

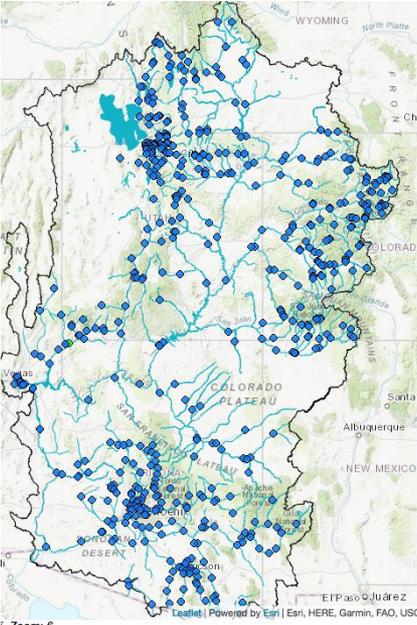
Overview of the Colorado Basin River Forecast Center

Michelle Stokes, Hydrologist in Charge
Paul Miller, Service Coordination Hydrologist
Pima County Local Drought Impact Group Meeting
Tucson, May 9th, 2018

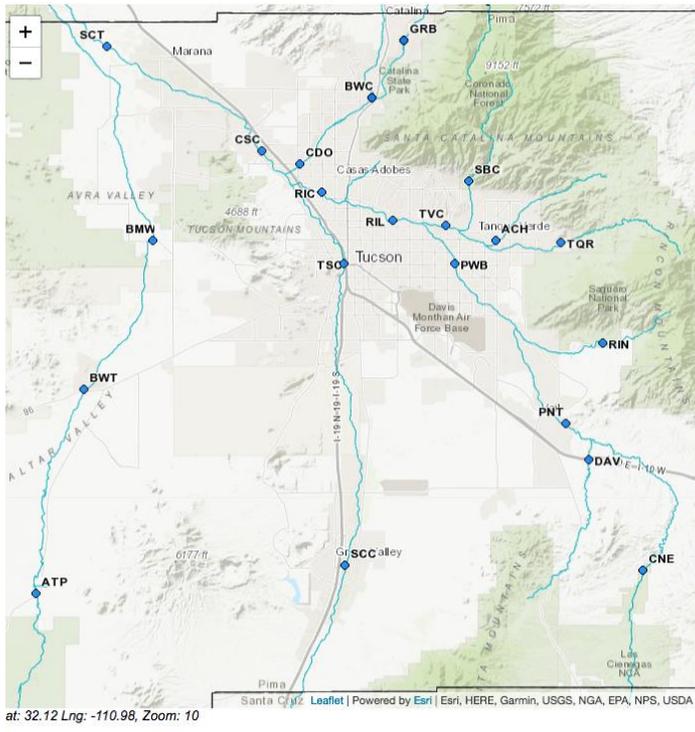
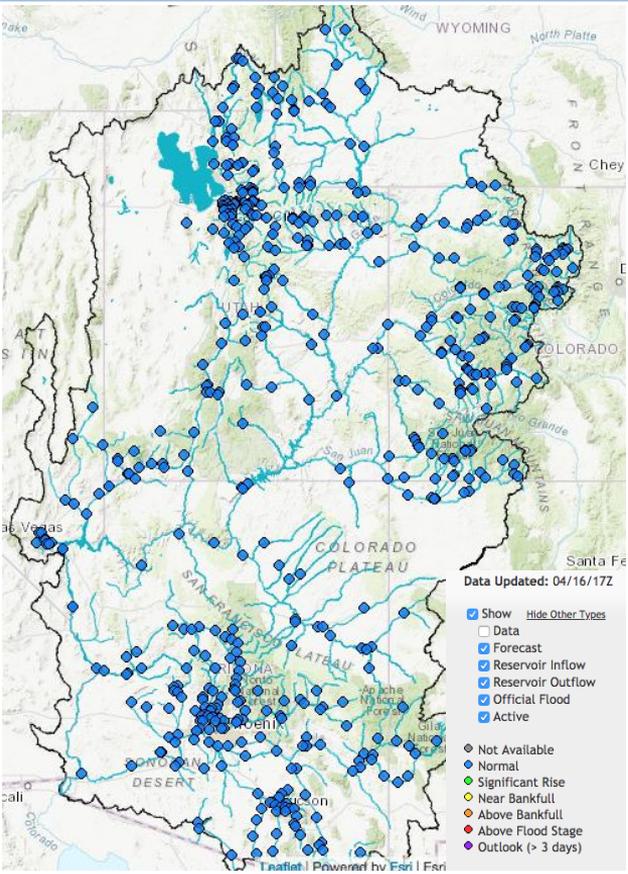


National Weather Service River Forecast Centers

- Provide streamflow forecasts for the next few hours to seasons
- 10 day forecasts for flood warnings, recreational use, etc..
- Develop probabilistic forecast of volume of water expected during the snow melt season for reservoir operations and planning - Water Supply Forecasts



Streamflow forecasts - Routine & Flood



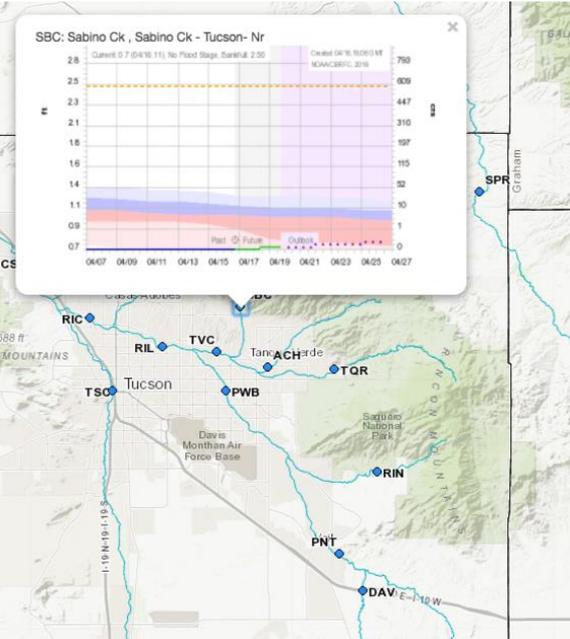
- ▶ River Conditions
- ▶ Snow Conditions
- ▶ Water Supply Forecasts
- ▶ Peak Flood Probability
- ▶ Reservoir Conditions
- ▶ Daily Precipitation
- ▶ Monthly Precipitation
- ▶ Soil Moisture
- ▶ Map Options
- ▼ Search Points

Help

Points in Map View
(23 River Points Found)

- ◆ ACH: Agua Caliente Wash , Agua Caliente Wash - Houghton Rd
- ◆ ATP: Altar Wash , Altar Wash - Three Points- Nr
- ◆ BMW: Brawley Wash At Milewide Rd, Brawley Wash At Milewide Rd
- ◆ BWC: Big Wash , Big Wash - Canada Del Oro
- ◆ BWC: Big Wash , Big Wash - Canada Del Oro
- ◆ BWT: Brawley Wash , Brawley Wash - Three Points
- ◆ CDO: Canada Del Oro , Canada Del Oro - Ina Rd- Blo- Tucson- Nr
- ◆ CNE: Cienega Ck , Cienega Ck - Sonoita- Nr
- ◆ CSC: Santa Cruz , Santa Cruz - Cortaro
- ◆ DAV: Davidson Canyon , Davidson Canyon
- ◆ GRB: Canada Del Oro , Canada Del Oro - Golder River Bridge

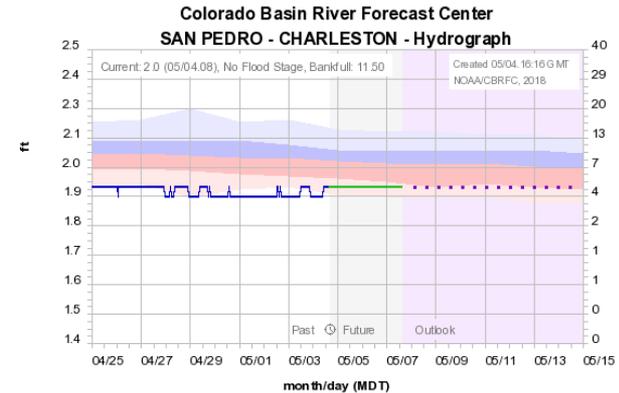
Streamflow forecasts - Hydrographs



SAN PEDRO - CHARLESTON (SAPA3)

Info: [Station](#) [Rating type](#) [Critical Stages](#) [Yearly Peaks](#) [Daily Stats](#) [Recent Verification](#) [Seasonal Verification](#)

[http://10.1.1.33/station/flowdata/flowdata.cgi?SAPA3?1525450611?0710?1070??](http://10.1.1.33/station/flowdata/flowdata.cgi?SAPA3?1525450611?0710?1070?)



Observed — Forecast (05/04 14:00) — Outlook (increasing uncertainty) ■

Historical Exceedance Probability (USGS): 90-75% ■ 75-50% ■ 50-25% ■ 25-10% ■

Observed=QRIRGZZ, Simulated=QRIZZZZ, Forecast=QRIFEZZ H (2018-05-04 14:00)
resoutid=

Hydrograph Options		Years	Date	Graphs	Tabular Data
<input type="checkbox"/> Critical Stages	<input type="checkbox"/> Simulated	1905	05-04-18	<input type="checkbox"/> Precipitation	<input type="checkbox"/> Precipitation
<input type="checkbox"/> Raw Data	<input type="checkbox"/> Six Hour	1906	Past Days	<input type="checkbox"/> Temperature	<input type="checkbox"/> Temperature
<input type="checkbox"/> Linear Flow	<input type="checkbox"/> Mean Daily Values	1907	10	<input type="checkbox"/> Freezing Level	<input type="checkbox"/> Freezing Level
<input type="checkbox"/> Forecast Peak	<input type="checkbox"/> Historical Peak	1908	Future Days	<input type="checkbox"/> Snow	<input type="checkbox"/> Snow
<input type="checkbox"/> Yearly Peaks	<input type="checkbox"/> Daily Maxima	1909	10	<input type="checkbox"/> Soil Moisture	<input type="checkbox"/> Soil Moisture
<input checked="" type="checkbox"/> Statistics	<input type="checkbox"/> Contingency	1910	ESP	<input checked="" type="checkbox"/> Hydrograph	<input type="checkbox"/> Flows
<input type="checkbox"/> Adjust	<input type="checkbox"/> Requery	1911	Off		
<input type="checkbox"/> Forecasts		1912	Analog Years		
		1913	Off		
			Analog Years Period		
			Off		

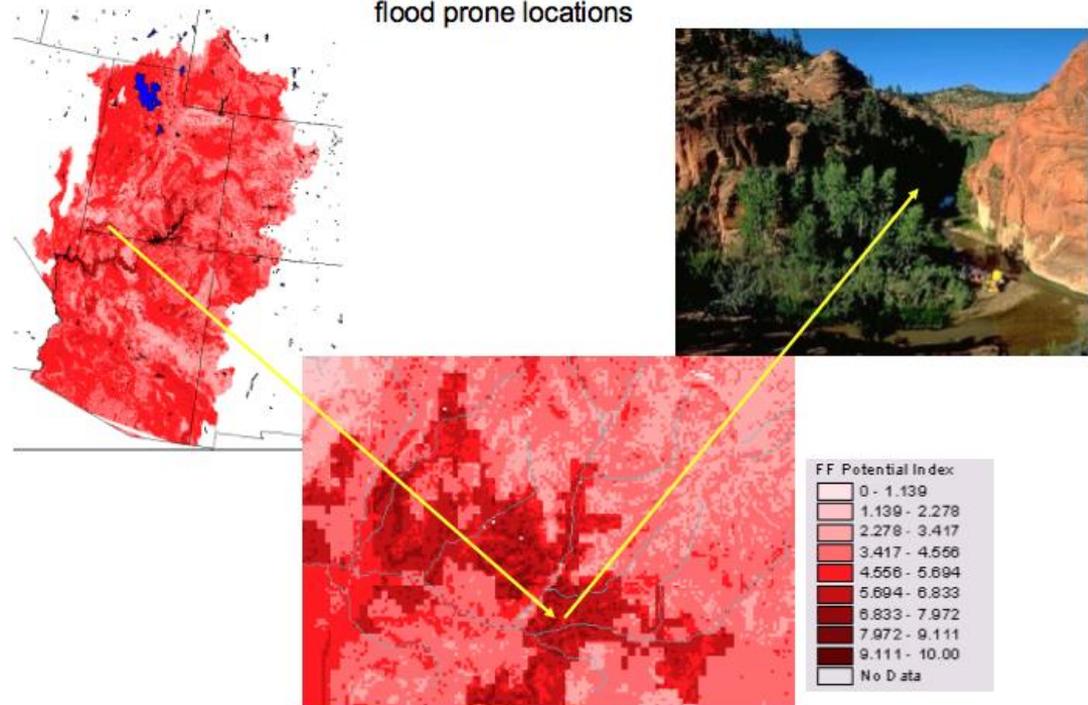
Clicking on a pop-up hydrograph will direct you to a page that allows for more interactive features and options for plotting



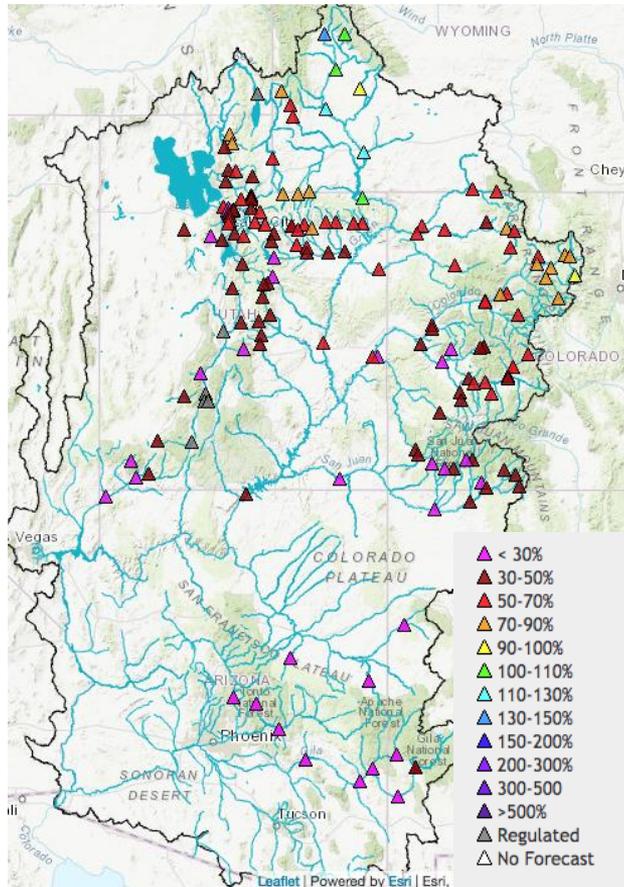
Flash floods

- Flooding in Arizona is most often caused by local, intense convective storms that lead to flash flooding
 - Too rapid for RFC to model
 - Weather Forecast Office issues warnings based on precipitation rate and location
 - RFC provides tools to help locate areas where flash floods are most likely (GIS based)

FFPI is designed to highlight flash flood prone locations



Water Supply Forecasts



Colorado - Lake Powell, Glen Cyn Dam, At (GLDA3)
 Period: Apr-Jul, Official 50% Forecast (2018-05-01): 3000 kaf (42% Average, 46% Median)
 ESP is Unregulated and No Precipitation Forecast Included



2018/05/01:
Max 1984: 15316.11
Min 2002: 963.96
Average: 7160
Median: 6470
Observed Accumulation: 382
Observed Total: 515
Normal Accumulation: 1130
ESP: 2940
Official 10: 4180
Official 30: 3300
Official 50: 3000
Official 70: 2610
Official 90: 2080

- Probabilistic volumetric seasonal forecast
- Driven by current snowpack, soil moisture, and future precipitation, temperatures, and potential weather scenarios

CBRFC Role in Colorado River Management

- CBRFC's water supply forecasts drive Reclamation's operational planning model (24-Month Study)
 - Determine operations of Lakes Powell and Mead
 - Determine shortage declarations
 - Direct impact to State, municipal, agricultural, water and energy managers and Mexico

Legend

- Hydrologic Basin
- Adjacent areas that receive Colorado River water

OPERATION PLAN FOR COLORADO RIVER SYSTEM RESERVE
September 2012 24-Month Study
Most Probable Inflow
Hoover Dam - Lake Mead

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Standard Deviation	Reserve	Reserve	ESM
Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2012	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2013	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2014	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2015	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2016	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2017	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2018	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2019	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2020	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2021	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2022	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2023	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2024	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2025	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2026	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2027	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2028	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2029	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000
2030	677	627	672	672	672	672	672	672	672	672	672	672	8176	672	1000	1000	1000

RECORD OF DECISION
Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead
December 2007

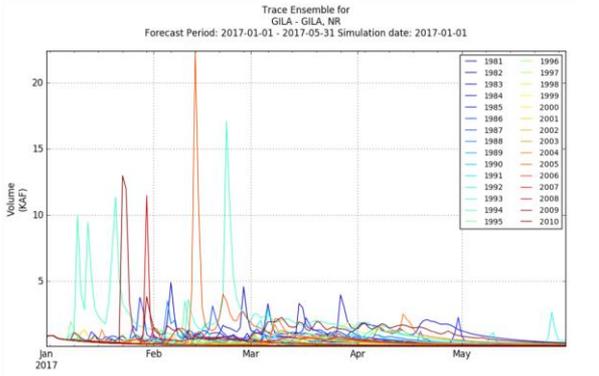
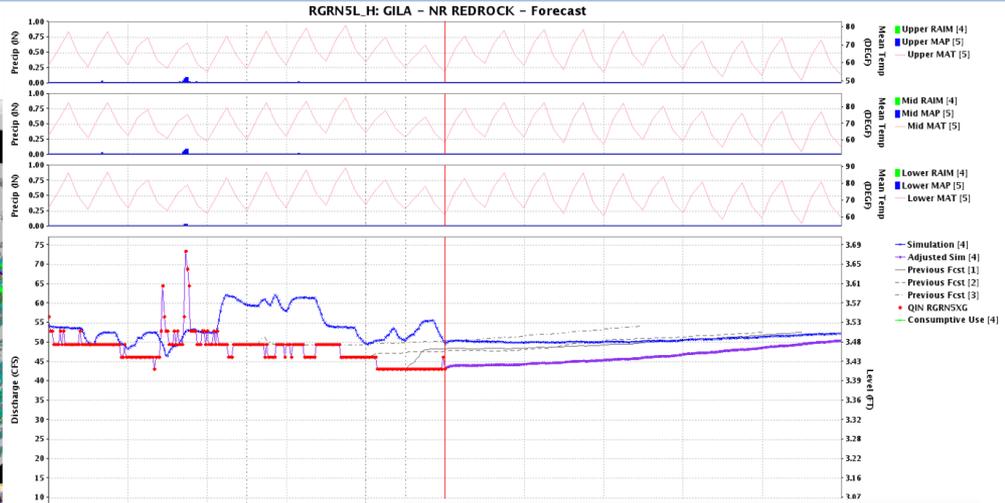
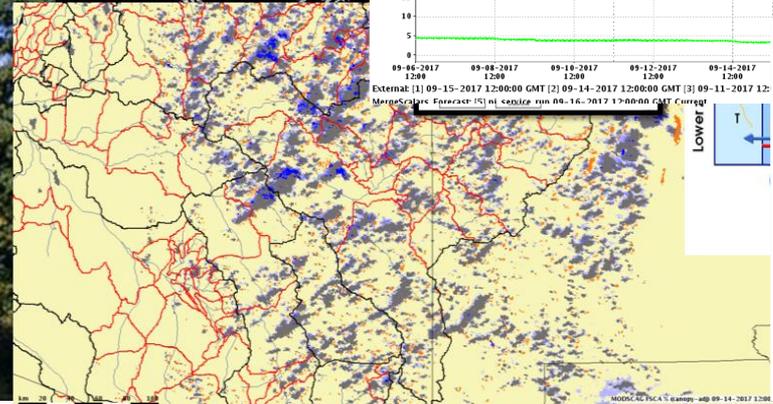
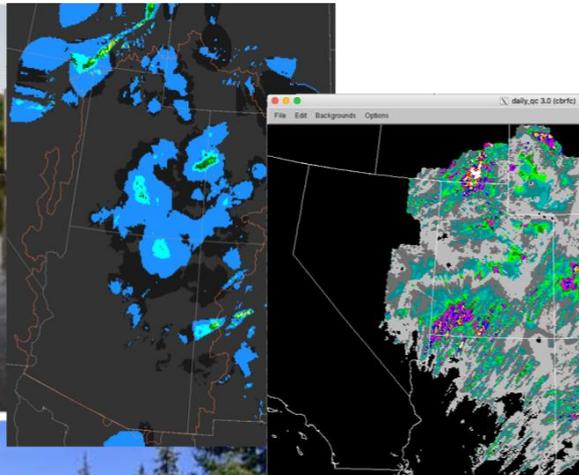
Recommending Official:
Robert Johnson December 13, 2007
ROBERT JOHNSON
Commissioner, Bureau of Reclamation

Approved:
Dirk Kempthorne December 13, 2007
DIRK KEMPTHORNE
Secretary of the Department of the Interior

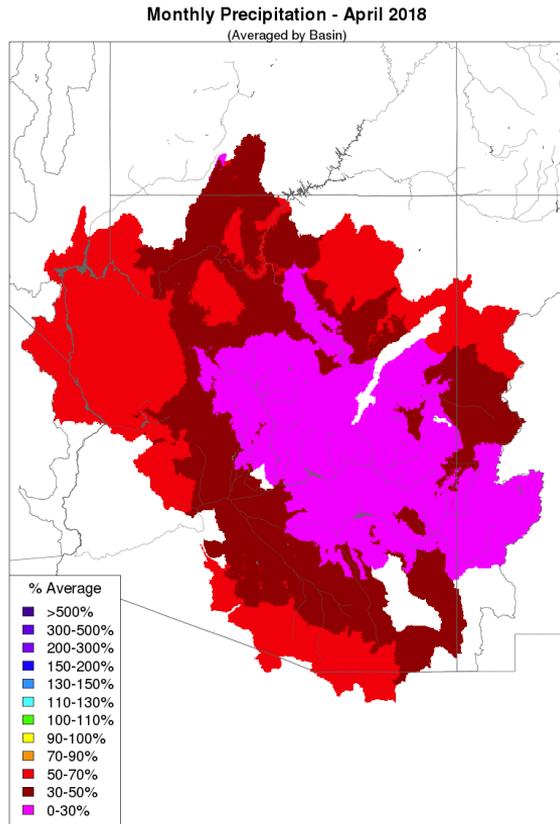
AOP consultation process. In making these projections, the Secretary shall utilize the April 1 final forecast of the April through July runoff, currently provided by the National Weather Service's Colorado Basin River Forecast Center.



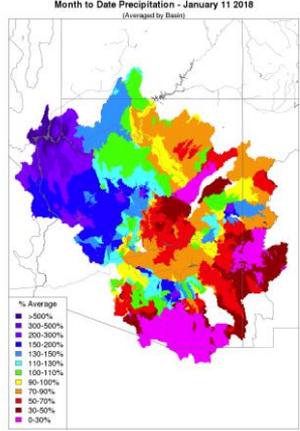
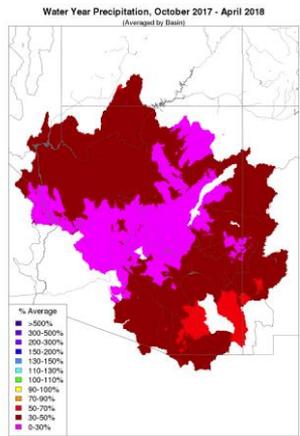
Data and developing a forecast



Precipitation Information



Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov



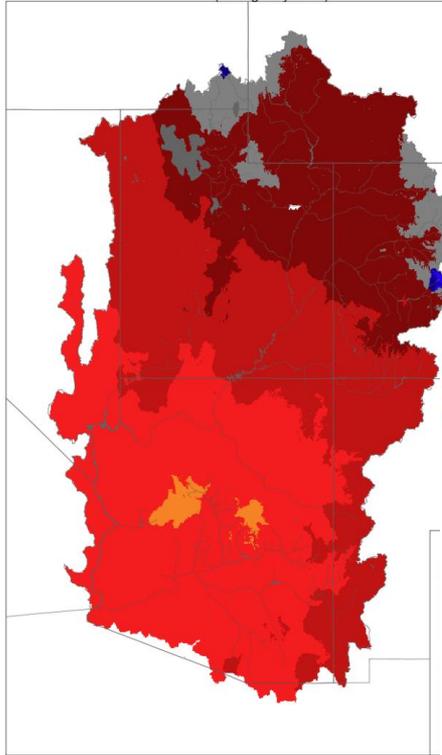
Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

- Observed:
 - Daily, monthly, water year, month to date, water year to date for the month, water year, and month to date.
- Forecast:
 - Next 5 days

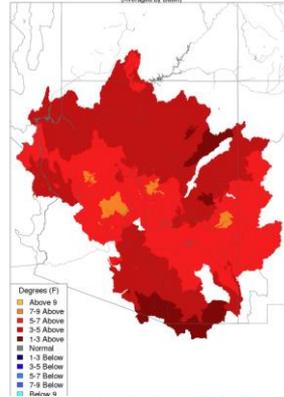


Temperature Information

Max Temp - Monthly Deviation - April 2018
(Averaged by Basin)



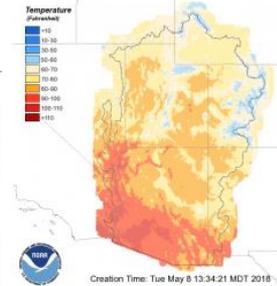
Min Temp - Monthly Deviation - April 2018
(Averaged by Basin)



24 Hour Observed Temperature -- Ending 12Z Tuesday, May 08

Max Temperature 05/08/2018

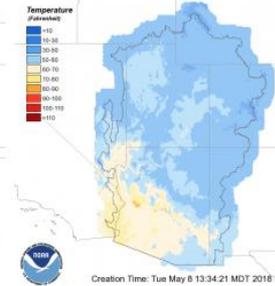
Observed Max Temperature, Ending 12Z, 05/08/2018



Creation Time: Tue May 8 13:34:21 MDT 2018

Min Temperature 05/08/2018

Observed Min Temperature, Ending 12Z, 05/08/2018



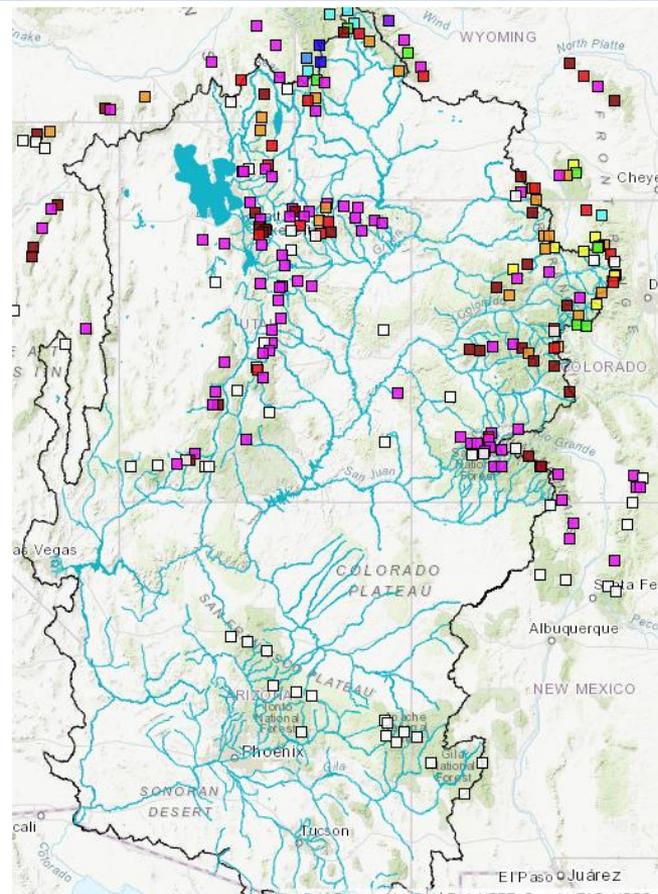
Creation Time: Tue May 8 13:34:21 MDT 2018

Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

- Observed:
 - Daily, monthly, for minimum and maximum temperatures, water year, month to date, water year to date for the month, water year, and month to date.

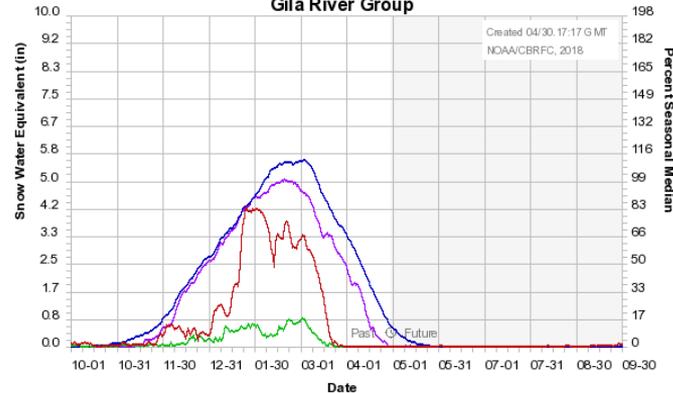
- Forecast:
 - Next 10 days

Snow Information



Gila River Snotel Group

Colorado Basin River Forecast Center
Gila River Group



Median 1981-2010 — Average 1981-2010 — 2018 — 2017 —

Missing Data Alerts

median
avg
2018
CND3 in 2018 only has 148/212 69%
2017
CND3 in 2017 only has 232/365 63%
FRDN5 in 2017 only has 239/365 65%

Group plots show a simple average of the individual stations.
Select multiple years and/or stations. Be sure to use your systems key-click combination to avoid inadvertent deselection.

Years Stations

Years	Stations
median	CND3 CORONADO TRAIL
avg	FRDN5 FRISCO DIVIDE
2018	HNMA3 HANNAGAN MEADOWS
2017	LKTNS LOOKOUT MOUNTAIN
2016	SCDN5 SILVER CREEK DIVIDE
2015	SGNN5 SIGNAL PEAK
2014	AGUU1 AGUA CANYON
2013	APSC2 APISHAPA
2012	ARPC2 ARAPAHO RIDGE
2011	ATA11 ATLANTA SUMMIT
2010	BAMN5 BATEMAN

Y axis

Percent Seasonal Median
Percent Median to Date

Similar/Historical Years

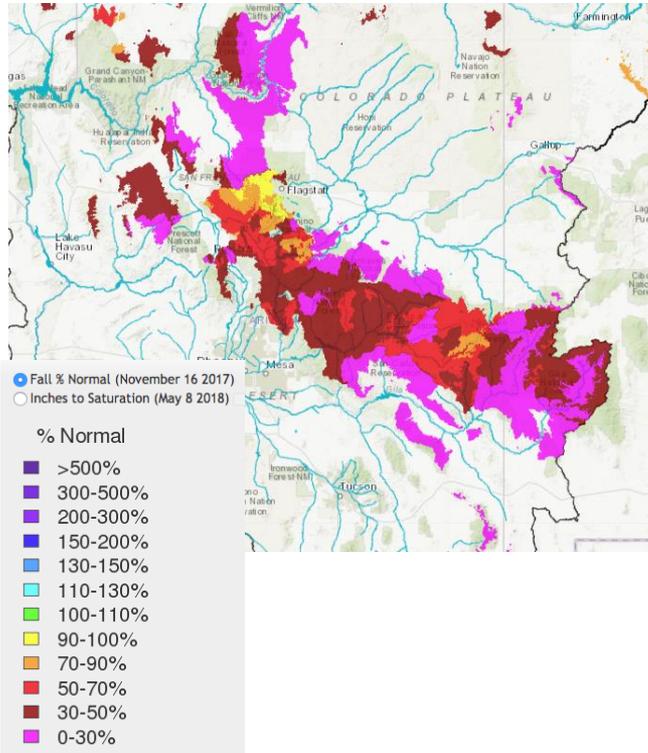
Off
Closest Pattern
Peak to Date
Current Observation
Highest Year
Lowest Year

Station Links

CND3
FRDN5
SCDN5
LKTNS
SGNN5
HNMA3



Other Information

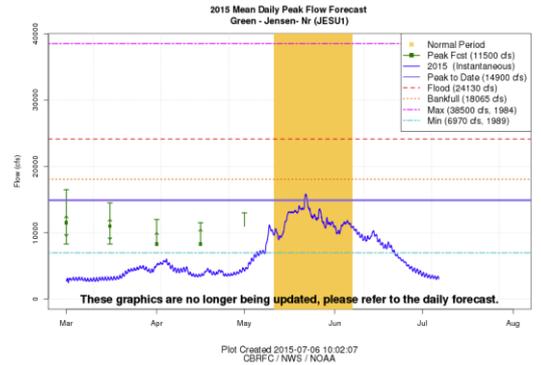


- Modeled soil moisture
- Reservoir information
- Peak Flow forecasts
- Verification

Providing Decision Support Services



May showers bring better outlook for Colorado River, but no miracle



A group of kayakers prepare to head down river while paddling the Black Canyon Water Trail on the lower Colorado River in Lake Mead National Recreation Area on the Nevada and Arizona border east of Las Vegas on Thursday, July 3, 2014. There are 16 routes within the National Water Trail System, and the Black Canyon Water Trail is the first water trail in the Southwest and the only water trail that traverses through a desert. (Jason Bear/Las Vegas Review-Journal)

By HENRY BREAN
LAS VEGAS REVIEW-JOURNAL
It wasn't the "Miracle May" that some observers called it, but a month of downpours in Colorado and Utah did provide a significant boost to the outlook for the Colorado River.
A terrible year became merely below average.
"Miracle" is probably a bit of an overstatement, but the unusually wet May did have a positive impact on water supply," said Paul Miller, a senior hydrologist with the National Weather Service's Colorado Basin River Forecast Center in Salt Lake City.

- Resource Management
 - Adaptive Management Program (Peak Flow Forecasts)
 - Day to day decisions, especially during times of active weather
- Technical Support and Communication
 - Meeting participation
 - Custom products and outreach



Our Arizona partners

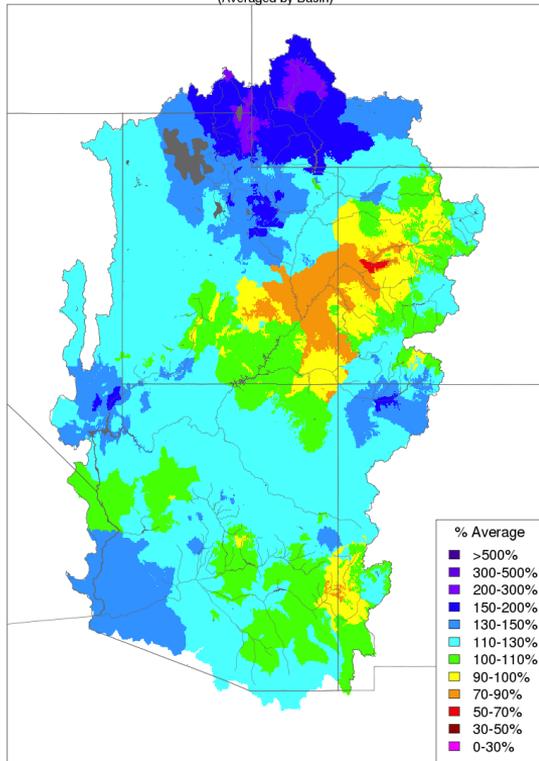


CBRFC Stakeholder Engagement meeting on **November 6th** at the Salt River Project offices in Phoenix.



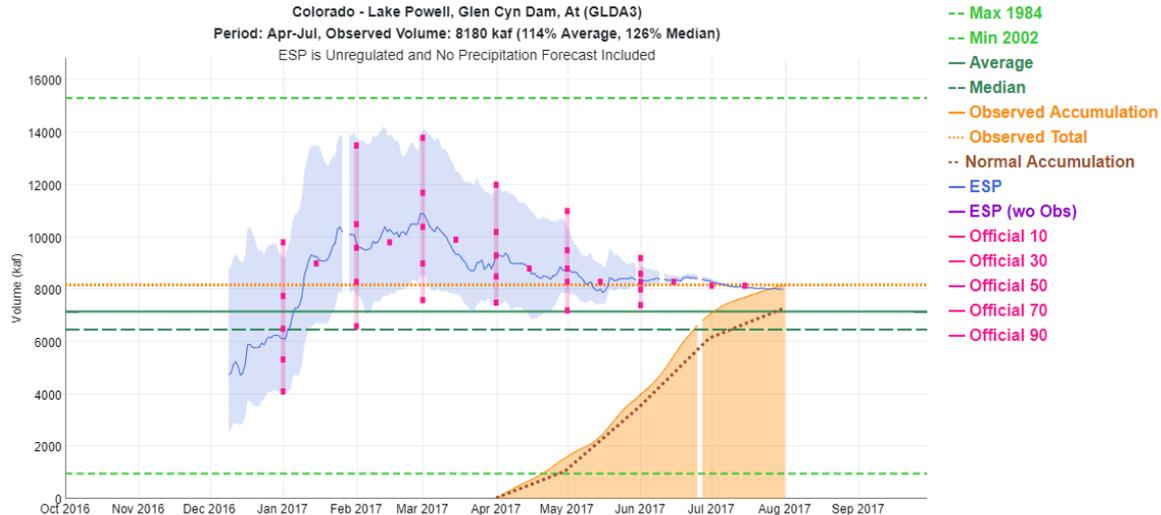
Last year's Water Supply Conditions

Water Year Precipitation, October 2016 - April 2017
(Averaged by Basin)



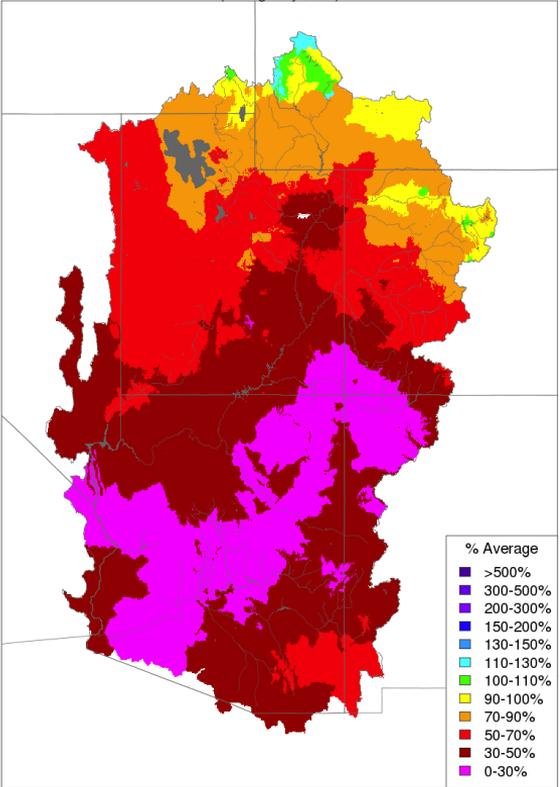
Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

Lake Powell inflow - 114% of average



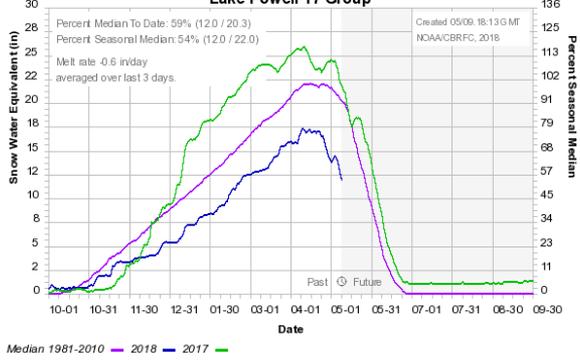
Current Conditions

Water Year Precipitation, October 2017 - April 2018
(Averaged by Basin)

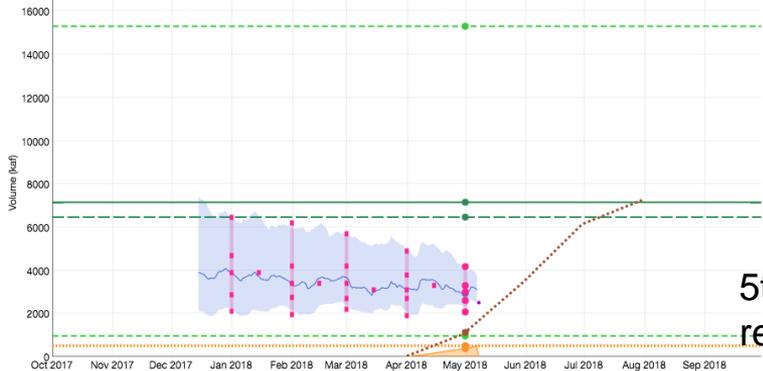


Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

Colorado Basin River Forecast Center
Lake Powell 17 Group



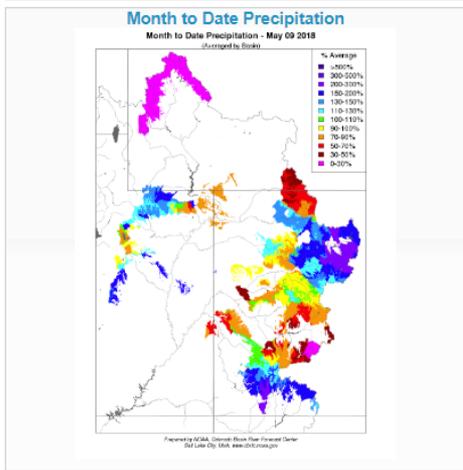
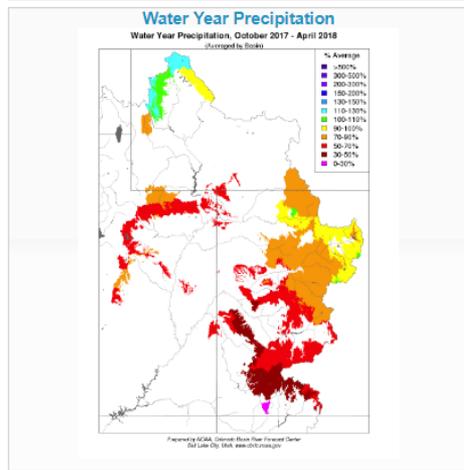
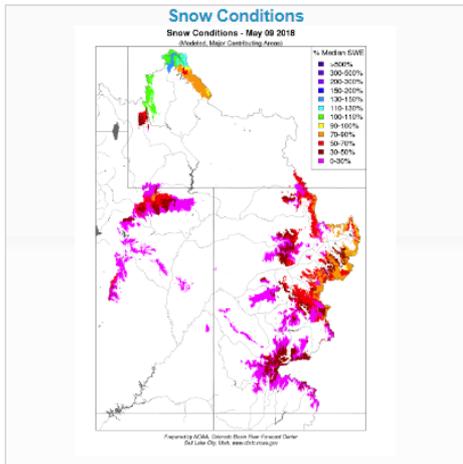
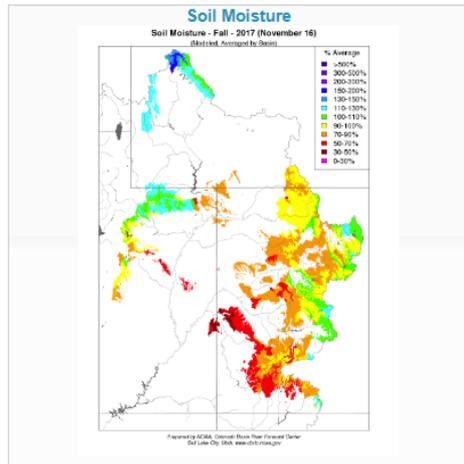
Colorado - Lake Powell, Glen Cyn Dam, At (GLDA3)
Period: Apr-Jul, Official 50% Forecast (2018-05-01): 3000 kaf (42% Average, 46% Median)
ESP is Unregulated and No Precipitation Forecast Included



5th driest on record



Upper Colorado Situational Awareness



Lake Powell Unregulated Inflow (kaf) Water Year 2018 Forecasts as of 2018-05-01

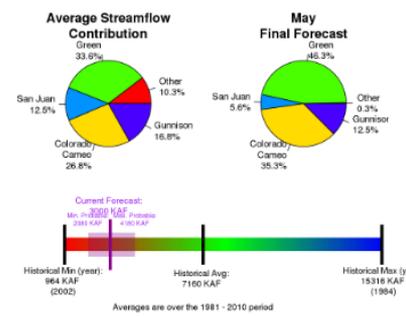
Period	Obs to Date	Full Fcst	%Avg
Apr-Jul	382	3000	42%
Water Year	2379	5497	51%

Lake Powell %Average Precipitation Water Year 2018

Area	Oct	Nov	Dec	Jan	Feb	Mar
UC-Powell	56	59	50	76	97	74

Area	Apr	Water Year
UC-Powell	89	72

April - July Unregulated Inflow into Lake Powell As of 2018-05-01



Thank you!

Michelle Stokes 801-524-5130 ext 322 michelle.stokes@noaa.gov

Paul Miller 801-524-5130 ext 335 paul.miller@noaa.gov

CBRFC Stakeholder Engagement meeting on **November 6th** at the Salt River Project offices in Phoenix.

www.cbrfc.noaa.gov

