Utah Water Supply Briefing

March 5th, 2021

Colorado Basin River Forecast Center

Presenter: Brenda Alcorn - Hydrologist

Utah Forecasters: Brent Bernard, Zach Finch, Patrick Kormos

Questions: Type questions into the ‘Questions’ Box or Raise Hand

Webinar recording & slides will be made available on CBRFC webpage
Utah Water Supply Briefing

1. Weather Review (Precipitation)
2. Current Snowpack
3. 2021 Water Supply Forecasts
4. Forecast Error
5. Upcoming Weather
6. CBRFC Hydro Science Update
7. Contacts & Questions
Below normal seasonal precipitation - All Basins
Above normal February precipitation - Bear, Weber, Six Creeks, Sevier
Near normal February precipitation - Provo / Utah Lake
Below normal February precipitation - Duchesne, Virgin
Utah Weather Review - Monthly and Water Year Precipitation
Utah Current Snowpack - March 2021

As of March 1, 2021

CBRFC Snow Groups (SNOTEL Stations)

- Bear: 85% of WY normal
- Weber: 75% of WY normal
- Six Cr: 85% of WY normal
- Provo: 65% of WY normal
- Duchesne: 70% of WY normal
- Sevier: 65% of WY normal
- Virgin: 65% of WY normal
February increased snowpack, but still below normal. Not much time to catch up to normal.
March 1, 2021 - Utah Water Supply Forecasts - Overview

- March 1 Forecast for April-July Volume in 1000’s acre feet (KAF)
- April-July Forecast Streamflow Volumes are in percent of 1981-2010 average

Median value of individual forecasts (in % of average) ...by Forecast Group.

<table>
<thead>
<tr>
<th>Forecast Group</th>
<th>Median Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bear</td>
<td>60</td>
</tr>
<tr>
<td>Weber</td>
<td>45</td>
</tr>
<tr>
<td>Duchesne</td>
<td>50</td>
</tr>
<tr>
<td>Provo / Utah Lake</td>
<td>45</td>
</tr>
<tr>
<td>Sevier</td>
<td>45</td>
</tr>
<tr>
<td>Virgin</td>
<td>35</td>
</tr>
</tbody>
</table>
March 1, 2021 - Utah Water Supply Forecasts - Bear

Bear River Basin Forecasts

January: **55%** of Normal
February: **50%** of Normal
March: **60%** of Normal

- Forecasts range from 35-85% of normal
March 2021 - Utah Water Supply Forecasts - Bear
Logan River

Logan - Logan, Nr, State Dam, Abv (LGNU1)
Period: Apr-Jul, Official 50% Forecast (2021-03-01): 70 kaf (63% Average, 72% Median)
ESP is Unregulated and No Precipitation Forecast Included

2021/03/01:
Max 1986: 222.92
Min 1977: 34.12
Average: 111
Median: 97
ESP: 72.1
Official 10: 105
Official 30: 83
Official 50: 70
Official 70: 63
Official 90: 57
March 1, 2021 - Utah Water Supply Forecasts - Weber River Basin

Weber River Basin Forecasts

January: 45% of Normal
February: 45% of Normal
March: 45% of Normal

- Forecasts range from 30-55% of normal
Utah Water Supply Forecasts - Weber

Rockport Reservoir

Weber - Rockport Res, Wanship, Nris (RKKU1)
Period: Apr-Jul, Official 50% Forecast (2021-03-01): 58 kaf (44% Average, 46% Median)
ESP is Unregulated and No Precipitation Forecast Included

2021/03/01:
Max 1986: 273.58
Min 1977: 30.07
Average: 132
Median: 125
ESP: 57.3
Official 10: 98
Official 30: 81
Official 50: 58
Official 70: 46
Official 90: 37
March 2021 - Utah Water Supply Forecasts - Six Creeks

Six Creeks Basin Forecasts

January: 40% of Normal
February: 40% of Normal
March: 50% of Normal

- Forecasts range from 45-60% of average
- Improvement in lower elevation basins
March 2021 - Utah Water Supply Forecasts - Six Creeks

Parleys Creek

Parleys Ck - Salt Lake City, Nr (PRLU1)
Period: Apr-Jul, Official 50% Forecast (2021-03-01): 6.6 kaf (46% Average, 62% Median)
ESP is Unregulated and No Precipitation Forecast Included

2021/03/01:
Max 1983: 41.98
Min 1961: 1.7
Average: 14.2
Median: 10.7
ESP: 6.51
Official 10: 12.4
Official 30: 9.6
Official 50: 6.6
Official 70: 5.2
Official 90: 3.7

<10% chance of normal volume
March 2021 - Utah Water Supply Forecasts - Provo - Utah Lake

Provo River Basin Forecasts

January: **50%** of Normal
February: **50%** of Normal
March: **45%** of Normal
- Forecasts range from 40-65% of normal

Percent of Average

- **Below 25%**
- **25% - 35%**
- **35% - 45%**
- **45% - 55%**
- **55% - 65%**
- **65% - 75%**
- **75% - 85%**
- **85% - 95%**
- **95% - 105%**
- **105% - 115%**
- **115% - 125%**
- **125% - 135%**
- **135% - 145%**
- **145% - 155%**
- **155% - 165%**
- **165% - 175%**
- **175% - 185%**
- **185% - 195%**
- **195% - 205%**
- **205% - 225%**
- **225% - 250%**
- Above 250%
- **NA**
March 2021 - Utah Water Supply Forecasts - Provo/Utah Lake

Utah Lake Inflow

Jordan - Utah Lake, Provo, Nr (UTLU1)
Period: Apr-Jul, Official 50% Forecast (2021-03-01): 131 kaf (40% Average, 51% Median)
ESP is Unregulated and No Precipitation Forecast Included

2021/03/01:
Max 1984: 859.97
Min 1961: 68.03
Average: 325
Median: 255
ESP: 124
Official 10: 205
Official 30: 175
Official 50: 131
Official 70: 108
Official 90: 87
March 2021 - Utah Water Supply Forecasts - Duchesne

**Duchesne River Basin**
- January: 50% of Normal
- February: 50% of Normal
- March: 50% of Normal
  - Forecasts range from 30-60% of normal

**Price River Basin**
- January: 50% of Normal
- February: 50% of Normal
- March: 45% of Normal
March 2021 - Utah Water Supply Forecasts - Duchesne

Upper Stillwater Reservoir

50% Forecast: 45 43 43

>10% chance of record low volume
March 2021 - Utah Water Supply Forecasts - Sevier and Virgin

Sevier River Basin Forecasts (regulated i.e. predicted Obs)

January: 40% of Normal
February: 40% of Normal
March: 45% of Normal
• Forecasts range from 11-85% of normal

Virgin River Basin Forecasts

January: 35% of Normal
February: 40% of Normal
March: 40% of Normal
• Forecasts range from 30-47% of normal
Historical (1981-2010) Forecast Verification

March Forecast Error: April-July Volume

Forecasts are better than just going with average Error tends to decrease each month into the spring

Where Forecasts are Better:
- Headwaters
- Primarily snow melt basins
- Known diversions / demands

Where Forecasts are Worse:
- Lower elevations (rain or early melt)
- Downstream of diversions / irrigation
- Little is known about diversions / demands

<table>
<thead>
<tr>
<th>Location</th>
<th>February Forecast Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEAR - UTAH-WYOMING STATE</td>
<td>18%</td>
</tr>
<tr>
<td>BEAR - WOODRUFF NARROWS</td>
<td>36%</td>
</tr>
<tr>
<td>LOGAN - LOGAN- NR</td>
<td>19%</td>
</tr>
<tr>
<td>WEBER - OAKLEY- NR</td>
<td>17%</td>
</tr>
<tr>
<td>WEBER - ROCKPORT RES</td>
<td>24%</td>
</tr>
<tr>
<td>BIG COTTONWOOD CK</td>
<td>19%</td>
</tr>
<tr>
<td>PARLEYS CK</td>
<td>32%</td>
</tr>
<tr>
<td>PROVO - WOODLAND- NR</td>
<td>16%</td>
</tr>
<tr>
<td>PROVO - DEER CK RES</td>
<td>23%</td>
</tr>
<tr>
<td>VIRGIN - VIRGIN</td>
<td>31%</td>
</tr>
</tbody>
</table>
Upcoming Weather: WPC March 5-12 Precipitation Outlook

- Ridge builds today and remains in place through early next week. Dry conditions with temperatures 5-10 degrees above normal are expected.

- Large scale trough develops by next Tues-Thurs (March 9-11). Cooler temperatures are likely. Weather models are currently forecasting modest precipitation amounts.
Model uncertainty is quite high in the 8-14 day period. While there is elevated odds for below normal temperatures across our region, there is little signal for precipitation odds.

**Upcoming Weather: 8-14 Day Outlook (March 12-19)**

**Precipitation Outlook**

**Temperature Outlook**
Elevated odds of below normal precipitation across especially the southern half of Utah/Colorado and the Lower Basin. Weaker precip signal further north.
Water year precipitation and snow are still below to much below normal across the state, as is soil moisture.

  ○ Some improvements in water supply forecasts in these basins since February 1.

Water Supply Forecasts reflect the dry conditions.
  ○ All water supply forecasts are below normal.

Weather models indicating a typical spring pattern through the middle of the month with periods of warm/dry intermixed with periods of cool/wet. Model uncertainty tends to increase during the transition to Spring.
  ○ Currently no indication of an extended warm and dry period which is good news for water supply.
CBRFC post fire decision support role

Python/GIS fire tool development

Hydrologic model considerations

Pre/post fire streamflow simulations
CBRFC Decision Support Role

- Be proactive and transparent in addressing stakeholder concerns related to how streamflow forecasts may be influenced by recent fire activity.
  - Communicate model limitations

- Determine if hydrologic model parameters need to be adjusted in basins significantly impacted by recent fire activity to account for changes in runoff timing, magnitude, and efficiency.
  - 10-day streamflow forecasts vs. water supply forecasts vs. peak flow forecasts
  - Snowmelt runoff vs. rain-on-snow events vs. rain events

- Forecasting challenge: How will the timing and magnitude of runoff change after a fire?
  - Numerous basins impacted to varying degrees
    - Burn coverage
    - Burn severity
    - 2021: Very dry soils + fire impacts

- Continually evaluate CBRFC hydrologic model performance in fire affected basins
  - Model verification - are the model parameter adjustments improving the streamflow forecast?
  - Compare any hydro forecaster intervention in both burned & nearby unburned basins.
    - Example: spatial snowmelt rate analysis

- Stakeholder/RFC collaboration
- Document/database
Python/GIS Fire Tool Development

- **Python/GIS Fire Tool**
  - Goal: quickly ingest/process burn data and consider impacts to CBRFC streamflow forecasting efforts.
  - Input: geo tiff or .shp file of burn area / severity
    - Source: Burned Area Reflectance Classification (BARC)
      - A satellite-derived data layer of post-fire vegetation condition.
      - The BARC has four classes: high, moderate, low, and unburned.
  - Outputs
    - Maps (various scales)
    - Plots (broken down by CBRFC elevation zone)
      - Size of fire (mi$^2$)
      - % of elevation zone burned & burn severity (low, moderate, high)
    - Tables
      - Tabular data of plots (html, .csv)
    - Shapefiles of burn areas
  - Future development:
    - Type of vegetation burned (forest, shrub, etc..)
Willow Creek basin (WCRC2)
-CBRFC water supply forecast point > model reservoir inflow/pool elev/outflow
-both elevation zones >70% burned
A few CBRFC model adjustment options:
- No change -> establish baseline verification using current model parameters
  - Analyze model performance at beginning of runoff season & compare with non-fire affected nearby basins; stay flexible during runoff season
- Adjust UNIT-HG model
  - Would not affect model simulated volume (only affects timing)
- Adjust soil moisture (SAC-SMA) model
  - Will affect model water balance and both timing and magnitude of model simulated flow
- Define/configure new ‘burn’ zone in model
  - Most time consuming and complicated in an operational forecast setting

Relevant SAC-SMA Model Parameters:

- **UZTWM** - upper soil zone layer tension water capacity (bucket size), units = millimeters
  - Parameter indicates the amount of rain that must fall after a long dry period before any runoff is produced

- **UZFWM** - upper soil zone layer free water capacity (bucket size), units = millimeters
  - Primary function is to control when surface runoff occurs
  - Surface runoff can only occur when the intensity rate of the rainfall or rain+melt is sufficient to fill the upper zone free water storage.
Pre/Post Fire Hydrologic Model Simulation Analysis - Lower Colorado

Model Upper Elevation Zone Changes

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre Fire</th>
<th>Post Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>UZTWM</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>UZFWM</td>
<td>40</td>
<td>10</td>
</tr>
</tbody>
</table>

Basin upper elevation zone >50% burned
Pre/Post Fire Hydrologic Model Simulation Analysis - Upper Colorado

Upper zone

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre Fire</th>
<th>Post Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>UZTWM</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>UZFWM</td>
<td>40</td>
<td>15</td>
</tr>
</tbody>
</table>

Lower zone

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre Fire</th>
<th>Post Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>UZTWM</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>UZFWM</td>
<td>40</td>
<td>15</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Model Bias</th>
<th>PreFire</th>
<th>PostFire</th>
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<tbody>
<tr>
<td></td>
<td>-2.1%</td>
<td>+1.4%</td>
</tr>
</tbody>
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Volume % Change

+0.2 to +10.3%
Average: +3.6%

Willow Creek Reservoir Inflow Simulations

Pre-Fire Sim → Post-Fire Sim
+4% increase in April-July volume
CBRFC Hydro/Fire Summary

- Developed Python/GIS tool
- Comparing pre vs. post fire model simulations in offline forecast system
- Operational SAC-SMA model parameter adjustments in basin zones that are > 50% burned.
  - Implementing before April 1, 2021
- Evaluate operational hydrologic model performance during spring runoff
- Develop best practices
- Stay proactive & transparent
# 2021 Water Supply Webinar Schedule

*All Times Mountain Time (MT)*

<table>
<thead>
<tr>
<th>Colorado River Basin</th>
<th>Great Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friday Jan 8th 10 am</td>
<td>Friday Jan 8th 11:30 am</td>
</tr>
<tr>
<td>Friday Feb 5th 10 am</td>
<td>Friday Feb 5th 11:30 am</td>
</tr>
<tr>
<td>Friday Mar 5th 10 am</td>
<td>Friday Mar 5th 11:30 am</td>
</tr>
<tr>
<td>Wednesday Apr 7th 10 am</td>
<td>Wednesday Apr 7th 11:30 am</td>
</tr>
<tr>
<td>Friday May 7th 10 am</td>
<td>Friday May 7th 11:30 am</td>
</tr>
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**Peak flow forecast webinar Thursday, March 18th, 10 am MT**

Additional briefings scheduled as needed

Webinar schedule & registration information has been posted to the CBRFC web page.
CBRFC Contacts & WY21 Basin Focal Points

Michelle Stokes
Hydrologist In Charge
Michelle.Stokes@noaa.gov

John Lhotak
Development and Operations Hydrologist
John.Lhotak@noaa.gov

Paul Miller
Service Coordination Hydrologist
Paul.Miller@noaa.gov

Cass Goodman
Computer Systems Analyst
Cass.Goodman@noaa.gov

Valerie Offutt
Administrative Assistant
Valerie.Offutt@noaa.gov

Ashley Nielson
Upper Green, Yampa
San Juan, Dolores, Powell
Ashley.Nielson@noaa.gov

Patrick Kormos
Lower Green, Duchesne
Weber, Provo
Patrick.Kormos@noaa.gov

Cody Moser
Upper CO Mainstem, Gunnison
Cody.Moser@noaa.gov

Brenda Alcorn
Senior Hydrologist
Brenda.Alcorn@noaa.gov

Craig Peterson
Senior Hydrometeorologist
Craig.Peterson@noaa.gov

Tracy Cox
Hydrometeorologist
Tracy.Cox@noaa.gov

Zach Finch
Lower Colorado River Basin
Zach.Finch@noaa.gov

CBRFC Webpage
https://www.cbrfc.noaa.gov/

CBRFC Operations
cbrfc.operations@noaa.gov
801-524-4004

CBRFC Water Supply Presentations
https://www.cbrfc.noaa.gov/present/present.php