United States Department of Agriculture

Natural Resources Conservation Service

Arizona Basin Outlook Report April 1, 2019

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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.

For more water supply and resource management information, contact:

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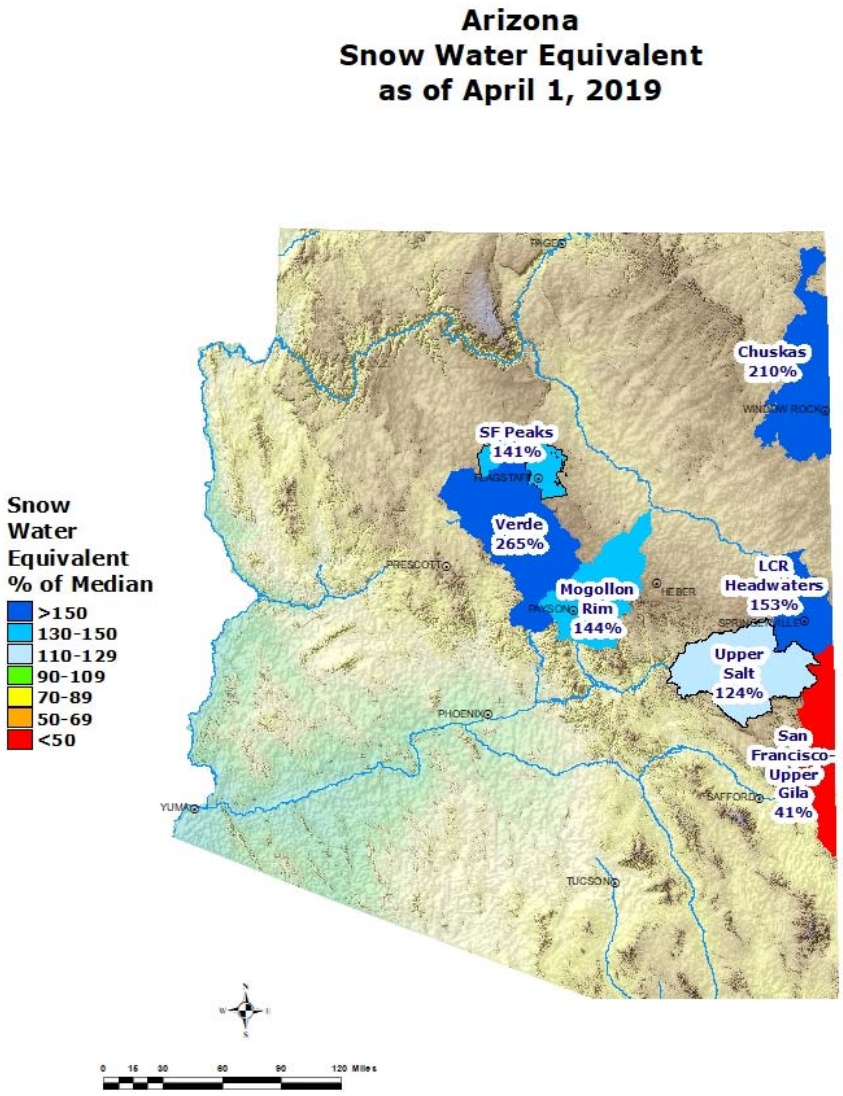
ARIZONA Basin Outlook Report
as of April 1, 2019

SUMMARY

As of April 1, snowpack levels are well below normal to well above normal throughout the major basins of the state. Precipitation for the month of March was normal to well above normal in the major river basins. The Salt and Verde River reservoir system stands at 78 percent of capacity, while San Carlos Reservoir is at 17 percent of capacity. The forecast calls for well below normal to above 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 to well above normal, ranging from 265 percent of median in the Verde River Basin to 41 percent of median in the Upper Gila River Basin. The statewide snowpack is well above normal at 167 percent of median.

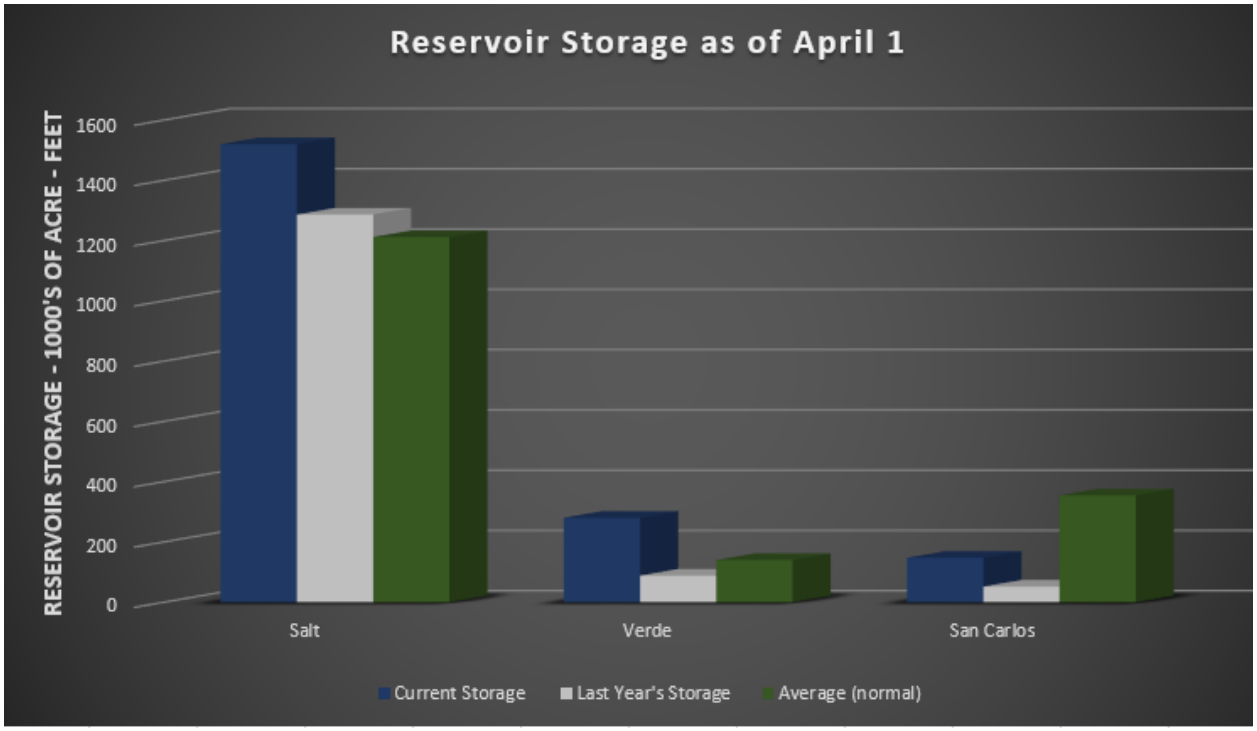


PRECIPITATION

Mountain data from NRCS SNOTEL sites and NWS Cooperator gages show that precipitation for March was average to well above average in the major river basins. Cumulative precipitation since October 1 is normal to well above 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 April 1, the Salt and Verde River reservoir system stands at 78 percent of capacity. San Carlos Reservoir is currently at 17 percent of capacity.

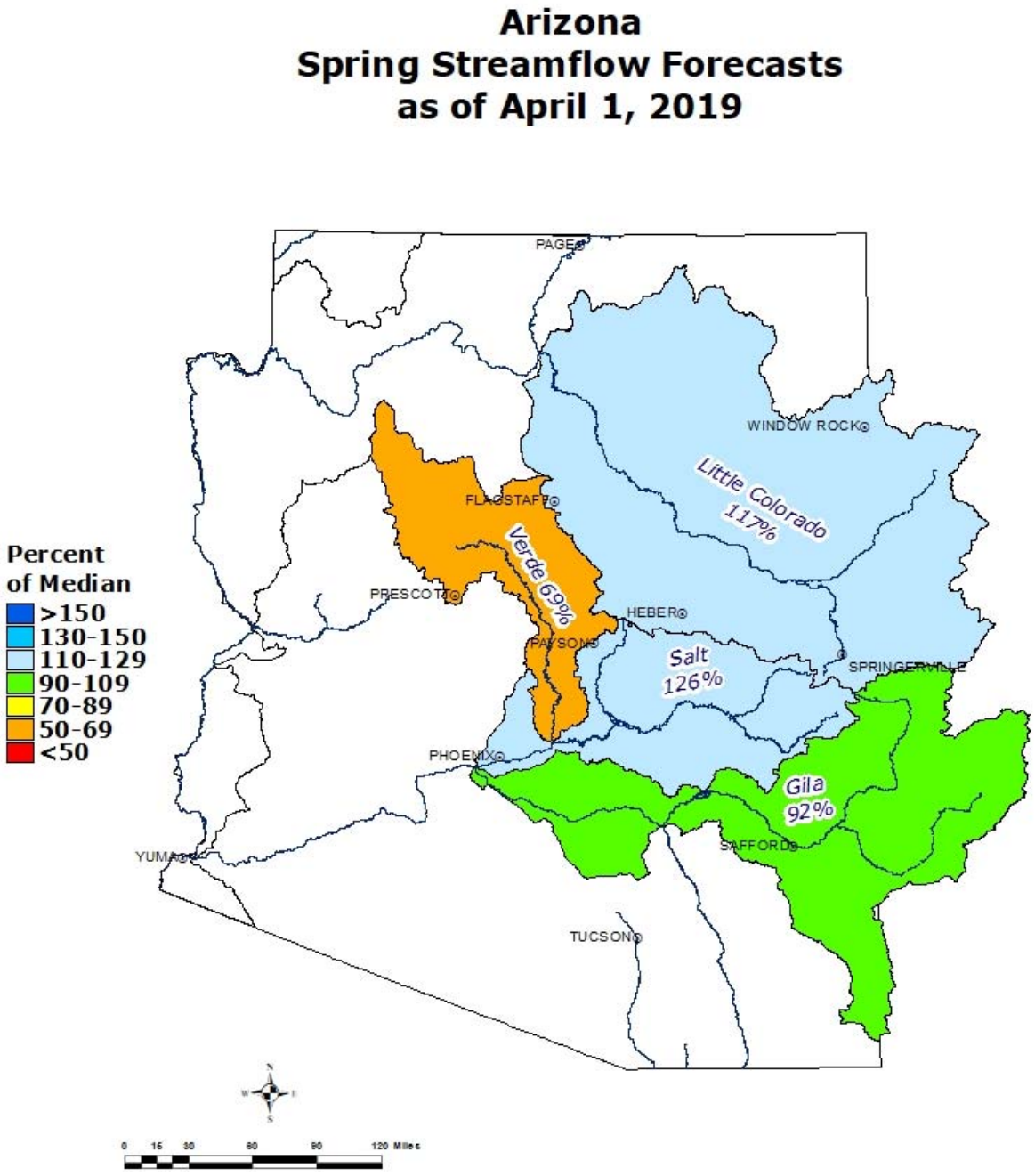


Key storage volumes displayed in thousands of acre-feet (x1000):

Reservoir	Current Storage	Last Year Storage	30-Year Average	Storage Capacity
Salt River System	1520.3	1286.9	1181.0	2025.8
Verde River System	280.5	88.7	135.7	287.4
San Carlos Reservoir	147.6	52.2	324.9	875.0
Lyman Lake	11.1	10.9	11.8	30.0
Lake Havasu	579.4	569.7	562.7	619.0
Lake Mohave	1687.0	1679.5	1602.0	1810.0
Lake Mead	10877.0	10695.0	20297.0	26159.0
Lake Powell	9049.0	13345.8	17745.0	24322.0

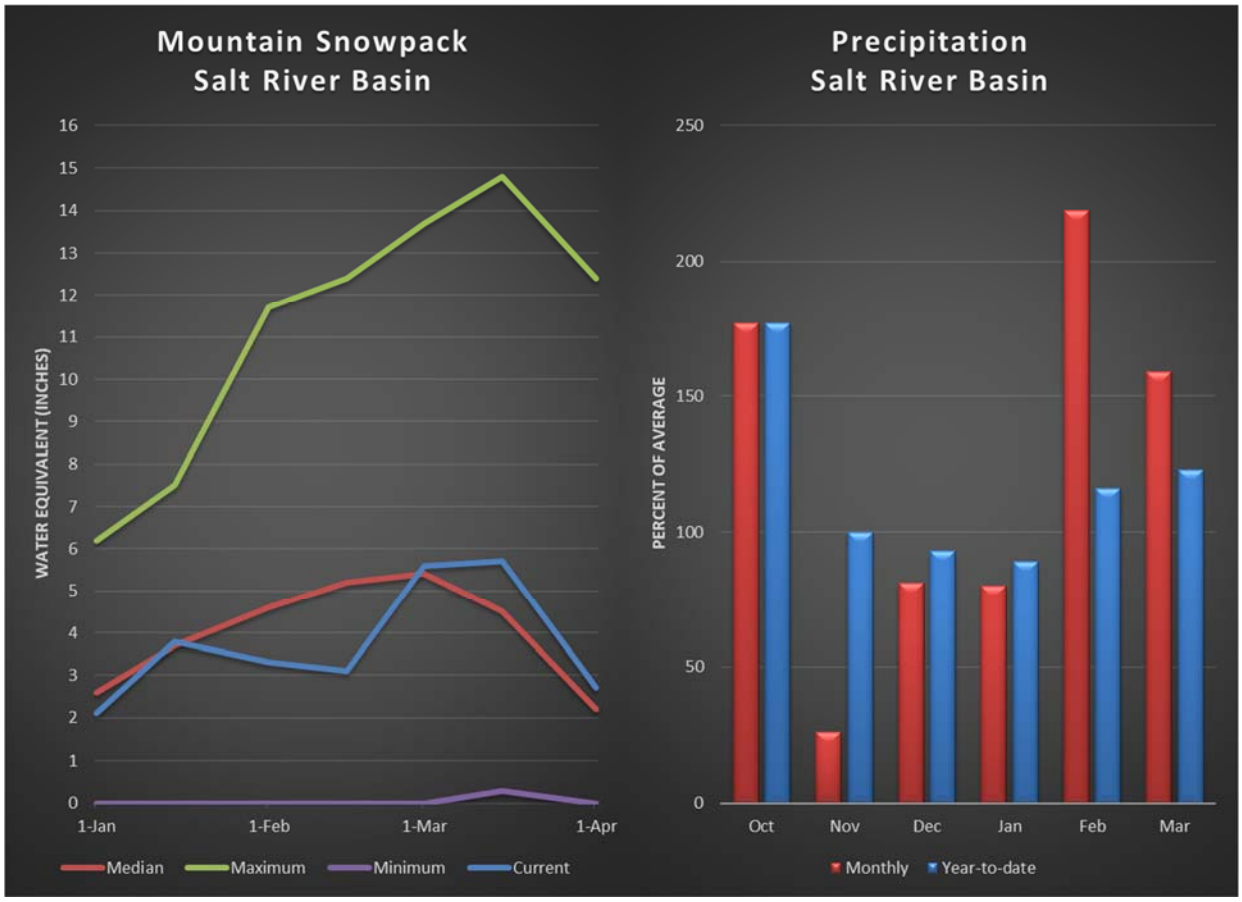
STREAMFLOW

As of April 1, the forecast calls for well below normal to above normal streamflow for the spring runoff period, ranging from 69% percent of median in the Verde River above Horeshoe Dam to 126 percent of median in the Salt River near Roosevelt. Total precipitation since the beginning of the water year has been well above average for the state, producing 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 April 1, 2019

Above normal streamflow levels are forecast for the basin. In the Salt River, near Roosevelt, the forecast calls for 126% of median streamflow through May, while at Tonto Creek, the forecast calls for 153% of median streamflow through May. Snow survey measurements show the Salt snowpack to be at 124% of median.



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Salt River Basin
Streamflow Forecasts - April 1, 2019

SALT 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						
Salt R nr Roosevelt[3]								
	APR			126	158%			80
	APR-MAY	102	134	160	126%	189	235	127
Tonto Ck ab Gun Ck nr Roosevelt[3]								
	APR			7.1	161%			4.4
	APR-MAY	3.5	6.4	9	153%	12.3	18.4	5.9

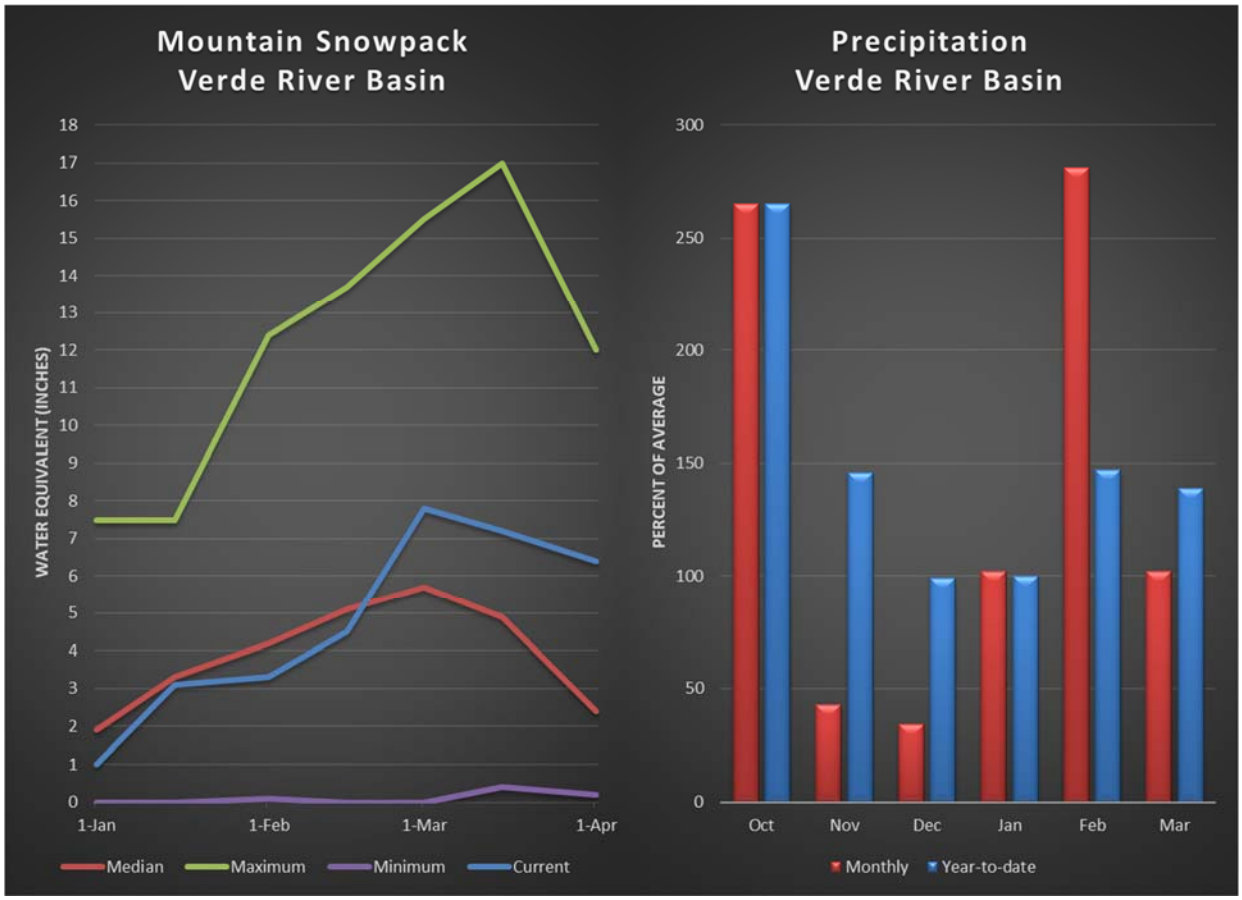
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of March, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Salt River Reservoir System	1520.3	1286.9	1378.0	2025.8
Basin-wide Total	1520.3	1286.9	1378.0	2025.8
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis April 1, 2019	# of Sites	% Median	Last Year % Median
SALT RIVER BASIN	11	124%	3%

VERDE RIVER BASIN as of April 1, 2019

Well below normal streamflow levels are forecast for the basin. In the Verde River above Horseshoe Dam, the forecast calls for 69% of median streamflow through May. Snow survey measurements show the Verde snowpack to be at 265% of median.



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Verde River Basin
Streamflow Forecasts - April 1, 2019

VERDE 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						
Verde R bl Tangle Ck ab Horseshoe Dam[3]								
	APR			22	92%			24
	APR-MAY	8.2	16.7	25	69%	36	56	36

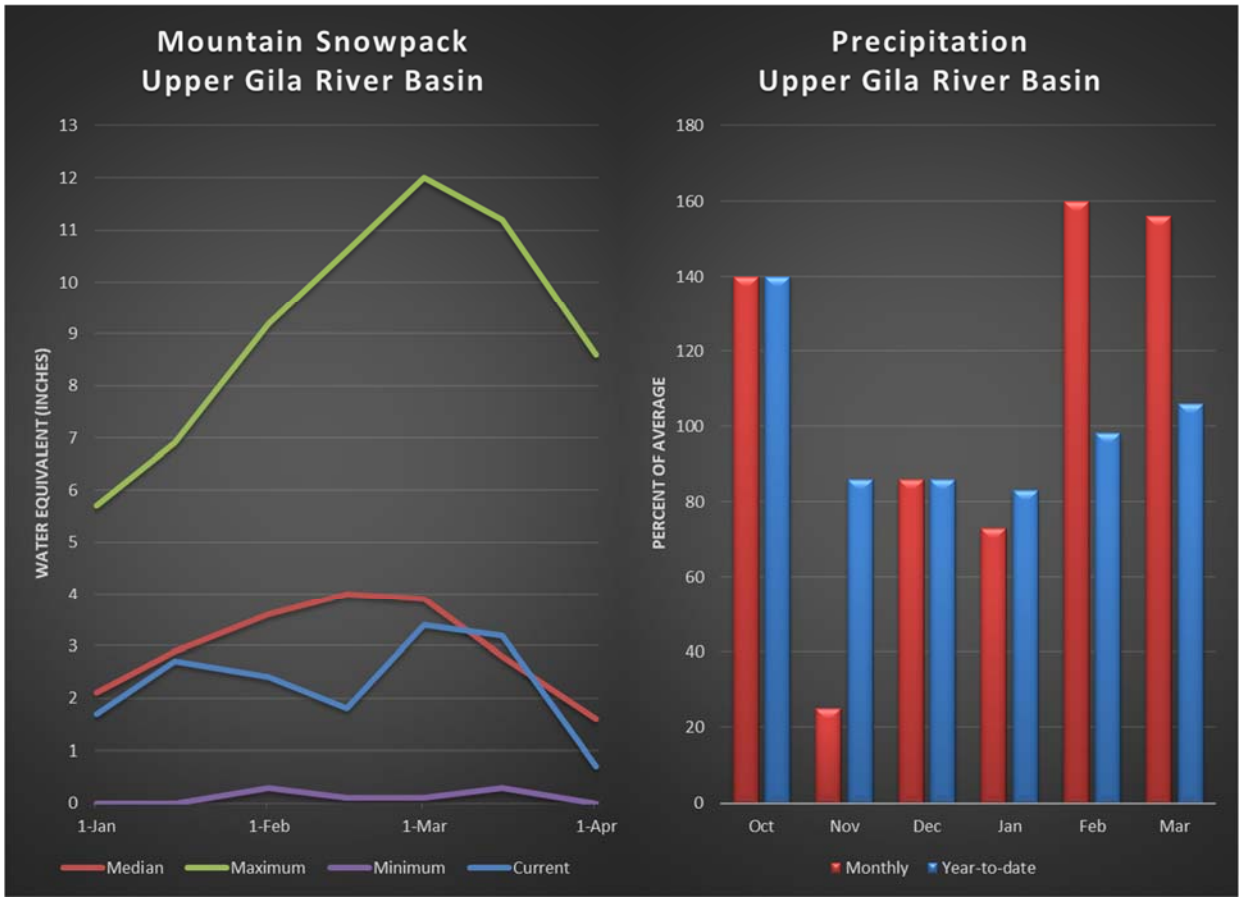
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of March, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Verde River Reservoir System	280.5	88.7	203.6	287.4
Basin-wide Total	280.5	88.7	203.6	287.4
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis April 1, 2019	# of Sites	% Median	Last Year % Median
VERDE RIVER BASIN	10	265%	15%

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

Normal streamflow levels are forecast for the basin. In the San Francisco River, at Clifton, the forecast calls for 95% of median streamflow levels through May. In the Gila River, near Solomon, the forecast calls for 92% of median streamflow levels through May. At San Carlos Reservoir, inflow to the lake is forecast at 98% of median through May. Snow survey measurements show the snowpack for this basin to be at 41% of median.



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San Francisco-Upper Gila River Basin
Streamflow Forecasts - April 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]								
	APR-MAY	10.7	14.7	18	109%	22	28	16.5
Gila R bl Blue Ck nr Virden[3]								
	APR-MAY	9.3	16.2	22	105%	29	40	21
San Francisco R at Glenwood[3]								
	APR-MAY	3.1	5.1	7	96%	9.3	13.4	7.3
San Francisco R at Clifton[3]								
	APR-MAY	6.7	12	16.5	95%	22	31	17.3
Gila R nr Solomon[3]								
	APR			33	132%			25
	APR-MAY	15.1	26	36	92%	47	66	39
San Carlos Reservoir Inflow[3]								
	APR-MAY	0.49	6.6	18	98%	38	88	18.4

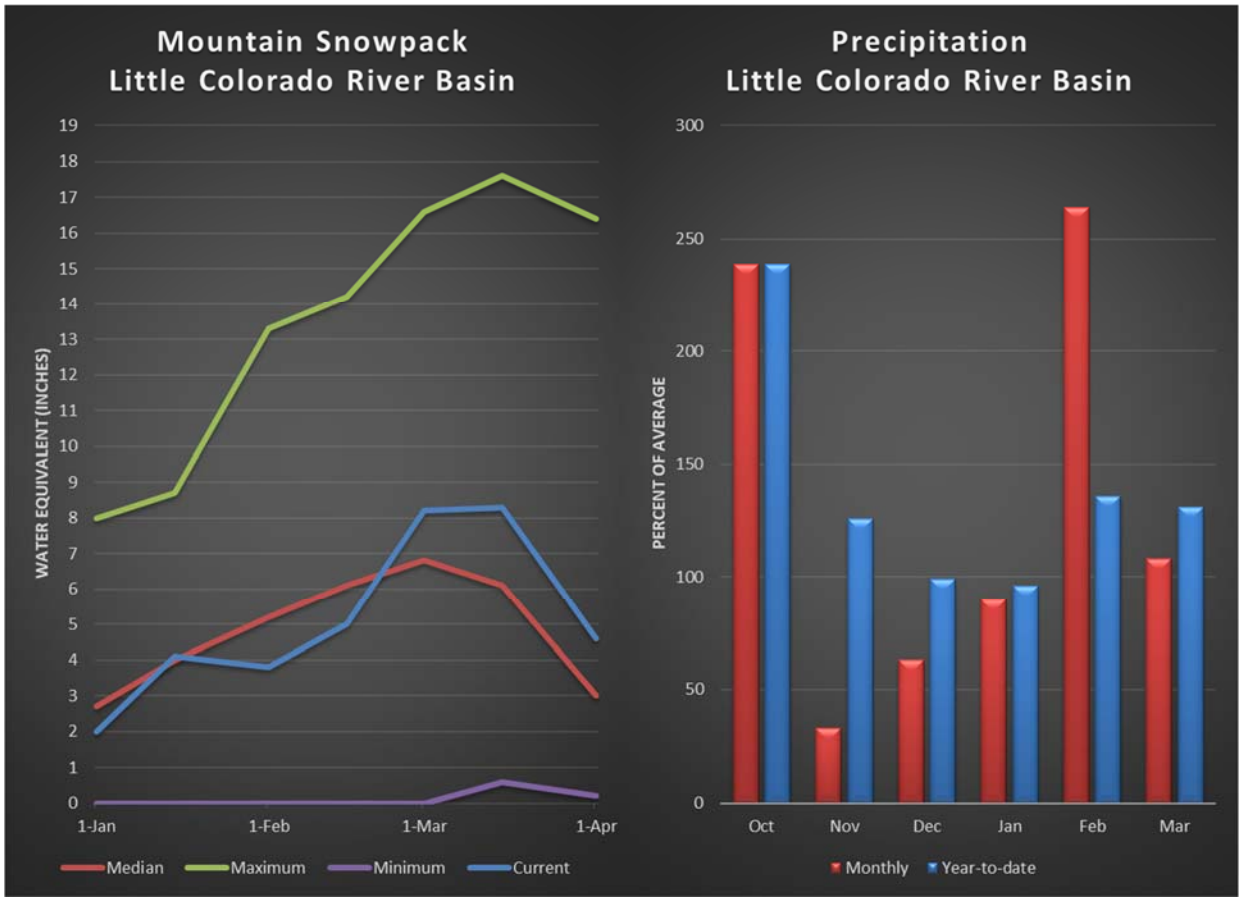
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of March, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
San Carlos Reservoir	147.6	52.9	413.8	875.0
Basin-wide Total	147.6	52.9	413.8	875.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis April 1, 2019	# of Sites	% Median	Last Year % Median
SAN FRANCISCO-UPPER GILA RIVER BASIN	10	41%	0%

LITTLE COLORADO RIVER BASIN as of April 1, 2019

Above normal streamflow levels are forecast for the basin. In the Little Colorado River, above Lyman Lake, the forecast calls for 117% of median streamflow through June. At Blue Ridge (C.C. Cragin) Reservoir, inflow to the lake is forecast at 117% of median through May. Snowpacks along the southern headwaters of the Little Colorado River, and along the central Mogollon Rim, were measured at 153% and 144% of median, respectively.



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Little Colorado River Basin
Streamflow Forecasts - April 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]	APR-JUN	1.79	3	4.1	117%	5.4	7.9	3.5
Rio Nutria nr Ramah[3]	APR-MAY	0.03	0.18	0.4	211%	0.74	1.54	0.19
Zuni R ab Black Rock Reservoir[3]	APR-MAY	0	0	0.12	120%	0.53	1.65	0.1
Blue Ridge Reservoir Inflow[3]	APR-MAY	1.42	3.1	4.8	117%	6.9	11.3	4.1
Lake Mary Reservoir Inflow[3]	APR-MAY	0.44	0.79	1.1	110%	1.48	2.2	1

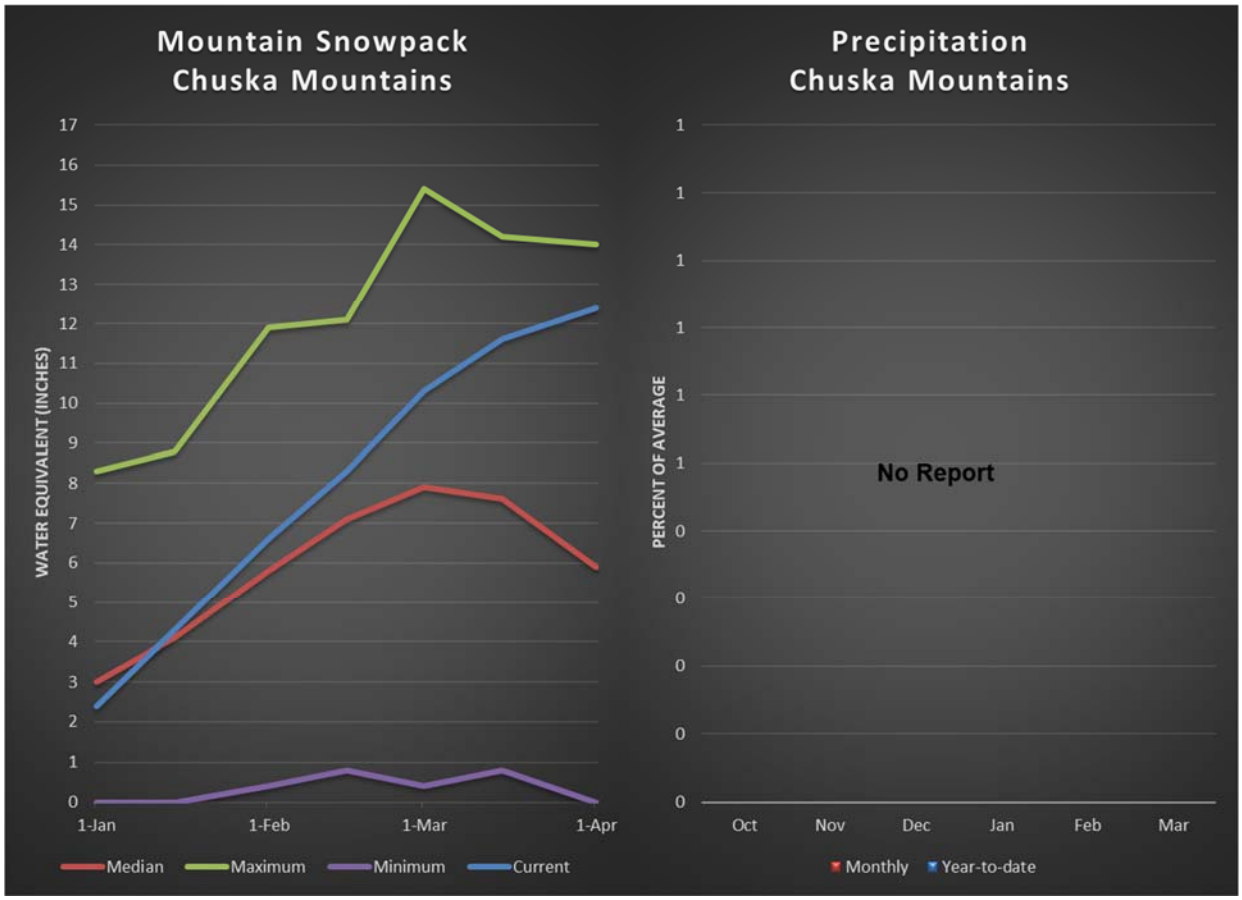
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of March, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lyman Reservoir	11.1	10.9	14.7	30.0
Basin-wide Total	11.1	10.9	14.7	30.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis April 1, 2019	# of Sites	% Median	Last Year % Median
LITTLE COLORADO RIVER BASIN	9	153%	3%
CENTRAL MOGOLLON RIM	3	144%	0%

CHUSKA MOUNTAINS as of April 1, 2019

Snow survey measurements conducted by staff of the Navajo Nation Water Management Branch show the Chuska snowpack to be at 210% of median. The forecast calls for normal runoff for Wheatfields Creek, Captain Tom Wash, and Bowl Canyon Creek.



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Chuska Mountains
Streamflow Forecasts - April 1, 2019

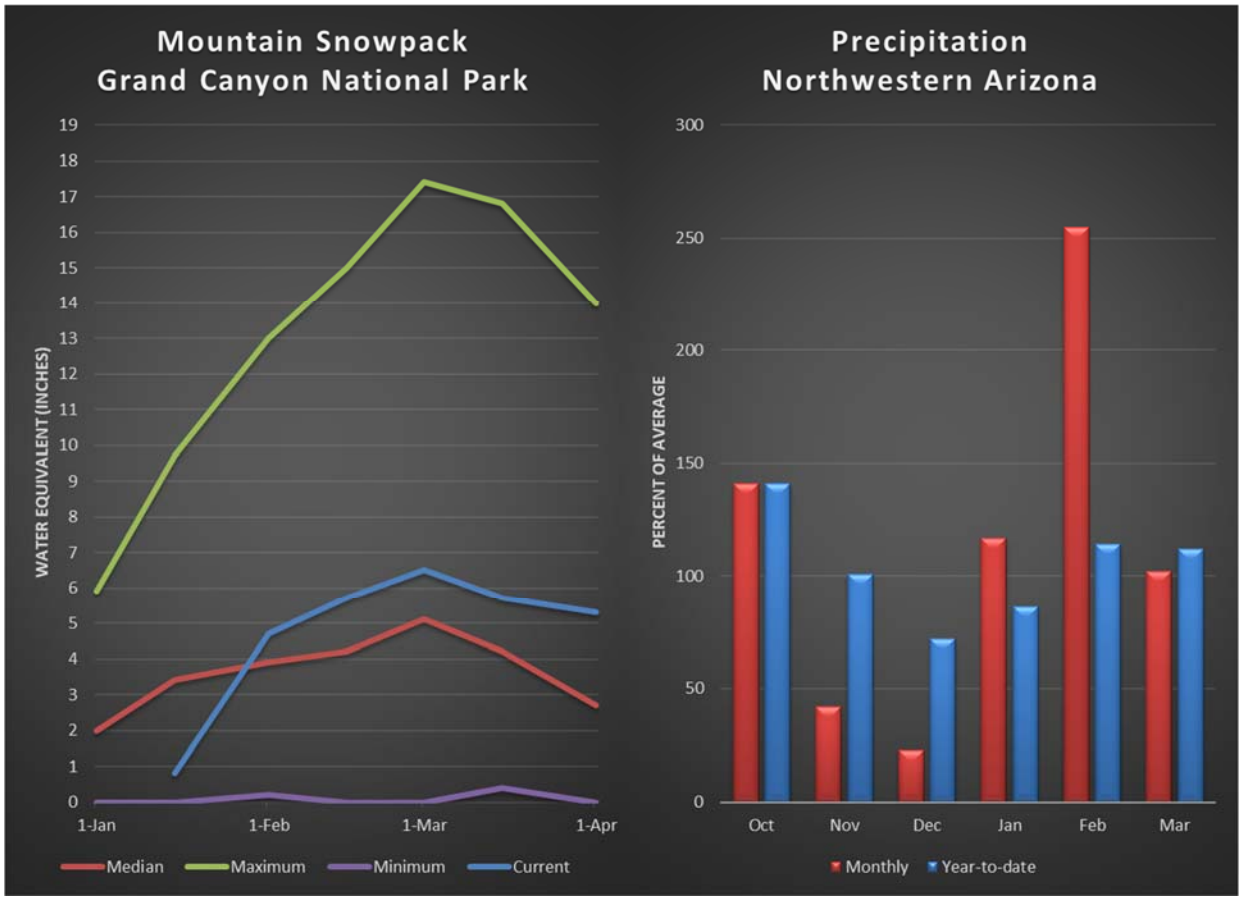
		Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						
CHUSKA MOUNTAINS	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Captain Tom Wash nr Two Gray Hills								
	MAR-MAY	0.45	1.32	2.3	88%	3.7	6.6	2.6
Wheatfields Ck nr Wheatfields								
	MAR-MAY	1.1	1.55	1.9	90%	2.3	2.9	2.1
Bowl Canyon Ck ab Asaayi Lake								
	MAR-MAY	0.61	0.94	1.2	92%	1.5	1.99	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 April 1, 2019	# of Sites	% Median	Last Year % Median
CHUSKA MOUNTAINS	6	210%	8%
DEFIANCE PLATEAU	1		

NORTHWESTERN ARIZONA as of April 1, 2019

On the Colorado River, well below normal inflow to Lake Powell is forecast at 142% 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 196% of median.



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Northwestern Arizona
Streamflow Forecasts - April 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	82	103	117	180%	131	152	65
Lake Powell Inflow [2]	APR-JUL	7290	8980	10200	142%	11500	13600	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 March, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lake Havasu	579.4	571.8	562.8	619.0
Lake Mohave	1687.0	1686.0	1687.0	1810.0
Lake Mead	10877.0	10695.0	20450.0	26159.0
Lake Powell	9049.0	12956.1	16942.0	24322.0
Basin-wide Total	22192.4	25908.9	39641.8	52910.0
# of reservoirs	4	4	4	4

Watershed Snowpack Analysis April 1, 2019	# of Sites	% Median	Last Year % Median
NORTHWESTERN ARIZONA	2	196%	2%

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

Snowpack Summary for April 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	9	4.3	2.5	172%	0.0	0%
Beaver Head	SNOTEL	7990	0	0.0	0.0		0.0	
Buck Spring	SC	7400	0	0.0	0.0		0.0	
Coronado Trail	SNOTEL	8400	0	0.0	0.0		0.0	
Hawley Lake	SNOTEL	8300	26	12.0			0.0	
Coronado Trail	SC	8350	0	0.0	0.0		0.0	
Fort Apache	SC	9160	25	8.9	6.2	144%	0.6	10%
Hannagan Meadows	SNOTEL	9020	11	5.2	7.7	68%	0.0	0%
Maverick Fork	SNOTEL	9200	18	8.4	5.3	158%	0.0	0%
Nutrioso	SC	8500	0	0.0	0.0		0.0	
Nutrioso	SNOTEL	8500	0	0.0			0.0	
Wildcat	SNOTEL	7850	0	0.0	0.0		0.0	
Workman Creek	SNOTEL	6900	0	0.0	0.0		0.0	
Basin Index						**124%**		**3%**
# 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	1	0.1	0.0		0.0	
Baker Butte No. 2	SC	7700			8.9		0.0	0%
Baker Butte Smt	SNOTEL	7700	45	17.4			3.5	
Bar M	SNOTEL	6393	0	0.0			0.0	
Chalender	SC	7100	0	0.0	0.0		0.0	
Chalender	SNOTEL	7100	0	0.0			0.0	
Fort Valley	SC	7350	0	0.0	0.0		0.0	
Fort Valley	SNOTEL	7350	0	0.0			0.0	
Fry	SNOTEL	7200	0	0.0	0.0		0.0	
Happy Jack	SNOTEL	7630	11	5.0	0.3	1667%	0.0	0%
Happy Jack	SC	7630	0	0.0	0.0		0.0	
Mormon Mountain	SNOTEL	7500	1	0.3	0.7	43%	0.0	0%
Mormon Mountain Summit #2	SC	8470			10.2		0.0	0%
Mormon Mtn Summit	SNOTEL	8500	28	12.6			0.3	
Newman Park	SC	6750	0	0.0	0.0		0.0	
White Horse Lake	SNOTEL	7180	0	0.0	0.0		0.0	
Williams Ski Run	SC	7720	37	14.5	6.5	223%	1.1	17%
Basin Index						**265%**		**15%**
# 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	75	23.4	19.2	122%	6.6	34%
Snowslide Canyon	SNOTEL	9730	56	27.8	17.0	164%	6.6	39%
Basin Index						**141%**		**36%**
# 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	0.0		0.0	
Coronado Trail	SNOTEL	8400	0	0.0	0.0		0.0	
Coronado Trail	SC	8350	0	0.0	0.0		0.0	
Frisco Divide	SNOTEL	8000	0	0.0	0.0		0.0	
Hannagan Meadows	SNOTEL	9020	11	5.2	7.7	68%	0.0	0%
Hummingbird - Aerial And Snow Course	SC	10550			9.0			

Lookout Mountain	SNOTEL	8500	0	0.0	0.0		0.0	
Nutrioso	SC	8500	0	0.0	0.0		0.0	
Nutrioso	SNOTEL	8500	0	0.0			0.0	
Signal Peak	SNOTEL	8360	0	0.0	0.0		0.0	
Silver Creek Divide	SNOTEL	9000	2	0.9	7.0	13%	0.0	0%
State Line	SC	8000	0	0.0	0.0		0.0	
Whitewater - Aerial And Snow Course	SC	10750			22.6			
Basin Index						**41%**		**0%**
# 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	1	0.1	0.0		0.0	
Baker Butte No. 2	SC	7700			8.9		0.0	0%
Baker Butte Smt	SNOTEL	7700	45	17.4			3.5	
Baldy	SNOTEL	9125	9	4.3	2.5	172%	0.0	0%
Buck Spring	SC	7400	0	0.0	0.0		0.0	
Cheese Springs	SC	8700	10	2.7	1.6	169%	0.0	0%
Fort Apache	SC	9160	25	8.9	6.2	144%	0.6	10%
Heber	SNOTEL	7640	0	0.0	0.0		0.0	
Lake Mary	SC	6930	0	0.0	0.0		0.0	
Maverick Fork	SNOTEL	9200	18	8.4	5.3	158%	0.0	0%
Promontory	SNOTEL	7930	20	7.8	5.5	142%	0.0	0%
Basin Index						**153%**		**3%**
# of sites						9		9

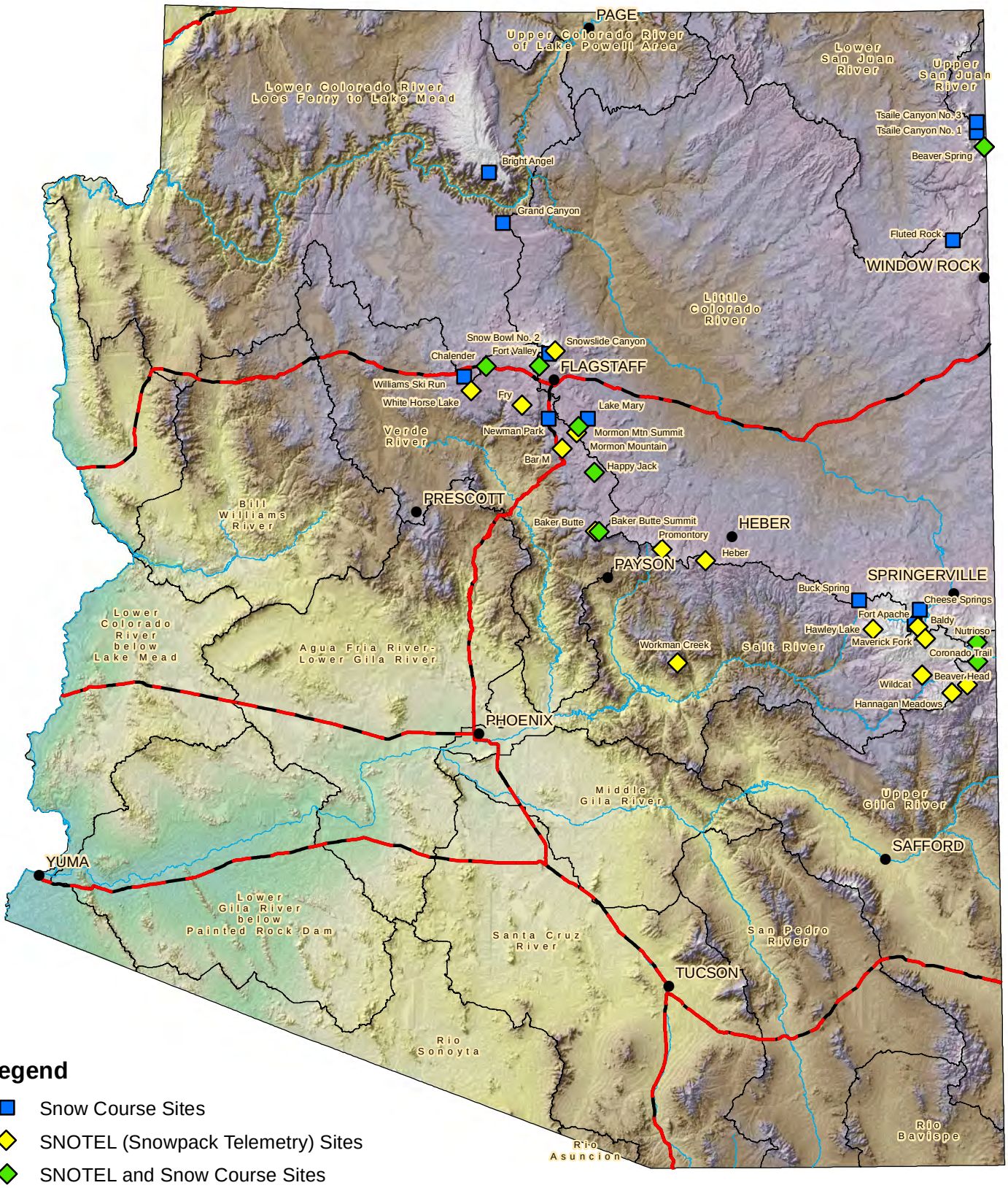
CENTRAL MOGOLLON RIM	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	1	0.1	0.0		0.0	
Baker Butte No. 2	SC	7700			8.9		0.0	0%
Baker Butte Smt	SNOTEL	7700	45	17.4			3.5	
Heber	SNOTEL	7640	0	0.0	0.0		0.0	
Promontory	SNOTEL	7930	20	7.8	5.5	142%	0.0	0%
Basin Index						**144%**		**0%**
# 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	40	15.9	8.0	199%	0.0	0%
Beaver Spring	SNOTEL	9200	38	15.1			0.0	
Bowl Canyon	SC	8980	33	13.5	7.8	173%	1.8	23%
Hidden Valley	SC	8480	27	11.7			0.0	
Missionary Spring	SC	7940	0	0.0	0.0		0.0	
Tsaile Canyon #1	SC	8160	24	10.4	3.4	306%	0.0	0%
Tsaile Canyon #3	SC	8920	42	16.1	7.2	224%	0.0	0%
Whiskey Creek	SC	9050	44	17.7	8.7	203%	1.0	11%
Navajo Whiskey Ck	SNOTEL	9050	33	15.1			0.0	
Basin Index						**210%**		**8%**
# 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	0	0.0	0.0		0.0	

NORTHWESTERN ARIZONA	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Bright Angel	SC	8400	25	10.4	5.3	196%	0.1	2%
Grand Canyon	SC	7500	0	0.0	0.0		0.0	
Basin Index						**196%**		**2%**
# of sites						2		2

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