FLOOD PROOFING TECHNIQUES FOR FLOOD RISK MANAGEMENT:

UNDERSTANDING FLOOD RISK ADAPTIVE MEASURES FOR BUILDINGS LOCATED IN FLOODPLAINS

Ellicott City, MD Webinar

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IS THIS THE NEW NORMAL?

Property damages of $10.2 Billion annually from 1985-2015

Hurricane Sandy

Colorado Flooding

Louisiana Flooding

2016 Major Disaster Declarations (Flooding)

Arkansas	Kentucky	Louisiana	Wisconsin	Montana	Oklahoma	West Virginia
Texas	Montana	Texas	Mississippi	Pennsylvania	Texas	Delaware
New Jersey	Louisiana	Virginia	Maryland	Georgia	District of Columbia	
Georgia	Oregon	Alaska	Oklahoma	Texas	Arkansas	Washington
Alabama	Missouri	Washington	Iowa	Minnesota	Hawaii	

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ELLICOTT CITY FLOOD EVENT

Three 1,000 year floods recorded during 2016 in Maryland West Virginia and Louisiana

Historic Rainfall and Flash Flooding Saturday Night in Ellicott City, Maryland

Duration	Rainfall Total	Time
1 minute	0.20"	7:51-7:52 pm
5 minutes	0.80"	7:50-7:55 pm
10 minutes	1.44"	7:50-8:00 pm
15 minutes	2.04"	7:46:8:01 pm
20 minutes	2.48"	7:44-8:04 pm
30 minutes	3.16"	7:36-8:06 pm
60 minutes	4.56"	7:30-8:30 pm
90 minutes	5.52"	7:00-8:30 pm
2 hours	5.92"	6:45-8:45pm

The storm total rainfall at Ellicott City was 6.50 inches. Based on the preliminary precipitation frequency estimates in NOAA Atlas 14 from the nearest location, the rainfall amounts with duration 10 minutes to 2 hours statistically have a less 0.1% chance of occurring in any given year, or a 1 in 1000 year event.

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FLOOD RISK

Risk = *f* [(Probability of Flooding) x (Consequences)]

(Probability of Flooding) is the frequency of flooding or how often does flooding occur in a particular location. Reduce the frequency of flooding and risk is reduced.

(Consequences) are the potential damages and life loss associated with flooding. The structures (critical, residential, commercial, public, and industrial), land use (agricultural, urban, public) , and infrastructure (highways, roads, rail, utilities) make up the potentially damageable assets. Reduce the consequences of flooding and risk is reduced.

Note: If critical facilities become inoperative during a flood event the area of impact extends beyond the area of flooding (i.e. electrical service, fire and rescue, hospitals, water and wastewater, etc.).

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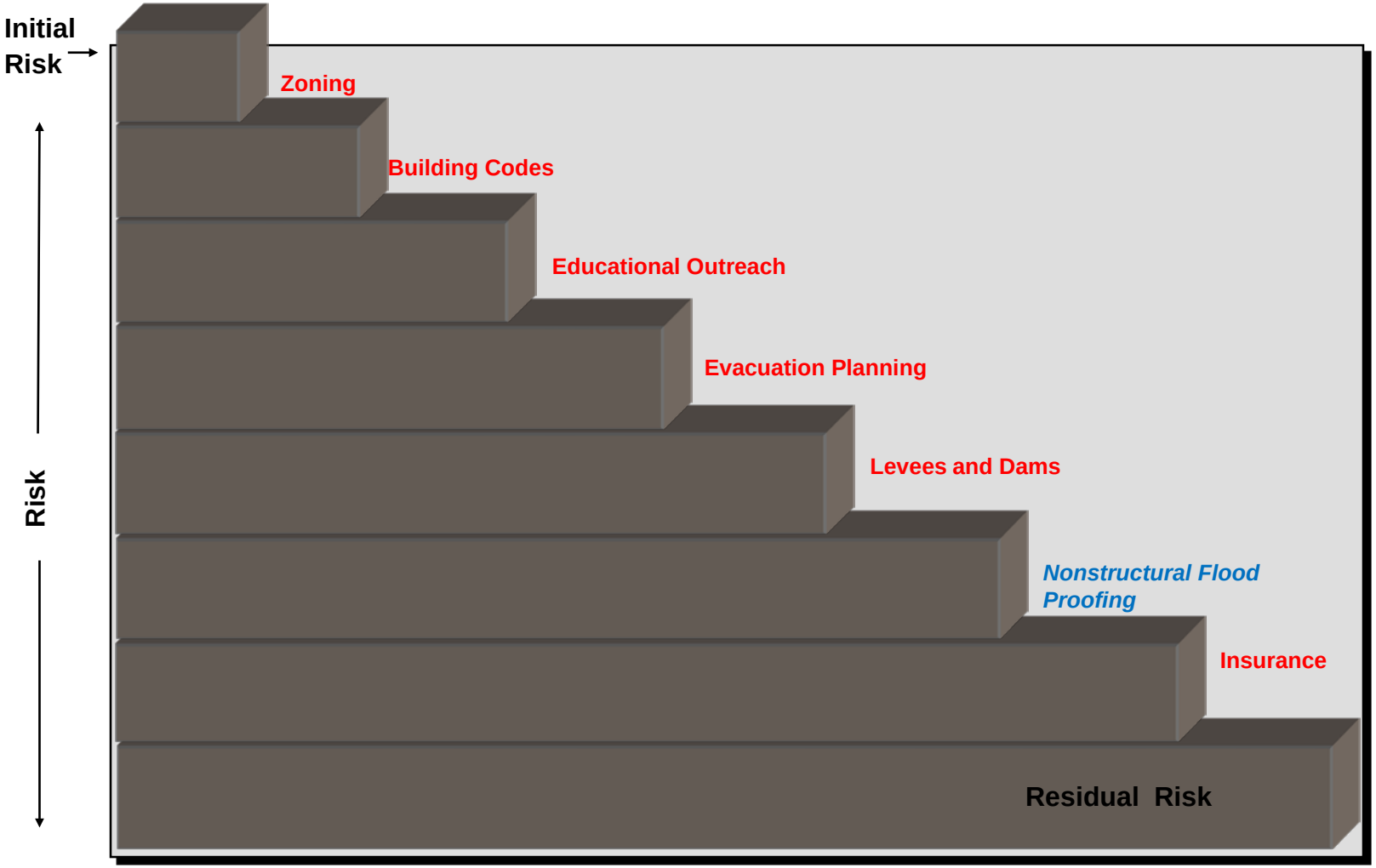
FLOOD RISK



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FLOOD RISK AND FLOOD INSURANCE

Elevation Reduces Insurance Premiums

Premium at 1 foot Below BFE	Premium set at the BFE	Premium at 3 feet above BFE
$4,786/years **$47,860/10 years**	$2,136/years **$21,360/10 years**	$591/years **$5,910/10 years**

Assumes AE zone and rates as of April 1, 2016

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NONSTRUCTURAL FLOOD PROOFING

The most common physical flood proofing measures implemented for flood damage and life loss reduction are considered to be:

Acquisition	Relocation	Elevation
Dry Flood Proofing	Wet Flood Proofing	Basement Removal

Nonphysical flood proofing measures are considered to be:

Floodplain Mapping	Land Use	Flood Insurance
Evacuation Plans	Flood Warning	Zoning
Operational Changes	Emergency Preparedness Plans	

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ASSESSING THE SITUATION

Flood Characteristics

- Depth, velocity, duration, rate of rise, debris/ice flows, wave action, floodway, floodplain

Site Characteristics

- Location, soil type, topography, site size, urban/rural

Building/Structure Characteristics

- Type of construction, foundation material, condition of the building, lower levels (basement/crawlspace), historical significance, building modifications

Other Considerations

- Occupancy, building codes, zoning, ordinances and local restrictions, building aesthetics, future conditions, public health/safety/welfare

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CAUTION! CAUTION! CAUTION!

While flood proofing measures may result in lower property damages, there could be potential restrictions that the property owner needs to investigate prior to implementation:

- Local Ordinances
- State Regulations
- National Flood Insurance Program (NFIP)

Some of the methods shown in this presentation may not comply with local code or the NFIP minimum requirements and may not be creditable for flood insurance savings. USACE focuses on flood damage reduction.

Flood insurance is always recommended, even for structures that may have been retrofitted with nonstructural measures.

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SELF-HELP FLOOD RISK MANAGEMENT MEASURES

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ACQUISITION

- Acquire the land and structures
- Demolish structures or sell and remove
- Technique eliminates risk of flooding

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RELOCATION

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ELEVATION ON FILL

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ELEVATION ON PIERS, POSTS, PILES OR COLUMNS

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ELEVATION ON EXTENDED FOUNDATION WALLS

Elevate to reduce flood risk (cannot inhabit lower level)

Flood Vent

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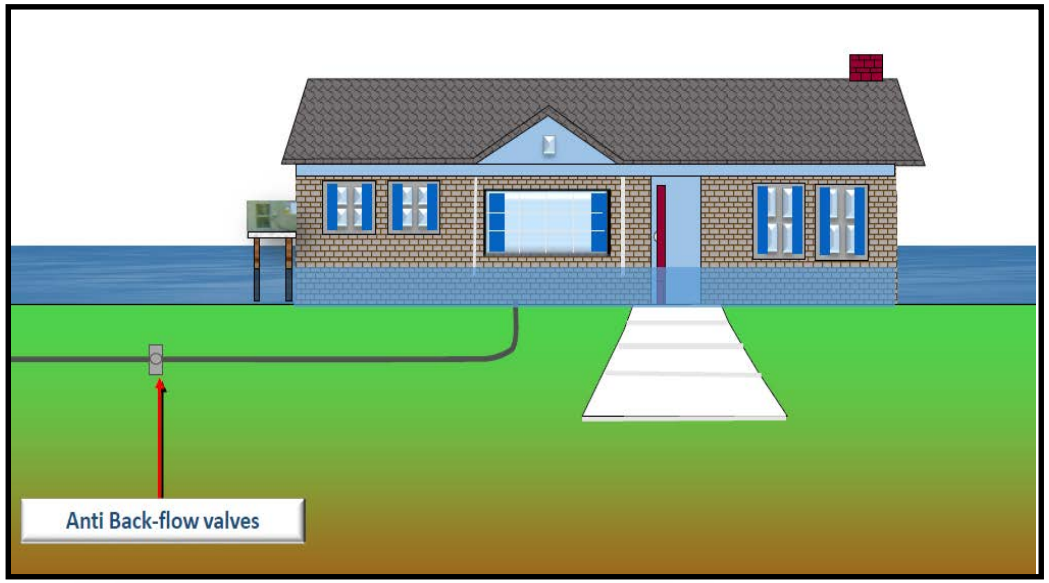
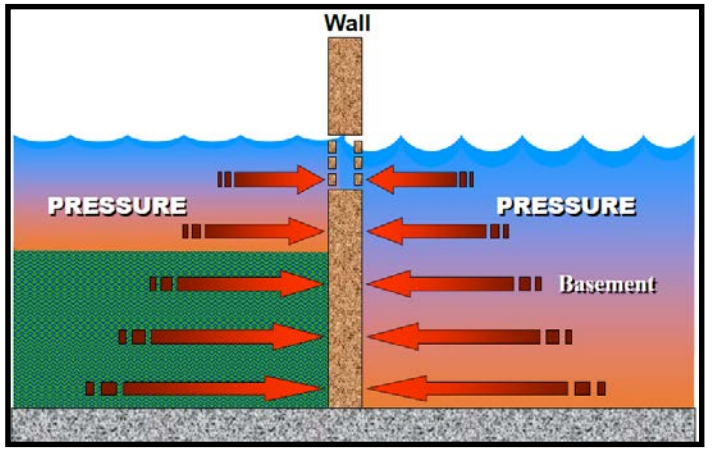
WET FLOOD PROOFING





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ELEVATE EXTERNAL UTILITIES

Air conditioning unit

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DRY FLOOD PROOFING

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DRY FLOOD PROOFING

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DARLINGTON, WISCONSIN COMMERCIAL FLOOD PROOFING

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ELEVATION AND FLOOD PROOFING WITHIN A COMMERCIAL (HISTORIC) STRUCTURE

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ELEVATION WITHIN AN EXISTING STRUCTURE

US Post Office

- Within 100-yr floodplain
- Relatively new building
- High ceilings
- Elevated interior
- Concerns:
  - Seepage
  - No flood vents
  - Standard glass doors

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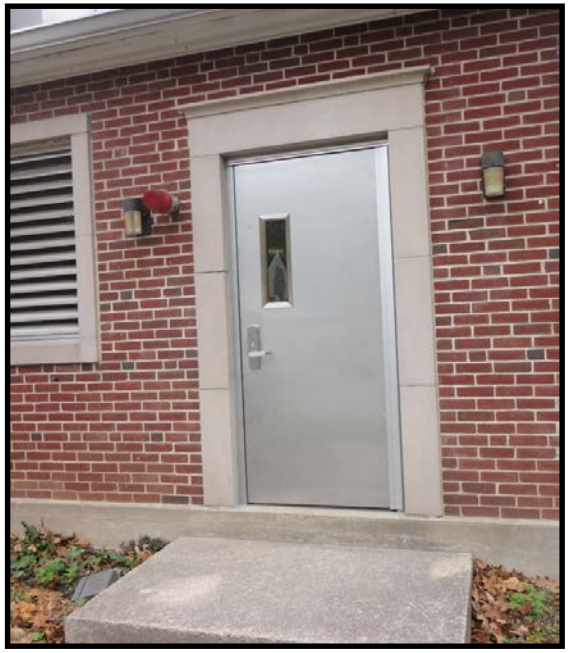
FLOOD BARRIERS FOR DOORS AND WINDOWS



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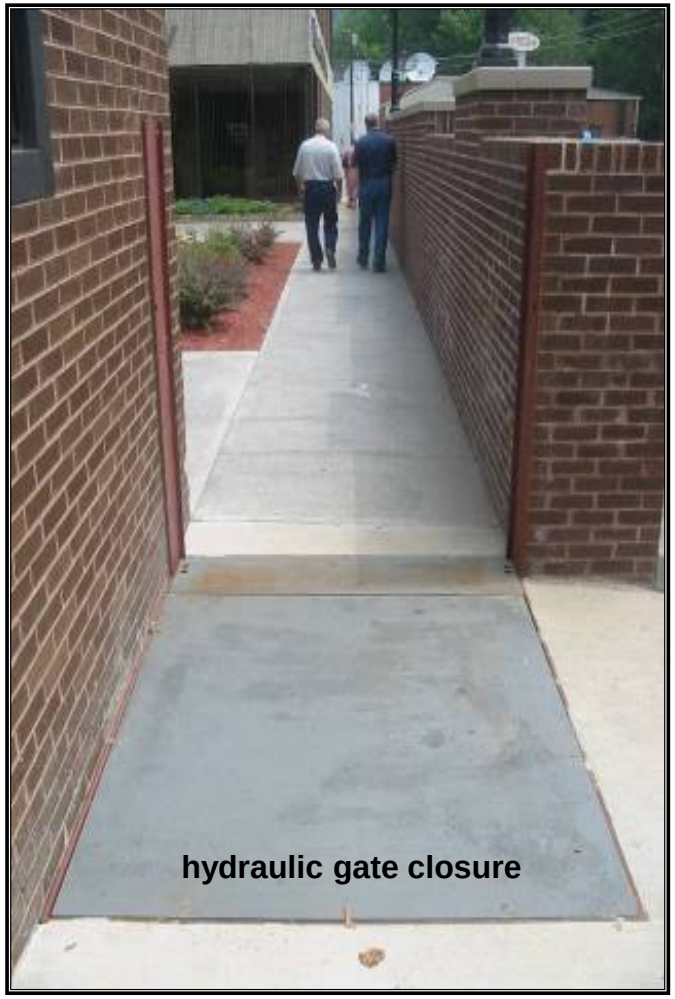
FLOODWALLS AND BARRIERS



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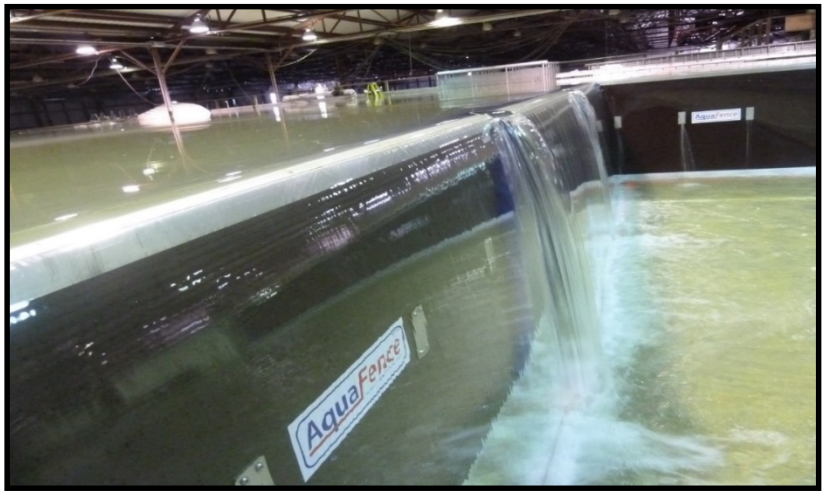
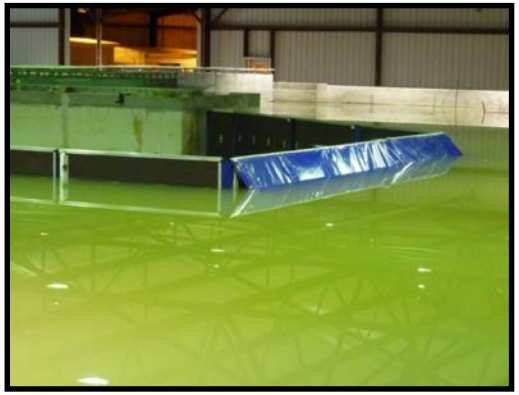
NATIONAL FLOOD BARRIER TESTING & CERTIFICATION PROGRAM

ERDC
Engineer Research and Development Center





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Nonstructural - Flood Proofing
National Nonstructural / Flood Proofing Committee
Association of State Floodplain Managers
ASFPM

FM Approvals
Member of the FM Global Group

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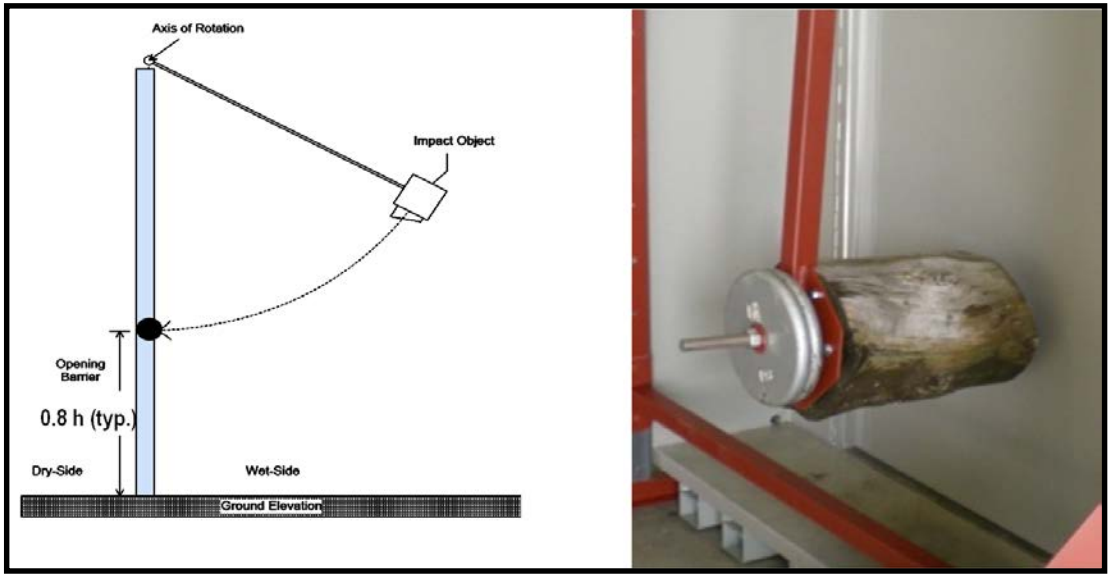
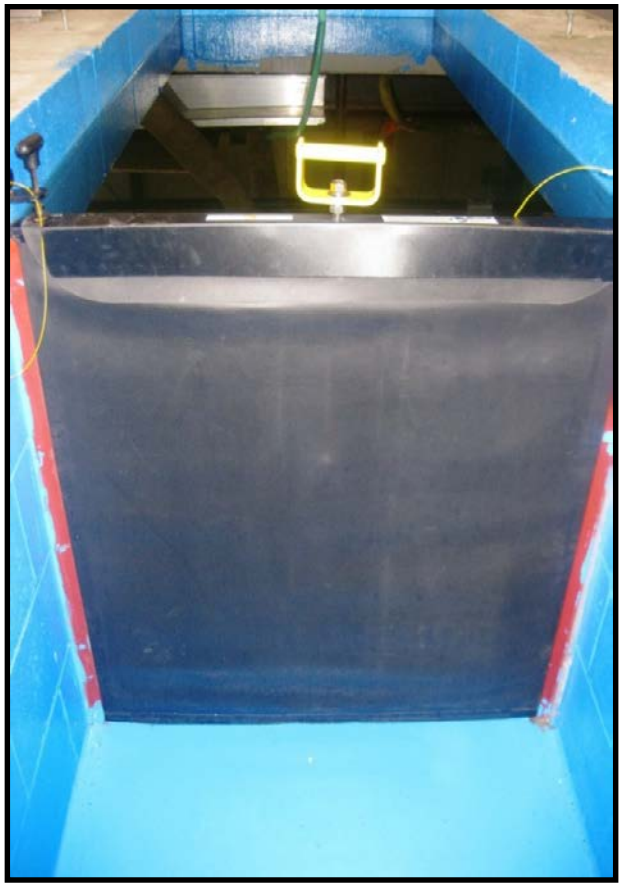
PEDESTRIAN AND VEHICLE OPENING BARRIER TESTING

website: http://nationalfloodbarrier.org/





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USACE NATIONAL NONSTRUCTURAL FLOOD PROOFING COMMITTEE

Chartered: 1985

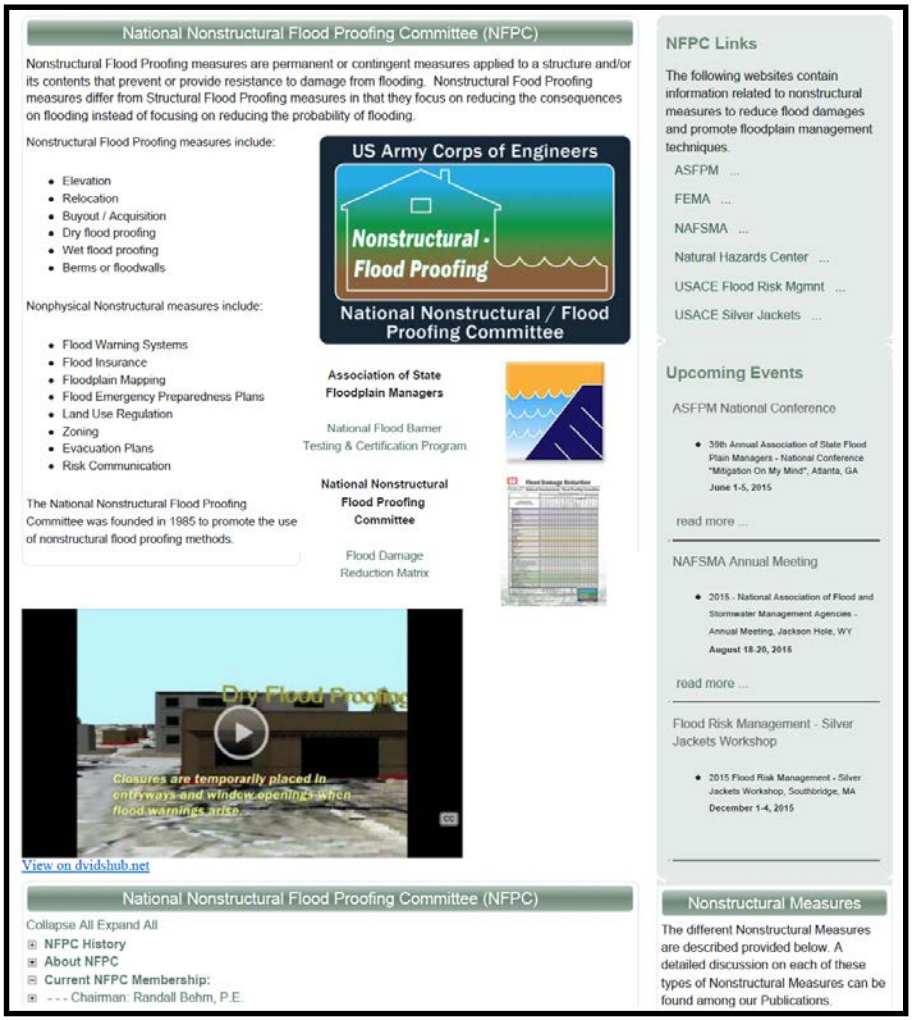
NFPC Members and Advisors

- Randall Behm, Chair, Omaha
- Steve O'Leary, Secretary, Huntington
- Kim Gavigan, Phoenix
- Keven Lovetro, New Orleans (MVD)
- Lea Adams, Davis (HEC)
- Mary Weidel, Detroit (IWR)
- Brian Rast, Kansas City (IWR)

Technical Resources

- Nonstructural Techniques
- Publications
- Assessment Tools
- National Flood Barrier Testing & Certification Program
- Links to Associated Sites

Google: **NFPC**



web site: http://www.usace.army.mil/Missions/CivilWorks/ProjectPlanning/nfpc.aspx

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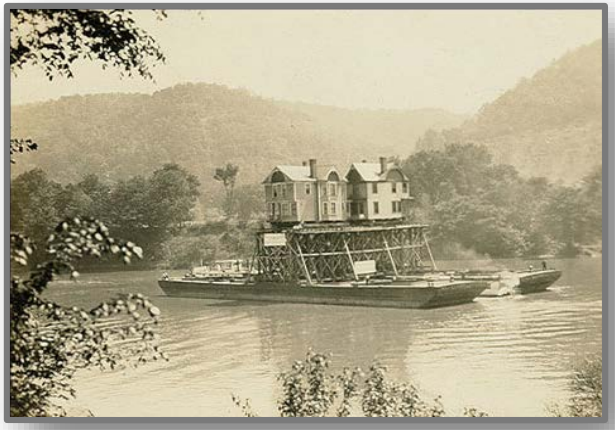
THANK YOU!



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