United States Department of Agriculture

Natural Resources Conservation Service

Arizona Basin Outlook Report March 1, 2018

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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.

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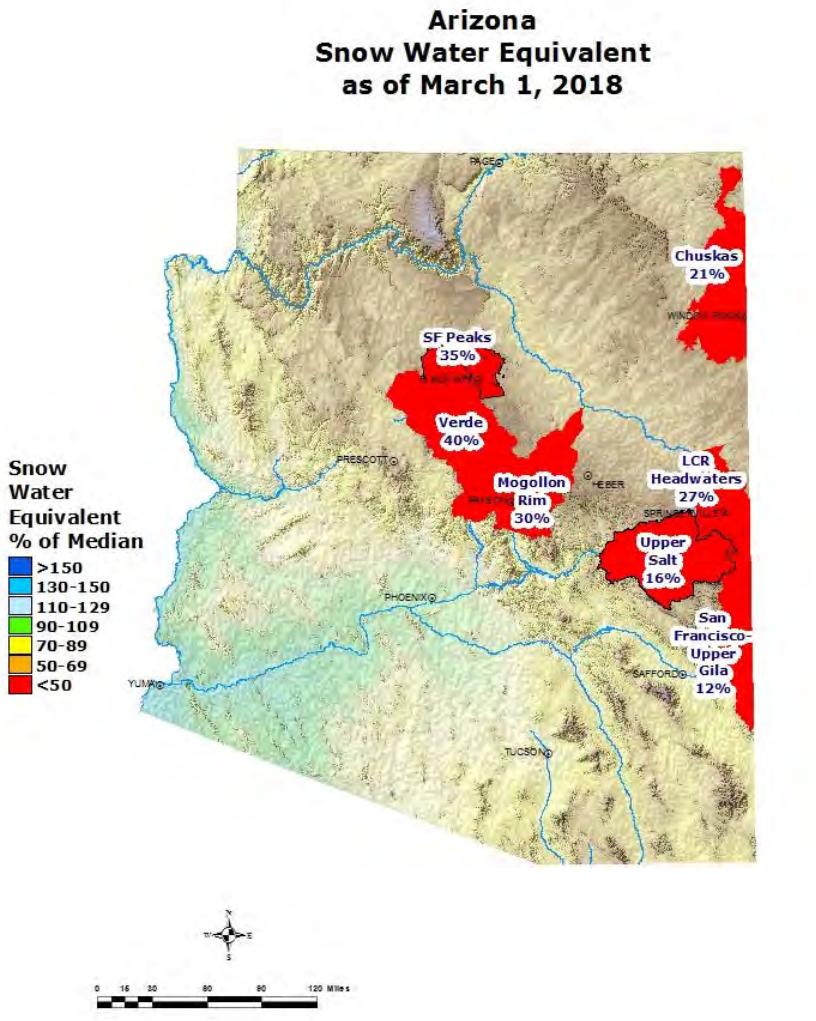
ARIZONA Basin Outlook Report
as of March 1, 2018

SUMMARY

As of March 1, snowpack levels are well below normal throughout the major basins of the state. Precipitation for the month of February ranged from below normal to well above normal in the major river basins. The Salt and Verde River reservoir system stands at 60 percent of capacity, while San Carlos Reservoir is at 7 percent of capacity. The forecast calls for well below 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, ranging from 40 percent of median in the Verde River Basin to 12 percent of median in the Upper Gila River Basin. The statewide snowpack is well below normal at 28 percent of median.

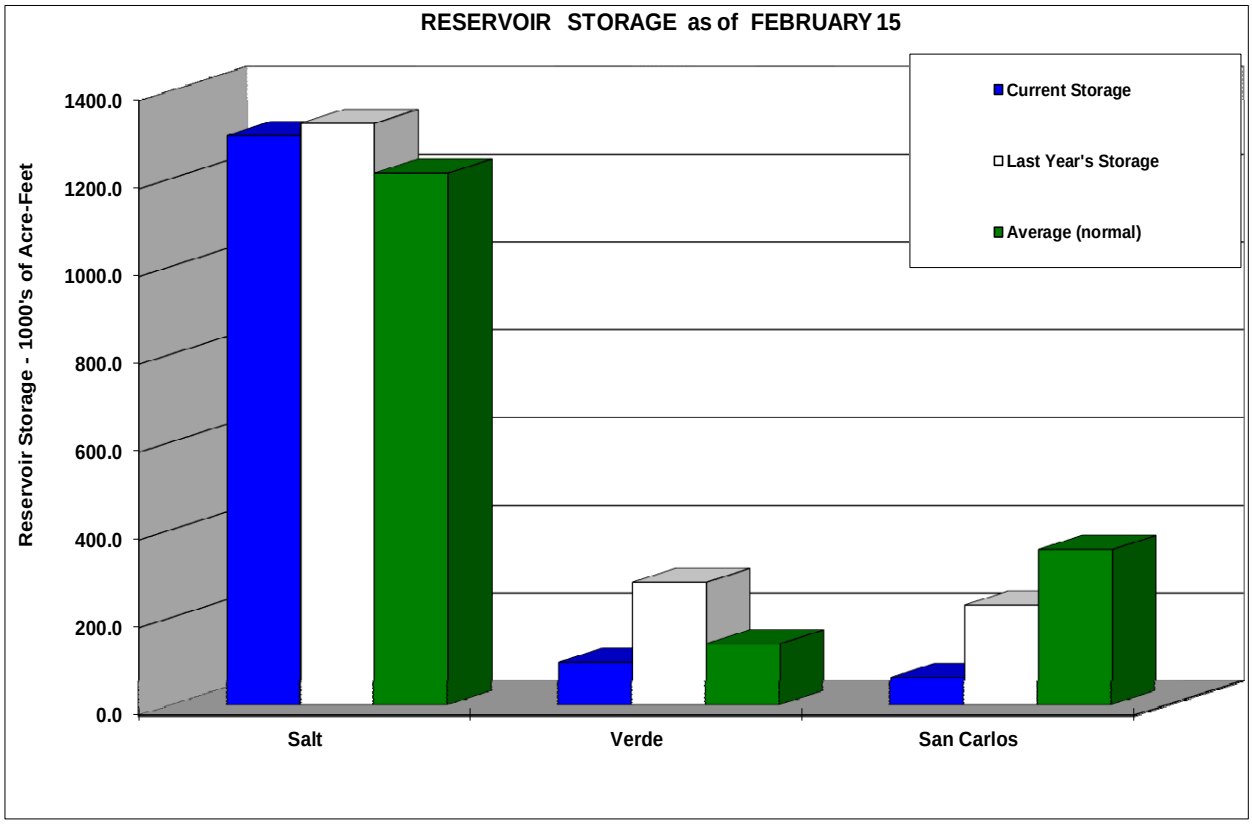


PRECIPITATION

Mountain data from NRCS SNOTEL sites and NWS Cooperator gages show that precipitation for February was below average to well above average in the major river basins. Cumulative precipitation since October 1 is well below 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 March 1, the Salt and Verde River reservoir system stands at 60 percent of capacity. San Carlos Reservoir is currently at 7 percent of capacity.

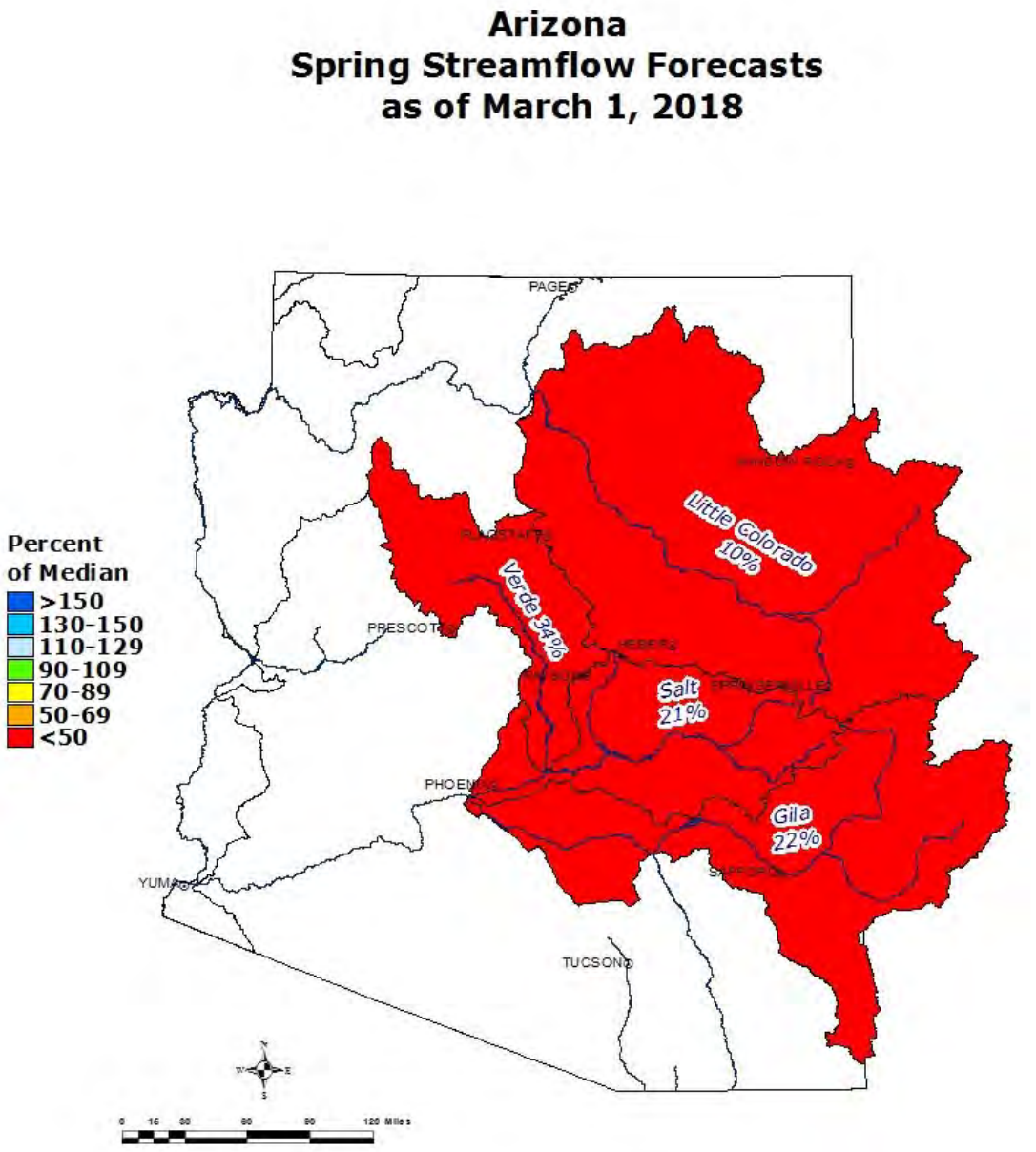


Key storage volumes displayed in thousands of acre-feet (x1000):

Reservoir	Current Storage	Last Year Storage	30-Year Average	Storage Capacity
Salt River System	1297.4	1325.3	1181.0	2025.8
Verde River System	98.0	280.1	135.7	287.4
San Carlos Reservoir	63.4	227.9	324.9	875.0
Lyman Lake	11.1	10.5	11.8	30.0
Lake Havasu	590.0	587.8	562.7	619.0
Lake Mohave	1703.6	1688.0	1602.0	1810.0
Lake Mead	10697.0	10826.0	20297.0	26159.0
Lake Powell	13335.0	11212.4	17745.0	24322.0

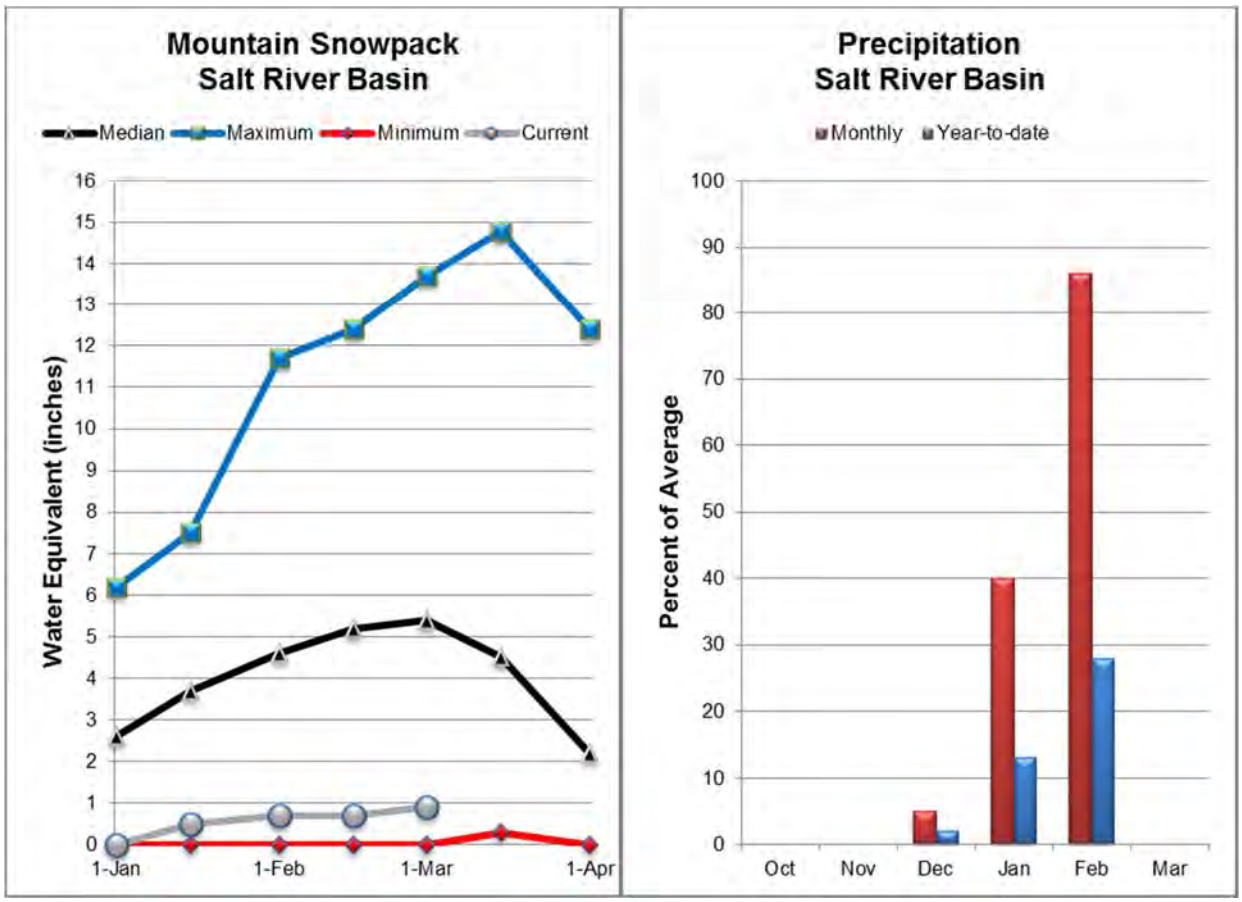
STREAMFLOW

As of March 1, the forecast calls for well below normal streamflow for the spring runoff period, ranging from 10 percent of median in the Little Colorado River above Lyman Lake to 34 percent of median in the Verde River above Horseshoe Dam. Total precipitation since the beginning of the water year has been well below average, leaving dry soils, and producing less than ideal conditions for runoff. Please refer to the basin forecast tables found in this report for more information regarding water supply forecasts.



SALT RIVER BASIN as of March 1, 2018

Well below normal streamflow levels are forecast for the basin. In the Salt River, near Roosevelt, the forecast calls for 21% of median streamflow through May, while at Tonto Creek, the forecast calls for 25% of median streamflow through May. Snow survey measurements show the Salt snowpack to be at 16% of median.



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Salt River Basin
Streamflow Forecasts - March 1, 2018

SALT RIVER BASIN	Forecast Period	Forecast Exceedance Probabilities for Risk Assessment: Chance that actual volume will exceed forecast — 90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Salt R nr Roosevelt[3]								
	MAR			22	19%			114
	MAR-MAY	15.9	33	50	21%	72	114	240
Tonto Ck ab Gun Ck nr Roosevelt[3]								
	MAR			2.1	14%			15.4
	MAR-MAY	0.51	2.6	5.6	25%	10.3	21	22

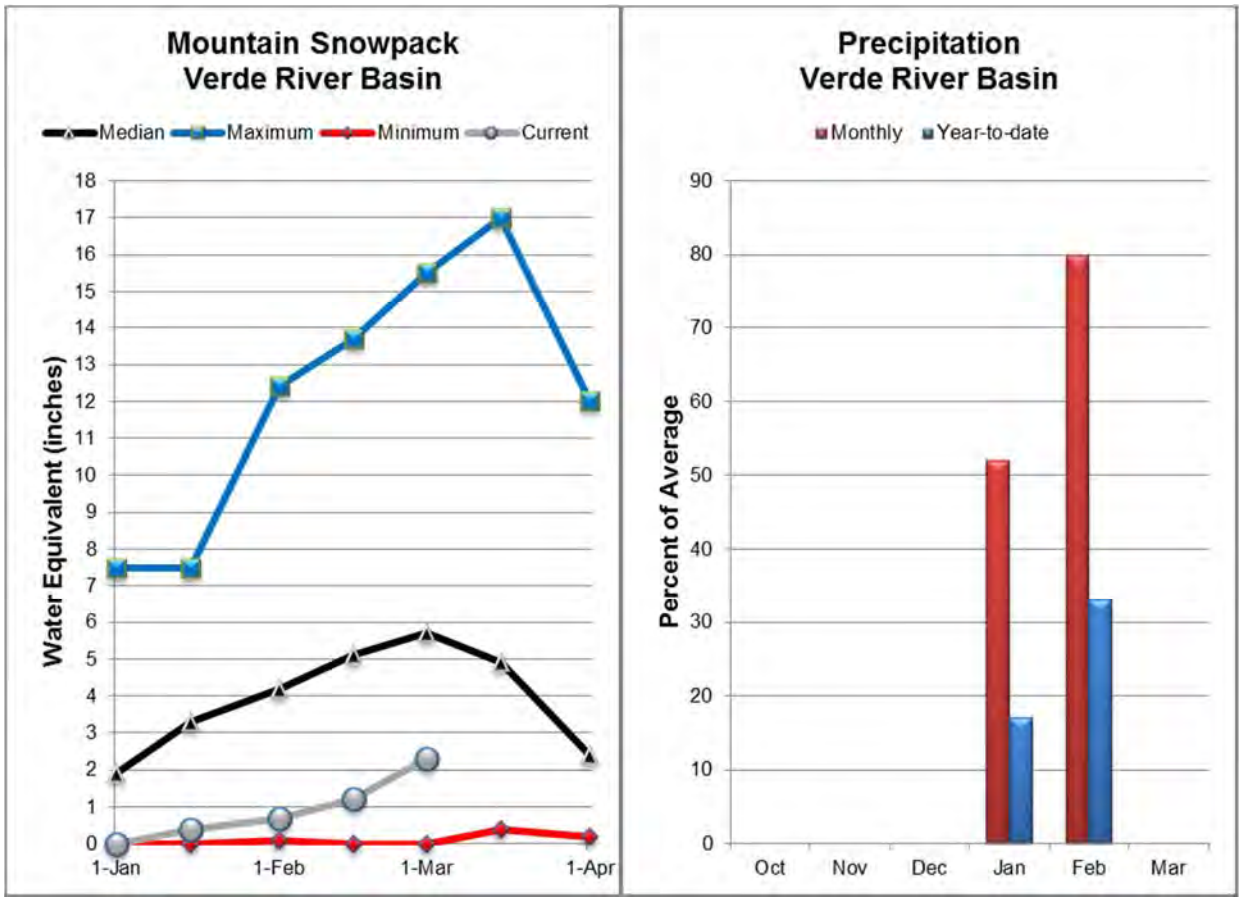
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of February, 2018	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Salt River Reservoir System	1297.4	1325.3	1302.0	2025.8
Basin-wide Total	1297.4	1325.3	1302.0	2025.8
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 1, 2018	# of Sites	% Median	Last Year % Median
SALT RIVER BASIN	11	16%	74%

VERDE RIVER BASIN as of March 1, 2018

Well below normal streamflow levels are forecast for the basin. In the Verde River above Horseshoe Dam, the forecast calls for 34% of median streamflow through May. Snow survey measurements show the Verde snowpack to be at 40% of median.



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Verde River Basin
Streamflow Forecasts - March 1, 2018

		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]								
	MAR			20	34%			59
	MAR-MAY	5.8	19.5	36	34%	60	111	107

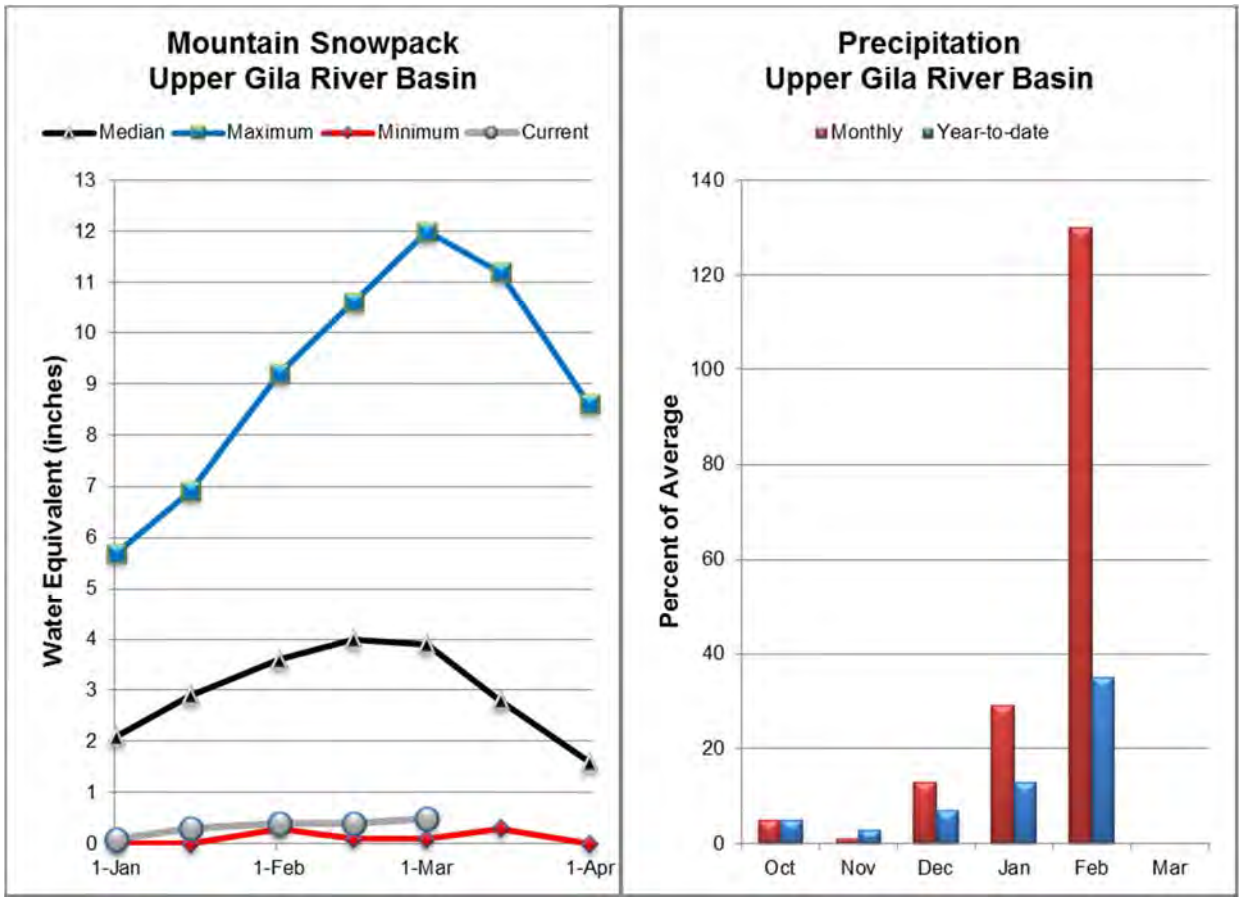
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of February, 2018	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Verde River Reservoir System	98.0	280.1	168.0	287.4
Basin-wide Total	98.0	280.1	168.0	287.4
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 1, 2018	# of Sites	% Median	Last Year % Median
VERDE RIVER BASIN	10	40%	110%

SAN FRANCISCO-UPPER GILA RIVER BASIN as of March 1, 2018

Well below normal streamflow levels are forecast for the basin. In the San Francisco River, at Clifton, the forecast calls for 29% of median streamflow levels through May. In the Gila River, near Solomon, the forecast calls for 22% of median streamflow levels through May. At San Carlos Reservoir, inflow to the lake is forecast at 16% of median through May. Snow survey measurements show the snowpack for this basin to be at 12% of median.



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San Francisco-Upper Gila River Basin
Streamflow Forecasts - March 1, 2018

SAN FRANCISCO-UPPER GILA RIVER BASIN	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
		Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						
Gila R at Gila[3]								
	MAR-MAY	4.3	7.7	10.8	32%	14.6	22	34
Gila R bl Blue Ck nr Virden[3]								
	MAR-MAY	0.9	5.6	11	26%	18.3	32	43
San Francisco R at Glenwood[3]								
	MAR-MAY	0.34	1.34	2.6	17%	4.5	8.8	15.2
San Francisco R at Clifton[3]								
	MAR-MAY	0.73	5.4	11	29%	18.6	33	38
Gila R nr Solomon[3]								
	MAR			9.6	25%			38
	MAR-MAY	0.93	9.5	20	22%	35	65	89
San Carlos Reservoir Inflow[3]								
	MAR-MAY	0.03	2.4	8.5	16%	21	54	53

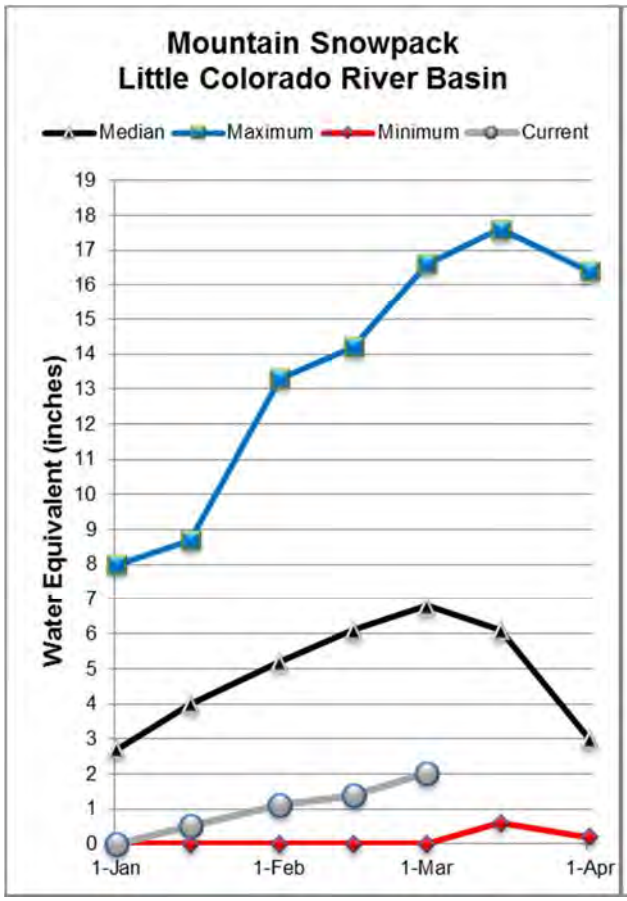
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

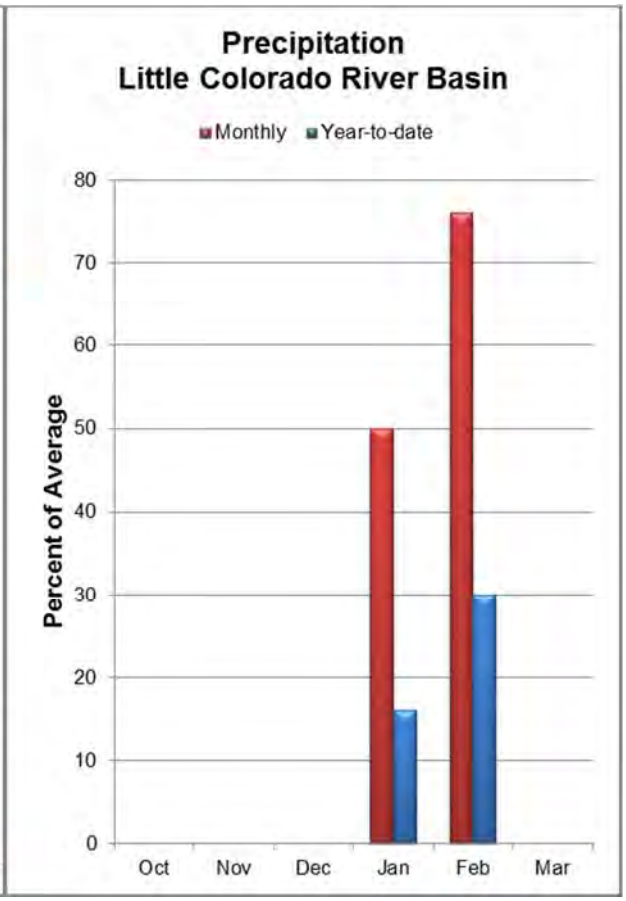
Reservoir Storage End of February, 2018	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
San Carlos Reservoir	63.4	227.7	404.1	875.0
Basin-wide Total	63.4	227.7	404.1	875.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 1, 2018	# of Sites	% Median	Last Year % Median
SAN FRANCISCO-UPPER GILA RIVER BASIN	10	12%	57%

LITTLE COLORADO RIVER BASIN as of March 1, 2018

Well below normal streamflow levels are forecast for the basin. In the Little Colorado River, above Lyman Lake, the forecast calls for 10% of median streamflow through June. At Blue Ridge (C.C. Cragin) Reservoir, inflow to the lake is forecast at 16% of median through May. Snowpacks along the southern headwaters of the Little Colorado River, and along the central Mogollon Rim, were measured at 27% and 30% of median, respectively.





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Little Colorado River Basin
Streamflow Forecasts - March 1, 2018

		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]	MAR-JUN	0.06	0.29	0.6	10%	1.07	2.1	6
Rio Nutria nr Ramah[3]	MAR-MAY	0	0.01	0.1	9%	0.33	1.06	1.12
Zuni R ab Black Rock Reservoir[3]	MAR-MAY	0	0	0.05	22%	0.38	1.91	0.23
Blue Ridge Reservoir Inflow[3]	MAR-MAY	0.16	0.93	2.1	16%	3.9	8.2	13.5
Lake Mary Reservoir Inflow[3]	MAR-MAY	0.15	0.49	0.9	31%	1.5	2.8	2.9

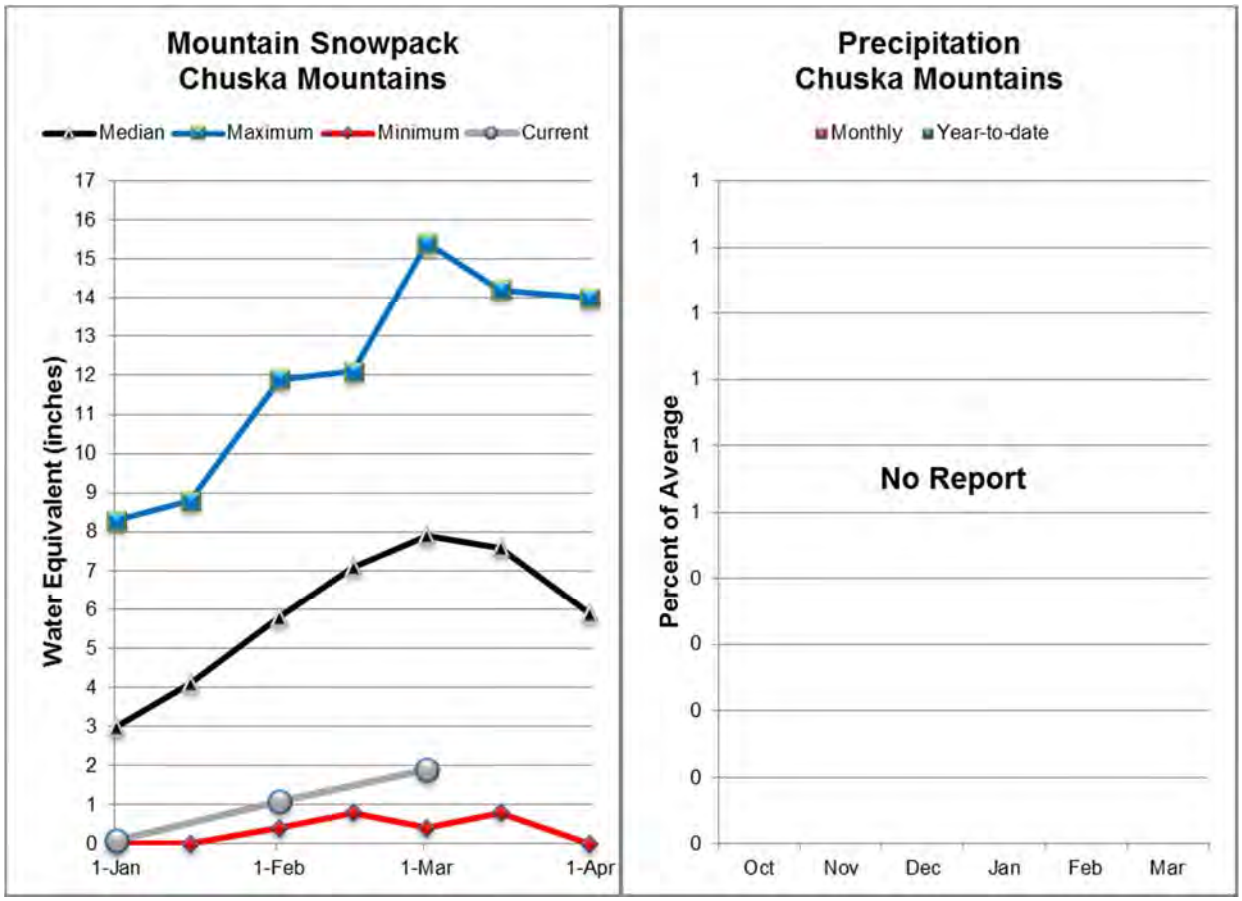
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of February, 2018	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lyman Reservoir	11.1	10.5	12.9	30.0
Basin-wide Total	11.1	10.5	12.9	30.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 1, 2018	# of Sites	% Median	Last Year % Median
LITTLE COLORADO RIVER BASIN	9	27%	112%
CENTRAL MOGOLLON RIM	3	30%	132%

CHUSKA MOUNTAINS as of March 1, 2018

Snow survey measurements conducted by staff of the Navajo Nation Water Management Branch show the Chuska snowpack to be at 21% of median. The forecast calls for well below normal runoff for Wheatfields Creek, Captain Tom Wash, and Bowl Canyon Creek.



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Chuska Mountains
Streamflow Forecasts - March 1, 2018

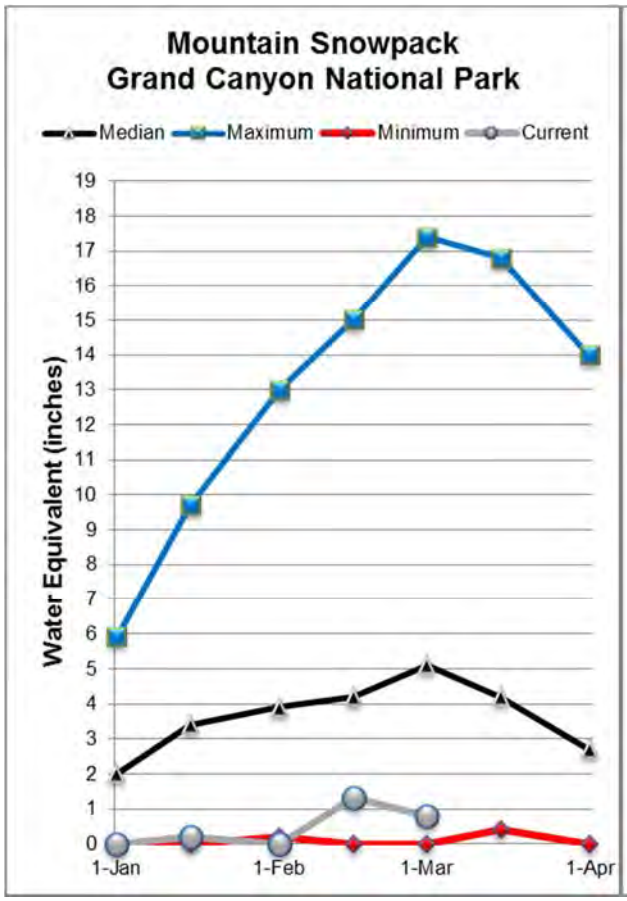
		Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						
CHUSKA MOUNTAINS	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Captain Tom Wash nr Two Gray Hills								
	MAR-MAY	0.25	0.61	1	38%	1.53	2.6	2.6
Wheatfields Ck nr Wheatfields								
	MAR-MAY	0.15	0.52	0.9	43%	1.39	2.3	2.1
Bowl Canyon Ck ab Asaayi Lake								
	MAR-MAY	0.2	0.41	0.6	46%	0.82	1.21	1.3

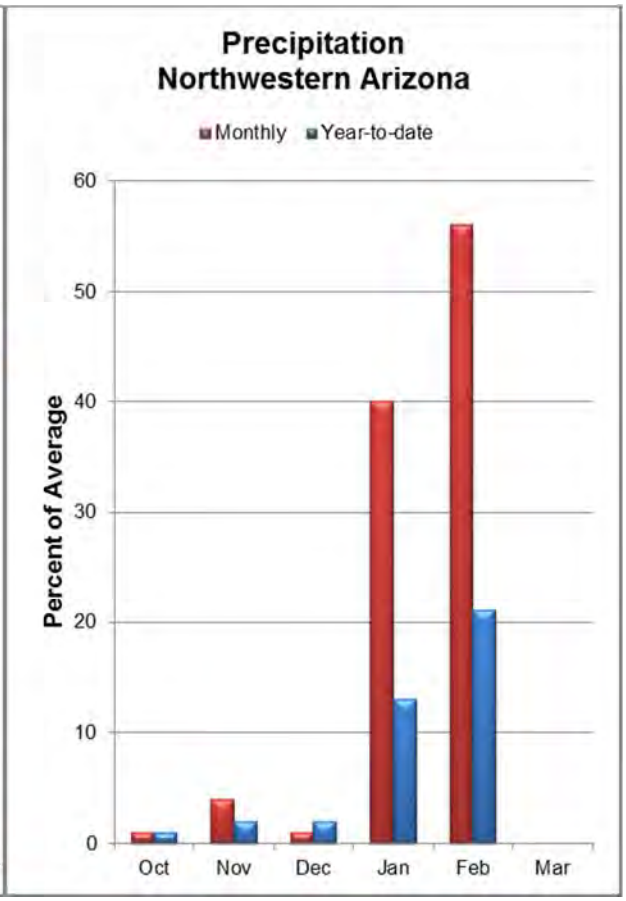
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Watershed Snowpack Analysis March 1, 2018	# of Sites	% Median	Last Year % Median
CHUSKA MOUNTAINS	4	21%	104%
DEFIANCE PLATEAU	1	19%	42%

NORTHWESTERN ARIZONA as of March 1, 2018

On the Colorado River, well below normal inflow to Lake Powell is forecast at 43% 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 15% of median.





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Northwestern Arizona
Streamflow Forecasts - March 1, 2018

		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	3.4	8.1	13	20%	19.5	33	65
Lake Powell Inflow [2]	APR-JUL	1460	2360	3100	43%	3940	5360	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 February, 2018	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lake Havasu	589.1	587.8	560.2	619.0
Lake Mohave	1700.0	1688.0	1673.0	1810.0
Lake Mead	10697.0	10826.0	20575.0	26159.0
Lake Powell	13345.8	11217.0	17055.0	24322.0
Basin-wide Total	26331.9	24318.8	39863.2	52910.0
# of reservoirs	4	4	4	4

Watershed Snowpack Analysis March 1, 2018	# of Sites	% Median	Last Year % Median
NORTHWESTERN ARIZONA	2	15%	141%

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Basinwide Summary: March 1, 2018
(Averages/Medians based on 1981-2010 reference period)

Snowpack Summary for March 1, 2018

SALT RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baldy	SNOTEL	9125	6	1.4	8.1	17%	6.6	81%
Beaver Head	SNOTEL	7990	0	0.0	5.2	0%	0.0	0%
Buck Spring	SC	7400	0	0.0	2.2	0%	0.0	0%
Coronado Trail	SNOTEL	8400	0	0.0	2.4	0%	0.0	0%
Hawley Lake	SNOTEL	8300	26	6.5			13.8	
Coronado Trail	SC	8350	1	0.0	1.8	0%	0.5	28%
Fort Apache	SC	9160	15	3.1	8.2	38%	9.7	118%
Hannagan Meadows	SNOTEL	9020	4	1.8	10.3	17%	9.8	95%
Maverick Fork	SNOTEL	9200	8	1.9	8.9	21%	12.0	135%
Nutrioso	SC	8500	1	0.1	0.6	17%	0.4	67%
Nutrioso	SNOTEL	8500	0	0.0			0.3	
Wildcat	SNOTEL	7850	0	0.0	3.2	0%	0.4	13%
Workman Creek	SNOTEL	6900	2	0.6	5.1	12%	1.9	37%
Basin Index						**16%**		**74%**
# of sites						11		11

VERDE RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	8	2.1	5.2	40%	6.0	115%
Baker Butte No. 2	SC	7700	17	4.4	10.5	42%		
Baker Butte Smt	SNOTEL	7700	21	6.0			15.5	
Bar M	SNOTEL	6393	2	0.6			3.7	
Chalender	SC	7100	5	0.6	2.0	30%	1.4	70%
Chalender	SNOTEL	7100	5	0.7			1.7	
Fort Valley	SC	7350	2	0.2	1.9	11%	2.4	126%
Fort Valley	SNOTEL	7350	2	0.4			1.2	
Fry	SNOTEL	7200	11	4.2	7.0	60%	10.3	147%
Happy Jack	SNOTEL	7630	12	3.0	5.9	51%	8.5	144%
Happy Jack	SC	7630	6	1.2	4.0	30%	0.3	8%
Mormon Mountain	SNOTEL	7500	10	1.9	4.7	40%	7.2	153%
Mormon Mountain Summit #2	SC	8470	20	4.2	11.2	38%		
Mormon Mtn Summit	SNOTEL	8500	19	3.6			14.6	
Newman Park	SC	6750	4	0.7	2.0	35%	2.9	145%
White Horse Lake	SNOTEL	7180	2	0.4	3.9	10%	3.2	82%
Williams Ski Run	SC	7720	16	3.6	8.2	44%	7.2	88%
Basin Index						**40%**		**110%**
# of sites						10		10

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	33	4.6	16.1	29%	31.0	193%
Snowslide Canyon	SNOTEL	9730	29	6.4	15.3	42%	31.3	205%
Basin Index						**35%**		**198%**
# 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	0	0.0	5.2	0%	0.0	0%
Coronado Trail	SNOTEL	8400	0	0.0	2.4	0%	0.0	0%
Coronado Trail	SC	8350	1	0.0	1.8	0%	0.5	28%
Frisco Divide	SNOTEL	8000	0	0.0	2.4	0%	1.2	50%
Hannagan Meadows	SNOTEL	9020	4	1.8	10.3	17%	9.8	95%
Hummingbird - Aerial And Snow Course	SC	10550			11.9			
Lookout Mountain	SNOTEL	8500	0	0.0	0.6	0%	0.0	0%

Nutrioso	SC	8500	1	0.1	0.6	17%	0.4	67%
Nutrioso	SNOTEL	8500	0	0.0			0.3	
Signal Peak	SNOTEL	8360	0	0.0	4.3	0%	0.0	0%
Silver Creek Divide	SNOTEL	9000	8	2.6	8.3	31%	8.7	105%
State Line	SC	8000	0	0.0	1.4	0%	0.8	57%
Whitewater - Aerial And Snow Course	SC	10750			18.6			
Basin Index						**12%**		**57%**
# of sites						10		10

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	8	2.1	5.2	40%	6.0	115%
Baker Butte No. 2	SC	7700	17	4.4	10.5	42%		
Baker Butte Smt	SNOTEL	7700	21	6.0			15.5	
Baldy	SNOTEL	9125	6	1.4	8.1	17%	6.6	81%
Buck Spring	SC	7400	0	0.0	2.2	0%	0.0	0%
Cheese Springs	SC	8700	11	2.4	5.8	41%	6.1	105%
Fort Apache	SC	9160	15	3.1	8.2	38%	9.7	118%
Heber	SNOTEL	7640	2	0.5	4.5	11%	6.1	136%
Lake Mary	SC	6930	3	0.5	3.4	15%	2.2	65%
Maverick Fork	SNOTEL	9200	8	1.9	8.9	21%	12.0	135%
Promontory	SNOTEL	7930	9	3.8	11.3	34%	15.7	139%
Basin Index						**27%**		**112%**
# of sites						9		9

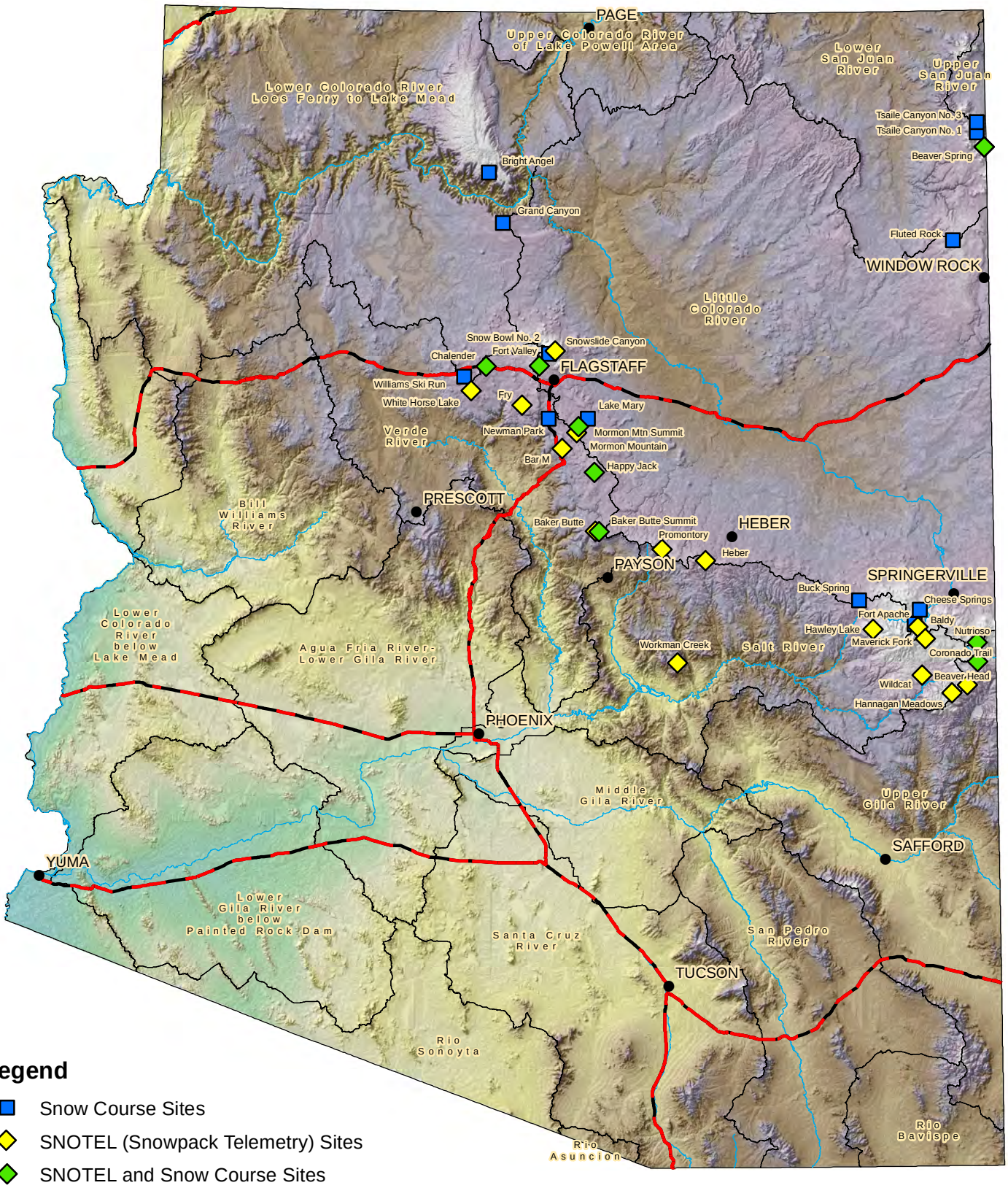
CENTRAL MOGOLLON RIM	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	8	2.1	5.2	40%	6.0	115%
Baker Butte No. 2	SC	7700	17	4.4	10.5	42%		
Baker Butte Smt	SNOTEL	7700	21	6.0			15.5	
Heber	SNOTEL	7640	2	0.5	4.5	11%	6.1	136%
Promontory	SNOTEL	7930	9	3.8	11.3	34%	15.7	139%
Basin Index						**30%**		**132%**
# of sites						3		3

CHUSKA MOUNTAINS	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Beaver Spring	SC	9220	11	2.6	10.0	26%		
Beaver Spring	SNOTEL	9200	5	1.5			12.6	
Bowl Canyon	SC	8980	12	2.8	8.7	32%		
Hidden Valley	SC	8480	4	0.8			8.2	
Missionary Spring	SC	7940	2	0.4	4.1	10%	0.0	0%
Tsaile Canyon #1	SC	8160	5	1.0	6.4	16%	5.4	84%
Tsaile Canyon #3	SC	8920	11	2.0	8.8	23%	13.3	151%
Whiskey Creek	SC	9050	11	2.6	9.3	28%	11.0	118%
Navajo Whiskey Ck	SNOTEL	9050	0	0.0			13.0	
Basin Index						**21%**		**104%**
# of sites						4		4

DEFIANCE PLATEAU	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Fluted Rock	SC	7800	2	0.7	3.6	19%	1.5	42%
Basin Index						**19%**		**42%**

NORTHWESTERN ARIZONA	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Bright Angel	SC	8400	10	1.5	8.7	17%	14.2	163%
Grand Canyon	SC	7500	0	0.0	1.4	0%	0.0	0%
Basin Index						**15%**		**141%**

Arizona Snow Survey Data Sites



Legend

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

January 2017
Data Sources: NRCS / ALRIS
Projection: UTM Zone 12 Datum: NAD83

0 12.5 25 50 75 100 Miles

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NRCS
Natural Resources Conservation Service