

## **A Comprehensive Monitoring Plan for Fossil Creek Watershed Restoration**

In March 2004, Northern Arizona University was awarded a grant by the Nina Mason Pulliam Charitable Trust to begin work on *A Comprehensive Monitoring Plan for Fossil Creek Watershed Restoration: a Model for Decommissioning Hydropower Facilities in the 21<sup>st</sup> Century*.

The Pulliam grant will underwrite the first year of what we hope will be a multi-year project to provide recommendations, assess progress and catalyze NAU involvement in the restoration of the Fossil Creek stream and watershed. Our actions in this effort are to: inform, monitor and evaluate the decommissioning and restoration actions, coordinate participation of diverse interest groups, and encourage dissemination of results. The project will build upon NAU's recent and current work to develop a scientific understanding of the Fossil Creek linked ecosystem and hydrosystem, as well as on NAU's relationships with APS, the U.S. Forest Service (USFS), the Federal Energy Regulatory Commission (FERC), Salt River Project (SRP) and conservation groups such as American Rivers and The Nature Conservancy.

### **Background**

Fossil Creek provides one of the best opportunities for riparian restoration in the Southwest, where over 90% of wetland and riparian areas have been lost or degraded over the last century. The decision to shut down the Childs-Irving hydroelectric facilities and restore flow to the creek is important at local, state and national levels; the ensuing restoration actions can serve as elements of a model, when restoration is sought for other aging dams around the nation and elsewhere.

The success of restoration projects and the development of restoration ecology depend upon linking on-the-ground practice with multi-disciplinary sciences, such as hydrology and geomorphology. Of the thousands of stream restoration activities carried out each year in the U.S., including a steadily increasing number of dam removals, only a fraction benefit from the combined insights of practitioners and scientists. Policy makers approve costly decisions to restore ecosystems with little ability, or effort, to measure the success of these actions. Because few dam removal projects have adequate baseline data to evaluate the effects of restoration, Fossil Creek can serve as a case study to inform and guide policy and practices surrounding flow restoration, watershed rehabilitation and facility removal projects. The results will be applicable to decisions concerning the tens of thousands of small dams that will be decommissioned in the years and decades to come – both nationally and internationally.

### **Goals, Strategies and Anticipated Outcomes**

Two major challenges in watershed and riparian restoration are to develop and incorporate scientific data early in the management process and to coordinate the varied responsibilities, mandates, and interests of multiple stakeholders.

Six goals to address these challenges and the proposed measurable outcomes are listed below.

**Goal 1: Document the baseline condition of the watershed prior to restoration of full flows.**

**Strategy** – Fossil Creek will serve as a case study for dam decommissioning because it will be one of the first projects with sufficient baseline data to critically evaluate the success of flow restoration. We will develop a comprehensive dataset characterizing physical, biological, and human-use parameters in both the channel and the overall watershed prior to flow restoration. Our interdisciplinary team will collect data on ecosystem health, native and exotic species distributions, sediment distribution, water quantity and quality, physical parameters of the stream and watershed, travertine distribution, and recreational use. Baseline information on the human dimension at Fossil Creek will characterize recreational user groups; strategies will include gathering public perceptions through public meetings and interviews, evaluating current ecological impacts (e.g. trails, roads, and campsites), and defining needed interpretive and educational themes.

*Outcome Indicator 1:* A *State of the Fossil Creek Watershed Report* will be published and electronically posted to the Verde Watershed Research & Education Program (VWREP) website. The report will be disseminated to land and resource management organizations, NGOs, local governments, and tribes. We fully anticipate that land and facility managers, conservation organizations and others will use the report to make informed decisions.

*Outcome Indicator 2:* Information on human dimensions will be synthesized into a Human Use Database of current ecological impacts using maps of current recreation use conditions and documentation of resident and visitor perceptions regarding the restoration of full flows.

*Outcome Indicator 3:* The State of the Watershed Report and Human Use Database will be used by management agencies. It will be referenced in agency management plans and incorporated into the official project documentation of the Federal Energy Regulatory Commission.

**Goal 2: Design and initiate a long-term monitoring and assessment program to measure restoration progress and identify changes in the watershed after flows are restored.**

**Strategy** – We will consult with management agencies and other interested parties to incorporate their monitoring needs, along with our baseline information, into a comprehensive monitoring plan that includes specific biological, physical, and human indicators. We will collect information on how different parties view a successful restoration project and develop biological, physical, and human use indicators to measure whether these criteria are met. We will develop cost estimates for implementing the monitoring plan and pursue funding for long-term implementation.

*Outcome Indicator 1:* Parties will be consulted for input on monitoring needs.

*Outcome Indicator 2:* The monitoring plan will be developed and disseminated.

*Outcome Indicator 3:* Proposals will be submitted to funding agencies for full or partial support of the monitoring program.

**Goal 3: Provide tangible, science-based recommendations to the U.S. Forest Service, APS, FERC and other decision makers.**

*Strategy* – From project inception, we will engage in dialogue with USFS, APS, FERC and other agencies guiding the decommissioning. We will work in an advisory capacity to facilitate and improve the decommissioning and restoration process. Building on the *State of the Fossil Creek Watershed Report*, we will develop a set of recommendations to address the major challenges facing sustainable management of the Fossil Creek riparian corridor, as well as recommendations for managing the entire watershed, which influences channel processes. Recommendations will incorporate ecological, hydrological and geological systems science, and the human dimension, and will address remote recreational site management, exotic species management, release of sediment stored above the dam, protection of springs, and management of sensitive species.

*Outcome Indicator 1:* Recommendations, including science-based recommendation that have the potential to affect policy, will be developed and written into a ‘Recommendations’ supplement to the *State of the Fossil Creek Watershed Report* and be provided to management agencies and organizations (e.g. USFS, FERC, Bureau of Reclamation, USFSW, Arizona Game and Fish Department and APS), and other interested parties (e.g. local communities).

*Outcome Indicator 2:* The project will provide, on a semi-annual basis, suggestions for additional scientific research, monitoring or evaluation to all interested parties as updates to the State of the Watershed report.

**Goal 4: Facilitate participatory meetings among management agencies, conservation organizations and local stakeholders to identify concerns related to monitoring and restoration and further refine the monitoring plan and restoration process.**

*Strategy* -- We will conduct interviews and meetings with key individuals and organizations promptly following project award to inform them of the monitoring plan and restoration process. We will seek input on how they perceive a successful restoration project and their priorities for monitoring. This will assure that multiple interests and perspectives are voiced and incorporated into management and monitoring plans. NAU has identified numerous diverse parties who have a direct interest in Fossil Creek restoration (see appendix), and additional interested parties may emerge through the process.

NAU will facilitate an open and collaborative process that will identify points of agreement on key elements of the monitoring plan as well as areas of concern regarding the restoration process. This will build upon information gathered through scoping meetings held previously by the U.S. Forest Service, but will emphasize development of a method to measure success of the restoration process.

*Outcome Indicator 1:* At least three participatory meetings will be organized and facilitated.

*Outcome Indicator 2:* Initial findings of participatory meetings will be disseminated to participating parties, and monitoring plan elements will be accepted and/or modified based on findings of the participatory meetings.

**Goal 5: Develop an adaptive management process to continuously improve and modify the monitoring plan and provide long-term input to the restoration process.**

*Strategy* -- Provide input to the Forest Service and APS concerning the planning and implementation of decommissioning and restoration. In concert with the Forest Service and APS, develop an adaptive management process for the decommissioning and restoration actions and monitoring activities. Actively participate in implementing the adaptive management program. NAU will provide input annually (beginning in spring 2005) to the decommissioning and restoration planning and implementation. NAU will also host an adaptive management meeting to initiate the adaptive management process.

*Outcome Indicator 1:* The success of an annual adaptive management meeting will be determined by reviewing the number and diversity groups participating, as well as the number of new ideas or issues that emerge that had not previously been considered.

*Outcome Indicator 2:* Input to the Forest Service and APS is considered, and hopefully implemented, within the decommissioning and restoration process. Barriers to implementation are identified.

**Goal 6: Disseminate lessons learned from Fossil Creek in the popular and scientific press, as well as through national conservation organizations. Create an on-line repository for project reports and information for use by agencies, conservation groups and others to guide and inform other dam removal, decommissioning and restoration projects and actions.**

*Strategy* -- Near the end of the project's initial year, we will disseminate information on the comprehensive monitoring plan and the participatory planning process, as well as baseline scientific and technical findings. Four populations will be the target recipients of initial year information:

- Local and regional interest groups;
- Public policy entities anticipating dam removal or watershed restoration in their locales;
- National conservation organizations engaged in projects to protect rivers and streams through decommissioning, dam removals or improved dam management;
- Science and technical professionals engaged in watershed restoration.

Within three months from project commencement, an information dissemination plan will be developed for each of the four target populations. This plan will outline the best ways to reach targeted audiences, including news releases, conference presentations, website postings (for example, using the [verde.nau.edu](http://verde.nau.edu) website) with links to other websites, distribution of report summaries to national organizations, scholarly publications, etc. Implementation of these dissemination strategies will then commence and continue indefinitely.

*Outcome Indicator 1:* Information on baseline data collection, recommendations, public meetings, monitoring plan developments, and lessons learned will be posted on the VWREP website and linked to other websites. (*July 2004-ongoing*)

*Outcome Indicator 2:* At least three organizations (e.g. The Nature Conservancy's *Freshwater Initiative*, American River's *National River Restoration Science Synthesis Project*, the U.S. Bureau of Reclamation, and the U.S. Forest Service) will distribute project information and lessons. (*August 2004 – April 2005 and ongoing*)

*Outcome Indicator 3:* At least three presentations at conferences or to local organizations will be made by the end of the first year of the project. (*August 2004 – April 2005*)

*Outcome Indicator 4:* At least two reports on the comprehensive monitoring plan and lessons learned from the first year of the project will be published in the popular and/or scientific press. (*January – April 2005*)

### **Partners and Staffing**

This effort reflects collaboration among faculty, staff and students from three NAU Departments (Biology, Civil & Environmental Engineering, and Geology), two Colleges (Arts & Sciences, Engineering), the School of Forestry, the Verde Watershed Research and Education Program, and the Center for Sustainable Environments. These programs have worked together, with proven success, and have an excellent track record of involvement with the key partners: APS and the U.S. Forest Service (Coconino, Prescott and Tonto National Forests).

Additionally, we have excellent working relationships with other governmental and non-governmental agencies participating in the decommissioning and restoration process at Fossil Creek: FERC; Arizona Game and Fish Department; U.S. Bureau of Reclamation; U.S. Fish and Wildlife Service; American Rivers; Audubon Society; Center for Biological Diversity; The Nature Conservancy; and the San Carlos Apache and Yavapai Apache Nations.

Although the above list of organizations is impressive, each organization has a well-constrained and often very limited role in the decommissioning and restoration process and none will be taking on the role of comprehensive monitoring of impacts or coordinating the efforts of the diverse group. It is a comprehensive monitoring and coordination role that NAU will undertake.

Jane Marks will lead efforts related to the ecosystem research conducted at Fossil Creek. Jane has completed or is completing a variety of evaluations and studies of the Fossil Creek ecosystem. Bill Auberle of the Department of Civil and Environmental Engineering will be responsible for dissemination of project results and facilitation of participatory meetings. Abe Springer will lead efforts related to the groundwater system and geological aspects of the Fossil Creek watershed. Martha Lee will lead efforts related to human (recreational) impacts. Charlie Schlinger will lead activities related to surface water hydrology and sediment transport, and serve as project leader; he serves as Co-Director of the Verde Watershed Research & Education Program (VWREP) at NAU. Three NAU graduate students and several undergraduate students will participate.