

Foster Meadow Restoration – Year 2 Water Benefit Narrative
January 9, 2022

Background:

The Foster Meadow Restoration Project at the headwaters of the Middle Fork Cosumnes River was implemented on public lands administered by the El Dorado National Forest (ENF), Amador Ranger District from September 23 to October 16, 2020. Principal funding for project construction was provided by the National Fish and Wildlife Foundation (NFWF). Additional project implementation, revegetation and monitoring contributions were provided by Bonneville Environmental Foundation (BEF), the American River Conservancy/Cosumnes Coalition and the ENF. The Foster Meadow Restoration Project was originally scheduled for implementation in 2019, but was delayed by a regulatory issue. This report constitutes the Year 2 groundwater monitoring report in support of BEF’s contribution to the project. Additional reports will be provided in 2023 & 2024.

Hydrologic Conditions- Pre- and Post project:

The pre-project water years 2017- 20 encompassed both very wet and abnormally dry precipitation regimes, which is typical for California, and one of the principal reasons these meadows and their hydrologic buffering functions are so important. In the absence of an on-site climate station, data from nearby climate stations will be used, along with the Northern Sierra 8-Station and Central Sierra 5-Station indices, to characterize each annual hydrologic year in the benefit validation period. The Podesta Snow Course is only one mile from the project, with an annual average April 1 snow water content of 41.1 inches.

This report discusses the now incorporates two first full water years post project. The 2022 water year was the 3rd consecutive dry year for both the 8-Station (45%) and 5-Station (47%) Indexes, in 115 years of record, as well as the driest 3-year period in the record. The Foster Meadow Restoration Project is situated near the boundary between the two Index regions, hence the dual Index values. As the data below indicates, precipitation has been highly variable during the pre- and post-project monitoring. Table 1 below summarizes the available precipitation data.

Table 1: Foster Meadow Annual Hydrologic Data

Foster Meadow Climate data - Water Year (WY) 2016-17 through 2022*						
<u>Water Year</u>	<u>Podesta (Apr. 1 SWC)</u>	<u>Salt Springs (SSR)</u>	<u>Owens Camp (OWC)</u>	<u>8-Station N. Sierra Index</u>	<u>5-Station C. Sierra Index</u>	<u>WY Class*** (SacBasin/SJBasin)</u>
<i>Averages</i>	41.1			51.8	40.3	
2017	74.0	81.2	74.3	94.7	72.7	W/W
2018	18.5	40.6	30.6	41.0	29.7	BN/BN
2019	74.0	67.8	50.6	70.7	50.0	W/W
2020	21.5	28.9	22.9	31.7	24.6	D/C
2021	28.5	20.1	18.4	24.0	18.8	C/C
2022	16.0	41.13	33.83	43.0	25.3	D/C
<i>*All values in inches of water</i>						
<i>**Post project values in blue</i>						
<i>***Class abbreviations: W-wet; AB- above normal; BN- below normal; D-dry; C- critically dry</i>						

The groundwater monitoring effort for this project is being conducted by Plumas Corporation to quantify overall groundwater change in the restoration project; and, in partnership with California State University Sacramento, to support a Wildlife Conservation Board-funded effort to more fully understand the groundwater/surface water processes in restored meadow systems, Sierra-wide. To that end, Plumas

Corporation staff installed four (4) groundwater wells, suitable for manually measuring each month when accessible. To more accurately attribute hydrologic change to the restoration work, ground and surface waters are sampled and analyzed for stable isotopes and conductivity. Additionally, a continuous recording stream gage has been operated at the bottom of the Foster Meadow Project since 2017. Plumas Corporation staff operate and maintain all of these hydrologic measurement devices.

Post-Project Monitoring Results, Year 2 Discussion: For three of the four years pre-project years, the first monthly monitoring visit was when accessible by vehicle (snow melt). At that point the meadow groundwater had already drained down several feet. In water year 2018-19, classified as a wet year, the first visit was on x-country skis. At that earlier stage, during active snowmelt, groundwater levels were higher. In the spring of water year 2020-21, the project was vehicle accessible at the earliest date yet, May 22, due to very low total precipitation and an early melt of the scant snowpack. The five years of record encompass two (2) wet years and three (3) dry years, including Year 1 post-project being the 3rd driest year in 115 years of record. Given this disparity, the Year 2 analysis will focus on comparing the dry years, 2020 and 2022. It should be noted that the July and August 2021 monitoring visits were missed due to the Dixie and Caldor fires, respectively, constituting an important late season data gap. Meadow groundwater elevations for all years are plotted in Appendix 2.

Foster Meadow is in a snowmelt dominated area of the Middle Fork Cosumnes River basin, with normal spring snowpack depths exceeding 10 feet, holding approximately 41 inches of water. The completion of this snowmelt process is what drives the initial monitoring visit, irrespective of the calendar date. Across all wells and a pre-project dry year with similar total annual precipitation, the Year 2 post project groundwater elevations are higher, both early season and late season for a meadow-wide average of 1.64. These increases are despite being the third of three consecutive, critically dry years. It is expected that in future years, presumably with more abundant precipitation, the above values will increase.

Table 2a. Environmental Water: net change in early season groundwater at Foster Meadow, Year 2 post-project.

Well Name	GW Date (highest annual pre-project)	Highest annual pre-project GW Elevation (ft)	GW Date (highest annual entry post-project)	Highest annual post-project GW Elevation (ft)	Total Δ GW (ft)
FM-W1	6/16/2020	6732.82	5/22/2022	6733.59	+0.77
FM-W2	6/16/2020	6732.58	5/22/2022	6733.70	+1.12
FM-W3	6/16/2020	6706.52	5/22/2022	6708.50	+1.98
FM-W4	6/16/2020	6706.76	5/22/2022	6709.16	+2.40
Total average net gain (ft)					+1.57

Table 2b. Environmental Water: net change in late season groundwater at Foster Meadow, Year 2 post-project.

Well Name	GW Date (lowest annual pre-project)	Lowest annual pre-project GW Elevation (ft)	GW Date (Lowest annual post-project)	Lowest annual post-project GW Elevation (ft)	Total Δ GW (ft)
FM-W1	11/12/2020	6727.50	9/08/2022	6728.82	+1.32
FM-W2	11/12/2020	6728.01	9/08/2022	6729.84	+1.83
FM-W3	9/23/2020	6704.55	9/08/2022	6706.30	+1.75
FM-W4	9/23/2020	6706.31	9/08/2022	6708.22	+1.91
Total average net gain (ft)					+1.70

Project Performance Discussion:

These montane meadows, when restored, continue to amaze with how consistently they respond to restoration work. Despite two extraordinarily dry years in the three years prior to restoration, and a critically dry year in the initial year post-project, the meadow has more than met the conservative minimum expected benefit quantity enumerated in the Agreement of 1.19 acre-feet.

The project entailed restoring the base level of the stream channel on 3 meadow segments; the Main Meadow and Pocket Meadows 1 and 2 (see Appendix 1). In addition, a major Forest Service system road crossing was modified to reduce the risk of catastrophic failure, and improve sediment transport and aquatic organism passage. All components are performing as expected, with select photos following to illustrate.



Photo 1 above: Foster Meadow main meadow after the only, and last, significant snow of 2021. Date: March 4, 2021. (Photo courtesy of Chuck Loffland, El Dorado Nat'l Forest)



Photo 2 above: Foster Meadow main meadow post-project, June 23, 2021.



Photo 3a above: Main meadow gully pre-project



Photo 3b: Main meadow channel, 2021 post-project

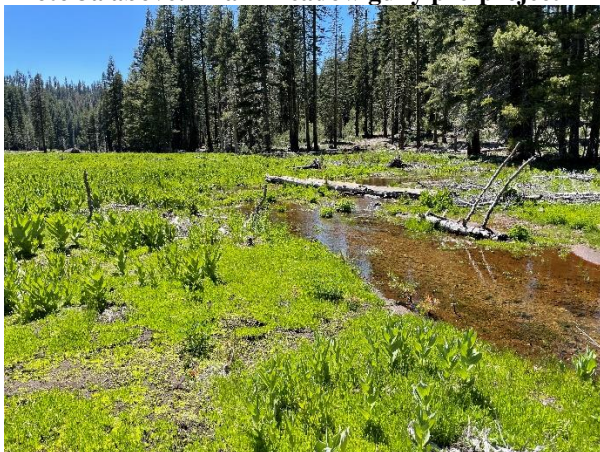


Photo 3c: Main meadow channel, 2022 post-project



Photo 4a: Pocket Meadow #2, 2021 post-project



Photo 4b: Pocket Meadow #2, 2022 post-project



Photo 5: Main meadow riffle, 2021 post-project



Photo 6a: Fish barrier culvert, 2020 pre-project



Photo 6b: Fish passable culverts, 2021 post-project

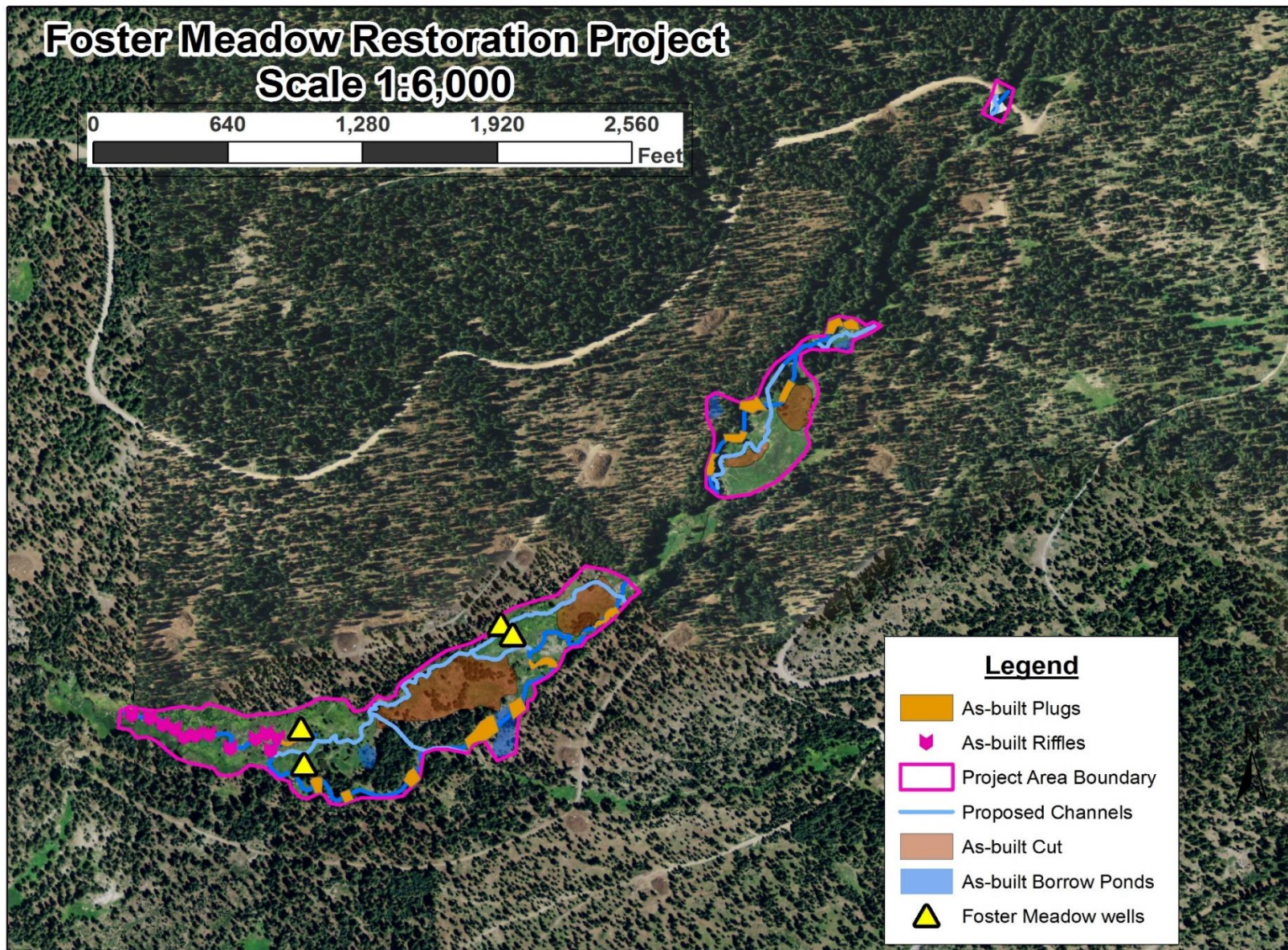


Photo 6c: Fish passable culverts, 2022 post-project

APPENDIX 1

Foster Meadow Restoration Project

Scale 1:6,000



Legend

- As-built Plugs
- As-built Riffles
- Project Area Boundary
- Proposed Channels
- As-built Cut
- As-built Borrow Ponds
- Foster Meadow wells

APPENDIX 2

