

BOLINAS COMMUNITY PUBLIC UTILITY DISTRICT

BCPUD

BOX 390 270 ELM ROAD BOLINAS CALIFORNIA 94924

415 868 1224



MEMORANDUM

TO: Board of Directors

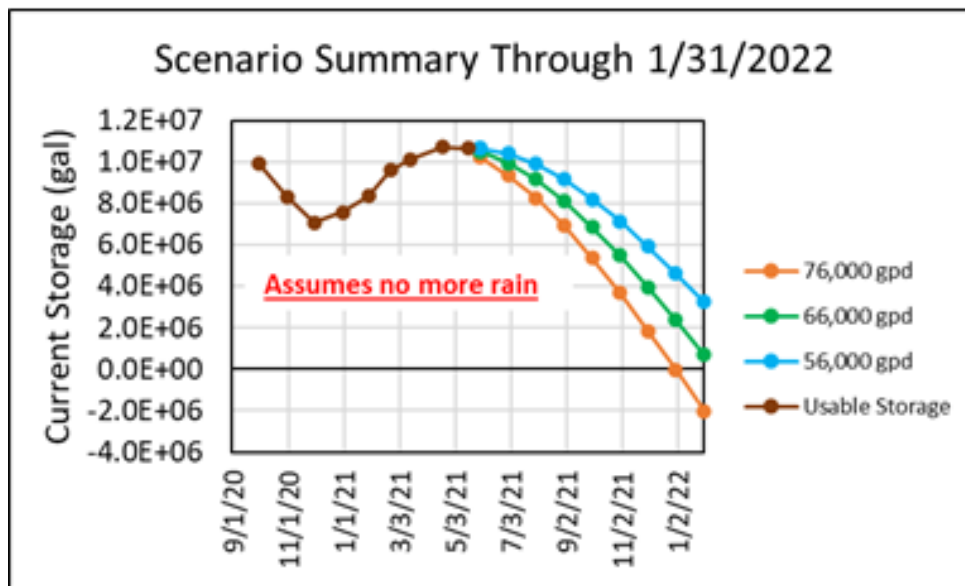
FROM: Jennifer Blackman

RE: Potential Impact of Late Year Rains on BCPUD's Water Supply

DATE: June 2, 2021

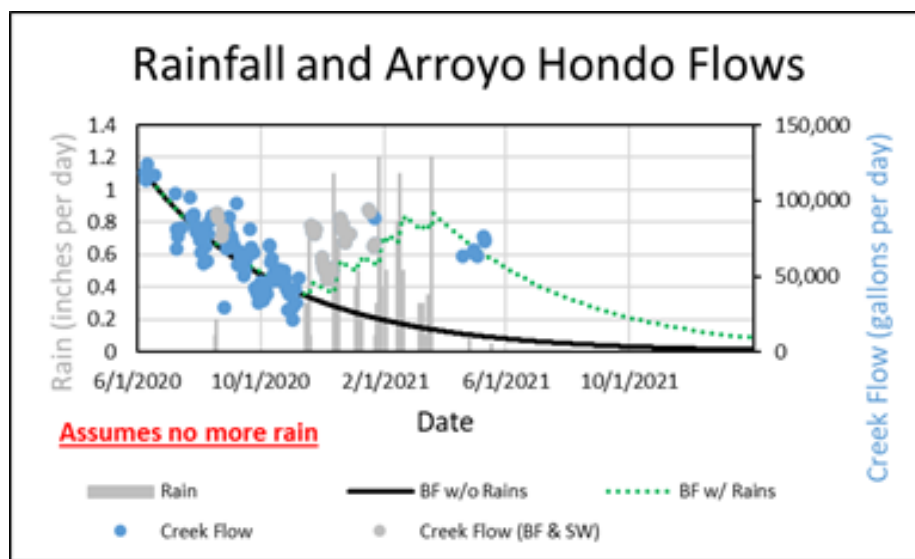
Following my update to the Board at the May 19, 2021 meeting, director Comstock noted that staff's projected storage and baseflow recession models assume no rainfall in the district through January 2022. He said he thought that was an unwarranted assumption given that it has never not rained *at all* during each/all of those months, and he requested that staff prepare an updated analysis taking into account potential different rain scenarios. This memorandum therefore provides an analysis of the impact of late year rains (i.e., specific measureable rainfall scenarios for the October 2021 – January 2022 timeframe) on the district's projected water supply.

As a reminder, at the May 19, 2021 Board meeting staff presented the following updated model of the district's projected storage in the Woodrat 1 and 2 reservoirs:



This graph indicates that if consumption stays at or below current levels (roughly 57,000 GPD), we will have water available in storage through January 2022 (3,241,000 gallons – blue dot on right side of graph box, or approximately 18% capacity). However, if consumption increases to an average of 66,000 GPD, the district will have only 688,000 gallons of water in storage as of January 31, 2022 (green dot on right side of graph box). And, if consumption increases to an average of 76,000 GPD (the mandatory ration “trigger”), the district effectively will be out of water by December 31, 2021.

At the May 19, 2021 Board meeting, I also presented an updated base flow (BF) recession model for the Arroyo Hondo creek, with the following graph projecting creek flows (via the downward sloped dotted green line) through January 31, 2022. Although creek flows increased as a result of the rain earlier in the year (jagged green dotted lines in December 2020 – March 2021 timeframe), the updated model is more pessimistic than the model previously presented to the Board (which was based on more limited data). For example, the updated model projects that creek flows will provide only about 28,272 gallons of water per day by September 1, 2021, whereas the previous model predicted 34,000 gallons per day by this same date.



I also presented graphs to depict a preliminary uncertainty analysis conducted by Rob Gailey for the purpose of exploring how confident the district should feel in the predictive accuracy of its updated base flow recession model given that certain model parameters values are difficult to estimate as a result of the impact of fog vs. sun and the difficulty of accurately measuring current creek flows. The bottom line of that analysis is that there is an “uncertainty band” of 10,700 gallons per day (at 95% confidence). I noted in my memo that if we apply the *lower confidence limit* projections from the uncertainty analysis to our stored water scenario summary, the overall situation worsens by about 1 million gallons, meaning that (1) we run out of water in November rather than in December at the 76,000 GPD consumption level, (2) we run out of water in January (or perhaps late December) at the 66,000 GPD consumption level, and (3) if consumption averages 56,000 gallons per day, the district would have 2,236,000 gallons in storage as of January 31, 2022 (not the 3,241,000 gallons otherwise predicted).

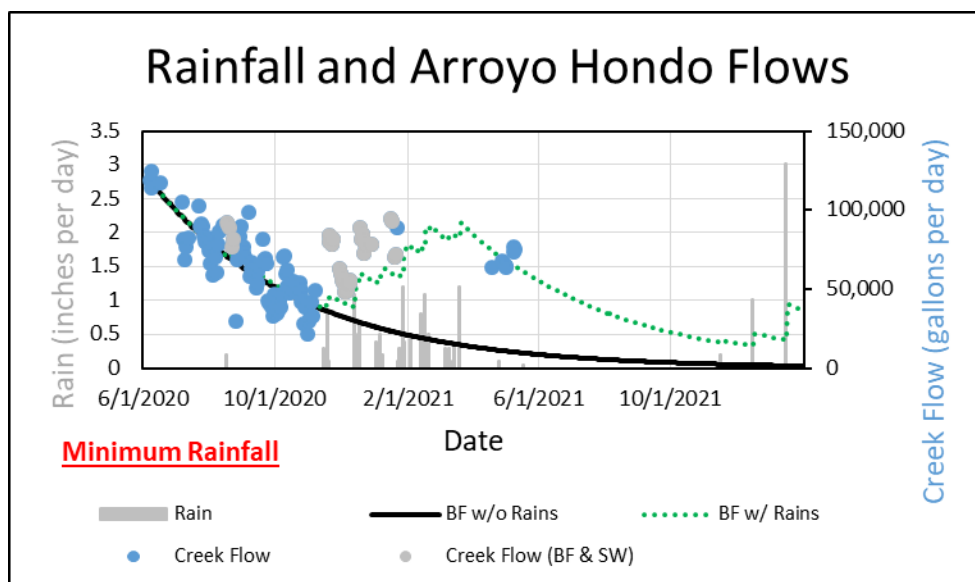
Per director Comstock’s request, staff (with assistance from Rob Gailey) has prepared the additional graphs to depict the impact on creekflows and storage of *three different potential rain scenarios* for October 2021 – January 2022 based on 69 years of rainfall data collected by the district.

The first scenario assumes that the district will receive amounts of rain equivalent to the **historic minimum rainfall received by the district during each of the months of October, November, December and January.**

1. Minimum Monthly Rainfall (Oct. – Jan.)

a. October:	0	inches
b. November	0.20	inches
c. December	1.02	inches
d. January	<u>3.02</u>	<u>inches</u>
Total:	4.24	inches

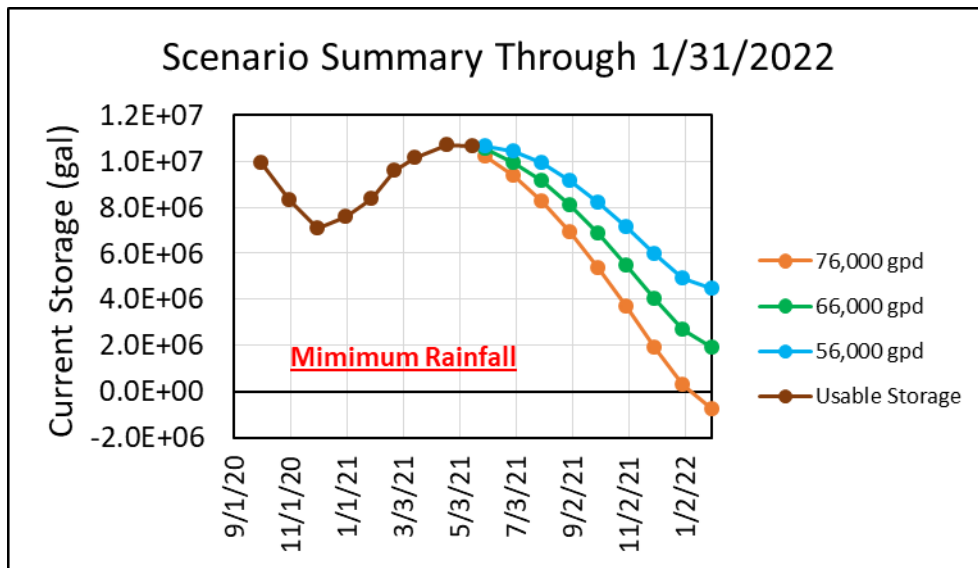
Under this assumed minimum monthly rainfall scenario, the current baseflow recession model predicts that stream flows will continue to decline (with only a minor uptick in November, which soon disappears) to a low of 15,481 GPD on December 5, 2021, and then increase to 21,947 GPD by December 17, 2021 and then to 40,491 GPD by January 17, 2022.



The next graph depicts the impacts on projected storage based on the minimum monthly rainfall scenario just described.¹ At the 76,000 GPD district wide consumption rate, the district would be out of stored water soon after December 31, 2021. At the 66,000 GPD district-wide consumption rate, the

¹ Staff's analysis of the impacts of different rainfall scenarios on storage assumes (based on district records and staff experience) that there is no overland run-off of rainfall into storage until the district has received a minimum 10 inches of rainfall. Based on the surface areas of the district's reservoirs, staff therefore estimates that each inch of rain *prior to* the district's receipt of 10 inches results in an additional 127,625 gallons in storage; once the district has received 10 inches of rainfall and overland run-off has begun, staff estimates that each inch of rain thereafter results in an additional 503,044 gallons in storage. Also, monthly rainfall for each scenario is simply applied in total to the 15th of each month. This approach is applied for convenience in performing calculations.

district would have 1,372,807 gallons remaining in storage at January 31, 2022 (i.e., approximately 8% capacity). And, at the 56,000 district-wide consumption rate, the district would have 3,926,438 gallons remaining in storage at January 31, 2022 (i.e., approximately 23% capacity).



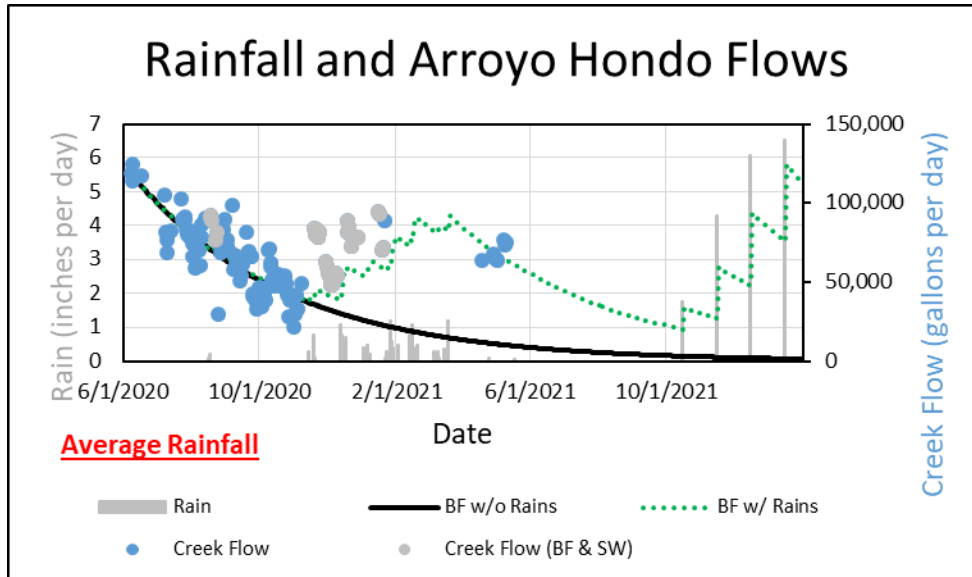
The district’s water supply status at January 31, 2022 would not be meaningfully different under the foregoing minimum monthly rainfall analysis than it is projected to be under the preceding “no rainfall” analysis.

The second scenario assumes that the district will receive amounts of rain equivalent to the historic average rainfall received by the district during each of the months of October, November, December and January.

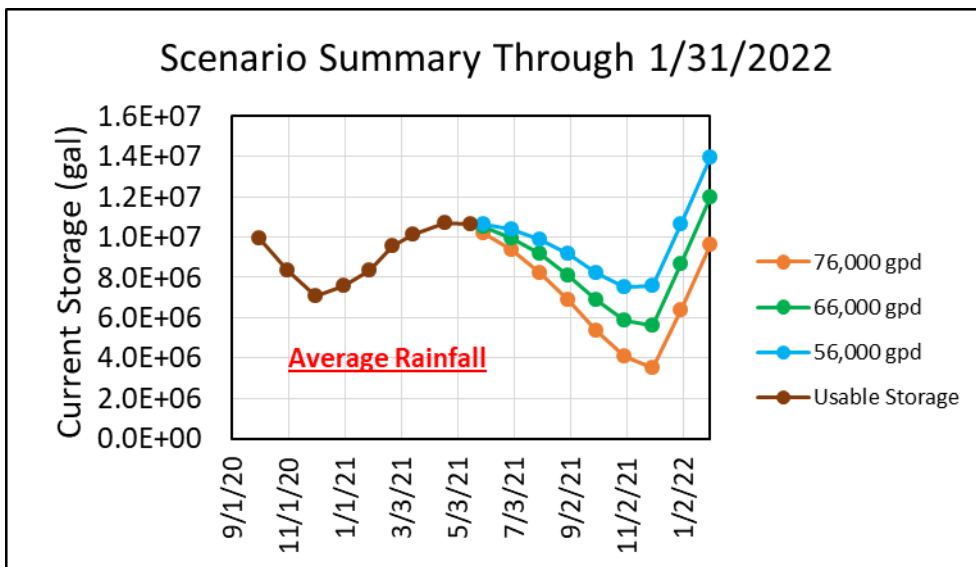
2. Average Monthly Rainfall (Oct. – Jan.)

a. October:	1.75	inches
b. November	4.28	inches
c. December	6.09	inches
d. January	<u>6.51</u>	<u>inches</u>
Total:	18.63	inches

Under this assumed average monthly rainfall scenario, the current baseflow recession model predicts *dramatic impacts on stream flows*. Specifically, creekflows will progressively increase, once the rains begin, from an October low of 20,366 GPD to 59,325 GPD by November 17, 2021, then to 94,018 GPD by December 17, 2021 and to 124,545 GPD by January 17, 2022.



The next graph depicts the *similarly dramatic impacts on projected storage* if the district were to receive rainfall equivalent to the average monthly rainfall scenario. At the 76,000 GPD district wide consumption rate, the district would have 9,628,338 gallons in storage at January 31, 2022 (i.e., approximately 55% capacity). At the 66,000 GPD district-wide consumption rate, the district would have 11,963,210 gallons in storage at January 31, 2022 (i.e., approximately 67% capacity). And, at the 56,000 district-wide consumption rate, the district would have 13,916,840 gallons in storage at January 31, 2022 (i.e., approximately 75% capacity).



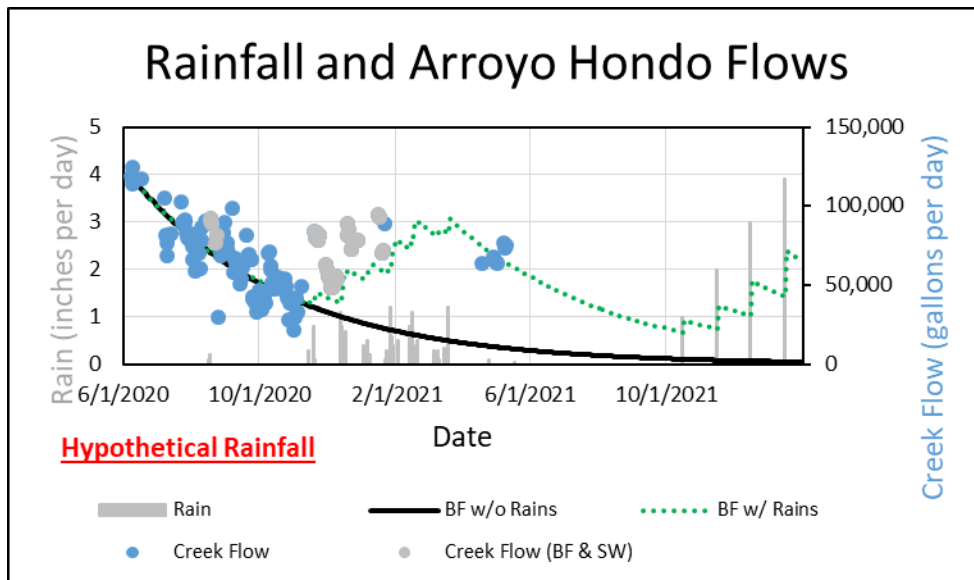
Note that even with dramatic increases in creek flows and the improved status of the district's stored water supply under the average monthly rainfall scenario, at the various different consumption levels the district's reservoirs would be at only 55 – 75% capacity on January 31, 2022.

The third scenario assumes that the district will receive **hypothetical amounts of rain during each of the months of October, November, December and January.** These hypothetical amounts represent staff's effort at a reasonable "mid-point" forecast for rain given the large span of potential impacts on creekflow and storage between the historic minimum – historic average amount of rainfall

3. Hypothetical Rainfall (Oct. – Jan.)

a. October:	1.0	inches
b. November:	2.0	inches
c. December:	3.0	inches
d. January	4.0	inches
Total:	10.0	inches²

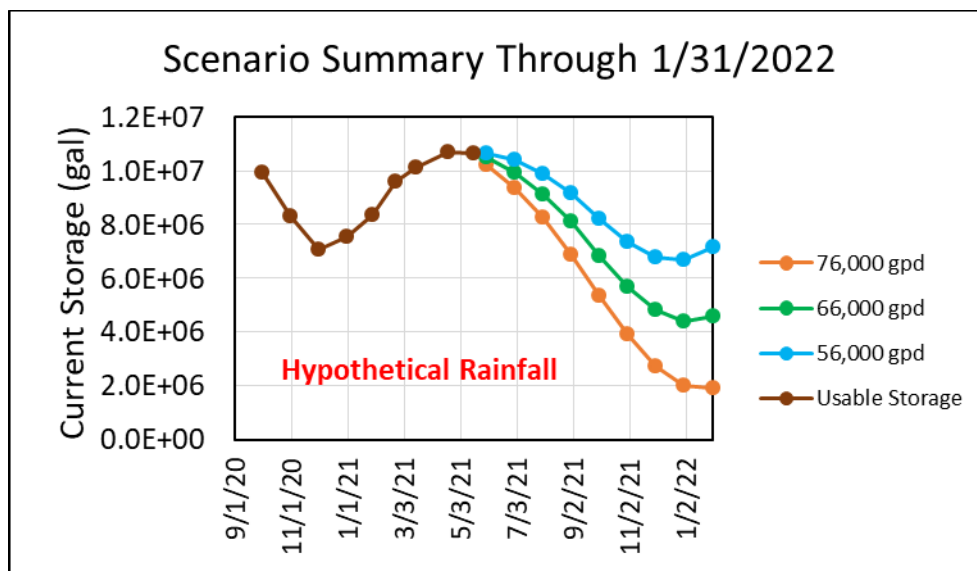
Under this hypothetical rainfall scenario, the current baseflow recession model predicts that stream flows will progressively increase from an October low of 20,366 GPD to 37,421 GPD by November 17, 2021, to 52,901 GPD by December 17, 2021 and to 71,882 GPD by January 17, 2022.



The impact on storage of this assumed hypothetical rainfall is depicted below. At the 76,000 GPD district wide consumption rate, the district would have 1,889,762 gallons in storage as of January 31, 2022 (i.e, approximately 10% capacity). At the 66,000 GPD district-wide consumption rate, the district

² Note: the total rainfall received in Bolinas during the 2020-21 rain year during this same time frame was 9.9 inches, with 0 inches in October; 1.2 inches in November, 4.2 inches in December and 4.5 inches in January.

would have 3,589,762 gallons in storage at January 31, 2022 (i.e., approximately 20% capacity). And, at the 56,000 district-wide consumption rate, the district would have 7,143,393 gallons in storage as of January 31, 2022 (i.e., approximately 41% capacity).



The district's water supply status at January 31, 2022 would not be robust under the foregoing midpoint hypothetical rainfall analysis.

Recommendations:

Given the worsening drought conditions and the relatively minimal impact on creekflows and/or storage to be anticipated from historic minimum rainfall or from rainfall similar to the 2020-21 rain year³, staff continues to recommend that the Board update and revise BCPUD Resolution 680 to ensure that water consumption in the district does not exceed a target 66,000 gallons per day in order to achieve the best possible water-in-storage position for the district mid-way through the 2021-22 rain year. To achieve and maintain this target level of consumption, the Board should amend BCPUD Resolution 680 to lower the ration "trigger" to 66,000 GPD. For the present time, because average district-wide consumption has remained below 66,000 on a seven-day average basis, staff defers its recommendations to (1) lower the mandatory ration amount to 100 GPD per property or less, depending on the extent of exceptions granted⁴; (2) to lower some or all of the existing 14 exceptions already granted under the resolution by a commensurate amount; and (3) to implement an intermediate prohibition on more than 175 GPD of water usage because the potential confusion that might be generated among our customers by such action outweighs the benefits (and, importantly, because the highest water users *are* responding to staff's direct outreach by reducing their usage).

³ Staff recommends against assuming the historic average rainfall for the upcoming October 2021 – January 2022 months as too risky under the circumstances. In fact, an analysis of district rainfall records indicates that in 52% of the past 69 rain years, the district received *less* than the historic average rainfall during the October – January timeframe.

⁴ Staff recommends that the Board set a deadline for all exception requests to be submitted so that the Board can comprehensively evaluate these requests and the impact of granting them on the overall mandatory ration amount in the context of the overall projected water supply.