Salt River & Verde River Watersheds Water Supply Update

Stephen Flora, Senior Hydrologist

ADWR Drought ICG Meeting – May 11, 2021

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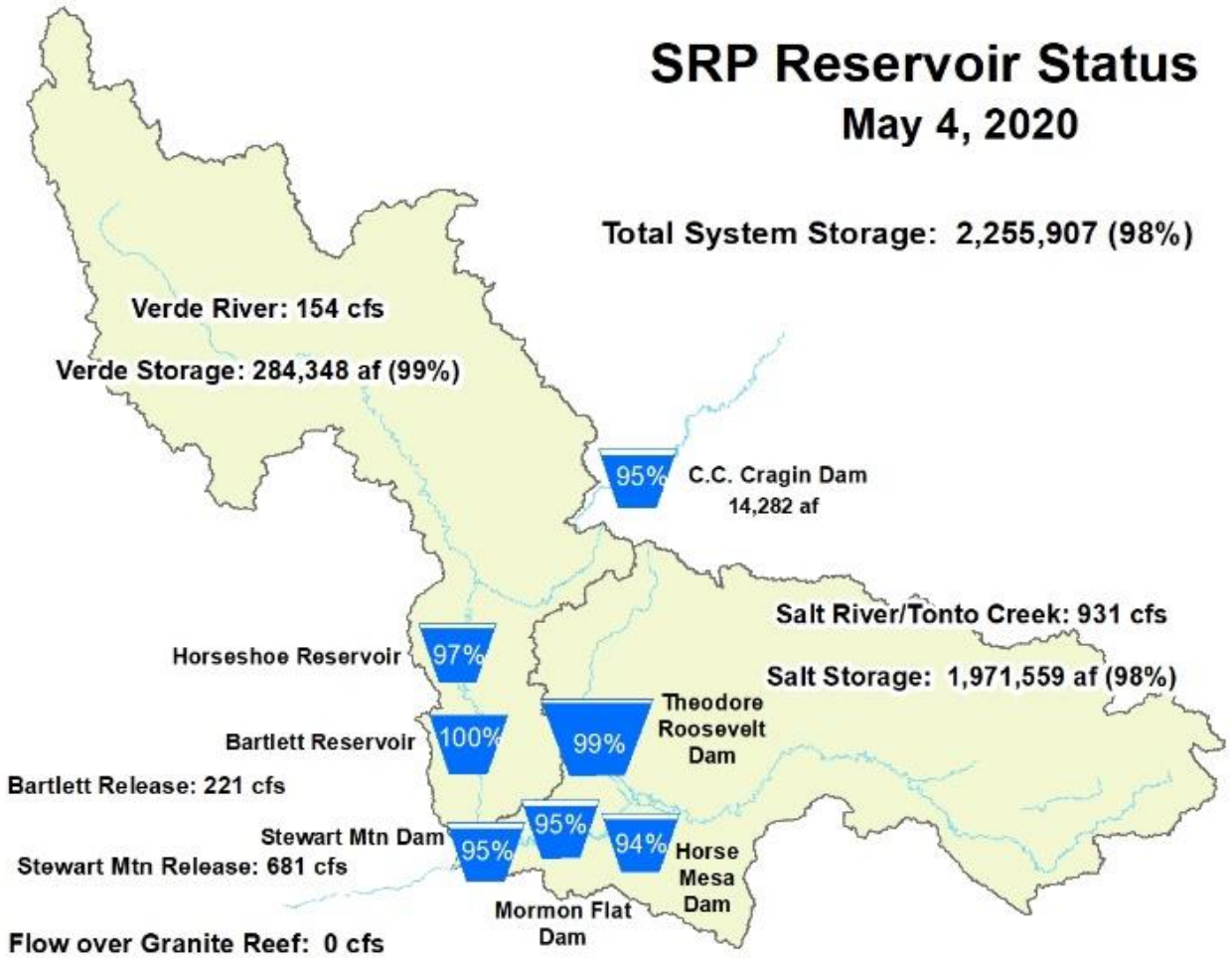
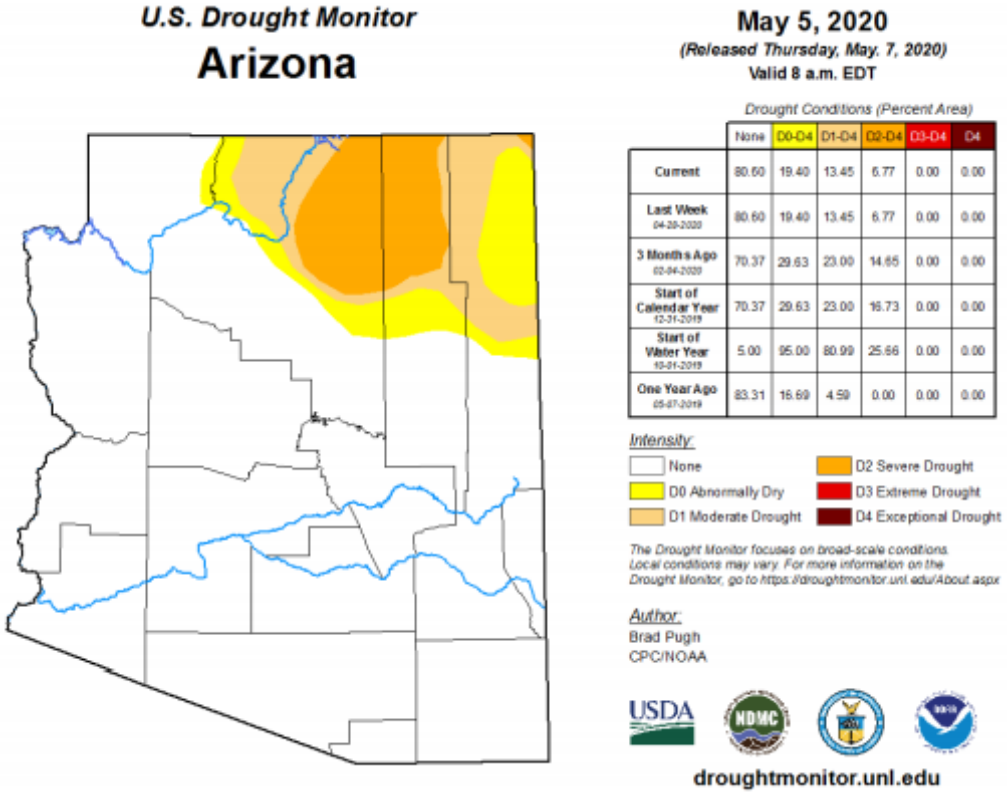
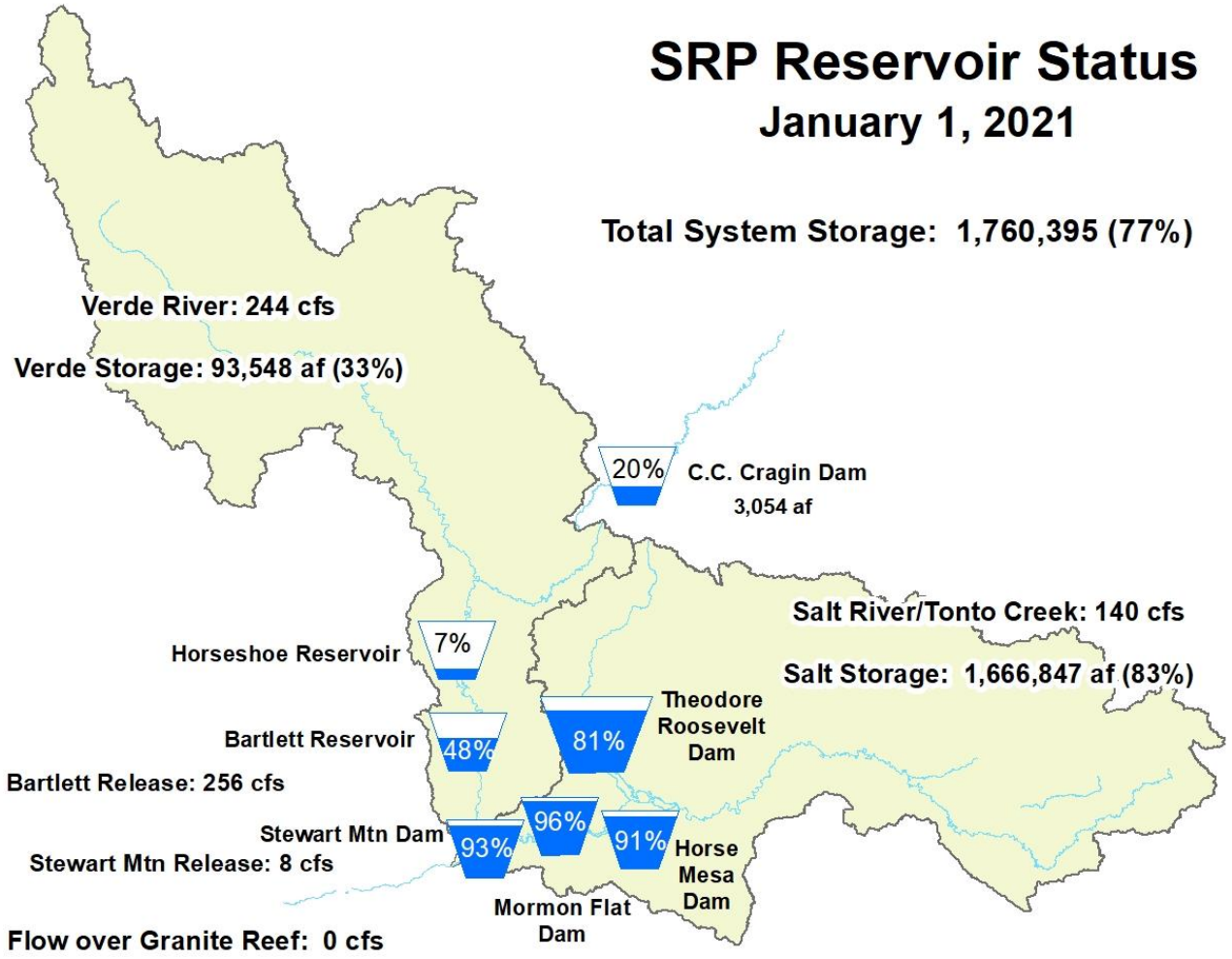
This time last year…

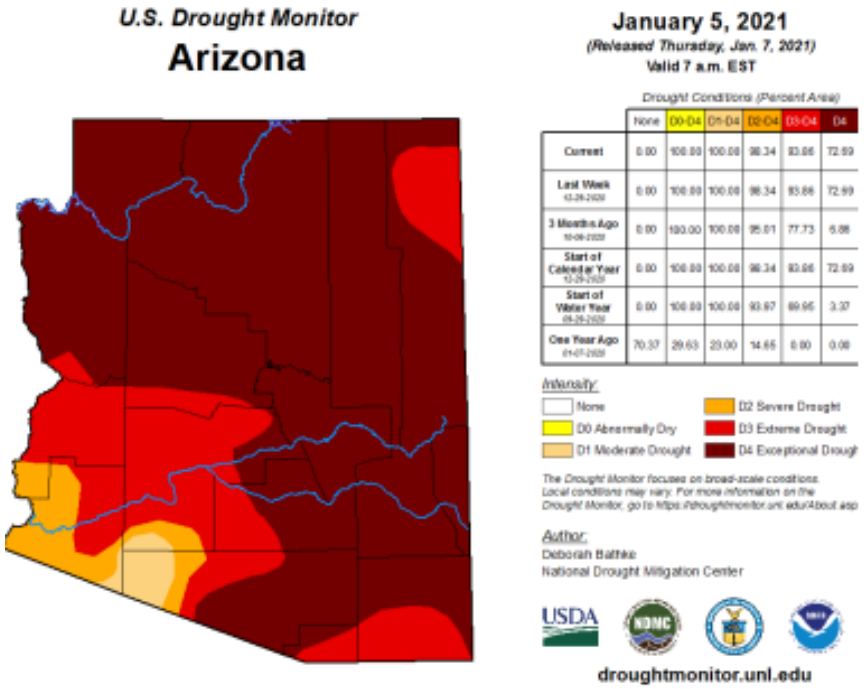




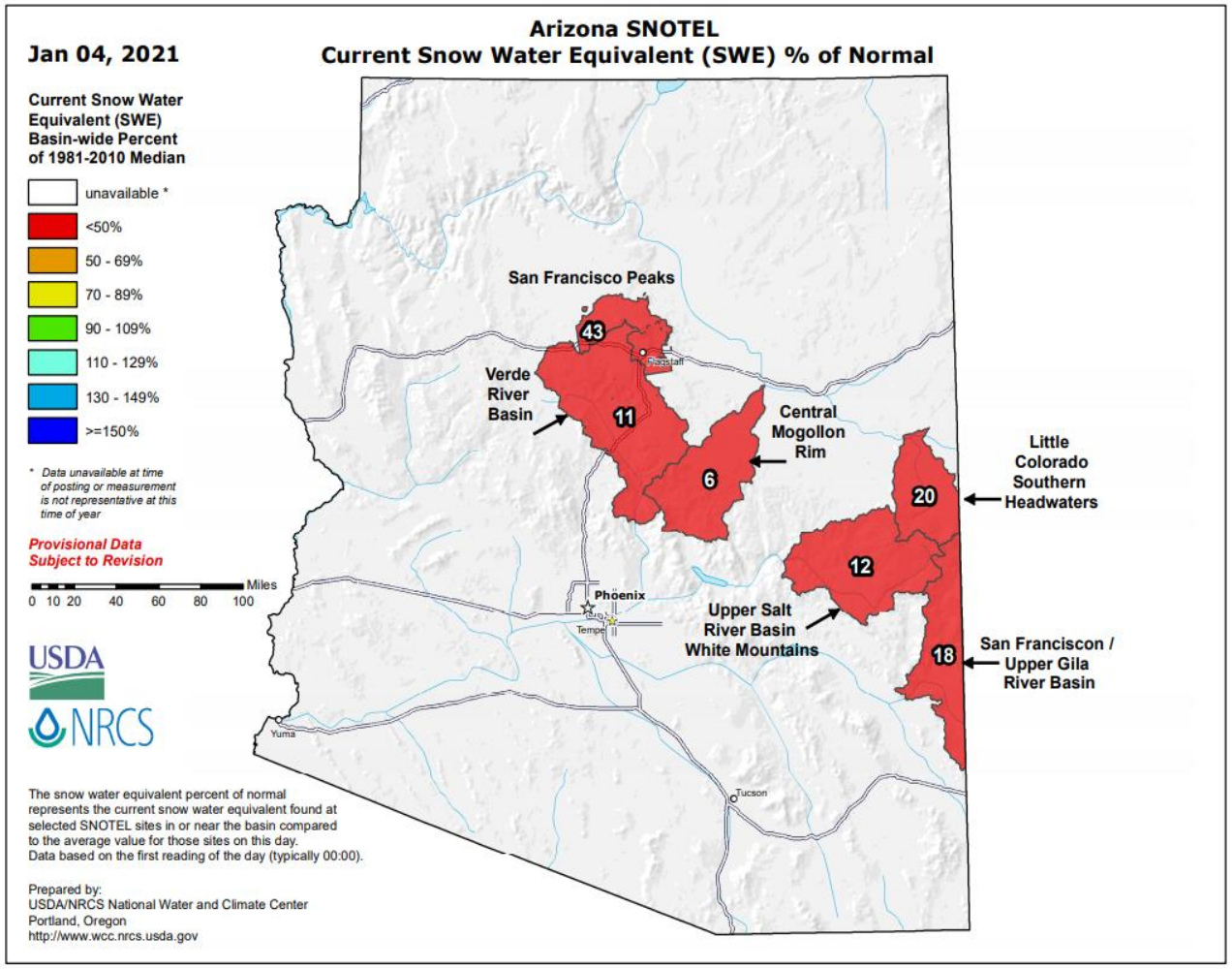


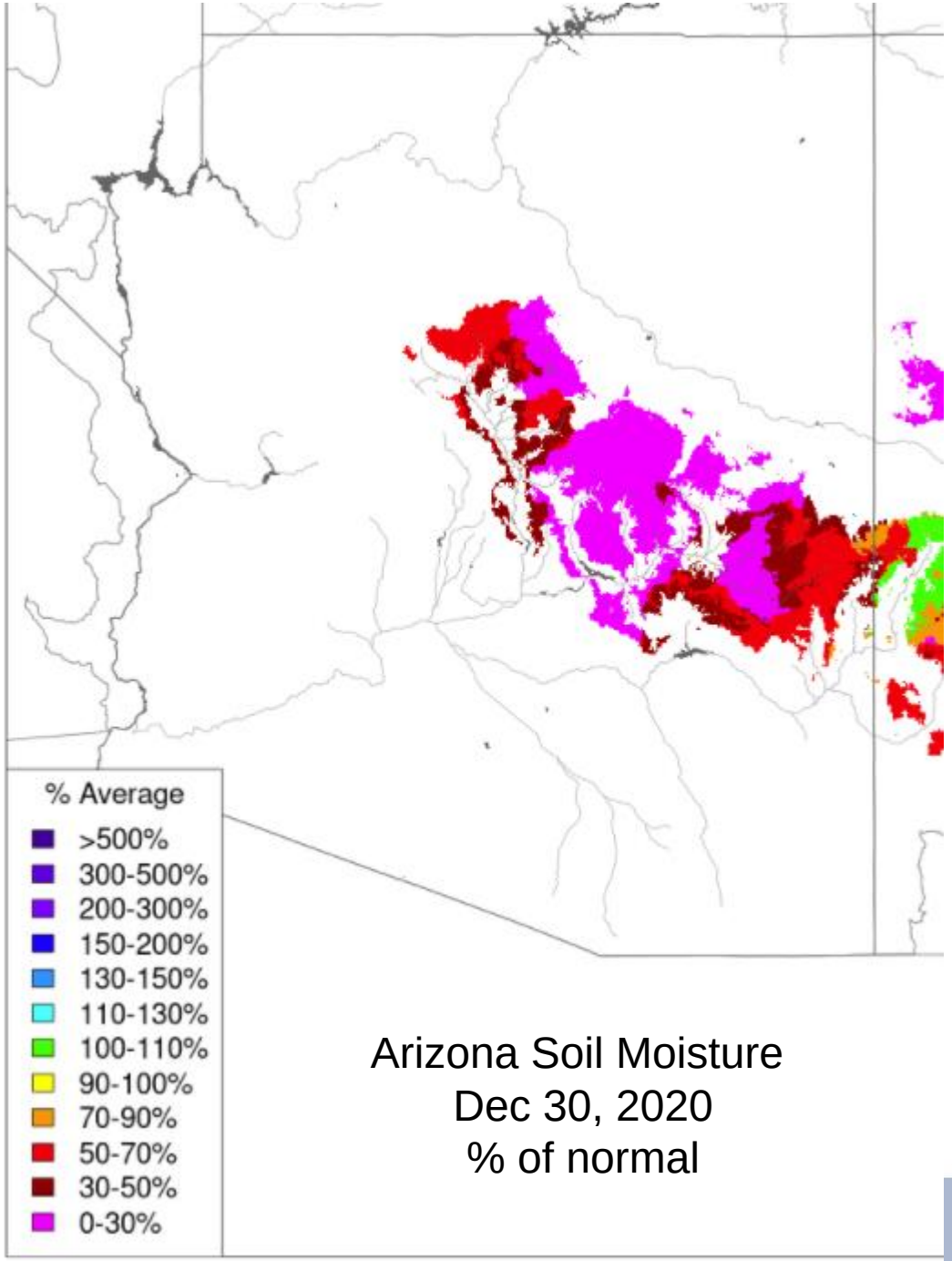
- Record low precipitation and inflows during summer monsoon
  - Precipitation = 1.93” (30%)
  - July – Sept Inflow = 32,354 AF (29%)

- Record low inflows during fall 2020
  - Oct – Dec Inflow = 51,193 AF (38%)

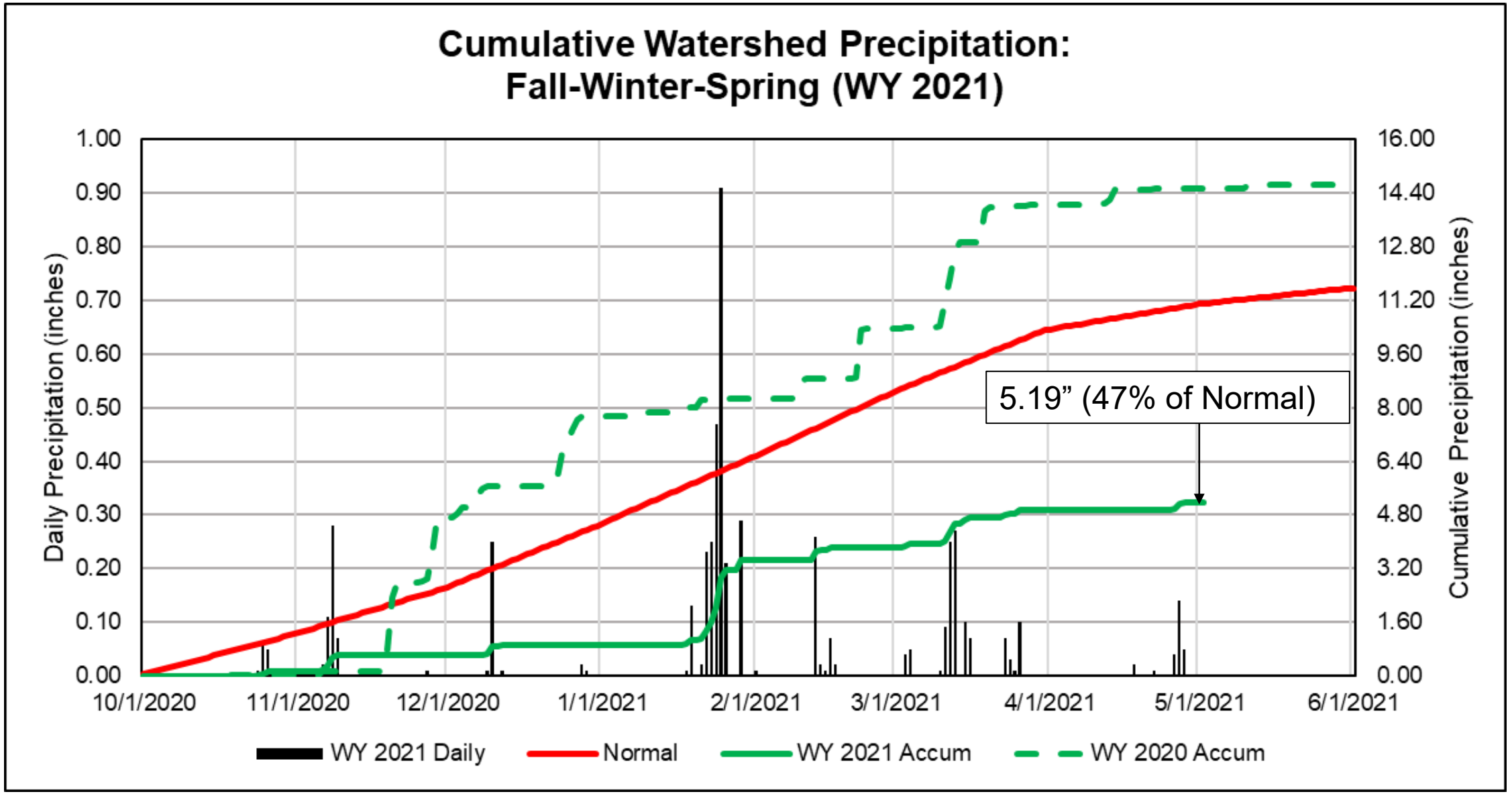


Soil Moisture and Snowpack - January 1, 2021





Arizona Soil Moisture
Dec 30, 2020
% of normal



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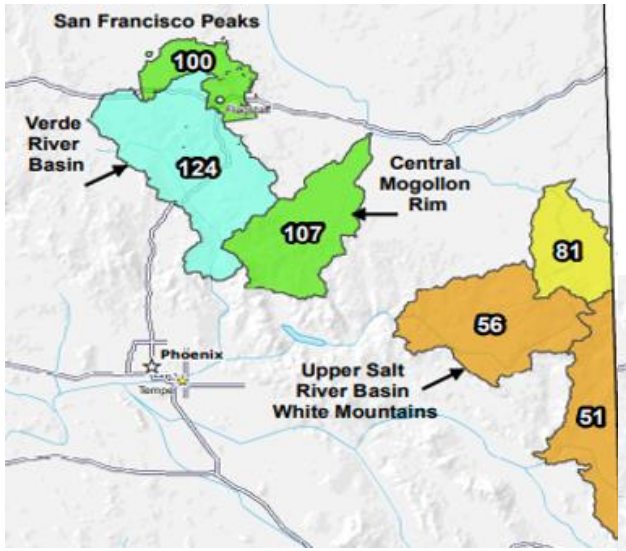
January is the only month in WY 2021 so far with above normal precipitation (2.51”, 124%)

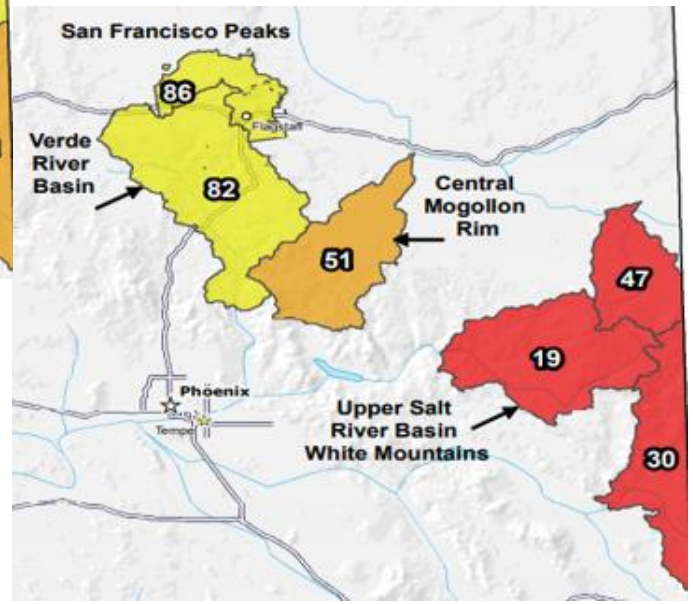
Jan - Mar Snowpack
Salt and Verde Watershed

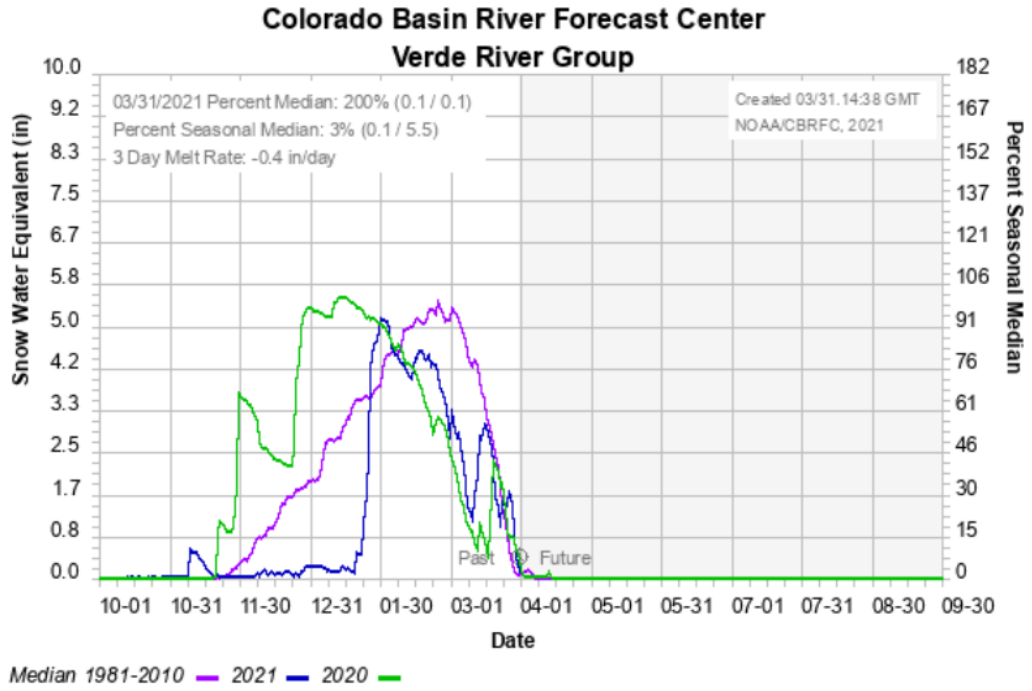
Cumulative SWE - % of normal

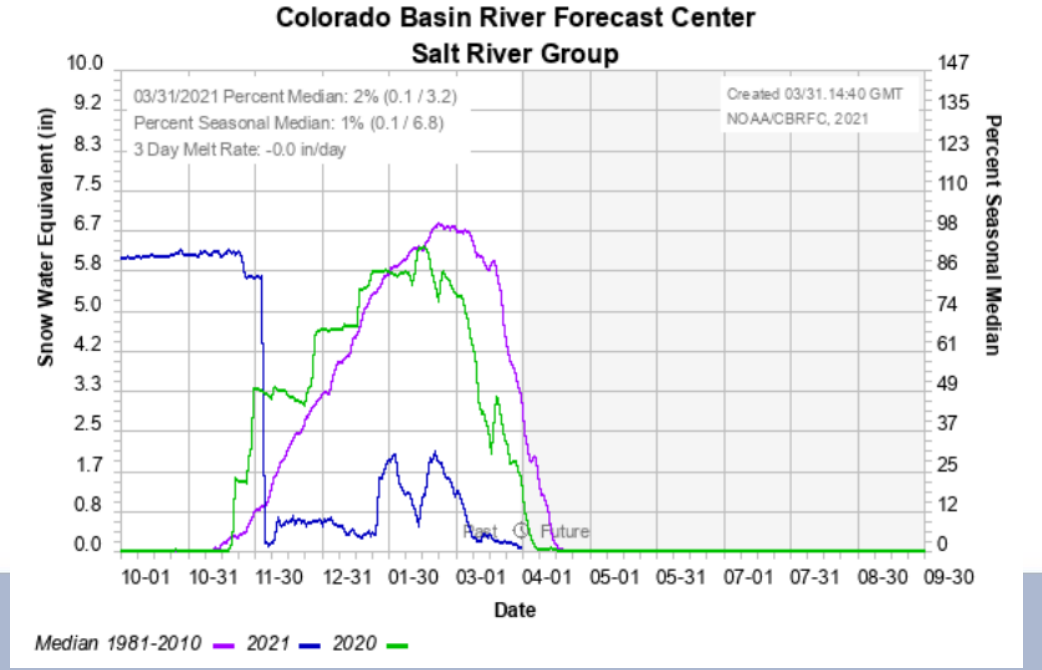


February 1, 2021
Verde – 124%
Salt 56%

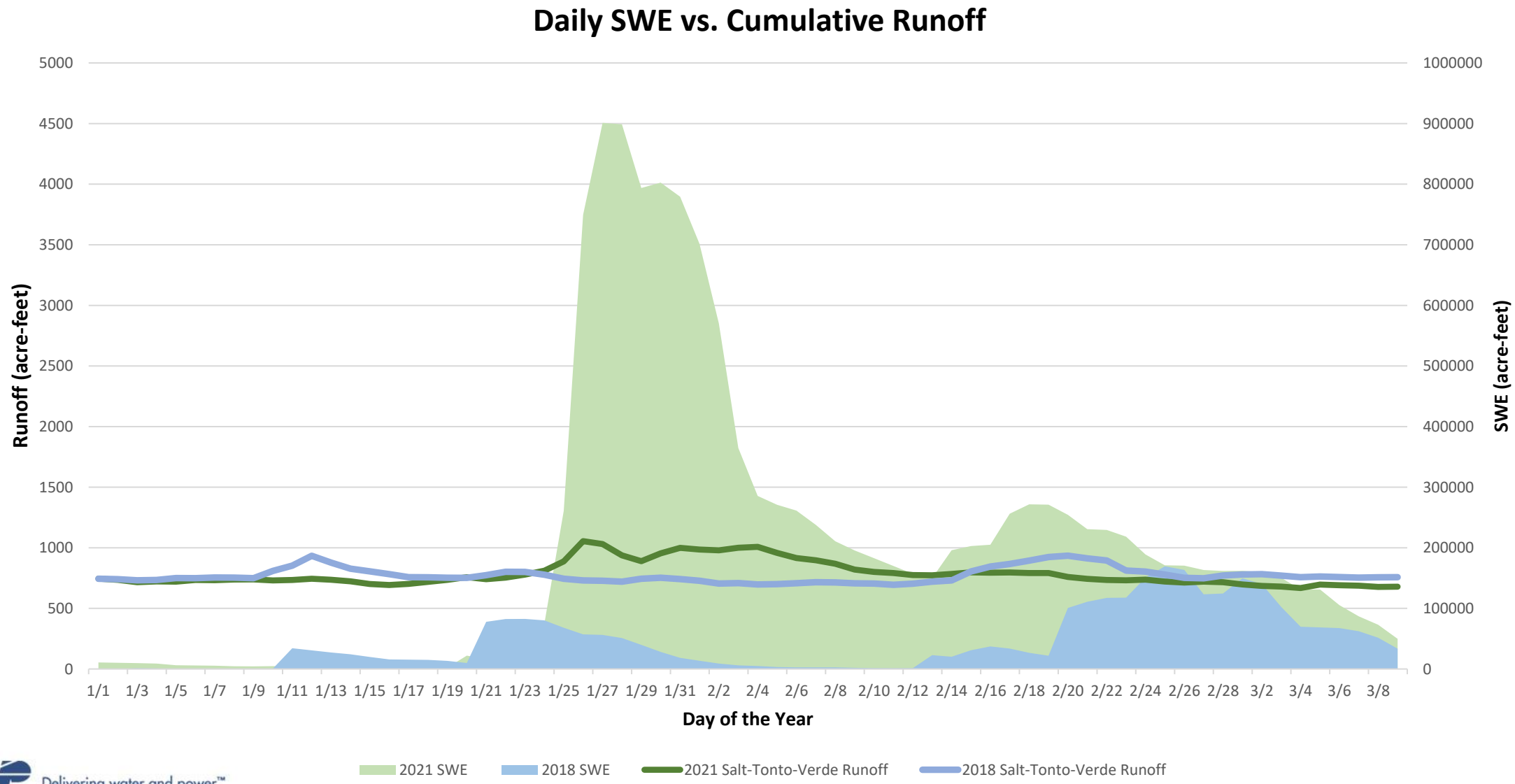
March 15, 2021
Verde – 82%
Salt 19%







Snowpack vs Streamflow – 2018 vs 2021



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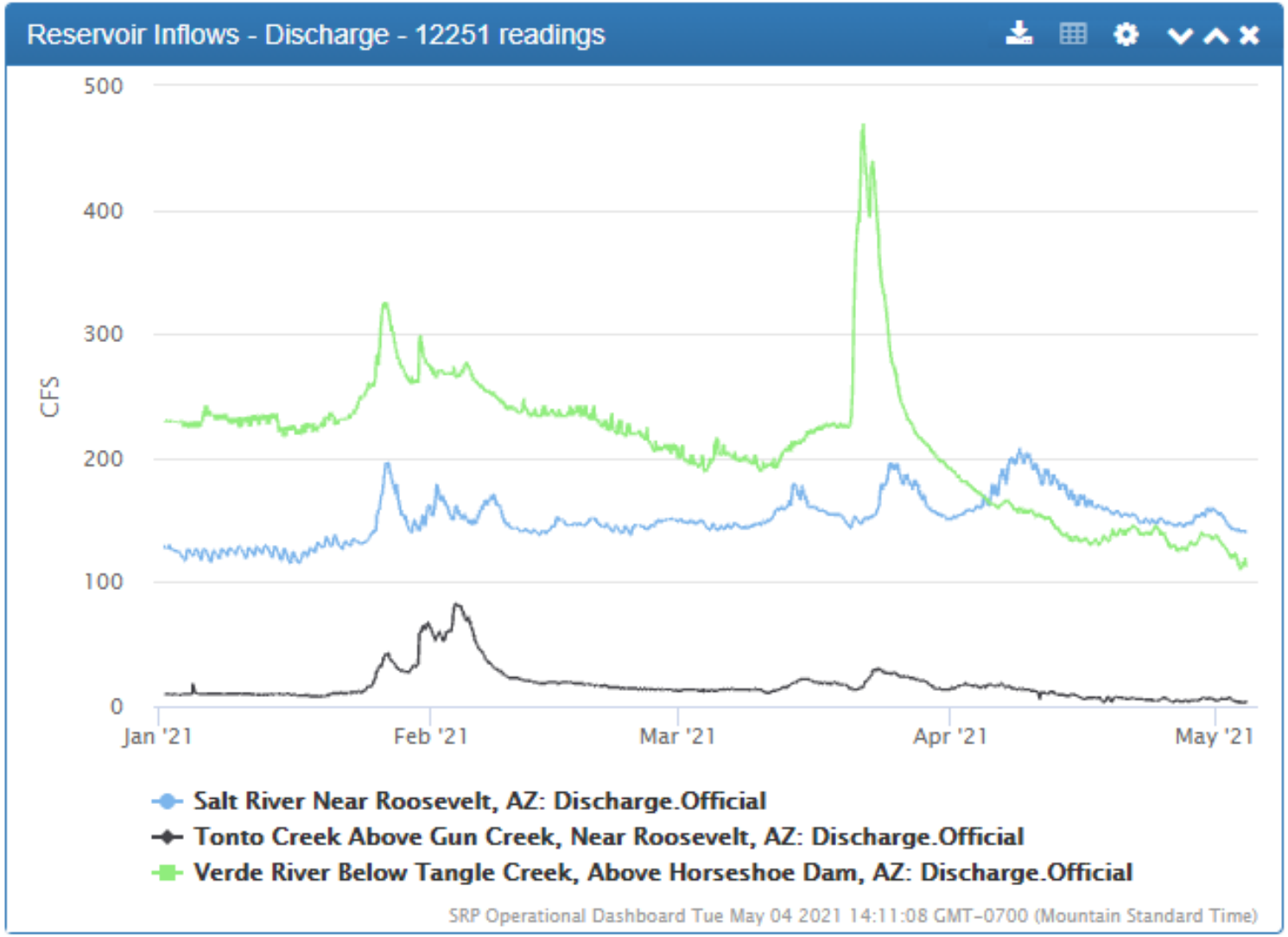
Winter 2021 Reservoir Inflows

	Salt/Tonto (AF)	Verde (AF)	Total (AF)
January	9,457*	14,938**	24,395**
February	9,991**	12,992**	22,903**
March	10,537*	14,273	24,810**
April	10,500**	8,565**	19,065**

*Lowest inflow on record,
**2nd or 3rd lowest inflow on record (2018 and/or 2002)

- Near Record low inflows winter 2021
  - Jan – Apr inflow ~ 91,173 AF
  - 2002 – 92,493 AF
  - 2018 – 87,819 AF

- Water Year Total Inflow (Oct - Apr)
  - 2021 – 142,366 AF (Record Low)
  - 2018 – 147,723 AF



SRP Streamflow Forecast Summary Report (Draft) January 1-May 31, 2021

SRP Forecast

Salt – 41,500 AF*

Tonto – 4,000 AF

Verde – 56,500 AF

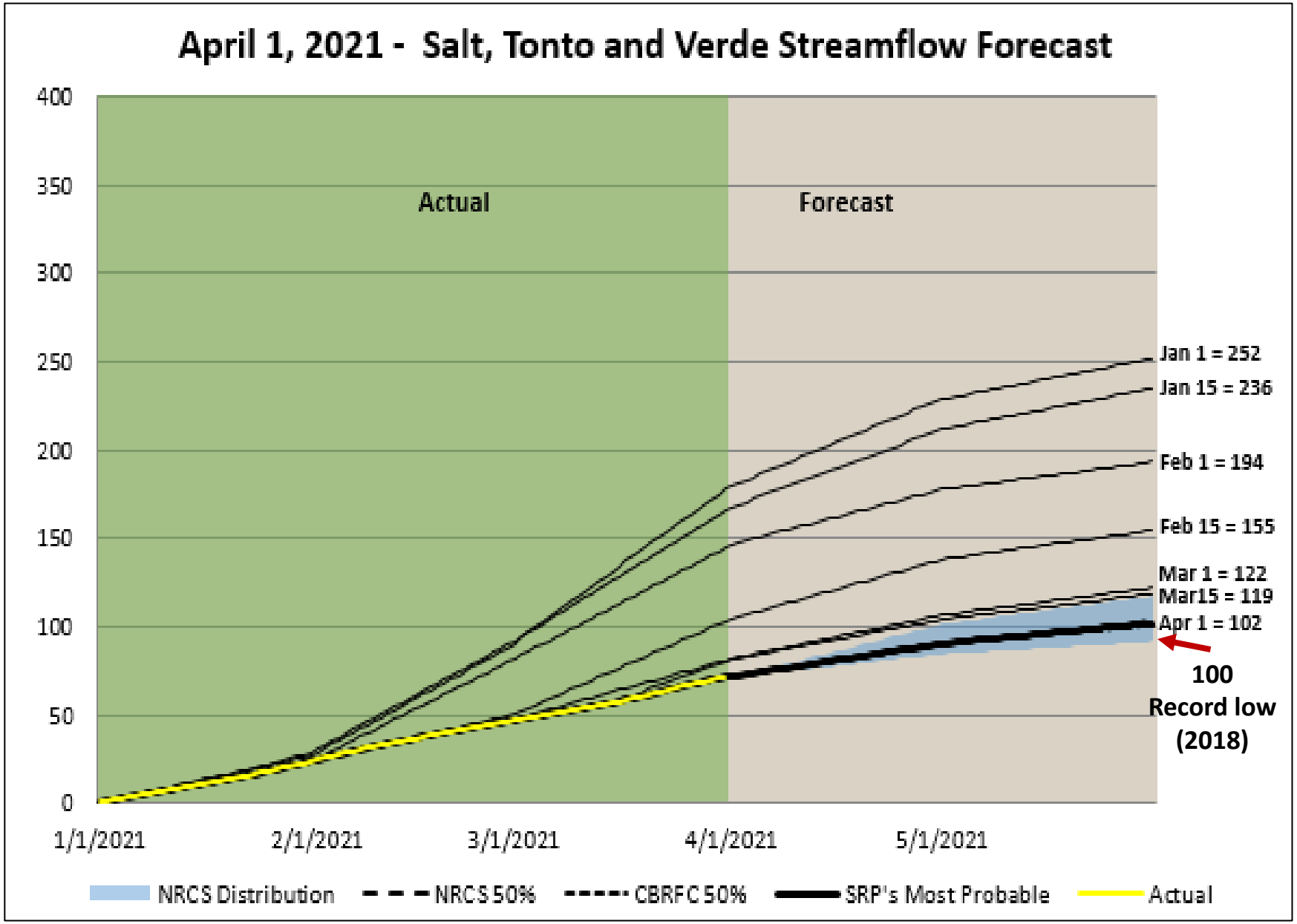
SRP Total – 102,000 AF
(19% of median)

NRCS – 104,000 AF

CBRFC – 101,000 AF

***would be record low**

****would be 2nd lowest on record**



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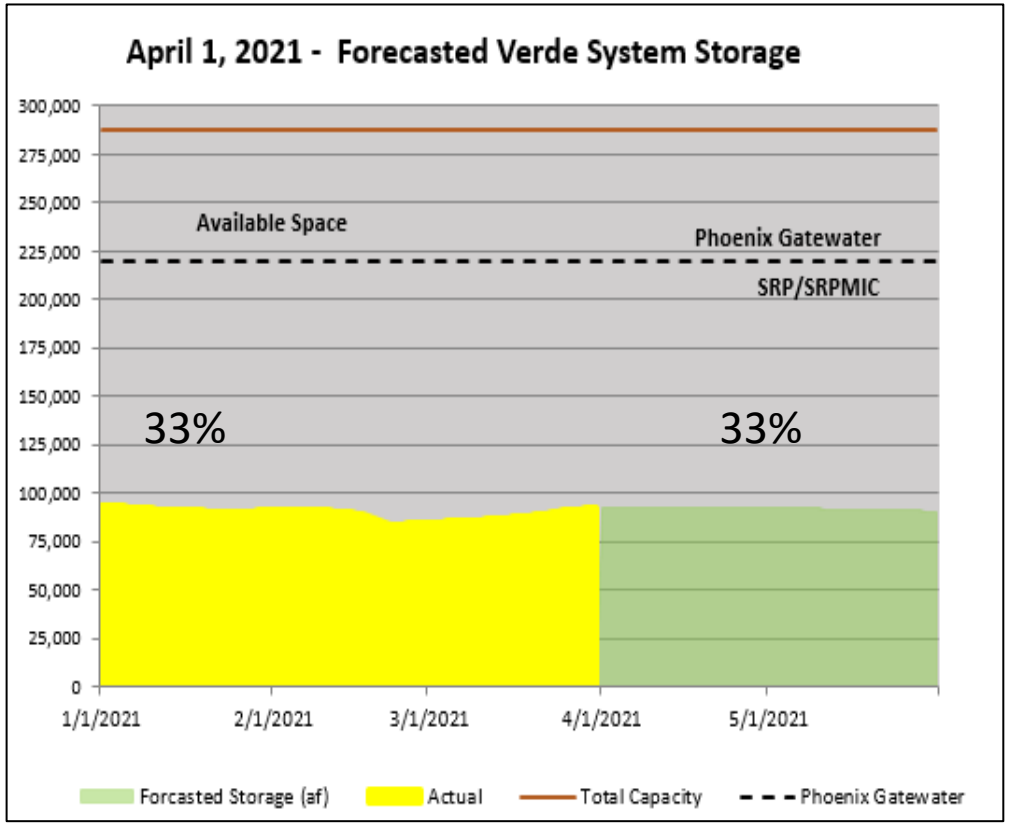
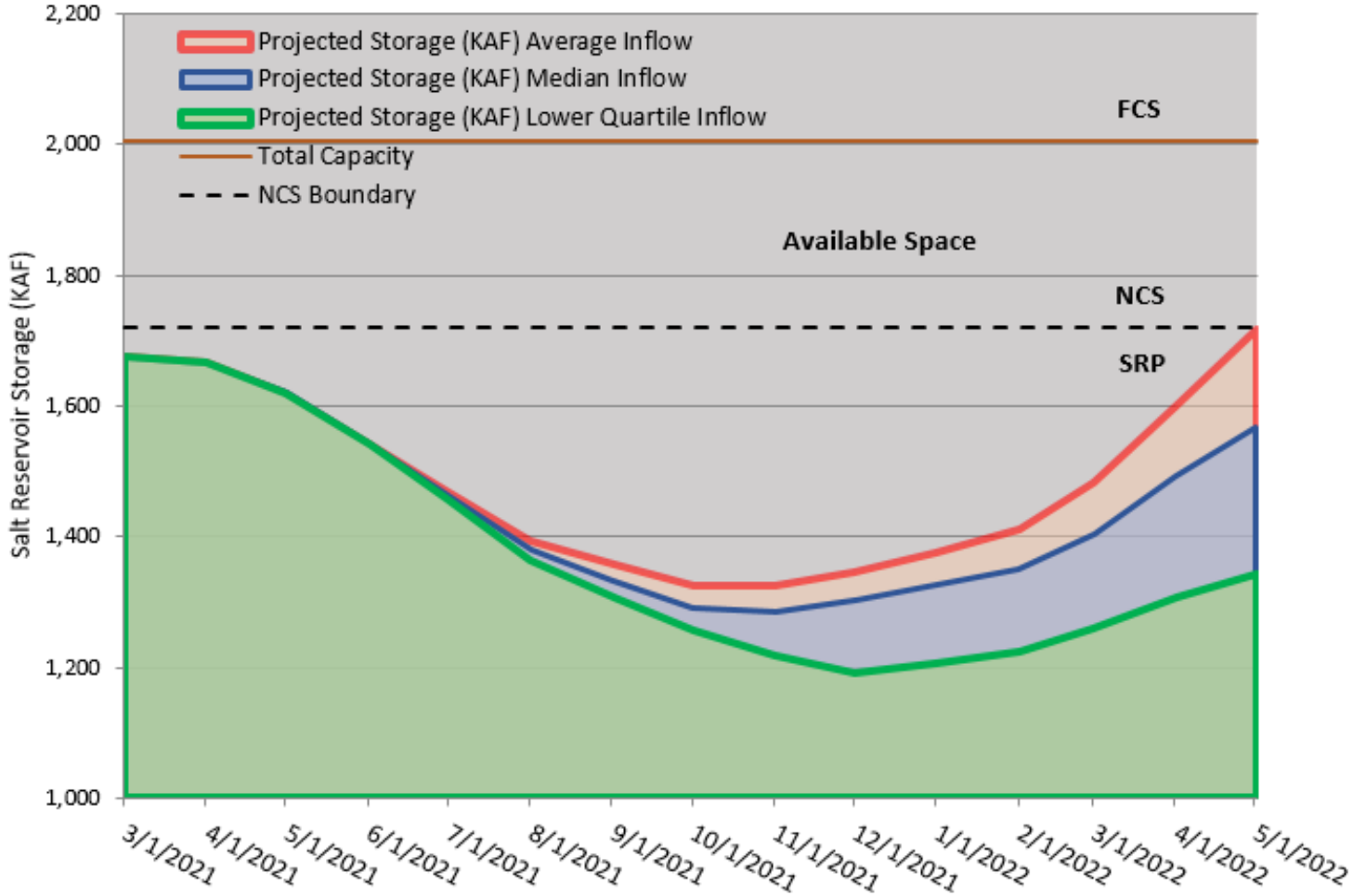
Projected Verde Reservoir Storage



Projected Salt Reservoir Storage
Demand - 750 KAF, NCS Demand - 73 KAF



Roosevelt Reservoir Storage Projections

76% **58%** **65-83%**

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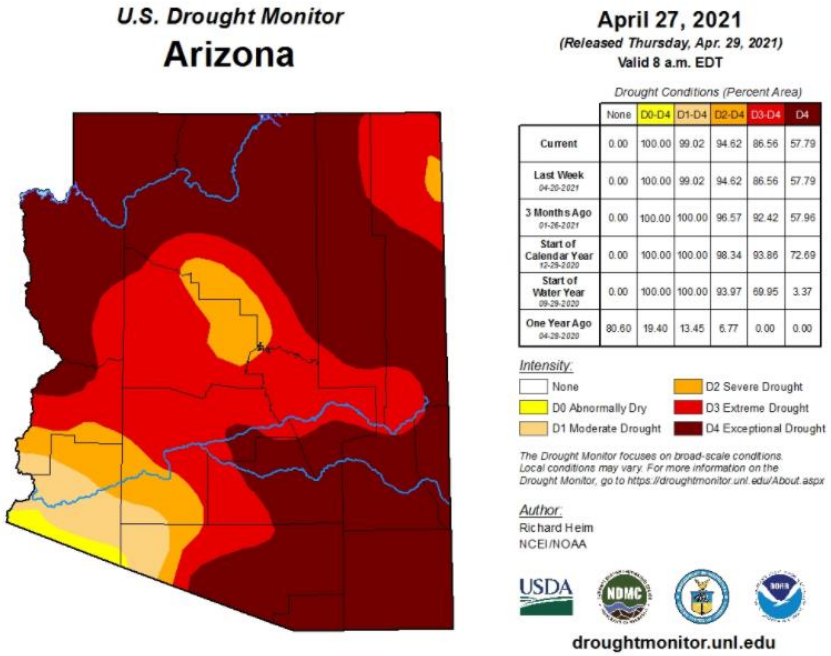
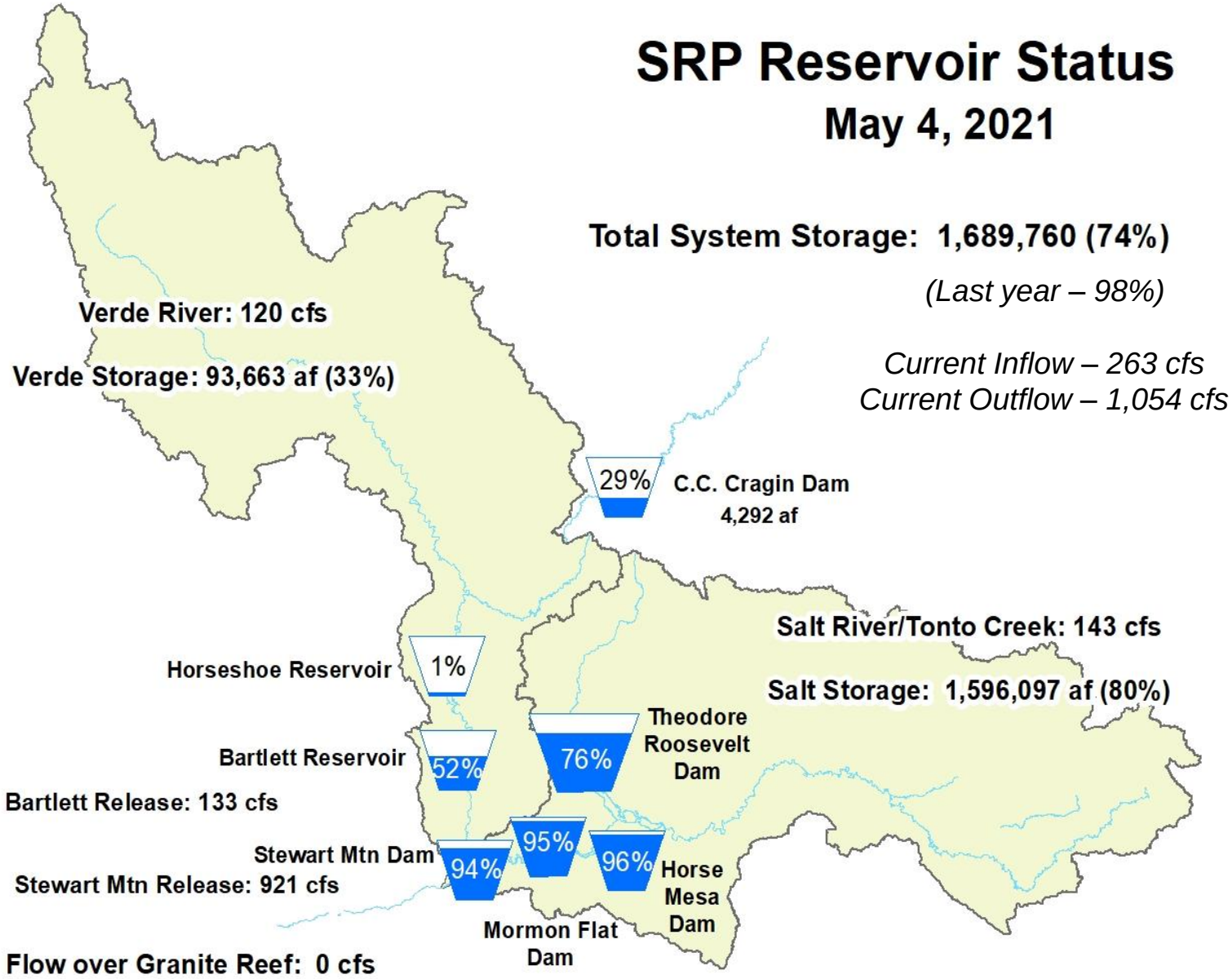
Reservoir Operation Impacts

- *River Swap to Salt system for deliveries occurred in late February*
- *GW pumping increased in February due to low Verde levels and is expected to increase in 2022.*





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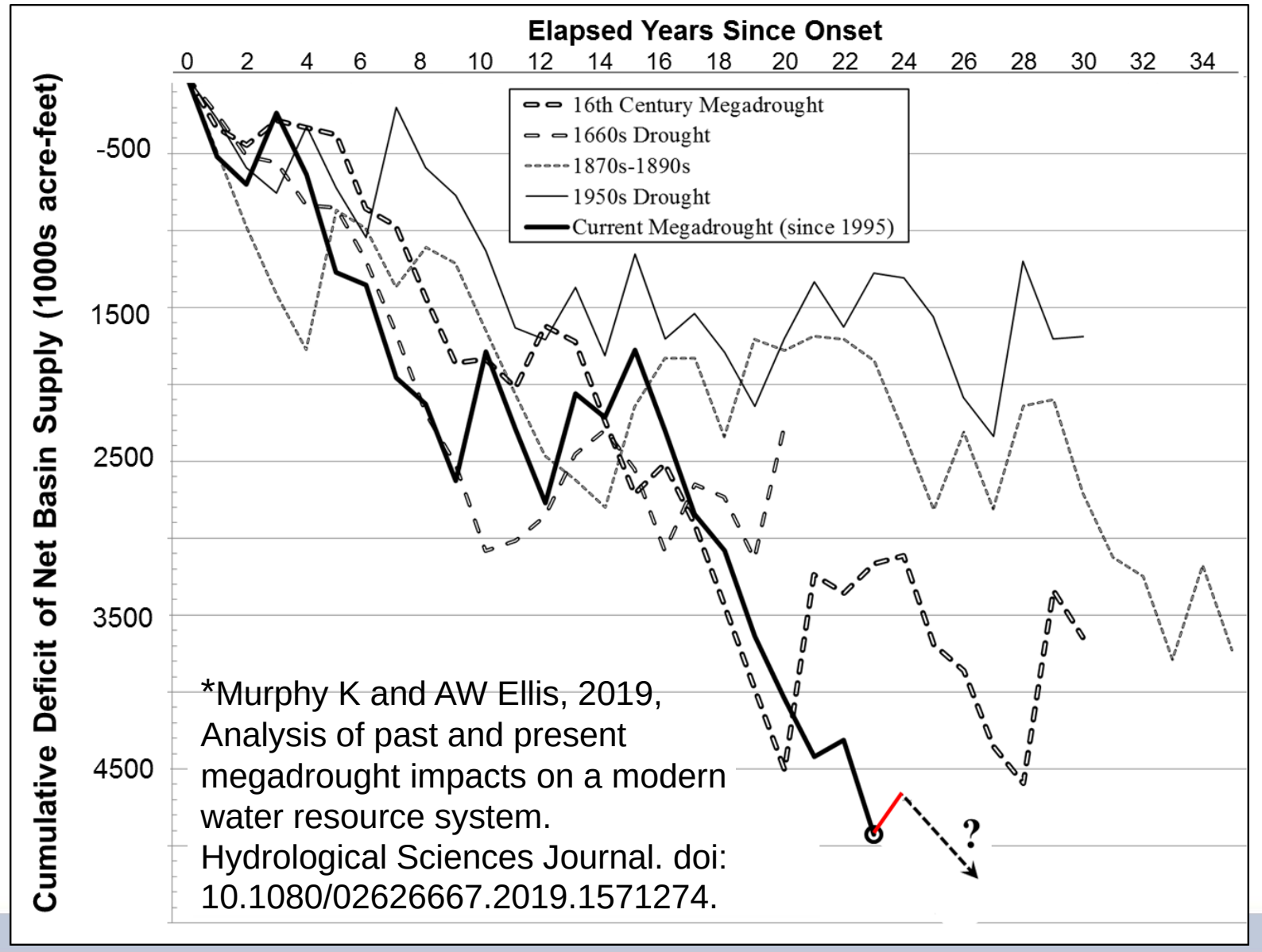
Droughts can last 20 to 35 years
Current mega drought is the most severe in the tree ring record*

- **2011-2018 lowest consecutive 8-year annual inflow on record**
- **1996-2020 lowest consecutive 25-year annual inflow on record**

What if the 20th century occurred in the 21st century climate?**

1. 2.2% decrease in average flow
2. Deeper droughts (12% decrease in flow)
3. Wetter pluvials (4% increase in flow)

**SRP modeling methods from BOR 2020 and Murphy 2016
https://www.usbr.gov/watersmart/pilots/docs/reports/Final_Reservoir_Operations_Pilot_Report-Salt_and_Verde_Az.pdf



*Murphy K and AW Ellis, 2019, Analysis of past and present megadrought impacts on a modern water resource system. Hydrological Sciences Journal. doi: 10.1080/02626667.2019.1571274.

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Mega Drought and Climate Impacts on Streamflow

Salt-Verde vs Upper Colorado River Basin

The peak energy available for evaporative loss occurs 3 months after peak streamflow on the Salt-Verde (Robles et al. 2021).

This is not case for the UCRB partly contributing to a 5 times greater streamflow sensitivity to warming on the UCRB than the Salt-Verde (BOR 2020).

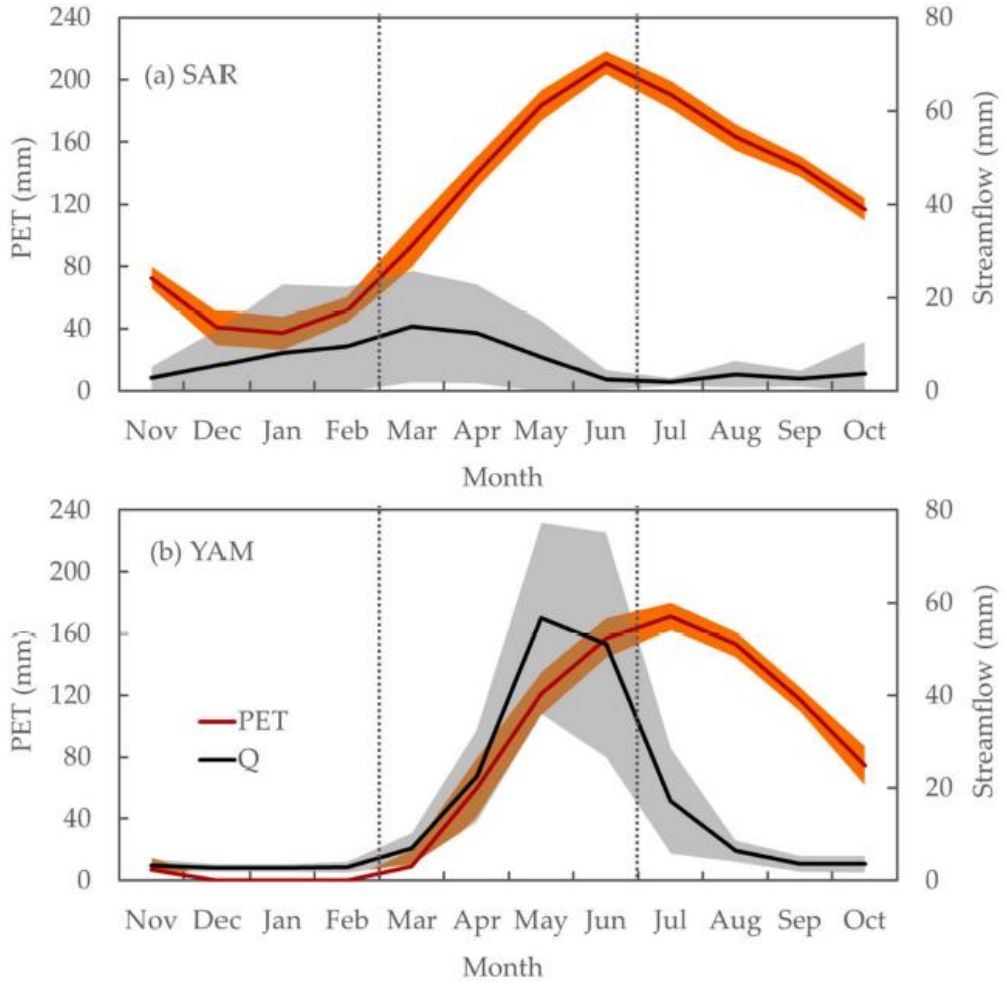
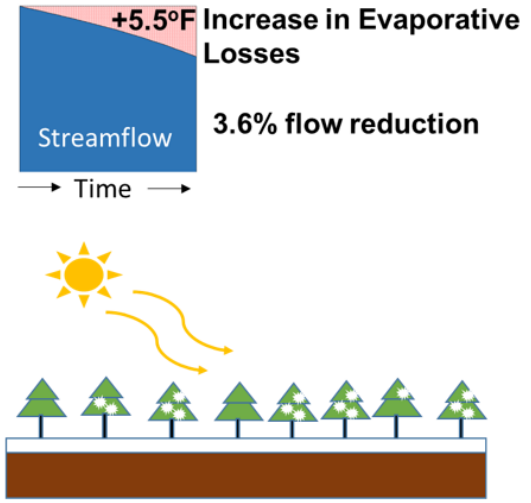


Figure 10. Comparison of peak water availability and energy demand in Lower Colorado River Basin (LCRB) and Upper Colorado River Basin (UCRB). Plots of mean (lines) and standard deviation (shaded areas) of streamflow (Q) and potential evapotranspiration (PET) for Salt River (SAR) in LCBR (a) and the Yampa River (YAM) in UCRB (b) from 1968–2011. To better illustrate basin differences, the scale of streamflow is magnified 3-fold relative to PET. PET from TerraClimate [38].

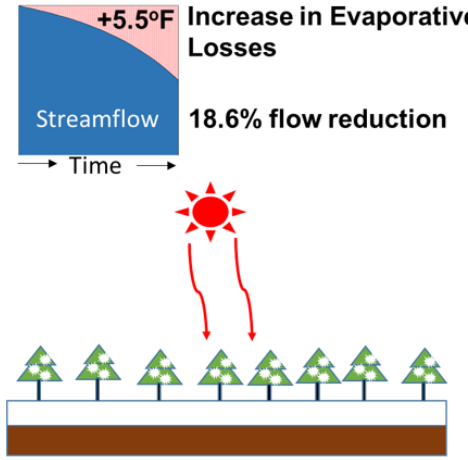
Salt-Verde Runoff Season

January-April



Colorado River Runoff Season

April-July

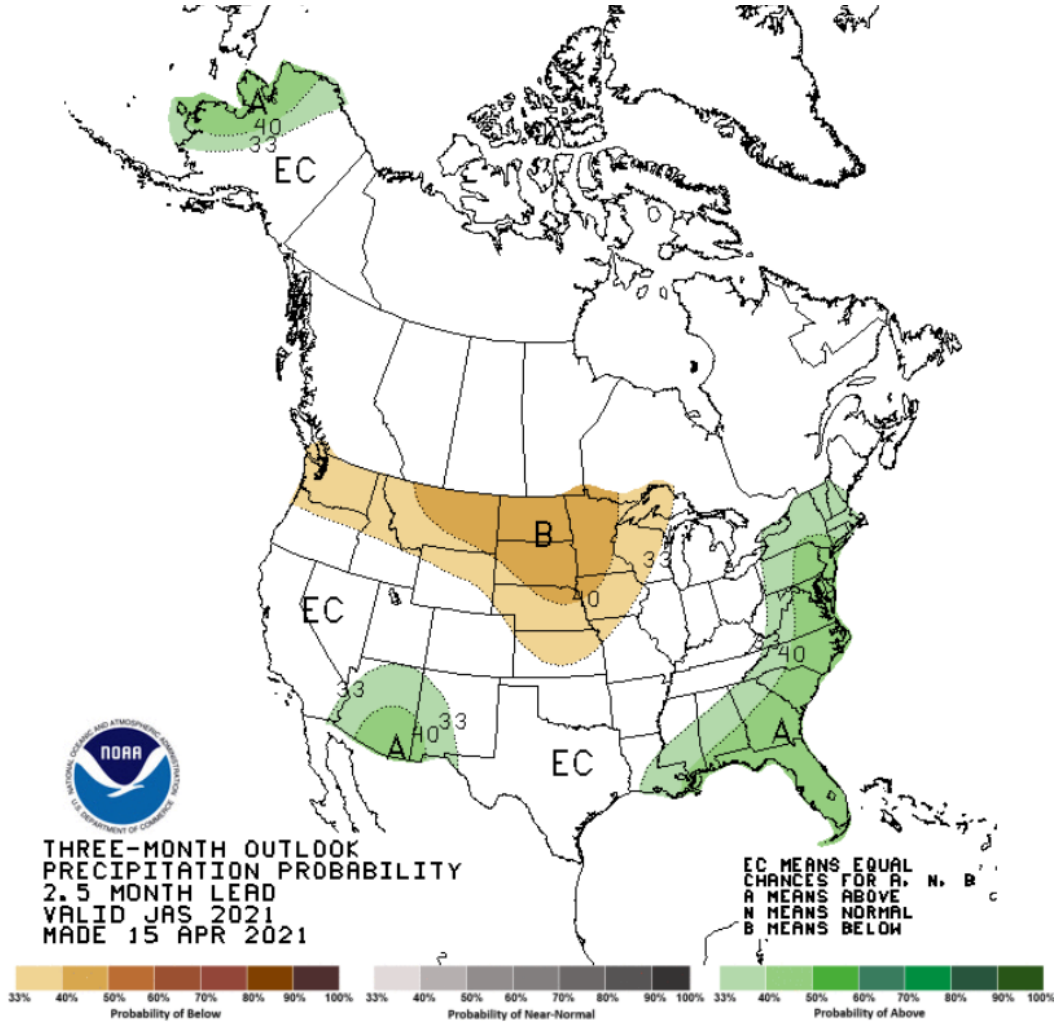


Robles et al. (2020)

Salt/Verde Watershed & SRP Reservoirs Summary

- **Total SRP Surface Water Supply is currently in good condition at 74% total storage capacity as of May 4.**
- **Dry Summer/Fall 2020 and Winter 2021 has resulted in near record low inflows for last 10 months.**
- **SRP April 1 Streamflow projection (Jan-May 2021) of 102,000 AF (19% of median). Reservoirs stayed level during winter before decreasing in the spring/summer.**
- **Drought conditions persist throughout the Salt/Verde watershed due to dry conditions over the last 12 months. Some relief occurred on the Verde this winter.**

Summer 2021 Outlook



- Drier winters tend to have a higher probability of above normal precipitation during the following monsoon season
  - 2018 - winter (2.84”) monsoon (7.49”)
  - 2021 – winter (4.29”), monsoon (???)

Watershed Precipitation Relationship – Winter/Monsoon (1950-2020)

Watershed Winter (Dec-Mar) Precipitation	Watershed Monsoon (Jun 15-Sep 30) Rainfall		
	Below Normal (1.93”-5.21”)	Normal (5.22”-7.09”)	Abv Normal (7.10”-12.65”)
Below Normal (1.47”-4.35”)	22%	30%	48%
Normal (4.36”-8.06”)	35%	30%	35%
Abv Normal (8.07”-20.53”)	44%	36%	20%

Questions?

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