

The Corps

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Environment



Enlisting flea beetle to combat invasive alligator weed

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Environmental Operating Principle #6

Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps of Engineers actions in a collaborative manner.



The Corps Environment

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Collaboration, partnership key to program execution

By Stacey Brown
Chief, Planning and Policy
Division
U.S. Army Corps of Engineers

In the early 1800s, shortly after the establishment of the U.S. Army Corps of Engineers, Congress enacted laws that provided the Corps with the authority to conduct civil works projects with a mission focus on water resources.

There are three primary mission areas that make up the civil works program: flood risk management, navigation and ecosystem restoration.

In addition, Congress has directed the Corps to also address recreation, hydropower and water supply in conjunction with the three primary mission areas.

Finally, the Corps' civil works program also engages in emergency response, providing infrastructure and engineering services to the nation in response to federally declared disasters.

Partnership is a key component of the U.S. Army Corps of Engineers Civil Works program.

The Water Resources Development Act of 1986 established a requirement for most studies and projects to include financial participation or cost-sharing by non-federal project sponsors.

Project sponsors can be

states, tribes, county or local governments, or agencies that are interested in working with the Corps to address a water resources problem that is beyond the ability of the non-federal interest to address on their own.

Studies are cost-shared equally between the Corps and a non-federal partner and reflect the shared responsibility for the management and protection of our nation's water resources. Non-federal partners pay a portion of the construction cost of each project. Without a non-federal partner, a civil works study or project cannot proceed.

However, the importance of the partnership between the Corps and the non-federal interest is not based solely on the financial resources the non-federal interest provides.

Non-federal interests are key members of the project delivery team and provide valuable insight into the local environment, history of the area and data/information about the area that are integral to the evaluation of the water resources problem being studied.

The importance of partnership and collaboration with non-federal interests was highlighted recently by the Assistant Secretary of the Army for Civil Works

R.D. James in a memo issued on Sept. 10, 2019. The memo highlighted the various functions that are to be afforded to non-federal interests.

These functions include: engaging and participating in project meetings, to include meetings with environmental resource agencies; working with Corps district teams to determine tasks that the non-federal interest may perform as part of the project study and implementation processes; consulting with Corps districts on study and project schedules, task sequencing, and budget development and participating in the development of environmental compliance tasks and reports, as well as participating and commenting on environmental compliance documentation in support of the National Environmental Policy Act, the Endangered Species Act, the Fish and Wildlife Coordination Act and other federal environmental laws related to the development of water resources projects.

The memo was issued to remind all Corps personnel of the importance of the partnership with non-federal interests and to ensure all non-federal interests are treated as full partners.

See **WATER**, page 5



Stacey Brown
Chief, Planning and Policy
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In an effort to ensure all project delivery team members are cognizant of these principles, Secretary James mandated that the principles be incorporated into all Project Management Plans for Army Civil Works projects within 90 days of the date of the memo. The memo also contained a requirement that Corps districts routinely engage with their non-federal interests at least monthly and provide them updated information related to the study, design or construction of the project.

The Chief of Engineers has also stressed the importance of partners. In materials outlining the definition of a

world class organization, the relationship of the Corps to its partners is highlighted.

The chief believes that we should build world class relationships with our partners; that we should strive to be our partners' first choice; and that we should invest in our relationships with our partners just as we invest in our relationships with the people that make up our organization.

At a recent town hall meeting, the chief challenged us to listen and be responsive to our partners while also communicating with them frequently and using different methods.

Given the legal requirement to

identify a non-federal sponsor in advance of conducting a civil works study or project, the importance of the partnership with non-federal interests cannot be understated! The civil works program could not exist without our non-federal sponsors—they are the reason we conduct studies, they are the people for whom we develop and maintain projects, and they are the people with whom we work to protect the nation's water resources needs. It is imperative that we collaborate with them and that we have a robust and healthy partnership – our nation's water resources depend on it!

Environmental Operating Principles

The Environmental Operating Principles reinforce the U.S. Army Corps of Engineers' role in, and responsibility for, sustainable use, stewardship and restoration of natural resources. Introduced in 2002, these guiding principles are integrated across all mission areas.

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all Corps of Engineers activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps of Engineers actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

Learn more about the EOPs at:

www.usace.army.mil/Environmental-Operating-Principles

Harbor project promotes marine diversity

By Sean McBride
USACE, Charleston District

Dredged material from the Entrance Channel of Charleston Harbor has typically been placed in an offshore ocean dredged material disposal site, or ODMDS.

As the U.S. Army Corps of Engineers, Charleston District planned to deepen the channel to 54 feet for the first time, it came up with a new use for the material – building underwater habitat.

“Building artificial reefs using the limestone rock that was being dredged from the Entrance Channel of the harbor had several advantages,” said Bethney Ward, planning biologist for the project. “We were able to use the reefs as a least-cost-beneficial-use since it was less expensive than placing the dredged material at the ODMDS, as well as mitigated for the loss of hard-bottom habitat.”

During the feasibility phase of the Charleston Harbor Post 45 Deepening Project, it was determined that approximately 30 acres of hard-bottom habitat would be impacted.

The artificial reefs would be three dimensional structures made of native substrate, which would be ideal for habitat, providing vertical relief and surface complexity to attract invertebrates and fish.

The project plans called for constructing eight 33-acre artificial reefs, two for mitigation and six for beneficial use.

The mitigation reefs included unique designs, one in the shape of the letter “S” and the other as a “J,” that exploit more edge diversity for organisms to attach to.

The beneficial use reefs were designed for ease of placement, with a uniform, mounded shape that could also provide bottom structure for marine life. All of the reefs would be offset from the Entrance Channel and other navigation features to avoid impacting cultural/historic resources and existing hard-bottom habitat.

“While avoiding impacts to existing hard-bottom was critical, we also strived to place the reefs in close proximity to them so we could promote a more continuous patchwork of fish habitat,” said Ward.

The mitigation reefs were completed in 2018 by the Great Lakes Dredge and Dock Company using the Dredge New York. This mechanical excavator dredge was ideal for extracting the large rocks needed to create the complex reef structure for the mitigation reefs.

The excavator dredge dug into the limestone rock and loaded the material into a dump scow that was then used to transport the material to the mitigation site. It took 100 loads and approximately 340,000 cubic yards of material to build the two mitigation reefs.

The beneficial use reefs are about 80% complete and

are being constructed by a hydraulic cutter head dredge, which grinds the rock into smaller pieces than the excavator dredge.

The Charleston District is using high resolution bathymetric data to document the size and shape of the reefs. The data will be collected annually for four years to help the district understand how the reefs settle over time.

Biological monitoring is also being conducted on the mitigation reefs to assess whether the district has met its mitigation requirement.

The district is also working with the South Carolina Department of Natural Resources (SCDNR) to conduct the biological monitoring of the mitigation reefs.

“We are fortunate to have a Marine Artificial Reef Program in our state so there are experienced divers who have the right equipment and understand how artificial reefs evolve,” said Ward.

It is expected to take about three-and-a-half years for the reefs to become fully-functioning fish habitats.

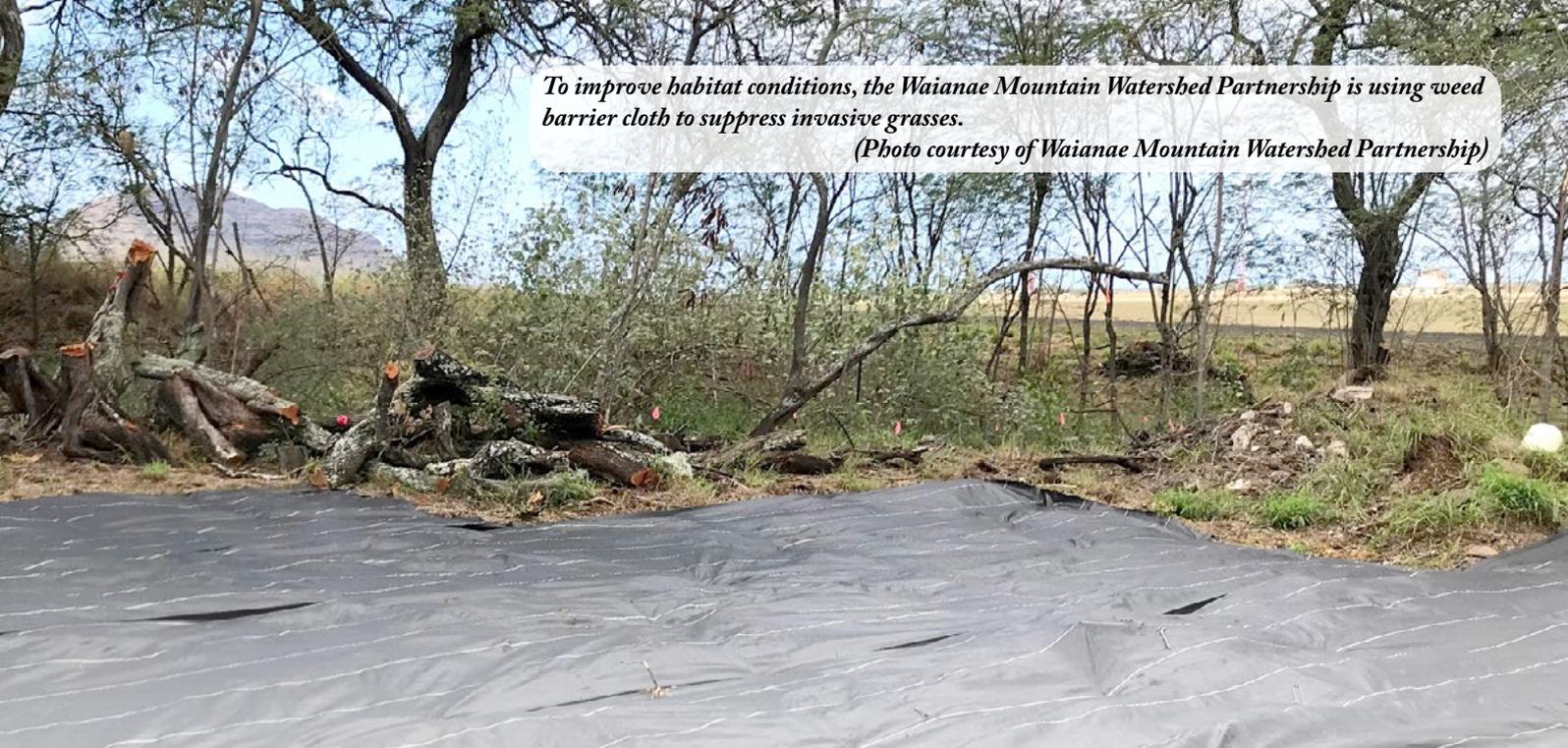
First, stationary organisms, such as algae, sponges and soft coral, attach themselves to the reefs. Then, juvenile fish and marine invertebrates, such as shrimp, crabs and starfish, follow suit and cling to the reefs for food and protection. Finally, larger fish, such as red drum and black sea bass, linger around the reefs for food, protection and to reproduce.

SCDNR is collecting information on the percent cover, size, abundance and diversity of the stationary organisms on the reef, as well as using underwater videography and acoustic telemetry to assess fish utilization around the reefs and to understand if resident populations are established over time.

Early observations are encouraging. Just a few months after construction, colonization of a few species of stationary organisms have been noted on the reef and fish are in the area. Sampling data is currently being analyzed and monitoring will continue until 2022.



The dredging operation in Charleston Harbor requires numerous dredges, scows and other equipment. Excavator dredges and hydraulic cutter head dredges place material in the scows to be transported to the new reef site. (Photo by Sean McBride)



*To improve habitat conditions, the Waianae Mountain Watershed Partnership is using weed barrier cloth to suppress invasive grasses.
(Photo courtesy of Waianae Mountain Watershed Partnership)*

Agency partnerships foster, protect sensitive ecosystem

By Kathy Mitchell
USACE, Fort Worth District
Cory Campora
Joint Base Pearl Harbor-Hickam

The U.S. Army Corps of Engineers Regional Planning and Environmental Center continues to foster successful relationships with Department of Defense agencies through their Cooperative Ecosystem Studies Units (CESU) program.

The U.S. Army Corps of Engineers, Fort Worth District has a master agreement in place with the Office of the Secretary Defense that authorizes their CESU team to work nationwide with DOD agencies to meet environmental project needs through cooperative agreements with non-profit organizations that are members of the CESU network. Fostering working relationships with agencies is key to successfully executing this nationwide program.

One such relationship includes the collaboration between the Regional Planning and Environmental Center and Joint Base Pearl Harbor-Hickam.

The Hawaii-based installation is one of the Navy's busiest harbors and one of the Air Force's top U.S. mobility hubs in the Pacific. However, it also includes areas on the island of Oahu, such as the Lualualei Annex within Lualualei Valley, that the

Navy utilizes for various purposes.

Lualualei Valley is in the Waianae Mountain Range and is the largest coastal valley on the leeward side of Oahu. Because there is very little development in the valley and the Navy's border extends to the top of the mountain ridgeline in many areas, there are a large number of endangered plant species (28 species) and one snail species on the property that are federally-listed as threatened or endangered under the Endangered Species Act.

The Navy must meet its environmental stewardship goals of managing natural resources in a responsible manner that benefits regional stakeholders, meets regulatory mandates and has the least impact on military missions.

Therefore, the Navy has chosen to use the Regional Planning and Environmental Center's Fort Worth CESU program to meet the goals and commitments for its natural resource programs. This includes a cooperative agreement to support the installation's commitments associated with the Lualualei Valley.

The project agreement was awarded to the Hawaiian and Pacific Islands' CESU program and the Waianae Mountain Watershed Partnership. This has been particularly beneficial to Joint Base Pearl Harbor-Hickam because the partnership brings together many large-

scale landowners in the Waianae Range and is able to leverage resources from the University of Hawaii, Department of Army (which owns and operates Schofield Barracks that shares a northern border with Lualualei), community groups, and private landowners to address landscape-level issues that cross borders.

The responsibilities of the Waianae Mountain Watershed Partnership under this cooperative agreement are to develop and implement management plans for endangered plants and snails within Lualualei. This includes an assessment of conservation needs of the listed species, a statement of goals and priorities, a detailed description of the actions to address the stabilization needs of these species, and includes a monitoring and adaptive management plan. This partnership has an in-house field crew that does the majority of the work, but it also works with intern programs and students from local schools to augment its manpower and capability.

There are many challenges to conservation of threatened and endangered plants and snails in the Lualualei. However, the work accomplished through this agreement demonstrates the Defense Department's commitment toward sustenance of relationships with regional stakeholders to protect sensitive species.

Resource efficiency managers reduce installation's energy, water costs

By John Trudell
U.S. Army Engineering and Support Center,
Huntsville

The value of a Resource Efficiency Manager, or REM, is traditionally measured using the amount of energy savings identified throughout the year. The Army's shifted focus to resilience and security makes the traditional metric outdated.

The Huntsville, Alabama-based U.S. Army Engineering and Support Center's REM Program enhances installation energy program effectiveness by identifying projects and practices to reduce energy and water costs through a contracted subject-matter expert.

So, how can we effectively measure the benefit and value of a resource manager? I recommend using the REM's accomplishments, tasks and deliverables – instead of identified savings – to meet the Army's energy goals.

The REMs accomplish a number of tasks on which an energy savings amount cannot be calculated. The REMs complete 17 contract tasks, which can be further subdivided into more than 30 activities, in addition to developing energy projects to identify savings.

So what are these activities? The REMs assist with data collection and review of installation energy and water plans, meter inventory validation, meter data analysis, building audits, energy conservation measure identification, document reviews, design reviews, building commissioning support, and operation and maintenance support.

They also attend meetings and energy training, offer energy awareness support (briefings and energy award development), support demand reduction to maximize cost avoidance, review energy data to identify and correct anomalies, do utility bill audits, assist with utility rebate preparation and submittal, support repair and construction activities, and many more activities to assist energy managers and help garrisons meet the Army's energy priorities and goals.

Depending on the assignment, REMs may be assigned to one garrison or geographically assigned to multiple garrisons or an Army Reserve Readiness Division's area of responsibility.

Measuring the REM activities seems like a huge task when you factor in the number of REMs (40-plus) and the commands and multiple garrisons they support. Well ... not really. The REMs currently submit a monthly report with details of their activities. The monthly report includes a narrative of their significant accomplishments and a spreadsheet with task/activity details.

The REM also provides deliverables including document

review comment submittals, building audit reports, energy project document development (scope, savings, lifecycle cost analysis), meter verification list, training materials, and utility bill audit reports, just to name a few. The deliverables are provided directly to the garrisons and commands they support.

How are the REMs successful at accomplishing these tasks? The REMs are trained, certified energy professionals and are successful in assisting the garrisons with their energy goals through the support provided by the U.S. Army Corps of Engineers REM Program.

The program provides support through the annual REM Workshop (next workshop is scheduled for March 10 through 12 and is open to energy managers), the REM Meeting after Energy Exchange, and webinars.

Additional training and support is offered through the USACE REM Program's partnership with the Department of Energy Federal Energy Management Program, or DOE FEMP. The workshops, meetings and webinars provide REMs with updates to laws, regulations, policies and guidance; technology training; and opportunities to share energy-savings project ideas with one another. REMs are also informed of various initiatives like the DOE FEMP no-cost initiative/assistance Building Re-Tuning and the PV Analysis.

What metric are we changing if the REM accomplishments are being measured?

It is not really a change in the metric but more of the perception and understanding of the benefit and value of an REM.

When I am asked about the REM's benefit and value, I respond that the REM accomplishes these activities (I discuss the list mentioned above) to assist the Army with meeting their energy goals. During the last two years, REMs identified savings of more than \$350 million for Army's future energy projects. The REM's current and future value becomes apparent by changing the perspective.

For those who are still stuck on a dollar metric. An audit of the Army's REM Programs noted a positive return of \$43 for every dollar spent on an REM – an excellent return on the money spent! And, by the way, they accomplish all these tasks.

To learn more about the REM Program and REM Workshop, email CEHNC-REM@usace.army.mil.

Or visit the webpage at: www.hnc.usace.army.mil/Missions/Installation-Support-and-Programs-Management/Energy-Division/Resource-Efficiency-Manager.

(Graphic by Michael May)



Corps investigates munitions found at former New York Harbor post

DIVING into the PAST

By JoAnne Castagna, Ed.D.
USACE, New York District

Decades ago, there was an active U.S. Army post on Governors Island, in the heart of the New York Harbor in New York City.

Military families resided on the island and stories exist of children getting into mischief and rolling cannonballs down a hill. Some possibly making it all the way to the water's edge and splashing into the harbor.

Cannonballs and other munitions or explosives of concern are believed to have wound up in the harbor in other ways as well.

"Our historical research indicates that besides the playing children, the cannonballs may have wound up in the water from past military operations or dumped or accidentally fell into the water off of vessels that were loading and unloading munitions at the piers," said Erik Jarger, project manager, U.S. Army Corps of Engineers, New York District.

This fall, the Corps has dispersed teams of divers to investigate the waters off the island so that munitions, such as cannonballs, can be found and removed for public safety.

"This work is to ensure that the waters are safer for the public, boaters, and for potential future development around the island," said Jarger.

The New York District is doing this work in collaboration with the New York State Department of Environmental Conservation, the U.S. Army Corps of Engineers, Baltimore District, New York State Department of Health, HydroGeoLogic of Reston, Virginia, the Trust for Governors Island and the National Park Service.

The diving work is being performed under the Formerly Used Defense Sites Program, a Department of Defense program for environmental restoration or cleanup of

properties that were formerly owned by, leased to, or otherwise possessed by the federal government to protect human health and the environment.

Governors Island is located in New York Harbor, a half mile from the southern tip of Manhattan at the confluence of the Hudson and East rivers.

Visitors can take a ten minute ferry ride from Manhattan or Brooklyn to the 172-acre island that has become a popular recreational, educational and cultural destination.

A big part of the island's attraction is its historical military buildings and its rich role in American history.

The island was formerly used as a military post for almost 200 years. Fort Jay and Castle Williams were built centuries ago on the island to prevent enemies from seizing control of New York Harbor, such as the British during the War of 1812.

Castle Williams was part of a system of forts designed and constructed in the early 19th century. It was designed and erected under the direction of Lt. Col. Jonathan Williams, chief engineer of the U.S. Army Corps of Engineers and first superintendent of the U.S. Military Academy at West Point, New York.

The Army post once served as a recruitment center, supply depot, prison and supply base where munitions, such as cannonballs, were stored, tested, transported, and used for training and coastal defense.

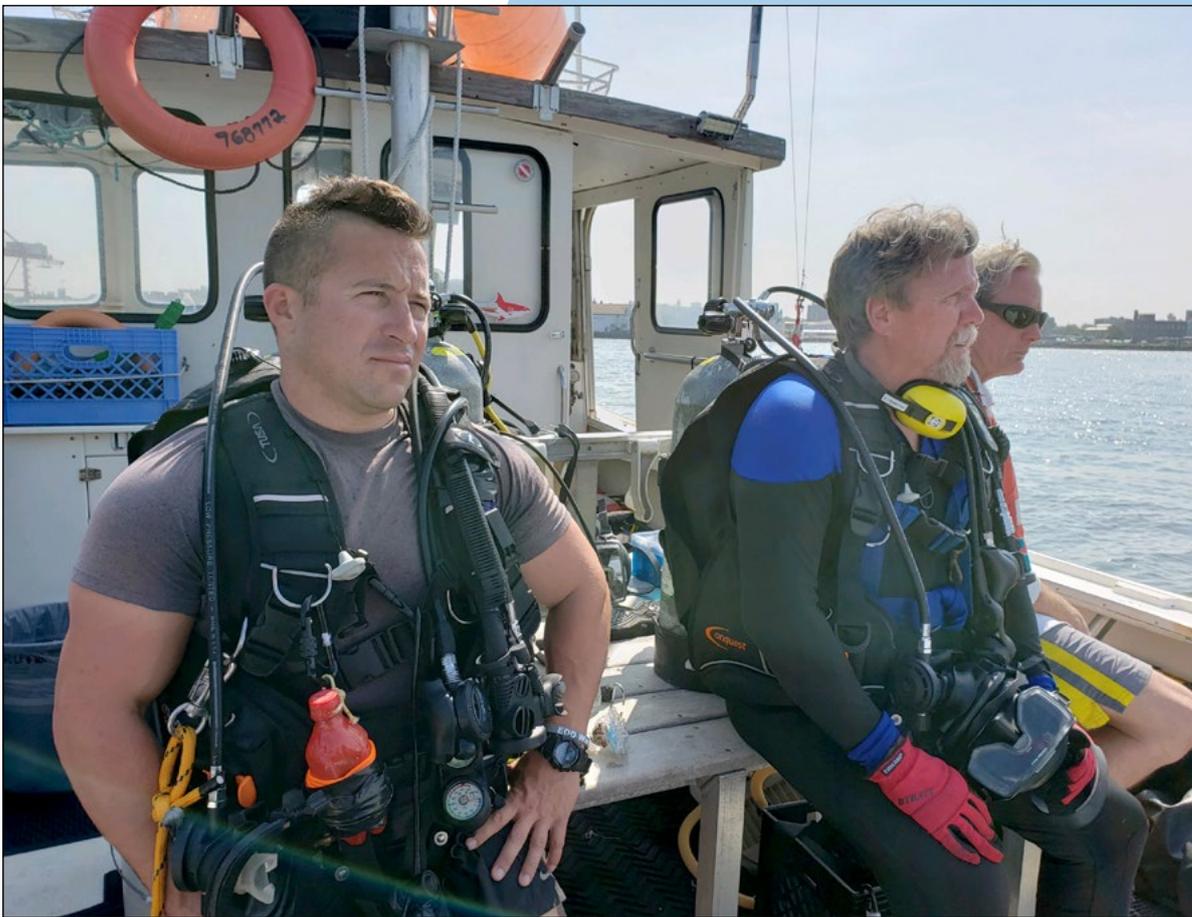
It was during this time that munitions ended up in the harbor. The Army Corps has teams of divers surveying the waters for them.

They are investigating the locations of old, historically significant, piers and other areas around the perimeter of the island. Jarger said that for safety purposes, the dive operations are being coordinated around ferry traffic.

See **CORPS DIVE**, page 13



Divers investigate the waters off of Governors Island, searching for cannonballs and other munitions that need to be removed to ensure public safety and future development prospects. (Photo courtesy of Aptim)



Contracted dive teams pause before going down to inspect almost three acres of the harbor floor, searching for suspected munitions that may have been dumped or accidentally dropped into the waters.
 (Photo courtesy of Aptim)

CORPS DIVE

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Castle William once served as a recruitment center, supply depot, prison and supply base where munitions, such as cannonballs, were stored, tested, transported, and used for training and coastal defense.

(Photo courtesy of U.S. National Park Service Website)

“The divers are looking for what we refer to as “metallic anomalies,” or essentially any metallic items of interest that have the potential to be considered munitions or explosives of concern,” said Jarger. “The munitions most likely to be found are cannonballs of various sizes, based on the historical knowledge of past island operations and munitions stored and used on the island.”

The dive teams are inspecting almost three acres of the harbor floor, going down as deep as 30 feet in some areas.

According to Douglas Schicho, project manager with Aptim, the subcontractor performing the diving operation, “The dive team is laying down approximately 12,000 linear feet of rope across an area to be surveyed. The divers are tied off to the rope and use it to navigate. They use hand held magnetometers - metal detectors - and survey a five foot swath on each side of the rope.”

“Any metal found with the metal detector is inspected visually and by touch to determine whether or not it is a suspected munition,” said Schicho.

Items found will be marked with weighted buoys for vessel safety, and will be removed appropriately at a later date for proper disposal.

These cannonballs are being retrieved to make the waters off of Governors Island safer for boaters, vessel traffic, and potential future development on the island, such as the construction of new piers, bulkheads or seawalls.

How cannonballs may have entered the waters off of Governors Island years ago, will never be known for sure. What is known, is that by searching for them, Governors Island’s future is bright.

Analysis team helps identify potential land use concerns

By Shiloh Dorgan
U.S. Army Geospatial Center

The Army Geospatial Center, a major subordinate command center under the U.S. Army Corps of Engineers, works with Corps districts to perform historical photographic analysis (HPA) of current, former and closing U.S. military sites to examine land use for potential concerns.

In many cases when a district is charged with removing polluted or contaminated soil, sediment, or surface water to reduce the impact on people or the environment, there is not a clear record of how the land was used, or the extent of usage, over the time of military ownership.

This problem is complicated because many of these sites were created by practices and activities undertaken decades ago. Complicating matters further, today these hazardous sites are often completely obscured due to the burial of materials, rapid re-vegetation, or dramatic changes in land use.

The Army Geospatial Center Environmental Analysis Team eases the burden of determining historical land use with an unlikely suspect—airial photography that was once used to survey training and installation areas favorable to military needs. Today, this same aerial photography is used to assist in the environmental remediation of the remnants of military activity.

An interdisciplinary team uses these aerial photographs, augmented by historical records, to identify features and activities having latent or definite environmental concern, thereby assisting in the investigation and remediation of environmental hazards.

District offices turn to AGC for a variety of reasons. The three most common include routine site closures before turnover, outside agency requests to have the Corps look into a problem and public concerns that set into motion an assessment of a remediated site. Early involvement by AGC can save a lot of money and damage that comes with problems discovered later. One district customer said that historical photo analysis saves them as much as \$10 for every \$1 spent.

A typical HPA begins with a conversation with customers. It helps to have as much background information as possible about the sensitivities and concerns before the HPA process starts. It's almost like going to court, because like attorneys, the more that is known up front, the better prepared AGC is to work effectively.

The next steps are to locate and manually scan historical aerial photography, including maps, ground photography and textual documents related to each site. Next, the team visits and queries government, academic, public and private repositories. Then, it correlates and synthesizes this information using a geographic information system. This process involves extensive analysis and review of data to find significant details.

AGC often looks at hundreds to thousands of photos for a site (depending on the site area and number of years of aerial coverage) to piece together a temporal narrative of a contemporary landscape changed by prior military activity.

Most remediations involve the allocation of heavy equipment, high-dollar manpower and materials—a substantial investment. The historical photographic analysis cuts costs by pinpointing the location on the site that is most likely to need attention, reducing the need for repeat visits.

An example of recent work was in New England where the photographic analysis team pointed to something underground early in the remediation process. Using the data provided in the HPA, the team focused their effort, coming full circle with a single picture and an accompanying note stating, "Please know that we discovered an underground storage tank in the launcher area, as you identified in the report."

The historical photo analysis allows partners to focus on restoration and remediation efforts, resulting in significant cost avoidance.

For more information about historical photographic analysis, call (703) 428-3626 or email Shiloh.M.Dorgan@usace.army.mil.

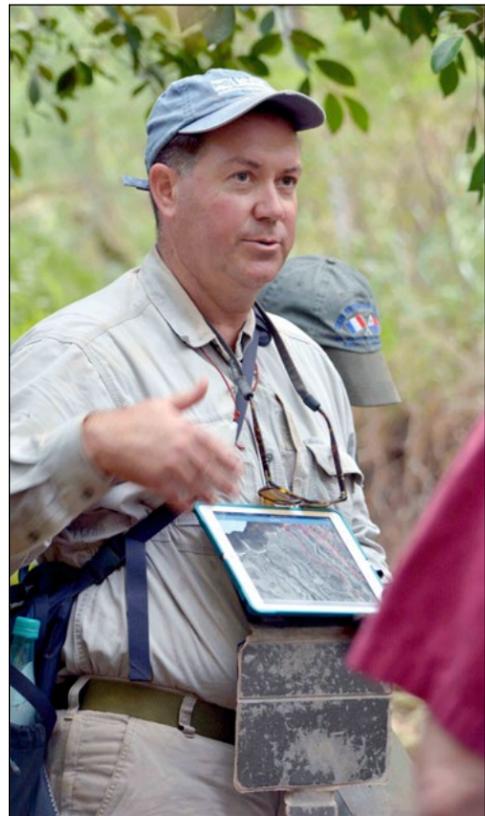


Abandoned storage tanks are indicators of potential sources of contamination. Corrosion of these tanks releases contents into the surrounding area. (USACE courtesy photo)



Army Geospatial Center and Corps district staff verify surface fractures to provide a comparative analysis with remotely sensed lineaments for areas where groundwater contamination is a concern. Such fractures can influence the migration of contaminants. (AGC courtesy photo)

Collaboration benefits flood control projects



John Stock with the U.S. Geological Survey discusses problem areas of the West Maui watershed during the 85th meeting of the Corps' Committee on River Engineering. The District civil works branch team asked for the committee's recommendations addressing the in-stream erosion as the primary source of sediment contributing to the degradation of near-shore coral reefs.

Story & photos by Bryanna R. Poulin
USACE, Honolulu District

The U.S. Army Corps of Engineers, Honolulu District civil works branch teamed with the Corps' Committee on River Engineering (CRE) July 19 to Aug. 2 to revisit two civil works project actions and evaluate the potential for future repairs.

Committee members are full-time Corps employees and subject matter experts who supply advisory consultation services.

While on Maui, the group provided their input for Honolulu District's Iao Stream Flood Control Project (FCP) General Reevaluation study and the West Maui Watershed study.

Coordinating the meeting and evaluating the district's projects took nearly a year.

"The committee supports districts across the nation working in urban and rural environments, large rivers and small streams," said John Remus II, Committee on River Engineering chairperson. "In addition, it assists districts in dealing with issues ranging from navigation, bank stabilization, dam removal and environmental restoration."

Since 1981, Iao Stream FCP, locally known as the Wailuku River, has experienced numerous floods that severely eroded the streambed and critical portions of the Corps-constructed levees.

Following the Sept. 2016 flood, the district completed emergency repairs to most of the right bank of the FCP levee, but recognized the need for additional project improvements, and requested CRE assistance to evaluate the flood control project.

"The technical committees bring their expertise in either assisting the district in initiating a project (West Maui) or act as a sounding board during project development (Iao Stream)," Remus said.



Honolulu District Civil Works Team Lead and Hydraulic Engineer Jessica Brunty (middle) views photos of the Iao Stream Flood Control Project. The district's civil works branch teamed with the Corps' Committee on River Engineering July 19 to Aug. 2 to revisit the project actions and evaluate the potential for future repairs.

Almost 40 miles west of Iao Stream, terrestrial sediment discharging from the West Maui watershed is a well-known stressor to local coral reef ecosystems. The adjacent offshore reefs have lost nearly one-fourth of its living corals in the last 13 years.

Over the last decade as part of the West Maui Ridge to Reef initiative, Honolulu District has been actively compiling the West Maui Watershed Study in partnership with the State of Hawaii and local agencies. The study's goal is to contribute to the restoration,

enhancement and resiliency of West Maui coral reefs and near shore waters through the reduction of land-based pollution threats.

The Ridge-to-Reef initiative builds on already established efforts underway and leverages resources across a number of agencies and community groups to implement actions to reduce one of the key sources of reef decline—land-based sources of pollution.

The district civil works branch team asked for the committee's recommendations addressing the in-stream erosion as the

primary source of sediment contributing to the degradation of near-shore coral reefs.

Honolulu District Civil Works Team Lead and Project Manager Jessie Paahana led the group on a site walk in the watershed for analysis.

"By providing technical advice like data collection, modeling recommendations, or other alternatives to consider, the CRE's goal is augmenting the expertise the district already has," Remus said.

See COLLABORATION, page 18



The Honolulu District's civil works branch teamed with the Corps' Committee on River Engineering to revisit two civil works project actions and evaluate the potential for future repairs.

COLLABORATION

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The district and CRE collaboration efforts are contributing to the restoration, enhancement, and resiliency of coral reefs and near-shore waters by identifying solutions to reducing sediments carried in streams from the summit of Pu'u Kukui in the West Maui Mountains to the outer reef.

One benefit of the partnership is the positive impact on the community.

"The public benefits anytime an agency can get a head start to marshal and focus their expertise to address a challenging problem, without having to reinvent the wheel," Remus said.

Another benefit is that CRE and Honolulu District engineers can collaborate, share knowledge, develop new skills, come up with new ideas by brainstorming and offer each other input and feedback.

"The goal isn't the committee transferring knowledge, but how the CRE and the district learn from each other," said Remus. "I have learned something on each CRE mission that I'm able to apply somewhere else."

Having more than two decades on the committee, Remus has seen how diversity in personnel experience affects the CRE.

"The committee is so diverse that the amount of "brainpower" and creativity

results in practical solutions the district can use to further the project."

The CRE and Honolulu District civil works team discussed various alternatives and future options.

"I feel the Honolulu District has done a good job of identifying alternatives for the (two) projects," Remus said. "The devil is in the details, but it's important to remember in those big problems are also

big opportunities."

"The committee provided the district with valuable insight on two critical projects," Brunty said in the final report highlighting the site visits. "By sharing its perspective, the committee has improved its ability to conduct flood and erosion studies and effectively deliver integrated water resource solutions to our local project partners."



John Stock with the U.S. Geological Survey addresses the effects of in-stream erosion and its contribution to the degradation of near-shore coral reefs.



High water on the Sacramento River flows under the Gianella Bridge in Hamilton City, California, during the 1986 floods. Flood fighting and evacuations have long been a normal occurrence when the river rises, but a new multipurpose project to construct 6.8 miles of setback levee aims to reduce the risk of future flooding.

Hamilton City project combines flood management, ecosystem restoration

Story & photo by J. Paul Bruton
USACE, Sacramento District

The Hamilton City Flood Damage Reduction and Ecosystem Restoration project is the first of its kind in the nation and earned the U.S. Army Corps of Engineers, Sacramento District an American Society of Civil Engineers award for Small Flood Management Project of the Year.

Approximately 90 miles north of Sacramento, Hamilton City sits in a low lying area behind a bend in the Sacramento River.

For years, the town's only defense has been the J levee – an un-engineered earthen levee built in 1904 – which provides such minimal benefit that there's about a 10% chance of flooding every year.

The town has long been at risk. There's been five recorded instances when flood fighting prevented major flooding. The town was evacuated six times during a 15-year period between 1983 and 1998. And portions of the town did, in fact, flood in 1974.

For years the small town of roughly 2,000 pursued federal help, hoping to secure a Corps of Engineers' federal project to build a new levee system. However, the combination of the town's small size and the cost of a federal flood risk management project dwarfing the value of nearby property and structures made it nearly impossible to justify a project that

warranted federal participation.

That didn't stop the community from continuing its pursuit to replace the aging J levee.

Approximately 30 years after beginning to look for opportunities to reduce Hamilton City's flood risk, the solution came about in a first-of-its-kind project that aligned flood risk management with ecosystem restoration.

The formation of strong partnerships led to a willingness to work together on a multipurpose project. The community wanted to create flood relief for the people of Hamilton City; the Nature Conservancy wanted to find a way to restore native habitat; and, area farmers wanted to reduce damages from flows that scoured their property along the edge of the river. The ecosystem restoration project was able to address these problems with one solution.

"The Hamilton City Flood Damage Reduction and Ecosystem Restoration project focused on measures that provide both flood risk reduction and ecosystem restoration benefits, establishing a restored riparian corridor along the Sacramento River," said Bryon Lake, Hamilton City project manager.

The project, authorized in the Water Resources Development Act of 2007, will cost approximately \$91 million to build 6.8 miles of setback levees and restore nearly 1,500 acres of riparian habitat, reconnecting the floodplain to the Sacramento River.

Rather than build up levees along the river, setback levees are placed further from the river and have a better foundation, allowing the river to expand more naturally during times of increased water flows. Setback levees also create space to allow for more habitat within the floodway.

"The key feature is the setback levee. Building a new levee on sound foundation significantly reduces risk of flooding to the community," said Alicia Kirchner, Sacramento District's deputy engineer for programs and project management. "Building that same new levee setback from the Sacramento River creates space to restore native floodplain habitat and more natural floodplain function. One feature, yielding two types of benefits resulted in a project that had funding priority."

During any substantial increase in river flows, the river will now widen into the restored floodplain channel rather than flow over, or through the levee, spilling into the town.

Another benefit is that riparian habitat now has connectivity up and down the river, providing wildlife increased native riparian habitat. The first phase of the project was completed five months ahead of schedule, and area wildlife has already benefitted from the restoration.

"This project is special. Everyone came together at the right time and place, and it is an example of the best that collaborative project planning has to offer," said Kirchner.

Enlisting flea beetle to combat invasive alligator weed



Story & photos by Brigida Sanchez
USACE, Jacksonville District

“In 1897, alligator weed was first introduced into the continental United States,” said Chelsea Bohaty, a biologist with the U.S. Army Corps of Engineers, Jacksonville District. “It caused a lot of problems in the waterways because these invasive plants began blocking navigation channels, causing flood risk management problems.”

Alligator weed outcompetes native plants throughout the state of Florida. As the plant grows into dense mats, the leaves that it sheds start to decay, robbing the waterbody of the oxygen it needs to support healthy aquatic wildlife.

“In the ‘60s, the Corps of Engineers understood the impact of the invasive species,” Bohaty said.

Invasive species cause economic losses of more than \$138 billion in the U.S. annually, and any given year, the Corps would spend over a million dollars on managing the environmental impacts of invasive species, like the alligator weed, with herbicide treatments.

“The alligator weed flea beetle was a game-changer,” she said.

Utilizing a strategy called Integrated Pest Management, scientists employ a combination of biological, mechanical and chemical control measures to mitigate the impacts of invasive plants.

Biocontrol agents, such as the herbivorous alligator weed flea beetle, go through years of rigorous research to determine whether they will adversely impact native plants and animals.

“The alligator weed flea beetle is a classic success story for aquatic weed biocontrol,” said Nathan Harms, a research biologist at the U.S. Army Engineering Research and

Development Center (ERDC).

Named for its flea-like jumping ability, the alligator weed flea beetle measures only 5-7 millimeters in length as an adult, but according to Harms, there are other attributes that make it a good agent.

“First, both the adults and the larvae feed on the plant,” he said. “The adults can live a long time, and the female can lay thousands of eggs. So a couple of fecund (productive) females with a short developmental time in all life stages, consuming the plant are effective.”

Under the right conditions, the beetle can make a significant impact.

According to the University of Florida’s Entomology and Nematology Department, the alligator weed flea beetle, once fully established, can decimate an acre mat of the alligator weed.

“The beetle has already established itself in Florida. They are doing their job out there right now,” says Bohaty, who coordinates and participates in the collection of the beetles and is the lead biologist for the Corps’ Alligator Weed Flea Beetle Program.

On this particular morning, the collection takes place on Lake Woodruff with five airboats swiftly plowing through the invasive weed.

Each boat goes to a designated location where the vivacious beetles have been scouted feasting on the alligator weed.

There’s a small craft operator and a collector on each airboat, standing on the craft’s bow.

These nimble collectors sweep the net back and forth, catching the beetles in a cloth net. When enough are collected, the insects are placed in cups and packed into a cooler with alligator weed.

Bohaty says, “We can typically collect anywhere from 10,000 to 50,000 beetles a day.”

See **FLEA BEETLE**, page 22



(From left) Mark Haltiwanger, small craft operator, Chelsea Bohaty, invasive species management biologist, and Will Goodhart, heavy equipment operator, U.S. Army Corps of Engineers, Jacksonville District, collect dozens of tiny alligator flea beetles in nets used to control the invasive alligator weed.

FLEA BEETLE

continued from page 21

The beetles are then shipped to Louisiana, Alabama, Arkansas and as far north as North Carolina to state and federal agencies, Corps districts, universities and ERDC.

“We have a valuable resource here at ERDC,” Harms said. “We have genetic diversity of all the alligator weed that is present in the U.S., and it lets us address questions about how the flea beetles might work and how they might control alligator weed given its introduction into different parts of the country.”

Jacksonville, Florida has the right climate to sustain the reproduction of the flea beetles. It is the perfect place to monitor the effects of generations of biocontrol and the ideal place to collect new beetles, in order to send them to places like the U.S. Army Corps of Engineers, Little Rock District in Arkansas where the alligator weed is aggressively taking over.

There, biologists like Cherrie Lee Phillip take the beetles back out into the waters of Arkansas.

Using an airboat, they collect alligator weed samples and demark areas to observe

both the alligator weed and the beetle.

“When we get beetles, [there are] 250 beetles per cup, and that one cup

collaborative efforts that the Corps participates in to help advance the study of the aquatic invasive species.

There are many research questions that ERDC strives to answer: How does the plant evolve, and once introduced how does it spread into an area?

The study helps identify the most efficient and sustainable ways to use the alligator weed flea beetle, especially when colder climates and plant variations become a factor.

The Corps constantly strives to combat the invasive species problem and it embraces the philosophy of early detection and rapid response—finding the best strategies with the least amount of environmental impact.

We understand that complete eradication of an invasive species may not be possible, Phillip

said. But by using the Corps’ collective knowledge, we can employ the best methods to manage the aggressive non-native species to keep them at the lowest feasible levels and reduce their negative impact on native ecosystems and our economy.

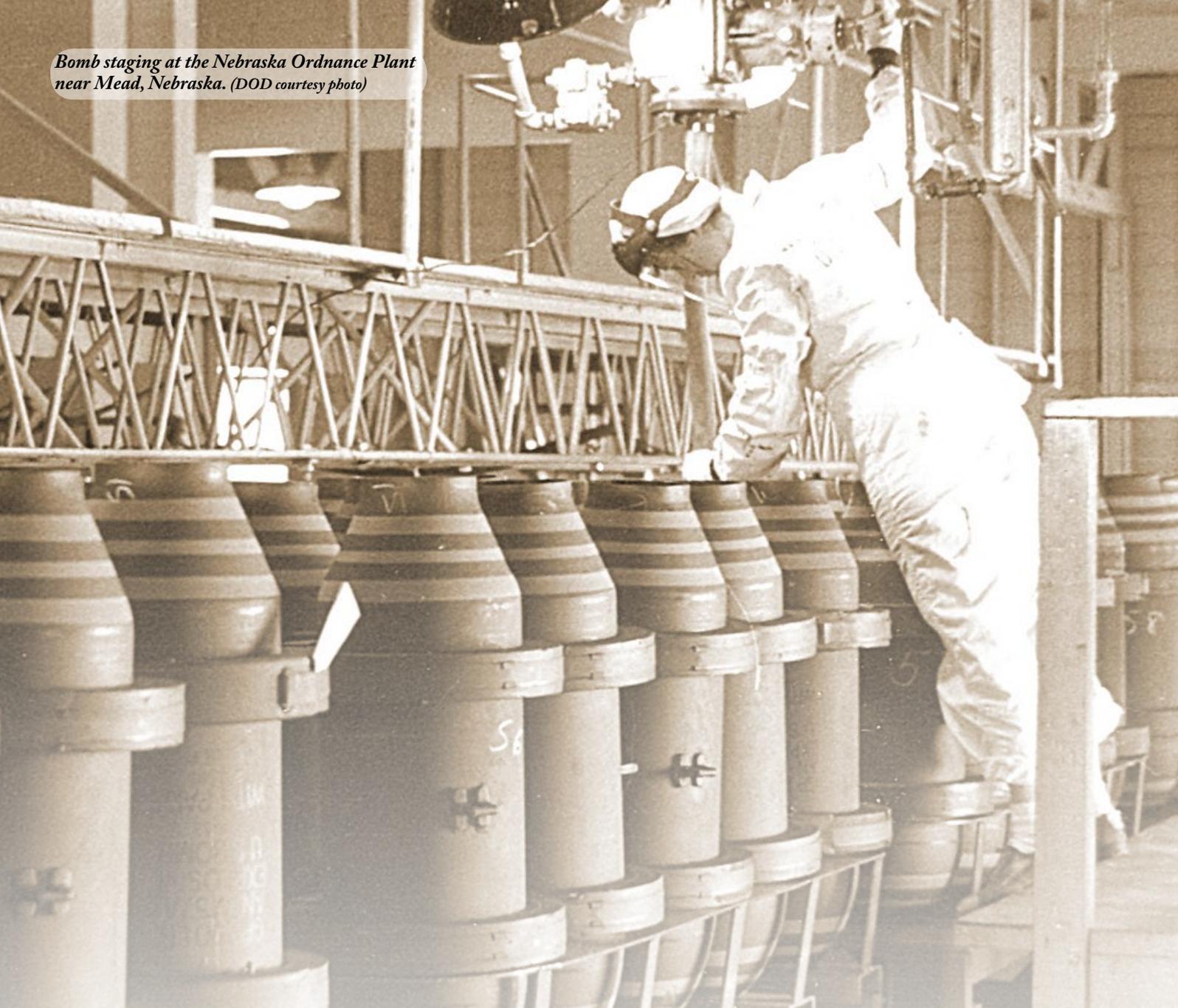


Conservation Biologist Cherrie-Lee Phillip with the U.S. Army Corps of Engineers, Little Rock District collects alligator weed samples at Millwood Lake near Ashdown, Arkansas. (Photo by Preston L. Chasteen)

will cover one acre of the alligator weed,” said Phillip. “Here at Millwood Lake, we have approximately a thousand acres (of alligator weed), but that varies year to year depending on the temperature.”

The cooperation between the district and ERDC is just one of the many

Bomb staging at the Nebraska Ordnance Plant near Mead, Nebraska. (DOD courtesy photo)



Corps innovates, optimizes cleanup efforts

By Molly Boughan
USACE, Kansas City District

The former Nebraska Ordnance Plant, located in rural Nebraska near the town of Mead, was a 17,250-acre load, assemble and pack facility that produced bombs, boosters and shells in support of World War II and the Korean Conflict. The facility included munition load lines and an Atlas Missile Area, added in 1959.

There are currently four groundwater plumes, each up to four miles long.

The primary contaminants within the groundwater are trichloroethene (TCE), a common solvent, and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), an

explosive.

Despite the existing contamination, the former Nebraska Ordnance Plant property is used today for residential, agricultural, and research purposes by the University of Nebraska-Lincoln. The U.S. Army Reserve and Nebraska Air National Guard also own portions of the property.

Groundwater contamination is treated and contained by a 2,500-gallon-per-minute treatment system that combines the following technologies: granular activated carbon, air stripping, and ultraviolet and ozone oxidation. This system has removed more than 49,000 pounds of TCE and RDX and prevents the plume from expanding downgradient.

Plume boundaries are monitored by a network of nearly 400 wells.

Though the existing treatment system removes significant contaminant mass, the groundwater model predicts that contamination will remain above cleanup goals (5 milligrams per liter for TCE and 2 milligrams per liter for RDX) until 2127.

For this reason, the U.S. Army Corps of Engineers and the Formerly Used Defense Sites (FUDS) program are considering optimization options to reduce the overall groundwater cleanup timeframe for this site. The most recent effort is a new source investigation to locate, and test potential treatment options to treat source material.

See **GROUNDWATER**, page 24

The source investigation includes high resolution sampling across the width of the plumes using direct-push profiling with the membrane interface and hydraulic profiling tool (MiHPT) from the surface to the top of bedrock (approximately 100 – 130 feet below ground surface).

This tool provides down-hole information such as hydrocarbon and solvent contamination as well as soil electrical conductance and permeability.

Wherever MiHPT readings indicate the presence of potential contamination, groundwater samples are also collected and analyzed for TCE and/or RDX to verify the MiHPT readings.

A review of the field data, once complete, will help determine what options exist to remediate any potential source areas.

Preliminary results have indicated that TCE concentrations adjacent to the likely Atlas Missile Area source areas (e.g. missile silos, flame pits and the former lagoon) were low or non-detect, suggesting that source material is no longer present near the source.

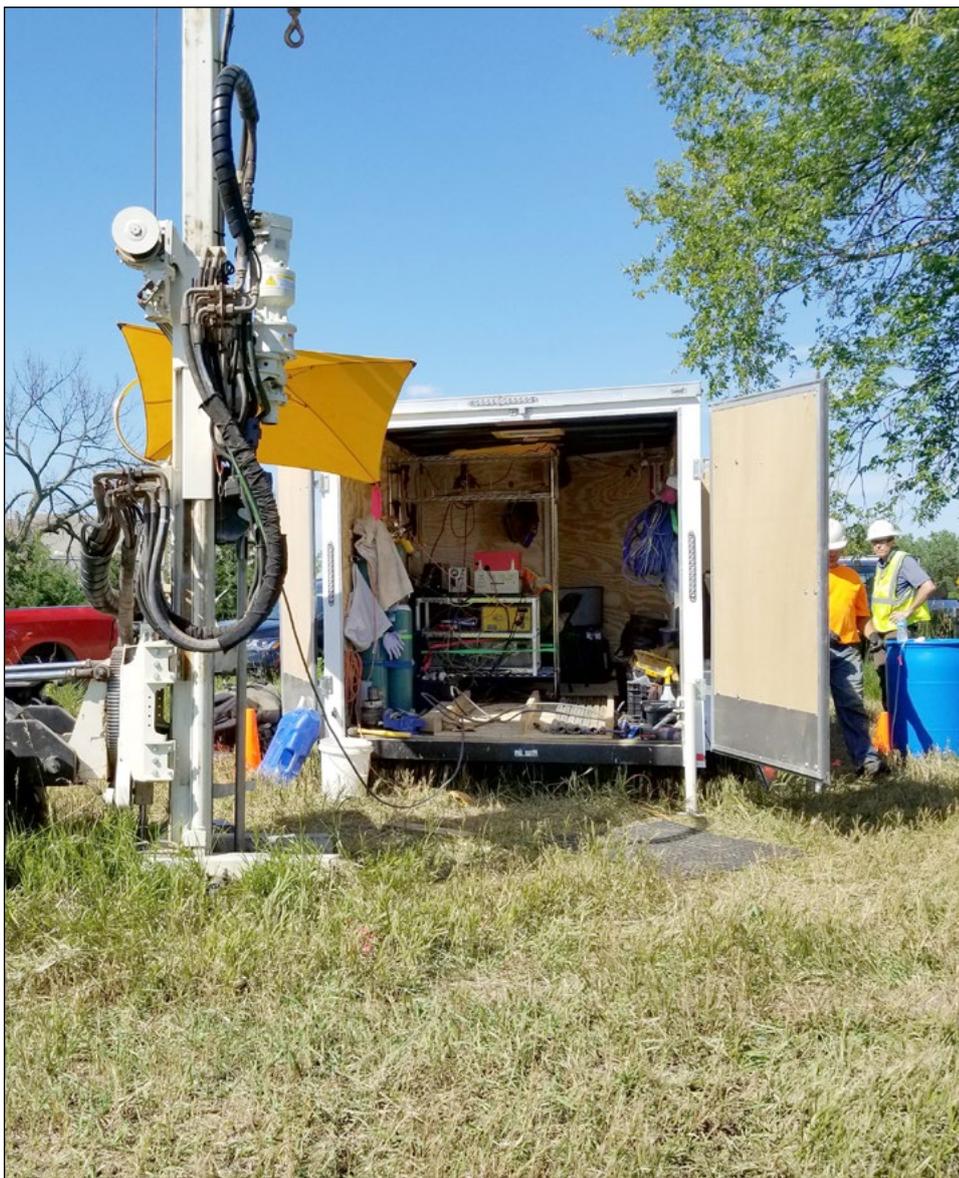
However, all samples, including clean locations, will help refine the groundwater model and improve the accuracy of cleanup timeframe estimates. Source optimization field work at Load Line 1 began in 2019 and will finish at Load Line 2.

Several other optimization efforts have been completed at the former Nebraska Ordnance Plant over the years. In 2019, the ozone generator that treats groundwater at the Advanced Oxidation Process plant was upgraded to increase treatment efficiency and decrease long-term operation costs.

Ultraviolet photolysis, another Advanced Oxidation Process, has been utilized at six locations within the plumes to treat RDX in groundwater prior to it reaching the treatment system. This resulted in an annual savings of 120,000 pounds of carbon as well as the ability to shut down one of the four treatment plants.

In 2015, the U.S. Geological Survey, in collaboration with the Nebraska Water Service, conducted a Heliborne Electromagnetic survey, to collect and interpret widespread information about the aquifer from a helicopter. This data allowed for more informed monitoring well placement.

Between 2014 and 2017, three solar arrays were installed at Mead to improve



The membrane interface and hydraulic profiling tool, or MiHPT, submerges multiple probes approximately 100 feet below ground. Real-time data from these probes were monitored within an adjacent trailer. (Brad Brink, USACE Kansas City District)

energy efficiency of the groundwater treatment systems. From Jan. 1, 2014, through Sept. 30, 2019, the solar arrays have generated over 500,386 kilowatt-hours of energy.

In 2012, a pilot study began within the Load Line 2 groundwater plume in an attempt to add in situ treatment to the overall cleanup process.

This study included enhanced bioremediation (sodium acetate injections for RDX and sodium lactate injections for TCE) and a zero valent iron permeable reactive barrier.

The results of this pilot study were summarized in 2017 and concluded that cost to implement these systems, as well as technical issues associated with the sodium

acetate injections, did not warrant large-scale application.

Regardless of what the most recent source optimization effort reveals, the Corps is committed to finding ways to reduce the overall cleanup timeframe at the former Nebraska Ordnance Plant and other complex groundwater contamination sites across the country.

Kansas City District Project Delivery Team members who have supported this effort include Molly Boughan, project manager; Brad Brink, geologist; Cathy Forç t, industrial hygienist; Jason L'Ecuyer, engineer and technical lead; Janet Matthews-Flynn, former project manager; Mayss Saadoun, assistant project manager; and Wendy Stonestreet, chemist.

Project nears completion with landmark publication

By Holly Kuzmitski

U.S. Army Engineer Research and Development Center

Nearly four years ago, a team led by the U.S. Army Corps of Engineers that now includes 189 scientists, engineers and resource managers from 73 worldwide organizations, gathered to work on a set of international guidelines for utilizing Natural and Nature-Based Features (NNBF).

Today, the project is nearing completion with the publication of “Guidelines on the Use of Natural and Nature-Based Features for Sustainable Coastal and Fluvial Systems.” Expected in 2020, the guidelines will provide practitioners the best available information on the conceptualization, planning, design, engineering, construction and maintenance of NNBF to support resilience and flood risk reduction for coasts, bays and estuaries, as well as river and freshwater lake systems.

“Until this project, there were no comprehensive set of NNBF guidelines available to support practitioners and stakeholders interested in these types of solutions,” said Dr. Jeff King, deputy national lead for the Engineering With Nature Initiative.

A part of the EWN Initiative, NNBF refers to those coastal and fluvial, or river system, landscape features, either natural or nature-based, that produce flood risk management and other benefits. Natural features are those created by nature; nature-based features are engineered by people to mimic natural conditions. NNBF projects provide multi-purpose functions related to flood and storm damage reduction and ecosystem restoration. They are designed to simultaneously deliver economic/engineering, social and environmental benefits.

Examples of coastal NNBF include beaches and dunes, salt marshes, oyster reefs and barrier islands. Fluvial NNBF, in addition to floodplain restoration in rivers and streams, encompasses a range of features to detain and retain floodwaters or otherwise create space for water.

“The public increasingly has an interest in these types of projects,” King said. “Rather than looking solely at traditional infrastructure, knowing that it may have unintended impacts down the road, communities are saying, ‘Mother Nature does such a great job at solving problems; we should really be looking at what she does and simulate it.’”

EWN National Lead Dr. Todd Bridges described how the National Oceanic and Atmospheric Administration’s National Centers for Environmental Information tracks economic damages exceeding \$1 billion that result from weather-climate events.

“Since 1980, there have been 219 weather-climate catastrophes that have collectively produced \$1.5 trillion in damages; that’s a big number,” Bridges said.



“We have to ask, what strategies can we employ to reduce future impacts?” he said. “We can’t build walls everywhere. There are practical limits to the use of conventional infrastructure. We need to identify ways to leverage natural systems in combination with structural measures.”

The Corps is hearing from local sponsors who are increasingly interested in integrating NNBF into projects.

“We have these major functional areas within the Corps: planning, engineering and operations,” Bridges said. “We’re addressing all of those topics within the guidelines in a way that demonstrates and documents the design, performance and quantified benefits of NNBF.”

King sees this as a newly developing field of engineering.

“The U.S. Army Engineer Research and Development Center is doing research and field studies to answer questions about the design and associated benefits of these features,” King said. “Several Corps districts are very hungry to advance NNBF practices, but are challenged to quantify why the practices should be incorporated into projects.”

Illustrating the international collaborative nature of the effort, contributors and co-leads for the project include the United States, Canada, the

Netherlands, the United Kingdom and New Zealand; additional contributors are from countries such as the Democratic Socialist Republic of Sri Lanka and the Republic of South Korea.

One international collaborator is Dr. Jo Guy, the Environmental Agency (EA) of England’s international lead for natural flood management (the United Kingdom’s equivalent of the NNBF). EA personnel are contributing to six chapters in the publication.

When asked why the EA has an interest in contributing to the guidelines, Guy mentioned that the EA intends to be a net-zero carbon emissions organization by 2030.

“NNBF will allow us to achieve this goal and deliver solutions that make communities resilient to flooding and able to adapt to the effects of climate change,” Guy said.

The guidelines are written for a varied audience, so that a city manager or community developer who may not have a technical background will gain critical knowledge to pursue these types of projects and to assemble the appropriate technical teams.

The NNBF guidelines will be a living document hosted on a website and will be approximately 600-pages-long, including 19 chapters divided into three sections: Overarching Topics, Coastal Features and Fluvial Features. Case studies will also be integrated to demonstrate the application of features.

“We anticipate revisions and additions to the publication every three to four years; this is such a developing body of knowledge,” King said. “We will also write a printable 20-page summary for higher-level decision makers.”

“There is a large and growing base of knowledge, experience and expertise around the world in using NNBF,” Bridges said. “With this project, we are leveraging that base to produce guidelines that will benefit the entire international community of practitioners.”

For more information about the EWN initiative, please visit www.engineeringwithnature.org.



BUILDING STRONG!

Innovative construction methods increase levee, flood wall confidence

By Andre Billeaudeau
USACE, St. Louis District

A massive boulder rests at the dusty intersection of Broadway and Mound as a remnant of “La Grange de Terre” or the “Great Mound.” This tribute marks the location of the largest of 27 sacred Mississippian earthen structures which not only provided the etymological source of America’s most important river but also created St. Louis’ secondary name as “Mound City” – a salute to the river region’s first influential builders.

From atop “Mound City’s” coffee-colored boulder one can clearly see its contemporary engineering cousin, a massive earth-and-concrete structure called the East St. Louis Flood Protection Project. This three-mile section of levees and floodwalls, part of the 37 miles in the larger system, stand guard in providing a trusted line of demarcation separating 280,000 people who live and work behind it from the naturally wandering and often-swollen Mississippi River.

Although successful at withstanding record floods in 1993, 2011, 2017 and again in 2019, the long-term health of the venerable East St. Louis project came into sharp focus in the wake of Hurricane Katrina where an American Society of Civil Engineer External Review made the re-evaluation of levee and floodwall standards a cornerstone philosophy in their 2007 New Orleans flood-based report.

This same year, East St. Louis underseepage became a catalyzer in bringing engineers in three contiguous counties of the Southwestern Illinois Flood Prevention District (SWIFPD) together in taking the first steps towards implementation of a joint plan to both avoid levee decertification and to launch innovative improvements to their weathered flood control barrier.

By joining forces and compiling layers of detailed input, the SWIFPD, the U.S. Army Corps of Engineers, and other state and local agencies have been able to provide a unique solution that works around the high density and highly urbanized environment where a maze of critical city services, infrastructure, employment, housing and transportation needs had to be considered and respected at every phase.

The SWIFPD’s teamwork and focus paid off as the \$156 million total project contract award that was envisioned back in 2007 will soon begin construction. Completion of the larger East St. Louis Flood Protection Project contract, which includes the forthcoming insertion of the deep cutoff wall, will mark it as the largest St. Louis District region’s greatest life and property risk reduction consequences since the 1987’s Mel Price Levee Project.

See **BRIDGE**, page 28

Meanwhile, Missouri native and the Corps' own Christopher Wheeler, is the East St. Louis Flood Protection Project's geotechnical engineer and technical lead. He confirmed that routine flooding had produced increased instances of poor performance where saturation weakened the East St. Louis levee foundations.

To this point, Wheeler produced multi-colored bottom contour and three dimensional maps emphasizing where the underseepage is currently degrading the integrity of the project's levees and floodwalls. The improved system will protect \$13.4 billion in infrastructure and, with its 100-year certification, will offer those living behind it less expensive flood insurance rates among other advantages.

The deep cutoff wall team is armed with these latest three dimensional maps highlighting the use of cutting edge technology that can identify exactly where levee underseepage is occurring so as to target where to install the project's deep cutoff walls.

"Our deep cutoff wall is specifically designed to stop the corrosive underseepage and will run for 4,600 feet," explained Tracey Kelsey, St. Louis District's Metro East Project program manager, tasked with carrying out a multi-layered plan of attack.

Kelsey emphasized the complexity and innovation of the team's plans by describing the "window" approach where the cutoff wall's construction slurry will be poured to specifically allow for city utilities to stay in place by passing through these windows.

This window strategy includes leaving the region's drinking water intake pipes and pump station discharge pipes to stay in place during construction.

"By utilizing this approach, we can eliminate the need for such work-around solutions such as diesel generated 'up and over' freshwater pumping. These at-depth windows are the answer," said Kelsey who also pointed out the cost savings, environmental impact (no additional diesel pump carbon discharge produced) and customer service consistencies provided by their plan.

Kelsey also noted that in addition to windows, the cut off wall will reach deeper than the current levee-and-floodwall system. It's a strategy that necessitates excavating at the riverside levee toe going down 140 feet to reach and then bond with bedrock.



(USACE courtesy photo)

The region's first success at cut off wall construction took place at Wood River, Illinois.

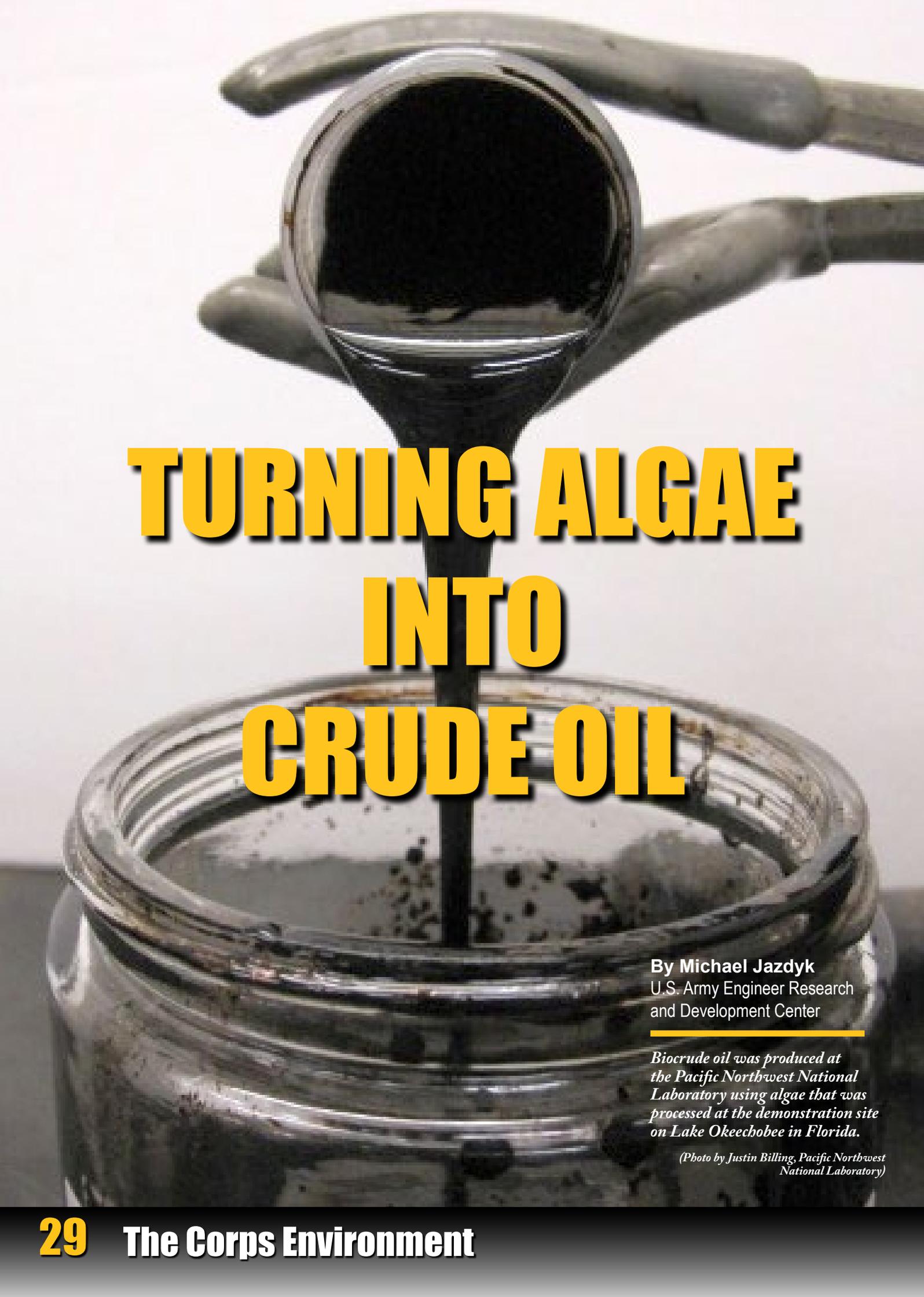
This rock-to-wall bond will limit the river's ability to saturate the base of the levee system and is reminiscent of securing the nearby James Eads Bridge footings where both projects face the loading pressure of the Mississippi's 1.68 million gallons passing per second at normal stage and as much as four times that during floods.

While Eads lost 14 workers due to the complications of working at depth during the bridges construction in the 1800s, the East St. Louis Flood Protection Project's plan relies on mechanical excavation utilizing self-hardening slurry comprising soil, cement, water, blast furnace slag, and an advanced admixture of Bentonite, which is both efficient under pressure and cost effective. This specialized mix has a delayed hardening process to allow for the at-depth excavation to bedrock before it hardens into

the seepage barrier.

While many of Ead's contemporaries said his innovative bridge couldn't be built, the spirit of Essayons (Let Us Try) prevailed in this case, and in seven years he provided middle Americans an engineering wonder that's still in use today.

Likewise, the diverse partners of the East St. Louis Flood Protection Project will honor the spirit of St. Louis engineering, the Great Mound builders and Eads, in overcoming location and design complexities through their team-based, novel and innovative construction methods. And while the deep wall construction is only the first of many phases as part of the \$156 million project, East St. Louis residents and employers can plan on gaining increased levee and flood wall confidence as ground is broken in 2020 on this long-awaited solution.

A close-up photograph showing a gloved hand holding a spoon filled with a thick, dark, viscous liquid. The liquid is being poured into a clear glass jar below. The background is a plain, light-colored surface.

TURNING ALGAE INTO CRUDE OIL

By Michael Jazdyk
U.S. Army Engineer Research
and Development Center

*Biocrude oil was produced at
the Pacific Northwest National
Laboratory using algae that was
processed at the demonstration site
on Lake Okeechobee in Florida.*

*(Photo by Justin Billing, Pacific Northwest
National Laboratory)*

Research center exploits science, converts algae into biocrude oil

The use of technology to remove Harmful Algal Blooms (HABs) from water bodies has historically been limited by costs and challenges with managing the resulting large quantities of algal biomass.

To this end, the U.S. Army Engineer Research and Development Center is performing research to assess and optimize the scalability of a promising approach for algae removal that turns the algal biomass into useful products like biocrude oil.

HABs are having negative impacts on ecosystems and economies across the nation, at times posing health threats that can shut down water bodies for recreational use or present risks and increased costs for drinking water supplies.

The U.S. Environmental Protection Agency estimates economic impacts of nutrients and HABs on tourism alone to be \$1 billion per year.

In addition to having the potential to emit potent toxins, HABs can contribute to nutrient and biomass loads on downstream water bodies. As such, there is a growing interest in the ability to remove HABs from the water at very large scales.

The research is being performed alongside other complimentary HAB-focused projects funded and managed through ERDC's Aquatic Nuisance Species Research Program (ANSRP).

"The ANSRP supports research that will identify and develop improved strategies for early detection, prevention,

and management techniques and procedures to reduce the occurrence and impacts of HABs on our nation's waterways," said Dr. Linda Nelson, associate technical director at ERDC's Environmental Laboratory and ANSRP program manager.

The ANSRP is the primary research and development program for addressing invasive and nuisance aquatic species that impact navigable waters, infrastructure and associated water resources.

In July 2019, ERDC researchers tested the Harmful Algal Bloom Interception, Treatment and Transformation System (HABITATS) on Lake Okeechobee in Florida. The goal of this research is to demonstrate a scalable capability to remove algae and nutrients from large water bodies and develop resource recovery methods that enable efficient and safe management of the resulting biomass.

The HABITATS approach intercepts concentrated algae in water bodies, cleans the water while further concentrating and separating the algae, and transforms the highly concentrated sludge into useful products such as biofuel while destroying any potential harmful toxins.

A dissolved air flotation process developed by engineering firm AECOM was successfully demonstrated for high throughput concentration of the algae, leaving clean water behind.

Samples of concentrated algae were

sent to the Department of Energy's Pacific Northwest National Laboratory for conversion to biocrude oil using a high throughput hydrothermal liquefaction process also destroying any potential toxins in the sludge.

"The HABITATS research project is developing a capability to remove and efficiently dispose of large quantities of algal biomass and entrained nutrients, which may someday help protect ecosystems and communities from HAB events," said Dr. Martin Page, material engineer at ERDC's Construction Engineering Research Laboratory and HABITATS project manager.

"By recovering resources in the process, the positive environmental impacts are achieved with reduced operational costs and environmental footprint," he said. "Those aspects are key to developing a truly scalable tool that can be used by stakeholders as part of a broader strategy to mitigate HABs."

Initial findings of HABITATS are published in a technical report that can be accessed through the ERDC webpage at: <http://dx.doi.org/10.21079/11681/35214>.

The ANSRP will continue collaboration with federal and state agencies, academic institutions and other stakeholders on HAB research in an effort to minimize duplication of effort and maximize efficiencies.



Concentrated algae is separated into one tank while clarified water is poured into another during a test of the Harmful Algal Bloom Interception, Treatment and Transformation System on Lake Okeechobee in Florida. After additional testing, the clean water is then returned to the waterbody, and the algae biomass is repurposed for use in a variety of other products such as biofuel and fertilizer. (Photo by: Ty Erickson)

Black Carp captured by Bonnet Carre Spillway

By Linda Nelson and Jack Killgore
U.S. Army Engineer Research and
Development Center

The U.S. Army Engineer Research and Development Center's Environmental Laboratory Fish Ecology Team recently caught five black carp while rescuing federally endangered pallid sturgeon entrained through the Bonnet Carre Spillway in Louisiana.

Black carp are one of four invasive Asian carp species in the United States. This was the first such capture documented

this far down the Mississippi River.

The team is also tagging and releasing bighead, silver and grass carp to monitor potential dispersal pathways via Lake Pontchartrain, which is the receiving waterbody from the Bonnet Carre Spillway.

Bighead and silver carp now occur in the Pearl River, the most likely pathway being inter-basin transfer during floodway operations in 2008 and 2011.

Collection of black carp at the Bonnet Carre suggest that floodway operations may present a risk of the species'

introduction into the Pearl River.

Black carp are molluscivores and could possibly threaten endangered mussels that populate in the Pearl River and other drainages.

The Fish Ecology Team is also researching salinity tolerances of Asian carp with funding from the Aquatic Nuisance Species Research Program.

To date, the data suggest that bighead carp can survive salinity levels from 10-12.5 parts per trillion, indicating brackish water may not limit Asian carp movement.



(Photo by Linda Nelson)

Steven George, Environmental Laboratory fish biologist, holds a 37-pound black carp caught with a net recently at the Bonnet Carre Floodway in Louisiana.

Course preps engineers for threat

By David San Miguel
U.S. Army Engineering and Support Center, Huntsville

It's the subject of sci-fi movies – a rogue nation detonates a nuclear weapon high above the Earth's surface and effectively shuts down electrical grids and supply systems, crippling the nation's critical infrastructure and plunging millions into the dark ages.

According to Jerrell Henley, electrical engineer with the U.S. Army Engineering and Support Center, the threat from such a high-altitude electromagnetic pulse, or HEMP, generated by nuclear detonation or solar flare is real, and it's important that our engineers understand it and learn how to mitigate its effects on the nation's electrical infrastructure.

Henley says that path forward includes the U.S. Army Engineering and Support Center developing a course to educate engineers on their responsibilities for HEMP projects, including the protection, testing, and project acquisition and execution activities throughout the project life cycle.

Registration has already begun for the initial four-day Proponent-Sponsored Engineer Corps Training course slated for April 6-9, 2020, at the USACE Learning Center in Huntsville, Alabama.

"This PROSPECT course (ULC-015) will familiarize students with the basic requirements of HEMP testing and HEMP protection techniques, including live demonstrations of testing and test equipment," Henley said. "They will also gain a better understanding of the national threat posed by a HEMP event, including the postulated sequence of events which could occur."

The effects of these electromagnetic pulses were fully identified in 1962 following a high-altitude nuclear test over the Pacific Ocean. There, though the explosion occurred some 800 miles away, radio stations and electronic equipment were disrupted throughout parts of Hawaii.

Since then, it has garnered increased attention as more nations gain nuclear capability.

Recognizing HEMP's potential impact to the nation, the president issued an executive order on March 26, 2019, putting the government and private sectors on a path to fostering sustainable, efficient and cost-effective approaches to improving the country's resilience to the effects of electromagnetic pulses.

"Human-made or naturally occurring electromagnetic pulses can affect large geographic areas, disrupting elements critical to the nation's security and economic prosperity, and could adversely affect global

commerce and stability," the order states. "The federal government must foster sustainable, efficient and cost-effective approaches to improving the nation's resilience to the effects of EMPs."

Citing the October 2018 Department of Homeland Security's Strategy for Protecting and Preparing the Homeland Against Threats of Electromagnetic Pulse and Geomagnetic Disturbances, Henley said that the effects of a high altitude magnetic pulse caused by nuclear detonation above the Earth's surface or a naturally occurring solar flare can literally black out and permanently damage electronic equipment, shut down the nation's electric grid, communications equipment, water and wastewater systems and transportation modes.

"This means no heating or cooling, no light, no water, and in a matter of days, no access to food or medications, for millions of people," he said. "It would take years before we're able to restore electricity to the country."

Though, the threat against the United States is hard to assess, Henley explained that it is important that engineers understand their role in hardening the nation's critical infrastructure.

As a precursor to the training, the Center hosted a dry run, Nov. 5-8, 2019, for a select

group of engineers to critique and refine the curriculum prior to its initial launch of the course in April.

Representatives of the Reliance Construction Management Company, a leader within the electromagnetic pulse industry, were invited to provide Huntsville Center engineers an in-depth demonstration and open dialogue discussion of the importance of quality control, acceptance and verification testing for HEMP projects.

Additionally, the participants broadened their knowledge on weld inspections, shielded enclosure leak detection systems, low level testing, shield effectiveness, pulsed current injection testing and continuous wave immersion equipment.

Individuals may register now by going to the ULC homepage at <https://ulc.usace.army.mil/> and click on the link to the 2020 Class Schedule.

Corps, Wild Whoopers team up to save conservation icon

Story & photo by David Hoover
USACE, Kansas City District

The whooping crane is one of the most endangered birds in the world and an iconic symbol of America's conservation movement. Standing 5-foot-tall and with a 7-foot wing span, it is the tallest bird in North America.

Once fairly common, the species was reduced to just 16 birds by 1943. Market hunting and indiscriminate shooting, along with habitat loss led to the decline of the species.

Conservation efforts in the United States and Canada have seen the population increase to an estimated 538 birds in 2019.

The Aransas-Wood Buffalo population of whooping cranes nests and rears their young in Wood Buffalo National Park, Alberta/Northwest Territories, Canada, during spring and summer. After the chicks fledge, adults and juveniles migrate 2,500 miles through seven states to the U.S. Fish and Wildlife Service's Aransas National Wildlife Refuge on the Gulf Coast of Texas where they spend the winter.

Cranes must stop 15 to 30 times to rest and feed during their migration. Radio telemetry conducted by the U.S. Geological Survey and direct field observation has documented migration stopovers that often occur in habitats associated with water resources development projects managed by the U.S. Army Corps of Engineers throughout the migration corridor.

The founder and president of the non-profit Friends of the Wild Whoopers, Chester McConnell is dedicated to natural resources conservation and to the recovery of the federally endangered species.

He realized that a lot of conservation efforts had been directed towards the nesting grounds in Canada and the wintering grounds in Texas, but that much less effort had been directed towards habitat conditions along the migration corridor.

McConnell also realized that the Corps' water resources development projects represented some of the greatest extent of potential whooping crane habitat on public lands within that corridor.

To that end, McConnell worked with Dr. Richard Fischer of the U.S. Army Engineer Research and Development Center; Jeremy Crossland, USACE Headquarters land uses and natural resources program manager; and Michael Champaign, USACE, Fort Worth District biologist, to develop and finalize a Memorandum of Understanding between the Corps of Engineers and FOTWW to assess whooping crane migration stopover habitat and identify measures to maintain or improve that habitat on water resources development projects in the migration corridor.

Annual north and southbound migration pathways of the Aransas-Wood Buffalo whooping crane population include portions of the Corps' Omaha, Kansas City, Tulsa, Fort Worth

and Galveston districts.

USACE and FOTWW biologists have completed field assessments at 34 Corps lakes within this migration corridor.

These initial habitat assessments have confirmed that Corps lands and waters currently are providing important migration stopover habitat, and with some minor habitat management actions those benefits can be increased.



Wetland and shoreline habitat work typically also provides benefits to numerous other species of native wildlife including waterfowl and shorebirds.

McConnell suggests that migratory stopover habitat at Corps lakes may especially be needed to support the needs of whooping cranes during drought years when surface water is reduced along the migration corridor. A primary goal of the partnership is ensuring that ongoing management of these areas continues to provide high-quality stopover habitat. This partnership is consistent with federal agency responsibilities under the Endangered Species Act, which states that federal agencies should use their existing authorities to assist in the recovery of listed species.

Through this partnership, teams recently completed habitat assessments at the six Missouri River mainstem reservoirs: Lewis and Clark Lake, Lake Francis Case, Lake Sharpe, Lake Oahe, Lake Sakakawea and Fort Peck Lake, including Pipestem Lake in

the Omaha District.

McConnell met with the Corps' natural resources managers to discuss the life history of whooping cranes and the requirements for migration stopover habitat. Visits included the team touring typical areas on the lakes that currently served or could be managed to provide whooping crane migration stopover habitat.

During these visits, he observed large expanses of suitable migration habitat within the mainstem reservoirs and that the extent was primarily dictated by the varying lake levels. McConnell further noted that the control of invasive species, especially phragmites, was needed to maintain suitable habitat. Other management actions identified were to curtail illegal off-road vehicle use on sandbar/shoreline areas and work with utility companies to place strike protectors on overhead lines on/ adjacent to suitable habitat.

According to McConnell, site visits by the FOTWW biologists have increased the natural resource management staff's awareness of whooping crane habitat needs, management options and agency responsibilities under the Endangered Species Act.

He noted that with projected increases in numbers of whooping cranes, Corps projects will play an ever increasing role as migration stopover habitat, which will hopefully contribute to the eventual recovery of this iconic conservation species.





District cleans up contaminated lands, eyes future for green solar power site

By JoAnne Castagna, Ed.D.
USACE, New York District

In 1945, following the United States' detonation of two atomic bombs over the Japanese cities of Hiroshima and Nagasaki, World War II ended and the Atomic Age began.

Research on the uses of atomic power also started and the forming of the U.S. Atomic Energy Commission was created to foster this.

As part of its work, the commission licensed National Lead Industries in Colonie, New York to manufacture some items for them using thorium, uranium and depleted uranium.

As a result of this production, the land and water on and around the site became contaminated.

The U.S. Army Corps of Engineers, New York District has cleaned up the property and the land is now being eyed as a possible location for a green solar power site.

"This is a milestone project because it is the 100th legacy site to be cleaned up and added to the Department

of Energy's Legacy Management Program," said Jim Moore, project manager, New York District.

"It's the second legacy project that the Army Corps' New York District has cleaned up and transferred to the DOE," he said. "This reflects the sustained progress by the DOE in partnership with the Army Corps in managing the responsibilities associated with the environmental waste legacy of World War II and the Cold War Era."

The National Lead Industries was a company situated on approximately 11 acres of land in the Town of Colonie in Albany County, New York.

Active from 1937-1984, the company manufactured a number of items including ones for the AEC from the 1950's through 1984. Thorium, uranium and depleted uranium were used to manufacture shielding components, aircraft counterweights, experimental nuclear reactors and artillery projectiles.

This production resulted in residual radiological contamination of the site's land and groundwater.

Neighboring properties were also impacted by contaminated dust particles from the burning of depleted uranium chips. This occurred before the United States had environmental laws enacted.

In 1984, the New York State Supreme Court closed the company due to environmental concerns, and subsequently ownership of the site was transferred to DOE.

At the time, DOE oversaw the Formerly Utilized Sites Remedial Action Program and began cleaning up what was named the Colonie FUSRAP Site, which included demolishing all of the site's buildings.

The FUSRAP was established by the federal government in 1974 to clean up low-level radioactive contamination from the nation's early atomic research program.

In 1997, Congress transferred responsibility of the FUSRAP mission to the U.S. Army Corps of Engineers and the agency continued the cleanup responsibility.

See **FUSRAP**, page

The Corps excavated and disposed of 135,000 cubic yards of soil contaminated with radionuclides, metals and volatile organic compounds. Approximately, two feet of clean soil was placed over the affected areas.

A groundwater monitoring program was also put in place to measure the progress in using natural processes to address contaminants in groundwater.

The site and nearby residential and commercial properties were also investigated for contaminated dust particles.

This contaminated land is in an urban area, near residences and businesses.

Throughout the cleanup process, the

Corps ensured that nearby residents and business owners were well-informed and kept safe during the cleanup.

This was carried out through the use of dust suppression efforts during active excavations and air monitoring at the excavation locations and along the perimeter of the property.

According to Moore, the most common concern of the community was the safety of the land.

“The land is safe and suitable for reuse,” he said. “Repeated investigations of the site and surrounding properties show that all of the land has been remediated to appropriate standards, and the New York State Department of Health concurs.”

This fall, the Corps transferred the completed project to the DOE’s Office of Legacy Management that strives to identify beneficial reuse opportunities for its sites. The plan for Colonie is to turn it into a green solar power site.

“This project was my first assignment when I joined the Army Corps in 2001 and it’s great to see our mission being accomplished,” Moore said. “A lot of very talented people worked very hard to accomplish this task and every one of them deserve recognition. I’m proud to be part of this success story.

“Most importantly, the land is safe once again and will serve its community in a beneficial capacity,” he said.



Largely through the cleanup efforts of the USACE, New York District, the property in Colonie, New York, is currently being eyed as a possible location for a green solar power site.

Lawrence ‘Leigh’ Skaggs retires

Environmental ‘hero’ recognized for dedication, service

By **Fay Lachney**
USACE, Headquarters

In December 2019, Lawrence “Leigh” Skaggs, one of the U.S. Army Corps of Engineers’ foremost experts in ecosystem restoration, retired after 32 years of public service.

Skaggs has served in many roles within the Corps and is one of the few employees who has served at a district, division, the Institute for Water Resources (IWR), and the U.S. Army Corps of Engineers Headquarters.

At the Jacksonville District, Skaggs was a leading team member on the Comprehensive Everglades Restoration Plan (CERP). There, he was involved in plan formulation and evaluation for the Indian River Lagoon – South, the Everglades Agricultural Area, and the C-43 West Basin Storage Reservoir projects.

Skaggs was the plan formulation lead for South Pacific Division from 2010-2015, and served as the division’s acting planning chief in 2014. At the division, he reviewed projects and advised project teams from the Albuquerque, Los Angeles, Sacramento and San Francisco districts, and provided technical, policy, and procedural advice, training and mentoring. Some of the ecosystem restoration projects he supported include the South San Francisco Bay Shoreline; Dry Creek, California Ecosystem Restoration; Los Angeles River Restoration; Malibu Creek, California Ecosystem Restoration; Tres Rios, Arizona Ecosystem Restoration; Yuba River Ecosystem Restoration; and Espanola, New Mexico Ecosystem Restoration.

While at U.S. Army Corps of Engineers Headquarters, Skaggs was a member of the Office of Water Project Review, lending his expertise to initiatives such as the Louisiana Coastal Area Program; CERP; Hudson-Raritan Ecosystem Restoration in New York; Anacostia Watershed Restoration in Prince Georges County, Maryland; St. Louis Riverfront Meramec/Big River/St. Louis Mississippi Riverfront in Missouri and Illinois; Arkansas River

Corridor Ecosystem Restoration in Oklahoma, as well as continuing to support several South Pacific Division projects.

Throughout his career, Skaggs taught multiple planning courses, including Planning Principles and Procedures, Plan Formulation, Planning for Ecosystem Restoration, and the Plan Formulation and Evaluation Capstone courses. In addition, he also served as an instructor for the Ecosystem Restoration module of the Planning Associates program.

According to Gregory Miller, operations director for the U.S. Army Corps of Engineers Ecosystem Restoration Planning Center of Expertise, Skaggs

economist at IWR, he was one of the original thought-leaders and creators of the IWR Planning Suite.

Rooks explained that the software was originally created to support planning and automation of calculations necessary to perform cost-effectiveness and incremental cost analysis (CE/ICA).

“However, it was Leigh’s foresight and initiation of work on an annualization calculator, multi-criteria decision analysis (MCDA) tool, and consideration of uncertainty that led to the incorporation of the annualizer, MCDA, and uncertainty modules into the software as we know it today,” Rooks said.

“We would have been years behind without his leadership and innovative mindset,” Rooks said. “It is difficult to think about plan formulation, ecosystem restoration, or CE/ICA without invoking Leigh’s name. He has been a mentor to many and pretty much taught everyone who now teaches this tool.”

This software tool is critical for ecosystem restoration planning because it is the only certified planning model for CE/ICA, calculation of average annual monetary and non-monetary benefits and monetary costs, multi-criteria decision analysis, and uncertainty and risk-informed CE/ICA. Since it became available, ecosystem restoration studies have used it to help identify a recommended restoration plan.

According to Shawn Komolos, a senior water resources planner at IWR, “His fingerprint is indelibly etched into the practices and tools used by virtually every Corps planner working in the field today.”

Though widely respected in both the environmental and plan formulation communities of practice because of his expertise in ecosystem restoration planning, Skaggs is chiefly recognized for almost three decades of teaching the planning community.

His integrity and commitment to the Corps’ missions resulted in the Planning Community of Practice recognizing him with the 2018 Planning Champion Award.



(Photo by Nancy Brighton)

Stacey Brown, USACE Planning and Policy Division chief, presents Leigh Skaggs with the Meritorious Civilian Service Medal.

inspired multiple generations of Corps civil works employees, and has been instrumental in the development of numerous ecosystem restoration projects across the country.

“But more importantly,” Miller said, “his lasting impact will be felt in the work of the hundreds of planners he has trained in the fundamentals of environmental planning.”

Skaggs has always had a specific niche in the area of environmental benefits.

According to Erin Rooks, a senior



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Karla Langland
USACE, Headquarters

All Army civilians are assigned to a career program. Career Program 18 (Engineers and Scientists – Construction) is one of 32 career programs available for Army civilian employees.

As do all of the career programs, CP-18 has several missions. CP advisors are there to help produce career maps to facilitate career planning. They address competency gaps, develop and execute gap close strategies, and look to future

workforce requirements.

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