

Operation Mighty Mo

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On the Cover

Trucks wait to deliver rock for downstream scour repair to Federal Levee L-488, Forest City, Mo., July 28. Photographed during daily aerial levee surveillance by the U.S. Army Corps of Engineers. (U.S. Army Photo / Susan Abbott, Kansas City District)

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Susan Abbott and team, from the U.S. Army Corps of Engineers, Kansas City District, conduct a daily inspection of the 2011 Missouri River flood from a helicopter, July 29. (U.S. Army Photo / Susan Abbott, Kansas City District)

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Evacuating the flood waters at Gavins Point Dam, Aug. 6. (U.S. Army Photo / Sarah Gross, Chicago District)

Preparing the Missouri River Basin for 2012

Water releases from the Missouri River Basin Main Stem System have been flowing at unprecedented levels since the end of June. Those releases have declined, but the basin is still saturated, and a long road to recovery remains ahead.

A historic amount of precipitation entered the Missouri River Basin starting in May 2011. During a five-month span (March 1 - July 1), approximately 49 million acre feet of runoff poured into the system overwhelming the floodplains, saturating and overtopping levee systems and forcing hundreds of homeowners, farmers and business owners to evacuate.

“The first thing we need is for the water releases to come down, so the saturated floodplains can drain back into the river channel,” said Brig. Gen. John R. McMahon, Northwestern Division commander. “Once the floodplains begin to drain, we can begin our inspection and assessment phase. The goal is to start construction on our dam and levee infrastructure by December.”

In order to reach that goal, the Northwestern Division’s Missouri River Basin Water Management Division, with the assistance of the Omaha and Kansas City Districts, created a drawdown strategy that would gradually decrease water releases from the main stem reservoir system.

Releases from Gavins Point, the Lewis and Clark Lake in Yankton, S.D., decreased from 160,000 cubic feet per second to 150,000 cubic feet per second on Aug. 1. After holding at that rate for approximately two weeks, releases decreased by 5,000 cubic feet per second every day until reaching 90,000 cubic feet per second.

“We needed to stay at 150,000 cubic feet per second for two weeks to evacuate the system out of the exclusive flood control zone,” said Jody Farhat, chief of the Missouri River Basin Water Management Division. “Once we were out of the exclusive flood control zone, we were able to regain the flexibility to absorb additional runoff this fall.”

The gradual and purposeful release decline also decreased the risk of massive bank erosion as the water in the floodplains moves back into the main river channel. The hydrostatic

pressure in the floodplains is high enough that decreasing releases too quickly would create a flushing effect that could potentially drag large quantities of sediment into the river channel and create instable riverbanks and deplete rich farmland. Hydrostatic pressure is the force that liquid has when it is at rest.

Once the releases reached 90,000 cubic feet per second from Gavins Point Dam, the Corps began preliminary inspection of the dams and levees in the northern portion of the basin. Formal assessments will begin once releases are drawn down to 40,000 cfs. Once damage assessments are complete, the Corps will create Project Information Reports that estimate damage costs, repairs needed and construction timelines. The reports are received and approved locally, regionally and finally nationally. Funding for construction is processed at the Corps Headquarters in Washington, D.C.

“There is a lot of damage out there—to the levees, to the dams, to other project sites—they can’t all be fixed before 2012,” said Col. Robert Ruch, Omaha District Commander. “But we will request funding for all the critical items that we need to repair to protect against flooding for next year. Public safety is our priority, and we will restore the most necessary projects to pre-flood condition.”

During the assessment phase, repairs will be prioritized to receive funding. Not all projects will see repairs before the 2012 runoff season begins, but the Corps plans to attend to the most critical repairs first.

The drawdown strategy intends to have water releases from Gavins Point Dam reach 40,000 cubic feet per second by the end of the first week of October. That rate is slightly above a normal fall rate of 30,000 cubic feet per second and will allow time for the downstream communities to dry out and also begin the recovery process before winter.

The levee systems below Gavins Point Dam were not constructed to hold water back for this extended period of time. That sustained high water mounted a surveillance effort that has kept inspectors in the air and on the ground for the entire summer. It also means that the flood fight isn’t over yet.



Dumping approximately 25 cubic yards from each of a serial of ten side dump trucks, bulldozers spread and compact composite material in levee support work, July 30. (U.S. Army Photo / Tommy Clarkson, Northwestern Division)

“There is still a danger of high water. The Corps will remain vigilant as long as there is water on the levee system and remains committed to support stakeholders,” said Col. Anthony Hofmann, Kansas City District commander.

Once the inspections are done and funding has been requested, construction will commence.

“Working through winter is much easier than any other season,” said Jud Kneuvean, Chief of Emergency Management, Kansas City District. “A dry winter allows you to scrape off the top layer to get to the more malleable material underneath.”

The Corps will begin an after action review that will examine how the organization performed during the flood—the infrastructure, the decision-making process and the decisions themselves will be reviewed.

“The review needs to be detailed and thorough,” said Chris Wiehl, acting chief of Planning Branch, Omaha District. “Once the review is put together, we need to discuss every aspect with the basin stakeholders—Tribes, states, congressionals and individuals of the basin. We need to hear their comments and concerns.”

The Corps’ drawdown strategy to prepare the basin for 2012 did not add flood control storage to the main stem system. To add storage would have kept releases from Gavins Point Dam at 150,000 cubic feet per second well into the fall. But

reassessing the current 16.3 million acre feet of flood control storage will be a part of the after action review. The decision to not add flood control storage was made based on the fact that the runoff amount from March to July 2011 had a 0.2 percent chance of reoccurring next year. In addition, there is no forecast that predicts, with certainty, that the spring of 2012 will be wetter than average.

Releases from the five other main stem reservoirs decreased at a proportional rate compared to Gavins Point Dam. Releases from Fort Peck are projected to average 23,500 cubic feet per second by the end of September; releases from Garrison will be 26,000 cubic feet per second; releases from Oahe will be 45,000 cubic feet per second; Big Bend will be at 45,000 cubic feet per second and Fort Randall will be 53,000 cubic feet per second. Gavins Point is expected to end the month at 55,000 cfs.*

“In order to be ready for 2012, we need to evacuate the majority of the 2011 floodwaters from the reservoir system and the floodplains before winter starts, so homeowners, farmers, business owners, state agencies and the Corps have time to inspect, assess and begin recovering,” said Brig. Gen. McMahon. “The Corps has the responsibility to execute this strategy and allow time for the recovery process so our flood control infrastructure will be ready for 2012 runoff.”

* Numbers are subject to change if forecast is adjusted.



Missouri River Operations: The Path Forward

The reservoir drawdown schedule hit an important milestone recently when we brought releases out of Gavins Point Dam down to 90,000 cubic feet per second. We will hold releases there for about two weeks to conduct initial inspections, read instruments and take stock of how the levees and dams are performing under the changing conditions. Once we complete these assessments, we will continue to drawdown releases to 40,000 cfs by early October, which will allow the water to drain out of inundated homes, farms and businesses in the flood plain. Then, those affected can begin their own assessments and repairs before winter sets in.

I was invited to meet with basin Governors recently and held a very productive discussion with them about the current situation on the river, the mandate to keep flood risk reduction as the top priority of the mainstem reservoir system, the need to get ready for the 2012 runoff season and our plan to conduct transparent, objective, timely and credible assessments of what happened this year. The Governors and our Congressional Leaders are deeply involved in shaping both what's in store for the remainder of 2011 as we prepare for the 2012 runoff season, and thinking about the future of the flood plain and longer-term restoration efforts. Meanwhile, there are a number of other important activities underway.

First, we will begin inspections of the levees, dams and other infrastructure in close cooperation with local levee sponsors and other stakeholders—this will be a race against time given the impending onset of colder weather, freezing conditions and current fiscal constraints. Under ideal circumstances, the timeline for initiating repairs has us completing inspections and damage assessments by late October, preparing cost estimates and contracting documents before Thanksgiving, and awarding contracts and

initiating construction before Christmas. The Corps is actively using existing authorities to fund critical, emergency repair needs and prepare for additional repair needs. We are also canvassing all possible funding sources from across all our programs to address needs throughout the country.

How we prioritize the repairs will be of interest to many—especially in this environment of limited time, competition for federal resources and approaching winter weather. Let me first assure you that life and safety are paramount in our emergency repair and multi-year investment decisions. We intend to apply a risk-based, decision-making process based on probability of failure and severity of consequence to make these important investment decisions of what to repair first. This will yield a phased plan of repairs based on availability of funding, getting our designs and contracts in place, consideration of what others need (e.g., the dependencies of say a highway repair and the levee repair that protects it) and so on. We plan to share this prioritized list with basin Governors, members of Congress, Tribes and other stakeholders, to elicit their input and support.

Second, the Corps, along with other federal and state agencies, Tribes and others, has begun a post-flood assessment effort. We have to be accountable to the people we serve. Specifically, we will assess our water management operations and decision making using an external multi-discipline team of experts; review the flood-fighting response through an internal after action review process in which stakeholders will be invited to participate; conduct damage assessments via inspections by Corps personnel, levee sponsors and contracted experts; and assess and collect data on other damages. These assessments will generally be concluded by the end of the year and lead to the development of a Comprehensive

Restoration Plan, one that builds on the immediate repairs being undertaken as soon as possible to be ready for the 2012 runoff season. Important questions will be addressed through this effort and a set of recommendations will form the basis of the plan. Concurrently, we will conduct our Annual Operating Plan meetings beginning in October, one of the many opportunities for citizens to provide us with input about the management of the Missouri River Mainstem Reservoir System.

Third, on the basis of discussions with the governors and other leaders in the region, and in close cooperation with the other federal agencies, Tribes and states, we have established the Missouri River Basin Flood Recovery Task Force, a temporary intergovernmental coalition of entities that has authorities, responsibilities and funding capability to contribute to flood-plain repair and restoration. The main purpose of this Task Force is to set conditions for success for private, public and governmental actors who have a role in the repair and/or restoration effort. It will remove bureaucratic roadblocks, apply agile and critical thinking to the problem set, and think beyond agency/state boundaries and restrictive policy/precedents, all aimed at effecting timely progress and the intended results on the ground. We don't have time to spin our wheels.

In short, we are doing everything we can within our own capability. We are getting organized for the near and long-term efforts at multiple levels to shape the future of the Missouri River Basin. This work is only beginning as the water recedes, and we seek to understand the changes and new conditions in the flood plain and its impact to life and livelihoods in the basin. We have much to do, and the only way it will get done is through active collaboration and teamwork. We all have a stake in this.



Flood Fight Brings Out Spirit of Basin Communities

Floodwaters are receding on the Missouri River and its tributaries. What lies beneath the monstrous, watery footprint fills our future with questions, challenge and hope.

Just like the citizens who came out to say they remembered the Flood of 1952, millions will remember the epic flood that rocked the prairie in the summer of 2011.

We've all read hundreds of stories, news clips and articles on the event... so I won't recount all the unprecedented statistics, events and occurrences of this spring and summer saga. (and yes, rehabilitation and repair efforts will begin in earnest this fall and winter and will possibly continue for years.)

The pictures that remain with me form a collage of collaboration involving thousands of hard-working people who took the burden of fighting this flood on their backs, and then fought it every way they knew how. These include residents of small towns and cities alike, members of the local emergency management agencies, city engineers and members of the National Guard. It includes homeowners, shop owners, farmers, business owners and peace officers, among others.

I especially marvel at some of the committed citizens we met along the way. They filled sandbags in hot humid weather, then placed them on newly built emergency levees and set them around neighbor's homes for protection. They attended meetings, asked questions, offered opinions, helped evacuees pack and leave their homes and guarded the property of neighbors who had relocated.

In short, the response to this traumatic event was awe inspiring. A memorable fight ensued between man and nature.

This effort within the basin had special meaning to the federal government, the

average citizen, Tribal members and state and local officials, who teamed up to prepare, respond and recover.

It will be many months before we know the total cost of damages from this flood event. And we'll never be able to calculate another kind of cost — human cost. There are no tangible figures for that.

But the "big picture" tapestry of this event hangs in the mind's eye of many, and all who took part in fighting and responding to the Flood of 2011 have a right to feel proud for the part they played in it.

If you slung sandbags to protect your community, or delivered pumps to flooded areas or answered phone calls to assist those under duress, you are part of this honorable group. If you worked 80-hour weeks, climbed slippery dam slopes to read piezometers, answered questions at emergency local meetings or met with Congressional officials or their staff, you deserve thanks for your efforts. If you spent all night patrolling towns, construction sites or monitoring levees, you are part of a great story.

For those who worked nearly around the clock, slogged through floodwaters and sewage, went entire days without sleep, wrote reports into the night, flew by chopper to emergency levee work sites or delivered answers to the thousands of phone calls received by a myriad of agencies, Tribes and townships, you deserve praise.

If you read 10,000 news clips, shared the information with coworkers or callers, and wrote news releases until you were fighting sleep, you are to be commended.

If you coolly responded with poise and certitude as unprecedented conditions and scrutiny mandated the use of operations,

procedures and communications efforts never before employed in the Omaha District, you should receive thanks.

True heroes tell us, not in words but through their actions, that we are all a part of something special.

Everyone feels pain for those impacted adversely by the summer events of 2011. But the good works of men and women throughout the basin should not go unmentioned. I want to sincerely express my gratitude and amazement to the people who came together to respond to this emergency.

I want to thank the Omaha District workforce and all who came to our assistance. You should be proud of making the extreme and supreme commitment.

What the Flood of 2011 has done for my perspective is to remind me of the ingredients that comprise true working heroes. The Corps has known many.

From Bunker Hill to Afghanistan... from Hurricane Hugo to Operation Snowplow... from the California earthquake to Hurricane Katrina — and in thousands of forests, battlefields, communities and floodplains in between — heroes extended the full measure of personal commitment in the face of danger, chaos and threatening conditions.

Today, proudly, communities, agencies, Tribes and industry have bonded together in the most meaningful posture of commitment imaginable.

To all who took part, thank you for your service to this great nation.



Vigilant 'til the End

There is nothing so fatal to character as half finished tasks —David Lloyd George

About a year ago, I sat in the U.S. Army Corps of Engineers pre-command course in Washington, D.C. The week-long course included numerous topics to prepare future district commanders for command, to include emergency management operations. As good as the course was, I don't think any course could fully prepare future commanders for every type of emergency response. So when the Kansas City District was challenged with an unprecedented Missouri River flood fight — it would seem the pressure of doing so would be off the charts. Nonetheless, I was confident in the district's ability to handle the situation until the mission is complete. Why? Four words: Experience and Exceptional People. The Kansas City District had been battle-tested in flood-fight operations in recent years. This experience, combined with the professionalism and work ethic of our Heartland Engineer workforce, made me fully confident that we could not only handle the challenge, but also excel while doing it. And that's exactly what has transpired.

As this article is being written, we have exceeded triple digits in the duration of the Missouri River Flood of 2011 — an unprecedented amount of time. Water is beginning to recede with the approved drawdown plan, but the process is slow, and the miles of levees the Kansas City District is responsible for remain hydraulically charged. Despite the duration of this event, we remain focused on this flood fight and will remain vigilant to the end.

A key test recently occurred that accurately depicts the mettle of our district and that our focus will not waver. Federal levee L-488 (left descending bank, approximate river mile 476-465) had severe scour issues, causing great concern. Essentially, the unruly Big Muddy was trying to cut a new channel — at an alarming rate. The levee, a one and a half hour drive from Kansas City, was in jeopardy. The district responded quickly, mobilizing technical experts and getting an emergency contract in place within hours. The district worked closely

with local levee sponsors and the contractor well into the early morning hours of a Sunday (3 a.m. to be exact), placing large quantities of rock in the right areas to attack the problem. Ultimately, these actions proved successful.

There are many other examples of "victories" during this flood fight, the direct result of technical teams on the ground assisting levee sponsors, daily aerial reconnaissance to identify potential problem areas early and a penchant for listening to our partners to ensure we continue to work together during this epic fight. Each of these examples, like the seepage battle at levee R-471-460, demonstrates the commitment of our workforce in supporting the public we serve. At the end of the day, our U.S. Army Corps of Engineers employees remain engaged, flood fighting shoulder-to-shoulder with our sponsors. We don't run from challenges — we embrace them. What we do matters and communities, businesses and lives are being preserved as a direct result of what we accomplish for them. We continue to run this marathon and are committed to finishing strong. It's what the Nation expects from its Corps of Engineers.

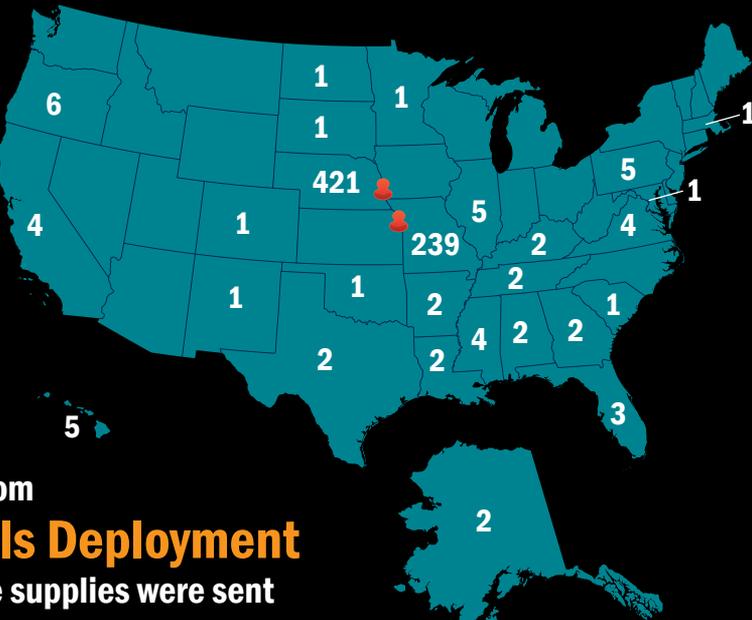


At the New Christopher S. Bond Bridge, Kansas City, Mo., one barge carries rock and one goes back for more to help repair levees along the Missouri River, August 15. (U.S. Army Photo / Susan Abbott, Kansas City District)

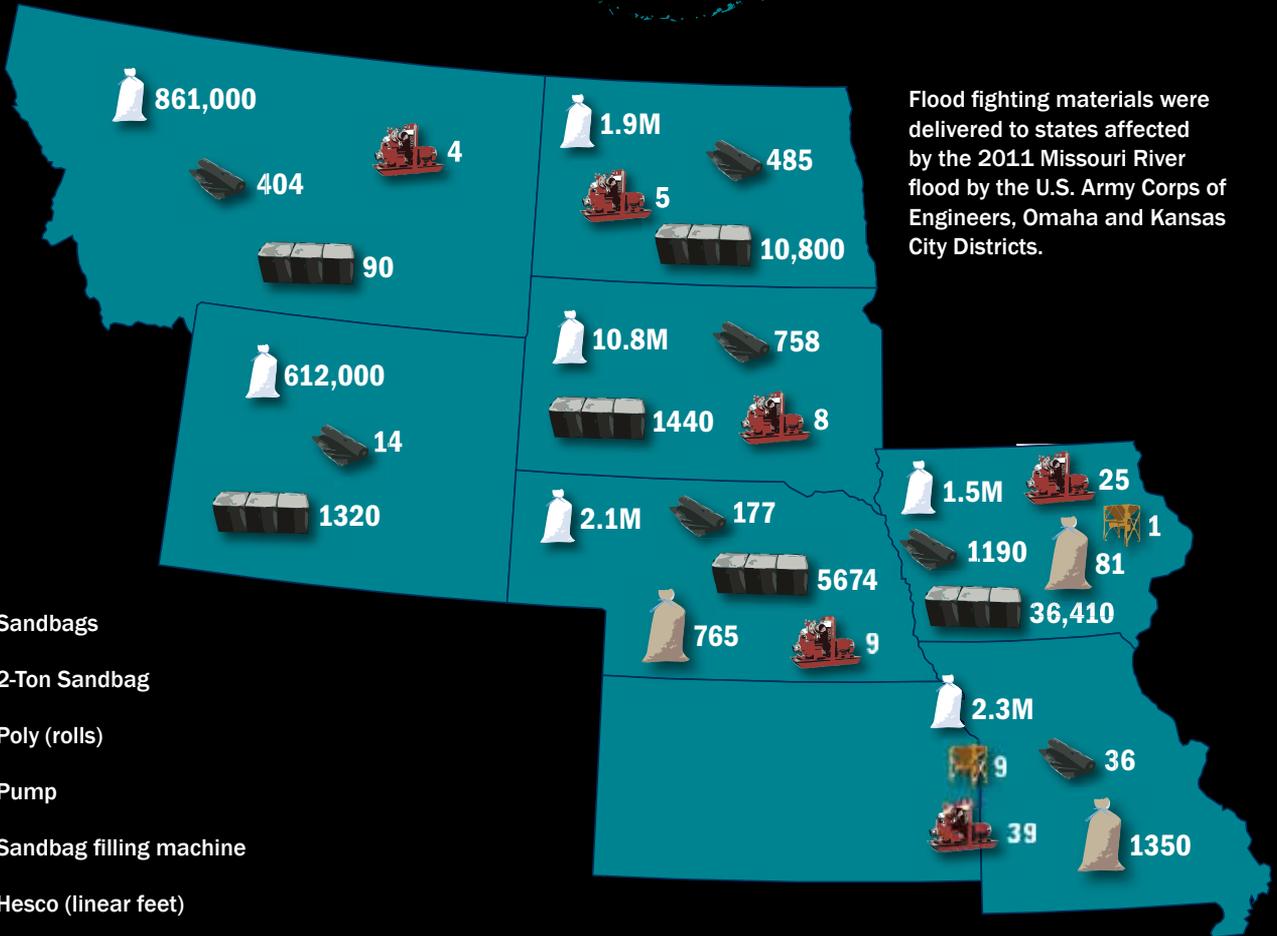
THE BIG PICTURE • FLOOD FIGHT BY THE NUMBERS



729 Corps Personnel were deployed to the Kansas City and Omaha Emergency Operations Centers over the course of the 2011 Missouri River flood. 495 people deployed to the Omaha EOC and 234 to Kansas City. This is where they came from.



where the people came from Personnel & Materials Deployment where the supplies were sent



Flood fighting materials were delivered to states affected by the 2011 Missouri River flood by the U.S. Army Corps of Engineers, Omaha and Kansas City Districts.

- Sandbags
- 2-Ton Sandbag
- Poly (rolls)
- Pump
- Sandbag filling machine
- Hesco (linear feet)

Deployed Personnel stats as of 09 August 2011, Materials Deployed per State stats as of 13 September 2011



Aerial Reconnaissance

by Kevin Wingert
Public Affairs Specialist, Omaha District

With a steady pull, the pilot guides the helicopter into a steep climb. He slides the stick to the left and forward, urging the chopper to bank to its side and roll forward into a dive.

“There! Right there!” Susan Abbott’s crisp voice pierces through the hum of the rotor blades on the helicopter.

Riding shotgun in the cockpit, Abbott had caught a glimpse of the telltale signs of a sand boil several yards behind a levee amid rows of rotting corn and substantial seepage.

This little dynamo of energy and mirth is a key component in the Kansas City District’s flood fight efforts. She is the district’s eyes in the sky.

“I am the consistency for our aerial reconnaissance and that consistency is important,” said Abbott, who heads up aerial reconnaissance for the Kansas City District. “If you had someone new

every day or every week, would you really know if something had changed? Plus, you cannot see, you can’t cover the territory on foot that we can do.

The southern portion of the Missouri River Basin is no stranger to flooding, having fought high water in four of the past five years. Through that process, the leadership of the Emergency Operations Center gained a greater appreciation of what aerial reconnaissance could add to the flood fight.

“Starting in 2007, we decided if we can fly, we can get a better idea of what’s going on,” said Jud Kneuvean, the Chief of Emergency Operations for Kansas City District. “It’s really come home to us here during this flood event. For the

duration of the flood event, we’re seeing so many geotechnical issues, foundation issues and sand boils.”

Early on, Kneuvean knew he wanted one person to take the job on – not a rotating team. One person could keep a constant eye on the situation and tell when levee or seepage conditions changed or even if river levels rose or fell significantly in a short span of time – which could be an indicator of overtopping or a breach.

He needed someone who could handle the long flights – upwards of 8 hours in the air, every day that the flood persisted even when temperatures soared above 100 degrees. Someone with a keen eye. Someone reliable.

Susan Abbott and a team from the U.S. Army Corps of Engineers, Kansas City District, conduct daily inspection of the 2011 Missouri River flood using aerial surveillance, July 26. (U.S. Army Photo / Susan Abbott, Kansas City District)

FLOOD FIGHT

And he found her – never mind she hadn't performed levee surveillance previously in her regular job as a dam engineer.

"Initially, she couldn't identify any of the levee systems without having a map book in front of her. She wasn't sure what she was supposed to be looking for," Kneuvean said. "And we told her, 'You just keep looking at those levees and we'll keep providing you with feedback, and the more you fly, the more you'll learn.'"

This once stay-at-home mom who began a second career after her children had grown now works relentlessly to document the river's impacts as it traverses the landscape from Rulo, Neb., to where it meets the Mississippi in St. Louis. After a flight, Abbott spends hours amassing reports with digital pictures and details that document her finds.

"It provides us a great opportunity to detect any problems the system may be having," said Cliff Sanders of the Non-Federal Levee Program of the Kansas City District. "It's been an instrumental tool in finding sand boils out away from the levees."

But that's not the only way she shares her unique vantage point.

Abbott will instruct the pilot to land on or near a levee where a surveillance team is working.

"We go ahead and get those guys who've been monitoring the levees on the ground and take them up with us," Abbott said. "We have them fly the entire levee unit. Usually, that'll take five to 20 minutes, and in that very brief period of time they are able to see what we can see."

Abbott also tries to pull in district employees from levee rehab teams, hydrology and GIS, in order to help those individuals get a better grasp and visual of what they are working on.

"Aerial surveillance is a key component for what we're doing in the field," said Scott Vollink, Levee Safety Program Manager for the Kansas City District. "With aerial surveillance, we are able to identify conditions that are difficult to get at on the ground. It's a more efficient process."

Susan Abbott (above and lower left) and Mike Dulin (lower right) collect data on animal borrows and monitor sand boils on the Miles Point Levee, east of Kansas City, Mo., July 27. (U.S. Army Photo / David Hewitt, Kansas City District)





Emergency Operations

The scalable hub for emergency response

The U.S. Army Corps of Engineers disaster and emergency response mission has been one for the record books in 2011 with deadly tornadoes in Alabama, Mississippi, Arkansas and Missouri and flooding from Montana to Ohio to Louisiana along the Ohio, Mississippi and Missouri River systems.

The Corps fulfills several missions under the Department of Homeland Security's National Response Framework including temporary power, roofing and housing, debris management and urban search and rescue.

The Corps also provides technical and direct assistance to communities under the Flood Control and Coastal Emergency Act. When requested, the Corps can assist in various ways including technical

Kansas City District, Emergency Operations Center (U.S. Army Photo / Trisha Dorsey, Kansas City District)

assistance, supplies and equipment, contracting to complete temporary risk reduction measures such as constructing temporary levees, strengthening existing flood control works, channel clearance and levee rehabilitation after a flood among others.

On what might be considered a normal day, the Omaha District Readiness Branch is a team of five. Readiness Branch Chief, Kim Thomas; Public Law 84-99 Natural Disaster Program Manager, Ryan Buckley; Program Analyst, JoAnn Selves; Emergency Operations Specialist, Phyllis Pistillo; and PL 84-99 Levee Program Manager, Chris Horihan.

In the Kansas City District, the readiness branch team includes Chief, Jud Kneuvean; Natural Disaster Program Manager, Josh Marx; National Disaster Program Manager, John Robinson; and EOC/Deployment Coordinator, Vira Dobbins.

The hub for disaster and emergency response is a district's readiness branch.

"The emergency operations center becomes the hub for all emergency response activity," said Kim Thomas, Readiness Chief for the Omaha District. "When we activated our EOCs in late May, our staffs expanded exponentially to more than 400 personnel."

These teams maintain constant communication to congressional delegations, federal, Tribal, state and county agencies, local stakeholders and media by providing updates on a daily basis.

States and Tribes must request assistance from the Corps before it can be provided. Because assistance from the Corps must supplement their efforts, the city, county, Tribes and state must exhaust their resources before coming to the Corps. Every request for assistance comes through the EOC.

Requests range from needing technical assistance on how to fill and place sandbags or determining whether critical public infrastructure is at risk from rising floodwater to requests for direct assistance such as providing sandbags, HESCO bastions or pumps. Larger requests may result in contracts to construct temporary levees or raise existing levees.

Responding to flooding along the Missouri River, the Omaha District has oversight from Montana to Rulo, Neb., and the Kansas City District has oversight from Rulo, Neb. to the Missouri River's confluence with the Mississippi River.

Omaha District

On May 19, as rain was falling in Montana and Wyoming, the Omaha District's EOC grew to a team of 15 with personnel deployed to places such as North Platte, Neb., at the request of state, county and local officials to assess what items considered critical public infrastructure might be impacted as river levels began to rise on the Platte River.

As the rain kept falling, requests for assistance continued to come into the EOC. By May 22, the EOC grew to a team of 30 with requests for tens of thousands of sandbags from places such as Bighorn County, the Crow Tribe and Fort Belknap in Montana.

Technical Assistance Teams deployed across Nebraska preparing for flooding

along the Platte River; to North Dakota and South Dakota where the states requested assistance in advance of forecast high releases from the Garrison and Oahe Dams.

As teams returned from providing assistance across Nebraska, calls from State emergency managers requesting assistance kept coming in. The Corps continued action by communicating with state political representatives advising them of the escalating flooding threat resulting from the still-pouring rain.

Kansas City District

That same night, May 22, a devastating tornado struck the communities of Joplin and Duquesne in Missouri. Within days, the Kansas City District activated its EOC for a disaster response mission to provide debris removal, temporary housing assistance, restoration of critical public facilities and urban search and rescue support. The emergency response team grew by 10 in three days and by May 28, 20 people were on the ground in Joplin with at least 20 more on the way. In all, more than 400 volunteers from the Corps would respond to that natural disaster.

By May 28, the situation on the Missouri River had escalated to the point that forecast releases from Gavins Point Dam would increase from the current rate of 60,000 cubic feet per second to a peak of 150,000 cfs within three weeks – more than twice what had ever been seen before.

“The Kansas City District is enduring two massive response efforts (the tornado and the River) and the entire district and those supporting us from across the Corps are pulling together to collaboratively fight mother nature,” said Jud Kneuvean.

A Multi-District Flood Fight

By Memorial Day, more than 100 people were providing full-time support to the Omaha District EOC and more than 80 people were providing full-time support to the Kansas City District EOC for a Recovery Field Office in Joplin and the flooding mission.

Geographic Information System (GIS) personnel were developing inundation maps to help inform state and local EOCs what areas were likely to see water to determine what emergency measures would be needed. Maps were also placed online for the public to access prior to the historic releases.

The release schedule meant more water on the levees from Montana to the south and flood fighting supplies inventories became crucial. Districts were providing sandbagging equipment, sandbags, pumps, HESCO bastions, hoses, plastic rolls and more as each request came in.

Deploying assistance teams evolved from technical assistance teams of geotechnical engineers and hydraulic engineers to direct assistance teams including project managers and contracting representatives.

EMERGENCY OPERATIONS



U.S. Army Corps of Engineers, Kansas City District (above) and Omaha District (below) Emergency Operations Centers. (U.S. Army Photo)

Personnel deployed to Montana, North Dakota and South Dakota to perform and supplement 24-hour dam safety surveillance operations.

As projects to construct temporary levees in the upper basin neared completion, releases from the main stem dams edged upward. In places like Bismarck, Pierre and Dakota Dunes, temporary levees saw floodwaters within hours of projects reaching final completion.

As the advanced measures response wrapped up, personnel redeployed to the lower basin to perform levee surveillance and support new technical assistance requests coming to the EOC.

Each day, each district held a Crisis Management Team briefing outlining

the weather that might impact river gages and reservoir elevations, a review of river gages and elevations, flood fighting response operations including input from operations project managers at each main stem dam, updates on ongoing temporary measures projects or issues with completed projects, levee surveillance reports, equipment updates, press queries and safety concerns.

The EOC prepares a Situation Report or SITREP daily, summing up the daily emergency response operations and submits it up through Division to Headquarters for their situational awareness.

“Between the lines of the daily SITREP is the hard work from the multiple teams coming together within the EOC framework – water management personnel, GIS personnel creating the inundation maps, contracting officers, project managers, safety surveillance teams, technical teams, communications teams, administrative personnel and more. Without the personnel supporting this mission, the work that needs to be accomplished in order to reduce flooding risks would be impossible,” said Thomas .

By the end of June, main stem releases were peaking with Oahe and Gavins Point Dams now releasing water at 160,000 cfs after heavy rainfall over South Dakota a week earlier. More than 125 personnel were directly supporting flood fight operations through the Omaha and Kansas City EOC’s. These figures don’t include the at least 300 more personnel working in project offices from Montana to Missouri to support the effort.

By mid July, levees from Omaha to Kansas City had seen water for more than a month and several contracts to construct seepage berms were underway or nearing completion.

Both districts have remained in constant communication with levee sponsors and stakeholders, Tribes, city, county and state emergency management operations and congressional delegations throughout this intense fight.

Extensive endeavors seeking to minimize flooding risks reached the length of the Missouri River from Fort Peck, Mont., to Kansas City, Mo., as well as along tributaries such as the Musselshell River and Milk Rivers in Montana that were more than swollen after the late-May rainfall.

“Within the Kansas City District, all non-federal levee systems upstream from Kansas City have either overtopped or breached, but the fight continues to ensure stabilization of the federal levee systems along the Missouri River,” said Kneuvean.

Aerial reconnaissance has been a regular process for monitoring levee systems for any issues or changes.

Technology has played a major role during this lengthy endeavor with teams using smart phones to photograph, document and report to the EOC any issues for immediate awareness or action.

Through personnel rotating in and out of the EOCs to support these efforts in the Omaha and Kansas City Districts, more than 1,000 people have contributed their skill and expertise.

Missouri River Joint Information Center

Northwestern Division's one-stop shop for collaborative flood response communications

Effective cooperation, communication and coordination among government agencies, the media and concerned citizens are vital components to gaining a community's confidence during an emergency.

The U.S. Army Corps of Engineers, Northwestern Division, put those elements to the test this summer as the agency managed historic flows through its six main stem dams along the Missouri River.

On May 30, the Corps established the Missouri River Joint Information Center to ensure timely and coordinated release of accurate information throughout the basin, said Erik Blechinger, Chief of the Missouri River Joint Information Center.

Following the heavy rains that fell in Montana, the Dakotas and Wyoming during the last few weeks of May, the Corps announced that reservoir releases would reach unprecedented levels in order to evacuate flood waters from the system to prevent unregulated flows from the main stem dams. The center has served as the single point of information for providing information to the public, stakeholders and the media.

"It has allowed us to respond to the public with direct information regarding our reservoir releases and flood fight efforts," said Blechinger. "It has also enhanced our two-way communication efforts."

Staff from the Corps, U.S. Army National Guard, FEMA, National Oceanic and Atmospheric Administration (National Weather Service and the Hydrometeorological Prediction Center), Nuclear Regulatory Commission, the Department of Transportation, U.S. Geological Survey, Tribal entities, state and county departments of emergency management and other entities have combined forces to inform concerned publics.

Staffed by engineers, public affairs and outreach specialists, attorneys and more, phone banks for private citizens and media provided live support to eager callers seven days a week.

Daily interagency and stakeholder conference calls allow for more in-depth information exchanges. Web sites and social media content updated daily, at a minimum, has increased options for the public to access relevant flood-fight information.

Deployed liaisons are also having a beneficial impact on accelerating information flow, said Richard Robinson, planning specialist with North Dakota's Department of Emergency Services.

"Having them provides a direct and constant link to the Corps," Robinson said.

Robinson also pointed out that the center model helps dispel false reports that could lead to widespread panic. Personnel from FEMA, NOAA, state departments of transportation and the Corps agree.

Yet even close proximity and connectivity is no guarantee against delays in the information flow.

"It's nearly impossible as busy as everyone is during emergencies to have the exact right answer at all times,"



MRJIC staff answer questions from the public, media and other stakeholders through social media outlets such as Facebook and from phone inquiries. (U.S. Army Photo / Kevin Wingert, Omaha District)

EMERGENCY OPERATIONS

Robinson said. “But agencies have been sharing as much information as possible, as quickly as possible.”

On a few occasions, information flowing through the center has been disorganized or delayed but, by-in-large, participants have received the data they have needed at the moment they have needed it, he said.

The Corps has been extremely responsive to requests for information, said Bob Younie of the Iowa Department of Transportation. Younie participates on the Corps’ daily conference call*, briefing the media, congressional representatives, the Tribes, and state and local emergency management officials about the status of Iowa roads.

“[The Corps] has made senior leadership and technical experts available and placed themselves in a position to respond to public criticism and queries, which is a difficult thing to do, but they’ve done it. I’m kind of impressed by the transparency,” said Younie.

Even with the best cooperation, competing mandates can be a tough thing to manage.

“What might be a policy solution in Iowa may not be a policy solution in Missouri,” said Younie.

He explained it takes frequent communication and deliberate coordination to reach good solutions that will work for all parties involved.

“It all comes down to how can we best serve the public interest, and we always come down on the side of public safety above public convenience,” he said. “Out of that, we sometimes are a little unpopular in some regions, but it all comes down to what’s in the public interest.”

During times of crisis, people need to know that all levels of government are working together for the benefit of communities at risk. Throughout the flood fight, MRJIC will continue to provide a space for all to connect, inform and share for the benefit of the public.

* As of August 24, the Corps’ regular conference call takes place Tuesdays and Thursdays.

40 people from around the country came to Omaha to support the MRJIC



92 daily MRJIC Congressional Delegation and stakeholder conference calls occurred

94 days of flood fight support and information from the MRJIC...and counting



231 photos of flooding, flood fight efforts and main stem dams were posted to Flickr

800 members of the media contacted MRJIC for 2011 Flood information (outside of daily calls)

1497 people have “Liked” the Kansas City District Facebook page, up from 376 “Likes” on May 30

2988 people “Liked” the Operation Mighty Mo Facebook page since it began on May 30



8136 people have “Liked” the Omaha District Facebook page, up from 1077 “Likes,” since May 30



500K Kansas City District Facebook News Feed story views by Fans and non-Fans

1.2M Operation Mighty Mo Facebook News Feed story views by Fans and non-Fans

7.9M Omaha District Facebook News Feed story views by Facebook Fans & non-Fans



All stats as of August 31, except media contact stat as of September 8

Missouri River Recovery Program Q and A

What does The Missouri River Recovery Program do?

The recovery program “mitigates” the environmental damages from the navigation channel and reservoir operations at a much lower cost than the initial investment and associate operation and maintenance of this valuable infrastructure, and is essential to continuing the operation of projects for all authorized purposes, including flood control and navigation.

What is the purpose of the dams?

Dams do not stop floods; dams do reduce the risk of flooding. In 2011, no operational decisions were driven solely by the needs of fish and wildlife or the

Endangered Species Act — in 2010 and 2011, the primary focus has been on the management of the full flood storage capacity provided for by the Master Manual.

What are the System Costs and Benefits of these programs?

Since the early 1900’s, Congress has invested more than \$35 billion (at 2010 cost levels) in infrastructure in the Missouri River Basin through the Bank Stabilization and Navigation Project, the Main Stem Reservoir System as well as other similar flood control and navigation legislation. Of that, approximately \$23 billion (at 2010 cost levels) has been invested on the Main Stem Missouri River itself. The Corps

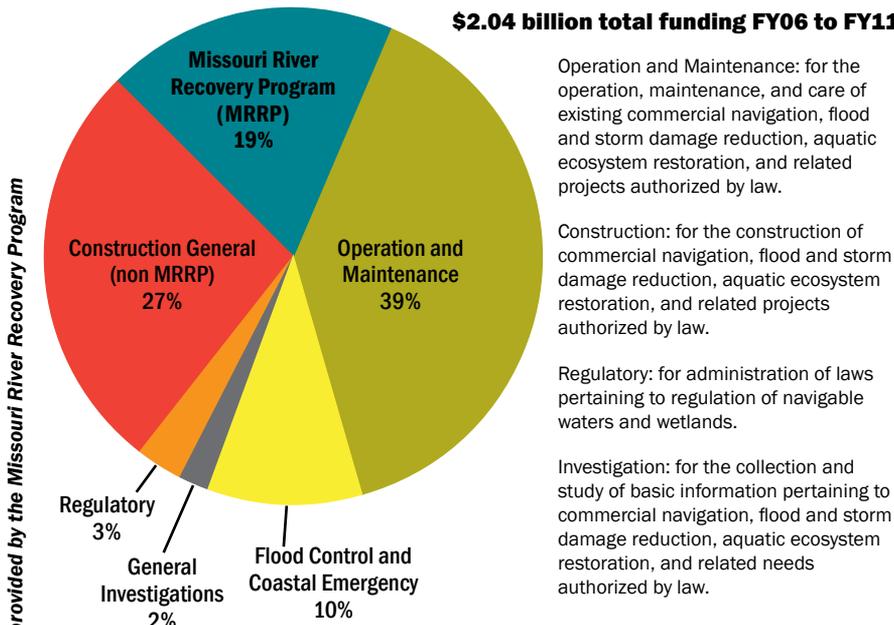
projects within the basin annually generate \$1.8 billion in benefits to the nation through flood risk management, hydropower, navigation and recreation.

The Corps currently spends around \$110 million per year to operate and maintain infrastructure (with the Bank Stabilization and Navigation Project historical average between \$6-10 million and the rest going to basin dams). The actual cost to implement the Missouri River Recovery Program has been \$50-85 million per year allowing continued operation of the system to benefit all purposes.

Nationally, in FY 2010, Corps of Engineers Aquatic Ecosystem Restoration received approximately \$568 million, which translates to just over ten percent of the total Civil Works appropriation.

Missouri River Basin Civil Works Funds: FY06 to FY11

\$2.04 billion total funding FY06 to FY11



Operation and Maintenance: for the operation, maintenance, and care of existing commercial navigation, flood and storm damage reduction, aquatic ecosystem restoration, and related projects authorized by law.

Construction: for the construction of commercial navigation, flood and storm damage reduction, aquatic ecosystem restoration, and related projects authorized by law.

Regulatory: for administration of laws pertaining to regulation of navigable waters and wetlands.

Investigation: for the collection and study of basic information pertaining to commercial navigation, flood and storm damage reduction, aquatic ecosystem restoration, and related needs authorized by law.

Within the Missouri River Basin, the Corps has implemented \$2 billion in its civil works mission over the last six years.

The Missouri River Recovery Program has been approximately 20% of this total, and is essential to continue to manage the navigation channel and reservoir operations for all authorized purposes on the Missouri River, including flood control and navigation. By contrast, nearly 40% of the total civil works mission was spent on operations and maintenance of flood control and navigation projects within the basin.

Definitions of Corps of Engineers Civil Works expenses from the Office of Management and Budget, The Budget for Fiscal Year 2012

Data provided by the Missouri River Recovery Program

Tribal Relations Stronger After 2011 Flood

The relationship between the U.S. Army and Native American Tribes is as old as this country. In the Missouri River Basin, the shared history of these two entities has had tense moments, but recent flood fight work to provide flood risk reduction to Tribal Lands, infrastructure, and a Native American heritage site has proven to be a turning point in this centuries-old relationship.

Through a series of conflicts and treaties in the late 1800s, the tense relationship between the Army and Lakota, Dakota and Nakota (Sioux) people developed for more than a century. With the creation of the Missouri River Main Stem Reservoir System, large amounts of Tribal lands were acquired to construct the dams and create the reservoir lakes, intensifying an already edgy relationship.

But time and a few tons of stone has helped pave the way for a more open and trusting relationship between the Standing Rock Sioux Tribe and the Omaha District, U.S. Army Corps of Engineers.

“We really appreciate your staff,” said Tribal Vice Chairman Mike Faith during an Aug. 15 council meeting attended by Col. Robert Ruch, Omaha District commander. “This was the first time that we worked really well with the Corps—it’s unfortunate it was during a crisis and we understand that it was an act of Mother Nature, but your team was here from the very beginning.”

That team included Joel Ames, Omaha District Tribal Liaison, geotechnical engineers, hydrologists and construction representatives who were on the shores of Lake Oahe in Fort Yates, N.D., to provide technical and direct assistance.

“The Tribes lost an immense amount of land during the creation of the main stem system,” said Ames. “We needed to battle the perception of ‘This is the same old Corps.’ And we’ve done that with individual face time. Our goal is to continue to work and coordinate and see where we can assist. When they raise an issue, they need to know we are actively pursuing ways to help them.”

Multiple teams of experts traveled across the basin to various Tribes to communicate the Corps plan to construct flood risk reduction measures for the Flood of 2011. One of those projects was stabilizing a bank near the Sitting Bull Monument.

“They have been asking us to protect the bank near the memorial for at least two to three years, but we’ve never had the authority to be able to do it,” said Eric Stasch, Oahe Dam Operations Project Manager. “With the threat of flood waters, we were able to go in and protect the Fort Yates Sitting Bull Monument.”

Public Law 84-99 gives the Omaha District the authority to construct emergency flood control works for critical infrastructure and the cultural resource site. Without the Flood Control

and Coastal Emergency funding, that berm would not have been constructed. A rock levee was also constructed along the causeway road connecting the majority of Tribal members to the island, where the Tribal Council and medical care is located.

While the work was ongoing in Fort Yates, other Corps teams were on the ground assisting Tribes across the basin. That effort included the deployment of 279,000 sandbags and 83 rolls of plastic, the construction of temporary levees and berms and fulfillment of nine requests for technical assistance.

The interactions with the Tribes concerning the effects of the 2011 flood are just beginning.

“When the water comes back down, our staff will become even more engaged,” said Julie Price, Omaha District Cultural Resource Program Manager. “In general, we are all worried about erosion along the river that will impact our cultural resources. Exposed sites will need to be assessed and may also need to be stabilized.”

Price said that the Corps will need to pursue funding in order to begin an extensive effort to send archaeologists into the field to inspect more than 5,000 cultural sites in the Omaha District. There is a concern that exposed sites will be looted or damaged by human interaction.

MO RIVER BASIN

Federal laws prohibit the damage or removal of any material remains of past human life or activities which are of archaeological interest. Additionally, it is illegal to sell or knowingly purchase these items. Penalties for the destruction of these resources include: fines, forfeiture of artifacts and equipment used in the commission of the crime, imprisonment and monetary restitution for damages to sites. Anyone who witnesses an individual tampering with a cultural resource site is encouraged to call the Omaha District hotline: 1-866-NO-SWIPE (1-866-668-9473).

“The Tribes tell their history differently than we do, and we need to document what’s there and then protect it in a way that’s right with their culture,” said Col. Ruch. “We need to remind people that they can go to jail for raiding grave sites and stealing artifacts.”

The centuries-old relationship between the U.S. Army and the Tribal Nations of the Midwest will continue in the months and years to come as the basin recovers from the Flood of 2011. There have been ups and downs, but this year has built a mutual understanding of Tribal needs and the Corps’ efforts to fulfill them.

“When the Corps has a way and an authority to go ahead and take care of an issue, we will and we do,” said Col. Ruch. “When we don’t have an authority, we need to continue to work with legislators and other folks who can make a difference.”



Col. Robert Ruch, Omaha District commander (left) meets with Charles W. Murphy, chairman of the Standing Rock Sioux Tribe, a Tribe whose land spans across portions of South Dakota and North Dakota, a span of land roughly the size of Connecticut. (U.S. Army Photo / Kevin Wingert, Omaha District)

Spatial Information Systems and Sonar Technology

GIS aids Corps in flood risk reduction efforts

How do you inform the public about the likely effects of a pending record-setting flood? How do you coordinate with local, state and federal emergency management officials to establish a joint flood fight strategy? Part of the answer is to provide flood inundation maps before the flood waters ever arrive. But how?

“Ya’ wanta’ see where we spent our vacation in Aruba? Let’s look at your place from space! Come on, let’s see where that tornado hit. Check it out. Go to Google Earth.”

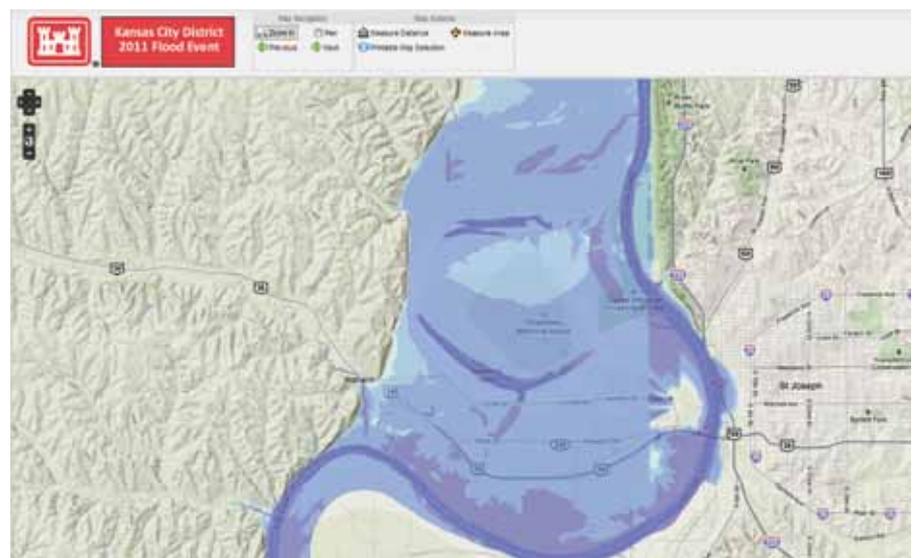
We’ve all heard friends and coworkers excitedly exclaim comments such as these. For the older set, the technology that allows this to be reality may seem like something from Star Trek. But with advancements in Geographic Information Science in the late 70s, to 35-year-olds or younger, it’s as assumed as a three network television system was to their parents.

Such analysis realized through spatial information systems, along with complementary sonar technology, has been effectively employed by the Kansas City District of the U.S. Army Corps of Engineers during the historic flood fight of 2011. Through its use, timely, visual and accessible data for communities along a 500-mile stretch of the Missouri River was incorporated in mitigating the effects of the flooding.

Jason Sheeley, the Supervisor of the Kansas City District Survey and

Geospatial Section, recently displayed its applications as he showed the location of a simulated levee breach. With this knowledge, he was then able to effectively forecast where flooding would significantly impact area residents within the first 24 hours. Such is a critical part of the Corps’ flood inundation maps and is well proving itself to be a vital tool in planning for emergencies.

Confident in the usefulness of the information, Sheeley states, “This shows when the floodwater is going to rise and how deep the water is going to get. This helps agencies like the Corps and Guard develop effective plans for how to fight the flood. And, most importantly, it allows them to see where they need to inform local citizens so they can do whatever they must do to get themselves and their belongings out of harm’s way.”



Projected inundation area and estimated depth for the release of 160,000 cfs from Gavins Point Dam shown in CorpsMap, a U.S. Army Corps of Engineers online mapping application. <http://www.nwk.usace.army.mil/Flood/InundationMaps.cfm>

GEOTECHNOLOGY

Obviously eager to share this information with others, he continues, “Anyone with a computer can access this information by using Google Earth and then typing in an address or community which takes them straight to that location.” His fingers flew across the key board and, just as stated, the site he sought appeared.

These maps include geo-referenced photographs, “So if you want to see some detail of how things really look on the ground it’s easy to do so,” he explains.

As this spring’s unprecedented amount of snowpack melt and rainwater surged down the Missouri River heading towards Kansas City, this technology made a difference.

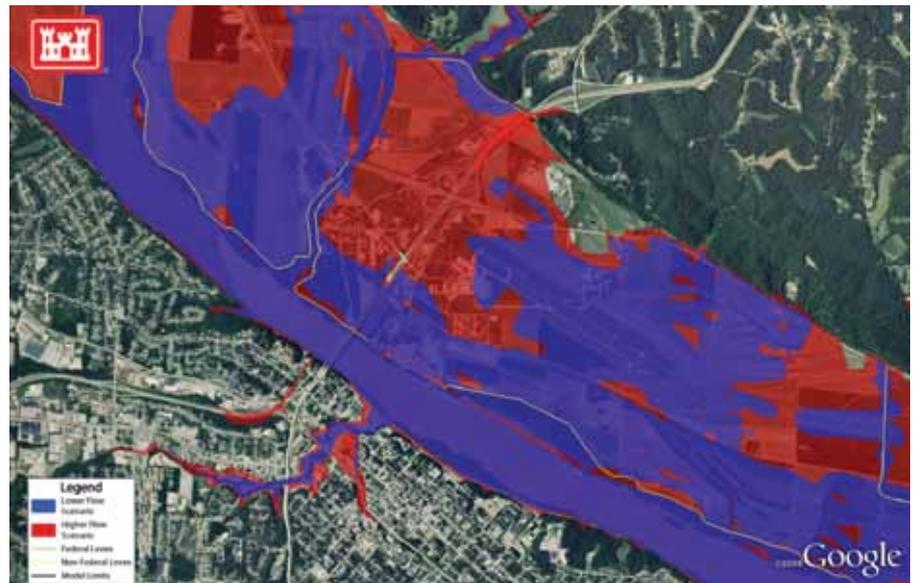
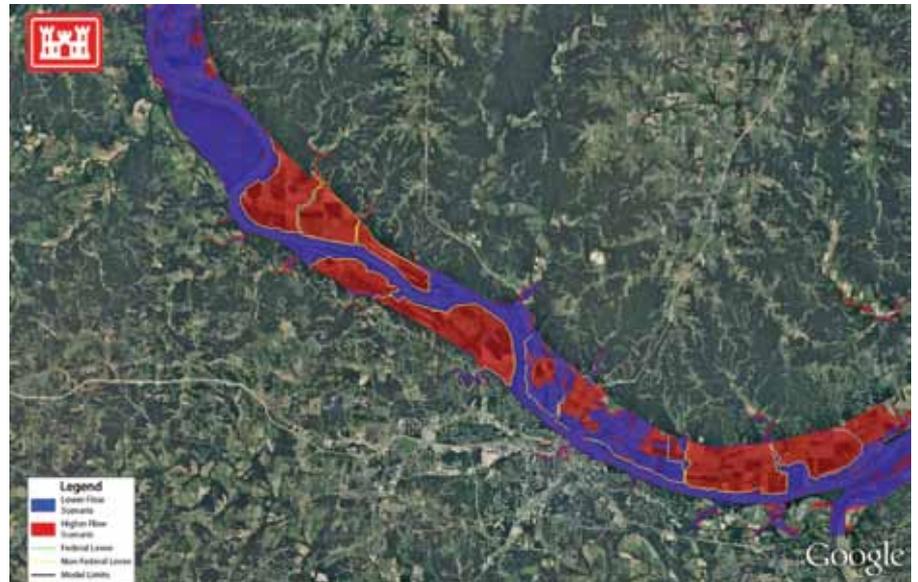
“These maps showed an estimation of which levees would overtop and which levees would likely hold. By looking at these maps, this awareness allowed the nearby communities to understand where to focus their efforts.”

An excellent example of interagency teamwork, the flood maps are based on weather predictions from the National Weather Service, evaluated by the Corps and acted upon by the National Guard. Corps cartographer, Alexandra Ubben says, “It is timely, visual and easily accessible information for all of those faced with and striving to address the uncertainty of a flood event.”

Standing nearby, Kansas City District Commander Col. Anthony Hofmann said, “It’s been a phenomenal effort in communicating with the public so that they are aware of the situation in

real-time. Through it, they can determine what actions we have taken and what measures they need to take. To say I was pleased with this

technology and the outstanding manner by which these folks have used it would be a massive understatement!”



Inundation estimates for the release of 160,000 cfs from Gavins Point Dam in Google Earth. A lower flow scenario is shown in blue and a higher flow scenario is shown in red. © 2011 Google, 2011 Digital Globe

Corps Smart Phone App Provides Instant Levee Data

While social media is a technology that has gotten a lot of credit for playing an integral role in keeping communities apprised during recent flood fights along the Mississippi and Missouri rivers, current internal communication technology has been under emphasized.

“Starting in late May, I was assigned to Mississippi River flood duty with the Memphis District. Without the appropriate technology, teams were restricted to reporting field images, and corresponding data, 24 to 36 hours old during daily briefing meetings. The only way we could get current data was to bring a team in with photos, GPS information and field notes. What was needed was up-to-date information on urgent situations to provide a better overview to the commander and senior staff,” said Michael Winkler, research hydraulic engineer, U.S. Army Corps of Engineers, Engineer Research and Development Center (ERDC) and former area commander, West Memphis levee area.



Jerry Folkers with team 3 levee surveillance, takes a picture of Ditch 6 levee to upload to MICA to share the substantial deterioration of the plastic covering. MICA helps teams get an almost instant assessment of an issue and makes it easy to find the site again. (U.S. Army Photo)

A smart phone mobile information collection application (MICA) is now enabling levee surveillance teams, in charge of daily monitoring and providing technical assistance to levee sponsors on an established set of levees within the Omaha District Missouri River Levee System, to share levee issues, almost instantly.

These teams, of which there are five to eight of on a daily basis, consist of individuals from the Omaha District, other Corps districts (including Alaska, Rock Island, Portland, Mobile, Huntsville, Albuquerque, Savannah, Seattle, Norfolk, Denver, Sacramento, Norfolk and Philadelphia), ERDC, Institute for Water Resources and the Northwestern Division of the Corps.

Along the Missouri River, there are approximately 250 miles of federal and nonfederal levees in the Omaha District, alone, active in the Public Law 84-99 program, Rehabilitation and Inspection Program. This law gives the U.S. Army Corps of Engineers specific authorities to conduct preparedness, response, recovery, and rehabilitation activities.

The Corps constructs many of these levees, and the local levee sponsors are responsible for the operations, maintenance and monitoring of their levee systems. While the Corps has a comprehensive and aggressive federal levee safety program that includes an annual inspection for adequate maintenance and a more rigorous structural review every five years, more meticulous surveillance is required during a flood event.

The Flood of 2011 brings with it extra vigilance, as levees along the Missouri River will be saturated for several months, potentially compromising the system’s integrity.

“This tremendous technology allows a team member to take a snapshot of a sand boil and upload for almost immediate assessment. MICA is invaluable to see where a critical matter is oriented and to be able to go back to the site,” said Dick Taylor, Operations project manager, Missouri River Project, Omaha District.

GEOTECHNOLOGY



MICA reading: cracking extends approximately 75 feet, crack strip to half an inch wide and greater than 10 inches deep in spots. Toe is wet but not saturated, July 21. (U.S. Army Photo)

MICA was adapted from the ongoing development of the Operation Blue Roof Field Management System, which is a smart phone-based data collection system, initiated by the Corps Reachback Operations Center, in the aftermath of Hurricane Katrina.

The Blue Roof tool, now in its pilot phase, is designed to collect data digitally, consequently replacing the stacks upon stacks of paper forms, creating slow responses to homeowners and the inability to provide ‘real-time’ images of damages and repairs.

“Because I knew about the Blue Roof application that ERDC was working on, I contacted them, and they agreed to adapt the program for flood fighting and send 25 smart phones to Memphis as a pilot program. The MICA system they delivered can be applied to any field situation where information needs to be communicated in a timely manner,” said Winkler.

Within a matter of 48 hours, the Corps ERDC team took the initiative to adapt their existing smart phone software program into an all purpose rapid field data collection application that could be used in the 2011 spring flood efforts.

MICA is rapidly configurable for use in emergency response to floods, tornados, hurricanes and various routine inspections performed by the Corps.

ERDC is one of the most diverse engineering and scientific research organizations in the world. ERDC Research and Design focuses on five primary technical areas to support the Army and the Corps to include flood control and storm damage reduction.

The ERDC laboratories, including the Coastal and Hydraulics Lab, conduct research to develop new methods and tools to reduce flood damage.

As the flood fight was ending on the Mississippi, the Missouri River flood was just beginning.

“Starting in late May, we communicated with the Chief of the Readiness at the Corps Northwestern Division and made the decision to bring the application to Omaha and Kansas City. Meanwhile, the system used in Memphis had been further refined,” said Winkler.

During this flood event, MICA has allowed for the efficient management of employee resources and standardization to the processes of inspection, data collection and reporting.

“Our team took a MICA coordinate of longitudinal cracking on Ditch 6. The Engineering Division decided that this data point was of an urgent enough nature to immediately deploy resources to strengthen the levee section,” said Andy Hill, levee surveillance team member for levees L-594, L-536 and Ditch 6.

Urgent MICA issues are discussed at command level at the Emergency Operation Center meeting at the same time, each afternoon. All MICA data are synced and uploaded to a shared database for discussion and potential “ways ahead” for these areas of concern.

During the flood fight, MICA helps the Corps determine the status of levee systems within PL 84-99.

“I have 100 plus levee sponsors and need to work with them carefully to see that the operation and maintenance is executed, so when there is a flood, their communities are protected,” said Bryan Flere, Corps levee safety program manager.

GEOTECHNOLOGY

“At the peak of this year’s flood-fighting efforts, more than 60 Android smart phones running MICA deployed to Memphis, Vicksburg, New Orleans, Omaha and Kansas City, Mo. To date, over 5,000 GPS data points have been collected that contain over 13,000 photos, videos, notes and audio clips,” said Robert Walker, MICA program manager, ERDC.

Like any technological tool, MICA is not without obstacles. Given the range of a certain area of concern, one MICA coordinate may not be representative of an entire issue, but it is important to make sure to not to overload the system with information.

Levee surveillance team members must decide on what constitutes a coordinate of critical nature.

“There was a muskrat swimming around the same section of one of the levees over the course of three days. It was difficult to decide whether to add this as a MICA coordinate or not,” said Hill.

MICA can transmit current data, given signal strength, and is a precursor to a potential levee failure; however, “it can’t preclude an event,” said Dick Taylor.

The Corps continues to explore strategies to harness technologies to provide timely, accurate and usable information, both internally and externally.

Any obstacles aside, they will be diminutive in comparison to how invaluable this tool will be in the Flood of 2011 post damage assessment report and in getting the Missouri River levee system back to pre-flood condition and ready for the spring 2012 runoff season.

After the floodwater recedes and the assessments are complete, these smart phones will be shipped back to ERDC where they will wait to be configured to assist with the next mission and maybe another natural disaster of historic proportions.

MICA Technology

The mobile information collection application (MICA) that the Corps is using for flood-fighting efforts is operating from the HTC Droid Incredible II smart phone, written using the source code HTC application development language from the Android operating system.

The MICA menu to input relevant data consists of the following subjects: urgent, burrows, waters edge, pumps, backwater flooding, racking, seepage, sand boils, sliding, dummy data (tests), gages, miscellaneous, failure, repair, erosion, closure structure, drainage structure, freeboard and relief wells. This menu is configurable to be relevant for any emergency situation.



The phone has a built in Global Positioning System (GPS) that geo-reference’s the flood-fight critical location, with the corresponding note, picture(s), audio or sketches, as needed.

The uploaded data is displayed in a web-based Geographic Information System (GIS), accessible to Corps employees with the appropriate credentials.

The MICA Web-based dashboard presents all the collected data in a standard Web browser, and the raw data can be analyzed and presented using other various tools, such as Corps Map and ArcView.

The MICA data is also stored in an SQL Server database where it can be edited, queried and compiled into reports. MICA coordinates with successful mitigation actions will still remain in the system.



Ground-Truthing the Data

by Sarah Gross
Public Affairs Specialist, Chicago District



\$150 for a 3-inch diameter stainless steel snow tube with welded handles, \$20 for a spring or digital scale...plains snowpack data - priceless.

Since the middle of the 20th century, during the founding of the Missouri River Basin Main Stem Reservoir System, the Corps has surveyed the plains for snowpack and potential runoff into the system.

After two consecutive years of significant plains snowpack, from 2009 to 2010, over the entire plains region - an area of nearly 200,000 square miles - encompassing the entire state of South Dakota, half of North Dakota, eastern Montana, and parts of Nebraska, Iowa and Wyoming, the Corps saw the necessity of a more comprehensive surveying effort.

In the fall of 2010, the Northwestern Division Missouri River Basin Water Management (MRBWM) unveiled its cooperative plan for gauging this data, prior to the recognition that the 2011 runoff season would produce record northern plains snowpack along with

a delayed snowmelt: one of the coupled scenarios that resulted in record releases from the six dams along the river.

The Cooperative Plains Survey is a collaborative effort to collect and disseminate plains snowpack information, pulling in expertise from the MRBWM, Omaha District Water Control and Water Quality and Omaha District Main Stem Project offices of the Corps, the National Oceanic and Atmospheric Administration (NOAA), the state of South Dakota, the state of North Dakota, the U.S. Geological Survey, various local and county emergency managers and private citizens.

Determining how much plains snowpack exists in the vast Missouri River Basin and then determining how much runoff will occur from the snowmelt, rather than infiltrate the ground, is very challenging.

Runoff from plains snowmelt is directly dependent on air temperature and precipitation patterns. A dry, cool spring vs. a wet, warm spring will produce

significantly different amounts of runoff with the same amount of snow.

Historically, 75 percent of the runoff into the Missouri River Main Stem Reservoir System occurs from March through July, which is when the plains and mountain snowpack is melting. The mountain snowmelt occurs from May through July. Historically, about 25 percent of the total runoff into the system occurs during March and April - equivalent to nearly 6 million acre feet (MAF). During years of heavy plains snow accumulation, significantly more runoff can occur.

In 2011, the March runoff was 6.7 MAF and the April runoff was 7.7 MAF: a combined 14.4 MAF.

Jim Laney collects snowpack information in Watertown, S.D., February 2010. A rehired annuitant, Laney worked in the Omaha District Water Control and Water Quality office as a hydrologic technician until his retirement in 1997. (U.S. Army Photo)

GEOTECHNOLOGY

While the mountain ranges have established reliable gauges to measure the potential mountain snowpack runoff into the Missouri River, this is not the case with the plains area of the basin.

Plains snowpack is more subjective, as there have not been records kept every year. The only data is based on years with above average snowpack. Therefore, data is compared to historically significant years.

“The 2011 Cooperative Plains Survey is our response to the difficulties presented in predicting plains snowmelt runoff through the Inflow Forecasting Technical Report,” said Kevin Stamm, senior hydraulic engineer, MRBWM Reservoir Regulation Team. This technical report was written and updated by the MRBWM.

In the 113 years since the Corps began keeping detailed records in 1898, there have been 71 years in which plains snowpack during March and April had little to no impact on the runoff into the Missouri River. This leaves 42 years that the snow cover condition was categorized as light, moderate, heavy (11.3 MAF) and very heavy (17.0 MAF).

Snow survey data compiled in a consistent manner over future years will provide the Corps with a better historical perspective of plains snow conditions and its relation to spring snowmelt runoff.

In October 2010, MRBWM called the National Operational Hydrologic Remote Sensing Center (NOHRSC), part of NOAA/NWS, to ask for input in planning the cooperative survey to better assist in snowmelt flood preparedness.

“We had several discussions on snow survey protocol. For example, what kind of observations we use, how we get those observations into our system and choice of equipment with regards to cost, ease of use, portability, accuracy, etc. What was most important for our interactions with the Corps was that we can and will incorporate any manual snow observations or data that we receive from them,” said Anne Sawyer, NOAA.

Commencing January 18, and every two weeks thereafter through March, volunteers took samples with their snow tubes at designated areas, five times: one central location and four corresponding locations, a cross pattern of a 50-foot radius in each direction. These designated areas were chosen to represent the snow conditions in a larger region of about 2500 square miles or 1.6 million acres.

“Part of what made this effort so important for us, and for them, is that the surveys were used to fill gaps in the data-sparse observational network across MBRFC. We sent GIS datasets on existing snow observations in the basin to assist them in determining where new observations would be most beneficial,” said Sawyer.

Around 42 sites of the 100 prospective sites (1 in Iowa, 8 in Montana, 14 in North Dakota, 3 in Nebraska and 6 in South Dakota) were active for the inaugural Cooperative Plains Survey, many of them airport locations, as they meet the climate stipulations.

In order to maintain consistency, the Corps provided all surveyors with a customized snowtube and digital scale. The surveyor only needs to provide their own bucket and tape measure.

Standardized sheets are filled out by the surveyors to include general snow conditions, snow depth, estimated soil moisture, snow density and snow water equivalent (SWE), among other collected data. These are the primary factors used by forecasters at both the Corps and NWS to predict snowmelt runoff. All of this pertinent survey data is emailed immediately to MRBWM, upon collection completion and reported to NOAA, NOHRSC and the NWS Missouri Basin River Forecast Center (MBRFC).

“Considering the enormous area upstream of the reservoir system, the difference of 1 inch could make a huge impact regarding runoff in March and April,” said Kevin Grode, Reservoir Regulation Team Lead. “The better information we have, the better decisions we can make.”

If you’re interested in participating in this cooperative plains snow survey, please e-mail the U.S. Army Corps of Engineers Northwestern Division Missouri River Basin Water Management at Missouri.Water.Management@usace.army.mil

“We hope to continue to add to our list of volunteers to get a clearer picture of the characteristics of plains snowpack and how it affects inflows to the Missouri River Reservoir System, as one element to define how the basin conditions are changing. We will continue to assess and reassess...assess and reassess,” said Grode.

Meet the Volunteers

"I have been very interested in the weather ever since our family farm was destroyed by a tornado when I was about nine years old. I learned of this opportunity through the emergency management personnel in McPherson County, S.D. I already report the temps and moisture for the National Weather Service, so I figured this would also be interesting. I think most people would be surprised of how much snow is actually out in the country in the middle of winter; it can be very deep in places," said **John Hilgemann** who surveys an area in Eureka, S.D. and is the Register of Deeds in McPherson County.

"I collected snow information from Spencer, Neb. to Chamberlain, S.D. This survey provides for high quality water forecast data with a minimal amount of burden," said **Cody Wilson**, Fort Randall Project.

"A fellow park ranger, **Karla Zeutenhorst**, and I did the snow surveys in the Yankton, S.D. and Wayne Neb. regions. We had to wait for a few storms to pass and had a little white knuckle driving during some surveying efforts. What stuck out to me was how new this was to most volunteers. Since becoming a summer ranger in 1994, I would work a little in the winter to help the full-time staff do snow samples, so the process was familiar to me," said **David L. Mines**, Corps park ranger, Gavins Point Project.

Right: Frank Lovejoy, a hydrologic technician in the Omaha District, gathers snowpack data in Florence, S.D., March 2011. (U.S. Army Photo)

"I had the advantage of the airport snow removal equipment to ensure I could get to the survey area. I just hope that the data helps save someone some loss due to high spring runoff," said **Larry Cooper**, manager, Huron Regional Airport in the Broadland Creek Drainage, asked to volunteer by the National Weather Service.

"The biggest challenge of this survey effort is recording the data during times of extreme cold and wind. Snow pack gives us good information on the soil moisture going into the spring and early summer. Soil moisture content can help predict runoff and erosion issues that may develop on project grounds," **LeeJay Templeton**, civil engineer, Oahe Project, recorded snow depths in two locations: Oahe Dam, near Pierre, S.D. and just north of Oneida, S.D.

"Assisting the Corps, National Weather Service, River Forecast Center and U.S. Geological Survey with potential flood information is the main mission of the survey effort," said **Tim Kearns**, Aberdeen weather service meteorologist, Hayti county emergency manager and Roy Lake, park ranger.



Materials Needed

- Standard 3-inch inside diameter snow tube,* assembled by a local welding company
- Square point shovel
- Spring or digital scale*
- Folder ruler
- Bucket with handle
- Pick axe
- Snow survey data sheet
- Calculator

*Equipment provided by the Corps

Additional Information

Cooperative Plains Snow Survey information: <http://www.nwd-mr.usace.army.mil/rcc/snowsurvey/snowsurvey.html>

Historic Plains Snow maps: <http://www.nwd-mr.usace.army.mil/rcc/historic/precipmaps.html>

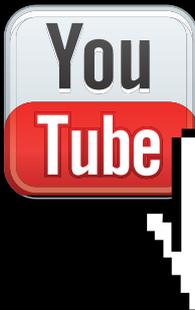
NOAA's National Operational Hydrologic Remote Sensing Center (NOHRSC - pronounced "no risk") interactive snow map: <http://www.nohrsc.noaa.gov/interactive/html/map.html>

Community Collaborative Rain, Hail and Snow Network: <http://www.cocorahs.org/>



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