SJRRP Flow Bench Evaluation
February 12, 2016

The Restoration Administrator, as of February 4, 2016, recommends Restoration Flow releases of 80 cfs past Gravelly Ford, beginning increases at Friant Dam on February 15, 2016 to reach this target. Lack of flowage easements in the Eastside Bypass restricts flow below Sack Dam to 0 cfs. The combined release from Friant Dam, including Restoration Flows and holding contract releases, will be increased to at least 180 cfs on February 15, 2016 at 12:00 pm.

As of February 12, 2016:

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

2. Operations Conference Call: An operations call was held February 5, 2016. Operations expressed concern regarding Mendota Pool Demand. It is not anticipated that Restoration Flows will reach Mendota Pool.

3. Seepage Hotline Calls: The seepage hotline has received no calls in Water Year 2016.

4. Real-time wells: Groundwater monitoring well levels are below thresholds. These wells do not restrict releases.

5. Priority wells: Weekly groundwater measurements in priority wells indicate no wells are above thresholds (Table 1). These wells do not restrict releases.

6. Flow Stabilization: No flows have been released below Gravelly Ford since summer 2015.

7. Projected Groundwater Level Increases: Projected groundwater levels indicate that all monitoring wells will remain below thresholds with the recommended Restoration Flow releases.

8. Levees: The LSJLD has not identified any concerns.

9. Water Districts: The SJRECWA has not identified any operational concerns. Demand at Mendota Pool is increasing due to pre-irrigation, and is not anticipated to restrict Restoration Flow releases.

Analysis

All groundwater monitoring wells currently are currently below seepage thresholds. Modeled groundwater levels resulting from the proposed Restoration Flows predict that all wells will remain below thresholds with this flow increase. The SJRRP will continue weekly monitoring of groundwater wells to track the impact of Restoration Flows, and will update this analysis if any increases to Restoration Flows are recommended.

Data

$$Field\ Depth_{Current} = D_{Well} + GS_{Buffer} + LG_{Buffer} \qquad (1)$$

Table shows the groundwater depth in seven real-time wells as of February 12, 2016 and ten manual measurements from field staff as reported in the weekly groundwater report with a publish date of February 12, 2016. 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/flows/Groundwater/Groundwater.html. To calculate field depths, Reclamation adds ground surface buffers and lateral gradient buffers to measured groundwater depths in the well (Figure 1, Equation 1). A negative ground surface buffer indicates the ground surface at the well is above the field ground surface elevation.

$$Field\ Depth_{Current} = D_{Well} + GS_{Buffer} + LG_{Buffer} \qquad (1)$$

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	18.8	-3.7	2.5	17.6	7.0	Acceptable
MW-09-47	2A	18.8	-3.5	3.3	18.6	7.0	Acceptable
MA-4	2A	20.5	-6.1	4.6	19.0	7.0	Acceptable
MW-09-49B	2A	15.9	-1.7	2.4	16.7	5.5	Acceptable
MW-09-54B	2B	18.9	-7.9	5.5	16.5	10.0	Acceptable
MW-09-55B	2B	11.5	-3.7	3.0	10.8	6.0	Acceptable
PZ-09-R3-5	3	12.1	-1.2	0.0	10.9	6.0	Acceptable
PZ-09-R3-6	3	10.8	-1.5	0.0	9.4	6.0	Acceptable
PZ-09-R3-7	3	9.2	-0.7	0.0	8.4	6.0	Acceptable
MW-10-75	3	23.0	-0.5	0.2	22.7	6.3	Acceptable
MW-11-130	4A	12.2	0.0	0.0	12.2	6.0	Acceptable
MW-14-208	4A	20.2	-2.1	0.0	18.1	5.0	Acceptable
MW-10-89	4A	25.2	-3.4	0.0	21.8	4.0	Acceptable
MW-10-92	4A	10.3	-2.6	0.0	7.7	5.6	Acceptable
MW-10-90	4B1	8.0	0.8	0.0	8.8	4.9	Acceptable
MW-10-94	4B1	18.5	0.0	1.0	19.4	6.0	Acceptable
MW-11-142	4B1	9.3	0.0	0.0	9.3	6.0	Acceptable

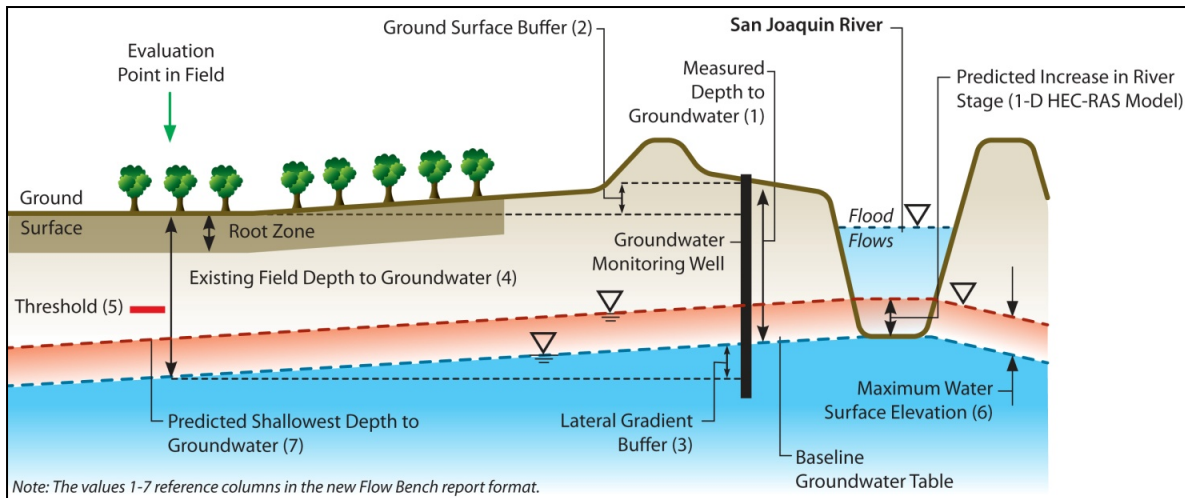bgs = below ground surface; GW = groundwater;

Figure 1: Conceptual Model for Increase in Stage Method

Table 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.

Table 2: Anticipated Change in Flows

	Recent Flows (cfs)	Projected Flows for Evaluation (cfs)
Reach 1	120	180
Reach 2A	0	80
Reach 2B	0	0
Reach 3	130	130
Reach 4A	0	0
Reach 4B1 (ESB)	0	0

Table 3 shows the current and maximum rise in groundwater based on estimated changes in river stage and the conceptual model shown in Figure 1. 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).

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

See Figure 3 for the locations of these monitoring wells and pages 6 – 13 of this report for the rating curves for each of the key wells from the San Joaquin HEC-RAS Model Documentation Technical Memorandum (Mussetter Engineering, Inc., 2008), prepared for California Dept. of Water Resources, Fresno, California. These rating curves are used to determine the maximum predicted increase in water surface elevation (Figure 2).

Table 3: Predicted Groundwater Levels for Key Wells – Increase in Stage Method

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	18.8	-3.7	2.5	17.6	1.7	15.9	7.0	Acceptable
MW-09-47	2A	18.8	-3.5	3.3	18.6	1.7	16.9	7.0	Acceptable
MA-4	2A	20.5	-6.1	4.6	19.0	2.5	16.5	7.0	Acceptable
MW-09-49B	2A	15.9	-1.7	2.4	16.7	0.8	15.8	5.5	Acceptable
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MW-09-55B	2B	11.5	-3.7	3.0	10.8	0.0	10.8	6.0	Acceptable
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MW-11-142	4B1	9.3	0.0	0.0	9.3	0.0	9.3	6.0	Acceptable

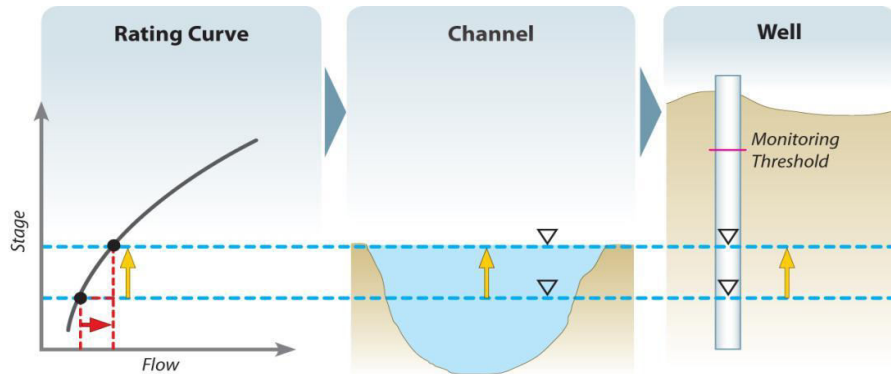bgs = below ground surface; GW = groundwater; WSEL = water surface elevation

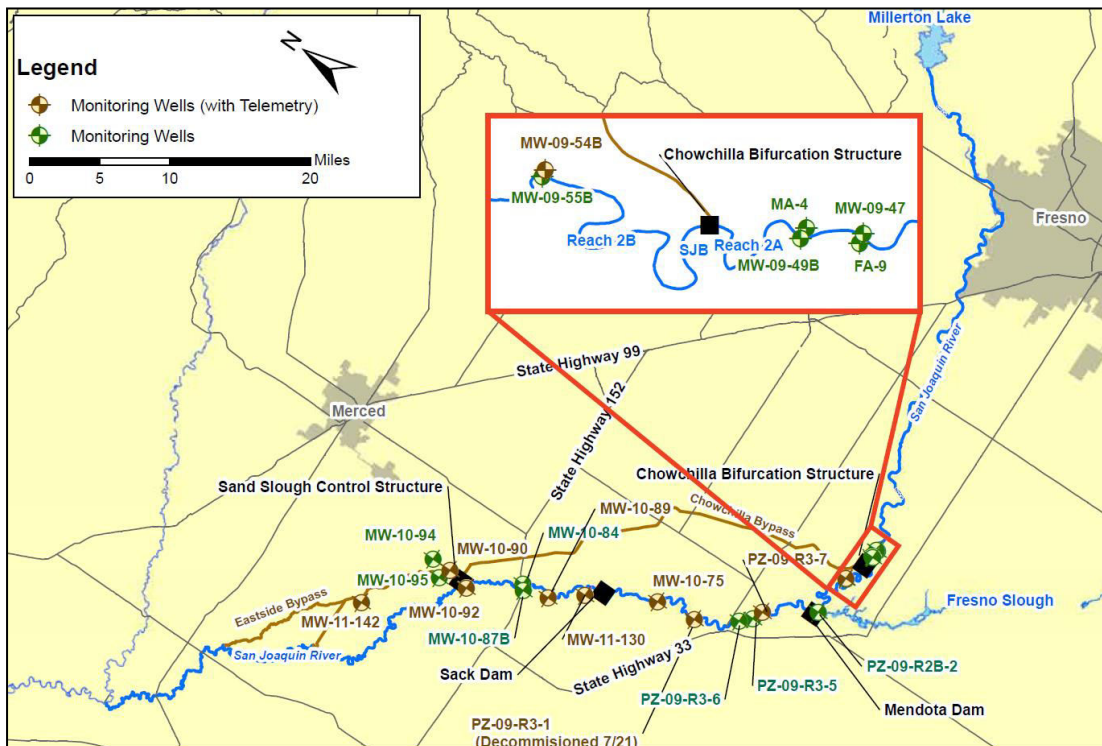**Figure 2: One to one surface to groundwater relationship for Increase in Stage Method**

Figure 3: Key Monitoring Well Locations

FA-9 and MW-09-47

MA-4

MW-09-49B

MW-09-54B and MW-09-55B

PZ-09-R2B-1

PZ-09-R2B-2

PZ-09-R3-5

PZ-09-R3-6

PZ-09-R3-7

MW-10-75

MW-10-92

Water Surface Elevation (feet) vs *Flow (cfs)*

MW-10-90

Water Surface Elevation (feet) vs *Flow (cfs)*

MW-10-94 and MW-10-95