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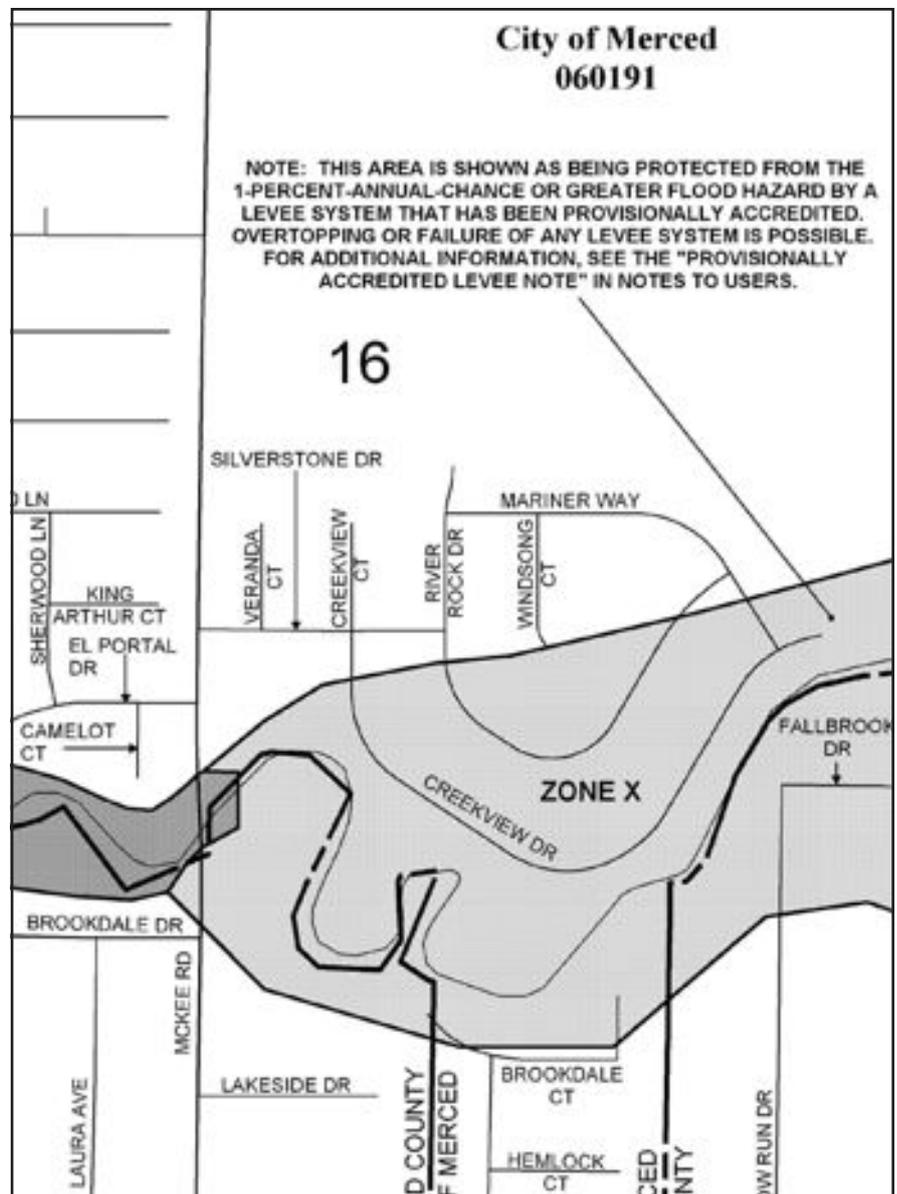
Life Behind Levees: an Overview and Update

Throughout history, mankind's interaction with water has been a love/hate relationship. We have loved to be near water for drinking, bathing, fishing, watering crops, navigating our ships, and just plain aesthetics. On the other hand we have hated the unpredictability of water rising up out of its banks or surging past its usual shorelines, flooding fields and homes and businesses, sometimes even scouring the land as clean as before human arrival and intervention. Our responses to flooding and attempts to "reclaim" land include ditching, damming, and diking.

In many parts of the country, reliance on levees has been a way of life for centuries. Low-lying areas on the "dry" side of the levees sprouted agricultural fields, grew towns and cities, or even became industrial hubs. Only relatively recently has the protection of levee systems begun to come under scrutiny, questioning the adequacy of the walls to prevent waters from the "wet" side from overtopping or destroying the levees and inundating the "dry" side.

Although the National Flood Insurance Program (NFIP) became law in 1968, it was not until 1986 that the managing agency issued regulations addressing protection offered by levees.

Extracted from the 2008 Merced County, California Flood Insurance Rate Map, this image contains a warning that levees do not provide fail-safe protection from flooding.



Provisionally Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by August 6, 2009. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at <http://www.fema.gov/business/nfip/index.shtml>.

Notes such as this one appear on Flood Insurance Rate Maps where Provisionally Accredited Levees may lull landowners and local regulators into a false sense of security. Mitigation and insurance are highly recommended in such areas.

At that time the managing agency was the Federal Emergency Management Agency (FEMA), created in 1979 to centralize all of the federal government's emergency management functions. 44 CFR 65.10 is entitled "Mapping of Areas Protected by Levee Systems", and establishes the minimum design, operation, and maintenance standards for a levee system that must be met before FEMA will acknowledge that

is greater) associated with the 100-year [1% annual chance] stillwater surge elevation at the site." But again, FEMA will not approve freeboard less than two feet above the stillwater surge elevation.

Besides freeboard requirements, engineering analyses must address embankment and foundation stability, levee settlement (which can reduce freeboard elevation), and interior drainage (to address evacuation of

"Clearly, just erecting a barrier to water is not adequate in and of itself."

the system offers sufficient protection from the 1%-annual chance flood event to map areas behind the levee as being outside of that base flood area.

For riverine levees, a minimum freeboard of three feet above the base flood elevation must be increased by an additional foot within 100 feet on each side of any location (not just bridges) on the "wet" side of the levee where the flow is constricted. While FEMA may approve some designs with lesser riverine freeboard, under no circumstances will it accept less than two feet of freeboard. For coastal levees, freeboard is to be established at "one foot above the height of the one percent wave or the maximum wave runup (whichever

interior floodwaters), and operation plans that include closure of levee openings, flood warning systems, and maintenance plans. Only when all factors are satisfactory to FEMA will it map an area as protected by the levee and outside of the Special Flood Hazard Area. Beyond the regulations, Appendix H to the *Guidelines and Specifications for Flood Hazard Mapping Partners* adds other protective requirements. Clearly, just erecting a barrier to water is not adequate in and of itself.

Supplementing the regulations and Appendix H, FEMA's series of Procedure Memoranda reflect the ongoing struggle to determine adequacy of levee structures to protect property from flooding.

- **Procedure Memorandum 34** (2005), "Interim Guidance for Studies Involving Levees": Establishes responsibility of community officials during the scoping of a flood study to identify levees for which they seek to establish protection from the 1% annual chance event
- **Procedure Memorandum 43** (2007, originally 2006), "Guidelines for Identifying Provisionally Accredited Levees": Allows for additional time to provide supporting data for full accreditation of a levee while the mapping process continues.
- **Procedure Memorandum 45** (2008), "Revisions to Accredited Levee and Provisionally Accredited Levee Notation": Revises "Notes to Users" on flood maps regarding the protection offered by Accredited Levees and Provisionally Accredited Levees to better communicate the true flood risk.
- **Procedure Memorandum 52** (2009), "Guidance for Mapping Processes Associated with Levee Systems": Provides guidance for mapping the landward side of levees beyond Appendix H of the Guidelines and Specifications for Flood Hazard Mapping Partners (including analysis with and without the levee) and provides a nationally consistent notification process to stakeholders regarding de-accreditation of levees.
- **Procedure Memorandum 53** (2009), "Guidance for Notification and Mapping of Expiring Provisionally Accredited Levee Designation": How to notify levee owners of impending certification expiration; re-mapping of areas impacted by accredited and de-accredited levee systems.
- **Procedure Memorandum 63** (September 2010), "Guidance for Reviewing Levee Accreditation Submittals": Improves and clarifies the levee review process as a "completeness check" for certification (not a determination by FEMA as to how the levee system will perform during a flood event). This recent memo describes a three-tiered review approach to allow for additional data to be requested at each level of review. FEMA will only accredit the levee on the NFIP maps when the full completeness check is finished.
 - **Tier One:** Certification by a licensed engineer; freeboard check

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- *Tier Two:* Compliance with local, state and federal regulation of levee operations; officially adopted operation and maintenance plans; floodplain analysis with and without the presence of the levee to determine true risk in case of breach.
- *Tier Three:* Levee system and cross reference check to ensure review of the complete system for accreditation; interior drainage analysis (topography, hydrologic and hydraulic analysis) to address the system's capacity to evacuate interior flood waters; structural design compliance with 44 CFR 65.10, including closure structure, embankment and foundation factors, and settlement; documentation of testing and inspection reports.

In acknowledgment of the possibility of failure, areas behind certified levees are now mapped as shaded Zone X, the 0.2% annual chance floodplain. Areas behind non-certified levees are mapped as "A" type zones, with flood insurance requirements. During Map

Modernization (prior to the current RiskMAP program), FEMA created new flood zones to address the temporary change in protection while levee systems are under repair. Zone AR affects areas behind a previously certified levee that is currently decertified while in the process of being restored. Mandatory flood insurance requirements apply in Zone AR since the area is no longer protected from the base flood; see 44 CFR 60.3(f) for determining base flood elevations in the various AR zones. Zone 99 is assigned when a protective system has reached satisfactory statutory completeness (and funds to complete the system are in place) to consider the levee system complete for insurance rating purposes. While flood insurance is still required, base flood elevations are not provided as the risk decreases in the process of reconstructing the protective system.

All of this adds up to telling us that not all levees provide protection from the 1% annual chance flood event. Check notes on the FIRM or DFIRM, contact your local community or regional floodplain manager, and document all research into the status of levee protection. *AS*



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