SJRRP Flow Bench Evaluation

November 25, 2022

Introduction

The following Flow Bench Evaluation (FBE) documents current releases and groundwater conditions and evaluates potential Restoration Flow changes based on an Ad Hoc Flow Recommendation from the Restoration Administrator (RA) provided on November 21, 2022. The current approved Restoration Flow Recommendation has gradually increasing Restoration Flows between late November and mid-December, culminating with a flow target at GRF of 400 cfs from Dec 20, 2022 through February 28, 2023. Given temperature measurements and in anticipation of a yearling spring-run Chinook release, the RA recommends an increase of 100 cfs to the GRF target (opposed to the preceding Recommendation to increase 40 cfs). This will result in a flow target of 360 cfs of Restoration Flows (365 cfs total flow) at GRF. This 360/365 cfs target would then be held until February 1, when the RA recommends to adjust flows to ensure that the total volume of Restoration Flows released by February 28th matches the approved Recommendation. Note that use of "FBE" throughout the report refers specifically to the FBE model-based analysis described in Appendix J of the Seepage Management Plan (SMP).

This FBE focuses on Reach 4A as it is the current limiting reach based on Seepage Management Plan (SMP) thresholds. The FBE evaluates the current releases and groundwater conditions monitored as of November 16, 2022 and determines at what flow rate groundwater thresholds may be exceeded. The new RA Recommendation calls for and expected Sack Dam target of 250 cfs, which may vary above and below this amount. This target Sack Dam flow is based on a Gravelly Ford target of 360 cfs.

As of November 16, 2022:

1. Channel conveyance: Flow rates are below known conveyance thresholds.

2. Operations Conference Call: An operations call was held on November 23, 2022. No known operational constraints were identified on the call.

3. Seepage Hotline Calls: The seepage hotline has received no calls regarding Restoration Flows in Water Year 2023.

4. Real-time wells: A number of real-time equipment locations are currently going through equipment upgrades. All functioning telemetered groundwater monitoring well levels are below SMP thresholds.

5. Priority wells: Weekly groundwater measurements in priority wells, both real-time and manually measured, indicate that all wells are below well thresholds. Note that manual monitoring efforts may be impacted by storm conditions, but data is collected using dataloggers at most locations and will be downloaded at the next opportunity.

6. Flow Stabilization: Releases at Sack Dam have been relatively stable (ranging approximately +/- 20 cfs) since November 5, 2022 through the manual measurements available on November 16, 2022 per SDP gage measurements available on CDEC.

7. Projected Groundwater Level Changes: With the flow scenarios evaluated in this FBE, groundwater levels are projected to increase between 1.4 ft and 3.5 ft depending on well location in Reach 4A (see Summary).

8. Levees: LSJLD has not expressed concerns about current flows.

9. Water Districts: The SJRECWA has not identified any operational concerns.

Data

The following Data section considers monitoring measurements collected during the stable flow period below Sack Dam beginning approximately November 5, 2022. These values are referred to as "pre-condition" to inform current groundwater levels before any changes to Restoration Flows. The "projected" values indicate the results from this FBE model-based analysis with the proposed flow changes based on the Ad Hoc RA Recommendation and also maximum projected flow before exceeding SMP thresholds.

Table 1 shows groundwater depths in one real-time wells and two manual measurements from field staff. Measurements were reported from the field on November 16, 2022 and are reported in the Weekly Groundwater Report with a publish date for the week ending November 19, 2022. Reclamation publishes the Weekly Groundwater Report with manual measurements via electronic well sounder on the SJRRP website HERE. To calculate field depths, Reclamation adds ground surface buffers and lateral gradient buffers to measured groundwater depths in the well (Equation 1, Figure 1).

$$Field\ Depth_{Current} = D_{well} - GS_{Buffer} + LG_{Buffer} \quad (1)$$

Where:

$Field\ Depth_{Current}$	Current groundwater level depth in the field
D_{Well}	Current groundwater level depth as measured in the monitoring well
GS_{Buffer}	Ground surface buffer, or the difference in elevation between the well and the field
LG_{Buffer}	Lateral gradient buffer, to account for losing reaches where the groundwater table slopes away from the river (if any)

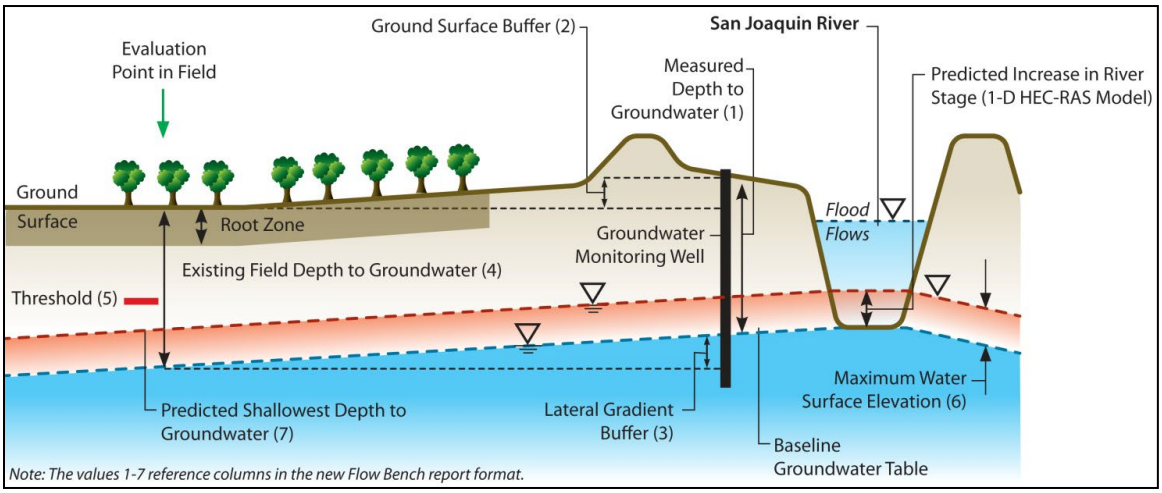

Figure 1. Conceptual Model for Observed Groundwater Level Method

The pre-condition well data in Table 1 show acceptable conditions throughout the critical monitoring locations in Reach 4A. Again, the pre-condition data represents the levels observed during the period of stabilizing flows below Sack Dam. Groundwater depths in all wells indicate conditions below thresholds. Groundwater levels are continuing to rise from previously dry conditions and will continue to be monitored.

Table 1. Pre-Condition Well Data

Well	Reach	1 - Measured Groundwater Depth in Well (feet bgs)	Date Measured	2 - Ground Surface Buffer (feet)	3 - Lateral Gradient Buffer (feet)	4 - Field GW Depth (feet bgs)	5 - Field Threshold (feet bgs)	Comment
MW-18-80B	4A	11.1	11/16/2022	4.2	1.2	8.1	6.7	Acceptable
MW-17-225	4A	14.6	11/16/2022	2.9	1.1	12.7	6.5	Acceptable
MW-10-89	4A	15.3	11/16/2022	1.0	-	14.3	6.5	Acceptable

bgs = below ground surface; GW = groundwater

Analysis

With well locations in Reach 4A starting from dry conditions due to lack of Restoration Flows since April until October (documented in Weekly Groundwater Monitoring Reports located HERE), groundwater levels are still well below threshold throughout the Restoration Area; however, the dynamic groundwater conditions will be closely monitored. Although groundwater levels are continuing to rise from previously dry conditions, no well thresholds are projected to be exceeded. After consideration of 250 cfs at Sack Dam based on the Ad Hoc RA Recommendation, the largest anticipated water level increases were estimated based on the concept illustrated in Figure 2. The water level increases are expected to have a buffer of at least 0.3 ft from the nearest field threshold. After any changes to Restoration Flows, subsequent FBEs may be completed to assess stabilizing conditions. The maximum flow estimate below Sack Dam before SMP thresholds are approached is 315 cfs.

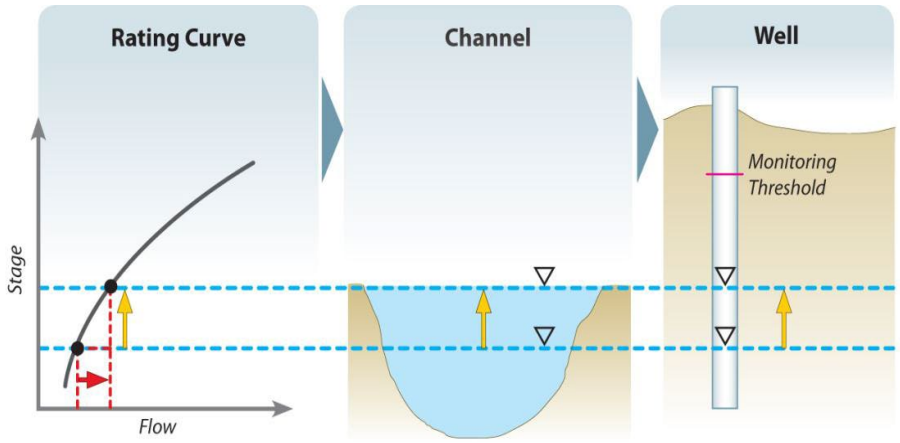

Figure 2. Conceptual Relationship between River Stage and Groundwater Levels

Table 2 shows the flow rates used to evaluate projected groundwater depths. Pre-condition flows are based on the current Sack Dam target of 150 cfs. The comparison of pre-condition, projected flows, and maximum flow informs the estimated result of changing flows to be consistent with the Ad Hoc RA Recommendation.

Table 2. Anticipated Change in Flows with Ad Hoc RA Recommendation

	Pre-condition Flows (cfs)	Projected Flows from Evaluation (cfs)	Maximum Flow before SMP Thresholds (cfs)
Reach 4A	150[1]	250[2]	315[3]

[1] Source: Current Sack Dam target
[2] Source: Expected Sack Dam target from Ad Hoc RA Recommendation
[3] Calculated from Flow Bench Evaluation

Table 3 shows the change in groundwater for the maximum flow of 315 cfs below Sack Dam based on estimated changes in river stage and the conceptual models shown in Figures 1 and Figure 2. Field depths are calculated by taking the most recent measurements from Table 1, adding the ground surface and the lateral gradient buffers, and subtracting the maximum predicted stage increase (Equation 2).

$$Field\ Depth_{Predicted} = Field\ Depth_{Current} - WSEL_{Max\ Increase} \quad (2)$$

Summary

This analysis, in combination with recent field measurements, indicates acceptable conditions for up to 315 cfs past Sack Dam, including the proposed 250 cfs Ad Hoc RA Recommendation at Sack Dam. Groundwater levels will continue to be monitored so as not to surpass thresholds. Reclamation retains the right to recapture Restoration Flows in Mendota Pool to adjust for any Restoration Flow constraints. Subsequent FBEs will be performed to inform any other potential flow changes.

Table 3. Predicted Groundwater Levels for Priority Wells with Maximum Flow of 315 cfs below Sack Dam

Well	Reach	1 - Measured Groundwater Depth in Well (feet bgs)	Date Measured	2-Ground Surface Buffer (feet)	3 - Lateral Gradient Buffer (feet)	4 - Field GW Depth (feet bgs)	6 - Predicted WSEL Change (feet)	7 - Predicted Shallowest GW Depth (ft bgs_field)	5 - Field Threshold (feet bgs)	Comment
MW-18-80B	4A	11.1	11/16/2022	4.2	1.2	8.1	1.4	6.7	6.7	Acceptable
MW-17-225	4A	14.6	11/16/2022	2.9	1.1	12.7	1.5	11.2	6.5	Acceptable
MW-10-89	4A	15.3	11/16/2022	1.0	-	14.3	3.5	10.8	6.5	Acceptable

bgs = below ground surface; GW = groundwater; WSEL = water surface elevation