



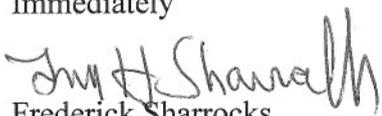
FEMA

December 2011
Operating Guidance No. 6-11

For use by FEMA staff and Flood Hazard Mapping Partners

Title: User Guidance for Flood Risk Datasets and Products

Effective Date: Immediately

Approval: 
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Operating guidance documents provide best practices for the Federal Emergency Management Agency's (FEMA's) Risk MAP program. These guidance documents are intended to support current FEMA standards and facilitate effective and efficient implementation of these standards. However, nothing in Operating Guidance is mandatory, other than program standards that are defined elsewhere and reiterated in the operating guidance document. Alternate approaches that comply with program standards that effectively and efficiently support program objectives are also acceptable.

Background: A suite of flood risk datasets and products is being made available to local stakeholders (engineers, planners, etc) through the Risk MAP program to enable effective flood risk reduction strategies and tactics.

Issue: Because this is a new and evolving program, it is anticipated that best practices for use of Flood Risk Datasets and Products need to be described in a manner that will allow local engineers and planners that use this information to best leverage it for flood risk mitigation planning purpose.

Action Taken: This document provides best-practices and guidance for the effective use of flood risk datasets and products at the local level for the purpose of effecting actionable risk mitigation tactics.

Supersedes/Amends: New guidance

Attachments:

Attachment A – User Guidance for Flood Risk Datasets and Products

Distribution List (electronic distribution only):

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Operating Guidance 6-11

User Guidance for Flood Risk Datasets and Products

For use by Local and State Officials, Planners and Engineers

December 2011



FEMA

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Acronyms and Abbreviations

AAL	Average Annualized Loss
AoMI	Areas of Mitigation Interest
BCA	Benefit-Cost Analysis
CIP	Capital Improvement Project
COG	Continuity of Government Plan
COOP	Continuity of Operations Plan
CRS	Community Rating System
CSLF	Changes Since Last FIRM
EOP	Emergency Operations Plan
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
G&S	Guidance and Standards
GIS	Geographic Information System
Hazus	Hazards U.S.
H&H	Hydrology and Hydraulics
HMA	Hazard Mitigation Assistance
HUC	Hydrologic Unit Codes
HUD	Housing and Urban Development (Department of)
IA	Individual Assistance
LOMR	Letter of Map Revision
NFIP	National Flood Insurance Program
PA	Public Assistance
SFHA	Special Flood Hazard Area
WSE	Water Surface Elevation

1. Introduction

Risk MAP provides communities with flood risk information and tools that can be used to enhance their mitigation plans and activities to better protect their citizens through clear and understandable flood risk information, more accurate flood maps, flood risk assessment tools, and outreach support. As such, the purpose of this guidance document is to provide local and state planners and engineers with information and best practices aimed at the maximizing the use of Risk MAP datasets and products (hereinafter referred to as “Flood Risk Datasets and Products”) to plan for and mitigate local flood risks.

This document addresses the following Flood Risk Datasets and Products:

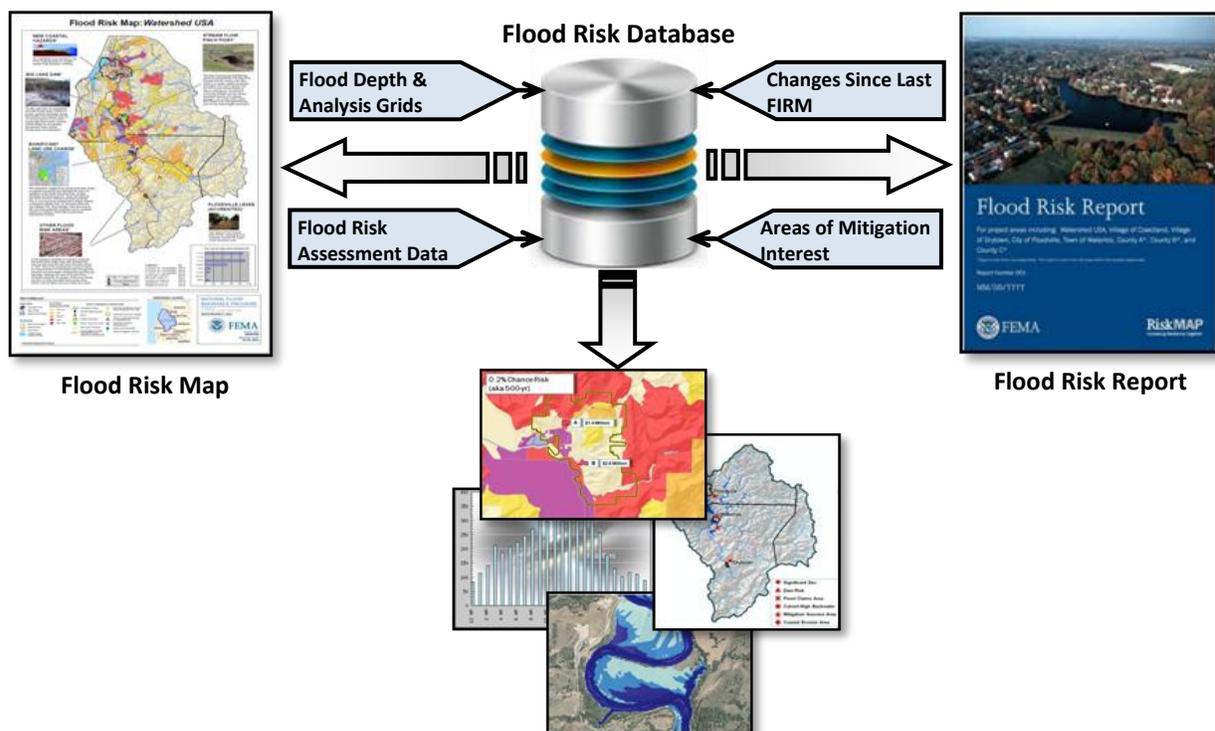
Flood Risk Datasets

- Changes Since Last FIRM
- Flood Depth and Analysis Grids
- Flood Risk Assessment
- Areas of Mitigation Interest

Flood Risk Products

- Flood Risk Database
- Flood Risk Report
- Flood Risk Map

As shown in Figure 1, in addition to the Flood Risk Map and Flood Risk Report (which provide high level flood risk information), the true power and value of Risk MAP is in the ability to visualize and analyze a wide variety of flood risk information from the Flood Risk Database that does not appear on either the Flood Risk Map, or in the Flood Risk Report.



Ad-Hoc & User-Defined Flood Risk Analysis and Mapping

Figure 1 - Flood Risk Data and Products Model

If a community has been provided this guidance from its FEMA Region or State National Flood Insurance Program (NFIP) coordinating agency, it will likely be receiving some or all of the Flood Risk Datasets and Products described herein. Although all of the Flood Risk Datasets and some of the Flood Risk Products are standard companion elements to new or revised flood hazard studies, some of the Flood Risk Datasets will be created based on the community's specific needs relative to flood risk mitigation opportunities. To properly access and use many of these datasets and products, a working knowledge of Geographic Information System (GIS) is necessary.

This document is intended to help local officials (e.g., floodplain administrators, planners, building permit officials, emergency managers, and engineers) and others to understand how to use the datasets and products. This will allow officials to prepare new (or build on existing) mitigation plans, enhance public safety management activities, identify areas of high flood risk that may require use of flood resistant designs and construction materials, identify potential mitigation projects, and collaborate with other officials on important planning processes where land suitability is a key consideration (e.g., comprehensive plans, capital improvement plans). If you are involved in any of the activities included below, this guidance will assist you in determining which of the Flood Risk Datasets and Products add value to your work:

- ***Hazard Mitigation Planning*** (Section 5.1)
- ***Floodplain Management and Community Rating System*** (Section 5.2)
- ***Community General or Comprehensive Planning*** (Section 5.3)
- ***Community Investment*** (Capital Improvement Planning) (Section 5.4)
- ***Public Outreach*** (Section 5.5)
- ***Hazard Mitigation Assistance Grant Application Prioritization and Support*** (Including Benefit Cost Analysis Screening) (Section 5.6)
- ***Other Non-FEMA Grants to Reduce Flood Risk*** (Section 5.7)
- ***Response and Recovery Planning*** (Section 5.8)

Following this introductory Section, the document is divided into the following six Sections:

- ***Section 2 (Flood Risk Datasets)*** – An overview of the Flood Risk Datasets and Products, including a sample graphic, detailed description, and a reference to best practices examples.
- ***Section 3 (Flood Risk Products)*** – Provides detailed descriptions of how the datasets and products can be used to add value to the planning activities and programs listed above.
- ***Section 4 (Summary of Flood Risk Datasets and Products)*** – Provides an overview of which elements of the flood risk datasets will be included in each Flood Risk Product.
- ***Section 5 (Use of Flood Risk Datasets and Products for Mitigation Activities)*** – Best practices for the use of Flood Risk Datasets and Products at the local level.

- **Section 6 (Accessing and Rendering of Flood Risk Data)** – General discussion of how to use data that resides in the Flood Risk Database to obtain images from the various Flood Risk Datasets.
- **Section 7 (Related Guidance)** – A summary of other related guidance.

If you are already familiar with the parameters and process of Risk MAP, proceed to Section 2.0 for details on the datasets and products. If you are new to it, the rest of Section 1.0 will provide the basic fundamentals that are important to know before learning the datasets and products details.

Flood Risk Datasets and Products will be developed within a flood study “project footprint,” which will have defined outer boundaries. While the typical project footprint for a non-coastal study will be a 8-Digit Hydrologic Unit Code (HUC-8) watershed level footprint, the flood risk data creation protocols in Appendix N are scalable to enable a flood risk study to be undertaken at a smaller, more refined scale than at the watershed level (e.g., an area being studied for a Letter of Map Revision or LOMR), or possibly at a larger scale, as with coastal analyses.

When initiating a watershed study, all flood hazards are evaluated within the HUC-8 cataloging unit, including levees and other flood control structures (such as dams), as well as riverine and all non-coastal flood hazards. Through this flood hazard evaluation at the HUC-8 level, potential flood engineering studies are determined based on the flood hazard risk and other factors, as outlined in the FEMA Procedure Memorandum 59, and other watershed implementation guidance documents. Whenever a watershed study is conducted to reflect new or revised flood hazard information, it should be expected that companion Flood Risk Datasets and Products will also be created.

The watershed approach will not automatically mean that the same level of mapping and risk assessment will be performed for the entire watershed. For example, while the entire watershed would receive a baseline Hazus risk assessment, other datasets, such as Changes Since Last FIRM and Flood Depth and Analysis Grids, would be limited to the areas of the project footprint where new hydrologic and hydraulic modeling are included. In most cases, watershed projects will likely include multiple jurisdictions and multiple counties, and in many cases, only portions of communities or counties.

Figure 2 shows the framework for development of Flood Risk Datasets and Flood Risk Projects under Risk MAP. This process is important, as it provides multiple opportunities to begin and/or continue discussions associated with mitigation planning, and mitigation planning technical assistance and training.

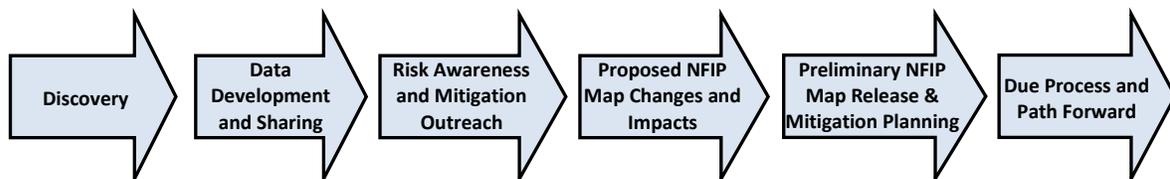


Figure 2 - Flood Risk Data Development Lifecycle

2. Flood Risk Datasets

This Section describes the flood risk datasets that will be created as companion elements to the hydrologic and hydraulic (H&H) study (or restudy) of flooding sources for a given watershed, coastal area, or site-specific project area.

2.1. Changes Since Last FIRM

The Changes Since Last FIRM dataset provides information regarding changes made to the mapped floodplain and floodway boundaries during the course of an updated study of flood hazards for the subject watershed and impacted jurisdictions. Figure 3 below is a sample visualization of what this dataset might look like if rendered from the Flood Risk Database.

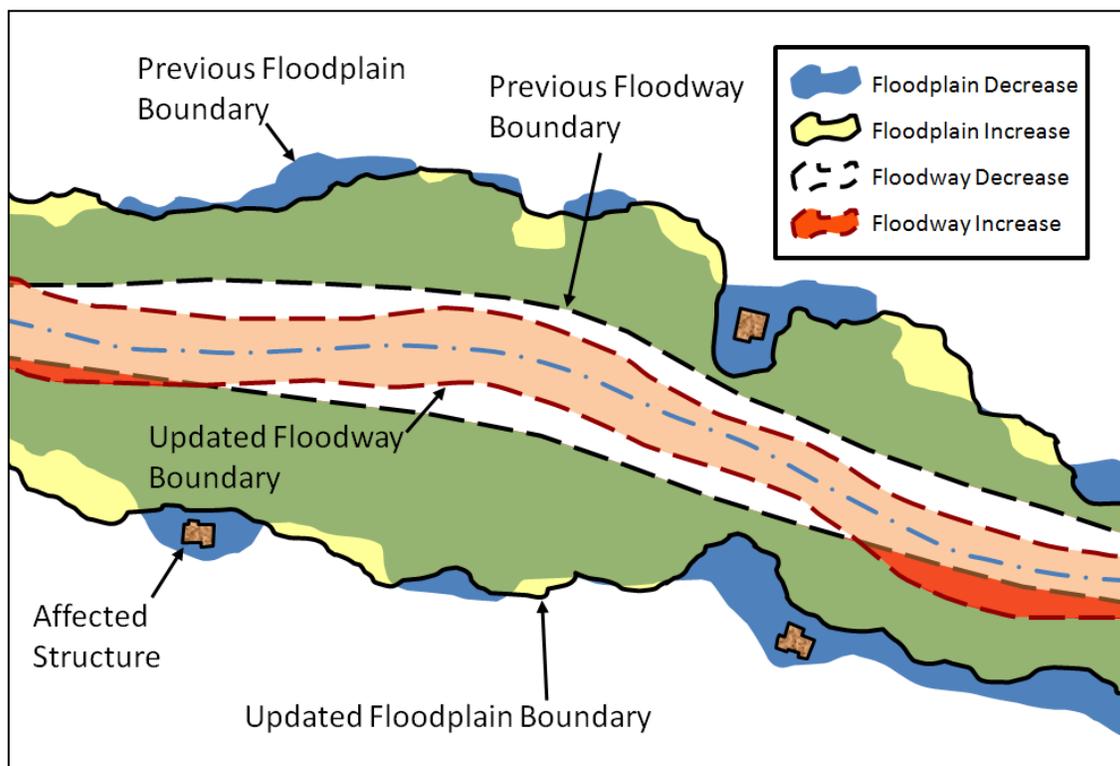


Figure 3 - Visualization of Changes Since Last FIRM

Features and Benefits

- Captures changes in mapped floodplain and floodway boundaries as well as flood zone designations
- Makes it easy for communities and homeowners to identify the impacts of new maps on the regulatory floodplain.
- Helps identify reasons for changes
- Assists in prioritizing mitigation actions

Intended Users

- Community officials and leaders
- Planners
- Engineers
- Developers
- Insurance Agents, Realtors, Lenders
- Citizens

The Changes Since Last FIRM dataset, which is provided to help communities understand the changes to the extent of the mapped floodplain since the prior FIRM was published, can help mitigation planners understand which areas are now at greater flood risk for future mitigation plan updates. Other benefits of the Changes Since Last FIRM dataset are:

- Provides a means by which local floodplain managers and building officials may gain insight into areas that will fall in or out of floodplain development regulations per local flood damage prevention ordinance.
- Serves as a valuable tool for enabling outreach to affected homes and businesses.
- Assists insurance agents, citizens, real estate professionals, and lending institutions understand which areas fall in or out of the NFIP mandatory purchase requirements once the FIRMs are effective.
- Communicates areas where mapped floodplain and/or floodway boundaries have changed, as well as areas where the flood zone designations have changed (e.g., A to AE).
- Communicates (via digital attributes) possible reasons why the mapped floodplain and/or floodway boundaries have changed. Examples might be new terrain data, updated discharge data, or a new structure placed in the mapped floodplain.

Overall, this dataset can help local officials explain changes to the mapped floodplain boundaries and/or flood hazard zones. Additional enhancements to this dataset include the ability to determine the number of structures and population impacted by changes to the extent of the mapped floodplain and floodway, which could assist future land use and mitigation planning decisions. Table 1 provides a high level summary of potential uses for this dataset.

Table 1 - Uses for Changes Since Last FIRM Dataset

Potential Uses for Changes Since Last FIRM Dataset	Where addressed in this document
Updates areas at risk in flood zones	Section 5.1.1: Local and State Mitigation Plan Development and Updates
Determining where flood mitigation is needed or possible	Section 5.1.2: Leveraging Flood Risk Data for Actionable Flood Risk Mitigation Strategies
Inform development decisions and community planning (land use, transportation, sustainability)	Section 5.3: Comprehensive Planning and Future Land Use Planning
	Section 5.4: Community Investment (Capital Improvement Planning)
Illustrating changing risk conditions	Section 5.3.2: Strengthening Sustainability Efforts
Updating evacuation plans	Section 5.8.1: Pre- and Post-Disaster Risk Analysis and Damage Projections

2.2. Flood Depth and Analysis Grids

The Flood Depth and Analysis Grid datasets provide a wide variety of information associated with determining and visualizing flood risk. The multiple datasets within this larger grouping that serve this purpose are summarized in Table 2. A sample visualization of one of the multiple datasets in this grouping of Flood Risk Datasets is shown as Figure 4 below. A full summary of the datasets that reside within this grouping is shown in Table 7 in Section 4 of this document.

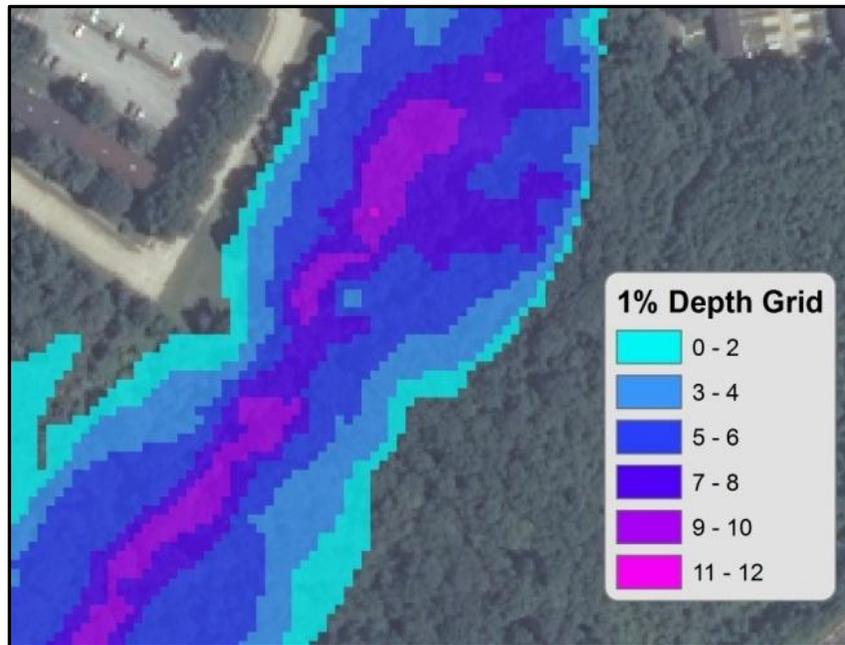


Figure 4 - Visualization of Depth Grid

Features and Benefits

- Flood Depth Grids for 10% (10-year), 4% (25-year), 2% (50-year), 1% (100-year), and the 0.2% (500-year) annual chance flood events
- Percent annual chance of flooding and chance of flooding over the average mortgage (30-year) time period
- Other flood risk grids such as velocity and water surface elevation change grids
- Assists with mitigation prioritization based on risk
- Assist local permit officials by identifying areas of high hazard
- Assists with cost effectiveness screening
- Effective visual tool to communicate risk to public

Intended Users

- Planners
- Local permit and construction inspection officials
- Officials preparing mitigation grants
- Elected officials and local leaders
- Home owners/Home buyers
- Realtors

Table 2 - Summary of Flood Depth and Analysis Grids Dataset

Grid	Description
Depth	Represents flood depth values across the entire mapped floodplain to enable an understanding of true flood risk in the identified floodplain. This dataset is derived by subtracting the terrain elevation from the water surface elevation for respective recurrence interval event.
Water Surface Elevation	Represents modeled water surface elevations for different flood frequency (or return interval) events within the identified floodplain.
Water Surface Elevation Change	Shows change in water elevation between the existing and revised mapped floodplain. This dataset is considered the vertical companion to the horizontal changes provided by the Changes Since Last FIRM dataset.
Velocity (Riverine)	Describes the average flood velocity for a specific location in the mapped floodplain for a given percent annual chance flood frequency profile.
Velocity (Coastal)	Similar to the riverine velocity grid and is located in mapped floodplain areas affected by coastal flood hazards and storm surge.
Percent Annual Chance Probability	Represents the percent annual chance of flooding for all areas within the identified floodplain.
Percent 30-year Chance Probability	Shows the likelihood of flooding at least one time during a 30-year period to relate to a typical mortgage lifespan for all areas within the identified floodplain.
1 Percent Plus Water Surface Elevation	Represents a higher flood elevation that reflects known uncertainties in water surface elevation by reflecting the upward limit of the horizontal extent of the 1-percent annual chance floodplain.
1 Percent Plus Depth	Similar to other depth grids, the terrain elevation is subtracted from the 1 Percent Plus water surface elevation to derive the 1 Percent Plus Depth Grid.

This dataset can help communities better understand more characteristics of their mapped floodplains and the area of highest flood risk in addition to the standard 1-percent (100-year) annual chance flood zone information. It visually shows varying levels of risk within the same identified floodplain and depths of flooding for multiple return frequencies at any location. It is a powerful communication and planning tool, enabling users to convey that a property may not just be in or out of the 1-percent annual chance floodplain, but that it may receive a specified level of flooding from an event of lesser magnitude. Using depth of flooding for a 4-percent annual chance (25-year) event, for example, simple depth to damage curve calculations can be applied to tell a particular property owner that in a particular event they can expect a specified amount of dollar damages.

Other benefits of Flood Depth and Analysis grids are as follows:

- Helping enlist the support of elected officials and key local leaders by identifying areas of highest flood risk according to frequency and magnitude (depths) for possible mitigation actions (even if that action is to maintain property as open space).
- Helping building officials, property owners, and developers understand the elevation requirements for specific sites according to local flood damage prevention ordinances and/or building codes, and how these may change over time.

See the Sections referenced in Table 3 below for more details:

Table 3 - Uses for Flood Depth and Analysis Grids Dataset

Potential Uses for Flood Depth and Analysis Grids	Where addressed in this document
Informs decision makers about potential risk reduction efforts	Section 5.1.2: Leveraging Flood Risk Data for Actionable Flood Risk Mitigation Strategies
Identify areas of greatest flood risk vulnerability	Section 5.2.1: Floodplain Management - Identifying Potential Risk "Hot Spots"
Clearly depicts high flood risk areas for future planning	Section 5.3: Comprehensive Planning and Future Land Use Planning
Informs decision makers regarding future development	Section 5.3.1: Evaluating Potential Impact of Proposed Development Section 5.4: Community Investment (Capital Improvement Planning)
Aids in understanding current and future risk	Section 5.3.2: Strengthening Sustainability Efforts
Helps visualize a variety of flood risk elements for local stakeholders. Enables a better understanding that knowing whether you are "in" or "out" of the floodplain is only the beginning of understanding relative flood risk, because flood risk varies within the mapped floodplain.	Section 5.5: Public Outreach
Demonstrates higher flood vulnerability in specific areas	Section 5.6: HMA Grant Application Prioritization and Support
Accessible source of data for cost effectiveness	Section 5.6.1 Evaluating Cost Effectiveness of Potential Mitigation Projects (including BCA Support)
Assists with advanced recovery planning and disaster preparedness	Section 5.8.1: Pre- and Post-Disaster Risk Analysis and Damage Projections

2.3. Flood Risk Assessment Dataset

The Flood Risk Assessment dataset provides potential flood damage estimates resulting from an analysis of flood depth within the built environment. Flood risk assessment data will be primarily based on the following two sources:

- Hazards U.S. (Hazus) MR4 Average Annualized Loss (AAL) Study
- “Refined” Hazus analysis for new or updated flood study reaches where the AAL data is replaced with more detailed information based on the new flood study information. For more information on Hazus, please refer to <http://www.fema.gov/plan/prevent/hazus/>

Flood Risk Assessment data is stored in the Flood Risk Database and is used to create the community-specific tables presented in the Flood Risk Report, similar to Table 4 below.

Table 4 - Sample Hazus Flood Loss Estimates

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses	Loss Ratio	Dollar Losses	Loss Ratio						
Residential Building/Contents	\$94,495,000	77%	\$10,439,000	11%	\$13,571,000	14%	\$19,273,000	20%	\$32,925,000	35%	\$176,000	0%
Commercial Building/Contents	\$15,127,000	12%	\$2,112,000	14%	\$3,225,000	21%	\$4,337,000	29%	\$4,925,000	33%	\$109,000	1%
Other Building/Contents	\$13,073,000	11%	\$1,660,000	13%	\$2,195,000	17%	\$3,620,000	28%	\$5,430,000	42%	\$79,000	1%
Total Building/Contents	\$122,695,000	100%	\$14,211,000	12%	\$18,991,000	15%	\$27,230,000	22%	\$43,280,000	35%	\$364,000	0%
Business Disruption	N/A	N/A	\$760,000	N/A	\$1,259,000	N/A	\$2,011,000	N/A	\$4,074,000	N/A	\$18,000	N/A
TOTAL	\$122,695,000	N/A	\$14,971,000	N/A	\$20,250,000	N/A	\$29,241,000	N/A	\$47,354,000	N/A	\$382,000	N/A

Features and Benefits:

- Identifies areas of higher flood risk by census block
- Quantifies potential future flood losses to existing structures
- Improves ability to identify effective mitigation actions, or areas requiring higher building code requirements, or use of flood resilient designs and construction materials
- Supports mitigation plan updates through improved risk quantification
- Supports disaster recovery planning by showing areas of highest expected damages

Intended Users:

- Planners
- Developers
- Community officials
- Emergency managers

The Flood Risk Assessment dataset helps guide community mitigation efforts by quantifying future potential flood losses, thereby showing where flood mitigation actions may produce the highest return on investment. This dataset, which is normally derived using Hazus, estimates potential flood losses for different flood frequencies levels and reports the results at the census block level.

These flood loss estimates provide valuable information for local planners and emergency managers to develop a mitigation plan vulnerability assessment. Although Hazus comes pre-packaged with census-based general building stock and critical facilities data, local officials may have more up-to-date data that (if made available) could be used by the Mapping Partner conducting the flood loss analysis to refine the loss estimates.

Communities are encouraged to utilize the Flood Risk Assessment data to form a scientific basis from which their mitigation strategy is developed. Building on the foundation of the 2010 AAL Hazus Study, refined flood loss estimates will normally be performed for flooding sources with new or updated flood modeling, with further flood loss estimate refinements enabled by the use of community-supplied building stock and essential facility data. Where general building stock data is available and provided to FEMA, an enhanced Risk Assessment loss analyses may be performed on a structure by structure basis. Communities are encouraged to pursue enhanced analyses where possible, and to supply FEMA with additional GIS data, such as tax parcel data, building footprints, or data from digital elevation certificates. Once FEMA receives this information, it can complete an enhanced loss analysis. Communities may also provide additional funding to support analysis enhancement. The results of both the Refined Hazus and enhanced loss analysis can be incorporated into hazard mitigation plans, and in many cases, will refine the flood risk assessment. See the Sections in Table 5 below for more details on the Flood Risk Assessment dataset and the use(s) of Hazus.

Table 5 - Uses for Flood Risk Assessment Data

Potential Uses for Flood Risk Assessment Data	Where addressed in this document
Quantifies flood risk and estimates projected loss for multiple flood scenarios	Section 5.1.1: Local and State Mitigation Plan Development and Updates
Identifies where mitigation activities may produce the greatest return on investment	Section 5.1.2: Leveraging Flood Risk Data for Actionable Flood Risk Mitigation Strategies
Identifies areas with greatest flood loss potential	Section 5.2.1: Floodplain Management - Identifying Potential Flood Risk “Hot Spots”
Helps identify areas where flood mitigation activities are most needed	Section 5.6: HMA Grant Application Prioritization and Support
Provides data to help screen for cost effectiveness	Section 5.6.1: Evaluating Cost Effectiveness of Potential Mitigation Projects
Provides data for Loss Avoidance Studies	Section 5.6.2: Evaluating Effectiveness of Completed Mitigation Projects
Identification of critical facilities at risk that may need relocation or retrofit	Section 5.8: Response and Recovery Planning
Predictor of where major damage may occur to aid first responders and for resource allocation purposes	Section 5.8.1: Pre- and Post-Disaster Risk Analysis and Damage Projections

2.4. Areas of Mitigation Interest

The Areas of Mitigation Interest dataset identifies physical factors that may contribute (positively or negatively) to flooding and flood losses warranting further research and focus to determine if it is feasible to address them through the implementation of future mitigation actions. The Flood Risk Map will include call-outs (space permitting) showing Areas of Mitigation Interest examples of potential mitigation opportunities, such as the one shown in Figure 5 below.



The Big Lake Dam, an unregulated structure located along Tributary A, causes upstream backwater during flood events; makes portions of River Road un-passable; and several homes receive flooded yards and basements

Figure 5 - Sample Area of Mitigation Interest

Features and Benefits:

- Identifies areas at-risk of flooding, along with the factors that contribute to those risks
- Informs decisions makers on where mitigation actions or additional building code requirements are needed or further research is warranted
- Useful in formulating building code enhancements and prioritizing mitigation actions and identifying needed resources
- Helps visually communicate flood risk to the public
- Allows neighboring communities in a watershed study area to see factors that may impact them, fostering collaboration.
- Can identify potential flooding issues associated with undersized culverts

Intended Users:

- Planners
- Developers
- Engineers
- Citizens

Similar to the engineering factors associated with the Changes Since Last FIRM dataset, the Areas of Mitigation Interest dataset will identify physical factors that may be contributing (positively or negatively) to flooding and flood losses in a study area. This dataset will come from three primary sources:

- Community provided data from local mitigation plans and local stakeholders,
- Engineering data from the revised H&H models, other studies or previous flood studies,
- Watershed association data
- State data
- Federal government data (e.g., flood claims).

The Areas of Mitigation Interest may also include information such as:

- Dams, accredited and non-accredited levees, and coastal structures contributing to flooding conditions,
- Significant land use changes, including major past and future development potentially impacting Special Flood Hazard Areas (SFHAs),
- Key emergency routes overtopped during frequent flood events,
- Stream flow constrictions (e.g., undersized bridges and culverts),
- Past claims “hot spots,” including flood claims and properties on the FEMA Repetitive Loss/Severe Repetitive Loss lists, and Individual Assistance/Public Assistance (IA/PA) data,
- Areas of significant riverine or coastal erosion,
- Locations of at-risk essential facilities,
- Other flood risk areas not identified on the FIRM,
- Significant embankments (non-levee) that contribute to flood hazards, and
- Areas of mitigation success, including previous mitigation projects and plans.

This dataset is provided to communities on the Flood Risk Map and in the Flood Risk Report, and is intended to help direct local government officials to areas warranting further investigation. It also adds value to the existing data by providing it in a single location, geo-referenced, and readily available. Further value will be added by attributing the data points with descriptive data and citations to additional data, and then validating the data. By providing areas of interest on a watershed basis, this dataset draws needed attention to the interconnectivity of actions, and the necessity of planning with upstream and/or downstream neighbors in an effort to reduce losses.

A robust study of Areas of Mitigation Interest should lead to the evaluation and prioritization of achievable mitigation actions, the essence of mitigation planning, and a targeted outcome. One example of how the Areas of Mitigation Interest dataset could benefit local stakeholders is by identifying structures located within a residual or active risk zone on the landward side of a levee.

Table 6 below provides potential uses for the Areas of Mitigation Interest dataset.

Table 6 - Uses for Areas of Mitigation Interest Data

Potential Uses for Areas of Mitigation Interest	Where addressed in this document
Identifies contributing factors to flood risk for vulnerability assessment and identifies past mitigation success	Section 5.1.1: Local and State Mitigation Plan Development and Updates
Identifies areas where major flooding could occur in the future due to substandard or decaying flood structures, and undersized or poorly maintained culverts	Section 5.1.2: Leveraging Flood Risk Data for Actionable Flood Risk Mitigation Strategies
Assists in prioritizing areas of greatest mitigation need	Section 5.2.1: Floodplain Management - Identifying Potential Risk “Hot Spots”
Aids in assessment of future key needs for investment to facilitate areas for development	Section 5.3.2: Strengthening Sustainability Efforts
Informs development decision-making of risk-prone infrastructure and areas	Section 5.4: Community Investment (Capital Improvement Planning)
Identifies potential need for infrastructure upgrades and other community investments	Section 5.4: Community Investment (Capital Improvement Planning)
Demonstrates specific contributing factors to flooding for evaluation of mitigation actions and alternatives	Section 5.6.1: Evaluating Cost Effectiveness of Potential Mitigation Projects

3. Flood Risk Products

This Section describes the Flood Risk Products which contain or summarize the information found in the datasets. The Flood Risk Database provides a framework for storage for the datasets, the Flood Risk Report is a summary of key information, and the Flood Risk Map is a visual depiction of select information found in the datasets.

3.1. Flood Risk Database

The Flood Risk Database is a product that contains the raw data and results from the Flood Risk Assessment analysis. It would include all the datasets generated for a community including the ones discussed above (Changes Since Last FIRM, Areas of Mitigation Interest, Flood Risk Assessment, and Flood Depth and Analysis Grids). The Flood Risk Database is the Flood Risk Product that will contain the results of the following Flood Risk Assessment data:

- Average Annualized Loss (Hazard) results for the entire project area
- Refined Hazard results for areas restudied
- Composite Flood Risk Assessment
- Analysis Required for Flood Risk Assessment Data in the Flood Risk Report
- Analysis Required for Flood Risk Assessment Data in the Flood Risk Map

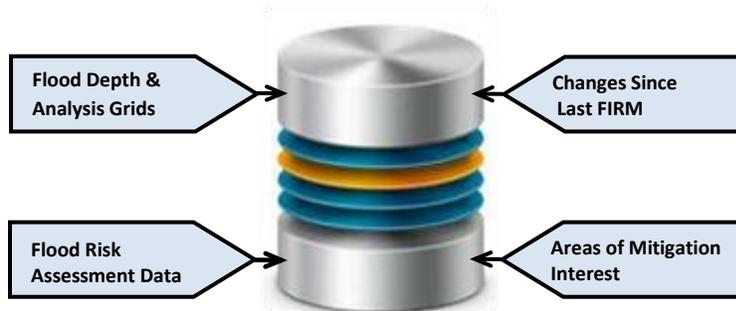


Figure 6 - Flood Risk Database

Features and Benefits:

- Serves as the “container” for all flood risk datasets
- May be used to facilitate visualization of flood risk using the four flood risk datasets (Changes Since Last FIRM, Depth & Analysis Grids, Flood Risk Assessment Data, and Areas of Mitigation Interest)

Intended Users:

- GIS Departments
- Planners with GIS skills

3.2. Flood Risk Report

The Flood Risk Report provides local communities with a summary of their flood risk developed during a Flood Risk Project that can be used for outreach and communications and to supplement or improve mitigation plan risk and vulnerability assessments. The data can also be used to support development of mitigation strategies and actions. Data within this report is presented at both the overall project area and community levels, in narrative and tabular formats. The Flood Risk Report provides watershed-specific and/or community-specific flood risk information to help local officials develop and prioritize meaningful mitigation strategies. For example, the community-specific Sections will include a table similar to Table 4 in Section 2.3 of this document. The report also allows neighboring communities within the watershed or project area to see relative risk in neighboring communities and specific risk that may have cross jurisdictional impact.

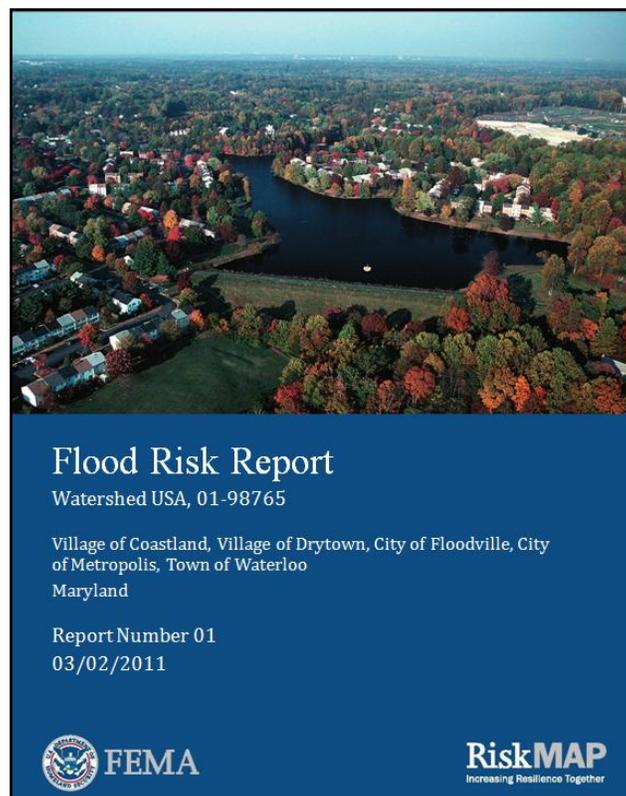


Figure 7 - Flood Risk Report

Features and Benefits:

- Provides communities with a high level summary of flood risk within the subject watershed or project area that may be included in a mitigation plan
- Detailed information on specific areas
- Useful tool for prioritizing mitigation actions and resources
- Useful for risk communication and outreach

Intended Users:

- Community Official and Leaders
- Planners
- Engineers

3.3. Flood Risk Map

The Flood Risk Map contains data from the Flood Risk Database that visually depicts flood risk including Hazus risk assessment results and selected Areas of Mitigation Interest. The Flood Risk Map provides local officials with a high-level flood risk overview of the project area to enable them to identify flood risk “hot spots” and Areas of Mitigation Interest to facilitate coordination with neighboring upstream and downstream communities. The Flood Risk Map will also include the composite total 1-percent annual chance (100-year) loss per census block as one of the GIS layers and charts with losses per community. Local officials may also create their own customized maps from within the Flood Risk Database.

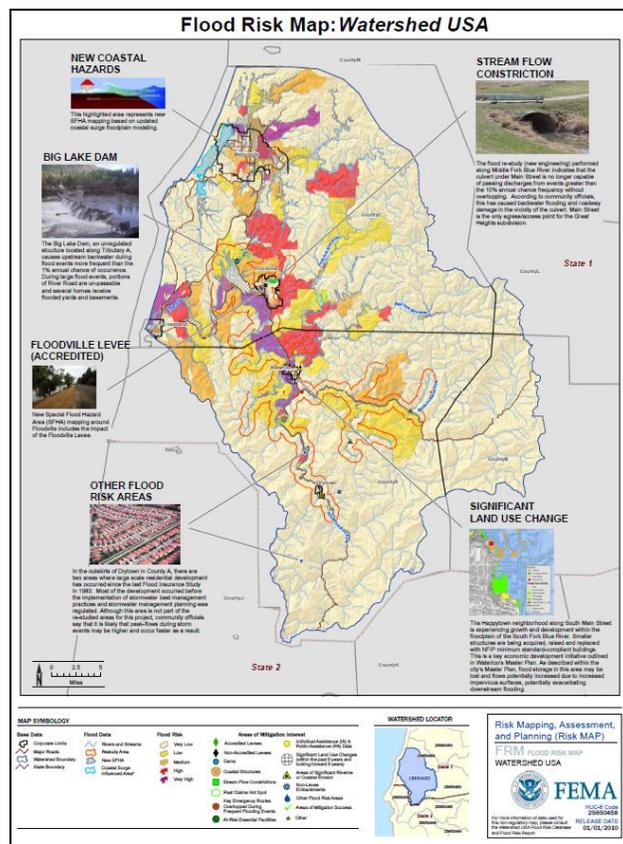


Figure 8 - Flood Risk Map

Features and Benefits:

- Visually depicts flood risk within a watershed
- Provides specific areas of focus for community consideration
- Shows the interrelation of flooding issues across jurisdictions within a watershed
- Combines multiple datasets from Flood Risk Database into one map

Intended Users:

- Community officials and leaders
- Developers
- Planners
- Citizens

4. Summary of Flood Risk Datasets and Products

Table 7 below provides an overview of which elements of the flood risk datasets will be included in each Flood Risk Product. A “Yes” shown in the Flood Risk Report column indicates that there is a tabular listing of attribute data for each layer. For example, in the Flood Risk Report, the Changes Since Last FIRM dataset is reported as a tabular summary of Special Flood Hazard Area square mile changes.

Table 7 - Summary of Flood Risk Datasets and Products

Dataset	Sub-Element	Flood Risk Database	Flood Risk Report	Flood Risk Map
Changes Since Last FIRM (CSLF)	Change polygons representing floodway and floodplain revisions	Yes	Yes	No
	CSLF Polygon Attributes	Yes	No	No
	Affected Structures	Yes	Yes	No
	Affected Population	Yes	Yes	No
Water Surface Grids	Water Surface Elevation	Yes	No	No
Depth Grids	Depth	Yes	No	No
Flood Risk Analysis Grids	Water Surface Change	Yes	No	No
	Velocity	Yes	No	No
	Percent Annual Chance	Yes	No	No
	Percent 30-year Chance	Yes	No	No
	1% Plus (Elevation)	Yes	No	No
	1% Plus (Depth)	Yes	No	No
Flood Risk Assessment	AAL Study Data	Yes	No	No
	Refined Hazus Data	Yes	No	No
	Composite Loss Data	Yes	Yes	Yes

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Dataset	Sub-Element	Flood Risk Database	Flood Risk Report	Flood Risk Map
Areas of Mitigation Interest	Dams	Yes	Yes	Yes
	Non-Accredited Levees	Yes	Yes	Yes
	Accredited Levees	Yes	Yes	Yes
	Coastal Structures	Yes	Yes	Yes
	Stream Flow Constrictions	Yes	Yes	Yes
	Key Emergency Routes Overtopped During Frequent Flood Events	Yes	Yes	Yes
	Past Claims Hot Spot	Yes	Yes	Yes
	Individual Assistance (IA) and Public Assistance (PA) data	Yes	Yes	Yes
	Significant Land Use Changes	Yes	Yes	Yes
	Areas of Significant Coastal or Riverine Erosion	Yes	Yes	Yes
	Non Levee Embankments	Yes	Yes	Yes
	Other Flood Risk Areas	Yes	Yes	Yes
	Areas of Mitigation Success	Yes	Yes	Yes
	Other	Yes	Yes	Yes

5. Use of Flood Risk Datasets and Products for Mitigation Activities

This Section provides general examples designed to generate thought and discussion appropriate to the circumstances of each community and shows the potential use of the datasets and products to add value to the following activities:

- Hazard Mitigation Planning
- Floodplain Management and Community Rating System
- Building code requirements, including use of flood resistant designs and construction materials
- Comprehensive Planning and Future Land Use Planning
- Community Investment (Capital Improvement Planning)
- Public Outreach
- Hazard Mitigation Assistance (HMA) Grant Application Prioritization and Support (Including Benefit-Cost Analysis or BCA Screening)
- Other Non-FEMA Grants to Reduce Flood Risk
- Response and Recovery Planning

Some of these activities (e.g., comprehensive planning, land use planning) are beyond the scope of the FEMA core mission. However, updated flood risk information can contribute to a better local understanding of characteristics of land in their jurisdiction, which can lead to more informed decisions to allow suitable and appropriate development in higher risk areas.

5.1. Hazard Mitigation Planning

This Section provides information on how to use the Flood Risk Datasets and Products for the various hazard mitigation planning activities, especially the risk and vulnerability assessment, and the development of mitigation strategies.

5.1.1. Local and State Mitigation Plan Development and Updates

Mitigation planning is a holistic, comprehensive, and strategic approach to risk reduction. One of the most important components of successful hazard mitigation planning is access to current and accurate data. Having up-to-date, relevant, and area-specific flood risk data, such as that provided by the Flood Risk Datasets and Products,

Multi-Hazard Mitigation Planning

“State, Indian Tribal, and local governments are required to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects. The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288), as amended by the Disaster Mitigation Act of 2000, provides the legal basis for State, local, and Indian Tribal governments to undertake a risk-based approach to reducing risks from natural hazards through mitigation planning.”

effectively informs decision makers, and aids in the prioritization of flood mitigation objectives and actions. This datasets and products, in many cases, will represent the best available and most current flood risk data.

Flood Risk Datasets and Products can be easily updated in a GIS environment to reflect changes to the built environment, thereby facilitating the preparation and update of local mitigation to comply with FEMA's multi-hazard mitigation planning requirements. As demonstrated through this document, they can also be used in support of HMA grants, Community Rating System (CRS) activities, and other community planning, communication and flood loss reduction initiatives. For example, the Flood Risk datasets can support mitigation plan updates by developing better flood risk quantification that can do the following:

- Provide for riverine and coastal flood vulnerability analysis in mitigation plans through the use of digital flood risk data that are easier and less expensive to update during subsequent revisions
- Communicate risk through flood loss estimation scenarios from Hazus information
- Reinforce interconnectedness of the riverine and/or coastal systems for multi-jurisdictional plans by using a watershed analysis
- Reduce costs for planning risk assessments from coastal and riverine studies because loss estimates may already be provided through the Flood Risk Assessment and Database
- Provide support documentation for grant submittals
- Provide information for the Risk Assessment Section of the local mitigation strategy by identifying hazards, profiling hazards, and assessing vulnerability through identifying structures, and estimating potential losses through the Flood Risk Assessment dataset
- Identify goals and mitigation actions for the Mitigation Strategy Section
- Provide more information to better match appropriate mitigation actions to the risk

Until recently, FEMA's focus was primarily on the 1-percent annual chance event with less emphasis on the more frequent and lower impact floods (e.g., 10-percent annual chance and higher frequency floods). It is often these higher frequency events, which have a more frequent impact, which communities and residents are more able to relate to. The flood risk data and products will greatly improve a community's ability to prioritize the areas needing local mitigation assistance, as well as enabling prioritization of mitigation resources, both of which are planning functions that are required under 44 Code of Federal Regulations (CFR) Part 201.

Note that mitigation planning may include the adoption of flood-specific or otherwise stronger building codes to address higher or expanded flood risks. Table 8 below demonstrates where the information provided in the Flood Risk Datasets and Products can provide communities with data that can assist in meeting the required and recommended elements of a Multi-Hazard Mitigation Plan.

Table 8 - Where Flood Risk Datasets and Products fit into FEMA Plan Regulations (44 CFR 201.6)

FEMA Planning Regulation from 44 CFR 201.6 (shaded rows are recommended but not required)	Relevant Flood Risk Dataset and/or Product
(b)(3) - Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?	<ul style="list-style-type: none"> • All of the Flood Risk Datasets and Products that are considered in the plan could contribute to this requirement if there is a proper description in the plan of how they were used.
(c)(2)(i) - Does the risk assessment identify the location (<i>i.e.</i> , geographic area affected) of each natural hazard addressed in the new or updated plan?	<ul style="list-style-type: none"> • Changes Since Last FIRM dataset • Areas of Mitigation Interest dataset ¹ • Section 3 of the FRR (Flood Risk Analysis Results) • Flood Depth and Analysis Grids
(c)(2)(i) - Does the risk assessment identify the extent (<i>i.e.</i> , magnitude or severity) of each hazard addressed in the new or updated plan?	<ul style="list-style-type: none"> • Changes Since Last FIRM dataset • Flood Depth & Analysis Grids • Section 3 of the FRR (Flood Risk Analysis Results)
(c)(2)(i) - Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?	<ul style="list-style-type: none"> • Areas of Mitigation Interest dataset ¹ • Section 3.3 of the FRR (Communities)²
(c)(2)(ii) - Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?	<ul style="list-style-type: none"> • Flood Risk Map • Flood Risk Assessment dataset • Section 1.1.1 of the FRR (Calculating Flood Risk) • Section 3 of the FRR (Flood Risk Analysis Results)
(c)(2)(ii) - Does the new or updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties located in the identified hazard areas?	<ul style="list-style-type: none"> • Areas of Mitigation Interest dataset ¹ • Section 3.3 of the FRR (Communities)²
(c)(2)(ii)(A) – Does the new or updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?	<ul style="list-style-type: none"> • Changes Since Last FIRM dataset • Flood Risk Assessment Dataset • Areas of Mitigation Interest dataset ¹ • Section 3.3 of the FRR (Communities)²

¹ Only if the dataset is ordered and developed as a component of the Flood Risk Project.

² If the Areas of Mitigation Interest dataset is included in the Flood Risk Project, the FRR will include mitigation information related to each community in the community-specific sections (Section 3.3)

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Table 8 - Where Flood Risk Datasets and Products fit into FEMA Plan Regulations (44 CFR 201.6)

FEMA Planning Regulation from 44 CFR 201.6 (shaded rows are recommended but not required)	Relevant Flood Risk Dataset and/or Product
(c)(2)(ii)(A)- Does the new or updated plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?	<ul style="list-style-type: none"> • Areas of Mitigation Interest dataset ¹ • Section 3.3 of the FRR (Communities)²
(c)(2)(ii)(B)- Does the new or updated plan estimate potential dollar losses to vulnerable structures?	<ul style="list-style-type: none"> • Flood Risk Assessment dataset • Hazus User Defined Facility (structure specific) analysis (if conducted) • Section 3 of the FRR (Flood Risk Analysis Results)
(c)(2)(ii)(C) - Does the new or updated plan describe land uses and development trends?	<ul style="list-style-type: none"> • Areas of Mitigation Interest dataset ¹ • Section 3.3 of the FRR (Communities)²
(c)(3)(ii)- Does the new or updated plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?	<ul style="list-style-type: none"> • Areas of Mitigation Interest dataset ¹ • Section 4 of the FRR (Actions to Reduce Flood Risk)³
(d)(3)- - Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (<i>i.e.</i> , deferred), does the updated plan describe why no changes occurred?	<ul style="list-style-type: none"> • Areas of Mitigation Interest dataset ¹

¹ Only if the dataset is ordered and developed as a component of the Flood Risk Project

² If the Areas of Mitigation Interest dataset is included in the Flood Risk Project, the FRR will include mitigation information related to each community in the community-specific sections (Section 3.3)

³ This section of the FRR offers examples of a comprehensive range of actions that will assist with this planning activity

Note: Relevant Flood Risk Datasets and Products identified in Table 8 can contribute significantly to the areas identified from 44 CFR 201.6. However, nothing in this table should be construed as implying that the Flood Risk Datasets and Products, on their own, will meet the planning regulatory requirements.

The Flood Risk Report, especially the Flood Risk Database, provides communities with readily available risk assessment data on flooding, which can be included in a mitigation plan. Flood risk data will be provided at both the watershed and community level, although it is important to note that only the portion of affected communities within the project area (watershed, coastal, or site-specific) will be represented in the flood risk data and products. Appropriate use of flood risk data and products will improve or supplement a community's understanding of flood risk and will enable decision-makers to make informed decisions regarding the most cost-effective mitigation actions to best reduce or eliminate flood risk.

Conversely, local mitigation plans may provide valuable information to inform flood risk dataset and product development, such as Areas of Mitigation Interest that may already be identified in local plans. Likewise, Areas of Mitigation Interest may assist the community during plan development or update to identify and prioritize mitigation actions. An Areas of Mitigation Interest, such as significant development in an upstream community in the watershed, but outside of a mitigation planning project area, may trigger increased communication and collaboration between neighboring communities in a watershed.

For mitigation planning purposes and particularly for required plan updates, the communities will be able to use the Changes Since Last FIRM dataset to inform local stakeholders of areas at risk, and to identify, through the engineering factors, possible mitigation activities that could lessen flood risk. The local planners will be able to focus on where vulnerability is changing and have insight into why. The planners will also have the means to quantify what is at risk in the change areas. Since most studies will be conducted on a watershed basis, communities will be able to work together to identify the impacts of actions upstream and downstream in a particular watershed affecting neighboring communities.

Other benefits of hazard mitigation planners getting involved with the Risk MAP program are that by using the Flood Risk Datasets and Products, funds or personnel resources previously needed to conduct a vulnerability assessment can be freed up to do the other planning work needed, like building public support or project scoping, which can lead to stronger mitigation plan development and implementation.

The interactive nature of developing flood risk products and datasets (e.g., the meetings held during the various stages of flood map, dataset, and product development) can be integrated into the local mitigation planning maintenance/update, and/or public involvement process required of new and updated plans, thus broadening awareness within the communities. The local community and the State can use the finalized datasets and products to update their risk and vulnerability assessments. The datasets and products can provide more quantifiable data for use in these Sections.

5.1.2. Leveraging Flood Risk Data for Actionable Flood Risk Mitigation Strategies

Flood risk data can be used as a basis to compare two or more options for mitigating risk in an identified flood prone area and enable selection of the most effective (and appropriate) action. It can also be used to evaluate whether the adoption of a new, stronger building code is warranted. As described earlier, datasets such as the ones listed in this guidance, can help local government decision makers fine-tune their understanding of the flood risk within their communities by identifying flood risk “hot spots.” Information from these datasets draws attention to particular areas of the community or watershed, and follow-up efforts will contribute to a more informed prioritization of flood risk mitigation strategies and actions.

Flood Risk Datasets and Products may assist local and State officials with developing actionable flood risk mitigation actions in the following ways:

- ***Changes Since Last FIRM.*** Mitigation strategies can be updated or created based on data provided in the Changes Since Last FIRM dataset. Depending on what changes have occurred to the identified floodplain extents, new areas may be found at risk to flooding. Likewise, the flood risk may have decreased in other areas. This information is essential in determining where flood risk mitigation strategies are needed, and also in determining what is contributing to increases in flooding, so mitigation might be focused on slowing, or reducing future increases in flooding.
- ***Areas of Mitigation Interest.*** This dataset provides information that can be used to investigate the need for flood risk mitigation strategies, perhaps on a watershed basis, by identifying specific areas or physical factors, which may contribute to increased risk and focusing local officials’ attention on those areas. Although much of this information may be already known to, and supplied by communities, by validating it, and sharing the data with a larger audience, attention to this information will increase, and potentially lead to further loss reduction action.
- ***Flood Risk Assessment.*** Through other datasets and products, such as Flood Risk Assessment, planners and officials can identify where risk reduction efforts may produce the highest return on investment. This can inform policy decisions about which mitigation actions are pursued and how they are prioritized. It may also provide a baseline against which to evaluate loss reduction upon future updates.
- ***Flood Depth and Analysis Grids.*** These datasets can enhance the understanding and visualization of where floods will occur and the degree of risk that exists from flooding within the mapped floodplain. This information can be useful for identifying vulnerability in terms of flood severity and frequency of occurrence, driving factors for enhancing the existing building code, or providing data needed for a BCA for recommended mitigation projects. Based on this information, communities have better data to use to select several strategies for reducing losses from flood, and to begin developing project funding

applications. Where historically most emphasis had been placed on whether a property was “in or out” of the 1-percent annual chance floodplain, communities will now be able to see the significant variation of risk to properties within the entire mapped floodplain, facilitating the prioritization process.

5.2. Floodplain Management and Community Rating System

This Section provides information on how to use the Flood Risk Datasets and Products to assist with local floodplain management activities, including participating in the CRS Program.

5.2.1. Floodplain Management - Identifying Potential Flood Risk “Hot Spots”

In both floodplain management and mitigation planning, it is important to understand that flood risk can change over time. There are also certain areas that remain flood risk “hot spots,” having a higher and/or more consistent level of risk than other areas. Several of the flood risk datasets are useful at revealing these specific high vulnerability areas. The Areas of Mitigation Interest dataset, as well as Flood Depth and Velocity Grids, may be helpful in identifying flood risk “hot spots,” which may warrant either enhanced building codes, or greater study for developing a potential project, increasing outreach activities, or changing regulatory standards.

An analysis of the change in flood risk over time is also a valuable and important element of an effective floodplain management program. This data will help users to effectively communicate risk and update local ordinances. These changes to flood risk may be based on factors such as:

- Development patterns that put additional structures and people at risk in previously undeveloped (and potentially unmapped) floodplain areas
- Increased upstream development that leads to additional runoff impacting the volume of water in the stream (the “urbanization” effect)
- Engineering factors that change the hydrology and hydraulics of the watershed
- Hydrologic and climate changes (e.g., sea level rise)

The local floodplain manager could use the 1-Percent Plus Water Surface Elevation Grid, which shows the upper bound vertical height of the Base Flood Elevation, for advising the local elected officials to consider adopting more freeboard in the local floodplain ordinance. This step could also be used for CRS points, which are discussed in more detail below. The local floodplain manager could create a map using the 1-Percent Plus Grids to create an additional map overlay depicting a wider floodplain based on a higher water surface elevation, which in turn is based on use of the upper bound information in the hydraulic model. This information could be used to advise elected officials and property owners that they should consider purchasing a Preferred Risk Flood Insurance policy due to their proximity of the SFHA.

Flood Risk Datasets and Products make it easier to capture and recognize these types of changes to flood risk. The risk data can then be used for an advanced effort to provide a more accurate portrayal of risk for risk awareness and reduction efforts (e.g., local observance of National Flood

Awareness Week, newsletters to the community, and information on the local community's Web site). As the flood risk datasets are updated in the future, it will become increasingly easy to show losses avoided, identify why and where the hazard is changing, and plan for it through further analysis.

The Depth and Velocity Grids could be used to develop higher regulatory standards for areas within the SFHA with higher risk. Areas of Mitigation Interest that show flooding areas not included in the SFHA could also be used to create overlay zones to include in development standards.

5.2.2. Community Rating System

Flood risk data can also be used to justify an investment in resources for managing the risk through programs such as the CRS, which provides financial incentives for participation. The CRS program gives points to many of these activities, including public information and flood damage reduction activities (e.g., floodplain management planning, acquisition/relocation of flood prone properties), and flood protection projects. For example, the Areas of Mitigation Interest dataset may identify stream flow constrictions, which could be mitigated locally through a culvert or bridge enlargement, an activity, which if it results in the protection of buildings in the SFHA, would accrue CRS points. As stated in 4.2.1 above, if the local community used the 1-Percent Plus Water Surface Elevation Grid for adopting freeboard in the local floodplain ordinance, substantial credit would be given for this increased regulation. Flood Risk Assessments show details of potential future flood losses of critical facilities using Hazus. If the community used this information, and determines the need to adopt a more stringent flood protection standard for critical facilities, the community could receive CRS points if they followed through on the adoption. Each accumulation of points that improves a community's CRS class rating results in a greater premium reduction for all the community's NFIP policy holders.

5.3. Community General or Comprehensive Planning

This Section discusses comprehensive planning, future land use planning, and guiding development through these types of planning processes. FEMA's Mitigation Planning regulation under 44 CFR Part 201 includes a requirement that communities identify planning mechanisms to incorporate mitigation actions. FEMA and the American Planning Association jointly released a publication entitled *Hazard Mitigation: Integrating Best Practices into Planning*, which can be found online at <http://www.fema.gov/library/viewRecord.do?id=4267>, to provide support in meeting this requirement.

Flood Risk Datasets can be useful for informing community planning strategies and actions beyond hazard mitigation plans and floodplain mapping. The Areas of Mitigation Interest, Flood Depth Grid, and Velocity Grid datasets depict different types of high risk areas that could help inform land use and comprehensive planning decisions to guide development to areas with lower flood risk. Additionally, communities can use these datasets to revise zoning codes and subdivision regulations to only allow appropriate land uses in high-hazard areas.

5.3.1. Evaluating Potential Impact on Proposed Development

Data included in the Changes Since Last FIRM dataset, which describes whether or not the relevant flood zone areas have changed, can directly impact long term development decisions for residential and commercial land uses, and infrastructure. If an area previously designated a Zone X has been changed to Zone AE in the revised FIRM, a higher development standard will be required. This dataset gives the local official a clear picture of where the changes have occurred so they can be more proactive in evaluating proposed development. Additionally, by understanding what has caused the change, planners may be able to identify trends impacting future planning decisions.

Development decisions can also be influenced by information gained from Flood Depth and Analysis Grids, which may provide new insight as to the potential flood recurrence, and severity in a given area. Datasets, such as the Flood Depth and Analysis Grids, show relative risk within the mapped floodplain, and can be used to make informed site-location decisions when floodplain development is proposed. Additionally, the Areas of Mitigation Interest dataset informs planners, citizens, and developers of other factors contributing to flood risk, which will enable more informed decisions on future development considerations.

5.3.2. Strengthening Sustainability Efforts

Sustainability planning considers the long-term environmental, economic, and social interests of a community, while also striving to provide short-term benefits, and address current needs. Within sustainability initiatives, a major component is planning for future environmental conditions. Communities that don't mitigate the impacts of repetitive natural hazard events like flooding may find it difficult to remain sustainable. Existing and prospective businesses and residents may make long-term decisions to stay in or locate to a community, respectively, based on its perceived sustainability.

Flood Risk Datasets and Products can provide a baseline of flood risk and can be used to study how future flood risk conditions are affected by factors like climate change. This could support the development of adaptation strategies or the need for enhanced building codes. For example, using the Changes Since Last FIRM dataset could enable a better understanding of how floodplain extents change over time due to environmental changes such as sea level rise, changes in precipitation patterns, changes in development or urbanization, and/or increased storm surges. On a shorter term basis, this dataset will allow a community planner to see how the impacts of increased impermeability in the watershed or planning area may have impacted flooding over time, helping to sell the importance of stormwater management best practices, cluster development, and a variety of other future land use techniques. This, in turn, will allow a community to better communicate risk to its citizens, and make informed decisions about planning aspects, such as zoning, future development, and increasing resiliency of current infrastructure. The more informed decision makers and planners can be regarding trends in environmental conditions and potential future scenarios, including those resulting from global climate change, the better they can be at developing adaptation strategies and creating a sustainable community.

Flood Risk Assessment data can be used to quantify potential losses from floods on the built environment, which would assist with the prioritization of mitigation areas, and could also be incorporated into a focused sustainability effort. By focusing on areas facing the greatest vulnerability, sustainability efforts can help a community reduce its short- and long-term risk from floods.

Many of the datasets and products described in this guidance can assist communities in planning for future environmental changes through a more accurate and complete awareness of present conditions, as well as a better ability to predict future flood risk, and flood patterns. Incorporating this flood risk data into sustainability efforts can help facilitate a community's strategies and plans, influence priorities, and help prepare for a future that may include environmental conditions different from those present today.

5.4. Community Investment (Capital Improvement Planning)

This Section discusses evaluating community budgets and capital expenditures including infrastructure such as drainage system upgrades, road upgrades, etc. If a community is evaluating maintenance or repair needs on a road, or developing new infrastructure in previously undeveloped area (i.e., new roads, water, and sewer services), the community can consult the Risk MAP datasets and products to determine if a higher flood risk mitigation standard is needed for construction or reconstruction. For example, knowing the depth of flooding from multi-frequency flood events at various locations could influence siting of future infrastructure. These datasets could also help guide strategic infrastructure investment and the resulting future land use in rapidly growing areas.

For example, data from the Areas of Mitigation Interest dataset can highlight where the greatest needs are for actions related to flood risk reduction, which is important for Capital Improvement Plans (CIP). If a community had several undersized bridges, which were causing constriction to the stream flow resulting in flooding, the community may want to list this need in its CIP. This information could also be integrated into Long-Range Transportation Plans to help prioritize future investments in road and bridge elevation and maintenance.

5.5. Public Outreach

The development process for Flood Risk Datasets and Products has several interaction points with the local officials and communities during the FIRM development process to generate awareness. Local officials and community members have opportunities to participate in Risk MAP throughout the development process. As a result of the community's involvement in the process, a greater degree of local support can be generated to help with the overall hazard mitigation process. One way to engage with the public is by using tools included in the Products and Datasets, such as the Changes Since Last FIRM dataset, and the Flood Depth and Analysis Grids. These tools can assist local officials in communicating risk to the public at-large and individual property owners in a more easily understood format than from only written documents or data. Increased public engagement and awareness can assist in overcoming misperceptions and obstacles, which may prevent open

communication about flood risk, and what appropriate steps can be taken to reduce risk. The Flood Risk Datasets and Products described in this document make flood risk easier to understand through the potential for visualization of flood risk.

The Flood Risk Report summarizes flood risk data, including the Changes Since Last FIRM, and Areas of Mitigation Interest datasets. Its layout allows community information to be extracted in a fact sheet format. The Flood Analysis Grid datasets include flood probability grids that can advance flood risk awareness by showing property owners the probability of their structure being flooded in a one-year period and also over a 30-year period (the typical mortgage term), where the flood risk is changing and why, and what the dollar estimate of damages are for specific flood frequency events. Rather than a simple analysis or “in or out” of the SFHA, as the FIRM shows, the datasets now enable a more comprehensive understanding of flood risk throughout the mapped floodplain, and clearly communicate that flood risk varies as proximity to the flooding source increases. In particular, the flood risk probability grids demonstrate how flood risk varies as proximity to the flooding source increases, including a better understanding of how flood risk varies widely even within the 1% and 0.2% annual chance floodplain extents

The refined Hazus analysis with annualized loss estimates makes the risk more tangible to the planners and property owners. Providing potential flood event scenarios with dollar damages for their properties create more understandable situations, which can be presented to the public. In addition to these benefits, elected officials, planners, and engineers can use these datasets to help address the concerns or criticisms expressed by local stakeholders associated with changing flood risk. The Flood Depth and Velocity Grids communicate valuable information to a property owner, especially concerning the need to evacuate quickly from their house if high depths and/or velocity are expected.

5.6. Hazard Mitigation Assistance Grant Application Prioritization and Support (Including BCA Support)

The Flood Risk Datasets and Products provide updated flood risk information, which can help revise existing project prioritization tools, a requirement of a local mitigation plan, and can make the prioritization tools more quantifiable and empirical. Some of the datasets provide quantifiable flood risk data in projected dollar losses (e.g., Refined Hazus analysis results) that can be used to identify and screen HMA projects for cost-effectiveness. Planners will be able to use the data from the Flood Depth and Analysis Grids to identify any particular location in the mapped floodplain to understand a wide variety of flood risk elements, such as the percent annual chance of flooding for any given area, as well as the depth of flooding for multiple return frequencies. This information helps planners more readily demonstrate that some parts of the SFHA are more vulnerable, both in terms of severity and frequency, to flooding than others.

5.6.1. Evaluating Cost Effectiveness of Potential Mitigation Projects

FEMA's HMA programs all require projects to be cost-effective to be eligible. Cost-effectiveness is evaluated through the FEMA BCA modules or other modules that have received FEMA's prior approval. There are several different BCA modules that address flood risk. The full data module requires accurate flood risk data, including terrain, and structural elevation data to run.

The Depth Grids will significantly help with project screening and development. For example, areas that are subject to damage by more frequent floods, such as the 10-percent annual chance flood, generally make better candidates for meeting the cost-effectiveness requirements of HMA programs. Multiple return frequency flood depths for specific properties may also be useful in supplementing data required to develop a BCA using FEMA's BCA flood module, such as predicting future losses at different return frequencies in the absence of historical damages. Knowing the depth of flooding at a particular structure helps estimate damages using the existing depth/damage curves of the BCA. Refined or enhanced Hazus results may alert BCA analysts to areas that merit a full-scale BCA to evaluate cost-effectiveness.

In some cases, the Areas of Mitigation Interest dataset may help identify alternative mitigation actions by demonstrating that a specific cause, like backwater flooding from a constriction, may be the greatest contributing factor to flooding in a specific area. Overall, the flood risk datasets will support the sub-applicants in providing refined flood risk data to communities, which in turn can be used to better evaluate potential mitigation actions by the communities. See the following Web site for more information on HMA grant programs:

<http://www.fema.gov/government/grant/hma/index.shtm>.

5.6.2. Evaluating Effectiveness of Completed Mitigation Projects

Demonstration of losses avoided has taken on a new importance as Federal, State, and local elected officials seek to ensure that limited funds are being used effectively. FEMA has developed a Loss Avoidance Study Riverine Flood Methodology Report and has conducted several specific studies in areas where previously completed flood mitigation projects were tested in the aftermath of another flood event. By demonstrating the degree to which a particular structure or project would have been damaged in various real-life flood events, Loss Avoidance Studies help justify the expenditure of public funds on mitigation projects.

The Flood Depth Grids provide a means by which local stakeholders may approximate the frequency of a local flood event using the actual reported or witnessed depths of flooding. For example, knowing that the 1% annual chance flood event is estimated to yield 3 feet of flooding in a specific location, a resident who experienced 2 feet of flooding may approximate the frequency of the specific flood event that impacted their property. Since States submitting Enhanced Mitigation Plans must demonstrate loss avoidance for projects funded, the Loss Avoidance Study methodology described above is a useful tool for meeting this requirement.

5.7. Other Non-FEMA Grants to Reduce Flood Risk

Risk Assessment Datasets and Products can also be used to support mitigation projects identified in mitigation plans being funded by other agencies. For example, levee risk assessments may support communities seeking additional funds from the U.S. Army Corps of Engineers, or the U.S. Department of Agriculture, for projects under their purview. The Department of Housing and Urban Development (HUD) has programs that include flood mitigation measures like buyouts of flood prone homes after larger disaster events. In addition, Federal grants are available for the planning of sustainable communities, like the HUD Sustainable Communities Regional Planning Grant Program, which is in collaboration with the U.S. Department of Transportation and U.S. Environmental Protection Agency.

5.8. Response and Recovery Planning

Emergency Response Planners could use the Flood Risk Assessment dataset to determine where resources will most likely be needed during a flood, or utilize Flood Depth and Velocity Grids to determine evacuation routes, which may be impassible during certain events. Recovery plans may also be informed by flood risk data. For example, the Flood Depth Grids and Risk Assessment datasets could help show areas where rebuilding may not be desirable. This data may also provide the impetus for a community to make the decision to relocate or retrofit its critical facilities to reduce flood risk.

5.8.1. Pre-and Post-Disaster Risk Analysis and Damage Projections

Flood risk data, as contained in the Flood Risk Assessment dataset, can be used as tools to estimate impacts of an approaching storm, help a community or State pre-position response resources, and plan for areas to conduct post-disaster assessments. Perishable data, like high water marks collected in the event's aftermath, can be used to “ground-truth” Hazus projections in order to calibrate the program for future use.

In a post-disaster setting, local and State officials may document high-water marks on structures and infrastructure like bridges to record flood heights and depths. The Depth Grids can be used as a better predictor of the highest levels of flooding, and Hazus results can be used as a more accurate projection of damage. Cumulatively, these datasets can help guide local and State officials in focusing the high water marks documentation efforts. These datasets will also help officials evaluate how closely the predicted level of damage matched the actual damage, and whether there were unexpected findings, which may warrant a new study and/or consideration of new mitigation projects. Post-disaster analysis can help “ground-truth” the integrity of the Flood Risk datasets, which should lead to calibration of the datasets, resulting in continuous improvement.

In addition to the mitigation planning, HMA grants, and other related mitigation and planning activities, Flood Risk datasets and products, may also assist local and State preparedness and recovery officials in the following ways:

- Hazus loss estimations, as well as Flood Depth and Analysis Grids, can be overlaid with population density and locations of vulnerable populations. This information can help responders and damage assessors focus efforts and understand resource needs.
- Risk assessment results may reveal vulnerable areas, facilities, and infrastructure to planning for Continuity of Operations Plans (COOP), Continuity of Government Plans (COG), and Emergency Operations Plans (EOP) would be essential. These results will also identify areas of highest flood risk where first responders should check first during a flood event.
- Depth and Velocity Grids can help with evacuation planning and implementation by showing which roads and bridges would be underwater first, and which ones would be subject to fast moving water, so local officials can direct evacuation routes and shelter sites away from these areas.
- The Changes Since Last FIRM data might help in making changes to older evacuation plans if conditions significantly change.
- Recovery planning could be informed by depth, velocity, and loss information so informed rebuilding decisions are made.

6. Accessing and Rendering Flood Risk Data

Basic GIS knowledge and GIS software is needed to access and render the Flood Risk Datasets from the Flood Risk Database. For communities that lack GIS knowledge or access, resources are generally available from State agencies, such as the State NFIP Coordinator's office, the State Offices of Emergency Management, or through Regional Planning Agencies, or Councils of Government. The datasets provided in the Flood Risk database are customizable to different planning areas and can be used with other community GIS data by experienced GIS users.

7. Related Guidance

This Guidance Document is intended to complement other FEMA guidance documents to address various components of the Risk MAP program including the following:

- *Risk MAP Outreach Toolkit* - This toolkit helps State, local, and tribal officials use tools and products to help communicate more effectively and consistently with their stakeholders about flood risk.
- Appendix I of the FEMA *Guidelines and Standards for Flood Risk Analysis and Mapping (G&S)*. Appendix I (Discovery) details the process for Flood Risk Project discovery, which has multiple overlaps with the mitigation planning process.
- Appendix N of the FEMA *G&S*. Appendix N (Flood Risk Data Development) provides detailed descriptions and standards for the creation of flood risk datasets that may be used for mitigation planning purposes.
- Appendix O of the FEMA *G&S*. Appendix O (Format and Standards for Non-Regulatory Flood Risk Products) describes the specifications for the products (map, report and database) delivered to FEMA for a particular Flood Risk Project. This Appendix is not intended to specify in-process methods and procedures, but to present the specifications for output and deliverables.
- *FEMA Operating Guidance 1-11: Risk MAP Guidance for Incorporating Mitigation Planning Technical Assistance and Training into Flood Risk Projects*. This Operating Guidance document provides insight into how FEMA Regional planners can ‘order’ planning technical assistance. Local planners should be aware of this document and process to discuss it with their State and FEMA counterparts.
- *FEMA Operating Guidance 3-11: Communicating Flood Risk with Risk MAP Datasets and Products*. This document provides insight into the appropriate use of Risk MAP Datasets and Products for community officials and business leaders.
- *FEMA Planning How-To Guides (386 series)* – These guides explain mitigation planning and provide adaptable tools to meet or exceed FEMA's requirements.
- *FEMA Hazard Mitigation Assistance Unified Guidance* – This guidance, which is issued on an annual basis, presents the rules, regulations, and guidelines of the FEMA mitigation grant programs providing significant opportunities to reduce or eliminate potential losses to State, Tribal, and local assets through hazard mitigation planning, and project grant funding.
- *FEMA Building Sciences Toolkit CD* (under development) – This CD is expected to contain information and resources on flood resistant design and materials, building code enhancements, and mitigation measures for individual structures.