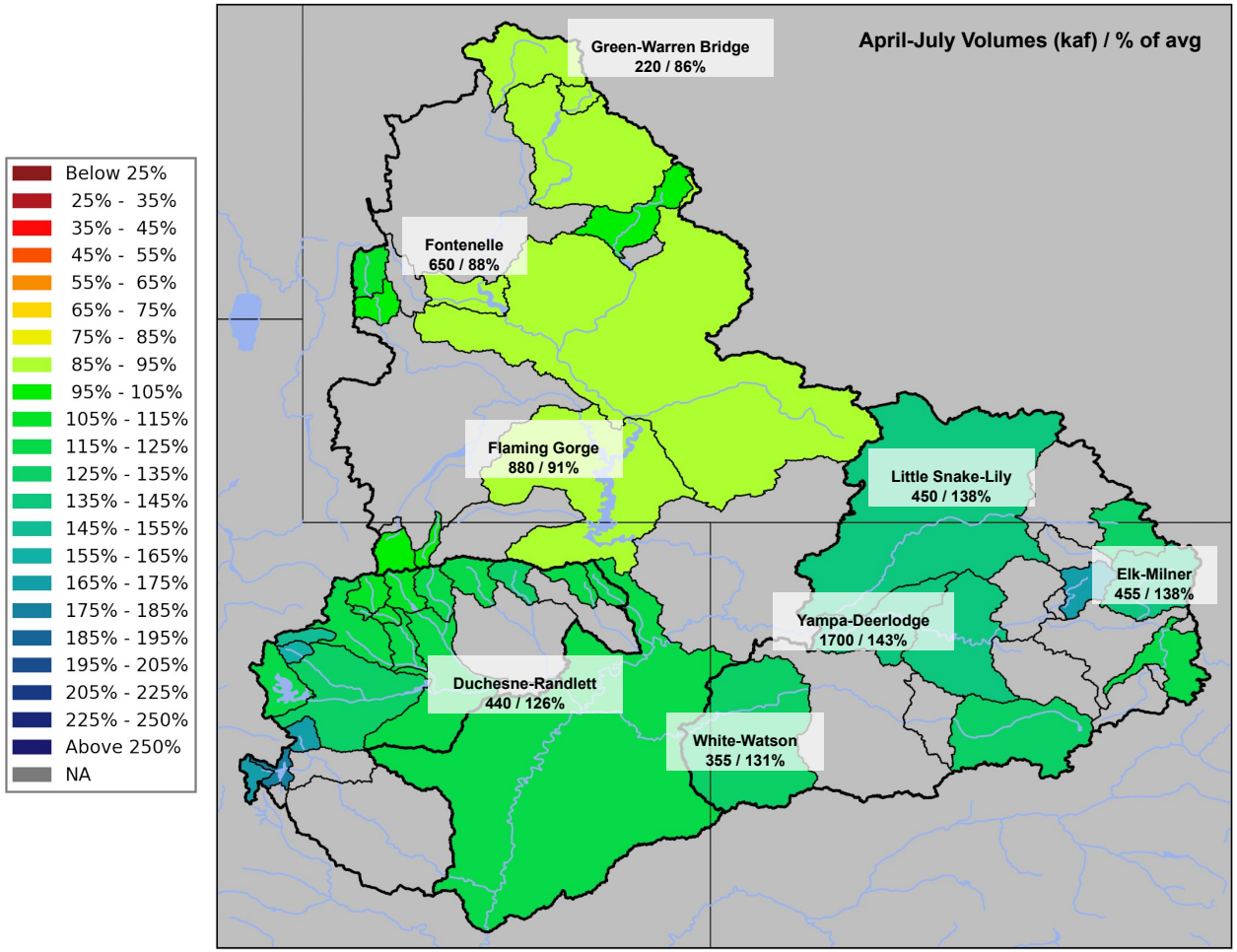
Official 50: 7500 → 50% chance of exceeding 7500 KAF / 117% avg
50% chance of **NOT** exceeding 7500 KAF / 117% avg

Official 70: 6600

Official 90: 5500 → 90% chance of exceeding 5500 KAF / 86% avg

20% chance observed runoff volume could be outside of the forecast range.
Large amount of uncertainty and spread in the forecast.

Feb 1st Water Supply Forecasts: Green, Yampa, White, Duchesne



February 1st 2023 Forecasts

Volume (kaf) / % of 1991-2020 avg

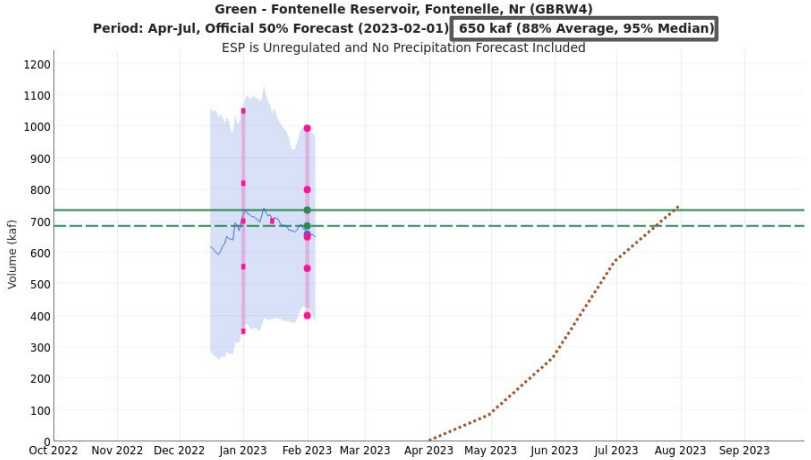
Forecast Ranges & (1-month Trend)

Upper Green: 85 - 105%
(0-5% decrease)

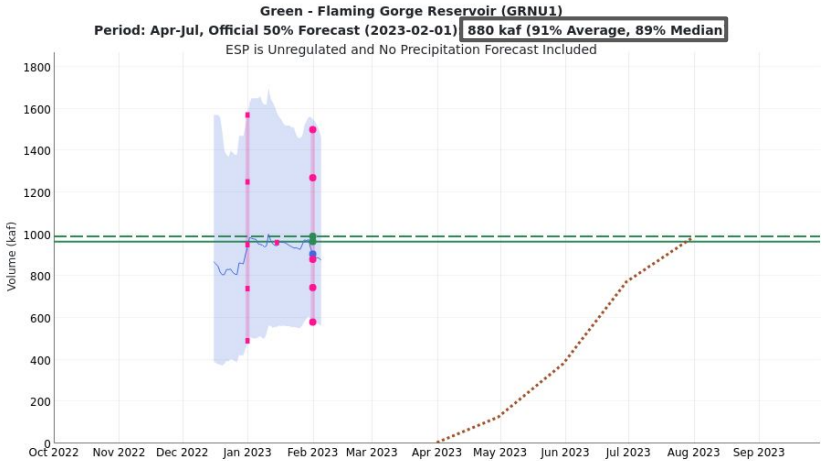
Yampa/White: 125 - 170%
(5-15% increase)

Duchesne: 110 - 160%
(5-35% increase)

Upper Green Water Supply Forecasts & Snow Conditions

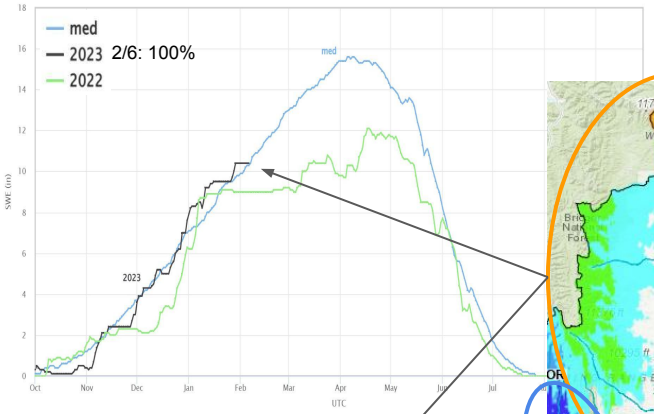


2023/02/01:
Average: 735
Median: 685
ESP: 658
Official 10: 995
Official 30: 800
Official 50: 650
Official 70: 550
Official 90: 400

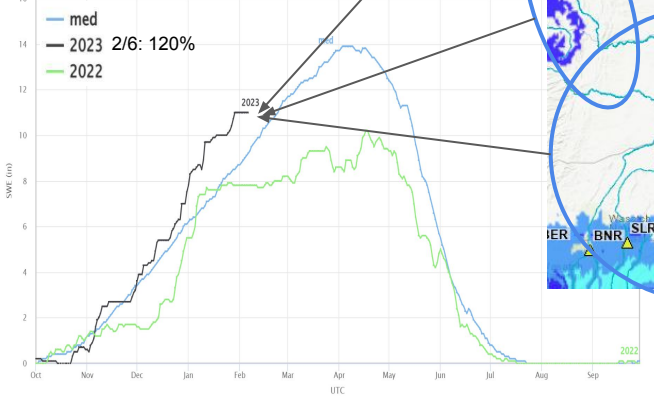


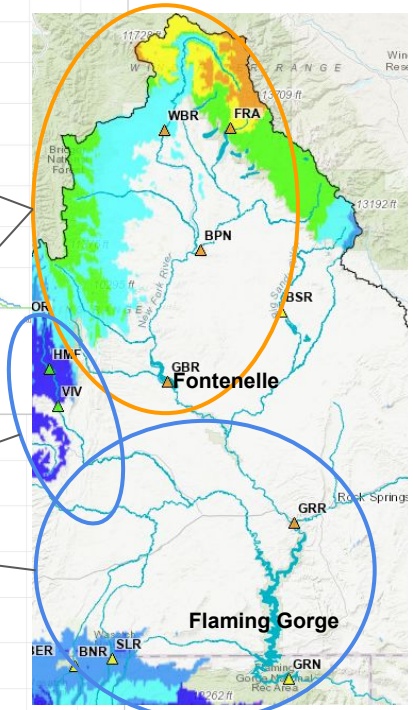
2023/02/01:
Average: 965
Median: 990
ESP: 905
Official 10: 1500
Official 30: 1270
Official 50: 880
Official 70: 745
Official 90: 580

CBRFC Model Group SWE Plot
Green River above Fontenelle

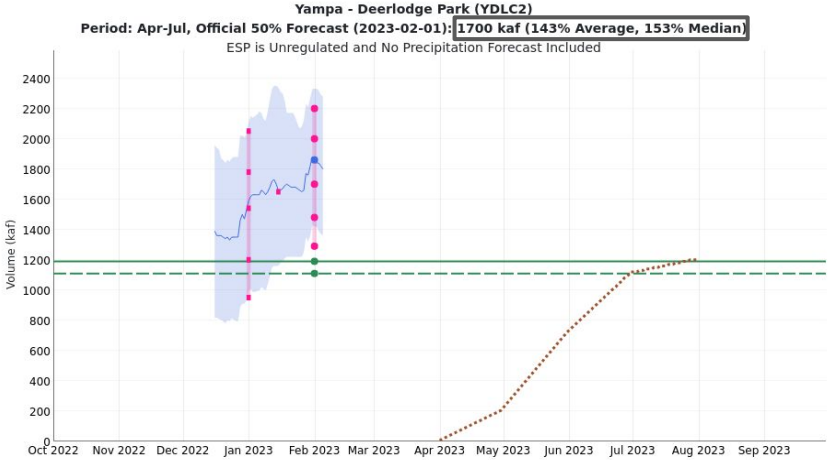


CBRFC Model Group SWE Plot
Green River above Flaming Gorge

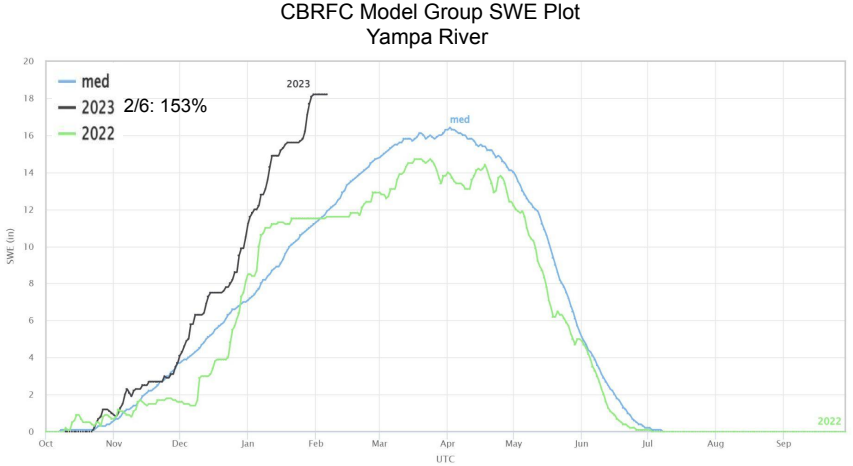


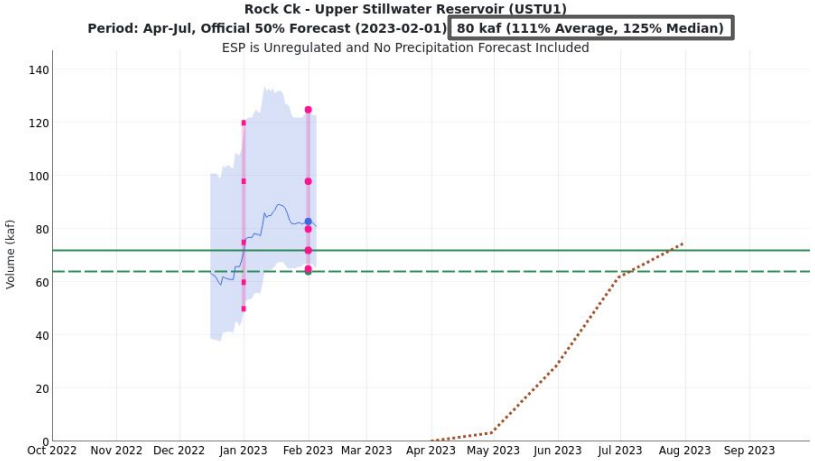


Yampa & Duchesne Water Supply Forecasts & Snow Conditions

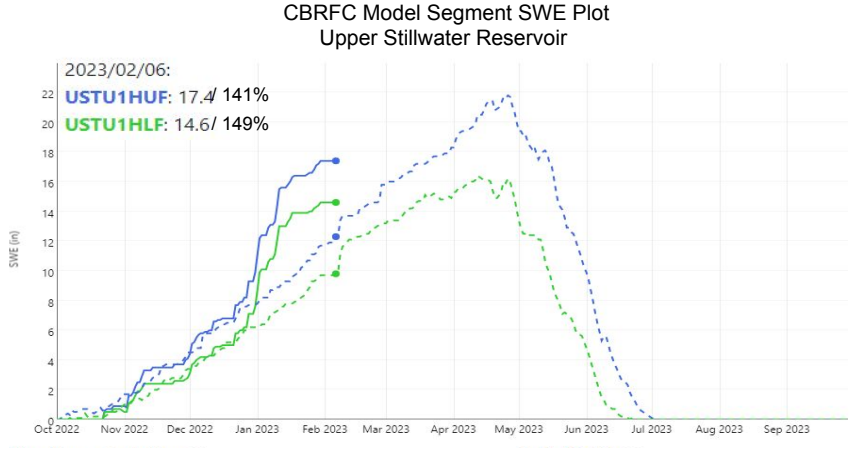


2023/02/01:
Average: 1190
Median: 1110
ESP: 1860
Official 10: 2200
Official 30: 2000
Official 50: 1700
Official 70: 1480
Official 90: 1290





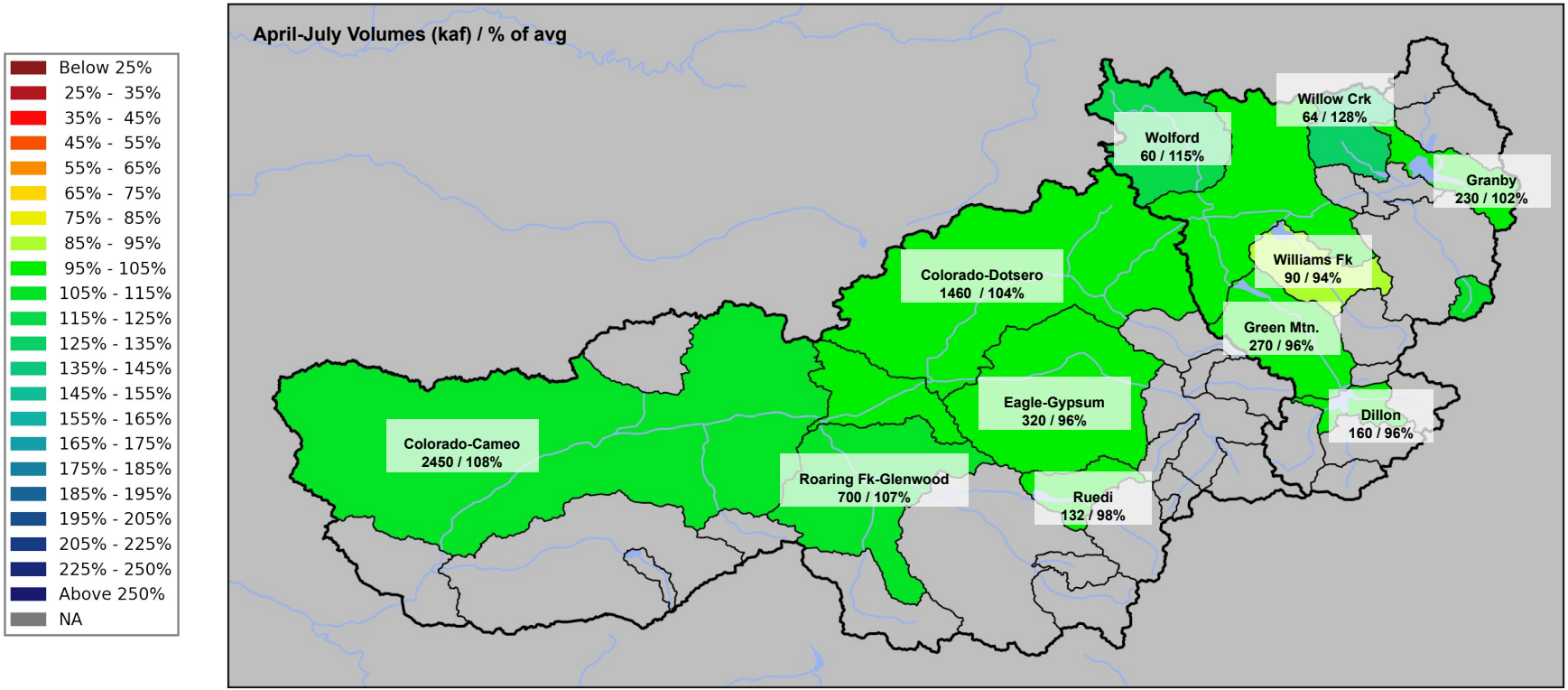
2023/02/01:
Average: 72
Median: 64
ESP: 82.9
Official 10: 125
Official 30: 98
Official 50: 80
Official 70: 72
Official 90: 65



Feb 1st Water Supply Forecasts: Upper Colorado River Mainstem

Forecast Ranges & (1-month Trend):

Granby to Kremmling: 95 - 130% of average (0-10% increase)
Kremmling to Cameo: 95 - 110% of average (0-10% increase)



Upper Colorado Mainstem Water Supply Forecasts & Model Snow Conditions

Wolford Reservoir
April-July (AMJJ) Volume Forecast: 115% of average
Above normal SWE

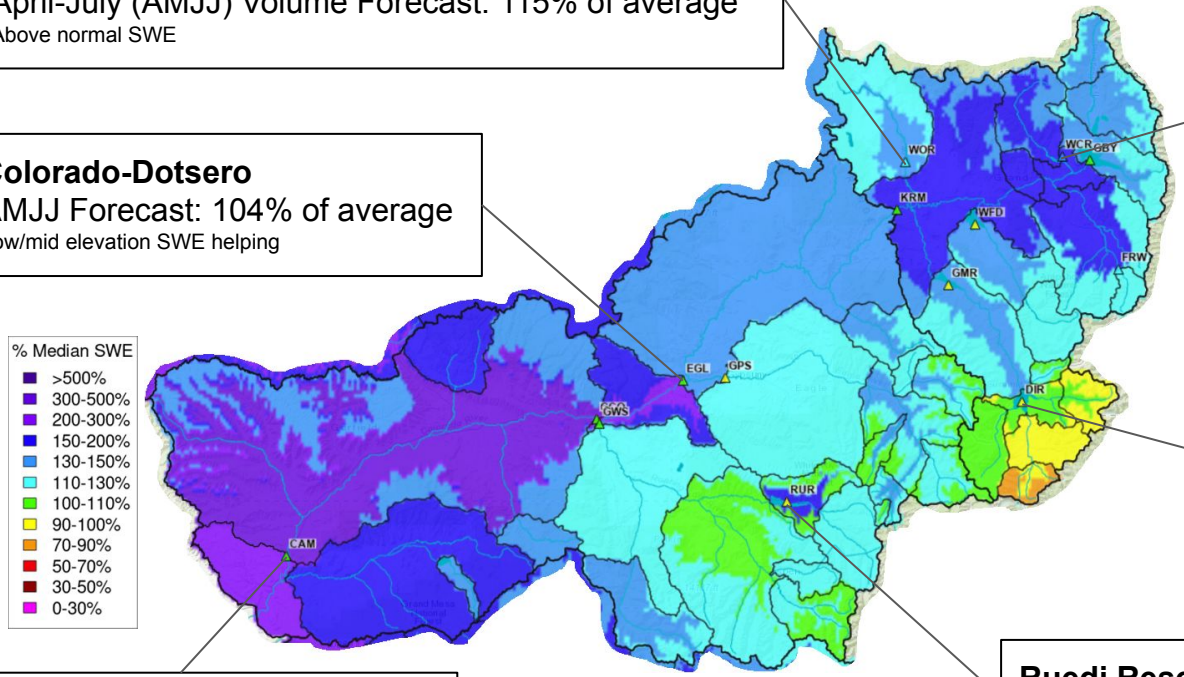
Colorado-Dotsero
AMJJ Forecast: 104% of average
Low/mid elevation SWE helping

Willow Creek Reservoir
AMJJ Forecast: 128% of average
Above normal SWE
Burned by East Troublesome Fire in Oct 2020

Dillon Reservoir
AMJJ Forecast: 96% of average
Less precip/SWE compared to surrounding areas

Ruedi Reservoir
AMJJ Forecast: 98% of average

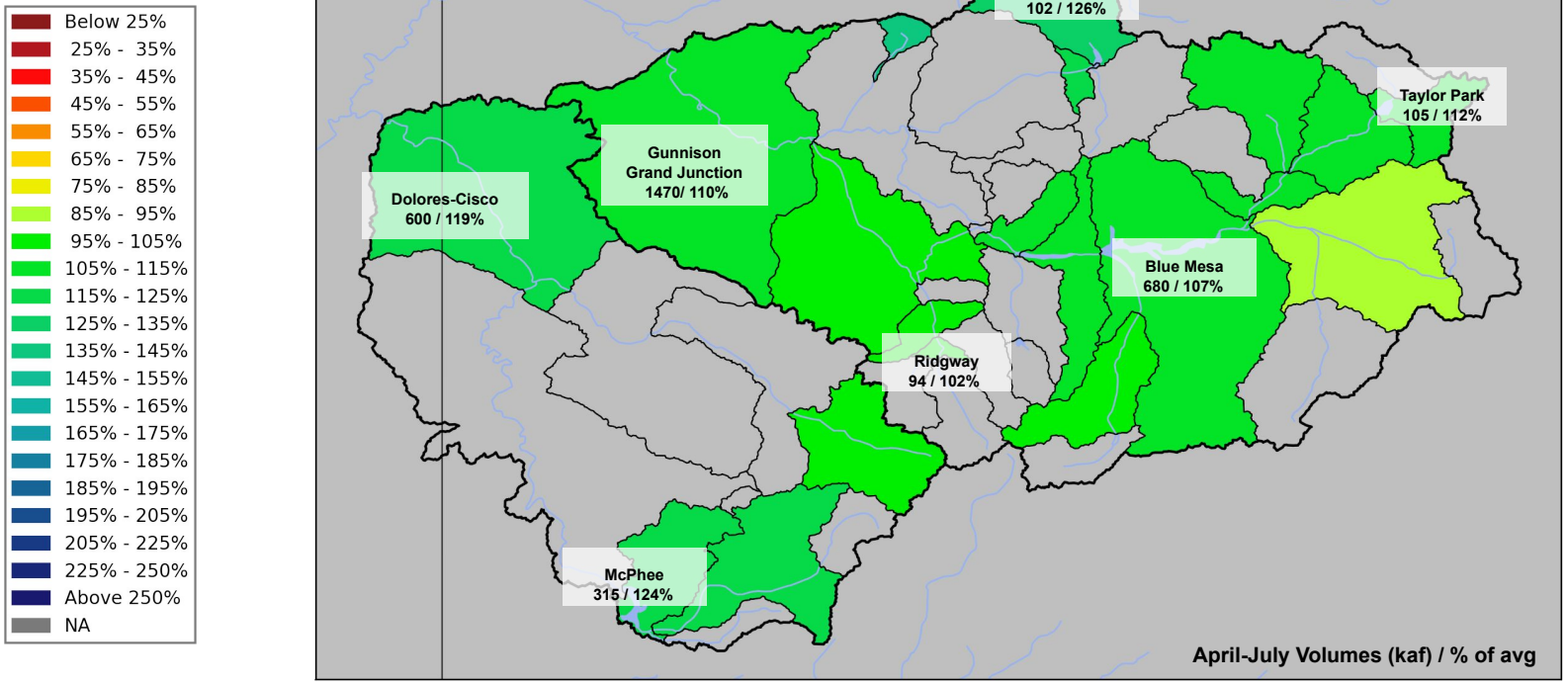
Colorado-Cameo
AMJJ Forecast: 108% of average
Low/mid elevation SWE helping



Feb 1st Water Supply Forecasts: Gunnison, Dolores

Forecast Ranges & (1-month Trend):

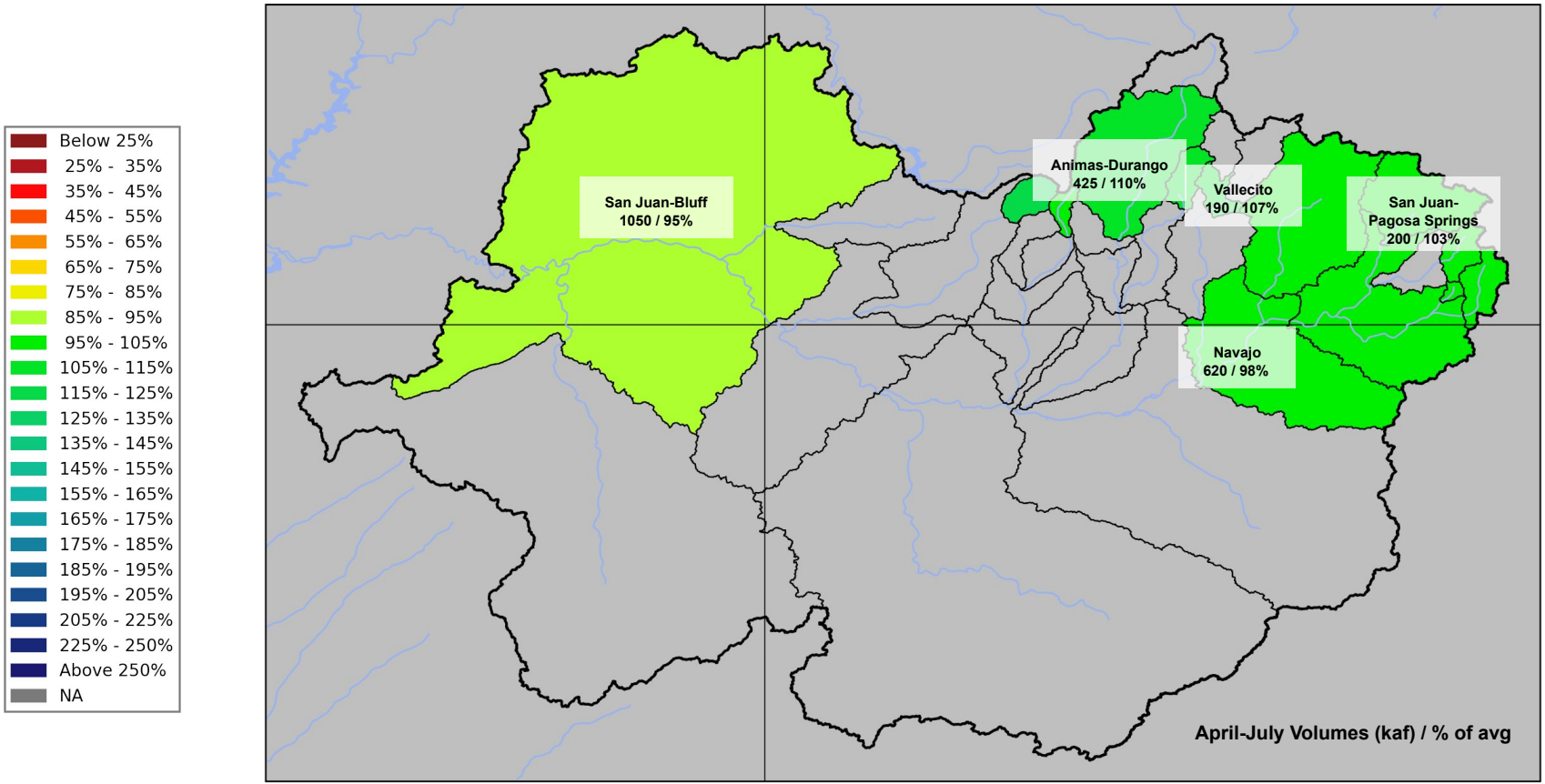
Gunnison: 90 - 145% of average (0-35% increase)
Dolores: 105 - 125% of average (5-20% increase)



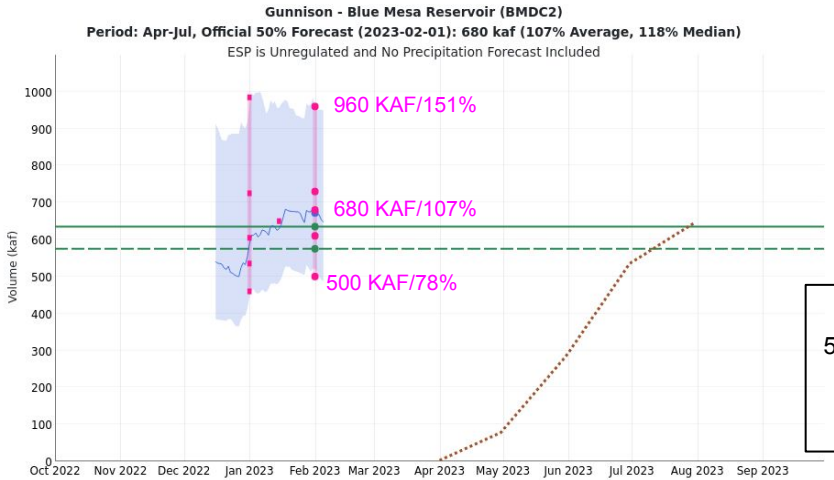
Feb 1st Water Supply Forecasts: San Juan

Forecast Range & (1-month Trend):

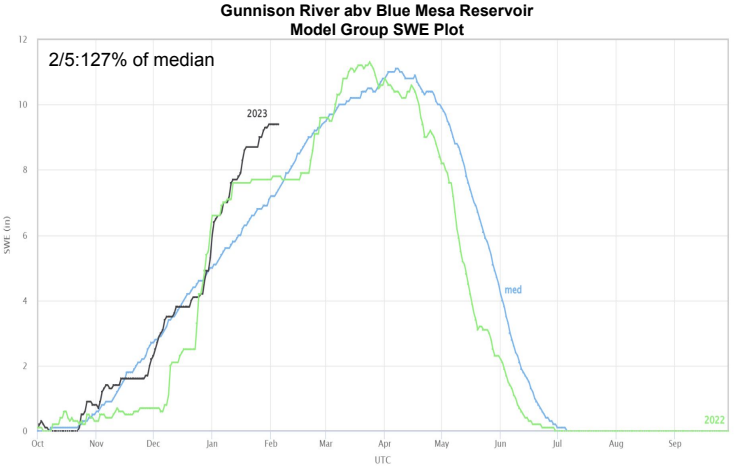
95 - 120% of average (5-25% increase)



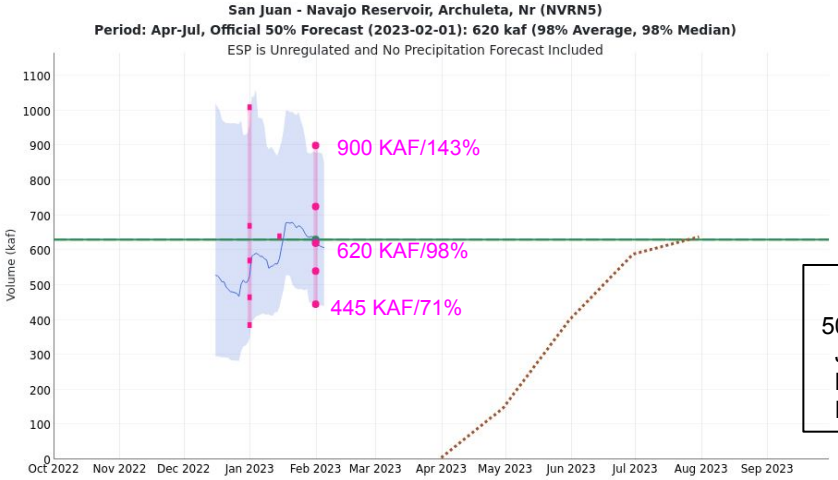
Southwest Colorado Water Supply Forecasts & Snow Conditions



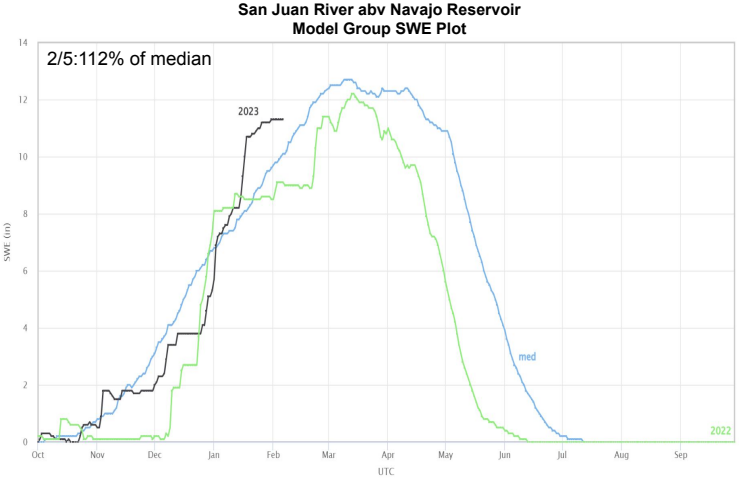
2023/02/01:
Average: 635
Median: 575
ESP: 672
Official 10: 960
Official 30: 730
Official 50: 680
Official 70: 610
Official 90: 500



Blue Mesa Res Inflow
50% Forecasts:
Jan: 605 KAF / 95%
Mid-Jan: 650 KAF / 102%
Feb: 680 KAF / 107%



2023/02/01:
Average: 630
Median: 630
ESP: 622
Official 10: 900
Official 30: 725
Official 50: 620
Official 70: 540
Official 90: 445

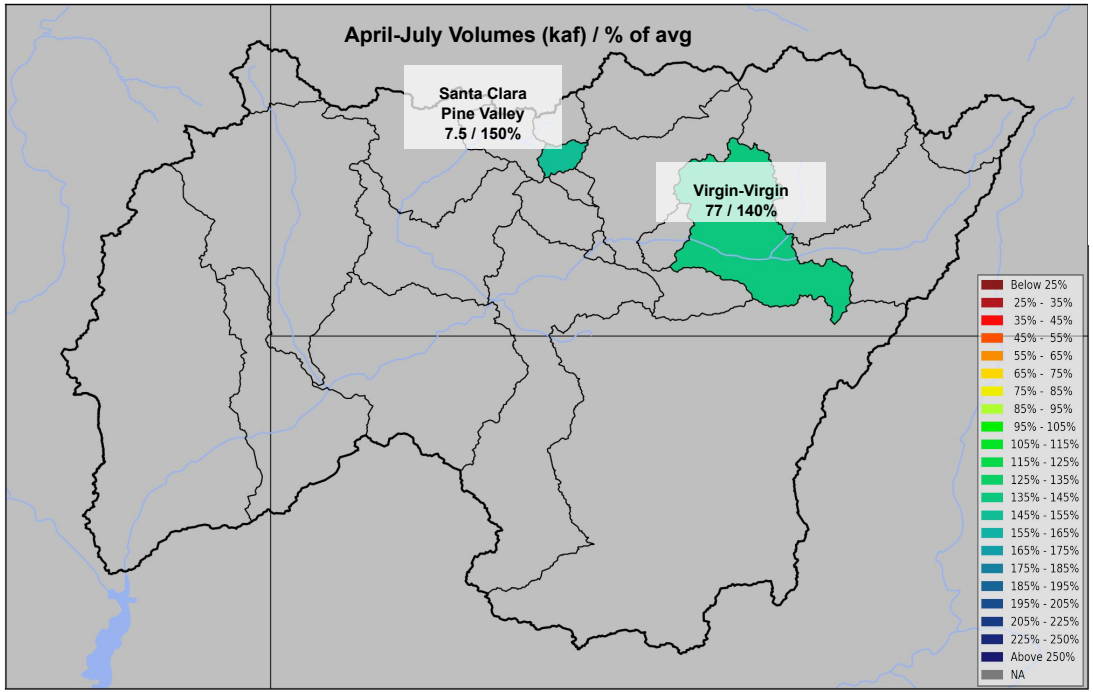


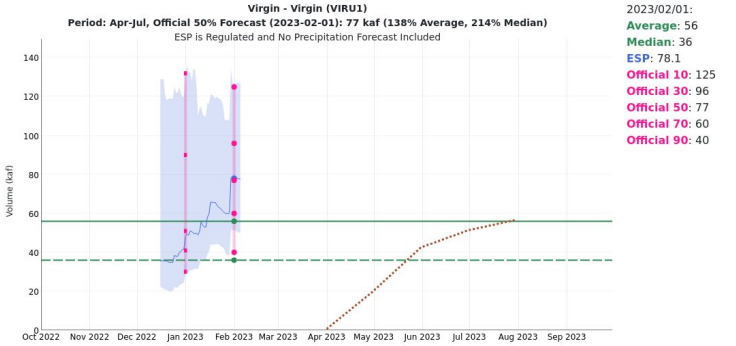
Navajo Res Inflow
50% Forecasts:
Jan: 570 KAF / 90%
Mid-Jan: 640 KAF / 102%
Feb: 620 KAF / 98%

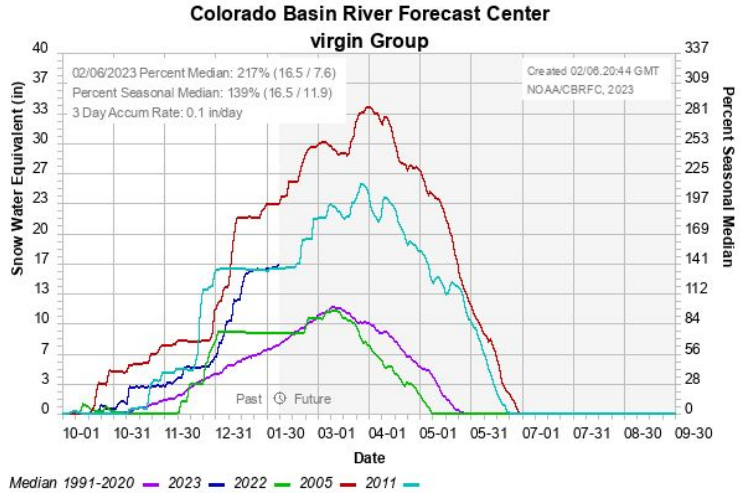
Feb 1st Water Supply Forecasts: Virgin River Basin

Forecast Range & (1-month Trend):

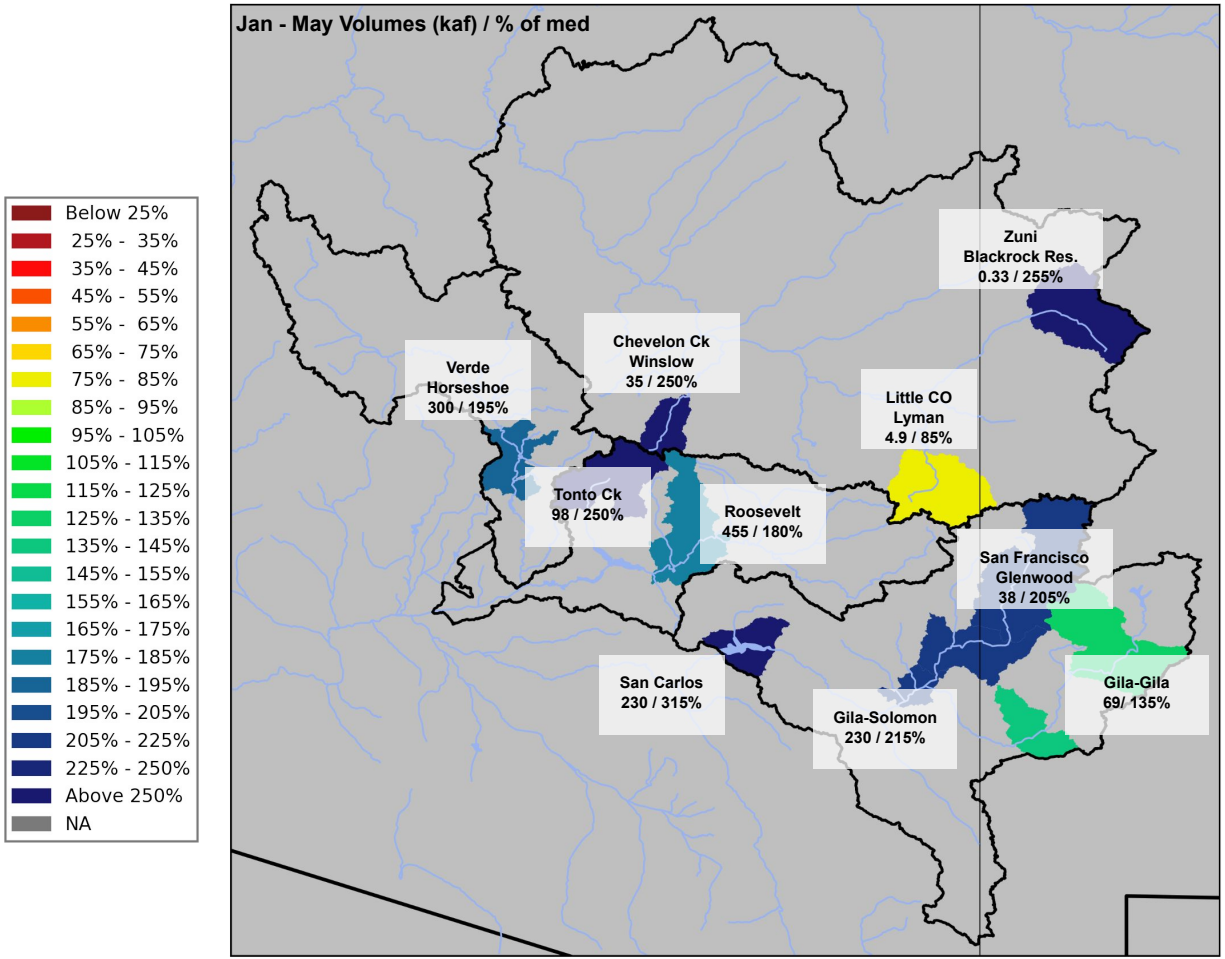
140 - 150% avg (40-45% increase)







Feb 1st Water Supply Forecasts: Lower Colorado River Basin



January - May Forecast Period
% of 1991-2020 Median

Forecast Ranges

Little Colorado: 85% - 255%

Upper Gila: 135% - 315%

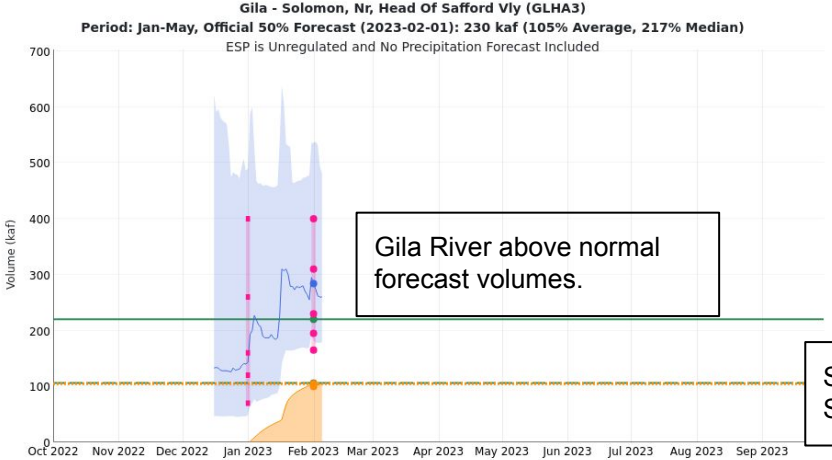
Salt: 180% - 250%

Verde: 195%

January Obs Streamflow Summary

Little Colorado – **329% Normal**
Upper Gila – **521% Normal**
Salt – **1,160% Normal**
Verde – **450% Normal**

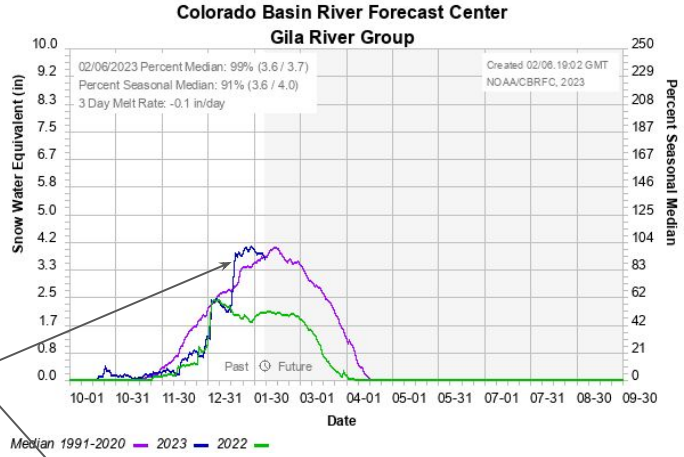
Lower Colorado Water Supply Forecasts & Snow Conditions

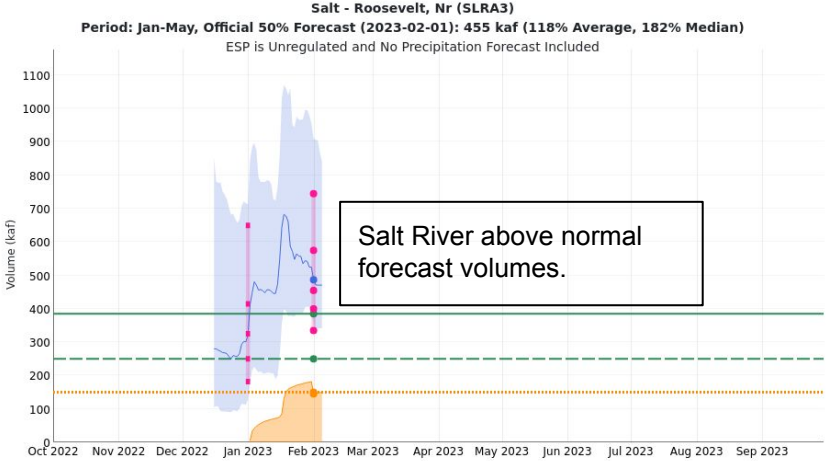


Gila River above normal forecast volumes.

2023/02/01:
Average: 220
Median: 106
Observed Accumulation: 99.8
Observed Total: 105
ESP: 284
Official 10: 400
Official 30: 310
Official 50: 230
Official 70: 195
Official 90: 165

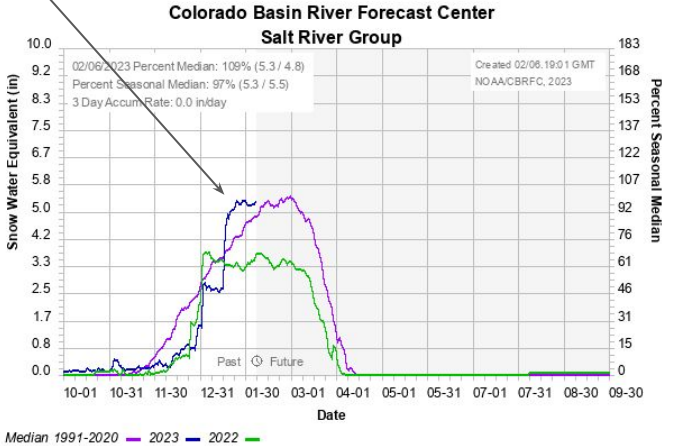
SWE near normal peak SWE during La Nina!





Salt River above normal forecast volumes.

2023/02/01:
Average: 385
Median: 250
Observed Accumulation: 145
Observed Total: 150
ESP: 487
Official 10: 745
Official 30: 575
Official 50: 455
Official 70: 400
Official 90: 335

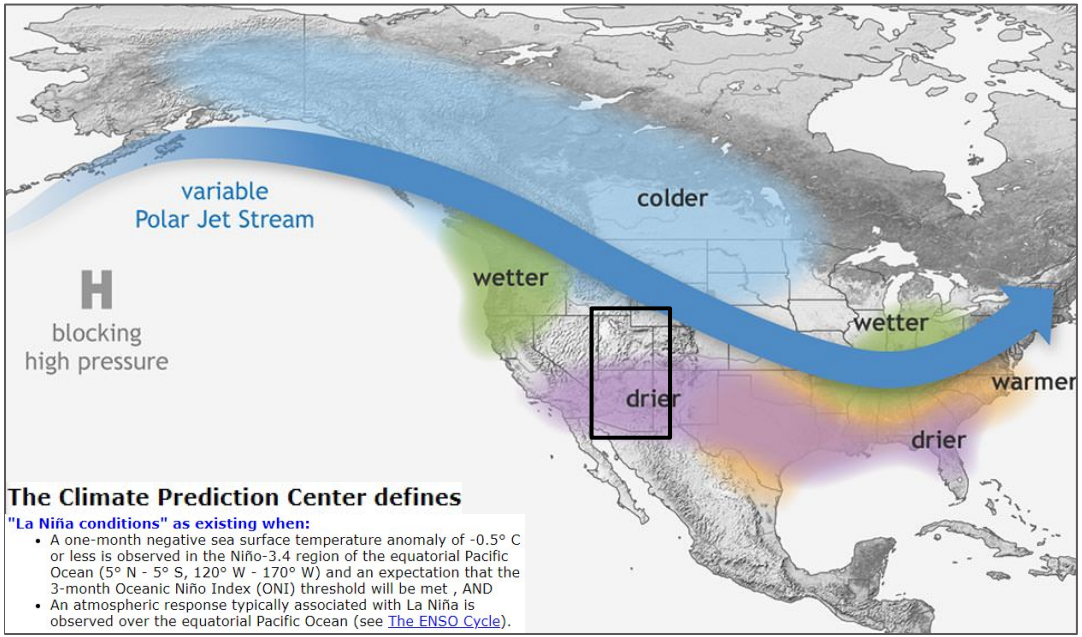


EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION
issued by
CLIMATE PREDICTION CENTER/NCEP/NWS
12 January 2023

El Niño Southern Oscillation (ENSO) Status

- **La Niña** Advisory
  - Increased chances of drier winter weather in Arizona/LCRB
  - Much weaker correlation/winter weather signal elsewhere in basin
  - A transition from La Niña to ENSO-neutral is anticipated during Feb-Apr
  - ~80% chance of ENSO-neutral in Mar-May 2023

La Niña - Typical Winter Weather Pattern

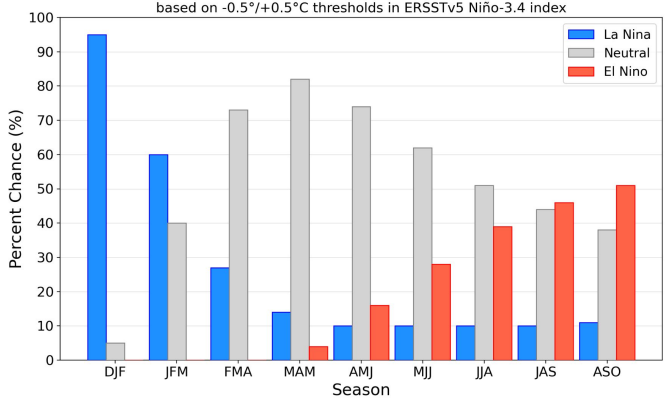


The Climate Prediction Center defines

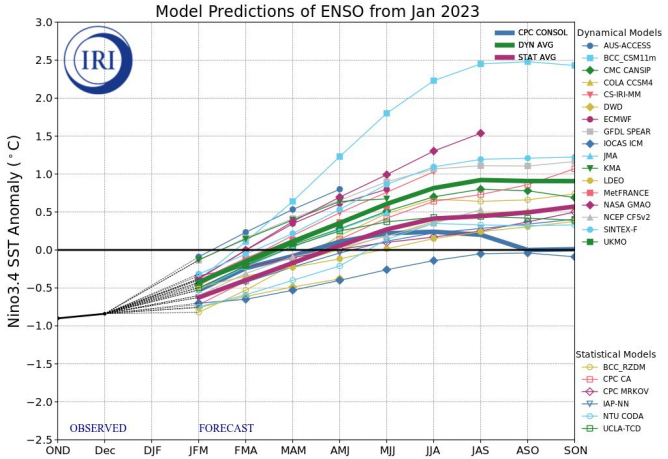
"La Niña conditions" as existing when:

- A one-month negative sea surface temperature anomaly of -0.5° C or less is observed in the Niño-3.4 region of the equatorial Pacific Ocean (5° N - 5° S, 120° W - 170° W) and an expectation that the 3-month Oceanic Niño Index (ONI) threshold will be met , AND
- An atmospheric response typically associated with La Niña is observed over the equatorial Pacific Ocean (see The ENSO Cycle).

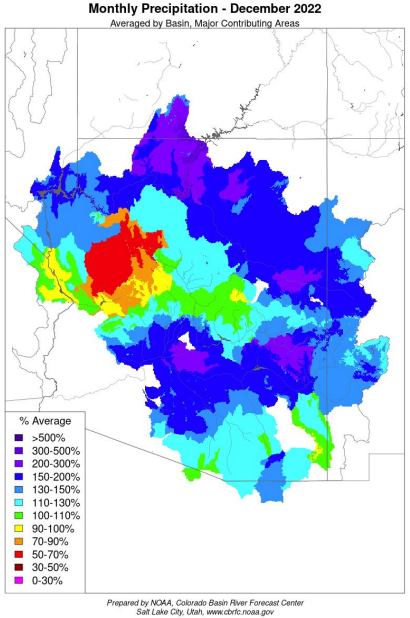
Official NOAA CPC ENSO Probabilities (issued Jan. 2023)

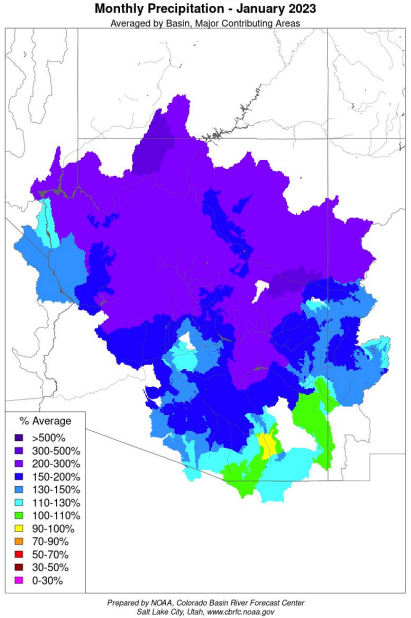


Model Predictions of ENSO from Jan 2023

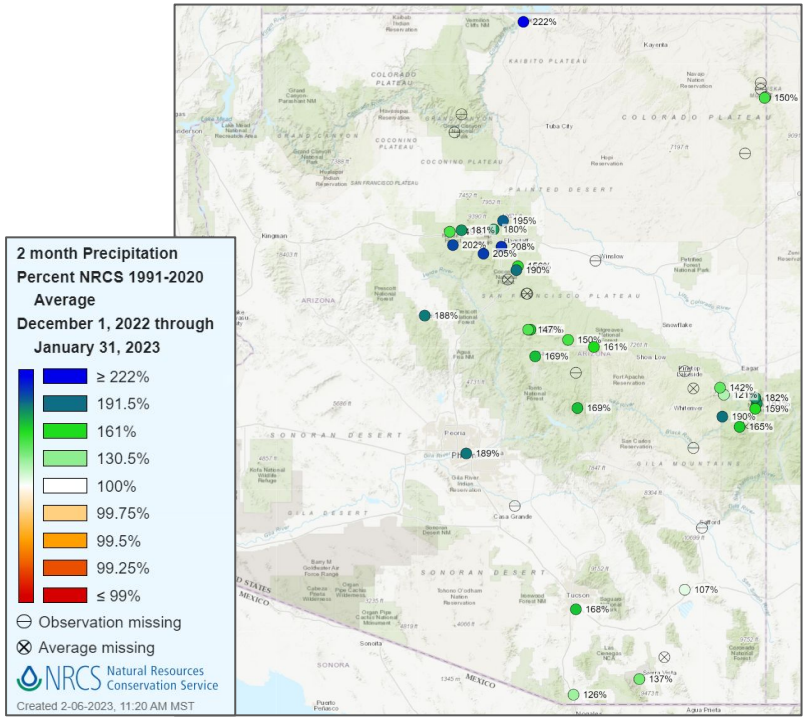


LCRB Winter (December/January) Precipitation Summary





December/January precipitation across the LCRB/AZ was above average, which is atypical given the current La Niña phase typically results in below average winter precipitation across the southwest US.



Water Year 2023
CBRFC Precipitation (Significant Runoff Areas)
Percent of 1991-2020 Average

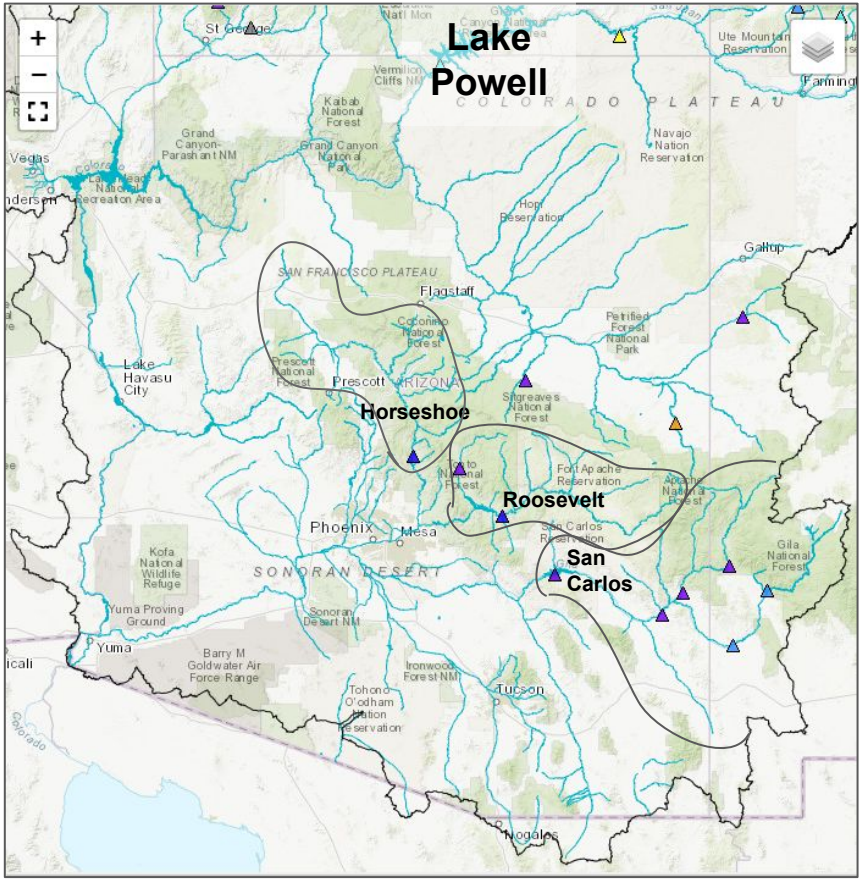
LOWER COLORADO RIVER BASIN		
	Dec	Jan
Virgin	114	291
Little Colorado	118	218
Verde	112	235
Salt	137	188
Upper Gila	151	151

Last Time Wetter Than Normal LCRB Winter During La Niña?

[CPC ENSO Data Link]

La Niña Period	Lower Colorado Basin January-May Observed Volume (%Median) Verde Horseshoe Res.	Salt Roosevelt Res.	Upper Gila San Carlos Res.
Sep-Jan 2017	34%	18%	28%
Jul-Jan 2016 - Wet La Niña	235%	197%	327%
Jun-Jan 2011	45%	47%	45%
May-Jan 2010	81%	31%	32%
July 2020-current			
Jan-May 2023 Forecast	300 kaf / 194%	455 kaf / 182%	230 kaf / 315%

Upper Colorado Basin - Comparable Volumes WY23 April-July Forecast Volume (%Average)		
Green Mtn Res. 270 kaf / 96% avg	Duchesne-Randlett 440 kaf / 126% avg	Lake Granby 230 kaf / 102% avg
McPhee Res. 315 kaf / 124%	Animas-Durango 425 kaf / 110%	East-Almont 200 kaf / 113%

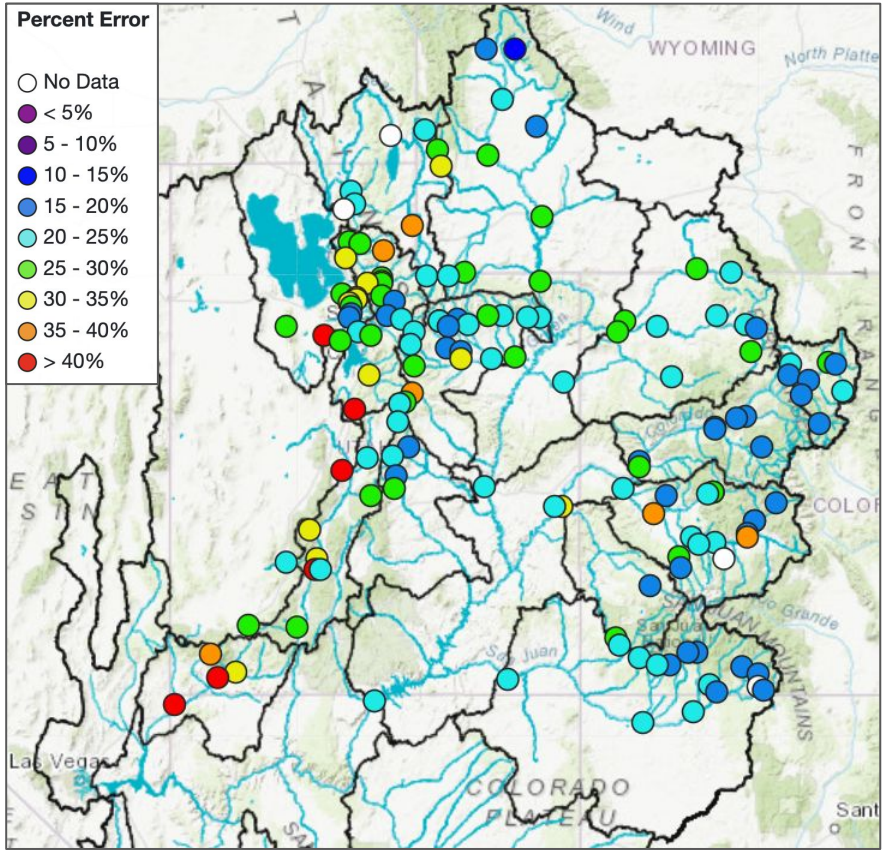


[ENSO Blog Link]

During the 2016-17 winter, the La Niña was anything but strong. It was one of the weakest La Niña qualifying events on record. And it didn't even last the entire winter, so it was one of the shortest too! Sea surface temperatures were near average, falling short of the La Niña threshold starting in January and were slightly above average by February.

Historical Forecast Verification

February Forecast Error: April-July Volume



Location	Avg Feb Forecast Error
Green River - Warren Bridge	15%
Fontenelle Reservoir	25%
Yampa River - Deerlodge	25%
Blue River - Dillon Reservoir	17%
Colorado River - Cameo	19%
Blue Mesa Reservoir (Gunnison)	20%
McPhee Reservoir (Dolores)	25%
Navajo Reservoir (San Juan)	22%
Lake Powell	24%
Virgin River at Virgin	34%

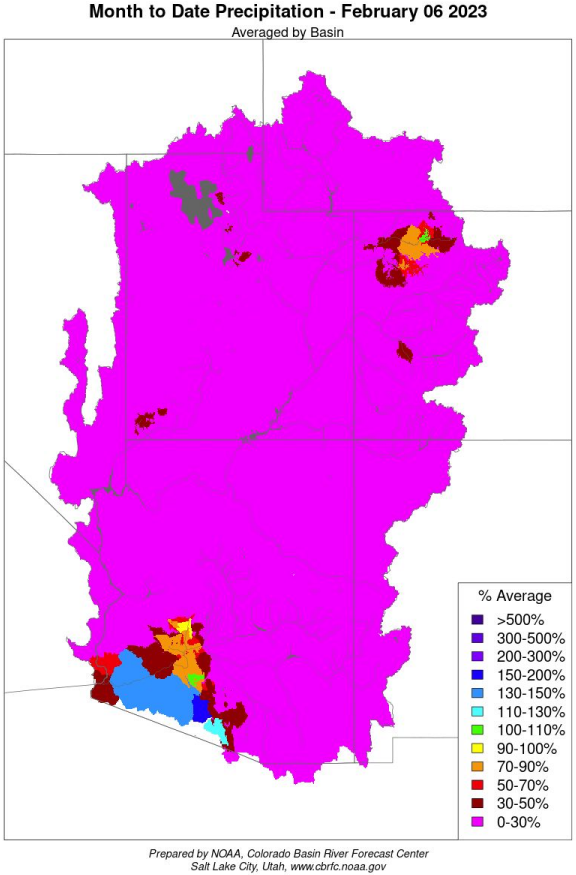
Error tends to decrease each month into the spring

Where Forecasts are Better:
- -Headwaters
- -Primarily snow melt basins
- -Known diversions / demands

Where Forecasts are Worse:
- -Lower elevations (rain or early melt)
- -Downstream of diversions / irrigation
- -Little is known about diversions / demands

Future weather is the primary source of early season water supply forecast error/uncertainty.

February 2022 Month-To-Date: Precipitation & Model SWE



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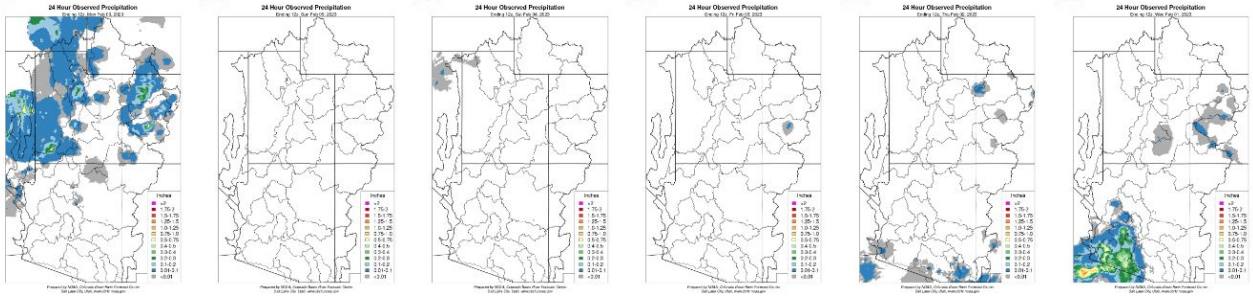
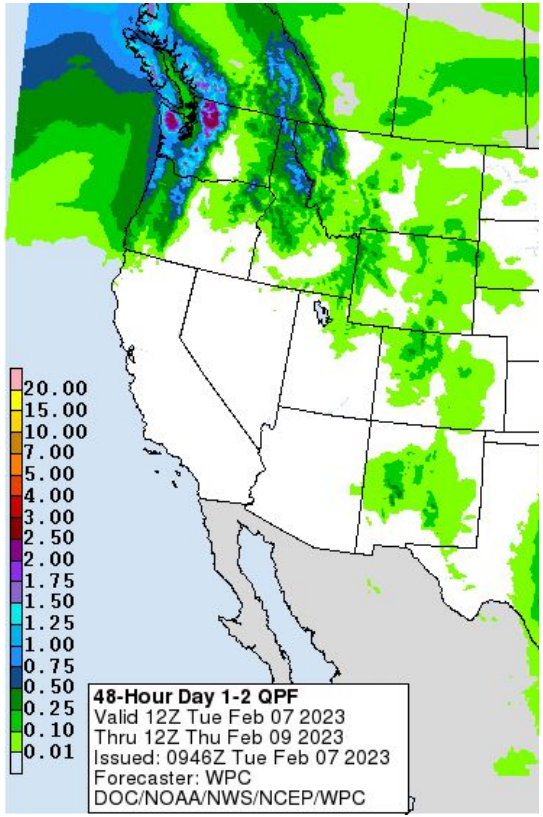


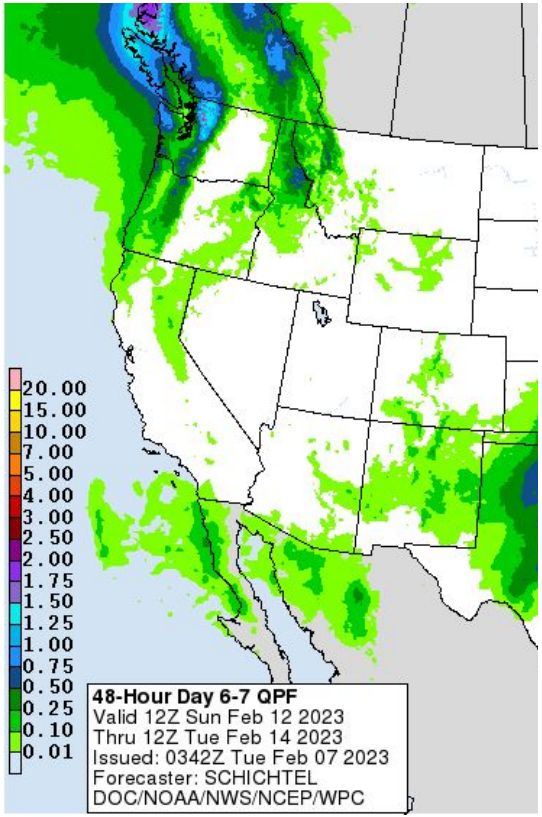
Mostly dry/less active early February weather across the region.

Water Year 2023 CBRFC Model SWE (Significant Runoff Areas) Percent of 1991-2020 Median			
UPPER COLORADO RIVER BASIN			
	Feb1	**Feb6**	**Change**
Above Lake Powell	144	138	-6
Green River Basin			
Above Fontenelle	106	101	-5
Above Flaming Gorge	126	120	-6
Yampa/White	163	156	-7
Duchesne	174	169	-5
Price/San Rafael/Dirty Devil	193	189	-4
Colorado River Headwaters			
Above Kremmling	126	120	-6
Eagle	120	116	-4
Roaring Fork	126	121	-5
Above Cameo	129	123	-6
Southwest Colorado			
Gunnison	137	132	-5
Dolores	165	156	-9
San Juan	124	118	-6
LOWER COLORADO RIVER BASIN			
Virgin	263	245	-18
Little Colorado	269	243	-26
Verde	541	459	-82
Salt	168	133	-35
Upper Gila	215	150	-65

Upcoming Weather: WPC February 7-14 Precipitation Outlook



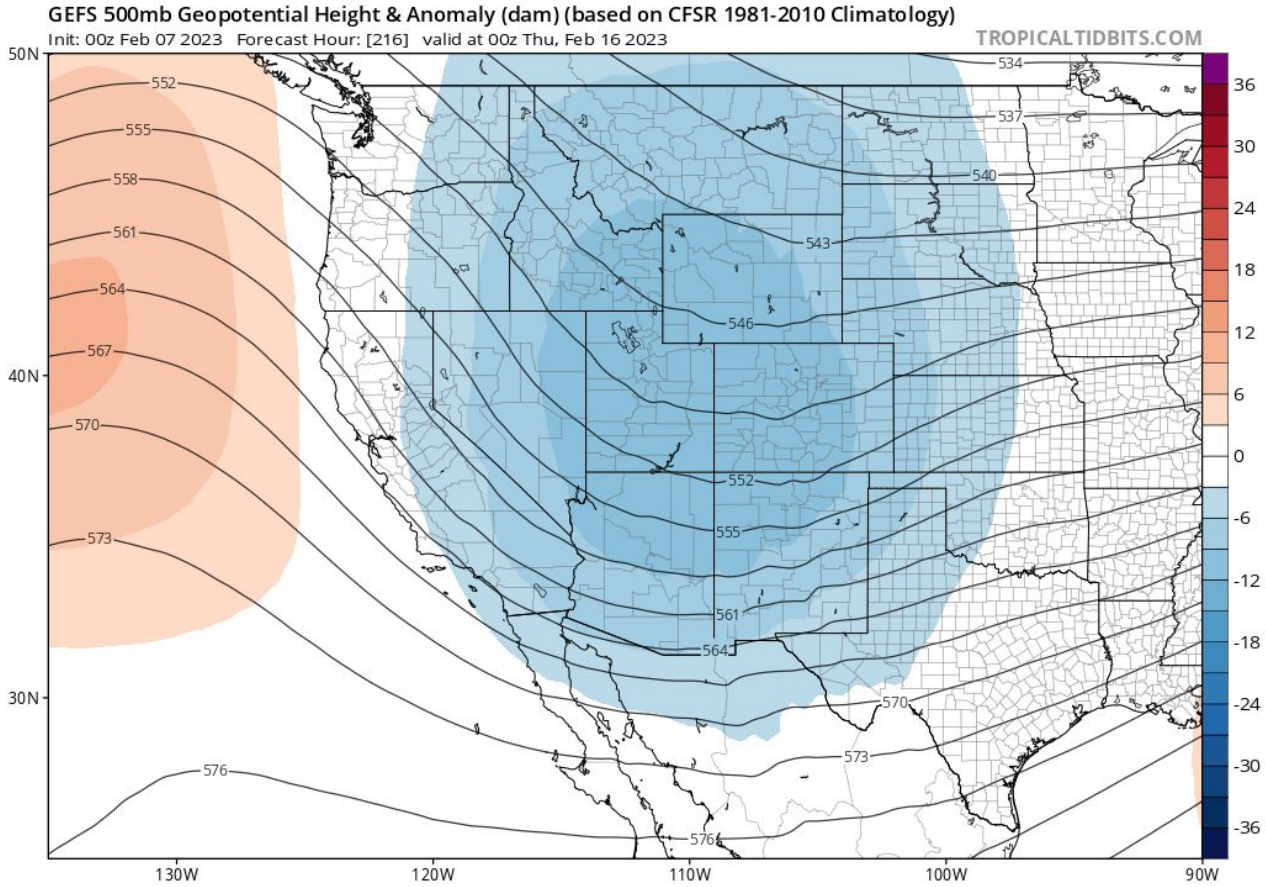
WPC QPF for days 1-2



WPC QPF for days 6-7

- A glancing trough will bring precipitation to northern and eastern portions of the UC on Wednesday
    - Highest precipitation above 0.25” for high terrain along the Continental Divide
- A ridge of high pressure will bring quiet weather and warming temperatures Thursday through Saturday
- On Sunday, trough of low pressure begins to form and moves towards Arizona
    - This will bring below average temperatures, and chances of precipitation, though total precipitation looks to be low at this time

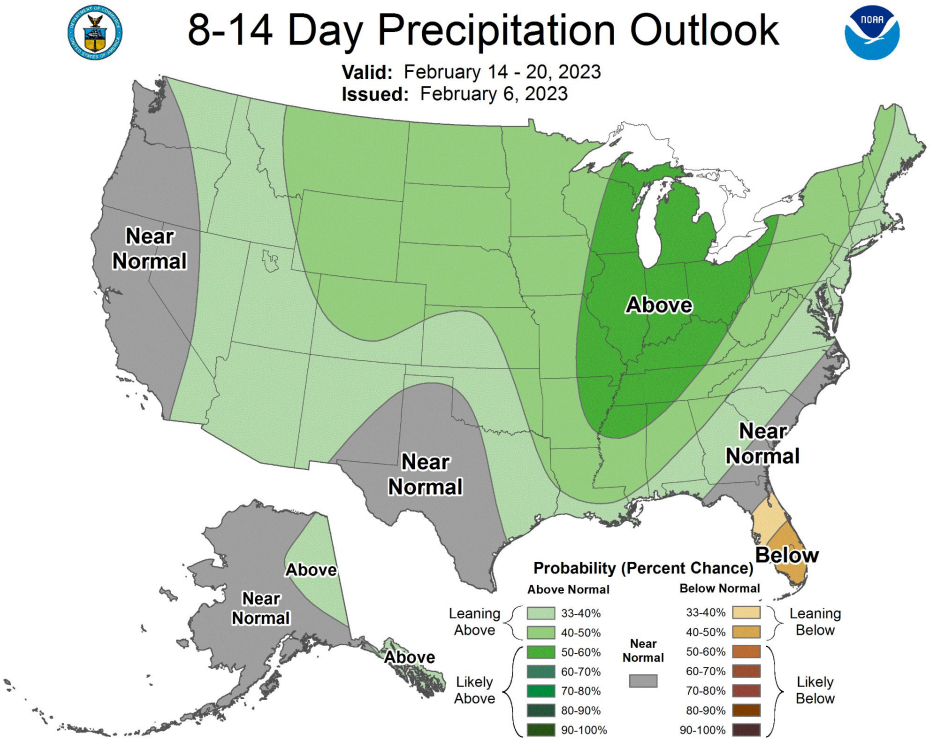
Upcoming Weather: Mid-February

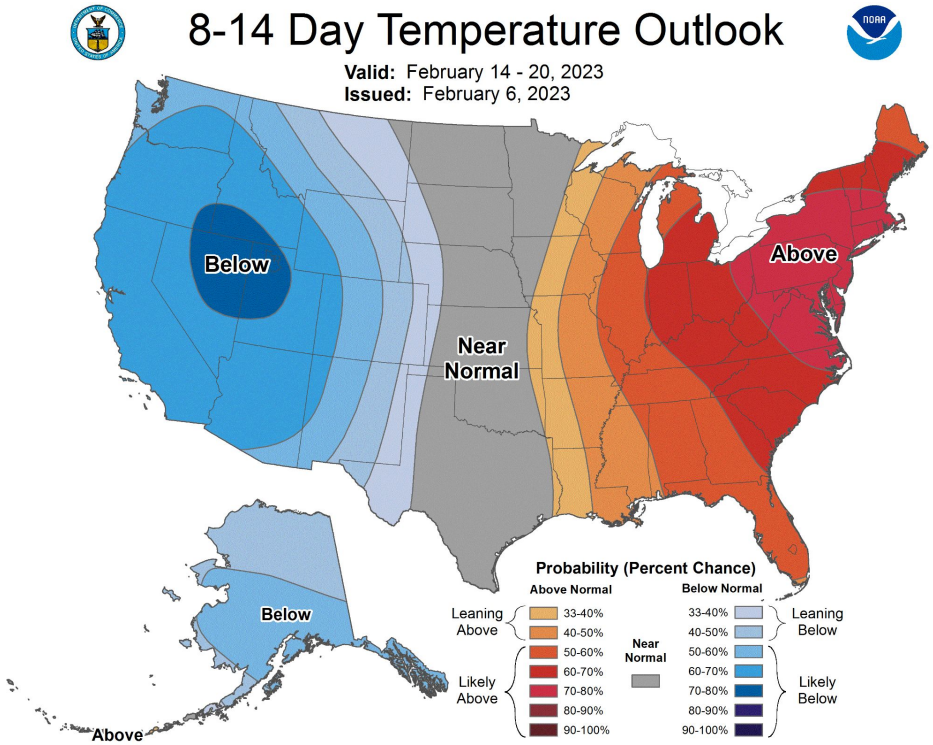


- An eastern Pacific ridge and Western US troughing pattern will remain in place
- This setup will favor below normal temperatures
- Additionally, chances of precipitation remain, though as in the 7-day forecast, no single event should produce substantial precipitation.

Upcoming Weather: 8-14 Day Outlook (February 14-20)

Slightly elevated odds of above average precipitation.
Elevated odds of below average temperatures across the entire region.





Summary

- Water year 2023 precipitation summary:
  - Mostly above average across the Colorado River Basin
  - UT and AZ have generally received more precipitation than WY and CO.
  - Near/record wet December-January period across central UT and northwest WY.
  - LCRB - wetter than normal winter during La Niña - unusual but not unheard of.

- CBRFC antecedent (Fall) model soil moisture conditions are near to below normal across many of the major runoff producing areas across the UCRB
  - LCRB - mostly above average early February soil moisture conditions

- Current (Feb 6) CBRFC model SWE conditions are mostly above normal across the Colorado River Basin:
  - Upper Colorado: 100-190%
  - Lower Colorado: 135-460%
  - Colder than normal January weather -> more low/mid elevation snow than normal

- February 1 water supply forecasts (% of normal):
  - Upper Colorado: 85-175%
    - Lake Powell = 117%
  - Lower Colorado: 85-315%

- Weather outlook
  - Weather pattern is expected to become more active during the next 2 weeks
    - Below normal temperatures; but most likely drier than December and January

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

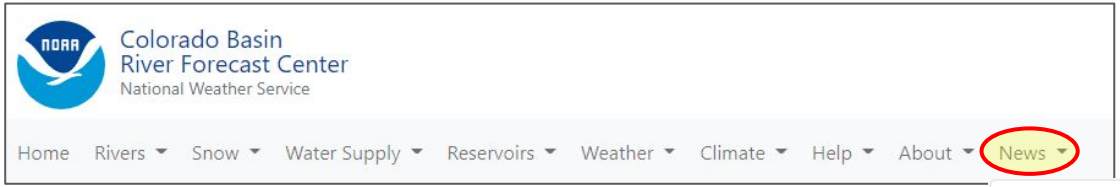
~~Monday~~	~~Jan 9th~~	~~11:30 am~~
Tuesday	Feb 7th	11:30 am
Tuesday	Mar 7th	11:30 am
Friday	Apr 7th	11:30 am
Friday	May 5th	11:30 am

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.noaa.gov CBRFC Webinar Registration / Presentations / Email List



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 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.

2023 Presentations

2023 Early Season Water Supply Outlook

- Slides (.pdf) | Recording (.mp4) | YouTube

January 2023

- Colorado River Basin Slides (.pdf) | Recording (.mp4) | YouTube
- Utah / Great Basin Slides (.pdf) | Recording (.mp4) | YouTube

CBRFC Contacts & WY23 Basin Focal Points

Basin Focal Points (Forecasters)

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Cody Moser – Upper Colorado Mainstem
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Patrick Kormos – Great Basin/Sevier
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Trevor Grout - Virgin, Lower Colorado
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Tracy Cox - Hydrometeorologist
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CBRFC Water Supply Presentations
https://www.cbrfc.noaa.gov/present/present.php