TECHNICAL MAPPING ADVISORY COUNCIL

TMAC

NATIONAL FLOOD MAPPING PROGAM REVIEW

June 2016

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TECHNICAL MAPPING ADVISORY COUNCIL

TMAC

National Flood Mapping Program Review

June 2016

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Authorization and Purpose

Pursuant to the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12), as amended (42 U.S.C. §§ 4001–4130), the charter filed with the Congress on July 29, 2013 formally established the Technical Mapping Advisory Council (TMAC). The TMAC was established in accordance with and operates under the provisions of the Federal Advisory Committee Act of 1972, as amended (FACA) (5 U.S.C. App 2).

Section 17 of the Homeowner Flood Insurance Affordability Act of 2014 (HFIAA) outlines the steps to be taken for the Federal Emergency Management Agency (FEMA) Administrator to certify that the National Flood Mapping Program results in technically credible flood hazard information in all areas where Flood Insurance Rate Maps (FIRMs) are prepared or updated.

This legislation also outlines the TMAC's role in this process, which is to provide a review of FEMA's National Flood Mapping Program for the Administrator's consideration when determining when to certify the program as technically credible. This report will be provided to the Congress by the FEMA Administrator if and when such a certification is made.

Section 17 of HFIAA
Flood Insurance Rate Map Certification

"The Administrator shall implement a flood mapping program for the National Flood Insurance Program, only after review by the Technical Mapping Advisory Council, that, when applied, results in technically credible flood hazard data in all areas where Flood Insurance Rate Maps are prepared or updated, shall certify in writing to the Congress when such a program has been implemented, and shall provide to the Congress the Technical Mapping Advisory Council review report."[1]

1 Homeowner Flood Insurance Affordability Act of 2014 (HFIAA) (Public Law 113–89, 128 Stat. 1021–22)

The purpose of this report is to provide FEMA with a review of the National Flood Mapping Program in regard to its ability to provide technically credible flood hazard information, when the Program is implemented as designed, in areas where FIRMs are prepared or updated.

This report also includes recommendations to FEMA, where appropriate, that will assist the agency to provide technically credible flood hazard data into the future.

Background

The TMAC used an agreed-upon method to review the National Flood Mapping Program, consisting of the following steps. The TMAC:

(1) Defined key terms and concepts from the legislation to assure a common understanding of and general agreement on these terms and concepts

(2) Reviewed information provided by FEMA describing the current National Flood Mapping Program

(3) Identified Subject Matter Experts (SMEs) and FEMA leaders on specific topics, from whom the TMAC received presentations, technical assistance, and other input on specific topic areas related to FEMA's National Flood Mapping Program

(4) Determined the method by which the National Flood Mapping Program would be reviewed, which included dividing the program into five areas:

- The National Flood Mapping Program Structure: The overall design and framework of the program, including the organizational structure of the agency, the partners it utilizes, the associated legislative requirements, the guidance and standards (G&S) it initiates and follows, and the maintenance of those standards
- The National Flood Mapping Program Process: The flood hazard identification and mapping process, from the Discovery process through the finalization of a new effective FIRM or FIRM update and the Letter of Map Change (LOMC) processes
- The National Flood Mapping Program Outputs: The products FEMA produces as a result of the Flood Hazard Mapping Program, including regulatory products (FIRM, Flood Insurance Study [FIS] Report, FIRM database, and LOMCs) and flood risk products (Flood Risk Report [FRR], Flood Risk Database [FRD], Flood Risk Map [FRM], and National Flood Hazard Layer [NFHL])
- The National Flood Mapping Program Quality Management Planning: The program's quality assurance/quality control (QA/QC) processes and requirements for contractors and other mapping partners that seek to assure quality outputs
- The National Flood Mapping Program Metrics: Currently, FEMA's metrics include four measures: NVUE (stream miles with New, Validated, or Updated Engineering), Awareness (percent of local officials who believe their community is at risk of flooding), Mitigation Action (number of communities that identify a mitigation action and take steps to move that action forward), and Deployment (the Risk Mapping, Assessment, and Planning [Risk MAP] footprint)

(5) Answered the question: When applied as designed, are the Structure, Process, Outputs, Quality Management, and Metrics sufficient to produce technically credible flood hazard data in areas where maps are developed or updated?

Cape Fear, North Carolina

Executive Summary

Summary of the Technical Mapping Advisory Council Review Report

The Nation's losses from flooding have been and continue to be devastating. Every year, the homes of thousands of families are destroyed or damaged by flooding, leaving the families permanently or temporarily displaced.

Flood-related damage between 1980 and 2013 totaled $260 billion, but the total impact to our Nation was far greater—more people lose their lives annually from flooding than any other natural hazard.[1]

1 FEMA, "Federal Flood Risk Management Standard (FFRMS)" (2015), http://www.fema.gov/federal-flood-risk-management-standard-ffrms; accessed January 5, 2016.

Legislation in Section 17 of the Homeowner Flood Insurance Affordability Act of 2014 (HFIAA) outlines the steps to be taken for the Federal Emergency Management Agency (FEMA) Administrator to certify that the National Flood Mapping Program results in technically credible flood hazard information in all areas where Flood Insurance Rate Maps (FIRMs) are prepared or updated.

The legislation also outlines the TMAC's role in this process, which is to provide a review of FEMA's National Flood Mapping Program for the Administrator's consideration when determining when to certify the resulting flood hazard data as technically credible. This report will be provided to the Congress by the FEMA Administrator, if and when such a certification is made.

The Technical Mapping Advisory Council (TMAC) compiled this report to answer the Congress' requirements to determine whether flood hazard data resulting from the National Flood Mapping Program is technically credible. First, this report identifies key terms and definitions, and then it reviews each facet of FEMA's program to provide a general overview of the entire program.

Pursuant to the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12), as amended (42 U.S.C. §§ 4001–4130), the charter filed with the Congress on July 29, 2013 formally established the Technical Mapping Advisory Council (TMAC). The TMAC was established in accordance with and operates under the provisions of the Federal Advisory Committee Act of 1972, as amended (FACA) (5 U.S.C. App 2).

Section 17 of HFIAA
Flood Insurance Rate Map Certification

"The Administrator shall implement a flood mapping program for the National Flood Insurance Program, only after review by the Technical Mapping Advisory Council, that, when applied, results in technically credible flood hazard data in all areas where Flood Insurance Rate Maps are prepared or updated, shall certify in writing to the Congress when such a program has been implemented, and shall provide to the Congress the Technical Mapping Advisory Council review report."

CREATION AND AUTHORITY OF TMAC

The TMAC is a federal advisory committee established to review the National Flood Mapping Program and make recommendations to FEMA on matters related to it.

The TMAC provides advice and recommendations to the FEMA Administrator to improve the preparation, presentation, and dissemination of FIRMs and flood hazard information. Among its specified statutory responsibilities, the TMAC examines performance metrics, standards and guidelines, map maintenance activities. It partners with state, tribal, and local communities on mapping activities, interagency coordination, and leveraging, and to address other requirements mandated by the authorizing Biggert-Waters Flood Insurance Reform Act of 2012 legislation.

The purpose of this report is to provide FEMA with a review of the National Flood Mapping Program in regard to its ability to provide technically credible flood hazard information, when the program is implemented as designed, in areas where FIRMs are prepared or updated.

This report also includes recommendations to FEMA, where appropriate, that will assist the agency in providing technically credible flood hazard data into the future.

Local, State and FEMA representatives assist and advise homeowners about flood map updates at the Advisory Base Flood Elevation community meeting in Wimberley, TX, August 26, 2015

FIVE AREAS OF PROGRAM REVIEW

The TMAC determined the method by which the National Flood Mapping Program would be reviewed, which included dividing the program into five areas:

(1) The National Flood Mapping Program Structure: The overall design and framework of the program, including the organizational structure of the agency, the partners it utilizes, the associated legislative requirements, the guidance and standards (G&S) it initiates and follows, and the maintenance of those standards

(2) The National Flood Mapping Program Process: The flood hazard identification and mapping process, from the Discovery process through the finalization of a new effective FIRM or FIRM updates.

(3) The National Flood Mapping Program Outputs: The products FEMA produces as a result of the Flood Hazard Mapping Program, including regulatory products (FIRM, Flood Insurance Study [FIS] Report, FIRM database, and Letters of Map Change [LOMCs]) and flood risk products (Flood Risk Report [FRR], Flood Risk Database [FRD], Flood Risk Map [FRM], and National Flood Hazard Layer [NFHL])

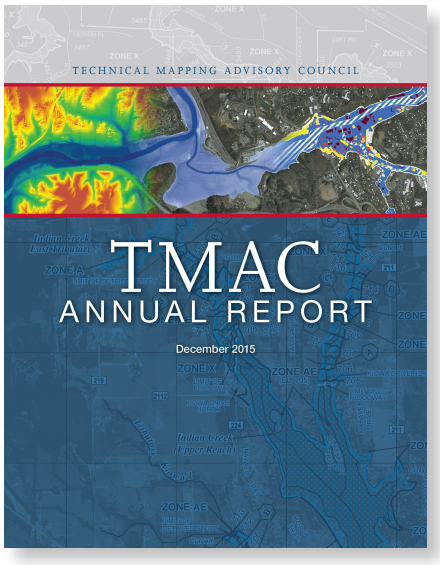
(4) The National Flood Mapping Program's Quality Management Planning: The program's quality assurance/quality control (QA/QC) processes and requirements for contractors and other mapping partners to assure quality outputs

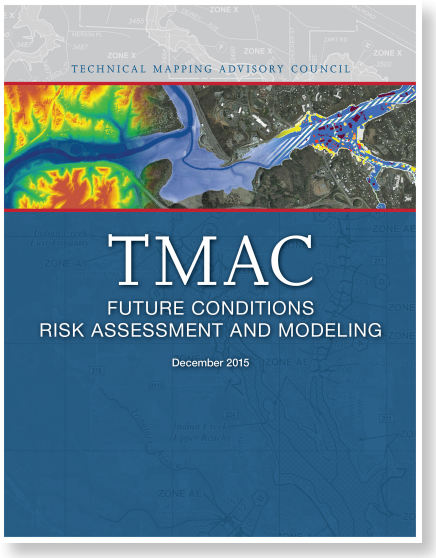
(5) The National Flood Mapping Program's Metrics: Currently, FEMA's metrics include four measures: NVUE (stream miles with New, Validated, or Updated Engineering); Awareness (percent of local officials that believe their community is at risk of flooding); Mitigation Action (number of communities that identify a mitigation action and take steps to move that action forward); and Deployment (the Risk Mapping, Assessment, and Planning [Risk MAP] footprint)

The TMAC answered the following question: When applied as designed, are the program's Structure, Process, Outputs, Quality Management, and Metrics currently sufficient to allow the production of technically credible flood hazard data in areas where maps are developed or updated? To remain technically credible in the future, TMAC suggests 14 recommendations throughout this report.

TMAC finds the National Flood Mapping Program, when applied as designed, supplies technically credible flood hazard data in areas where Flood Insurance Rate Maps are prepared or updated.

FEMA supports outreach for Hurricane Sandy in Staten, Island, New York November 18, 2012





Full TMAC reports are available for download http://www.fema.gov/tmac.

ALIGNMENT WITH OTHER RECOMMENDATIONS AND REQUIREMENTS

In 2015, the TMAC produced two reports as required by BW-12:

- An annual report containing recommendations to improve the effectiveness of the National Flood Mapping Program, and
- A future conditions risk assessment and modeling report containing seven overarching recommendations regarding the inclusion of future conditions in flood hazard data developed by FEMA.

Together, these reports contained the TMAC's recommendations to FEMA resulting from 2014-2015 TMAC efforts, including meetings, Subject Matter Expert (SME) presentations, and research; and through application of the technical expertise of TMAC members on aspects of FEMA's mapping program.

Through BW-12, FEMA's mapping program became authorized in its own right for the first time. The National Flood Mapping Program authorized by the Congress went much further than past National Flood Insurance Program Reform Acts. It tasked FEMA with updating and maintaining the nation's flood maps and flood risk information, required minimum datasets to be developed and published, and directed minimum activities to be performed. The Congress established minimum parameters for what would be deemed necessary and credible through the authorization of such a program.

Recommendations related to Other Recommendations and Requirements to continue to create technically credible products into the future:

1. FEMA should adopt TMAC's 2015 recommendations that relate to the National Flood Mapping Program's technical credibility from the TMAC 2015 Annual Report. These are summarized in Appendix A.
2. FEMA should adopt the future conditions recommendations from the 2015 TMAC Future Conditions Risk Assessment and Modeling report. These are listed in Appendix B.
3. FEMA should complete the implementation of the statutory requirements of the National Flood Mapping Program as summarized in Appendix C.

RECOMMENDATIONS TO CREATE TECHNICALLY CREDIBLE PRODUCTS INTO THE FUTURE

As the nation's population grows and new development shifts to currently unpopulated areas, climate changes continue to change weather patterns and impact flood risk, and other natural and manmade changes occur, FEMA must adapt the National Flood Mapping Program to ensure the flood hazard data and products created from those data remain technically credible. Therefore, the TMAC recommends that FEMA incorporate the following recommendations to create technically credible products into the future:

STRUCTURE RECOMMENDATIONS

Recommendations to the Structure of the National Flood Mapping Program to continue to create technically credible products into the future:

4. FEMA should continue to enhance communication and transparency with program stakeholders by, for example, including organizational and contact information on the Internet.
5. FEMA should investigate offering multi-year program management grant periods (versus annual) to Cooperating Technical Partnerships (CTPs).

PROCESS RECOMMENDATIONS

Recommendations Related to the National Flood Mapping Program Processes to continue to create technically credible products into the future:

6. FEMA should facilitate, partner, and leverage current high resolution topographic data (e.g., Light Detection and Ranging [LiDAR] data, other new and emerging technologies).
7. FEMA should work with the Congress and other partners to examine ways to shorten the study process, including the time added to the mapping process by QRs, KDPs, and legislated due process, as identified in TMAC's 2015 Goal 2 Annual Report Recommendation number 11.
8. FEMA should move to a database-derived display, as outlined in the TMAC 2015 Annual Report Recommendation number 16.

OUTPUT RECOMMENDATIONS

Recommendations to the National Flood Mapping Program Outputs to continue to create technically credible products into the future:

9. FEMA should work to identify residual risk areas behind levees and other flood control structures and downstream of dams.

10. For non-accredited levees, FEMA should replace the Zone D designation in levee-protected areas with risk zones that are more appropriate for the level of risk.

METRIC RECOMMENDATION

Recommendation for Modifications to Metrics to provide technically credible products into the future:

11. FEMA should evaluate the current metrics to better measure the efficient production, valid inventory, and stakeholder acceptance of the National Flood Mapping Program. TMAC recommends that FEMA should:
    A. Discontinue the current Deployment and Mitigation Action metrics and replace them with more effective measures, and

B. Focus revised metrics on measuring the quality and quantity of flood hazard and risk products delivered to communities.

Recommendation for New or Revised Metrics to continue to create technically credible products into the future:

12. FEMA should have an inventory metric that reports quantity, quality, and time aspects on national, regional, tribal, state, and watershed levels:
    A. Quantity: Quantity should be tracked through the life of a floodplain from no study through to detailed study. Statistics should be provided annually.
    B. Quality: Quality should be measured by retaining the existing NVUE metric of the current inventory and adding an NVUE metric for coastal flood hazard miles.
    C. Time: Timing should be measured from Discovery to the issuance of Preliminary maps and from the issuance of Preliminary maps to Effective maps for active projects.

13. FEMA should have a metric that shows progress towards meeting a digital platform goal by area of the nation to compliment FEMA's current population metrics. This metric could include the total area of the country, as well as progress towards Goal 3 and Recommendation 16 in the TMAC 2015 Annual Report.

14. FEMA should evaluate the benefits and costs and its value to the nation as a result of different levels of funding to the National Flood Mapping Program.

Key Terms and Phrases

A common understanding of key terms and phrases is needed to interpret the Congress' intent in its legislative directives. Below is the authorizing legislation for this report with the key terms and phrases highlighted, followed by the TMAC's general understanding and definition of these items.

> *The Administrator shall implement a* **flood mapping program** *for the National Flood Insurance Program, only after review by the Technical Mapping Advisory Council, that, when applied, result in* **technically credible flood hazard data** *in* **all areas where Flood Insurance Rate Maps are prepared or updated***, shall certify in writing to the Congress when such a program has been implemented, and shall provide to the Congress the Technical Mapping Advisory Council review report.*

Table 1. Key Terms and Phrases

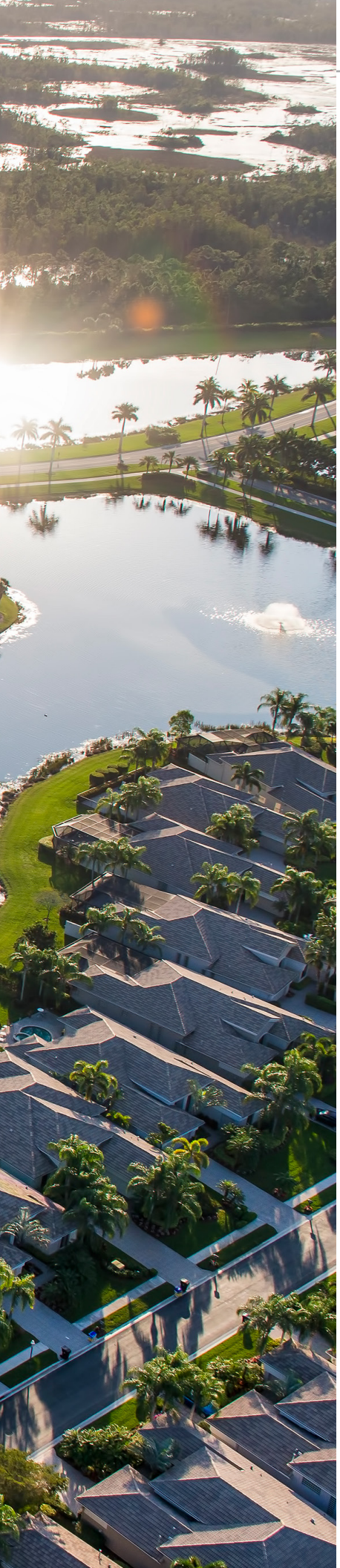
LEGISLATIVE LANGUAGE	TMAC DEFINITION
The National Flood Mapping Program	The National Flood Mapping Program has undergone many revisions since the Congress initiated the program in 1973. The first major updates occurred starting in 2003 when the Congress funded FEMA to update the flood hazard maps nationally from a paper-based system to a digital system for a large portion of the nation (Map Modernization). The second major update occurred in 2009 when FEMA began to transition from Map Modernization to Risk MAP. In 2012 and 2014, the Congress directed FEMA to evolve its program to be more risk-based and initiated other significant changes to the mapping program (National Flood Insurance Program [NFIP] Reform). Major updates will continue to occur in the future. TMAC considers the National Flood Mapping Program to be a single mapping program that does not change through realignment via Map Modernization, Risk MAP, or other future iterations of the program. The program is evolving as science and customer needs change over time. TMAC also considers the National Flood Mapping Program to include both the regulatory and non-regulatory elements of the program. Regulatory products include the FIRMs, flood profiles, and narrative that describe the 1-percent-annual-chance water surface elevation and boundary. Non-regulatory products are all products that are not regulatory in nature (FRM FRD, and FRR).
Technically Credible Flood Hazard Data	TMAC considers flood hazard data to be technically credible if the products show quality flood hazard information to the extent possible given the level of study and available data. Furthermore, technically credible flood hazard data is developed using computer models and up-to-date ground elevation data that result in realistic flood characteristics. The final product submitted to FEMA is sealed by a Professional Engineer.
All Areas Where Flood Insurance Rate Maps are Prepared or Updated	TMAC considers all areas where FIRMs are prepared or updated to include both first time mapping and updates to current maps, including all floodplains that drain a drainage area of greater than one square mile where the floodplain is not on public lands, such as U.S. Forests, State game lands, and Department of Defense training facilities. TMAC further considers that this definition applies to products initiated as of July 2016 and does not apply to products produced before July 2016.

LEGISLATIVE LANGUAGE	TMAC DEFINITION
	OTHER IMPORTANT TERMS AND CONCEPTS
Quality	TMAC considers quality to address the accuracy, precision, resolution, and uncertainty associated with data, models, and study methods that yield the final products, including published flood hazard information. TMAC realizes that quality comes at a cost, both in terms of resources required and time required, and that these costs should be compared with benefits.
Best Value	FEMA must strive for the best value for the nation when disseminating flood hazard information by employing different types or levels of analyses. Users have different needs, flood characteristics vary, and FEMA has constraints that affect the level of effort and resources that can be devoted to flood hazard mapping for any given location and situation. For example, flood hazard mapping in dense urban areas is quite different from flood hazard mapping in sparsely-populated rural areas. TMAC considers best value to be technically credible mapping products that yield the greatest expected benefits in relation to expected costs when considering existing and future development conditions while still creating technically credible products.
Concept of an Ongoing Mapping Program	TMAC recognizes that the mapping program can never be fully completed. Currently, FEMA has mapped 25% to 30% of the floodplains that drain a drainage area over one square mile that reside on non-public lands, and 100% of the populated coastal areas are being mapped. In addition, of the miles mapped, 5% to 10% of the streams have computer models and ground elevation data. Once complete coverage of an area is obtained, significant maintenance is required to maintain technically credible data due to: 1) changes in the nation's understanding of the science of flooding, and 2) population shifts that occur that then require a higher level of study for a particular flooding source, and 3) impacts of climate change on Sea Level Rise (SLR) and intensity of hurricanes.

Acronym List

3DEP	3D Elevation Program
BFE	Base (1-percent-annual chance) Flood Elevation
BW-12	Biggert-Waters Flood Insurance Reform Act of 2012
CERC	Community Engagement and Risk Communication
CNMS	Coordinated Needs Management System
CoP	Community of Practice
CTP	Cooperating Technical Partner
DHS	Department of Homeland Security
FACA	Federal Advisory Committee Act of 1972
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FIMA	Federal Insurance and Mitigation Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FRD	Flood Risk Database
FRM	Flood Risk Map
FRR	Flood Risk Report
G&S	Guidelines and Standards
GIS	geographic information system
HFIAA	Homeowner Flood Insurance Affordability Act of 2014
HUC8	Hydrologic Unit Code 8
IDS	Intermediate Data Submission
IPT	Integrated Project Team
KDP	Key Decision Point
LAMP	Levee Analysis and Mapping Procedures
LiDAR	Light Detection and Ranging
LOFD	Letter of Final Determination
LOMA	Letter of Map Amendment
LOMC	Letter of Map Change
LOMR	Letter of Map Revision
LOMR-F	Letter of Map Revision based on Fill
LOMR-FW	Letter of Map Revision in the Floodway
MIP	Mapping Information Platform
MSC	Map Service Center
NAPA	National Academy of Public Administration
NFHL	National Flood Hazard Layer
NFIP	National Flood Insurance Program
NIBS	National Institute of Building Sciences
NOAA	National Oceanic and Atmospheric Administration
NVUE	New, Validated, or Updated Engineering
P4	Project Planning and Purchasing Portal
PM	Program Management
QA/QC	Quality Assurance/Quality Control
QR	Quality Review
Risk MAP	Risk Mapping, Assessment, and Planning
SFHA	Special Flood Hazard Area
SLR	Sea Level Rise
SME	Subject Matter Expert
SRP	Scientific Resolution Panel
SOMA	Summary of Map Actions
SDN	Technical Support Data Notebook
TMAC	Technical Mapping Advisory CouncilTSDN Technical Support Data Notebook
USACE	U.S. Army Corps of Engineers
USGCRP	U.S. Global Change Research Program
USGS	United States Geological Survey

Source: Thinkstock Photos



Section 1: Review of FEMA'S National Flood Mapping Program

STRUCTURE

The TMAC reviewed the Structure of the current Flood Hazard Mapping Program, now known as Risk MAP, and its relationship to producing technically credible flood hazard data in areas where FIRMs are prepared or updated. This effort included a review of the overall design and framework of the program, the associated legislative requirements, the organizational structure of the agency, the partners it utilizes, the G&S it implements and follows, and the maintenance of those standards.

The architecture of the NFIP includes four intertwined program areas: floodplain identification and mapping, floodplain management, flood insurance, and flood mitigation (see Figure 1). Although the program has grown and evolved since its infancy, flood hazard identification and mapping remains the foundation supporting floodplain management, flood insurance, and mitigation.

The Risk MAP process focuses on engaging state, tribal, and local governments and stakeholders in evaluating the need for map updates. Updates are prioritized with substantial community input and draft documents are shared multiple times for local government review. A public review is also

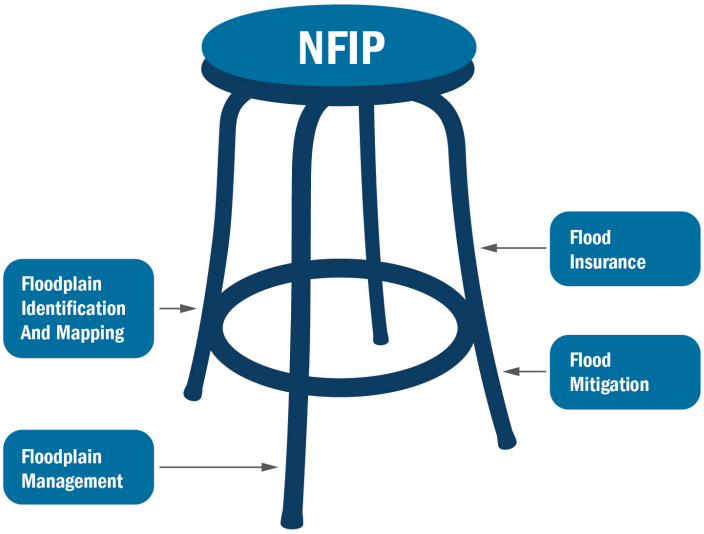


Figure 1. Components of the National Flood Insurance Program

This word cloud represents key words and themes from all of the participants at the 2015 Public-Private Partnerships Conference.

conducted. FEMA conducts updates through agreements with other federal agencies and Cooperating Technical Partnerships (CTPs) with state, tribal, local, or other governmental entities, such as water management or drainage districts and through contracts with professional engineering firms. As these mapping partners play a crucial role in the successful implementation of the National Flood Mapping Program, TMAC finds that, to create technically credible flood hazard data, FEMA should use CTPs, Federal agencies, state governments, local and tribal governments, private contractors, and non-governmental organizations to allow program flexibility as program requirements change.

The technical credibility of the National Flood Mapping Program is centered on creating and updating flood hazard information balancing the best value for the nation with the appropriate science and data provided by licensed professionals. The program operates based upon G&S that are vetted, peer-reviewed, made available for public comment, and published — all of which improve the consistency, efficiency, and transparency of mapping activities and enhances public engagement. The G&S define the processes for flood hazard analysis, map production, and related Risk MAP programmatic activities.

> The TMAC finds the Program Structure, when followed, results in technically credible flood hazard data in areas where FIRMs are prepared or updated.

PROCESS

The U.S. Department of Housing and Urban Development began preparing maps delineating flood hazards in support of the NFIP soon after the 1968 establishment of the program, which was then transferred to FEMA upon its creation in 1979. Risk MAP is the current FEMA program under which flood hazard information is produced and disseminated. The National Flood Mapping Program is synonymous with the "M" in Risk MAP. Flood hazard information is constantly in need of updating.

TMAC reviewed in detail the typical avenues or processes for changing or refining regulatory flood hazard information: 1) FEMA initiates a project; 2) States, tribes, communities, or individuals submit new study data through the Letter of Map Revision (LOMR) process; and 3) States, tribes, communities, or individuals submit data to refine the flood hazard status of individual structures or small geographical areas through the Letter of Map Amendment (LOMA), Inadvertent Inclusion in the Floodway (LOMR-FW), or Letter of Map Revision based on Fill (LOMR-F) processes. FEMA also produces non-regulatory products as part of the Risk MAP program; there is no defined protocol for updates to those products.

FEMA-initiated projects follow the Risk MAP program process to assess, at a watershed scale, flood study needs and simultaneously gather information about potential mitigation actions to reduce risk. The Risk MAP project process (see schematic shown in Figure 2) starts with Project Planning and may end there or at any phase in the process. Currently, under the Risk MAP program, any regulatory product project initiated by FEMA begins by assessing resources and needs (Discovery) for the entire designated watershed.

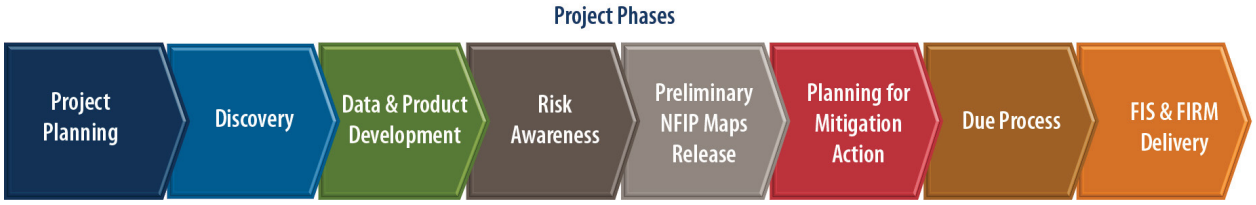


Figure 2. Risk MAP Project Phases

Embedded within the Risk MAP project phases are Key Decision Points (KDPs), which are "pauses" in the project to decide if the next step will be taken. There are also eight Quality Reviews (QRs) (see the Quality Management Planning section) for regulatory products and documentation. These QRs must be passed for the project to proceed.

There are statutory due process requirements for regulatory projects that ensure that public comment is solicited and addressed. HFIAA also established two

additional, one-month community review periods: one for proposed model review, and one to provide additional data after viewing draft product data.

The protocol for KDPs includes a window of time to submit the KDP documentation to the FEMA Regional Office, and time for the Region or FEMA Headquarters to review. The time from KDP submittal to decision whether to proceed with the project could take a month; in practice, however, the decision is taking much less time. (KDPs also play into the timing of funding decisions, which is outside of the focus of this report.)

FEMA has established a maximum turnaround time for most of the QRs, varying between 14 days and 60 days depending on the QR. Due process mandated by legislation is a fixed time period. Based on the potential and mandated turn-around time that is built into the regulatory product process, QRs account for 5 months, KDPs on average account for 1 month, legislated due process takes up to 14 months, and the required Federal Register publication typically takes 2 months, for a potential total of 23 months for review and due process.

The LOMR process provides states, communities, tribes, and individuals an avenue to submit new study data and update the flood hazard information. LOMRs that are approved are incorporated into the digital flood hazard layers of the National Flood Hazard Map, which increases transparency and provides a seamless representation of the Special Flood Hazard Area (SFHA, or 1% annual chance floodplain). However,

NFHL incorporation is only possible where the digital flood hazard data has been developed.

The LOMA, LOMR-FW, and LOMR-F processes serve primarily to establish the flood zone for a parcel, a portion of a parcel, or for specific buildings. For all three processes, it is necessary to have ground elevation data that can be compared to the Base (1-percent-annual chance) Flood Elevation (BFE); for a successful application, ground elevations must meet or exceed the BFE. There are now hundreds of thousands of LOMAs, LOMR-FWs, and LOMR-Fs. Each time FIRMs and/or FISs are updated, all of the LOMAs, LOMR-Fs, and LOMR-FWs in the vicinity of the flood hazard must be reviewed to determine whether they remain valid.

In its review of the National Flood Mapping Program Process, TMAC found that:

- FEMA continues to utilize the paper cartographic-driven process in constructing FIRMs, which is time-consuming and adds expense to the process.
- FEMA has modified its policy on the size of project watersheds (Program Standard ID 17), so that a project watershed can be smaller than the Hydrologic Unit Code 8 (HUC8), which was the original requirement for Risk MAP projects. This modification helps avoid a number of problematic issues encountered when attempting to apply the Risk MAP goals at the large geographic scale of most HUC8s in the United States.
- The Project Planning phase, when FEMA engages its state, tribal, regional partners, and CTPs, benefits the program by engaging active partners and gaining local insights, which is a foundation for acceptance of flood hazard and risk information.
- Community engagement at each project phase is critical to the successful adoption of the flood products; in particular, the discussion of proposed models is needed while FEMA continues to develop guidelines for the use of various coastal and riverine models as they become available.
- FEMA Program Standard ID 62, which requires that new or updated flood hazard data used for the regulatory products must be supported by modeling or sound engineering judgment and all regulatory products must be in

agreement, is an appropriate standard that will support the credibility of the mapping products.

- Long flood study process times jeopardize technical credibility. A balance between community engagement with due process and time for product QA/QC is needed.
- The Scientific Resolution Panel (SRP) provides an effective process for resolving disagreements between stakeholders and FEMA.

> The TMAC finds the National Flood Mapping Program Process, when followed, results in technically credible flood hazard data in areas where FIRMs are prepared or updated.

OUTPUTS

TMAC reviewed the regulatory and non-regulatory flood hazard products developed by FEMA and its mapping partners through the Risk MAP program, the users and uses of those products, and the connection to products developed by other Federal agencies. FEMA provides flood hazard information in five regulatory mapping products:

- FIS Report: Detailed Base (1-percent-annual-chance) Flood Elevation (BFE) data and other information in narrative text, flood profiles, and data tables
- FIRM: Official flood map showing the delineation of SFHAs and rounded BFEs
- FIRM Database: Contains the geographic information system (GIS) data for the information shown on the FIRM and described in the FIS Report

- LOMCs: Revisions or amendments to small portions of a FIRM without requiring the FIRM to be republished
- NFHL: An official representation of the SFHA and BFEs

The regulatory flood hazard products present several different datasets; it is those pertaining to the 1-percent-annual chance flood event that are regulatory under the minimum federal requirements of the NFIP (base/1-percent-annual chance floodplain boundary, BFE, and floodway boundary), although communities may adopt more stringent standards that will result in safer, more resilient communities. Other datasets included on FIRMs and detailed in FIS reports, such as the 0.2-percent-annual-chance flood boundary and/or elevations of the 1-percent-plus, 10-percent, 4-percent, and 2 percent-annual chance flood elevations, may be used for local requirements and for other Federal, state, or local standards outside the NFIP.

These TMAC regulatory products are supplemented by a series of non-regulatory products, commonly referred to as flood risk products, which are intended to better communicate the impacts resulting from flooding by helping community officials and the public view and understand those impacts. FEMA has a set of defined flood risk products that is intended to supplement the regulatory hazard identification products. These outputs are sometimes created as part of a flood mapping project to provide additional flood hazard information and are not generally created as stand-alone products.

- FRR: Summary of flood risk information on Risk MAP projects
- FRM: Map depicting potential losses associated with the 1 percent-annual-chance flood event and other information
- FRD: Database of all flood risk data for a Risk MAP project, including the flood risk products, such as depth grids, water surface elevation grids, probability grids, flood risk assessment, changes since last FIRM, and areas of mitigation interest

Some newly required data (e.g., residual risk zones) may be informational, although communities or lenders can use these datasets for floodplain management or flood insurance purchase requirement purposes at their discretion.

The TMAC finds the National Flood Mapping Program Outputs, when created as designed, supply technically credible flood hazard data in areas where FIRMs are prepared or updated.

TMAC's review found that since FEMA began developing flood risk products, state, tribal, and local mapping partners have developed other products, not only to communicate flood risk, but to better define the flood hazard.

QUALITY MANAGEMENT PLANNING

FEMA's flood mapping is performed by licensed professionals whose work is held to standards of professional conduct. FEMA and CTPs select engineering contractors based on their qualifications and experience with water resources engineering. The mapping standards used to guide flood mapping work are published, vetted, have been peer reviewed, and are updated twice per year by FEMA to ensure they are aligned with current best practices.

Both coastal and riverine studies include five KDPs at various stages in the project schedule to make certain that a new study is needed or to obtain concurrence or support from the local community (see the chapter on the National Flood Mapping Program Process). However, coastal and riverine studies are very different from each other and require differing quality management steps.

COASTAL INTERMEDIATE DATA SUBMISSIONS

IDS 1: Data Acquisition and Technical Approach

IDS 2: Offshore Water Levels and Waves: Storm Selection and Numerical Model Validation

IDS 3: Offshore Water Levels and Waves: Production Runs and Statistical Analyses

IDS 4: Nearshore Hydraulics

IDS 5: Flood Hazard Mapping

For coastal studies, five Intermediate Data Submissions (IDSs) document the basis and results of coastal flood hazard analyses during the course of the project. The IDSs are required deliverables that mapping partners must provide to the FEMA Project Officer at key milestones during the engineering analysis and mapping process. The IDSs provide checkpoints after each phase in the study to allow for FEMA review and comment. Given the complexity and long durations of coastal studies, the IDS review process serves an important risk management function: it helps ensure that each phase of the study is completed satisfactorily prior to moving forward with the next phases of the study, which are dependent on the results of the earlier phases.

Documentation of the progress of a coastal flood hazard study is captured through the IDS, while the final project deliverables are captured in the Technical Support Data Notebook (TSDN). The TSDN encompasses the entirety of the final project datasets, such as base maps, bathymetric and ground elevation data, model input and output files, communication logs, and technical reports, that are archived for the study. These data form the scientific and technical basis for the flood map and are needed in the future to address challenges or changes to the maps.

Mapping partners compile TSDNs for riverine flood hazard studies as well. Riverine studies do not have an IDS requirement, but FEMA does require the Mapping Partner to submit deliverables through the Mapping Information Platform (MIP) at certain points during the study to check for correct and appropriate formatting as required by program standards, and to serve as a repository of these data.

Each Mapping Partner is required to have its own internal process for reviewing its products before a professional engineer or surveyor signs and seals them prior to sending them to FEMA. FEMA may also request an independent QA/QC for any project using the information that was uploaded to the MIP. This QA/QC is required for:

- Topographic mapping
- Base map
- Hydrologic data
- Hydraulic data
- Floodplain mapping
- Preliminary map products

In addition, for both coastal and riverine studies, eight QR points — some focused on the database and some on map production — are included at various stages in the project schedule.

In addition to the quality review requirements:

- Each studied community is now given the opportunity to review and comment on modeling decisions and data choices early in the study schedule.
- Each studied community and the public are given the opportunity to review preliminary maps and to appeal the maps by presenting better technical evidence.

In summary, the current Risk MAP process provides sufficient opportunity to identify and correct errors and omissions. If followed properly, all of these steps should lead to high quality regulatory products.

The TMAC's review found that FEMA does not have a quality management process for the flood risk products. As such, FEMA is currently reviewing these products in accordance with TMAC's Annual Report Recommendation 1. (The future conditions recommendations from the 2015 TMAC Future Conditions Risk Assessment and Modeling report are listed in Appendix B.) Many of the non-regulatory products are very useful, both for risk communication and flood

Quality Reviews

QR1: Validate Draft FIRM

QR2: Validate Preliminary FIRM

QR3: Validate Preliminary FIS, FIRM, and SOMA

QR4: Validate Proposed Flood Hazard Determination Notice

QR5: Validate Final FIRM Database and FIRM Panels

QR6: Check LFD Before Distribution

QR7: Validate MSC Deliverables

QR8: MSC Review of Final Deliverables

The TMAC finds the National Flood Mapping Program's Quality Management Planning, when followed, supports the production of technically credible flood hazard data in areas where FIRMs are prepared or updated, and has no further recommendations for the Quality Management Planning of the program.

insurance rating; as such, there should be increased attention to the quality management process used in their production.

METRICS

TMAC reviewed FEMA's current metrics for the Risk MAP program and evaluated them based on their applicability to the technical credibility of the program. TMAC also researched information about metrics from other sources.[1,2] FEMA's current performance measures to assess Risk MAP are:

- **Deployment:** The percentage of the population in the HUC8 watershed (or other project footprint, including levee and coastal) where Risk MAP has begun. The method of counting population is based on census blocks within the project footprint. If a portion of the census block is included, it is counted in the deployment measure. The minimum criteria for deployment in a watershed are: (1) holding a Discovery meeting to assess needs and (2) delivering a certain set of flood risk products for the entire watershed, if it is determined that they are needed. Because Deployment is not related to mapping, the entire population of a watershed is counted as Deployed,

1 National Research Council, 2005, Thinking Strategically: The Appropriate Use of Metrics for the Climate Change Science Program
2 OMB, 2005

even in instances where the Discovery process led to the conclusion that no new engineering studies should be performed.

- **Quality Data:** The validity of existing flood hazard data, which is maintained through a Coordinated Needs Management System (CNMS) validation process to determine whether a mapped flood hazard is still valid. National targets are established yearly based on the current inventory data and forecasts, taking congressional funding levels into consideration. Each FEMA Region works with FEMA headquarters to establish the targets based on such factors as funding and anticipated state, tribal, and local leverage. The current quality data metric is to have 80 percent of the flood hazard stream miles identified as valid. NVUE-related data are updated at various points within the Risk MAP project lifecycle, starting with the Discovery phase. FEMA is making progress towards implementing coastal Quality Data measures as well.
- **Awareness:** The percentage of local officials who are aware of the flood risk affecting their community after engaging in the Risk MAP process. Since 2010, FEMA has surveyed local officials annually to determine awareness and understanding of flood risk, mitigation actions, communicating flood risk, and the need for assistance in communicating risk. The survey is authorized by the U.S. Office of Management and Budget, and is summarized and analyzed by the National Business Center. The survey results are posted on FEMA's website.
- **Mitigation Action:** The primary measure used to evaluate the success of the Risk MAP program, since it indicates which communities are taking action to reduce flood risks. FEMA tracks mitigation actions throughout the Risk MAP lifecycle in a community using two action measures. Action 1 measures the number of communities where Risk MAP has helped identify new or improved mitigation actions to reduce flood risks. Action 2 measures the number of communities that have advanced or initiated a mitigation action. FEMA has developed a Web-based tool known as the Mitigation Action Tracker to enable multiple users to search, view, and update mitigation actions or projects. Information on mitigation actions is also collected at various times during a Risk MAP project.

The TMAC finds that the National Flood Mapping Program's Metrics can track the production of flood hazard data in areas where FIRMs are appropriately prepared or updated.

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Albie Lewis - FCO
NATIONAL IMAT - West
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Section 2: Recommendations For Maintaining Technical Credibility Into The Future

ALIGNMENT WITH OTHER RECOMMENDATIONS AND REQUIREMENTS

In 2015, the TMAC produced two reports as required by BW-12:

- An annual report containing recommendations to improve the effectiveness of the National Flood Mapping Program and products
- A future conditions risk assessment and modeling report containing seven overarching recommendations regarding the inclusion of future conditions in flood hazard data developed by FEMA

Together, these reports contained TMAC's recommendations to FEMA resulting from TMAC's 2014-2015 TMAC efforts, including meetings, SME presentations, and research; and through the technical expertise of TMAC members on all aspects of FEMA's mapping program.

In addition, through BW-12, FEMA's mapping program became authorized in its own right for the first time. The National Flood Mapping Program authorized by the Congress went much further than past reforms to update and maintain the nation's flood maps and flood risk information, requiring minimum datasets to be developed and published and minimum activities to be performed. It could be argued the Congress established minimum parameters for what would be deemed necessary and credible through the authorization of such a program.

Recommendations related to Other Recommendations and Requirements to provide technically credible products into the future:

1. FEMA should adopt TMAC's 2015 recommendations that relate to the National Flood Mapping Program's technical credibility from the TMAC 2015 Annual Report. These are summarized in Appendix A.
2. FEMA should adopt the future conditions recommendations from the 2015 TMAC Future Conditions Risk Assessment and Modeling report. These are listed in Appendix B.
3. FEMA should complete the implementation of the statutory requirements of the National Flood Mapping Program as summarized in Appendix C.

STRUCTURE

The Federal Insurance and Mitigation Administration (FIMA), a component of FEMA, manages the NFIP and a range of programs (including the National Flood Mapping Program) designed to reduce future losses to homes, businesses, schools, public buildings, and critical facilities from floods, earthquakes, tornadoes, and other natural disasters. Several changes have occurred since FIMA was established in 1993, most recently in February 2016 when FIMA launched a new governance and organizational structure to improve integration and efficiencies across programs, such as the ongoing mapping program that supports the NFIP.

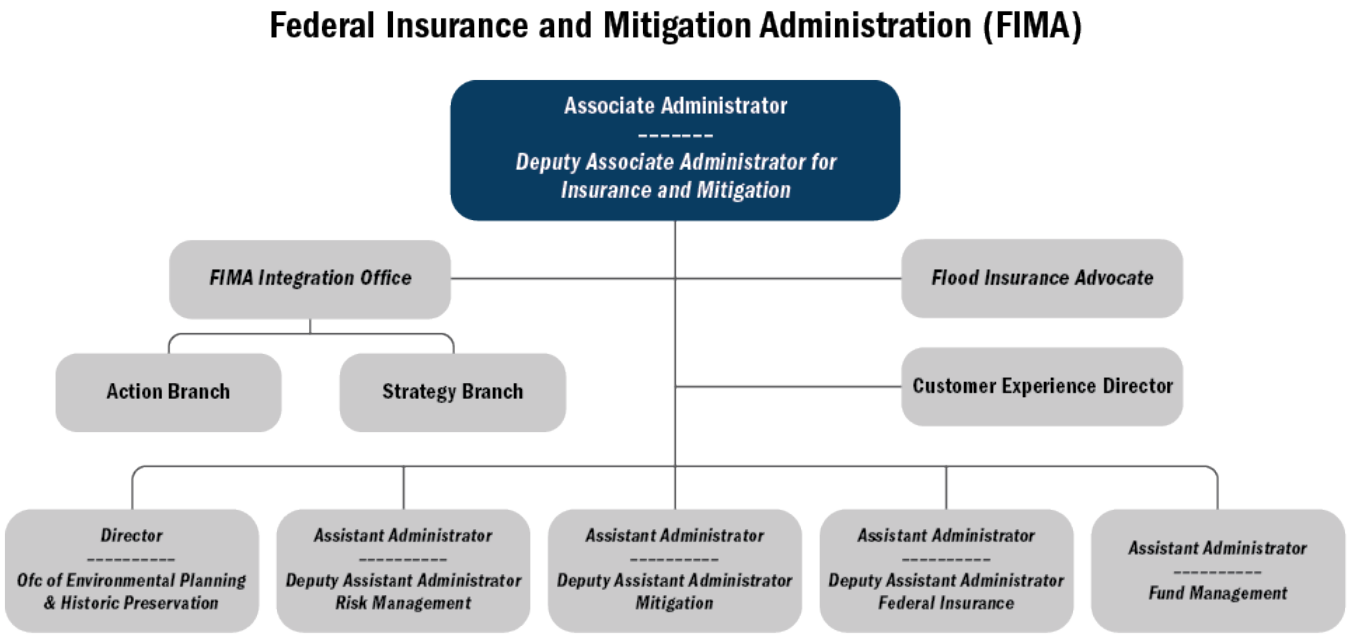


Figure 3. FIMA Organizational Chart

FIMA's mission is "Working in partnership to support sustainable, disaster-resilient communities, to avoid or reduce the loss of life, loss of property, and the financial impacts of hazards."[3]

This governance and organizational structure is centered on the following guiding principles, established to help advance the FEMA mission and strategic priorities and act as touchstones as progress is achieved: [4]

- Improve integration and collaboration to support efficiency, agility, and adaptiveness to increase opportunities for learning, innovation, and improved program delivery
- Build on what works by identifying what is working well within the organization, learning from it, and building on it
- Improve the customer experience by identifying customer needs and opportunities for improvements in communication and outreach, and by enhancing trust by improving transparency

3 Federal Emergency Management Agency. FEMA Mitigation and Insurance Strategic Plan: 2012-2014. http://www.fema.gov/media-library-data/20130726-1811-25045-8194/fema_mitigation_strategic_plan_508.pdf, accessed May 31, 2016.

4 Summarized by sub-committee members from information shared with TMAC from FEMA on FIMA's new organizational structure in Spring 2016..

- Improve organizational health by defining a clear direction for the future of the organization and expectations for conduct, by nurturing a culture of high performance, and by fostering a strong connection between employees and the agency by showing appreciation and by bringing meaning to work

TMAC also reviewed FEMA's partnering activities with CTPs. To serve as a CTP, partners must first sign a mutual cooperative agreement with FEMA, which outlines the commitments, roles and responsibilities, and mutual goals of each party. With the agreement in place, CTPs are given the opportunity to submit annual grant applications to FEMA for Program Management (PM), Community Engagement and Risk Communication (CERC), LOMR Review, and Risk MAP Project activities. FEMA prepares and provides application templates known as Mapping Activity Statements for Risk MAP Projects and LOMR Review, and a Scope of Work for PM and CERC applications. PM and CERC applications require the development of a Business Plan, including the budget and mapping priorities (when applicable).

Each fiscal year, FEMA issues a Notice of Funding Opportunity document to announce the availability of the CTP cooperative agreement funding. Risk MAP Project grants may extend over several years; however, the PM, CERC, and LOMR Review grant periods are 12 months and must be applied for annually under the current structure. state, regional, tribal, and local agencies make commitments through program development and staffing to support risk analysis activities and implement FEMA's programs, such as Risk MAP.

Through this commitment, these partners have developed expertise in preparing NFIP regulatory and non-regulatory products, community engagement and outreach, and overall delivery of Risk MAP. This expertise can only be maintained through some baseline, consistent funding stream. The short timeframe of grant

Recommendations to the Structure of the National Flood Mapping Program to provide technically credible products into the future:

4. FEMA should continue to enhance communication and transparency with program stakeholders by, for example, including organizational and contact information on the Internet.
5. FEMA should investigate offering multi-year program management grant periods (versus annual) to CTPs.

periods also requires CTPs to expend resources inefficiently through the annual repetition of grant applications.

PROCESS

While FEMA's current process is expected to produce credible products, moving forward, FEMA should continue to improve and evolve processes to keep up with changing conditions, improvements in data and modelling, and changing technology.

Accurate ground elevation data is essential to the production of credible and accurate flood hazard maps. Light Detection and Ranging (LiDAR) has become the preferred way to obtain the necessary high accuracy topography used in FEMA's mapping process. FEMA not only currently makes a significant investment in LiDAR data collection, but also relies on interagency partnerships to leverage collection of new LiDAR data.

Through the 3D Elevation Program (3DEP), the United States Geological Survey (USGS) partners with other federal agencies (FEMA, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration [NOAA], U.S. Department of Agriculture, U.S. Army Corps of Engineers [USACE]) as well as state and local agencies to identify existing LiDAR data via the U.S. Interagency Elevation Inventory and planned data collections via the Interagency Working

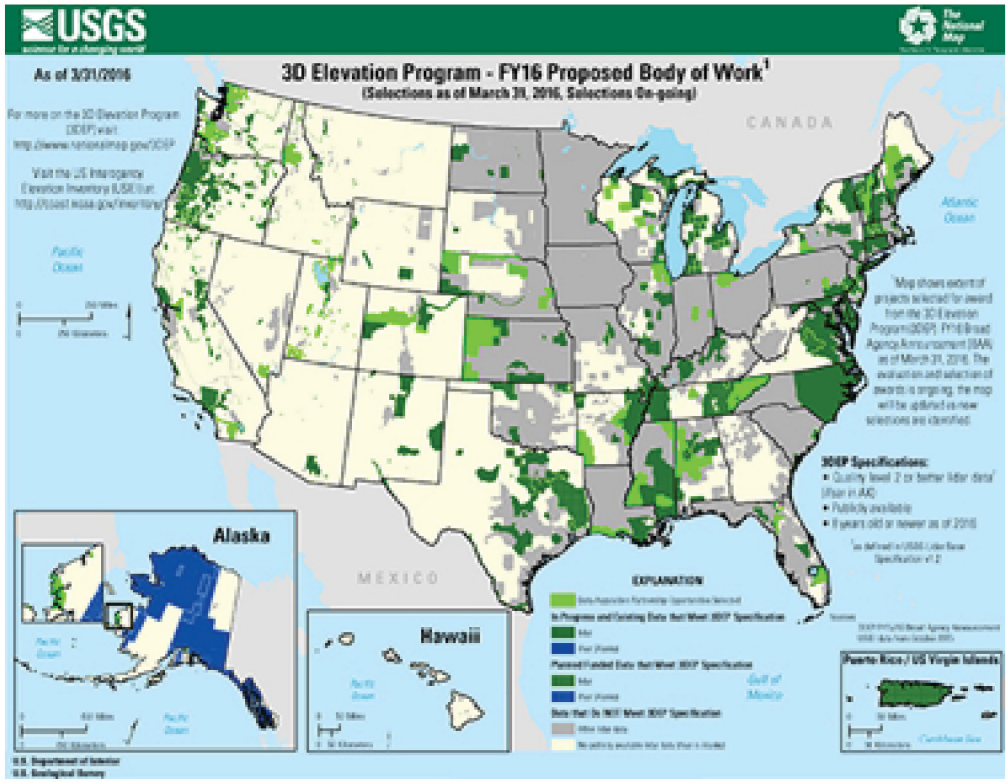


Figure 4. USGS 3DEP Program Status

Group on Ocean and Coastal Mapping. See Figure 4, which shows the status of the 3DEP Program.

Partnering and data sharing lead to resource efficiencies and expanded capabilities. As one example, North Carolina is demonstrating the value of high-accuracy LiDAR data by mapping the entire state for the second time using second generation LiDAR. While more detailed ground elevation data than is required for floodplain mapping, the information can be utilized for a variety of other applications, such as risk communication of risk-based insurance rates, evaluating alternative mitigation measures, and dealing with affordability issues. These additional uses extend the value of LiDAR data, which are gathered once, but used multiple times by both public and private sectors. As a result, the private sector, which is providing a significant portion of the funding, has supported the investment in this level of detailed mapping. Such partnerships and multiple users promote opportunities for expanded mapping capabilities, whether increasing the areas covered or increasing the level of detail and accuracy of data acquired.

TMAC found that data reflecting current conditions are needed to produce technically credible products. Data should be collected in consideration of planned study needs. Large data acquisition efforts are more efficient than a number of smaller, less-coordinated efforts, and acquisition far in advance of a study may lead to the need for new data acquisition. Large-scale data acquisition efforts need to be coordinated carefully with new study starts.

There are many hydrology and hydraulics models available for use in flood studies, and the key to technical credibility is the selection of the model(s) that balance complexity and study needs. There is no need to use the most complex models everywhere, but complex models may be needed for some studies. Unsteady 1-D models or 2-D models may be needed to accurately model river reaches with breakout flow locations or significant floodplain storage. Complex models have more extensive data requirements and can involve more engineering time to develop, so they should be selectively applied. In addition, the standards and criteria in-place for 1-D steady models, especially for floodway analyses, need to be evaluated for application with more complex models, as outlined in the 2015 Annual Report Recommendations 7a and 7b.

FEMA should phase out the cartographic effort of using paper panels for new and updated studies as soon as possible. TMAC recognizes that many communities can only adopt paper maps for regulatory purposes; however, many other communities have transitioned to digital procedures and do not need the paper panels. FEMA can use the Discovery process to determine the need of the community for a paper

Recommendations Related to the National Flood Mapping Program Processes to provide technically credible products into the future:

6. FEMA should facilitate, partner, and leverage the efficient acquisition of nationwide, high-resolution ground and built environment data (LiDAR data or new emerging technologies), appropriately timed to support planned studies.
7. FEMA should work with the Congress and other partners to examine ways to shorten the study process, including the time added to the mapping process by QRs, KDPs, and legislated due process, as identified in TMAC's 2015 Goal 2 Annual Report Recommendation number 11.
8. FEMA should move to a database-derived display, as outlined in TMAC's 2015 Annual Report Recommendation number 16.

product. For those communities still requiring paper panels, technology has advanced to the point that FEMA should be able to develop a cheaper and faster way to satisfy this requirement.

OUTPUTS

RESIDUAL RISK

To create technically credible flood hazard data, FEMA needs to address residual risk areas in the near term. Residual risk areas associated with levees and dams are of great concern.

The National Flood Mapping Program requires that FEMA review, update, maintain, and publish FIRMs with respect to residual risk areas, including those areas protected by levees, dams, and other flood control structures, including the level of protection provided by such structures and areas that could be inundated as a result of the failure of such structures.[5] Each type of structure has its own history as to how it is identified and portrayed on FEMA's flood mapping products.

5 condensed from BW-12 Sec. 100216

LEVEE RESIDUAL RISK

For most of the history of the NFIP, levee risk identification was fairly simple and straightforward: either a levee needed to meet the standards of 44 Code of Federal Regulations 65.10, or the FIRM would show an SFHA as if the levee didn't exist

FEMA's new Levee Analysis and Mapping Procedures (LAMP) approach allows non-accredited levee systems to be broken down into multiple reaches to allow the risks due to identified deficiencies to be better understood and determined. The adopted suite of modelling procedures include:

Sound Reach: A levee reach designed, constructed, and maintained to withstand and reduce the flood hazard posed by a base flood event.

Freeboard Deficient: Can be used for levee reaches that meet all of the requirements of 44 CFR 65.10, except freeboard.

Overtopping: Can be used for levee systems, or portions of a levee system, where the crest of the levee is below the BFE. In addition, information must be submitted that demonstrates the levee would remain in place during the overtopping event.

Structural-Based Inundation: Applies to levee reaches that do not meet the structural standards outlined in Title 44 CFR 65.10, but may still provide a measure of flood risk reduction.

Natural Valley: Can be used when a levee reach is not hydraulically significant or where the quality and quantity of data are insufficient to support the other procedures. Because of the more limited data and resources needed, a community may prefer to use this method.

(this was called the "without levee approach"). This binary approach for levee risk identification was increasingly seen as insupportable given the implications of floodplain management standards and flood insurance purchase requirements associated with SFHAs.

Communities — and the Congress — wanted something more refined. In 2011, the Congress sent a letter to FEMA requesting that more refined processes be developed and that FEMA discontinue the "without levee" approach. At that time, FEMA had already been struggling with levee identification issues as Map Modernization forced the need to analyze levees throughout the country.

FEMA's subsequent response and process improvements ultimately resulted in the Levee Analysis and Mapping Procedures (LAMP) process that is being used today. The LAMP process, which was developed in partnership with the USACE, was initially piloted with a small number of communities, and refined based on these pilots. The final process was released in July 2013.

FEMA's LAMP approach includes new reach-based analyses that are consistent with the risk-based approach recommendation. In addition, it was determined that the uncertainty in the levee analysis would be addressed by the use of Zone

D, defined as an area of undetermined/undefined risk. In feedback from both FEMA and communities, it appears LAMP is a significant improvement on the older ("without levee") approach. It is more refined, more flexible, and includes more coordination and communication with the community.

One criticism is the use of Zone D, which results in precisely the ambiguity the Congress and communities want to avoid. However, because FEMA does not have other existing flood zones to handle some of the more complex, levee-related risk areas, the only currently-available zone to use in some areas is Zone D. FEMA has recognized the need for establishing a new set of zones for such areas in the future.

DAM RESIDUAL RISK

FEMA has traditionally not modeled dam inundation areas, nor incorporated such data into its flood mapping products, although at least one instance has been found. (See the sidebar on Richland County, South Carolina.)

Under the Risk MAP program, FEMA has provided for optional flood risk products to be produced in association with a flood map update. The FRM, FRR, and FRD can include information on dams and the associated flood risk.

An ongoing issue is the lack of public access to dam failure inundation information. Much of such data from the Federal Government is restricted; it is usually made available to emergency management personnel, but not to the general public. In 2004, The Department of Homeland Security (DHS) released its Security Classification Guide for the Protection of Critical Infrastructure and Key Resources – Information for Dams and Related Facilities, which listed dam failure inundation maps as "For Official Use Only." This guide was updated in 2010 and the update was silent on dam failure inundation maps.

Richland County, South Carolina Dam Breach Analysis and Flood Insurance Impacts

In a flood hazard study completed by the USACE in the 1980s for Richland County, South Carolina, dam breach analyses on Gills Creek were integrated into the hydrologic and hydraulic flood modeling to establish the SFHA.

These data were shown on the FIRM and described in the FIS Report. However, breach areas were only shown as enlargements of the 1 percent-annual-chance and 0.2 percent-annual-chance floodplains where the breach made a difference in the size of the inundation area.

The SFHA was reduced by a LOMR that became effective in August 2015 based on an alternative hydrologic and hydraulic analyses, which had the practical effect of removing the dam breach impacts.

Just days before the October 2015 flood that breached several dams on Gills Creek, property owners received letters indicating that flood insurance was no longer required. State officials indicated that in the aftermath of the October 2015 flooding, property owners were very confused about the flood risk and reduction of floodplain areas.

In 2015, the Dams Sector Government Coordinating/Sector Coordinating Councils Information Sharing Workgroup developed a white paper outlining the benefits and potential risks associated with sharing dam safety and security information with stakeholders. Although no consensus was reached, a majority of the workgroup members agreed that the public should not be able to access information related to inundation maps. A minority of the workgroup members believed inundation maps should always be made easily accessible so members of the public can make personal decisions about risk and promote risk awareness.

At the state level, the availability of this information ranges widely. The Association of State Dam Safety Officials does not have an official position on this issue. Supporting wider public availability, a Virginia law passed in 2008 essentially requires that all inundation mapping developed for state-regulated dams be made available to communities and the public. Organizations like the Association of State Floodplain Managers believe that the benefits of public availability of inundation mapping far outweigh any perceived security risks of that data by adversaries for exploitation.

This position would appear consistent with the congressional intent of the National Flood Mapping Program (BW-12) requirement to provide inundation mapping on FIRMs. As the flood mapping program transitions to incorporate the statutory requirements of the National Flood Mapping Program, the technical credibility of the program will be negatively impacted if residual risk and inundation data is not developed and provided to communities.

Recommendations to the National Flood Mapping Program Outputs to provide technically credible products into the future:

9. FEMA should work to identify residual risk areas behind levees, and other flood control structures and downstream of dams.
10. For non-accredited levees, FEMA should replace the Zone D designation in levee-protected areas with risk zones that are more appropriate for the level of risk.

METRICS

Currently, FEMA uses four performance measures to assess Risk MAP progress: Deployment, Quality Data, Awareness, and Mitigation Action. While TMAC believes that the current metrics have allowed FEMA to show the progress towards the production of technically credible products and meeting the goals of Risk MAP, TMAC's review revealed important findings about each metric that should be considered for the future of the program:

Deployment: The current deployment performance metric over-reports the total population affected by Risk MAP projects by counting the population in all census blocks within a watershed as receiving Risk MAP products when only a small portion of the population receives new flood hazard studies or mapping. For example, if the footprint of a Risk MAP project (HUC8 watershed) has 10 miles of stream and only 1 mile of stream is studied, the current metric counts 100 percent of the population that is within the project footprint as opposed to only 10 percent of the population as long as Discovery was conducted for the entire footprint area, and FRD, FRM, and FRR are provided for the entire project footprint area. The deployment metric is easily misunderstood and can lead policymakers to believe that more of the nation's population is covered by modern flood maps and other flood risk data and products than is actually the case.

This over-counting has led to a credibility problem related to the results of this metric. If the intent of deployment was to show the scope and extent of mapping projects, the NVUE data can be broken down by region, state, tribal, county, or watershed by stream reach to accurately show deployment and completion of mapping efforts.

Quality Data: The current quality data measure is based on data that are maintained in CNMS and the Project Planning and Purchasing Portal (P4), a planning tool used by FEMA Regions. New flood studies (referred to as "initiated" miles) in CNMS are provided by FEMA's P4 tool and updated with studies that are complete or re-validated (referred to as "attained" miles). The P4 tool is populated by the FEMA Regions based on each Region's priorities and goals; however, due to funding and other uncertainties, this project sequencing is subject to change. TMAC finds that the process used to determine the quality data metric is not consistent (initiated versus attained).[6] The concept of tracking both initiated and attained study miles for new studies is unclear, and counting all prioritized studies as "initiated," whether funded or not, leads to confusion on the actual number of newly-studied stream miles and the impact on the NVUE status.

Furthermore, it is critically important that the unmapped miles be studied and added to FEMA's inventory. Some analyses estimate that only one-third of the potential miles of floodplain in the nation have been studied and are part of FEMA's inventory.[7] For planning purposes, the potential target miles could be developed by determining the miles of streams that have a drainage area greater than 1 square mile. In developed areas, the potential miles should be determined using one-half square mile of drainage area or less, because in many areas of the nation it can be appropriate to identify streams where the drainage area is less

6 Miles may be "initiated" without being "attained" in some cases.

7 ASFPM's Report, Flood Mapping for the Nation, notes that, based on the National Hydrographic Dataset, there are 3.5 million miles of streams in the nation. Currently, only 1.2 million miles (approximately 34%) have flood maps.

than one-half square mile as floodprone. Additionally, since FEMA assesses the inventory of studied streams every 5 years to determine whether the information is still valid, it is important that FEMA track and report on how many miles are assessed each year.

TMAC is also concerned that there isn't currently an NVUE measure for coastal delineations, though TMAC understands that FEMA is working to develop one. Since FEMA is nearing completion of a major effort that focused on updating the nation's coastal floodplain delineations, it is vitally important to have a coastal NVUE measure in place soon.

Awareness: A feature of an effective metric is that it promotes strategic analysis and tracks progress towards meeting a goal or goals. However, in the application of this metric, there are questions as to the usefulness of the information collected (when comparing results each year). The objectives of the survey tool are to measure awareness of flood risk, knowledge of ways to mitigate flood risk, barriers to mitigation activities, and understanding of steps that can be taken to reduce risks. Interestingly, none of these focus areas really involve the quality of the program's efforts or its credibility.

Risk MAP's outreach efforts are currently being evaluated by FEMA. The Risk MAP CERC contractor is currently reviewing the mapping program's outreach efforts and working with FEMA to improve the process. The Congress has also directed FEMA to increase outreach efforts for mapping changes. Because of the coming changes to Risk MAP's outreach efforts. TMAC would like to review this metric in the future after the changes to the program's outreach and communications have been implemented.

Mitigation Action: This metric is highly problematic because Risk MAP takes credit for an entire community based on a single action which may impact only one structure. It should be noted that Mitigation Action is not limited only to elevating structures, but includes anything that reduces risk (adoption of higher standards and other efforts). Also, once Action 2[8] is attained, subsequent mitigation actions are essentially ignored. Lastly, this measure doesn't reflect the credibility and effectiveness of the mapping program. TMAC is concerned that this metric measures activities that are largely out of the sphere of control of the National Flood Mapping Program, and may lead to the shifting of funds and resources away from needed mapping and risk assessment activities because it is a program metric within Risk MAP. This is a metric that ultimately is better suited for other FEMA programs.

8 A full description of all metrics are in the 2015 Annual Report

TMAC believes that additional metrics should be added to track the value of the program. These include metrics for digital maps and value of the mapping program.

Digital Goal: One of the goals of Risk MAP is to provide an enhanced digital platform and FEMA should have a metric that shows its progress towards meeting this goal. During the Flood Map Modernization initiative, one of the goals was to use state-of-the art technology and advanced engineering to increase the quality, reliability, and availability of flood hazard maps and data. Up-to-date maps were identified as a need to support the flood insurance program, improve determinations for mandatory food insurance purchase requirements, encourage better community-based floodplain management, and increase flood hazard awareness. Advances in dynamic database querying and digital display generation enable more time and cost efficient maintenance and display of hazard data, models, and services. In addressing the goals of Risk MAP and Map Modernization, flood hazard data, models, and reports need to be incorporated into a digital display database that supports dynamic maintenance and digital display of FIRMs.

Value of the Mapping Program: FEMA should consider the benefits and costs to the nation as a result of different levels of funding to the National Flood Mapping Program. This would be applied at a nationwide level, not at the individual study level. This assessment should include all damages paid out by the Federal Government, including NFIP insurance claims and individual and public assistance funds, and some consideration for loss of life, and environmental consequences. The assessment should detail an array of possible outcomes based on different funding levels, which should include leveraged funds.

In the process of compiling this information, FEMA should use the best value concept (see the Definition of Key Terms and Phases chapter of this report) in

deciding the appropriate modeling methods and level of mapping detail. A single home that is built to the incorrect elevation or an incorrectly-sized stream crossing can sometimes justify the investment in more detailed flood hazard mapping of a large area. As a nation, we need to reduce the consequences that new and substantially-improved structures and other development and infrastructure bring when they are permitted in high-risk areas without the benefit of quality flood hazard information. If technically credible flood hazard information is not available for communities, states, tribes, and other government entities to use to plan accordingly, the Federal Government will always be looked to for assistance after the disaster. This assistance is likely to be significantly more costly than providing technically credible flood hazard data would have been.

TMAC has two sets of recommendations for FEMA on the topic of Metrics: a recommendation for discontinuing certain metrics that may no longer be needed, and a set of recommendations for new or revised metrics for the program.

Recommendation for Modifications to Metrics to provide technically credible products into the future:

11. FEMA should evaluate the current metrics to better measure the efficient production, valid inventory, and stakeholder acceptance of the National Flood Mapping Program. TMAC recommends that FEMA should:
    A. Discontinue the current Deployment and Mitigation Action metrics and replace them with more effective measures, and
    B. Focus revised metrics on measuring the quality and quantity of flood hazard and risk products delivered to communities.

Recommendation for New or Revised Metrics to provide technically credible products into the future:

12. FEMA should have an inventory metric that reports quantity, quality, and time aspects on national, regional, tribal, state, and watershed levels:
    A. Quantity: Quantity should be tracked through the life of a floodplain from no study through to detailed study. Statistics should be provided annually.
    B. Quality: Quality should be measured by retaining the existing NVUE metric of the current inventory and adding an NVUE metric for coastal flood hazard miles.
    C. Time: Timing should be measured from Discovery to the issuance of Preliminary maps and from the issuance of Preliminary maps to Effective maps for active projects.
13. FEMA should have a metric that shows progress towards meeting a digital platform goal by area of the nation to compliment FEMA's current population metrics. This metric could include the total area of the country, as well as progress towards Goal 3 and Recommendation 16 in TMAC's 2015 Annual Report.
14. FEMA should evaluate the benefits and costs and its value to the nation as a result of different levels of funding to the National Flood Mapping Program.

Appendix A: TMAC 2015 Annual Report Recommendations

TMAC's 2015 Annual Report contained 22 recommendations. These recommendations impact technical credibility and, if followed, will assist FEMA in maintaining and improving the technically credibility of the program. Table 2 lists the 2015 Annual Report Recommendations that TMAC has identified as being important for continuing and enhancing the technical credibility of the National Flood Mapping Program associated with the National Flood Mapping Program's Structure, Process, Outputs, and Metrics.

Table 2. TMAC 2015 Annual Report Recommendations Related to Technical Credibility

RECOMMENDATION FROM 2015 ANNUAL REPORT	RELATED SECTION OF TECHNICAL REVIEW REPORT
Program Structure-Related Recommendations	
Recommendation 2: FEMA should develop a national 5-year flood hazard and risk assessment plan and prioritization process that aligns with program goals and metrics (see Recommendation 3). This process should incorporate a rolling 5-year plan to include the establishment and maintenance of new and existing studies and assessments, in addition to a long-term plan to address the unmapped areas. Mapping and assessment priorities should be updated annually with input from stakeholders (e.g., Multi-Year Hazard Identification Plan). The plan should be published and available to stakeholders.	Structure
Recommendation 7a: (Riverine) FEMA should develop guidelines, standards, and best practices for selection and use of riverine and coastal models appropriate for certain geographic, hydrologic, and hydraulic conditions. a) Provide guidance on when appropriate models would be 1-D vs 2-D, or steady state versus unsteady state; b) Support comparative analyses of the models and dissemination of appropriate parameter ranges; and c) Develop quality assurance protocols.	Structure
Recommendation 12: FEMA, in its update of guidance and standards, should determine the cost impact when new requirements are introduced and provide guidance to consistently address the cost impact to all partners.	Structure
Recommendation 17: FEMA should consider National Academy of Public Administration (NAPA) recommendations on agency cooperation and federation (6, 7, 8, 9, 13, and 15), and use them to develop more detailed interagency and intergovernmental recommendations on data and program-related activities that can be more effectively leveraged in support of flood mapping.	Structure
Recommendation 18: FEMA should work with federal, state, local, and tribal agencies, particularly the USGS and the National Ocean Service, to ensure the availability of the accurate water level and streamflow data needed to map flood hazards. Additionally, FEMA should collaborate with the USGS to enhance the National Hydrography Dataset to better meet the scale and resolution needed to support local floodplain mapping while ensuring a consistent national drainage network.	Structure

RECOMMENDATION FROM 2015 ANNUAL REPORT	RELATED SECTION OF TECHNICAL REVIEW REPORT
Recommendation 19: FEMA should develop and implement a suite of strategies to incentivize communities, non-government organizations, and private sector stakeholders to increase partnering and subsequent contributions for flood hazard and risk updates and maintenance.	Structure
Recommendation 20: FEMA should work with CTPs to develop a suite of measures that communicate project management success, competencies, and capabilities of CTPs. Where CTPs demonstrate appropriate levels of competencies, capabilities, and strong past performance, FEMA should further entrust additional hazard identification and risk assessment responsibilities to CTPs.	Structure
Recommendation 21: To ensure strong collaboration, communication, and coordination between FEMA and its CTP mapping partners, FEMA should establish a National Flood Hazard and Risk Management Coordination Committee. The role of the committee should be focused around the ongoing implementation of the 5-year Flood Hazard Mapping and Risk Assessment Plan. FEMA should add other members to the committee that have a direct bearing on the implementation of the plan.	Structure
Program Process-Related Recommendations	
Recommendation 4: FEMA should work with federal, state, local, and tribal partners to ensure topographic, geodetic, water-level, and bathymetry data for the flood mapping program are collected and maintained to federal standards. Future FEMA topographic and bathymetric LiDAR acquisition should be consistent with 3DEP and Interagency Working Group on Ocean and Coastal Mapping standards, and all geospatial data for the flood mapping program should be referenced to current national datums and the National Spatial Reference System. Water level gage datums for active gages should be referenced to current national datums and the National Spatial Reference System and, to the extent practical, datums for inactive gages should be converted to meet these standards.	Process
Recommendation 5: FEMA should document the horizontal and vertical accuracy of topographic data input to flood study models and the horizontal and vertical accuracy of topographic data used to delineate the boundaries of the flood themes. These data should be readily available to users, and clearly reported with products.	Process
Recommendation 6: FEMA should periodically review and consider use of new, publicly available statistical models, such as the proposed Bulletin 17C (Water Information Coordination Program, the Advisory Committee on Water Information, Subcommittee on Hydrology), for flood-frequency determinations.	Process
Recommendation 7b: (Coastal) FEMA should develop guidelines, standards, and best practices for selection and use of riverine and coastal models appropriate for certain geographic, hydrologic, and hydraulic conditions. a) Provide guidance on when appropriate models would be 1-D vs 2-D; b) Support comparative analyses of the models and dissemination of appropriate parameter ranges; and c) Develop quality assurance protocols.	Process
Recommendation 8: FEMA should develop standards, guidelines, and best practices related to coastal 2-D storm surge modeling to expand the utility of the data and more efficiently perform coastal flood studies.	Process
Recommendation 9: FEMA should review and update existing coastal event-based erosion methods for open coasts, and develop erosion methods for other coastal geomorphic settings.	Process
Recommendation 10: FEMA should transition from identifying the 1 percent-annual-chance floodplain and associated base flood elevation as the basis for insurance rating purposes to a structure-specific flood frequency determination and associated flood elevations.	Process

RECOMMENDATION FROM 2015 ANNUAL REPORT	RELATED SECTION OF TECHNICAL REVIEW REPORT
Recommendation 13: FEMA should develop guidelines and procedures to integrate a mass LiDAR-based LOMA process into the National Flood Hazard and Risk Assessment Program. As part of this process, FEMA should also evaluate the feasibility of using parcel and building footprint data to identify eligible "out as shown" structures as an optional deliverable during the flood mapping process.	Process
Recommendation 14: FEMA and its mapping partners including the private sector, should transition to a flood risk assessment focus that is structure specific. Where data are available, FEMA and its partners should contribute information and expertise consistent with their interests, capabilities, and resources towards this new focus. a) A necessary prerequisite for accurate flood risk assessments is detailed flood hazard identification, which must also be performed to advance mitigation strategies and support loss estimations for insurance rating purposes. b) FEMA should initiate dialogue with risk assessment stakeholders to identify potential structure-specific risk assessment products, displays, standards, and data management protocols that meet user needs. c) FEMA and its partners should develop guidelines, best practices, and approaches to implementing structure-specific risk assessments.	Process
Program Output-Related Recommendations	
Recommendation 1: FEMA should establish and implement a process to assess the present and anticipated flood hazard and flood risk products to meet the needs of the various users. As part of this process, FEMA should routinely: a) Conduct a systematic evaluation of current regulatory and non-regulatory products (data, maps, reports, etc.) to determine if these products are valued by users, eliminating products which do not cost effectively meet needs; b) Consider user requirements prior to any updates or changes to data format, applications, standards, products, or practices are implemented; c) Proactively seek to provide authoritative, easy to access and use, timely, and informative products and tools; and d) Consider future flood hazards and flood risk.	Outputs
Recommendation 15: FEMA should leverage opportunities to frame and communicate messages to stakeholders in communities so they understand the importance of addressing the flood risk today and consider long-term resilience strategies. Messages should be complemented by economic incentives, such as low-interest loans and mitigation grants, that lead community leaders and individuals to undertake cost-effective risk reduction measures.	Outputs

RECOMMENDATION FROM 2015 ANNUAL REPORT	RELATED SECTION OF TECHNICAL REVIEW REPORT
Recommendation 16: FEMA should transition from the current panel-based cartographic limitations of managing paper maps and studies to manage NFIP data to a database-derived, digital-display environment that are fully georeferenced and relational, enabling a single digital authoritative source of information and database-driven displays. Towards this transition, FEMA should: a) Prepare a multi-year transition plan to strategically transition all current cartographic and/or scanned image data to a fully georeferenced, enterprise relational database; b) Update required information for map revisions (MT-2 forms) and LOMC applications to ensure accurate geospatial references, sufficient data to populate databases, and linkages to existing Effective data; c) Adopt progressive data management approaches to disseminate information collected and produced during the study and revision process, including LOMCs; d) Ensure that the data management approach described in (c) is sufficiently flexible to allow efficient integration, upload, and dissemination of NFIP and stakeholder data (e.g., mitigation and insurance data that are created and maintained by other federal agencies), and serve as the foundation for creating all digital display and mapping products; and e) Provide a mechanism for communities to readily upload jurisdictional boundary data, consistent with requirements to participate in the NFIP, as revised, allowing other stakeholders access.	Outputs
Program Metrics-Related Recommendations	
Recommendation 2: FEMA should develop a national 5-year flood hazard and risk assessment plan and prioritization process that aligns with program goals and metrics (see Recommendation 3). This process should incorporate a rolling 5-year plan to include the establishment and maintenance of new and existing studies and assessments in addition to a long-term plan to address the unmapped areas. Mapping and assessment priorities should be updated annually with input from stakeholders (e.g., Multi-Year Hazard Identification Plan). The plan should be published and available to stakeholders.	Metrics
Recommendation 3: FEMA should develop National Flood Hazard and Risk Assessment goals that include well-defined and easily quantifiable performance metrics. Specifically, the program goals should include metrics for the following: a) Maintaining an inventory of valid (verified), expiring, unverified, and unknown flood hazard miles; b) Addressing the non-modernized areas of the nation and unstudied flood hazard miles; c) Conducting flood risk analysis and assessments on the built environment; and d) Counting population having defined floodplains using a stream level performance indicator for a better representation of study coverage.	Metrics

Appendix B: TMAC 2015 Future Conditions Risk Assessment and Modeling Report Recommendations

Per BW-12, the TMAC was directed to develop recommendations for incorporating the best available climate science in flood insurance studies and maps, and using the best available methodology when considering the impacts of sea level rise (SLR) and future development on flood risk.

The identification and broad availability of future conditions hazard and risk information is of utmost importance to our nation's citizens and economy as development and population growth occur in areas that are at risk now, or will be in the future. Planning, zoning, land use, and other development decisions made by communities today will impact the buildings and infrastructure that will be in existence for decades to come.

The recommendations outlined in the Future Conditions Risk Assessment and Modeling report were intended to counsel FEMA on the utilization and incorporation of best available climate science and methodology to assess possible future flood risk. These recommendations support the assertion that, to become a more resilient nation, elected officials, community planners, engineers, architects, emergency management officials, and decision makers will need the tools necessary to plan, prepare for, and mitigate against future risks from natural and manmade hazards. Thus, they support the ability of FEMA to continue to produce technically credible data and products into the future.

The report contains 7 overarching recommendations and 37 sub-recommendations that support each overarching recommendation. The tables below show the seven primary Future Conditions recommendations from the TMAC, as well as sub-recommendations that support the primary recommendations. The sub-recommendations are numbered according to the section of the Future Conditions and Modeling report in which they appear, and reflect the numerical order in which they appear in that section. For example, Sub Recommendation 3-1 is the first sub-recommendation in Section 3 of that report, Sub-Recommendation 3-2 is the second, and so on.

Table 3. TMAC 2015 Future Conditions Risk Assessment and Modeling Report Recommendations

Recommendation 1: Provide future conditions flood risk products, tools, and information for coastal, Great Lakes, and riverine areas. The projected future conditions should use standardized timeframes and methodologies wherever possible to encourage consistency and should be adapted as actionable science evolves. Sub-recommendations:	
3-2	FEMA should use future risk assessments to take into account the likelihood of events occurring and their impacts, as well as the associated uncertainties surrounding these estimates.
3-4	FEMA should define a future population metric that uses a standard future population database along with various budget scenarios for keeping the data current to predict the percent of the population covered at various points in the future.
3-5	FEMA should take into account future development (excluding proposed flood control structures for the base condition/scenario) for future conditions mapping. An additional scenario can be generated that does include future flood control structures.
3-6	FEMA should use population growth as an indicator of areas with increased potential flood risk.
4-4	FEMA should develop guidance for how local zoning and land use planning can be used to identify where and how land use will change in the future, and incorporate that into local hazard and risk modeling.
4-11	FEMA should develop a policy and standards on how to consider and determine erosion zones that are outside of the SFHA as they ultimately affect flooding and environmental conditions within the SFHA.
5-2	FEMA should use a scenario approach for future conditions flood hazards calculation and mapping that will allow users to evaluate the robustness of proposed solutions to a range of plausible future conditions including uncertain land use and climate change impacts.
Recommendation 2: Identify and quantify accuracy and uncertainty of data and analyses used to produce future conditions flood risk products, tools, and information. Sub-recommendations:	
3-2	FEMA should use future risk assessments to take into account the likelihood of events occurring and their impacts, as well as the associated uncertainties surrounding these estimates.
3-7	FEMA should publish multiple future conditions flood elevation layers that incorporate uncertainty so as to provide a basis for building designs that lower flood risk.

Recommendation 3: Provide flood hazard products and information for coastal and Great Lakes areas that include the future effects of long-term erosion and sea/lake level rise. Major elements are:

- Provide guidance and standards for the development of future conditions coastal flood hazard and risk products.
- Incorporate local relative sea/lake level rise scenarios and long-term coastal erosion into coastal flood hazard analyses.
- Consider the range of potential future natural and manmade coastal changes, such as inundation and coastal erosion.

Sub-recommendations:

4-1	FEMA should use a scenario approach when considering shoreline location for the estimation of future conditions flood hazards. At least two scenarios should be evaluated: one in which the shoreline is held at its present location and another in which the shoreline is eroded, according to the best available shoreline erosion data.
4-6	FEMA should develop guidance for incorporating future conditions into coastal inundation and wave analyses.
4-8	FEMA should develop consistent methods and models for long-term coastal erosion hazard mapping.
5-4	FEMA should use Parriss*, et. al., 2012, or similar global mean sea level scenarios, adjusted to reflect local conditions, including any regional effects (Local Relative Sea Level) to determine future coastal flood hazard estimates. Communities should be consulted to determine which scenarios and time horizons to map based on risk tolerance and criticality.
5-5	FEMA should work with other federal agencies (e.g., NOAA, USACE, USGS), the U.S. Global Change Research Program (USGCRP), and the National Ocean Council to provide a set of regional sea-level rise scenarios, based on the Parris, et al., 2012 scenarios, for the coastal regions of the United States out to the year 2100 that can be used for future coastal flood hazard estimation.
5-7	FEMA should prepare map layers displaying the location and extent of areas subject to long-term erosion and make the information publicly available. Elements include: • Establishing the minimum standards for long-term erosion mapping that will be used by FEMA and that must be met by partners/communities if such mapping is to be incorporated into FEMA products; • Working with federal, state, and local stakeholders to develop these minimum standards via pilot studies; and • Securing funding that can support sustained long-term erosion monitoring and mapping by allowing for periodic updates.
5-9	FEMA should support additional research to characterize how a changing climate will result in changes in Great Lakes and ocean wave conditions, especially along the Pacific Coast. The relative importance of waves on this coast makes this an important consideration.
5-10	For the Great Lakes, the addition or subtraction of future lake level elevations associated with a changing climate is not recommended at this time, due to current uncertainty in projections of future lake levels.
5-11	FEMA should build upon the existing current conditions flood hazard analyses prepared by FEMA for the NFIP to determine future coastal flood hazards.

* Parris, A., P. Bromirski, V. Burkett, D. Cayan, M. Culver, J. Hall, R. Horton, K. Knuuti, R. Moss, J. Obeysekera, A. Sallenger, and J. Weiss, "Global Sea Level Rise Scenarios for the U.S. National Climate Assessment," NOAA Technical Report OAR CPO-1 (2012), http://cpo.noaa.gov/sites/cpo/Reports/2012/NOAA_SLR_r3.pdf.

5-12	FEMA should incorporate local Relative SLR scenarios into the existing FEMA coastal flood insurance study process in one of the following ways: • Direct Analysis: Incorporate SLR directly into process modeling (ex. surge, wave setup, wave runup, overtopping, and erosion) for regions where additional sea level is determined to impact the BFE non-linearly (e.g., 1FT SLR = 2FT or more BFE increase). • Linear Superposition: Add sea level to the final calculated total water level and redefine base flood elevation for regions where additional sea level is determined to impact the BFE linearly (e.g., 1FT SLR = 1FT BFE increase). Wave effects should be calculated based on the higher Stillwater, including SLR.
5-13	Maps displaying the location and extent of areas subject to long-term coastal erosion and future SLR scenarios should be advisory (non-regulatory) for federal purposes. Individuals and jurisdictions can use the information for decision-making and regulatory purposes if they deem appropriate.

Recommendation 4: Provide future conditions flood risk products and information for riverine areas that include the impacts of: future development, land use change, erosion, and climate change, as actionable science becomes available.

Major elements are:

- Provide guidance and standards for the development of future conditions riverine flood risk products.
- Future land use change impacts on hydrology and hydraulics can and should be modeled with land use plans and projections, using current science and build upon existing model study methods where data are available and possible.
- Future land use should assume built-out floodplain fringe and take into account the decrease of storage and increase in discharge.
- No actionable science exists at the current time to address climate change impacts to watershed hydrology and hydraulics. If undertaken, interim efforts to incorporate climate change impacts in flood risk products and information should be based on existing methods, informed by historical trends, and incorporate uncertainty based upon sensitivity analyses.

Where sufficient data and knowledge exist, incorporate future riverine erosion (channel migration) into flood risk products and information.

4-7	FEMA should evaluate previously-issued guidance for future conditions land use and hydrology to incorporate best practices and lessons learned from communities that have implemented the guidance since 2001.
4-9	FEMA should determine long-term riverine erosion hazard areas for areas subject to high erosion and provide these data to the public in a digital layer.
4-10	FEMA should utilize a national standard for riverine erosion zone delineations that reflects geographic variability.
5-6	FEMA should take the impacts of future development and land use change on future conditions hydrology into account when computing future conditions for riverine areas.
5-8	FEMA should implement riverine erosion hazard mapping (E Zones that define channel migration zones) by leveraging existing data, models, and approaches that reflect site-specific processes and conditions.

5-15	FEMA should use observed riverine trends to help estimate what future conditions might look like. In watersheds where floods of interest may decrease in magnitude and frequency, and then use existing riverine study results as the basis for flood hazard mapping. In watersheds where floods exhibit increase in magnitude or frequency, FEMA should then use best available science to determine future hydrology and flood hazards.
5-16	FEMA should work with other federal agencies via the Advisory Committee on Water Information's Subcommittee on Hydrology to produce a new method to estimate future riverine flood flow frequencies. This method should contain ways to consistently estimate future climate-impacted riverine floods and address the appropriate range of flood frequencies needed by the NFIP.
5-17	FEMA should produce, and should encourage communities to adopt, future conditions products to reduce flood risk.

Recommendation 5: Generate future conditions data and information such that they may frame and communicate flood risk messages to more accurately reflect future hazard in ways that are meaningful to and understandable by stakeholders. This information should enable users to make better-informed decisions about reducing future flood-related losses.

Sub-recommendation:

3-3	FEMA should frame future risk messages for future conditions data and information such that individuals will pay attention to the future flood risk. Messages may be tailored to different stakeholders as a function of their needs and concerns.

Recommendation 6: Perform demonstration projects to develop future conditions data for representative coastal and riverine areas across the nation to evaluate the costs and benefits of different methodologies or identify/address methodological gaps that affect the creation of future conditions data.

Sub-recommendations:

3-1	FEMA should perform a study to quantify the accuracies, degree of precision, and uncertainties associated with respect to flood studies and mapping products for existing and future conditions. This study should include the costs and benefits associated with any recommendation leading to additional requirements for creating flood related products.
5-3	FEMA should conduct future conditions mapping pilots to continue to refine a process and methods for mapping and calculating future flood hazards and capture and document best practices and lessons learned for each.
5-14	FEMA should support research for future conditions coastal hazard mapping pilots and case studies using the latest published methods to determine the best means to balance the costs and benefits of increasing accuracy and decreasing uncertainty.

Recommendation 7: Data and analysis used for future conditions flood risk information and products should be consistent with standardized data and analysis used to determine existing conditions flood risk, but also should include additional future conditions data, such as climate data, SLR information, and long-term erosion data. FEMA should develop scenarios that consider land use plans, planned restoration projects, and planned civil works projects, as appropriate, that would impact future flood risk.

Sub-recommendations:

4-2	FEMA should support expanded research innovation for water data collection, for example, by using Doppler radar.
4-3	FEMA should use a scenario approach to evaluate the impacts of future flood control projects on future conditions flood hazards.
4-5	FEMA should support research on future conditions land use effects on future conditions hydrology and hydraulics.
4-12	FEMA should develop guidance for evaluating locally developed data from states and communities to determine if it is an improvement over similarly-available national data sets and could be used for future condition flood hazard analyses.
4-13	FEMA should develop better flood risk assessment tools to evaluate future risk, both population-driven and climate-driven. It should improve integration of hazard and loss estimation models (e.g., Hazus, geographic information system-based natural hazard developed and freely distributed by FEMA) with land use planning software designed to analyze and visualize development alternatives, scenarios, and potential impacts to increase use in local land use planning.
5-1	Future flood hazard calculation and mapping methods and standards should be updated periodically as FEMA learns more through observations and modeling of land surface and climate change, and as actionable science evolves.

Appendix C: Review of Legislative Objectives Impacting Technical Credibility

Both BW-12 and HFIAA contain requirements that relate to the technical credibility of the flood hazard data produced by FEMA. Section 100216 is the most significant portion of BW-12 that impacts the technical credibility of the program. It requires the establishment of the National Flood Mapping Program, in coordination with the TMAC, under which FEMA must review, update, and maintain the NFIP rate maps and authorizes funding for the program up to $400 million annually.

HFIAA Sections 27 and 30 amended parts of BW-12 Section 100216. The requirements for the National Flood Mapping Program, as established by BW-12 and HFIAA, are codified in 42 U.S. Code §4101b, and focus on four areas: Mapping and Mapping Elements, Standards, Communication and Outreach, and Community Remapping Requests.

BW-12 and HFIAA included other mapping-related provisions, in addition to the requirements for the National Flood Mapping Program. For example, BW-12 Section 100215 established the TMAC and Sections 100217 and 100218 addressed FEMA's map appeal process SRP. Table 4 outlines all of the mapping-related provisions contained in BW-12 and HFIAA, FEMA's reported status of implementation for each.

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
REQUIREMENTS RELATED TO PROGRAM RECOMMENDATIONS				
1	In updating maps under 42 U.S. Code §4101b, the Administrator shall include—(E) any other relevant information as may be recommended by the Technical Mapping Advisory Committee.	May 2016 G&S – FEMA will incorporate via policy where TMAC recommendations can be addressed and/or align with statutory requirements to be addressed in May 2016.	Cannot be fully addressed until policy, regulatory changes, and funding, enable FEMA to fully implement all TMAC recommendations.	Partially Addressed
REQUIREMENTS RELATED TO PROGRAM STRUCTURE				
2	**BW-12 §100231(e) Study and Report on Graduated Risk** - The Administrator shall enter into a contract under which the National Academy of Sciences shall conduct a study exploring methods for understanding graduated risk behind levees and the associated land development, insurance, and risk communication dimensions.	Completed 2013		Addressed
3	In updating maps under this section, the Administrator shall include—(A) any relevant information on coastal inundation from—(i) an applicable inundation map of the Corps of Engineers; and(ii) data of the National Oceanic and Atmospheric Administration relating to storm surge modeling;	May 2016 G&S Cycle – FEMA will update its guidance to document the consideration of "other inclusions" cited in the statute. These updates will add clarity about relevant information from sources such as other Federal agencies to consider during the mapping process and ensure documentation of how such information was incorporated in the FEMA analyses, where appropriate.	FEMA is exploring how to leverage its geo-platform or other tools to better connect communities with the data and information from other Federal agencies.	Addressed
4	In updating maps under this section, the Administrator shall include—(B) any relevant information of the United States Geological Survey on stream flows, watershed characteristics, and topography that is useful in the identification of flood hazard areas, as determined by the Administrator;	May 2016 G&S Cycle – FEMA will update its guidance to document the consideration of "other inclusions" cited in the statute. These updates will add clarity about relevant information from sources such as other Federal agencies to consider during the mapping process and ensure documentation of how such information was incorporated in the FEMA analyses, where appropriate.	FEMA is exploring how to leverage its geo-platform or other tools to better connect communities with the data and information from other Federal agencies. FEMA will explore redesigning the Flood Insurance Study (FIS) to explicitly include references to these inclusions.	Addressed

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
5	In updating maps under this section, the Administrator shall include—(C) any relevant information on land subsidence, coastal erosion areas, changing lake levels, and other flood-related hazards;	May 2016 G&S Cycle – FEMA will update its guidance to document the consideration of "other inclusions" cited in the statute. These updates will add clarity about relevant information from sources such as other Federal agencies to consider during the mapping process and ensure documentation of how such information was incorporated in the FEMA analyses, where appropriate.	FEMA will explore redesigning the Flood Insurance Study (FIS) to explicitly include references to these inclusions.	Partially Addressed
6	In updating maps under this section, the Administrator shall include—(D) any relevant information or data of the National Oceanic and Atmospheric Administration and the United States Geological Survey relating to the best available science regarding future changes in sea levels, precipitation, and intensity of hurricanes; and	May 2016 G&S Cycle – FEMA will update its guidance to document the consideration of "other inclusions" cited in the statute. These updates will add clarity about relevant information from sources such as other Federal agencies to consider during the mapping process and ensure documentation of how such information was incorporated in the FEMA analyses, where appropriate.	TMAC - This requirement is directly tied to the TMAC's work and upcoming report Future Conditions Risk Assessment and Modeling Cannot be fully addressed until policy/ regulatory change enables FEMA to utilize this information for future conditions mapping.	Partially Addressed (pending May G&S updates)
7	**BW-12 §100221 Interagency Coordination Study**	Procured and received the report in 2013. FEMA has analyzed the recommendations in the National Academy of Public Administration (NAPA) report and has started implementing the recommendation.		Addressed

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
8	**BW-12 §100220(a) and (b) Budget Crosscut and Interagency Coordination**	FEMA is already complying with the requirements in Section 220 of BW-12, and has begun implementing the recommendations contained in the NAPA report. FEMA and DHS participate actively in a number of coordination bodies to enhance coordination and sharing of flood and geospatial data, including the Federal Geographic Data Committee Executive Committee and FGDC Steering Committee. FEMA is a primary supporter of the 3D Elevation Program, and also participates on the Federal Interagency Floodplain Management Task Force, National Levee Safety Committee, and many others.		Addressed
9	In updating and maintaining maps under this section, the Administrator shall—(1) establish standards to—(A) ensure that maps are adequate for—(i) flood risk determinations			Addressed
10	In updating and maintaining maps under this section, the Administrator shall—(1) establish standards to—(B) facilitate identification and use of consistent methods of data collection and analysis by the Administrator, in conjunction with State and local governments, in developing maps for communities with similar flood risks, as determined by the Administrator; and			Addressed

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
11	**BW-12 §100218 Scientific Resolution Panel** - formalizes/codifies the SRP	Procedure Memorandum (PM) 58 was converted. A standard was incorporated as part of the May 2015 Guidance and Standards maintenance cycle to align with the new law. National Institute of Building Sciences (NIBS) will update its documentation and web content.		Addressed
12	In carrying out the program established under subsection (a), the Administrator shall (E) work to enhance communication and outreach to States, local communities, and property owners about the effects—(i) of any potential changes to National Flood Insurance Program rate maps that may result from the mapping program required under this section; and (ii) that any such changes may have on flood insurance purchase requirements;(F) engage with local communities to enhance communication and outreach to the residents of such communities, including tenants (with regard to contents insurance), on the matters described under subparagraph (E);	May 2016 G&S – FEMA will tailor the communication and outreach associated with the twice annual release of FEMA's Guidelines and Standards for Flood Risk Analysis and Mapping to ensure that the messaging addresses the effects highlighted and the stakeholders identified in these provisions.• CERC to Integrate with insurance better and communicate insurance impacts in Changes Since Last Firm.	FEMA's new Communications CoP and the Flood Insurance Advocate will continue to explore potential implementation actions and opportunities.	Addressed (pending May 2016 G&S update)

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
13	In carrying out the program established under subsection (a), the Administrator shall (G) not less than 30 days before issuance of any preliminary map, notify the Senators for each State affected and each Member of the House of Representatives for each congressional district affected by the preliminary map in writing of—(i) the estimated schedule for—(I) community meetings regarding the preliminary map;(II) publication of notices regarding the preliminary map in local newspapers; and (III) the commencement of the appeals process regarding the map;			Addressed
14	In carrying out the program established under subsection (a), the Administrator shall (G) not less than 30 days before issuance of any preliminary map, notify the Senators for each State affected and each Member of the House of Representatives for each congressional district affected by the preliminary map in writing of—(ii) the estimated number of homes and businesses that will be affected by changes contained in the preliminary map, including how many structures will be that were not previously located in an area having special flood hazards will be located within such an area under the preliminary map; and		Requires investment to obtain data	Not Yet Addressed

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
15	In updating and maintaining maps under this section, the Administrator shall—(H) upon the issuance of any proposed map and any notice of an opportunity to make an appeal relating to the proposed map, notify the Senators for each State affected and each Member of the House of Representatives for each congressional district affected by the proposed map of any action taken by the Administrator with respect to the proposed map or an appeal relating to the proposed map.			Addressed
16	(2) Required activities: The communication and outreach activities required under paragraph (1) shall include—(A) notifying property owners when their properties become included in, or when they are excluded from, an area covered by the mandatory flood insurance purchase requirement under section 4012a of this title;	FEMA will explore best practices to address this requirement- including coordination with and through communities, and distinguishing this notification from the LOMA process	May require investment to obtain data Privacy Act implications since there'd be collection, maintenance, use, and dissemination of personally identifiable info	Not Yet Addressed
17	Required activities: The communication and outreach activities required under paragraph (1) shall include—(B) educating property owners regarding the flood risk and reduction of this risk in their community, including the continued flood risks to areas that are no longer subject to the flood insurance mandatory purchase requirement;	May 2016 G&S Cycle- Guidance documents will be updated and template materials provided to ensure that FEMA works with community officials to further educate property owners about the flood risk in their community and how the flood risk can be addressed.		Partially Addressed
18	(1) In general The Administrator shall—(A) before commencement of any mapping or map updating process, notify each community affected of the model or models that the Administrator plans to use in such process and provide an explanation of why such model or models are appropriate	May 2016 G&S Cycle- New standard that will require FEMA to provide written notification to community officials to inform them about engineering model selected before starting analysis for a flood risk study and provide a 30-day review period. This will be supplemented by guidance and template materials issued to ensure consistent implementation of the standard.		Addressed (pending May 2016 G&S update)

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
19	B) provide each community affected a 30-day period beginning upon notification under subparagraph (A) to consult with the Administrator regarding the appropriateness, with respect to such community, of the mapping model or models to be used; provided that consultation by a community pursuant to this subparagraph shall not waive or otherwise affect any right of the community to appeal any flood hazard determinations;	May 2016 G&S Cycle- New standard that will require FEMA to provide written notification to community officials to inform them about engineering model selected before starting analysis for a flood risk study and provide a 30-day review period. This will be supplemented by guidance and template materials issued to ensure consistent implementation of the standard.		Addressed (pending May 2016 G&S update)
20	(C) upon completion of the first Independent Data Submission, transmit a copy of such Submission to the affected community, provide the affected community a 30-day period during which the community may provide data to (the) Administrator that can be used to supplement or modify the existing data, and incorporate any data that is consistent with prevailing engineering principles;	May 2016 G&S Cycle- New standard that will require FEMA to transmit engineering data to community after the first Independent Data Submission and provide a 30-day review period. This will be supplemented by guidance and template materials issued to ensure consistent implementation of the standard.		Addressed (pending May 2016 G&S update)
21	**BW-12 §100217 Scope of Appeals** - opens appeal-able information to flood hazard information in general, not just BFEs.	Procedure Memorandum (PM) 57 was converted, to include clarification of terms, and align with new law		Addressed
REQUIREMENTS RELATED TO PROGRAM OUTPUTS				
22	**BW-12 §100230 Eligibility for flood insurance** for persons residing in communities that have made adequate progress on the reconstruction or improvement of a flood protection system			No Action Planned/ Addressed

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
23	**Homeowner Flood Insurance Act of 2014 §19 Flood Protection Systems** - Adds the term "reconstruction" to what is to be determined by FEMA as adequate progress on flood protection systems for flood insurance rating purposes, and allows for consideration of projects using all sources of funding, including local sources.	Standards issued for November 2014 Guidelines and Standards Maintenance Cycle. Updated AR and A-99 flood zone fact sheets reflect the changes in the law are now published online. Economic analysis to support rulemaking is underway.		Addressed
24	**BW-12 §100226 Flood Protection Structure Accreditation Task Force** - The Administrator and the Secretary of the Army, acting through the Chief of Engineers, in cooperation with the National Committee on Levee Safety, shall jointly establish a Flood Protection Structure Accreditation Task Force. The task force shall develop a process to better align the information and data collected by or for the Corps of Engineers under the Inspection of Completed Works Program with the flood protection structure accreditation requirements so that— (i) information and data collected for either purpose can be used interchangeably; and (ii) information and data collected by or for the Corps of Engineers under the Inspection of Completed Works Program is sufficient to satisfy the flood protection structure accreditation requirements.	Submitted Report to Congress in November 2013. Memorandum of Understanding was signed by FEMA (Wright) and USACE (Dalton) in November 2014.		Addressed
25	In updating and maintaining maps under this section, the Administrator shall— (2) publish maps in a format that is— (A) digital geospatial data compliant;(B) compliant with the open publishing and data exchange standards established by the Open Geospatial Consortium; and (C) aligned with official data defined by the National Geodetic Survey.			Addressed

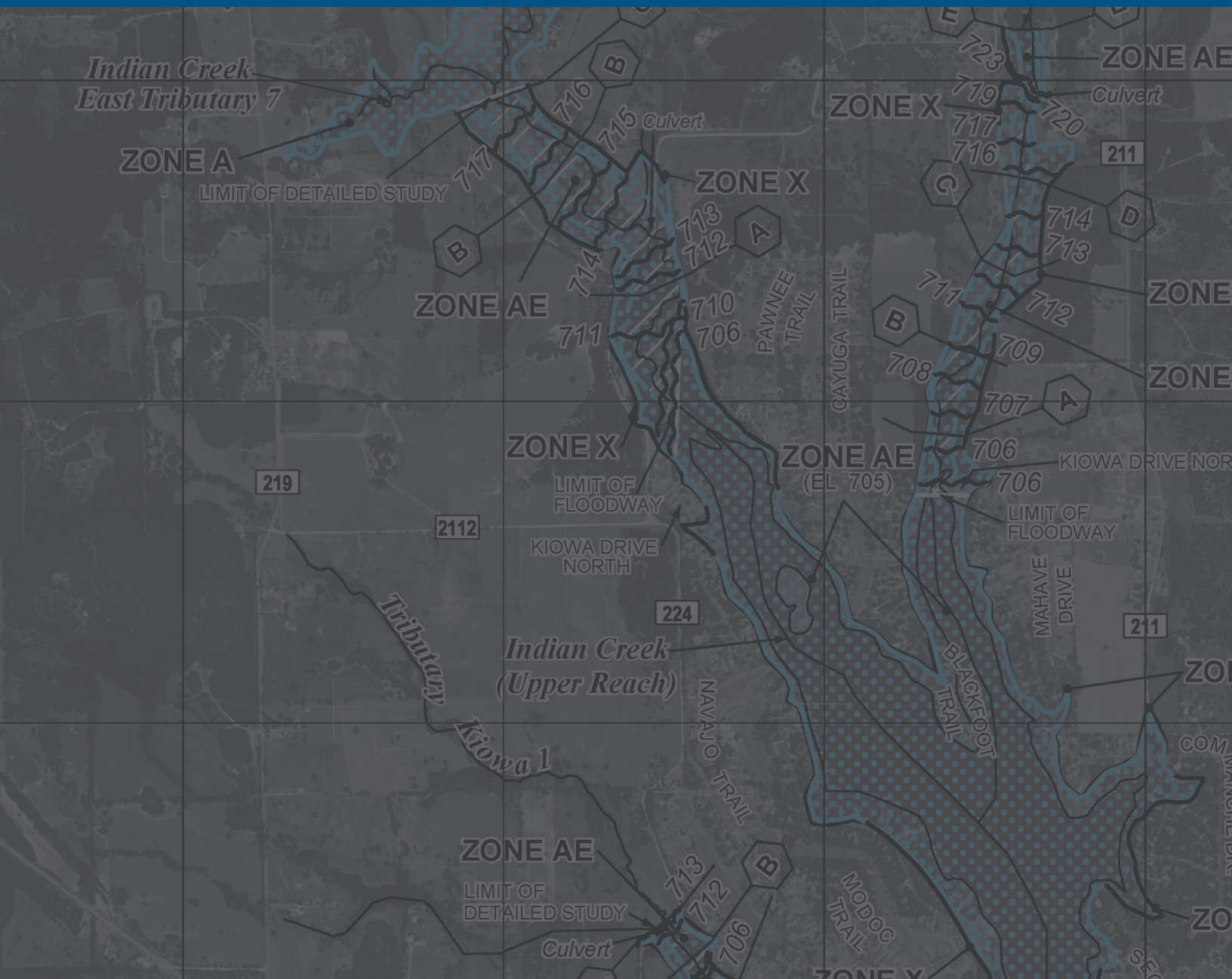
NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
26	In updating and maintaining maps under this section, the Administrator shall establish standards to ensure that maps are adequate for use by State and local governments in managing development to reduce the risk of flooding;			Addressed
27	In carrying out the program established under subsection (a), the Administrator shall—(A) identify, review, update, maintain, and publish National Flood Insurance Program rate maps with respect to— areas of residual risk, including areas that are protected by levees, dams, and other flood control structures; areas that could be inundated as a result of the failure of a levee, dam, or other flood control structure;	FEMA will collaborate with Other Federal Agencies and TMAC on how to implement these requirements.	Flood Risk Products will be used to partially address through the delivery of Risk MAP Regulatory changes are required to fully address via risk identification on FIRMs	Partially Addressed
28	In carrying out the program established under subsection (a), the Administrator shall—(A) identify, review, update, maintain, and publish National Flood Insurance Program rate maps with respect to— areas that are protected by non-structural flood mitigation features; and	May 2016 G&S – Guidance will require FEMA work with communities during the Discovery process to collect to begin identifying and collecting the locations of such features to inform and serve longer-term solutions.	Regulatory changes are required to reflect protected areas on a FIRM.	Partially Addressed
29	In carrying out the program established under subsection (a), the Administrator shall—(A) identify, review, update, maintain, and publish National Flood Insurance Program rate maps with respect to— the level of protection provided by flood control structures and by non-structural flood mitigation features;	May 2016 G&S – Guidance will require FEMA work with communities during the Discovery process to collect to begin identifying and collecting the locations of all relevant features to inform and serve longer-term solutions.	Risk-based analysis for levees initiative Regulatory changes are required to fully implement this change.	Partially Addressed (pending May G&S updates)
30	In carrying out the program established under subsection (a), the Administrator shall 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 such area; and		Regulatory changes are required.	Not Yet Addressed

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
31	In carrying out the program established under subsection (a), the Administrator shall work with States, local communities, and property owners to identify areas and features described in subsection (b)(1)(A)(v);	May 2016 G&S Cycle- FEMA will publish guidance/standard to implement this requirement.		Addressed (pending May 2016 G&S update)
32	Homeowner Flood Insurance Act of 2014 §27 Mapping of Non- Structural Flood Mitigation Features (Amendments to the wording of Section 216 of the Biggert Waters Flood Insurance Reform Act of 2012 regarding the mapping of non-structural flood mitigation features)	This will be addressed during a Guidelines and Standards update. Coastal Integrated Project Team (IPT) is currently looking at initiatives that may inform implementation of this provision.		In Progress
REQUIREMENTS RELATED TO PROGRAM METRICS				
33	(b) Mapping (1) In general, In carrying out the program established under subsection (a), the Administrator shall— (A) identify, review, update, maintain, and publish National Flood Insurance Program rate maps with respect to— (i) all populated areas and areas of possible population growth located within the 100-year floodplain;(ii) all populated areas and areas of possible population growth located within the 500-year floodplain;	May 2016 G&S Cycle – FEMA will issue a guidance or standard to clarify that population growth is considered when FEMA is defining the scope and area for mapping, and that consideration of population and potential growth is documented in the Discovery report.		Addressed

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
REQUIREMENTS RELATED TO PROGRAM QUALITY				
34	In carrying out the program established under subsection (a), the Administrator shall use, in identifying, reviewing, updating, maintaining, or publishing any National Flood Insurance Program rate map required under this section or under the National Flood Insurance Act of 1968 (42 U.S.C. 4011 et seq.), the most accurate topography and elevation data available.	May 2016 G&S – FEMA will enhance existing standards if needed, pending coordination with TMAC.		Addressed
35	Each map updated under this section shall—(B) develop National Flood Insurance Program flood data on a watershed basis—(i) to provide the most technically effective and efficient studies and hydrologic and hydraulic modeling; and(ii) to eliminate, to the maximum extent possible, discrepancies in base flood elevations between adjacent political subdivisions	May 2016 G&S Cycle - FEMA will modify guidance documents to ensure alignment between current watershed mapping policy and the legislative requirements to develop data on a watershed basis.		Addressed
36	Each map updated under this section shall—(A) assess the accuracy of current ground elevation data used for hydrologic and hydraulic modeling of flooding sources and mapping of the flood hazard and wherever necessary acquire new ground elevation data utilizing the most up-to-date geospatial technologies in accordance with guidelines and specifications of the Federal Emergency Management Agency;			Addressed

NO.	REQUIREMENT	NEAR-TERM IMPLEMENTATION ACTIONS TO ADDRESS	LONGER-TERM IMPLEMENTATION AND DEPENDENCIES	FEMA REPORTED STATUS
37	**BW-12 §100229 Local Data Requirement** - no area or community participating in the National Flood Insurance Program that is or includes a community that is identified by the Administrator as Community Identification Number 360467 and impacted by the Jamaica Bay flooding source or identified by the Administrator as Community Identification Number 360495 may be or become designated as an area having special flood hazards for purposes of the National Flood Insurance Program, unless the designation is made on the basis of— (1) flood hazard analyses of hydrologic, hydraulic, or coastal flood hazards that have been properly calibrated and validated, and are specific and directly relevant to the geographic area being studied; and (2) ground elevation information of sufficient accuracy and precision to meet the guidelines of the Administration for accuracy at the 95 percent confidence level.	FEMA determined the effective map properly designated areas in the Town of Hempstead and the Village of Valley Stream impacted by flooding from Jamaica Bay as special flood hazards, and, as a result, re-mapping was not required.		Addressed

Indian Creek
East Tributary 7
ZONE A
LIMIT OF DETAILED STUDY
ZONE X
Culvert
ZONE X
ZONE AE
ZONE X
LIMIT OF FLOODWAY
ZONE AE
(EL 705)
KIOWA DRIVE NORTH
219
2112
224
Indian Creek
(Upper Reach)
Tributary
Kiowa 1
PAWNEE TRAIL
CAYUGA TRAIL
NAVAJO TRAIL
BLACKFOOT TRAIL
MAHAVE
ZONE AE
LIMIT OF DETAILED STUDY
Culvert
Culvert
MODOC TRAIL
ZONE X
HURON TRAIL
LIMIT OF FLOODWAY
ZONE X
FM ROAD 3496
ZONE AE
COCOPA DRIVE W.
Indian Creek East
Tributary No. 2
ZONE X
295
LIMIT OF DETAILED STUDY
COCOPA
DRIVE
Lake
Kiowa
295


Indian Creek
East Tributary 7
ZONE A
LIMIT OF DETAILED STUDY
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Culvert
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ZONE X
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712
714
ZONE AE
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706
711
PAWNEE TRAIL
CAYUGA TRAIL
ZONE X
LIMIT OF FLOODWAY
KIOWA DRIVE NORTH
ZONE AE
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Indian Creek
(Upper Reach)
Tributary
Kiowa 1
NAVAJO TRAIL
ZONE AE
LIMIT OF DETAILED STUDY
Culvert
MODOC TRAIL
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ZONE AE
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Culvert
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KIOWA DRIVE NOR
LIMIT OF FLOODWAY
MAHAVE DRIVE
BLACKFOOT TRAIL
211
COM