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MEMORANDUM

To: Swan Fall Technical Working Group, IDWR

From: Sophia C. Sigstedt

Subject: Comments on Analysis for SFIG Question 5

Date: January 13, 2025

This memorandum provides comments on the IDWR response to Swan Fall Implementation Group (SFIG) Question 5.

Question 5. Analysis of the necessary ESPA levels required to maintain the minimum flow rate at the Snake River nr Murphy Gage during the low flow period.

Swan Falls Minimum Streamflow

The Swan Falls Settlement Agreement result was a minimum streamflow of 3,900 cfs from March to November, and a 5,600 cfs minimum streamflow for the rest of the year. The streamflow used as the basis for compliance is determined based on the Average Adjusted Daily Flow (AADF) calculation. The historical low flow period for the AADF is during July when the minimum streamflow is 3,900 cfs. As there is typically no discharge passing Milner Dam during the critical low flow period in the summer (TWG, 2014), the Milner to Murphy reach gain is equivalent to the flow at the Snake River at the Murphy gaging station during the low flow period.

Comments on IDWR Question 5 Analysis

1) Question 5 is ambiguous as to the hydrologic condition under which the SFIG is interested in understanding the necessary ESPA levels required to maintain the minimum streamflow.

   The IDWR analysis (pg 1) states that their purpose is "to evaluate how much of a buffer in aquifer water levels would be needed to reduce the risk of falling below the minimum streamflow during a multi-year drought".

   The scenarios IDWR developed are based on identifying the minimum non-ESPA inflow and maximum demand for each year and applying the 10th|90th percentile, 5th|95th percentile, 1st|99th percentile, (Table 3), the minimum net contribution observed in any one year (Table 2, 2003), and the minimum non-ESPA inflow and

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maximum demand, irrelevant of the same year (Table 2, "minimum non-ESPA inflow and maximum demand").

The percentiles are calculated values corresponding to a rank from the sample based on a statistical distribution. Using percentiles allows us to consider rare and sometimes high-impact events (10th and 90th percentiles). ***Because Question 5 is not specific as to hydrologic conditions to be analyzed*** I would recommend including scenarios that don't just represent the most extreme and rare conditions. As is the case with the IDWR analysis which only represents minimum non-ESPA inflow below the 10^{th} percentile and maximum demand above 90^{th} percentile. I would also include the 25^{th}|75^{th} and 20^{th}|80^{th}. Standard use of streamflow percentiles defines 21^{st}-30^{th} percentiles as abnormally dry, 11^{th}-20^{th} percentiles as moderate drought, 6^{th}-10^{th} percentiles as severe drought, 3-5^{th} percentiles as extreme drought, and 0-2^{nd} percentiles as exceptional drought.

It is valuable to have a wider range of the projections, even with an understanding that the high-impact events are important in the decision-making context. This would ultimately allow the decision makers to choose the percentile according to the decision-maker's risk tolerance and the sensitivity of measures and actions to the scale of change. The broader presentation of percentiles enables us to appreciate the context of the results. If a percentile is to be chosen for the implementation of an adaptation solution, the decision context must be taken into account. How sensitive are measures to the extent of the prediction? What is the risk tolerance? What are the associated costs and benefits? How will the adaptation measure be accepted by the community?

2) Please provide more information on the selection of the 37 wells and how different subsets of wells would impact the results. I have worked extensively with developing various groundwater level indices across the ESPA and in my experience the decision to include or exclude various wells does have an impact on the index and result of the analysis. I would have liked to perform this analysis myself but there was not time to develop the datasets in the review period. Please provide the full well dataset used to narrow the 400 wells used in the ESPA storage change calculation down to 37 wells.

3) I recommend using more wells rather than fewer in the GWI predictor. The full set of 37 wells appears to be the better predictor compared to the subset of 16 recommended. I don't understand the justification proposed:

   "While the fall GWI could be used to predict aquifer discharge to the Kimberly to King Hill reach, using the average normalized water level for subgroups 3 and 4 is expected to be more resistant to potential changes in the spatial distribution of water use and managed aquifer recharge within the ESPA."

   Why would we want the discharge prediction to be insulated from aquifer management across the plain? Changes in aquifer levels east of the Great Rift affect the groundwater gradient and ultimately discharge at Kimberly to King Hill.

4) The poor correlation between the groundwater index and the reach gain leads to doubt in the overall approach. More analysis should be done to explain why the predictor is so low in explanatory power, adapt the current predictor or find a better predictor. I would have liked to perform this analysis myself but there was not time to develop the datasets in the review period. Please provide the dataset of IDWR's reach gain calculations to generate the correlation to total Kimberly to King Hill discharge.

5) The approach produces extremely conservative groundwater level target goals that result in reach gains that are 600 cfs or greater than the Swan Falls Agreement July minimum streamflow (IDWR's Figure 13), as well as, ESPA cumulative storage volumes that are above levels seen in the historically wet periods of the 1980's and 1990's (as illustrated in the figure a below). This is the effect of using multiple instances of extremely low or extremely high percentiles to model the risk. Which is then compounded by the additional buffer for "multi-year drought". The extremely low non-ESPA flow percentiles selected initially already include the drought effects of lower groundwater levels. Historically the minimum streamflow has been met during multi-year droughts at ESPA storage levels below any of those proposed as a result of this analysis. Earlier iterations of the analysis by IDWR using the Swan Fall Forecast Tool, any of the historical April water levels as the starting head, and extremely low flow contributions (tributary streamflow SWSI value -4: Extreme Drought & minimum observed return flows), no managed recharge, minimum upper Snake River Reservoir storage and high demand also showed the minimum streamflow would be met.

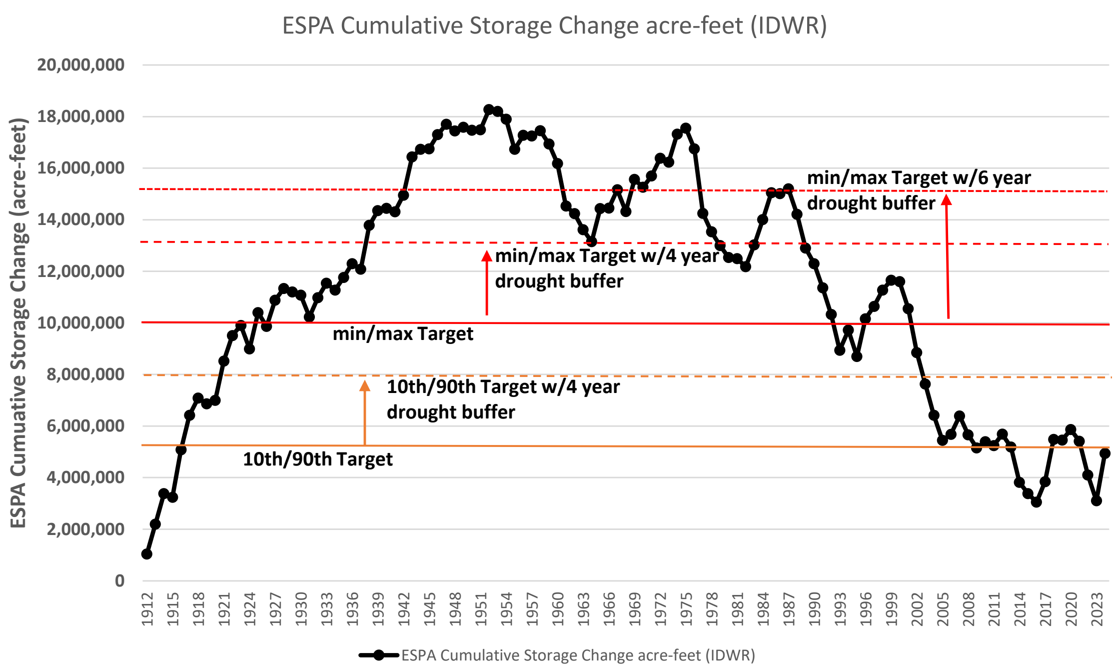

Figure a: ESPA cumulative storage change with select ESPA storage target ranges proposed by IDWR. ESPA cumulative storage change data 1912-2023 is based on IDWR dataset, 2024 value is inferred from memo statement that 2024 was 3.9 MAF above 1912 levels.

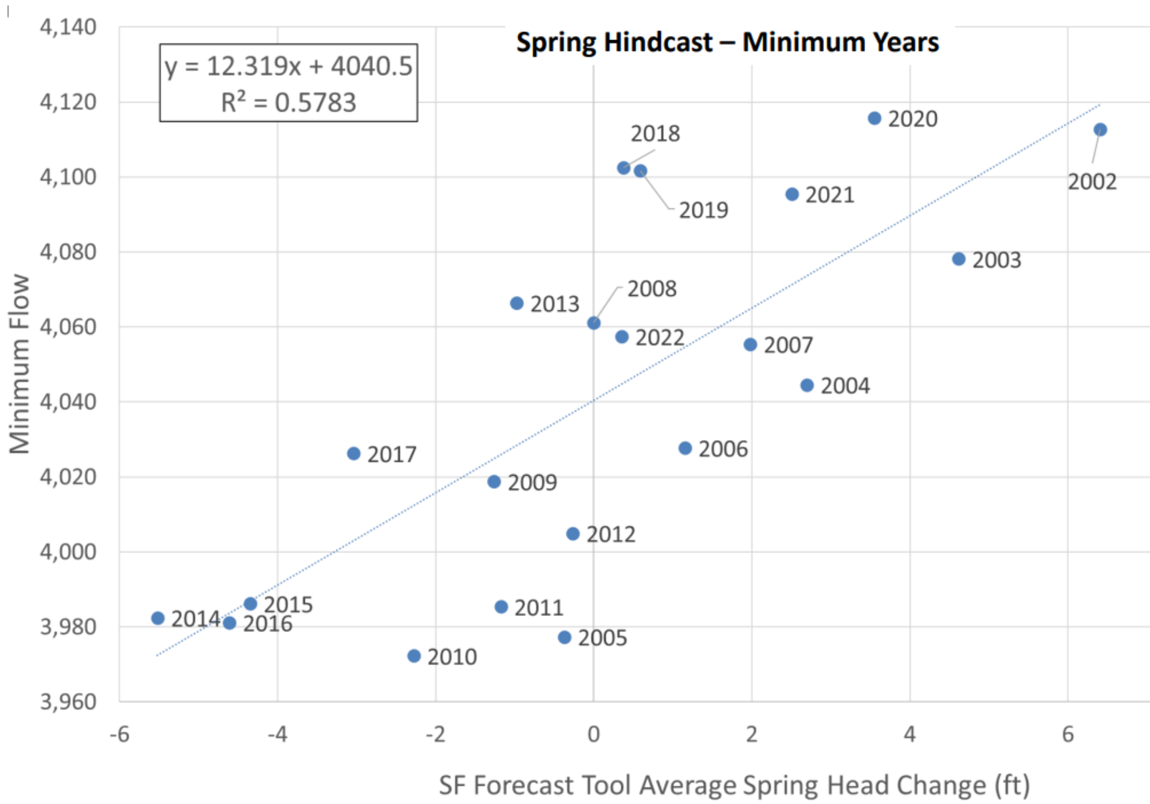

Figure b: SFFT Low Water Supply, High Demand Hindcast (IDWR presentation March 16, 2023)

6) The analysis results in target water level increases anywhere from 6-35 feet above 2016 levels depending on how the recommendation is implemented. If this approach is ultimately used, for the decision makers to make an informed selection there needs to be analysis on whether the target increases are achievable and what aquifer management actions would need to be affected at the different levels. This will help with the underlying considerations in the implementation. What is the risk tolerance? What are the associated costs and benefits? How will the adaptation measure be accepted by the community? I would have liked to perform this analysis myself but there was not time to develop the datasets in the review period.

7) The IDWR analysis of historical drops in ESPA groundwater levels during multi-year droughts does not take into account changes in current aquifer management practices that were not in place during past droughts. Conclusions should be adapted to reflect present aquifer management.

Please let me know if you have any comments, questions, or concerns.