

# Our Mississippi

PARTNERING TO KEEP  
AMERICA'S RIVER GREAT

FALL '14

## Preventing Flood Damage along the Mississippi River

**W**hile spring flooding on the upper Mississippi River caused some stall of commercial river traffic, the real story of this year's flood season is that the system of levees and flood risk reduction measures put in place by the Corps of Engineers worked as designed. Thanks to such measures, catastrophic damage to property along the river was avoided, and commercial traffic and the economy along the river kept pace with demand.

Depths ranged from 5 to 19 feet above flood stage along the upper Mississippi, north of St. Louis, while the lower Mississippi experienced depths between 3 to 5 feet above flood stage.

According to Chuck Shadie, watershed division chief for the Corps' Mississippi Valley Division, this year demonstrated once again the value of the Flood Risk Reduction Program managed by the Corps. "That system was credited with saving more than \$230 billion in losses during the record breaking flood of 2011, truly demonstrating the enormous value to taxpayers of the program," Shadie said.

Not all the levees along the Mississippi River were constructed by the federal government and more than a few are still privately owned. But stemming

from the 1955 Emergency Flood Control Act, non-federal levees could come under the supervision of the Corps if they first pass an inspection, ensuring proper construction and maintenance. Once accepted by the Corps, the levees become part of the Rehabilitation and Inspection Program administered by the Corps and funded by federal tax dollars. That means that should the levees become damaged after being accepted into the program, the federal government will cost-share repairs (80% federal - 20% local). The benefit to taxpayers is that the Corps will annually inspect these levees to ensure they are being well maintained and are capable of withstanding rising river levels that could theoretically cause billions of dollars in damage. Currently, about half of the levees along the upper Mississippi are non-federal levees while along the lower Mississippi, where the river is much wider, only about 10 percent are non-federal levees.

Over-the-top flooding this year was primarily experienced by local non-federal agricultural levees, according to Carl Pigott, civil engineer and natural disaster operations manager for the Corps' Mississippi Valley Division. "Flooding levels reached the level of top five events in tributaries," Pigott said. "So while no records were set, it was still a significant flood event in some areas in the upper Mississippi area."



 **Our Mississippi** is a quarterly newsletter of the U.S. Army Corps of Engineers about its work in the Mississippi River Basin. It is published in cooperation with other state and federal agencies and other river interests with whom the Corps collaborates and partners toward long-term sustainability of the economic uses and ecological integrity of the river system.

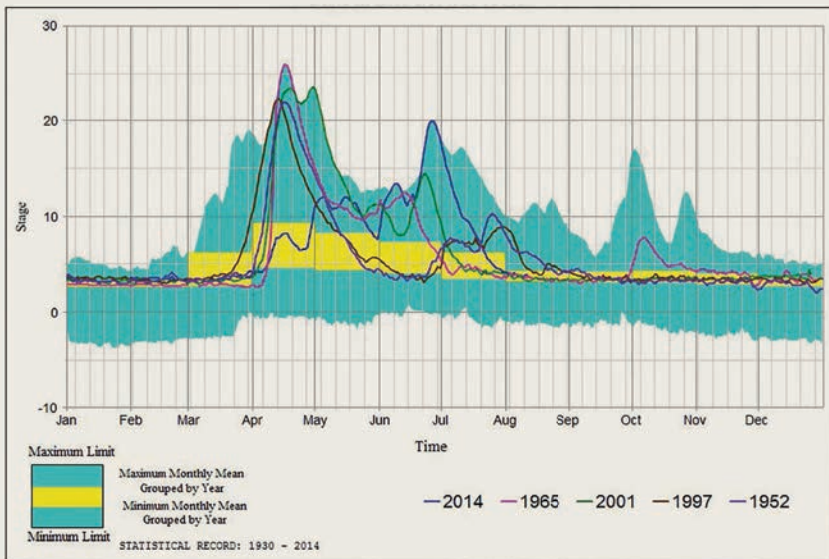
ABOVE: The Dredge Goetz near Wabasha, Minn., Pool 4 of the St. Paul District.

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## TOP FIVE FLOOD EVENTS AT ST. PAUL

St. Paul, Minnesota 1930-2014

The below chart shows the top five flood events for the Mississippi River at St. Paul, Minn., since 1930. June 26, 2014 marked the 7th highest stage on record for St. Paul at 20.13 ft. Typically, though, flooding and past records occurred in April. The teal-shaded outer band represents the full range of daily stages over time for St. Paul, indicating the maximum and minimum stage on record relative to time of year. The inner yellow band is the statistical average of what stages are normal for the month shown. Each line is for the individual flood years for the top five events compared to 2014.



To gain perspective on just how large the responsibility and scope of work is that the Corps puts into flood risk management along the Mississippi, it is helpful to know that the federal levee system overseen in the lower Mississippi, if placed end to end, would stretch more than 3,500 miles in length, making it longer than the Great Wall of China.

The flooding in the upper Mississippi required the closing of most of its 29 navigational locks and dams for up to three weeks as the flood worked its way down from St. Paul, Minn., to St. Louis, Mo. In addition, for approximately six weeks, the required the opening of the dams' gates, resulting in what is known as "open river" conditions. The Corps publishes elevations for each lock that dictates when it is taken out of service due to high water. The published elevation is included in the U.S. Coast Guard High Waterways Action Plan. During high-water events, the Corps is responsible for closures of the locks and the U.S. Coast Guard is responsible for closing the channel, working in tandem to minimize the impacts to industry.

"Each year, the ability of the Flood Risk Reduction Program can be improved so long as Congress funds the projects," said Robert Anderson, public affairs officer for the Corps' Mississippi Valley Division. "The system has already demonstrated its economic benefit and can get better each year if we continue to invest in the program."

BELOW, LEFT TO RIGHT: Flooding of Mississippi River at St. Paul, Minn. Flood debris at Lock and Dam 21 in Quincy, Ill., creates major work for cleanup crews on the Mississippi River. The maintenance crew from the Mississippi River Project uses a crane on a floating deck barge to remove a large tree from above the gates at Lock and Dam 21 in Quincy, Ill.

PHOTOS BY PATRICK MOES, GEORGE STRINGHAM AND JIM MCDANIEL



### MY MISSISSIPPI | St. Louis Mayor Francis Slay

St. Louis Mayor Francis Slay speaks at the August 2013 groundbreaking of the CityArchRiver project, which will better connect downtown St. Louis to the Arch and the Mississippi River.

"The Mississippi River is one of the nation's gems. It gave birth to the City of St. Louis 250 years ago and became one of the greatest economic arteries in the world.

River-borne commerce supports thousands of regional barge, rail,

trucking and warehousing jobs. More than 107 million tons of cargo, including 60 percent of North America's grain, travel past the Arch and our 19 miles of riverfront every year.

Over the last decade, our Port Authority and the St. Louis Development Corporation have taken steps to realize the City's vision of a major multimodal inland port and distribution center in St. Louis. We finished the North Riverfront Commerce Corridor plan in 2012, and have completed a \$20 million rebuild and expansion of the City's docks at the Municipal River Terminal, located about a mile and a half north of downtown.

We also founded the Port Working Group in 2009, a regional initiative that meets bi-monthly to promote our port.

The Mississippi River is also one of the great civic symbols of St. Louis.

For that reason, we are better connecting our region's greatest assets: the City, the Arch and the Mississippi River. The CityArchRiver 2015 project is an ambitious, \$380 million public-private partnership designed to rejuvenate the Arch grounds and downtown experience, giving people new reasons to visit the Arch, the City of St. Louis and its riverfront - and to stay longer once they get here.

The Mississippi River plays a fundamental part in the daily life of this city. It provides St. Louis its drinking water - which is plentiful, delicious and among the most highly rated municipal water supplies in the nation.

But the Mississippi River's health and prominence goes beyond local importance, and the river is not without challenges.

That's why I became a founding member of a bipartisan caucus called the Mississippi River Cities and Towns Initiative, which is headquartered in St. Louis, but promotes good stewardship of the river nationally. The group is made up of 50 mayors, who, like me, have a vested interest in the river because our cities depend on it.

We are working to draw attention to issues like water quality and habitat restoration, flooding and floodplain issues, recreation on the river and sustainable economies. Our group is using its collective voice to help focus federal resources to improve the river.

We are deeply committed to promoting the river's sustainability, culture and history, advancing opportunities for river-based industry, while protecting its environmental integrity, and making it ever more compatible for heritage tourism, cultural tourism, eco-tourism and sightseeing.

The Mississippi is mighty, indeed. Please come to St. Louis to see and experience it for yourself."

PHOTO BY BILL GREENBLATT/UPI

# Adventurers Advance Educational Themes Along the Mississippi River

The great outdoors has always been a phenomenal learning environment. Now, with the help of social media and other technology, schools across America can join together in educational adventures online, thanks to partnerships with groups such as Wild River Academy and Ocean Adventures Rowing and Education (OAR) Northwest.

Natalie Warren of Wild River Academy and Jordan Hanssen of OAR Northwest share a love of learning about rivers and providing access to them using virtual learning techniques. The Mississippi River provides unique opportunities to show connections to the environment and educate youth on a variety of topics, including history, science, agriculture and transportation.

These organizations provide the next best thing to actual hands-on learning by documenting their discoveries and sharing them through an interactive, internet-based curriculum. Students can email, text or use social media to ask questions or share feedback, videos and photos. Hanssen said, "Our goal is to create an easy-to-use, flexible educational tool that is available on a regular basis and bring in themes that students have already studied and bring them to life."

OAR Northwest is kicking off its education series this year with Adventure: Mississippi River. They plan to paddle from Lake Itasca, Minn., to the Gulf of Mexico during the fall academic semester, visiting at least 15 schools and interacting with more than 50 schools online. "Field trips are an invaluable experience but they're hard logistically," Hanssen said. "This project is a tool that can fill in gaps. Learning via the computer can spark the interest of kids who may get involved on a bigger level."

BELOW: The team members of Wild River Academy's Paddle Forward and OAR Northwest's Adventure: Mississippi River share a love of learning about rivers and sharing those experiences with communities and children.



PHOTOS BY LEE VUE, OAR NORTHWEST, ERINN J. HALE

ABOVE: OAR Northwest visits the International School of Dakar, Senegal before the Canadian Wildlife Federation Africa to Americas row from Dakar to Miami in December 2012.

The Corps is sharing its Our Mississippi teachers' guide curriculum with OAR Northwest; activities will be incorporated into the online program. The Corps is also providing logistical and outreach support.

Wild River Academy spent 70 days last fall paddling the Mississippi River from Bemidji, Minn., to New Orleans, La., and the adventurers connected with more than 40 elementary, middle and high schools, sharing their online stories of discoveries made and people they met. Curriculum for the "River Ambassador Schools" includes lesson plans using math, science, language arts and more, complete with teachers' notes and rubrics. Classroom activity suggestions range from describing the water cycle to studying river-related poetry to estimating the cost of a two-week vacation on a houseboat. Their curriculum, which also includes discussion questions and blogs, can be used in classrooms from kindergarten through high school.

This fall, they are paddling the Illinois River starting in Chicago and ending in Alton, Ill., which is near the river's confluence with the Mississippi River. "We're doing the Mississippi River's larger tributaries in order to have a better understanding of the river as a whole," Warren said. They will describe the history of small towns and wildlife, relate the experiences of people they meet along the way and share that information with schools. The team partnered with organizations including the Corps and stayed at schools and various organizations along the Mississippi River last fall, including the National Mississippi River Museum & Aquarium in Iowa and the Corps' St. Louis District's National Great Rivers Museum.

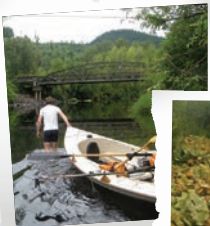
Laura Gross, a special education teacher at Camelot Therapeutic Day School of Mount Prospect, Ill., is participating in this year's program with 25 of her students. Wild River Academy presented at the school on Sept. 8 and tied Google Earth maps of cities' pollution and data into the classes' biology and environmental science curriculum. "It's hard to be in a classroom and tell students why to care about the environment using just textbooks. This made it much more meaningful," she said.

The engaging teaching methods of OAR Northwest and Wild River Academy help make the connection between youth and the environment.

## To Learn More:

Visit OAR Northwest's Adventure Mississippi River 2014 page, [oarnorthwest.com/expeditions/adventure-mississippi-river/](http://oarnorthwest.com/expeditions/adventure-mississippi-river/), and Wild River Academy's website, [www.paddle4ward.com](http://www.paddle4ward.com). Sign up to be a River Ambassador School at [www.paddle4ward.com/signup](http://www.paddle4ward.com/signup).

## PADDLE FORWARD





CLOCKWISE, FROM LEFT: Male Little Brown Bat from Fuller Lake. Close up of bat feet. Indiana bat from Batchtown Landing.

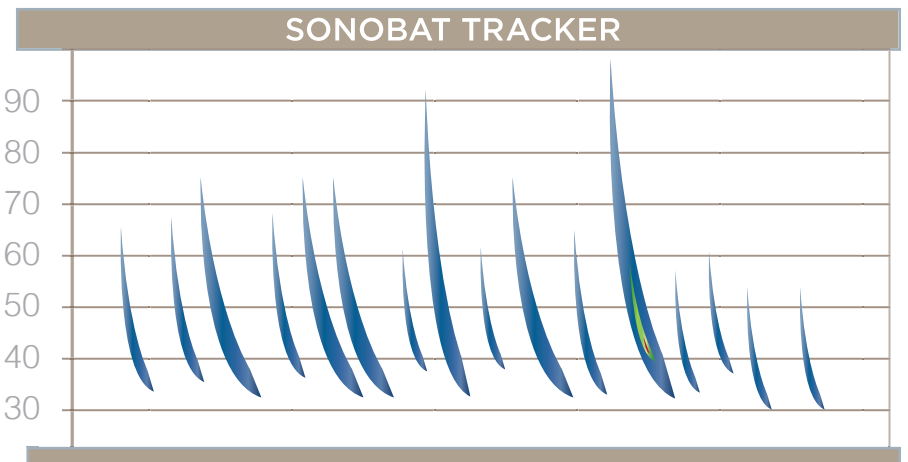
reserves during cold weather. According to McGuire, since it was first documented in New York during the winter of 2006-2007, WNS has killed more than 5.5 million bats in the northeastern United States and eastern Canada. In some areas, 90 to 100 percent of bat populations have died as the disease has rapidly spread across the eastern and midwestern United States, according to a USFWS fact sheet.

This year, SCI Engineering caught a total of six Indiana Bats by placing three “mist” nets that are made of nylon mesh and suspended between two poles. The nets were placed at various sites for two nights each, over three weeks in June. The researchers also caught a variety of other bat species, including Little Brown Bat, Red Bat, Big Brown Bat, Evening Bat and Tri-Colored Bat. Some bats were then tagged with a radio telemetry tracking tag, which enabled the biologists to “follow” them to their “day roost tree,” where the bats perch to sleep. Devices at each mist net site recorded bat calls in the immediate area, allowing the researchers to document additional species of bats that might not be physically caught. The team could then determine which bats were present through listening for the frequency and duration of the calls.

All the data collected will be shared through a science support partnership organized by the USFWS and the U.S. Geological Survey. The goal of the partnership is to improve the understanding of bat populations and the impact upon bats coming from extreme loss of roosting and foraging habitat. Data will be used to help improve the habitat of Indiana Bats and help everyone avoid negatively impacting the species through poor management practices.

“When many people think of wildlife, they may think of deer and turkey, but there are all these other species to consider, including bats,” Deutsch said. “They are all part of the bigger ecosystem and support the food web.” Bats consume a lot of pests and are a benefit to the economy because they eliminate a lot of pests that damage food crops.

Dead trees in the landscape can be a benefit to bats and a whole host of other wildlife. If you own land and have dead trees on your property that do not endanger people or buildings, leave them standing and see what might make a home or forage in your tree. For more information on bats and bat monitoring or locations of this year’s surveys, you are invited to contact the Rivers Project Office at (636) 899-2600 or [riversproject@usace.army.mil](mailto:riversproject@usace.army.mil).



This graph shows a portion of a Northern Long-Eared Bat (*Myotis septentrionalis*) call. The program analyzes bat calls based on the frequency and duration of the call’s pulses and runs them through about 70 parameters for each pulse to determine a maximum/minimum likelihood that the call is of a certain species.

# SURVEYING BATS

## One Important Aspect of Wildlife Management Along Our Rivers

To better understand the composition of ecological habitats in their management of public lands, the Army Corps of Engineers inventories a variety of animal species - including bats.

According to Charlie Deutsch, supervisory wildlife biologist at the St. Louis District’s Rivers Project, to better understand which species are using the lands along the rivers they, along with natural resource managers from other agencies, monitor bats on a regular basis using field surveys. This monitoring helps the Corps make better decisions when planning projects and developing management objectives. For example, Deutsch said, some bats favor more open forest communities. If there is a significant number of those bats, foresters and biologists may utilize timber stand improvement techniques in order to thin the forest in an attempt to provide a better habitat.

The U.S. Fish & Wildlife Service (USFWS) establishes protocols for bat monitoring to ensure consistency by various agencies. The Rivers Project Office in St. Louis started conducting bat surveys in 2010 on a biannual basis to specifically document endangered species on Army Corps of Engineers’ property.

“There’s lots of potential for species to completely disappear,” said Rivers Project Office Wildlife Biologist Ben McGuire. “Habitats for bats are disappearing and species numbers are continuing to decline.”

This year, the Rivers Project Office and its contractor, SCI Engineering, Inc., monitored the federally endangered Indiana Bat, *Myotis sodalis*, and the Northern Long-Eared Bat, *Myotis septentrionalis*, which may be listed endangered in the near future, McGuire said. The Indiana Bat was listed as endangered in 1967 and was one of the first species listed as endangered by the USFWS.

One factor contributing to the decline in bat populations is White-Nose Syndrome (WNS), which affects hibernating bats, including the Indiana Bat, the Northern Long-Eared Bat, the Little Brown Bat, the Tri-Colored Bat and the Big Brown Bat. WNS is characterized by a white fungus, possibly *Pseudogymnoascus destructans*, which appears on the muzzle and other parts of the bat. WNS affects the bats’ immune system, burning through their energy

PHOTOS BY RIVERS PROJECT OFFICE



# RIVER TRAINING STRUCTURES:

## Innovative engineering keeps a dynamic river open for navigation

As the water level in the Mississippi River gets lower, rock structures in the river start to emerge: long dikes of limestone jut from the banks, and arch-shaped chevrons point upstream. These river training structures are a part of the innovative engineering that allows for safe passage of commerce on the Mississippi River, saving taxpayer money and creating habitat in the river.

The U.S. Army Corps of Engineers has a Congressionally-mandated mission to ensure that our inland waterways are navigable. The Corps' St. Louis District combines a tradition of river engineering with award-winning innovation to accomplish its mission and keep the Mississippi River open.

The Mississippi River is in an alluvial valley, which means the riverbed is made up primarily of moving sand and prone to changes in depth, like shoaling. The ability of waterborne commerce to move on the river plays an important role in the nation's economy: more than 300 million tons of barge cargo moves on the river annually, including 60 percent of America's agricultural exports.

River training structures, including dikes, chevrons and bendway weirs, are used to keep the dynamic river navigable in the most efficient and environmentally sound manner.

"It takes a combination of structures, revetments, and dredging to keep sediment moving through the system and maintain the nine foot navigation channel on the Mississippi," said Eddie Brauer, river engineer at the Applied River Engineering Center in St. Louis.

The structures work by using the river's energy to move sediment out of the navigation channel, reducing the need for dredging. While dredging remains an important part of the Corps' navigation mission, there are associated limitations that make river training structures a financially and ecologically sound alternative.

"Dredging is expensive; there's no way we could dredge the entire channel all the time," Brauer said. "It's also very intrusive to fish habitat when we dredge up material from the bottom, not to mention the placement of dredged material."

A dredge mechanically lifts sand from one area to another without making a permanent change to the river's energy and flow. The

RIGHT: Wing dikes such as those pictured here near Mississippi River mile 100 have been in use on the river since the 1830s to help maintain the shipping channel.

*By Mike W. Petersen (St. Louis District Public Affairs)*

ABOVE: An artist's depiction shows underwater bendway weirs which slow the current and reduce the need for towboat pilots to practice the risky maneuver of flanking through turns.

dredge has to be used in the same area over and over again because the river continually replaces the sand that is removed. The river training structure takes the place of the dredge and moves this continuous supply of sand out of the channel by using the river's own energy.

Similar structures have been used in the Mississippi River since the 1830s to deal with the ever-changing nature of the river. While designed to help provide a navigable channel, the river training structures have a secondary benefit: creating or improving habitat for wildlife.

In cooperation with natural resource agencies, the Corps has conducted numerous studies that demonstrate the positive ecological effects of river training structures. Recent studies include fish and macroinvertebrates in bendway weir fields, and numerous fish sampling studies associated with chevrons, to include a recent study of St. Louis Harbor.

Along with decades of study, river training structures have also received awards and accolades. The St. Louis Harbor chevrons earned the 2010 Chief of Engineers Design Team of the Year Award for Environmental projects by USACE Headquarters, and most recently the 2011 Project of the Year from the St. Louis chapter of the American Society of Civil Engineers.

The Applied River Engineering Center's website has more information, including studies, reports and videos, on how innovative river engineering fuels the American river industry in a sustainable and cost-effective way.



PHOTOS BY USACE



PHOTO BY USACE

ABOVE: Thomas George packed a lot of life into his brief 56 years with us. The St. Louis District employee passed away April 5, 2013, doing one of the many things he loved - being close to the river. Thomas was master of the Corps' Dredge Potter based in the St. Louis District. He died in his sleep aboard the dredge, which was at Ensley Engineer Yard in Memphis for maintenance work.

Mentor, river man, devoted family man... innovator. These are all words that are used to describe the late Thomas George, master of the St. Louis District U.S. Army Corps of Engineers' Dredge Potter.

During his time with the Corps, George worked diligently to bring to life an innova-

## Newest Corps Vessel Honors River Innovator

tion that will improve versatility and provide ecological benefits from routine maintenance dredging on the Mississippi River. The Corps' District team recognized his efforts when the MV Thomas N. George, a specialized barge that completes his vision, was christened in a ceremony July 15 on the Mississippi River at the Corps' St. Louis Service Base.

Each year dredging is performed on the Mississippi River in order to maintain the congressionally mandated depth of 9 feet for river traffic. Historically, dredged material placement locations and options have been limited by both equipment constraints and cost.

Starting as a drawing on a napkin, early designs for the specialized spill barge was conceived by George, who had a vision of using a flexible floating dredge pipeline with the Corps' dustpan dredges. His colleagues at the St. Louis District Service Base credit him with moving his concept to reality through

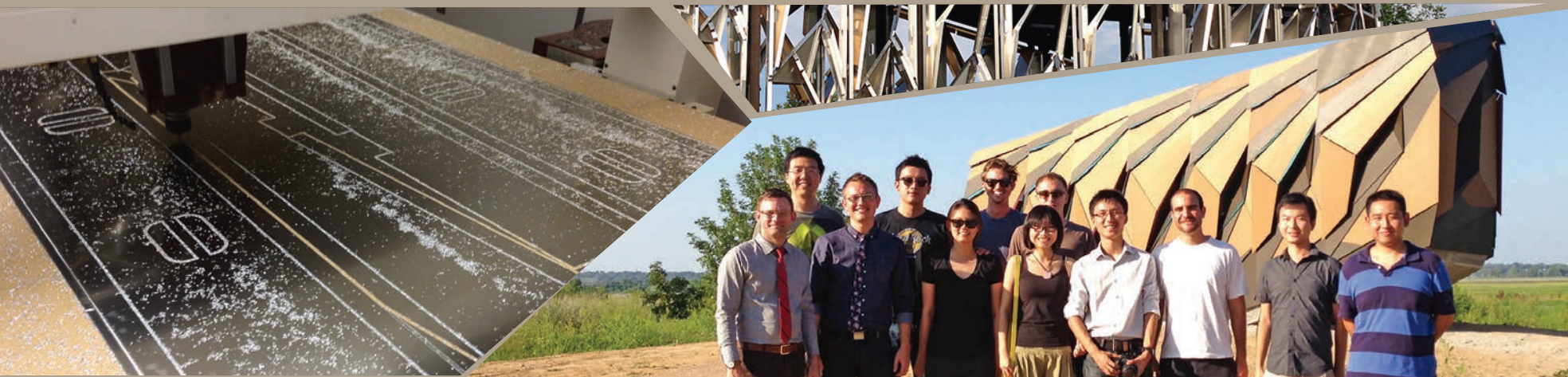
a mix of tenacity, creativity and decades of experience on the river.

"This was his vision, he is totally linked to it in every way," Jared Schmidt, project engineer with the St. Louis District, said. "This is more than a great tool for the Corps. To us, this is Thomas George."

When feasible, dredged material is recycled for beneficial uses within the river. Reuse is the preferred approach by the Corps of Engineers, and the St. Louis District is always seeking out innovative and creative ways to accomplish this task.

"Our partners and stakeholders have challenged us to find more ways to reuse dredged material in an environmentally friendly way," said Brian Johnson, biologist and chief of the Environmental Compliance Branch with the St. Louis District.

Flexible pipe dredging is more efficient and faster than using a traditional rigid



## WORKING TOGETHER to Build a Better Bird Blind

Collaboration between the Army Corps of Engineers, The Audubon Center at Riverlands and Washington University School of Architecture has brought about a unique avian observatory at the Riverlands Migratory Bird Sanctuary that opened in August 2013.

Over 15,000 visitors have visited the new avian observatory in West Alton, Mo., where Heron Pond, part of the Riverlands Migratory Bird Sanctuary, is geographically located at the confluence of the Mississippi River and Missouri River, said Katy Fechter, a biologist at the Corps of

LEFT: The Architecture School's computer numerically controlled Milling Machine used to fabricate all the aluminum frame components (shown), the exterior resin composite surface panels, and the concrete framework. RIGHT: The two instructors and 10 of 11 students from the original design studio in front of the completed observatory at the opening celebration.

45 acres of managed wetland habitat within the sanctuary. The primary management objective at the pond is to have seasonal mudflat habitat for shorebirds and winter resting habitat for waterfowl.

"The sanctuary is a home and stopover for over 300 migratory bird species," Fechter said. These birds include songbirds, shorebirds, bald eagles, trumpeter swans, gulls, American white pelicans and more. For many years, the wide diversity of birds has attracted a large amount of birdwatchers to the sanctuary, but with the construction of the observatory, public visitation has increased by about 3,000 visitors, Fechter said. Lane Richter, senior ecologist at The Audubon Center, said that the observatory has helped people to study and learn more about the sanctuary as well as the birds who migrate there.

"We've had portable plywood structures since about 2011," Fechter said. "We used those portable structures to select a location that



### TRUMPETER SWAN

Trumpeter swans often visit the Sanctuary in the winter.

Engineers' Rivers Project Office. The sanctuary encompasses 3,700 acres total, including a backwater bay, wetlands and 1,200 acres of native prairie marsh. Heron Pond provides about

PHOTOS BY ANDREW COLOPY

pipe, which limits the opportunity to reuse the dredged material, due to the rigid metal disposal pipe that is used. “Normally dredged material is side-cast along the main channel border in a linear fashion, resulting in a long, narrow disposal bar that is limited in size, elevation and location,” Lance Engle, dredge manager with the St. Louis District, explained.

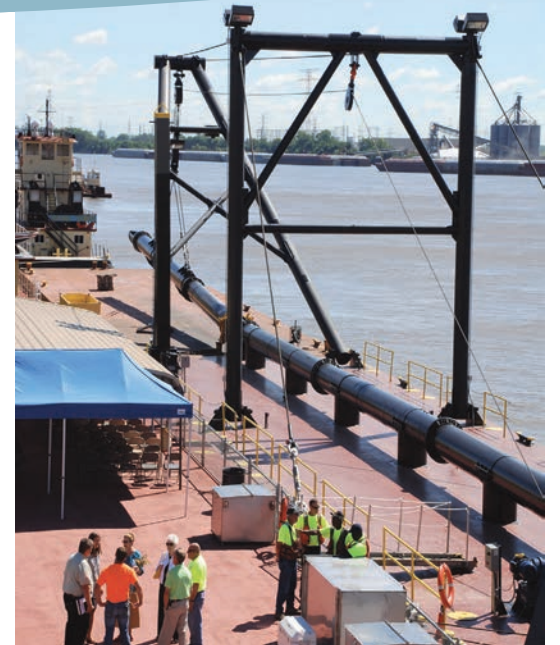
The pipe’s flexibility allows the dredged material to be placed independently of the dredge as it moves to avoid fleeting areas and allow for more versatility around well-used areas of the river. This also allows material to build up to create sandbars and island habitats in various shapes, sizes and elevations in the middle Mississippi River while maintaining the navigation channel.

“The flexible floating dredge pipe provides the St. Louis District opportunities to create a diversity of aquatic habitats such as sand islands and shallow water habitats in areas

where it may not be possible without the use of dredged material,” Johnson said. Designed and constructed entirely by the St. Louis District’s Service Base team, the completion of the Spill Barge Thomas George is a tribute to their departed friend and leader.

“It’s sad to think that he is not here to see it deployed, but seeing his vision complete and knowing he had a hand in it, that’s what’s so special about this,” Schmidt said. “It’s a promise fulfilled to him from everyone at the Service Base.”

RIGHT: Thomas George’s family christens the vessel bearing his name, which will carry on the legacy of its namesake as it benefits the Mississippi River and those who depend on it.



PHOTOS BY MIKE PETERSEN, ST. LOUIS DISTRICT PUBLIC AFFAIRS



### AMERICAN AVOCET

The American avocet, a shorebird, occasionally visits the Sanctuary.



LEFT: Students carry the final full-scale prototype of one exterior panel to their final review in May 2013. MIDDLE: The nearly complete interior just before the opening in August 2013. RIGHT: Students testing the final prototype in May 2013. They tested both the functionality of the diagonal apertures, here testing visibility with a birding scope, and ensured proper fit and installation sequence.

would be best for good access to the public and wouldn’t cause a disturbance to the wildlife and waterfowl. The site for the observatory was selected because it is on a natural ridge, or higher elevation, allowing optimal 360-degree views of the sanctuary. The location is positioned on the southern edge of the pond so as to obscure the structure from the birds. This allowed us to position the structure in a location closest to the water around the entire perimeter of the pond to provide visitors up close views without disturbing the wildlife.”

“Finally,” Fechter said, “the parking area and trail were designed to minimize the disturbance caused by vehicles and hikers. The natural ridge blocks lights and noise, and the trail gravel is made from small limestone rock to minimize sounds from foot traffic. All of the design criteria were decided upon to allow for year-round visitor access.”

Andrew Colopy, a former visiting assistant professor at Washington University’s Graduate School of Architecture and Urban

Design, said the camouflage element students used in the design was not so much about concealing the building - because a motionless building is not very distracting - but rather concealing the movement of people within the building.

Colopy said the students would work for three weeks and then present their progress for the Corps of Engineers and The Audubon Center and then get back to work. The project vision started “open-ended,” he said, and then dialogue through the meetings led to the students’ better understanding of what was important to the Corps and The Audubon Center in making design decisions. “This was one of the most positive interactions with a client I’ve ever had,” Colopy said. “[The Corps and The Audubon Center] helped educate us about birds - what was and wasn’t important in the design.”

“We consider ourselves fortunate to partner with Washington University and The Audubon Center on this project,” Fechter said. “It was interesting to observe the design development with the students. They put so much effort into this project and the result is tremendous. People could spend hours in there.”

The project was a finalist for the International Architizer A+ Awards and was chosen to be presented at the American Association of Collegiate Schools of Architecture National Conference this past April.

# Yellow Fever in Memphis 1878

## A City That Almost Died

by Robert A. Dunn, Ph.D., USACE Memphis District

“Walking in Memphis” is not just a great song by Marc Cohn. It is an activity thousands of tourists do yearly while making pilgrimages to Graceland, Sun Studios, Beale Street and many other attractions in the “Home of the Blues” and the “Birthplace of Rock and Roll.” But all this tourism might never have happened. Three outbreaks of the dreaded yellow fever in the 1870s almost destroyed the city on the bluff.

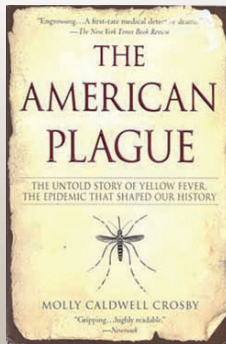
Yellow fever is an acute viral hemorrhagic disease transmitted by the bite of female mosquitoes and is normally found in tropical and subtropical areas in Africa and South America. Scientists now believe the disease originated in Africa and that it was introduced to South America through the slave trade in the 16th century. By the mid-19th century, it was regarded as one of the most dangerous infectious diseases. Its physical effects are devastating. People infected with the virus experience high fever, chills, nausea, muscle pain (backache) and headache. For many victims, a more toxic phase then ensues in which liver damage with jaundice usually leads to a painful death. The epidemic that struck Memphis in 1878 was one of the most severe ever recorded.



### To Learn More

*The American Plague* by Molly Caldwell Crosby contains a dramatic account of the suffering endured by the residents of Memphis in 1878.

There are numerous other detailed accounts of the Great Yellow Fever epidemic of 1878 in both published sources and websites. One of the best online sources is *Yellow Fever - The Plague of Memphis* at [www.historic-memphis.com/memphis-historic/yellow-fever/yellow-fever.html](http://www.historic-memphis.com/memphis-historic/yellow-fever/yellow-fever.html)



The epidemic began in early August when a steamboat crew member named William Warren died from yellow fever in a Memphis hospital. He had come upriver from New Orleans and had avoided the quarantine set by the mayor of Memphis in July. On August 13, a local Memphis woman who operated a food stand near the waterfront died from yellow fever. Within days of the local newspaper report, Memphis residents began leaving the city by the thousands. It is estimated that of the total population of 47,000, more than 25,000 evacuated to rural areas to the north and east, away from the river. Many small towns met the evacuees with “shotgun barricades,” armed men who prevented them from entering their communities. As a result, the disease travelled with the fleeing refugees to Kentucky, Indiana, Illinois and Ohio. For those who chose to stay in Memphis,



including many African-Americans, there was no prevention and no cure once the fever struck. Once the mosquito bit an infected person, it became a vector for the disease and infected many more people. Memphis historian John Harkins noted in his book *Metropolis of the American Nile* that if the yellow fever did not kill the patient outright, the treatment

LEFT: Children in St. Vincent's Infant Asylum, New Orleans, attended by Sisters of Charity. (Photo by Harper's Magazine)

usually did. Some doctors bled their patients and gave huge doses of purgatives and quinine. Others called for closing windows in the sweltering heat and keeping fires going indoors to clear the air. An average of 200 people died each day from mid-August until the first frost on October 18, 1878, finally began to kill off the mosquitoes.

But the horror of those months is overshadowed by the courage and the sanctity of the caretakers of the stricken. Of the 111 doctors in the city who valiantly fought the disease, yellow fever killed 33. External organizations such as the Howard Association, created by doctors and nurses to fight yellow fever in the New Orleans area, also came to the rescue. Catholic and Episcopal priests and nuns cared for the sick and paid with the sacrifice of their own lives. Martyrs Weekend, observed in September each year, recognizes those heroes who came to the aid of people who were helplessly dying of a disease they did not understand and could not control.

Survivors of the 1878 epidemic faced a financially ruined city and another smaller yellow fever epidemic, about 600 deaths, in the summer of 1879. The city was forced to declare bankruptcy and lost its city charter from the state of Tennessee. The community, now a taxing district, was placed under state control and put on a forced austerity program until it cleaned up its environment and paid off its creditors. There was one unexpected positive result. For the first time in Memphis history, the African-American community became integrated into the city's workforce. While African-Americans



Historic aerial view of Memphis (1870)

also contracted yellow fever in large numbers, only about 7 percent died from it. Scientists now believe that repeated exposures to yellow fever over many generations in West Africa resulted in higher resistance to the disease. The African-American survivors in Memphis became the glue that held the city together, caring for the sick and dying, burying the dead, and taking over many positions in the Memphis police, fire and other city services.

As a result of a massive post-epidemic clean-up and new stricter sanitation laws, much of the habitat for the mosquitoes was eliminated. The centerpiece of the sanitary reforms was a revolutionary sewer system designed by George Waring of New York that separated the sanitary sewer system from the storm sewers. This design not only helped the city of Memphis clean up its environment, it revolutionized the design of sewer systems across the nation. About a decade after the 1878 epidemic, an artesian aquifer was discovered under Memphis that provided the city with abundant clean drinking water for the first time. The horror in Memphis also gained the transmission of yellow fever more attention by the medical community. The mosquito vector, first hypothesized in 1880 by Dr. Carlos Findlay, was finally proven by Army Surgeon Dr. Walter Reed. He showed conclusively that yellow fever was caused by the bite of an infected mosquito. The control of mosquitoes marked the death knell of yellow fever and gave Memphis a second chance to become a great city. Next time you visit Memphis and start walking “10 feet off of Beale,” think about how this vibrant city recovered from one of the greatest calamities in U.S. history.

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## MY MISSISSIPPI

**Wayne Hahn; volunteer at the National Great Rivers Museum**



ABOVE: Hahn near the National Great Rivers Museum's barge simulator that shows visitors how to lock a barge through the Melvin Price Locks and Dam.

"I started volunteering for the National Great Rivers Museum in November 2006 after I came for a tour with my wife. After our visit, I got asked whether I might like to be a volunteer. I'd worked as an engineer at Boeing's defense division at their St. Louis office for 44 years. In my retirement, the volunteer work gives me something to do. I've been very

blessed, and I thought it was time to give back. It's been working out great!

As a volunteer at the National Great Rivers Museum, I give tours of the Melvin Price Locks and Dam and the museum, welcome visitors, help with stocking the gift shop and displays and anything else the staff might need help with. I especially enjoy giving tours. I get to meet people from all over the world and I enjoy interacting with them. We have a number of displays here, which help explain how the Mississippi River works. The barge simulator and the movies we show in our theatre that describe the Mississippi River are also very popular. Something surprising that people may not know is that over the past 20 years, the Melvin Price Locks and Dam has moved about 1¾ inches down the Mississippi River because of expansion and contraction.

The Mississippi River is very important for the whole country. We move somewhere between 80 to 100 million tons of freight through these locks and dam every year. The Midwest farmers really count on this system to move the products they need as well as what they want to send to foreign markets. The river is a major attraction for recreational activities such as sailing, water skiing, fishing and just taking a drive up the Great River Road from Alton to Grafton. This is considered to be one of the most scenic drives in the country. There is a lot to see and do in the Alton, Illinois area, and I enjoy sharing it with all those who visit us."



PHOTOS BY ROXANE KRUTSINGER

ABOVE: Hahn speaks with visitors and shows them a barge locking through near the National Great Rivers Museum in Alton, Ill.



## Embarking on New Leadership Through Change of Command

Brig. Gen. (P) Michael C. Wehr assumed command of the Corps' Mississippi Valley Division (MVD) in a Vicksburg, Miss. ceremony Aug. 29 that saw Brig. Gen. Duke DeLuca depart for a well-earned retirement following an exceptional 32-year career with the United States Army.

Lt. Col. (P) Torrey DiCiro, deputy commander of the MVD, presided over the Change of Command ceremony that reflected procedures practiced since the days of the Continental Army. It included displays of long held tradition like presenting roses to the generals' wives on behalf of the division's employees and spouses. Marianne Paciulli, DeLuca's wife, received red roses in full bloom, reflecting the loving concern she has shown the division over the past year and the beauty of that time. The MVD welcomed Deborah Kalisz Wehr with yellow rosebuds, signifying welcome and friendship.

MVD Director of Programs Eddie Belk, representing the division's civilian partners, presented the colors to DeLuca, who symbolically relinquished command to Wehr by passing him the flag via Lt. Gen. Thomas Bostick, commanding general of the Corps. The transfer of the colors signifies that the outgoing commander has passed the mantle of leadership to the new commander and that the loyalty of all should also be shifted to the new commander.

As MVD commander, Wehr is responsible for a \$2 billion civil works program and plays a vital role in managing the Corps' water resources program in the Mississippi River Valley, a

ABOVE: Corps of Engineers personnel wait on stage for the national anthem to be sung as part of the Change of Command ceremony. From left to right: Brig. Gen. (P) Michael C. Wehr, incoming commander; Lt. Gen. Thomas P. Bostick, Chief of Engineers; Brig. Gen. Duke DeLuca, outgoing commander; and Mr. Eddie Belk, Programs Director for the MVD.

370,000-square-mile area extending from Canada to the Gulf of Mexico. Additionally, Wehr will also be the president-designee of the Mississippi River Commission, overseeing flood control and navigation projects upon the entire Mississippi River and her tributaries.

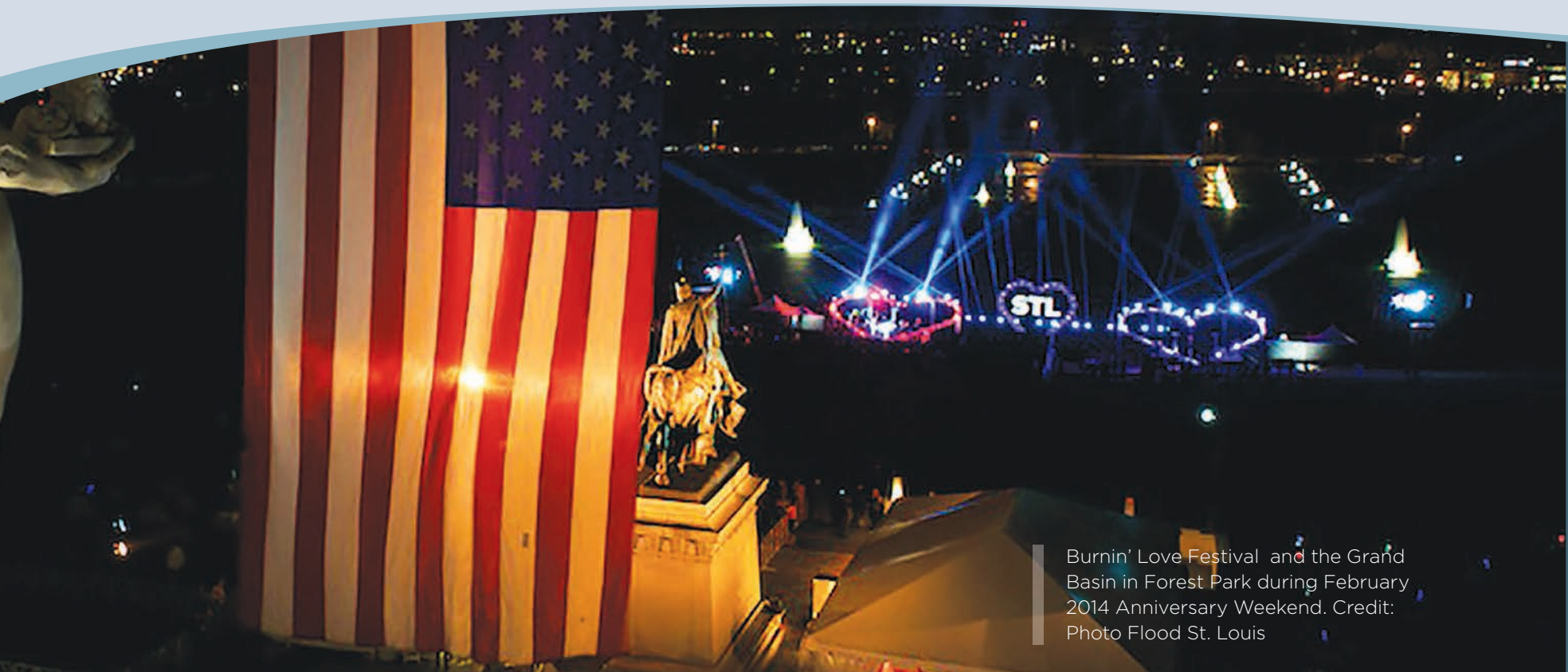
Wehr was promoted to Major General in a separate ceremony Sept. 12. His military background includes service in Afghanistan and the Japan Engineer District. He grew up in a military family and was commissioned a second



Major General Michael C. Wehr

lieutenant through the ROTC program at Santa Clara University in 1985. His education includes engineer officer courses, a master's degree in civil engineering from the University of Texas, the Command and General Staff College, and Joint Forces Staff College.

PHOTOS BY USACE



Burnin' Love Festival and the Grand Basin in Forest Park during February 2014 Anniversary Weekend. Credit: Photo Flood St. Louis

## ST. LOUIS CELEBRATES ITS **250TH ANNIVERSARY**

“Gateway to the West” is a fitting nickname for St. Louis, the city used as the starting point for settlers heading West in search of opportunities. This year marks the 250th anniversary of the city’s 1764 founding by Auguste Chouteau and Pierre Laclède, who named it in honor of 13th century French King Louis IX, the patron saint of the then current French king, Louis XV.

The United States acquired St. Louis in 1803 as part of the Louisiana Purchase, the largest land acquisition in history. At 828,000 square miles, the purchase included the total territory of six modern-day states and parts of nine others west of the Mississippi River. In 1804, Lewis and Clark began their expedition from nearby Hartford, Ill., becoming the first to use the area as a staging ground for western expansion. Steamboats arrived at St. Louis beginning in 1817 and by 1858, the traffic on the river had increased a thousand-fold, turning it into a shipping superhighway.

This increase in traffic fueled the destruction of resources along the river. As the river widened, the banks became unstable and began crumbling, allowing trees to fall in the river. During low-water periods, the upper Mississippi River had shallow and swift currents, small waterfalls and other hazards. The river became too treacherous to be navigated safely and many lives and vessels were lost.



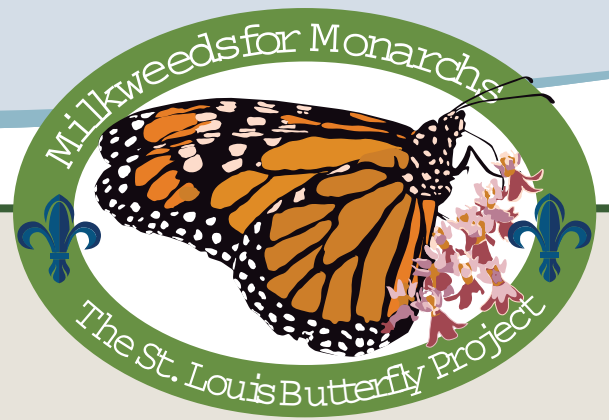
LEFT TO RIGHT: Member of the Osage Nation in ceremonial dress at the Reenactment of the Founding of St. Louis. Auguste Chouteau at the Reenactment of the Founding of St. Louis. Credit: J. Klein © Dario-Digital.com. Cakeway to the West cake at Gateway Arch. Artwork by Andy Cross.

To address these issues, Congress in 1880 directed the Corps of Engineers to fix the conditions by creating and maintaining a safe and dependable navigation channel. It also directed the Corps to return the river to its majestic condition. This began the historical partnership that continues today between the Corps and St. Louis to balance navigational needs along the river with those of the environment.

The celebration to commemorate the 250th anniversary was planned by a board of directors and 200 volunteers, collectively known as “STL 250.” STL 250 reached out to more than 3,000 organizations across the 15-county bistate region, extending an invitation to plan events. Their efforts culminated in more than 300 events for the year.

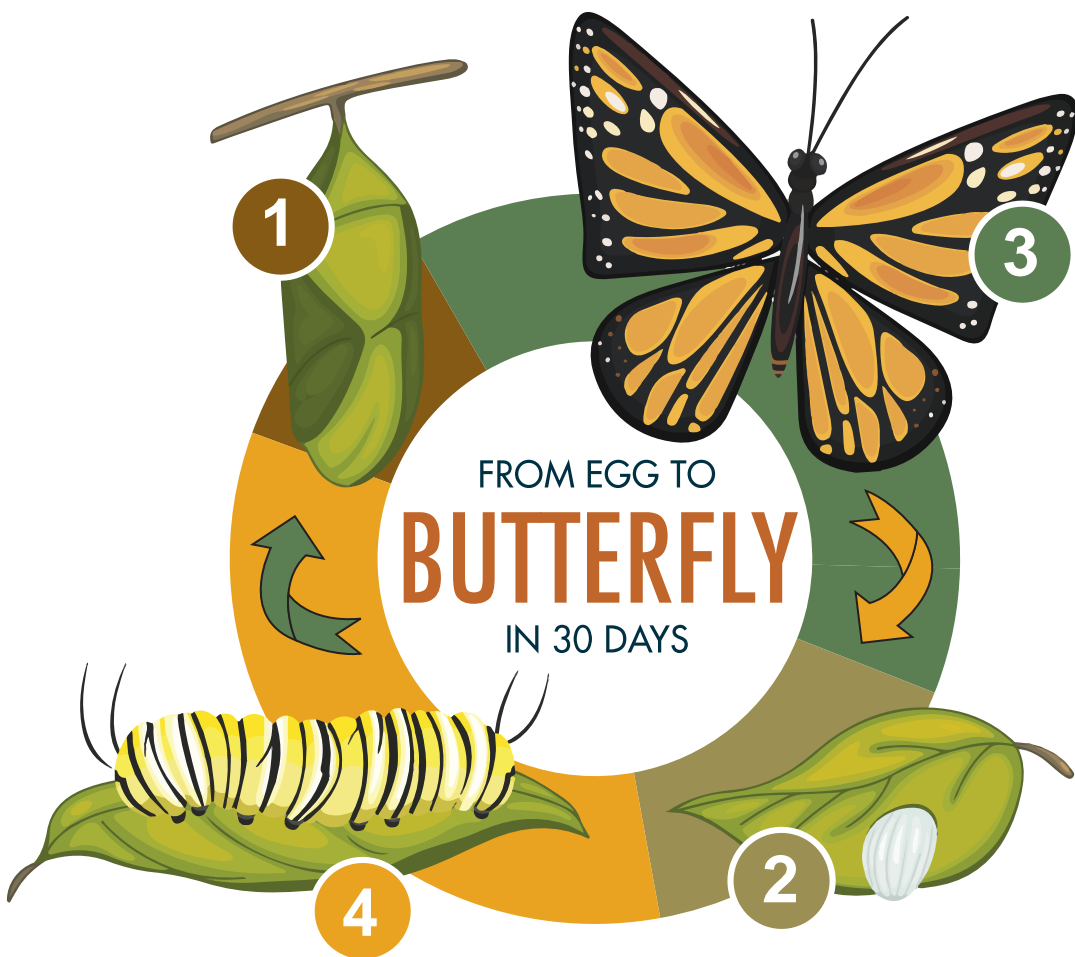
*Continued on page 11 >>*





## OUR MISSISSIPPI KIDS

Monarch butterflies transform through four stages from egg to adult. Trace their life cycle by matching the stages below to the diagram.



- A. \_\_\_ CATERPILLAR (17 DAYS)      C. \_\_\_ PUPA (8 DAYS)  
 B. \_\_\_ ADULT BUTTERFLY (1-8 MONTHS)      D. \_\_\_ EGG LAID (3-5 DAYS)

A:4 | B:3 | C:1 | D:2

## Monarch Butterflies

Monarch butterflies, known for their brilliant, bright orange color contrasted with black and white markings, are famous for their annual migrations between their winters in Mexico and their summers in Canada, traveling hundreds to thousands of miles!

### LIFE CYCLE

On their way back north from Mexico City, monarch butterflies look for gardens where they can lay their eggs. About four days after monarch, butterfly mothers lay eggs, the eggs will hatch, according to the National Wildlife Federation. The caterpillars are small to start but grow a lot in the first two weeks, eating milkweed. When they're big enough, they go through the pupa stage in a green and yellow chrysalis, which protects them as they transform from a caterpillar into a butterfly over a two-week period. They then continue migrating north.

### BUTTERFLY GARDENS

Monarch butterflies like a variety of plants, including Milkweed, Black-Eyed Susans, Goldenrods, and New England Asters. Female monarchs especially like milkweed. They use those flowers to lay their eggs and feed their caterpillar larvae. While other flowers can give the butterflies nectar, the monarch butterflies need milkweeds so we can have more butterflies! The number of monarch butterflies has declined 90 percent over the last 20 years, partly due to habitat loss, so we invite you to build a garden to help the butterflies!

For more information on The St. Louis Butterfly Project "Milkweeds for Monarchs," go to [www.stlouis-mo.gov](http://www.stlouis-mo.gov) and search for "Monarch Butterflies." Enjoy your garden and the butterflies that visit. Consider sharing photos and reporting butterfly sightings with them by emailing [werner@stlouis-mo.gov](mailto:werner@stlouis-mo.gov).

### FUN FACT!

The monarch is the only butterfly that migrates north and south. No one individual can make the entire trip. It takes three or four generations to complete the migration from Mexico to Canada and back again. During the migration, female monarchs lay their eggs along the way and their offspring finish the trip.

PHOTOS BY CATHERINE WERNER

## ST. LOUIS CELEBRATES *Continued from page 10*

One such event is "Cakeway to the West." STL 250 and nominations from the public led to identifying 250 sites plus one "bonus" site, located within the 15-county region. Each site received a 4-foot-tall fiberglass "cake" personalized by local artists. The sites, ranging from the Corps of Engineers' National Great Rivers Museum to Lewis and Clark Boat House and Nature Center to hospitals and schools, will display the cakes until the end of the year. The cakes serve not only for decoration; they also play into a scavenger hunt featured on a STL 250 app, which is also active until the year ends. Residents and visitors to St. Louis can use the app to find the cakes and collect points to win prizes. The app also shares fun facts about each site with users, who in turn can share their own photos via social media, as well as details about other events throughout the region.

PHOTO BY STL250

Visit [stl250.org](http://stl250.org) for more information on the anniversary celebration as a whole, and visit <http://www.mvs.usace.army.mil/About/History.aspx> to learn more about the history of the partnership between the USACE and St. Louis.



LEFT & ABOVE: Missouri and St. Louis leaders plant milkweeds for monarch butterfly habitats as part of the St. Louis Butterfly Project.

U.S. Army Corps of Engineers, Rock Island  
 PM-A (Dolan), Clock Tower Building  
 P.O. Box 2004  
 Rock Island, IL 61204-2004

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PHOTO BY USACE



## MY MISSISSIPPI

**Ron Deiss; Archeologist for the Regional Planning and Environmental Division North at Rock Island District**

"I've worked with the Corps since 1988 and as a professional archaeologist since 1976. I've been involved with Corps projects related to navigation studies and civil works projects, improving transportation, flood control projects and ecosystem restorations within the upper Mississippi River drainage basin. Archeologists assure that cultural concerns are addressed by discovering, identifying and inventorying the historic properties on federal and public lands potentially impacted by proposed projects or permits. We do our best to avoid disrupting these sites, which may include buildings, villages, burial mounds and wrecks, by all means possible. As part of the proposed construction and environmental efforts at or near lock and

dam sites, we look for archeological sites, write reports and request input from other federal agencies, states, the public, historical societies and Native American tribes. We want people involved in the process. Initial surveys are followed by testing and excavation reports. Major priorities include avoiding significant sites and maintaining their integrity for future protection. Complete excavation is our last resort way of reporting and recording these sites for posterity. As a Corps archeologist, I've explored how the Mississippi River has influenced the earliest settlers along this system and vice versa. There's always something more to learn. Through our protecting the resources, future generations can enjoy them as well."

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**What's your Mississippi?** Email responses to: [editor@ourmississippi.org](mailto:editor@ourmississippi.org)

Scan here with your smartphone to go to the *Our Mississippi* website. There, you can subscribe to our e-edition, read past editions and find river-related education materials.



Send story ideas to [ourmississippi@usace.army.mil](mailto:ourmississippi@usace.army.mil)

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This newsletter is a quarterly update of ongoing efforts in the Mississippi River Watershed and does not necessarily reflect the views of the U.S. Army.