

Levee Safety Program – Non-routine Activities

Introduction

This is the final paper in a series of three written to describe the principles and concepts being considered for use in the US Army Corps of Engineers (USACE) levee safety program. Three webinars have been developed to discuss proposed program features with stakeholders.

The presentations and supporting documents from the first two webinars have been posted to the USACE Levee Safety website:
[\[http://www.usace.army.mil/LeveeSafety/Activities\]](http://www.usace.army.mil/LeveeSafety/Activities)

Webinar 1 presented an overview of program goals and guiding principles. Webinar 2 addressed routine activities including:

- Risk communications and stakeholder involvement;
- USACE programmatic roles and responsibilities;
- Routine activities of Levee Safety portfolio risk management process:
 - Operations, maintenance, and monitoring;
 - Inspections;
 - Screening and initial levee safety action classification (LSAC);
 - Incident reporting; and
- The national levee database.

Webinar 3 participants are encouraged to refresh their understanding of the USACE levee safety program by browsing or re-reading the Webinar 1 and Webinar 2 papers.

Webinar 3 and this paper focus on the 'non-routine' and closely associated activities that are elements of the levee safety program. The non-routine activities discussed in Webinar 3 are:

- Risk Communication and Planning Non-routine Activities
- Interim Risk Reduction Measures (IRRM);
- Reconnaissance-phase investigation with base condition risk assessment
- Feasibility-phase investigation /Major Rehabilitation Studies (Levee Safety Risk Management - LSRM);
- Implementation of Risk Management Measures; and
- Non-Federal modification of Federal Levee 33 USC Section 408 Permit Process

Although not addressed in Webinar 3, concepts of Tolerability of Risk including the "As Low As Reasonably Practicable" (ALARP) principle for use in evaluating and managing the inundation risk associated with levee systems are introduced in this paper.

As a reminder, the intent of this webinar series is to initiate engagement of stakeholders in the process of developing a document, referred to as an Engineer Circular (EC), which will define the detailed policy and procedures for the USACE levee safety program.

Because a number of USACE authorities and programs are discussed in this paper, Attachment 1 provides condensed descriptions of them to provide a ready reference for the reader.

Categories of Levee Systems: Please note that the portfolio of levee systems to which this program applies contains the following categories of levees each with different responsible entities:

- 1) USACE operated and maintained;
- 2) Federally authorized - local sponsor operated and maintained;¹ and
- 3) Non-Federal levee systems in the Rehabilitation and Inspection Program (RIP) under provisions of PL 84-99.

In this paper these three categories will be referred to as:

- 1) USACE O&M levee systems
- 2) Federally Authorized-Local O&M levee systems
- 3) Non-Federal levee systems

Some History and Context

Historical Overview: As noted in the Webinar 1 paper, prior to 2007, a 'USACE Levee Safety Program' did not exist. USACE monitored the status of levees within the portfolio via annual inspections, or review of inspections performed by local sponsors to determine eligibility for inclusion in the PL 84-99 Rehabilitation and Inspection Program (RIP), or to determine eligibility to remain in the RIP. Depending on the findings of the inspections, levee system performance during the occurrence of an event, such as a significant flood or earthquake, or other evidence of an issue of concern action may have been initiated to repair deficiencies, to restore the levee system to its authorized condition, or to study the need to expand the scope of the system. Economic analysis and net benefit optimization was generally the basis for the preferred alternative recommendation. The response by USACE to a levee deficiency issue took one of several paths depending on the category of levee system as described below.

USACE O&M Levee systems: For USACE operated and maintained levee systems, Congressional authority and potential funding for studies are embodied in the Operations and Maintenance (O&M) program. The 'Major Rehabilitation Program' process enabled addressing existing levee system deficiencies for this category.

¹ Refers to (a) Federally authorized levee system projects constructed by USACE and operated and maintained by non-federal entity and, (b) Levee systems constructed by non-Federal entities or other (non-USACE) Federal agencies, and incorporated into a Federal system by specific Congressional action (i.e., United States law) and operated and maintained by a non-Federal entity.

Studies under this process are accomplished in a single phase (post authorization) using a risk informed approach.

Federally Authorized-Local O&M Levee Systems: For Federally authorized, locally operated and maintained levee systems, the process is that of 'Modification to Completed Projects,' the so-called Section 216 process. USACE has standing authority under the Flood Control Act of 1970 to investigate modifications of completed projects or changes in their operation. Studies under this authority are accomplished in two phases (reconnaissance and feasibility) in accordance with the Water Resources Development Act of 1986. The reconnaissance phase which includes an initial appraisal followed by a reconnaissance study is Federally funded. The feasibility-phase requires a local cost sharing sponsor. Implementation of the recommended solution requires Congressional authorization and appropriation of construction funds. Levee systems in this category are eligible for rehabilitation assistance under the PL 84-99 program.

Non-Federal Levee Systems: For locally developed and locally operated and maintained levee systems, the identification of potential deficiencies for the most part, takes place locally. USACE has no existing study, nor construction authority to participate in developing a solution. Short of Congress providing a new USACE study authority, the local entity was on its own to seek assistance and funding as might be available locally or via other non-USACE programs. Levee systems in this category are eligible for 'repair or restoration of levees threatened or destroyed by flood' under the PL 84-99 program.

Proposed USACE Levee Safety Program Non-Routine Activities

The USACE proposes an overall portfolio risk management process comprised of logical and hierarchical activities that are used to assess and manage the risks associated with the portfolio of levees. The proposed activities for Federally Authorized-Local O&M levee systems are presented in the portfolio risk management process depicted on Figure 1. The proposed process stays within existing USACE authorities but would require some modifications to existing policy contained within ER 1105-2-100, the Planning Guidance Notebook (PGN). The proposed changes will support a more robust risk informed national level prioritization and a more efficient use of available resources. Key features of the proposed process are:

- 1) National Level Management: All levee systems in the USACE portfolio are screened via a risk-informed process. This offers the opportunity to prioritize systems in an approximate order to efficiently buy-down national life-safety risk associated with the presence of levee systems.
- 2) Life-safety to Guide Decisions: Life-safety is held paramount in the risk management decisions made within the USACE levee safety program. The intent is to work with stakeholders to manage life-safety risks that result from potential inundation associated with the presence of a levee system. In concert, USACE will strive to reduce the likelihood and magnitude of economic and environmental inundation consequences associated with the presence of levee systems

- 3) Shared Solutions: 'Shared solutions' is an important underpinning of the USACE Levee Safety Program activities. Because those shared solutions must be implemented by various parties, the solutions will be developed with all responsible and affected parties involved.

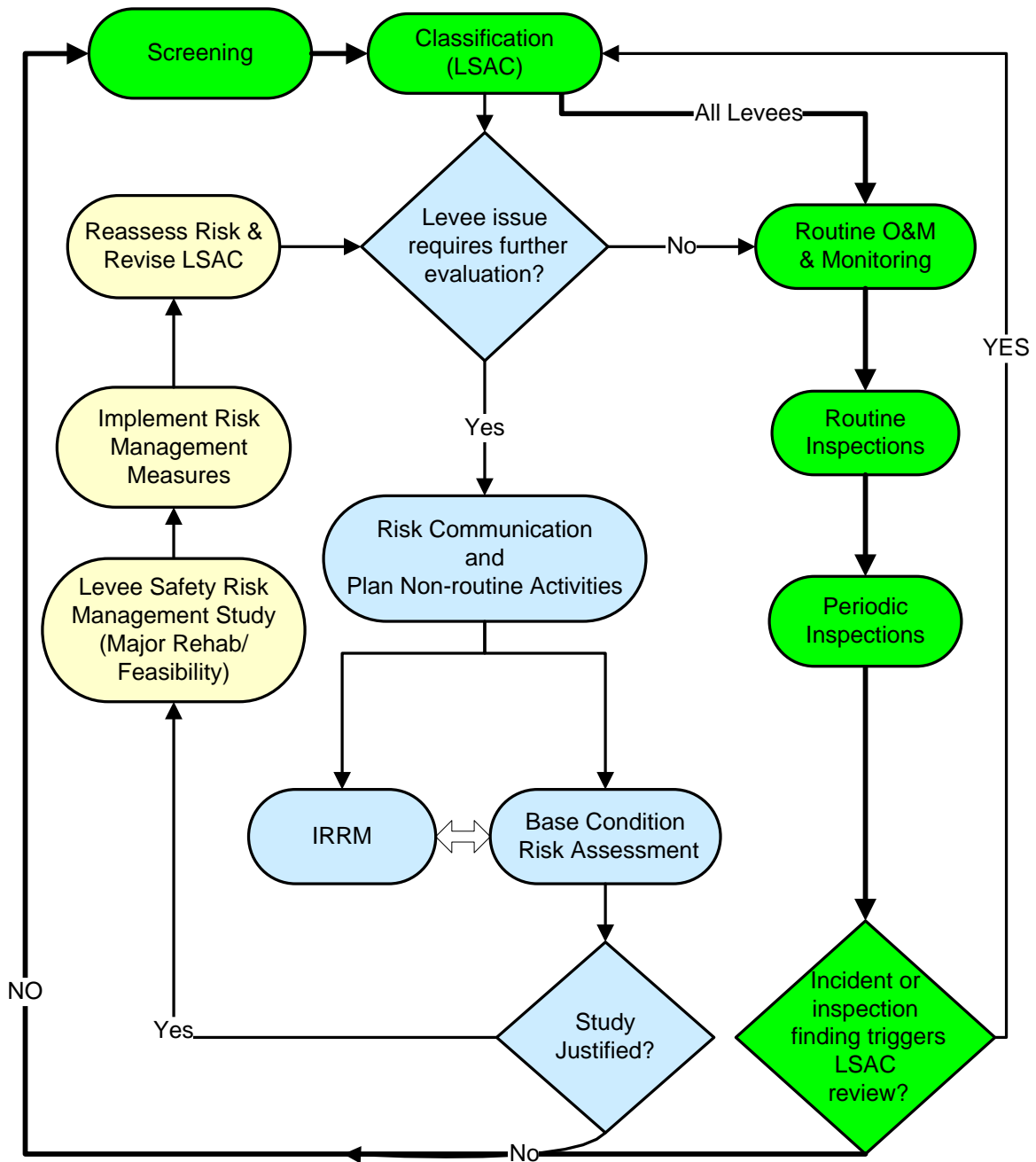


Figure 1. Routine and Non-routine Activities of the USACE Levee Safety Portfolio Risk Management Process

Tolerability of Risk for Levee Systems: Life Safety is Paramount

Tolerability of Risk (TOR) Framework: USACE proposes to pursue the ‘life safety is paramount’ principle through application of a Tolerability of Risk (TOR) framework. The TOR framework is depicted in Figure 2 (Adapted from HSE, 2001):

- a) At the bottom are risks that are “**broadly acceptable**”. These are risks people live with everyday, and that those who are exposed to the risk regard as insignificant and adequately controlled - *for example, cell phones and televisions.*
- b) At the top is the “**unacceptable**” region in which risks are generally believed by individuals and society at large to be not worth taking, except in extraordinary circumstances, regardless of the benefits – *for example, building new residential areas on hazardous waste landfills or building a nuclear power plant without a containment structure.*
- c) The middle region is the “**range of tolerability**”. In this region individuals and society are prepared to live with the risks of an activity, provided that they meet the conditions listed below - *for example, vehicular and airline travel.* Risk in this range are defined as:
 - Risks that individuals and society are willing to live with so as to secure certain benefits;
 - Risks that individuals and society do not regard as negligible (broadly acceptable) or something to be ignored;
 - Risks that individuals and society are confident are being properly managed by the stakeholders; and
 - Risks that the responsible stakeholders keep under review and reduce still further if and as practicable.

Tolerable Risk Guidelines (TRG): USACE proposes to implement the TOR framework by applying TRG to its responsibilities for the management of the risk posed by the levee systems in its portfolio. TRG require that the principles of **equity** and **efficiency** are both considered in establishing where a levee system falls in Figure 2. Equity requires that the interests of all are treated with fairness, with the goal of placing all members of society on an essentially equal footing in terms of levels of life risk with respect to the presences of an existing levee system. For risks that fall in the unacceptable region, USACE will work with stakeholders to reduce inundation risks by structural or non-structural measures to bring them into the range of tolerability. Efficiency requires society to distribute and use available resources to achieve the greatest benefit. Equity suggests that a tolerable risk limit (the lower boundary of the unacceptable region) should be met regardless of the lack of economic justification or the magnitude of the cost. Equity implies the need for this limit even if efficiency does not support reducing risks to meet the tolerable risk limit. There is, therefore, a need to obtain an appropriate balance between equity and efficiency.

This balance is achieved by the selection of the tolerable risk limit and by using the **as low as reasonably practicable** (ALARP) principle. In Figure 2, for a risk to be tolerable, it should be reduced as low as reasonably practicable below the tolerable risk limit. Determining that ALARP is satisfied is ultimately a matter of judgment of the stakeholders. In making a judgment on whether risks are ALARP, the following factors should be taken into account:

- The level of risk in relation to the tolerable risk limit;
- The disproportion between the sacrifice (money, time, trouble and effort) in implementing the risk management measures and the subsequent risk reduction achieved;
- The cost-effectiveness of the risk management measures;
- Any relevant recognized good practice;
- Technically feasible; and
- Societal concerns as revealed by consultation with the community and other stakeholders.

Once a levee system enters into the non-routine activities described in this white paper, the logic of Tolerability of Risk including ALARP is applied using the best available

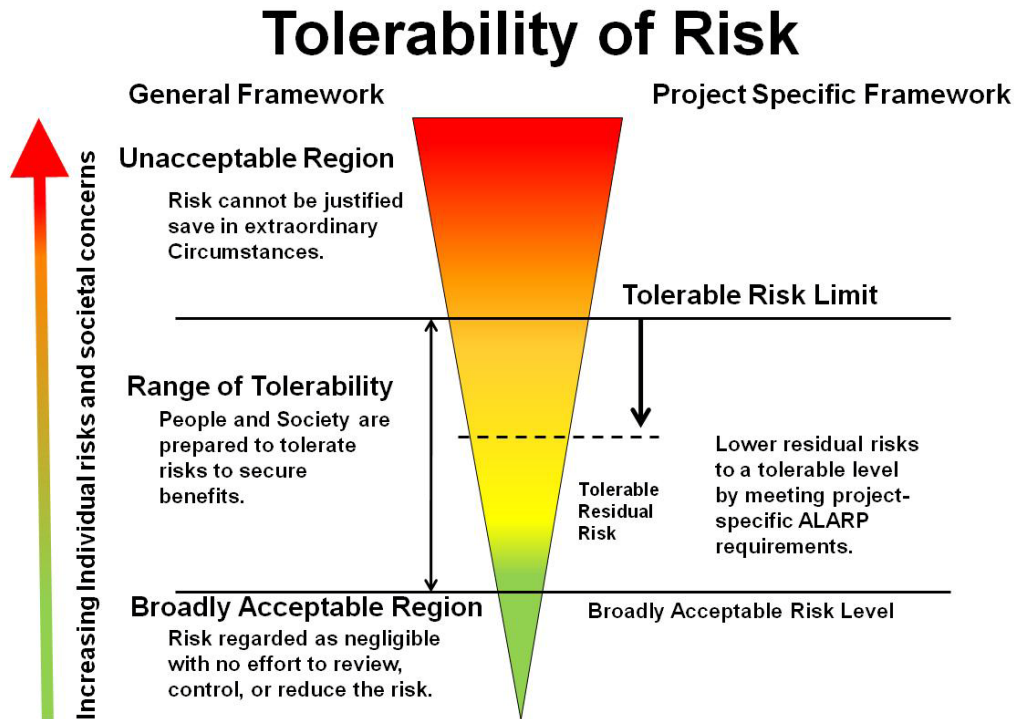


Figure 2. Tolerability of Risk Framework (adapted from HSE 2001)

information to characterize the benefits, risks and costs of risk reduction, and engaging responsible, affected and interested stakeholders in making the ALARP judgment.

For more detailed information and discussions on TOR, TRG, and ALARP, recommend reading to the USACE workshop proceedings, "Exploration of Tolerable Risk Guidelines for the USACE Levee Safety Program," 17 -18 March 2010. The link to the report is http://www.usace.army.mil/LeveeSafety/Partners/Documents/iwr_trg.pdf .

Inundation Risk: In applying tolerable risk guidelines for levee safety, the inundation risk in leveed areas will be used. The inundation risk arises from the following scenarios: breach prior to overtopping, overtopping with a breach, overtopping without breach, and malfunction of levee system components and is summed to represent the inundation risk in the leveed area.

Levee Safety Portfolio Risk Management Process

Figure 1 illustrates the major features of the proposed USACE levee safety portfolio risk management process for USACE operated and maintained levee systems. As a reminder, the outer loop of activities comprises routine activities - operation, maintenance, monitoring, inspections, levee risk screening, and classification which are routinely performed on all levees in the USACE portfolio and which are – the topic of Webinar 2.

The non-routine activities, discussed in this paper, are depicted by the inner loop and vary depending on the levee system category as noted in a prior section in this paper.

As a preface to discussions of non-routine activities in this paper, note that initially, USACE assigns all levee systems to a Levee Safety Action Class (LSAC) based on the screening process described in Webinar 2. The five LSAC classes used in the USACE levee safety portfolio risk management process are:

- Class I - Urgent and Compelling (i.e. unsafe)
- Class II – Urgent (i.e. unsafe or potentially unsafe)
- Class III - High Priority (i.e. potentially unsafe)
- Class IV – Priority (i.e. marginally safe)
- Class V – Normal (i.e. adequately safe)

The screening-level risk assessment involves estimating the likelihood and consequences of potential inundation, with life loss the consequence of paramount concern. The likelihood that a levee system breach or component malfunction would occur at water levels before overtopping is a particularly important consideration because the element of surprise could significantly increase the potential for loss of life. The loss of life potential is a vital consideration in making the LSAC assignment. Because the LSAC assignment is based on the best available information, sponsors and stakeholders should understand that the classification may change as further investigations go forward as part of the non-routine activities described below, in particular the Reconnaissance phase and Feasibility phase investigations.

USACE Roles and Responsibilities for Non-routine Activities

Overview: Briefly recapping from Webinar 2, the Corps of Engineers maintains a three-level decentralized organization - HQUSACE, MSC (regional division) and district. Each level will be staffed with qualified personnel in areas of flood risk management and design, construction, inspection and operations of levee systems and appurtenant structures, with appropriate training and experience in levee safety risk assessment, risk management, and risk communications. Each organizational level will have a Levee Safety Officer (LSO), Levee Safety Program Manager (LSPM) and Flood Risk Manager (FRM) with supporting organizations.

In general, the USACE districts have the overall responsibility for execution of the Levee Safety studies and to either implement or to support risk management actions by non-Federal partners as discussed in this paper. The studies will be undertaken in partnership with stakeholders, the nature of the partnership depending on the source of the inundation risk and the flood risk management measures that will likely to be recommended. Other USACE organizations such as: The Risk Management Center (failure modes analysis and risk assessment), Flood Risk Reduction Planning Center of Expertise (planning process and methodologies) and USACE organizations such as the research and development laboratories, will provide support for the program execution.

USACE proposes to use risk-informed procedures to aid in the prioritization of actions to address levee safety concerns on a nation-wide basis. HQUSACE manages the program from the national level, setting policies, prioritizing studies and actions, and ensuring appropriate support for the districts in execution of their assigned mission. National oversight is furnished by the Levee Safety Steering Committee and the Levee Safety Senior Oversight Group (LSOG). All levee systems in the three categories of levee systems will be inspected and screened at the district level and an LSAC will be recommended by the LSOG to the HQUSACE LSO. The HQUSACE LSO approves the classification assignments and communicates the classifications to the MSC and the district. Subsequent communication regarding LSAC classifications is jointly undertaken with the local sponsor.

The district FRM is responsible for establishing and managing a district activity that facilitates internal coordination and integration of the related flood risk management programs, activities, and initiatives. The district FRM also participates as the lead USACE member on the local Silver Jackets team.

Additional discussion of the roles and responsibilities of the various USACE organization elements and stakeholders is summarized in attachment 2.

Proposed Non-Routine Activities/Study Process for Categories of Levee Systems

USACE Operated and Maintained Levee Systems: Studies would continue to follow the risk informed principles of the established Major Rehabilitation Program. Screening and classifying all levee systems and subsequent national prioritization will enable efficient and effective allocation of resources to most efficiently buy down risk for this category of levee systems. In general, the proposed process for this category of levees follows the same steps as those summarized below for Federally Authorized, Locally O&M levee systems and depicted in Table 1. The difference being USACE activities for

levee systems in this category are O&M funded with no required study cost sharing. Construction of recommended flood risk management measures requires Congressional appropriation of construction funding.

Federally Authorized Locally Operated and Maintained Systems: This category of levee systems will be addressed via the Section 216 process adapted to emphasize the importance of early risk assessments. The risk screening and early-on risk assessments provide the opportunity to better ensure the highest priority reconnaissance and feasibility studies receive the resources for execution thus, leading to efficient and effective buy-down over time of national life-risks posed by levee systems in the portfolio. USACE is exploring the possibility of supporting development of IRRM plans and possibly some implementing actions under the 'Advanced Measures' section of PL 84-99. See Table 1 for a tabulation summarizing the proposed process for this category of levees.

Non-Federal Levee Systems: As in the current process, a new study authorization will be required for USACE involvement. Relative risk information derived from the screening would inform those interested in pursuing means to reduce the life-safety risk posed by these levee systems in the USACE portfolio. USACE is exploring the possibility of supporting development of IRRM plans and possibly some actions under the 'Advanced Measures' section of PL 84-99. Levee systems in this category continue to be eligible for rehabilitation assistance under PL 84-99.

Descriptions of the Non-Routine Activities: There are a number of steps that comprise the USACE proposed Portfolio Management Process and are discussed in some detail in following sections.

Step 1: The LSAC is established²: USACE has the responsibility to establish the LSAC, using information available to USACE or evidence that may be provided by others. Because the LSAC can change as the non-routine activity steps are followed, the logic for, and confidence in, the LSAC for any levee will be carefully communicated. Levee System O&M agencies will be invited to participate in compiling the information and reviewing credibility of LST results.

Step 2: Risk Communication and Planning Non-routine Activities: The USACE district communicates the assigned LSAC and inundation risk to the sponsor and responsible stakeholders. For USACE O&M levee systems the USACE districts leads the effort to communicate with the stakeholders and the community. For Federally Authorized- local O&M and Non-Federal levee systems the sponsor and responsible stakeholders lead and USACE will assist in the effort to communicate with the stakeholders and community. After the release of the LSAC information, the USACE district will work with stakeholders to better define the roles of the stakeholders, and jointly plan for the next steps to be undertaken.

² Note – LSAC assignment is a routine activity, but is the general trigger for non-routine activities.

Step 3: IRRM planning and selection: Interim Risk Reduction Measures (IRRM) are actions taken to reduce the likelihood and consequences of catastrophic breaching or overtopping of the levee system while long-term solutions are pursued. USACE recommends IRRM for all levee systems that receive assigned an LSAC I, II, or III. IRRM do not replace required operation and maintenance of levees.

Examples of non-structural interim risk reduction measures include:

- Temporarily changing operation of upstream reservoirs to reduce flood flows;
- Developing flood warning-preparedness plans to include forecasting and floodplain evacuations;

Table 1. Proposed Study Process (Section 216 Authority) for Federally Authorized, Locally Operated and Maintained

Process Step	Funding	Purpose	Information Source	Cost	Time Frame to Initiate
Initial Appraisal – Screening	O&M	Determine if reconnaissance study is justified. Characterize risk, assign and prioritize actions.	Routine and periodic inspections, National Levee Data Base, Levee Screening Tool.	~\$20k	Existing FY
Communications/ Activity Planning	O&M	Communicate risk, plan next activities for non-routine activities.	LSAC, community contact rosters		Existing FY
IRRM	O&M	Plan to reduce risk in short term.	Levee Safety Action Classification.	~\$10k	Existing FY
Reconnaissance Phase 1 (905b)	GI and O&M Wedge	Determine if feasibility study is justified. Identify problem and define Federal interest.	Readily available information. Base condition risk assessment.	~\$100-\$200k	Existing FY using wedge funding.
Reconnaissance Phase 2 (905b)	GI, O&M Wedges plus GI	Prepare Project Management Plan and execute cost sharing agreement.	Readily available information.	~\$100k	Existing FY using wedge funding.
Feasibility (Levee Safety Risk Management Study)	GI/Cost shared	Develop and recommend plan with life-risk paramount; technical, economic and environmental. Shared solutions, commitments by non-USACE.	Data gathering, investigations, and risk assessment as needed to support formulation, evaluation, and solution.	~\$1M+	Two years after Reconnaissance Report approval

Bottom Line Up Front: Doing right studies in the right order, higher success rates for feasibility studies, buys down risk quicker, makes more efficient and effective use of resources.

Support the development and implementation of interim risk reduction measures; informs outreach and communication with credible risk characterization.

Features: 1) Improved national prioritization of reconnaissance studies; 2) Phase I (Risk Assessment) provides go/no go decision point for investment in Phase II Reconnaissance/905B tasks; 3) Improved national prioritization of feasibility studies; and 4) Higher success rates for feasibility studies reduces life cycle financial risk for Federal and local sponsor investments;

Increases Federal investment during reconnaissance phase.

- Communicating residual risk to residents and stressing the importance of purchasing flood insurance.

Examples of structural measures include:

- Improving toe drains for seepage;
- Building a seepage berm; and
- Increasing erosion protection.

Planning for IRRM will involve a variety of stakeholders, including other Federal agencies. Other agencies may have the authorities and budgets to implement measures that are outside of the USACE capabilities. USACE will provide general advice on IRRM subject to availability of resources and authorities.

For all Federal O&M levee systems, O&M funds will be used to develop IRRM. Additionally, USACE will involve other stakeholders in the IRRM selection process, especially where an IRRM is not within the Corps authority to implement (for examples, building limitations in vulnerable areas of flood plains or holding annual emergency warning and evacuation exercises).

For Federally authorized-Local O&M and non-Federal levees, the USACE will provide upon request and as authorities and resources permit, technical advice on the options for IRRM. USACE is exploring providing technical assistance in developing IRRM plans under the authority of 'Advanced Measures' section of PL 84-99. Note that the responsibility to plan and take action belongs to the responsible stakeholders. Other USACE programs such as Flood Plain Management Services (FPMS) and Planning Assistance to States (PAS) provide authority to provide helpful advice for communities but resources for these programs are very limited at the present time. The Silver Jackets program brings together USACE, FEMA, and State hazard mitigation offices, in addition to other Federal and state agencies for the purpose of reducing flood risk. However, the resources to develop the analyses and plans to identify which IRRM to implement may need to come from other sources, if the USACE programs are not available.

Step 4: IRRM implementation: IRRM implementation will require drawing upon a mix of authorities and budgets, specifically available for the different categories of levee systems. For USACE O&M levee systems, IRRM can be implemented under O&M. In addition, implementation of some IRRM may not fall within USACE and thus must be undertaken by non-USACE entities.

For other levee categories, there is no generally available source of USACE funding for IRRM implementation. Non-USACE programs (federal or state) may be relied on for funding and the responsible entity will need to apply for such funds following the processes that apply to those programs

Even though a specific IRRM may eventually be included in the permanent risk reduction solution IRRM are considered temporary and would be unlikely to reduce the risk to a tolerable level by itself. Thus, the role of communication is central to the

understanding and effectiveness of the IRRM, especially when dealing with emergency evacuation programs or other measures that are not USACE responsibilities.

Step 5: Reconnaissance-phase with Base Condition Risk Assessment: The proposed base condition risk assessment is a more detailed risk assessment than provided by the Levee Screening Tool (LST). This step focuses on reducing the uncertainties in the screening and the effect of those uncertainties on base condition risk estimates. The level of detail in a base condition risk assessment should only be what is needed to justify the decision to pursue or not to pursue a Feasibility-phase studies (identified as Levee Safety Risk Management Studies (LSRM) in Webinar 1).

Additionally, it should provide the information so that USACE levee safety officials can prioritize the Feasibility-phase studies for the USACE O&M and Federally Authorized-Local O&M levees in the USACE portfolio of levees. Because of the added detail in the base condition risk assessment, however, the LSAC classification assigned to the levee system will be reviewed and may be revised. Also, a base condition risk assessment can highlight the need for additional IRRM actions or a review of existing IRRM.

The scope and level of rigor required for a base condition risk assessment will be based upon the complexity of the levee safety issues, and the ability to identify and evaluate the potential failure modes using existing data, analyses, and performance history. The base condition risk assessment is intended to achieve a defensible, risk-informed justification for completion of the Reconnaissance-phase study including identification of a cost share partner, and development and signing of a cost sharing agreement. An important aspect of a defensible risk assessment is that the confidence in the risk estimates must be supported by evidence. This means providing an assessment, quantitatively or qualitatively, of the uncertainties in the assessment and their importance to the recommendation on whether to proceed to the LSRM study.

In summary, the overall objectives of a Reconnaissance-phase study are to:

- Evaluate a levee safety issue found during a screening, incident, inspection, or study, in relation to the USACE tolerable risk guidelines;
- Obtain a base condition risk estimate to be evaluated using USACE tolerable risk guidelines;
- Confirm / modify the Levee Safety Action Classification;
- Understand and communicate the inundation risk;
- Determine whether or not a Levee Risk Management Study is warranted;
- Support prioritization of Levee Risk Management Studies;
- Develop LSRM scope of work;
- Support negotiation of cost-sharing agreements; and
- Reevaluate the effectiveness of IRRM and recommend changes as justified.

If a Federal interest is identified, then the following additional activities may be undertaken:

- Preparation of a Project Management Plan (PMP);

- An assessment of the level of interest and support of non-Federal entities in the identified potential solutions and cost-sharing of a feasibility phase study and construction;
- A letter of intent from the local sponsor stating the willingness to pursue the cost shared feasibility study described in the PMP and to share in the costs of construction is required; and
- A negotiated and executed Feasibility Cost Sharing Agreement (FCSA).

Step 6: Feasibility Study or LSRM Study³: The Feasibility-phase investigation (Levee Safety Risk Management Study (LSRM)) is a decision document that reassesses baseline risks, evaluates alternative risk management plans, and recommends actions to reduce or manage inundation risk. Depending on the sources of the inundation risk, different study procedures may apply due to the sources of the risk as defined by the inundation scenarios that contribute to the inundation risk. Where the major source of the inundation risk is breach prior to overtopping, USACE has existing policy and procedures under the Major Rehabilitation program (ER 1130-2-500) for USACE O&M levees.

For USACE O&M levee systems, the project Congressional authority as well as sources of the risk will determine the LSRM study approach as applied by the USACE. For Federally Authorized-Local O&M and non-Federal levee systems, a study cost share partner would be required. For Federally Authorized-Local O&M levees it is possible that the cost of the LSRM study will vary according to the sources of the risk and project authorities that exist at the time the LSRM study is initiated.

In most cases, the study process, level of detail, and documentation of findings for a LSRM study are modeled after the traditional civil works planning decision process, often referred to as a 'feasibility phase study'. The distinction is that LSRM studies emphasize life-safety associated with levee systems as a paramount interest. The intent is to work with sponsors and stakeholders to manage life-safety risks that result from inundation associated with the presence of a levee system. In concert, USACE will strive to reduce the likelihood and magnitude of economic and environmental inundation risks associated with the presence of levee systems.

A Feasibility-phase LSRM study will follow the six-step framework of civil works planning presented in ER 1105-2-100 "Planning Guidance Notebook" as adapted herein for addressing levee safety issues:

- 1) Identify levee safety problems (sources of risk);
- 2) Estimate baseline (without future action) risk condition;
- 3) Formulate comprehensive risk management alternative plans;
- 4) Evaluate effectiveness of alternative risk management plans, with attention to changes in the likelihood and magnitude of predicted loss of life;

³ Webinar 1 White Paper, referred to a Levee Safety Risk Management Study (LSRMS): To maintain consistency with existing processes and authorizations, this study is equated with the current Feasibility phase study process.

- 5) Compare alternative risk management plans, following principles of TOR including the ALARP principle; and
- 6) Recommend a risk management plan, in consideration of tolerable risk guidelines.

Any USACE-led LSRM study will include formulation of a full range of levee safety risk management alternatives, including measures that may be beyond the authority or responsibility of the USACE to implement. The following must be part of the process, to the extent that their participation can be obtained: a) cost share partners; b) other Federal agencies that have responsibilities and programs in flood risk management; c) other agencies of government, non-governmental organizations, and d) individuals representing those who bear the inundation risks, those who will obtain benefits, or who will bear the financial costs or other adverse consequences of any alternative. The LSRM study decision document will present a comparison of alternatives and then present the rationale for the recommended risk management plan, and defends that recommended plan by applying TRG. Ideally, the plan selection must be made jointly by all the entities that are financially or administratively responsible for implementing the measures that are included in the preferred plan. Those entities should formally endorse and commit to implementation of the measures within the plan that are their responsibility.

If the USACE has no financial participation in the study (Federally Authorized-Local O&M or non-Federal levees), and if the entity responsible for the study does not anticipate USACE financial participation in plan implementation, that entity might not choose to use the plan development and selection process described herein. Some entity has to provide funding, and the requirements to received funding will vary by programs and/or the requirements of that entities funding sources.

Finally, if a Section 408 permit is going to be required (Federally Authorized-Local O&M levee system) the sponsor or entity responsible for the levee system O&M should coordinate and communicate continuously with the USACE during the planning process with the goal that recommended alternatives affecting the levee structures themselves will be approved.

Step 7 LSRM Study Recommendations Implementation: For USACE authorized activities, standard budget processes will apply. However, the requirements to receive funding will vary by programs (local tax increment financing, FEMA grant, etc.). The responsible entities may need to apply to multiple funding sources and implement actions according to the requirements of those programs.

Reference;

HSE (2001), Health and Safety Executive, "Reducing Risks, Protecting People: HSE's Decision-making Process," Risk Assessment Policy Unit, HSE Books, Her Majesty's Stationery Office, London, England, 2001.

Attachment 1 – Brief Overview of USACE Authorities and Other Federal Programs

Section 216 – Review of Completed Projects: In the course of routine activities the Chief of Engineers has authority to observe and monitor projects to ascertain whether they continue to function in a satisfactory manner and whether the potential exists for better serving the public interest. Prior practice has been to use this authority to document the need for modification or rehabilitation of completed works due to significantly changed physical or economic conditions and for improving the quality of the environment in the overall public interest. The process includes three reporting phases: 1) an initial appraisal; 2) a reconnaissance report often referred to as a 905B document; and 3) a feasibility report.

The initial appraisal reports document the nature of the problem and are used to support a budget request for a reconnaissance study. The cost of preparing the initial appraisal report is limited to \$20,000 and is Federally funded. Following the initial appraisal, the 216 study process is the same as a conventional General Investigations (GI) study comprised of a reconnaissance phase (Federally funded and by current policy, generally limited to \$100,000 (set in 1995) and 12 to 18 months duration) and the feasibility phase, which must be cost shared with a local sponsor. The feasibility phase follows the standard six-step planning process and concludes with recommended actions for Congressional authorization.

Planning Assistance to States (PAS): Section 22 of the Water Resources Development Act (WRDA) of 1974, as amended in 1992, provides authority for the Corps of Engineers to assist the States, local governments, and other non-Federal entities, in the preparation of comprehensive plans for the development and conservation of water and related land resources. Section 208 of the Water Resources Development Act of 1992 amended the WRDA of 1974 to include Native American Tribes as equivalent to a State. In recent years, the program has received limited/declining funding. The program can encompass many types of studies dealing with water resources issues.

Flood Plain Management Services (FPMS): The program's authority stems from Section 206 of the 1960 Flood Control Act (PL 86-645), as amended. 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 flood plains. The FPMS Program provides technical services and planning guidance that is needed to support effective flood plain management. The program develops or interprets site-specific hydrologic and hydraulic data on flood flows; flood depths or stages; flood-water velocities; and frequency of flooding. It can also provide information on natural and cultural flood plain resources of note.

On a larger scale, the program provides assistance and guidance in the form of "Special Studies" on all aspects of floodplain management planning. The program can also provide guidance and assistance for meeting standards of the National Flood Insurance Program and for conducting workshops and seminars on non-structural flood plain management measures, such as flood proofing. The program enables studies to be

conducted to improve methods and procedures for mitigating flood damages. Also, for preparing guides and pamphlets on flood proofing techniques, flood plain regulations, flood plain occupancy, natural flood plain resources, and other related aspects of flood plain management. In recent years, the program has received limited/declining funding.

Emergency Management Program PL 84-99: Rehabilitation and Inspection Program (RIP): The purpose of the Emergency Management (EM) program is to enable the Corps to prepare for, respond to, and help communities to recover from natural disasters and other national emergencies. Thus, the EM program reacts to flood events and focuses primarily on promoting resilience—that is, the ability of people and assets to return to pre-flood conditions.

The EM program also funds disaster preparedness activities, such as the inspection of levee systems enrolled in the USACE RIP program; emergency operations, including supplementing state and local flood-fighting efforts and the provision of emergency water supplies; and recovery activities, such as the repair or rehabilitation of eligible Corps-built and turned-over F&CSDR projects and non-federal F&CSDR projects enrolled in the RIP.

While the program is often used to repair levee systems to pre-flood conditions, non-Federal sponsors have the option to request that non-structural alternatives be formulated and evaluated. USACE cannot consider these options unilaterally. They must be specifically requested by non-Federal sponsors. Once requested, USACE will work with sponsors and other stakeholders to evaluate features that promote resiliency within the community and the natural systems.

Attachment 2 - Roles and Responsibilities for USACE Levee Safety Activities

Overview: the Corps of Engineers maintains a three-level decentralized organization - HQUSACE, MSC (regional division) and district. Each level will be staffed with qualified personnel in areas of flood risk management and design, construction, inspection and operations of levee systems and appurtenant structures, with appropriate training and experience in levee safety risk assessment, risk management, and risk communications. Each organizational level will have a Levee Safety Officer (LSO), Levee Safety Program Manager (LSPM) and Flood Risk Manager (FRM) with supporting organizations.

In general, USACE districts have the overall responsibility for execution of the studies and to either implement or to support actions by non-Federal partners as discussed in this paper. The studies will be undertaken in partnership with stakeholders, the nature of the partnership depending on the source of the inundation risk and likely flood risk management measures. Other USACE organizations such as: The Risk Management Center (failure modes analysis and risk assessment), Planning Center of Expertise (planning methodologies) and several of the research and development laboratories, will provide support for the program execution. HQUSACE manages the program from the national level, setting policies, prioritizing studies and actions, and ensuring appropriate support for the districts.

USACE district: The district is the action level in USACE, and therefore in general, is responsible for budgeting for, staffing, studies, and execution of solutions within the present authority of USACE.

1. The district performs the **screening** and is responsible for the screening report. In executing this task, the district engages an experienced risk assessment facilitator to help guide the activities and compiles data and executes the Levee Safety Screening Tool (LST) to compute the relative risk.
2. The USACE district communicates the assigned LSAC classification and inundation risk to the sponsor and responsible stakeholders. For USACE O&M levee systems the USACE districts leads the effort to communicate with the stakeholders and the community. For Federally Authorized- local O&M and Non-Federal levee systems the sponsor and responsible stakeholders lead and USACE will assist in the effort to communicate with the stakeholders and community. If the sponsor and local non-USACE officials choose not to inform the public the USACE district will make a direct public release of the LSAC and inundation risk output from the screening. After the release of the LSAC information, the USACE district will work with stakeholders to better define the roles of the stakeholders, and jointly plan for the next steps to be undertaken.
3. The district compiles an **appraisal** report using output from the screening and other readily available information. The appraisal report is forwarded to USACE approving officials.

4. The district works with stakeholders to formulate the ***Interim Risk Reduction Measures (IRRM)*** plans using output from the screening, advice from the RMC on risk assessments, and input from other sources of expertise such as the USACE research laboratories. As may become available, information from the Reconnaissance base condition risk assessment may also be used during IRRM development. Upon approval, the district executes those measures within USACE authorities and works with stakeholders for implementation of other non-USACE measures.
5. The district performs the ***reconnaissance phase*** of the feasibility study using output from the screening, baseline risk assessment with assistance from the RMC, and as appropriate, counsel and others in identifying, negotiating, and executing the feasibility study cost sharing agreement.
6. After receiving funding, the district performs the ***feasibility-phase*** study in partnership with the local sponsor and as appropriate, other stakeholders. The district accomplishes this task by forming a Product Delivery Team (PDT) with team members drawn from appropriate USACE Communities of Practice (CoP), RMC risk assessment expert, and other resources as needed. The feasibility-phase study for the Levee Safety program is patterned after the traditional GI program feasibility study with a specific focus on life safety.
7. Subsequent to Congressional authorization and appropriation, the district in partnership with the sponsor, implements the elements of the plan within USACE authorities, and works with local stakeholders in implementing the non-USACE elements of the plan.

USACE MSC: The MSC is the forward office of HQUSACE functioning as the regional managers of districts within their geographic areas. The MSC will work with the districts to ensure that the Levee Safety activities discussed above are effectively accomplished in the agreed upon priority order. The reports and decision documents developed by their subordinate districts are reviewed at the MSC level to enable quality assurance and a degree of consistency among the district's products. Selected MSC senior staff may, on occasion, serve as representatives on the Levee Safety Senior Oversight Group (LSOG) and may on occasion, make presentations to the national roll-up meeting of the levee safety expert cadre.

HQUSACE: HQUSACE provides executive direction and control with regard to the Levee Safety program activities of USACE. This includes managing the portfolio management process of routine and non-routine activities. Activities include setting priorities among studies and implementation actions from a national perspective, preparing the Levee Safety component of the USACE budget, and allocation of wedge and other appropriated funds to districts for execution of activities according to priorities. HQUSACE officials engaged in directly managing the Levee Safety program are the

Levee Safety Officer (LSO) and Levee Safety Program Manager (LSPM). The Levee Safety program falls within the sphere of activities of Flood Risk Management (FRM).

1. The LSO is the USACE Levee Safety Officer with the responsibility of ensuring that the inundation risk that exists for levee systems within the USACE portfolio does not present unacceptable risks. The HQUSACE Chief of Engineering and Construction is the LSO.
2. The Special Assistant for Dam and Levee Safety is day-to-day staff lead for directing and overseeing the USACE levee safety program. All HQUSACE responsibilities related to levee safety are directed and managed by the Special Assistant. The Special Assistant serves as the chair of the Levee Senior Oversight Group (LSOG).
3. The LSPM provides staff support for the Special Assistance in the areas of program management and budgeting for the Levee Safety Program. The LSPM also chairs the national roll-up cadre review of district LSAC reports and makes LSAC recommendations for the LSOG, and serves as the recording secretary for LSOG meetings.
4. The FRM functions as a coordination and integration catalyst for USACE flood risk management activities. These functions address internal USACE activities in these areas, and outreach to other Federal agencies, and NGO's.

Risk Management Center (RMC): The Corps of Engineers is establishing a risk-informed levee safety program management. The objective is to support effective evaluation, prioritization and justification of dam and levee safety decisions. In order to realize the full benefits of risk-informed program management, the RMC has been established to provide technical expertise and advisory services to assist in managing and facilitating the USACE-wide levee safety program. The RMC is a support organization located within the Institute of Water Resources (IWR). The director of the RMC reports through the IWR Director to the Director of Civil Works. The RMC has close ties to the Chief of Engineering and Construction and to the Special Assistant for Dam and Levee Safety. The RMC assists the Special Assistant in implementation of dam and levee safety policy using a combination of centralized staff as well as other national, regional, and district resources. Specific functions performed by the RMC **in support of HQUSACE levee safety program management.**

1. In assisting HQUSACE the RMC will coordinate with the SOG, MSC, and district offices to prioritize the Reconnaissance and Feasibility (Levee Safety Risk Management Studies) from a national perspective.
2. In further assistance to HQUSACE, the RMC will schedule and budget centralized resources needed for the execution of the Reconnaissance and LSRM studies based on the LSOG's prioritization and help with finding facilitators

for districts in their performance of the potential failure mode analysis (PFMA) and risk assessments.

3. The RMC will also assign a separate risk assessment expert(s) to assist with the internal agency technical review requirements.
4. The RMC will participate in, and occasionally lead, development of levee safety policies, procedures, and methodology.
5. The RMC will represent the Levee Safety program perspective with the USACE R&D community.

Flood Risk Reduction Planning Center of Expertise (FRM-PCX): The FRM-PCX will support district Product Development Team (PDTs) in the accomplishment of levee safety studies that are nationally significant, complex, large in scope, and/or are controversial by developing, maintaining and applying the best and most appropriate engineering, economic, and environmental expertise and considerations in response to the Nation's flooding. The FRM-PCX will be the coordinating office for the agency technical review of such studies, with coordination from the RMC for ATR of the risk assessment.

Silver Jackets Program (SJ): Silver Jackets teams are continuously operating, state-led, interagency teams working together to facilitate strategic life-cycle flood risk reduction at the state level. Through the Silver Jackets program, the U.S. Army Corps of Engineers, the Federal Emergency Management Agency, additional federal, state and sometimes local and Tribal agencies provide a unified approach to addressing a state's priorities. Often, no single agency has the complete solution, but each may have one or more pieces to contribute. The Silver Jackets team is the forum where all relevant agencies come together with the state to collaboratively plan and implement that interagency solution. Through partnerships, Silver Jackets seeks to optimize the multi-agency utilization of Federal resources, leverage additional state/local/Tribal investment, including funding, talent and information, and prevent duplication among federal and state agencies.

The program operates at the state level. A state Silver Jackets team includes representatives from the Corps and FEMA, the state National Flood Insurance Program coordination office, and the state hazard mitigation office as standing members, and lead facilitators. Other agency representatives may vary based on current team focus and activities, and a team may expand or contract depending on its focus areas and priorities. Silver Jackets teams have been established in 21 states; efforts to offer a team to an additional 28 states are ongoing. Resources for activities associated with any team are to be accomplished through the individual programs of each agency within the constraints of available budgets.

Stakeholders: Stakeholders will be partners with USACE to work toward a sustainable solution composed of complementary actions that reduce inundation risk and will have

the opportunity to participate throughout the entire process including the development of alternatives and identification of preferred solutions. The nature and responsibility of the stakeholders depends on pre-existing agreements, the source of the inundation risk and likely flood risk management measures. Responsible stakeholders such as sponsors and/or levee maintenance organizations will share responsibility for communicating risk. Affected stakeholders share responsibility for their individual decisions and should take actions regarding such personal aspects as insurance, evacuation planning and flood proofing.