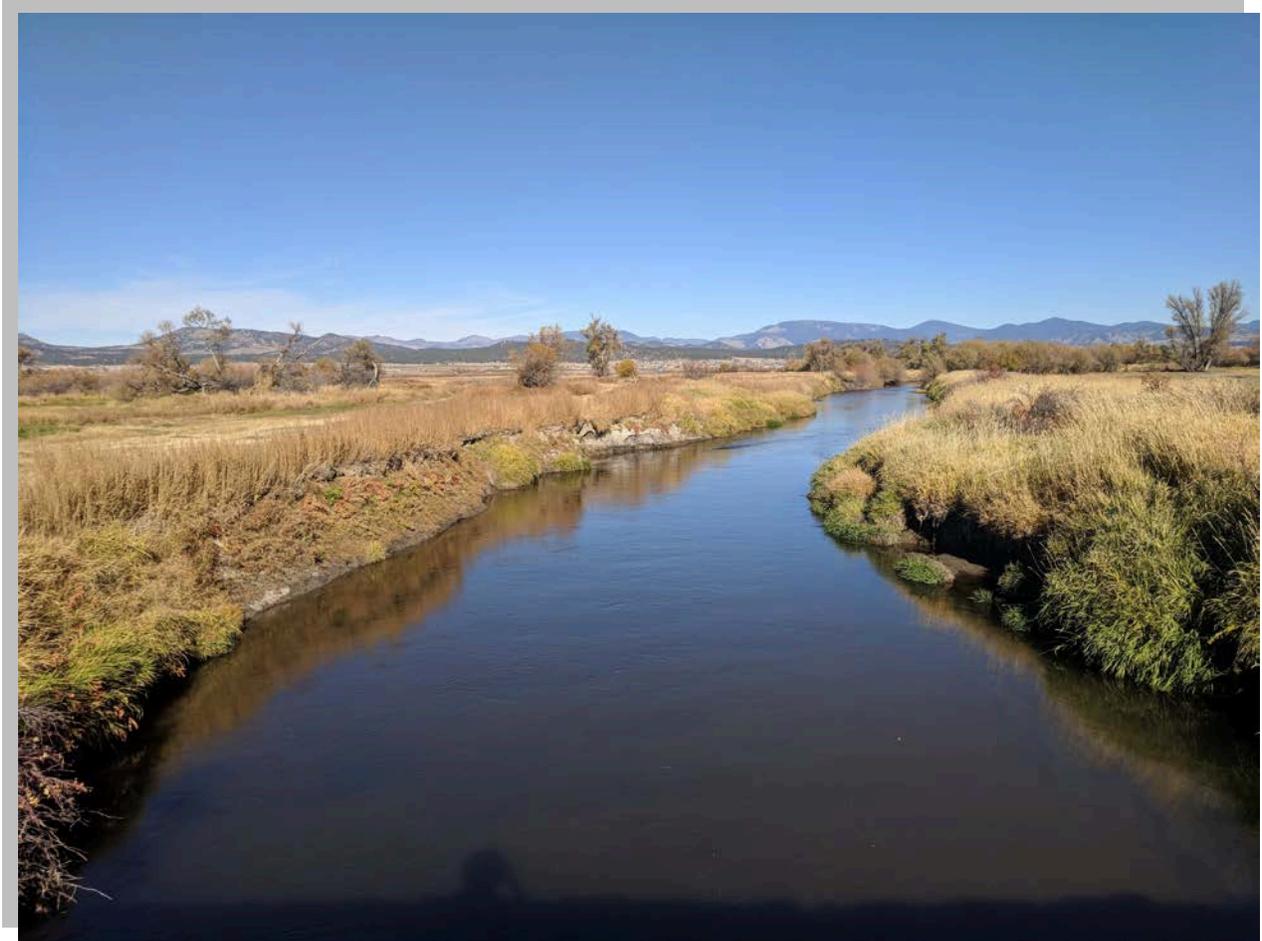


**PRICKLY PEAR CREEK
2019 REWATERING PROJECT
FINAL REPORT**



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1. Introduction

1.0 Executive Summary

Prickly Pear Creek is a perennial stream that flows from its headwaters in the Elkhorn Mountains of southwest Montana to Lake Helena, north of the city of Helena, Montana (Figure 1). Upon entering the Helena Valley near East Helena, the waters of Prickly Pear Creek have historically been used for irrigating lands in the Helena Valley. Because of this condition, Prickly Pear Creek suffered from chronic dewatering, and segments of Prickly Pear Creek in the Helena Valley were typically dry for much of the summer months, limiting agricultural use, fisheries support, and recreational opportunities. In 2008, the Prickly Pear Creek Rewatering Project was initiated to alleviate these historic and ongoing impacts.

The Prickly Pear Creek Rewatering Project (Rewatering Project) is a joint effort between the Lewis & Clark County Water Quality Protection District (WQPD), the Helena Valley Irrigation District (HVID), the Prickly Pear Creek Water Users Association (PPWU), the US Bureau of Reclamation (BOR) and annual funders, with the objective of meeting irrigation demands while maintaining summer streamflow in Prickly Pear Creek. During the summer irrigation season (July-Sept), rather than diverting in-stream flows from Prickly Pear Creek, the Rewatering Project agreement directs the PPWU to use water supplied by the BOR from Canyon Ferry Reservoir and delivered through the HVID canal and ditch system. The result of this agreement is that Prickly Pear Creek has maintained baseflow throughout the summer months, and the PPWU has received its full allotment of water. 2019 marks the 12th consecutive season for the Rewatering Project, in which the PPWU has agreed to receive water through the HVID instead of using their seasonal water rights from Prickly Pear Creek for irrigation demands.

Thick winter snowpack in the winters of both 2018 and 2019 combined with lingering cold temperatures and early spring snowpack contributed to higher than average flows on Prickly Pear Creek throughout the 2019 summer months. The lowest recorded flows were 32 CFS at Station P-4 on 09/05/2019 and 25 CFS at Station P-5 on 09/03/19. This is in sharp contrast to 2017 when the lowest flows recorded were 7.5 CFS and 1.7 CFS at Stations P-4 and P-5, respectively.

The Prickly Pear Creek Rewatering Project agreement is scheduled to be implemented when flow triggers of 40 CFS at Station P-4 or 20 CFS at Station P-5 are reached. Notwithstanding seasonal (June/July) flows well above trigger values, the Prickly Pear Rewatering Project was implemented on July 2nd by the Helena Valley Irrigation District (HVID). On July 2nd, HVID closed the main headgate drawing water from Prickly Pear Creek, instead drawing water from the irrigation network fed by water delivered from the Helena Valley Regulating Reservoir. The attached water usage report shows the schedule of water delivery from the HVID network to water users as allowed by the Prickly Pear Rewatering Project agreement with HVID. In total, 2,000 acre-feet of water was delivered to water users that, prior to the Prickly Pear Rewatering Project, would have been sourced from Prickly Pear Creek itself.

Benefits of the Rewatering Project include both improvements in water availability to water users as well as enhancements of in-stream flows in support of habitat, fisheries and associated aquatic life. Due to the success of the Rewatering Project over the past twelve years, stream restoration projects on Prickly Pear Creek that improve stream and riparian habitat have become

viable, and great potential exists to further improve the riparian corridor of Prickly Pear Creek and provide long-term benefits for irrigators, recreationist and overall stream health.

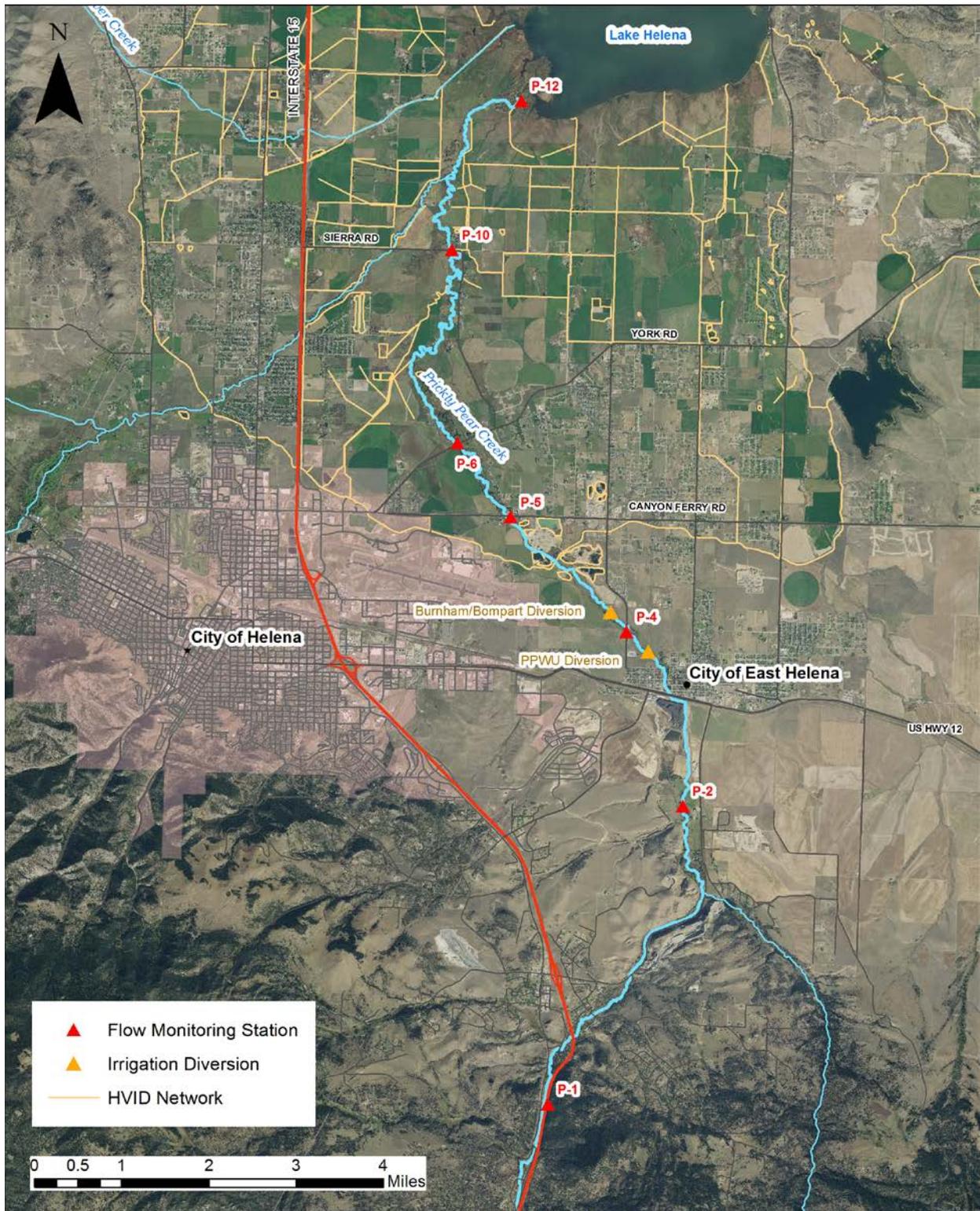


Figure 1: Prickly Pear Creek Rewatering Project Area

1.1 Project Background

The Prickly Pear Creek Rewatering Project was first initiated in 2008 and was coordinated by the Montana Water Trust for its first three years (2008-2010), before being adopted by the Clark Fork Coalition in 2011. Subsequently, Farm-Stream Solutions managed project coordination with financial backing from the Bonneville Environmental Foundation.

In 2013, Farm-Stream Solutions reached out to the WQPD to bring in more local involvement and assistance with project management for the project's immediate and long-term future. The WQPD accepted and since 2014 has been the sole administrative agency and has conducted all activities in support of the Rewatering Project.

1.2 Project Objectives and Structure

The Prickly Pear Creek Rewatering Project (Rewatering Project) is a joint effort between the Lewis & Clark County Water Quality Protection District (WQPD), the Helena Valley Irrigation District (HVID), the Prickly Pear Creek Water Users Association (PPWU), the US Bureau of Reclamation (BOR) and annual funders, with the objective of meeting irrigation demands while maintaining summer streamflow in Prickly Pear Creek. During the summer irrigation season (July-Sept), rather than diverting in-stream flows from Prickly Pear Creek, the Rewatering Project agreement directs the PPWU to use water supplied by the BOR from Canyon Ferry Reservoir and delivered through the HVID canal and ditch system. The result of this agreement is that Prickly Pear Creek has maintained baseflow throughout the summer months, and the PPWU has received its full allotment of water. Prior to the initiation of the Rewatering Project in 2008, Prickly Pear Creek routinely went dry as a result of water diversions, and junior water rights holders typically did not receive late-season water from Prickly Pear Creek. Since the inception of the project in 2008, Prickly Pear Creek has maintained streamflow every year throughout the summer months, and water rights users on Prickly Pear Creek have had access to their full water right.

In addition to maintaining streamflow and supporting water rights holders, the Rewatering Project also provides benefits for instream aquatic habitat, fisheries connectivity, and recreational uses. Because of the success of the Rewatering Project in restoring summer baseflow, the Lewis & Clark Water Quality Protection District has actively pursued restoration of several impacted stream segments on Prickly Pear Creek and has partnered with the Montana Department of Fish Wildlife and Parks and landowners on Prickly Pear Creek to increase fish habitat and recreational access on Prickly Pear Creek. 2019 marks the 12th consecutive season of the Rewatering Project, in which the PPWU has agreed to receive irrigation water from HVID instead of relying upon their late season Prickly Pear Creek water rights for irrigation demands.

The Rewatering Project agreement is set to initiate when streamflow falls below 40 cubic feet per second (CFS) at monitoring station P-4 (downstream from the PPWU diversion) and/or when streamflow in the creek falls below 20 CFS at monitoring station P-5, whichever occurs first. If trigger values are not met, the Rewatering Project agreement is typically implemented during the first week of July.

In order to track and quantify benefits of the Project, stream discharge measurements are taken weekly by the WQPD throughout the summer irrigation season at numerous locations along Prickly Pear Creek. At each flow monitoring station, continual stage monitoring data-loggers are installed to record stream stage throughout the summer (Figure 2).



Figure 2: Monitoring Station on Prickly Pear Creek

Due to sustained high flows in the spring and early summer of 2019, instrumentation was not installed at station P-4 until August. Manual discharge measurements at monitoring stations P-2, P-4, P-5 and P-6.1 are conducted throughout the summer in order to establish a rating curve and stage-discharge relationship at each monitoring station. In addition to the monitoring stations established to track effectiveness of the Rewatering Project, the WQPD also collects flow and water quality data periodically at several other monitoring stations on Prickly Pear Creek and its tributaries.

2. Field Monitoring Results

During the 2019 water year (Oct 2018 – Sep 2019), the Prickly Pear Creek watershed experienced above average precipitation during the winter and spring seasons (Figure 3). Heavy winter snowpack combined with lingering cold temperatures and late spring snowfall resulted in well above-average flows on Prickly Pear Creek through the summer months. Typically,

streamflows reach trigger values of 40 CFS at station P-4 and 20 CFS at station P-5 sometime during the month of June or early July. (If trigger flows are not reached by early July, the HVID implements the agreement the first week of July, nonetheless). During the first week of July 2019, flows at stations P-4 and P-5 were in excess of 100 CFS: on July 2nd the HVID closed the main headgate drawing water from Prickly Pear Creek, instead drawing water from the irrigation network.

2019 seasonal low flows recorded at station P-4 and station P-5 were 32 CFS and 25 CFS on 9/05/19 and 9/03/19 respectively. This is in sharp contrast to 2017 when the lowest flows recorded were 7.5 CFS and 1.7 CFS at stations P-4 and P-5. Below is a discussion of specific flow conditions and influencing factors at monitoring stations P-1, P-2, P-4, P-5 and P-6.1.

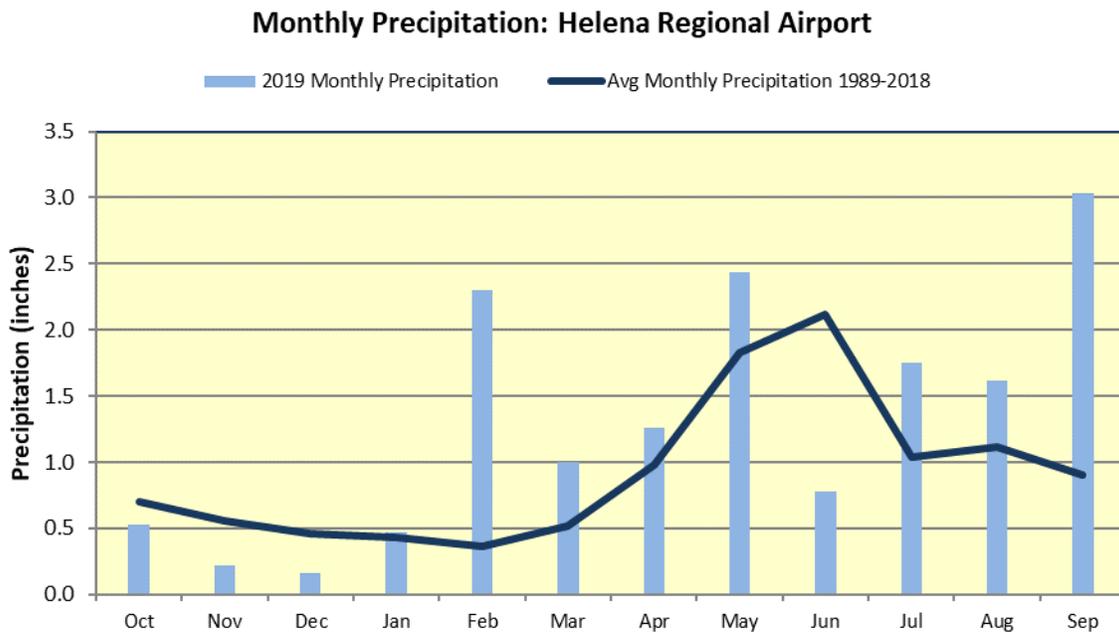


Figure 3: 2019 Water Year Monthly Precipitation

2.1 Monitoring Stations P-1 & P-2

With precipitation conditions well above average during the winter and spring of 2019, streamflow in Prickly Pear Creek was significantly above the 30-year average at USGS Station 06061500 on Prickly Pear Creek, also identified as monitoring station P-1. Flow at station P-1 represents natural flow conditions several miles upstream of the project area and is used to evaluate annual flows in comparison to long-term flow conditions. McClellan Creek, an ungauged tributary to Prickly Pear Creek, enters Prickly Pear Creek between Station P-1 and P-2 and is responsible for a majority of the baseflow increase between the two stations (Figure 4). Flows recorded at station P-2 represent incoming flows to the project area, before any irrigation withdrawals. Figure 5 illustrates the dramatic difference in flow conditions observed at station P-2 in 2019 in comparison with the low-flow conditions experienced in 2017.

Prickly Pear Creek 2019 Streamflow
Station P1 v Station P2

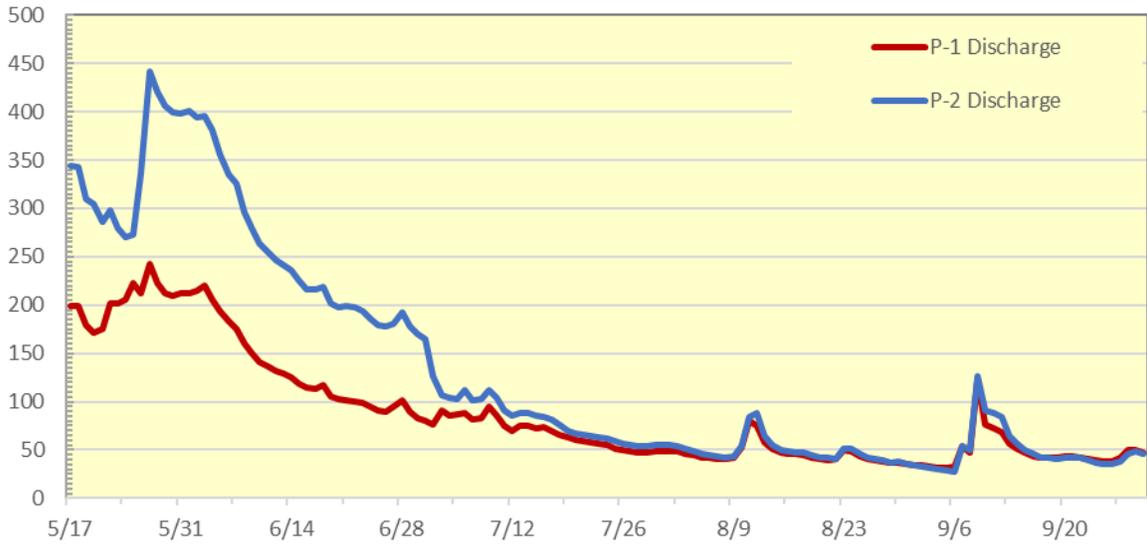


Figure 4: 2019 Flows at Prickly Pear Creek Monitoring Stations P-1 and P-2

Prickly Pear Creek at Kleffner Ranch
Station P-2

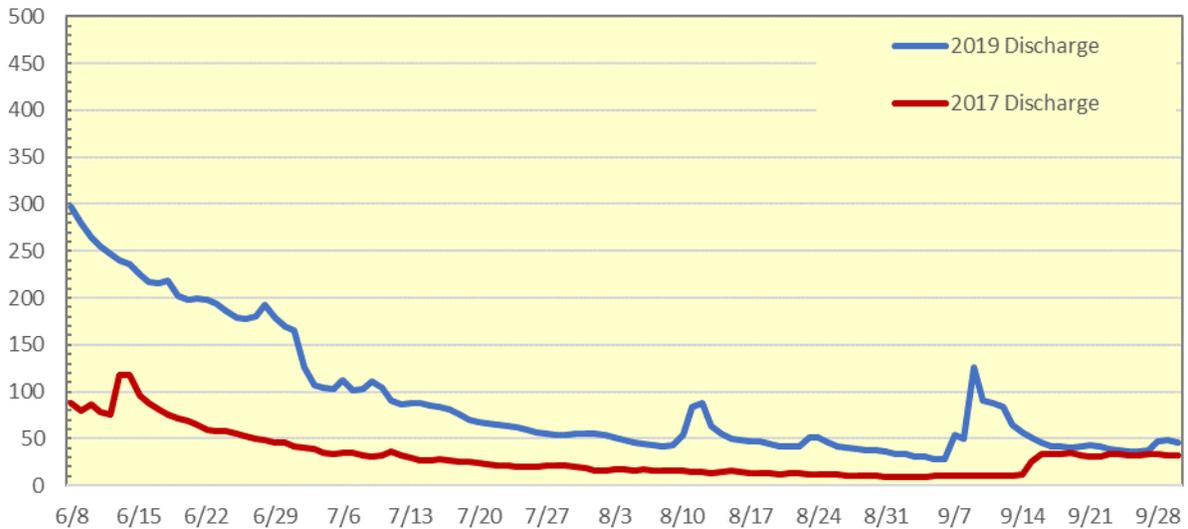


Figure 5: Comparison of 2017 and 2019 Streamflow at Monitoring Station P-2

2.2 Monitoring Station P-4

Monitoring station P-4 is located immediately downstream from the PPWU irrigation diversion. Due to sustained high flows on Prickly Pear Creek in the spring of 2019, the flow-monitoring station at P-4 was damaged, necessitating the installation of a new monitoring station. The new

flow monitoring station was not installed until mid-August, primarily due to safety concerns associated with high-flow installation and monitoring. Figure 6 shows the hydrograph at station P-4 in comparison to the hydrograph at upstream station P-2. Flow differences between P-4 and upstream station P-2 were slight, with only 1 to 3 CFS difference throughout the summer months. The 2019 seasonal low-flow recorded at station P-4 was 32 CFS on 9/05/2019.

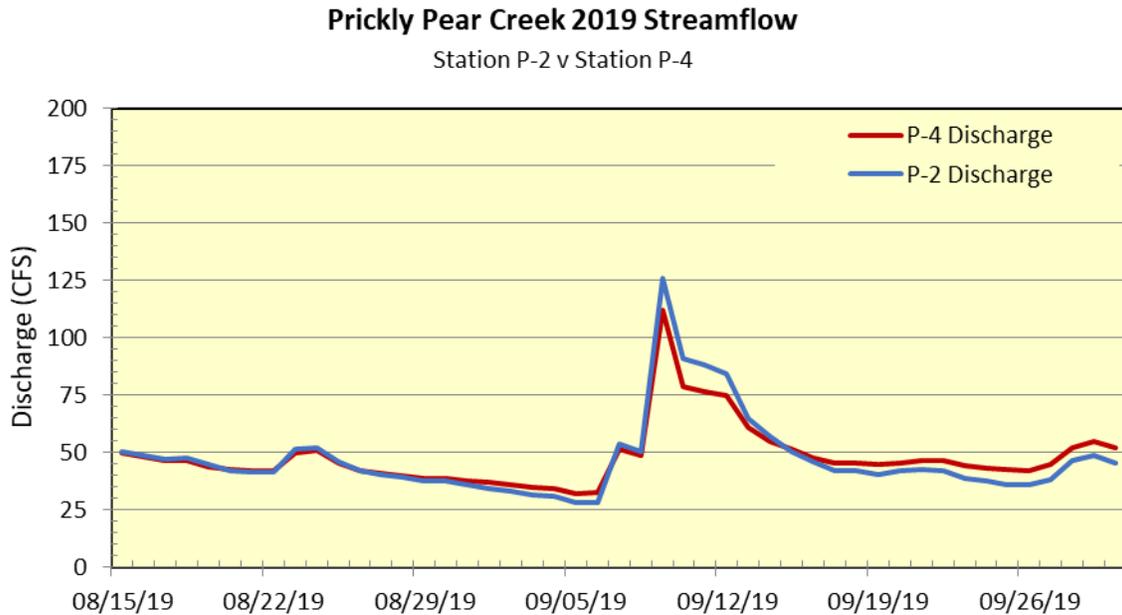


Figure 6. 2019 Flows at Prickly Pear Creek Monitoring Stations P-2 and P-4

2.3 Monitoring Station P-5

Monitoring station P-5 is located downstream from station P-4 at the crossing of Canyon Ferry Road. Streamflows (Figure 7) at the P-5 site were 10 to 12 CFS lower than upstream station P-4 during late season summer flow (Aug- early Sep 2019).

Flow losses through this reach (Figure 10) are the result of a few factors. Losses to groundwater occur as the creek flows through and recharges valley-fill sediments, and irrigation diversions of up to 6 CFS occur within this reach, with the majority of the diverted flows occurring at the Bonham/Bomparte diversion about ¼ mile downstream from station P-4. It is suspected that additional streamflow losses through this reach are the result of alluvial losses to groundwater associated with several gravel pits located adjacent to the stream channel. While this supposition has not been investigated formally through targeted assessments, it does not seem unreasonable that the nearby gravel operations are at least partially responsible for the flow losses observed through this reach.

Over a decade of flow monitoring on Prickly Pear Creek has shown that station P-5 is typically the location on the creek where the lowest seasonal flows have been recorded. In 2019 a seasonal low flow of 25 CFS was recorded on September 3rd at station P-5. This is in sharp

contrast to the seasonal low flow in 2017 of 1.7 CFS at station P-5. Figure 8 illustrates the difference in flow conditions at station P-5 from 2017 to 2019.

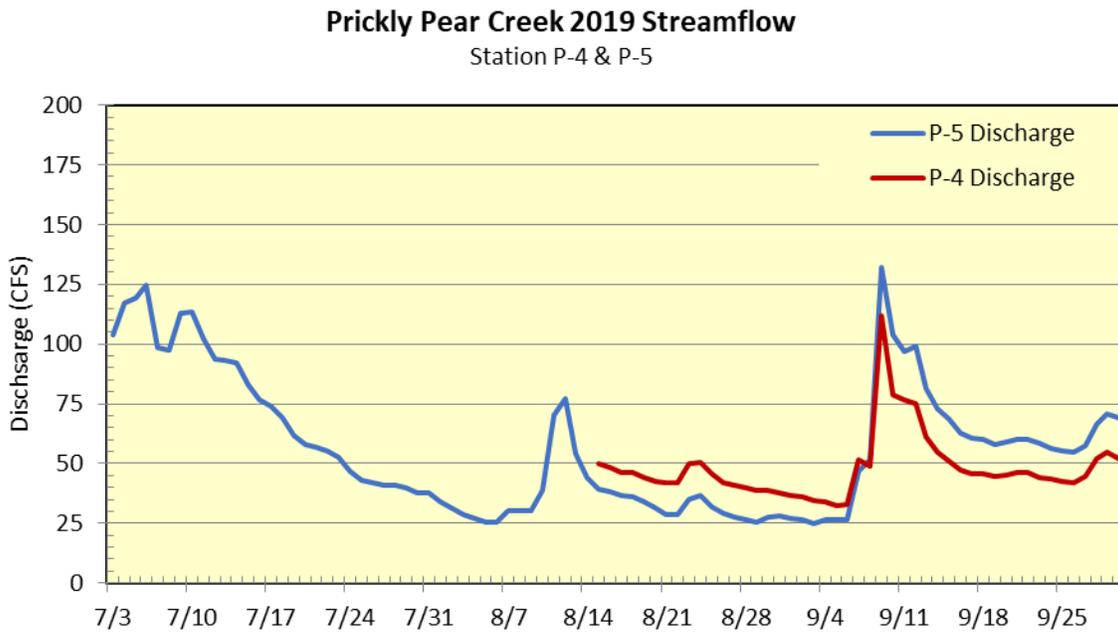


Figure 7. 2019 Flows at Prickly Pear Creek Monitoring Stations P-4 and P-5

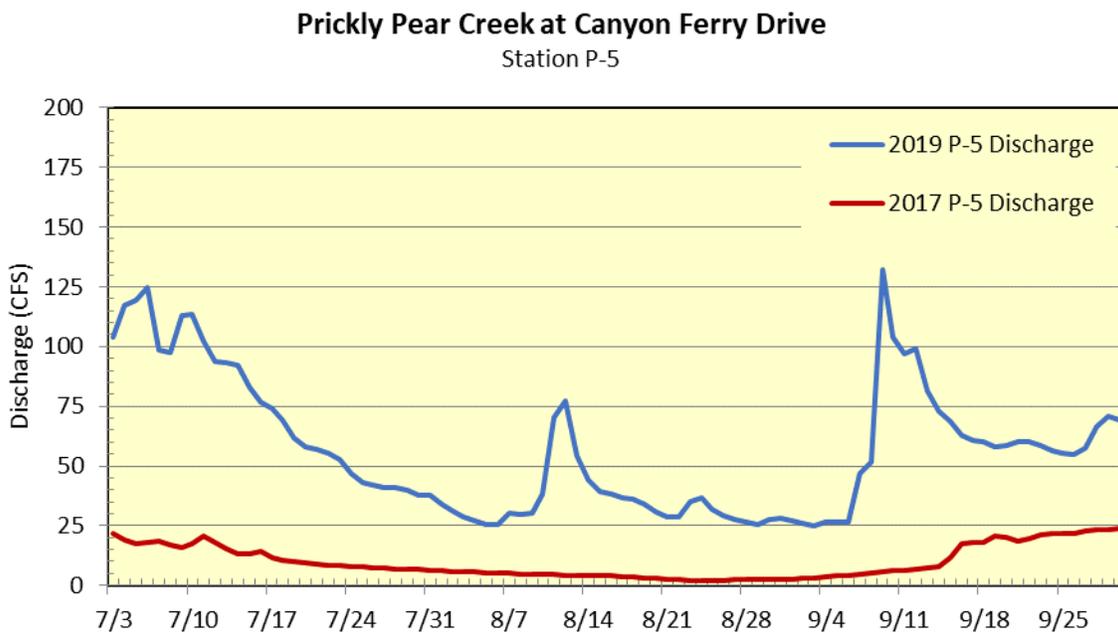


Figure 8. Comparison of 2017 and 2019 Streamflow at Monitoring Station P-5

2.4 Monitoring Station P-6

Monitoring station P-6 is located downstream from station P-5 at the York Road crossing. Due to stream access and channel stability issues, in 2018, the monitoring station was moved approximately 0.5 miles downstream to the state-owned Prickly Pear Creek Fishing Access Site and renamed station P-6.1.

During most years, streamflows at stations P-5 and P-6 are somewhat equivalent, with less than 2 CFS difference between the two stations. Figure 9 shows that streamflow at stations P-5 and P-6.1 were roughly equal during the summer of 2019.

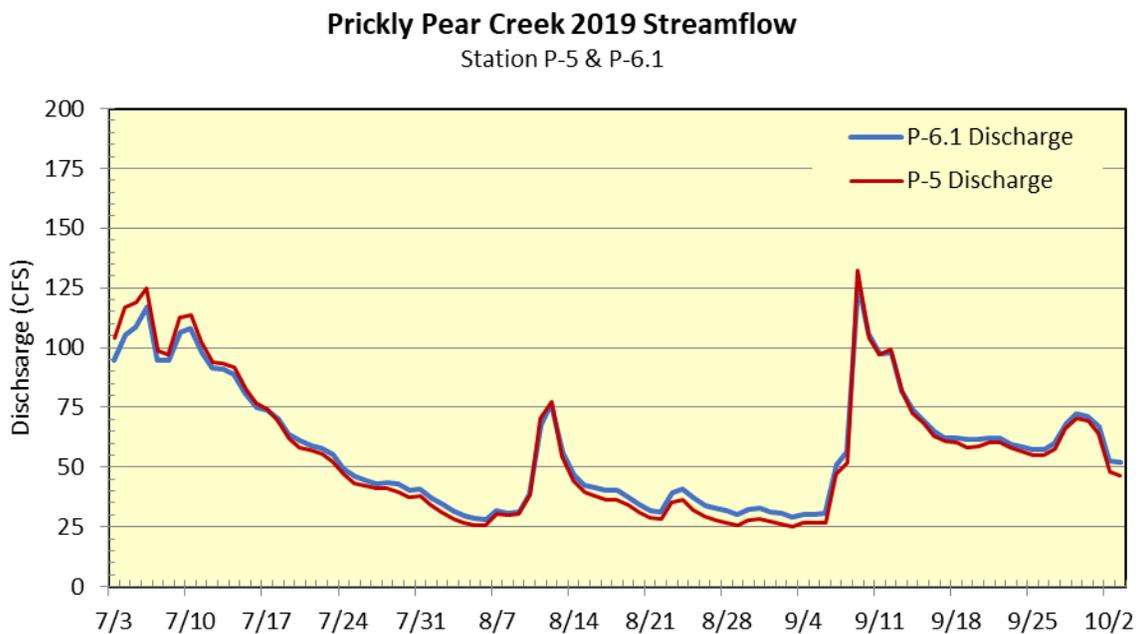


Figure 9. 2019 Flows at Prickly Pear Creek Monitoring Stations P-5 and P-6.1



Figure 10: Prickly Pear Creek and Project Monitoring Stations

3. Project Discussion

3.1 Project Benefits

The Rewatering Project was initiated on July 2nd, 2019 by the Helena Valley Irrigation District, which delivered 2,000 acre-feet of water (See Table 1) to the Prickly Pear Water Users Association, leaving an equivalent amount of streamflow in Prickly Pear Creek through these efforts. Prior to the Rewatering Project's genesis in 2008, long reaches of Prickly Pear Creek would go dry due to irrigation withdrawals. Since initiation of the Project, Prickly Pear Creek has not gone dry and has maintained a baseflow even during periods of extreme drought. This flow improvement has undoubtedly improved the physical and biological integrity of the stream corridor and has greatly improved recreational opportunities on the creek also.

2019 was an unusual water year in that Prickly Pear Creek maintained flow well above historic levels throughout the entire summer season. Streamflow in Prickly Pear Creek never fell below 25 CFS within the project reach in 2019. This is sharp contrast to 2017 when summer flows fell to below 2 CFS in mid-August.

3.2 Project Future

With another successful year implementing the Prickly Pear Creek Rewatering Project, we again begin to work to secure financial support for continuing this project for years to come. In 2016 the WQPD and the PPWU created a five-year agreement to continue the Rewatering Project until 2021. Also, a contract with the HVID was signed to continue the arrangement to deliver water to the PPWU system for the next five years. Both agreements are conditional on the WQPD having sufficient funding to implement the project each year. Funding for 2020 has been secured thanks to generous support from the Bonneville Environmental Foundation and Northwestern Energy.

In addition to flow monitoring, the Water Quality Protection District collected high flow and low flow water quality samples in both 2017 and 2018, aquatic insects in 2017, and collected benthic stream sediment samples in 2018. While beyond the scope of this report, these data will assist in evaluating water quality and ecological benefits to Prickly Pear Creek realized through the Rewatering Project.

The WQPD will continue to manage all project components moving forward and continue project effectiveness monitoring. All parties remain committed to seeing this project continue onward successfully, and with the continued support of the HVID, the BOR and the PPWU, there is reason for us to believe this project can find solid foundational support necessary to continue for years to come.

3.3 Acknowledgments

The 2019, Prickly Pear Creek Rewatering Project was made possible by numerous sponsors and partnerships. Primary funding and support was provided by the Bonneville Environmental Foundation (BEF), Northwestern Energy Corp., the Montana Department of Environmental Quality and the Lewis and Clark County Water Quality Protection District (WQPD). See Appendix A for project expenses.

Table 1: 2019 Water Usage Report: Prickly Pear Rewatering Project

Lateral	T.O.	Month	Day On	Time	Month	Day Off	Time	Total Days	Total Ac/FT Usage
HVC	123A	7	2	1000	7	16	1600	13	113.0
HVC	123A	8	6	900	8	9	800	2	11.7
HVC	123A	8	9	800	8	31	2400	21	134.8
HVC	123A	9	1	100	9	9	900	7	49.6
14.8	92B	6	3	1500	6	25	1700	21	21.9
14.8	92B	8	2	900	8	12	1300	9	60.5
14.8	92B	8	19	1100	8	23	1200	3	24.0
HVC	S1	6	2	900	6	4	900	1	39.7
HVC	S1	6	4	900	6	7	1400	2	89.1
HVC	S1	7	2	1100	7	30	1100	27	666.3
HVC	S1	7	30	1100	7	31	2400	0	24.5
HVC	S1	8	1	100	8	14	800	12	210.9
HVC	S1	8	28	900	8	31	2400	2	39.5
HVC	S2	7	2	1100	7	30	1100	27	277.6
HVC	S2	7	30	1100	7	31	2400	0	6.1
HVC	S2	8	1	100	8	31	2400	29	122.1
HVC	S2	9	1	100	9	4	900	2	13.2
HVC	S1	9	1	100	9	9	1000	7	95.5

2,000

APPENDIX A

2019 Prickly Pear Creek Rewatering Project Expenses

US Bureau of Reclamation Water Purchase	\$1,720
Helena Valley Irrigation District (HVID) Water Service Contract	\$12,000
Prickly Pear Creek Water Commissioner	\$1,500
Cash Totals	\$15,220
Lewis & Clark County In-Kind Contributions: Stream monitoring equipment & services, project administration, funding solicitation, reporting, and staff time	\$4,526
Total Project Cost	\$19,746