

FLOODS, FLOODPLAINS AND FOLKS



NATIONAL PARK SERVICE
RIVERS, TRAILS AND CONSERVATION ASSISTANCE PROGRAM



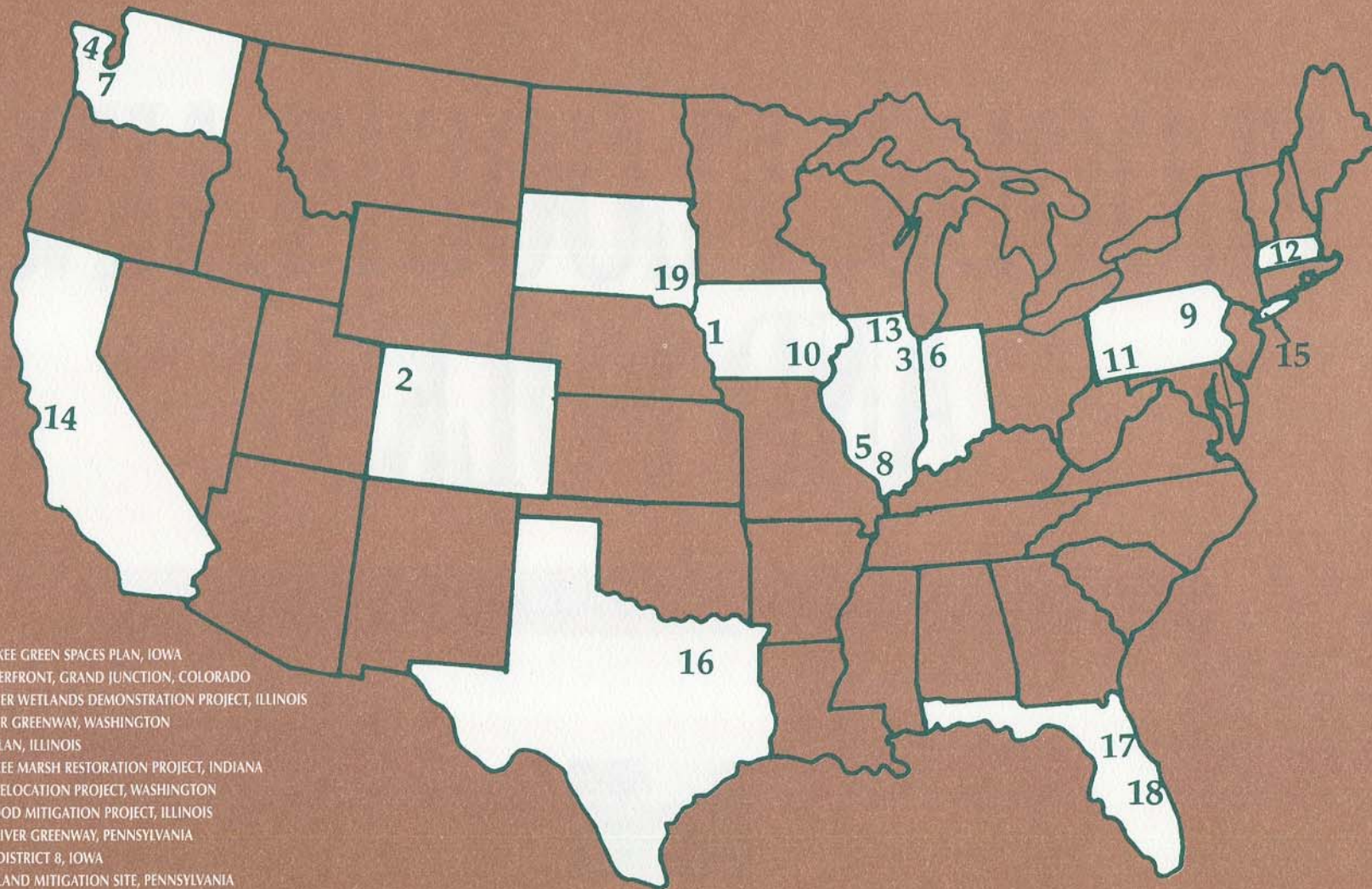
FLOODS, FLOODPLAINS AND FOLKS

A CASEBOOK IN MANAGING RIVERS FOR MULTIPLE USES



National Park Service
Rivers, Trails and Conservation Assistance Program

1996



1. CITY OF CHEROKEE GREEN SPACES PLAN, IOWA
2. COLORADO RIVERFRONT, GRAND JUNCTION, COLORADO
3. DES PLAINES RIVER WETLANDS DEMONSTRATION PROJECT, ILLINOIS
4. DUNGENSS RIVER GREENWAY, WASHINGTON
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THE CHALLENGE

“Streeettch!” That was what I was called in my high school when I grew eight inches in two years. An apt metaphor but painful to a suddenly highly visible, gangly adolescent. I would not have chosen to stretch so fast. But you can choose to stretch, and probably not with so much discomfort.

Stretch seems a good metaphor as well for multi-objective approaches to river planning and flood loss reduction. For multi-objective implies not so much a single standard to attain—a greenway, a restored wetland, a recreation area—as a process which calls on you, as a participant, to stretch, to go a step or two beyond what you would ordinarily do. It calls for creativity, innovation, and risk-taking.

On a project that was to be a concrete holding tank, the engineer now plans a contoured, vegetated detention basin with a dry-phase soccer field. Where rip-rap was to be used, soil engineering techniques are now employed. At public request, wildlife habitat and the preservation of an historic train depot are added to the objectives of a single-purpose floodway project.

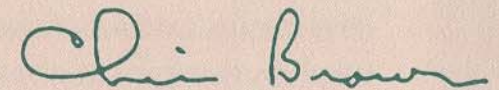
The multi-objective approach also implies stretching that can't be observed. Partners you have never worked with before—birders and historic preservation folks if you're an engineer, storm water managers and aquatic biologists if you're a bicyclist—now are considered key members of the planning team. Neighbors to the floodway are given a seat at the table, not simply in the audience at a public hearing.

A rule of thumb: think of who should be your project partners, then stretch yourself to double that, then double it again. You've got your invitation list.

Easy? Neat? Not always. But the payoffs, in fresh ideas, public and political support, and previously untapped funding sources, are enormous.

So, as you peruse the following case studies, ask yourself: “am I stretching, in my current work, as those who created these successes did?” For these case studies, in all their diversity, are unified by the theme of stretching. In every case, project leaders went a step beyond and were rewarded with project success and public support they had not imagined possible.

The Rivers, Trails and Conservation Assistance program of the National Park Service is privileged to produce this book as a sequel to our A Casebook in Managing Rivers for Multiple Uses (1991). It is exciting and gratifying to share the new “era” of community-based flood loss reduction accomplishments with you.



Chris Brown
Acting Chief
Rivers and Watershed Division
Rivers, Trails and Conservation Assistance Program
National Park Service

SOLUTIONS

River communities across the United States are reconsidering traditional practices and are seeking innovative solutions to reduce flood losses. While each case study is different, they have in common the use of locally agreed upon approaches. This table provides an overview of the primary objectives being met by each project.

	FLOOD LOSS REDUCTION	FLOW CONTROL	STREAMBANK STABILIZATION	RESTORATION	FISHERIES IMPROVEMENT	RECREATION	NATURAL HAZARD MITIGATION	WETLAND ENHANCEMENT	HABITAT IMPROVEMENT	CULTURAL RESOURCE ENHANCEMENT	ECONOMIC REVITALIZATION	ENVIRONMENTAL EDUCATION
CITY OF CHEROKEE GREEN SPACES PLAN, IOWA	✓		✓	✓		✓	✓	✓	✓	✓		✓
COLORADO RIVERFRONT, GRAND JUNCTION, COLORADO	✓		✓	✓		✓	✓	✓	✓	✓	✓	
DES PLAINES RIVER WETLANDS DEMONSTRATION PROJECT, ILLINOIS	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
DUNGENESS RIVER GREENWAY, WASHINGTON	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓
THE GRAFTON PLAN, ILLINOIS	✓			✓		✓	✓	✓	✓	✓	✓	✓
GRAND KANKAKEE MARSH RESTORATION PROJECT, INDIANA	✓	✓		✓	✓	✓		✓	✓			
INDIAN CREEK RELOCATION PROJECT, WASHINGTON	✓	✓		✓	✓				✓	✓		✓
KAMPSVILLE FLOOD MITIGATION PROJECT, ILLINOIS	✓	✓				✓	✓			✓	✓	
LACKAWANNA RIVER GREENWAY, PENNSYLVANIA	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
LOUISA LEVEE DISTRICT 8, IOWA	✓		✓	✓	✓	✓		✓	✓			
MAYVIEW WETLAND MITIGATION SITE, PENNSYLVANIA	✓					✓	✓	✓	✓			
NORTH RIVER STREAMBANK DEMONSTRATION PROJECT, MASSACHUSETTS	✓	✓	✓	✓	✓		✓		✓			
PRAIRIE WOLF SLOUGH DEMONSTRATION PROJECT, ILLINOIS	✓			✓		✓		✓	✓		✓	✓
SANTA ROSA CREEK, CALIFORNIA	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
STATEN ISLAND BLUEBELT, NEW YORK	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓
TRINITY RIVER COMMON VISION PROGRAM, TEXAS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
UPPER OCKLAWAHA RIVER BASIN, FLORIDA	✓			✓	✓	✓		✓	✓			
UPPER ST. JOHNS RIVER BASIN PROJECT, FLORIDA	✓	✓		✓	✓	✓		✓	✓			
VERMILLION RIVER BASIN, SOUTH DAKOTA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

CITY OF CHEROKEE

GREEN SPACES PLAN

I O W A

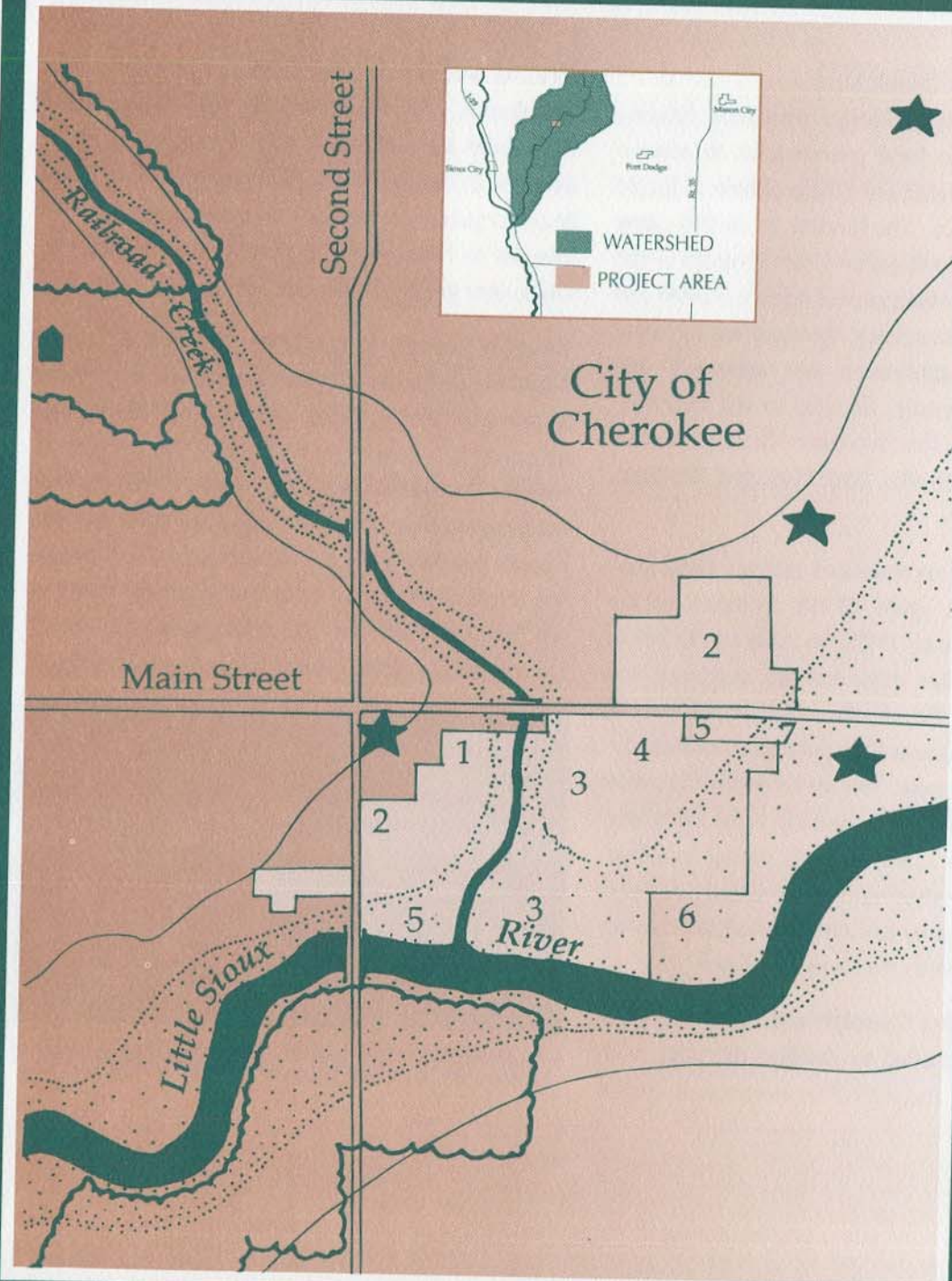


WHAT WE WERE FACING

In the great Midwest floods of 1993, the Little Sioux went out of its banks five times between April and July. The impact on the city of Cherokee, a community of 7,000, was hardship to residents and costly damage to both homes and businesses. The Little Sioux drains a five-county area to the north of Cherokee (approximately 2,000 square miles). The river has a history of repeated flooding, dating back to the early 1900s.

The Cherokee Comprehensive Plan (revised in 1979) recognized the problem of flooding from the Little Sioux, identified areas at risk, and recommended that over time, properties be acquired and structures removed from the floodplain. Following adoption of the comprehensive plan, the city council adopted a policy statement that identified the floodplain corridor as a greenbelt and encouraged private donation of land within the corridor. The city has had only limited success in acquiring land through donations.

LITTLE SIOUX RIVER FLOODS MAIN STREET IN THE CITY OF CHEROKEE IN JULY 1994. THE RIVER HAS A HISTORY OF REPEAT FLOODING DATING BACK TO THE EARLY 1900S.



Re-use plan addresses multiple community needs and complements existing plans and programs to restore floodplain.

- ✓ FLOOD LOSS REDUCTION
- FLOW CONTROL
- ✓ STREAMBANK STABILIZATION
- ✓ RESTORATION
- FISHERIES IMPROVEMENT
- ✓ RECREATION
- ✓ NATURAL HAZARD MITIGATION
- ✓ WETLAND ENHANCEMENT
- ✓ HABITAT IMPROVEMENT
- ✓ CULTURAL RESOURCE ENHANCEMENT
- ECONOMIC REVITALIZATION
- ✓ ENVIRONMENTAL EDUCATION

- | | | | |
|--|---------------------|----|-----------------------------|
| | 100 YEAR FLOODPLAIN | | BUY-OUT AREA |
| | FLOODWAY AREA | 1. | GREEN SPACE CENTER |
| | EXISTING PARKLAND | 2. | NEIGHBORHOOD GATEWAY CENTER |
| | HISTORIC SITE | 3. | HABITAT RESTORATION AREA |
| | SCHOOL | 4. | COMMERCIAL FORESTRY AREA |
| | | 5. | RECREATION FACILITY |
| | | 6. | OUTDOOR CLASSROOM |
| | | 7. | STORMWATER RETENTION AREA |

WHERE WE'RE HEADING

- Restoration and enhancement of Cherokee's diverse natural features and habitat areas including wetland resources, forested river corridors, and prairie habitats.
- Adoption of a green space concept plan that proposes open space uses for three zones in the flood buy-out area and adjacent flood plain: the River Edge Zone; Low Lying Terrace Zone; and Upland Floodplain Zone.
- An outdoor classroom and interpretive trail that links historic, cultural, and natural areas.
- Connections made between existing and proposed trail systems, parks, public spaces, and community facilities both within and outside city limits.
- Vegetated buffers that improve water quality, protect streambanks from erosion, improve habitat, and enhance visual quality.
- Enhanced recreational facilities.

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STUDENTS IN THE "TALENTED AND GIFTED" (TAG) PROGRAM PRESENT THEIR OPEN SPACE PLANS AT A CHEROKEE COMMUNITY WORKSHOPS IN THE SPRING OF 1995.



HOW WE GOT STARTED

After the 1993 floods, disaster assistance funding became available to local governments to acquire flood-damaged properties and help people re-locate out of the floodplain. The funding to do this came through the Hazard Mitigation Grant Program of the Federal Emergency Management Agency (FEMA) and the State of Iowa Emergency Management Division. Cherokee's grant application was approved, and owners of 187 properties decided to sell their residences to the city. This floodplain, by law, must be used as open space after flood-damaged structures are removed.

To help interested communities convert flood buy-out areas to open space, FEMA arranged for the National Park Service (NPS) to provide technical assistance. Cherokee requested this assistance and NPS worked with the city for more than a year to develop a Green Spaces Plan through a community-based planning process. This included the formation of a steering committee to provide local leadership for the floodplain open space planning initiative. NPS supported the steering committee and facilitated a series of community planning workshops through which a Green Spaces Plan was developed.

NPS also helped link Cherokee with additional technical assistance needed to develop the plan, with potential funding, and with other resources to implement the plan.

WHAT WE'RE LEARNING

The groups with an interest in open space use of floodplains are generally not the same groups initially involved in disaster recovery. It takes effort to identify and organize the people and groups with skills and interests to help plan and develop open space (i.e., clubs, user groups, educators, local officials, etc.).

Timing is of extreme importance. It is critical to coordinate the timing of a buy-out project (i.e., information to property owners, offers on property, land transfer, demolition, or relocation of housing, etc.) with planning for floodplain open space areas. Since the buy-out program is voluntary, the city must allow property owners time to decide individually if they wish to pursue the buy-out option so as not to appear that they are "forcing people out." Careful coordination of the various phases of the project is key to public support.



A CHEROKEE, IOWA HOUSE BEING MOVED FROM FLOOD BUYOUT AREA, IN THE SUMMER OF 1995, TO IT'S NEW SITE.

MILESTONES

- *First FEMA-NPS partnership formed to assist a community with open space planning of floodplain areas in a post-disaster situation.*
- *Largest buy out in State of Iowa after the 1993 floods.*
- *Formation of the Green Spaces Advisory Committee to provide local leadership for floodplain open space planning and development.*
- *Elementary school children developed plans to share their ideas for floodplain open space uses. Their recommendations were incorporated into the Green Spaces Plan.*
- *A variety of local, state, and federal agencies and private groups are cooperating with the city of Cherokee and the Green Spaces Committee to help develop flood plain open space.*

OUR PARTNERS

Federal Emergency Management Agency (FEMA)

FEMA funded the buy out and relocation project through the Section 404 Hazard Mitigation Grant Program. FEMA also funded open space planning assistance from the National Park Service as a form of disaster recovery.

National Park Service's Rivers, Trails, and Conservation Assistance Program (RTCA)

RTCA provided overall coordination to assist Cherokee in developing an open space plan for buying out its floodplain and related areas. RTCA has facilitated a community-based planning process and has assisted, and will continue to assist, the community in identifying funding, technical assistance, and other resources for implementation.

City of Cherokee

The city provides local project coordination. City staff coordinate the open space planning effort with the flood buy-out project and serve as the primary contact for information and publicity.

Siouxland Interstate Metropolitan Planning Council (SIMPCO)

SIMPCO, a regional planning agency, provides technical assistance in buy-out project administration and graphics (i.e., brochures, maps for planning workshops). SIMPCO will serve as the primary support agency for implementation.

Natural Resources Conservation Services (NRCS)

NRCS provided technical support for site analysis, landscape design, and mapping. A landscape architect and additional support staff from NRCS developed open space concept maps and other graphics based on ideas from planning workshops. NRCS will provide technical assistance for aspects of plan implementation.

US Fish and Wildlife Service (USFWS)

Through the Partners for Wildlife Program, USFWS is providing funding and technical assistance for habitat restoration and stream-bank stabilization in the flood buy-out area.

Iowa Department of Natural Resources, Forestry Division (DNR)

DNR's area forester has prepared a reforestation plan for the buy-out area, including potential sources of funding.

Green Spaces Advisory Committee

The Advisory Committee is a local board established by the Cherokee Mayor and City Council. The principal role of the committee is to provide guidance and general oversight for development of the Green Spaces Plan. It is the entity responsible for developing the plan and making recommendations to the Mayor and City Council.

CONTRIBUTORS

The following organizations have contributed to the plan's development and will play a critical role in plan implementation.

*Cherokee Area Economic
Development Corporation
Cherokee County Conservation Board
Cherokee Historical Commission
Ducks Unlimited
Iowa Wildlife Federation
Little Sioux Spoke Folks
Little Sioux Wildlife Federation
Pheasants Forever
Ridgerunners
Western Hills Area Education
Association*

Contact

*PAM PIERCE
City Hall
416 W. Main Street
Cherokee, IA 51012
712.225.5749*

COLORADO RIVERFRONT, GRAND JUNCTION

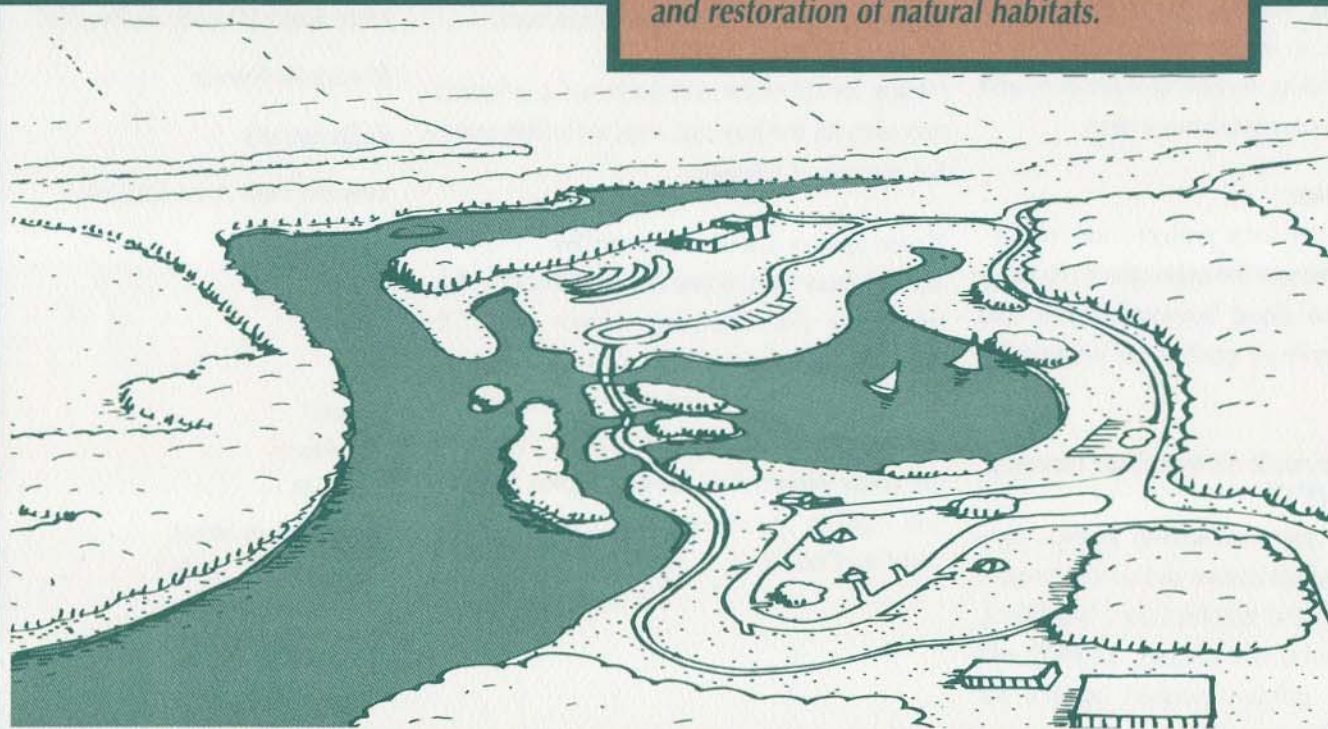
WHAT WE WERE FACING

The portion of the Colorado River flowing through Grand Junction was typical of an urban waterway. Its use for railroads, sewage treatment plants, gravel pits, chemical storage facilities, and junkyards had virtually made the river inaccessible to the town. When repeated severe flooding occurred in 1983 and 1984, Grand Junction focused its attention on correcting the river's ills.

A multi-disciplinary development plan and design strategy focuses on flooding hazardous material removal, scenic access, and restoration of natural habitats.

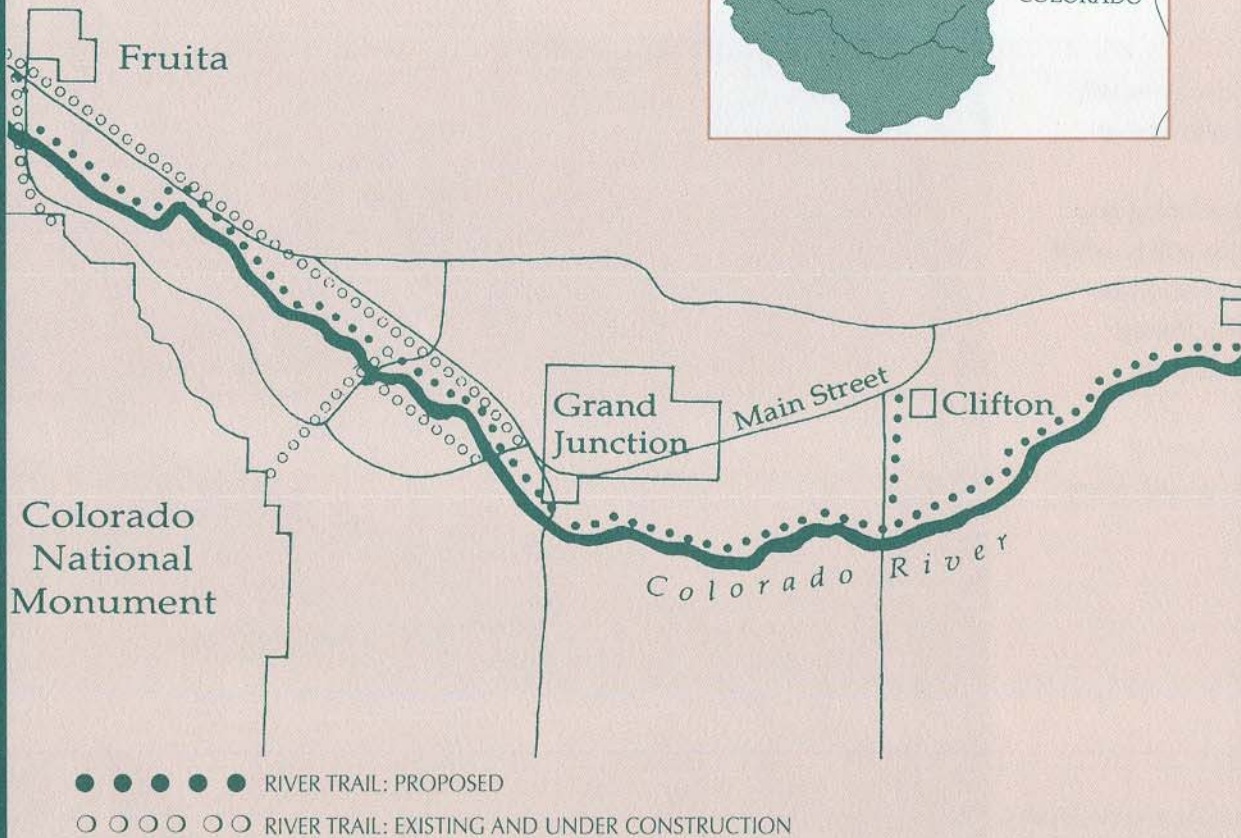
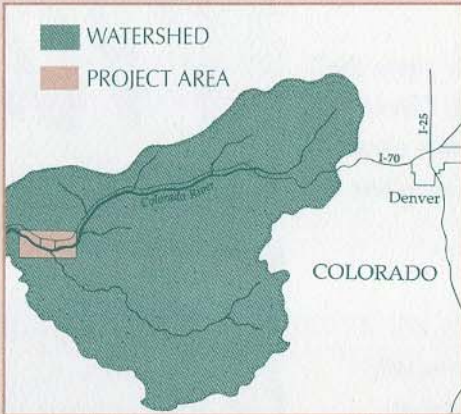
Grand Junction is the county seat of Mesa County and the largest city between Salt Lake City, Utah, and Denver, Colorado. The city is home to some 30,000 people and serves as a trade and business center for western Colorado and eastern Utah. Among those businesses was the Climax Uranium Company located at the eastern edge of the urban riverfront. After their mill closed in 1970, Climax left a pile of radioactive

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- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- ✓ STREAMBANK STABILIZATION
- ✓ RESTORATION
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- ✓ ECONOMIC REVITALIZATION
- ✓ ENVIRONMENTAL EDUCATION

LAKE BRONTOSAURUS STATE RECREATION AREA, COLORADO RIVER, GRAND JUNCTION WATERFRONT.



MILESTONES

- *First multi-objective, multi-disciplinary, and multi-agency river corridor planning project.*
- *Removal of 5,000,000 cubic yards of radioactive uranium mill tailings from the active floodplain by the US Department of Energy as a Superfund site.*
- *Recipient of a National Endowment for the Arts Design Advancement Grant for developing design alternatives.*
- *Establishment of a Class A campground at the Colorado Riverfront State Park to attract a greater number of overnight stays by travelers.*
- *Reconnaissance Study completed by the Corps of Engineers recommending a flood control levee be built.*
- *Development of 9.5 miles of trail, acquisition of the 20-acre Watson Island, plus a total of 68 acres on the mainland.*
- *Expansion of greenway to east (Palisade) and to west (Fruita).*
- *As of April 1994, approximately \$5 million raised, including and donations, for trail development, bridges, parking, fencing, signs, boat launch facilities, rest rooms, shelters, fishing pier for the disabled, and levee design.*

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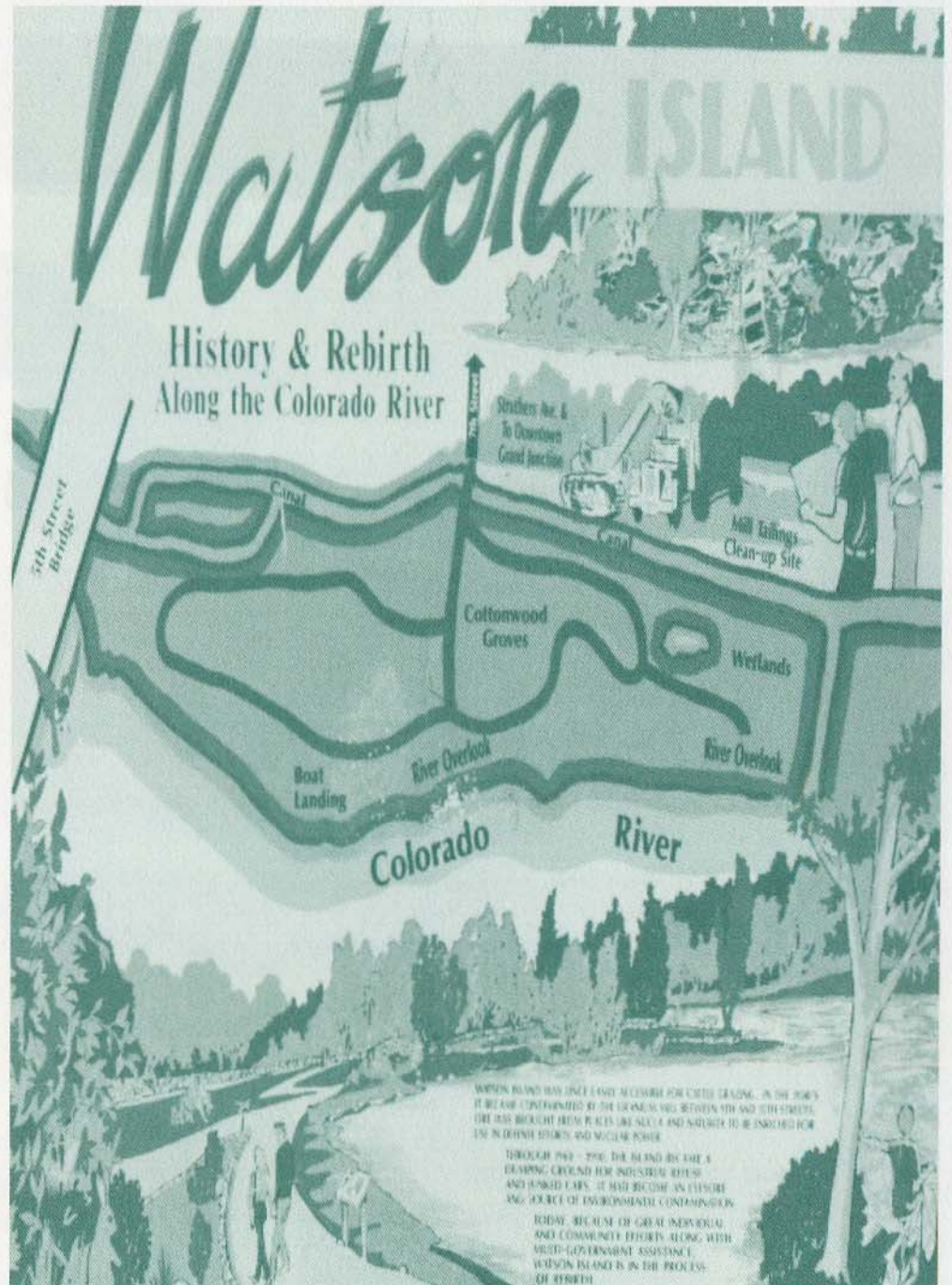
tailings that covered about 57 acres. Other tailings were removed from additional properties throughout the valley and deposited at a temporary state repository.

Despite its location and the existing major industrial zone along the river, the riverfront was failing to attract new, clean industry. Likewise, despite its proximity to Colorado National Monument, which attracts more than 800,000 visitors yearly, Grand Junction was not attracting a large tourist population.

WHAT WE DID

- Visually improved the appearance of the river corridor, especially near the downtown area, through revegetation and removed or screened areas of junk and trash.
- Provided increased recreational opportunities by developing river side hike/ bike trails, picnic areas, and boating access points, while retaining the majority of the river environment in a natural state.
- Reduced public and private losses caused by flooding through protecting developed areas while maintaining a viable river environment.
- Created an attraction designed to improve redevelopment of adjacent industrial and business areas, providing focus and strong ties to the downtown area.

BECAUSE OF GREAT INDIVIDUAL AND COMMUNITY EFFORTS
ALONG WITH MULTI-GOVERNMENT ASSISTANCE, WATSON
ISLAND IS IN THE PROCESS OF REBIRTH.



HOW WE GOT STARTED

In 1985, the City Council saw the potential for the riverfront to become an amenity for economic, social, and recreational activities. They created the Riverfront Project based on three goals: Improve the image of city entrances; develop a high quality industrial park to stimulate economic development; and encourage the clean-up and use of the Colorado River.

The city then contacted the River, Trails and Conservation Assistance (RTCA) Program of the National Park Service to request assistance in organizing and leading a planning effort to improve the waterfront. Staff from RTCA assisted with the development of a grant proposal to the National Endowment for the Arts to bring together leading design and development experts for the planning effort. City and RTCA staff worked together to identify and select consultants, design a public involvement plan, and create a planning process.

WHAT WE'RE LEARNING

Coordination with all relevant levels of local government, as well as stake-holders, is crucial to the development of multi-objective management plans. These plans need a lot of coordination to develop and a lot of persistence and creativity to implement; however, the range of benefits that resulted from this effort more than made up for the effort expended. A successful plan can actually be developed in a good, three-day planning workshop.

OUR PARTNERS

Grand Junction/ Mesa County Riverfront Commission

The Commission was formed to guide the urban riverfront revitalization and the redevelopment of the entire river corridor throughout the valley. Members were jointly appointed by the City Council and County Commissioners. They have been instrumental in rallying political support and in fundraising.

Mesa County Planning Department

The Riverfront Project extends beyond the incorporated limits of Grand Junction into Mesa County on both the east and west sides of the city. Mesa County provided information on its lands within the corridor, county policies and authorities, and assisted in conducting the overall planning effort.

Department of Local Affairs (DLA)

DLA selected the Riverfront Project for concentrated community development assistance and offered technical assistance, which included preparing conceptual drawings, conducting research, and completing a transportation study.

National Park Service: Rivers, Trails, & Conservation Assistance Program (RTCA)

RTCA developed a public input strategy using a community-based planning process and is assisting the community in identifying programs and funding sources for implementation. RTCA staff was also responsible for overall facilitation of the planning workshop that resulted in the multi objective management plan.

Department of Energy (DOE)

Authorized under the Uranium Mill Tailings Remedial Action program, DOE agreed to cooperate with the city on the overall clean-up of riverfront properties contaminated with tailings.

National Endowment for the Arts (NEA)

NEA provided a grant to bring together leading design and development experts to analyze the opportunities and constraints for Grand Junction's riverfront.

Army Corps of Engineers

The Corps conducted a section 205 Small Flood Control Study to provide flood protection for the urban area. The designated 100-year floodplain extends well into the industrial area.

Bureau of Reclamation

The Bureau completed a project to reduce the salinity of the Colorado River Basin by lining or piping irrigation canals and laterals. The Bureau mitigated the loss of wetlands, resulting from the lining of canals, by acquiring 2,090 acres of wetlands elsewhere.

Colorado Division of Parks and Outdoor Recreation

The Division of Parks identified the Colorado River in Mesa County as a recreational site. The state assumed responsibility for identifying, purchasing, and preparing land for a park. The site chosen was the old Climax Superfund site.

Contact

STEPHANIE SCHMID

Grand Junction-Mesa County Riverfront Commission
P.O. Box 2477
Grand Junction, CO 81502
970.245.0045

SITE CONDITIONS DURING WINTER RE-GRADING TO CREATE WETLANDS. THESE EXPERIMENTAL WETLANDS ARE TRAPPING OVER 80% OF THE SEDIMENTS AND NUTRIENTS CONTAINED IN THE INCOMING WATER.



ILLINOIS

DES PLAINES RIVER WETLANDS

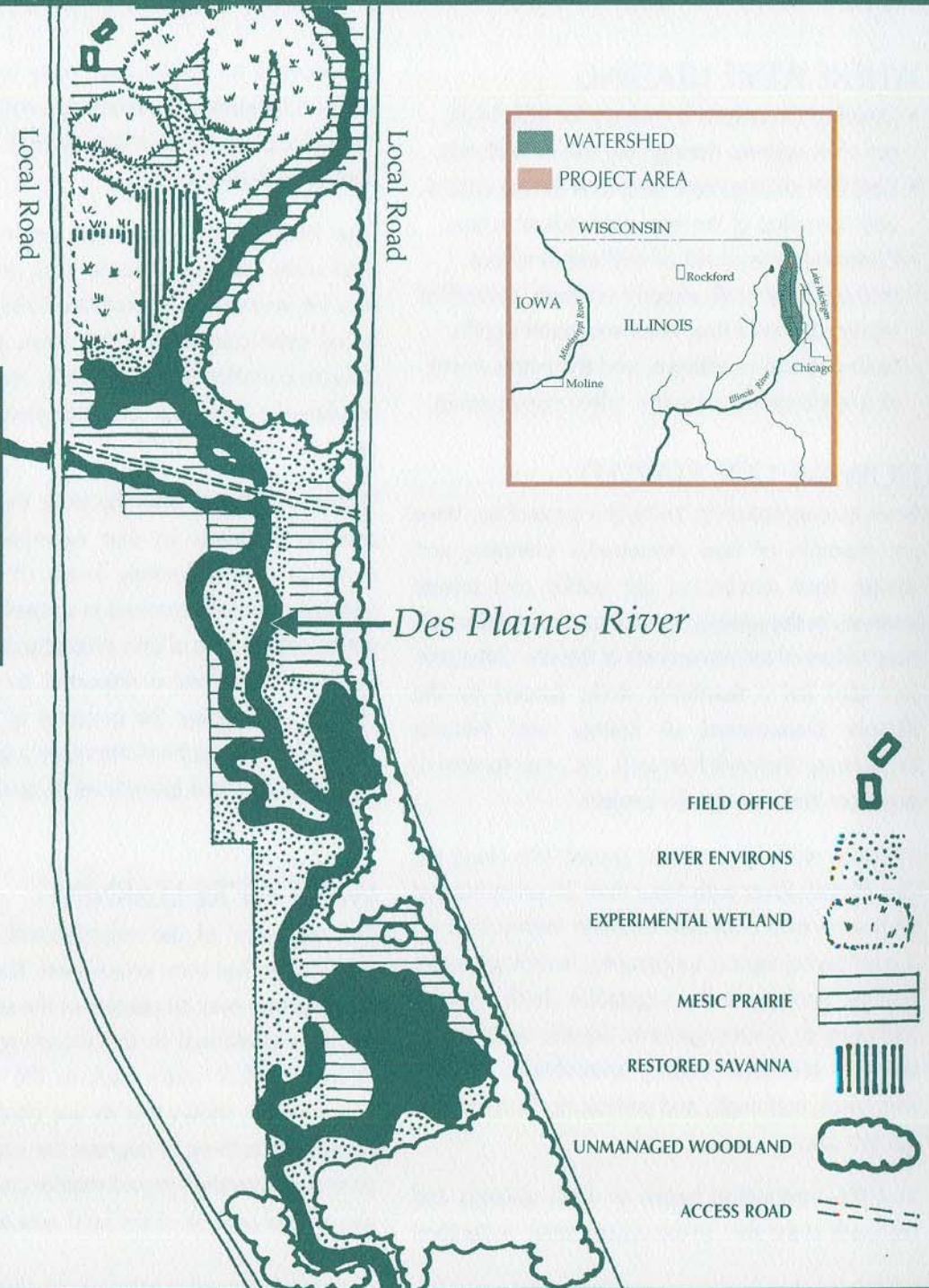
DEMONSTRATION PROJECT *Interdisciplinary team of researchers brought together to improve water quality, decrease flood loss, provide recreational use, and expand wildlife habitat through wetland and river restoration.*

WHAT WE WERE FACING

Over the last half century, a great deal of public and private money has been spent to control flooding and achieve clean, ecologically sound streams and rivers. Return on this investment has been poor because flood control and pollution abatement strategies fail to address the physical conditions of our nation's surface waters.

- | | |
|----------------------------|---------------------------------|
| ✓ FLOOD LOSS REDUCTION | NATURAL HAZARD MITIGATION |
| ✓ FLOW CONTROL | ✓ WETLAND ENHANCEMENT |
| ✓ STREAMBANK STABILIZATION | ✓ HABITAT IMPROVEMENT |
| ✓ RESTORATION | ✓ CULTURAL RESOURCE ENHANCEMENT |
| ✓ FISHERIES IMPROVEMENT | ✓ ECONOMIC REVITALIZATION |
| ✓ RECREATION | ✓ ENVIRONMENTAL EDUCATION |

We are working with 2.8 miles of the upper Des Plaines River and 550 acres of abandoned farm fields and gravel quarry pits. The site is 35 miles north of Chicago in the town of Wadworth, Illinois. The river flows south, draining 200 square miles in southern Wisconsin and northeastern Illinois. Eighty percent of the watershed is agricultural and 20 percent is urban. The river is polluted with non-point source contaminants from a variety of land use activities and point source contaminants from small domestic treatment plants. In support of agricultural uses, low-lying portions of the site were drained by means of tiles. Past uses of the site resulted in the demise of most of the original wetlands and associated fauna and flora.



WHERE WE'RE HEADING

- Develop the criteria necessary for rebuilding our river systems through the use of wetlands.
- Establish management programs for the continued operation of the new wetlands structure.
- Complete assessment of wetland functions through large-scale experimentation, controlled manipulation of flow rates and water depths, testing of soil conditions, and the employment of a wide variety of native plant communities.

HOW WE GOT STARTED

From its conception in 1979, this project has been an example of how resourceful planning and design have maximized the public and private interests in the project, as well as the interdisciplinary nature of the researchers at the site. After project staff led a feasibility study, funded by the Illinois Department of Energy and Natural Resources, Wetlands Research, Inc., was formed to organize and manage the project.

In 1985, work began at the project site along the Des Plaines River with more than 20 scientists and engineers who collected baseline information on the following topics: topography, hydrology, water quality, geology, soils, vegetation (both wetland and upland), microorganisms, aquatic macroinvertebrates, terrestrial insects, amphibians, reptiles, fish, birds, mammals, and prehistoric, historic, and current uses.

In 1986, restoration began on both uplands and wetlands of the site. In the upland areas, restoration

has focused on eliminating many Eurasian plant invaders, regrading the landscape and re-establishing native plant communities through planting and controlled burning.

Four hydraulically controlled experimental wetland areas, totaling 22 acres, were put into operation for research in September 1989. Two additional experimental wetland areas, containing a 28-acre complex of 10 wetlands, are designed to emulate the hydrology of sedge meadows. These areas started up in 1991.

Water is pumped from the river into these constructed wetlands so that experimentation can continue despite varying levels of precipitation and associated fluctuations in streamflow. The irrigation system also allows researchers to test water quality and biological responses to various flow regimes, addressing the question of how large a wetland area must be to attenuate a given flood or to treat waters to a given level of quality.

WHAT WE'RE LEARNING

The efficiency of the experimental wetlands to purify water has been established. The experimental areas trap over 80 percent of the sediments and nutrients contained in the incoming river water, delivering clear water back to the Des Plaines. Our research shows that to use constructed wetlands such as these to improve the water quality of an entire watershed would require converting only two to four percent of the land area to this use.

MILESTONES

- *Licensing by the Lake County Forest Preserve District to conduct research on its land with the agreement that the district will maintain the created wetlands.*
- *Construction of eight experimental wetland areas resulting in substantial changes to the landscape, vegetation, and wildlife, including an increased population of shore birds.*
- *Observed dramatic changes in water quality and improvements to the general environment.*
- *Completion of two-year research grant from the US Environmental Protection Agency for the deep marsh research program; 15 papers were produced based on the findings.*
- *The river, once obscured by a wall of weedy vegetation, is now visible through a rehabilitated oak grove and wetland-dependent flora and fauna are now present.*
- *Restored mesic prairies are increasing in diversity, thus supporting a wider variety of fauna species. Water rests on land that formerly was drained for farming.*
- *Groundwater is being recharged and base flow increased.*
- *Three state designated bird species (least bittern, yellow-headed blackbird, and snowy egret) are now using the site and 36 different fish species have been observed on the site, up from only 20 species before the restoration work.*

OUR PARTNERS

Wetlands Research, Inc.

Wetlands Research, Inc. is responsible for the administration and coordination of the Des Plaines River Wetlands Demonstration Project.

Lake County Forest Preserve District

Owners of the land where the research project is taking place, Lake County has also appointed three elected officials and four private citizens to the Wetlands Research governing board.

Government Agencies

The following agencies have contributed to this project:

City of Chicago Department of Aviation
Cook County
Illinois Department of Energy and Natural Resources
US Army Corps of Engineers
US Environmental Protection Agency
US Fish and Wildlife Service
US Soil Conservation Service

Other Participants

Researchers have participated representing the following institutions:

College of Lake County, IL
Iowa State University
Miami University
North Carolina State University
Northern Illinois University
Northwestern University

Private Donors

The following list of individuals, corporations, and foundations have provided funding for this project:

Atlantic Richfield Foundation
Amoco Oil Corporation
Annexter Brothers, Inc.
Ash, Anos, Freedman & Logan
Badger Meter, Inc.
Borg-Werner Foundation
The Brunswick Foundation, Inc.
Campanella & Sons, Inc.
J.I. Case
Caterpillar Tractor Company
Chauncey and Marion Deering-McCormick Foundation
Chicago Community Trust
Commonwealth Edison Company
Anthony T. and Lawrie C. Dean
R.R. Donnelley & Sons Company
Gaylord and Dorothy Donnelley Foundation
Exxon Company USA
Garden Guild (Winnetka, IL)
Sidney G. Haskins
The Indevco Group
Industrial Towel & Uniform, Inc.
International Minerals & Chemical Corp.
The Joyce Foundation
Kelso-Burnett Co.
Land & Lakes Company
The John D. and Catherine T. MacArthur Foundation
The McKnight Foundation
MidCon Corporation

Morton Arboretum

The Curtis and Edith Munson Foundation
The Ohio State University
State University of New York, Syracuse
University of Illinois
University of Michigan
Western Illinois University
National Terminals Corp.
Northern Illinois Gas
Olson Oil Company
Parikh Family Investment Management Corp.
Palwaukee Municipal Airport
Prince Charitable Trusts
Sudix Foundation
Sundance Homes
USX Foundation, Inc.
Walgreen Company
Waste Management of North America Midwest
Western Development Corp.

Contact

DONALD HEY, Director
Wetlands Research, Inc.
53 West Jackson Blvd., Suite 1015
Chicago, IL 60604
312.922.0777


DUNGENESS RIVER GREENWAY

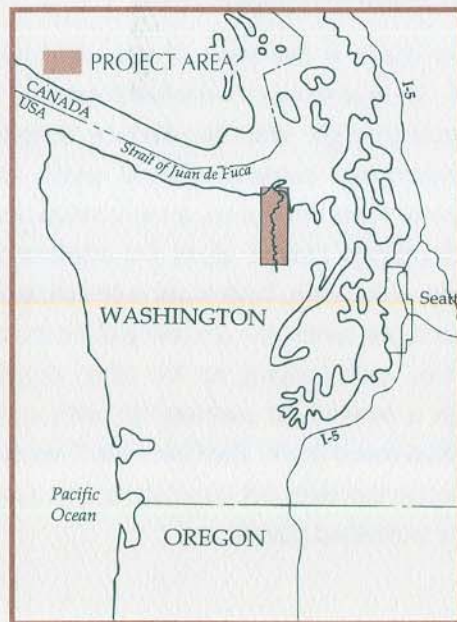
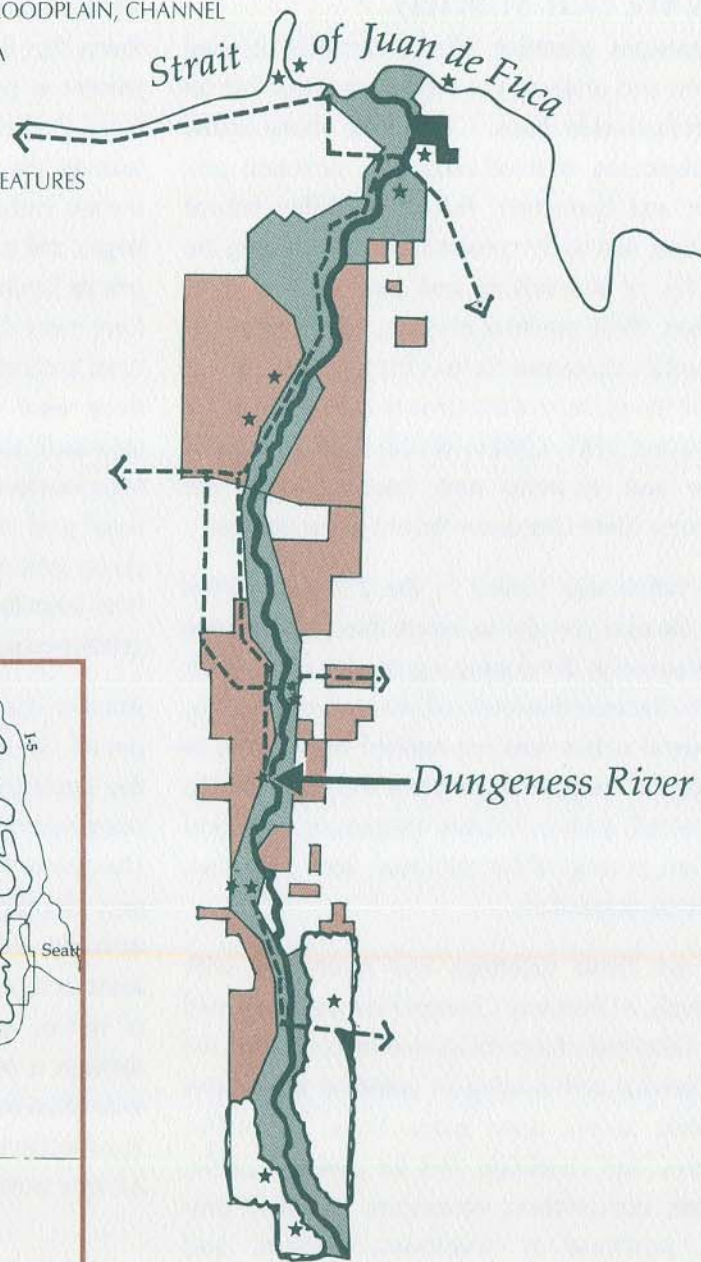
Land owners create a conceptual design to address habitat enhancement, flood protection, recreation, and open space.

WASHINGTON

- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- ✓ STREAMBANK STABILIZATION
- ✓ RESTORATION
- ✓ FISHERIES IMPROVEMENT
- ✓ RECREATION
- ✓ NATURAL HAZARD MITIGATION
- ✓ WETLAND ENHANCEMENT
- ✓ HABITAT IMPROVEMENT
- ✓ CULTURAL RESOURCE ENHANCEMENT
- ✓ ECONOMIC REVITALIZATION
- ✓ ENVIRONMENTAL EDUCATION

BEFORE BANK STABILIZATION.

-  RIVER CORRIDOR: FLOODWAY, FLOODPLAIN, CHANNEL
-  CANDIDATE CONSERVATION AREA
-  FOREST LAND
-  FOOT TRAIL
-  PUBLIC ACCESS AND CULTURAL FEATURES
-  HISTORIC DUNGENESS



WHAT WE WERE FACING

When property boundaries were drawn in the North Olympic Peninsula in Clallam County, Washington, the delineations were extended into the channel of the Dungeness River. As a consequence, the bed and banks of the river are in private ownership. Thus public access to the river is limited to a few, small county- or state-owned access points and an even fewer points on private land. Private ownership has also meant that flood control projects were undertaken by private landowners rather than public agencies, leading to a piecemeal approach that did not usually consider critical habitat values in tandem with protection of property. Further, there are nine irrigation districts and companies in the Dungeness Valley whose combined allocation of water from the river exceeds the actual flow of the river during critical months.

Private ownership, land use practices, flood control, water rights, and environmental conditions are all affecting the overall health of the Dungeness River ecosystem. The county has been heavily dependent upon timber, fishing, and agriculture for its economic base; yet changing markets and a changing environment are threatening these industries. For example, Dungeness River pinks and Chinook are listed as "critical" under Washington State's Salmon and Steelhead Stock Inventory (SASSI, Washington Department of Fish and Wildlife, 1992), and Dungeness River steelhead and coho are listed as "depressed." A new approach was needed to sustain both the economy and the environment.

WHERE WE'RE HEADING

- Conservation and enhancement of the Dungeness River as a greenway corridor for the benefit of fish, wildlife, flood protection, people, and open space.
- Encouragement for the continued establishment and maintenance of open space within, and adjacent to, the floodplain of the river.
- Education of the public about the nature and dynamics of the river system including landowners' rights, land use practices affecting the river's water quality and habitat value, and fisheries and wildlife issues. Also educate landowners about the options available for the preservation and/or development of their lands contributing to the Dungeness River Greenway.
- Development of the Dungeness River Greenway as a partnership among all landowners, citizens, public and private nonprofit agencies.
- Identification and provision for increased recreational and public access opportunities where appropriate and complimentary to the natural and cultural characteristics of the greenway.
- Protection of landowners' rights by providing incentives, not regulations, for participation in the Dungeness River Greenway such as public acquisition, purchase of development rights, or property tax reduction.
- Assurance that any public access that is developed is adequately policed and maintained.

HOW WE GOT STARTED

Four previous planning efforts identified needed programs and projects, not only on the river, but on a watershed-wide basis. The plans incorporated multi-objectives of flood reduction, pollution prevention and correction, fish and wildlife habitat restoration, and water conservation. By stressing the principles of stewardship and incentives to meet objectives, these previous planning efforts stated the community's consensus on river management. It was not until the passage of the Growth Management Act in 1990 and 1991, combined with studies on water quality and quantity and flooding, that the Dungeness River Greenway Project got under way.

An invitation was mailed to the 250 landowners within the river corridor to inform them of four open houses aimed at developing a greenway concept for the river. Because this involved private property only, the general public was not notified or included in this process. Landowner concerns and opportunities were voiced, such as liability, trespassing, litter and vandalism, privacy, habitat restoration, flood protection, and access acquisition.

Based on these meetings and interviews with individuals, a Greenway Concept Plan was developed which consisted of a parcel-based map showing the river corridor and existing or potential future uses for public access, open space, trails, interpretive structures, and candidate sites for potential public purchase, conservation, easements, tax credit programs, purchase of development rights, and cluster development.

WHAT WE'RE LEARNING

Rivers that flow through predominantly private land present a profoundly different conservation challenge than do rivers that flow on public land. We learned the importance of enrolling the property owners early in the process before media coverage begins and rumors start to fly. Even though the initial private landowner meetings on the Dungeness River Greenway Concept Plan were intentionally structured to elicit landowners' concerns and opportunities, there were some landowners who mistrusted the approach and opposed any greenway discussion. Most landowners believe they can achieve their personal goal (to be left alone to do what they want to do on their properties) by not participating. The key is to identify how doing what they want to do can achieve maximum public benefit.

Another lesson is that years of watershed planning pay off. Because so much work had been done during the previous eight years to produce coordinated, comprehensive, consensus-based plans for the Dungeness River Watershed, a momentum and synergy developed around all of the implementation activities. Education, landowner outreach, technical assistance, and restoration are taking place in a variety of venues, each building on the other, coordinated through a network of partnerships with common, watershed-based goals. The Greenway Concept Plan is a success that does not stand alone; it is a piece of a larger watershed puzzle.

MILESTONES

- *Establishment by joint resolution of Clallam County and the Jamestown S'Klallam Tribe of the Dungeness River Management Team who will provide oversight, technical review, and coordination of activities among agencies, organizations, and property owners.*
- *Publication of the Dungeness River Information and Action Guide, a 35 page booklet introducing landowners to some basic tools, techniques and sources of assistance for greenway corridors.*
- *A total of 18 acres has been donated by two landowners for county maintained park sites and an additional ten-acre parcel was offered for habitat conservation.*
- *With a grant from the Washington State Department of Natural Resources, Clallam County employed five displaced timber workers to stabilize over 3,000 feet of river bank using vegetation, logs, geotextile fabric, and willow stakes. One-and-a-half miles of stream have also been rehabilitated including pool and riffle construction, bioengineered banks, re-establishing meanders, and placement of large woody debris.*
- *Participation of landowners in stream walks to examine management goals and potential habitat enhancement projects.*
- *Groundbreaking for a 6,000-square-foot Dungeness River Natural History Center in part of the 15-acre Railroad Bridge Park.*
- *Grant received for the Jamestown S'Klallam Tribe to create a trail to link with the Olympic-Discovery Trail that the County is developing with federal Intermodal Surface Transportation Enhancement Act (ISTEA) funds.*

OUR PARTNERS

Clallam County Planning Division

The Division provided project development and coordination as well as planning services.

MR Stearns Planning and Design

MR Stearns facilitated group process and led public participation, publications, and development plans.

Clallam County Parks and Recreation

The County Parks Department is responsible for maintenance of county owned public lands. The department provided assistance in working with landowners and in identifying and designing for potential public access sites.

Washington Department of Fish & Wildlife

A habitat biologist for the state gave technical assistance to design and implement a bank stabilization project. (The landowner had lost 40 acres of land since the 1970s due to erosion from flood events.)

Jamestown S'Klallam Tribe

The Jamestown S'Klallam Tribe has an historical and cultural relationship with the Dungeness River. The Tribe and the Rainshadow Natural Science Foundation are establishing a natural history center associated with the river.

Washington Department of Natural Resources

The department provided funding for bank stabilization and habitat restoration projects through "Jobs for the Environment" grant.

Clallam Conservation District

The district also provided technical assistance in bank stabilization project design and implementation.

Washington State Department of Ecology, Shorelands and Coastal Zone Management Program

Department provided Greenway Project funding and oversight allowing for meetings with landowners to develop site plans, model conservation easements, and to revise the Open Space Tax Program to reflect the goals of the Greenway Concept Plan.

National Oceanic and Atmospheric Administration (NOAA)

NOAA provided Greenway Project funding.

Contact

LEANNE JENKINS

Water Quality Planner

Clallam County Department of Community Development

223 East Fourth Street

Port Angeles, WA 98362

360.417.2520

TWO HUNDRED AND SIXTY-TWO STRUCTURES WERE DAMAGED DURING THE GREAT FLOOD OF 1993 RESULTING IN THE DEVELOPMENT OF A 235-ACRE RELOCATION SITE ABOVE THE FLOODPLAIN.

THE GRAFTON PLAN

*People, homes, and businesses
move out of flood zone saving
future insurance claims, restoring
natural habitats, and developing
recreational opportunities.*

✓ FLOOD LOSS REDUCTION

FLOW CONTROL

STREAMBANK STABILIZATION

✓ RESTORATION

FISHERIES IMPROVEMENT

✓ RECREATION

✓ NATURAL HAZARD MITIGATION

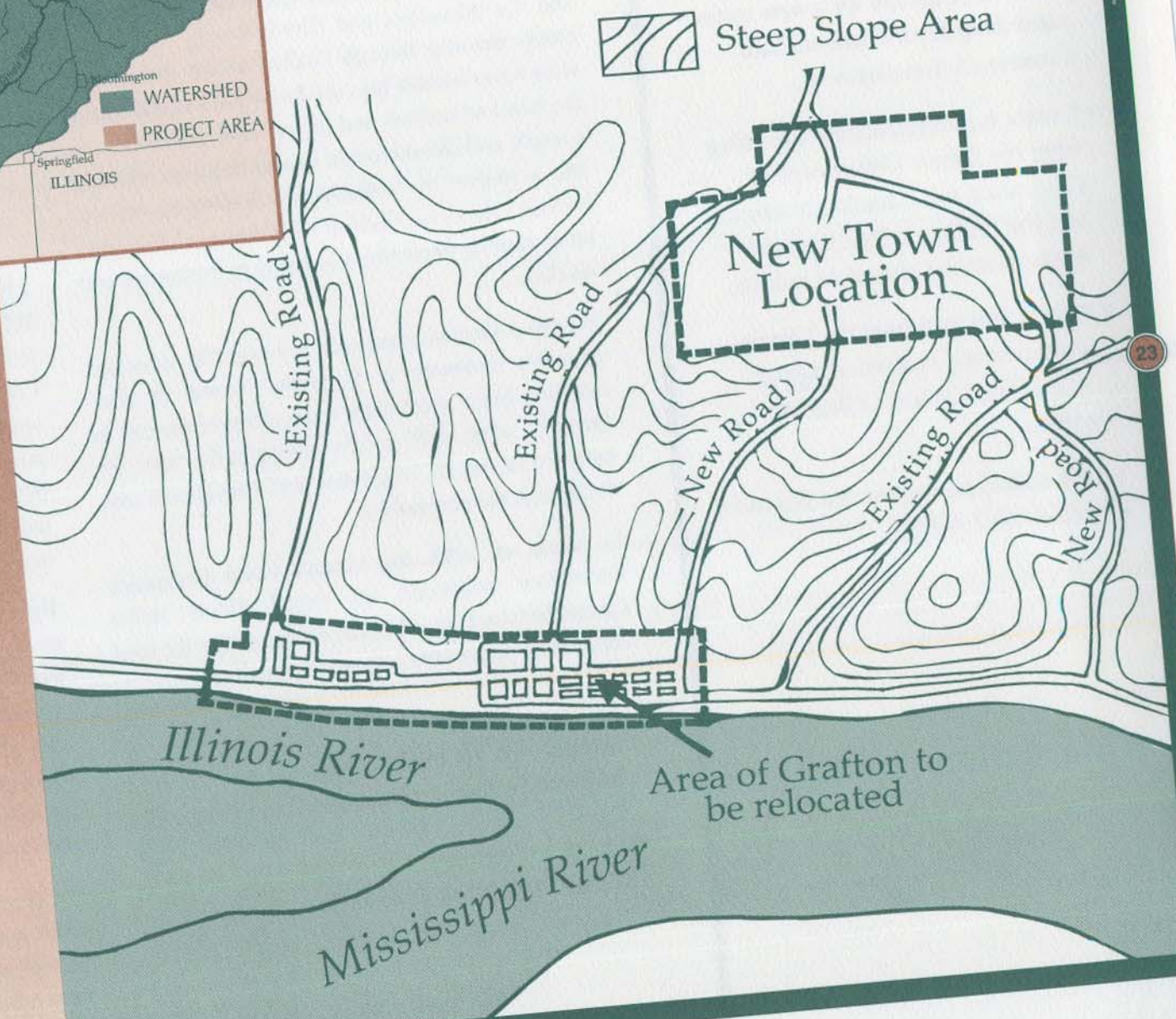
✓ WETLAND ENHANCEMENT

✓ HABITAT IMPROVEMENT

✓ CULTURAL RESOURCE ENHANCEMENT

✓ ECONOMIC REVITALIZATION

ENVIRONMENTAL EDUCATION



MILESTONES

- *A 404 permit granted by the Army Corps of Engineers for construction of new Grafton Marina.*
- *Grant of \$500,000 for a new water plant from Rural Economic and Community Development.*
- *Grants for infrastructure rebuilding from the Illinois Department of Commerce and Community Affairs and the Economic Development Agency totaling almost \$8 million.*
- *A \$635,000 loan from the Illinois Environmental Protection Agency for a Sanitary Sewer Collection System.*
- *A \$4 million grant from the Economic Development Agency.*

WHAT WE WERE FACING

Grafton, Illinois, has suffered from floods since it was settled in the 1830s. Grafton is two miles long and two blocks wide, hemmed between steep limestone bluffs and the Mississippi and Illinois Rivers. With seven creeks draining through Grafton to the river, levees were never feasible because heavy rains would run off the hills and hollows and fill the town with water. As a result, each flood brought various degrees of damage and a routine of "hosing-down-cleaning-up-moving-back-in." The Great Flood of 1993 damaged 262 structures, causing tremendous suffering to businesses and residents.

The city of Grafton, population just over 900, is located 37 miles northwest of St. Louis. Linear in plan, Grafton's Main Street is the main street of the city in the truest sense of the words, serving as the nexus for commercial, social, residential, and educational uses throughout the community.

In August of 1993, the Mayor's Flood Emergency Committee produced an initial Flood Relief Comprehensive Plan. The plan estimated that the total community needs were just over \$29 million.

WHERE WE'RE HEADING

- Building of a new housing subdivision, Grafton Hills, on a 235-acre site, high on a bluff, for flood victims and for new residents.
- Restoration of prairie grass fields.

- Utilization of newly acquired green space.
- Encouraging tourism business enterprises.
- Establishment of a visitor's center, a light house (symbol of Grafton), and park benches in the business district.
- Enhanced recreation through a marina, a walking path in the wetlands (within city limits), and a bike and hike trail system.
- Construction of new water and sewer plants, which were both under water during the flood.

HOW WE GOT STARTED

While the Mississippi River was still at its record high level, the Mayor appointed the Grafton Rebuilding Committee. Sixteen committees were established to work on the various rebuilding projects, including a new water plant, a new water tower, a new sewer plant, relocating flood victims out of the floodplain, creating green spaces and new parks, and building new housing and new roads.

The city surveyed flooded-out residents to determine emergency and long-term needs. Over 93 percent of those surveyed said they would like the government to buy out their homes and would be willing to resettle above the floodplain. Approximately 135 homes are in a Federal Emergency Management Agency (FEMA) buy-out program and are to be demolished and turned into designated open space.

The development of a strategic community plan is also under way and will include the 235-acre relocation site and a comprehensive review of the city's development ordinance.

WHAT WE'RE LEARNING

The time that it takes to get projects started and completed is much greater than we ever expected. As a result, many citizens moved away and relocated elsewhere rather than wait two or three years to resettle in our new subdivision. Now the sale of lots has begun.

We have learned how to work with government bureaucracy and have met dozens of people from state and federal agencies who have been of great help. Included in this list are Governor Jim Edgar, James Lee Witt, Director of FEMA, and Vice President Al Gore.

In working with the Grafton Rebuilding Committee, if given the chance to do it over, we would have appointed smaller committees with as few as two or three people. This may have enabled faster meetings and thus quicker decisions. Even still, a positive, "can do" attitude by everyone involved has promoted a spirit of teamwork and cooperation. We have depended heavily upon volunteers both during the '93 flood and in this subsequent planning effort.

OUR PARTNERS

Federal Emergency Management Agency (FEMA)

FEMA has provided assistance and guidance with planning the rebuilding of Grafton. They have also helped to connect the city with other federal and state agencies.

US Coast Guard

The Coast Guard provided assistance with obtaining photographs and drawings of lighthouses to be used as models. A lighthouse will be built along the waterfront as a tourist and boaters' attraction.

US Department of Agriculture and Illinois Department of Agriculture

Both agencies assisted in the planning of Grafton Hills housing subdivision to prevent erosion and to blend in with natural surroundings and animal life. Several types of housing (mobile home, modular homes, and standard homes) will be offered in a wide price range.

US Fish and Wildlife Agency and the Illinois Department of Conservation

Joint technical assistance with the ecological planning of riverfront recreational use.

National Trust for Historic Preservation

With the help from the Trust, almost 20 buildings have been named to the National Register of Historic Places.

Illinois Department of Transportation (IDOT)

IDOT engineered emergency roads during the floods and provided funding for a new visitors' center.

Illinois Emergency Management Agency (IEMA)

IEMA provided temporary housing for flood victims and has funded the buy out of destroyed homes.

Illinois Historic Preservation Agency

The Agency has funded the rehabilitation of historic Grafton buildings.

University of Illinois

Architecture students assisted with developing preliminary plans for the rebuilding of Grafton.

Additional Partners:

Illinois Emergency Management Agency (IEMA)

US Economic Development Agency

Illinois Department of Commerce and Community Affairs

Contact

LARRY WRIGHT

Administrative Assistant to the Mayor

City of Grafton

Box 640

Grafton, IL 62037

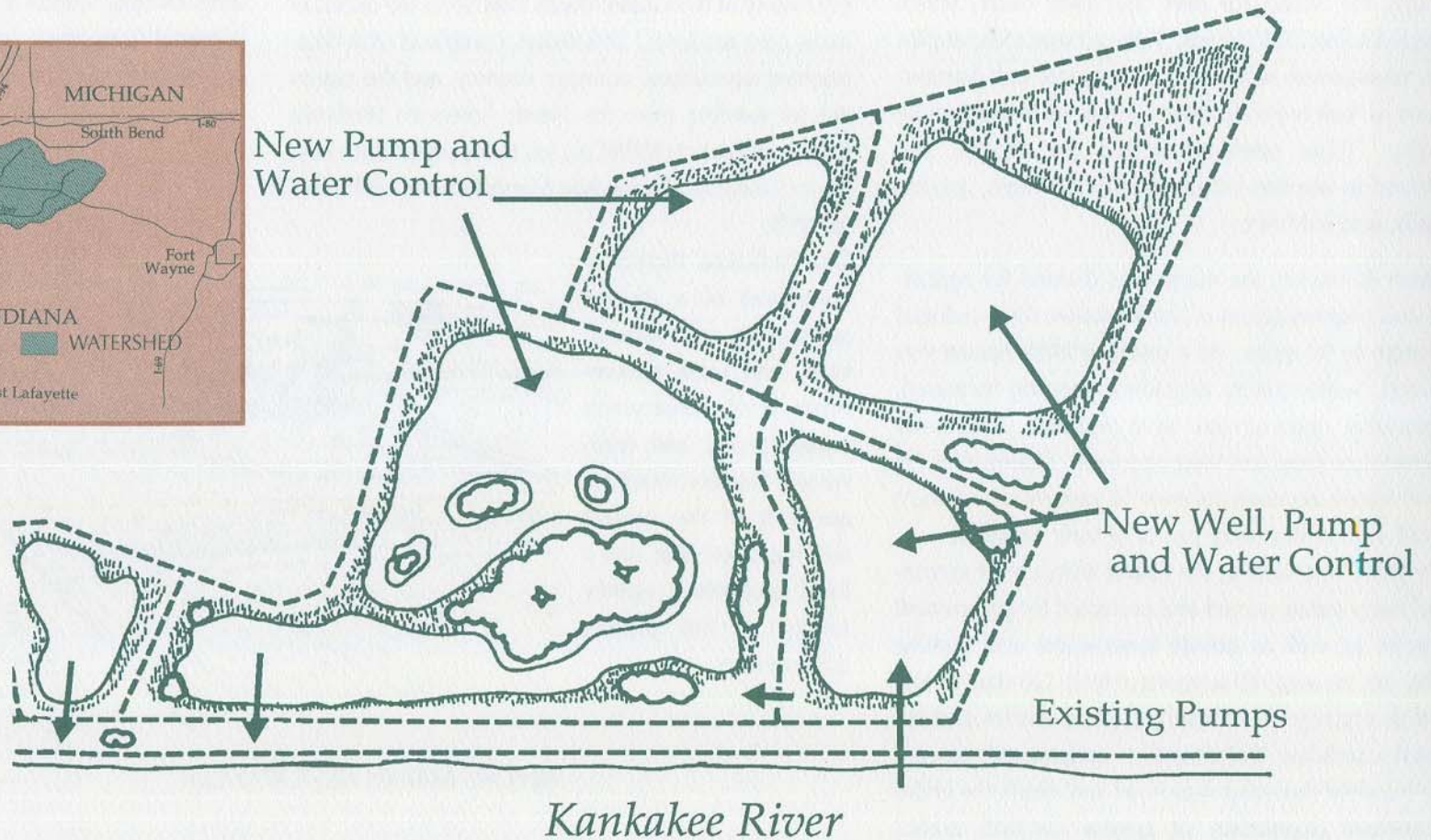
618.786.3555

Restoration of one of the world's finest wetland habitats increases waterfowl populations, meeting objectives of the North American Waterfowl Management Plan.

GRAND

- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- STREAMBANK STABILIZATION
- ✓ RESTORATION
- ✓ FISHERIES IMPROVEMENT
- ✓ RECREATION
- NATURAL HAZARD MITIGATION
- ✓ WETLAND ENHANCEMENT
- ✓ HABITAT IMPROVEMENT
- CULTURAL RESOURCE ENHANCEMENT
- ECONOMIC REVITALIZATION
- ENVIRONMENTAL EDUCATION

KANKAKEE MARSH RESTORATION



WHAT WE WERE FACING

At the turn of the century, the Grand Marsh of the Kankakee was one of the largest, most ecologically complex and biologically rich wetlands in the interior United States. Its size was estimated to be between 400,000 and one million acres depending upon water levels. Formed between two glacial moraines, the Grand Marsh extended from the Illinois state line north-easterly towards South Bend, Indiana, a distance of 85 air miles. The Kankakee River itself slowly meandered through the Marsh for over 250 river miles, which included some 2,000 bends. This vast wetland complex was interspersed with sand dunes and oak barrens, known as "oak openings," rising ten to 35 feet above the Marsh. These openings dotted the interior and appeared as wooded islands in a sea of sedges, grasses, cattails, and wild rice.

28

In years following, the marsh was drained for agriculture and channelization of the Kankakee River reduced its length to 90 miles. As a result, wildlife habitat was reduced, water quality degraded, flooding increased, recreational opportunities were restricted, and costly maintenance programs were required. Drainage of the Grand Marsh accounts for over 10 percent of Indiana's overall 4.85 million-acre loss of historic wetlands. Only small remnants of the Grand Marsh exist in scattered tracts today, owned and protected by government agencies as well as private landowners and hunting clubs. Yet the area still supports at least 220 state threatened or endangered animal and plant species and ten federal candidate threatened or endangered species. One hundred thousand waterfowl and nearly the entire continental population of greater sandhill cranes migrate through the region during the spring and fall.

WHERE WE'RE HEADING

- Restoration of 26,500 acres of wetland and associated uplands in ten years.
- Increased understanding that the restoration of habitat is a practical land use.
- Education of landowners on restoration techniques and wetland management.

HOW WE GOT STARTED

Although much of its historical grandeur has changed, the history of the Grand Marsh lives on in the minds of many area residents. This vision, combined with deteriorating agricultural drainage systems, and the potential for funding from the North American Wetlands Conservation Act (NAWCA), led to the establishment of the Indiana Grand Kankakee Marsh Restoration Project in 1993.

The Kankakee Project is comprised of a diverse partnership of federal, state, and local governments, private conservation organizations, and businesses. Fourteen members are part of the project steering committee, and a local government agency serves as the project administrator.

WHAT WE'RE LEARNING

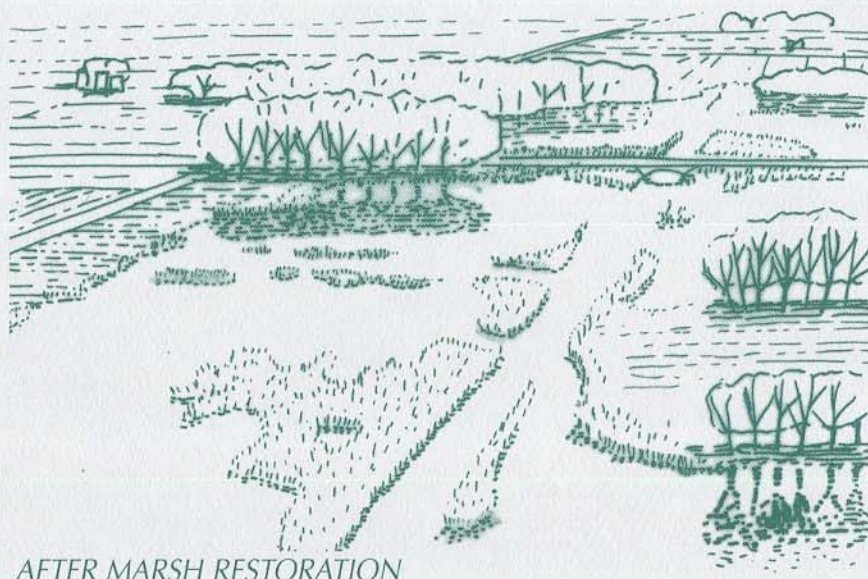
The diversity of project partners is allowing us to capitalize on different areas of expertise. For instance, partners who are realtors are intimately familiar with land that is available for sale, as well as having an understanding of the suitability of lands for restoration; local conservation organizations can involve their members in contacting fellow landowners and implementing restoration activities; business owners are able to use their long-standing contacts to generate support and potential supporters; and biologists bring their expertise in habitat restoration techniques.



BEFORE MARSH RESTORATION

MILESTONES

- *Received \$1.5 million from North America Wetlands Conservation Act.*
- *Project partners generated \$2.3 million in cash, land donations, and in kind services.*
- *Donation of 840 acres by Northern Indiana Public Service Company (NIPSCO), the primary power utility serving northern Indiana.*
- *Acquisition, restoration, and enhancement of 3,000 acres, out of 4,600 acres goals, of wetlands and uplands.*
- *Generated additional sources of nonfederal funding (over \$700,000 to date).*
- *On-going receipt of offers for land sales and appraisals.*



AFTER MARSH RESTORATION

OUR PARTNERS

North America Wetlands Conservation Council

The Council funded the largest portion of the work in October 1994 through the North American Wetlands Conservation Act. The Council is coordinated by the US Fish and Wildlife Service.

Indiana Department of Natural Resources (IDNR)

IDNR made both cash and in-kind contributions as they took a leading role in project implementation and development. They will also be responsible for managing restored lands for waterfowl production.

Northern Indiana Public Service Company (NIPSCO)

NIPSCO donated 840 acres of restorable wetland and savanna areas that are adjacent to the Kankakee River and the project.

Lake County Parks and Recreation Department

Lake County Parks contributed a grant and in-kind services to the project. They are key players in developing and implementing the plan. They are also the administrators of the North America Wetlands Conservation Act funds.

US Fish and Wildlife Service

This agency provided funding for the project as well as taking a leading role in project implementation and development.

Supporting Agencies and Organizations

The following organizations gave grants or donated land, or both, to the project. Many of them have also given their input and assisted in project implementation as project partners:

Cedar Lake Fish and Game

Ducks Unlimited

Indiana Heritage Trust

J. F. New and Associates

Kankakee River Basin Commission

Lowell Parks Department

The Nature Conservancy

Prime Time Cable Ads

SEG Engineering

Waterfowl USA Northwest, Indiana Chapter

Wille & Steiner Real Estate

Contact

JAMES J. RUWALDT

US Fish and Wildlife Service

Private Lands Office

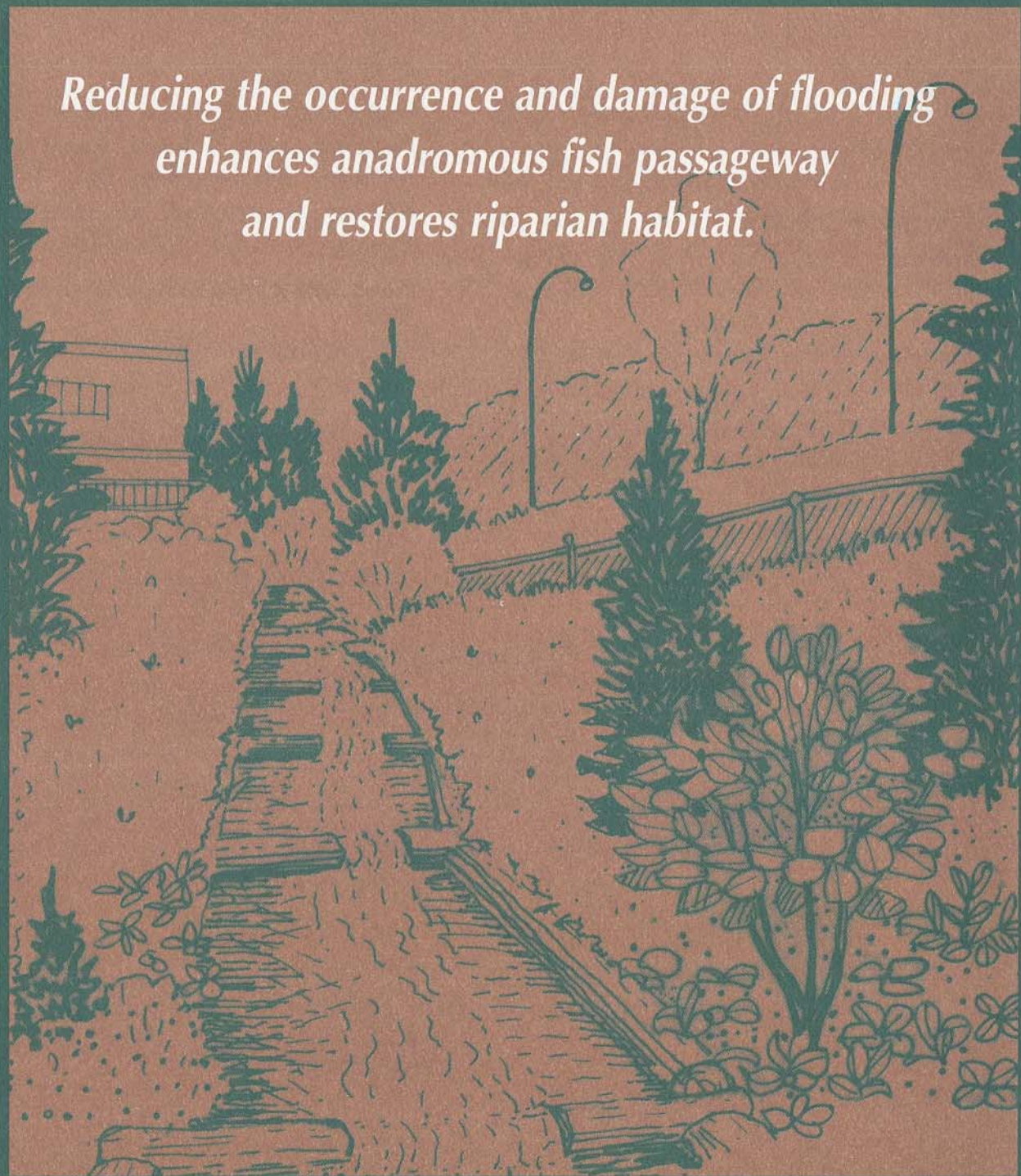
700 Rayovac Drive, Suite 207

Madison, WI 53711

608.264.5469

INDIAN RELOCATION PROJECT CREEK

*Reducing the occurrence and damage of flooding
enhances anadromous fish passageway
and restores riparian habitat.*



LOG WEIRS AND CRIBBING PROVIDE WINTER EROSION CONTROL FOR 900 FEET OF RESTORED CREEK CHANNEL.

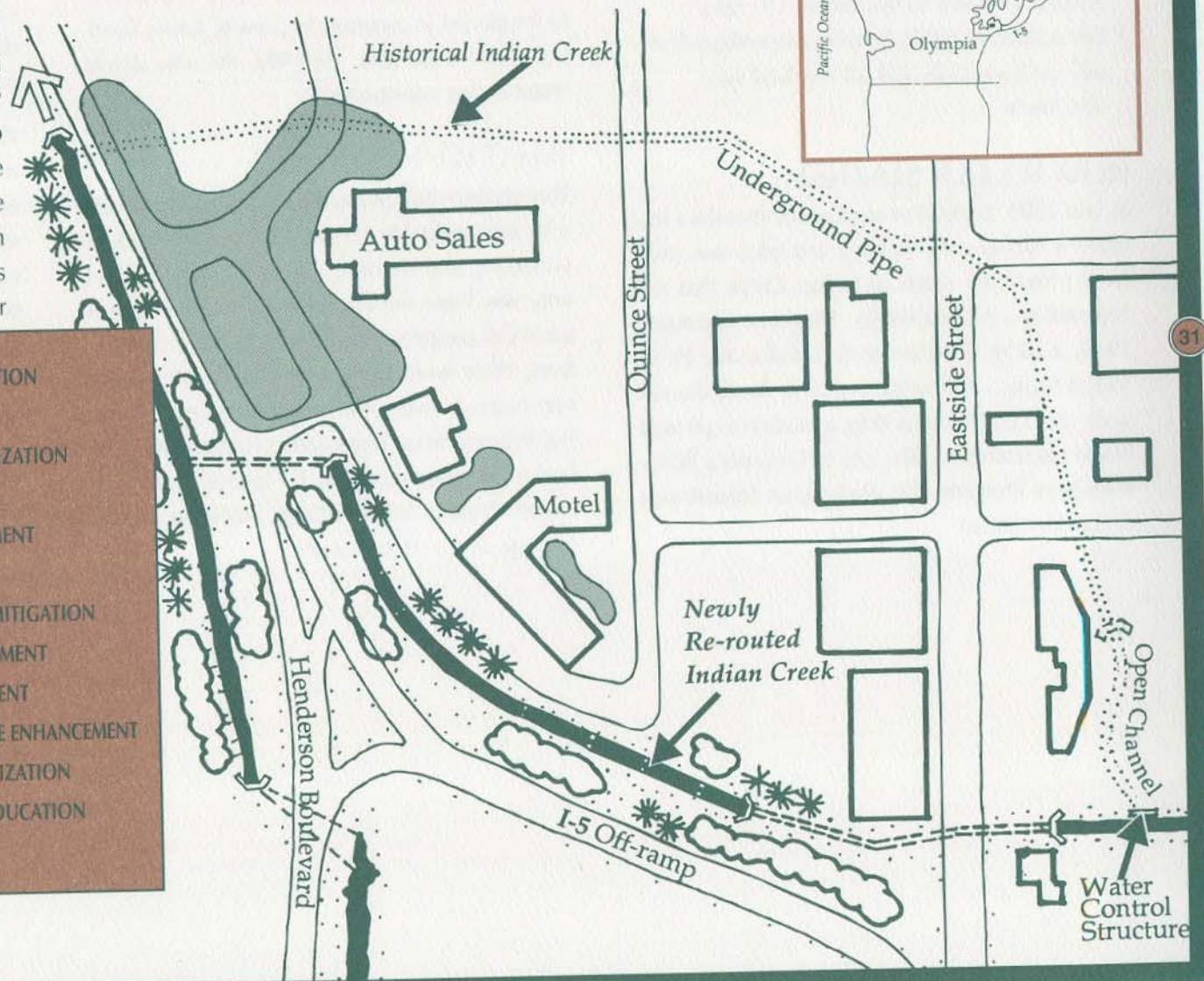
WHAT WE WERE FACING

Indian Creek flows approximately 3.5 miles from a small lake located on the fringes of the city of Olympia, through heavily developed residential and industrial neighborhoods, and into the downtown core. In 1990, a major storm in the Puget Sound region caused Indian Creek to crest its banks. Undetained storm water runoff from a nearby interstate highway and other impervious surfaces contributed to the flooding problem. The result was severe damage to a car dealership, increasing the dealer's liability, voiding a purchase offer on the property, as well as damaging the vehicles in the lot. It also completely closed a major arterial entrance to Olympia.

Indian Creek's summer base flow is about four cubic feet per second (cfs), but it has a flood flow capable of exceeding 100 cfs. While still supporting beneficial instream and riparian habitat, Indian Creek has been substantially degraded by various urban impacts.

- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- ✓ STREAMBANK STABILIZATION
- ✓ RESTORATION
- ✓ FISHERIES IMPROVEMENT
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- ✓ CULTURAL RESOURCE ENHANCEMENT
- ✓ ECONOMIC REVITALIZATION
- ✓ ENVIRONMENTAL EDUCATION

■ AREAS FLOODED: JANUARY 1990 STORM



WHERE WE'RE HEADING

- Solution to a serious flooding problem to protect businesses and transportation routes.
- Restoration of fish passage to upstream habitat that had been unavailable for years.
- Creation of a unique educational opportunity at a major entryway to downtown Olympia.
- Conception of public/private partnerships that will continue to benefit all involved into the future.

HOW WE GOT STARTED

In late 1989, a group of community members initiated a habitat enhancement and education plan for an impacted reach of Indian Creek that ran adjacent to a car dealership. However, in January 1990, a major flood event occurred in the Puget Sound region. Following the 1990 flood, discussions centered around finding a solution to prevent future reoccurrence. The city of Olympia's Water Resources Program, the Washington Department of Transportation,

Washington Department of Fisheries, and the car dealership combined forces to find a solution.

A year later, in 1991, the Olympia City Council agreed to provide funding for the creation of a new channel for Indian Creek. At the same time, the existing channel that periodically flooded was to be placed in a culvert to prevent future flooding of the dealership. In 1992, the new stream channel was constructed.

WHAT WE'VE LEARNED

This project has provided Olympia and others with an invaluable lesson on the challenges of protecting and restoring an urban stream. Not only was there the challenge of working with a variety of partners with differing goals and objectives, there were some very challenging design constraints to overcome. These included conveying 100-year flood flows and accommodating the backwater effects created by high winter tides, extremely poor soil conditions, and ensuring fish passage up the new channel.

The project was also pursued on a very limited timetable. In retrospect, having a more experienced contractor, more attention from a knowledgeable inspector, and more oversight from the design engineer would have improved the construction of the project. Interpretation of plans, construction inspection, and the need to make design modifications in the field were much more extensive than expected.

While city staff had anticipated maintaining the stream banks and channel over time, the extent of this project component was probably underestimated. Regular maintenance of the stream banks was critical to successful establishment of the desired native riparian cover and to prevent a narrow channel from becoming clogged. Fortunately, there are many dedicated "Stream Team" volunteers who assist in maintenance.

One of the pleasant surprises demonstrated by this project was how quickly the relocated creek established a relatively "natural" appearance with abundant vegetation cover on the banks and a gradually meandering channel with a healthy mix of pools, riffles, and runs. While a good design was an important component of this success, we learned how resilient an urban creek can be despite its suboptimal conditions.

MILESTONES

- *Piping of 230 feet of Indian Creek piped on the auto dealership site.*
- *Creation of a fish passage structure at the inlet of the 48-inch pipe.*
- *Excavating and installing log weirs and cribbing, creating meanders, planting native vegetation, and providing winter erosion control for 900 feet of restored creek channel.*
- *Construction of a diversion weir at the upstream end of the project so that a portion of flood flows could be directed through the existing piped system rather than through the more sensitive, newly constructed open channel.*
- *Adult salmonid fish species are migrating upstream to potential spawning beds that were previously unreachable due to a long stretch of culverted creek.*
- *City staff and volunteers in place to monitor the new channel to assess its habitat resource value and hydraulic characteristics.*

PARTNERS

City of Olympia, Water Resources Program

Staff from the city of Olympia provided overall project coordination, including acquisition of project funding and permits, oversight of the design consultant, construction management and inspection, and ongoing maintenance.

Washington Department of Community, Trade, and Economic Development

This agency provided a substantial Flood Hazard Mitigation Grant which enabled the project to be funded.

Washington Department of Ecology

This agency provided a Flood Control Assistance Account Program Grant which was also used to fund the project.

Washington Department of Fish and Wildlife (WDFW)

WDFW gave technical review comments on the project design and issued Hydraulic Project Approval permits that enabled the project to be constructed.

Washington Department of Transportation (WSDOT)

WSDOT contributed funding for the project and allowed the relocation stream channel to be sited in state right-of-way land adjacent to a freeway off-ramp.

Squaxin Island Tribe

This tribal agency helped develop the project scope and provided technical review comments on the project design.

Evergreen State College

Students in the ecology department monitored Indian Creek for many years. Dr. Oscar Soule provided valuable background information as well as technical review comments on the design.

Trout Unlimited

Members of this organization helped to develop the project scope and provided technical review comments on the project.

Hulbert Pontiac/Cadillac

Prior to the relocation project, Indian Creek flowed in an open channel through this car dealership. The Hulberts were very supportive of efforts to restore and enhance the creek. They were instrumental in developing the project scope for the relocated channel.

Kramer, Chin, & Mayo, Inc.

This engineering consultant firm provided hydraulic modeling and project design services for relocating the creek.

Contact

JOANNE E. RICHTER

City of Olympia Water Resources Program

P.O. Box 1967

Olympia, WA 98507

360.753.8463

Community improvement plan addresses reducing flood damage.

KAMPSVILLE

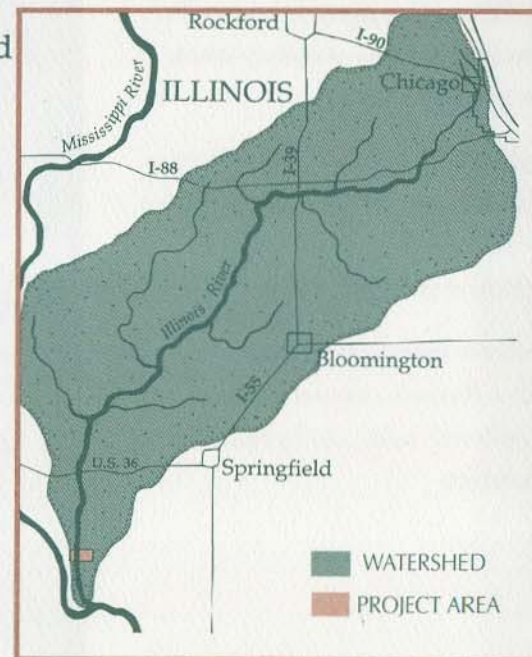
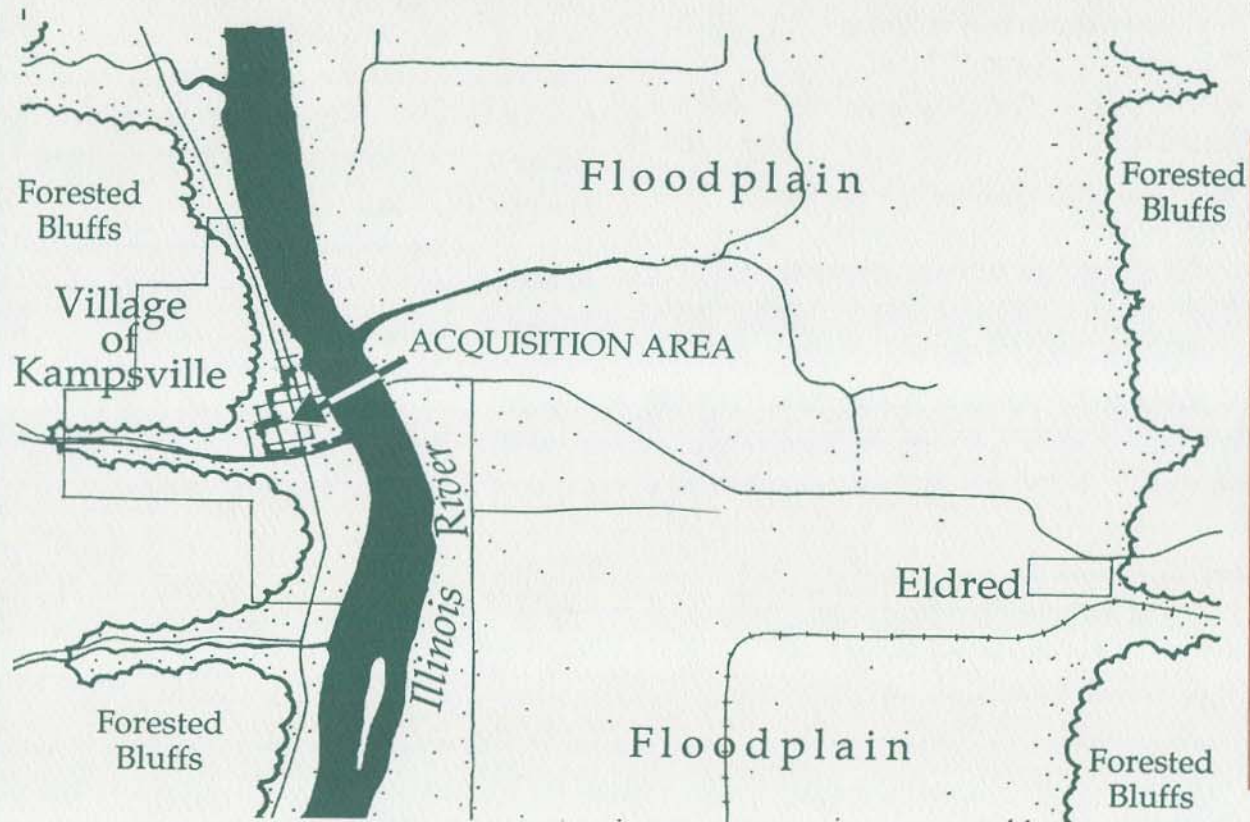
FLOOD MITIGATION PROJECT

WHAT WE WERE FACING

Kampsville, Illinois is a small town, population 423, situated between the Illinois River and its forested bluffs in rural Calhoun County. Eight floods occurred between 1979 and 1987, and Kampsville was declared a disaster area five times in seven-and-a-half years. Not taking into account the flood of 1993, the annual expected high water increased by more than four feet during the past 50 years. Flood waters rise and fall slowly, generally flooding the town for several weeks.

continued on page 36

ILLINOIS





✓ FLOOD LOSS REDUCTION

✓ FLOW CONTROL

STREAMBANK STABILIZATION

RESTORATION

FISHERIES IMPROVEMENT

✓ RECREATION

✓ NATURAL HAZARD MITIGATION

WETLAND ENHANCEMENT

HABITAT IMPROVEMENT

✓ CULTURAL RESOURCE ENHANCEMENT

✓ ECONOMIC REVITALIZATION

ENVIRONMENTAL EDUCATION

BROADWAY STREET IN KAMPSVILLE, A TOWN DECLARED A DISASTER AREA FIVE TIMES IN SEVEN-AND-A-HALF YEARS.

continued from page 34

Calhoun County is confined between the Illinois and Mississippi Rivers, accessible only by one bridge and four ferries. During floods, the only access to Kampsville and other neighboring towns is through the hills, by way of narrow gravel roads.

In 1985, Kampsville had 111 buildings in the 100-year floodplain, nearly half of the total buildings in town. Most of the businesses were subject to flooding, including all of the restaurants, the grocery store, and the gas station. Tax revenues and employment opportunities had declined due to business interruptions caused by flooding and by many flood-prone businesses closing permanently.

WHERE WE'RE HEADING

- Redevelopment of the floodplain as an asset to the town.
- Preservation of business district's location near the riverfront.
- Elimination of flood damages to buildings. Maintenance of state road access and key public utilities during high water.
- Provision of affordable housing for relocated floodplain residents.

HOW WE GOT STARTED

Early in 1985, a citizen effort persuaded Federal Emergency Management Agency (FEMA) to reconsider a buy-out. The town council proceeded with formalizing a planning process and seeking funding to carry out a more extensive project to buy out or elevate about half of the structures in the floodplain. A planning grant was obtained from FEMA, which was matched with a grant from the Illinois Department of Water Resources. A floodplain planning committee was set up to write a hazard mitigation plan which included economic development for Kampsville. Its members consisted of village residents and technical advisors from federal, state, and county agencies.

After goals for the project were created, a door-to-door survey was conducted to determine the method of flood protection preferred by each property owner and to see how many would be interested in the buy-out project. A second survey was done of first floor elevations and building conditions. The results of both were used as documentation in applying for assistance from federal and state agencies. The survey of first floor elevations was also used to create a flood warning and response plan.

MILESTONES

- *Approval for acquisition of 20 properties using FEMA funds for 75 percent of the cost with 25 percent from the State of Illinois Department of Commerce and Community Affairs (DCCA).*
- *Acquisition and clearance of additional floodplain land either vacant or with buildings not covered by flood insurance. This included relocating structures out of the floodplain and selling them back to the property owner for \$1.00.*
- *Elevation of seven flood-prone structures not included in buy-out.*
- *Creation of a riverfront park.*
- *Reconstruction of a ferry landing so that Kampsville would not be isolated during floods of lesser magnitude. This included the raising of the access road.*



WHAT WE'RE LEARNING

When the project was first completed, it took a while to become accustomed to the new open appearance of the town between Main Street and the river. Some people were disappointed that the park never developed into a campground as was originally planned. However, after the most recent flood in 1995, there was only gratitude expressed for the efforts that went into the original buy-out.

OUR PARTNERS

Illinois Department of Transportation, Division of Water Resources

This agency provided technical assistance in formulating the plan.

Center for American Archeology

Largest employer in Calhoun County, the Center had 80 percent of its 35 buildings in the 100-year floodplain. The research firm donated office space and overhead to the project, allowed time-off for an employee to write grant proposals, and serve as project administrator at the request of the town council.

Regional Planning Commission

The Planning Commission became involved after the project was progressing, providing overall project coordination.

Sources of funding:

Federal Emergency Management Agency (FEMA)

Illinois Division of Water Resources

Illinois Department of Commerce and Community Affairs

Illinois Department of Transportation, Division of Highways

Contact

GAIL ANDERSON

Center for American Archeology

P.O. Box 365

Kampsville, IL 62053

618.653.4316

*Public-private partnerships
address environmental
reclamation, water quality
improvement, recreation,
flood loss reduction.*

PENNSYLVANIA

LACKAWANNA RIVER GREENWAY

WHAT WE WERE FACING

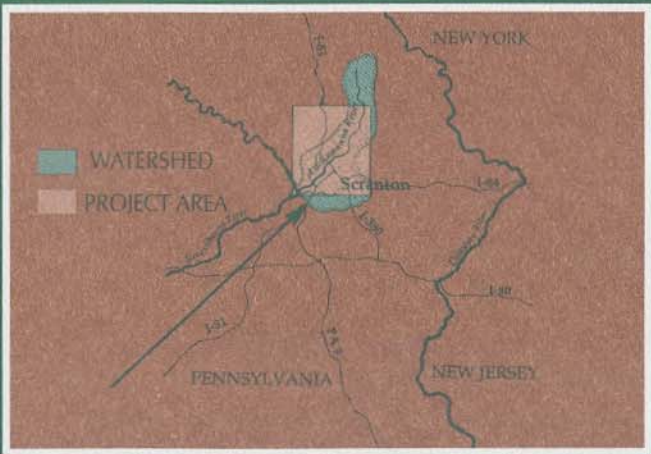
The Lackawanna River flows for 40 miles from its headwaters before joining the North Branch Susquehanna River in northeastern Pennsylvania. Draining a 350-square-mile watershed, the river flows through the Lackawanna Valley, a large geosyncline in the Appalachian Ridge and Valley province. The Northern Anthracite coal field is found here, with the hardest, highest carbon of all coals. From the 1880s to the 1950s, it was mined



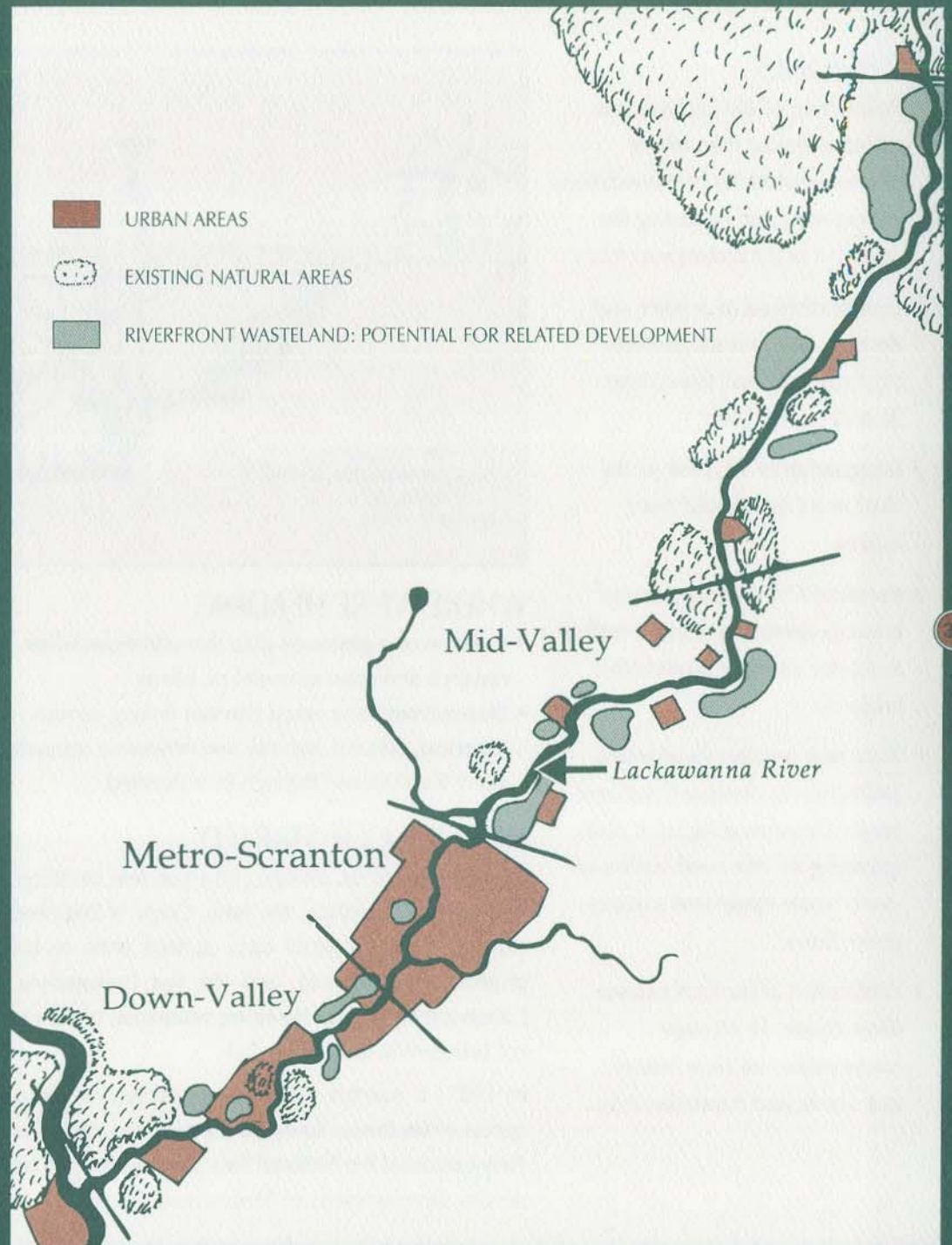
and used for industrial and domestic purposes. One hundred and fifty years of coal mining, industrial and urban development has heavily impacted the watershed. By the 1930s, the Lackawanna River was dead. Its water course was choked with coal waste and silt; municipal garbage and sewers were dumped into its brackish waters. Flash floods were frequent due to deforestation,

unregulated strip mining and urban encroachment along stream corridors and river floodplains.

The collapse of the anthracite industry left an enduring legacy of abandoned mine sites, thousands of acres of despoiled terrain, burning coal waste (culm dumps), burning underground mine fires, and flooded mine workings pouring millions of gallons of acidic mine drainage into the Lackawanna River.

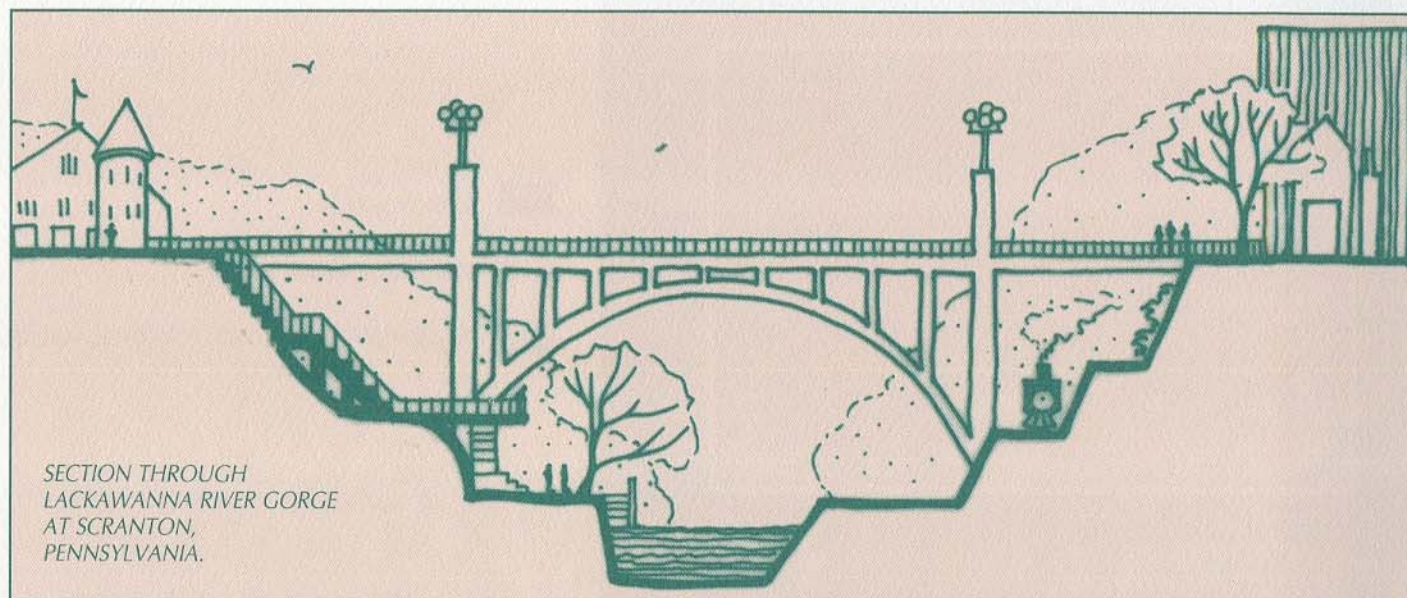


- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- ✓ STREAMBANK STABILIZATION
- ✓ RESTORATION
- ✓ FISHERIES IMPROVEMENT
- ✓ RECREATION
- NATURAL HAZARD MITIGATION
- ✓ WETLAND ENHANCEMENT
- ✓ HABITAT IMPROVEMENT
- ✓ CULTURAL RESOURCE ENHANCEMENT
- ✓ ECONOMIC REVITALIZATION
- ✓ ENVIRONMENTAL EDUCATION



MILESTONES

- *Publication of the Lackawanna Citizens Master Plan which offered over 200 recommendations on restoring and managing the resources of the Lackawanna River.*
- *Grants received to acquire and develop rails-to-trails projects on abandoned rail lines along 26 miles of the river.*
- *Designation of 12 miles of the river as a Class A wild trout fishery.*
- *Received EPA funding directed towards combined sewer overflow and mine drainage remediation projects.*
- *State now requires local sewer authorities to develop Combined Sewer Overflow mitigation plans (planning for the combination of storm water runoff and sanitary sewer flows).*
- *Publication of the Lackawanna River Guide, an 80-page compendium on river history and scenic and recreation sites.*



WHERE WE'RE HEADING

- Creation of a greenway plan that addresses water resource and environmental problems.
- Development of a linear corridor linking various historical, cultural, natural, and economic resources along the river and through its watershed.

HOW WE GOT STARTED

By the early 1970s, sewage collection and treatment facilities were put in place, the Army Corps of Engineers constructed a flood control dam, surface mine reclamation projects were initiated, and the first Lackawanna River Canoe-a-thon began. However, restoration of the river was not proceeding quickly enough.

In 1987, a number of citizens gathered to discuss the opportunities the Lackawanna River offered the community. They contacted the National Park Service who was working on the development of Steamtown National

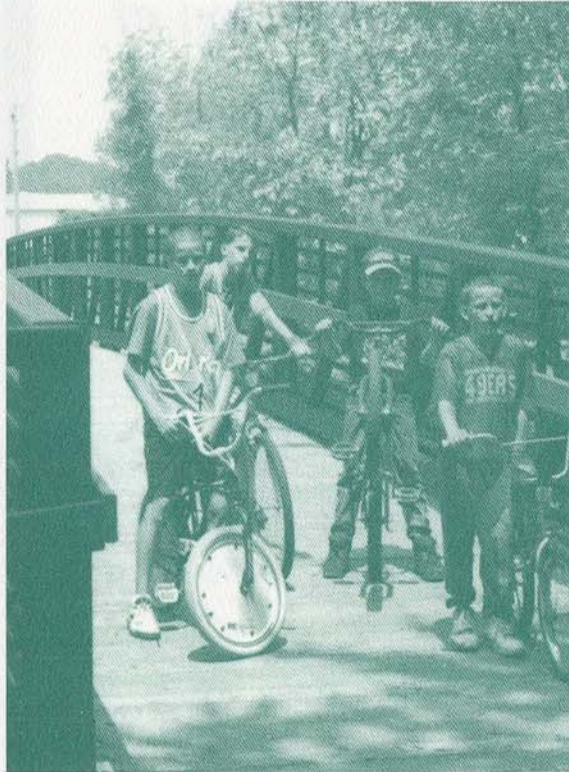
Historic Site as a living museum of steam era railroading. The Lackawanna River Corridor Association was created by the citizens group to work with the community and government agencies to develop a comprehensive plan for the Lackawanna River.

WHAT WE'RE LEARNING

The plans that we have in place clearly define the path we need to take towards a revitalized river and watershed. The partnerships exist to guide the work; yet the potential for the Lackawanna will not be realized in the short term. One hundred and fifty years of exploitation have left a legacy of challenges for resource managers both today and in the future.

The vision for the river needs to be shared by more and more individuals and organizations. That sharing is the mission of a good river conservation effort. We are in many respects like Tom Sawyer, we need everyone to believe that painting the fence is fun!

Managing a river for multiple uses means getting to know the river and the wide variety of river users from kayakers and anglers to waste water plant operators, highway engineers, borough managers, little old ladies with 200 year-old oak trees, and junk yard operators. Our effectiveness as river stewards is dependent upon creating and maintaining a shared value system with the community. This is the art of good citizenship, the craft of good government. It requires patience, persistence, flexibility, and a willingness to listen.



BIKE RIDERS ON THE NEW LACKAWANNA HERITAGE VALLEY CROSSING BRIDGE AT OLYPHANT, PENNSYLVANIA.

OUR PARTNERS

Lackawanna River Corridor Association (LRCA)

Organized by citizens in 1987, LRCA has acted as the catalyst and advocate for river greenway initiatives.

Pennsylvania Department of Community Affairs (PADCA)

PADCA assisted with funding for the master plan through a community grants program. PADCA's Heritage Park Program developed the Plan for the Lackawanna Heritage Valley and the Heritage Valley Authority.

National Park Service (NPS)

NPS provided funding and technical assistance to Lackawanna County and the citizens' group through the River and Trails Conservation Assistance Program. They also assisted with the Heritage Valley plan and the greenway/rails-to-trails components of the Corps of Engineer's studies.

US Army Corps of Engineers

Authorized to conduct a reconnaissance study, the Baltimore District planning division recommended numerous activities and programs for environmental restoration, water quality improvements, flood loss reduction, and recreation. The projects may be implemented by federal, state, and/or local agencies over a 20-year period.

Lackawanna County Commissioners

The County Commissioners have provided the political leadership to focus local government's attention to the value of a river restoration program.

Lackawanna County Regional Planning Commission

The Planning Commission has provided technical assistance and policy support for the river and heritage planning initiatives.

Lackawanna Heritage Valley Authority (LHVA)

LHVA, a local municipality authority, is implementing several greenway rail-to-trail projects with LRCA and local municipalities.

National Institute for Environmental Renewal (NIER)

A nonprofit educational, research, and policy institute created by LHVA through a cooperative research and development agreement with the United States Department of Energy, Oak Ridge National Laboratory. NIER is examining the problems of industrial site contamination, mine reclamation, and mine drainage along the river.

Pennsylvania Department of Environmental Protection (PA DEP)

The Bureau's Water Management and Abandoned Mine Reclamation are implementing a variety of programs related to recommendations in the Citizens Master Plan and the Corps of Engineers Reconnaissance Study.

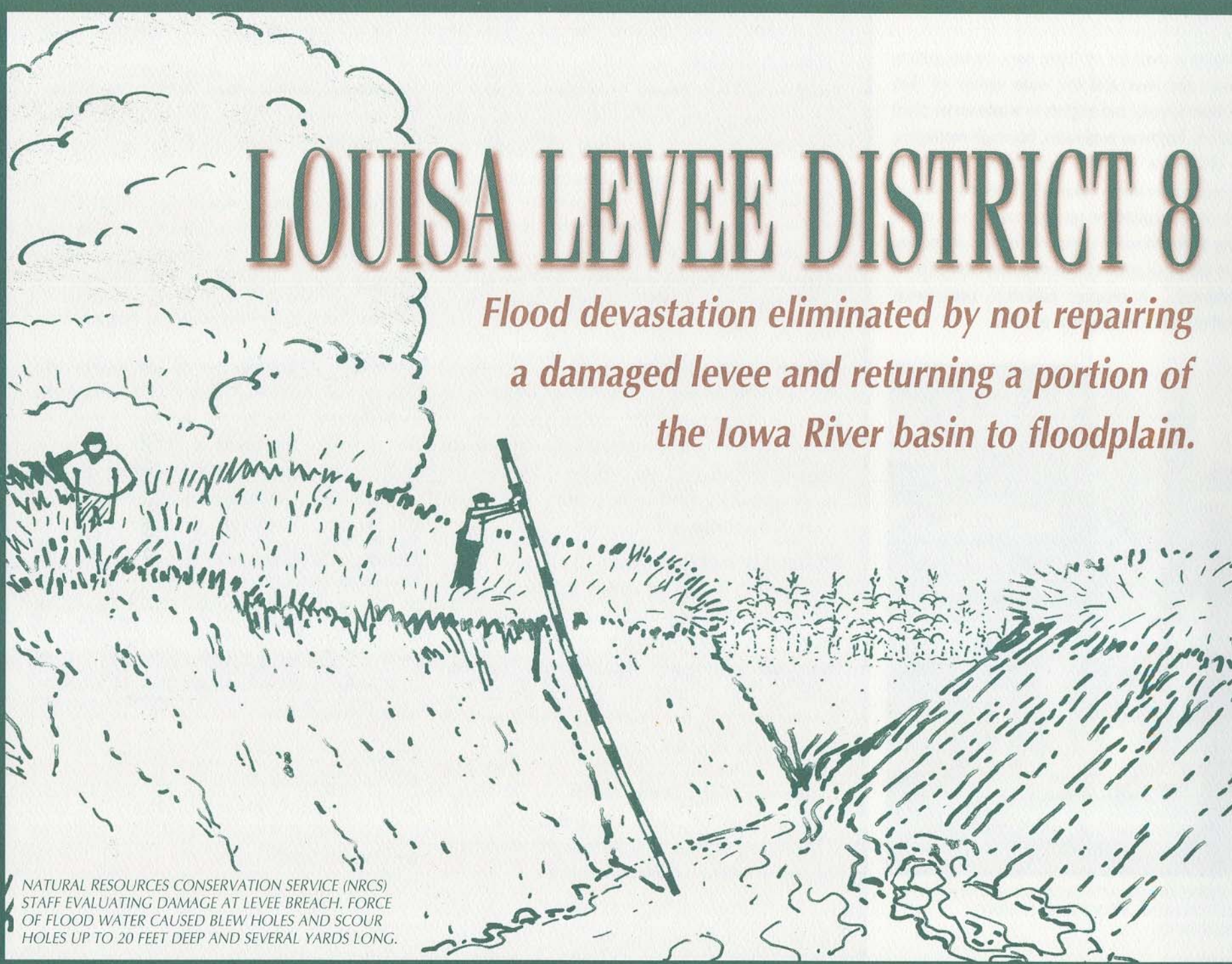
Contact

BERNARD MCGURL, Executive Director
Lackawanna River Corridor Association
P.O. Box 368
Scranton, PA 18501
717.347.6311

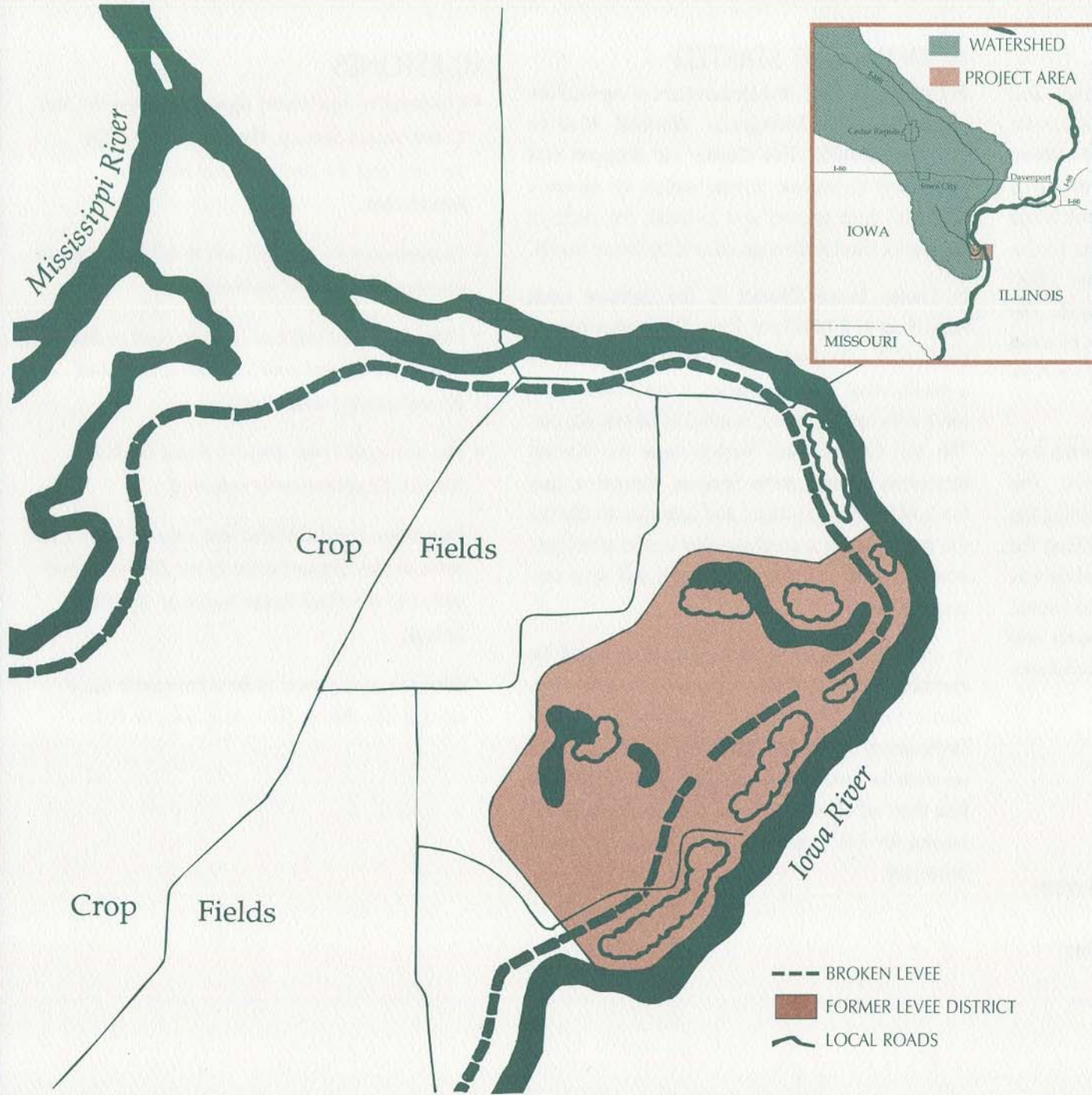
LOUISA LEVEE DISTRICT 8

Flood devastation eliminated by not repairing a damaged levee and returning a portion of the Iowa River basin to floodplain.

IOWA



NATURAL RESOURCES CONSERVATION SERVICE (NRCS)
STAFF EVALUATING DAMAGE AT LEVEE BREACH. FORCE
OF FLOOD WATER CAUSED BLEW HOLES AND SCOUR
HOLES UP TO 20 FEET DEEP AND SEVERAL YARDS LONG.



✓ FLOOD LOSS REDUCTION

FLOW CONTROL

✓ STREAMBANK STABILIZATION

✓ RESTORATION

✓ FISHERIES IMPROVEMENT

✓ RECREATION

NATURAL HAZARD MITIGATION

✓ WETLAND ENHANCEMENT

✓ HABITAT IMPROVEMENT

CULTURAL RESOURCE ENHANCEMENT

ECONOMIC REVITALIZATION

ENVIRONMENTAL EDUCATION

--- BROKEN LEVEE

■ FORMER LEVEE DISTRICT

~ LOCAL ROADS

WHAT WE WERE FACING

The Iowa River starts in southern Minnesota and runs 366 miles to the Mississippi River in Louisa County, Iowa, draining more than eight million acres along the way. Six miles from the mouth of the Iowa River, there is a large bend which has been levied since 1910 and is known as Louisa Levee District 8. This district encompasses 3,000 acres, including 2,000 acres of crop ground. The area, all privately owned, is made up of crop ground, floodplain forests, and several old ox bow lakes.

When the levee broke in July 1993, it was the seventeenth time it had happened since 1910. The estimated cost of rebuilding the levee, clearing the drainage ditch, removing the sandbags, filling the scour holes, and removing the flotsam debris was \$2.9 million. This amount excludes the additional costs in federal dollars for disaster payments and crop insurance payments, as well as the landowners' nonrecoverable costs.

WHERE WE'RE HEADING

- Dissolution of the entire levee district.
- Restoration of riverine wetlands.
- Improved wildlife habitat and fisheries.
- Relocation of landowners to non-flood-prone acreage.
- Reduction of flood damages through flood water storage.

HOW WE GOT STARTED

In October of 1993, the Department of Agriculture announced the Emergency Wetland Reserve Program (EWRP). This disaster aid program was developed to provide compensation for severely damaged crop ground and to break the cycle of paying for similar damage caused by future floods.

In Louisa Levee District 8, the damage costs ranged up to \$3,000 per acre. The landowners in the district were tired of fighting the Iowa River. As a result, most were receptive to the EWRP easement concept and some wanted to be bought out. The Soil Conservation Service (now the Natural Resources Conservation Service) formed a task force of interested groups and agencies to discuss the possibility of a purchase that would give maximum revenue to landowners and still save taxpayer dollars.

A unique financing package was developed by combining EWRP easement payments and additional funds to equal a purchase price that landowners would accept. This gave maximum revenue to landowners and still cost 50 percent less than what repairing the damaged levee and paying for lost crops and future subsidies would have cost.

MILESTONES

- *Cooperative agreement signed between the Soil Conservation Service, the Fish and Wildlife Service, and the Iowa Natural Heritage Foundation.*
- *Commitment by the Fish and Wildlife Service to manage the restored wetlands.*
- *Farmers given choice of cash buy-out or like-kind exchanges of land which required a total of 27 real estate transactions.*
- *The damaged Levee District 8 and Drainage District 22 permanently removed.*
- *Horseshoe Bend Division was created from 2,600 acres of the former Louisa Levee District 8 and added to the Mark Twain National Wildlife Refuge.*
- *Restored area proves to be a beneficial flood storage site during the spring rains in 1995.*

WHAT WE LEARNED

We were able to successfully restore a floodplain conversion area in a very short period of time at a cost savings to the government. One of the reasons we did is that in our buy-out plan we firmly believed that the farmers must receive a fair price for their lands. All offers were made, therefore, based on a consistently applied formula. By sticking to this strategy, individual negotiations were avoided. We also avoided time costly, unnecessary, or duplicative government regulations by having a private (versus government) organization manage acquisition and financing of the project.

Another reason for our success was the commitment and cooperation of all of the involved partners. By working together, the partners were able to implement imaginative initiatives. To do so required flexibility within each organization and a clear focus on the goals, not the procedures, of the project.

Throughout the development of the project, communications were an important aspect. It was important to have a good supply of brochures and high quality maps to distribute to landowners, the press, other agencies, and individuals. These pieces helped to manage the "rumor mill" that inevitably surrounds any buy-out proposal.

OUR PARTNERS

USDA Soil Conservation Service (renamed the Natural Resources Conservation Service)

The SCS initiated the project and provided most of the funding through the Emergency Wetland Reserve Program (EWRP). They handled implementation of the EWRP easement and wetland reserve plans of operation and completed necessary land surveys and flood damage evaluations.

US Fish and Wildlife Service (USFWS)

USFWS conducted environmental assessment and impact studies and provided funds to purchase land and secured title evidence and title opinions. They also acquired the remaining fee title interest after placement of the EWRP easements. USFWS currently manages the 2,600-acre national wildlife refuge.

Iowa Natural Heritage Foundation (INHF)

INHF was the project coordinator. Staff met with landowners to explain the proposal, evaluated the land, devised the buy-out plan, negotiated sales, and managed grant funds used to finance purchases. INHF also developed a project timeline to ensure that all public and private participants were fulfilling their responsibilities.

National Fish and Wildlife Foundation (NFWF)

NFWF provided a matching grant that was used as a revolving fund so that land payments could be quickly made to landowners. This grant was matched by The Conservation Fund.

Iowa Emergency Management Division

This agency helped redirect FEMA funds designated for repairing the levee to be used as an alternative plan in the buy-out program.

Pheasants Forever

Eliciting support from five local chapters, Pheasants Forever made a financial donation that was used for the purchase of lands.

Contact

BRUCE G. MOUNTAIN

Iowa Natural Heritage Foundation

505 Fifth Avenue, Suite 444

Des Moines, IA 50309

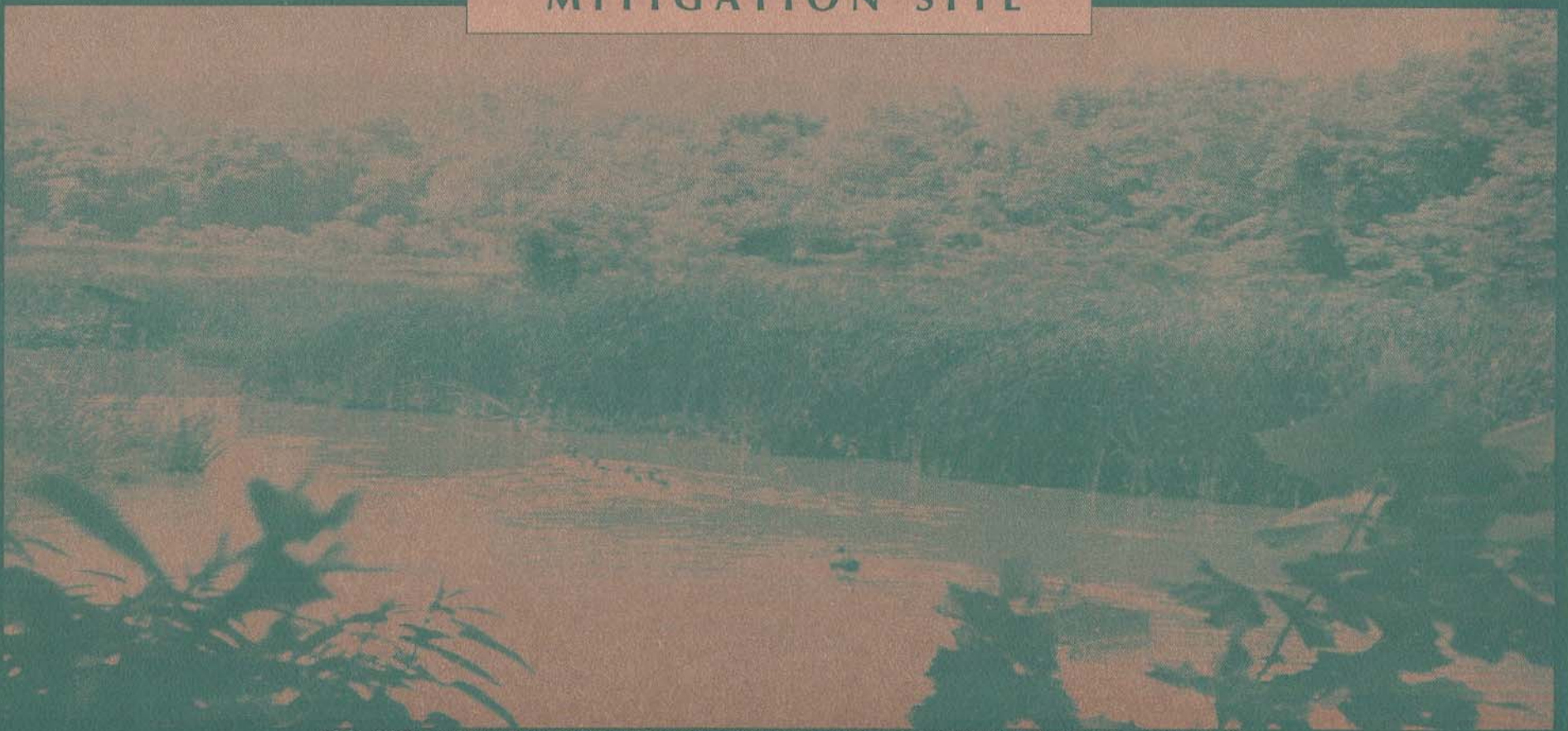
515.288.1846

Construction of transportation facilities leads to mitigation for wetlands.

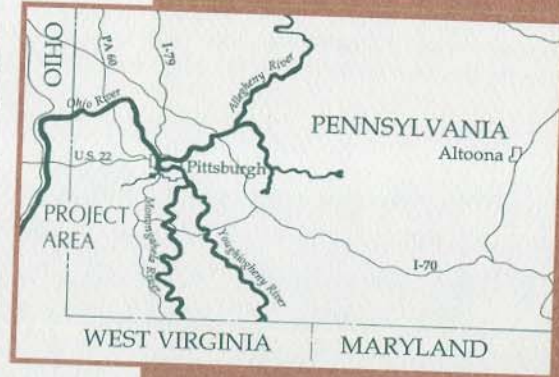
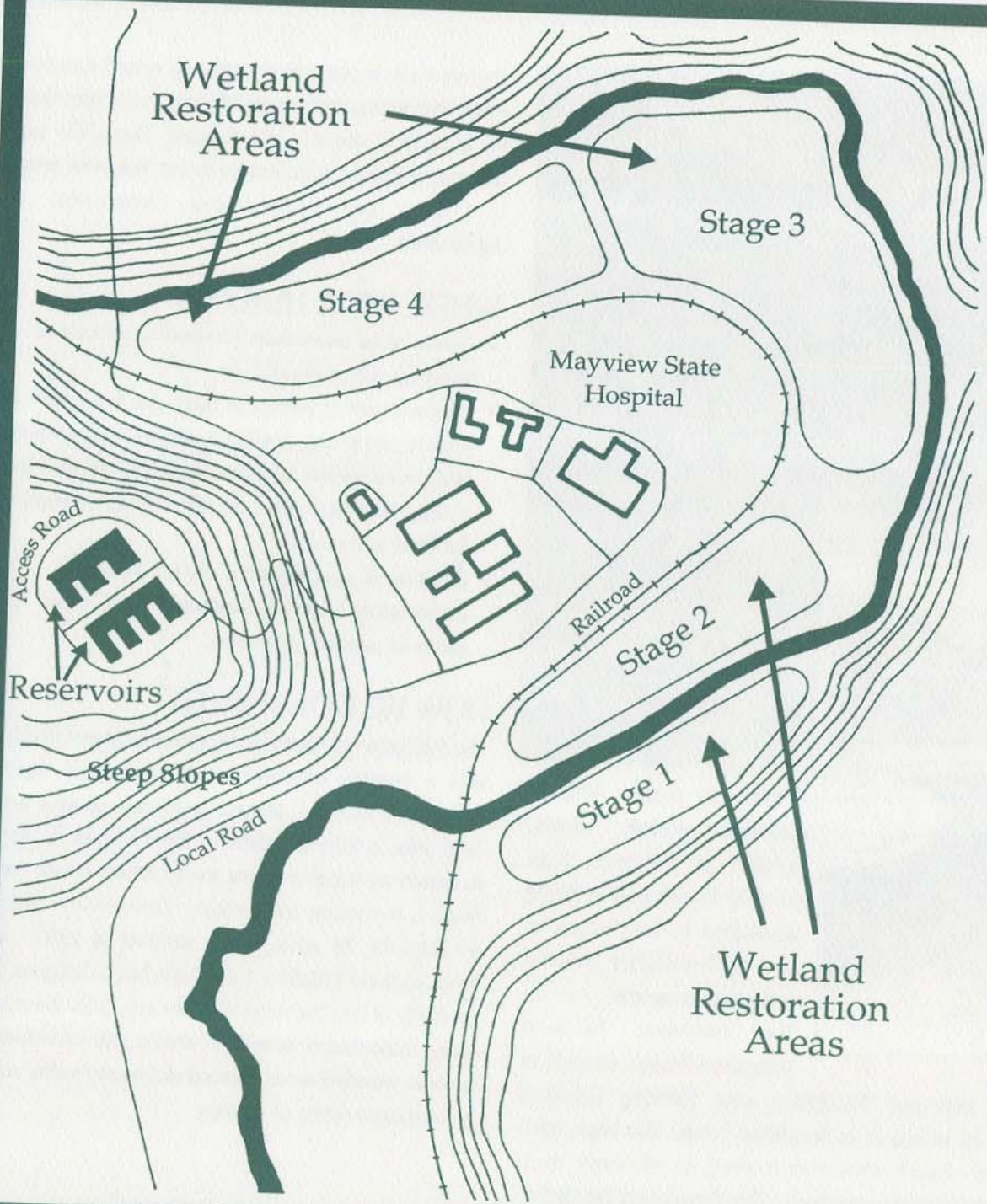
MAYVIEW WETLAND

MITIGATION SITE

PENNSYLVANIA

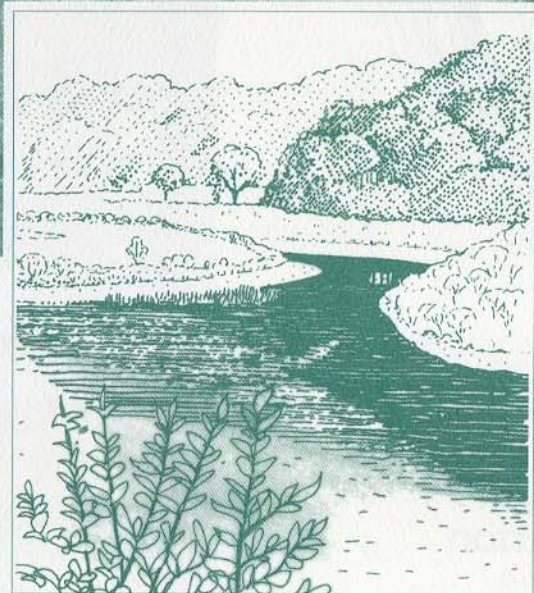
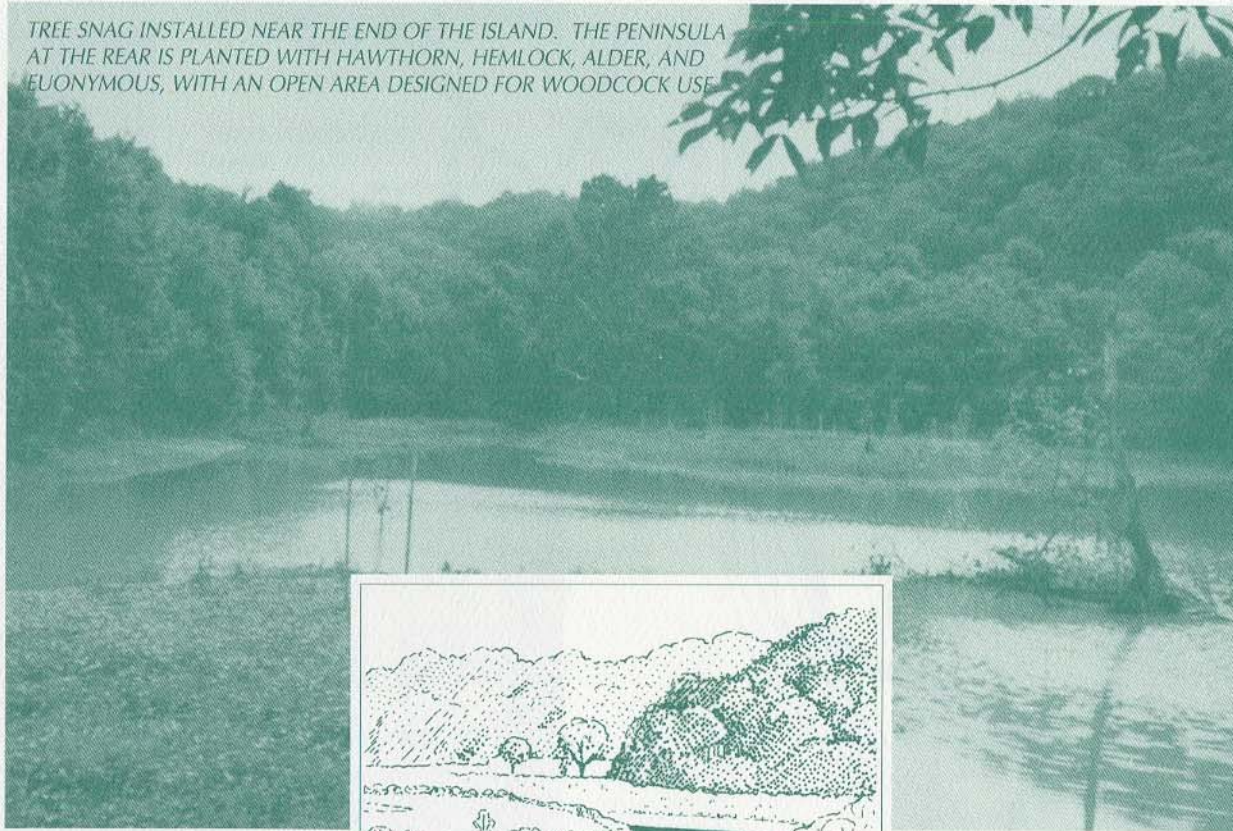


POOL OF THE WETLAND CREATION AREA WITH GOOSE AND WOOD DUCK HABITAT VISIBLE NEAR THE ISLANDS.



- ✓ FLOOD LOSS REDUCTION
- FLOW CONTROL
- STREAMBANK STABILIZATION
- RESTORATION
- FISHERIES IMPROVEMENT
- ✓ RECREATION
- ✓ NATURAL HAZARD MITIGATION
- ✓ WETLAND ENHANCEMENT
- ✓ HABITAT IMPROVEMENT
- CULTURAL RESOURCE ENHANCEMENT
- ECONOMIC REVITALIZATION
- ENVIRONMENTAL EDUCATION

TREE SNAG INSTALLED NEAR THE END OF THE ISLAND. THE PENINSULA AT THE REAR IS PLANTED WITH HAWTHORN, HEMLOCK, ALDER, AND EUONYMOUS, WITH AN OPEN AREA DESIGNED FOR WOODCOCK USE.



WHAT WE WERE FACING

During the construction of Interstate 279 through southwestern Pennsylvania, 12 acres of wetlands were filled. When the Southern Expressway was built, 20 acres were filled. For every acre of wetland that is filled, the Pennsylvania Department of Transportation (PennDOT) is required to design, construct, and monitor replacement wetlands. Mayview is a 65-acre parcel of land through

an extensive floodplain area, flanking Chartiers Creek in one of its horseshoe bends. This large, open and relatively level area is along an otherwise steep and forested watershed. The department needed a

which a major stream, Chartiers Creek, flows. Subject to frequent, high velocity flooding, it is being developed in four stages as part of PennDOT's wetland mitigation program.

The Mayview Wetland Mitigation Project consists of

site where its replacement wetlands would function. After convincing regulatory officials that a preselected mitigation site was not feasible, PennDOT was ultimately able to acquire title to the Mayview property from the Pennsylvania Department of Agriculture.

WHERE WE'RE HEADING

- Detention of more than 240 million gallons of water on site at flood stage.
- Improvement of habitat through the placement of underwater snags, nesting boxes for various birds and cavity nesters and bats, nesting platforms for various mammals, and the selection of vegetation for food and cover.
- Creation of a recreational site for wildlife observation, scientific exploration, and other forms of passive recreation.

HOW WE GOT STARTED

The mitigation program for Mayview has been divided into a number of construction phases or stages. Completed in 1992, Stage I, a 15-acre diverse wetland area, is fully functional. The 12 acres of Stage II, which are located across the Chartiers Creek from Stage I, is nearing completion. Construction began on Stage III, 36 acres, in the summer of 1995. All three wetland creation areas have been designed to carefully fit into the natural landscape, fully incorporating important or sensitive existing natural features such as wooded areas, natural drainage swales, and groundwater seeps or springs.

MILESTONES

- *Archeological dig (late Woodland period hunting or seasonal camp) featured on local cable television station and visited by 800 elementary and middle school students.*
- *Construction of an interpretative trail (with modifications for the visually impaired) which includes two observation decks for wildlife observation.*
- *Construction of duck and geese nesting forms/ platforms and houses for bats and purple martins.*
- *Created flood storage capacity for 63 million gallons of water.*
- *Received state's 1991 Design in Excellence Award.*
- *Received 1995 Tom Lee State Award for Excellence from the Association of State Floodplain Managers.*

WHAT WE'RE LEARNING

We discovered that several items we had planned for had to be readjusted during actual construction. One discovery was the lack of an extensive, dense clay area in the bank separating Chartiers Creek and the proposed wetland site. As a result, we had to create an alternative hydrologic link to the creek. This was done by providing a small channel and a weir structure to impound water in the wetland basin. In addition, several small permanent springs emanating from the opposite hillside were captured and piped into the wetland for supplemental water input.

We also found that original site plans called for the interpretative trail to cut through a swath of mature hardwood trees. We increased the trail's slope to meander the centerline around significantly large trees. At another location, an archeological study area was discovered which we chose not to disturb. As a result, we created an unexpected upland area that now creates habitat diversity within the wetland itself.

In regard to the planting plans, we discovered that several species of aquatic plants became severely grazed by white tailed deer. Trial and error led to the use of larger plant stock, which were found to be more tolerant of grazing and could continue to grow. Some plantings were also substituted with more suitable species. Overall we were surprised by the vigorous proliferation of native wetland plant species throughout the new wetland. This result may lead to a reexamination of the need to install numerous plants into a created wetland system. If suitable wetland hydrological conditions are achieved, high density plantings may be unnecessary.

OUR PARTNERS

Pennsylvania Department of Transportation (PennDOT)

PennDOT is the primary project planner. As part of its mitigation commitments, PennDOT must monitor all constructed wetlands for five years and remediate for any failures. This involvement will guarantee successful wetland enhancement.

Supporting Agencies

The following agencies participated in the project through issuance of permits and/ or conducting technical reviews:

Pennsylvania Department of Environmental Protection

US Army Corps of Engineers

US Environmental Protection Agency

US Fish and Wildlife Service

Pennsylvania Fish and Boat Commission

Pennsylvania Game Commission

Pennsylvania Historical and Museum Commission

Allegheny County Conservation District

Contact

PATRICIA REMY

PennDOT

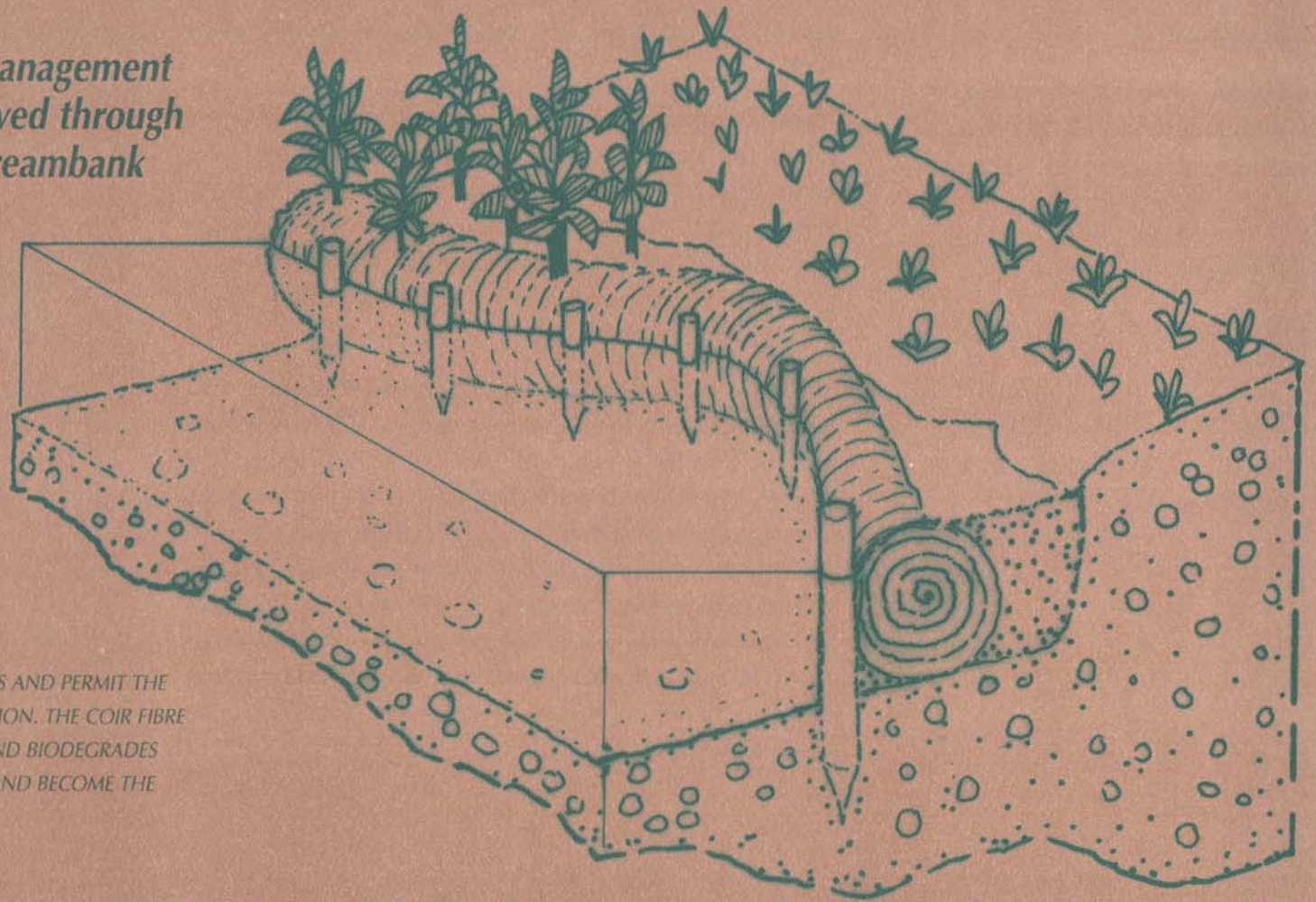
45 Thoms Run Road

Bridgeville, PA 15017

412.429.5084

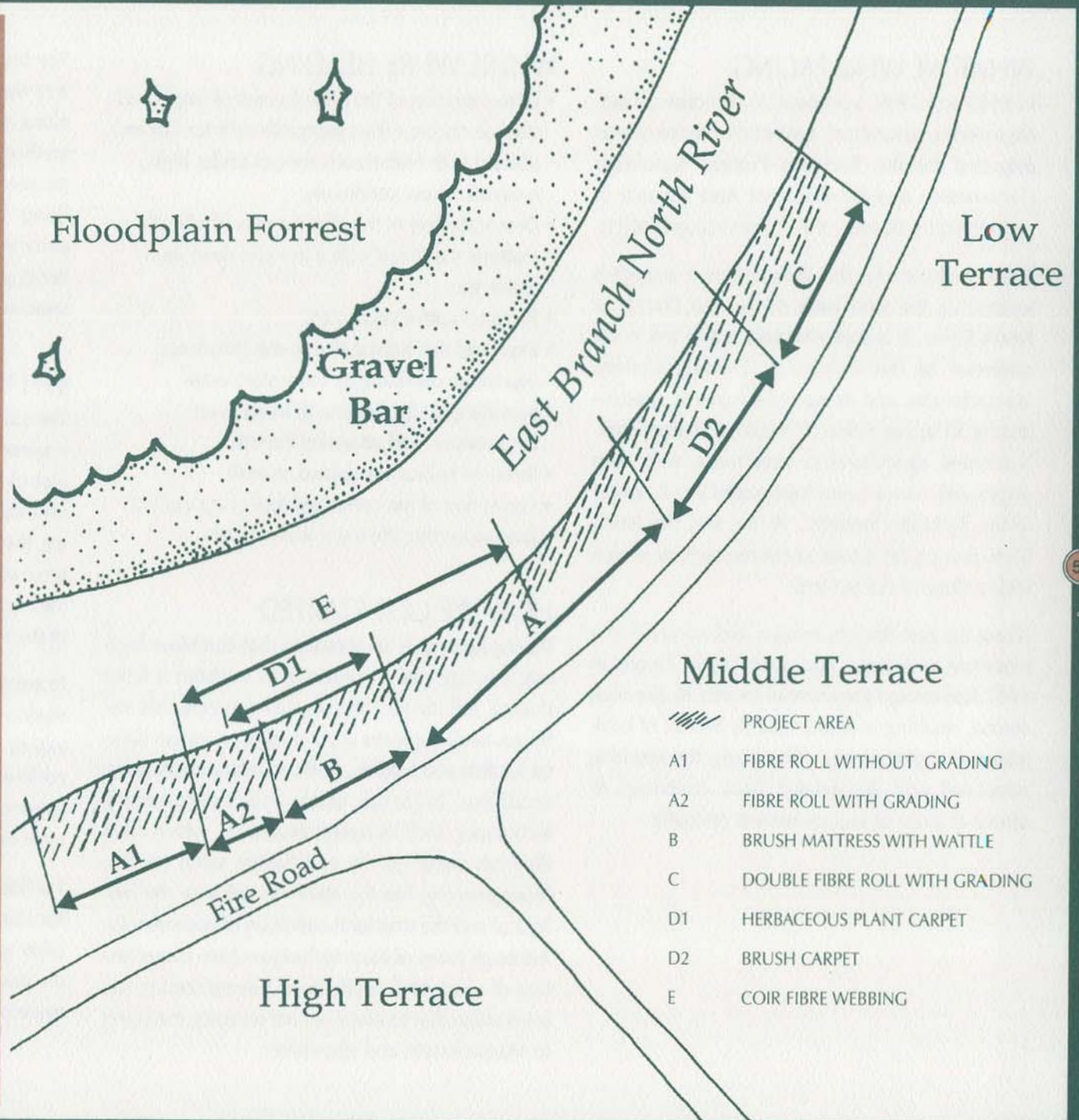
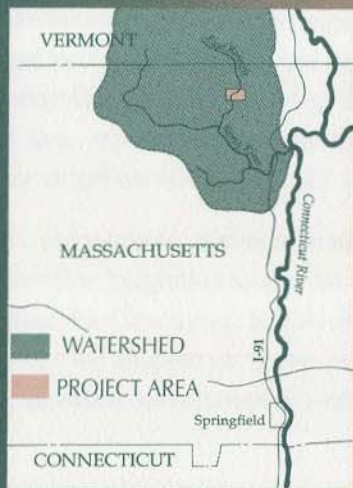
NORTH RIVER STREAMBANK

Multiple river management objectives achieved through cost-effective streambank treatments.



FIBRE ROLLS STABILIZE BANKS AND PERMIT THE ESTABLISHMENT OF VEGETATION. THE COIR FIBRE ACCUMULATES SEDIMENT AND BIODEGRADES AS PLANT ROOTS DEVELOP AND BECOME THE STABILIZING ELEMENT.

- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- ✓ STREAMBANK STABILIZATION
- ✓ RESTORATION
- ✓ FISHERIES IMPROVEMENT
- RECREATION
- ✓ NATURAL HAZARD MITIGATION
- WETLAND ENHANCEMENT
- ✓ HABITAT IMPROVEMENT
- CULTURAL RESOURCE ENHANCEMENT
- ECONOMIC REVITALIZATION
- ENVIRONMENTAL EDUCATION



- ### Middle Terrace
- PROJECT AREA
 - A1 FIBRE ROLL WITHOUT GRADING
 - A2 FIBRE ROLL WITH GRADING
 - B BRUSH MATTRESS WITH WATTLE
 - C DOUBLE FIBRE ROLL WITH GRADING
 - D1 HERBACEOUS PLANT CARPET
 - D2 BRUSH CARPET
 - E COIR FIBRE WEBBING

WHAT WE WERE FACING

In 1989 and 1990, a proposal to demonstrate bioengineering streambank protection measures was prepared by the Berkshire-Pioneer Resources Conservation and Development Area Council in cooperation with four other conservation districts.

The site chosen for this demonstration project is located on the west bank of the East Branch of North River. It is approximately 2,400 feet north northeast of the Colrain in Franklin County, Massachusetts, and its watershed area is approximately 50 square miles. The land is predominantly forested, agricultural, or open space, with steep slopes and narrow valley topography that is typical in the Berkshire foothills. At the site, the North River is a coarse gravel to cobble-bedded stream with a slope of 0.5 percent.

Along the East Branch, erosion had occurred at a moderate to extreme rate since 1985. Floods in 1987 had caused the channel to alter its previous course, resulting in approximately 50 feet of bank retreat that year alone. Afterwards, the resulting steepened and unvegetated bank continued to retreat at a rate of four to five feet annually.

WHERE WE'RE HEADING

- Demonstration of the effectiveness of single and stacked coconut fiber geotextile rolls (or fascine) planted with herbaceous species under high hydraulic stress conditions.
- Demonstration of the effectiveness of a brush mattress stabilized with a live and dead stem wattle toe.
- Restored native vegetation.
- Improved fish habitat due to the introduced vegetation overhanging the water's edge providing shade, helping to lower water temperature, and attracting insects.
- Restored habitat for upland animals.
- Prevention of the continued loss of agricultural land protecting the town water supply.

HOW WE GOT STARTED

Bioengineering is an approach that combines biology, ecology, and engineering to establish a functioning, self-maintaining vegetative system that stabilizes land, improves water quality, enhances habitat for fish and wildlife, and can adapt to changing conditions. In contrast to conventional engineering techniques, such as riprap revetments, which often diminish water quality and habitat value on site, bioengineering has the ability to enhance the biological and the structural condition of streambanks. Although many of these techniques have a long history of successful application, bioengineering has been unfamiliar to many natural resource managers in Massachusetts and elsewhere.

The bioengineering treatment of the East Branch was designed to demonstrate a variety of methods along approximately 500 lineal feet of bank. These methods were to be evaluated based on their comparative effectiveness in mitigating erosion and flood damage hazards, cost, and ecosystem enhancement. The treatments employed were designed to maintain stability during peak floods (reaching 12 ft/s).

WHAT WE'RE LEARNING

The summer following the first installation of bioengineering materials was exceedingly dry, and record-low precipitation exposed the plantings to unusually high stress. Due to these setbacks during the first growing season, herbaceous species were replanted at the site. Fortunately, the cost of the replantings amounted to less than five percent of the total project cost.

In areas where both brush matting and prevegetation brush carpet were installed, however, the woody vegetation was healthy and did not require additional planting or maintenance. Despite the stressful conditions for vegetation and high hydrolic stresses, the bank remained highly stable.

Traditional bioengineering approaches have focused on the use of live cuttings of willows and other woody species that sprout and root easily. In the past 20 years, newer techniques have made it more practical to use herbaceous plants as well,

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MILESTONES

- *Modification of original design substituting coir fiber blankets prevegetated with woody shrubs for portions of the original brush mattress.*
- *Minimized grading and bank reshaping to preserve existing trees and sections of dense shrub which appeared stable.*
- *Extensive regrading on areas with minimal vegetation.*
- *Installation of bioengineering materials within the original estimated budget and within two weeks of the planned schedule.*
- *Two weeks after installation, plantings appeared in excellent condition and seeded areas germinated, showing uniform cover.*
- *Successful prevention of notable erosion in the first year after the installation, following a summer of record drought and a winter of record discharge.*
- *Two years after installation, vegetation cover is greater than a hundred percent, with a diversity of native species providing herbaceous, shrub, and sapling cover.*

OUR PARTNERS

Bestmann Green Systems, Inc.

Bestmann Green provided overall project design and implementation.

US Environmental Protection Agency (EPA)

The EPA provided funding for the project under the 319 Grant Program.

Supporting Agencies and Organizations

The following organizations assisted with plan development by providing input, suggestions, and recommendations.

*Berkshire-Pioneer Resource Conservation and
Development Area Council*

Franklin, Hampden and Hampshire

Conservation District

*Massachusetts Department
of Environmental Protection*

New England Environmental

Worcester County Conservation District

Contact

WENDI GOLDSMITH

Bestmann Green Systems

53 Mason Street

Salem, MA 01970

508.741.1166

VIEW ACROSS THE NEW WETLAND AREA IN EARLY SPRING.

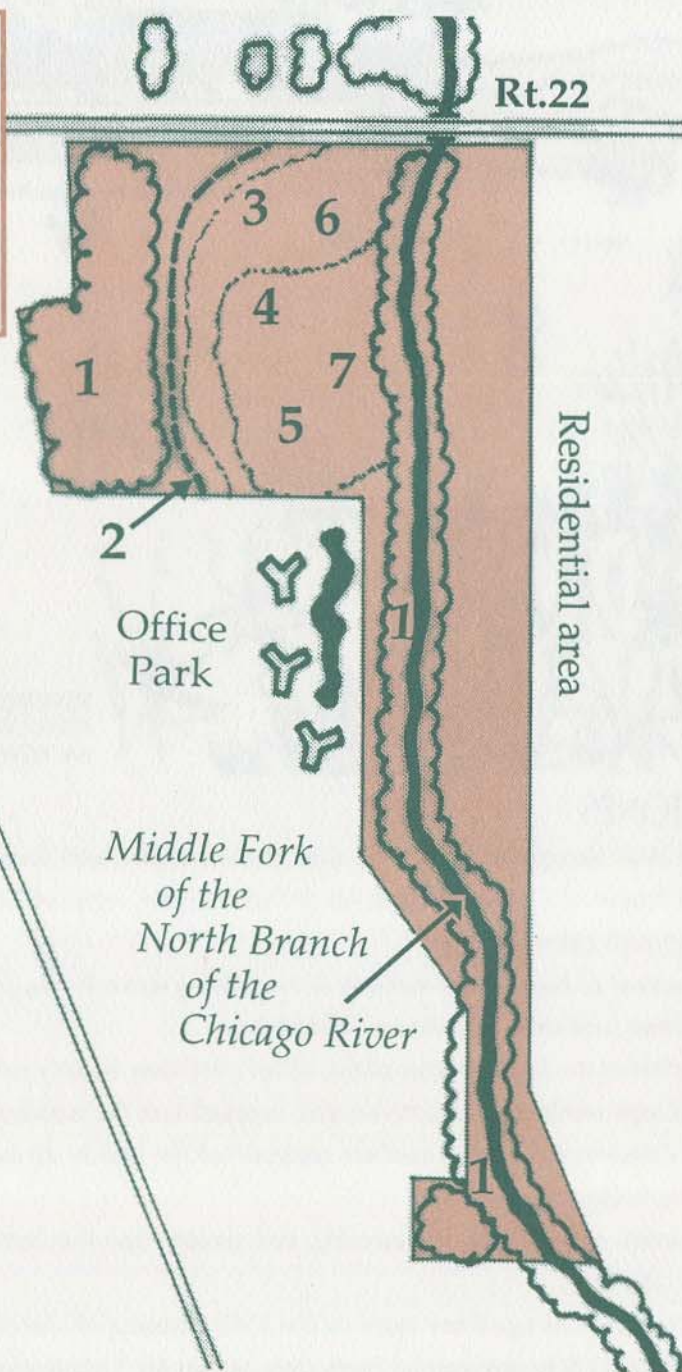
- ✓ FLOOD LOSS REDUCTION
- FLOW CONTROL
- STREAMBANK STABILIZATION
- ✓ RESTORATION
- FISHERIES IMPROVEMENT
- ✓ RECREATION
- NATURAL HAZARD MITIGATION
- ✓ WETLAND ENHANCEMENT
- ✓ HABITAT IMPROVEMENT
- CULTURAL RESOURCE ENHANCEMENT
- ✓ ECONOMIC REVITALIZATION
- ✓ ENVIRONMENTAL EDUCATION

ILLINOIS

PRAIRIE WOLF SLOUGH

DEMONSTRATION PROJECT

Innovative multi-purpose approaches used to enhance and restore Chicago River's North Branch.



WHAT WE WERE FACING

Thirty miles north of Chicago in southeastern Lake County is the Middle Fork of the North Branch of the Chicago River. It flows through an orphaned farm field in a suburban area immediately adjacent to a retail shopping mall.

The project encompasses 42 acres of former wetlands, prairie, and savanna complex. The site includes 28 acres of drained farm land to be restored to wetlands and prairie and 14 acres of degraded woodlands to be restored to savanna.

Owned by the Lake County Forest Preserve District, the site was identified a few years ago for trail location as a part of the Greenway Plan by the Northeastern Illinois Planning Commission and Open Lands, a regional open space advocacy organization.

WHERE WE'RE HEADING

- Restoration of wetlands hydrology, clearing non-native vegetation, and planting wetlands, prairie, and savanna vegetation.
- Enhanced ecosystems that provide habitat for wildlife.
- Improved water quality water.
- Disabling of drainage tile and construction of a water control structure that will decrease sedimentation entering the river.
- Moderation of stormwater flows.
- New environmental education opportunities for nearby schools and park districts.
- Construction of a loop trail with interpretive signage and a connecting trail between the wetlands, a high school, and a local park district property.
- Permanent protection of open space.

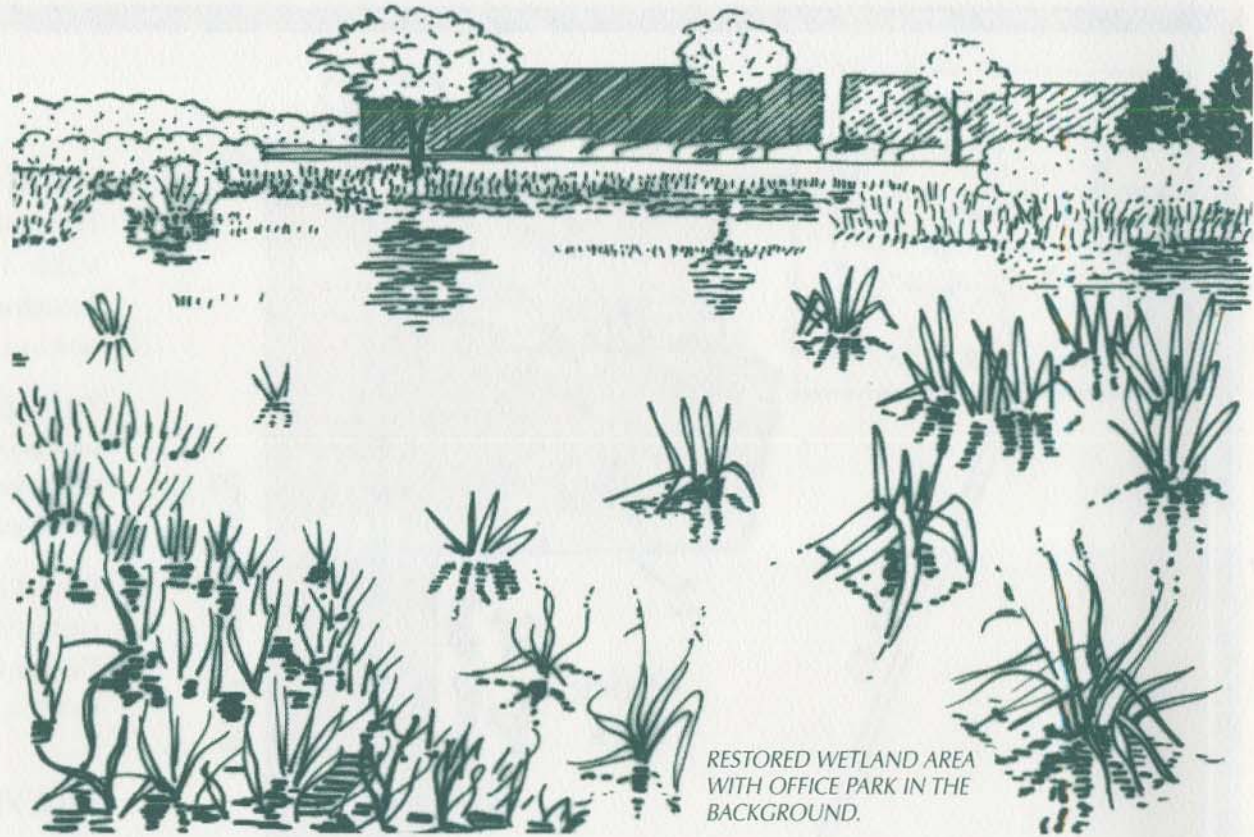
HOW WE GOT STARTED

In 1993, as a part of the ChicagoRivers Project, Friends of the Chicago River, the National Park Service, and other federal agencies conducted a major assessment of natural resources along the river corridor, documented public perception and usage, and began determining possible locations of locally based projects that would: improve water quality, wetlands, fisheries, open space, and wildlife habitat; and create new opportunities for environmental education, nature observation and outdoor recreation.

A major emphasis of ChicagoRivers is to direct efforts towards creation of community-led, hands-on river enhancement projects that develop leadership, river constituency, and educate the next generation of river advocates. ChicagoRivers has involved communities from the very beginning with project identification through planning, design, construction, and stewardship.

WHAT WE'RE LEARNING

Accomplishing a collaborative project with several government agencies is very rewarding but requires a major commitment from all of the parties involved. There is always a tendency to underestimate the amount of time and communication needed to establish such a collaboration and keep it moving forward. Yet we have found, without question, that collaborations break down barriers, overcome



RESTORED WETLAND AREA WITH OFFICE PARK IN THE BACKGROUND.

MILESTONES

- *Prairie Wolf Slough Project named after an early settler who lived near the site.*
- *Establishment of a coalition made up of federal, state, regional, and local governments working in concert with citizen groups.*
- *Involvement of high school students in monitoring water levels, planting vegetation during site restoration, and using the site for field biology.*
- *Enlistment of the local chapter of the Illinois Audubon Society volunteers to monitor wildlife.*
- *AmeriCorps workers cleared non-native vegetation in the wooded portion of the site.*
- *Youth Conservation Corps members constructed the trail in the wooded area by building boardwalks and improving the ecology.*
- *Completion of the design, engineering, and construction that reestablishes the wetlands hydrology on the site.*
- *Friends of the Chicago River received the 1995 National Wetlands Award from the Environmental Law Institute and US Environmental Protection Agency for "Outstanding Program Development."*

fragmentation of services, and establish new productive linkages between the agencies and the communities they serve.

We know well the extraordinary importance of approaching communities, and their governments, with sensitivity. Through this approach it is possible to learn about their issues and concerns. Only after one sees the world through the eyes of the community does one earn the right to promote one's own agenda.

One of the most powerful ways to create committed leadership and interest in the rivers and associated ecosystems is hands-on restoration and education. In the Chicago metropolitan area the largely voluntary prairie restoration movement has provided a model for this project. Once a person has spent time cutting brush, collecting and planting seeds, planting new vegetation, and watched the awe-inspiring rejuvenation of a wetlands (prairie or savanna), his or her life is changed forever.

One observation concerns funding and grants. Although the project partners have been highly successful in obtaining grants, a mismatch developed between the specific items that the grants will fund and the needs of the project. For example, it has been much easier to obtain funding for the wetlands restoration component than for the trails and bridge. Part of the difficulty was that grant applications were submitted long before the details and cost factors for project components were accurately known.

OUR PARTNERS

Friends of the Chicago River

The Friends are providing overall project coordination, fund raising, community involvement, supervising volunteers, and coordinating the education programs.

Illinois Environmental Protection Agency (IEPA)

The IEPA 319 Grant Program is providing funding for the water quality components of the project.

Lake County Forest Preserve District

The Lake County Forest Preserve District is the landowner of the site. They are providing staff assistance for the planning, design, and construction of the project; accepting and administering certain grants; administering the Youth Conservation Corps work program; working with volunteers for planting the vegetation; and providing for long-term maintenance of the site.

National Park Service's Rivers, Trails, and Conservation Assistance Program (RTCA)

RTCA is providing technical assistance for program planning and implementation, funding and grants, trails and bridges, and public involvement.

USDA Natural Resources Conservation Services (USDA-NRCS)

NRCS has surveyed the soils and site, created a topography map, installed the piezometers, and assisted in the coordination of the AmeriCorps Volunteers. They also provided design and engineering drawings for the water control structures and water detention berms.

Stormwater Management Commission of Lake County (SMC)

SMC conducted an assessment of hydrology for the project, located the site utilities, assisted with obtaining the necessary permits, and assisted in the supervision of construction of the water control structure and the earthen berms. SMC also provided two grants for the project.

US Fish and Wildlife Service, Chicago Metro Wetlands Office (USFWS)

USFWS provided for a survey and mapping of the subsurface drain tiles, did the preliminary site revegetation plan, developed the list of native plants and secure sources, and assisted in establishing a program for the biological monitoring of the site. They will also assist in the evaluation of the project, conduct seminars and help supervise volunteers for planting vegetation, and train grade school and high school teachers.

Urban Resources Partnership (URP)

URP is providing funds for the project through its innovative 50 percent matching funds grant program which is designed to support grass-roots natural resource enhancement efforts in four urban areas.

Contact

DAVID RAMSAY

Friends of the Chicago River
407 South Dearborn Street
Suite 1580
Chicago, IL 60605
312.939.0490

SANTA ROSA CREEK

*Flood protection for adjacent landowners
also benefits declining steelhead population
and other wildlife.*

CALIFORNIA

*"Every child should have mudpies,
grasshoppers, water-bugs, tadpoles, frogs,
...trees to climb, brooks to wade, water lilies,
...any child who has been deprived
of these has been deprived of the best part
of his education."*

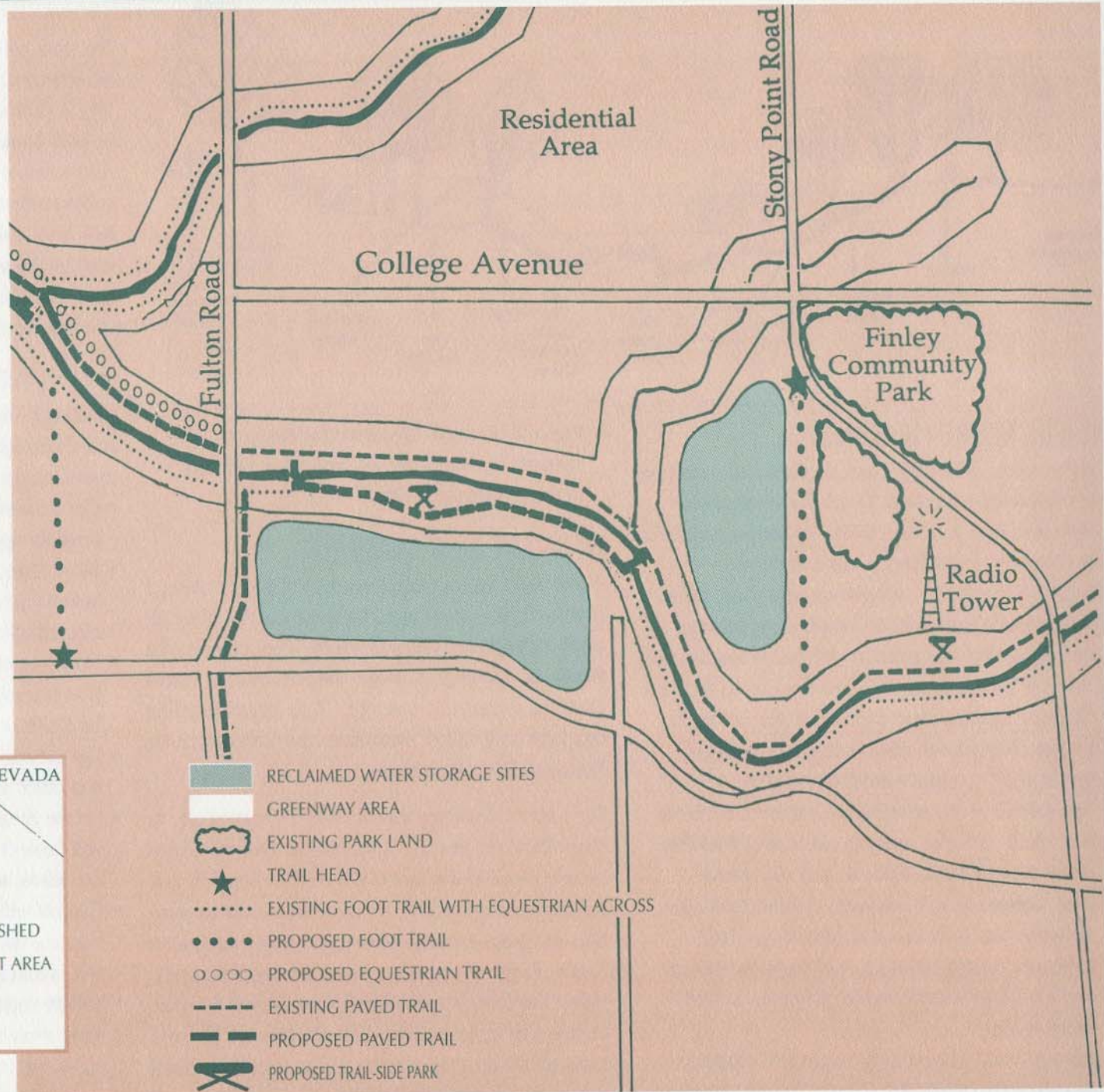
LUTHER BURBANK

WHAT WE WERE FACING

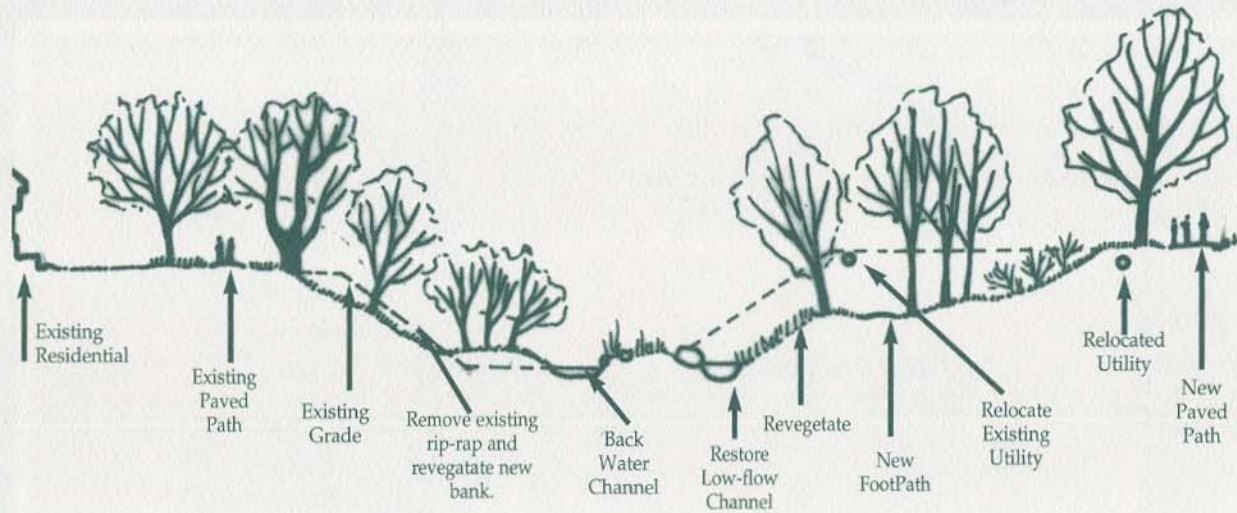
Santa Rosa Creek, a major tributary in the Russian River watershed, travels 22 miles from its headwaters in the mountains that separate Napa and Sonoma counties to its confluence with the Laguna de Santa Rosa. The creek drains over 50,000 acres of mixed-evergreen forest, chaparral, agriculture, and the city of Santa Rosa (population 128,000), located 50 miles north of San Francisco.

Channelization along seven miles of the creek has eliminated much of the steelhead nursery habitat, dramatically reducing population of the prized sport fish. Lack of shade, cover, in-stream structures, riffles, and pools make the creek inhospitable for juvenile steelhead. Creekside development has also prevented people from accessing the creek and from enjoying the natural environment.

- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- ✓ STREAMBANK STABILIZATION
- ✓ RESTORATION
- ✓ FISHERIES IMPROVEMENT
- ✓ RECREATION
- NATURAL HAZARD MITIGATION
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- ✓ ENVIRONMENTAL EDUCATION



- RECLAIMED WATER STORAGE SITES
- GREENWAY AREA
- EXISTING PARK LAND
- TRAIL HEAD
- EXISTING FOOT TRAIL WITH EQUESTRIAN ACROSS
- PROPOSED FOOT TRAIL
- PROPOSED EQUESTRIAN TRAIL
- EXISTING PAVED TRAIL
- PROPOSED PAVED TRAIL
- PROPOSED TRAIL-SIDE PARK



WHERE WE'RE HEADING

- Preservation of healthy creek sections and restoration of channelized sections. This includes removing cemented rock armoring, widening and reconfiguring the channel, and adding pools and riffles.
- Enhanced habitat for indigenous cold water fishes and for birds and small mammals using channel reconfiguration, revegetation with native species, and instream habitat structures (boulders, tree parts, etc.)
- Maintain existing flood protection and utilize an energy dissipater to slow water merging from the "tunnel" to reduce erosion potential.
- Acquisition of a greenway that improves access to the creek, provides multiple paths, and links the urban area to local, regional, and state parks. (The Greenway will ultimately connect with the 400-mile San Francisco Bay Area Ridge Trail.)
- Increased opportunities for environmental education for school science and art programs, as well as recreationists.
- Establishment of interpretive signs by volunteers describing the creek's importance to Native Americans.

- Preparation of guidelines for the design of signage, lighting, benches, and other furniture in the greenway corridor.

HOW WE GOT STARTED

A few years ago, several people took a walk along a channelized portion of Santa Rosa Creek. They all agreed that something was wrong. They convened a group of individuals who, despite diverse backgrounds, shared this concern. They began meeting regularly and called themselves the Committee for Restoring Santa Rosa Creek.

The Creek Committee then invited the community to share their dreams for Santa Rosa's creeks. Some people recalled the "good old days" when fish and wildlife were abundant, the creek was easily accessible, and people could swim in it. Some compared Santa Rosa to creeks in other communities. When the committee had sufficient interest from the community at large, they brought their vision of a restored creek environment to local governmental agencies. There they asked for a Master Plan.

The plan calls for the creek's cross-sectional areas to be enlarged, increasing the flood carrying capacity. This is achieved by removing soil from the top of one or both banks. Then the extra capacity will be filled with native trees, shrubs, rocks, and large tree parts to enhance the aquatic and riparian habitats. Restoration will also enhance the natural creek characteristics such as the pool-riffle sequence, undercut banks, and other aquatic niches. The project was outlined as a cooperative effort of citizens and government agencies.

WHAT WE'RE LEARNING

Creating a multiple-purpose greenway can be both fun and challenging. Here are our suggestions for a successful program:

- Get a diverse group of citizens involved, including possible opponents (invite children, too).
- Build support from organizations and individuals before you ask the public agencies for their support; elected officials like a politically popular effort.
- Hold a public workshop to involve more people, gain support and let the vision of a restored creek be expressed.
- Get people to the creek by organizing creek walks and other activities that get the word out.
- Let the dream get bigger; new ideas will come that you haven't yet considered. Start with broad goals and ideas; refine them later.
- Consult with hydrologists or hydraulic engineers who are familiar with creek restoration techniques and practices.
- Initiate cooperative efforts to include creek restoration in city and county general plans and in capital improvement programs.
- Overcome obstacles one at a time.

MILESTONES

- *Unanimous adoption of the Santa Rosa Creek Master Plan by the City of Santa Rosa, the County of Sonoma, and the Sonoma County Water Agency in 1993.*
- *Established the Creek Implementation Advisory Committee, appointed by the Mayor of Santa Rosa, who are charged with implementing the plan.*
- *Constructed a trail winding through the riparian forest, bringing people close to the creek for three-quarters of a mile. In addition, two paved multiple-use paths and seven miles of walking paths have been finished, connecting the creek to the community.*
- *Received grant funding for the acquisition of four parcels for creekside parks and 6,600 lineal feet of easements for trails (this will create a continuous 10-mile trail system along and near the creek).*
- *Planted 1,500 native, riparian trees along Brush Creek, a major tributary to Santa Rosa Creek. The planting will benefit steelhead and rainbow trout by cooling warm water which enters Santa Rosa Creek in an area of spawning and rearing habitat.*

OUR PARTNERS

Local citizens and organizations

These are the people who initiated the project. They have held community creek events and public workshops, articulated the project vision, and participated as planning team members. They also formed the citizen group Committee for Restoring Santa Rosa Creek.

City of Santa Rosa

The city is a cosponsor of the Master Plan. This included providing project management, funding, and planning team members from the planning, parks, police, and transit departments. The city is actively implementing the plan through writing grant applications, creek design guidelines, planting trees, and overseeing a \$5.5 million restoration project. It is also acquiring creek-side properties from willing sellers with a \$1.4 million grant from the Sonoma County Agricultural Preservation and Open Space District.

Sonoma County

The county is a cosponsor of the Master Plan. This included providing funding and having members from the planning, parks, and sheriff's departments participate on the planning team.

Sonoma County Water Agency

This agency is a cosponsor of the Master Plan. They are represented on the planning team and have provided funding.

National Park Service's Rivers, Trails, and Conservation Assistance Program (RTCA)

RTCA provides technical assistance for program planning and implementation and participated as a member of the planning team.

California Department of Fish and Game

This agency provides technical assistance and was represented on the planning team.

Consultants

Consultants were planning team members and contributed technical expertise in land planning, landscape architecture, hydrology and geomorphology, ecology, civil engineering, public involvement, and environmental assessment.

Contact

FRANK KASIMOV
City of Santa Rosa
Department of Community Development
P.O. Box 1678
Santa Rosa, CA 95402
707.543.3258



CITIZENS PARTICIPATED IN THE COMMUNITY DESIGN AND PLANNING WORKSHOP KNOWN AS "TAKE PART".

STATEN ISLAND

- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- ✓ STREAMBANK STABILIZATION

- ✓ RESTORATION

FISHERIES IMPROVEMENT

- ✓ RECREATION

- ✓ NATURAL HAZARD MITIGATION

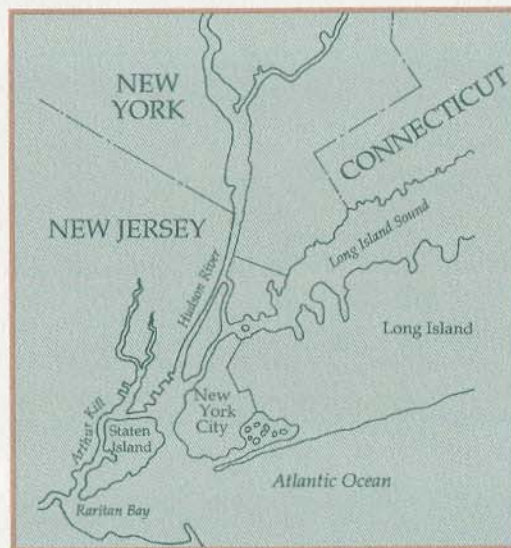
- ✓ WETLAND ENHANCEMENT

- ✓ HABITAT IMPROVEMENT

CULTURAL RESOURCE ENHANCEMENT

- ✓ ECONOMIC REVITALIZATION

- ✓ ENVIRONMENTAL EDUCATION







BLUEBELT DRAINAGE BASINS

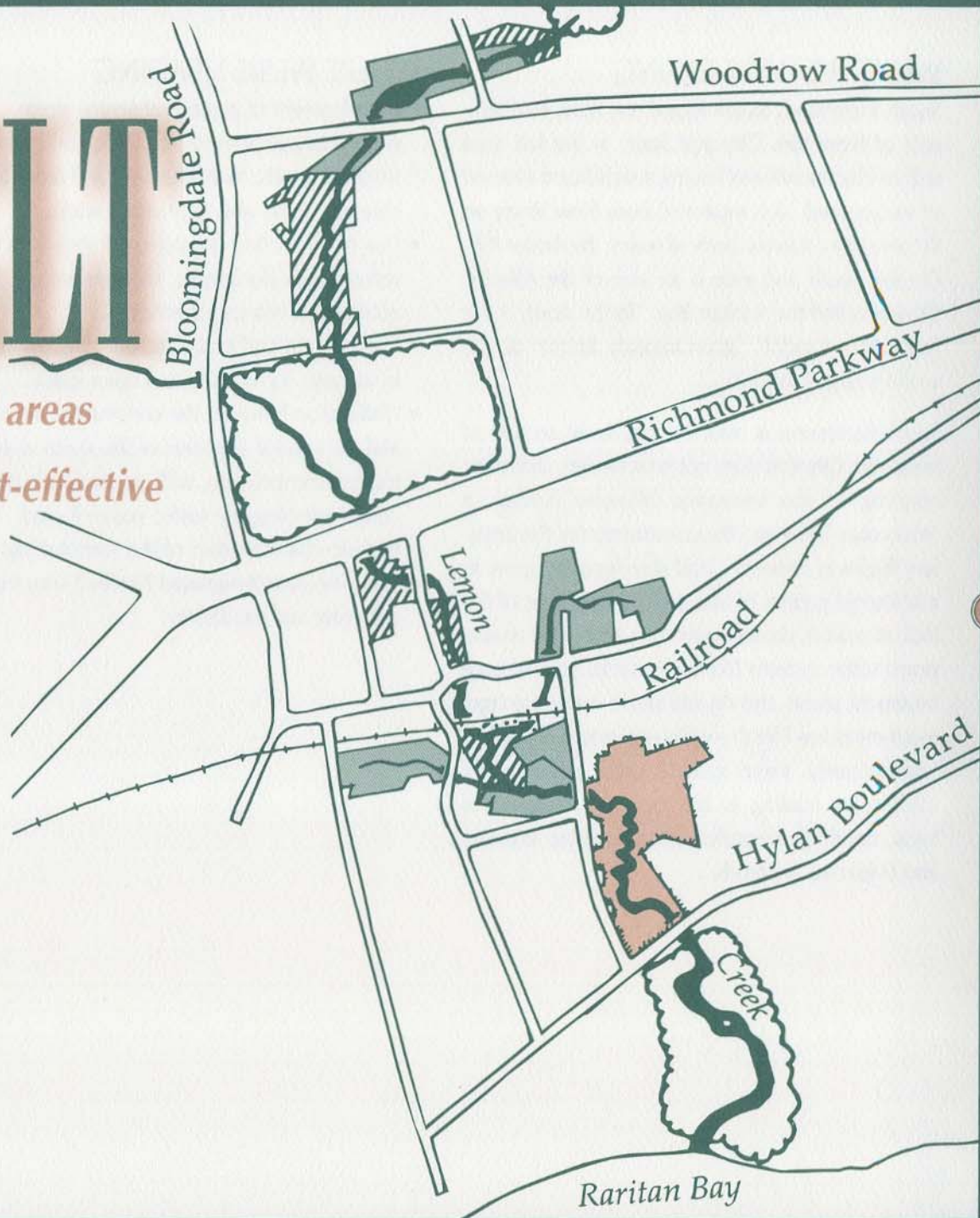
1. BUTLER MANOR
2. MILL CREEK
3. LEMON CREEK/SANDY BROOK
4. WOLFE'S POND
5. ARBUTUS CREEK
6. BLUE HERON
7. SWEET BROOK
8. RICHMOND CREEK



BLUEBELT

*Streams, ponds, and other wetland areas
used as ecologically sound and cost-effective
storm water management.*

-  NYC PARKLAND
-  NY STATE WETLAND PRESERVE
-  PRIVATELY OWNED DESIGNATED OPEN SPACE
-  BLUEBELT PROPERTY



WHAT WE WERE FACING

South Richmond, Staten Island, the most southerly part of New York City and State, is the last area within city boundaries having a significant amount of vacant land. It is separated from New Jersey on the west by a narrow body of water, the Arthur Kill. On the south and east is an arm of the Atlantic Ocean called the Raritan Bay. To the north is the Fresh Kills Landfill, ignominiously known as the world's largest landfill.

South Richmond is also the last, large section of New York City that does not have sewers. Since the opening of the Verrazano Narrows Bridge in November 1964 and the construction of the ancillary highway network, land development grew in a scattered pattern of low density. Because of the lack of sewers, development has employed on-site storm water systems like septic tanks and package treatment plants and on-site storm water management measures like dry-wells and retention basins. Unfortunately, these systems often prove to be inadequate leading to the current conditions of local flooding, degraded water quality, erosion, and impacted wetlands.

WHERE WE'RE HEADING

- Development of a comprehensive storm water management system which utilizes streams, ponds, and other wetland areas to channel, store, and filter storm water.
- Use of urban Best Management Practices to reduce peak discharges, improve water quality and enhance aesthetics.
- Preservation and enhancement of ecosystems in the area for wildlife and open space.
- Unification between the constructed elements and the natural elements of the storm water management system, with an emphasis on complementing the rustic, pastoral, and historic characteristics of the surrounding area.
- Securing state designated Bluebelt sites from dumping and vandalism.

HOW WE GOT STARTED

In 1975, the city enacted the Special South Richmond Development District, which is a special purpose zoning district to preserve the area's low density open character. To achieve the goals of preserving natural features such as ponds and streams, an Open Space Network (OSN) of nearly 700 acres was designated to remain in its natural state. It was determined that the OSN should be used as a storm water management system.

Following the creation of the OSN, the New York State Department of Environmental Conservation began regulating development in an extensive system of freshwater and tidal wetlands in South Richmond. During the 1980s, the state issued a series of maps for the freshwater wetlands on Staten Island which include the streams and ponds of importance for storm water management. The on-going regulatory program has resulted in the preservation of some wetland areas with significance for the overall drainage system.

In 1990, the New York City Department of Environmental Protection (DEP) created the Staten Island Bluebelt unit, and a major effort began to acquire wetland properties in order to complete the continuity of the stream corridors and other wetlands in the OSN. In 1995, DEP began redesigning the storm and sanitary sewer drainage plan to respect and utilize the area's natural features.

WHAT WE'RE LEARNING

We found that the benefits of Bluebelt acquisitions are multiplied by grouping them with other wetlands properties protected by state regulations. In addition, the Bluebelt assemblage is consolidated by including wetland properties taken by the city because of failure to pay real estate taxes and the land covered by mapped, but unbuilt, streets.

Similarly, when we linked the wetland acquisitions to savings in the construction of storm sewers, we were able to establish a strong economic and anthropocentric argument for wetland preservation.

This type of project requires a lot of outreach to property owners and flexibility. For neighboring landowners, we needed to explain the purpose of open space and other matters such as how to properly dispose of yard waste. During the public review process for the acquisitions, flexibility with those owners who had particular problems with the proposed acquisition of their parcels was critical. We were able to use partial fee simple acquisitions and conservation easements in these cases.

Finally, it has been vital to have political leadership at the highest levels of the city's government both for launching the project and now for sustaining momentum.

MILESTONES

- *Acquisition of 211 acres in the Bluebelt and scheduled acquisition of remaining 55 acres.*
- *Hiring of consultant to redesign drainage plan to incorporate the Bluebelt into the overall storm water management system.*
- *Establishment of a Citizens' Advisory Committee to comment on new drainage plan.*
- *Design and construction of a storm sewer system to keep a neighborhood pond adequately filled with water.*
- *Restored streambank through reconstruction of stone walls and installation of coconut fiber-covered gabions to support the banks, installation of coconut fiber rolls along streams' edges to anchor plants, and plantings of native trees, shrubs, and ground cover to hold soil in place.*
- *Enlistment of volunteers to organize cleanup and monitoring projects.*
- *Presentations for community groups and school children.*

OUR PARTNERS

New York City Department of Environmental Protection (DEP)

DEP is responsible for implementing the Bluebelt project, including identifying and acquiring land, designing and reviewing a new drainage plan, supervising construction, and managing properties for storm water management.

New York City Department of Parks and Recreation

This city agency will take jurisdiction of two Bluebelt areas to manage as park land. In addition, wetlands preserved in existing city parks will be used for storm water management.

New York City Department of City Planning

This department played an important role in developing the Bluebelt concept and creating a Designated Open Space zoning classification on Staten Island to protect natural areas. In addition, the Department of City Planning works with DEP to process requests for acquiring land for the Bluebelt.

Citizens' Advisory Committee

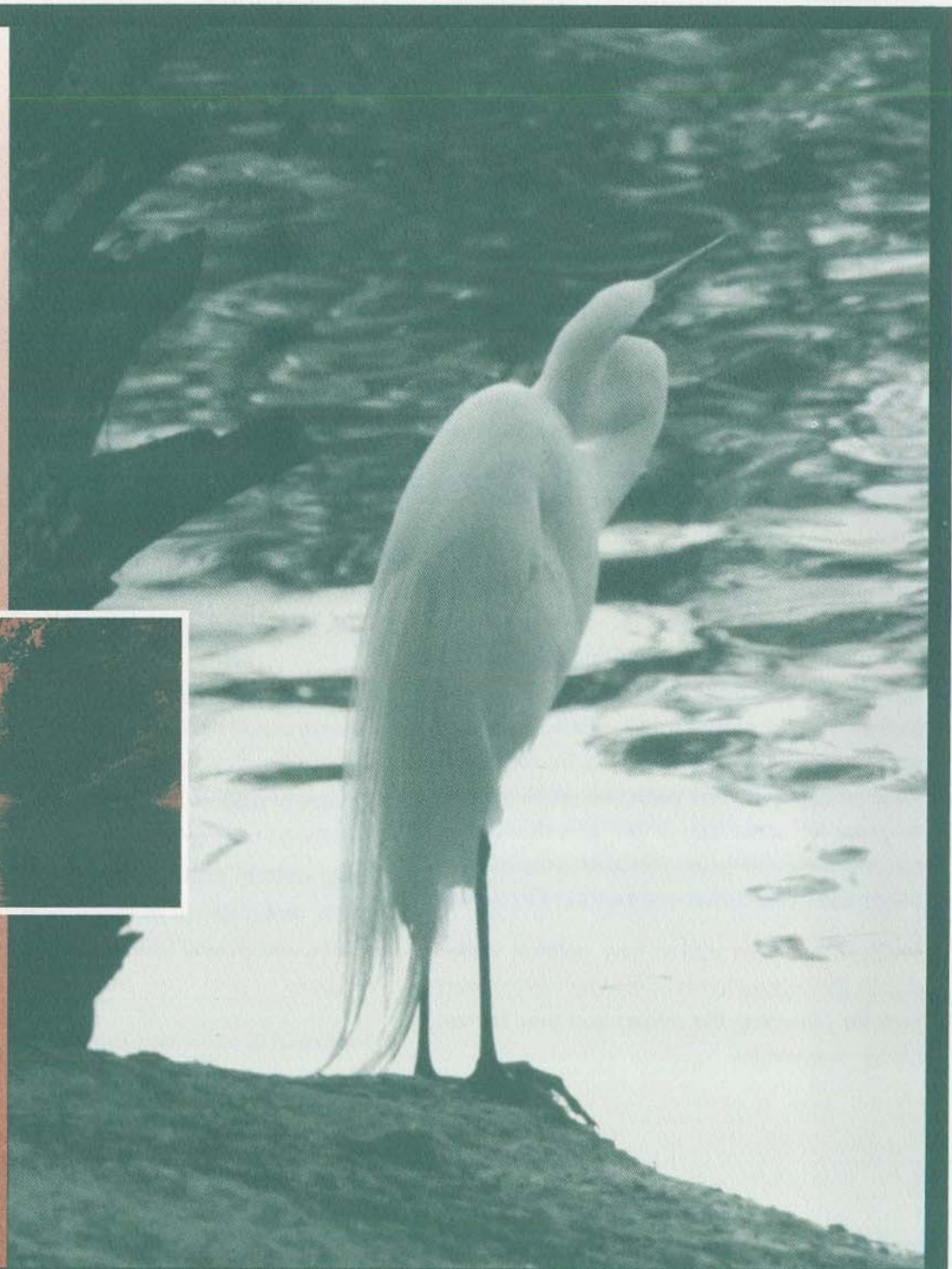
This newly formed committee will participate in the redesigning of the drainage plan for South Richmond.

Contact

DANA GLUMB, Director, Staten Island Bluebelt Unit
New York City Department of Environmental Protection
59-17 Junction Blvd.
2nd Floor High Rise
Corona, NY 11368
718.595.4549

*Resource transformed
into a clean, safe,
natural, enjoyable, and
diverse environment.*

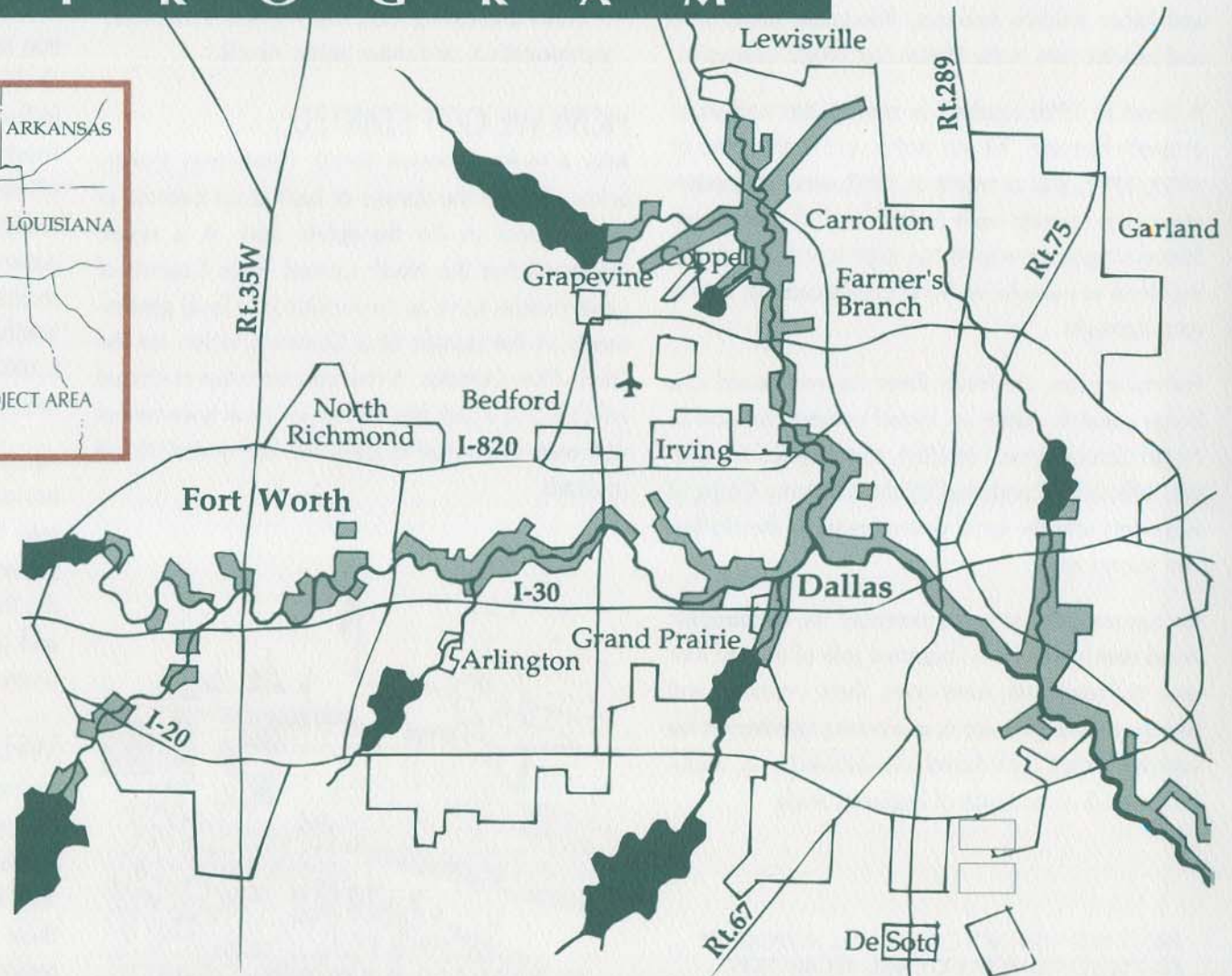
- ✓ FLOOD LOSS REDUCTION
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CANOERS, BIKERS, FISHERMAN AND WILDLIFE ENJOY THE TRINITY RIVER AND IT'S INCREASED RECREATION OPPORTUNITIES AND RESTORED NATURAL AREAS.

TRINITY RIVER COMMON VISION

P R O G R A M



WHAT WE WERE FACING

The Trinity River runs through the metropolitan area of Dallas-Fort Worth. This corridor is made up of approximately 240 square miles of standard project flood floodplain land. The river corridor is the largest remaining tract of open space, holding important community assets such as wetlands, fish, and other wildlife habitats, floodplain protection, and historic sites in the Dallas-Fort Worth metroplex.

A flood in 1990 resulted in some \$300 million of property damage. Yet this storm, and similar ones in 1989, 1991, and as recent as 1995, were all moderate storm events; well below a 100-year flood. Stated simply, the region has experienced an alarming trend of cumulative flood events causing significant damages.

For many years, the Trinity River was envisioned as a barge canal to create an inland commercial port in North Central Texas. In 1981, this idea for the river was officially abandoned by the US Army Corps of Engineers and the local governments in the Dallas-Fort Worth area.

Recognizing the growing potential for catastrophic flood damage and the important role of the corridor as a regional asset, nine cities, three counties, and two special districts are now working together on the nation's largest cost-shared inter-jurisdictional, multi-purpose US Army Corps of Engineers study.

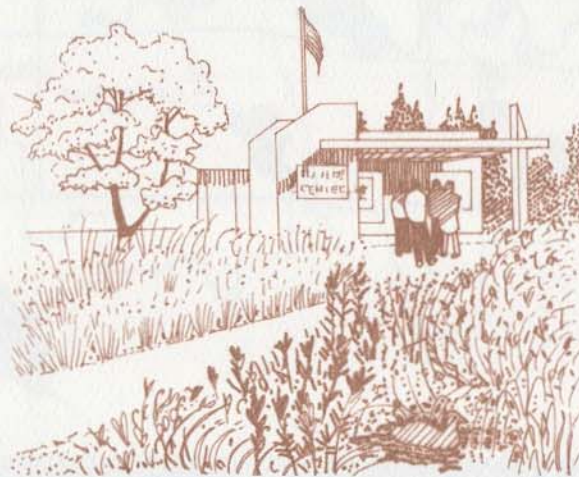
PROPOSED VISITOR'S CENTER WILL INTRODUCE PEOPLE TO THE ECOLOGY AND RECREATION OPPORTUNITIES OF THE TRINITY RIVER CORRIDOR.

WHERE WE'RE HEADING

- Stabilization and reduction of flooding risks.
- Fishable and swimmable waters.
- Increased recreational opportunities within a world-class greenway.
- Preservation and restoration of natural and cultural resources.
- Soundly addressing local and regional economic, transportation, and other public needs.

HOW WE GOT STARTED

After a series of recent floods, community leaders acknowledged the danger of haphazard patterns of development in the floodplain and, as a result, requested that the North Central Texas Council of Governments serve as the facilitator of local governments in the pursuit of a Common Vision for the Trinity River Corridor. A steering committee of elected officials and a task force of senior local government staff were assembled to guide the inter-jurisdictional program.



One of the main purposes of the Upper Trinity River Feasibility Study is to reduce the potential for flood damages. Before the potential can be reduced, a strategy needed to be developed to stop its increase. The Corridor Development Certificate (CDC) Process was developed to do just that. The CDC Process proposes to stabilize the flood risk along the Trinity Corridor through the acceptance and application of uniform floodplain development criteria and decision making process in the corridor. This was followed by initiating the Upper Trinity River Feasibility Study. The study, being conducted by the US Army Corps of Engineers, will identify ways to reduce the potential for flood damage, improve water quality, enhance the environment, and provide recreation opportunities through out the Upper Trinity River corridor. The study will examine a 6,100-square-mile watershed that includes over 147 miles of stream and a defined floodplain of 70,000 acres.

Numerous private interest groups, park foundations, businesses, and universities have also played a key role in building community support, publicizing, promoting, raising funds, and refining the vision for the Trinity River and associated projects. These plans and projects represent strong community efforts to promote multi-objective uses of the river corridor.

WHAT WE'RE LEARNING

Partnerships between the public and private sectors continue to be imperative to move projects towards implementation. While most of the COMMON VISION projects will be developed at the local level, there continues to be substantial interest in the regional coordination and information sharing on a number of broader issues.

MILESTONES

- *Release of "A Benefit/ Cost Analysis" paper by the US Army Corps of Engineers.*
- *Completion of a detailed mapping project of the corridor and development of computer floodplain models.*
- *Adoption of the Corridor Development Certificate Process, a flood risk stabilization policy for the corridor that includes no loss of valley storage in the 100-year floodplain, a maximum allowable valley storage loss in the Standard Project floodplain of five percent, maximum allowable velocities, no allowable loss in conveyance, requirements for erosion and sediment controls, and a "peer pressure" system of regional review and comment.*
- *Dallas' Trinity River Corridor Citizens' Committee reached consensus on plans for the Trinity River in Dallas. During the Spring 1995 Bond Election, Dallas citizens approved the spending of \$7.3 million to begin implementing Phase I of the recommendations.*
- *The Dalhoma Implementation Plan was completed for a 120-mile multi-jurisdictional, multi-purpose corridor linking Dallas and Oklahoma.*
- *Completed the Regional Flood Warning Implementation Plan and the Greenway and Trinity Trails Implementation Plan.*
- *To date, over \$13 million in ISTE A Transportation Enhancement funds have been awarded for projects along the Trinity River and its tributaries.*

OUR PARTNERS

North Central Texas Council of Governments (NCTCOG)

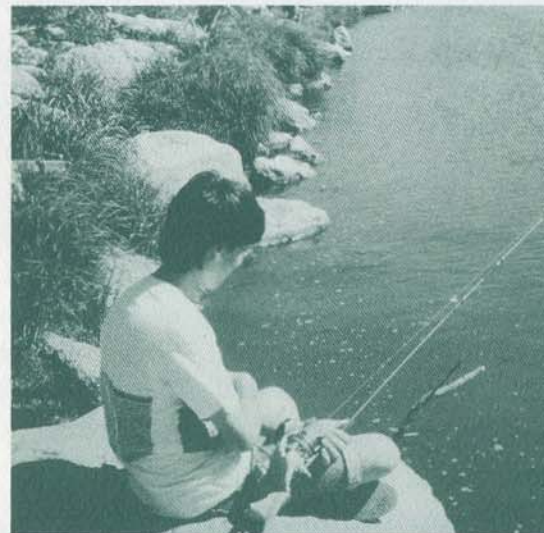
NCTCOG is a regional planning agency which serves local governments. They are representing the interests of nine cities, three counties, and two special districts in the Upper Trinity River Feasibility Study.

US Army Corps of Engineers

The Army Corps of Engineers is the federal sponsor of the Upper Trinity River Feasibility Study, currently in the fifth year of six-year long, \$8 million study.

National Park Service's Rivers, Trails and Conservation Assistance Program (RTCA)

RTCA signed a Memorandum of Understanding with NCTCOG in 1991 to provide technical assistance. They will identify recreation and environmental opportunities along the Trinity River, conduct community outreach, and assist in the planning of a greenway.



Supporting Agencies and Organizations

The following organizations are assisting with the Feasibility Study through technical assistance and input. They are represented by NCTCOG.

City of Arlington

City of Carrollton

City of Coppell

City of Dallas

City of Farmers Branch

City of Fort Worth

City of Grand Prairie

City of Irving

City of Lewisville

Dallas County

Denton County

Tarrant County

Tarrant County Water Improvement District #1

Trinity River Authority

Numerous private interest groups, independent school districts, universities, park foundations, businesses, and landowners.

Contact

JODI HERNANDEZ

National Park Service-RTCA

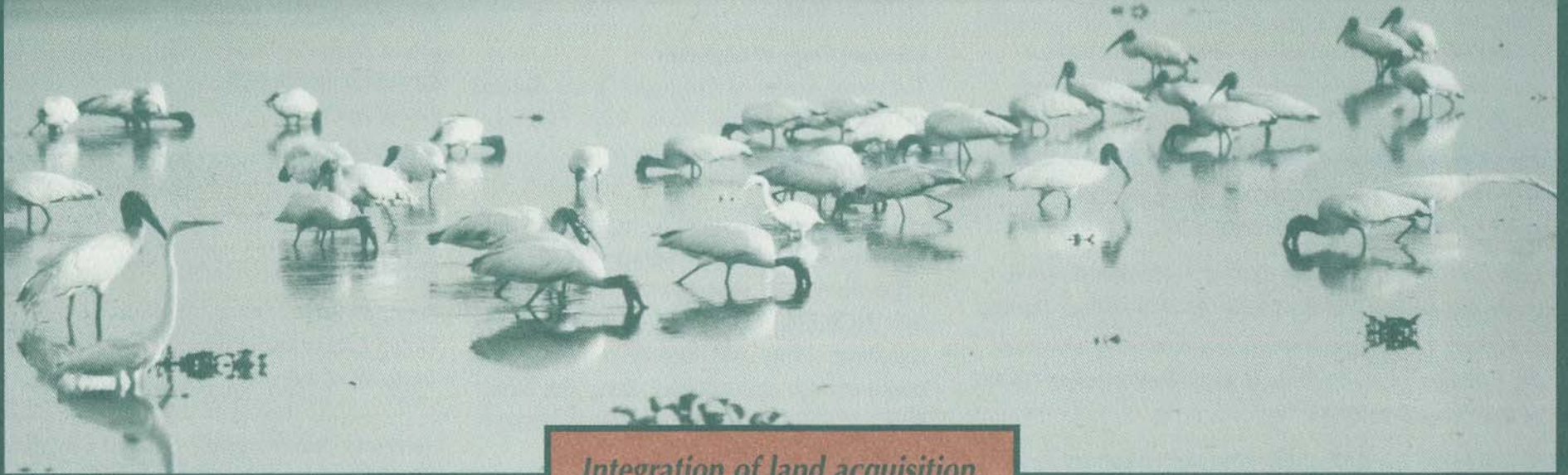
P.O. Box 5888

Arlington, TX 76005

817.695.9228

UPPER OCKLAWAHA RIVER BASIN

FLORIDA



*Integration of land acquisition,
wetland and lake restoration,
and scientific analysis results in
recovery of aquatic resources.*

WHAT WE WERE FACING

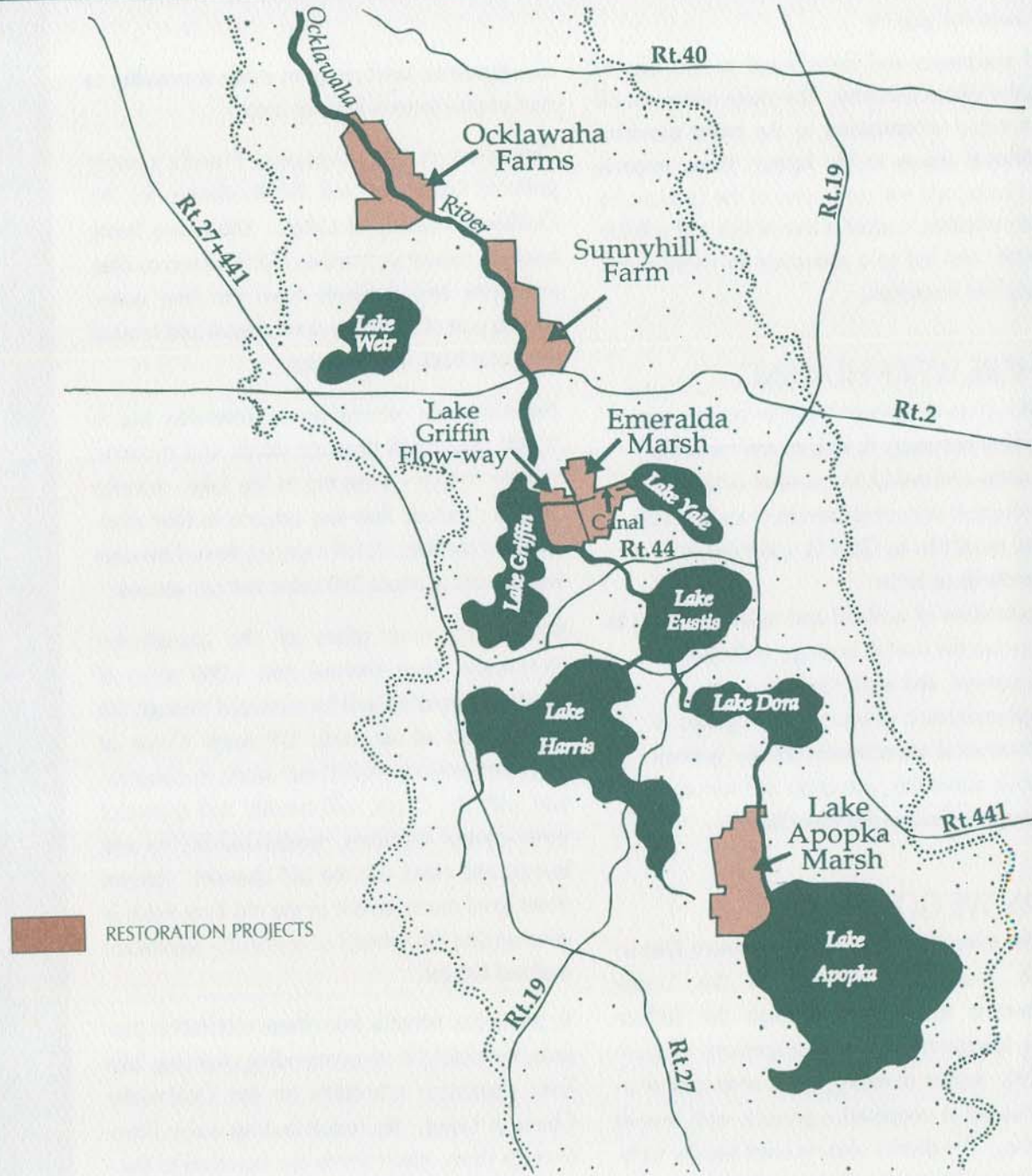
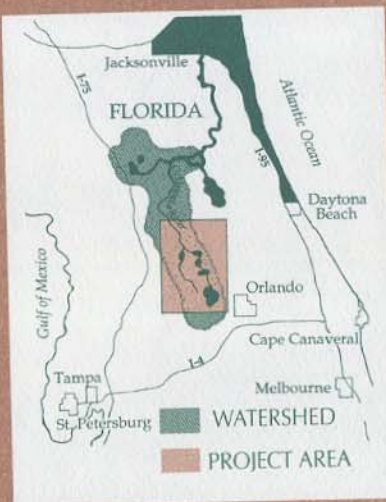
At the turn of the century, the Ocklawaha River ran wild through central east Florida. The lower river wound its way through vast cypress and hardwood bottomland forests. The upper river flowed more slowly from the headwaters to lakes through broad, flat sawgrass prairies, a basin covering 640 square miles. Then long stretches were diverted into canals for navigation, a series of locks and dams were constructed to control water levels, and the sawgrass marshes were converted to muck farm land through the construction of levees and ditches. Water levels on these

farms were controlled by pumping the accumulated agricultural runoff into the lakes and river system.

The gains were protection against the 10-year flood, stabilization of lake levels for year-round navigation, and 30,000 acres of productive muck farm land. However, water quality and aquatic and wetland habitat were lost. The farms discharged huge amounts of nutrient rich water into the Ocklawaha River and adjacent lakes. The dams have kept water levels in the lakes from rising and falling with natural rainfall patterns. This limits the normal flushing of nutrients

continued on page 72

- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- ✓ STREAMBANK STABILIZATION
- ✓ RESTORATION
- ✓ FISHERIES IMPROVEMENT
- ✓ RECREATION
- ✓ NATURAL HAZARD MITIGATION
- ✓ WETLAND ENHANCEMENT
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- ✓ CULTURAL RESOURCE ENHANCEMENT
- ✓ ECONOMIC REVITALIZATION
- ✓ ENVIRONMENTAL EDUCATION



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and sediments and contributed to the loss of healthy lake ecosystems. The storm water run-off from rapid urbanization in the basin provided additional inputs to the lakes. These impacts have increased eutrophication of the Ocklawaha Chain of Lakes, caused a loss of fish and wildlife habitat, and led to a reduction in riverine and floodplain resources.

WHERE WE'RE HEADING

- Reduction of nutrient levels to attain water quality necessary to restore and maintain healthy and productive natural systems.
- Reduction of concentrations of toxic metals and pesticides to Class III water quality standards or better.
- Restoration of wetland and upland habitats to improve the overall ecology, pollution abatement, and aesthetic resources.
- Implementation of education programs to inform local governments and the general public about the protection and restoration of the upper Ocklawaha River basin.

HOW WE GOT STARTED

The St. Johns River Water Management District began restoration activity in the Upper Ocklawaha River Basin through the Surface Water Improvement and Management Program (SWIM). Action in intergovernmental coordination has led to cooperative projects with several agencies. The district also receives regular technical input from an advisory committee composed of several participants.

An aggressive land program made it possible to start improvements in three areas.

One area is Lake Apopka, Florida's most polluted large lake and the headwater for the Ocklawaha Chain of Lakes. Efforts are being made to restore its marshes (5,000 acres) to filter sediments and nutrients from the lake water, cycling part of the water downstream and most of the water back into the lake.

The long-term restoration of Emerald Marsh (7,000 acres) will produce viable and dynamic aquatic habitat connected to the lake. Interim measures include flow-way projects to filter nutrients from the lake. At full capacity, these flow-ways will operate at about 500 cubic feet per second.

More than nine miles of the abandoned Ocklawaha River channel and 3,000 acres of floodplain marshes will be recreated through the modification of an early US Army Corps of Engineers project. Additional work, in cooperation with the Corps, will modify and construct water control structures, remove old ditches and levees, and clean out the old channel. Interim water level management of the old farm fields is encouraging the growth of regionally significant wetland habitat.

To maximize benefits from these restoration projects, the district is recommending changing lake level regulation schedules on the Ocklawaha Chain of Lakes. By redistributing water flows through dams, water levels are expected to fluctuate more naturally following seasonal and long-term changes in rainfall.

MILESTONES

- *Purchase of 20 parcels totaling 24,000 acres of muck farms.*
- *Series of public presentations and workshops to receive input on proposals to change the way lake levels are managed.*
- *Completed phase one construction of flow-ways at Emerald Marsh. Additional marsh areas are attracting large populations of wintering waterfowl and are open for fishing, hunting, and other types of recreation.*
- *Private landowner filled internal drainage ditches, removed more than 13 miles of levees, and cleaned six miles of the abandoned Ocklawaha River after the district purchased the property in lieu of lease payments.*
- *Restored old farm house for use as information center and field office, and for educational programs.*



UNDISTURBED SAWGRASS MARSH COMPLEX AT EMERALD MARSH

WHAT WE'RE LEARNING

Most of our successes result from the district's ability to integrate restoration activity with other district programs and to work closely with other federal, state, and local governments.

The implementation of the upper Ocklawaha River basin restoration program would not be possible without the financial resources provided by the district and state land acquisition programs. The most significant problem we are facing has been the reduction in yearly appropriations from the state of Florida for SWIM programs. The main consequences of these funding constraints has been to delay implementation of a number of projects and has forced an even greater reliance on supplemental funding sources. The most important action the State of Florida could take to ensure the completion of programs would be to create a stable, long-term funding source similar to those for land acquisition programs.

Overall, the beginnings and successes within the upper Ocklawaha River basin restoration program far exceed delays caused by funding constraints. The partnership of agencies has proved essential in developing a viable and comprehensive restoration program.

OUR PARTNERS

St. Johns River Water Management District

Lead agency in coordinating restoration activities in the upper Ocklawaha River basin.

US Army Corps of Engineers

This agency completed a feasibility study for one of the target project areas for prairie restoration under Section 1135 program.

Lake County Water Authority

The Water Authority provided funding for the flow-way project and partially funded a eutrophication study of the Ocklawaha Chain of Lakes.

Ocklawaha Farms, Inc.

This group conducted important earthwork related to the restoration project in lieu of lease payments, realizing a savings of nearly \$1 million.



CLEARED BEND OF HISTORIC OCKLAWAHA RIVER AT SUNNYHILL RESTORATION AREA.

Advisory Committee

In addition to the US Army Corps of Engineers, representatives from the following agencies and organizations participate in an Advisory Committee. They give regular technical input to the district.

Florida Department of Environmental Protection

Florida Game and Fresh Water Fish Commission

Lake County Environmental Services

Lake County Water Authority

Marion County Planning Department

Orange County Environmental Protection Department

University of Florida

Contact

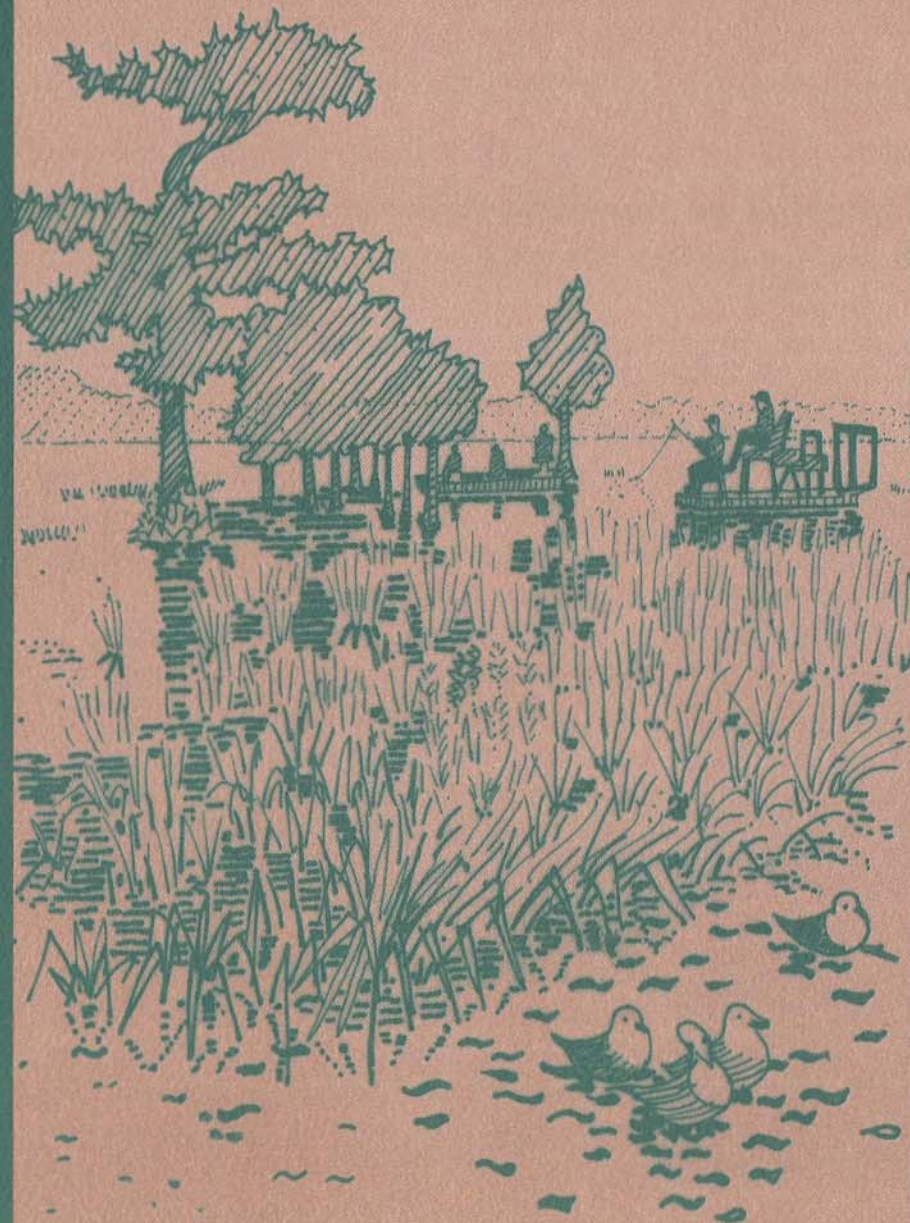
DAVID WALKER

St. Johns River Water Management District

19561 Southeast Highway 42

Umatilla, FL 32784

904.821.1489



UPPER ST. JOHNS RIVER BASIN

P R O J E C T

*Environmental needs balanced with
need for reliable flood protection.*

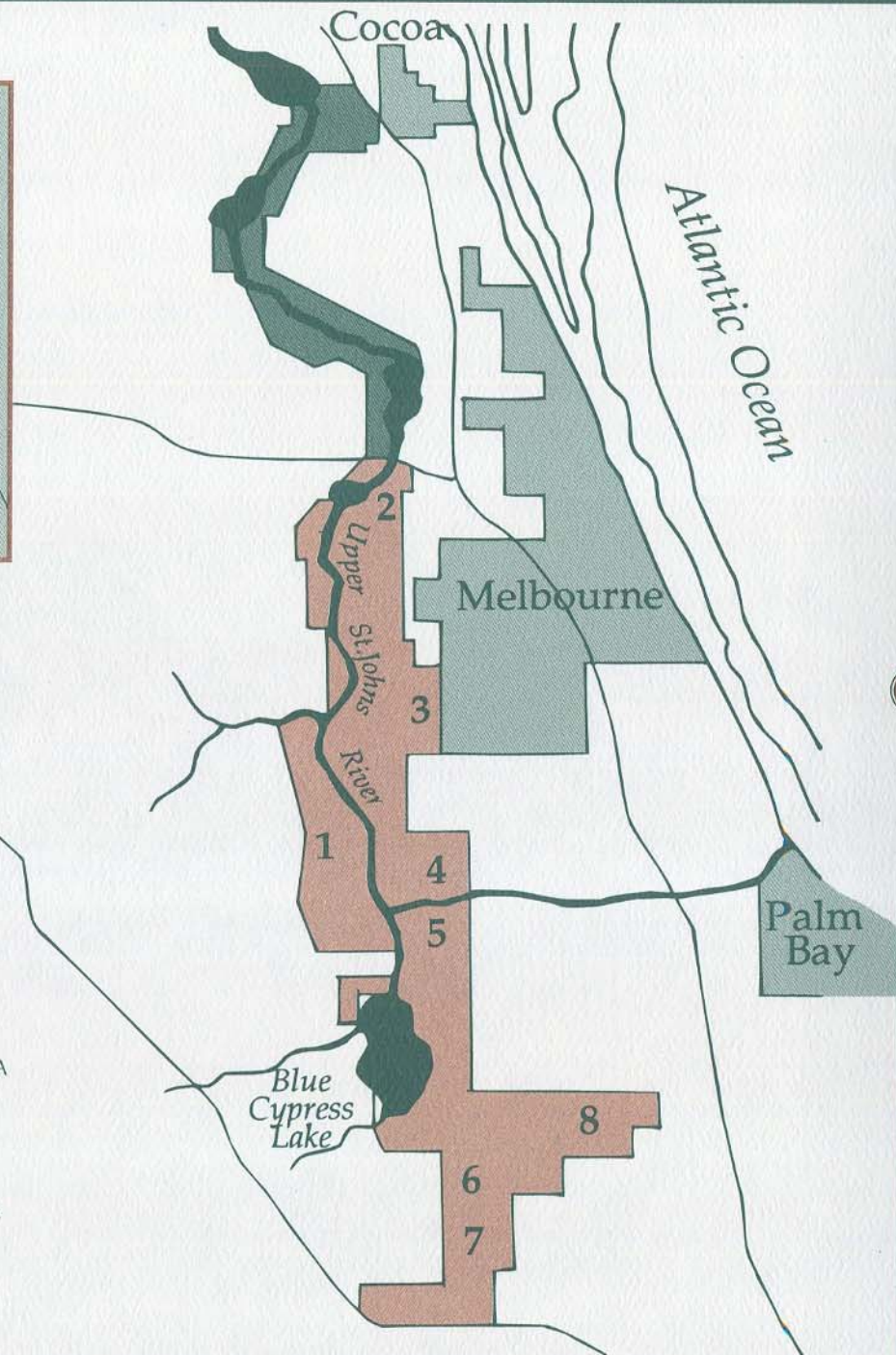
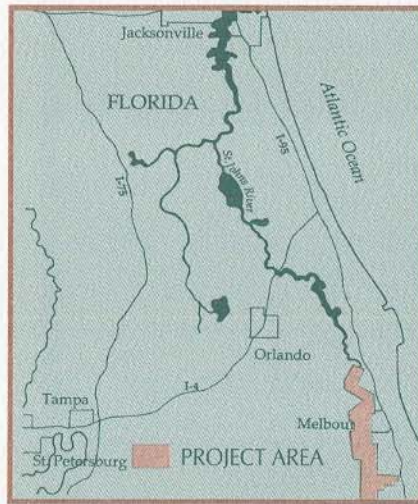
WHAT WE WERE FACING

Seventy-five miles from the Florida Turnpike, in the east central portion of the state, flows the St. Johns River. Its headwaters include a vast marsh and lake complex intertwined with a major agricultural area.

In the early 1900s, thousands of floodplain acres in the river's headwaters were diked and drained to create fertile farmlands. Canals were constructed across the marsh to connect the hamlet of Fellsmere with the small town of Kenansville and provide drainage improvements. Other private canals followed, diverting the fresh water from the St. Johns River to the Indian River and Atlantic Ocean. As dikes were constructed and pumps installed for private flood protection needs, thousands of acres of nutrient-rich floodplains were opened for citrus, cattle, and row crops.

Devastating hurricanes in the 1920s and 1940s clearly showed the serious impact the loss of floodplain storage had on the region. The need for a public flood loss project became clearly evident.

- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- STREAMBANK STABILIZATION
- ✓ RESTORATION
- ✓ FISHERIES IMPROVEMENT
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- ✓ WETLAND ENHANCEMENT
- ✓ HABITAT IMPROVEMENT
- CULTURAL RESOURCE ENHANCEMENT
- ECONOMIC REVITALIZATION
- ENVIRONMENTAL EDUCATION



- URBAN AREA
 - DISTRICT PROJECT AREA
 - FEDERAL PROJECT AREA
1. ST. JOHNS MARSH
 2. SAWGRASS LAKE WATER MANAGEMENT AREA
 3. THREE FORKS MARSH AREA
 4. "C-54" RETENTION AREA
 5. ST. JOHN WATER MANAGEMENT AREA
 6. BLUE CYPRESS MARSH CONSERVATION AREA
 7. FORT DRUM MARSH AREA
 8. BLUE CYPRESS WATER MANAGEMENT AREA

RESTORATION AND PRESERVATION OF HISTORIC FLOODPLAIN IS THE EMPHASIS OF THE UPPER ST. JOHN PROJECT. MANY EXISTING FLOOD CONTROL LEVEES ARE RELOCATED TO RE-CREATE RIVERINE MARSH. APPROXIMATELY 150,000 OF WETLAND HABITAT ARE BEING ENHANCED AND RESTORED.



WHERE WE'RE HEADING

- Lowering of peak flood stages and constructed or improved flood protection levees to reduce flood damage.
- Improved water quality through filtering of agricultural discharge, removal of canal plugs, and purchase of land formerly used for farming.
- Decrease of freshwater discharge to Indian River Lagoon through safe storage of increased amounts of storm water.
- Creation of several large marsh conservation areas for flood storage and long-term water conservation storage.
- Enhancement and restoration of wetland habitat on approximately 150,000 acres.
- Increased recreational opportunities in adjacent parks.

HOW WE GOT STARTED

In 1966, the Jacksonville District, US Army Corps of Engineers (Corps) prepared a project General Design Memorandum in coordination with the Central and Southern Florida Flood Control District. Construction soon began to divert water from the St. Johns River to the Indian River Lagoon during major storms via a canal. Downstream of the canal, flood stages would be attenuated by the detention and storage of surface water runoff in large upland reservoirs west of the river valley.

In 1970, the Corps began preparing an Environmental Impact Statement (EIS). After a technical evaluation of the EIS in 1974, the State of

Florida determined that the project was unacceptable based on environmental concerns. As a result, project construction was indefinitely suspended.

In 1977, local sponsorship for the project was transferred to the St. Johns River Water Management District who conducted an extensive study of the basin's condition.

In 1982, the Corps determined that the plans called for in the reconnaissance report were economically justifiable and warranted federal participation. A final plan was adopted in 1985 and construction began in 1988. The project has a benefit/cost ratio of 1.7.

WHAT WE'RE LEARNING

The challenge to build a flood protection system that was environmentally friendly and sustainable was great but possible. Water control structures and new construction are kept to a minimum. Many existing flood control levees are relocated to recreate riverine marshes. Other dikes are fortified and agricultural drainage rerouted to improve water quality and enhance the marsh.

Waters from nearby citrus groves and livestock pastures are now discharged into large reservoirs called water management areas, keeping agricultural runoff isolated from water that recharges the marsh. When necessary, this water can be reused for farm irrigation and freeze protection. Water

preserved in large marsh conservation areas improves the river's hydrology and is available to maintain flows downstream.

The emphasis of the Upper St. Johns Project is on the restoration and preservation of historic floodplain. The system, with some human help, will function as nature intended. Building such a project requires extensive cooperation between the US Army Corps of Engineers and the St. Johns River Water Management District, as well as other state environmental agencies and interest groups.

MILESTONES

- *Conversion of previously farmed lands to floodwater storage areas that support a world-class largemouth bass fishery.*
- *Introduction of gamefish into water management areas.*
- *The return of endangered wildlife species, such as the Everglades kite and the wood stork, to the area.*
- *Improved water quality detected through ongoing monitoring.*
- *Reduction of freshwater inflows from the St. Johns River to the Indian River Lagoon, a valuable shell fishery.*

OUR PARTNERS

St. Johns River Water Management District

Lead agency in acquiring lands and in operating and maintaining the project.

US Army Corps of Engineers (Corps)

The Corps performs engineering design and is managing construction of the project.

Contact

MAURICE STERLING

Director of Project Management

St. Johns River Water Management District

P.O. Box 1429

Palatka, FL 32178

904.329.4320

AERIAL VIEW OF THE CONFLUENCE OF THE VERMILLIAN AND MISSOURI RIVERS.

- ✓ FLOOD LOSS REDUCTION
- ✓ FLOW CONTROL
- ✓ STREAMBANK STABILIZATION
- ✓ RESTORATION
- ✓ FISHERIES IMPROVEMENT
- ✓ RECREATION
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SOUTH DAKOTA

VERMILLION RIVER BASIN

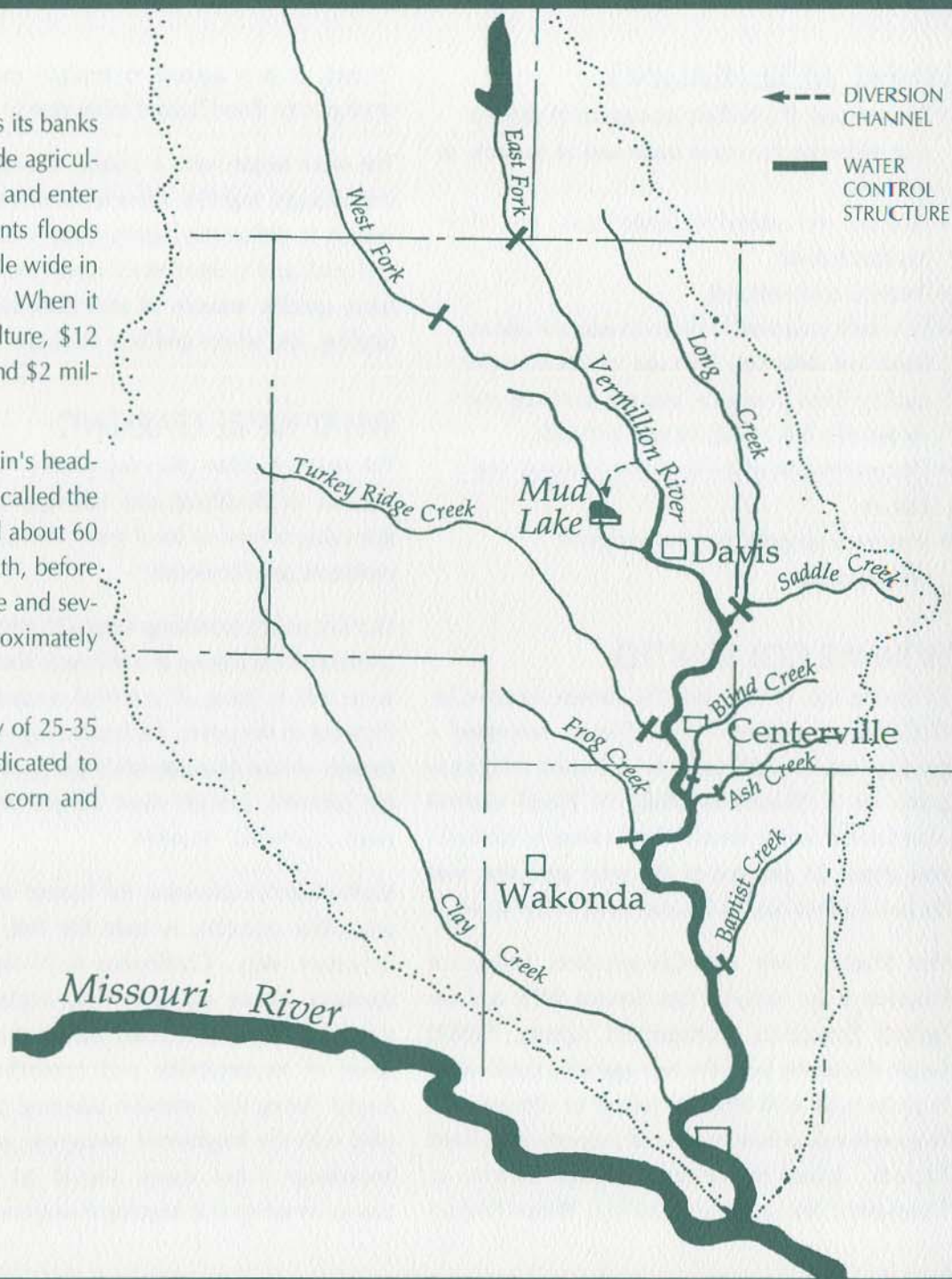
Basin-wide and community-wide goals and objectives target mitigating effects of flooding.

WHAT WE WERE FACING

Like all bodies of water, the Vermillion River naturally overflows its banks from time to time. The flood waters inundate farmlands, impede agricultural drainage and community stormwater runoff, damage roads, and enter homes and businesses. The history of the Vermillion documents floods from 1881 to today. In June 1993, the Vermillion rose over a mile wide in places, and many communities along its banks were flooded. When it was over, damage was approximately \$204 million to agriculture, \$12 million to public facilities, \$10 million to private residences, and \$2 million to businesses.

Located in southeastern South Dakota, the Vermillion River Basin's headwaters are in the lake country of Kingsbury County. Commonly called the James River Lowland, this area is more than 200 miles long and about 60 miles wide. It drains 2,185 square miles, running north to south, before joining the Missouri River. Along the way it is fed by three large and several smaller tributaries. The gradient of the river system is approximately 400 feet throughout its length.

Since the 1930s, the basin has maintained a population density of 25-35 people per square mile. About 95 percent of its land is dedicated to agriculture, dominated by forage and grain crops, especially corn and soybeans.



WHERE WE'RE HEADING

- Recognition of a holistic management process that addresses the entire basin and its flooding as one unit.
- Restored and created wetlands habitat and other riparian habitat.
- Protection of wetlands.
- Outreach programs in place to educate about flood loss reduction, land use practices, water quality, flood insurance, and the functions and values of wildlife habitat and wetlands.
- Documentation of the Vermilion's history and culture.
- Improved opportunities for economic development.

HOW WE GOT STARTED

Following the 1993 flood, the Turner-Lincoln-Clay (TLC) Counties Water Project District submitted a pre-application notification for a hazard mitigation grant for a "Feasibility Study of Flood Control Alternatives" for the basin. The flooding in the basin was about 25 percent of the total area that was declared a Presidential Disaster Area in the state.

The Rivers, Trails and Conservation Assistance Program of the National Park Service (NPS) and the Federal Emergency Management Agency (FEMA) began discussing how the two agencies could work in partnership with others to reduce or eliminate the long-term risk to human life and property from flood hazards. Joined by the South Dakota Division of Emergency Management and TLC Water Project

District, it was agreed to explore multi-objective strategies for flood hazard mitigation in the basin.

The work began with a public, five-day workshop that brought together agencies and interested individuals to define the basin's flood-related problems and goals and to develop solutions, including identifying specific sources of technical assistance and funding, and where and how to obtain it.

WHAT WE'RE LEARNING

The multi-objective planning process can be highly effective in identifying and making progress toward achieving numerous local goals and solving several problems simultaneously.

Our first public workshop helped to get this planning process off the ground in a relatively short time as we were able to bring all potential obstacles and conflicts out in the open. Each planning area will have its own unique characteristics and needs, and hence the planning process must always be adapted to meet a particular situation.

Multi-objective planning for hazard mitigation, or any other purpose, is only the first, albeit most important, step. Continuous multi-objective management follows naturally from implementing the measures that are selected during planning. The sense of responsibility and commitment that is forged during this intensive planning process, coupled with the heightened awareness and improved knowledge about issues, should go a long way toward ensuring that ongoing management happens.

MILESTONES

- *Publication of a multi-objective flood mitigation plan for the Vermillion River Basin.*
- *Production of a 17-minute video describing the planning process.*
- *Publication of a document describing the multi-objective hazard mitigation planning workshop process.*
- *Creation of a "Grantsmanship Catalog" of programs and funding that could be used to implement multi-objective flood mitigation.*



A FIVE-DAY WORKSHOP BROUGHT TOGETHER AGENCIES AND INTERESTED INDIVIDUALS TO EXPLORE MULTI-OBJECTIVE STRATEGIES TO MITIGATE FLOODING IN THE VERMILLION RIVER BASIN.

OUR PARTNERS

Federal Emergency Management Agency (FEMA)

FEMA contributed the primary funding for this project including mitigation funding and programs and funding to NPS in response to the midwest floods of 1993. FEMA also provided natural hazard mitigation strategies, strong federal-state partnership, and facilitation support.

National Park Service's Rivers, Trails and Conservation Assistance Program (RTCA)

RTCA provided expertise in the facilitated planning process and consensus building and planning for greenways and river corridors. RTCA also served as planning workshop coordinator and facilitator.

Supporting Agencies

In addition to several conservation districts, the following agencies and organizations have participated in the planning process through technical assistance and by providing input:

South Dakota Division of Emergency Management

Turner, Lincoln, Clay County Water Project District

US Army Corps of Engineers

US Environmental Protection Agency

South Dakota Geological Survey

South Dakota Department of Wildlife and Fisheries

South Dakota Department of Transportation

US Geological Survey

US Department of Housing and Urban Development

South Dakota Department of Health

South Dakota Lakes and Streams

South Dakota Community Development Block Grant

South Dakota State Historical Society

South Dakota Council of Governments

South Dakota Department of Game, Fish, and Wildlife

US Fish and Wildlife Service

South Dakota National Biological Survey

US Department of Agriculture

US Soil Conservation Survey

South Dakota Department of Agriculture

South Dakota Department of Environment and Natural Resources

Trust for Public Land

Small Business Administration

Contact

BOB COX

Federal Emergency Management Agency

Denver Federal Center, Building 710

P.O. Box 25267

Denver, CO 80225

303.235.4714

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FLOODPLAIN MANAGEMENT RESOURCE CENTER

The Resource Center is a library and referral service for floodplain management publications. It is located at the Natural Hazards Research and Applications Information Center in Boulder, Colorado.

Over 400 floodplain publications in the Center's library have been entered into a computer data base which has been coded with key words to facilitate quick searches. Most inquiries are handled over the telephone Monday - Friday, 9:00 a.m. - 4:00 p.m. (Mountain Time).

Natural Hazards Center
IBS #6
Campus Box 482
Boulder, CO 80309-0482
Tel: 303.492.6818
Fax: 303.492.2151

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For more information on multi-objective approaches contact:

National Park Service • Rivers, Trails and Conservation Assistance Program •

Association of State Floodplain Managers • 608.274.0123

Association of State Wetland Managers • 518.872.1804

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The contents of this book do not necessarily reflect the positions of the National Park Service or the Secretary of the Interior.

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

Gilbert White



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