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Maintenance and
Engineering**

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An Army lieutenant checks valve operation on a 12" line at an installation. Courtesy Photo

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Stormwater Management: Calming the Storm (Before it Hits)

by Brian Dosa, P.E., and Adam Alexander

Today, Fort Hood, Texas, regards stormwater infrastructure as an asset. The nation's largest active duty armored post, known as "The Great Place," is developing and implementing a comprehensive Stormwater Management Program that protects and enhances stormwater infrastructure. The installation is moving to assure that the quality of stormwater management matches the high quality-of-life standards provided to Soldiers and their families.

To develop this clear path to address flooding, water quality and infrastructure issues, Fort Hood followed a systematic approach that included four key steps:

1. Inventory of the stormwater infrastructure over Fort Hood's 340 square miles
2. Identify problem areas through stormwater modeling
3. Propose solutions
4. Develop a comprehensive plan for preventative maintenance and improvements

Prior to developing a Stormwater Management Program, Fort Hood focused on planning for only four utilities: water, wastewater, gas and electrical. There was limited comprehensive data showing existence, location or condition of existing stormwater infrastructure, nor was there adequate data showing flooding issues due to deteriorating or undersized storm drainage systems. Planning of new developments rarely considered impacts to stormwater conveyance infrastructure.

This led to a practice of reacting to stormwater issues as they arose, and resolving them with patchwork fixes that did not address stormwater management on the installation as a system and, at times, did not completely resolve the problem(s).

After repetitive flooding of real property and frequent complaints from Soldiers and civilians, Fort Hood made a change: budgeting a portion of Sustainment Restoration and Modernization funds

Acronyms and Abbreviations	
SRM	Sustainment Restoration and Modernization
MS4	Municipal Separate Storm Sewer System
NFH	North Fort Hood
WFH	West Fort Hood
MC	Main Cantonment
SDSFIE	Spatial Data Standards for Facilities, Infrastructure and Environment
North Fort Hood 100	Year floodplain scenario with varying ponding depths

to study stormwater conveyance system conditions and capacities throughout the installation.

With a long-range vision in mind, both the Environmental and Engineering divisions collaborated to develop an inventory of stormwater outfalls and their entire stormwater network. Recognition of the need for, and benefits of, having the stormwater conveyance system mapped was the first step in building the Stormwater Management Program. With this information, the teams could address both stormwater quality and quantity management across the installation.

Step 1: Inventory

In 2009, Fort Hood began collecting survey grade information about all the stormwater infrastructure at Fort Hood. Data was collected on channels, culverts, storm drains, inlets and any infrastructure that conveyed stormwater. In addition to elevations of pipes and inlets, the data included sizes, channel information, condition, material and other relevant facts to locate and assess their current systems. The project was completed in 2011 with a database in the Spatial Data Standards for Facilities, Infrastructure and Environment configuration to be updated as new projects and developments occur. This data became the basis for all future stormwater master planning and assists in understanding how stormwater is conveyed throughout the installation.



Ponding near Longhorn Airfield could create potential damage to important infrastructure and military equipment. A plan to improve stormwater was needed to reduce damages from storm events. Courtesy photo



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Step 2: Locate the Problem

Stormwater planning needed to keep up with new development at Fort Hood. While many structures had not been updated in decades, new developments and improvements had caused rapid increases in stormwater volume over the years. Identifying potential flooding and erosion issues, and proposing solutions to prevent damage to existing and new real property during this kind of growth, requires a regional study, or master plan, of stormwater infrastructure. At Fort Hood, stormwater master planning addresses three regions: North Fort Hood, West Fort Hood, and the Main Cantonment.

NFH, the first regional stormwater master plan, began in 2011, followed by WFH in 2012. The MC master plan is anticipated to be complete in June 2016. High-level 2D stormwater modeling software models the runoff spilling

onto a topographic surface once the capacity of the infrastructure is exceeded. This modeling scenario represents real world conditions more accurately as it demonstrates runoff spreading over the surface, as well as how deep and fast it will flow.

The model identified flooding issues including roads that frequently experience overtopping due to rain events and buildings that may experience inundation in larger storm events. Floodplains from the storm drain system, as well as from the open channel systems, were used to show where ponding of water is likely.

Step 3: Propose Solutions

Once flooding locations were identified, the models were used to determine what types of improvements could prevent or alleviate potential and existing flooding issues. After considering preventative maintenance, aesthetics and environmental impacts, chosen alternative solutions



Recognizing benefits of having the stormwater system mapped was the first step in building the Stormwater Program.

include:

- culvert and storm drain upsizing
- adding inlets
- widening and improving open channels
- detention

Step 4: Implementation

Stormwater data is used both to support a systematic engineering approach to stormwater management and to manage future development. New developments can be entered into the model to see how they impact nearby stormwater systems and infrastructure. This also helps improve relations with neighboring communities, enabling an understanding of the impacts of installation development on upstream or downstream neighbors.

Fort Hood continues to develop its stormwater engineering master plan involving inventory and analysis of all stormwater infrastructure. Fort Hood's stormwater engineering master plan has identified over 75 projects and \$25 million worth of infrastructure improvements moving forward into 2016.

Stormwater master planning also benefits the Environmental, Engineering and Maintenance divisions. Planned low impact developments can be incorporated into the stormwater models so that stormwater capacity can be measured, and preventative maintenance projects can



Inventory and Aging Infrastructure. Survey grade information of stormwater infrastructure was taken. Examples of aging stormwater systems was evident and recorded during the inventory.



USACE Maintains Arctic Air Base Supporting National Security

by JoAnne Castagna, Ed.D.

It's 9 p.m. and 2 degrees at Thule Air Base in the northwestern corner of Greenland in the Arctic Circle. A team from the U.S. Army Corps of Engineers is haggard after a long overnight flight followed by a day of visiting projects. They were about to call it a day when they decide to visit the base's museum.

They step out of the cold into a warm building where they are greeted by a pleasant woman wearing a parka. She enthusiastically shows them around and tells them she has been living and working at the remote base since the 1960s.

On display are base memorabilia including photos of visiting dignitaries, a large round radar screen, a wooden sled used by the native Inuit people and a manikin wearing a fur hunting outfit.

As they prepared to leave, she asks them if they want to see an old film strip about the base. The film shows how the base was secretly and quickly constructed in the early 1950s because the United States felt a foreign threat.

In record time, massive amounts of supplies, equipment and 12,000 men were transported to Thule to construct the base. This enormous effort, which included the



Contractors working inside one of the dormitories. Photo by JoAnne Castagna

Army Corps, was an incredible feat that was fueled by the country's intense need to preserve the American way of life.

It seemed fitting that the team saw this film and met this devoted woman that night because it reminded them of why they were there.

For decades the U.S. Army Corps of Engineers, New York District has constructed facilities for the base, and now they are constructing two new dormitories

that are replacing old structures that were constructed in the 1950s.

"These new dormitories will help to provide Airmen with the quality of life they deserve on a difficult assignment to Thule Air Base in the Arctic Circle," said New York District Commander Col. Paul Owen. "Thule's remoteness and harsh climate restricts all personnel assigned there to living on base, which is why it's so important to provide top notch housing facilities."

Thule Air Base – "Two Lee" – is the U.S. Armed Forces' northernmost installation that was established to perform national security. The Air Force performs several missions there including monitoring U.S. airspace for foreign missiles.

Hundreds of active-duty U.S. Air Force personnel and American, Danish and Greenlandic civilian contractors are stationed there. Quality housing is needed for these individuals to keep them safe from the harsh weather and to keep their morale up in this remote area of the world.

Both of the dormitories – one housing 54 people and the other 48 people

Acronyms and Abbreviations

USACE	U.S. Army Corps of Engineers
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solve more than just eroding channels or failing pipes. Failed detention ponds and overgrown swales can be identified and resolved to maintain safe conditions for future storms.

Fort Hood's increased focus on stormwater master planning has allowed the installation to realize a more cost effective and efficient approach to the management of surface water conveyance assets. The hydraulic models provide the necessary data to allow

planners to better target and allocate diminishing resources to ensure the safety of installation personnel and the long-term sustainability of installation infrastructure.

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– were designed by New York District and are being constructed by Danish contractors with USACE supervision. Greenland is a province of Denmark.

The three-story dorms will house junior and senior noncommissioned officers visiting or on temporary duty. Rooms will be divided into four-bedroom modules with individual bathrooms, walk-in closets, a shared social space, housekeeping areas and laundry rooms on each floor. There is also a common area day room with a kitchen with appliances in the center on each floor with large windows overlooking the base, providing occupants with a place where they can relax and socialize.

The dorms are being constructed using techniques that will help them withstand the harsh Arctic elements. Techniques include using special arctic foundations, steel frames, insulated panel exteriors and

pitched metal roofs.

Construction in the Arctic can be challenging due to severe weather and limited daylight, which requires the use of unique building techniques and fast paced construction.

One of the challenges is ice. Most of northern Greenland is covered with permafrost, which is permanently frozen ground – ranging from 6 to 1,600 feet deep.

Because of permafrost, both dorms are being constructed with a special elevated Arctic foundation. If buildings are not constructed off the ground, the heat from inside the building can melt the permafrost, making the ground unstable and causing buildings to sink. The buildings need to be elevated 1 meter (39 inches) from the ground. Buildings are elevated with the use of spread footings that go down about 10 feet deep and concrete columns that come up and

support the floor system above the ground.

Another challenge is limited daylight. Because of Thule's proximity to the North Pole, it has 24 hours of sunlight from May through August and 24 hours of darkness from November through February. Temperatures can drop as low as minus 40 degrees Fahrenheit. Therefore, construction is limited to May through October, because there is sufficient sunlight and temperatures are bearable.


It is also only during the summer months that shipments of building materials and fuel can be received via cargo. During the summer, Greenland's iced shipping lanes can be broken up to allow supply ships into port. Greenland is locked in by ice nine months out of the year.

Since work needs to be performed rapidly, most of the building materials are prefabricated elsewhere before being shipped in. Prefabricating the parts helps the workers to rapidly perform the construction. These materials include concrete foundations, structural steel, insulated metal walls and roof panels.

“The Thule dorm shells of the building were completed last summer and interior work was going on all winter. Only inside work remained since last fall, however, outside work is starting to begin on other projects at Thule,” said Stella Marco, project manager. “The contractors are starting to travel there to start up their equipment, check supplies, etc. The first ship isn't coming in until the very end of June so only the contractors who already had their supplies on-site could keep working.”

The dorms will be ready for occupation later this year.

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Engineering team discussing one of the dorm construction projects. Photo by JoAnne Castagna



Savannah Corps' FEST-A Delivers Unmatched Engineering Support

by Chelsea Smith

Four months after launching into a six-month deployment to Kuwait, Savannah District's Forward Engineering Support Team – Advanced convened to discuss engineering solutions supplied to the region and assignments on the horizon.

Their nomadic adventures across four Middle Eastern countries test the team's capacity to provide first-rate support in the sprawling arid landscape, said FEST-A Commander Maj. Jason Winkelmann.

The team works under the direction of the Combined Joint Task Force Engineer Section, which provides an organizing framework designed to synchronize and integrate capabilities and amplify the efforts of 60-plus nations. The coalition's ultimate mission is to degrade and defeat the Islamic State, Winkelmann said.

The team's recent trip to Amman, Jordan, introduced them to new territory

spatially and professionally, as many of them performed tasks for the first time in their careers. They conducted Unified Facility Criteria detailed evaluations on more than 100 buildings at one location, to identify life, health and safety issues in the areas of structural, electrical, mechanical and fire protection. The results of the assessments will be used to improve conditions for U.S. forces occupying bases in the region, according to Winkelmann.

The team also provided a building design for the Army Central Command if the three-star commander decides to relocate his headquarters element, he said.

"We've done a lot of things that we trained on back in the United States, but it's different executing in a deployed environment and delivering a product," Winkelmann said.

And Winkelmann said that pre-deployment training couldn't possibly have prepared them for all they'd encountered

Acronyms and Abbreviations	
FEST-A	Forward Engineering Support Team – Advanced
CJTF	Combined Joint Task Force
ISIL	Islamic State of Iraq and the Levant
UFC	Unified Facility Criteria
Wi-Fi	A local area wireless computer networking technology that allows electronic devices to network

because there were unexpected demands.

"We assigned tasks that we hadn't trained on," he said. "We had no idea we'd be assigned the UFC detailed evaluations, so we had to figure that out in-country. Everyone on the team has a small part that plays in the bigger piece, and now, about halfway through the deployment, we're getting good at all of our tasks."

The tight-knit coalition of people typically spends 10-12 hours a day, six days a week working closely together, and they confess these circumstances contribute significantly to their team unity.

"We've been lucky because everybody gets along and is in the same mindset," he said. "They want to be here and get the job done. I think the key to our success is that everybody is here for the right reasons."

Second in command, Sgt. 1st Class Demetrius Moore, champions the first-class support the team imparts in the region.

"This is my first time working with civilians," Moore said. "I observe a lot. Understanding personalities or what makes them successful has been eye-opening. These guys go over and beyond and have very strong work ethics."

Although frequent visits to Kuwait, Qatar, Iraq and Jordan compress the team's busy schedule, they find time to transform into fierce competitors during team-building activities, often sponsored by the base Morale, Welfare and Recreation office. Recreation



Members of the 542nd Forward Engineering Support Team – Advanced gather for a group photo at a camp in Iraq April 2015. The team is completing a six-month deployment supporting the Combined Joint Task Force with a wide array of engineering missions across the U.S. Central Command area of responsibility. Courtesy photo



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often breaks the monotony of extended workdays, Winkelmann said.

However, with more than 7,000 miles separating the unit from home, some of its members admit coping with distance can be taxing. Piper Bazemore, FEST-A topographer, said FaceTime, Skype and Wi-Fi connections keep the team linked to friends and family in the States.

Winkelmann, a new father six weeks before departing, said he's watching his infant son grow through family photos and videos sent from home.

"My son will be 7-and-a-half months when I return," he said. "So it's hard. I'm looking forward to getting back to seeing

[my family]."

Though apart from their own families, the family created as comrades delivers moments that cut their silence with laughter.

"I don't ever want to drive in Jordan again!" bellows Mike Kessler, FEST-A interdisciplinary engineer. "It's very aggressive driving in a lot of traffic. Let's just say it's a unique experience."


As the team prepares for new projects, Winkelmann stresses that their tactical footprint fortifies larger unified command strategic efforts in the region.

"We may get caught up in the details of designing a plan, but the effect of that plan has a great impact," he said. "While

conducting detailed evaluations to help fix infrastructure for our Soldiers, the team produced 3,000 pages of documents on the condition of the base's buildings and found over 2,000 issues that cost approximately \$3 million to fix. These are important issues to relay to leadership. We're supporting a mission that makes a difference in the lives of our Soldiers."

And hopefully, the first few months are harbingers of what's to come.

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Three members of the 542nd Forward Engineering Support Team - Advanced compete in a base-sponsored BubbleBall soccer tournament. BubbleBall is the latest sports craze that encases players in the center of an over-sized polyvinyl bubble ball during play. Between missions, FEST-A members recreate during team-building activities or connect with family and friends in the states via FaceTime, Skype and other forms of electronic communication. Photo by Joseph Brubaker



Customer-Focused Redesign Increases Command's Responsiveness

by USAEC Public Affairs

The U.S. Army Environmental Command is transforming. A new regional support structure increases the staff's ability and agility, while enhancing technical capabilities. This allows the command to focus on customer priorities, new and changing laws and regulations, stationing actions, evolving weapon systems, budget realities and better business practices that drive its workload.

"As the Army and its installations' environmental needs change, USAEC must provide services and solutions to minimize the impacts the Army has on the environment and minimize the impact environmental compliance has on Army training and operations now and in the future," said USAEC Commander Col. Rob Wittig.

Everyone in the command is involved in the restructure, which is designed to increase responsiveness to customer needs and facilitate improved communications. The focus is collaboration with internal and external Army Environmental Program partners and building organizational, as well as individual relationships.

The commander considered input from USAEC customers, Army Environmental Program partners and higher headquarters in developing the redesign. Feedback from one-on-one meetings with USAEC team members, and planning sessions with the division and branch supervisors were considered along with the input from the command's Armywide customers.

The transition, which took effect Jan. 26, dedicates a significant portion of the staff to handling installation- or region-specific issues. It also maintains a team of functionally focused technical experts to provide installations with customized environmental support. USAEC is working with customers to identify areas for improved service and expects to fully integrate all changes by Oct. 1.

"We identified changes in our customers' needs and established an especially aggressive schedule to be responsive to their requirements," said Command Sgt. Maj.

Joe Ulloth. "We're on track to meet that schedule."

The resulting organization is comprised of four Environmental Service and Support Divisions, three National Capital Region Environmental Service and Support Coordinators, an Environmental Solutions Division, Organizational Support Division, Office of Counsel, and Environmental Futures, Communications and Engagement Team.

Each ESSD supports a geographical region. Team members provide a wide spectrum of environmental services and support to installations within their region. Environmental resources from USAEC, other Army partners or contractor support is used to meet the installation's environmental requirements. USAEC environmental services managers within the ESSDs work with one or more installations as the support desk or "single point of contact" for those installations.

National Capital Region Environmental Service and Support Coordinators provide key communication links with partners and customers supporting the Army Environmental Program. These individuals build relationships with their assigned partners or customers, obtaining important and immediate feedback through direct and frequent communications. They will coordinate work with the divisions and help prioritize USAEC services and support to their partners and customers to ensure USAEC is meeting customer needs.

"Though resources are limited throughout the Army, staying in close contact with our partners and customers makes the command more efficient and effective," Wittig said. "We are already seeing the benefits of the three coordinators working with our partners in the National Capital Region."

The Environmental Solutions Division provides the highly responsive central program management support and technical expertise for the command. The ESD is where technical experts on air, water, waste, natural resources, cultural resources and pest

Acronyms and Abbreviations	
AEP	Army Environmental Program
ESD	Environmental Solutions Division
ESSD	Environmental Service and Support Division
IMCOM	U.S. Army Installation Management Command
OSD	Organizational Support Division
U.S.	United States
USAEC	U.S. Army Environmental Command

management reside, along with National Environmental Policy Act practitioners. They are responsible for looking at regional and Armywide environmental challenges to minimize or eliminate training impacts and environmental liabilities for the Army.

The Organizational Support Division provides management support functions, including operations and logistics; personnel, training and workforce development; and resource management. USAEC is designing and coordinating training for all IMCOM environmental professionals, as well as the continuous development of internal technical experts.

The Environmental Futures, Communications and Engagement Team leads the effort on strategic planning for the command and determining the best way to communicate current AEP successes and goals to partners, customers and stakeholders.

While USAEC's staff has supported its customers since 1972, the command sees the redesign as an opportunity to position its team for the future, and optimize the volume, speed and quality of its Armywide support. USAEC's goal is to be an innovative, value-added, customer-focused partner, providing environmental services and solutions to the Army through expertise, communications and partnering.

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Galveston District Creates Tool to Monitor Water Levels

by Isidro Reyna

The U.S. Army Corps of Engineers Galveston District created the ESRI Operation Dashboard, a geographic information system tool that allows Corps employees, partners and community to monitor water levels throughout the district’s area of operation along the Texas coast.

The tool customizes and consolidates data layers from the U.S. Geological Survey, National Weather Service and USACE with a base map, and allows interested parties to share information related to federal projects that may be affected by rainfall and increases in river

or stream elevation.

“Due to the high number of data sets we must monitor during a weather event or disaster, it can often be difficult to go back and forth between websites and agencies to get all the data required to make informed decisions,” said Mike DeMasi, emergency management chief for the USACE Galveston District. “Pulling all the information for a particular type event, such as the recent flooding in Texas, allows us to see where the rain is falling, what streams and rivers are rising and/or falling, and where the federal projects are in relation.”

Acronyms and Abbreviations	
GIS	Geographic Information System
USACE	U.S. Army Corps of Engineers

According to DeMasi, while the tool does not provide analytical instruments, it does consolidate all the information into a single viewer and is usable on any smartphone, providing the capability for staff to get into the field with data readily available in hand.


“We discussed the various data that we were monitoring with our GIS team and asked if they could pull all of the various data providers’ data into a single map, usable by anyone,” DeMasi said. “The GIS team linked our base map, which included all of our areas of responsibility and projects, with data that is maintained by many other agencies.”

A feature currently being tested is the ability to upload images to the site in real time, which will allow users to see graphics of river elevations at specific points on the map.

The ESRI Operation Dashboard is available at: <http://www.arcgis.com/apps/dashboard/index.html#/ad46e3dcae3048ed89706314ed68fce3>.

The USACE Galveston District was established in 1880 as the first engineer district in Texas to oversee river and harbor improvements. Its main missions include navigation, ecosystem restoration, emergency management, flood risk management and regulatory oversight.

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Courtesy graphic



USACE Galveston District Hosts Dam Safety Workshop

by Sandra Arnold

The U.S. Army Corps of Engineers Galveston District hosted Corps project managers from around the nation during a dam safety modification studies workshop May 12-14 at the district's headquarters building in Galveston, Texas.

The purpose of the meeting was to share lessons learned and best management practices between project managers in order to improve program and project execution and report quality for dam safety studies throughout the Corps.

"The Corps currently has 12 dam safety modifications studies underway, in addition to five recently completed studies that are now in the pre-construction engineering and design phase or early stages of construction," said David E. Carlson, program manager for the Corps' Risk Management Center in Pittsburgh, Pennsylvania. "The outcomes of the workshop will provide insight on necessary training, staffing, process improvements and management practices that can be implemented to make future project studies more efficient and effective."

According to Carlson, each project manager presented lessons learned and recommended best management practices pertaining to project planning, scoping, budgeting, risk assessment, alternative plan formulation and preliminary design of dam safety modifications studies.

"The primary objective of the Corps' Dam Safety Program is to maintain public safety by ensuring that dams we own and operate are safe and that risks to the public are minimized," said Rick Villagomez, USACE Galveston District project manager for the Addicks and Barker Dam Safety Program. "Houston's own Addicks and Barker dams, constructed in the 1940s to protect downtown Houston from flooding in response to devastating floods that hit the city earlier in the century, have continued to protect the Houston metropolitan area for nearly 70 years."

According to Villagomez, a Dam Safety



Project managers from around the nation convened at the USACE Galveston District's headquarters building in Galveston, Texas, during a dam safety modification studies workshop May 12-14 to share lessons learned and best management practices to improve program and project execution and report quality for dam safety studies throughout the Corps. Photo by Tina Ybarra

Modification Study was completed for the Addicks and Barker Dam Safety Program, which took a comprehensive look at concerns associated with the dams.

"First and foremost, these dams are not in danger of failing," Villagomez said. "Addicks and Barker are dry reservoirs about 90 percent of the time, and they undergo daily, weekly and annual inspections and monitoring. While the likelihood of overtopping or failure is very low, the fact the dams protect the nation's fourth largest metropolitan area makes the consequences to life safety relatively high risk."

According to Carlson, the Addicks and Barker Dams project is currently one of the Corps' highest priority dam safety projects in the country and has been well-managed while experiencing numerous challenges and lessons learned over the course of the study, making the district an excellent choice to host the workshop.

"The goal is to conduct these meetings

so that the knowledge we gain can be collected and passed along from the completed and ongoing projects to the new start projects," Carlson said.

While attendance was limited to the project managers who are currently managing the 17 dam safety projects, an internal webpage will be established to post all the white papers, project briefings, project lessons learned and recommended best management practices, so that the findings of the workshop can be referenced by dam safety project managers at any time and shared with a wider USACE audience who may have interest or find applicability to their own projects.

The USACE Galveston District was established in 1880 as the first engineer district in Texas to oversee river and harbor improvements. The district is directly responsible for maintaining more than 1,000 miles of channel, including 250 miles of deep draft and 750 miles of shallow draft as well as the Colorado River





Inspections Assess Maintenance Needs Along Lower Missouri River

by the Missouri River Recovery Program

The Missouri River Bank Stabilization and Navigation Project is a system of dikes and revetments (structures) along the lower 735 miles of the river from Sioux City, Iowa, to the mouth near St. Louis, Missouri. These structures are maintained by the U.S. Army Corps of Engineers. The Omaha District inspects and maintains the structures from Sioux City to Rulo, Nebraska, while the Kansas City District does the same for the structures from Rulo to the mouth. All structures are inspected at least annually to ensure they are at the required height and configuration standards, and the project is performing as authorized.

The structures of the Corps' BSNP were authorized and designed to provide for a reliable, self-scouring navigation channel. Completed in 1981, the project consists of approximately 7,500 individual structures and is maintained using annual appropriations from Congress. Under the Endangered Species Act, the Corps is required to operate and maintain the BSNP in a way that does not jeopardize the continued existence of any federally listed threatened or endangered species.

Annual inspections of the structures are intended to provide an overall assessment of maintenance needs for the BSNP. This effort begins after the water levels drop in

Acronyms and Abbreviations	
BSNP	Bank Stabilization and Navigation Project
HAMP	Habitat Assessment and Monitoring Program
MRRP	Missouri River Recovery Program

late fall and continues through the winter as ice and weather conditions allow.

During the inspections, structures showing signs of deterioration are evaluated and recorded. Structures with the greatest damage and posing a risk to the BSNP's authorized purposes are given the highest priority for repair. All structures are evaluated every year and an updated priority repair list is compiled yearly.

During inspections, engineers use detailed information about the structures including design height and design length, type of structure (dike or revetment), contents of structure (piling or piling with stone fill), construction type (standard revetment or toe trench revetment, etc.), year the structure was built, height each segment of each structure was built to or last repaired to, location and size of notches, density of structure spacing, presence or absence of infrastructure on the over bank, history of navigation problems in the area, etc.

Stakeholders, such as the navigation industry, levee districts and adjacent landowners often provide input to the Corps' Missouri River Office on structures they feel need attention. Engineers also take that information into account during inspections, and deficient structures determined to be in an area with a navigation channel concern are given the highest priority.

In addition to the navigation features, another component of the Corps' work on the river consists of developing aquatic habitat to meet the U.S. Fish and Wildlife Service's Biological Opinion metrics for threatened and endangered species. This habitat also helps mitigate for environmental damages caused



Missouri River Recovery Program Tadpole Island project site. Photo by Trisha Dorsey

(continued from previous page)


Locks and Brazos River Floodgates.

Its main missions include navigation, ecosystem restoration, emergency management, flood risk management and regulatory oversight.

To learn more about the Addicks and

Barker Dam Safety Program, visit www.addicksandbarker.info.

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(continued from previous page)

by the construction of the BSNP. The Corps has constructed side channel chutes, modified existing BSNP rock structures and completed river widening projects to create habitat. Maintenance of these structures is accomplished using Missouri River Recovery Program funds. The annual inspection also looks at these structures to ensure they are within their design dimensions, are diverting the proper amount of flow into side channel chutes, are not causing any adverse impacts to the navigation channel or private property, and to ensure they are functioning as designed or intended.

In a parallel effort, the Corps' Habitat Assessment and Monitoring Program collects biological information on the MRRP projects to evaluate if they are providing the intended biological response. HAMP biologists use the best available scientific information and adaptive management approach to provide feedback to river engineers concerning site adjustments to improve habitat. This is done to ensure the sites continue to provide

biological outputs for species.

A prime example of where the annual Missouri River inspections have identified the need for further work is at the MRRP Tadpole Island Chute. This project is on the right descending bank near river mile 180 and was constructed in 2006 by cutting through the existing revetment. Initially, the chute appeared to be developing as expected. Through the Corps' Missouri River annual inspections and stakeholder observations, crews noticed that shoaling was beginning to occur immediately upstream from the chute exit. Thanks to these inspections, plans were put into place to modify existing structures near the entrance of the chute and to construct a new flow control structure to limit the amount of water flowing into the chute. Currently, engineers and biologists are evaluating whether the aquatic habitat within the chute can be improved with additional modification of the existing structure or the construction of new structures.


The annual Missouri River inspection, along with congressional funding to support needed repairs, are two key



*Revetment notch on Missouri River.
Photo by Dereck Wansing*

components that allow the Corps to operate and maintain the Missouri River Bank Stabilization and Navigation Project consistent with the project authority and in a manner that does not jeopardize the continued existence of any federally listed threatened or endangered species while meeting all other authorized purposes.

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Stakes inform workers of dike numbers and locations. Photo by Trisha Dorsey



*Contractor placing rock on a Missouri River revetment.
Photo by Dereck Wansing*



Climate Change Considerations for INRMP Updates

by Nicole Sikula

When Fort A.P. Hill’s staff needed to gauge the possible effects of climate change on the installation’s most critical natural resources, they partnered with the U.S. Army Environmental Command to identify best practices that helped achieve Fort A.P. Hill’s objective and can assist installations Armywide.

The Department of Defense now requires military installations to consider climate change when updating their Integrated Natural Resource Plans. In response, A.P. Hill planned to update their INRMP with information about the



Swamp pink, *Helonias bullata*, a federally threatened and state-endangered plant, is protected on Fort A.P. Hill, Virginia, and included in their Integrated Natural Resources Management Plan. Photo by Robert H. Floyd

potential climate change effects on the federally listed, threatened, swamp pink plant (*Helonias bullata*), and the oak-pine forests that define the habitat. Working with USAEC helped identify a number of resources that made their task less daunting.

One means of informing managers about the potential impacts of climate change on their natural resources is the Climate Change Vulnerability Assessment as described by National Wildlife Federation’s Guide to Climate Change Vulnerability Assessment at: <http://www.nwf.org/pdf/Climate-Smart-Conservation/ingtheConservationHorizonFINAL92311.pdf>.

“The CCVA was our first step toward evaluating potential impacts of climate change to natural resources management,” said Jason Applegate, natural resources program manager at Fort A.P. Hill.

“Over the years, cumulative habitat destruction from development, draining and filling of wetlands, and timbering and clearing activities significantly reduced the natural range available for *Helonias*,” Applegate said. “While Fort A.P. Hill hasn’t experienced that habitat destruction, altered hydrology is still the principal threat to *Helonias*. We need to know if climate change could alter hydrology, impacting *Helonias* sites.”

At Fort A.P. Hill’s request, USAEC developed a specific CCVA methodology by studying various climate change models and data sources to identify the most precise, up-to-date and user-friendly models available to installation managers. USAEC recommends the following for use in developing a CCVA:

U.S. Geological Survey’s National Climate Change Viewer (http://www.usgs.gov/climate_landuse/clu_rd/nex-dcp30.asp) helps determine installation-level exposure to climate change variables. This service offers downscaled climate change projections from the latest global climate models.

Acronyms and Abbreviations	
CCVA	Climate Change Vulnerability Assessment
INRMP	Integrated Natural Resource Plans
NWF	National Wildlife Federation
U.S.	United States
USAEC	United States Army Environmental Command
USGS	United States Geological Survey
USDA	United States Department of Agriculture

NatureServe’s Climate Change Vulnerability Index (<http://www.natureserve.org/conservation-tools/climate-change-vulnerability-index>) can help rank the relative sensitivity of species, especially for installations that do not plan to develop a full ranking of relative vulnerabilities of multiple species. This tool is a free download and considers every major aspect of species sensitivities. It uses threshold criteria to rate species based on extensive species-level research across the United States. The use of national criteria makes this tool very useful.

The ecosystem-level models USAEC reviewed were less informative. In the A.P. Hill CCVA, USAEC used the U.S. Department of Agriculture Forest Service Climate Change Tree Atlas, a multispecies-based model.

The Atlas maps result in a complex climate-change model that assesses the vulnerability of 134 eastern U.S. tree species. Predictions from this model are based on assumptions that do not consider actively managed forests, as on military installations. However, the results emphasize the importance of best management practices and may help inform or reprioritize INRMP objectives.

“Going forward, I think that CCVAs will need to be revisited every few years to be updated based on the latest model predictions,” Applegate said.

Climate change adaptation is a process rather than an outcome. Adjusting the INRMP and associated management ➤



Real-Time Feedback Goal of New Customer Comment Card Program

by Julia Bobick

The Interactive Customer Evaluation (ICE) system is a web-based tool that collects feedback on services provided by various organizations throughout the Department of Defense. ICE (<http://ice.disa.mil/>) allows customers to submit online comment cards to provide feedback to the service providers they have encountered at military installations and related facilities around the world. It is designed to improve customer service by allowing managers to monitor the satisfaction levels of services provided through reports and customer comments.

ICE provides the following benefits:

- Allows DOD customers to quickly and easily provide feedback to service provider managers.
- Gives leadership timely data on service quality.
- Allows managers to benchmark the performance of their service providers.
- Encourages communication across organizations by comparing best practices to increase performance results.
- Saves money by providing managers a free tool to collect and organize feedback data that can be used for process improvement.

At the U.S. Army Corps of Engineers,

Engineering and Support Center, Huntsville, ICE is used to solicit inputs on the products and services provided to customers. Customers' feedback/inputs help project managers improve what Huntsville Center does for them and also help improve the Center's overall business processes.

While Huntsville Center had a good response rate (42 percent) and overwhelmingly positive feedback (91 percent overall satisfaction) on the 2014 External Customer Survey conducted Oct. 29-Dec. 11, an end-of-year survey is not always the best indicator of how well the Center is performing to meet customer expectations, according to Charles Ford, Huntsville Center's Programs Director.

"That's just one snapshot in time; it might not accurately reflect customer opinions or satisfaction for a project that might have finished several months before," he said.

Ford said he wants customers to be able to provide feedback immediately following an exchange with a project manager, a milestone achievement or completion of a project, or any time they have something they want to share with the Center – positive or negative.

Using ICE, Huntsville Center's Process Improvement and Survey Manager Carolyn Harris developed the short survey asking customers to rate Huntsville Center project managers on teamwork, communication, timeliness of service and overall satisfaction. There is also an optional field for customers to provide more detailed comments and/or recommendations for improvement.

"One good thing about the ICE program is that there is a follow-up response tool," Harris said. "Customers simply check a box if they would like for someone to get back with them. In addition, there is a tab within the ICE system that enables each program's ICE manager to record follow-up conversations

Acronyms and Abbreviations	
DOD	Department of Defense
ICE	Interactive Customer Evaluation
USACE	U.S. Army Corps of Engineers

and dates for full-circle reporting."


All the programs currently use the same comment card format, but each program has a separate URL and its own service provider manager who monitors and tracks responses. Harris said as the program evolves she would like to tailor the comment card questions for each program to elicit even more specific feedback.

"Are we meeting customer needs and expectations?" Ford questioned. "These ICE comment cards are a great tool to help us determine that at every level of our organization."

Just over a month into the program the more than two dozen customer comment cards received have all rated the Center's service as excellent. Word of the customer comment card program is also spreading throughout the Corps. Both Ford and Harris have received calls from other USACE organizations interested in taking advantage of the Army's ICE tool for immediate customer engagement.

"I think it's critical for any organization – regardless of whether they are government or private, or who their customers are – to always have some sort of customer satisfaction measure in front of them when discussing the performance, health and service quality of the organization," Ford said. "Customer satisfaction and return customers are part of the equation for success in our organization and USACE as a whole."


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plans to align current goals with climate-informed goals, requires information gathering. CCVAs provide a starting point for INRMP updates by giving managers a data-driven, risk-based, decision analysis.

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New Flight Center Takes Off

by JoAnne Castagna, Ed.D.

In the skies somewhere above the Middle East, several Black Hawk helicopters hover. Their doors open and American service members exit and swiftly descend by rope to the ground. They move in on high value targets of interest and confiscate their weapons, ammunition and intel.

What helped make this mission a success was the fast rope system installed on the Black Hawks by the Flight Activity Center that is part of the Communications Electronics Research, Development and Engineering Center in Lakehurst, New Jersey.

In order for the center to continue to

create these much needed technologies, they realized they had to upgrade their facilities to match the challenges being presented during their missions. As a result, the U.S. Army Corps of Engineers, New York District is constructing a new energy-efficient multi-purpose complex that will help the center to continue their important mission while at the same time save the base and taxpayers considerable money.

The center is at the forefront of aviation technology. Its goal is to keep our Soldiers and members of other Department of Defense related agencies safe in the sky. The center provides end-

Acronyms and Abbreviations	
CERDEC	Communications Electronics Research, Development and Engineering Center
DOD	Department of Defense
LEED	Leadership in Energy and Environmental Design

to-end aviation support in partnership with the DOD agencies, members of industry and academia.

They research, test and evaluate technologies that enable pilots to promptly receive information while in flight and react appropriately.

Technologies include various infrared counter measures, signals intelligence ➤

FY13 CERDEC Flight Activity Facility (PN 071675)
Lakehurst Naval Air Engineering Center
Joint Base McGuire-Dix-Lakehurst, NJ



Perspective View Looking Northeast



Rendering of finished complex expected to be completed in winter 2016. Illustration by Frankfurt Short Bruza.



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sensor systems and radar systems. In addition, the center performs post-production aircraft modifications, like the fast rope system that was installed on the Black Hawks. Flight tests are performed by their team of combat experienced pilots.

A few years ago, the center realized that in order to continue to successfully perform their mission they had to upgrade their center that was degrading. Their pre-World War II building was not safe for workers, was energy inefficient and was costly to maintain.

The center is on Joint Base McGuire-Dix-Lakehurst. The Army Corps has successfully performed several other projects on the base and was called upon to do this project.

Army Corps contractor, Pennsylvania-based Bedwell Company is performing the construction. The 107,000 square foot facility will include a high-bay and low-bay aircraft hangars, aircraft parking apron, aircraft-component maintenance shops, administrative offices, and a fixed-wing taxiway and a rotary-wing landing pad.

Paul Jalowski, project manager, New York District, U.S. Army Corps of Engineers said, “What makes this complex unique is that it will be using energy saving measures that will certify the complex as Leadership in Energy and Environmental Design Silver.”

One of the energy saving methods the project is using is geothermal energy. Naturally occurring heat from deep within the ground near the complex is going to be harnessed and used to heat and cool the entire structure.

“This will reduce the complex’s energy consumption by approximately 44



Aerial of complex under construction in May 2015. Photo by RC Smith.

percent and save the base and taxpayers approximately \$150,000 annually,” said Jalowski.


It’s important that the center be upgraded and kept at this location because the base has the restricted airspace needed to perform the flight tests.

Col. Paul Owen, commander of the New York District said, “As the guy who’s been on the ground in Iraq and Afghanistan in a different role, you never really know what goes on behind the scenes to have the products and

things you need to help you protect your Soldiers, save lives and execute your mission.”

The new complex will be completed in winter 2016.

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Fort Carson's Older Barracks Receive Modular Mech Room Systems

by Mike Henderson

Close to half of Fort Carson, Colorado's, older barracks are getting an energy efficiency overhaul through the installation of new mechanical equipment room skids.

The modular systems are being installed in 34, older three-story barracks buildings, each containing 70 Soldier rooms. All the buildings underwent a major renovation upgrading of the Soldiers' living spaces close to 15 years ago, but that renovation excluded any work within the mechanical equipment room at each building.

"Fort Carson is continuously researching and investing in new energy efficiency technologies to achieve its Net Zero energy goals," said Martin Rasmussen, Fort Carson Directorate of Public Works, Engineering Division chief. "Through the use of these mechanical equipment room skids, Fort Carson saves construction costs and time, as the contractor is able to change out a unit in less than 24 hours. These skid-mounted units increase substantial energy savings in these older barracks, improving system reliability and comfort for the Soldiers living in them."

The existing equipment and pipes have exceeded life expectancy, requiring increasingly more labor and material costs for unscheduled repairs and maintenance to keep all the building systems operating. As pipe leaks became more of a problem,

and concern for personnel safety should a failure in the high temperature hot water system happen during maintenance work, the issue led to a push to replace everything in each of the older mechanical equipment rooms.

Common items within the mechanical rooms provide building heating, cooling and supply the water for flushing toilets, showers, drinking, laundry and other uses. The existing mechanical rooms all had similar systems but each was slightly different in how the pipe and equipment was originally installed for the different systems.

High temperature hot water enters at 375 degrees and 325 pounds per square inch, or psi, from a central heat plant then gets converted by heat exchangers to a lower 180 degree hot water for heating, and 120 degree hot water for domestic use like showers and laundry.

Chilled water enters at 42 degrees from a central cooling plant, which provides building cooling during the summer season. The domestic cold water also enters this space. All these different pipe systems included numerous valves, pumps, temperature converting heat exchangers, storage tanks, expansion tanks and more plus power and controls to operate it all making the rooms very congested and hard for more than a couple people to work in.

The biggest challenge in completing the project was how to remove and replace all mechanical room equipment and piping without relocating about 2,000 Soldiers living in the buildings and minimizing disruptions in water use, while maintaining heating and cooling comfort with no natural gas or additional electrical capacity nearby to operate temporary systems during construction.

A mechanical equipment room design was selected that could be combined into a modular package called an equipment skid that would be slipped into the small mechanical room using the existing double doors of the room.

Acronyms and Abbreviations

EMCS	Energy Management Control System
------	----------------------------------

The equipment selected first had to be extremely energy efficient in pursuit of Fort Carson's goal toward Net Zero energy use, compact due to space limitations, meet all requirements to withstand the fluid temperatures and pressures placed on the various components, have a single power and graphic touch screen control panel that would provide a vast amount of information and also allow full remote control to Fort Carson's Energy Management Control System via local operating network-based controls.

The graphic touch screen would allow real time data to be viewable by maintenance staff, and also include graphic historical operation data along with a digital copy of the operation and maintenance manuals.

Some additional goals were developed during the project, including to provide as much space in the room for maintenance staff to work, provide the EMCS the ability to make adjustments to equipment operation, change valves between heating and cooling seasons at each building and remotely provide historical data on water and electrical energy use along with the heat and cooling load at each building.

Project contractors selected a boiler manufacturer to construct an initial prototype equipment skid that contained the design basis equipment items. Installing an initial prototype would confirm the skid construction and whether installation methods work or not, and allow for changes before proceeding with constructing additional equipment skids the following spring.

The first skid was installed in a partially occupied barracks in the middle of November 2014, with demolition starting at 5 a.m. The contractors had the new skid installed and heat restored in the building by 8 p.m. the same day.

Late March 2015, the contractor



*Mechanical equipment room skids are compact, energy-efficient systems that can be quickly installed into a facility mechanical room as one unit, minimizing utility down time in the buildings.
Photo by Bruce Faul*



Fort Benning Saves Energy, Maintenance Costs with Chiller Bypass

by Kirk Ticknor, Geoff Ray and Romel Shaheed

Fort Benning, Georgia, like all installations Armywide, is rising to the new challenges presented by the Net Zero Energy initiative. Innovative solutions to changing demands are illustrated clearly in the newly renovated McGinnis Wickam Hall (headquarters for the Maneuver Center of Excellence). Upon completion, McGinnis Wickam Hall met the criteria for Leadership in

Energy and Environmental Design Gold and had a significant reduction in energy consumption.

However, due to budget constraints for this multimillion dollar renovation, utilities such as chillers and cooling tower units were not replaced. Upon completion of the renovation, the building was much better insulated, thus reducing demand on the existing 700-ton and 1,400-ton chillers

Acronyms and Abbreviations	
DPW	Directorate of Public Works
LEED	Leadership in Energy & Environmental Design

for cooling the building. As a result of this reduced demand, the chiller units would short cycle causing excessive wear and tear on the units.

To combat this problem, Directorate of Public Works engineers and Georgia Trane devised a solution to use existing cold water produced by the cooling tower unit to supply cooling water for the building. This solution was achieved through the installation of a bypass piping system.

Due to the process of evaporation, water produced by the cooling tower would return to the chiller around 40 degrees Fahrenheit. Instead of routing this cool water to the chiller, the bypass system would simply route the cool water to a new heat exchanger, eliminating the need for the chiller unit.

In the heat exchanger, the cold water from the cooling tower is used to cool the circulating water that feeds all air handlers within the building (thus the heat exchanger essentially replaces the function of the chiller). As a result, this bypass process gradually increases the temperature of the water produced by the cooling tower. When the temperature reaches a level to which it cannot provide adequate cooling load to the building, the bypass is cut



The newly renovated McGinnis Wickam Hall (headquarters for the Maneuver Center of Excellence), Fort Benning, Georgia. Photo by Geoff Ray

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began installing more new skids. The skid installation process is now refined to the point that the contractor begins demolition Monday mornings at 6 a.m. and has demolition complete, new skid installed and domestic cold water restored before noon and the domestic hot water and heat restored by 4 p.m.

the same day. Cooling and insulation and final controls adjustments take place the following day and generally completing work on Wednesday.

Preliminary findings from the new systems is that pump energy use has been reduced by over 50 percent during the heating season and cooling season operation is expected to have similar results. As the EMCS operators collect

more history, and refine set points, greater energy savings are expected.

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Water Tower Demolition Presents Unique Challenge

by Jo Anita Miley

Figuring out the best, safest way to demolish an old water tower at Aberdeen Proving Ground, Maryland, challenged the U.S. Army Engineering and Support Center Huntsville's Facilities Reduction Program team to find an innovative way to complete the project.

The water tower was originally part of an old boiler plant used to make steam for heating purposes.

"The water tower demolition was unique due to the many safety aspects relative to its location," said Anthony Gibson, FRP project manager. "Generally we like to see a short time frame in completing projects. However, because of safety and other work plan requirements, it took a bit longer to complete this project. Since our main goal is to ensure safe and efficient demolition methods are used, we want to use innovations that are environmentally friendly to avoid putting human lives at stake."

Gibson said this project had safety concerns like asbestos abatement, the presence of unexploded ordnance and threat of white phosphorous in the area; Aberdeen's Directorate of Public Works and UXO environmental teams provided

the support the team needed to get the project completed.

Donnie Butler, safety engineer in Huntsville Center's Safety Office, said his office will not approve a demolition and disposal plan if methods and procedures don't meet strict safety guidelines. He said it takes lots of coordination with other entities on a military installation to get the job done.

According to Butler, the unwavering support he gets from program and project managers makes doing his job easier. He also works closely with other technical folks at project sites worldwide. For this particular project, he worked with the FRP team, Edgewood's DPW staff and the Corps' Baltimore District's field representative to come up with the best plan for removing the structure.

"I am the safety point of contact for review and acceptance of the FRP's Contractor's Accident Prevention Plan. A contractor cannot begin work on a project without an approved plan," Butler said. "I also do periodic safety audits at some of the site locations and resolve any safety questions and concerns throughout the lifecycle of a project."

Dale Duncan, Baltimore District's field representative and project engineer,

Acronyms and Abbreviations	
FRP	Facilities Reduction Program
MATOC	Multiple Award Task Order Contract
USACE	U.S. Army Corps of Engineers
UXO	Unexploded Ordnance

said she and Gibson worked together to find an innovative way to meet the needs of the customer and maintain optimal project safety.

"The initial work plan was to make cuts on the structure's legs and simply allow the tower to fall," Duncan said. "After taking a closer look, some team members weren't comfortable with making cuts to the structure's legs because the structure was unstable based on the contractor's analysis. So we all agreed to allow the contractor to tip the tower instead of tripping the tower. This is a much safer way to fell the structure with fewer cuts to do, and most importantly the structure remains stable during the process. Also, the center steam pipe of the tank receives a set of cuts instead of a section removed because once you remove the section, the steam pipe is hanging from the tank, so you have the pipe stressing the connection below the tank. We were able to avoid any of these issues." ➤

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off with electronic control measures, and water once again resumes flow to the chiller, cooling the water to the building as designed.

The combination of efficient insulation and mild spring and fall temperatures allows for comfortable cooling without activating the high energy chiller. This bypass system cost the DPW approximately \$150,000.

Over the course of a year, this bypass system operates approximately four to five months, primarily during the early spring and late fall months when temperatures are moderate. Assuming normal chiller operation for this time frame, the annual savings from this design change are approximately \$21,000 per year.

Additional savings incurred from reduced wear and tear on the units is estimated to be \$50,000 per year. With the annual savings from the bypass and

reduced chiller maintenance, this bypass system pays for itself after two-and-a-half years, saving the Army money and furthering the goal of Net Zero Energy at Fort Benning.

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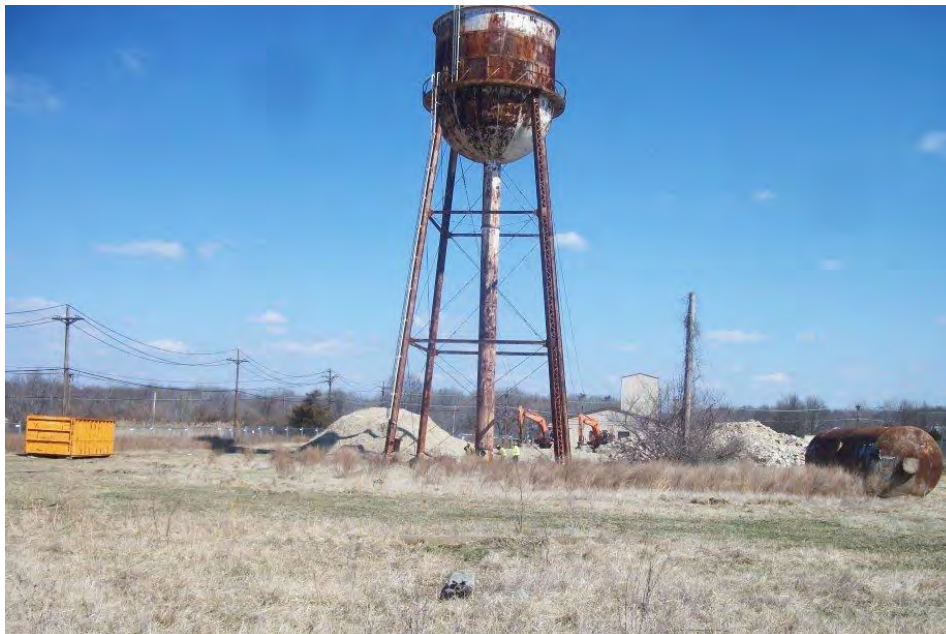
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Allen Shelvin, the FRP program manager stresses the impact of choosing the correct destruction method for the customer and the Huntsville Center.

“Following the strict safety guidelines set forth by our safety staff plays an important role in the successful completion of our mission,” Shelvin said. “We’re always going to opt for demolition methods that focus on safety over meeting deadlines. Sometimes we have to adjust a project delivery date due to safety issues. There is also a significant focus on recycling and reusing materials, which allows us to reduce our project costs. Reducing our project costs allows the program funds to go further, and we get more done with less.”

“FRP manages four regional Multiple Award Task Order Contracts with a \$48 million capacity per region for a total of \$192 million,” said David Shockley, chief of the FRP, Access Control Point Program and Special Projects Branch. “These national MATOCs utilize an improved acquisition strategy with standardized contract language to ensure employment of industry best practices, thus reducing costs and improving recycling and waste stream reduction.


“FRP has a programmatic landfill diversion rate of approximately 72 percent by weight on all demolition over the last 10 plus years,” Shockley said. “FRP uses competition between expert demolition contractors to maximize the salvage value of recyclable materials to offset the cost of demolition. On this project, workers recycled uncontaminated concrete and asphalt, stone, steel, grass and soil from the water tower and surrounding area. The contaminated materials were disposed of in the proper manner.



The U.S. Army Corps of Engineers, Huntsville Center's Facilities Reduction Program completed a project to demolish a water tower that was originally part of an old boiler plant at Aberdeen Proving Ground, Maryland. Courtesy photo

“FRP does not perform unnecessary lead-based paint abatement, uses appropriate asbestos abatement standards for demolition and crushes concrete on-site as backfill whenever possible, which substantially reduces execution costs,” Shockley said. “Understanding what the best removal methods are and then going the extra mile to ensure they’re used produces amazing results. It sounds too good to be true, but making safety a priority on our end has driven facility reduction costs down, way down. I’m proud of my team.”

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System Maintenance Key to Addressing Water System Vulnerability

by Thomas Runyon

When assessing the potential vulnerabilities of potable water systems, restriction to key access points of the system and facility security have been two of the primary factors considered. Preventing both intentional contamination and physical destruction is paramount to thwart terrorist activities that could harm consumers and this critical infrastructure. Beyond terrorism, engineering and utility managers have now broadened their perspective to include assessing all potential causes of disruption of the water system that might bring harm to consumers and/or adversely impact the mission(s) of the installation. This “All-Hazards” approach encompasses water system disruptions and the degradation of water quality due to natural hazards and normal operational wear-and-tear of system components, as well as intentional actions.

Within this broadened paradigm, the degradation of distribution system piping and appurtenances and the existence of inadvertent contamination sources have been identified as vulnerabilities or critical concerns at many installations. These



An Army lieutenant checks valve operation on a 12” line at an installation. Courtesy photo



Personnel at Umatilla performing annual flushing. Courtesy photo

potential hazards create a majority of the disruptions seen in water systems, and they adversely impact the utility’s ability to quickly respond and recover. Routine system maintenance has always been part of the operational plans and procedures for every distribution system; however, such programs have been significantly curtailed or completely eliminated as a result of prolonged reductions in Operation and Maintenance funding. In the short term, curtailing maintenance programs may save money with minimal effects immediately noted; however, within a very few years, the system will become quite impaired operationally and its ability to deliver consistent, high-quality water deteriorates.

The activities of primary concern in water system maintenance programs include sequential hydrant flushing; valve inspection, repair and documentation; cross connection control and backflow prevention; and hydrant access control. Each of these activities is critical in achieving and maintaining water system integrity.

Effective water system flushing requires that each hydrant be sequentially flushed to clean debris (e.g., soils, tubercles from corrosion, biomass) from the piping

network. Flushing is considered sequential when it begins from a primary/source point (e.g., treatment plant, local interconnection, storage tank) and proceeds toward an end point (e.g., dead end main or major area of consumption/use). The water is made to flow through the section being flushed at a calculated scouring velocity until it is clear and a stable disinfectant residual is achieved. This process serves several purposes: it keeps the piping network clean; minimizes the potential for debris and corrosion buildup; maintains a stable disinfectant residual throughout the distribution system; reduces the chance of stagnant water remaining in the system; and extends the useful life of the distribution network. The absence of such a program will lead to the degradation of distribution system valves and hydrants, as well as a reduction in general potability and palatability of the water supply.

The valves within a distribution system must be exercised and maintained or repaired annually. Valves often stick or corrode within a couple of years if not exercised or operated. They are often forgotten as long as the water flows unimpeded during normal conditions and are frequently paved over. However,



ERDC Applies Novel Materials to Civil Works Infrastructure

by Megan Holland

Aging infrastructure has become a huge problem for the U.S. Army Corps of Engineers. The mean age of our structures currently sits at more than 60 years, well beyond the original functionality and service life span they were designed to withstand. Keeping them in commission is becoming a liability, not only in the area of safety but also in regard to high costs and efforts; however, simply abandoning them isn't an option either. So what's the solution? Researchers at the U.S. Army Engineer Research and Development Center believe they know.

"If we don't address these issues now by performing proper maintenance, including the use of durable materials, the cost of fixing these problems in the future will be even greater," said Research Civil Engineer Dr. Robert Moser. "Deterioration of our civil works infrastructure means that locks are being closed for maintenance more frequently, structures are not performing as designed and maintenance costs are increasing. In many cases this is an operations concern, affecting the movement of goods, but in some cases life-threatening safety concerns can also be raised. It's time we fix the problem rather than simply

putting a Band-Aid on it."

Bypassing unsatisfactory traditional repair methods, researchers decided to explore the idea of applying novel materials to reconstruction and repair efforts. Novel materials are essentially new materials that are not typically used in infrastructure applications but have the potential to facilitate groundbreaking improvements in areas such as strength and increased durability. For most repair applications, main costs come from labor and equipment rather than materials so the primary goal is to alleviate the issues that cause the need for repair in the first place. According to Moser, these solutions will not only fix current ailing infrastructure, they will also be implemented into new structures to keep the problems from reoccurring down the road.

"Much of our work is focused on maintenance and repair of existing structures, since USACE is not currently building many large civil work structures," Moser said. "We have to maintain our existing inventory of infrastructure across the country. However, that's not to say that these materials cannot be applied for new

Acronyms and Abbreviations	
ERDC	U.S. Army Engineer Research and Development Center
R&D	Research and Development
USACE	U.S. Army Corps of Engineers

construction as well, and much of that is already in the works and even incorporated into current guidance documents and specifications."

Research areas included rapid repair materials, which provide the strength of traditional repair materials in hours versus weeks. The quick setting time means repairs in the field can be completed without having to make difficult decisions such as shutting down operations on a river system or closing a vital airfield runway for a long period of time. These materials also help prevent the need to delay repairs. An example can be found in fiber-reinforced polymeric composites, which are used to rapidly retrofit structures to maintain or increase capacity without requiring replacement of metallic or concrete components.

High performance and ultra-high performance concretes are also being

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these appurtenances play critical roles during emergency circumstances and water system repairs. For example, should water be needed in an area for fire suppression, to perform water system flushing or in support of a particular mission activity, the valves need to be controlled to ensure that adequate water is provided. A major aspect of this particular program is documenting the location and condition of each valve, so that anyone tasked with the responsibility of controlling valves can find and operate them, as needed.

The final two programs identified – cross connection control and hydrant access – are somewhat related, as the latter is implemented to better prevent cross connections and back-siphonage

of contaminants into the water system. Backflow prevention devices must be installed on all water line connections to nonpotable lines where contamination could possibly be introduced that would compromise the water quality or health of consumers. Devices are available to address various levels of risk and should be installed by a state-certified individual. All such devices must be inspected annually and maintained, as warranted, to ensure proper operation. Failure to perform the required maintenance may cause harm to consumers and to the overall distribution system, putting the installation at considerable risk. A hydrant access program allows the engineers and Directorate of Public Works to require that anyone connecting to a hydrant for any reason must install a reduced-pressure cross connection control device to prevent potential back-siphonage

of contamination into the system. Such a program generally requires an official policy signed by the commander that includes requiring anyone who observes parties connected to a hydrant to be reported. Operational sanctions may be imposed upon violators of these policies.

Water system integrity is achieved through the performance of such maintenance programs. Assistance in performing water system assessments may be obtained by contacting the author/point of contact.

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examined. ERDC has a long history of developing novel concrete formulations, resulting in an increase in both strength and toughness by up to an order of magnitude when compared to traditional concretes. With a dense microstructure that makes them significantly more durable, these materials are prime candidates to retrofit structures that have suffered from impact and abrasion or erosion damages, as well as for new construction.


Underwater repair materials, which would require structures to be dewatered

for maintenance less frequently, are also of interest. Because many of the current areas of deterioration concern are underwater and not easily accessible, inspection and repairs can be extremely tedious. ERDC is developing rapid repair underwater grouts and concretes, as well as investigating and demonstrating the ability to perform repairs using fiber-reinforced polymeric composites in underwater conditions.

“ERDC has been researching novel materials for quite some time, from the historical Repair, Evaluation, Maintenance and Rehabilitation Program to military efforts to current civil works R&D

programs,” Moser said. “Since many of these issues are unique for each structure, they often require an understanding of the problem to identify which material will work best, and if modifications are needed to address operational issues. Past experience means ERDC is up to the task.”

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*ERDC researchers work with Tulsa District field engineers at Newt Graham Lock and Dam during maintenance and repair operations.
Photo by U.S. Army Corps of Engineers*



ERDC Performs Forensic Investigations of Infrastructure Deterioration

by Megan Holland

U.S. Army Engineer Research and Development Center researchers know a thing or two about aging and ailing infrastructure, currently one of the largest issues facing the U.S. Army Corps of Engineers. ERDC is leading the charge to bypass traditional repair methods and pursue the use of novel materials in hopes of finding a permanent solution for reconstruction and repair efforts rather than a temporary fix; however, before this step can be reached, the cause of the problem must be identified – that’s where forensic investigation comes in.

“We are often asked to figure out what is going on with a structure and determine why it’s deteriorating,” said ERDC Research Civil Engineer Dr. Robert Moser. “This can mean that we head to the field or that the customer sends samples for various types of analysis, including optical and electron microscopy, chemical analysis, accelerated durability testing, mineralogical analysis, mechanical testing and other types of characterization. Based on the analysis performed, the cause is identified, potential issues are noted and repair concepts are developed.”

While there are a variety of issues affecting USACE infrastructure, problems related to corrosion and environmentally assisted cracking of metallic components

seem to be the most prevalent. Occurrences can be found in hydraulic steel structures, embedded reinforcing steel bars and prestressing tendons in concrete, among other components. Alkali-aggregate reactions in concrete are another critical issue. The processes, which include alkali silica reactions and/or alkali carbonate reactions, can cause extensive damage such as cracking, moving of concrete elements and operational issues in structures as joints close and mechanical systems with tight tolerances become misaligned.

Though they may be the most prevalent, these problem-causers are just the tip of the iceberg when it comes to deterioration issues ERDC has investigated. From freeze-thaw action, sulfate attack and erosion to fatigue, embrittlement and exposure to moisture, the root of the problem can be difficult to ascertain. According to Moser, this means the investigation process is often uniquely developed for each issue, material and structure.

“Our solutions and characterization techniques are typically customized for each project based on discussions with the customer and our best professional judgment,” Moser said. “The goal is to suppress the source of the deterioration and bring the serviceability of the structure

Acronyms and Abbreviations	
ERDC	U.S. Army Engineer Research and Development Center
USACE	U.S. Army Corps of Engineers

back up to an acceptable level. Once we determine the problem, we bring in structural engineers to assess the level of deterioration and consequences that come along with that.

“Some customers come to us specifically for our characterization capabilities and have their own in-house engineers who can develop repair concepts based on our input,” Moser said. “In other cases, we recommend solutions to the problems.”

ERDC employs a tiered approach to forensic investigation, beginning with rapid-screening studies to identify deterioration mechanisms and pinpoint appropriate research techniques. More in-depth characterization and testing is then performed in pursuit of definitive answers. The organization’s unique capabilities allow research to be performed from large scale testing all the way down to the nano level, providing an unparalleled ability to determine what is occurring in a variety of materials. Changes in chemistry, mineralogy, electrochemical conditions and mechanical properties can easily be detected.

Recent projects include work for USACE and additional agencies, both internal and external to the Department of Defense, related to alkali-aggregate reaction damage in concrete. The issue has been found in lock and dam structures, airfields and bridges, among other locations. The work specifically focused on characterizing damage, mineralogy of aggregates that are reacting in concrete and predicting future damage. Work also has been ongoing with the USACE Jacksonville District regarding geochemical dissolution issues with locally available limestone aggregates in southeast coastal regions.

“Maintenance and repair operations are often conducted without an



An ERDC engineer takes measurements on corrosion-damaged power transmission towers at Sam Rayburn Dam near Jasper, Texas. Photo by U.S. Army Corps of Engineers



A severe alkali-silica reaction is shown in a dam pier at David Terry Lock and Dam in Pine Bluff, Arkansas. Photo by U.S. Army Corps of Engineers



Lock Sector Gates Raised, Repaired After 35 Years

by Samantha Heilig

For the first time in 35 years, the 255,000-pound sector gates at the Thomas J. (T.J.) O'Brien Lock were raised and repaired as part of a critical maintenance project to rehabilitate the 54-year-old facility. T.J. O'Brien Lock and Dam is a unit of the Illinois Waterway Navigation System located at the entrance to Lake Michigan in Chicago, Illinois.

According to Mike Zerbonia, Illinois Waterway Project operations manager, T.J. O'Brien is unlike any other lock in the Rock Island District. On occasion the water level on the downstream side of the lock becomes higher than the side closest to Lake Michigan. A miter gate or lift gate used at other locks in the district would not work in this type of situation. Instead, T.J. O'Brien Lock uses sector gates that allow water to move both directions through the lock.

Sector gates are shaped like a slice of pie with a triangular framework making up the majority of the gate. A solid skin plate then wraps around the outer curved edge. Although the T.J. O'Brien Lock is the only facility in the district that uses sector gates, the design is not unique and several other locks throughout the country use these types of gates, particularly in coastal areas.



Illinois Waterway Maintenance Crew members, Craig Williams, Cory Bowen and Mark Hanson remove the pintle ball and bushing from the lower right sector gate at the T.J. O'Brien Lock. Photo by Brady Beckman

The last time the T.J. O'Brien Lock was dewatered for repairs was in 1979 when the entire lock chamber was emptied and it took 60 days to complete. This type of extended closure was not favored by the commercial industry that

depends on the Illinois Waterway to be open even through the winter months. To reduce the impact to the navigation industry, Zerbonia worked with the Maintenance Section, the Illinois River Carriers' Association and the U.S. Coast Guard to develop a plan for two separate dewatering projects each lasting 47 days with a 30-day open navigation window between the two closures.

"It is important for the Corps to make the necessary repairs to keep the lock at T.J. O'Brien operational," Zerbonia said. "At the same time we needed to do our best to work with the industry to lessen the impact on navigation in a heavily used waterway system."


In November 2014 a set of bulkheads were placed above and below the downstream sector gates of the T.J.

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understanding of the underlying problems that are causing the distress, which causes the same problems to occur over and over," Moser said. "By determining what those underlying issues are, we can help identify a better solution that will prevent or minimize distress and reduce the overall lifecycle maintenance and repair costs associated with the structure. At ERDC, we're

playing on the same team as our USACE districts and want to do everything we can to determine the right answers, in a timely manner, and as cost-effectively as possible."

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O'Brien Lock. Then, large submersible pumps were used to remove the water from the gate bay and work began on raising the first set of sector gates using a unique jacking system capable of

raising the 255,000-pound structure. Typically when repairs are needed at the other locks and dams in the district, the Maintenance Section uses a large crane to lift the gates and take them to an off-site location for repairs. Due to limited access to the T.J. O'Brien Lock and Dam

as well as bridge clearance issues and the overall structure of the gates, the use of a crane was not possible for this repair.


The purpose of dewatering the gate bays was to address alignment issues preventing proper gate operations at the lock. The lifting of the sector gates was a complex task involving a team of about 30 people.

"Since it had been 35 years since the lock was last inspected, the process of jacking and raising the gates was unlike any project that our current work crew had ever performed," said Brady Beckman, general foreman for the Illinois Waterway Maintenance Section.

For each of the four gates raised, crews had to pull three pins at the top of the lock, detaching the gate from the wall. Then, in seven different locations at the bottom of the gate's framework, crews used hydraulic jacks to raise the gate a few inches at a time, eventually reaching a height of more than 4 feet. Each gate was then repaired by having the pintle ball, bushings and pins that the gate swings on, replaced. The sector gate seals and timbers were replaced, and each gate was then sandblasted and repainted before reinstallation.

After months of work, the T.J. O'Brien Lock reopened to navigation in March with fully functional sector gates ready to serve the navigational needs of users of the Illinois Waterway for many years to come.

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For the first time in 35 years, the Illinois Waterway Maintenance Section of the Rock Island District dewatered the gate bays at the Thomas J. O'Brien Lock in Chicago, Illinois, to raise and repair the 255,000-pound sector gates. The large sector gates found at the T.J. O'Brien Lock are different from other gates used throughout the district because they have the ability to move water both directions through the lock.

Photo by Samantha Heilig



Recovery: Restoring a Flood-Battered System

by Bob Anderson

The Mississippi River and Tributaries project is perhaps the world's most comprehensive and successful flood risk management system. More than a dozen significant floods have tested the MR&T since its inception over 80 years ago, and in 2011, the MR&T system passed the largest flood in its history. Even though this was the river's flood of record, astonishingly not a single life was lost, despite the fact that 4 million people live and work in areas protected by the levee system.

To understand how vital the MR&T system is, an incredible \$230 billion in

flood damages were prevented during the 2011 event alone. And since its inception, the MR&T system has prevented \$612 billion in cumulative flood damages. At an investment level of \$14 billion, those savings result in a \$44 return on every \$1 invested.

"We owe a debt of gratitude for the wisdom, tenacity and efforts of our forebearers who devised, funded, constructed and maintained this innovative system that has proven so beneficial to so many for so long," said Mississippi River Division Commander Maj. Gen. Michael Wehr.

Acronyms and Abbreviations	
FEMA	Federal Emergency Management Agency
MR&T	Mississippi River and Tributaries
MVD	Mississippi Valley Division
OW-R	Operation Watershed-Recovery
USACE	U.S. Army Corps of Engineers

Still, a winning performance comes at a cost. The MR&T System performed like a champion, although components of the system looked like Rocky Balboa after his first title match with Apollo Creed. Most importantly, the system needed to be ready for the next big flood fight. ▶



Gary Lee, chief, Design Branch, left, and Kyle Arentsen, structural engineer, inspect the Wappapello Lake, Missouri, spillway failure during the Great Flood of 2011. Courtesy photo



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“We began developing our recovery strategy and mobilizing our teams even in the midst of still-rising floodwaters,” said Scott Whitney, Mississippi Valley Division’s Regional Flood Risk Manager and lead for Operation Watershed-Recovery. Operation Watershed-Recovery was organized around three interdependent components: assessments, evaluation and repairs.

Initial “make-safe/make stable” work at the Birds Point–New Madrid Floodway (activated by explosively removing an earthen fuse plug) topped restoration priorities. The floodway serves as a safety valve during extreme flooding and was activated for only the second time since the MR&T was constructed in 1927, with the first activation in 1937. Other make-safe work included significant levee issues around the confluence of the Mississippi and Ohio rivers. That included uncontrolled seepage and sand boils, leaking joints and possible stability issues in the floodwall. Some high-energy boils measured 8 to 15 feet, dwarfing the thousands more small-to-medium boils located throughout the system.

Riverbanks suffered, too. At the Merriwether–Cherokee Bend in the Memphis District, the river attempted to cut through a mile wide bend, shortening the river by some 9 miles. River shortening acts to destabilize the navigation channel and unravel some \$60 million in channel improvements invested in this 9-mile bend over the years.

Very early in the recovery process, the U.S. Army Corps of Engineers convened an Interagency Recovery Task Force recognizing the flood damaged area spread across seven states and speedy recovery would require the combined

tenacity, experience and resources of multi-state/federal agencies. USACE and Federal Emergency Management Agency co-chaired the task force comprised of governor appointees and regional/national agency representatives. According to Whitney, the IRTF collaborated regularly for nearly 18 months on solutions for short- and long-term restoration efforts and ongoing flood risk issues throughout the Lower Mississippi River Valley. Team members were executive level federal and state leaders with direct oversight and expertise with authorities and programs that could prove beneficial in the assessment, prioritization and recovery process.

Whitney also praised the IRTF for helping to differentiate and focus necessary expertise and resources on repairs deemed critical (requiring immediate action) and noncritical (deferring actions for several months). Through this framework, the task force reviewed and endorsed 143 projects requiring critical repairs at a cost of more than \$1 billion, plus another 262 non-critical projects at a cost of \$543 million.

The MR&T Post Flood Report and its widely acclaimed companion Room for the River booklet were two critically important OW-R products that carefully documented the 2011 flood, the Corps’ response and the performance of the MR&T system. These documents were developed to serve as valuable education tools and reference points for our citizens, decision makers and future flood fighters. Lessons learned and recommendations contained in these post-flood assessments will serve to guide continued investment and improvement in the MR&T system for many years to come.

The one thing major flood events have taught us is that they are recurrent.

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Despite the successful MR&T performance and recovery work, Whitney points out the next big flood may be just around the corner, and we need to remain vigilant and embrace the shared responsibility that ensures our flood risk management systems are properly repaired, maintained and ready for the next big test. The performance and resilience of the MR&T is a testament to the wisdom and dedication of our forebears, not to be taken lightly. Our commitment to future generations that will enjoy the benefits of the MR&T requires continued investment, improvement and adaptation.

“We extend our sincere appreciation to the thousands of local land owners, levee boards, cities, states and other partners who desperately fought the flood fight alongside us and who continue to stand with us during the path to recovery,” Wehr said.

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What is FEM, and Why is it Important?

by Al Barrus

The U.S. Army Corps of Engineers is the nation's leading provider of hydropower. Even still, power production is only one of eight authorized purposes for Omaha District's six main-stem dams along the Missouri River. These dams, along with a system of federal and private levees, reduce flood risks for urban and agricultural property and improve public safety throughout the Missouri River watershed. The Omaha District estimates that this system has prevented billions of dollars in damages.

For the dams to work properly, they need regular maintenance. To keep them running, each dam has a staff of electricians, mechanics and outdoor maintenance crews to do the physical work. One of the more common maintenance tasks is performing annual maintenance on the hydropower units, each of which generates electricity for thousands of homes. To track the maintenance, USACE uses a program called Facilities and Equipment Maintenance.

"We shut down the unit, and we pull it apart to make sure it works; we drain the oil out of it for regular maintenance and replace old parts," said Rod Bergin, the senior mechanic at Fort Randall Dam in Pickstown, South Dakota: one of the six

main-stem dams in the Omaha District. "FEM is a good system for tracking all these repairs."

FEM is practical not only for the mechanics and electricians doing the physical labor needed to keep the dam in operating order. It also ties into the USACE financial management system and has proven to be an effective tool for administrators and finance experts who need to keep track of high dollar assets, such as a dam.

IBM Maximo Asset Management, used in the private sector, is the parent program of FEM, a version of Maximo designed especially for USACE. FEM has been used in hydropower projects in the Northwestern Division since 2000 and has been moving its way east to the other divisions, integrating more data as more features are put to use at the projects.

In short, FEM records everything that the laborers need to do to keep the dams running. All tasks are written down plainly in the work orders stored in the system. The worker writes down notes on the printed work order, entering pertinent data (such as oil levels or a voltage reading) for entry into FEM, along with how much time the task took, as well as what parts were used. All the work that an electrician or mechanic does is recorded in

Acronyms and Abbreviations	
FEM	Facilities and Equipment Maintenance
IBM	International Business Machines
USACE	United States Army Corps of Engineers

this system.


"If we're assigned a task that's not a routine work order, that helps us keep track of what may need to be done in our future preventative maintenance timelines," said Bill Reiser, the senior electrician at Fort Randall."

Each month, the maintenance control technician at each project uses FEM to generate the regular preventative maintenance work orders for each of the maintenance crews. From there, the maintenance supervisor can schedule the regular preventative maintenance work for their employees, all while balancing hours to deal with non-routine, incidental work.

The maintenance technician (or FEM Tech) has a unique position at USACE dams. They have to work with the administrative and finance staff to keep track of budgeting and accounting, and they also have to maintain records for the trades and crafts crews as well.

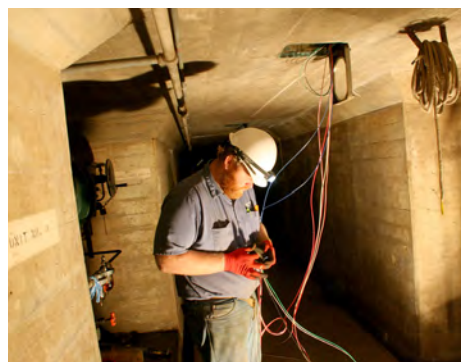
"As the maintenance tech, you're in a unique position to communicate between the administrative staff and the maintenance crews. You need to understand what they are working with," Hubert explained. "I need to have a foot in each area. I go down to the powerhouse when I have time to see a concept. If there's a unique thing happening, they will ask me to come down and look at it so I can understand what they are doing."

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Electrician Connor Florey (left) assists mechanic Bryce Stasch (right) with new cooling coils to be installed on the hydropower units at Fort Randall Dam. Photo by Al Barrus



Brian Bogenbagen, a contractor with Schuman Electric LLC, installs new wiring for the powerhouse lamps at Fort Randall Dam. Photo by Al Barrus



Strategy Balances Military's, Northern Long-Eared Bats' Needs

by Lucas Cooksey

For the first time, the Army conducted a regional programmatic endangered species informal consultation under Section 7(a)(2) for Army installations across 13 states with the U.S. Fish and Wildlife Service.

The U.S. Army's Assistant Chief of Staff for Installation Management staff led an initiative to conduct programmatic Section 7 consultation for both U.S. Army Installation Management Command and the Army National Guard installations across the known U.S. range of the northern long-eared bat. The bat, known as NLEB and to biologists as *Myotis septentrionalis*, was listed as a federally threatened species May 4.

The regional programmatic approach was coordinated with Region 3 experts



The northern long-eared bat has been listed as threatened by the U.S. Fish and Wildlife Service. The listing became effective May 4. The northern long-eared bat is one of the species of bats greatly affected by white-nose syndrome, which has spread rapidly across the eastern U.S. and been detected as far west as Oklahoma. Photo by Al Hicks, New York Department of Environmental Conservation

Acronyms and Abbreviations	
ACSIM	Assistant Chief of Staff for Installation Management
ESA	Endangered Species Act
IMCOM	U.S. Army Installation Management Command
NLAA	May affect, but not likely to adversely affect
NLEB	Northern Long-eared Bat
U.S.	United States
USFWS	U.S. Fish and Wildlife Service

of the U.S. Fish and Wildlife Service, as they are the species lead for the NLEB. The Army and USFWS worked together to develop a mutually agreed upon informal consultation. This cooperation results in military mission accomplishment and conservation for the NLEB simultaneously. The pay-off of this cooperation reduces time and manpower and increases cost savings for both federal agencies and ultimately the U.S. taxpayer.

When new species are listed under the Endangered Species Act of 1973, known as ESA, all federal agencies have an unwaiverable duty to ensure their actions do not threaten the long-term recovery of that species. Typically federal agencies consult with the USFWS on individual projects and their locations under Section 7 of the ESA. This generates numerous individual actions that the agency prepares and USFWS reviews. When listed species have a localized range, this process is not a problem. When species are listed with an extensive range, the complexity of Section 7 consultation is exponential.

When the NLEB was listed by the USFWS as a threatened species under the ESA, the Army immediately recognized the impact this could have on operations. The NLEB has a historic range that covers all Canadian Provinces, 37 of the United States and the District of Columbia. In recent years the NLEB has seen up to a 99 percent population decline in surveys in the northeast. Declines are attributed to white-nose syndrome caused



The northern long-eared bat hibernates in caves and mines in the winter and roosts underneath bark, and in cavities or crevices of both live and dead trees in the summer. The population has decreased significantly due to white-nose syndrome. Photo by Ann Froschauer, U.S. Fish and Wildlife Service

by a fungus. Infected bats act strangely and arouse often while hibernating. This uses valuable energy stores during the winter. Bat survival odds are greatly diminished due to this weakened state.

Twenty-five IMCOM installations, consisting of 809,000 acres, of which 453,000 are forested woodlands, are located in the NLEB's range. The listing of the NLEB creates the potential to either impact or cancel some mission essential activities to ensure ESA compliance. Given the range of these impacts across multiple installations a rangewide programmatic approach for this species was needed.

In a collaborative effort, members from ACSIM, USFWS, U.S. Army Environmental Command, IMCOM Installation and headquarters staff and the Army National Guard developed





District Conducts Pre-Hurricane Surveys of Texas Coast Waterways

by Sandra Arnold

The U.S. Army Corps of Engineers Galveston District is expected to finish its annual pre-hurricane survey of its navigation projects along the Texas coast in late May; a process that provides the district with data to establish baseline conditions of all 1,000 miles of channels located within its area of operation.

“This significant effort provides us with essential data that we can use to compare channel conditions pre- and post-storm to determine if shoaling occurred and subsequently request supplemental funding to clear these shoaled channels,” said Terrell Smith, hydrographic survey coordinator with the USACE Galveston District. “Hydrographic surveying also assists us in creating plans and specifications for channel improvements.”

The USACE Galveston District begins the three-month surveying project March 1 each year to ensure ample time to complete the surveys before the beginning of the June 1 Atlantic hurricane season.

“We work on several projects simultaneously but sometimes are temporarily reassigned to jobs that take priority over the pre-hurricane survey



The 26-foot RGV-1 Munson boat undergoes a sea trial after being retrofitted with the Ross Sweep System. The vessel, equipped with a drop gate on the bow, can run a sweep-type survey along channels and single beam surveys when weather prevents deployment of the sweep booms. The Galveston District acquired this vessel in March to assist with its survey mission along the Texas coast. Photo by Sandra Arnold

mission,” Smith said. “If a ship collision occurs, we survey those waterways to ensure that nothing is left in the channel (such as an anchor) that could cause an

obstruction and pose a safety hazard for waterborne vessels in transit.”

Smith explains that he’s able to gather this data using multi-beam sonar

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the IMCOM consultation. The programmatic informal consultation was initiated, developed and concurred on in approximately 45 days, which is a testament to the dedication of all involved. It resulted in advisory measures to minimize or avoid jeopardizing the NLEB.

Military training, aircraft operations and recreation are covered without restriction for all locations through meeting a determination of “May affect, but not likely to adversely affect” coded as NLAA. NLAA is a keystone principal of the informal consultation process to ensure “take” of a threatened

or endangered species does not occur, which would require formal consultation and much longer time frames. Other activities on installations such as smoke/obscurant use, forest management, prescribed burning, construction and pest management also continue, but with the implementation of simple conservation measures. These measures include project timing and protective buffers; restrictions that can be reduced or eliminated through USFWS protocol surveys; or local consultation between the installation and the USFWS field office.

The regional informal consultation process initiated with the listing of the NLEB is new for the Army, but has proven both beneficial and efficient. This

programmatic conference informal consultation leads the way for follow-on consultations and/or revisions as new information about the species or military missions emerge. Additionally, it can be used as an example in the future for other wide-range proposed species to ensure their protection in parallel with the conservation of lands that directly support the men and women who defend our freedom.

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Watertown FUDS Property, Remediated, Returned to Residents

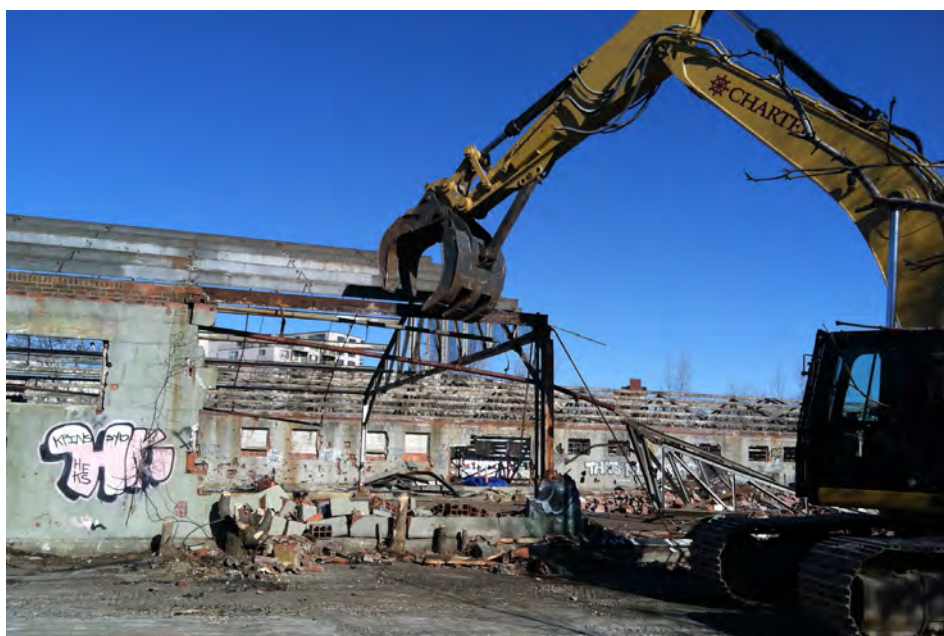
by Ann Marie R. Harvie and Maryellen Iorio

The General Services Administration Formerly Used Defense Site property in Watertown, Massachusetts, has won the 2014 EBC James D. P. Farrell Brownfield's Project of the Year Award, which is awarded by the Environmental Business Council of New England.

EBC held an evening award ceremony to present the award to the team June

18 at the Marriott Hotel in Newton, Massachusetts. The U.S. Army Corps of Engineers, New England District along with contractor Charter Environmental and partners, GSA, the Massachusetts Department of Conservation and Recreation, Nobis Engineering, and the Massachusetts Department of Environmental Protection all had representatives at the event. According to the EBC, the team received

Acronyms and Abbreviations	
DCR	Department of Conservation and Recreation
DEP	Department of Environmental Protection
EBC	Environmental Business Council
FUDS	Formerly Used Defense Site
GSA	General Services Administration
PCB	Polychlorinated Biphenyl
USFWS	U.S. Fish and Wildlife Service



Buildings are demolished as part of the remedial action plan for the Watertown GSA Formerly Used Defense Site. Courtesy photo

the award, "In recognition of the multifaceted, collaborative remediation of the Watertown, Massachusetts, GSA Property that transformed an urban Brownfield site into a community green space and wetlands habitat."

The successful remediation of the GSA Watertown FUDS marks the completion of the last remaining site associated with the Watertown Arsenal cleanup. The site was restored from a hazardous waste site to a lush, green recreation space allowing the federal government to return the property to the people of Massachusetts after 94 years. The New England District was the lead agency for the cleanup and worked closely with the DEP, DCR and GSA to ensure the site was suitable for its future use as park land.

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technology, which uses sound waves to find and identify objects in the water and to determine water depth.

"These multi-beam systems are placed on three of our boats to survey the channels," Smith said. "Using a fanlike sound scanning system, we will have the capability to identify shoaling areas and objects in channels along the Texas coast, which will help in fulfilling our mission of keeping waterways open for navigation."


According to Smith, the district's Rio Grande Valley Office is preparing to use an alternate method of capturing data that he hopes to soon put into practice along the Gulf Intracoastal Waterway to improve efficiency and optimize the life expectancy of the equipment.

"We installed a sweep system on one vessel to allow us to run longitudinal lines and cover a wider area with this type of system," Smith said. "Survey lines will be designed to run along the channels instead of back and forth across the channel to improve coverage of each survey line and

reduce wear and tear on the vessels. Initially, it will take more effort to process the data, but we will gain overall efficiencies."

The survey data will be made available online at <http://www.swg.usace.army.mil/Missions/Navigation.aspx>.

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A ribbon cutting ceremony to mark the turnover to the public took place at the Commander's Mansion in Watertown, Dec. 3, 2014. Col. Christopher Barron, New England District commander, joined congressional, federal, state and local partners in celebrating the land turnover.

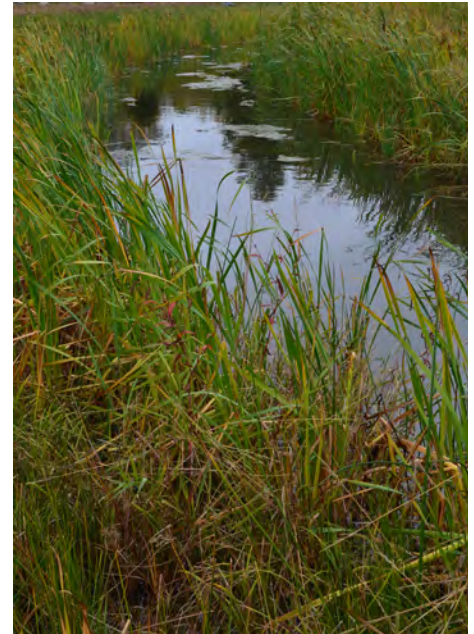
The New England District became involved with the project in May 1991 when the site was determined to be eligible for remedial investigation under the FUDS program.

The New England District was responsible for completing remedial activities at the site, under the FUDS program. With the exception of one building that was demolished with GSA funding, the \$3.68 million project is completely funded under FUDS.

The property was part of Watertown Arsenal during World War II. The U.S. Army constructed five structures on the GSA property to store various materials and equipment. As part of the Manhattan Project, the site was used to stabilize depleted uranium to allow for it to be shipped for disposal off-site.

From 1991, a variety of investigations and removal actions were performed by the New England District. In May 2012, the Decision Document was signed, paving the way for the remediation of the site.

Charter Environmental of Boston, Massachusetts, and its subcontractor, Nobis Engineering of Concord, New Hampshire, mobilized to the site in November 2012. Remedial action work on the site included demolishing all the structures that were unoccupied and deteriorated, excavation and off-site disposal of 450 cubic yards of PCB-contaminated soil above 50 parts per



Remediated wetland at the Watertown Arsenal FUDS Site in Watertown, Massachusetts. Courtesy photo




Remediated wetland at the Watertown Arsenal FUDS Site in Watertown, Massachusetts. Courtesy photo

million, construction of a 2-acre soil cover, and 2-acre compensatory wetland. All work was completed in July 2014.

As part of long-term monitoring to ensure the remedy performs as designed, the New England District will perform inspections of the wetlands twice a year for five years and inspections of the soil cover annually.

Plans are to use the site for passive recreation such as walking trails and bird watching.

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Army CP-18 Proponency Office Helps Careerists Meet Future Needs

by Lerone Brown

There are many challenges facing Army Career Program-18 careerists today, such as understanding how to use Army Career Tracker and GoArmyEd. To help reduce confusion and make the challenges more manageable for all CP-18 careerists, the CP-18 Proponency Office developed five steps.

Step one “develops core competencies” to de-clutter the career path by defining what skills, training and development experiences are required to be successful. The Proponency Office uses careerists to support subject matter expert panels to define core competencies required to meet the specific occupation task standards. SME panel competency results are used to update occupational series Career Maps. Career Maps are populated on Army Career Tracker at <https://actnow.army.mil> and on the CP-18 website at Engineering Knowledge Online at <https://eko.usace.army.mil/>.



Chun Wong, CP-18 Civil Engineer, meets with careerists to develop core competencies for Lock and Repairing Operations. Photo by John Hoffman

Step two facilitates gap closure strategies. A gap is an assessment that shows where employees are and where they need to be to be able to complete assigned tasks to standard. The SMEs analyze competency gaps for technical and nontechnical skills and provide specific recommendations to close them. These gap strategies cover the entire Civilian Occupation Career Path life-cycle, from entry to intermediate and advanced level. Once the careerist’s assessment

is complete, the next step would focus on obtaining the required competencies through training and development.

AMERICA'S ARMY THE STRENGTH OF THE NATION		
Develop strategies to close competency Gaps		
Competency (Type)	Description	GAP Strategy
Technical	Electrical Maintenance Knowledge of reading, repairing & installing electrical equipment.	HEC Vendor training, electrical tool/bosch and repair courses, formal Certification, training, Mentorship and OJT
Non-Technical	Personal Communication Applies effective verbal and written communication skills in group & interpersonal communication to positively affect work-center efficiency.	Formal, interpersonal and group communication Training, Toast Masters, Army training program, OJT and Mentorship.
Technical	Real Estate Acquisition Knowledge & skills in land acquisition, site, right of way, permits, leasing, public records as it pertains to military & Civilian works projects.	Federal Real Estate Leasing and Negotiation, Appraisal Reporting, Survey and Title evidence, warrants, permits, air/right of way, Environmental Law, Mentorship and OJT

An example of Technical & Non-Technical competencies with gap strategies

Step three uses the Army Career Tracker located at: <https://actnow.army.mil>, which allows careerists to create, edit and submit their Individual Development Plan for their supervisor’s review and approval. The creation of an IDP, which outlines career objectives along with activities to achieve the objectives, affords employees opportunities to cultivate their skills. The IDP also provides supervisors and employees (military and Department of the Army civilians) an opportunity to characterize training and developmental needs, like current and evolving occupational competencies, in order to ensure job and organizational success.

“The IDP is a careerist’s own developmental action plan. The IDP is also the supervisor’s tool to link and synchronize careerists’ developmental goals to the organization’s goals,” said Ted S. Kanamine, director, CP-18 Career Program Office, at Headquarters, U.S. Army Corps of Engineers in Washington, District of Columbia.

Step four is the Army Developmental Assignment Program, which is another avenue for employee development. Developmental assignments enhance competencies by providing employees an opportunity to perform duties in other

Acronyms and Abbreviations	
ACT	Army Career Tracker
ACTEDS	Army Civilian Training, Education and Development System
CP-18	Career Program 18
DAP	Developmental Assignment Program
IDP	Individual Development Plan
SME	Subject Matter Expert

occupational, functional or organizational elements. This enhances employee understanding of other operations, systems and relationships. The length of assignments may vary, and all must have a well-defined learning objective and be established in conformance with all applicable civilian personnel management regulations.

Step five helps careerists maximize their competencies by encouraging them to use the GoArmyEd system (<https://www.goarmyed.com/>) to apply for civilian education, training and leader development events.



TRAINING CORNER - Training Application and SF182 Submission Deadlines			
Funding Type	Submitting Training Application Deadline	Training Application Submission Deadline	Submitting a SF 182 Deadline
Centrally Funded (ACTEDS)	Training Applications should be submitted not later than 30 business days prior to the start date of training. A5 business days if OCCUSGUS travel is required unless otherwise directed by the ACTEDS Catalog instructions or the CPST.	• Email reminders - will be sent to the careerist 25 business days prior to the training start date reminding them that an SF 182 must be submitted not later than 20 business days before the class start date associated with the Training Application or the application will expire. • Training Applications expire on the class start date listed on the Training Application.	• Careerists can submit SF 182 up to 130 days prior to the training start date. • SF 182 MUST be submitted not later than 20 business days prior to the class start date.
Command Funded	Recommend Training Applications should be submitted not later than 30 business days prior to the start date of training. A5 business days if OCCUSGUS travel is required unless otherwise directed by the Command Training Manager.	• Email reminders - will be sent to the careerist 25 business days prior to the training start date reminding them that an SF 182 must be submitted not later than 20 business days before the class start date associated with the Training Application or the application will expire. • Training Applications expire on the class start date listed on the Training Application.	• Careerists can submit SF 182 up to 130 days prior to the training start date. • SF 182 MUST be submitted not later than 20 business days prior to the class start date.

Army Civilian Training and Leader Development Division GoArmyEd Chart

SF 182 Submissions: The restriction limiting submission of SF 182 Training Requests to under 130 days now applies only to Army Civilian Training, Education and Development System-funded courses. This does not apply to command-funded courses.

Training Application Reminder Email: Emails will be sent to Army civilians



Assessment to Aid Liberia's Fight Against the Ebola Virus

by Megan Holland

More than 27,000 suspected, probable and confirmed cases of the Ebola Virus have been documented since the beginning of the 2014 outbreak in West Africa, according to the Centers for Disease Control and Prevention, with more than 11,000 of those cases tragically resulting in death. Dealing with a crisis of unprecedented proportions and limited resources, the countries of Guinea, Liberia and Sierra Leone heavily relied on outside sources and aid as they attempted to rein in this seemingly unstoppable disease – and that influx of visitors and imports caused issues of its own.

Researchers from the U.S. Army Engineer Research and Development Center's Geotechnical and Structures Laboratory Airfields and Pavements Branch received a request to support U.S. Africa Command in the assessment of airfield pavements at Roberts International Airport, Monrovia, Liberia. AFRICOM needed to know if the airport had the continued ability to handle humanitarian airlift operations and also needed recommendations on airfield pavement maintenance and repair requirements to sustain the operations. ERDC's first step was to contact the Air

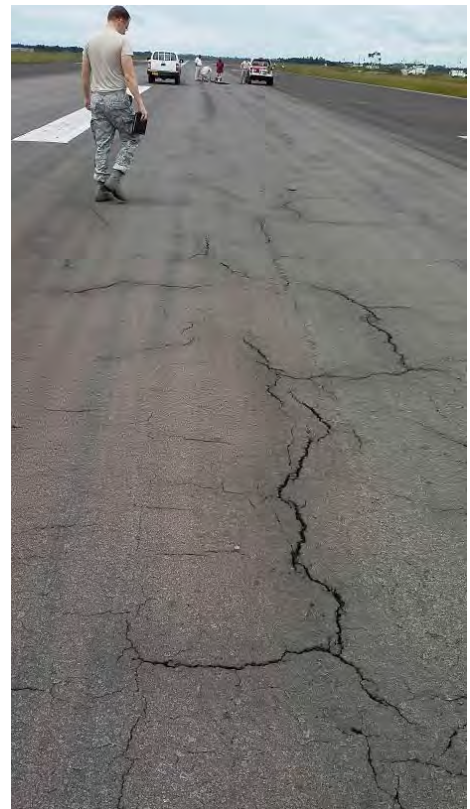
Force Civil Engineer Center and the U.S. Army Corps of Engineers Transportation Systems Center to request help collecting and analyzing the data needed to support the assessment. AFCEC had direct communications with the team conducting the preliminary analysis on the ground in Monrovia and TSC has expertise in airfield pavement geometric requirements.

AFCEC provided reports and other data from the U.S. Air Forces Europe Contingency Response Group and the Air Mobility Command Joint Assessment Team; both organizations had conducted field tests at Roberts International Airport. A report on surface and subsurface conditions commissioned by the Liberia Civil Aviation Authority and prepared by Netherlands Airport Consultants B.V. also was provided. Research Civil Engineer and Chief of the Airfields and Pavements Branch Dr. Gary Anderton, along with Research Civil Engineer Andrew Harrison, served as technical leads for the assessment, and the pair worked closely with TSC to analyze all available information.

"Our assessment supported the U.S. Air Force quick analysis in that there

Acronyms and Abbreviations	
AFCEC	Air Force Civil Engineer Center
AFRICOM	U.S. Africa Command
ERDC	U.S. Army Engineer Research and Development Center
GSL	Geotechnical and Structures Laboratory
TSC	Transportation Systems Center
USACE	U.S. Army Corps of Engineers

were a number of critical issues with the pavements that had to be resolved before the humanitarian airlift operations intensified," Anderton said. "We provided three potential courses of action, with each one depending upon the projected mission timetable – short-term or three to five months; mid-term or six to 12 months; and long-term or years of



Severe block cracking and possible delamination can be seen throughout a runway at Roberts International Airport, Monrovia, Liberia. Photo by U.S. Air Force

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The CP-18 Propensity Office supports these Occupations

25 business days before the class start date to remind them that they must submit an SF 182 by the class start date.

Please send all questions to the CP-18 Propensity Office at CP18PropensityTeam@usace.army.mil.

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Lerone Brown is a program analyst in the CP-18 Propensity Office, at Headquarters, U.S. Army Corps of Engineers in Washington, District of Columbia.



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service. Our short-term recommendations have already been implemented.”

With pavement that is 40 years old, the surface condition of much of the airfield was classified as fair to poor and past repairs following war-related damage were not constructed well. Additional problems included drainage issues and water infiltration, along with the likelihood that deterioration would require more than localized repairs due to the age of the pavement. Final recommendations were delivered only one week after the request was received and multiple courses of action were offered including placing a maintenance and repair team on-site to identify and repair the weakest patches; maintaining operability with continuous repair work while milling and replacing portions of the pavement; and rehabilitating the worst areas with full depth repairs.

Roberts International Airport remained in use throughout the evaluation.



With pavement that is roughly 40 years old, Liberia's Roberts International Airport struggled under the demand for humanitarian aid in the midst of the Ebola Virus crisis. Photo by U.S. Air Force


Humanitarian aid flows heavily through the area in the form of doctors, medicine and supplies and clinics have been built near the airport site for easy access. Continued operations are vital to the people of Liberia – of those 27,000 plus cases, almost 11,000 have occurred in

Liberia. Though the country doesn't hold the highest infection rate, it does hold the highest death rate. Almost 5,000 people have died there, giving the country a current survival rate of only 55 percent for those who contract the disease. For the people of West Africa, assessments such as these can literally mean the difference between life and death.

“It's almost natural for people not to think about transportation infrastructure until it doesn't work for them, and then it becomes one of the most important things to get right in order to move forward,” Anderton said. “ERDC often provides engineering support to areas around the globe during humanitarian crises; airports and all manner of infrastructure become vitally important when a crisis hits and the world wants to help.”

Now the world can help Liberia.

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Megan Holland is the business subject matter specialist in the Public Affairs Office with the U.S. Army Engineer Research and Development Center. 



A depression, the result of a failed subgrade and the source of multiple issues, is examined at Roberts International Airport, Monrovia, Liberia. Photo by U.S. Air Force



USACE Names Installation Support Professional of the Year

by Debra Valine

When the U.S. Army Corps of Engineers Executive Governance Board meets in August, Dominic Ragucci will receive the Installation Support Professional of the Year Award.

Ragucci, a native of Huntsville, Alabama, is a project manager in the U.S. Army Engineering and Support Center's Facilities Repair and Renewal and Base Operations programs. He currently manages five projects in the FRR Program valued at more than \$13 million, and nine projects valued at \$11 million in the BASEOPS Program.

He said while he is honored to receive the award, it is really his team and their contributions that get the work done.

Ragucci said he read in a management book, "If you get a pat on the back from your higher leadership, you remember it for a month; if you get a pat on the back from your supervisor, you remember it for three months; but, if you get a pat on the back from your peers, you never forget it."

"It is truly a blessing to be awarded this distinction," Ragucci said. "I'm excited. It's great to be nominated by your peers. I have a very good team; that is what makes me achieve success. Every time I would

get up on a mountain, my team would bring me back down. It is a team effort for me; I wouldn't be successful without them."

The FRR Program provides direct support to Army and other Department of Defense installations by managing projects that refurbish and renew facilities to extend their useful life and bring the facilities into compliance with the latest life-health-safety codes and provisions. The BASEOPS Program provides a suite of installation support services such as: facility maintenance, roads and grounds, environmental operations, waste management, pest control, snow removal, and tree and shrub management. Both programs support a diverse customer base of Army installations and support all other services in both the active and reserve components.

"Mr. Ragucci's support to our installations is noteworthy and is making a positive impact on the installation's ability to achieve mission success," said Col. Robert Ruch, Huntsville Center commander. "His efforts allow our installations to better operate day in and day out and directly impact the ability of the installation to thrive and accomplish its mission."

In an era of declining Directorate of Public Works resources and capability, the Huntsville Center receives numerous requests for installation support in a variety of BASEOPS areas. Ragucci, who has been with the Center seven years, started the entire BASEOPS endeavor with a single facility at the National Defense University at Joint Base Myer-Henderson Hall, Washington District of Columbia. He disciplines and developed comprehensive and executable performance work statements (PWS) that ensured sustained facility mission readiness. His success has led to ever-increasing project size, complexity and


Acronyms and Abbreviations	
BASEOPS	Base Operations
DOD	Department of Defense
DPW	Directorate of Public Works
FRR	Facilities Repair and Renewal
PDT	Project Delivery Team
USACE	U.S. Army Corps of Engineers

responsibility – from one building to an entire installation to a soon to be 19-state region consisting of nearly 350 installations and sites.

As an FRR project manager, Ragucci has led cradle-to-grave project management life-cycle actions on more than 50 projects valued in excess of \$100 million. He served as project manager on small projects such as a \$300,000 administrative facility renovation for the Defense Logistics Agency at Susquehanna, Pennsylvania, up to a \$7.5 million Research, Development and Engineering Command Headquarters repair and renovation at Aberdeen Proving Ground, Maryland.

"In every endeavor, Ragucci's project management skills result in successful project execution and satisfied customers," said Chip Marin, director of the Center's Installation Support and Programs Management Directorate. "His success is hinged directly to his professionalism, outstanding project management skills and second-to-none communication skills. There is simply no more deserving and no better qualified person to be recognized as the USACE Installation Support Professional of the Year."

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Debra Valine is the chief of Public Affairs with the U.S. Army Engineering and Support Center, Huntsville. 



Dominic Ragucci, a project manager with the U.S. Army Engineering and Support Center, Huntsville, has been named the USACE Installation Support Professional of the Year. Photo by William S. Farrow



Economic Analysis Aids Metric-Driven Decision Making

by Maj. Bryan Dunker

The Defense Budget was reduced from \$721 billion in Fiscal Year 2010 to \$637 billion in FY 2015. Specifically, funding for Military Construction decreased by 75 percent. Resourcing for necessary training, administrative and maintenance buildings for our U.S. Army will likely follow this declining trend over the next several years.

As Engineer professionals, how do we determine the best way to allocate diminishing funds for MILCON?

One powerful tool and solution is the Economic Analysis. This method allows planners to evaluate all project alternatives and furthermore provide a process to identify the optimal solution. This article will briefly describe the fundamentals of the Economic Analysis and why it's important for Engineer professionals to understand this effective tool.

The EA is a systematic method to identify, quantify and analyze alternative approaches for achieving the most efficient economical solution to resolve a specific requirement. Due to budgetary limitations, the Army is not capable of funding and

constructing all required projects. The EA provides a metric-driven comparison for all possible alternatives to meet the project requirements. Ultimately, the decision makers in the Department of Defense and Congress will review this data to make the best, informed decision on the use of resources.

There are seven steps in the EA as shown in Figure 1.

1. Establish the Project Objective – A clear and concise statement that quantitatively describes the project requirements is a critical beginning step. The key to the objective is that it's an unbiased statement and does not postulate a possible solution.
2. Identify Alternatives – All viable and nonviable alternatives need to be identified to ensure that methodical and thorough analysis was incorporated into the process. It's important to note that failure to include all alternatives might challenge the validity of the EA.
3. Formulate Assumptions – Identifying assumptions is necessary to account for circumstances that may impact the results. A few common assumptions include the estimated life cycle of a building, estimated replacement time of different building components, and estimated future costs of typical mechanical repairs.
4. Perform Cost / Benefit Analysis – All the costs and benefits associated with each alternative over the life of the project are assessed. In an EA, costs are compared over the period of the analysis which takes into account sums of money that are received or spent at different times. In order to accurately account for the time value of money, present value calculations are completed. This "discounting" calculation converts future values of money to the present value to ensure a fair comparison of costs and benefits are reported for each alternative.
5. Determine Nonmonetary Considerations – This is an opportunity to define issues of morale, mission impact, security and safety for all viable alternatives. It allows the decision-makers to review and weigh

Acronyms and Abbreviations	
DOD	Department of Defense
EA	Economic Analysis
FY	Fiscal Year
MILCON	Military Construction

- the impact of nonmonetary conditions.
6. Perform Sensitivity Analysis – This step in the process is necessary to address the "what if" questions. For example, what is the impact if construction costs turn out to be 15 percent higher than estimated? Selected expenses can be varied between lower and upper limits, and it often brings more clarity to two alternatives that are similarly ranked from previous steps.
 7. Report Results and Recommendations – The EA Report states significant detail of the analysis and also includes data sources for estimated costs and benefits. Finally, the report states the recommendation since the cost comparison alone may not determine which alternative best meets the project objective.
- A properly executed EA requires a significant amount of data, advanced accounting calculations, and a clearly stated report that summarizes the results. The software program ECONPACK helps facilitate the EA process and accurately calculates the results. Furthermore, it produces the results in a concise report that complies with DOD regulations. The ECONPACK program is available on the MILCON Programming, Administration and Execution (PAX) System.

The EA is a powerful tool for Engineer professionals to support data-driven decisions in MILCON. It provides comparable metrics for decision makers in the DOD and ultimately Congress to best allocate funding in this age of limited resources.

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Maj. Bryan Dunker is an Engineer project officer, Directorate of Public Works, 63rd Regional Support Command in Mountain View, California.

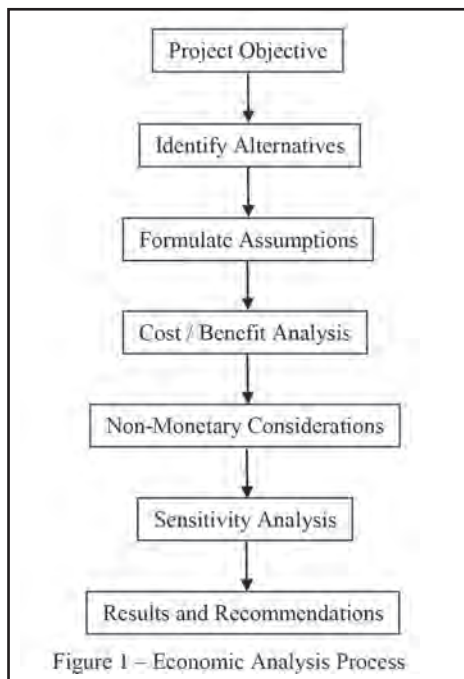


Figure 1

U.S. Army Installation Management Command
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