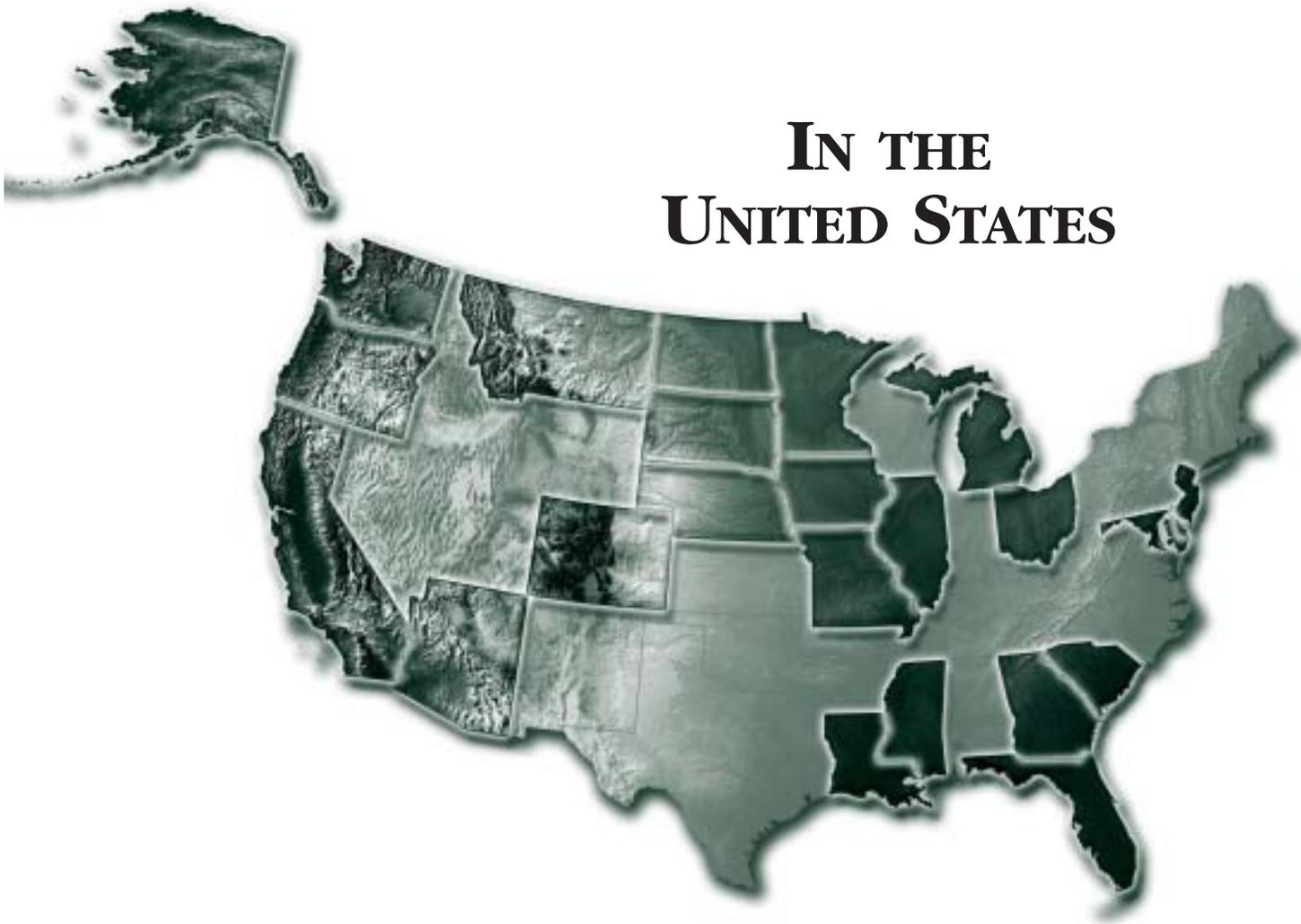


MITIGATION SUCCESS STORIES

**IN THE
UNITED STATES**



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, Association of State Floodplain Managers' Flood Mitigation Committee Chairs Mark Matulik (Colorado) and Bob Boteler (Mississippi).

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MITIGATION SUCCESS STORIES



A joint project of the Association of State Floodplain Managers and the Federal Emergency Management Agency.



Mitigation effectively lessens the potential for future flood damages by breaking the damage-repair-damage cycle.

For over two decades, mitigation activities have been implemented across the country to save lives, reduce property damage and lessen the need for recovery funding. In many cases, mitigation success has been achieved following devastating disasters, when local officials and the general public have realized the need to effect change in their community. Major efforts to reduce flood damage in the nation include programs such as the Federal Emergency Management Agency's Hazard Mitigation Grant Program and Flood Mitigation Assistance Program. Of particular note is FEMA's funding of local acquisition programs, which have resulted in the relocation of 30,000 floodprone structures since 1993. Certainly structural projects have their place as well, such as dams, levees and locks undertaken by such agencies as the Army Corps of Engineers, Natural Resource Conservation Service and others. In the 21st Century, more and more communities are mitigating flood damage through a combination of approaches.

As our country grows, flood damages are ever increasing. Annual flood losses in the United States continue to worsen, despite 75 years of federal flood control and 30 years of the National Flood Insurance Program. The general trend is for flood losses to increase every decade. Even though floods are the single most predictable natural hazard, the cost of flood damages per capita has doubled over the past century. Our average annual flood losses are currently estimated at \$6 billion. Something must be done!

Early mitigation activities, which focused on preventing loss of life, were being implemented as early as the 1880's. For instance, Johnstown, Pennsylvania, built the famous "Johnstown Incline Plane" in 1891 to lift people, horses and wagons to safety after a 37 foot wall of water hit the Conemaugh Valley in 1889. That flood killed more than 2,200 people! The Incline Plane carried people to safety during the 1936 and 1977 floods in Johnstown. It is now a focal point of an economic resurgence for the community.

Mitigation Success Stories, Edition 4 showcases examples of natural hazard mitigation activities and publicizes the benefits of mitigation successes across the country from 39 communities in 24 states. The examples included in this document can serve as models for other communities and can provide decision-makers with valuable information about how to achieve natural hazard reduction. A Glossary of Terms at the back of the document provides definitions for common terms and abbreviations used throughout the document.

We applaud the contributing authors for showcasing their hazard mitigation activities. Their effort and assistance made it possible to develop this document by providing factual and compelling evidence that hazard mitigation is working in the United States. Association of State Floodplain Managers and FEMA are pleased to provide this information for the benefit of communities and citizens who continue to live and work "in harm's way". We hope that the success stories presented here will encourage other communities to invest in hazard mitigation activities that ultimately will save lives, reduce property damage and reduce disaster costs.

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MITIGATION SUCCESS STORIES



**IN THE
UNITED STATES**



Location: Alakanuk Village, Alaska

Project: Erosion Stabilization and Flood Mitigation Project

Techniques: Land Use Planning, Multi-Agency Coordination, Erosion Stabilization, Elevation, Relocation

Contact: Christy Miller, Alaska Community and Economic Development, christy_miller@dced.state.ak.us or 907-269-4567

Alakanuk Village, Alaska

Background

Alakanuk is a Yup'ik Eskimo word meaning “wrong way,” aptly applied to a village located on a major channel of a maze of ever shifting channels on the Yukon River Delta, 15 miles from the Bering Sea. The entire commercial fishing and subsistence community, in addition to the surrounding tundra for miles around, are within the floodplain of the Yukon River. There are no roads connecting Alakanuk with other communities in the region. Boats are the primary means of transportation in the summer and snow machines are used in the winter. The 2,200 ft. gravel airstrip is the primary means of access. The city of Alakanuk is not a participant in the NFIP. Also, there are no surveyors, engineers, banks or insurance agencies in the village.

The height of the 1952 flood that reached depths of 5 feet is used as the flood of record. Ice run-up during annual Spring Breakup often causes damage or destruction to riverfront structures. However, it has been the riverbank erosion that has caused the greatest disturbance.

Project Description

Erosion has been a constant threat over the last 25 years. Multiple studies indicated \$6 to \$7 million needed for a structural erosion protection project that still would not have addressed the damage from flooding and ice run-up. Finally when the phased construction of the community’s first fully-piped water and sewage system was underway, a land use plan for long term avoidance of erosion and minimization of flood damages was developed. This planning effort involved community prioritization of goals and multi-agency coordination. One priority was to use elevation to address the community’s extreme erosion threat. Another priority was to move twenty-one homes, three public buildings and a church beyond the 30-year erosion zone. All structures were elevated one foot above estimated “1% chance flood event”*, except the fire station and public works building.

Benefits

◆ Utilized multi-agency coordination to meet State priorities of bringing water/sanitation facilities to the community and meeting public safety concerns.

- ◆ Created a city ordinance regulating new development against flood and erosion risks.
- ◆ Identified high water marks of record so that new and relocated structures could be properly elevated.
- ◆ Mapped the estimated 30-year erosion zone.

Costs and Funding Sources

- ◆ Plan development total costs, including designating 30-year erosion zone = \$77,000
 - ▼ Community Development Block Grant = \$54,000
 - Alakanuk Erosion and Land Use Plan, prepared by Dames & Moore (6/10/98), financed in part from the CDBG administered by the Department of Community and Economic Development, Division of Community and Business Development
 - ▼ USACE Planning Assistance to States and Emergency Shoreline Protection, Section 14 = \$23,000
- ◆ Relocation and building elevation costs = \$391,420
 - ▼ CDBG funds to date = \$137,805
 - ▼ Additional CDBG funds approved = \$62,000
 - ▼ Native American Housing & Self-Determination Act Program = \$124,667
 - ▼ Alaska Capital Matching Grants = \$78,948
 - ▼ FEMA HMGP approximately = \$50,000

Note

* “1% chance” = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the “100 year flood”.

Credit: Ray Oney



Relocated house during elevation.

Credit: Ray Oney



Ice damage during spring run-up.

MITIGATION SUCCESS STORIES

**IN THE
UNITED STATES**

A topographic map of the United States, including Alaska and Hawaii, rendered in shades of green and grey. An inset map of Arizona is shown in the western part of the main map, with the word "Arizona" overlaid in a large, bold, green font.

Arizona



Location: Maricopa County, Arizona

Project: Legislative Action, Tax Levy, Flood Control District, Phoenix and Vicinity Flood Control Project, Indian Bend Wash, Cassandro Dam Wash

Techniques: Legislative Action, Tax Levy, Storm Drainpipes, Headwalls, Detention Basins, Grading, Landscaping, Multi-use Parks/Athletic Fields, Greenbelt, Channelization, Erosion Control, Canal Diversion Channel, Bank Stabilization, Acquisition of Flowage Easements, Dams

Contact: Vic Calderon, Arizona Division of Emergency Management, calderov@dem.state.az.us or 602-231-6327

Maricopa County, Arizona

Background

Maricopa County has been no stranger to disaster. Historically, flash floods and flooding are a frequent occurrence due to the topography and arid lands. Less than thirty years ago major storms in Phoenix caused flooding in the state capitol. Less than 20 years ago, there was flooding in the downtown district. The airport had been closed at times due to flooding. Luke Air Force Base had experienced flooding. Ironically, the

very conditions that allow flooding have attracted an influx of hi-tech companies bringing increased population and new construction. This new migration creates on-going challenges for residents, businesses and public officials of Maricopa County.

Major Flood Damages in Maricopa County from 1965 - 1993
(Source: Flood Control District of Maricopa County, The Arizona Republic, August 13, 1999)

Year	Month	Damage Estimate
1993	January	\$38 million
1980	February	\$63.7 million
1978	December	\$51.8 million
1978	March	\$37 million
1972	June	\$10.6 million
1970	September	\$590,000
1963	August	\$2.9 million
1965-66	Winter	\$6 million

Once again, the County experienced flooding during October of 2000. A severe weather disturbance dumped four to six inches of rain in western Maricopa County and eastern La Paz County causing flash flooding in the upper part of the Centennial Wash watershed between the Harcuvar and Harquahala mountain ranges. The Wenden Area reported close to nine inches of rain during the same period. Heavy rains flowed into the northeast part of the wash, producing a flash flood that surged through one unincorporated town in La Paz County in addition to one unincorporated town and the City of Wickenburg in Maricopa County.

Flood control in the desert is not a simple task. The hazards and risks to both incorporated and unincorporated communities are clear. The combined efforts of local, state and federal agencies continue to be needed to minimize flood damage. Results of their activities and the effectiveness of mitigation projects will be described in this story and will illustrate how Maricopa County has worked toward minimizing the risks by striving to build a sustainable community. A key element for success is the integration of non-structural and structural mitigation efforts.

Project Description: Legislative Action

On August 3, 1984, the Arizona State Legislature, with the Arizona Revised Statutes (ARS 48-3609), enacted legislation requiring builders and developers to comply with strict standards for flood control and stormwater management of their projects. The statute includes residential (built or mobile home), commercial and industrial properties. All buildings are required to be built one foot above the base flood elevation. The statute also includes compliance language for failing to adopt the regulations.

Enforcement of both the ARS and the NFIP on developers in Maricopa County has worked well to reduce disaster costs to the communities. A model is Manistee Ranch Housing Development in Glendale. This project consists of 410 lots, including a large park area and several retention basins. The system of storm drainpipes, headwalls, detention basins, grading work and landscaping installed during construction was "tested" during the October 2000 storms and all performed as planned. There was standing water in the detention basin, the ground saturated and the dry wells saturated, indicating the large amount of water that was prevented from flooding the homes. This water percolates down and eventually adds to valuable ground water resources. The residential community was protected.

Other housing developers plan their projects to provide for controlling stormwater runoff. Attention has been paid to keeping the required flood control measures, such as detention basins and storm drains, attractive as well as functional. Many have parks and athletic fields that are multi-use, providing new recreation areas and serving as catchment basins during flood conditions.

Benefits: Legislative Action

- ◆ Stormwater management in the newer housing developments has avoided the cost of displacement of residents due to flooding, temporary housing, repair and rebuilding of residences, loss of business, damage to infrastructure such as roads and access, search/rescue/emergency response and unemployment.
- ◆ It is estimated that \$45,469,000 in property value was protected by \$292,000 in builders cost of compliance with the statute. The average value of each home is \$110,900. This amount multiplied by the 410 homes equals \$45,469,000 in property value.

- ◆ The October 2000 storm resulted in a state and federal disaster declaration with an estimate of over \$10 million in costs for recovery. Houses, developments and larger incorporated communities that had built to and above the language of the statute had zero impact from this storm.
- ◆ It is estimated that \$2.9 billion was saved as avoided damages. With an estimate of 150,000 homes protected and an average of \$20,000 of assistance per home for the 2000 storm, the potential damages are \$3 billion. With the \$10 million in damages, this leaves \$2.9 billion in avoided damages.

Project Description: Tax Levy

In 1959, the Arizona State Legislature realized that something needed to be done to control flooding. The Legislature approved the creation of the Flood Control District of Maricopa County (FCDMC) and gave it the authority to place a levy on property taxes. The rate now is 29 cents per \$100 of assessed valuation, or about \$29 annually on a home assessed at \$100,000. When the district began operating, the county had a population of only 630,000 and \$600 million in taxable property. Now the population is 2.9 million and the district must protect taxable property estimated at \$161 billion as well as public facilities worth billions more.

By establishing the FCDMC, the legislature created an operating entity charged with keeping county residents safe from flood hazard and established an independent funding source for the projects necessary to meet the charge. The tax levy, as an on-going funding source, is considered non-structural mitigation.

Of the many projects completed by the FCDMC using tax levy and community cost-sharing funds, three are good examples of providing protection during the October 2000 severe storm. The channelization and bank erosion projects of Skunk Creek brought property out of the floodplain in parts of Peoria. Completion of this project removed several hundred homes from flood danger, saving residents money and providing them peace of mind. The project combined flood safety, environmental consciousness and multi-use elements. Adobe Dam, completed in 1982, kept the flood waters from the City of Phoenix. Cassandro Wash Dam functioned as designed in keeping floodwaters from North Wickenburg.

Benefits: Tax Levy

- ◆ Adobe Dam and Skunk Creek protected Phoenix, Glendale, Peoria and the State Capitol complex in the 2000 storm. The investment of \$23.2 million (in 1982 dollars) provided protection for several billion dollars in property value.
- ◆ Cassandro Dam Wash protected North Wickenburg. Based on current property values, the initial investment of \$5 million (in 1996 dollars), saved three times that amount in property damages.

Project Description: Flood Control District of Maricopa County

Established as a result of action taken by the Arizona State Legislature in 1959, the FCDMC today has a staff of 200 and an annual operating budget of approximately \$60 million. Over 70% of the district's operating revenue comes from the state levied flood control tax. During the district's 40 years of operation, more than 80 major projects have been completed. These projects, combined with non-structural approaches to flood control, are tangibly reducing disaster risks to residents and businesses as well as reducing the cost of disasters.

The mission of the FCDMC is, in part, "To reduce flood risks for the people of Maricopa County by providing comprehensive flood and stormwater management services. These activities are provided through regulatory activities, master planning, regional coordination, technical assistance in addition to implementation and maintenance of both non-structural and structural projects."

Benefits: Flood Control District of Maricopa County

- ◆ Flood control measures, both non-structural and structural, within Maricopa County proved their worth during the year 2000 storm. This storm proved the value of the unique approaches to flood control that are in place within Maricopa County. It also served as a reminder of the need to continue to work toward reducing vulnerability to flood disasters.
- ◆ Floodplain management through the FCDMC seeks insurance discounts for residents by actively participating in FEMA's CRS. Maricopa County has a current CRS of 6, which is among the highest CRS ratings in FEMA Region IX.
- ◆ The Drainage Administration coordinates closely with other agencies to ensure that new development does not increase runoff, divert flows or back water onto other properties.
- ◆ FCDMC participates in master plans for flood control with counties that border Maricopa County.



Example of the detention basin, Manistee Ranch, Glendale, Arizona.

- ◆ FCDMC partners with construction firms to ensure compliance with the ARS.
- ◆ The Flood Alert Warning System (ALERT) has been successfully implemented.
- ◆ Implementation of recommendations resulted in community enhancement through multi-use corridors, i.e., parks, golf courses, equestrian, biking and hiking trails.
- ◆ Public Information Outreach Program has been very successful
- ◆ FCDMC partners with federal, state, county, city and local agencies for cost sharing of funding and maintenance on flood control projects.
 - ◆ Return of water into the underground water table has been programmed into projects.



Cyclists enjoy the recreation paths in the ACDC flood control channel.

Project Description: Phoenix and Vicinity Flood Control

This project is part of a five-phase flood control plan for the metropolitan Phoenix area. The plan was developed between 1959 and 1963 with Congress authorizing federal funding in 1965.

An integral part of the Phoenix and Vicinity Flood Control Project is the Arizona Canal Diversion Channel (ACDC). The ACDC is a 16.5-mile channel designed to intercept stormwater runoff that occurs north of the Arizona Canal from large urban washes as well as city storm drains. The ACDC is designed to protect developed areas, including parts of Phoenix, Glendale, Peoria and the state Capitol complex up to the “1% chance” flood event*. In the metropolitan Phoenix area, a 1% chance flood event would inundate 31,540 acres and cause billions of dollars in damages. The ACDC was started in 1983 and completed in 1995.

Municipalities within the Phoenix and vicinity boundaries adopted a “get tough” policy with developers. They enforced the requirement for developers to include flood control plans, encouraging the creation of greenbelts and retention basins to hold as much water on site as possible. Cities along the ACDC’s path (Paradise Valley, Phoenix, Glendale and Peoria) studied and approved the project through their city limits.

There are other elements of the overall project, namely dams on Dreamy Draw, Cave Creek, Skunk Creek and New River, channelization of Cave Creek; and bank stabilization and acquisition of flowage easements on Skunk Creek, New River and Agua Fria. All of these structures work together with the ACDC to provide substantial flood relief for residents in Phoenix, Glendale and Peoria.

Benefits: Phoenix and Vicinity Flood Control Project

- ◆ Overall project cost was \$422 million providing protection to \$10 billion (in 1981 dollars) of development.
- ◆ “If the Adobe Dam, completed in 1982, had not been in place, the City of Phoenix would have had water again”, states Joe Munoz, FCDMC Public Information Officer.
- ◆ The Arizona Canal Diversion Channel (ACDC) and systems that support it to divert water around the city protect the City of Phoenix.
- ◆ Removed properties out of the floodplain, thus reducing cost of flood insurance to homeowners.
- ◆ Population growth of 45% since the project’s completion has increased tax dollars providing increased economic base for Phoenix and the surrounding area.
- ◆ Reduced cost of search and rescue operations.
- ◆ Less public health issues.

Costs and Funding Sources: Phoenix and Vicinity Flood Control Project

Total Project Cost = \$422 million.

Funding, construction and continued maintenance of the ACDC is shared by federal, county and city entities. Federal money, through the USACE, was used for the overall design and construction. The FCDMC is the local sponsor and is responsible for acquiring land, building bridges and relocating utilities. FCDMC is funded by a secondary tax levy on all real property in Maricopa County. Glendale and Phoenix share the maintenance responsibilities in areas where there are recreation features. This partnership works well to create and sustain a more livable community.

Project Description: Indian Bend Wash

Scottsdale is no stranger to severe storms and flooding and the devastation they can bring. Indian Bend Wash runs through the city and has historically rampaged through the community. Two major floods in the early seventies, one in June of 1972, caused a fatality and left seventeen families homeless. City workers used helicopters and ropes across the flooded Wash to rescue residents. The need for flood

control in Scottsdale was dramatically evident. Following this event, city government and residents agreed to approve the Indian Bend Wash project. The City Council called a special flood control bond election in April, 1973 and voters were asked to approve the sale of \$10 million in general obligation bonds to finance flood control and storm drain projects. The bonds were approved by a margin of seven to one. The project began in 1971 and was completed in 1999.

The project protects an extensively developed residential area along Indian Bend Wash in and adjacent to Scottsdale and Tempe, and an area zoned mainly for light industrial development in Tempe. The project provides protection against floods up to the “1% chance flood event”* or 30,000 cubic feet per second. The flood of record is 22,000 cubic feet per second, which occurred in June 1972.

Today, the City of Scottsdale encompasses 184.5 square miles and enjoys a population of over 208,000 residents. The vision of the planners for a linear park in the Wash rather than a concrete channel paved the way for the development that Scottsdale currently enjoys. The Indian Bend Wash Greenbelt runs the length of the city, 7.5 miles long, and is a system of parks, lakes and golf courses. High-end apartment complexes, attractive shopping centers and resorts line the slopes of the once dangerous wash. Scottsdale has made the Indian Wash greenbelt an integral part of its outdoor lifestyle. Due to the City’s linear shape, about 80 percent of Scottsdale’s citizens are within walking distance of the Wash. Estimates are that one million people make use of the greenbelt annually. The Wash has attracted high-priced homes, condominiums and apartments, as well as businesses that thrive on the traffic generated around and through the area.

Benefits: Indian Bend Wash

- ◆ The project will prevent damages estimated at about \$30.3 million (1999 dollars), if the “1% chance flood”* should occur.
- ◆ The average annual flood damages prevented would be \$6.42 million (1999 dollars).
- ◆ The greenbelt has added to the tax base rather than continuing as a liability.
- ◆ The average annual benefits from area redevelopment are about \$1.12 million (1999 dollars). Improvement of quality of life has attracted high-end housing developments, continuing the increase of property values.
- ◆ Large and small businesses benefit from traffic generated through area.
- ◆ The USACE estimates the average annual benefits from recreational facilities at \$5.74 million (1999 dollars). The attractive recreational area due to multi-use of land and surroundings is responsible for this benefit.
- ◆ Annual events held on the park grounds also add to the tax base. Local festivals such as the Festival of Nations draw people and tax dollars from tourists and surrounding cities.
- ◆ “Indian Bend Wash is what people point to when they talk about quality of life in Scottsdale,” says Dave Roderique, Economic Developer for the City. “We can’t put a dollar value on the impact it’s had, but Indian Bend Wash is one reason we attract higher end businesses and homes. “

Costs and Funding Sources: Indian Bend Wash

Total Project Cost = \$55.5 million

- ◆ USACE provided funding for design and construction = \$29 million
- ◆ The City of Scottsdale provided funding for greenbelt development = \$14 million
- ◆ FCDMC provided the funding for the purchase of land rights, building bridges and relocating utilities = \$12.5 million
- ◆ The cost and sponsorship of the project is shared, with the FCDMC as the local flood control sponsor and the City of Scottsdale as the recreation sponsor. The sharing of the project cost, construction and maintenance by these agencies exemplifies how federal, county and city interests can join together to make a community more livable and sustainable.

Project Description: Cassandro Wash Dam

The City of Wickenburg lies perilously close to two major washes, Sol’s Wash and Cassandro Wash. North Wickenburg is home to 100 families that are in the middle-low income group. These residences were in the floodway of Cassandro Wash which is the oldest part of the city. The Wash out-falled to two residential streets before ending at Sol’s Wash. The community experienced severe flooding many times, and one time, water was so deep in the streets that emergency vehicles could not pass through.

The City of Wickenburg worked with FEMA to examine solutions for removing the homes of North Wickenburg from the floodplain. As a result, the city teamed with the FCDMC to build the Cassandro Wash Dam. The dam was built to alleviate flooding of homes on the Cassandro Wash and to allow future development of the property. The town has designated the area downstream of the dam within the banks of the natural wash a “no build



Residents of Wickenburg watch the floodwaters of Sol’s Wash at US Highways 98/93 during the October storm.

area” so that homes will not be built in the path of the outfall.

The Cassandro Wash Dam was the first dam in which the FCDMC was the owner. The district provided design, ownership, continued operation and maintenance.

Benefits: Cassandro Wash Dam

- ◆ Shortly after completion of the construction of the dam, Wickenburg experienced a major storm event. The dam impound area contained water that previously would have flowed through the streets, filling to 20% capacity and preventing a major deluge.
- ◆ The dam proved effective again during Hurricane Nora in 1997 and the severe storms of October 2000. No flooding problems occurred to North Wickenburg because the dam functioned as designed.
- ◆ Project cost of \$5 million avoided \$15 million in damage, based on current land values of 100 homes.
- ◆ Removed 100 homes from the floodplain and reduced cost of flood insurance to other homeowners.
- ◆ An immediate benefit from the dam project is that the area, which was referred to as “blighted,” has now become livable.
- ◆ Roads made impassable by floods and dust when dry have now been paved, thus eliminating the daily dust control problems that come with dirt roads. Therefore there are less health risks because of dust control.
- ◆ Construction of the dam also removed homes from the “1% chance flood”* event and map revision has since occurred.
- ◆ Proven reduced vulnerability to flooding and flash flood.
- ◆ “No build area” designation within the banks of the natural wash.
- ◆ A future benefit to the town includes plans for a community park in the area behind the dam. Property was made available for redevelopment into recreation area.
- ◆ The Cassandro Wash Dam, completed in 1996 to protect North Wickenburg, “functioned as designed and the homes were protected from flooding”, states Skip Blunt, Floodplain Manager for the City of Wickenburg.

Costs and Funding Sources: Cassandro Wash Dam

Total Project Cost = \$5 million

Note

* “1% chance” = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the “100 year flood”.

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

California



Location: Napa County, California

Project: Flood Protection and Watershed Improvement Project

Techniques: Living River Strategy, Public/Private Partnership, Multi-Agency Coordination, Non-structural Channel Modification, Redesign of Bridges, Dikes and Levees

Contact: Clark Frentzen, U.S. Army Corps of Engineers, South Pacific Division, Clark.D.Frentzen@usace.army.mil or 415-977-8164

Napa County, California

Background

Napa City and Napa County have a history of periodic flooding from the Napa River and Napa Creek. At one time, the Napa River supported a

dense riparian forest, provided significant wetland habitat and included productive spawning areas for fish, such as salmon and steelhead. Pressures from urbanization, agriculture and grazing have degraded these habitats and the quality of the Napa River's natural environment. The existing natural drainage system provided by the Napa River and Napa Creek is not adequate to prevent extensive flooding and associated property damage. In the past 36 years, Napa County residents have sustained \$542 million in property damage alone. The City of Napa has experienced 27 major floods during a 135 year period, from 1862 to 1997; on the average this is a major flood every five years!

Project Description

The Napa County Flood Protection and Watershed Improvement Project will provide flood protection by reconnecting the Napa River to its floodplain, creating wetlands throughout the area, maintaining fish habitat, maintaining wildlife habitats and retaining the natural characteristics of the River. Residents, businesses, local government, State government, environmental groups, wineries, the Chamber of Commerce and the USACE formed a coalition and agreed to the following goals:

- ◆ Achieve “1% chance flood”* protection.
- ◆ Restore the living environment of the Napa River.
- ◆ Enhance the opportunity for economic development.
- ◆ Develop a local financing plan that the community can support.
- ◆ Develop a plan that addresses the entire watershed, county-wide.

Several specific project features will help to achieve these goals:

- ◆ Lowering or removing the dike south of Imola Avenue to allow the Napa River to flow in a wider area, thereby increasing conveyance capacity and reducing upstream water surface elevations.
- ◆ Modifying the channel to create flood terraces, which will create additional storage capacity along the River and lower water surface elevations, contributing to approximately 500 acres of created wetland and upland habitat.
- ◆ Develop a “dry” bypass channel to bridge the Oxbow. This bypass will allow low water flows to remain in the Oxbow, and help maintain natural characteristics. During flood flows, water will be diverted out of the Oxbow and onto a more direct route through central Napa.
- ◆ Construct new dikes, levees and floodwalls to contain the “1% chance flood”* event. Three pump stations will remove water from behind floodwalls and levees and pump water into the Napa River.
- ◆ Remove and replace a number of bridges in downtown Napa City. The replacement bridges will be designed with higher clearances to better pass flood flows.
- ◆ Reduce dredging and return tidal influence to historic baylands.

Benefits

- ◆ Increase in conveyance capacity and reduction of upstream water surface elevations.
- ◆ Creation of additional storage capacity along the River and lower water surface elevations.
- ◆ Low water flows will remain in the Oxbow and help maintain natural characteristics. Flood water will be diverted out of the Oxbow and onto a more direct route through central Napa.
- ◆ Replacement bridges will better pass flood flows.
- ◆ Tidal influence will be returned to historic baylands.
- ◆ Realization of \$26 million, annually, in avoided property damage, reduced insurance costs, avoided clean-up, avoided costs of emergency services and enhanced environmental improvements.

Costs and Funding Sources

Total Plan Costs = \$220 million.

- ◆ In 1998, the voters of Napa County approved a half-cent sales tax increase (estimated at \$6 million per year) for 20 years to help fund the improvements.
- ◆ FEMA HMGP funds, awarded by the Governor's Office of Emergency Services, were used for the acquisition of 90 mobile home park units, acquisition of 7 homes on Napa Creek and construction of drainage improvements = \$7 million
- ◆ FEMA also funded the elevation of 70 single family homes.
- ◆ California Department of Water Resources provided a grant to purchase a non-residential parcel in the floodplain.
- ◆ CALFED**, in conjunction with the Coastal Conservancy, is providing additional grants to acquire land and remove levees from the floodplain.
- ◆ USACE is responsible for the design and construction of 13 additional bridges.
- ◆ Federal Highway Administration may provide \$20 million to replace three bridges. The City of Napa has applied for these funds.
- ◆ Additional grants are being sought for door dams in Napa City and elevation of homes in St. Helena, Yountville and unincorporated parts of Napa County.

Note

* "1% chance" = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the "100 year flood".

** CALFED is a conglomerate of California State and Federal agencies with management and regulatory responsibility in the Bay-Delta Estuary. It was formed in 1994.

Location: Sacramento County, California

Projects: Dry Creek Parkway Acquisitions and Sacramento County Elevations and Elevation Reimbursements

Techniques: Acquisition, Elevation, Elevation Reimbursement, Open Space

Contact: George Booth, Sacramento County Department of Water Resources, boothg@sacounty.net or 916-874-6851

Sacramento County, California

Background

In 1995 heavy rains hit the Sacramento region causing widespread localized flooding. Two years later, a series of tropical storms hit northern California. After the flood of 1997, grant money was obtained through the Governor's Office of Emergency Services. The Federal grant money was based upon a 75% Federal-25% local cost share. These grant dollars were for acquisitions in the Dry Creek Parkway, home elevations county-wide and reimbursements for elevations due to substantial improvements. Recently, Sacramento County obtained FMA grant money for further acquisitions and elevations.



Residence prior to elevation.



Residence after elevation.

Project Descriptions

Dry Creek Parkway Acquisitions

The Dry Creek Floodway, located between converging north and south branches of Dry Creek, was targeted for recovery activities due to the large number of repetitive loss structures located there. The Dry Creek Parkway home acquisition program would eliminate further health and safety problems associated with those properties and allow people to move out of harm's way. The properties would then become part of the future Dry Creek Parkway, managed by Sacramento County Department of Regional Parks, Recreation and Open Space. To date, 13 homes have been acquired, demolished and the property has been returned to open space. An additional five properties will be acquired with an FMA grant. There are 28 residences on a waiting list to be acquired when more funding becomes available.

Sacramento County Elevations and Elevation Reimbursements

The Home Elevation program lowered the risk of flooding for a number of Sacramento County homeowners, by helping them to elevate above the 100-year floodplain. Applicants for the home elevation program were identified through public outreach activities. The applicants were then ranked for participation using a County-developed point system based on repetitive loss status, flood depth and flood frequency. A cap was placed on the Federal cost share to ensure a minimum number of homes were elevated. To date, 41 residences have been elevated above the "1% chance flood"* event. Three structures are in the process of being elevated. There are 250 residences on a list waiting for a chance to participate when more funding becomes available.

HMGP funds allowed Sacramento County to reimburse residents who took a proactive approach to raising their homes after the 1995 floods. Residential properties that were included within the application were eligible to have up to 75% of the cost of raising the structure reimbursed to them. To date, 18 residents have been reimbursed for elevating following the floods of 1997.

Benefits

- ◆ Homeowners are removed from harm's way.
- ◆ Emergency response requirements are reduced on the communities.
- ◆ Estimates of \$2.4 million federal dollars were saved from the acquisitions, \$3.4 million from elevations and \$1.0 million from the elevation reimbursements.

Costs and Funding Sources

- ◆ Acquisitions were funded by FEMA HMGP, HUD, Sacramento County, Sacramento Area Flood Control Agency = \$2.2 million
- ◆ Elevations were funded by FEMA HMGP, Sacramento County and Homeowners = \$2.7 million
- ◆ Elevation reimbursements were funded by FEMA HMGP = \$650,000

Note

* "1% chance" = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the "100 year flood".

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Colorado



Location: Otero County, Colorado
 Project: Otero County Acquisitions
 Techniques: Acquisitions and Demolitions
 Contact: Mark Matulik, Colorado Water Conservation Board,
 mark.matulik@state.co.us
 or 303-866-3441 x301

Otero County, Colorado

Background

In late April 1999, heavy rains in the southern front range of Colorado caused significant and sometimes catastrophic flooding within the Fountain Creek watershed. Fountain Creek is a tributary of the Arkansas River with its confluence at Pueblo, Colorado. In late April, a flood crest on Fountain Creek began building. It joined the main stem of the Arkansas River at Pueblo and flowed toward the City of La Junta, Colorado, sixty miles east of Pueblo. In La Junta and adjoining Otero County, residents initially felt lucky since the majority of the flooding was occurring in El Paso County over 60 miles to the northwest. But such comfort was short lived when the flood crest reached the levee on the north side of the Arkansas River at La Junta. A severely aggraded channel resulted in a reduced carrying capacity of the river and the north Arkansas River levee was breached during the early morning hours of May 2, 1999. Floodwaters of up to four feet in depth inundated the unincorporated area of Otero County known as north La Junta. The area contains over 400 residences and very few were spared the effects of floodwaters. Significant damage occurred to at least 200 residences.



Flooded residential area in north La Junta, May 1999.



Levee break on the east bank of the Fort Lyon sluiceway, May 1999.

Project Description

The project consisted of the acquisition and removal of 53 houses damaged by flooding. This project has eliminated repetitive damage and significant risks to public health and safety issues for this area in the future. The success of the project was totally dependent on the professional expertise and abilities of Tri-County Housing, Inc. which works with residents in Otero County. They accomplished the acquisition program with efficiency and effectiveness – under budget.

Benefits

All of the purchased properties have been dedicated as open space, thus increasing the amount of area for the retention of future floodwaters. Future considerations for parts of the area include a park.

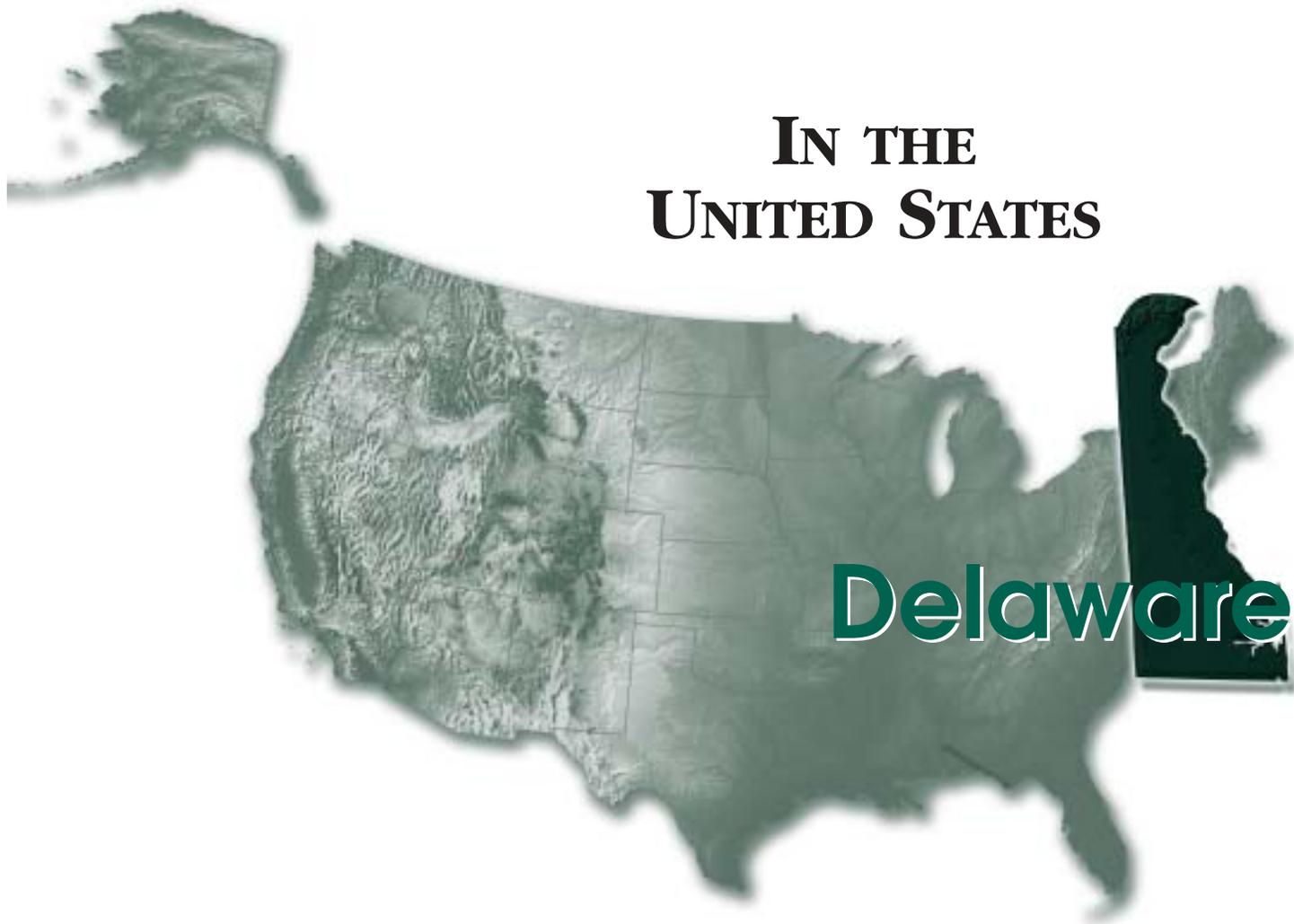
Cost and Funding Sources

Total Project Cost = \$2,800,000

Funding Sources included FEMA HMGP, Unmet Needs, FEMA FMA Program and the State of Colorado's CDBG

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Delaware



Location: Delaware

Project: Elevation and Relocation of Coastal Repetitive Loss Properties

Techniques: Elevation, Relocation

Contact: Mike Powell, Delaware Department of Natural Resources, mpowell@state.de.us or 302-739-4411

Coastal Delaware

Background

Property values and land-use practices in coastal Delaware have made the acquisition of coastal repetitive flood loss properties impossible from a cost-benefit perspective. Nevertheless, the majority of Delaware's repetitive loss properties are located in coastal V-Zones. The State of Delaware's Emergency Management Agency (DEMA) and Department of Natural Resources and Environmental Control (DNREC) have jointly worked with local governments to elevate and in some cases relocate high risk homes in coastal floodplains.

Project Description

Using FEMA HMGP funding from three disaster declarations and several years of FEMA FMA Program funding, 15 homes have been elevated and two have been relocated. All 15 homes were flooded in 1992 and 1998. Several of the properties were flooded many other times. None of the storms in the 1990's exceeded a "4% chance flood"* event.

The Town of Lewes, Town of South Bethany, Fenwick Island, Kent County Department of Planning and Delaware DNREC each acted as sub-grantee for homes within their jurisdiction.

Benefits

- ◆ The average cost of elevating these homes has been roughly \$35,000. The homes have received an average of \$20,000 of insured flood-damages during the 1990's.
- ◆ Relocating two homes out of the flood hazard area has two primary benefits: residents are not subject to future flooding and no further federal dollars will be spent subsidizing repair.

Costs and Funding Sources

Total Project cost for elevations and acquisitions = \$525,000

Funding has been provided by FEMA HMGP, FEMA FMA Program, property owner contribution and local utility contribution.



Residence prior to elevation.



Residence after elevation.

Note

* "4% chance" = a flood event that has a 4% chance of occurring or being exceeded in any given year. This is a replacement term for the "25 year flood".

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Florida



Location: Collier County and the City of Tallahassee, Florida

Project: Collier County Elevation and the City of Tallahassee Acquisition

Techniques: Elevation, Acquisition

Collier County Contact: Bob Devlin, City of Naples, bdevlin@naplesgov.com or 941-213-5039

Tallahassee Contact: David Henry, City of Tallahassee, henryd@talgov.com or 850-891-6860

Collier County and the City of Tallahassee, Florida

Background: Collier County

Over a three year period, a residential structure with a market value of \$90,000 incurred over \$78,000 in flood damages. In addition, the property owners incurred over \$3,500 in indirect costs. The home is in the AE Flood Hazard Risk Zone, with a BFE of 8 feet and a Lowest Floor Elevation of 5 feet 2 inches.

Project Description: Collier County

The structure was elevated as a part of the comprehensive strategy to reduce disaster vulnerability throughout Collier County by retrofitting floodprone structures, specifically targeting repetitive loss properties. The structure was elevated approximately 4 feet so that the lowest floor elevation of the structure is now 9 feet 3 inches.

Benefits: Collier County

- ◆ Flood insurance premium went from \$1300 per year to just over \$200 per year.
- ◆ Assuming one flood loss per year over the 50-year useful life of the structure, the benefit-cost ratio exceeded 18.
- ◆ The structure incurred no flood loss as a result of the Tropical Storm Gabrielle in September, 2001.

Flooding History		
Date	Flood Damages	Storm
24, August, 1995	\$50,230.16	Tropical Storm Jerry
October 1996	\$8,889.32	Hurricane Josephine
September 1998	\$18,377.56	Hurricane Georges
November 1998	\$800.00	Heavy Rains
Total	\$78,297.04	

Costs and Funding Sources: Collier County

Total Project Cost = \$54,000

- ◆ The FEMA FMA Program provided 75% of the required funds for this elevation project = \$40,500
- ◆ Homeowner, through the insurance company, provided the local cost-share of 25% = \$13,500

Background: Tallahassee

Over the past 10 years, a residential structure in Tallahassee received three flood insurance claims in excess of \$50,000.

Project Description: Tallahassee

The City of Tallahassee was awarded funding under FEMA's FMA Program to acquire a repetitively flooded structure. On April 26, 2001, the City and homeowner completed all necessary closing activities associated with acquiring the structure.

Benefits: Tallahassee

- ◆ The City was in the process of finalizing activities to demolish the structure when Tropical Storm Allison hit Tallahassee. As a result of this event, the interior of the structure was inundated by more than four feet of water and would have been considered more than 50% damaged. However, since the structure was vacant, both the former homeowner and the city were spared the cost associated with responding to and recovering from this event.
- ◆ Because Tropical Storm Allison was a presidential disaster in Tallahassee, the federal government was spared the expense of paying an additional flood insurance claim on the structure.

Costs and Funding Sources: Tallahassee

Total project cost - \$113,982

- ◆ FEMA FMA Program funded 75% of the acquisition.
- ◆ The City of Tallahassee funded 25% of the acquisition.
- ◆ FEMA PA funded the asbestos removal and the demolition.

Sarasota County, Florida

Location: Sarasota County, Florida

Project: Bahia Vista/Lockwood Ridge
Floodplain Reclamation Project

Techniques: Acquisition, Demolition,
Construction of Earthen Berm and Pump
Station

Contact: Carolyn Eastwood, Sarasota County
Stormwater Management,
ceastwood@co.sarasota.fl.us
or 941-861-0903

Background

The Bahia Vista/Lockwood Ridge Floodplain Reclamation Project is located within the Phillippi Creek Drainage Basin in Sarasota County.

The project is intended to reduce the risk of flooding to approximately 100 homes in the Oak Shores and Bellevue Terrace subdivisions.

Project Description

As part of the Reclamation Project, Sarasota County has acquired and demolished 31 homes on the northwest side of Phillippi Creek in order to construct an earthen berm and pump station to protect the remaining 75 homes. As part of the final design process, a parallel storage facility will be constructed alongside the berm. Final design of the Bahia Vista/Lockwood Ridge Floodplain Reclamation Project is nearing completion.

Included in this project is the acquisition of a vacant nine-acre parcel containing two lakes to provide stormwater retention. Creation of a passive neighborhood park with a playground and hiking/biking trails has been proposed for this site.

Project design is currently in the final stages of development. It is anticipated that construction of this project will begin in early 2002.

Benefits

- ◆ Provides flood relief for adjacent residential neighborhoods.
- ◆ Provides for surface water quality improvements.
- ◆ Promotes resource conservation.
- ◆ Creates a passive park along the berm area. Among the amenities will be picnic shelters, grills, gazebos, a hiking trail and a canoe launch site. Parking areas and handicap accessibility also will be provided.

Project Cost and Funding Sources

- ◆ Florida Communities Trust (FCT) through the Preservation 2000 Grant Program for acquisition and demolition = \$840,000
- ◆ Construction cost estimate = \$4,700,000
- ◆ Manasota Basin Board through cooperative funding from the Southwest Florida Water Management District for construction = \$1,450,000

Nature is always hinting at us.
It hints over and over again.
And suddenly we take the hint.
– *Robert Frost*

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

Georgia



Location: Dougherty County, Georgia
 Project: Flint River Acquisition Project
 Techniques: Acquisition, GIS
 Contact: Terry Lunn, Georgia Emergency Management Agency,
 tlunn@gema.state.ga.us or 404-635-7016

Dougherty County, Georgia

Background

In early July of 1994, Tropical Storm Alberto ravaged southern Georgia, leaving a trail of flooding and devastation. It was the most devastating and costly flood in recent history. After one week of heavy rain caused by Tropical Storm Alberto, the Flint River watershed became saturated with water. Rainfall totaled 27 inches in some parts of Southern Georgia. The flood crested in Albany, Dougherty County, at 44.3 feet; this was 24.3 feet above “flood stage”. Thousands of structures were flooded, including many residential neighborhoods in Dougherty County.

In March of 1998, a flood event caused by torrential rains of almost a foot for a three day period forced the Flint River to peak at 37 feet; this is 17 feet above “flood stage”. Although the flooding was much less severe than the 1994 flood event, more than 11,000 residents were evacuated from their homes, including 3,000 students from Albany State University. The 1998 flood event has been approximated to be a “2.5% chance flood”* event.



Acquisitions completed at the time of the 1998 flood event.

Project Description

As a result of the devastating flooding in 1994 and the need to mitigate the significant flood losses, Dougherty County submitted a FEMA HMGP application to voluntarily acquire 42 properties at an estimated cost of \$3.8 million. These properties included 37 residences, three vacant lots and two commercial properties.

Benefits

- ◆ The following table illustrates the savings to Dougherty County, Georgia State government and the federal government on avoided damages from the March 1998 flood event. The structures have been grouped by estimated flood depth.
- ◆ The mitigation measures completed at the time of the 1998 flood paid off. Of the properties acquired by Dougherty County since the 1994 flood, it has been determined that 19 of the properties would have flooded again, based on finished floor elevations and projected flood levels based on the recorded flood stage. Using FEMA’s benefit-cost software, which is a tool to estimate scenario damages based on flood depth, it has been determined that the original investment in mitigation made between the 1994 and 1998 flood event had already resulted in avoided losses that exceed the original investment. Mitigation does pay off! Investment was \$3.8 million and damages avoided in the 1998 flood alone were \$4.6 million.

Number of Structures	1998 Flood Depth In Structure (Feet)	Avoided Damages (Benefits)
1	9	\$115,898
2	6	\$525,868
2	5	\$2,972,953
5	4	\$432,778
3	3	\$282,613
1	2	\$155,235
3	1	\$124,936
2	0	\$27,560
Totals		
19		\$4,637,841

Costs and Funding Sources

Total Project Cost = \$3,806,797 (not including demolition)

- ◆ Funding Sources included FEMA HMGP, FEMA PA, HUD CDBG supplemental appropriation, HUD Disaster Recovery Initiative, State of Georgia Governor’s Emergency Fund.
- ◆ For the demolition component FEMA provided 90% funding and the State of Georgia Governor’s Emergency Fund provided 10% funding.

Note

* “2.5% chance” = a flood event that has a 2.5% chance of occurring or being exceeded in any given year. This is a replacement term for the “40 year flood”.

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Illinois



Location: Petersburg, Illinois

Project: PORTA High School Community Solving (CmPS) Team

Techniques: Open Space Creation and Preservation

Contact: Mary Mies, PORTA CmPS Team Coach, mmies@roe38.k12.il.us or 217-632-3216

Petersburg, Illinois

Background

When the settlers built Petersburg, Illinois, they chose a site on the banks of the Sangamon River. However, the river's flooding often plagued the oldest part of Petersburg. Families living there suffered declining property values and an overall degeneration of the area. The city could not squeeze enough money from an already strained budget to contain the flooding. After devastating floods in 1979, 1981, 1983, 1990 and 1993, the city sought outside help. Petersburg applied for and received federal funds from FEMA HMGP.

The Hazard Mitigation Project enabled the city to acquire and remove residences and other structures located in the designated floodplain in preparation for project development. The City Council was delighted when the PORTA High School CmPS team expressed an interest in seeking permission to design a re-use plan for a portion of the property after the acquisition program was completed. For each aspect of the project, the team carefully considered all appropriate floodplain uses and incorporated designs that would withstand occasional flooding. The greatest hindrance was that the team had little money to work with. The daunting question was how to raise enough funds to do anything significant with the land?



Problem solvers enjoy their work time in the new park.



Problem solvers prepare flower beds for the winter.

Project Description

In two lots, the CmPS team planted flower gardens containing landscaped beds of perennials, installed paths of water-resistant brick paving stones and added accents such as a flagpole, birdbath/fountain, ornamental trees and rustic benches. Natural plantings of hedge roses, which grow to six feet at maturity, define park boundaries.

Three other lots were designed as a pre-school playground. Selection of playground equipment reflected the results from polls of elementary school students' favorite play equipment.

Fund raising activities raised more than \$15,000 and included *Decorate an Abe (Lincoln)* auction, sponsorships by civic groups and donations from private citizens. An additional \$51,000 was contributed by Illinois Department of Commerce and Community Affairs (DCCA) and the Association of State Floodplain Managers.

As the project work was implemented, the city council designated additional lots for which the CmPS team could develop plans for re-use. Teams efforts motivated other groups to become involved in the re-use of floodplain lots. The Petersburg Tree Committee planted a Memorial Grove and the High School Science Club began a prairie grass restoration project on lots that adjoined the pre-school playground.

Benefits

- ◆ Community and neighborhood pride has been restored by re-using an area of town that was devastated by floods. The whole community has benefited by becoming involved in reclaiming and restoring land previously deemed unusable.
- ◆ A useful recreation area was created. Neighborhood children can now play in a clean, safe playground.
- ◆ Fund raising efforts and sponsorships stimulated community interest in the park and instilled feelings of personal ownership and pride.
- ◆ The re-use efforts have been cited as a "blueprint" for other small towns facing similar problems. The team has presented the project to many state agencies, federal agencies and associations.
- ◆ The CmPS team has proven that through education, initiative and persistence, communities can revitalize flood prone areas. These properties can become a focal point of pride and beauty.
- ◆ This project has brought together a community, has restored the integrity of the land and has created a lasting contribution to Petersburg.

Costs and Funding Sources

Total project cost = \$67,000

- ◆ DCCA and Association of State Floodplain Managers funded the shelter, picnic tables, grills, benches and other amenities of the playground = \$51,000
- ◆ Local fundraising and private contributions = \$15,000

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Location: Cedar Falls, IOWA

Projects: Cedar River Flood Management Using an Invisible Flood Control Wall

Techniques: Invisible Flood Control Wall

Contact IFCW: George Fryklund, Flood Control America, fryklund@ma.ultranet.com or 978-440-8902

Cedar Falls, IOWA

Background

Cedar Falls is a quiet residential community of 34,000 people in Black Hawk County. Wide streets, lined with old growth maple, oak and walnut trees shade grand Victorian homes, traverse a gently sloping hill and wander through a flourishing downtown business area which abuts the Cedar River. The City of Cedar Falls reports that the river has crested above flood stage at least 94 times since 1929. When the water flows, it flows onto the “Cedar City” neighborhood. Since 1990, Black Hawk County including Cedar Falls, has had six federally declared flood disasters. In 1999 there was another record flood.



Cedar Falls chose the IFCW to protect the historic Broom Factory Restaurant from the Cedar River.

Project Description

The USACE funded a flood control project in Cedar Falls. The city officials of Cedar Falls chose to install an Invisible Flood Control Wall (IFCW) in lieu of the folding wall proposed by the Army Corps. The IFCW tries to achieve “Harmony with Nature”. It is a removable wall that is erected only during the threat of a flood. Patented, twenty-foot sealed, interlocking, hollow aluminum planks stack on top of a sill plate integrally constructed on a permanent concrete foundation. Intermediate posts provide additional support.

Benefits

- ◆ Protection of the Broom Factory Restaurant, a building listed in the National Registry of Historic Places.
- ◆ Because of the IFCW’s “invisible” aspect, the Broom Factory Restaurant can remain open and retain unobstructed views of the Cedar River.
- ◆ A former parking lot across the street from the restaurant has been renovated into a “gateway” into the city, complete with a river-front promenade.
- ◆ The city is developing a recreational trail system to compliment the 36 miles of paved bike trails already in existence.
- ◆ “We could maintain the view of the river [by using the IFCW]... We’re real happy with it.” said City Engineer Ron Arends.
- ◆ Benefits of erecting the IFCW are “you only put up what you need. They’re light, so you only need a few people.... Sandbagging is labor intensive. Then when the emergency passes, nobody is left to dispose of the sandbags,” said City Engineer Ron Arends.

Costs and Funding Sources

Total cost for the IFCW Project = \$4.6 million

Funding provided by the USACE and the City of Cedar Falls

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Louisiana



Location: City of Covington, Louisiana
Project: Elevation and Acquisitions
Techniques: Elevation, Acquisitions
Contact: Mark Howard, Aegis Innovative Solutions, Inc.,
 mkhoward@environmental-advantage.com
 or 225-766-2760

City of Covington, Louisiana

Background

The City of Covington is located at the convergence of two major drainage basins: the Tchefuncte River Basin to the west and the Bogue Falaya River Basin to the east. Rainwater that falls within the northeast area of St. Tammany Parish flows through the city of Covington to Lake Pontchartrain. Much of the City floods due to intense rainfall, riverine flooding of the Tchefuncte River/tributaries, riverine flooding of the Bogue Falaya River/tributaries, hurricanes or lesser tropical storms, southerly wind and rainfall.

More than 35% of the land area of the City of Covington is within the “1% chance flood”* event area. More than 10% of the land area of the City is within the “.2% chance flood”** event area.

The City of Covington has experienced a number of natural disasters in the past years. Hurricanes and tropical storms are a yearly threat in South Louisiana. However, they are not as regular an occurrence as the effects of riverine flooding and heavy precipitation. St. Tammany Parish, including the city of Covington, has experienced 13 presidentially declared disasters since 1965. The estimated damages in the City during the devastating May 1995 flood were over \$5 million dollars. Approximately \$400,000 of that damage was suffered by five residential owners and one commercial property owner.



Prior to elevation.



A beautiful facade was added to the front of this home at the conclusion of the elevation project.

Project Description

The five homes targeted in this project were within the Riverbend and Old Landing areas of Covington and were considered repetitive loss properties. All of the homes were flooded prior to the May 1995 flood and during the May 1995 flood. Elevation was determined to be the most practical and least costly method of alleviating flood hazards, while reducing any negative environmental impacts. Elevation was less costly than acquiring and clearing the properties. It was also not as disruptive to the families and the neighborhood. Elevation of the five residential structures would allow flood waters from the scenic stream to still flow through the area while not having to alter the water-course through more expensive drainage work.

The one commercial structure had flooded at least four times, was the structure that flooded most often, had the worst flood damage and was not occupied. It was determined that it would be more feasible to acquire the commercial property rather than elevate.

Structure	Previous Damages	# of Times Flooded	Deepest Inside Flood Depth	Market Value	Mitigated Elevation	Evaluation Cost	Future Damages Per Event	Future Damages Structure Life	Future Damages Avoided
Home #1	\$75,000	2	1 feet 2 inches	\$300,000	16 feet	\$112,300	\$30,000	\$300,000	\$187,700
Home #2	\$510,000	4	5 feet	\$300,000	13 feet	\$95,000	\$200,000	\$4,000,000	\$3,905,000
Home #3	\$370,000	3	4 feet	\$375,000	15 feet	\$145,000	\$150,000	\$1,500,000	\$1,355,000
Home #4	\$68,000	2	2 feet	\$125,000	13 feet	\$65,000	\$30,000	\$300,000	\$285,000
Home #5	\$94,000	7	5 feet	\$200,000	13 feet	\$60,000	\$20,000	\$400,000	\$340,000
Commercial	\$65,000	2	2 feet 6 inches	\$60,000	18 feet	\$60,000	\$30,000	\$900,000	\$820,000
Totals	\$1,182,000					\$537,300			\$6,892,700

LOUISIANA

Benefits

- ◆ For an expenditure of \$537,300, the savings in future damages avoided will be \$6,892,700.
- ◆ Peace of mind. “My husband, a veterinarian, had recently retired and we didn’t need the extra expense, but raising our home has taken a real load off our minds. Although it was inconvenient to have to be out of our home during the major part of the construction, it was worth it! We are so relieved.” Homeowner #1
- ◆ “We are thrilled with the results. During the recent flood (June 2001), we had a foot of water under our home. Before raising our home, that water would have been inside! We were surrounded by water, but not flooded. Further, the construction was done very well and so our house also looks great... In the past, we were afraid of every storm, but now we feel safe. I don’t know why more people don’t take advantage of this grant program,” Homeowner #2

Project Cost and Funding Sources

FEMA HMGP funds, administered through the Louisiana Office of Emergency Preparedness (LOEP), became available in 1995 for projects that included elevation, acquisition, structure relocation and facility retrofitting.

Project Cost and Funding Sources: Home #1

Total Project Cost = \$112,300

- ◆ FEMA HMGP 75% funding = \$84,225
- ◆ Homeowner 25% cost share = \$28,075

Project Cost and Funding Sources: Home #2

Total Project Cost = \$95,000

- ◆ FEMA HMGP 75% funding = \$71,250
- ◆ Homeowner 25% cost share = \$23,750

Project Cost and Funding Sources: Home #3

Total Project Cost = \$145,000

- ◆ FEMA HMGP 75% funding = \$108,750
- ◆ Homeowner 25% cost share (The homeowner paid an additional \$1,480 not covered by the grant) = \$36,250

Project Cost and Funding Sources: Home #4

Total Project Cost = \$65,000

- ◆ FEMA HMGP 75% funding = \$48,750
- ◆ Homeowner 25% cost share = \$16,250

Project Cost and Funding Sources: Home #5

Total Project Cost = \$60,000

- ◆ FEMA HMGP 75% funding = \$45,000
- ◆ Homeowner 25% cost share = \$15,000

Project Cost and Funding Sources: Commercial property

Total Project Cost = \$60,000

- ◆ FEMA HMGP 75% funding = \$45,000
- ◆ Business owner 25% cost share = \$15,000

Notes

* “1% chance” = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the “100 year flood”.

** “.2% chance” = a flood event that has a .2% chance of occurring or being exceeded in any given year. This is a replacement term for the “500 year flood”.

Location: East Baton Rouge Parish, Louisiana

Project: Elevations and Acquisitions

Techniques: Elevation, Acquisition

Contact: Brian Harmon, East Baton Rouge Floodplain Management, BHARMON@ci.baton-rouge.la.us or 225-389-3197

East Baton Rouge Parish, Louisiana

Background

East Baton Rouge Parish is located in southeast Louisiana on the east bank of the Mississippi River, north of New Orleans. The Parish is in the alluvial valley of the Mississippi River, where the land is generally flat and at low elevations. East Baton Rouge Parish has many natural waterways and man made canals that are subject to periodic flooding.



O'Reilly Auto Parts prior to the storm event.



Floodwaters inundated the area surrounding O'Reilly Auto Parts. Because the store was constructed above the BFE, it was spared from damage during Tropical Storm Allison.



After five previous flood insurance claims, this home was acquired and removed from the cycle of repetitive losses.

Project Description: Elevation

In 1998, building permits were secured to construct a 6,800 square foot structure to be used as an auto parts store. When the plans were completed, the owner discovered that his property was in a SFHA and a city code required a new building to be elevated above BFE or the highest recorded inundation level. BFE in the area is 49 feet. Ground level is at 46.33 feet. Code required the first floor elevation to be at least one foot above BFE, and/or one foot above the recorded inundation level. The owner needed to change his plans to accommodate a new floor level of 52.13 feet.

The fill needed to create the elevation had to come from a location within that particular flood zone area in order to minimize changes to the storage capacity of the floodplain. The rear of the building was built on an eight-foot foundation wall. A retaining wall built on the east side of the building protected the structure from high water in that direction.

Benefits: Elevation

Floodwaters from Tropical Storm Allison rose to over five feet in the area surrounding O'Reilly Auto Parts. Had the business been at street level it would have suffered loss of inventory, loss of business and extensive damage to the building. In addition to the recovery costs, employees would have been idled, customers would have been inconvenienced and business could have been lost to competitors. Inventory in the auto parts store ranges from \$300,000 to \$500,000.

Project Cost and Funding Sources: Elevation

Total Project Cost = \$500,000

- ◆ Cost of elevation, with additional concrete and fill, funded by owner = \$150,000
- ◆ Cost of the building, funded by owner = \$350,000

Project Description: Acquisition

East Baton Rouge Parish has also acquired homes in flood-prone areas. One particular home has five previous flood claims and was one of the top 30 homes identified by the Parish for acquisition through FEMA's HMGP. Previous claims for this property totaled \$154,644 while the appraised value was \$121,080.

Benefits: Acquisition

- ◆ Only two weeks after the owners moved out of their residence, Tropical Storm Allison caused flooding in the neighborhood and in many parts of southern Louisiana. The now vacant home had five feet of water inside it!
- ◆ "The headaches were all eliminated," stated Mrs. Brooks, "the negotiations went smoothly." The Acquisition Program saved this property owner from losing everything. "We are so grateful and thank God for being so fortunate!"

Project Cost and Funding Sources: Acquisition

Total project cost = \$122,580

- ◆ FEMA HMGP 75% = \$91,935
- ◆ Local Match 25% = \$30,645

Jefferson Parish, Louisiana

Background

Jefferson Parish has the dubious distinction of having the greatest number of “Repetitive Loss” flooded structures in the country... 5,495! This condition can be attributed to the fact that most of the land is below sea level and the geographic location is near the Gulf of Mexico. The Parish is surrounded by rivers, lakes, bayous and canals and is protected by a series of levee systems. Due to the nature of this condition, the Parish must use drainage canals and pumping stations to move stormwater into the surrounding bodies of water beyond the above levees.

A series of flood events from May 1978 to June 2001 have resulted from heavy rains associated with Hurricanes, Tropical Storms and severe prolonged thunderstorms. Shortly after the last major flood event, in May 1995 the Parish President Tim Coulon embarked on an initiative to relieve the flooding problems for the repetitive loss homes, residents who have experienced flooding and residents that could be subjected to flood losses.

Project Description

In 1996 the Parish was funded to implement improvements to drainage canals, construction of new pump stations, improvements to existing pump stations and the purchase of more modern pump station equipment. Through the Southeast Louisiana Urban Flood Control (SELA) Program, 20 canal projects have been completed to date, one pump station project has been completed and nine pumping units have been purchased. The pumping units include diesel engines and gear drives. An additional 29 canal projects and four pump station projects are either under construction or in the design phase.

Benefits

- ◆ Improvements to the overall drainage system.
- ◆ The lining of canal banks with concrete has allowed stormwater to flow at a more rapid pace to the new and improved pump stations. The stations can then readily deposit a greater volume of this flow into the bodies of water outside the levee systems.
- ◆ During Tropical Storm Allison in June 2001, Jefferson Parish received more than 19 inches of rain in a four-day period. This resulted in flooding of only 61 structures. If the SELA projects had not been accomplished, most likely a majority of the 5,495 repetitive loss structures would have flooded. Jefferson Parish had the fewest structures flooded of any of the Parishes affected by this storm.
- ◆ The cost of these projects will be of immense benefit for the parish in the future.
- ◆ There will be less NFIP claims.
- ◆ Upon completion of the remaining projects, the positive results already experienced will be much greater for any future flood events.

Costs and Funding Sources

Total project costs = \$324 million (\$83 million has been spent on the completed projects and \$241 million is estimated for the remaining projects.)

For completed projects:

- ◆ Federal funds appropriated by Congress = \$62,250,000
- ◆ Parish Capital Improvement Program (derived from local property tax assessments) = \$20,750,000

For remaining projects:

- ◆ Federal funds appropriated by Congress = \$180,750,000
- ◆ Parish Capital Improvement Program = \$60,250,000

Funding was provided through the USACE for participation in the SELA Program. This Program provides funding on a 75% Federal share and 25% local share ratio. The 25% local share can be satisfied through credits on previous drainage work performed by the Parish or through actual funding in lieu of credits. The SELA projects are accomplished in conjunction with Jefferson Parish’s existing Capital Improvement Program projects, which are funded 100% from Parish resources.

Location: Jefferson Parish, Louisiana

Project: Drainage Canal and Pump Station Improvements

Techniques: Improvements to Drainage Canals, New Pump Stations, Improvements to Existing Pump Stations, Purchase of Pump Station Equipment

Contact: Tommy Rodrigue, Jefferson Parish, TORodrigue@jeffparish.net or 504-349-5360



Woodmere Canal



Avenue D Canal



Keynote Canal

Location: City of Mandeville, Louisiana

Project: Dry Floodproofing

Techniques: Dry Floodproofing

Contact: Bob Dahlman, Dahlman
Floodproofing, rdahlman2@home.com
or 225-273-9977

City of Mandeville, Louisiana

Background

The City of Mandeville is located in St. Tammany Parish on the north shore of Lake Pontchartrain. This area has many old homes and businesses that lend to the historic nature of the area. Approximately 80% of the City is mapped as SFHA. The outfall for all the streams in the Parish is Lake Pontchartrain. The Lake is subject to tidal influence as well as southerly winds that can cause flood waters to back up into the developed areas. The majority of flooding occurs when there is a strong southerly wind and intense rainfall. When these two hazards occur, the result is backwater flooding along all of the drainage arteries.

Regardless of acquisition and elevation programs that may be available in a community, some structures will inevitably continue to be located in hazardous locations. There should be alternatives available to avoid damages from floods for homeowners that, for numerous reasons, may not be able to participate in such programs. In some cases, a structure may not be structurally sound enough to be elevated. Or the property may have been inherited from deceased family and the homeowners may not want to sell. Fortunately, there is an alternative.

Dry floodproofing is a process that completely seals the exterior of a building to prevent the entry of floodwaters. Dry floodproofing seals all openings below the flood level and relies on the walls of the structure to hold water out. Because the walls are exposed to flood waters and the pressures they exert, dry floodproofing is practical only where flood depths are low (no more than 3 feet).

Floodproofing is also an excellent choice for historic buildings and for areas in which the capital investment in the existing urban infrastructure requires continued occupation of a hazardous location. In these situations, floodproofing can be indispensable.

Project Description

Bechac's and RIP's restaurants were both historic structures and the State Historic Preservation Office had strict guidelines on what could be done to the structures.

The main cause of flooding on these two structures was heavy rain occurring along with a strong southerly wind on the lake. The water from the lake would "push" up into the rivers and bayous and not allow the rainwater to drain. This would result in ponding. Both of the structures had received 6 to 12 inches of floodwaters on numerous occasions due to this type of rain event. Bechac's was a priority for some type of mitigation because it was one of the target 107 highly repetitively flooded structures in Louisiana. It had an estimated value of \$1.5 million and a history of four flood claims totaling \$35,175. Bechac's was floodproofed using a coating of a polyethylene material, which was painted allowing the structure to maintain its original appearance. RIP's, with an estimated value of \$700,000, had a history of eleven flood claims totaling \$94,055. RIP's was floodproofed using a waterproof membrane covered by bricks.

Another commercial structure involved in this project, the Lake House, a guidance center for mentally handicapped adults, is located just two blocks from the north shore of Lake Pontchartrain. It sat well below the crown of the road because the road was elevated after the building was built. As a result, all water drained into their building. It suffered flood damage in 1995 and 1998 totaling \$20,034. Water resistant material, three feet from the ground, with closures, was the dry flood proofing technique used to protect the Lake House.



The homeowner demonstrates how easily he puts his front door gate in place.



Bechac's after floodproofing. After painting, the waterproof membrane could not even be seen.



The Lake House was successfully floodproofed.

LOUISIANA

One residential property was also an excellent candidate for floodproofing. In the flood of 1995, the home had two feet of water. On three other occasions after 1995, the home received five inches of floodwater. The enclosed garage on the front of the house has flooded eight additional times. Making the situation even more difficult to bear, this house was the only house on the street that flooded because it was located on a corner where all of the draining collected. This house was also one of the top 107 structures in the State of Louisiana that had been identified by FEMA as a priority to mitigate due to the repetitive losses.

The homeowner explored the possibility of elevating the home, but his personal share required for the 25% cost share was approximately \$20,000. This was not a realistic economic option. Every time the home flooded, the claims to the NFIP would total approximately \$32,000. The hassle of moving out and cleaning up was just too much. He was looking for an economical alternative. The same dry flood proofing technique of using water resistant material three feet from the ground, with closures, was applied.

Benefits

- ◆ Since the floodproofing, both Bechac's and RIP's have avoided damage from at least two floods.
- ◆ When Tropical Storm Allison blew ashore, RIP's had approximately one foot of rising tide water outside its floodproofed doors, but the only water that got in was about an inch that blew in through a window and was mopped up.

Costs and Funding Sources

- ◆ Bechac's total project cost = \$190,000
- ◆ RIP's total project cost = \$200,000
- ◆ Lake House's total project cost = \$190,000
- ◆ Residence total project cost = \$49,500

Location: St. James Parish, Louisiana

Project: Drainage Projects

Techniques: Asphalt Coated Culverts, Added Culverts, Regrading Ditches, Replacement of Undersized Culverts, Standard Culvert Program, "At or Above" BFE Ordinance

Contact: Jody Chenier, St. James Parish Operations, sjop@stargazer.net or 225-562-2262

St. James Parish, Louisiana

Background

St. James Parish in South Louisiana is characterized by flat terrain and low elevation. There is no place for floodwaters to drain. Fortunately, the

Parish has found a cost efficient and very effective means of mitigating flooding problems. The solution has been a number of drainage projects which involve regrading ditches, placement or replacement of culverts and filling ditches.

Project Description

The life span of culverts in St. James Parish averaged only 10 years due to saltwater intrusion from the Gulf of Mexico, which deteriorated the galvanized culverts quickly. To alleviate this problem, the Parish replaced damaged culverts with asphalt-coated culverts. New culverts were installed to replace open ditches, greatly reducing maintenance problems.

Central Canal, located in the Town of Gramercy, used to flood on a regular basis, affecting 500 residential and commercial structures with an estimated value of \$50 million and 2,000 residents. The drainage system, which provides an outfall for approximately 700 acres of residential, commercial and agricultural properties, had damaged undersized culverts and inadequate ditches. The Parish replaced culverts to alleviate the flooding in the area.

Margaret Street Ditch, located in South Vacherie, is a primary drainage canal in the area. The ditch was originally six feet wide but had eroded to 20 feet due to heavy rainfall and tidal influence. The erosion was threatening several buildings adjacent to the ditch. Due to the increased size of the canal, flooding was occurring at an increased frequency and velocity. Flooding affected 50 residents and directly threatened 14 structures. The Parish installed a new culvert system with appropriately graded fill material to ensure that rainwater drained from the area faster.

Redbud Street Ditch, also located in South Vacherie, was designed to 5 feet width. It had eroded to 24 feet in some places. The erosion, caused by rainfall and backwater flooding, was threatening several structures. Redbud Street Ditch is a primary drainage for Louisiana Highway 643 as well as several residential streets. In areas where underground drainage had been installed, the culverts were grossly undersized, further exacerbating the flooding problem. The drainage project consisted of regrading the ditches and installing new culverts in some locations and replacing undersized culverts.

Once every three years, six to ten inches of rainwater from a single storm event would inundate the North Bank Street drainage area of North Vacherie area. Damages were in excess of \$275,000 for each flood event. Culverts under the Union Pacific Railroad were identified as a major cause of flooding and the Railroad agreed to replace these. At the same time, the Parish replaced over 2,000 feet of undersized and damaged culverts.

To ensure that properly-sized culverts continue to be used during construction or replacement, a standard culvert program has been implemented whereby the Parish will provide installation services to citizens.

Additionally, the Parish passed an ordinance requiring developers to build roads at or above the BFE.



Erosion, due to heavy rains, had widened the ditch to a point that it threatened several structures.



Since completion of the project, flooding has not occurred and the threat to buildings located on the banks has been eliminated.



Undersized piping was replaced with larger, asphalt-coated piping to facilitate drainage and reduce corrosion of piping.

Benefits

- ◆ These drainage projects have been highly successful as evidenced by recent Tropical Storm Allison. In June 2001, the St. James area received approximately 20 inches of rain over a 3-day period. In the past, this amount of rainfall would have caused as much as 10 inches of water in homes. However, during Tropical Storm Allison, all homes within drainage of the mitigated sites stayed dry.

- ◆ Since the replacement of the Central Canal culverts in November of 1994, no flooding has occurred in this area.
- ◆ Since the improvements to the Margaret Street Ditch in November of 1994, no flooding has occurred in this area. The value of the structures located immediately adjacent to the ditch that were protected by this mitigation project is \$500,000.
- ◆ Because floodwaters have not risen to dangerous levels since the Redbud Street Ditch improvements were completed in June of 1997, forty residents who had become accustomed to regular flooding have not had to sandbag their properties.
- ◆ Redbud Street Ditch improvement costs of \$345,000 would protect adjacent structures valued at \$400,000.
- ◆ Inundation in the North Bank Street area has not occurred since the culvert improvements were completed in August of 1998.
- ◆ Improvements to the North Bank Street culverts provided flood relief for 78 homes and 18 commercial structures, with an estimated value of \$14.8 million.
- ◆ The number of repetitive loss structures in the Parish has been reduced to four because of the improvements described above, the culvert program and the new ordinance.

Costs and Funding Sources

- ◆ Total project cost, Central Canal Culvert Improvements = \$68,198
- ◆ Total project cost, Margaret Street Ditch Improvements = \$170,000
- ◆ Total project cost, Redbud Street Ditch Improvements = less than \$345,000
- ◆ Total project cost, North Bank Street Culverts Improvements = \$72,500
- ◆ State HMGP = 50% of project cost
- ◆ FEMA = 50% of project cost

For each of these projects, the Parish has used its own engineering staff and work crews to design and construct the drainage system, thereby meeting its in-kind contribution to the project and reducing costs to the taxpayers.

May we resolve
to be part of the answer,
not part of the problem
– *Anonymous*

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Location: Allegany County, Maryland

Project: Lonaconing Stream Restoration and Greenway Park Development Project

Techniques: Acquisition, Restoration of Channel Features, Wetland Creation, Greenway Park Development, Habitat Restoration, Sustainable Development, Comprehensive Planning

Contact: Virginia McGann, Allegany County, vmcgann@allconet.org or 301-777-2199 ext. 353

Allegany County, Maryland

Background

The Georges Creek Watershed, located in the rugged Allegheny Mountains coal-mining region of Western Maryland, is rich in history,

cultural heritage and natural resources. Many of the watershed's communities, however, continue to be plagued by challenging water resource problems such as economic loss and personal hardship from persistent flooding, catastrophic flooding and poor water quality.

The Allegany County Project Impact Initiative, established in the summer of 1998, provided a new vehicle for discussions of multi-flood hazard mitigation and water quality issues during regular monthly meetings. Because the Project Impact group was comprised of many people who have a broad perspective on the Georges Creek Watershed, discussions led to a plan for completing a full-scale mitigation, habitat restoration and sustainable development program. The Lonaconing Stream Restoration and Greenway Park Development Project is an example of this comprehensive planning approach developed by a diverse group with common goals.

Project Description

The Lonaconing Stream Restoration and Greenway Park Development Project is a three phase comprehensive project which addresses the following problems: poor water quality, severe erosion, bank destabilization and channelization. The three phases of this project include: Phase I- acquisition of four properties, Phase II- restoration of channel and banks (1,600 linear feet), and Phase III- wetland and greenway park development (3 acres).

Project features include:

- ◆ Creation of a water quality wetland.
- ◆ Development of a greenway park.
- ◆ Establishment of educational signs/stations explaining restoration activities and the benefits to the local ecosystem.
- ◆ Utilization of community support and input.
- ◆ Improved habitat area.
- ◆ Improvement and proper utilization of acquired floodplain property.

Benefits

- ◆ Reduction in flooding.
- ◆ Improvement in the aesthetics of the community at a highly visible location adjacent to Maryland Route 36.
- ◆ The project will enhance educational opportunities for the local high school, which is approximately a quarter mile from the project site.
- ◆ Effective comprehensive planning can incorporate the vested interests of many agencies and residents.

Project Costs and Funding Sources

Total Project Cost = \$265,500

- ◆ Acquisitions (Phase 1) = \$62,500
- ◆ Maryland Department of Natural Resources 319 (h) Grant = \$57,500
- ◆ Upper Potomac Tributary Team = \$28,000
- ◆ Maryland Department of Natural Resources = \$80,000
- ◆ FEMA Project Impact = \$5,000
- ◆ Maryland State Highway Administration = \$20,000
- ◆ Program Open Space (P.O.S.) = \$12,500
- ◆ Volunteer work time provided by Georges Creek Watershed Association, Trout Unlimited and Town of Lonaconing

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

Michigan



Location: Spaulding Township, Michigan

Project: Flint River Flood Control Project

Techniques: Earthen Dike Relocation, Excavation of Floodway Shelf, Stabilization of Overflow Channels, Excavation of Overflow Channel

Contact: Dawn Schuler, Michigan Department of State Police, Emergency Management Division, SchulerD@michigan.gov or 517-333-5040

Spaulding Township, Michigan

Background

The Flint River and its connecting drainage systems, covering the counties of Genesee, Shiawassee, Lapeer, Sanilac, Tuscola, Oakland and Saginaw, have been drastically changed in the last 30 years. These modifications are man-made and not natural. The growth and development of the upstream drainage basin has radically increased the flow of water into the Flint River channel and has compounded the speed at which water and storm sewers dump into this drainage network. This increases both the frequency and the intensity of flooding in southern Saginaw County.

While the upstream community has changed rapidly, rural areas and agricultural areas downstream, toward Saginaw County, have not changed fast enough to cope with the increased volume of drainage water. There are farms that have been owned by the same family for more than 100 years (“Centennial farms”) in the area that had never lost a harvest to flooding until the 1980’s. In 1985, after approximately 10,000 acres were inundated for over two weeks, Governor Blanchard ordered the National Guard to repair area dikes because of the potential health hazards.

The flood control problem became obvious due to the frequent and devastating flooding to the community. The extensive economic losses, health and safety risks were unbearable. Residents had to evacuate homes, suffered household damage and lost income due to missed work. Financial losses to farmers in 1985 alone totaled \$1,600,000. In 1986, losses of crops totaled an additional \$2,805,760. An additional consequence of flooding is the millions of gallons of raw sewage released and by-passed into the Flint River from upstream wastewater treatment plants during flooding and high flow conditions.

Communities and farmers south of Saginaw and downstream from Flint, in order to protect their land and homes, have formed a four-township Flood and Erosion Control board to institute flood protection for the area.



Reconstruction and setback of the existing dike will reduce or eliminate future damages for at least 100 homes and prime farmland in the area.

Communities and farmers south of Saginaw and downstream from Flint, in order to protect their land and homes, have formed a four-township Flood and Erosion Control board to institute flood protection for the area.

Project Description

The Flint River Flood Control Project encompasses 8 miles of river, 11,145 acres of prime agricultural land, 340 homes and 16 miles of riverbank. Specific project activities include:

- ◆ Relocation of existing earthen dikes and excavation of a floodway shelf along the Flint River involving about 410,000 cubic yards of material. The excavated material will be used for the construction of about 46,500 lineal feet of proposed dikes.
- ◆ Stabilization, with rip-rap underlain by filter fabric, of both the upstream and downstream ends of two existing overflow channels.
- ◆ Excavation of an overflow channel about 1,150 feet in length and stabilization of both upstream and downstream ends with rip-rap underlain by filter fabric.

Benefits

- ◆ A conservative estimate of damages that have occurred over the past century is \$100 million. To date, \$2.8 million has been spent on flood improvements. An additional \$2.26 million is required to complete the project. The ratio of \$100 million in damages to \$5.06 million in total project costs is nearly 20:1.
- ◆ Without mitigation improvements, the average annual damage to dikes, crops, homes, roads, bridges and other property is estimated at \$2.8 million.
- ◆ On an investment of \$141,820, damages of \$2,836,400 were avoided. On February 8, 2001, a major storm event occurred during frozen ground conditions. This event was recorded as the third highest flow event since 1948. With the improvements in place, damages in the amount of \$2,836,400 were avoided. This is 20 times the project cost of \$141,820.
- ◆ Reconstruction of the dikes will protect 340 homes, at least 6 commercial businesses and 72 business landowners with crop-producing farm land.
- ◆ Completion of the dikes will prevent contamination to households, wells, crops, soils and restore both safety and productivity to the community.

Project Cost and Funding Sources

Total Project Costs = \$5.06 million (To date, \$2.8 million has been spent on flood improvements and an additional \$2.26 million is required to complete the project.)

FEMA HMGP funds from Disaster #1128 were utilized to accomplish the activities listed above. Additional funding was provided by a Michigan Department of Commerce Block Grant, Michigan Department of Agriculture, Natural Resource Conservation Service and Spaulding Township Assessments.

Vassar, Michigan

Location: Vassar, Michigan

Project: Elevations

Techniques: Elevation

Contact: Wallace Wilson, W.A. Wilson

Consulting Services,

wilsonconsulting@worldnet.att.net or

517-655-1828

Background

The City of Vassar, located along the Cass River in the “Thumb” area of Michigan, has long suffered from flooding. Since 1904, there have been approximately 28 floods of significance, including the 1986 flood exceeding the “1% chance flood”* event. The Cass River drains approximately 710 square miles through a relatively flat watershed. Most of its area is in agricultural use with a few cities and villages. Vassar, by far, has been the most adversely effected over the years. Floods of significance inundate the downtown business district and many residences to depths of six feet or more.

Since 1986, strong efforts have been put forth to relocate or acquire floodprone homes. Section 1362 funds from the NFIP and from CDBG grants from the state allowed nine residential properties to be purchased and removed from the floodplain. Subsequently seven additional structures were removed from the floodplain. No further mitigation actions occurred until September 1998, due to the lack of funding.

A Flood Mitigation Plan was developed in 1998 for the City using funding from FEMA’s HMGP in the amount of slightly more than \$30,000. This plan was adopted by the City Council and identified 32 separate actions that could be taken to reduce flood damages in Vassar. The Plan included a structure inventory that identified 130 structures within the City as being prone to flooding. They included 91 residential, 7 multi-family and 32 commercial buildings. The inventory also identified such information as flood elevation, lowest opening elevation, first floor elevation, lowest adjacent ground grade and whether or not the building was located within the floodway.

The City Council and the City Manager were concerned with the shrinking population of Vassar as homes were acquired and either demolished or relocated out of the city limits. Virtually all quality building sites are occupied with little room for the City to expand and grow. As buildings were demolished, the occupants relocated to the surrounding township lands or out of the area. When new funds became available through FEMA’s FMA Program or FEMA’s HMGP, the City Council decided it was time to approach flooding from a different perspective; floodproofing through elevation instead of acquisition and demolition.

Project Description

Four homes, all with flood insurance and all outside of the floodway, were identified as potential candidates for elevation. The City Manager and the City’s consulting engineer sat down individually with each of the homeowners to discuss the program. The homeowners, while having some reservations, all joined into the program with the anticipation of not having to live through the recurring flood nightmares again. The four houses are all older, having been built in about 1910 or 1920, with wood frame construction and basements. One home had brick facing. Two homeowners opted to convert to a crawl space under the house as opposed to an elevated basement. During the elevation project, all sub-grade basements were filled, new footings and foundation walls laid and the houses reset on the new extended concrete block foundation walls.

- ◆ House #1 was elevated 4.9 feet with a crawl space and 9 hydrostatic vent relief openings installed at a foot or less from the ground grade.
 - ◆ House #2 was elevated 8.2 feet with the lower portion of the building now being used for incidental storage and access to the upper floors. It has 10 vent openings installed.
 - ◆ House #3 was elevated 7.9 feet with the lower portion now being used for parking, incidental storage and access to the upper level. There are 10 vents installed.
 - ◆ House #4 was elevated 4.2 feet with the lower portion converted to a crawl space. There are 12 hydrostatic vent openings installed.
- Of critical importance to the elevation project was the coordination required at all stages of the project. Initial and continuing contacts with the homeowners were vital. Then permits and approvals were needed from the Michigan Department of Environmental Quality’s Land and Water Management Division for modifications to the floodplain. The Emergency Management Division of the Michigan Department of



House #3 prior to elevation.



House #3 elevated 7.9 feet with the garage under the house.

State Police served as FEMA's representative, providing project oversight and fund allocation. Very critical to the project was continuing coordination with the Tuscola County Building Inspector, ensuring that building permits were in-hand and that all aspects of the building code were met. Finally, the Vassar City Council was kept fully informed of the project's progress by the City Manager. Several decisions at the Council level helped keep the project moving forward.

Problems Encountered

Because the elevation projects were a new "venture" for the City, the City Council and City Manager received many vocal opinions. Many believe that the houses look funny elevated and others thought the process took far too long. House #2 stands out as the most obvious elevation. The homeowner plans to use new siding that will cover the extended foundation walls, improving the appearance significantly. The other elevated homes all had fill placed around their perimeters, making them look like homes built on small hills.

The length of time that it took to elevate the structures was due primarily to the contractor's inability to schedule and communicate properly with all parties. This led to high levels of angst with everyone. Future projects will be done with a better qualified contractor.

Benefits

- ◆ Four homes are no longer prone to flood damage from the "1% chance flood"* event.
- ◆ The homeowners are satisfied because their flood insurance rates will drop.
- ◆ NFIP claims will be reduced.

Costs and Funding Sources

The federal portion of the elevation project came from FEMA FMA PProgram, passed through the Michigan Department of State Police, Emergency Services Division. The City of Vassar paid for 12.5% of the elevation costs and each of the homeowners paid the remaining 12.5%.

Total project cost = \$199,980

House #1 total cost = \$49,140

- ◆ FEMA FMA Program grant = \$41,600
- ◆ City of Vassar = \$3,770
- ◆ Homeowner = \$3,770

House #2 total cost = \$43,920

- ◆ FEMA FMA Program grant = \$36,500
- ◆ City of Vassar = \$3,710
- ◆ Homeowner = \$3,710

House #3 total cost = \$52,200

- ◆ FEMA FMA Program grant = \$45,100
- ◆ City of Vassar = \$3,550
- ◆ Homeowner = \$3,550

House #4 total cost = \$54,720

- ◆ FEMA FMA Program grant = \$47,200
- ◆ City of Vassar = \$3,760
- ◆ Homeowner = \$3,760

Note

* "1% chance" = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the "100 year flood".

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

Minnesota



Location: Breckenridge, Minnesota

Project: Ottertail and Bois de Sioux Rivers Flood Management Using an Invisible Flood Control Wall

Techniques: Invisible Flood Control Wall

Contact: George Fryklund, Flood Control America, fryklund@ma.ultranet.com or 978-440-8902

Breckenridge, Minnesota

Background

Breckenridge, Minnesota is at the confluence of the Ottertail and Bois de Sioux Rivers, which combine to form the headwaters of the Red River. As

a result, this small city of 3,660 people needs protection from a total of four riverbanks. When the Red River flooded in 1997 and covered the city with a 3-foot wall of floodwater, per capita damage was high. The city sustained approximately \$35 million in damage. With fewer businesses to generate tax revenue than larger cities, Breckenridge was faced with a slower recovery time than some other areas in the Red River floodplain.

Project Description

One option, earthen levees, would have displaced about 36 businesses. Instead, the City Council Flood Committee opted for a concrete levee for much of its mitigation plan. But due to aesthetic concerns, the city invested in the Invisible Flood Control Wall (IFCW) to protect scenic Headwaters Park.

The IFCW, a product of Flood Control America, is a removable wall that is erected only during the threat of a flood. Patented twenty-foot sealed, interlocking hollow aluminum planks stack on top of a sill plate integrally constructed on a permanent concrete foundation. The IFCW can be quickly assembled in the event of a flood; the rest of the time the riverfront is available for the enjoyment of citizens.

“There’s not just a big cement wall when you’re coming into town,” said Mayor Cliff Barth. “The wall has a nice design and is relatively simple to put up.” Mayor Barth said it takes the Breckenridge street and fire departments about 45 minutes to erect the IFCW.

Benefits

- ◆ There has been no flooding since 1997
- ◆ Due to the new flood mitigation system, more people have moved to Breckenridge since the 1997 flood. Two new businesses have also moved into the area.
- ◆ The 130 homes demolished by the flood were replaced with improved houses and the tax base has grown.
- ◆ “We’ve had a 100% recovery,” Mayor Barth said. “The flood was terrible and demoralizing, but good things have come out of it.”



The only trace of the IFCW at Breckenridge is its unobtrusive foundation.



The erected IFCW is visible only during a flood.

Costs and Funding Sources

Total project costs = \$540,000

- ◆ Minnesota Department of Trade and Economic Development = \$540,000

Additional disaster recovery efforts resulted in close to \$27 million

- ◆ Breckenridge ended up with about \$23 million in disaster relief that was used for commercial rehabilitation, rental housing rehabilitation, new houses, acquisitions, a storm pumping station, dikes and levees.
- ◆ The City of Breckenridge established a recovery fund called “Lend a Helping Hand,” receiving donations from across the country. These funds were used to help recover damages not covered by insurance. Approximately 1,130 volunteers spent 22,670 labor hours to help other citizens affected by the flood = \$913,000
- ◆ FEMA = \$3,000,000
- ◆ Minnesota Departments of Natural Resources, Trade and Economic Development, Emergency Management Services and Housing Finance Agency = \$18,000,000
- ◆ The City of Breckenridge = \$642,000

Location: East Grand Forks, Minnesota

Project: Red River Flood Management Using an Invisible Flood Control Wall

Techniques: Invisible Flood Control Wall

Contact: George Fryklund, Flood Control America, fryklund@ma.ultranet.com or 978-440-8902

East Grand Forks, Minnesota

Background

During the 1997 Red River flood in East Grand Forks, sandbags and levees didn't hold. The water level reached 54 feet and hit the top of handrails on the Demers Avenue Bridge. Damage was estimated at \$500 million with four feet of water covering Main Street and only eight homes unaffected. According to Mayor Lynn Stauss, "Our downtown district was basically destroyed."

Project Description

City officials invested in a new flood control technology, the Invisible Flood Control Wall (IFCW), whose mission is "Harmony with Nature." IFCW is a product of Flood Control America. Construction of the IFCW at East Grand Forks occurred from September of 1998 to its completion in March of 1999, providing over 980 linear feet of floodwall protection up to 14' in height.

The IFCW is a removable wall that is erected only during the threat of a flood. Patented twenty-foot sealed, interlocking hollow aluminum planks stack on top of a sill plate integrally constructed on a permanent concrete foundation. Posts and pin mounted diagonal braces provide additional support. A working crew of 3 people can install 1200 square feet in 2 hours.

Benefits

- ◆ Since the erection of the IFCW, East Grand Forks has experienced close to \$20 million in investment. Some investments include construction of an \$8 million Cabela's (a hunting and fishing retail store), an Appleby's, the Blue Moose Café, Whitey's and the Riverwalk Center.
- ◆ East Grand Forks is in the first phase of a four year project to develop the 2200-acre Red River State Recreation Area.
- ◆ Because the IFCW protected commercial properties, over 500 jobs were created or retained, resulting in tax revenues to support local government, schools and public services.
- ◆ "We would have a twelve-foot concrete wall there right now if it weren't for the IFCW. Many people comment on how attractive the approach to the riverfront is. They don't feel like they're driving into a flood control project," according to City Engineer Gary Sanders of Floan-Sanders.
- ◆ In 2000, the IFCW was awarded the "7 Wonders of Engineering in Minnesota Award for Distinguished Engineering Achievement" by the Minnesota Society of Professional Engineers.
- ◆ The IFCW was also recognized by the Economic Development Administration of the U.S. Department of Commerce as one of its five major "success stories" in the 20th century.

Cost and Funding Sources

Total Project Cost = \$1.2 million

- ◆ Minnesota contributed general fund monies through the Department of Natural Resources = \$200,000
- ◆ Economic Development Administration of the U.S. Department of Commerce grant = approximately \$1,000,000

As a result of the floods of 1997 FEMA contributed over \$300 million to East Grand Forks and Grand Forks.



Preservation of the riverfront view through the IFCW was the spark that generated \$20 million in investment and preservation.



"Once every 100 years, you have to look at the erected IFCW instead of the Red River."

Location: East St. Peter, Minnesota
Project: Commercial Buyouts
Techniques: Acquisition, Relocation, Elevation
Contact: Terri Smith, Minnesota Division of
 Emergency Management,
 Terri.Smith@state.mn.us, 651-296-0469

East St. Peter, Minnesota

Background

After floodwaters devastated the area in the 1960s, the Army Corps of Engineers constructed a dike as a temporary solution in 1969. It served its purpose prior to the 1990s, holding high waters back from flooding homes and businesses. Since it was built as a temporary protective measure, no funding was in place for maintenance or upgrading. The community needed a permanent solution.

The Minnesota River covered Highway 99 in Le Sueur County in 1993, 1997 and 2001. In each case, the high water caused the closing of the busy roadway that crosses the river and made the bridge from the unincorporated community of East St. Peter to the city of St. Peter impassable. The flood of 1993 caused hundreds of thousands of dollars of business losses from damages and lost revenue.

Repetitive flooding endangers communities at many levels: loss of life, reduction of property values, significant losses in revenue and stress-related illnesses. These severe consequences push citizens and local officials to action and force difficult decisions.

The concept of FEMA's acquisition program is simple. When homes and businesses have been involved in heavy flooding (especially multiple flooding events), and local officials and owners of these properties are looking for a solution, acquisition can completely eliminate future flooding problems by removal of structures. The acquisition process can take years to complete.

Project Description

An acquisition program, initiated after devastating flood damage in 1993, helped 16 business owners and two homeowners move out of the floodplain by the time the 1997 flood hit.

In the East St. Peter project, a number of businesses were involved and various funding agencies participated. Public meetings were held, and subsequently, appraisals and negotiations were conducted on all the properties. Owners were offered a pre-flood fair market price and additional monies for relocation expenses. Environmental testing took place as required by federal law in the purchase of commercial property. By the next major flood, the acquisitions were complete.

The decision to "get out" was an agonizing one. For some, it was saying good-bye to the livelihoods they had known for twenty to thirty years and a lifetime of customer-based relationships. One East St. Peter business, Whiskey River restaurant and bar, chose to rebuild on much higher ground.

The owners of the Whiskey River, the largest dining establishment in the St. Peter area, choose to remain along Highway 99 and undertook a major rebuilding effort. Cooperating with local, state and federal agencies, the Whiskey River was elevated on fill in compliance with the local floodplain ordinance, greatly reducing the risk of flooding. "We owned the land already. We had been in business for fifteen years and had a good reputation. We checked into other sites in St. Peter and they just didn't have the space," said the owner.

A short grass prairie now grows where a cement plant, auto body shop, furniture store and grain elevator once conducted operations. The Le Sueur County Park Committee has responsibility for managing 40 acres that Le Sueur County now holds title to through the acquisition project. Plans for the space include use by community groups for Boy Scout encampments and as a picnic area.

Picture courtesy of St. Peter Herald



Aerial view of 2001 Minnesota River Valley Flooding.

Picture courtesy of St. Peter Herald



The rush of the waters was a repeat of the flooding in 1997, and before that in 1993.

Picture courtesy of St. Peter Herald



Family and friends helped move furniture out of Homeline Furniture during the 1993 flood to save the inventory from damage.

MINNESOTA

Benefits

- ◆ During the 1997 and 2001 flood events, there were no damages to residences and businesses along Highway 99 in the East St. Peter area. “Had the houses and businesses still been located in East St. Peter, they would have had two to six feet of water in them,” said Darrell Pettis, Le Sueur County Engineer, describing the 2001 flood.
- ◆ Removal of commercial structures (e.g. auto body) helps to reduce the risk of surface and groundwater contamination.
- ◆ “The river was so powerful, the movement of the water would make the ground shake,” said John Zimmerman, a long time resident. “Today, if the Minnesota River floods, it floods and it’s okay.”

Costs and Funding Sources

Total project cost = \$2,331,000

- ◆ FEMA HMGP = \$828,000
- ◆ Le Sueur County stepped up to be the local-share partner for FEMA’s HMGP acquisition project, administered through the Minnesota Division of Emergency Management (DEM) after the presidentially-declared disaster of 1993. = \$46,000
- ◆ The Minnesota Department of Trade and Economic Development (DTED) provided funding for commercial relocation, business reestablishment, environmental studies and cleanup = \$1,182,000
- ◆ Minnesota DNR funded = \$25,000
- ◆ Minnesota DEM funded = \$250,000

Never doubt that a small group
of thoughtful, committed citizens
can change the world;
indeed it is the only thing
that ever has.

-Margaret Mead

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

Mississippi



Location: City of Gulfport, Mississippi

Project: Brickyard Bayou Acquisition

Techniques: Acquisition

Contact: Bob Boteler, Mississippi Emergency Management Agency,
bboteler@memaorg.com or 601-960-9031

City of Gulfport, Mississippi

Background

The City of Gulfport, the second most populous city in the State, lies at the center of the Mississippi Gulf Coast. Gulfport's southern boundary is

fronted by coastal waters while numerous rivers, streams and bayous traverse the interior of the city, making their way to the gulf. Heavy rain events coupled with high tides and storm surges create near impossible conditions for the timely discharge of stormwater.

At the near center of the city lies the Bayou View West and the Pineland subdivisions. These moderate income subdivisions were developed in 1969 and 1970 with over 300 small ranch-style homes that lie north and south of Brickyard Bayou. Over the years the bayou has been partially channelized and today it flows west to east in a series of bends and turns, through numerous bridge culverts and other impediments, eventually making its way to the back bay and on to the Gulf.

In 1979, at the time the first Flood Insurance Rate Maps were produced, both subdivisions were mapped outside of the SFHA. The regulated floodway was contained within the banks of the bayou. However, over the years heavy rain events overflowed the bayou and flooded many of the homes. In October of 1998, Hurricane Georges' provided heavy rains that again flooded a majority of the homes; the area was part of a presidential disaster declaration.

Through the recovery efforts of the Mitigation Bureau of Mississippi Emergency Management Agency (MEMA) and FEMA Region IV, Mitigation Strike Teams were dispatched to survey the flooded homes. The strike teams identified all affected properties, determined high water marks for follow-up survey teams, secured digital photographs of the structures and obtained GPS locations. This information was entered into the state's repetitive loss database and became the baseline for developing a mitigation strategy.

Project Description

Using information from the survey teams, a Hazard Mitigation Technical Assistance Contract was secured for re-mapping the area. The re-mapping revealed a floodway that encompassed nearly a hundred homes, a Zone A with a width of nearly half a mile and flood depths of five feet. With FEMA HMGP funds in-hand from the disaster declaration, and a documented basis for qualifying for additional funding under the Supplemental Appropriation for Unmet Needs, the MEMA/FEMA Mitigation Project Team met with City of Gulfport officials.

While comparable housing in other areas of the coast had experienced dramatic increases in value since the arrival of the "gaming industry", the new flood maps documented a downward spiraling value for the "Brickyard Bayou" area. City officials, faced with ever increasing recovery cost, were hard pressed to commit \$5,000,000 to a small segment of the city's residents.

A plan was adopted by the Gulfport City Council to fund the entire non-Federal share, with much input and support from the flooded residents. A total of 243 homes and two apartment buildings were identified for acquisition. Phase I of the acquisition project included 82 structures in the floodway and 28 adjacent structures. Phase II of the acquisition project includes the remaining 133 structures.

Even though the acquisition project had been identified and funded, a local Hazard Mitigation Plan was required by the State and a Flood Mitigation Plan was required to meet the CRS and FEMA's FMA Program standards. Concurrent with project development, the City established a Hazard Mitigation Council, selected a consultant and completed the initial planning requirements within six months. The Gulfport Hazard Mitigation Council continues to implement the mitigation strategies identified in their post-disaster mitigation planning and was recently awarded a significant improvement in their CRS rating.

By June of 2001, 54 homes in Phase I had been acquired. The project was clearly accelerating. Homes could now be appraised, negotiations completed and closings consummated, all within 30 days. But, for many of the remaining 189 flood victims, a reminder of the need to sell came in mid-June with the arrival of Hurricane Allison. Eighty-five of the remaining homes had significant flooding. Knowing they were targeted for acquisition, many of the residents had not renewed their flood insurance.

While flood losses to the homes will not significantly effect the acquisition fair market value, the loss of personal property and the repeated devastation to the spirit of these hardworking people will linger. And while additional losses were incurred, the losses were reduced by the 54 previously acquired homes. Had efforts been more focused from the beginning, had pre-disaster mitigation plans been in place, had public policy regarding local funding and local needs been resolved, the June 2001 storm would have flooded an open field, a developing wetlands, that was once the home to 189 families.

Through December 2001, 145 homes in the Brickyard Bayou project were approved and acquired. All 243 will be acquired by mid-summer of 2002.

MISSISSIPPI

Benefits

- ◆ It is projected that the nearly \$19 million project will have an increased benefit-to-cost ratio from 1.37 to 1.50 due to increased flood frequencies.
- ◆ The purchase of the 54 homes avoided one-time recovery cost from Hurricane Allison of over \$650,000.

Cost and Funding Sources

Total project cost = \$19 million

- ◆ FEMA HMGP = \$3 million
- ◆ FEMA FMA = \$1,149,000
- ◆ FEMA Unmet Needs = \$5,174,000
- ◆ FEMA future obligations committed = \$4,936,000
- ◆ City of Gulfport through general fund and short term borrowing = \$4,750,000

Significant problems we face today
cannot be solved
at the same level of thinking
we were at when we
created the problem.

-Albert Einstein

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

Missouri



Location: City of Union, Missouri

Project: Single Family Home Acquisitions,
Mobile Home Park Acquisitions and
Assistance

Techniques: Acquisition, Demolition

Contact: Sheela Amin, Missouri Emergency
Management Agency
samin@sema.state.mo.us or 573-526-9116

City of Union, Missouri

Background

With both the Mississippi and Missouri Rivers located within its borders, it is obvious that the State of Missouri is highly susceptible to riverine flooding. The State, however, is also susceptible to flash flooding. In fact, since 1993, 64 of the 88 flood-related deaths were due to flash floods, not riverine. Therefore, in Missouri, flash flooding is a more severe threat in regards to individual lives and property than riverine flooding.

The City of Union, located just 45 minutes from Saint Louis, Missouri, is the governmental and legal seat for Franklin County. It is a peaceful community of 7,757 people. Flooding in Union is usually caused by the Bourbeuse River. In fact, it was several of the normally quiet little streams with names like Flat Creek, Possum Creek and Fenton Creek that were suddenly transformed into raging torrents of sewer and stormwater runoff when more than 14 inches of rain fell in less than eight hours in May, 2000. This incredible, unexpected discharge formed a destructive wall of water that rudely awakened many of the city's sleeping residents, immediately endangering their lives and damaging or destroying numerous homes, vehicles and personal belongings.

The State of Missouri received a presidential declaration on May 12, 2000, establishing funding for disaster relief and mitigation activities through FEMA.

Project Description

On May 30, 2000, the City of Union submitted an application to the State of Missouri Emergency Management Agency (SEMA) to purchase 29 residential structures and five mobile home parks. The value of the initial application was \$2,044,340. Due to funding limitations, the application was modified to include only substantially damaged residential "stick built" structures located within the "1% chance flood"* event area.

The City of Union ultimately acquired a total of 17 properties. The demolition project was completed on January 18, 2001. As a result of the acquisition program, 17 families are now "out of harms way". Those 17 properties are deed restricted for "open space", which will prevent future development and the potential for flash flood related deaths in that area.



Damage caused by May 2000 storm.



A portion of the area where structures were demolished and cleared for open space.

The State of Missouri CDBG program was notified by SEMA and the City of Union of the funding shortfall, specifically in regards to the mobile home parks. The May 2000 flood event displaced approximately 225 people from three mobile home parks. Debris removal costs of \$241,262 were due to damage in the three mobile home parks. In addition, a majority of the IFG and Disaster Housing payments, which totaled over \$722,000, were also provided to the residents of the three mobile home parks. The City of Union applied for and received a grant to acquire the land and financially assist the owners of approximately 58 mobile homes in the three mobile home parks. These mobile home parks will also be deed restricted for "open space".

Benefits

- ◆ The costs associated in response and recovery of future flooding in the "acquisition" areas will no longer exist. This includes approximately \$963,262 spent for IFG, Disaster Housing and PA.
- ◆ The flash floods of May 2000 demonstrate the value of disaster and mitigation money invested by the federal, state and local governments in voluntary flood acquisition programs. When a property is acquired and demolished in an acquisition program and the area is converted to "open space" for perpetuity, that area may flood again at some time, but people and property simply will not be there to suffer further injuries and damage. In the City of Union, when the next flood event occurs, the damage will be much more limited because many of the homes and people will no longer be in harm's way.

Costs and Funding Sources

Single Family Home Acquisition and Demolition

Total project cost = \$926,412

- ◆ FEMA HMGP funds for acquisition = \$628,336
- ◆ State of Missouri General Revenue HMGP funding for acquisition = \$209,446 (25% of the non-federal matching funds)
- ◆ FEMA PA funds were used for demolition = \$66,472
- ◆ State of Missouri General Revenue funding for demolition = \$8,863 (10% of the non-federal matching funds)
- ◆ Local costs for the demolition = \$13,295 (15% of the non-federal matching funds)

Mobile Home Parks Acquisition and Assistance

Total project cost = \$435,000

Missouri's Community Development Block Grant Program to acquire the land and financially assist the mobile home owners = \$435,000

Note

* "1% chance" = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the "100 year flood".

It is important that
we plan for the future,
imperative that
we accept an
outcome unplanned.
-Molly McDonald

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Montana



Location: Glasgow, Montana

Project: Residential House Elevation

Techniques: Elevation

Contact: Tom Sanburg, Montana Department of Natural Resources and Conservation, tosanburg@state.mt.us or 406-444-9362

Glasgow, Montana

Background

The residential structure is located on State Highway 42, on the bank of the Milk River, approximately two miles east of Glasgow, Montana. Many houses were built with basements in this area prior to floodway mapping in the 1970's. The house was listed as a repetitive loss after receiving over \$26,000 in flood insurance claims from 1978 to 1979. Additional flood damage was incurred without claims in 1986 and 1997. In October of 2000, the basement walls were seriously near collapsing from hydrostatic pressure. The owner said that he was not willing to relocate because his house is adjacent to his family greenhouse business. The total damages experienced by this structure rose over \$48,000. The location is a high frequency area for riverine flooding, averaging recurrence every seven years.



Repetitive loss residence prior to elevation.

Project Description

The house is located in the "1% chance flood"* event area and partially in the floodway. Since the owner was not willing to move away from his family business, the decision was made to elevate the house two feet above the BFE and remove the damaged basement. A new foundation was poured and an addition was built onto the back of the structure to replace the floor space lost by removing the basement.

This project was accomplished by a combination of several different contractors including a house mover to lift the structure, a concrete worker to remove the basement and pour the new foundation and a carpenter to build the addition to replace the basement.



Residence during elevation to two feet above BFE.

Benefits

The project will save an estimated \$96,000 in future claims over the next 80 years.

Costs and Funding Sources

Total project costs = \$88,822

- ◆ FEMA funded 75% = \$66,616
- ◆ The owner funded 12.5%, in cash = \$11,103
- ◆ The owner funded another 12.5% in indirect costs (labor) = \$11,103

Note

* "1% chance" = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the "100 year flood".

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Nebraska



Location: Beatrice, Nebraska

Project: Beatrice Acquisitions

Techniques: Acquisition, Bank Stabilization

Contact: Steve McMaster, Nebraska
Department of Natural Resources,
smcmaster@dnr.state.ne.us or 402-471-3957

Beatrice, Nebraska

Project Description

After major floods on the Big Blue River in 1973 and 1984, the City of Beatrice instituted its own voluntary acquisition project for residential structures. After another flood in 1993, the City continued to acquire flood-prone structures with funding from FEMA HMGP and FEMA FMA Program.

Beatrice was the first community in the nation to receive a grant from FEMA's FMA Program after a flood mitigation plan was completed. This funded the acquisition of 12 residential structures in the Big Blue River floodplain.

To date, Beatrice has almost completed the goal of removing all of the residential structures in the city's regulated floodplain. The majority of the remaining insurable structures are commercial. Of the 16 repetitive loss structures in the City, 14 have been acquired and demolished. Most of the acquired open space is being used for athletic fields and parks. A hiking and biking path is planned to be constructed in the future.



Open space remains after structures were demolished and removed.

Benefits

◆ No more federal disaster assistance will be paid for these properties ever again.

- ◆ Only open space uses that are compatible with flood storage will be permitted.
- ◆ Reduction of flood clean-up, fire department/law enforcement overtime for flood duty and rescue.
- ◆ Increased public safety.
- ◆ Increased natural habitat for wildlife.
- ◆ Increased wetland acreage.
- ◆ Creation of natural buffer strip (riparian corridor) which increases water quality.
- ◆ The mitigation planning initiative led Beatrice to be selected as Nebraska's first Project Impact community.

Costs and Funding Sources

Total cost of the project (including demolition) = \$370,000

- ◆ FEMA FMA Program funds were first received in 1997 and were used to acquire 12 homes at 75% = \$277,500
- ◆ City of Beatrice funding at 25% = \$92,500

Superior, Nebraska

Location: Superior, Nebraska

Project: Lost Creek Clearing and Bank Stabilization Project

Techniques: FIRM Up-date, Vegetation Clearing, Bank Stabilization

Contact: Steve McMaster, Nebraska Department of Natural Resources, smcmaster@dnr.state.ne.us or 402-471-3957

Background

Lost Creek has experienced significant flooding on the average, every five years. It flows through Superior from north-to-south, separating the High School and park from the rest of town, during flood stage. Additional risks involve a gas main attached to the upstream side of the 8th Street bridge, as it crosses Lost Creek.

Project Description

It was determined that it would be necessary to update Superior's FIRM. This greatly increased the cost of the plan because the engineering work was expensive

Through the planning process, it was determined that Lost Creek needed to be cleared of vegetation because trees that fell into the Creek were backing-up floodwater at downstream constrictions, usually at bridge crossings. Along with the clearing, the community decided to stabilize the Creek banks by excavating a stable slope. The stabilization project was completed in the summer of 2000. It included the use of rock riprap, channel bank germination mats and grass seed germination mats.

Benefits

- ◆ A more accurate FIRM.
- ◆ Reduced flood impacts to important reaches of Lost Creek.
- ◆ Plans to remove and replace the 8th Street bridge.
- ◆ This planning initiative led to Superior being selected as Nebraska's second Project Impact community.

Costs and Funding Sources: Beatrice

Total cost of project = \$170,529

- ◆ FEMA FMA Program funds covered costs for the clearing and bank stabilization in one of the City identified target areas = \$125,160
- ◆ CDBG Disaster Recovery Grant used as matching funds = \$37,208
- ◆ In-kind contributions by Nuckolls County = \$8,161



Lost Creel stabilized with rock rip rap and channel bank germination mats.

As we lengthen and elaborate
the chain of technology
that intervenes between us
and the natural world,
we forget that we become
steadily more vulnerable
to even the slightest
failure in that chain.

-Paul B. Sears

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

New Jersey



Location: Oceanfront Shoreline of New Jersey

Project: Dune Building and Enhancement in New Jersey

Techniques: Beach Nourishment, Dune Creation and Enhancement

Contact: Mark Mauriello, New Jersey Department of Environmental Protection, Office of Coastal Planning, mmauriel@dep.state.nj.us or 609-292-2662

Oceanfront Shoreline of New Jersey

Background

The densely developed oceanfront shoreline of New Jersey is vulnerable to a number of coastal hazards, including hurricanes, extratropical storms (northeasters), flooding and erosion. The number of people and properties at risk continues to rise, as the coastal population and associated investments in developed property increase over time. Historically, New Jersey has responded to these hazards by constructing seawalls, bulkheads and revetments, all intended to harden the shoreline and protect landward development. Despite their construction, damages to coastal property and infrastructure continue and the long-term adverse impacts of structures on beaches have become evident.

In response to these trends, New Jersey adopted a shore protection policy favoring beach nourishment and dune creation/enhancement. Since the mid-1980's, the New Jersey Department of Environmental Protection has documented significant damage reduction benefits of well-developed and maintained sand dunes. Sand dunes provide a buffer to storm waves, storm surge and flooding while providing a reservoir of sand that erodes during storms to nourish adjacent beaches.

Project Description

The State of New Jersey currently appropriates \$25 million per year for the purpose of shore protection, much of which is dedicated to funding beach nourishment and dune creation/enhancement projects along the oceanfront. The large volume of sand being pumped onto these beaches offers new opportunities for shoreline management and coastal storm hazard mitigation through dune creation and enhancement. The beach nourishment projects are designed and constructed with a dune component, using a combination of sand fencing and beachgrass plantings to establish and/or enhance dunes along the backshore. Over time, beach sand is transported by wind onto the dune, facilitating growth of the dune and the vegetation that anchors the dune in place.

The cost of dune creation and enhancement projects is relatively low, compared to the cost of nourishing beaches or constructing structural shore protection works. Required materials include sand fencing, support posts, wire, plant materials and fertilizer. In New Jersey, the preferred plant material is American beachgrass (*Ammophila breviligulata*), which is commercially available at a number of nurseries throughout the coastal area. The labor costs are generally low, as these projects do not require excavation or grading, and essentially involve only the erection of fencing and planting of beachgrass. In many cases, work release and other community service programs provide a no-cost labor force.

Oceanfront communities with protective dune ordinances allocate funds specifically for ongoing dune maintenance and enhancement activities. In addition, all State or Federal beach nourishment projects must be designed and constructed with a dune creation or enhancement component. Lastly, many private property owners conduct dune maintenance activities at their own cost in recognition of the hazard mitigation benefits that dunes provide.

One of the more successful dune creation projects was undertaken in the Borough of Lavallette, with approximately 1.5 miles of oceanfront shoreline. The initial dune creation project was implemented for the entire municipal beachfront.



Photos were taken, looking from north to south along the oceanfront. The Atlantic Ocean is on the left with the municipal boardwalk and adjacent residential development on the right. Photos show the construction and development of a protective sand dune between the ocean and the developed shorefront. These dunes have increased the level of storm protection and, as evidenced by post-storm damage surveys, have reduced the amount of storm damage to the municipal boardwalk and oceanfront homes.

NEW JERSEY

Benefit

- ◆ The primary benefit of a dune creation and enhancement effort is increased protection against coastal storm waves, surge and flooding and a reduction of vulnerability of coastal development and infrastructure to these storm hazards. This increased level of protection translates into reduced storm damages and associated recovery costs.
- ◆ Secondary benefits include the establishment of naturally functioning landforms and biota, enhancement of wildlife habitat and promotion of scenic/aesthetic resources.
- ◆ Post-storm damage surveys in oceanfront municipalities where these dune creation projects were initiated indicate significant damage reduction, particularly to boardwalks, roads and other infrastructure.
- ◆ In the case of the Borough of Lavallette, an investment of \$69,000 over four years resulted in subsequent damage reduction of over \$600,000. This figure is based on pre-dune storm damage to the municipal boardwalk.

Costs and Funding Sources

Total project cost for Lavallette = \$69,000

- ◆ Initial dune creation project for the entire municipal beachfront = \$60,000
- ◆ Maintenance costs for additional fencing and plant materials = \$3,000 per year

Many dune creation/enhancement projects have been funded through the New Jersey Coastal Zone Management Program and through FEMA HMGP.

Nature is often hidden,
sometimes overcome,
seldom extinguished.
-Francis Bacon

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

North Dakota



Location: Fargo, North Dakota

Project: Red River Flood Management Using an Invisible Flood Control Wall

Techniques: Invisible Flood Control Wall

Contact: George Fryklund, Flood Control America, fryklund@ma.ultranet.com or 978-440-8902

Fargo, North Dakota

Background

The 1997 Red River Flood was a “record” flood in Fargo. The temporary earthen dikes and sandbags failed, causing millions of dollars in damage, including \$3.5 million to Oak Grove Lutheran High School. The public spent an estimated \$7 million on restoration and flood protection and \$20 million on improvements.

Project Description

The city acquired 30 houses in the flooded neighborhood and considered acquiring the Oak Grove Lutheran High School because of the extent of its damage. But rather than relocate the entire school to another location, city officials hired a local architect to design a flood protection system, including flood barrier access points to the school. The city then invested in the Invisible Flood Control Wall (IFCW) to protect those five access points from the Red River during flood intervals.

The IFCW, a product of Flood Control America, is a removable wall that is erected only during the threat of a flood. Patented, twenty-foot sealed, interlocking, hollow aluminum planks stack on top of a sill plate integrally constructed on a permanent concrete foundation. Intermediate posts provide additional support.

Construction of the IFCW occurred from July 2000 to November 2000, just ahead of the next flood. “We were just in time,” said City Engineer Mark Bittner. “It worked like a charm.”

Benefits

- ◆ In Spring of 2001, the IFCW was tested when the Red River flooded again. At the time of the flood, 6 crewmembers erected the IFCW in approximately 75 minutes. The IFCW is credited with protecting not only the Oak Grove Lutheran High School, but a portion of the adjacent neighborhood, as well as preventing a breach of the sanitary sewer system.
- ◆ According to Senior Engineer Lynn Brilz, “As it turned out, the IFCW served us quite well. We’re happy with the system.”
- ◆ As a result of the success of the IFCW during the Spring 2001 flood, the city of Fargo has decided to install the IFCW to protect the Fargo Dome, which flooded during the summer of 2000.



A student at Oak Grove Lutheran High School waves from the dry side of the IFCW, happy to have dry feet during the Spring 2001 flood.



Oak Grove Lutheran High School, protected by the IFCW.

Cost and Funding Sources:

Total project cost = \$719,785

- ◆ FEMA HMGP funding = \$496,113
- ◆ Local match contributed by:
 - ▼ Special Assessment Project Property Tax fund = \$96,816
 - ▼ Oak Grove Lutheran High School = \$100,000
 - ▼ City of Fargo Street Rehabilitation funds = \$26,856

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Location: New Richmond, Ohio

Project: 1996 and 1997 Residential and Property Acquisitions

Techniques: Acquisition

Contact: Christopher Toms, Ohio Department of Natural Resources, Floodplain Management Program, Christopher.Thoms@dnr.state.oh.us or 614-265-6750

New Richmond, Ohio

Background

The March 1997 flood had far-reaching effects for southern Ohio with 18 counties included in state and national flood disaster declarations. Statewide, 5 deaths resulted, almost 20,000 people were evacuated, close to 6,500 homes and 833 businesses were flooded, with damage costs of around \$180 million.

The Village of New Richmond, a community of about 3,000 in Clermont County, is along the Ohio River, 20 miles upriver of Cincinnati. There are 550 of the village's 800 households within the "1% chance flood"* event area.

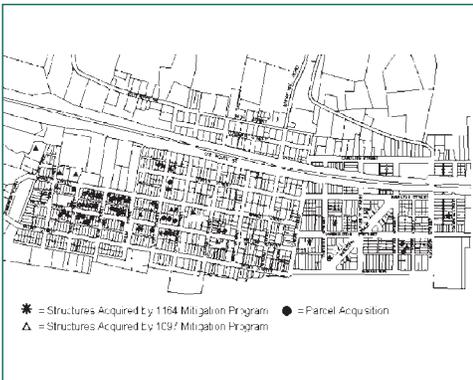
In March 1997, the community was not fully prepared to deal with floodwaters that rose faster than one foot an hour, and close to eight feet above the first floor in some homes. During the March 1997 flood, 500 village residences, including 150 mobile homes, were flooded. Countywide, 511 structures were reported as destroyed, even though the county's floodwaters were three to four feet below the mapped BFE. Manufactured home owners sought refuge by parking their homes alongside US 52 about 1/4 of a mile inland. While fleeing ever-rising floodwaters, some residents found the precious few escape routes aggressively blocked by vehicles of upland gawkers. Surprisingly, no altercations were reported. The floodwaters rose more than 30 feet until even US 52 was covered, inundating the trailers lining the highway. Then finally, the floodwaters receded.

Nothing on earth is quite like flood mud. It's slimy, slippery, sticky and it stinks to high heaven. Step in it once and you'll remember forever. Mud-matted people were the norm. The omnipresent mud was an invasive reminder of the immense recovery effort required. Understandably distressed and exhausted evacuees then faced well-intentioned but oftentimes frustrating post-disaster-response agency protocols. On this unpromising foundation, village officials proceeded to seek ways to help in the rebuilding of New Richmond.

Village officials joined with floodplain managers and other emergency response personnel from around the county to attend a special one-hour post-flood Substantial Damage Assessment Workshop conducted by the State Floodplain Management Program staff.



Firefighters during the 1997 flood.



Village of New Richmond Mitigation Site Locations.

Incorporating this guidance, village officials identified structures by their degree of damage. Theoretical recovery procedures were refined in light of actual conditions. County building officials offered assistance in making these determinations immediately following the flood. Switching to outside-contracted building inspectors to complete the inspections appeared to offer the village consistency, although unfortunately it was not timely and added considerable delays in some residents receiving their inspection results.

A Mitigation Committee consisting of village officials and residents with assistance from the Ohio Emergency Management Agency (OEMA) Mitigation Branch-staff was formed to consider mitigation options. The committee considered structural and non-structural acquisition, elevation, wet floodproofing, flood-safety education, flood response evaluation and "no action". Acquisition was the most logical option for two reasons. First, the committee agreed that the structures in the area were not structurally sound enough for elevation. Second, acquisition was a permanent solution because residents would no longer be living in the floodplain.

A smaller Mitigation Board succeeded the Mitigation Committee. The Board has been instrumental in achieving the goals of the project. Every decision about the project or mitigation in general is determined by the Board, which assures consistency.

Prior to the 1997 flood, the State Floodplain Management staff strengthened the village's floodplain management program. New Richmond is considered "in good standing" with the NFIP. When properly enforced, the NFIP is a tremendous mitigation tool. The village further advanced its flood safety by adopting higher regulatory standards, including increased lowest floor elevation, additional structural engineering criteria and a more restrictive floodway definition. In 1991, New Richmond officials applied for participation in the CRS and earned a Class 9-rating. The village annually mails a leaflet, "Flood Protection Information", to all residents and provides additional mailings to owners of repetitive loss structures.

Project Description

Though happily only suffering limited damage as a result of the two declared 1996 flood disasters, the village was approved for their first FEMA HMGP project in 1996. This project resulted in the acquisition of 29 structures and 19 vacant lots.

Due to pre-1997 flood efforts, the village has a comprehensive database listing the lowest floor elevations of each structure and the corresponding Ohio River flood stage that would affect each floodplain structure. With OEMA's guidance, village officials amended their 1996 HMGP project to acquire 18 more structures and 17 more vacant lots. Habitat for Humanity joined the mitigation effort by building five NFIP-compliant replacement houses.

Benefit

- ◆ The Habitat for Humanity houses are a great example of how mitigation can work. Five families are able to live in affordable housing with the added benefit of living in a flood-safe house.
- ◆ Prior to the 1997 flood, new and substantially altered structures had been properly elevated, reducing flood risk.
- ◆ With the elevation database, village officials could make site-specific flood warnings allowing evacuations that reduced risk to life and possessions.
- ◆ The 52 sites acquired through the two HMGP projects further reduced flood exposure.
- ◆ The 5% reduction in flood insurance premiums due to the CRS Class 9 rating made flood insurance even more affordable, allowing greater coverage with increased overall flood safety awareness.
- ◆ In 1998, David Kennedy, New Richmond Village Administrator and Floodplain Administrator, was recognized by the Association of State Floodplain Managers for his and New Richmond's exemplary floodplain management efforts when he received the Larry R. Johnson Memorial Award. David has since lent his expertise to help other Ohio communities implementing mitigation programs.

Cost and Funding Sources

Total Project Cost = \$1,239,470 (1996 and 1997 acquisitions)

- ◆ FEMA HMGP provided assistance through both regularly- and specially-funded activities = \$932,794
- ◆ ODNR and OEMA provided assistance through both regularly- and specially-funded activities = \$75,676 (total state contribution)
- ◆ The village operating budget covered most of the local floodplain management expense not covered by the HMGP-project = \$231,000
- ◆ A HUD Community Development Block Grant was included as part of the local match, with the state match coordinated by OEMA and Ohio Department of Development.

Note

* "1% chance" = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the "100 year flood".

When disaster strikes,
the opportunity to prepare
has passed.

-Dan McCormick

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES



Location: Portland, Oregon

Project: Johnson Creek Willing Seller Land Acquisition Program

Techniques: Acquisition

Contact: Alison Young, City of Portland Environmental Services, ally@bes.ci.portland.or.us or 503-823-5781

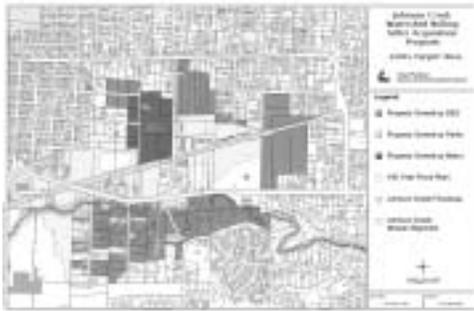
Portland, Oregon

Background

Johnson Creek is 26 miles long and drains approximately 52 square miles. It is a tributary of the Willamette River and part of the Lower Columbia River Basin. It also flows through six jurisdictions before reaching the

Willamette River, however most of the creek's flooding problems occur in Portland, Oregon.

While only 6% of Portland's "1% chance flood"* event area is in Johnson Creek, 78% of the City of Portland's repetitive loss claims come from Johnson Creek. Seven major floods occurred on Johnson Creek in the last 35 years. Floods in February of 1996 on Johnson Creek totaled \$4.7 million in damages, including loss of revenue to businesses. In October of 1996, the Portland City Council adopted the Flood and Landslide Hazard Mitigation Plan, which recommends acquisition of the most vulnerable properties from willing sellers for multi-objective projects.



Map of the Johnson Creek Willing Seller Land Acquisition Program: Lents Target Area

Project Description

In 1997, as part of a changing national trend to avoid risk in floodplains, the City of Portland Bureau of Environmental Services developed the Johnson Creek Willing Seller Land Acquisition Program. The program's goal is to help move people and property out of harms way of flooding and minimize repetitive losses. Land acquired through the program provides the City the opportunity to increase flood storage capacity, restore wetlands, create passive recreational activities for City residents and improve both fish and wildlife habitat. Willing sellers are offered fair market value for their property and are under no obligation to sell. Once the City purchases a property, structures and impervious surfaces are removed. The City places deed restrictions on each property designating it as open space in perpetuity and ensuring no future expenditure of federal disaster assistance funds for the property.



SE Foster Road during the November 1996 floods.

The Johnson Creek Willing Seller Land Acquisition Program is an implementation strategy for the Johnson Creek Restoration Plan. The Restoration Plan uses a multi-objective, watershed approach to develop solutions on a broad suite of issues in the Johnson Creek Watershed. The Restoration Plan addresses "nuisance" flooding, water quality problems, fish declines, wildlife declines and identifies common solutions to restore natural floodplain functions. Currently, acquired properties are land banked while floodplain management concepts are designed and funds are secured. Ultimately, many of the properties will be used to create constructed wetlands, floodplain terraces and open space for flood management, habitat and passive recreation purposes.



SE Foster Road after purchase and demolition of structures. Since the purchase, one telephone pole has been removed.

Benefits

- ◆ Through the Johnson Creek Willing Seller Land Acquisition Program, 61 properties have been purchased since 1997, totaling more than 110 acres.
 - ◆ The program has assisted over 30 of these households in moving out of flood prone neighborhoods.
 - ◆ The program has also led to the development of a successful land acquisition team consisting of multiple local agencies with acquisition funds focused on Johnson Creek.
- By working together this team has been able to leverage existing money to achieve the objective of separate but very similar City programs. This team has provided a great deal of outreach to residents of the floodplain and succeeded in educating a large portion of that community about the goals of the program.
- ◆ Fortunately, Portland has not endured a catastrophic flood event since 1996 to test the success of the land acquisition program.
 - ◆ In 1997, City of Portland Bureau of Environmental Services constructed the Brookside Wetland, the first floodplain restoration project on Johnson Creek. The 14-acre wetland can store up to 20 million gallons of floodwater. The wetland also provides habitat for fish, amphibians, reptiles, birds and small mammals.

Project Costs and Funding Sources

Project total cost = \$8.7 million

- ◆ FEMA HMGP contributed three \$375,000 grants = \$1,125,000
- ◆ Portland Parks and Recreation contributed through the local share of the Greenspaces Regional Bond Measure 26-26 = \$1 million
- ◆ Metro contributed through the regional share of the bond = \$626,250
- ◆ A HUD, CDBG was received through Multnomah County, for the purpose of moving people and structures out of harm's way of flooding in frequently flooded areas = \$1.5 million
- ◆ Since 1997, the City's Bureau of Environmental Services Capital Improvement Program has contributed funds to the project = \$1,625,000 + \$300,000 per year for the next 5 years

Since 1997 the Johnson Creek Willing Seller Land Acquisition Program has purchased properties in these three target areas.

Target Area	Acres Acquired	Money Spent	Sources
Lents	25.45	\$3,397,956	BES, CDBG, FEMA, PPR (26-26)
Lower Powell Butte	71.96	\$4,083,490	BES, CDBG, FEMA, Metro (26-26), PPR (26-26), Water Bureau
Tideman Johnson	2.65	\$521,000	BES, CDBG
Miscellaneous	10.03	\$743,750	BES, Metro (26-26), PPR
Total	110.09	\$8,746,196	

Note

* "1% chance" = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the "100 year flood".

You get nervous with no one
supporting you. People don't
always have the vision,
and the secret for the
person with the
vision is to stand up.
It takes a lot of courage.

-Natalie Cole

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

South Carolina



Location: Charleston County Area, South Carolina

Project: Marriage of the Community Rating System and Project Impact

Techniques: Creation of New Dunes, Ditches and Inlets Marked with Signage, Professional Training Programs, Storm Surge Signage, Outreach (Science Fairs, Hazards Expo, Information in Tax Bills, Speaker's Bureau)

Contact: Joni Rennhack, Charleston County, jrennhack@charlestoncounty.org or 843-202-6940

Charleston County Area, South Carolina

Background

The Charleston County Area was selected to be a Project Impact Community in December of 1999. The decision was made that the most effective way to organize Project Impact was to follow the CRS planning model. It was also decided that since hazard events do not recognize geographic borders, all sixteen of the local jurisdictions within Charleston County would be encouraged to participate so that every resident of the County could benefit from the projects undertaken through Project Impact.

Charleston County also provides coordination services for the CRS for seven local municipalities. The Project Impact/CRS process began by developing the "Charleston Regional Hazard Mitigation Plan", which is being used by several of the local jurisdictions for their CRS. Even those jurisdictions within Charleston County that are not participating in the CRS program have adopted the plan in support of the Project Impact initiative. Flooding and hurricanes were identified in the planning process as two of the most serious and potentially damaging hazard threats facing the Charleston County area. Other hazards, such as earthquakes, tornadoes, wild fires, hazardous materials incidents and acts of terrorism, were also identified as potential hazards to the Charleston County area.

The "Charleston Regional Hazard Mitigation Plan" serves as the blueprint for the organizational structure and identification for project selection under the Project Impact initiative. A series of nine committees, mirroring the project categories identified under the CRS program, were established to select and prioritize projects to be undertaken for multi-hazard mitigation under the Project Impact initiative. These committees include members from local governments, state government, federal government, the private sector, the not-for-profit sector and interested citizens. The Project Impact initiative currently has over 165 partners who participate in committees and/or support projects.



Drainage Awareness Campaign Project



Storm Surge Signage Project

Project Description

To date, the Charleston County Area Project Impact committees have identified over 50 projects to be undertaken to make the Charleston County Area more disaster resistant. Nearly 30 of these projects have been flood or hurricane related. Following are brief descriptions of a few of the projects that have been successfully implemented under the Project Impact initiative.

Project Description: Build-A-Dune Project

This project involved the creation of new dune systems by installing sand fencing, then planting native dune vegetation on the sand that has accumulated on the fencing. This project was undertaken through the cooperation of Charleston County and the Town of Sullivan's Island and with the participation of many volunteers, several of whom were young people who learned about preserving the natural environment through their participation. The newly created dunes help to stabilize the beach against erosion.

Project Description: Drainage Awareness Campaign Project

For this project, ditches and drainage system inlets are marked with signs or decals indicating that materials dumped into the drainage system end up in waterways. The signs and markers also feature the telephone number to report violators. Door hangers indicating that foreign materials in drainage systems may cause flooding and/or pollution are distributed in neighborhoods where the drainage system is marked. Posters describing the program are also in the process of being printed for distribution to local schools and for hanging in local government offices and other places of business.

Project Description: Storm Surge Signage Project

Project Impact identified a need for advising local residents of potential hazards they may face if they do not evacuate in the event of a hurricane threat. The South Carolina Department of Transportation, a Project Impact partner, offered to donate signs for placement at high-traffic locations indicating the potential flood water elevation over the road surfaces in the event of hurricane storm surge. Signs have now been installed in 10 locations across Charleston County in areas with a combined average daily traffic count of over 144,000 vehicles. Two media events have been conducted where local elected officials spoke about the signs and hurricane safety.

Project Description: Training Programs for Professional Audiences

Project Impact has sponsored or co-sponsored several training programs on flood-related subjects for architects, engineers, land surveyors, insurance agents, building code officials, contractors and others. Two workshops on the new FEMA flood elevation certificate and one floodproofing workshop have been conducted. Over 200 professionals have attended these workshops to date. A workshop on Coastal Construction is currently under development. Other workshops on hazard-related topics, such as procedures for decontamination of hazardous materials for health care professionals, are also under development.

Project Description: Outreach Projects

The CRS provides credit to local communities for educating residents regarding flood protection measures as an effective mitigation strategy. As part of this public education effort, the Charleston County Area Project Impact initiative has conducted a hazards expo, sponsored awards at the Lowcountry Science Fair, partnered with the Trident Regional Arts Collaborative Endeavor to educate third grade students about hazard preparations, provided flood information in tax bills and developed a Speaker's Bureau with speakers willing to address flood and other hazard related topics.

Benefits

- ◆ It is estimated that more than 2 million people in the Charleston County Area have received information regarding means to minimize losses of life or property through the multiple activities undertaken by Project Impact during the past fiscal year.
- ◆ Since the Project Impact initiative undertakes projects in line with the goals of the CRS, several local jurisdictions have also been able to enhance their CRS ratings and consequently obtain additional flood insurance premium reductions for their residents.
- ◆ Project Impact has also offered support to several local jurisdictions as they have sought other grant funding for drainage improvement projects to reduce flooding for multiple repetitive flood loss properties in the Charleston County area.
- ◆ The Charleston County Area is better prepared for flood events as a result of these efforts. Since flooding is one of the major hazard events that occur in the Charleston County area, the benefits of this initiative have been extensive.

Project Cost and Funding Sources

Total project costs = \$241,000 to date

- ◆ FEMA Project Impact grant funding = \$305,000 (To date, approximately \$136,000 has been spent)
- ◆ South Carolina Emergency Preparedness Division grants to develop a hazard curriculum for schools to develop a risk assessment methodology and to produce "Superior Code" books = \$38,940
- ◆ South Carolina Department of Insurance grant for GIS work stations = \$32,000
- ◆ Charleston Soil & Water Conservation District grant for Build-A-Dune grasses = \$500
- ◆ Other grants, cash, materials and labor = \$35,560

Location: Conway, South Carolina

Project: Acquisitions

Techniques: Acquisition and Demolition

Contact: Tabby Shelton, Horry County,
sheltont@horrycounty.org or 843-248-1830

Conway, South Carolina

Background

On September 16, 1999, Hurricane Floyd, a Category 4 hurricane, made initial landfall across the South Carolina border into North Carolina. In

Conway, South Carolina residents initially felt blessed since they didn't get a direct hit by this hurricane, yet this growing coastal community received over 16 inches of rain in the next several days. This rainfall caused several days of flooding, overwhelming the Crabtree Swamp and the Waccamaw River. Approximately 24 homes and 10 businesses were damaged enough to need building permits to make repairs. Nineteen residences were immediately determined greater than 50% damaged.

Project Description

The project consists of the acquisition and removal of 24 houses damaged by flooding. To date, 18 homes have been acquired. This project has eliminated repetitive damage and significant risks to public health and safety issues for this area in the future.

Benefits

- ◆ Most of the property has been returned to greenway, thus increasing the amount of area for the retention of future floodwaters. Future consideration for the property includes a city park.
- ◆ The flooding of these homes prompted the city to pass an ordinance to set a new flood protection elevation.
- ◆ This acquisition project, in conjunction with the new elevation ordinance, will reduce potential property damage, minimize damage to critical facilities and diminish future community disruption.

Cost and Funding Sources

Total project cost = \$2,716,306 (to date, 18 homes)

- ◆ FEMA HMGP = \$2,128,514
- ◆ FEMA FMA Program = \$55,664
- ◆ State of South Carolina = \$532,128

Location: Horry County, South Carolina

Project: Single Family and Mobile Home Park Acquisition Project, Wind Resistance Research, Fire and Rescue Training

Techniques: Acquisition, Demolition, Wind Resistance Retrofit Research, Fire and Rescue Training

Contact: Tabby Shelton, Horry County, sheltont@horrycounty.org or 843-248-1830

Horry County, South Carolina

Background

In September of 1999, Hurricane Floyd dropped 16 to 23 inches of rain along the Waccamaw River Basin. On September 16, Horry County experienced widespread flash flooding from the storm, but within 24 hours the waters had receded and the community believed that the worst had passed. It was not until several days later that the real impact of the storm became evident. A phone call from the National Weather Service warned officials that the County would be receiving record flooding along the Waccamaw River. Over the next week, the river would begin to rise slowly but would not crest until early to mid October.

The flood fight operation was extensive. It included, but was not limited to:

- ◆ Sandbagging portions of Highway 501, the main artery that connects the western part of the County to Myrtle Beach.
- ◆ Encircling sixteen pump stations within the City of Conway with sandbags in order to prevent the evacuation of the City.
- ◆ Managing several Community Field Sites within the damaged area.
- ◆ Coordinating relief and recovery efforts with the multitude of agencies assisting with the disaster operation.

One of the main concerns was the number of residential structures substantially damaged by the rising water. Many of the four hundred flooded homes had water in them for over thirty days. Weeks later, as the waters finally began to recede, Hurricane Irene approached the coast and delivered an additional five to six inches of rain, which caused the already saturated area to flood again.

Project Description: Acquisition

The ongoing property acquisition project includes the acquisition and removal of 35 single-family residences and a 30-unit mobile home park, all of which are located in the “1% chance flood”* event area. Demolition of the acquired structures is currently underway and should be completed by April 2002.

Future considerations for the properties include: multiple riverine access points for water rescue missions, training sites for local search and rescue team exercises, utilization by local university students for wetland/water quality research and open-space greenway areas.

Project Description: Wind Resistance Research

Clemson University has been engaged in research to develop measures that can be taken to improve the wind resistance of existing houses in severe wind events such as hurricanes and tornadoes. This research has been carried out over a period of several years under the sponsorship of a number of organizations including Horry County, Horry-Goergetown Homebuilders Association, The South Carolina Sea Grant, South Carolina Sea Consortium, South Carolina Department of Insurance, FEMA and the Institute for Business and Home Safety.

The acquisition of the damaged homes in Horry County offers a unique opportunity for implementation of these retrofit ideas in real-world conditions. Testing of the retrofit structures will help to determine how much additional capacity is actually achieved in a field application.

This cooperative effort will provide educational opportunities for all involved by providing new ideas for strengthening homes and practical constraints of real world construction. Furthermore, the project will provide more accurate estimates of retrofit costs and potential benefits of retrofit measures.

Project Description: Fire and Rescue Training

Horry County Fire Rescue has used a number of the damaged structures for training purposes. The types of training that have been accomplished are roof ventilating, forcible entry on single-family dwellings and overhaul operations. The use of these structures has proved a valuable component of the training exercises.

Benefits: Acquisition

- ◆ Vulnerable populations have been removed from the floodplain, which will reduce future health and safety concerns associated with flooding.
- ◆ The need for rescue and response operations, conducted by the Public Safety Department, will be reduced.
- ◆ Many of the substantially damaged structures have endured repetitive losses over the years; therefore, by removing the structures from the floodplain, future economic losses will be minimized.
- ◆ Removal of these structures will also benefit the surrounding neighborhoods by providing added green space and a natural flood buffer.

Cost and Funding Sources: Acquisition

Total project cost = \$5.9 million

- ◆ FEMA HMGP = \$4,425,000
- ◆ State of South Carolina = \$1,475,000

Cost and Funding Sources: Wind Retrofit

Total project cost = \$84,000

Contributors:

- ◆ Horry County
- ◆ Horry-Goergetown Homebuilders Association
- ◆ The South Carolina Sea Grant
- ◆ South Carolina Sea Consortium
- ◆ South Carolina Department of Insurance
- ◆ The Institute for Business and Home Safety
- ◆ FEMA

Note

* “1% chance” = a flood event that has a 1% chance of occurring or being exceeded in any given year. This is a replacement term for the “100 year flood”.

Town of Hilton Head Island, South Carolina

Location: Town of Hilton Head Island, South Carolina

Project: Jarvis Creek Project

Techniques: Drainage Improvements, Community Park, Wetland Mitigation, Stormwater Retention Lake

Contact: Steven Grant, Town of Hilton Head, steveg@ci.hilton-head-island.sc.us or 843-341-4686

Background

In 1995, the Town of Hilton Head Island conducted an island-wide drainage study to identify existing stormwater improvement needs. The study recommended upgrading the stormwater outfall under US 278 and enlarging the natural freshwater creek upstream of tidal Jarvis Creek, thus reducing problematic flooding in the Main Street area. During large storm events, the Main Street commercial areas, the public school complex (comprising K-12 with 4,500 students) and the Hilton Head Plantation residential areas experience extreme flooding.

Work began in fiscal year 1996-1997 on the conceptual design and topographic survey of the Jarvis Creek Ditch Project. Significant wetlands and trees were found within the proposed project location. Therefore, the Town began to pursue an option that minimized the wetland impact by rerouting the ditch. Rerouting also meant lengthening the ditch, which in turn increased the amount of excavation and loss of trees and wildlife habitat. Estimated construction costs increased from \$1.6 million to \$3 million. The original drainage plan included widening the natural freshwater creek adjacent to the Jarvis Creek Tract (at that time privately owned) to a bottom width of 35 feet and a depth of approximately six feet. The sloping bank would create a 100-foot wide canal. Enlarging the freshwater creek would destroy a large and unique area of upland habitat and more than four acres of freshwater wetlands. A different approach would be needed to minimize the projected disturbance.

Project Description

It was also during the summer of 1996 that the Town was negotiating the purchase of the Jarvis Creek Tract adjacent to the existing Jarvis Creek ditch. The 50-acre Jarvis Creek tract was purchased by the Town for \$5,040,000 and staff began to explore additional design options to solve the drainage problem. A 13-acre lake, capable of storing and conveying the necessary stormwater, was envisioned. A pump station was needed in order to move the water from the ditch to the lake. From the lake, water would flow through a vegetated spillway discharging into the headwaters of Jarvis Creek. This alternative plan was adopted and the site was ideal for the creation of the lake, because a majority of the site had been previously cleared and used for cattle grazing. The selection of the Jarvis Creek Tract resulted in the protection of 3.5 acres of valuable freshwater wetlands and a reduction in the loss of upland habitat and trees.

The Jarvis Creek Project has been designed to actually be a combined drainage improvement project and community park. The tract is approximately 50 acres, of which roughly half is wooded. The remainder was cleared for pasture as part of the antebellum Honey Horn Plantation. The drainage project involved the construction of a borrow pit on the cleared portion of the tract into which pumps deliver stormwater from the upstream drainage area. The borrow pit forms the central feature of a passive park which will be constructed following the drainage project. The dirt removed from the borrow pit has been sold for over \$500,000 to help finance the park element.

As a result of the construction of the pump station, approximately a half acre of wetland was filled. To compensate, the Town constructed a one acre transitional wetland at the outfall of the borrow pit and a wetland littoral shelf in the borrow pit itself. The area is designed for passive recreation, with trails and picnic areas. Walking trails have been designed around trees and little vegetation is being removed for park infrastructure. A boardwalk will guide visitors through the constructed wetland to teach them about wetland mitigation. The majority of the site will be left in its natural state as a haven for wildlife. Local groups have expressed interest in stocking the lake with native fish species. Effort was made to include the historical roots of the site into the design of the park element of the project. Before



1995 Aerial view of the Jarvis Creek Tract, pre-construction.



Wetland mitigation area in November, 1999.



Conceptual drawing for the park.

construction of the Cross Island Parkway, the Jarvis Creek Tract was part of a larger parcel called Honey Horn Plantation. This antebellum plantation, which is now also owned by the Town at a cost of \$9,750,000, has several historic buildings and a very interesting cultural history. The design of the park buildings was fashioned after the buildings at Honey Horn. The design consultants were directed to Honey Horn for inspiration; the details in the park plan reflect this cultural heritage well. The use of a barn type construction for the picnic pavilions and a split-rail fence through the site reflect the old island character. Purchasing this tract eliminated possible development generating 1,300 car trips a day.

To accomplish the goal of stormwater improvement, the Town needed to construct a pump station near Highway 278, which would pump the stormwater through four 48 inch pipes to the lake. The layout of the pipes was a particularly critical decision, given the abundance of specimen size live oaks and pine trees. The pipes were laid out in such a way that the entrance road to the park would eventually be paved on top of the pipes, requiring that only one swath be cleared through the parcel.

During construction of the wetland mitigation areas, and during plant selection for the remainder of the parcel, only plants native to Hilton Head Island were used. This selection improved the quality of the parcel for native wildlife by providing their indigenous food and cover sources. The selection of native plants also reduces the need for pest management, irrigation and long-term maintenance.

The change from a 100 foot wide canal to a stormwater retention lake with wetland filter will have profound impacts on water quality. The stormwater is designed to flow into the lake, through the vegetated wetland mitigation site, into an existing bottomland hardwood wetland and then into the freshwater creek. The detention time in the lake and the filtering effect of the wetlands is designed to improve the quality of water flowing into Jarvis Creek.

The wetland mitigation area is perhaps the most exciting aspect of the project. In designing the wetland, Town staff visited existing reference wetlands in the watershed to determine appropriate plant species. Because the mitigation area is a transitional wetland moving from the saturated lake edge to a higher site, plant species change from aquatic species such as pickerel weed to red maples and cypress on the spillway. In addition, all wetland areas are protected by restrictive covenants.

This project has been very much a community effort. The need for a community park was identified in the Town's 1991 Comprehensive Plan and the 1995 Recreation and Open Space Plan. Prior to design of the park, questionnaires were distributed to Island residents asking them what types of amenities they would prefer. The park's final design was a combination of citizen input and site constraints. The Jarvis Creek project presents a great opportunity for public education about our natural resources. Town staff have already conducted several field trips with school children to teach them about wetlands and wetland mitigation. The park design includes interpretive trails that will educate the public about the native species in the park and about the unique wetlands. It is hoped that a cooperative partnership will be arranged with Hilton Head Middle School to design the signage for the trail.

Monitoring

Because the water quality aspect of the project is innovative, monitoring the progress has occurred since September 1999. Bi-weekly water quality monitoring is conducted at the pump station site near Highway 278 and at the freshwater creek behind the outfall. This monitoring checks for 10 different water quality parameters including nitrogen, phosphorous and fecal coliform bacteria. The intention was to get a good baseline of data before the pump station became operational to use as a comparison once the stormwater is actively pumped through the system. The data collected and the lessons learned will be applied to other stormwater improvement projects.

In addition to water quality, there is active monitoring of the progression of the created wetland. There are three permanent vegetation plots to monitor plant growth. Quarterly soil samples are also taken to determine if hydric characteristics are present and to measure levels of nutrients in the soil. In addition, there is a record taken of all wildlife species encountered and lake evolution from a barren pit into a diverse wildlife habitat.

Benefits

- ◆ The initial investment of \$4,059,951 will protect \$46,806,786 in residential property and \$21,600,439 in commercial property.
- ◆ Reduction in flood water levels due to stormwater improvements, retention lake and wetland mitigation.
- ◆ Monitoring program that will provide meaningful feedback to improve the project effectiveness.
- ◆ Park as a community asset includes interpretive trails, other recreation, celebration of the Town's historical roots, observation piers and picnic areas.
- ◆ This project is one of the most innovative in the Town's Capital Improvements Program.
- ◆ The project's unique design has been recognized as "outstanding" by the Association of State Floodplain Managers, who invited Town staff to present the project at their 1998 national conference.
- ◆ In addition, because of its ability to mitigate upstream flooding, the project was awarded a South Carolina DNR Flood Mitigation Assistant Grant two years in a row. These grants, worth over \$500,000, represented all the money available in South Carolina for this program during those two years.
- ◆ The project was the only recipient of the 2000 South Carolina DNR's Stewardship Development Award.

Costs and Funding Sources

Total project costs (not including land purchase) = \$4,699,000

- ◆ Pump Station funded by Town of Hilton Head General Fund = \$3,454,000
- ◆ Culvert
 - ▼ FEMA FMA Program = \$528,970
 - ▼ Town of Hilton Head General Fund = \$166,030
- ◆ Lake excavation funded by sale of excavated dirt = \$550,000

Purchase of land funded through the Town of Hilton Head's Real Estate Transfer Fee = \$5,150,000

Put fun in the movement
to conserve, preserve, and restore,
and celebrate it,
and the people will run to sign up.

-David Brower

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

South Dakota



Location: City of Parkston, South Dakota

Project: Storm Sewer Extension Project

Techniques: Sewer System Extension

Contact: Tina Titze, South Dakota Division of
Emergency Management,
Tina.Titze@state.sd.us or 605-773-3231

City of Parkston, South Dakota

Background

The geographic area affected by the flooding was the southeast section of Parkston, which experiences flooding on average two times per year.

Most affected by the flooding were eight residential houses and four businesses. The majority of the flooding was due to heavy rains, which occurred in spring when there is very little absorption due to partially frozen ground.

Project Description

This project channels the water towards Pony Creek, the major waterway in Parkston, in an organized storm sewer system. It provides a better channel for water to escape the southeast section of Parkston. The drainage ditch already existed, so the function of the area did not change. Two smaller storm sewer systems were hooked into the Extension Project drain into Pony Creek. The Extension Project consisted of burying 490 feet of 36 inch reinforced concrete pipe with flared ends and two junction boxes. This connected with an existing 36 inch concrete pipe. The project allows for water to enter the system at different locations, keeping water from impacting or overloading the system at one or two locations.

Benefits

- ◆ The water is channeled and controlled for a longer period of time, allowing the water to drain from the residential and commercial areas faster, causing less water damage.
- ◆ A “4% chance flood”* event would have affected an additional six businesses, 44 residential houses and two garages.
- ◆ The Project eliminated the majority of standing water along Ben Street and protects the road from “sitting water” damage.
- ◆ Because the ditch is underground there is not a safety hazard in a residential area.
- ◆ The project makes the area within the city limits easier and faster to maintain.

Project Costs and Funding Sources

Total project costs = \$64,134.63

- ◆ FEMA FMA Program = \$46,000
- ◆ City of Parkston from city budget = \$18,000

Note

* “4% chance” = a flood event that has a 4% chance of occurring in any given year. This is a replacement term for the “25 year flood”.

MITIGATION SUCCESS STORIES

IN THE
UNITED STATES

Washington



Location: King County, Washington

Project: Priority Home Elevations

Techniques: Elevation, Covenant Restrictions
Recorded with Property Title

Contact: Steve Bleifuhs, King County
Department of Natural Resources Rivers
Section, Steve.Bleifuhs@METROKC.GOV or
206-296-8011

King County, Washington

Background

Since November 1986, King County, Washington has been a presidential-declared flood disaster area seven times, with millions of dollars in damage to public and private property. The flood event in November 1990 alone resulted in the flood of record at several river gage locations on King County's six major river systems and their tributaries.

In 1993, King County adopted a flood hazard reduction plan that addresses both comprehensive and long-term solutions. Topics include riverine flood problems, flood-related hazards, flood related damages, environmental impacts, long-term costs of flood control and long-term costs of floodplain management. The plan contained a number of new initiatives, including residential elevation projects, which had never before been administered or funded by King County. Residential elevation projects were identified as the preferred project alternative at several repetitive loss locations because this mitigation technique would provide a permanent, cost-effective alternative rather than the repetitive maintenance or construction of new flood protection facilities.



Residence prior to elevation.



Residence during elevation.



Residence after elevation.

Project Description

King County elevated 10 residential structures that were repetitively damaged from and continuously susceptible to the deep, low velocity floodwaters triggered by high water flows from the Snoqualmie River and its tributaries. Six of these homes were elevated during the summer of 2000 and four homes were elevated during 2001. For each home, the lowest habitable finished floor was elevated at least one foot above the BFE.

The project had two primary goals. First, to mitigate against future flooding by elevating each of the residential structures at least one foot above the BFE. Second, to mitigate against future seismic activity by designing and constructing the residential structure's new foundation based on individual soils evaluation identifying the liquefaction hazard as well as consistency with today's building codes and standards. Additional goals were to:

- ◆ Eliminate the potential risks to life and limb.
- ◆ Eliminate the vulnerability of existing private structures to flood damage.
- ◆ Extend targeted repetitive loss area elevations/acquisitions in King County and adjacent communities.
- ◆ Eliminate the repetitive and exceptionally high costs for continued insurance claims, disaster loans and grants, flood warning services, private expenditures for repairs, emergency housing and response.

King County involved the homeowners in all aspects of decision making to allow homeowners to be in control of their own project and to minimize project management costs. This was primarily achieved by requiring the homeowners to initiate nearly all phases of their elevation project, including obtaining three qualified bids, selecting their own contractor and working with their contractor to draft design plans and secure building permits.

Each of the homeowners was required to record a covenant on the property's title stating that no part of the raised residence located below the level of the lowest habitable finished floor would thereafter be converted to living area for human habitation, or otherwise altered in a manner which would impede the movement of waters beneath the structure. The covenant also states that the homeowners agree not to file insurance claims for contents stored beneath the lowest habitable finished floor that may be damaged by floodwaters or for damages to the area beneath the lowest habitable finished floor as a result of conversion for human habitation. Recording this covenant on the property's title ensured that future owners would be notified and would comply with the limitations of the property established in the recorded covenant.

These elevation projects are a component in King County's CRS upgrade to Class 4. King County is the first county in the country to receive this classification.

Additionally, these elevation projects were accomplished adjacent to residential elevations completed in the City of Snoqualmie. This represents a cooperative, interjurisdictional effort by King County and the City of Snoqualmie to reduce the impacts of flooding throughout a larger project area.

Benefits

- ◆ Based on previous known damages from flood events, these 10 elevations are expected to save approximately \$2,152,168 in avoided damages over the life of the project. The benefits derived from the project are based on the flood and seismic mitigation initiatives.
- ◆ While a flood event has not occurred on the Snoqualmie River since the elevation projects have been completed, the region did experience a 6.8-magnitude earthquake centered 36 miles southwest of Seattle on February 28, 2001. The six elevations completed prior to the earthquake experienced no damage as a result the earthquake.
- ◆ Residential elevations do not diminish over time nor do they require any new publicly funded long-term maintenance costs.
- ◆ Elevation will make homeowners eligible for lower flood insurance rates.
- ◆ Elevation will not have an adverse impact to residents upstream, residents downstream or to the riverine environment.

Project Cost and Funding

Total Project Cost = \$567,195

- ◆ FEMA FMA Program grants, administered by Washington State Emergency Management Division covered 73% of the costs = \$413,573
- ◆ Homeowners covered 26% of the costs = \$148,865
- ◆ King County covered 1% of the costs = \$4,756

Human history becomes more and more
a race between future education
and catastrophe.

-H.G. Wells

GLOSSARY

Unless otherwise noted, all terms used are the same as those defined in the National Flood Insurance Program Rules and Regulations (44 CFR 59.1).

ASFPM: Association of State Floodplain Managers

Base flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the "1% chance flood" (or the "100-year" flood). The base flood is a statistical concept used to ensure that properties are protected to the same degree against flooding.

BFE: Base flood elevation. The elevation of the crest of the base or 1% chance flood.

CDBG: Community Development Block Grant

Critical facilities: Buildings or locations vital to the disaster response and recovery effort, such as police and fire stations, telephone exchanges, water treatment plants, vehicle and equipment storage facilities, and emergency operations centers. The term also includes buildings or locations that, if damaged, would create secondary disasters, such as hazardous materials facilities, hospitals, nursing homes and housing likely to contain occupants who are not very mobile.

CRS: Community Rating System

CRS classification: A rating of a community's floodplain management program according to the Community Rating System Schedule. Class 1 is the highest rating and Class 10 is the lowest. A community that has not applied for CRS classification is a Class 10 community.

Detention: Storing runoff for release at a restricted rate after the storm subsides.

Discharge: The amount of water that passes a point in a given period of time. Rate of discharge is usually measured in cubic feet per second (cfs).

Dry floodproofing: see Floodproofing

Federal Insurance and Mitigation Administration: The part of FEMA that administers the National Flood Insurance Program and FEMA's mitigation programs.

FEMA: Federal Emergency Management Agency

FIMA: see Federal Insurance and Mitigation Administration

FIRM: see Flood Insurance Rate Map

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A Flood Insurance Rate Map identifies most, but not necessarily all, of a community's floodplain as the Special Flood Hazard Area.

Floodproofing: Protective measures added to or incorporated in a building that is not elevated above the base flood elevation to prevent or minimize flood damage. "Dry floodproofing" measures are designed to keep water from entering a building. "Wet floodproofing" measures minimize damage to a structure and its contents from water that is allowed into a building.

Floodway: The channel of a river and the portion of the overbank floodplain that carries most of the base flood. The floodway must be kept open so that floods can proceed downstream and not be obstructed or diverted onto other properties. The National Flood Insurance Program regulations allow construction in the floodway provided that it does not obstruct flood flows or increase flood heights.

Flood fringe: The portion of the floodplain lying on either side of the floodway.

Flood hazard mitigation: Sustained actions taken to reduce or eliminate long-term risk from floods and their effects.

Flood Insurance Rate Map: An official map of a community, on which FEMA has delineated both the Special Flood Hazard Areas and the risk premium zones applicable to the community.

Flood Mitigation Assistance Program: A grant program funded by the National Flood Insurance Program.

FMA Program: see Flood Mitigation Assistance Program

Freeboard: A margin of safety added to the base flood elevation to account for waves, debris, miscalculations or lack of data.

Hazard mitigation: see Flood hazard mitigation

Hazard Mitigation Grant Program: A FEMA disaster assistance grant that funds mitigation projects.

HMGP: see Hazard Mitigation Grant Program

HUD: Housing and Urban Development

ICC: see Increased Cost of Compliance

IFG: see Individual and Family Grants

Increased Cost of Compliance: A flood insurance claim provision that helps fund the cost of bringing a flood-damaged building

into compliance with floodplain management standards.

Individual and Family Grants: A FEMA disaster assistance grant that helps people with their unmet needs (i.e., needs not helped by other disaster assistance programs).

ISO: The Insurance Services Office, Inc., a corporation that conducts Community Rating System application review, verification of community credit and program improvement tasks for FEMA.

MOM: see Multi-objective management

Multi-objective Management: An approach to planning and funding local programs that includes a variety of local interests and concerns.

Natural and beneficial functions of floodplains: The functions associated with the natural or relatively undisturbed floodplain that moderate flooding, retain flood waters, reduce erosion and sedimentation, and mitigate the effects of waves and storm surges from storms. Additional ancillary beneficial functions include maintenance of water quality, recharge of ground water, and the provision of fish and wildlife habitat.

NFIP: National Flood Insurance Program

Non-structural flood protection measures: Administrative tools for minimizing flood damage, including regulations on development, building codes, property acquisition and structure relocation, and modification of existing buildings.

PA: see Public/Infrastructure Assistance

Project Impact: FEMA's initiative to change the way America deals with natural disasters. The goal of Project Impact is to reduce the personal and economic costs of disasters by bringing together community leaders, citizens and businesses to protect themselves against the ravages of nature.

Public/Infrastructure Assistance: A FEMA disaster assistance grant that helps public agencies and nonprofit organizations finance repairs and reconstruction.

Relocation: A non-structural mitigation measure used to describe the physical moving of a structure.

Repetitive loss community: A community with one or more repetitive loss properties.

Repetitive loss property: A property for which two or more National Flood Insurance Program losses of at least \$1,000 each have been paid within any 10-year rolling period since 1978.

Retention: Storing stormwater runoff for later use in irrigation or groundwater recharge, or to reduce pollution.

Retrofitting: Retrofitting techniques include floodproofing, elevation, construction of small levees and other modifications made to an existing building or a property to protect it from flood damage.

Riparian ecosystem: A distinct association of flora, fauna and soil occurring along a river, stream or other body of water and dependent upon high water tables and occasional flooding to maintain its viability. These areas often exhibit high biological productivity and species diversity. Although riparian ecosystems are closely associated with a body of water, they may extend beyond the Special Flood Hazard Area.

Riverine: Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Special Flood Hazard Area: The base floodplain delineated on a Flood Insurance Rate Map. It is mapped as a Zone A or Zone V. The Special Flood Hazard Area may or may not encompass all of a community's flood problems.

SFHA: see Special Flood Hazard Area

Stormwater detention: Storing stormwater runoff for release at a restricted rate after the storm subsides. see Detention

Stormwater retention: Storing stormwater runoff for later use in irrigation or groundwater recharge, or to reduce pollution. see Retention

Structural flood control: Measures that control floodwaters by construction of barriers or storage areas or by modifying or redirecting channels.

Substantial damage: Damage of any origin sustained by a structure whereby the cost of restoring the structure to its undamaged condition would equal or exceed 50% of the market value of the structure before the damage occurred.

USACE: United States Army Corps of Engineers

Watershed: An area that drains into a lake, stream or other body of water.

Wet floodproofing: see Floodproofing

THE ASSOCIATION OF STATE FLOODPLAIN MANAGERS

A National Non-Profit Membership Organization

THE ASFPM STORY . . .

The Association of State Floodplain Managers began in 1977 as the supporting organization of professionals involved in all aspects of floodplain management. ASFPM is committed to improving and extending our members' knowledge and understanding of the need for comprehensive floodplain management. Our 4,000 national and chapter members represent local, state and federal government agencies, citizen groups, private consulting firms, academia, environmental organizations, the insurance industry and lenders. ASFPM's influence is expressed through policy and practice changes that impact floodplain management in the U.S. and internationally. Our mission and goals are simple – helping the public and private sectors to:

- ◆ Reduce the loss of human life and property damage resulting from flooding;
- ◆ Preserve the natural and beneficial functions of floodplains;
- ◆ Promote flood mitigation for the prevention of loss; and to
- ◆ Avoid actions that exacerbate flooding.

ASFPM INITIATIVES THAT GUIDE THE INDUSTRY . . .

- ◆ We promote flood policies, like No Adverse Impact Floodplain Management, to reverse the continuing trend of ever increasing flood damages.
- ◆ We operate the only nationwide Certified Floodplain Manager program (CFM) which includes an aggressive continuing education element.
- ◆ We conduct technical conferences to bring together practitioners on a variety of “cutting edge” topical issues.
- ◆ We publish proceedings from our conferences to shape the landscape of floodplain management and policy with state-of-the-art thinking.
- ◆ We helped establish the Community Rating System as a means to reward a community's flood insurance policy holders for sound floodplain management. We continue to assist in the operation and refinement of CRS.
- ◆ We develop papers and reports analyzing flood policy in the nation, with recommendations for modifications and enhancements to foster effective mitigation at the local level.
- ◆ We address topical issues pertinent to flood hazards - arid west, alluvial fan flooding, coastal hazards, ice jams, etc.
- ◆ We confer annual national awards to recognize and encourage exemplary achievements in floodplain management.
- ◆ We established the ASFPM Foundation to attract and direct funds to projects vital to broadening the base of informed and technically capable persons responsible for decisions affecting floodplains.

HOW YOU CAN GET INVOLVED . . .

The opportunity to provide protection for our citizens and businesses has never been greater. We must begin to make use of our floodplains in ways that are not only ecologically correct, but are acceptable to our society as a whole. Wise floodplain management will provide both the mechanisms to address our flooding problems as well as the flexibility to embrace sustainable development for future generations. We invite all who are dedicated to the future well being of this nation to join us in working toward reduced overall flood losses and the wise use of our land and water resources. ASFPM is committed to working with local and state governments, federal agencies, the insurance field, the land development industry, other organizations, Congress, researchers and academia, our numerous partners in the private and public sectors, and other professionals in floodplain management as well as related fields.

Look for additional information and the membership application on our website at www.floods.org. That's where you will also find the goals, activities and accomplishments of our 12 policy committees who orchestrate the bulk of our national flood policy work. You may contact our Executive Office at:

Association of State Floodplain Managers, Inc.

2809 Fish Hatchery Road

Madison, WI 53713

Phone 608-274-0123 Fax 608-274-0696

Email: memberhelp@floods.org

Website: www.floods.org