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on Tuesday, Nov. 15, 2011

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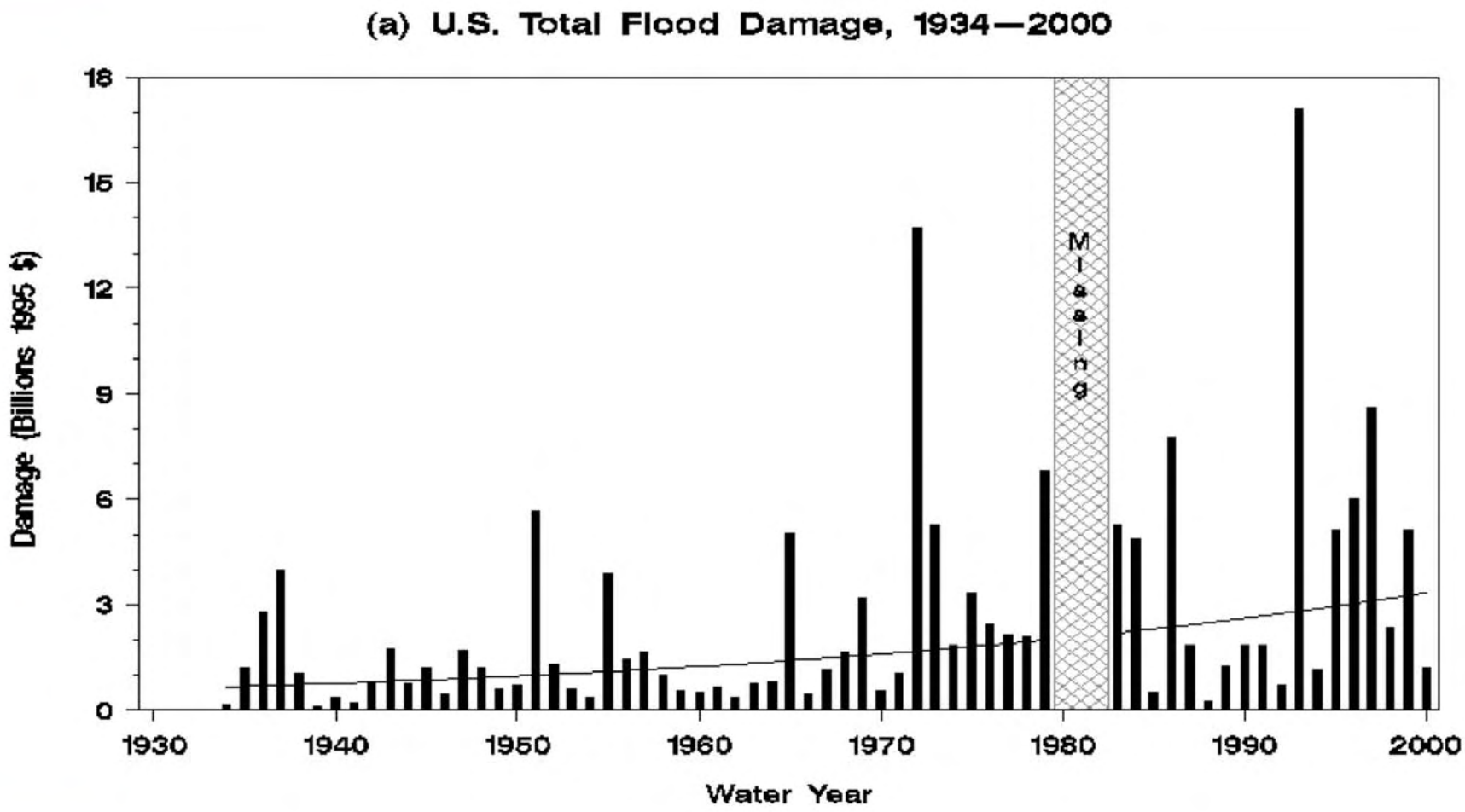
How Can We Best Communicate Flood Risk?

Michael S. Scott, PhD, GISP
Department of Geography and Geosciences
Salisbury University

November 15, 2011



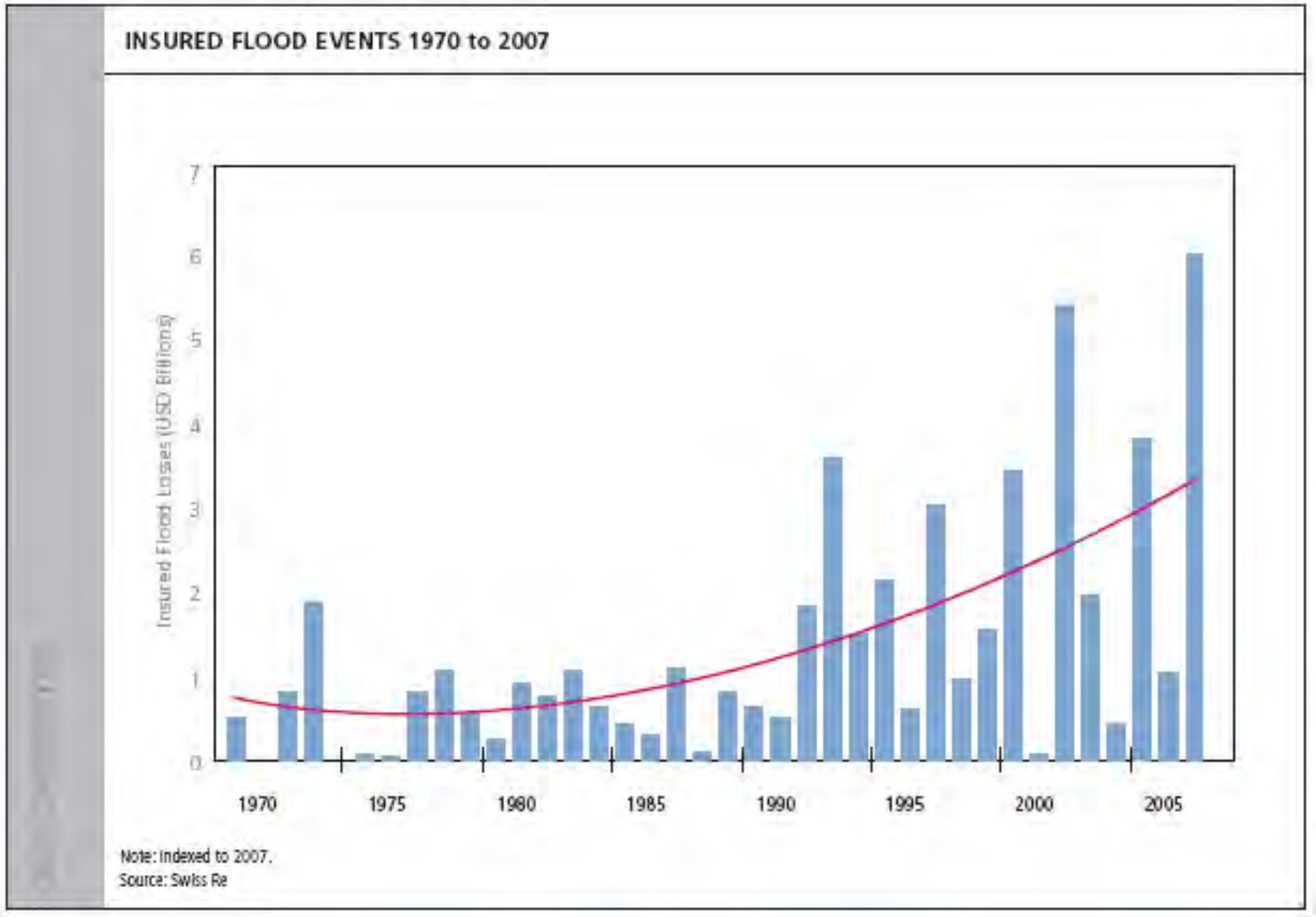
Pielke, Jr., R.A., M.W. Downton, and J.Z. Barnard Miller, 2002: Flood Damage in the United States, 1926-2000: A Reanalysis of National Weather Service Estimates. Boulder, CO: UCAR.

Gilbert White, 1911 - 2006

- "The broad problem of flood-loss reduction is that the rate at which flood losses are being eliminated by construction of engineering or land-treatment works is of about the same magnitude as the rate at which new property is being subjected to damage."
- "The construction of new flood-protection works frequently has been the signal for accelerated movement into the floodplain."
- 1960. "Strategic Aspects of Urban Flood Plain Occupance." Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers 86 (HY2):89-102.

FEMA's Mitigation Concerns

- Dr. Sandra Knight, FEMA Deputy Chief for Mitigation @ ASFPM 2011 Conference in Louisville, KY
- Top Priorities
  - Engaging the whole community/grassroots
  - Document/communicate mitigation value
  - Present a holistic view of FIMA
  - Promote employee empowerment
- Things that "keep her up at night"
  - Levees, Dams, Need for a National Strategic Water Resource Policy, Valuing Mitigation



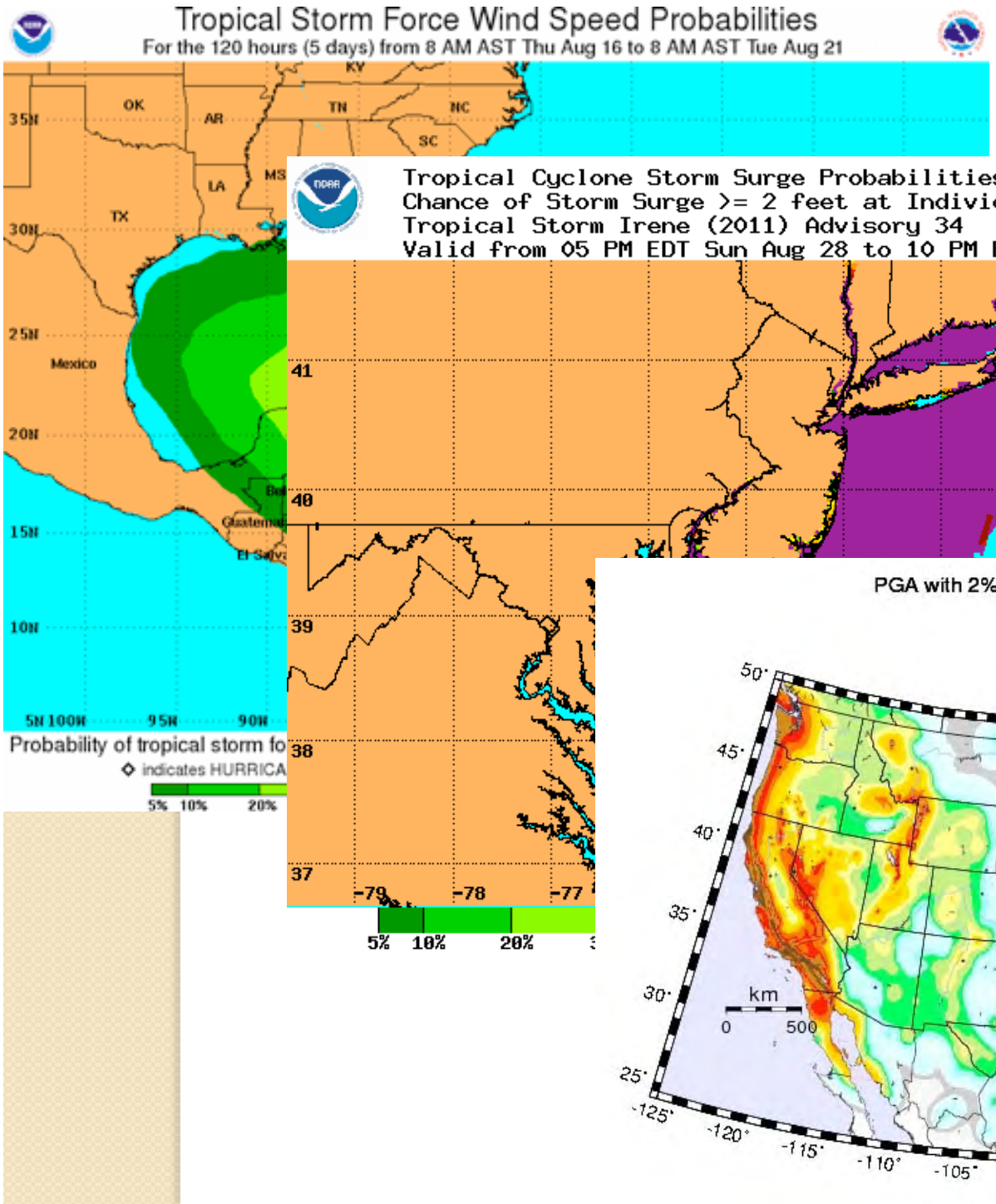
Carpenter, Guy. (2008). Flood Losses Worldwide. http://www.gccapitalideas.com/2008/09/10/chart-room-flood-losses-worldwide/

What is causing the loss increase?

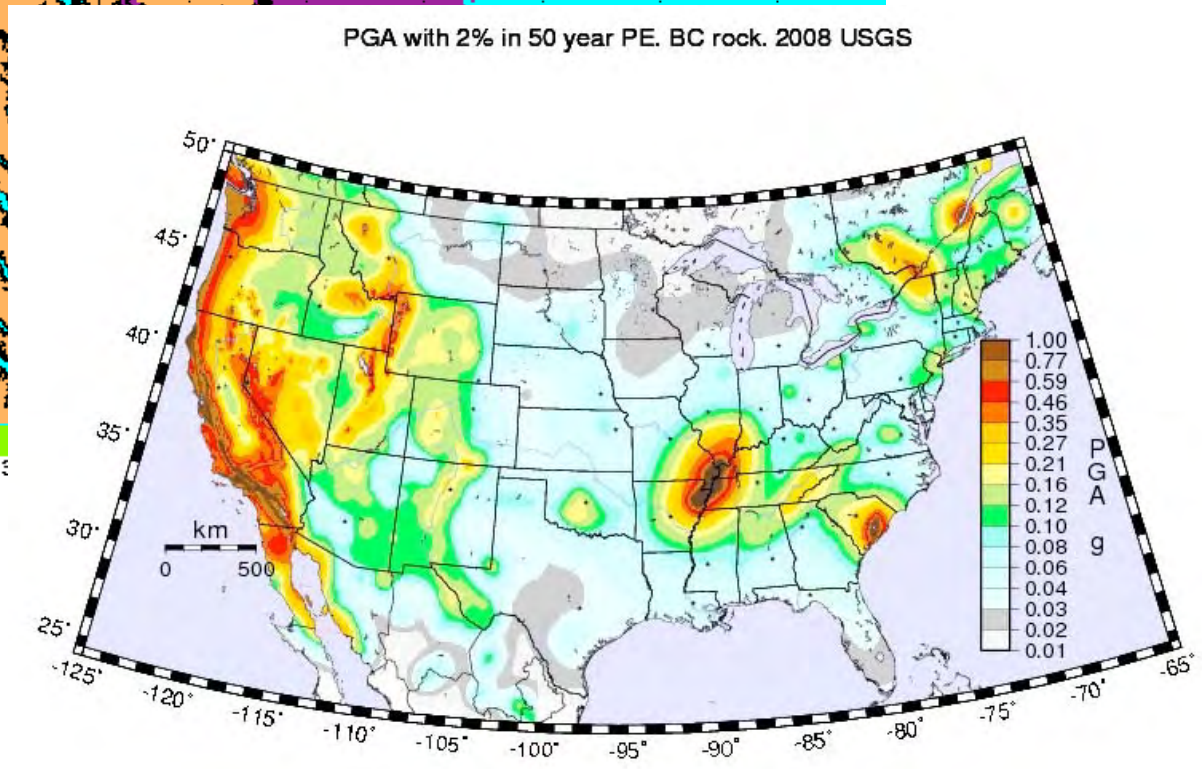
- Increase in population
- Increase in asset value
- Increase in severity/frequency
- Inadequate mitigating impact of top-down hazards management
  - Flood insurance creating "moral hazard"
  - "Safety" provided by flood control structures
  - Limitations of land use constraints
- Need to re-emphasize the bottom-up, personal responsibility component

The Time Has Come...

- ...to update the way we communicate flood risk
- Not much innovation since the 1970's
- Insurance requirement ≠ at risk
- Many other hazards are making great strides
- Risk – likelihood of impactful hazard occurrence

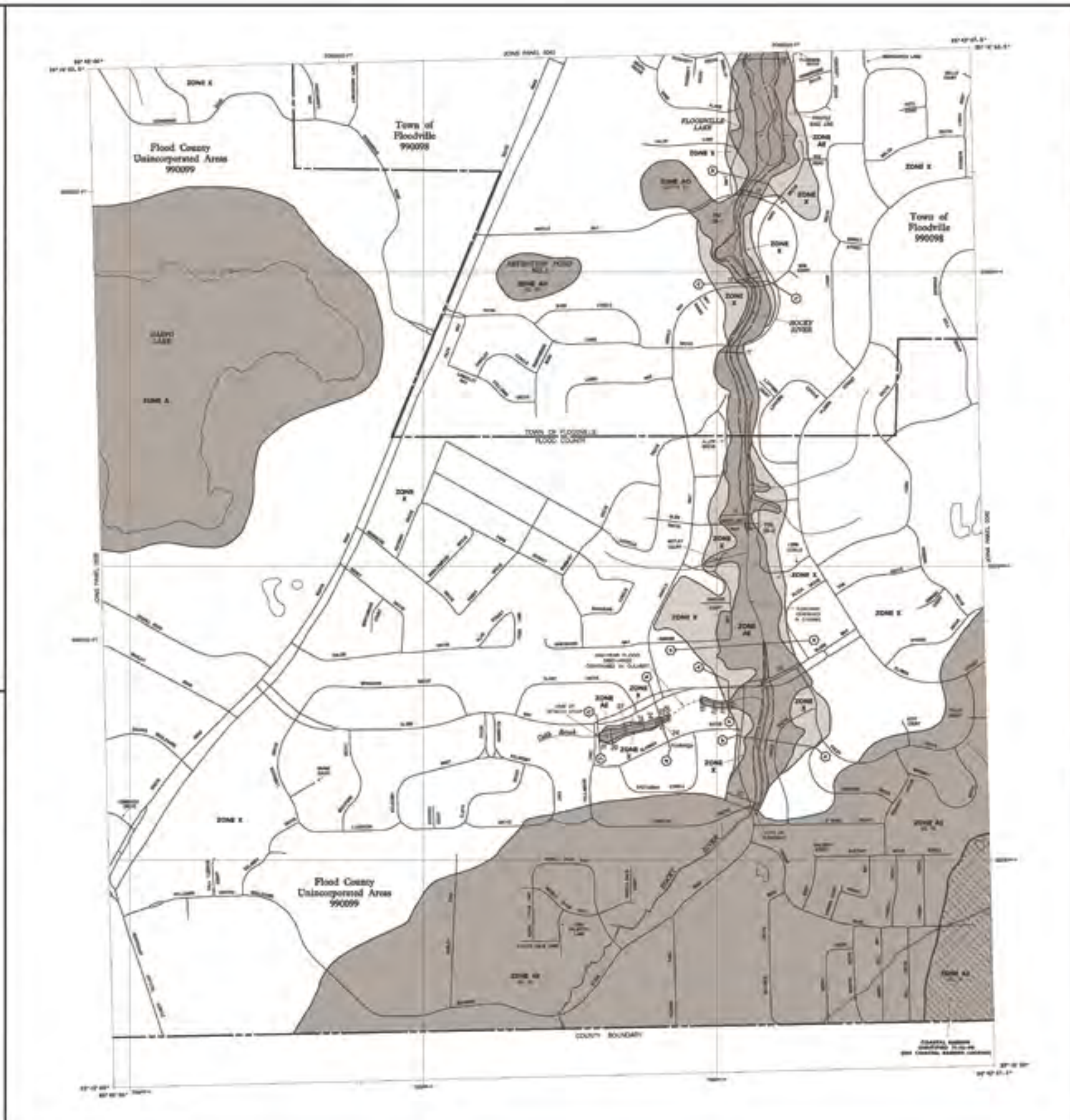

Tropical Storm Force Wind Speed Probabilities
For the 120 hours (5 days) from 8 AM AST Thu Aug 16 to 8 AM AST Tue Aug 21
KY
OK
AR
TN
NC
SC
LA
MS
TX
35N
30N
25N
20N
15N
10N
Mexico
5N 100W
95W
90W
Probability of tropical storm fo
indicates HURRICA
5% 10% 20%

Tropical Cyclone Storm Surge Probabilities
Chance of Storm Surge >= 2 feet at Individual Locations
Tropical Storm Irene (2011) Advisory 34
Valid from 05 PM EDT Sun Aug 28 to 10 PM EDT Wed Aug 31
41
40
39
38
37
-79
-78
-77
5% 10% 20%


PGA with 2% in 50 year PE. BC rock. 2008 USGS
50°
45°
40°
35°
30°
25°
-125°
-120°
-115°
-110°
-105°
-100°
-95°
-90°
-85°
-80°
-75°
-70°
-65°
km
0
500
1.00
0.77
0.59
0.46
0.35
0.27
0.21
0.16
0.12
0.10
0.08
0.06
0.04
0.03
0.02
0.01
PGA
g

NOTES TO USERS

COASTAL BARRIER LEGEND



LEGEND

NATIONAL FLOOD INSURANCE PROGRAM

NFIP

FIRM

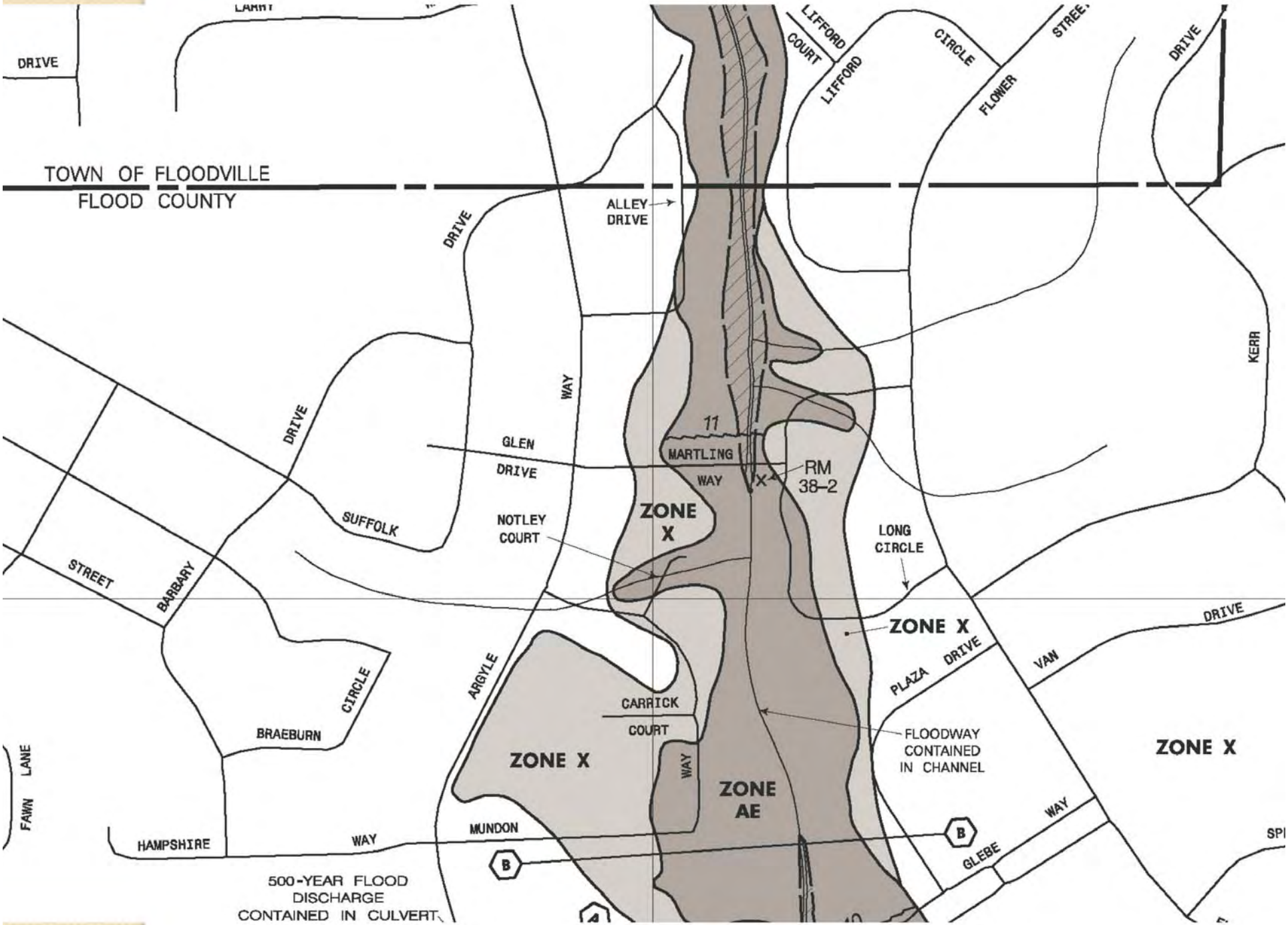
FLOOD INSURANCE RATE MAP

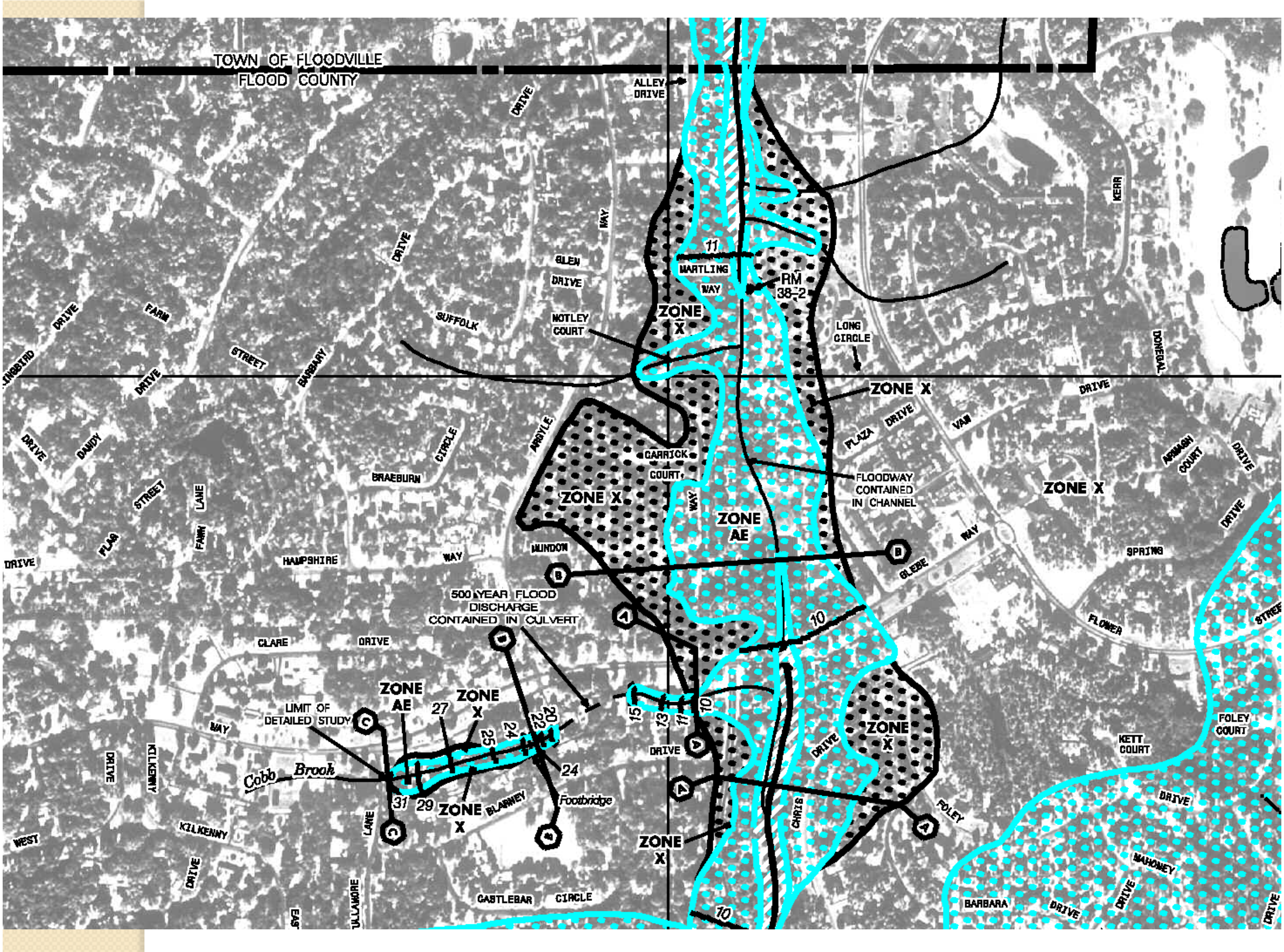
FLOOD COUNTY, USA AND INCORPORATED AREAS

MAP NUMBER

EFFECTIVE DATE

Federal Emergency Management Agency


TOWN OF FLOODVILLE
FLOOD COUNTY
DRIVE
LIFFORD
COURT
CIRCLE
FLOWER
STREET
DRIVE
ALLEY
DRIVE
DRIVE
WAY
KERR
11
GLEN
DRIVE
MARTLING
WAY
RM
38-2
DRIVE
SUFFOLK
NOTLEY
COURT
ZONE
X
LONG
CIRCLE
STREET
BARBARY
ZONE X
DRIVE
PLAZA DRIVE
VAN
ARGYLE
CIRCLE
CARRICK
COURT
FLOODWAY
CONTAINED
IN CHANNEL
ZONE X
BRAEBURN
ZONE X
WAY
ZONE
AE
FAWN LANE
HAMPSHIRE
WAY
MUNDON
B
B
WAY
GLEBE
500-YEAR FLOOD
DISCHARGE
CONTAINED IN CULVERT



TOWN OF FLOODVILLE
FLOOD COUNTY
ALLEY DRIVE
HARTLING WAY
RM 38-2
NOTLEY COURT
GLEN DRIVE
SUFFOLK
LONG CIRCLE
ZONE X
ZONE AE
CARRICK COURT
FLOODWAY CONTAINED IN CHANNEL
BRAEBURN
HAMPSHIRE
MUNDON
GLEBE
SPRING
FLOWER
500 YEAR FLOOD DISCHARGE CONTAINED IN CULVERT
CLARE
DRIVE
LIMIT OF DETAILED STUDY
Cobb Brook
Footbridge
BLARNEY
KILKENNY
LANE
CASTLEBAR
CIRCLE
FOLEY
FOLEY COURT
KETT COURT
CHRIS
MAHONEY
BARBARA
KERR
DONEGAL
ARMAGH COURT
PLAZA
VAN
STREET
DANDY
FLAG
FAWN
FARM
BARBARY
ARGYLE
WEST

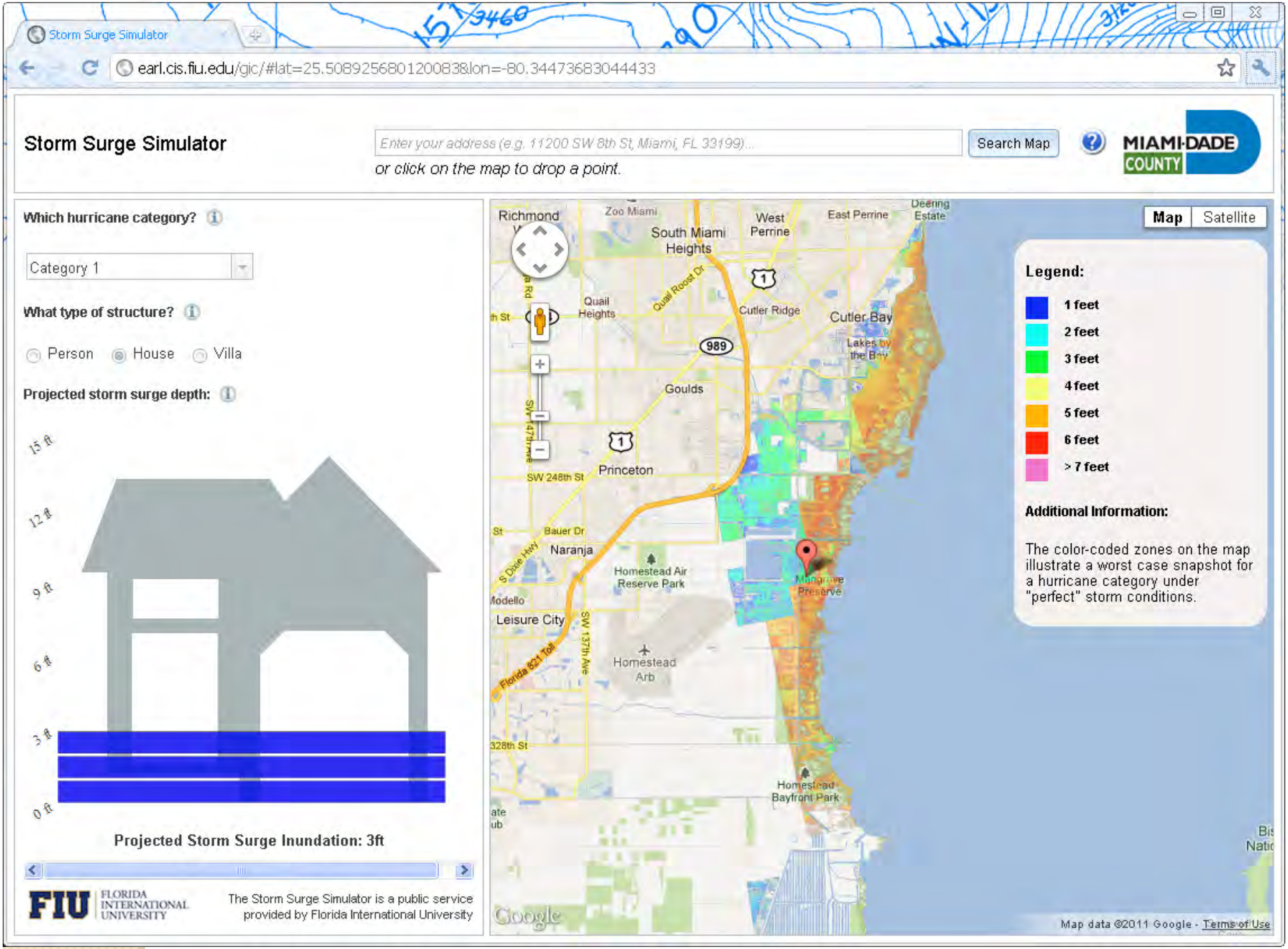
Flood Insurance Studies

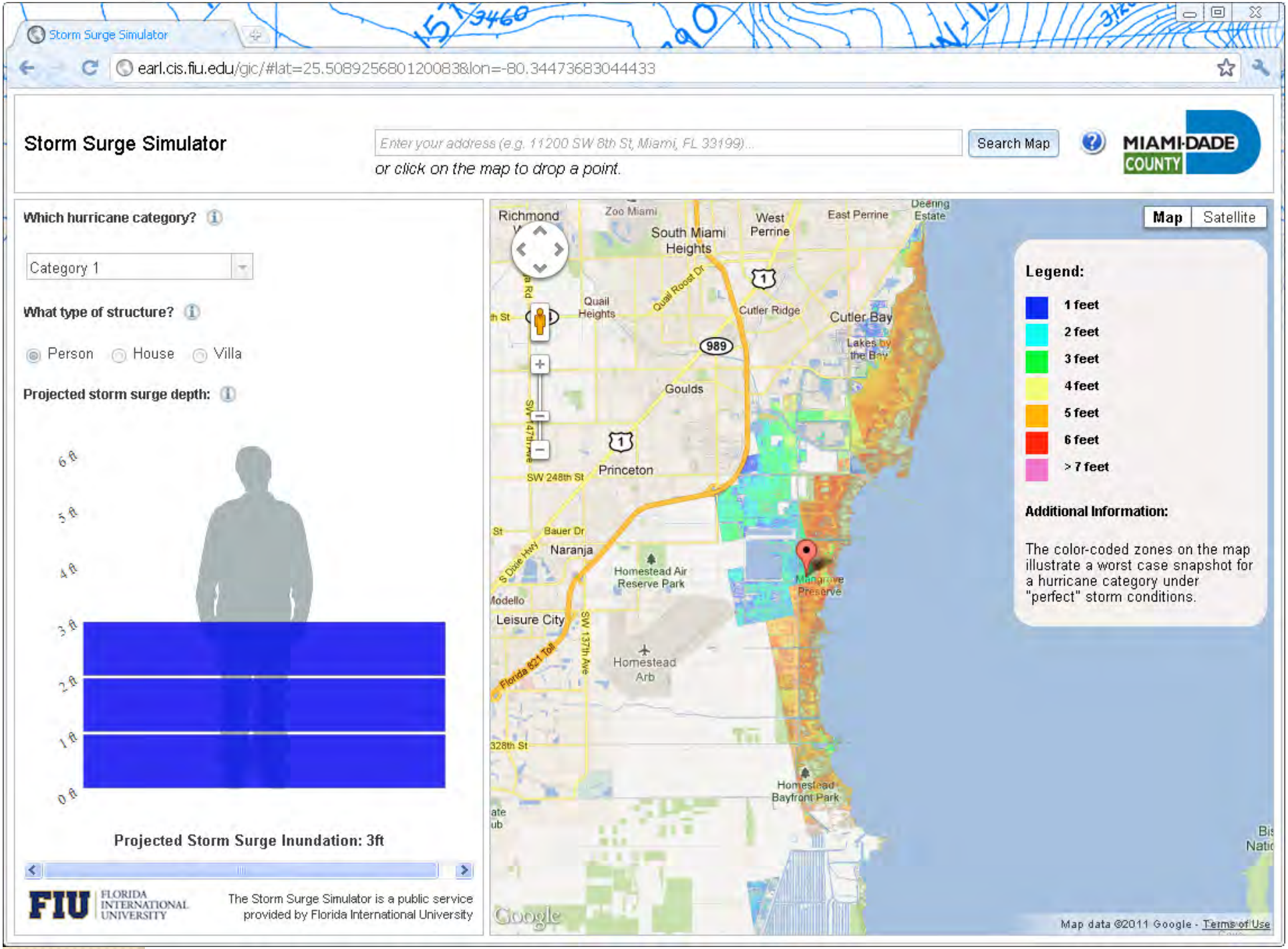
TABLE 1 - SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CHESAPEAKE BAY				
Choptank River	3.9	5.1	5.9	7.5
Hoopers Island	3.5	4.7	5.3	6.6
Hunting Creek	3.9	5.1	5.9	7.5
Nanticoke River	4.2	5.4	5.8	6.8

Why Now? Technology!

- Advances in modeling
  - Better accuracy
  - Better precision
  - Better inputs
- Advances in mapping
  - More automated
  - Better resolution
  - Aerial photography
- Advances in visualization
  - Dynamic
  - Multi-dimensional
  - Multi-frame


Storm Surge Simulator
earl.cis.fiu.edu/gic/#lat=25.508925680120083&lon=-80.34473683044433
Storm Surge Simulator
Enter your address (e.g. 11200 SW 8th St, Miami, FL 33199)...
Search Map
or click on the map to drop a point.
MIAMI-DADE COUNTY
Which hurricane category?
Category 1
What type of structure?
Person
House
Villa
Projected storm surge depth:
15 ft
12 ft
9 ft
6 ft
3 ft
0 ft
Projected Storm Surge Inundation: 3ft
FIU FLORIDA INTERNATIONAL UNIVERSITY
The Storm Surge Simulator is a public service provided by Florida International University
Map
Satellite
Legend:
1 feet
2 feet
3 feet
4 feet
5 feet
6 feet
> 7 feet
Additional Information:
The color-coded zones on the map illustrate a worst case snapshot for a hurricane category under "perfect" storm conditions.
Richmond
Zoo Miami
South Miami Heights
West Perrine
East Perrine
Deering Estate
Quail Heights
Quail Roost Dr
Cutler Ridge
Cutler Bay
Lakes by the Bay
Goulds
Princeton
SW 248th St
Bauer Dr
Naranja
Homestead Air Reserve Park
Mangrove Preserve
Leisure City
SW 137th Ave
Homestead Arb
Homestead Bayfront Park
Florida 821 Toll
S Dixie Hwy
SW 47th Ave
Google
Map data ©2011 Google - Terms of Use


Storm Surge Simulator
earl.cis.fiu.edu/gic/#lat=25.508925680120083&lon=-80.34473683044433
Storm Surge Simulator
Enter your address (e.g. 11200 SW 8th St, Miami, FL 33199)...
Search Map
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Category 1
What type of structure?
Person
House
Villa
Projected storm surge depth:
6 ft
5 ft
4 ft
3 ft
2 ft
1 ft
0 ft
Projected Storm Surge Inundation: 3ft
FIU FLORIDA INTERNATIONAL UNIVERSITY
The Storm Surge Simulator is a public service provided by Florida International University
Map
Satellite
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1 feet
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6 feet
> 7 feet
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Quail Heights
Quail Roost Dr
Cutler Ridge
Cutler Bay
Lakes by the Bay
989
Goulds
SW 47th Ave
SW 248th St
Princeton
Bauer Dr
Naranja
S Dixie Hwy
Homestead Air Reserve Park
Mangrove Preserve
Leisure City
SW 137th Ave
Florida 821 Toll
Homestead Arb
328th St
Homestead Bayfront Park
Google
Map data ©2011 Google - Terms of Use

Does Risk Communication Matter?

- Research says yes, but…
- People have difficulty estimating risk
- People will take remedial action at some threshold
- The potential for action is limited by lack of knowledge of options
- Options are considered one at a time
- May be factors external to individuals that influence behavior
  - Cultural traditions
  - Political-economic context
  - Information gatekeepers
  - Peer influence

Flood Risk is Complicated

- It's dependent on input amount
  - Rainfall, surge amount
- It's dependent on input timing
  - Inches per hour, tide
- It's dependent on building construction
  - Can be different than other hazards, where the results are different, not the risk
- It's three-dimensional

FEMA has an answer: RiskMap

- Vision: To deliver quality data that increases public awareness and leads to action that reduces risk to life and property.

FEMA's Goals for RiskMap

- Data Gaps (27 projects in FY11)
  - Address gaps in flood hazard data
- Awareness and Understanding (3 projects)
  - Measurably increase of the public's awareness and understanding
- Mitigation Planning
  - Lead effective engagement in mitigation planning
- Digital Platform (1 project)
  - Provide an enhanced digital platform that improves management
- Synergize Programs
  - Align Risk Analysis programs and develop synergies

Risk Map Products

- Changes Since Last FIRM
- Flood Depth and Analysis Grids – Percent Annual Chance Grid
- Flood Depth and Analysis Grids – Percent Chance over a 30-yr Period
- Flood Risk Assessment
- Areas of Mitigation Interest
- Flood Risk Database/Map/Report
- Levee Project with Multi-Frequency Flood Depth and Analysis Grids
- Additional Enhanced Datasets (Velocity grids)

Figure 2.5 Potential flooding and building damage in Church Creek/Madison

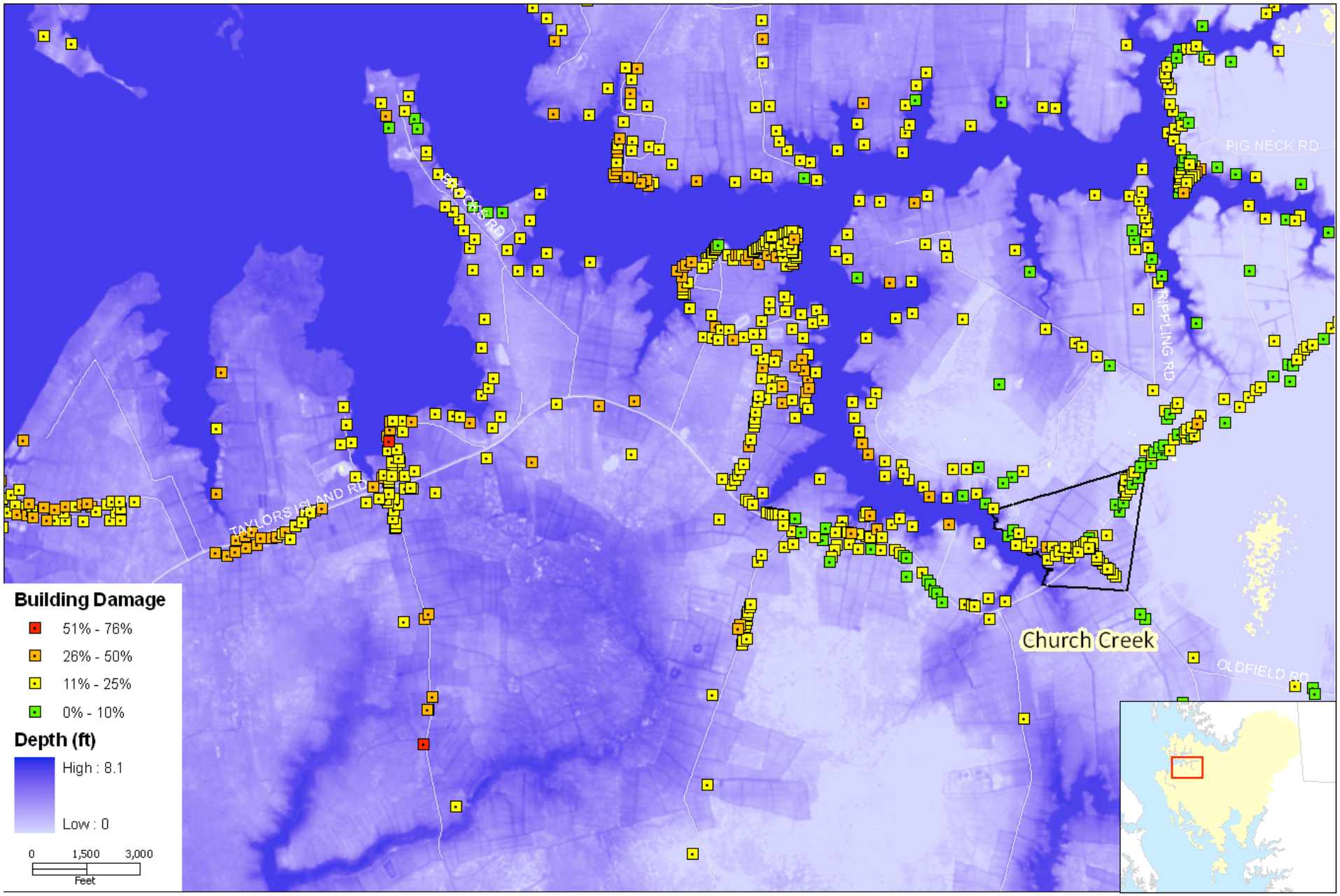


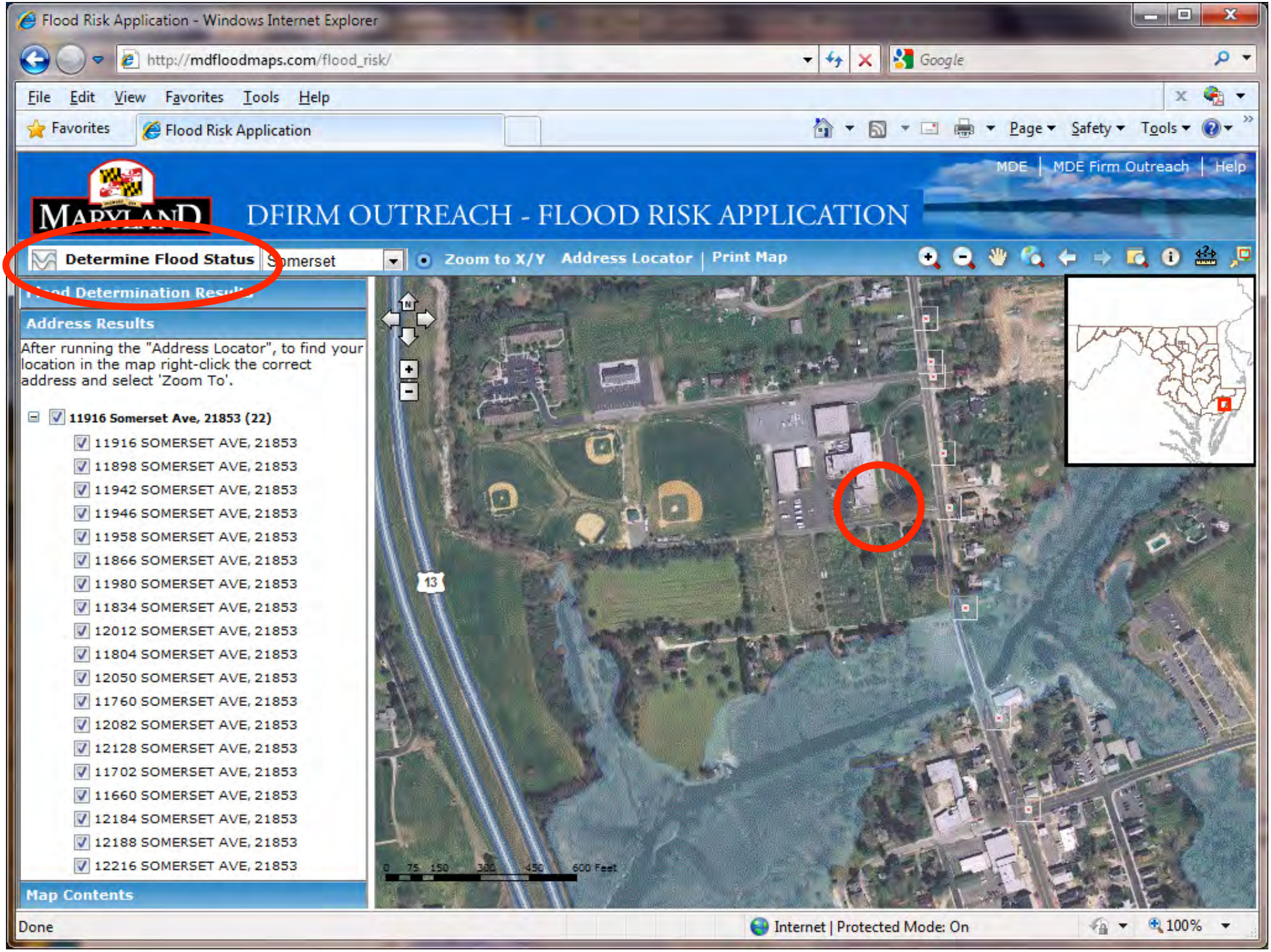
Figure 2.14 Potential flooding and building damage in the Town of North East

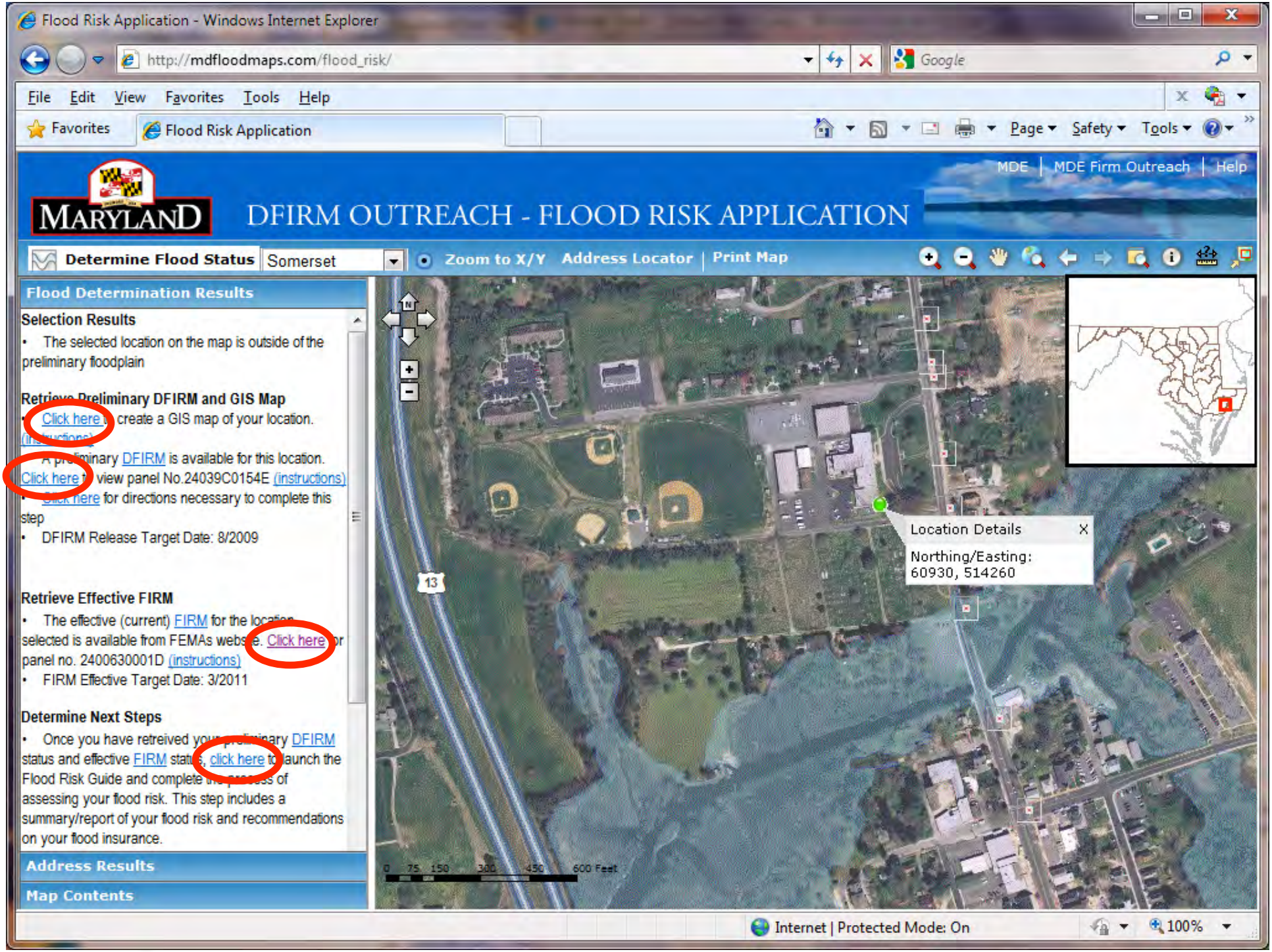
A Call for More Research

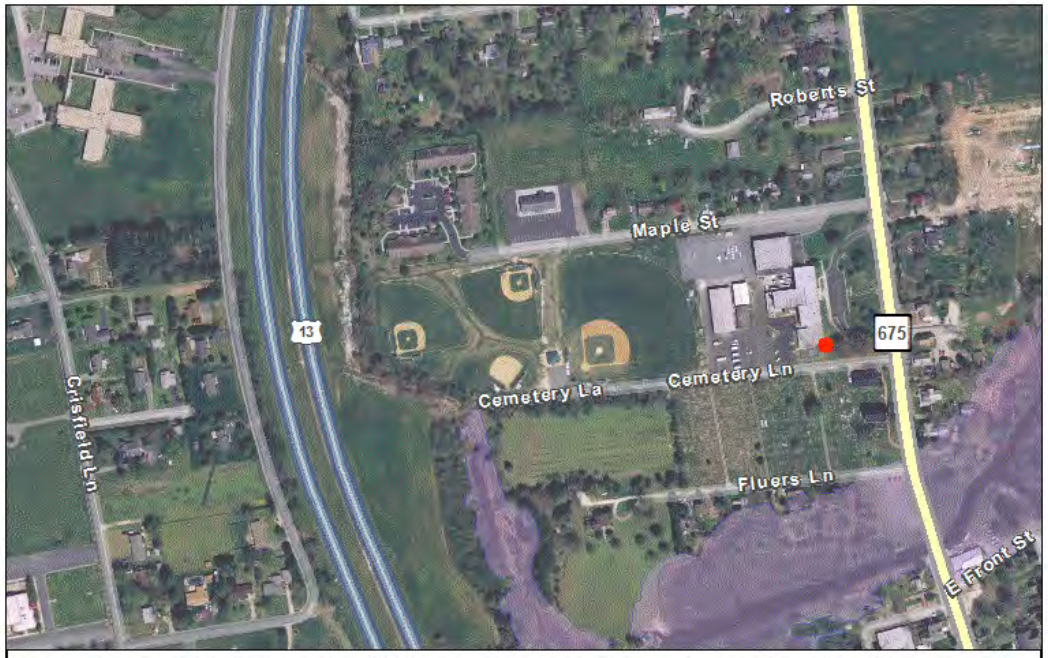
- Our understanding of what flood risk communication components motivate or confuse residents and business owners is woefully inadequate
- Flood risk metrics
  - Percent chance?
  - Depth vs probability?
  - Usefulness of loss estimates?
- Flood risk visualization
  - Dynamic mapping?
  - Fuzzy zones, color combinations, 3-D?

MD Flood Risk Application

- www.mdfloodmaps.com
- Internet-based mapping application designed to use a selected location to help determine current status versus proposed status
- Helps make a decision regarding purchasing flood insurance
- Can be accessed by citizens, or with the help of the County staff, or perhaps a realtor or flood insurance agent


Flood Risk Application - Windows Internet Explorer
http://mdfloodmaps.com/flood_risk/
Google
File Edit View Favorites Tools Help
Favorites
Flood Risk Application
Page Safety Tools
MDE | MDE Firm Outreach | Help
MARYLAND
DFIRM OUTREACH - FLOOD RISK APPLICATION
Determine Flood Status
Somerset
Zoom to X/Y
Address Locator
Print Map
Address Results
After running the "Address Locator", to find your location in the map right-click the correct address and select 'Zoom To'.
11916 Somerset Ave, 21853 (22)
11916 SOMERSET AVE, 21853
11898 SOMERSET AVE, 21853
11942 SOMERSET AVE, 21853
11946 SOMERSET AVE, 21853
11958 SOMERSET AVE, 21853
11866 SOMERSET AVE, 21853
11980 SOMERSET AVE, 21853
11834 SOMERSET AVE, 21853
12012 SOMERSET AVE, 21853
11804 SOMERSET AVE, 21853
12050 SOMERSET AVE, 21853
11760 SOMERSET AVE, 21853
12082 SOMERSET AVE, 21853
12128 SOMERSET AVE, 21853
11702 SOMERSET AVE, 21853
11660 SOMERSET AVE, 21853
12184 SOMERSET AVE, 21853
12188 SOMERSET AVE, 21853
12216 SOMERSET AVE, 21853
Map Contents
13
0 75 150 300 450 600 Feet
Done
Internet | Protected Mode: On
100%


Flood Risk Application - Windows Internet Explorer
http://mdfloodmaps.com/flood_risk/
Google
File Edit View Favorites Tools Help
Favorites
Flood Risk Application
Page Safety Tools
MDE | MDE Firm Outreach | Help
MARYLAND
DFIRM OUTREACH - FLOOD RISK APPLICATION
Determine Flood Status
Somerset
Zoom to X/Y
Address Locator
Print Map
Flood Determination Results
Selection Results
• The selected location on the map is outside of the preliminary floodplain
Retrieve Preliminary DFIRM and GIS Map
• Click here to create a GIS map of your location. (instructions)
• A preliminary DFIRM is available for this location. Click here to view panel No.24039C0154E (instructions)
• Click here for directions necessary to complete this step
• DFIRM Release Target Date: 8/2009
Retrieve Effective FIRM
• The effective (current) FIRM for the location selected is available from FEMAs website. Click here for panel no. 2400630001D (instructions)
• FIRM Effective Target Date: 3/2011
Determine Next Steps
• Once you have retreived your preliminary DFIRM status and effective FIRM status, click here to launch the Flood Risk Guide and complete the process of assessing your flood risk. This step includes a summary/report of your flood risk and recommendations on your flood insurance.
Address Results
Map Contents
Location Details
Northing/Easting:
60930, 514260
13
0 75 150 300 450 600 Feet
Internet | Protected Mode: On
100%



This map is not the official regulatory FIRM or DFIRM. Its purpose is to assist with determining potential flood risk for the selected location.

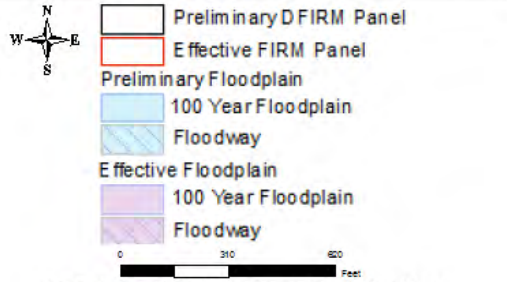
Flood Risk Map

- Northing/Easting: 60930, 514260
- The selected location on the map is outside of the floodplain
- Your local NFIP Office / Coordinator can be reached at 410-651-1726
- DFIRM Panel Number:
- DFIRM Release Target Date: 12/2008*
- Effective/Current FIRM Panel Number: 24039C0154E
- FIRM Effective Target Date: 3/2011*

*DFIRM release and effective dates are subject to change

Data Sources:

Preliminary and Effective Floodplain: FEMA, 2010
FIRM and DFIRM Grid: FEMA, 2010
County Parks: Maryland DNR, 2007
DNR Land: Maryland DNR, 1999
Federal Land: Maryland DNR- Wildlife and Heritage Division, 2002
Roads/Highways: Maryland SHA-Highway Information Services 2007
Municipalities: Maryland SHA- Highway Information Services, 2003
Water Bodies: Maryland SHA, 2004; ESRI ArcGIS & Partners, 2009
ZIP Codes: Maryland Department of Planning, 2004
Low-Resolution Aerial Photography: NAIP, 2007
High-Resolution Aerial Photography: State of Maryland, 2007
Shaded Relief: ESRI ArcGIS Online & Partners, 2009



Map Projection: State Plane Maryland (NAD83 - Meters)

Disclaimer:

The Mapping Services provided herein are for reference only. The user of this information understands and acknowledges that the data may be inaccurate or contain errors or omissions and the user assumes full responsibility for any risks or damages resulting from any use of or reliance upon this data. MDE and their Agents or Affiliates do not guarantee the accuracy or reliability of the data generated from this service.

The user of this information should always consult official FEMA flood maps and certified elevation data if there is any doubt of a property's flood risk. Please consult with your local, county, and/or community floodplain administrator for availability of official DFIRMs in your county.

FEMA MDE MARYLAND

Loss estimates for mitigation

- HAZUS-MH
  - GIS-based public domain hazard loss estimation software
  - Earthquake, flood, hurricane (more coming)
  - Used by planners and managers determine potential losses and the most beneficial mitigation approaches to take to minimize them
  - Subject to a great deal of validation testing
- Totally top-down

Loss estimates for mitigation

- Research has shown that people are more likely to adopt mitigation measures when there is a credible specific threat
- What if stakeholders could use HAZUS to determine a personal loss estimation, to establish the credibility and specificity?
- What if stakeholders could create loss estimations without having the overhead of HAZUS at all?

MD RiskMap - Demo

- http://fairview.salisbury.edu/mdriskmap
- Extracts the depth/damage curves from HAZUS
- 10%, 5%, 1%, 0.5%, 0.2% chance flood depths grids pre-calculated
- User selects location
  - Address, click spot, device location
- User enters property characteristics
- Depth of flood selected using building footprint in property parcel
- Damage estimates are calculated

Is this the answer?

- Doubtful…
- Much more work needs to be done
  - User testing, longitudinal, visualization
- More importantly, the hazard mitigation community needs to put a priority on solving risk communication problems
- Need to separate desire to sell insurance from risk communication
- It will take a partnership of federal, state, local, and academia

Conclusion

- Top-down, prescribed mitigation measures are not working as effectively as we'd like
- There must be increased attention paid to bottom-up, citizen empowerment mitigation
- To engage citizens, we must be able to communicate a credible, specific threat and what to do about it
- Our understanding of what it takes to have a working level of risk communication is not yet up to the task…we need to get to work!