



DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

CECW-HS

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MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Resilience Integration in the USACE Flood Risk Management Mission

1. Purpose

This memo describes how the United States Army Corps of Engineers (USACE) Flood Risk Management (FRM) activities, projects, and programs currently consider resilience. The memo highlights work already underway within USACE to identify ways to further actualize resilience throughout the FRM project life cycle and encourages resilience-focused thinking when discussing FRM-related community needs, while aligning with the USACE FRM mission of reducing the threat to life and property from flooding and coastal storms.

2. References

- a. Engineer Pamphlet (EP) 1100-1-2: 2016 USACE Resilience Initiative Roadmap, 16 October 2017
- b. EP 1100-1-3, USACE Sustainability: Definition and Concepts Guide, 19 July 2018
- c. EP 1105-2-57, Subject: Stakeholder, Engagement, Collaboration, and Coordination, 1 March 2019
- d. Engineer Regulation (ER) 1100-2-8162: Incorporating Sea Level Change in Civil Works Programs (revised), 15 Jun 2019
- e. Director's Policy Memorandum (DPM) 2019-02, Subject: Operationalizing Risk-Informed Decision Making in Project Management (Planning Phase), 2 July 2019
- f. ER 1105-2-101: Risk Assessment for Flood Risk Management Studies, 15 July 2019
- g. EP 1100-2-2, Civil Works Sustainable Infrastructure Practices Guidebook, 1 December 2019
- h. EP 1100-1-5: USACE Guide to Resilience Practices, 1 December 2020
- i. Engineering and Construction Bulletin (ECB) 2020-6: Implementation of Resilience Principles in the Engineering & Construction Community of Practice (revised), 9 May 2022
- j. ECB 2018-14: Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects (revised), 19 Aug 2022

3. Background and Discussion

a. USACE has long delivered resilient solutions for its FRM projects. Resilience is integral to all functional areas, including planning, design, engineering and construction, operations and maintenance, and re-evaluation. USACE recognizes resilience as "the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions." (USACE Guide to Resilience

Practices (EP 1100-1-5)). There are four principles of resilience: Prepare, Absorb, Recover, and Adapt; referred to as the PARA Principles. Individually, each principle guides the development and incorporation of specific actions and measures into projects. Together, these principles span the project life cycle to build and maintain resilience.

b. USACE analyzes and incorporates resilience at the project, system, and community level. Understanding the application of resilience first requires identifying and defining the vulnerabilities facing a particular project, system, or community (see Enclosure 1). Natural and anthropogenic drivers such as climate change, land use and land cover change, as well as social community assets and characteristics, can influence all levels of resilience. Identifying and mapping the risks associated with these drivers is critical for the development of PARA strategies. Efforts are underway within USACE and with project partners to define procedures and processes for examining drivers and applying resilience factors into FRM projects.

c. Community resilience can be more challenging to address as it is influenced by socio-ecological factors that are difficult to measure and may fluctuate over time. As a result, resilience should not be considered an end state but a constant condition to be regularly evaluated and sustained. USACE decisions should look across the full FRM project life cycle (e.g., planning, construction, operation and maintenance, inspections, re-evaluations) to assess nonstructural, structural, nature-based solutions (NBS), and hybrid approaches. Considering the full spectrum of solutions across project life cycles allows for exploration of a variety of alternatives to identify actions that could lead to the outcomes that promote resilience from flooding and coastal storms. The approaches used, the incorporation of resilience benefits, the people involved, the tools and models applied, and the solutions selected all factor into making decisions that promote resilience. USACE FRM programs and activities should continually examine their interactions, guidance, procedures, and tools to identify ways to evolve risk-informed decision-making practices for improved project resilience and to provide greater support to community resilience both locally and through national policies.

4. Action

To promote resilience as a fundamental component of work performed through the USACE FRM mission, the following information is provided as a guide for the USACE FRM Community of Practice (CoP):

a. *FRM Resilience Focus.* Resilience is integral to all aspects of the FRM project life cycle. USACE FRM programs and activities range from structural measures to natural/NBS to nonstructural approaches, as well as hybrid combinations. Finding the right combination of FRM actions to encourage resilience may require thinking differently and working together to identify the best solution. Enclosure 2 provides best practices linked to PARA as well as existing USACE direction, such as the 2016 Resilience Roadmap and the USACE Guide to Resilience Practices, to promote taking a collaborative approach to develop innovative and resilient approaches.

b. *Internal Coordination.* USACE Headquarters (HQUSACE) leadership established a cross-functional FRM CoP to bring together USACE programs and functional areas to facilitate integrated solutions to FRM challenges. The FRM CoP's Advisory Board is exploring ways to actualize resilience into FRM activities. Improving awareness of

USACE employees about FRM topics, building situational awareness of opportunities, and reinforcing a culture that considers FRM more broadly with an eye toward resilience facilitates stronger partnering and leads to resilient projects. USACE FRM CoP members should be aware of the range of USACE FRM programs and initiatives and seek opportunities to leverage the experience and resources that support resilience. Informal internal interactions or more formalized venues, such as FRM CoP events, promote the relationship building and sharing of lessons learned and best practices needed for whole-community resilience.

c. Adaptability. Resilience requires a holistic and collaborative approach. There is no perfect resilience strategy; it is a process that will be unique to each community and adaptable to tolerate future uncertainty. USACE has built adaptability into many of its new projects with a scenario-based approach. USACE also continues to work with the Assistant Secretary of the Army for Civil Works, the Office of Management and Budget, Congress, and the Administration to determine areas where USACE is a part of the solution. Each situation has unique stakeholders, values, and community structure, to which USACE should be sensitive and be prepared to adjust based on the needs of the community. Open and ongoing communication with the full suite of FRM stakeholders will provide a well-rounded understanding of the concerns and interests that influence the direction of community resilience; to be more effective, USACE will strive to participate in adaptation.

d. External Collaboration.

(1) A fully resilient project must provide outreach and incorporate meaningful involvement with communities. USACE recognizes the challenges and potential barriers underserved communities face when attempting to work with the Federal Government. In this context, underserved communities generally refer to communities that have been systematically denied a full opportunity to participate in key aspects of economic, social, and civic life. Working with underserved communities to develop a common understanding of project purposes and community needs to co-develop solutions may be best facilitated through engaging trusted community members to foster deep and productive communication and build trust. Frequent, trusted engagements can build bridges toward facilitating future support and assistance. Additionally, coordination with other federal agencies is essential to ensure underserved communities are not overwhelmed by the numerous agencies. USACE is committed to leveraging agency-wide expertise and resources, fostering awareness across programs, sharing technical and programmatic information, and improving collective capacity and capabilities to provide underserved communities with opportunities to participate in USACE studies and projects, including being part of the decision-making process when possible.

(2) USACE is dedicated to advancing FRM efforts for building community resilience. State-led "Silver Jackets" teams bring together state, federal, Tribal Nations, Territories, and local agencies to learn from one another about reducing flood and coastal storm risk and other natural disasters to collaborate on efforts that advance the state's priorities toward greater resilience. Nonstructural technical and planning assistance programs such as the Floodplain Management Services and Planning Assistance to States directly support community resilience by providing expertise in engineering and planning approaches to reduce risk from flooding and coastal storms and promote resilience.

(3) USACE oversees the management of hundreds of FRM projects. Many of these projects have exceeded their intended project life. Adapting aging infrastructure to be more resilient requires a collaborative effort between government agencies, industry, academic partners, and public/private partnerships. It is critical that USACE continue its commitment to work with interagency partners, co-develop solutions with communities, and integrate financing tools such as public-private partnerships into FRM business processes.

e. Tools, Models, Nonstructural and Nature-Based Solutions.

(1) USACE tools and models will be instrumental in understanding opportunities and challenges to identify feasible measures and approaches that support resilience. To support resilience at a systems level, USACE is standardizing how water resources efforts are carried out across USACE by creating a centralized repository for regional and district level data. This data supports resilient investments by helping to characterize flood and coastal storm risk as well as other hazards, and then allow for standardized approaches for accurate comparisons among sites to support the selection of potential methods to increase resilience. Standardizing methodologies also provides for better understanding of spatial and temporal distribution of risk, supporting more effective preparation, and response and recovery.

(2) Methods that expand the ability to quantify resilience, as well as measure and report benefits supporting resilience, need to be developed and integrated into USACE risk-informed decision-making for new and existing FRM projects. As USACE advances methods that embrace resilience, it will be important to modernize how benefits are quantified and evaluated. By applying project operations data and performance knowledge along with predictive models, the best investment in rehabilitating infrastructure can be made. These investments can promote resilience through novel materials, repair methods, infrastructure adaptations, and techniques to streamline operations while supporting resilience. The FRM CoP is advancing partnering opportunities related to Research and Development within the FRM business line for more effective development and transfer of FRM tools and techniques that support integration of resilience factors.

(3) The number of nonstructural applications included in USACE projects has risen due to several different factors including relative costs as compared to traditional built measures and uncertainty in the future magnitude of FRM hazards. Nonstructural solutions focus on reducing the consequences of FRM hazards instead of focusing on reducing the probability of the hazard and can be more adaptable than traditional structural infrastructure. Also, nonstructural solutions can provide a wider distribution of resilience in some instances by providing a wider choice of solutions and through greater collaboration with non-federal sponsors, states, Tribal Nations, Territories, and local governments. USACE is currently working on detailed guidance for nonstructural project implementation as well as tools that can be used by districts. HQUSACE is also exploring alternative delivery methods that could better utilize the skills and capacities of states, Tribal Nations, Territories, and local governments.

(4) NBS provide important socio-ecological values and can provide critical community resilience functions. NBS can be stand-alone measures in FRM projects, or they can be developed as complementary features that enhance the flood and coastal storm risk performance of structural and/or nonstructural solutions while providing

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ecosystem habitat, increased recreational access, and serve cultural functions. USACE is working towards providing additional clarification and information for the justification, design, and performance of NBS in FRM projects.

5. Conclusion

USACE recognizes resilience as a fundamental characteristic of its projects, systems, and operations and will continue taking steps to further incorporate resilience into planning, designing, constructing, and operating its FRM projects. Administration and Congressional directives as well as USACE leadership endorsement demonstrate that resilience is of national importance and an agency priority. Across the FRM CoP, at all levels, we will promote this forward momentum, moving in the direction of fuller integration of resilience considerations.

6. Point of Contact

Questions regarding this memorandum should be directed to Lisa Kiefel, National Flood Risk Management Business Line Manager and FRM CoP Lead, HQUSACE - Office of Homeland Security, at 202-761-0626 or lisa.d.kiefel@usace.army.mil.



STEPHEN L. HILL, PMP, SES
Director of Contingency Operations and Chief,
Office of Homeland Security

2 ENCLS

1. Types of Resilience
2. Best Practices

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Enclosure 1: Types of Resilience (from EP 1100-1-5: USACE Guide to Resilience Practices)

FRM project resilience looks at ways to plan, engineer, design, construct, and operate a single project that takes into consideration how well that project can prepare for, absorb, recover from, and adapt to flooding and coastal storm hazards. It can be challenging to take steps toward resilience of a single independent project/ structure. USACE has worked to integrate this “bounce back better” mindset when designing and evaluating FRM approaches. This is a work in progress and will be furthered along with the advancement of predictive models and tools as well as the adoption of cost/benefit assessments that more fully incorporate resilience factors and consider resilience drivers.

FRM systems resilience adds another layer of complexity, since it considers the overall resilience of a collection of interdependent projects, such as dams and levees along a river. Internal coordination and leveraging of resources support integration of this level of resilience into system evaluations. Gaining awareness of how the system of projects function in context with understanding the various factors that influence the systems performance under different situations requires the collective knowledge of key aspects of the system. The Roadmap goal for system resilience is “to ensure that USACE considers and provides system resilience to the greatest extent possible within its authorities and abilities.”

Community resilience is even more complicated than considering a single system of interdependent projects since it looks at the relationship among several systems of projects. It encompasses the entirety of all aspects that make up a community. This perspective requires examining things through a wide aperture, enlisting a comprehensive view of the range of factors that affect a community’s vitality. It is complex and complicated, and each community is different. Like watershed management, community resilience requires involvement by the wide range of stakeholders and interested parties. The main categories of a community are often described as social well-being, natural environment, and economy, which can be broken down into several sub-categories such as supporting underserved populations, maintaining ecological diversity, and improving utility and road infrastructure. Communities identify what is most important for them to be resilient to and make decisions as to how to balance the benefits and risks, identify additional actions to further buy-down risk, and increase resilience and sustainability overall. The USACE goal for community resilience, described in the Roadmap is to “provide direct and indirect support to community resilience wherever and whenever USACE engages with a particular community.”

Enclosure 2: Best Practices (from EP 1100-1-5 and EP 1100-1-2: 2016 USACE Resilience Initiative Roadmap)

The following best practices align USACE philosophy with the four principles of resilience: Prepare, Absorb, Recover, and Adapt; referred to as PARA.

- i. Prepare:
 - a. Build and maintain meaningful partnerships that can shape and influence the development of projects that promote resilience
 - b. Develop strategies and plans assessing existing and future vulnerabilities
 - c. Re-evaluate the existing USACE portfolio through a lens of climate change at a watershed scale and prioritize for PARA application
 - d. Evaluate water resource project vulnerability by hazard categories (e.g., drought, wildfire, historic extremes, coastal storm damage, heat, riverine flooding, land degradation, and energy demand to account for multiple objectives)
 - e. Establish project planning metrics using resilience to re-evaluate the USACE portfolio and rank for future adaptive measures
 - f. Promote community education and awareness, including emergency planning and buying flood insurance
- ii. Absorb:
 - a. Utilize features designed to absorb impacts and resist damage, such as levee armoring and turf-reinforcing mats
 - b. Provide diverse and redundant measures for risk reduction
 - c. Incorporate a watershed scale of multiple layers of FRM features for added risk reduction
 - d. Increase the strength and reliability of existing features
- iii. Recover:
 - a. Ensure availability of alternate networks
 - b. Design and manage operations for rapid recovery
 - c. Consider the critical infrastructure such as utilities, evacuation routes, hospitals, and emergency shelters, that increase the speed with which an impacted community can recover from an event
 - d. Utilize features that can be repaired quickly in case of damages sustained during disruptive events
 - e. Stockpile critical project features to accelerate USACE portfolio recovery
- iv. Adapt:
 - a. Foster human actions for natural, nature-based, and hybrid feature to facilitate adaptation
 - b. Consider nonstructural measures e.g., zoning, relocation, etc.
 - c. Identify ways of measuring the intended benefits that can map out performance as well as support the need for determining any adjustments needed
 - d. Apply tools to determine adaptability to climate change during both wet and dry periods
 - e. Incorporate adaptation pathways into project plans, so that adaptation actions can be taken when specified indicators exceed defined thresholds that imply changed conditions
 - f. Make liberal use of after-action reviews and lessons learned to utilize information for preparation of future events