

Colorado River Basin Water Supply Briefing

March 7, 2024



Colorado Basin
River Forecast Center
National Weather Service



Presentation Overview

Soil Moisture Conditions

Precipitation Review

Snowpack Conditions

Water Supply Forecasts

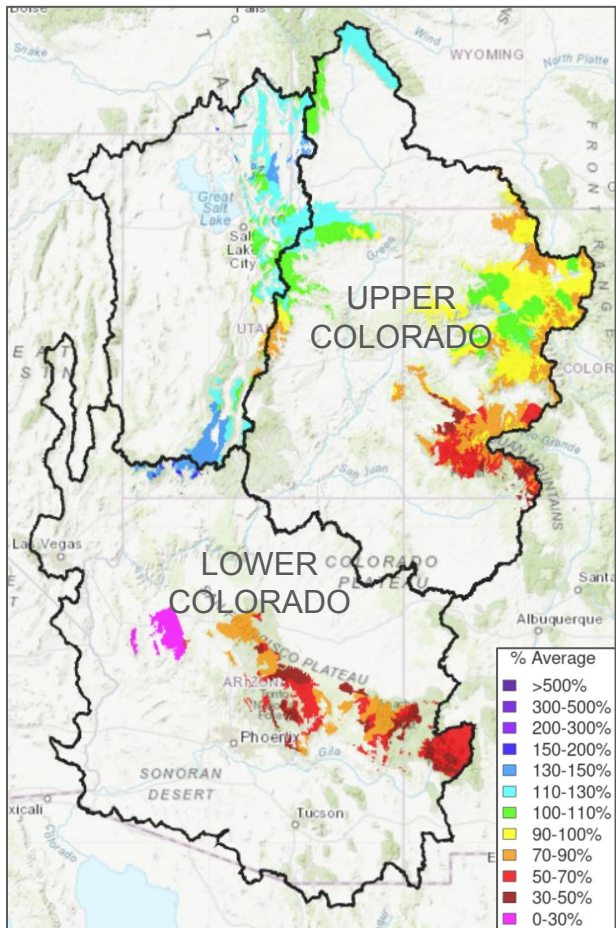
Water Supply Forecast Error

Upcoming Weather

Contacts & Questions

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

Fall 2023 Hydrologic Model Soil Moisture Conditions



CBRFC hydrologic model soil moisture is adjusted (if necessary) every fall after irrigation season has ended and before winter.

Data used to make adjustments:

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

Soil Moisture Impacts on Water Supply / Runoff

Above normal soil moisture conditions → positive impact (increased runoff efficiency)

Below normal soil moisture conditions → negative impact (decreased runoff efficiency)

Colorado River Basin: near to below normal; improves from south to north

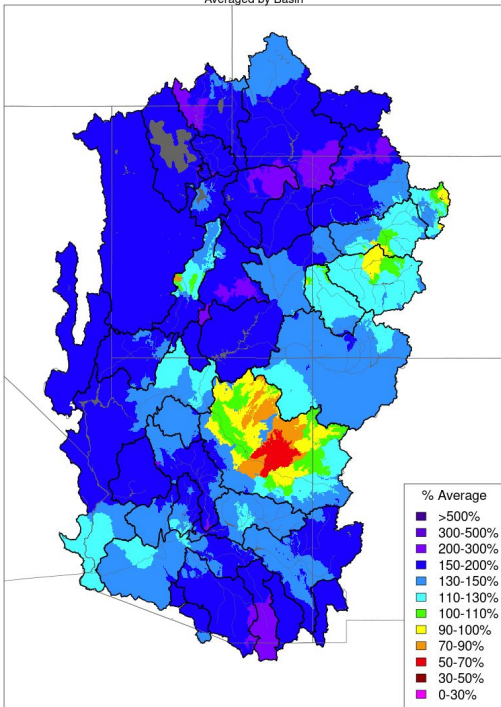
The timing and magnitude of spring runoff is ultimately a result of snowpack conditions, spring weather, and soil moisture conditions.

February 2024 Precipitation Summary

February precipitation was above normal across most of the region, and ranked in the wettest five on record at a number of SNOTEL sites across the UCRB.

Monthly Precipitation - February 2024

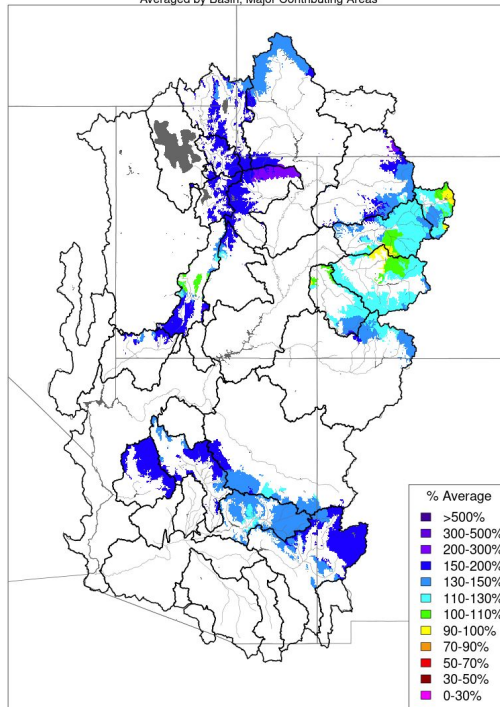
Averaged by Basin



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

Monthly Precipitation - February 2024

Averaged by Basin, Major Contributing Areas



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

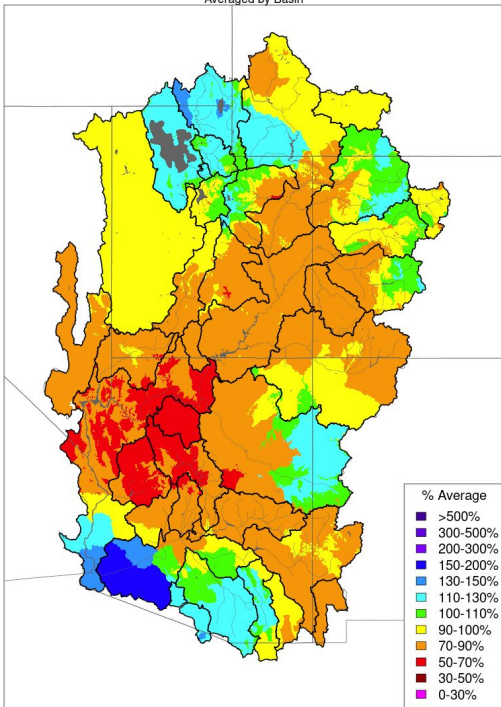
Water Year 2024 CBRFC Precipitation (Major Contributing Areas) Percent of 1991-2020 Average		
UPPER COLORADO RIVER BASIN		
	Feb	Oct-Feb
Above Lake Powell	137	96
Green River Basin		
Above Fontenelle	137	92
Above Flaming Gorge	153	99
Yampa/White	154	108
Duchesne	199	102
Price/San Rafael/Dirty Devil	154	104
Colorado River Headwaters		
Above Kremmling	112	95
Eagle	129	103
Roaring Fork	114	98
Above Cameo	118	98
Southwest Colorado		
Gunnison	114	95
Dolores	127	83
San Juan	138	82
LOWER COLORADO RIVER BASIN		
Virgin	154	83
Little Colorado	144	79
Verde	161	74
Salt	139	82
Upper Gila	163	88

Water Year 2024 Precipitation Summary

October-February precipitation is generally near normal across northern areas of the Colorado River Basin, but remains below normal across southern areas.

Water Year Precipitation, October 2023 - February 2024

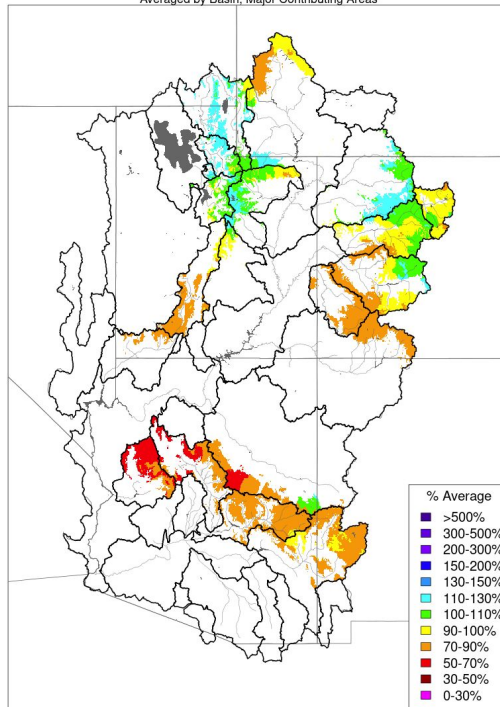
Averaged by Basin



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

Water Year Precipitation, October 2023 - February 2024

Averaged by Basin, Major Contributing Areas



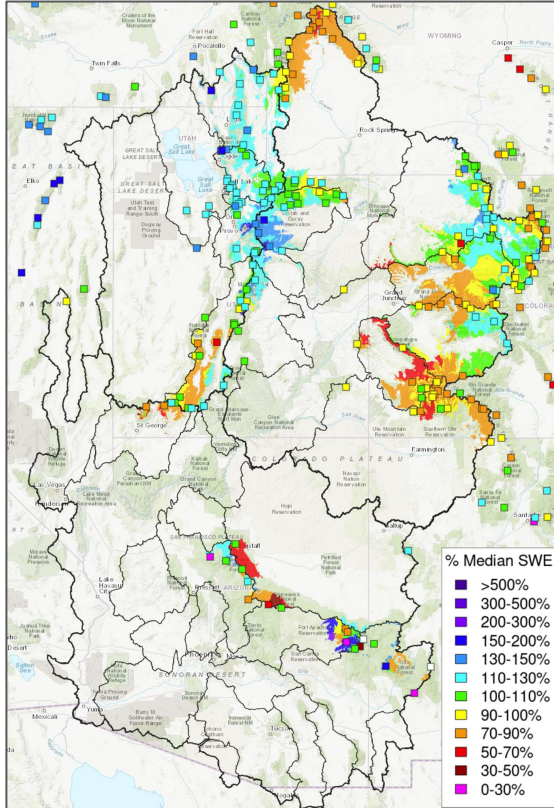
Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

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Little Colorado	144	79
Verde	161	74
Salt	139	82
Upper Gila	163	88

Snowpack Conditions

March 1 SWE Conditions

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



SWE = Snow Water Equivalent
The amount of water in snow.

Water Year 2024 CBRFC Model SWE (Major Contributing Areas) Percent of 1991-2020 Median			
UPPER COLORADO RIVER BASIN			
	Feb1	Mar1	Change
Above Lake Powell	84	97	13
Green River Basin			
Above Fontenelle	67	81	14
Above Flaming Gorge	75	91	16
Yampa/White	94	108	14
Duchesne	70	110	40
Price/San Rafael/Dirty Devil	95	116	21
Colorado River Headwaters			
Above Kremmling	97	100	3
Eagle	91	98	7
Roaring Fork	87	92	5
Above Cameo	91	96	5
Southwest Colorado			
Gunnison	88	95	7
Dolores	75	84	9
San Juan	68	84	16
LOWER COLORADO RIVER BASIN			
Virgin	43	83	40
Little Colorado	38	82	44
Verde	45	93	48
Salt	73	104	31
Upper Gila	57	117	60

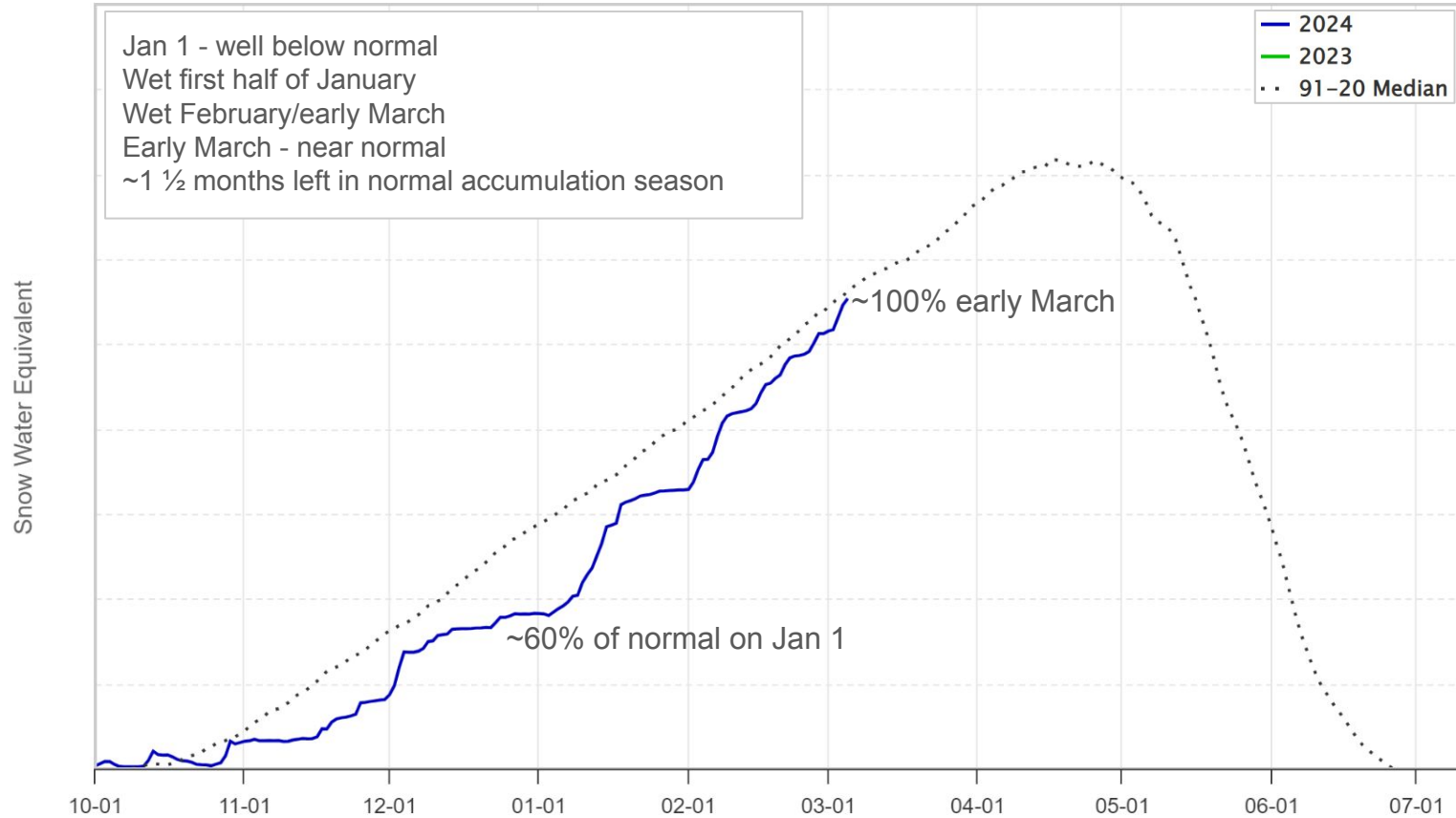
SWE conditions improved during February and are now near normal in many areas.

UCRB
85-115% of normal

LCRB
80-115% of normal

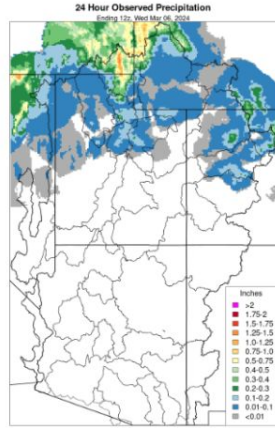
UCRB Snowpack Evolution

SWE Above Lake Powell

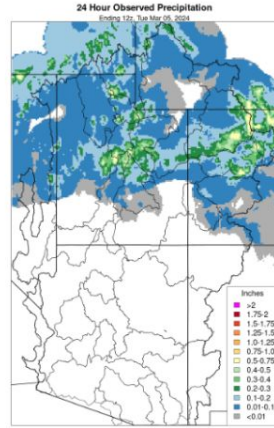


March Observed Precipitation/Snow

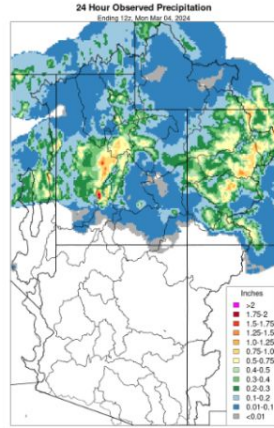
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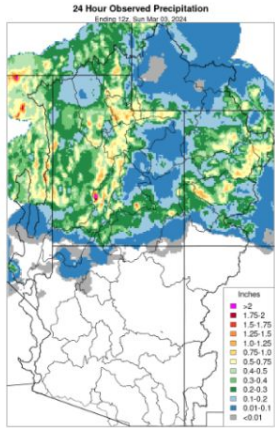
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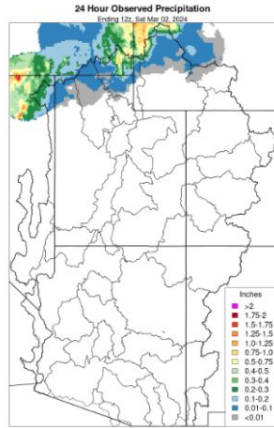
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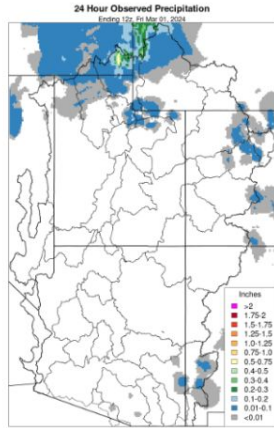
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02



01



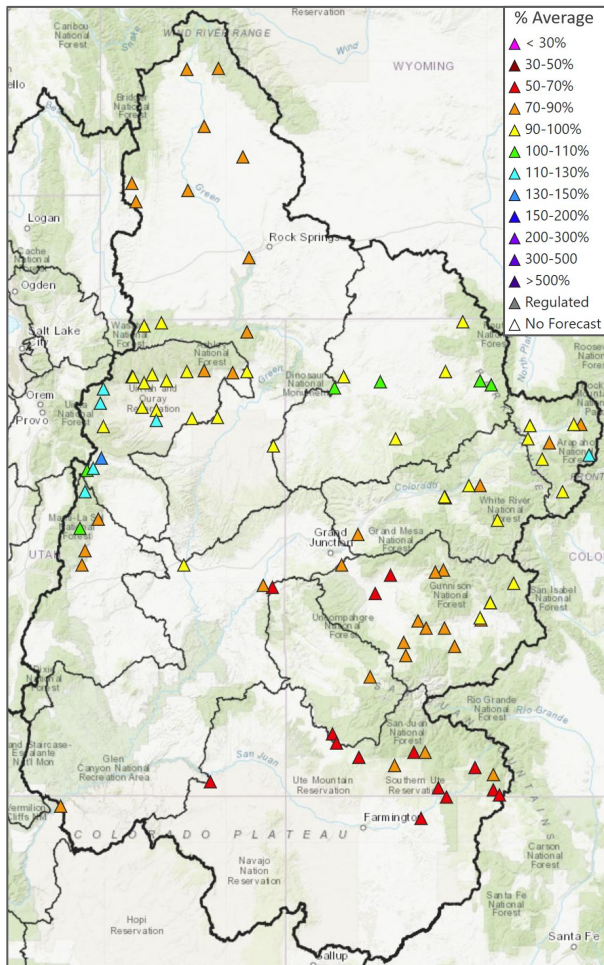
Inches

- >2
- 1.75-2
- 1.5-1.75
- 1.25-1.5
- 1.0-1.25
- 0.75-1.0
- 0.5-0.75
- 0.4-0.5
- 0.3-0.4
- 0.2-0.3
- 0.1-0.2
- 0.01-0.1
- <0.01

Continued active weather
UCRB: additional snow accumulation
LCRB: snow melt

Water Year 2024 CBRFC Model SWE (Major Contributing Areas) Percent of 1991-2020 Median			
UPPER COLORADO RIVER BASIN			
	Mar1	Mar6	Change
Above Lake Powell	97	103	6
Green River Basin			
Above Fontenelle	81	89	8
Above Flaming Gorge	91	98	7
Yampa/White	108	114	6
Duchesne	110	117	7
Price/San Rafael/Dirty Devil	116	130	14
Colorado River Headwaters			
Above Kremmling	100	105	5
Eagle	98	107	9
Roaring Fork	92	102	10
Above Cameo	96	104	8
Southwest Colorado			
Gunnison	95	98	3
Dolores	84	86	2
San Juan	84	85	1
LOWER COLORADO RIVER BASIN			
Virgin	83	83	0
Little Colorado	82	73	-9
Verde	93	97	4
Salt	104	99	-5
Upper Gila	117	101	-16

UCRB Water Supply Forecasts: Overview



The water supply outlook has improved due to above average February precipitation.

Central areas: near to above normal

Northern/southern areas: below normal

Colorado Basin River Forecast Center Water Supply Forecasts March 1, 2024

UPPER COLORADO RIVER BASIN

Basin	Volume (KAF)	%Normal (1991-2020)	Period
Lake Powell	5000	78	Apr-Jul
Green River Basin			
Green-Flaming Gorge Reservoir	780	81	Apr-Jul
Yampa-Deerlodge	1250	105	Apr-Jul
Duchesne-Tabiona	100	97	Apr-Jul
Colorado River Headwaters			
Colorado-Kremmling	800	92	Apr-Jul
Eagle-Gypsum	295	88	Apr-Jul
Roaring Fork-Glenwood Springs	560	85	Apr-Jul
Colorado-Cameo	2040	90	Apr-Jul
Southwest Colorado			
Gunnison-Blue Mesa Reservoir	560	88	Apr-Jul
Dolores-McPhee Reservoir	167	65	Apr-Jul
San Juan-Navajo Reservoir	390	62	Apr-Jul
Animas-Durango	285	74	Apr-Jul

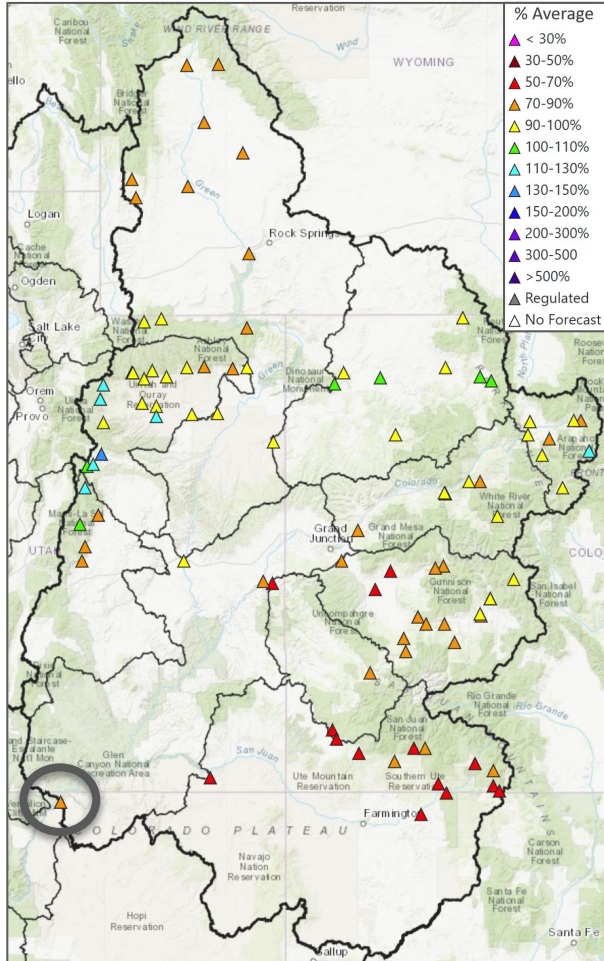
KAF
thousand acre-feet

Best conditions

Worse conditions

Lake Powell Water Supply Forecast

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



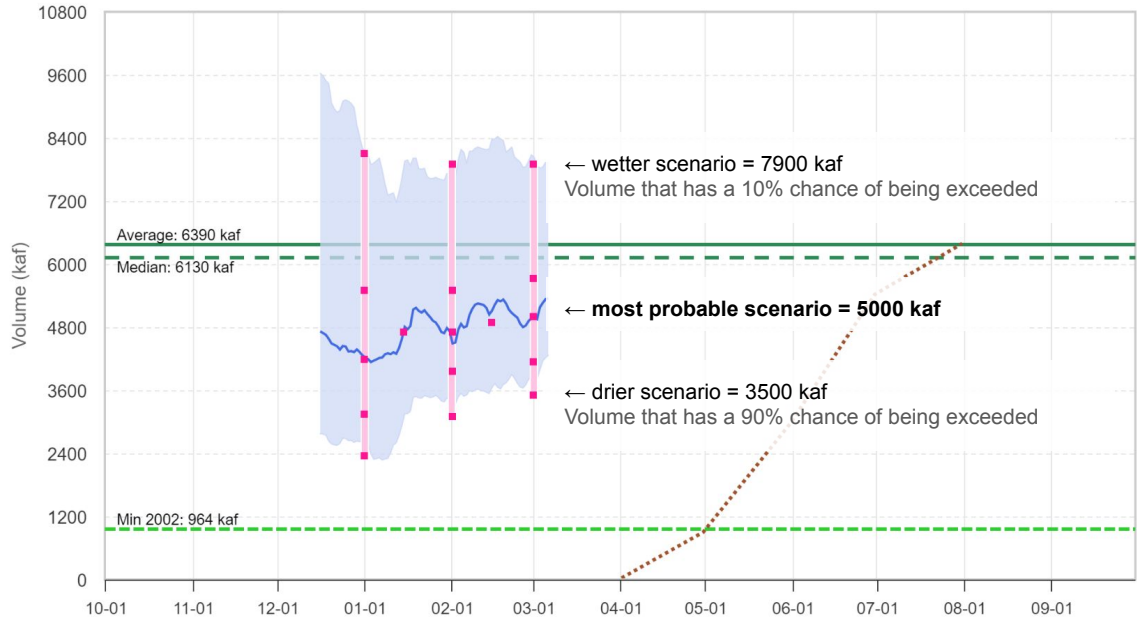
2024 Water Supply Forecast - Colorado - Lake Powell, Glen Cyn Dam, At (GLDA3)

ESP is Unregulated and No Precipitation Forecast Included

Official 50% Fcst (2024-03-01): 5000 kaf (78% Avg, 82% Med), (33% of Yrs Below Fcst, 41 Highest Flow / 60 Tot Yrs)

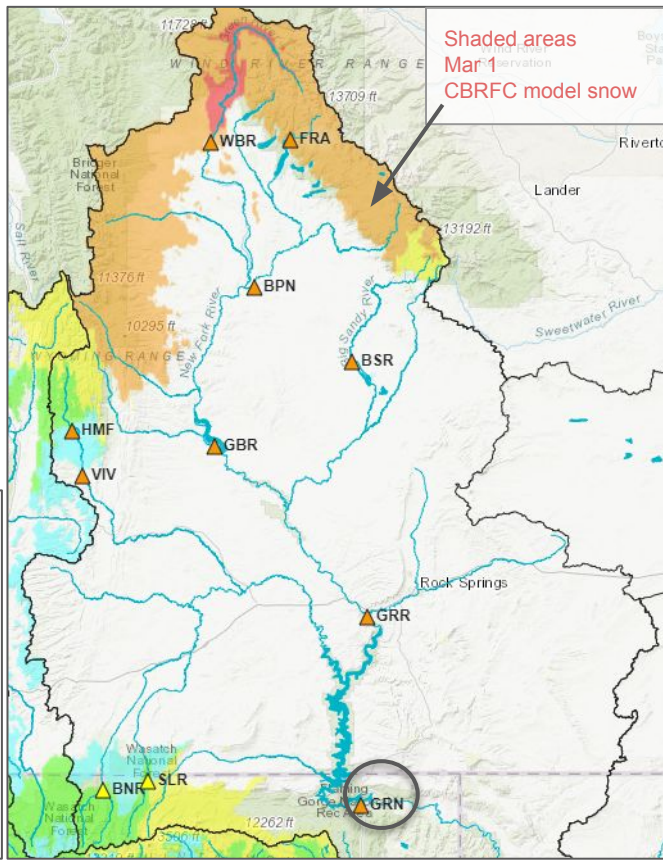
ESP 50% Fcst (2024-03-06): 5353 kaf (84% Avg, 87% Med), (40% of Yrs Below Fcst, 37 Highest Flow / 60 Tot Yrs)

No Observed



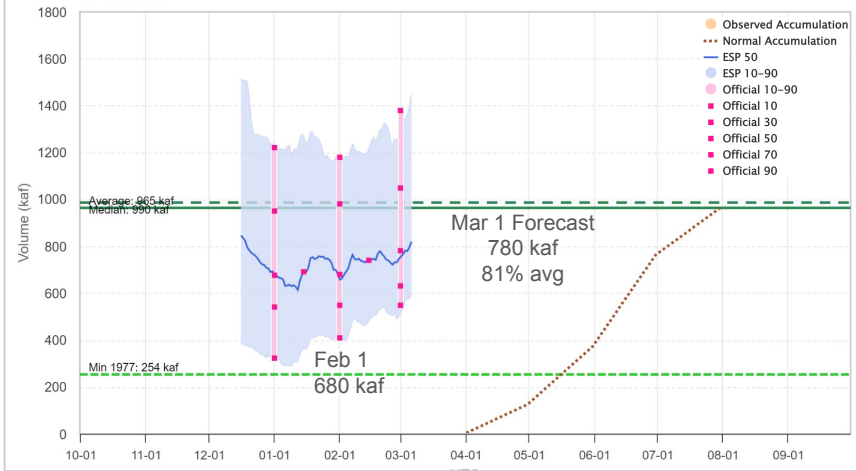
Upper Green River Basin

Forecast Range: 75-95%

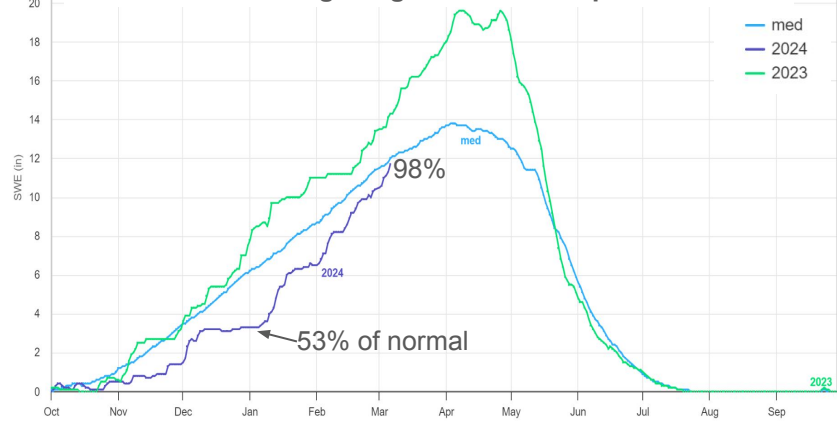


2024 Water Supply Forecast - Green - Flaming Gorge Reservoir (GRNU1)

ESP is Unregulated and No Precipitation Forecast Included
 Official 50% Fcst (2024-03-01): 780 kaf (81% Avg, 79% Med), (37% of Yrs Below Fcst, 39 Highest Flow / 61 Tot Yrs)
 ESP 50% Fcst (2024-03-06): 820 kaf (85% Avg, 83% Med), (37% of Yrs Below Fcst, 39 Highest Flow / 61 Tot Yrs)
 No Observed

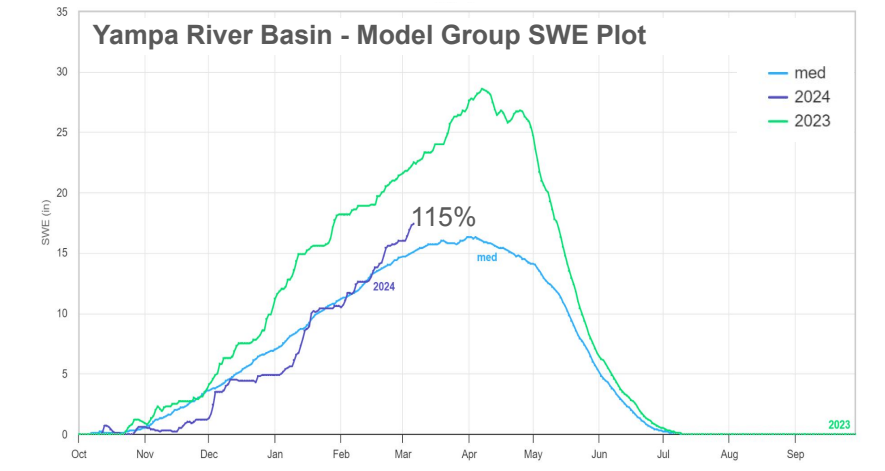
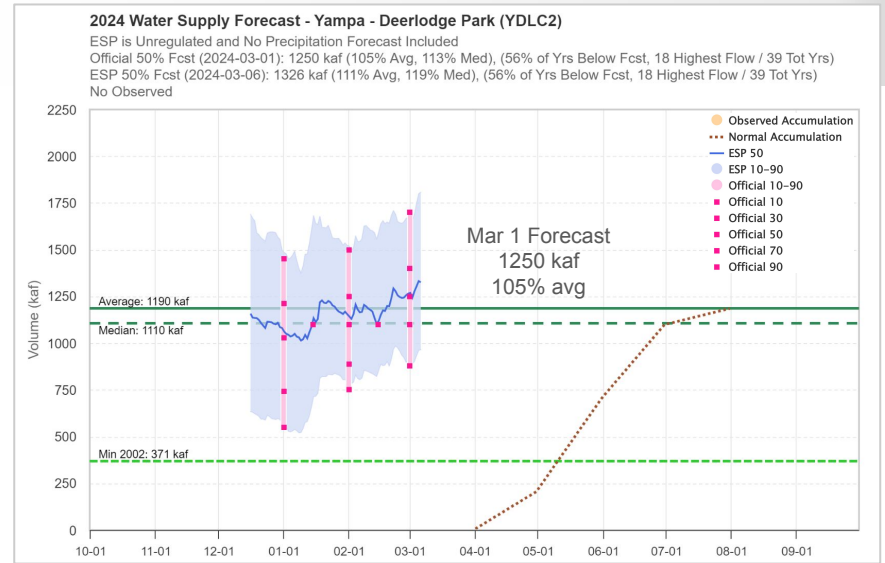
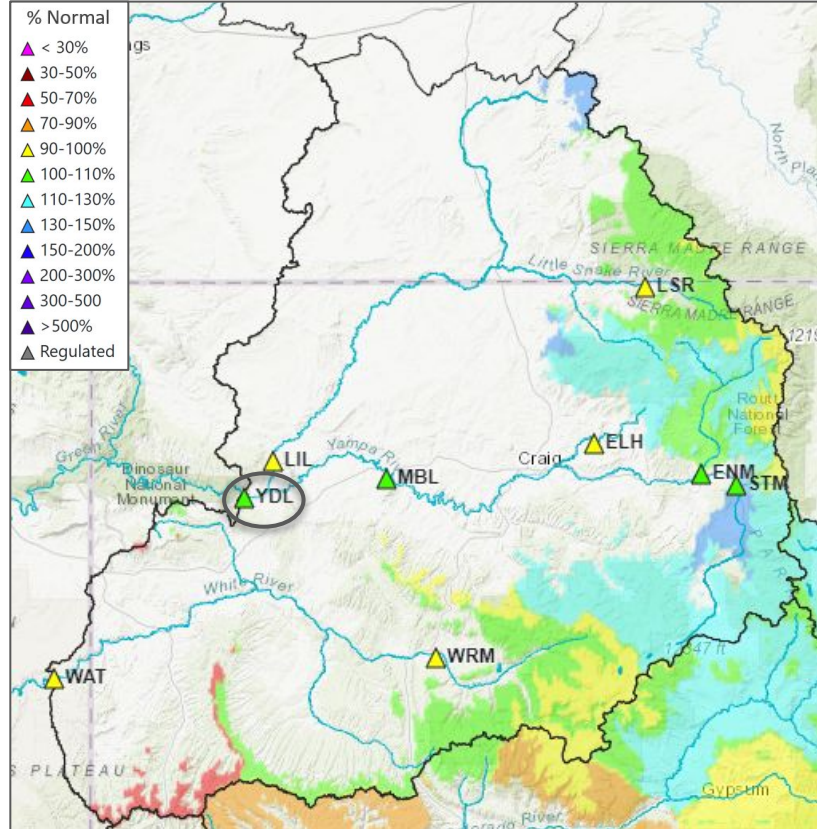


Green above Flaming Gorge - Model Group SWE Plot



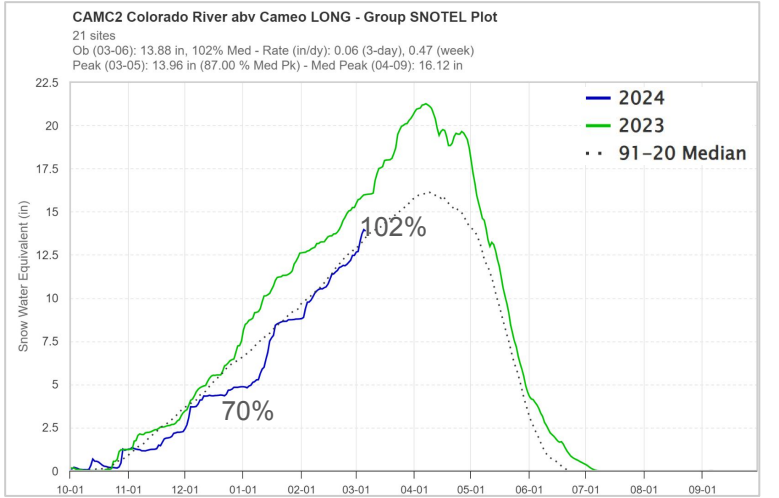
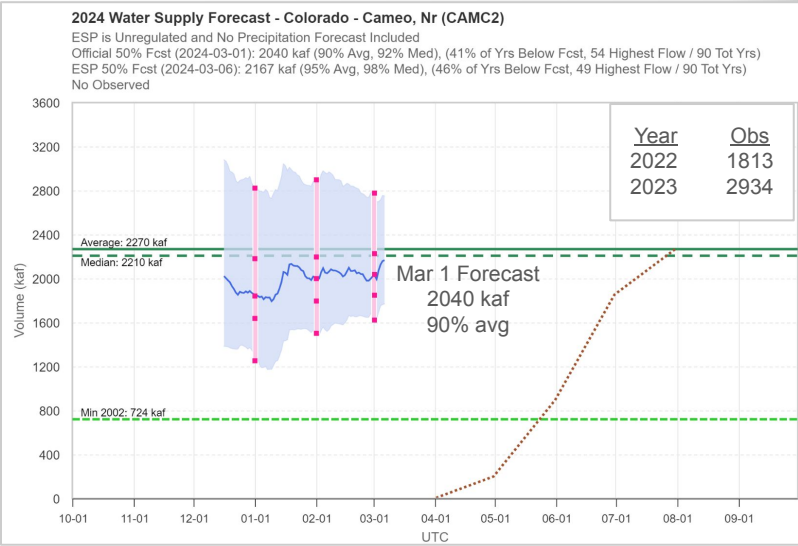
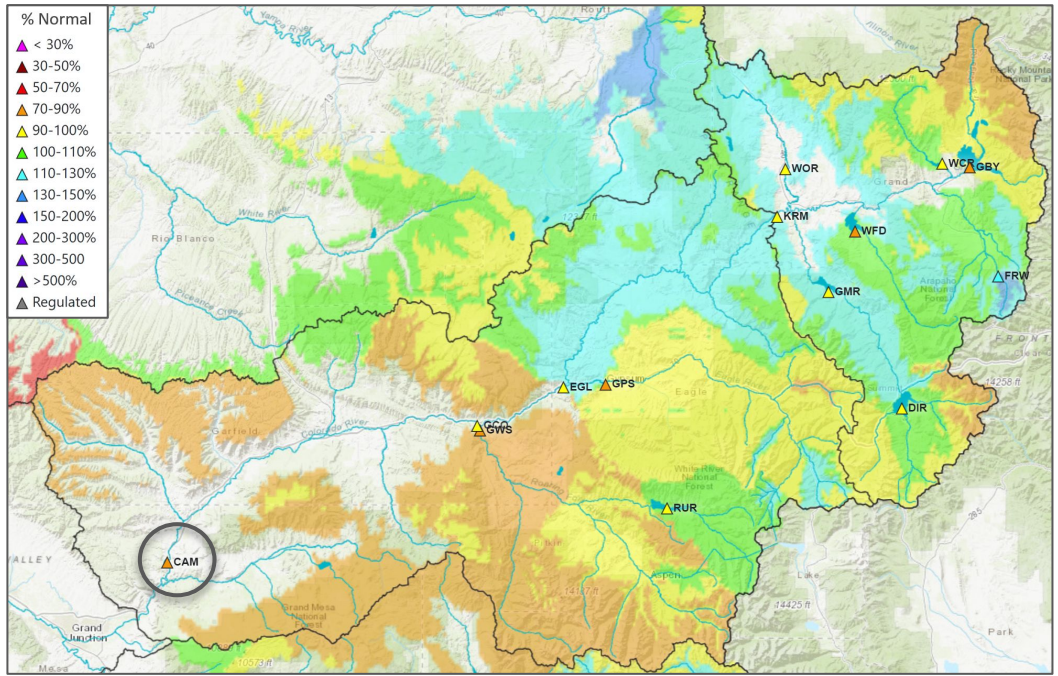
White/Yampa River Basin

Forecast Range: 90-105%



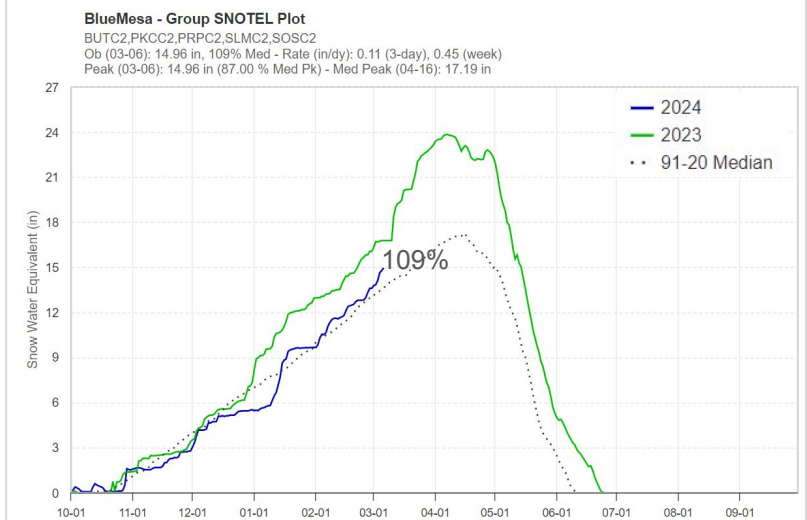
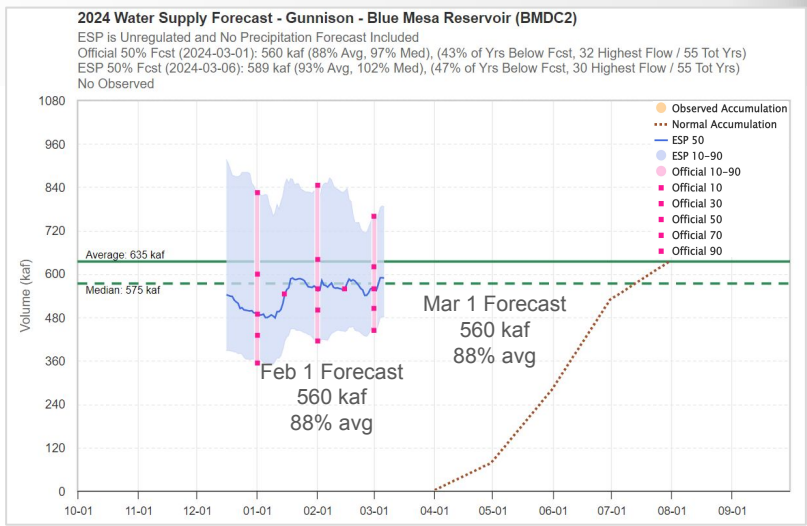
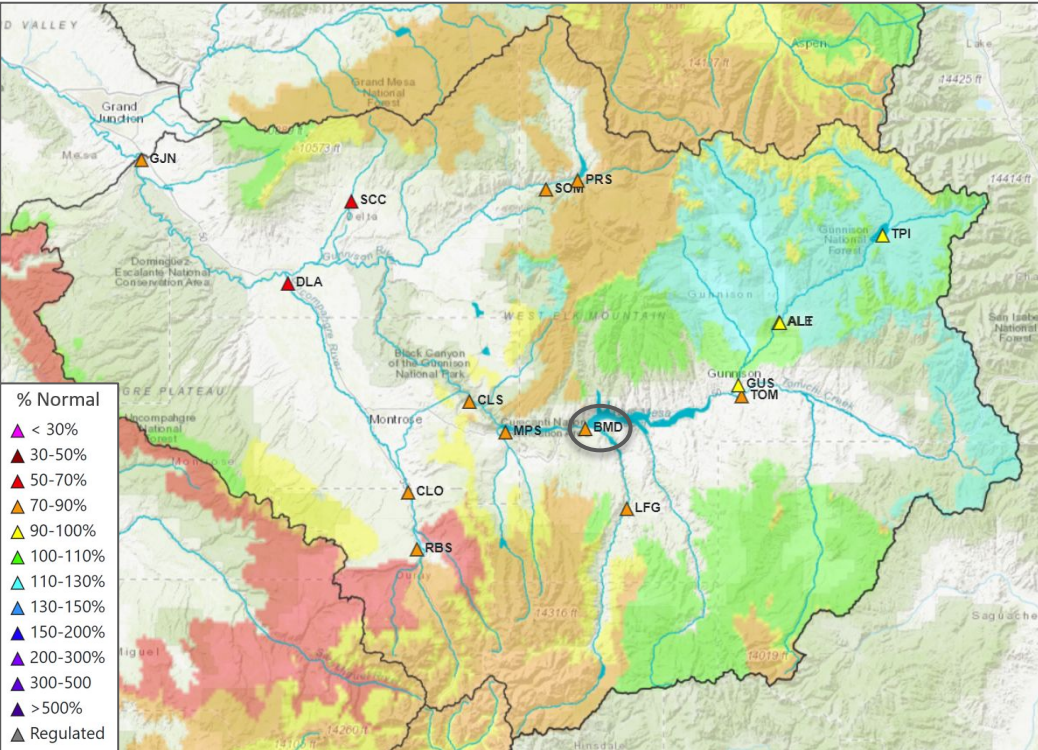
Colorado River Headwaters

Forecast Range: 85-115%



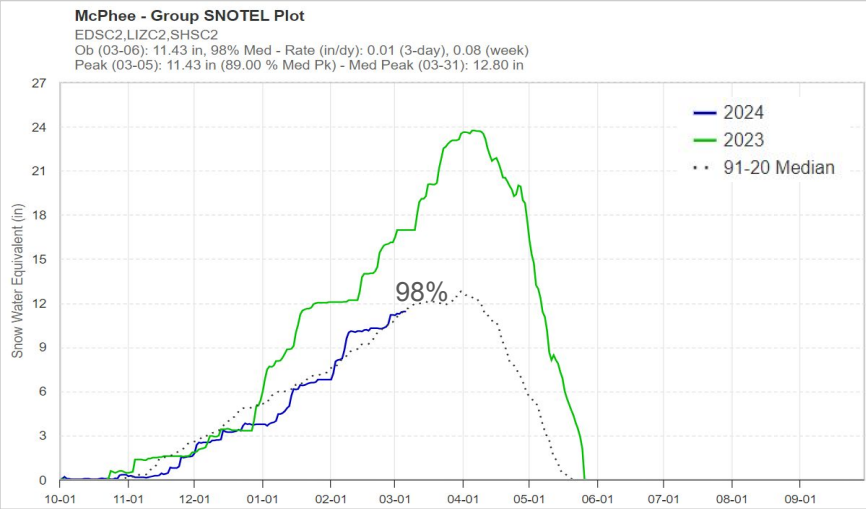
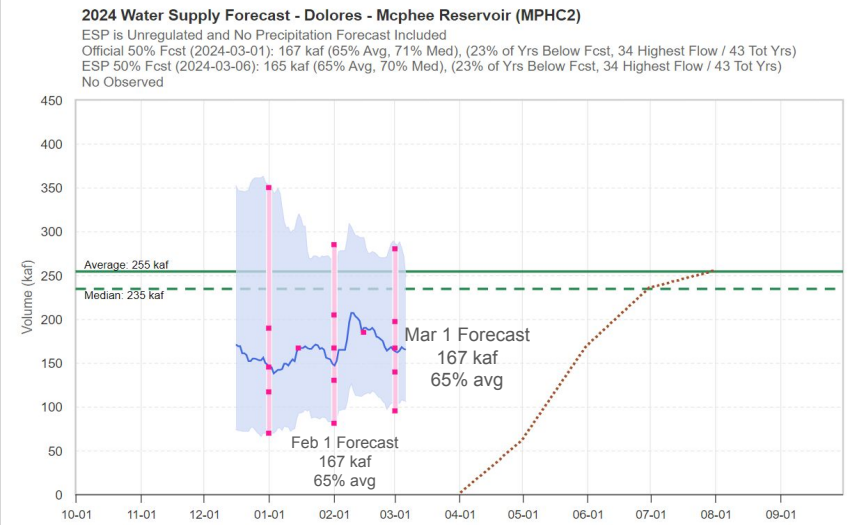
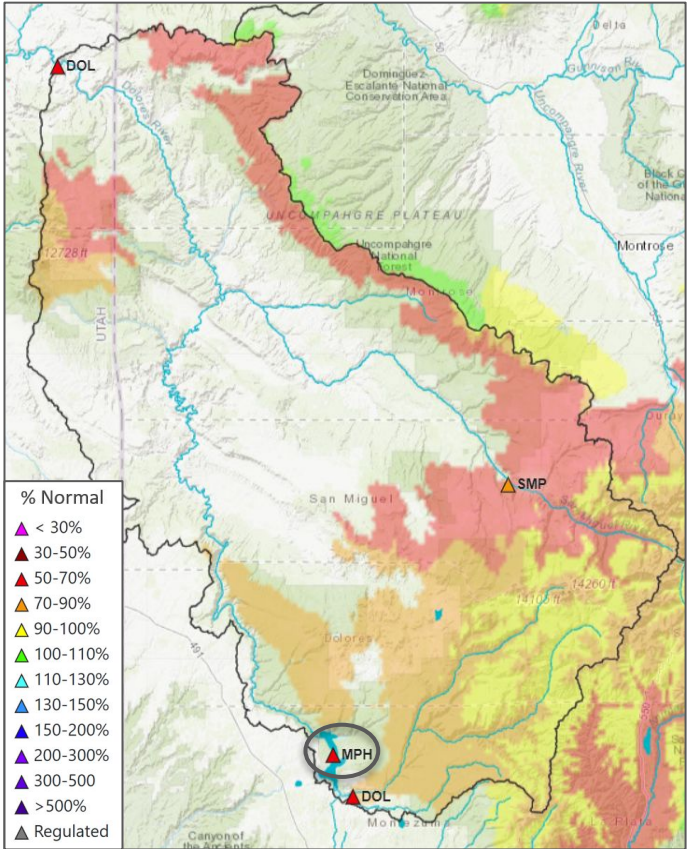
Gunnison River Basin

Forecast Range: 60-95%



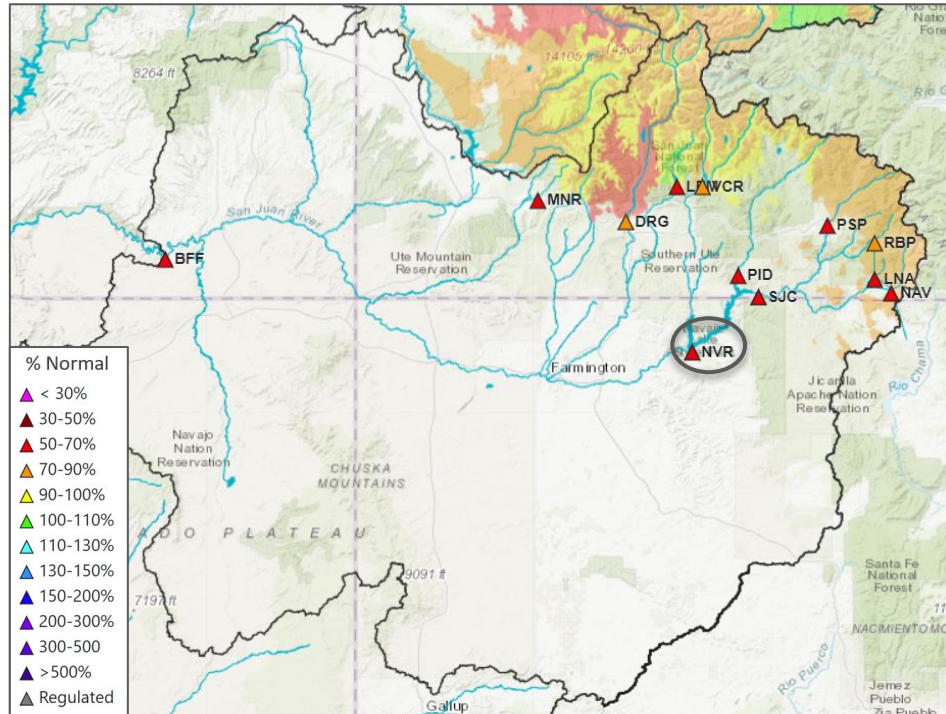
Dolores River Basin

Forecast Range: 55-75%



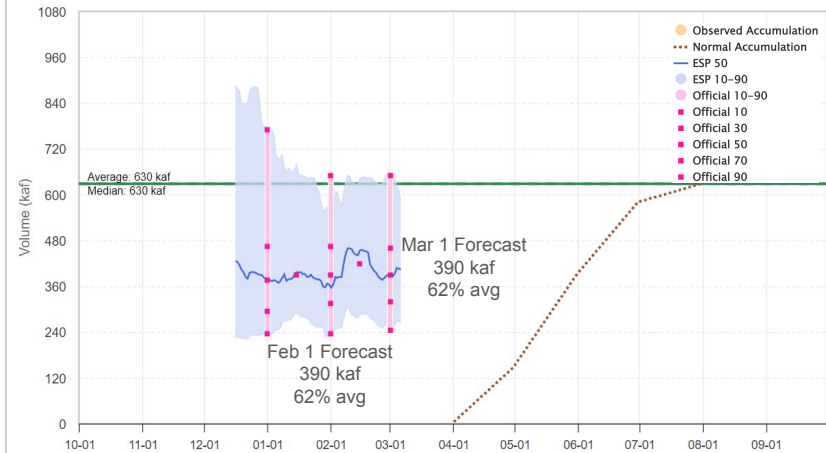
San Juan River Basin

Forecast Range: 60-75%

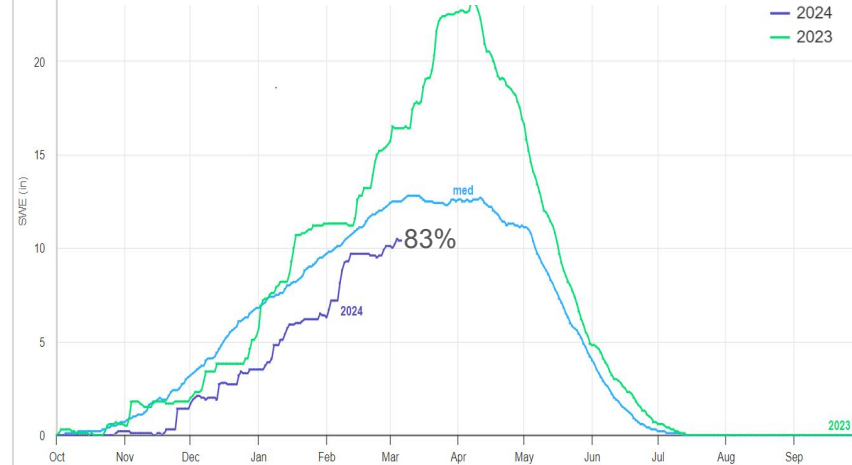


2024 Water Supply Forecast - San Juan - Navajo Reservoir, Archuleta, Nr (NVRN5)

ESP is Unregulated and No Precipitation Forecast Included
 Official 50% Fcst (2024-03-01): 390 kaf (62% Avg, 62% Med), (30% of Yrs Below Fcst, 38 Highest Flow / 53 Tot Yrs)
 ESP 50% Fcst (2024-03-06): 404 kaf (64% Avg, 64% Med), (30% of Yrs Below Fcst, 38 Highest Flow / 53 Tot Yrs)
 No Observed

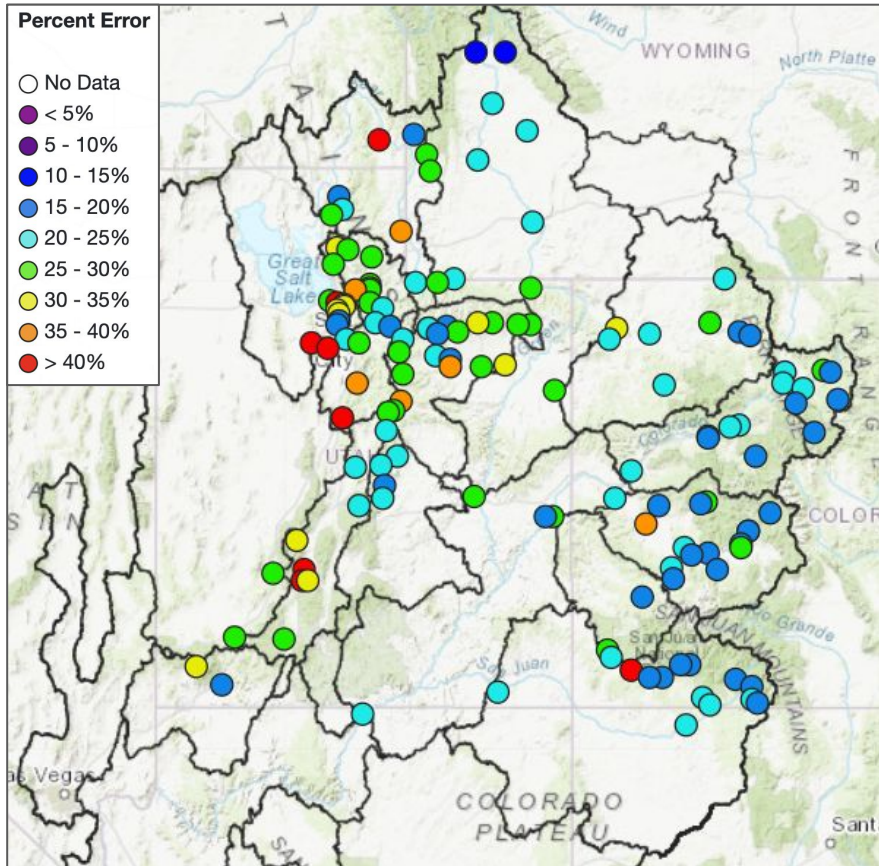


San Juan River Basin - Model Group SWE Plot



Historical Forecast Verification

March Forecast Error: April-July Volume



Location

Avg March Forecast Error

Green River - Warren Bridge	14%
Fontenelle Reservoir	23%
Yampa River - Deerlodge	23%
Blue River - Dillon Reservoir	17%
Colorado River - Cameo	20%
Blue Mesa Reservoir (Gunnison)	19%
McPhee Reservoir (Dolores)	26%
Navajo Reservoir (San Juan)	22%
Lake Powell	24%
Virgin River at Virgin	18%

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 water supply forecast error/uncertainty.

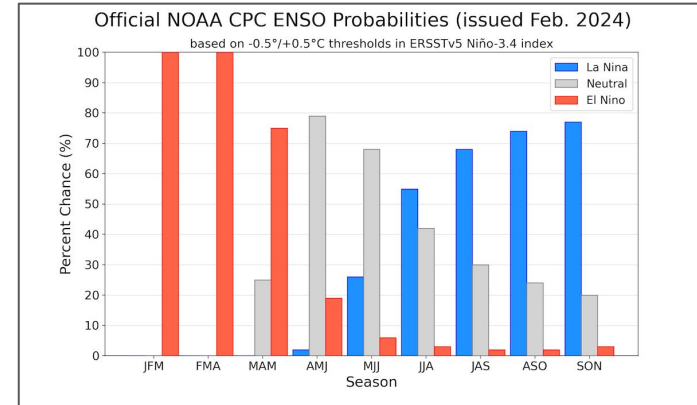
El Niño Southern Oscillation (ENSO) Status

EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

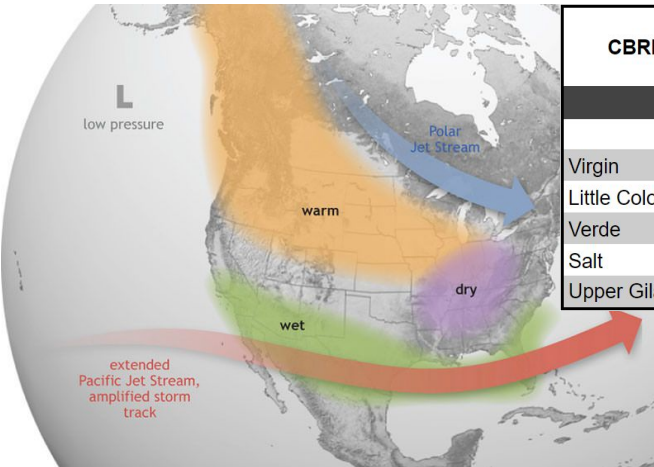
issued by
CLIMATE PREDICTION CENTER/NCEP/NWS
8 February 2024

ENSO Alert System Status: El Niño Advisory / La Niña Watch

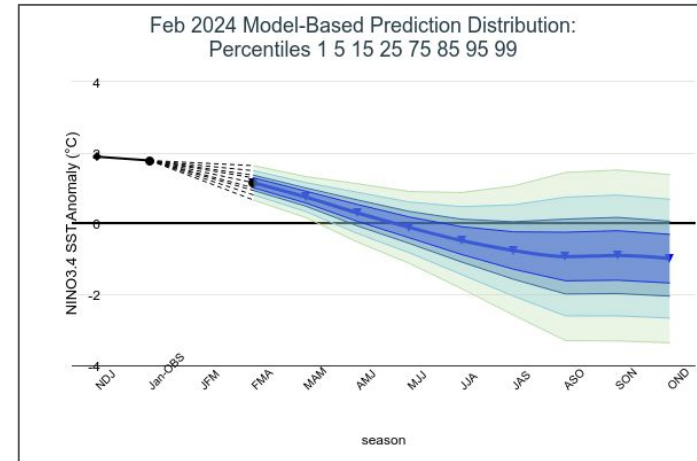
- A transition from El Niño to ENSO-neutral is likely by April-June 2024
 - Increasing odds of La Niña developing in June-August 2024



Typical El Niño Winters



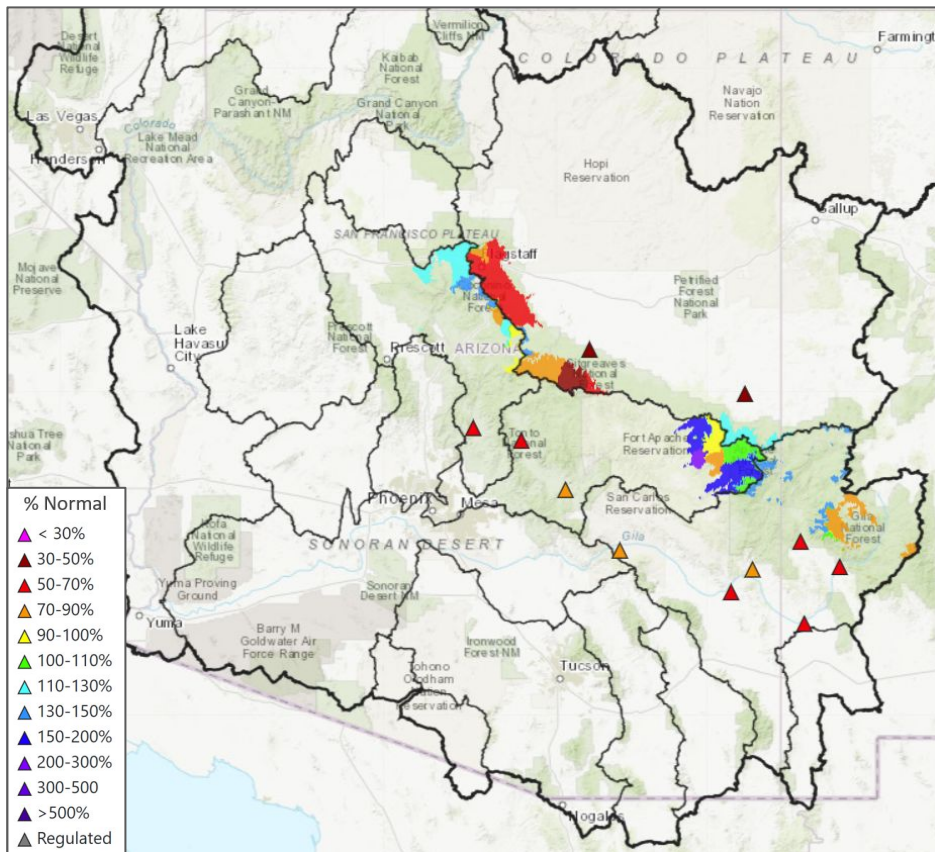
Water Year 2024 CBRFC Precipitation (Major Contributing Areas) Percent of 1991-2020 Average				
LOWER COLORADO RIVER BASIN				
	Dec	Jan	Feb	Oct-Feb
Virgin	19	112	154	83
Little Colorado	43	94	144	79
Verde	31	79	161	74
Salt	60	92	139	82
Upper Gila	82	107	163	88



LCRB: Jan-May Water Supply Forecasts

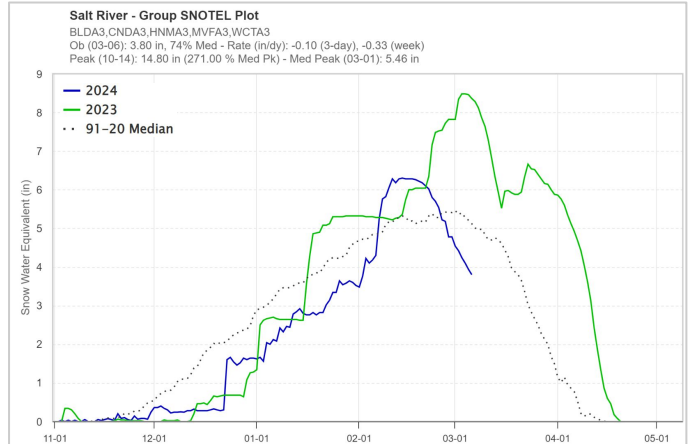
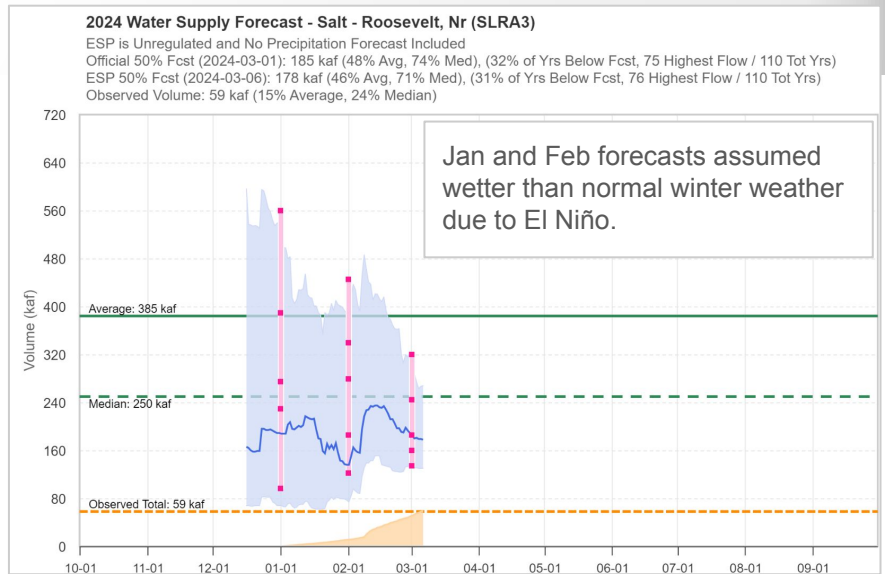
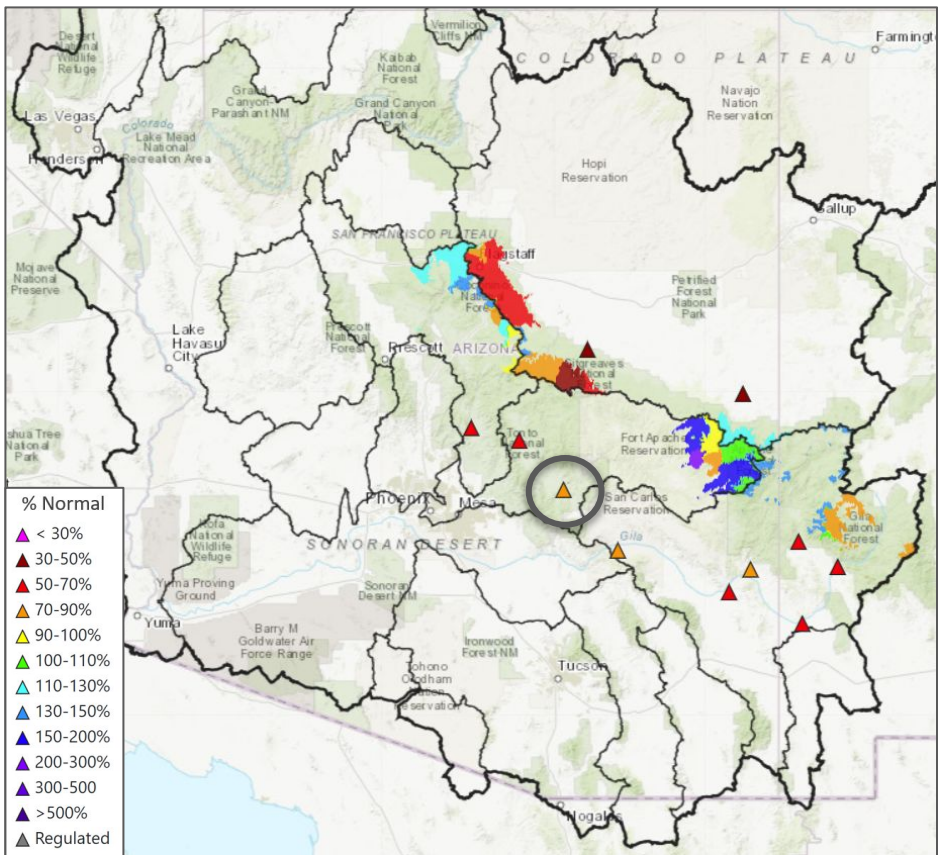
Forecast Range: 35-75%

LCRB January-May volume forecasts are below normal due to poor antecedent soil moisture conditions and drier than average El Niño winter weather.

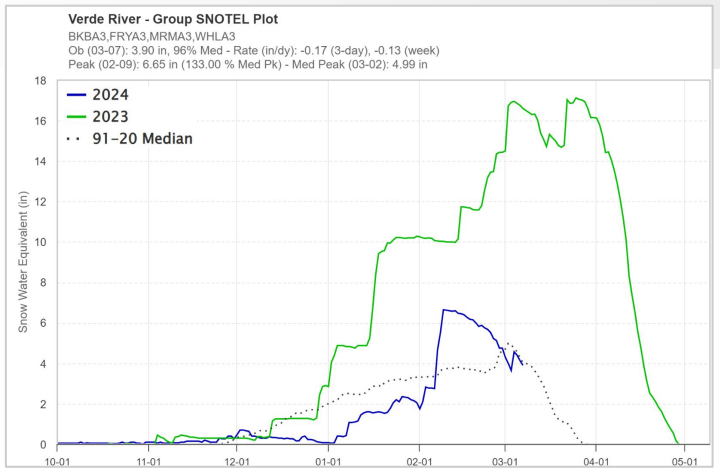
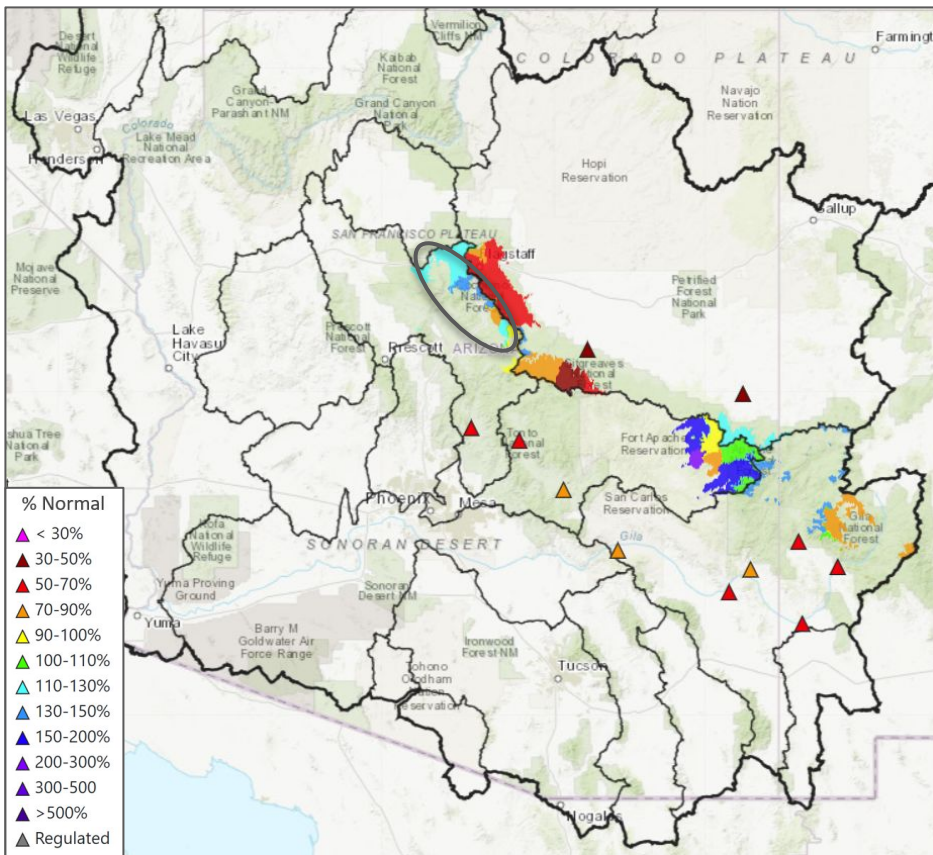


ID	Vol	%Avg	%Med	%ile	Description
▲ CHWA3	4.9	26	35	19	Chevelon Ck - Winslow Nr Wildcat Cyn Blo
▲ CLDA3	54	27	74	45	Gila - San Carlos Reservoir Coolidge Dam At
▲ GILN5	35	49	67	42	Gila - Gila Nr
▲ GLHA3	70	32	66	40	Gila - Solomon Nr Head Of Safford Vly
▲ GSFN5	9.6	25	52	33	San Francisco - Glenwood Nr
▲ GVRN5	38	36	59	41	Gila - Virden Nr Blue Ck Blo
▲ LCLA3	2.9	36	49	31	Little Colorado - Lyman Lk Abv St. Johns Nr
▲ SFCA3	31	33	70	37	San Francisco - Clifton
▲ SLRA3	185	48	74	32	Salt - Roosevelt Nr
▲ TNRA3	22	28	56	38	Tonto Ck - Roosevelt Nr Gun Ck Abv
▲ VDTA3	90	33	58	35	Verde - Tangle Ck Blo Horseshoe Dam Abv

Salt River Basin

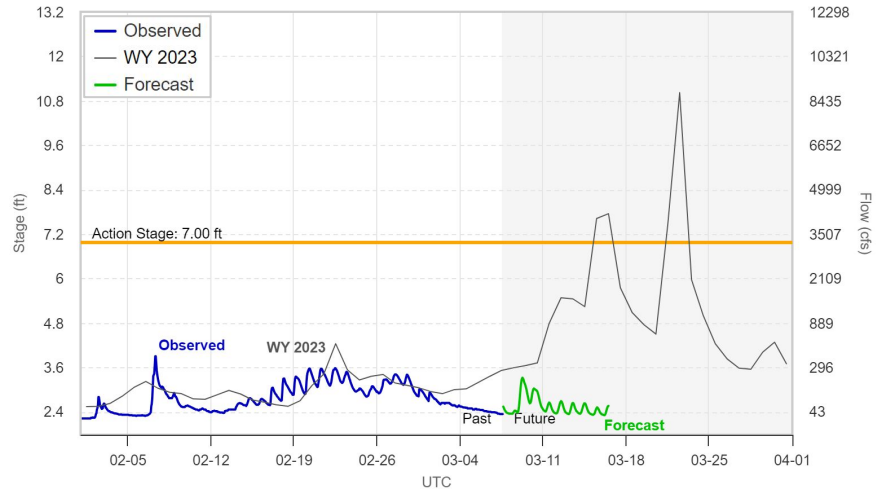


Verde River Basin



Forecast Hydrograph - Oak Ck - Sedona (OAKA3) - NOAA/CBRFC

Fast Date: 03/06/16Z - Latest Ob: 2.34 ft, 37 cfs (03/07/14Z) - Flood: 14.0 ft, 13664 cfs - Action: 7.0 ft, 3268 cfs



Upcoming Weather: 7-Day Precipitation Forecast

Active weather will continue today and tomorrow across the CRB.

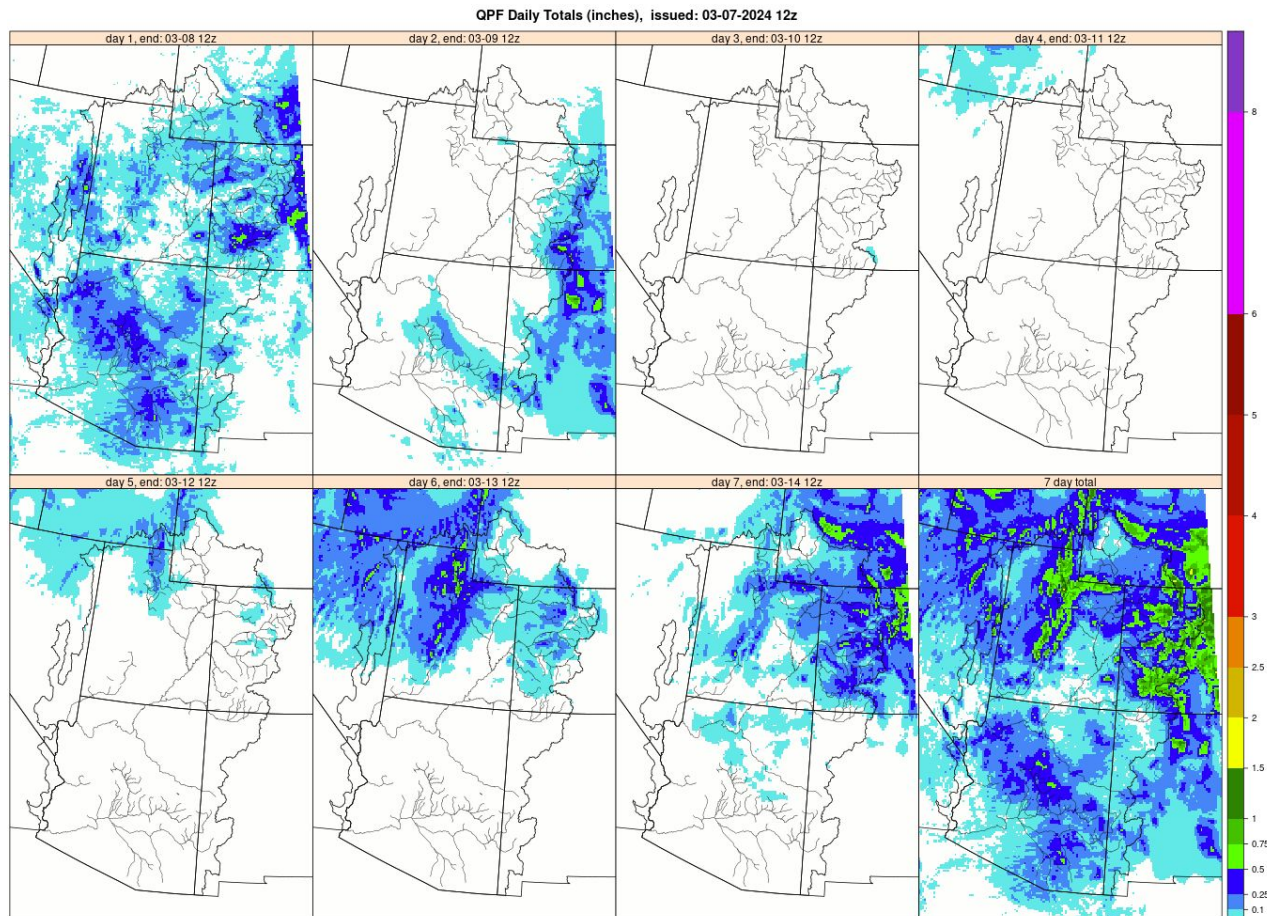
A break in precipitation is expected this weekend.

Unsettled weather will return early next week, primarily across UCRB.

7-Day Forecast Precipitation Totals

UCRB: 0.50" - 1.0"

LCRB: 0.10" - 0.25"



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

Increased chances of below average precipitation in northwestern basins.
 Increased chances of above average precipitation in southeastern basins.

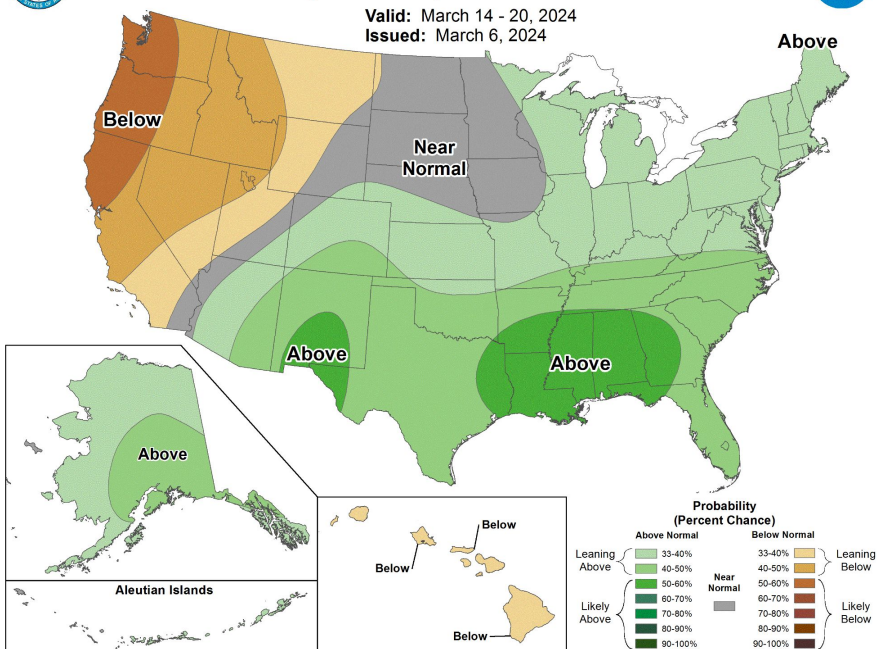
Increased chances of above average temperatures in western basins.
 Near normal temperatures favored in eastern basins.



8-14 Day Precipitation Outlook



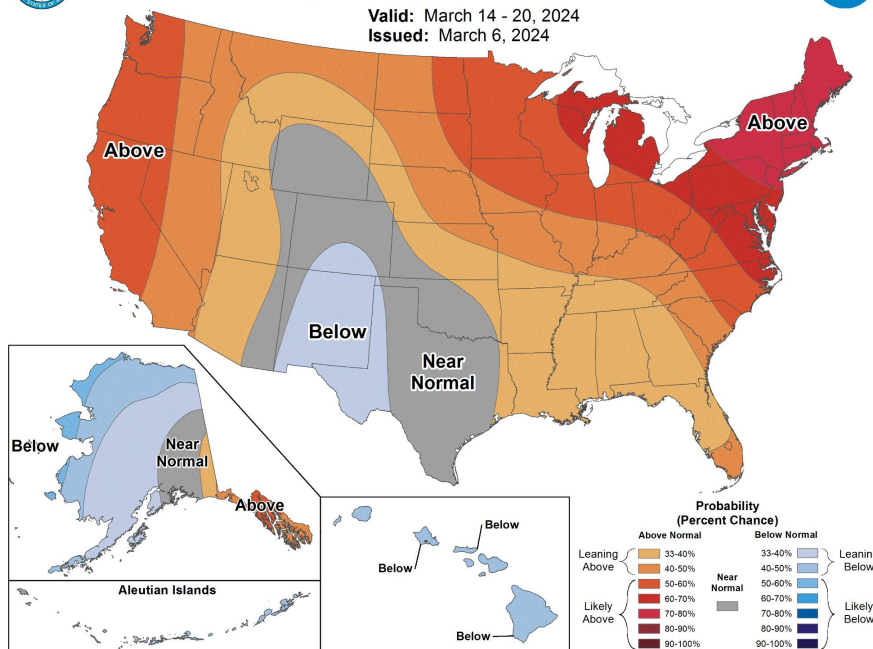
Valid: March 14 - 20, 2024
 Issued: March 6, 2024



8-14 Day Temperature Outlook



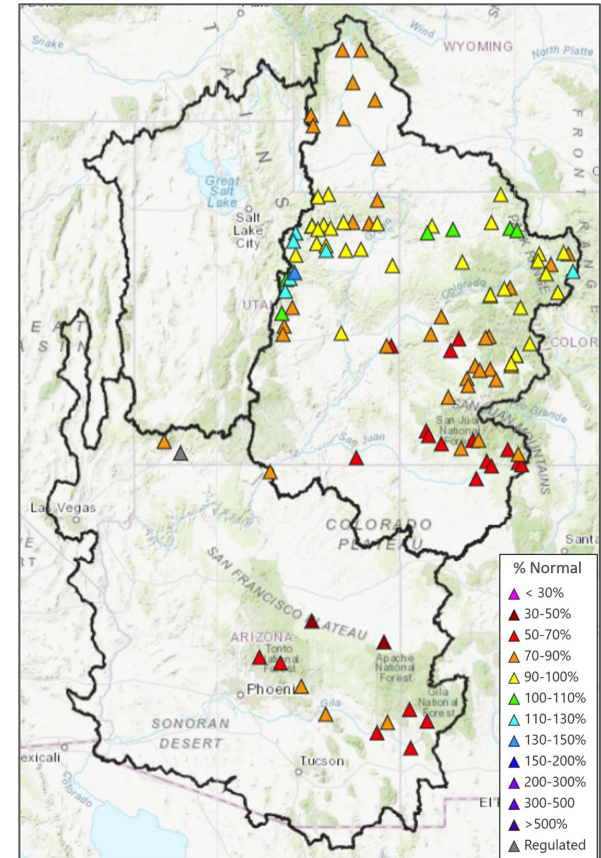
Valid: March 14 - 20, 2024
 Issued: March 6, 2024



Summary

- **Above average January/February precipitation**
- **Upper Colorado**
 - Soil moisture:
 - Northern basins - near/above average
 - Southern basins - below average
 - Mar 6 SWE: 85-130%
 - April-July volume forecasts: 60-115%
- **Lower Colorado**
 - Soil moisture: below normal
 - Drier than normal El Niño across LCRB
 - Mar 6 SWE: 75-100%
 - January-May volume forecasts: 35-75%
- **Weather forecast**
 - 7-day precipitation forecast
 - UCRB: 0.50" - 1.0"
 - LCRB: 0.10" - 0.25"

March 1 Water Supply Forecasts
Percent of 1991-2020 Normal Seasonal Volume



Dust-On-Snow

Dust-on-snow events can:

- advance snowmelt timing
- enhance snowmelt runoff intensity
- decrease snowmelt yields

Dust-on-snow reduces the snow surface albedo (reflectance)

High albedo snow surface: reflects upwards to 90% of solar radiation
Low albedo snow surface: reflects around 30%-70% solar radiation

When the dust layer nearest the surface is exposed, it increases the absorption of solar radiation and warms/melts the snowpack faster than it would have otherwise.



Figure 8: May 2009 at Swamp Angel study site in SBB. Particularly bad Dust-on-Snow year.

Dust layer from March 2nd/3rd, 2024



Source
www.codos.org

2024 Water Supply Webinar Schedule

**All Times Mountain Time (MT)*

Colorado River Basin

Monday	Jan 8th	10 am
Wednesday	Feb 7th	10 am
Thursday	Mar 7 th	10 am
Friday	Apr 5 th	10 am
Tuesday	May 7 th	10 am

Utah/Great Basin

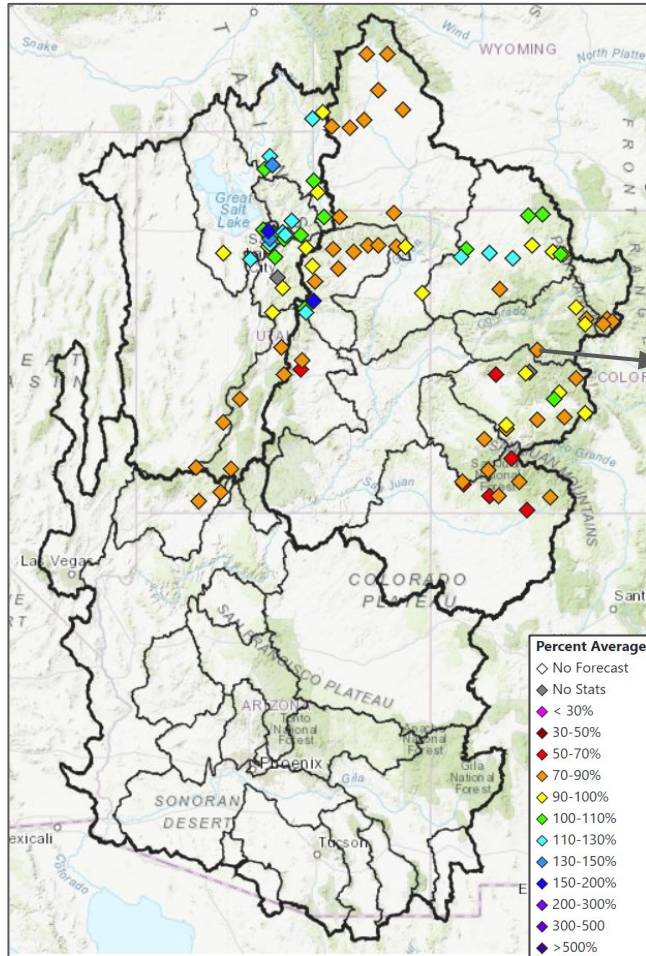
Monday	Jan 8th	11:30 am
Wednesday	Feb 7th	11:30 am
Thursday	Mar 7 th	11:30 am
Friday	Apr 5 th	11:30 am
Tuesday	May 7 th	11:30 am

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

Additional briefings scheduled as needed

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

Peak Flow Forecasts



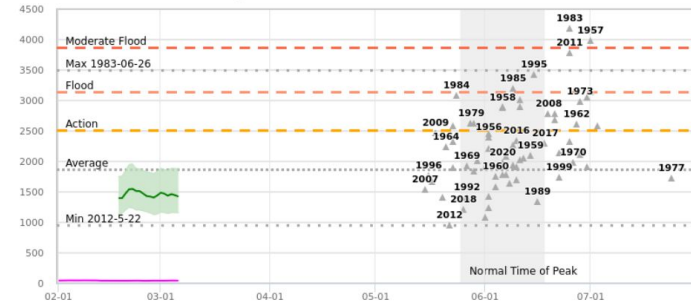
Daily Peak Flow Forecast - RCYC2 - Crystal - Redstone Nr Avalanche Ck Abv

Overview Forecast Tables Forecast Graphic 10-day Streamflow Forecast Historical Peaks Model Show Help

Model Run Date	2024-03-06 (Incl 7 Day Precip Forecast)
Flood Flow	3149 cfs
50% Forecast	1425 cfs
Rank of 50% Forecast	57th Highest Flow / 68 Total Years
Percentile	17% of Years Below Forecast
Peak to Date	
Average Peak	1873 cfs
Percent Average	76%
Normal Time of Peak	05-25 - 06-18
Last Year's Peak	1770 cfs, on 2022-06-13

Crystal - Redstone, Nr, Avalanche Ck, Abv (RCYC2) NOAA

7 Day QPF, Mean Daily ESP
No Special Forecast
ESP 50% (2024-03-06): 1425 cfs (76% Avg), (17% below 57/68)



Daily Peak Flow Forecast Magnitude

Exceedance Probability	Mean Daily Flow (cfs)
Maximum	2112
10%	1885
25%	1584
50%	1425
75%	1270
90%	1160
Minimum	914

Daily Peak Flow Forecast Timing

Exceedance Probability	Date of Peak
Latest	07-01
10%	06-26
25%	06-18
50%	06-08
75%	06-01
90%	05-25
Earliest	05-17

CBRFC Contacts & Water Year 2024 Basin Focal Points

Basin Focal Points (Forecasters)

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CBRFC Water Supply Presentations
<https://www.cbrfc.noaa.gov/present/present.html>