



FLOOD VULNERABILITY ASSESSMENT FOR CRITICAL FACILITIES

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OUTLINE

Motivation

- Project details
- Partners
- Development and pilot of assessment

Overview of the online *Flood Vulnerability Assessment for Critical Facilities*

- Goals
- Taking the assessment
- Risk summary and recommendations report

MOTIVATION

Flooding has caused significant impacts throughout Cook County (Illinois) for decades.

- Riverine and urban flooding
- April 2013: critical facility that supplies power for major international airport was 4" away from potentially catastrophic flooding.

Hurricane Sandy's impact in 2012 on the East Coast proved that there is a need to assess the infrastructural preparedness of critical facilities across major U.S. cities.



PROJECT DETAILS

Reducing the Flooding Vulnerability of Chicago Critical Facilities

Funded by National Sea Grant College Program (NOAA)

July 2013-January 2016

Partners

Cook County Department of Homeland Security and Emergency Management (DHSEM)

Coordinated Hazard Assessment and Mapping Program (Illinois State Water Survey)

Midwestern Regional Climate Center

PROJECT DETAILS

Objectives

Historical precipitation analysis for Cook County, using data from the Cook County Precipitation Network.

Develop a site vulnerability assessment tool that will assess specific vulnerabilities of a critical facility (e.g., hospitals, utilities, police/fire stations) to flooding.

Use the vulnerability assessment at 25 critical facilities across Cook County.

Provide risk summary reports with recommendations on how facilities can reduce their flood risk.

Convert the assessment into an online tool.

DEVELOPMENT AND PILOT

2014-2015: Developed the assessment with CHAMP and DHSEM

October 2015: Piloted assessment at 3 Cook County critical facilities

November 2015: Finalized assessment; sent to 30 more Cook County critical facilities

Winter 2015-16: Provided *Facility Risk Summary and Recommendations* reports to facilities

2016: Converted assessment into an **online tool**

FINAL PRODUCT...

An online *Flood Vulnerability Assessment for Critical Facilities*

Who should take this assessment?

- Any critical facility
- Likely the **critical facility manager**
- Designed to assess a one-building critical facility, or a small facility (up to 7 buildings)
 - E.g., medical campus

Facilities that serve the community or affect the safety, health, and welfare of the surrounding population (FEMA).

Hospital or medical clinic
Electric power facility
Natural gas facility
Communication facility
Transportation facility
Water treatment plant
Hazardous material facility
Military facility
Nuclear facility
Oil facility
Emergency Operations Center
Fire or police station
Business
School
Nursing home
Government building

GOALS OF FVA

Identify **specific vulnerabilities of a particular critical facility to flooding** by looking at factors such as proximity to floodplain, past flooding issues, and location of critical systems like primary and back-up power.

Provide **recommendations and resources** to critical facility managers for short- or long-term changes that could be made to reduce their facility's risk to flooding.

Provide **educational information** to increase awareness of critical facility managers to their facility's risk of either riverine or urban flooding.

WHAT CAN YOU EXPECT?

What do you need to complete?

- Computer/internet access
- Knowledge about the facility and where critical systems are located
- Basic engineering knowledge about the building (preferred)
- Access to emergency response plans for weather (preferred)

How long will it take?

- 45 minutes to 1.5 hours

WHAT CAN YOU EXPECT?

What is the format of this assessment?

- Majority of questions are **Yes/No** or **Multiple Choice**
- Some open-ended questions

What will you receive after taking this assessment?

- *Facility Risk Summary and Recommendations Report*
 - Key recommendations and resources that could be taken to reduce facility's risk to flooding

SECTIONS OF FVA



Facility Siting Conditions



Communication and Emergency Operations Planning



Past Flooding Issues and Mitigation Efforts

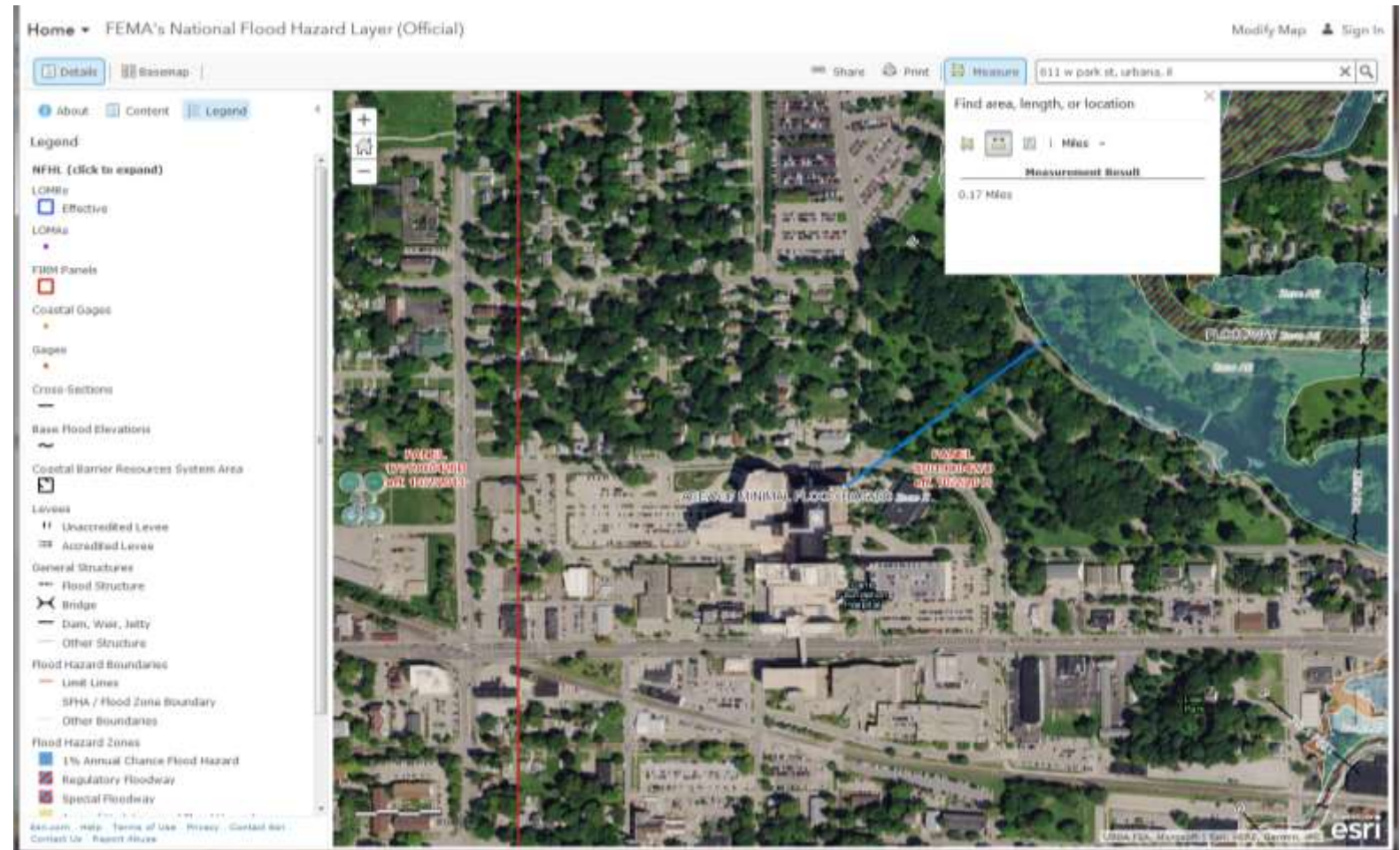


Importance & Location of Critical Systems

FACILITY SITING CONDITIONS

In a floodplain? If not,
how close?

Distance to nearest body
of water.



COMMUNICATION AND EMERGENCY OPERATIONS

How do you receive weather information?

Is there redundancy in communication systems?

Formalized emergency plan for flooding?

Communication System Redundancy

Please identify which communication system(s) are in place at your facility (check all that apply):

- Basic telephone systems (i.e. landline)
- Voice over Internet Protocol (VoIP) system (i.e., phone communication via the internet)
- Cell Phones
- Government Emergency Telecommunications Service (GETS)
- Beepers or pocket pagers
- Email
- Satellite communication systems (radio or phone)
- Ham radio systems
- Overhead announcement and paging systems
- Communication systems for the deaf and hearing impaired
- Mass notification systems (mass email or text alert)
- Internal intranet message notification
- Communication with Emergency operations center

PAST FLOODING ISSUES

Has this site flooded in the past? If so, how frequent?

Mitigation steps taken or planned?

Historical Flood Information

Has this site been affected by past flood events? Yes No I don't know

HAD PAST FLOODING EVENTS:

What is the frequency of flooding in the past at this location?

- Approximately two times a year Approximately once a year Approximately once every other year
 Approximately once every five years Typically more than five years between events I don't know

Please provide dates of flood events (if known):

When flooding, does this facility experience back-up? Yes, with clean water Yes, with sewage Yes, with clean water and sewage No

Was the facility's structure or contents damaged during any past flood events? Yes No I don't know

If "Yes" to the question above, please describe how the structure or contents were damaged:

Was the facility's function impaired? Yes No I don't know

If "Yes" to the question above, please describe how the facility's function was impaired:

IMPORTANCE & LOCATION OF CRITICAL SYSTEMS

Does the facility have a sump pump?

Do staircases to the basement have flood protection doors?

Is there an Emergency Operations Center (EOC) in the building?

Importance of Critical Systems

Please indicate the LOWEST FLOOR these critical systems are located on in this building:

Servers	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Routers	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Computer work stations	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Primary electric power system	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Secondary electric power system (from utility)	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Back-up generator	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Heating system	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Air conditioning system	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Security system controls	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Telephone/communication system	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Fuel/gas system	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Hazardous material storage (Hazmat storage)	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Critical data (non-electric)	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Potable water system	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg
Wastewater system	<input type="radio"/> Basement	<input type="radio"/> First Floor	<input type="radio"/> Above 1st floor	<input type="radio"/> Outside	<input type="radio"/> Other bldg

FACILITY RISK SUMMARY AND RECOMMENDATIONS REPORT

RISK SUMMARY REPORT

Facility Flood Risk Summary and Recommendations Report

[HOME](#)

[DETAILS](#)

[DISCLAIMER](#)

[ASSESSMENT](#)

[ABOUT](#)

Assessment completed for: **123 Sesame Street , Champaign, IL**

Respondent Information

Name: Molly Woloszyn

Department/Agency: MRCC/IISG

Title: Ext Climatologist

Facility Description

Facility Address: 123 Sesame Street

City/State: Champaign, IL

County: Champaign County

The following four factors can make a facility be at a higher risk for flooding. The ones that apply to your facility are bolded and checked:

- ✓ **You are located in a FEMA mapped floodplain.**
 - You are located within 0.5 miles of a floodplain.
- ✓ **Your facility has been affected by past flooding.**
- ✓ **You have identified that either your potable water supply or wastewater/sewer pipes enter the building in the same room as either your primary electric power, secondary power source, back-up generator, or fuel/gas system**

INCREASED RISK OF FLOODING

Facility located in a FEMA mapped floodplain (either 100-year or 500-year).

OR

Facility is within 0.5 miles of a floodplain.

Facility has been affected by past flooding.

Facility has identified water supply pipes enter the building in the same room as the primary electric power, emergency power, and/or fuel/gas system.

INCREASED RISK OF FLOODING

FEMA Report: Reducing Flood Effects in Critical Facilities

*Hurricane Sandy Recovery Advisory
April 2013*

Reducing Flood Effects in Critical Facilities



HURRICANE SANDY RECOVERY ADVISORY

R.A.2, April 2013

Purpose and Intended Audience

In the hours and days after Hurricane Sandy struck, damage to essential equipment, including mechanical, electrical, and plumbing systems prevented many critical facilities in New York and New Jersey from serving their communities when those communities needed them most. In numerous instances, critical facilities could not function because essential equipment was placed in basements, sub-basements, or ground floor levels that flooded. In some cases, components of essential systems were elevated well above the floodwaters, while other critical system elements (transformers, transfer switches, fuel tanks, pumps, etc.) were placed at lower levels and therefore were vulnerable to flooding. When those vulnerable critical elements failed, the systems were rendered inoperative and the functionality of the critical facilities suffered as a result.

This Recovery Advisory provides information and recommendations to improve the functionality of critical facilities by reducing the vulnerability of essential systems and equipment to flooding. Critical facilities include hospitals and other health care facilities; fire and police stations; emergency operations centers; communication and data centers; essential government buildings; and other critical facilities and their contents, machinery, and equipment therein, that serve the community or affect the safety, health, or welfare of the surrounding population. In some cases, the community may determine that wastewater treatment plants, water treatment plants, electrical substations, transportation facilities, and buildings such as schools or community centers are critical or essential for their community. In these situations, the recommendations in this advisory should be applied to those buildings. This Recovery Advisory describes how essential equipment must be protected from flooding to allow a critical facility to perform its primary function during and after a flood event. To accomplish this, facility owners and operators should work with a design professional, emergency manager, and their facility manager to help identify vulnerabilities in essential facility systems and equipment using a holistic approach well in advance of an event so that identified vulnerabilities can be reduced.

For more information on category classification requirements, see Occupancy Category Table 1-1 ASCE 7-05 and Risk Category Table 1.5-1 in ASCE 7-10 as well as the guidance in FEMA 543; *Design Guide for Improving Critical Facility Safety from Flooding and High Winds*, January 2007. Note: ASCE 7-05 and ASCE 7-10 have differences in category classifications; also, check for any modifications made by your State or local jurisdictions.

The information in this Recovery Advisory is most useful for new construction, although the same concepts can be applied to retrofits of existing construction. Although the focus of this advisory is on critical facilities, many of the recommendations can also be applied to other types of facilities. The intended audience for this Recovery Advisory includes facility owners and operators and other individuals involved in making decisions for critical facilities. If reconstructing a critical facility, FEMA recommends relocating the facility outside of the floodplain in addition to applying the other mitigation options described in this advisory.

Key Issues:

1. Major components of essential systems and equipment are frequently placed on the lowest floors or subgrade (basement) levels potentially well below the base flood elevation (BFE). Equipment located on lower floors and basements is often vulnerable to flood damage even when the building is located outside of mapped Special Flood Hazard Areas (SFHA) or is above the BFE.

RISK SUMMARY REPORT

Recommendations and resources for...

- Facility Siting Conditions
- Receiving Weather Information
- Continuity of Operations & Planning Agreements
- Communication System Redundancy
- Emergency Management Plans
- Historical Flood Information
- Other Flood-Related Issues
- Mitigation Efforts
- Building Specifics (for each building assessed)

RISK SUMMARY REPORT

Communication System Redundancy

Recommendations

- You have identified that three or more communication systems are in place at your facility. This is ideal, since the more modes of communication that are in place, the better it is for emergency situations.
- Your facility may want to explore obtaining GETS, the Government Emergency Telecommunications Service. It is intended to be used in an emergency or crisis situation when the landline network is congested and the probability of completing a normal call is reduced. There is no charge to subscribe, the only charge is for usage. For more information, please visit: <http://www.dhs.gov/government-emergency-telecommunications-service-gets>
- It is recommended you assess the need for an emergency communication system for the deaf and hearing impaired at your facility.
- An Emergency Operations Center (EOC) is the physical location at which the coordination of information and resources to support on-scene operations activities normally takes place. Contact your local emergency management department and/or city government to obtain information on how to communicate with your EOC as needed in the event of an emergency.

Resources

- [National Association of the Deaf: Emergency Preparedness \(website\)](#)

RISK SUMMARY REPORT

Importance & Location of Critical Systems

Critical system	Importance Ranking	Lowest Location
Servers	5	Above 1st floor
Routers	5	Above 1st floor
Computer work stations	2	Above 1st floor
Primary electric power system	5	Basement
Secondary electric power system (from utility)	5	Basement
Back-up generator	5	1st floor
Heating system	3	Basement
Air conditioning system	3	Basement
Security system controls	2	Above 1st floor
Telephone/communication system	2	Above 1st floor
Fuel/gas system	5	1st floor
Hazardous material storage (Hazmat storage)	0	
Critical data (non-electric)	0	
Potable water system	3	Basement
Wastewater system	3	Basement

Red: critical systems that were ranked as those of high importance AND those that are located either in the basement or the first floor of the building.

FEEDBACK

Leading wastewater treatment facility in Chicago – experienced a 9” rainfall that flooded the plant pump house in 2008.

Facility manager that took the assessment said:

“The assessment report would have been helpful prior to the storm – it’s very thorough. I liked the links to more information – instead of having to search for those myself.”

FEEDBACK

The facility manager is now considering the following recommendations:

- Installing flood doors to basement.
- Increasing communication redundancy – potentially getting “GETS” for the facility.
- Hadn’t thought about the deaf and hearing impaired communication issue – he’ll look into it.

[HTTP://MRCC.ISWS.ILLINOIS.EDU/FVA](http://MRCC.ISWS.ILLINOIS.EDU/FVA)

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