

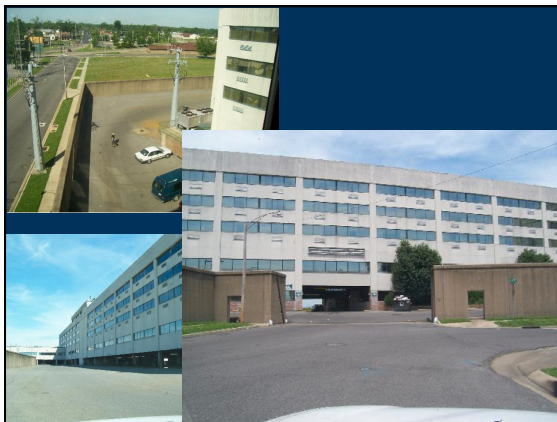
Floodplain Development for Design Professionals

Wendy Lathrop, PLS, CFM
Cadastral Consulting, LLC
NJSPLS, February 2010

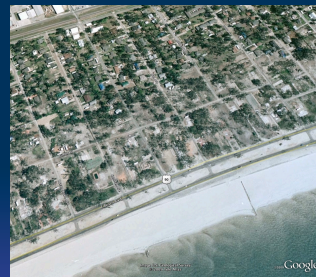
The importance of design



Paducah, KY 2009

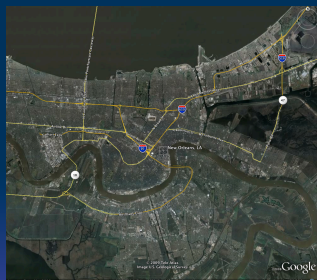


The importance of location



Gulfport, MS 2009

The importance of planning



New Orleans, LA 2009

NFIP Basic Objectives:

Reduce the exposure to flood damages through the use of minimum standards for the placement and design of structures located in flood hazard areas.

Important Concepts:

- Existing Construction (Pre-FIRM)
- New Construction (Post-FIRM)
- Substantially Improved Construction (Post-FIRM)

National Flood Insurance Program Purposes

- Identify and map flood hazard areas
- Provide a framework for floodplain management regulations
- Make flood insurance available in communities participating in the NFIP

The Legislative Side

- The National Flood Insurance Act of 1968
- The Flood Disaster Protection Act of 1973
- EO 11988, 1977
- The National Flood Insurance Reform Act of 1994
- And most recently...

Flood Insurance Reform Act of 2004

- Repetitive Loss Provisions
- New Insurance Agent training requirements
- FMA \$ Increase for Repetitive Loss mitigation
- Digital maps approved as a legal FIRM

THE NATIONAL FLOOD INSURANCE PROGRAM

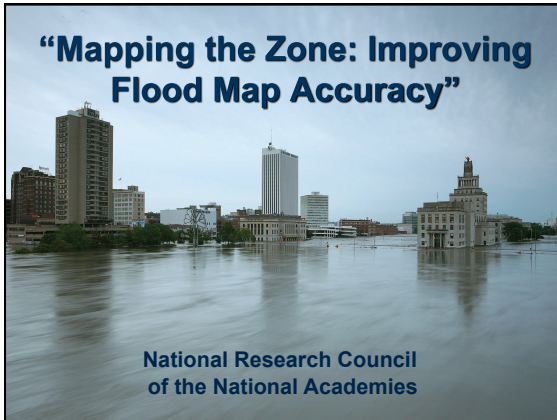
- **Mapping**
- **Insurance**
- **Regulation**

IMPORTANCE OF MAPS TO THE NFIP - *Regulations*

- If a flood hazard area isn't mapped, it isn't regulated
- If it is mapped incorrectly, it is being regulated incorrectly

IMPORTANCE OF MAPS TO THE NFIP - *Insurance*

- If a flood hazard area isn't mapped, flood insurance isn't required
- If it is mapped incorrectly, flood insurance is being required incorrectly
- Pre-FIRM buildings - subsidized insurance
- Post-FIRM buildings - rate based on elevation



The sponsors

- FEMA - Risk Analysis Division
- NOAA - Coastal Services Center, supported by
 - National Weather Service
 - National Geodetic Survey
 - Coast Survey Development Laboratory

Flood Mapping and Flood Insurance

- Incorporate new flood information, revisions, and LOMC into digital FIRMs when effective
- Require metadata for each stream and coastline reach - how studied, methods identifying magnitude and extent of flood hazard
- Reference all studies in FEMA's MIP to the USGS National Hydrography Dataset

Elevation and Height Data

- Rate of sea level rise matters in setting flood map accuracy standards
- Increase collaboration with USGS and state and local government agencies to acquire high resolution, high accuracy topographic data

Inland Flooding

- Calibrate hydrologic models using actual storm rainfall data from multiple historical events, not just from flood design storms
- Use more 2-dimensional hydraulic models
- Commission scientific review of the H&H needed to produce guidelines for ponded landscape flood mapping

Coastal Flooding

- Work with other federal agencies and academia to test, assess, and compare coastal flood mapping models
- Surge and wave modeling improvements to reduce uncertainties in current approaches
- High-resolution topography, high-accuracy bathymetric data, and post-storm topographic data
- External advisory group to assess models

Benefits and Costs of Accurate Flood Mapping

- Benefit - reduce/avoid flood losses of new buildings and infrastructure
- Benefit - insurance better matches risk
- One size does not fit all: base selected flood study method on accuracy of the topographic data as well as current and future risk in the mapped area

Mapping and Risk Communication - the Future

- Redefine V-zone based on 1.5' breaking wave rather than current 3'
- Begin mapping E-zones
- Study the technology and metrics to analyze and communicate flood risk

Bottom Line

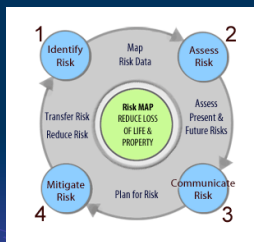
- **Elevation matters!**
- Better elevation data means better mapping
- Benefits of more accurate elevation outweigh the costs
- The most appropriate flood study method depends upon the accuracy of topographic data and the overall flood risk

“Mapping the Zone: Improving Flood Map Accuracy”

- Available from the National Academies Press
- http://www.nap.edu/catalog.php?record_id=12573

“Map Mod is Dead, Long Live Risk MAP”

- “...to deliver quality data that increases public awareness and leads to action that reduces risk to life and property.”



What we have so far

- Consistency of digital floodplain boundary
- (PM 38 on Floodplain Boundary Stds. 10/2007)

Table 1. Floodplain Boundary Standard for Flood Insurance Rate Maps

Risk Class	Characteristics	Delineation Reliability of the floodplain per study methodology ¹	
		Detailed	Approximate ²
A	High population and densities within the floodplain, and/or high anticipated growth	+/- 1.0 foot/ 95%	+/- 1/2 contour 95%
B	Medium population and densities within the floodplain, and/or modest anticipated growth	+/- 1.0 foot/ 90%	+/- 1/2 contour 90%
C	Low population and densities within the floodplain, small or no anticipated growth	+/- 1.0 foot/ 85%	+/- 1/2 contour 85%
D	Undetermined Risk, likely subject to flooding	NA	NA
E	Minimal risk of flooding, area not studied	NA	NA

¹The difference between the ground elevation (defined from topographic data) and the computed flood elevation.

² For Approximate studies the vertical tolerance should be +/- 1/2 contour or 1.0 ft which ever is greater.

Vertical accuracy requirements specified in Table 1 can be achieved within a horizontal accuracy of +/- 38 feet for each risk class. The horizontal tolerance addresses varying floodplain delineation techniques (automated versus non-automated) and map scale limitations.

Significance of NFIP regs

- Guide development planning/regulation
- Guidance to developers
- Proper insurance coverage
- Protect against loss of loan collateral
- Disaster assistance repercussions
- Repercussions of inaccurate map / no map

NFIP Regulations

- Title 44 CFR
- Part 59
- General Provisions
 - Definitions
 - Program description
 - Eligibility requirements

NFIP Regulations

- Title 44 CFR
- Part 60 - Criteria for Land Management and Use
 - Subpart A-Requirements for Flood Plain Management Regulations
 - Subpart B-Requirements for State Flood Plain Management Regulations
 - Subpart C -Additional Considerations in Managing Flood-Prone, Mudslide (i.e. Mudflow)-Prone, and Flood-Related Erosion-Prone Areas

NFIP Regulations

- Title 44 CFR
- Part 64
- Communities eligible for the sale of insurance
 - Flood Insurance Rate Maps and zones (symbols) to be utilized
 - Flood Hazard Boundary Maps
 - Effect of boundary changes and governmental reorganization on community eligibility
 - Relationship of insurance rates to zone designations

NFIP Regulations

- Title 44 CFR
- Part 65
- Identification and Mapping of Special Flood Hazard Areas
 - Requirement to submit technical data (65.3)
 - Right to submit new technical data
 - Map revisions
 - Floodways
 - Levees

NFIP Regulations

- Title 44 CFR
- Part 67
- Appeals from Proposed Flood Elevation Determinations
 - Right of appeal
 - Types of appeals
 - Appeal procedures

NFIP Regulations

- Title 44 CFR
- Part 70
- Procedure for Map Correction
- "Mapping Deficiencies Unrelated to Community-Wide Elevation Determinations"
 - Right to submit technical information
 - Letters of Map Amendment
 - Review of proposed projects

NFIP Regulations

- Title 44 CFR
- Part 72
- Procedures and Fees for Processing Map Changes
 - Defines CLOMA, CLOMR, CLOMR-F, LOMR, LOMR-F, PMR
 - Fee schedule
 - Submittal and payment procedures
 - Fee exemptions
 - Resubmittals

Other NFIP Regulations

- Part 61 - Insurance coverage and rates
- Part 62 - Sale of insurance and adjustment of claims
- Part 63 - Implementation of Section 1306(c) of the National Flood Insurance Act of 1968
- Part 66 - Consultation with local officials
- Part 68 - Administrative hearing procedures
- Part 71 - Implementation of Coastal Barrier legislation

Additional NJ regulations

- NJ Tidelands (grants and licenses)
- CAFRA (development near the MHWL)
- Coastal Zone Management/CZM (NJ, US)
- NJ Waterfront Development Act
- Hudson River Waterfront Rule
- NJ Wetlands Act of 1970

Designing in floodplains

- Consider:
- The site in question
 - The site next door
 - The site downstream
 - The site upstream

Protecting buildings, facilities

- **FEMA 259:** "Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings"
 - Elevation
 - Relocation
 - Dry floodproofing
 - Wet floodproofing
 - Floodwalls/levees
- **FEMA 348:** "Protecting Building Utilities from Flood Damage"

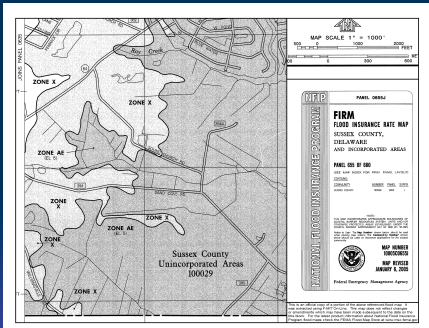


"No Adverse Impact" Defined

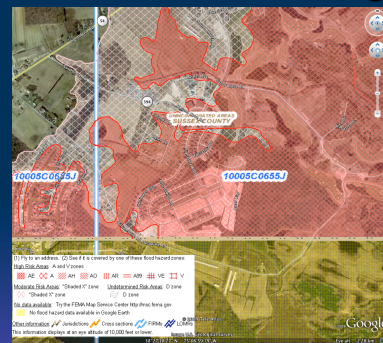
- The action of one property owner does not adversely impact the rights of other property owners, as measured by increased flood peaks, flood stage, flood velocity, and erosion and sedimentation. (ASFPM)



Remember your neighbors



Where would the water go?



The Forces of Water

- Hydrostatic pressure
- Hydrodynamic pressure
- Buoyancy
- Debris impact

Construction factors:

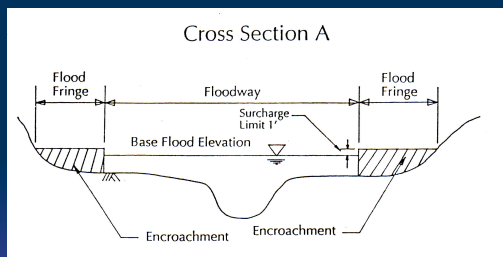
Enclosures, venting, break-away walls

It's nothing new...



Ivan's aftermath
Richmond, VA
August 30, 2004
11 inches in 5 hours

Floodway / Flood Fringe



Floodway / Flood Fringe

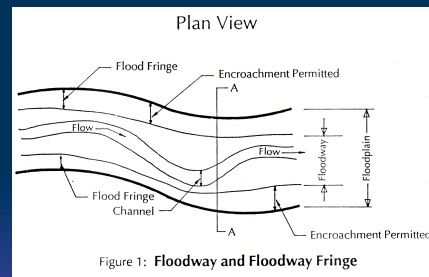
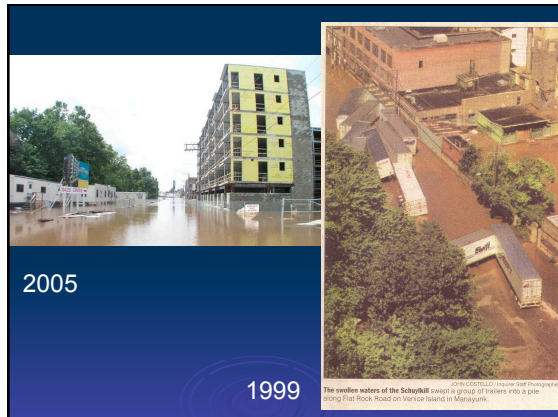
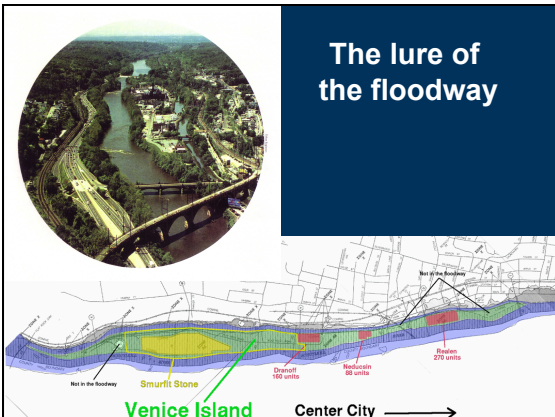


Figure 1: Floodway and Floodway Fringe

The lure of the floodway

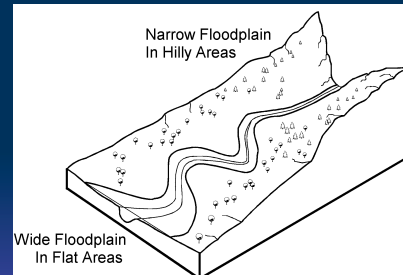


Flooding types

Three main categories:

- Riverine flooding
- Coastal flooding
- Shallow flooding

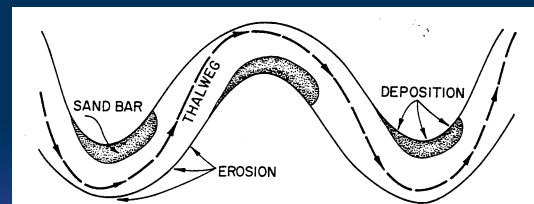
Riverine Watershed and Floodplain



44 CFR 59.1 - Definitions

- **Erosion** means the process of the gradual wearing away of land masses. This peril is not per se covered under the Program.
- **Flood-related erosion** means the collapse or subsidence of land along the shore of a lake or other body of water as a result of undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level...

Riverine Erosion

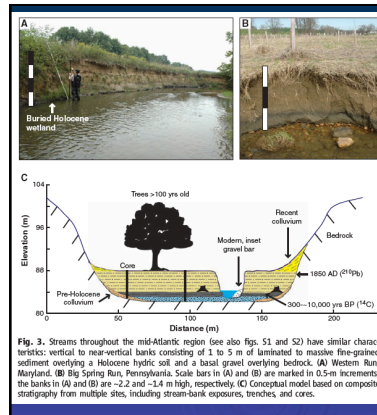


Erosion and deposition processes

(water and sediment seeking dynamic equilibrium over time; effect on channel bed)

- Degradation (lowering over time)
- Aggradation (rise over time)
- General scour (sudden lowering)
- Local scour (lowering over time)
- Deposition (sudden rise)
- Lateral migration

Legacy sediments

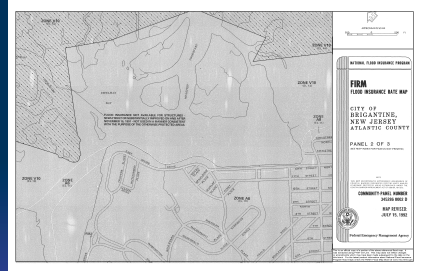


CBRA and OPA

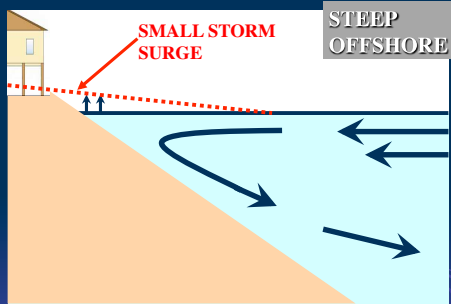
- > 1982 - Coastal Barrier Resources Act
- > 1991 - Coastal Barrier Improvement Act added restrictions in Otherwise Protected Areas
- > No new federal flood insurance after identified date
- > Privately financed development not prohibited

FIRM notes for CBRS

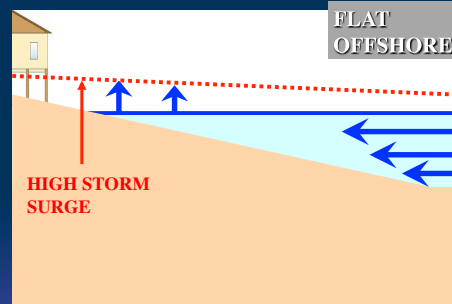
Note multiple zones and BFEs in the vicinity



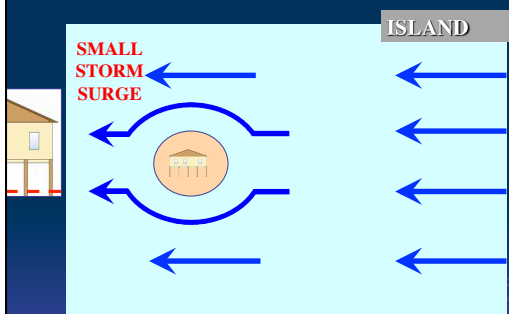
Storm Surge



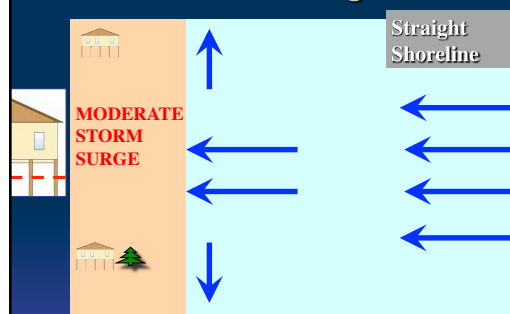
Storm Surge

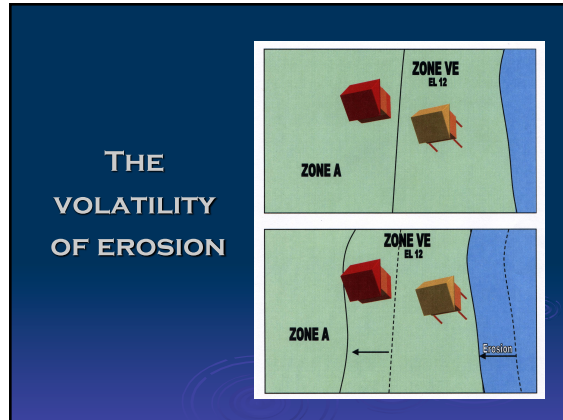
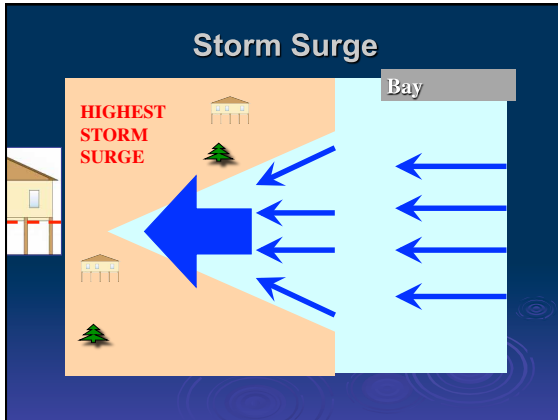


Storm Surge



Storm Surge





- ### NFIP Zones: 44 CFR 64.3
- **Zone E** - Area of special flood-related erosion hazards
 - **Zone M** - Area of special mudslide (i.e., mudflow) hazards
 - **Zone N** - Area of moderate mudslide (i.e., mudflow) hazards
 - **Zone P** - Area of undetermined, but possible, mudslide hazards

- ### Other “Unique” Flood Hazards
- Alluvial Fans
 - Migrating streams
 - Mud Flows
 - Ice/debris Jams
 - Dam Failures
 - Tsunamis

So what is an Elevation Certificate?

FEMA

FEDERAL EMERGENCY MANAGEMENT AGENCY
NATIONAL FLOOD INSURANCE PROGRAM

ELEVATION CERTIFICATE
AND
INSTRUCTIONS

- Standardized form
- Comparison of elevations

The various uses of Elevation Certificates

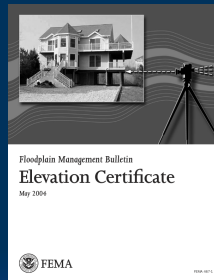
- Rating insurance (the "I" in NFIP)
- Community compliance with NFIP
- Community records of LFE
- CRS requires use of EC for LFE
- Applications for LOMC

NFIP Zones: 44 CFR 59.1, 64.3

- Zone A
- Zone A1 through A30, Zone AE
- Zone AO, Zone AH
- Zone AR, Zone A99
- Zone B, Shaded Zone X
- Zone C, Unshaded Zone X
- Zone V
- Zone V1 through V30, Zone VE
- Zone VO
- Zone D

Terminology/acronyms

- **LAG** = Lowest adjacent grade
- **HAG** = Highest adjacent grade
- **LFE** = Lowest floor elevation
- **Addition** = increases the square footage of a structure (lateral and/or vertical)
- **Extension** = construction not within the footprint of a building



Floodplain Management
Bulletin:
Elevation Certificate
(FEMA 467-1, May 2004)

www.fema.gov/pdf/fima/fema467-6-10-04.pdf
www.cadcon.com/floods.html

The big picture

- Two new building diagrams
- Engineered flood openings addressed
- Additional documentation requested
- Distinction between LAG and "LOMA LAG"
- Use of GPS for elevations addressed
- "Crawlspace" changed to one word

Section A

- New lines A8(d) and A9(d): engineered openings
- New instructions for A5, A6, A8b-d and A9b-d

SECTION A - PROPERTY INFORMATION		For Insurance Company Use
A1. Building Owner's Name		Policy Number
A2. Building Street Address (including Apt. Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.		Company NAIC Number
City	State	ZIP Code
A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.)		
A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.) _____		
A5. Elevation/Longitude: Lat. _____ Long. _____ Horizontal Datum: <input type="checkbox"/> NAD 1927 <input type="checkbox"/> NAD 1983		
A6. Attach at least 2 photographs of the building if the Certificate is being used to obtain flood insurance.		
A7. Building Diagram Number _____		
A8. For a building with a crawlspace or enclosure(s):		A9. For a building with an attached garage:
a) Square footage of crawlspace or enclosure(s) _____ sq ft	b) No. of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade _____ sq in	a) Square footage of attached garage _____ sq ft
c) Total net area of flood openings in A8.b _____ sq in	d) Engineered flood openings? <input type="checkbox"/> Yes <input type="checkbox"/> No	b) No. of permanent flood openings in the attached garage within 1.0 foot above adjacent grade _____ sq in
		c) Total net area of flood openings in A9.b _____ sq in
		d) Engineered flood openings? <input type="checkbox"/> Yes <input type="checkbox"/> No

Building Photos

- Minimum of two photos (insurance)
- Date and ID
- See line A-6

Building Photographs
See Instructions for Item A5

Building Street Address (including Apt., Unit, Suite, and/or Slog. No.) or P.O. Route and Box No. _____
City _____ State _____ ZIP Code _____

Please attach the following: Checkboxes to obtain 100% flood insurance, etc. in front of building photographs taken according to the instructions to Item A5. Identify all photographs with date taken, "Front View" and "Rear View" and "Side View" and "Other View" if required. "Right Side View" and "Left Side View" if applicable. More photographs than will fit on this page, use the Construction Page following.

Section A Instructions

- > A5 - check box in Section D if PLS supplies lat/long, identify the method
- > A6 - photos to show entire front of building, including foundation
- > A8b-d and A9b-d - interior or exterior grade for grade adjacent to flood openings (which are defined). Documentation of flood openings if available

Section B

- > New instructions regarding effective map at time of building construction

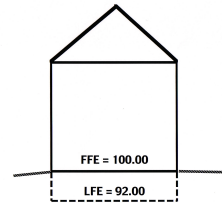
SECTION B - FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1. NFIP Community Name & Community Number		B2. County Name		B3. State	
B4. Map/Panel Number	B5. Suffix	B6. FIRM Index Date	B7. FIRM Panel Effective/Revised Date	B8. Flood Zone(s)	B9. Base Flood Elevation(s) (Zone AO, Use base flood depth)

B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in Item B9:
 FIS Profile FIRM Community Determined Other (Describe) _____

B11. Indicate elevation datum used for BFE in Item B9: NAVD 1988 Other (Describe) _____

B12. Is the building located in a Coastal Barrier Resources System (CBRS) zone or otherwise Protected Area (CPA)?
 Designation Date: _____ CBRS CPA Yes No



Original Study:

BFE = 100.00

LAG = 100.00

What is the effect if the BFE is revised higher?

What is the effect if the BFE is revised lower?

What is the apparent effect of a datum shift?

<http://water.usgs.gov/osw/streamstats/ssonline.html>

- > Watershed delineation from point
- > Terrain profile
- > Basin characteristics
- > Estimate flows using Regression equations
- > Save stats in Excel
- > Shapefiles of basins

Section C

- > C2 addresses BFE datum; instructions for GPS
- > C2e instructions re: machinery/equipment
- > C2f and C2g add "next to building"
- > New line C2h for LOMA LAG

SECTION C - BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: Construction Drawings* Building Under Construction* Finished Construction
*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations - Zones A1-A30, AE, AH, A with BFE, VE, V1-V30, V1 with BFE, AR, AR/AE, ARA1-A30, ARIAH, ARIAQ. Complete items C2.a-h below according to the building diagram specified in Item A7. Use the same datum as the BFE. Benchmark Utilized: _____ Vertical Datum: _____

Conversion/Comments: _____

	Check the measurement used:	
a) Top of bottom floor (including basement, overpass, or enclosure floor)	_____ feet	<input type="checkbox"/> meters (Puerto Rico only)
b) Top of the next higher floor	_____ feet	<input type="checkbox"/> meters (Puerto Rico only)
c) Bottom of the lowest horizontal structural member (V Zones only)	_____ feet	<input type="checkbox"/> meters (Puerto Rico only)
d) Attached garage (top of slab)	_____ feet	<input type="checkbox"/> meters (Puerto Rico only)
e) Lowest elevation of machinery or equipment servicing the building (Describe type of equipment and location in Comments)	_____ feet	<input type="checkbox"/> meters (Puerto Rico only)
f) Lowest adjacent (finished) grade next to building (LAG)	_____ feet	<input type="checkbox"/> meters (Puerto Rico only)
g) Highest adjacent (finished) grade next to building (HAG)	_____ feet	<input type="checkbox"/> meters (Puerto Rico only)
h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support	_____ feet	<input type="checkbox"/> meters (Puerto Rico only)

M & E - Elevators (line C3e)

- TB 4-93
- Machine room location
- Float switch system
- Water-resistant components

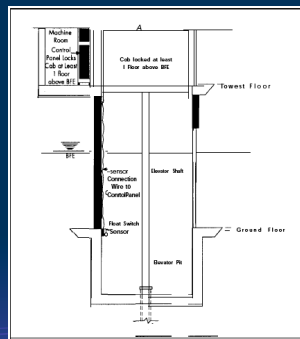


Figure 3. Float and Control Mechanism to Control Cab Descent

Protecting Your Business From Flooding

FEDERAL EMERGENCY MANAGEMENT AGENCY

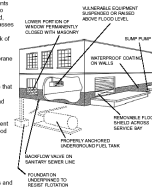
Are You at Risk?
 If you want to know whether your business is at risk from flooding, check with your local floodplain manager, building official, city engineer, or planning and zoning administrator. They can tell you whether you are in a flood hazard area, and they can also tell you how to protect your business from flooding.

What You Can Do:
 Protecting your business from flooding can involve a variety of actions, from inspecting and maintaining your building to installing protective devices. Most of these actions, especially those that affect the structure of your building or your utility systems, should be carried out by qualified maintenance staff or professional contractors licensed to work in your state, county, or city. One example of flood protection is using dry floodproofing techniques to protect buildings in flood hazard areas.

DRY FLOODPROOF YOUR BUILDING

One way to protect a building and its contents from flood damage is to seal the building so that flood water cannot enter. This method, known as dry floodproofing, encompasses a variety of measures (some of which are explained by separate fact sheets – see back of this sheet):

- installing a waterproof coating or membrane to the exterior walls of the building
- installing watertight doors, windows, and other openings
- anchoring the building as necessary so that it can resist flotation
- installing backflow valves in sanitary and storm sewer lines
- raising utility system components, machinery, and other pieces of equipment so that they are above the expected flood level
- anchoring fuel tanks and other storage tanks to prevent flotation
- installing a sump pump and foundation drain system
- strengthening walls so that they can withstand the pressure of flood waters and the impacts of floodborne debris



Structural vs. Finish Materials

"Flood insurance will not pay a claim for finish materials located in basements or in enclosed areas below the lowest floor of elevated buildings, even if such materials are considered to be flood damage-resistant. NFIP claims for damage below the BFE are limited to utilities and equipment, such as furnaces and water heaters." (TB 2)



Flood Damage-Resistant Materials Requirements

for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program Technical Bulletin 2 / August 2008



TB 3-93: Non-Residential Floodproofing - Requirements and Certification

TB 6-93: Below-Grade Parking Requirements

- See 44 CFR 60.3(c)(3)(ii) for design performance standards (including utilities and sanitary facilities)
- Army Corps "Flood Proofing Regulations": Impermeable means not more than 4 inches of water depth during a 24 hour period if no devices provide for its removal

Note: While the NFIP regulations require that non-residential buildings be floodproofed only to the BFE, flood insurance rating procedures include a freeboard, or level of safety criterion. When a floodproofed building is rated for flood insurance, the level of flood protection is assumed at 1 foot below the top elevation of the floodproofing. For rating purposes, the NFIP requires that non-residential buildings be floodproofed to 1 foot above the BFE in order to receive rating credit for the floodproofing design.

Floodproofing Certificates

- From the form's header:

"...Floodproofing of a residential building does not alter a community's floodplain management elevation requirements or affect the insurance rating unless the community has been issued an exception by FEMA to allow floodproofed residential basements..."

Floodproofing Certificates

- From Section II:

"NOTE: For insurance rating purposes, the building's floodproofed design elevation must be at least one foot above the Base Flood Elevation to receive rating credit. If the building is floodproofed only to the Base Flood Elevation, then the building's insurance rating will result in a higher premium."

- **Title 44 CFR Part 60**
Criteria for Land Management and Use
 - Subpart A-Requirements for Flood Plain Management Regulations
- **Title 44 CFR Part 65**
Identification and Mapping of Special Flood Hazard Areas
 - Map Revisions

44 CFR 60.3 - Flood plain management criteria for flood-prone areas

- Minimum standards for communities
- Requirements for Zone A1-A30, AE, AH:
 - (c)(2) Residential structures
 - (c)(3) Non-residential structures
- "lowest floor (including basement) elevated to or above the base flood level"

44 CFR 60.3 - Flood plain management criteria for flood-prone areas

- Requirements for Zone AO:
 - (c)(7) Residential structures
 - (c)(8) Non-residential structures
- "lowest floor (including basement) elevated above the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified)"

Key Terms

- Lowest Adjacent Grade (LAG)
- Highest Adjacent Grade (HAG) in Zone AO
- Base Flood Elevation (BFE)
- Fill
- Lowest Floor
- Basement versus Crawlspace

Definition of Lowest Floor

- "... the lowest floor of the **lowest enclosed area** (including **basement**). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; Provided, that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of Sec. 60.3."

TABLE 39. REGULAR PROGRAM - POST-FIRM CONSTRUCTION RATES
ANNUAL RATES PER 100 OF COVERAGE
(dollars/100)

REGULATED AS A1-A30 - RESIDENTIAL RATES												
Elevation of Lowest Floor Above or Below BFE	One-Floor, No Basement/Enc.		More Than One Floor, No Basement/Enc.		More Than One Floor With Basement/Enc.		Manufactured (Mobile) Home					
	Residential	Non-Residential	Residential	Non-Residential	Residential	Non-Residential	Family	Non-Residential				
0	10.00	15.00	10.00	15.00	10.00	15.00	10.00	15.00				
1	12.00	18.00	12.00	18.00	12.00	18.00	12.00	18.00				
2	14.00	21.00	14.00	21.00	14.00	21.00	14.00	21.00				
3	16.00	24.00	16.00	24.00	16.00	24.00	16.00	24.00				
4	18.00	27.00	18.00	27.00	18.00	27.00	18.00	27.00				
5	20.00	30.00	20.00	30.00	20.00	30.00	20.00	30.00				
6	22.00	33.00	22.00	33.00	22.00	33.00	22.00	33.00				
7	24.00	36.00	24.00	36.00	24.00	36.00	24.00	36.00				
8	26.00	39.00	26.00	39.00	26.00	39.00	26.00	39.00				
9	28.00	42.00	28.00	42.00	28.00	42.00	28.00	42.00				

REGULATED AS A1-A30 - CONTENTS RATES												
Elevation of Lowest Floor Above or Below BFE	Lowest Floor Only Above Official Grade (No Basement/Enc.)		Lowest Floor Above Official Grade & Higher Floors (No Basement/Enc.)		More Than One Floor With Basement/Enclosure		Manufactured (Mobile) Home					
	Residential	Non-Residential	Residential	Non-Residential	Residential	Non-Residential	Family	Non-Residential				
0	10.00	15.00	10.00	15.00	10.00	15.00	10.00	15.00				
1	12.00	18.00	12.00	18.00	12.00	18.00	12.00	18.00				
2	14.00	21.00	14.00	21.00	14.00	21.00	14.00	21.00				
3	16.00	24.00	16.00	24.00	16.00	24.00	16.00	24.00				
4	18.00	27.00	18.00	27.00	18.00	27.00	18.00	27.00				
5	20.00	30.00	20.00	30.00	20.00	30.00	20.00	30.00				
6	22.00	33.00	22.00	33.00	22.00	33.00	22.00	33.00				
7	24.00	36.00	24.00	36.00	24.00	36.00	24.00	36.00				
8	26.00	39.00	26.00	39.00	26.00	39.00	26.00	39.00				
9	28.00	42.00	28.00	42.00	28.00	42.00	28.00	42.00				

REGULATED AS A1-A30 - CONTENTS RATES				
Elevation of Lowest Floor Above or Below BFE	REGULATED AS A1-A30 - CONTENTS RATES			
	Single Family	2-4 Family	Other Residential	Non-Residential
0	10.00	10.00	10.00	10.00
1	12.00	12.00	12.00	12.00
2	14.00	14.00	14.00	14.00
3	16.00	16.00	16.00	16.00
4	18.00	18.00	18.00	18.00
5	20.00	20.00	20.00	20.00
6	22.00	22.00	22.00	22.00
7	24.00	24.00	24.00	24.00
8	26.00	26.00	26.00	26.00
9	28.00	28.00	28.00	28.00

1. Flooded Floor Area - In cases of elevated garages, basements, enclosures for special construction. See the Flooded Floor Area section of the Flood Insurance Manual for more information. See the Flooded Floor Area section of the Flood Insurance Manual for more information. See the Flooded Floor Area section of the Flood Insurance Manual for more information.

2. **NOT FOR RATING**

NOTE: The average annual household (Mobile) Home includes household trailers.

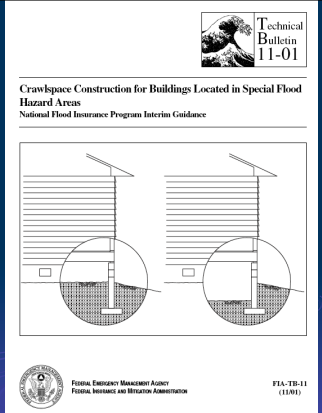
RATE 4
May 1, 2002

Definition of Basement

- “**Basement** means any area of the building having its floor subgrade (below ground level) on all sides”. (44 CFR 59.1)
- “NFIP rules and regulations specify that a crawlspace with its interior floor below grade on all sides is considered a ‘basement’.” (NFIP Insurance Agent’s Manual, RATE 25)

Crawlspace

Relation to LAG and BFE affects insurance and structural integrity



For a crawlspace not to be considered a basement, drainage and velocity also must be considered.

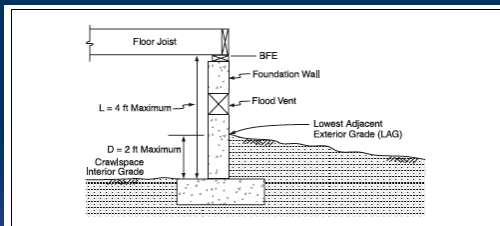


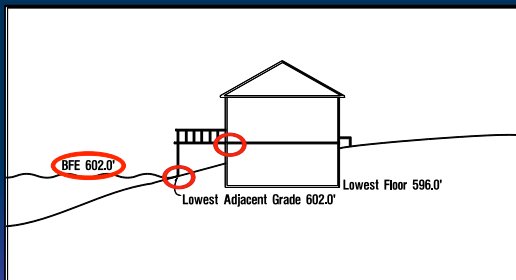
Figure 3 Requirements regarding below-grade crawlspace construction.

Caution

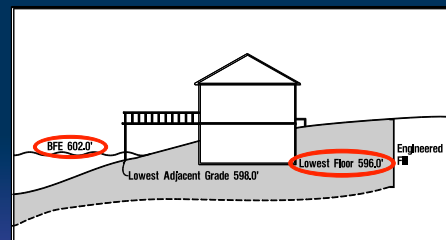
Buildings that have below-grade crawlspaces will have higher flood insurance premiums than buildings that have the preferred crawlspace construction, with the interior elevation at or above the lowest adjacent exterior grade (LAG).

(From Technical Bulletin 11)

Cross Sectional View of a LOMA Request (C2h)



Cross-Sectional View of a LOMR-F Request



Section D

- Box regarding latitude/longitude
- Comment on method if latitude/longitude by PLS

SECTION D - SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION

This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by law to certify elevation information. I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.

Check here if comments are provided on back of form. Were latitude and longitude in Section A provided by a licensed land surveyor? Yes No

Certifier's Name _____ License Number _____

Title _____ Company Name _____

Address _____ City _____ State _____ ZIP Code _____

Signature _____ Date _____ Telephone _____

SECTION D - SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION (CONTINUED)

Copy both sides of this Elevation Certificate for: (1) community official, (2) insurance agent/company, and (3) building owner.

Comments _____

Signature _____ Date _____ Check here if attachments

Section E

- No changes to form or instructions beyond references to new building diagram numbers

SECTION E - BUILDING ELEVATION INFORMATION (SURVEY NOT REQUIRED) FOR ZONE AO AND ZONE A (WITHOUT BFE)

For Zones AO and A (without BFE), complete items E1-E5. If the Certificate is intended to support a LOMA or LOMR-F request, complete Sections A, B, and C. For items E1-E4, use natural grade, if available. Check the measurement used. In Priority Flood only, enter meters.

E1. Provide elevation information for the following and check the appropriate boxes to show whether the elevation is above or below the highest adjacent grade (HAG) and the lowest adjacent grade (LAG).

a) Top of bottom floor (including basement, crawlspace, or enclosure) is _____ feet _____ meters above or below the HAG.

b) Top of bottom floor (including basement, crawlspace, or enclosure) is _____ feet _____ meters above or below the LAG.

E2. For Building Diagrams 5-9 with permanent flood openings provided in Section A items 5 a) or 9 (see pages 9-4 of instructions), the next higher floor elevation (Z2 in the diagrams) of the building is _____ feet _____ meters above or below the HAG.

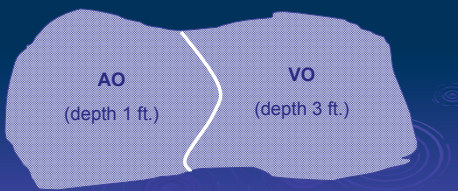
E3. Attached garage (top of slab) is _____ feet _____ meters above or below the HAG.

E4. Top of platform of machinery and/or equipment servicing the building is _____ feet _____ meters above or below the HAG.

E5. Zone AO only. If no flood depth number is available, is the top of the bottom floor elevated in accordance with the community's floodplain management ordinance? Yes No Unknown. The local official must certify this information in Section G.

Areas of shallow flooding and/or unpredictable flow paths

- Zone AO or VO in areas of low relief
- Depth in whole feet (1, 2, 3) on FIRM
- Regulatory height, not Design Elevation



Section F

- No changes to form or instructions

SECTION F - PROPERTY OWNER (OR OWNER'S REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and E for Zone A (without a FEMA-issued or community-issued BFE) or Zone AO must sign here. The statements in Sections A, B, and E are correct to the best of my knowledge.

Property Owner's or Owner's Authorized Representative's Name _____

Address _____ City _____ State _____ ZIP Code _____

Signature _____ Date _____ Telephone _____

Comments _____

Check here if attachments

Section G

- New line G10 - design flood elevation

SECTION G - COMMUNITY INFORMATION (OPTIONAL)

The local official who is authorized by law or ordinance to administer the community's floodplain management ordinance can complete Sections A, B, C, (or E), and G of this Elevation Certificate. Complete the applicable items and sign below. Check the measurement used in items G5 and G6.

G1. The information in Section C was taken from other documentation that has been signed and sealed by a licensed surveyor, engineer, or architect who is authorized by law to certify elevation information. (Indicate the source and date of the elevation data in the Comments area below.)

G2. A community official completed Section E for a building located in Zone A (without a FEMA-issued or community-issued BFE) or Zone AO.

G3. The following information (items G4-G9) is provided for community floodplain management purposes.

G4. Permit Number: _____ G5. Date Permit Issued: _____ G6. Date Certificate Of Compliance/Occupancy Issued: _____

G7. This permit has been issued for: New Construction Substantial Improvement

G8. Elevation of six-inch lowest floor (including basement) of the building: _____ feet _____ meters (PR) Datum _____

G9. BFE or (in Zone AO) depth of flooding at the building site: _____ feet _____ meters (PR) Datum _____

G10. Community's design flood elevation: _____ feet _____ meters (PR) Datum _____

Local Official's Name _____ Title _____

Community Name _____ Telephone _____

Signature _____ Date _____

Comments _____

Check here if attachments

Title 44 CFR, Section 60.3

Flood plain management criteria for flood-prone areas

FLOODPLAIN MANAGEMENT ORDINANCES AND NFIP REGULATIONS

1% annual chance flooding	BFEs	Floodway	V Zone	Land Use Classification
no	no	no	no	60.3(a)
yes	no	no	no	60.3(b)
yes	yes	no	no	60.3(c)
yes	yes	yes	no	60.3(d)
yes	yes	no	yes	60.3(e)
yes	yes	yes	yes	60.3(d) & 60.3(e)

44 CFR Sec.60.2 - Minimum compliance with flood plain management criteria.

- Communities shall meet Section 60.3 requirements for flood insurance eligibility
- Mudslide-prone (mudflow): must meet 60.4
- Flood-related erosion-prone: must meet 60.5
- If multiple hazards, must meet all applicable regulations in Sections 60.3, 60.4, and/or 60.5

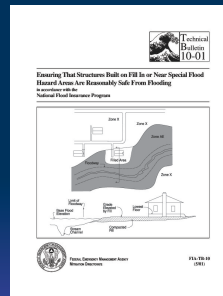
44 CFR 60.6 - Variances and exceptions

- Insurance premiums not affected; variance from floodplain management regulations
- Variances for historic structures and for structures functionally dependent upon water
- No rise in BFE if in floodway
- Floodproofing, flood warning

44 CFR 60.7 - Revisions of criteria for flood plain management regulations.

- From time to time part 60 may be revised as experience is acquired under the Program and new information becomes available. Communities will be given six months from the effective date of any new regulation to revise their flood plain management regulations to comply with any such changes.

44 CFR 65.2(c)



“Reasonably safe from flooding’ means base flood waters will not inundate the land or damage structures to be removed from the SFHA and that any subsurface waters related to the base flood will not damage existing or *proposed* buildings.”

From Technical Bulletin 10-01

Warning

In filled areas adjacent to floodplains, floods can still greatly influence the groundwater at the filled site. High groundwater at a site with a basement can result in water infiltrating the basement or greatly increased hydrostatic pressures on the walls and basement slab that can cause failure or permanent deformation. Even when floods have not reached houses with basements, FEMA has seen numerous examples of flooded basements, bowed basement floors, and collapsed basement walls that have resulted from the effects of high groundwater caused by flooding. In addition, the collapse of flooded basements has also occurred when water is rapidly pumped from basements surrounded by saturated soils whose pressure exceeds the capacity of the basement walls.

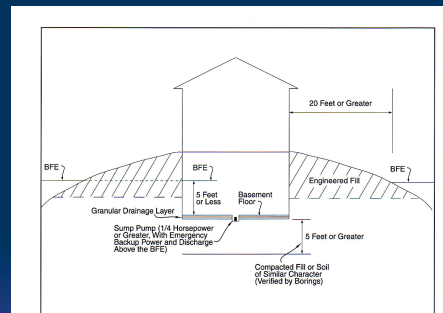


Figure 10 Requirements for use of the simplified approach to basement construction.

The Implications of TB 10-1

- Land removed from the SFHA by a LOMR or LOMR-F technically becomes unregulated land based on most local ordinances.
- However, according to the definition and the forms, future buildings on the land must be "reasonably safe from flooding."
- Communities must provide assurance that existing or proposed buildings are or will be "reasonably safe from flooding" per 44 CFR 65.2(c), and also indicate compliance with conditions per 44 CFR 65.5 (4) (i-iv).

Alternatives to comply with TB 10-1

- Community may place a restriction on future development of an area that is the subject of a LOMR or LOMR-F request.
- Locate building further back from edge of fill closest to flooding source.
- Elevate basement floor or allow no basements in fill area.
- Require a certification by a qualified design professional that the land or structures to be removed from the SFHA are "reasonably safe from flooding."
- Require compensatory storage in floodplain to make up for reduced flood storage capacity.

What elevation for design?

- Use flood profile data rather than the map
- Use floodway data tables when available
- Consider future conditions and cumulative effects of development/impervious surface
- Verify that the FIRM is realistic/accurate
- "Best available" data from Preliminary maps

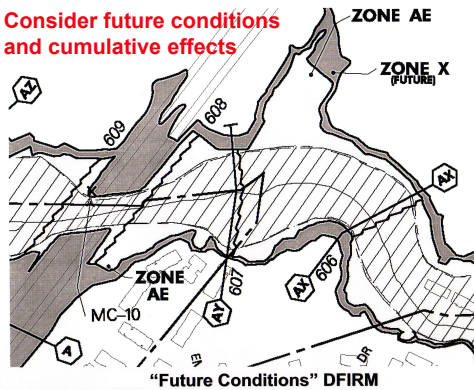
FLOODING SOURCE	FLOODWAY				BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)				
	CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Cumberland River (downreach)									
K	178.50	1,151	32,418	4.8	410.1	410.1	411.1	1.0	
L	179.76	1,217	33,018	4.7	410.8	410.8	411.8	1.0	
M	180.09	1,335	43,558	3.8	411.1	411.1	412.1	1.0	
N	181.00	1,581	39,013	4.1	411.4	411.4	412.4	1.0	
O	182.05	948	27,848	5.6	411.6	411.6	412.6	1.0	
P	183.12	599	26,284	5.9	411.8	411.8	412.8	1.0	
Q	184.33	1,028	26,195	5.3	412.0	412.0	413.0	1.0	
R	185.22	529	24,195	5.7	412.4	412.4	413.4	1.0	
S	185.97	868	21,415	4.9	412.8	412.8	413.8	1.0	
T	187.12	581	21,345	5.7	414.1	414.1	415.0	0.9	
U	188.32	680	24,490	4.8	415.2	415.2	416.1	0.9	
V	189.96	796	32,169	4.8	415.0	415.5	416.4	0.9	
W	190.09	680	28,643	5.4	415.2	415.7	416.6	0.9	
X	190.43	610	30,327	5.1	415.9	415.9	416.8	0.9	
Y	190.60	599	25,168	6.2	415.9	415.9	416.8	0.9	
Z	190.74	526	22,639	6.8	415.9	415.9	416.8	0.9	
AB	191.16	610	22,458	6.8	416.1	416.1	417.0	0.9	
AC	193.26	696	28,382	5.5	417.3	417.3	418.2	0.9	
AD	193.15	679	23,221	5.1	418.1	418.1	419.0	0.9	
AE	195.48	620	28,277	5.5	419.3	419.3	420.2	0.9	
AF	197.30	620	24,466	5.3	419.3	419.9	420.9	1.0	
AG	198.70	624	21,478	4.8	420.3	420.3	421.3	1.0	
AH	197.30	620	24,466	5.5	420.0	420.8	421.6	1.0	
AI	198.70	596	24,176	5.4	421.0	421.0	421.9	0.9	
AJ	200.00	682	25,050	6.2	421.5	421.5	422.5	1.0	
AK	206.81	533	24,173	6.0	422.3	422.3	423.2	0.9	
AL	209.11	782	25,972	6.0	423.1	423.1	424.0	0.9	

¹Meas above river.

FEDERAL EMERGENCY MANAGEMENT AGENCY
METROPOLITAN GOVERNMENT OF NASHVILLE AND DAWSON COUNTY, TN AND INCORPORATED AREAS

FLOODWAY DATA
CUMBERLAND RIVER

Consider future conditions and cumulative effects



Current map?

- Map Service Center
- Community Status list
- Federal Register
- Legal notices in paper
- Contact the community

FEMA Map Service Center - FEMA Flood Maps Page 1 of 2

FEMA Map Service Center

FEMA Flood Maps

Map ID: FEMA-FLOOD-MAPS State: IN County: INDIANAPOLIS COUNTY Date: 08/01/2012

Map ID	Map Name	Scale	Date	View	Download
34020201A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020202A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020203A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020204A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020205A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020206A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020207A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020208A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020209A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020210A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020211A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020212A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020213A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020214A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020215A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020216A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020217A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020218A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020219A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0
34020220A	FLOOD INSURANCE RATE MAP (FIRM)	00000000	11/05/00	0	0

Building Types

- Three basic types
 - Slab on grade
 - Basement
 - Elevated
- Building diagrams (enter ID No. on A-7)
 - 1A, 2 through 4 = Slab on grade and basement foundation
 - 1B, 5 through 9 = Elevated

Enclosure

- That portion of an elevated building below the lowest elevated floor that is either partially or fully closed in by rigid walls.

Building Diagrams 1A & 1B

- Use new 1B for raised foundation

DIAGRAM 1A
All slab-on-grade single- and multiple-floor buildings (other than split-level) and high-rise buildings, either detached or row type (e.g., townhouses), with or without attached garage.
Distinguishing Feature - The bottom floor is at or above ground level (grade) on at least one side.

DIAGRAM 1B
All raised-slab-on-grade or slab-on-stem-wall-with-fill single- and multiple-floor buildings (other than split-level), either detached or row type (e.g., townhouses), with or without attached garage.
Distinguishing Feature - The bottom floor is at or above ground level (grade) on at least one side.

Diagram 2

- Now for basements only
- Use Diagram 9 for subgrade crawlspace

DIAGRAM 2
All single- and multiple-floor buildings with basement (other than split-level) and high-rise buildings with basement, either detached or row type (e.g., townhouses), with or without attached garage.
Distinguishing Feature - The bottom floor (basement or underground garage) is below ground level (grade) on at least one side.

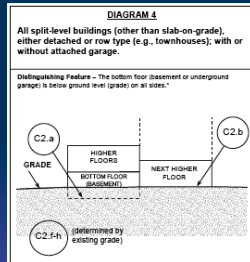
Diagram 3

- For "walk outs" (no changes)

DIAGRAM 3
All split-level buildings that are slab-on-grade, either detached or row type (e.g., townhouses), with or without attached garage.
Distinguishing Feature - The bottom floor (including garage) is at or above ground level (grade) on at least one side.

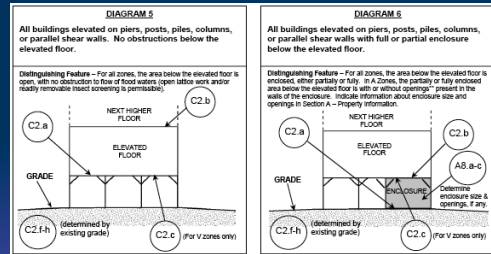
Diagram 4

- Not for subgrade crawlspaces (use Diagram 9)



Diagrams 5 and 6

- No changes



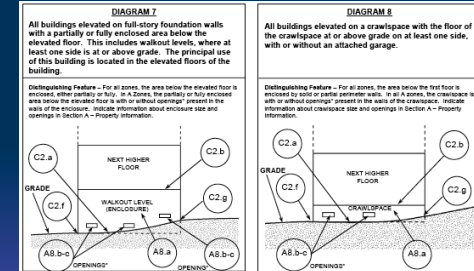
What's an obstruction?

- Access stairs, elevators
- Accessory buildings
- Bulkheads
- Concrete pads
- Decks, patios
- Enclosed areas
- Fences
- Fill
- Foundation bracing
- Grade beams
- Septic systems
- Swimming pools



Diagrams 7 and 8

- No changes



New Diagram 9

- Crawlspace at or below grade on all sides

