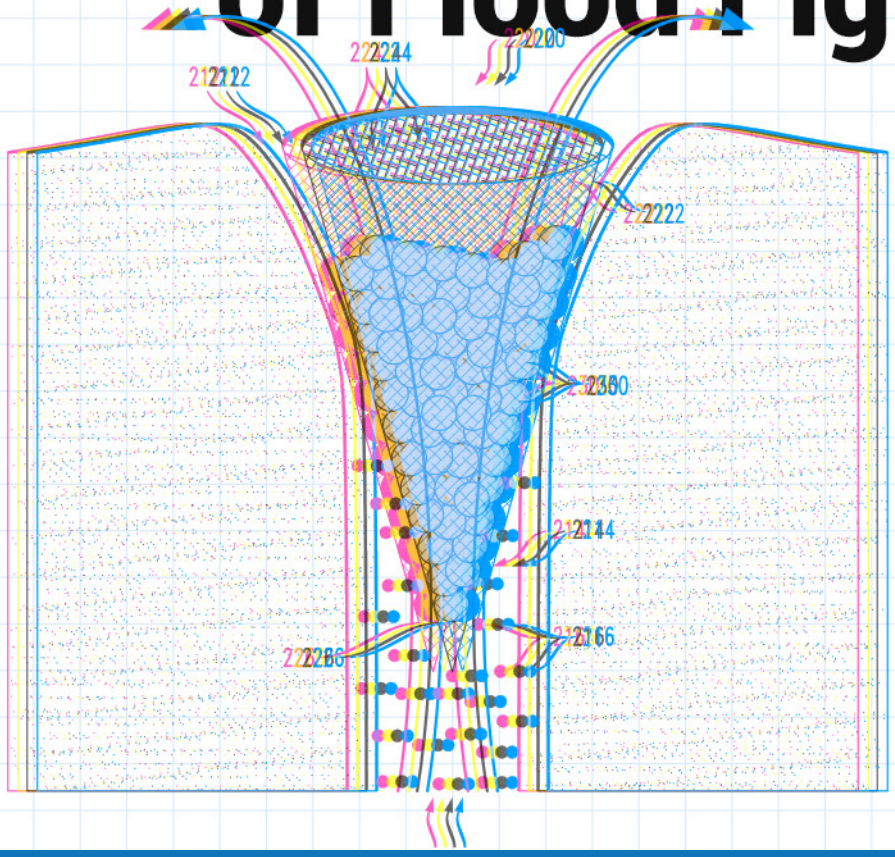
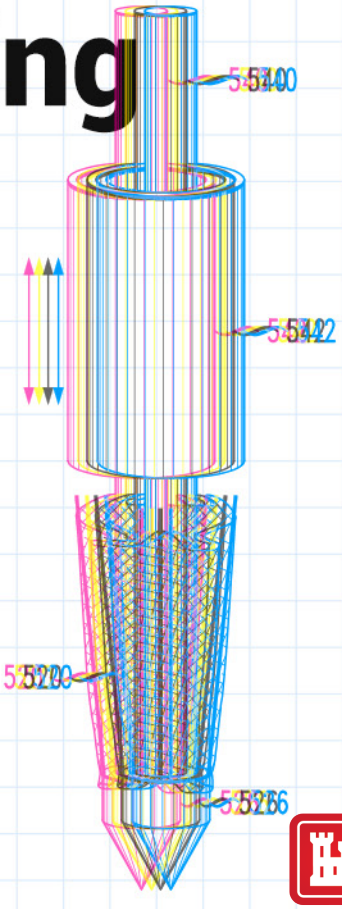
FRM

Flood Risk Management Newsletter

Testing the Future of Flood Fighting





July 2018 • vol 11 no 1

Flood Risk Management Newsletter

US Army Corps of Engineers

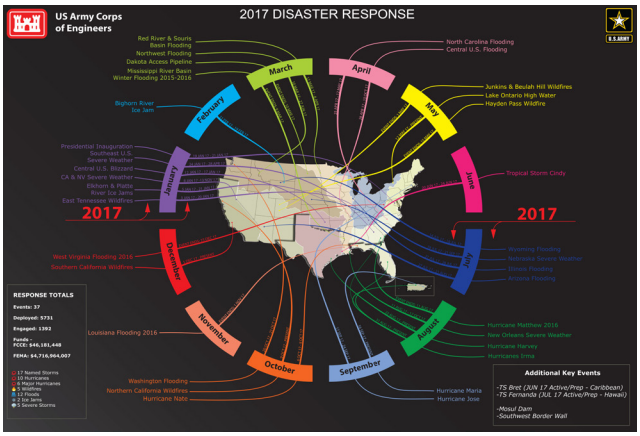
July 2018 • vol 11 no 1

CONTENTS
July 2018

FRM Newsletter
Office of Homeland Security
441 G Street, NW
Washington, D.C. 20134-1000

FRM Newsletter is an unofficial publication. Views and opinions expressed are not necessarily those of the U.S. Army Corps of Engineers or the Department of the Army.

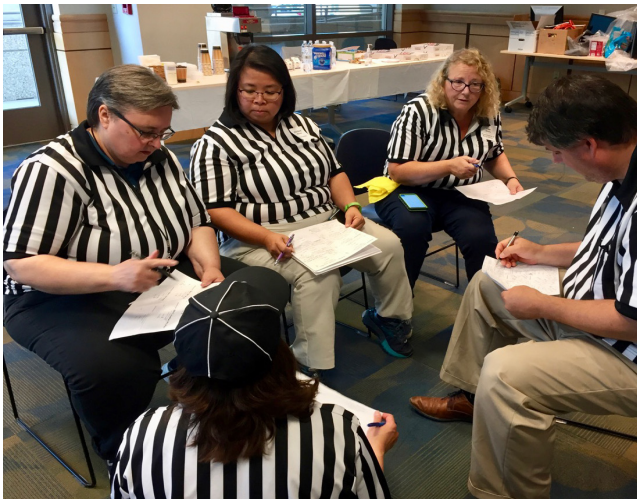
In This Issue



Interagency FRM Training Seminar

The objectives of the training seminar were to expand knowledge of new and continuing flood risk management team members, strengthen skills necessary for repeatable and achievable interagency successes in flood risk management, and enhance capacity to deliver integrated and adaptive approaches to flood risk management.

P.1

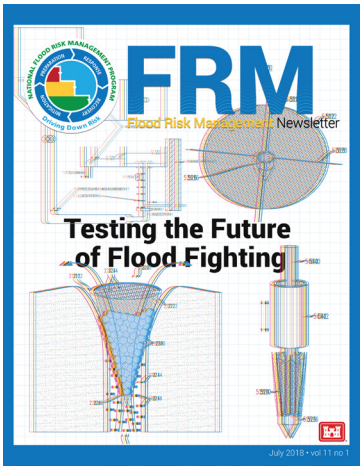


Lower Virginia Peninsula Coastal Resilience Tournament

The event is the latest installment of the multi-hazard series culminating a collaboration of the U. S. Army Corps of Engineers Institute of Water Resources and Norfolk, Pittsburg and New England Districts to bring the multi-hazard tournament to coastal communities.

P.10

On the Cover



A Sand Boil Laboratory – Testing the Future of Flood Fighting

ERDC research on sand boils is focused on developing alternative flood fighting measures that are less labor intensive than placing sand bags, yet equally as effective. As part of product testing and development, a sand boil laboratory has been developed that generates full scale sand boils in a controlled setting.

P.7

Interagency Flood Risk Management Training Seminar Increases Capacity and Capability in the Flood Risk Management and Silver Jackets Programs

By Mark Roupas, Deputy Chief, Office of Homeland Security

The National Flood Risk Management Program, which includes the Silver Jackets Program, held its annual training seminar in Indianapolis, IN from 30 April to 4 May 2018. The objectives of this training seminar were to expand knowledge of new and continuing flood risk management team members; strengthen skills necessary for repeatable and achievable interagency successes in flood risk management; and enhance capacity to deliver integrated and adaptive approaches to flood risk management. This training event brought together 212 people, half of whom were USACE representatives, while the other half was composed from our state, other federal, local community, and university partners.

The afternoon of the first day and the morning of the second day were spent strengthening and further developing our internal USACE flood risk management community. Participants came together to discuss recent and anticipated near-term changes in the program direction, using the recently issued (mid-April 2018) updated program guidance as a guide for the program direction. Groups organized by USACE Division discussed how these changes would impact implementation of the program within their Areas of Responsibility. Resulting feedback and suggestions will be evaluated in the coming weeks and, to the extent possible, incorporated into the program as changes are implemented.

In the afternoon on the second day, the USACE team was joined in the training seminar by its interagency partners. COL Antoinette Gant, Commander of the USACE Louisville District, and Mr. Bryan Langley, the Executive Director of our host agency, the Indiana Department of Homeland Security, welcomed us to their area. Mr. Langley provided one of the memorable quotes of the week by urging us to "Put the swagger back in mitigation." He is proud of the achievements the State of Indiana has made in mitigating risk and suggested to the group that we do more to claim our successes! Various flood events of 2017 were used as the backdrop and framework for presentations throughout the afternoon, helping to set the context for why the group had gathered for this training opportunity. Dr. Sam Brody, Texas A&M University, and Mr. Steve Fitzgerald, Harris County Flood Control District, both discussed their experiences in Texas before, during, and after Hurricane Harvey. Sherriff Kory Honea, Butte County, CA, discussed his experience with the Oroville Dam spillway failure and the resulting evacuation order. Sherriff Honea added another memorable quote for the week with "They don't teach dam failure in sheriff school." Sherriff Honea gave us a glimpse into his risk-informed decision-making process, and explained that his difficulty came in understanding the technical language being used to explain the changing risk. Once a common lexicon was established, he and his team knew exactly what to do in terms of executing the evacuation. The lesson for all was that we must constantly tune our risk messages to each audience. Mr. Jonathan Godt, USGS Landslide Hazards Program Coordinator, and Mr. Steve Martin, Florida State Floodplain Manager and NFIP Coordinator, also shared their experiences with events over the 2017 disaster season, including the California wildfires and debris flows, the landslides in Puerto Rico following Hurricane Maria, and the experience in Florida with Hurricane Irma. We were reminded through these presentations just how critical it is to strengthen our partnerships to ensure that very limited resources are directed to where they can best be utilized.

> "We were reminded through these presentations just how critical it is to strengthen our partnerships to ensure that very limited resources are directed to where they can best be utilized."

The theme for the third day was

Continued on page 2.

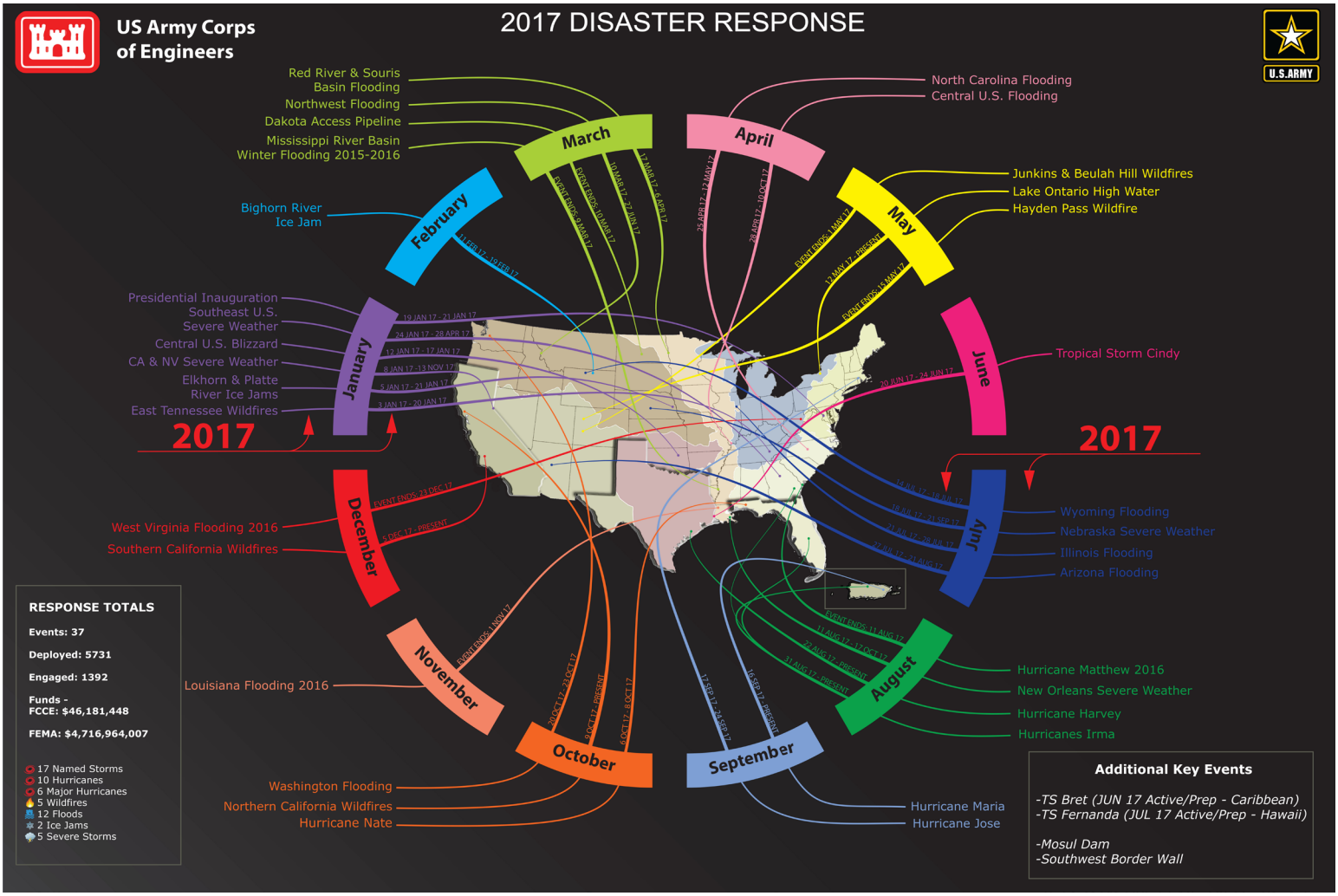


Figure 1 - Time wheel of Calendar Year 2017 disasters shared by Mr. Alexander on 3 May.

interagency collaboration, particularly within the post-disaster recovery period. The first session of this day focused strongly on this theme through opening remarks by Mr. Ray Alexander, who reflected on his experience and observations from the on-going recovery in Puerto Rico and the historic nature of calendar year 2017 in terms of both the number of events the Federal government assisted in responding to and the overall damages that occurred. Figure 1 shows just how many disasters there were and the challenges this presented for Federal emergency managers. After his presentation, Ms. Hibba Haber (USACE NAD), Ms. Mary Moran (IN DHS), and Mr. Kenny Hale (Morgan County, IN) provided examples of interagency coordination after flood events. Ms. Haber focused on coordination in New York after Hurricane Sandy, particularly the work of the Infrastructure Systems Recovery Support Function under the National Disaster Recovery Framework, and Ms. Moran and Mr. Hale provided state and local perspective, respectively, on coordination after the 2008 flooding in Indiana. The importance of strong partnerships was highlighted here as a means of allowing for implementation of "out of the box" solutions. Only with strong partnerships in place can there be the trust, knowledge, and understanding needed to identify innovative solutions. A series of break-out sessions followed, offering additional time to learn about interagency coordination opportunities in various areas of flood risk management. The final session of the day brought together three local government representatives, Mr. John Zakian (City of Minot, ND), Mr. Dave Canaan (Charlotte-Mecklenburg, NC), and Mr. Brad Jackson (City of Tulsa, OK), to provide perspective on the competing priorities within local jurisdictions. This session explored how flood risk management compares to other local priorities, how different priorities within the area (recreation, environmental, water quality, and flood risk management) can come together to solve flood risk management challenges, and how to work with the public and other city officials to communicate about flood risk and obtain support for flood risk management priorities. This served as an important reminder of the differences in priorities, concerns, and challenges experienced at different levels of government. Bringing all levels of government together is critical to developing the solutions that will work on the ground.

Continued on page 3.

The overall theme for the fourth day focused on development and implementation of plans. Mr. Chris Judge, US Department of Homeland Security, Mr. J.P. Carsone, Louisville Metropolitan Sewer District (KY) and Dr. Gavin Smith, State of North Carolina, spoke of the importance of integrating various plans to improve regional resiliency. They provided examples of development and implementation of plans pre- and post-flood disaster. The importance of developing these plans with all partners and stakeholders was emphasized. Private sector partners were also highlighted as an often overlooked sector of partners who have an important role to play in flood risk management. A series of breakout sessions offered numerous other examples of the opportunities that can be developed through use of integrated planning. Break-out sessions highlighted tools that could be used in development of plans, nonstructural and nature-based approaches, and risk communication and outreach efforts. A final plenary session, featuring Mr. Rob Davis (City of Cedar Rapids) and Mr. George Ramseur, Jr. (Mississippi Department of Marine Resources), highlighted the importance of using adaptive techniques to improve resilience over time. The day ended by recognizing the 2017 Flood Risk Manager of the Year (Mr. Tracy Schwarz, USACE NWW), Silver Jackets Coordinator of the Year (Ms. Michelle Hamor, USACE NAO), and Silver Jackets Team of the Year (Indiana). Mr. Schwarz, Ms. Hamor, and representatives from the Indiana Silver Jackets Team provided Training Seminar participants with tips and best practices for flood risk management success. Congratulations to all on earning this recognition.

To maintain the training context of these events, each day also included an exercise, culminating in the team development of plans for interagency efforts to be undertaken when they return home. On the second day, Training Seminar participants broke into

Participants listen during a break-out session.

Mr. Mark Roupas presents Mr. Tracy Schwarz with the 2017 Flood Risk Manager of the Year Award.

Mr. Mark Roupas presents Ms. Michelle Hamor with the 2017 Silver Jackets Coordinator of the Year Award.

The Indiana Silver Jackets Team is recognized as the 2017 Silver Jackets Team of the Year

Continued on page 4.

Participants discuss a partner program during the Interagency World Café.

groups to discuss various topics related to flood risk management. The purpose of these discussions was to share challenges and ideas across the interagency participants about these aspects of flood risk management, and to spur creative thinking about ways in which to address the challenges being faced. The exercise on the third day provided an opportunity, through an Interagency World Café, to meet with various agency representatives to discuss programs and resources that may be available to help address flood risk challenges of interest. This exercise facilitated the identification of new partnerships to better leverage available resources. Finally on the fourth day, state teams and partners met to review the information gathered over the earlier exercises to begin to scope an interagency effort that they could undertake in the future to address one or more of the challenges or opportunities identified throughout the week. I look forward to learning more in the future about how the content of the Training Session facilitated the development of these interagency efforts and how the efforts were implemented.

The training seminar concluded with a series of field tours and more detailed training sessions. Participants selected between a field trip to Waverly, where they visited a Living History Park and urban forest developed using hazard mitigation grant funding to buy out flood-damaged properties or a field trip to the School Branch watershed, where they learned about collaborative efforts to develop conservation practices at the watershed, sub-watershed, and edge-of-field levels to encourage better agricultural water management. Rather than a field tour, participants could also select among three in-depth training sessions. Options included a hands-on nonstructural vulnerability training assessment hosted by the USACE National Nonstructural Committee, risk communication training entitled "Storytelling Works Better than Fact Sharing" hosted by the Federal Emergency Management Agency, or a training session to help attendees understand the roles and responsibilities of the Infrastructure Systems Recovery Support Function (IS-RSF) Field Coordinator, hosted by several USACE employees who have had this role in past disaster events.

Throughout the training seminar, participants could view nearly 150 posters from states across the nation and the District of Columbia, highlighting efforts undertaken via interagency partnership to address a wide variety of flood risk management issues. Posters, presentations, handouts, and other training seminar information is available at https://www.iwr.usace.army.mil/Missions/Flood-Risk-Management/Flood-Risk-Management-Program/News-and-Events/2018-Interagency-Training-Seminars/.

In closing, I offer my sincere thanks to all those involved in planning this Training Seminar, the State of Indiana for hosting us at their wonderful facility, the presenters and moderators who helped make the sessions successful, and the participants who provided their active energy and engagement over the course of the week for making this year's Training Seminar a huge success. Looking forward to the next training event in 2019.

Participants view and discuss interagency partnership efforts highlighted on posters.

First Combined Super Research Area Review Group (SuperRARG) Meeting, April 2-5, 2018

By Mary A. Cialone, and Julie D. Rosati, ERDC-CHL

Figure 1 - 2018 SuperRARG participants represented Navigation, Environmental, and Flood Risk Management Business lines.

Each year, new research is prioritized to address emerging needs within the Navigation, Environmental, and Flood Risk Management business lines. This year, the first-ever combined "Super Research Area Review Group" SuperRARG meeting was hosted by the Engineer Research and Development Center's Coastal and Hydraulics Laboratory to engage USACE leadership and practitioners in a discussion of research that cuts across all three business lines. The SuperRARG had 150 attendees including Division and District practitioners, investigators from the Engineering Research & Development Center (ERDC) and the Institute for Water Resources Hydraulic Engineering Center (IWR-HEC), and Headquarters (HQ) leadership from the three Civil Works Business Lines (Navigation, Flood Risk Management, and Environmental) (Figure 1). Mr. James Dalton, Director of Civil Works, USACE Headquarters, provided the keynote address. Dr. David Pittman, ERDC Director, and Dr. Beth Fleming, ERDC Deputy Directory, provided welcoming remarks to inspire the three business lines to think beyond their specific focus areas and search for opportunities for cross-cutting research that leverages multiple business lines.

Each of the USACE HQ Business Line Leads summarized their priorities and strategic needs. Five panel sessions on cross-cutting research were aligned with the USACE R&D Strategy, and included (1) Infrastructure Reliability and Resilience, (2) Integrated Water Resources Technology, (3) Integrated Hydraulics, Hydrology, Coastal, and Sedimentation, (4) Engineering with Nature, and (5) Planning and Decision Support, all of which generated discussion and ideas on additional collaborative research. Demonstrations of laboratory tests, physical models, and innovative technologies related to the cross-cutting topics were also part of the 3-day meeting. A poster competition with 70 posters gave researchers additional opportunities to interact with District, Division, and Headquarters attendees (see Figure 2). The third day of the SuperRARG was devoted to discussing Statements of Need (SoN) for research related to the USACE Civil Works missions, and prioritizing those needs as part of the FY19 research planning process. This Spring, the Civil Works R&D Steering Committee will review the SuperRARG and Business Line leaders' priorities and make final recommendations for which research is selected for funding in FY19.

It is likely that a SuperRARG will be held every 2-4 years to leverage strengths and identify cross-cutting needs within the three business lines. The RARG provides vital input to the R&D process and helps to ensure that R&D is able to deliver on the goal of being a requirements-driven program. Our thanks to all who participated in this year's SuperRARG and we look forward to everyone's continued participation in the R&D process through identification and submission of SoNs and by discussing R&D needs with CoP leaders. Corps of Engineers District and Division personnel can submit SoNs via the Operations & Regulatory Gateway, https://gateway.erdc.dren.mil/son/index.cfm at any time in the FY. Submissions received within each calendar year (e.g., 2018) will be ranked for consideration at the subsequent RARG (e.g., FY19 RARG), and higher priority SoNs would initiate new research at the start of the following Fiscal Year (e.g., FY20).

Figure 2 - SuperRARG participants promote a poster titled "Extreme Biology of Asian Carp", one of 70 posters featured during the SuperRARG.

US Coastal Research Program Hosts Storm Processes and Impacts Workshop, 16-18 April 2018

By Kathryn McIntosh, ERDC, **Knauss Fellow, Julie Rosati, and Mary Cialone,** ERDC-CHL

The U.S. Coastal Research Program (USCRP) originated in 2014 based on a need identified by a community of researchers from federal agencies, academia, industry, and non-government organizations to provide a sustained and coordinated National science plan to address coastal science, engineering, and societal needs. In 2015, the USCRP had their first community workshop on Dune Management Challenges and, as a result, partner federal agencies awarded more than $260K in academic grants to fund coastal dune research and community challenges that were identified during the workshop. During the 2017 Hurricane season, the USCRP again recognized a critical need of the coastal community to discuss the accuracy and uncertainty associated with coastal storm predictions and how risks are best communicated to the public. A workshop was conceived to understand the research community's present capabilities for modeling storm processes and forecasting impacts; how best to communicate these risks and uncertainties to coastal inhabitants; and then identify and prioritize topics for advancements.

During 16-18 April 2018, the USCRP hosted the Storm Processes and Impacts Workshop in St. Petersburg, FL. The workshop attracted 105 attendees which included federal agencies, academia, and state and local emergency managers. Presentation topics included federal, state, and academic research programs, discussed how to engage the public with dynamic storm information during a hurricane event, and discussed new research needs related to storm prediction and impacts. Workshop attendees also participated in breakout sessions designed to identify challenges in forecasting storm impacts and communication during storms, in addition to discussing research and infrastructure needs. Attendees voted and identified priority topics, which were developed into Storm Processes Challenges (see text box).

The USCRP will release a report on the Workshop Findings related to research, forecasting, infrastructure, and communication challenges in Summer 2018. As part of the workshop, the USCRP's federal agency partners have identified approximately $550K in FY19 competitive academic research awards that are available to stimulate research in storm processes and impacts. Only workshop attendees are eligible to submit proposals and they must be in collaboration with coastal community practitioners. For more information on the USCRP please see the USCRP website https://uscoastalresearch.org.

USCRP Storm Processes Workshop Challenges

Research:

- Quantify the spatial and temporal resolution and accuracy required for decision-making during coastal hazards
- Improve integration of relevant physical processes in numerical models
- Improve sediment transport knowledge and integrate into morphology change models
- Incorporate feedback between physical processes in numerical predictions
- Define data requirements for accurate coastal hazard forecasts in a probabilistic model
- Develop guidance for mitigation solutions
- Learn from model error to improve process understanding and models
- Quantify the value of natural and nature-based features in reducing storm hazards
- Improve knowledge of natural beach & dune recovery
- Understand variability of impacts depending on shoreline type – cliff, marsh, mangrove, ice, etc.
- Better understand storm impacts to structures
- Assess available statistical methods to best utilize limited model results

Infrastructure:

- Establish a community of practice for coastal storm modeling, instrumentation, and communication
- Conduct a comprehensive process-based study during a coastal storm
- Address data needs:
  - Archive coastal hazard data in common language, central repository
  - Provide real-time data with adequate spatial coverage
  - Update initial conditions
  - Provide observations during storms
  - Provide access to high resolution remote sensing data
- Arrange the built environment for rapid response measurements (smart structures)
- Integrate, support, and coordinate field studies
- Community involvement (citizen science)
- Develop and test novel/appropriate instrumentation platforms for better observations of sediment and morphodynamics
- Establish a pre-event funding source

Forecasting:

- Integrate multiple hazards and processes over temporal and spatial scales
- Improve accuracy of meteorological conditions
- Determine and propagate uncertainty
- Predict timeline and level of storm impact
- Help under-served communities access and receive information

Communication:

- Communicate and manage uncertainty
- Translate numerical output into relatable user products
- Educate the public on storm surge impacts and post storm conditions
- Communicate economic benefits of mitigation
- Integrate with social science experts
- Tailor messaging to best communicate
- Develop mechanisms to share best practices and data
- Consolidate and unify tools

A Sand Boil Laboratory – Testing the Future of Flood Fighting

By Isaac Stephens, P.E. and Bryant Robbins, P.E., U.S. Army ERDC, Vicksburg, MS.

Introduction

Researchers at the U.S. Army Engineer Research and Development Center (ERDC) are developing new and innovative approaches and tools to improve existing flood fighting techniques. The phrase "flood fighting" as used in this article refers to emergency operations and efforts that take place during flood events to reduce the risk of levee failure. One of the major risks is backward erosion piping (BEP), a type of internal erosion that causes open erosion channels to progress through foundation sands beneath levees, creating sand boils as shown in Figure 1. In an attempt to control the erosion process, sand boils are often ringed with sand bags (Figure 2) or covered with barrels to raise the water level in the boil. By raising the water level, the horizontal hydraulic gradient in the foundation is reduced, and the erosion process will slow down, potentially stopping altogether.

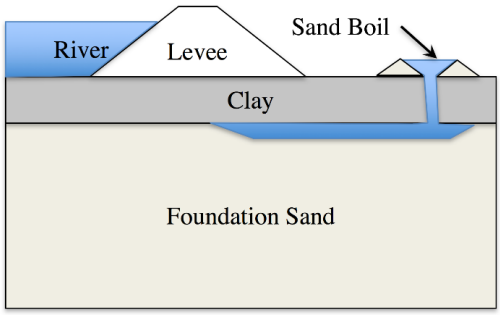


Figure 1 - Illustration of backward erosion piping beneath a levee.

Figure 2 - Photograph of typical sand bag ring used to control sand boils.

Although sand bags have successfully been used to control BEP for decades, the use of sand bags is incredibly labor intensive. ERDC research on sand boils is focused on developing alternative flood fighting measures that are less labor intensive than placing sand bags, yet equally as effective. As part of product testing and development, a sand boil laboratory has been developed that generates full scale sand boils in a controlled setting. Efforts are currently underway to evaluate alternative flood fighting measures using this laboratory.

The Sand Boil Generator

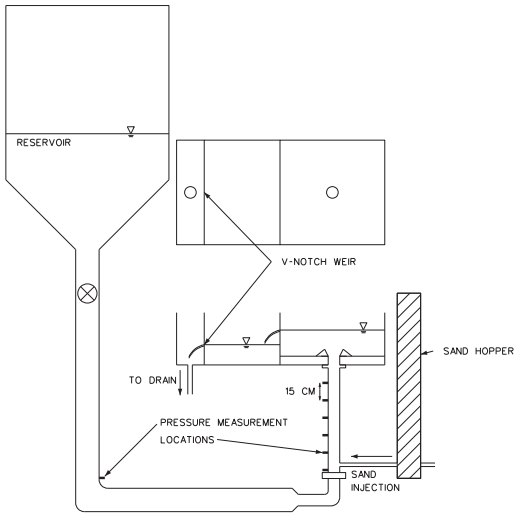


Figure 3 - Schematic of the sand boil generator.

ERDC's Geotechnical and Structures Laboratory has developed a device that is capable of generating full scale sand boils in a controlled environment. This device allows researchers to duplicate sand boil conditions with control over a wide range of variables, including hydraulic gradient, flow rate, grain size, throat diameter, and the amount of suspended solids, while allowing observers to see and measure the effects of different flood fighting strategies. The drawing below shows how this device is set up (Figure 3).

The device consists of an elevated reservoir connected to an instrumented, vertical column used to simulate the throat of a sand boil through a confining layer. A sand hopper is connected to the base of the column that is capable of injecting sand into the vertical column at controlled rates. The sand is injected into the column to simulate the sand that would be transported to the boil by the erosion channels in the foundation. The sand is then transported vertically through the column and deposited on a level surface resulting in the formation of a sand boil. The water surface in the discharge area is regulated by a series of weirs that control the level of sand boil submersion and determine the flow rate through the boil. The outflow from the system is captured in a tank and continuously recirculated. Photographs of the completed sand boil generator and an active sand boil created in the device are shown in Figure 4.

Continued on page 8.

Figure 4 - Overview of the sand boil generator (left) and an active sand boil (right).

Future Sand Boil Control Measures

"These initial tests demonstrated that the filters are indeed effective at preventing further erosion while still allowing the water to freely drain from the foundation."

In 2016, the USACE Risk Management Center funded a small team to collect measurements of sand boils during flood events on the Mississippi River and Tributary levee system. This funding provided an opportunity to measure many of the hydraulic characteristics of sand boils in the field. As a result of these field investigations, various concepts for mechanically restrained sand boil filters were developed. A few sample designs for sand boil filters are shown in Figure 5 and Figure 6. The filters consist of geotextile filter fabric that is held in place by either friction, self-weight, and/or mechanical restraints (such as prongs as shown in Figure 6). In order to ensure these ideas can be freely developed and used by Corps entities, a patent application has been filed by the Engineering Research and Development Center that covers all devices intended to filter sand boils. Additional variations of this concept are currently under development.

A prototype of the conical sand boil filter (Figure 5) underwent preliminary field testing during high water levels on the Mississippi River & Tributaries levee system in 2017. These initial tests demonstrated that the filters are indeed effective at preventing further erosion while still allowing the water to freely drain from the foundation. Although effective during initial field tests, the test conditions were rather limited. More exhaustive testing of these sand boil filters is currently being conducted in the laboratory sand boil generator.

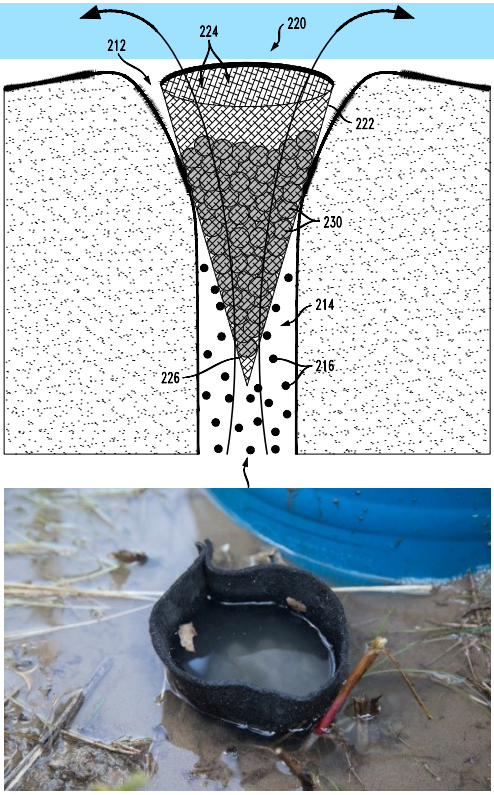


Figure 5 - A conical sand boil filter restrained by gravel as a concept (top) and as installed in the field (bottom).

Continued on page 9.

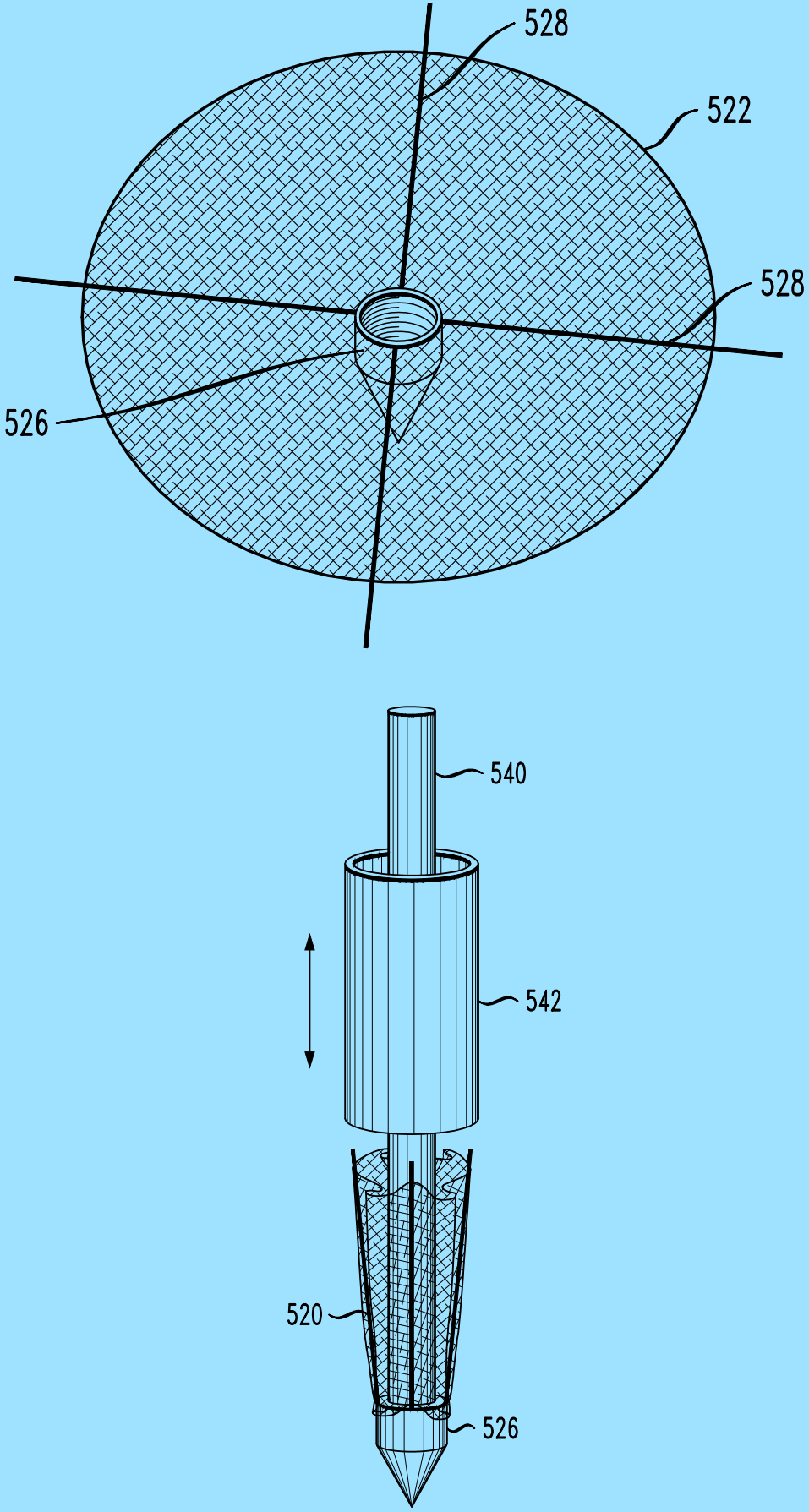


Figure 6 - . A conical sand boil filter with prongs shown (top) fully expanded and (bottom) fully contracted for insertion into the sand boil throat.

"Extensive testing of these new technologies is currently underway in the sand boil laboratory to examine their effectiveness compared to traditional measures."

Conclusions

The Corps has effectively managed risks associated with BEP through active flood fighting of sand boils along levees during flood events, most commonly through labor-intensive placement of sand bags. Flood fighting operations can potentially be made more efficient and effective by developing alternate means of controlling sand boils. This paper describes a sand boil laboratory that was developed for testing potential control measures in a laboratory setting. Further, example designs of new sand boil control measures were presented. Extensive testing of these new technologies is currently underway in the sand boil laboratory to examine their effectiveness compared to traditional measures. While this testing allows careful evaluation of product performance, field validation of these technologies is also needed. Should you encounter active sand boils during flooding in which these products can be tested, or for more information about the sand boil laboratory and innovative sand boil control measures, please contact the authors.

Lower Virginia Peninsula Coastal Resilience Tournament

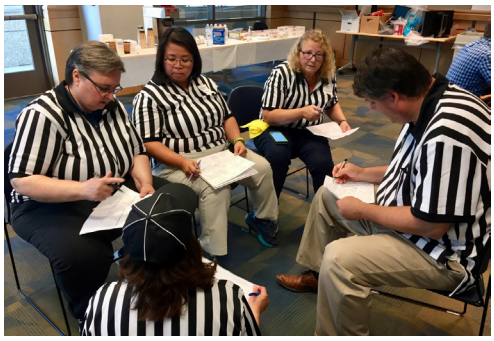
By Lower Virginia Peninsula Coastal Resilience Tournament Project Delivery Team

The Day arrived! The whistle blared signifying the start the Lower Virginia Peninsula Coastal Resilience Tournament. The event, hosted by the city of Hampton on June 5, 2018, is the latest installment of the multi-hazard series culminating a collaboration of the U. S. Army Corps of Engineers Institute of Water Resources and Norfolk, Pittsburg and New England Districts to bring the multi-hazard tournament to coastal communities.

Andrea Carson, Michelle Hamor and Harvey Hill introduce the game

Representatives from the Virginia Department of Emergency Management, Virginia Department of Conservation and Recreation, Hampton Roads Planning District Commission, cities of Hampton and Newport News, Old Dominion University, Virginia Institute of Marine Science comprised five teams charged with developing strategies to employ multiple funding programs to reduce the greatest amount of risk in two watersheds. The goal of the event was to encourage participants, from a variety of backgrounds, to think broadly about management measures, opportunities for multiple benefits and available funding programs to reduce risk for communities. Because the demand is high even on sunny days, budgets are more reactive to flood events. Add in the high inventory of repetitive and severe repetitive loss structures, the uncertainty of the availability of the amount and timing of budgets, requirement to reduce Total and Maximum Daily Loads within the Chesapeake Bay Watershed citizen feedback, localities need creative solutions to face the complex problem.

During the event, teams developed investment strategies using a Decision Support Tool (DST) on a Microsoft Excel platform. The DST, originally developed for multi-hazard tournaments in San Antonio and Cedar Rapids, provided a local budget offered funding programs and opportunities for multiple benefits such as combining acquisition with wetland creation or recreation and management measures from the North Atlantic Coast Comprehensive Study (NACCS). As investment decisions were made, teams could monitor the demands on the local budget and their citizen response. Taxes could be raised for strategies that exceeded the local budget. The DST calculated damage reduction benefits using depth damage functions from a Continuing Authorities Program, Section 205 project and NACCS water surface elevations.



Michelle Hamor, USACE Norfolk District Project Leader and her "referees"

Teams developing their action plans

While games to encourage flood risk management, such as the Game of Floods by Marin County, are not a new concept, this tournament strove to employ relevant local data to facilitate meaningful conversations that could lead to implementable strategies. The teams reducing the greatest amount of risk and having the most improved score received Silver Jacket medals.

http://www.wavy.com/news/local-news/tournament-pits-teams-against-each-other-to-fight-flooding/1220557044

Rethinking America's Costliest Disaster - Floods

By Dr. David Alexander, Director, DHS S&T Flood Apex Program and Chief Geospatial Scientist

In 2014, the Administrator of the Federal Emergency Management Agency (FEMA) requested that the Department of Homeland Security's (DHS) Science and Technology Directorate (S&T) develop a cross-cutting program to improve the way our nation copes with flood disasters.

Floods afflict every state and virtually every county. The nation's annual cost of damage from floods is about $8 billion per year. More than 330 people die in floods each year and the National Flood Insurance Program is still $14 billion in debt, even after the latest budget forgave $16 billion, and that does not include the billions in emergency funds spent for floods caused by record-setting hurricanes.

The DHS S&T Flood Apex program brings an entrepreneurial, insightful and disciplined approach to improve the nation's response to flood disasters in collaboration with the FEMA.

S&T takes advantage of both cutting-edge and off-the-shelf technologies in new ways, applying them in various aspects of flood management.

The program compartmentalizes its research and development efforts in three major areas:

- **The flood event itself.** We can respond to floods faster if we have more timely and accurate warnings. We can also use automated technologies to measure flood damage immediately, so we can send funds and help to the right places, right away.

- **Insurance for individuals and business.** We can close the flood insurance gap in the United States by establishing an effective public-private partnership. S&T supports studying the nature of the private flood insurance market across the country and analyzing factors that influence the number and form of flood insurance policies offered by the private market to develop policy recommendations.

- **Community investments in flood protection.** Communities can avoid or reduce flood damage in lots of ways. They can change zoning; plan green zones to absorb water; build dams, levees and storm sewers; and plan for quicker and safer evacuations. But they need better data and forecasts if they are to enlist their citizens in knowledgeable discussions of what is best **for them**.

Some exciting ways Flood Apex is advancing our national flood response capability are:

Low cost flood alert sensors: In collaboration with Lower Colorado River Authority in Texas, the Flood Apex is pioneering lightweight, networked flood sensors that are cheap enough to deploy in substantial numbers, virtually anywhere. These will relay flood warnings to smartphones, targeting first responders and people in flood risk areas.

Dam health and safety monitoring: The United States has over 90,000 dams; of which about 65,000 are small/medium size and privately owned[i]. Because there is no national standard for dam health assessment and reporting, Flood Apex is working with the Kentucky Division of Water to help develop an assessment standard and the sensor and monitoring technology to support it.

Radar satellites for quick damage assessments: Low altitude radar satellites can see through clouds. Today's technology now allows them to see fine detail—enough to measure flood levels and damages to individual structures while a storm is in progress. Flood Apex is working with satellite companies to create near-real-time flood damage assessment.

Comprehensive national structures data: High-resolution satellite photographs can now be read using artificial intelligence to pick out and map individual buildings and structures. Working with the Oak Ridge National Laboratory, Flood Apex is using this technology to build the first national structures inventory, allowing private insurance companies to enter the flood insurance market more confidently.

National flood proofing standards: In partnership with the Association of State Flood Plain Managers, Flood Apex commissioned national standards for flood-proofing materials, such as barriers and sealants. This will open the way to upgrade local building codes in flood-prone areas to help homeowners lower their insurance costs.

Using better data and advanced tools, Flood Apex is leading the way in rethinking the roles of government, the insurance industry, non-profits and the private sector in many aspects of flood management. Flood Apex **will continue to provide its stakeholders with expertise and leadership in emergency management and disaster response.**

If you are interested in learning more about the Flood Apex Program, visit https://www.dhs.gov/science-and-technology/flood-apex or contact us at flood.apex@hq.dhs.gov

[i] https://www.dhs.gov/dams-sector

Integrating Ice Jam and Sediment Transport Model Results into Flood Frequency Statistics

By Stanford Gibson, PhD., IWR-HEC, **Mary Weidel,** LRE, and **Carrie Vuyovich,** ERDC-CRREL

In 2013, a mid-winter rain fell on accumulated snow in central Michigan. The rising river flows broke up nearly a foot of ice cover on the Muskegon River The ice jammed at the upstream end of the Rogers Dam reservoir delta, backing up river levels enough to displace residents and cause over $3 million of damage through Big Rapids, MI (Figure 1 – left shows ice-induced flooding from 2013). The 2013 flood event was the latest in a long history of ice jam impacts on the Muskegon River. A historic analysis that surveyed over 1,500 issues of a local newspaper, associated with likely ice jam conditions, identified at least sixteen other ice jam events since 1938. The right side of Figure 1 shows an ice jam in 1988. Additionally, sediment is accumulating in the Big Rapids reach of the Muskegon River making the flooding worse. Sediment deposition at the upstream end (reservoir delta) has increased the probability of ice jams in the Big Rapids reach of the Muskegon River. The reservoir decreases river velocity, which causes sediment to settle. The sediment reduces channel capacity and river slope, making ice more likely to accumulate.

The complex interaction of hydrology, hydraulics, ice physics, and sediment transport processes make standard flood risk analysis methods difficult to apply in these types of complex systems. Rivers with ice jams reach flood stage at much lower flows than rivers without ice, so standard flood-frequency approaches can significantly under-predict flood risk in ice jam impacted systems. Additionally, sediment deposition increases the risk of future ice jams. But the Big Rapids reach of the Muskegon River does not have sufficient historical river stage data to assess these flood risks, requiring a modeling approach. Therefore, a joint team from the Hydrologic Engineering Center, the Detroit District, and the Cold Regions Research Center used the ice jam (Figure 2) and sediment transport capabilities in HEC-RAS – tools developed and enhanced by the Flood and Coastal Systems R&D Program – to develop a mixed frequency, stage-probability curve that accounts for present and future flood risk associated with ice and sediment impacts (Figure 3). Ice scars on trees and surveyed high water marks on buildings were used to calibrate HEC-RAS. The integrated sediment and ice analysis predicted that ice increases 1% flood stage near Rogers Dam by over two feet and that sediment deposition will increase future flood stages by another foot. Modeling sediment and ice in this system generated a much more accurate assessment of present and future flood risk on the Muskegon River. The same models were then used to evaluate the flood risk reduction benefits of a suite of mitigation alternatives that were presented to the local communities. This type of study illustrates how complex hydrology, hydraulics, ice, and sediment transport processes interact, and how alternatives can be developed in a risk-based analysis to mitigate present and future damages. More details on this project and analysis are available in the project report: Ice and Sediment Impacts on Flood Risk on the Muskegon River." Peer review publications are in development and review.

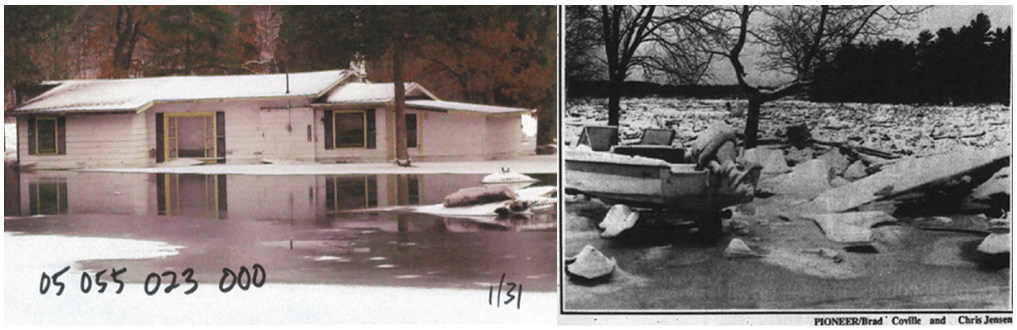


Figure 1 - Ice-induced flooding on the Muskegon River in 2013 (left) and a historic ice jam from 1988 (right, courtesy of the Pioneer).

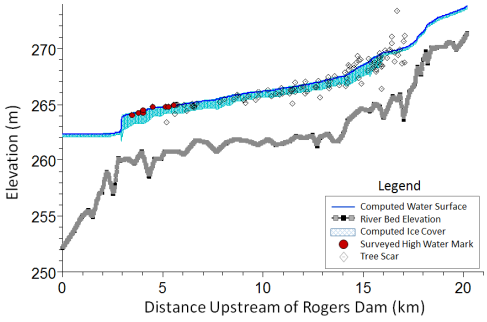


Figure 2 - HEC-RAS Ice Jam Model of the 2013 event, calibrated to surveyed high water marks and tree scars.

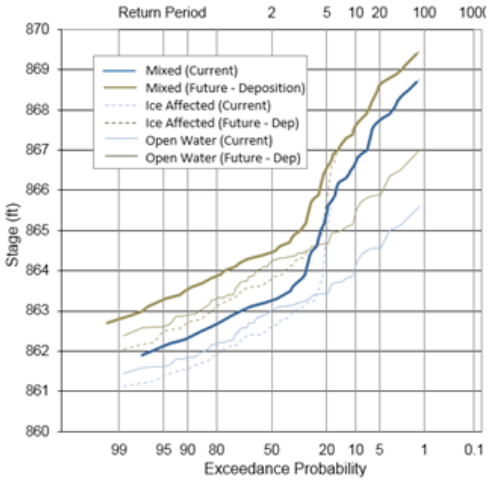
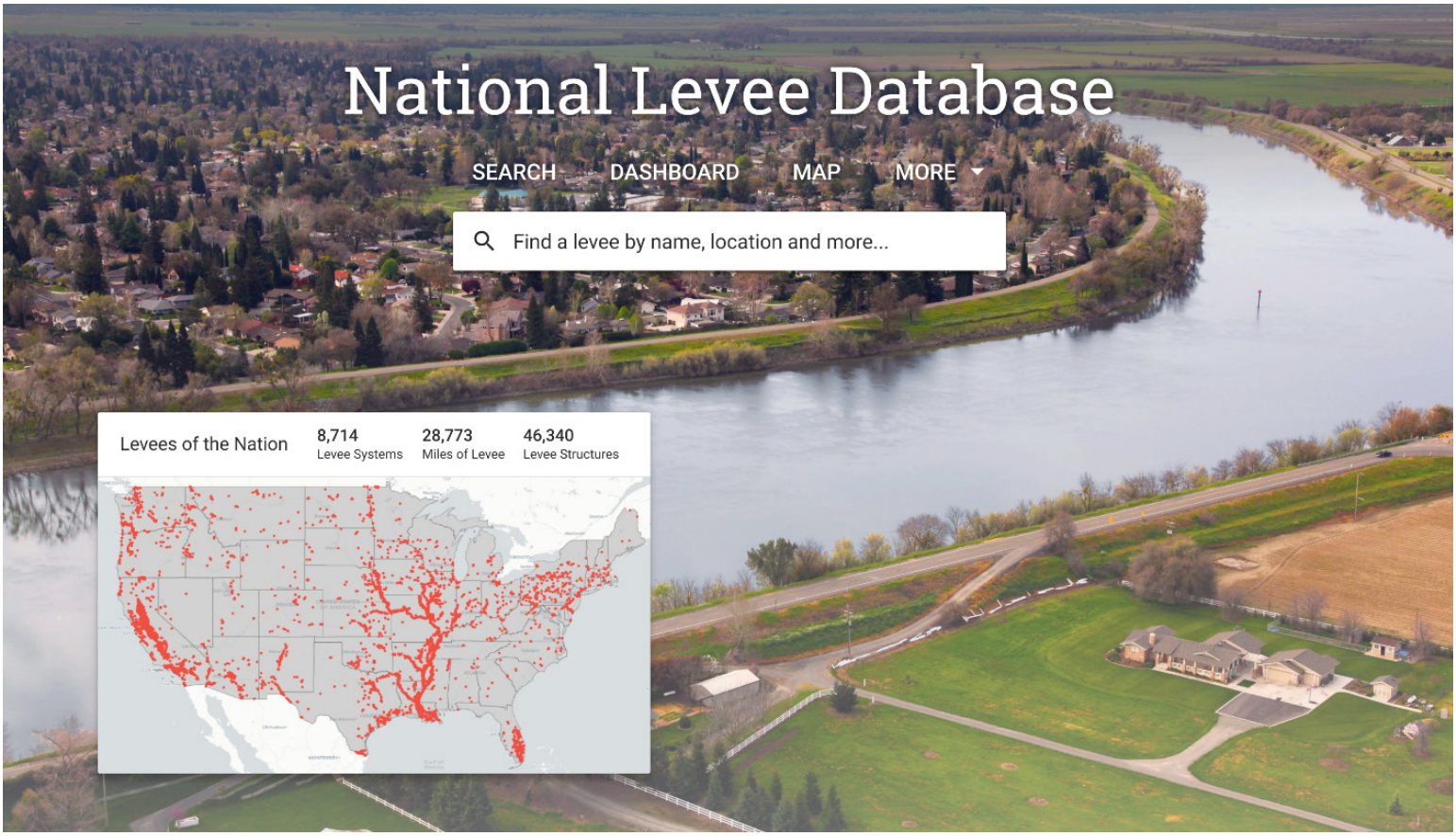


Figure 3 - Stage-Frequency curves for annual open water and ice affected events, and the combined, mixed frequency curve for present conditions and after 50 years of deposition.

National Levee Database Updates

By Cathi Sanders, NWK



National Levee Database homepage

On June 5th, the U.S. Army Corps of Engineers (USACE) launched an updated, more user-friendly version of the National Levee Database (NLD), located at https://levees.sec.usace.army.mil. The NLD provides USACE personnel, local levee sponsors and owners, flood risk managers, emergency managers and community members with visualization and search capability of levee systems nationwide. It is a dynamic, living database that includes information such as levee location, condition and risk assessment findings.

"The National Levee Database provides information that builds public understanding of the benefits and potential risks levees pose," said Eric C. Halpin, P.E., USACE Deputy Dam and Levee Safety Officer. "The database now contains more of the nation's levees. In addition to information about levees that participate in USACE Programs, it also now includes information about levees in communities that participate in FEMA's National Flood Insurance Program. Some levees have also been added from federal agencies and states. We continue to work closely with additional federal, state, and local governments and tribes to include the information about other levees on a voluntary basis."

The updated NLD now provides users with information on approximately 30,000 miles of levees. About half of those levee miles are associated with USACE programs. USACE levees alone reduce flood risk to more than a trillion dollars of public and private property, including homes and businesses, critical infrastructure, such as highways, hospitals, schools, utilities, and significant environmental and cultural resources. Over 11 million people live and work behind USACE levees, making the NLD an invaluable resource for those who want to understand more about their local levee system and their flood risk.

USACE and FEMA worked together to double the miles of levees in the Nation's Inventory by integrating FEMA's dataset of levees into the NLD. The agencies used a series of data quality protocols to ensure the best information would be available to database users. For each added system, FEMA and USACE estimated the leveed area -- the area that is likely to be inundated should the levee overflow or breach – and determined the population at risk, structures at risk, and other information relevant to those living and working behind a levee system. The updated NLD website also includes a new FEMA tab.

Continued on page 14.

"Users can also now more easily identify and access basic information about the physical attributes of the levee system relevant to flood fighting, design, construction, operation, maintenance, repair and inspection."

This new tab allows the end user to quickly find accreditation information about any levee system. It also links users to more specific information about FEMA and its levee-related programs and mission.

The updated NLD website has also been reconfigured to provide users with ready access to levee risk information. Levee system information is presented in an easy to understand manner and the new layout of the NLD website moves the user from an overview of the levee system through series of "tabs" to more detailed information. Users can also now more easily identify and access basic information about the physical attributes of the levee system relevant to flood fighting, design, construction, operation, maintenance, repair and inspection.

Of note:

- Every levee system now has an Executive Summary page (illustration A) that displays the most critical information for the levee in one location. The page includes a Project Description, a brief overview of the system that specifies levee location, provides a physical description of the levee, details when, by whom and why the levee was built, and indicates who is responsible for its current operation.
- From the Executive Summary page, the user can select other, more detailed, tabs with information on the System, the Segments, levee Inspections, the levee Profile/survey, FEMA information and more.
- A new Risk tab (Illustration B) provides details about risk assessments performed on the system, information about potential consequences should the levee overflow or breach, and an overall risk characterization for the levee system, which briefly describes the results of the most recent assessment.
- The Executive Summary page now includes an interactive map view.
- The updated NLD platform has updated ability for users to search and find specific information.

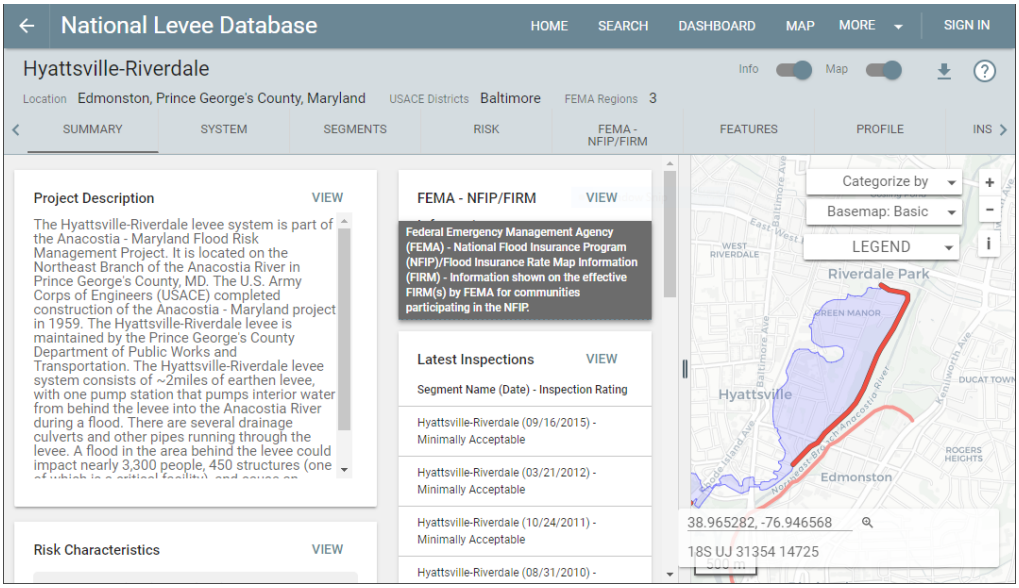


Illustration A

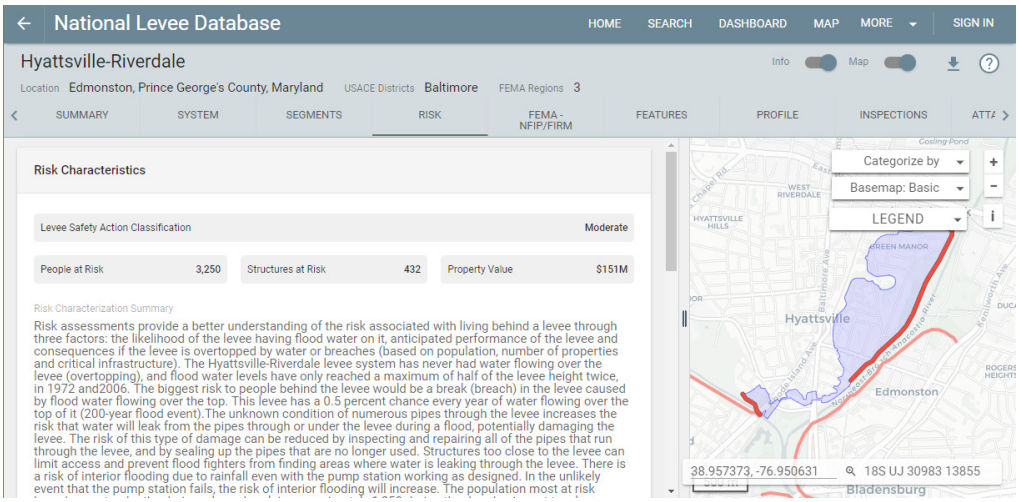


Illustration B

Moving forward, the NLD team, comprised of both FEMA and USACE personnel, will continue to refine and add enhancements for the end-user. Building the Nation's Inventory of levees remains a key goal for both agencies, along with enhancing data quality and data freshness for all levee systems.

The NLD not only supports the levee community (including Federal, Tribal, state and local entities) in its management of levee systems including emergency management and flood risk management activities but also will help build awareness of the risks and benefits of levees for individuals who live and work behind a levee system.

Other Important Information

Events

This listing is for information only and is not a complete list of FRM-related meetings. These meetings are not endorsed by the Corps of Engineers unless specifically stated. If we have failed to list a conference/meeting/symposium that would be of interest to the Flood Risk Management community, please forward the conference details to us.

9-12 July 2018 – **NAFSMA 40th Anniversary Meeting** – Santa Fe, NM - http://www.nafsma.org/event/nafsma-40th-anniversary-meeting

4-8 November 2018 – **2018 AWRA Annual Conference** – Baltimore, MD - http://awra.org/meetings/Baltimore2018/index.html

8-13 December 2018 – **9th National Summit on Coastal and Estuarine Restoration and Management** – Long Beach, CA – https://www.estuaries.org/2018-summit-general-info

6-10 January 2019 – **99th American Meteorological Society Annual Meeting** – Phoenix, AZ - https://annual.ametsoc.org/2019/

23-27 March 2019 – **2019 AWRA Spring Specialty Conference** – Omaha, NE - http://awra.org/

22-25 April 2019 – **National Hurricane Conference** – New Orleans, LA - http://hurricanemeeting.com/

19-24 May 2019 – **ASFPM Annual Conference** – Cleveland, OH - http://www.floods.org/index.asp?menuID=223&firstlevelmenuID=181&siteID=1

Be sure to check out floods.org for the dates of state conferences and training opportunities: http://www.floods.org/n-calendar/calendar.asp?date=3/12/2016

FRM Statements of Need: Submitting "Statement of Need" is the first step in the process of a concept becoming a requirement for research and development. If USACE District personnel have problems or situations they feel should be addressed by research, the Flood Risk Management Gateway, http://operations.usace.army.mil/flood.cfm, is the place to submit these research Statements of Need (SoNs).

Past issues of this newsletter, various links, news items, and presentations, are all available on the Flood Risk Management Gateway, https://operations.erdc.dren.mil Check it out!

This newsletter is a product for and by the Flood Risk Management Community. The views and opinions expressed in this unofficial publication are not necessarily those of the U.S. Army Corps of Engineers or the Department of the Army.

If you would like to submit an article or an idea for an article for the next edition of the newsletter, or if you have any comments or questions about articles in this edition, please email ***Stephanie.N.Bray@usace.army.mil.***

FRM Flood Risk Management Newsletter

US Army Corps of Engineers®