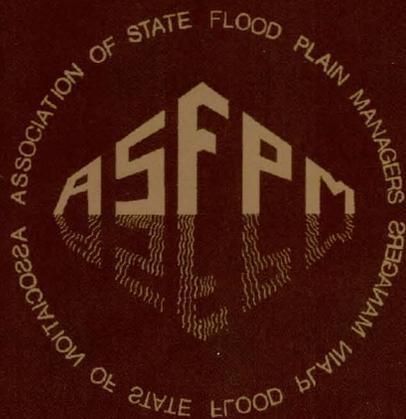


MITIGATION SUCCESS STORIES



MITIGATION
SUCCESS
STORIES

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

IN THE
UNITED STATES



TABLE OF CONTENTS

INTRODUCTIONv

REGIONAL WATERSHEDS1

ALABAMA3

COLORADO7

CONNECTICUT15

DELAWARE19

GEORGIA21

ILLINOIS25

MARYLAND.....35

MINNESOTA39

MISSISSIPPI.....43

MISSOURI47

MONTANA53

NORTH DAKOTA55

PENNSYLVANIA63

SOUTH DAKOTA.....67

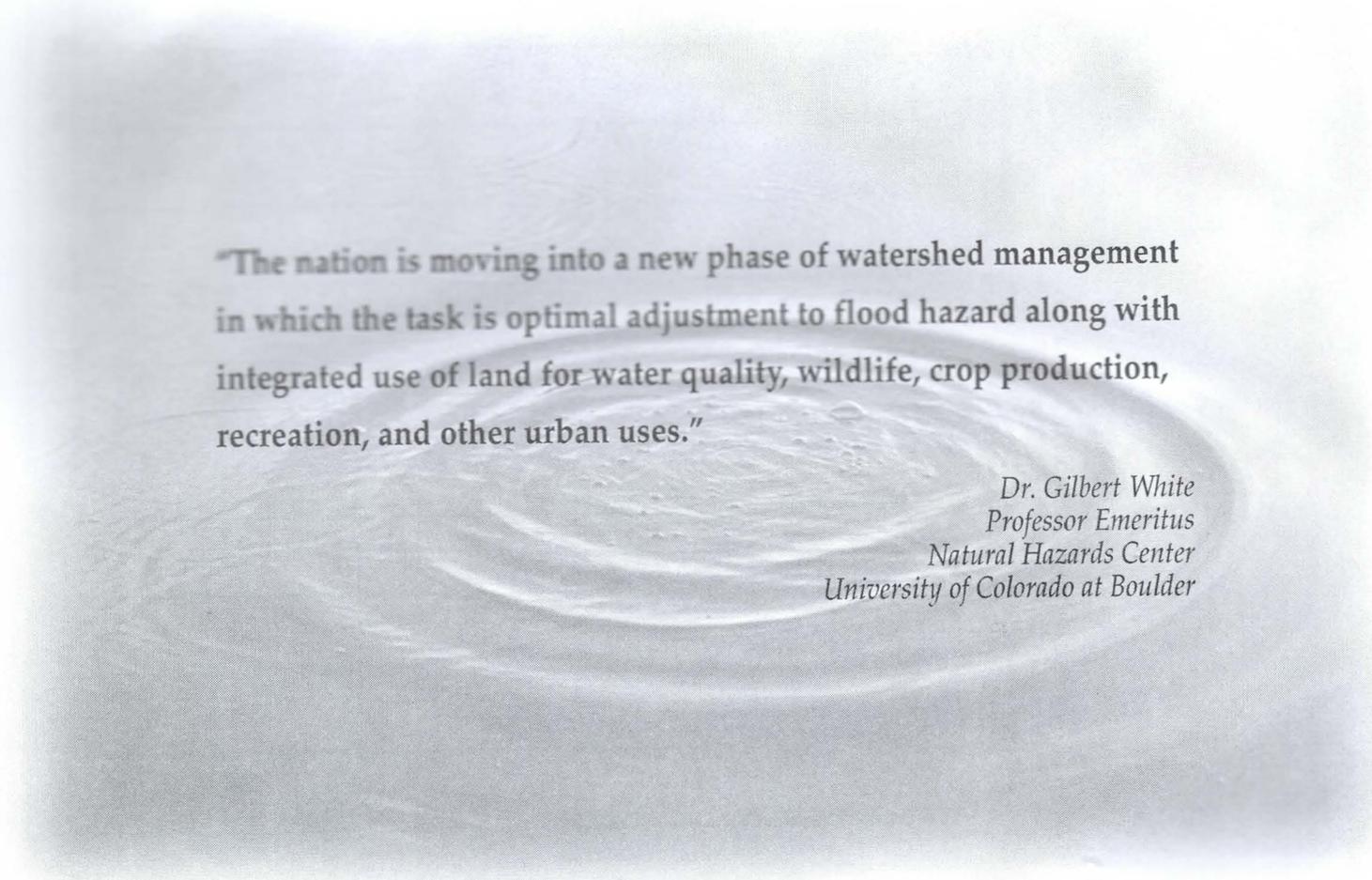
TEXAS71

UTAH.....75

WYOMING.....79

BIBLIOGRAPHY82





"The nation is moving into a new phase of watershed management in which the task is optimal adjustment to flood hazard along with integrated use of land for water quality, wildlife, crop production, recreation, and other urban uses."

*Dr. Gilbert White
Professor Emeritus
Natural Hazards Center
University of Colorado at Boulder*

Mitigation Success Stories



A joint project of the Association of State Floodplain Managers' Flood Mitigation Committee and the Federal Emergency Management Agency Mitigation Directorate, 1999.



INTRODUCTION

Mitigation - To Reduce or Eliminate Adverse Effects

One of the primary goals of local, state and federal floodplain managers and emergency managers is to reduce or eliminate the effects of natural hazards such as flooding, hurricanes, tornadoes, winter storms, wildfires, etc. in communities nationwide. Efforts to achieve and implement mitigation techniques, approaches and successes have been actively underway in the United States for over two decades. Great strides have been made, lives saved, and property damage avoided by numerous communities across the U.S. More often than not, these achievements have been made following devastating disasters, when affected local officials and the general public realized the need to effect change in their communities. Change through mitigation means breaking the disaster/rebuild/disaster cycle.

Today, the Hazard Mitigation Grant Program (HMGP) and the Flood Mitigation Assistance (FMA) program are two primary sources of funding used to implement mitigation measures. But, as the Association of State Floodplain Managers (ASFPM) Mitigation Committee has found out, there are many other mitigation initiatives throughout the country that are beginning to make a difference in reducing or eliminating the effects of natural disasters.

The purpose of this document is twofold: to showcase examples of natural hazard mitigation activities and to publicize the benefits of mitigation successes across our country. Hopefully, these examples can serve as models for others to use and provide decision-makers with valuable information about how to formulate, undertake and ultimately achieve natural hazard reduction in our communities.

The ASFPM Mitigation Committee is pleased to provide this information for the benefit of communities and citizens who continue to live and work in harm's way. It is our hope that the document will encourage all of us to make the sometimes difficult decisions which ultimately save lives, eliminate property damage and reduce disaster costs through the positive benefits of hazard mitigation.

ACKNOWLEDGEMENTS

The spirit of cooperation among the individuals, agencies and organizations who contributed to this publication serves as an example of the inter-disciplinary approach of multi-objective management which is so essential to the success of hazard mitigation. Special appreciation is extended to the driving force behind this effort, ASFPM Flood Mitigation Committee Chairs Mark Matulik (Colorado) and Mike Powell (Delaware).

The following were helpful in the development and production of this publication:

The Contributing Authors

The Colorado Water Conservation Board

FEMA Mitigation Directorate

FEMA Region VIII

Synergy Ink

*Permission to reproduce any or all portions
of this publication is hereby granted.*

This publication is available free on the ASFPM website at www.floods.org.

Association of State Floodplain Managers, Inc.

2809 Fish Hatchery Road, Suite 204

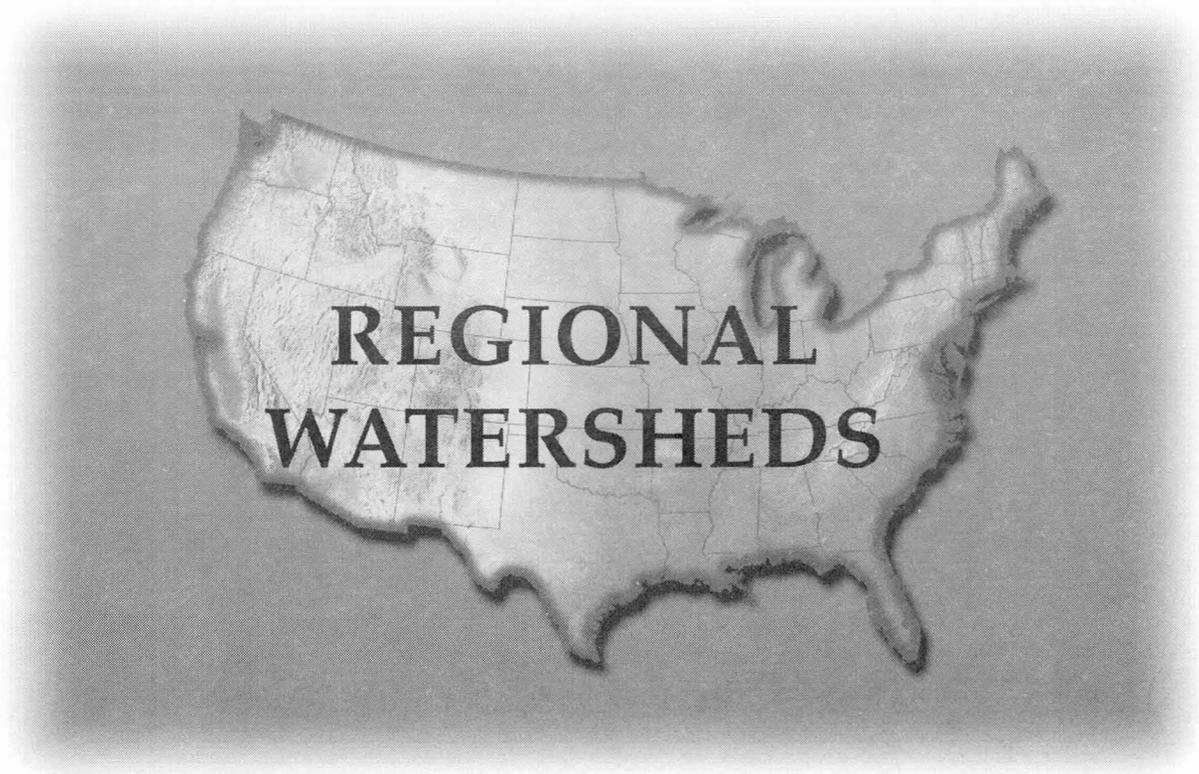
Madison WI 53713

(608) 274-0123 • Fax (608) 274-0696

Email: asfpm@floods.org

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Flood Mitigation in the Delaware River Basin

by the Delaware River Basin Commission
in New Jersey, New York and Pennsylvania

BACKGROUND

Flooding at the City of Port Jervis, New York occurs as a result of heavy runoff or ice jams that form downstream of the city. During the 1981 flooding event, an ice jam formed about five miles downstream where two islands divide the flow of the Delaware River. As the ice jam progressed, a severe backup of water and ice occurred at Port Jervis and at Matamoras Borough and Westfall Township, Pennsylvania. Then several ice jams upstream broke loose and traveled downstream. Because the downstream ice jam had already formed, the water level rose 14.5 feet in one hour and large blocks of ice damaged the low lying areas of the Pennsylvania municipalities and Port Jervis when the stream banks and levees were overtopped. Approximately 950 structures sustained damage amounting to \$14.7 million (1981 dollars) and one death was attributed to the flooding. In February 1982 another ice jam formed, again below Port Jervis. A State of Emergency was declared by local officials, but this time the increase in water level did not result in damages.

PROJECT

Based on an engineering feasibility study authorized by Congress and conducted by the U.S. Army Corps of Engineers (Corps), a flood mitigation project was recommended. The project consisted of tree removal in a 200 feet wide and 2.5 mile long section of a natural back channel between Machipacong Island and the river shoreline in Montague, New Jersey. The project did not entail any excavation, only the removal of trees. The Delaware River Basin Commission agreed to be the non-federal sponsor of the project in 1985 and coordinated the local project funding for the purchase of real estate easements and for obtaining New Jersey State and federal permits. The twenty-five percent local cost share for tree removal, right of way acquisition, and the construction of an access road was shared among New York State and the City of Port Jervis as well as Pennsylvania and its municipalities of Matamoras Borough and Westfall Township. The project was designed to alleviate flooding from an ice jam similar to that which impacted Port Jervis and the Pennsylvania municipalities in 1981 by allowing ice and water to flow through the back channel of Mashipacong Island if the main channel were blocked with ice.

BENEFITS

The diversion channel was completed in 1995 by the Corps. In January 1996, another severe ice jam occurred on the Delaware River in the Port Jervis area. The project was successful in that water and ice were conveyed through the back channel. This alleviated flooding upstream in the Port Jervis, Matamoras Borough and Westfall Township areas.

An initial benefit-cost analysis by the Corps determined that the project would be cost effective with a ratio of 1.31. No structures existed within the project right-of-way and all real estate for the project was secured by easements. The completed project cost \$1.495 million. The environmental impacts of the cleared channel were mitigated by off-site wetland enhancement. This project has received recognition as an effective example of federal, interstate and local municipal government cooperation.

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Alabama Flood Mitigation

BACKGROUND

At the end of a week of rain and flooding in March 1990, about 6,000 people in Alabama had lost their homes or seen their property damaged. Hundreds more had to seek shelter in neighboring Georgia and the Florida Panhandle. Some estimates placed damages from the storms and flooding throughout the state at more than \$100 million.

The hardship was summed up at the time by Alabama governor Guy Hunt: "A lifetime of hard work for some disappeared into the raging floodwaters. A lot of our people have never witnessed such devastation from floods before."

Elba, Alabama

Elba has a long history of flooding stemming from two different causes: 1) failure of the town's protective ring levee, which causes major flooding throughout the downtown area—as happened in 1990 and in 1998, and 2) stormwater accumulation within the levee, in the low-lying southcentral and southwestern areas of town—as happened in 1994.

Geneva, Alabama

Like Elba, Geneva has a long history of flooding. In 1861, the town was destroyed by a flood and relocated to higher ground. Since the turn of the century, Geneva has been flooded four times. Three of those events occurred in this decade.

Although not all residents of Geneva were hard hit in each flood, the small residential area of Baptist Bottoms has always received the brunt of the damage. According to the Geneva City Clerk, "with the exception of what they could carry out during the evacuation, [Baptist Bottoms residents] lost everything in the [1990 and 1994] floods."

PROJECTS

After the 1994 flood, Elba applied for a hazard mitigation grant to install a stormwater drainage system. FEMA approved the grant application in July of that year. The system was built in 1997 by widening an existing drainage channel and installing two pumps at low-lying points in the town's southeast quarter. The pumps, designed to remove water quickly from flooded areas, are each capable of moving 17,500 gallons per minute.

To stem the cycle of disasters, Geneva applied for hazard mitigation grant funds to acquire structures most at risk. FEMA agreed to fund the buyout of dozens of buildings within the floodway of Double Bridges Creek in Baptist Bottoms. A number of additional applications are pending.

BENEFITS

After Tropical Storm Alberto, staff from FEMA's regional office in Atlanta, Georgia worked with local Elba officials to determine the best approach for hazard mitigation. FEMA's benefit-cost analysis determined that the stormwater pumping project the town proposed was cost-effective. The project was designed to mitigate damage from frequent stormwater flooding, such as the town experienced in 1994.

In the aftermath of the 1994 flood, Geneva officials developed what could be considered a model hazard mitigation project. They began an aggressive campaign to convince homeowners in the flood-prone Baptist Bottoms area to sell their homes and relocate out of the floodplain. Eventually, they submitted a grant application to FEMA for the acquisition of 54 homes.

An initial benefit-cost analysis determined that the project would be cost-effective. All of the structures lay deep in the floodplain, and it was clear that damages from repeated flooding in the future would take a heavy toll on the community.

Of the original 54 structures included in the application, 30 were actually acquired and removed before the March 1998 flood. A revised and updated benefit-cost analysis for this group found that the acquisition was even more cost-effective than initially projected.

Elba Analysis

• Project Cost	\$391,114
• Benefits	\$517,293
• Benefit-Cost Ratio	1.32

Geneva Analysis

• Project Cost	\$672,555
• Benefits	\$1,329,373
• Benefit-Cost Ratio	1.98

PROJECT COST

Elba	\$391,114
Geneva	\$672,555

FUNDING SOURCES

FEMA's Flood Hazard Mitigation Program.

\$1.7 million in HUD CDBG funds also assisted in the Geneva project.

For copies of the comprehensive report entitled "Hazard Mitigation at Work - Two Alabama Communities" contact FEMA Region IV at 770-220-5200.

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Urban Drainage & Flood Control District - Colorado

City of Arvada

Acquisition and Removal of Valley View Mobile Home Park

BACKGROUND

The Valley View Mobile Home Park was located totally within the 100-year floodplain of Ralston Creek at its confluence with Clear Creek. Ralston Creek has a drainage area of 91 mi², and a 100-year peak discharge of almost 10,000 ft³/sec at its mouth. The mobile home park had gradually been experiencing more frequent flooding as the upper basin became more fully developed. The existing channel through the mobile home park was not even capable of handling the 2-year flood, and the park had been flooded most recently in 1989 and 1991.

PROJECT DESCRIPTION

In 1995, the City of Arvada embarked on the expansion of a major arterial street in the Ralston Creek floodplain upstream from the mobile home park. The project included construction of a 100-year capacity channel adjacent to the new road. In order to release the discharges from the channel the decision was made to acquire and relocate the mobile home park. In 1995, Arvada, in cooperation with the Urban Drainage & Flood Control District, entered into a purchase agreement with the owners of the park. The agreement called for the complete removal of the 72 tenant-occupied and 10 vacant mobile homes no later than June 1, 1996. Purchase price of the property was set at \$1,575,000. Ownership of the mobile homes and subsequent responsibility to remove them from the site remained with the seller. The now vacant site was flooded again in 1997.

Arvada and the District have now begun the development of a city park on the site, which will become known as Gold Park, as this is believed to be the site where gold was first discovered in Colorado. This will be accomplished in conjunction with the needed drainage and flood control improvements. Other partners in the development of the park include the Jefferson County Open Space Department and the Colorado Historical Society. Construction of the first phase of the park project began in early 2000.

BENEFITS

When fully completed, this project will have developed a park celebrating the history of the area; while removing one of the greatest flood damage potential areas in the entire Denver region.

PROJECT COST

Acquisition of the mobile home park - \$1,575,000

Gold Park Construction – Park Improvements - \$3,500,000

FUNDING SOURCES

City of Arvada

Urban Drainage and Flood Control District

Jefferson County Open Space

Colorado Historical Society

Urban Drainage & Flood Control District - Colorado

In 25 years, we have seen the District's population in the Denver Metro area grow by about 850,000 people, along with all of the structures needed to support that population. However, the number of structures located in identified 100-year floodplains is approximately 4000 fewer than 25 years ago. This is the result of the District's long standing policy of correcting past mistakes through the planning, design, construction and maintenance of flood mitigation projects while preventing new development in floodplains through the Floodplain Management Program. Of course none of this could have happened without the participation of our local government partners.

FLOOD CONTROL PROJECT TESTED BY DESIGN STORM

In 1988, the District and the City of Broomfield completed \$370,000 in flood control improvements along Basin 3207 Drainageway (also known as Nissen Reservoir Channel) between E. 10th Ave. and Ash St. in Broomfield. This project involved the construction of two detention facilities (Ponds 6 and 7), which effectively reduced the 100 year discharge downstream by more than half (from 1090 to 480 cfs). This peak flow reduction resulted in a regulatory floodplain confined to the street and front yards along E. 7th Ave, thus removing more than 60 residential properties from the 100-year floodplain.

One decade later on Saturday, July 25, 1998, these improvements returned dividends when a thunderstorm produced in excess of three inches of rain over significant portions of Basin 3207.

At Pond 6, the July 25 storm produced 2.76" of rain and resulted in a peak stage of 38.6 feet, equaling the 100-year design flood according to the consulting engineers' design report prepared by Sellards & Grigg, Inc. A data plot showed the stage hydrograph and 30 minute rainfall amounts between 7/25 noon and 7/26 midnight. A resident at the intersection of E. 7th Ave. and Birch St. measured 3.45" of rain. The storm hit the Basin 3207 area shortly after 5 p.m., with the first inch of rain falling within the first 20 minutes, causing major street flooding. Runoff quickly filled both detention ponds to capacity. The Pond 6 peak occurred at 6:54 p.m., cresting at a depth of 19" over the spillway and releasing 470 cfs.

Measurements at Pond 6 were made by an automated gauge that was installed as part of the flood control improvements. Prior to the July 25 storm, the largest recorded event occurred on May 17, 1995, with the water surface reaching a maximum stage of 35.7 feet. It is suspected that this stage may have been exceeded on July 19, 1997, but no data was available for this event thanks to the work of vandals on the preceding day. The Basin 3207/Pond 6 gaging station is one of 143 ALERT stations operated by the District.

During and following the July 25 storm, local officials received reports concerning flood problems at a number of locations throughout the City, but the actual damages were relatively low considering the magnitude of the event. Five homes in the 900 block of Birch St. and three in the Eagle Trace Subdivision had water backup in their basements from sanitary sewers. The City later determined that this problem was caused by some unsealed manholes and property owners were compensated for their losses. No sewer backups were reported along E. 7th Ave. At least one resident along E. 7th Ave. did report two-inch deep water in her basement, presumably from seepage or poor site drainage. She also said that her property had been flooded five times in the past 26 years and this was the first high water since the flood control improvements were completed.

An Engineering Department official noted that storm drainage facilities at the new Broomfield Town Center along 120th Ave. (US 287) were flowing full and performed well on July 25. If the storm had been worse, businesses in this area may have sustained significant damages. Recent drainage improvements along City Park Drainageway were credited with preventing damages on July 25. The City official also noted that a smaller event had just occurred a few days earlier that nearly flooded the U.S. West

Communications building located in the floodplain at 120th and Sheridan. The July 22 flooding was aggravated by a construction project that partially obstructed the City Park Drainageway channel. The problem was immediately remedied, which proved fortunate just three days later.

RESTORATION MAINTENANCE

In 1998 the restoration program completed \$1,428,000 of work. Restoration projects typically address isolated drainage problems where the solution involves small scale construction. One hundred individual activities were completed during the year. A major advantage of the restoration program is the opportunity to use it to react quickly to local drainage needs.

An example of reacting to a drainageway maintenance need occurred in Brighton, Colorado during the summer of 1998. City staff informed us that **Line B**, also known as South Urban Channel, needed repairs. Line B was originally improved by the City of Brighton and the District Design and Construction Program about 20 years ago. Changes in the upstream reaches of the creek coupled with natural processes caused sediment deposition to occur in the improved section. What was originally intended to be an urban passive-recreation corridor was becoming a marshy and mosquito ridden area. The channel was wide and flat-bottomed with a riprap-lined trickle channel. The deposition was occurring in and around the trickle channel due to the frequency of the smaller storm events and the roughness of the riprap. Our work included removing the sediment as well as reshaping and resetting the riprap for much of the length of the trickle channel. Not all the problems were solved, however. This section of Line B is still awaiting an improved outlet to the South Platte River.

A similar opportunity to react arose in mid-1998 on what is called the **Pinehurst Tributary** to Bear Creek in southwest Denver. At a rear-yard location, overland flow was captured by an inlet and pipe system. Because of its setting, the pipe inlet frequently became plugged with debris. The result was that runoff could not enter the pipe and would back up enough that the water, in its obligation to seek the lowest point, would sweep around and through several homes. The final solution to this problem was not in a maintenance project but in capital improvements that would ultimately remove the homes from the floodplain. Such improvements had yet to be planned, designed and built. Recognizing that it could be years before such improvements would be made project planners hoped to make short term changes to help the neighborhood. It was recommended that the inlet to the pipe be improved to increase the amount of water it let into the pipe. This fell within the work the Maintenance Program could perform. The inlet design and construction were completed within a couple months. While the development of the master plan for flood control improvements is still underway, the improved inlet will now provide better water carrying capacity for the neighborhood than it had before.

Flood Mitigation in Fort Collins, Colorado

Spring Creek Improvements

Since 1989, over \$5 million was spent on improvements to Spring Creek. These projects included acquisition and relocation of structures, channelization to remove pre-FIRM properties from the floodplain, storm drainage improvements, reinforcement of the Burlington-Northern Railroad embankment, and bridge improvements.

Approximately 86 structures were removed from the 100-year floodplain, including approximately 41 that were acquired by the City.

LIST OF ACQUIRED STRUCTURES

- 30 mobile homes in the area that is now Creekside Park (adjacent to the devastated Johnson Mobile Home Park). These structures were in a very high hazard portion of the Spring Creek floodplain.
- 9 residential homes.
- 1 retirement home that could have housed more than 15 people - this would be considered a "critical facility" according to the revised 1995 City Code.
- 1 business, a Kentucky Fried Chicken, located along College Avenue in the area that is now Creekside Park.

POSSIBLE LIVES SAVED BECAUSE OF ACQUISITION

- | | |
|---|-------------|
| • Mobile Homes - assume 2 people to a mobile home | 2 X 30 = 60 |
| • Residential structures - assume 2 people per home | 2 X 9 = 18 |
| • Retirement Home - 15 residents | 15 |
| • Business - assume 3 workers and 2 customers | 5 |

TOTAL 98 lives saved

ADDITIONAL MITIGATION ACTIVITIES

The City of Fort Collins also is involved in many city-wide floodplain mitigation activities:

Outreach Activities

- **Residents in or near the floodplain receive floodplain brochures** in the mail each year. These brochures discuss the local flood hazard, safety, property protection, flood insurance, etc. These were mailed in May of 1997.
- **Flood Awareness Week** - In the spring of each year, City Council proclaims one week as "Flood Awareness Week." Activities include **newspaper articles and booths at City Hall and the public library with informational brochures**. The 1997 Flood Awareness Week was held May 12-18.
- **A mailing is sent to all City residents** in their Utility Bills with a flood-related article at least annually. The topic of the May 1997 mailer was Flood Safety.
- **FEMA's "Best Build"** video and a local floodplain video are telecast on the local Cable channel annually. These are shown in conjunction with Flood Awareness Week.
- **A mailing is done to the members of the Board of Realtors publicizing the map information services** provided by the City (i.e. map determinations, elevation data).

- In addition, the City offers **training classes to local realtors on how to read Flood Insurance Maps** because the realtors are required to determine if the property is in a floodplain before it is listed.
- **Flood safety** section published in the **yellow pages**.
- **"City Line"** phone system with flood safety and hazard information recordings.
- **Educational programs for schools**.
- **Informational brochures** are available at the Stormwater Utility Office.
- The City provides **flood assistance site visits** to advise property owners of mitigation and property protection measures.
- A **flood resource collection** was established at the public library.

OPEN SPACE

- Of the approximately **2,823 acres of floodplain in the City of Ft. Collins** (including both FEMA regulatory floodplains and locally designated floodplains), approximately **958 acres** are preserved as Open Space. More open space is continually being acquired.
- On Spring Creek, 313 acres are floodplain and 97 acres are open space. This includes several parks and a bike trail along the entire length of the stream.

HIGHER REGULATORY STANDARDS

- **Class 6 rating** Community Rating System (CRS) October 1996, entered into CRS in 1990.
- **Administer floodplain regulations** for all floodplains within the City **to standards exceeding those of the National Flood Insurance Program (NFIP)** minimum requirements, including those not studied in detail by the Federal Emergency Management Agency (FEMA). For example, hydrology standards are based on fully developed conditions instead of existing conditions, the floodway standard is more restrictive with a **0.5 foot rise instead of a 1.0 foot rise**, and on one stream the floodplain is administered as the floodway.
- Maintain **higher regulatory standards** for Freeboard, Cumulative Substantial Improvements, Lower Substantial Improvements Threshold, Protection of Critical Facilities.
- Maintain **Floodplain Use Permits, Floodproofing Certificates, and Elevation Certificates**.

LAND-USE PLANNING

- Conducts studies on **channel stability** and delineation of **erosion buffer zones** along certain channels. The purpose of these studies is to: 1) characterize the stability of the stream on the basis of evaluation of hydrologic, hydraulic, geomorphic, and sediment transport characteristics of the stream basin and develop practical improvements for mitigating adverse impacts on the streams; 2) develop design criteria and construction standards for improvements in drainageways with regard to reaching stability within the City of Fort Collins; and 3) establish erosion buffer zones to restrict development along the floodplain. This will help to mitigate the effects of flooding along unstable reaches of the stream.
- **Watershed Approach** to address **environmental impacts associated with urban runoff**. This integrates water quality mitigation with water quality control in the City's watersheds. Mitigation objectives include: preventing the introduction of environmental pollutants onto lands within the watershed; treating runoff contaminated by urban land uses in the tributary system; and protecting receiving waters' riparian, wetland, and aquatic habitats from deterioration.

ADVANCED PLANNING

- **City Plan** that establishes **core community values, an overall vision, and broad planning goals to the year 2015**. This plan addresses city structure, principles and policies, land-use code, as well as implementation procedures.
- Develop and maintain **Master Drainageway Plans** for all streams within the Urban Growth Area. Each Plan specifies the regulatory flood elevation data as well as mitigation plans to address flooding problems.

For more information contact:

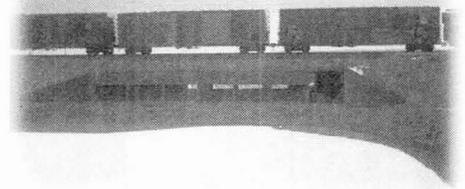
Marsha Hilmes
Floodplain Administrator
City of Ft. Collins, Stormwater Dept.
235 Mathews St., Box 580
Ft. Collins, CO 80522-0580
mhilmes@ci.fort-collins.co.us
(970) 221-6589

Limon, Colorado Multi-Objective Flood Mitigation Project

BACKGROUND

The Town of Limon needed to mitigate floodplain problems created by actions of the long-bankrupt Rock Island Railroad. Past actions by the railroad had resulted in enlargement of the floodplain to cover almost 1/3 of the Town of Limon. The rail line is currently owned by Mid-States Port Authority and operated by Kyle Railways, Inc.

of Kansas and offers a valuable component of agriculture grain shipping for area farmers. Neither the Town of Limon, Mid-States nor Kyle had the resources needed to mitigate the problem. By town ordinance, development was prohibited within the floodplain as long as it existed.



PROJECT

The project consisted of various phases: 1) channelization of the drainageway, 2) placement of 70 feet by 100 feet of concrete box culverts, 3) removal of silt from an existing highway structure, 4) removal and replacement of railroad tracks, and 5) creation of wetlands for the CDOT wetland banking program. Representatives from the Town of Limon, Colorado Water Conservation Board, Colorado Department of Transportation (CDOT), Soil Conservation Service, East Central Council of Local Governments, Kyle Railways, Colorado Department of Local Affairs (DOLA), and Mid-States Port Authority began to meet regularly in 1992 to attempt to find a way to mitigate the problem. A key early component was the discovery that a fishing pond could serve a portion of the required channelization and the Colorado Division of Wildlife (DOW) became another partner. As a result, the Town of Limon began to coordinate, apply for and manage a unique flood mitigation funding package.

BENEFITS

Not only did the project physically remove a large portion of Town from the floodplain, but the resulting 1.1 acre fishing pond is a favorite activity of youth in the community. In addition:

1. Over 400 properties have been physically removed from the 100-year floodplain.
2. Numerous residents and businesses in the original floodplain will be saving the annual costs of flood insurance.
3. The Town will be allowed to develop open space initiatives in the area of the floodplain without costly and time-consuming restrictions.
4. The partnerships developed between individuals and agencies continue to benefit all.
5. Improved channel conveyance was achieved at the Colorado Highway 71 bridge.

PROJECT COST

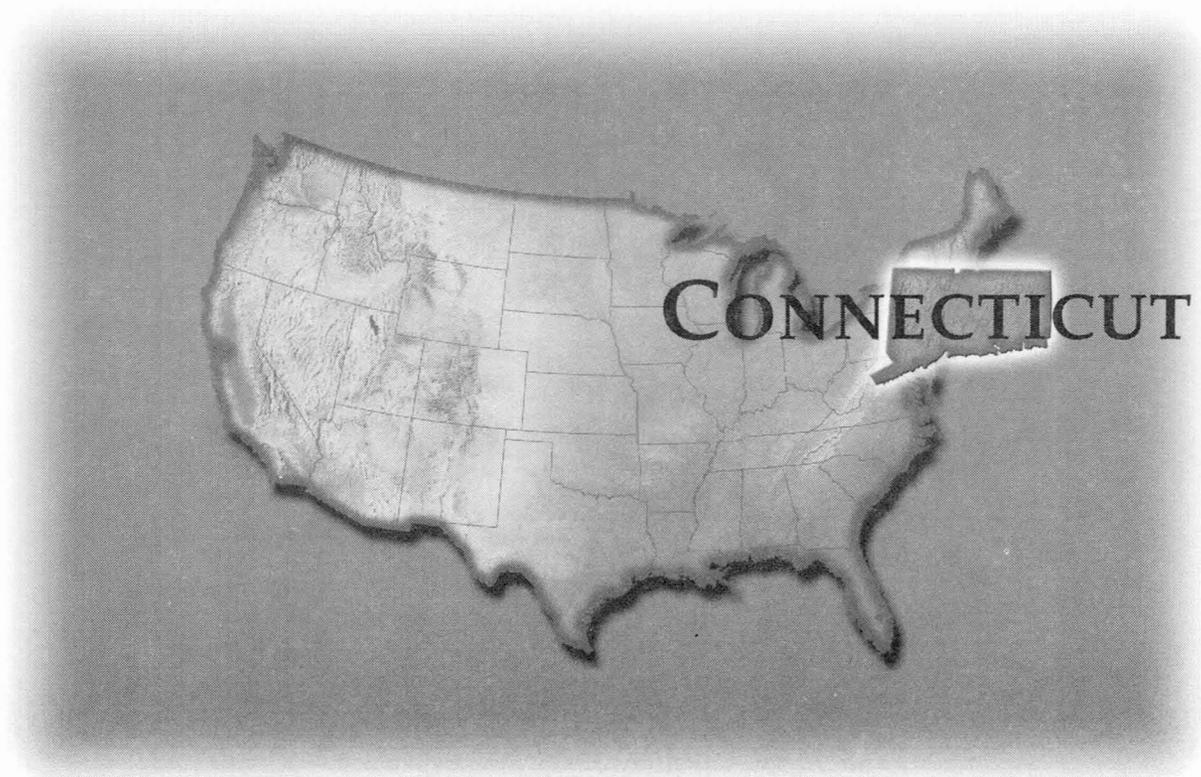
\$850,000

FUNDING SOURCES

Community Development Block Grant funds of \$225,000; a Local Rail Freight Assistance Program Grant of \$209,255; a Fishing Is Fun Grant of \$114,934; a Transportation Enhancement Grant of \$59,414; in-kind services of over \$10,000 from CDOT to remove silt under the highway bridge; over \$75,000 of in-kind rail removal and re-installation; perpetual easements from Mid-States Port Authority and Kyle Railways, and \$50,000 in cash from the Town of Limon.

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Mitigation Success Story in Milford, Connecticut

PROJECT BACKGROUND

The City of Milford is a middle-class community located along the shores of Central Long Island Sound. Milford has population of 48,762 persons, with 57% (27,846) of the population living within the 100 year floodplain. The City of Milford is vulnerable to inland riverine flooding along the Wepawaug River, which flows through the center of town, as well as coastal flooding. Milford suffered four major flooding events during the 90's. The first event involved riverine-flooding along the Wepawaug River on June 6th, 1992. The second event was a powerful winter storm (a.k.a. "Northeaster") which struck Connecticut on December 11, 1992. Very strong Easterly gales of 55 mph created by the storm caused severe coastal flooding in Milford and several other communities.

MITIGATION MEASURES EMPLOYED

When Milford was struck again in 1996 by a severe riverine flooding event on April 16th and a Coastal-flooding event on October 20th, the City of Milford had already mitigated both hazards. The City of Milford installed an Automated Flood Warning (Alert) System for the Wepawaug River in 1993. The Alert System provided the City and its residents and businesses with 5 hours of lead-time to make preparations. One warehouse was able to save \$125,000.00 in stock and computers by elevating its inventory on pallets and tables above the floodwaters.

When coastal flooding struck on October 20th, the City of Milford was able to order a coastal evacuation using a newly installed Public Address system and evacuation signs. Flood damage was prevented to dozens of automobiles that were driven out of harms way within minutes of the warning. The P.A. system has been used on over 20 occasions since its inception in 1994 to save tens of thousands of dollars in damage to moveable items such as cars, trucks, and building contents in Milford's coastal floodplain. Combined, the Alert system and Public Address system have saved the City of Milford four times the cost of their installation in just the past 7 years.

THE FLOOD AUDIT PROGRAM

The damage reduction resulting from Milford's Alert System would not have been possible without a pre-disaster vulnerability and planning effort called the Flood Audit Program. During the installation of an Alert system in Connecticut, all buildings within the 100-Year Floodplain of the flood prone river basin are surveyed for their elevations. Data from the building surveys is used to create a database display system. Each building is listed in the order of flood vulnerability. Owners are called prior to flooding by local police or fire personnel. The building owners then follow a step by step prepared checklist of actions to reduce or prevent flood damage.

PROJECT COST, FUNDING SOURCES

Automated Flood Warning System (1993)	\$42,000 (66% State / 17% Local 17% HMGP)
Public Address System (1994)	\$85,000 (50% HMGP / 50% Local)
Evacuation Sign Project (1995)	\$ 3,570 (100% State Funded)

Total Mitigation Cost:	\$130,570
Total Mitigation Benefits:	\$525,000*
Benefit/Cost Ratio:	4.02

**Since the installation of both systems in 1993 - 94.*

Mitigation Success Story in Westport, Connecticut

PROJECT BACKGROUND

The Town of Westport is a coastal community located along the shores of Western Long Island Sound. Westport has population of 24,410 persons, with 26% (6,251) of the population living within the 100 year floodplain. On December 11, 1992, a powerful winter storm (a.k.a. "Northeaster") struck Connecticut. Very strong Easterly gales of 55 mph created by the storm caused severe coastal flooding in Westport and several other communities. The Compo Beach and Saugatuck Shores areas of Westport were especially hard hit with virtually every building in both areas being inundated. Along the Connecticut coastline, a total of 1,345 homes were destroyed or suffered major damage. The flooding caused by the Northeaster was the highest on record since the Hurricane of 1938. Public assistance damage totaled over 4 million dollars, and private insured damage totaled over 20 million dollars.

MITIGATION MEASURES EMPLOYED

In February 1993, the Town of Westport made an application to the Connecticut Department of Environmental Protection (DEP) for a \$168,000 grant to elevate 7 coastal homes under the Hazard Mitigation Grant Program (HMGP). The seven homes were successfully elevated during 1994 and 1995 at a total cost of \$336,000. Other measures taken by the Town of Westport included installing 16 combination staff gauges/evacuation signs, and the printing of a disaster preparedness brochure (privately funded by one of the elevated homeowners) for it's residents. The acquisition of homes for open space and the construction of a berm around the Compo Beach development were also considered, but were determined to be too costly to implement with the available funds.

In 1998 Westport was nominated as Connecticut's first Project Impact Community. Westport is also the first community in Connecticut to have an approved Hazard Mitigation Plan as required by Project Impact. This plan has served as a model for the communities of Milford and East Haven, which have also been nominated for Project Impact.

PROJECT BENEFITS

During another flooding event, which occurred on October 20, 1996, damage to the seven elevated homes was completely prevented. Unfortunately, several dozen other homes in Compo Beach area, which were not elevated, were flooded again. This project has set an excellent example for the coastal residents of Westport. Since 1996 a total of 15 additional homeowners have received grants under the HMGP and the newly adopted Flood Mitigation Assistance (FMA) to elevate their homes in Westport.

Westport has also amended its National Flood Insurance Program (NFIP) regulations to include a tough new provision. Homeowners or businesses which construct additions or renovations to their buildings that exceed 50% of the fair market value in any 5 year period, must elevate the structure to one foot above the Base Flood Elevation (BFE). This stricter provision has resulted in the elevation of several additional buildings using private funds.

PROJECT COST, FUNDING SOURCES

Home Elevation Project (7 Homes: 1994-95)	\$336,000 (50% HMGP / 50% Local)
Evacuation Sign Project (1995)	\$ 3,570 (100% State Funded)
Home Elevation Project (15 Homes: 1996 - 99)	\$990,803 (75% FMA/HMGP / 25% Local)

Total Mitigation Cost:	1.33 Million
Total Mitigation Benefits:	4.78 Million*
Benefit/Cost Ratio:	3.58**

**Over the 30 year life of the project.*

***Based on the Coastal A-Zone Benefit/Cost Model provided by FEMA .*

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Sussex County Sanitary Sewer Upgrade

BACKGROUND

The project involved floodproofing a sanitary sewer system along the shore of Indian River Bay, Sussex County, Delaware. Hatch cover doors were vulnerable to direct salt water flooding in the 10-year event, allowing salt water and sand to be pumped towards the treatment plant damaging pumping equipment. Additionally, large volumes of floodwater overwhelmed the treatment capacity, potentially discharging undertreated sewage into the environment.

PROJECT

Hatch cover openings, previously below the 10-year flood elevation, were elevated to the 50-year flood elevation or above. Electronic components were relocated to watertight cabinets. This mitigation effort was a result of a federal disaster declaration.

BENEFITS

In February 1998, a coastal storm caused Indian River Bay to reach the 35-year flood stage. This event would have flooded the entire project area and floodwaters would have entered every opening. The County estimates that the event would have caused \$98,947 in damage, primarily related to direct property damage, sewer back-ups and loss of revenue to businesses which would have been forced to close. Since the disaster occurred, another disaster has tested the value of this mitigation effort.

PROJECT COST

\$49,454

FUNDING SOURCES

HMGP - 50%
Sussex County 50%

FUNDING RECIPIENT

Sussex County Department of Engineering

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Georgia Flood Mitigation

BACKGROUND

In early July of 1994, Tropical Storm Alberto ravaged southern Georgia, leaving a trail of flooding and devastation that is considered the worst natural disaster in the state's recorded history. Alberto, which meandered over the state for several days before dying out, dumped up to 28 inches of water in some areas. One third of Georgia's counties were declared federal disaster areas.

Newton, Georgia

Some of the worst devastation in the flood occurred in Newton. The downtown area was under 12 feet of water for several days, and flood depths in some areas were as high as 20 feet. Over 150 homes and businesses were flooded. According to some local estimates, damages came to \$4.5 million—that's \$5,000 for every man, woman, and child.

Albany, Georgia

As one of the larger cities in the path of Alberto, Albany was also one of the hardest hit. Within a few days of the storm's arrival, the water level of the Flint River rose from 8 feet to 42 feet—22 feet above flood stage. Flash flooding overwhelmed the city's drainage system, and nearly one third of the city's residents were left homeless. Over 6,500 homes and hundreds of businesses were damaged or destroyed. Several schools were also destroyed.

PROJECT

In the Newton mitigation project, FEMA funded the acquisition and demolition of 20 residential and 19 commercial structures. All but one business moved out of the floodplain. The result? Many people were spared from the flooding that hit the town in 1998. Local officials indicate that eventually even more Newton residents are likely to move out of the floodplain.

In Albany, over 700 structures were approved for acquisition with funding from various government sources. Some homeowners who originally wanted to have their properties acquired, eventually decided not to join the program. Other structures, including the local schools, were rebuilt on higher ground. To date, a total of 146 structures have been "bought out" by FEMA. Data for 105 of these structures were available for purposes of this analysis. (Additional structures are expected to be considered for acquisition by FEMA.)

According to one local official, the buyout not only prevented flooding of hundreds of homes, but also permitted city workers to concentrate on preparing for flood waters during the March 1998 storm instead of evacuating people from low lying areas.

BENEFITS

Newton Analysis

• Project Cost	\$754,464
• Benefits	\$1,645,426
• Benefit-Cost Ratio	2.18

Avoided Damages

Newton

• Project Cost	\$754,464
• Avoided Damages	\$1,915,923

Albany

• Project Cost	\$2,478,476
• Avoided Damages	\$3,193,783

PROJECT COST

Newton \$754,464

Albany \$2,478,476

FUNDING SOURCES

FEMA's Flood Hazard Mitigation Program provided the above figures.

Albany – \$10,496,599 in HUD CDBG funds also provided for acquisition of 1,132 housing units and vacant lots.

Newton – \$167,610 in HUD CDBG funds were used to acquire 52 residences, businesses, vacant lots and abandoned properties.

For copies of the comprehensive report entitled "Hazard Mitigation at Work - Two Georgia Communities" contact FEMA Region IV at 770-220-5200.

For a copy of "An Assessment of Floodplain Management in Georgia's Flint River Basin", by Elliott Mittler, contact ASFPM at www.floods.org/pubs.htm or call 608-274-0123.

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Lake County, Illinois

BACKGROUND

Countywide stormwater regulations related to new development are in place to prevent new flooding from occurring and from current flooding problems from getting worse. To mitigate the existing flooding problems, the Lake County Stormwater Management Commission (SMC) has instituted a flood mitigation program that includes a mitigation plans and projects at the countywide, watershed and site levels each including a repetitive loss component. At the foundation of the program is interjurisdictional cooperation among local, state and federal entities to cost-share on mitigation efforts.

MITIGATION PROJECTS AND BENEFITS

To date, SMC has utilized \$2.2 million in FHMP funds for two buyout projects resulting in the acquisition of nearly 30 structures located in older subdivisions. Local match was a combination of SMC funds and Community Development Block Grants.

The Sturm Subdivision, located in a depressional area and built in the 1950s, on average lost road access and suffered damaged homes twice a year after 2" rain events. One home had sandbags surrounding the home year-round and managed to landscape with short evergreens in the front of the home. HMGP and FHMP funds were used to acquire two homes, install a detention basin with native vegetation, and a wetland complex to increase storage and improve water quality. SMC is responsible for operation and maintenance of the mitigated wetland complex for the next five years.

The Williams Park Subdivision is located in the floodplain of Slocum Lake, a tributary to the Fox River. Once summer homes, over the past 30 years the homes have been converted to year round homes with roads and ditches that attempted to drain runoff away from homes already below the lake level. To date, 23 homes and lots have been acquired. SMC anticipates a phase two buyout will include up to five more homes. Low-maintenance native vegetation has been planted on vacant lots. Once phase two is complete, SMC will work with the homeowners association to develop a neighborhood plan to enhance the family-oriented community.

In addition to the buyouts, SMC has drafted a countywide flood hazard mitigation plan – the first of its kind for the county. The plan, once adopted later this year, incorporates other mitigation measures, both structural and non-structural. The plan will assist communities and the county in flood mitigation planning, direct resources to the highest priority flood damage sites, and allow county access to state and federal cost-share funds. A major component of the plan is sub-watershed maps showing flood hazard areas. To date, SMC has identified and mapped over 350 of these areas. Key to plan adoption and acceptance will be the work of the Flood Hazard Mitigation Task Force formed in 1999 to review the plan and finalize an action plan.

A component to the flood hazard mitigation plan is a repetitive loss property audits this year, which will result in a parcel-specific strategy. The investigation will require obtaining data including but not limited to elevation, topography and construction data, of approximately 60 IEMA identified repetitive loss structures and surrounding areas throughout Lake County. Once the audits are completed, SMC and the county have earmarked local match funds to begin an initial \$1 million buyout.

A cornerstone to all of SMC's mitigation efforts is public awareness. For the past four years, the agency has sponsored a Flood Awareness Week to inform the public about flood risk potential, safety tips, and actions to take to be flood safe. Activities have included radio call-in talk show appearances, meetings with newspaper editorial boards, open houses, and tours of mitigation projects with county and municipal officials, flood insurance workshops for insurance agents and realtors, and web page information.

PROJECT COST, FUNDING SOURCES

Sturm Subdivision Phase I Acquisition, Phase II Detention & Wetland Complex

\$429,200 total cost

Phase I \$265,700 HMGP for acquisition, \$88,500 Ela Township, \$75,000 IDNR-OWR for wetland complex

Williams Park Subdivision Acquisition Phase I, Demolition

\$2.24 million total cost

\$1.9 million HMGP and IEMA Public Assistant Grant (75%), \$340,000 CDBG and SMC (25%)

Flood Hazard Mitigation Plan

\$120,000 total cost

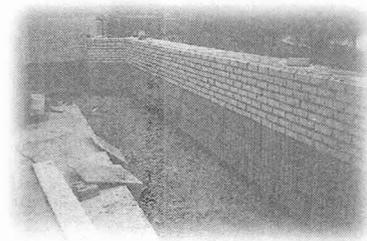
\$60,000 CDBG, SMC in-kind

The Illinois Emergency Management Agency administers and coordinates the State's flood hazard mitigation programs.

Valmeyer, Illinois

PROJECT BACKGROUND

Prior to 1993, the Village of Valmeyer was a small farming community of approximately 900 residents in southwestern Illinois. The Village is located 5 miles east of the Mississippi River, just south of St. Louis, Missouri. The Village is protected by levees and consequently has rare but extreme flood events. In the Great Flood of 1993, the Village experienced record flooding. The 1993 flood inundated almost the entire Village for months. It caused substantial damage to over two hundred homes.



MITIGATION MEASURES EMPLOYED

Rather than rebuild in the wide Mississippi River floodplain, the Village utilized funds from the Hazard Mitigation Grant Program, Illinois Department of Commerce and Community Affairs, and the Economic Development Administration to permanently mitigate any future flood damages. The Village implemented an acquisition project to acquire 242 properties, many of them substantially damaged. An additional 92 structures were acquired using National Flood Insurance Program Section 1362 funding (which is no longer available). To completely mitigate the threat of flooding, the entire Village relocated three miles away to a bluff overlooking the site of the former Village.

PROJECT BENEFITS

The acquisition project moved quickly and within 2 years nearly the entire flood-ravaged Village had been acquired and demolished. The site of Old Valmeyer has been dedicated to open space and will be used for recreation and farming purposes. The Village has successfully relocated above the floodplain, and most original town residents now live in the "New Valmeyer". The new Village includes residential areas, commercial and industrial districts, school buildings, churches, and public offices. Located within commuting distance of St. Louis, New Valmeyer is a prosperous community experiencing rapid growth.

PROJECT COST

\$8,345,914

FUNDING SOURCES

\$6,259,435 in FEMA-HMGP (75%).

\$2,086,478 in Illinois Department of Commerce and Community Affairs (25%) from HUD CDBG funds.

The Illinois Emergency Management Agency administers and coordinates the State's hazard mitigation programs.

City of Peoria and Peoria County

PROJECT BACKGROUND

Acquisition and relocation of frequently flood-damaged buildings have been taking place in the City of Peoria and unincorporated Peoria County for nearly fifteen years. Beginning in 1982 with FEMA's Section 1362 floodprone property acquisition program and continuing through today's Hazard Mitigation Grant Program, the City, County and the Park District have acquired, relocated, and demolished dozens of structures and restored an open floodplain along a 25 mile reach of the Illinois River.

MITIGATION MEASURES EMPLOYED

The City and County have obtained Illinois Department of Natural Resources funding to continue to acquire flood-prone properties. All the properties have been cleared to create open space and residents have relocated to flood-free locations. The County also participates in the Community Rating System (CRS) and has used the acquisition projects to reduce their CRS rating, which lowers flood insurance premiums for County residents.

PROJECT BENEFITS

Record floods occurred in 1979, 1982, 1985 and 1995. The success of the program is obvious when the damages for the 1985 and 1995 floods are compared. Although the 1995 flood crested 1.4 feet higher than the 1985 flood, very little damage occurred, and flood insurance claims were reduced by almost ninety percent. Taxpayers were saved millions of dollars in relief costs and the benefits are continuing. Removing the exposure to flood damage pays real benefits. Also, the jurisdictions have continued these ongoing efforts by applying for \$1.3 million in HMGP funding and \$383,000 in Flood Mitigation Assistance Program funding, which will be matched by State agencies.

PROJECT COST

\$4.7 million

FUNDING SOURCES

\$2.2 million in FEMA's obsolete Section 1362 Program (under the National Flood Insurance Program).

\$1.5 million from IDNR.

\$1 million from Illinois Department of Commerce and Community Affairs.

The Illinois Emergency Management Agency administers and coordinates the State's hazard mitigation programs.

Kampsville, Illinois

PROJECT BACKGROUND

The Village of Kampsville is a small tourist-based community in west central Illinois. The Village is home to the Center for American Archeology, which attracts visitors from across the Nation. The Village is located about 15 miles north of the confluence of the Illinois and Mississippi rivers and is along the Great Rivers National Scenic Byway, designated in 1999. The location of the Village, confined between the Illinois River and its forested bluffs, makes it extremely flood-prone. Prior to the Great Flood of 1993, the Village had experienced many repetitive floods, with the most severe damage occurring in 1973. The 1993 flood inundated almost the entire Village for months, causing substantial damage to over a dozen buildings.

MITIGATION MEASURES EMPLOYED

Following the 1973 flood, which was then the worst on record, the Village received a grant from FEMA and the Illinois Department of Natural Resources (then IDOT) to acquire flood damaged structures. The Village acquired 34 structures using FEMA, IDNR, and Illinois Department of Commerce and Community Affairs funding. This initial mitigation project cleared much of the repetitive flood areas in the Village by acquiring structures located in the lowest portion of the floodplain.

Following the 1993 flood, the Village utilized FEMA's Hazard Mitigation Grant Program to acquire several additional structures that were not acquired in the 1973 buyout. With matching funds provided by the Illinois Department of Commerce and Community Affairs, the Village acquired an additional 13 properties. The acquired properties are all dedicated to open space.

The Village also received funding to develop a Hazard Mitigation Plan to address all hazards in the area. The Mitigation Plan was updated following the 1993 buyout.

PROJECT BENEFITS

The success of the 1973 buyout program was obvious during the 1993 flood. Although several structures flooded in 1993, the severe damage in 1973 would have been repeated and greatly intensified had there not been a buyout project implemented. In 1993 there was a significant reduction in damage to homes. The benefits of an open floodplain were clearly evident in this Village which experiences repetitive flooding. The benefits of an open floodplain influenced other communities and organizations as well. Following the 1993 flood, Kampsville's mayor encouraged nearby communities to implement a buyout, saying it was, "the hardest thing the Village had ever done but also the best thing the Village had ever done".

The reuse of the land is also beneficial to the Village. To serve tourists, the Village has created a riverfront campground in one area of the buyout with gravel pads and an unobstructed view of the River.

PROJECT COST, FUNDING SOURCES

\$382,200 (1973)

\$269,325 (1993) - \$182,732 in FEMA-HMGP (75%)

\$86,593 in Illinois Department of Commerce and Community Affairs funds (25%) from HUD CDBG funds.

The Illinois Emergency Management Agency administers and coordinates the State's hazard mitigation programs.

City of Grafton, Illinois

PROJECT BACKGROUND

The City of Grafton is a small tourist-based community of 900 people in west central Illinois. The City is located at the confluence of the Illinois and Mississippi rivers and just north of the Mississippi and Missouri rivers' confluence. The location of the City makes it extremely flood-prone. Flooding on the Mississippi, Illinois, or Missouri Rivers can all affect Grafton. Prior to the Great Flood of 1993, the City had experienced many floods but none to the degree that it experienced in 1993. The 1993 flood inundated almost the entire City for months. In places, flood depths exceeded 15 feet in the city. Four homes floated away down the Mississippi River. Over one hundred homes in Grafton were substantially damaged. The city, known for its resiliency to flooding, was devastated.

MITIGATION MEASURES EMPLOYED

The City opted to utilize the Hazard Mitigation Grant Program to acquire the substantially damaged structures and end the cycle of flood-rebuild-flood. With matching funds provided by the Illinois Department of Commerce and Community Affairs, the City implemented an acquisition project to acquire 100 properties, many of them located in the floodway of the River. The acquisition project moved relatively quickly and within 2 years the City had acquired and demolished most of the properties. The properties are all dedicated to open space, which provides an unobstructed, scenic view of the River from the Great River Road which runs the length of town.

A new subdivision has been constructed on the rolling bluffs above Grafton. Dozens of new homes are under construction.

PROJECT BENEFITS

The success of the 1993 buyout program was obvious in 1995 when the City again experienced flooding at the 100-year level. In previous years that degree of flooding would have caused extensive damage, but in 1995, the City continued to function as if the flood was non-existent. There was almost no damage to homes and flood insurance claims were drastically reduced. The City did not even get a disaster declaration in 1995. The benefits of an open floodplain are clearly evident in a City that has flooding on an almost annual basis. In fact, since 1993, the City has experienced flooding in 1995, 1996 and 1998, and no significant damage has occurred in any of those events. The benefits of an open floodplain reach other organizations as well. The Red Cross is able to direct its private contributions to other needy sources, and local emergency services agencies can focus on other emergencies in the area. The reuse of the land has been very beneficial to the City. With its strong tourism base, the City is using some of the acquired property to connect a bicycle trail that begins at Pere Marquette State Park, ten miles north of the City, and ends at the City of Alton, fifteen miles to the south. Other buyout sites will be used for public fishing access, parking lots, and city parks. A large new flood-resistant marina is proposed along the riverfront. Since the 1993 flood, Grafton has seen a major change and the once sleepy, flood-damaged city is now a revitalized, energetic city.

PROJECT COST

\$4,735,832

FUNDING SOURCES

\$3,551,874 in HMGP (75%)

\$1,183,958 in DCCA funds (25%), \$864,958 of this is from HUD CDBG funds.

The Illinois Emergency Management Agency administers and coordinates the State's hazard mitigation programs.

Evansville, Illinois

PROJECT BACKGROUND

The Village of Evansville is a small community in southwestern Illinois along the Kaskaskia River, about 10 miles from its confluence with the Mississippi River. In the Great Flood of 1993, the Village experienced record flooding as the Mississippi River floodwaters backed up the Kaskaskia River. Homes and businesses were inundated with more than ten feet of water, causing severe damage to over twenty structures.

MITIGATION MEASURES EMPLOYED

The Village utilized the Hazard Mitigation Grant Program to acquire the substantially damaged structures. The Illinois Department of Commerce and Community Affairs and U.S. Economic Development Administration funds were used to relocate the Water Treatment Plant away from the threat of flooding. The Village acquired 12 properties, including residences and businesses. The properties are all dedicated to open space and are planned to be used for recreational purposes to promote tourism in the Village.

The Village also developed a Hazard Mitigation Plan to address all hazards within the Village, including earthquake since the Village is within the New Madrid seismic zone. An ordinance implementing BOCA building codes was adopted to encourage earthquake-resistant construction.

PROJECT BENEFITS

The Village has successfully removed many of its residences away from the threat of flooding. Evansville has received recognition across the Nation for its successful implementation of mitigation measures in a small community.

PROJECT COST

\$296,000

FUNDING SOURCES

\$220,000 in FEMA-HMGP (75%).

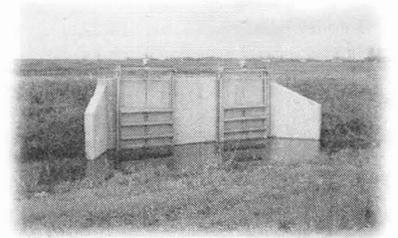
\$74,000 in Illinois Department of Commerce and Community Affairs (25%) from HUD CDBG funds.

The Illinois Emergency Management Agency administers and coordinates the State's hazard mitigation programs.

City of Chicago Inlet Control Valve

PROJECT BACKGROUND

In August of 1997, the City of Chicago experienced flooding and sewer back-up damage during a torrential rainstorm. The flood caused hardship and property loss for over 35,000 City residents. Because of the population density, many basements are utilized as garden apartments and many of the affected residences have experienced damages on a recurring basis. In addition to property loss, four fatalities occurred as a result of the flood disaster.



MITIGATION MEASURES EMPLOYED

The City has been awarded Hazard Mitigation Grant Program funds to install valves that attach to the inlets of the combined storm water and sewer system to restrict the flow of rainwater into the combined system at the peak of a storm. Engineering studies determined that the inlet valves were the most cost effective mitigation measure. The inlet control valves will be located throughout the area based on topography and other engineering criteria.

PROJECT BENEFITS

The result is that the combined system functions at no more than full capacity. The sewers function as they are intended, and the inlet valves prevent back up of sewage into the residential basements. During peak periods of full capacity, the excess storm water is temporarily stored in the streets and not contaminated with sewage.

PROJECT COST

\$14.3 million

FUNDING SOURCES

\$7,875,000 in HMGP funding (55%).

\$6,425,000 (45%) of the local match provided by the City of Chicago.

The Illinois Emergency Management Agency administers and coordinates the State's hazard mitigation programs.

City of Belleville

PROJECT BACKGROUND

The City of Belleville is located in southwestern Illinois, across the Mississippi River from St. Louis, Missouri. The City experiences repetitive flooding along Richland Creek in various locations identified as 100-year floodplain. The City experienced damaging floods in 1995 and 1996. The 1996 flood was the worst the City has encountered in 15 years and prompted the implementation of the acquisition program.

MITIGATION MEASURES EMPLOYED

The City received funding to acquire 36 properties, including 19 residences, two commercial properties, and 15 vacant lots. The acquisition project involved demolishing the acquired structures and clearing the land to open space. The properties acquired will be retained by the City for open space, to be included in the Richland Creek Greenway Project.

PROJECT BENEFITS

Prior to the 1996 flood, the City had been working on a Greenway Project to mitigate damages in the flood-prone area. The Richland Creek Greenway Master Plan calls for the City to acquire various properties along the entire length of Richland Creek within the City. The Greenway will eliminate properties from the threat of flooding and provide the City with a link to several public parks developed along Richland Creek in the recent past. The Greenway Project was initiated through a public/private effort and was recognized in 1995 as a model public/private partnership project by the East-West Gateway Coordination Council.

PROJECT COST

\$1,177,220

FUNDING SOURCES

\$882,915 in HMGP (75%).

Local match provided by the Illinois Department of Natural Resources.

The Illinois Emergency Management Agency administers and coordinates the State's hazard mitigation programs.

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Westernport Flood Mitigation Project

In September 1996, a major flood event resulting from Hurricane Fran devastated many of the homes located along Georges Creek in the Town of Westernport, Maryland. Following immediate clean-up efforts, a team led by engineers from Allegany County, Maryland; Maryland State Highway Administration (SHA); and USDA Natural Resources Conservation Services (NRCS) began working with the Town to develop, secure funding, design and construct the Westernport Flood Mitigation Project. The \$2.5 million project involved the purchase and removal of 27 homes from the floodplain, construction of streambank retaining walls to protect a major highway, repair and relocation of sanitary sewers, and restoration of the stream and riparian areas for a one-half mile section of Georges Creek.

The Town then initiated a second phase in their Flood Recovery Program - a community planning effort to identify open space uses and activities for the buyout area. At the Town's request, the Rivers, Trails, and Conservation Assistance Program (RTCA) of the National Park Service joined the planning team to assist in the coordination, development, and implementation of a Floodplain Park Concept Plan. A community-based planning approach was used that included community workshops, citizen surveys, interest group meetings, outreach through the local media, and a local steering committee to oversee plan development.

The Westernport project demonstrates the importance of interagency cooperation and grassroots community involvement in developing long term solutions to flooding problems. By integrating flood mitigation, stream restoration, infrastructure development, and park planning, Westernport was able to improve stream health, reduce the cost of future flooding, and increase opportunities for recreation and education. Most importantly, through an extraordinary level of cooperation between local, state, and federal agencies, residents of Georges Creek were able to permanently move out of harm's way.

BACKGROUND

On September 6, 1996, Hurricane Fran deposited 7 inches of rain on the Georges Creek watershed in Allegany County, Maryland, resulting in devastating floods that literally ripped apart many homes located in the steeply sloped mountain valley. Particularly hard hit was the the Town of Westernport, located at the confluence of Georges Creek and the Potomac River. Over 10 homes along Front Street and Main Street Extended were rendered structurally unsound, with a dozen more seriously flooded. In addition, the embankment of Maryland Route 36 was seriously eroded, and sections of the sanitary sewer were washed away or plugged with debris.

Allegany County was subsequently declared a Federal Disaster Area, the third of three declarations in less than 12 months. Although the declaration brought needed financial assistance from FEMA and NRCS to remove debris from the stream, there were no readily available funds to assist those homeowners who wished to relocate permanently out of the floodplain. Being a small town in an economically depressed area, Westernport had no financial resources to address this problem.

PROJECT DESCRIPTION

In October 1996, a team led by the chief engineers of Allegany County, SHA, and NRCS convened meetings with other government entities and town representatives to brainstorm ways to pool resources, programs, and talents to assist Westernport. After much discussion, the following project goals were agreed upon:

1. Remove residents from the floodplain through a voluntary buyout program which adequately compensates and assists with relocation;
2. Utilize environmental treatment to restore Georges Creek to a stable form providing its maximum available flow capacity;
3. Provide for stabilization of Maryland Route 36;
4. Repair or relocate damaged sanitary sewer line; and
5. Manage long term use of the acquired floodplain as community open space.

Once the scope was defined, the project team began the task of piecing together the estimated \$3 million required to complete the project. Funding was made possible through innovative pilot programs developed by SHA and NRCS that redirected funds from normal highway maintenance and stream-clearing activities to property acquisition and stream restoration activities. A deadline of June 1997 was established for completion of the project, in order to comply with NRCS program deadlines.

Tasks were then allocated based on the specific expertise of each agency. Allegany County provided cash payments and settlement services on acquired properties and designed and supervised sewer repair work. SHA performed property appraisals, designed and inspected the highway stabilization work, and led the stream restoration effort, including acquiring the services of stream geomorphologic experts. NRCS assisted with stream design work and contracted for all construction services.

In July 1997, as construction work drew to a close, efforts turned toward the issue of long term management of the floodplain buyout area. The Westernport Mayor and Town Council met to discuss options with interested citizens and agency representatives. Town leaders wanted to explore alternatives that would preserve the integrity of the stream restoration while affording citizens some use of the area. In addition, there was interest in involving area residents in decision-making, and in building local support for long-term floodplain open space protection. At the request of the Town, the National Park Service, Rivers, Trails, and Conservation Assistance Program (RTCA) joined the planning team to serve as coordinator for the open space planning phase of the project.

In September 1997, RTCA began working with the Town to develop recommendations for long term use of the floodplain and adjacent areas. Due to the interdisciplinary nature of the project, a Floodplain Park Planning Team was formed that included representatives from the community as well as technical experts in land use planning, recreation, conservation, and floodplain management. Project partners included Allegany County Planning Department, Maryland Department of Natural Resources, Maryland Department of the Environment, Maryland Office of Planning, NRCS, and the University of Maryland Landscape Architecture Design Studio.

A community-based planning approach was used with the goal of integrating the knowledge and expertise of local citizens, in terms of community needs, with the technical expertise of agency professionals. An on-going dialog between local residents and technical experts developed, which resulted in the formation and adoption of a plan for the site that was both technically sound and conformed to the needs of the community.

The Planning Team sponsored a series of community meetings, workshops, and public surveys to serve as a forum for citizens to contribute ideas to the planning process. The Planning Team was instrumental in helping the community evaluate options for use of the floodplain buyout area developed through the workshops. In addition, the Planning Team was able to expand the network of partners, and link the town with additional public and private sources of funding and technical assistance.

By September 1998, a Final Concept Plan including a detailed site plan for the Main Street Extended area was endorsed by the Town Council that included the following:

- Areas for passive recreation including a walking trail, pavilion, handicapped accessible picnic area, open area for lawn games, and related park amenities;
- Outdoor educational facilities including a nature trail, stream access area, shelter/pavilion for arts, science, and history classes, and interpretive signage explaining flood history and stream restoration goals; and
- Improvements to habitat value of the stream and adjacent lands through revegetation of the site with native plants and enhancement of stream buffers.

With the final concept plan in hand, the Westernport Parks Committee began efforts to see that the plan became a reality. They sponsored a "Name The Park" contest, organized community projects and events, coordinated local fundraising efforts, and provided recommendations to the Mayor and Town Council on various park development decisions. The Parks Committee was successful at leveraging state and federal funding sources with local volunteer services and private donations of supplies and materials.

PROJECT COST

Property acquisition	1,284,475
Stream restoration	298,995
Highway stabilization	743,572
Sewer repair/relocation	142,813
Park planning and development	(estimate) 40,000
Miscellaneous	1,484
Total:	\$ 2,511,339

FUNDING SOURCES

Acquisition, stream restoration, and infrastructure improvements

Allegany County, Maryland	403,382
MD State Highway Administration	1,747,903
USDA-Natural Resources Conservation Service	320,054
Subtotal (phases 1 - 4)	\$ 2,471,339

Park planning, design, and construction:

DNR Program Open Space	14,000
Appalachian Regional Commission	3,000
Chesapeake Bay Trust	3,000
Cumberland Rotary	2,000
American Forest Association	1,000
NPS-Rivers and Trails Program	1,000
NRCS	500
WalMart	500
Town of Westernport	5,000
Local fundraising including in-kind services	10,000
Subtotal (phase 5)	\$ 40,000

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Flood Damage Reduction Grant Assistance Program

BACKGROUND

One of the important ways that Minnesota DNR Waters accomplishes its strategic mission is the Flood Damage Reduction Grant Program. The Flood Damage Reduction Grant Assistance Program (FDR) was established by the 1987 Legislature to provide technical and financial assistance to local government units for reducing the extent of flood damages. Under this program the state makes cost-share grants for up to 50% of the total local cost of flood mitigation projects. Since the inception of the program, almost \$61 million in state grant monies have been distributed to local units of government across Minnesota for flood damage reduction projects. Flood damage mitigation projects in Minnesota have averted over one-half billion dollars in damages.

The flood damage reduction grant assistance program is designed to mitigate damages due to flooding in rural and urban floodplain areas. The commissioner may also make grants to local government to conduct studies to determine the most feasible, practical, and effective methods and programs for mitigating the damages due to flooding within flood prone areas. Some eligible project examples are:

- Structural acquisition in the 100-year floodplain
- Levees, Ring Dikes, Flood Walls
- Flood warning systems
- Feasibility studies
- Public education workshops
- Flood Insurance Studies
- Floodplain ordinance changes
- Floodplain mapping
- Comprehensive watershed plans
- Flood storage easements
- Floodplain/river restorations
- Cost-share on federal projects

There are currently two different classes of grants available. Small grants are for projects with a total cost of less than or equal to \$300,000 (state share less than \$150,000). Small grants are made directly by the DNR from funds appropriated by the legislature. Large grants are for projects with a total cost greater than \$300,000 (state share greater than \$150,000). Large grant applications are received and prioritized by the DNR and then presented to the Governor and the legislature for consideration in a capital bonding bill.

In addition to partnering directly with local units of government, FDR grants can be used to leverage financial and technical assistance from other agencies. DNR Waters and local units of government have partnered with the U.S. Army Corps of Engineers on federal flood control projects as well as projects in the Federal Section 14, 22 and 205 programs. FDR funds can also be used to leverage acquisition and hazard mitigation funding from the Federal Emergency Management Agency through the State Division of Emergency Management following a disaster.

The ravages of flooding can have disastrous effects on peoples lives and their community. Participation in the FDR program enables communities to break the tremendously expensive damage - repair cycle and is extremely cost effective. The flood control project in Oslo, Minnesota was built using \$100,000 in local funding. The project has averted damages totaling almost \$16 Million in 1996 and 1997 alone. The FDR program shields people and their communities from future disasters.

DNR Information: 651-296-6157 • 1-888-646-6367 • TTY: 651-296-5484 • 1-800-657-3929

FLOODPLAIN ACQUISITIONS

- Over 203 homes were removed from the floodplain following the 1993 flood
- Over 1200 homes were removed from the floodplain following the 1997 flood

FARMSTEAD RING DIKES

- Over 100 farmstead ring dikes have been constructed in 1997-1998
- Another 200 ring dikes are planned for the future

COMMUNITY LEVEES

- Total cost \$1.4 million
- Local share \$100,000
- Damage averted \$15.8 million
 - \$6.8 million in 1996
 - \$9.0 million in 1997
- Henderson flood damage reduction project
 - Total cost \$1.8 million
 - State share \$203,000
 - Damages averted 4.9 million
 - \$2.8 million in 1993
 - \$2.1 million in 1997
 - Highly cost effective

FLOOD DAMAGE REDUCTION FISCAL YEAR 1998

- \$28.5 M - LERRDs (Federal Projects)
 - Chaska - levee system
 - Crookston - levee and high flow cutoff
 - East Grand Forks - setback levee and greenway
 - Marshall - acquisition, levee, and bypass
 - Stillwater - levee and floodwall
 - Warren - off channel storage and bypass
- \$9 M - Structural Acquisition
- \$8 M - Flood Proofing
- \$2.4 M - Farmstead Ring Dikes
- \$1.5 M - General Fund Money
 - 250K - Section 22
 - 500K - Section 205
 - 200K - Alternative Flood Control

Moorhead, Minnesota

PROJECT BACKGROUND

The River Oaks Subdivision in southwestern Moorhead was developed on a meander bend of the Red River in the 1950's and 60's before the area became part of the City, and prior to modern floodplain management regulations. Over a dozen large, expensive homes in the subdivision sustained repeated damage totaling nearly \$350,000 in six floods between 1969 and 1993.

MITIGATION MEASURES EMPLOYED

In 1994, the City received funding from the Hazard Mitigation Grant Program (MN Division of Emergency Management) and the Flood Damage Reduction Program (MN Dept. of Natural Resources) to acquire 8 of the homes at greatest risk. About an equal number of homeowners declined to participate in the buyout program. Owners of the acquired properties contributed about 15% of the total cost. Four of the homes were demolished after being used by the FBI for a training exercise. The other four were relocated out of the floodplain. Empty lots were converted to open space and added to an existing city park in the area.

PROJECT BENEFITS

In 1997, a record flood caused extensive damage to the homes that remained in the subdivision. No damage occurred to the homes that had been removed. The cost of the 1994 buyout of 8 homes was more than recouped by avoiding damage to them in one flood event in 1997. Since the '97 flood, the City has received additional funds from the Hazard Mitigation Grant Program to buy 16 additional flood-prone homes in several locations, including some in the River Oaks Subdivision that did not participate in 1994.

PROJECT COST

\$1,030,424

FUNDING SOURCES

\$772,818 in HMGP (75%)

\$60,000 in MDNR funds from Flood Damage Reduction Program (6%)

\$42,126 in MN Division of Emergency Management state match funds (4%)

\$155,480 in match by owners of acquired properties (15%)

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Mississippi Flood Mitigation

BACKGROUND

The Mississippi Delta region along the north-south traverse of the Mississippi River has a long history of flooding. The four major river drainage systems that flow out of the northeastern hills of the state into the delta and finally empty into the Mississippi River create a network of delta tributaries that have proved to be untamable. Today the years of attempts to channelize and the annual buildup of deposits of sediment make these delta rivers and bayous extremely unpredictable and subject to low-level, seasonal flooding and catastrophic flooding with above average rain events.

TOWN OF LOUISE

Louise, Mississippi is a small delta farm community located west of author Willie Morris's Yazoo City "where the Delta meets the Hills". The "Gill Quarter" section of Louise, Mississippi lies within the floodway of Silver Creek, a tributary of the Sunflower and Yazoo Rivers. The area consisted of twenty-six residential structures, all with long histories of flooding. During the previous twelve years, all homes in the area had been flooded at least once on an annual basis and four flood events were recorded during three of the twelve years.

CITY OF GREENWOOD/LEFLORE COUNTY

Greenwood is a historically agricultural-based community located in Leflore County that serves as one of the financial and social centers of the Mississippi delta. The City is surrounded by the Yalobusha and Yazoo Rivers and, much like New Orleans, is protected from flooding by levee systems and pump stations. Viking Industries, the manufacturer of upscale kitchen appliances, is headquartered in Greenwood and operates a major manufacturing facility located across the river from Greenwood in Leflore County. The facility employs over 600 workers from an area with an unemployment rate of 15%. Unlike Greenwood, the plant site and a small adjoining residential subdivision were subject to flooding that endangered residents, flooded homes, overtopped the only road servicing the area and interrupted normal business operations.

PROJECT DESCRIPTIONS, COSTS AND FUNDING SOURCES

While both communities applied for Hazard Mitigation Grant funds to address repetitive flooding, solutions to their similar problems proved to be very different. The success of both projects is attributed in part to the flexibility of the Hazard Mitigation Grant program in allowing the State and local communities to determine the most cost-effective, long-term and attainable solution available.

The Town of Louise project was easily determined to be an acquisition project. However, the community was faced with the problem of providing replacement housing and relocation assistance for the low-income residents. The project was leveraged with funding from the Hazard Mitigation Grant Program (HMGP) and Community Development Block Grant (CDBG) Housing funds to successfully acquire all of the at-risk structures, develop a small residential subdivision, build five new houses, and pay relocation cost to eleven families. The \$700,000 project was funded with \$392,500 in HMGP funds and the balance with CDBG funds. South Delta Planning & Development District acted as the Applicant's agent and handled the relocation.

The Greenwood/Leflore County project was more difficult. Relocation was not an option. Not only was relocation not cost-effective under the HMGP, it could have triggered competitive recruitment of Viking Range by communities throughout the country, and residents of the small residential subdivision had strongly voiced their opposition to relocation. A drainage and structural flood protection project was finally determined to be the most acceptable and cost-effective solution. Using the FEMA Benefit-Cost model, an acceptable ratio of 1.2:1 was determined. However, using the State's Economic Impact Analysis the benefit-cost was 7.29:1. The total project cost is \$2,776,952, with additional related expenditures by Leflore County, the City of Greenwood and Viking Range totaling over \$750,000. The Federal share of the project is \$1,958,942.

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Missouri Flood Mitigation Project

BACKGROUND

The 1993 Midwestern flood was a record-breaker both in terms of river levels and duration.

Of the nine Midwestern states affected, the State of Missouri was undoubtedly the hardest hit by the flood and state officials estimate that damages totaled \$3 billion. Assistance to an estimated 37,000 Missouri families on that flood alone included \$41.7 million spent in Disaster Housing (DH) assistance and \$23.4 million in Individual and Family Grants (IFG) to those who were uninsured. An additional \$40.1 million in low interest loans had been approved by the Small Business Administration (SBA) to cover disaster-related losses to homeowners and businesses. Add to these figures \$7.8 million in disaster unemployment and \$120 million in Public Assistance to repair damaged public facilities and the costs are obviously staggering.

PROJECTS

The Missouri Buyout Program received close to \$100 million which flowed through the state to local communities.

To create a solution which was permanent, Missouri's Governor Mel Carnahan decided that these funds would be best used to buy out flood-prone properties with an emphasis on those which were primary residences. A concentration on this option would alleviate future problems for both homeowners, emergency managers and taxpayers alike.

The Missouri Buyout Program is an exemplary program which is proactive and cost-effective. It stresses a collaborative partnership between federal, state and local governments. It's also a voluntary program which allows residents a practical solution by relocating their homes outside of the floodplain. Once the properties are cleared, the publicly-owned ground may then be used for open space purposes more consistent with the threat of repeat flooding.

BENEFITS

Missouri's Buyout Program is already paying for itself. Over half of the 5,500 targeted properties were purchased in the buyout program since 1993 and, therefore, that many properties were unaffected by the 1995 event.

By way of example, St. Charles County sits at the confluence of the Missouri and Mississippi Rivers. In that county alone, the combined costs of the 1993 flood have exceeded \$160 million.

The number of potentially occupied parcels of property in the 100 year floodplain purchased under the buyout program in St. Charles County was 1374. This included over 560 single family residences and three mobile home parks with 814 pads. It's estimated that the occupancy rate in those parks was 84% at the time of the 1993 flood. Residents in these repeatedly flooded parks were among the neediest from the standpoint of needing disaster assistance from both public and private sources.

When the 1995 spring rains hit, causing the third worst flood of record, 1,000 fewer families (approximately 2,500 people) were out of harm's way as a result of the buyout program in St. Charles County alone.

Missouri Leads the Way in Acquisition Projects
FEMA REGION VII ACQUISITION PROJECTS

(As of 7/13/95)

STATE	#of Projects	Approved Properties	Withdrawn or Refused	Properties Purchased	Percent Complete
MO	44	5,305	1,065	2,958	69.76

PROJECT COST

Disaster Assistance in St. Charles County
(As of 7/14/95)

Floods	Number of Applicants	Disaster Housing	Individual/ Family Grants	SBA Loans
1993	4,277	\$8,359,550	\$5,818,167	\$11,898,600
1995	333	\$204,493	\$11,601	\$67,000

1993 federal flood costs on purchased properties in St. Charles County (eliminated in the future through the buyout)

NFIP Structural claims	10,312,733
NFIP Contents claims	2,987,797
Emergency Repair (EMR)	836,391
Individual/Family Grant (IFG)	419,797
Mobile home NFIP claims/disaster aid (est.@ 60% occupancy)	5,169,872
SBA Loans	3,804,390
NFIP loss processing costs (est.)	399,000
Total federal '93 flood costs on St. Charles Co. buyout properties	\$ 23,929,980

St. Charles County Buyout Program Facts and Figures

Total fair market value	\$20,525,624
Actual purchase price	\$10,146,810
Administrative costs	\$3,554,000
Duplication of benefits (SBA loans, NFIP proceeds, disaster benefits) subtracted from the sale price	\$10,538,437
Cost per property - 1374 (includes all mobile home lots)	\$9,971
Cost per Unit purchased (640)	\$21,408

Note: Floodwater in 1995 affected virtually all of the same 1,374 properties bought out after the 1993 flood albeit to a lesser height and a shorter period of time. Were it not for the buyout program, it is reasonable to assume a much larger number of applicants would have been requesting disaster assistance and submitting flood insurance claims, leaving the structures at risk for the next flood. In fiscal years 1997 and 1993, the federal government spent \$64 billion in direct disaster relief and \$55 billion indirectly through low-cost loans. In addition, Congress spent nearly \$3 billion to cover unmet costs in the National Flood Insurance Program (NFIP).

FUNDING SOURCES

This included \$30 million in FEMA 404 funds, \$28 million in FEMA 406 funds for demolition due to health and safety reasons, and \$42 million in Community Development Block Grant (CDBG) funds through the Department of Housing and Urban Development (HUD).

For copies of the comprehensive report titled "Out of Harm's way, Missouri's Flood Buyout Program" please contact the Missouri State Emergency Management Agency (SEMA) at 573-526-9141

City of Arnold

PROJECT BACKGROUND

The City of Arnold, Missouri is located just off interstate 55 about 20 miles south of St. Louis. Near the point where the Meramec River empties into the Mississippi, a bend in the river has formed a peninsula. Situated on this peninsula, the City of Arnold has been the site of nine major floods since 1973.

With so much flood history, the citizens of Arnold have long demonstrated a progressive attitude toward "flood-proofing it" and otherwise "mitigating" the adverse effects caused by flooding. For example, since 1980, the City of Arnold has required that all new construction projects include the installation of valves in the plumbing systems to protect sewer lines and prevent the contamination of the city water system in the event of flooding. The government of Arnold also has passed local ordinances, including strict building codes, and has required developers to observe rigid easement regulations along the Meramec River in order to better protect the town's residents.

Moreover, Arnold was one of the first towns to participate in FEMA's early flood buyout – the "1362 program" in 1980 and has continued aggressively participating in flood buyout programs following Presidential Declarations in the years since then. By the end of 1995, the City of Arnold had purchased 155 mobile home pads and 202 single family residences in the floodplain. In 1997, the national Association of State Floodplain Managers presented its annual award to Arnold in recognition of the community's successful buyout program.

MITIGATION MEASURES EMPLOYED

Working with the Missouri State Emergency Management Agency, the City of Arnold has continued its aggressive campaign to buy repetitive flood loss structures, using Flood Mitigation Assistance Program grant funds to purchase an additional nine homes over the last two years. The key focus of this project was to stem the tide of future losses was to purchase structures that had been the subject of four or more repetitive loss claims previously paid by the National Flood Insurance Program (NFIP). The nine properties purchased in Arnold had been subjected to past repetitive NFIP claim losses totaling some \$961,846 by 1995. This represented 43 flood claims, for an average of 4.77 flood claims per property, over roughly a 16 year period. In seven of the nine properties, the NFIP claims paid had already exceeded the fair market value of the properties. In three of those cases, the NFIP claims paid were close to double the fair market value of the properties.

PROJECT BENEFITS

Based upon the above statistics, it is possible to anticipate conservatively that sometime during the next 15-20 years the NFIP savings alone will recoup the entire cost of this project.

The opportunity to avoid future flooding offers even greater benefit to Arnold residents like Joe Moore who took advantage of a flood buyout offer following the '93 flood. During the 1995 flood, Mr. Moore remembers driving back to his old homestead on the floodplain as the water was rising.

I felt relieved. I was laughing. I even drove down to the old house. I could see the water coming up and I was so relieved that I could just sit there and watch it come up. I didn't have to sandbag...I was happy because I was bought out and I'm gone. I don't have to worry about it the rest of my life. (Schneider and Klise, "Out of Harms Way: Missouri's Flood Buyout Program")

PROJECT COST

\$840,000

FUNDING SOURCE

FEMA – FMA

City of Lupus

PROJECT BACKGROUND

The small Village of Lupus, Missouri is located at the termination of route P, just off highway 179 in Moniteau County in the central region of the state. The community lies along the western edge of the Missouri River in a valley situated between the Big and Little Splice Creeks. With the exception of only two residences, the entire town of twenty-one houses sit within the floodplain.

During the Great Flood of 1993, the small town was inundated. Although the Village of Lupus had been a participant in the National Flood Insurance Program (NFIP) since 1986, only a few owners actually had taken out policies until the '93 flood event. The townspeople faced a rebuilding process that was both emotionally and financially difficult because of the lack of flood insurance. The subsequent flood in 1995 still struck five of the twenty-one residences. If anyone thought that serious flooding problems in Lupus, the '95 flood effectively dampened that illusion.

Once the flood waters had receded and as time passed, the citizens of Lupus examined their options and determined that their best course of action was to rebuild their properties a few feet higher at the same location rather than selling them as part of a buyout project and relocate elsewhere. By 1996, over 90 percent of the inhabitable floodplain dwellings in Lupus were covered by NFIP policies. By mid-1997, only one property owner in the Lupus floodplain remained without an NFIP policy. The Village of Lupus became very serious about implementing some effective mitigation measure, and focused intensively on developing an elevation project to save their village.

MITIGATION MEASURES EMPLOYED

The Village of Lupus wrote and adopted a Flood Mitigation Assistance Plan which was approved by the Missouri State Emergency Management Agency (SEMA) on July 1, 1997 and by the Federal Emergency Management Agency (FEMA) on August 1, 1997. The government of Lupus then submitted a Flood Mitigation Assistance (FMA) application which was approved by SEMA on July 23, 1997 and by FEMA on July 30, 1997.

The scope of the FMA project was to elevate thirteen structures and the relocation of one structure. Ultimately, eleven structures were elevated and none were relocated. FEMA contributed \$138,839.13, a Community Development Block Grant (CDBG) paid \$89,195.38, and Interfaith provided \$5,000 for a total project cost of \$233,034.51. In addition, Interfaith and several property owners spent another \$29,250.00 to pay for other non-eligible project costs.

PROJECT BENEFITS

Several benefits resulted from the Lupus Elevation Project. For example, the Village of Lupus remains in its original location, and none of the residents had to relocate. This minimized out of pocket expenses for the participants who did not go beyond the scope of the project. In addition, the project required that the lowest floor, to include the basement, be elevated at a minimum to the flood protection level, i.e. base flood elevation (BFE), and that the lowest finished floor be at least two feet above BFE to maximize protection against likely future floods. This method of mitigation was a relatively inexpensive way to move those properties out of future harms way. The elevation project also is a good example of how to use FMA, CDBG, non-profit, and owner funding to successfully accomplish a flooding mitigation project.

PROJECT COST

\$233,035

FUNDING SOURCES

FEMA – FMA, CDBG, INTERFAITH

BUYOUT PROPERTIES IN LUPUS, MO

Property Address	Final BFE	Program Eligible Fund Source
3780 Walnut	589.8 feet	FEMA
3820 Adams	585.9 feet	CDBG and Interfaith
3830 Adams	586.2 feet	FEMA
3838 Adams	587.0 feet	FEMA
3840 Adams	584.4 feet	FEMA
3850 Adams	589.5 feet	FEMA and Interfaith
3870 Adams	586.4 feet	CDBG
3740 Main	589.4 feet	CDBG and Interfaith
3750 Main	586.3 feet	CDBG and Interfaith
3760 Main	586.1 feet	FEMA
3800 Oak	586.7 feet	FEMA

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Yellowstone Mitigation Project

BACKGROUND

Park County experienced a record flood on the Yellowstone River in June of 1996. The River stayed at a very high flow for over a week causing massive bank erosion and a number of houses being flooded. In June 1997, the Yellowstone River produced yet another record flood. More bank erosion occurred, and the same houses were flooded again. Both floods were equal to the 100-year, 1% frequency flood. Mitigation was obviously needed for the residential structures, yet relocation was out of the question due to the price of land/lots in this area, which is known as Paradise Valley. Many property owners did not have the resources necessary to mitigate the flooding problem. But thanks to FEMA and the Flood Mitigation Assistance Program (FMAP), funding was available to assist in mitigating hazards. One property owner took advantage of this program. He worked with the County, who acted as the applicant, and applied for a grant to elevate his house. Park County applied for a FMAP grant to the DNRC Floodplain Management Program. The Grant was awarded in the middle of February, 1998.

PROJECT

The project consisted of simply elevating the house to the standards identified in the Park County Floodplain Management Ordinance. The structure was elevated so the lowest floor was at least two feet above the BFE. The Centers contracted with a house mover to elevate the structure and place a new foundation under the structure. Once the foundation was completed, the house was set back down and the fill material was placed around the structure for foundation protection. The project was completed in less than a month, except for final landscaping.

BENEFITS

The benefits are simple. The structure, now elevated two feet above the 100-year flood elevation, will not experience flood damage to the structure, even during a 500-year event. Thus, there should be no future flood insurance claims. The Benefit Cost Ratio should prove to be greater than 1:1.

PROJECT COST

\$18,304

FUNDING SOURCES

Flood Hazard Mitigation Program (FMAP) Grant funds of \$13,728.

Property owner match of \$4,576.

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Barnes County, North Dakota

BACKGROUND

An abnormally wet cycle since 1993 had flooded homes yearly along the Sheyenne River north and south of Valley City, ND. The houses were built prior to issuance of Flood Insurance Rate Maps (FIRM), and all but one were 1970's or early 1980's housing. The only other flooding the structures sustained was in 1979.

PROJECTS

A relocation of the house at the lowest elevation and a seven-home buyout represented the hazard mitigation project. Barnes County Commissioners could not put any money into the project, though they agreed to act as governmental sponsor so the emergency manager could accomplish the project. The land owners paid for the local share since they were getting the greatest benefits. At the time of these projects, substantial damage had not been experienced by the 8 homes. However, these projects were determined to be repetitive loss structures.

BENEFITS

The homeowners are now safe and out of the floodway, relocated out of the floodplain. They no longer experience yearly flooding, septic tank back ups, catastrophic private dike failures and dangerous travel through rapidly moving flood water (getting to and from their houses to keep pumps going behind sandbags) or "toughing it out", living in the upper floor without power or toilet facilities while battling the water to minimize damage. Barnes County taxpayers did not have to pay for the land owners' purchasing mistakes. The land owners either were bought out for 86 percent of the appraised value or had a home relocated that they could not sell because of repetitive flooding. All but one home owner stayed in the county.

Banks did not experience losses from bankruptcies or home owners walking away from their mortgages.

Where possible, Barnes County offered the upper floor of these houses for sale rather than demolition. This dramatically reduced lot salvage costs. The county collected \$50,000 on sales for relocation of structures out of the floodplain. This reduced demolition and lot restoration to \$12,000 for six properties of the buyout. The seventh has not been purchased. The \$50,000 was deposited into the project account. At account close-out, the remainder of funds will be turned back to the state and FEMA.

The NRCS purchased two lots that it is returning to natural vegetation as a educational plot. Barnes County is leasing out other properties for pasture or for hay land to partially make up for the tax losses. The Department of Interior has purchased another for a recreational area adjacent to the fish hatchery.

In addition, when personnel from the National Flood Insurance Program came to photograph repetitive loss structures, three of the four properties targeted had been turned to empty lots. One of the home owners had at least three \$30,000 claims, and would have had two more floods had the home remained on the lot. The fourth land owner who has experienced repetitive losses has never requested a buyout or other aid.

PROJECT COST

\$650,000

FUNDING SOURCES

Landowners, State, FEMA-HMGP.



Storm Sewer Lid Station Installations

City of Fargo

BACKGROUND

The City of Fargo is located in the Red River Valley. The topography of the Valley and City is very flat and the river is prone to spring flooding associated with snowmelt runoff. The City's 60 storm sewer outfalls that discharge into the Red River must be protected from backup during flooding conditions on the Red River. Backup protection consists of installing sluice gates or flap gates on storm sewers and lift stations to provide storm sewer capacity during high water conditions.

PROJECTS

Since 1990, the City has completed installation of eight storm sewer lift stations. Each lift station was approved individually for HMGP funding based on the flood protection benefits these lift stations provide. These eight lift stations are located as follows:

18th Avenue North at Elm Street	70,000
8th Avenue North at Oak Street	70,000
32nd Avenue South at 11th Street	160,000
Milwaukee Road at 40th Avenue	74,000
25th Street at Rose Coulee	53,000
52nd Avenue South at University Drive	102,000
32nd Street at 47th Avenue Southwest	84,000
38th Street Southwest at Drain 27	87,000
Total	\$700,000

The City is also currently working on the installation of three additional storm lift stations under the HMGP with completion scheduled for mid-1999.

BENEFITS

The City has invested heavily in storm sewer backup prevention and pumping stations. Why is preventing storm sewer flooding so important in Fargo? There are two basic reasons:

- a) In some locations, land adjacent to the river is slightly higher than the land further to the east. This high ground along the river's edge generally prevents surface flood waters from inundating the lower property. Without backup protection, the flood waters will backflow through the storm sewer coming out of the inlets and flooding all low-lying property to a level similar to the river level.
- b) The second main reason to keep the storm system as dry as possible is to prevent possible transfers from the storm sewer to the sanitary sewer system. A flooded storm sewer tends to leak at its joints. Since the streets are underlain with a maze of different utility pipes, storm sewers and sanitary sewers often cross near each other, particularly sewer service connections to homes and businesses. Water leaking out of a flooded storm sewer can leak into a sanitary sewer service or main at quite rapid rates causing sanitary sewer flooding.

These eight permanent lift stations eliminate the need for temporary emergency pump operations during flood conditions. Since permanent pumps offer capacities ranging from 6 to 20 times greater than portable

temporary pumps, the permanent installations offer much greater protection with minimal setup and operator intervention. It is estimated that these pump stations reduce damages and flood protective costs by approximately \$800,000 for a 10-year flood occurrence.

The City believes that these projects are extremely successful in improving flood preparedness and minimizing flood damages.

PROJECT COST

\$700,000 for 8 Sites

FUNDING SOURCES

FEMA- HMGP

North Dakota

CDBG

Local

4th Street Floodwall Project

City of Fargo

BACKGROUND

During spring flooding in 1969, the City of Fargo constructed an emergency earth dike along 4th Street between 9th Avenue & 14th Avenue South. The "temporary" dike was left in place after the flood event serving to protect the area from flood events occurring in 1975, 1978, 1979, 1989 and 1993. City attempts to upgrade this dike to a permanent certified dike were stymied for many years by building encroachments, right-of-way limitations, riverbank stability concerns and funding availability. Following the 1993 flood disaster declaration, FEMA approved a conceptual plan to upgrade this dike.

PROJECT

The dike upgrade project included a river hydraulic analysis to determine floodplain impacts, reconstruction of existing "temporary" dike, relocation of one house, dike raising to levels appropriate for certification through use of concrete and segmented block retaining walls, and storm sewer lift station enhancements for storm sewer penetrations through the dike/floodwall.

BENEFITS

The existing temporary dike was unstable and not high enough to provide flood protection to the area. Upgrading the dike has provided permanent and secure flood protection for the City's new \$70 million water treatment and distribution facilities and public sewer facilities, along with approximately \$75 million of private facilities in the area. The permanent facility will prevent the need for extensive emergency flood protective measures required during the spring flood of 1997. It is estimated that the improvements will prevent future flood damages of approximately \$3.8 million for flood events similar to 1997.

PROJECT COST

\$804,000

FUNDING SOURCES

FEMA- HMGP
North Dakota
CDBG

Flood Prone Property Acquisition

City of Fargo

BACKGROUND

Record flooding occurred in the Red River Valley during the early spring of 1997 following the rapid melting of record amounts of snowfall from the winter of 1996/1997. In Fargo, ND the flooding severely impacted five residential neighborhoods. In spite of massive pre-flood preparations, four of these five neighborhoods were impacted by significant flooding of houses. Approximately 80 houses were severely damaged by flooding with nearly 30 of these damaged in excess of 50% of full value.

PROJECT

The project consisted of the acquisition and removal of 54 houses damaged by flooding. The removal of these houses occurred at a very rapid pace thanks to the cooperation of the FEMA and North Dakota Division of Emergency Management (NDDDEM) Mitigation team. The project application was submitted in June 1997 and approved in July. Appraisals and acquisition began immediately, with house removal beginning in October 1997 and removal of all 54 houses completed by December 1998. The City also independently acquired and removed 26 additional houses as part of their overall flood prone property acquisition program.

BENEFITS

The City of Fargo considers the project as a success story in minimizing future flood damages and also in improving flood preparedness. Approximately \$2.1 million in flood damages were sustained at these 54 properties during the 1997 flood. These damages were incurred in spite of the placement of approximately 750,000 sand bags to protect these properties at a cost of approximately \$1 million (not counting volunteer and homeowner time and expenses). The removal of these houses will prevent need for future flood protective measures and eliminate a repeat of 1997 flood damages. Removal of these houses has also enhanced the river corridor with added green space and flood buffer area to the benefit of the neighborhoods and the river's flow capacity.

PROJECT COST

\$6,200,000

FUNDING SOURCES

FEMA - HMGP

CDBG

Highway 81 Culverts

City of Fargo

BACKGROUND

During 1997 spring flooding, breakout flood flows from the Wild Rice River were trapped between Highway 81 and 25th Street Southwest. As the water moved north, it ponded behind roadways causing significant flooding. This flood water could not get back into the Red River channel due to limited culvert capacity under Highway 81. To ease flooding in 1997, Highway 81 was open cut to allow water to drain from west to east, with a temporary bridge installed to keep the highway open to traffic.

PROJECT

Two culverts were installed across Highway 81 at the location of the roadcut. Sluice gates were installed on the culverts to control the flow during normal and flooding conditions.

BENEFITS

The culvert installation will prevent the need for extensive emergency protective measures while also significantly reducing future potential for flood damages. Maintaining permanent access along Highway 81 is crucial during flood events. The emergency measures necessary in 1997 limited access to the area. The new culverts will provide permanent flood flow capacity while eliminating access limitations.

PROJECT COST

\$90,000

FUNDING SOURCES

FEMA HMGP
North Dakota
Local

Forest Avenue Storm Sewer System

City of Fargo

BACKGROUND

The 2nd Street North area between 28th Avenue North and Forest Avenue is an old drainage swale. This swale was substantially filled prior to development in the area; however, the area remains between 2' to 4' below the surrounding property. Trunk storm sewers are located on both 2nd Street and Forest Avenue, collecting runoff from surrounding higher ground. During intense rainfall, the storm sewer fills up and floods the low lying area along the trunk storm line. Extensive overland flooding has occurred in the past. Flooding levels build up and enter homes through exterior openings in basements and first floors.

PROJECT

The project consisted of installing a separate storm sewer system in the low lying area prone to flooding and isolating the new storm system from the existing storm sewers in the area with backup flap gates, lift station and manhole sealing. Flow from the old storm sewer system can no longer spill out, flooding the low area. Runoff from the low area is collected in the new storm sewers and pumped out of the area into the existing sewer system.

BENEFITS

Since completion in early 1996, the area has endured four intense rain storms that would have previously resulted in significant surface water flooding. The project has operated as intended to prevent street and property flooding, saving an estimated \$400,000 in flood damages the past three summers.

PROJECT COST

\$507,000

FUNDING SOURCES

FEMA- HMGP
North Dakota
CDBG
Local

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Flood Mitigation in Lycoming County, Pennsylvania

BACKGROUND

Lycoming County in Central Pennsylvania encompasses over 2,200 miles of riverine waterways including a 16-mile section of the West Branch of the Susquehanna River. This extensive water system, combined with the area's mountain and valley geography, have made the county one of the most flood prone regions in the United States, with 48 recorded flood events since 1814. In 1996, the most recent wide-scale flood event, federal disaster relief expenditures totaled \$147 million. 160 businesses and 1,418 homes were damaged, with nearly 700 homes destroyed or heavily damaged; 1,000 jobs were interrupted or threatened, 200 people were injured, 88 were hospitalized and there were 6 fatalities.

PROJECT DESCRIPTION

County government officials, realizing that a comprehensive mitigation strategy was necessary to end the cycle of recurrent damage, began a local initiative to develop a new approach to flood management.

- The county flood warning system was modernized and upgraded with the installation of 23 automated stream gauges. With the state and federal assistance, a county program of acquisition and demolition, elevation, and relocation has removed 196 homes and businesses from repetitive flood areas.
- In cooperation with the Army Corps of Engineers, the County is establishing 19 first order vertical elevation benchmarks throughout the county watersheds.
- A county-wide survey of floodplain management regulation administrative and enforcement practices was conducted in 52 floodprone municipalities for use in preparing and recommending more effective local land use regulations, including Flood Hazard Area Construction Standards for local building codes.
- The County's GIS program has been expanded to include a range of land use information in determining hazard vulnerability areas. The vulnerability analysis database (VAD) also includes elevation certificates, repetitive loss property information, public infrastructure and critical facilities. The County is currently partnering with FEMA and USGS to develop Digitized Flood Insurance Rate Maps for 52 municipalities. This project will incorporate the County GIS base data, DEM elevation data and hydraulic and hydrologic data for a new Flood Insurance Study and digitized flood modeling and forecasting.

BENEFITS

- Improved and extended flood early warning system
- 196 homes and businesses removed from repetitive flood areas since 1996. Fifty of these structures were repetitive loss properties under the National Flood Insurance Program (NFIP) comprising one quarter of all repetitive loss properties in the county.
- The VAD system will assist local officials and emergency service providers in determining hazard vulnerabilities, risk relationships and damage reduction actions and will improve disaster preparedness, response and recovery efforts.
- Improved floodplain management administration and enforcement
- County-wide involvement and awareness of flood risks and safety measures
- Reduction in future damages estimated at \$35.6 million

PROJECT COST

\$15.3 million to date

FUNDING SOURCES

U.S. Army Corps of Engineers

Federal Emergency Management Agency

Pennsylvania Emergency Management Agency

County of Lycoming

52 Lycoming County municipalities

Lycoming County businesses, organizations and citizens

For additional information about Lycoming County's comprehensive mitigation effort visit their Internet website at: <http://www.lyco.org/projectimpact/default.htm>

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Mickelson Memorial Wetlands

BACKGROUND

A large wetland basin of more than 1,000 acres existed adjacent to the Big Sioux River and Stray Horse River for many years. Left in their natural state, these wetlands stored large amounts of water. Around 1910, a large drainage ditch almost three miles in length was constructed running west to east directly through the middle of this large wetland. The west (terminal) end of the large drainage ditch empties directly into the Big Sioux River, thus adding a tremendous volume of water to the river during periods of high water. The completion of this drainage ditch effectively eliminated the storage and holding capacity of this large wetland basin, thus effectively eliminating the wetland's ability to reduce high water flows.

MITIGATION MEASURES EMPLOYED

The drainage ditch reduced the wetlands to approximately 57 acres, with a storage capacity of 58 acre feet. This project restored the wetlands to over 700 acres with a storage capacity of more than 1,500 acre feet. The project was carried out in two phases. Phase one consisted of the acquisition of approximately 1,800 acres of flood-prone private land. Phase two involved the actual construction work to restore the wetlands. Four water control structures were placed at various points in the existing drainage ditch. These structures created pools that greatly reduced the volume of water emptying into the Big Sioux River, lessening the effects of damaging downstream floods.

BENEFITS

The one-time expense of this project will provide permanent flood control benefits. Federal disaster payments for crop losses, deficiency payments, flood insurance payouts, etc. are eliminated. Protecting the affected cropland with permanent vegetation reduces siltation into the Big Sioux River. Repairs to local roads and bridges resulting from high water levels are eliminated. Property and structures downstream are protected. Moreover, the aquatic habitat of the area is enhanced.

PROJECT COST

\$1,010,286

FUNDING SOURCES

South Dakota Department of Game, Fish & Parks
FEMA Hazard Mitigation Grant Program
Friends of George Mickelson
Ducks Unlimited

Tri-County Electric Cooperative Power Line A

BACKGROUND

1998 winter ice storms brought heavy mechanical stress to the overhead power line's poles, hardware and wire. As a result, the line was weakened and its ability to withstand normal stress brought about by natural forces was impaired. As a result of these damages, the line would become more vulnerable to each storm. Approximately 770 people depended on the electricity provided by this line. An outage hour in this area cost the cooperative \$2,087 per hour. The damaged line had a value of \$1.1 million over the next 35 years. The proposed replacement line had a cost totaling \$217,059 over the same timeframe.

BENEFITS

By replacing the overall line with underground cable, the threat of damage from ice and wind is eliminated. The use of the underground cable will also eliminate "sagging" which all damaged power lines will experience over time. Property and economic losses due to unexpected electrical outages will be reduced.

PROJECT COST

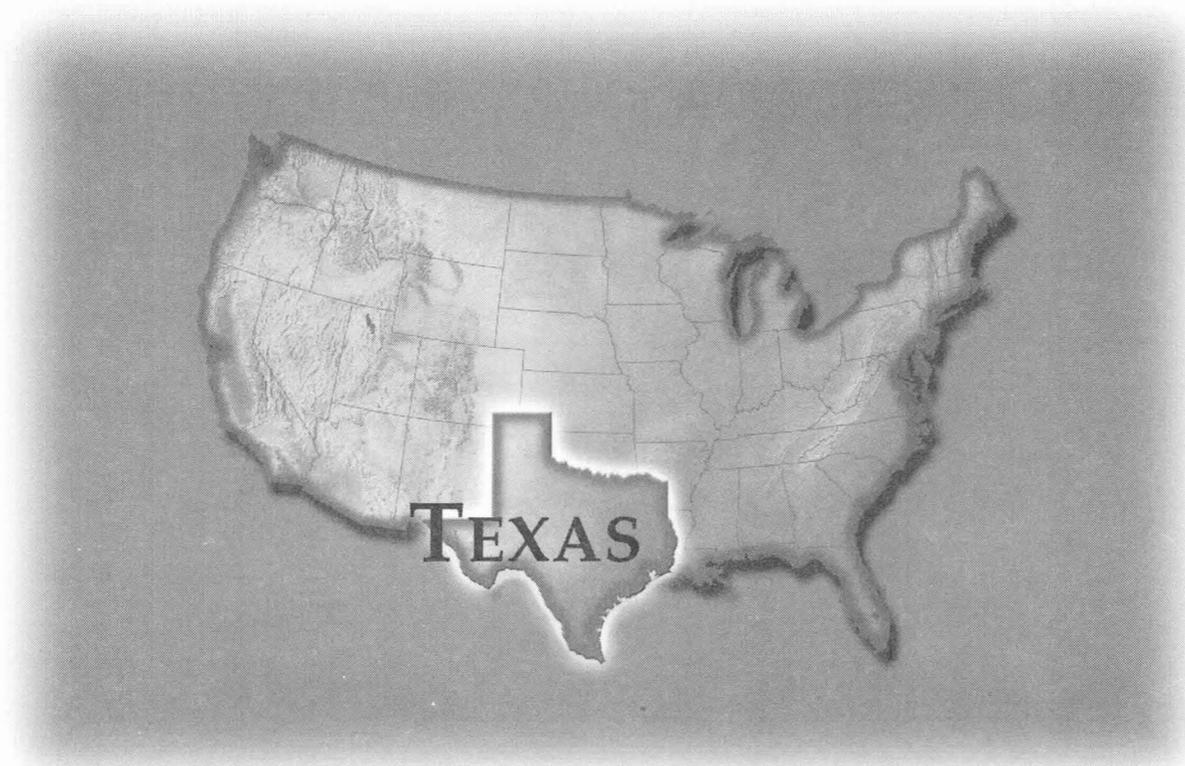
\$316,641

FUNDING SOURCES

Tri-County Electric Cooperative
FEMA's Hazard Mitigation Grant Program

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Permitting to Reduce Future Flood Risks: The Corridor Development Certificate Process

BACKGROUND

Eleven communities along the Trinity River in North Central Texas are reducing future flood risks through an innovative floodplain permitting program known as the Corridor Development Certificate (CDC) Process. The CDC process does not prohibit floodplain development but, through common criteria and modeling, ensures that any development that does occur in the floodplain will not raise flood water levels or reduce flood storage capacity.

Under the CDC process, local governments retain ultimate control over local floodplain permitting decisions, but other communities along the Trinity River Corridor are given the opportunity to review and comment on projects in their neighbor's jurisdiction. As the Dallas/Ft. Worth Metroplex economy continues to grow and develop, the CDC process will prevent increased flood risks.

PROJECT DESCRIPTION

All of the communities along the Trinity River in the North Central Texas region (9 cities and 2 counties) are participating in the Corridor Development Certificate Process. To stabilize flood risks, these communities have adopted the following CDC floodplain permit criteria as part of their local floodplain ordinances:

1. **No rise is allowed in the base flood elevation throughout the 100-year floodplain.** Many floodplain permitting systems, including those that meet National Flood Insurance Program standards, allow projects outside the floodway to increase base flood elevations by up to one foot. While this may not represent a significant increase for just one project, the cumulative impact of a number of projects in the same floodplain can be significant.

By prohibiting any rise throughout the 100-year floodplain, the CDC criteria ensures that the cumulative impact of multiple permitted projects will not cause flood elevations to rise to unacceptable levels. Any significant rise in the standard project flood is also prohibited.

2. **No loss in valley storage is allowed for the base flood throughout the 100-year floodplain.** If a planned structure would reduce valley storage, excavation must increase valley storage by an equal amount. For the Standard Project Flood, the maximum allowable loss in valley storage is 5%.
3. **Hydraulic modeling must be based on discharges expected from ultimate development anticipated in the watershed, and must incorporate permitted projects.** Many floodplain management tools, including standard NFIP maps and hydraulic modeling, are based on existing hydrologic discharges and existing projects located in the floodplain. Future discharges based on watershed build-out and future floodplain permitted projects are not considered. This means that floodplain projects built with adequate flood protection today may sustain flood damages tomorrow as the watershed continues to develop and flood discharges increase.
4. **In contrast, the CDC process requires discharges based on ultimate hydrologic discharges and incorporation of permitted projects.** This ensures that projects built in the floodplain are designed from the outset to accommodate maximum flood elevations that would be expected as the watershed and floodplain develop.
5. **No increases in erosive water velocity are allowed on-site or off-site.** What constitutes an erosive velocity is left to engineering judgment based on site-specific conditions.

To receive a permit to develop within the Regulatory Zone (based on the 100-year floodplain), a developer must submit appropriate hydraulic data to demonstrate that the above criteria have been met. The local floodplain administrator typically requests that the US Army Corps of Engineers review the hydraulic data to provide expert technical advice on the proposed permit action.

When a CDC permit application is submitted, the local floodplain administrator forwards copies to each of the other local governments that participate in the CDC process. This "peer review process" gives communities an opportunity to comment on projects in neighboring jurisdictions. This is especially important when a project may adversely impact upstream or downstream communities.

The local floodplain administrator then makes the final call of whether to issue a CDC permit. The fact that each individual local government retains authority over final local development decisions is critically important to the communities that participate in the CDC process.

The CDC process allows parallel review of the various federal, state, and local regulatory permits required for floodplain development to occur simultaneously. This feature of the CDC permit process ensures that no additional time is added to the local development decision-making process and that the overall federal, state, and local approval process is streamlined for quicker decision-making. In fact, TNRCC and USACE have adapted their respective programs procedurally to allow for local government input through the CDC process.

Since the CDC process was initiated in 1991, 47 CDC Applications have been received. As the Metroplex's economy continues to grow and develop, the CDC process will continue to prevent increased flood risks. More information about the CDC process is available at http://www.dfwinfo.com/envir/trin/C_vision/safe/certificate.html.

BENEFITS

The CDC Process provides a number of benefits and innovations discussed above, including:

- Stabilization of future flood risks,
- Common permitting criteria,
- Hydrologic modeling based on full watershed development,
- An up-to-date hydraulic model incorporating permitted floodplain development,
- Regional review & comment, and
- Guarantee of local control of floodplain permitting decisions.

PROJECT COST

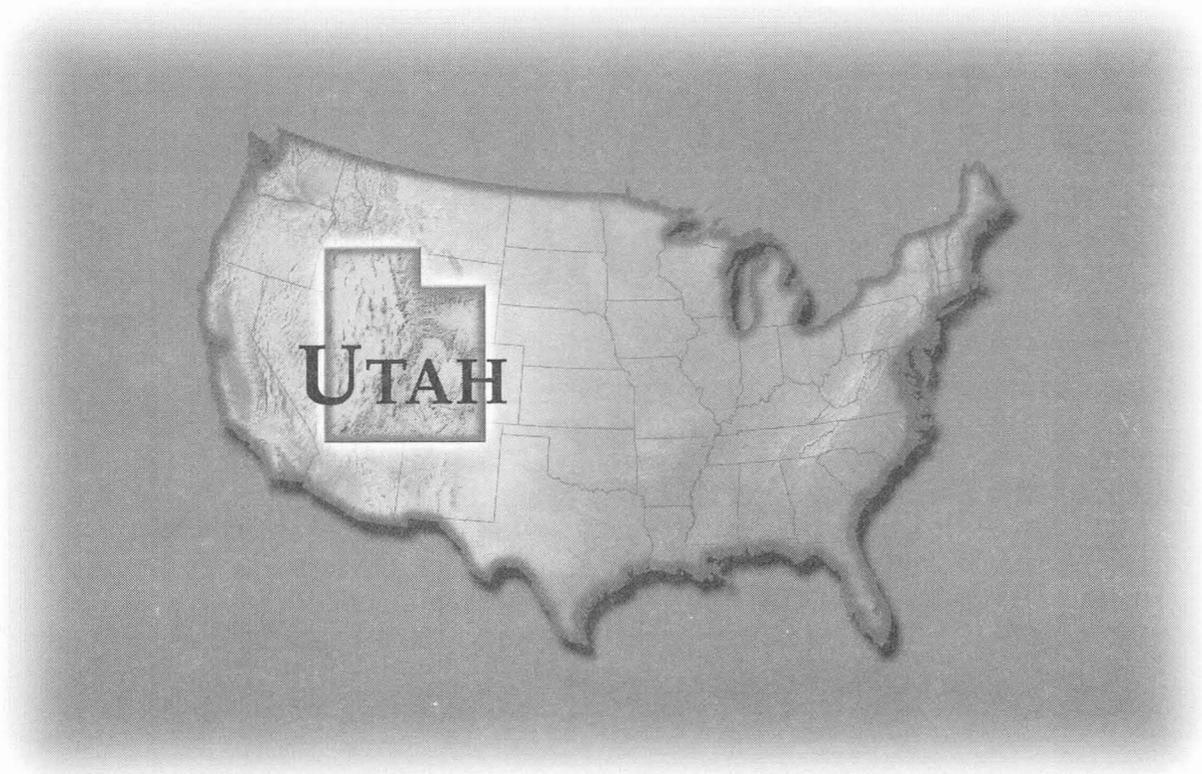
Developers pay a \$1500 or \$750 fee for each CDC permit application, depending on the extent of hydraulic review required.

FUNDING SOURCES

Initially, the CDC Process was funded by the communities and US Army Corps of Engineers as part of the Upper Trinity River Feasibility Study. Now, developers seeking a CDC permit pay a fee to cover administrative costs and the cost of US Army Corps of Engineers review of their hydraulic data.

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Teaching Mitigation to Children

BACKGROUND

The Urwin and Wufi Children's Adventure With Wildfire Coloring Book was created in 1994 as an interagency effort between the Utah State Hazard Mitigation Program and the Utah Division of Forestry, Fire, and State Lands. The purpose is to educate children about wildfires and further children's understanding of their role in future fires by learning ways to prevent them now.

PROJECT

The story is about a squirrel named Urwin, who lives in the forest and knows about wildfire, and a dog named Wufi, who is new to the forest community. Urwin teaches Wufi about wildfire, and this is how the children and parents learn to live safely in URWIN communities.

BENEFITS

The program has gone to nearly every county in Utah and is being used in South Dakota as well. Several other states have inquired about using it. The Urwin and Wufi coloring book now finds itself on the FEMA for Kids website with actual online coloring capability using color palettes and brushes. Thus, the program is now available internationally and can be used in classrooms and at home with much less need for hard copies. This program offers participating third graders a certificate entitled "Friends of Urwin and Wufi", provided they color some pictures and take the book home to review with their parents.

PROJECT COST

Undetermined, at present.

FUNDING SOURCES

Grants from FEMA and the USDA Forest Service.

Virgin River Parkway

BACKGROUND

Following the 1989 Presidential Disaster Declaration for the breach of Quail Creek Dike and resulting flooding, a parkway was developed along the Virgin River in St. George, Utah.

PROJECT

This parkway prevents development within the floodplain of the Virgin River. The project has expanded from its original two miles of greenbelt along the Virgin River. The project has been such a success that city and county planners are discussing extending the path all the way to Zion National Park.

BENEFITS

Floods continue to occur in St. George, but the prevention of encroachment has reduced vulnerability to flood damage considerably. Otherwise, the area would be considered prime developable land and could have incurred many losses due to floods. Instead, the city has a beautiful recreational feature that is enjoyed by many residents and visitors and the floodplain is open space.

PROJECT COST

Undetermined, at present.

FUNDING SOURCES

Hazard Mitigation Grant Program, State Disaster Relief Board funds.

Jordan River Parkway

BACKGROUND

The Jordan River is a meandering floodplain that has caused many floods to nearby residents over the years. Many tributaries empty into the River, making for increased flow during high runoff in the Spring. Overflow from Utah Lake also flows into the Jordan River. The Jordan River carries water to the Great Salt Lake. This parkway took many jurisdictions to coordinate the project.

PROJECT

Build a parkway to allow the natural meander of the Jordan River, protect open space, and provide a place for the community to enjoy and recreate.

BENEFITS

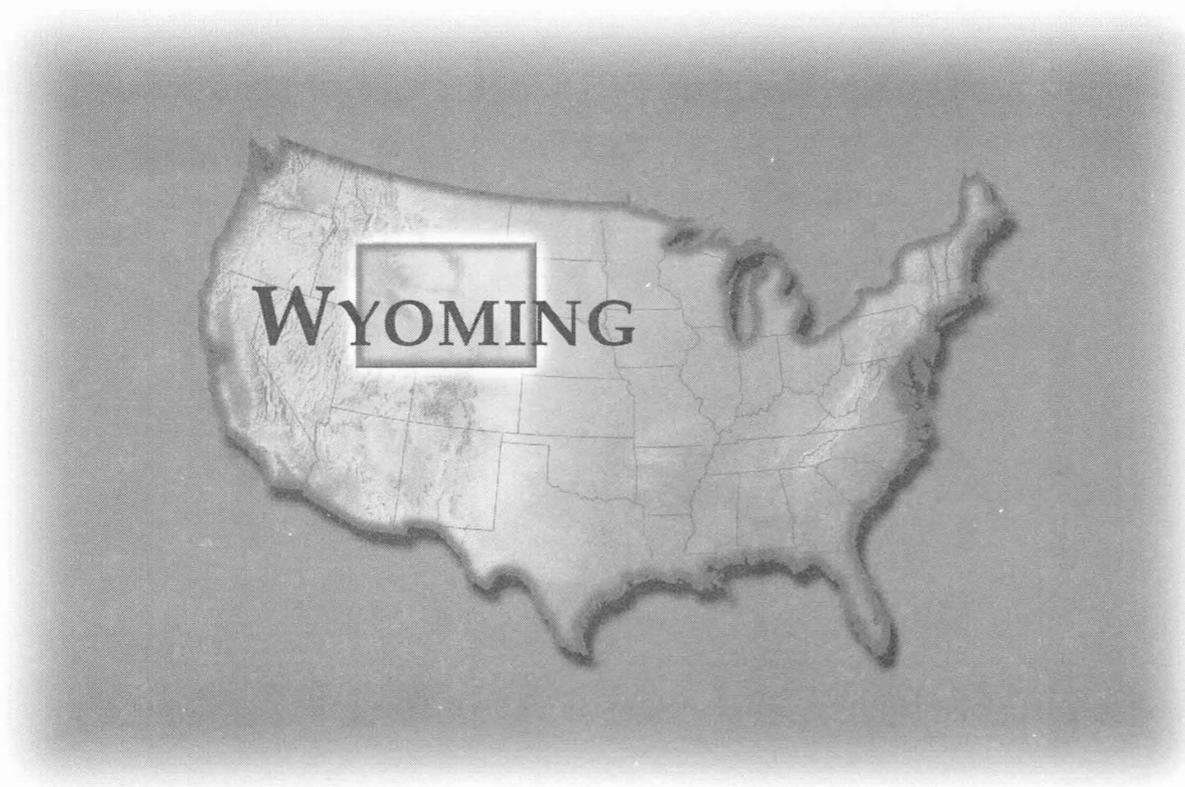
This parkway prevents development within the floodplain of the Jordan River. The open space and floodplain/floodway of the Jordan River are protected and provide a park for the community.

PROJECT COST

Undetermined, at present.

MITIGATION
SUCCESS
STORIES

IN THE
UNITED STATES



Town of Greybull Levee Protection

BACKGROUND

In August 1998, the Wyoming National Guard, 133rd Engineering Company, completed a streambank stabilization project adjacent to the Town of Greybull, Wyoming, on the Big Horn River. The streambank in front of a levee protecting the town was eroding away. The erosion occurred during spring high water. The Big Horn River is regulated by the Boysen Reservoir 85 miles south of Greybull.

During periods of excessive spring runoff, the river level has come within ten inches of overtopping the levee. The streambank is composed of mostly sand, with the remainder comprised of a silt/clay mix. In preceding years, the river flow had created a gravel bar which was channeling the flow toward the bank in front of the levee. The bank was eroding at the rate of approximately 8 to 10 feet annually.

The U. S. Army Corps of Engineers Omaha District Hydrologic Engineering Division recommended construction of a jetty system to move the river back from the levee. Since the water often reaches or exceeds the bank top elevation, the sides and top of the jetties are constructed of rock. This construction should permit the high water to flow over the jetties and still push the current far enough into the main channel to attack the gravel bar. A twenty foot shift in channel flow would match the amount of bank loss documented over recent years.

BENEFITS

In addition to adding to the overall stability of the bank, the channel movement might reduce the effect of high water along the bank seeping into a gravel vein which runs under the levee. The water seepage does not pose a structural problem for the levee, but the water floods basements in the area.

PROJECT COST

This mitigation project has an estimated value of \$300,000.
No FEMA funding was utilized in this project.

FUNDING SOURCES

Planning for the jetties construction project began in September 1995. The Town of Greybull purchased all the material utilized to construct the jetties and the Wyoming National Guard, 133rd Engineering Company constructed the jetties.

Hazard Assessment & Vulnerability Analysis

BACKGROUND

The State Hazard Mitigation Program (SHMP) funds were directed in FY 97 to be utilized to conduct a statewide hazard assessment and hazard vulnerability study. The University of Wyoming Survey Research Center located in the University College of Business was contracted to conduct the survey.

The Wyoming Emergency Management Agency (WEMA) submitted 100 suggested survey questions and they were modified into the final telephone survey. Wyoming has 23 counties and at least 400 surveys were conducted in each county. This telephone survey required respondents (selected at random by the UW Survey Research Center) to spend approximately 12 to 15 minutes answering the survey questions. Even though this survey was extremely lengthy for the respondents, the response rate (callers agreeing to participate in the survey) was the best the UW Survey Research Center had experienced.

BENEFITS

In total, 9,204 respondents participated. Planning for this project began in November 1996 and the tabulated survey results were given to WEMA in July 1998. The tabulated results have been utilized by the Coordinator of the Wyoming Emergency Management Agency to brief county/city/town elected officials and private citizen groups concerning their citizens' perceptions of the hazards affecting their jurisdiction. The response from those attending the briefing sessions has been very positive.

BIBLIOGRAPHY

The following federal agencies, states and local governments provided the Mitigation Success Stories contained within this publication. Their efforts and assistance made it possible to develop a document which provides factual and compelling evidence that hazard mitigation is working in the United States.

Alabama Flood Mitigation, FEMA Region IV, Atlanta, GA

Urban Drainage and Flood Control District, Denver, Colorado

Fort Collins, Colorado Flood Mitigation, City of Fort Collins Stormwater Department

Limon Colorado Multi-Objective Flood Mitigation Project, Town of Limon

Flood Mitigation in Sussex County Delaware, Delaware Department of Natural Resources

Georgia Mitigation, FEMA Region IV, Atlanta, GA

Seven Illinois Mitigation Success Stories, FEMA Region V, Chicago, IL and Illinois Emergency Management Agency

Westernport, Maryland Mitigation Project, National Park Service

Minnesota Flood Damage Reduction Grant Assistance Program, Minnesota Department of Natural Resources

Missouri Buyout Program, Missouri State Emergency Management Agency

Yellowstone, Montana Mitigation Project, Montana Department of Conservation and Natural Resources

Barnes County Mitigation, Barnes County, North Dakota

Storm Sewer Lid Installation Mitigation Project, Fargo, North Dakota

Fourth Street Floodwall Mitigation Project, Fargo, North Dakota

Floodprone Property Acquisition Project, Fargo, North Dakota

Highway 81 Culvert Mitigation Project, Fargo, North Dakota

Storm Sewer Isolation Mitigation Project, Fargo, North Dakota

Mikelson Memorial Wetland, South Dakota Emergency Management Agency

Tri-County Electric Cooperative Power Line A Mitigation Project, South Dakota Emergency Management Agency

Teaching Mitigation to Children, Utah Emergency Management Agency

Virgin River Parkway, Utah Emergency Management Agency

Jordan River Parkway, Utah Emergency Management Agency

Greybull, Wyoming Levee Mitigation Project, Wyoming Emergency Management Agency

Wyoming Hazard Assessment and Vulnerability Analysis, Wyoming Emergency Management Agency