

# Flood Map Modernization Mid-Course Adjustment – Executive Overview

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**FEMA**



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### 1. Introduction

Map Modernization is a multiyear Presidential initiative supported by Congress that is directed at improving and updating the Nation’s flood hazard identification maps. These flood maps were initially intended to be used principally by insurance agents, floodplain managers, and others charged with implementing the National Flood Insurance Program (NFIP). However, over the years the flood maps have become essential tools for a much wider range of users, from builders and developers to real estate agents and lenders to local planners and citizens attempting to make informed decisions about the degree of flood risk faced by particular pieces of property.

As the initiative reaches the halfway point, FEMA has performed a mid-program evaluation that considered input from Congress, the U.S. Government Accountability Office (GAO), the Department of Homeland Security’s Inspector General (IG), and other stakeholders. As a result of this evaluation, FEMA is implementing changes that will result in providing better-targeted and more accurate flood data, while also producing digital flood maps for a significant portion of the Nation. As initially envisioned in 2003, Flood Map Modernization was focused on creating a digital flood layer for all communities at risk of flooding. The recommendations from stakeholders indicated a preference for FEMA to focus on developing flood maps that meet new higher standards for mapping and for a greater allocation of resources to those communities at greatest flood risk. States and professional organizations have continued to express this preference, realizing that it would result in a delay in lower-risk communities’ receiving a new map.

The mid-course adjustment described in this report will provide greater flexibility for FEMA to meet state needs and is estimated to result, at the end of the initiative, in a digital flood layer that covers 90 percent of the Nation’s flood risk. This mapping will have been based on factors such as population, flood history, growth potential, and other similar characteristics. More importantly, this mid-course adjustment will ensure that those communities at greatest flood risk will be less vulnerable to future flood events.

This approach will delay reaching the goal of having a complete national digital flood layer. Specifically, it is now estimated that at the end of the 5-year Map Modernization initiative:

- Digital flood map products will be available for 92 percent of the Nation’s population.
- 30 percent of the stream miles mapped will be based on new, updated, or validated engineering analysis, affecting 40 percent of the Nation’s population.
- Digital flood map products will cover 65 percent of the land area of the continental United States.

# Flood Map Modernization

In response to input from Congress and the GAO on Map Modernization, and based on experience gained in converting paper maps to digital format, midway through the initiative FEMA implemented an additional mapping standard related to the conversion of digital flood boundaries. This new standard, called the Floodplain Boundary Standard, requires matching the available flood boundary (from the paper map) to the best available topographic information and merging both into the digital format. This results in a digital map whose floodplain boundary line corrects any discrepancies in the paper map's boundary that existed either because topographic information was insufficiently detailed when the paper map was created or as a result of the conversion process.

Because many flood maps had been produced before this standard's adoption, FEMA determined that the implementation plan for Map Modernization should be adjusted to allow for touchups to the maps of those stream miles that do not meet the new standard. These touchups are relatively minor and require a mapping specialist to compare the flood boundary with the topography and make adjustments needed to ensure that the boundary follows the topography. FEMA remains committed to ensuring compliance with the Floodplain Boundary Standard as well as all the other standards set out in the *Guidelines and Specifications for Flood Hazard Mapping Partners* used in the development of flood maps.

Section 2 of this report provides background information on the NFIP and the Map Modernization initiative. Section 3 presents a brief overview of Map Modernization progress to date. Sections 4 and 5 describe the course adjustment and future directions, respectively, for Map Modernization.



**Figure 1.** In these sample flood map panels, the enhanced detail shown on the digital map (right) can be compared to the older paper map (left).

## 2. Background

### 2.1. Purpose of the National Flood Insurance Program

The U.S. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968 (P.L. 90-448). The NFIP was envisioned as a program that over time would provide management measures to reduce vulnerability to flood damage while providing a flood insurance safety net for individuals. Flood insurance was not generally available through the commercial markets, and remains so today.

The NFIP enables property owners in participating communities to purchase insurance as a protection against flood losses. A community's participation in the NFIP is voluntary and is based on an agreement between communities and the Federal Government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in floodplains, the Federal Government will make flood insurance available within the community.

The NFIP provides an alternative to continual outlays in Federal disaster assistance funds in two ways. First, the floodplain management and mitigation measures that are put in place in communities that participate in the NFIP operate to reduce future flood damage to buildings and their contents. Second, the flood insurance policies purchased by individual property owners not only help people recover from flooding more quickly but also partially shift the costs of flooding from the Federal taxpayers to those whose properties are at risk.

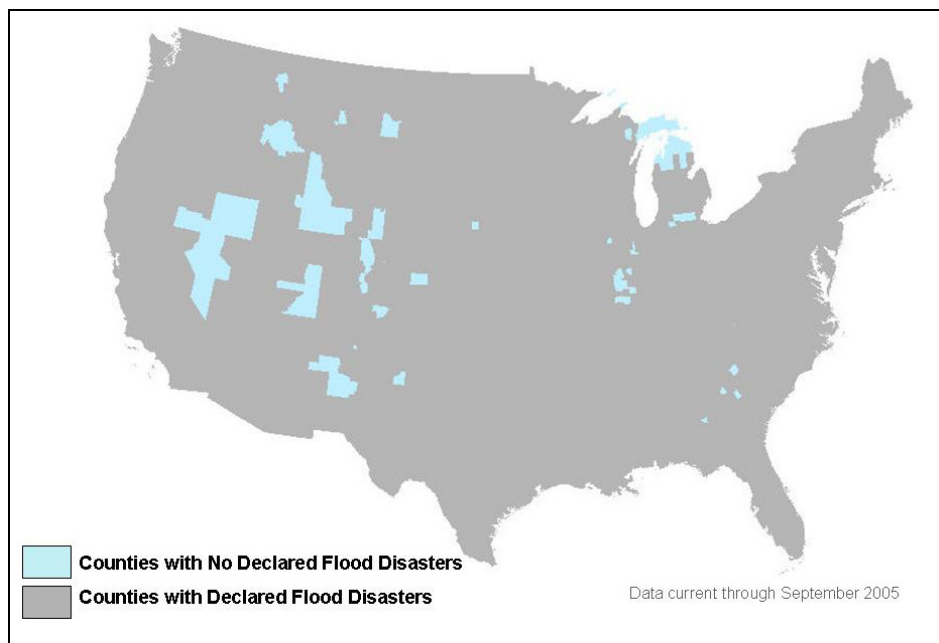


Figure 2. Presidential disaster declarations for floods are made throughout the Nation.

## Flood Map Modernization

To determine which areas are prone to flood hazard, the 1968 Act authorized the Federal Government “to identify and publish information with respect to all floodplain areas, including coastal areas located in the United States” that have floodprone areas and then “to establish or update flood-risk zone data in all such areas, and make estimates with respect to the rates of probable flood caused loss for the various flood risk zones for each of these areas.” Over the years, the NFIP developed several types of paper maps and related products to identify flood hazards in accordance with this direction, including detailed engineering studies of floodprone areas, maps of the floodplain boundary, zones of different levels of risk, maps of the floodway portion of the floodplain, and other information as needed.

### **2.2. Modernization of Flood Maps**

For 35 years FEMA, charged with administration of the NFIP, used the prevailing paper-based cartographic production methods when creating flood maps for the Nation. However, with the development of computer-based geographic information system (GIS) technologies, the paper mapmaking procedure has given way to an improved digital process.

The Map Modernization initiative was established to provide a technology-based, cost-effective, long-term process for updating, maintaining, storing, and distributing the flood risk information portrayed on the flood maps. A corollary intention is that engineering tools and analysis be used to update the flood maps so that they reflect physical changes that have occurred since the original mapping. Digital maps have tremendous advantages over paper maps, including improved and more detailed topographic detail, ease of modification and updating, electronic access and transmission, and lower long-term production and maintenance costs.

In addition to providing digital flood maps, Map Modernization was designed to provide for engineering updates, which include the update or validation of existing flood data or the development of new flood data for stream miles or areas not previously studied. In some cases the existing flood data is adequate, based on a current evaluation of the flood history within the community and whether significant changes have taken place that might have changed the severity of the flood hazard. Flood data that is adequate and that requires no update is considered validated.

Flood Map Modernization is a complex process that requires integrating engineering data, street information and other local data, and flood insurance rating information into a clear and concise map that can benefit multiple users. The process cannot be accomplished remotely, but requires a study team to meet with local officials in order to obtain the best data and better define the potential flood risk in the community. Ongoing community coordination is essential during the mapmaking process because ultimately the community must adopt and use the finished product as part of the community’s public process. Concurrently, the finished map product and supporting reports must be integrated into the Nation’s flood hazard inventory to ensure their long-term recovery and availability.



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The modernization of flood maps had its origins in the NFIP Reform Act of 1994 (P.L. 103-325). The Act mandated a 5-year review cycle for all flood maps, and established the Technical Mapping Advisory Council (TMAC) to provide FEMA with expert input on mapping issues. TMAC and FEMA worked collaboratively to shape a program for modernizing maps.

As a result of these efforts, FEMA developed an initial strategy for Map Modernization, and provided a vision for a 5-year, \$1 billion program. This approach targeted the creation of a digital flood layer for the Nation as the highest priority. This vision was formalized in 1997 and subsequently updated and refined in 1999 and 2001. Map Modernization was designed to achieve this vision, as well as to respond to Congressional intent and stakeholder input, by leveraging program resources through partnerships with other Federal agencies and State and local governments involved in the NFIP.

The goals of the Map Modernization initiative in 2001 as stated in *Modernizing FEMA's Flood Hazard Mapping Program: A Progress Report* were to convert approximately 80 percent of existing paper map panels to digital format with a high-quality base map, update 20 percent of the existing panels with new flood risk information while converting them to digital format, and add 13,700 completely new panels (also in digital format) to cover previously unmapped communities.

It should be noted that when FEMA developed the initial Map Modernization plan for updating the Nation's flood maps, a sampling of existing paper flood maps was the best means available to establish these estimates and baselines that were needed to develop the parameters of a nationwide rollout of this important initiative.

In 2003, funding for the Map Modernization program was initially appropriated and since then FEMA has been implementing a program consistent with that described in the 2001 progress report. However, as implementation of the initiative has progressed, FEMA's understanding of the Nation's mapping needs and how best to meet them has deepened.

Firstly, as FEMA gained experience in modernizing the maps, it became apparent that a better standard was necessary for transferring the existing flood boundaries from the paper maps to the much more exacting digital product. This led to the adoption of a new Floodplain Boundary Standard.

Secondly, as the initiative got underway, new procedures were developed to collect information on where flood data and mapping needed to be updated and improved. This additional, more accurate information and the mechanisms for obtaining continual input have led to a broader and more detailed picture of the Nation's mapping needs. These procedures also have served as an impetus for important State and local government involvement.

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Finally, since FY 2003, Congress, GAO, the IG, and initiative stakeholders have urged improved measures for evaluating and monitoring the Nation's flood risks and the progress made with Map Modernization. The insights gained from this input have resulted in more effective management of the initiative by FEMA, including the use of tools that help track progress, incorporate feedback, and monitor schedules and resources.

The result of this experience and stakeholder involvement is that FEMA now has a more-informed perspective on how to implement the Map Modernization initiative. The more flexible processes and enhanced products will support the identification of flood hazards in the Nation so that flooding impacts can be reduced.

### 3. Progress in Map Modernization

#### 3.1. Summary of Output to Date

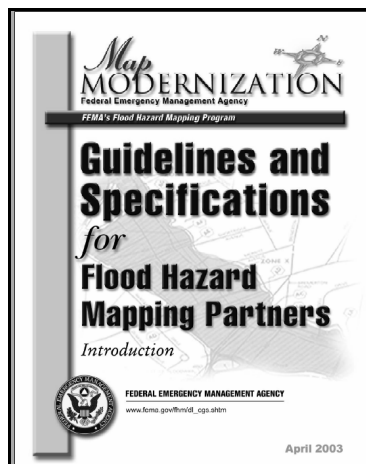
Progress in the production of modernized flood maps for the Nation can be assessed in three ways: (1) the percentage of the Nation's population with digital flood maps available; (2) the proportion of stream or coastal miles mapped that is based on new, updated, or validated engineering; and (3) the land area covered by digital maps. FEMA has developed and adopted these measurements as additional ways to assess progress towards initiative goals. These measures also respond to recommendations and requests from Congress, the Office of Management and Budget, GAO, the IG, and stakeholders. As of the end of FY 2005, FEMA estimates this progress in Map Modernization:

- Digital flood map products are available for 39 percent of the Nation's population.
- 11 percent of the stream miles mapped have been based on new, updated, or validated engineering analysis, covering 4 percent of the population.
- Digital flood map products cover 15 percent of the land area of the continental United States.

#### 3.2. Summary of Progress in the Mapping Process

With Map Modernization well underway, FEMA is managing a large and complex group of mapping partners, including other Federal agencies and State and local entities, that produce new flood maps directly for FEMA. FEMA provides the management system, guidelines, technology, and digital Web-based infrastructure necessary to support the Map Modernization initiative and to standardize the flood map study production cycle. The major advances FEMA has made in the process for modernizing the Nation's flood maps are listed below.

- Standardized Guidelines—A major achievement in coordinating and fostering accuracy and consistency in flood mapping nationwide was the release of FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners*. This document and its appendixes define the technical requirements and product specifications for flood hazard maps and related NFIP products, and also reflect changes to processes and products that have come about with Map Modernization, such as data capture standards and guidelines. When needed, FEMA updates the *Guidelines and Specifications* with input from and review by its mapping partners.
- Plans and Schedules—Another critical implementation aid developed by FEMA is the *Multi-Year Flood Hazard Identification Plan* (MHIP), which details FEMA's plan for prioritizing and delivering modernized flood maps for the Nation. A standardized procedure for refining the MHIP annually is based on input from States and other



**Figure 3. Guidelines and Specifications for Flood Hazard Mapping Partners helped standardize flood mapping nationwide.**

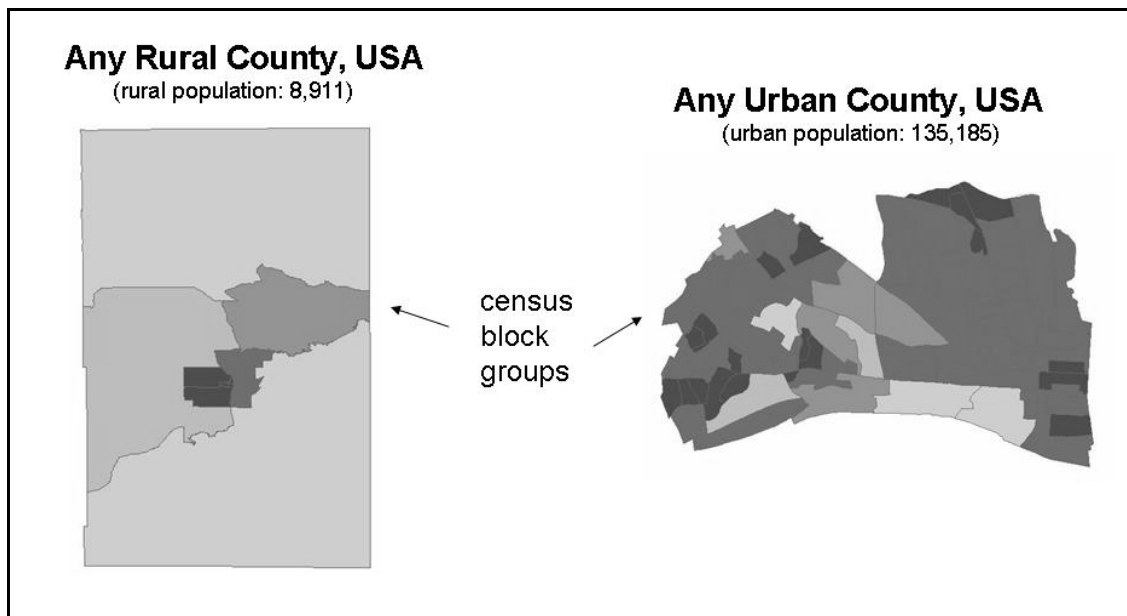
stakeholders. Through this procedure, FEMA maintains communication with those affected by the Map Modernization schedule and priorities.

- Flood Boundary Standard—Section 7 of FEMA’s *FY04–FY08 Multi-Year Flood Hazard Identification Plan* (Version 1.0, issued November 2004) established a Floodplain Boundary Standard that must be met in order for a map to be considered “modernized.” Guidance on implementation of the standard was issued to mapping partners in September 2005. This single step goes a long way toward alleviating the concerns of map users that the boundaries that were improperly drawn on the paper maps would simply be transferred to the digital maps. With the standard in place, this potential inaccuracy is avoided.
- Mapping Information Platform—In 2004, FEMA launched the Mapping Information Platform (MIP) as the foundation of the Web-based infrastructure that provides the ability to manage, extract, share, and produce mapping information for Map Modernization. The MIP is enhanced continually to provide upgraded engineering and mapping tools to FEMA’s mapping partners. FEMA is already seeing benefits of the MIP’s capacity for streamlining the process of turning data into useful information. The MIP will be a management platform for all flood map study projects nationwide, providing a base from which program managers and the public can determine the current status of Map Modernization. It is the site on which all of FEMA’s mapping partners will post and share data developed for all flood study projects.
- Risk-based Mapping Priorities—FEMA has instituted a ranking/prioritizing process (called “sequencing”) to determine which areas should be given the highest priority in receiving modernized maps. Using a series of such factors as population and growth, housing units, flood insurance policies and claims, and repetitive flood losses, every county in the Nation

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has been assigned a “risk factor.” This is the value used by FEMA to make decisions about effective allocation of study funds and priorities. In general, counties with the highest risk factor are high-priority targets for new maps.

- **Census Block Groups**—Beginning with FY 2006 funding, the sequencing described above will be based on prioritized census block groups rather than on prioritized counties. Block groups are the smallest geographic unit for which the U.S. Census Bureau tabulates sample data. This adjustment will allow for additional focus on those areas that comprise 90 percent of the Nation’s risk, and account for 92 percent of the Nation’s population.



**Figure 4. Flood mapping by census block group allows for more detailed attention to areas with higher flood risk.**

- **Stream Mile Measurements**—The higher level of detail and accuracy available with digital mapping techniques is enabling FEMA to shift to the use of stream miles (including shoreline for the open ocean, lakes, and ponds) as a measure of progress, rather than map panels. There are about 3 million stream and coastal miles of floodplains in the United States. Of those, about 1 million lie within Federal lands (such as national parks and military bases). Of the remaining 2 million that are or could be subject to some degree of flood risk due to development, about 1 million have been the subject of some type of flood hazard analysis.

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- At the outset of the NFIP, counting map panels was a convenient way of accounting for the flood maps in the Nation, because each of them covered a given area and the number remained fairly constant for a region. With GIS, however, the scale of a flood map can readily be tailored to show whatever details are needed for its purpose. Thus the size of the “panels” and the number of panels needed to cover the Nation are no longer constant. The number of stream and coastal miles in the Nation, on the other hand, is fixed and thus provides a standard against which progress can be measured. Using stream miles rather than rectangular panels also allows depiction of a specific potential hazard so that differing vulnerabilities to flooding can be targeted individually. Further, it permits more precise identification of areas that need additional attention, whether it be new flood data or a review of whether the mapping standards are being met along that reach of stream.

### 4. A Course Adjustment

To achieve the crucial goal of national coverage described above, it has become necessary to slightly modify FEMA’s approach to Map Modernization. During the initial planning for Map Modernization, FEMA determined that the initiative’s first priority should be the full digitization of all flood maps in the Nation. The plan was that, during the initiative, those maps that required engineering updates first would be converted to a digital format. Then, during the planned maintenance phase that would follow the initiative, they would be updated with new engineering data.

With 2 years of program experience and based on input from Congress, requests for engineering updates submitted through annual State business plans, adoption of the 2005 Floodplain Boundary Standard, and feedback from stakeholders, FEMA has decided that a course adjustment is warranted. FEMA has determined that delaying the goal of having a nationwide digital flood layer, in favor of having more focus on ensuring compliance with the 2005 Floodplain Boundary Standard and providing additional resources for engineering analysis, will better meet the near-term needs of the map users and the Nation. The enhancement of existing standards and the additional gains in product quality that will result from this adjustment also are responsive to Congressional direction that quality not be sacrificed for quantity in modernizing the flood maps.

Accordingly, in FY 2006, FEMA began prioritizing funding based on mapping 90 percent of the Nation’s flood risk using the census block group level of detail. This, combined with implementation of the 2005 Floodplain Boundary Standard, will address many of the more immediate needs of the program, even though it will lead to a delay in achieving a national digital flood layer.

By the end of the Map Modernization initiative, FEMA will have achieved its targets of success as described in Section 4.1, below. It bears noting that, based on the current success of the program and the active involvement of key stakeholders, it must be anticipated that future additional demands will be made for important engineering updates.

#### **4.1. Rationale for an Adjustment**

FEMA believes the “adjusted” course it is now implementing for Map Modernization is responsive to user and Congressional input and, based on improved data collected as part of the initiative, reflects a sound direction for the future. Recognizing that demand for new products may exceed current budgets, FEMA is attempting to balance several competing objectives. FEMA’s modified objectives for the initiative are (1) producing new digital products; (2) providing new, updated, or validated engineering analysis; and (3) integrating the 2005 Floodplain Boundary Standard into the digital maps.

## Flood Map Modernization

The new estimates of the digital products that will result from the new course direction (expressed on the basis of population) are:

- 92 percent of the Nation’s population will have new digital flood maps.
- 40 percent of the Nation’s population will have maps that encompass stream miles based on new, updated, or validated engineering analysis.

**Table 1: Comparison of Map Modernization Output, Original Course vs. Adjusted Course**

	Original Course	Adjusted Course
Percentage of mapped stream and coastal miles meeting 2005 Floodplain Boundary Standard	57%	75%
Percentage of mapped stream and coastal miles with new, updated, or validated engineering analysis	22%	30%
Percentage of population covered by maps with new, updated, or validated engineering analysis	15%	40%
Percentage of land area of continental United States covered by digital flood maps	100%	65%
Percentage of U.S. population covered by digital flood maps	100%	92%

Table 1 shows that, with the adjusted course, more engineering analysis will take place and there will be a higher level of compliance with the Floodplain Boundary Standard than would have been possible under the course originally intended. On the other hand, there will be a decrease in the total land area being mapped and the percentage of U.S. population receiving a digital map product.

The initial program vision was one of providing a digital flood layer for the entire Nation. The first objective, producing a digital layer, continues to be an important program goal because it will simplify the development, update, and distribution of flood maps, and provide immediate benefit to many areas that simply needed an improved base map or the benefit of being able to work with digital data. While this remains important, achieving 100 percent nationwide coverage will necessarily be delayed in favor of the vitally important goals of providing more detailed and accurate digital maps for those parts of the Nation that have the highest flood risk and ensuring that the floodplain delineations on the digital maps meet the Floodplain Boundary Standard. Further, FEMA’s decision to prioritize mapping needs based on census block groups allows for deployment



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of resources in a manner that optimizes benefits for the largest proportion of the Nation's population. This method of prioritization is also in keeping with Congress's continual encouragement of FEMA's partnership with State and local governments, who have indicated a preference for focusing on risk areas within counties.

In furtherance of the second objective, providing new, updated, or validated engineering analysis, FEMA has collected additional data about mapping needs as part of the Map Modernization initiative. Before Map Modernization it was generally understood that insufficient funding existed to provide timely, comprehensive updates to flood maps. Funding of the Map Modernization initiative has led to the development of State-led business cases and the creation of other tools that now are identifying a colossal demand for new flood data and mapping that far exceeds the scope that was originally envisioned. Slowing down the digital conversion and providing additional resources for engineering analysis will alleviate some of this demand.



**Figure 5. Accurate flood hazard maps are essential for the application of appropriate construction standards, such as elevation above the flood level.**

The third objective of the initiative is compliance with FEMA's 2005 Floodplain Boundary Standard. High quality has been an important goal throughout the Map Modernization effort. FEMA issued several standards to ensure that flood maps achieve an appropriate degree of

## Flood Map Modernization

consistency and quality, ranging from the engineering analysis to how maps are created to the final visual presentation of the map itself. As experience was gained with converting existing maps to digital format during Map Modernization, the need for a new standard for delineating the boundary of the floodplain was revealed.

Digital conversion of the paper map was the major impetus of this standard. If the task is to provide a digital representation of the existing map, then the map can simply be converted. However, when engineering data is being moved to the new digital platform there is necessarily an additional objective of ensuring that the data depicted corresponds to the configuration of the land surface and other ground-level conditions. FEMA determined that the best means of ensuring consistency in the flood data shown on the new digital maps was to include a step that entailed matching the existing flood boundary to the best available topographic information. Because this new standard was introduced halfway through the initiative, those stream miles mapped before the effective date of the new standard need to be checked, and touchups made to some of them, to ensure that they meet this essential standard.

### 5. Future Directions

At the end of the 5-year period of FEMA's Map Modernization initiative, with the course adjustment described above, the Nation can expect digital flood maps to cover 92 percent of the population of the United States and 65 percent of its land area. Overall, 75 percent of the mapped stream miles will meet the 2005 Floodplain Boundary Standard, meaning that the floodplain boundary on the maps is drawn using the best available topographic data. Of the stream miles mapped, 30 percent will be based on new, updated, or validated engineering analysis, covering 40 percent of the population.

FEMA will accomplish these final outcomes of the Map Modernization initiative provided that funding levels are maintained through FY 2008. No additional funding or schedule adjustments are required to meet FEMA's new targets as outlined in this report.

From the inception of the Map Modernization initiative and continuing through to the present, there always has been an identified need for a post-Map Modernization phase that will account both for map maintenance and for other unmet needs. This anticipated maintenance phase is not affected by FEMA's adjustments in implementation of the initiative. Specifically, areas that must be addressed during that phase include:

- Completion of a digital flood layer for the Nation, focusing on the low-risk areas that were not addressed during the Map Modernization initiative
- Meeting additional needs for new flood data that either had not been identified or could not be accommodated during the initiative
- Normal maintenance activities associated with the 5-year review mandated under Section 575 of the National Flood Insurance Reform Act of 1994 (every year, 20 percent of the existing maps will be evaluated to determine what revisions and updates are needed)
- Ensuring that, as technology improves, the modernized maps and the process FEMA uses to produce them evolve as well

The conversion from a paper map system to a digital system is a monumental step forward and revolutionizes how flood maps are maintained, stored, and distributed. The use of digital tools is resulting in dramatically improved efficiency in the process of making, using, and updating flood maps and also enhancing their accuracy.

The course adjustment FEMA is making in implementing the Map Modernization initiative will yield cost-effective benefits in terms of timely realization of digital flood map coverage for those areas of the Nation in which it is most needed. Over the long term, these modernized flood maps will more accurately portray flood hazards so that risks to life and property can be assessed and appropriate action taken. Flood maps support the creation of safer communities and contribute to effective risk management nationwide.