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**SUBJECT:** Implementation of Resilience Principles in the Engineering & Construction Community of Practice

**CATEGORY:** Policy and Guidance

## 1. References:

- a. Engineer Pamphlet (EP) 1100-1-2, 2016 U.S. Army Corps of Engineers (USACE) Resilience Initiative Roadmap, 16 Oct 17
- b. EP 1100-1-3, USACE Sustainability: Definition and Concepts Guide, 19 Jul 18
- c. EP 1100-2-2, Civil Works Sustainable Infrastructure Practices Guidebook, 01 Dec 19
- d. Engineer Regulation (ER) 1105-2-101, Risk Assessment for Flood Risk Management Studies, 15 Jul 19
- e. ER 1100-2-8162, Incorporating Sea Level Change in Civil Works Programs, 15 Jun 19
- f. EP 1100-2-1, Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation, 30 Jun 19
- g. Engineer Technical Letter (ETL) 1100-2-3, Guidance for Detection of Nonstationarities in Annual Maximum Discharges, 28 Apr 17
- h. Engineering and Construction Bulletin (ECB) 2019-8, Managed Overtopping of Levee Systems, 24 Apr 19

2. **Purpose.** This Engineering and Construction Bulletin (ECB) provides the policy and guidance for applying the U.S. Army Corps of Engineers (USACE) principles of resilience – Prepare, Absorb, Recover and Adapt (PARA) – to Engineering & Construction (E&C) Community of Practice (CoP) efforts.

3. **Applicability.** This ECB applies to the Military Programs, Civil Works, and International and Interagency programs.

## 4. Background.

- a. The USACE Resilience Initiative was initiated in 2015 to address an increasing focus on resilience internally and with partners and stakeholders. The Initiative was established to clearly articulate (1) how USACE's actions, projects, and/or systems support community resilience, and (2) how USACE provides increased project and system resilience within its authorities and

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capabilities. These considerations complement USACE’s approach to resilience via risk-informed decision making and coincide with partners’ and stakeholders’ increased focus on resilience.

b. As part of the Resilience Initiative, USACE introduced “resilience thinking” to more effectively apply established and emerging practices and procedures that lead to improved resilience. This includes applying four principles of resilience – Prepare, Absorb, Recover, and Adapt (PARA) – to USACE activities. The 2016 USACE Resilience Initiative Roadmap encouraged all personnel to use the PARA principles to consistently provide more resilient solutions at the project, system, and community levels. A description of each PARA principle is provided below:

(1) Prepare. The *Prepare* principle considers measures to meet the needs of a project component or system, including reducing risks or costs under loading conditions beyond those required by technical standards or norms (e.g., USACE, International Code Council, American Society of Civil Engineers, American Society of Mechanical Engineers).

(2) Absorb. The *Absorb* principle considers measures to limit damage to, or loss of function of, a project component or system due to both acute and chronic loading conditions, including conditions beyond those used for the design. This principle can also be used as an opportunity to consider adding system component robustness, redundancy, and increased reliability.

(3) Recover. The *Recover* principle stresses wise and rapid repair or functional restoration of a project component or system.

(4) Adapt. The *Adapt* principle considers modifications to a project component or system that maintains or improves future performance based on lessons learned from a specific loading condition or loadings associated with changed conditions.

c. Resilience is the ability to anticipate, prepare for and adapt to changing conditions; and withstand, respond to and recover rapidly from disruptions. This ECB reflects this definition and also supports the application of a more project-specific definition of resilience as the capacity of a component, unit, or system to withstand occasional large overloads (for a definite duration of time) that cause minimal permanent deformation, damage, or cumulative degradation and then essentially recover (within a specified time) its original state and function after the overloading event.

5. **Policy.** As established in the 2016 Resilience Initiative Roadmap, resilience thinking is to be implemented USACE-wide through the application of the PARA principles and in support of risk-informed decision making. The E&C CoP and sub-CoPs will reflect resilience thinking in their practices and in new and updated standards and criteria.

6. **Guidance.** To apply resilience thinking at the project or system level, an evaluation should be performed using the PARA principles during planning and design.

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a. Resilience evaluations should be completed as needed based on engineering judgment and reflective of project complexity and assessed risk. Analyses and outcomes should be formally documented. Where appropriate, interconnections between project components and systems, and their individual and cumulative effect on project performance and resilience should be considered.

b. Consideration of resilience may result in recommendations by the project team for measures to improve resilience. These recommendations can be incorporated into the design when they are permitted by project authorities and do not significantly increase total project life cycle cost, including recovery costs. Recommendations that result in significant cost increases may also be considered in some cases, but these recommendations must be appropriately justified.

7. **Update.** New requirements will be included in the next appropriate policy document update.

8. **Point of Contact.** The HQUSACE E&C CoP point of contact for this ECB is Dr. Kate White, CECW-EC, (202) 761-4163.

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CHRISTINE T. ALTENDORF, P.E., PHD, SES  
Chief, Engineering and Construction  
U.S. Army Corps of Engineers