

Portland Water Bureau

Water Quality



2023 Seasonal Water Supply– Retrospective
Prepared: May 6, 2024, Portland Water Bureau

Summary

The 2023 Seasonal Supply year provided unique challenges in managing the drinking water system to meet the needs of all customers.

- 2023 saw a **quick transition from high precipitation in April to dry conditions in May. Melting snowpack sustained streamflow into May.** Drawdown began approximately five weeks earlier than the historical average timing in early July.
- The early start to drawdown, and an **extended summer and dry fall** resulted in utilizing the Columbia South Shore Well Field for supply augmentation from August 24 to November 15.
- On August 24, **lightning started a wildfire in the Bull Run watershed**, threatening treatment facilities and resulting in increased concern for water quality impacts.
- As a result of the Camp Creek fire in the Bull Run Watershed, **the groundwater augmentation run was extended** as a precaution to mitigate for potential impacts from the fire. Once the soils in the watershed were saturated and the reservoirs were near full, with little to no impacts from the fire, the groundwater supply was shutoff.

Weather

The accumulation of snowpack during the snow season of 2022-23 started in early November, a few weeks earlier than average, and was above average for most of the snow season. Considerable accumulation in the latter part of the season in March and April brought snow water equivalent (SWE; the depth of liquid water if the snowpack were completely melted) values well above average. SWE values peaked very late in the season, and the start of snowmelt began late April, coinciding with a rapid shift to dry conditions. SWE values remained above average for the rest of the spring, with the snowpack melting more slowly in dry conditions than it would have in rainy conditions. This convergence of factors created an atypical dynamic in the Bull Run in which snowmelt sustained streamflow, rather than spring rain events, and governed the timing of reservoir drawdown onset. Snowmelt was complete within the first week of June. Figure 1 shows snow water equivalent at the three snow monitoring sites in the watershed.

Precipitation during 2023 was, overall, below average in the Bull Run watershed. Total rainfall for the calendar year was 69 inches at Headworks, 87% of the 80 inches of annual average rainfall from 1899-2022. Every month except April and December had below average precipitation. The transition from a very precipitation-heavy April (much of which fell as snow) to a very dry May was a stark and rapid shift. Fall rains in September and October, though below average, were fairly near average. Figure 2 shows monthly precipitation at Headworks for 2023.

Demand

Historic winter base demand peaked between 1979 and 1991 at an average of approximately 100 million gallons per day (MGD). Since then, winter base demand (November-March) has declined, with demand over the past 5 years approximately 20% lower at an average of about 80 MGD. In 2023, average demand was 92 MGD, lower than the previous 5-year average of 93 MGD. Figure 3 shows

demand from 2023 and the preceding five-year average. These demand numbers reflect the total amount of water supplied to serve Portland retail and wholesale customers and are not equivalent to the total amount of water that is metered and billed.

Bull Run Supply

Drawdown of the Bull Run Reservoirs began on June 1, which is earlier than the historical average onset of drawdown on July 10. The reservoirs reached their minimum storage on September 25, when 2.3 of 9.9 billion gallons (BG) of usable storage (23%) remained in the reservoirs. The reservoirs completed filling on November 7. Figure 4 shows the 2023 drawdown of the Bull Run Reservoirs.

Groundwater Use

Each year, the Portland Water Bureau (PWB) plans to operate the Columbia South Shore Well Field to exercise equipment and identify repair needs. In 2023 the need for groundwater to augment supply replaced the groundwater maintenance operation. Groundwater was used to augment the Bull Run supply from August 24 to November 15. The start of this operation was delayed for several weeks so that the regulatory Lead and Copper Rule samples could be collected while there was 100% Bull Run supply throughout the distribution system to demonstrate the effectiveness of the improved corrosion control treatment for the Bull Run.

Due to the delayed start to the augmentation run, PWB planned an initial groundwater production rate of 72 MGD for the first two weeks, then maintain a minimum flow from two conduits from the Bull Run of about 40 MGD and adapt the rate of groundwater supply to meet remaining demands. However, due to the Camp Creek Fire in the Bull Run Watershed having the potential to shutdown the Bull Run, groundwater production was reduced to approximately 52 MGD for the first 4 weeks of the operation, and then around 36 MGD through the end of the run to ensure the system was ready to use as part of a Bull Run replacement while conserving as much groundwater supply capacity as possible.

Despite reservoir refill beginning with precipitation in mid-October, the potential for increased risk of turbidity from the Camp Creek Fire drove the decision to continue the groundwater operation until refill was completed and the risk of a turbidity event was reduced. As a result, groundwater was shut-off on November 15. Figure 6 shows the instantaneous and cumulative groundwater pumping during the 2023 supply augmentation run.

During 2023, Production Well (PW)4 was out of service for routine 20-year maintenance. PW6 experienced a failure in August, and PW16 was showing poor electrical readings and was not used.

The Camp Creek Fire emergency declaration allowed for the emergency procurement of a spare pump and motor that can be used in either PW19 or PW13, two large capacity wells in the Blue Lake Aquifer that had experienced failures in 2022. An emergency contract for repairs has also been put in place to expedite repairs in future seasons if needed.

Groundwater Use Model

The Groundwater Use Model was run in the spring of 2023 before drawdown began. The model does not incorporate weather forecasts and is therefore run only once each year. Subsequent application of the Groundwater Use Model involves comparison of the actual course of drawdown to the groundwater pumping curves generated by the model. Figure 5 shows the groundwater pumping curves that were developed, along with the actual reservoir volumes that were observed during the drawdown season.

During drawdown, if the actual storage volume in the Bull Run Reservoirs drops below a groundwater pumping curve, then the pumping rate corresponding to that curve is recommended to augment supply.

Instream Flows and Fish Habitat Management

PWB managed water releases downstream of Bull Run Reservoir 2 to meet minimum flow requirements and water temperature targets for the lower Bull Run River, which are required by the Bull Run Water Supply Habitat Conservation Plan (HCP).

Per requirements as defined in the HCP, lower Bull Run flows stayed at or above 120 cubic feet per second (cfs) January through May. After reservoirs started drawing down on June 1, triggering critical spring conditions, lower Bull Run flows were brought below 120 cfs and above the minimum 30 cfs required for critical spring. In July through September, summer flow minimum requirements of 20 cfs were observed. Summer flow releases were actively managed each day to meet the water temperature goal of keeping the 7-day average of the daily maximum water temperatures at the warmest point on the Bull Run River, measured at Larson's Bridge, below the temperature target, which moves according to temperatures observed at the Little Sandy River. August and September cumulative tributary inflows to Bull Run reservoirs were below the tenth percentile of historic flows, which allowed for implementation of reduced flow releases in October and November. According to the critical fall requirements, lower Bull Run River flows stayed at the summertime minimum of 20 cfs through October 15 and then increased to reflect a percentage of tributary inflows for the remainder of October and all of November. In December, minimum flows returned to 120 cfs.

PWB met downstream water temperature targets in the HCP for 2023 with the exception of a period of time in the fall. Figure 7 shows the temperature of the Lower Bull Run River. Throughout the management season, PWB presented the 2023 water temperature information to the Oregon Department of Environmental Quality, the National Marine Fisheries Service, and the Oregon Department of Fish and Wildlife.

Cold-water Transfer

In 2023, PWB completed a cold-water transfer to move the bottom-most cold water from Reservoir 1 downstream into Reservoir 2, where it would be available for release to town or downstream. The transfer started on August 1 and continued through September 23 releasing a total of 5.0BG of bottom water from Reservoir 1 via the Dam 1 fixed cone valves (using the 895' elevation gates) into Reservoir 2. The temperature effect of these releases was most apparent in the upper and middle elevations of Reservoir 2.

Water Efficiency and Conservation

Water Efficiency programs and services continue to be one component of Portland's approach to meeting customer water use demands. Programs available in the 2023 supply season included:

- Distributed water saving devices and information through community events, partner workshops, and customer requests.
- Provided rebates to replace inefficient toilets with WaterSense labeled toilets for residential, commercial, and multi-family customers.
- Provided rebates to replace an irrigation controller with a WaterSense weather-based model in addition to rebates for retrofit of efficient sprinkler nozzles.
- Provided rebates to commercial customers to replace water-cooled equipment and to support other water efficiency projects.

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- Published a Customer Newsletter with water conservation information that was included in all bills that were sent out in the summer.
 - Income-qualified customers received critical leak repairs through the Water Leak Repair Program. PWB partners with the African American Alliance for Homeownership (AAAH) and Community Energy Project (CEP) to fund repairs. Eligible customers received repairs or replacement of service-lines, toilets, faucets, in-home pipes, outdoor spigots, and inefficient clothes washers.
 - Data logging and on-site water use assessments for commercial and large multi-family customers.
 - Community engagement and outreach through workshops and participation in community events including Community Services Network Resource Fairs, Good in the Hood, Sunday Parkways, and the sponsorship of DIY plumbing workshops through the Rebuilding Center.
 - The PWB is a member of the Regional Water Providers Consortium (RWPC), and an active participant in the Conservation subcommittee. The bureau achieves public education and communication goals through the RWPC's regional conservation programming. Below is a summary of key offerings completed in Summer 2023:
 - Multimedia campaign: ***“Use water wisely. It’s just the right thing to do.”***
 - The water conservation campaign ran in English and Spanish from June through mid-September. Campaigns ran on television, radio, social media, and several other online platforms. Messaging focused on seasonal irrigation tips, ways for kids to save water, and tips for protecting local waterways.
 - Summer outreach messaging was also distributed through the RWPC's website www.regionalh2o.org, social media, and through Spanish language media partners.
 - Provided the Weekly Watering Number (WWN) on www.regionalh2o.org and via a weekly listserv that reached approximately 4,012 recipients from April-September. The WWN is the amount of water in inches to apply to lawns and gardens based on local weather conditions and evapotranspiration.

Curtailment and Contingency Planning

PWB's 2020 [Water Management and Conservation Plan](#) outlines the process to be followed if a curtailment action was necessary. The Water Manager's Advisory Board also has a curtailment plan which guides how curtailment would work for PWB wholesale customers. Curtailment is a call to action for all water users to reduce water use with three levels of urgency.

The Camp Creek Fire created an uncertain supply situation and to be ready to respond, PWB activated contingency planning work that included curtailment communications. Building off of PWB's 2022 multilingual Curtailment Communications Manual, the Water Manager's Advisory Board Curtailment Plan, and learning from the 2022 RWPC's 'Curtail your Enthusiasm' exercise, PWB adapted messages and created communication materials to be able to address potential curtailment scenarios due to the fire.

The following describes work that was advanced as a part of the Camp Creek Fire response:

- Curtailment messages were expanded from five languages (Spanish, Vietnamese, Russian and simplified Chinese and English) to include the [entire Portland Language List](#).

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- Messaging and graphics were tailored for the Camp Creek Fire Scenario and work has started to adapt messages for a turbidity/winter scenario.
 - A communication toolkit for wholesale customers and regional water providers was developed and distributed.
 - Key customer accounts were identified and curtailment planning technical support was offered.
 - Frequent briefings and email updates for wholesale customers and regional partners and key customer accounts were provided.
 - Sector specific commercial communications were developed.
 - A multi-lingual community partner toolkit and training was developed.
 - Communications on how to transition from a curtailment to a boil water notice were drafted.

While a curtailment wasn't activated for the Camp Creek Fire response, critical preparation work was completed that will likely be of great benefit in future events.

Conclusions

During the 2023 supply season, PWB was able to meet all in-town and in-stream demands using its baseline resources—Bull Run Reservoirs, streamflow, conservation, and groundwater. Several key points from the supply planning season:

Groundwater

As captured above, groundwater was instrumental in meeting system demands in 2023 with a supply augmentation run of 83 days contributing 3.2 BG of groundwater to supply.

Demand

A rapid onset of warm weather in spring and an earlier than average start to drawdown saw higher than average demand for the start of summer, with demands returning to near average for most of summer. Extended hot weather into the fall saw above average demands before fall rains in October reduced demands close to average.

Emergency Supply Contingencies

The Camp Creek Fire in the Bull Run Watershed highlighted the importance of emergency supply contingencies. Faced with the potential to shut off the Bull Run supply when demands exceeded groundwater capacity, having additional supply contingencies was critical in planning to meet system demands. PWB was able to quickly prepare for a full groundwater activation, offloading of wholesaler demands to other regional sources, and potential emergency curtailment. Such a situation also emphasized the need for reliable groundwater production, driving the decision to procure an emergency pump and motor for key wells.

In summary, the bi-weekly meetings of the Supply Planning Group were integral to the successful management of supply operations. The group balances multiple objectives to ensure a reliable high-quality water supply for all users while effectively managing costs.

Figure 1. Snow water equivalent, in inches, at snow monitoring sites in Bull Run during water year (WY) 2023

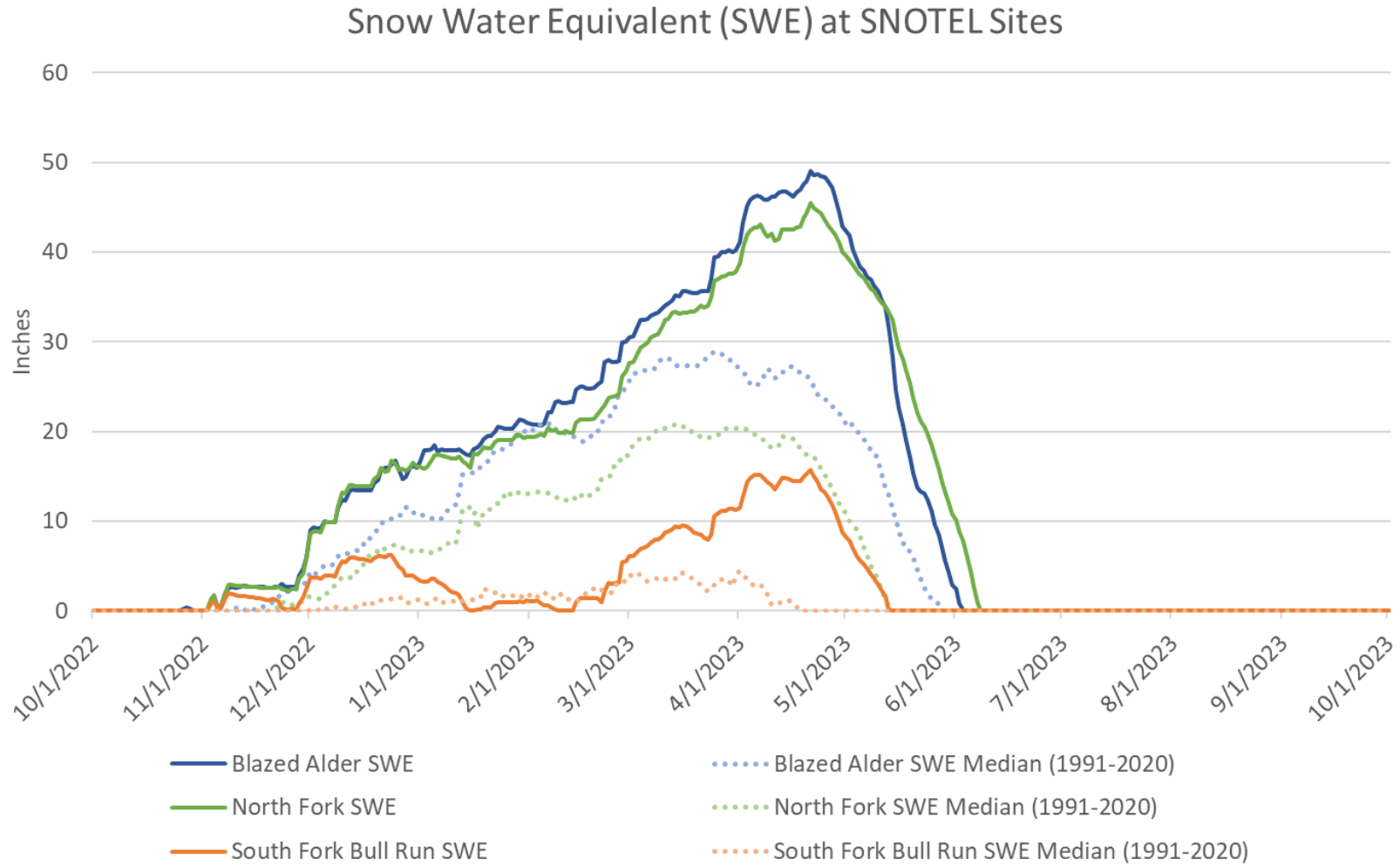


Figure 2. Monthly precipitation at Headworks

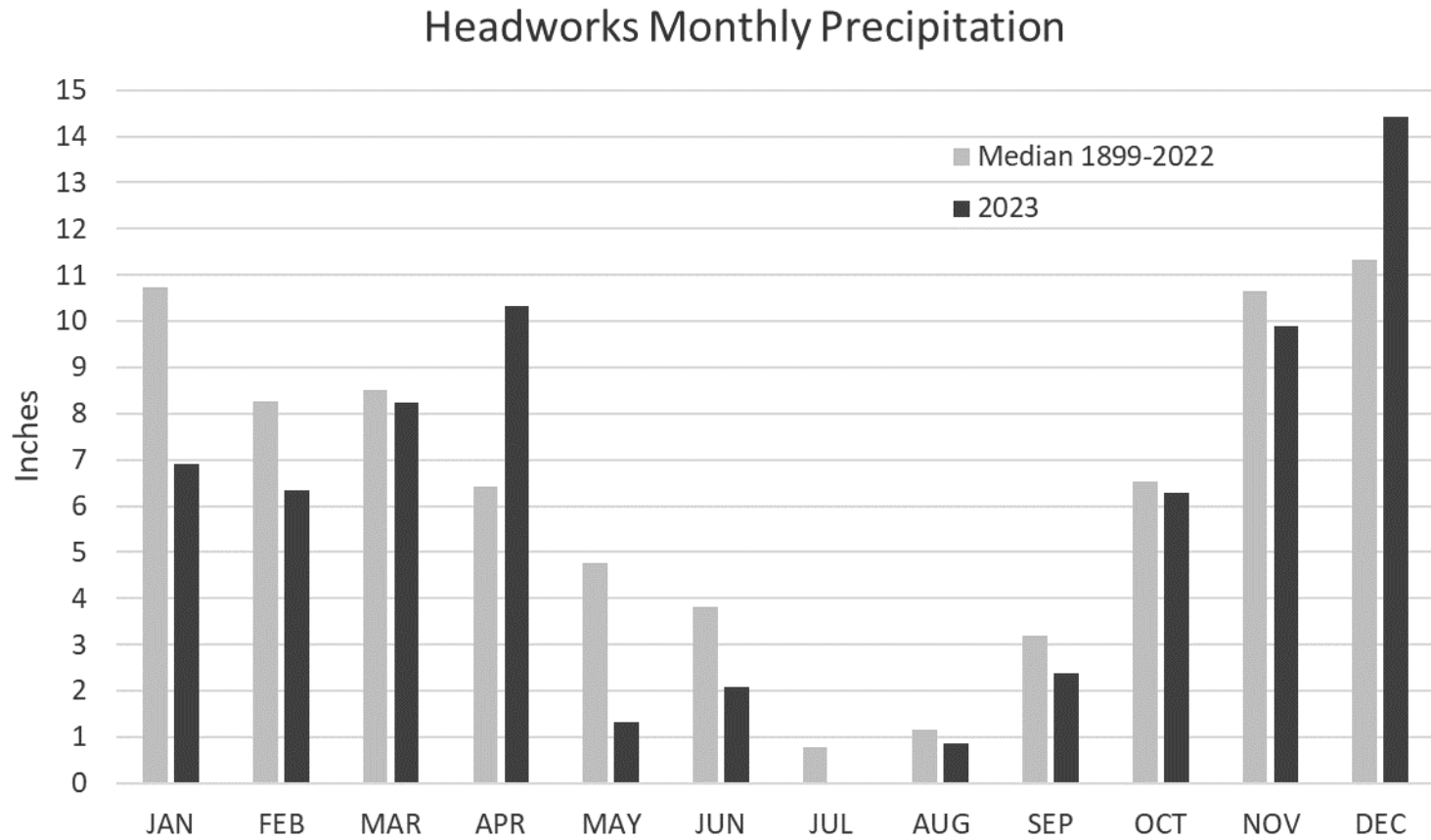


Figure 3. Current demand compared to previous five years; 7-day moving averages

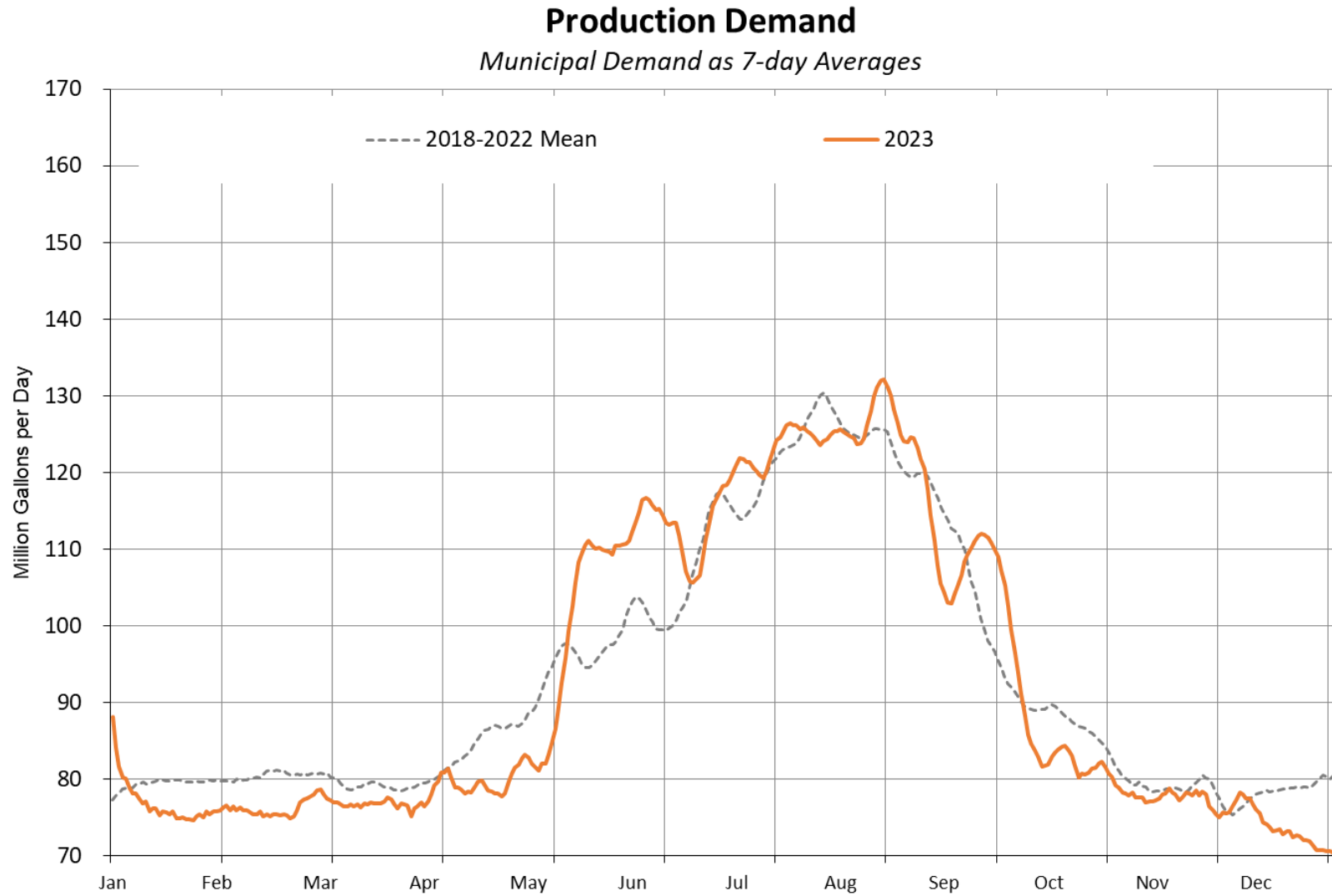


Figure 4. 2023 Bull Run Reservoirs drawdown and refill

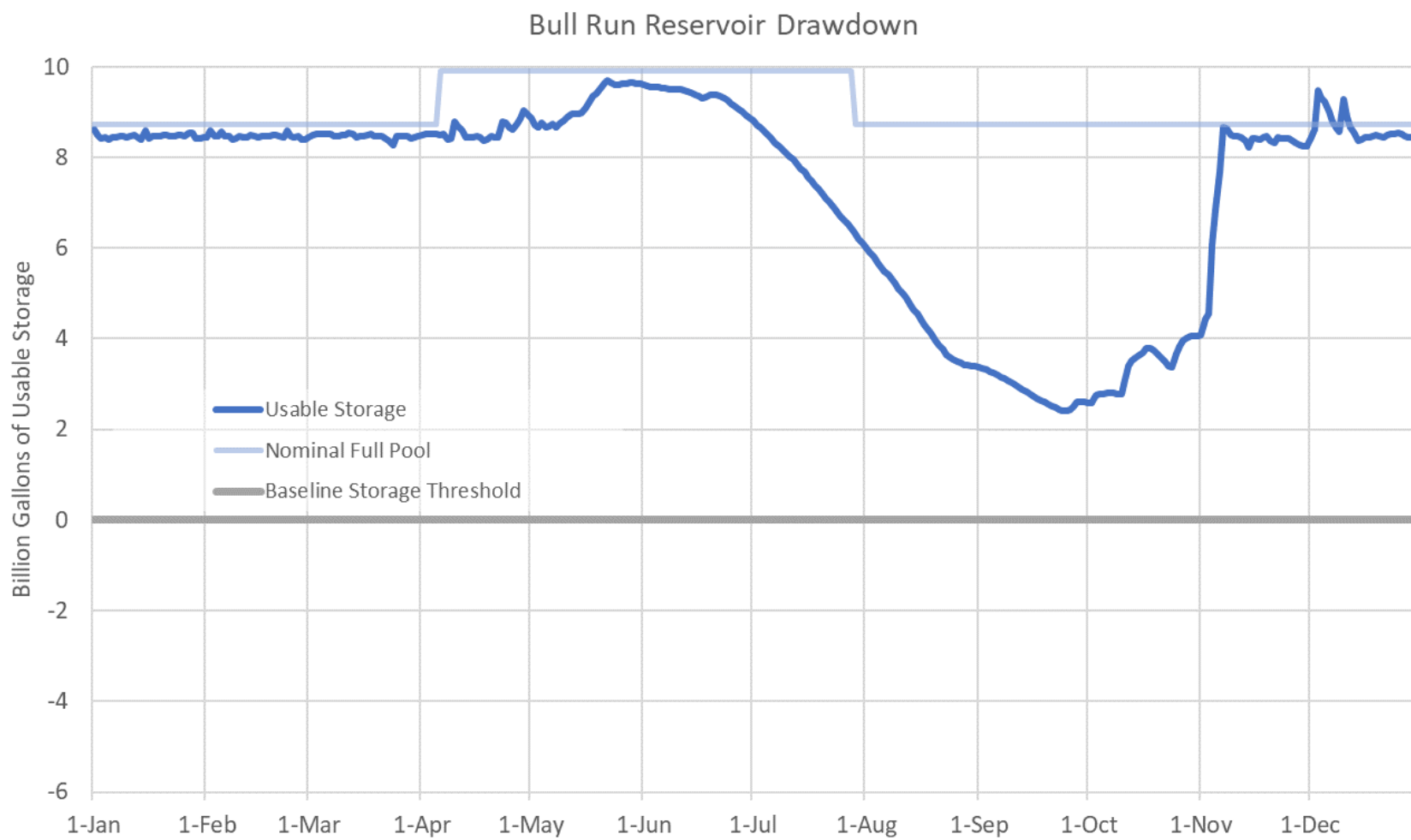


Figure 5. 2023 Observed Bull Run Reservoirs storage and modeled groundwater pump rates

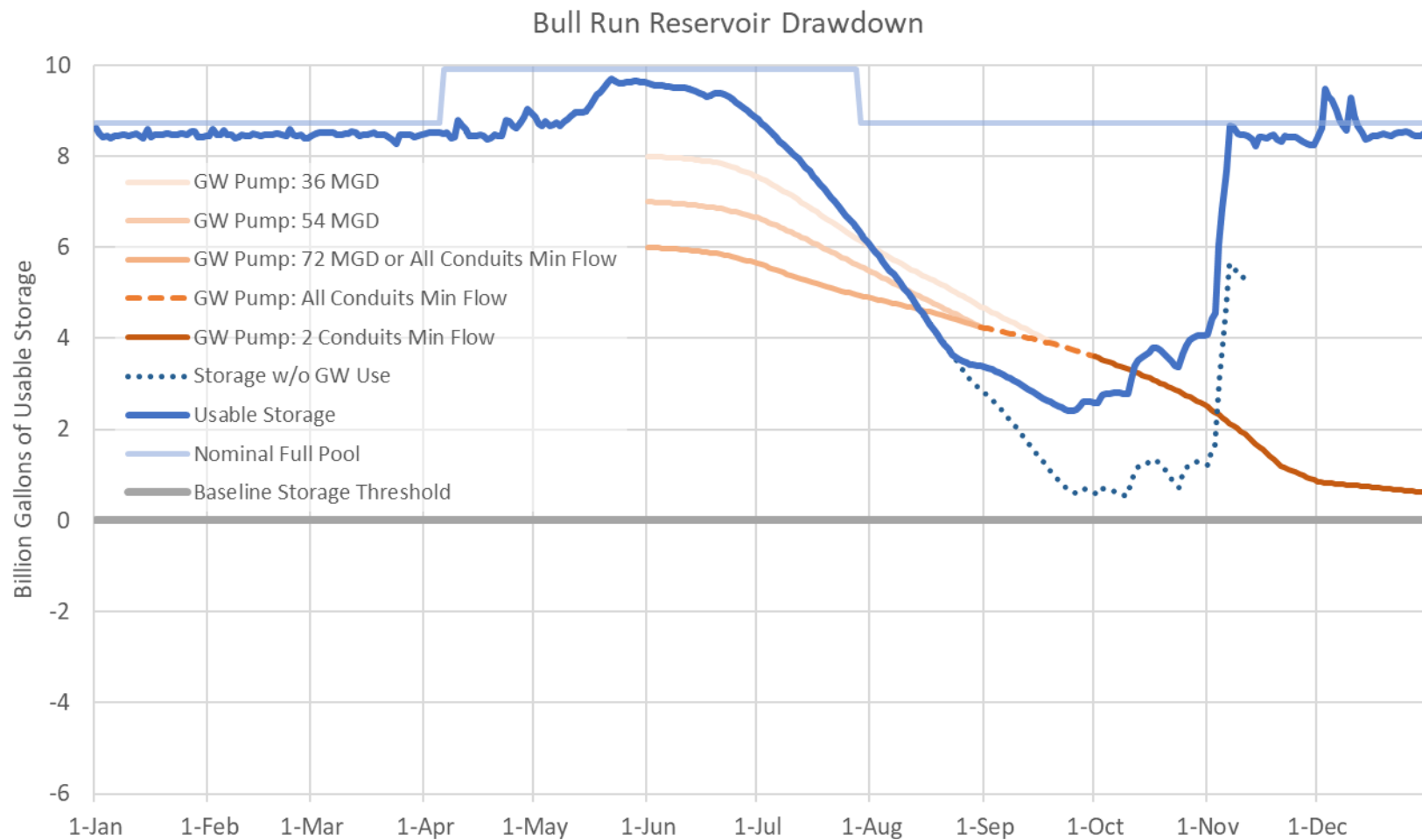


Figure 6. Instantaneous and Cumulative Groundwater Pumping Aug – Nov 2023

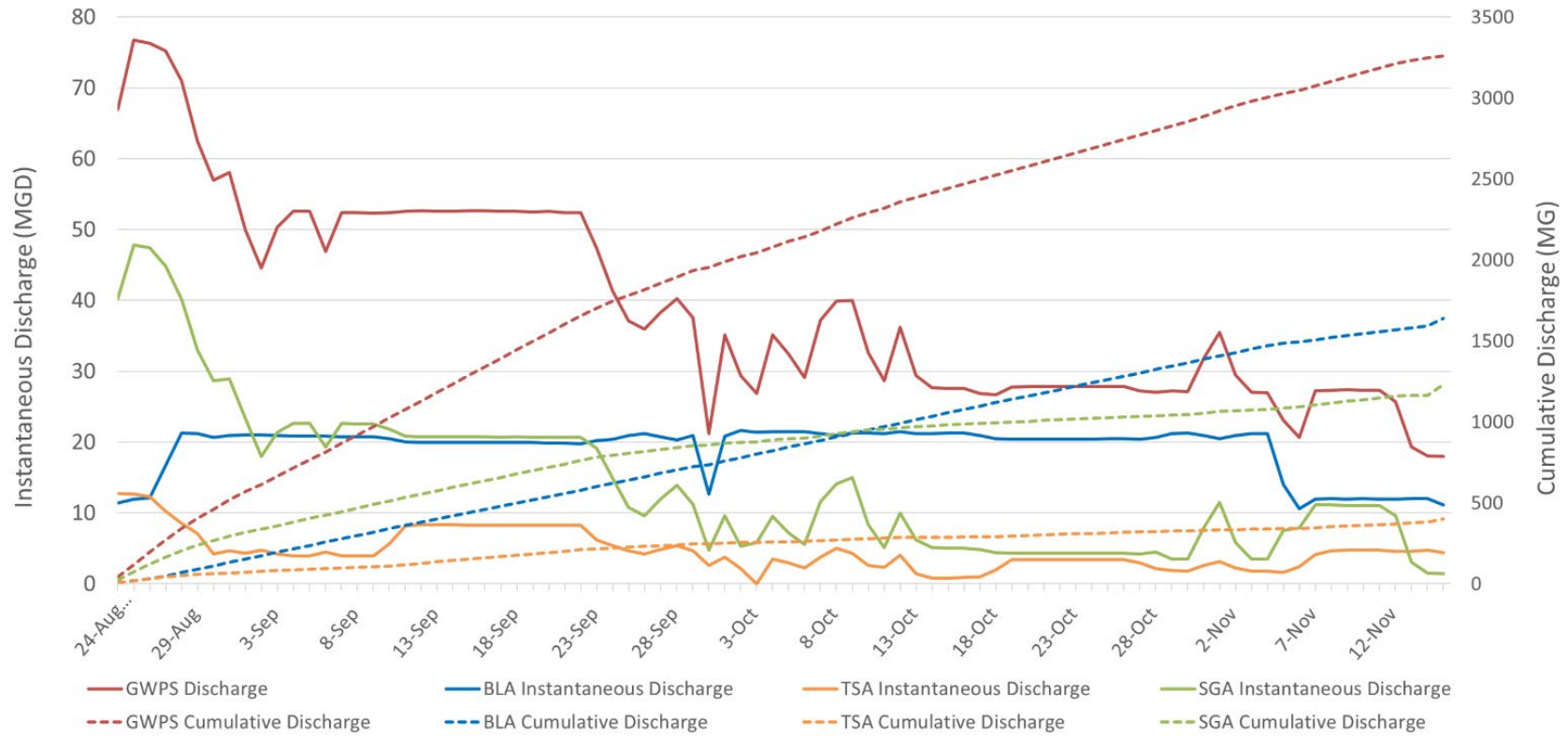


Figure 7. Water temperature of the Lower Bull Run River, May-November 2023

