

# Moving from Impairment to Delisting

## Committed Landowner Implements and Advocates Improved Grazing Practices in Nutrioso Creek, Reducing Turbidity Levels to Attain Water Quality Standards

Since the late 1800s, the Nutrioso Valley experienced heavy grazing that contributed to excessive erosion and elevated turbidity levels. The excessive turbidity resulted in unsuitable stream habitat for Nutrioso Creek’s aquatic communities. As a result, the Arizona Department of Environmental Quality (ADEQ) placed a seven mile stretch of Nutrioso Creek on the state’s section 303(d) list of impaired waterbodies and developed a turbidity TMDL approved in 2000. Although historic grazing practices were the primary cause of impairment in Nutrioso Creek—it was progressive grazing practices implemented by a committed local landowner that led to the restoration of Nutrioso Creek. TMDL effectiveness monitoring data collected from 2004 to 2006 indicated that Nutrioso Creek met the TMDL load allocation and attained water quality standards. In 2009, Nutrioso Creek was the first waterbody removed from the Arizona’s section 303(d) list of impaired waters due to implementation activities.

### TMDL at a Glance: Nutrioso Creek TMDLs— Turbidity

(approved September 2000)

[www.azdeq.gov/environ/water/assessment/download/nutrioso.pdf](http://www.azdeq.gov/environ/water/assessment/download/nutrioso.pdf)

- Factors causing impairment:**  
Elevated turbidity levels for aquatic and wildlife cold water streams
- Sources contributing to impairment:**  
Stream bank and channel erosion induced by livestock grazing practices, livestock and wildlife access to streams, and riparian vegetation loss
- Restoration options:**  
Improve range management practices, exclude livestock and wildlife from streams, re-vegetation of riparian areas, conservation easements, and adopting livestock, nutrient, irrigation, and pest management strategies
- Stakeholder involvement:**  
EC Bar Ranch owner, local watershed residents, Little Colorado River Watershed Partnership, Nutrioso Creek Watershed Partnership, state and federal agencies
- Status of waterbody:**  
Full attainment of water quality standards; removed from 303(d) list in 2009

- Benefits to stakeholders:**  
Water quality, wildlife habitat, education, funding, partnerships

### How are TMDLs at work in Nutrioso Creek?

The ADEQ developed the turbidity TMDL for Nutrioso Creek to protect aquatic wildlife, including the federally endangered Little Colorado spinedace, from excessive sedimentation. Through the TMDL analysis, stakeholders were provided with an understanding of the significant sources and critical flow conditions contributing to the turbidity impairment in Nutrioso Creek. In addition, the TMDL analysis provided a link between turbidity and total suspended solids, providing stakeholders with an understandable and measurable end point for assessing progress toward achieving the turbidity water quality standard. The final TMDL report also provides a description of the effectiveness monitoring planned to determine progress of TMDL implementation, along with a phased TMDL implementation timeline, description of goals, and implementation milestones.

### Who were the participating stakeholders and key partners?

ADEQ is responsible for developing Arizona’s TMDLs, including the Nutrioso Creek turbidity TMDL, with participation from key partners and stakeholders. Unlike TMDL development, TMDL implementation for nonpoint source-related issues is in the hands of local stakeholders and partners. Local stakeholders that initiated implementation activities, as well as participated in TMDL development,

### What is a total maximum daily load (TMDL)?

It is a study or analysis that calculates the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. The TMDL establishes a pollutant budget and then allocates portions of the overall budget to the pollutant’s sources. For more information on TMDLs, visit EPA’s website at [www.epa.gov/owow/tmdl](http://www.epa.gov/owow/tmdl).

include members of the Nutrioso Creek Watershed Partnership and the Upper Little Colorado River Partnership. A key stakeholder involved in TMDL implementation is Jim Crosswhite, the owner of the E.C. Bar Ranch that contained 3 miles of the impaired Nutrioso Creek. Key state partners, in addition to ADEQ, included the Arizona Game and Fish Department (AGFD), Arizona State Land Department, Arizona Department of Agriculture, and the Arizona Water Protection Fund. The U.S. Environmental Protection Agency (EPA) is a key federal partner involved in both reviewing and approving the turbidity TMDL for Nutrioso Creek and providing funding to support implementation. Other key federal partners include the U.S. Forest Service, responsible for managing the Apache-Sitgreaves National Forest that contained 4 miles of the impaired Nutrioso Creek, as well as the U.S. Fish and Wildlife Service.

## **How did stakeholders participate in the TMDL process?**

The overall TMDL process includes the following elements: section 303(d) listing decisions, TMDL development, and TMDL implementation. Each element of the TMDL process provided stakeholders with an opportunity to express concerns and share information about the water quality problems in Nutrioso Creek with the ADEQ and other key partners. A description of each element of the TMDL process is provided below.

### *Section 303(d) Listing Decisions*

If a waterbody does not meet water quality standards (i.e., numeric or narrative criteria) for one or more pollutants, it goes on a state's 303(d) list. Impaired waterbodies on this list require a TMDL for each pollutant contributing to the impairment. Stakeholders have the opportunity to provide input during the 303(d) listing process. ADEQ placed Nutrioso Creek on the state's 303(d) list in 1996. To verify and identify the turbidity impairment, ADEQ conducted three-days of intensive watershed-wide turbidity sampling in 1999 and in 2000 in addition to targeted monitoring.

### *TMDL Development*

ADEQ initiated the development of the Nutrioso Creek turbidity TMDL due to turbidity levels in a seven-mile stretch of the creek that exceeded the turbidity water quality standard for aquatic and wildlife cold water streams. The turbidity water quality standard of 10 Nephelometric Turbidity Units (NTU) is an indirect measure intended to protect aquatic and wildlife designated uses from excessive sedimentation. Therefore, the ultimate goal of restoring the condition of the biological communities and in-stream habitat in Nutrioso Creek is linked to reducing the amount of sediment entering Nutrioso Creek from the identified sources.

Although turbidity is a useful indirect measure for the purposes of water quality standards, it is challenging to use in the context of TMDL development. The TMDL framework requires a pollutant quantified using a measure of mass to develop a daily load. The unit used to measure turbidity—NTU—measures light refraction. As a result, ADEQ needed to identify a related surrogate for turbidity for calculating a pollutant load. ADEQ selected total suspended solids (TSS) as the surrogate for turbidity and established a quantifiable, statistical relationship between turbidity values and TSS values. ADEQ used this relationship to understand how reductions in TSS would translate into reductions in turbidity levels, allowing them to identify the TSS value that would correlate to the turbidity water quality standard. The final TMDL report stated that the turbidity water quality standard of 10 NTUs is equivalent to a TSS target value of 7.91 milligrams per liter (mg/L) and a TSS target load of 183 pounds per day (lbs/day).

The TMDL development process revealed that excessive turbidity levels in Nutrioso Creek are due to suspended solids resulting from excessive sediment loads. Factors contributing to the excessive sediment loads include streambank erosion due to stream channel degradation, loss of floodplain, and lack of adequate riparian vegetation. ADEQ determined that Nutrioso Creek has no point sources of turbidity. As a result, the TMDL

report contains a load allocation for nonpoint sources and a wasteload allocation of zero for point sources.

Through the TMDL analysis, ADEQ identified the period from February to May as the critical season for sediment loading in Nutrioso Creek. These months are critical because they are characterized by high spring flows from snow melt and rainfall. The final TMDL report states that the measured load of TSS is 1,020 lbs/day (44 mg/L) with a critical flow in Nutrioso Creek of 4.3 cubic feet per second (cfs). To achieve the turbidity water quality standard in Nutrioso Creek, the TMDL analysis assigned a TSS load allocation to nonpoint sources in Nutrioso Creek of 154.8 lbs/day, an allocation to background sources of 5 lbs/day, and a margin of safety of 23.2 lbs/day (15 percent of the load allocation), for a total TSS target load of 183 lbs/day. Because the existing measured TSS load during the critical flow period was 1,020 lbs/day, ADEQ determined that a TSS load reduction of 837 lbs/day would be necessary to achieve the turbidity water quality standard in Nutrioso Creek.

Once developed, ADEQ made the draft Nutrioso Creek turbidity TMDL available for a public comment period lasting 30 days. Public notice of the availability of the draft document was disseminated through a local newspaper (*The Observer*), email notifications, phone calls, and webpage postings. ADEQ also presented the draft TMDL at a meeting of the Upper Little Colorado Watershed Group to obtain additional public comments.

### **TMDL Implementation**

The Nutrioso Creek turbidity TMDL discusses implementation-related issues, including best management practices (BMPs), effectiveness monitoring, timeline, and milestones. The final TMDL report presents the following implementation goals:

- 1) Increase education and public awareness to local landowners through the public participation process and watershed group activities
- 2) Create milestones for each BMP project and reevaluate the effectiveness as necessary
- 3) Decrease Stream Velocities during critical flow events utilizing
  - a) Willow vegetation
  - b) Stream grade stabilization structures
  - c) Increased flood plain (addition of point bars), natural creation preferred
- 4) Decrease sheet flow and wind erosion contributions to Nutrioso Creek by
  - a) Removing Rabbitbrush
  - b) Increasing density of grasses as land cover
  - c) Promoting BMPs
- 5) Stop downcutting of the stream channel and promote stabilization of the channel by
  - a) Removing cattle and wildlife from the stream channel during critical flow periods
  - b) Allowing cattle to graze in the dormant winter months, under a range management system
  - c) Revegetating the stream channel
  - d) Allowing time for stabilization of stream banks to occur
  - e) Promoting BMPs
  - f) Using stream restoration techniques to speed up recovery of stream corridor sections

The final TMDL report discusses strategies that could help to reduce sediment loads along the 7 mile impaired stretch of the creek—4 miles flowing through the Apache-Sitgreaves National Forest administered by the U.S. Forest Service (USFS) and 3 miles flowing

through the privately-owned lands. The USFS implemented several BMPs to address the sources of sediment from the Apache-Sitgreaves National Forest affecting turbidity levels in Nutrioso Creek. These BMPs included reductions in timber cutting, road closures, and cattle grazing allotment revisions.

According to the final TMDL report, the 3-mile stretch of Nutrioso Creek through private lands had the highest turbidity levels based on data collected during the TMDL sampling activities. These privately-owned lands were characterized by historic overgrazing and poor range management practices. TMDL implementation efforts were led by Jim Crosswhite, the owner of the EC Bar Ranch and one of the three landowners in this stretch of Nutrioso Creek. Crosswhite changed his range management practices and used state and federal funding to implement several BMPs suggested in the final TMDL report. BMPs implemented by Crosswhite include fencing out elk from the riparian corridor on his property and limiting cattle grazing to the dormant winter months; revegetating the riparian corridor with willow plantings and grass seeds; and adopting the conservation plan developed by the Natural Resources Conservation Service (NRCS) for Nutrioso Creek. Crosswhite's implementation activities cost approximately \$2 million, with funding from ADEQ, NRCS, wildlife agencies and other key partners. Crosswhite also provided personal resources to fund these implementation efforts by matching 60 percent of the public funding.

### **What is the current status of Nutrioso Creek as a result of the TMDL process?**

The final TMDL report describes the use of a phased-implementation approach, dependent on the availability of funding for implementation projects. In 2000, before implementation projects were initiated, Nutrioso Creek had a measured turbidity level of 55 NTU, equivalent to a measured TSS load of 1,020 lbs/day at the critical flow of 4.3 cfs. ADEQ estimated that Nutrioso Creek would require 5–20 years to meet the turbidity water quality standard. Effectiveness monitoring conducted between 2004 and 2006, demonstrated the success of implementation activities in decreasing turbidity levels and associated TSS levels in Nutrioso Creek. In the January 2007 Nutrioso Creek Turbidity TMDL Effectiveness Monitoring Report, ADEQ presents data that indicates TSS levels in Nutrioso Creek fall below the TMDL TSS target load of 183 lbs/day. Therefore, Nutrioso Creek turbidity levels were well below the turbidity water quality standard of 10 NTU. During the 2004–2006 monitoring period, the measured turbidity level in Nutrioso Creek dropped to 5.68 NTU, equivalent to a TSS load of 138.65 lbs/day at the same critical flow.

As a result of successful implementation efforts illustrated through the effectiveness monitoring, ADEQ recommended delisting Nutrioso Creek from the state's section 303(d) list of impaired waters. The 2007 ADEQ report acknowledges that measured water quality data are not the only indicator of stream health and that future water quality standards, such as biocriteria, might require ADEQ to reassess the conditions and status of Nutrioso Creek.

### **How did local stakeholders benefit from the TMDL process?**

The most significant benefit of the TMDL process has been the attainment of the turbidity water quality standard and the removal of Nutrioso Creek from the Arizona section 303(d) list of impaired waters. While attaining water quality standards is the primary goal of the TMDL process, stakeholders benefitted from the efforts in Nutrioso Creek. Benefits from TMDL implementation included the following:

- **Increased wildlife populations and improved wildlife habitat.** Water quality improvements led to significant increases in Little Colorado spinedace populations upstream of the previously impaired Nutrioso Creek segment. Improved riparian vegetation and habitat is anticipated to benefit the Southwest Willow Flycatcher, a federally endangered bird species of Arizona.

- **Increased public education and awareness.** Through Crosswhite's outreach efforts, other local and regional ranch owners have an increased understanding about the benefits of conservation practices to Nutrioso Creek and other waterbodies.
- **Effective local partnerships and leveraged financial resources.** Crosswhite's initiative, coupled with the involvement of the Nutrioso Creek Watershed Partnership, established an effective local partnership with other key partners at the state and federal level. Through these partnerships, Nutrioso Creek benefitted from a \$2 million restoration effort that leveraged private and public financial resources.

## ■ Stakeholders Say...

*"If other landowners in Nutrioso and elsewhere in Arizona cooperate with governmental agencies to meet public policy goals, they can improve their property and enhance natural resources just like I have. Clearly, conservation pays off."*

—Jim Crosswhite,  
Nutrioso resident, owner of EC Bar Ranch  
(September 2006 press release, E.C. Bar Ranch)



December 2009 • EPA 841-F-09-002Q

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