The Corps
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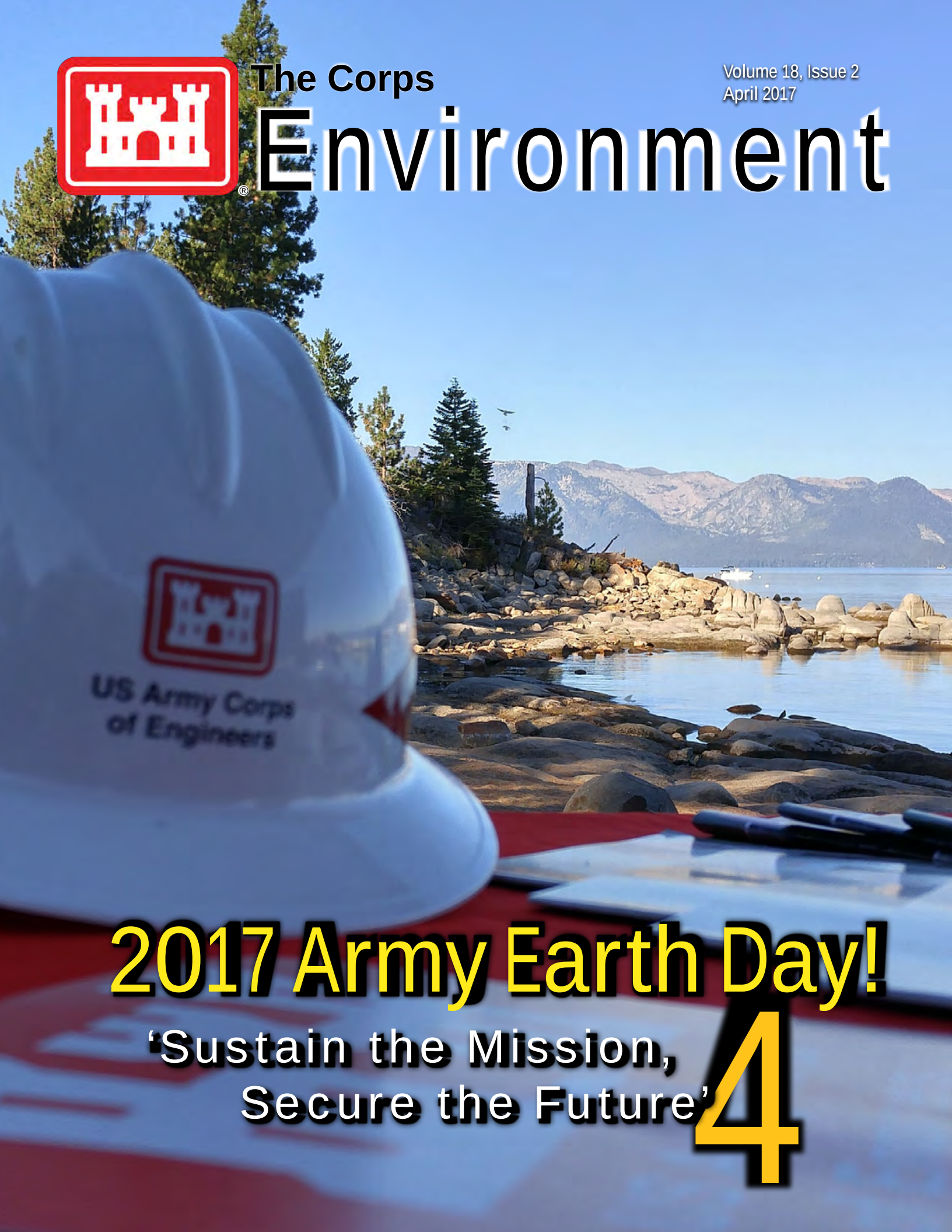


## 2017 Army Earth Day!

'Sustain the Mission, Secure the Future'

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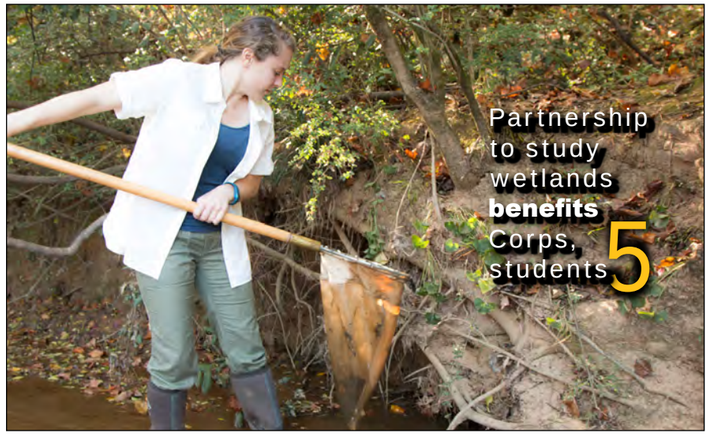


*Clemson University student, Rebeckah Hollowell, uses a net to catch macroinvertebrates. She is part of the U.S. Army Corps of Engineers' school partnership studying the Hunnicutt Creek.*

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The Corps Environment

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**The Corps Environment is an online quarterly publication produced by the U.S. Army Corps of Engineers as an unofficial news magazine under the provisions of AR 360-1. The purpose of this publication is to provide information about USACE and Department of the Army environmental actions, issues, policies and technologies.**

**Opinions expressed are not necessarily those of the U.S. Army. Inquiries can be addressed to U.S. Army Corps of Engineers, ATTN: CEHNC-PA, P.O. Box 1600, Huntsville, AL 35807-4301. Telephone: 256-895-1150.**

**Submissions**

**The Corps Environment editorial staff welcomes submissions with an environmental, sustainability or energy focus from USACE and Army units worldwide. Send articles, photos, events, letters or questions to the editor at CEHNC-PA@usace.army.mil.**

**Deadline for submissions:**

**Nov. 15 (January) Feb. 15 (April)**

**May 15 (July) Aug. 15 (October)**

Whenever possible, please enjoy *The Corps Environment* without using paper.

**www.usace.army.mil/Missions/Environmental.aspx**


# Army announces 2016 environmental award recipients

*U.S. Army Environmental Command*

**The Army recently announced the winners of the fiscal 2016 Secretary of the Army Environmental Awards.**

**Five installations and three teams received the highest honor in the field of environmental science and sustainability conferred by the Army.**

**"These awardees clearly demonstrate how fully engaged leadership, coupled with sound environmental practices and innovative approaches, can directly enhance Army readiness," said Eugene Collins, Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health.**

**This year's nominations included a wide variety of winning solutions, ranging from alternative remediation strategies for accelerated cleanup to innovative land and pest management practices, all demonstrating mission-enhancing environmental stewardship.**

**The Army's fiscal 2016 award winners are:**

- **Natural Resources Conservation (large installation)**
  Minnesota Army National Guard, Camp Ripley, Little Falls, Minnesota
- **Cultural Resources Management (small installation)**
  Virginia Army National Guard, Camp Pendleton, Blackstone, Virginia
- **Sustainability (non-industrial)**
  Hawaii Army National Guard, Honolulu, Hawaii
- **Environmental Quality (overseas installation)**
  U.S. Army Garrison, Bavaria, Germany
- **Environmental Restoration (installation)**
  Fort Bragg, North Carolina
- **Cultural Resources Management (team/individual)**
  Alabama Army National Guard, Montgomery, Alabama
- **Sustainability (team/individual)**
  Pennsylvania Army National Guard, Fort Indiantown Gap, Pennsylvania
- **Environmental Excellence in Weapon System Acquisition (small program)**
  Army Research Laboratory Wash Primer Replacement Team, Aberdeen Proving Ground, Maryland

# Fort Riley project recognized for excellence in water, energy management

**By Maria Childs**
*1st Infantry Division Post*
*Fort Riley, Kansas*

**FORT RILEY, Kansas** - A project completed by a team of employees from the post's Environmental Office, the Environmental Protection Agency, U.S. Army Corps of Engineers and the Unified School District 475 out of Junction City, Kansas, was recognized in December 2016 with a Federal Energy and Water Management Award.

The project was the construction of a permeable parking lot located behind Seitz Elementary School here on Rifle Range Road. Construction was completed in August 2015, and is expected to capture 443,000 gallons of storm water annually that otherwise would have been lost as runoff. The project included the installation of a weather station to collect and measure the rainwater on the rooftop. Water collected will be used by the school to flush toilets and various other water-related tasks.

Chris Otto, Net Zero water coordinator, Directorate of Public Works, Environmental Division, said he thinks the project is unique because of the partnership developed between the agencies involved in the construction. Scientists from the EPA visited the post to gather data about the rainwater collected in the tanks buried beneath the concrete pavers. The data is then used to create curriculum for the Fort Riley students.

"This is one of the only projects in the Army that I know of where it has been followed up by the education component to teach the average person what is going on," Otto said. "It's reaching more people."

During the summer, teachers from USD 475 met to better understand what role the parking lot plays in water conservation. Through this meeting, they developed curriculum to teach their students.

Michael Borst, EPA engineer, National Risk Management Research Laboratory, accepted the award in Washington D.C. He was part of the team who designed the parking lot.

He said substituting permeable surfaces for traditional asphalt or concrete is becoming more common as a way to manage stormwater. As part of this project, EPA personnel are trying to better understand how the water moves after it is captured by the permeable surface.

"From a technical perspective, parking lots redirect runoff generated by the rainfall," he said. "A traditional design using storm sewers routes the water to surface water such as the Republican River where it flows away. Permeable systems allow that water to flow into the dirt where it becomes part of the groundwater. The groundwater can then be used to supply our future water needs."

An array of sensors in and around the parking lot allow scientists from the EPA to measure the movement of the water collected.

**See Parking lot, page 14**

# ENVIROPOINTS

## 2017 Army Earth Day!

### Theme reminds us to 'Sustain the Mission - Secure the Future'

Eugene Collins

**By Eugene Collins**

*Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health*

On April 22, the Army joins the nation in commemorating Earth Day and renewing its commitment to sound environmental stewardship. The Office of the Secretary of Defense is sponsoring an event April 21 at the Pentagon, focusing on climate preparedness and water resilience, disease vector shifts, and water-related illness and drought and atmospheric river prediction.

The 2017 Army Earth Day theme is "Sustain the Mission - Secure the Future," which embodies the Army's commitment in supporting military readiness through environmental protection. Readiness of the Army and security of the nation are linked to protection and preservation of natural and cultural resources on our installations. The sound environmental stewardship demonstrated on Army Earth Day supports the quality of Soldier training, quality of life for families, the Army workforce and neighboring communities.

The Army is steward to more than 12 million acres of land used to support the military training and testing mission. Those lands contain 1.3 million acres of wetlands. The Army protects 224 threatened and endangered species on 119 installations within the United States.

Army lands include more than 91,000 historic buildings, more than 82,000 archeological sites and more than 180 Native American sacred sites. The Army has cleaned up remnants of past practices at more than 11,000 sites at active and excess installations. Army installation environmental activities also include sampling and analyzing air and water, maintaining environmental permits, providing safe drinking water, properly storing and disposing of waste, and environmental analysis of Army actions.

*"We manage our natural resources to help shape a realistic training environment that enhances training and testing operations..."*

The Army has maintained the lowest number of environmental enforcement actions within the Department of Defense, while having the largest inventory of land and facilities. The Army decreased and is sustaining an enforcement action rate under 10 percent, and has achieved an 80 percent decline in the number of enforcement actions issued to the Army over the last 25 years.

Fort Hood, Texas, is a prime example of how the Army manages natural resources, including threatened and endangered bird species in a manner that supports the training mission and our military readiness.

Fort Hood is home to the black-capped vireo and has worked with federal and state partners to help meet the songbird's population recovery goals. There are now more than 5,200 known birds and more than 14,000 estimated across the breeding range.

Due in large part to Fort Hood's efforts, the U.S. Fish and Wildlife Service has the black-capped vireo planned for de-listing as an endangered species. This action benefits military readiness by eliminating prior restrictions on 23,000 acres of the installation's training area.

Fort Hood is also home to the golden-cheeked warbler. The post has managed the warbler population and worked with the Fish and Wildlife Service to eliminate restrictions to training on 50,000 acres of training area.

Military readiness is compatible with sound environmental stewardship. The air, water and land on military installations provide the natural infrastructure for realistic training for our Soldiers to maintain mission readiness.

We manage our natural resources to help shape a realistic training environment that enhances training and testing operations, while striving to reduce restrictions on military activities through endangered species conservation.

The Army has also made great strides in implementing sustainable operations including green building designs in new construction and becoming more energy efficient to improve energy security.

Energy conservation is a critical component of Army installation sustainability. It eliminates inefficiencies in existing facilities, increases efficiency in new construction and renovation, reduces dependence on fossil fuels and improves national security.

See EnviroPoints, page 6



*Clemson University students, Rebeckah Hollowell and Brett Kelly, monitor the Hunnicutt Creek amphibian environment.*

## Partnership to study **wetlands benefits** Corps, students

**Story & photos by Sara Corbett**
*USACE, Charleston District*

What do the U.S. Army Corps of Engineers, a grocery store and Clemson University have in common?

Usually nothing but, in this unusual case, mitigation is the common factor.

In 2011, a grocery store owner applied for a permit, which would impact .41 acres of wetlands and 237 linear feet of fill, requiring participation in the Corps' mitigation banking program.

The goal of mitigation is for the property owner to restore, establish, enhance or preserve other aquatic resources, replacing those impacted by the proposed project to ensure zero net loss of wetlands.

Since no mitigation banks were available there, the merchant partnered with a contractor who was already set up on the Hunnicutt Creek site.

This resulted in a win-win-win solution because Clemson University was already using the creek as an outdoor classroom to teach undergraduate and graduate students about watersheds and stream restoration.

"This is a very unique mitigation site because Hunnicutt Creek is being studied for mitigation purposes as well as for educational purposes," said Brice McKoy, chief, Regulatory Division Northwest, Charleston District. "This project helps us protect waters of the U.S. and promotes STEM (science, technology, engineering and math) to students with the hopes of igniting a passion in science."

To protect the nation's waters, the Corps uses a watershed approach when reviewing permit applications.

Watersheds are areas of land where water from rain, snow or ice can drain to a common waterway such as a creek, stream, lake, wetland, or, eventually, the ocean. Since streams and creeks feed into watersheds, stream restoration projects, such as at Hunnicutt Creek, are vital to keeping watersheds healthy and functioning properly.

Several small, separate projects can significantly impact water quality and aquatic resources within a watershed, so the effects of the project on the entire watershed are considered when making a permit decision.

*"This project provides a tangible asset in which students can explore the physical and biological processes associated with stream restoration."*

*Calvin Sawyer, Ph.D.*
*Associate Professor*
*Department of Agricultural Sciences*
*Clemson University*

"This project provides a tangible asset in which students can explore the physical and biological processes associated with stream restoration," said Calvin Sawyer, Ph.D., associate professor, Department of Agricultural Sciences. "It also introduces them to the regulatory process and what role the Corps plays in ensuring protection of the functions and values of streams, wetland systems and watersheds."

Rebeckah Hollowell is pursuing her master's degree at Clemson in plant and environmental sciences. She has been working on the mitigation project at Hunnicutt Creek since the fall of 2014 and is using it for her thesis.

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# ENVIROPOINTS

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*Earth Day provides installations an opportunity to share the good news of the Army's environmental protection programs with neighboring communities.*

We are committed to energy conservation, sustainable operations and protecting the environment to ensure that the Army remains ready, resilient and capable of accomplishing its mission of defending our nation, and because it is the right thing to do.

Earth Day provides installations an opportunity to share the good news of the Army's environmental protection programs with neighboring communities.

Today, the Army and its installations and organizations around the world embrace Earth Day. Earth Day is an opportunity for Soldiers, their families and civilians to consider the environmental footprint they make, and the influence they have on natural resources whether they are on installations, deployed overseas or in their homes.

To commemorate Earth Day, Army installations and organizations host various events on and around Earth Day.

In 2016, the Army celebrated Earth Day with hundreds of activities from installations, Army National Guard and Army Reserve sites, and at U.S. Army Corps of Engineers' districts.

A few of the outstanding Army Earth Day events that took place in 2016 included: Fort Campbell's Environmental Division hosting an event at the installation's PX Mall. Participants included the qualified recycle, forestry, conservation, cultural resources, air quality and stormwater programs that offered free giveaways. For the young at heart and children, Smokey Bear and Wally Waterdrop were on site for pictures. U.S. Army Garrison Rheinland-Pfalz, Germany, cleared trash and dumped objects from the woods, and with school children, decorated and hung bird boxes. U.S. Army Garrison Humphreys, Korea, held an Earth Day "Eggstravaganza" in conjunction with the children's Easter activities and the installation's 5k run. Fort Hood participates in Earth Day Dallas, widely recognized as the nation's largest Earth Day event.

The Army leads the way with annual activities of cleaning up installations and other public lands, gardening and tree planting, household hazardous waste collection, students from local schools who volunteer to support and set up exhibits and educational booths, and all types of recycling and outdoor educational activities such as seedling planting, trail work, wildlife habitat improvement, litter pickup, landscaping and other projects.

Last year's Earth Day activities within USACE included an Omaha District celebration for the completion of a stream ecosystem restoration project along a 1-mile stretch of Lower Boulder Creek in Boulder County, Colorado. The purpose of the project was to restore critical habitat for migratory birds and other wildlife, and reestablish wetland and stream values. As part of the ceremony, cottonwood trees were planted from saplings propagated from Boulder County's 150-year-old national champion cottonwood. The USACE Baltimore District's Earth Day commemoration events included Tioga, Hammond and Cowanesque lakes' participation in the annual Earth Day event at Mill Cove in Mansfield, Pennsylvania, with outdoor activities for adults and children. Presentations on the Corps' mission areas there included recreation, dredging, the Washington Aqueduct, Chesapeake Bay oyster restoration, Raystown Lake shoreline cleanup and paddle cleanup at Snyders Run Boat launch. Baltimore District's participation at Phillips Wharf Oyster House on Tilghman Island included exhibitors, authors, educators and experts on a range of Chesapeake Bay conservation topics including rain gardens, native plants, oyster restoration, stormwater management, wildlife habitat, living shorelines and energy alternatives. USACE held an Earth Day event at Bonneville Lock and Dam featuring rangers performing invasive weed control and promoting the "Leave No Trace" message.

The Army anticipates that 2017 Army Earth Day activities will be as great a success as last year's!

In support of 2017 Army Earth Day, the Acting Assistant Secretary of the Army for Installations, Energy and Environment and the Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health, collaborate with the U.S. Army Environmental Command on the Army's annual Earth Day poster. This command is the Army's primary support for Earth Day, and it creates a custom designed Army Earth Day poster each year.

See EnviroPoints, page 8



*The Muddy River Flood Risk Management and Environmental Restoration Project was completed June 2016.* (Photo by Jennifer Flanagan)

# Muddy River restoration project garners Build America Award

## *Project encompasses oldest linear urban park system in the United States*

**By Ann Marie R. Harvie**
*USACE, New England District*

**The Muddy River** Flood Risk Management and Environmental Restoration Project in Boston, Massachusetts, has been honored with the Associated General Contractors of America's Alliant Build America Award.

According to AGC, the award recognizes members who build the nation's most impressive construction projects ranging across the building, highway and transportation, utility infrastructure, and federal and heavy divisions.

"These projects, with their vision, scope and grandeur, literally dare to change," said J. Doug Pruitt, AGC past president.

The Muddy River is a small waterway located within the city's metropolitan area. Most of the 5.6-square-mile watershed is located in Boston and the town of Brookline, with a small portion in Newton.

The 3.5-mile-long river flows through Frederick Law Olmsted's famed Emerald Necklace, one of the most carefully crafted park systems and the oldest remaining linear urban park system in the United States.

As a result of multiple floods, Boston's Parks and Recreation Department, working with the Boston Water and Sewer Commission, the Commonwealth of Massachusetts, the town of Brookline, the Federal Emergency Management Agency, and non-profit community groups such as the Emerald Necklace Conservancy and Fenway Alliance, developed a comprehensive master plan to identify and address these issues.

The Corps of Engineers was authorized to study the Muddy River by a series of legislative acts, resulting in the 2003 Feasibility Study.

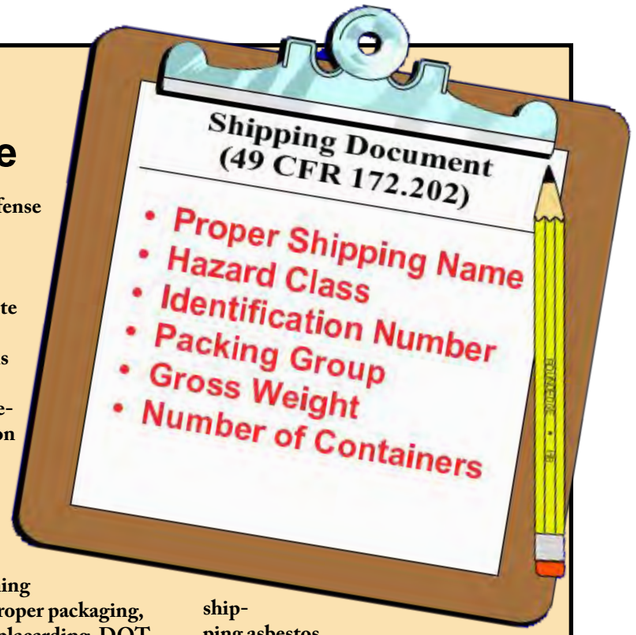
"The recommended plan from the feasibility study consisted of a combination of the 20-year flood risk management plan and extensive environmental dredging," said Jennifer Flanagan, project manager.

She said the plan encompasses protection against a flood with a return frequency of 20 years to include channel improvements, removal of undersized culverts, installation of two new culverts and daylighting two sections (about 700 linear feet) of the Muddy River. Plans also include dredging approximately 96,000 cubic yards of sediment from five areas in the Riverway, Leverett Pond and in the Back Bay Fens (the material will be dewatered on site and disposed of in licensed upland landfills); the removal of phragmites from wetland and riparian areas affected by dredging for the flood risk management channel; and preservation and restoration of the historic park shoreline and vegetation in construction areas.

The first phase of the two-phase project, initiated in January 2013, was completed in June 2016 at a cost of $35.2 million. Work consisted of removing undersized culverts with new Riverway and Brookline Avenue culverts; daylighting of the former Sears parking lot and area upstream of Avenue Louis Pasteur to construct the FRM channel; removing 2 inches of accumulated sediment from Upper Fens Pond; and the construction of the Avenue Louis Pasteur culvert extension.

See Muddy River, page 14

## USACE offers hazardous waste recertification course




Do you sign hazardous waste manifests or other Department of Transportation shipping documents?

If yes, this is a course for you.

Open to all federal agencies, this course is being offered in Omaha, Nebraska, July 19-20, to provide recurrent training regarding regulatory requirements of the Hazardous Materials Transportation Act and the Resource Conservation and Recovery Act as it applies to the generation, transportation and disposal of hazmat, focusing on hazardous waste.

The 16-hour course enables employers to certify, as required by 49 CFR 172 Subpart H, that their employees have been trained and tested in general awareness and function-specific elements described below.

In addition, the course is approved by the Interservice Environmental Education Review Board as well as the Department of Defense in accordance with DOD 4500.9-R.

Training topics include RCRA waste classification; land disposal restrictions and notification; manifesting requirements; identification of a DOT reportable quantity; use of the hazardous materials table; and DOT requirements for determining a shipping name, proper packaging, labeling, marking, placarding, DOT emergency response requirements and general security awareness.

In addition, the course addresses special Environmental Protection Agency and DOT requirements for shipping asbestos and polybrominated biphenyls, or PCBs.

For more information and/or course registration, visit the USACE website at http://ulc.usace.army.mil/.

## ENVIROPOINTS

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The posters are distributed Armywide and used as a form of outreach and awareness. For a two-week period leading up to the event, the Army Earth Day poster is also displayed throughout the Pentagon in designated areas and is posted on the electronic Infonet Board the entire month of April. In addition, the U.S. Army Environmental Command has tools available for download by installations, such as the Earth Day guide and an activity book for children.

We look forward to the many opportunities to celebrate and commemorate 2017 Army Earth Day. The Army takes great pride in its commitment to protect the environment and continues to lead the federal government through sustainability initiatives. The Army has been at the forefront in finding and implementing ways to protect, preserve, conserve and restore the natural environment, and has done so much over the years to protect the natural and cultural resources on our installations. We encourage everyone to take an active role in sustaining the Earth's resources and supporting the Army's commitment to maintain a quality environment.

Army leaders at all levels actively support Earth Day. I commend the contributions by so many in our Army community to enhance the mission, preserve the environment and protect our way of life; however, there is still more to be done. We must continue to consider the impact on everything we do and strive to meet the operational and financial challenges of the future. Consider the environmental footprint we make and the effect our actions have on the environment, and continue to lead the federal government through sustainability initiatives to protect, preserve, conserve and restore the natural environment.

The Army is constantly seeking innovative ways to minimize and eliminate inefficiencies on the environment. Using our resources wisely now and in the future are ways to preserve America's heritage, now and for generations to come.

Earth Day is a time for all of us to get involved and make a difference by doing our part, using best practices and new technologies to help sustain the environment for a secure future. By making the right choices today, our Army will remain the world's premier military force into the future.

Join us in our commitment to commemorate 2017 Army Earth Day, to preserve a quality environment that will "Sustain the Mission and Secure the Future" for generations to come. "Army Readiness Depends on It" to remain the Strength of the Nation!

For more information, visit the Army Earth Day website at https://aec.army.mil/outreach/publicinitiatives/earthday.aspx.



# USACE rangers' count confirms eagle population growth

By Bryanna R. Poulin
*USACE, Little Rock District*

ROGERS, Arkansas - Living on mountaintops amidst the solitary splendor of nature, bald eagles have infinite freedom. Their distinctive brown bodies, white heads and up to 7-foot wingspans allow them to dive with speeds up to 99 mph into valleys below or soar upward into the boundless spaces and beyond.

Though most are familiar with the nation's symbol that graces the reverse side of quarters and half dollars, many still think the American bald eagle is endangered.

"It's important to remember that bald eagles are protected and are no longer on the endangered species list," said Alan Bland, park ranger, Beaver Lake Project Office, U.S. Army Corps of Engineers - Little Rock District.

It wasn't so long ago that the eagles were considered endangered.

Shortly after World War II, dichloro-diphenyl-trichloroethane, or DDT, was developed to control mosquitoes in an effort to contain insect-borne disease and to protect crop and livestock production. When the pesticide entered the food chain, however, it adversely affected the eagle population. DDT would contaminate the lakes and rivers where the eagles would eat the poisoned fish and plants.

"DDT made the eggshells very thin so they would bust before the eaglet could hatch," Bland said. This reproductive failure hampered the eagle's survivability and resulted in a decline of the eagle population.

This decline was the primary reason DDT was banned in 1972, allowing the U.S. Fish and Wildlife Service to list the bald eagle as an endangered species.

"DDT was around for years and many people used it because it was a very effective chemical," Bland said. "When they finally banned it, they started hacking stations to repopulate the bird."

Removed from their wild habitats, the eaglets are relocated to hacking stations, or artificial surroundings, where they're monitored and cared for until they've matured enough to survive on their own.

Bland explained that caretakers at these hacking stations go to extraordinary lengths to ensure minimal human contact.

"They would go up to the nest with a puppet that looks like an eagle to feed them, so the birds never see a human," Bland said.

There, the eagles matured and were evaluated to determine when they should be released and returned to their natural habitat. Once that determination was made, the eagles were fitted with neck transmitters to help track and monitor their status in the wild, he added. In time, the eagles reproduced and replenished their population, steadily allowing them to be upgraded off the endangered list and onto protected species status.

This protected status is why Beaver Lake rangers participate in the National Midwinter Bald Eagle Survey each January. The survey is an agreement with the U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center and the Corps of Engineers. Its purpose is to establish a partnership between the organizations that maintain long-term, national coordination of the count, data, analysis and reporting.

"We have a certain time frame that we have to do our count," said Donna Bryant, Beaver Lake park ranger, USACE - Little Rock District. "Usually, it's sometime in the middle of January."

Setting a date may seem easy, but there are variables the rangers have to consider.

"A date is set but never confirmed until about a week out," she said. "The count is dependent on the weather."

See Eagles, page 14

# USACE investigates latest techologies, research to manage invasive species

The U.S. Army Corps of Engineers is the steward of 12 million acres of public lands and waters at hundreds of water resource projects nationwide.

As such, the Corps is investigating the latest technologies and research, including biological control methods that manipulate organisms genetically, to manage the threat of invasive species and conserve, protect and restore these lands and waters.

Recently, a mechanism called "gene drive" has emerged as a promising genetic biocontrol strategy to combat invasive species like carp and mosquitoes. Gene drive works by spreading desired genes and associated traits into the target population. For example, it might impart sterility or an inability to transmit a pathogen into the target population in a time frame that is appropriate to control a disease or eradicate a population.

*A mechanism called the CRISPR/Cas9 "gene drive" has emerged as a promising genetic biocontrol strategy to combat invasive species like carp and mosquitos.*

The CRISPR/Cas9 gene drive relies on exactly the same copying/homing mechanism as naturally existing homing endonucleases. These mediated gene drives can sweep a "deleterious" gene through a population exponentially faster than the normal Mendelian "cross-breeding" inheritance, thus suppressing or eradiating the target invasive species.

Unlike existing technologies that depend on the cumbersome custom-making of new proteins for each DNA target, the CRISPR system uses RNA as its DNA-homing mechanism. This makes CRISPR low cost, high efficiency and easy to implement. It also dramatically shortens the design-build-test cycle for gene drive development.

Recently published studies have demonstrated that RNA-guided gene drives mediated by CRISPR-Cas9 can efficiently bias inheritance in the Baker's yeast, the fruit fly, and disease vector mosquitoes.

The high efficiency, robust and versatile CRISPR/Cas9 technology also makes it feasible to alter multiple places at the target gene to prevent mutations from blocking the spread of the drive. This makes it possible to quickly develop multiple types of drives to precisely target a specific subpopulation, to protect a population from future gene drive "invasions," or to overwrite previously released drives in the event of unanticipated effects.

Precise genome-wide gene editing can now be rapidly and efficiently recapitulated in animal or cellular models. Studies have highlighted CRISPR-Cas9's ability to specifically alter targeted traits of entire populations. For instance, Cas9 was packaged in bacteriophage and programmed to selectively kill virulent bacteria within microbial communities by targeting virulence genes, while leaving other bacteria unaffected. In animal populations, Cas9-based gene drives could be used to rapidly spread altered traits and control invasive species.

In addition to invasive species control, this technology holds great promise in enabling a broad range of applications:

- **Materials development.** Manipulating biological circuits could facilitate the generation of useful synthetic materials, such as algae-derived, silica-based diatoms for oral drug delivery.
- **Food security.** Precise genetic engineering of important agricultural crops could confer resistance to environmental deprivation (drought, heat, cold) or pathogenic infection (disease) so as to improve food security in such major staple crops as bread wheat.
- **Fuel.** Creating efficient metabolic pathways for ethanol production in algae or corn could yield sustainable, cost-effective and renewable biofuels.
- **Gene surgery.** Direct in vivo correction of genetic or epigenetic defects in somatic tissue would yield permanent genetic solutions to the root cause of genetically encoded disorders.
- **Drug development.** Engineering cells to optimize high yield generation of drug precursors in bacterial factories could significantly reduce the cost and accessibility of useful therapeutics.
- **Gene therapy.** Proof-of-concept experiments in mice have demonstrated that a Cas9-based therapeutic strategy successfully corrected a disease-causing Fah mutation and prevented Duchenne muscular dystrophy. While significant hurdles exist before similar experiments can be performed on human patients, CRISPR-Cas9 has the potential of treating human genetic diseases.

Among this host of benefits, CRISPR/Cas9-based gene drives are poised to become a self-sustaining, highly efficient, environmentally benign and cost-effective alternative for invasive species control.



# New guide provides installation resources for organic waste diversion

**By Curtis Fey**
*U.S. Army Environmental Command*

**As installations strive to meet the Army's goal of diverting 50 percent of their landfill waste, they are presented with a unique set of options, each with its own challenges, for reducing and diverting their organic waste stream.**

**When considering declining defense budgets and labor projections, installations will no longer be able to add additional duties or implement novel technologies that require additional training, testing, operations time and maintenance.**

**To assist installations, the U.S. Army Environmental Command teamed with the U.S. Army Corps of Engineers, Engineer Research and Development Center to identify alternatives to support organic waste diversion specific to their locations.**

**Project efforts culminated in new guidance for on- and off-post waste diversion, an overview of small scale food waste technologies and a situational-based flow chart decision support tool. Each section of the guide presents case studies of installations currently implementing the various diversion alternatives described.**

## Off-post diversion

**The guide emphasizes the importance of first reducing the amount of waste generated. Guidance for donating edible, wholesome food to charities and farmers is discussed and case studies reveal how installations have donated several tons of food to local food banks and hog farmers.**

**The number of commercial composting operations and their availability to installations are increasing and a list of these facilities is also included. Case studies of installations who have modified their waste disposal contracts to secure local commercial composting services are provided along with sample contract language used when contracting for this service.**

**One case study covers an analysis conducted at Fort Jackson, South Carolina, which showed that as much as $24,000 may be saved annually by using commercial composting services.**

*Accompanying the report is an interactive **flowchart tool to help** guide waste diversion practitioners in selecting organic waste management practices and technology that best **meet their specific** capacities and preferences.*

## On-post diversion

**Other opportunities installations may wish to explore include partnerships, such as the utilization of federal civilian inmates to augment labor, producing installation net-cost avoidance on the order of hundreds of thousands to several million dollars.**

**Case studies of installations adopting inmate labor are provided and excerpts from installation – prison memorandums of understandings as well as a list of prison facilities near installations are included.**

**Several installations have implemented on-post composting operations to manage large volumes of organic waste. Fort Leonard Wood, Missouri, and Joint Base Lewis-McChord, Washington, have established contract agreements with waste service providers to operate their composting sites. The guide presents case studies providing insight as well as language associated with securing contracting support services by these two posts.**

## Food waste technologies

**An overview of the most common types of technologies available for processing food waste is discussed. A handy side-by-side comparison of four categories of small-scale technologies over 12 metrics is shown.**

**Case study presentations include Fort Bragg, North Carolina, successfully adopting food waste digesters; Fort Lee, Virginia, incorporating food waste dehydrators; Fort Leonard Wood completing a demonstration of an in-vessel food waste composter; and Wright-Patterson Air Force Base, Ohio, employing a vermicomposting, or worm-based composting system.**

## Situational-based flow chart

**Accompanying the report is an interactive flowchart tool to help guide waste diversion practitioners in selecting organic waste management practices and technology that best meet their specific capacities and preferences. The tool uses a set of "if-then" questions, and responses direct the user to appropriate information and resources.**

**The guide and associated references provide practical guidance to enable installations to adapt organic waste diversion solutions tailored to their requirements.**

**These new resources are available for downloading at https://erdc-library.erdc.dren.mil/xmlui/handle/11681/20415.**

**Questions or comments associated with this or other organic waste disposal projects may be directed to U.S. Army Environmental Command's Acquisition and Technology Branch at https://aec.army.mil/.**

# Ecosystems depend on plant pollinators

Pollinators and pollinator-dependent plants are critical components of functioning ecosystems on Department of Defense installations.

Nearly 88 percent of extant flowering plant species are dependent on animal pollinators, including many agricultural plants.

Recent declines of pollinator species, particularly bees, have received global attention and the dire consequences of these declines have been well documented.

While the attention has led to a proliferation of research on the topic, much is still unknown. For many systems, basic information, such as the identities and relationships of plants and pollinators, has not been explored.

The existence of federally listed species on military lands can incur substantial costs to the military in terms of management costs and more importantly in costs associated with reduced ability to train, which could compromise the Army's obligation to maintain range lands so that troops can "train as they fight."

Many federally listed threatened/endangered species depend on plant-pollinator interactions, either because the listed species is itself a pollinator species, or because it depends on one. Currently, approximately 75 percent of 296 species of at-risk flowering plants on installations are pollinator dependent— a number that is likely to grow.

For this reason, regulations require land managers to conduct "pollinator-friendly" land management - a daunting task for installations where plant-pollinator relationships haven't been identified. To help fill that gap, the U.S. Army Corps of Engineers has undertaken research to demonstrate methods to compile and analyze publicly available plant-pollinator information and to provide guidance on how to locate valid sources of information, compile species and region-specific data, and conduct basic plant-pollinator network analyses.

This study demonstrated methods for compiling and analyzing readily available information for insect pollinators and pollination-dependent plants for a single installation, Fort McCoy, Wisconsin.

Of the 1,470 insect species and 972 plant species identified on the installation, this work focused on 12 species of conservation concern (nine insect and three plant species).

Published information on insect pollinators and pollination-dependent plants was then used to conduct a basic plant-pollinator network analyses using free analytical network software, which revealed that all the plant species of conservation concern are pollinated by several insect pollinator species.

The results suggest that analyses that rely on publicly available information provide a useful starting point in determining basic, binary plant-pollinator relationships. Field-collected data, e.g., frequency of pollinator-plant interactions, would be required for a more detailed, robust network analysis.

The results at Fort McCoy provide a template for assessing plant-pollinator networks on military installations that can help achieve pollinator management objectives.

Fort McCoy was used to develop guidance on how to acquire data on plant and pollinator distribution, ecology and network traits. Other installations can use this method to assess plant-pollinator communities on their lands and their vulnerability to declining pollinator populations.

The exercise also provided guidance on how to construct plant-pollinator databases and conduct basic network analyses that can help fill critical knowledge gaps and identify the need for field-collected data. Identifying plant-pollinator interactions is a key step in the conservation of species dependent on this mutualistic relationship.

Pollination network analysis is one method that enables the examination of plant-pollinator interactions at the community level.

A simple pollination network can be created via a binary network in which both pollinators and plants are nodes and the plant-pollinator interactions form the links between the nodes. Although far from comprehensive, an extensive amount of data is readily available on the distribution of plants and pollinators and their potential relationships.

Information gathered from publicly available sources is useful, but may be incomplete. This effort used published plant and insect species lists identified in Fort McCoy's Integrated Natural Resource Management Plan.

For installations/regions where species lists have not already been compiled, county-level species occurrence data is available from a variety of sources. More detailed research, such as field collected data documenting plant visitation by pollinators, analysis of pollen loads present on insects or use of insect traps, would strengthen the conclusions drawn from a network analysis.

Nearly all of the pollinator species of conservation concern on Fort McCoy were dependent on a single genus or species of host plant. For example, two of the pollinator species of concern, the frosted elfin and karner blue butterflies, are dependent on lupine species, which plays an important role in plant-pollinator networks here. Fort McCoy has engaged in numerous management actions to increase the lupine population on the installation.

Although this study provided information specific to Fort McCoy, the information and methods developed here may well be applied to prevent further pollinator and flowering plant declines on other installations.

Follow-on work to this study could entail the documentation to support stewardship obligations of insect pollinator-plant networks for other Midwestern installations, for installations in the Northeast and Northwest, and for locations in sensitive ecosystems predisposed to climatic pressures such as the Arctic or the Pacific Islands.

## Eagles Continued from page 9

*"Over the years, the eagle population has grown such that we see them everywhere. I've seen as many as 269 eagles in one day."*

**- Alan Bland**
*USACE, Little Rock District*

Not only does weather play a role for the rangers, it also impacts the eagles.

With high winds, they could be carried off as far as Missouri or Kansas, Bland said. "Wind makes them exert less energy so it doesn't take them long to get anywhere."

Luckily, he and his rangers have been able to cover the miles of shoreline without any glitches.

Despite sometimes experiencing extreme cold and freezing temperatures, he said, "we haven't had any excruciating circumstances or major problems so far."

In addition to weather, Bland said the lake's immense size also impacts counts.

It's huge and we try to cover as much area as we can, he said. This year, we, nonetheless, covered 400 miles of shoreline and about 30,000 acres of waters.

While this year's count was slightly less than in previous years, Bland has seen an increase in his 30 plus years of experience.

Basically, the eagles are making a comeback, he said. Over the years, their population has grown such that we see them everywhere. In fact, I've seen as many as 269 eagles in one day.

Even though their numbers have increased and most of the rangers know the lake like the back of their hands, that still doesn't make the count easy, Bland said. There are no fancy devices to count the birds, and the rangers have only their experience and a pair of binoculars for the count.

"We have to physically count each bald eagle we see," he said. "With dense woods and limited visibility, it's impossible to get an exact number. We try to get the best estimate, but sometimes we just don't see them because they're too far into the wood line."

Despite these limitations, Bland said that getting an accurate count is important, especially to the surrounding community.

This is beneficial to the public because people are fascinated by the eagles and our yearly counts, he said.

Overall the park rangers felt this year's count was a success.

This year, the weather was warmer and conditions better than previous years, Bland said. We saw a few nests and our count was more than 100.

This year, the Beaver Lake's final count was 105 total, 80 matures and 25 immatures.

## Parking lot Continued from page 3

Michael Nye, Net Zero program manager, EPA National Exposure Research Laboratory, works closely with the installation's environmental division. He said the EPA is always looking for ways to make projects more useful and interesting for Fort Riley residents.

"Our scientists are working with those teachers and the wonderful science team from USD 475 to incorporate precipitation and parking lot performance data from the project itself directly into those lesson plans," Nye said. "So when it rains, students can see how the permeable parking lot quickly soaks up the rain… and they can also see data that shows how even a small amount of rain makes a lot of water runoff."

Nye said the goal is to combine the data from the parking lot with real-life examples, such as how much rainwater it takes to flush a toilet. This will ultimately make the science lessons more meaningful for the students of Seitz Elementary.

Every year enough rain falls on the roof of the school to fill up the Forsyth community pool three and a half times.

"There's a lot we can do with technology these days to treat contaminated water or reclaim clean water from almost any source," he said.

"EPA scientists are world leaders in this area, and that's why the Army wants us to work with them on projects like this," Nye said.

Conservation is also important because anyone can help make sure there is enough water to go around, both now and for future generations, and "kids are often better at remembering to conserve water than their parents," he said.

## Muddy River Continued from page 7

In addition to Flanagan, district team members working on the project are Steve Umbrell, technical lead; Michelle O'Donoghue, project engineer; and Mike Penko, biologist.

"The Commonwealth of Massachusetts, the city of Boston and town of Brookline are the local sponsors for the project and will be responsible for long-term operation and maintenance of the project," Flanagan said. "This will include monitoring water quality, removal of future accumulations of sediment to maintain flood control, water quality and habitat benefits, and monitoring/treatment to guard against recolonization by phragmites."



# Detroit District views dredged material as resource, not waste

*USACE, Detroit District, employees walk across the shoal feature of the 21st Avenue West embayment in Duluth Harbor.*

**By 1st Lt. Erica Mitchell**
*USACE, Detroit District*

Last year, the U.S. Army Corps of Engineers, Detroit District, dredged over 1.8 million cubic yards within the Great Lakes federal channels and, of that, more than 60 percent of dredged material was used beneficially.

Dredged material is considered beneficial when used as a resource, not as waste.

The district has successfully used and continues to facilitate the beneficial use of dredged material through beach nourishment, habitat development, island creation, and construction and industrial use.

"The days of treating dredged material as 'waste' are behind us," said Lt. Col. Dennis Sugrue, district engineer, Detroit District. "We need to view it as a resource, and projects throughout the Great Lakes have already demonstrated how it can benefit coastal resilience, fish and bird habitat and a range of other crucial needs."

Most prominent has been the district's use of dredged material for beach nourishment. Beach nourishment is a low-cost, beneficial option in use for operating and maintaining projects within the district. Many of the district's harbors provide clean, sandy material from the navigation channels that is then transferred to nearby beaches to help diminish the effects of erosive wind, waves and weather.

St. Joseph Harbor is a classic example of a beach nourishment project. Last year, the district placed over 26,000 cubic yards of clean dredged material on the beach.

Sometimes overlooked, habitat development is beneficial in the restoration of aquatic wildlife habitats or nesting meadows in upland disposal areas.

The district has had success with placing suitable dredged material within 21st Avenue West and 40th Avenue West embayments to support aquatic habitat restoration initiatives near the Duluth-Superior Harbor in Minnesota/Wisconsin. Since 2013, when a pilot program at the 21st Avenue site began, more than 600,000 cubic yards of dredged material has been placed, and has contributed greatly to the start of placement at the 40th Avenue location this year. Placing material at these sites improves aquatic habitat diversity and restores aquatic ecosystem functions impacted by soil pollutants. Since the late 1800s, these unchecked pollutants often resulted in reduced and damaged wildlife habitats.

Prior to the Corps' authority to construct confined disposal facilities in 1970, material was mainly deposited in deep water sites. Since then, several projects were developed to also utilize dredged material for island creation and enhancement such as the Cat Island project in Green Bay, Wisconsin. Cat Island has been among one of the district's most effective beneficial use of dredged material projects to date. Since 2014, almost 750,000 cubic yards of material has been used to begin restoring the islands that were washed away in the 1960s by high water levels, waves and ice. The Cat Island chain consisted of three islands located west of the mouth of the Fox River in Green Bay. In the next 20-30 years, this island chain will be rebuilt with the placement of clean dredged material from the Green Bay (outer) navigation channel. The Cat Island Dredged Material Placement Site will reestablish and protect 274 acres of terrestrial habitat and 1,400 acres of wetland. These newly restored islands will help coastal marsh, underwater plants, and various fish and wildlife.

"The Corps must always deal with dredged material that results from annual maintenance dredging in the least cost and environmentally acceptable manner," said Dave Wright, operations chief, Detroit District. "It is a win-win situation when we are able to place material in a manner that meets these requirements, and also ultimately supports other efforts such as environmental habitat restoration or facilitates use of the material for other construction purposes."

There is growing interest in the reuse of dredged material as construction material for various purposes such as parking lots, roadway construction or landfill cover. Local sponsors for several of the district's confined disposal facilities are pursuing the mining of suitable material from these facilities for construction or industrial use.

See Dredging, page 16

# Surry Mountain Lake hosts anglers for New Hampshire **winter fishing**

**Story & photo by**
**Ann Marie R. Harvie**
*USACE, New England District*

Surry Mountain Lake opened its gates and welcomed the public to the first ever Winter Free Fishing Day, Jan. 21.

According to the agency's press release, the New Hampshire Fish and Game invited the public to enjoy the day fishing without having to go through the expense of purchasing a license.

Although usually closed for the year, the Surry Mountain Lake team measured the thickness of the ice for safety and invited residents to visit the project and try their hand at ice fishing.

In keeping with the "free" theme, guests were not charged admission to visit the lake.

"The people who attended were grateful to have had the opportunity to fish an area they usually have to walk quite a distance to get to," said John Asseng, project manager.

To ensure participants would enjoy the day's activities, personnel with the New Hampshire Fish and Game issued safety rules and regulations that had to be followed.

The New Hampshire state legislature authorized the winter event last year, complementing the state's free fishing day on the first Sunday in June which has been in place for many years.

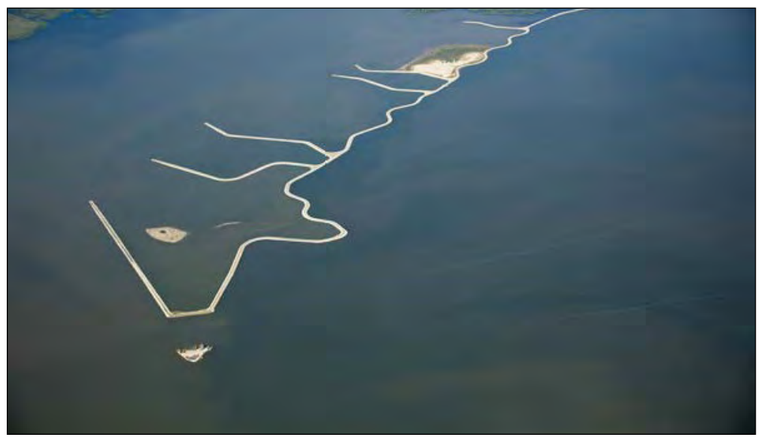
Surry Mountain Lake offers hunting, trapping and snowmobiling with applicable licenses and permits in accordance with state and federal regulations.

In warmer weather, fishing, swimming, boating and picnic facilities are made available to the public.

For more information on the project, go to their website at: **www.nae.usace.army.mil/Missions/Recreation/SurryMountainLake.aspx**.

***This little angler shows off his catch following the Winter Free Fishing event at Surry Mountain Lake, Jan. 21.***

# Dredging **Continued from page 15**



*(Photo courtesy of USACE, Detroit District)*

***Aerial photo of the Cat Island project depicts sand and vegetation that was placed in 2014.***

One such facility can be found at Erie Pier where dredged material is rinsed with on-site water from the Duluth-Superior Harbor. There, fine materials are washed away, leaving behind clean sand which the local community can then use for various construction and industrial applications.

Operated and maintained by the Corps, the Erie Pier CDF in Duluth encompasses approximately 82 acres with a capacity to hold 2.5 million cubic yards of dredged material. Because the CDF is almost at full capacity, the Corps, the Seaway Port Authority of Duluth, as well as the city of the Duluth strive to find other uses for the clean dredged material.

For more information, visit the website at **http://www.lre.usace.army.mil/Missions/Great-Lakes-Navigation/**.



# Wetlands **Continued from page 5**

Always drawn to the prospect of permitting and mitigating, Hollowell jumped at the chance to be part of this "real world" project and hopes to work for the Corps or an environmental agency once she graduates.

"Since working on Hunnicutt Creek and with the Corps, I am much more interested in going into this line of work," she said. "I want to make a difference and there is so much advancement that can be achieved in this STEM field, especially on the restoration side of things."

The mitigated portion of the creek was completed in 2013 and included the enhancement of 2 acres of wetlands and the restoration of 300 linear feet of streams.

The Corps has specific performance standards the applicant must meet, such as the amount of native trees planted, buffers being used and the completed work staying in place.

The Clemson students help the Corps by monitoring the creek for not only these standards, but also for chemical qualities (pH, temperature, conductivity and dissolved oxygen), bacteria (E.coli), macroinvertebrates, native plant species and amphibians.

***The mitigated portion of the Hunnicutt Creek.***

By using the deterioration and restoration of the creek as an educational tool, the college is teaching and reinforcing the Corps' main regulatory mission: conservation, restoration and stabilization of the environment.

"The partnership between Clemson and the Corps has been very productive and beneficial," Sawyer said. "We've had to rely on the Corps to communicate with the permittee on several occasions to achieve an equitable solution. The Corps has been flexible in their advice and counsel to Clemson and in how they make their permit-related decisions."

Over the last few years, the students have seen positive results in the restored portion of the creek; one unique improvement is an increase in amphibians.

Students set up cover boards and polyvinyl chloride, or PVC, pipes next to the creek and monitor those sites as a way to gauge if the restoration is successful. The amphibian increase shows that the environment is becoming more hospitable and is returning to its natural state.

"Amphibians and tree frogs can be used as bio-indicators," said Brett Kelly, senior biology major. "Typically these species are sensitive to pollution, or poor water quality, so we are encouraged by their presence in the restoration area. This means that the restored area is giving the frogs all of the resources they need to survive and thrive."

While it's not possible to gather an exact count, the students have observed 71 green tree frogs over the course of 15 samples in the restored section and only one green tree frog in the unrestored sections that were surveyed.

The Corps will monitor the mitigation site for five years after the project is complete, but Clemson University students will continue monitoring the progress and restoration of Hunnicutt Creek for years to come.

To keep up with the restoration project visit the Clemson University website at: **http://www.clemson.edu/public/hunnicutt/index.html**.

# Buffalo District supports nationwide waste investigation, clean up

**By Andrew Kornacki**
*USACE, Buffalo District*

The nationwide focus on environmental sustainability has increased public interest in sites found to contain hazardous waste; and for local communities, often there's a perception that these sites are unsuitable for other purposes.

The U.S. Army Corps of Engineers, Buffalo District, takes these environmental concerns head on with a team of individuals who specialize in hazardous, toxic and radioactive waste investigation and clean up. This team of specialists performs environmental investigation and human health risk assessments, remedial actions to remove or control exposure to hazardous materials, and monitoring of completed remedies.

Experts in the fields of health physics, chemistry, environmental engineering, toxicology, industrial hygiene, ecology and cartography, these individuals are at the top of their field and much sought after by agencies such as the Army, the Environmental Protection Agency and the New York State Department of Environmental Conservation.

"The Buffalo District HTRW team is a great example of how we are 'improving regional processes' across the division," said Brig. Gen. Mark Toy, USACE Great Lakes and Ohio River Division commander. "This in-house technical expertise can be shared among other districts or agencies to reduce the need for duplicating efforts and passes on cost savings to the taxpayers while maintaining the highest standards."

When the National Institute of Standards and Technology began planning renovations and construction for their campus in Boulder, Colorado, the Corps of Engineers Center of Expertise contacted Neil Miller, health physicist, Buffalo District, to be part of the team that would conduct a radiological site assessment before the project moved forward with construction.

"Initially, we conducted a radiological historical site assessment, which means we looked at log books, records, licenses, and talked with employees to identify potential areas and laboratories where radioactive materials might have been used within the buildings," Miller said. "Moving forward, we will go back to the site and use radiation detectors to scan floors and walls and collect smears with filter pads to confirm or deny the presence of the residual radioactivity. Ultimately, we will have to collect sufficient data to verify that the facilities can be recommended for unrestricted release prior to renovation."

The Corps of Engineers typically performs historical site assessments and investigations at properties where formerly used hazardous materials may be prevalent. It also performs routine monitoring of active HTRW sites under both the Formally Utilized Sites Remedial Action and Formally Used Defense Sites programs. But what really makes the Buffalo District stand out is their community outreach aimed at engaging the public on risks associated with HTRW. For example, the team has organized numerous public technical demonstrations and has even participated in educational events held at the Buffalo Museum of Science, covering topics ranging from evaluating radiation levels to the various types of monitoring options available.

"What a lot of people do not realize is that every day we are exposed to some level of radiation, but that is not to say that type or level of radiation would be harmful," Miller said.

He explained that part of the job is to ensure sites are safe for future use.

A perfect example of this is when we performed gamma walkover surveys at a Staten Island park, he said. A section of the park was closed because large portions of it were found to contain some radioactive material.

Subsequently, we were able to identify and map the areas contaminated by gamma radiation that allowed for unaffected sections of the park to be re-opened for recreational use, Miller said.

(USACE, Buffalo District courtesy photo)

***The USACE, Buffalo District, team of specialists investigates and cleans up contaminated environments for communities nationwide.***

The level of expertise required for this type of high-profile and sensitive work is significant, as the Buffalo District HTRW team is in charge of some of the most complex, intense and important work that the Corps of Engineers performs.

"Education, outreach, monitoring and eliminating future risk across the nation is how the Buffalo District is building strong and taking care of people!" Toy said.



# Innovative technology to aid environmental investigations

**By Katie Newton**
*USACE, Louisville District*

*The project teams are developing creative and innovative approaches with the technology that will set a precedent.*

The Louisville District, working with U.S. Army Engineering and Support Center, Huntsville, will be using cutting-edge geophysical technology at three formerly used defense sites this year.

The munitions response projects at Lockbourne Air Force Base and Camp Sherman Artillery Range in Ohio and Camp Breckinridge in Kentucky will be some of the first in the nation to use the technology for purposes of determining the nature and extent of munitions contamination.

"Although this technology was developed primarily for site remediation, there are numerous benefits of using it in the characterization phase such as more reliable data obtained without the need to make physical contact with items that have the potential to explode," said Nick Stolte, environmental engineer with the Huntsville Center.

Munitions response activities involve detection and inspection of buried metallic objects, or anomalies, that may be munitions and explosives of concern. Because traditional munitions response actions using single loop sensors require a significant amount of digging to determine whether they are MEC or other metallic debris, an innovative solution was needed.

"Often, less than 1 percent of the detected anomalies are actual MEC; thus, this method expends a huge amount of resources digging up items that turn out not to be hazardous," Stolte said.

The Department of Defense, through its Environmental Security Technology Certification Program, developed new geophysical sensors capable of detecting and classifying anomalies as MEC or other metallic debris for use in munitions response activities. This process, known as advanced geophysical classification, allows geophysicists to locate and distinguish between ordnance and other metallic items more efficiently.

"The AGC fits physics-based models to the observed sensor responses to determine physical characteristics such as geometry and wall thickness. The physical properties are compared to a library of known MEC items to classify them based on the closest match and then the library match forms the basis for determining if anomalies are potentially MEC or other metallic debris," Stolte said.

Additionally, advanced classification has been shown to significantly reduce the cost of a munitions response.

"The project teams are developing creative and innovative approaches with the technology that will set a precedent for the Defense Environmental Restoration Program," he added.

"This is a huge national initiative coming to fruition via the Huntsville Center and Louisville District partnership we have developed," said Chris Karem, chief, Louisville District Environmental Branch.

"In 2013, Huntsville and the Louisville District signed a memorandum of agreement to form a Combined Support Center for munitions response," Karem said. "These projects are a great example of how this partnership works, with scientists and engineers from Louisville and Huntsville forming virtual teams to contribute their expertise and promote coordination and cross training."

(Photo courtesy of U.S. Army Corps of Engineers)

***New geophysical technology allows teams to detect and classify anomalies as munitions and explosives of concern or other metallic debris more efficiently at formerly used defense sites. The man-portable vector shown above is a handheld technology designed for use on sites where vegetation or terrain limit access to the vehicle-based metal mapper.***

# USACE, The Nature Conservancy join forces, enhance Roanoke River

**Story & photo by Lisa Parker**
*USACE, Wilmington District*

In 2002, the U.S. Army Corps of Engineers and The Nature Conservancy formed a partnership and established the Sustainable Rivers Project.

The SRP focuses on modifying water operations at USACE dams to enhance the habitat conditions for plants and animals who depend on downstream river flows.

SRP activities are occurring in eight river basins nationwide, making it the largest coordinated effort of its kind in the world.

Currently, the Roanoke River is one of the basins focusing on defining environmental strategies as part of a water management plan. At SRP sites, scientists gather data on the river flows and work with water managers to modify dam and reservoir operations within existing water control policies and manuals for each reservoir.

USACE reservoirs affect the timing and magnitude of river flows to meet the competing needs of both human and environmental impacts. The reservoirs generate increased benefits by improving fish migration and water quality, flood damage reduction and hydropower while also supporting navigation and recreation.

One of the largest and least disturbed Bottomland Forest Systems on the Atlantic Coast, the lower Roanoke River floodplain is approximately 137 miles long, up to 5 miles wide, and one of the largest and least disturbed Brown Water River Systems in North America. Furthermore, its 31 natural communities provide habitat for two federally listed animals, 16 state-listed animals, 13 state-listed plants, and 214 bird species, 88 known to nest including 44 neo-tropical migrants and several heron rookeries. Also, the Roanoke has the most diverse and significant populations of migratory fish on the United States' Atlantic Coast.

The TNC Roanoke River Project started in 1982 with 176 acres of land donated from Union Camp Corporation. Since that time, TNC along with various partners have conserved approximately 95,000 acres along the river, its floodplain and in the surrounding watershed. The majority of these lands are managed in the public trust and/or recreational use by the North Carolina Wildlife Resources Commission and the United States Fish and Wildlife Service. As the TNC Roanoke River project grew, they reached out to other stakeholders.

"One of the things that led us to a successful outcome is everyone who is concerned with recreation on the river, came together and said, 'We need to coordinate among ourselves in a more unified voice to USACE,'" said John Morris, former director of North Carolina Division of Water Resources. "Starting in 2014 this stakeholder group really took hold and we've had many meetings with USACE. We did some coordination with ourselves and gave USACE a more unified partner to work with as they were looking at different ways to improve the operation of Kerr Lake."

It became apparent that the USACE operation at Kerr would need to be modified. John H. Kerr Dam and Lake has been in place for more than 50 years and has played a pivotal role in the life of the Roanoke Valley.

"We have shaped our operations regime, as we usually do, to optimize the dam's many authorized purposes and in accordance with prevailing conditions, flood, drought, etc. But as we began our work with TNC and our state partner in North Carolina, we could see that there were additional opportunities to enhance operations and improve conditions for the floodplain ecosystem," added Col. Kevin P. Landers Sr., commander, USACE, Wilmington District.

"The Roanoke River begins in the mountains, comes through the Piedmont, and ends here on the coastal plains and empties out into the sound. The coastal plain reach is the most significant part of the river because it's your typical alluvial flood plain. You have the levee, you have the swamp area, you have the high ridges, and you have the low ridges. The diversity that you're going to find here is just unbelievable," said Jean Richter, biologist with the USFWS.

The floodplain on the lower Roanoke River is considered one of the largest intact and least disturbed bottomland forest ecosystems remaining in the mid-Atlantic region. The unique thing about this river is the floodplain is still very active because there's not a lot of development. We have a pretty intact floodplain as far as the forest goes. So you're going to have a forest in all stages of growth. Some cutting has occurred so you're going to have early forests, and you'll have nice mature hardwood forests, and then you're going to have areas in between," Richter said.

A change at any USACE dam requires a 216 study, and through modeling and review of historic river flows, USACE came up with an alternative that more closely mimics the natural variations of the river. This alternative, known as QRR, or quasi-run-of-river, is the operational paradigm for releases out of Kerr Lake today.

"Working with USACE, we came up with an optimal solution where the plan kicks in only when Kerr Reservoir is in flood control operations," said Chuck Peoples, the director of conservation, North Carolina Chapter of Nature Conservancy. "It allows USACE the flexibility to send a bit more water downstream, but within the way the dam was designed to operate. So USACE is able to maintain its flood control operations and the river gets the sustaining flows that it needs at the same time."

"At 35,000-cubic-feet-per-second flow, which is the maximum flow that you can release under QRR, the river passes through the forest and is quickly gone. Flows of significantly less than 20,000, say in the neighborhood of 11,000 cfs, don't make it over the levees so they stay in the river," explained Sam Pearsall, member of board of science advisers, Roanoke River Basin Association, and the former director of science, Nature Conservancy.

He added that flows around 20,000 cfs flood the forest and as the water continuously sits there, it gradually loses all of its oxygen. Additionally the temperature goes up and it becomes more acidic and the trees gradually die along with other wildlife, including box turtles, lizards, salamanders and ground nesting birds such as wild turkeys.

Even the wasps that control the forested caterpillar populations all get killed when water sits at 20,000 cfs for a long time, Pearsall said.

QRR will significantly reduce the frequency and severity of bank collapse, preventing further degradation of fish and aquatic habitat and reducing the rate of shoreline land loss.

According to Richter, the group's main concern is when the banks become vertical through erosion.

There are bird species that use the banks for forage, he said. When you have vertical banks, they can no longer use those banks.

"When the river is at flood stage, they can actually use the vegetation along the banks as refuge," Richter said. "But if you have a vertical bank with no vegetation, they have no place to go to. So what happens is the river starts looking like a bathtub; the banks have no vegetation and wildlife can't use it anymore.

"That's why we're trying to preserve what we have so the wildlife can continue to use it; aquatic life in the river can use it as refuge to escape from predators and as feeding and nursery areas," he added.

"You can't find forests like you find in the Roanoke River basin like you perhaps could a hundred years ago," Landers said. "I think it's important for us as a nation to make sure that we're being good stewards of our environment that we live around."

He emphasized the importance of striking a balance with nature.

"We have to try and strike a balance that both meets our project's intent, but also incorporating into that solution, the environment and the needs of the stakeholders," he said. "There's a whole myriad of different angles that have to be looked at and addressed in coming up with the optimum solution. Sometimes, we don't ever reach the optimum solution, but at the end of the day we're definitely trying to strike a balance among the stakeholders by collaborating and understanding their needs."

*The U.S. Army Corps of Engineers partnered with The Nature Conservancy to ensure the survival of lower basin wildlife on the Roanoke River.*

# New England District proposing solar array at Cape Cod Canal

**By Ann Marie R. Harvie**
*USACE, New England District*

A team of New England District personnel is working on a proposed project with U.S. Army Corps of Engineers Headquarters and the USACE Engineering and Support Center, Huntsville, which would reduce the carbon footprint of the Cape Cod Canal in Bourne and the New Bedford hurricane barrier in New Bedford, Massachusetts.

The New England District proposes to lease approximately 6 acres at the Cape Cod Canal for the installation of a solar array via a Power Purchase Agreement. This would be the first civil works renewable energy PPA within USACE, connecting both the canal and hurricane barrier to the solar energy grid.

"The solar array will be constructed approximately halfway between the Bourne and Sagamore bridges on the Cape Cod side of the canal," said Lindsay Flieger, Sustainability Program coordinator for New England District. "The project will require 5-6 acres of land and will provide 680 kW of power."

According to Erika Mark, project manager, USACE Headquarters provided the funding to do the feasibility work such as real estate, National Environmental Policy Act and environmental baseline conditions, but the district will not be paying for the array itself.

"The vendor who wins the bid for this contract will pay for installation, operation and maintenance costs," she said. "There are no out-of-pocket costs for USACE as the array will be fully funded by the vendor and the district benefits by paying a discounted rate on our power."

According to Mark, Congress mandated the federal government in 2007 to acquire 25 percent of its energy needs through renewable resources by 2025.

Flieger said the canal and NBHB, the district's second largest energy user, have had several energy-saving initiatives introduced over the last few years. These initiatives included replacing the lighting along the canal and on the Bourne Bridge with LED lights and making the maintenance building a high-performance sustainable building. Despite all these efforts, the canal still uses a huge amount of energy.

"New England District enlisted the support of Huntsville to assess the canal and determine what type of large scale renewable energy project would be the best fit," she said.

The team visited the canal in 2014 and determined a solar panel array would be the best method.

"The Power Purchase Agreement method was also determined as the best way to make the project a reality," said Flieger. "The solar array will provide 100 percent of the power to the Cape Cod Canal and the New Bedford hurricane barrier."

Mark said the canal's and hurricane barrier's energy needs would be covered on days when solar power might not be an option.

"Both will be on solar power most of the time; however, this is New England and we have some pretty grim winters," she said. "If there isn't sun, or it's night and they're not producing power, we will still have access to a power grid as a backup."

The canal and the hurricane barrier will be running on solar power as soon as the array is installed and online, according to Mark.

Flieger said because the district will be the first to have an agreement of this kind, the team will compile a summary of the process, tools and lessons learned into a guidance document for other districts who wish to implement something similar.

The New England District team members on the Cape Cod Canal Solar Power PPA project are: Erika Mark, Megan Burke, Anne Kosel, Mary Mason, Rose Schmidt, Grace Moses, Kate Atwood, Jeff Teller, Scott Barr and Eric Pedersen.

*Kaiserslautern High School students harness aerial camera technology to capture progress at a construction site. The group was joined by Bernhard Ochsenreither, senior project engineer, USACE-Europe District.*

# Engineers, students team up, photograph project

**Story & photo by Lori Egan**
*USACE, Wiesbaden District*

**KAISERSLAUTERN, Germany** - Two Kaiserslautern High School seniors and a teacher used an aerial camera to get construction pictures of the new high school for U.S. Army Corps of Engineers, Europe District, Nov. 1.

As 21st century schools emerge to provide new ways of learning, the flyover was a great STEM-related activity, said Joseph Toups, a district resident engineer. STEM stands for science, technology, engineering and mathematics.

"It's only fitting that students participate in this activity in a way that encourages them to use modern technology to learn about construction," Toups said.

Chris Putnam, who teaches career technical education courses at the high school, flew the aerial camera while Evan Mackie and Christopher Craven operated the camera. The school has used the aerial camera to film graduation, pep rallies and football practices.

The construction site was a first, but Bernhard Ochsenreither, a district senior project engineer, worked with Putnam to fly an aerial camera on a Rheinland-Pfalz holiday, so it wasn't an active construction site.

Ochsenreither and Putnam said the project is beneficial to both the Corps and the school; the district gets a bird's-eye view of the construction and the students get practical experience. And they said they hope to continue to film the high school construction process.

"They're building a technical skill before they graduate," explained Putnam as he listed markets for aerial photography.

"Evan and Chris are both in the video communication class. The aerial camera makes a great addition to the course," said Putnam, who will teach in the school when it opens for the 2018-19 school year.

"The aerial camera has applications for the engineering and robotics courses when we start talking about how motors and sensors work," he continued. "Right now, the aerial camera can only be flown by a teacher, but as experience and trust build, I see students piloting it."

Jose Tovar, chief, Department of Defense Education Activity, Europe, facilities, said it was appropriate for the site to be used as a learning tool because that is a key component of 21st century learning.

"One of the key aspects for our facilities is that it is a teaching tool, the learning is student centered and kids are not just sitting in classrooms but are actively engaged in the learning process throughout the school," Tovar said.

USACE is one of the design and construction agents for the construction and renovation of DoDEA schools worldwide.

The 185,100 square-foot, 21st century school was funded in fiscal 2010 for a programmed amount of $74 million.

DoDEA calls the design of the school "student centered" with seven learning neighborhoods; a shift from traditional classrooms. The more flexible spaces with moveable walls, called learning hubs and learning studios, will accommodate large, medium and small groups, individual learning and one-to-one pairings.

According to DoDEA, true 21st century learning moves beyond the school and extends the learning space to the global community through technology, virtual instruction and real-time projects.

For more information on 21st century schools, visit www.dodea.edu/edSpecs.