

Assessing Water Supply Conditions for Utah

Brian McInerney, NWS Salt Lake City Weather Forecast Office and Christina Alvord, Western Water Assessment

Introduction

The timing and volume of spring runoff determines the annual water supply in Utah and surrounding Intermountain West states. Because water supply estimates are important for water managers' annual planning, the National Weather Service (NWS) develops forecasts of water supply, based on hydrologic, climate, and geomorphic parameters. This article describes how the Salt Lake Weather Service Forecast Office (WFO) in conjunction with the Colorado Basin River Forecast Center (CBRFC) forecasts spring snowmelt runoff and resulting water supply conditions as they adjust throughout the course of a water year. The Salt Lake WFO disseminates the information to water managers, and federal, state and local agencies.

months. Groundwater is the water that sits beneath the surface (between 24 inches and 500 feet) in porous rock formations called aquifers. The USGS records groundwater levels late fall and makes comparisons to past years. If the ground water levels are lower than normal, the NWS anticipates that a greater portion of the spring runoff will infiltrate through the soil layer to recharge groundwater levels instead of flowing over the ground to rivers and reservoirs. Autumn soil moisture and groundwater are only the first pieces of the water supply puzzle.

Winter

The second aspect of water supply is determined in part by the accumulation of snow during the months of December, January, February, and March. Snow accumulation during the winter months is critical because if statewide percent of normal snowpack levels are below 60% by January 1st, the probability of reaching average snowpack by April 1st is slim.

Presence and strength of El Nino is an important indicator of amount and location of precipitation deposition in Utah, and is the main water supply component evaluated during the winter. During moderate to strong El Nino episodes, storms tracking from the Southwest bring warmer than normal temperatures and above average precipitation to the southern half of Utah. In non-El Nino years, storms tend to track towards the Pacific Northwest region of the U.S., away from Utah.

Spring

Snowpack conditions, temperature, rate of snowmelt, and amount and aerial extent of precipitation in April, May and June are the final components of the water supply equation. Snowpack levels entering into the spring months are largely indicative of water supply conditions during this time, however, rate and behavior of snowmelt is also important. A common misconception is that 100% of the total snowpack on April 1st will produce 100% streamflow volumes in May and June. This is not necessarily true every year (Figure 15a). Snowpack to runoff ratios are largely influenced by spring weather conditions. For example, as a result of a cool wet spring, snowmelt enters surface water systems in a shorter time frame, which enhances total snowmelt volume.

A cool, wet spring preserves snowpack conditions until the warm temperatures in May and June melts the snowpack all at once, yielding higher streamflow volumes. In comparison, a warm dry spring lengthens the period of snowmelt, promot

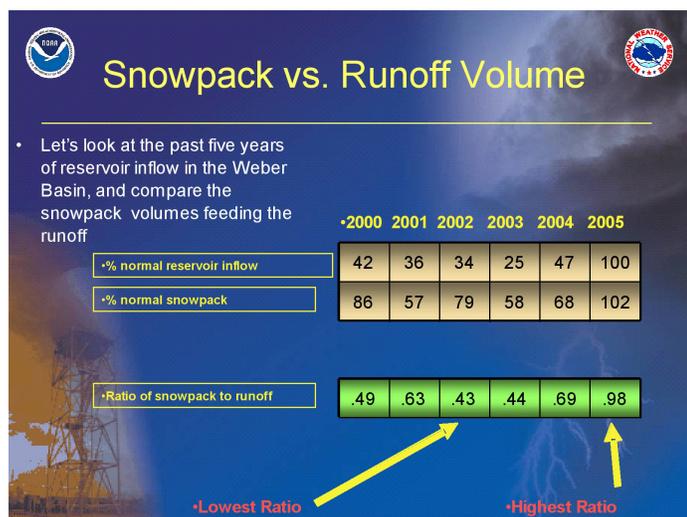


Figure 15a: Snowpack runoff ratio is a function of percent of reservoir inflow over percent of normal snowpack. As an example, the 2002 snowpack recorded 79% of average snowpack, but only yielded 34% of the expected streamflow into basin reservoirs, resulting in a snowpack runoff ratio of 43%.

Autumn

The first hydrologic parameters that forecasters use to assess water supply conditions are the amount of autumn rainfall, resulting soil moisture, and groundwater conditions for the months of September, October, and parts of November. During the autumn months widespread, low intensity/long duration rainfall events can saturate soil levels 24 inches deep, but a persistent high-pressure ridge can block storm activity. The Utah Natural Resources Conservation Service (NRCS) recently began tracking soil moisture at various Snotel sites across the state (Figure 15a).

Groundwater conditions are also monitored during the fall



ing greater evaporation, seepage, and transpiration over an extended period of time. Water supply conditions are based on multiple physical parameters to the extent that a dry and hot spring could threaten water supplies even if snowpack conditions are above average.

Measurement of the above parameters is necessary to accurately forecast spring snowmelt runoff and resulting water supply conditions. As we are in early January, water supply conditions are still uncertain at this time. We must wait until the physical parameters of snow collection evolve, then as we move into spring, snowmelt runoff forecasts will once again be adjusted based on spring weather and snowpack conditions. Snowmelt runoff volume forecasts are issued by the CBRFC and graphical versions are generated by the Salt Lake WFO for use by Utah water managers about every month. (Figure 15b, c). You can see Salt Lake WFO monthly forecasts at <http://www.wrh.noaa.gov/slc/river/presentations>. CBRFC forecasts are available January-June at: <http://www.cbrfc.noaa.gov/wsups/wsups.cgi>.

Sources

National Weather Service Forecast Office, Salt Lake City, UT: <http://www.wrh.noaa.gov/slc/>

CBRFC: <http://www.cbrfc.noaa.gov/wsups/wsups.cgi>

NRCS: Climate Information, including soil moisture charts and the Utah Soil Moisture Update Report: <http://www.ut.nrcs.usda.gov/snow/data/monthly/Soil%20Moisture%20Charts.pdf>

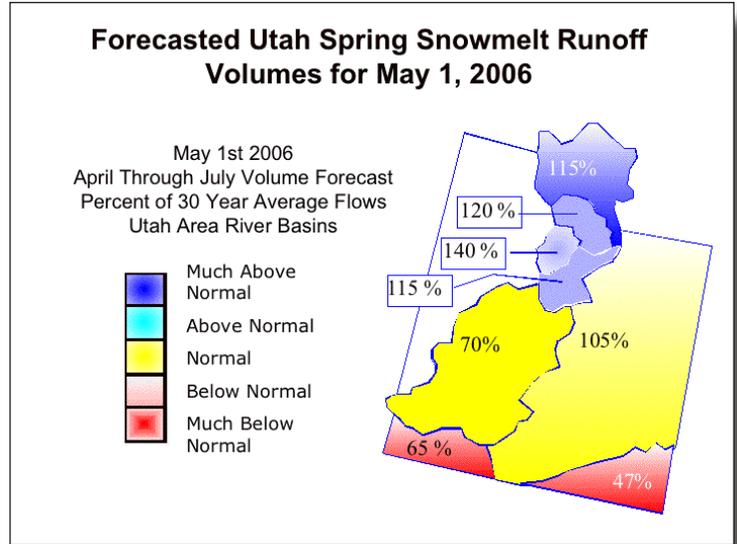


Figure 15b: Graphic example of statewide snowmelt runoff volume forecasts for May 1, 2006 generated by the Salt Lake WFO.

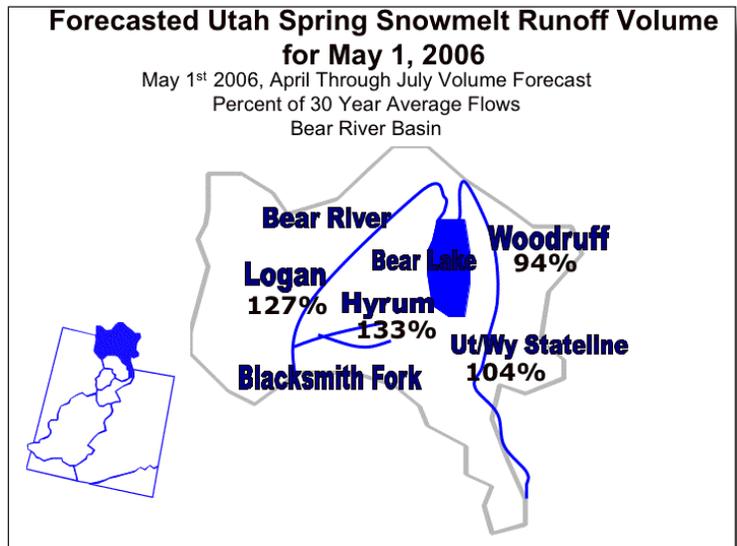


Figure 15c: Snowmelt runoff volume forecasts for the Bear River Basin in Northern Utah for May 1, 2006. These snowmelt volume forecasts are presented at monthly water supply meetings at the WFO office in Salt Lake City.

On the Web

- Salt Lake WFO monthly water supply outlook presentations are available at: <http://www.wrh.noaa.gov/slc/river/presentations>.
- For CBRFC forecasts visit: <http://www.cbrfc.noaa.gov/wsups/wsups.cgi>.
- Additional information about the Salt Lake WFO is available at: <http://www.wrh.noaa.gov/slc/>, or contact Brian McInerney at brian.mcinerney@noaa.gov.

