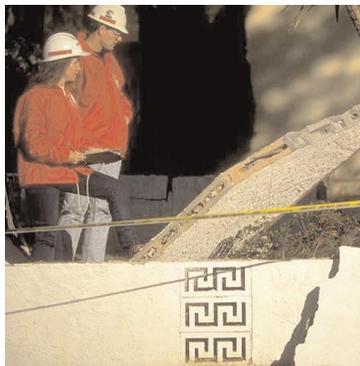


# ASSESSMENT

## Hazard Identification and Hazard Vulnerability

The first task of the *Disaster Resistant Community Planning Committee* is to examine the community's risks for natural disasters and to identify its vulnerabilities to those risks. This will provide a solid background on which to build mitigation priorities.



# CASE STUDY

DES MOINES, IA



## Risk Assessment: The Guiding Light

If you could invest \$14 million in your community to save \$300-400 million, you would do it, wouldn't you? No, it is not a trick question. It is the financial basis for the reason communities need to identify the risks that they face.

During the 1993 Midwest Floods, the City of Des Moines, Iowa, suffered extensive damage to the Des Moines Water Works after floodwaters entered the facility. Because the treatment plant and associated equipment were under floodwater, the plant could not operate. More than 250,000 customers were without water service for 11 days.

More important, the business community was devastated. Although only a small percentage of the businesses in Des Moines reported closing due to direct flood damages, more than 40 percent of them were closed for some period of time due to the lack of water service. Even businesses that did not rely on water for production or operation were forced to close for health, sanitation, and fire safety reasons. A large percentage of area businesses remained closed until water service was restored. This resulted in a reduction of staff productivity and product inventory, as well as a loss of sales revenue. In addition, tax revenue was lost and the workforce suffered depressed wages.

In all, the damage incurred cost \$14 million to repair while business losses in the Des Moines were estimated at between \$300-400 million—a staggering comparison.

Since 1993, Des Moines wisely moved forward. The Des Moines Water Works has taken action to increase the reliability of the area's water service during a natural hazard event. The emergency protection measures that will provide a consistent water supply for their expanding customer base involve a two-step approach: the construction of a second, smaller treatment facility at another location and the use of aquifer storage. The second treatment facility will meet growing water demands and provide a limited back-up to the main plant if flooding should occur.

The experience of the City of Des Moines during the floods of 1993 illustrates how utility-related or lifeline disaster costs often stretch well beyond physical damage. Communities need to implement mitigation measures to protect the lifeline services that are critical to businesses and other functions of the community.

Communities face many decisions about the allocation of resources. These decisions are by no means easy. However, identifying the risks your community faces will help you make those decisions.

The idea behind risk assessment may be simple, but its results are powerful: Target your lifelines before Mother Nature does it for you.

► A community that wants to reduce its existing exposure to natural disaster losses and ensure that its exposure to these hazards does not worsen should take these preliminary steps:

- Hazard Identification—Define the extent to which natural hazards threaten your community (e.g., mapping)
- Hazard Vulnerability—Identify, using current knowledge or some degree of existing building stock, those structures and areas that are vulnerable to hazards. In addition, a community growth plan or plat map superimposed on the hazards map will help you identify areas vulnerable to natural hazards

*For related questions that will help you map both operational and economic considerations in your community, refer to the Identifying Risk Checklist at the back of the guidebook.*

## HAZARD IDENTIFICATION

What is it, and how is it done?

Everyone knows that natural disasters pose some threat to homes, businesses, and communities. We know that severe winds can damage the roofs on our houses and that heavy rains can flood our basements. We usually are aware of the natural disaster history in our communities. We know whether there have been floods, earthquakes, tornadoes, hurricanes, or wildfires. We also know that it is always a good idea to have some access to scientific expertise when identifying our natural hazards.

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Hazard identification determines which areas of your community are affected by disasters, how likely it is that the disaster may occur, and how intense the disaster might be.

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Floods, hurricanes, earthquakes, tornadoes, and wildfires are the most frequently occurring natural hazards. Some of these events can cause related or secondary hazard problems. For example, floods can cause mudslides, earthquakes can cause landslides, and wildfires (because they destroy plants) can make hillsides prone to landslide or mudslide.

► Quantifying the natural hazard threat to your community helps you prioritize the neighborhoods and areas where you should be most concerned:

- Where are floods most likely to occur?
- How strong are the winds that can affect us?
- Where are the earthquake fault zones located?
- Does the composition of a community's soil make it prone to problems like landslides?
- Are our native plants the sort that exacerbate or retard fires?

Mapping the hazards that threaten your community allows you to begin a process of identifying the areas that are most at risk and therefore the areas where you may want to concentrate your community risk-mitigation programs. It also provides an objective basis for your decisions. The more refined your maps of natural hazards can be, the more refined your decisions about those hazards can be. If you know the probabilities of a hazard event in each area, you can apply a “cost-benefit” approach to your decisions.

**Flood Hazard** Prolonged rainfall, hurricanes, or tropical storms bring enough water to our rivers and streams that they overflow their banks and cause damage. In delineating a flood hazard, a judgment is made about the frequency of an event. For example, an estimation of annual flooding can help define the magnitude of the hazard against which you will make mitigation decisions. A topographical map can be used to delineate the geographic extent to which a disaster will have an impact.

As part of its statutory responsibilities to carry out a National Flood Insurance Program, FEMA has mapped most of the flood risk areas of the U.S. About 19,000 communities participate in the National Flood Insurance Program, and if your community has a 1% chance of a flood occurring in any given year, there is probably a flood map in your community's planning office. If your community does not have a copy of its flood map, you can request a copy by calling (800) 358-9616 or contacting the FEMA Regional Office for your community.

**Severe Weather & Windstorms** Strong gusts of winds up to 70 miles per hour are not uncommon anywhere in the U.S. But sustained winds of that magnitude, or winds of higher speed, are generally associated with hurricanes, nor'easters, and trop-



ical storms. The wind hazard maps developed for today's model building codes can provide a community-wide wind speed that your community might expect. Additionally, you may wish to take into account some of the special wind hazard circumstances of your community, drawing from the history of wind damage and related problems, the topography of the land, and other relevant input from the professionals and residents of your town.

The National Oceanic and Atmospheric Administration (NOAA), an agency of the U.S. Department of Commerce, can offer technical support in the identification of special wind hazards for your area. If you are unsure which office of NOAA to call, or where to initiate your contact, call the FEMA Regional Office for your community.

#### Earthquakes & Related

**Hazards** An earthquake can hit almost every state in the U.S. In fact, about 40 states have a moderate to high hazard risk. It isn't necessary to be the site of an earthquake in order to feel its effects, particularly in the eastern U.S. The great earthquakes that struck the southeastern bootheel region of Missouri in the winter of 1811-1812 caused ground shaking that resulted in some structural damage as far away as Cincinnati. Ground failures from those events (e.g., sand blows or liquefaction) covered an area approximately the size of West Virginia.

Earthquake hazards have also been mapped for the model building codes of today. FEMA, working in partnership with the U.S. Geological Survey (USGS), has been able to develop state-of-the-art earthquake hazard maps that can be

used as resources for those building codes. USGS has also worked on national liquefaction maps, and your state's geological survey will have soil maps to help identify at-risk areas.

**Wildfires** As our urban areas grow closer to wilderness areas, the risk of wildfire increases. Often referred to as "urban-wildfire interface," this hazard, once thought to threaten principally the dry southern areas of California, is now being seen in places as distant as Long Island, New York and the State of Texas.

A range of resources at the national and state levels (e.g., forestry services and natural resource departments) can help you identify areas at risk. Still, the best resource to start with is right in your own backyard—your local fire department. They will undoubtedly have the information to help get you started on identifying the hazards from wildfire in your community.

#### ASSESSING YOUR COMMUNITY'S VULNERABILITY TO HAZARDS

How is it done, and why?

Natural hazards invariably "seek out" the weakest part of buildings or systems. Strong winds will find the portion of the roof not properly nailed down. Ground motions will find the weak building connectors—structural damage, or worse, building failure, will result. The water treatment plant in the floodplain will stop functioning, and businesses throughout the community will be forced to close until water is restored. Finding the weak points in systems—identifying building types that are vulnerable to damage and anticipating the loss in high risk areas—helps you make decisions later about the expenditure of resources to reduce the potential for disaster.

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Vulnerability identification determines which facilities are at risk and to what degree they might be affected, as well as how they might affect the vulnerability of other structures.

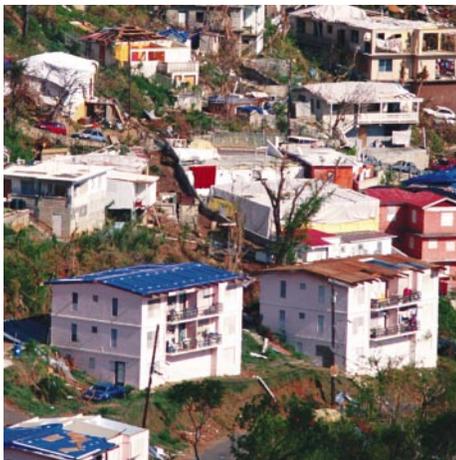
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In assessing your community's vulnerability to a natural hazard, you need to know what level of hazard has been identified and what kind of building (function and construction type) you are considering. Geographic Information Systems (GISs) can help to overlay hazards mapping onto building locations and structure types. Moreover, a GIS can plot utility systems and grids so that weak points (e.g., in the electrical distribution system) can be spotted.

► There are a variety of scientific and technical resources to consult for local buildings and systems. For example:

- FEMA's Hazards U.S. (HAZUS) is a GIS that includes an inventory, or varying levels of refinement, for all of the U.S. It also has an earthquake loss model and a flood hazard identification model within it. You can refine the inventory and bring wind loss modeling on line as FEMA develops it.
- Construction engineers in your community can obtain technical materials to assist in very broad or very detailed analysis of buildings throughout the jurisdiction.
- Utility system engineers and associations can help identify the vulnerabilities of power, water, transportation, or communications systems.

To start the process of assessing your community's vulnerability, call your FEMA Regional Office and inquire about HAZUS, partnerships with professional associations, and other sources of guidelines or expertise.



## HAZARD IDENTIFICATION PROCESS SUMMARY

### Purpose

To gather existing information about areas with a high likelihood of hazard occurrences and compile the information into a useful format.

### Products

Maps depicting zones with a high hazard potential and digitized as part of a Geographic Information System (GIS).

Information about where to expect significant damage following natural hazard events for use in setting loss-reduction priorities, community growth management, emergency response, and recovery planning.

## VULNERABILITY ASSESSMENT PROCESS SUMMARY

### Purpose

To gather and organize existing information about the location and vulnerability of buildings, utilities, and transportation systems serving the community.

### Product

► A consistent database that can be used to:

- Identify significant buildings by use, type, date of construction, location, ownership.
- Identify utilities and transportation systems.
- Estimate the potential for damage and loss of function due to different levels of natural hazards, using information about expected performance of buildings, utilities, and transportation systems.
- Set loss-reduction priorities and land use policies for emergency and recovery planning.

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Risk assessment defines the potential consequences of a disaster based upon a combination of the community's hazard and vulnerability identification.

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► Upon completion of the Second Phase of Project Impact you should have:

- Gathered hazard identification and vulnerability information
- Compiled information into a GIS format or other useful format
- Begun the process of prioritization
- Developed hazard awareness materials for you community
- Developed graphic materials to support decision-making

# CHECKLIST

## IDENTIFYING RISK



Use the suggestions below to help you map operational and economic considerations in your community. Identify:

What are the largest and most critical employers (including government and education)?	
How do employees reach their workplace?	
What utilities and modes of transportation are needed to keep businesses operating?	
What is the impact on local economy if businesses are not fully operational?	
What is the likelihood of permanent business closings and increases in unemployment?	
What are the location and hazard risks of customers and suppliers?	
What are the specific hazards to employees at specific facilities during a disaster?	
Are schools the primary form of temporary housing?	
What is the impact of closed schools to education funding and school year?	
How many people would each health care facility be able to accommodate?	
How important are rail, air, and port functioning to response and recovery after disasters?	
What communications channels are in place to relay important information in times of disaster?	

RISK / RESOURCE ID

*Please copy for use by planning committee*

# CHECKLIST

## RESOURCE IDENTIFICATION



The following categories, organizations, and incentive ideas should provide your Project Impact partners with a starting point in determining who has an investment in the disaster resistance of your community and what everyone can bring to the table to make the partnership successful.



Federal Agencies	
•FEMA	
•Agriculture	
•Commerce	
•Defense	
•Education	
•Energy	
•Health and Human Services	
•Housing and Urban Development	
•Interior	
•Labor	
•Transportation	
•Environmental Protection Agency	
•Small Business Administration	
•Other federal agencies	
State Agencies Relating To:	
•Office of the Governor	
•Transportation	
•Environment	
•Housing	
•Economic Development	
•Education	
•Budget	
•Insurance	
•Building or Construction Departments	
•Community Affairs	
•Public Health and Safety	
•Other state agencies	

Non-Profit Institutions	
• Community Foundations	
• Charitable Trusts	
• Colleges and Universities	
Banking & Insurance	
• Low interest mitigation	
• Premium reductions	
• Flood determinations for clients	
• Other financial incentives	
Employers	
Develop reasonable cost-effective incentives that will benefit your company, employees, and community	
Employee Organizations	
Donate labor for carrying out minimally engineered mitigation solutions in houses	
Professional Organizations	
Donate professional services or assistance in code enforcement, plan reviews, etc.	