

Ecosystems Research Institute, Inc.



San Juan River Basin Recovery Implementation Program Habitat Monitoring 2019-20

Technical Proposal

March 2019

Introduction

In 1998, flow recommendations were developed by the SJRIP for the San Juan River below the confluence with the Animas River (River Mile 180). The details of the flow recommendations were heavily based upon river channel and habitat response to flows determined from a 7-year research study of channel morphology and habitat. In 1999, long-term monitoring was established to monitor channel and habitat response to flows. The protocols were continuations of those established during the 7-year research period and continued through 2004. From 1992 to 2007, the river-wide habitat mapping was conducted by ERI staff.

During the data integration process of 2004–2005, it became evident that backwater habitat types during base flow periods (800-1500 cfs) had been reduced in number and surface area beginning in September, 1995. Backwater surface areas between River miles 2 to 180 had decreased from 140,000 m² in September 1995 to less than 20,000 m², river wide by October 2003. From 2005 to 2015, backwater surface areas have stabilized at approximately 30,000 to 40,000 m². However, during 2016, the area of backwaters increased to over 90,000 m². It was hypothesized that the characteristics of the 2016 San Juan River spring runoff (magnitude, duration, etc.) were instrumental in the increase in low velocity habitats. These habitats persisted in 2017 with another high spring flow. However, in 2018, there was no spring release from Navajo Reservoir and the San Juan River experienced significant periods with summer baseflows less than 500 cfs. These resultant low flows reduced backwater surface areas to levels near their lows in 2004.

The 2019-20 habitat monitoring will document the impacts of the 2019 hydrograph, which is anticipated to be a better than average flow year. We are hypothesizing that the backwater habitat areas created in 2017 and 2018 will partially return if baseflows can be maintained at flows greater than 500 cfs.

Within the major goals of the SJRIP monitoring program, the results of this proposed project will in part meet goal number (2) “Track changes in abiotic parameters, including water quality, channel morphology, and habitat, important to the fish community in particular and the aquatic community in general”. Specifically, the major tasks to be undertaken are:

Task 1) Arrange the acquisition of high- resolution digital imagery from Rm 180 to Rm -10, (confluence with Lake Powell) and prepare maps for field verifications. Aerial imagery will be obtained from a consultant contracted by ERI. The ortho corrected photography will be acquired for the post run-off summer baseflows as soon as possible given the instability of flows due to the summer monsoonal season.

Task 2) Field habitat mapping will be conducted to verify flowing secondary channel types, backwaters, embayments, islands and total wetted areas under summer baseflow conditions in critical complex areas of the San Juan River that are problematic in interpreting conditions on the aerial images (channels with minimal inflow through cobble at the inflow area)

Task 3) Post-process the planform geometry into ARC GIS and determine density and area for each habitat type.

Task 4) Analysis data and prepare a final report describing the effects of the 2019 high flow hydrograph on the habitats and secondary channel types found in 2018 and compare them to the habitats created in 2016 and 2017.

The proposal time frame is from July 1, 2019 to September 31, 2020.

Project Justification

The SJRIP has, as one of its two primary goals, the conservation of populations of Colorado pikeminnow and razorback sucker in the San Juan River basin. To aid in the evaluation of achievement of these program goals, the following monitoring plan goals were developed (San Juan Draft Monitoring Protocols, 2010):

- 1) Track the status and trends of endangered and other fish populations in the San Juan River;
- 2) Track changes in abiotic parameters, including water quality, channel morphology, and habitat, important to the fish community in particular and the aquatic community in general;
- 3) Utilize data collected under Goals 1 and 2 to help assess progress towards recovery of endangered fish species; and,
- 4) Assess effectiveness of management actions, implemented flows, and intra- and inter-annual variability in flows on recovery of Colorado pikeminnow, razorback sucker and population status of other fish species.

Relative to this proposal, SJRIP goal (2) and (4) above will be met in part. Specifically, achievement of this goal will occur through the tracking of species important backwaters (numbers and areas), as well as channel complexity necessary for all life stages of the two rare fish in the San Juan River. Updating the existing database and comparing the current information will provide a status and trends.

Project Objectives

The specific objectives of this work-plan correspond to the overall objectives of the monitoring protocols (2012). Specifically the direct linkage of objectives between this study and protocol objectives (by number) that are in common include:

Objective 1) Annually, following spring runoff, document abundance and distribution of key habitats and geomorphic features (backwaters, embayments, islands and total wetted area) that indicate the response of the river channel and habitat to antecedent runoff conditions and specific management actions... *(Specifically determine the impact of the 2019 water hydrograph conditions on habitat planform)*. However, in 2019-20, mapping maybe done with a test higher baseflow (1,000-1,500 cfs). The test will depend on available water and the desire and direction of the San Juan River Recovery Implementation Program Biology Committee

Objective 8) Develop relationships between habitat availability and antecedent flow conditions. Use key habitats for this analysis. *(For example, the hydrograph for 2016 and 2017 produced more days above 8,000 and 5,000 cfs since the high flows of 2008 and produced the most backwater area since 1995. Conversely, flows in 2018 were well below those in 2016-17 and backwater habitat was reduced to the second lowest level since 2004). The project will evaluate if the existing*

relationships between habitat densities and antecedent conditions are still valid for the habitat densities that will be found after the 2019 spring runoff).

Objective 9) Track long-term trends of habitat availability

Task 1. Develop high-resolution Digital Imagery for Rm 3 to Rm 180.

The San Juan River will be flown and digital images captured at a resolution of 10 centimeters. Images will be printed with a 20% overlap between images and placed in plastic overlays.

Task 2 Field Habitat Mapping

If necessary, field-verify selected problematic marginally flowing secondary channels during the summer base-flow period (2019) captured in the aerial images. This will be dependent upon flow at image capture. All secondary channels, main channel splits, island splits and cobble/sand bar splits will be noted on base-maps and compared to the newest images.

Task 3) Post-process the planform geometry into ARC GIS and determine density and area for each habitat type.

Once the digital frames have been registered, ArcGIS will be used to digitize the boundaries of the wetted secondary channels. In addition backwaters, embayments islands and in-stream sand/cobble bars will be mapped. The data will be processed and summarized by river-mile to match existing datasets.

Task 4) Prepare a final report describing the effects of the 2019 high flow hydrograph on the habitats and secondary channel types compared to 2016, 2017 and 2018.

A final report will examine the relationships between hydrology (especially recent antecedent hydrology conditions prior to image capture and mapping) and habitat conditions (density and area) throughout the river. Trend analysis will be performed on all habitat types mapped to assess trend with time and flow at mapping. Trends with time will be analyzed with raw data (habitat count and area by river-mile with time) and with data normalized for flow at mapping where flow is a covariate. Antecedent conditions will be calculated and relationships to habitat abundance compared to previously developed relationships.

One of the following hypothesizes to be addressed for the 2019 data depending upon the hydrologic conditions prior mapping.

H₀₁: If the spring runoff is greater than the average runoff, TWA, Island Count and Backwater Type area will increase compared to the 2018 habitat characteristics (density and area)

H₀₂: If the spring runoff is equal to the average runoff, TWA, Island Count and Backwater Type area will remain the same compared to the 2018 habitat characteristics (density and area)

H₀₃: If the spring runoff is less than the average runoff, TWA, Island Count and Backwater Type area will not change compared to the 2018 habitat characteristics (density and area)

H₀₄: If mapping is done at an elevated baseflow (1,000-1,500 cfs) the added flow over normal

baseflow conditions will result in greater TWA, Island counts and flowing secondary channels as part of the habitat post processing analysis, backwater and embayments will be divided into several types. These types of backwaters include those associated with main channel point bars and point bars on islands. In addition, backwaters associated with dry secondary channels and dry island split channels will be defined and quantified by river mile (count and area). Recent analysis has resulted in all historical backwater data being reclassified into these categories.

Schedule

Base photography will be acquired in late July or early August 2019 (flow permitting). Frame capture, rectification, and photo-interpretation will be completed by September 15, 2019. Field mapping will occur as soon as possible following spring runoff and will be done by the end of September, 2019. If water is available, mapping may occur at a higher baseflow as previously noted. Field verification will occur immediately following image capture. ARC GIS data transfer will be completed by December 31, 2019. The draft annual report will be completed by March 31, 2020 with the final report due June 1, 2020.

Deliverables

- 1) Aerial images of channel at a flow between 500 and 1,000 cfs.
- 2) Polygon area, perimeter and geo-referenced location of backwaters, embayments, islands, and channel margins
- 3) Flow at mapping (flight date) for each USGS gage. Distribution and abundance (area and density) of backwaters, embayments and total wetted area in response to antecedent runoff condition and other management actions. Channel complexity (e.g. island count and total wetted area per river mile)
- 4) Date of mapping
- 5) Antecedent runoff hydrograph
- 6) Data summarized by river mile, geomorphic reach and full range
 - An annual draft report prepared and submitted by March 31, 2020
 - A final report submitted by June 1, 2020
 - Attendance at the annual report meeting

APPENDIX A

Qualifications of Investigators

The project team will be made up of staff from Ecosystems Research Institute, Inc (ERI) ERI has extensive experience on the San Juan River and its tributaries having annually mapping aquatic habitats since 1991. In addition, the principal (Dr. Vincent Lamarra, ERI) has a long-standing presence on the Biology Committee of the SJRIP. Mr. Daniel Lamarra of ERI will be responsible for the field and laboratory habitat portion of the work elements. Mr. Daniel Lamarra has mapped the habitats used by the SJRIP for the last five years, including the RERI Phase I and II channels. That same group of scientists at ERI will be used on this project. This will result in a consistent database between the current project and the historical information gathered by the program.

In addition, these scientists have written numerous reports dealing with habitat quality, habitat and fish interactions as well as the effect of physical factors (temperature) on fish distributions in the San Juan River.

For convenience, ERI will manage the Image acquisition contractor (Blue Sky Consulting) as part of this project.

APPENDIX B

Budget for 2020 Habitat Monitoring

TASK (2020)	Labor	Direct Costs	Total by Task
Contractor Image Capture (Blue Sky Consulting)	\$0	\$58,500	\$58,500
Task 1 Map Preparation			
<i>Image Clipping and Capture</i>	\$2,060	\$1,267	\$3,327
Task 2 Field Verification			
<i>Habitat and Channel determination</i>	\$9,840	\$1,184	\$11,024
Task 3 Post Process			
<i>Image rectification</i>	\$2,060		\$2,060
<i>Digitizing Waters Edge</i>	\$16,782		\$16,782
<i>Back Water/ Embayment Identification</i>	\$8,672		\$8,672
Task 4 Final Report and Presentation			
<i>Data Analysis</i>	\$21,985	\$984	\$22,969
<i>Reporting</i>	\$17,308	\$870	\$18,178
Total Cost Estimate	\$78,707	\$62,805	\$141,512

SUMMARY

TASK	Labor	Direct Costs	Total by Task
Contractor Image Capture	No Charge	No Charge	No Charge
Task 1 Map Preparation			
Image Clipping and Capture	\$2,060	\$1,267	\$3,327
Task 2 Field Verification			
Habitat and Channel determination	\$9,840	\$1,284	\$11,024
Task 3 Post Process			
Image rectification	\$2,060		\$2,060
Digitizing Waters Edge	\$16,782		\$16,782
Back Water/ Embayment Identification	\$8,672		\$8,672
Task 4 Final Report and Presentation			
Data Analysis	\$21,985	\$984	\$22,969
Reporting	\$17,808	\$870	\$18,678
Total Cost Estimate	\$66,607	\$4,365	\$83,012

LABOR (Hours)

Principal \$150/hr	Ecologist \$150/hr	Sr. Scientist \$120/hr	Biologist \$62.5/hr	GIS Analyst \$103/hr	GIS Specialist \$88/hr	Tech Editor \$62.5/hr
				20		
		82				
				20		
8		8		130	14	
8		8		16	58	
60		80	8	6	8	24
16		100			16	24
92	8	194	8	172	96	48

EXPENSES

Direct Costs

Task	Unit	QTY	Cost	Totals by Task
Task 1 Image Capture				
Printing	\$175	5	\$875	
Printing/Shipping	\$392	1	\$392	
				\$1,267
Task 2 Field Verification				
Travel	0.52	1200	\$624	
Per Diem	14	40	\$560	
				\$1,184
Task 3 Data Analysis				
Travel	0.52	1200	\$624	
Per Diem	4	40	\$160	
Lodging	100	2	\$200	
				\$984
Task 4 Final Report and Presentation				
Airfare	\$450 /Trip	1	\$450	
Lodging and Meals	\$140 /day	3	\$420	
				\$870