



# Arkansas Water Resources Center

## MUD CREEK URBAN NONPOINT SOURCE DEMONSTRATION

### Final Report

Project 700 FY 1998, CWA Section 319(h)

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### Introduction

Northwest Arkansas is the seventh fastest developing area in the nation. The conversion of rolling pastureland into paved city streets, parking lots, and buildings within this rapidly urbanizing region is reducing infiltration and intensifying stormwater runoff. In the city of Fayetteville alone, the population increased from 42,099 to 58,163 between 1990 and 1999, moving the city across the population threshold which will require the Phase II Stormwater Permit process. Approximately half of Fayetteville is included in the Illinois River Watershed, which has been identified as the third highest priority watershed in need of restoration in the state of Arkansas. Mud Creek, an urban tributary to the Illinois River, receives half of the treated effluent from the Fayetteville municipal wastewater treatment plant in addition to capturing residential and commercial runoff in Northeast Fayetteville. Pollutants including sediment, nutrients, bacteria and chemicals can be channeled off residential lawns, parking lots, and construction sites, through stormdrains, and into area water resources.

For these reasons, the Mud Creek sub-basin of the Illinois River was the focus of an EPA 319(h) grant-funded project focusing on urban NPS prevention education. The Mud Creek Project was the first of its kind in Arkansas to target urban audiences, promoting their role and responsibility in improving and protecting the water quality in an urbanizing watershed.

### Successful Educational Programs

The goals and objectives of the "Mud Creek Project" were to establish the community-based education infrastructure that promotes the acceptance of future investment in urban nonpoint source pollution prevention programs. A kickoff breakfast meeting was held to introduce the project to key community leaders including representatives from the City of Fayetteville Parks and Recreation Department, the Washington County Planning Commission, the City of Fayetteville Public Works Division, the Four County Solid Waste Management District, and the city wastewater treatment management staff as well as a State Representative and the County Judge, and interested local citizens. At the kickoff, a short introductory program highlighted the importance of the Mud Creek watershed and outlined various activities in the watershed that can impact water quality. Those in attendance were very supportive of the project and several were interested in developing partnerships to meet project goals.

Successful public awareness campaigns, hands-on youth activities, and adult water quality education programs have increased public awareness of watershed dynamics, equipped residents with NPS prevention knowledge, and offered opportunities for individual decisions and actions to protect water quality on a community scale. Throughout the project, all water quality educational programs, the message promoted was simple: "Pay close attention to what you do in and around your home, because stormwater runoff can carry pollutants to regional water resources."

### Public Awareness

As this was the first urban NPS educational effort in Arkansas, an initial element of the project was to evaluate the initial level of the community's awareness, knowledge, attitudes, and opinions about water quality. A water quality survey was developed and conducted and the results were used to identify educational needs, target specific audiences, and guide educational methods. Based on survey responses, public awareness programs focused on increasing watershed residents' knowledge of the hydrologic cycle, the potential nonpoint pollution sources in their urban watershed, and the effect of fertilizers, pesticides, solvents and other common hazardous household products in runoff.

### *Water Quality Surveys*

Once the 33-question survey was developed and fine-tuned through focus groups, the questionnaires were distributed at Extension meetings and University of Arkansas classes, door-to-door in Mud Creek neighborhoods, sent home to parents with local school students, and offered in stand alone display boxes in local businesses. A total of 157 surveys were completed.

When asked about water quality-related terms, most respondents were not familiar with “hydrologic cycle”, “nonpoint source pollution”, “Best Management Practices”, “watershed”, or “runoff”. The survey also asked respondents where they thought water flowed once it left their property (a ditch, a storm drain, a creek, or don’t know) with a follow-up question asking where does the water flow from there (Beaver Lake, Illinois River, Municipal Wastewater Treatment Plant, or don’t know). Few residents of the project area were aware that runoff from their property flows into storm drains or a drainage ditch, under city streets, to small urban creeks along walking trails in local parks, and ultimately drains to the Illinois River.

One of the opinion questions was, “Among all of the things that might affect ground and surface water quality in Northwest Arkansas, which do you think might contribute the most impact in terms of water pollution?” The most frequent responses included agricultural and industrial sources like poultry production, farm fertilizer and pesticide use, and industrial wastewater. Alternately, the impacts of population growth and development and residential activities (including lawn care practices and automotive maintenance) were thought to have the least impact.

And while nearly all respondents said that water quality was very important to them, most said that their efforts to prevent water pollution were limited by their “lack of information” or because they “don’t know how”. Overall, the survey results indicated an outstanding opportunity to educate project area residents about decisions and actions that can improve and protect the quality of regional water resources.

### *Creek Signs*

Although many Mud Creek sub-basin residents live along drainage ways and creeks, many don't understand the direct connection between stormwater runoff from their residential property and the water quality of local streams and regional water resources. To help the public become familiar with terms such as “watershed” and “runoff” and recognize the importance of local creeks, potential runoff sources, and pathways to regional lakes and streams, the Washington County Cooperative Extension Service wanted to create and install signs labeling Mud Creek and its tributaries.

In May of 1999, CES staff met with Charles Venable, City of Fayetteville Public Works Director, to discuss the idea of creating signs for Mud Creek which would help people understand where the water went and also that they had a part in protecting the creek. Mr. Venable saw a long-term benefit in such a program and volunteered that the city make and install the signs which read, "Mud Creek. This creek flows to Clear Creek then to the Illinois River. It carries water which runs off from neighborhoods, businesses, pastureland, and treated wastewater. Please help keep it clean. City of Fayetteville." Thanks to the city's involvement, a total of 18 signs were installed in high visibility areas along Mud Creek and its tributaries. The Mud Creek signs and the educational elements of the Mud Creek project were featured in both the Northwest Arkansas Times and the Springdale Morning News newspapers and included photos of the signs and the County Agents working on the project alongside Charlie Venable. As an indication that residents were reading and reacting to the signs, one local woman contacted the city and requested that a similar sign be installed near her property to help her neighbors become familiar with their waterway and help play a role in protecting it.

### *Stormdrain Messages*

In much the same way, the water quality survey indicated that many residents were under the misconception that water flowing into stormdrains from streets and parking lots was carried to the municipal wastewater plant for treatment. This gap in knowledge was acknowledged as an opportunity for education.

Stormdrain stenciling projects have been used successfully by numerous cities across the country to raise public awareness that stormdrains are simply conduits to channel untreated stormwater to the nearest creek or stream. Teams of volunteers travel along city and neighborhood streets, painting the message “Don’t Dump, Drains to Stream” on the curb beside the stormdrain openings. Because a stormdrain stenciling project was to be included in conjunction with Mud Creek youth programs, there was a concern about the safety of working with kids along city streets.

But, in Fayetteville, there is a manhole access point in the sidewalk next to each stormdrain. Therefore, CES staff approached the Fayetteville Street Department about “borrowing” and painting spare manhole covers which could be painted in schoolyards or at the CES office, but would then be replaced with those next to stormdrains throughout the Mud Creek project area.

During a Washington County 4-H “Water Days” Summer Day Camp, the first round of stormdrain manhole covers were painted in 2000 with the message “Don’t Dump, Drains to Creek” along with images of fish, frogs, and turtles. These covers were located around the Fayetteville downtown square where festivals and the Farmers Market are held, along roads that receive a lot of foot traffic, near city parks, and throughout housing developments in the project area. Like the creek signs, residents noticed and responded to the stormdrain covers asking that the message be painted at specific locations where they had witnessed people pouring materials down stormdrains.

### *Promotion*

These public awareness campaigns have received further attention as the city of Fayetteville has been featured in local newspapers, radio, and television programs for their support and involvement in public water quality education programs. Each time the story runs, the public’s knowledge of urban NPS pollution issues has grown.

Morning CES television interviews on Arkansas’ NBC - 24/51, CES news columns in the *Northwest Arkansas Times*, and newspaper feature articles in the *Morning News*, the *Northwest Arkansas Times*, and the *Arkansas Democrat-Gazette* have explained stormwater principles, outlined urban nonpoint source pollution BMPs, and promoted successful project educational programs and services. Programs highlighted in the media included the creek signs, the stormdrain messages, the Urban Home\*A\*Syst homesite environmental self-assessment guide, Fayetteville’s Pollution Prevention Partners’ household hazardous waste management program, and hands-on youth programs such as summer camps and the Mud Creek Aquarium. The project and the city’s involvement and support were also featured in an article in the Arkansas Municipal League *Town and City Magazine*.

Beyond promotion through traditional media, CES staff have given presentations to the Fayetteville Planning Commission, the Washington County League of Women Voters, the Northwest Arkansas Regional Wastewater Operators, 1999 EPA Region VI Nonpoint Conference, and the EPA Region Environmental Education Roundtable in Dallas, TX. Displays about the project have also been featured at the first annual Fayetteville Urban Resources Stream Teams Scull Creek Clean Up, and at numerous state and regional water quality conferences.

### Youth Programs

Urban NPS educational efforts for youth were largely conducted for students at the Butterfield Trail Elementary School, a kindergarten through sixth grade school located in the Mud Creek sub-basin project area. These hands-on water quality programs were designed to support the existing science curriculum as outlined in the Arkansas State Framework while providing real world examples of local issues affecting water quality. As the project progressed, youth programs were expanded and replicated beyond the project area. Throughout the project, more than 2,000 youth increased their awareness and knowledge about urban NPS pollution sources and prevention through these education programs.

### *Mud Creek Aquarium*

One of the most successful programs evolved as a solution to a transportation problem. When it became apparent that, although the teachers at Butterfield Trail School were interested in having their students monitor water quality, their inability to have regular field trips during school was going to limit their participation. Instead of adopting a streamside location and missing school to visit the site regularly, the creek was brought **into** the school.

Through a mini-grant from the Arkansas Game and Fish Commission, a year-round, 29-gallon fish tank was purchased in and filled with water and rocks collected from a tributary to Mud Creek which was near the school. Each year, 6<sup>th</sup> grade students were allowed three trips to the creek, a quick 10-minute walk down paved sidewalks. In the Fall, the first visit was used to set mason jar fish traps baited with saltine crackers and help the students begin to recognize the catchment area which collected runoff for the creek. Two days later, the second trip was to retrieve the fish traps which typically contained an array of minnows, darters, crayfish, and bass to stock the “Mud Creek Aquarium” and discuss the ecology of the creek. Throughout the school year, the students took turns feeding the fish, cleaning the tank, and recording observations. In the Spring, the students took their third trip to the creek to measure flow rate, turbidity, nitrate, orthophosphate, and collect benthic macroinvertebrates. By helping to evaluate the creek site and maintaining the aquarium, the students have learned about the habitat that these fish need to

survive and how man's activities such as lawn fertilizers or pesticides in urban runoff can impact that habitat.

The fish tank was positioned at a high traffic area at near the entrance of the school where it made quite an impact on all of the students from kindergarten through 6th grade. Trash picked up from the creek, including a piece of PVC pipe, a G.I. Joe leg, and an old pull-tab can, were also initially included in the tank. Once the students picked up trash along the creek during their Spring creekside sessions, the garbage was also taken out of the fish tank. In May, the 6<sup>th</sup> graders were given certificates for being "Friends of Mud Creek".

#### *Hands-On Experiential Learning Programs for Youth*

Additional water quality programs for the Butterfield Trail Elementary school classes included groundwater flow simulator, EnviroScape runoff model, and Project WET/Project WILD exercises about the water cycle, NPS pollution, groundwater contamination, water quality standards, benthic macroinvertebrates as water quality indicators, and water use. Creekside programs were included, as possible, to help youth understand and measure water quality parameters. Additional and related activities included reading topography maps to delineate watersheds and learning how Geographical Information Systems (GIS) can be used to address water quality and landuse planning issues. Teacher evaluation comments about the various program were very positive. One teacher remarked, "Sometimes I hate to do something that will take a lot of time because we have so much to cover in the 5<sup>th</sup> grade curriculum, but your program was really impressive... Thank you. Our classes were really involved and learning." Feedback from the students usually came through thank you notes and follow-up writing exercises. "Thank you for coming to our class and demonstrating to us how watersheds work. I learned that what you do to your own yard could affect someone 10 miles away," wrote one student.

After experiencing initial success at Butterfield Trail, similar programs were also developed and used with youth audiences beyond the Mud Creek sub-basin. More than 650 pre-schoolers "Swam" through a walk-through farm pond display which was used in conjunction with the Farm Friends program, a county-wide agricultural education program for Washington County pre-school youth. Nearly 400 students at J.O. Kelly Middle School in Springdale rotated through groundwater model demonstrations, learning about the water cycle and pollution prevention at a Career Day event. "Water Wonders" water quality programs were conducted for the University of Arkansas E-Camps. Water quality activities were an integral part of the Washington County 4-H E.A.R.T.H. Summer Day Camp in 1998, and became the entire focus of the 1999 and 2000 "Water Days" 4-H Summer Day Camps. Camp programs focused on land use, watersheds, stream ecology, pollution prevention, and recreational fishing to teach campers how different land activities can affect stream life and water quality.

#### *High School and College Programs*

While the majority of youth programs were directed toward younger kids, educational opportunities arose with high school and college students. Fayetteville High School Field Biology students were interested in studying the quality of Mud Creek as the land around it was being developed. In response, CES staff provided support to help them become familiar with how to characterize and assess (physical, chemical, and biological parameters) the three study reaches along Mud Creek and Clear Creek that they monitored over several school years. Also, each year, presentations were given to an AP Biology class at Springdale High School about NPS issues and the educational methods and impacts of past and current watershed water quality projects. Finally, a poster contest "Protecting Water Quality by Properly Disposing of Household Hazardous Wastes" co-sponsored through the 4-County Regional Solid Waste District and OMI, Inc. (Fayetteville Wastewater Treatment Plant) with a Springdale High School senior winning 1<sup>st</sup> Place.

At the college level, a presentation on water quality and public health impacts was given to a University of Arkansas Environmental Health class. The "Pollution Prevention Starts at Home" program was presented to the University of Arkansas Scientific Presentations class. Each Spring, a programs on urban and agricultural NPS pollution, ground and surface water quality, and an overview of the educational methods and impacts of past and current USDA and EPA 319(h) watershed water quality projects was presented to University of Arkansas Soil and Water Conservation classes. Lastly, Power Point programs featuring Mud Creek urban water quality education programs were presented to University of Arkansas Environmental Economics students as well as a group of Jackson State Community College Environmental Science students.

## Adult Programs

### *Household Hazardous Waste Education*

When pesticide misuse and improper disposal resulted in municipal wastewater treatment plant upsets and fish kills in Fayetteville in 1996 and 1997, the Washington County CES helped form a partnership to ensure that occurrences such as these did not happen again. The "Pollution Prevention Partners" (PPP) included the University of Arkansas Cooperative Extension Service in Washington County, OMI, Inc. (the firm managing Fayetteville's municipal wastewater treatment facility), the Fayetteville Solid Waste Division, the 4-County Northwest Regional Solid Waste Management District, and the University of Arkansas Physical Plant.

The PPP group began meeting in 1998 to collaborate on a comprehensive public awareness program to educate local residents on how to use, handle, and dispose of pesticides and other household hazardous products in a safe, environmentally sound manner. A 20-minute PowerPoint program entitled "Pollution Prevention Begins at Home" was developed to provide an overview of the water cycle, potential pollutant pathways, proper pesticide use, the consequences of improper household hazardous product disposal, and environmentally-friendly alternative options to hazardous product use. An accompanying brochure entitled "Protecting Fayetteville from Household Hazardous Wastes" highlights the role of each organization in hazardous household chemical management, provides contact information for PPP members, and was distributed as a follow-up resource in conjunction with presentations.

From August 1998 through December 2000, the program was presented to more than 30 residential organizations, civic clubs, city committees, and schools as well as local, regional and national educators. These groups included the Fayetteville Chamber of Commerce Business Development sub-committee, Fayetteville Kiwanis, Fayetteville Lion's Club, Washington County Extension Homemaker Council, Butterfield Trail Elementary School PTO, the Goshen Extension Homemaker Club, the Washington County Master Gardeners, the Washington County Master Composters, the City of Fayetteville Environmental Concerns Committee, the Northwest Regional Wastewater Operators, and the Washington County Health Department Environmental Committee reaching more than 1,500 area residents overall.

Although these agencies had not worked together previously, the partnership's collaborative education activities have successfully unified and strengthened local water quality protection efforts which have been showcased locally, regionally, and nationally. Beyond presenting the informative program itself, the process of forming the PPP group and developing our "Pollution Prevention Starts at Home" joint program has been presented as a successful and innovative partnership to CES County Extension Agents from 20 counties in the Northwest District and the Arkansas Environmental Federation as well as at the Southern Regional Water Quality Conference, the National Watershed Conference in San Diego, CA., and the 2<sup>nd</sup> National Extension Natural Resources Conference in Lake Tahoe, NV.

### *Urban Home\*A\*Syst*

In order to help Mud Creek homeowners evaluate the potential impact that their decision and actions might have on local water resources, Washington County CES staff and State Specialists collaborated to develop an Urban Home\*A\*Syst environmental risk homesite self-assessment guide.

This homesite assessment tool was based on the national Home\*A\*Syst guide as well as Florida, Kentucky and South Carolina versions. To create a resource appropriate for an urban audience, chapters on septic system and groundwater well management were dropped from previous Home\*A\*Syst versions and replaced with chapters on urban stormwater runoff management and municipal wastewater treatment. The seven chapters included are Site Assessment, Runoff Management, Lawn and Garden Care, Storage and Handling of Hazardous Household Products, Automotive Products, Household Wastewater Treatment, and Managing Household Trash.

The guide begins with a short series of general "yes" or "no" questions about homesite characteristics and management actions. A "yes" answer indicates that there is a potential water quality risk. The reader is directed to a specific chapter where there is a detailed risk assessment on that subject and support information designed to help them implement practices to reduce their contribution to nonpoint source pollution. Local examples, resources, and contacts were included in all chapters to tailor the guide for Fayetteville residents. An Urban Home\*A\*Syst evaluation was developed and included with each book to record BMP implementation and gain feedback on how the book could be more effective. One

participant wrote, "I learned a great deal about my own impacts on the environment with these materials. It was easy to read and absorb."

Feature articles, news columns, and television interviews were helpful in promoting the Urban Home\*A\*Syst program. The guidebooks were presented Beaver Lake Implementation Grant working group and the Washington County Master Gardeners Master Composters. Display copies of the Urban Home\*A\*Syst book were also located in the waiting room of a medical clinic, the Fayetteville Public Library, the Fayetteville Mayor's Office, and a popular local coffee shop with contact information on how to receive a free copy. An on-line version was also posted on the Washington County Cooperative Extension Service web page <http://washington.uaex.edu>.

The program was introduced to National Farm\*A\*Syst/Home\*A\*Syst Coordinators and EPA Region VI at a meeting in Dallas in 1999. Tom Riley, Environmental and Natural Resources Section Leader, also shared copies of Urban Home\*A\*Syst with members of the Sparta Coalition as a potential tool in source water protection in the Sparta aquifer region in southern Arkansas.

## **Lessons Learned**

As the Mud Creek Project evolved and urban water quality education programs were developed, implemented, and evaluated, the most successful education efforts have included common elements of relevance, visualization, repetition, partnerships and permanence.

For urban NPS pollution prevention techniques to be understood and implemented by the public, they must relate to specific individual interests or community needs. Negative publicity of local water quality issues including boil orders, raw sewage overflows, wastewater treatment plant permit violations, illegal dump sites, and closed swimming beaches due to elevated bacteria levels are often featured on the front page of newspapers or as the lead story on television news. And, although these reports are often alarming, well-publicized incidences such as these prompt discussion and can help increase public interest in NPS pollution and water quality protection. If fact, when capitalized upon, they can serve as an impetus for both reaction and action!

In order to compel people to put NPS pollution prevention activities put into practice, several components need to be included in water quality awareness and education programs. First of all, potential urban pollutants and pollutant sources have to be identified and explained. Secondly, basic water principles including an overview of the water cycle, NPS pollution transport mechanisms, and watershed dynamics need to be covered. Thirdly, the network of local water resources and drainage basins should be emphasized so residents can recognize their "watershed address" and relate their property to their water supply. Finally, watershed residents have to be able to see how their personal actions have an impact on the water resources that they and their entire community depend on.

Water models like groundwater flow simulators and the EnviroScape® surface runoff model are extremely effective in helping audiences get a mental picture of pollutant sources, transport mechanisms, and pathways to ground and surface water supplies. Graphs comparing runoff rates from pastures, forests, and urban areas, maps highlighting urban streams and watershed boundaries, and diagrams of the city's system of stormdrain inlets and outlets provide compelling images to support why of urban NPS pollution prevention is critical. Even when stakeholders are presented with information about the direct effect that a simple pollution prevention technique can have on water quality, the message must be heard over and over through a variety of media and methods before consistent habits are formed.

Grant-funded projects such as the Mud Creek Project are intended to be used as seed money to get NPS pollution prevention education programs established. Given the two- to three-year duration of most educational grant projects, partnerships are essential in providing permanence for effective programs long after the grant period has ended. Furthermore, non-traditional partnerships which seek common ground can be extremely effective in presenting a unified message to varied audiences.

Like partnership development, train-the-trainer programs help to establish and expand successful education efforts and provide permanence for programs to continue beyond the length of grant projects. Urban NPS pollution prevention training has been provided for groups including public school teachers, 4-H Program Assistants, 4-H Adult and Teen Leaders, CES County Agents and State Specialists, Master Gardeners, and Master Composters. Once presented with nonpoint source pollution prevention information, the participants are given materials and resources to help teach others. This process has a ripple effect of reaching many more individuals throughout the community while it solidifies their own knowledge and understanding of pollution prevention techniques.

## **Challenges to Success**

One of the most difficult challenges in water quality education is finding formats that allow repeated contact with the same individuals. This is particularly true for adult audiences. PowerPoint presentations are often given at civic club and community organization meetings to illustrate current watershed conditions, highlight potential problem areas, describe methods of NPS pollution prevention and encourage grassroots involvement. But, these 20-minute programs are presented to the same group once a year, at best. Greater impact seems to be achieved when these presentations are videotaped and replayed over and over on local public access and government cable television stations.

While many NPS pollution education programs have been effective, stumbling blocks have been encountered when education programs attempted to provide too much information at once, failed to define distinct goals, or did not provide a clear impetus for change. To address the importance of homeowner decisions and actions, the Urban Home\*A\*Syst environmental homesite assessment guide was designed to help individuals recognize potential water quality risk behaviors. This self-assessment tool has received limited response when presented in whole (seven chapters) because the amount of information was overwhelming. Many have remarked that they liked the idea of a self-assessment, but didn't know how to begin to make all of changes suggested through the Urban Home\*A\*Syst guide. But, when a specific chapter such as Lawn and Garden Care was presented as a stand-alone exercise during Master Gardener training, participants were interested in using the tool to evaluate their actions because it targeted a specific area of home management that they already had an interest in.

Another challenge has been to incite residents to take action on what they learn. Many individuals have become aware of urban stormwater runoff and have learned that over- or mis-application of lawn fertilizers and pesticides can degrade local streams, but what pushes one step further to take actions like reading product labels, measuring the lawn area to be treated, and calibrating their fertilizer/pesticide spreaders? It seems that a portion of the population will act out of environmental consciousness, but many have to see a clear link between the pollution prevention action and bottom line economics before they are willing to develop pollution prevention habits. A concept that has been easily understood is that when pollutants are transported to Beaver Reservoir through nonpoint runoff, more intensive treatment is required to ensure that the water is safe for public drinking water supplies. The cost of this increased treatment is then passed on to water customers in the form of higher utility bills. These increased city water and sewer fees, fines for illegal dumping, and free household hazardous waste drop-off sites help provide the monetary incentive necessary to spur residents to initiate and continue voluntary pollution prevention actions.

## **Next Steps**

In a follow-up grant entitled "Expansion and Implementation of the Mud Creek Urban Project", project methods, successful partnerships, and lessons learned from this pilot project will be developed into an urban nonpoint source pollution education toolbox. The toolbox will be promoted in the Spring of 2003 during a statewide In-Service training for University of Arkansas Cooperative Extension Service faculty. Similarly, these urban NPS pollution prevention education successes are also slated for replication across communities in the 4-County area of Benton, Carroll, Madison, and Washington counties through an additional 3-year EPA 319(h) implementation grant "Beaver Lake Public Awareness and Education Project".