

# Meeting the Criteria for Accrediting Levees on Flood Maps

## How-to-Guide for Floodplain Managers and Engineers

A levee is a manmade structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding. Levees include floodwalls and other flood-control structures (not including dams).

As part of the countywide flood mapping process, the Department of Homeland Security, Federal Emergency Management Agency (FEMA) and its State and local mapping partners need to review data associated with levees.

It is the levee owner's or community's responsibility to provide data and documentation to demonstrate that a levee meets the requirements of the National Flood Insurance Program (NFIP) as described in Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44 CFR Section 65.10) which you may view on FEMA's Web site at [www.fema.gov/plan/prevent/fhm/lv\\_fpm.shtm](http://www.fema.gov/plan/prevent/fhm/lv_fpm.shtm).

To be recognized as providing protection from the 1-percent-annual-chance flood on Flood Insurance Rate Maps (FIRMs), levee systems must meet *and continue to meet* the minimum design, operation, and maintenance standards of 44 CFR Section 65.10 of the NFIP regulations.

To help clarify the responsibilities of community officials, levee owners, or other parties seeking recognition of a levee for providing information on levees identified during a mapping project, FEMA issued Procedure Memorandum No. 34 (PM 34), *Interim Guidance for Studies Including Levees*, on August 22, 2005. PM 34 provided clarification of the existing procedures, which were provided in Appendix H of FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners*.

FEMA issued Revised Procedure Memorandum No. 43, *Guidelines for Identifying Provisionally Accredited Levees*, on March 16, 2007, which will allow mapping contractors and partners to issue preliminary and, in some cases, effective flood maps while communities and levee owners are compiling and submitting the full documentation necessary to show compliance with 44 CFR Section 65.10 requirements.

This document provides information regarding what types of information you'll need to submit during the mapping process for your levee to be recognized as providing protection on FIRMs, including a checklist and an index of further resources you may wish to consult.

### COMMUNITIES WITH LEVEES SHOULD KNOW:

- The participating community and/or other party seeking recognition or continued recognition must provide sufficient data showing that the levee provides protection from the 1-percent-annual-chance flood (also known as the base flood) for FEMA to recognize the levee on a FIRM.
- Communities *must* actively participate in the levee documentation process.
- Levees structures without sufficient documentation will not be credited as providing flood protection.
- Some levees may qualify to be shown as Provisionally Accredited Levees on the FIRM. Guidance regarding Provisionally Accredited Levees is available at [www.fema.gov/plan/prevent/fhm/lv\\_fpm.shtm](http://www.fema.gov/plan/prevent/fhm/lv_fpm.shtm).



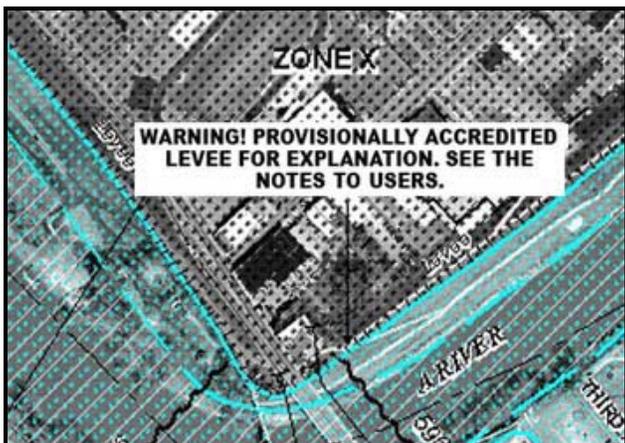
## HOW WILL FEMA MAP LEVEES?

FEMA's mapping requirements are designed to provide the people living and working behind the levee with appropriate risk information so that they may minimize damage and loss of life. It is important to note that FEMA does not evaluate the performance of a levee—this is the responsibility of the levee owner. FEMA is responsible for establishing mapping standards and risk determination zones and reflecting these determinations on flood maps.



### Levee Accredited on FIRM

An accredited levee is a levee that FEMA shows on a FIRM as providing protection from the 1-percent-annual-chance or greater flood. This determination is based on the submittal of data and documentation as required by the NFIP regulations. The area landward of an accredited levee is shown as Zone X (shaded) on the FIRM except for areas of residual flooding, such as ponding areas, which will be shown as Special Flood Hazard Area. Flood insurance is not mandatory in Zone X (shaded); however, it is strongly encouraged for all structures in areas behind levees.



### Provisionally Accredited Levee (PAL)

A PAL is a designation for a levee that FEMA has previously accredited with providing 1-percent-annual-chance flood protection on an effective FIRM, and for which FEMA is awaiting data and/or documentation that will show the levee's compliance with NFIP regulations. Before FEMA will designate a levee as a PAL, the community or levee owner will need to sign and return an agreement that indicates that documentation required for compliance with 44 CFR Section 65.10 of the NFIP regulations will be provided within a specified timeframe, depending upon the levee's status. Flood insurance is not mandatory for structures behind a levee with provisional status however, it is strongly encouraged.



### Levee Not Accredited or De-accredited on FIRM

If the levee is not shown as providing protection from the 1-percent-annual-chance flood on an effective FIRM, the levee is considered "not accredited" and is mapped as Zone AE or Zone A, depending upon the type of study performed for the area. If the levee was previously shown providing protection from the 1-percent-annual-chance flood on an effective FIRM but does not meet the Provisionally Accredited Levee (PAL) requirements or is no longer eligible for the PAL, FEMA will "de-accredit" the levee and the area landward of the levee will be remapped as Zone AE or Zone A (high-risk flood zones) depending on the type of study performed for the area. Flood insurance will be required for structures with a federally backed mortgage.



Design Criteria*	Section of the NFIP Regulations: 65.10(b)
<p><b>Description:</b> For levees to be recognized by FEMA, evidence that adequate design and operation and maintenance systems are in place to provide reasonable assurance that protection from the base flood exists must be provided. The following requirements must be met:</p>	
<p><b>Checklist for Design Criteria:</b></p>	
	<p><b>Freeboard.</b> Minimum freeboard required 3 feet above the Base Flood Elevation (BFE) all along length, and an additional 1 foot within 100 feet of structures (such as bridges) or wherever the flow is restricted. Additional 0.5 foot at the upstream end of levee. Coastal levees have special freeboard requirements (see 65.10(b)(1)(iii) and (iv)).</p>
	<p><b>Closures.</b> All openings must be provided with closure devices that are structural parts of the system during operation and designed according to sound engineering practice.</p>
	<p><b>Embankment Protection.</b> Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability.</p>
	<p><b>Embankment and Foundation Stability Analyses.</b> Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability. An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in the U.S. Army Corps of Engineers (USACE) manual, <i>Design and Construction of Levees</i>, (EM 1110-2-1913, Chapter 6, Section II), may be used.</p>
	<p><b>Settlement Analyses.</b> Engineering analyses must be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained. This analysis must address embankment loads, compressibility of embankment soils, compressibility of foundation soils, age of the levee system, and construction compaction methods. In addition, detailed settlement analysis using procedures such as those described in the USACE manual, <i>Soil Mechanics Design— Settlement Analysis</i> (EM 1100-2-1904), must be submitted.</p>
	<p><b>Interior Drainage.</b> An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than one foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters.</p>



**Operation Plan\* Section of the NFIP Regulations: 65.10(c)(1)**

**Description:** For a levee system to be recognized, the operational criteria must be as described below. All closure devices or mechanical systems for internal drainage, whether manual or automatic, must be operated in accordance with an officially adopted operation manual, a copy of which must be provided to FEMA by the operator when levee or drainage system recognition is being sought or when the manual for a previously recognized system is revised in any manner. All operations must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP.

**Checklist for Operation Plan:**

	<b>Flood Warning System.</b> Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials that will be used to trigger emergency operation activities; and demonstration that sufficient flood warning time exists for the completed operation of all closure structures, including necessary sealing, before floodwaters reach the base of the closure.
	<b>Plan of Operation.</b> A formal plan of operation including specific actions and assignments of responsibility by individual name or title.
	<b>Periodic Operation of Closures.</b> Provisions for periodic operation, at not less than one-year intervals, of the closure structure for testing and training purposes.
	<b>Interior Drainage Plan.</b> See below.

**Interior Drainage Plan Section of the NFIP Regulations: 65.10(c)(2)**

**Description:** Interior drainage systems associated with levee systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof. These drainage systems will be recognized by FEMA on NFIP maps for flood protection purposes only if the following minimum criteria are included in the operation plan.

**Checklist for Interior Drainage Plan:**

	<b>Flood Warning System.</b> Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials that will be used to trigger emergency operation activities; and demonstration that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system.
	<b>Plan of Operation.</b> A formal plan of operation including specific actions and assignments of responsibility by individual name or title.



	<b>Manual Backup.</b> Provision for manual backup for the activation of automatic systems.
	<b>Periodic Inspection.</b> Provisions for periodic inspection of interior drainage systems and periodic operation of any mechanized portions for testing and training purposes. No more than 1 year shall elapse between either the inspections or the operations.
<b>Maintenance Plan</b>	<b>Section of the NFIP Regulations: 65.10(d)</b>

**Description:** For levee systems to be recognized as providing protection from the base flood, the maintenance criteria must be as described herein:

**Checklist for Maintenance Plan:**

	Levee systems must be maintained in accordance with an officially adopted maintenance plan, and a copy of this plan must be provided to FEMA by the owner of the levee system when recognition is being sought or when the plan for a previously recognized system is revised in any manner.
	All maintenance activities must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance.
	This plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained. At a minimum, the plan shall specify the maintenance activities to be performed, the frequency of their performance, and the person by name or title responsible for their performance.

**Certification**      **Section of the NFIP Regulations: 65.10(e)**

**Description:** Data submitted to support that a given levee system complies with the structural requirements set forth in “Design Criteria” (paragraphs (b)(1) through (7) of the regulations) must be certified by a registered PE. Also, certified “as-built” plans of the levee must be submitted. Certifications are subject to the definition given in Section 65.2 of the NFIP regulations. In lieu of these structural requirements, a Federal agency with responsibility for levee design may certify that the levee has been adequately designed and constructed to provide protection against the base flood.

**Checklist for Certification Requirement:**

	All data submitted is certified by Professional Engineer or certified by a Federal agency.
	Certified as-built levee plans are included in the submittal.

## A NOTE ABOUT RISK AND FLOOD INSURANCE

It is important to note that levees are designed to provide a *specific level of protection*. They can be overtopped or fail in a larger flood events.

Levees also decay over time. They require regular maintenance and periodic upgrades to retain their level of protection. When levees do fail, they fail catastrophically. The damage may be more significant than if the levee was not there at all.

For all these reasons, FEMA strongly urges people to understand their flood risk, know their evacuation procedures, and protect their property by purchasing flood insurance.

## CHECKLIST INFORMATION

The checklist provided in this publication is meant to assist local officials and levee owners in gathering the documentation that will be required for FEMA to show a levee as providing base flood protection on the community's FIRM. Where possible, text from the actual NFIP regulations (44 CFR Section 65.10) was used.

The checklist is set up according to the appropriate paragraph of 65.10. For example, Design Criteria can be found in Paragraph 65.10(b):

Design Criteria*	Section of the FEMA Regulations: 65.10(b)
<b>Description:</b> For levees to be recognized by FEMA, evidence that adequate design and operation and maintenance systems are in place to provide reasonable assurance that protection from the base flood exists must be provided. The following requirements must be met:	

For a comprehensive description of each item in this checklist, please see Appendix H of the *Guidelines and Specifications for Flood Hazard Mapping Partners*. Locations of this resource, and other useful resources, are provided below.

## INDEX OF RESOURCES

This resource, and other levee-related information and materials, can be found at [www.fema.gov/plan/prevent/fhm/lv\\_intro.shtm](http://www.fema.gov/plan/prevent/fhm/lv_intro.shtm).

Procedure Memorandum No. 34, *Interim Guidance for Studies Including Levees*, can be found at [www.fema.gov/plan/prevent/fhm/lv\\_fpm.shtm](http://www.fema.gov/plan/prevent/fhm/lv_fpm.shtm).

Revised Procedure Memorandum No. 43, *Guidelines for Identifying Provisionally Accredited Levees*, can be found at [www.fema.gov/plan/prevent/fhm/lv\\_fpm.shtm](http://www.fema.gov/plan/prevent/fhm/lv_fpm.shtm).

Appendix H of the *Guidelines and Specifications for Flood Hazard Mapping Partners* can be downloaded at [www.fema.gov/plan/prevent/fhm/dl\\_cgs.shtm](http://www.fema.gov/plan/prevent/fhm/dl_cgs.shtm).

44 CFR Section 65.10 of the NFIP regulations can be downloaded at [www.fema.gov/plan/prevent/fhm/lv\\_fpm.shtm](http://www.fema.gov/plan/prevent/fhm/lv_fpm.shtm).

Flood insurance information can be found at [www.fema.gov/business/nfip](http://www.fema.gov/business/nfip) or on the NFIP's consumer site, [www.FloodSmart.gov](http://www.FloodSmart.gov).