Aquifers Discussion
Big Wood River Groundwater Management Area

1. What are the general impacts of groundwater pumping in Big Wood River Groundwater Management Area (BWRGWMA)?

    a. Big Wood River aquifer
        - Big Wood River aquifer downstream of the Glendale Bridge.
            i. Pumping primarily affects Silver Creek and the Big Wood River

        - Big Wood River aquifer upstream of the Glendale Bridge
            i. Pumping primarily affects the Big Wood River with some minor impacts to Silver Creek.

    b. Camas Prairie aquifer (Camas Aquifer)
        - Pumping affects flow in Camas Creek and inflows to Magic Reservoir.

Figure 1 is a map of the BWRGWMA aquifers is.

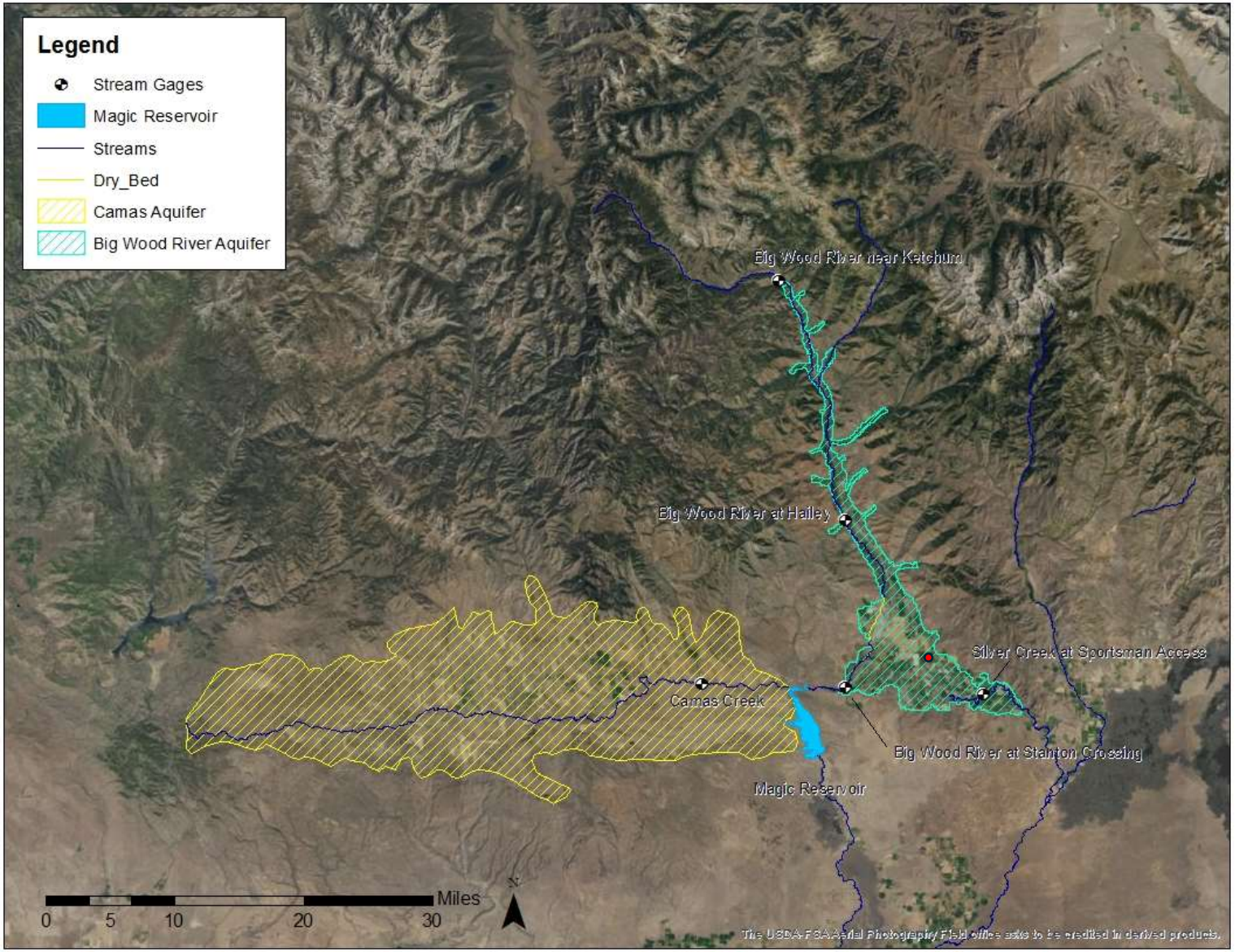

Figure 1: WRGWMA Hydrologic Features

2. Is the long-term groundwater supply of the BWRGWMA Aquifers sustainable without management?

    a. Yes, if consumptive use of groundwater does not increase. If groundwater consumptive use in the BWRGWMA aquifers increases in the future, additional declines in groundwater levels can be expected. IDWR has issued a moratorium on new water rights for consumptive use. Increases in consumptive use under existing water rights could occur in the future because of changes in irrigation practices, crop type, or climate conditions that increase crop water need or the use of supplemental groundwater to replace declining surface water supplies

    b. Groundwater levels in the Big Wood River aquifer respond based on the relative amounts of inflows and outflows to the aquifers. When inflows exceed outflows, groundwater levels rise. When inflows are less than outflows, groundwater levels decline.

    c. **Figure 2** presents a plot of the cumulative decreed pumping rates (cfs) versus priority for groundwater rights in the BWRGWMA. Establishment of the BWRGWMA and a moratorium against new consumptive groundwater water rights in 1991 generally put an end to the continued expansion of groundwater pumping.

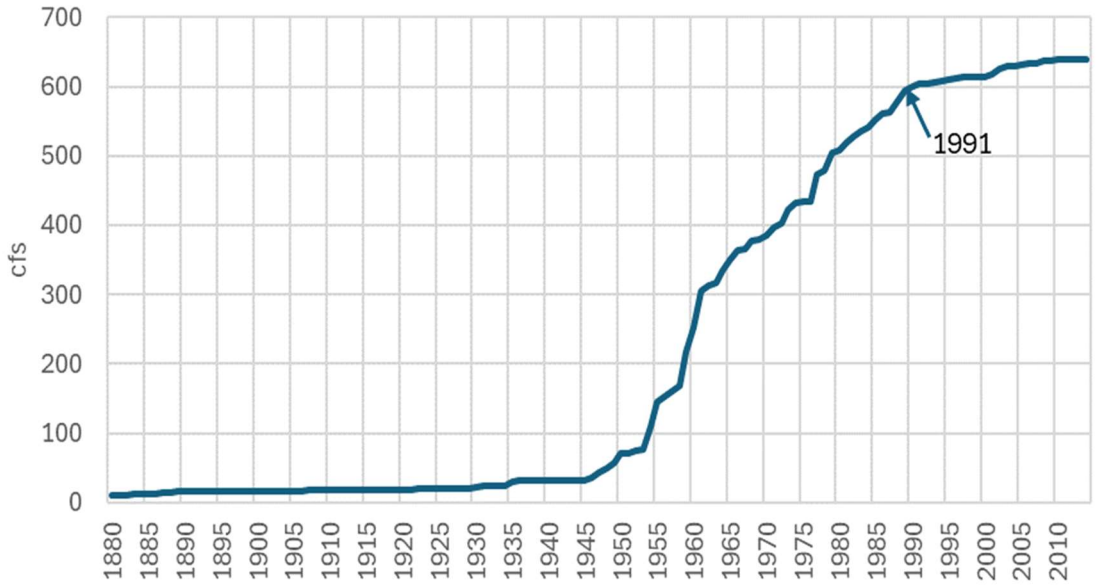

Figure 2: Cumulative BWRGWMA Groundwater Rights through Time (cfs)

    d. Consistent with the expansion of groundwater rights shown in **Figure 2**, groundwater levels in the Triangle Aquifer generally declined from the mid-1970s to the mid-1990s as shown in **Figure 3**. However, since the moratorium in 1991, groundwater levels have been relatively stable with some cyclical fluctuations in response to alternating wet and dry periods. These cyclical fluctuations are caused by variations in pumping, recharge from surface irrigation, and natural recharge.

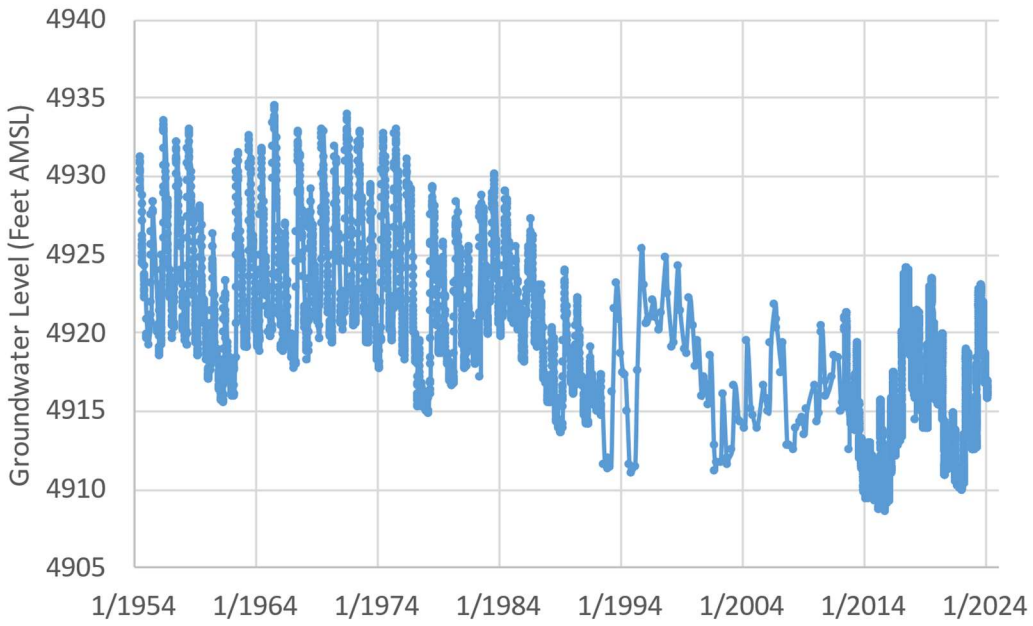

Figure 3: USGS Baseline Well Groundwater Levels (Triangle Aquifer)

3. How does managing "Aquifer Health" relate to the Management Plan goal of managing *"the effects of ground water withdrawals on the aquifers from which the withdrawals are made and any other hydraulically connected sources of water."* Idaho Code § 42-233b.

    a. Groundwater levels have been relatively stable from 1991-2014; however groundwater pumping affects surface water flows.

    b. Minimal adverse impacts to the groundwater water supplies of groundwater users in have been identified (e.g., groundwater level declines causing significant loss in groundwater pumping capacity).

    c. Therefore, any Management Plan goals should reasonably be to manage the effects of groundwater withdrawals on hydraulically connected sources of water.

    d. The following important hydraulically connected sources of surface water have been identified:
        - Big Wood River upstream of Magic Reservoir
        - Willow Creek (tributary to Big Wood River between Stanton Crossing and Magic Reservoir)
        - Silver Creek (and the Little Wood River to which Silver Creek connects)
        - Camas Creek

4. WHAT are the effects on hydraulically connected surface water sources caused by groundwater withdrawals?

    a. Reduction in Reach Gains: In a gaining stream, where groundwater flows into the stream, groundwater pumping reduces the flow of groundwater into the stream.

    b. Increases in Reach Losses: In a losing stream, where water seeps from the stream into the groundwater system, groundwater pumping increases the seepage from the stream.

5. WHERE do the changes in reach gains/losses caused by groundwater withdrawals occur in the BWRGWMA?

    a. Groundwater seepage to Silver Creek from the Big Wood River aquifer south of Glendale Bridge.

    b. Groundwater seepage to Willow Creek and the Big Wood River between the Dry Bed and Stanton Crossing from the Big Wood River aquifer.

    c. Groundwater seepage to and from the Big Wood River upstream of the Dry Bed

    d. Groundwater seepage to Camas Creek from the Camas aquifer

6. WHEN do the changes in reach gains/losses caused by groundwater withdrawals occur?

    a. The effects of groundwater withdrawals on reach gains/losses occur year around although the effects are greatest during the mid- to late-summer months (July – August).

    b. Graphs of the simulated impacts of pumping on the Big Wood River above the Dry Bed, the Big Wood River at Stanton Crossing, and Silver Creek are shown in **Figure 4**, **Figure 5**, and **Figure 6**, respectively (note the different y-axis scales). These graphs show the historical average monthly flow at each gage as blue bars with the computed average depletions from pumping shown as black bars stacked on top of the blue bars.

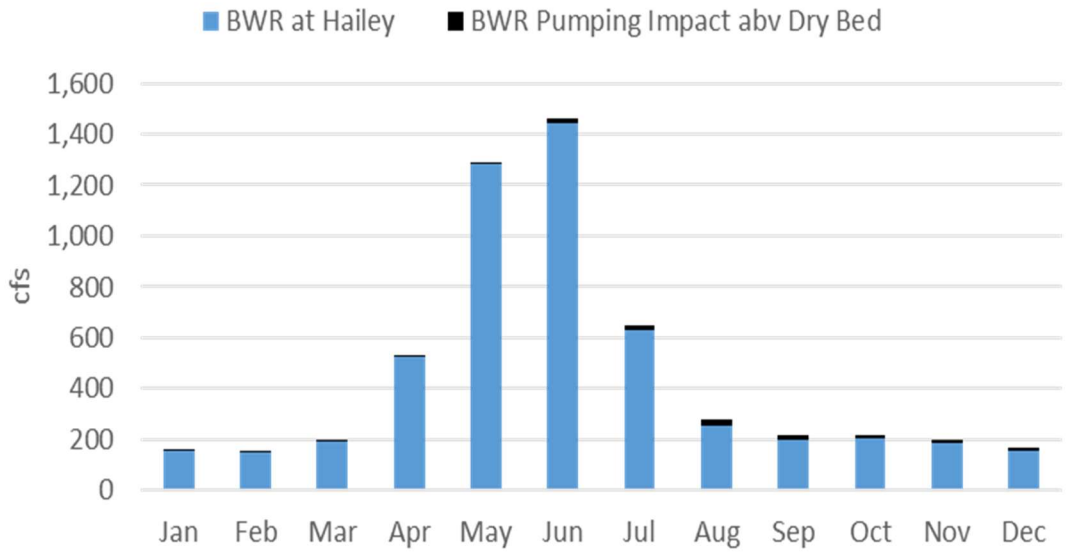

Figure 4: Monthly Average Streamflow and Simulated Pumping Impact, Big Wood River above Dry Bed

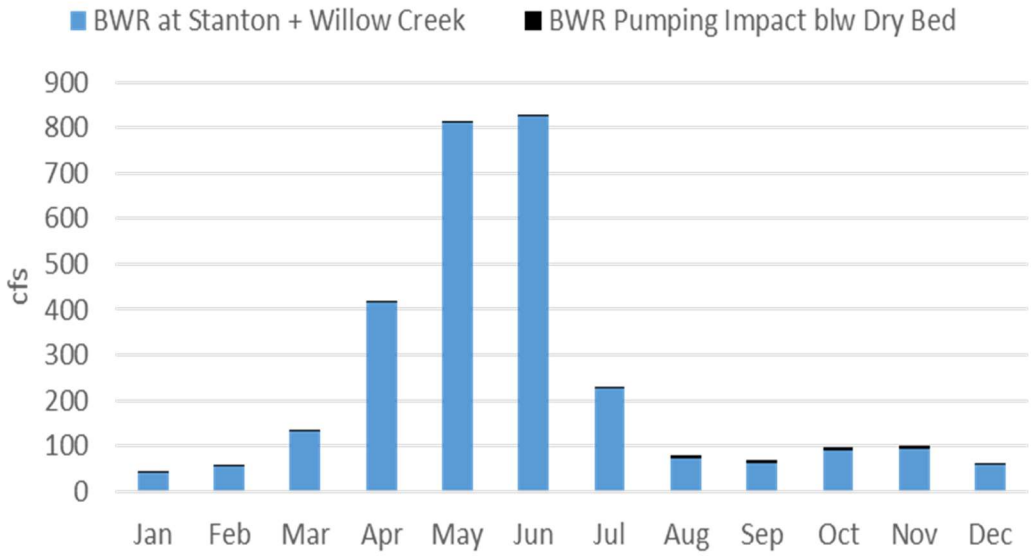

Figure 5: Monthly Average Streamflow and Simulated Pumping Impact, Big Wood River from Dry Bed to Stanton Crossing

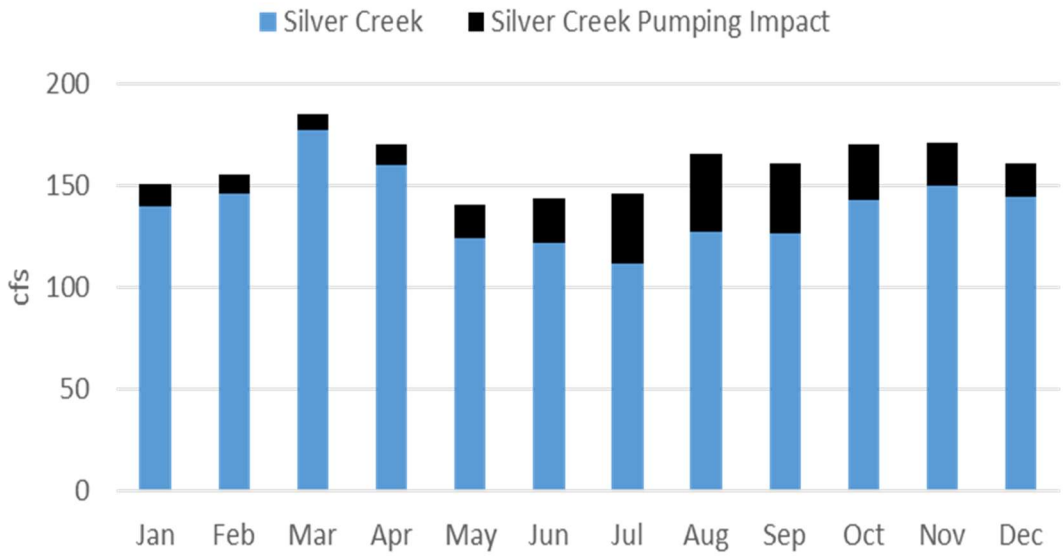

Figure 6: Monthly Average Streamflow and Simulated Pumping Impact, Silver Creek

7. What is the TIMING of the impacts reach gains/losses caused by pumping?

    a. The timing of all pumping impacts on surface water sources in the BWRGWMA is relatively rapid.

    b. **Figure 7** shows the results from a run of the Big Wood GW Model in which May-October pumping was curtailed in one year. The curtailed pumping is shown as a dotted black line. The simulated increases in streamflow are shown in purple for Silver Creek, blue for Big Wood River above the Dry Bed, and orange for the Big Wood River below the Dry Bed plus Willow Creek. The graph shows that nearly all of the effects of curtailment are realized by the end of the second year.

    c. Approximately 84% of impacts to Silver Creek and the Big Wood River from pumping in the Big Wood River aquifer below Glendale Bridge occur within 12 months after curtailment commences.

    d. Approximately 75% of impacts to the Big Wood River from pumping upstream of the Glendale Bridge occur within 12 months after curtailment commences.

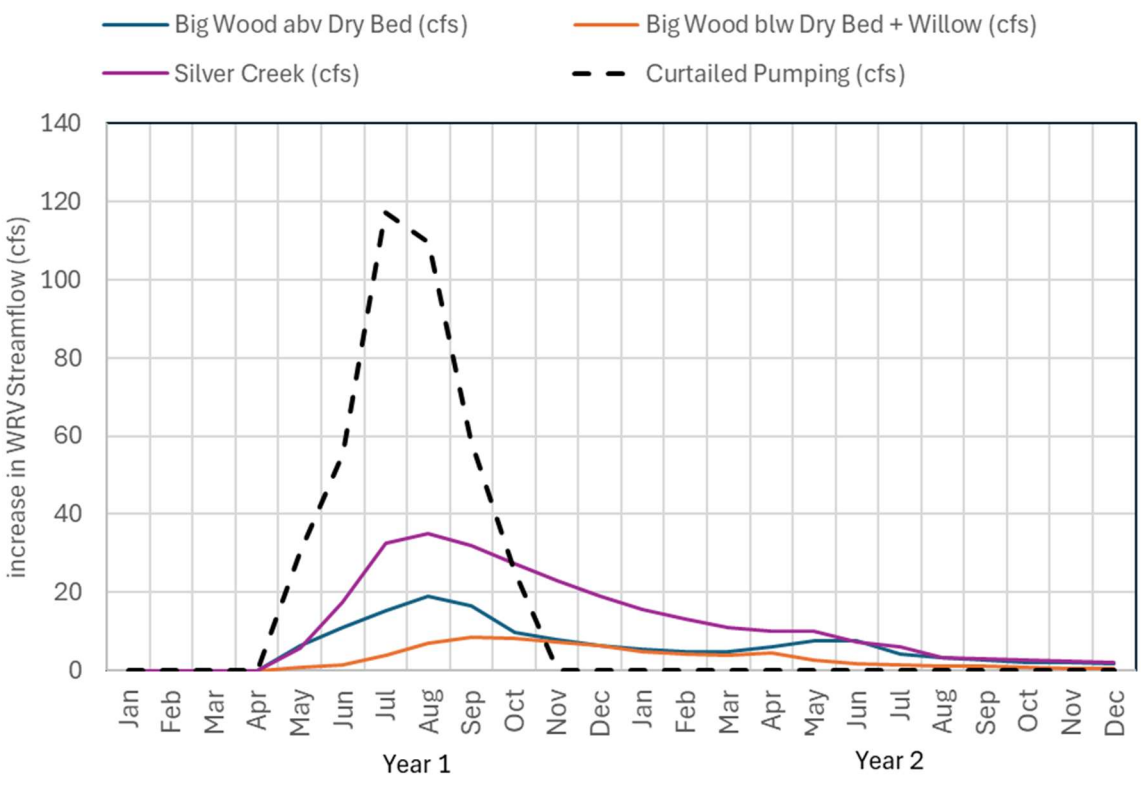

Figure 7: Change in WRV Streamflow from Single Year Pumping Curtailment

8. How are impacts of groundwater withdrawals within the BWRGWMA similar or different compared to the impacts of groundwater withdrawals from the ESPA?

    a. Similarities:

        - Groundwater levels are responding to changes in the water budget (inflows and outflows).

        - Impacts vary depending on location of pumping.

    b. Differences:

        - Accrual to Surface Water from Curtailed Pumping

            1. **Figure 8** shows a comparison of the streamflow response to a single year of pumping curtailment (May-Oct) in the WRV and the ESPA. The blue line shows the cumulative portion of the curtailed pumping that accrues to all surface water sources in the Big Wood River basin over time. The red line shows the cumulative portion of the curtailed ESPA pumping that accrues to the Snake River and its tributaries over time.

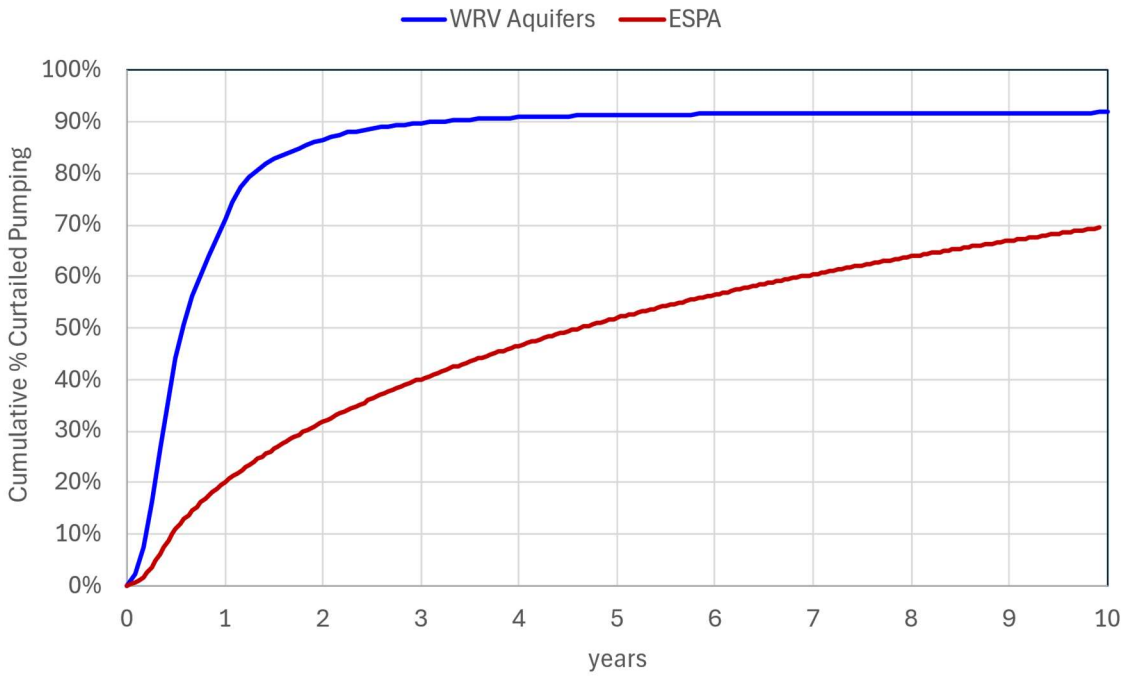

Figure 8: Cumulative Accrual to Surface Water from Curtailed Pumping Single-Season (May-Oct) Curtailment, WRV Aquifers vs ESPA

2. BWRGWMA: Approximately 71% of pumping impacts to hydraulically connected streams occur within 1 year.

3. ESPA: Approximately 19% of pumping impacts to hydraulically connected streams occur within 1 year, and 52% within 5 years.

- Curtailed Pumping Remaining in Groundwater Storage

1. **Figure 9** shows a comparison of the curtailed pumping volume that remains in storage over time in response to curtailment of a single year of pumping curtailment (May-Oct) in the WRV and the ESPA. The blue line shows the cumulative portion of the curtailed pumping that remains in groundwater storage in the Big Wood River basin over time. The red line shows the cumulative portion of the curtailed ESPA pumping that remains in groundwater storage over time.

2. BWRGWMA: Approximately 23% of curtailed pumping remains in the aquifer after 1 year, and 7% after 2 years.

3. ESPA: Approximately 81% of curtailed pumping (or recharge) remains in the aquifer after 1 year, and 48% after 5 years.

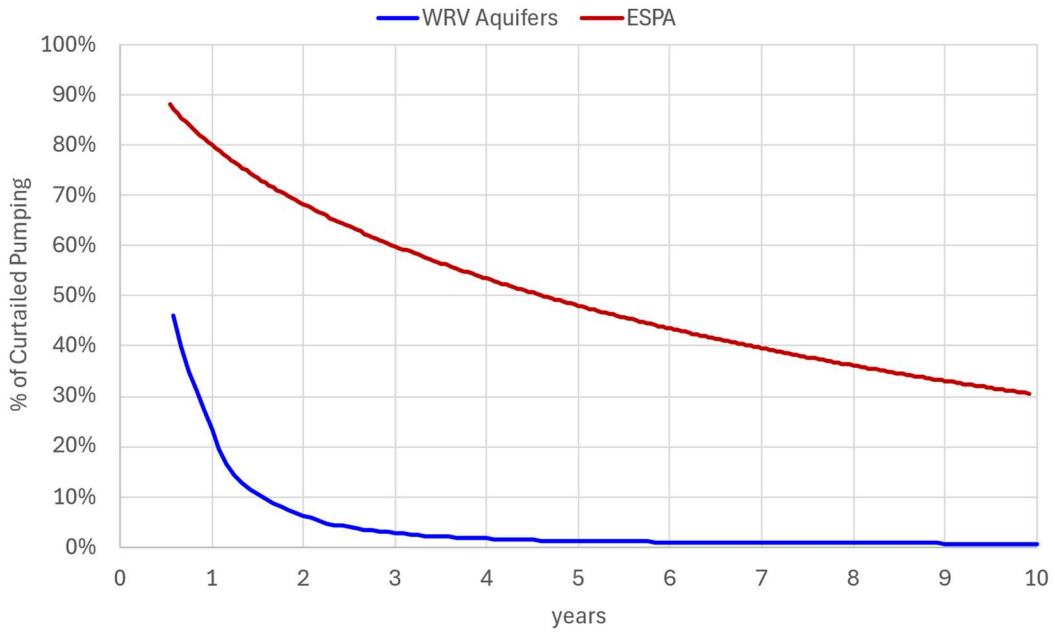

Figure 9: Portion of Curtailed Pumping Remaining in Storage, Single-Season (May-Oct) Curtailment, WRV Aquifers vs ESPA

- Historical Groundwater Level and Groundwater Storage Changes

    1. **Figure 10** compares the historical groundwater level changes over time for the USGS Baseline Observation Well in the WRV Triangle Aquifer to the USGS Little Park Observation Well in the ESPA. This comparison illustrates how groundwater levels have continued to decline during recent decades in the ESPA while groundwater levels in the WRV do not display an obvious downward trend since the mid-1990s (with fluctuations due to wet and dry years).

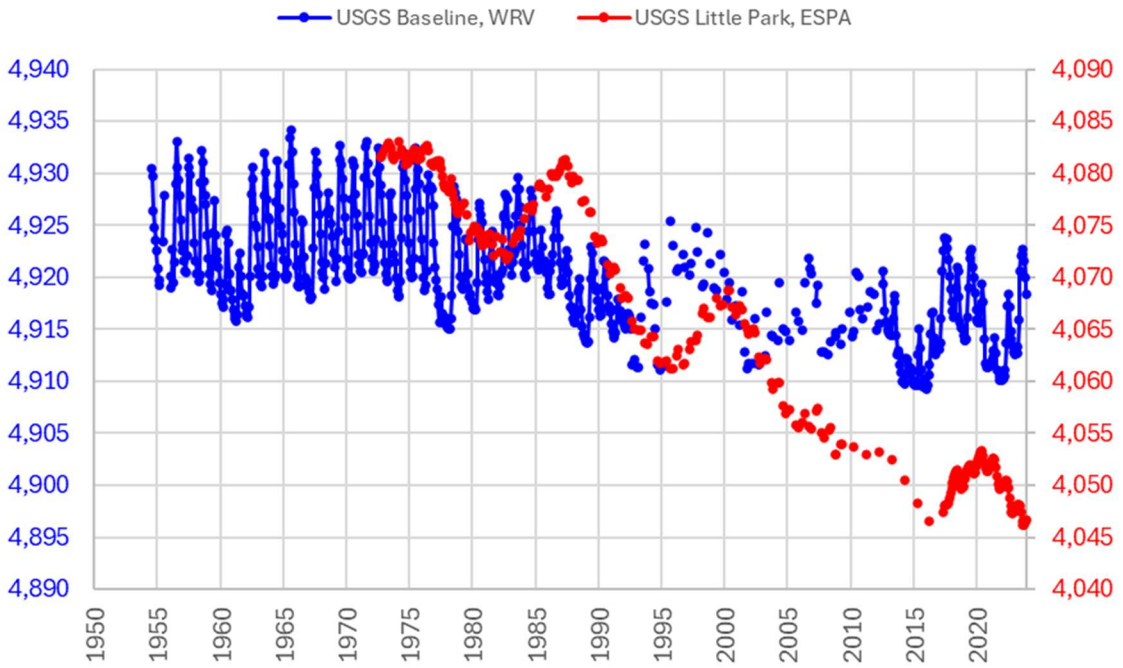

Figure 11: Comparison of Historical Groundwater Levels, WRV Aquifers vs ESPA

9. INEFFICENCY of managing groundwater levels to address specific water delivery needs in hydraulically connected surface water sources.

    a. Only a portion of the increased streamflows occur at the time and location of the targeted shortage.

    b. The remainder of the increased streamflows may occur at times and locations other than the targeted shortages. There are often benefits to other senior water users. For example, increases in aquifer discharge to Silver Creek during the non-irrigation season result in increased stream seepage to the ESPA, benefiting senior water users within the ESPA and on the Snake River.

    c. The efficiency of groundwater management in meeting certain acute shortages to hydraulically connected surface water sources is relatively low. For example, if pumping in the Big Wood River aquifer is curtailed starting in May to alleviate shortages to senior surface rights on the Little Wood or Big Wood River during Jul-Sep, the following percentages of the curtailed groundwater would accrue during Jul – Sep:

        - Silver Creek/Little Wood River - 17%
        - Big Wood River above Magic - 12%
        - Total – 29%

d. Alternatives for mitigating shortages to senior surface water rights may be more “efficient” in addressing a specific delivery need. For example, deliveries of storage water for mitigation can be targeted to benefit affected senior surface water rights.

Notes and Source Information for Figures 1 - 10:

- Figure 1: BWRGWMA Map
    - Data from IDWR shapefiles
- Figure 2:
    - Data from WRVPOD shapefile and is the sum of the Podcfs column.
- Figure 3:
    - Data from Technical Working Group File: Water_Level_Export_2024-05-23.csv
- Figure 4:
    - Data from Wood River Valley model input files and WMIS.
- Figure 5:
    - Average monthly streamflow computed from historical record starting and ending with complete years.
    - Average monthly pumping impact computed from 1995-2014 pumping off run of WRV Model included in WRV 1.1 scenario files.
    - Pumping impact is for the reach gains near Ketchum to Hailey + Hailey to Heart Rock Ranch
- Figure 6:
    - Average monthly streamflow computed from historical record starting and ending with complete years.
    - Average monthly pumping impact computed from 1995-2014 pumping off run of WRV Model included in WRV 1.1 scenario files.
    - Pumping impact is for the reach gains Heart Rock Ranch to Stanton Crossing + Willow Creek
- Figure 7:
    - Average monthly streamflow computed from historical record starting and ending with complete years.
    - Average monthly pumping impact computed from 1995-2014 pumping off run of WRV Model included in WRV 1.1 scenario files.
    - Pumping impact is for reach gain Silver Creek Above
- Figure 8:
    - Data from WRV_ESPA_modcurt.xlsx, modeling performed by Jennifer Sukow.
    - Model simulates curtailing pumping in 2002 from May – October.
- Figure 9:
    - Figure from WRV_ESPA_modcurt.xlsx, modeling performed by Jennifer Sukow.
    - Cumulative WRV Discharge to near Ketchum to Hailey, Hailey to Stanton, Willow Creek, and Silver Creek divided by curtailed pumping volume.
    - Cumulative ESPA Discharge to abv Min, nB-Min, and Kim-KH divided by curtailed pumping volume.
- Figure 10:
    - Figure from WRV_ESPA_modcurt.xlsx. Line begins at end of irrigation season.
- Pumping impact percentages:
    - Percentages from pumping above triangle and below triangle are from Sukow 2021 staff memo backup files.
    - Percentages for basin wide pumping scenarios are from WRV_ESPA_modcurt.xlsx