



Natural
Resources
Conservation
Service

Arizona

Basin Outlook Report

February 1, 2019



Issued by

Matt Lohr
Chief
Natural Resources Conservation Service
U.S. Department of Agriculture

Released by

Keisha L. Tatem
State Conservationist
Natural Resources Conservation Service
Phoenix, Arizona

Basin Outlook Reports And Federal – State – Private Cooperative Snow Surveys

How forecasts are made

Most of the annual streamflow in Arizona originates as snowfall that has accumulated in the mountains during the winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Measurements of snow water equivalent at selected manual snow courses and automated Snow Telemetry (SNOTEL) sites, along with precipitation and streamflow values, are used in statistical and simulation models to prepare runoff forecasts. These forecasts are coordinated between hydrologists in the Natural Resources Conservation Service (NRCS) the National Weather Service, and the Salt River Project.

Forecasts of any kind are not perfect. Streamflow forecast uncertainty arises from three primary sources: (1) uncertainty of future weather conditions, (2) uncertainty in the forecasting procedure, and (3) errors in the data. The forecast, therefore, must be interpreted not as a single value but rather as a range of values with specific probabilities of occurrence. The middle of the range is expressed by the 50% exceedance probability forecast, for which there is a 50% chance that the actual flow will be above, and a 50% chance that the actual flow will be below, this value. To describe the expected range around this 50% value, four other forecasts are provided, two smaller values (90% and 70% exceedance probability) and two larger values (30%, and 10% exceedance probability). For example, there is a 90% chance that the actual flow will be more than the 90% exceedance probability forecast.

The wider the spread among these values, the more uncertain the forecast. As the season progresses, forecasts become more accurate, primarily because a greater portion of the future weather conditions become known. This is reflected by a narrowing of the range around the 50% exceedance probability forecast. Users should take this uncertainty into consideration when making operational decisions by selecting forecasts corresponding to the level of risk they are willing to assume about the amount of water to be expected. If users anticipate receiving a lesser supply of water, or are concerned about having an adequate water supply, they may want to base their decisions on the 90% or 70% exceedance probability forecasts. On the other hand, if users anticipate receiving too much water, or are concerned about the threat of flooding, they may want to base their decisions on the 30% or 10% exceedance probability forecasts. Regardless of the forecast value users choose, they should be prepared to deal with either more or less water.



For more water supply and resource management information, contact:

Travis Kolling
Water Supply Specialist
230 N. First Ave., Suite 509
Phoenix, AZ 85003-1706
Phone: (602) 280-8834
Email: travis.kolling@az.usda.gov

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ARIZONA Basin Outlook Report as of February 1, 2019

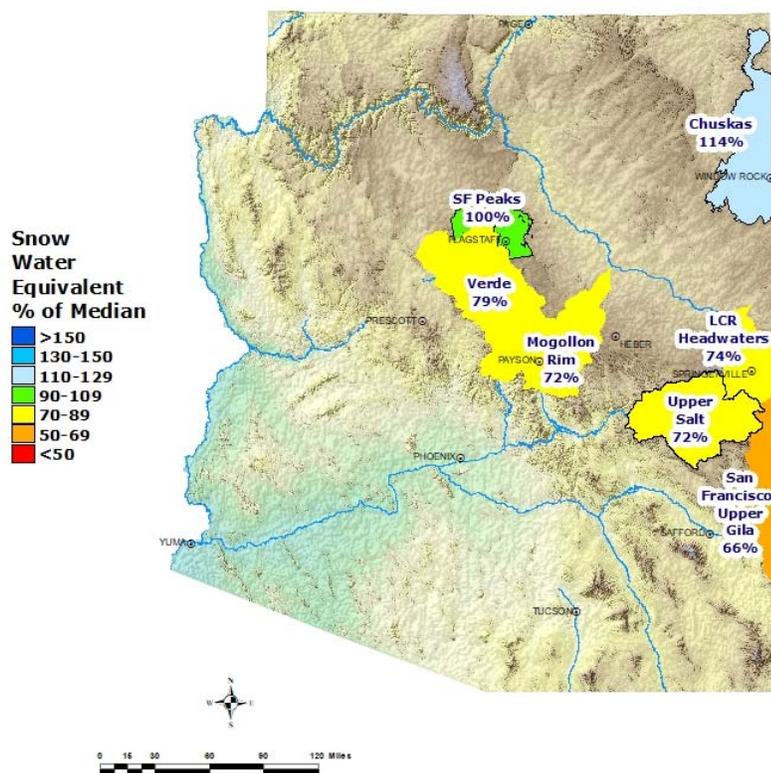
SUMMARY

As of February 1, snowpack levels are below normal to well below normal throughout the major basins of the state. Precipitation for the month of January ranged from below normal to normal in the major river basins. The Salt and Verde River reservoir system stands at 48 percent of capacity, while San Carlos Reservoir is at 4 percent of capacity. The forecast calls for well below normal to normal runoff in all basins for the spring runoff period.

SNOWPACK

Snow water equivalent levels in the state's major river basins are well below normal to normal, ranging from 79 percent of median in the Verde River Basin to 66 percent of median in the Upper Gila River Basin. The statewide snowpack is below normal at 85 percent of median.

**Arizona
Snow Water Equivalent
as of February 1, 2019**

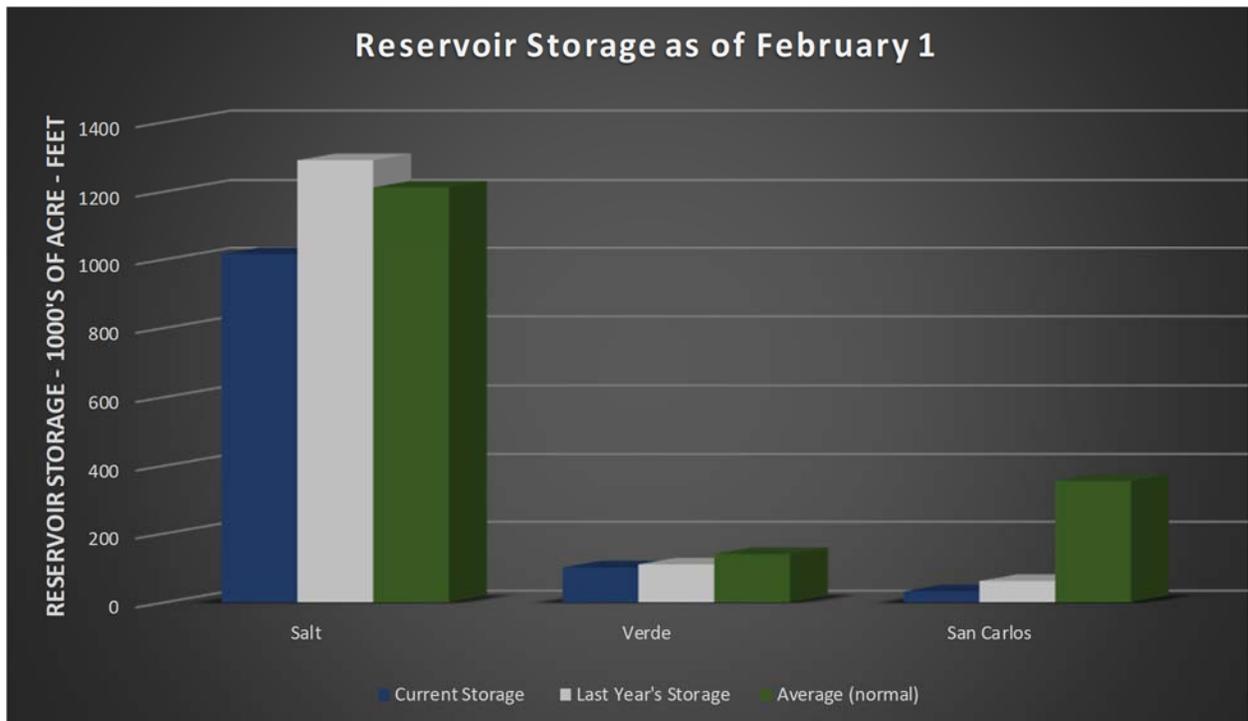


PRECIPITATION

Mountain data from NRCS SNOTEL sites and NWS Cooperator gages show that precipitation for January was below average to average in the major river basins. Cumulative precipitation since October 1 is below normal to normal throughout the basins. Please refer to the precipitation bar graphs found in this report for more information on precipitation levels in the basins.

RESERVOIR STORAGE

As of February 1, the Salt and Verde River reservoir system stands at 48 percent of capacity. San Carlos Reservoir is currently at 4 percent of capacity.



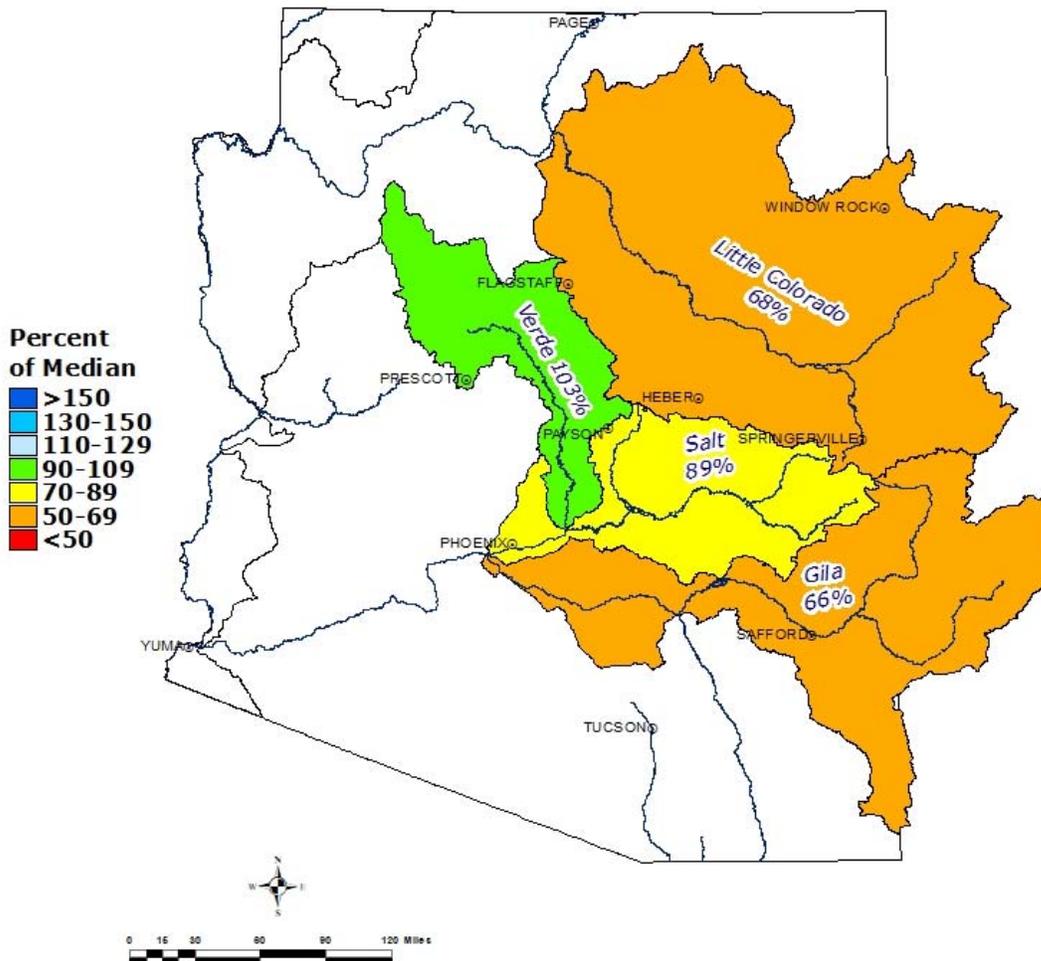
Key storage volumes displayed in thousands of acre-feet (x1000):

<u>Reservoir</u>	<u>Current Storage</u>	<u>Last Year Storage</u>	<u>30-Year Average</u>	<u>Storage Capacity</u>
Salt River System	1015.7	1291.0	1181.0	2025.8
Verde River System	101.0	110.2	135.7	287.4
San Carlos Reservoir	31.8	62.0	324.9	875.0
Lyman Lake	3.7	11.0	11.8	30.0
Lake Havasu	553.4	539.3	562.7	619.0
Lake Mohave	1668.4	1640.7	1602.0	1810.0
Lake Mead	10495.0	10642.0	20297.0	26159.0
Lake Powell	9612.0	13688.2	17745.0	24322.0

STREAMFLOW

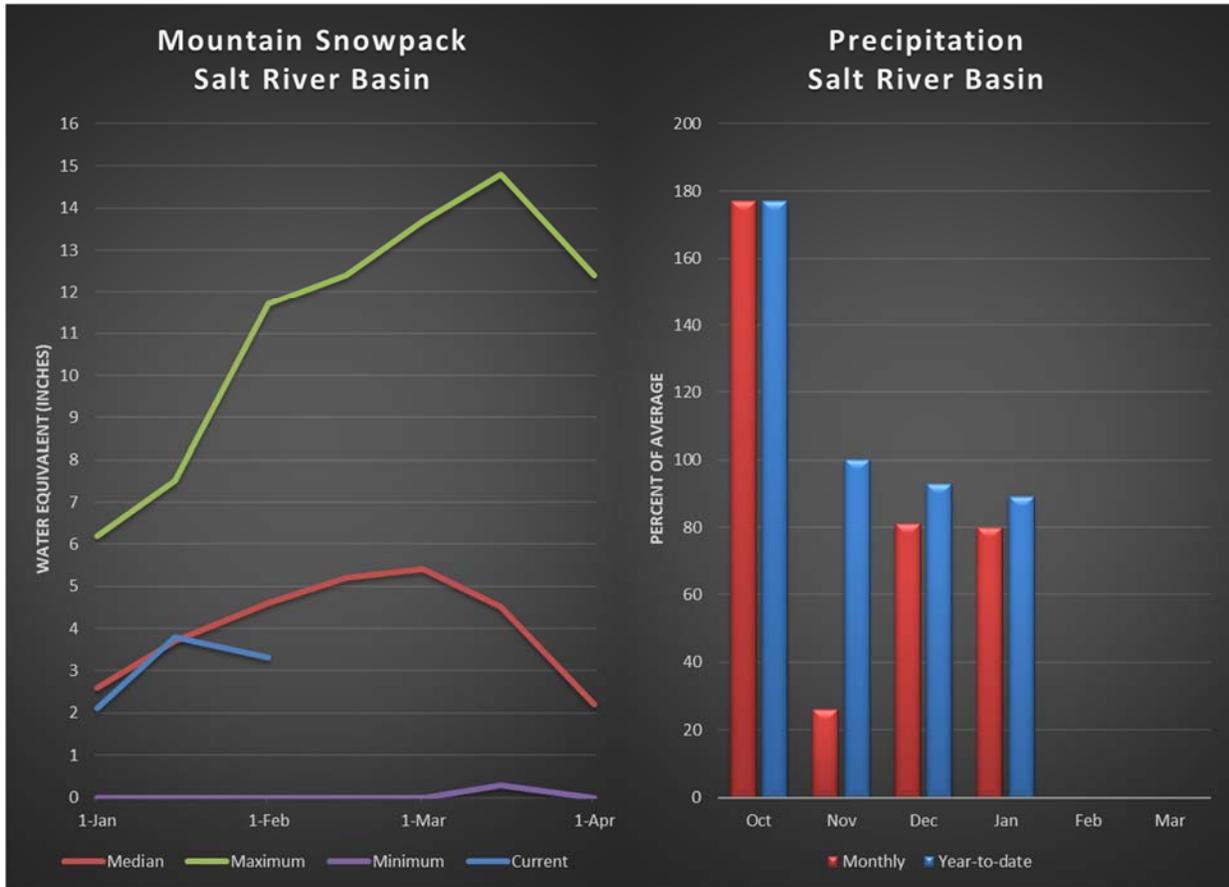
As of February 1, the forecast calls for well below normal to normal streamflow for the spring runoff period, ranging from 66 percent of median in the Gila River near Solomon to 103 percent of median in the Verde River above Horseshoe Dam. Streamflow forecasts are down slightly from the last report, mainly due to warmer temperatures diminishing lower elevation snowpack and lack of precipitation during the latter part of January. Please refer to the basin forecast tables found in this report for more information regarding water supply forecasts.

Arizona Spring Streamflow Forecasts as of February 1, 2019



SALT RIVER BASIN as of February 1, 2019

Slightly below normal streamflow levels are forecast for the basin. In the Salt River, near Roosevelt, the forecast calls for 89% of median streamflow through May, while at Tonto Creek, the forecast calls for 97% of median streamflow through May. Snow survey measurements show the Salt snowpack to be at 72% of median.



Salt River Basin Streamflow Forecasts - February 1, 2019

SALT RIVER BASIN	Forecast Period	Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast					30yr Avg (KAF)
		90% (KAF)	70% (KAF)	50% (KAF)	% Avg	10% (KAF)	
Salt R nr Roosevelt ³							
	FEB			35	90%		39
	FEB-MAY	124	194	255	89%	325	285
	MAR-MAY	111	175	205	85%	295	240
Tonto Ck ab Gun Ck nr Roosevelt ³							
	FEB			9.7	94%		10.3
	FEB-MAY	8	21	34	97%	52	35

1) 90% and 10% exceedance probabilities are actually 95% and 5%

2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions

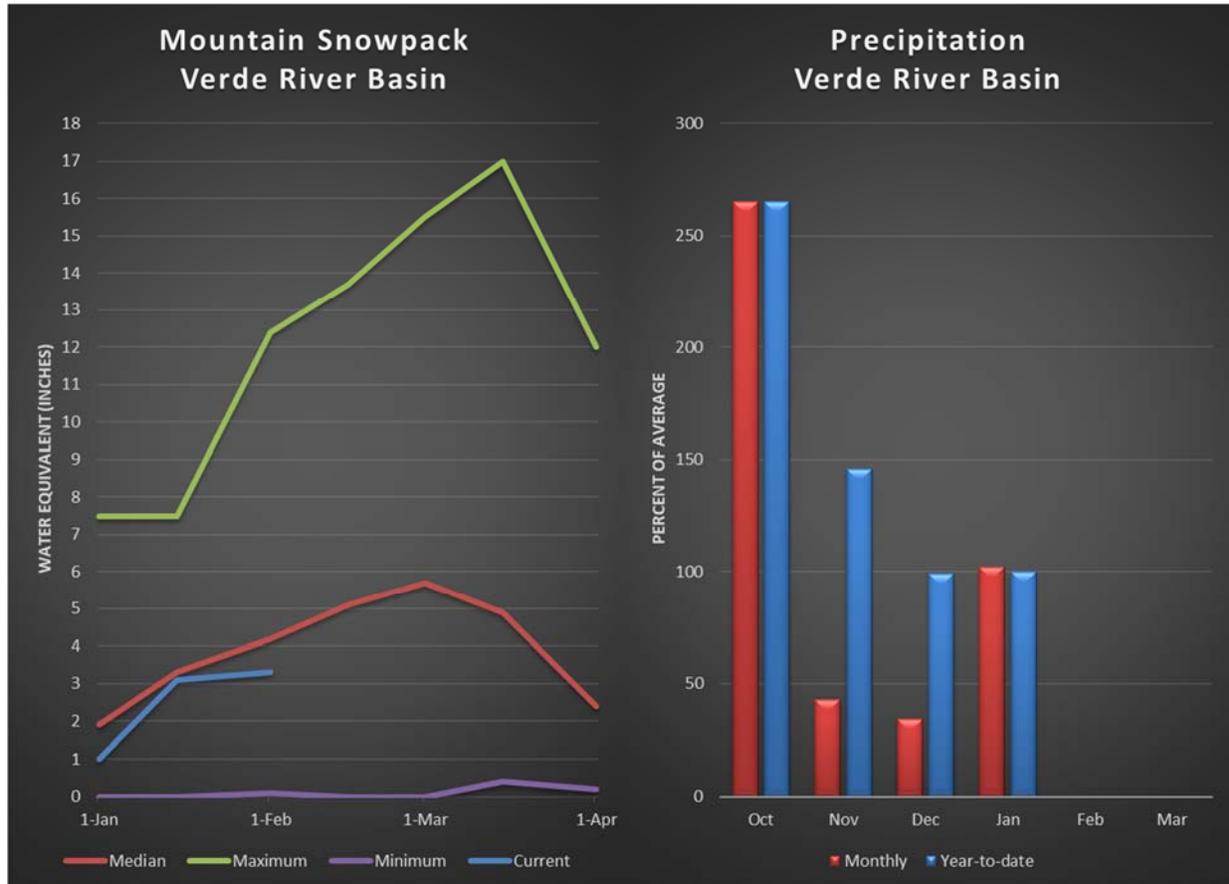
3) Median value used in place of average

Reservoir Storage End of January, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Salt River Reservoir System	1015.7	1291.0	1240.0	2025.8
Basin-wide Total	1015.7	1291.0	1240.0	2025.8
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 1, 2019	# of Sites	% Median	Last Year % Median
SALT RIVER BASIN	9	72%	16%

VERDE RIVER BASIN as of February 1, 2019

Normal streamflow levels are forecast for the basin. In the Verde River above Horseshoe Dam, the forecast calls for 103% of median streamflow through May. Snow survey measurements show the Verde snowpack to be at 79% of median.



Verde River Basin Streamflow Forecasts - February 1, 2019

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

VERDE RIVER BASIN	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Verde R bl Tangle Ck ab Horseshoe Dam ³	FEB			34	97%			35
	FEB-MAY	52	98	140	103%	194	295	136

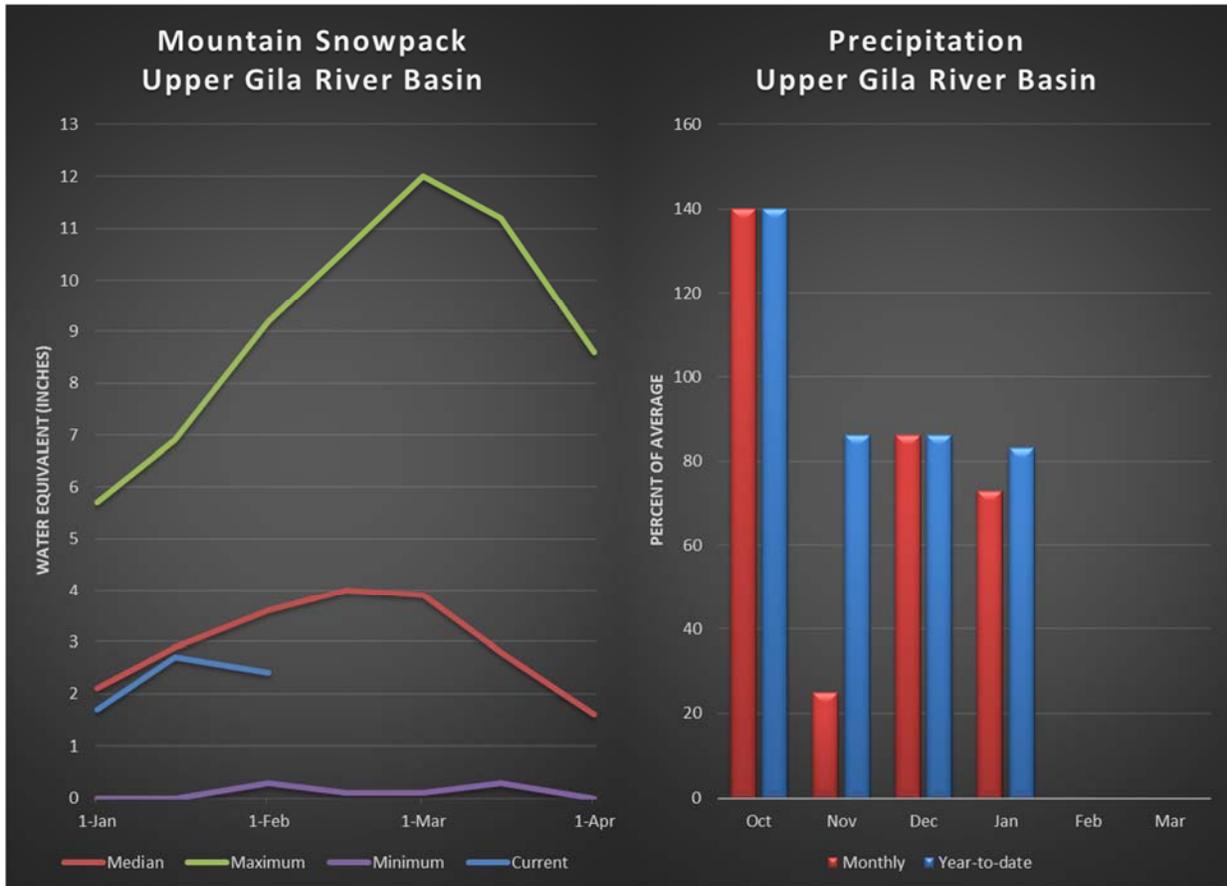
- 1) 90% and 10% exceedance probabilities are actually 95% and 5%
- 2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
- 3) Median value used in place of average

Reservoir Storage End of January, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Verde River Reservoir System	101.0	110.2	154.4	287.4
Basin-wide Total	101.0	110.2	154.4	287.4
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 1, 2019	# of Sites	% Median	Last Year % Median
VERDE RIVER BASIN	12	79%	16%

SAN FRANCISCO-UPPER GILA RIVER BASIN as of February 1, 2019

Well below normal streamflow levels are forecast for the basin. In the San Francisco River, at Clifton, the forecast calls for 65% of median streamflow levels through May. In the Gila River, near Solomon, the forecast calls for 66% of median streamflow levels through May. At San Carlos Reservoir, inflow to the lake is forecast at 58% of median through May. Snow survey measurements show the snowpack for this basin to be at 66% of median.



San Francisco-Upper Gila River Basin Streamflow Forecasts - February 1, 2019

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

SAN FRANCISCO-UPPER GILA RIVER BASIN	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Gila R at Gila ³	FEB-MAY	13.3	23	32	64%	43	63	50
Gila R bl Blue Ck nr Virden ³	FEB-MAY	9.2	25	41	65%	60	95	63
San Francisco R at Glenwood ³	FEB-MAY	3.4	7.7	12	66%	17.7	29	18.2
San Francisco R at Clifton ³	FEB-MAY	7.3	20	33	65%	49	77	51
Gila R nr Solomon ³	FEB			17.3	75%			23
San Carlos Reservoir Inflow ³	FEB-MAY	19.7	51	81	66%	118	184	123
	FEB-MAY	5.5	23	47	58%	83	162	81

1) 90% and 10% exceedance probabilities are actually 95% and 5%

2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions

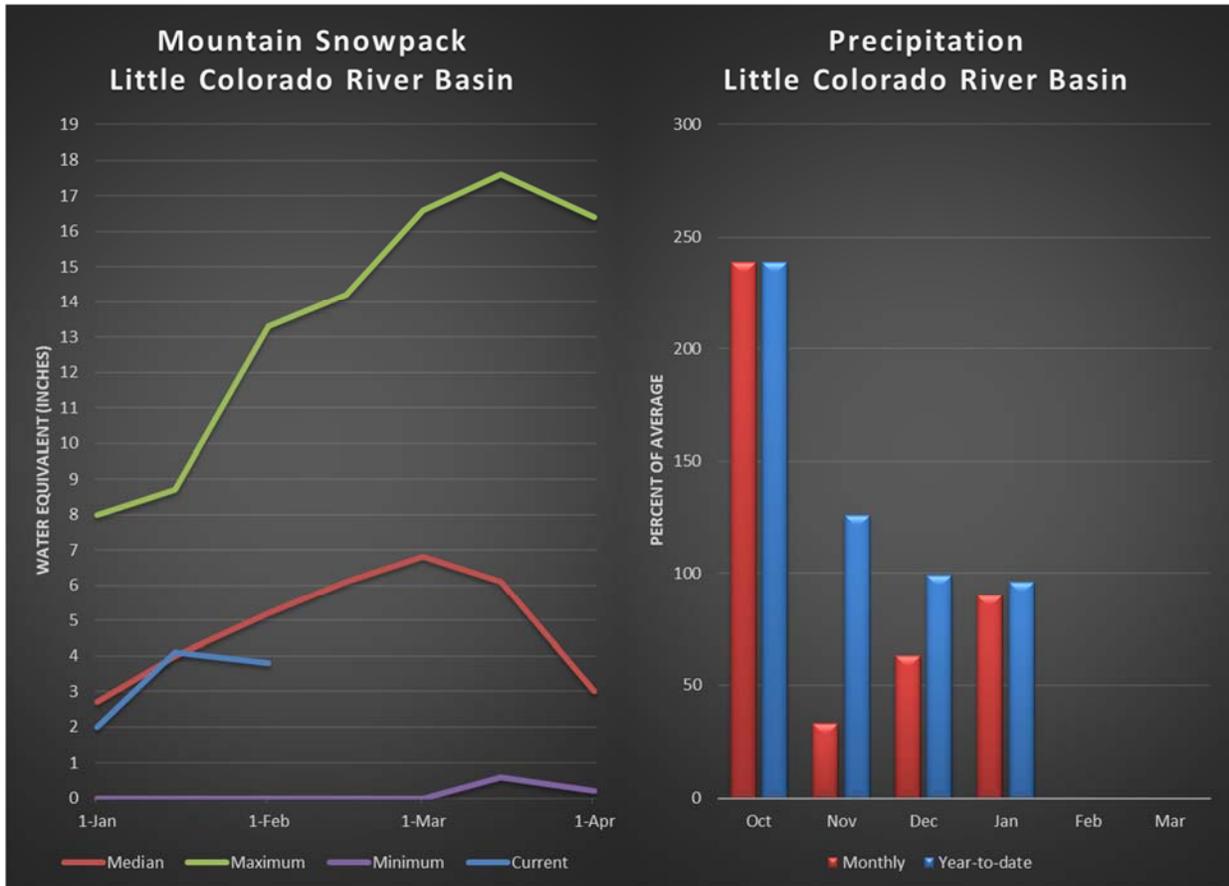
3) Median value used in place of average

Reservoir Storage End of January, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
San Carlos Reservoir	31.8	62.1	366.8	875.0
Basin-wide Total	31.8	62.1	366.8	875.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 1, 2019	# of Sites	% Median	Last Year % Median
SAN FRANCISCO-UPPER GILA RIVER BASIN	7	66%	11%

LITTLE COLORADO RIVER BASIN as of February 1, 2019

Well below normal streamflow levels are forecast for the basin. In the Little Colorado River, above Lyman Lake, the forecast calls for 68% of median streamflow through June. At Blue Ridge (C.C. Cragin) Reservoir, inflow to the lake is forecast at 65% of median through May. Snowpacks along the southern headwaters of the Little Colorado River, and along the central Mogollon Rim, were measured at 74% and 72% of median, respectively.



Little Colorado River Basin Streamflow Forecasts - February 1, 2019

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

LITTLE COLORADO RIVER BASIN	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Little Colorado R ab Lyman Lake ³	FEB-JUN	1.86	3.2	4.5	68%	6	8.9	6.6
Rio Nutria nr Ramah ³	FEB-MAY	0.1	0.51	1.1	79%	2	4.1	1.4
Zuni R ab Black Rock Reservoir ³	FEB-MAY	0	0.03	0.3	79%	1.04	3.5	0.38
Blue Ridge Reservoir Inflow ³	FEB-MAY	2.6	6.5	10.6	65%	16.1	27	16.3
Lake Mary Reservoir Inflow ³	FEB-MAY	1.06	2.1	3	70%	4.2	6.5	4.3

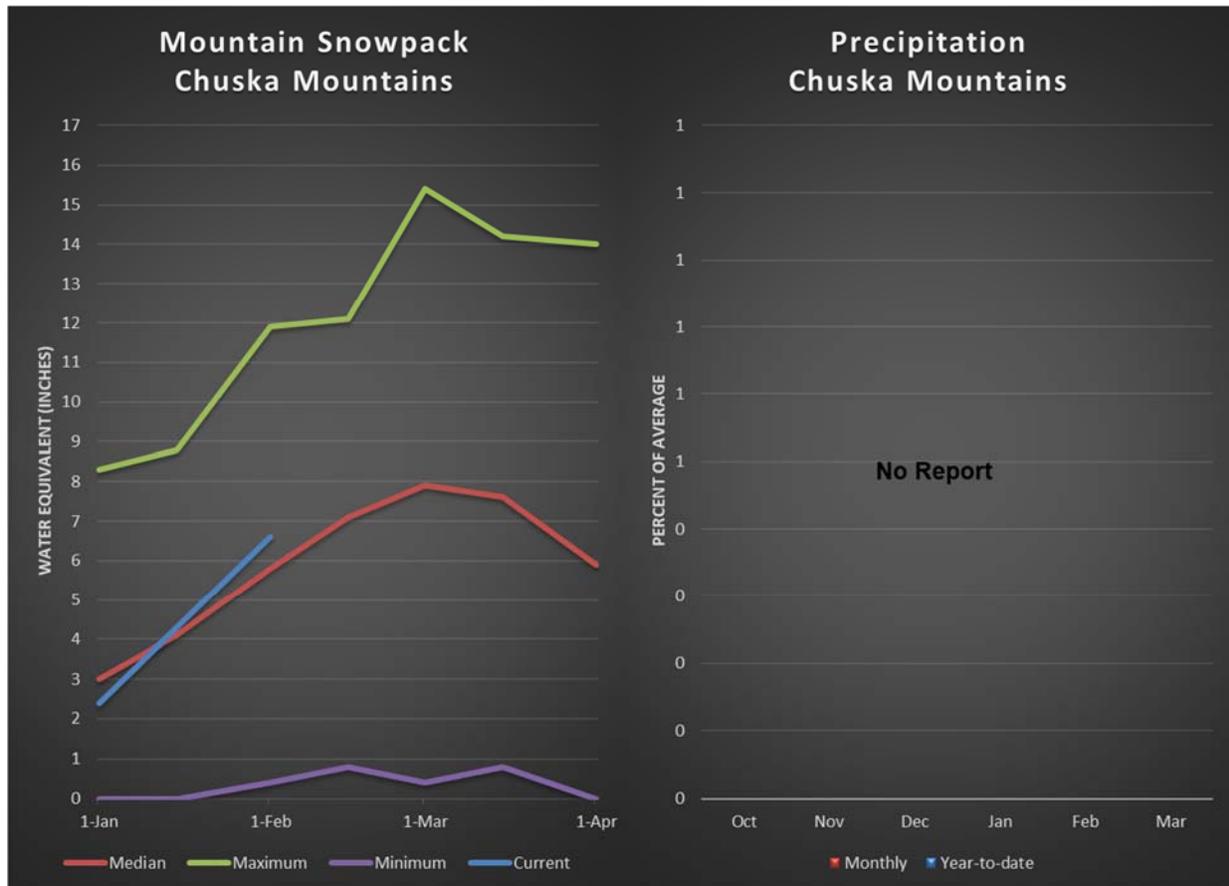
- 1) 90% and 10% exceedance probabilities are actually 95% and 5%
- 2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
- 3) Median value used in place of average

Reservoir Storage End of January, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lyman Reservoir	3.7	11.0	12.3	30.0
Basin-wide Total	3.7	11.0	12.3	30.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 1, 2019	# of Sites	% Median	Last Year % Median
LITTLE COLORADO RIVER BASIN	10	74%	21%
CENTRAL MOGOLLON RIM	4	72%	20%

CHUSKA MOUNTAINS as of February 1, 2019

Snow survey measurements conducted by staff of the Navajo Nation Water Management Branch show the Chuska snowpack to be at 114% of median. The forecast calls for well below normal runoff for Wheatfields Creek, Captain Tom Wash, and Bowl Canyon Creek.



Chuska Mountains Streamflow Forecasts - February 1, 2019

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

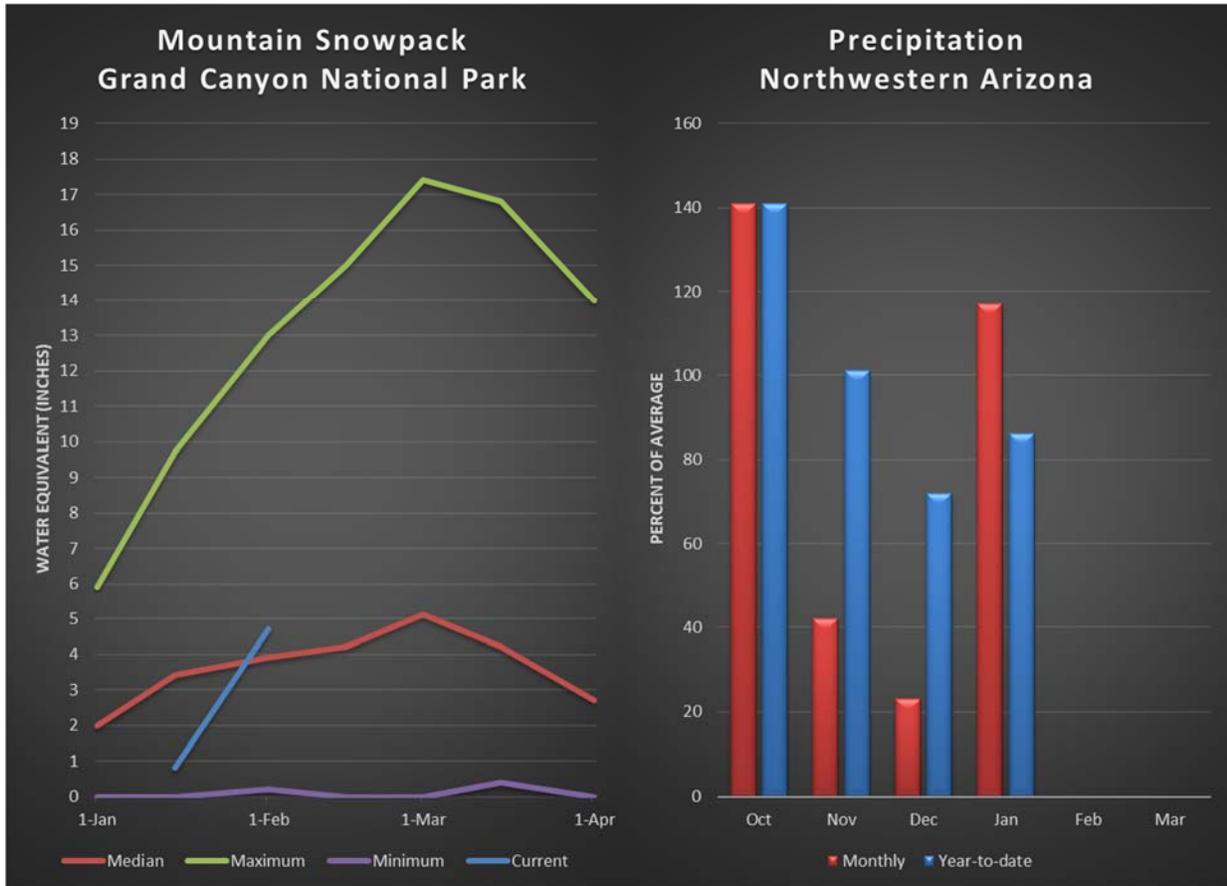
CHUSKA MOUNTAINS	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Captain Tom Wash nr Two Gray Hills	MAR-MAY	0.05	0.38	0.91	35%	1.8	4	2.6
Wheatfields Ck nr Wheatfields	MAR-MAY	0.12	0.45	0.8	38%	1.25	2.1	2.1
Bowl Canyon Ck ab Asaayi Lake	MAR-MAY	0.08	0.3	0.52	40%	0.8	1.32	1.3

- 1) 90% and 10% exceedance probabilities are actually 95% and 5%
- 2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
- 3) Median value used in place of average

Watershed Snowpack Analysis February 1, 2019	# of Sites	% Median	Last Year % Median
CHUSKA MOUNTAINS	6	114%	19%
DEFIANCE PLATEAU	1	158%	35%

NORTHWESTERN ARIZONA as of February 1, 2019

On the Colorado River, below normal inflow to Lake Powell is forecast at 87% of the 30-year average for the forecast period April-July. At the Grand Canyon, measurements conducted by park rangers show the snowpack to be at 120% of median.



Northwestern Arizona Streamflow Forecasts - February 1, 2019

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

NORTHWESTERN ARIZONA	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Virgin R at Littlefield	APR-JUL	7.2	35	58	89%	81	116	65
Lake Powell Inflow ²	APR-JUL			6200	87%	7510		7160

- 1) 90% and 10% exceedance probabilities are actually 95% and 5%
- 2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
- 3) Median value used in place of average

Reservoir Storage End of January, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lake Havasu	555.8	541.4	556.4	619.0
Lake Mohave	1666.0	1638.0	1676.0	1810.0
Lake Mead	10495.0	10642.0	20452.0	26159.0
Lake Powell	9629.2	13672.3	17338.0	24322.0
Basin-wide Total	22346.0	26493.7	40022.4	52910.0
# of reservoirs	4	4	4	4

Watershed Snowpack Analysis February 1, 2019	# of Sites	% Median	Last Year % Median
NORTHWESTERN ARIZONA	1	120%	0%

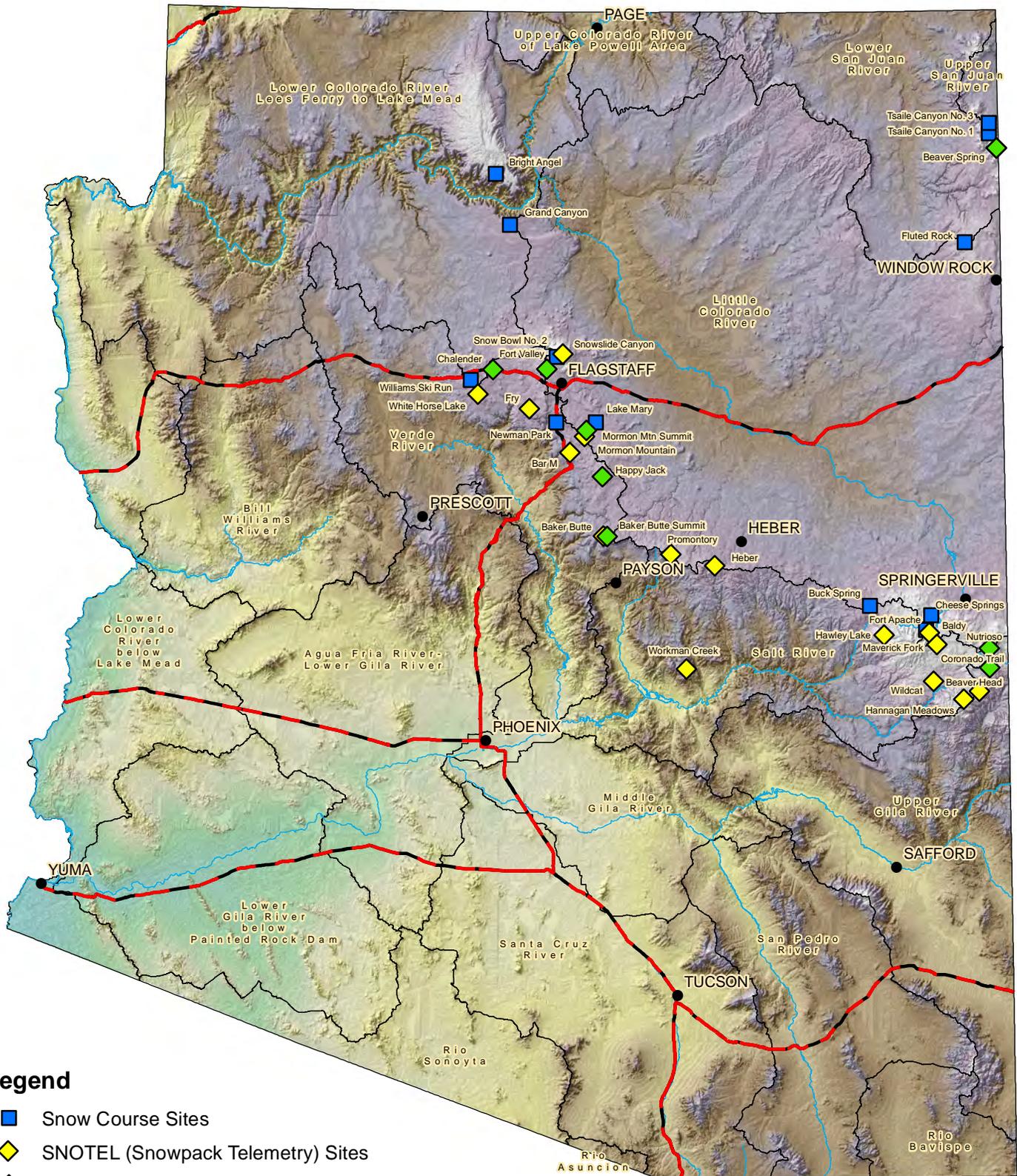
Basinwide Summary: February 1, 2019
(Averages/Medians based on 1981-2010 reference period)

Snowpack Summary for February 1, 2019

SALT RIVER BASIN		Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baldy	SNOTEL	9125	20	5.8	6.4	91%	2.1	33%	
Beaver Head	SNOTEL	7990	6	2.1	3.4	62%	0.0	0%	
Buck Spring	SC	7400	2	0.8	2.0	40%	0.0	0%	
Coronado Trail	SNOTEL	8400	6	2.6	3.2	81%	0.0	0%	
Hawley Lake	SNOTEL	8300	28	8.4			2.2		
Coronado Trail	SC	8350			2.0		0.0	0%	
Fort Apache	SC	9160	23	5.9	6.8	87%	1.9	28%	
Hannagan Meadows	SNOTEL	9020	24	7.0	8.3	84%	2.0	24%	
Maverick Fork	SNOTEL	9200	20	5.2	6.8	76%	1.2	18%	
Nutriosio	SC	8500			1.2		0.0	0%	
Nutriosio	SNOTEL	8500	0	0.0			0.0		
Wildcat	SNOTEL	7850	6	2.4	3.0	80%	0.0	0%	
Workman Creek	SNOTEL	6900	1	0.1	4.5	2%	0.0	0%	
Basin Index						72%		16%	
# of sites						9		9	
VERDE RIVER BASIN		Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	6	2.4	4.3	56%	0.7	16%	
Baker Butte No. 2	SC	7700	17	4.0	6.9	58%	1.0	14%	
Baker Butte Smt	SNOTEL	7700	21	5.8			1.8		
Bar M	SNOTEL	6393	0	0.0			0.0		
Chalender	SC	7100	3	0.6	1.8	33%	0.0	0%	
Chalender	SNOTEL	7100	6	3.1			0.0		
Fort Valley	SC	7350	3	0.9	1.8	50%	0.0	0%	
Fort Valley	SNOTEL	7350	1	0.3			0.0		
Fry	SNOTEL	7200	16	5.0	5.0	100%	1.7	34%	
Happy Jack	SNOTEL	7630	12	4.1	3.8	108%	0.8	21%	
Happy Jack	SC	7630	7	2.2	3.2	69%	0.0	0%	
Mormon Mountain	SNOTEL	7500	5	2.6	4.0	65%	0.9	23%	
Mormon Mountain Summit #2	SC	8470	23	6.8	7.7	88%	1.4	18%	
Mormon Mtn Summit	SNOTEL	8500	16	4.8			1.4		
Newman Park	SC	6750	0	0.0	2.0	0%	0.0	0%	
White Horse Lake	SNOTEL	7180	5	2.3	3.4	68%	0.0	0%	
Williams Ski Run	SC	7720	21	8.3	5.6	148%	1.3	23%	
Basin Index						79%		16%	
# of sites						12		12	
SAN FRANCISCO PEAKS		Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Snow Bowl #2	SC	11200	32	10.2	11.6	88%	2.4	21%	
Snowslide Canyon	SNOTEL	9730	31	11.4	10.0	114%	2.7	27%	
Basin Index						100%		24%	
# of sites						2		2	
SAN FRANCISCO-UPPER GILA RIVER BASIN		Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Beaver Head	SNOTEL	7990	6	2.1	3.4	62%	0.0	0%	
Coronado Trail	SNOTEL	8400	6	2.6	3.2	81%	0.0	0%	
Coronado Trail	SC	8350			2.0		0.0	0%	
Frisco Divide	SNOTEL	8000	5	2.0	2.5	80%	0.0	0%	
Hannagan Meadows	SNOTEL	9020	24	7.0	8.3	84%	2.0	24%	
Hummingbird - Aerial And Snow Course	SC	10550			8.9				

Lookout Mountain	SNOTEL	8500	1	0.2	2.3	9%	0.0	0%
Nutriosio	SC	8500			1.2		0.0	0%
Nutriosio	SNOTEL	8500	0	0.0			0.0	
Signal Peak	SNOTEL	8360	0	0.0	3.9	0%	0.0	0%
Silver Creek Divide	SNOTEL	9000	20	5.8	6.1	95%	1.4	23%
State Line	SC	8000			1.8		0.0	0%
Whitewater - Aerial And Snow Course	SC	10750			17.8			
Basin Index						66%		11%
# of sites						7		7
LITTLE COLORADO RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	6	2.4	4.3	56%	0.7	16%
Baker Butte No. 2	SC	7700	17	4.0	6.9	58%	1.0	14%
Baker Butte Smt	SNOTEL	7700	21	5.8			1.8	
Baldy	SNOTEL	9125	20	5.8	6.4	91%	2.1	33%
Buck Spring	SC	7400	2	0.8	2.0	40%	0.0	0%
Cheese Springs	SC	8700	17	4.3	4.2	102%	1.0	24%
Fort Apache	SC	9160	23	5.9	6.8	87%	1.9	28%
Heber	SNOTEL	7640	12	4.0	4.6	87%	1.1	24%
Lake Mary	SC	6930	0	0.0	3.0	0%	0.0	0%
Maverick Fork	SNOTEL	9200	20	5.2	6.8	76%	1.2	18%
Promontory	SNOTEL	7930	20	6.2	7.2	86%	1.9	26%
Basin Index						74%		21%
# of sites						10		10
CENTRAL MOGOLLON RIM	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	6	2.4	4.3	56%	0.7	16%
Baker Butte No. 2	SC	7700	17	4.0	6.9	58%	1.0	14%
Baker Butte Smt	SNOTEL	7700	21	5.8			1.8	
Heber	SNOTEL	7640	12	4.0	4.6	87%	1.1	24%
Promontory	SNOTEL	7930	20	6.2	7.2	86%	1.9	26%
Basin Index						72%		20%
# of sites						4		4
CHUSKA MOUNTAINS	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Beaver Spring	SC	9220	24	6.7	7.7	87%	1.4	18%
Beaver Spring	SNOTEL	9200	25	6.9			1.3	
Bowl Canyon	SC	8980	26	7.0	5.8	121%	1.2	21%
Hidden Valley	SC	8480	23	6.1			1.0	
Missionary Spring	SC	7940	16	4.6	3.6	128%	0.0	0%
Tsaile Canyon #1	SC	8160	22	5.9	4.8	123%	1.2	25%
Tsaile Canyon #3	SC	8920	27	7.1	6.3	113%	1.2	19%
Whiskey Creek	SC	9050	27	7.9	6.3	125%	1.4	22%
Navajo Whiskey Ck	SNOTEL	9050	26	7.9			0.0	
Basin Index						114%		19%
# of sites						6		6
DEFIANCE PLATEAU	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Fluted Rock	SC	7800	17	4.1	2.6	158%	0.9	35%
Basin Index						158%		35%
NORTHWESTERN ARIZONA	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Bright Angel	SC	8400	24	6.5	5.4	120%	0.0	0%
Grand Canyon	SC	7500			2.3		0.0	0%
Basin Index						120%		0%

Arizona Snow Survey Data Sites



Legend

- Snow Course Sites
- ◆ SNOTEL (Snowpack Telemetry) Sites
- ◆ SNOTEL and Snow Course Sites
- Basin Boundaries

