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Water Resource Policies and Authorities
US ARMY CORPS OF ENGINEERS LEVEE SAFETY PROGRAM

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VOLUME I:
LEVEE SAFETY OVERVIEW

1.1 Purpose and Intent. Effective flood risk management requires the integration of preparedness, response, recovery, and mitigation activities. Levee safety is a component of overall flood risk management and is the art, science, and practice of managing flood risks associated with levee systems. The U.S. Army Corps of Engineers (USACE) and levee sponsors, who are public entities that have responsibility for operation and maintenance for all or a certain portion of a levee system, have a long history of working together to build and maintain levees. In 2006, USACE formally established its Levee Safety Program to work with levee sponsors to better understand, prioritize, and manage the flood risks associated with levees. The purpose of this Engineer Circular is to provide context and guidance related to the USACE Levee Safety Program. This document is divided into four volumes. Volume I describes overarching terms and levee types within the USACE Levee Safety Program. Volume II describes roles and activities of levee sponsors that relate to management of a levee system and how USACE Levee Safety Program activities integrate with those activities. Volume III contains more detailed technical policies related to the implementation of the USACE Levee Safety Program. Volume IV summarizes USACE responsibilities and decisions related to the Levee Safety Program and how program information can be or is used by others to make decisions. The ultimate intent of the Levee Safety Program is to understand, monitor, and manage flood risks associated with levees over time, provide a framework to sustain long-term benefits, and adapt activities and actions based on the dynamic nature of flood risk. The benefits of this approach include the following:

a. Provides a decision-making process that is scalable to unique circumstances.

b. Allows consideration of historic levee performance.

c. Provides a way to acknowledge uncertainty and whether or not reducing that uncertainty would change the decision.

d. Provides a way to describe the benefits provided by the levee.

e. Helps in prioritizing and optimizing resource decisions (i.e., supports a risk-informed “fix-the-worst-first” approach).

f. Informs design and construction decisions to maintain and improve levee systems.

1.2 Applicability. This document is applicable to all USACE Headquarters (HQUSACE) elements, divisions, districts, laboratories, centers of expertise, and field operating activities with responsibility for planning, design, construction, operation, maintenance, inspection, assessment, and rehabilitation of levee systems. In this document, “district” refers to a USACE district office and “division” refers to a USACE division office.

1.3 Distribution Statement. Approved for public release; distribution is unlimited. Please send any comments, questions, or suggestions for improvement to this guidance to EC218@usace.army.mil.

1.4 References. References are listed in Appendix A.

1.5 Authority. Activities described in this document are authorized by various statutes, including project-specific authorizations, which are specifically referenced throughout where appropriate.

1.6 Key Terms. The following are key terms that are used throughout this document.

a. Levee Segment. A levee system can be composed of one levee segment or multiple levee segments. The term "levee segment" is used to identify a discrete portion of a levee system that is operated and maintained by a single levee sponsor. USACE provides each levee sponsor their individual levee segment results so they know what specific information relates to their areas of responsibility, as well as information that shows how their levee segment relates to the entire levee system. See Figure I.1.1 for a diagram of a levee system and levee segment.

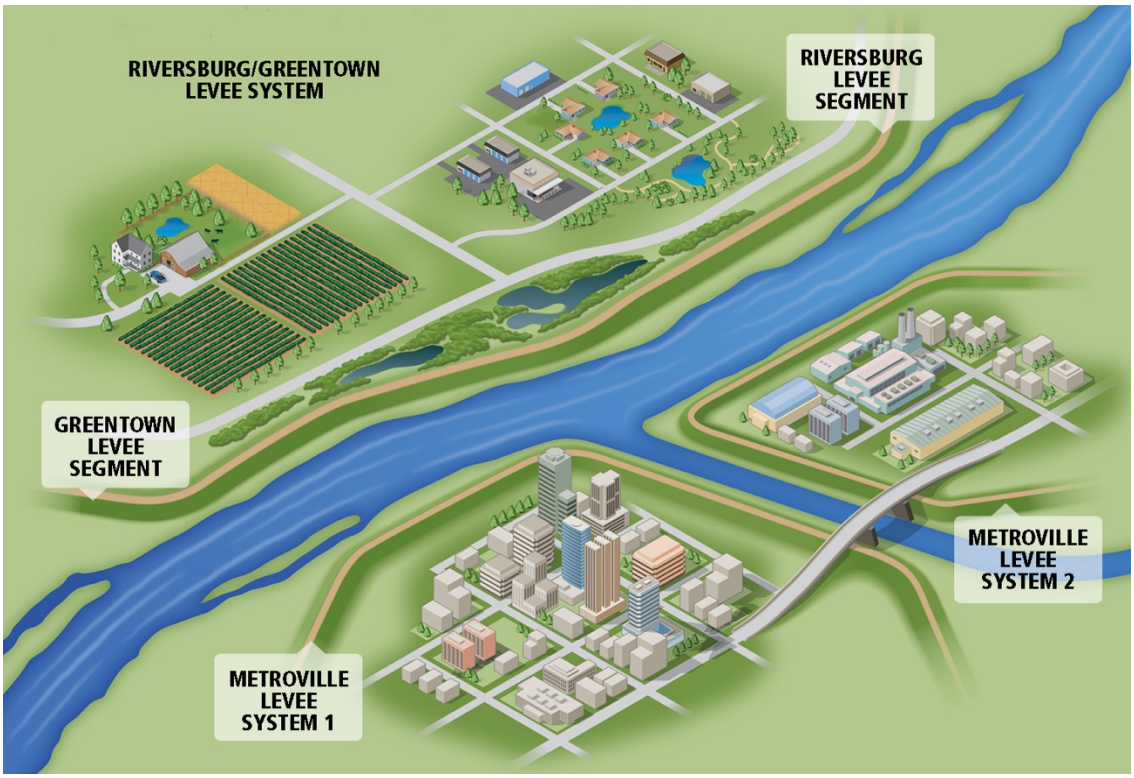

Figure I.1.1 – Levee System/Segment Diagram

b. Levee System. A levee system is a manmade barrier along a watercourse with the principle function of excluding flood waters from a limited range of flood events from

a portion of the floodplain (referred to as "leveed area"). A levee system is composed of one or more levee segments and other features that are collectively integral to excluding flood water from the leveed area. Levee features may consist of embankments, floodwalls, pipes and associated drainage features, closures, pumping stations, and channels. Within this document "levee" and "levee system" are used interchangeably.

c. Risk. Risk is a tool that is used to understand and communicate the probability (or likelihood) and consequence of uncertain future events. If there is no chance of an event occurring, then there is no risk. If there are no consequences resulting from an event occurring, then there is no risk. There could be two situations that seemingly have identical risk, but what is driving the risk for each of the two situations can be extremely different. Figure I.1.2 illustrates the main components of risk.

(1) Hazards. Hazards are events that cause the potential for an adverse consequence. Typically, the hazards considered in levee safety are potential flooding sources and seismic hazards. Risk enables an understanding of the likelihood of possible hazards and how they may change over time.

(2) Performance. Risk provides a framework for consistently evaluating the probability (or likelihood) of how the levee system is anticipated to function given possible hazards. This is done through considering a combination of past performance, existing conditions, maintenance, and how the existing levee compares to current engineering standards. How the levee is expected to perform may change over time based on the current understanding of industry best practices for levee design and operation despite unchanging levee conditions.

(3) Consequence. Consequences are the effect or outcome resulting from the combination of the hazards and performance. In order to provide a complete picture of the risk and to facilitate more informed decisions, consequences are included in the risk discussion. Potential consequences can also be used to show the benefits provided by a levee system. Consequences may include estimates of potential impacts to life, property, environment, or navigation. All consequences should be considered to inform responsible and transparent decisions.

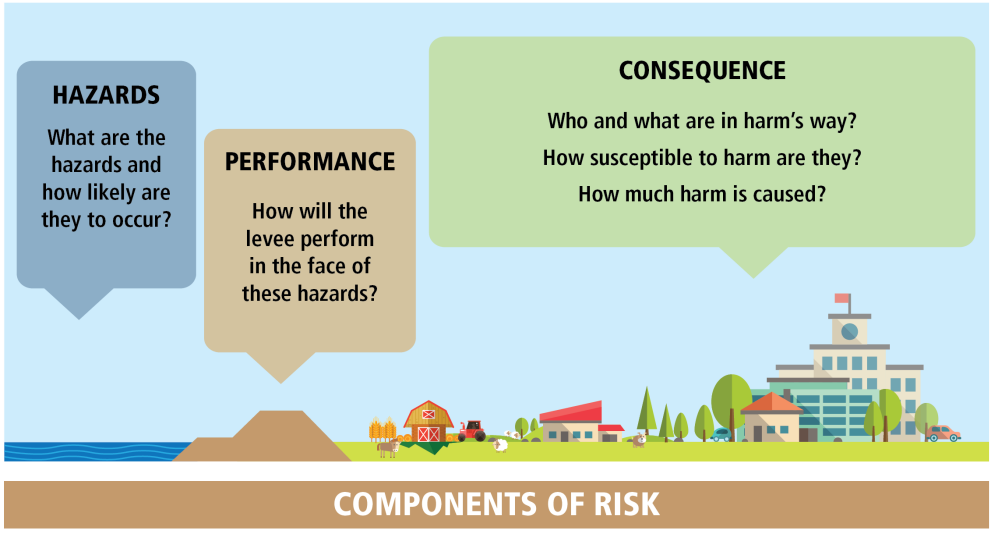

Figure I.1.2 – Components of Risk

1.7 Types of Levee Segments in the Levee Safety Program. This document applies to levees within the USACE levee portfolio, defined as levees for which USACE has some responsibility, pursuant to a variety of Congressional authorities. Flood risk management occurs on a levee system basis; however, a levee system can be composed of one levee segment or multiple levee segments with differing levee sponsors. The types of levee segments in the USACE portfolio are described below. Figure I.1.3 shows the general percentage of levee segment types within the USACE portfolio.

a. USACE Operated and/or Maintained. These are levee segments that USACE has full or partial responsibility to operate and/or maintain as well as to rehabilitate and modify as appropriate using existing authorities.

b. Federally Authorized and Locally Operated and Maintained. These are levee segments that are Congressionally authorized and operated and maintained by a local public sponsor through a project cooperation agreement with USACE. This category includes levee segments constructed by USACE and those constructed by others and federally authorized by law.

c. Non-federal and Eligible for the Rehabilitation Program. These are levee segments that are not federally authorized, are locally operated and maintained, and have been deemed eligible for the USACE Rehabilitation Program (reference A.4). If these levee segments become ineligible for the Rehabilitation Program, they are no longer considered part of the USACE levee portfolio unless they are connected to a federally authorized levee segment. These levee segments will be considered "non-project segments" as further described below. Regardless of eligibility status in the Rehabilitation Program, information collected on these levee segments is retained in the National Levee Database as a non-federal levee (reference A.26).

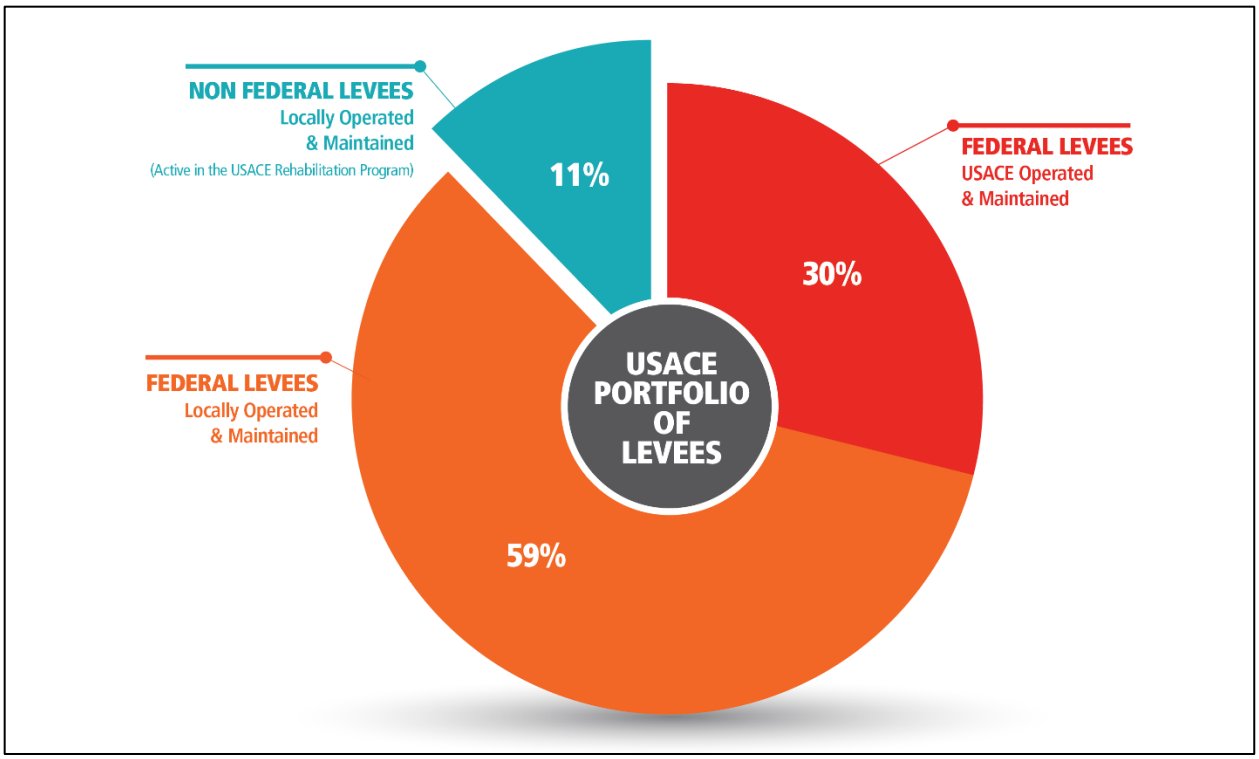

Figure I.1.3 – USACE Portfolio of Levees as of 2020

d. In addition to the three main categories, the following factors must occasionally be taken into consideration when determining whether the structure is included in the USACE portfolio. Typical factors include:

(1) Non-Project Segments. A non-project segment is manmade high ground which a levee system/segment ties into and whose existence and performance is necessary for excluding flood waters from the leveed area. Some examples of these are roadways, railroads, canals, and other levee embankments. Non-project segments are included as part of the USACE portfolio if they make up part of the levee alignment and are necessary for the proper functioning of the levee system.

(2) Designed channels that are integral to a levee system are included as part of the USACE Levee Safety Program portfolio.

(3) An auxiliary or appurtenant structure for a dam can sometimes be considered a levee. If the structure would likely be necessary without the dam, the structure is managed under the USACE Levee Safety Program. If the structure is needed so the reservoir pool can be used and/or regulated, then the structure is managed under the USACE Dam Safety Program and included in the National Inventory of Dams (reference A.8).

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VOLUME II:
LEVEE SPONSOR ACTIVITIES

CHAPTER 1

Introduction

1.1 Purpose.

a. The main purpose of Volume II is to provide levee sponsors, who are a key part of the USACE Levee Safety Program (reference A.9), with a single point of reference that describes the activities necessary for effective flood risk management in communities where levees are part of the landscape. Volume II references more specific technical guidance documents on a variety of topics and indicates the type of assistance USACE can provide before, during, and after a flood. Chapters 2 through 5 cover each of the four main areas of flood risk management: preparedness, response, recovery, and mitigation. The chapters describe the set of activities important for each area and clarify roles and responsibilities for levee sponsors and USACE.

b. In conjunction with the activities described in Volume II, USACE districts are to develop and maintain a ten-year outlook of anticipated activities. This outlook must include inspections and risk assessments in conjunction with levee sponsors for scheduling and planning purposes. This is also a good opportunity for levee sponsors to work with USACE districts to develop procedures for coordinating permit requests on or around levee systems, such as Section 408 permissions if applicable (reference A.15).

1.2 Levee Sponsor Roles and Responsibility.

a. Levee sponsors are vital participants in levee-related risk management. Sponsors have firsthand knowledge of the levee structure, its construction and maintenance history, prior performance data, and a detailed understanding of cultural and historic sites, vulnerable populations, and evacuation effectiveness. Additionally, sponsors can take information from a levee inspection or risk assessment and prioritize actions to implement risk management activities and decisions. For these reasons, sponsors must be partners in USACE Levee Safety Program activities and afforded the opportunity to participate in every step of the risk-informed decision-making process.

b. Levee sponsors who are part of the USACE Levee Safety Program fall into one of the following two categories:

(1) Public entities that have a written, executed partnership agreement with USACE to identify the items of local cooperation for USACE projects. This includes operation and maintenance requirements necessary to the functioning of the levee (codified at 42 United States Code 1962d-5b.). These levee sponsors also follow the requirements in 33 Code of Federal Regulation 208.10 (33 CFR 208.10, reference A.1). Nothing in this document modifies or takes the place of the responsibilities of levee sponsors identified in 33 CFR 208.10 (reference A.1) or project partnership agreements. However, many

Levee Safety Program activities will be complementary and will help inform these responsibilities.

(2) Public entities that operate and maintain non-federal levees and have submitted a written request to participate in and have been accepted by USACE to be in the USACE Rehabilitation Program (reference A.4). The Rehabilitation Program is a voluntary program by which USACE can assist in repairing levee systems and other flood risk management projects after a flood event if the projects meet specified eligibility criteria.

c. All levee sponsors are responsible for: ensuring that the levee is maintained properly and inspected routinely; performing response and recovery efforts; and ensuring that levee condition information is shared with USACE.

1.3 Use of Risk Information.

a. Risk-informed decision-making improves understanding of the benefits and risks associated with a levee that results in the ability to prioritize and plan for activities associated with the four main areas of flood risk management: preparedness, response, recovery, and mitigation (as shown in Figure II.1.1).

Figure II.1.1 – Flood Risk Management

(1) Preparedness: Actions taken before a possible future flood event, including planning, training, communication, and anticipation of how the levee will perform (e.g., operations and maintenance, inspections, assessments).

(2) Response: Actions taken during a flood event, including those to save lives and prevent damage.

(3) Recovery: Actions taken after a flood event, including those directed toward a return to normalcy.

(4) Mitigation: Actions taken after a flood event that reduce potential loss of life and property by lessening the impacts of the flood.

b. Risk information can help inform and improve the efficiency and effectiveness of actions across all activities for flood risk management. This information can provide helpful information related to:

(1) Informing routine maintenance activities and formal inspections;

(2) Improving objectives in emergency action plans;

(3) Improving awareness of the levee condition, flooding probabilities, and related potential consequences for all impacted people and decision makers, appropriately tailored to each audience;

(4) Encouraging collaboration among levee sponsors that are part of the same system;

(5) Informing where to focus or prioritize flood fight activities during flood response; and,

(6) Developing of short-term and long-term risk reduction measures.

(7) Taking lessons learned during each of the four flood risk management areas to improve the understanding of risk associated with a levee thereby improving future actions and decisions.

c. USACE and levee sponsors will work together to develop and continuously update a planned approach to manage levee related risks. They will typically use the Levee Risk Management Summary, which is a document that summarizes the most current risk information regarding a levee. As activities described throughout Volume II are completed, levee sponsors and USACE should update the risk management actions documented in the Levee Risk Management Summary. A template of the Levee Risk Management Summary is located in Appendix B.

CHAPTER 2

Preparedness

2.1 Purpose. This chapter describes the activities associated with preparedness. Preparedness refers to actions taken before a flood event in order to anticipate levee performance based on its condition, understand operational roles during a flood event, and be ready to initiate emergency procedures if necessary. Activities include planning, training, communication, and preparation.

2.2 Activities Summary. The preparedness activities summarized in Table II.2.1 include those that help levee sponsors understand the risk and benefits associated with their levee in order to be better prepared for a potential future flood. These activities also provide opportunity for USACE and levee sponsors to build a trusting relationship that can be relied upon during flood events. More detailed explanation for each activity is provided in Section 2.3, Activity Details.

Table II.2.1 – Preparedness Activities

Activity	Description	Sponsor Role	USACE Role
Routine Maintenance	▪ Perform maintenance activities	Lead	Support
USACE Inspection (at a minimum every 5 years)	▪ Conduct formal inspections ▪ Conduct special inspections based on changed conditions	Support	Lead
Levee Sponsor Inspections	▪ Conduct field inspections ▪ Document levee conditions ▪ Update project maintenance plan/priorities	Lead	Support
USACE Risk Assessment (every 10 years*)	▪ Conduct project risk assessment	Support	Lead
Data Management	▪ Update National Levee Database ▪ Update local data management system, if applicable	Shared	Shared
Risk Awareness	▪ Develop and communicate risk and benefit information with community leaders and stakeholders	Lead	Support

Emergency Planning	▪ Develop flood emergency action plans ▪ Coordinate with all relevant emergency management entities	Lead	Support
*Unless population in the leveed area is less than 100 individuals			

2.3 Activity Details.

a. Routine Maintenance. Levee sponsors are responsible for ensuring that their levee is properly maintained. Routine maintenance helps keep the levee in good, working condition. By performing routine maintenance, levee sponsors can extend the service life of their levee, help prevent bigger problems before they occur, and may reduce the cost of recovery after a flood event.

(1) The following are common routine maintenance activities:

(a) Assessing, removing, or relocating encroachments

(b) Backfilling animal burrow holes

(c) Clearing debris from outlet structures

(d) Clearing drainage ditches

(e) Clearing ponding areas

(f) Exercising gates

(g) Following manufacturer-recommended maintenance plans for pump station items

(h) Implementing an animal control program

(i) Inspecting culverts/pipes

(j) Lubricating gate systems

(k) Megger testing

(l) Mowing grass

(m)Pump testing and cleaning relief wells

(n) Removing sedimentation, vegetation, and debris from channels

(o) Removing unwanted vegetation

(p) Repairing bank instability

(q) Repairing concrete surface deterioration

(r) Repairing cracks

(s) Repairing erosion

(t) Repairing ruts and depressions

(u) Replacing riprap

(v) Reseeding grass

(w) Sealing monolith joints

(x) Testing and reading instrumentation equipment

(y) Testing flood warning systems

(z) Trial installations of closure structures

(2) Basic Procedures. Levee sponsors must plan ahead for maintenance and follow a schedule that indicates what levee features should be maintained or tested at specific times and frequencies. Common examples of routine maintenance are above. When planning for routine maintenance, some factors that sponsors may want to consider include:

(a) Maintenance that can only be performed during low-water periods (e.g., pipe inspections);

(b) Seasonally required maintenance (e.g., opening sluice gates prior to freeze-up);

(c) Potential high-cost maintenance (e.g., replacing a culvert); and

(d) Local, state, or federal regulations (e.g., regulations restricting allowable animal control methods).

(3) Levee Sponsor Roles. Levee sponsors must perform all routine maintenance including maintaining records of details and repairs. Levee sponsors may find it useful to index equipment and outline preventative maintenance. Some examples of information included in maintenance records include:

(a) Manufacturer's drawings and instructions

(b) Operating pressure limits

(c) Parts catalogues

(d) Reference field tests

(e) Equipment inspection

(f) Maintenance logs

(g) Number and hours of operation

(h) Test results

(i) Inspection results

(4) USACE Role. While USACE does not perform routine maintenance (except for on USACE operated and/or maintained levees), staff are available to advise on routine maintenance best practices. Levee sponsors may contact their local USACE district for more information on routine maintenance best practices.

b. USACE Inspection. At a minimum of every five years, USACE will work together with sponsors to inspect each levee within its portfolio using the USACE Levee Inspection System (reference A.24). The purpose of these levee inspections is to document the physical condition of a levee system using consistent criteria at a given point in time. The Levee Inspection System is software that is integrated with the National Levee Database and can be used by any levee sponsor. Levee sponsors interested in using the Levee Inspection System should make this request with their specific USACE district. USACE can conduct levee inspections out of cycle in response to changed conditions and/or at the request of a levee sponsor. At any time, levee sponsors may request a USACE inspection or site visit between the five-year prescheduled inspections. Site visits are more informal than inspections and typically focus on a particular area of concern. Levee sponsors will be a team member on the inspection or site visit team, unless they choose not to attend, and will be provided the opportunity to review the inspection report or summary and provide input before it is finalized. It is important to note that overall inspection ratings of levee systems or levee segments will no longer be assigned.

(1) Basic Procedures. There are six basic steps in a USACE inspection. The basic procedures for a USACE inspection and the general roles for both USACE and the levee sponsor are shown in Table II.2.2. Note, USACE conducts inspections on the entire levee system, including those with multiple levee sponsors. Levee sponsors that are a part of a system with more than one sponsor should be aware that information about their segment may be shared with the other sponsors. More detailed requirements can also be found in Volume III, Chapter 5.

Table II.2.2 – USACE Inspection Procedures

USACE Inspection Steps	USACE Role	Sponsor Role
Prepare for the levee inspection.	▪ Identify inspection team members based on expertise needed. ▪ Coordinate inspection time/date and logistics with levee sponsor (providing at least ten business days' notice prior to inspection).	▪ Identify levee sponsor team members and coordinate time/date with USACE.
Pre-inspection data collection and review.	▪ Coordinate with sponsor to obtain pre-inspection documents. ▪ Gather relevant documents and information about levee and provide to team.	▪ Provide pre-inspection information to USACE (pre-inspection form, maintenance records, sponsor inspection results, testing results, progress of actions taken since last inspection).
Conduct the levee inspection.	▪ Walk the entire levee and record individual observations (using the USACE Levee Inspection System).	▪ Walk the levee with USACE inspectors and provide input for documented observations.
Assign inspection observation and item ratings.	▪ Assign observation and item ratings documented by USACE inspector and levee sponsors. (This is NOT referencing an overall inspection rating for the levee. Inspection ratings for levee systems will no longer be assigned.)	
Prepare inspection report.	▪ Prepare inspection report. ▪ Provide inspection report to sponsor for review.	▪ Review inspection report.
Final documentation and risk-informed recommendations.	▪ Upload inspection report to National Levee Database (report not publicly available). ▪ Work with levee sponsor to update risk management actions (see Volume II, Chapter 5).	▪ Work with USACE to update risk management actions.

c. Levee Sponsor Inspection. Levee sponsors are best able to catch problems associated with their levee ahead of time and will perform their own levee inspections in addition to the inspections conducted in collaboration with USACE. These inspections may happen on a regular interval as part of routine maintenance, or they may occur as needed. Levee sponsors can use their own inspection procedures, but the USACE inspection procedures shown in Table II.2.2 and the Levee Inspection System may be used by levee sponsors. After inspections, the levee sponsors must provide USACE with their inspection information for updating the information in the National Levee Database, including flood damage assessments, to be ready to use for the next USACE inspection.

d. USACE Risk Assessment. At a minimum of every ten years, USACE will perform a risk assessment on each levee within its portfolio. A risk assessment is a systematic, evidence-based approach for quantifying and describing the nature, likelihood, and magnitude of risk. Risk assessments may also occur out of cycle in response to changed conditions or for a specific decision that requires a risk assessment. Levee sponsors will be members of the risk assessment team and will be provided the opportunity to review the risk assessment results and provide input. Levee sponsors will be given the anticipated schedule for the risk assessment at least 30 days prior to the initiation of a risk assessment for their consideration of level of participation at their discretion.

(1) Basic Procedures. There are eight basic steps in a USACE risk assessment. The basic procedures for a USACE risk assessment along with general roles for USACE and the levee sponsor are shown in Table II.2.3. Note, USACE conducts risk assessments on the entire levee system, including those with multiple levee sponsors. Levee sponsors that are a part of a system with more than one sponsor should be aware that information about their segment may be shared with the other sponsors. More detailed requirements can also be found in Volume III, Chapter 6.

Table II.2.3 – USACE Risk Assessment Steps

USACE Risk Assessment Steps	USACE Role	Sponsor Role
Scoping. Identifying decisions that the assessment will inform and defining key questions that the assessment will answer.	▪ Coordinate risk assessment schedule with levee sponsor at least 30 days prior to scoping meeting. ▪ Develop key questions the risk assessment will try to answer.	▪ Provide input on key decisions and questions the risk assessment can help answer.*

Data preparation and hazard identification. Gather pertinent information such as design and as-built documentation, performance history, river/flood gage data, etc. Identify the likelihood of flooding, seismic hazards, and security hazards to be considered in the risk assessment.	▪ Identify and gather all existing information. Identify gaps in information.	▪ Provide best available information to USACE.
Likelihood of breach assessment.	▪ Estimate the likelihood of breach for most likely scenarios.	▪ Participate in likelihood assessment.
Consequence assessment.	▪ Work with levee sponsor to estimate potential loss of life, economic losses, and environmental impacts. ▪ Lead consequence assessment.	▪ Provide best available information regarding emergency procedures to USACE. ▪ Participate in consequence assessment.
Risk estimate.	▪ Calculate the combination of the likelihood of flood inundation (due to levee breach) within the leveed area and the associated consequences and plot the results as a combined risk estimate.	▪ Participate in risk estimate.
Risk characterization.	▪ Draft a narrative that describes the benefits of the levee system, key drivers of risk, consequences, and uncertainty.	▪ Review characterization and provide comments to USACE.
Risk results.	▪ Work with levee sponsor to update risk management actions (see Volume II, Chapter 5).	▪ Work with USACE to update risk management actions.

Review and approval.	▪ Follow review procedures. ▪ Provide risk assessment report to levee sponsor for review. ▪ Upload final documentation to National Levee Database after levee sponsor review (report not publicly available).	▪ Review risk assessment report and provide comments to USACE.
* At any time, levee sponsors of federally authorized levees may request USACE conduct a risk assessment for the purpose of a National Flood Insurance Program (NFIP) accreditation recommendation that may be accomplished on a cost-shared or reimbursable basis (reference A.17).		

e. Data Management. Levee sponsors have valuable data related to their levee and may have their own system for data management. USACE also collects data on each levee in its portfolio. It is a best practice for data to be shared between sponsors and USACE. The National Levee Database is a common access point for USACE, sponsors, and the public to review information about levee systems. Levee sponsors have access to detailed information regarding risk assessments, levee condition, and inspection results, while individual and community users are provided summary information to increase their awareness of levee safety and levee safety support activities without disclosing sensitive information.

(1) Levee Sponsor Roles. Sponsors should continue collecting, sharing, and storing data. At any time, levee sponsors may provide any data they may have on their levee (e.g., maintenance records or inspection results) to USACE for inclusion in the National Levee Database.

(2) USACE Roles. USACE will coordinate with levee sponsors to provide them access to detailed information about their levee(s) in the National Levee Database. At the completion of a joint USACE/sponsor activity, when information is received from levee sponsors, USACE will update the information in the National Levee Database.

f. Risk Awareness. Levee safety activities are intended to raise understanding of what hazards exist, their potential impacts, and how they are being managed. It is also an opportunity to communicate what benefits the levee system is providing. Sharing information about risks associated with the levee with the broader community, including governmental bodies, risk managers, and key stakeholders, can help levee sponsors in their efforts, as well as help others take action that can reduce loss of life, personal injuries, and damage from natural disasters. It is important to note that it is the responsibility of the levee sponsor to inform the local population of the risks associated

with their levees. USACE is available to support and provide assistance to levee sponsors in order to effectively communicate risks.

(1) Levee sponsors are in the best position to identify and involve those in the community critical to levee safety communication (e.g., elected officials, emergency managers) and they understand the optimal methods of communication that would be most effective in their specific leveed area. USACE encourages levee sponsors to develop a strategy to engage key community stakeholders and the broader community. USACE is available to assist in a support role. The strategy should include a plan for sharing information about the levee including: why the levee is there; how it works; what condition it is in; how it will perform under a variety of circumstances; and how levee benefits may be impacted during the performance of the levee. Levee sponsors should discuss ongoing or planned actions to reduce risks associated with the performance of the levee.

(2) Sharing this information will provide the broader community insight to what would be impacted if the levee does not perform as intended, as well as bring attention to the benefits the levee provides the community. The levee sponsors are encouraged to support the broader community in identifying actions they can take to further minimize harm if the levee does not perform as intended. Levee sponsors are encouraged to help communities use levee safety information to inform local flood evacuation plans and consider how communities can contribute to levee flood response plans and procedures.

(3) Suggested procedures for developing a risk awareness strategy are discussed below and included in Table II.2.4.

(a) Identify information to share.

(i) Identify key information from risk assessments and levee inspections that will help describe why the levee is there, what is behind it, how it works, what condition it is in, and how it is anticipated to perform.

(ii) Develop key points that describe the levee system and why it is important to the community.

(iii) Develop a summary of this information that can be used in a variety of ways (e.g., in a publication, during a conversation).

(b) Identify with whom to share information about risk associated with the levee. Identify members of the broader community, including other governmental bodies, risk managers, and key stakeholders who should have access to the risk information.

(c) Choose an information sharing approach.

(i) Plan information sharing based on what levee sponsors know about the broader community and the best ways to let those who live and work behind the levee system have access to information.

(ii) Example tools/opportunities include: town hall meetings; public meetings; media roundtable; press release; social media; local community newsletter notice; fact sheets, etc.

(d) Support broader community risk management actions. Participate in broader community activities to adopt other risk management options (e.g., flood proofing, evacuation planning).

(e) Support pre-flood planning. Share emergency preparedness plans and identify actors and actions that will be key during a flood.

Table II.2.4 – Risk Awareness Roles

Levee Sponsor Partnering Roles	USACE Partnering Roles
Identify with whom risk information should be shared.	If requested, provide fact sheets and other information on key topics related to flood risks associated with levees.
Plan for how risk information with the broader community will be shared.	Support sponsors and communities in public meetings to explain risk information and to raise awareness of levee-related flood risk and discuss pros and cons of risk management options.
Share risk information along with what actions are planned or ongoing to reduce levee risk to the public.	If requested, provide professional facilitators and public involvement specialists to assist in planning and facilitation of public meetings. Assist with media outreach on levee-related flood risk.
Participate in broader community activities to adopt other risk management options.	Serve as a conduit/connection with other federal and state agencies to bring the right expertise, talent, and credibility to discuss risk in each community.

g. Emergency Planning. For each levee, there are a range of flooding scenarios, and while emergency planning should identify the entire range of scenarios, sponsors should carefully consider what flood scenarios planning efforts should focus on (i.e., the worst-case and most likely flooding). Emergency planning helps everyone involved act quickly and decisively during a flood event and can prevent loss of life and injury and minimize property damages. Emergency planning involves identifying pre-planned actions to be implemented during a flood in order to reduce potential consequences. Other important components of emergency planning include coordinating ahead of time with local and state partners.

(1) Emergency Action Plan. Planned emergency activities are typically formally documented in an emergency action plan, also sometimes referred to as an emergency plan or emergency preparedness plan. An emergency action plan related to a levee

system is a formal document that identifies the range of potential flooding scenarios at a levee and specifies pre-planned actions to be followed to reduce consequences of that flooding. The emergency action plan should contain procedures and information to assist the sponsor in issuing early warning and notification messages as well as inundation maps intended to highlight the critical areas within the leveed area. Levee sponsors are encouraged to coordinate or develop plans with local emergency management authorities whenever possible or to ensure that existing evacuation plans address the appropriate flooding scenarios. Other typical content or references for emergency action plans may include a glossary of terms, sample checklists for emergency response and flood response activities, a sample emergency responsibility assignment matrix, surveillance plan, and the project operation and maintenance manual. See references A.13, A.28, and A.29 for guides for developing emergency action plans.

(2) Working with Local and State Partners. To obtain state assistance during a flood fight, it is often necessary for a local municipality, tribe, or county to first declare an emergency, so coordination with local and state partners ahead of a flood is important. During a flood, states may provide trucks, tractors, radios, helicopters for emergency inspections, support from the National Guard, or financial assistance. If supplies needed for a flood fight run out, levee sponsors should try to find the needed supplies at the local and state level before requesting this aid from the federal government. USACE expects counties and states to be involved with the levee districts and provides support only when state resources are being utilized fully. For these reasons, levee sponsors are strongly encouraged to maintain relationships with the emergency managers at the local and state emergency management office and to contact them at least once annually, well in advance of a flood. Levee sponsors should keep state and local partners informed on the condition of their levee and send them ongoing situation reports during any flood response. It is important that sponsors know what kind of support the state and counties can provide and who to call in order to get the support required.

2.4 How USACE Can Help Sponsors be Prepared.

a. The following are examples of preparedness technical assistance that USACE can provide.

(1) Provide assistance to develop and review levee sponsor and community natural hazard contingency plans, evacuation plans, and emergency action plans.

(2) Provide assistance in the development of community emergency plan exercises.

(3) Provide assistance to develop emergency response training for levee sponsors and community disaster response personnel.

(4) Provide floodplain and flood hazard analysis and data to assist the levee sponsor and community to understand their flood hazard.

(5) Provide technical inspections and risk assessments of levee sponsor's levee systems that identify the systems' risk drivers and prioritized recommendations to manage the levee systems' risk.

b. USACE has the authority to provide assistance in the areas of disaster preparedness, emergency operations, rehabilitation, and advance measures (reference A.4). Assistance can include providing guidance on flood fight techniques, emergency construction methods, or current best available information such as mapping and modeling. The USACE Rehabilitation Program is a voluntary program that provides for the rehabilitation (repair) of damage to eligible flood risk management projects and federally authorized and constructed coastal storm damage reduction projects that have been damaged by natural disasters. Being active in the USACE Rehabilitation Program prior to an event can contribute to being more prepared for recovery after an event. USACE may perform advance measures prior to flooding or flood fighting activities to mitigate against damage to levee systems due to an imminent threat of unusual flooding to reduce risk to loss of life and economic damage. Advance measures assistance can be temporary or permanent. Permanent construction standards may be considered when the advance measures are intended to address interim risk reduction measures. Direct assistance may include providing supplies, equipment, and/or contracting for the construction of temporary and/or permanent flood risk management measures. Examples include the construction of temporary levees or the repair, strengthening, or temporary raising of levees. Indirect assistance includes providing technical and contingency planning assistance.

c. Silver Jackets. State-based Silver Jackets teams collaboratively address flood risk management priorities based on state priorities, including enhancing mitigation, preparedness, and recovery efforts. Common team participants include state and federal agencies with mission areas of floodplain, emergency and/or natural resources management, and hazard mitigation.

d. Planning Assistance to States. The Planning Assistance to States program provides technical expertise to support state, territorial, and tribal preparation of comprehensive water and related land resources development plans, generally the State Water Plan or efforts that support the State Water Plan. Additionally, USACE may provide technical assistance, including providing and integrating hydrologic, economic, and environmental data and analysis in support of state-wide plans. Planning Assistance to States technical assistance is at the planning level of detail and does not include detailed design for construction. Typical studies include water supply, flood risk management, and environmental restoration. Assistance is given within the limits of available appropriations and is cost-shared on a 50% federal, 50% non-federal basis. Work-in kind is allowed for comprehensive plans, but not for technical assistance. Non-federal entities may voluntarily contribute funds in excess of the cost-share (reference A.5).

e. Floodplain Management Services. USACE can provide technical and planning assistance through the Floodplain Management Services program. Its objective is to foster public understanding of the options for dealing with flood hazards and to promote

prudent use and management of the nation's floodplains. Upon request and within program funding limits or through voluntary contributions, program services may be provided to tribal, state, regional, and local governments as well as other non-federal public agencies without charge. Program services also are offered to non-water-resource federal agencies and to the private sector on a 100% cost-recovery basis. Most studies under this program include flood hazard evaluation, flood warning/ preparedness, flood-proofing, and flood risk management plans (reference A.5).

CHAPTER 3

Response

3.1 Purpose. This chapter outlines flood response activities that levee sponsors should be prepared to execute immediately before, during, and after high water flood events. These activities can be adjusted to address special situations associated with a specific levee. An emergency action plan or flood response plan should guide how, when, and where these activities are performed. The flood response activities listed in this chapter have been separated into the following two phases.

a. Phase I activities are those activities needed to prepare for expected flood conditions. These activities would ideally be completed before the river reaches bank-full stage. At the completion of Phase I activities, all preparatory actions should be complete and all necessary personnel should be prepared to respond to the flood.

b. Phase II activities generally take place after the river rises above some gage level or flood stage beyond bank-full. These activities are necessary to monitor how the levee system is operating and, if necessary, whether emergency actions are ready to go.

3.2 Recommended Activities. Table II.3.1 and Table II.3.2 summarize the recommended activities in each phase of the flood response.

Table II.3.1 – Phase I Response Activities

Activity	**Description**	**Sponsor Role**	**USACE Role**
Planning	▪ Review emergency action plan ▪ Identify potential problem areas	Lead	Support
Emergency Communication	▪ Establish communications with community emergency managers and adjacent levee sponsors	Lead	Support
Conduct Pre-flood Inspection	▪ Initiate system inspection ▪ Confirm emergency material stock piles ▪ Inspect closure equipment and materials	Lead	Support
Perform Pre-flood Operations and Maintenance	▪ Initiate low water drainage, culvert closures ▪ Conduct critical outstanding maintenance	Lead	Support

Begin Incident Reporting	▪ Begin reporting with local or state emergency operations centers ▪ Initiate reporting with USACE	Lead	Support

Table II.3.2 – Phase II Response Activities

Activity	**Description**	**Sponsor Role**	**USACE Role**
Operate System	▪ Initiate system closures ▪ Initiate pump station operations	Lead	Support
Conduct Levee Patrolling	▪ Increase patrolling activities based on flood conditions	Lead	Support
Conduct Emergency Response Operations	▪ Initiate flood response operations ▪ Respond to levee system performance concerns	Lead	Support
Use Volunteer Assistance	▪ Organize and manage volunteer and national guard personnel	Lead	Support
Evacuation	▪ Initiate/support evacuation plans	Lead	Support
Conduct System Performance Data Collection	▪ Begin observation of high-water elevations ▪ Begin observation of system performance concerns ▪ Document levee system performance	Lead	Support

3.3 Phase I Response Activities.

a. Planning. Upon receipt of official information forecasting imminent high water, the levee sponsor prepares for and immediately alerts all personnel identified in their emergency action plan. If the levee sponsor is responsible for many miles of a levee system, specific sections of the levee should be assigned to individual section leaders/ supervisors. During Phase I planning activities, the levee sponsor should:

(1) Review emergency action plans and past lessons learned; identify problem areas.

(2) Verify that personnel have access to all gate keys, current rosters, and maps of important features (e.g., road and culvert closings, pumps, access points, sandbag/stop log storage locations, radios, safety gear, and other critical items).

(3) Review assignments for patrols, closings, etc.

(4) Obtain lists of all construction equipment, motorboats, cars, earthmoving equipment, and trucks that can be made available.

(5) Assess needed support (e.g., vehicles, radios).

(6) Close the levee to the public and remove livestock as necessary.

(7) Review and understand the trigger elevations for closures and pump operations for both phases of the response.

b. Emergency Communication.

(1) During Phase I, the levee sponsor should establish communications with appropriate community emergency managers, leaders, adjacent levee sponsors, and local and state emergency operations centers. This communication is intended to establish contact with stakeholders and begin the process of communicating information necessary for them to prepare for possible emergency actions.

(2) During Phase II, this communication changes to informative or directive communications that is intended to update stakeholders of the current situation and provide direction of specific actions that should be taken to respond to changing flood conditions (reference A.10).

c. Conduct Pre-flood Inspection.

(1) As soon as they have been notified that high water is expected, levee sponsors should immediately conduct a thorough inspection of their entire levee system, omitting nothing from this pre-flood inspection regardless of the levee's performance during past flood events. This may require coordination among levee sponsors if there are more than one for a levee system.

(2) In addition to the levee system features that are typically inspected during Phase II levee patrols, special attention should to be given to the following items during this pre-flood inspection.

(a) For large levee systems, ensure that the dividing lines between levee system sections with different assigned personnel and responsible section leaders are clearly defined and marked.

(b) Review the condition of any recent repairs to the levee.

(c) Observe water conditions and any accumulation of trash, debris, or ice on the levee, culverts, pump station intakes, and other closure structures.

(d) Observe the condition of transportation, including roads, rail, and water access points, on and around the levee system.

(e) Identify the location, quantity, and conditions of all necessary tools and materials (e.g., sacks, sandbags, lumber, lights) and distribute and store them at points where maintenance is anticipated.

(f) Monitor drainage structures that are situated to convey interior drainage from low points of the leveed area through the levee by gravity flow. Because of their location, these drainage structures are generally subject to inundation at lower stages than other features and potentially will not be accessible later during the flood event.

(g) Use the most recent USACE inspection and risk assessment to help inform if there are any items that require immediate attention prior to a high-water event. The USACE inspection and risk assessment can also inform pre-flood operations and maintenance activities of the levee system.

d. Perform Pre-flood Operation and Maintenance.

(1) Once the pre-flood inspection has been completed, the levee sponsor should organize their labor force to take care of any pressing maintenance issues before the water rises further.

(2) Manually check all flap gates that are critical or in questionable repair to ensure that the gates will function appropriately during the flood event.

(3) Perform necessary maintenance on sluice gates before the outlet end of the structure becomes submerged.

(4) Remove any trash, debris, or other potential obstructions from culvert inlets and outlets, closure gates, pump station trash racks, and inlets.

(5) If, for any reason, the gate system on a drainage structure fails to operate and cannot be repaired because of high water, immediate consideration should be given to blocking the structure opening by other means. If stream stages permit, the outlet end of the structure should be blocked using timber, metal plates, tarps, sandbags, or by other means. If the efforts to plug the outlet structure fail, immediate action should be taken to build a sandbag or earth ring around the inlet structure. While the primary concern in blocking the structures is to prevent high stages of the river from flowing into the leveed area, emergency closures that are installed should be able to be readily removed after the river recedes.

(6) Attention should be given to the grade line or profile of the levee system. Personnel should fill any holes, gullies, and washes in the levee crown, embankment side slopes, and land-side berms with compacted fill material whenever possible, or

sandbags if compacted fill cannot be placed. Avoid taking material for these repairs from the area adjacent to the levee, particularly in the area of a seepage berm.

(7) Perform repairs to gate sills and components as necessary to ensure closures can be exercised during Phase II operations.

(8) Examine all drainage ditches on the land-side of the levee and remove any obstructions. Be prepared to construct seepage drainage ditches, but not until actual seepage appears. Excavation of ditches near the levee or in the long berm area is hazardous and should not be undertaken except under direct supervision of the section leader and with the advice of the USACE advisor from the local district.

e. Begin Incident Reporting.

(1) During Phase I response operations, it is necessary for levee sponsors to develop and initiate an incident reporting procedure that can efficiently collect and report critical awareness activities to community leaders within the leveed area, county emergency managers, the state emergency operations center, and the local USACE district's emergency operations center.

(2) The incident reporting procedures should identify critical information regarding flood stage elevations, established trigger points for reporting flood response operations such as levee gate closures, transportation road closures, public warnings, and evacuation notices.

(3) During Phase II response operations, the incident reporting procedures should be expanded to include levee system distress that could lead to life loss, significant damage, and other critical performance concerns with the levee system. These critical incidents can include projected levee system overtopping or critical damages that impact the integrity or performance of the levee system.

(4) Additional critical reporting information should include levee system personnel safety incidents and incidents impacting the public's safety.

3.4 Phase II Response Activities.

a. Operate System.

(1) Install levee system closures and gates based on the emergency action plan and established procedures and trigger points.

(2) Staff and operate pumping stations. Ensure staffing to operate continuously (24/7) throughout the flood response. Trained operators should be on duty whenever pump stations are in operation. Operators should understand the manner in which the pumping station was designed to operate and be capable of manual operation should automated equipment or sensors fail.

(3) Monitor debris basins, trash racks, closure structures, drainage and pump station inlets, and riverside project fencing for sediment and accumulated debris. As debris and sediment continue to be deposited in the basin, debris loads will substantially block racks and sediment deposits will block the entrance to the basin, forcing the flow against the sides. Any large accumulation of debris on racks or flow directed on the sides of basins will cause local erosion and scour. Levees and concrete structures that are part of the debris basin facility will need to be monitored closely to ensure good performance.

b. Conduct Levee Patrolling.

(1) To minimize damage and to prevent the levee system from breaching, any problems must be detected early and treated appropriately. The entire levee system should be patrolled at least once a day during the Phase I response and continually during Phase II. For safety and efficiency, patrols should be conducted by teams rather than by individuals. Where access to the levee has been compromised, consideration should be given to working with local law enforcement or the National Guard to utilize helicopters to make patrols. During each patrol, levee performance concerns should be documented using photographs and other automated inspection tools that can identify the location and condition of the levee performance concern.

(2) Many of the tasks typically accomplished during flood inspections and patrols are listed in Table II.3.3. Any significant or unusual conditions identified should be reported in accordance with the levee sponsor's incident reporting procedures.

Table II.3.3 – Recommended Patrolling Observations

Levee System Component	Recommended Patrolling Observations
General System	▪ Record gage readings (hourly). ▪ Inspect fences on riverside of levee to make sure they are free from debris. ▪ Inspect ponding areas. ▪ Verify that all necessary access roads and ramps along the levee system are usable and in satisfactory condition. ▪ Document the location and take photographs of all observed issues.

Levees	▪ Look for sand boils or unusual wet areas near the land-side toe. ▪ Look for slides or sloughs in levee side slopes. ▪ Look for wave wash or scouring of the riverside levee slope. ▪ Look for low areas in levee crown. ▪ Monitor relief wells and associated instruments such as piezometers. ▪ (Are the wells flowing or not? If so, measure and document the flow rate. Record the water level in the piezometers.) ▪ Check flap/sluice gates for proper closure. ▪ Check gap closures (e.g., stop logs, sandbags, swing gates).
Floodwalls	▪ Look for saturated areas or sand boils landward of the floodwall. ▪ Look for settlement or misalignment of the floodwall. ▪ Look for bank caving which may affect the structural stability of the floodwall. ▪ Inspect toe drain risers (discharging/non-discharging). ▪ Inspect the land-side of floodwall for any leakage, especially around the monolith joints. ▪ Inspect for wet areas, soft areas, seeps, sand boils, and sink holes landward of the toe of the floodwall. ▪ Check gap or gate closures (e.g., stop logs, sandbags, swing gates) and monitor for leakage.
Pump Stations	▪ Verify proper ventilation (e.g., turn fans on, open vents) of the pumping plant, to prevent overheating of pump motors. ▪ Look for sink holes or wet areas or sand boils around the perimeter of the pumping plant, and/or settlement of the pump house, all of which could potentially be the result of separation in the conduits. If this condition is suspected, the pumps and motors should be shut down until an engineering review can be conducted to analyze the condition. ▪ Verify that assigned operators are on duty 24 hours daily. Make sure that operators have enough food and water onsite to last for several days in case the situation worsens and/or back-up assistance is unavailable. ▪ Test the back-up power supply. ▪ Verify that the trash racks are free of debris.

Necessary Patrol Equipment	▪ Portable radio or cell phone (NOTE: cell service can be unreliable during storm events). ▪ Watch. ▪ Equipment log book. ▪ Patrolling instructions. ▪ Plan of action for patrolling. ▪ Plan drawings of the flood risk management system. ▪ Operation and maintenance manual for the levee system. ▪ Weather gear. ▪ Flashlights and extra batteries. ▪ Record log for documenting conditions. ▪ Life jackets. ▪ Probing rod. ▪ Short wooden stakes and neon flagging (pink and orange have the highest visibility). ▪ 40 feet of ½-inch nylon safety line to connect team members. ▪ Camera (GPS cameras are preferred since they show the location of each photo). ▪ Evacuation plan. ▪ Emergency contact list.

(3) The following safety precautions are recommended to ensure the safety of patrol personnel.

(a) The members of the levee patrol team should walk with one person on the water-side of the levee near the water surface and one person at the top of the levee. The team should move slowly enough to enable the member closest to the water to probe below the surface with a rod in order to discover any erosion that may be taking place. The person closest to the water should be wearing a safety line. Patrol team members should also be wearing life jackets with high visibility reflective tape that allows them to be seen in all light conditions, including low-light. For the return patrol, one person should inspect the crest while the other person inspects the area near the land-side levee toe.

(b) The person walking closest to the water should be especially observant of floating objects. The limbs and roots of a floating tree that has been uprooted can extend above the water surface and strike anyone walking along the water's edge. To increase the chance of seeing floating objects, it is best to walk in an upstream direction when patrolling the water side of the levee.

(c) When patrolling floodwalls, the patrol should not attempt to walk the top of the wall, but should concentrate on potential problem areas on the land-side (inside) of the wall. Where the wall is more than five feet above the land-side ground level, it is recommended that observation points be selected every 100 yards or so, and ladders used to observe the water side of the floodwall.

(d) Each person on the patrol should be thoroughly familiar with the community evacuation plan and signals. If evacuation is necessary, the patrol should move to a pre-determined location and keep the team intact.

(e) If the area is evacuated, be aware when returning to the levees and floodwalls that the physical conditions may be considerably different from those observed prior to the evacuation, especially if the levee was overtopped. If overtopping occurs during darkness, it is recommended that the patrols not resume until daylight.

(f) Patrols should also keep an eye out for anyone that seems out of place or who is acting suspiciously. Unfortunately there are some people, terrorists or otherwise, who may try to take advantage of an already dangerous situation for their own purposes. Any suspicious activities observed by the patrol should be reported immediately to the local law enforcement agency.

c. Conduct Emergency Response Operations.

(1) Flood response operations during Phase II consist of the actions that should be taken when the flood waters have exceeded bank-full condition and are loading the levee system. The following is a summary of actions that should be taken during Phase II of the flood response.

(a) Establish an emergency operations center to oversee the emergency response, manage communications and coordination, and conduct incident reporting. This operations center should be staffed 24-hours daily until the flood emergency is over.

(b) Increase frequency and duration of levee patrols to continuous (24/7) coverage or as the situation requires.

(c) Monitor the inventory of flood response equipment, material, and supplies as they are used. Replenish supplies and material as required.

(d) Repair any erosion, seepage, or stability problems identified by patrols as quickly as possible.

(e) Use portable pumps to pump water over the levee if water is ponding in undesirable areas or is rising too quickly in ponding areas within the leveed area.

(f) Remove debris from debris basins, trash racks, closure structures, drainage and pump station inlets, and river-side project fencing.

(2) When levee systems are loaded during a flood, they have a higher chance of experiencing performance issues. This increases with the height of the water, the duration of the flood stage, the intensity of the current, and the wave action against the levee face. This loading can lead to specific damages that may require emergency actions to prevent further levee damage or activation of emergency evacuation plans.

The following are three primary conditions that may impact the performance of the levee system. Development of response actions to these specific conditions is recommended to be included in a levee emergency action plan.

(a) Erosion of the levee slope – During high water, continuing wave action and current against the levee slope can erode the toe and slope of the levee system. This erosion can potentially lead to breach of the levee system if not corrected. The occurrence of erosion on the levee toe and slope should be monitored during the levee patrols and the levee sponsors should take immediate action to treat erosion activities on the levee toe and slope.

(b) Seepage – As the flood stage rises, the hydrostatic pressure against the levee slope increases significantly and can force water through and under the levee embankment or floodwall. Seepage is a concern if: 1) the landward levee slope or floodwall becomes saturated over a large area; 2) seepage water is carrying material from the levee or foundation; and/or 3) pumping capacity to remove the seepage flow is exceeded. The occurrence of sand boils on the land-side of the levee and toe area should be monitored during the levee patrol and the levee sponsor should take immediate action to treat seepage activities.

(c) Stability – Earthen levee embankments are susceptible to slope instability as a result of weak soil layers in the levee embankment and/or foundation. Slope stability issues may occur during flood and non-flood conditions. During flood loading conditions, seepage through the levee embankment may manifest in land-side slope instability. In addition, slope instability is possible as flood waters recede in a process referred to as rapid drawdown. Once initiated, slope instability can progress through continued sloughing and sliding resulting in a levee breach. Early indications of slope instability include the development of tension cracking, bulging at the levee toe, and/or vertical displacement. Flood responders should patrol levees for these early indications to implement successful mitigation techniques.

(d) Overtopping – A levee system is overtopped when flood waters flow over the levee crown. If the flood elevation is predicted to approach or exceed the height of the levee, the levee sponsor should immediately consider the appropriate actions necessary to minimize the impact of the overtopping. Consideration should be given to the severity of the predicted flood elevation. The best approach may be to implement the emergency evacuation plan and allow the levee to overtop. However, there may be appropriate techniques for temporarily increasing the levee height. These techniques should be analyzed to determine how they can be implemented in a safe manner for each specific levee system ahead of time. USACE can provide technical assistance and experience to assist in planning for these scenarios.

d. Use Volunteer Assistance.

(1) If it becomes necessary to recruit volunteers and/or use National Guard personnel during the emergency response, a number of actions that can be taken to

organize their support are summarized below.

(a) Establish primary and alternate assembly areas with adequate parking for volunteers.

(b) Arrange transportation, subsistence, and shelter for workers as appropriate.

(c) Contact media to request that volunteers report to the designated assembly area.

(d) Instruct volunteers to bring flashlights, work gloves, rain gear, shovel, snacks, and water.

(e) Maintain a sign-in roster at the assembly area to account for volunteers and personnel (e.g., name, phone number, e-mail address, address, work group assignment).

(f) Establish staging areas away from the work site but as close to the flood response locations as possible and with good access to clear roads. Separate areas in the staging site should be established for sandbag filling, carrying and loading, materials stockpiles, rest and breaks, and first aid.

(g) Establish traffic patterns that will be used to move the sandbags from the staging area to the work site. If conditions permit, one-way traffic patterns should be established on the levee system if trucks are being used to transport the filled sandbags.

(h) Be certain that the people laying sandbags are well supervised by a trained individual who knows how to properly place and stack the sandbags.

(i) Volunteers may be exposed to strenuous activities accompanied by extreme weather conditions that include the full range between excessive heat and extreme cold. Supervisors of volunteer workers must be trained to notice signs of heat stress or exhaustion, frost-bite, general fatigue, dehydration, and other physical distress. Proper techniques for lifting and placing the sandbags should also be observed to prevent injury.

e. Evacuation.

(1) Levee sponsors need to be prepared to implement or support evacuation plans when necessary and should also consider the following.

(a) Immediately coordinate evacuation with police, the fire department, and first responders.

(b) Follow the pre-determined plan for evacuation.

(c) Meet in pre-determined locations and immediately verify the safety of all

personnel.

(d) If the Emergency Operations Center requires evacuation, collect and bring contact information, sign-in registers, and other critical information to the center.

f. Conduct System Performance Data Collection.

(1) Levee system performance observations during flood events, both positive and negative, are essential to confirm levee integrity and identify inherent strengths and weaknesses of levee performance so that remediation measures can be identified and performed. The data collection focuses on identification of weaknesses and positive confirmation of good performance during flood loading, especially in areas where previous remedial actions have taken place.

(2) Collection of levee system performance data generally occurs during the flood event by levee patrol personnel and after the flood event generally in coordination with the local USACE emergency management office. Individuals collecting data should recognize conditions that may lead to breach of levees and have knowledge of temporary and permanent remediation techniques.

(3) The USACE Levee Inspection System may be used to collect performance data during floods. Levee sponsors should contact the local USACE district to obtain assistance in the use of the Levee Inspection System (reference A.24).

(4) The basic data that should be collected include the following elements when available.

(a) River hydrograph with stage readings and frequencies and/or high water marks.

(b) Written observations of performance issues by stationing along with GPS coordinates where applicable.

(c) Photographs of all performance issues.

(d) Maps showing all observation points collected.

(e) Instrumentation readings and evaluations.

(f) Any levee system breach dimensions (width, scour depth) if applicable.

(g) Plot of breach development over time if available.

(h) Photographs of areas of inundation if applicable.

(i) Estimated area and depth of inundation if applicable.

(5) The National Levee Database is the repository of all levee performance data collected during emergency flood operations. Data collected from any devices or methods other than the Levee Inspection System should be uploaded to the National Levee Database (reference A.26).

3.5 USACE Assistance During Flood Response.

a. The USACE local district emergency management office can provide emergency assistance to levee sponsors and communities for flood response operations when requested. USACE assistance is to supplement tribal, state, and local efforts. While a written request from a tribe, state, or local entity is not required, it is recommended in order to facilitate and clarify the overall assistance requested.

b. Advance measures assistance is another type of assistance available to levee sponsors and communities upon request. Advance measures assistance is provided when there is a clear prediction of an imminent threat of unusual flooding that would result in substantial flood damages to an area if no preventative action is taken in advance of the flooding. This assistance is provided prior to the predicted flooding and can include technical assistance and/or direct assistance such as supplies, equipment, and/or emergency contracting.

c. Technical assistance consists of providing review and recommendations in support of tribal, state, and local efforts, and helping determine feasible solutions to uncommon situations. The following are examples of technical assistance available from USACE.

(1) Provide experienced personnel to offer guidance on flood fight techniques and emergency construction methods. This may also include providing USACE or contracted technical experts to offer guidance on the use and application of USACE-owned regional flood fight products.

(2) Provide personnel to inspect existing levees and identify problem areas and recommend corrective measures.

(3) Provide hydraulic or hydrologic analysis, geotechnical evaluations, topography, and stream data, maps, and historic flood or storm information from existing hydraulics and hydrology studies and/or project data.

(4) Develop decision-support products, such as inundation mapping using the National Levee Database or other available data or tools, in order to assist in flood response decision-making and tribal, state, and local community flood fight actions.

d. Direct assistance may include the issuance of supplies, the loan of equipment or regional flood fight products, and contingency contracting. Direct assistance is limited to

flooding and coastal storm-related emergencies and is temporary in nature. The following are examples of direct assistance from USACE.

(1) Loan supplies and equipment to levee sponsors or tribal, state, and local officials for use in supplementing their flood emergency operations.

(2) Provide sandbags, polyethylene, pumps, sandbag machines, and other supplies and equipment.

(3) Provide emergency contracting to support levee sponsor's emergency operations (e.g., construct temporary levees, temporary breach repairs).

CHAPTER 4

Recovery

4.1 Purpose. This chapter describes activities that take place after a flood event. As the response requirements for a flood diminish, recovery activities become the focus of effort. The goal of recovery is to return the levee system to its pre-flood condition and to document lessons learned about levee system performance to aid in future preparedness, response, recovery, and mitigation. Recovery begins right after the emergency although some recovery activities may overlap with response and mitigation efforts. Although recovery is primarily a responsibility of the levee sponsor, USACE may be able to provide some assistance. For levee systems with multiple levee sponsors, coordination between sponsors during the recovery phase is important. Flood recovery is unique to each levee system depending on the severity and extent of damage caused by the flood, resources available for recovery, and the level of effort needed to document what happened during the flood event. Anticipated recovery actions have been divided into short-term and long-term activities.

4.2 Short-Term Post-Flood Activities.

a. Post-flood operation.

(1) Purpose. The purpose of short-term post-flood operation is to reestablish the condition of levee features (e.g., closures, culvert gates) that were not damaged during the flood event. This activity should not be initiated until the water has subsided and it is not predicted to rise again. Short-term post-flood operation activities may occur in conjunction with immediate repairs and interim risk reduction measures depending on the extent of damage to the levee system.

(2) Basic Procedures.

(a) Re-open gates and closures.

(b) Remove temporary flood response measures such as sandbags.

(c) Remove material placed during temporary levee raises.

(d) Clean debris from trash racks and/or other openings such as culverts.

(e) Properly clean all components.

(f) Inventory items, return borrowed equipment, and determine what can be re-used.

(g) Salvage and store any materials and supplies.

b. Assess levee condition and performance.

(1) Purpose. Once flood waters have receded to an adequate elevation, it is important to assess how the levee performed during the event and its post-flood condition. This allows for effective assessment of damages, determination of immediate and long-term repair needs, and development of lessons learned.

(2) Basic Procedures.

(a) Post-flood inspection. See Volume II, Chapter 2, Preparedness, for recommended inspection procedures. USACE refers to post-flood inspections as Special Inspections and will coordinate and conduct these inspections with levee sponsors. Inspect the entire system, noting locations of damage and the extent of damage at each location. Take photographs to document the conditions observed. Document the event and keep a map record of the levee system, indicating areas that were in distress during the event. This is useful for making repairs or improvements and for use as a guide to focus attention on these areas during the next flood. For future planning, locate and keep records of the flood's high-water marks. Keep these records, along with any rainfall and river data that was gathered.

(b) Performance assessment. Levee sponsors should work with USACE to evaluate how the levee performed during the flood event. The evaluation should consider the following information that is typically collected during the response phase when available.

(i) River hydrograph (with stage readings and frequencies) and/or high water marks.

(ii) Written observations of performance issues by stationing along with GPS coordinates where applicable.

(iii) Photographs of all performance issues.

(iv) Maps showing all observation points collected.

(v) Instrumentation readings and evaluations.

(vi) Final breach dimensions (width, scour depth) if applicable.

(vii) Plot of breach development over time if applicable

(viii) Levee material and surface protection description

(ix) Estimated number of houses/businesses flooded if applicable.

(c) Damage assessment. Based on the post-flood inspection and review of the performance assessment, a damage assessment can be accomplished to determine locations and extent of damages to levee features (e.g., embankment erosion, seepage, floodwall displacement). This damage assessment should be used to identify immediate repair needs and inform future long-term mitigation actions necessary to manage and reduce flood risk. Levee sponsors are encouraged to evaluate and document the flood

damages prevented in order to reflect the contributions of the levee system to the community.

c. Determine and implement immediate repair needs. Priority repairs should be made as soon as possible.

d. Develop interim risk reduction measures. These are actions to reduce risk associated with the levee while more long-term and comprehensive risk reduction and management solutions are pursued.

4.3 Long-Term Post-Flood Activities.

a. Develop long-term risk reduction measures. Utilizing the information gathered through the short-term activities, levee sponsors in collaboration with USACE, should generate a tentative list of long-term risk reduction measures beyond those taken to address immediate needs of the levee system. Some of these measures may be related directly to needed levee improvements while others will result from an understanding of emergency response activities during the event. For example, levee sponsors should work with local and state emergency management agencies as appropriate to update local emergency plans to account for lessons learned, levee system operation issues, and evacuation effectiveness. These long-term measures will be further developed during the mitigation phase further described in Volume II, Chapter 5.

b. Documenting lessons learned and updating risk information.

(1) Purpose. Documentation of levee condition, performance, damages, and short-term actions taken on the levee can be very helpful for future preparedness, response, and mitigation efforts.

(2) Basic Procedure.

(a) Soon after the event, the sponsor should meet with key personnel, volunteer representatives, and community partners to de-brief, share remaining concerns, and discuss lessons learned during the event.

(b) Consider documenting the following information in addition to the information evaluated in the short-term activities (performance assessment), if applicable:

(i) Estimated population impacted.

(ii) Estimated area and depth of inundation.

(iii) Information regarding evacuation procedures and successes.

(iv) Time of incident notification to evacuation authorizing agency.

(v) Time of evacuation warning.

4.4 USACE Rehabilitation Program Assistance. If a levee system is damaged during a flood and is eligible for rehabilitation assistance from USACE, a written request to USACE must be submitted to the local district's emergency management office.

a. If the flooding was significant, the levee sponsor may receive a letter informing them that USACE is accepting rehabilitation assistance requests. Generally, the timeframe for submission of rehabilitation assistance requests is not more than 30 days after the flood waters have receded to normal levels. Upon receipt of a request, USACE will determine whether the requested repairs are eligible for rehabilitation assistance.

b. If program qualifications are met, USACE will coordinate repair alternatives with the levee sponsor and prepare an appropriate cooperation agreement depending on whether the system is federally or non-federally constructed. The cooperation agreement clarifies details of the rehabilitation effort, including the specific work to be done and sponsor requirements of cost sharing and local cooperation. The cooperation agreement must be signed by both the levee sponsor and the District Engineer before rehabilitation construction can begin. To prevent additional costs, the cooperation agreement should be signed within 30 days after it has been prepared.

c. The cooperation agreement outlines the cost breakdown for the work to be accomplished. The following sections outline the types of items that will typically be paid for by the federal government, the items that may be cost shared, and the items the levee sponsor would typically be responsible for at 100% local cost. This is not a complete list and certain details have been omitted for brevity. Specific details concerning the cooperation agreement can be found in reference A.4.

d. Rehabilitation components typically covered at 100% federal cost.

(1) Preparation and approval of preliminary investigation reports; and

(2) Engineering and design costs.

e. Items that may be cost-shared. If the levee system was originally constructed by the federal government, the following items are covered at 100% federal cost, but if it was non-federally constructed, they are typically cost-shared at 80% federal cost and 20% local cost:

(1) Cost of construction;

(2) Contingency costs for construction; and

(3) Supervision and administration costs.

f. Items the levee sponsor is responsible for at 100% local cost.

(1) Land, easements, and rights-of-way;

(2) Improvements requested by the levee sponsor;

(3) Deliberate levee cuts; and

(4) Repairs beyond the least cost alternative.

CHAPTER 5

Mitigation

5.1 Purpose. This chapter describes activities associated with mitigation. Mitigation is taking actions to reduce loss of life and property by lessening the impacts of floods. Mitigation actions aim to address the cause, reduce the occurrence, and minimize exposure to the effects of a hazard. To be successful, mitigation measures for levees should be consistent with the overall strategy to manage risk associated with the levee and consider all sources of risk, including the hazard, levee structure performance, and potential consequences to the people and the property in the leveed areas. As a result, mitigation activities should be coordinated with other levee sponsors and the broader community including state, local, and federal governmental bodies, risk managers, and key stakeholders.

5.2 Mitigation Activities. Table II.5.1 provides a summary of activities levee sponsors can take to reduce risk and improve the performance of the levee. The table also includes how levee sponsors can support others to reduce the consequences of flooding.

Table II.5.1 – Mitigation Activities

Activity	Description	Levee Sponsor Role	USACE Role
Develop a strategy to manage risk.	▪ Use best available risk information to develop a strategy for managing and reducing levee-related risks. ▪ Identify other actions that could be taken by the broader community.	▪ Review risk information from previous assessments, inspections, or recent floods. ▪ Develop/confirm planned mitigation actions. ▪ Prioritize actions. ▪ Share planned mitigation activities with the broader community.	▪ Provide relevant risk information to levee sponsors. ▪ Provide advice on mitigation actions and prioritization. ▪ Support the levee sponsor in sharing planned mitigation actions with others.
Implement planned mitigation actions.	▪ Implement planned mitigation actions in priority order. ▪ Support broader community mitigation action implementation.	▪ Implement actions consistent with the planned approach. ▪ Communicate schedule, progress, and intent of planned mitigation action. ▪ Support broader community mitigation actions.	▪ Provide technical assistance for implementing mitigation actions. ▪ Support levee sponsor communication.

Activity	Description	Levee Sponsor Role	USACE Role
Track progress.	▪ Monitor progress of short- and long-term mitigation actions. ▪ Establish a benchmark to determine how risk changes over time.	▪ Monitor progress of mitigation actions. ▪ Document decisions to change prioritization. ▪ Document when work is completed. ▪ Communicate activity schedule, progress, and completion. ▪ Share progress reports with other levee sponsors and the broader community.	▪ Assist with documenting mitigation action progress. ▪ Consider if mitigation actions merit an updated risk assessment. ▪ Support communication with other levee sponsors and the broader community.
Assess how mitigation actions change risk over time.	▪ Using the established benchmark, determine how risk has changed. ▪ Identify new or remaining mitigation actions. ▪ Document changes in risk for future use.	▪ Assess how much risk has changed. ▪ Determine what else could be done to further reduce risks. ▪ Prioritize new or remaining mitigation actions. ▪ Share information on completed and remaining mitigation actions with others. ▪ Use changes in risk to inform preparedness actions.	▪ If requested, perform a new risk assessment or inspection. ▪ Help document changes in risk. ▪ Provide technical assistance identifying new or completing remaining mitigation actions. ▪ Support information sharing with others.
Coordinate with the broader community.	▪ Coordinate mitigation actions with other levee sponsors. ▪ Share changes in risk. ▪ Support others' risk management actions.	▪ Coordinate efforts to reduce risks, particularly where levees act as a system. ▪ Continue to share information with the broader community. ▪ Help the broader community implement their mitigation actions.	▪ Support levee sponsors' coordination. ▪ Support broader community risk management. ▪ Identify other federal programs available to support risk management.

5.3 Description of Activities.

a. Develop a strategy to manage risk.

(1) Successful mitigation requires an overall strategy that considers all sources of risk, including hazard, levee structure performance, and potential consequences. When developing this strategy, levee sponsors should use best available information to inform which mitigation actions they identify and whether those actions should be taken in the short- or long-term.

(2) Levee sponsors have access to a variety of sources for information on their levee. Levee sponsors should consult the following resources to inform how they take action to reduce risk over time:

(a) Inspections;

(b) USACE-performed risk assessments; and

(c) Lessons learned during preparedness, response, and recovery.

(3) When identifying potential mitigation measures, levee sponsors should consider all sources of risk and prioritize their planned mitigation actions based on what is driving the risk. Levee sponsors may not have the ability to implement some of these actions, so it may be necessary to work with other entities and communicate risk so the responsible parties can make informed decisions and take action accordingly. Table II.5.2 provides example mitigation actions that could be taken to address the different areas of risk.

(4) Flood risk management activities can and should be undertaken at many levels (e.g., governmental, business, community association, individuals/families). Responsibility, authority, and ability to implement risk management activities vary across sponsors, communities, and individuals.

(5) The best risk management approaches are usually a combination of activities and actions shared across a variety of roles and entities. Therefore, levee sponsors should coordinate with other levee sponsors and the broader community when confirming and prioritizing planned mitigation actions.

Table II.5.2 – Areas of Risk Mitigation

Hazard	Performance	Consequence
▪ Bridge enlargement ▪ Channel conveyance modifications ▪ Clearing snagging and debris ▪ Interior drainage features Reservoir operations	▪ Construct levee cutoff walls ▪ Construct seepage berm ▪ Controlled overtopping ▪ Erosion protection ▪ Improve operations and maintenance ▪ Increase erosion protection ▪ Install instrumentation to facilitate performance monitoring ▪ Monitor levee performance ▪ Overtopping resilience ▪ Pre-position emergency supply contracts/stockpile materials ▪ Train all personnel for prompt emergency response ▪ Update levee operation and maintenance manual	▪ Buy out low-lying property ▪ Develop a risk awareness campaign ▪ Emergency action plan ▪ Evacuation plans/drills ▪ Flood insurance ▪ Flood proof structures ▪ Improve/adopt a flood warning system ▪ Land use regulation ▪ Raise structures in low-lying areas ▪ Relocation ▪ Zoning

b. Implement planned mitigation actions.

(1) Levee sponsors should implement planned mitigation actions consistent with their strategy to manage risk. Levee sponsors may wish to document their strategy and planned mitigation actions, including prioritization, to track implementation and monitor progress. Levee sponsors should implement planned mitigation actions consistent with any required federal, state, or local policies and regulations.

(2) Levee sponsors should maintain open lines of communication during implementation of their planned mitigation actions. Keeping others apprised of activities and changes in risk helps levee sponsors plan for and adopt their own strategies to take action to manage risk.

c. Track progress.

(1) Mitigation actions taken to manage risk should be tracked over time. Levee sponsors should establish a benchmark to measure progress. Doing so will help levee sponsors and others understand how risk changes over time, prioritize remaining or additional mitigation actions, and inform pre- and post-flood activities.

(2) Recognizing that budgets and priorities will change, actions to reduce risk may occur over longer or shorter durations. It is important to note the temporal nature of any measure and to track these actions during planning and once completed.

d. Assess how mitigation actions change risk over time.

(1) Levee sponsors should assess how mitigation actions change risk over time. Assessing changes in risk establishes a new baseline condition that will be used for future inspections, risk assessments, and mitigation actions. As risk reduction activities are completed, levee sponsors should document them and determine which component of the risk has been addressed.

(2) For example, a levee sponsor may have taken action to improve the performance or response of the levee system by adding or modifying features of the levee system to promote system resilience. Completing this action changes but does not eliminate risk.

(3) Understanding the change in conditions will help levee sponsors determine remaining mitigation actions to address other potential components of risk, such as reducing the vulnerability of people and items, by strengthening emergency action plans.

e. Coordinate with the broader community.

(1) Levee sponsors should share what they learn about the change in risk with other levee sponsors. Levees are often located close to one another, have different sponsors, and can be operated with one another; this can affect how another levee performs during a flood. As a result, changes in risk in one area of a levee could impact anticipated performance of other levees or the levee system. When levee sponsors share information with each other, it helps them understand how their risk has changed and informs their actions to manage risk.

(2) Levee sponsors should also coordinate with the broader community, including federal, state, and local governmental bodies, risk managers, and key stakeholders in order to support mitigation actions that address all of the components of risk (e.g., the consequences in addition to the hazard). Levee sponsors should participate in and support community efforts to conduct pre-event planning and preparedness efforts, and share information that will inform community and individual actions to manage flood risks (e.g., flood insurance, evacuation planning).

f. How USACE can help sponsors.

(1) Within the USACE Levee Safety Program, USACE intends to convey information with a Levee Risk Management Summary (Appendix B). This summary is a way to help organize, monitor, and manage risk associated with a levee system.

(2) USACE is available to support levee sponsors as they work with the community and other partners to focus resources on effectively managing the levee-related flood risk. An effective risk management approach uses a combination of activities and approaches aimed at different risk drivers to maximize risk reduction opportunities.

(3) USACE works with levee sponsors and, as requested, communities to evaluate levee-related flood risk and make recommendations regarding the scope and

development of risk management options. USACE is available to support meetings with elected officials, emergency managers, land use and transportation planners, stormwater and floodplain managers, public works directors, and others who have public responsibilities to ensure that levee-related flood risk is understood.

(4) USACE has programs beyond the Levee Safety Program that provide assistance to levee sponsors, states, and other flood risk managers in developing and implementing risk management efforts in communities with and without levees. The following programs are two possible opportunities to leverage existing USACE relationships and coordination efforts to build relationships in support of broader flood risk management:

(a) Silver Jackets. State-based Silver Jackets teams collaboratively address flood risk management priorities based on state priorities, including enhancing mitigation, preparedness, and recovery efforts. Common participants include state and federal agencies with mission areas of floodplain, emergency and/or natural resources management, and hazard mitigation.

(b) USACE Flood Risk Management Program. USACE flood risk managers focus the policies, programs, and expertise of USACE toward reducing overall flood risk.

(5) Table II.5.3 highlights a variety of USACE programs that provide technical assistance, share expertise, and support coordination work across all components of risk (e.g., hazard, performance, and consequences). USACE has programs to assist states and communities in reducing flood damages and promoting sound flood risk management. These resources (along with other activities) should be considered within the context of the risk assessment information to determine what will have the biggest risk reduction impacts with the least amount of cost.

(6) There are additional federal agencies that have a flood risk management mission and related programs and authorities that can help with risk management. USACE can help levee sponsors and the broader community identify and gain access to those opportunities. USACE has compiled a searchable database of federal programs related to flood risk management (reference A.30).

Table II.5.3 – USACE Programs and Authorities for Flood Risk Management

Overview of USACE Programs and Authorities With Potential to Contribute to the Development and/or Implementation of Flood Risk Management Options		
Technical Services and Assistance: Programs and authorities potentially available to provide information, conduct limited studies, support risk communication and perform coordination		
Program/Authority	**Goal**	**Potential Activities/ Products Supported**
▪ Planning Assistance to States Program (42 United States Code (USC) 1962d-16)	▪ Technical expertise to help states and tribes in management of water and related land resources to solve water resource problems	▪ Technical support, including data, analysis, and assistance to develop state water resources management plans
▪ Floodplain Management Services Program (33 USC 709a)	▪ Technical/planning assistance for non-federal public agencies to help with floodplain management planning and studies	▪ Flood hazard evaluation, flood warning/ preparedness, floodproofing, structure inventory, and flood risk management plans
▪ Emergency Preparedness, Response, and Recovery (33 USC 701n)	▪ USACE technical assistance for sponsors and other public agencies based on particular program criteria	▪ Flood disaster preparedness, advance measures before a flood, emergency operations, rehab of flood control works threatened/ destroyed by flood
▪ Interagency and International Services (10 USC 3036e/31 USC 6505)	▪ USACE reimbursable technical assistance to non-Department of Defense federal agencies, tribes, and state/local governments	▪ Engineering/construction services, environmental restoration and management, management of water and land-related natural resources

Cost-Share: Potential opportunities for USACE to cost-share studies/flood risk management projects	
Program/Authority	**Potential Studies/Projects**
▪ Continuing Authorities Program (CAP) — assistance to plan, design, and implement water resources projects of limited size, cost and scope, without specific legislative authorization	▪ Flood Damage Reduction - design/implementation with the federal share capped at $10 million ▪ Product Modifications for Improvement of the Environment - structural or operational changes to projects for restoration/enhancement of environment ▪ Channel Clearing for Flood Control - clearing of stream channels to increase channel flow capacity, decrease flooding and reduce damage from the debris carried by flood flows ▪ Hurricane and Storm Damage Reduction - allows for study, design and construction of small coastal storm damage reduction projects ▪ Emergency Streambank and Shoreline Protection - to prevent damage from erosion to non-profit facilities
▪ WRDA 1999, Sec. 212 Projects	▪ Nonstructural measures to significantly reduce flood hazards/restore the natural function and values of rivers
▪ River and Harbor/Flood Control Act, Sec. 216 Studies	▪ Modification of completed projects due to significantly changed physical/ economic conditions and for improving the quality of the environment

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VOLUME III:
USACE LEVEE SAFETY PROGRAM – POLICY AND PROCEDURES

CHAPTER 1

Introduction and Overview

1.1 Purpose. The purpose of Volume III is to provide USACE personnel with high-level policies and procedures for the implementation of the USACE Levee Safety Program. Reference to other guidance documents is noted when appropriate.

1.2 Authority. Activities described in Volume III are authorized by various statutes, including project-specific authorizations. Below are the main authorities.

a. Title IX of the Water Resources Development Act of 2007 (Public Law 110-114), the National Levee Safety Act of 2007, as amended, includes authorities for the National Levee Database and inventory and assessment of levee systems. (Codified at 33 United States Code 3301-3305.)

b. Section 221 of the Flood Control Act of 1970 (Public Law 91-611), as amended, requires that a written partnership agreement be executed between the Secretary of the Army and non-federal interests (e.g., levee sponsors) to identify the items of local cooperation for USACE projects, including operation and maintenance requirements necessary to the functioning of the project for its purposes. (Codified at 42 United States Code 1962d-5b.)

c. Section 5 of the Flood Control Act of 1941 (Public Law 77-228), as amended, commonly referred to as Public Law (PL) 84-99, authorizes USACE to participate in activities related to the preparation for emergency response to natural disasters; flood fighting and rescue operations; repair or restoration of flood risk management projects, including levee systems; and emergency protection, repair, and restoration of federally authorized hurricane or shore protection projects. (Codified at 33 United States Code 701n.)

d. Section 100226 of the Moving Ahead for Progress in the 21st Century Act (MAP-21) (Public Law 112-141) required the Federal Emergency Management Agency (FEMA) and USACE, in cooperation with the National Committee on Levee Safety, to establish a “Flood Protection Structure Accreditation Task Force.” The purpose of this task force is to develop and implement a process to: first, align processes so information collected for the USACE Inspection of Completed Works program and National Flood Insurance Program (NFIP) levee accreditation purposes can be used interchangeably, and second, align the levee information and data collected by USACE so the data collected is sufficient to reach a levee accreditation decision under the NFIP (44 Code of Federal Regulations 65.10 (44 CFR 65.10)) (reference A.22).

e. Section 3014(a) of the Water Resources Reform and Development Act of 2014 (Public Law 113-121) directs the Secretary to ensure that at least one activity carried out under the USACE Inspection of Completed Works (ICW) program provides adequate information to reach a levee accreditation decision under the NFIP (44 CFR 65.10), and to the maximum extent practicable, carry out activities under the ICW program in alignment with the schedule established for the NFIP. In addition, Section 3014(b) provides that, at the request of a non-federal interest, the Secretary may accelerate carrying out a levee system evaluation of a federally authorized levee for purposes of the NFIP and that the evaluation shall comply with regulations for levee accreditation (44 CFR 65.10) and be carried out in accordance with procedures established by the Secretary, in consultation with the FEMA Administrator. It also provides that the funds made available under Section 22 of WRDA 1974 (Public Law 93-251), as amended (42 United States Code 1962d-16), are available to carry out Section 3014(b) and that the cost sharing under Section 22 of WRDA 1974, as amended, applies to activities carried out under Section 3014(b). (Codified at 42 United States Code 4131.)

1.3 Levee Safety Program Mission Statement. The mission of the USACE Levee Safety Program is to ensure levee systems perform as designed and provide benefits to the nation by working with sponsors and stakeholders to assess, communicate, and manage flood risks to people, property, navigation, and the environment.

1.4 Levee Safety Program Guiding Principles. Guiding principles are fundamental values that represent what is desirable and serve as a guide for decision-making. The following are guiding principles for the Levee Safety Program.

a. Hold life safety paramount. Life safety is the highest priority for USACE while managing levee-related flood risk.

b. Corporately manage risk. Flood risks will be managed on a portfolio and individual levee system perspective using consistent and credible engineering analyses and risk-informed processes. Decisions for risk management actions will be commensurate with the level of flood risk and to ensure wise federal investments.

c. Ensure open and transparent engagement. USACE will engage levee sponsors in all Levee Safety Program activities related to their levees and treat them as partners. USACE will work with levee sponsors and, through them, with other stakeholders to provide opportunities for exchange of information, feedback, and discussion.

d. Learn and adapt. Policies and procedures are updated based on best practices and science.

1.5 Levee Safety Program Objectives. Program objectives are desired, measurable results from activities, both singular and collective, that meet the established intent. The following are the programmatic objectives for the Levee Safety Program.

a. Maintain an effective program through a combination of competent staff, updated and relevant guidance, and credible processes and tools.

b. Increase the understanding of benefits and risks of levee systems for all stakeholders.

c. Levee sponsors and communities use increased understanding of benefits and risks to effectively and efficiently manage flood risk in communities with levees. This objective will be accomplished by recognizing the benefits levees provide, identifying opportunities to manage flood risk, and taking actions based on the Tolerable Risk Guidelines (see Volume III, Chapter 4).

d. USACE program activities will support risk-informed federal investments and identify opportunities for actions to manage flood risk outside of federal investments.

1.6 Flood Risk and Levee Risk. The term "flood risk" is used in this document to represent what is commonly referred to as "residual risk." Flood risk is defined as the risk of flooding in a leveed area that remains at any point in time after accounting for the flood risk reduction contributed by the levee system. The term "levee risk," sometimes referred to as "incremental risk," is used to refer to the risk associated with the levee system itself. Under likely events, a properly designed and constructed, well-maintained levee can perform well for the duration of its intended life. When flooding in a leveed area occurs, it will most likely occur from one of four scenarios, referred to as "inundation scenarios." These four inundation scenarios are: 1) breach prior to overtopping; 2) overtopping with breach; 3) malfunction or improper operation of levee system components; and 4) levee overtopping without breach (also referred to as non-breach). Consideration of interior drainage and its contribution to the flood risk in a leveed area will be done on a case-specific basis. Figure III.1.1 displays how the different inundation scenarios are considered related to flood risk for a leveed area. The term "annual exceedance probability" is used in Volume III in the same manner as "probability of inundation" or "probability of failure."

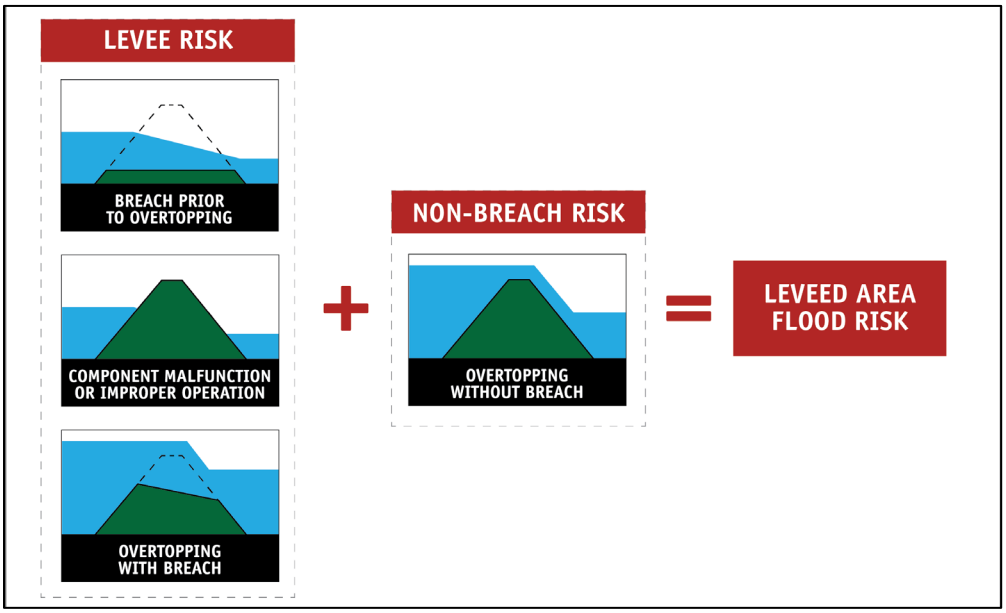

Figure III.1.1 – Components of Flood Risk

CHAPTER 2

Program Oversight

2.1 Overview. The District Commanders, as well as the Division Commanders, have ultimate responsibility for ensuring that their implementation of the Levee Safety Program complies with current policy and procedures. Commanders will approve all Levee Safety Program products, except for the risk categorization, unless the Commander delegates approval to appropriate levee safety experts (reference A.20). The risk categorization is approved by the agency lead for the Levee Safety Program to ensure continuity across the nation.

2.2 Levee Sponsors. A majority of the levee systems within the USACE Levee Safety Program have a levee sponsor who is responsible for all or part of operation and maintenance of those levees. As such, levee sponsors are integral in assessing and making decisions about levee systems. The exact nature of each sponsor's role and responsibility for the levee is determined by the specific authorities and agreements applicable to the levee. The local USACE districts are responsible for building and maintaining the relationship with levee sponsors within their area of responsibility. USACE will treat sponsors as partners in all levee safety activities and will afford them the opportunity to partner in all aspects of the program. Approaches and opportunities to engage levee sponsors should be scalable and tailored to best optimize involvement.

2.3 Other Stakeholders. In order to accomplish the mission and objectives of the Levee Safety Program and to support a process of continuous improvement, USACE will engage with external entities such as other federal, state, and local agencies, tribes, non-governmental organizations, universities, and international organizations.

2.4 Program Monitoring. A series of activities and reviews will be conducted in order to monitor progress of the Levee Safety Program and to identify improvements and changes. Overall program monitoring will be accomplished by USACE Headquarters (HQUSACE) through the following activities.

a. Programmatic metrics. Specific programmatic metrics will be established by HQUSACE to measure USACE's progress in meeting the programmatic objectives. Metrics will be reviewed and periodically updated and disseminated. Metrics will be documented in the HQUSACE program management plan, as described in paragraph 2.5. Commanders will be required to report progress on metrics.

b. Rotating programmatic audits. Annually, and on a rotating basis, a programmatic audit will be conducted by two divisions. These audits will be selected and funded by HQUSACE. Programmatic audits will be led by the division and result in an audit report to be submitted to HQUSACE. At a minimum, the audit report must include a review of each district's implementation of the Levee Safety Program to analyze compliance with policy, the ability to meet the programmatic metrics, engagement with levee sponsors and FEMA, internal coordination with other USACE programs, and quality of levee

safety program products and decisions. The process for conducting these audits will be detailed in the HQUSACE program management plan described in paragraph 2.5.

c. Programmatic independent, external peer review. At a minimum of every five years, HQUSACE will initiate an independent review of the Levee Safety Program, including review of policies, procedures, and performance. The review will be conducted following the procedures in reference A.14. Results from the review will be used to adapt and improve program implementation.

2.5 Program Management Plans. HQUSACE, divisions, and districts will each create and maintain a program management plan for implementation of the Levee Safety Program to have a 10-year outlook and to be updated on an annual basis. A program management plan is a formal, approved, living document used to define program requirements and expectations, assess accountability and performance measurements, and guide program execution (reference A.2). Each program management plan will, at a minimum, include the following.

a. Organizational structure established to implement the program, including coordination with other USACE programs, vertical teams, and reporting requirements.

b. Roles and responsibilities of team members in the organizational structure.

c. Projected list and schedule of Levee Safety Program activities, including inspections and risk assessments, to be used for metric monitoring, budgeting, and levee sponsor and FEMA engagement.

d. Process for coordination of results and information of program activities with USACE emergency management for eligibility determination for the Rehabilitation Program (reference A.4). It is required that all deliverables developed by the Levee Safety Program be provided to USACE emergency management for their use for the Rehabilitation Program.

e. Process for monitoring and updating the National Levee Database.

f. Levee sponsor engagement processes linked to the list and schedule of Levee Safety Program activities. Engagement processes will be developed with the levee sponsors, including sponsor participation with all Levee Safety Program activities and risk communication activities associated with their levee.

g. FEMA engagement processes linked to the list and schedule of Levee Safety Program activities. Engagement processes will be developed with the appropriate FEMA regional offices and should identify processes to ensure information is exchanged in the most efficient, beneficial, and meaningful ways possible. More specifically, processes should be identified for how and when the district will provide assessment and inspection results to FEMA. Engagement processes should include coordinating and aligning FEMA mapping efforts with USACE Levee Safety Program

activities, when possible, and planning for joint engagement with levee sponsors and communities.

h. Process for vetting, review, and approval of final products, such as Levee Risk Management Summaries (see Volume III, Chapter 7), inspection reports, and communication materials.

i. Process for reviewing and coordinating USACE permits for activities on or around levee systems, such as Section 408 requests (reference A.15).

j. Process for distribution of final products as required and/or as needed.

k. Risk communication activities, including public outreach.

l. Training for levee safety staff.

m. Tracking of funding and staffing resources by activity.

2.6 Data Management and Tools. The objective of data management is to ensure that information generated by the Levee Safety Program under the USACE flood risk management mission is stored in the appropriate system of record and is broadly accessible by those who need the information. In addition, as part of data management, it is important to ensure that information is timely (available when needed), current, and accurate. Levee Safety Program data systems and tools will be established so that information can be shared to appropriate audiences and synchronized.

a. For Official Use Only. For requests of information, districts will coordinate with the District Operational Security Officer, who will assist in determining the sensitivity of information and ensuring that sensitive information is appropriately labeled as For Official Use Only. Sensitive information includes information that could pose a security risk or aid those intending to do harm to a USACE levee system. Examples include, but are not limited to, design analyses, as-built or other drawings, specifications, location of deficiencies, detailed inspection reports, and operational information. For Official Use Only information is not publicly releasable but may be shared on a need-to-know basis with the sponsor of the levee system. When sharing sensitive information with the levee sponsor, the districts must inform the levee sponsor that the information is sensitive and that the sensitive information should not be released publicly. See reference A.13 for guidance related to the release of inundation mapping.

b. Civil Works Business Intelligence. To ensure interoperability and an optimized information system portfolio, all levee safety program data management systems and tools will adhere to the standards for data management and architecture established for the Civil Works automated information system. This is inclusive of database standards and application development standards. The safety program's document metadata standard is to be implemented for all Levee Safety Program record documents.

c. Upon finalization of the program activity, the information from those tools is to be migrated to the appropriate system of record for long-term data storage and dissemination.

(1) The National Levee Database is the database system of record. The National Levee Database is also the system used for disseminating database information and documents outside USACE.

(2) ProjectWise is the document management system of record.

(3) Additional program tools include the Levee Inspection System, Levee Screening Tool, and other tools developed for specific program activities.

2.7 Portfolio Management. USACE uses portfolio risk management to understand the risk across the entire USACE inventory of levee systems in order to prioritize actions and investments across the portfolio. Figure III.2.1, Portfolio Risk Management Process, is a generalized flowchart that illustrates the major features of the USACE portfolio risk management process. The risk-informed process that USACE uses for all levees in its portfolio is intended to be repeated at regular intervals or if a change in condition occurs. In the levee safety portfolio risk management process, there are multiple queues that require prioritization decisions due to resource limitations, sponsor and stakeholder considerations, and the desire to reduce overall portfolio risk as efficiently as possible. The associated queues contain the set of levee systems awaiting studies or processing to the next step. While the intent is that the levee systems in the queues are eventually cleared in the priority order assigned, a more urgent issue may arise due to new information that requires reprioritization. It is recognized that districts will have a queue for recurring activities such as operations and maintenance and risk assessments. Districts will exercise judgment in conjunction with policies in this document for each activity when establishing and managing district-level queues. The general prioritization criteria in order of consideration is listed below.

a. Levee Safety Action Classification.

b. Life Safety Risk.

c. Economic Risk.

d. Other considerations include environmental, navigation, cultural, iconic (national) implications, and sponsor activity (other agency priorities - timing).

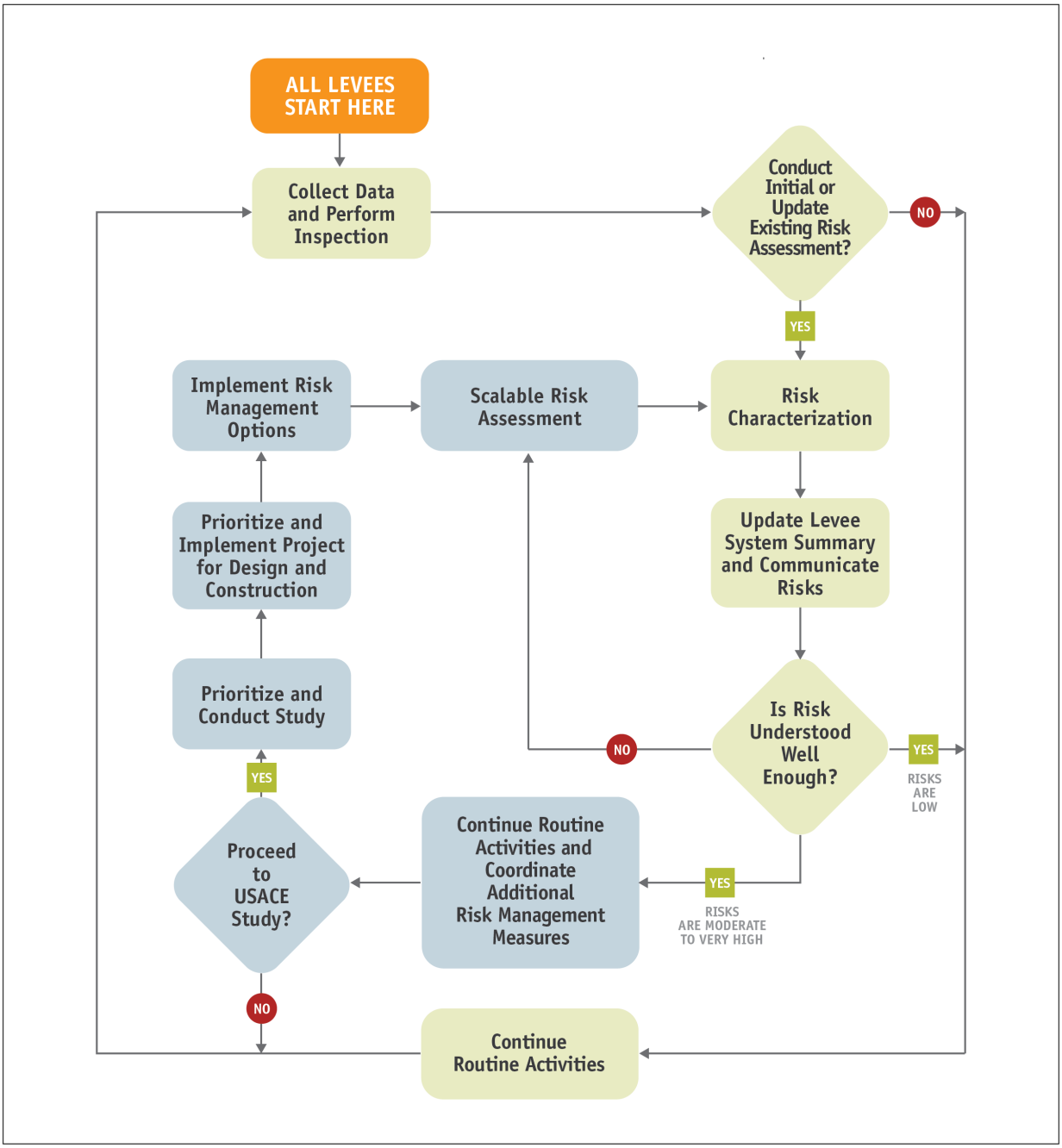

Figure III.2.1 – Portfolio Risk Management Process

2.8 Program Funding. Funding needs for program requirements should be budgeted in accordance with the current budgetary guidance and processes. Funding sources and requirements for specific Levee Safety Program activities are described in further detail in applicable chapters in this document. The following are the general programmatic budgetary guidelines.

a. For HQUSACE-led, agency-wide activities, including overall program governance, development and management of tools, policy development and revisions, selected risk assessments, and external engagement at the national level, budgeting and management of associated funding will be accomplished by HQUSACE.

b. District-led Levee Safety Program activities related to levee systems that are federally authorized and locally maintained will be budgeted by the state under ICW in the Operation and Maintenance account. ICW was created based on Section 221 of the Flood Control Act of 1970, as amended (84 Stat. 1831, 42 U.S.C. l962d-5b) and a requires a written agreement be executed between the Secretary of the Army and the non-federal sponsor to identify the "items of local cooperation" for USACE projects, including operation and maintenance requirements. To determine whether the items of local cooperation are being performed, USACE conducts coordination, inspection, and assessment activities with funding budgeted under ICW. ICW activities encompass all federally constructed and locally maintained flood risk management projects. However, due to potential life safety consequences, Levee Safety Program activities are a priority for this program.

c. District-led Levee Safety Program activities related to levee systems in which USACE has project-specific appropriations or the Mississippi River and Tributaries account will be budgeted under those project-specific line items.

d. Levee Safety Program activities related to non-federal levee systems eligible for the Rehabilitation Program (reference A.4), will be budgeted under the Flood Control and Coastal Emergencies account.

e. A levee system that has at least one federally authorized levee segment will be treated as a federally authorized levee system related to frequency of risk assessments, inspections, and associated funding sources to conduct these activities.

f. Studies, design, and construction activities will be funded from the appropriate accounts based on authorizations for these activities.

CHAPTER 3

National Levee Database

3.1 Purpose. This chapter establishes the policy associated with maintaining information related to levee systems in the Levee Safety Program in the National Levee Database (the Database). The Database is the information management tool for the location, general condition, and risks associated with the nation's levees. The Database provides publicly available levee information for the general public and stakeholders, as well as tools for data managers to keep information updated. The long-term goal for the Database is to include information for all levees in the nation, allowing for a comprehensive understanding of the benefits and risks associated with levees throughout the country. The Database is a dynamic, searchable inventory of information about all known levee systems in the nation and serves as a key resource for supporting decisions and actions affecting levee safety. Coastal systems and channels are included in the Database if they include levee segments. The Database is accessible through the webpage in reference A.26. Maintaining current information about levee systems is an important element of risk management.

3.2 Background. The main data types within the Database framework include geographic information, specific physical attributes and features, risk information, activities-based information (e.g., inspections, flood damage assessments, risk assessments), NFIP status, and other key documents. See database structure and data dictionary on the Database help page (reference A.26).

3.3 Oversight and Management. A Database program manager will be designated by HQUSACE to be responsible for execution of database maintenance, support, enhancement, and access activities.

3.4 Data Submission, Management, and Quality. The Database is dynamic and will reflect the most current and best information available. The district is responsible for maintaining the Database data, in their area of responsibility, for levees in the USACE levee portfolio. The district will be responsible for ensuring the quality and timeliness of spatial data inputted into the Database and for establishing processes to ensure the data is updated on a quarterly basis at a minimum.

a. If new information is provided to a district for a USACE portfolio levee within its area of responsibility, the district has the responsibility to evaluate that data, determine if the data represents best available data, and when applicable, update that data in the Database.

b. Data updates for districts will take the form of spatial, business data, and documents. All data entry into the Database will contain certain validation business rules that will enforce specific data quality needs. Although the Database contains a data validation process, it only verifies minimum required data standards. This process does not provide quality control or quality assurance on the accuracy of the data.

c. The data submission process may be different for each type of data: spatial or non-spatial, media, or documents. See the Database internal website documentation for the most current data submission process (reference A.26).

d. Federal agencies are responsible for updating and managing information related to the levees they manage and regulate, or those on located on federal lands.

e. FEMA is responsible for maintaining information and data in the Database related to the National Flood Insurance Program.

f. Levee owner/operators who are not part of a USACE or other federal portfolio will work with the USACE Database team to import and manage their data.

3.5 Mandatory Fields. HQUSACE will identify and maintain a list of mandatory fields in the Database that will be monitored and required to be updated and kept current by districts on a regular basis as part of programmatic metrics.

3.6 Database Surveying Requirements.

a. Refer to the levee field survey and data collection standard found at reference A.26 for surveying requirements associated with the Database.

b. Districts will add non-project segments to the Database, as part of the levee system, following the digitizing process found at reference A.26.

c. Levee modifications and/or levee systems constructed by USACE will be surveyed and entered into the Database by the district using project construction funds. For other existing federal levee systems or eligible non-federal levee systems in the Rehabilitation Program not in currently in the Database, districts should contact HQUSACE for the proper course of action.

d. Alterations Pursuant to 33 United States Code 408 (Section 408). Requesters of alterations to levee systems pursuant to Section 408 will be required to provide the information needed, as determined by the district, to appropriately update the Database once the alteration is put in place (reference A.15).

3.7 Information Access. The goal is to provide maximum access to information within the Database while complying with security requirements.

a. The general public can view the Database by going to the Database website where it will have viewing access to a majority of data fields. See security matrix at reference A.26.

b. All USACE employees will have access to view all Database fields if provided a user account. For district and division personnel, a Database user account can be

requested through the district or division to the database program manager. Those USACE employees not within a district or division office can submit a request directly to the database program manager.

c. For individuals external to USACE, but associated with a governmental organization, access will be relevant to their role or authority. In general, those at the federal level will be granted full viewing access. Levee sponsors and those at a state or local level will be provided viewing access to localized information, based on their area of responsibility. These and other external individuals can request a user account through the Database help desk. The level of information access will be assessed at the time of the user account request by the Database support team.

3.8 Sensitive Information. The public view of the Database was created to balance providing maximum information to the public while also protecting security interests by safeguarding sensitive information. The remaining fields that are not publicly viewable are considered For Official Use Only. It is important that the district recognize the fields and reports that are accessible to the public in the Database to ensure data and information are uploaded appropriately. See security matrix at reference A.26. The district will ensure the proper For Official Use Only status is applied when uploading files to the Database.

3.9 Requests for Information. For requests for Database information that cannot be accessed through the public view or the access level that was granted to the individual requesting the information, the district will coordinate such requests with the National Levee Database program manager.

CHAPTER 4

Tolerable Risk Guidelines

4.1 Background.

a. In order to achieve the mission of the Levee Safety Program, the ultimate goal is to manage the changing risks associated with levee systems over time by adapting actions based on the associated risks. Because flood risk changes over time, no levees are considered risk free, despite their condition.

b. Risk can be described as spanning from broadly acceptable to unacceptable, with a tolerable risk region in between this range.

(1) Broadly acceptable risk is a determination that the probability of occurrence is so small, the consequences are so slight, or the benefits are so great that risks are considered insignificant or negligible. Given the nature that flood risks are dynamic, USACE will not consider the risks associated with levee systems as being insignificant or negligible; therefore USACE will never characterize levee systems as having broadly acceptable risk.

(2) Tolerable risk, as it relates to levees systems, is defined by USACE as levee risk that:

(a) First, society is willing to live with the risk associated with the levee system to secure the benefits of living and working in the leveed area.

(b) Second, there is a continuation of recognition and communication of the levee risk, because the risk associated with levee systems are not broadly acceptable and cannot be ignored.

(c) Third, the risks associated with the levee system are being properly monitored and managed by those responsible for managing the risk.

(d) Fourth, those responsible for creating or managing the risk continue to review, reduce, and manage the risk still further, as practicable, considering cost effectiveness and social and environmental acceptability.

(3) Unacceptable risks are those risks which are not broadly acceptable or tolerable except in exceptional circumstances.

c. USACE has chosen to use the concept of Tolerable Risk Guidelines, based on the four principles of tolerable risk for levees described in paragraph 4.1.b.(2), which were originally developed in the United Kingdom and adapted as the goal for managing risk associated with a levee system. The concept evolved from the recognition that absolute safety is not practical and that managing risks needs to reflect how people and society

view risk. At its most basic, Tolerable Risk Guidelines ask the question, “Are the risks commensurate with the benefits?” Risk assessments help answer the question, “Is the risk high?” Tolerable Risk Guidelines help answer the question, “Is there more that should be done?”

d. There are four areas (or guidelines), further described in paragraphs 4.3 to 4.6, that USACE will evaluate and consider for each levee system with the goal of being successful in all four areas, resulting in the risk associated with a levee system as being “tolerable.” The four Tolerable Risk Guidelines are not mutually exclusive and therefore each will be considered individually and collectively by USACE. USACE’s tolerability determination will be based from the perspective of the federal interest, not an individual’s or community’s perception of tolerability. The activities that will be used to help inform USACE’s tolerability determination are risk assessments and levee sponsor activities (Volume II). There is no prescriptive list of criteria to each of the four guidelines and often, actions and recommendations will overlap between them. USACE will develop recommended risk management actions based on these four guidelines as further described in Volume III, Chapter 7.

e. Meeting Tolerable Risk Guidelines does not mean no more action is needed because risk management for levees must be continuous due to flood risk being dynamic.

4.2 Tolerable Risk Guideline 1 – Understanding the Risk (Risk Assessment). The first tolerable risk guideline involves answering the basic question: Are the levee risks commensurate with the benefits when considering life safety, economics, and environmental aspects? In order to answer this question, there must be an understanding of the levee risk associated with life loss, economic losses, and environmental impacts. The process to evaluate this guideline will include a combination of considering the risk estimates from a risk assessment with qualitative factors.

a. Evaluation of Life Safety Risk. The life safety risk matrix shown in Figure III.4.1 will be used to illustrate risk estimate results and evaluate societal life risk and individual life risk. Consideration of uncertainty in the risk estimates will be a factor in this determination, especially for those risk estimates that plot on or around the individual and/or societal risk lines. When the life safety risk has average loss of life of 1,000 or more with an annual exceedance probability of breach of 1.E-06 or less, those situations will be closely scrutinized prior to deciding if the life safety risks are tolerable due to limitations with methods to estimate probabilities that low. For those situations where societal life risk is tolerable but not individual life risk, further considerations related to identifying the most at-risk individuals in the leveed area, verifying the potential for life loss, and considering whether individuals exposed consider the benefits worth the levee risk will be taken into account.

(1) Evaluation of Societal Life Risk. Societal life risk is the risk of widespread or large-scale catastrophes from the inundation of a leveed area that would result in a negative societal response. In general, society is more averse to risk if multiple fatalities

were to occur from a single event. In contrast, society tends to be less averse to risks that result from many events resulting in only one or two fatalities, even if the total losses from the small events are larger than that from the single large event. The societal life risk line is shown in Figure III.4.1 as the diagonal line. Risk estimates that plot above the societal life risk line are considered unacceptable except in exceptional circumstances. Exceptional circumstances refer to a situation when USACE, acting on behalf of society, may determine that the life safety risks, although high, can be considered meeting the first guideline based on benefits that the levee system brings to society at large and that additional risk reduction is not justified or feasible. Typically, it takes a feasibility level of effort to determine if this type of exceptional circumstance exists. Generally, risk estimates that plot below the societal life risk line are considered to have met the first guideline for life safety risk.

(2) Evaluation of Individual Life Risk. The individual life risk is represented by the probability of life loss for the identifiable person or group by location that is most at risk of loss of life due to a levee breach. Individual life risk is influenced by location, exposure, and vulnerability within a leveed area. USACE has chosen to use 1 in 10,000 per year (1.E-04) for the probability of life loss for an individual or group of individuals most at risk. The goal is to keep the risks associated with USACE Safety Program levees from increasing the probability of death for an individual above annual mortality rates. The individual life risk line is shown in Figure III.4.1.

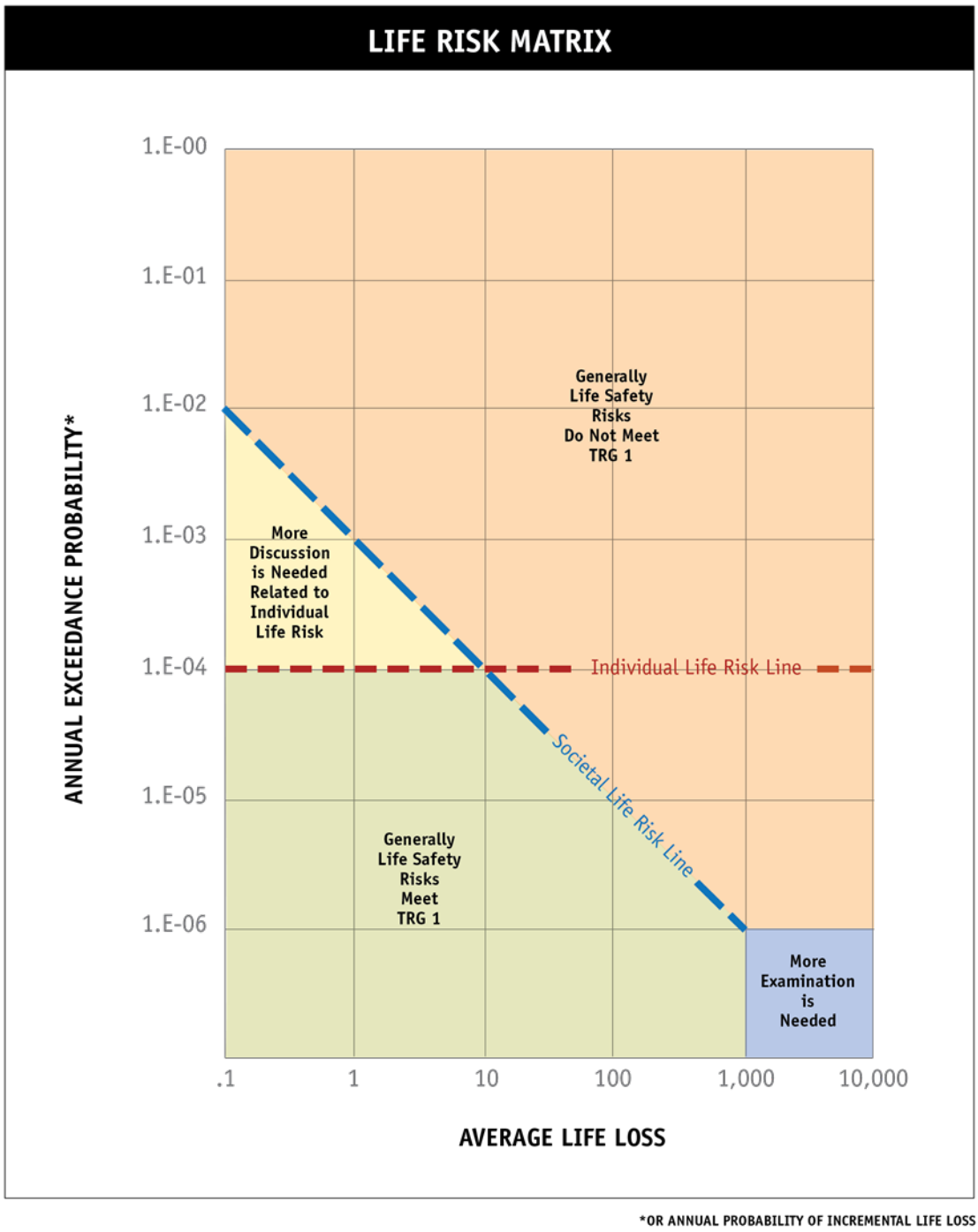

Figure III.4.1 – Life Risk Matrix

b. Evaluation of Economic Risk. After evaluating life safety risks, USACE will consider how economic risks, determined from the risk assessment, may influence a determination for meeting the first guideline. Similar to risk estimates for life safety, situations will be closely scrutinized when the economic risk associated with a

seemingly remote annual exceedance probability of breach or overtopping with breach of 1.E-06 or less.

c. Evaluation of Environmental Risk. USACE will consider, through qualitative discussion, how non-monetized risks determined from the risk assessment may influence a determination of meeting this guideline.

4.3 Tolerable Risk Guideline 2 – Building Risk Awareness (Risk Communication). The second tolerable risk guideline involves determining that there is a continuation of recognition and communication of the levee risk, because the risk associated with levee systems are not broadly acceptable and cannot be ignored. The rationale for meeting this guideline will be determined qualitatively and may be met through USACE Levee Safety Program activities and/or levees sponsor activities, which includes risk communication. The following questions should be considered for this guideline.

a. Does the levee sponsor have access to, and are they aware of, the best available levee risk information? Examples of this include participation in screening or higher level risk assessments with USACE and updating and posting to the National Levee Database.

b. Has the community in the leveed area been provided the best available risk information associated with the levee system? Examples include public engagement activities, media stories, or a current community website.

c. Have flood risk (residual risk) and potential changes to flood risk over time been communicated to the community? Examples include public engagement activities, media stories, or a current community website.

4.4 Tolerable Risk Guideline 3 – Fulfilling Daily Responsibilities (Risk Management). The third tolerable risk guideline involves determining that the risks associated with the levee system are being monitored and managed properly by those responsible for managing the risk. The rationale for meeting this guideline will be determined qualitatively and may be met through USACE Levee Safety Program activities and levees sponsor activities. Fulfilling daily responsibilities include activities such as an active operation and maintenance program, visual monitoring (documented regular inspections), an updated and tested emergency action plan, and a risk communication strategy.

4.5 Tolerable Risk Guideline 4 – Actions to Reduce Risk (Risk Management). The fourth guideline is determining if there are cost effective, socially acceptable, or environmentally acceptable ways to reduce risks from an individual or societal risk perspective. If it is determined that there are no acceptable ways to further reduce risks, USACE may consider this an exceptional circumstance and therefore might consider the levee risk to be tolerable even if the life safety risk exceeds the associated tolerability guideline under Tolerable Risk Guideline 1. The following questions should be considered for Tolerable Risk Guideline 4:

a. Have appropriate actions been taken to reduce risks?

b. Could any actions reasonably be taken that would further reduce risks?

c. What is the cost to reduce the risk and how much is the risk reduced?

d. Should actions be evaluated in a detailed study?

e. Is there demonstrated progress towards risk reduction measures?

CHAPTER 5

Levee Inspections and Site Visits

5.1 Overview. Levee inspections and site visits will be conducted as part of the Levee Safety Program to document the physical condition of a levee system at a given point in time. Levee inspections and site visits provide information on continuous risk management activities and serve as a primary source of information related to levee condition and performance for risk assessments.

5.2 Levee Inspections and Site Visit Basic Requirements.

a. The district is responsible for ensuring inspections and site visits are conducted by qualified personnel.

b. Inspections and site visits will be documented using specified procedures and the Levee Inspection System in reference A.24. This field tool connects directly to the National Levee Database and allows inspectors to immediately upload inspection data and results.

c. Inspections and site visits will be conducted with the levee sponsor, unless they opt not to attend. The district will notify levee sponsors of the date of the scheduled inspection at least 10 business days in advance. All effort must be given to accommodate the sponsor if the selected dates do not fit a sponsor's availability.

d. If inspectors encounter conditions that put the inspectors at personal risk and make it physically impossible to conduct the complete inspection, inspectors will stop the inspection and rate accessibility as appropriate.

e. If an area of distress is encountered during an inspection, reference A.13 for incident reporting requirements.

5.3 Levee Inspections.

a. There are two types of documented levee inspections: formal and special.

b. A formal inspection is a pre-scheduled levee inspection that will be conducted at a frequency of every five years.

c. A special inspection follows the same procedures as a formal inspection, but is conducted between the five year frequency of formal inspections, if needed, due to changed conditions or to document performance. Districts may work with levee sponsors to plan when specific inspections may be needed based on the characteristics of the specific levee system for scheduling and budgeting purposes in the district program management plan.

d. Levee inspections will be conducted by a comprehensive team of subject matter experts led by a professional engineer or professional geologist to: (1) document levee condition; (2) assess progress of ongoing risk management activities; (3) inform risk assessments and new risk management recommendations; and (4) include specific considerations that may need to be evaluated or tested at the time of the inspection. The inspection team is to be led by a licensed professional engineer or professional geologist with experience in the design, construction, and operation and maintenance of levee systems. The composition of the team will be commensurate with the features of the levee system. When a levee inspection is conducted in conjunction with an update to a risk assessment, members of the team for the risk assessment should participate in the field inspection to the maximum extent possible.

e. Inspections must be conducted on the entire levee system at one time or within a relatively short timeframe depending on length or number of individual segments.

f. Non-project segments.

(1) A non-project segment is manmade high-ground tied into a levee system or segment. Its existence and performance is necessary for excluding flood waters from the leveed area, but is not under any USACE authority. Some examples of these are embankments related to roadways, railroads, and other levees.

(2) USACE districts will exercise due diligence to perform levee inspections on non-project segments that are integral to a USACE portfolio levee system (i.e., federally authorized levee system or active non-federal levee system in the Rehabilitation Program). USACE districts will seek to obtain rights-of-entry to perform a levee inspection, following specific inspection procedures. Funding to research, seek, obtain access, and conduct the inspection will come from the district's appropriate fiscal year allocation for the inspection of that specific levee system.

(3) If no right-of-entry or access can be obtained to conduct the inspection for a non-project segment, then it will be documented that the segment could not be inspected, which will result in a No Verdict Levee Safety Action Classification, see Volume III, Chapter 6. USACE districts will document as much information as possible about the non-project segment in a levee inspection report for that segment.

g. Linkage with the National Flood Insurance Program (NFIP).

(1) Each time a USACE district conducts a levee inspection, it will identify when a levee segment meets or does not meet a specified subset of requirements in 44 Code of Federal Regulations Section 65.10 (44 CFR 65.10) for the NFIP, as identified in the Levee Inspection System, by providing a positive or negative finding. Levee sponsors and communities may use positive findings to meet the specified criteria of 44 CFR 65.10 but will be responsible to provide FEMA with the remaining requirements for 44 CFR 65.10, in order for FEMA to accredit the levee system on a NFIP map. At a minimum, the USACE district will notify FEMA directly when the inspection results in a

negative finding for any of the criteria after notification and coordination with the sponsor.

(2) Other information obtained from the inspections may also inform an NFIP levee accreditation decision. Therefore, it is important to consider the full inspection results and not just the limited 44 CFR 65.10 criteria specifically assessed during an inspection. Inspections are performed on a levee segment basis and caution should be taken to ensure that inspection results are used, presented, and considered collectively on a levee system basis.

(3) FEMA will consider the USACE levee inspection results and corresponding risk assessment results and will determine if any additional coordination is needed with the community and the levee sponsor for NFIP mapping purposes. See reference A.17 for additional information about USACE policies related to NFIP accreditation.

h. Final deliverables for formal levee inspections. All formal inspections will result in a final comprehensive deliverable of information on a levee system basis. The following is the minimum that must be included in the deliverable. Additional information can be included, if applicable to the support and understanding of results and recommendations. No inspection reports will be provided to levee sponsors without items in paragraphs 5.3.f.(2) – (4).

(1) Transmittal letter (optional). Districts have the flexibility to include a transmittal letter, signed by the most appropriate signatory at the discretion of the District Commander, to provide a summary and serve as a cover letter when providing deliverables to others, such as levee sponsors or FEMA. Note, to maximize efficiency, it is encouraged that deliverables to a levee sponsor include their eligibility determination for the USACE Rehabilitation Program at the same time if applicable. A coordinated transmittal letter with USACE emergency management can serve this purpose.

(2) Levee Risk Management Summary. The district is to consider all results from each levee segment inspection, in conjunction with the best available risk assessment, and update the summary. See Volume III, Chapter 7 for more details on the Levee Risk Management Summary.

(3) If the best available risk assessment is a screening level risk assessment, then the deliverable will include the fact sheet for each levee segment generated in the Levee Screening Tool. Districts will verify content of the fact sheet and ensure it is accurate and current related to the screening. If the best available risk assessment is a semi-quantitative or quantitative risk assessment, the deliverable will include the executive summary from the risk assessment report.

(4) Final levee inspection report. Each individual levee segment will have a separate levee inspection report.

(5) Levee sponsors will be provided an opportunity to review inspection results and provide input that should be considered before finalizing.

(6) A final deliverable will be completed within 90 days of the completion of the field inspection of the entire levee system.

5.4 Site Visits. A site visit is a collaborative activity at a levee system to observe or verify any changed conditions or capture progress of risk management measures for consideration in the next more detailed inspection and/or risk assessment. A site visit is not intended to be a detailed inspection nor require extensive documentation and can be conducted at any time. It is intended to provide the flexibility to conduct a visual observation of the levee system between formal inspections. USACE districts will notify sponsors at least ten business days in advance of the site visit when possible and every effort will be made to accommodate the levee sponsor's schedule so they are able to attend. A site visit summary will be the final product for a site visit and will be provided to the levee sponsor within 30 days of the site visit.

CHAPTER 6

Risk Assessments

6.1 Overview. Risk assessment is a systematic process for describing the nature, likelihood, and magnitude of risk associated with some situation, action, or event, including consideration of relevant uncertainties. It provides an understanding of risks, their causes, and potential consequences. Risk assessments can be qualitative, quantitative, or a blend of both (semi-quantitative). The Levee Safety Program will use risk assessments to provide a factual and analytical basis for risk-informed decision-making. The Levee Safety Program risk assessments are scalable and range from a screening level to semi-quantitative risk assessment to quantitative risk assessment based on the decision to be made. Moving from screening to a quantitative risk assessment incrementally increases in detail and confidence to reduce uncertainty in the results. Each risk assessment will assess the levee risk, non-breach risk, and combine the two for a total flood risk in a given leveed area. Risk assessments evaluate three distinct factors of levee-related flood risk, which are shown in Figure III.6.1. By looking at all three major factors that drive risk, hazards, levee performance, and consequences, risk assessments better inform risk management actions.

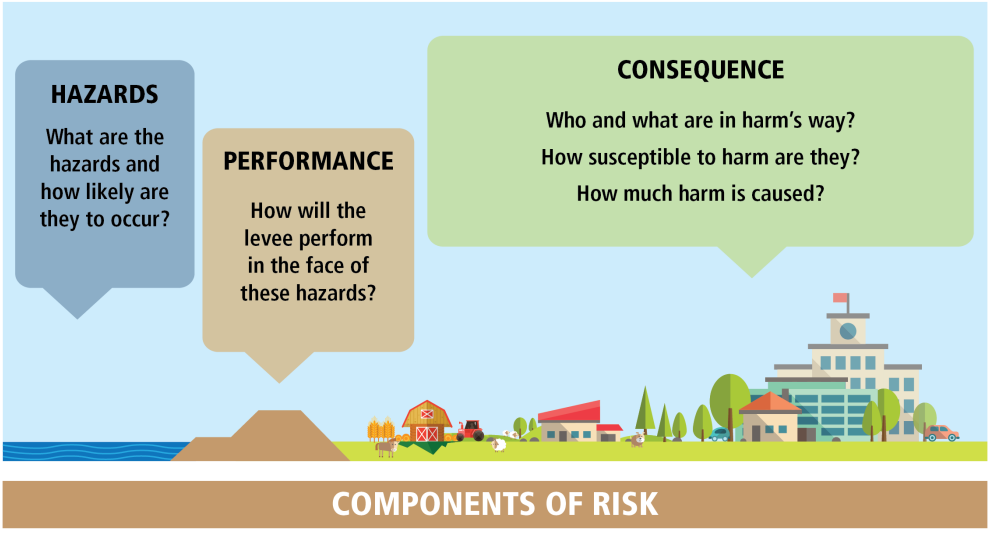

Figure III.6.1 – Components of Risk

6.2 Risk Assessment Methodology. All Levee Safety Program risk assessments will follow the methodologies developed and disseminated by the USACE Risk Management Center (reference A.3).

6.3 Risk Assessment Team.

a. Team Lead. Each risk assessment will be led by a qualified district staff with experience in leading multi-disciplinary teams. The team lead's responsibilities include but are not limited to the following.

(1) Leading and coordinating the activities of the risk assessment team.

(2) Ensuring that the levee sponsor and FEMA have opportunities for participation in the process.

(3) Ensuring appropriate reviews are conducted.

(4) Overseeing the preparation and presentation of the results during the review and vetting process.

(5) Ensuring all comments and questions that arise during the process are addressed.

b. Risk Facilitator. All risk assessment teams will have a trained risk facilitator. The facilitator responsibilities include, but are not limited to the following.

(1) Ensuring the team composition is appropriate to the levee system being assessed.

(2) Fostering brainstorming, critical thinking and open discussion during the process.

(3) Ensuring the risk assessment findings and recommendations are appropriately documented.

c. Other USACE Team Members. Other district levee safety experts, as determined by the risk facilitator, will be on the risk assessment team and will be dependent upon the levee system and expertise needed for the risk assessment.

d. Levee Sponsor. The district will ensure the levee sponsor, if different than USACE, is a risk assessment team member. Opportunities for the levee sponsors to participate should be scalable and tailored to optimize involvement. Districts will provide levee sponsors the anticipated schedule for the risk assessment at least 30 days prior to the initiation of a risk assessment for their consideration of level of participation.

e. Federal Emergency Management Agency (FEMA). The USACE district will coordinate with the appropriate FEMA regional office prior to the start of each risk assessment to determine the level of engagement FEMA should have with the assessment. Coordination with FEMA throughout the risk assessment process should include awareness of the data and modeling being used for the risk assessment. This

will enable FEMA to determine potential changes to the published Base Flood Elevation, assess if and how FEMA will be able to use the modeling to update the NFIP map (if necessary), and determine whether or not interior drainage is addressed in the risk assessment. See reference A.17 for policies related to USACE levee evaluations for the purposes of the National Flood Insurance Program.

6.4 Funding and Frequency. All risk assessments will be updated at a minimum every 10 years in conjunction with a formal levee inspection and funded by district-level appropriate funding based on the authorization of the levee, with the following exceptions.

a. For levee systems with an average life loss of less than 0.1 and a population or risk less than 100, no updated risk assessment will be required every 10 years; however, levee inspections will continue as required.

b. Risk assessments initiated by HQUSACE will be funded by HQUSACE.

c. Risk assessments conducted for the purposes of a planning study or design and construction project will be funded by the appropriate project funds. See references A.16, A.18, and A.19 for guidance on risk-informed planning, design, and construction.

e. At any time, a district may decide to update a risk assessment based on a changed condition, such as if there is an indication that the average life loss and/or population of risk as increased.

6.5 General Process Components. The following are the basic steps for all USACE levee risk assessments and may be performed in an iterative and combined manner.

a. Scoping. This step involves identifying the decision(s) the risk assessment will help to inform, including the key questions the risk assessment is intended to answer. Identification of the decisions and questions will determine the scale of risk assessment that will be needed. The main questions that will be addressed at a minimum by all USACE levee risk assessments include the following.

(1) What are the primary risk drivers?

(2) How does the risk associated with the levee system compare to the four Tolerable Risk Guidelines?

(3) What are the sources of uncertainty and is further investigation or evaluation necessary?

(4) What are the recommended risk management options or actions to address the risk?

(5) Does the levee system meet some or all requirements for NFIP accreditation?

Other questions should be identified based on specific decisions needed.

b. Data Preparation and Hazard Identification. This step involves identifying and gathering all pertinent information to be used for the risk assessment. Any gaps in information will be identified and a determination will be made if more data collection or analysis are needed in order to answer the questions identified during the scoping step. This step also involves identifying the potential hazards (sources of harm) to be considered for the risk assessment. For levee systems, the typical hazards are flood, seismic, and security (i.e., intrusions, attacks, or effects of natural or manmade disasters). The levee inspection used for the risk assessment will not be older than two years old unless it has been verified that there has been no change in levee condition. If the levee system contains a non-project segment that could not be inspected, all relevant information that is known about the non-project segment will be considered for the risk assessment.

c. Likelihood Assessment. This step determines the likelihood, or annual exceedance probability, of the leveed area considering the four inundation scenarios. This involves looking at the combination of the occurrence of the hazards (magnitude and frequency) with the performance of the levee system to determine probability of breach and the non-breach scenarios.

d. Consequence Assessment. This step determines the potential consequences that could occur as a result of inundation of the leveed area. It includes consideration of loss of life, economic losses, and environmental impacts. Consequence information can be supplemented with more detailed information from sources like detailed studies and direct input from the levee sponsor, community representatives, and other sources.

(1) Life Loss Consequences. The potential life loss estimates are developed based on breach location assumptions, including specific breach locations and initiation and formation times. The risk assessment team may choose to supplement the life loss consequence information with other sources of information, such as information provided by the levee sponsor, community, or websites. The team may also choose to do more detailed evacuation modeling. For evaluating potential for life loss consequences, the team will consider the following.

(a) Initial distribution of people: population centers, total population in the leveed area, distance of population from the levee, spatial location, and population density.

(b) Redistribution of people (evacuation effectiveness) including: threat recognition and warning issuance, warning diffusion, individual protective action initiation, and evacuation potential (ability to get to safety before the water arrives).

(c) Flood characteristics including: flood arrival time, depth, and velocity (if available).

(d) Shelter at final evacuation location, including the potential for vertical evacuation and shelter in place.

(e) Survivability, including structure damage, human resiliency, and vehicle stability.

(2) Economic Consequences. The potential economic consequences are typically developed based on prescribed breach location assumptions but can be refined for specific breach locations and breach parameters. Both direct and indirect economic consequences can be considered. Detailed analysis of indirect economic consequences is more common for quantitative risk assessments. Direct economic consequences include both the direct losses due to breach of a levee system and other economic impacts on the national economy. Direct economic consequences include damages to buildings and infrastructure, costs of emergency efforts, and repair/replacement costs of the levee system. Indirect economic consequences are those associated with or stemming from the destruction of property and the displacement of people due to inundation of a leveed area.

(3) Non-monetary Consequences. Inundation of a leveed area may have both direct and indirect consequences for the environment and cultural and historic resources that are not easily measured in monetary terms. These consequences can provide additional information for decision-making and may also identify risks to be managed separately. Non-monetary consequences will be qualitatively documented.

e. Risk Estimate. This step involves the calculation of the combination of the annual exceedance probability of the leveed area and the associated consequences and plotting the results as a combined risk estimate. Risk estimates may be plotted on risk matrices (x-axis displaying consequences; y-axis displaying likelihood performance) for different flood loading conditions, flood loading ranges, potential failure modes, consideration of human intervention, spatial segments, or other combinations and situations.

f. Risk Characterization. The final step in the risk assessment process is the development of the risk characterization, which is a narrative description of the levee system in the context of risk by describing the key drivers of likelihood of performance, potential consequences, and sources of uncertainty. The risk characterization is used to assign a Levee Safety Action Classification as further described in paragraph 6.7.

g. Review and Approval. Quality management processes are detailed in reference A.6. Each risk assessment follows a tiered and scalable review and approval process. The Risk Management Center will oversee review plans for risk assessments in accordance with reference A.14. The review of each risk assessment should be covered by either a programmatic review plan (typically screenings) or a risk assessment specific review plan. Requirements for review plans can be found in reference A.14.

6.6 Types of Risk Assessments. Typically, all levees undergo a screening level risk assessment to establish the baseline for risk management. If it is determined that

additional detail would help inform specific decisions, a more detailed risk assessment is conducted. Each updated risk assessment will serve as the best available risk assessment for that levee system from that point forward.

a. Screening level risk assessments. A screening level risk assessment (levee screening) is a simplified semi-quantitative risk assessment that relies on existing data, historical performance, engineering judgment, and consequence estimation to quickly characterize the relative risks posed by levees in terms of annual exceedance probability and potential risk to life and property. The results of a levee screening will be used to identify performance concerns, assess potential consequences for breach prior to and due to overtopping, identify critical issues that need further action or investigation to reduce uncertainty, and determine Levee Safety Program priorities.

(1) All levee screenings will be performed using the web-based USACE Levee Screening Tool and procedures in the associated technical manual (reference A.25).

(2) Levee screenings will be performed on each levee segment, including non-project segments, but results are rolled up to the levee system level. All levee screenings for all segments of a levee system will be performed collectively and moved forward in the screening process together. The resulting risk for the levee system is based on the highest risk levee segment (if there is more than one levee segment).

(3) For levee segments that could be loaded by multiple water sources, the district will consider each loading source separately and will use the loading source that poses the highest risk for the screening. For documentation and communication purposes, the district will explain the rationale for the selected loading source.

(4) Sources of uncertainty for screenings will be associated with the amount of readily available and current information, will vary for each levee system, and should be documented. Numeric risk estimates from screenings should be used with caution, because even though shown as point estimates, the results do not display uncertainty.

(5) Each time a district conducts a levee screening, it will identify when a levee segment meets or does not meet a specified subset of requirements in 44 Code of Federal Regulations Section 65.10 (44 CFR 65.10) as identified in the Levee Screening Tool by providing a positive, negative, or inconclusive finding. Levee sponsors and communities may use positive findings to meet certain criteria of 44 CFR 65.10, but will be responsible for providing FEMA the remaining requirements for 44 CFR 65.10 in order for FEMA to accredit the levee system on a NFIP map. At a minimum, the district will notify FEMA directly when a screening results in a negative finding for any of the 44 CFR 65.10 criteria. When using screening information to inform a levee accreditation decision, caution should be taken to ensure that screenings and the corresponding inspection results are used, presented, and considered collectively, along with the results for all the levee segments for the system. FEMA will consider the USACE levee screening results (and corresponding inspection results) and determine if any additional coordination is needed with the community and the levee sponsor for the NFIP mapping

purposes. Once a levee system undergoes a semi-quantitative or quantitative risk assessment, the NFIP findings associated with a screening are no longer considered valid and cannot be used to fulfill any part of 44 CFR 65.10 requirements. See reference A.18 for policies related to USACE levee evaluations for the purposes of the NFIP.

(6) To record and summarize each levee screening, a levee screening fact sheet initially generated in the Levee Screening Tool will be reviewed and verified within 30 days of receipt of the final risk characterization. The final levee screening fact sheet will be provided to the levee sponsor as part of the comprehensive deliverable with an updated Levee Risk Management Summary (see Volume III, Chapter 7).

b. Higher-level Risk Assessments. There are two main types of higher-level risk assessments. The first is a semi-quantitative risk assessment, which is a risk assessment that uses a combination of limited numerical estimates that result in risk estimates based on orders of magnitude. The second is a quantitative risk assessment, which is a risk assessment that results in numerical calculations for annual exceedance probability of breach and consequences combined to calculate a numeric risk estimate. Higher level risk assessments are performed on complete levee systems, not by levee segment like levee screenings. The process is scalable and iterative with some of the steps being performed concurrently. The basic process for semi-quantitative and quantitative risk assessments are similar, with key differences associated with level of detail and uncertainty.

(1) A written scope will be developed that will identify the objectives and questions the risk assessment is intended to meet and answer. All scopes will include assessment of levee accreditation for the NFIP (reference A.17). Unless identified differently in the scoping step, it is assumed that upstream levee systems will perform as designed. Upstream dam operations are assumed to operate in accordance with their water control plan or regulation schedule in developing the loading conditions. Interior drainage is considered part of the levee risk if it is a result of a levee system component malfunction or mis-operation. If the interior drainage capacity is exceeded, this scenario is considered as non-breach risk. Coincident analysis for interior areas is explained in reference A.11.

(2) Risk Estimates.

(a) Risk estimates for semi-quantitative risk assessments are plotted as boxes the same size as the grid representing order-of-magnitude estimates for the likelihood and consequences on risk matrices for each risk-driving potential failure mode, levee risk, overtopping without breach, and total flood risk (see Figure III.6.2 for an example). The life loss matrix includes the societal and individual life risk lines. Environmental and cultural risks will be discussed qualitatively. Along with each risk estimate, the team will assign a level of confidence (low, moderate, high) that the resulting annual exceedance probability and consequences are within the order-of-magnitude range selected for each. The confidence category should be considered as part of the recommendation process for any additional evaluation or investigation that may be warranted to reduce

uncertainty. For semi-quantitative risk assessments, consideration of uncertainty that leads to the team's confidence category is accomplished qualitatively and is not visually portrayed with the risk estimates.

(b) Risk estimates for quantitative risk assessments are point estimates displayed with the quantified uncertainty associated with those point estimates on the risk matrices, Figure III.6.2, for each risk-driving potential failure mode. In addition, the levee risk, overtopping without breach, and total flood risk will be plotted. Uncertainty is quantified and portrayed along with the expected value risk estimates on the risk matrices. Environmental and cultural risks are typically discussed qualitatively.

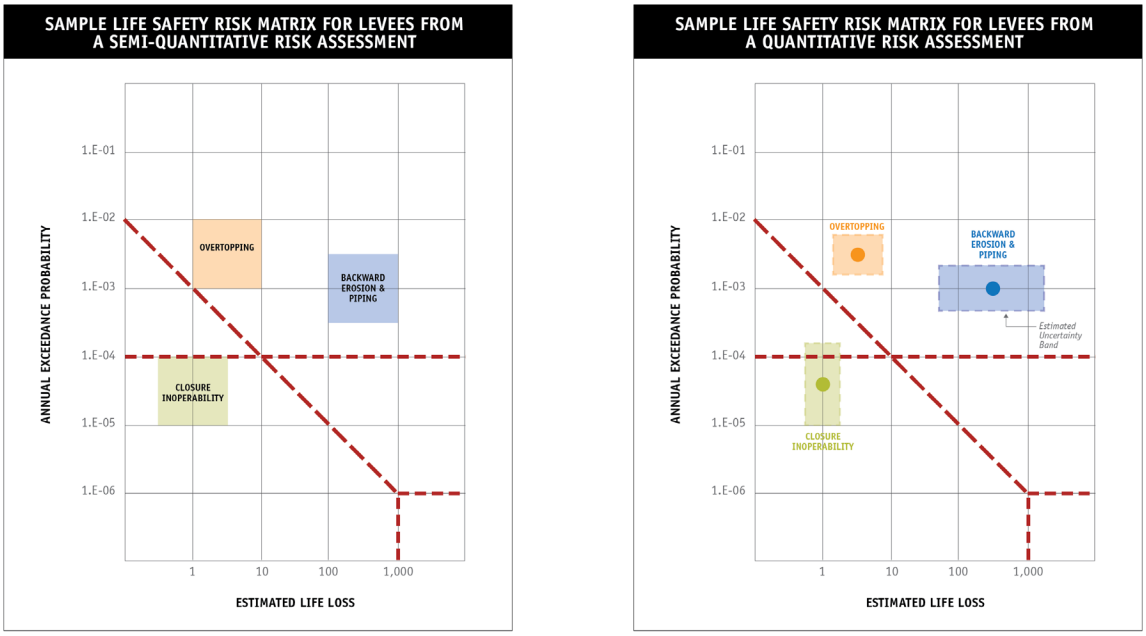

Figure III.6.2 – Example Risk Matrices

c. Final Deliverable. A copy of the final higher-level risk assessment report will be provided to each levee sponsor and FEMA within 30 days after finalization.

6.7 Levee Safety Action Classification (LSAC). USACE uses LSACs to analyze the risk characterization of levee systems across its portfolio. The LSAC assignment is based on levee risk from a life safety perspective, but also recognizes the economic and environmental considerations. The flood risk associated with the overtopping without breach scenario (non-breach) is not used to inform the LSAC assignment but will be assessed and communicated. USACE uses LSAC assignments as a primary factor to prioritize Levee Safety Program activities on a programmatic level. Table III.6.1 contains the LSAC table used to assign an LSAC reflecting different levels of levee risk. LSACs range from LSAC 1, "very high" risk, to LSAC 5, "very low" risk. Levee segments that

could not be inspected will receive a No Verdict LSAC. USACE will determine how a No Verdict LSAC for a levee segment may contribute to the overall risk of the levee system based on available information for that levee segment and if an overall system LSAC can be assigned. If there is not enough evidence to determine this, then the entire levee system will be given a No Verdict LSAC.

Table III.6.1 – USACE Levee Safety Action Classification*

Risk Classification		Actions for Levee Systems and Leveed Areas in this Class *(Adapt actions to specific levee system conditions.)*	Risk Characteristics of this Class
Very High (1)		Based on risk drivers, take immediate action to implement interim risk reduction measures. Increase frequency of levee monitoring, communicate risk characteristics to the community within an expedited timeframe; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning systems and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as very high priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in very high risk.
High (2)		Based on risk drivers, implement interim risk reduction measures. Increase frequency of levee monitoring; communicate risk characteristics to the community within an expedited timeframe; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as high priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in high risk.
Moderate (3)		Based on risk drivers, implement interim risk reduction measures as appropriate. Verify risk information is current and implement routine monitoring program; assure operation and maintenance is up to date; communicate risk characteristics to the community in a timely manner; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions as a priority.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in moderate risk.

Low (4)		Verify risk information is current and implement routine monitoring program and interim risk reduction measures if appropriate. Assure operation and maintenance is up to date; communicate risk characteristics to the community as appropriate; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance. Support risk reduction actions to further reduce risk to as low as practicable.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in low risk.
Very Low (5)		Continue to implement routine levee monitoring program, including operation and maintenance, inspections, and monitoring of risk. Communicate risk characteristics to the community as appropriate; verify emergency plans and flood inundation maps are current; ensure community is aware of flood warning and evacuation procedures; and recommend purchase of flood insurance.	Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in very low risk.
No Verdict		Not enough information is available to assign an LSAC.	
*Levee risk is the risk that exists due to the presence of the levee system and this is the risk used to inform the decision on the LSAC assignment. The information presented in this table does not reflect the overtopping without breach risk associated with the presence or operation of the levee system.			

CHAPTER 7

Tracking Levee Risk

7.1 Overview.

a. Risk management for a levee system is implemented continuously and is adapted based on changes in levee risk. Development and implementation of risk management measures as part of the USACE Levee Safety Program requires an integrated effort internally and externally because responsibility is shared between multiple entities within a complex set of programs and authorities. USACE will work with levee sponsors to identify, monitor, track, and adapt activities and actions for a levee system to be commensurate with the changing levee risk. The intent is to monitor and manage levee risk on a system basis, as well as provide relevant segment-related information to each levee sponsor for a specific segment. Multiple activities accomplished by levee sponsors and others will contribute to successful risk management. See Figure III.7.1 for example risk management measures for the different components of risk. It is important to note that in most instances, USACE does not execute consequence risk management measures. Those activities are to be led by other agencies and sponsors.

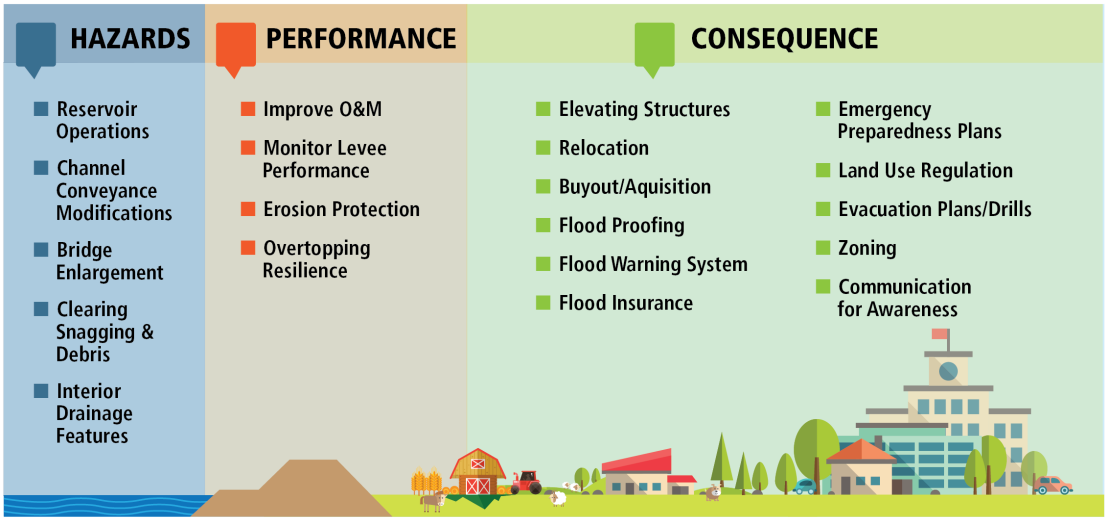

Figure III.7.1 - Example Risk Management Measures

b. The district will create and/or update a Levee Risk Management Summary, including risk management recommendations and supporting information, for each levee system when new information is collected or made available. The Levee Risk Management Summary is considered For Official Use Only and will be used to monitor and manage levee risk over time. As part of the Levee Risk Management Summary, risk management recommendations will be identified, monitored, tracked, and adapted commensurate with the changing levee risk. The intent is to monitor and manage levee risk on a system basis, but also provide pertinent segment-related information to each

levee sponsor for a specific segment. See Appendix B for the Levee Risk Management Summary template.

7.2 Basic Requirements. At the completion of a levee related activity (e.g., levee inspection, construction of an alteration, development or update of an emergency action plan), the final deliverable will include an updated Levee Risk Management Summary along with other supporting information such as levee inspection reports and a current screening fact sheet. The Levee Risk Management Summary serves as the mechanism to: consolidate newly collected information; assess how the newly collected information in combination with other changed conditions may impact the risk characterization; and develop, update, and adapt risk management recommendations. The following are the basic requirements for a Levee Risk Management Summary.

a. Risk will be managed at the levee system level. For single segment systems, there will be one Levee Risk Management Summary. If a levee system is composed of more than one segment, a Levee Risk Management Summary will be completed for each segment, but contain risk information at the system level, in addition to segment-specific information, in order to understand how a particular segment contributes to the risk of the entire system.

b. The levee system's most recent risk assessment will serve as the primary basis for monitoring risk.

c. Comprehensive recommended actions will be placed in priority order and will be categorized by the concepts of Tolerable Risk Guidelines (referred to as categories of recommendations): 1) understanding the risk; 2) building risk awareness; 3) fulfilling daily responsibilities; and 4) actions to reduce risk.

7.3 Risk Management Recommendations. The primary purpose of monitoring levee risk is to create, evaluate, and/or update risk management recommendations in order to measure and assess progress in risk reduction and management over time. USACE districts will evaluate all current information relative to the levee system risk characterization and risk drivers and develop recommendations (with levee sponsors) in priority order, based on the associated levee risk and urgency of action. Risk management recommendations will likely cover more than one category. Districts will use their judgment regarding how best to portray the recommendation under a single category. For example, risk communication could influence public awareness (building risk awareness) and emergency planning (fulfilling daily responsibilities).

7.4 Recommendations Related to Understanding the Risk. Recommendations associated with "understanding the risk" are related to assessing the confidence of the current risk estimate and risk characterization. The following are some questions to consider when developing recommendations.

a. What are the sources of uncertainty related to the condition of the levee or other data gaps? Would reducing this uncertainty change the risk estimate and/or risk drivers?

b. Based on the new information collected or assessed, is an updated risk assessment needed?

c. Based on the new information collected or assessed, is a more detailed higher-level risk assessment needed?

7.5 Recommendations Related to Building Risk Awareness. The USACE district will evaluate and create/update risk management recommendations associated with the recognition and awareness of the levee system risk. Districts will consider the associated levee risk and develop recommendations for risk communication efforts commensurate with that risk within the leveed area. The levee sponsor will be the lead in carrying out risk communication efforts. Factors to consider include availability of the best information about the levee system, including emergency procedures. At a minimum, districts will update the National Levee Database and Levee Risk Management Summary.

7.6 Recommendations Related to Fulfilling Daily Responsibilities. An important component of risk management is a comprehensive set of activities to continuously monitor the performance and manage the risk of an existing levee system so changes can be identified to adapt to the dynamic nature of flood risk. These activities are typically associated with operation and maintenance activities, performance monitoring, and emergency planning. Some of the key activities that districts will consider related to these recommendations include the following.

a. Operation and maintenance activities. Districts will consider the appropriateness of the current operation and maintenance manual that provides guidance and instructions to project personnel, including training and exercises, for proper operation and maintenance for each levee system. All federally authorized levee systems should have a levee-specific USACE developed operation and maintenance manual (reference A.7). The operation and maintenance manual should be updated to reflect any modifications or changes in operation and maintenance. Districts will also review the implementation of operation and maintenance activities. See reference A.23 for additional good practices for managing levee systems.

b. Levee inspections. Levee inspections should be conducted on a regular frequency to assess and document the physical condition of the levee system. Districts will use information from levee inspections to inform recommendations. Districts should also consider any recommendations related to how levee inspections are conducted, participation of levee sponsors, and frequency of inspections based on the condition and levee risk.

c. Performance data collection. Districts will consider recommendations related to activities needed to document and record real-time performance information. This may include collecting information from instrumentation and during flood events. The frequency of data collection during a flood, and the stage at which data collection starts, should be evaluated in advance of a flood event and should be tailored to the risk and flood history of the levee system. This plan should include who will collect the data, what loading conditions will trigger the data collection, and the criteria for data collection. The start of data collection should generally start in advance of stages that historically produced performance issues. If no documentation exists for a levee system, then the levee should be patrolled during loadings in excess of 25 percent of the levee height. It is important to have qualified personnel in the field before performance issues arise so it can be accurately determined when the levee started to show signs of distress. Instrumentation can assist in performance monitoring by providing data to assess groundwater pressure, deformation, total stress, temperature, seismic events, leakage, and water levels. A variety of instruments may be used in a comprehensive performance monitoring program (reference A.12).

d. Emergency Planning. Districts will support sponsors by considering recommendations related to emergency planning which involves identifying potential emergency conditions that could occur with a levee system. Pre-planned actions to be implemented in such emergency conditions in order to reduce potential consequences should be specified. These planned activities are formally documented in an emergency action plan, also sometimes referred to as an emergency plan or emergency preparedness plan. An emergency action plan is prepared, coordinated, and implemented by the sponsor of a levee system. Districts will develop emergency action plans for all USACE operated, and/or maintained levees. Emergency action plans are strongly recommended for all other levee systems within the USACE portfolio. Key components of an emergency action plan include, roles and responsibilities, process for internal and external communications, notification triggers, emergency actions to be taken based on different scenarios, inundation maps, and evacuation plans. Other important components of emergency planning are training and regular exercises to maintain proper operational readiness. Regular meetings and exercises between project operators and emergency responders can: facilitate a better understanding of roles and responsibilities; enhance emergency readiness; and result in an improved emergency action plan as lessons learned during the exercise can be incorporated into the updated document for detailed policy and procedures for emergency action plans related to levee systems (reference A.13).

e. Incident Management. Districts will consider recommendations related to processes involving incident management. An incident is an event or signs of distress occurring at a levee system that could potentially result in a levee safety issue. The USACE levee safety vertical team and emergency management personnel should be kept aware of reported incidents. The main objective is to get the information to those who need it as quickly as possible so that appropriate evaluation and response decisions can be made. Distress may be detected by any means, but should be confirmed by visual inspections, measurements, instrumentation, and monitoring. Since

all levee systems are different, engineering judgment must always be exercised in determining whether or not an item warrants upward reporting for policy and procedures for incident management activities (reference A.13).

7.7 Recommendations Related to Reducing Risk. These recommendations are associated with actions that will reduce either the likelihood or consequences associated with a risk driver. As a priority, recommendations should aim for reducing risk drivers for life safety risks to below identified guidelines for societal and individual risks unless it has been demonstrated that there is no reasonable or effective means to accomplish that. The current risk assessment will be the basis for this evaluation along with consideration of any new information (e.g., a new levee inspection) or changed condition. Recommendations will be adjusted or created accordingly. Districts will consider and provide sponsor recommendations that include system-wide improvements and studies that have potential to either further reduce the levee risk or demonstrate that it is not reasonable to further reduce the levee risk. Districts will consider interim risk reduction measures as appropriate. Interim risk reduction measures are actions to reduce levee risk while more long-term and comprehensive risk reduction and management solutions are being pursued. Many interim risk reduction measures are good practice for levee operators and maintainers, regardless of the levee condition. In establishing interim risk reduction measures, the prevention of loss of life is priority, followed by prevention of high economic or environmental losses. The following are some example interim risk reduction measures.

a. Conduct appropriate emergency exercises that plan for a range of breach scenarios (including the combined effects of multiple failure modes and different timing of detection).

b. Pre-position emergency supply contracts or stockpile emergency materials, such as rock, sand, sand bags, emergency bulkheads, or other operating equipment or supplies.

c. Consider temporary deviations to upstream reservoirs' water control plans within existing authorities and policies to reduce the potential impact of known levee deficiencies.

d. Improve and/or increase inspection and monitoring before, during, and after the flood event to detect evidence of worsening conditions.

e. Install instrumentation to facilitate performance monitoring.

f. Create and implement a communication plan to actively advise people about the levee condition and potential levee risk, flood insurance availability, and emergency measures.

g. Isolate problem area (for example construct sub-levee around failed gravity drain(s) or other levee feature to reduce head differential).

7.8 Tracking and Monitoring Risk Management Recommendations. The initial Levee Risk Management Summary for a levee system will serve as the benchmark against which progress on risk reduction and risk management will be measured. Progress on each recommendation identified will be tracked until a recommendation has been marked complete or removed because the recommendation is no longer considered necessary.

CHAPTER 8

Risk Communication

8.1 Overview. This chapter provides guidance to integrate levee-specific risk communication and public awareness activities throughout the activities of the USACE Levee Safety Program. Risk communication is directly related to the second Tolerable Risk Guideline (building risk awareness), is a critical component of effective risk-informed decision-making, and is a continuous activity for the risk management of a levee system. In the Levee Safety Program, risk communication will typically involve USACE, levee sponsors, FEMA, communities in the leveed area, and other stakeholders. When there is a levee sponsor, USACE will be in a support role, as necessary. Effective risk-informed decision-making is predicated on understanding key risk drivers and potential consequences. Risk communication is essential to effective risk management by all potential risk managers. Below are some considerations to help guide effective risk communication.

a. Risk communication is the open, two-way exchange of information and opinion leading to a better understanding of the risks and improved risk management decisions.

b. Risk communication does not require consensus or agreement. It does, however, provide meaningful opportunities for input and feedback.

c. To be effective, risk communication must be timely. This is particularly important when there are life safety concerns.

d. Risk communication strategies and materials are scalable and will be tailored based on the level of risk, audience technical sophistication/flood risk awareness, and other contextual factors.

e. Verbal and written communication will be in clear, plain language, and be usable with appropriate local, state, or tribal governments.

f. Wherever possible, levee-related risks will be communicated in the context of the overall flood risk in a community.

8.2 Risk Communication Objectives. Objectives of risk communication in the Levee Safety Program are to: ensure levee sponsors understand risks and benefits of the levee systems and segment(s) for which they have responsibility; improve community understanding of the risks and benefits of levee systems; and promote actions to reduce and manage levee risk at all levels of government, the private sector, and individuals.

8.3 Risk Communication Planning. As part of each district program management plan, districts are to develop and maintain a district-level risk communication strategy (coordinated with levee sponsors and FEMA) to correspond with Levee Safety Program activities (reference A.21). This strategy can be incorporated into the district project management plan or may be a separate corresponding document to the district plan.

The purpose is to plan risk communication activities in order to accomplish them efficiently and in a timely manner with all who may be affected by a potential flood in the leveed area. As part of these activities, districts will describe district-specific approaches and strategies, prioritization, sequencing/timing, staffing and resources, key messages, and materials needed. Risk communication approaches may be similar for multiple levee systems or may need to be planned and tailored for an individual levee system. For levee systems that span multiple districts and/or divisions, the districts and divisions are required to coordinate between offices.

a. Districts can use the communication plan formats and templates made available through the USACE public affairs office to develop the risk communication strategy.

b. Most levee systems within the USACE Levee Safety Program have a levee sponsor who is responsible for risk management of a levee system (including operation, maintenance, repair, replacement, and rehabilitation of the levee system). Levee sponsors are in the best position to identify those in the community critical to involve in risk communication (e.g., elected officials, emergency managers) and the optimal methods of communication that would be most effective in their specific leveed area.

c. For levees without a levee sponsor or where USACE is responsible for operation and/or maintenance, the district is responsible for identifying those in the community critical to involve in risk communication, methods for risk communication, and implementation of risk communication as necessary based on the levee risk.

d. Districts will seek to leverage relationships, teams, and coordination activities that may already be established through other USACE programs or activities. Most common sources of these opportunities include district and division emergency managers, flood risk managers, and Silver Jackets coordinators.

e. Districts will work with appropriate subject matter experts, such as USACE public affairs or members of the USACE Collaboration and Public Participation Center of Expertise, to assist with risk communication activities including, but not limited to development of strategy, technical writing, meeting support, activities, and implementation of risk communication activities.

f. Districts will coordinate risk communication activities with the FEMA regions to do the following.

(1) Identify levee-impacted areas where FEMA is actively engaging communities to update flood hazard analyses and NFIP maps, identify risk and mitigation opportunities, and/or review levee accreditation data submittals, in order to coordinate corresponding Levee Safety Program activities.

(2) Ensure alignment of messages and activities, including review of the National Levee Database, between FEMA and USACE to eliminate conflicts and minimize confusion.

(3) Seek to leverage opportunities with FEMA-led community meetings or other engagement activities.

g. Districts will coordinate with the District Operational Security Officer who will assist in determining the sensitivity of information and ensuring that sensitive information is appropriately labeled as For Official Use Only. For Official Use Only information is not publicly releasable but may be shared on a need-to-know basis. If the district believes it cannot adequately communicate to those living and working in leveed areas the risks without disclosing sensitive information, the district should consult with the District Office of Counsel and, if needed, elevate the issue to the division and the HQUSACE Regional Integration Team.

8.4 Risk Communication with Levee Sponsors.

a. Districts will encourage levee sponsors to participate in all Levee Safety Program activities specific to their levee(s), including inspections and risk assessments. Levee sponsors who participate in these activities will have a better understanding of the risks and benefits of their levees, which will facilitate both risk communication and risk management discussions and activities.

b. Districts will ensure levee sponsors remain current with USACE Levee Safety Program changes and solicit feedback on implementation of any program changes. Examples may include conducting annual meetings with levee sponsors and/or providing updates at local government or levee sponsor events, newsletters, and emails.

c. Districts will review content of Levee Risk Management Summary, see Volume III, Chapter 7, and the content to be used for the levee system summary in the National Levee Database, with levee sponsors to establish a common understanding of the levee risk, any changed conditions, and recommendations (reference A.21). As part of this activity, districts will discuss the following.

(1) Key components of risk, including likelihood and nature of flood threat (hazard), physical condition of the levee and likelihood of breach (performance) and the nature and severity of consequences should the levee breach or be overtopped (with or without breach).

(2) Any areas of uncertainty and the relevance of that uncertainty.

(3) Information about individual segments and how each segment contributes to the overall risk.

(4) Priority and sequencing of recommended risk management activities.

(5) In addition to review of the content of the Levee Risk Management Summary on routine activities, districts will reach out to sponsors if there is a change in risk (e.g., flood event) or if there is significant change in sponsor personnel.

8.5 Risk Communication with Communities.

a. Districts can assist levee sponsors with community meetings and serve as the technical expert to explain levee-related risk to the public.

b. Districts can also assist levee sponsors in developing publicly consumable information or other visual tools.

8.6 Crisis Communication. Where risk communication supports preparedness activities, crisis communication is communication that is reactive based on an immediate circumstance. Planning for communication during an active flood event should be done as part of an emergency action plan (reference A.13).

CHAPTER 9

Integration with Other Programs and Processes

9.1 Introduction. This chapter describes how information from the USACE Levee Safety Program is used for other decisions in other programs. The Levee Safety Program staff at HQUSACE, division, and district levels will engage and interact with other programs and initiatives as necessary. At a minimum, the key programs that will require Levee Safety Program interaction on a continuous basis are listed below.

9.2 USACE Flood Risk Management Program. The USACE Flood Risk Management Program takes a comprehensive approach to coordination of internal and external programs, activities, and initiatives related to flood risk management. The Levee Safety Program will coordinate with the designated flood risk managers at HQUSACE, division, and district offices. Levee safety is one component of a broad flood risk management approach, and Levee Safety Program activities and information will contribute to the objectives of the USACE Flood Risk Management Program. In turn, the USACE Flood Risk Management Program can be used to leverage opportunities for coordination and risk communication of Levee Safety Program activities (reference A.27).

9.3 Dam Safety Program. Within the USACE Dam Safety Program, some USACE dams have appurtenant structures that function like levees. In these cases, the Levee Safety Program will work with the Dam Safety Program to coordinate assessment and management of these structures. If the structure is upstream and within or around the reservoir pool, a determination should be made as to whether or not the structure would exist without the dam. If the structure would exist without the dam, then the structure should be managed under the USACE Levee Safety Program. If the structure is needed so the reservoir pool can be used and/or regulated, then the structure should be managed under the USACE Dam Safety Program. When there is doubt as to the appropriate course of action, the district should coordinate with its respective division and then, if necessary, with HQUSACE for a determination. Implementation of both programs will be coordinated in order to share lessons learned as both programs continue to improve. Information will be shared between programs as needed because in many watersheds dams and levees are interrelated for flood risk management. See reference A.8 for policies and procedures related to the USACE Dam Safety Program.

9.4 Emergency Management. USACE has the authority to provide assistance in the areas of disaster preparedness, emergency operations, rehabilitation, and advance measures. The USACE Emergency Management Community of Practice is the lead for these activities and will rely on information from the Levee Safety Program when levee systems are involved. Information from Levee Safety Program activities, such as inspections, risk assessments, interim risk reduction measures, and emergency action plans relate directly to emergency management and contingency operation activities. Information from Levee Safety Program activities are important for identifying critical locations on levee systems for potential flood fighting, identifying locations of known deficiencies for monitoring during a flood event, identifying initial overtopping locations

for evacuations, using the risk associated with levee systems for prioritization of emergency activities, and using condition information to assist in the evaluation of post-event repairs. See reference A.4 for policies and procedures related to emergency management and contingency operations.

a. USACE can provide direct or technical assistance related to emergency operations, including flood fighting, to supplement local efforts. Direct assistance for levee systems can include providing surveillance teams for monitoring and performing flood fight activities. Technical assistance can include providing guidance on flood fight techniques, emergency construction methods, or current best available information such as mapping and modeling.

b. The USACE Rehabilitation Program is a voluntary program that provides for the rehabilitation (repair) of damage to eligible flood risk management projects and federally authorized and constructed coastal risk management projects that have been damaged by natural disasters. Levee projects that participate in this program are included in the USACE Levee Safety Program portfolio. Information from the Levee Safety Program will be used to inform eligibility of levee systems for the Rehabilitation Program. Pursuant to this program, there is an option to develop system-wide improvement frameworks for levee systems, which are plans developed by the levee sponsor(s) and accepted by USACE to implement system-wide improvements to a levee system (or multiple levee systems within a watershed) to address system-wide issues.

c. USACE may perform advance measures prior to flooding or flood fighting activities to mitigate against damage to levee systems due to an imminent threat of unusual flooding to reduce risk to loss of life and economic damage. Advance measures assistance can be temporary or permanent. Permanent construction standards may be considered when the advance measures are intended to address interim risk reduction measures. Direct assistance may include providing supplies, equipment, and/or contracting for the construction of temporary and/or permanent flood risk management measures, such as the construction of temporary levees or the repair, strengthening, or temporary raising of levees. Indirect assistance includes providing technical and contingency planning assistance. Information from the Levee Safety Program can be used to assist in planning for and designing the appropriate advance measure for a given levee system.

9.5 Critical Infrastructure Protection and Resilience (CIPR) Program. This USACE program leads the implementation of a consequence-based screening and prioritization process to identify and prioritize high-consequence facilities from a critical infrastructure perspective. “Critical infrastructure” is defined as systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters. This program implements the consistent portfolio-wide process on USACE Civil Works projects to identify those whose potential failure, damage, or disruption through physical or cyber means could lead to the most significant consequences in terms of human, economic, and mission disruption impacts. This systematic process is used to identify those

projects considered critical within USACE's portfolio and informs which projects should be assigned a higher priority for conducting physical and cybersecurity risk assessments. The results from these assessments inform future security investments for implementation across the Civil Works portfolio. Levee systems themselves may be critical infrastructure and also may contribute to reducing the potential impacts associated with significant flooding events to other interdependent critical infrastructure. The Levee Safety Program will engage and share information with the CIPR program to identify if and when a levee system in the USACE portfolio warrants further action related to criteria set forth by this program. See reference A.8 for more information on approaches to critical infrastructure protection.

9.6 Section 408 Program. Section 14 of the Rivers and Harbors Act of 1899, as amended and codified in 33 United States Code 408 (Section 408), authorizes the Secretary of the Army to grant permission to a private, public, tribal, or another federal entity for the temporary or permanent alteration or use of a USACE Civil Works project if the Secretary of the Army determines that the alteration or use will not be injurious to the public interest and will not impair the usefulness of the project. See reference A.15 for USACE's process for Section 408.

a. Section 408 provides a mechanism to alter an existing USACE Civil Works project without seeking reauthorization of the project as long as the project continues to deliver the public benefits as intended. Depending on the complexity and associated impacts of the proposed levee alteration on life safety as determined by the district, a risk assessment showing risk estimates associated potential failure modes with and without the proposed alteration in place may be required in order to assess the following.

(1) Whether the benefits of the alteration are generally commensurate with the risks.

(2) Whether the alteration potentially worsens or creates new failure modes or risk drivers for the project.

(3) Whether the alteration is exceptionally complex or high risk.

b. Data in the National Levee Database will be updated to reflect changes to the levee system based on constructed alterations.

9.7 USACE Planning, Design, and Construction Projects. Information from the Levee Safety Program will be used to inform USACE projects in the planning, design, and construction phases if they involve levee systems.

a. Typically, planning studies that include alternatives associated with levee systems will have a broader flood risk management purpose in which levee systems are being considered as part of an array of alternatives. Studies will evaluate the major contributors to the flood risk, including existing and proposed infrastructure and floodplain activities. The goal of a study that includes addressing levee risk is to achieve

all four Tolerable Risk Guidelines (Volume III, Chapter 4) through the formulation, recommendation, and implementation of cost-effective plans as further described in reference A.19. The extent to which the goals can be met will vary based on conditions in the study area. Study teams will explicitly plan for and consider life safety when formulating and evaluating alternatives, in accordance with references A.16 and A.19.

b. A risk-informed approach will be used for all levee design and construction projects for new projects, modifications, improvements, rehabilitation, or repairs (reference A.18).

9.8 National Flood Insurance Program (NFIP). FEMA has a national role in flood hazard identification and flood risk management activities, including administering the NFIP and disaster recovery under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the National Response Framework, and the National Disaster Recovery Framework. Though FEMA and USACE have different roles and responsibilities related to levee systems, both agencies have complementary objectives related to reducing risk to life and property and communicating flood hazards and risks. FEMA has information and data to help inform Levee Safety Program activities and information from Levee Safety Program activities will help inform FEMA activities. Together with levee sponsors, FEMA and USACE districts will align activities, information, and messaging related to levee systems to improve public awareness (reference A.22). The main areas of engagement between the Levee Safety Program and FEMA are further described below. See reference A.17 for more information on policies related to USACE levee evaluations for the purposes of the NFIP.

a. Leveraging Data. Both USACE and FEMA perform activities using the best available information including, but not limited to, mapping, hydrologic, hydraulic and coastal modeling, and infrastructure condition. Early coordination of both Levee Safety Program and FEMA activities will result in identifying opportunities to share and leverage information that will benefit both agencies, as well as levee sponsors and other stakeholders. In areas with levee systems, USACE typically engages directly with levee sponsors and FEMA engages directly with community officials and levee sponsors. Coordination of these relationships helps improve public awareness and effective risk communication. USACE and FEMA will coordinate to ensure consistent messages related to risk, levee condition, and mapping/modeling efforts are provided to all external stakeholders. The following are the main areas of engagements for data exchange related to levees between USACE and FEMA.

(1) Both agencies will use the National Levee Database to manage and share levee related data in real time.

(2) Together with levee sponsors, USACE districts and FEMA regional offices will coordinate schedules and scopes of NFIP mapping efforts, USACE levee inspections, and USACE risk assessments.

(3) For USACE levee inspections, at a minimum the USACE district, after consultation with the levee sponsor, will notify FEMA if there are any negative findings related to 44 CFR 65.10 criteria for NFIP accreditation.

(4) For USACE levee screenings, at a minimum the USACE district, after consultation with levee sponsors, will notify FEMA if there are any negative findings related to 44 CFR 65.10 criteria for NFIP accreditation.

(5) For USACE levee screenings and inspections, levee sponsors and communities may use positive findings to meet the specified criteria of 44 CFR. 65.10 but will be responsible to provide FEMA with the remaining requirements for 44 CFR 65.10 in order for FEMA to accredit the levee system on a NFIP map.

(6) Every time USACE performs a higher-level risk assessment, it will provide an NFIP accreditation recommendation to FEMA.

(7) USACE and FEMA will coordinate to ensure consistent messages related to risk, levee condition, and mapping/modeling efforts are provided to all external stakeholders.

(8) Districts will coordinate with FEMA regional offices on risk communication products.

b. Disaster Recovery. Under the Stafford Act, FEMA may direct USACE to use its available resources to provide assistance in the case of a major disaster or emergency declaration by the President of the United States. In areas with levee systems, USACE levee safety information and expertise contribute to the recovery efforts by providing levee condition information.

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Volume IV:
SUMMARY OF SHARED INFORMATION AND USES

1.1 Purpose. This Volume recognizes that effective flood risk management requires integration of activities and authorities across a variety of entities mainly driven by state and local governments. This Volume describes how USACE uses information from the Levee Safety Program for its responsibilities and how Levee Safety Program information can be used in broader flood risk management activities conducted by others.

1.2 Flood Risk Management Roles and Responsibilities. The responsibility, authority, and ability to implement flood risk management activities often vary across federal, state, and local governments, levee sponsors, and private citizens. The best approaches result in leveraging a combination of activities and actions across a variety of entities. Flood risk management activities, such as warning and evacuation plans, land use zoning, land use permitting, public communication, emergency response, and enforcement of floodplain requirements are the responsibility of state and local governments. FEMA administers the NFIP, which is a voluntary program for state and local governments. In exchange for state and local governments enforcing minimum FEMA floodplain management requirements, FEMA offers federal flood insurance to those states and local communities, as well as a variety of grant programs. USACE has a variety of programs and authorities that can be used when requested by state/local governments to provide technical assistance, collect and provide information, conduct studies, and perform coordination. These include Floodplain Management Services, Planning Assistance to States, and specific project and study authorities. USACE aims to provide information about flood risk to jurisdictions in such a manner as to be efficient and reduce costs.

1.3 Levees as a Component of Flood Risk Management. Levee systems can be one effective tool to help manage floods and potential impacts. For example, USACE can help construct a levee, whereas, in a coordinated but independent action, local government can further help manage flood risk by implementing floodplain management actions such as evacuation plans, zoning ordinances, and public outreach. Levees can reduce the frequency of flooding in a floodplain, in addition to providing state and local governments time for emergency response and evacuations for anticipated larger flood events.

1.4 USACE's Role with Levees.

d. USACE's authorized responsibilities related to levees mainly include the following.

(1) Planning, designing, and constructing/modifying levees when authorized by Congress.

(2) Assessing the condition of existing levees within the USACE portfolio with levee sponsors.

(3) Providing recommendations and technical support when requested.

(4) Conducting emergency response activities as requested to supplement local efforts.

(5) Rehabilitating eligible levees damaged by flooding,

(6) Performing operation and/or maintenance activities on specific levees as authorized.

e. USACE Levee Safety Program activities include evaluating information related to the hazard, performance, and potential consequences of the existing levee systems in the program. USACE's primary role with existing levees is to work with levee sponsors to collect and assess information to help fulfill its authorities and ensure that the information is made available to those who can use it to help with their own decisions and responsibilities. USACE is available to support levee sponsors as they work together with states, communities, and others to focus resources to most effectively manage flood risk.

1.5 Shared Information and Potential Uses

a. Table IV.1.1 summarizes sources of flood hazard information, relevant information, and a description of levee sponsor, local and state government, and federal agency roles collecting and using this information.

Table IV.1.1 – Flood Hazard Information

Sources of Flood Hazard Information: Best available modelling, typically from USACE or FEMA. **Key Information**: different flooding source scenarios, expected water levels, type of flow (slow versus flashy) and expected duration of water on the levee.	
Uses of Hazard Information by Entity	
Levee Sponsor	▪ Determine water level triggers for operations (e.g., gate closures). ▪ Improve understanding of potential flooding scenarios, especially when there are multiple sources (e.g., riverine, coastal, tributary).

Local/State Government	▪ Determine water level triggers for activation of emergency and evacuation preparedness, including where levee is most likely to overtop first. ▪ Use hazard information and modeling as part of FEMA's National Flood Insurance Program accreditation/reaccreditation. ▪ Conduct potential hazard management options (e.g., remove debris/blockages, reduce upstream impervious surfaces, enlarge bridges). ▪ Assess and improve stormwater management behind the levee (interior drainage).
USACE	▪ Determine if a levee system continues to meet its Congressionally authorized level (if a federally constructed levee). ▪ Understand how USACE dam operations impact downstream levees for reservoir operations and notifications.
FEMA	▪ Develop flood hazard information and flood risk data to enhance the nation's understanding of flood risk and deliver National Flood Insurance Program rate maps.

b. Table IV.1.2 summarizes sources of levee performance information and a description of levee sponsor, local and state government, and federal agency roles collecting and using this information.

Table IV.1.2 – Performance Information

Sources of Performance Information: USACE and sponsor inspections, potential failure mode analyses, monitoring data, performance assessment data and data from instrumentation activities. **Key Information**: potential failure modes and associated relative criticality to levee performance, location of deficiencies, likelihood of performance at various water levels (up to the crest and with overtopping).	
Uses of Performance Information by Entity	
Levee Sponsor	▪ Prioritize maintenance and repair activities to maximize investments where they can achieve the biggest performance benefit. ▪ Incorporate deficiencies and other vulnerabilities into flood preparedness and flood response activities (e.g., stockpiling sandbags and other materials, monitoring protocols). ▪ Identify areas that may need resiliency. ▪ Demonstrate value of maintenance activities conducted and flood damages prevented. ▪ Share key performance information with local/state emergency managers to tailor location and sequencing of response and evacuation activities based on known vulnerabilities. ▪ Use USACE performance information to support accreditation for the NFIP.
Local/State Government	▪ Incorporate detailed vulnerability and previous performance information into content and sequencing of emergency planning, warning, alerts and evacuation activities (including overtopping vulnerabilities, low spots in the levee, etc.). ▪ Incorporate/prioritize critical levee safety repairs and improvements into municipal/state budgets, bonding, etc.
USACE	▪ Develop recommendations related to levee performance. ▪ Share results of levee inspections and risk assessments related to NFIP accreditation.
FEMA	▪ Consider best available performance information when determining accreditation status for the NFIP and evaluating flood hazards and flood risk.

c. Table IV.1.3 summarizes sources of information on the potential consequences associated with levee risks. The table also includes a description of levee sponsor, local and state government, and federal agency roles collecting and using this information.

Table IV.1.3 – Consequence Information

Sources of Consequences Information: National Structures Inventory which includes data sources from online building footprints, FEMA HAZUS, and others; other available databases for road networks; and sponsor-provided information. **Key Information**: population behind levee and their distribution, potential life and economic loss for different scenarios, critical infrastructure and transportation locations, depths of potential inundation, effectiveness of evacuation planning, potential regional/national impacts (e.g., economic development, navigation, agricultural, cultural resources, refineries, or other industries).	
Uses of Consequences Information by Entity	
Levee Sponsor	▪ Share detailed information with community leaders, emergency managers and others to assist with community-based risk management and communication activities. ▪ Use information to show value of the benefits provided to the community by the levee system.
Local/State Government	▪ Share risk information with people and entities that are potentially impacted – provide information as to how they can manage flood risks. ▪ Develop alert, warning and evacuation plans, especially with vulnerable populations (e.g., mobility restricted, elderly, hospitals, schools). ▪ Consider altering land use in key areas (e.g., create community greenspace in high risk areas). ▪ Develop/implement floodplain management activities and regulations.
USACE	▪ Supporting information for prioritization of risk assessments and inspections. ▪ Supporting information for determining design criteria for structural components. ▪ Supporting information for prioritization of repairs for the Rehabilitation Program. ▪ Determining design of temporary construction methods.
FEMA	▪ Collaborate with USACE to ensure that any flood consequence tools (such as HAZUS) or flood consequence information consistently serve shared objectives before, during, and after disaster events.

d. Table IV.1.4 summarizes how hazard, performance, and consequence information is combined to help sponsors, local and state government, and federal agencies apply a risk-informed decision making approach to risk management.

Table IV.1.4 – Risk-Informed Decision-Making Information

Uses of Combined Information for Risk-Informed Decision-Making: Risk is the combination of hazard, performance, and consequences. Risk-informed decision-making uses qualitative and/or quantitative information about risk in conjunction with other considerations to lead to more comprehensive, transparent, and informed decisions. To apply risk-informed decision-making to levees, information about the hazard, performance, and consequences are combined.	
Uses of Combined Information by Entity	
Levee Sponsor	▪ Prioritize inspections across multiple levee systems. ▪ Determine frequency of inspections for a levee. ▪ Understand the relative risk between levee segments for multiple segment systems to determine the overtopping point for the whole system and priority areas for maintenance and repair. ▪ Distinguish between short-term and long-term measures based on urgency for action. ▪ Provides information to support funding for levee investments. ▪ Prioritizes risk communication efforts toward populations with life safety risk. Helps tailor risk communication approaches and messages to potential on-the-ground scenarios. ▪ Helps in developing system-wide improvement frameworks to retain eligibility in the USACE Rehabilitation Program by providing supporting information to justify and develop a risk reduction approach.
Local/State Government	▪ Helps with prioritizing levee infrastructure investments across levee portfolio and within the context of other community or state needs. ▪ Provides information that can be incorporated into local/state emergency action plans, including evacuation procedures. ▪ Informs priorities for updating evacuation and floodplain management plans.

USACE	▪ Understand the relative risk for the levees across the USACE portfolio and the main risk drivers in order to help inform USACE investments. ▪ Provide a national baseline for levee-related risk and tolerability to determine effectiveness of activities and investments. ▪ Informs appropriate design standards for new and existing levees. ▪ Informs priorities for more detailed risk assessments. ▪ Determines approval level for risk characterizations and USACE emergency action plans. ▪ Informs prioritization of USACE inspection frequency. ▪ Informs quantification of risk reduction (especially potential life loss) across alternatives for a study.
FEMA	▪ Ensure that the appropriate flood hazard information and flood risk data, regardless of source, is considered when implementing FEMA programs that, collectively, reduce disaster suffering.

FOR THE COMMANDER:

Appendices (3)

NAME
Director of Civil Works

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APPENDIX A
References

A.1 United States Code of Federal Regulations. 33 CFR § 208.10: Title 33 - Navigation and Navigable Waters; Chapter II - Corps of Engineers, Department of the Army (Parts 203-208); Part 208 - Flood Control Regulations; Section 208.10 - Local flood protection works; maintenance and operation of structures and facilities. (July 1, 2005 edition)

A.2 ER 5-1-11, USACE Business Process

A.3 ER 10-1-55, Roles and Responsibilities – Risk Management Center

A.4 ER 500-1-1, Civil Emergency Management Program

A.5 ER 1105-2-100, Planning Guidance Notebook

A.6 ER 1110-1-12, Quality Management

A.7 ER 1110-2-401, Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors

A.8 ER 1110-2-1156, Safety of Dams – Policy and Procedures

A.9 EP 1105-1-1, The Sponsor's Guide to the USACE Levee Safety Program

A.10 EP 1110-2-17, A Guide to Public Alerts and Warning for Dam and Levee Emergencies

A.11 EM 1110-2-1413, Hydrologic Analysis of Interior Areas

A.12 EM 1110-2-1908, Instrumentation of Embankment Dams and Levees

A.13 EC 1110-2-6074 (or most recent guidance), Guidance for Emergency Action Plans, Incident Management and Reporting, and Inundation Maps for Dams and Levee Systems

A.14 EC 1165-2-217 (or most recent guidance), Review Policy for Civil Works

A.15 EC 1165-2-220 (or most recent guidance), Policy and Procedural Guidance for Processing Requests to Alter US Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408

A.16 ECB 2019-3, Risk Informed Decision Making for Engineering Work During Planning Studies

A.17 ECB 2019-11, Transition Guidance for Levee System Evaluations for the National Flood Insurance Program (NFIP)

A.18 ECB 2019-15, Interim Approach for Risk-Informed Designs for Dam and Levee Projects

A.19 PB 2019-04, Incorporating Life Safety into Flood and Coastal Storm Risk Management Studies

A.20 Memorandum, HQ USACE (CECW-CE), subject: Policy Guidance Letter for the Appointment of Levee Safety Officers (LSOs) and Levee Safety Program Managers (LSPMs) and Establishment of the Levee Senior Oversight Group (LSOG), Levee Safety Steering Committee (LSSC), and Levee Safety Committees (LSCs)

A.21 Memorandum, HQ USACE (CECW-CE), subject: Policy Guidance Letter – Placing Levees in a Risk Context, Emphasis on Communication and Sponsor Engagement

A.22 Flood Protection Structure Accreditation Task Force report and November 13, 2014 Memorandum of Understanding (MOU) between USACE and FEMA on the alignment of levee activities can be found at: http://www.usace.army.mil/Missions/Civil-Works/Levee-Safety-Program/Task-Force

A.23 International Levee Handbook. www.ciria.org/ilh

A.24 Levee Inspection System. http://lis.usace.army.mil/

A.25 Levee Screening Tool. https://lst.sec.usace.army.mil

A.26 National Levee Database. http://levees.sec.usace.army.mil

A.27 USACE Flood Risk Management Program. http://www.iwr.usace.army.mil/Missions/Flood-Risk-Management/Flood-Risk-Management-Program/

A.28 Department of Homeland Security (DHS) document entitled Emergency Preparedness Guidelines for Levees, A Guide for Owners and Operators. This document may be obtained at https://www.fema.gov/media-library/assets/documents/131081 or by requesting a copy from the DHS-FEMA Map Information eXchange (FMIX) toll free at 1-877-FEMA MAP (1-877-336-2627).

A.29 FEMA, “CPG 101, Developing and Maintaining Emergency Operations Plans, Version 2”, dated November 2010, website: https://www.fema.gov/media-library/assets/documents/25975?id=5697

A.30 Federal Flood Risk Management Programs. https://ffrmp.nfrmp.us/

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APPENDIX B
Levee Risk Management Summary Template

[See Following Pages]

Levee Risk Management Summary

Date: dd *mmm yyyy*

US Army Corps of Engineers®

Purpose:
The intent of the Levee Risk Management Summary is to summarize the best available information related to risk assessments, levee inspections, past performance, and recent risk management activities to aid in the generation of an up-to-date set of risk-informed recommendations for the levee system.

Levee System (Name, NLD ID):

Comprehensive Recommended Actions – Prioritized by Risk			
Tracking No.	**Priority Category**	**Action**	**Category** *Four Categories based on Tolerable Risk Guidelines* *1. Understanding the Risk* *2. Building Risk Awareness* *3. Fulfilling Daily Responsibilities* *4. Actions to Reduce Risk*
Recommend Update to the Risk Assessment: ☐ YES ☐ NO			

Levee System Risk					
Risk Assessment Type:		Classification:		Date:	
Levee System Risk Characterization:					
Factors Driving the Risk:					

Recent Levee Inspection Summary			
Levee Inspection Type:		Date:	
Critical Inspection Items Rated Unacceptable and Description of Observations:			

Risk Management Actions Taken Since the Last Risk Assessment
1. Operation and maintenance actions/improvements:
2. Improvements to factors driving the risk from most recent risk assessment:

3. Operation and maintenance actions/improvements previously planned but not accomplished:
4. Coordination/improvements to emergency action plans: *[date of most recent emergency action plan, updates since the last risk assessment, activities performed during recent flood events]*
5. Other:

Risk Communication Actions Taken Since the Last Risk Assessment

Notable Changes in Condition Since the Last Risk Assessment
1. Performance during recent flood events:
2. Observation and item conditions from the most recent inspection:
3. Any changes to factors previously driving the risk:
4. New factors that influence the risk:
5. Other: *[e.g. approved/unapproved alterations]*

Sources of Uncertainty	
Sources of uncertainty related to the condition of levee features due to lack of inspection, testing, or other data gaps	
Source	**Description**

National Flood Insurance Program	
The tables below summarize any negative findings associated with program accreditation criteria as derived from recent USACE inspection and screening level risk assessments. *[Note: For levee systems with higher level risk assessments, no Findings are included in this section. Please refer to the risk assessment report for details related to USACE accreditation recommendations]*	
Levee Inspection Negative Findings: NA	
44 CFR 65.10 Provision	Description of Negative Finding

Screening Level Risk Assessment Negative Findings: NA	
44 CFR 65.10 Provision	Description of Negative Finding

Risk Management Summary Approval
Signature: _____ Date Approved: _____

GLOSSARY

Terms

Annual Exceedance Probability – Annual exceedance probability represents the probability that flooding from levee breach or overtopping will occur in any given year considering the full range of possible annual floods. Sometimes also referred to as annual probability of inundation or annual probability of failure.

Base Flood Elevation – Term used for the National Flood Insurance Program: the computed elevation to which floodwater is anticipated to rise for a flood event having a one percent chance of being equaled or exceeded in any given year.

Benefits (attributed to a levee system) – A qualitative or quantitative description of the positive contributions the levee system has or can provide to the community in the leveed area. This can include: reduction in potential flood damages to residential structures and businesses; potential for the reduction of loss of life; prevention of damages to community services such as schools, hospitals, water treatment plants and other municipal services; prevention of damages to roadways; and providing critical time for the population to get out of harm's way during a flood event.

Breach – The formation of a gap in the levee system through which water may flow uncontrolled onto the adjacent leveed area. A breach in the levee system may occur prior to or subsequent to overtopping.

Broadly Acceptable Risk – Risk that has been determined that the probability of occurrence is so small, the consequences are so slight, or the benefits are so great, that risks are considered insignificant or negligible. USACE will not consider risk associated with levee system to ever be broadly acceptable.

Community – Any state or area or political subdivision thereof, or any Indian tribe or authorized tribal organization, or Alaska Native village, or authorized native organization that has the authority to adopt and enforce regulations for the areas within its jurisdiction.

Consequences (of flooding) – The effect, result, or outcome of inundation as reflected in the potential loss of life, economic losses, and adverse environmental impacts.

Critical Infrastructure – Systems or assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems or assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters.

Critical Location – A location along a levee system at which a risk-driving potential failure mode is most likely to occur.

Dam – An artificial barrier, including appurtenant works, constructed for the purpose of storage, control, or diversion of water.

Deliverable – A compilation of multiple products packaged together to relay comprehensive results and recommendations for a levee system.

Direct Economic Consequences – Economic consequences that include both the direct losses due to inundation of the leveed area and other economic impacts on the national economy.

Economic Risk – The measure of the probability (or likelihood) of direct and indirect economic losses within a leveed area.

Emergency Action Plan (EAP) – A formal document that identifies potential emergency conditions at a levee and specifies pre-planned actions to be followed in order to reduce consequences of the emergency.

Environmental Risk – Risk associated with the likelihood of both direct and indirect impacts on environmental, cultural, and historic resources within the leveed area that cannot be measured in monetary terms.

Exposure – People or items in harm's way, such as the population, property, or infrastructure in the leveed area.

Exceptional Circumstances – A situation when USACE, acting on behalf of society, may determine that the life safety risks can be considered tolerable based on special benefits that the levee system brings to society at large even though the risk estimate for life safety usually would be considered unacceptable.

Federal Flood Risk Management Project – Features, components, and/or systems that are under the same Congressional authorization.

Flood – An overflow of water that submerges land which is normally dry.

Flood Risk (or Residual Risk) – The risk of flooding in a leveed area that remains at any point in time after accounting for the flood risk reduction contributed by the levee system.

For Official Use Only – Information that is not publicly releasable but may be shared on a need-to-know basis.

Formal Inspection – A pre-scheduled comprehensive levee inspection by a team of subject matter experts led by a professional engineer or professional geologist to: document levee condition; assess progress of ongoing risk management activities; inform risk assessments and new risk management recommendations; and include specific considerations, such as testing gates.

Positive Finding – A conclusion that there is sufficient information to determine that a specific criteria of 44 CFR 65.10 for the NFIP has been met as a result of a screening level risk assessment or levee inspection.

Hazard – An event that causes the potential for an adverse consequence.

Incident – An event occurring at a levee system that could potentially result in a levee safety issue.

Inconclusive Finding – A conclusion that there is insufficient information to determine whether or not a specific criteria of 44 CFR 65.10 for the NFIP has been met as a result of a screening level risk assessment or levee inspection.

Incremental Risk (or Levee Risk) – The risk of inundation posed by a levee system for the following three inundation scenarios: prior to overtopping; overtopping with breach; and component malfunction/mis-operation.

Indirect Economic Consequences – Economic consequences associated with or stemming from the destruction of property and the displacement of people due to inundation of a leveed area.

Individual Life Risk – The probability of life loss for an identifiable person or group by location that is most at risk of loss of life due to a levee breach. Individual life risk is influenced by location, exposure, and vulnerability within a leveed area.

Interim Risk Reduction Measure – An action to reduce levee risk while more long-term and comprehensive risk reduction and management solutions are being pursued.

Intervention – Actions taken to detect a developing failure mode and actions taken to prevent breach due to that failure mode.

Inundation – In the context of this EC, this refers to flooding in a leveed area.

Inundation Scenario (for a levee system) – A scenario which could result in flooding in a leveed area. The four inundation scenarios for a levee system are: breach prior to overtopping; overtopping with breach; component malfunction/mis-operation; and overtopping without breach.

Levee (or Levee System) – A manmade barrier that does not cross a watercourse with the principle function of excluding flood waters from a limited range of flood events from a portion of the floodplain (referred to as “leveed area”). A levee system is composed of one or more levee segments and other features that collectively are integral to excluding flood waters from the leveed area.

Levee Accreditation – The process in which a levee system is evaluated to determine how it will be mapped by FEMA for the purposes of the NFIP.

Levee Feature – A levee feature is a structure that is critical to the functioning of a levee system. Examples include embankment sections, floodwall sections, closure structures, pumping stations, interior drainage works, and flood damage reduction channels.

Levee Inspection System – The electronic tool used by USACE to document levee inspections.

Levee Risk (or Incremental Risk) – The risk of inundation posed by a levee system for the following three inundation scenarios: prior to overtopping; overtopping with breach; and component malfunction/mis-operation.

Levee Risk Management Summary – Document that summarizes the best available information related to risk assessments, levee inspections, past performance, and recent risk management activities to aid in the generation of an up-to-date and comprehensive set of risk-informed recommendations for a levee system; also serves as the mechanism to monitor levee risk.

Levee Safety – The art, science, and practice of managing flood risks posed by levee systems.

Levee Segment – A levee segment is a discrete portion of a levee system that is operated and maintained by a single entity. A levee segment may be composed of one or more levee features.

Levee Sponsor – A public entity that has responsibility for operation and maintenance for all or a certain portion of a levee system.

Levee System (or Levee) – A manmade barrier that does not cross a watercourse with the principle function of excluding flood waters from a limited range of flood events from a portion of the floodplain (referred to as “leveed area”). A levee system is composed of one or more levee segments and other features that collectively are integral to excluding flood waters from the leveed area.

Leveed Area – The lands from which flood water is excluded by the levee system.

Life Safety Risk (or Life Loss Risk) – A measure of the probability and severity of loss of life resulting from inundation of a leveed area.

Likelihood (or Probability) – Likelihood is a measure of the chance, or degree of belief that a particular outcome or consequence will occur. A probability provides a quantitative description of the likelihood of occurrence of a particular event. Probability is expressed as a value between 0 (impossible) and 1 (certain). Likelihood can be expressed qualitatively as well (e.g., high, medium, or low).

Mitigation – Actions taken that reduce potential loss of life and property by lessening the impacts of flood.

National Flood Insurance Program (NFIP) – Administered by FEMA, the NFIP is a voluntary program authorized by Congress to mitigate flood losses through community-enforced building and zoning ordinances and to provide property owners with access to federally-backed flood insurance. As part of the NFIP, FEMA issues Flood Insurance Rate Maps (FIRMs) that depict flood hazards and are used by local communities for the purposes of determining flood insurance and floodplain management requirements. The NFIP requires federally-regulated lending institutions to ensure that mortgage loans secured for buildings in high flood hazard areas, referred to as Special Flood Hazard Areas, are covered by flood insurance.

Negative Finding – A conclusion that there is sufficient information to determine that a specific criterion of 44 CFR 65.10 for the NFIP has not been met as a result of a screening level risk assessment or levee inspection.

No Verdict – An inspection rating and Levee Safety Action Classification assignment given when no access has been obtained in order to perform an inspection.

Non-Breach Risk (or Overtopping Without Breach Risk) – The risk associated with the scenario of the still-water level and/or associated waves, wind runup, or surge exceeds the top of the levee system, but does not result in a breach of the levee system.

Non-Project Segment – Manmade high ground which a levee system/segment ties into, whose existence and performance is necessary for excluding flood waters from the leveed area, but is not under any USACE authority.

Overtopping – A condition that occurs when the elevation of the still-water level and/or associated waves, wind runup, or surge exceeds the top of the levee system. This may or may not result in a breach of the levee system.

Performance – How the levee system has functioned or is anticipated to function during specified hazards.

Potential Failure Mode – A potential failure mode is a mechanism that once initiated potentially could progress to breach of a levee system or inundation of the leveed area. Overtopping without breach is not called a potential failure mode.

Preparedness – Actions taken before a possible future flood event, including planning, training, communication, and anticipation of how the levee will perform based on operation and maintenance, inspections, and assessments.

Quantitative Risk Assessment – A risk assessment that results in numerical calculations for probability of breach and consequences combined to quantify a numeric risk estimate and associated uncertainty.

Recovery – Actions taken after a flood, including those directed toward a return to normalcy.

Response – Actions taken during a flood, including those to save lives and prevent damage.

Resilience – The ability to avoid, minimize, withstand, and recover from the effects of adversity, whether natural or manmade, under all circumstances of use.

Risk – The measure of the probability (or likelihood) and consequence of uncertain future events.

Risk Assessment – A systematic, evidence-based approach for quantifying and describing the nature, likelihood, and magnitude of risk.

Risk Cadre – A multidisciplinary team of experts trained in conducting risk assessments.

Risk Characterization – Description of the levee system in the context of risk by considering the key drivers of likelihood of performance, potential consequences, and sources of uncertainty.

Risk Communication – The open exchange of information between risk assessors, decision makers, and those who are affected by the risks and risk management measures to improve decisions.

Risk Estimate – The combination of the probability of inundation of the leveed area and the associated consequences and portraying the results as a combined risk estimate typically portrayed in a risk matrix.

Risk Facilitator – A licensed engineer or geologist with experience in leading multidisciplinary teams through risk assessments.

Risk Management – The process of problem finding and initiating action to identify, evaluate, select, implement, monitor, and modify associated risks.

Risk-driving Potential Failure Mode – Potential Failure Mode that has been determined as having the most influence on levee risk and is carried through to determine its associated risk estimate in a semi-quantitative risk assessment or quantitative risk assessment.

Screening Level Risk Assessment (or levee screening) – A simplified semi-quantitative risk assessment that relies on existing data, historical performance, engineering

judgment, and consequence estimation to quickly characterize the relative risks posed by levees in terms of a relative probability of breach and potential risk to life and property.

Semi-Quantitative Risk Assessment – A risk assessment that uses a combination of limited numerical estimates with qualitative descriptions that result in risk estimates based on orders of magnitude.

Sensitive Information – Information that could pose a security risk or aid those intending to do harm to a levee system.

Site Visit – A site visit is an optional collaborative activity at a levee system to observe or verify any changed conditions or capture progress of risk management measures for consideration in the next more detailed inspection and/or risk assessment.

Societal Life Risk – The risk of widespread or large-scale catastrophes from the inundation of a leveed area that would result in a negative socio response.

Special Inspection – A special inspection is a formally documented visual inspection that is requested by the levee sponsor or required due to changed conditions or to document performance.

Stakeholder(s) – An individual or group of individuals who are responsible, interested, and/or affected by a levee system. An individual stakeholder may belong to more than one group of stakeholders.

Tolerable Risk (related to levee systems) – Levee risk that meet all of the following: (1) society is willing to live with the risk associated with the levee system to secure the benefits of living and working in the leveed area; (2) there is a continuation of recognition of the levee risk, because the risk associated with levee systems is not broadly acceptable and cannot be ignored; (3) risks associated with the levee system are being properly monitored and managed by those responsible for managing the risk; and (4) those responsible for managing the risk associated with a levee system continue to reduce the risk still further as practicable.

Unacceptable Risk – Risks which are not acceptable or tolerable except in exceptional circumstances.

Uncertainty – The deficiency or unsureness in information related to the understanding or knowledge of the risk or components of risk.

Vulnerability – Susceptibility of exposed persons and property to harm from an identified hazard.