

G361

Flood Response Operations

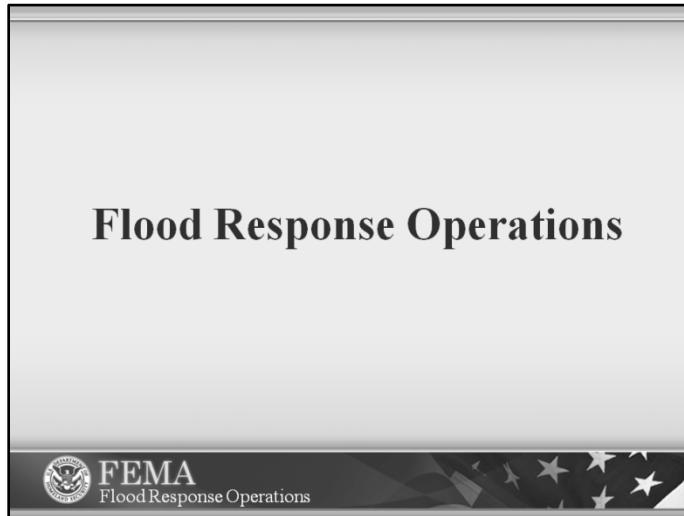
Student Manual

FEDERAL EMERGENCY MANAGEMENT AGENCY
EMERGENCY MANAGEMENT INSTITUTE

October 2013

Table of Contents

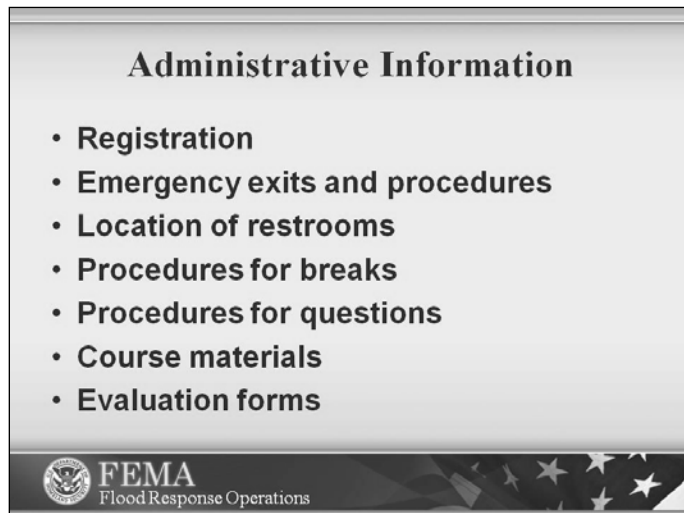
Course Overview	I-i
Lesson 1: Introduction to Riverine Flooding	I-1
Lesson 2: Information Gathering	II-1
Lesson 3: Planning and Coordination.....	III-1
Lesson 4: Flood Response Methods	IV-1
Lesson 5: Decision Making	V-1
Lesson 6: Volunteer Management.....	VI-1
Lesson 7: Flood Works Monitoring.....	VII-1
Lesson 8: Reports and Documentation	VIII-1
Lesson 9: Returning to Normal.....	IX-1
Appendices	A-1



Course Overview

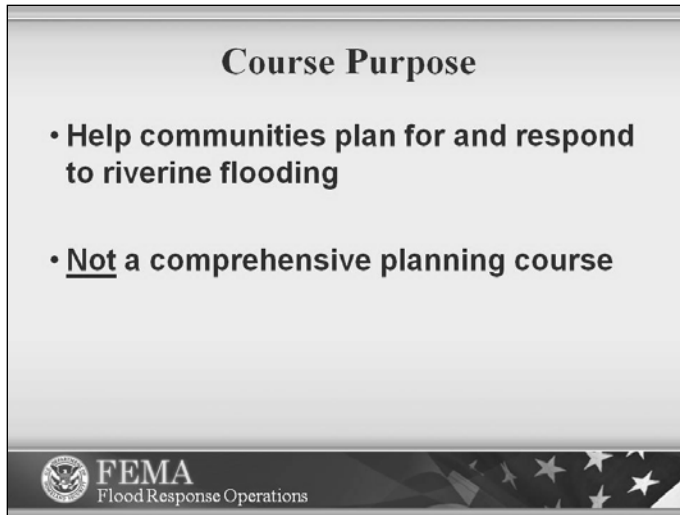
Welcome to G361, *Flood Response Operations*. This program is designed to help communities plan for and respond to riverine flooding.

Specialized flooding situations such as alluvial fan floods, coastal floods, flash floods, or floods related to ice jams, present unique problems which are beyond the scope of this course. However, because there are similarities among the types of floods, the same basic planning and response procedures could apply in these situations.




Take a moment to look through the Student Manual. As you can see, there is added space on the right side of the page for you to take notes. Bold text on this side of the page indicates the beginning of a new lesson.

Occasionally, special notes like this one will be inserted on this side of the page.



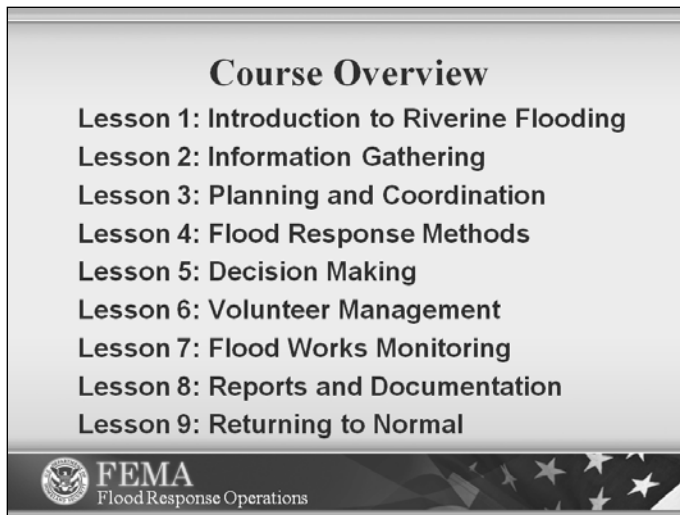
Course Purpose

- **Help communities plan for and respond to riverine flooding**
- **Not a comprehensive planning course**

 **FEMA**
Flood Response Operations


Flooding is the most common natural disaster in the United States, killing about 140 people each year and causing \$6 billion in property damage.

Community planning helps protect people and property from the devastating effects of a flood.



Course Overview

- Lesson 1: Introduction to Riverine Flooding
- Lesson 2: Information Gathering
- Lesson 3: Planning and Coordination
- Lesson 4: Flood Response Methods
- Lesson 5: Decision Making
- Lesson 6: Volunteer Management
- Lesson 7: Flood Works Monitoring
- Lesson 8: Reports and Documentation
- Lesson 9: Returning to Normal

 **FEMA**
Flood Response Operations

Course objectives are listed on the next page of this manual.

During this course, we will discuss flooding, flood planning, and how to respond to floods. Also, we will talk about roles for responders, as well as the importance of reporting and documentation. Finally, we'll discuss some considerations for restoring the community to as near-normal as possible after a flood event.

Course Objectives

The following are the terminal objectives for the course, which identify the primary action you should be able to accomplish upon completion of each lesson.

Lesson	Terminal Objective
1	Discuss the basic concepts related to riverine flooding.
2	Analyze flood threats for a given scenario.
3	Determine how to coordinate with multiple agencies, groups and organizations to plan for riverine flooding.
4	Explain the advantages and disadvantages of expedient flood works.
5	Develop a flood emergency plan for a given scenario.
6	Summarize the considerations involved in managing a volunteer workforce.
7	Describe the processes, equipment, and considerations for monitoring flood works.
8	Evaluate the actions taken during a riverine flood event, for a given scenario.
9	Explain the challenges and resources associated with the recovery process.

Introductions


- **Name**
- **Location**
- **Job description**
- **Flood experience**

FEMA
Flood Response Operations

Introduce yourself to others in your class. Let them know about yourself and your experience with previous floods. Trade contact information so you can build a network of professionals to contact for support after the class is over.

**Lesson One: Introduction
to Riverine Flooding**

**OBJECTIVE: Discuss the basic concepts
related to riverine flooding**




Lesson 1: Introduction to Riverine Flooding

There are over 3 million miles of waterways in the United States; ranging from creeks and brooks to expansive waterways, like the Mississippi River. All are subject to flooding.

Supporting Objectives

- **Define the basic terms associated with riverine flooding**
- **Explain the relationship between a river, its floodway, and its floodplain**
- **Describe different methods for monitoring river levels**



These objectives support the accomplishment of the overall (terminal) objective for this lesson: Discuss the basic concepts related to riverine flooding.

You need to become familiar with riverine flooding terms for effective communications during emergencies. It is also important to understand how a river relates to the floodway and the floodplain.


The Flood Threat in the U.S.

- Over 20,000 communities
- Approximately 1/3 of the population
- High economic losses
- May allow time for planning



Each year, floods affected communities across the United States, causing both personal loss and destruction of property.

Team Activity: Knowledge Bowl



A list of terms you'll be asked about in this activity appears on the next two pages of this manual. Definitions for these terms can be found in your glossary. You are encouraged to take notes of any additional information shared about each term on the following pages.

For this activity, the class will be divided into two teams. A captain for each team will be designated.

Teams will have 5 minutes to study the glossary terms, and then the knowledge bowl will begin.

When it is your team's turn to answer, you will have 15 seconds to provide the correct response. If you do not provide the correct answer, another team will have a chance to answer.

Team Activity: Knowledge Bowl

This activity will include the following terms, which can be found in the glossary. Space is provided for you to take notes about their definitions if you like.

0.2% flood

1% flood

Bank-full

Base Flood Elevation (BFE)

Berm

Drainage basin/watershed

Flood Insurance Rate Map (FIRM)

Flood stage

Flood warning

Flood watch

Floodplain

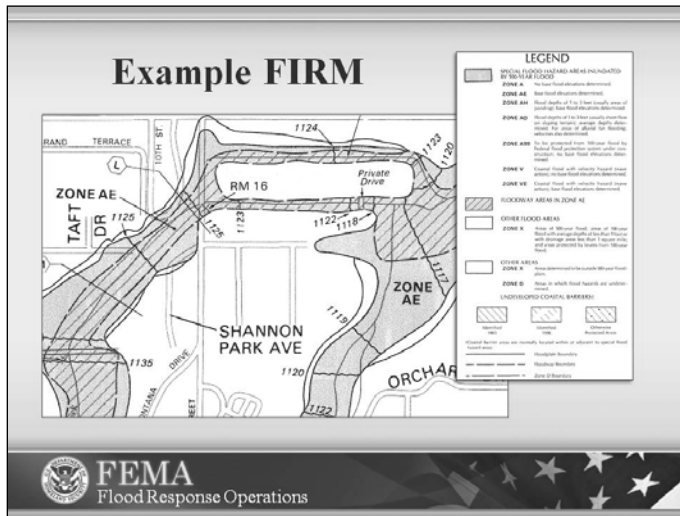
Floodway

Levee

National Flood Insurance Program (NFIP)

Right/left river bank

River channel



For purposes of the NFIP, the 1% floodplain is also called the Special Flood Hazard Area (SFHA).

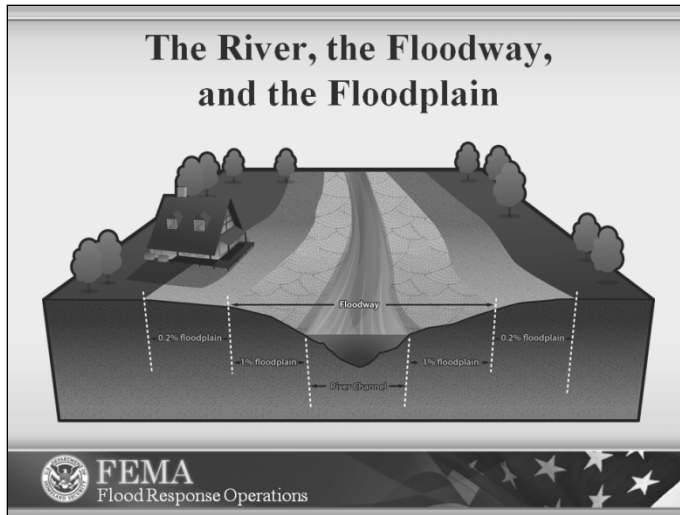
- SFHAs are labeled as zones beginning with A or V (e.g., Zone AO, Zone VE).
- Moderate flood hazard areas are labeled Zone B or X.
- Minimal flood hazard are labeled Zone C or X.

Comparison of Flood Terms

Preferred Term	Also Called	FIRM Labels
1% Floodplain	100-year Floodplain	SFHA Zones beginning with A or V
0.2% Floodplain	500-year Floodplain	Usually shaded as Zone X or Zone B

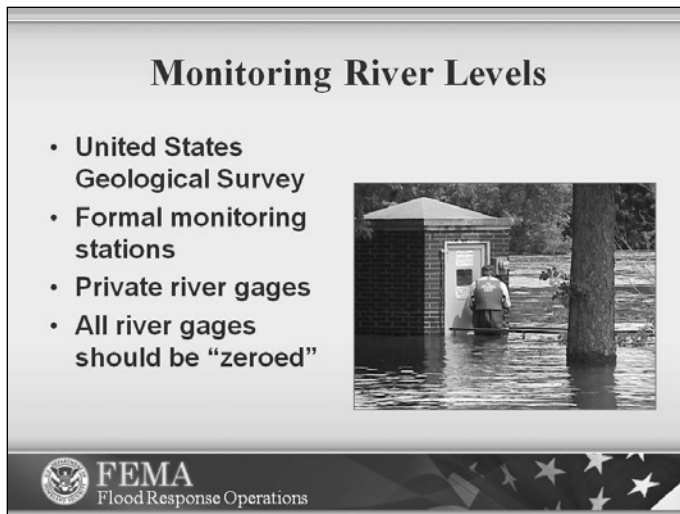
FEMA Flood Response Operations

Remember, these terms are engineered limits to define the flood threat. Floods are not limited to these areas.



Water entering the river system has two noticeable effects on the river.

- Increased flow raises the water level in the channel.
- As the river rises, the velocity of the water flow increases.



For more information about the National Geodetic Vertical Datum (NGVD) of 1929 and the North American Vertical Datum (NAVD) of 1988, visit the National Geodetic Survey Frequently Asked Questions page:

<http://www.ngs.noaa.gov/faq.shtml>


The United States Geological Survey (USGS) maintains a system of river monitoring stations. A complete system of river gages is an important river forecasting tool that can increase the accuracy of flood warnings.

Ideally, gages are placed where they can be easily read, even at high water levels.

The "zero" of a gage is the elevation added to a gage to obtain the true height of the gage above the datum.

Gage Readings

- **Normal conditions:**
 - 7:00 a.m.
- **High water conditions may require:**
 - 1:00 p.m.
 - 7:00 p.m.
 - 1:00 a.m.

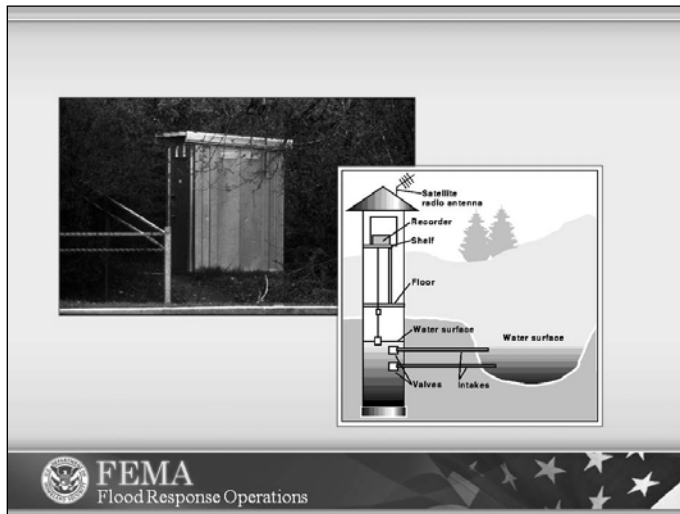


Accurate river forecasts require regular gage readings. Normally, river gages are read at 7:00 a.m. and reported to the National Weather Service (NWS). During periods of high water, additional gage readings may be requested.



This is an example of a Type A wire weight gage used by NWS to measure river stage. This gage consists of a drum wound with a single layer of stainless-steel cable attached to a bronze weight, a graduated disc, and a counter, all within a cast-aluminum box.

The weight is lowered until the bottom of the weight cylinder just touches the surface of the water. The water level can be determined from the combined readings of the counter and the graduated disc inside the housing box.



The photograph shows a standard USGS gage hut. These locations are secured by padlocks and are used to house a variety of gages including bubble units and stilling well gages (as shown in the diagram).


These stations are routinely serviced by USGS agents who calibrate the units, repair vandalism, and deal with other maintenance issues.



The larger photograph shows a bubble system, which can be used when construction of a well is not feasible. The smaller photograph shows the interior layout of a bubble gage station.

How River Monitoring Information Is Used



- **Used by NWS to determine**
 - Volume of water in river
 - When to issue flood watch or warning
- **NWS also uses other data**
 - Rainfall reports
 - Soil saturation
 - Snow depth
 - Temperature readings



Information from river gages is used by the National Weather Service to determine the volume of water flowing in the river. The NWS uses this river monitoring information, along with other data, to determine when to issue flood watches and warnings.

Forecast Variables and Dealing With the Flood Threat


- **Levee failures**
- **Debris**
- **Flood control works**



Forecasting, based on many variables, leads to flood control works including levees, dikes, and flood walls. Flood control projects, while well-intended and preventative, can have drastic effects on the waterway by preventing the natural inundation of the floodplain.


Lesson Summary

0.2% flood	Drainage basin / watershed	Floodplain
1% flood	FIRM	Floodway
Bank-full	Flood stage	Levee
BFE	Flood warning	NFIP
Berm	Flood watch	Right/left river bank
River channel	SFHA	



Every hazard has its own unique set of terminology and flood emergency planning is no different. It is imperative that you know this terminology and are able to use it intelligently.

What is the relationship among a river, its floodway, and its floodplain?



You may use the questions on the slides to check your understanding of the content presented in this lesson.



**What are different methods
available for monitoring
river levels?**


Do you have questions for the instructor?

Suggested Action Items

- Contact the USGS office for your area and obtain a printout of the river gages in your community. Would all these gage sites be accessible in high water conditions?
- Contact your local weather service office and learn the reporting procedures for river gages in your area. Who is responsible for reading these gages?
- If you have levees in your community, investigate when they were last inspected. Are all levees being properly maintained or did the inspection find problem areas?
- When was the last flood in your community? Was the flood stage accurate in predicting when appreciable flood damage would occur in urban and rural areas?

**Lesson Two:
Information Gathering**

**OBJECTIVE: Analyze flood threats for a
given scenario**




Lesson 2: Information Gathering

In this lesson, you will learn how to analyze flood threats.

The success of the planning process will partly depend on the accuracy and amount of information obtained and readily used by local planners. While the information gathering process may seem tedious, it is a critical step and is a fairly easy task to complete.

Supporting Objectives

- Summarize the types and sources of information needed for flood planning
- Explain how different types of maps are used in flood planning
- Explain the difference between a topographic map and a Flood Insurance Rate Map (FIRM)
- Use a map to identify locations that are vulnerable to flooding



Knowing the various types of maps and their uses is critical when combining other information gathered to effectively plan for floods.

You should explore and use all of the information resources at your disposal.

Maps



- Topographic Maps
- Highway and Minor Road Systems
- Levee and Water Control Systems
- Sewer and Utility Systems
- Zoning and Plat Grids
- FEMA Flood Insurance Rate Maps
- Specialty Maps and Photographs



An extensive collection of maps will be used and cross-referenced during the planning process.

Topographic Maps

- Produced by the USGS
- Usually updated every 10 years
- Land elevations remain stable
- Map features change


Map courtesy of U.S. Geological Survey


Commonly called “topos,” these maps display information on river channels and elevations that can be used to determine and plot areas of inundation. Topographic maps provide accurate information that is critical when determining flood risks and planning a flood response.

Highway and Road System Maps

Can be used to:

- Indicate flood-affected roads
- Find secure evacuation and supply routes

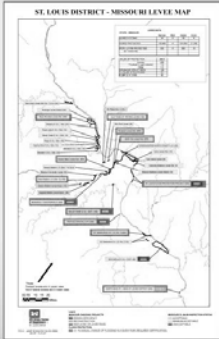




FEMA
 Flood Response Operations

Highway and road system maps will also be used. These maps can be used to indicate road systems affected by flooding, access routes to water control structures, and to plot secure evacuation and supply routes.

Levee and Water Control System Maps

- Rivers and waterways
- Access roads
- Sewer outfall locations
- Conduit and utility crossings
- Railroad gap placements
- Floodgates and barriers
- Dams and water control systems





FEMA
 Flood Response Operations


Map courtesy of the U.S. Army Corps of Engineers

Levee and water control system maps are invaluable. These are highly detailed maps that provide excellent information on rivers and waterways.

Sewer and Utility Maps

- Utility crossings
- Pipelines
- Sewer outfalls
- Transformer stations
- Water treatment facilities





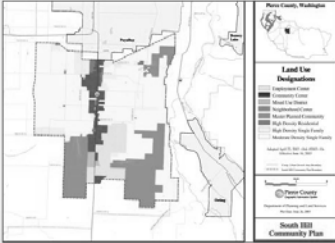
Map courtesy of Pierce County, Washington


Sewer and utility maps are essential to flood response planning. Knowing the locations of all sewer outfalls and their piping patterns helps emergency planners prepare and deal with backflow issues, which can negate flood response efforts.

Sewer and utility maps may also identify the locations of vital facilities, such as transformer stations and water treatment facilities, that may require special protection during high water events.

Zoning and Plat Grids

- Define land use around river systems
- Set priorities for expedient flood protection
- Map historic flood plots







Map courtesy of Pierce County, Washington

Zoning and plat grids define the land use around river systems. Knowing if the inundation area is primarily set aside for housing or industrial uses is important information during the planning process.

Flood Insurance Rate Maps (FIRMs)

- Expected floodplain and floodway boundaries
- Based on 1% and 0.2% events
- Developed for NFIP
- Used to determine actuarial rates




FEMA
 Flood Response Operations

FEMA produces FIRMs that can assist during the flood planning process.

FIRMs document the expected floodplain and floodway boundaries for rivers and streams in many communities. FIRMs are used to determine the actuarial rates that apply to structures within established flood zones.

Specialty Maps


- Chemical facilities
- Cemetery and burial ground maps
- Park system maps
- Soil composition maps
- Railroad maps
- Field drainage maps


FEMA
 Flood Response Operations

There are many specialty maps that you should become familiar with to aid you in the flood response planning process. The time spent in collecting this type of information will be beneficial during the planning process and may prove to be invaluable in the response phase.

Reports and Analysis Data

- **Historic Flood Information**
- **After-Action Reports**
- **Flood Studies (Public & Private)**
- **Hazard Analysis Information**



Information on historic flood events should be gathered. Newspaper archives, historical societies, and universities are often good sources of information. Some of the historical information may have to be put into perspective to account for the addition of water control or other facilities since the last historic flood event.


Historic Flood Information




Photographs can be a tremendous tool to identify flood areas and review past flood conditions. Pictures of past floods and high water events provide a visual reference showing inundation areas and other information.

After-Action Reports

- **Collected and filed by one agency**
- **After last event**






Detailed after-action-reports are valuable sources of information. Ideally, these reports were collected and filed by one agency after the last event, but researchers should be prepared to go agency-to-agency to obtain this information.

Flood Studies

- **Insurance reports**
- **Hazardous waste investigations**
- **Subdivision reports**
- **Bank and underwriting reports**
- **Community development studies**
- **Agricultural agencies**





Flood studies can range from highly scientific reports to general overviews. Information on flood threats can be found in insurance reports, hazardous waste site investigations, subdivision reports, bank and underwriting reports, and community development studies.

The Natural Resources Conservation Service (NRCS) of the US Department of Agriculture (USDA) may have detailed flood studies for the community and surrounding areas.

Hazard Analysis Information

- Emergency preparedness office
- Flood mitigation plan




The emergency management office may have a formal hazard analysis that covers the flood threat. This analysis may be a general overview of the threat or a highly detailed document; and can provide the basis for further risk assessment during the flood planning process.

A flood hazard mitigation plan provides information on the steps that were and are to be taken to reduce future flood threats.

Existing Planning Documents


- Local/Agency Flood Plans
- Regional Flood Plans
- State Flood Plans
- Planning Guides and Reference Materials




Existing planning documents and reference materials should be reviewed before undertaking any additional efforts.

Local/Agency Flood Plans

- Municipalities
- Water utilities
- Other utilities
- Railroads
- Industrial complexes




 FEMA
Flood Response Operations

Localities may have plans and procedures in place to protect water treatment facilities and pumping stations. Since flood planning is a community-wide process, existing local flood plans should be incorporated into the final comprehensive planning package.

Regional and State Flood Plans


- Flood is often a regional problem
- Plans may already exist for:
 - Watershed districts
 - Conservation zones
- Local plans should coordinate with regional and state flood plans

 FEMA
Flood Response Operations

Local emergency planners should see that all local operations fit into the concepts and operational design of the regional plan to produce a seamless response program.

**Planning Guides and
Reference Materials**

- **Emergency planning guides**
 - FEMA CPG 101
 - State emergency management agencies
 - U.S. Army Corps of Engineers
 - Salvation Army





See the Resources section of the Appendix for links to some helpful planning documents.

There is a variety of planning guides and documents published by federal, state, and regional agencies. These guidance documents should be reviewed for applicability to local planning programs and efforts.

Forecasts and Warning Systems

- **National Weather Service**
 - River forecasts
 - Bulletins
 - Flood watches and warnings
- **Other warning systems**





The National Weather Service (NWS) is usually the primary source of river forecasts. Communities should find out which weather service office is responsible for their area.

Not only will the weather service provide local communities with information, but there is likely a need for communities along the river to give information back to the weather service.


Lesson Summary

Types of Maps	Information to Review
• Topographic	• Historic Flood Data
• Highway/Road Systems	• After-Action Reports
• Levee/Water Control Systems	• Flood Studies
• Sewer/Utility	• Hazard Analysis
• Zoning/Plat Grid	• Existing Plans
• FIRMs	• Forecasting Resources
• Specialty	• Warning Systems




The data collection process is essential to the completion of a workable planning system and document. Although it may seem to be a tedious process, when a flood event happens, the value of the time spent collecting information and planning for floods will be proven time and time again.

What could be some of the difficulties in using historical information for flood planning?




You may use these questions to check your understanding of the content presented in this lesson.

Explain the difference between a topographic map and a FIRM


The logo for FEMA Flood Response Operations, featuring the FEMA seal on the left and the text "FEMA Flood Response Operations" on the right, set against a background of a stylized American flag.

How are different types of maps used in flood planning?


The logo for FEMA Flood Response Operations, featuring the FEMA seal on the left and the text "FEMA Flood Response Operations" on the right, set against a background of a stylized American flag.

What type of information is needed for flood planning?


Where might this information be obtained?

The logo for FEMA Flood Response Operations, featuring the FEMA seal on the left and the text "FEMA Flood Response Operations" on the right, set against a background of stars and stripes.


What information might the LEPC have and why would it be valuable to flood planners?

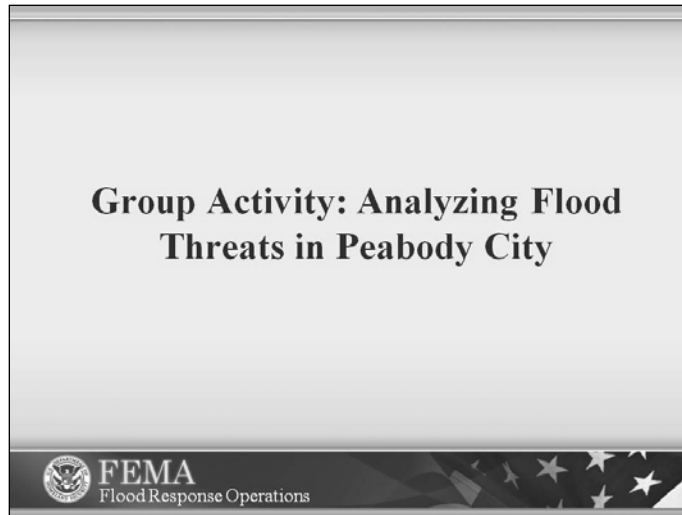
The logo for FEMA Flood Response Operations, featuring the FEMA seal on the left and the text "FEMA Flood Response Operations" on the right, set against a background of stars and stripes.

Why is it important to coordinate local actions with regional organizations?



Why is it important for agencies to work together during the flood planning process?





The instructions and questions for this activity are on the next page of this manual. Maps and supporting information can be found in Appendix A.

In this activity, you will analyze flood threats for the fictional community of Peabody City.

As a group, you will be given 30 minutes to read the scenario information, discuss the questions, and record your answers.

Select a spokesperson to report your findings to the class.

Group Activity: Analyzing Flood Threats in Peabody City

In your group, using the maps and information sheets provided in Appendix A, discuss and answer the questions below. Select a spokesperson to report your findings to the rest of the class.

1. Briefly describe the areas most likely to sustain flood damage. Do any areas pose special planning concerns or problems? If so, what are they?

Damage Area	Special Problems

2. Which flood-prone areas deserve a high priority for protection? How difficult will it be to protect these areas?

Possible Priority Sites	Protection Difficulty

- Are there any areas shown on the map that appear to be indefensible in a 100-year flood?

Possible Area	Alternate Actions

- What other information would your group need to begin a flood response plan? Where would you get this information?


Information Required	Possible Source of Information

Suggested Action Items

- Obtain a set of floodway maps for your community. What information do they provide?
- Contact the U.S. Army Corps of Engineers for your area and determine what support they can give your community both during the planning phase and when high water threatens.

**Lesson Three:
Planning and Coordination**

**OBJECTIVE: Determine how to
coordinate with multiple agencies,
groups, and organizations to plan for
riverine flooding**




Lesson 3: Planning and Coordination

In this lesson you will learn how to coordinate with multiple agencies, groups, and organizations to plan for riverine flooding.

Planning for a high water event should begin long before a flood occurs. A good flood emergency plan will contain many elements and functions that must be designed to work cohesively and seamlessly during the emergency phase.

Supporting Objectives

- Describe the pre-flood planning process
- Describe the agencies and organizations with which partnerships should be established for effective flood planning
- List methods of coordinating the flood plan with other emergency management plans



Supporting Objectives, continued

- List potential members of the planning team
- List key areas that should be considered in pre-flood planning
- Summarize the special hazards or concerns that should be considered when planning for a high water event
- Explain the steps involved in phased response planning




FEMA
Flood Response Operations

Remember, this is not intended to be a comprehensive planning course. More training on creating emergency plans is available from FEMA and State emergency preparedness agencies.

Elements of Effective Flood Planning

Flood plans must:

- **Be based on what can be done**
- **Complement other planning documents**
- **Serve as basis for private flood plans**
- **Identify roles and responsibilities**
- **Be proactive**

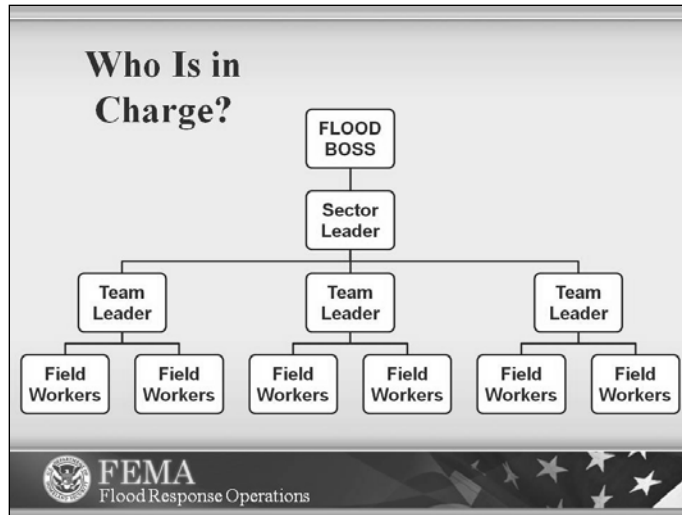


You can learn more about mitigating flood damages in the following FEMA training course:

- *E273, Managing Floodplain Development through the National Flood Insurance Program (a 4-day course)*

Remember these elements of a flood plan:

- Plans must be based on what you can do, not what you would like to do.
- When the flood response plan is completed, all planning documents should fit together into a seamless response system.
- Local flood plans should serve as a basis for private flood plans.
- The plan must contain information on the command and reporting systems to be used in the community for directing emergency operations.
- The most important step communities can take to be better prepared for flooding events is to ensure compliance with the National Flood Insurance Program (NFIP).



Many people are required to perform flood response operations and with that is a command and control structure for effective operations.

The Flood Boss is in charge and is assisted by Sector Leaders. A Sector Leader is responsible for all flood response operations within a given zone.

Team Leaders guide and supervise specific flood response functions and report to the Sector Leader. Besides general supervisory duties, they are charged with monitoring safety conditions and the well-being of the workers under their control.

Field workers are the people who make it all happen and report to one team leader. These are the true heroes of the flood response.

Partnerships in Flood Planning

- Not a one-person (or one-agency) job
- Information comes from a variety of sources
- Coordination issues can be resolved early






FEMA
Flood Response Operations

Since many elements must come together in a flood response, planning coordination is essential.


Information must be gathered from a variety of sources, and the concerns of each planning team member and element must be addressed in the final document.

Coordination issues should be solved during the planning process, not when problems arise in the field.


Local Organizations and Agencies




School Districts



Utility Providers



Civic Organizations



FEMA
Flood Response Operations

Organizations such as schools, utility providers, and civic organizations, provide the backbone for many flood response actions.



State agencies can provide valuable expertise and support with the planning process. This is particularly true when coordinating planning elements.




Some regional organizations may have an interest in your local flood response/recovery programs.


Organizations should be polled to determine what information and services they have available and to assess where cooperative efforts can be made.

It is important to note that some organizations in this category have broad powers and responsibilities in a high water emergency.

National Weather Service


- Forecast information
- Flood stages
- River monitoring systems
- Flood warning bulletins



 **FEMA**
Flood Response Operations


The National Weather Service assists with the development of forecasting systems to provide the information necessary for the community to adequately respond to flood threats.

**United States Geological Survey
(USGS)**




Assists with:

- Interpretation of topographic maps
- Use and positioning of river gages
- Water level reporting systems


 **FEMA**
Flood Response Operations


The USGS and its supporting contract agencies can assist with the interpretation of topographic maps, , and use and positioning of river gages and water level reporting systems.

U.S. Army Corps of Engineers



- **Surveys waterways and flood-prone areas**
- **Assists in planning and flood response**





The U.S. Army Corp of Engineers provides emergency planners to survey waterways and flood-prone areas. They can also aid in planning flood responses and exploring mitigation programs.

It is also important to understand the limitations of the Corps and understand what procedures must be used to obtain Corps assistance in an emergency.

Federal Energy Regulatory Commission (FERC)

- **Provides flood planning guidance regarding hydroelectric dams**
- **Coordination with dam owners/operators is essential**






If hydroelectric dams are present on the waterway, the Federal Energy Regulatory Commission may provide help and guidance in the flood planning process.

Private Forecasting Services

- Used by power utilities with hydroelectric capabilities
- Internet weather forecasting supplements other forecasts
- All forecasting services can be useful



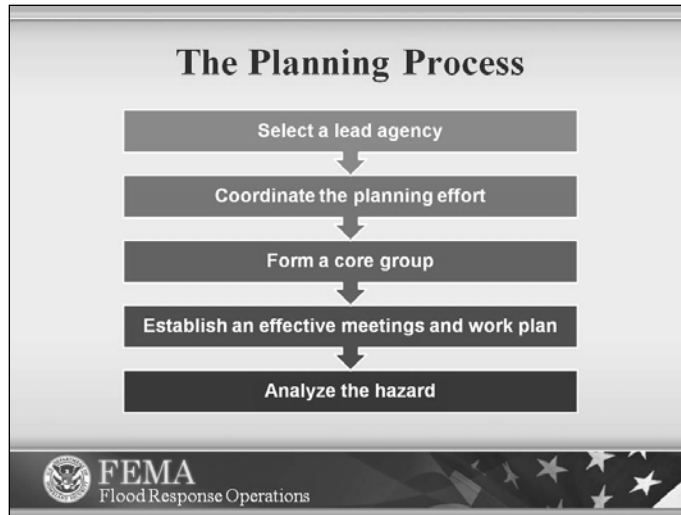
Some private forecasting services also provide river information. Any forecasting service, public or private, can be useful in an emergency.

Communication Resources

- Amateur radio
- Citizen band (CB) radio
- 2-way radios
- Cellular telephones
- Normal public service radio systems

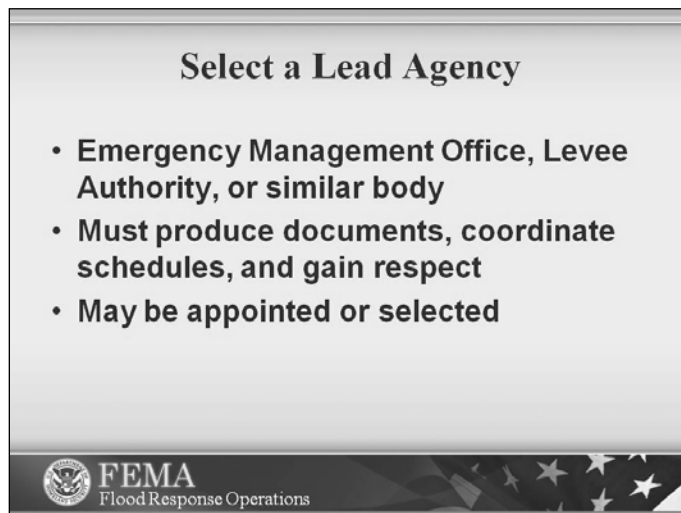


Other communication resources should be reviewed and incorporated into the planning process. These include those systems that will be used to communicate with levee patrols and officials along expedient flood works. Interfacing with these systems can greatly ease coordination problems.



Plan coordination requires that all response entities meet and discuss their roles and abilities during the planning process.

People and agencies involved in the planning process will develop working relationships and build trust. In an emergency, the relationships developed during the planning stage can greatly enhance emergency problem solving skills.





Whichever body is selected to lead the effort, it must have support services capable of managing the process.

The lead agency must be able to produce draft documents for review, handle meeting minutes, and coordinate schedules.

Coordinate the Planning Effort

- **Collect and organize information**
- **Identify the key players**
- **Call an initial organizational meeting**






To save time, planning information and data can be collected and organized before the first meeting of the planning team. The planning coordinator should identify the key players in the planning process and call an initial organizational meeting.

Form a Core Group

- **Include the primary players**
- **Maintain a manageable size**
- **Use subcommittees to expand base**




The lead agency should then form a core group to work on the flood response plan. This core group should be comprised of the primary players involved in a flood crisis.

To be effective, the primary planning group should be kept to a manageable size, with no more than 15 representatives.

Subcommittees can be used to expand the planning team base and to add the input of planners with specialized skills.

Establish an Effective Meetings and Work Plan



- **Schedule regular meetings**
- **Meet frequently in initial planning stages**
- **Decrease frequency as plan evolves**
- **Focus on building relationships**



The planning team should meet on a regular basis. Meeting regularly fosters the growth of planning team relationships that may prove to be useful during emergency operations. Different organizations in the community may be able to work together more effectively during an emergency if they have already formed relationships.

Planning Meeting Practices


- **Use an agenda**
- **Establish timelines**
- **Follow a process**
- **Stay on track**




Planning meetings must be conducted using basic business practices. The standard practices of using an agenda, establishing timelines, following processes, and staying on track. These practices keep the meeting focused and directed, allowing the most value in flood preparation.

Analyze the Hazard

- Review existing flood control systems
- Evaluate critical facilities
- Plot expected flood levels
- Review land uses




FEMA
 Flood Response Operations

A key starting point is the creation or review of a flood hazard analysis. A complete and up-to-date hazard analysis will provide a comprehensive review of the threat faced by the community during a flood response event.

- Review existing flood control systems

A review should be made of any flood control systems already in place which helps assess the risk faced by a community during a high water event.
- Evaluate critical facilities

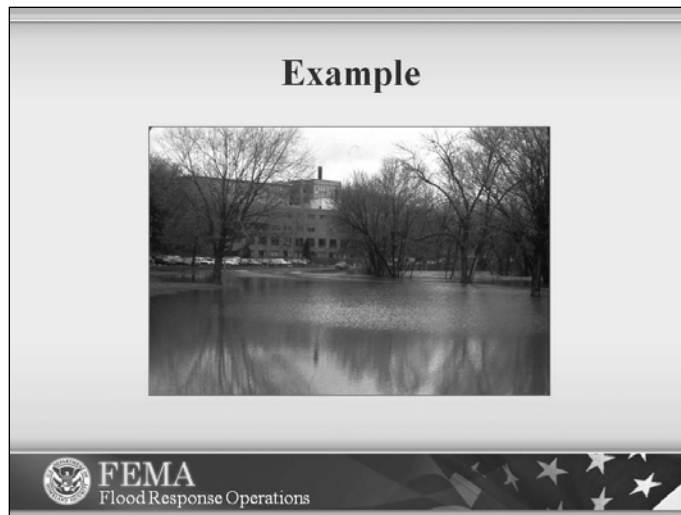
Specific flood response plans and options may be needed for these and other critical facilities to maintain normal service levels.
- Plot expected flood levels

Expected flood crests can be plotted on topographic and other maps so various response options can be evaluated.
- Review land uses

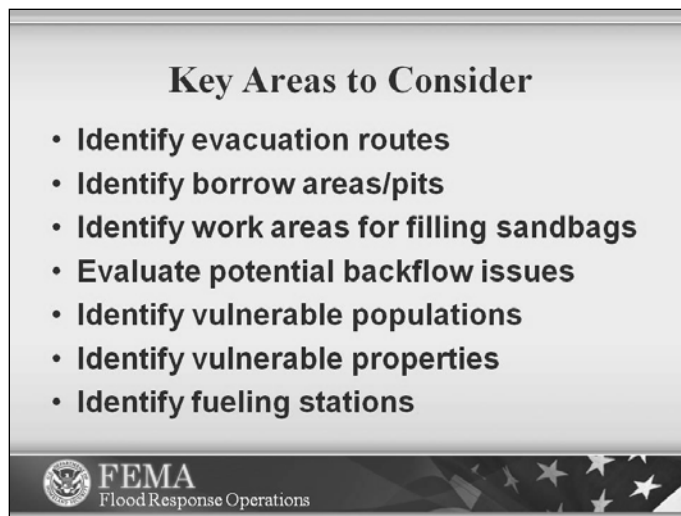
When determining how to plan for flood emergencies, the planners should review the land use of affected areas that have been plotted on the maps.

NOTE: Critical facilities include:

- Power substations and switching yards
- Water treatment plants
- Potable water facilities
- Hospitals
- Prisons
- Major economic centers
- Extended medical care facilities
- Emergency services (police, fire)
- Emergency operations centers
- Government buildings
- Chemical storage facilities
- HAZMAT facilities
- Backup data/information storage facilities
- Computer centers
- Childcare facilities
- Assisted living facilities

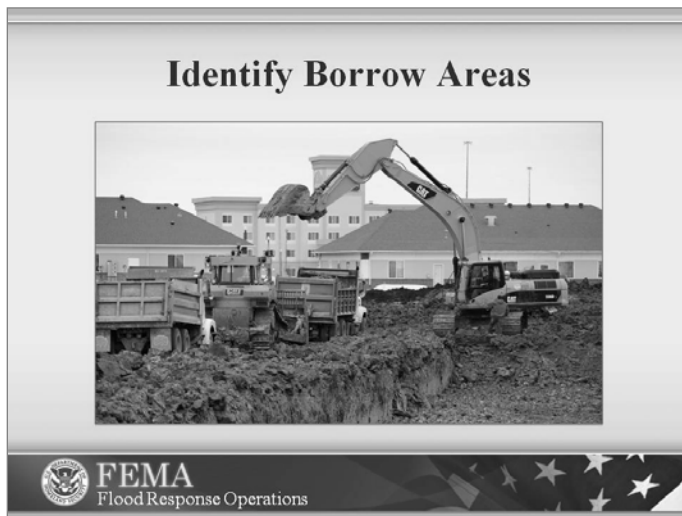


This hospital, built along a scenic river, presents a major problem to flood emergency planners. The only access road to the hospital is quickly submerged during flood events.

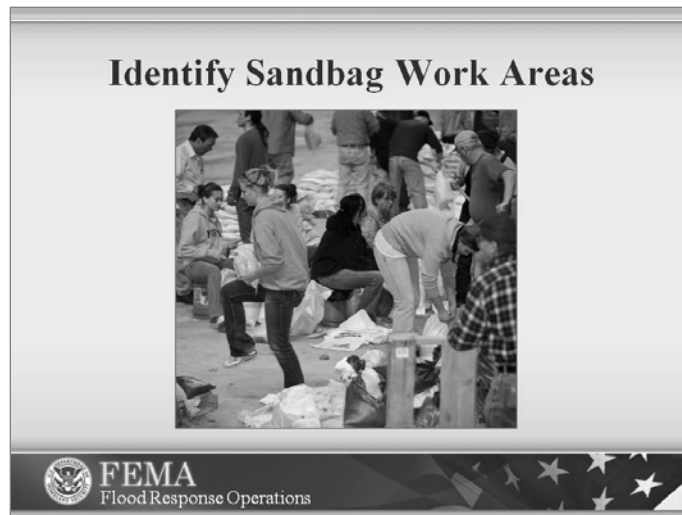




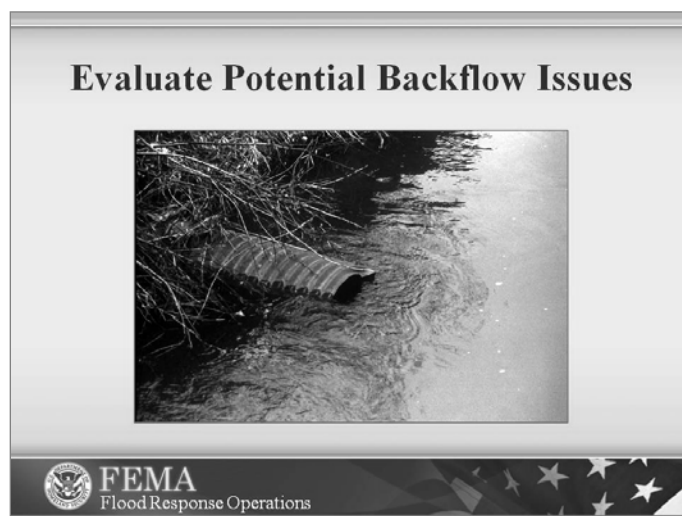
Once the flood zones are plotted on maps, evacuation routes should be identified using locally accepted traffic patterns.



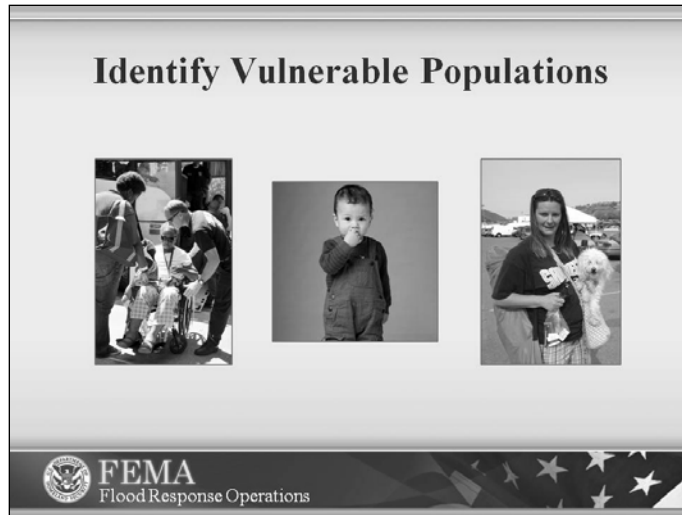
Borrow areas must be identified to obtain the clay soils, sand, and stone needed for levee capping and the construction of other expedient flood works.



When identifying work areas for filling sandbags, consider portable lighting systems and potential indoor areas for volunteers during cold weather.

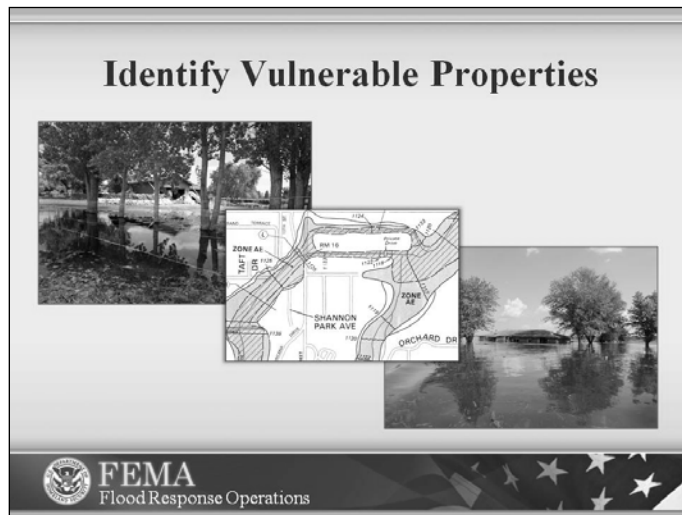


Locating sewer and drainage lines is an important part of flood planning. Open drainage lines can defeat flood works by allowing water to backflow through utility systems behind the flood works.

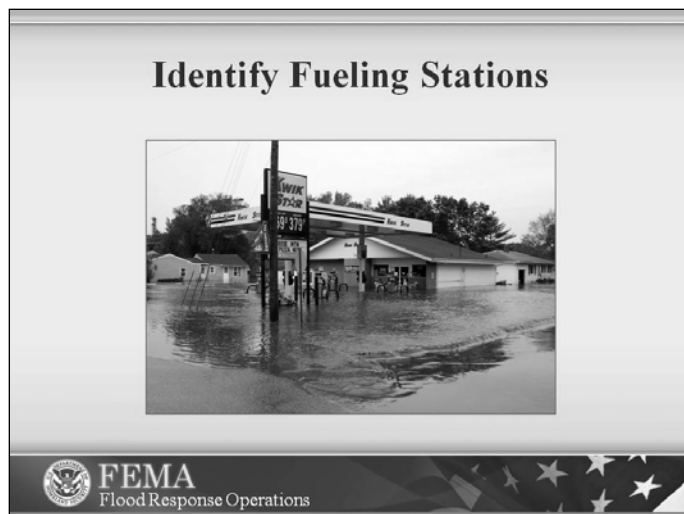


It is important to identify in your community populations who may be more vulnerable because of immobility or their inability to take protective action.

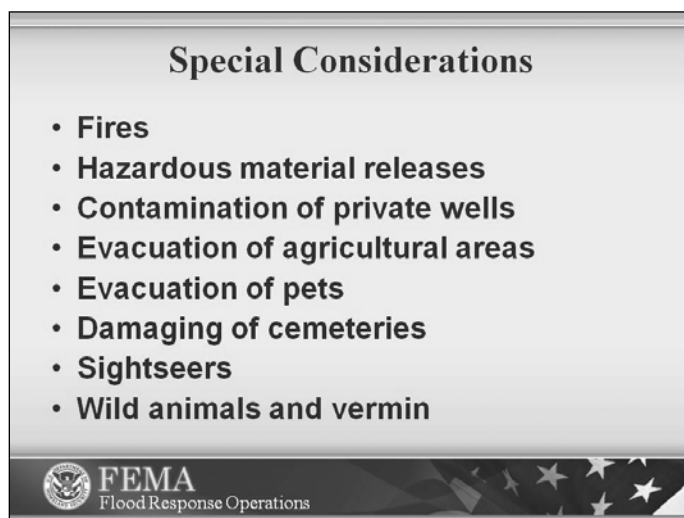
These populations may have additional needs before, during, and after a flood event in functional areas, including maintaining independence, communication, transportation, supervision, and medical care.



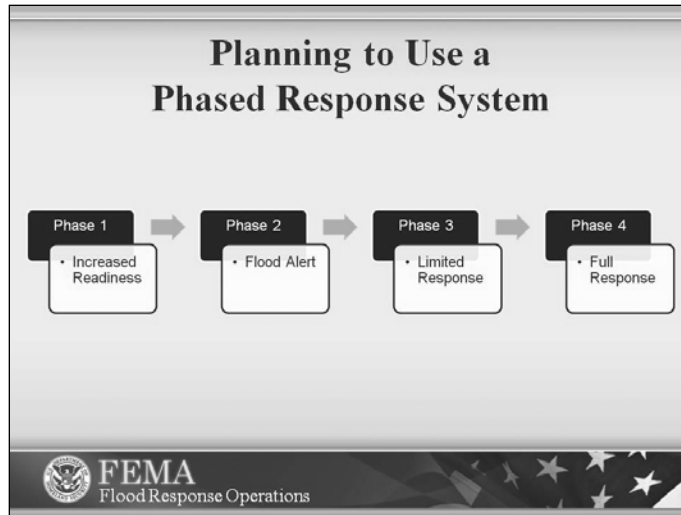
By using the different types of maps discussed in the previous lesson, you should be able to identify areas in your community most susceptible to flooding.



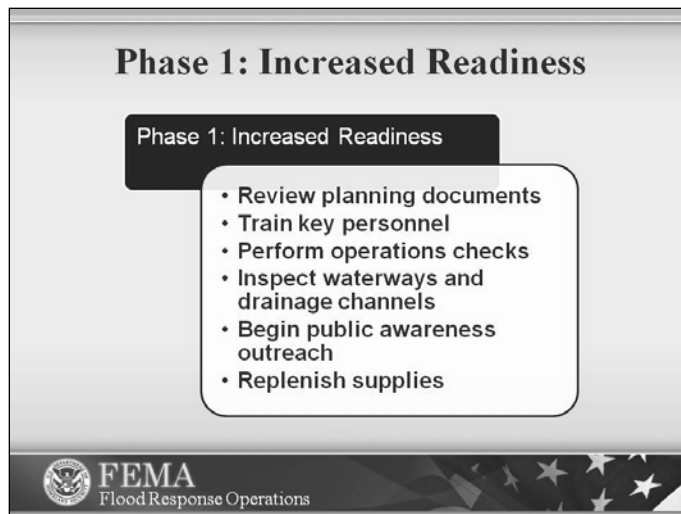
Fueling stations are of particular concern when planning for flood events. A flooded gas station could mean leakage from an underground storage tank or increased risk for fires.



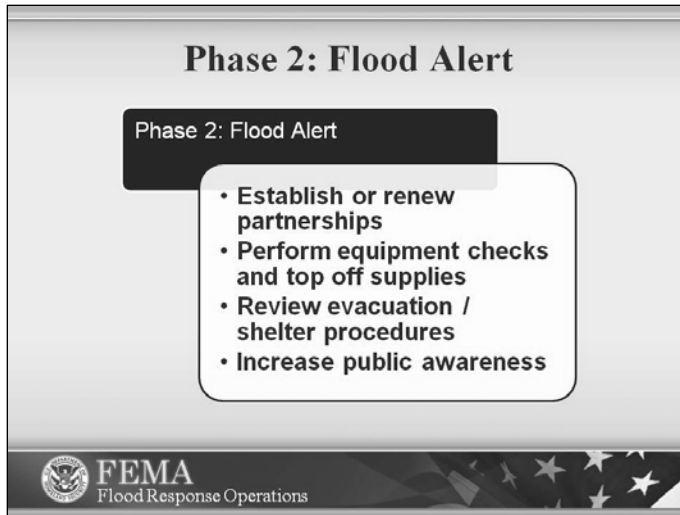
The flood response itself may be only one problem faced by communities. All emergency plans must be coordinated so that they can readily interface during multiple hazard events.



Many communities find a phased response flood plan is the most effective means of dealing with a flood threat. A phased response allows community response to evolve as the threat increases. There are many different levels of delineations, but most plans favor a four-phase process.

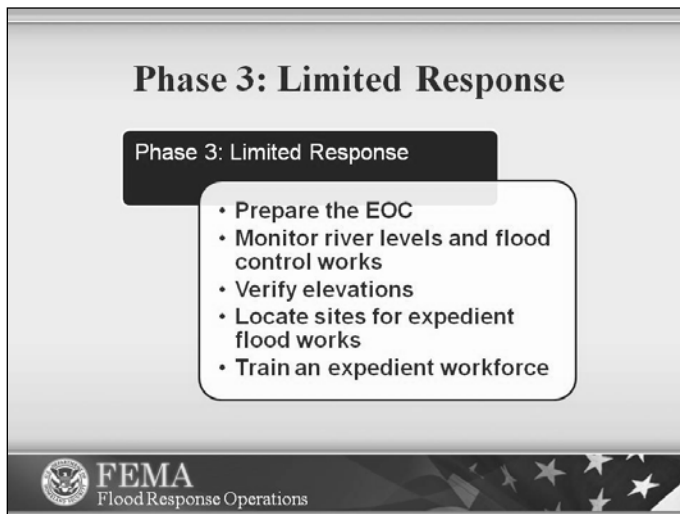


The Increased Readiness Phase is generally called when there are strong indicators of a flood threat. These indicators may include excessively deep snowpacks, the approach of seasonal flood threats, or predicted long-term changes in weather patterns.



If the flood threat continues to rise, a Flood Alert may be declared. This is a higher state of readiness, but still short of a flood response.

Common response actions include making regular contact with the local weather service office and increased monitoring and reporting of river stages, precipitation reports, and snowpack depths.




As the rivers approach the bank full stage, or when the National Weather Service issues a Flood Watch, communities initiate preliminary actions to mount a flood response and go into the Limited Response Phase. At this point, a community may already have minor flooding in low-lying areas.

Phase 3: Limited Response, continued

Phase 3: Limited Response cont'd

- Continue public information programs
- Stage heavy equipment
- Prepare congregate care centers
- Prepare volunteer recruitment sites
- Test communication lines
- Move farm equipment and animals




Any actions that can be taken now will save precious time if a full scale flood response is mounted.

Phase 4: Full Response

Phase 4: Full Response

- Evaluate:
 - Amount of time before the river crest(s)
 - Height of expected river crest(s)
 - Duration of the crest(s)



When the National Weather Service issues a Flood Warning, it triggers a Full Response. Steps taken during this response may vary and are based on a careful evaluation of the threat outlined in the flood forecast.

At this point, local officials should gather and review the threat and their response options. These response actions can include evacuating the public from the threat, conducting a limited or full flood response, or a combination.

Planning for Recovery

- Clean-up and debris removal
- Restoration of critical services
- Inspections, permits, and zoning applications
- Mental health counseling
- Medical treatment





FEMA
 Flood Response Operations


While much attention is generally paid to the creation of response plans, good flood plans also include information about what should happen after the flood. While plans cannot guarantee success, they can go a long way to easing the disaster response and recovery process.


Lesson Summary

The Planning Process



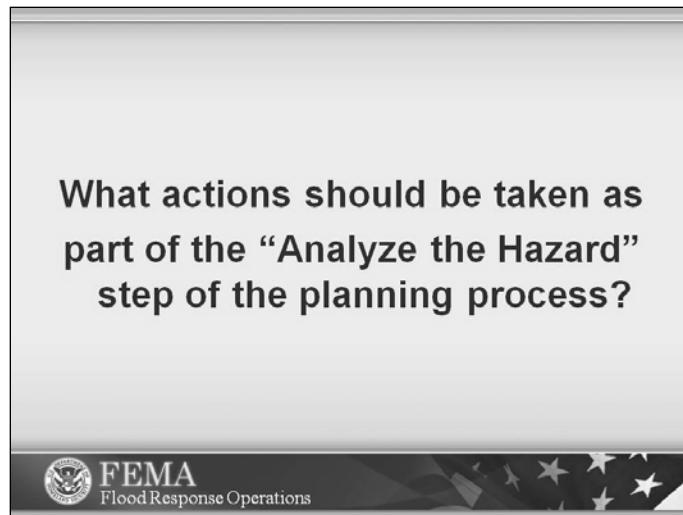
- Consider:
 - Evacuation routes
 - Borrow and work areas
 - Backflow issues
 - Vulnerable populations and properties
 - Fueling stations



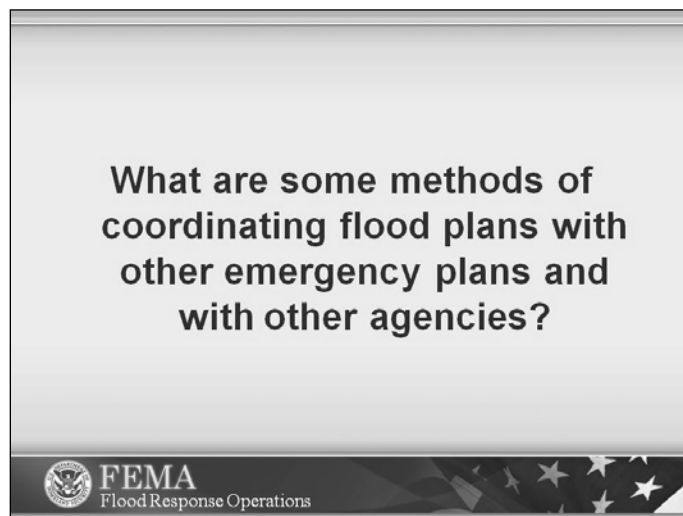

FEMA
 Flood Response Operations

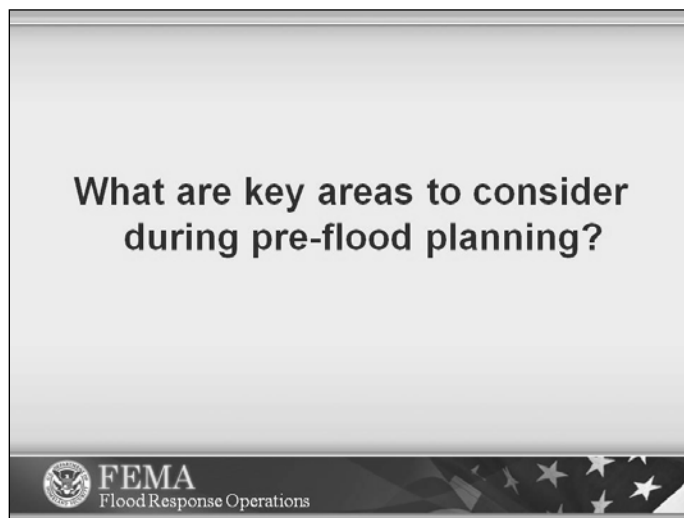
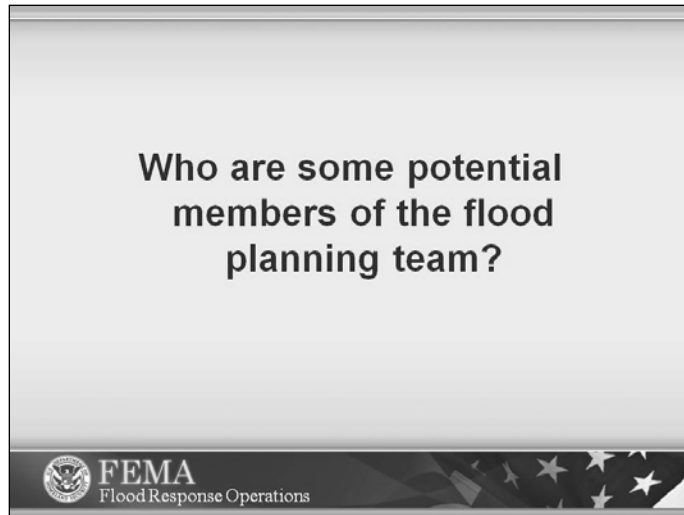
Even though the planning process creates a document, the work does not stop there. The degree of success of the plan is established only when it is tested. The plan must be a living document that is constantly reviewed and improved.

It is not unusual for a flood plan to take years of development before the plan can really be placed in a mode where updates are generally limited to minor tweaking.



You may use the questions on these slides to check your understanding of the content presented in this lesson.





What are some special concerns that should be considered when preparing for a high water event?

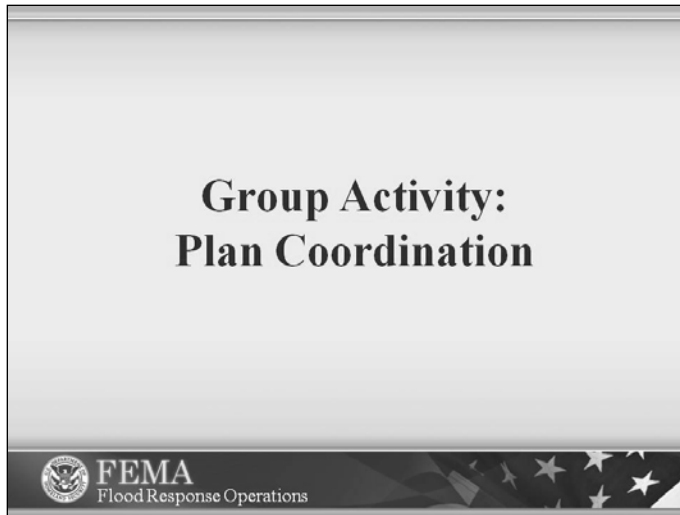


FEMA
Flood Response Operations

What are the four recommended phases in the phased response system?



FEMA
Flood Response Operations



The instructions for this activity are on the next page of this manual. Supporting materials can be found in Appendix A.

Your group will have 30 minutes to review the sample plan and discuss the questions.

Choose a spokesperson to share your group's responses to the questions with the rest of the class.

Group Activity: Plan Coordination

Review the Flood Emergency Plan for the Peabody City Wastewater Treatment Plant, found in Appendix A. As a group, discuss and answer the following questions. Select a new spokesperson to report your findings to the group.


1. What are your overall opinions on this plan?
2. List two points or concepts you like about the plan. Why?
3. List two points or concepts you dislike about the plan. Why?
4. Are there any glaring problems with the plan? If so, what are they?

Suggested Action Items

- Determine the location of your community's EOC. Is it located out of the SFHA?
- Identify bridge and river crossing structures that are subject to flood damage in your community. How many of these carry utility or pipelines? What would happen to utility or pipeline service if these crossings were shut down or damaged?
- Check with local agricultural officials to determine the replacement costs for various types of farm equipment and machinery. What types of clearances are required to move various pieces of equipment over highways? How much lead time would be required to relocate farm equipment out of the floodplain in your community?
- Check with several state agencies and obtain copies of any planning guidance they may offer. Review the material and report the advantages and disadvantages of using this guidance to the class.

**Lesson Four:
Flood Response Methods**

**OBJECTIVE: Explain the advantages
and disadvantages of expedient
flood works**




Lesson 4: Flood Response Methods

In this lesson, you will learn the advantages and disadvantages of expedient flood works.

Selecting the proper flood response technique is essential to the success of the operation. This lesson provides an overview of some of the basic flood response methods.


Supporting Objectives


- **Describe various expedient flood works**
- **Identify four methods of capping a levee**
- **Identify the basic materials required for various methods of expedient flood control**



Selection Variables

- **Current and wave conditions**
- **Duration of water exposure**
- **Soil composition**
- **Terrain**





 FEMA
Flood Response Operations

A flood response method that works in one community may not work in another. Before selecting any form of expedient flood works, it is advisable to consult with the U.S. Army Corps of Engineers on what will work best in your situation.

Categories of Expedient Flood Protection

- **Adding height to existing flood works**
- **Creating flood works in open areas**
- **Floodproofing structures**





 FEMA
Flood Response Operations

The type of expedient flood works that may be used will depend on the location where flood protection is needed.

Placing Expedient Flood Works on Existing Levees (Capping)

- **Build to 2 feet above predicted flood crest**
- **Place on the crown of the structure**





FEMA
 Flood Response Operations


Expedient flood works placed on top of levee systems and berms is called capping. Several methods of capping are available depending upon the situation.

Normally, capping is constructed on the crown of the levee to a height of two feet, plus or minus six inches, above the predicted flood crest.

Preparing a Levee for Expedient Flood Works

- **Watertight bond**
- **Establish or verify gradelines**
- **Depressions restored to natural grade**

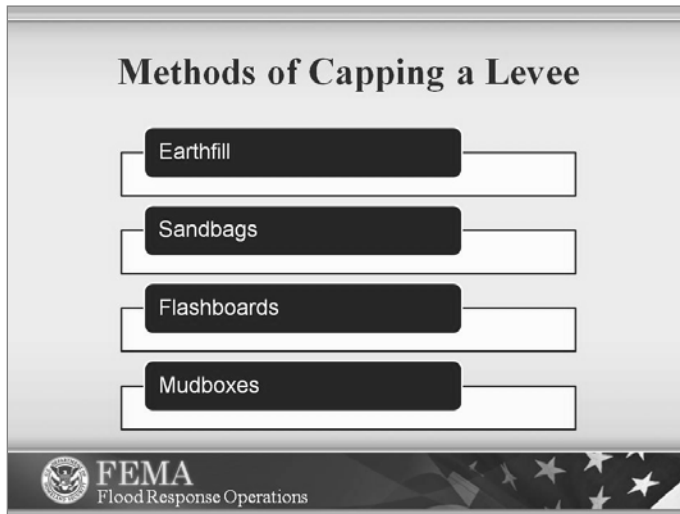



FEMA
 Flood Response Operations

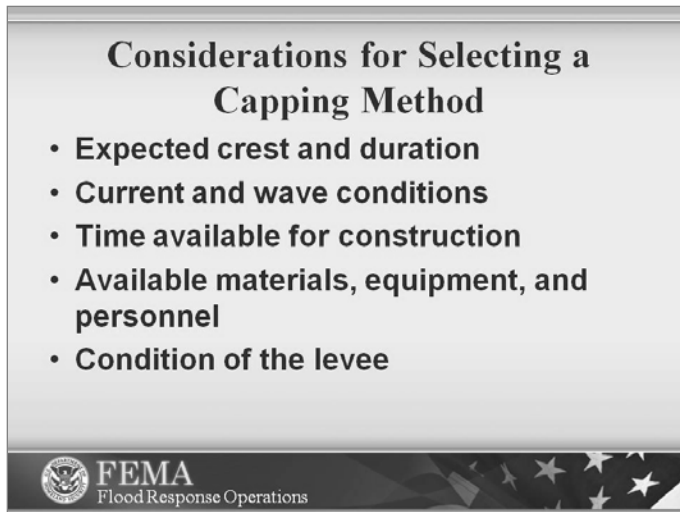
When preparing a levee for expedient flood works, the bond between the levee and the capping must be as watertight as possible.

The first step in the process is to establish or verify gradelines and elevations.

All depressions should be restored to the natural levee grade and provided with an adequate cross section.



There are four basic methods that have traditionally been used to cap a levee. Each method has its own advantages and disadvantages that must be evaluated by local responders.




No single capping method is best for all sites. The U.S. Army Corps of Engineers should be consulted on the best method to use in any given situation.

Because crest forecasts have been known to increase, it is wise to select a capping method that can be easily modified upward should the need arise.

Earthfill

- **Relatively easy and fast**
- **Susceptible to erosion**
- **Restricted to 3'**







Earthfill is a simple and relatively easy method of capping a levee that is used quite often. It is a relatively fast method of adding up to 3 feet of protection to a levee, but is susceptible to erosion problems.

It is best to use heavy equipment to construct an earthfill cap. Scrapers and trucks can work on top of the levee when it is dry and stable, but if the levee is wet and soggy, the equipment vibration may cause the levee to fail. In these circumstances, wheelbarrows and hand labor must be used, but this is extremely labor intensive.

Sandbags

- **Dependable and easily adaptable**
- **Resistant to wave actions and erosion**
- **Very labor intensive**
- **Relatively slow**




FEMA
 Flood Response Operations

Sandbag caps are relatively resistant to wave action and erosion. The process of filling and laying sandbags is very labor-intensive which makes this method relatively slow to construct.

Since sandbagging is labor intensive, detailed procedures should be developed for the evacuation of the massive workforce should the levee fail.

Sandbag Expedient Levee




FEMA
 Flood Response Operations

Sandbags must be neatly stacked, not dumped into place. The joints between rows and layers of sandbags should be lapped to improve strength and reduce water seepage.

If available, polyethylene sheeting is placed on the water side of the sandbag line to reduce seepage. When completed, a well-built sandbag line should look as neat as a brick wall.



Thousands of sandbags are needed for even minor capping. Hundreds of workers may be employed to fill sandbags while a handful of people can lay the output on the levee.

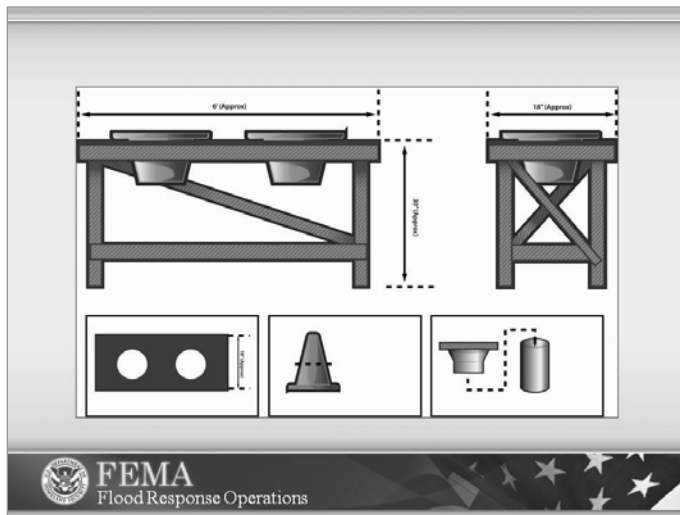


Often, shopping center parking lots are used as filling sites. These locations offer some of the basic support services needed by the workforce, such as restrooms, water, etc., and may have loading equipment, such as fork lift trucks. Whatever location is chosen, you should make sure proper facilities are available for workers and equipment.

Filling the sandbags at a remote site lessens confusion along the expedient flood works as well as the danger to the workforce.



To be effective, sandbags must be properly filled. The average sandbag is approximately 14 x 26 inches and should be filled approximately half full or to about 43 lbs. Untied sandbags are recommended for most situations. Tied sandbags should be used only when special situations require pre-filling and stockpiling.



This diagram is included in Appendix D.


To speed the process of filling sandbags, filling stations may be constructed. This can be as simple as using a ladder supported by sawhorse.

Sandbags

**Materials Required per 100' Sandbag
Expedient Flood Protection**

Height	Sandbags Required	Tons of Sand Required*	Cu. Yd. Sand Required
1 Foot	800	13	8
2 Feet	2,400	41	25
3 Feet	5,000	84	52
4 Feet	8,800	147	91
5 Feet	13,600	228	141
6 Feet	19,500	327	202


*Wet sand weight, all figures rounded



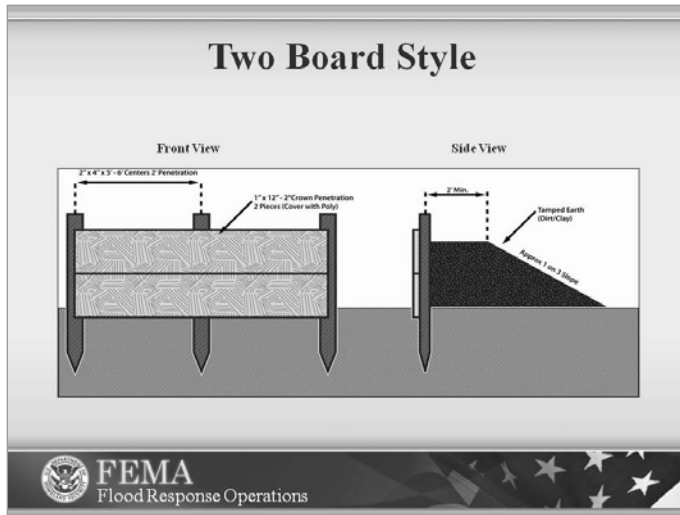
This chart illustrates the number of sandbags required per 100 feet for various heights. Note that as the height of the sandbag wall increase, the number of sandbags required increases in almost geometrical proportion. This sandbag chart reflects weights based on wet sand, rather than dry.

Flashboards

- **Used if required capping is:**
 - Greater than 1.5 feet
 - Less than 3 feet
 - Exposed to waves, currents, or erosion
- **Useful on barrow crowns, limited space**
- **Costly to construct**

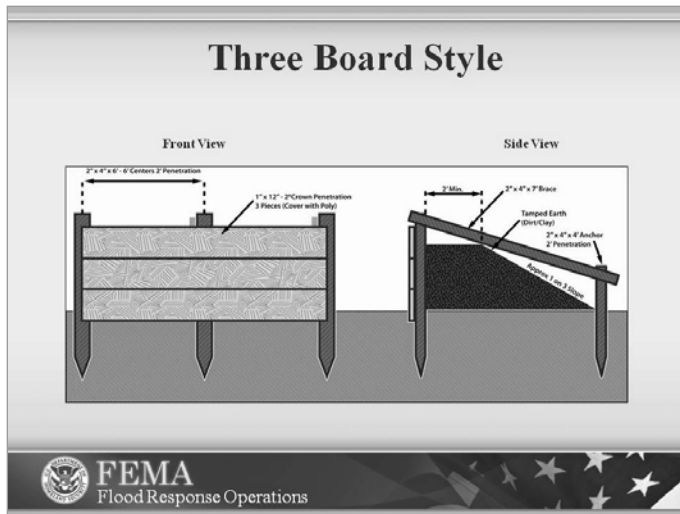


With this method, a board fence is built approximately two feet from the riverside edge of the levee crown. Earthfill is used on the landward side to reinforce the fence and provide resistance against the hydrostatic forces of the flood waters.



These diagrams are included in Appendix D.

The two-board style adds about two feet to the crown of a levee, by using two 1" x 12" boards for each section of the levee, sealed with poly and held in place with tamped earthfill, extending at least two feet horizontally behind the boards, and then meeting the crown at a 3:1 slope.




Three-board flashboards may be used to add about three feet to the height of a levee.

Due to the added water pressure that will be exerted against the flashboard, bracing is added to the top of the works.

Building Flashboards


- **Drive the stakes**
- **Do not excavate holes**
- **Tamp all backfill firmly**
- **Use poly sheeting**
- **Use marine grade materials**



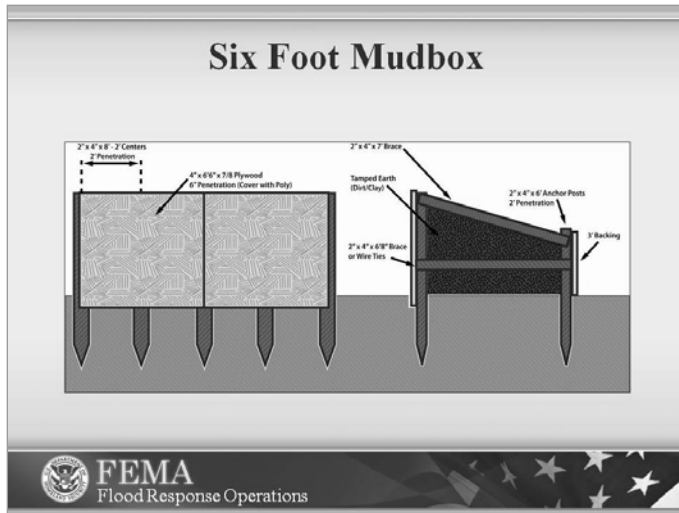
It is important to drive the stakes rather than excavate holes and backfill the posts. It is also extremely important to tamp all the backfill firmly into place. Use poly sheeting to reduce water seepage and to maintain the integrity of the flashboard structure.

Mudboxes

- **Useful on narrow crowns**
- **Can add 6 feet of height**
- **Costly to construct**
- **Very labor and time intensive**

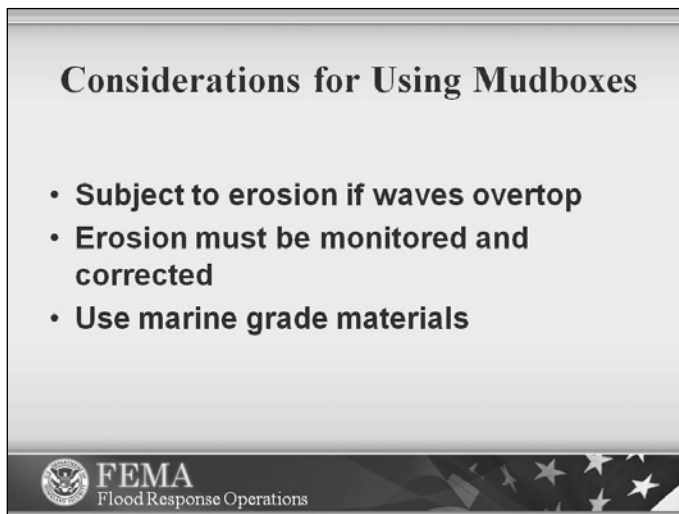


This method involves constructing a wooden box near the river edge of the levee crown and filling the box with tamped earth or clay fill. The box should never be filled with sacks or sandbags.



This diagram is included in Appendix D.

If possible, the width of the mudbox should be twice the height of the fill. As with flashboards, the stakes must be driven rather than drilled and backfilled. It is extremely important to firmly tamp the backfill into place.




Sandbags or added poly covers may be used to limit or reduce fill erosion.


During extended high water events, the mudbox may deteriorate, particularly if standard grades of plywood are used.

For extended high water conditions, serious consideration should be given to the use of marine grade materials. This will increase the cost of the project but may reduce more expensive losses in the community.

Expedient Flood Works in Open Areas

- Provides more space for floodwaters to fill
- May affect overall crest
- Keeps flood works away from current scour
- Lessens damage by floating debris






The majority of rivers do not have levees or other flood control structures. Open areas offer different challenges and advantages for the construction of expedient flood works.

General Considerations

- Access and right of way issues
- Gradelines are difficult to establish and maintain
- Seal sewer lines and drain tiles




When locating expedient flood works in open areas, it is best to keep the construction as far away from the waterway as possible.

As with any method of flood protection, it is essential to seal sewer lines, and drain tiles and other conduits that would allow water to bypass the expedient flood work and flood the area.

Open Area Expedient Flood Works Methods

- **Flashboards and mudboxes**
 - Difficult to adapt to changing grades
- **Sandbags**
 - Versatile, commonly used
 - Very labor intensive
- **Earthfill**
 - Fast and easy
 - Subject to erosion



Because flashboards and mudboxes are difficult to adapt to changing grades, they are generally not used in open areas. Sandbags are more versatile and are commonly used in open areas for expedient flood protection.

Earthfill is often used for building expedient levees but are subject to erosion problems.

Constructing an Earthfill Expedient Levee


- **Survey the area**
- **Build in one-foot increments**
- **Compact each layer**
- **Base is 4 times height (minimum)**




If available, polyethylene sheeting can be used to protect the river side of the expedient levee from erosion and reduce seepage. Another alternative to limit erosion is to cover the river side slope of the expedient levee with sand bags.

Jersey Barriers

- Readily available materials
- Restricted to 3 feet
- Must use heavy machinery
- Used only on flat surfaces






Jersey barriers offer a means of expedient protection where only three feet or less of added protection is required.

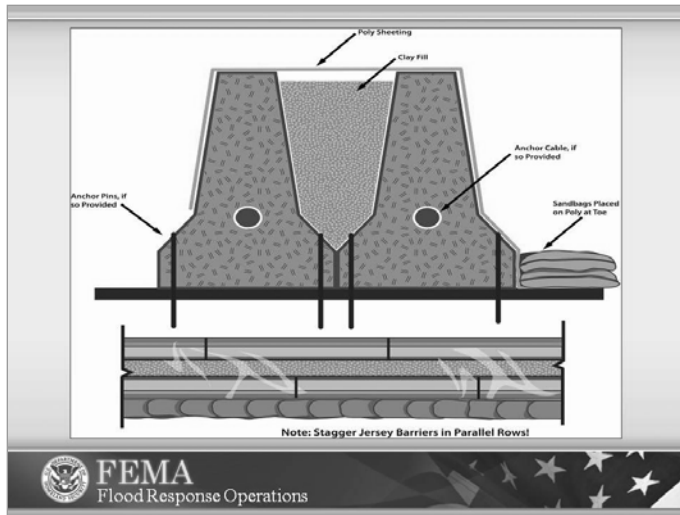
These concrete barriers may be readily available through a variety of sources in the community such as highway and street departments, or construction firms.

Constructing a Levee Using Jersey Barriers

- Survey the area
- Use two rows of barriers side-by-side
- Stagger the joints between the rows
- Use tamped earth to fill in gaps
- Use polyethylene and sandbags to reduce seepage

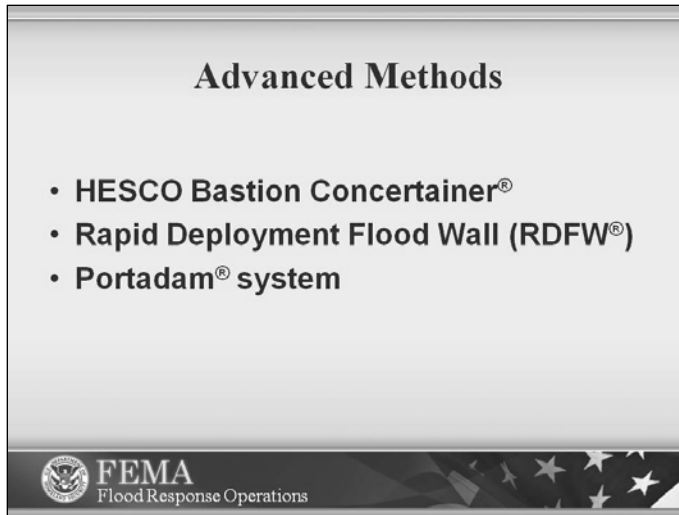


As with all expedient levees, a survey should be performed before placement to assure that the level of protection given by the barriers will be sufficient for the expected crest.



This diagram is included in Appendix D.

It is absolutely essential that the barriers be anchored to prevent movement when they are exposed to the tremendous forces of the flood waters. The barriers should be locked to each other by cables or pins and further anchored to the ground with drive spikes or pins through the anchor holes provided in the barrier.



Information about each of these products can be found at the companies' websites, included in Appendix C.

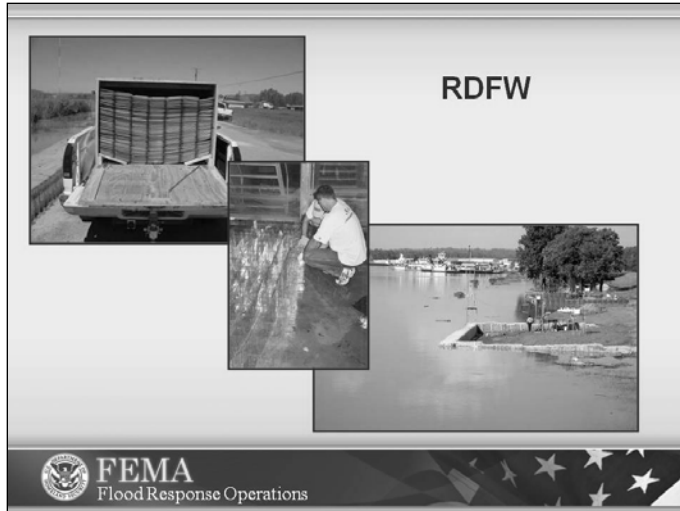
More expedient, cost-effective, interim flood-response technologies are now available.

The HESCO Bastion, RDFW, and the Portadam structures are capable of being built more quickly and with a much smaller work force than similar sandbag structures.

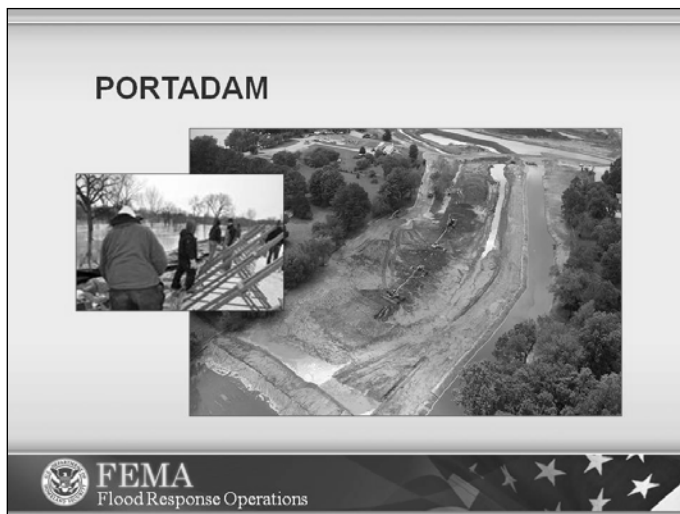


The baskets are stackable, so they are versatile and adaptable for the needs of the flood response. A HESCO system can be constructed in much less time than traditional sandbag methods.

In fact, according to the manufacturer's website, a wall the equivalent of 1500 sandbags can be built by two workers using a front loader in 20 minutes.




A container holding 100 RDFW units easily fits into the bed of a pickup and, the units are light enough to be handled by two people. An RDFW levee needs half the amount of fill that a levee using sandbags would require.



With a footprint of 15 feet in width, the Portadam is most appropriate for use in open areas. It can also be placed in open water up to 12 feet deep on uneven bed contours. The system is easy to install and can be constructed in multiple configurations.

Comparison of Advanced Methods


Comparison Item	Portadam	Hesco Bastion	Sandbags	RDFW
Construction man-hours	26.2	57.5	453.1	48.4
Fill	450 sandbags	91 cu yd	132 cu yd	85 cu yd
Removal man-hours	12.6	36.3	3.5	113.4
Total man-hours	38.8	93.8	456.6	161.8
Reusability	100 %	> 95 %	0 %	> 90 %
Materials cost	\$71,300	\$26,398	\$30,000	\$151,525




All three advanced methods were less time-consuming and labor-intensive than sandbags, and all were reusable to some extent, while sandbags are not.

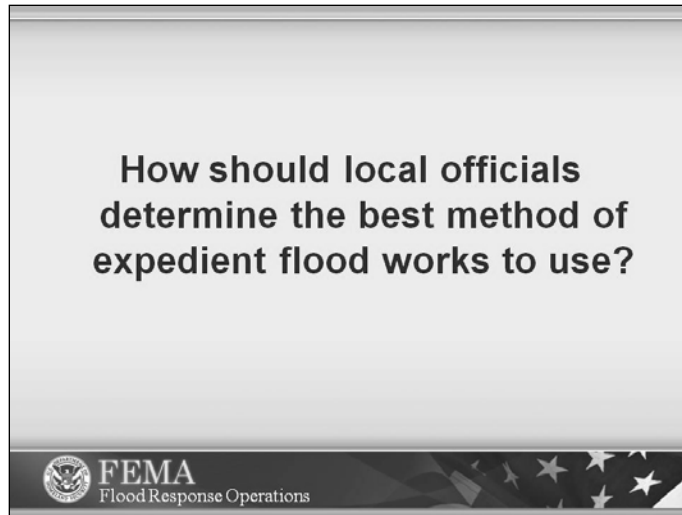
Lesson Summary

- Earthfill
- Sandbags
- Flashboards
- Mudboxes

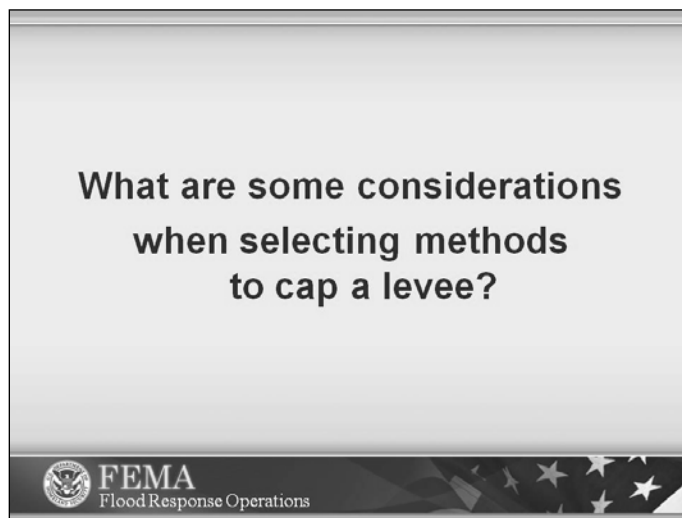


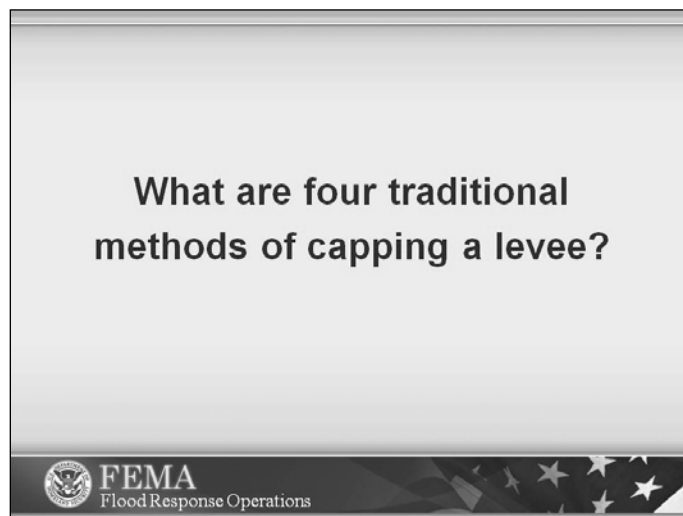
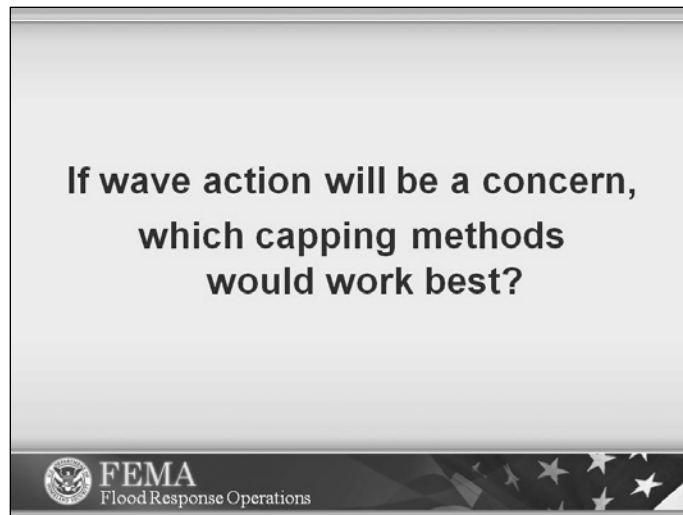


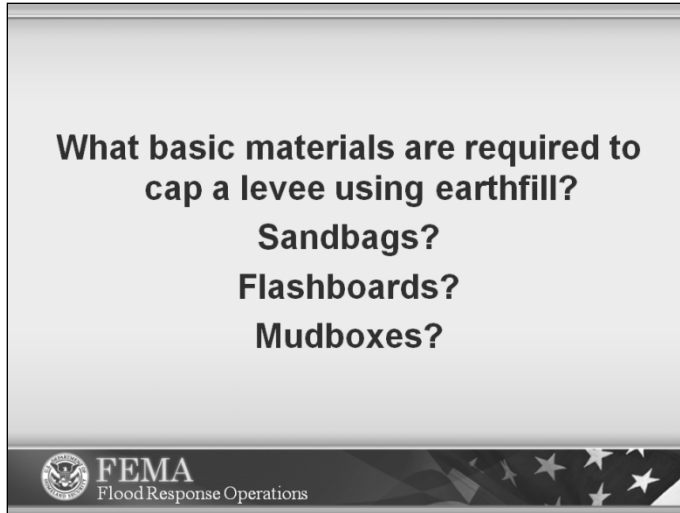
Remember, no single structure is suitable for use in all situations. The selection of the proper style of expedient flood works can be a complex issue driven by many variables.



You may use these questions to check your understanding of the content presented in this lesson.







The instructions and questions for this activity are on the next page of this manual. Supporting materials can be found in Appendix A.

In this activity, you will work with your group to plan for a flood event, using the scenario information for Peabody City.

You will have 40 minutes to address the questions on the activity sheet. Everyone in your group should be familiar with the plan and be prepared to answer questions about it.

4. List any other protective steps that may be required (e.g., evacuation, relocation, etc.)

5. List action levels for specific emergency response measures.

6. List and describe any support services that might be required.


7. How do you plan to monitor any flood works that you plan to construct?

Suggested Action Items

- Review past high water events. Which capping methods or expedient flood protection systems were used? How effective were they?
- Review your local flood emergency plan. Does it show the gradelines for protective actions? Who will set the gradelines and how long will it take to mark them?
- Research newer technologies in flood response methods such as the HESCO Bastion Concertainer®, the RDFW®, and the Portadam® system. What other methods are available? How much would it cost for your community to invest in one or more of these methods?

**Lesson Five:
Decision Making**

**OBJECTIVE: Develop a flood
emergency plan for a given scenario**



Lesson 5: Decision Making


In this lesson, you will learn how to develop a flood emergency plan.

During a flood response, decision makers need to evaluate the response options included in the flood plan and choose the best option for the conditions.

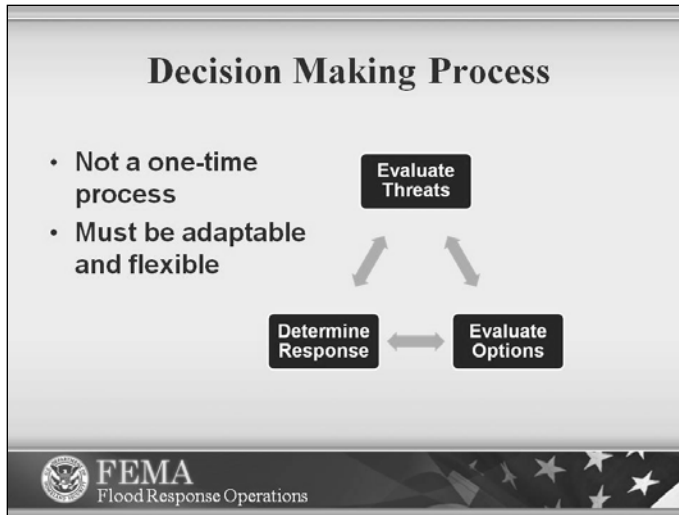
Selecting the correct response option is critical to the success of the flood response. This normally involves a formal decision-making process to evaluate all of the potential viable options.

Supporting Objectives

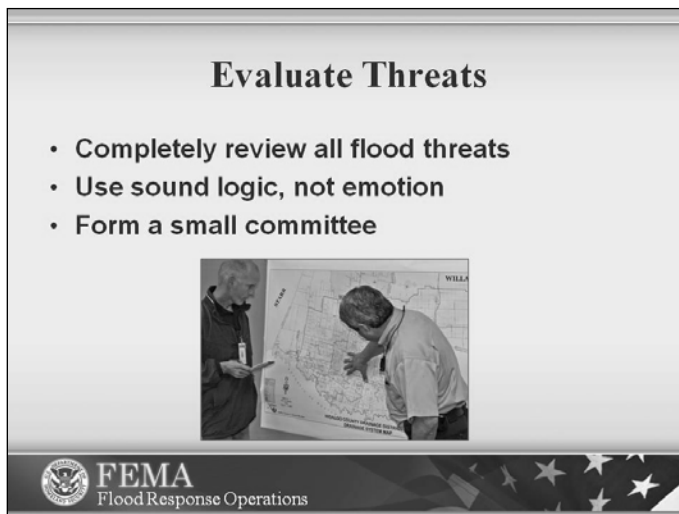
- Describe the decision-making process
- List important questions to ask during the decision-making process
- Summarize the priorities that should be set before and during the flood response
- Examine factors that can influence the decision-making process
- Identify available resources for the flood response



There are many factors that come into play when making decisions for a flood response. We'll explore them here.




The decision-making process must be adaptable and flexible enough to continually evaluate the flood threat and the available options, to ensure that the current course of action remains the most desirable course of action.




It is important to remember that threat evaluations are typically best handled by small committees rather than relying on the judgment of any one person, no matter how knowledgeable that person may be.

Evaluate Options

- Review options for each threat
- Use sound logic, not emotion
- Some situations have no effective options






Once the flood threats have been identified, the options for dealing with each threat are reviewed. This too must be handled objectively. Responders must recognize the unfortunate fact that there will be situations when there isn't an effective response option other than to let the situation play out and deal with clean-up issues after-the-fact.

Key Questions to Ask When Evaluating Response Options

- When will the river crest?
- Are multiple crests expected?
- How long will we have high water?
- How high?
- What structures could be affected?
- Could the flood forecast change?
- What other factors are present?




You must know when a river is expected to crest and at what height, as well as if there will be one or multiple flood crests. If longer duration events are anticipated, different techniques and materials may be required for the flood response.

You should also identify structures that could be affected and consider what factors may cause the forecast to change or complicate the response operations.


Determine the Response


- **Select the best response**
- **This may involve elected officials**
- **There may not be a “best” method**




Once all of the information has been considered, it is decision time to select from the options outlined in the flood response plan. Selecting response methods may involve policy decisions by the elected leadership of the community. As stated earlier, there may not be a best method in some situations, and the selection may boil down to the lesser of two evils.

Response Priorities









Protection of
Human Life

Protection of
Critical Facilities

Protection of
Property



The flood response planning document should list response priorities based on the policy decisions of the community leadership. The information outlined in the plan will help to create an orderly process for protecting the community at risk.




Protection of Human Life


- **May require evacuation**
- **Consider notification and moving times**
- **Consider special risk facilities**
- **Evaluate evacuation routes and care centers**
- **Consider flood response worker safety**

The obvious first priority in a flood situation is the protection of human life. Evacuation routes and congregate care centers must also be evaluated for adequacy. Another key factor in protecting human life is considering the safety of the flood response worker. If reasonable safety plans cannot be implemented to protect the workforce, it may be best to abandon flood response efforts rather than risk the lives of the workers on the flood response teams.

Protection of Critical Facilities

- Waste water treatment plants
- Potable water sources
- Essential government functions
- Hospitals
- Schools



 **FEMA**
Flood Response Operations

After the protection of human life, the next priority is to protect critical facilities and key resources such as waste water treatment plants, potable water sources, essential functions, hospitals, and schools.

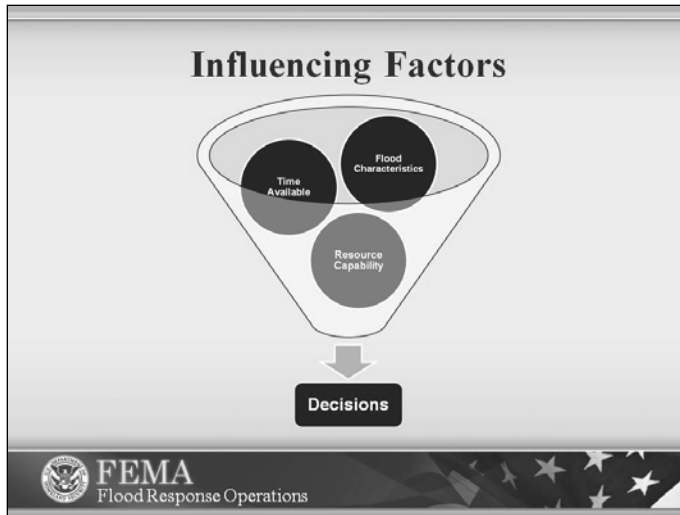
Protection of Property

- Commercial properties
- Industrial properties
- Personal property



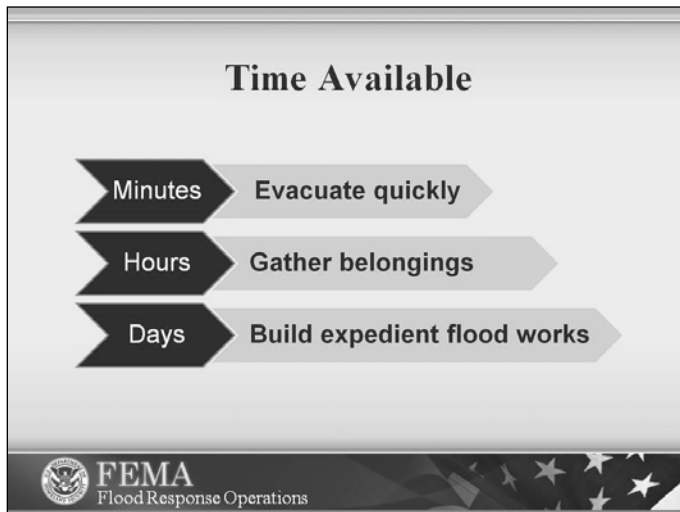
 **FEMA**
Flood Response Operations

The next priority level is to protect the economic and industrial base of the community. There are no universal sets of priorities to follow in a flood emergency other than the protection of human life.



There are many factors that may influence the decision-making process during a flood response situation, such as the flood characteristics of:

- Depth
- Velocity
- Duration
- Location



Time frames will also play a critical role in the flood response decision-making process. Most flood response decisions will propose a combination of systems using some actions as delaying efforts while more complex methods can be employed.

Resource Capabilities



- **Equipment**
- **Materials**
- **Personnel**
- **Support Systems**




Resources are generally organized into four categories:

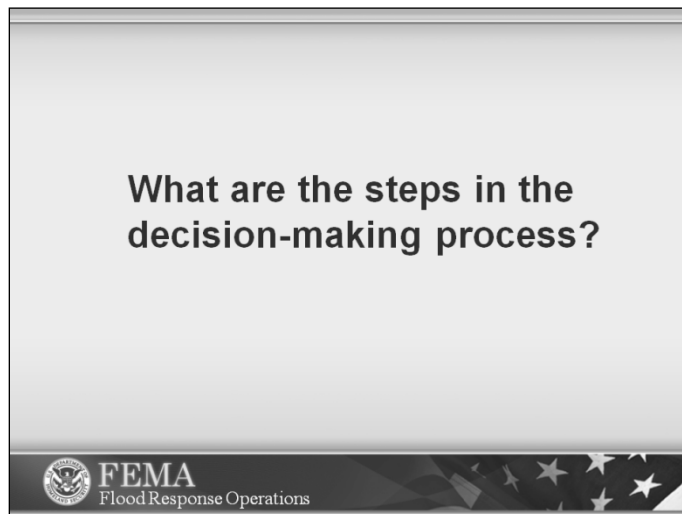
- Equipment (e.g., trucks and forklifts)
- Materials (e.g., sandbags, wood, sand)
- Personnel (ensure relief workers and rest periods)
- Support Systems (e.g., mechanics, portable toilets, feeding stations)

Lesson Summary

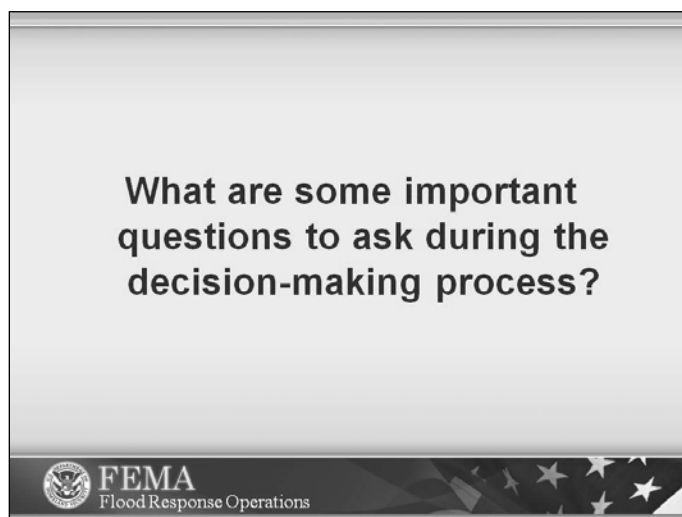



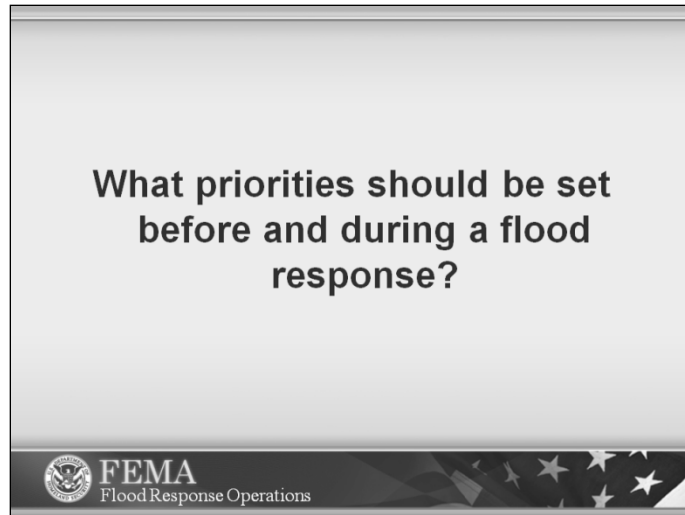
Appendix E contains a guide for the selection of expedient flood response methods.

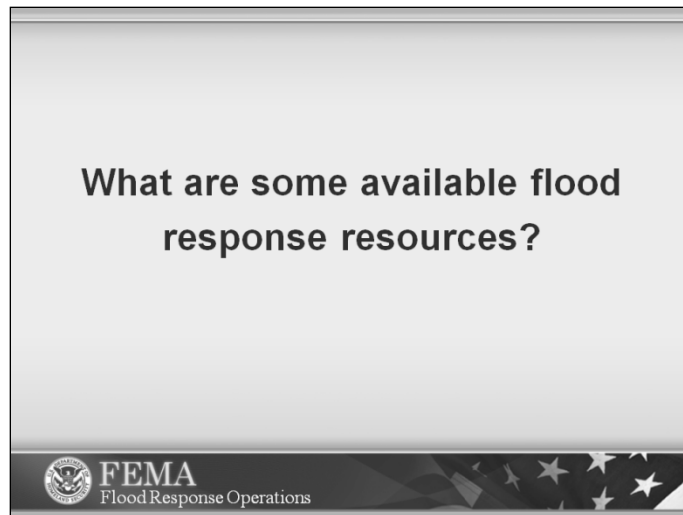
Remember, no single flood response option is best in all situations, and the goal of the decision-making process is to match the best option with the expected threat to provide the best chance of success in any given situation. It is also important to remember to include back-up plans in the flood response package.



You may use the questions to check your understanding of the content presented in this lesson.







During this activity, your group will represent several entities within Peabody City. During the first 10 minutes of the activity, use the worksheet labeled “Part One” to assess your resource information.

When you are finished (or after 10 minutes have expired), choose approximately half of the group members to be responsible for gathering information from the other groups about the resources they have available, using the worksheet labeled “Part Two.”

The remaining half of the group members will stay at the table to answer questions from other groups.

You will be allowed 15 minutes to gather information in this way.


Suggested Action Items

- Describe the decision making process in your community and list the benefits and shortfalls of using this system.

- Determine who has the final authority in your community for making emergency management decisions related to flood responses.

**Lesson Six:
Volunteer Management**

OBJECTIVE: Identify the considerations involved in managing a volunteer workforce




Lesson 6: Volunteer Management

In this lesson, you will learn about the considerations involved in managing a volunteer workforce.

Flood responses are very labor intensive. Planning ahead for addressing the workforce needs, volunteer recruitment, training, and tracking will greatly reduce or eliminate wasted efforts during the flood response and prevent time delays.

Supporting Objectives

- List existing organizations that might be able to provide volunteers for flood emergencies
- List the considerations involved in registering and tracking volunteers
- Identify the services needed to support a volunteer workforce during a flood response
- Match volunteer skills with service areas
- Identify the training needs of flood response volunteers





It is important to plan for the need for human resources during a flood response. You should maintain a list of volunteer sources. Also, you will need to know how to register and track volunteers. As mentioned before, you will need to provide services for the volunteers working for you.

Getting the most out of your volunteers occurs when you match their abilities with your needs. In cases where this match is not possible, ensure that your volunteers are properly trained to perform the duties you will assign them.

How Many Volunteers Are Needed?

- **Hundreds, maybe thousands**
- **A good workforce is a critical resource**



 **FEMA**
Flood Response Operations

The flood emergency plan should make personnel estimates for various flood response options. While such estimates are often “field modified,” they provide a good starting point for recruitment programs.

The workforce must be managed to provide 24-hour coverage, and shifts must be rotated to prevent the volunteers from burning out too early in the flood response.

Recruiting Volunteers

- **Develop guidelines**
- **Research State regulations**
- **Establish recruitment centers**
- **Advertise the opportunities**

 **FEMA**
Flood Response Operations

Recruitment centers should be established where independent volunteer workers can be registered, trained, and directed to job sites. These recruitment centers should be well-advertised to reduce the number of volunteers that “show up.”

Where Can Volunteers Be Found?

- **Individuals**
- **Civic Organizations**
- **Faith-based groups**
- **Schools**
- **Prisons**
- **Emergency Services**





The following are some suggested groups that may provide organized pools of volunteers:

➤ **Civic Organizations**

Many civic and fraternal organizations have well-defined organizational structures that make it easier to train and direct a workforce.

➤ **Faith-based Groups**

Community churches, synagogues, and other faith-based groups are often the first to volunteer to help others in an emergency.

➤ **Schools**

Students are accustomed to working in organized groups and have a general willingness to accept and follow directions.

➤ **Prisons**



Trustees, work release program participants, and the general inmate population have proven to be an effective flood response force.

➤ **Emergency Services**

Police and Fire Departments are another possible source for volunteers.

How Can Volunteers Be Registered and Tracked?


- Legal requirements
- Designated clothing/tags
- Staging areas and buses
- Processing centers
- Team leaders


Planners should research the legal requirements of the registration process to provide the best possible legal and benefit protection to both the community and workforce. Once registered, workers should be organized for training and assignment.

During a flood response, every worker should be accounted for by their assigned team leader. This control is necessary to prevent searches in the middle of a flood response for “missing persons.”


What Can Volunteers Do?



Flood Response Operations



Support Services



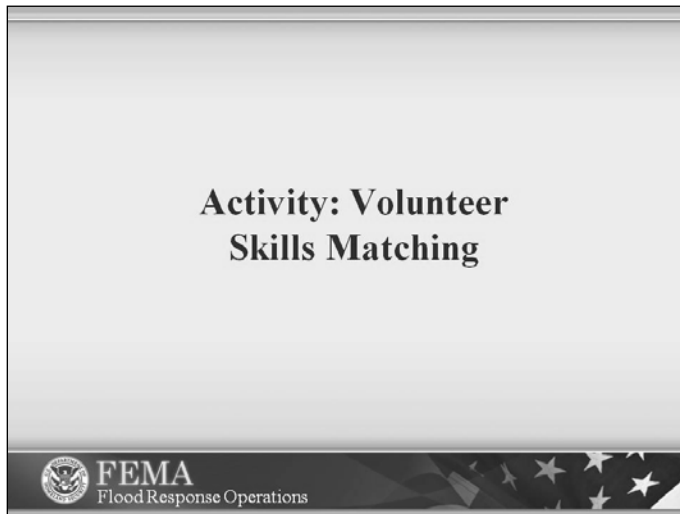
In a flood emergency, there are many tasks other than filling sandbags that can be performed. Workforce administrators must be willing to be creative when establishing work assignments.



While some people may not be able to man the floodline, they can support other operations such as feeding, transportation, and child care. There is room for every volunteer in a flood response.

Other key services to provide include portable toilets (1 unit per 100 workers), hand washing stations, bottled water, and a place for workers to relax and take occasional breaks.

Unless the needs of the volunteer workforce are met, the workers will quickly disappear.



You'll need the National VOAD Members Resource Directory located in Appendix A for this activity.

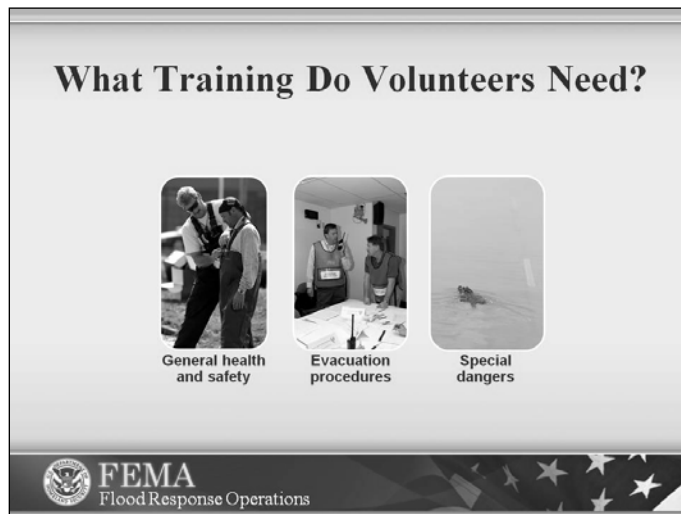
You will find an activity worksheet on the next page with directions for completing the worksheet. You will be allowed 10 minutes to complete the activity.

Individual Activity: Volunteer Skills Matching

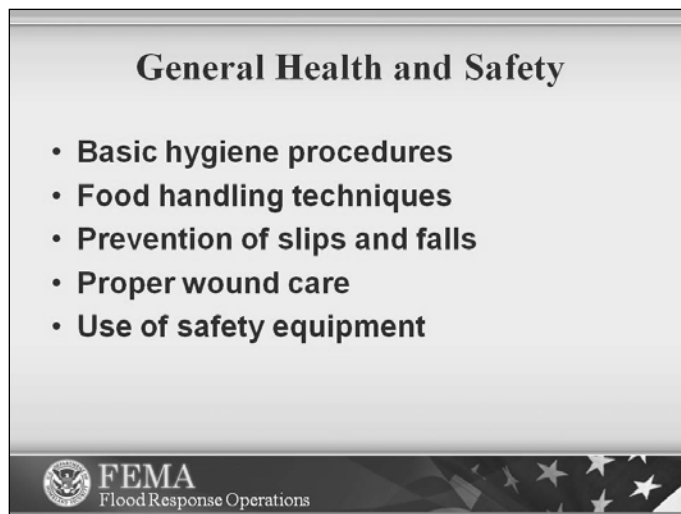
Imagine that volunteers from the groups listed in the table below have offered to help during a flood response effort. What work should they do?

Using the descriptions in the National VOAD Members Resource Directory, located in Appendix A, match each group with one or more appropriate job function(s).

	American Radio Relay League	Brethren Disaster Ministries	Catholic Charities, USA	Churches of Scientology Disaster Response	Foundation of Hope – ACTS World Relief	National Emergency Response Team	Noah’s Wish	Southern Baptist Disaster Relief / NAMB
Fill sandbags / Build expedient flood works								
Manage volunteers, staging areas, and/or donations								
Provide / distribute food and water								
Operate / manage shelters								
Provide child care for workers and/or evacuees								
Provide counseling								
Provide backup communication services								
Perform animal rescue								



Most training will involve informal briefings given by the team leader. On-the-job training is an important element, and supervisory staff should take corrective action before problems evolve into more significant issues.




Because safety and health issues are so important, a section on safety issues should be included as part of the workers' initial briefing.

It is very important to ensure that volunteers understand what safety equipment they need during a flood response and how to use it.

Evacuation Procedures

- Alarm signals
- Escape routes
- Groups of three
- Communications equipment





Volunteers should be given information on emergency evacuation procedures and signals.

Workers on flood patrols should always travel in groups of at least three. Flood patrols should be provided with mobile phones or two-way radios and every member of the group should understand how to operate the equipment.

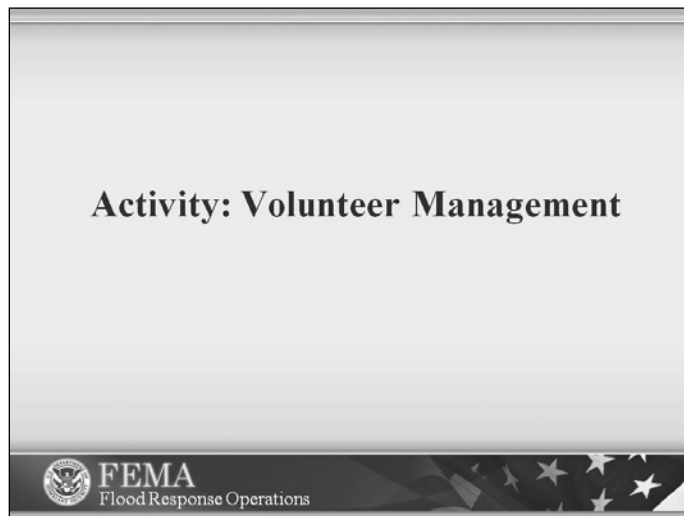
Special Dangers

- Manhole covers
- Unstable areas



It is extremely dangerous to walk in flooded areas. Flood waters can lift manhole covers and expose unseen water filled shafts. Workers should be advised to avoid areas subject to collapse, such as areas next to inundated foundation walls.

Workers should also be advised to look out for snakes, distressed animals, nails/other sharp objects, and debris impacts.




You will be given 5 minutes to answer the questions on the worksheet on the next page of this manual.

Individual Activity: Volunteer Management

1. What organizations or groups exist in your community that might be able to provide volunteers for flood emergencies?
2. What recruiting techniques could you use to obtain volunteers in your area?
3. How could you register volunteers in your community?
4. How could you train volunteers in your community?
5. What processes will you use to match volunteer skills with service areas?
6. Where could you obtain the services that you will need to support your volunteer workforce during a flood response?

Lesson Summary



The volunteer force can make or break the flood response

Provide training for volunteers

FEMA
Flood Response Operations

Do you have anything new to add to your Action Item List?

The volunteer force can make or break a flood response, and planning for this valuable resource is an essential element of the community response system.


The safety of the workers during a flood response operation is critical. The continued monitoring and reinforcement of safety rules are the responsibility of every volunteer.

What existing organizations might be able to provide volunteers?


FEMA
Flood Response Operations

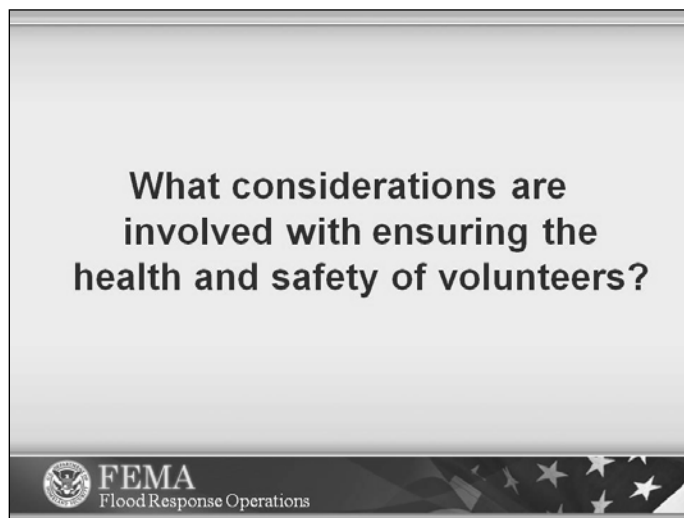
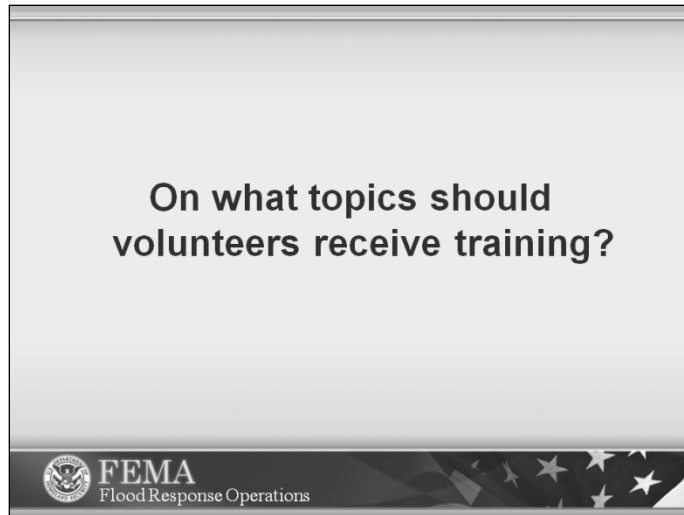
You may use these questions to check your understanding of the content presented in this lesson.

**What considerations
are involved with
registering and tracking
volunteers?**



**What services are needed to
support a volunteer workforce?**






Suggested Action Items

- Review the procedures used in your community to recruit and track volunteers. When was the last time that these procedures were tested or used? Did they work?
- Review the volunteer training procedures used in your community. Do you feel these are adequate to deal with a flood emergency?
- Find out what organizations in your community are affiliated with a National, State, or Local VOAD member. What assistance do they provide during a disaster?

**Lesson Seven:
Flood Works Monitoring**

**OBJECTIVE: Identify the processes,
equipment, and considerations for
monitoring flood works**



Lesson 7: Flood Works Monitoring


An effective monitoring program is essential for safety during flood responses. In this lesson, you will learn about the processes, equipment, and considerations for monitoring flood works.

Levees and expedient flood works should be constantly monitored during periods of high water. The discovery of problems early on may provide time for the repair or reinforcement of failing devices and systems.

If severe damage is discovered, emergency evacuation warnings can be given so that the remaining residents and flood workers can flee to higher ground ahead of the raging floodwaters.


Supporting Objectives

- **List types of threats to a levee system**
- **Explain the difference between a clean and a dirty sand boil**
- **Explain how flood works can be monitored during high water conditions**
- **Describe the safety procedures to be followed by monitoring teams**





Maintenance and Inspection

- **Reduces risks to levee systems**
- **Ensures easier visual inspections**
- **Enables early identification of problems**
- **Facilitates corrections and repairs during normal low water periods**

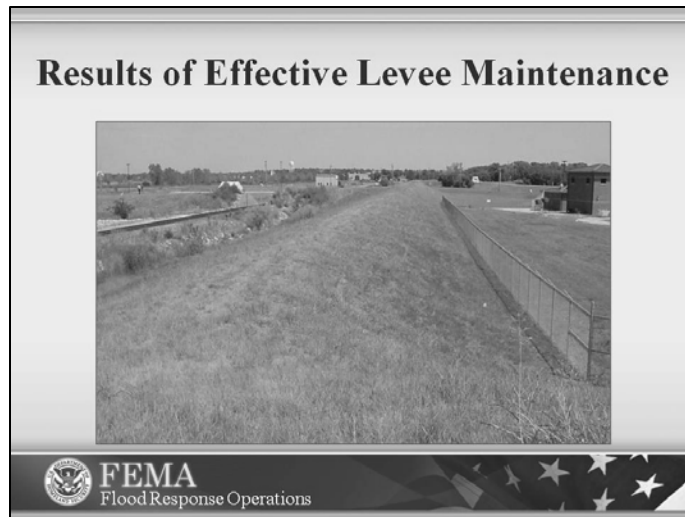


Adhering to a scheduled levee maintenance program is crucial to allowing proper levee inspection at all times.

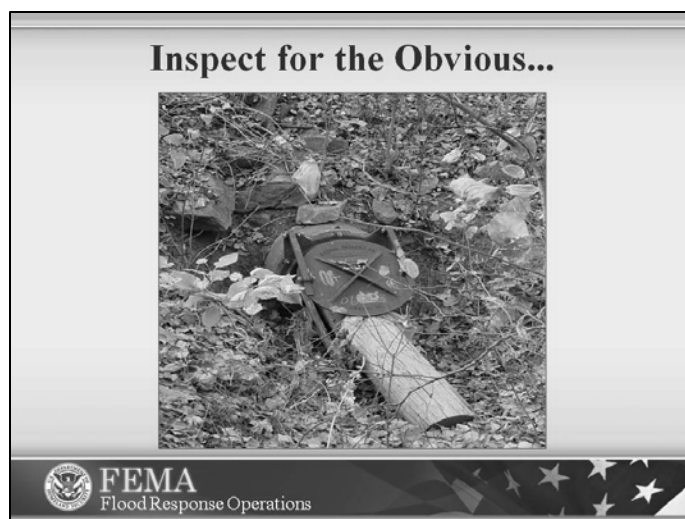
Importance of Levee Maintenance



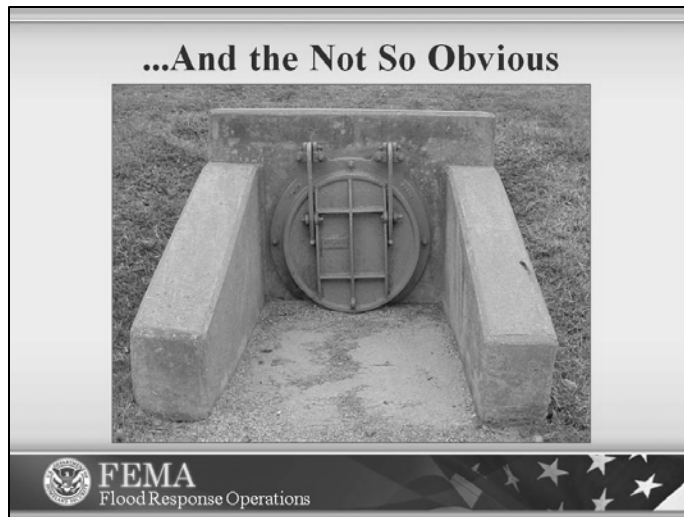
It is virtually impossible to effectively monitor the pictured levee due to the unmowed grass cover.



A levee in this condition makes it very easy to monitor signs of levee problems during normal low water times, as well as during high water or flood events, especially compared to the previous slide.



Following an effective maintenance and inspection program during normal low water times can identify obvious problems, which can be corrected easily.



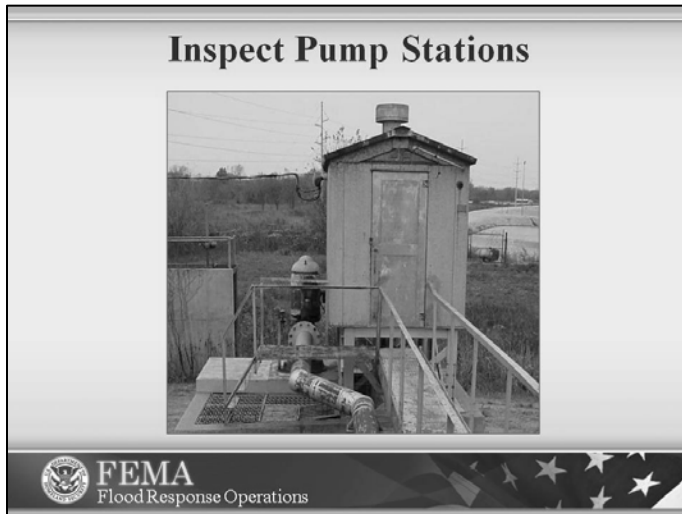
Look closely when following your inspection program – things may appear to be normal from a distance.



While this flap gate may look fine from farther away, a closer inspection reveals a problem. This gap between the concrete headwall and flap gate frame is now obvious. Failure to correct this problem during normal low water periods will lead to problems you will have to contend with during high water or a flood event, when this structure becomes covered with water and is inaccessible.



The photograph shows the outfall structure of a levee toe drain system. Following a normal annual maintenance and inspection program will help you document and monitor all of the components of your levee systems.



Pump stations are typically critical components of a levee system. Scheduled inspection and testing, at least annually, of all components ensures they will operate when needed.



There are many threats to a levee system that team members should be aware of and report back to the command post.

When in doubt, team members should be instructed to report any levee system issues. Timely reports may help to save the flood works from catastrophic failure.



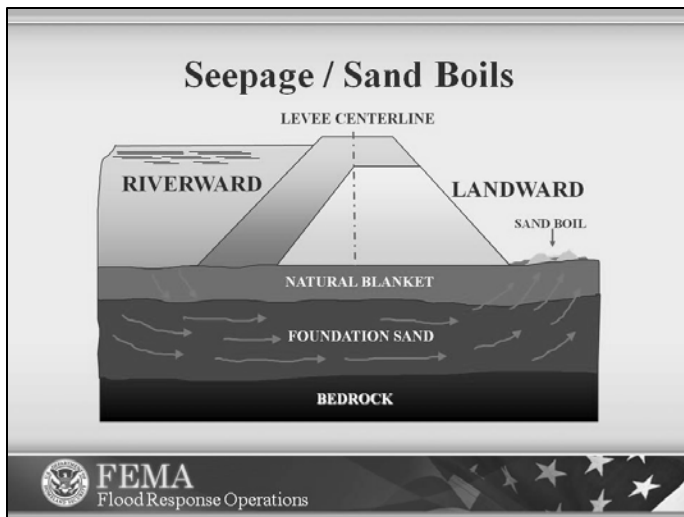
With your group, list as many threats to a levee system as you can in 3 minutes.

Levee System Threats

<ul style="list-style-type: none"> • Seepage <ul style="list-style-type: none"> • Sand Boils • Slumps, Slides, and Sloughs • Erosion • Animal Burrows • Wave Action <ul style="list-style-type: none"> • Wave Wash • Overtopping 	<ul style="list-style-type: none"> • Dam and Spillway Water Movement • Backflow • Debris • Sabotage/Terrorism • Saturation
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------




Listed are some of the most likely types of threats you may have to monitor and contend with on your levee system during high water or flood events.



Groundwater seepage is a normal part of the soil and groundwater dynamics beneath a levee. However, the increased head on the groundwater caused by higher river elevations can increase the seepage velocities of the groundwater beneath the levee.

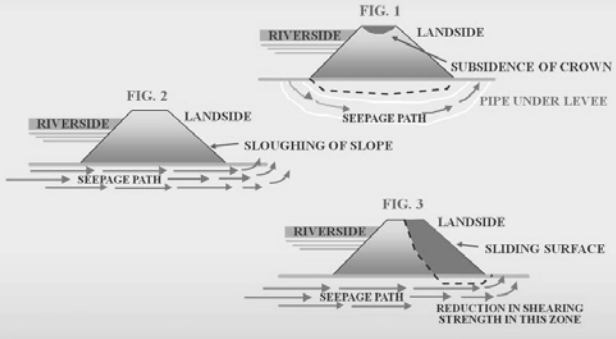
Sand Boils


- Common problem along levees and flood works
- May range from a few inches to several feet across
- May be a single sand boil or a group (boil field)
- Must be monitored
- Can cause flood control structure to fail



Sand boils are the result of water under pressure finding a path under the flood works, usually through a sand lens, and resurfacing behind the protective device.

Effects of Sand Boils on Levees







- A concentrated area subsidence of the levee crown, lowering the top of the levee and possibly allowing water to flow through the lowered crown section, leading to severe erosion
- Sloughing of the landside toe of the slope, degrading levee structural integrity
- The development of a shear slide (slope failure) on the landside or the river side of the levee, severely impacting the overall structural integrity of the levee

The slide illustrates three potential effects of sand boils on the structural integrity of the levee, as explained on the right.

Clean Sand Boils

- No sand, dirt, or debris in water flow
- Should be reported and monitored
- Do not pose a threat





 FEMA
Flood Response Operations

A clean sand boil is noted by the lack of sand, dirt, and debris in the water flow. Clean sand boils should be reported and monitored.

Dirty Sand Boils

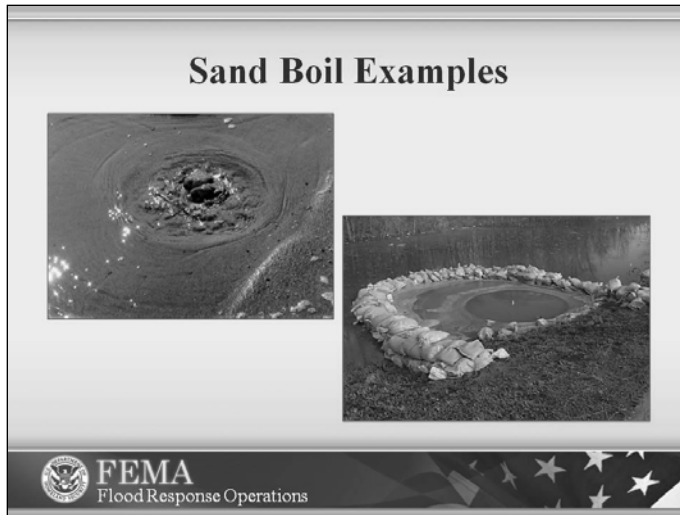
- Sand, dirt, and debris in water flow
- Can cause rapid levee failure
- Report immediately
- Surround by sandbags



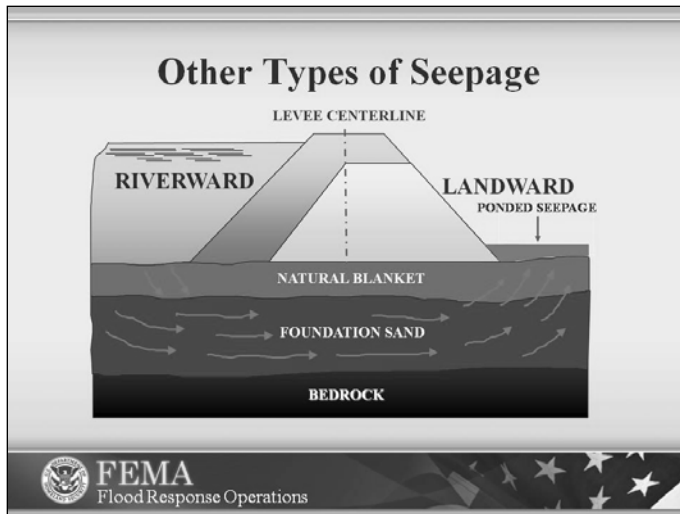
 FEMA
Flood Response Operations

A dirty sand boil is noted by the flow of sand, dirt, and debris in the water flow. This is an indication that the water flow is tunneling out an area below the flood works.

When dirty sand boils are discovered, they should be reported immediately. Dirty sand boils should be surrounded with sandbags to slow, but not stop the water flow.



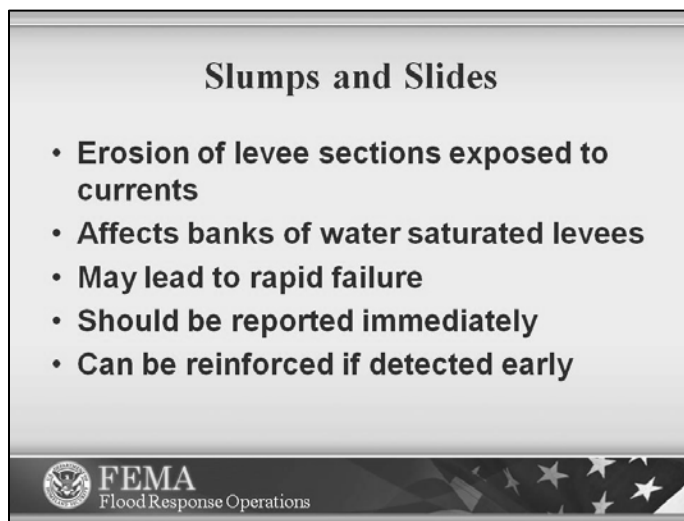
Note the soil materials being carried by the sand boil in the upper left photograph. This sand boil must be controlled by establishing a sandbag ring around it. Note in the lower right photograph, the water is still flowing, but now it is running clear and no longer carrying soil materials with it.



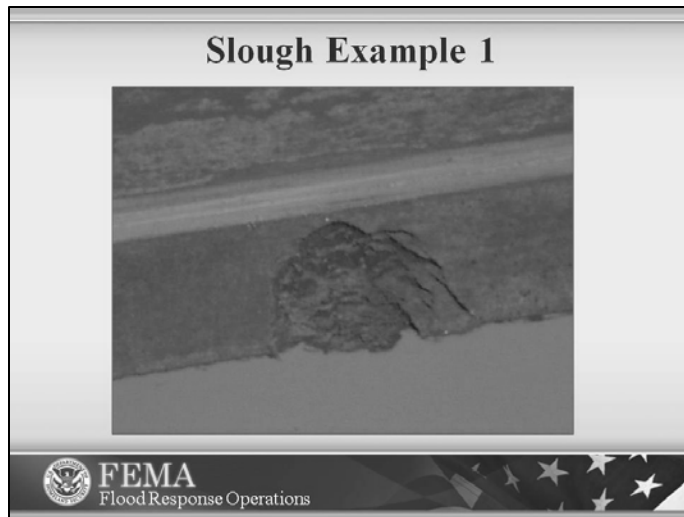
At times, groundwater rises to the surface on the landward side of the levee across a wider area, unlike in the concentrated locations shown in the sand boil examples. Despite the area being broader, problems can still develop, and this situation must be monitored.



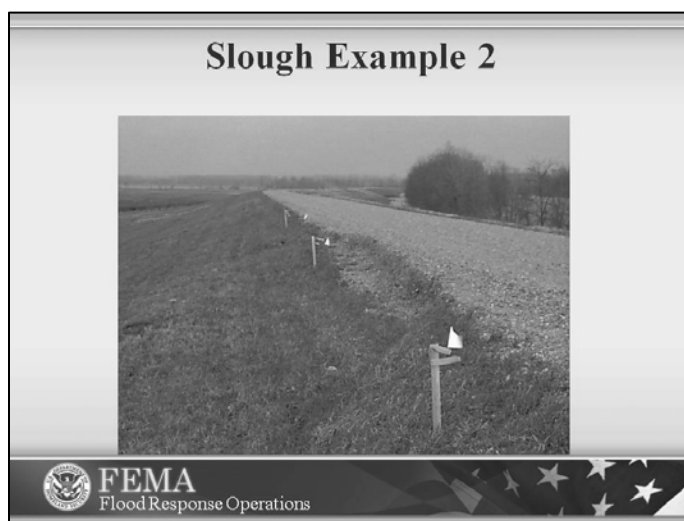
Sloughing was identified earlier as a possible effect of sand boils. One of the most likely impacts of seepage is a slough developing across a large segment of the landward side of the levee.



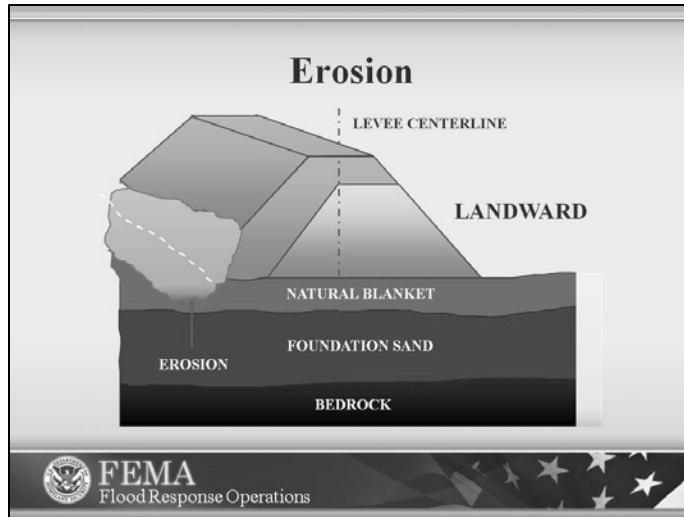
The banks of a water saturated levee may slide or slump and lead to the rapid failure of the structure. Slides, slumps, and cave-ins should be reported immediately after they are discovered.



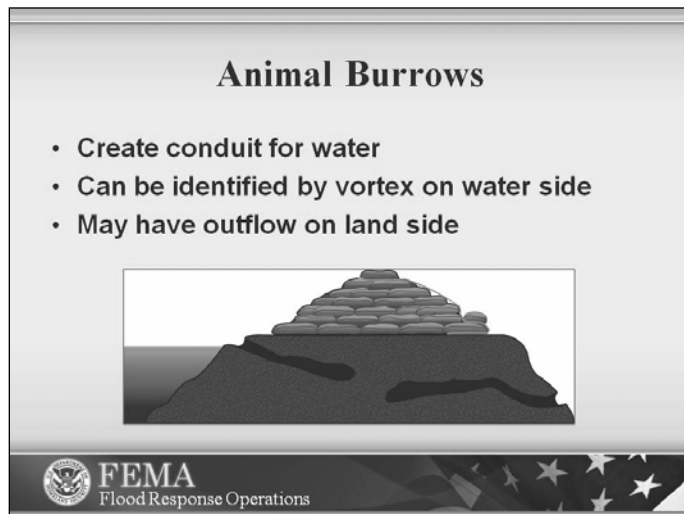
Note that a slough can develop on the riverside of the levee as well as on the landside.



This slough has developed on the landward side of the levee. While not as dramatic looking as the previous slide, this area must be monitored as the flood event occurs because the levee's overall structural integrity has been compromised in this area.




Erosion typically occurs along the base of the levee and is caused by increased river flow velocities. This particular type of damage is hard to detect. A developing riverside levee slough may be an indication this type of damage is occurring.



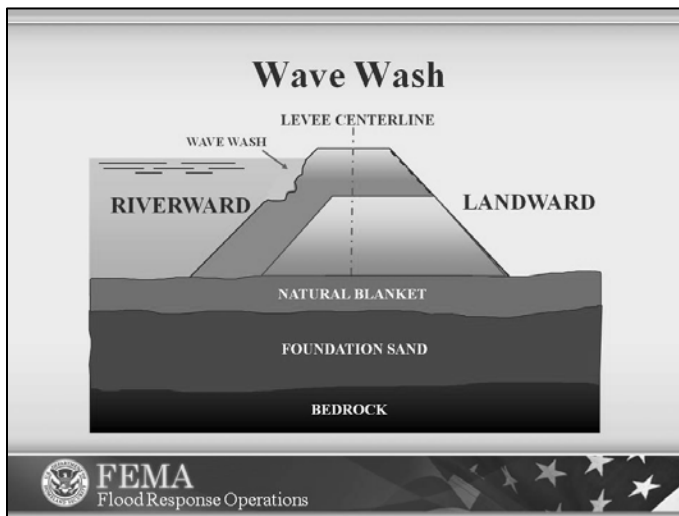
Weighted sheets of plastic and other materials may be dropped on the water side of the levee to seal the opening of an animal burrow and reduce the water flow. Another method uses a mixture of animal manure and straw, which is cast out into the waterway. As the mixture is drawn into the burrow, it effectively plugs the water flow.

Wave Action

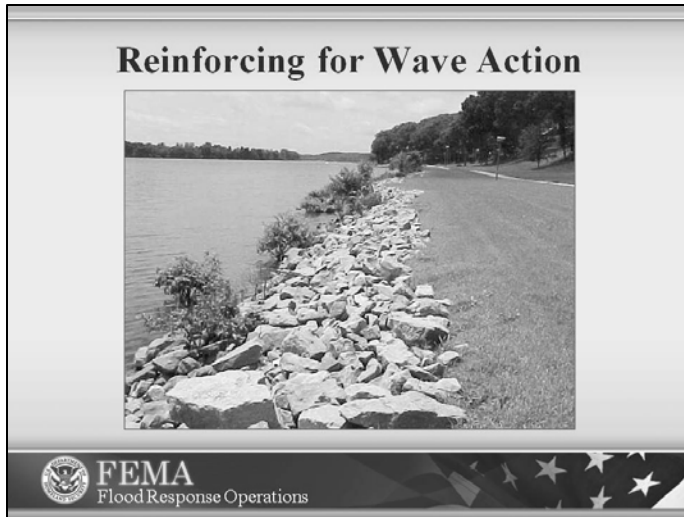
- Occurs along larger waterways
- Waves overtop structures, erode soil and fill
- Erosion leads to structure failure
- Levee can be “armored” to reduce scour



Wave action can take a severe toll on flood control structures in surprisingly little time. Actions may be necessary to provide additional protection to levee systems exposed to wave assault. The levee may also be “armored” with sheets of plastic and sandbags or riprap to reduce wave impacts on the levee face. Bioengineered options are also available to provide environmentally friendly solutions.

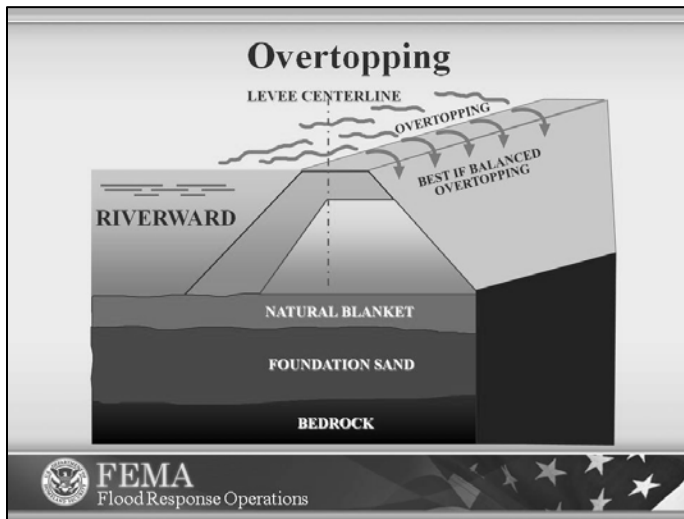


Wave wash is typically caused by wave action that erodes the riverside of the levee near the waters' surface. It will reduce the overall cross section of the levee and impact the structural integrity of the levee as a result.

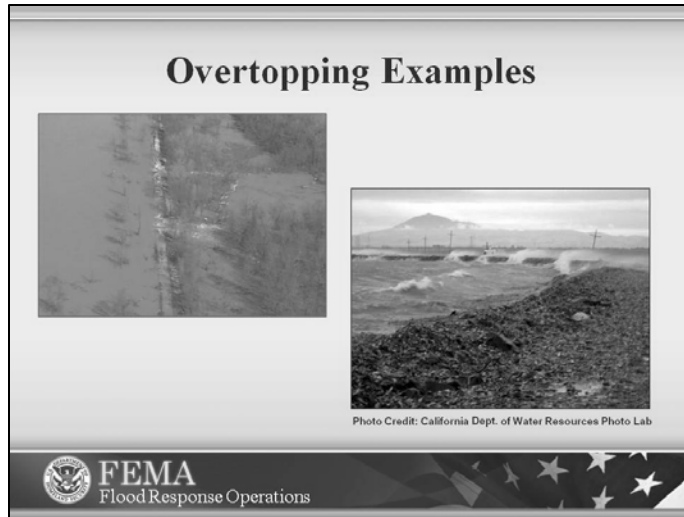


Actions may be necessary to provide additional protection to levee systems exposed to wave assault. The levee may also be “armored” with sheets of plastic and sandbags or riprap to reduce wave impacts on the levee face. Bioengineered options are also available to provide environmentally friendly solutions.

The photo shows riprap being used along a riverbank.

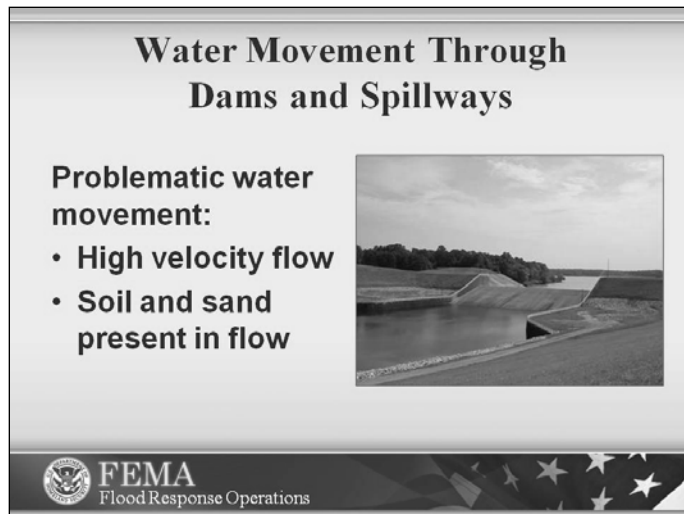


Here is a graphical representation of overtopping.



Concentrated areas of overtopping typically lead to erosion at concentrated areas, which can then lead to a levee breach. If the overtopping occurs over a broader and wider area, the levee erosion and breaching may not occur.


Monitoring the overtopping situation is critical.




Although spillways are designed to release water to protect the dam, high velocity flows can cause erosion of unprotected slopes. Water movement through dams, particularly if soil and sand are detected in the flow, must be reported to higher authorities at once because rapid failure of the structure could occur.

Backflow Issues

- Sewers
- Manholes
- Utility conduits
- Drain tiles
- Manually operated valves







The monitoring team should be alert to problems associated with backflows. These include sewers, manholes, utility conduits, or drain tiles which are not blocked may provide easy paths for water to bypass flood works.

Many levees have manually operated valves, which may cause problems due to the potential for human error.

Backflow Example







Here is an example of the effects of backflow. Water from the river flowed back through a storm drain outfall, which did not have any means to prevent the back flow. It caused a sinkhole to develop along that drain line, which was well inside the landward side of the levee.

Debris

- Can damage flood works and harm personnel
- Structures on river bends and near bridges are most susceptible







Monitoring teams should be on the lookout for damage caused by floating debris that can act as battering rams and punch holes through flood works.

Use extreme caution when investigating debris as the turbulent waters may cause the material to lurch or shift suddenly and without warning.

Debris Example






One impact of the debris accumulation is that the concentration of overtopping may lead to erosion, and a potential breach. Debris accumulating along a levee can also compound the impacts of wave action or erosion.

Sabotage / Terrorism


- **Authorized personnel only near flood works or levees**
- **Report suspicious persons immediately**

The logo for FEMA Flood Response Operations, featuring the FEMA seal on the left and the text 'FEMA Flood Response Operations' on the right, set against a background of stars.

Sabotage of levee systems and other flood works occasionally occurs. Only authorized personnel may be allowed near flood works or levee systems. Suspicious persons should be reported to authorities at once.


Saturation

- **Can be extremely dangerous**
- **Likely to fail when at the “pudding” stage**
- **Report saturated levees immediately**
- **Remove monitoring teams from water, nearby land**




Saturated levees can be extremely dangerous and should be reported immediately. Teams monitoring flood works by foot or boat should be pulled from the patrol of unstable levees and flood works.


Methods of Monitoring Flood Works




Foot Patrols



Boat Patrols




Air Patrols



Levees may be monitored by foot, boat, or air. In addition to these methods, communities may use remote video cameras to monitor levees.

Safety Considerations

- **Organization and training**
 - Careful selection
 - Proper training
 - 3-person teams
- **Equipment**
 - Safety
 - Communication






Monitoring teams should be carefully selected and trained so every team member has a thorough understanding of what to look for and how to respond to threatening conditions. Remember, flood patrols should consist of three-person teams, so if someone becomes injured, one person can provide first aid while another calls or goes for help.


The monitoring team must be given the appropriate safety equipment, which, at a minimum, should include good quality life vests and waterproof flashlights. Chemical light sticks may also be given to team members as an added safety device.

Lesson Summary

- **Monitor levees closely**
- **Be sure patrol teams are trained**

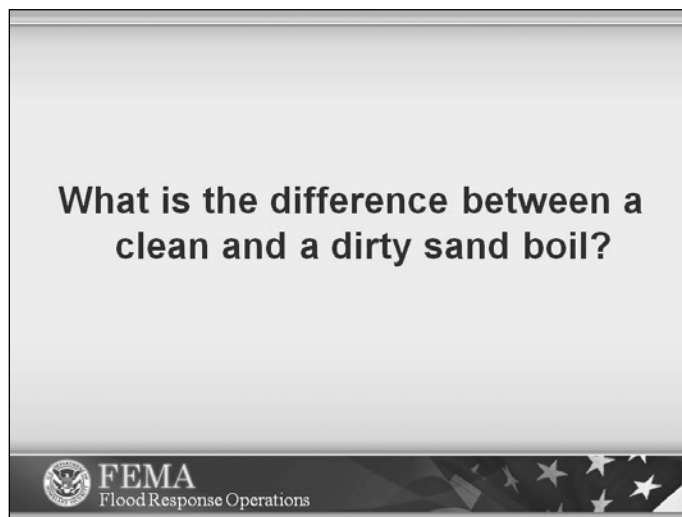
Foot Patrols
Boat Patrols
Air Patrols




The monitoring team is the early warning system for the community. It is critical to have carefully selected, well-trained monitoring teams in place to spot trouble before the problem becomes a disaster.



You may use these questions to check your understanding of the content presented in this lesson.

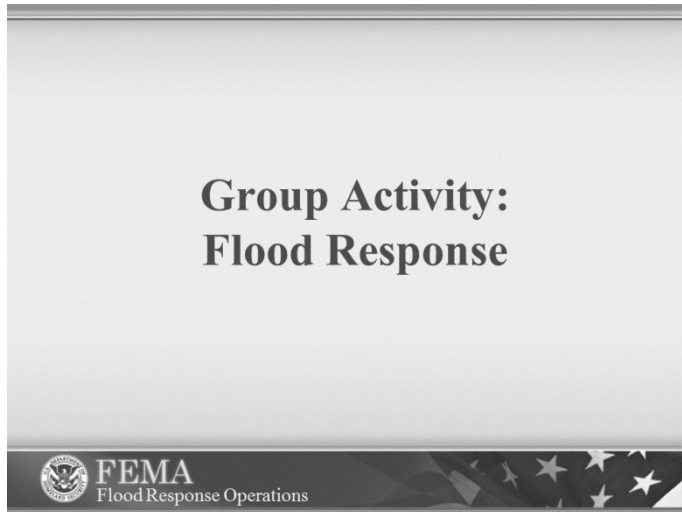


What are some ways in which flood works can be monitored?

The logo for FEMA Flood Response Operations, featuring the FEMA seal on the left and the text "FEMA Flood Response Operations" on the right, set against a background of stars and stripes.

What safety procedures should be used by flood works monitoring teams?

The logo for FEMA Flood Response Operations, featuring the FEMA seal on the left and the text "FEMA Flood Response Operations" on the right, set against a background of stars and stripes.



The instructor will provide a Flood Response Resource Availability List for this activity.

This activity provides controlled flood response experience, allows you to employ the plans created earlier in the course, and demonstrates the need for planning flexibility.

Working with your group, discuss the beginning scenario information and determine what actions you should take, if any, to deal with the weather events. You will receive additional information as the activity progresses.

Instructions for Group Activity: Flood Response

Read the beginning scenario below. With your group, determine how to respond to the flood threat for the fictional community of Peabody City. You will need to refer to the Flood Response Resource Availability list and additional inputs provided by the instructor for this activity. Note that the Resource List does not include all of the items from the inventory conducted earlier in the course. This is to simulate real-life conditions where all inventoried resources are not normally available for disaster use or may have already been diverted to other emergency projects.

Be sure to record the actions of the group and be prepared to report out about your actions to the rest of the class after the activity.

Beginning Scenario – Monday AM

It is 8:00 a.m. on Monday. The temperature is 50°F and the sky is cloudy. Over the past few days, a warm spell has melted the 12" snowpack which had blanketed the area. The ground is saturated and very muddy. At 7:00 this morning, the River Trail Gage on the Gantt River read 10.6 feet, up .6' from Sunday's 7:00 p.m. reading.

The National Weather Service forecast for the next 24 hours shows that an area of rain will be moving through the county and rainfalls of up to ¼ inch will be common. The extended outlook calls for cloudy conditions and warm temperatures as the current weather front stalls.

The river forecast for the Gantt River calls for it to rise to 12 feet by this evening and crest at 14 feet on Tuesday morning.


Suggested Action Items

- Check with local authorities and determine what safety training monitoring teams receive. Do you feel this is adequate?

- What types of communication systems are used by monitoring teams in your area? Are there any problems with the use of these systems?

**Lesson Eight:
Reports and Documentation**

**OBJECTIVE: Evaluate the actions taken
during a riverine flood event**




Lesson 8: Reports and Documentation

In this lesson, you will evaluate the actions taken during a riverine flood event.

Since floods may occur decades apart or multiple times in a single year, it is important to record and preserve as much information as possible for use in future planning efforts so you are prepared whenever they occur. Real-life experiences provide one of the best learning tools available to the flood emergency planner.


Supporting Objectives


- **Conduct a debriefing session**
- **Describe how post-flood evaluations, reports, and meetings contribute to continuous improvement in the planning process**



Debriefing Sessions

- Provide feedback on lessons learned
- Help identify areas for improvement
- Not used to fix blame




 **FEMA**
Flood Response Operations

Debriefing sessions provide valuable feedback on the lessons learned. While debriefing sessions may not be necessary after every flood event, nor need be formal, communities should conduct them after major events or any time flooding results in a loss of life.

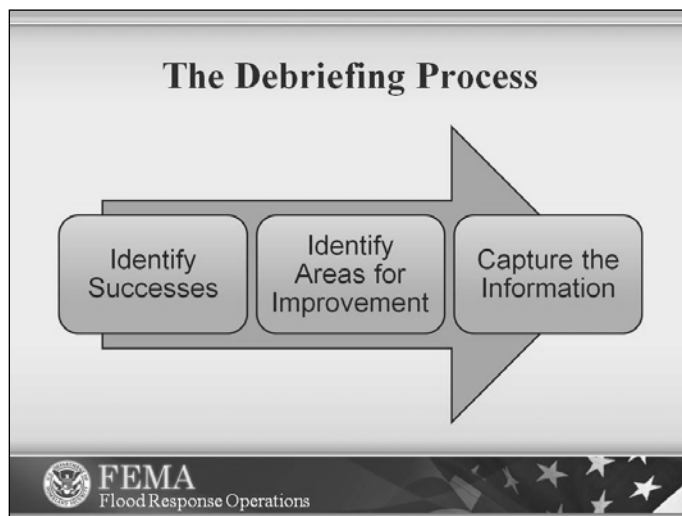
While most debriefings are held face to face, some agencies have been experimenting with questionnaires or surveys to broaden the response base. Surveys may also provide for a more definitive review of problem areas.

Flood Response Activity Debrief

- In what areas were the options you chose during the activity successful?
- In what areas could you have improved? How?

 **FEMA**
Flood Response Operations

Consider your group's decisions during the Lesson 7 activity. Your group will be given 10 minutes to discuss these questions in relation to that activity.



The steps in the debriefing process are shown on the slide.




It is a good idea to start debriefing sessions on a positive note. Areas and functions that went well should be identified and recorded.

Another topic to explore is why a function was successful. Identifying the reasons for success can be of great value where conflicting information is gathered over a period of time.

The debriefing leader should provide positive reinforcement throughout the process.

Identify Areas for Improvement


- **Seek suggestions to correct problems**
- **Continue to provide positive reinforcement**
- **Do not fix blame**
- **Document the findings**



Look at areas for improvement and suggestions to correct any problems. Many problems encountered in the field will be solved by individual initiatives that can be used to prevent a recurrence of the situation. Remember, the focus is not on placing blame but on improving response actions.

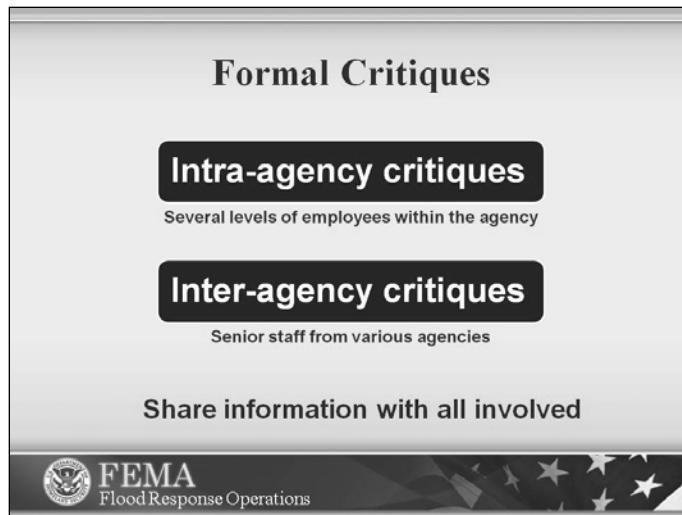
Capture the Information

- **Keep a written record of key ideas**
- **Consider using stenographers or court reporters**
- **Collect all notes and reports**
- **Collate information for the incident record**



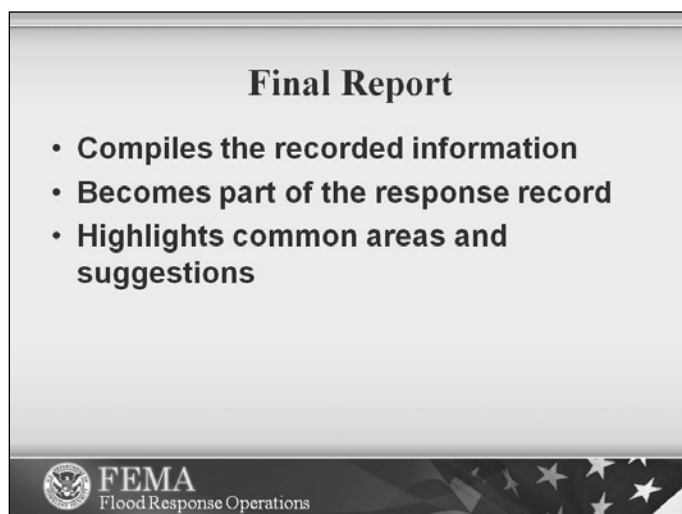
During debriefing sessions, key ideas should be kept on flip charts or otherwise recorded. Consider involving stenographers or court reporters in the session for this purpose.

All notes and reports should be collected and collated for inclusion in the incident record.



Formal critiques are typically held as the response system and community return to normal. Inter- and intra-agency critiques are valuable feedback sources, particularly in dealing with coordination issues.

It is important to share information with all individuals involved.



A final report should be drafted using the information recorded throughout the process. This report should capture key points and become a part of the response record.

Using After-Action Reports to Improve the Plan

- **Rank areas or functions for improvement**
- **Evaluate all information**
- **Ensure the flood plan meets needs**





After-action reports can be useful tools for ranking areas or functions for improvement after a test of the flood plan as a result of an actual flood event. It may bring to light issues with the plan that must be reconsidered.

The planning team should evaluate all the information provided after a flood event in order to help ensure that the flood plan meets the community's needs.

Response Data


- **Collect hard data on the response effort**
- **Preserve it for future use**
- **Save all collected data for review and evaluation**



Hard data on the response effort should also be collected and preserved for future use and reference. When in doubt, save all the data collected until the materials can be fully reviewed and evaluated.

Examples of Response Data



- Purchase orders and supply requests
- Man-hour estimates
- Financial data and damage estimates
- Legal documents
- Disaster declarations
- Weather reports and bulletins
- Damage reports
- Evacuation and re-entry data



This information can be used to validate or improve planning assumptions. For example, planning estimates of sand use can be compared with actual figures and, if necessary, adjustments can be made in the planning documents and resource lists.

Flood Data

- Surveys
- Photographs and video
- Invoices
- Legal documents
- Information from private sources






Information on the extent and exact nature of the flood should be gathered as soon as the water recedes. This information that should be included is listed to the right.

- Survey information, plotted on maps, to correlate gage readings and validate prediction levels
- Photographs and video, to depict the extent of flooding
- Invoices, to adjust the amount of materials called for in the plan if needed, and to document expenses for cost recovery under the provisions of a disaster declaration
- Legal documents, including declarations, resolutions, right-of-way filings, development permits, and requests for assistance
- Information from private sources, such as disaster relief agencies, hospitals, an insurance companies

Planned vs. Actual Response

- Compare the plan with actions taken
- Evaluate the plan
- Make revisions







The validation of the existing planning document is necessary before revisions are undertaken. Some communities have waged very successful flood responses that only slightly resembled the methods and procedures outlined in a written plan. Any plan discrepancies must be corrected to reflect the procedures that worked in the real life situation.

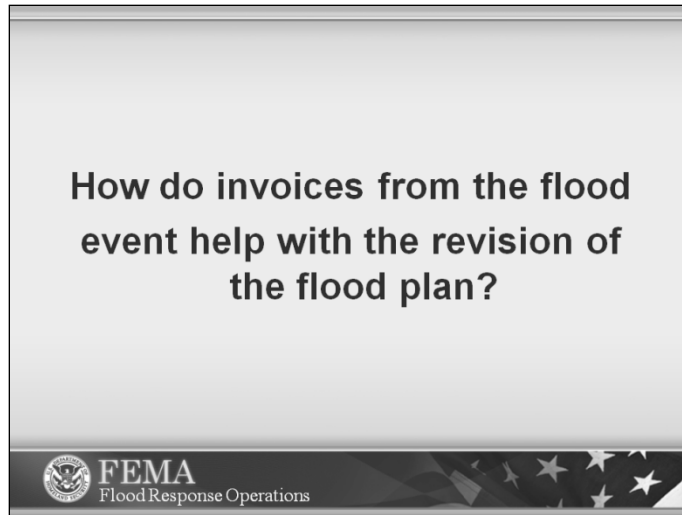
Lesson Summary

- The plan is a living document
- It must be continually reviewed
- Update the plan using after-action reports

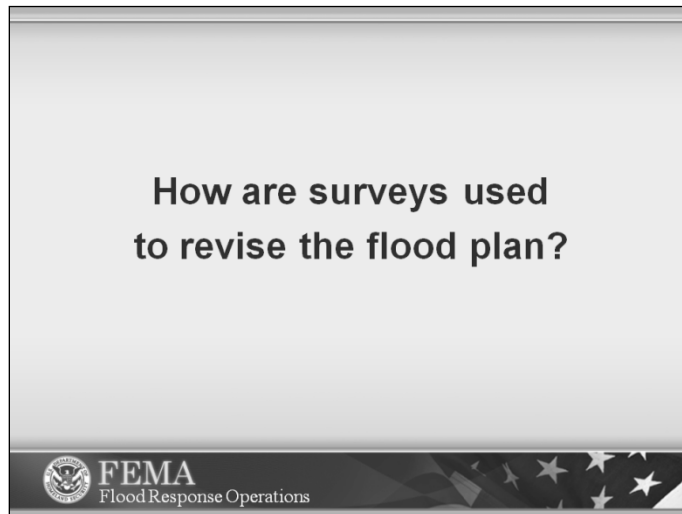


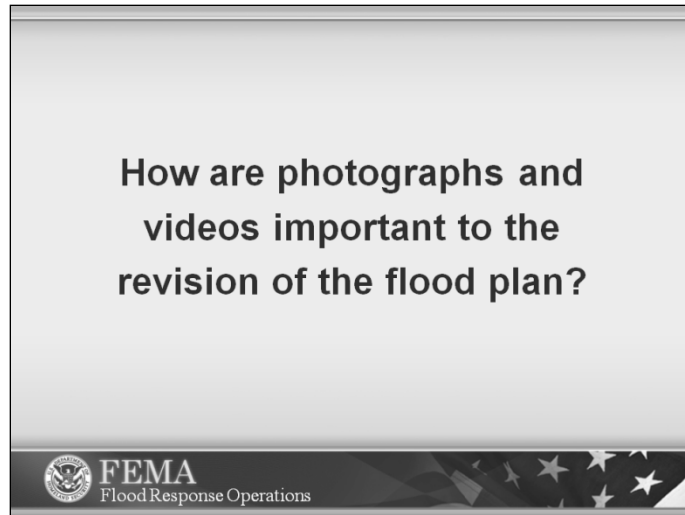


The flood response plan is a living document that must be continually reviewed. After a flood event, a community's flood plan should be updated using after-action reports created from debriefing sessions and formal critiques. Community planning teams must also review data about the flood and the response in order to improve the plan to increase readiness for the next flood event. Ensure that the plan updates are communicated to the county (if a municipality) and the state.



You may use these questions to check your understanding of the content presented in this lesson.






Suggested Action Items

- Review the records of previous floods in your community. Do you feel that adequate records were kept on these events? How would you improve the record keeping process?

**Lesson Nine:
Returning to Normal**

**OBJECTIVE: Explain the challenges
and resources associated with the
recovery process**




Lesson 9: Returning to Normal

In this lesson, you will learn about the challenges and resources associated with the recovery process.

Receding flood waters signal the start of the recovery process. Recovery for most communities is an emotionally draining, time-consuming, and expensive proposition. The restoration process may place greater demands on government and private services than the flood response.


Supporting Objectives


- **List sources of recovery information**
- **List the challenges faced by a community after a flood**
- **Describe the role of community and social agencies during the recovery process**



Sources of Public Education on Recovery

- FEMA
- American Red Cross
- Private Firms




 FEMA
Flood Response Operations

While some training programs or briefings can be conducted in a classroom setting, most information will be disseminated to the public in the form of brochures, flyers, and newspaper articles.

FEMA and the American Red Cross have materials to assist the public during the recovery phase. Some private restoration and recovery firms have excellent information packets for use by their potential clients.

Methods of Distributing Public Information on Recovery

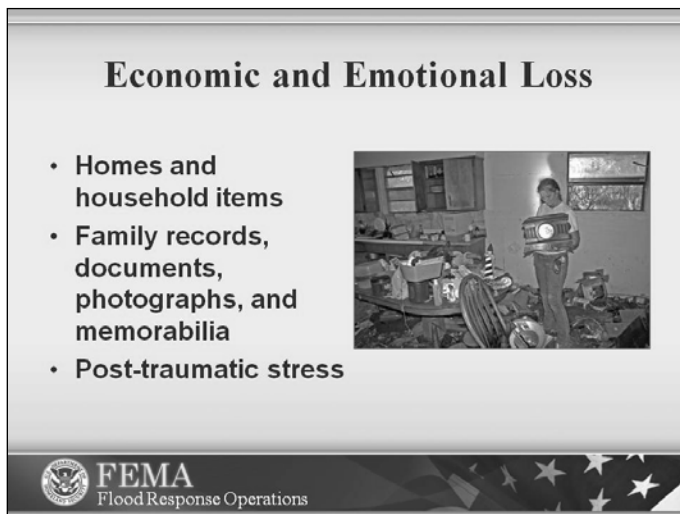
- **Packets should be readily available at the following distribution outlets:**
 - Disaster assistance and recovery centers
 - Supermarkets
 - Hardware stores
 - Anywhere cleaning/restoration supplies are sold

 FEMA
Flood Response Operations

Informational packets and information should be readily available to the public. It is important not to wait until the last minute to begin the distribution of recovery information. The earlier the information is made available to the public, the more effective it will be.



Communities will face many challenges after a flood event. Although community leaders should be able to look to the emergency plan for guidance during this difficult time, many challenges may be unique to the event.



Many residents' homes will have been destroyed, resulting in a need for temporary housing. Emergency housing units will need to be set up in lots or on park lands while permanent residences are being repaired.

Emotional problems are normal following any disaster and therefore the public at large may be in need of critical incident stress debriefing and other intervention programs.

Restoration of Critical Infrastructure

- Sewer and drainage systems
- Roads and bridges
- Water systems
- Fire stations
- Hospitals
- 911 centers
- Schools and child care centers



 **FEMA**
Flood Response Operations


Restoring critical infrastructure as soon as possible is vital to the recovery of the community. The sewer system and drains may have become clogged with mud left by floodwaters and require cable or water jet cleaning. Water systems must also be restored.


Emergency services such as fire stations, hospitals, and 911 centers must be returned to normal working operations as soon as possible.

It is also important to get the school and child care areas within the flood zone back up and running as soon as possible. Children and parents alike will need the normalcy and routine that they provide.

Clean Up

- Flood debris
- Personal items
- Hazardous waste
- Mud and dust
- Water damaged furnishings
- Expedient flood works
- Burn/disposal site regulation



 **FEMA**
Flood Response Operations

Provisions must be made for the removal and disposal of floodborne debris, water damaged furnishings, personal items, and the eventual removal of expedient flood works.

Many of these materials will end up in community landfills, but in certain instances contaminated items may have to be packaged and handled as hazardous or regulated waste.


If the community is providing debris removal for commercial establishments, hazardous waste issues can arise and complicate removal programs. Failure to follow hazardous waste regulations can subject communities to significant fines and penalties.

Communities contemplating the incineration of floodborne debris should thoroughly investigate state and Federal regulations before committing to this course of action.

The receding flood waters are likely to reveal a thick layer of mud covering the flood zone. As the mud dries, dust will become a problem. Dust masks and other forms of respiratory protection will be needed to protect clean-up workers.

The Role of Community and Social Agencies

- **Sanitation and health**
- **Water**
- **Zoning, building, and business**
- **Consumer protection**
- **Mental health**
- **Public information**



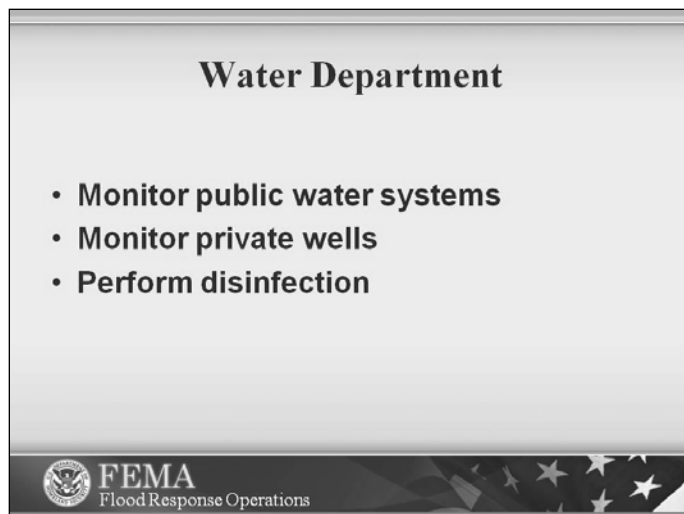
Many of these agencies are not normally included in the planning process and therefore may be completely overwhelmed in the aftermath of a disaster.

Sanitation and Health Officials

- **Monitor food safety**
- **Control vector and vermin populations**
- **Address other public issues**



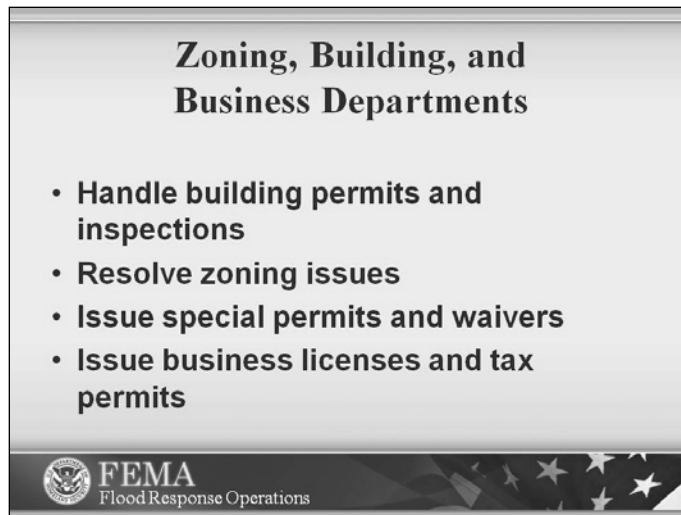
Sanitarians and health officials will be needed to monitor food safety, control the vermin and vector population, and deal with other public health issues.



Harmful protozoa are often present in floodwaters. Cryptosporidium is highly resistant to the standard chlorine disinfection process. Should this protozoan be introduced into a water system, it may be weeks before potable water supplies can be restored.


Private wells also require special attention after a flood. All wells should be thoroughly flushed, disinfected, and tested by competent authorities to assure the safety of the water supply.

Local health officials should be contacted for advice on the need for special testing procedures for cryptosporidium and chemical contamination. It is highly recommended that wells be closely monitored for several months after being subjected to flood waters.



Zoning, Building, and Business Departments

- **Handle building permits and inspections**
- **Resolve zoning issues**
- **Issue special permits and waivers**
- **Issue business licenses and tax permits**


 FEMA
Flood Response Operations

Zoning, building, and business departments can anticipate an increased workload during recovery, due to:

- Building permits and inspections are required for many restoration activities. These may include general building, electrical, mechanical, plumbing, occupancy, and health permits.
- Zoning and planning departments typically face a difficult period after the flood waters recede. Zoning regulations may prevent citizens from rebuilding or improving their homes in the flood-plain.
- Special permits or temporary zoning variances may be necessary to allow for the placement of emergency housing units on lots or park lands while permanent residences are being repaired.
- The demand for business licenses and tax permits may increase as a demand for building contractors, restoration services and products become likely after a high water event.

Consumer Protection Departments


- **Increase staff if possible**
- **Handle consumer complaints**
- **Investigate fraud accusations**



While most contractors and restoration services are reputable, problems with unscrupulous vendors will arise. Police and consumer protection agencies should ramp up their staff to be sure they are capable of handling increased consumer complaints and fraud accusations after the flood.

Mental Health Services


- **Increase staff if possible**
- **Be ready to intervene quickly**
- **Provide training for school staff**



Human service agencies and community counseling services should be prepared to deal with the increased need following the flood. Social agencies must be ready to make quick interventions.

Public Information Officer



- **Handle all media requests**
- **Provide timely and accurate information**
- **Warn public of post-flood dangers**



A public information officer should be appointed to deal with media requests. The public should be kept informed with all the necessary and accurate information that can be provided.

Mitigating Future Flood Losses

- **Critical step**
- **May be required if Federal aid is received**
- **Could involve zoning and inspection**



Mitigation is the most important step communities can take to prevent flood losses. After a flood event, mitigation plans may be required if Federal disaster aid has been received, to identify procedures to reduce future flood losses.

Part of the mitigation plan includes new zoning and land use regulations and changes in building codes and inspection systems.



On the next page you will find a Personal Take-away Worksheet. You will be given 10 minutes to answer the questions presented on this worksheet. Refer back to the suggested action items at the end of each lesson for ideas.

Individual Activity: Your Community**Personal Take-Away Worksheet**

1. Write down three take-aways you have from this training (or action items). It may be something you want to begin, change, implement, research, or try when you get home. You can refer back to the suggested action items at the end of each lesson for ideas.

a.

b.

c.

2. How will you begin, change, implement, research, or try this? Describe your plan of action.

a.

b.

c.

3. When will you begin, change, implement, research, or try this? (Write down a specific date or time. "As soon as I can" is not specific.)

a.

b.

c.

Lesson Summary

Economic and Emotional Loss

Restoration of Critical Infrastructure

Clean Up

Out of the ruin comes opportunity

FEMA
Flood Response Operations

Economic and emotional losses can produce extremely stressful situations; however, out of the ruin also comes an opportunity for community improvement.

Entire communities have relocated to higher ground to prevent a recurrence of past flood disasters. During the recovery phase, public and private partnerships may blossom and set the stage for future cooperative developments and programs.


What are some good sources of recovery information?

FEMA
Flood Response Operations


You may use these questions to check your understanding of the content presented in this lesson.

What are some of the major problems that can be expected during the recovery phase?

In what ways could planning help reduce these problems?

The logo for FEMA Flood Response Operations, featuring the FEMA seal on the left and the text "FEMA Flood Response Operations" on the right, set against a background of a stylized American flag.

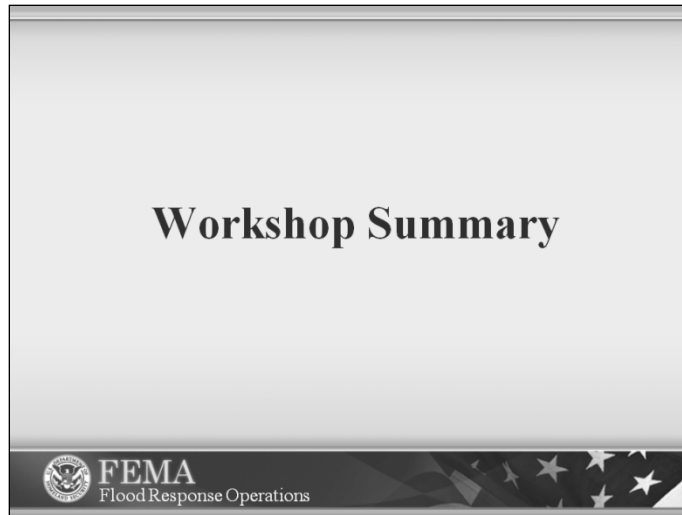
What is the role of community and social agencies during the recovery process?

The logo for FEMA Flood Response Operations, featuring the FEMA seal on the left and the text "FEMA Flood Response Operations" on the right, set against a background of a stylized American flag.

Suggested Action Items

- Check with local officials and determine what plans have been made to deal with the recovery period. Do you feel that these plans are adequate?

- How will public information be disseminated in your community? What additional methods could be used to educate the public?



What questions do you have for the instructor?

Flooding is the most common natural disaster in the United States; therefore, it is critical that communities plan to protect themselves against flood losses through effective mitigation and the development of a flood plan.

When developing the document, planners should analyze the kinds of threats faced by their community and include several response options in the plan to deal with those threats.

Effective coordination among multiple organizations and agencies is a vital component of any kind of emergency planning effort.

When a flood event occurs, decision makers will need to evaluate the response options included in the plan and determine the best response. Whatever option is chosen, decision makers must determine priorities and base their decision on available time and resources.

One of the most important resources during a flood response is the volunteer workforce. Flood plans must identify ways to recruit, register, track, and train volunteers.

After a large flood event, planners should reconvene to evaluate the actions that were taken, comparing them to the plan and making revisions as needed. It's also important to document information for reference during future flood events.

Flood Response Operations

Appendices

FEDERAL EMERGENCY MANAGEMENT AGENCY
EMERGENCY MANAGEMENT INSTITUTE

G 361
October 2013

Table of Contents

APPENDIX A: ACTIVITY MATERIALS	A-1
APPENDIX B: GLOSSARY	B-1
APPENDIX C: RESOURCES	C-1
APPENDIX D: CONSTRUCTION PLANS AND DIAGRAMS	D-1
APPENDIX E: JOB AIDS	E-1

Appendix A: **Activity Materials**

This section contains supporting materials for the activities in the course. The following documents are included in this appendix:

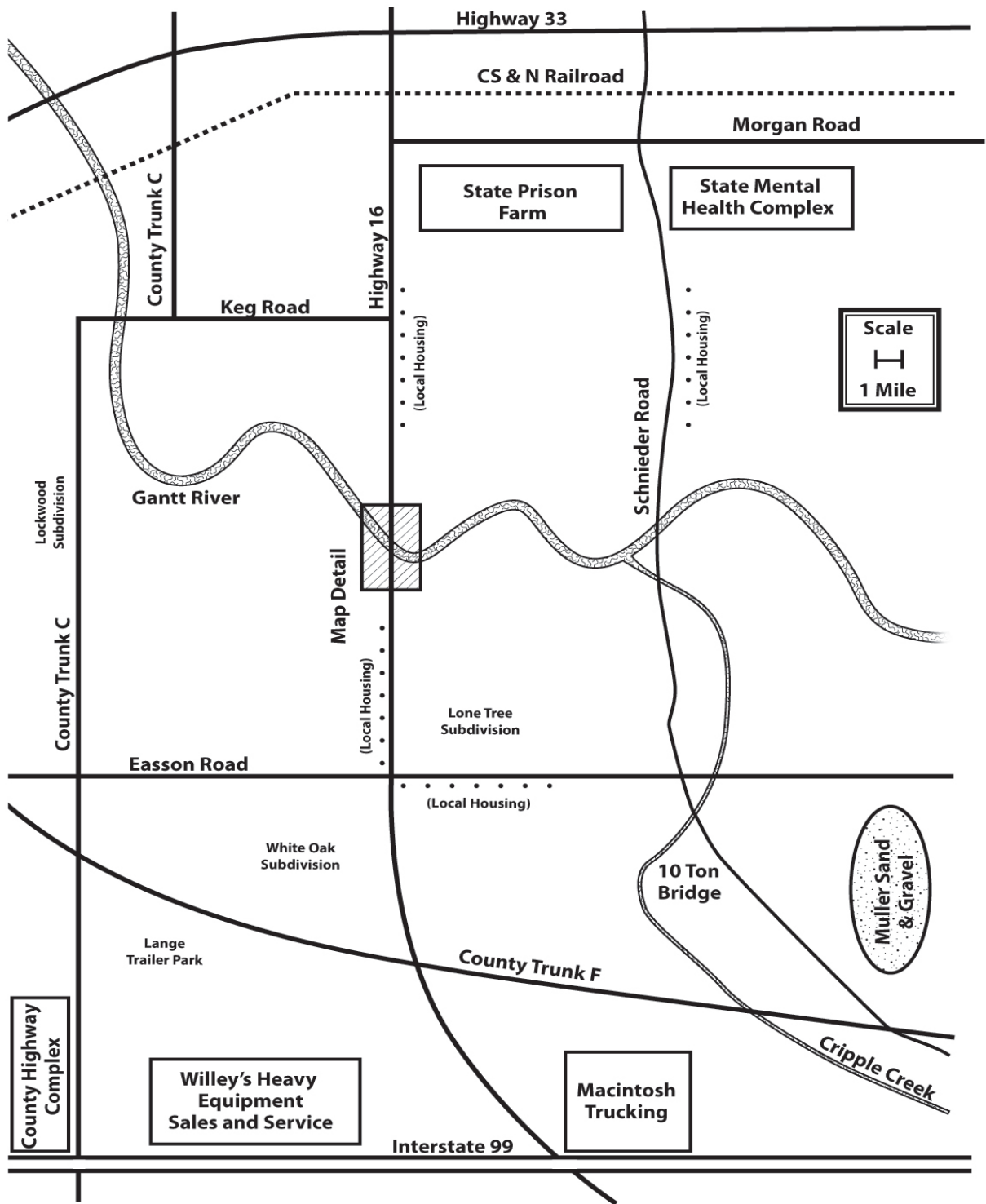
- Action Item List
- Group Activity: Peabody City
 - Peabody City Map
 - River Bend Map Detail
 - Overview Map Information
 - Gant River Information
 - River Bend Guide
- Group Activity: Plan Coordination
 - Wastewater Treatment Plant Flood Emergency Plan
- Individual Activity: Volunteer Skills Matching
 - National VOAD Members Resource Directory

Group Activity: Peabody City

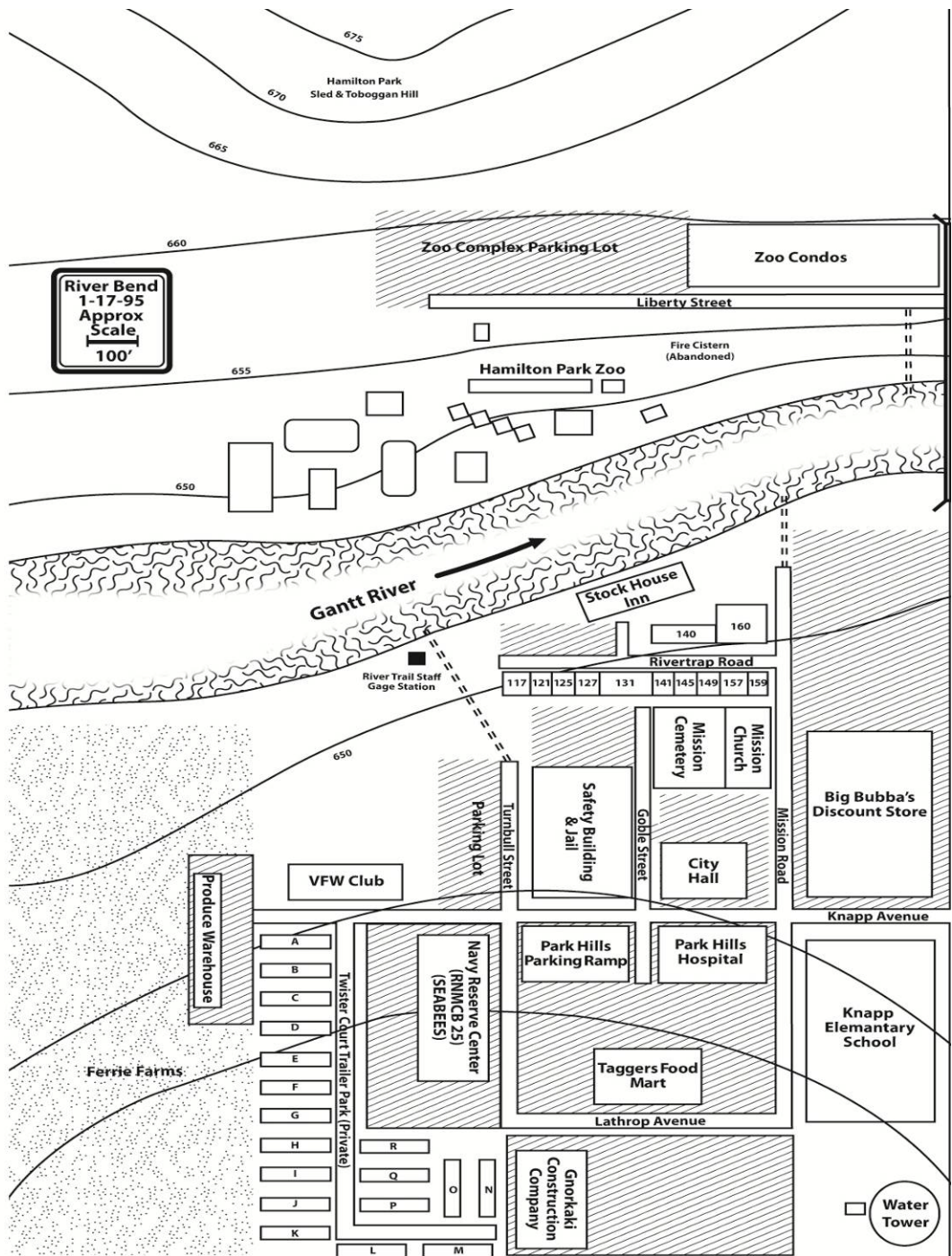
The following materials are included in this section for use with this activity:

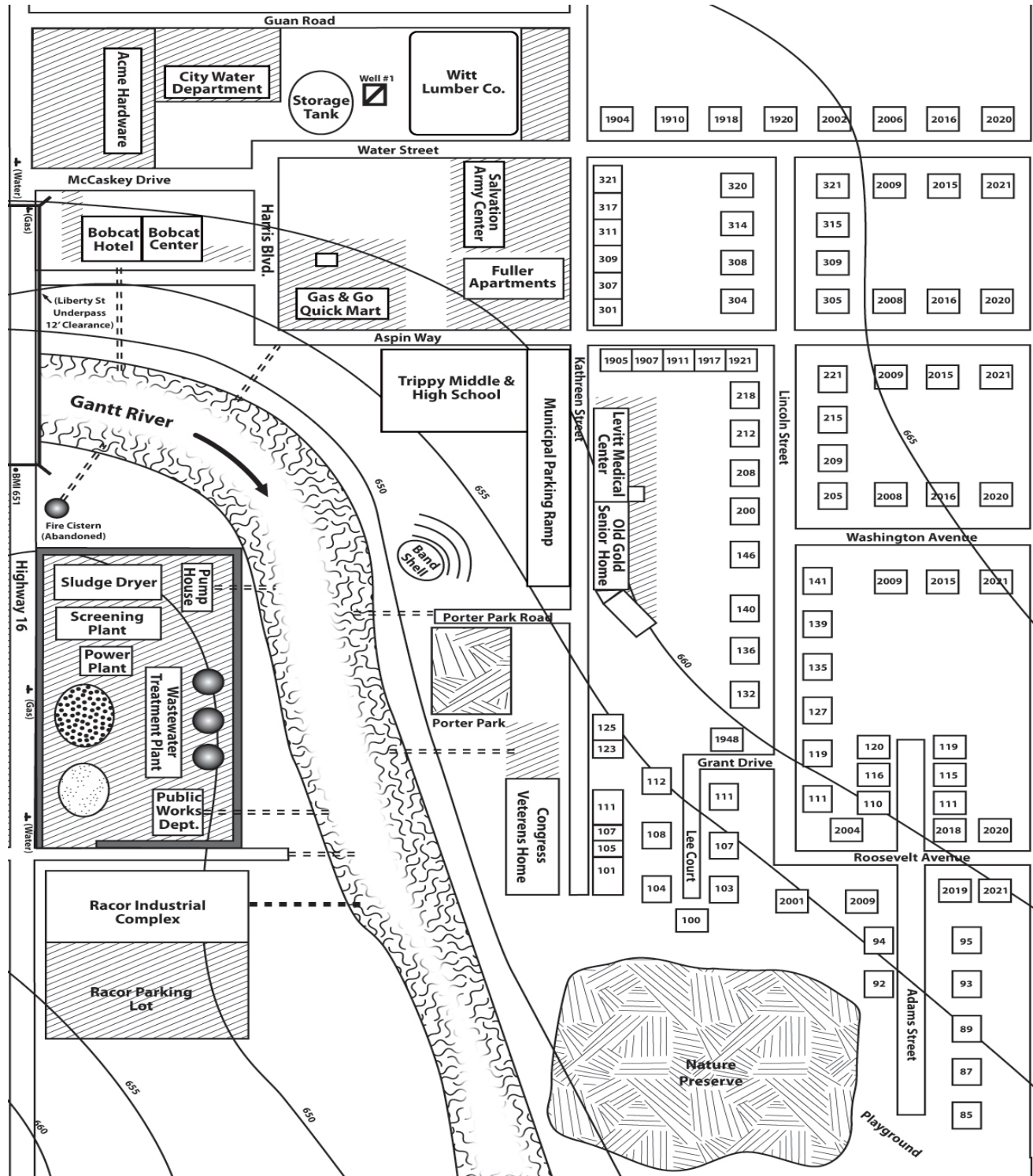
- Peabody City map
- River Bend map detail
- Overview map information
- Gantt river information
- River Bend guide

Peabody City Map



River Bend Map Detail





Overview Map Information**Interstate 99**

I-99 is a four-lane divided roadway. There are freeway entrances at Highway 16, County Trunk C, and Highway 33 (12 miles North of County Trunk C).

Highway 16

Highway 16 is a two-lane road that crosses the Gantt River in Peabody City. The Highway 16 crossing is an antiquated, open-steel truss bridge built in the 1930s. It has no weight restrictions. It is narrow, and subject to flooding during high water events.

The following utilities are hung under the bridge: an 8" high pressure gas main; a 12" water main; three 100 pair telephone cables; and a cable TV distribution line. The 12" water main provides water service from Municipal Well # 1 to the East half of Peabody City.

Highway 33

Highway 33 is a two-lane road between Highway 16 and County Trunk C. There is construction on it, with the roadway being rebuilt. During the construction, a detour is rerouting traffic along Highway 16, Keg Road, and County Trunk C. The intersection of Highways 16 & 33 is controlled by automatic traffic signals.

County Trunk C

County Trunk C is a two-lane road that crosses the Gantt River downstream from Peabody City. This road was rebuilt in 1988 and is not subject to flooding. While Highway 33 is under construction, a set of temporary automatic traffic signals control the intersection of County Trunk C and Highway 33.

County Trunk F

County Trunk F is a two-lane road. Traffic on County Trunk F is controlled by two-way stop signs at Highway 16. Four-way stop signs control traffic at County Trunk C. A one-way stop sign controls traffic at Easson Road. County Trunk F is not subject to flooding.

Easson Road

Easson Road is a two-lane town road. It is controlled by two-way stop signs at Highway 16 and County Trunk C. Four-way stop signs control traffic at Schneider Road. It is not subject to flooding along Cripple Creek.

Schneider Road

Schneider Road is a two-lane town road that crosses the Gantt River upstream from Peabody City. There is a bridge over Cripple Creek with a 10-ton limit, and its crossing at the Gantt River is subject to flooding at 647 feet. It is controlled by two-way stop signs at Highway 33 and County Trunk F. Four-way stop signs control traffic at Easson Road and Morgan Road.

Keg Drive

Keg Drive is a narrow, two-lane town road. It is controlled by a one-way stop sign at County Trunk C. Temporary automatic traffic signals control traffic at Highway 16.

Morgan Road

Morgan Road is a two-lane town road. It is controlled by a one-way stop sign at Highway 16. Four-way stop signs control traffic at Schneider Road.

CS & N Railroad

The CS & N railroad is a busy, single track, freight railroad that crosses the Gantt River downstream of Peabody City. It passes under the Highway 16 viaduct. The crossing at County Trunk C is gate-controlled and at-grade. The crossing at Schneider Road is uncontrolled and at-grade.

State Prison Farm

The State Prison Farm is located on Morgan Road near its intersection with Highway 16. It is a minimum security facility that houses 510 men and 145 women. In addition to normal farm equipment, the facility has three buses. Each bus has a capacity of 45 prisoners and a guard complement.

State Mental Health Complex

The State Mental Health Complex is a long-term resident care facility for the mentally handicapped and criminally insane. The facility originally had 340 beds. A state program to put more people into residential care facilities resulted in the closing of two wings, reducing the total number of beds by 80. This facility has two specially designed transportation buses. Each bus has a capacity of either 12 sitting patients or 7 wheelchairs.

Gantt River Information

The Gantt River is recreational flowage and is noted for its excellent fishing. It is fed by a number of smaller tributaries, which drain primarily from agricultural areas. Approximately 35 miles downstream of Peabody City, the Gantt enters the Fox River, which flows on the border of McKay and Grunde counties. Farms, and a section of Peabody City, rest within the Gantt's floodplain, which is not restricted by any flood control systems.

Only a few of those eligible for flood insurance in Peabody City hold policies. Past campaigns to sell flood insurance have been largely ineffective. In Peabody City, the Gantt River is measured at the River Trail Gage Station, a porcelain plate staff gage mounted on a plank set in the river bank. This gage is zeroed at 630 feet MSL. Normal river measurements at this site range between 3 and 12 feet.

Gantt River Flood and Stage Information	
Channel Capacity	15 Feet
Flood Stage	18 Feet
1% (100-year) flood	21 Feet
0.2% (500-year) flood	30 Feet

Year	Crest	Comments
1911	650	Ice blockage reported as contributing factor
1923	649	Flooding associated with heavy rains
19310	649	No information available
1947	656	Extensive damage reported
1953	649	Flooding associated with heavy rains and snow melt
1953	651	Flooding associated with heavy rains
1953	649	Flooding associated with heavy rains & debris blockage downstream from Porter Park
1974	648	Minor damage reported
1975	657	Severe flood damage due to ice and debris blockage at Highway 16 bridge
1986	648	Minor damage reported
1999	649	Flooding associated with heavy rains and snowpack melt

River Bend Guide

Community Background & Points of Interest

Peabody is a small city in the heart of McKay County. It recorded 8,752 residents during the last census. During the 80s and early 90s the area was suffering economically. In 1995, Gilbert Snor was elected mayor, and began new efforts to attract businesses and residents to the area. This new development was particularly successful in the River Bend section of town.

River Bend is the trendy portion of the city. It is bordered by State Highway 16 and the Gantt River. The Stock House Inn was built in the 1880s, and the area around River Trail Road was settled at that time. In recent years this area has become the center of redevelopment in the community, and it is now listed as a state historic district. Five years ago the Stock House Inn underwent a \$500,000 renovation, and is now an upscale restaurant with a bed and breakfast. The old warehouses at 140 & 160 River Trail Drive have been converted into expensive condos, and the East side of River Trail Road hosts a number of exclusive shops, stores, and art galleries.

The Hamilton Park Zoo is located across the river from River Bend and is a small, traditional, cage zoo that dates back to the 1950s. Its main features are the big cat exhibits, a den of bears, and a petting zoo. In 2000, the Zoo Society built the Zoo condominiums. Mayor Snor and State Senator Glich both live in the Zoo condominiums. The Mayor and Senator have been working hard to get the state to improve the Highway 16 Bridge that passes over Liberty Street. This old structure provides a 12 foot clearance for traffic on Liberty Street and is the only access route to the condos and to the zoo.

The Bobcat Hotel and Center were built in 2001. The hotel has 150 rooms and a small convention center. Directly beneath the convention center, a three-level underground parking garage provides parking for the convention center and the hotel.

In the 1998, the Levitt Medical Clinic and the Old Gold Senior Citizens home were purchased by Park Hills Hospital. They were then renovated. These buildings are, in large part, the reason Park Hills is able to provide such a high level of health care in Peabody City. At the dead end of Katharine Street is the Congress Veteran's Home, which was built in the historic Mudge Wagon Works building. On the opposite side of the street are several historic buildings which are now exclusive private residences.

Porter Park is home to one of the few remaining examples of 1930s style art-deco band shells. The local municipal band uses the band shell for concerts in the summer. Porter Park is listed on the National Register of Historic Places.

The late 90s and early 2000s saw a building boom in Peabody City. The area North of Katharine Street was rapidly built up with very expensive multi-level homes and condos.

A modern wastewater treatment plant for Peabody City is located at the intersection of Highway 16 and Knapp Avenue. This site, shielded from public view by shade trees, also contains a small public works garage that is used to store snow removal equipment.

East of the wastewater plant is the Racor Industrial Complex. This facility is home to an increasing number of high-tech firms. Several of them employ up to 600 people. Many of these positions are among the highest paying jobs in the county.

The Park Hills Hospital is a regional medical center, and the only hospital in McKay County. It is located on Knapp Avenue across from City Hall, in a facility that dates back to the 1940s. This building also houses general medical offices and a rehabilitation clinic.

The City Hall is designated as a historic building. The municipal court of Peabody City is housed in this building. The Safety Building and Municipal Jail were built in the 1960s, and the Peabody City EOC is located in the basement of this complex. The police and fire departments are both located in the Safety Building.

There are two schools in Peabody City. Knapp Elementary School serves grades K-6, and has 457 students. Trippy Middle and High School has 410 students in grades 7-12.

Transportation Routes and Information

State Highway 16 is the main transportation route into and out of the River Bend area. A two-lane, historic steel truss bridge built in the 1930s is the only crossing over the Gantt River for 10 miles in either direction upstream or downstream.

Mission Road, River Trail Road, and Inn Court have all been restored to historic paving block surfaces. The remainder of the roads in the community have hard surfaces (with the exception of Porter Park Road, which is gravel), and are in good to fair condition.

The area is served by the Stripe Cab Company, and by interurban bus lines. School bus service is provided by the Cripple Creek Transportation Cooperative.

Group Activity: Plan Coordination

Flood Emergency Plan Peabody City Wastewater Treatment Plant January 17, 2011

Current Status

The Peabody City Wastewater Treatment Plant is a licensed secondary wastewater treatment facility. It has a maximum capacity of 3.75 MGD and services an average inflow of 2.5 MGD. During periods of heavy rain, plant inflow may increase by as much as 30%.

In 1975, a clay berm with a black dirt topping was installed around the plant with a grade elevation of 653 feet MSL. This berm has a crown width of 8 feet. An entrance cut at the south-east corner of the plant must be sealed to complete the protective barrier.

At the direction of the Mayor in 1980, trees were planted on the outside of the berm to hide the plant. These hardwood trees have matured and now provide a visual barrier on all four sides of the facility.

In 1984, the power plant was updated, and the overhead power lines were replaced with an underground service from Highway 16. A 640 Kva, 30 turbine generator was also installed to provide emergency power. This unit has an underground fuel tank with sufficient capacity for 7 days of operation. Transfer time from failure to full back up power is approximately 2 minutes.

With upgrades to the facility in 2000, an electrical system stabilizer was added to service the new computer equipment and plant monitoring system.

In 2006, storage capacity was added to the plant, and the facility now has chemical feedstock sufficient for 5 days of operation.

Approximately 15,000 sandbags are stored in the pump house. Sand to fill the bags can be taken from the public works yard pile.

Known Problem Areas

During the flood of 1986, water backed up through the yard drainage system and inundated the north half of the yard with up to two feet of water. The outfall for the yard drains is approximately 100 feet west of the northeast corner of the site. This line can be blocked from manhole #7, located 6 feet from the inside toe of the berm.

In 1999, the blocking of the yard drain line, combined with heavy rains, flooded the plant yard. An agreement has been made with the Peabody City Emergency Management Director to use the 750 GPM civil defense fire pump stored at the public works depot to drain the yard when

flooding is a problem. As part of this agreement, the plant will be responsible for maintaining this unit.

In 2007, the U.S. Army Corps of Engineers was asked to inspect the berm around the plant. The Corps strongly suggested the removal of all trees and brush from the berm. The City Council refused to permit the removal of the trees, but the brush has been kept cut, and an animal control program is in place to reduce the number of burrows in the berm.

Effluent from the plant is normally gravity-discharged into the Gantt River. But when the Gantt River reaches a stage of 19 feet, effluent begins to back up in the facility. A jet booster pump can be activated to pressure discharge the effluent during periods of high water. However, as the discharge head pressure increases, the effectiveness of the pump decreases. The following table shows the engineering calculations of output capacity at various head levels.

River Stage	Pump Output MGD 80% Load Factor
19 Ft. (649 MSL)	3.750 MGD
20 Ft. (650 MSL)	3.638 MGD
21 Ft. (651 MSL)	3.456 MGD
22 Ft. (652 MSL)	3.214 MGD
23 Ft. (653 MSL)	2.925 MGD
24 Ft. (654 MSL)	2.603 MGD
25 Ft. (655 MSL)	2.265 MGD
26 Ft. (656 MSL)	1.925 MGD
27 Ft. (657 MSL)	1.598 MGD
28 Ft. (658 MSL)	1.262 MGD
29 Ft. (659 MSL)	0.972 MGD
30 Ft. (660 MSL)	0.729 MGD

Emergency Response Procedures

Action Level for 15 Foot Predicted River Stage

- Test emergency generator and civil defense fire pump.
- Fill 50 sandbags and place materials in preparation to block manhole 7.
- Top off fuel tanks.
- Monitor river forecasts from National Weather Service.

Action Level for 16 Foot Predicted River Stage

- If not already taken, complete steps for the 15 foot level.
- Block manhole #7 with sandbags and lumber. Place fire pump at this location and extend drainage line well away from berm toe on river side. Have yard worker monitor pump and water levels and take necessary actions to drain water from yard.
- Ask Mayor for permission to cut trees on north and west sides of the berm. This must be done early and is particularly important if crest may go higher than 20 feet.

Action Level for 18 Foot Predicted River Stage

- If not already taken, complete steps for the 16 foot level.
- Monitor plant effluent and engage booster pump if needed.
- Have carpenters build 3 sandbag filling stations.
- Call Safety Building Jail and request 12 trustees (or as many as available) for work assignment. Call in all yard staff to fill sandbags.
- Fill 3,500 sandbags and place on pallets near plant entrance (approximately 6 hours needed to complete task).
- Call in two extra workers per shift for duration of high water threat.

Action Level for 20 Foot Predicted River Stage

- If not already taken, complete steps for the 18 foot level.
- Move all construction equipment from yard with the exception of one front end loader and one forklift truck.
- Close entrance gap in berm. If necessary, use boats to get staff into work.
- Monitor Influent and effluent levels.
- Order an additional 10,000 sandbags for immediate delivery.

Action Level for 21 Foot Predicted River Stage

- If not already taken, complete steps for the 20 foot level.
- Build an additional 8 sandbag filling stations.
- Call Safety Building Jail for all available trustees and community service workers. Call in all yard staff. Call Rogers Temporary Services for extra help as needed. (Total staff required: 160 workers.)

- Fill and place 31,000 sandbags to add another foot to berm.
- Order an additional 52,000 sandbags for immediate delivery.

Action Level for 22 Foot Predicted River Stage

- If not already taken, complete steps for the 21 foot level.
- Build an additional 8 sandbag filling stations.
- Call Safety Building Jail for all available trustees and community service workers. Call in all yard staff. Call Rogers Temporary Services for extra help as needed. (Total staff required: 160 workers.)
- Fill and place 31,000 sandbags to add another foot to berm.
- Order an additional 52,000 sandbags for immediate delivery.

Action Level for 23 Foot Predicted River Stage

- If not already taken, complete steps for the 22 foot level.
- Build an additional 10 sandbag fillings stations.
- Call Safety Building Jail for all available trustees and community service workers. Call in all yard staff. Call Rogers Temporary Services for extra help as needed. (Total staff required: 260 workers).
- Fill 52,000 sandbags and place on berm for an added foot of protection.
- Begin public service announcements requesting reductions in water usage to reduce plant inflow.

Action Level for 26 Foot Predicted River Stage

- Place plant in full bypass mode. Notify State Water Resources Office and EPA of this action.
- Begin removal of plant electronic equipment and motors.
- Pump out underground fuel tanks.
- Remove chemical stocks and supplies.
- Abandon plant.

Group Activity: Volunteer Skills Matching

National VOAD Members Resource Directory

The following lists each National VOAD member organizations and the types of services provided during emergencies and disasters. This is not a guarantee of services nor does it list every possible service provided. Much is dependent upon the type of disaster, services provided by other coordinating nonprofits, and local resources.

Agency	Function
National Voluntary Organizations Active in Disaster	<ul style="list-style-type: none"> • Facilitates and encourage collaboration, communication, cooperation, and coordination, and builds relationships among members while groups plan and prepare for emergencies and disaster incidents. • Assists in communicating to the government and the public the services provided by its national member organizations. • Facilitates information sharing during planning, and preparedness, response, and recovery after a disaster incident. • Provides members with information pertaining to the severity of the disaster, needs identified, and actions of volunteers throughout the response, relief, and recovery process.
Adventist Community Services (ACS)	<ul style="list-style-type: none"> • Distributes relief items such as: drinking water, groceries, clothing and more. • Provides warehousing & other donation coordination services such as Points of Distribution centers (PODs). • Operates volunteer centers where community members can volunteer during disaster response. • Provides victims with Emotional & Spiritual counseling.
American Baptist Men/USA	<ul style="list-style-type: none"> • Provides cleanup, repair and initial rebuilding. Short-term volunteers work cooperatively with Church World Service. • Provides financial assistance to victims during both the relief & recovery stages. • Operates volunteer centers to serve as clearing houses for relief teams.

Agency	Function
<p>American Radio Relay League (ARRL) – Amateur Radio Emergency Services (ARES)</p>	<ul style="list-style-type: none"> • Operators setup and run organized communication networks locally for governmental and emergency officials, as well as non-commercial communication for private citizens affected by the disaster. They activate after disasters damage regular lines of communications due to power outages and destruction of telephone, cellular and other infrastructure-dependent systems. • ARRL volunteers act as communications volunteers with local public safety organizations. In addition, in some disasters, radio frequencies are not coordinated among relief officials and Amateur Radio operators step in to coordinate communication when radio towers and other elements in the communication infrastructure are damaged. • At the local level, Hams may participate in local emergency organizations, or organize local “traffic nets.”
<p>American Red Cross</p>	<ul style="list-style-type: none"> • Provides Mass Care operations such as: shelter, fixed and mobile feeding services for disaster victims and emergency workers in the affected area, and the distribution of supplies and commodities. • Provides emergency and preventive health services to people affected by disaster. • Provides individual assistance at service delivery sites and through outreach, by referral to government and/or voluntary agencies through distribution or financial assistance. • Provides services leading to reunification of family members in the affected area. • Performs damage assessments. • Provides emergency and preventive mental health services.

Agency	Function
Ananda Marga Universal Relief Team (AMURT)	<ul style="list-style-type: none"> Provides food and clothing, shelters, counseling; it also renders emergency medical services, sanitation, short-term case management.
Billy Graham Rapid Response Team	<ul style="list-style-type: none"> Provides emotional and spiritual care National database of more than 3,200 crisis trained chaplains and ministry volunteers
Brethren Disaster Ministries	<ul style="list-style-type: none"> Engages a network of volunteers to repair or rebuild homes for disaster survivors who lack sufficient resources to hire paid labor, focusing on vulnerable communities. Trained, skilled project leaders supervise volunteers. BDM cooperates with the local disaster recovery organization to enhance the long-term recovery of the community. Provides Maryland-based warehousing & distribution services through the Church of the Brethren's Material Resources center. Children's Disaster Services (CDS) alleviates disaster-related anxiety in children through specially trained and certified volunteers. Provides children a safe, secure and comforting environment in shelters and assistance centers. Offers specialized care for children experiencing grief and trauma. Educates parents and caregivers on how to help children cope.
Catholic Charities, USA	<ul style="list-style-type: none"> Provides assistance including direct financial assistance to communities in addressing the crisis and recovery needs of local families. Performs initial damage assessments. Provides ongoing and long-term recovery services for individuals and families, including temporary & permanent housing assistance for low income families, counseling programs for children and the elderly, and special counseling for disaster relief workers. Provides relief stage services including shelter and emergency food.
Christian Reformed World Relief Committee (CRWRC)	<ul style="list-style-type: none"> Fully equipped & trained Rapid Response teams for clean up, chain saw & mucking out Trained volunteer managers assist local community in the formation and operation of long term recovery organizations. Provides community wide Unmet needs assessments for long term recovery organizations Provide construction estimating services using skilled volunteers Provide accounting services for long term recovery and VOAD organizations using volunteer CPA's Provide skilled teams for long term housing repair and construction. Chaplaincy services Community Development consultants after the recovery.

Agency	Function
<p>Churches of Scientology Disaster Response</p>	<ul style="list-style-type: none"> • Emotional and Spiritual Care for survivors, responders and care-givers. • POD volunteers and management • Clean-up • Direct services to individuals – un-met needs • Volunteer coordination • On-site needs assessment and help • Volunteer assistance to other organizations – shelter management, other needs
<p>Church World Service</p>	<ul style="list-style-type: none"> • Provides advocacy services for survivors. • Provides case management for low income & marginalized groups. • Provides emotional and spiritual care as well as physical rebuilding programs. • Assists in long-term recovery of those in need. • Restores and build community relationships.
<p>City Team Ministries</p>	<ul style="list-style-type: none"> • Supports first responders during rescue phase. • Provides food, water & shelter during the relief phase. • Provides emotional & spiritual care and case management to assess the needs of victims. • Is committed to the effort of rebuilding homes and communities.
<p>Convoy of Hope</p>	<ul style="list-style-type: none"> • Facilitates relief efforts between churches and other organizations to help best serve the needs of survivors. With our fleet of trucks, 300,000 square foot warehouse, Mobile Command Center, and utilizing the first response P.O.D. (Points of Distribution) model, USDR has become an active and efficient disaster relief organization, providing resources and help to victims in the first days of a disaster.
<p>Episcopal Relief and Development</p>	<ul style="list-style-type: none"> • Sends immediate relief grants for such basics as food, water, medical assistance, and financial aid within the first 90 days following a disaster. • Provides on-going recovery activities through rehabilitation grants, which offer the means to rebuild, replant ruined crops, and counsel those in trauma. • Delivers relief kits and other emergency supplies and food to emergency shelters & camps. • Works primarily through Church World Service in providing its disaster-related services. • Does rebuilding for individual homes damaged during disasters. • Helps residents restore the social and economic fabric of their communities by providing economic and educational opportunities and improving access to legal services and home ownership. • Trains & equip local denominations to prepare for and respond to disasters that devastate their communities.

Agency	Function
<p>Feeding America</p>	<ul style="list-style-type: none"> • Collects, transports, warehouses, and distributes donated food and grocery products for other agencies involved in both feeding operations and distribution of relief supplies through its national network of food banks. • Processes food products collected in food drives by communities wishing to help another disaster-affected community. • Develops, certifies, and supports their food banks. • Positions frequently used emergency food products and personal care items in strategic locations and regularly cycles inventories to ensure usage by survivors immediately following a disaster • Serves as a liaison between the food banks and the donors. • Educates the public about the problems and solutions of hunger. • Specializes in disaster training for its network, and continually improves standard operating procedures that enable member food banks to develop seamless, coordinated approaches to delivering disaster assistance.
<p>Feed the Children</p>	<ul style="list-style-type: none"> • Provides help to survivors of natural disasters occurring in the United States and around the world. • Provides food, water, blankets, cleaning supplies or other relief supplies to individuals and families affected. • Through a subsidiary, picks up in-kind contributions from corporate warehouses and individual donors, to any of its six regional distribution centers for either bulk distribution or directly to individual relief boxes for families.
<p>Foundation of Hope – ACTS World Relief</p>	<p>ACTS is striving to be a NIMS (National Incident Management System) Compliant disaster response agency, able to respond within 24 hours of federally declared incidents, using its volunteer army of everyone. We have been most active in the Gulf Coast which is FEMA Region IV; but are now expanding our organization nationwide and internationally. We are proud of the services that we currently provide utilizing our fleet of trucks, forklifts, heavy equipment, refrigeration trailers, tents and support equipment for:</p> <ul style="list-style-type: none"> ○ Establishing Points of Distribution to rapidly and efficiently distribute goods within six hours of their arrival by common carrier. ○ Cooking and distributing hot meals with self-contained mobile disaster kitchens of various sizes and capacities. ○ Staging area or Base camp management at the request of State or Local Emergency Operation Centers. ○ Mobile Public Address Systems (mobile sound stages). ○ Debris removal and personal item recovery teams. ○ Registration and coordination of unaffiliated volunteers within the impacted area. Using mobile volunteer registration centers we are able to organize and form work teams to provide workforce resources to assist in recovery.

Agency	Function
<p>Habitat for Humanity International</p>	<ul style="list-style-type: none"> • Conducts community housing assessments for long-term recovery. • Works with partner families to build or rehabilitate simple, decent, and affordable homes after a disaster. • Offers construction and development technical assistance to communities. • Facilitates community involvement and support during the long-term recovery process. • Introduces alternative construction technologies (modular, panelized/SIP housing, etc) to communities to speed up the delivery of permanent housing solutions.
<p>HOPE Coalition America (Operation Hope)</p>	<ul style="list-style-type: none"> • Supports disaster survivors by assisting with budgeting and developing financial recovery plans: <ul style="list-style-type: none"> ○ Pre-disaster preparedness seminars ○ Emergency budget counseling ○ Emergency Credit Management ○ Assistance with working with creditors ○ Referrals to government and private agencies ○ Assistance with obtaining copies of destroyed financial documents ○ Insurance claim assistance
<p>HOPE worldwide, Ltd.</p>	<ul style="list-style-type: none"> • Changes lives by harnessing the compassion and commitment of dedicated staff and volunteers to deliver sustainable, high-impact, community-based services to the poor and needy • Partner with the American Red Cross to help prevent, prepare and respond to emergencies • Utilizing a large international volunteer base • Establishing centers on all six inhabited continents that are rooted in the community • Creating networks of people, organizations and governments that work together
<p>Humane Society of the United States</p>	<p>Provides assistance with animal rescue, handling and transport in a timely and humane way:</p> <ul style="list-style-type: none"> • Assessment of animal related needs. • Establishment & management of temporary emergency animal shelters. • Evacuation support. • Veterinary evaluation of animals. • Relocation and support of disaster affected animal facilities. • Transition of support to local resources during the recovery phase. • Donations & volunteer management including emergent volunteers. • Serves as resource for individuals, animal-related organizations, and others concerned about the urgent needs of animals before, during and after disasters.

Agency	Function
International Critical Incident Stress Foundation	Emotional and Spiritual Care: <ul style="list-style-type: none"> • Pre & post-incident training. • Risk & Crisis Communication. • Crisis planning & intervention with communities& organizations. • Spiritual assessment and care.
International Relief & Development	<ul style="list-style-type: none"> • Distributes food and critical relief supplies. • Helps communities develop effective social services through collaborative efforts to improve roads, renovate schools, rebuild utilities: water and sewage systems, and establish health facilities. • Collaborates with other organizations to provide shelter and necessary tools such as financial counseling to disaster victims. • Performs needs assessment and mapping.
Latter-Day Saint Charities	<ul style="list-style-type: none"> • Provides food and other emergency supplies & kits during response.
Lutheran Disaster Response	<ul style="list-style-type: none"> • Provides response efforts through a pre-selected group of Lutheran social service agencies with established standing in the affected communities. • Provides spiritual and emotional counseling for affected persons • Helps in coordinating volunteer teams for cleaning-up and rebuilding disaster affected homes. • Provides case management services for long-term recovery • Provides training and expertise on volunteer coordination, case management, long-term recovery, construction, and database management.
Mennonite Disaster Services	<ul style="list-style-type: none"> • Assists disaster victims by providing volunteer personnel to clean up and remove debris from damaged and destroyed homes and personal property. • Repairs or rebuilds under-insured primary residence homeowners with emphasis on assisting with the special needs of the vulnerable populations such as: elderly & people with disabilities.

Agency	Function
<p>Mercy Medical Airlift (Angel Flight)</p>	<p>Services of the Homeland Security Emergency Air Transportation System (HSEATS):</p> <ul style="list-style-type: none"> • Transport into disaster response areas of small high-priority non-hazardous cargo (including blood) up to 300-400 pounds (boxed) when commercial ground or air not available. • Aerial reconnaissance of disaster area. • Air transport of disaster response personnel and evacuees into/from/within disaster area when commercial ground or air not available. • Relocation of special populations including special "surge services" using commercial air ambulance services (by pre-arranged MOU only) • Coordination of available corporate jet aircraft for disaster response in cooperation with NBAA. • Management of large-scale airline provided relocation movements in support of FEMA, Red Cross, etc.
<p>National Association of Jewish Chaplains (NAJC)</p>	<p>Provides spiritual crisis counseling, short term pastoral care and long term pastoral counseling through its board certified chaplains and professionally trained chaplains.</p> <ul style="list-style-type: none"> • Provides education and training in disaster spiritual care. • Helps organize volunteer disaster chaplains, through its association with American Red Cross' Critical Response Team and other professional chaplaincy organizations, who wish to provide immediate disaster spiritual care services in the aftermath of disasters.
<p>National Baptist Convention USA</p>	<ul style="list-style-type: none"> • To lessen the impact of disasters and potential catastrophic incidents by meeting the needs of communities through preparedness and mitigation • Provides the following services: <ul style="list-style-type: none"> ○ Mass care ○ Emergency assistance and casework ○ Emotional and/or spiritual care ○ Supporting services to state and local VOAD member agencies ○ Recovery ○ Donations Management ○ Volunteer Management ○ Outreach and/or information and referral
<p>National Emergency Response Team (NERT)</p>	<ul style="list-style-type: none"> • Provides coordinated emergency services with federal, state and local government agencies and non-profit agencies. • Transports food and other disaster goods through trailer units. • Provides communication services through trailers equipped with ham radios, scanners etc. • Provides direct financial aid to victims. • Home repair services for special needs group (elderly).

Agency	Function
National Organization for Victim Assistance (NOVA)	<ul style="list-style-type: none"> • Provides social and mental health services for individuals and families, who experience major trauma after disaster, including: psychological first aid, crisis intervention, crime victim resources, crisis management consultation.
Nazarene Disaster Response (NDR)	<ul style="list-style-type: none"> • Provides clean-up and rebuilding assistance, especially to the elderly, persons with disabilities, the widowed, and those least able to help themselves. • Works in the recovery phase by assisting with the emotional needs of disaster victims.
Noah's Wish	<p>The mission of Noah's Wish is to save animals during disasters by providing:</p> <ul style="list-style-type: none"> ▪ Rapid deployment of disaster response teams ▪ Operation of temporary animal shelters ▪ Rescue and evacuation assistance ▪ Veterinary care for disaster related injuries or illness ▪ Short and long term foster care for animals ▪ Permanent placement for all unclaimed or surrendered animals ▪ Coordination and distribution of donated supplies and food
Operation Blessing	<ul style="list-style-type: none"> • Transports food and emergency supplies to disaster survivors. • Assists in disaster medical relief. • Provides direct financial assistance to victims.
Points of Light Institute/Hands On Network	<ul style="list-style-type: none"> • Creates innovative, actionable models for citizen-centered problem solving, and direct, tangible tools and opportunities for people and organizations to apply their interests and passions to make a difference. • Serves 83% of the American population and 12 international communities in nine countries through hundreds of affiliates — places where people can get connected, get involved and make change happen in their communities. • Focus on helping people plug into volunteer opportunities in their local community, helping non-profits manage volunteer resources and developing the leadership capacity of volunteers.
Presbyterian Disaster Assistance (PDA)	<ul style="list-style-type: none"> • Works primarily through Church World Service in providing volunteers to serve as disaster consultants. • Funding for local recovery projects that meet certain guidelines. • Provides trained volunteers who participate in the Cooperative Disaster Child Care program. • Provide volunteer labor and material assistance at the local level. • Supports volunteer base camps for volunteer groups assisting with the rebuilding efforts.

Agency	Function
REACT International	<ul style="list-style-type: none"> • Provides emergency communication facilities for other agencies through its national network of Citizen Band radio operators and volunteer teams.
The Salvation Army	<ul style="list-style-type: none"> • Provides emergency assistance including mass and mobile feeding, temporary shelter, counseling, missing person services, medical assistance. • Provides warehousing services including the distribution of donated goods including food, clothing, and household items. • Provides referrals to government and private agencies for special services. • Does individual & family counseling. • Recruits, trains, house, and transports volunteers. • Coordinates economic reconstruction efforts. • Provides financial assistance to victims through case management to include: housing needs, disaster related medical & funeral expenses. • Emotional & Spiritual care.
Samaritan's Purse	<ul style="list-style-type: none"> • Emotional and Spiritual Care. • Provides cleanup assistance. • Emergency home repairs.
Save the Children	<ul style="list-style-type: none"> • Provides disaster relief services for children in shelters including food, clothing, diapers, evacuation backpacks. • Also provides supervision in designated areas within shelters.
Society of St. Vincent De Paul	<ul style="list-style-type: none"> • Provides social services to individuals and families, and collects and distributes donated goods. • Makes store merchandise available to disaster victims. Operates retail stores, homeless shelters, and feeding facilities that are similar to those run by the Salvation Army. • Provides warehousing facilities for storing and sorting donated merchandise during the emergency period.
Southern Baptist Disaster Relief/North American Mission Board	<ul style="list-style-type: none"> • Provides mobile feeding units staffed by volunteers who prepare and distribute thousands of meals a day. • Provide disaster childcare – mobile units transport equipment and supplies to a facility where trained workers provide safe and secure care for children. • Provide units and trained volunteers to assist with clean-up activities, temporary repairs, reconstruction, chaplains, command/communication, and bilingual services. • Provide water purification, shower and laundry units and trained volunteers for disaster responses.
Tzu Chi Foundation	<ul style="list-style-type: none"> • Emotional and Spiritual Care. • Provides Medical and Financial assistance.

Agency	Function
United Church of Christ	<ul style="list-style-type: none"> • Coordinators help to organize volunteers for clean-up and rebuilding efforts; as well as participate in response and long term recovery efforts in communities affected by natural disasters.
United Jewish Communities (UJC)	<ul style="list-style-type: none"> • Organizes direct assistance, such as financial and social services, to Jewish and general communities in the U.S. following disaster. • Provides rebuilding services to neighborhoods and enters into long-term recovery partnerships with residents.
United Methodist Committee on Relief (UMCOR)	<ul style="list-style-type: none"> • Raises and distributes funds equitably to the most vulnerable populations in affected communities. • Provides case management services and related training for the long term recovery of victims. • Coordinates shipments of disaster relief supplies and kits, including cleanup supplies. • Provides spiritual and emotional care to disaster victims and long-term care of children impacted by disaster. • Offers training in support of volunteer activities in disaster recovery.
United Way of America	<ul style="list-style-type: none"> • Provides experience, expertise, and resources to local United Ways facing local, regional, state or national emergencies. • Gives direct grants to support disaster recovery, such as: home repairs, food vouchers, counseling. • Acts as a resource & information guide for survivors, through its 2-1-1 call centers.
World Hope International (WHI)	<ul style="list-style-type: none"> • WHI has worked in 5 national disasters within the last 3 years. • As an organization we have the ability to initiate a strong volunteer response to our work through the partnership of 1500 Wesleyan Churches and their membership located within the United States. • Our volunteers have donated thousands of hours of time and are highly skilled. • Our leaders coordinate well with churches and pastors in the disaster areas to establish distribution sites and housing facilities for volunteers. • Our volunteers are willing and ready to do clean up, gut houses or rebuild homes. • WHI also has relief kits and tool resources available for disaster response.

Agency	Function
World Vision	<ul style="list-style-type: none">• Trains and mobilizes community-based volunteers in major response and recovery activities.• Provides consultant services to local unaffiliated churches and Christian charities involved in locally-designed recovery projects.• Collects, manages, and organizes community based distribution for donated goods.

Appendix B: Glossary

Term	Definition
0.2% Flood Hazard	Also known as a 500-year event, the 0.2% flood hazard represents the statistic that a home located within the 0.2% floodplain has a 6% chance of being inundated by floodwaters over the life of a 30-year mortgage.
1% Flood Hazard	Also known as a 100-year event, the 1% flood hazard represents the statistic that a home located within the 1% floodplain has a 26% chance of being inundated by floodwaters over the life of a 30-year mortgage.
Air Patrols	Volunteers assigned to monitor levees and flood control structures from the air.
Backwater Flooding	Flooding caused by water “backing” into an unprotected area from rising major rivers.
Bank Full Stage	The river stage when the water is at the average natural ground elevation and some minor flooding of low lying areas can be expected.
Base Flood	A flood having a one-percent probability of being equaled or exceeded in any given year; also referred to as the 100-year flood.
Base Flood Elevation (BFE)	A level that is mapped using topographic data to produce a 1% floodplain.
Berm	A mound of earth shorter than a levee engineered to keep water out of a flood plain.
Boat Patrols	Volunteers assigned to monitor levees by boat.
Boil Field	A group of sand boils.
Bubble Gauge Station	A river gauge that uses a cylinder of compressed gas and a backpressure monitoring system to record water levels on a strip monitor and then feed the data to remote locations via radio or telephone lines.
Caps	Expedient flood works placed on top of levee systems and berms normally constructed to a height of two feet, plus or minus six inches, above the predicted flood crest.
CB	Citizen Band radio
CFS	Cubic Feet per Second. One cubic foot per second is equivalent to approximately 7.5 gallons per second.
Clean Sand Boils	A clean sand boil is a sand boil that lacks sand, dirt, and debris in the water flow. Clean sand boils should be reported and monitored, but no other action is required.
CPG	Civil Preparedness Guide

Term	Definition
Crown	The level area on top of the levee.
Cryptosporidium	Harmful protozoa present in floodwaters which can produce severe nausea, vomiting, and diarrhea in humans. Cryptosporidium, which is highly resistant to standard chlorine disinfection processes, may result in outbreaks fatal to persons with depressed immune systems.
Debris	Trees, pieces of houses and other structures, cars, and similar materials that act as battering rams and punch holes through flood works.
Dirty Sand Boils	A dirty sand boil is a sand boil where sand, dirt, and debris are present in the water flow.
Drainage Basin	An area of land where water from rain or snowmelt drains into a body of water.
Earthfill	A simple and relatively fast method of capping a levee using heavy equipment to add several feet of protection.
Earthfill Expedient Levee	A levee built in one-foot increments using cohesive materials such as clay where each layer is compacted before the next layer is placed down.
EAS	Emergency Alert System
Encroachment	Construction, placement of fill, or similar alteration of topography in the floodplain that reduces the area available to convey floodwaters.
EOC	Emergency Operating Center
FERC	Federal Energy Regulatory Commission
Final Report	A report capturing the key points of the response efforts which will become a part of the response record. The report should highlight common areas and suggestions to be reviewed as possible starting points for the plan revision and improvement.
Flashboard	A levee capping method where a board fence is built approximately two feet from the riverside edge of the levee crown and earthfill is used on the landward side to provide reinforcement against the hydrostatic load of the flood waters.
Flood Alert	A higher state of flood response readiness, but still short of a flood response.
Flood Boundary and Floodway Map	A floodplain management map issued by FEMA that depicts the boundaries of the 100-year and 500-year flood and the 100-year floodway.

Term	Definition
Flood Data	Information on the extent and exact nature of a flood including surveys, photographs and videos, invoices, legal documents, and information from private sources.
Flood Hazard Boundary	An initial insurance map issued by FEMA that identifies areas of 100-year flood hazards.
Flood Insurance Rate Map (FIRM)	A map published by FEMA showing the boundaries of certain high water events that is used to determine the actuarial rates that apply to structures within established flood zones.
Flood Stage	The river stage established by the National Weather Service when appreciable flood damages begin to occur in urban or agricultural areas.
Flood Warning	A warning issued by the National Weather Service when flooding conditions are expected.
Flood Watch	A watch issued by the National Weather Service when conditions are favorable for flooding.
Floodplain/Flood Hazard Area	A land area subject to inundation by water from a flooding source.
Floodway	The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.
Floodway Maps	Maps that document the expected flood boundaries based on 1% (100-year) and 0.2% (500-year) high water events for rivers and streams and display roads, elevation reference points, and major water control structures.
Foot Patrols	Volunteers of three person teams assigned to monitor one or two mile sections of the levee on foot.
Freeboard	The amount of protection provided by a flood works above the designated crest height of a flood.
Gage Reading	The reading of the actual water height at a gaging station.
GPS	Global Positioning Systems
HAZMAT	Hazardous Materials
Headwater Flooding	Flooding caused by an unusually heavy rainfall that is unable to run off fast enough.
HESCO Bastion Concertainer	A structural system of linked baskets containing fill material that can be used to construct expedient levees in open areas or to add height to existing levees.
Highway and Road System Maps	Maps used to plot road systems affected by flooding and indicate access routes to water control structures, secure evacuation routes, and supply routes.

Term	Definition
Jersey Barriers	An expedient levee type where concrete barriers are set side-by-side on a level surface, staggering the joints between the two rows. Tamped earth is used to fill the space between the rows, and to provide the mass that is needed to withstand the pressure of the flood waters.
Left River Bank	A term used for describing a location when facing downstream.
LEPC	Local Emergency Planning Committee
Levee	A man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices, to contain, control, or divert the flow of water so as to provide protection from temporary flooding.
Levee and Water Control System Maps	Highly detailed maps that provide excellent information on rivers and waterways as well as: <ul style="list-style-type: none"> • Location and type of access roads • Elevation markers • Sewer outfall locations • Conduit and utility crossings • Railroad gap placements • Information on flood gates and barriers
LPG	Liquefied Petroleum Gas
MSL	Mean Sea Level
Mudboxes	A levee capping method that involves constructing a wooden box near the river edge of the levee crown and filling the box with tamped earth or clay fill.
National Flood Insurance Program (NFIP)	A federally regulated program under which flood-prone areas are identified and insurance is made available to residents of participating communities.
National Geodetic Vertical Datum (NGVD)	Refers to elevations above mean sea level (MSL).
NVOAD	National Voluntary Organizations Active in Disaster
NWS	National Weather Service
Portadam System	A steel framework supporting a vinyl liner which acts as a dam to prevent floodwater damage inside the area protected by the structure.
Rapid Deployment Flood Wall (RDFW)	A collapsible plastic sand grid system that is filled with a loader or other piece of earth-moving equipment.
Responsible Local Official	County judge, levee board president, mayor, state, county, city, or emergency service official, etc.

Term	Definition
Right River Bank	A term used for describing a location when facing downstream.
River Channel	A natural or artificial watercourse that has a definite bed and banks to confine and direct the water flow.
Sand Boils	The result of water under pressure finding a path under the flood works, usually through a sand lens, and resurfacing behind the protective device.
Sandbag Expedient Levee	A method of capping a levee using sandbags.
SATERN	Salvation Army Team Emergency Radio Network
Sewer and Utility Maps	Maps that provide information on gas, water, and petroleum pipeline crossings, locations of all sewer outfalls and their piping patterns, and the locations of vital facilities, such as transformer stations and water treatment facilities that may require special protection during high water events.
Topographic Maps	Commonly called “topos,” these maps produced by the USGS display information on river channels and elevations which can be used to determine and plot areas of inundation and provide accurate information that is critical when determining flood risks and planning a flood response.
United States Geological Survey (USGS)	An organization that maintains a system of river monitoring stations throughout the nation.
Wave Action	Waves that overtop the structures and erode significant quantities of soil and fill flushing away the mass of the structure and reducing the hydrostatic pressure which can lead to the failure of the flood control device.
Wire-Weight Gauge	A river gauge that uses a weight cylinder touching the surface of the water that is read using the markings on the wire drum inside the housing box.
Zero Gauge	A number that must be added to a gauge reading to obtain the height of the gauge above Mean Sea Level.
Zoning and Plat Grids	Grids that define the land use around river systems and can be used to set priorities for expedient flood protection based upon community policies.

Appendix C: Resources

Flood Planning and Response Resources

- Association of State Floodplain Managers
www.floods.org
- FEMA Are You Ready? (Floods)
<http://www.fema.gov/areyouready/flood.shtm>
- FEMA's Comprehensive Preparedness Guide (CPG) 101
www.fema.gov/about/divisions/cpg.shtm
- National Flood Insurance Program
<http://www.floodsmart.gov>
- National Weather Service – Flood Brochures
<http://www.weather.gov/om/brochures.shtml#floods>
- U.S. Army Corps of Engineers Emergency Reference Library
http://www.nww.usace.army.mil/html/offices/op/em/EM_library.htm
- U.S. Army Corps of Engineers Flood Risk Management
<http://www.usace.army.mil/CECW/PlanningCOP/Pages/flood.aspx>
- U.S. Geological Survey (USGS) Water Resources
<http://water.usgs.gov/a-z/>

Advanced Flood Response Products

- HESCO Bastion Concertainer®
<http://www.hesco-usa.com>
- Rapid Deployment Flood Wall (RDFW®)
<http://www.geocellsystems.com>
- Portadam® System
<http://www.portadam.com>

Recovery Resources

- FEMA Community Assistance Programs
<http://www.fema.gov/government/recovery.shtm>
- National Voluntary Organizations Active in Disaster
<http://www.nvoad.org>

Acknowledgements

- Cost of Hurricane Katrina
<http://www.usgs.gov/hazards/floods/>
- U.S. Army Corps of Engineers Research
<http://chl.ercd.usace.army.mil/ffs>
- U.S. Flood Statistics
<http://pubs.usgs.gov/fs/2006/3026/2006-3026.pdf>

The following materials provided information for the development of the original 1996 version of the course:

- *Field Practices and Construction Methods for a Flood Emergency*, US Army Corps of Engineers, Chicago District, Chicago, IL.
- *Flood Emergency Handbook*, DP500-2-1, US Army Corps of Engineers, Vicksburg District, Vicksburg, MS., 1994
- *Flood Hazard Mitigation Handbook*, Michigan Department of Natural Resources, Lansing, MI., 1988
- *Flood Hydrology Manual*, Bureau of Land Reclamation, U.S. Department of Interior, Denver, CO., 1992.
- *Floodproofing Non-Residential Structures*, FEMA 102, Federal Emergency Management Agency, Washington, DC., 1986.
- *Guide to Flood Insurance Rate Maps*, FIA-14, Federal Emergency Management Agency, Washington, DC., 1988.
- Jensen, Peter R., *Expedient Flood Training-IG 270.3*, ISBN 0-9630429-4-7, Federal Emergency Management Agency, Washington, DC., 1994.
- Kiley, Martin D., 1996 *National Construction Estimator, 44th Edition*, ISBN 1-57218-017-X, Craftsman Book Company, Carlsbad, CA., 1995.
- *Recommended Field Practices and Construction Methods for Flood Fighting*, NCS 500-1-1, US Army Corps of Engineers, St. Paul District, St. Paul, MN., 1982.
- Turk, George F. and Victor H. Torrey III, *Upper Mississippi River Basin Flood of 1993 Flood Fight Reconnaissance and Survey of Expedient Methods Employed*, Waterways Experiment Station, U.S. Army Corps of Engineers, Vicksburg, MS., 1993.

The following individuals provided expertise and assistance for the 2011 revision of this course:

- Andy Traffanstedt, Pulaski County, AR
- Bill Irwin, U.S. Army Corps of Engineers
- John Burton, Pulaski County, AR
- Kary Cox, Washington County, OK
- Lizbeth Miller, U.S. Army Corps of Engineers
- Mark Clark, U.S. Army Corps of Engineers
- Michelle Shafer, U.S. Army Corps of Engineers
- Mitch Antle, Washington County, OK
- Pete Navesky, U.S. Army Corps of Engineers
- Sherman Smith, Pulaski County, AR
- Steve Palladino, State of Oklahoma

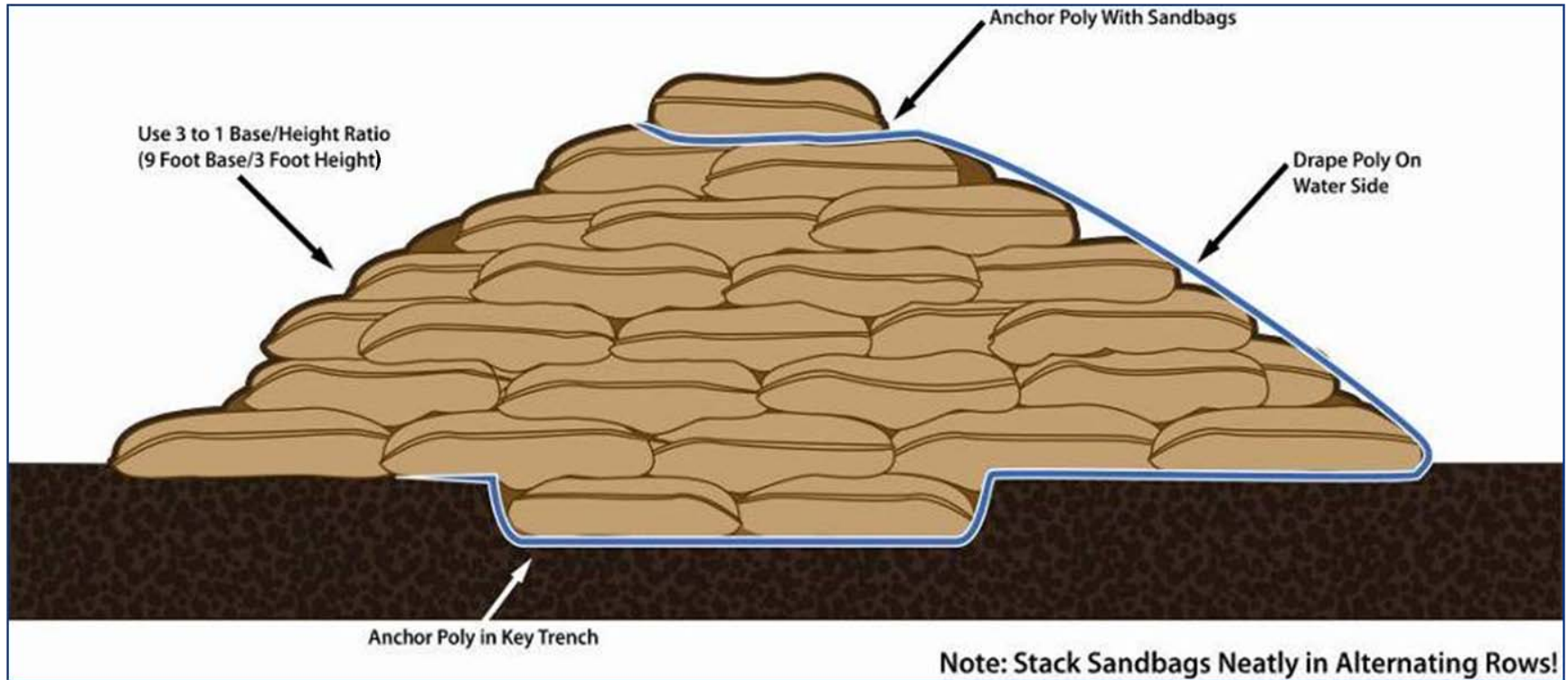
Appendix D: **Construction Plans and Diagrams**

This appendix contains the following information:

- Sandbag Levee
 - Construction Diagram
 - Materials List
- Filling Station
 - Construction Diagram
 - Materials List
- Two Board Type Flashboard Cap
 - Construction Diagram
 - Materials List
- Three Board Type Flashboard Cap
 - Construction Diagram
 - Materials List
- Mudbox Cap
 - Construction Diagram
 - Materials List
- Jersey Barrier Flood Works
 - Construction Diagram
 - Materials List

For information about advanced methods of flood response, please see the Resources list in Appendix C.

Sandbag Levee



3 Foot Sandbag Expedient Levee

Approx. Construction Time: 4 Hours

Materials for 1,000 Linear Feet:

50,000 Sandbags

840 Tons Sand (wet weight)

1000 L.F. 20 ft. wide, 6 mil Poly

63 Sandbag Filling Stations

Personnel & Equipment:

Personnel:

- 1 Foreman (Sector Leader)
- 6 Team Leaders
- 500 Workers*

*Assumes 50 ft. Max. Gang Line

Tools and Equipment:

- 144 Shovels

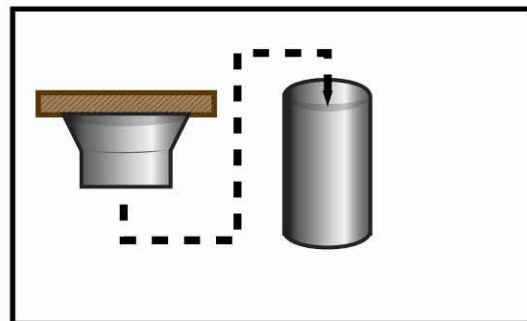
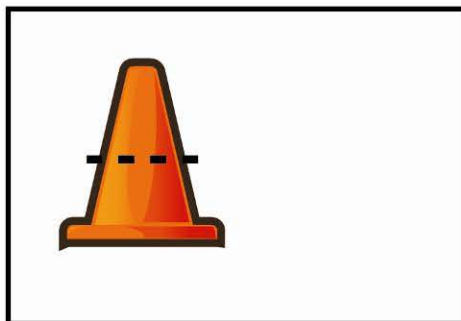
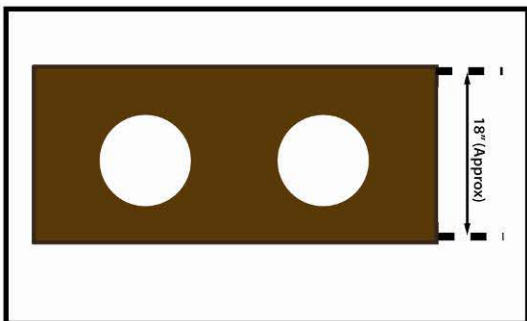
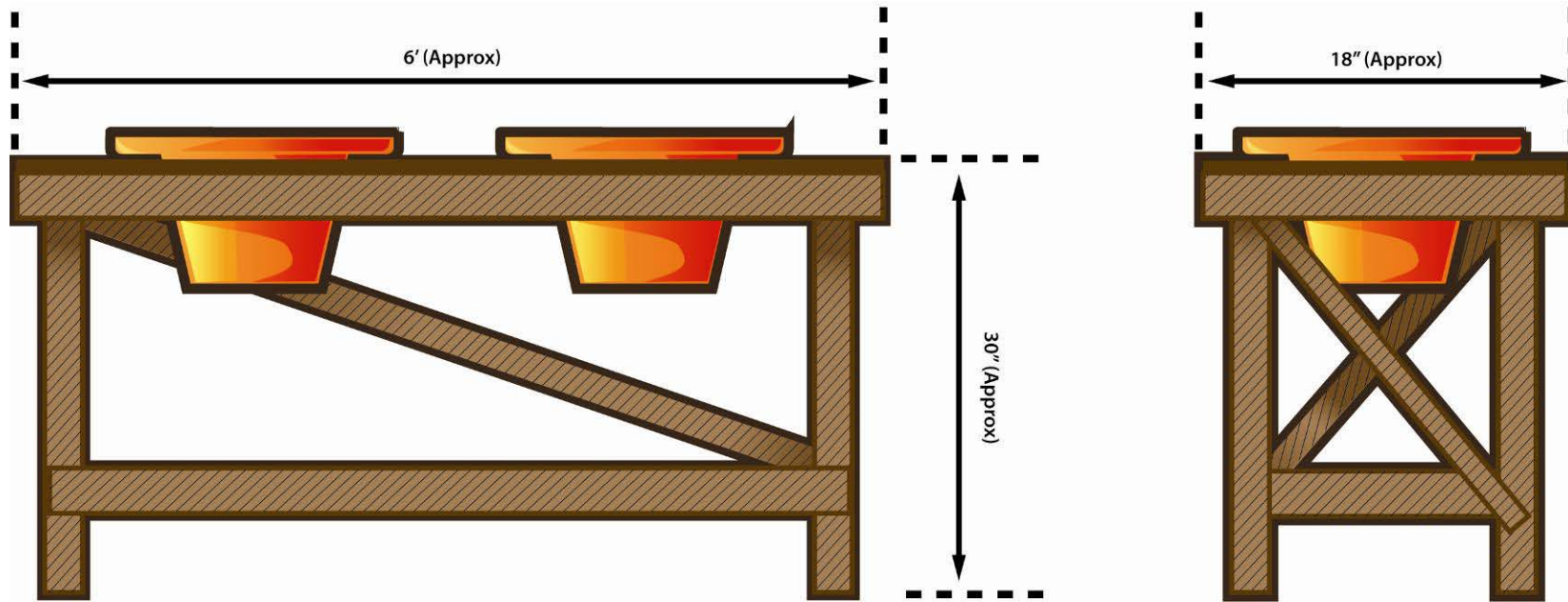
Lighting Equipment as Needed

Optional Equipment:

- 125 Pallets**
- 6 Fork Lift Trucks
- 1 Front End Loader (Sand Moving Equipment)
- 1 18" Backhoe (For Key Trench)
- Pallet Transport Vehicles

**Assumes 4 Trips/Hour

Filling Station



2 Cone Sandbag Filling Station

Approx. Construction Time: 1.75 Hours

Materials Per Station:

2 - 1" x 3" x 8' Boards

2 - 4" x 4" x 8' Lumber

5 - 2" x 4" x 8' Lumber

1 - Sheet 1/2" Plyscore Board or 7/8" Wafer Board

2 - Traffic Cones

Hardware:

8d, 16d, 20d Nails

4 1/2" Lag Screws

Personnel & Equipment:

Personnel:

2 Carpenters

Tools and Equipment:

1 Saw

2 Hammers

1 Drill & Bits

1 Wrench Set

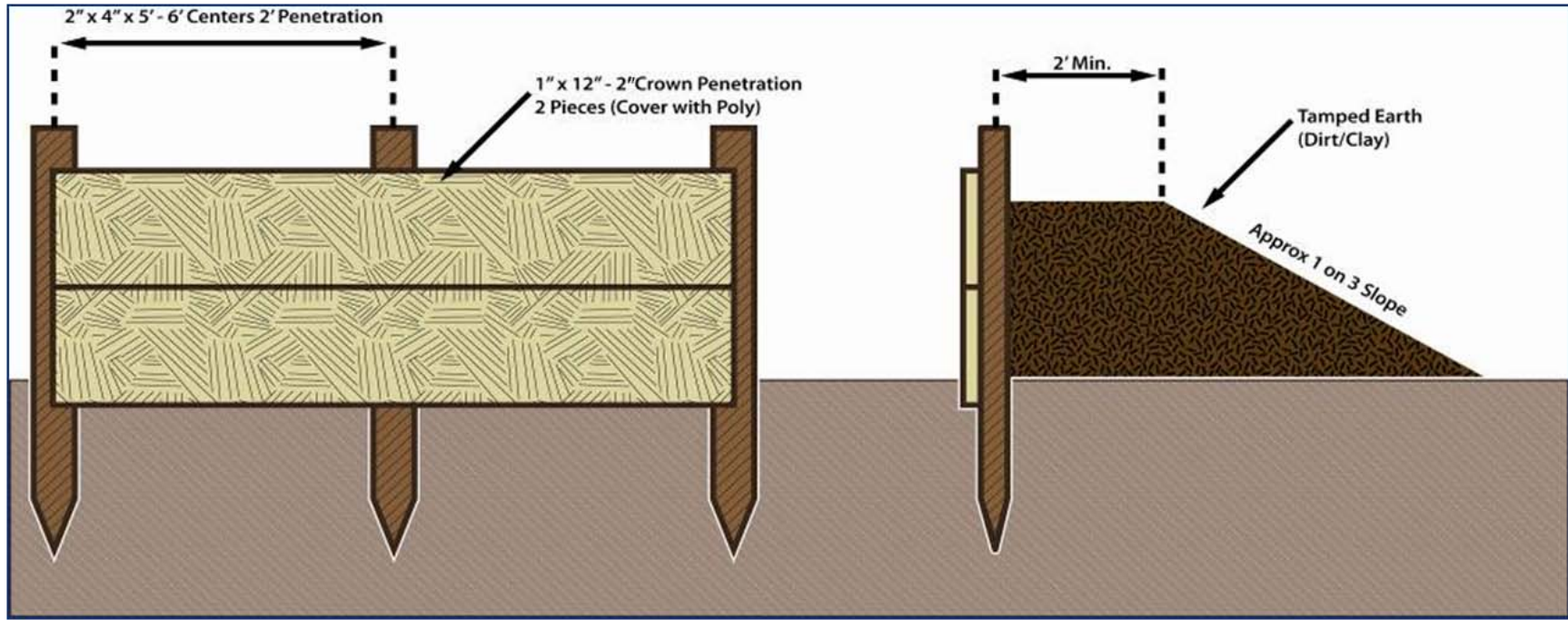
1 Square

1 Measuring Set

Lighting Equipment as Needed

Note: Capacity of Sandbag Station is 200 Bags/Hour with a Filling Crew of 6 Workers.

Two Board Type Flashboard Cap



Two Board Flashboard Cap

Approx. Construction Time: 4 Hours

Materials for 1000 Linear Feet:

168 each 2" x 4" x 5' Posts

2000 L.F. 1" x 12" Boards

50 Lbs. 20d Common Nails

1000 L.F. 2.5 ft., 6 mil Poly

400 cu. yds. Clay Earthfill

Personnel & Equipment:*

Personnel:

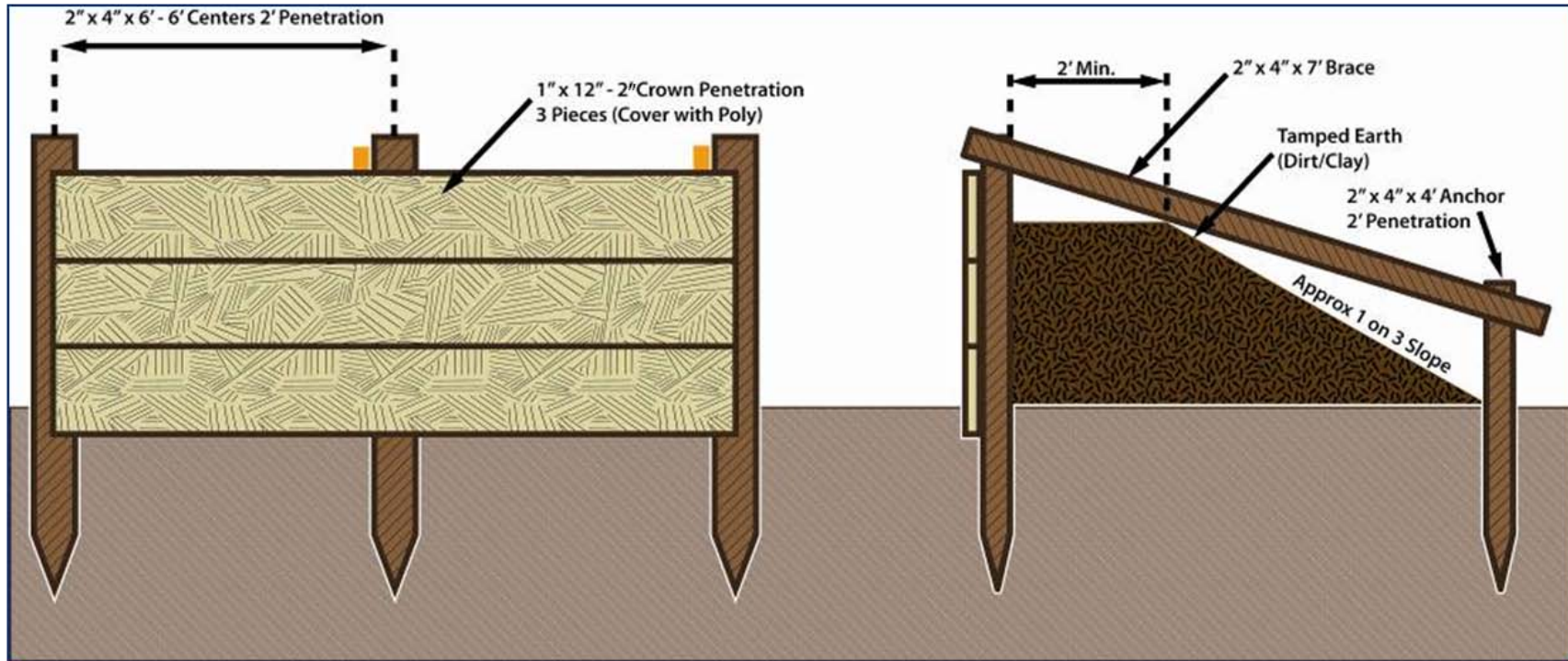
- 1 Foreman (Sector Leader)
- 6 Team Leaders
- 116 Workers

Tools and Equipment:

- 4 Axes
- 6 Claw Hammers
- 4 Mauls (Post)
- 110 Shovels
- 100 Wheelbarrows
- 1 Chain saw w/5 gal Fuel, Oil,
Spare Chain
- 2 Saws (Crosscut - Hand)
- 1 Plow
- Lighting Equipment as Needed

*For use where earthmoving equipment cannot be used.

Three Board Type Flashboard Cap



Three Board Flashboard Cap

Approx. Construction Time: 4 Hours

Materials for 1000 Linear Feet:

168 each 2" x 4" x 6' Posts

168 each 2' x 4"x 4' Anchor Posts

168 each 2" x 4" x 7' Braces

3000 L.F. 1" x 12" Boards

30 lbs. 8d Common Nails

60 lbs. 20d Common Nails

1000 L.F. 3.5 ft., 6 mil Poly

575 cu. yds. Clay Earthfill

Personnel & Equipment:*

Personnel:

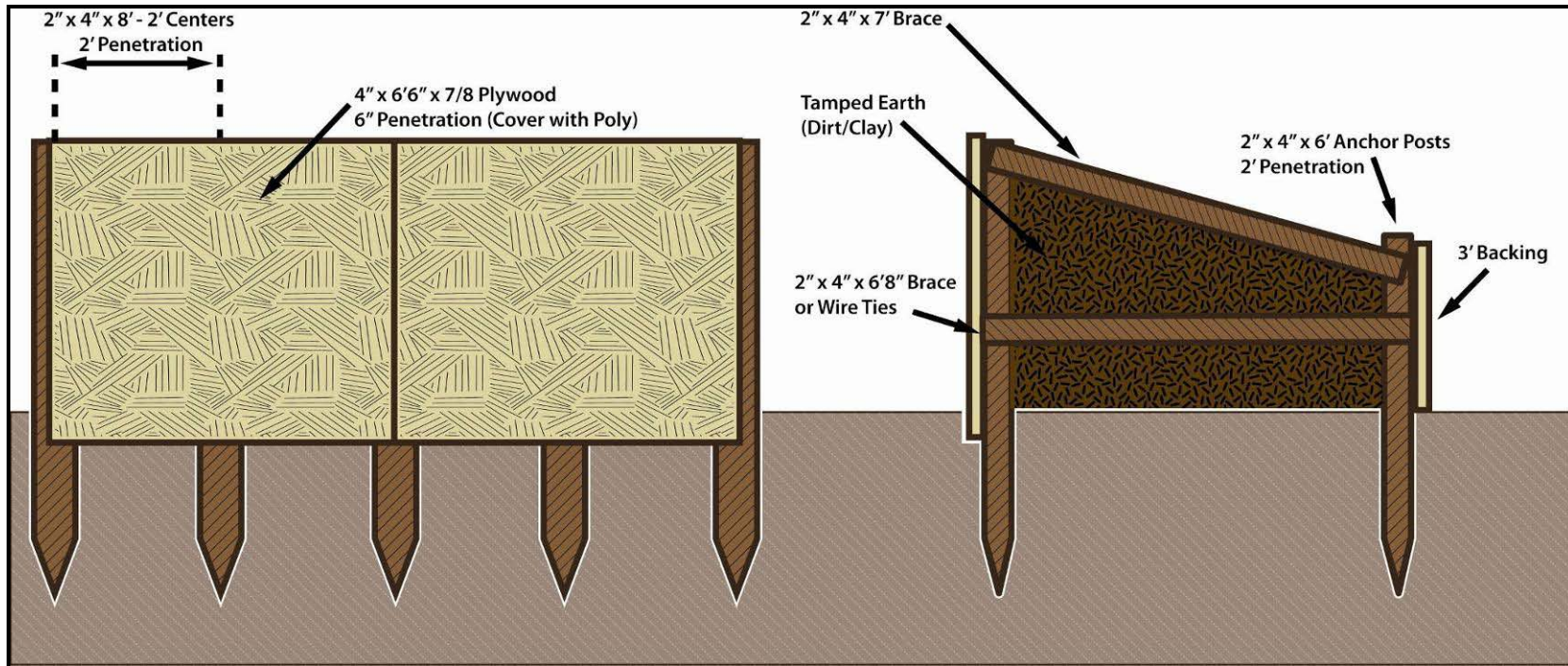
- 1 Foreman (Sector Leader)
- 6 Team Leaders
- 190 Workers

Tools and Equipment:

- 4 Axes
 - 6 Claw Hammers
 - 4 Mauls (Post)
 - 175 Shovels
 - 165 Wheelbarrows
 - 1 Chain saw w/5 gal Fuel, Oil,
Spare Chain
 - 2 Saws (Crosscut - Hand)
 - 1 Plow
- Lighting Equipment as Needed

*For use where earthmoving equipment cannot be used.

Mudbox Cap



Mudbox Cap

Approx. Construction Time: 4 Hours

Materials for 1000 Linear Feet:

- 500 each 2" x 4" x 8' Posts
- 500 each 2' x 4" x 6' Anchor Posts
- 500 each 2" x 4" x 7' Braces
- 500 each 2" x 4" x 6'8" Braces
- 312 sheets 7'18" Plywood
- 437 lbs. 10d Common Nails
- 375 lbs. 16d Common Nails
- 1000 L.F. 8 ft., 6 mil Poly
- 925 cu. yds. Clay Earthfill

Personnel & Equipment:*

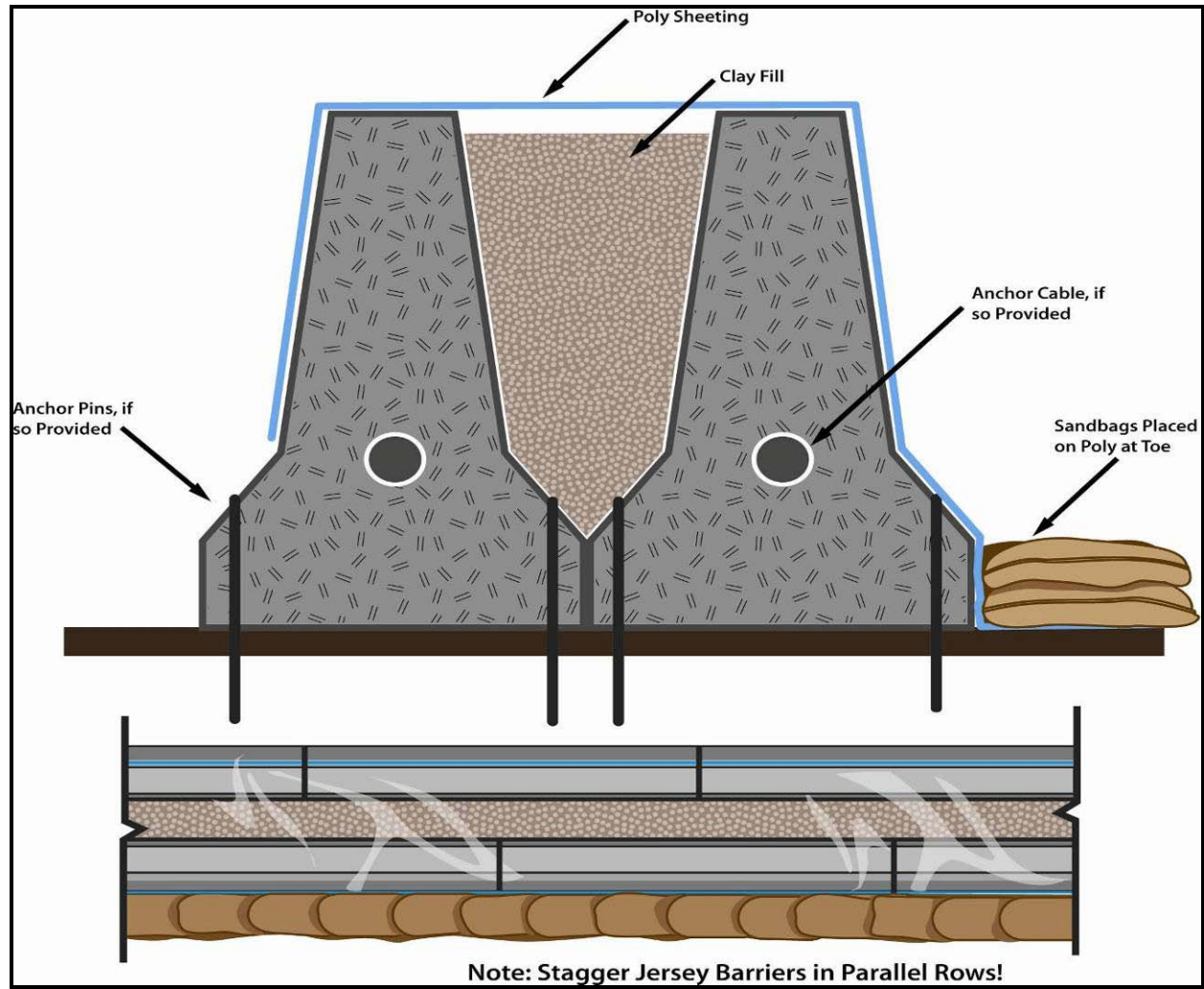
Personnel:

- 1 Foreman (Sector Leader)
- 6 Team Leaders
- 225 Workers

Tools and Equipment:

- 5 Axes
- 12 Claw Hammers
- 8 Mauls (Post)
- 200 Shovels
- 180 Wheelbarrows
- 1 Chain saw w/5 gal Fuel, Oil, Spare Chain
- 6 Saws (Crosscut - Hand)
- 1 Plow
- Lighting Equipment as Needed
- ⊘ For use where earthmoving equipment cannot be used.

Jersey Barrier Flood Works



Jersey Barriers

Approx. Construction Time: 5 Hours

IMPORTANT NOTICE: Time and equipment needs can vary greatly with this method. Factors to consider include travel distance, type of barrier used (i.e., pin anchors vs. cable system) and type of placement equipment used at the destination. The information presented below should be used only as a rough guide.

Materials Per 1,000 Linear Feet:

- 200 - 10' Long Jersey Barriers
- 400 - Anchor Pins (if required)
- 200 - Connector Pins (if required)
- 2,010 - ft. Connector Cable (if required)
- 145 - cu. yds. fill
- 1,000 L.F. 8 ft., 6 mil Poly
- 4,000 Sandbags
- 65 Tons Sand for Above (wet weight)

Personnel & Equipment:

Personnel:

- 1 Foreman (Sector Leader)
- 3 Team Leaders
- 30 Workers*

*Number is highly variable depending on deployment system.

Tools and Equipment:**

- 2 Transport/Placement Trucks
- 1 Front End Loader
- 2 Mechanical Tampers w/5 gal. Fuel, Oil, Etc.
- 1 Drill/Pin Driver (if required)
- 1 Cable Puller (if required)

**Equipment needs will vary depending on type of barrier and deployment system.

Appendix E: **Job Aids**

The following documents are included in this appendix:

- Planning and Coordination: The Phased Response System
- Selection of Flood Response Methods
- Sample Planning Resource Checklist
- Weights and Measures
- Conversion Factors

Planning and Coordination Job Aid

Answer the following questions to help your community prepare to use a phased response system.

Phase One: Increased Readiness

1. Create a plan for training key personnel. Be sure to answer such questions as:

What topics will the training discuss?

Who will give the training?

Where will the training be held?

How long will the training session be?

Who will take the training?

What supplies will be needed to conduct the training?

2. Create a plan for performing operations checks on equipment and inspecting waterways and drainage channels. Be sure to answer such questions as:

Who will check the equipment?

Who will check the waterways and drainage channels?

What will they need to check?

How will they check it?

3. Create a plan for performing public awareness outreach functions. Be sure to answer such questions as:

What outlets can be utilized to get the message to the public?

Where could items like posters and fliers be placed to get the most exposure?

Phase Two: Flood Alert

1. Create a plan for establishing and renewing partners. Be sure to answer such questions as:

Who will you contact?

What method will you use to contact them?

What will you say when you contact them?

2. Create a plan for performing equipment checks. Be sure to answer such questions as:

Who will check the equipment?

What will they need to check?

How will they check it?

3. Create a plan for evacuation procedures. Be sure to answer such questions as:

What evacuation routes will be used?

What will be the time frame for evacuating?

Where will the evacuees be evacuated to?

4. Create a plan for sheltering procedures. Be sure to answer such questions as:

What areas are available for use as shelters?

Who will establish and run the shelters?

What supplies will be needed at the shelters?

How many people will each shelter hold?

Will the shelters have kitchen facilities?

Will the shelters have showering facilities?

Phase Three: Limited Response**1. Create a plan for training personnel. Be sure to answer such questions as:**

What topics the training will discuss?

Who will give the training?

Where will the training be held?

How long will the training session be?

Who will take the training?

What supplies will be needed to conduct the training?

2. Create a plan for performing public awareness outreach functions. Be sure to answer such questions as:

What outlets can be utilized to get the message to the public?

Where could items like posters and fliers be placed to get the most exposure?

3. Create a plan for sheltering procedures. Be sure to answer such questions as:

What areas are available for use as shelters?

Who will establish and run the shelters?

What supplies will be needed at the shelters?

How many people will each shelter hold?

Will the shelters have kitchen facilities?

Will the shelters have showering facilities?

4. Create a plan for establishing volunteer sites. Be sure to answer such questions as:

What areas are available for use as volunteer headquarters?

Who will establish and run the volunteer headquarters?

What supplies will be needed at the volunteer headquarters?

Phase Four: Full Response

1. Create a plan for full response. Be sure to answer such questions as:

How much time is left before the river is expected to crest?

What is the expected height of the river crest?

What is the expected duration of the crest?

Selection of Flood Response Methods

Flood Characteristics	Sand bags	Expedient Levee	Flashboard	Mudbox	Jersey Barrier
<u>Flood Depth</u>					
- Less than 3 feet	Yes	Yes	Yes	Yes	Yes
- 3-6 feet	Maybe	Yes	No	Maybe	Maybe
Greater than 6 feet	No	Maybe	No	No	No
<u>Velocity</u>					
- Less than 5 fps	Yes	Yes	Yes	Yes	Yes
- Greater than 5 fps	Maybe	Maybe	No	Maybe	Maybe
<u>Flood Warning Time</u>					
- Minutes	No	No	No	No	No
- Hours	Maybe	Maybe	No	No	Maybe
- Days	Yes	Yes	Yes	Yes	Yes
<u>Duration of Flood</u>					
- Hours	Yes	Yes	Yes	Yes	Yes
- Days	Yes	Yes	Maybe	Maybe	Yes
- Weeks	Maybe	Maybe	No	No	Yes
<u>Locations</u>					
- Severe Waves	No	No	No	No	Maybe
- Limited R-0-W	Maybe	No	Maybe	Maybe	No
<u>Resources</u>					
- Heavy Equipment	Some	Must	Suggested	Suggested	Must
- Personnel	Very Many	Moderate	Many	Many	Moderate
- Clay Soils	No	Yes	Best	Best	Suggested
- Sand	Yes	No	Maybe	Maybe	Maybe
- Lumber	No	No	Yes	Yes	No

Sample Planning Resource Checklist

Maps and Charts

- _____ Topographic Charts Source(s): _____
- _____ Highway/Road Systems Source(s): _____
- _____ Levee/Water Control Systems Source(s): _____
- _____ Sewer/Utility Systems Source(s): _____
- _____ Zoning/Plat Grids Source(s): _____
- _____ Historic Flood Plots Source(s): _____
- _____ Flood Insurance Maps Source(s): _____
- _____ Other: _____ Source(s): _____

After Action Reports/Hazards Analysis

- _____ Historic Flood Information Source(s): _____
- _____ After Action Reports Source(s): _____
- _____ Flood Studies Source(s): _____
- _____ Hazard Analysis Source(s): _____
- _____ Flood Mitigation Plans Source(s): _____

Existing Flood Plans/Resource Documents

- _____ Local/Agency Flood Plans Source(s): _____
- _____ Regional Flood Plans Source(s): _____
- _____ State Flood Plans Source(s): _____
- _____ Planning Guides/References Source(s): _____

Weather and Warning Systems

- _____ Public Forecast Information Source(s): _____
- _____ Private Forecast Services Source(s): _____
- _____ Warning Systems Source(s): _____

Critical Facilities and Elevations

- _____ Government Buildings Source(s): _____
- _____ Utility Structures & Facilities Source(s): _____
- _____ Hospitals/Medical Providers Source(s): _____
- _____ Congregate Care Centers Source(s): _____
- _____ Schools & Day Care Centers Source(s): _____

Resources and Staging Areas

- _____ Borrow Areas Source(s): _____
- _____ Sand & Gravel Source(s): _____
- _____ Sandbags, poly & lumber Source(s): _____
- _____ Heavy Equipment Source(s): _____
- _____ Pumps Source(s): _____
- _____ Misc. Tool & Supplies Source(s): _____
- _____ Landfills and Disposal Sites Source(s): _____

Weights & Measures

Material	Lbs./Cu. Yd.	Lbs./Cu. Yd.	Swell	< of Repose
Clay, dry excavated	68	1836	33%	25-35°
Clay, wet excavated	114	3078	33%	30-45°
Earth, dry loam excavated	78	2106	25%	30-45°
Earth, moist excavated	90	2430	24%	30-45°
Earth, wet excavated	100	2700	23%	30-45°
Earth, soft loose mud	108	2916	21%	30-45°
Gravel 1/2 to 2 inches	104	2800	12%	30-45°
Gravel w/sand (pit run)	120	3240	12%	30-45°
Hay, compressed	24	648		
Salt, road	50	1350		30-45°
Manure	25	675		
Sand, dry	100	2700	13%	30-40°
Sand, damp	110	2970	12%	35-45°
Sand, wet	120	3240	11%	40-45°
Stone, crushed	100	2700	12%	30-45°
Water, clear	62.5	1687.5		
Water, muddy	72	1944		

Stockpile Volume in Cubic Feet

$0.2618 \times D^2 \times h$ where:

D = Diameter of pile cone base in feet

h = Height of pile cone in feet

Conversion Factors

To Convert	To	Multiply by
Acres	Square Feet	43560
Acres	Square Yards	4840
Acre Feet	Cubic Feet	43560
Acre Feet	Gallons	2.296×10^5
Cubic Feet	Cubic Yards	0.03704
Cubic Feet	Acre Feet	2.293×10^5
Cubic Feet	Gallons	7.481
Cubic Feet/Hour	Acre Feet/Hour	0.00138
Cubic Feet/Minute	Gallons/Minute	7.481
Cubic Feet/Second	Million Gallons/Day	0.64632
Cubic Yards	Cubic Feet	27
Cubic Yards	Gallons	201.974
Cubic Yards/Minute	Cubic Feet/Second	0.45
Cubic Yards/Minute	Gallons/Second	3.3662
Feet	Miles (Statute)	0.000189
Feet	Miles (Nautical)	0.000165
Feet	Yards	.333333
Gallons	Cubic Feet	0.13368
Gallons	Acre Feet	3.0689×10^{-6}
Gallons	Cubic Yards	0.00495
Gallons/Second	Cubic Yards/Minute	8.0208

To Convert	To	Multiply by
Million Gallons/Day	Cubic Feet/Second	1.547
Miles (Statute)	Feet	5280
Miles (Nautical)	Feet	6076
Mils	Inches	0.001
Pounds (avdp)	Tons (Short)	0.0005
Square Feet	Acres	2.2957×10^{-5}
Square Feet	Square Yards	0.1111
Square Yards	Square Mile	3.228×10^{-7}
Square Yards	Acres	0.000207
Square Yards	Square Feet	9
Tons (Short)	Pounds (avdp)	2000

