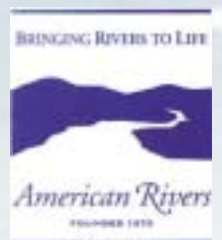


# RIVER OF RENEWAL

A Vision for Reconnecting  
Communities to a Living  
Upper Mississippi River

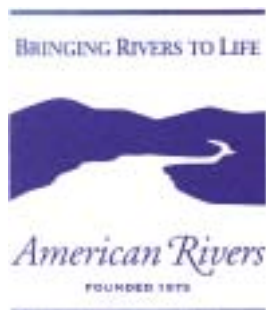




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# RIVER OF RENEWAL

A Vision for Reconnecting  
Communities to a Living  
Upper Mississippi River



August 2001

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Cover photo: View of Mississippi River from Effigy Mounds National Monument in Iowa (Jeff Stein).

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# INTRODUCTION

The Upper Mississippi is an extraordinary river. From the moment it trickles out of Minnesota's Lake Itasca, the Mississippi River shapes the lives of the communities along its banks. As the Mississippi courses through the nation's heartland, it winds through hundreds of communities and thousands of years of human history.

Millions make their homes along the river's shores, and millions more use the waterway every year for industry, recreation, to move goods, supply water, transport wastewater, and generate power.

The river is also home to an abundance of wildlife, including: 326 species of birds and fully 40 percent of all North American waterfowl; 260 species of fish; 37 species of freshwater mussels; 45 amphibian and reptile species; and 50 mammal species.

The Upper Mississippi's ecosystem is a vibrant mosaic of many habitats. The diversity of these habitats is unparalleled - including thousands of wetlands, side channels, backwaters, prairies, and forests. Each of these habitats serves a different purpose, yet they all are interconnected and contribute to the overall health of the river. The river ecosystem acts as the essential connector between large conservation areas in an otherwise highly-fragmented Upper Midwest landscape. Migrating birds and fish are especially dependent on the river's connectivity.

The natural resources of the Upper Mississippi support thriving local economies. More than 12 million people annually recreate on or along the Mississippi River - four times more than visit Yellowstone National Park - spending \$1.2 billion and supporting 18,000 jobs in riverside communities. A large portion of this economic activity depends on the natural ecosystem that is associated with hunting, fishing, and bird watching. Millions of people hunt waterfowl and watch birds along the Mississippi, spending nearly \$400 million each year on equipment and travel-related expenses in riverside communities. Wildlife watching alone in Midwestern states generates nearly \$6 billion in annual spending, supporting more than 150,000 jobs.

But, for the river to continue to be an asset to communities, all of the river's "parts" must be in working order. The river ecosystem must be intact and healthy. And each habitat type has a valuable role to play.

Wetlands are important because they not only store and slowly release flood waters and help maintain water quality, they also provide homes and breeding areas for waterfowl and other wildlife. Upland prairies and flood-

**More than 12 million people annually recreate on or along the Mississippi River - four times more than visit Yellowstone National Park.**



**Lake Itasca in Minnesota, headwaters of the Mississippi River.**

plain forests help control the amount of runoff that enters a river. They also provide important habitat for a diverse array of wildlife. Tributaries are essential to the survival of many fish species-species that require areas of slower water velocity and fewer predators. Backwaters also provide diverse habitats and breeding areas for wildlife away from the river's main channel.

As significant as each of these habitats are to the Upper Mississippi ecosystem and economies, we are losing them at an alarming rate. For over 200 years, human pressures have been building up to push the river's natural systems to the breaking point. Agriculture and urbanization have eliminated habitat and have increased the rate of runoff and the amount of pollutants in the river. Erosion has led to greater sedimentation, filling in Upper Mississippi River backwaters and wetlands with silt.

This continued habitat loss threatens both the ecological and economic value of the Upper Mississippi region. It is a sobering picture, and one that could get worse if communities do not start to aggressively protect and restore these vital pieces of the river ecosystem.

The good news is that even a single community effort can have an impact.

Today, communities across the country are turning back to their rivers, restoring habitat and revitalizing downtown riverfronts. There are a number of benefits for a community that takes on a restoration project. The most obvious are the ecological benefits-cleaner water and more abundant fish, birds and wildlife. But there are other benefits, too. Restoring a natural area or revitalizing a long-neglected riverfront can give a remarkable boost to a town's quality of life. A restoration project can renew civic pride as people feel reconnected to the river. A revitalized riverfront is a welcoming "front yard," that attracts visitors and creates local business opportunities.

The purpose of this report is to provide a vision for Upper Mississippi River communities to reconnect to the river and become more active stewards to protect their watershed's unique habitats and the river as a whole.

Part I of this report examines the variety of habitats in the Upper Mississippi River floodplain and discusses the status and threats to each habitat type. Part II addresses restoration opportunities and gives examples of instances when communities might consider a restoration project. Part III provides design principles for ecologically sensitive riverfront development, as well as resources for technical assistance and funding.

**If we give the river the chance, it can bring new life and new opportunities to the communities along its banks.**





# PART I: UPPER MISSISSIPPI RIVER HABITATS

The Upper Mississippi River's habitat diversity forms the basis of a healthy river ecosystem, and makes the region a dynamic and beautiful place to live.

Wetlands that provide flood control also help maintain water quality and shelter waterfowl and other wildlife, while upland prairies and floodplain forests decrease the amount of runoff that enters the river. These and other habitat types have important roles to play.

Unfortunately, these natural places are under attack. They continue to be degraded or lost because of a number of human impacts.

One major impact has been the construction and operation of locks and dams. Navigation dams, which keep river levels between Saint Louis and the Twin Cities artificially high during the summer, have contributed to the deterioration of the river's floodplain forest and aquatic vegetation.

Agriculture has been another wide-reaching cause of habitat decline. More than half of the land in the Upper Mississippi basin has been cleared for farming. Not only has agricultural development eliminated natural areas it has degraded water quality. Pollutants, like nitrates and phosphorus found in crop fertilizers, have had a significant impact on water quality in both the mainstem Mississippi and its tributaries. An increase in sedimentation from farm fields has filled in many Upper Mississippi backwaters and wetlands.

Urbanization has contributed to the destruction and clearing of upland prairies and bluff areas. As more and more "impermeable surfaces" (e.g., paved roads, parking lots, and roof tops) cover the region, the runoff rate increases and the water quality decreases. Additionally, rainfall runoff in both urban and suburban areas is contaminated with industrial contaminants, pesticides, fertilizers and automobile wastes.

Today, floodwaters move downstream faster and with more force, thanks to our "replumbing" of the landscape. With urbanized drainage basins, less rain puts communities downstream at a greater risk for floods. Increased runoff results in higher, more frequent and destructive floods. Urban sprawl and unmanaged development, as well as structural changes to the river channel (i.e., levees and wing dikes) put communities at an increased risk for more frequent flooding events.

Now is the time to address these threats and stop the damage. Every type of habitat is precious. If communities begin now, they can protect and restore

**Every habitat in the river system is essential - from tributaries that serve as breeding grounds for many species of fish to slow backwaters that provide places of refuge.**

these habitats, priceless pieces of their natural heritage and a living and vibrant Mississippi River.

The following section describes each of the key habitat types on the Upper Mississippi.

### ***UPLAND PRAIRIES***

Typically located on river bluffs and higher floodplain elevations, upland prairies are dominated by vegetation such as big blue stem, Indian grass, and cord grass. Many species of birds, including the red wing blackbird, that depend on this habitat were once prominent features along the Upper Mississippi, but are now quite rare.

Native prairie plants evolved after the Ice Age, when fire was a natural element of the landscape. Periodic fires helped shape and maintain diversity in prairie communities. Fires that historically swept across the prairies during the late summer, especially those at higher and extremely dry upland elevations, returned nutrients back to the soils. Fires also decreased forest invasion and succession rates (encroachment of forest communities into prairies), and helped stem invasion of non-indigenous species such as purple loosestrife.

In 1816, prairies made up 22 percent (105,200 acres) of the basin's landscape. In 1994, prairie habitat had been reduced to 2.7 percent, or less than 13,000 acres.

When we began suppressing fires in the Upper Mississippi region, we changed how the ecosystem functioned. Without the burning and recycling of nutrients in the soil, and the suppression of woody vegetation, the native prairie plants cannot continue to thrive. This has led to the invasion of non-indigenous species, such as European buckthorn and purple loosestrife, which out-compete native vegetation.

In addition to fire suppression, agriculture is a main reason for the disappearance of prairies. An estimated 60 percent of the basin landscape is dominated by farm fields, many of which are located on cleared prairies. Replacing the native vegetation with major cash crops, including corn and soybeans, has changed the native plant and animal communities. More recently, unchecked urban development is to blame. As land has been cleared and paved over for roads, highways and parking lots, we have lost more of the remaining prairie habitats.

Whitney Clark



**In 1816, prairies made up 22 percent of the basin's landscape. Today, prairie habitat has been reduced to less than 3 percent (Pine Bend Bluff, Minnesota).**

## WETLANDS

Wetlands - transition zones between land and water - support countless fish, bird, and wildlife species. They are the river's nurseries, providing nesting and rearing areas, as well as food and shelter. Nearly 70 percent of all vertebrate species rely on wetlands along the river edge during their life cycle. Healthy wetlands create a vegetated transition zone between rivers and upland habitats to provide shelter, food, and migration pathways for river wildlife. For example, waterfowl and songbirds use wetland areas during their annual migrations.

Wetlands also act as natural "sponges," reducing flood heights by absorbing, storing, and then slowly releasing vast quantities of rainwater. And as natural "filters," wetlands improve and maintain water quality by trapping sediments and pollutants.

The richness and beauty of wetlands are also attractive to people. Millions of Americans use wetlands for hunting, fishing, bird watching and other activities.

## WETLANDS LOSS

### NATIONAL STATUS

- € It is estimated that at the time of European settlement, there were over 221 million acres of wetland in the U.S. As of 1997, an estimated 103 million acres of those wetlands have been lost.
- € Between 1986 and 1997, the net loss of wetlands was 664,000 acres (an annual loss rate of 58,500 acres).
- € Urban development accounts for 30 percent of the total loss, 26 percent to agriculture, 23 percent to logging and 21 percent to rural development from 1986 to 1997.
- € An estimated 98 percent of all the wetlands converted to other uses were freshwater wetlands.

### UPPER MISSISSIPPI RIVER STATUS

- € Agricultural development is responsible for the elimination of 26 million acres of wetlands in the Upper Mississippi basin over the last century.
  - € Between 1945 and 1985, the application rate of commercial fertilizers increased twenty fold and contributed to nutrient enrichment in the Upper Mississippi basin. With the loss of wetlands throughout the Upper Mississippi basin, excess runoff has made our rivers and streams too polluted to support fishing and swimming.
  - € It is estimated that approximately 70 percent of backwater sloughs and wetlands in the Upper Mississippi basin have been lost due to urbanization, erosion and sedimentation.
- Source: U.S. Fish and Wildlife Service, 2000.

Our wetlands are being lost at an alarming rate - not just on the Upper Mississippi, but nationally. Between 1986 and 1997, the total net loss of wetland areas was estimated at 644,000 acres out of a total 105.5 million acres - an average annual loss of 58,500 acres nationally. It is estimated that agricultural development is responsible for the elimination of 26 million acres of wetlands nationwide over the last century alone.

Agriculture has been the cause of 26 percent of the wetland loss in the Upper Mississippi basin. Wetlands continue to disappear as they are converted for row cropping and other agricultural uses. Wetlands have the ability to filter out agricultural pollutants such as nitrates and phosphorous, but only to an extent. As row crop development in wetland areas has increased, so has the use of fertilizers containing these contaminants.

Wetland plants play a critical role in capturing these pollutants before they can reach the river, thus improving water quality. But between 1945 and 1985, the application rate of commercial fertilizers increased twenty fold and contributed to significant nutrient enrichment - to the detriment of water quality and native species - in the Upper Mississippi system.

High levels of nitrates and phosphorus in runoff reduce the amount of oxygen in the river, suffocating fish and other aquatic organisms. The Mississippi's once-diverse population of freshwater mussels has taken an especially hard hit. Of the river's 38 mussel species, only 16 have been able to survive increased pollution and sedimentation. Additionally, people along the river have had to alter their lifestyles, and are no longer able to eat the fish they catch or swim in the river.

Urbanization also is to blame, responsible for 30 percent of wetland loss in the basin. As wetlands have been filled and drained, the height and velocity of flood waters has increased. Rain no longer slowly percolates into the ground, to be released into streams and rivers. Urban and agricultural drainage systems are structured to move the rain off of the land as quickly as possible. As wetlands have been replaced with farms, roads, and parking lots, water rushes quickly over the land, picking up pollutants along the way.

As wetlands are drained and filled, we not only lose critical wildlife habitat, we lose the important functions of natural flood control and water quality maintenance that wetlands provide.

Betsy Otto



**Wetlands play a critical role in capturing sediment and excess nutrients, and also provide essential habitat for fish, birds and other animals (Onalaska, Wisconsin).**

## ***FLOODPLAIN FORESTS***

Forests along the Mississippi's floodplain are another important piece in the habitat puzzle. Floodplain forests in the basin include willow, cottonwood, silver maple and oak hickory forest communities, as well as some swamp cypress and shrub communities.

Before European settlement, forests in the Mississippi floodplain covered over 70 percent of the landscape. By 1989, this coverage was reduced to less than 20 percent of the floodplains. This decrease in coverage has been attributed to the clearing of forests for agricultural land and the use of trees for fuel wood and lumber. Today, levee construction and drainage projects continue to change the landscape of the forests to the point where they are now mainly restricted to narrow parcels of land on the river side of levees.

The Upper Mississippi's forests support a large number of bird species - more than any other habitat on the river. Large parcels of land (up to 160 acres) are likely to support 30 to 50 different species of birds, including wood ducks, red-shouldered hawks, hooded mergansers and prothonotary warblers. Floodplain forests are critical stopover points for migratory waterfowl and songbirds. They also serve as important roosting and nesting areas for raptors like the bald eagle.

Bottomland forests, which are close to the river in elevation, are often inundated. These natural areas host migrating and nesting populations of songbirds, bald eagles, ospreys, herons, egrets, hooded mergansers, mallards and wood ducks.

Mallards, Canada geese and blue-winged teal nest on the river's forested islands; mallard nesting densities on islands can reach as high as 172 nests per acre. American redstart, prothonotary warbler and many other species of neo-tropical migrants also nest in tremendous numbers in thick forests along parts of the Mississippi bordering Minnesota and Wisconsin. Floodplain forests typically feature twice as many songbird nests as upland forests.

The river's forests also are important habitat for the red-shouldered hawk, which is considered rare by four states bordering the Mississippi, and the forests serve as important nesting and foraging habitat for great blue herons and great egrets. Overall, eight species of colonial water birds nest or breed in the forests bordering the Mississippi.

In addition to providing homes for birds and other wildlife, forests perform important natural ecosystem functions, including providing forest shade that helps control water temperature. They also reduce sedimentation and generally improve water quality. Tree roots hold soils and filter sediment from upland runoff. In fact, forests can reduce suspended sediment levels by 94 percent,

**In addition to providing homes for birds and other wildlife, forests perform important natural ecosystem functions.**

Whitney Clark



**Floodplain forests trap sediments and improve water quality, as well as provide habitat for birds and wildlife (Vermillion Bottoms, Minnesota).**

improving water quality by reducing phosphorus levels by 88 percent and nitrogen levels by 71 percent. Leaf fall and other woody debris from the forest also provides an important source of organic matter that forms the basis of the food chain and provides important in-stream habitat for aquatic insects and animals.

Seasonal flooding is an important process in floodplain ecosystems because it connects the river to its floodplains. Willow and cottonwood communities require specific flooding and drying cycles, and new deposits of nutrient-rich sediment for successful reproduction. The natural flooding and drying cycle on the Upper Mississippi River has been severely altered since the construction of lock and dam systems. Water levels are artificially high and unnaturally uniform under this man-made regime. Because of the construction of river training structures such as

levees, dams, dikes and revetment alterations in many places, the main river channel is no longer connected with its floodplain. As a result, the quantity and diversity of the Upper Mississippi's floodplain forests have suffered.

Today, forests are more often present in more frequently flooded lands adjacent to the river and are scarce in unflooded areas such as levee protected and terraced lands. Many of the present forests in the basin have emerged from abandoned cropland acquired by the federal government - but they are less valuable habitats because they are cut off from the river by manmade structures. These woodlands contain fewer species and have less diversity of oaks and hickories as compared to pre-settlement floodplain forests.

Oak hickory forest communities have suffered greatly from agricultural development. These trees thrive in well-drained areas that experience little flooding - areas that are highly desirable for farming. Logging has also taken its toll, with oak hickory wood highly valued for fuel and building material.

In addition to agriculture and the lock and dam system, urban development has been a factor in forest destruction. By 1929, farmland and urban areas covered 22 percent of the floodplain while the forests declined to 29 percent coverage. By 1989, forest coverage had declined to 14.3 percent.

As floodplain forests have been lost, populations of several colonial waterbirds found along the Upper Mississippi River - great blue heron and great egrets - have declined. Both resident songbirds and neo-tropical migrants are struggling, according to surveys. Studies also show that the small fraction of remaining floodplain forest - most of which is no longer linked hydrologically

## TIMELINE OF MAJOR UPPER MISSISSIPPI RIVER ALTERATIONS

**1838-1839:** U.S Army Corps of Engineers is authorized to improve navigation of the Mississippi River by blasting a channel five feet deep and 200 feet wide through the Des Moines River.

**1854:** U.S Army Corps of Engineers is authorized to create a channel through the Rock Island Rapids and clear snags and other hazardous materials in the river.

**1866:** Congress authorizes a 4-foot channel project involving dredging and snag clearing to maintain navigational function of the channel.

**1878:** The 4-foot channel project is replaced by a 4.5-foot channel project.

**1900:** Chicago Sanitary and Ship Canal completed creating a permanent connection between Lake Michigan and the Illinois River through the Des Plaines River. The diversion of water flow from the lake allowed wastes to flow downstream from Chicago, increased the Illinois River flow, raised water levels 3 feet, and permanently inundated 22,500 acres of terrestrial and floodplain wetland habitats, filling it with domestic sewage and other industrial pollutants.

**1907:** With pressure from navigation and business interests, Congress authorizes a 6-foot channel project.

**1927:** Levee construction in the unimpounded Mississippi River was coordinated by the U.S Army Corps of Engineers resulting in increasing sedimentation, gradual loss of depth and aquatic area coverage in the river's

backwaters. Expanded levee construction begins to protect river bottom farmlands and urban areas from moderate floods. Levee construction and agricultural encroachment decreased productive river floodplains that supported diverse habitats and wildlife.

**1930:** A 9-foot channel was authorized by Congress and is the project that is currently operated and used by the U.S Army Corps of Engineers today and led to the construction of 29 locks and dams on the Mississippi and 8 locks and dams on the Illinois River. Nearly seven decades of channel improvement projects were beginning to show negative effects towards the river environment.

**1945:** Congress authorized the U.S Army Corps of Engineers to deepen the Illinois waterway and the Mississippi River from Cairo to Grafton to a minimum of 12 feet.

**1949:** U.S Army Corps of Engineers completed the first 12-foot channel survey.

**1968:** Phase I of the 12-foot channel survey begins with opposition from fish, wildlife and recreational interests fearing that it would cause substantial negative changes to the river's ecology.

**1975:** U.S. Army Corps of Engineers begin reduced depth dredging to cut down the on the quantity of dredged material.

**1978-1990's:** Major flood control projects begin to be implemented establishing the construction of dams, floodwalls and levees for flood control purposes.

to the Mississippi River - will not meet the needs of wintering waterfowl. In addition, forest fragmentation increases the likelihood of predation.

### **BLUFFS**

The rolling hills and high limestone bluffs along the Upper Mississippi have long been home to a variety of plant and animal species. A patchwork of upland prairies, steep hill prairies and upland forests, these bluffs are characterized by plant species such as big blue stem and Indian grass (upland prairies), little blue stem and post oak (hill prairies), and white oak, northern red oak, and hickories (upland forests).

Blufftop areas provide stunning panoramic views of the river. Many people in Minnesota, Iowa, Wisconsin, and Illinois consider the blufflands to be the highlight of their states' natural features.

The area is nationally recognized as an important migratory route for neotropical birds and waterfowl, and as habitat for endangered birds of prey and other species. Some of the nation's rarest species of plants and animals live in the confines of this rugged terrain. The bluff slopes are extremely sensitive to agricultural and lawn chemicals, and to soil erosion.

In 2000, the group Scenic America named the blufflands region as one of its "Last Chance Landscapes," claiming, "The unique beauty of the Upper Mississippi Blufflands Region of Minnesota, Iowa, Wisconsin, and Illinois is different from any other areas in these states. In addition to the scenic qualities of the blufflands, the area contains historic towns, important archaeological sites, small working farms, and rare ecosystems. The region is experiencing tremendous pressure from residential development and resource extraction, and needs a regional strategy to protect its special qualities."

The greatest problem facing the blufflands region today is unchecked, sprawling development. Valuable farmland is being subdivided, and large, continuous tracts of woodland are being divided into smaller island parcels, threatening the rare migratory birds that need large interior forests for nesting.

Protecting the remarkable natural and scenic vistas on both sides of the river through development restrictions, design covenants, and other measures will be increasingly important as development encroaches on these beautiful areas.

Dakota County, MN



**Bluffs provide stunning panoramic views of the river, and habitat for some of the nation's rarest plant and animal species (Pine Bend Bluff, Minnesota).**

## **BACKWATERS**

Backwaters are formed as the river meanders, deposits sediments, and changes alignment as it moves across its floodplain. Single opening and isolated backwaters on the Upper Mississippi River lack flow at low river stages and tend to accumulate fine-grained sediment. During drought periods, backwater sediments are exposed, consolidating it into firm soils, benefiting the growth of marsh plants. Some backwaters fill in with sediment and gradually become wetlands and floodplain forests. Others remain as true backwaters with a physical water connection to the river, and continue to provide diverse and extremely important off-channel habitats for many aquatic species, including amphibians (i.e., frogs) and reptiles (i.e., turtles).

Sedimentation, the gradual filling of backwaters and side channels with sediment carried by the Mississippi, is a major threat to the Mississippi's fisheries - an important food source for migrating waterfowl. Sediment continues to enter the Upper Mississippi River at unsustainable levels - that is, sediment enters the Mississippi at a rate that exceeds the river's ability to move sediment downstream.

Excess sedimentation is the leading threat to backwater habitats and is among the major threats to the entire basin. On average, the Upper Mississippi River backwaters have lost 74 percent of their volume due to sedimentation from farms and urban areas. Remaining backwaters are projected to fill within 50 to 100 years.

Current land use practices accelerate the loss of side channels by increasing the rate at which soil is washed off the land, into feeder streams, and ultimately into the Mississippi and its backwaters. Much of this sediment is the result of historic farm practices that maximized production and gave less attention to soil conservation. Although these practices are beginning to change, large sediment deposits in small feeder streams remain, and urban development is contributing to excessive sediments as well.

Levee district development has added to the problem by reducing the floodplain area over which the sediments can be deposited, where they are beneficial - which increases the rate of sediment deposits in the backwaters.

In addition to reducing nursery and refuge habitat for fish, burying mussel beds, and blocking the sunlight needed by aquatic plants, the excess sediments



Jeff Stein

**At high water, backwaters act as nurseries for fish, amphibians and reptiles; during droughts, their sediments consolidate, benefiting marsh plant growth (Milan Bottoms, Iowa).**

raise the cost of maintaining the navigation channel. Removing the sediments is a federal responsibility that now costs more than \$100 million annually.

### ***SIDE CHANNELS***

Side channels are upstream and downstream connections that run parallel to the main river channel. Side channels occur around main channel islands, can be either stable or transient, and provide a diversity of channel depth and habitat for river wildlife including fish and mussels.

The quality and quantity of this habitat is continually diminished with practices such as dredging and the construction of locks and dams for navigation, as well as increased sedimentation from agriculture and urbanization.

Side channel loss continues to be a major concern along the Upper Mississippi. Construction projects that support navigation have contributed to the modification of side channels. Generally, dams raise water levels, slow down current velocities, and flood low-lying floodplain and backwater areas that otherwise would be only seasonally inundated. This eliminates critical habitat for aquatic species such as fish and mussels. Also, wing dams and closing structures (structures that prevent flow from entering a side channel or backwater) significantly alter flow characteristics, dramatically changing side channel habitat.

Between 1907 and 1949, wing dam construction caused significant changes in flow patterns and exacerbated sedimentation by trapping sediments that would normally flow downstream. Side channels, which suffer from excessive sedimentation, are further degraded by the reduced flows caused by the closing structures.

Excessive sedimentation not only closes off side channels and backwaters with heavy sediments, but also deposits fine sediments such as silts and clays that, over time, can be redistributed by currents and wind. This fine sediment settles in the deeper areas of the floodplain and within navigational pools and channels, resulting in simplistic uniformity of bottom topography. As islands, which serve as wind and wave breaks, erode, wind and waves build up energy to re-suspend the bottom sediments. This creates excessively murky water which harms fish that rely on sight to find food. It also limits light penetration needed for aquatic plant growth.

Jeff Stein



**Side channels, which provide critical habitat for fish and other aquatic animals, are being degraded by excess sedimentation (near Mill Creek, Illinois).**

## TRIBUTARIES

The tributary rivers and streams that feed the Upper Mississippi play an important role in the overall health of the basin. Historically, when the Mississippi's water levels rose, fish and other aquatic organisms could migrate from the main channel onto the flooded land and up into slower flowing tributary streams. Once in these tributaries - often a more sheltered environment than the Mississippi's main channel - the aquatic organisms could spawn and seek refuge from predators. For the many aquatic organisms that need periodic protection from the harsh and fast moving water flow of the main river system, or for those who may need to escape pollutants in the main river, tributaries are an essential habitat.

Seasonal flooding is an important event in the Upper Mississippi ecosystem because periods of high water connect the river with its floodplain. Unfortunately, many of the low elevation floodplains no longer benefit from seasonal flooding and drying because they are now permanently flooded by dams. Thanks to wetland loss, flood stages are higher and floodwaters reach the river faster. Water that would have been stored in wetlands is now moving downstream rapidly via tributaries, compounding the harshness of the main channel environment.

Since the Mississippi has been blocked by dams and disconnected from its floodplain, it has been more difficult for fish to migrate in the mainstem river and up into the tributaries. Floodplain animals and plants are specially adapted to the rivers "flood pulse" - the annual advancement and retreat of the floodwaters onto the floodplain. For many of the fish species, this acts as an essential reproductive cue, signaling the time for fish to begin their migration and spawning. The locks and dams and the impoundments behind them not only keep important "refuge" habitat off limits, they inhibit fish and other floodplain plants and animals from receiving their reproductive cue to begin their spawning migrations. It is estimated that flood control and dams block access to over 50 percent of the length of tributary streams and rivers.

Agricultural fertilizers and pollutants, as well as urban runoff, have drastically compromised the water quality of tributaries. The Upper Mississippi basin is one of the largest consumers of commercial nitrogen in the United States. Fertilizer application in the basin contributes to high nutrient loads in the river and its tributaries. Three percent of the total amount of applied pes-



Betsy Otto

**Tributaries offer fish and other aquatic animals a refuge from the Mississippi's fast-moving waters (Bear Creek, Hannibal, Missouri).**

ticides such as Atrazine reaches tributaries. Intensive livestock production, tile drainage systems, and the leachable quality of the soils all contribute to severity of nutrient loading in the tributaries. These pollutants are toxic and can cause stress, injury or death to aquatic organisms. Compounding the problem of toxic runoff and excess nutrients, these compounds often bind with soil particles and are carried downstream into the river. The contaminants can be continually re-suspended as they move down the river channel. Excess nutrients delivered downstream are a major cause of the "Dead Zone," that is, severe oxygen deprivation in the Gulf of Mexico.

## DEFINITIONS OF UPPER MISSISSIPPI RIVER HABITAT TYPES

**Floodplain Forests:** Forests that grow on floodplains (the areas of a river valley covered with materials deposited by floods) serve as a rich habitat for wildlife and fish during floods, reduces soil erosion, improves water quality and provides for recreational landscapes.

**Backwaters:** Areas of slow moving or standing water formed by geological formations such as the growth of natural levees, channel migration, tributaries, or by floodplain scouring. They can be isolated or contiguous depending on the presence or absence of a connection between the backwater and the river; and may be susceptible to flooding as well as sediment accumulation.

**Side Channels:** Upstream and downstream connections to the main channel that provide a diversity of depth parallel to the main channels. They are present around main channel islands and can be either stable or transient.

**Tributaries:** Streams and rivers that drain into the Mississippi, used by fish during times of spawning and to seek refuge from harsh water flow or water quality conditions on the main river system.

**Floodplain Wetlands:** Lands located within

the floodplain, but not necessarily directly adjacent or hydrologically connected, in which the water levels are usually at or near the surface. They contain undrained wet soil and are saturated with water or covered by shallow water during the growing season. Native wetland plants that are adapted to this environment thrive in these areas.

**Riparian Wetlands:** Wetlands that are located directly on the bank of the river or natural watercourse and are hydrologically connected to the river. They create a vegetated transition zone between rivers and upland habitats, providing food, shelter and migration pathways for river wildlife.

**Bluffs:** Area of rock outcroppings that typically create the river valley border directly outside of the floodplain. Bluffs provide dramatic vistas, often have cultural significance, and commonly support habitat types such as hill prairies (e.g., little blue stem and post oak), and upland forests (e.g., white oak, northern red oak and hickories).

**Upland Prairies:** Usually located on the river bluffs and typically consist of vegetation like big blue stem, Indian and cord grass.

**RESOURCES FOR MORE INFORMATION**

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## PART II: RESTORATION OPPORTUNITIES

While the Mississippi ecosystem has undergone significant changes over the past 200 years and continues to be threatened by a variety of human impacts, it is still a rich and vibrant river, full of potential.

Despite the damage the river has suffered, it is still home to more than 400 different species of wildlife, 326 bird species (60 percent of all species in North America), and 40 percent of North America's migratory waterfowl.

A concerted effort by many communities and river enthusiasts is needed to save the Mississippi, one of the world's most diverse ecological systems.

Some of the human alterations - such as the navigation channel and the lock and dam system - can't and shouldn't be undone. They are too important to river commerce and the regional and national economy. But there are still many positive steps that can be taken to restore Upper Mississippi River habitat.

Local communities, whether working on their own or partnering with non-profit conservation groups, civic organizations, government agencies or other communities can help set the river on a positive course for the future.

There is no shortage of opportunities for communities to protect and restore habitat and revitalize their riverfronts. However, there are certain instances where a community can have an especially significant impact and get the greatest results for its investment.

The following section describes some of the most significant river habitat protection and restoration opportunities along the Upper Mississippi. These include:

- € Habitat restoration
- € Flood management
- € Land acquisition and open space protection
- € Watershed management
- € Brownfields reuse
- € Riverfront redevelopment

### ***HABITAT RESTORATION***

For people who own land along a river or stream, the property is more than a yard or a farm. It's special - as a place of natural beauty, a place for birds and wildlife, a place to swim or boat, a place of spiritual renewal.

**A concerted effort by many communities and river enthusiasts is needed to save the Mississippi.**

These lands are valuable - and can be even more valuable if they are cared for properly. Scenic beauty and good water quality are “musts” for high property value along a river.

Many people feel they have no choice but to reinforce their riverbanks with stone, concrete, or metal to protect their property from a river’s naturally dynamic meandering and flooding. But these actions prevent the growth of trees and vegetation that would naturally stabilize the banks. These solutions don’t foster habitat for fish and wildlife. Further, armoring riverbanks can worsen the problem, exacerbating erosion and flooding for downstream neighbors.

A better approach to bank protection is to use natural materials, like tree root masses, brush, and boulders along the outside curves of the river. Property owners can also sink short stakes of living willow branches both vertically and horizontally into the banks - “bio-engineering” that creates natural protection against erosion.

ACTIVATING LOCAL COMMUNITY STEWARDSHIP  
*Nahant Marsh, Davenport, Iowa*

Jeff Stein



**Early morning at Nahant Marsh.**

Nahant Marsh, 513 acres of urban wetlands along the Mississippi River in Davenport, Iowa, is home to a diverse species of flora and fauna. In 1995, however, the U.S. Fish and Wildlife Service discovered dangerous levels of lead shot on a section of the property owned by a sportsmen’s association.

In addition to being contaminated, the marsh had been under increasing pressure from urbanization and industrialization. Fish and wildlife, as well as the fertility of the soils, were at risk. The marsh’s questionable health generated much public concern.

One year after the dangerous lead contaminants were discovered, the group River Action led a committee of representatives from environmental organizations, local colleges, city officials and local citizens to establish a Nahant Marsh Master Plan.

The goal of the plan was to improve the water quality and natural water flows within the marsh, to protect and improve habitat for plants and animals, and to provide recreational and educational opportunities for the area’s residents. The City of Davenport adopted this

Better yet, property owners should allow the riverbanks to be naturally vegetated with natural grasses, shrubs, and trees (ordinary lawn grass has short, fine roots that do not hold soil well). A good buffer strip along the riverbank will not only prevent erosion and bank failure by capturing and slowing runoff, it will help filter runoff and improve water quality.

Natural vegetation can go a long way in filtering contaminants, but landowners should still be cautious about the amount of chemicals they spray on lawns, gardens, and farms. When herbicides and pesticides run off into streams and percolate into groundwater, they can have serious health implications for both the river ecosystem and the people living in the area. Exposure to some chemicals has been linked to certain cancers and the disruption of the endocrine system. Children who walk barefoot on recently-treated areas, as well as pets and resident wildlife, are at risk.

Most importantly, however, property owners would benefit from learning

plan for the restoration of Nahant Marsh.

The EPA determined the cost of clean up at \$2 million. The EPA was paid the purchase price of the land by the City of Davenport and the sportsmen's association in exchange for the clean-up cost, with the stipulation that the property was to be sold and maintained as a natural habitat and used for educational purposes.

The EPA handled the removal of the lead components from the marsh. Thanks to some additional fundraising, an existing clubhouse was renovated into an educational facility and public access trails were developed.

The benefits of this project have been substantial. The marsh's water quality, natural hydrology, and habitat have improved significantly. The marsh continues to teach area residents about the importance of wetlands. The educational research center, public boardwalk, and school programs are providing both educational and recreational opportunities.

Funding for the project was provided by The McKnight Foundation, Scott County Regional Authority, Carver Charitable Trust, Quad City Audubon Society, Ralston Purina Foundation, and the U.S. Fish and Wildlife Service's North American Conservation Act Grant Program.

**For more information:**

River Action  
822 East River Road  
Davenport, IA 52801  
(319) 322-2969  
<http://www.riveraction.org>

BRINGING THE BOTTOMLANDS BACK TO LIFE  
*Milan Bottoms, Milan and Andalusia, Illinois*

Jeff Stein



**Typical floodplain forest in Milan Bottoms.**

ing and urban sprawl encroached over the past 200 years.

A powerline service road built in 1959 at the downstream end of the project site altered the hydrology of the area by ponding water in the remaining sloughs and wetlands on the upstream side of the road. After construction of the I&M Canal, the South Slough side channel of the Rock River was diverted near Milan to create what is now Mill Creek. Mill Creek began to flood Milan and steps were taken to manage flooding by straightening the creek with a nine-foot-deep Channel Navigation Project. This project altered the hydrology of the marsh, however, drying the surrounding floodplain wetlands. Turkey Hollow Creek had also been channelized and cut across the powerline road where it contributed to sedimentation of the wetlands and unnatural water increase in the bottomland forests.

The Milan Bottoms is a stretch of floodplain along the Mississippi River between the Illinois towns of Milan and Andalusia. Prior to European settlement, the bottoms were characterized by forests and wet prairies. Today, the bottoms continues to be an important breeding and nesting area for the red shouldered hawk and provides winter nesting areas for the bald eagle. Herons and other waterfowl, as well as numerous mammals, reptiles, amphibians and fish thrive there.

Like many forests and wetlands, the bottoms suffered as agricultural clear-

the river's cycles and understanding the river as a dynamic living system. Landowners should try to plan land use activities so they are in better balance with the natural system. For example, landowners should consider where high waters will affect their land and plan accordingly, such as placing parks and open space that can withstand flooding near the river.

***FLOOD MANAGEMENT***

In an effort to control floods, the federal government has spent more than \$25 billion on levees and dams. Yet flood losses have continued to rise. Poor

The habitat restoration project in Milan Bottoms started in April of 1999 and should be completed by October of 2002. Groups including the Rock Island Corps of Engineers, River Action, and the Illinois Department of Natural Resources collaborated on the project. Project objectives include restoring the natural timing and amounts of flows in the Mississippi River and to maintain forest diversity, migratory bird habitats and natural life cycles of other wildlife.

To accomplish these objectives, road modifications, forest enhancement, and creek restorations are being implemented. The powerline road will be lowered in elevation between the two sloughs to decrease sedimentation rates into the wetland and forest areas. Forest enhancement efforts include planting various tree species on selected natural ridges and adjacent to Mill Creek to help in the reduction of flooding and increase the amount of forested area. A section of Turkey Hollow Creek will be restored by re-routing the creek to flow downstream of the powerline road.

The Milan Bottoms restoration project will improve an important and increasingly rare area of habitat of the Upper Mississippi. Water level modifications, stream channel restoration, and tree planting have all aided in restoring the bottomland forest and improving habitat diversity.

Funding for this project came from both federal and non-federal sources. The project sponsors included Illinois Department of Natural Resources and River Action. Other groups participating included the Quad City Conservation Alliance, Quad City Audubon, Mid-American Energy Company and Midwest Raptor Research Fund. Grants from the United States Fish and Wildlife Service and the McKnight Foundation also contributed to the project.

**For more information:**

U.S. Army Corps of Engineers  
Rock Island District  
P.O. Box 2004  
Rock Island, IL 61204  
(309) 794-5224  
<http://www.mwr.usace.army.mil>

land-use decisions have put more people at risk by allowing development in harm's way and by eliminating the natural flood control functions of wetlands and floodplains.

In recent years, flood control experts have encouraged policymakers and local officials to make greater use of **non-structural solutions** like directing development away from floodplains, pre-disaster relocations, greater incentives for strong local floodplain management and flood tolerant crops, and basin-wide flood loss reduction plans which focus on protecting and restoring wetlands and floodplains.

### *Directing Development Away from Floodplains*

Development in flood-prone areas just doesn't make sense. When a flood hits, people are forced from their homes and businesses, and are faced with often devastating financial losses. Local, state, and federal governments are faced with rescue operations, caring for displaced people, and repairing damaged infrastructure.

Limiting development in flood-prone areas is the most effective way to reduce the costs of floodplain development.

Many communities have decided to restrict development in floodplains for a multitude of reasons beyond flood protection, including better water quality, wildlife habitat, and recreation opportunities. In some cases, communities have permitted developers to intensify development in already urbanized areas in exchange for a limitation on development in floodplains.

Some state and local governments have created tax incentives for strong floodplain management. The City of Des Plaines, Illinois began a permit surcharge for floodplain development projects to help finance city flood protection activities. The City of Stamford, Connecticut has required developers of projects constructed in the floodplain to contribute funds for the operation and maintenance of their automated flood warning system. After flooding in 1982, the state of Connecticut enacted special flood relief legislation that included a provision for tax abatements for floodplain property owners.

Many communities have gone beyond the minimum requirements of the National Flood Insurance Program to create more innovative programs. For example, some communities have adopted policies that discourage the extension of infrastructure such as roads, water mains and sewers into floodplains in order to discourage development in these risky areas. Through floodplain zoning, other communities have placed special restrictions on floodplain land uses. Development in the floodway - the area of the floodplain closest to the river - often is prohibited. Increasingly, subdivision regulations impose stronger controls on stormwater runoff to reduce downstream flooding.

Most states have adopted floodplain management programs. In ten states, officials regulate a wide variety of activities, ranging from new dams and channels to the development of homes and businesses. Some states delegate permitting authority to local communities while others require that state governments regulate floodplains.

### *Pre-Disaster Planning*

Taking steps to relocate vulnerable homes and businesses before disaster strikes - and being prepared to act quickly when it does - can help reduce long-term flood losses.

**Limiting development in flood-prone areas is the most effective way to reduce the costs of floodplain development.**

The experience of Arnold, Missouri, located at the confluence of the Meramec and the Mississippi Rivers, demonstrates the benefits of pre-disaster planning. Disaster relief for Arnold's flood victims topped \$2 million following the Great Flood of 1993. But, following a voluntary relocation program, federal assistance was less than \$40,000 when floodwaters returned in 1995. Unlike most flood-prone communities, Arnold had completed a long-term pre-disaster mitigation plan in 1991 - before the flood waters arrived - and was prepared to move quickly when disaster struck to relocate vulnerable homes and business.

An essential element of pre-disaster planning includes identifying those homes and business that are most vulnerable to flooding. Federal officials have identified more than 30,000 repeatedly flooded homes, including more than 5,000 homeowners who have received flood insurance payments that exceed the value of their home. To date, few efforts have been made to target those flood-prone homes and communities where pre-disaster planning could yield the greatest benefits.

The development of state and local pre-disaster plans could significantly reduce future flood losses. Unfortunately, federal funding for programs designed to help identify and relocate vulnerable homes before disaster strikes is insufficient - less than \$50 million a year spread across 21,000 flood-prone communities. Far more is spent annually on disaster relief and recovery.

### *Buy-Outs and Relocations*

While levees and floodwalls will continue to play a role in flood loss reduction, experts agree that many sections of flood-prone communities, where frequent flooding had been a way of life for residents, should become river-focused parks and recreation areas, with the former occupants relocating to safer areas on higher grounds.

Unlike levees and dams, solutions such as acquisition and restoration of floodplain land give rising rivers more room to spread out and meet other important needs of riverside communities: improved water quality, opportunities for recreation, and enhanced habitat for river wildlife. Parks, meadows, wetlands, and woods can absorb excess water and keep homes and businesses from suffering expensive losses.

Following the Great Flood of 1993, many repeatedly flooded homeowners opted to use federal relief to relocate their homes to higher ground - ending the cycle of rebuilding their homes in harm's way. In the past, flood-weary residents of bottomland homes had no choice but to return to the floodplain, repair their homes, and wait for the next disaster to strike. But the Great Flood shook the nation's faith in levees and dams and set many communities on a new course.

BUCKING THE FLOOD CONTROL STATUS QUO  
*Multi-Objective Flood Prevention Program, Tulsa, Oklahoma*

City of Tulsa Stormwater Drainage Advisory Board



**Looking east toward downtown: Tulsa's 1984 flood damaged nearly 7,000 buildings.**

The City of Tulsa, Oklahoma has developed a system of greenways and trails linking multi-purpose flood control structures along one of its most flood-prone rivers, Mingo Creek.

Until recently, Tulsa had a long history of flooding. The city is subject to high intensity rainstorms that can strike with little warning and dump as much as fifteen inches of rain in eight hours. Much of the city was built within the floodplain of the Arkansas River or one of its tributaries. Over 25,000 homes and businesses were built in flood-prone areas. Between 1970 and the mid-

1980s, Tulsa County led the nation in flood disasters and was declared a federal disaster area ten times.

In the wake of the Mother's Day flood of 1970, the city joined the National Flood Insurance Program and developed floodplain regulations which, according to local interests, were not well enforced. A subsequent flood caused \$18 million in damage and led to the relocation of 33 homes. However, the flood also led to a channelization project that simultaneously increased downstream flooding and destroyed wetlands and bottomland hardwoods.

The Memorial Day flood of 1976, which caused three deaths and \$34 million in damages, revolutionized thinking about floodplain land use strategies and renewed emphasis on regulating new development. More money was spent to remove thirty additional homes from the Mingo Creek floodplain and the city initiated plans to create a series of detention basins. But, a series of dry years followed and the program lost momentum and support.

Then, in 1984, Tulsa had the worst flood in its recorded history which resulted in 14 deaths and \$180 million in damage. Five deaths and over \$125 million in property damage occurred along Mingo Creek.

Once again, the flood renewed local interest in reducing flood losses and stimulated greater support for re-examining past approaches to floodplain management. The City of Tulsa and the Corps of Engineers signed a cooperative agreement in 1987 to implement a local flood control project.

The Corps submitted designs for five structural detention sites along Mingo Creek to the city for review. The detention basins were located close to established neighborhoods in Tulsa and city officials recognized that development of these facilities, unless carefully designed, could have adverse impacts on the community. The Corps' original design proposed that the sole purpose of these basins would be to retain floodwaters and construction of the basins would destroy two community parks as well as Mingo Creek's remaining wetlands and bottomland hardwoods.

In response, the city organized a team of civil engineers, landscape architects, and urban planners to develop design alternatives. The teams were charged with developing a design which would provide stormwater detention benefits but would also meet the community's environmental, aesthetic and recreational needs.

The design alternative prepared by the city - which included a series of permanent lakes combined with some relocation of structures - cost the same as the original design by the Corps. But the alternative plan served a broader range of objectives. Today, the Mingo Creek floodplain features woodlands, wetlands, trails and parks.

Funding for the projects was obtained from a variety of sources, including Federal Emergency Management Agency (FEMA) programs, Small Business Administration (SBA) loans, and a local revenue bond sale. As part of the city's stormwater management program, Tulsa established a stormwater utility fee which requires residents to pay \$2.95 per month and requires businesses to pay according to the runoff they create. In addition to the fee - which generates more than \$10 million per year - the city put aside capital funds specifically for the acquisition of frequently flooded properties. Overall, more than 900 structures have been relocated from Tulsa's floodplain since the 1970s.

As a result of Tulsa's struggle to reduce flood losses, the community's flood insurance rates have dropped by 25 percent and are now the lowest in the nation.

**For more information:**

City of Tulsa Stormwater Drainage Advisory Board  
 Department of Public Works  
 200 Civic Center  
 Tulsa, OK 74103  
 (918) 596-7806  
<http://www.cityoftulsa.org>



**Tulsa's Woodward Park provides recreation and scenic amenities, as well as flood storage.**

Ultimately, more than 10,000 homes and businesses throughout the Midwest were relocated from the river bottoms, the largest voluntary relocation in the nation's history. In Illinois and Missouri alone, 5,100 homes and businesses were relocated at a cost of \$66 million - structures that had previously received \$191 million in flood insurance payments.

In some cases, entire communities were relocated to higher ground, forever reducing the risk of flooding. In Grafton, near the confluence of the Illinois and Mississippi Rivers, more than 100 homes and businesses have been relocated to a 235-acre site on the bluff and replaced by a park, marina and bike trail to attract recreation and tourism. When floodwaters returned in 1995, 1996 and 1998, Grafton residents were high and dry.

Since 1993, nearly 10,000 additional homes, farms and businesses have been voluntarily relocated or acquired in flood-prone communities across the nation. An entire mobile home park located in the floodplain of the Truckee River was acquired and converted into a recreational area for nearby neighborhoods. In Fredericksburg, located along the Blue River in southern Indiana, local officials worked with the Indiana Housing Finance Authority to acquire 20 flood-prone properties, including 17 homes.

In 1996, more than 700 homes and businesses were moved from the Flint River floodplain in Albany, Georgia. When floodwaters returned two years later, relief costs fell by nearly \$2 million - a net savings of \$500,000. Relocating 96 homes (including a retirement home) and businesses from the Spring Creek floodplain in Fort Collins, Colorado before a record flood in July 1997 probably saved nearly 100 lives and \$5 million in damages.

River edge lands that are acquired and protected from development can be an important strategy for reducing flood damages. For example, Davenport, Iowa has set aside riverfront areas as public parks and ballfields that can temporarily store floodwaters, minimizing damage to downtown buildings and other structures. Protecting upland wetlands and other natural areas that can hold and slowly release rainwater and snowmelt can also reduce flooding. Even small areas can capture and infiltrate precipitation, thus reducing the amount and rate of runoff that would otherwise add to waters flooding into the Mississippi.

### ***LAND ACQUISITION AND OPEN SPACE PROTECTION***

The acquisition and protection of land in a floodplain can have significant benefits for the river ecosystem and the community. But protecting against flooding isn't the only reason that land acquisition and protection are important.

Preserving open space either directly alongside the river or elsewhere in the watershed can benefit a community in many ways.

Some communities acquire land to provide better recreation opportunities. Others protect natural areas for wildlife habitat, or to ensure safe drinking water supplies. Many towns want to preserve places of historical or cultural importance. Whatever the goals, land acquisition and open space protection can simultaneously fulfill park, recreation, quality of life, and ecosystem needs.

Open space gives people a place to walk and play and simply enjoy the river's beauty and changing moods. These spaces, whether alongside the river or along bluffs and uplands within sight of the river, improve our quality of life. They provide places of quiet and serenity, a respite from the congestion of busy streets and growing communities. Communities should strive to provide both active and passive recreation, such as boat launches, trails, quiet places for sitting, and nature observation areas.

Ideally, open spaces should be designed with native vegetation and a natural character to enhance wildlife habitat values and to give people a sense of context and connection with the river's unique natural habitats.

Open space also can serve as a natural protection system for drinking water, an irreplaceable environmental and economic resource. Technology can only go so far with its filtering and disinfecting to keep our drinking water clean. Many communities are finding that preserving buffer areas and other watershed lands that can filter and protect water sources can be one of the most cost-effective ways to guarantee clean drinking water.

A recent study by the Environmental Protection Agency predicted the need for more than \$100 billion in the next 20 years to bring the safety of America's water supply to adequate standards. Much of these funds would be needed for costly filtration technology. Many towns have decided to protect open space around their drinking water sources to ensure good water quality and avoid these costly treatments.

Landowners who want to protect their property and the river in perpetuity have a variety of options. Organizations such as the Trust for Public Land, American Farmland Trust, and local conservancy groups can help. One popular option is the conservation easement. A conservation easement is a legal way for landowners to permanently protect their land from future development in order to preserve natural resources and open space. The owner retains title to the property, continued use of it (subject only to the easement restrictions), and the right to sell, lease or bequeath the property. Because the easement is granted in perpetuity and will apply to all future landowners, conservation easements provide permanent environmental protection for the land.

**Land acquisition and open space protection can simultaneously fulfill park, recreation, quality of life, and ecosystem needs.**

## EAGLES SOAR OVER PROTECTED HABITAT

*Cedar Glen Eagle Roost and Preserve, Hamilton and Warsaw, Illinois*



**More than 400 bald eagles have sought shelter at Cedar Glen Preserve during cold winters.**

The Cedar Glen property was originally owned by Western Illinois University. The Nature Conservancy began acquiring the property in 1971 when it was threatened by logging. Currently, more than 1,200 acres are held by The Nature Conservancy, the Illinois Department of Natural Resources, and Western Illinois University.

The preserve's three miles along the Mississippi (including three islands) contains a variety of habitats: limestone bluffs, upland oak-hickory forests, cottonwood floodplain forests, and prairies.

The limestone formations are especially important to bald eagles, as they create a rounded-out narrow glen where the eagles can roost protected from the winter winds. More than 400 eagles have been counted here during some of the coldest winters.

Thanks to a ban on pesticides like DDT, eagles have been on a rebound since the 1970s. But other threats, especially habitat loss, remain. Protection of the bald eagle demands protection of places like Cedar Glen.

And eagles aren't the only wildlife to benefit-the preserve is home to at least fourteen species listed as endangered or threatened in Illinois. Fox, mink, and badger thrive here, as do mussels - considered among our country's most imperiled freshwater species.

The university uses the preserve in the spring and summer months for biology classes and research projects. The public may enjoy hiking, bird watching, and exploring in the preserve-except between November 1 and March 1, when the roost is closed to protect the eagles from disturbance.

### **For more information:**

The Nature Conservancy  
Illinois Field Office  
8 S. Michigan Avenue, Suite 900  
Chicago, IL 60603  
(312) 346-8166  
<http://nature.org/states/illinois/preserves/art1114.html>

## ***WATERSHED MANAGEMENT***

The philosophy behind watershed management is that thousands of individual land use decisions have cumulative effects on flooding, water quality, and wildlife habitat. Individual decisions to tile a farm field, fill a wetland or build a parking lot have little measurable impacts on flooding. But, when combined with thousands of similar decisions over hundreds of years and hundreds of miles, the impacts can be devastating.

A special White House Task Force, during its review of the causes of the Great Flood of 1993, found that the “loss of wetlands and upland cover and the modification of the landscape throughout the basin over the last century and a half ” had indeed significantly increased the rate at which water moved off the land and into river bottoms.

Although the restoration of upland and bottomland wetlands probably would have made little difference during the Great Flood, the Interagency Floodplain Management Review Committee concluded that restoring some of these “natural sponges” will help reduce losses during smaller, more frequent floods.

Today, communities are working with their upstream and downstream neighbors to develop flood loss reduction plans for entire watersheds, not just the areas directly alongside their riverfronts.

In many cases, watershed-wide flood loss reduction strategies have been selected because they are often far less expensive than structural solutions like levees and dams. In others cases, communities wanted to meet other objectives for rivers and streams, including improved water quality and enhanced habitat for river wildlife.

Thousands of communities have been working together to develop watershed-wide strategies, primarily to address water quality problems. By using a variety of techniques that apply to agricultural lands, forest management activities and urban areas, these communities are protecting the quality of drinking water supplies and reducing long-term water treatment costs. Measures have included everything from soil conservation practices and the acquisition of buffer strips to grazing restrictions and better animal waste management.

Many of the techniques used to address water quality have also been used to reduce flood losses. In particular, communities have acquired floodplain lands, restored and protected wetlands, created buffer strips along streams, reduced impermeable paved surfaces, captured and treated stormwater on-site, redesigned flood control channels, and encouraged farmers to adopt better tillage practices to reduce the rate at which water moves off the landscape.

**Watershed: the entire land area drained by a particular river and its tributaries.**

LOOKING TO THE WATERSHED TO PROTECT DRINKING WATER  
*Raccoon River Watershed Project, Iowa*

Iowa Soybean Association



**The Raccoon River provides drinking water for one in ten Iowans.**

excessive nutrients, particularly nitrogen. Public concern about the quality of drinking water came to a head in the spring of 1990 when daily media reports gauged the amount of nitrates in the Des Moines and Raccoon Rivers, the primary sources of drinking water for over 370,000 Des Moines area residents. The U.S. Environmental Protection Agency's (EPA) maximum contaminant level (mcl) is 10 milligrams per liter or parts per million for nitrates. Although the number of days when nitrate maximum were exceeded has dropped since the early 1990s, as late as 1998, these contamination levels were still exceeded on as many as 80 days each year.

Local residents recognized the need for leadership from the agriculture sector, and an appreciation for voluntary education and information-based strategies for water quality protection led to the creation of the Raccoon River Watershed Project. The project has active membership of key agriculture, environmental and municipal groups, including the Agribusiness Association of Iowa, Des Moines Water Works, Iowa Cattlemen's Association, Iowa Corn Growers Association, Iowa Farm Bureau Federation, Iowa Natural Heritage Foundation, Iowa Pork Producers Association, and the Iowa Soybean Association.

The Raccoon River watershed covers parts of 17 counties in central Iowa. Water in the Raccoon River watershed flows to the city of Des Moines, empties into the Des Moines River and eventually ends up in the Mississippi River, then finally the Gulf of Mexico.

The Raccoon River watershed comprises many subwatersheds, encompassing 2.3 million acres, including 1.7 million in corn and soybean production. The river is the drinking water source for one-tenth of all Iowans.

Sections of the Raccoon River that are used for drinking water have experienced problems caused by

***BROWNFIELDS REUSE***

Many cities and small towns are faced with the problem of abandoned, under-utilized, and often contaminated industrial lands. Known as "brownfields," these can be places like cargo yards and harbor terminals, manufacturing plants, and abandoned gas stations.

The watershed project generated a report that recommended funding for adaptive research, specifically for the development of improved techniques and equipment to manage organic fertilizer, as well as a research and education approach to encourage farmers to change their nitrogen application and manure management practices voluntarily.

In addition to these broad-scale efforts, many demonstration projects are underway. For example, Chris Henning Cooklin and her husband, Max, planted 26-acres of native grass and wildflowers on their farm near Cooper, Iowa in 1996. The 99-foot-wide strips were planted along all of the creeks on their farm through the Conservation Reserve Program offered by the U.S. Department of Agriculture, and with technical assistance from the Iowa Natural Heritage Foundation and West Central Cooperative agronomists. The five grass and 16 flower species planted as a part of this project are reducing sediment entering the creeks, increasing the amount of water soaking into the soil, and creating a pleasing landscape feature.

In another example, a 200-acre farm was donated to the Iowa Natural Heritage Foundation by Kenneth and Helen MacDonald, and now hosts a variety of demonstrations. The farm now contains 66 acres of wetland and prairie areas which were protected and restored through the Wetlands Reserve Program (WRP) offered by the U.S. Department of Agriculture. These areas have improved water quality, wildlife habitat and wildlife food sources. Many farmers attended a field day showcasing different strategies for optimizing nitrogen management at the farm, which are managed by Iowa State University, West Central Cooperative, farm tenant Don Dunlop and farm manager Harlan Helgren of Brenton Farm Management.

**For more information:**

Raccoon River Watershed Project  
4554 N.W. 114th Street  
Urbandale, IA 50322  
(515) 251-8640 or (800) 797-4322  
<http://www.rrwp.org/>

Huron River Watershed Council  
<http://comnet.org/hrwc/index.html>

U.S. Environmental Protection Agency's Office of Water, Watershed Protection Page  
<http://www.epa.gov/OWOW/watershed/>

Today, more communities are seeing brownfields as areas of opportunity rather than liabilities. The City of Chicago, for example, has become a nationally recognized leader in cleaning up and redeveloping brownfields. A brownfields project can not only clean up environmental hazards, it can remove neighborhood eyesores, create jobs, boost tax revenue, provide housing, and promote general economic health in local communities.

Brownfields located along rivers pose special opportunities. Redeveloping these areas into parks and promenades can have positive benefits for water quality and the river ecosystem. It also can create new assets for the community.

There are some potential barriers to redeveloping brownfields. Developers and investors, cautious of environmental liability, have traditionally shied away from brownfield sites. And even if this barrier is overcome, the parties reusing the site still need funds to survey the type of contamination, develop

RECLAIMING AND CELEBRATING INDUSTRIAL AND NATURAL HERITAGE  
*Mill Ruins Park, Minneapolis, Minnesota*

Betsy Otto



**Mill Ruins Park will provide historical interpretation of the Mississippi’s role in making Minneapolis a lumber and flour milling center.**

The Twin Cities have been turning back to the Mississippi River. After years of neglect and hard use, Minneapolis and Saint Paul are reconnecting with the river’s unique natural features that are a storied part of their history. In Minneapolis, an innovative riverfront historical interpretation effort is underway to reconnect residents with their early industrial history, and act as a catalyst for riverfront revitalization and restoration.

The Minneapolis Park and Recreation Board is developing a new city park near St. Anthony Falls along the Mississippi River. Mill Ruins Park will feature the remains of numerous water-powered mills

that are currently buried below the surface of what was recently a gravel storage facility. The project area is within the St. Anthony Falls Historic District in the shadow of the standing ruins of the old Washburn “A” Mill.

The new Mill Ruins Park is the site of Minneapolis’ former flour milling district near St. Anthony’s Falls. Minneapolis owes its location, history, and growth to St. Anthony Falls. Capitalizing on the presence of a cheap and dependable supply of waterpower, nineteenth-century entrepreneurs developed that energy source to build one of the world’s greatest industrial districts. The city’s initial growth resulted from the development of industries established on lumber and flour milling. As timber resources were depleted, flour milling became the dominant force in the city’s history. From 1880 to 1930 Minneapolis, present-day home of General Mills and Pillsbury, led the world in flour production and earned the nickname of “Mill City.”

a cleanup plan, and perform the cleanup.

In an attempt to overcome these barriers, 47 states (all but North Dakota, South Dakota, and Wyoming) have some sort of brownfield program in place according to the Northeast Midwest Institute. These state programs vary in terms of comprehensiveness, incentives, level of state liability relief granted, and overall effectiveness. They regulate differently and emphasize different types of reuse, whether industrial, commercial, housing, or open space.

Water from the river powered the mills through an elaborate series of underground canals. Water was directed from millponds into canals that ran under the street parallel to the river. The canals supplied waterpower to mills constructed along their route, giving the milling districts a linear configuration that is still in evidence today.

The Mill Ruins interpretive park is located across the Mississippi River from the city's Nicolet Island and Boom Island parks. The new interpretive center is connected to these river islands and the other side of the city by the beautiful Stone Arch Bridge, which was formerly a railroad bridge, and is now a highly popular pedestrian bridge. The Washburn Crosby "A" mill building is being restored to house the Mill City Museum, which will be built within the ruin walls. Five additional floors in the building will house private offices.

Every June at the Stone Arch Bridge, Minneapolis also holds a popular River solstice celebration. Music is composed specifically for the event, and the costumes and dance are designed solely for the site. Up to two thousand people have participated in these events in the past. The music begins with the blast of a horn at St. Anthony Falls Lock and Dam, and concludes precisely at sunset.

**For more information:**

Minnesota Historical Society  
345 W. Kellogg Boulevard  
Saint Paul, MN 55102-1906  
(651) 296-6126  
<http://www.mnhs.org/>  
<http://www1.umn.edu/marp/dig/update2000.html>

Minneapolis Park & Recreation Board  
400 South 4th Street  
Minneapolis, MN 55415-1400  
(612) 661-4800  
<http://www.minneapolisparcs.org>



**Early excavation of an original brick arch over Minneapolis Mill tailrace tunnel.**

The federal government, particularly the Environmental Protection Agency, has a wide array of resources to help communities clean up and reuse brownfields sites. The U.S. Army Corps of Engineers also can provide technical assistance in the assessment, clean-up, and redevelopment of brownfields where such help would improve water quality in streams, rivers, lakes, wetlands, and floodplains. (See Part III: Guide to Federal Funding Sources for more information on technical assistance and federal funding).

### ***RIVERFRONT REDEVELOPMENT***

In the mid-nineteenth century, many river towns turned away from their rivers as railroads made water transportation obsolete. Waterfront streets and shops were abandoned. The banks were overtaken by industries and scrap yards. Most urban rivers were treated as open sewers, open conduits for waste.

Today, however, River “renaissances” are blossoming in river towns across the country. These towns - including many along the Mississippi River - are revitalizing their riverfronts, developing parks and natural areas, building trails and greenways, and redeveloping commercial districts in an effort to rejuvenate the riverfront a true community center.

Riverfront revitalization projects can be excellent for a town’s economy. An attractive riverfront with promenades, restaurants, and shops can attract new businesses and visitors.

A riverfront project can also be good for the river ecosystem and the plants and animals that depend on it. The challenge for towns is designing a riverfront project so it has the maximum benefit for both the river and community - integrating the three objectives of ecological integrity, economic vitality, and a sense of community.

Many towns have realized that the most successful riverfront project is one that focuses on water quality improvement, natural flood control, habitat for fish and wildlife, greenways and trails, and open space for recreation.

Replacing floodwalls with trails, open space, or a park can give the river room to spread out naturally during flood events, and prevent expensive damages to property.

Restoring wetlands and buffer strips along a riverfront can capture runoff from urban streets and parking lots, improving water quality. Greenways can provide this water quality service, while also providing habitat for fish, birds, and wildlife and walking/biking trails for people.

Creating parks and buffer strips that benefit the river ecosystem might mean giving up some traditional ideas of what a park is, or notions of what

**The challenge for towns is designing a riverfront project so it has the maximum benefit for both the river and community - integrating the three objectives of ecological integrity, economic vitality, and a sense of community.**

## BRINGING US THE MIGHTY MISSISSIPPI

### *Mississippi River Museum, Dubuque, Iowa*

Mississippi River Museum



**The Mississippi River Museum draws 65,000 visitors per year.**

The Mississippi River Museum, located in Dubuque, Iowa, is dedicated to collecting, interpreting and sharing the rich and important history of the Mississippi River, America's river systems, and our local and regional heritage. The museum is a major attraction in Dubuque, drawing 65,000 visitors per year. The museum features nationally recognized exhibits and programs including the award-winning film, "River of Dreams." Narrated by renowned story-teller Garrison Keillor, this two-screen, 15-minute film features the spectacular sights and sounds of the Mississippi River. Artifacts and special effects help bring the river to life for museum visitors.

special effects help bring the river to life for museum visitors.

The museum's exhibit, "Make Me A River," supported by the National Endowment for the Humanities and Humanities Iowa, examines the complex relationship between humankind and the river throughout history. Visitors can walk below the river's surface in a simulated underwater experience, view live fish and turtles, and touch American Indian and fur trade artifacts. Other exhibits celebrate the river's transportation and fishing heritage, allowing visitors to view an authentic dugout canoe, a clamming boat, and an early 20th century pleasure craft.

The Mississippi River Museum recently embarked on a substantial expansion, including a new \$188 million Mississippi River Science Discovery Center. The Center will have 11 aquaria displaying Mississippi River habitat types covering the entire length of the river, including flooded bottomland forests, marshes, and southern bayous. Attendance at the museum is anticipated to quadruple once the construction of the new Discovery Center is complete.

#### **For more information:**

The Mississippi River Museum  
 3rd Street Ice Harbor  
 Dubuque, IA 52004-0266  
 (563) 557-9545  
<http://www.mississippirivermuseum.com>

is “pretty.” Pruned geometric shrubs or overly landscaped and manicured turf lawns, for example, don’t encourage biodiversity and often require harmful pesticides and herbicides. Instead, native wildflowers, plants, and trees should be used. They are more suited to the environment and provide food and habitat for insects, butterflies, birds, and wildlife.

Easy, safe, and affordable access is key to a successful riverfront. Access via foot, bike, public transit, or boat should be maximized wherever possible. The river should also be visually accessible (frequent, interesting views from parks, picnic areas, shops, and restaurants).

Finally, a good riverfront design captures the town’s unique character and fosters education. Interpretive kiosks can celebrate the town’s history and the river’s special features. Strategically-placed signs can help people understand the river’s place in their lives.

**RESOURCES FOR MORE INFORMATION**

City of Portland, Bureau of Environmental Services, *Willamette Riverbank Design Notebook*, 2000. <http://www.enviro.ci.portland.or.us/>

Federal Interagency Stream Restoration Working Group, *Stream Corridor Restoration: Principles, Processes, and Practices*, 1998.  
[http://www.usda.gov/stream\\_restoration/](http://www.usda.gov/stream_restoration/)

Friends of the Chicago River, Northeastern Illinois Planning Commission, and City of Chicago Department of Planning and Development, *From Stockyards to Spawning Beds: A Handbook of Bank Restoration Designs for the Chicago River and other Urban Streams*. <http://www.chicagoriver.org/>

Huron River Watershed Council  
<http://comnet.org/hrwc/index.html>

Anne Riley, *Urban Stream Restoration*, Island Press, 1999.

J. William Thompson and Kim Sorvig, *Sustainable Landscape Construction: A Guide to Green Building Outdoors*, Island Press, 2000.

University of Minnesota, College of Architecture and Landscape Architecture, Design Center for the American Urban Landscape:  
[http://www.cala.umn.edu/design\\_center/dcaul.html](http://www.cala.umn.edu/design_center/dcaul.html)

Smithsonian Environmental Research Center, *Vegetated Stream Riparian Zones: Their Effects on Stream Nutrients, Sediments, and Toxic Substances*.  
[http://www.serc.si.edu/SERC\\_web\\_html/pub\\_ripzone.htm](http://www.serc.si.edu/SERC_web_html/pub_ripzone.htm)

U.S. Environmental Protection Agency  
Office of Water, Watershed Protection Page  
<http://www.epa.gov/OWOW/watershed/>

U.S. Forest Service's Recreation, Wilderness, and Demographic Research:  
<http://www.srs.fs.fed.us/trends/>

U.S. Geological Survey National Water Quality Assessment Data Warehouse:  
<http://infotrek.er.usgs.gov/wdbctx/nawqa/nawqa.home>

Upper Mississippi River Organizations

American Heritage Rivers  
Owen Dutt - Upper Mississippi "River Navigator"  
U.S. Army Corps of Engineers  
1222 Spruce Street  
Saint Louis, MO 63103-2833  
(314) 331-8450

The Blufflands Alliance  
P.O. Box 6  
Scales Mound, IL 61075  
(810) 777-4011  
<http://humus.com/jdcf/blufflands.htm>

Bridging the River  
Center for Urban and Regional Affairs  
330 HHH Center  
301 19th Avenue S.  
Minneapolis, MN 55455  
(612) 625-0347  
<http://www.missriver.umn.edu/about.html>

Friends of the Mississippi River  
46 East 4th Street, Suite 606  
Saint Paul, MN 55101-1112  
<http://www.fmr.org>

Iowa Natural Heritage Foundation  
505 Fifth Avenue, Suite 444  
Des Moines, IA 50309-2321  
(515) 288-1846  
<http://www.inhf.org/>

Mississippi River Basin Alliance  
708 N. First Street, Suite 238  
Minneapolis, MN 55401  
(612) 334-9460  
<http://www.mrba.org>

Mississippi Valley Conservancy  
P.O. Box 2611  
La Crosse, WI 54602-2611  
(608) 784-3606  
<http://www.centurytel.net/mvc/>

National Audubon Society - Upper Mississippi River Campaign  
26 Exchange Street, Suite 215  
Saint Paul, MN 55101  
(651) 290-1695

River Action  
822 E. River Drive  
Davenport, IA 52801  
(319) 322-2969  
<http://www.riveraction.org>

Trailnet  
3900 Reavis Barracks Road  
Saint Louis, MO 63125  
(314) 416-9930  
<http://www.trailnet.org>

### *National Organizations*

American Water Resources Association: <http://www.awra.org/>

Association of State Floodplain Managers: <http://www.floods.org/>

The Center for Watershed Protection: <http://www.cwp.org>

University of Washington, The Center for Urban Water Resource  
Management: <http://depts.washington.edu/cuwrp/>

The Waterfront Center: <http://www.waterfrontcenter.org/>



## PART III: RIVERFRONT REVITALIZATION BASED ON ECOLOGICAL PRINCIPLES

The Upper Mississippi offers unique opportunities to integrate the river's ecological needs with community economic and social goals. Riverfront towns are directly linked to the river's remarkable role in the nation's history; a past that has shaped the character of individual communities, as well. The Upper Mississippi also is remarkable in that long stretches of the river retain remarkable scenic beauty and natural character. For wildlife, the river is an extraordinary corridor of life, harboring tremendous numbers and diversity of birds, fish, mammals, and other wildlife. This is a relationship to celebrate and cherish. Upper Mississippi communities have a chance to act as stewards of the river's natural and cultural history in meaningful ways that are not always available in other parts of the country.

### ***NEW ALTERNATIVES TO RIVERFRONT DESIGN***

The riverfront is the zone of interaction between the city and the river. It is here that the needs of the river, the city, and its inhabitants come together. There is a unique opportunity to apply riverfront revitalization energies to engage the public and help bring communities *and* rivers back to health. As riverfront cities rediscover their connection to the river, there is a rare opportunity to repair past damage and prevent new injury, to reconnect to what is special and remarkable about the river, and to achieve a more sustainable and enjoyable quality of life.

Imbedded in this approach is the belief that development along a riverfront should meet human needs *and* river needs. While we already have some mechanisms, such as water quality regulations, for protecting our environment, the full range of issues facing our rivers are an afterthought at best in riverfront planning. Communities can find better, more appealing, and more sustainable solutions by integrating river considerations upfront. Indeed, the experience of many communities suggests that treating the river as an equal partner improves environmental quality and quality of life - both of which have a material and important economic impact for riverfront towns.

This section offers first, a set of guiding principles that communities can apply to achieve more ecologically sound riverfront development; and, second, resources for technical and federal funding information related to river restoration and riverfront revitalization efforts.

**There is a unique opportunity to apply riverfront revitalization energies to engage the public and help bring communities *and* rivers back to health.**

## ***INTEGRATING ECOLOGICAL AND HUMAN GOALS ON RIVERFRONTS***

There are a number of factors that communities should keep in mind when they consider their community's relationship to the river. These fall basically into three categories:

- € A more holistic general philosophy toward the river, river edge and near-river zones;
- € Planning considerations that can help to integrate ecological goals with social and economic goals in these areas; and
- € Design approaches to help riverfront communities implement more ecologically sensitive plans.

There are many examples of the following basic principles - many of which are detailed earlier in this report. American Rivers has developed the following principles with the assistance of experts in urban planning, landscape design, restoration ecology, and river restoration. These points are intended to provide a basic platform for communities to consider. They are not intended to be exhaustive, and they provide only general detail. American Rivers is preparing a more in-depth report on these principles that will be available in the coming months.

### **General Principles**

#### **1. Recognize that ecological goals and economic development goals are mutually beneficial.**

Healthy, functioning rivers are more appealing and attractive to residents and businesses. An engaged public that enjoys riverfront features and activities will care about the long-term health of their river. Communities are beginning to understand the allure of a more natural riverfront for residents and visitors. The economic benefits extend beyond tourism to reduced flood damage, better water quality, and reduced infrastructure costs. At the same time, public and private development that brings people to the waterfront for events, to experience culture, shop, eat, and live, helps to build a sense of connection and stewardship for the river.

#### **2. Make it a priority to protect and restore natural river features and functions.**

Rivers provide vital human and natural ecosystem benefits that must be protected. Natural rivers features such as meanders, backwaters, wetlands and gradually sloped banks serve essential ecological functions and also provide human benefits such as cleaner water and flood storage. In some settings, particularly urban areas, it may not be possible to restore most of these features. But even small efforts can have a positive impact. Environmental improvements can be made along even the most heavily impacted river and riverfront.



- 3. Regenerate the riverfront as a human realm - for everyone.** Rivers are a public resource, and the riverfront has a remarkable ability to break down political, social, and economic barriers - if it is designed with that goal in mind. Even members of the community that may feel disconnected from the river deserve access and a chance to experience rivers up close and alive. The needs of all neighborhoods, ages, cultures and traditional river users should be taken into account. Certain people may not come to the riverfront or enjoy the river because they lack physical and visual access, or because it doesn't meet their needs in other important ways.
- 4. Recognize that compromises are necessary to achieve multiple objectives along urban riverfronts.** Urban waterfronts are a meeting ground of a complex array of sometimes competing interests. Recreational trails and wetlands are interwoven with waterfront restaurants and industrial facilities. It is not possible - or even desirable - to focus exclusively on economic development or environmental concerns along most rivers. Few cities could recreate a completely natural river environment. At the same time, narrow economic considerations are not an excuse for limiting public access, or compounding riverfront damage. Riverfront communities will benefit more by integrating and balancing ecological, social, and economic concerns.
- 5. Make the process of designing the riverfront broadly inclusive.** The riverfront is a public resource, and care should be taken to make riverfront planning efforts broadly participative. This goes beyond just identifying stakeholder groups, and requires reaching out to neighborhoods that may not now use the riverfront, but could. The wishes and needs of various constituencies and neighborhoods may differ, and the riverfront will be more vibrant, inclusive, and successful if all these are taken into account. It also is essential to include regulators and developers in citizen forums to ensure that everyone is working toward the same vision and that all important considerations are on the table.



### Planning Principles

It is crucial to integrate ecological considerations upfront with the important social and economic considerations that normally drive riverfront development and revitalization. The following principles should be applied throughout the planning process.

**1. Understand the city’s relationship to the river, and reflect what is unique about the river and the city in the riverfront design.**

Each city has a unique relationship and history that is intertwined with its river. Minneapolis and Davenport have very different riverscapes, scales of develop-

ment, and historic uses along their rivers of the same name. Riverfronts should have a look and feel that evokes and celebrates a look and feel that evokes and celebrates their special city character and that directly relates to their unique natural history.

**2. Know the river ecosystem, including its historical character.**

As this report details, riverfront development should be considered in the context of the river’s natural habitat and structure. These considerations include the characteristics of the area it drains (the watershed), the floodplain, the river channel, its unique habitat types, the structure of its bed and banks; its water flows and timing (hydrology), water chemistry, and the biological needs of its wildlife (insects, fish, amphibians, reptiles, birds, and mammals). It is also important to understand how the river’s structure has been altered, and how it may change in the future.

**3. Think at a scale larger than the riverfront.**

The river is affected at all times by what happens in its watershed. Riverfront activity, in turn, can have impacts that extend beyond the river’s edge. It is critical to keep in mind both what impact the watershed may have on the riverfront, and the consequences of riverfront designs and activities downstream, and in the riparian zone, tributary streams, and other areas within the watershed.

**4. Recognize and anticipate that rivers are dynamic systems.**

It is the nature of rivers to be constantly changing. Nowhere is this more true than along the Mississippi River. For example, flood elevations in spring can exceed non-flood levels by 30 feet or more. Allowed to function normally, the river will change its alignment, creating new back and side channels and islands. Some river sections freeze in winter, and others experience less seasonal change. The effects of changes upstream and in the surrounding watershed also must be taken into account.

**5. Avoid new development in the floodplain.** Undeveloped, connected floodplains are essential to river health. New development on the riverfront, including trails and park features, should be designed to minimize impacts to the ecological function of the floodplain. Where new development must occur, structures or facilities should be designed to (1) ensure that contaminants will not be released during flooding, (2) cause no net decrease in flood storage capacity, and (3) prevent downstream impacts. Non-structural flood control approaches should be emphasized in cases where unavoidable development must be protected.

**6. Maximize public access and connections.**

Multiple, easy access points are important to draw people down to the riverfront. Points of visual access to the river from nearby commercial and residential areas are also important. Physical and visual access should not be reserved for only certain residents or businesses along the redeveloped river. It also is important for people to be able to actually touch and interact with the river, whether wading, fishing, launching a boat, or merely sitting.



U.S. Fish and Wildlife Service

**7. Maximize the variety of recreational uses.**

Riverfronts can include many recreational uses from ball fields to boating, fishing, walking, and bicycling. Wildlife watching is a booming recreational interest and can be pursued anywhere. Riverfront communities should provide facilities for as many of these uses as possible.

**8. Celebrate and teach the environmental and cultural history of the river and the community.**

Riverfronts are rich in both human and natural history. Ecological interpretation and education is especially meaningful and important along urban riverfronts, because so much of the original natural systems and references have been erased. Because rivers are active and visually striking environments, they can be a powerful tool for science and nature education.

### Ecological Design Principles

As with planning, ecological considerations should be incorporated directly into riverfront facilities and features. Designing with the river and its natural processes in mind ensures that parks, trails, public plazas, homes, and commercial spaces along the riverfronts will create minimal new damage to rivers. In many cases, these designs also help to improve water quality, physical integrity, and wildlife habitat. Equally important, ecologically based designs are appealing to people and bring them into more meaningful contact with the river and nature.

U.S. Fish and Wildlife Service



#### **1. Preserve natural river features and functions.**

Sensitive natural features such as wetlands, tributary stream outlets, riparian forests, old growth trees, geologic and topographic features, bluffs and steep slopes, seeps and springs, among others should be identified and protected from development.

**2. Buffer sensitive natural areas.** Buffers between these sensitive areas and development should be designed to protect ecological integrity, and to enhance connectivity between wildlife habitats. Designed correctly, buffers can protect water quality and protect sensitive habitats from disturbance.

**3. Restore riparian and in-stream habitat.** Many riverfronts areas also are prime areas for restoration, including floodplains, tributary streams, wetlands, riparian vegetation communities (e.g., grasses and forests), and streambanks. Based on ecological goals for the riverfront, missing or altered natural processes (e.g., channel meanders and natural timing and duration of overbank floods) and structures (e.g., in-stream woody debris) should be identified and new objectives set for restoration. Research should be conducted on upstream and downstream natural communities to identify likely restoration areas and habitat types along the riverfront that might be used by fish, birds, and other animals of concern. These areas should be viewed in the context of the larger river system as a whole (e.g., smaller feeding or nursery areas related to larger upstream or downstream habitats).

**4. Use non-structural alternatives.** Engineered structures like flood levees should be minimized with preference given to natural floodplain storage, riparian wetland restoration, and infiltration areas to reduce storm runoff volumes. Natural bank slopes and vegetation should be used to stabilize riverbanks and prevent erosion instead of riprap, concrete or steel walls, or other techniques.

**5. Reduce hardscapes.** Many riverfront redevelopments actually increase the amount of hard or paved surfaces, loading increased runoff with con-

centrations of contaminants that collect on these surfaces in urban areas. Riverfront designs should explicitly strive to reduce the overall area that is covered with impervious surface, use permeable or semi-porous materials wherever possible, including trail surfaces, and intersperse hard surfaces with “softscapes” where rain and snowmelt can collect and infiltrate into the soil.

- 6. Manage stormwater on-site and use non-structural approaches wherever possible.** Even narrow riverfront areas can contribute significant amounts of stormwater runoff and urban contaminants. Ecologically sensitive riverfronts should capture, store, and infiltrate, or otherwise naturally treat and release smaller amounts of stormwater. Systems like treatment wetlands can provide wildlife habitat and aesthetic values in addition to effective stormwater management. These should be used in preference to stormwater pipes and other structural systems, most of which send high volumes of untreated stormwater directly to the river.
- 7. Balance recreational and public access goals with river protection and restoration.** Riverfront communities should provide facilities for as many of recreational uses as possible, while balancing potential use conflicts (e.g. jetskis and bird watching platforms) and the impacts of overuse on the river corridor and its wildlife.
- 8. Incorporate information about how rivers work and the relationship of the city and the river through history into the design of riverfront features, public art, and interpretive information.** Creative public art pieces and performance art should be employed to bring people to the river and engage their curiosity to walk along the riverfront. Riverfronts also should employ wayfinding and other signage systems that reflect unique characteristics of the river (e.g. a backwater) using materials that locally are prevalent or representative.

## ***RESOURCES FOR MORE INFORMATION***

### ***Riverfront Development Principles and Guidelines***

The Waterfront Center  
1622 Wisconsin Avenue, N.W.  
Washington, DC 20007  
(202) 337.0356  
*Urban Waterfront Manifesto*  
<http://www.waterfrontcenter.org/manifesto.html>

Waterfront Regeneration Trust  
207 Queen's Quay West  
Suite 403, Box 129  
Toronto, Ontario, Canada M5J 1A7  
(416) 943-8080  
*Waterfront Principles*  
<http://www.waterfronttrust.com/docs/trustdoc/principles.html>

GreenInfrastructure.Net  
*Principles for Successful Green Infrastructure Initiatives*  
<http://www.greeninfrastructure.net/>

### ***Natural Area Restoration***

U.S. Environmental Protection Agency  
River Corridor and Wetland Restoration  
<http://www.epa.gov/owow/wetlands/restore/>  
(This website is a treasure trove of information with links to many other resources and publications within EPA and elsewhere.)

*Federal Interagency Stream Corridor Restoration Handbook*  
[http://www.usda.gov/stream\\_restoration/newgra.html](http://www.usda.gov/stream_restoration/newgra.html)  
(A terrific, comprehensive and detailed resource on stream and river ecology and restoration.)

Iowa Natural Heritage Foundation  
505 Fifth Avenue, Suite 444  
Des Moines, IA 50309-2321  
(515) 288-1846  
<http://www.inhf.org/index.html>

*A Practical Guide to Prairie Reconstruction*

<http://www.inhf.org/prairieguide.htm>

(A guide to reintroducing tallgrass prairies to landscapes, written by noted expert Carl Kurtz.)

*Attracting Iowa Wildlife on Private Lands*

(This booklet presents measures Iowa private landowners can take for improving the wildlife habitat on their property.)

*The Landowners' Options: A guide to the voluntary protection of land in Iowa.*

(This 64-page guide is provided to those who would like to seriously consider some form of protection on natural lands they own. To request a copy, e-mail us your name and mailing address.)

Natural Area Guardians  
227 N. Main Street  
Elizabeth, IL 61028  
(815) 858-2227  
<http://www.naturalareaguardians.org>

Great River Greening  
35 West Water Street, Suite 201  
Saint Paul, MN 55107  
(651) 665-9500  
<http://www.greatrivergreening.org/>

*Field Guides and Manuals on Native Vegetation of the Upper Midwest*

<http://www.greatrivergreening.org/ValsReferences.doc>

(A Bibliography from Val Cervenka, River Steward)

*Other Excellent River Restoration and Revitalization Resources*

American Heritage Rivers

<http://www.epa.gov/rivers/>

Bridging the River

<http://www.missriver.umn.edu/about.html>

City Parks Forum (American Planning Association)

<http://www.planning.org/cpf/front.htm>

Low Impact Development Center

<http://lowimpactdevelopment.org/>

National Environmental Education and Training Foundation

Water Quality Reports

<http://www.waterqualityreports.org/>

National Park Service

Rivers, Trails, and Conservation Assistance

<http://www.ncrc.nps.gov/rtca/>

Nonpoint (Pollution) Education for Municipal Officials

<http://nemo.uconn.edu/>

North American Water Trails

<http://www.watertrails.org/>

Northeast Midwest Institute

Upper Mississippi River Ecosystem

<http://www.nemw.org/uppermiss.htm>

Project for Public Spaces

<http://www.pps.org/>

U.S. Forest Service

Recreation, Wilderness, and Urban Forests Demographic Trends Research

<http://www.srs.fs.fed.us/trends/>

U.S. Geological Service

National Water Quality Assessment Data Warehouse

<http://infotrek.er.usgs.gov/wdbctx/nawqa/nawqa.home>

Urban Water Resources Research Council (American Society of Civil Engineers)  
National Stormwater Best Management Practices  
<http://www.bmpdatabase.org/>

*Resources for Funding Information*

American Rivers  
(202) 347-7550  
[www.americanrivers.org](http://www.americanrivers.org)

*River Restoration Funding Sources: A Selected Guide to Federal Programs*  
<http://www.americanrivers.org/restorationfinancetoolkit/fedfunding.htm>

Bridging the River - University of Minnesota  
*Financial/Technical Assistance Resources Matrix (for Upper Mississippi States)*  
<http://www.missriver.umn.edu/resourcematrix.cgi>

Catalogue of Federal Domestic Assistance  
<http://www.cfda.gov/>

Catalog of Federal Funding Sources for Watershed Protection - U.S. EPA  
<http://www.epa.gov/owow/watershed/wacademy/fund.html>

River Network  
(503) 248-4172  
[www.rivernetwork.org](http://www.rivernetwork.org)

*Directory of Funding Sources*  
<http://www.rivernetwork.org/library/libfundir.cfm#dfund>

*Watershed Assistance and Partner Grants*  
<http://www.rivernetwork.org/howwecanhelp/howwag.cfm>

Sonoran Institute - Conservation Assistance Tools  
<http://www.sonoran.org/cat/default.asp>

Water Quality Information Center (USDA) - Funding Sources  
<http://www.nal.usda.gov/wqic/funding.html>



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## ***ABOUT AMERICAN RIVERS***

Since our founding in 1973, American Rivers has been dedicated to protecting and restoring North America's rivers and to fostering a river stewardship ethic.

We have successfully preserved more than 22,000 miles of nationally and regionally significant rivers and over 5.5 million acres of riverside lands. Along with our conservation efforts, American Rivers promotes public awareness about the importance of healthy free-flowing rivers and the threats they face.

As the leader of the nationwide river conservation movement, we are striving to secure a future in which healthy rivers support diverse species of wildlife, fish, and plants, provide recreational opportunities and safe drinking water, contribute to sustainable local economies, and improve the quality of life for all Americans.

American Rivers has a strong track record of enhancing grassroots river restoration and protection efforts through our nationally recognized conservation expertise and public education campaigns. By partnering with a broad array of stakeholders, we advocate river conservation solutions that are community-based, scientifically valid, and economically viable.

We operate a national office in Washington, DC and offices in Lincoln, NE; Davenport, IA; Seattle, WA; Portland, OR; San Francisco, CA; Great Falls, MT; Glastonbury, CT; and Chattanooga, TN.

To become a member or supporter of American Rivers, visit our website at [www.americanrivers.org](http://www.americanrivers.org) or contact us at (202) 347-7550 or toll free, (877) 4RIVERS.

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