

# SJRRP Flow Bench Evaluation

July 28, 2017

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The Restoration Administrator (RA), as of July 28, 2017, continues to recommend Restoration Flow releases of 125 cfs past Gravelly Ford through August 31, 2017. The recommendation also includes a release of 43 cfs past Sack Dam, specifying that any additional Restoration Flows that arrive at Mendota Pool in excess of the Sack Dam target also be released downstream. Groundwater levels continue to drain and decrease due to the end of flood operations. The combined release from Friant Dam, including Restoration Flows and holding contract releases, will remain at least 350 cfs. This Flow Bench Evaluation continues to evaluate the transition from flood flows to Restoration Flows, which took effect on July 21, 2017, per Section J.3 of the Seepage Management Plan.

As of July 28, 2017:

1. Channel conveyance: Flow rates are below known conveyance thresholds.
2. Operations Conference Call: An operations call was held on July 26, 2017. No issues were raised. Stakeholders have been notified of the switch to Restoration Flows.
3. Seepage Hotline Calls: The seepage hotline has received no calls regarding Restoration Flows in Water Year 2017.
4. Real-time wells: All telemetered groundwater monitoring well levels are below thresholds except for MW-09-49B. This well does not restrict releases since the projected groundwater elevation will fall below threshold with the current RA Recommendation.
5. Priority wells: Weekly groundwater measurements in priority wells, Table 3, indicate that most wells are below thresholds. FA-9, MW-09-47, MA-4, and MW-09-49B are projected to be below threshold with the decrease in river stage. MW-14-208 is projected to be below threshold by the drainage method (refer to Appendix J of the Seepage Management Plan).
6. Flow Stabilization: Flows in the system are not currently stable, and are decreasing from flood control releases. Since January 4, 2017, Friant Dam has been releasing flood flows. For the first week of July, flood flows were at 2,500 cfs. Flows ramped up to as high as 3,500 cfs in the second week of July and ramped back down to 2,150 cfs. For the third week, releases from Friant reduced to 500 cfs and fell to 350 cfs on July 20, 2017. On July 21, 2017, flood flows ceased and Restoration Flows resumed, continuing the 350 cfs Friant Release. Groundwater levels have been in flux due to the recent decrease in flow.
7. Projected Groundwater Level Changes: Groundwater levels are predicted to continue to fall as a result of transitioning to Restoration Flows, with flow rates lower than recent flood control releases. The Reach 3 and Reach 4A priority wells are projected to have a minimal increase in elevation with Sack Dam releases ranging from 43 cfs to 129 cfs. All groundwater well levels are still projected to be below threshold by the Observed Groundwater Level Method or the Drainage Method (Appendix J). The Observed Groundwater Level Method applies the change in stage observed in the river to the well

elevation. The Drainage Method accounts for sufficient drainage from the well to the river channel.

8. Levees: LSJLD has not expressed concerns about this flow increase.
9. Water Districts: The SJRECWA has not identified any operational concerns.

## Analysis

All thirteen priority groundwater monitoring wells are predicted to remain below seepage thresholds, with most currently below thresholds at present.

Groundwater levels below Sack Dam were analyzed, and found to remain below the thresholds identified in the Seepage Management Plan for flows up to 129 cfs, as shown in Tables 2 and 3 below.

The SJRRP will continue weekly monitoring of groundwater wells to track the influence of Restoration Flows, and will update this analysis if any changes to Restoration Flows are recommended. Real-time monitoring equipment that required removal during flood flows will also be restored.

## Data

**Table 1** shows the groundwater depth in three real-time wells and ten manual measurements from field staff as reported in the weekly groundwater report with a publish date for the week ending July 29, 2017. Reclamation publishes the weekly groundwater report with manual measurements via electronic well sounder and recent flow data on the SJRRP website at: <http://www.restoresjr.net/monitoring-data/groundwater-monitoring/>. To calculate field depths, Reclamation adds ground surface buffers and lateral gradient buffers to measured groundwater depths in the well (Figure 1, Equation 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)

**Table 1. Well Data**

Well	Reach	1 - Measured Groundwater Depth in Well (feet bgs)	2 - Ground Surface Buffer (feet)	3 - Lateral Gradient Buffer (feet)	4 - Field GW Depth (feet bgs)	5 - Field Threshold (feet bgs)	Comment
FA-9	2A	7.6	2.0	2.5	8.1	6.0	Acceptable
MW-09-47	2A	7.3	2.5	3.3	8.1	6.5	Acceptable
MA-4	2A	9.1	6.1	4.6	7.6	7.0	Acceptable
MW-09-49B	2A	5.0	1.7	2.4	5.8	5.5	Acceptable
MW-09-54B	2B	11.7	7.9	5.5	9.3	7.0	Acceptable
MW-09-55B	2B	7.7	3.7	3.0	7.1	5.5	Acceptable
PZ-09-R3-5	3	9.1	1.2	0.0	7.9	5.7	Acceptable
MW-12-191	3	10.5	0.0	0.0	10.5	7.0	Acceptable
PZ-09-R3-7	3	7.3	0.7	0.0	6.5	6.5	Acceptable by Drainage
MW-10-75	3	18.2	0.5	0.2	17.9	8.0	Acceptable
MW-14-208	4A	5.6	0.0	0.0	5.6	7.0	Acceptable by Drainage
MW-10-89	4A	11.5	1.0	0.0	10.5	6.5	Acceptable
MW-10-92	4A	7.4	1.0	0.0	6.4	4.8	Acceptable by Drainage

bgs = below ground surface; GW = groundwater

**Table 2** shows the anticipated flow rates used to evaluate future groundwater depths. Reclamation calculated losses from Friant Dam to the Mendota Pool based on the long-term pattern established by Exhibit B. Actuals were used at gage locations in Reach 1, 2A, 2B as of 0000 (12:00 am) on July 20. Reaches 1, 2A and 2B currently represent higher flows than anticipated in steady-state conditions for a 350 cfs Friant release.

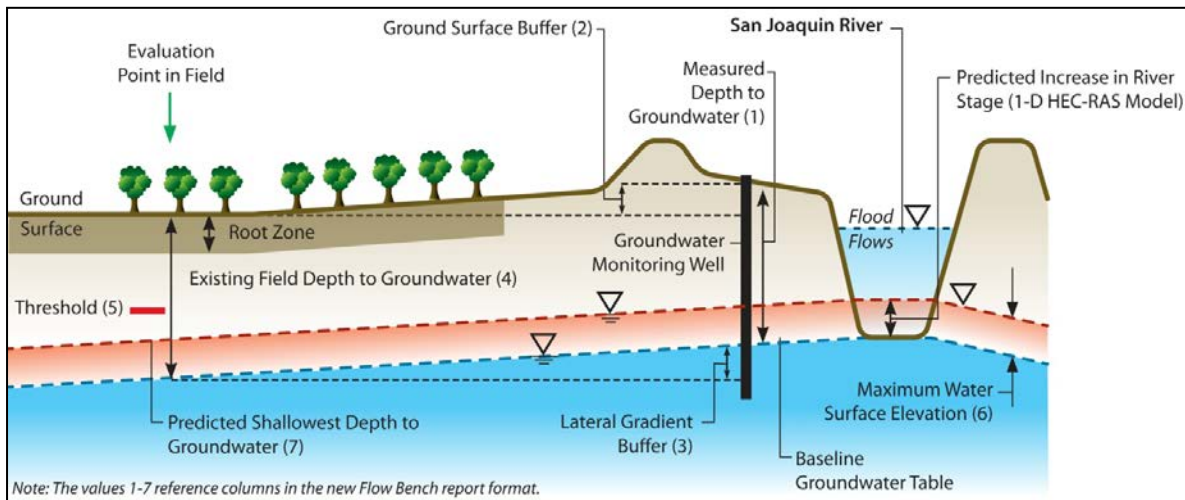
**Table 2. Anticipated Change in Flows**

	Recent Flows (cfs)	Projected Flows for Evaluation (cfs)
Reach 1	496	350
Reach 2A	671	125
Reach 2B	625	45
Reach 3	542	629
Reach 4A	42	129

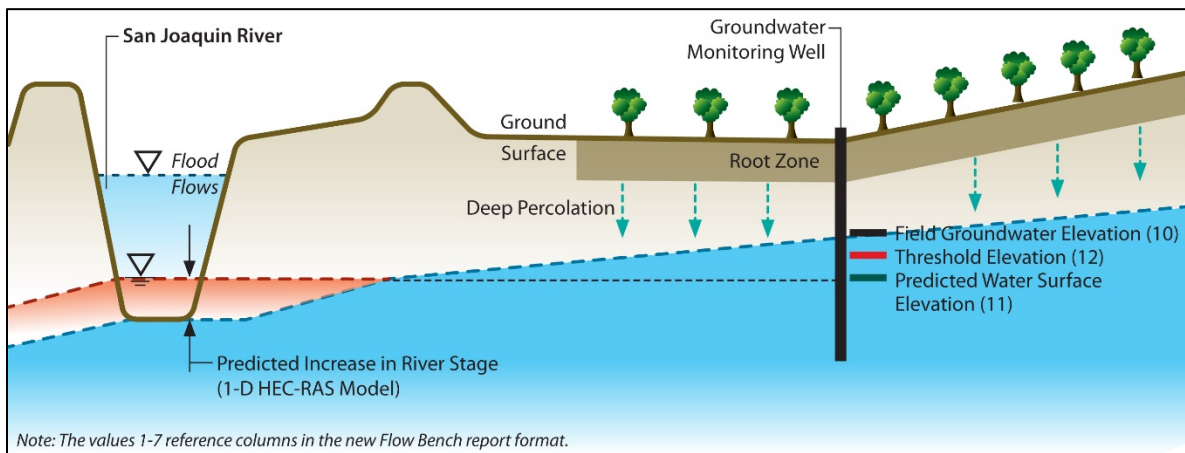
**Table 3** shows the current and maximum rise in groundwater based on estimated changes in river stage and the conceptual models shown in Figure 1 and Figure 2. Field depths are calculated by taking the most recent measurements from Table 1, adding the ground surface and the lateral gradient buffer, and subtracting the maximum predicted stage increase (Equation 2).

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

This analysis shows acceptable conditions for the maximum allowable flow below Sack Dam, 129 cfs. Actual Restoration Flow amounts below Sack Dam will depend on Restoration Flow inflow to Mendota Pool, and may vary between 129 cfs and 43 cfs as inflow recedes.



**Figure 1: Conceptual Model for Observed Groundwater Level Method**



**Figure 2: Conceptual Model for Drainage Method**

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**Table 3: Predicted Groundwater Levels for Priority Wells**

Well	Reach	1 - Measured Groundwater Depth in Well (feet bgs)	2 - Ground Surface Buffer (feet)	3 - Lateral Gradient Buffer (feet)	4 - Field GW Depth (feet bgs)	6 - Maximum Predicted WSEL Increase (feet)	7 - Predicted Shallowest GW Depth (feet bgs)	5 - Field Threshold (feet bgs)	Comment
FA-9	2A	7.6	2.0	2.5	8.1	-1.9	10.0	6.0	Acceptable
MW-09-47	2A	7.3	2.5	3.3	8.1	-1.9	10.0	6.5	Acceptable
MA-4	2A	9.1	6.1	4.6	7.6	-1.7	9.4	7.0	Acceptable
MW-09-49B	2A	5.0	1.7	2.4	5.8	-1.7	7.5	5.5	Acceptable
MW-09-54B	2B	11.7	7.9	5.5	9.3	-4.5	13.8	7.0	Acceptable
MW-09-55B	2B	7.7	3.7	3.0	7.1	-4.5	11.6	5.5	Acceptable
PZ-09-R3-5	3	9.1	1.2	0.0	7.9	0.3	7.6	5.7	Acceptable
MW-12-191	3	10.5	0.0	0.0	10.5	0.4	10.2	7.0	Acceptable
PZ-09-R3-7	3	7.3	0.7	0.0	6.5	0.3	6.2	6.5	Acceptable by Drainage
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bgs = below ground surface; GW = groundwater; WSEL = water surface elevation

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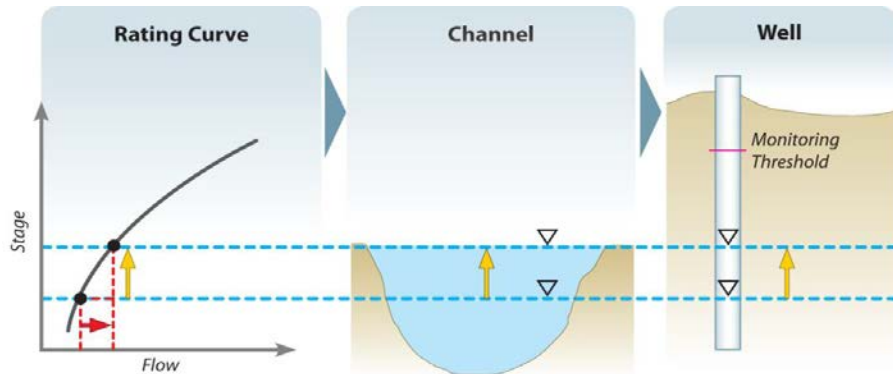


Figure 3: Conceptual Relationship between River Stage and Groundwater Levels

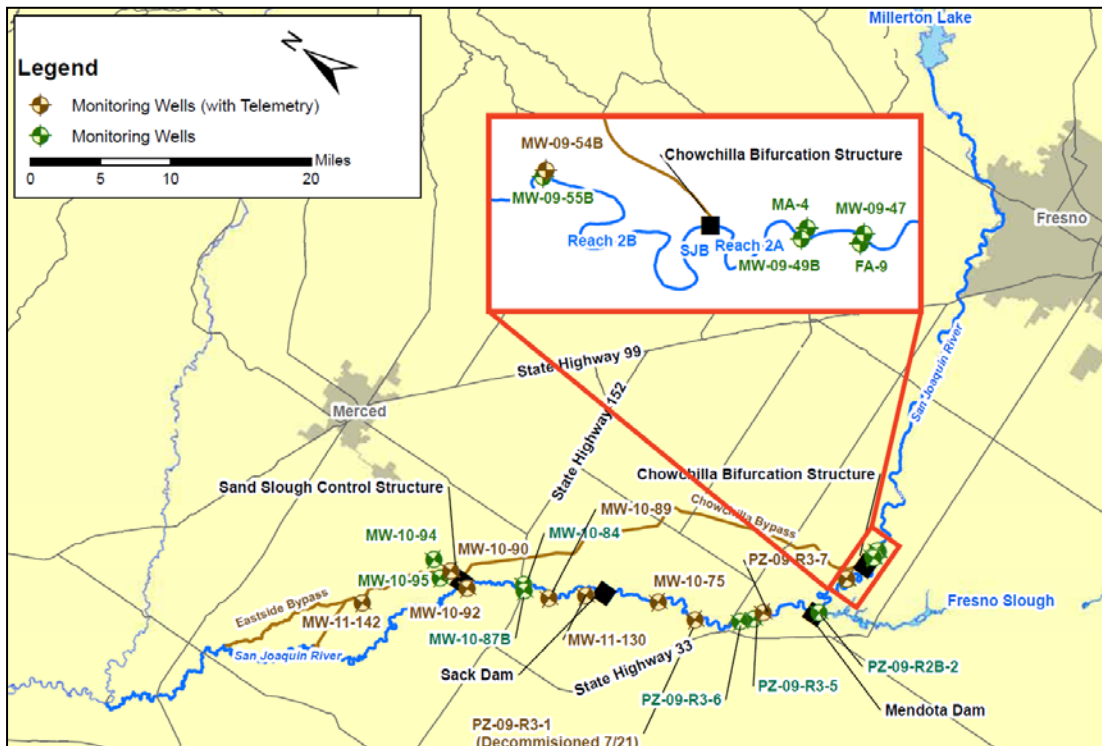


Figure 4: Key Monitoring Well Locations

