



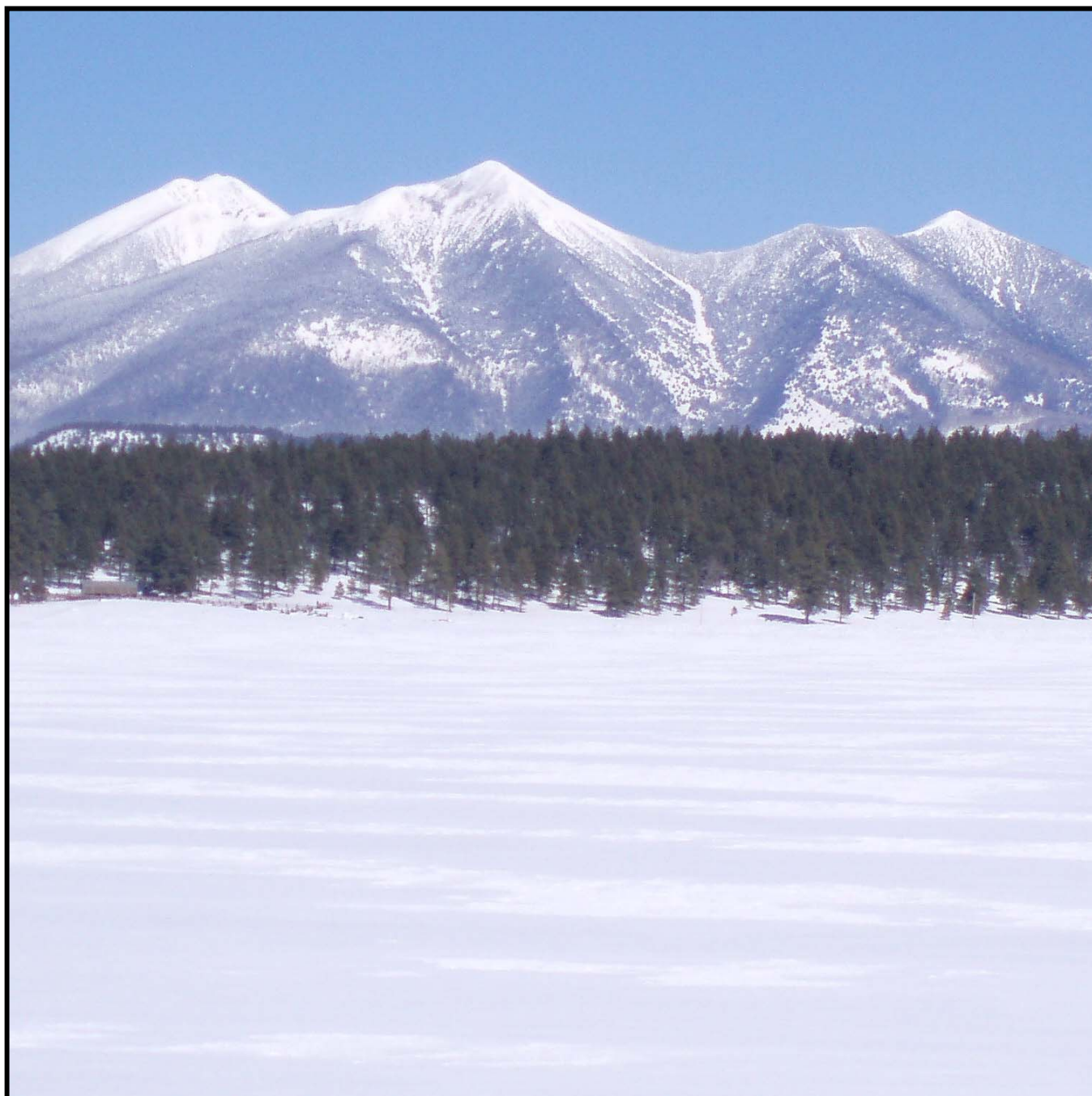
United States
Department of
Agriculture

Natural
Resources
Conservation
Service

Arizona

Basin Outlook Report

March 15, 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

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C., 20250, or call 1-800-245-6340 (voice) or (202) 720-1127 (TDD). USDA is an equal employment opportunity employer.

ARIZONA Basin Outlook Report as of March 15, 2019

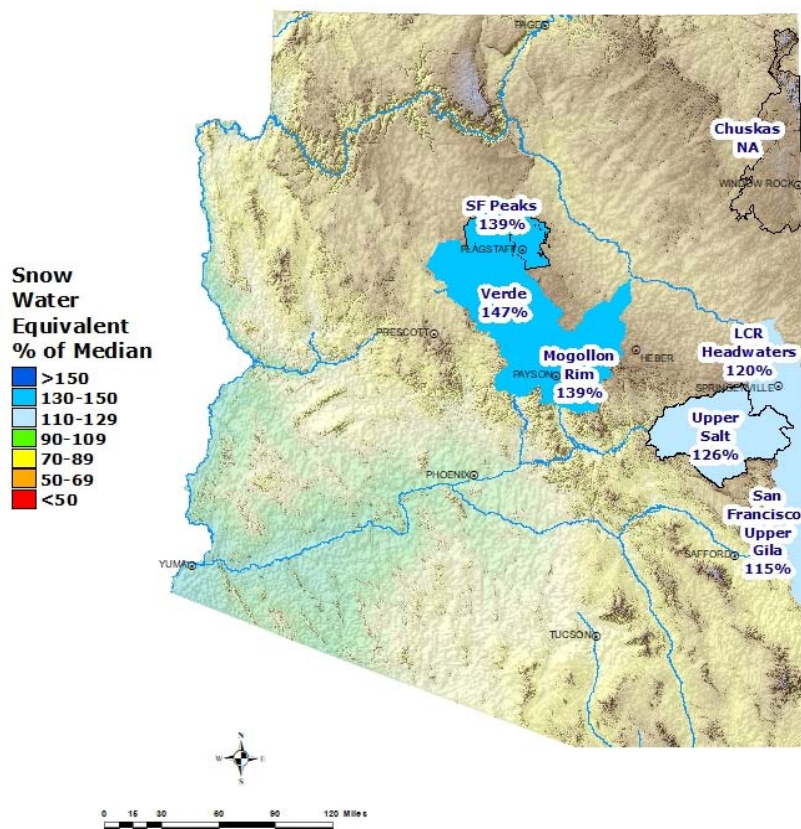
SUMMARY

As of March 15, snowpack levels are above normal to well above normal throughout the major basins of the state. Precipitation for the first half of March was well above normal in the major river basins. The Salt and Verde River reservoir system stands at 73 percent of capacity, while San Carlos Reservoir is at 11 percent of capacity. The mid-month forecast calls for normal to well above normal runoff in all basins for the spring runoff period.

SNOWPACK

Snow water equivalent levels in the state's major river basins are above normal to well above normal, ranging from 147 percent of median in the Verde River Basin, to 115 percent of median in the Upper Gila River Basin. The statewide snowpack is well above normal at 141 percent of median.

Arizona Snow Water Equivalent as of March 15, 2019

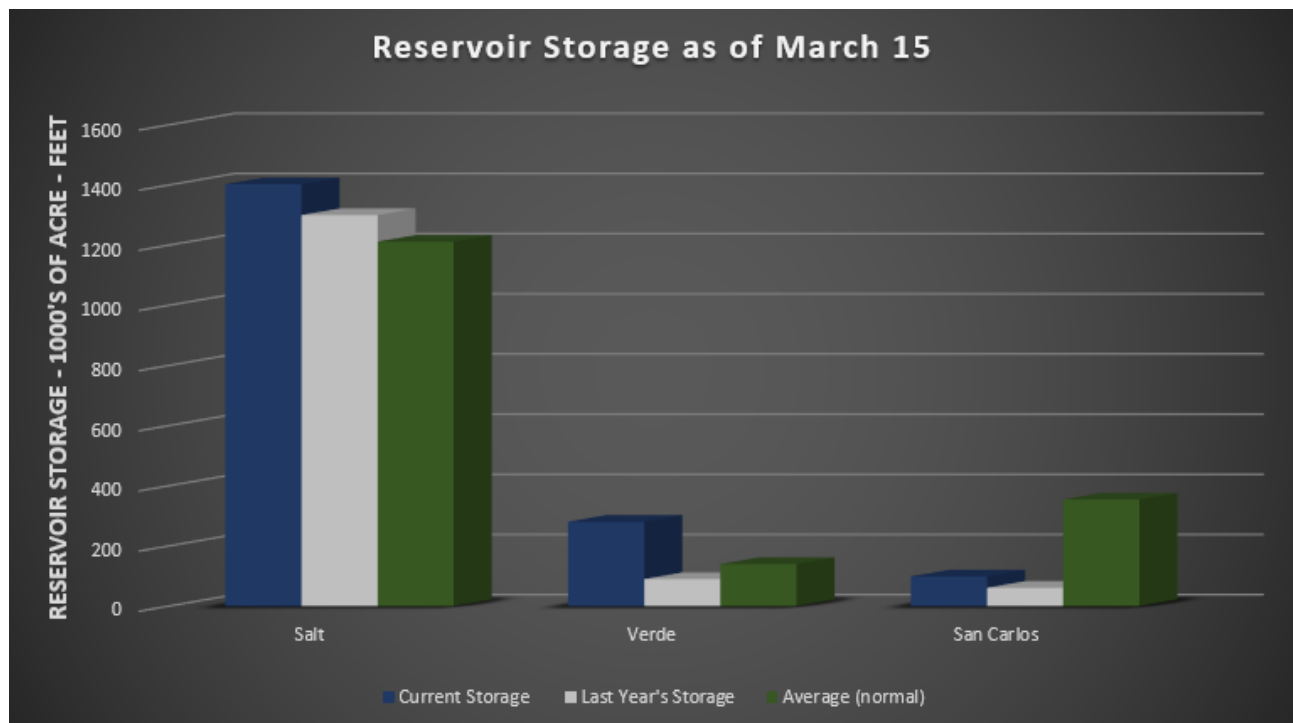


PRECIPITATION

Mountain data from NRCS SNOTEL sites and NWS Cooperator gages show that precipitation for the first half of March was well above average in the major river basins. Cumulative precipitation since October 1 is above 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 March 15, the Salt and Verde River reservoir system stands at 73 percent of capacity. San Carlos Reservoir is currently at 11 percent of capacity.



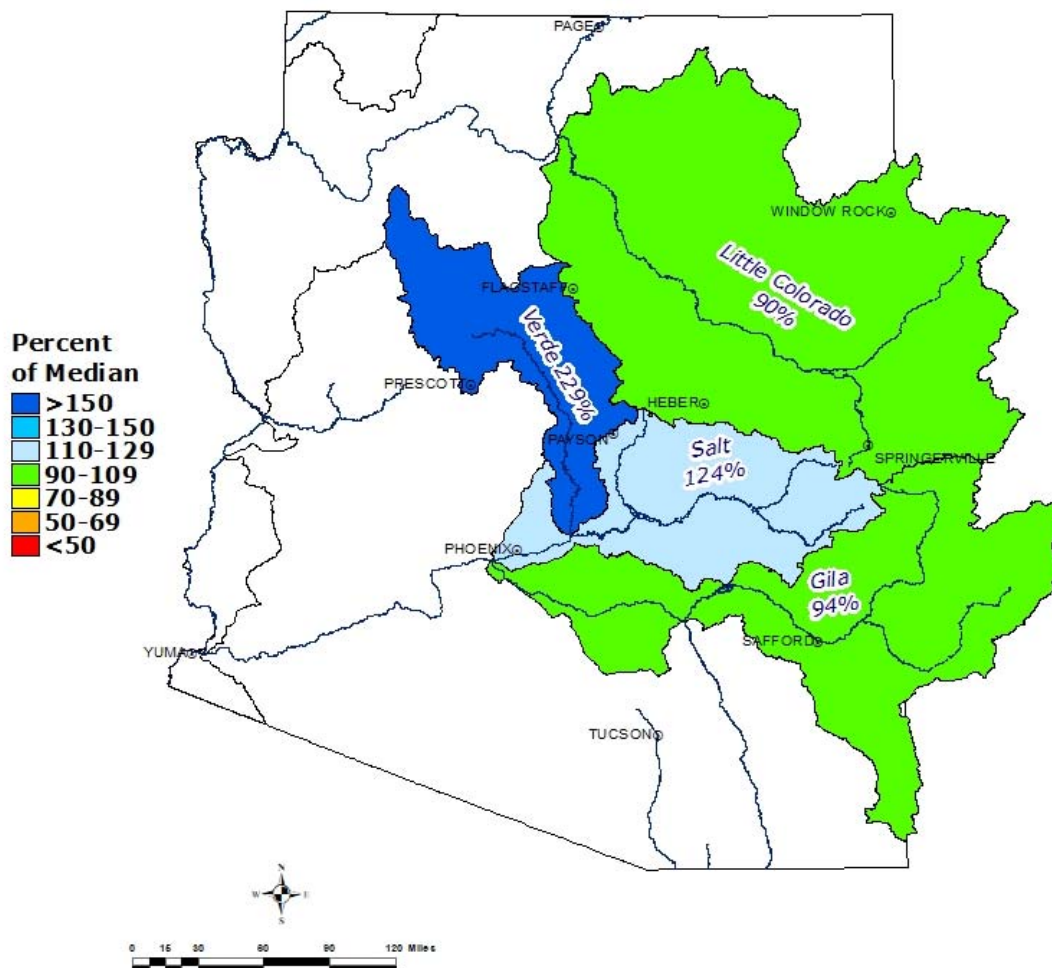
Key storage volumes displayed in thousands of acre-feet (x1000):

<u>Reservoir</u>	<u>Current Storage</u>	<u>Last Year Storage</u>	<u>30-Year Average</u>	<u>Storage Capacity</u>
Salt River System	1402.9	1300.5	1212.0	2025.8
Verde River System	281.0	90.3	140.2	287.4
San Carlos Reservoir	99.2	61.4	355.0	875.0
Lyman Lake	5.4	11.0	12.0	30.0
Lake Havasu	589.7	576.0	561.2	619.0
Lake Mohave	1728.0	1720.9	1659.0	1810.0
Lake Mead	10800.0	10698.0	20361.0	26159.0
Lake Powell	9174.3	13161.0	17553.0	24322.0

STREAMFLOW

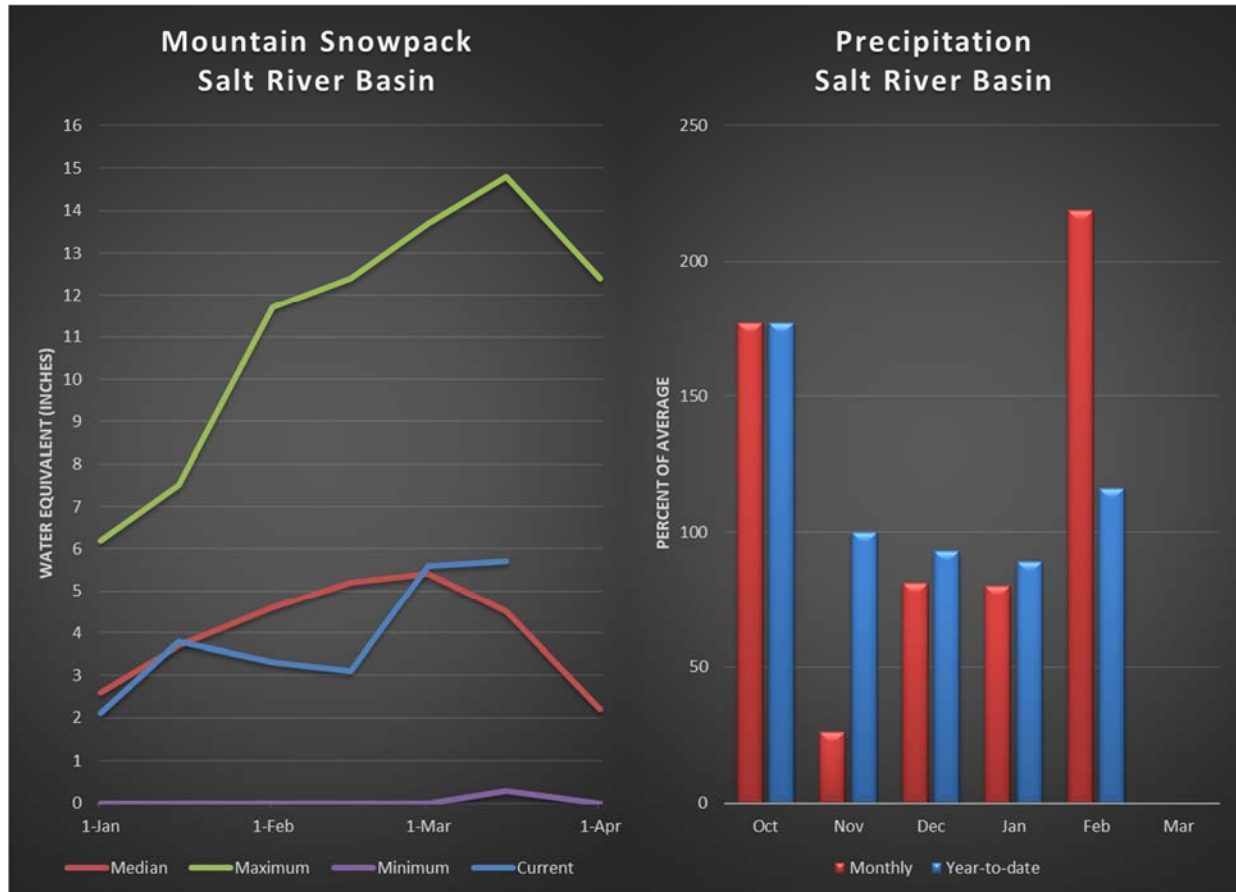
As of March 15, the forecast calls for normal to well above normal streamflow for the spring runoff period, ranging from 90 percent of median in the Little Colorado River above Lyman Lake to 229 percent of median in the Verde River above Horseshoe Dam. Total precipitation since the beginning of the water year has been well above average, saturating the soils, and producing ideal conditions for runoff. Please refer to the basin forecast tables found in this report for more information regarding water supply forecasts.

Arizona Spring Streamflow Forecasts as of March 15, 2019



SALT RIVER BASIN as of March 15, 2019

Above normal streamflow levels are forecast for the basin. In the Salt River, near Roosevelt, the forecast calls for 124% of median streamflow through May, while at Tonto Creek, the forecast calls for 172% of median streamflow through May. Snow survey measurements show the Salt snowpack to be at 126% of median.



Salt River Basin Streamflow Forecasts - March 16, 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	30% (KAF)	10% (KAF)	
Salt R nr Roosevelt ³	MAR			300	263%			114
	M15-MAY	161	215	255	124%	300	380	205
Tonto Ck ab Gun Ck nr Roosevelt ³	MAR			52	338%			15.4
	M15-MAY	7.5	14.4	21	172%	29	45	12.2

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

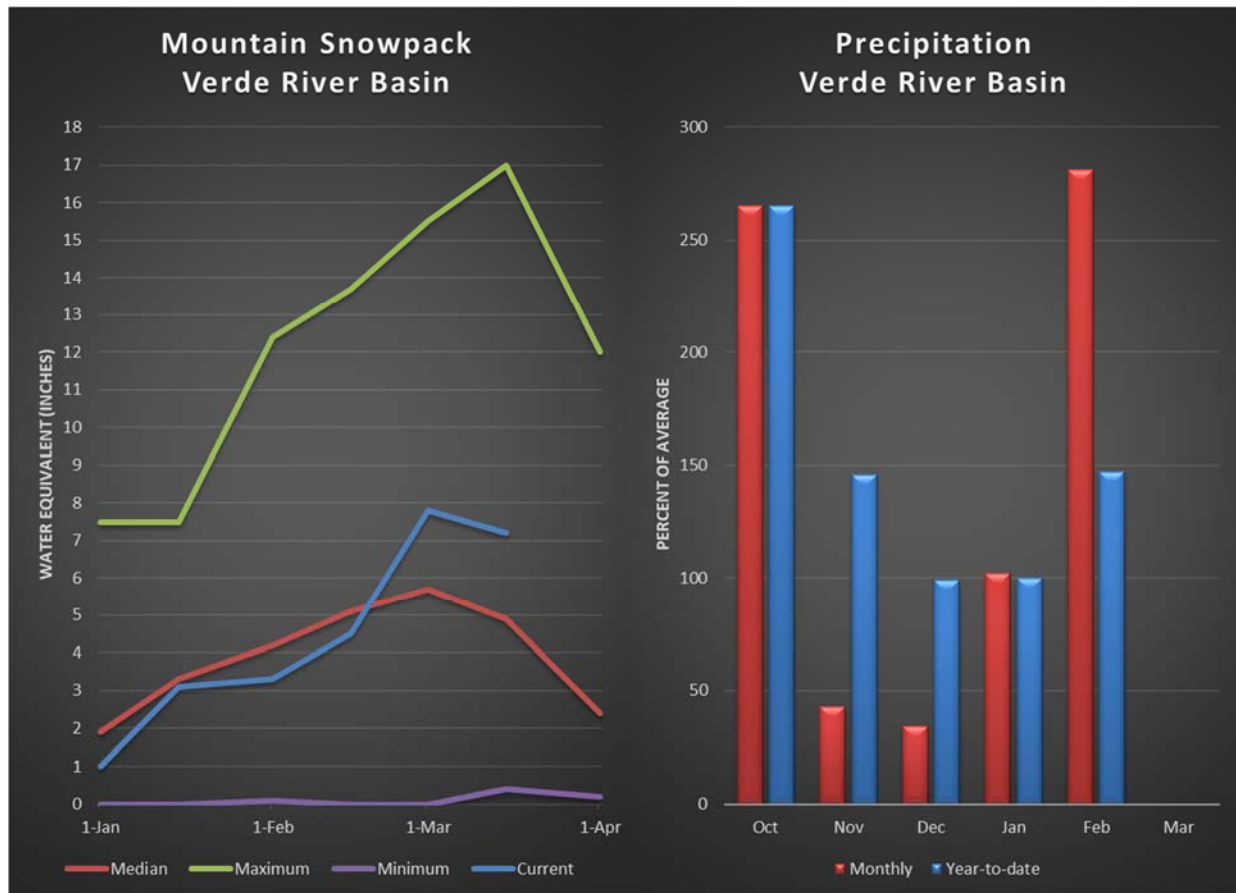
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions

3) Median value used in place of average

Reservoir Storage Middle of February, 2019		Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Salt River Reservoir System		1402.9	1300.5	1344.0	2025.8
Basin-wide Total		1402.9	1300.5	1344.0	2025.8
# of reservoirs		1	1	1	1
Watershed Snowpack Analysis March 16, 2019		# of Sites	% Median	Last Year % Median	
SALT RIVER BASIN		11	126%	5%	

VERDE RIVER BASIN as of March 15, 2019

Well above normal streamflow levels are forecast for the basin. In the Verde River above Horseshoe Dam, the forecast calls for 229% of median streamflow through May. Snow survey measurements show the Verde snowpack to be at 147% of median.



Verde River Basin Streamflow Forecasts - March 16, 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								
	MAR			175	297%			59
	M15-MAY	60	100	135	229%	178	255	59

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

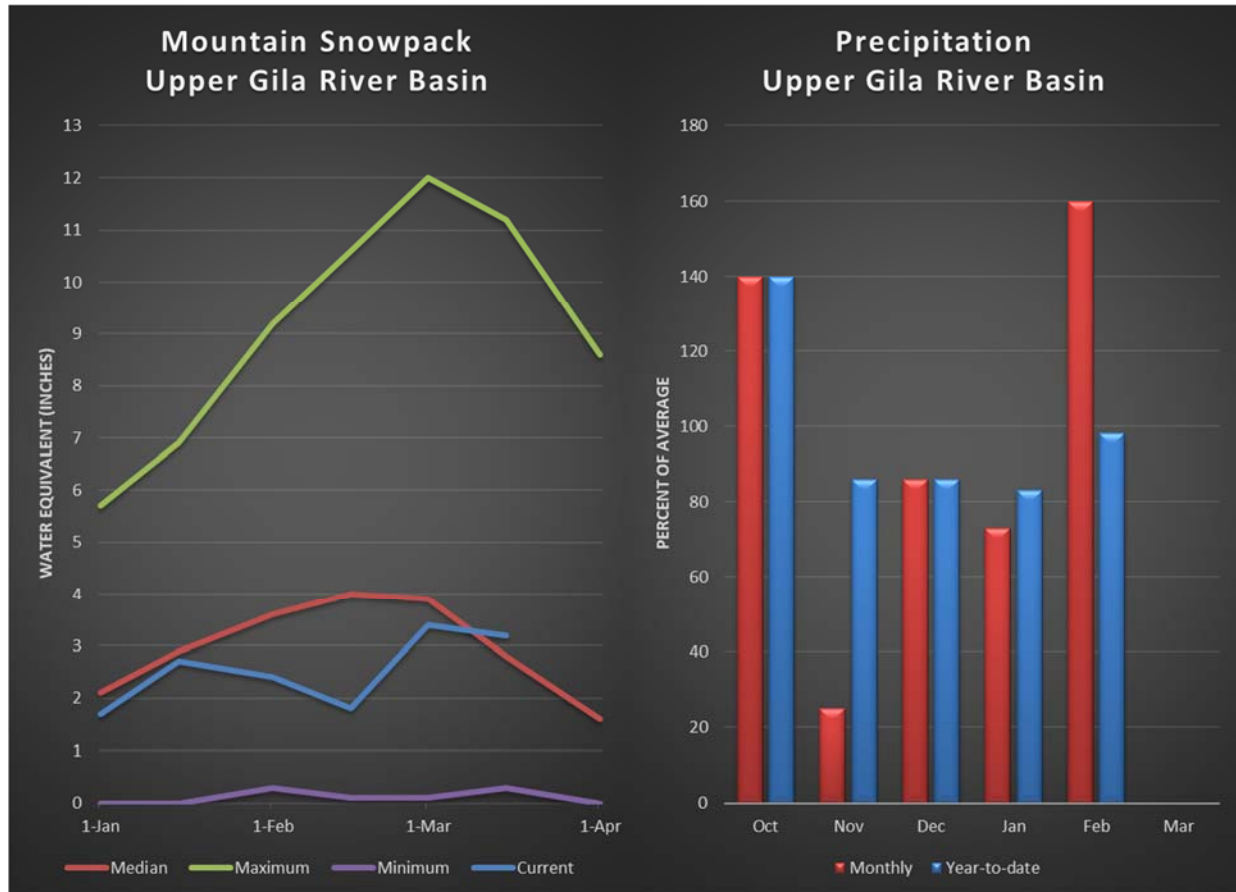
3) Median value used in place of average

Reservoir Storage Middle of February, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Verde River Reservoir System	281.0	90.3	187.1	287.4
Basin-wide Total	281.0	90.3	187.1	287.4
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 16, 2019	# of Sites	% Median	Last Year % Median
VERDE RIVER BASIN	12	147%	22%

SAN FRANCISCO-UPPER GILA RIVER BASIN as of March 15, 2019

Normal streamflow levels are forecast for the basin. In the San Francisco River, at Clifton, the forecast calls for 124% of median streamflow levels through May. In the Gila River, near Solomon, the forecast calls for 94% of median streamflow levels through May. At San Carlos Reservoir, inflow to the lake is forecast at 93% of median through May. Snow survey measurements show the snowpack for this basin to be at 115% of median.



San Francisco-Upper Gila River Basin Streamflow Forecasts - March 16, 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	M15-MAY	15.5	20	24	92%	28	35	26
Gila R bl Blue Ck nr Virden ³	M15-MAY	13.6	22	28	90%	35	47	31
San Francisco R at Glenwood ³	M15-MAY	3.8	6.8	9.6	79%	13.1	19.6	12.1
San Francisco R at Clifton ³	M15-MAY	16.6	27	36	124%	46	63	29
Gila R nr Solomon ³	MAR			62	163%			38
	M15-MAY	31	50	66	94%	84	115	70
San Carlos Reservoir Inflow ³	M15-MAY	0.19	6.6	39	93%	30	58	42

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

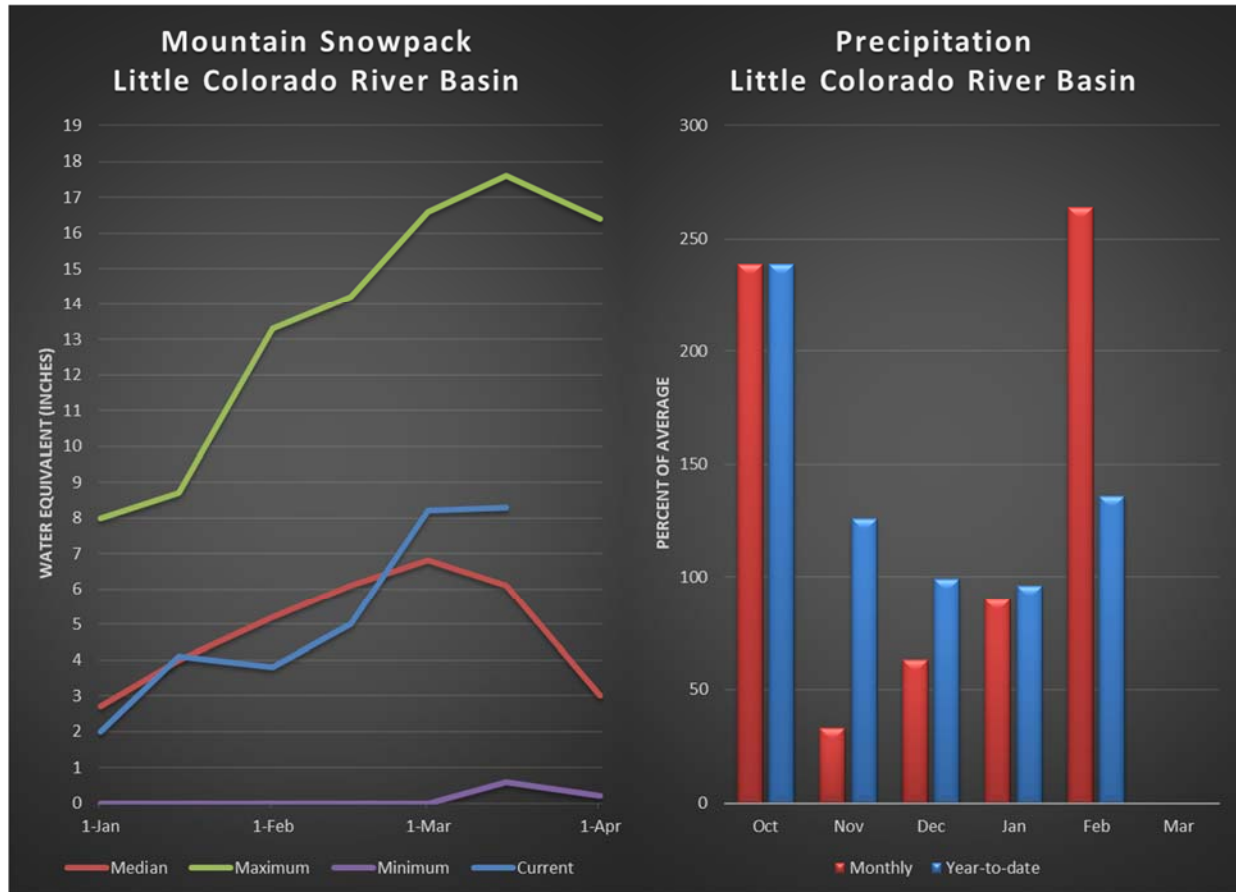
3) Median value used in place of average

Reservoir Storage Middle of February, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
San Carlos Reservoir	99.2	61.3	413.2	875.0
Basin-wide Total	99.2	61.3	413.2	875.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 16, 2019	# of Sites	% Median	Last Year % Median
SAN FRANCISCO-UPPER GILA RIVER BASIN	9	115%	3%

LITTLE COLORADO RIVER BASIN as of March 15, 2019

Normal streamflow levels are forecast for the basin. In the Little Colorado River, above Lyman Lake, the forecast calls for 90% of median streamflow through June. At Blue Ridge (C.C. Cragin) Reservoir, inflow to the lake is forecast at 90% of median through May. Snowpacks along the southern headwaters of the Little Colorado River, and along the central Mogollon Rim, were measured at 136% and 139% of median, respectively.



Little Colorado River Basin Streamflow Forecasts - March 16, 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	MAR-JUN	2.3	4	5.4	90%	7.2	10.4	6
Blue Ridge Reservoir Inflow ³	MAR-MAY	5.6	9.1	12.2	90%	15.9	23	13.5
Lake Mary Reservoir Inflow ³	MAR-MAY	1	1.88	2.7	93%	3.7	5.7	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

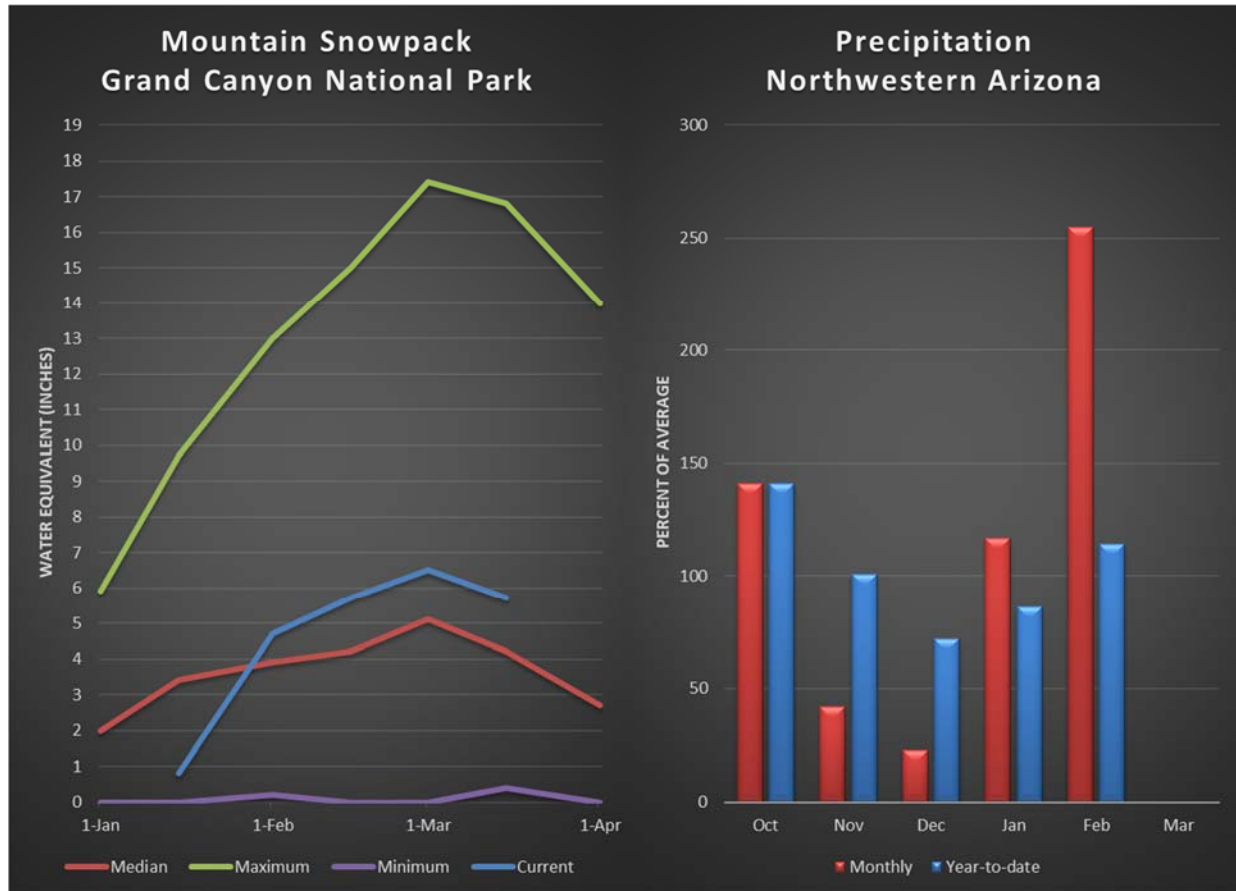
3) Median value used in place of average

Reservoir Storage Middle of February, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lyman Reservoir	5.4	11.0	13.6	30.0
Basin-wide Total	5.4	11.0	13.6	30.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 16, 2019	# of Sites	% Median	Last Year % Median
LITTLE COLORADO RIVER BASIN	10	136%	10%
CENTRAL MOGOLLON RIM	4	139%	12%

NORTHWESTERN ARIZONA as of March 15, 2019

On the Colorado River, well above normal inflow to Lake Powell is forecast at 154% 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 136% of median.



Northwestern Arizona Streamflow Forecasts - March 16, 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)
Lake Powell Inflow ²	APR-JUL	8010	9730	11000	154%	12300	14500	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 Middle of February, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lake Havasu	589.7	577.7	559.5	619.0
Lake Mohave	1728.0	1721.0	1692.0	1810.0
Lake Mead	10800.0	10698.0	20543.0	26159.0
Lake Powell	9174.3	13160.8	16977.0	24322.0
Basin-wide Total	22292.0	26157.5	39771.5	52910.0
# of reservoirs	4	4	4	4

Watershed Snowpack Analysis March 16, 2019	# of Sites	% Median	Last Year % Median
NORTHWESTERN ARIZONA	2	136%	6%

Basinwide Summary: March 16, 2019
(Averages/Medians based on 1981-2010 reference period)

Snowpack Summary for March 16, 2019

SALT RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baldy	SNOTEL	9125	30	10.2	7.9	129%	0.0	0%
Beaver Head	SNOTEL	7990	2	0.6	3.8	16%	0.0	0%
Buck Spring	SC	7400	7	1.0	0.9	111%	0.0	0%
Coronado Trail	SNOTEL	8400	3	1.4	0.0		0.0	
Hawley Lake	SNOTEL	8300	48	15.8			5.0	
Coronado Trail	SC	8350	4	1.0	0.7	143%	0.0	0%
Fort Apache	SC	9160	40	11.3	8.0	141%	1.7	21%
Hannagan Meadows	SNOTEL	9020	35	13.7	11.1	123%	0.4	4%
Maverick Fork	SNOTEL	9200	35	12.7	9.1	140%	0.1	1%
Nutriosio	SC	8500	5	0.9	0.4	225%	0.0	0%
Nutriosio	SNOTEL	8500	2	0.8			0.0	
Wildcat	SNOTEL	7850	4	1.3	1.9	68%	0.0	0%
Workman Creek	SNOTEL	6900	9	3.2	1.5	213%	0.0	0%
Basin Index						126%		5%
# 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	19	6.5	3.6	181%	0.0	0%
Baker Butte No. 2	SC	7700	42	13.1	12.1	108%	3.1	26%
Baker Butte Smt	SNOTEL	7700	55	17.8			5.2	
Bar M	SNOTEL	6393	2	0.7			0.0	
Chalender	SC	7100	6	1.5	1.1	136%	0.0	0%
Chalender	SNOTEL	7100	7	4.6			0.0	
Fort Valley	SC	7350	5	0.9	1.0	90%	0.0	0%
Fort Valley	SNOTEL	7350	1	0.6			0.0	
Fry	SNOTEL	7200	22	7.4	3.7	200%	1.9	51%
Happy Jack	SNOTEL	7630	27	9.6	4.9	196%	0.5	10%
Happy Jack	SC	7630	12	2.7	3.0	90%	0.3	10%
Mormon Mountain	SNOTEL	7500	17	7.1	4.6	154%	0.4	9%
Mormon Mountain Summit #2	SC	8470	49	16.3	11.6	141%	3.4	29%
Mormon Mtn Summit	SNOTEL	8500	42	14.8			3.1	
Newman Park	SC	6750	6	1.2	0.4	300%	0.0	0%
White Horse Lake	SNOTEL	7180	9	4.2	2.1	200%	0.0	0%
Williams Ski Run	SC	7720	43	12.5	8.4	149%	2.8	33%
Basin Index						147%		22%
# 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	76	20.6	17.8	116%	5.0	28%
Snowslide Canyon	SNOTEL	9730	72	27.9	17.1	163%	7.3	43%
Basin Index						139%		35%
# 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	2	0.6	3.8	16%	0.0	0%
Coronado Trail	SNOTEL	8400	3	1.4	0.0		0.0	
Coronado Trail	SC	8350	4	1.0	0.7	143%	0.0	0%
Frisco Divide	SNOTEL	8000	1	0.7	0.1	700%	0.0	0%
Hannagan Meadows	SNOTEL	9020	35	13.7	11.1	123%	0.4	4%
Hummingbird - Aerial And Snow Course	SC	10550						

Lookout Mountain	SNOTEL	8500	1	0.6	0.0		0.0	
Nutriosio	SC	8500	5	0.9	0.4	225%	0.0	0%
Nutriosio	SNOTEL	8500	2	0.8			0.0	
Signal Peak	SNOTEL	8360	6	1.4	1.0	140%	0.0	0%
Silver Creek Divide	SNOTEL	9000	23	9.2	8.5	108%	0.4	5%
State Line	SC	8000			0.7			
Whitewater - Aerial And Snow Course	SC	10750						

Basin Index	115%	3%
# of sites	9	9

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	19	6.5	3.6	181%	0.0	0%
Baker Butte No. 2	SC	7700	42	13.1	12.1	108%	3.1	26%
Baker Butte Smt	SNOTEL	7700	55	17.8			5.2	
Baldy	SNOTEL	9125	30	10.2	7.9	129%	0.0	0%
Buck Spring	SC	7400	7	1.0	0.9	111%	0.0	0%
Cheese Springs	SC	8700	25	7.2	5.7	126%	0.9	16%
Fort Apache	SC	9160	40	11.3	8.0	141%	1.7	21%
Heber	SNOTEL	7640	15	5.1	1.2	425%	0.0	0%
Lake Mary	SC	6930	2	0.2	0.6	33%	0.0	0%
Maverick Fork	SNOTEL	9200	35	12.7	9.1	140%	0.1	1%
Promontory	SNOTEL	7930	40	14.7	11.4	129%	0.3	3%

Basin Index	136%	10%
# 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	19	6.5	3.6	181%	0.0	0%
Baker Butte No. 2	SC	7700	42	13.1	12.1	108%	3.1	26%
Baker Butte Smt	SNOTEL	7700	55	17.8			5.2	
Heber	SNOTEL	7640	15	5.1	1.2	425%	0.0	0%
Promontory	SNOTEL	7930	40	14.7	11.4	129%	0.3	3%

Basin Index	139%	12%
# 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			9.2			
Beaver Spring	SNOTEL	9200	54	16.6			0.0	
Bowl Canyon	SC	8980			9.1			
Hidden Valley	SC	8480						
Missionary Spring	SC	7940			2.4			
Tsaile Canyon #1	SC	8160	23	9.6	6.4	150%		
Tsaile Canyon #3	SC	8920	42	14.2	9.3	153%		
Whiskey Creek	SC	9050			9.2			
Navajo Whiskey Ck	SNOTEL	9050	52	16.7			0.4	

Basin Index		
--------------------	--	--

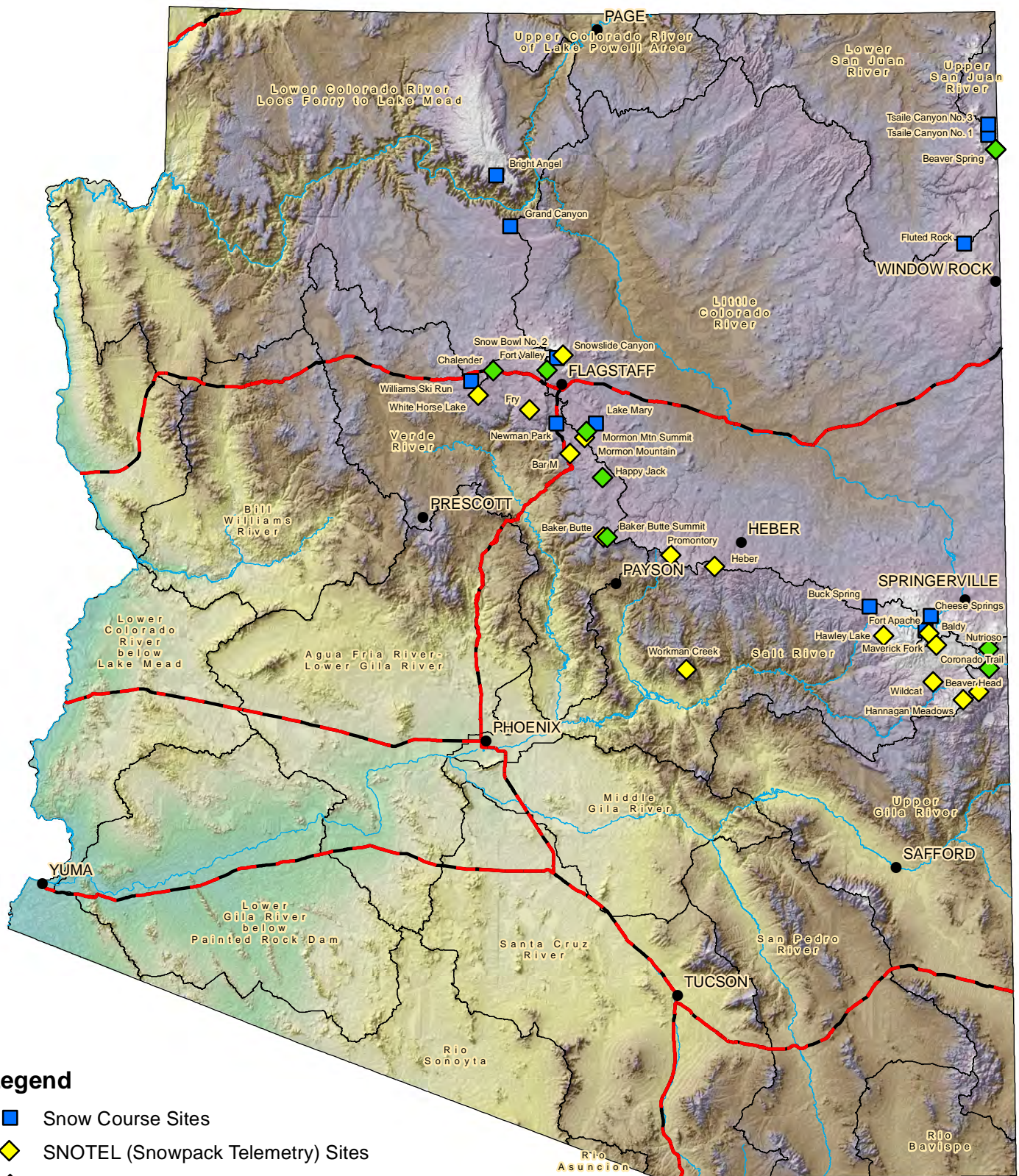
DEFIANCE PLATEAU	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Fluted Rock	SC	7800	20	4.8	2.0	240%		

Basin Index		
--------------------	--	--

NORTHWESTERN ARIZONA	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Bright Angel	SC	8400	42	11.0	8.0	138%	0.5	6%
Grand Canyon	SC	7500	1	0.3	0.3	100%	0.0	0%

Basin Index	136%	6%
# of sites	2	2

Arizona Snow Survey Data Sites



Legend

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