



Mitigation Overview

Laurie Bestgen, FEMA Region VII Mitigation Planner



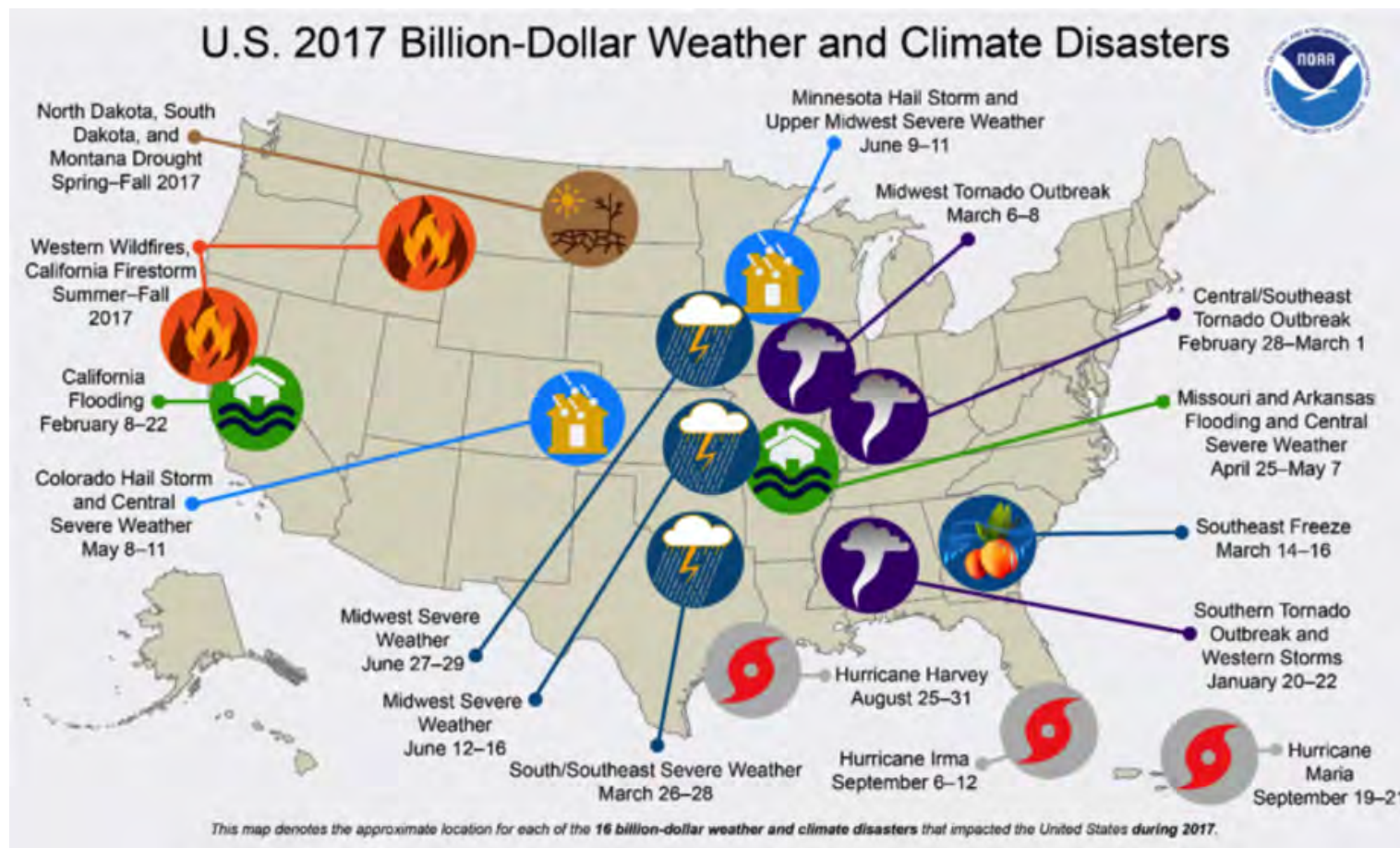
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Overview Topics

- ▶ **Why Mitigate?**
- ▶ **Mitigation Planning**
- ▶ **Purpose of Risk Assessment**
- ▶ **Risk Assessment Methodologies**
- ▶ **Mitigation Solutions**
- ▶ **Mitigation Cost-effectiveness**

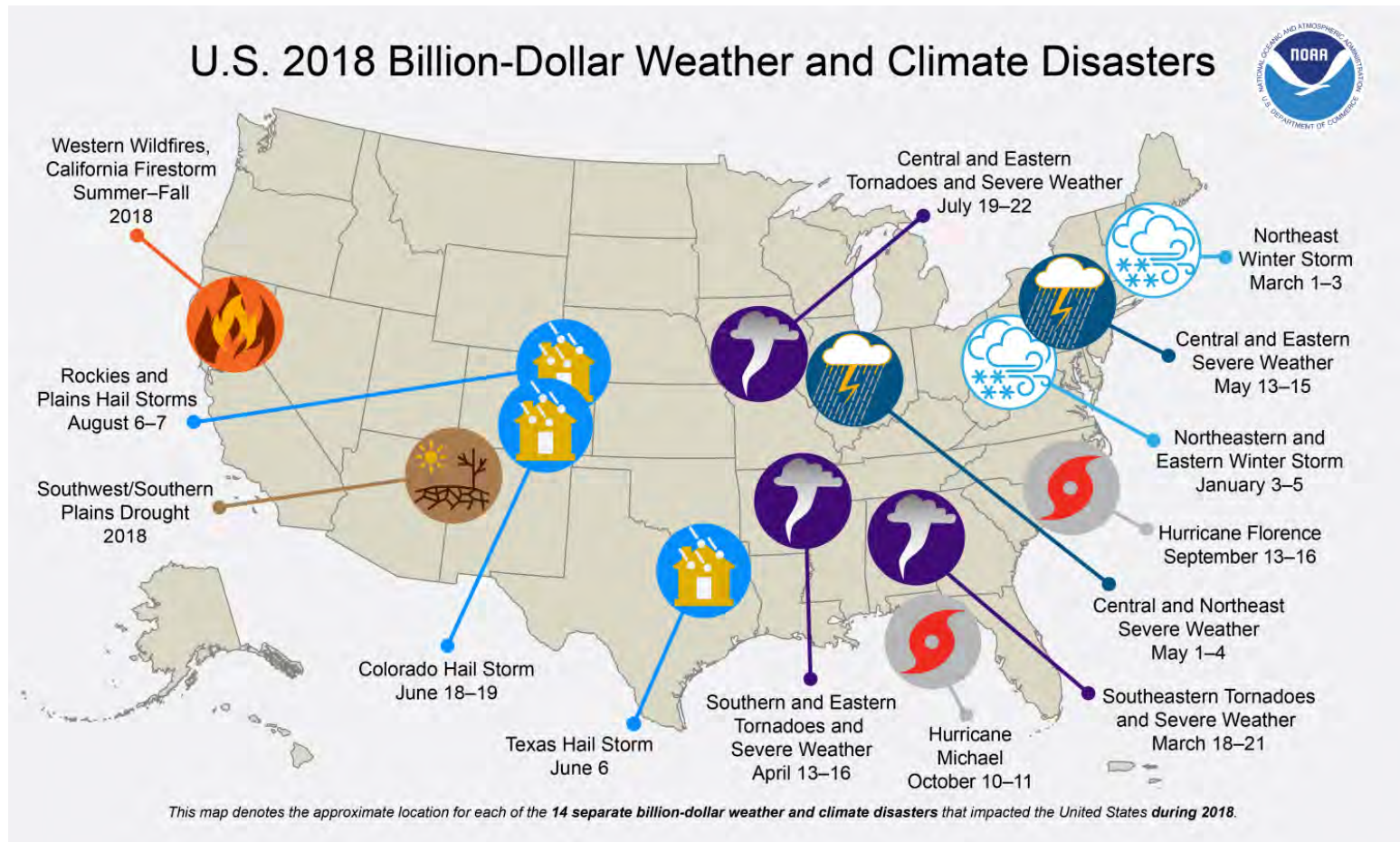
Mitigation Defined: Those activities that reduce or eliminate the risk of loss of life and property by lessening the impact of future disasters

Why Mitigate? Disasters are Costly!



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Why Mitigate? Disasters are Costly!

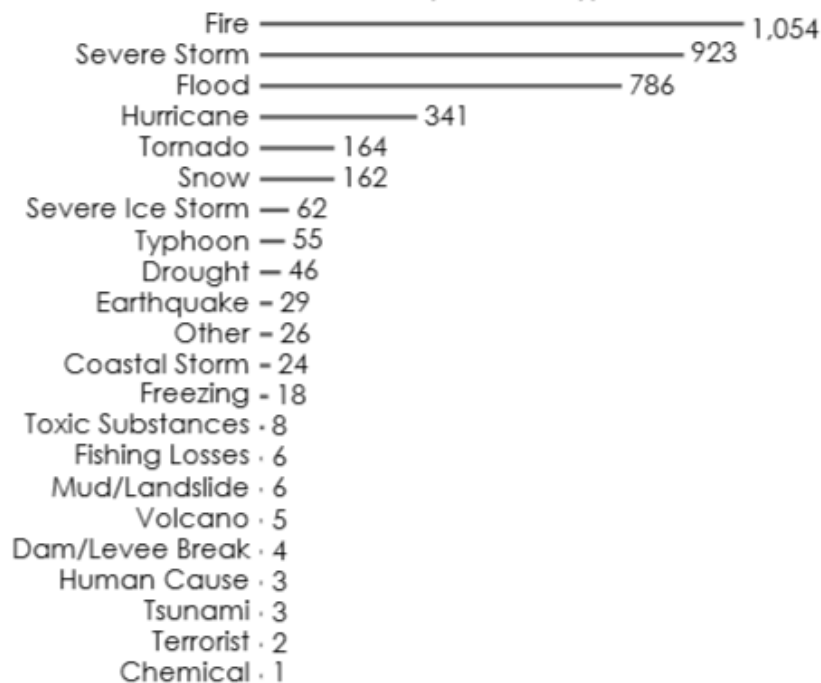


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Federally Declared Disasters Since 1953

Total Declaration(s) **3,728**

Declarations by Incident Type



\$6,739M



Fire Grants

\$915M

Individual Assistance

\$11,123M



Mitigation

\$26,119M



Preparedness

\$36,491M



Public Assistance

Disaster Assistance and Preparedness Grants



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Why Mitigate? Mitigation Saves

Natural Hazard Mitigation Saves



Natural Hazard Mitigation Provides the Nation \$6 in Benefit for Every \$1 Invested

National Benefit-Cost Ratio (BCR) Per Peril
*BCR numbers in this study have been rounded

Overall Hazard Benefit-Cost Ratio

**Beyond Code
Requirements**

\$4:1

**Federally
Funded**

\$6:1



Riverine Flood

\$5:1

\$7:1



Hurricane Surge

\$7:1

Too few
grants



Wind

\$5:1

\$5:1



Earthquake

\$4:1

\$3:1



**Wildland-Urban
Interface Fire**

\$4:1

\$3:1

This Interim Study quantified a number of benefits from mitigation, including reductions in:

- Future deaths, nonfatal injuries, and PTSD
- Repair costs for damaged buildings and contents
- Sheltering costs for displaced households
- Loss of revenue and other business interruption costs to businesses whose properties are damaged
- Loss of economic activity in the broader community
- Loss of service to the community when fire stations, hospitals, or other public buildings are damaged
- Insurance costs other than insurance claims
- Costs for urban search and rescue



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Mitigation Planning



Disaster Mitigation Act of 2000

► **The Disaster Mitigation Act of 2000 (DMA 2000) amended the Stafford Act:**

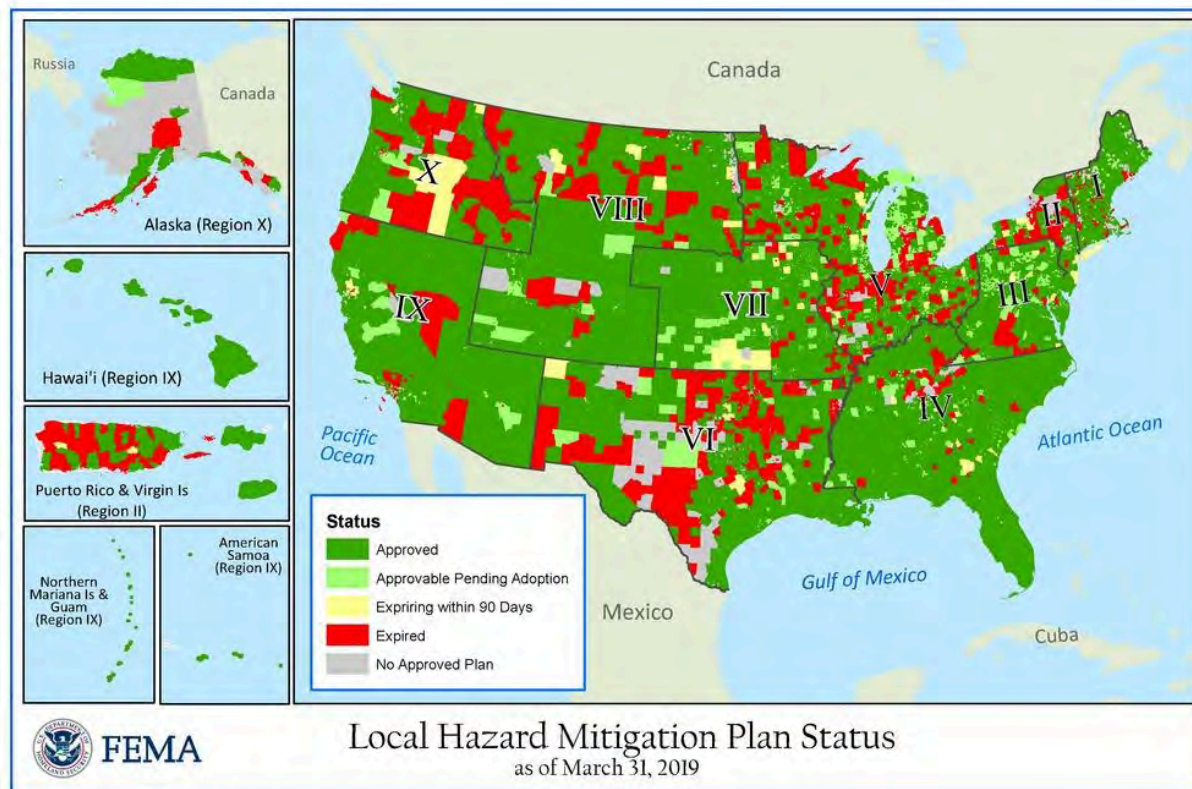
- Created an emphasis on hazard mitigation planning at the state, tribal, and local levels of government
- Streamlined administration of disaster relief
- Emphasized the need for states, tribes, and communities to systematically address threat of future damages
- Established a pre-disaster hazard mitigation program

Mitigation Planning

- **Task 1: Determine the Planning Area and Resources**
- **Task 2: Build the Planning Team**
- **Task 3: Create an Outreach Strategy**
- **Task 4: Review Community Capabilities**
- **Task 5: Conduct a Risk Assessment**
- **Task 6: Develop a Mitigation Strategy**
- **Task 8: Review and Adopt the Plan**
- **Task 7: Keep the Plan Current**
- **Task 9: Create a Safe and Resilient Community**

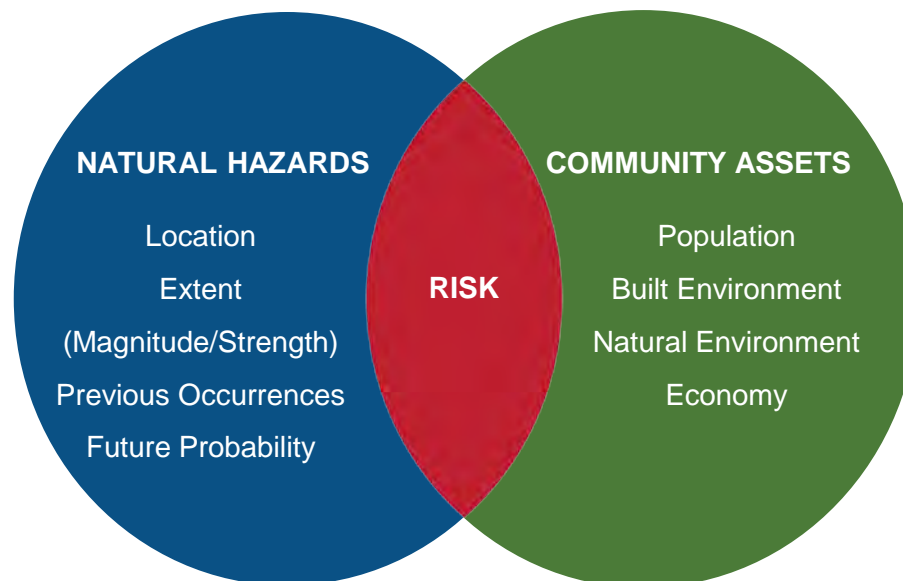
FEMA-Approved Hazard Mitigation Plans

- ▶ As of March 31, 2019, all 50 states, District of Columbia and five territories have FEMA-approved Hazard Mitigation Plans
- ▶ Over 87% of nations population covered by a plan
- ▶ Over 21,000 local governments, 187 Tribal governments



Risk Assessments Are The Foundation for Mitigation Planning

The Risk Assessment in a Hazard Mitigation Plan is a product or process that collects information to determine the potential impacts of hazards to the people, economy, and built and natural environments of the community for the purpose of informing priorities, developing or comparing courses of action, and informing decision making



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Note: Modified from U.S. Geological Survey and Oregon Partnership for Disaster Resilience Models.

RiskMAP
Increasing Resilience Together

Steps to Conduct a Risk Assessment

- ▶ **1. Identify/Describe Hazards**
 - State Hazard Mitigation Plans are an excellent resource
- ▶ **2. Identify Community Assets**
- ▶ **3. Analyze Risks**
- ▶ **4. Summarize Vulnerability**

Step 2: Identify Community Assets



► **Natural Environment**

- Natural Resources (clean air/water)
- Recreation Areas
- Critical Habitat

► **Economy**

- Major Employers
- Primary Economic Sectors (e.g., agriculture)
- Commercial Centers

► **Population**

- General Demographics
- Concentration/Density
- Functional and Access Needs Populations
- Consider Projected Growth

► **Built Environment / Lifelines**

- Existing Structures
- Infrastructure
- Critical Facilities
- Cultural Resources
- Future Development

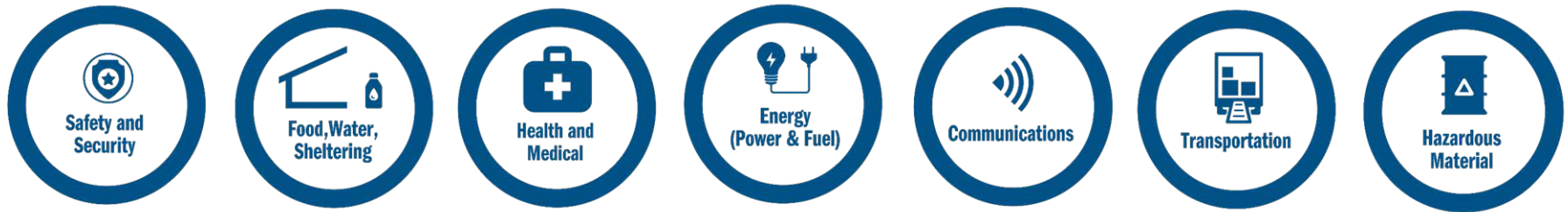
Incorporating Community Lifelines into Risk Assessment and Mitigation Planning

- ▶ **The 2017 Hurricane Season FEMA After-Action Report identified the need to create a new operational prioritization and response tool which would:**
 - Characterize the incident and identify the root causes of priority issue areas in order to create effective solutions
 - Distinguish the highest priorities and most complex issues from other incident information
- ▶ **Lifelines construct originally developed for response reporting**
- ▶ **Provides targeted framework for Mitigation to address most critical potential impacts**

Community Lifelines Defined

A Construct for Outcome-Based Efforts

- ▶ **A lifeline enables the continuous operation of government functions and critical business, and is essential to human health and safety or economic security.**



- Lifelines are designed to highlight priority areas and interdependencies
- Each lifeline is comprised of multiple components and essential elements of information needed to stabilize the incident

Community Lifeline Components

1. Safety and Security

- Law Enforcement/Security
- Search and Rescue
- Fire Services
- Government Service
- Responder Safety
- Imminent Hazard Mitigation

2. Food, Water, Sheltering

- Evacuations
- Food/Potable Water
- Shelter
- Durable Goods
- Water Infrastructure
- Agriculture

3. Health and Medical

- Medical Care
- Patient Movement
- Public Health
- Fatality Management
- Health Care Supply Chain

4. Energy

- Power (Grid)
- Temporary Power
- Fuel

5. Communications

- Infrastructure
- Alerts, Warnings, Messages
- 911 and Dispatch
- Responder Communications
- Financial Services

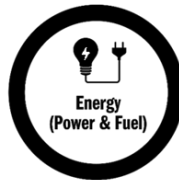
6. Transportation

- Highway/Roadway
- Mass Transit
- Railway
- Aviation
- Maritime
- Pipeline

7. Hazardous Material

- Facilities
- Hazardous Debris, Pollutants, Contaminants

Infrastructure associated with Lifelines is mix of public and private ownership

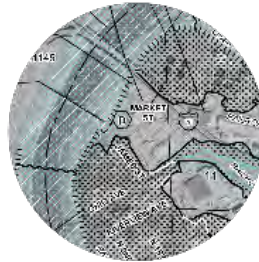


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Step 3: Analyze Risks

Risk Assessment Methodologies

- ▶ **Exposure/GIS Analysis** – hazards with geographic areas of known risk
- ▶ **Historical Analysis** – hazards with a repository of historical data
- ▶ **Scenario Analysis** – hazards with no defined pattern, geography, or historical record
- ▶ **Combination**



Exposure/GIS-based Analysis Methods

► Natural Flood-Related Hazards

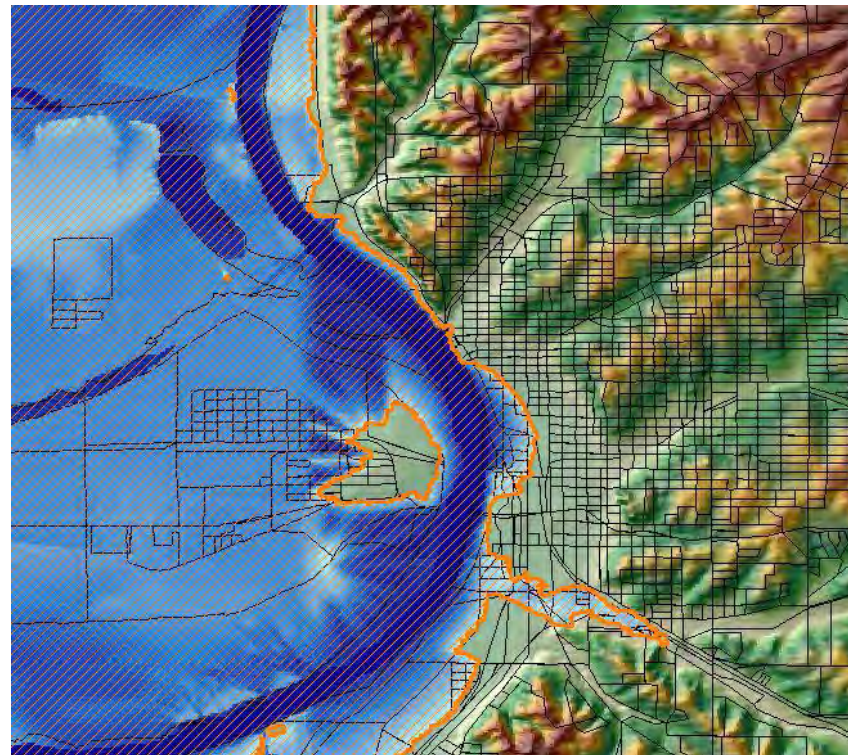
- Flooding
- Levee Failure
- Dam Failure

► Natural Geologic Hazards

- Earthquake
- Land Subsidence / Sinkholes

► Natural “Other” Hazard

- Wildfire



FEMA Map Service Center



Navigation

Search

Languages

MSC Home

MSC Search by Address

MSC Search All Products

▼ MSC Products and Tools

Hazus

LOMC Batch Files

Product Availability

MSC Frequently Asked Questions (FAQs)

MSC Email Subscriptions

Contact MSC Help

FEMA Flood Map Service Center: Welcome!

Looking for a Flood Map? [?](#)

Enter an address, a place, or longitude/latitude coordinates:

Search

Looking for more than just a current flood map?

Visit [Search All Products](#) to access the full range of flood risk products for your community.



► Available Product Categories

- **Effective Products** – regulatory products authorized by law to be used in making determinations under the NFIP.
- **Pending Products** – products released at the conclusion of a regulatory flood mapping project and have an effective date on which they will become regulatory. May be considered best available data for mitigation planning.
- **Preliminary Products** – provide an early look at the projected risk identified by an in-progress flood hazard study prior to it becoming final. May be considered best available data for mitigation planning.
- **Historic Products** – Flood Insurance Rate Map (FIRM), Flood Insurance Study (FIS), or Letter of Map Change (LOMC) products that have been superseded by a new version. These products are no longer official and binding under the NFIP.
- **Flood Risk Products** – non-regulatory products to help community officials and the public view and understand their local flood risk.

FEMA Map Service Center: Flood Risk Products – A Closer Look

FEMA Publication: Using Flood Risk Products in Hazard Mitigation Plans Guide – July 2018



Looks like FEMA has a lot of data...what's in it for me?

- ▶ **Best available flood risk data**
- ▶ **Flood Risk Products to use in your Hazard Mitigation Plan**

[https://www.fema.gov/media-library-data/1533059807625-e1a0d07e4326e2ec4f027ce41befe922/Using FRPs in HMPs Guide 508 07-31-18.pdf](https://www.fema.gov/media-library-data/1533059807625-e1a0d07e4326e2ec4f027ce41befe922/Using_FRPs_in_HMPs_Guide_508_07-31-18.pdf)

Flood Risk Products
USING FLOOD RISK PRODUCTS IN HAZARD MITIGATION PLANS

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RiskMAP
Increasing Resilience Together

Hazard mitigation is the effort to reduce loss of life and property by reducing the impact of disasters. Disasters can cause injury and death, damage buildings and infrastructure, and have devastating consequences for a community's economic, social, and environmental well-being. Hazard mitigation plans are key to breaking the cycle of disaster damage, reconstruction, and repeated damage, and they allow communities to remain eligible to receive certain types of state, tribal, and federal assistance.

The Federal Emergency Management Agency (FEMA) provides policy, guidance, products, tools, training, and technical assistance to state, local, and tribal jurisdictions to help them develop and update mitigation plans. More information on available resources can be found on FEMA's Hazard Mitigation Planning website, www.fema.gov/hazard-mitigation-planning. In addition, FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program has developed Flood Risk Products (FRPs), which are tools created to assist in mitigating flood risk. Under the Risk MAP program, FEMA partners with local, state, and tribal governments to identify flood hazards, assess flood risks, develop plans and mitigation strategies, and implement mitigation actions using a wide range of public and private resources. Data produced from Risk MAP projects can be incorporated into a mitigation plan and help inform mitigation strategies and prioritize mitigation activities.

WHAT ARE FLOOD RISK PRODUCTS?

FRPs are data communication tools intended to be used with National Flood Insurance Program (NFIP) regulatory products, such as Flood Insurance Rate Maps (FIRMs). Communities can use FRPs to transform traditional flood mapping efforts into an integrated process of identifying, assessing, communicating, and

BENEFITS OF FLOOD RISK PRODUCTS

- Enhance emergency, community, and mitigation



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National Levee Database (U.S. Army Corps of Engineers)



National Levee Database – Summary

East Bottoms Unit

Location: **Kansas City, Jackson County, Missouri** USACE District: **Kansas City** FEMA Region: **7**

SUMMARY SYSTEM SEGMENTS RISK FEMA - NFIP/FIRM FEATURES PROFILE ATTACHMENTS

Project Description

[VIEW](#)

The East Bottoms project is a levee system that reduces the risk of flooding within its leveed areas in Kansas City, Missouri. The levee system includes one closure gap, 13 drainage structures, 6 pump stations, 45 relief wells, 0.3 miles of floodwall, and 9 miles of earthen levee along the Missouri River and the Blue River. The levee was redesigned and reconstructed by the Corps of Engineers and turned over for operation and maintenance to the local sponsor, the City of Kansas City, MO, in 1950. The area behind the levee features significant residential, commercial, and local government development. The leveed area daytime population is estimated at 16,500 and estimated property value is approximately \$5.6 billion. The levee faced record flooding in 1993 when river levels reached within a few feet of the top of the levee.

Risk Characteristics

[VIEW](#)

Levee Safety Action Classification: **Moderate**

People at Risk: **16,539** Structures at Risk: **751** Property Value: **\$5.6B**

Assessment Date: **05/03/2018**

Risk Characterization Summary

The likelihood of flood overtopping this levee in the next year has been estimated as is 0.1% (one chance in 1000). This equals a 3% likelihood of water overtopping the levee over the life of a typical 30-year mortgage. The risk assessment identified some performance concerns with the seepage collector system, deficiencies in pipes, and concerns with private party relief wells. Flooding of the levee could lead to flood depths up to 15 feet, which would result in moderate to large consequences due to the high population at risk and property values behind the levee. Recommended risk management activities include continuing good operations and maintenance practices, monitoring levee performance during periods of high river stages, and ensuring emergency plans are reviewed and updated regularly. Efforts should also be made to inform those that live or work behind the levees of their flood risk.

Structure and Features

[VIEW](#)

Total Miles	Length of Embankment (miles)	Length of Floodwall (miles)
9.49 Miles	9.15	0.33
Year Constructed	Average Height	Number of Closure Structures
1950	No Data Entered	1

Key Documents

[VIEW](#)

[Levee System Summary](#)

[FEMA - NFIP/FIRM Information](#) [VIEW](#)

[Levee System Status on Effective FIRM](#)
Accredited

[USACE Rehabilitation Status](#) [VIEW](#)

Status: **Active**

Latest Inspections


Segment Name	Inspection Date
East Bottoms	04/17/2018

[Segments](#) [VIEW](#)

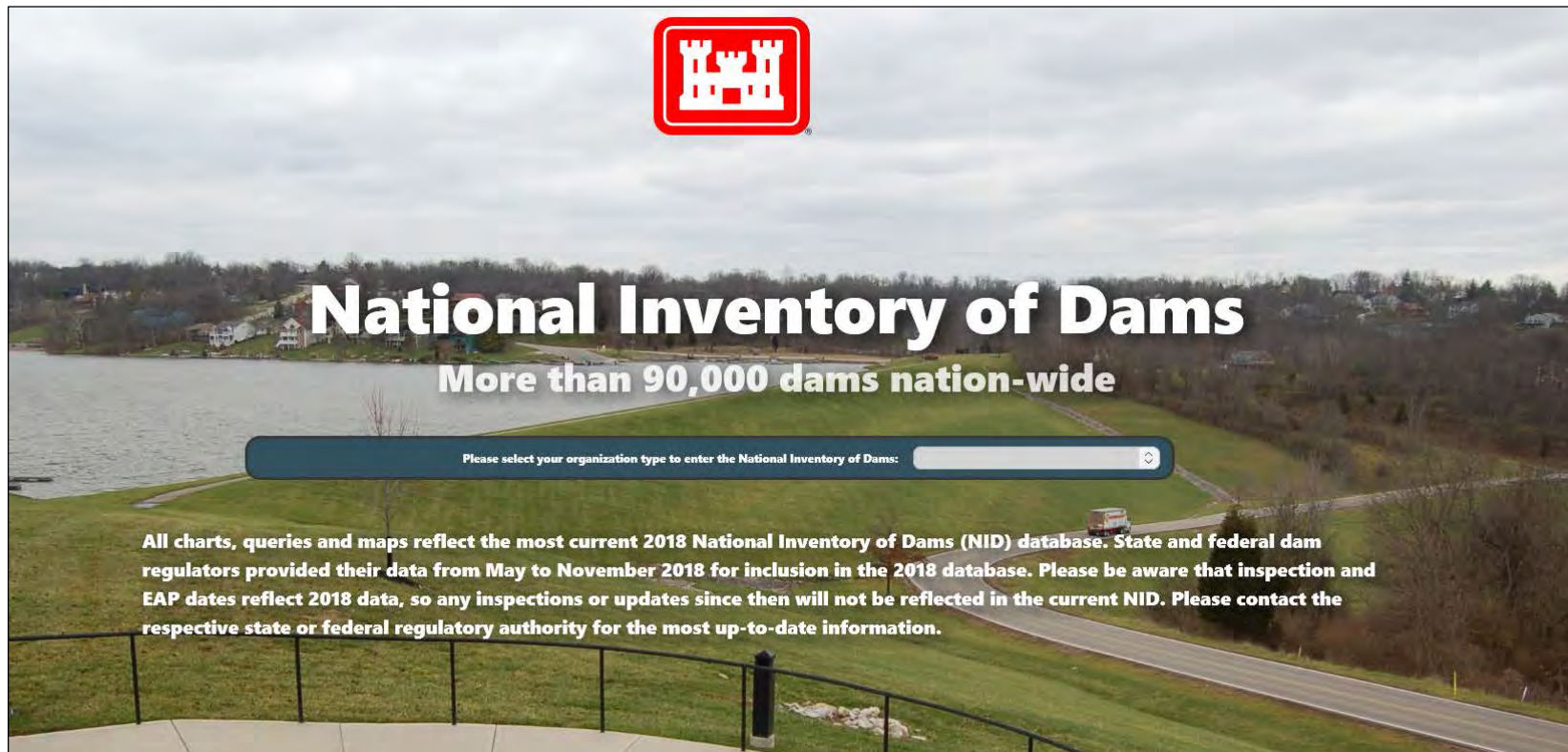
East Bottoms


Basemap: Basic [+](#) [-](#)

[LEGEND](#) [i](#)



National Inventory of Dams

The image shows a screenshot of the National Inventory of Dams (NID) website. At the top center is a red square logo with a white castle icon. Below the logo, the title "National Inventory of Dams" is displayed in large white text, followed by the subtitle "More than 90,000 dams nation-wide" in smaller white text. A dark blue horizontal bar contains the text "Please select your organization type to enter the National Inventory of Dams:" followed by a dropdown menu. Below this bar, a paragraph of text provides information about the 2018 database update. The background of the website is a photograph of a large dam and reservoir under a cloudy sky.



National Inventory of Dams

More than 90,000 dams nation-wide

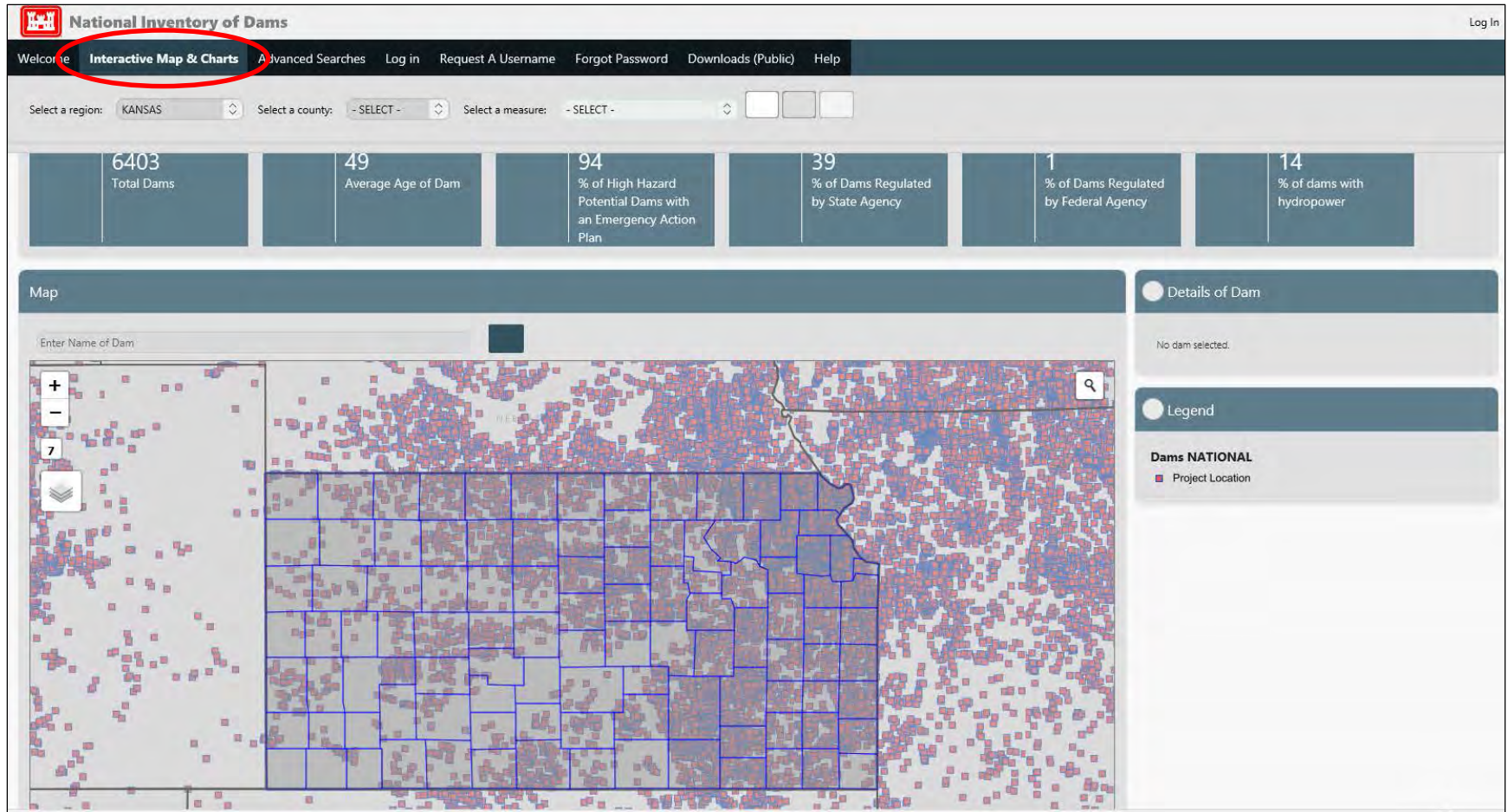
Please select your organization type to enter the National Inventory of Dams:

All charts, queries and maps reflect the most current 2018 National Inventory of Dams (NID) database. State and federal dam regulators provided their data from May to November 2018 for inclusion in the 2018 database. Please be aware that inspection and EAP dates reflect 2018 data, so any inspections or updates since then will not be reflected in the current NID. Please contact the respective state or federal regulatory authority for the most up-to-date information.



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National Inventory of Dams – Interactive Map and Dashboard



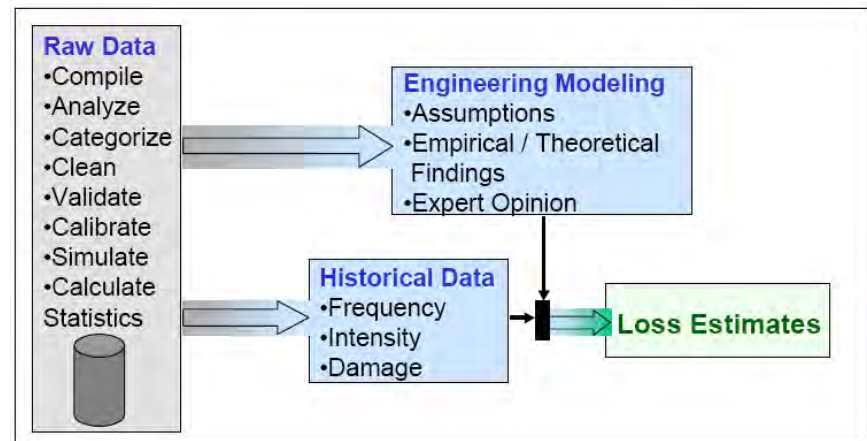
Historical Analysis Methods (statistical analysis)

► Natural Meteorological Hazards

- Drought
- Extreme Temperature
- Severe Thunderstorms
- Severe Winter Weather
- Tornadoes

► Human-Caused / Technological

- Fires (Urban/Structural)



Used for hazards that occur often with a repository of historical data

Employs Analysis of previous events and locations/impacts/costs to determine potential future locations/impacts/costs

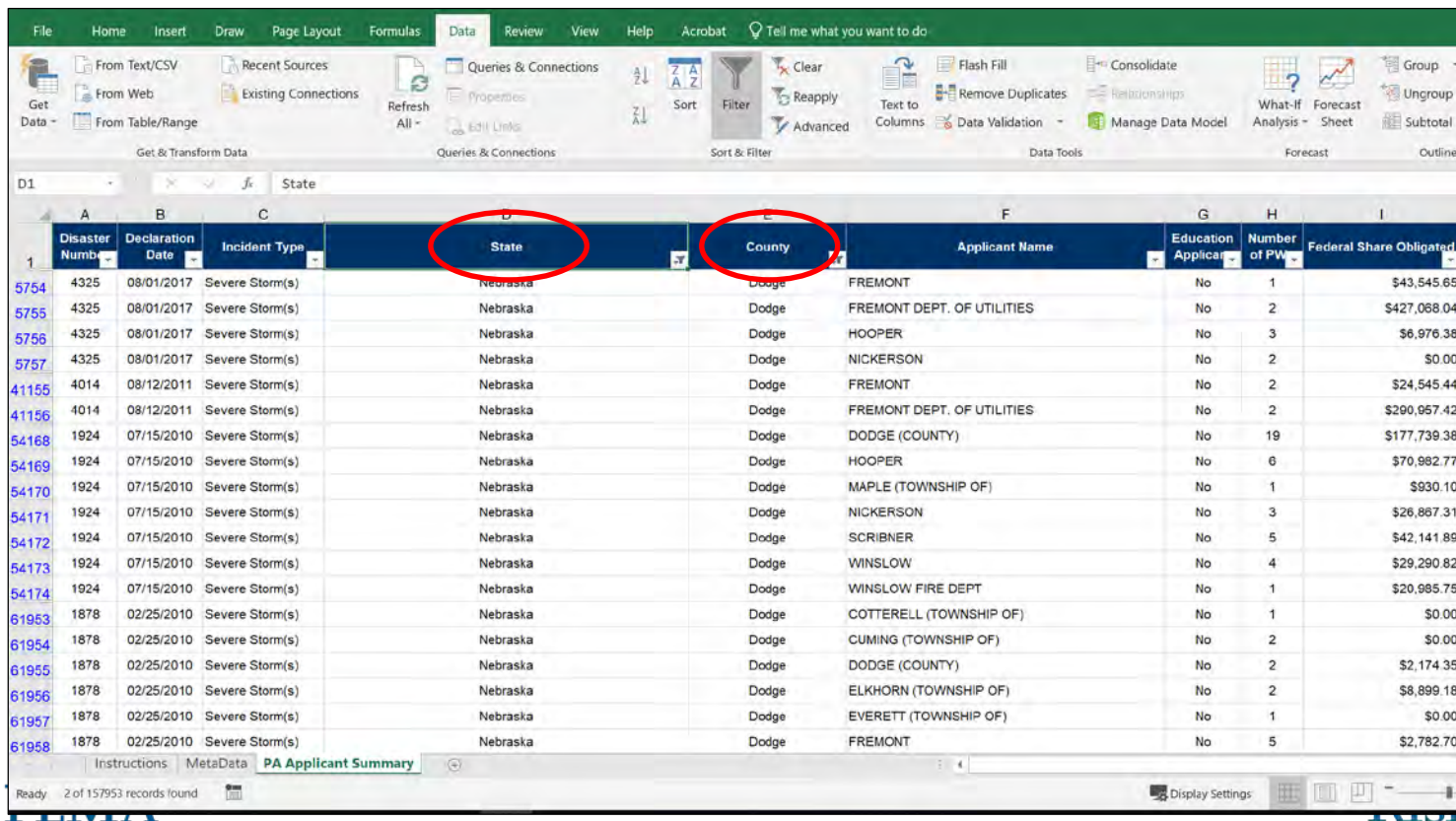
FEMA Data Visualization



NOTE: These visualizations leverage data from OpenFEMA

FEMA Data Visualization: Public Assistance Funded Projects Summary

- Datasets: Public Assistance Funded Projects Summary
- Filter by State/County



	A	B	C	D	E	F	G	H	I
	Disaster Number	Declaration Date	Incident Type	State	County	Applicant Name	Education Applicant	Number of PW	Federal Share Obligated
5754	4325	08/01/2017	Severe Storm(s)	Nebraska	Dodge	FREMONT	No	1	\$43,545.65
5755	4325	08/01/2017	Severe Storm(s)	Nebraska	Dodge	FREMONT DEPT. OF UTILITIES	No	2	\$427,068.04
5756	4325	08/01/2017	Severe Storm(s)	Nebraska	Dodge	HOOPER	No	3	\$6,976.38
5757	4325	08/01/2017	Severe Storm(s)	Nebraska	Dodge	NICKERSON	No	2	\$0.00
41155	4014	08/12/2011	Severe Storm(s)	Nebraska	Dodge	FREMONT	No	2	\$24,545.44
41156	4014	08/12/2011	Severe Storm(s)	Nebraska	Dodge	FREMONT DEPT. OF UTILITIES	No	2	\$290,957.42
54168	1924	07/15/2010	Severe Storm(s)	Nebraska	Dodge	DODGE (COUNTY)	No	19	\$177,739.38
54169	1924	07/15/2010	Severe Storm(s)	Nebraska	Dodge	HOOPER	No	6	\$70,982.77
54170	1924	07/15/2010	Severe Storm(s)	Nebraska	Dodge	MAPLE (TOWNSHIP OF)	No	1	\$930.10
54171	1924	07/15/2010	Severe Storm(s)	Nebraska	Dodge	NICKERSON	No	3	\$26,867.31
54172	1924	07/15/2010	Severe Storm(s)	Nebraska	Dodge	SCRIBNER	No	5	\$42,141.89
54173	1924	07/15/2010	Severe Storm(s)	Nebraska	Dodge	WINSLOW	No	4	\$29,290.82
54174	1924	07/15/2010	Severe Storm(s)	Nebraska	Dodge	WINSLOW FIRE DEPT	No	1	\$20,985.75
61953	1878	02/25/2010	Severe Storm(s)	Nebraska	Dodge	COTTERELL (TOWNSHIP OF)	No	1	\$0.00
61954	1878	02/25/2010	Severe Storm(s)	Nebraska	Dodge	CUMING (TOWNSHIP OF)	No	2	\$0.00
61955	1878	02/25/2010	Severe Storm(s)	Nebraska	Dodge	DODGE (COUNTY)	No	2	\$2,174.35
61956	1878	02/25/2010	Severe Storm(s)	Nebraska	Dodge	ELKHORN (TOWNSHIP OF)	No	2	\$8,899.18
61957	1878	02/25/2010	Severe Storm(s)	Nebraska	Dodge	EVERETT (TOWNSHIP OF)	No	1	\$0.00
61958	1878	02/25/2010	Severe Storm(s)	Nebraska	Dodge	FREMONT	No	5	\$2,782.70



OpenFEMA: Public Assistance Funded Project Details

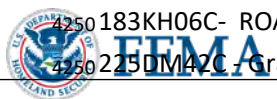
disasterNumber	applicationTitle	applicantId	damageCategoryCode	projectSize	county	state	projectAmount	federalShareObligated	totalObligated
4250	GEG001F - Electric Damage Incurred	000-UL314-00	F - Public Utilities	Small	Statewide	Missouri	20219.87	15164.9	15164.9
4250	221JB2C - Washington County District 2	221-99221-00	C - Roads and Bridges	Small	Washington	Missouri	84773.39	63580.04	63580.04
4250	161SB38 Roadway Ditch washed out	161-19828-00	C - Roads and Bridges	Small	Phelps	Missouri	10159.2	7619.4	7619.4
4250	076SB26G - Hermann Airport	073-31762-00	G - Recreational or Other	Small	Gasconade	Missouri	20519.35	15389.51	15389.51
4250	169SB03 - Culvert Red Oak Road	169-99169-00	C - Roads and Bridges	Small	Pulaski	Missouri	8859.64	6644.73	6644.73
4250	GEG002F - Electric Distribution Damage	000-UVJ29-00	F - Public Utilities	Small					
4250	324ZMSA - 853 - Section 324 Management Costs	000-UCPCP-00	Z - State Management	Large					
4250	169SB12G - Waynesville Parks	169-77992-00	G - Recreational or Other	Small					
4250	055SB41C - Road Washouts & Thatcher Bridge	055-99055-00	C - Roads and Bridges	Small					
4250	TJF002F - Electrical Distribution System	000-UM03N-00	F - Public Utilities	Small					
4250	209LM02G - Park Embankment Damages	209-33922-00	G - Recreational or Other	Small	Stone	Missouri	7177	5382.75	5382.75
4250	99JB12F - Lift Station Pumps	099-10240-00	F - Public Utilities	Small	Jefferson	Missouri	33695	25271.25	25271.25
4250	029SB32C - Low Water Crossing	029-UNJ6E-00	C - Roads and Bridges	Small	Camden	Missouri	37332.25	27999.16	27999.16
4250	029SB33C - Low Business Park Rd	029-UNJ6E-00	C - Roads and Bridges	Large	Camden	Missouri	77415.37	58061.52	58061.52
4250	077SF04F - Electrical City Wide	077-70000-01	F - Public Utilities	Large					754.92
4250	153MO19C - Eastern District - Roads	153-99153-00	C - Roads and Bridges	Large					625.14
4250	169SB05C - County Roads	169-99169-00	C - Roads and Bridges	Large					669.41
4250	71LK021C - Culvert Repairs	071-99071-00	C - Roads and Bridges	Large					78.15
4250	225DM41C - Grader District 8 - Roads	225-99225-00	C - Roads and Bridges	Large	Webster	Missouri	190273.77	142705.33	142705.33
4250	189MD02 - Valley Park - Meramac Levee Recreation	189-75472-00	G - Recreational or Other	Large	St. Louis	Missouri	1349658.3	1012243.72	1012243.72
4250	183KH06C- ROAD SLIP	183-54074-00	C - Roads and Bridges	Large	St. Charles	Missouri	94950.64	71212.98	71212.98
4250	225DM42C - Gravel Roads Grader District 3	225-99225-00	C - Roads and Bridges	Large	Webster	Missouri	203295.45	152471.58	152471.58



Why is this level of detail better?



To inform the development of specific local mitigation actions



NFIP Policies and Claims Data



NEW ORLEANS, LA., NOVEMBER 16, 2008 -- COMMUNITY REBUILDING AND FLOOD PROTECTION EXPO. THIS UNFINISHED MITIGATED HOUSE IS A PRIME EXAMPLE OF THE RECOVERY PROCESS TAKING PLACE IN LAKEVIEW--A SUBURB OF GREATER NEW ORLEANS. PHOTO BY RALPH SIMCOX - NOV 15, 2008 - LOCATION: NEW ORLEANS, LA



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Scenario-based Analysis

► Tornado / Human-Caused / Technological Hazards

- Tornado
 - CBRNE Attack
 - Civil Disorder
 - Cyber Disruption
 - Hazardous Materials
 - Mass Transportation Accidents
 - Nuclear Power Plants
 - Public Health Emergencies / Environmental Issues
 - Special Events
 - Terrorism
 - Utilities (Interruptions and System Failures)
- Used for hazards that are low frequency, high consequence events
 - Asks “what if” a particular event occurred.

Combination

A good flood risk assessment will use a combination of:

- Model-based Flood Risk Products
- Historical Flood Data



Photo credit: NDNR

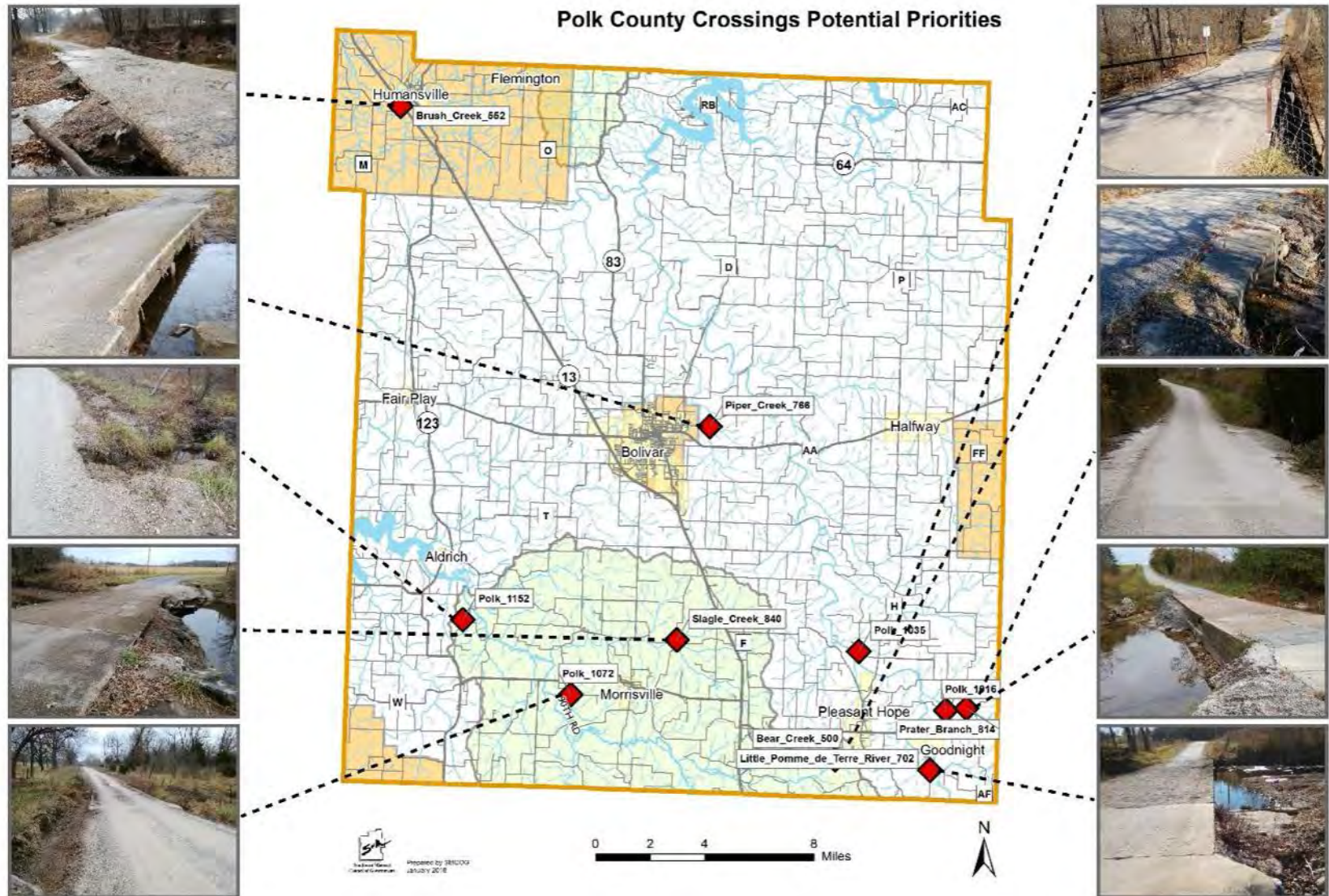
Step 4: Summarize Vulnerability

- Summarizes information from Steps 1-3
- Highlights most significant risks and vulnerabilities
- Informs the Mitigation Strategy
- Communicates findings to elected officials/stakeholders
- Presented as Problem Statements

Problem Statements Are Critical

- Problem statements are the “so what” of the vulnerability assessment.
- They summarize how a hazard has or could impact a community and identify specific issues (PROBLEMS) that can be solved.
- **Basis for mitigation actions.**

Visual Problem Statement



Action Life Cycle

DEVELOP PROBLEM STATEMENT

from risk assessment

**IDENTIFY
SOLUTIONS**

comprehensive range



**ANALYZE
POTENTIAL
SOLUTIONS**



**SELECT
ACTIONS**

*jurisdiction intends to
implement*

**PRIORITIZE
ACTIONS**



**DEVELOP
ACTION PLAN**

INTEGRATE ACTIONS

*into existing planning
mechanisms*



IMPLEMENT ACTIONS



Action Life Cycle: **Sample Problem Statement**

EXAMPLE Jurisdiction-specific Problem Statement



- **Sorg City is experiencing rapid population growth in flood-prone areas. Current stormwater management infrastructure is inadequate resulting in frequent flooding at the intersection of Main and 3rd, which limits access to the hospital when rainfall exceeds ½ inch over a 2-hour period. The FIRM is outdated and there are concerns that new development could occur in unmapped floodplains. Few homeowners have flood insurance. The county has received nine Presidential Disaster Declarations for flooding in the past 18 years.**

Problem statements developed for EACH jurisdiction for EACH hazard with identified risk will promote development of solutions to specific and unique problems in the mitigation strategy.

Action Life Cycle: **IDENTIFY Solutions for the Problems**

**Problem:
Inadequate
stormwater
management
system**

❑ Possible Solutions:

- ❑ Conduct updated H&H studies to identify and implement system improvements such as culvert enlargements
- ❑ Manage upstream runoff with conventional detention/retention structures
- ❑ Create bioswales or bioretention corridors
- ❑ Install pervious pavers in parking lots of upstream adjacent shopping centers

**Problem: Outdated
FIRMs**

Possible Solutions:

- ❑ Initiate regulatory map update process
- ❑ Request Risk MAP project – BLE/non-regulatory products for planning

**Problem:
Lack of homeowner
flood insurance**

Possible Solutions:

- ❑ Flood Insurance Ad Campaign
- ❑ Education for lenders and agents
- ❑ Join CRS to reduce premium costs
- ❑ Floodproofing outreach

Action Life Cycle: **ANALYZE Mitigation Actions**

Evaluate possible solutions to solve a single problem to select the best alternative. Repeat this process for possible solutions for EACH problem

In this example, at the outset of analyzing mitigation actions, the jurisdiction chose to eliminate two of the possible solutions from further consideration as there is no location upstream that is suitable for detention/retention structures and shopping center parking lots are too large to consider large-scale application of pervious pavers.

**Problem:
Inadequate
stormwater
management
system**

► **Possible Solutions:**

- Conduct updated H&H studies to identify and implement system improvements such as culvert enlargements
- ~~Manage upstream runoff with conventional detention/retention structures~~
- Create bioswales or bioretention corridors
- ~~Install pervious pavers in parking lots of upstream adjacent shopping centers~~

Action Life Cycle

ANALYZE Actions

Solution #1: Conduct updated H&H studies to identify and implement system improvements

Solution #2: Create bioswales or bioretention corridors

STAPLEE Considerations	Solution #1 Score	Solution #2 Score	Rationale
<u>S</u> ocially acceptable	●	◐	Society looks to government to solve the problem
<u>T</u> echnically feasible	●	●	Both solutions are technically feasible
<u>A</u> ministrative Capability	●	◐	Administration of stormwater improvements may be more manageable than green infrastructure that may extend on to private property. Consider capabilities from C1
<u>P</u> olitically acceptable	◐	●	Environmentally-friendly solutions may be more politically acceptable
<u>L</u> egal authority	●	●	Legal authority exists within the right-of-way
<u>E</u> conomic benefit	◐	●	Estimating similar reduction in damages, stormwater improvements will cost more
<u>E</u> nvironmental benefit	●	●	Green infrastructure is environmentally beneficial

Risk Assessment Informs Mitigation Needs

Four Broad Categories of Mitigation

Local Plans and Regulations

- Update building codes
- Revise zoning ordinances
- Develop defensible space ordinances

Structure and Infrastructure Projects

- Improve drainage to reduce flood threat
- Integrate green and gray infrastructure
- Acquire and demolish or move structures in hazard prone areas

Natural Systems Protection

- Erosion control
- Wetland restoration
- Riparian buffers

Education and Awareness

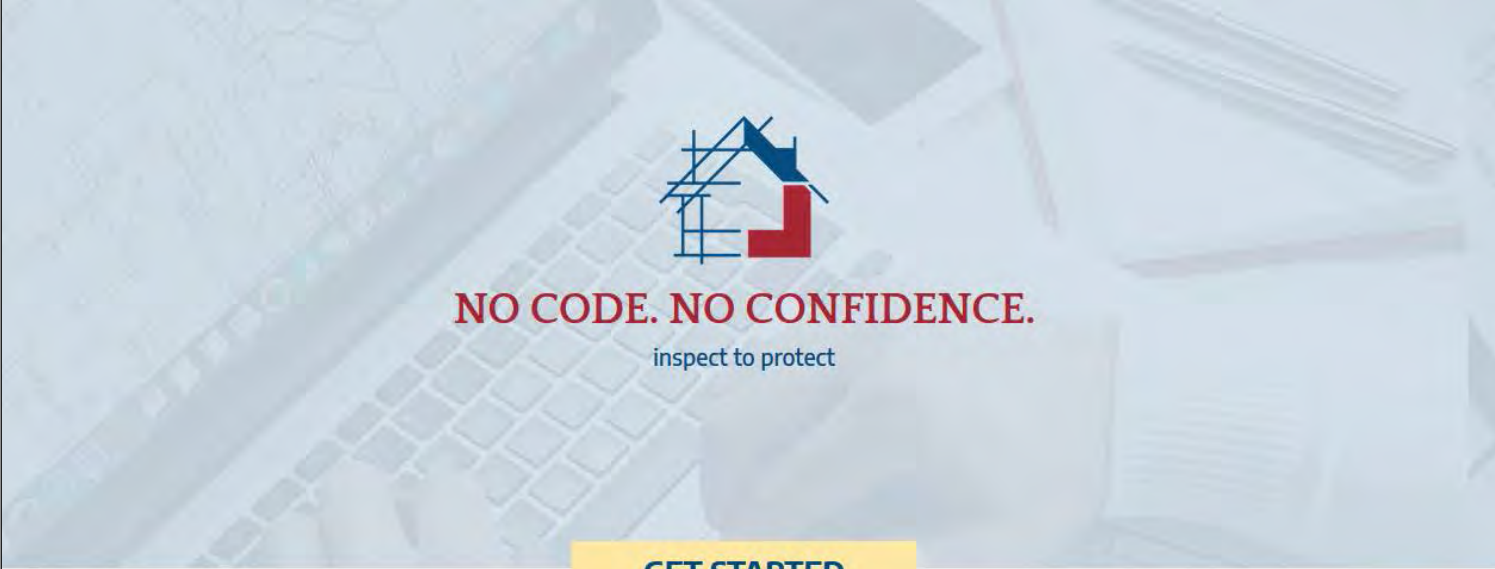
- Incentivize drought tolerant landscaping
- Publish websites and maps
- Install historic high water markers



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Local Plans and Regulations

Building Code Adoption Visualization



NO CODE. NO CONFIDENCE.
inspect to protect

GET STARTED

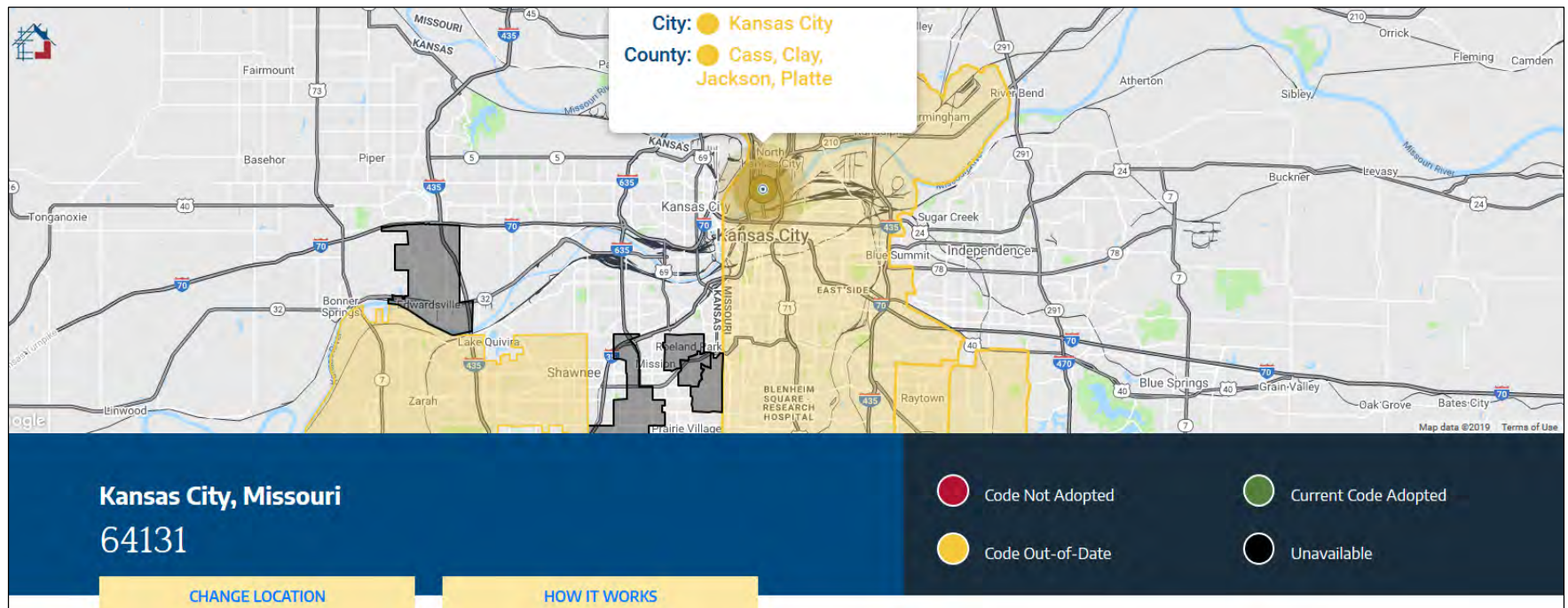
Modern building codes ensure that your home is built using the latest practices and standards. Use this tool to determine the building codes used in your community today, or contact your local government for information about building codes used in the past.

Frequently Asked Questions **Request Partner Toolkit**



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Building Code Adoption Visualization



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National Building Code Awareness Project Data

The Facts:

About **69 percent** of jurisdictions facing one or more hazards don't have current, relevant structural building codes.

Building to higher standards means damage is **77 percent** less likely.

What People Think:

8 out of 10 Americans assume they are moderately protected (through their building codes).

Two-thirds of Americans would be very or extremely concerned if there were no building codes.



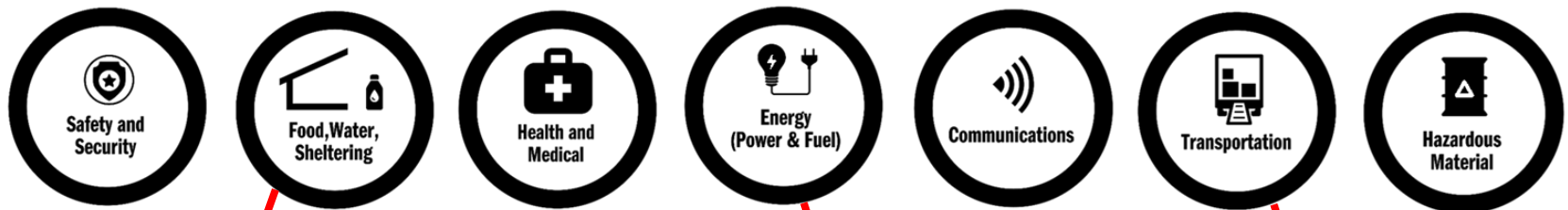
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Structure and Infrastructure Mitigation

► Mitigation for the Built Environment

- What structures/infrastructure has been damaged in the past?
- What structures/infrastructure are in at-risk areas based on risk modeling?

► What Structure/Infrastructure Mitigation can address problems associated with lifelines?



Natural Systems Protection

This reconstructed culvert in Moosalamoo National Recreation Area in Arlington, Vermont uses rocks and sand to simulate a natural fish passage.



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Education and Awareness

► High Water Mark Signs in Kansas



Mitigation Activities for Communities

Typical community risk-reducing mitigation activities include:



Adopting and enforcing regulatory tools, including ordinances, regulations, and building codes to guide and inform land use, development, and redevelopment decisions in areas affected by hazards.



Creating a buffer area by protecting natural resources, such as floodplains, wetlands, or sensitive habitats.



Acquiring or elevating flood-damaged homes or businesses and retrofitting public buildings, schools, and critical facilities to withstand hazard events.



Implementing outreach programs to educate property owners and the public about risk and about mitigation measures to protect homes and businesses.

Mitigation Activities for Homeowners

There are things you can do to make your home and family safer through mitigation.

Homeowners can reduce their own risk of loss by:

- Elevating their home's living floor above the Base Flood Elevation shown on the community's effective Flood Insurance Rate Map, which can be viewed at FEMA's Map Service Center (<https://msc.fema.gov>). This may also be done as a requirement to be compliant with your community's regulations. However, the savings is lower flood insurance premiums and protection from future flood levels.
- Elevating HVAC and/or mechanical units above the Base Flood Elevation.
- Installing flood vents, which reduce the risk of damage by allowing flood water to flow through and drain out.
- Using flood-resistant materials in areas of your home below the Base Flood Elevation, like replacing carpeting with tiles, to prevent water from doing major damage.



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The Parkers realized that weather is unpredictable and that flood risk can change. Another big flood could happen at any time. But could they really afford to build higher? It was time to break out the calculator and do the math.



Option 1: Building to the current requirements

- Estimated construction costs: **\$250,000**
- Estimated monthly mortgage payment: **\$1,122**
- Flood insurance premium: **\$143 per month or \$1,716 per year**
- Total monthly costs: **\$1,265**

Option 2: Building 3 feet above the current requirements

- Estimated construction costs: **\$252,125**
- Estimated monthly mortgage payment: **\$1,132**
- Flood insurance premium: **\$46 per month or \$552 per year**
- Total monthly costs: **\$1,178**

Note: This comparison is based on a 1-story home in an AE Flood Zone built at BFE and 3 feet above BFE on a concrete or CMU perimeter with vents. It has the NFIP maximum coverage of \$250,000 building coverage and \$100,000 contents coverage with a \$1,000 deductible. Elevation costs are estimated at roughly 0.85 percent of total construction costs per additional foot of elevation. Cost savings could vary for different construction methods. Insurance premiums are based on rates published in the Jan. 2013 NFIP Manual. Mortgage payments are based on a 30-year fixed-rate mortgage at 3.5 percent APR for the full construction amount and exclude all insurance costs. Flood insurance must be paid in full at the beginning of the coverage year.

Good news!

The Parkers will save about \$90 every month by building 3 feet higher.
Spending a little extra on construction reduced the Parkers' flood risk, cut their



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Future Events: Think About Changing Climate Conditions



Will aging dams or levees have a greater probability of failure?



Will heavier rainfall stress the stormwater system?



Will more frequent extreme heat days be a greater challenge for an aging population?



Mitigation Cost-effectiveness

- ▶ **Ensures future benefit is greater than cost**
- ▶ **FEMA BCA Toolkit**
- ▶ **www.fema.gov/benefit-cost-analysis**
- ▶ **The BCA Toolkit consists of modules for a range of major natural hazards and project types including:**
 - Flood
 - Tornado Safe Room
 - Hurricane Wind
 - Hurricane Safe Room
 - Earthquake
 - Wildfire
 - Drought

Thank you!

Any Questions?

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