

California Water Supply Outlook Report

May 2024



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Map Updated 4/18/2024

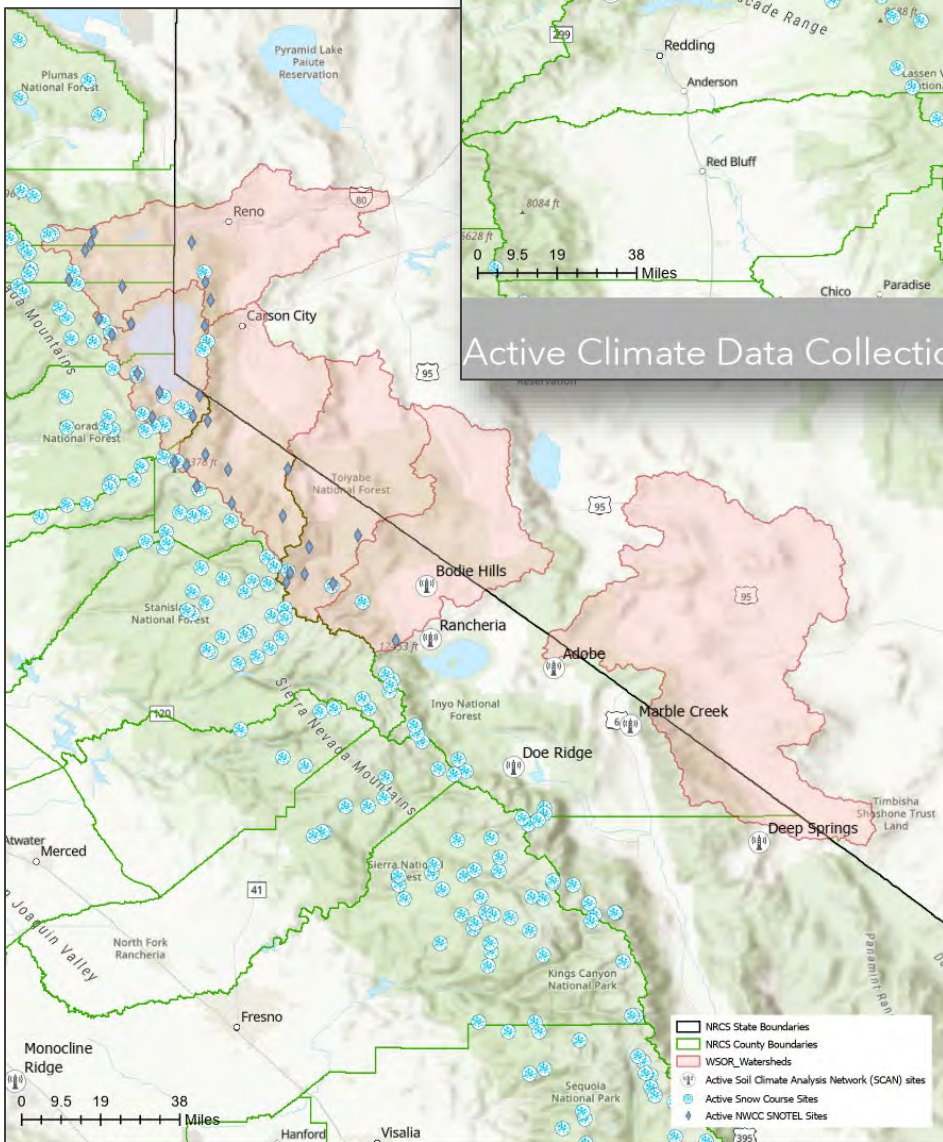


**Don Pedro Reservoir is not labeled at this scale but is situated between New Melones and Lake McClure.

Map Updated 4/18/2024



Active Climate Data Collection sites in the Klamath Area



Active Climate Data Collection sites in the Tahoe Area

*Maps only show forecasted basins that are partially or completely contained in CA. Maps Updated 4/18/2024

STATE OF CALIFORNIA GENERAL OUTLOOK

May 2024

2024 UPDATES:

Water Supply Outlook Report Format Updates

Historically, NRCS CA has displayed data from 2 other agencies: California Department of Water Resources (DWR) and the National Weather Service (NWS) for the western Sierra streamflow predictions. Together with NRCS's forecasting data, the major irrigation watersheds are covered for the whole state. NRCS CA is transitioning to providing links to the most up to date data as opposed to providing a snapshot of the data collected and provided by these Partner agencies. *NRCS CA is interested in your feedback on the new format. If you have any comments, please email them to: NRCS.CA.Engineering@usda.gov.*

NRCS Water Supply Forecast System for the American West

This year, the NRCS begins using a new water supply forecast (WSF) system, the Multi-Model Machine-Learning Metasystem, or M4. In comparison to the historic singular WSF model, the new system creates a mean value from six different forecast models. Using the mean of the ensemble of models harnesses the strengths of each technique while insulating against potential individual model vulnerabilities. The original NRCS WSF model remains as part of the suite of ensemble models. Testing shows that the ensemble mean generally equals or exceeds the performance of any individual model member. Application of NRCS water supply probabilistic forecasts remains unchanged.

Contact:

Angus Goodbody, angus.goodbody@usda.gov, Lead Forecast Hydrologist, USDA NRCS Snow Survey and Water Supply Forecasting Program

Additional reading:

- [Assessing the new NRCS water supply forecast model for the American West](#)
- [A Machine Learning Metasystem for Robust Probabilistic Nonlinear Regression-Based Forecasting](#)

Snow Survey

NRCS CA completed its annual snow survey in March 2024 for the April WSOR. Some other CA Cooperative Snow Survey partners complete additional snow surveys in April. That data can be found in the DWR B120 links below.

Snowpack

As of May 10th, snowpack is 128 percent of normal for the dates in the northern Sierras (up from 122% early last month); 98 percent of normal in the central Sierras (down from 109% early last month); and 66 percent in the southern Sierras (down from 105% early last month). The DWR Daily Statewide Summary of Snow Water Content map is attached at the end of the General Outlook. More information is available online at: <http://cdec.water.ca.gov/snow/current/snow/index2.html>.

Precipitation

As of May 10th, the Northern Sierra-, San Joaquin-, and Tulare Basin Index stations received 95-, 88-, and 85 percent of average for this date. April's precipitation kept seasonal averages equivalent to last month. More information is available online at: http://cdec.water.ca.gov/snow_rain.html

Reservoirs

As of April 30, 2024, total reservoir storage in intrastate California is 118 percent of average. Total interstate reservoir storage, including Lake Powell, Lake Mead and the North Coast watershed is 87 percent of average. As of April 12, 2024, storage at Shasta Reservoir was 114 percent of average, down from 118 percent of average early last month. Oroville Reservoir was 126 percent of average, up from 122 percent of average early last month. Don Pedro Reservoir was 113 percent of average, up slightly from 111 percent of average early last month. The DWR Selected Reservoirs Daily Graph – Water Supply summary chart is attached at the end of the General Outlook. More information is available online at: <https://cdec.water.ca.gov/reservoir.html>.

Lake Oroville, along with 16 other reservoirs, is managed by [DWR](#) through the [State Water Project](#). Shasta Dam, along with 5 other storage reservoirs, is managed by the US Bureau of Reclamation as part of the [Central Valley Project](#). Don Pedro Dam and Reservoir is jointly owned by [Turlock and Modesto Irrigation Districts](#). These three reservoirs are just one example of why the [CA Cooperative Snow Survey Partnership](#) is so critical understanding where and how the water is stored and eventually distributed.

Streamflow

NRCS forecasts in the Tahoe, Truckee, Carson, and Walker River basins are approximately 99 - 214 percent of the 1991-2020 median. NRCS forecasts for stations in the Klamath Basin are 76 - 84 percent of the 1991-2020 medians between March and September NRCS Forecast summaries are attached after the General Outlook Report.

For the Sacramento, San Joaquin, Tulare, North Coast, and Owens Lake forecasts, please refer to the most up to date information on the DWR and NWS webpages. Links with instructions on how to access the data are provided below.

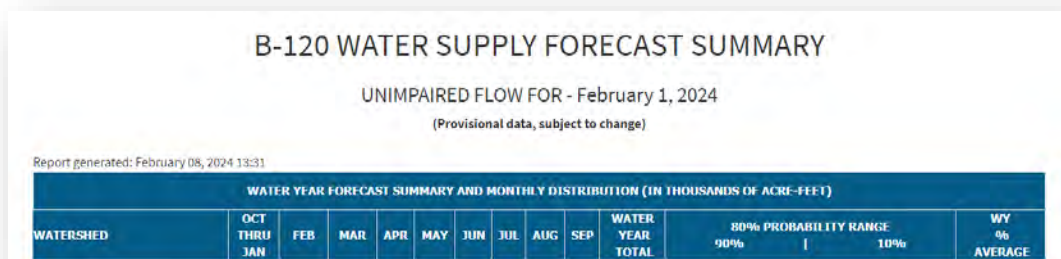
Links to Data for Sacramento, San Joaquin and Tulare Lake Basins data:

Please note that DWR and NWS use percent of average while NRCS uses percent of median to display forecasted stream flows.

- California Department of Water Resources (DWR):
 - [B120 \(ca.gov\)](#) This version of DWR's Bulletin 120 links to the seasonal (April – July) forecasting summary for 18 points in the three watersheds and also provides DWR staff contact information.



- [B120DIST \(ca.gov\)](https://www.ca.gov) This version of DWR’s Bulletin 120 links to the monthly stream forecasts (Feb – Sept) for 16 points in CA and also provides DWR staff contact information.



- National Weather Service (NWS): [CNRFC - Water Resources - Daily Water Resources Update \(noaa.gov\)](https://www.noaa.gov) The California Nevada Forecast Center provides Daily Water updates. The report that is closest to the NRCS forecasting report is the “Seasonal %Avg” product in the “Forecast Flow” data type.

Daily Water Resources Update Web content below courtesy of: Other Resources

1 Select data type below:

Precipitation	Snow	Observed Flow	Reservoir Storage	Forecast Flow	Point Forecasts
---------------	------	---------------	-------------------	---------------	-----------------

2 Select product below:

Water Year %Avg	Seasonal %Avg	Spring Peak Flow Dates	Seasonal Volumes (text)	Seasonal Tracker (text)
Water Year Tracker (text)	Seasonal Breakdown (text)	Water Year Breakdown (text)	Next 12 Months (text)	Spring Peaks (text)

Forecast Seasonal Volume (WY2024)
Click for more options
Data Mode:

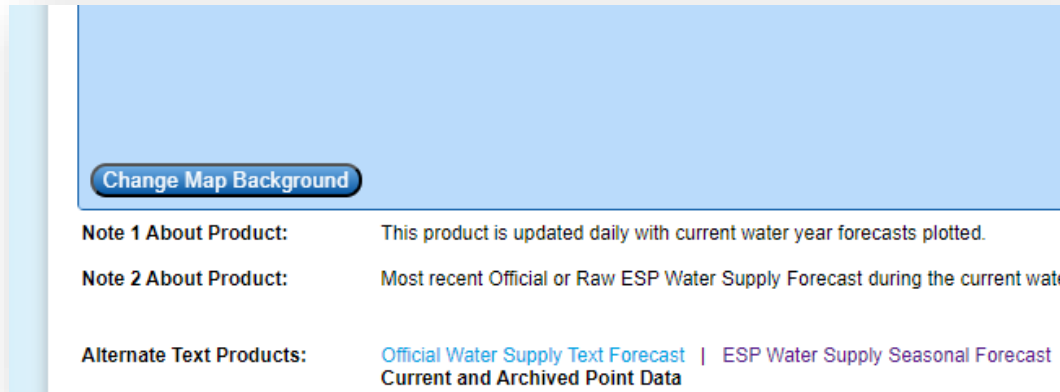
Percent of Normal

Extreme Below	Much Below	Below	Near Normal	Above	Much Above	Extreme Above
50%	70%	90%	110%	130%	150%	

Marker size scaled by average seasonal flow.

Created: Thu Feb 08 2024 at 10:15 AM PST

Seasonal Forecast Volumes (as percentages) can be provided by clicking the “show data table” button on the top right of the interactive map. This value is for the whole water year and is not broken down by month. In order to get monthly forecasting data, text reports are available. The “ESP Water Supply Seasonal Forecast” product is the one NRCS used to report data in its previous products.



The screenshot shows a light blue header area with a button labeled "Change Map Background". Below the header, there is a white box containing product information:

Note 1 About Product:	This product is updated daily with current water year forecasts plotted.
Note 2 About Product:	Most recent Official or Raw ESP Water Supply Forecast during the current water year.
Alternate Text Products:	Official Water Supply Text Forecast ESP Water Supply Seasonal Forecast Current and Archived Point Data



STATEWIDE SNOW WATER CONTENT

CURRENT REGIONAL SNOWPACK FROM AUTOMATED SNOW SENSORS

% of April 1 Average / % of Normal for This Date



NORTH	
Data as of May 10, 2024	
Number of Stations Reporting	26
Average snow water equivalent (Inches)	20.5
Percent of April 1 Average (%)	72
Percent of normal for this date (%)	128

CENTRAL	
Data as of May 10, 2024	
Number of Stations Reporting	48
Average snow water equivalent (Inches)	16.2
Percent of April 1 Average (%)	61
Percent of normal for this date (%)	98

SOUTH	
Data as of May 10, 2024	
Number of Stations Reporting	27
Average snow water equivalent (Inches)	8.4
Percent of April 1 Average (%)	38
Percent of normal for this date (%)	66

STATE	
Data as of May 10, 2024	
Number of Stations Reporting	101
Average snow water equivalent (Inches)	15.2
Percent of April 1 Average (%)	59
Percent of normal for this date (%)	99

Statewide Average: 59% / 99%

Data as of May 10, 2024

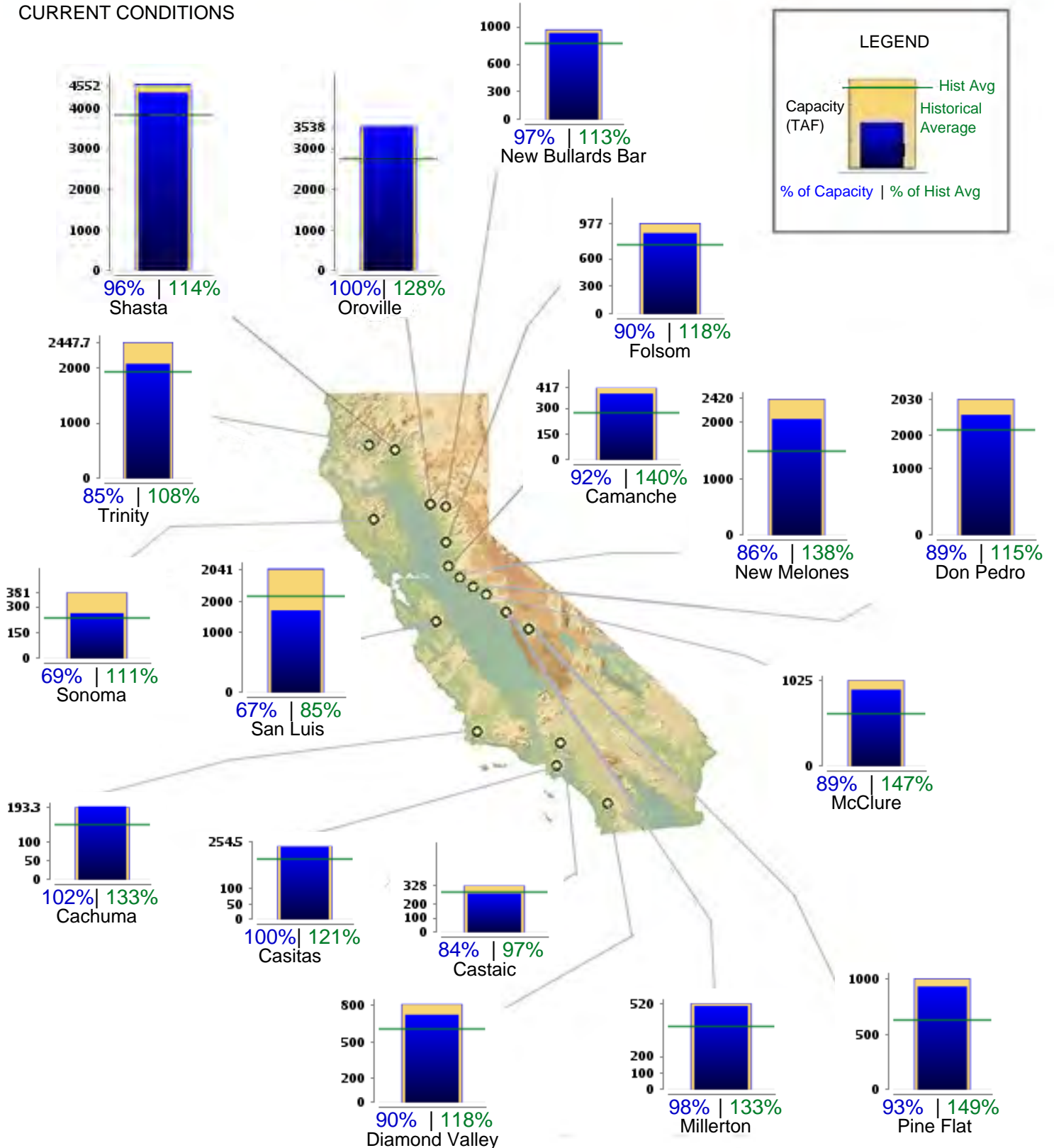


CURRENT RESERVOIR CONDITIONS

CALIFORNIA MAJOR WATER SUPPLY RESERVOIRS

Midnight - May 9, 2024

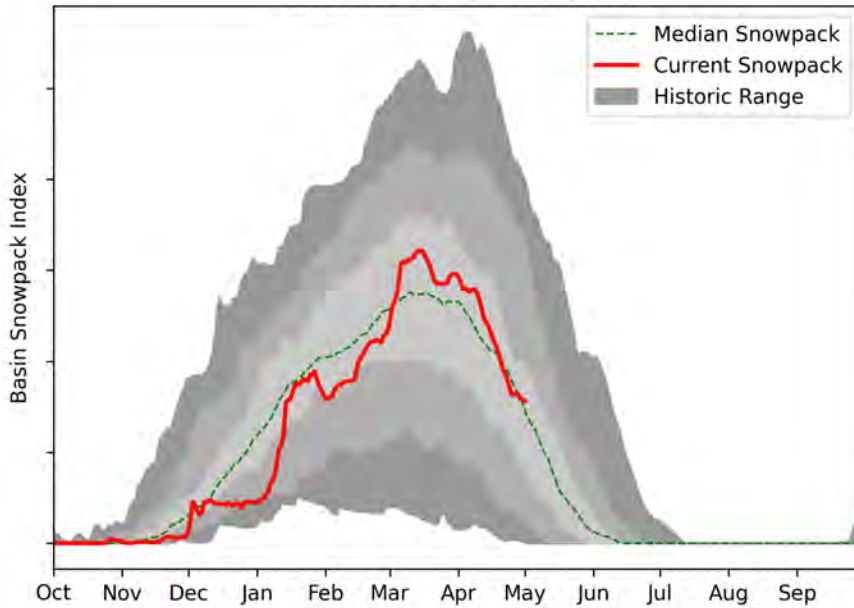
CURRENT CONDITIONS



Klamath Basin Summary

SNOWPACK

Klamath Basin Snowpack

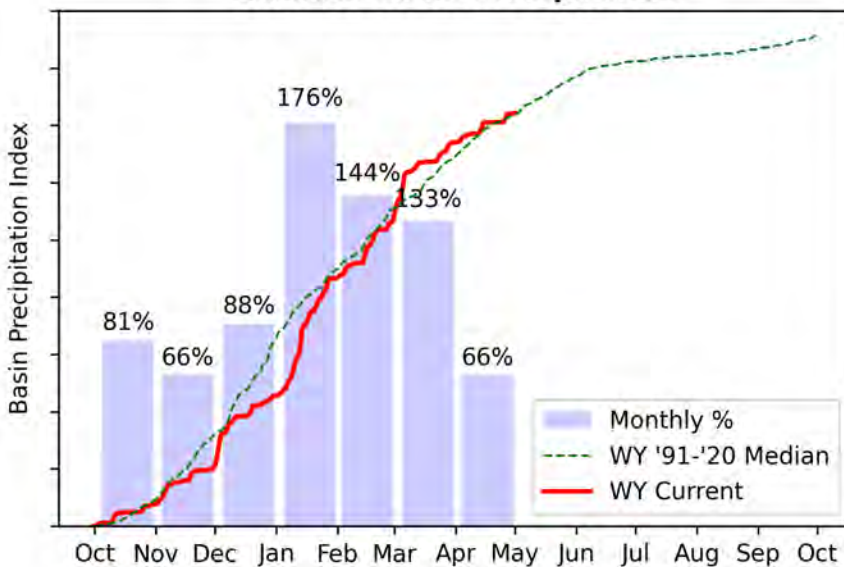


► View snowpack for individual sites by accessing the basin data report [here](#).

As of May 1, the basin snowpack is 102% of median. Last month on April 1 the basin snowpack was 109% of median.

PRECIPITATION

Klamath Basin Precipitation



► View precipitation for individual sites by accessing the basin data report [here](#).

April precipitation is below normal at 66% of median. Precipitation since the beginning of the water year (October 1 - May 1) is 100% of median.

RESERVOIR STORAGE

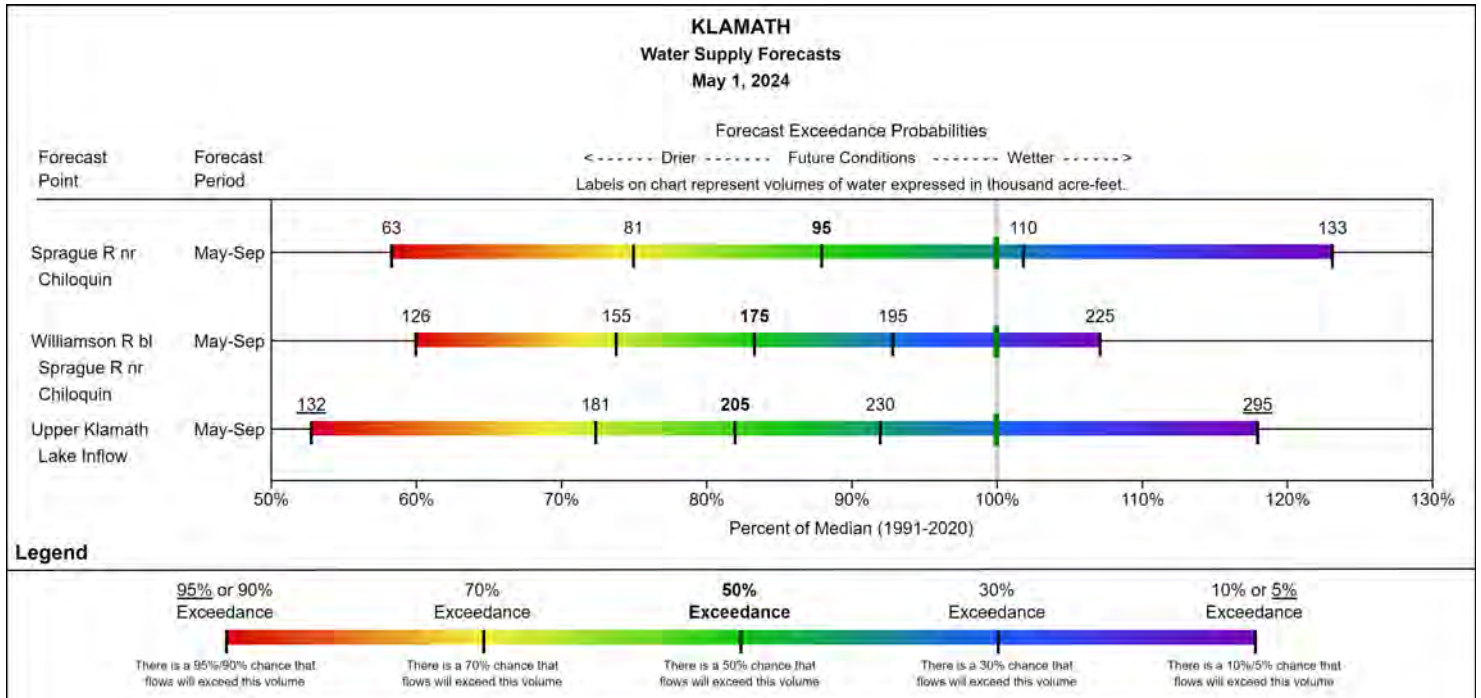
As of May 1, storage at major reservoirs in the basin ranges from 63% of median at Gerber Reservoir to 113% of median at Upper Klamath Lake.

Klamath	Current (KAF)	Last Year (KAF)	Median (KAF)	Capacity (KAF)	Current % Capacity	Last Year % Capacity	Median % Capacity	Current % Median	Last Year % Median
Howard Prairie	31.1	21.9	42.2	62.1	50%	35%	68%	74%	52%
Fourmile Lake	6.6	5.5	8.5	15.6	42%	35%	54%	77%	64%
Upper Klamath Lake	528.1	479.2	466.3	523.7	101%	91%	89%	113%	103%
Clear Lake	139.9	128.9	174.3	513.3	27%	25%	34%	80%	74%
Hyatt Prairie	9.7	6.2	12.5	16.2	60%	38%	77%	77%	49%
Gerber	41.5	47.4	66.3	94.3	44%	50%	70%	63%	71%
Basin Index					62%	56%	63%	98%	89%
# of reservoirs					6	6	6	6	6

STREAMFLOW FORECAST

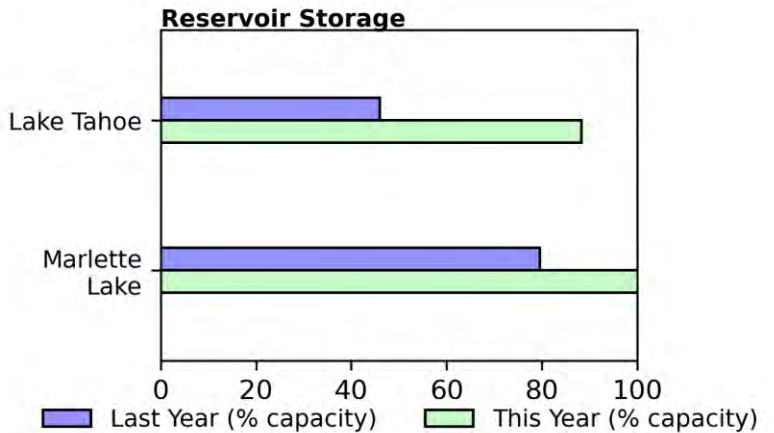
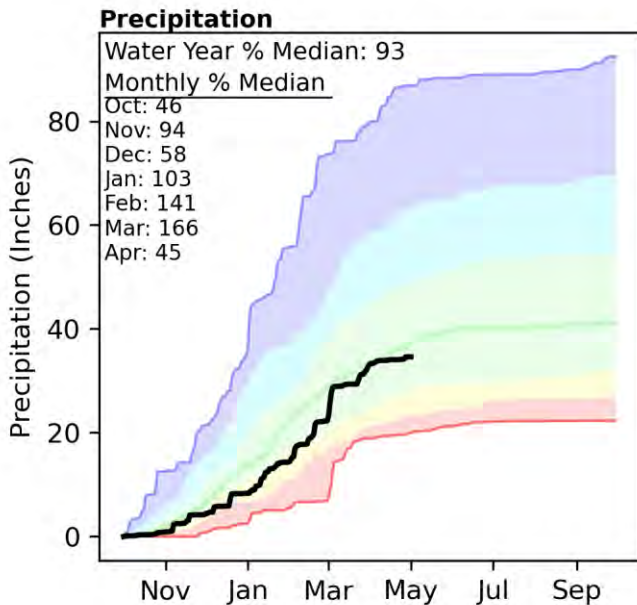
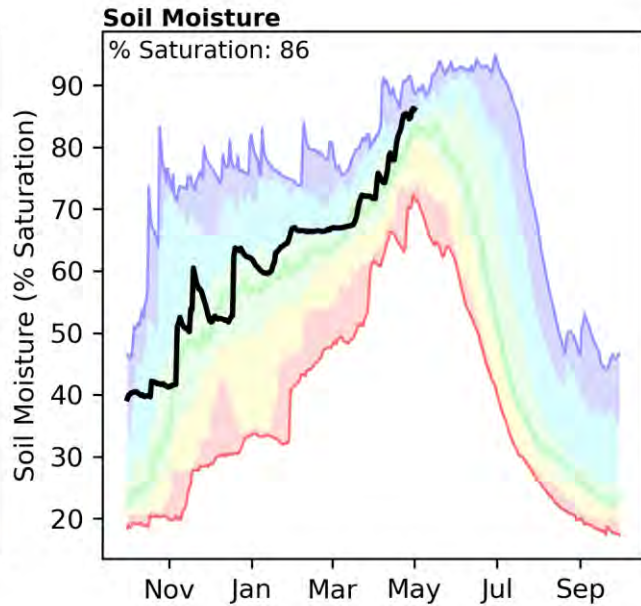
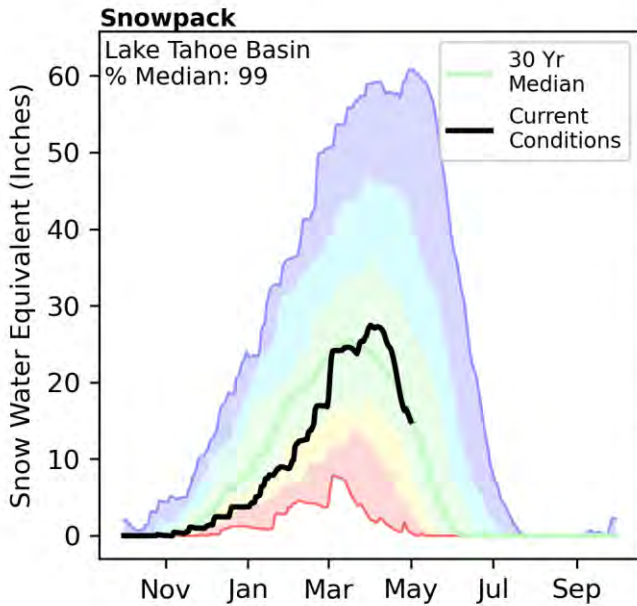
The streamflow forecasts for the primary period in the basin range from 82% to 88% of median.

For data in tabular format and to view other forecasts please view the basin data reports [here](#).



Lake Tahoe Basin | May 1, 2024

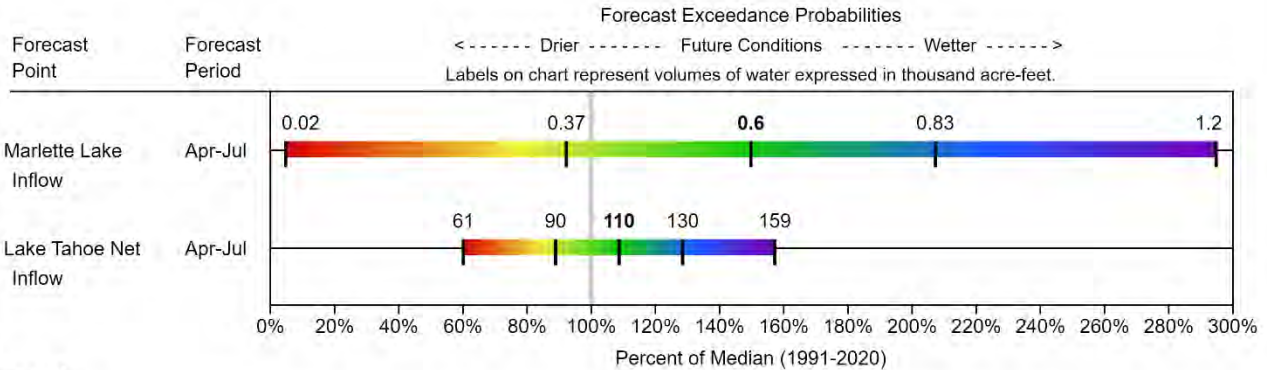
Snowpack in the Lake Tahoe Basin is about normal at 99% of median, compared to 301% at this time last year. Precipitation in April was well below normal at 45%, which brings the seasonal accumulation (October-April) to 93% of median. Soil moisture is at 86% saturation compared to 84% saturation last year. Reservoir storage is 88% of capacity, compared to 47% last year.



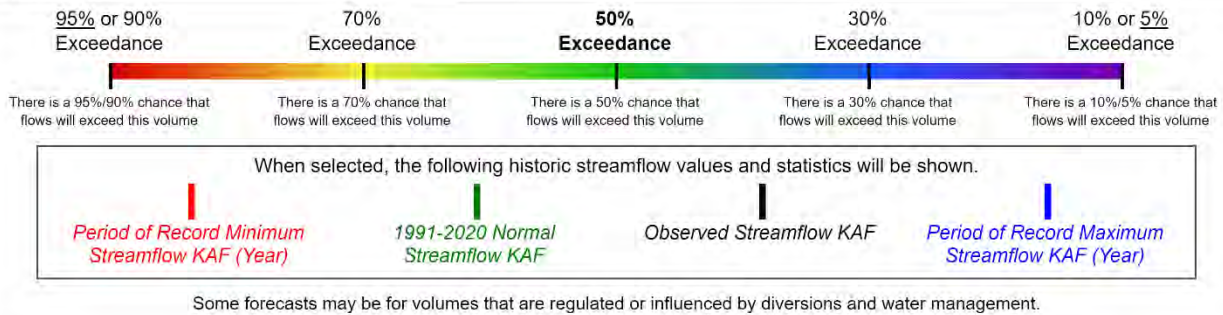
Statistical shading breaks at 10th, 30th, 50th, 70th, and 90th percentiles.
For more information visit: [30 year normal calculation description](#)

Important Information about Forecast Coordination: Hydrologists with the NRCS and National Weather Service California Nevada River Forecast Center (CNRFC) coordinate Lake Tahoe Rise, Truckee River at Farad, Little Truckee River near Boca, and the Carson River at Ft. Churchill forecasts (following page) using output of their respective hydrology models at the request of the Bureau of Reclamation. The NRCS model is a statistical model based on the current data as of the first of each month. The CNRFC ensemble forecasting system incorporates near-term weather prediction and climatology into their model. These models can provide different answers because of the nature of the model systems, and from the inclusion of future weather in the CNRFC model. The hydrologists agree on forecast values using guidance from both models to best provide an accurate water supply forecast for these points.

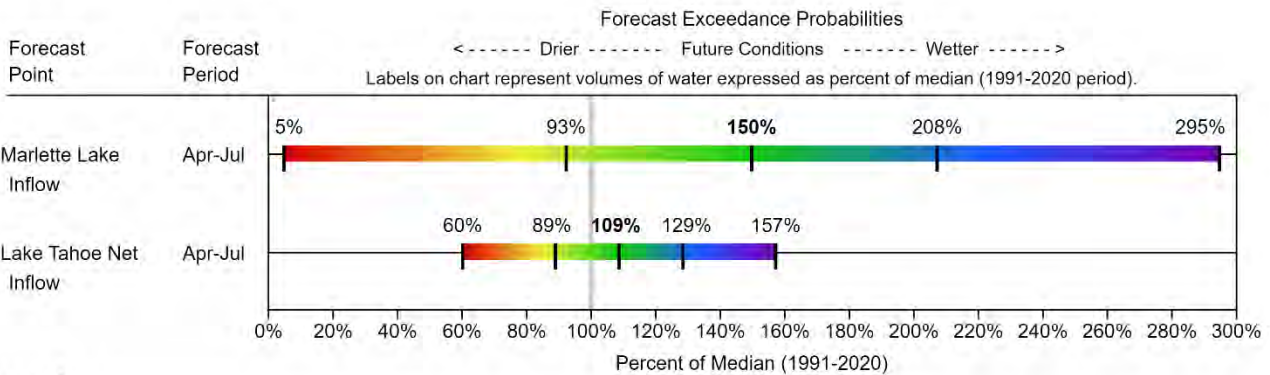
**TAHOE
Water Supply Forecasts
May 1, 2024**



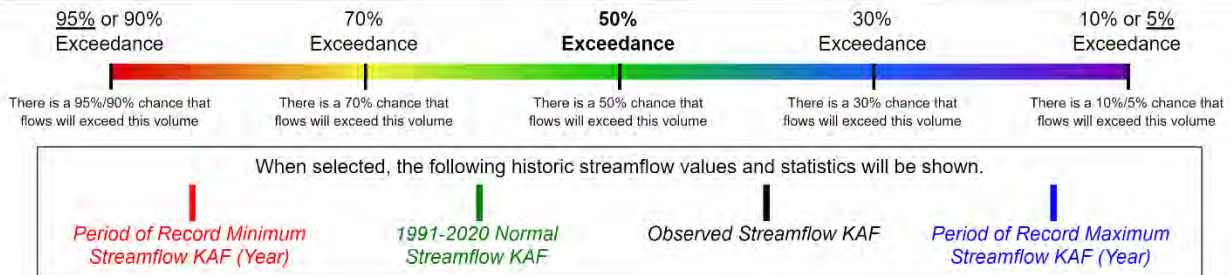
Legend



**TAHOE
Water Supply Forecasts
May 1, 2024**

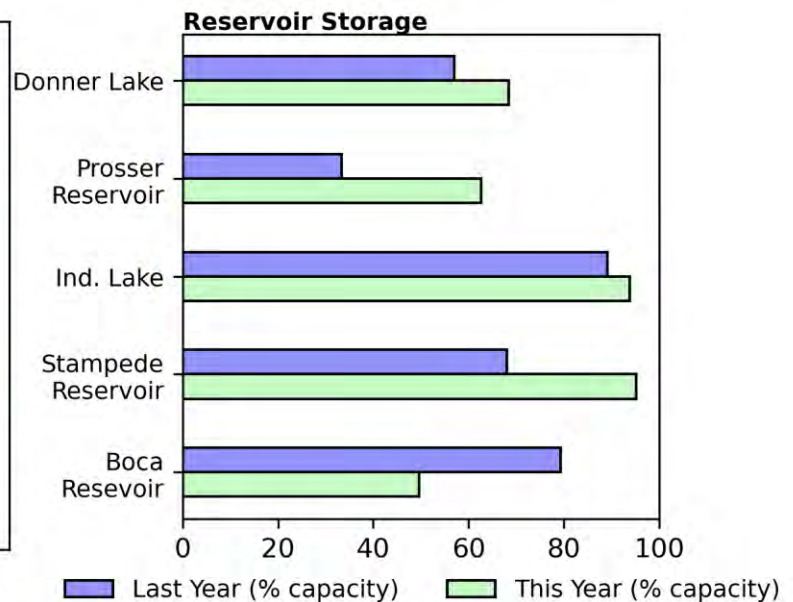
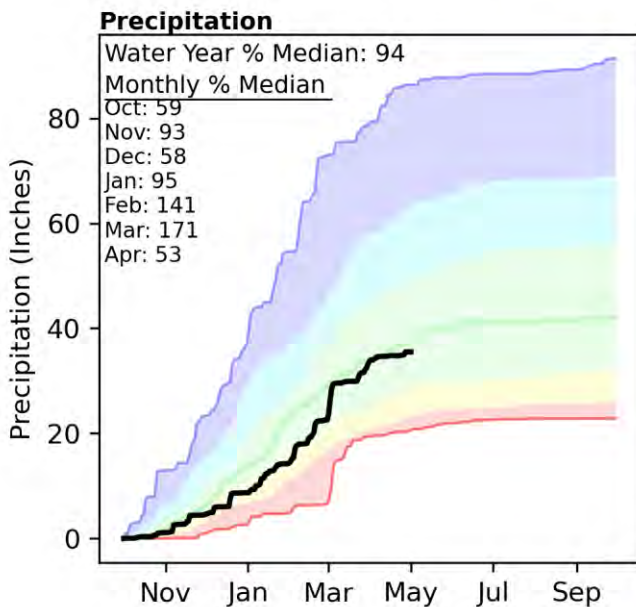
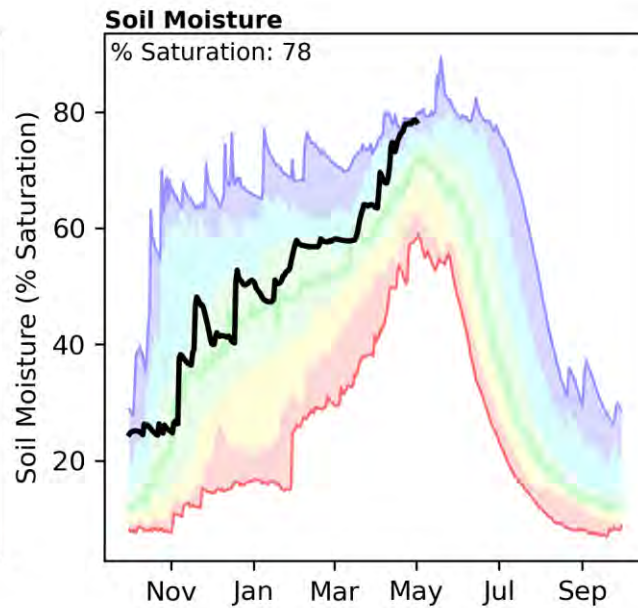
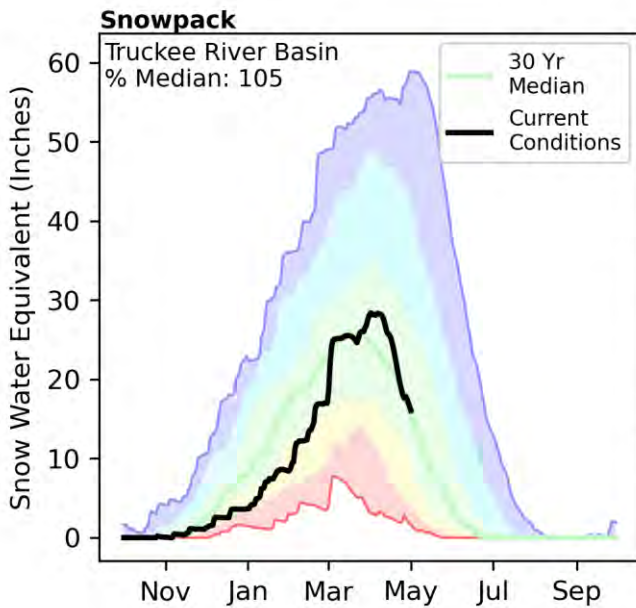


Legend



Truckee River Basin | May 1, 2024

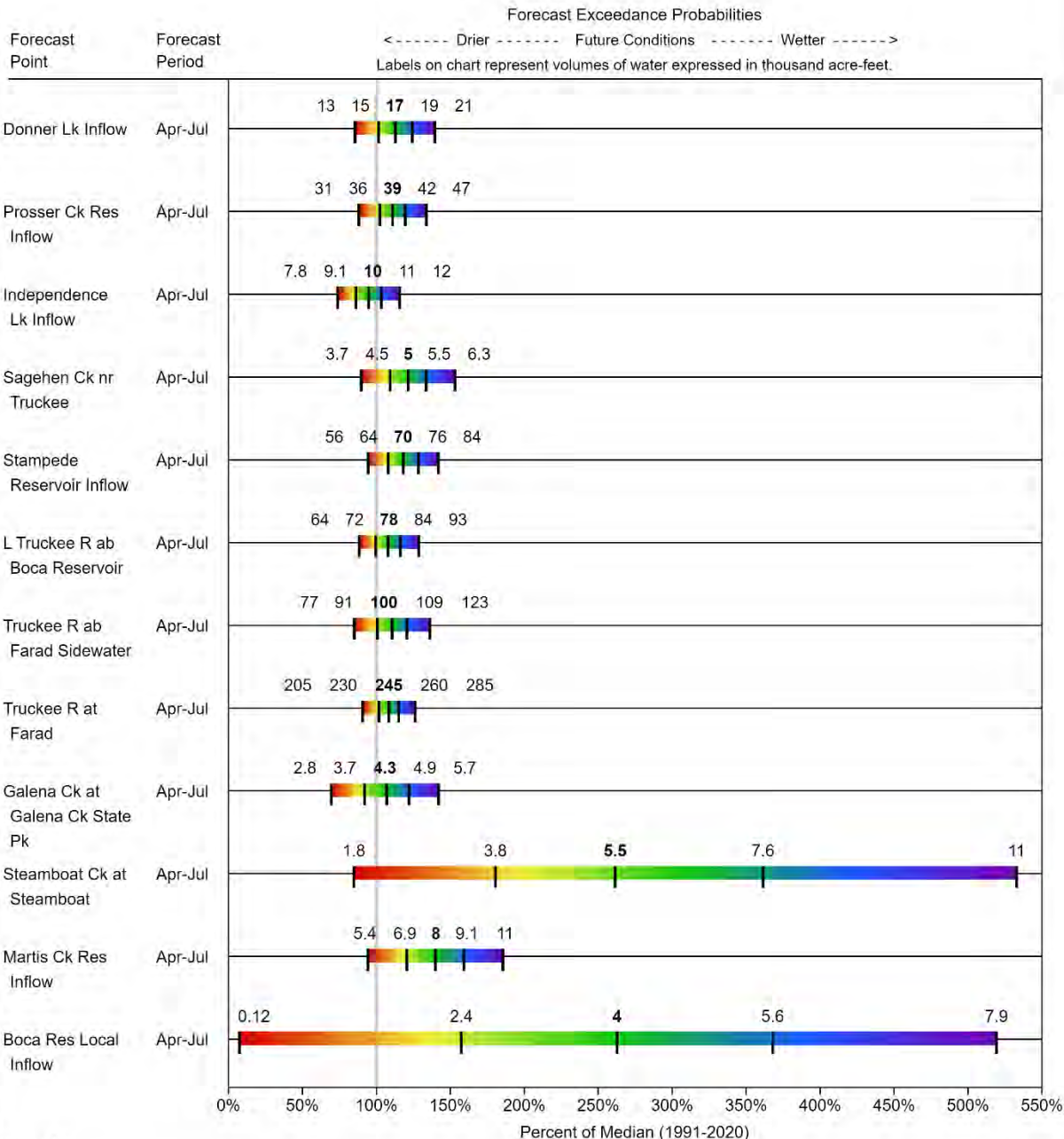
Snowpack in the Truckee River Basin is about normal at 105% of median, compared to 270% at this time last year. Precipitation in April was well below normal at 53%, which brings the seasonal accumulation (October-April) to 94% of median. Soil moisture is at 78% saturation compared to 76% saturation last year. Reservoir storage is 86% of capacity, compared to 67% last year.



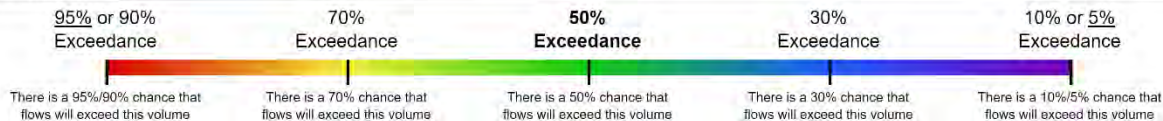
Statistical shading breaks at 10th, 30th, 50th, 70th, and 90th percentiles.
For more information visit: [30 year normal calculation description](#)

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TRUCKEE Water Supply Forecasts May 1, 2024



Legend



When selected, the following historic streamflow values and statistics will be shown.

Period of Record Minimum Streamflow KAF (Year)

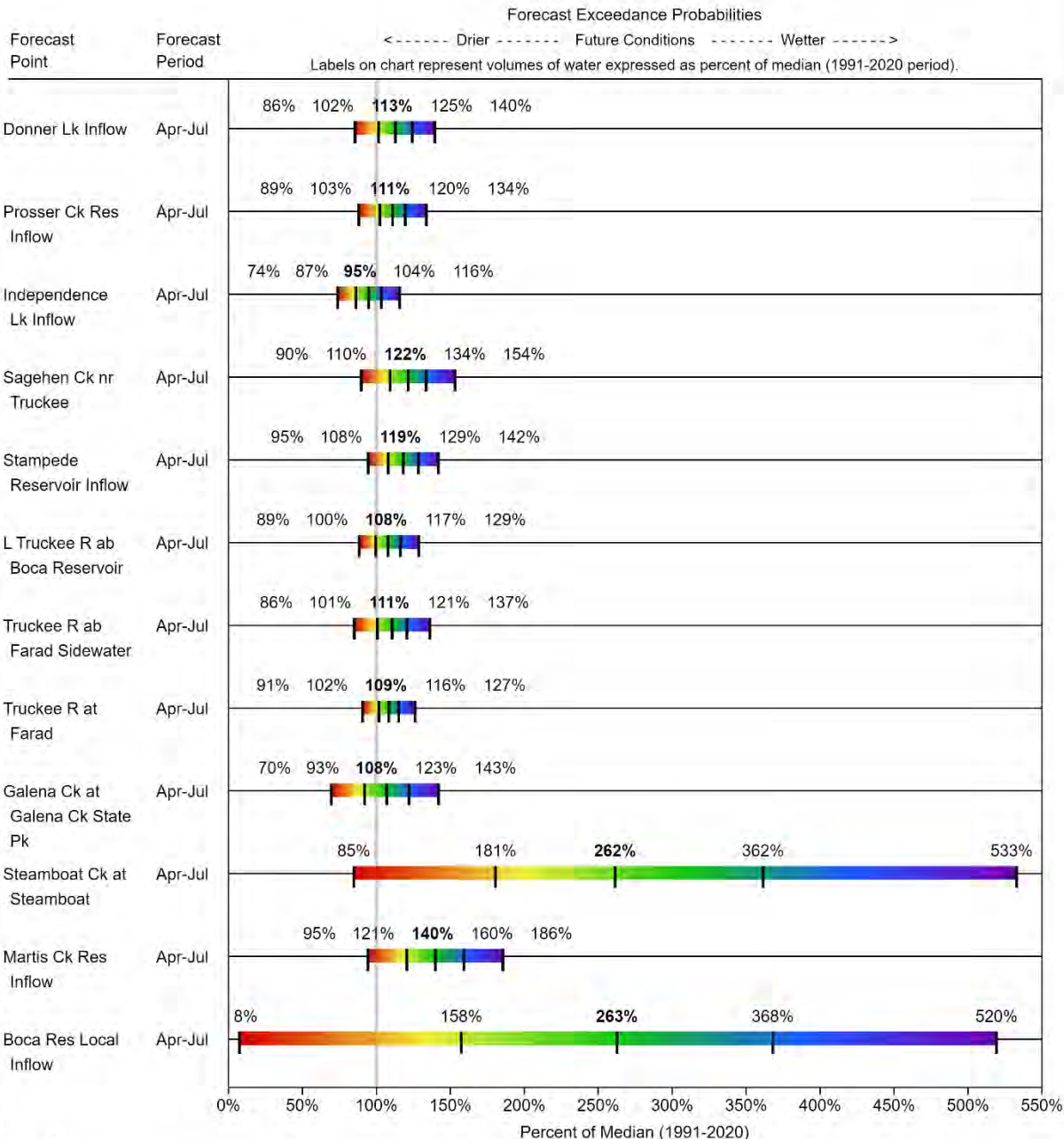
1991-2020 Normal Streamflow KAF

Observed Streamflow KAF

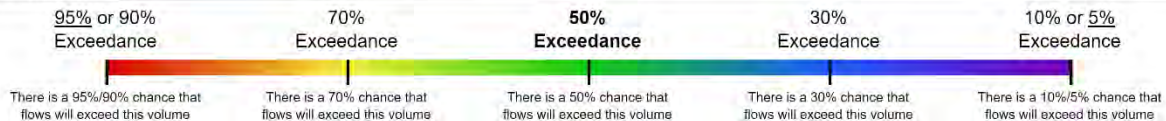
Period of Record Maximum Streamflow KAF (Year)

Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

TRUCKEE
Water Supply Forecasts
May 1, 2024



Legend



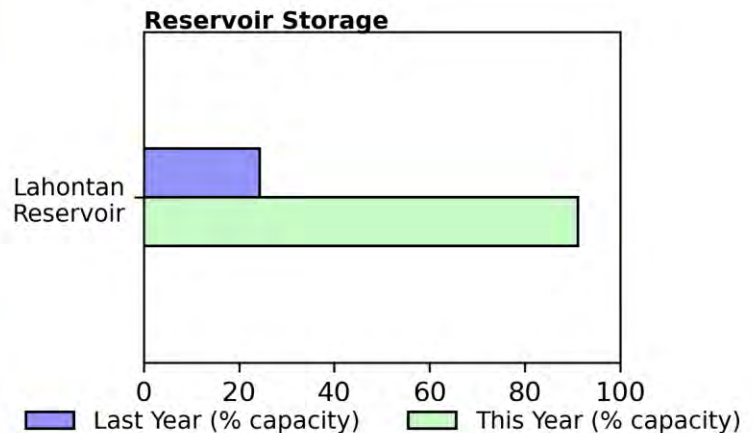
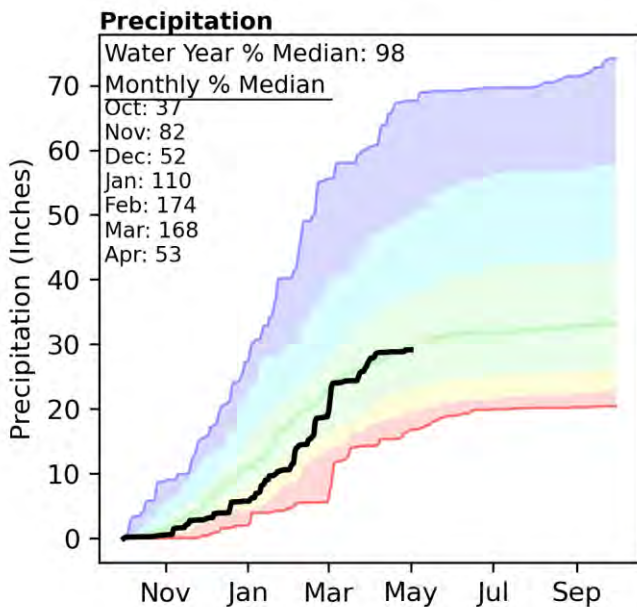
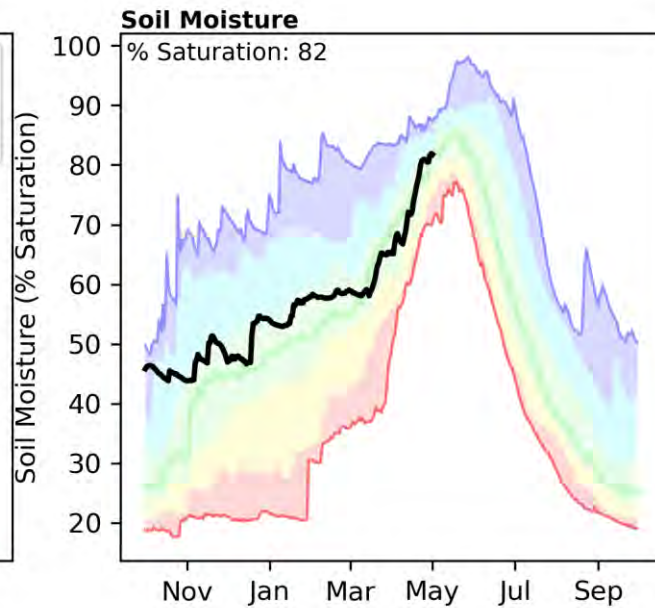
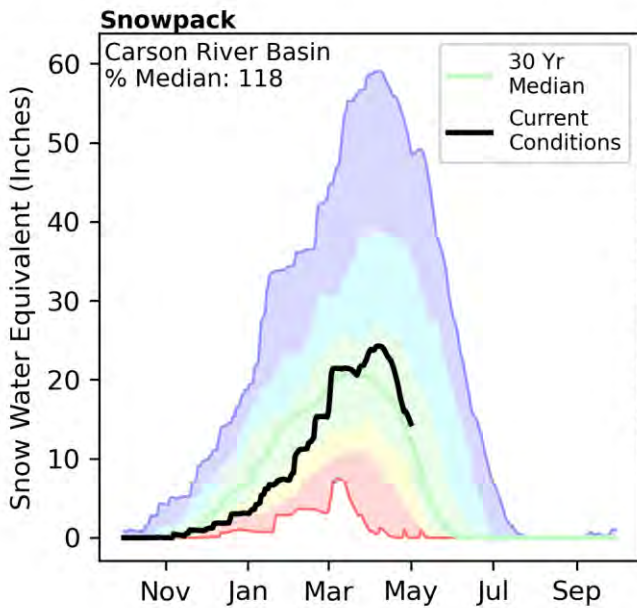
When selected, the following historic streamflow values and statistics will be shown.

<i>Period of Record Minimum Streamflow KAF (Year)</i>	<i>1991-2020 Normal Streamflow KAF</i>	<i>Observed Streamflow KAF</i>	<i>Period of Record Maximum Streamflow KAF (Year)</i>

Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

Carson River Basin | May 1, 2024

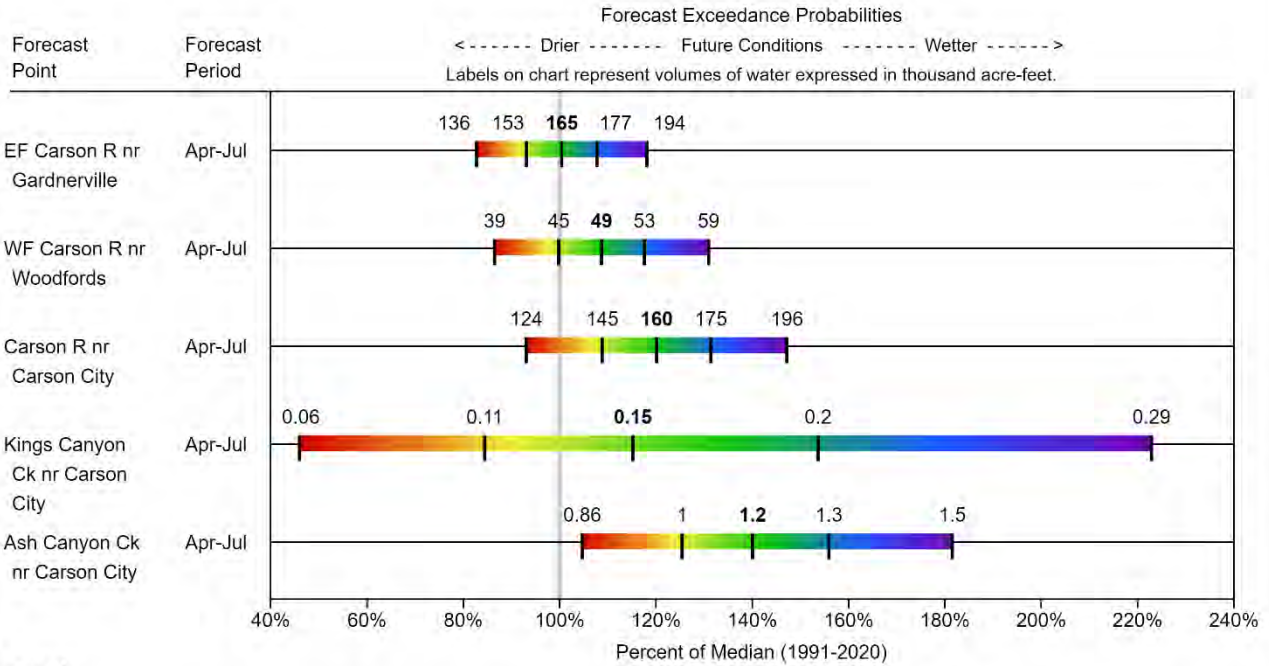
Snowpack in the Carson River Basin is above normal at 118% of median, compared to 381% at this time last year. Precipitation in April was well below normal at 53%, which brings the seasonal accumulation (October-April) to 98% of median. Soil moisture is at 82% saturation, same as last year at this time. Reservoir storage is 91% of capacity, compared to 24% last year.



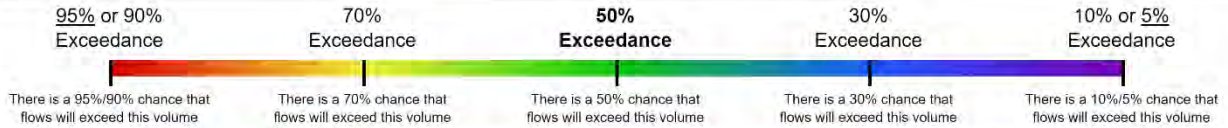
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CARSON Water Supply Forecasts May 1, 2024



Legend

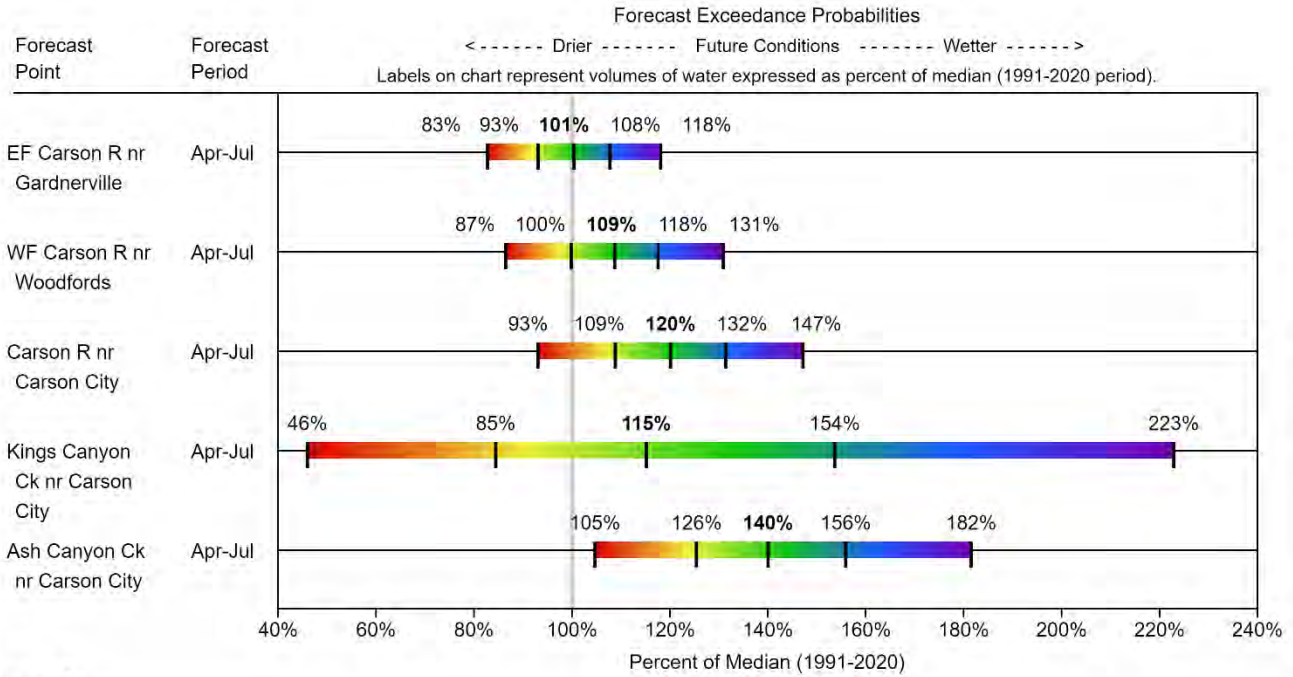


When selected, the following historic streamflow values and statistics will be shown.

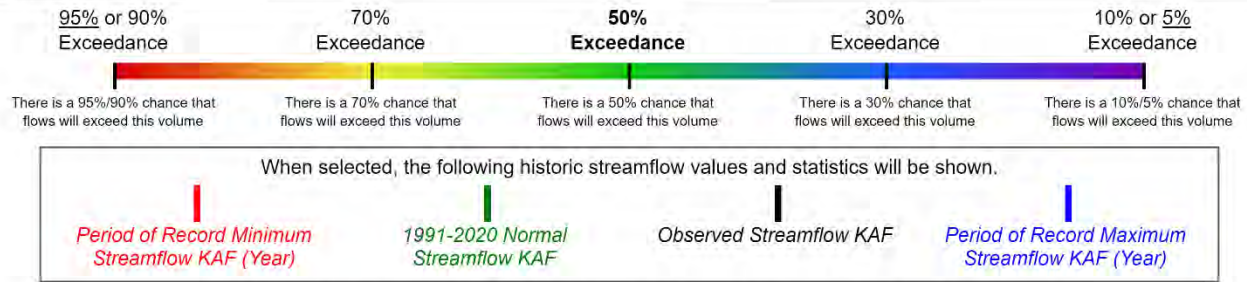
 <i>Period of Record Minimum Streamflow KAF (Year)</i>	 <i>1991-2020 Normal Streamflow KAF</i>	 <i>Observed Streamflow KAF</i>	 <i>Period of Record Maximum Streamflow KAF (Year)</i>
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Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

CARSON
Water Supply Forecasts
May 1, 2024



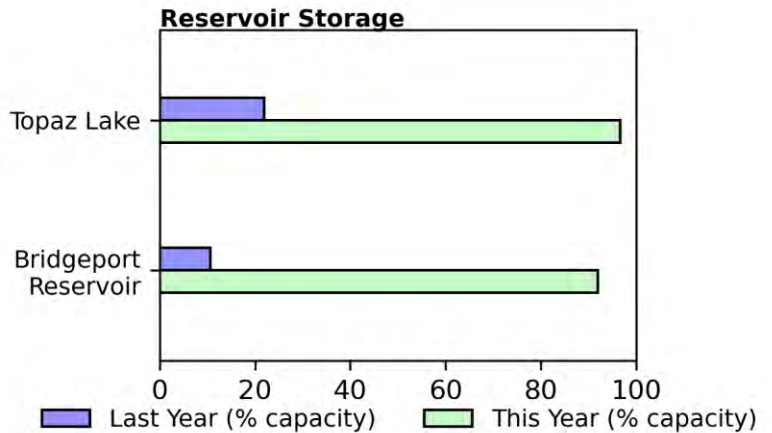
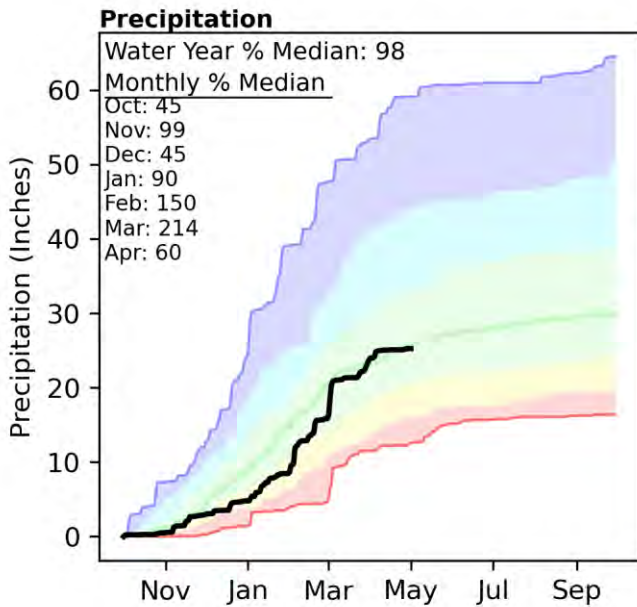
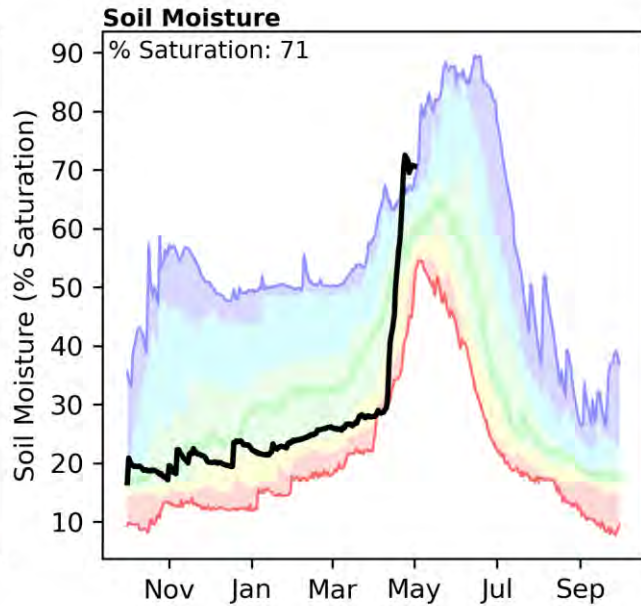
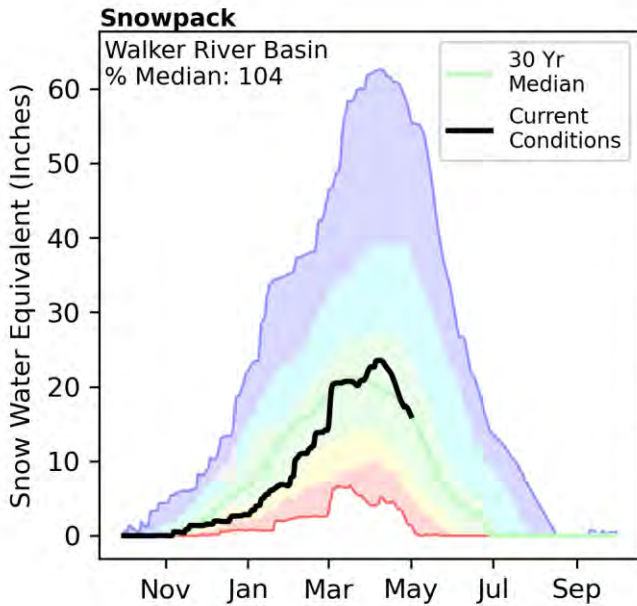
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Some forecasts may be for volumes that are regulated or influenced by diversions and water management.

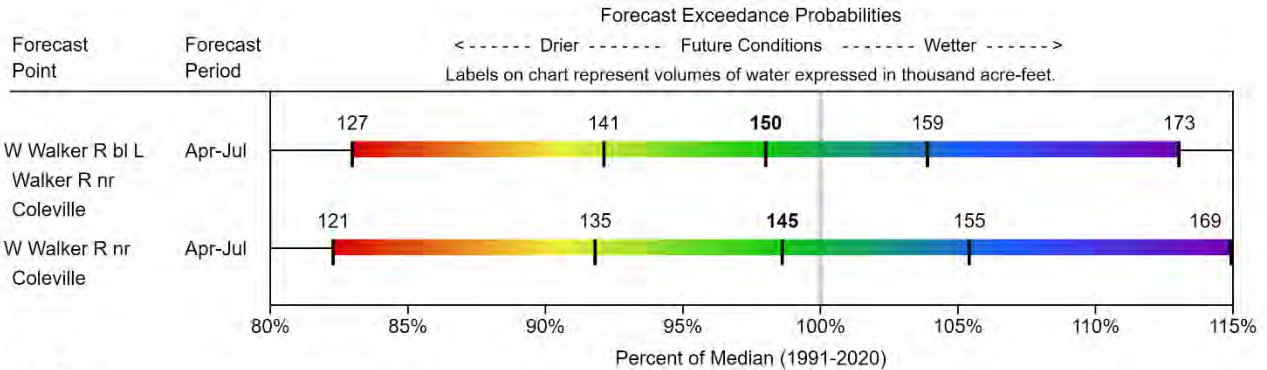
Walker River Basin | May 1, 2024

Snowpack in the Walker River Basin is about normal at 104% of median, compared to 345% at this time last year. Precipitation in April was well below normal at 60%, which brings the seasonal accumulation (October-April) to 98% of median. Soil moisture is at 71% saturation compared to 64% saturation last year. Reservoir storage is 95% of capacity, compared to 17% last year.

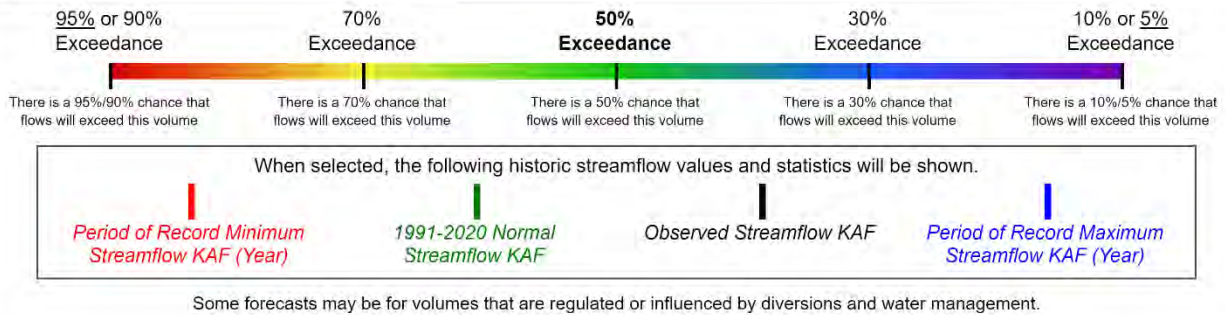


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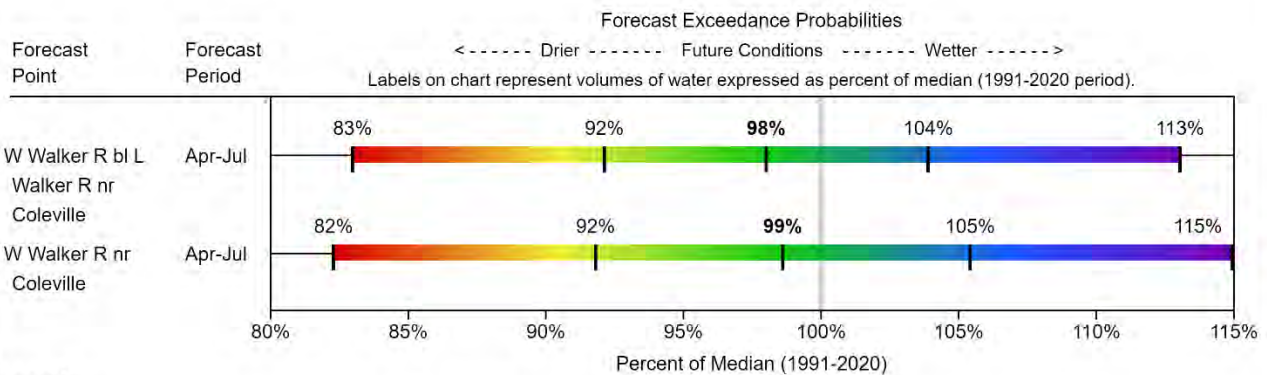
WALKER
Water Supply Forecasts
May 1, 2024



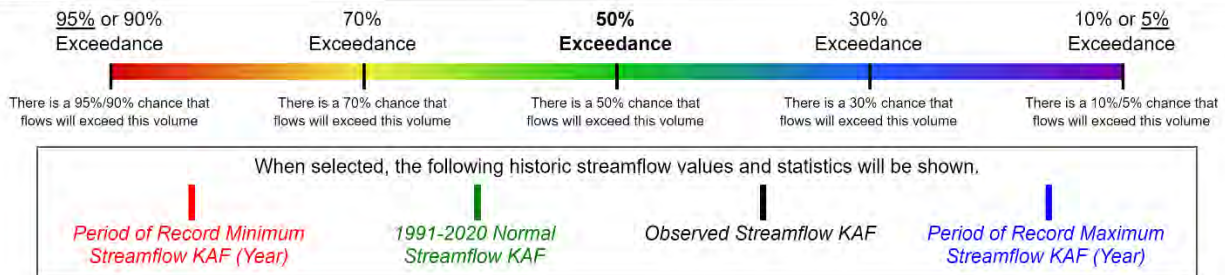
Legend



WALKER
Water Supply Forecasts
May 1, 2024

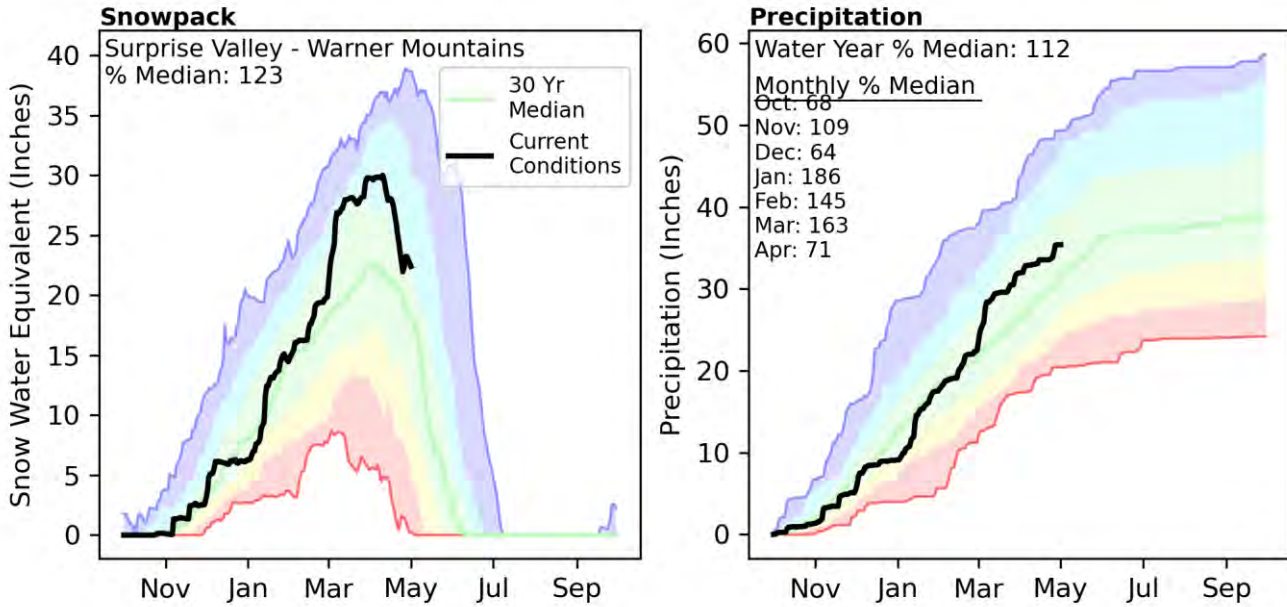


Legend



Surprise Valley - Warner Mountains | May 1, 2024

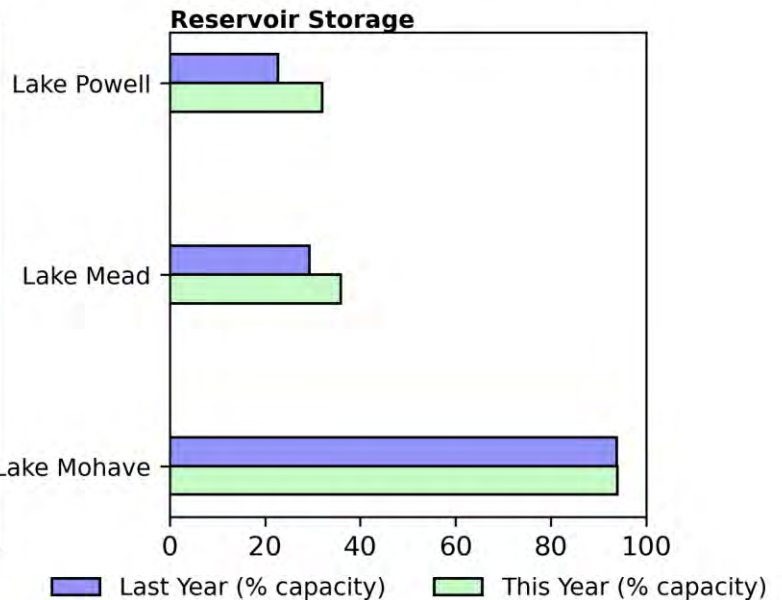
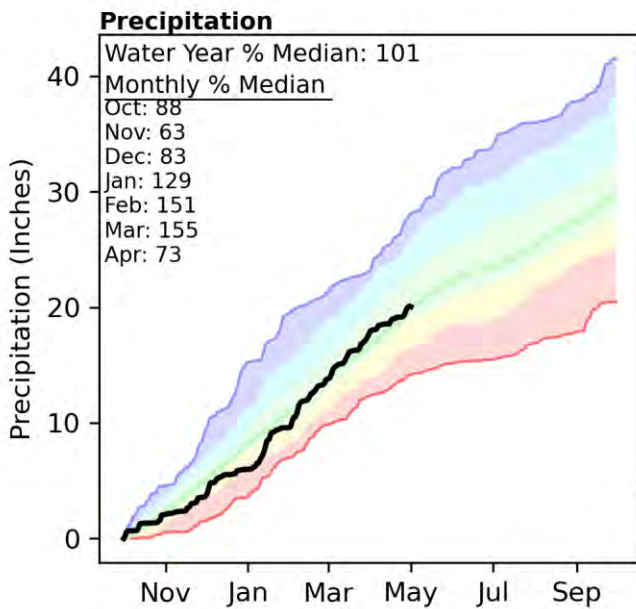
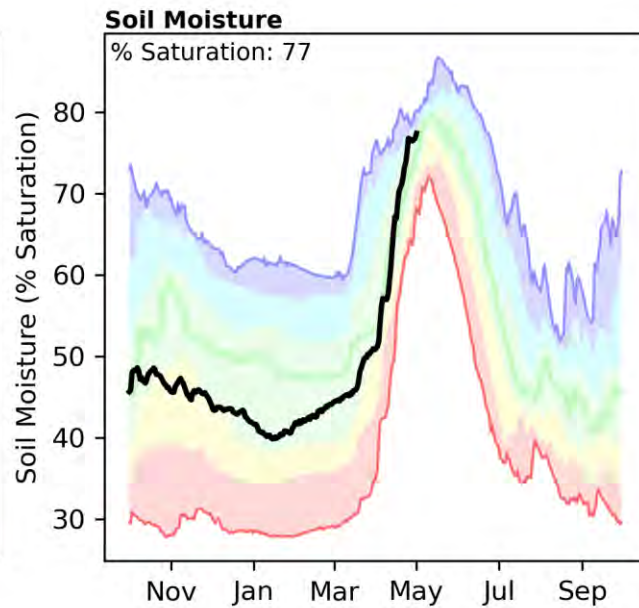
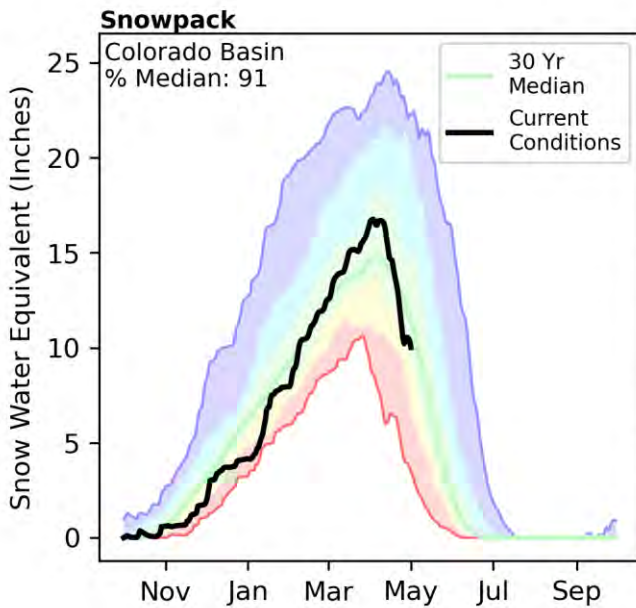
Snowpack in the Surprise Valley - Warner Mountains is above normal at 123% of median, compared to 151% at this time last year. Precipitation in April was below normal at 71%, which brings the seasonal accumulation (October-April) to 112% of median.



Statistical shading breaks at 10th, 30th, 50th, 70th, and 90th percentiles.
For more information visit: [30 year normal calculation description](#)

Colorado Basin | May 1, 2024

Snowpack in the Colorado Basin above Lake Powell is about normal at 91% of median, compared to 162% at this time last year. Precipitation in April was below normal at 73%, which brings the seasonal accumulation (October-April) to 101% of median. Soil moisture is at 77% saturation compared to 75% saturation last year. Reservoir storage in the Lower Colorado Basin is 36% of capacity, compared to 28% last year.



Statistical shading breaks at 10th, 30th, 50th, 70th, and 90th percentiles.
For more information visit: [30 year normal calculation description](#)

Appendix: Interpreting the Streamflow Forecast Chart

Forecast Exceedance Probabilities for Risk Assessment
Chance that actual volume will exceed forecast

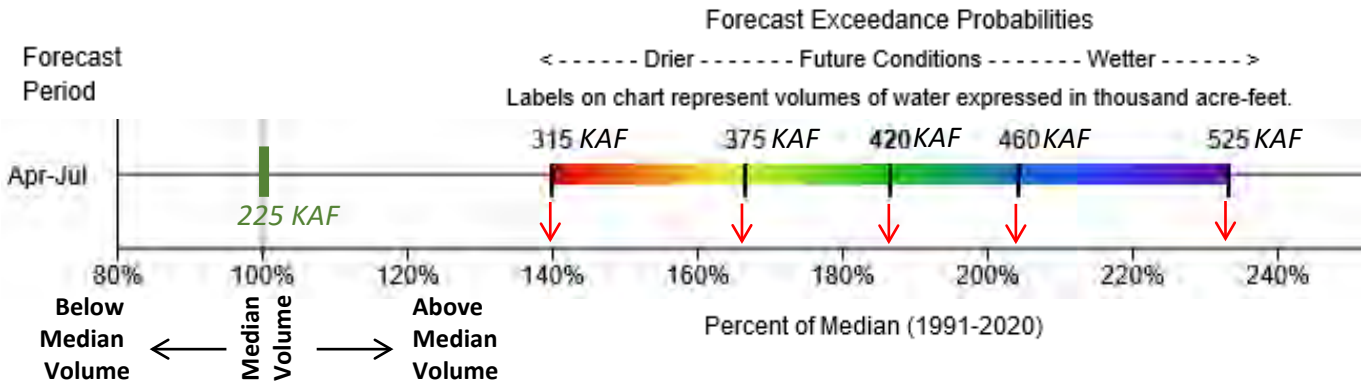
Provided by:
 NRCS NV

Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Median	30% (KAF)	10% (KAF)	30yr Median (KAF)
APR-JUL	315	375	420	187%	460	525	225

The Forecast Chart (below) provides an alternative to the tables (above) used in the basin summaries. The chart displays the forecast exceedance range as a colored bar. The vertical lines on the bar signify the five forecast exceedances.

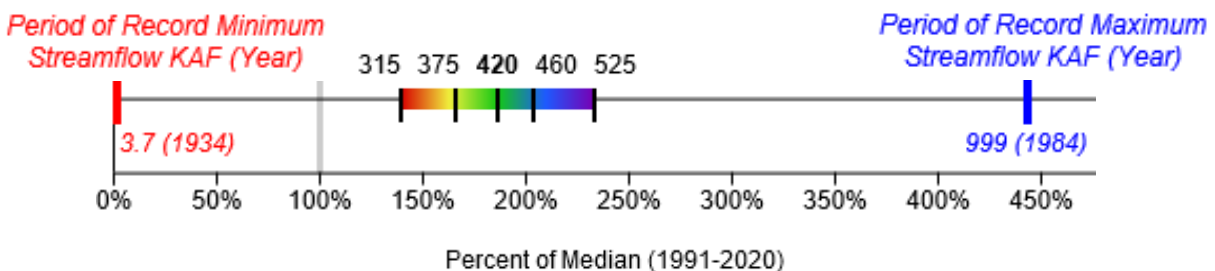


The numbers above the forecast bar are the five exceedance probability volumes in thousand acre-feet (KAF). Each exceedance forecast's percent of median can be estimated by looking at the horizontal axis. The green line and number centered above 100% on the horizontal axis represents the 1981-2010 historical median streamflow for the forecast period in KAF.



In the example above, the entire forecast bar is shifted right of the green bar indicating a forecast for above the median Apr-Jul streamflow of 225KAF. The 50% exceedance is represented by the black line in the green portion of the colored bar. This represents a forecast volume of 420KAF which is ~185% of median. If drier than normal future conditions occur the 70% exceedance forecast may be more likely (375KAF or ~165% of median). If future conditions turn wetter than normal, the 30% exceedance forecast may be more likely (460KAF or ~205% of median). Water users are encouraged to consider the range of forecast exceedances instead of relying solely only on the 50% forecast.

In very wet or dry years forecasts may approach historical records. In these cases the period of record minimum or maximum is displayed. The minimum is represented by a heavy red line, while the maximum is represented by a heavy blue line. The numbers below the red and blue lines represent the volume in KAF and the year it occurred in parentheses.

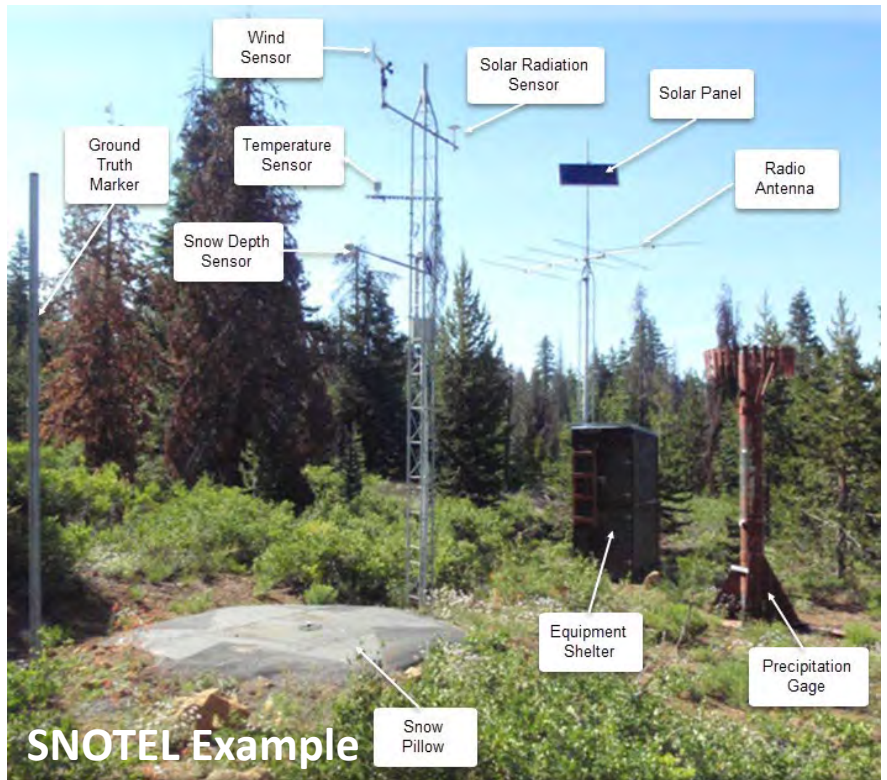


[Click here](#) for an online version which allows users to see averages instead of medians, as well as historic forecasts.

Appendix - SNOTEL and Snow Course Overview

SNOTEL

The NRCS operates an extensive, automated data collection network called SNOTEL (short for Snow Telemetry). SNOTEL sites are designed to operate unattended in remote mountain locations. Data are collected and transmitted hourly and available on the internet. Daily data (midnight values) are quality checked by NRCS hydrologists on at least a weekly basis. SNOTEL sites provide snowpack water content data via a pressure-sensing snow pillow. Other data include snow depth, water year precipitation accumulation, air temperature with daily maximums, minimums, and averages, soil moisture and soil temperature at depths of 2, 8 and 20 inches. The earliest NRCS SNOTEL sites have data back to 1981 or a bit earlier.



SNOTEL Example

Snow Course

Snow courses are measurement transects where snow tubes are used by snow surveyors during the winter season to determine the depth and water content of the snowpack. Hollow snow tubes are used to vertically core the snowpack. The tubes are then weighed to determine the water content of the snow. Generally, snow courses are situated in meadows or forest openings protected from the wind. A snow course measurement is the average of a number of sample points, typically 5 to 10. Snow courses are measured on a monthly basis typically between February 1 and April 1. Snow courses provide a longer record than SNOTEL. The earliest snow courses in the Lake Tahoe and Truckee basins have data back to 1910.



Snow Course Example

Provided by:
NRCS NV

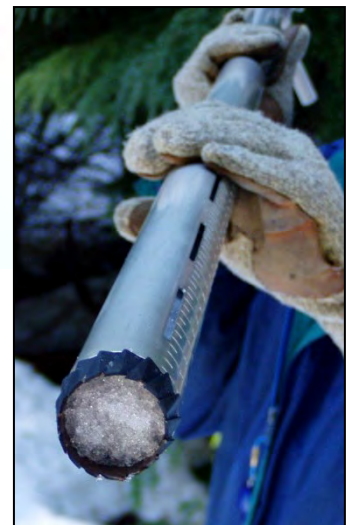
Snow Water Equivalent (SWE):

Sometimes also called snow water content, this is the amount of water contained within the snowpack. It can be thought of as the depth of water (in inches) that would result if you melted the snowpack. For example, if the snowpack was contained 12 inches of SWE, then when melted there would a puddle of water 12 inches deep on the ground.

SWE measurements made by snow pillows or snow tubes rely on the fact that water weighs the same whether it is liquid or frozen.



Weight of frozen water = Weight of liquid water



Snow core inside snow tubes

Issued by
Terry Cosby, Chief
Natural Resources Conservation Service
U.S. Department of Agriculture
Washington, D.C.



Released by
Carlos Suarez, State Conservationist
Natural Resources Conservation Service
U.S. Department of Agriculture
Davis, CA

For questions, please contact Ernesto De La Riva,
California NRCS State Conservation Engineer at
NRCS.CA.Engineering@usda.gov

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WATER SUPPLY INDEX, AND OTHER DATA BY
VISITING OUR WEB SITE:
<https://www.nrcs.usda.gov/resources/data-and-reports/california-snow-survey>



California Water Supply Outlook

