

Ecosystems Research Institute, Inc.



San Juan River Basin Recovery Implementation Program Habitat Monitoring 2018-19

Technical Proposal

March 2018

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.

The data integration analysis in 2005 also indicated that complex channel reaches (those with high habitat diversity, islands, multi-threaded channels and complex channel margins) correlated to native fish abundance. Furthermore, capture of Young-of-year (YOY) endangered fish also tended to correlate with channel complexity. Finally, backwater and low velocity habitats were more likely to occur in these reaches with high complexity.

Standardized habitat monitoring for the San Juan River was included in the 2000 monitoring plan and was reviewed and revised for the 2011 to 2015 monitoring project. Those revisions were formalized in the 2012 San Juan River Monitoring Plan and Protocols. The initial five- year effort with the revised habitat protocols was completed in 2015.

The final report on this 5-year monitoring effort concluded that there has been a significant loss in critical habitats over time (significant negative regression slope) and that certain low – flow antecedent conditions were correlated with these habitat losses.

As noted previously, several of these habitat characteristics, (Total Wetted Area, Island Count, and Low Velocity Habitats) increased after the 2016 San Juan River spring runoff. Currently, the Bureau of Reclamation is predicting that the 2017 spring runoff will be above average and similar to the 2016 flows.

The 2018-19 habitat monitoring will document the impacts of the 2018 hydrograph on the newly created critical habitats from 2017 and evaluate the mechanisms hypothesized to have created or reduced the amount of these habitats (threshold flows and/or duration in magnitude of flows for 2018).

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 Powel) and prepare maps for field verifications. Areal imagery will be obtained from a consultant contracted by the Program Office. Photography may occur in either the spring (pre-runoff) or the summer/fall (post run-off) if water is available to test an elevated baseflow

Task 2) Field Habitat Mapping (verification of flowing secondary channel types, backwaters, embayments, islands and total wetted areas under summer baseflow conditions) in critical complex areas of the San Juan River

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 2017 high flow hydrograph on the habitats and secondary channel types found in 2015 and created in 2016.

The proposal time frame is from July 1, 2018 to September 31, 2019.

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 2018 high water hydrograph on habitat planform*). However, in 2018-19, mapping maybe done with a test higher baseflow (1,000-1,500 cfs). The test will depend on available water

Objective 8) Develop relationships between habitat availability and antecedent flow conditions. Use key habitats for this analysis. (*The hydrograph for 2016 has produced more days above 8,000 and 5,000 cfs since the high flows of 2008 and produced the most backwater area since 1995. Evaluate if the existing relationships between habitat densities and antecedent conditions are still valid for the habitat densities that will occur after the 2017 spring runoff*).

Objective 9) Track long-term trends of habitat availability

Task 1. Develop high-resolution Digital Imagery for Rm -10 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. Field mapping will be on these plastic sheets and will cover key reaches of the river where overhanging vegetation conceals the entrance of secondary channels.

Task 2 Field Habitat Mapping

Field verification of flowing secondary channel types will occur during the summer base-flow period (2018), that may include elevated baseflows.

Using these habitat categories at a scale of 1" = 200', map directly onto field images developed in Task 1. All flowing secondary channels, main channel splits, island splits and cobble/sand bar splits will be noted and included as total wetted area.

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

Once the digital frames with the field mapping 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 2018 high flow hydrograph on the habitats and secondary channel types compared to 2016 and 2017

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 2018 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 2017 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 2017 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 2017 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 2018 (flow permitting). Frame capture, rectification, and photo-interpretation will be completed by September 15, 2018. Field

mapping will occur by the end of September, 2018. If water is available, mapping may occur at a higher baseflow as previously noted. Field verification will occur immediately flow image capture. ARC GIS data transfer will be completed by December 31, 2018. The draft annual report will be completed by March 31, 2019 with the final report due June 1, 2019.

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, 2019
 - A final report submitted by June 1, 2019
 - 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.

APPENDIX B

Budget for 2019 Habitat Monitoring

Budget: 2019

TASK	Labor	Direct Costs	Total by Task
Contractor Image Capture	No Charge	No Charge	No Charge
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	\$66,807	\$4,305	\$83,012