

MEMO

State of Idaho

Department of Water Resources

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Date: May 17, 2021

To: Gary Spackman, Director

From: Sean Vincent, Hydrology Section Manager

Subject: Surface Water Supply Forecasts for the Wood River Basins

This memorandum has been prepared in response to the Director's request for staff memoranda dated May 11, 2021. This memorandum addresses item 2 in the request:

- 2. Describe methods of predicting surface water supplies for the Wood River Basins. Based on IDWR expertise, recommend a method for predicting the water supply for the upcoming 2021 irrigation season and identify potential analog years.***

Description of Methods

Three methods for predicting surface water supplies for the upcoming irrigation season were considered:

- SWSI**

The Surface Water Supply Index (SWSI) is a predictive indicator of surface water availability in a basin compared to historic supply. The Natural Resources Conservation Service (NRCS) computes the SWSI by summing the two major sources of surface water supply for irrigation: streamflow runoff and reservoir carryover. According to the NRCS website, "SWSI uses non-exceedance probabilities to normalize the magnitude of annual water supply variability between basins. The non-exceedance values are then rescaled to range from +4.1 (extremely wet) to -4.1 (extremely dry). A SWSI value of 0.0 indicates a median water supply as compared to historic occurrences." SWSIs are computed for many of the irrigated basins in the western United States including the Big Wood River basin below Magic Reservoir and the Big Wood River above Hailey.

At the beginning of each month (excluding November and December), the NRCS publishes a table with 10-, 30-, 50-, 70-, and 90-percent exceedance forecasts for the coming season along with measured total annual water supply volumes for the previous 30 years and an estimate of the adequate water supply volume for irrigation.

- WRWC Model**

The predictive model developed by Dr. Kendra Kaiser for the Wood River Water Collaborative (WRWC) provides forecasts for irrigation season streamflow, total volume, and runoff timing for

gages on the Big Wood (Hailey, Stanton Crossing), Silver Creek, and Camas Creek. The WRWC model also estimates annual diversions and curtailment dates for three water right priorities on each reach (Big wood above Stanton, Big Wood below Magic Reservoir, and Silver Creek). The WRWC model, like those used for NRCS water supply forecasts, is a suite of statistical models based on linear regressions between streamflow and predictive variables such as Snow Water Equivalent, precipitation, antecedent streamflow, and climate teleconnection index.

IDWR staff downloaded and ran the WRWC model and then compared WRWC model output with NRCS forecasts for runoff volume at the Big Wood at Hailey gage (no other gage sites are included in both forecast models). IDWR also contacted Dr. Kaiser and learned that the WRWC model is still in development and that modifications to the code are being made based on input from the WRWC.

3. NWRFC ESP

The Northwest River Forecast Center (NWRFC) currently uses an ensemble streamflow prediction (ESP) technique to make water supply forecasts for the Columbia River Basin; the coastal streams of Washington and Oregon; and the Great Basin of Oregon. The ESP streamflow volume forecast has two components: (1) a 10-day streamflow forecast based on the current 10-day weather forecast and information relative snow water content, snow cover, soil moisture, and reservoir levels (found at: <https://www.nwrfc.noaa.gov/rfc/>), and (2) an ensemble of 40 streamflow forecasts based on historic temperature and precipitation datasets from the period 1981 to present. Each of the historic forecasts is appended to the end of the 10-day forecast and the resulting ensemble of 40 forecasts are described using exceedance probabilities. The ESP forecasts are revised daily.

Method Selection

IDWR chose the SWSI for predicting surface water supplies for the 2021 irrigation season for the following reasons:

1. The SWSI and NWRFC ESP are both good methods for predicting agricultural water supplies in reservoir-regulated basins, like the Big Wood River basin below Magic Reservoir, because they consider reservoir storage in addition to natural flow.
2. The SWSI is normalized, making it easy to compare the forecast supply with historical water supplies in the same basin and in other basins.
3. SWSI tables include exceedance forecasts for the coming season along with historical water supply volumes for previous years. For this reason, SWSI tables are especially useful for choosing analog water years.
4. SWSI tables also include an estimate of the adequate water supply volume, which can be used to determine if the current year will have a shortage or surplus of irrigation water.
5. The WRWC model is still in development.

SWSI Selection

Because it includes a reservoir storage component, the SWSI for the Big Wood River basin below Magic Reservoir is the obvious choice for forecasting surface water availability for irrigators with access to storage water in Magic Reservoir. On the other hand, the SWSI for the Big Wood River above Hailey is a better choice for predicting the available supply for surface water users in the Wood River Valley as well as downstream users that don't have access to Magic Reservoir but instead divert from Silver Creek and/or the Little Wood River.

Forecast supplies for the 2021 irrigation season

The April 2021 Big Wood River below Magic Reservoir SWSI for the most probable case (50% exceedance) was -2.7 with a total projected water supply of 116 thousand acre-feet (KAF), which is the sum of the end of March reservoir storage (32 KAF) plus the projected April through September natural flow (84 KAF). The projected total irrigation season water supply is less than one-half of the adequate water supply volume of 275 KAF.

The April SWSI for the Big Wood River above Hailey (used as an indicator for the Wood River Valley) was also -2.7 with a predicted April through September runoff volume of 127 KAF. The projected total water supply for the Big Wood River above Hailey is only slightly less than the adequate water supply volume of 135 KAF.

Potential analog years for the Big Wood River Basin below Magic Reservoir

For the period 1991 to 2020, the years with the most similar total supplies to the April 50% exceedance forecast for 2021 are 1994 (SWSI = -2.6) and 2004 (SWSI = -2.8). In both years, Magic Reservoir failed to fill, the shutoff date occurred in early July, and the reservoir was essentially empty on the shutoff date.

Potential analog years for the Wood River Valley

For the period 1991 to 2020, the years with the most similar total supplies to the 50% exceedance forecast for 2021 are 2004 (SWSI = -2.6) and 2020 (SWSI = -2.8). Despite being a poor water supply year, the water supply volume in 2004 (136 KAF) just exceeded the 135 KAF adequate water supply.