27th Annual National Conference on Beach Preservation
February 13, 2014

FEMA Flood Insurance Rate Maps Changes and How to Respond

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Tem Fontaine, P.E.

COASTAL TECH
COASTAL TECHNOLOGY CORPORATION
Enhancing Coastal Life.

Presentation Outline

- **Historic origins of the National Flood Insurance Program (NFIP)**
- **Risk methodology, models, and mapping**
- **Building codes and regulations for Coastal A Zone designation**
- **Community Rating System**
- **LOMR**
- **2012 Biggert Waters Flood Insurance Reform Act (BW-12)**

History

1950's

The feasibility of providing flood insurance first proposed

1965

Southeast Hurricane Disaster Relief Act

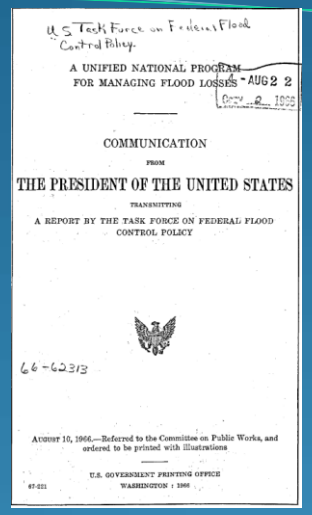
Public Law 89-339

AN ACT

To provide assistance to the States of Florida, Louisiana, and Mississippi for the reconstruction of areas damaged by the recent hurricane.

1966

House Document 465, "A Unified National Program for Managing Flood Losses"



U.S. Task Force on Federal Flood Control Policy

A UNIFIED NATIONAL PROGRAM FOR MANAGING FLOOD LOSSES

COMMUNICATION

FROM

THE PRESIDENT OF THE UNITED STATES

TRANSMITTING

A REPORT BY THE TASK FORCE ON FEDERAL FLOOD CONTROL POLICY

66-6213

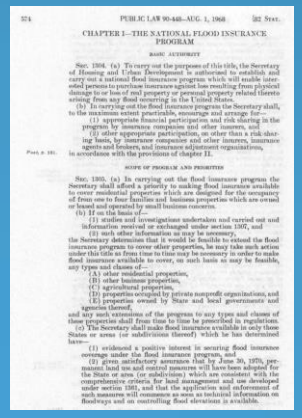
AUGUST 10, 1966.—Referred to the Committee on Public Works, and ordered to be printed with illustrations

U.S. GOVERNMENT PRINTING OFFICE

WASHINGTON : 1966

1968

National Flood Insurance Act of 1968 – Creates National Flood Insurance Program (NFIP)



CHAPTER I—THE NATIONAL FLOOD INSURANCE PROGRAM

1973

Flood Disaster Protection Act of 1973

1973 "General Guidelines for Identifying Coastal High Hazard Zones", USACE Galveston / Flood Disaster Protection Act of 1973

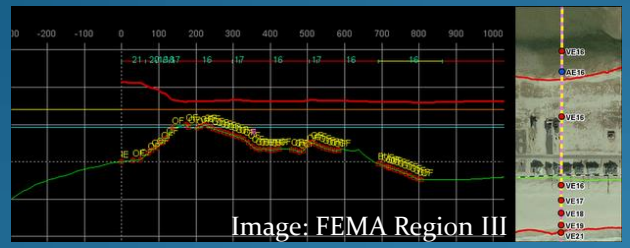
1975 "Guidelines for Identifying Coastal High Hazard Zones", USACE Galveston

NATIONAL FLOOD INSURANCE PROGRAM

History

1975 - 1980

Flood Insurance Rate Maps (FIRMs) for ~ 270 communities published

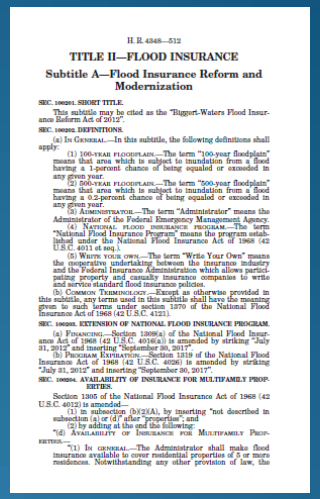


1980

FEMA issues "Users Manual for Wave Height Analysis" and WHAFIS

1994 "Flood Insurance Reform Act of 1994"

2012 Biggert-Waters Flood Insurance Reform Act of 2012



H. R. 4348—512

TITLE II—FLOOD INSURANCE

Subtitle A—Flood Insurance Reform and Modernization

SEC. 100201. SHORT TITLE.

This subtitle may be cited as the "Biggert-Waters Flood Insurance Reform Act of 2012".

SEC. 100202. DEFINITIONS.

(a) In General.—In this subtitle, the following definitions shall apply:

(1) 100-year floodplain.—The term "100-year floodplain" means that area which is subject to inundation from a flood having a 1-percent chance of being equaled or exceeded in any given year.

(2) 500-year floodplain.—The term "500-year floodplain" means that area which is subject to inundation from a flood having a 0.2-percent chance of being equaled or exceeded in any given year.

(3) Administrator.—The term "Administrator" means the Administrator of the Federal Emergency Management Agency.

(4) National flood insurance program.—The term "National Flood Insurance Program" means the program established under the National Flood Insurance Act of 1968 (42 U.S.C. 4011 et seq.).

(5) Write your own.—The term "Write Your Own" means the cooperative undertaking between the insurance industry and the Federal Insurance Administration which allows participating property and casualty insurance companies to write and service standard flood insurance policies.

(b) Common Terminology.—Except as otherwise provided in this subtitle, any terms used in this subtitle shall have the meaning given to such terms under section 1370 of the National Flood Insurance Act of 1968 (42 U.S.C. 4121).

SEC. 100203. EXTENSION OF NATIONAL FLOOD INSURANCE PROGRAM.

(a) Financing.—Section 1309(a) of the National Flood Insurance Act of 1968 (42 U.S.C. 4016(a)) is amended by striking "July 31, 2012" and inserting "September 30, 2017".

(b) Program Expiration.—Section 1319 of the National Flood Insurance Act of 1968 (42 U.S.C. 4026) is amended by striking "July 31, 2012" and inserting "September 30, 2017".

SEC. 100204. AVAILABILITY OF INSURANCE FOR MULTIFAMILY PROPERTIES.

Section 1305 of the National Flood Insurance Act of 1968 (42 U.S.C. 4012) is amended—

(1) in subsection (b)(2)(A), by inserting "not described in subsection (a) or (d)" after "properties"; and

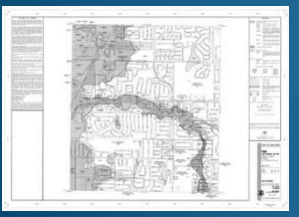
(2) by adding at the end the following:

"(d) Availability of Insurance for Multifamily Properties.—

"(1) In general.—The Administrator shall make flood insurance available to cover residential properties of 5 or more residences. Notwithstanding any other provision of law, the

1977

National Academy of Sciences "Methodology for Calculating Wave Action Effects Associated with Storm Surges"



1981 - 1990

Improvements and additions to the NAS Methodology

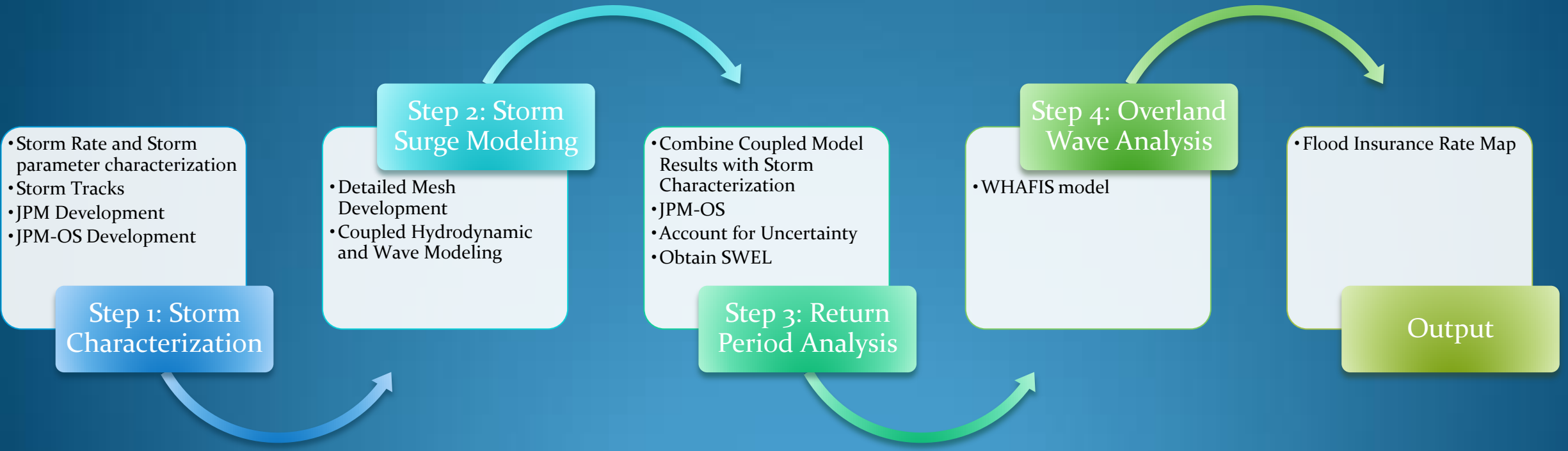
2005 Hurricane Katrina: Remapping follows throughout the Gulf Coast and Southeast

2012 Superstorm Sandy

National Flood Insurance Program

- "A program of flood insurance can promote the public interest by encouraging sound land use by minimizing exposure of property to flood losses …" (FEMA, 2004)
- Enables property owners in participating communities to purchase insurance protection from the government against losses from flooding
- More than 21,800 local governments participate in the NFIP
- Three main elements
  - Hazard ID and mapping
  - Floodplain management criteria
  - Flood insurance

Hazard ID and Mapping:
Numerical Modeling Overview for Atlantic and GOM Coasts



Step 1: Storm Characterization

- Analyze historic climatology for region
  - Storm rate
  - Storm characterization

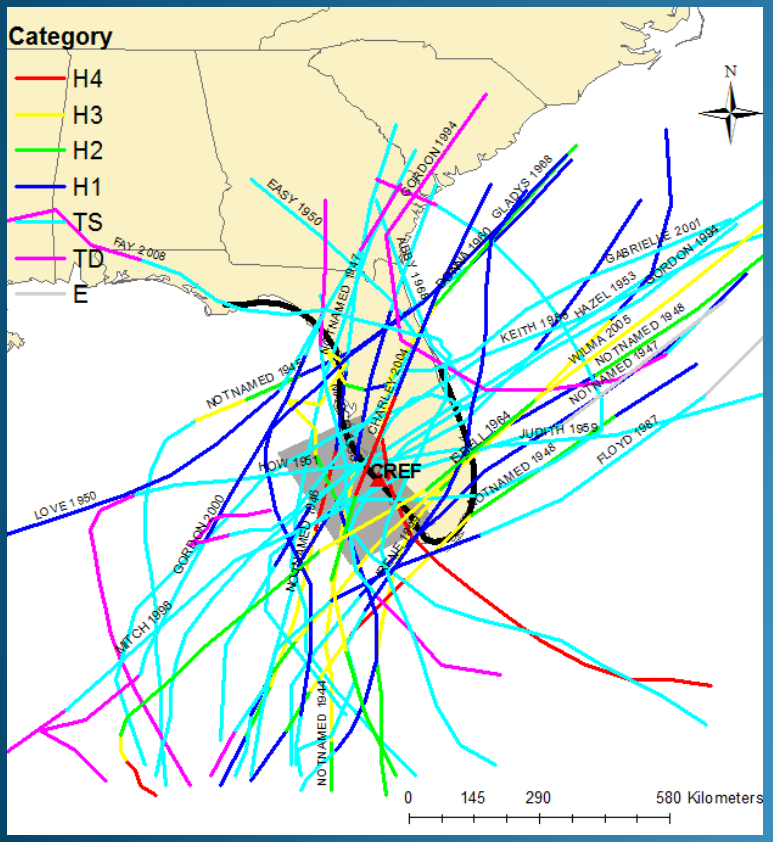


Image: Condon & Sheng / Natural Hazards 62, 2 (2012) 345-373

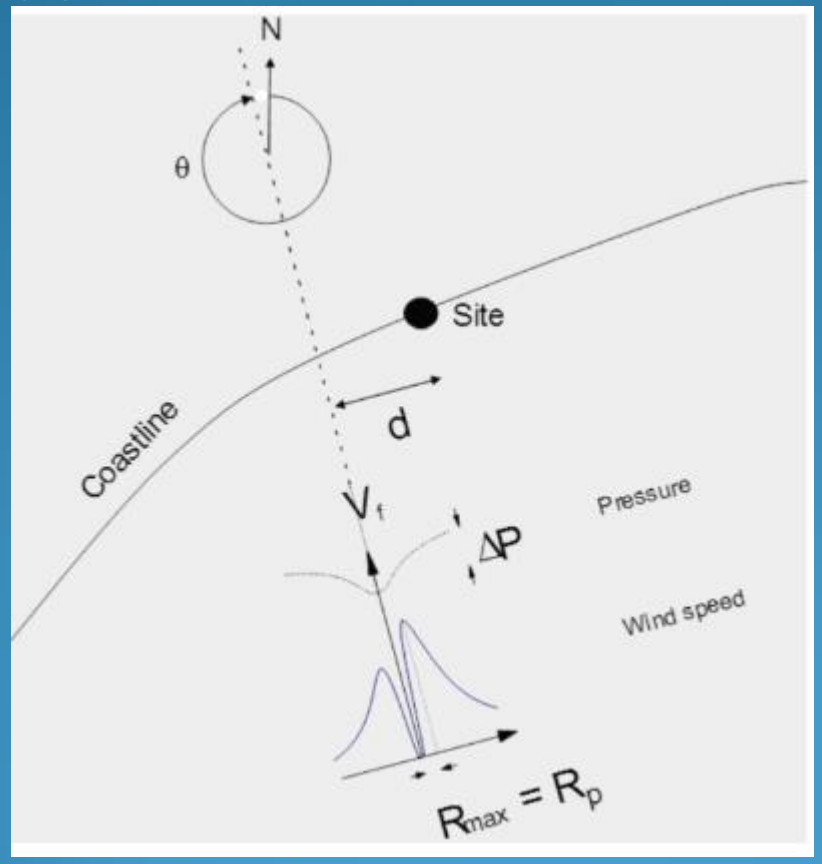


Image: G. R. Toro et al. / Ocean Engineering 37 (2010) 114-124

Historical Storm (year)	Central Pressure Deficit (hPa)	Radius to Maximum Winds (km)	Forward Speed (m/s)	Storm Heading (°N)
Notnamed (1944)	45	63	8.0	10
Notnamed (1945)	37	---	5.8	62
Notnamed (1946)	27	46	8.5	13
Notnamed (1947)	22	---	4.0	12
Notnamed2 (1947)	29	24	6.7	39
Notnamed (1948)	52	13	3.6	24
Notnamed2 (1948)	38	24	7.6	42
Easy (1950)	55	28	2.2	24
Love (1950)	23	---	8.0	46
How (1951)	20	---	7.2	81
Notnamed (1953)	28	---	8.9	51
Hazel (1953)	23	---	8.9	46
Judith (1959)	14	---	5.8	45
Donna (1960)	75	44	4.0	338
Isbell (1964)	45	56	7.2	36
Abby (1968)	20	---	4.0	27
Gladys (1968)	36	31	3.6	47
Floyd (1987)	20	---	7.6	61
Keith (1988)	18	135	7.6	65
Marco (1990)	14	19	4.0	354
Gordon (1994)	18	148	4.0	27
Mitch (1998)	23	278	8.9	62
Irene (1999)	27	74	4.5	33
Gordon (2000)	24	46	4.9	21
Gabrielle (2001)	30	46	8.0	34
Charley (2004)	66	19	8.9	15
Wilma (2005)	60	56	7.6	47
Fay (2008)	19	37	2.7	10

Step 1: Storm Characterization

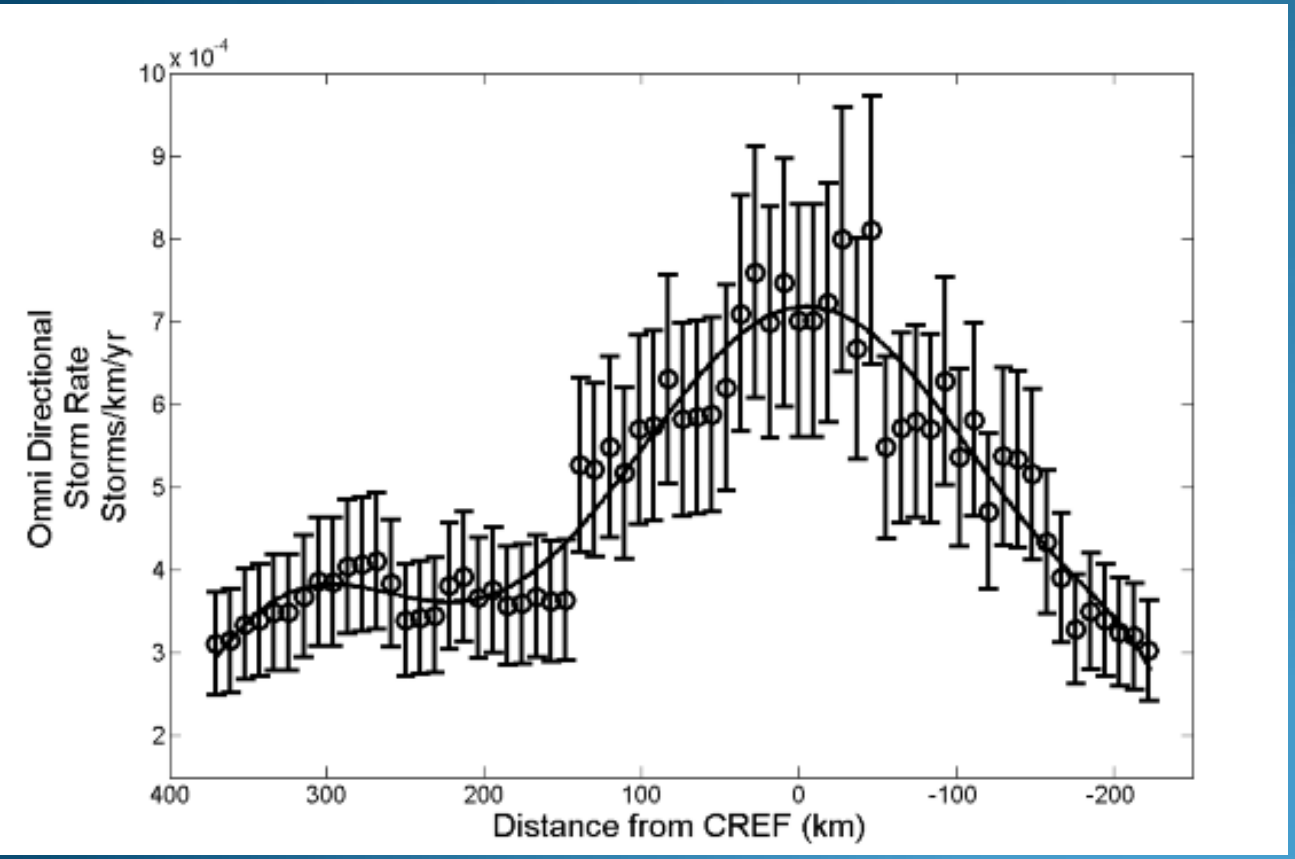


Image: Condon & Sheng / Ocean Engineering 43 (2012) 13-22

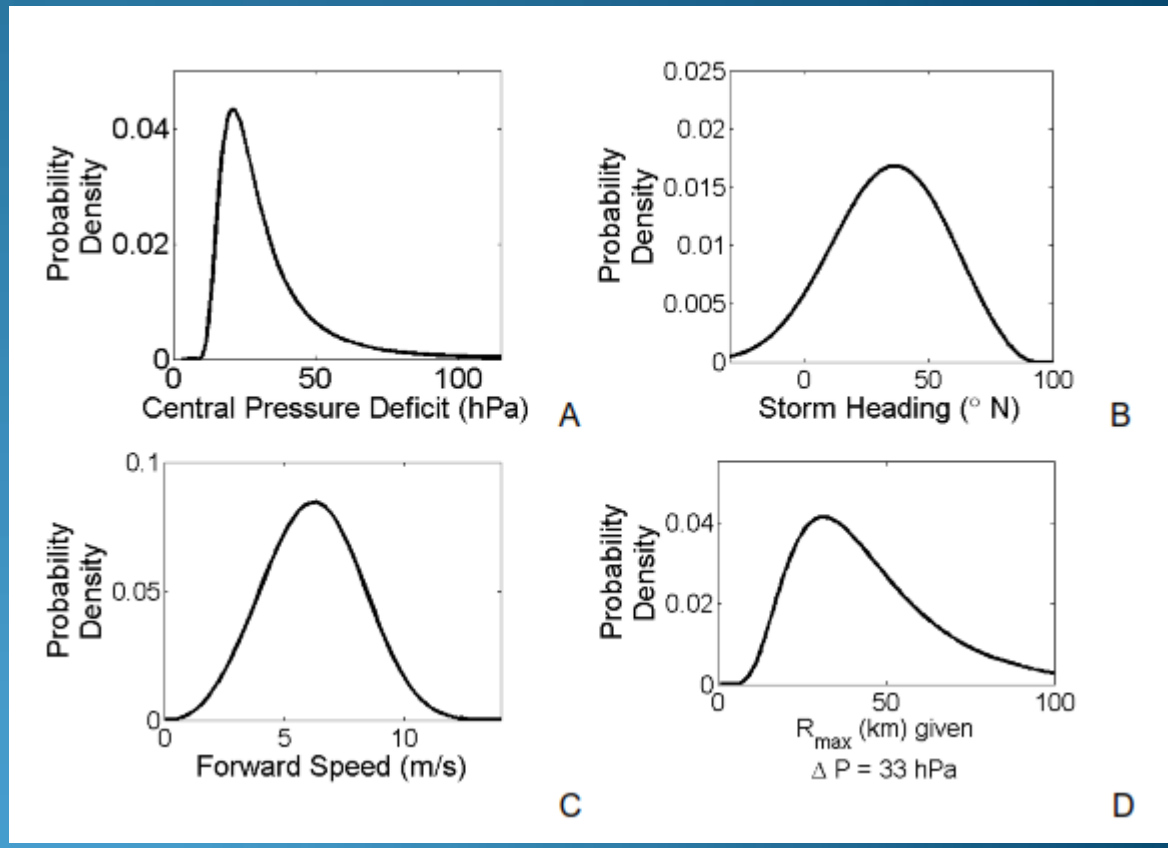
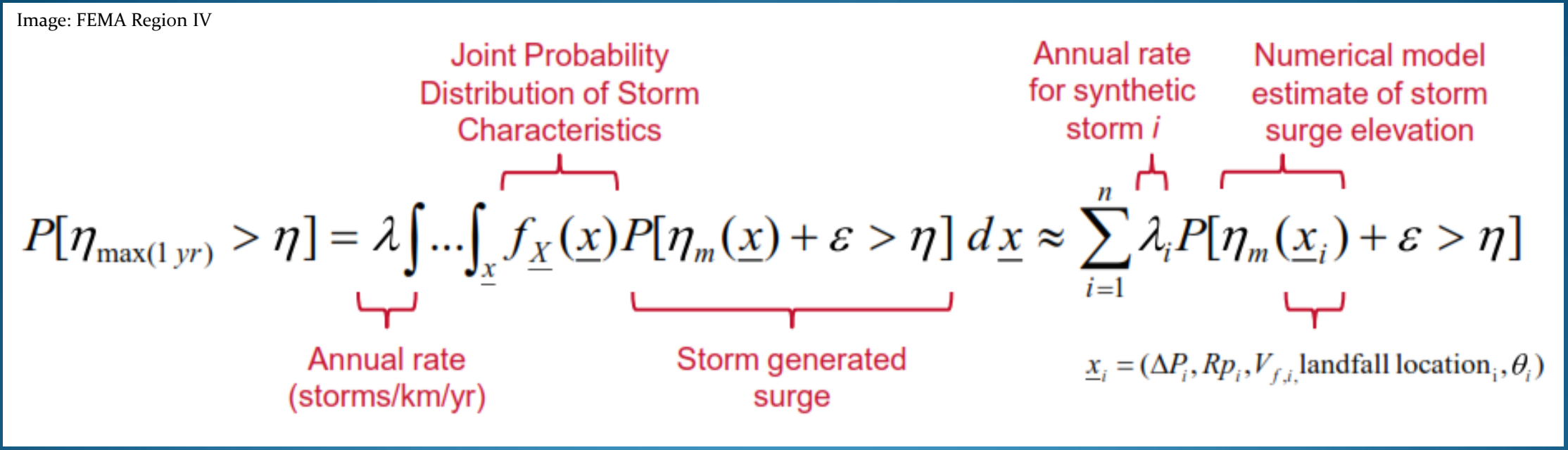


Image: Condon & Sheng / Ocean Engineering 43 (2012) 13-22

Step 1: JPM Development

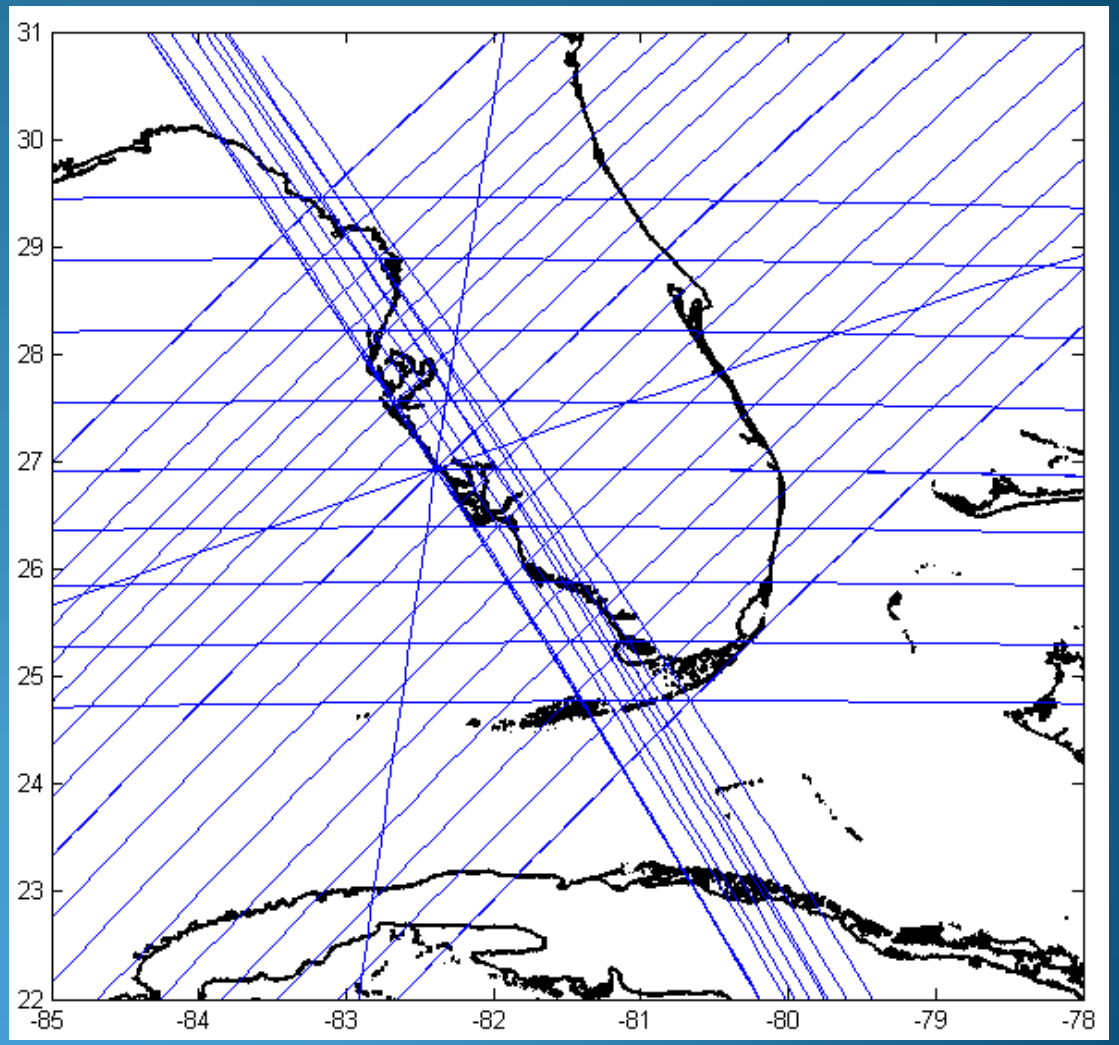
Image: FEMA Region IV



- The conditional probability that a storm with the specific characteristics $\underline{x}$ will generate a flood elevation in excess of η
- Infinite number of possible hypothetical storm tracks based on the multiple integral
- Multiple integral is approximated as a summation over a discrete set of storm-parameter values (each term (*i*) corresponds to one combination of storm parameters
- Need for optimal sampling techniques!

Step 1: JPM-OS Development

- Optimal Sampling (OS)
  - Develop an optimal ensemble of storms which can adequately represent the inundation threat to a region
  - Based on the historical tracks & climatology
  - Cover the expected surge response in the region for any climatologically possible storm
  - Storm characteristics are varied for each track

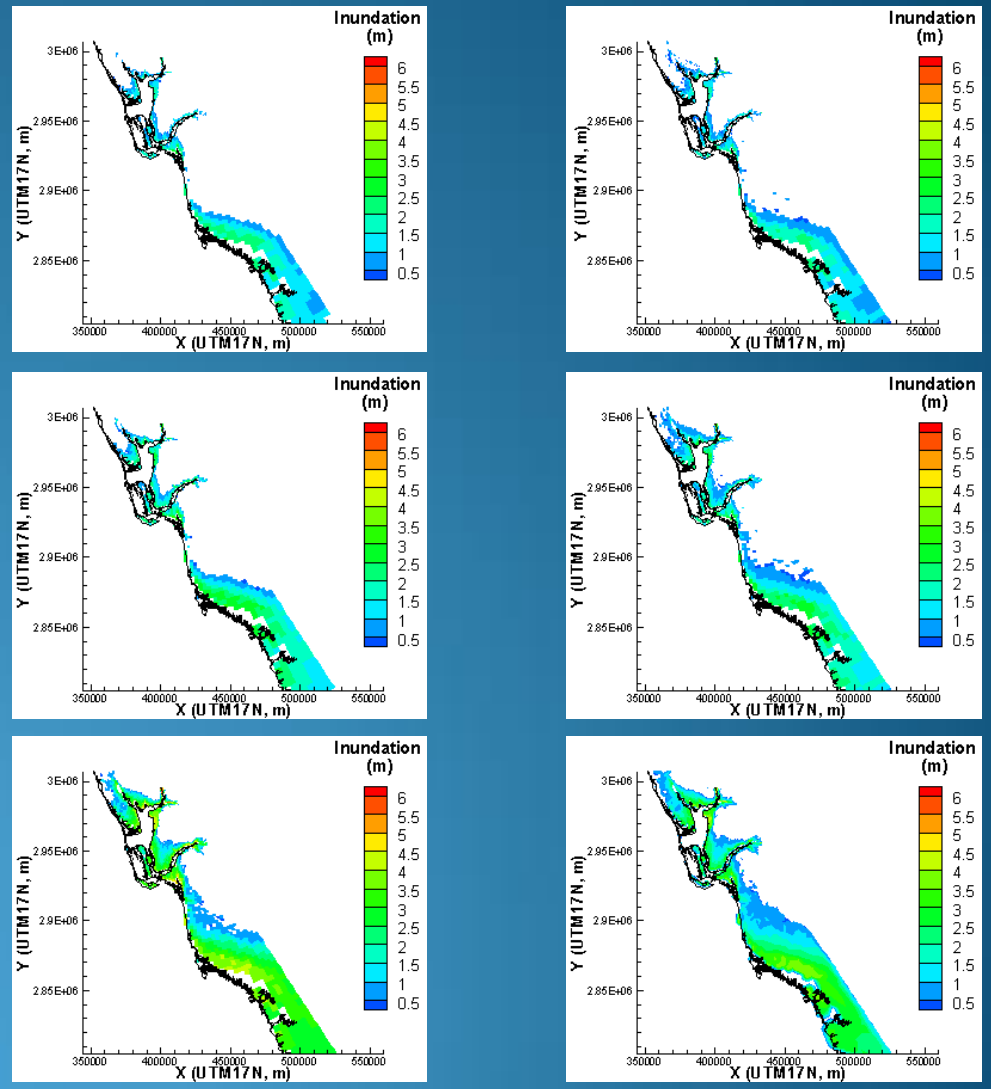


Step 1: JPM-OS

- Selecting combinations of storm parameters and their weights to minimize the number of simulations needed
- An order of magnitude or more reduction

Traditional JPM BFE
- 46,800 simulations

Optimal Storm BFE
- 197 simulations



Images: Condon & Sheng / Natural Hazards 62, 2 (2012) 345-373

Step 2: Storm Surge Modeling

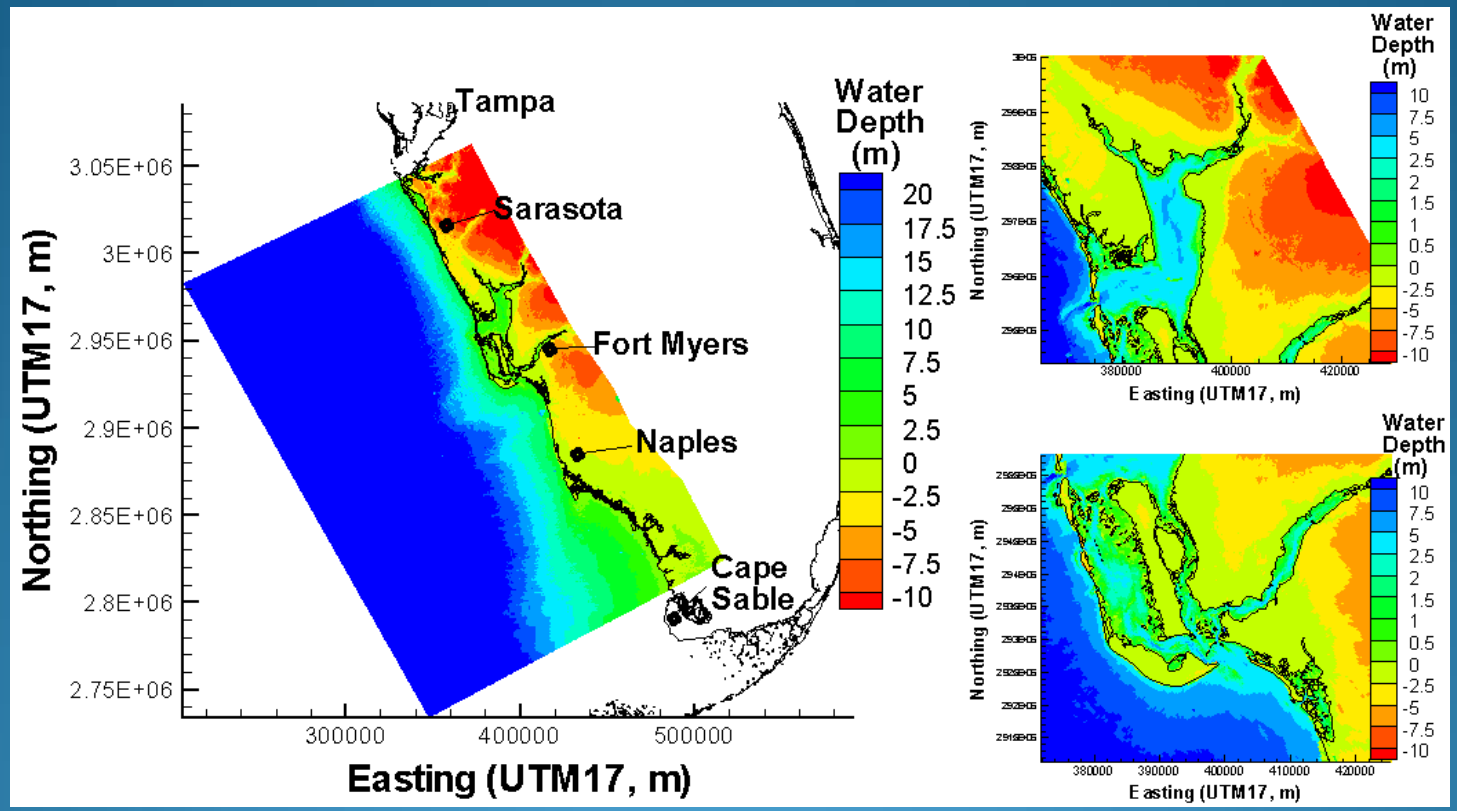


Image: Condon & Sheng / Natural Hazards 62, 2 (2012) 345-373

- Use detailed, high resolution (10s of meters) numerical grids with dynamically coupled hydrodynamic-wave modeling systems
- https://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/numerical-models-meeting-minimum-requirement-0

Step 3: Return Period Analysis

- Calculation of still water elevation made at each grid cell
- At each cell, *i* peak surges each with an associated rate of occurrence is obtained
  - Histogram of accumulated surge rate is constructed (at each cell) – approximation of surge height density distribution
- Secondary error terms are accounted for by redistributing the contents of the bins in a Gaussian pattern over neighboring bins
  - astronomical tide level
  - variations in the surge response caused by random variations in Holland *B* and departures of the actual wind from the idealized modeled wind
  - Random errors caused by lack of skill of the numerical modeling
- Develop modified histogram which is summed from the highest bin down to the lowest, resulting in an estimate of the cumulative surge distribution

Step 3: Return Period Analysis

Image: A.W. Niedoroda et al. / Ocean Engineering 37 (2010) 82-90

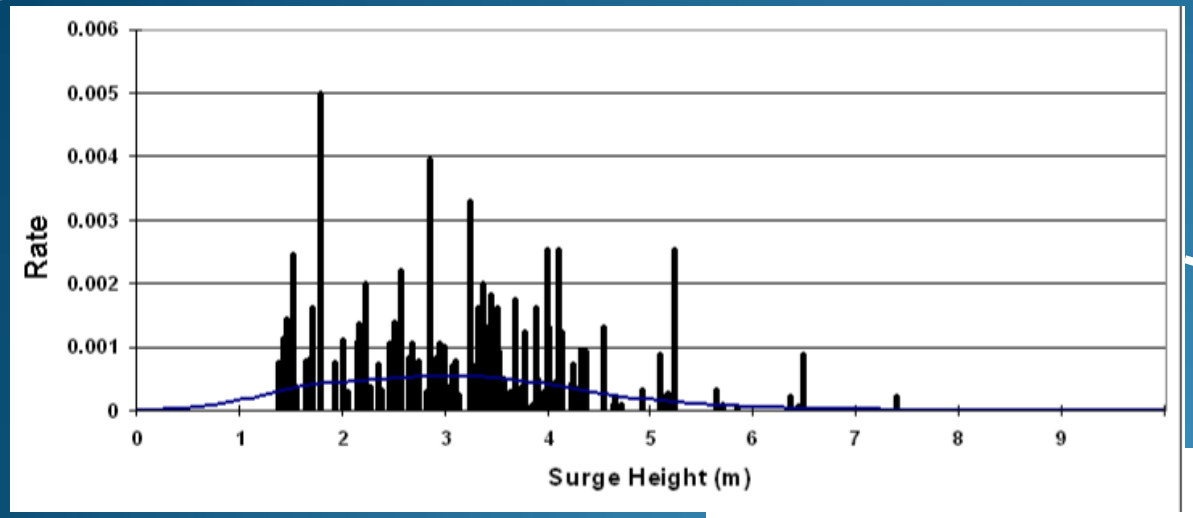
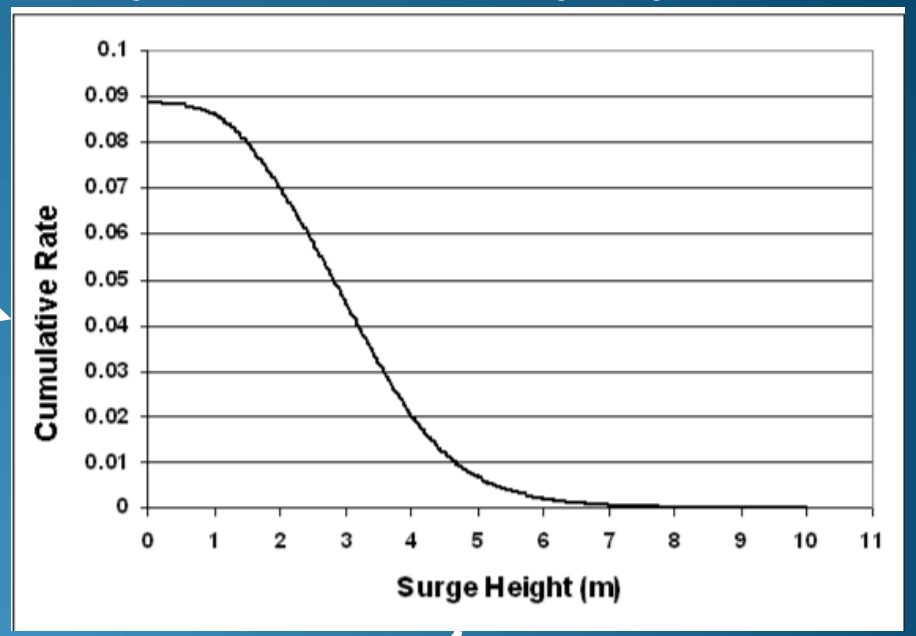


Image: A.W. Niedoroda et al. / Ocean Engineering 37 (2010) 82-90



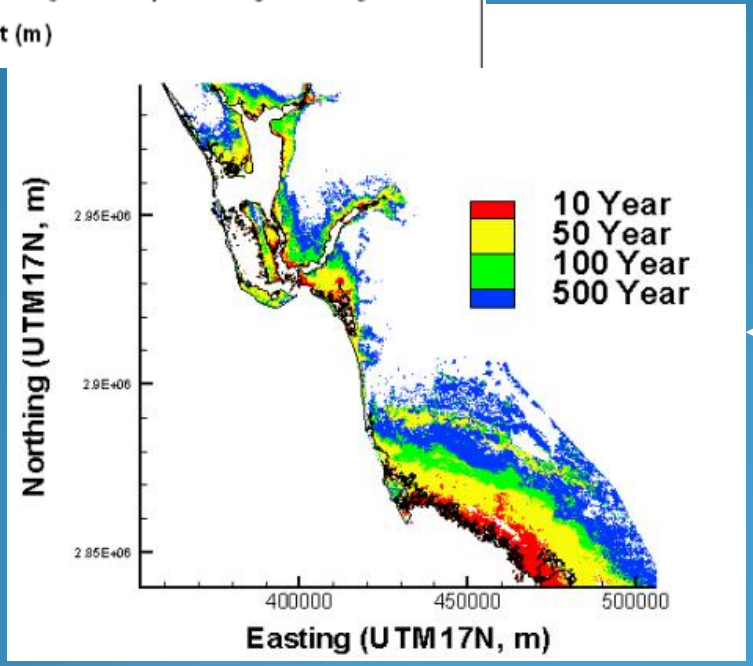


Image: Condon & Sheng / Natural Hazards 62, 2 (2012) 345-373

Step 4: Overland Wave Analysis

Using the updated stillwater elevations, overland wave hazard analysis is performed to create FIRMS by:

1. Developing layout of transects
2. Performing storm induced erosion assessments and updating primary frontal dune (PFD) determinations
3. 1-Dimensional overland wave height modeling
4. Wave runup modeling

Step 4: Overland Wave Analysis

1. Developing layout of transects
   - **Physical factors** (topography, bathymetry, shoreline orientation, land cover data)
   - **Societal factors (**variations in development and density)
   - **Field reconnaissance** (verify placements, direct modeling efforts to focused areas, hydraulic and/or flood control structures, maintenance or condition of existing hydraulic structures, verification of land type data for wave modeling)

Step 4: Overland Wave Analysis

2. Performing storm induced erosion assessments and updating primary frontal dune (PFD) determinations
   - Coastal Hazard Analysis Modeling Program (CHAMP) used to assess storm-induced beach & dune erosion (540 ft^2 rule)
   - 540 ft^2 rule says that an average cross-sectional area of 540 ft^2 (or 20 cyds volume per foot along the shore) is required above the SWEL and seaward of the dune crest to prevent dune breaching or removal
     - Remove the dune, if reservoir is less than 540 ft^2
     - Retreat the dune, if reservoir is more than 540 ft^2

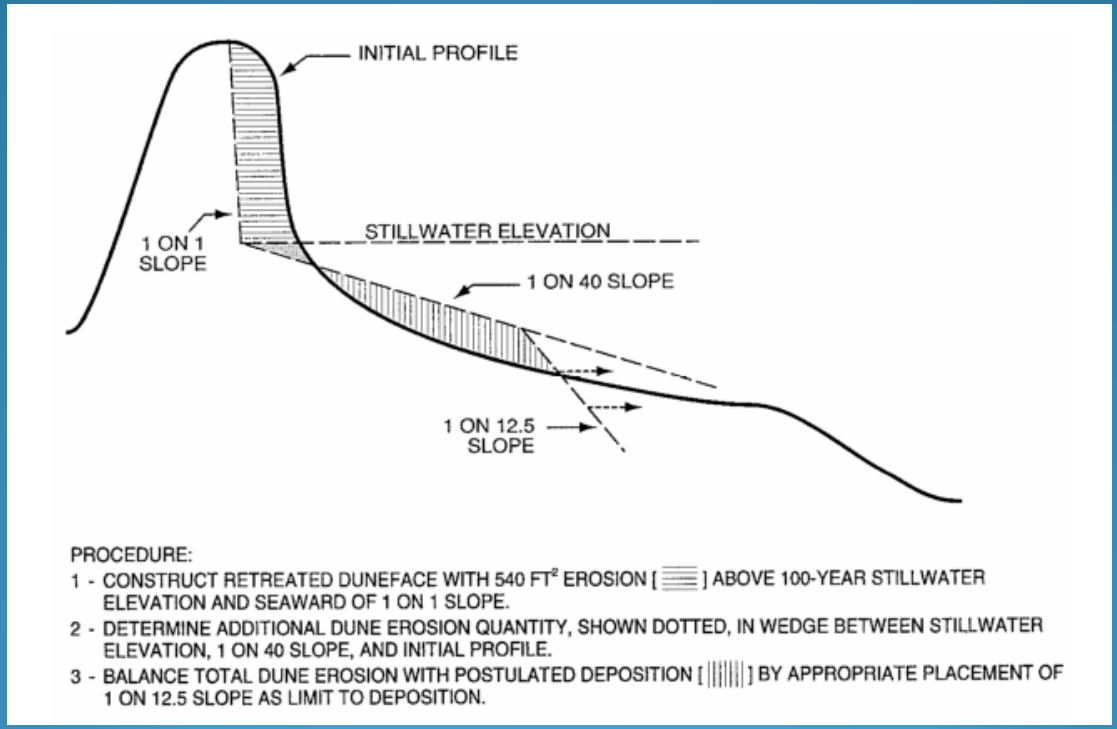


Image: FEMA

Step 4: Overland Wave Analysis

3. 1-Dimensional overland wave height modeling
   - Wave Height Analysis for Flood Insurance Studies (WHAFIS)
     - Computes wave heights, wave crest elevations, flood insurance risk zone designations, and flood zone boundaries along the transects
     - Incident wave height can be specified or computed by WHAFIS based on fetch (no refraction, diffraction)

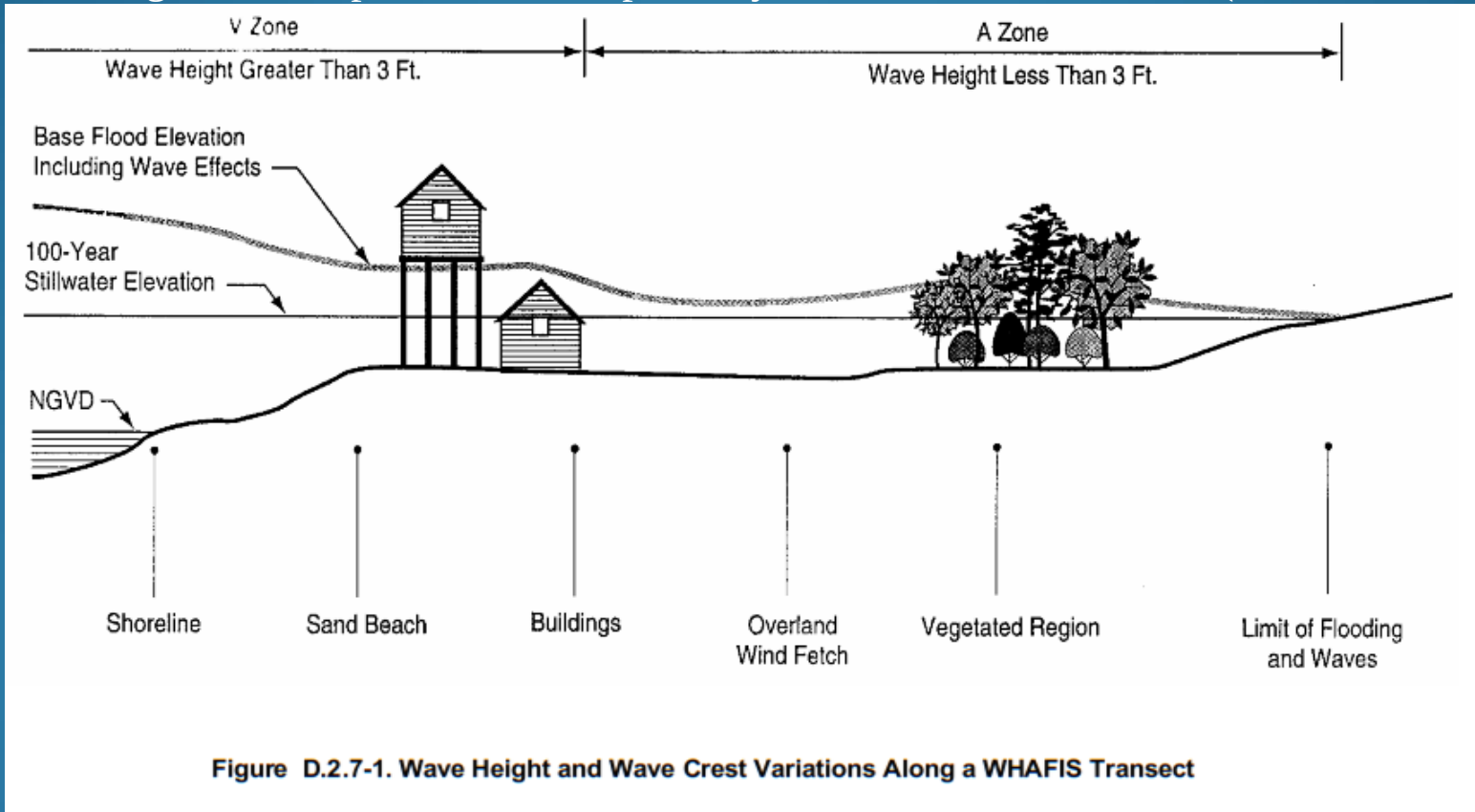
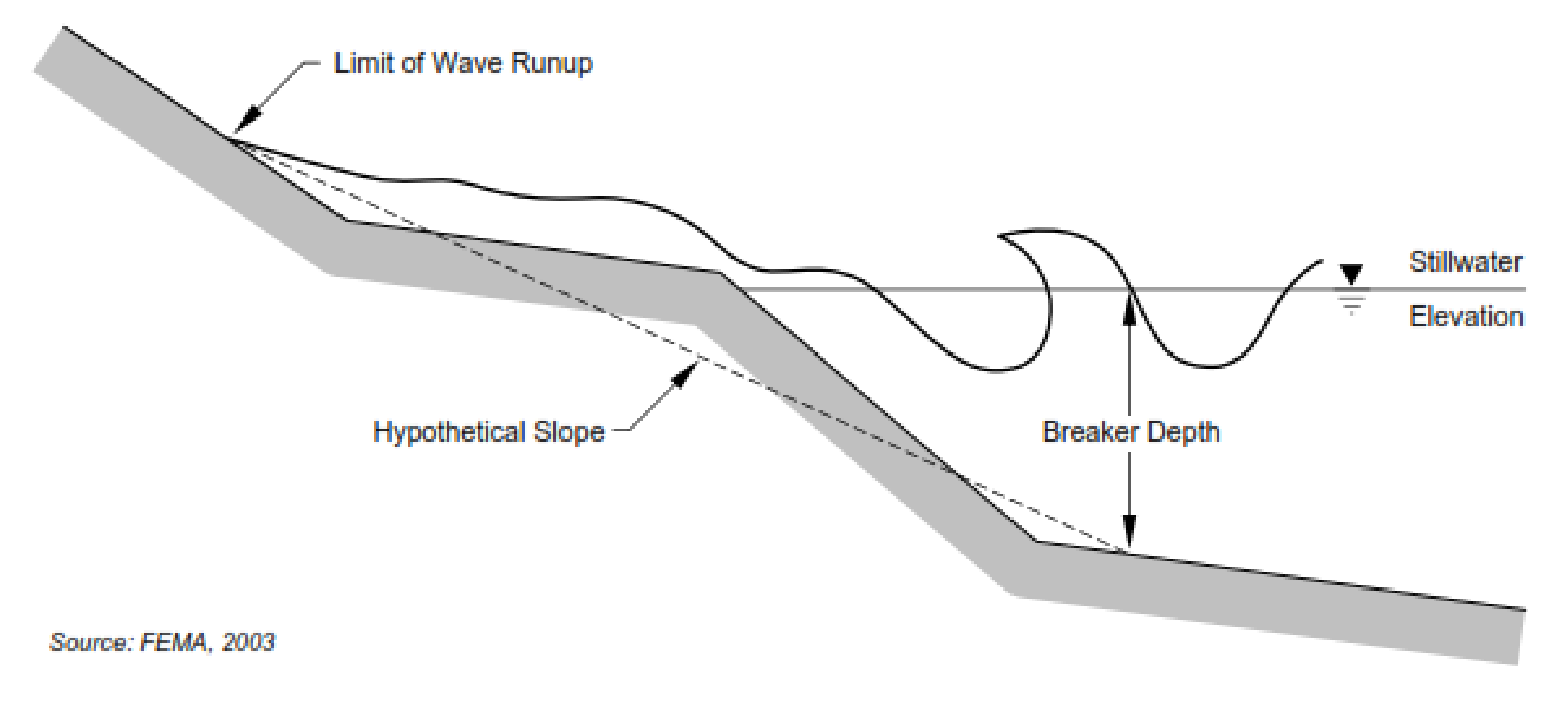


Figure D.2.7-1. Wave Height and Wave Crest Variations Along a WHAFIS Transect

Image: FEMA

Step 4: Overland Wave Analysis

4. Wave runup modeling
   - Uprush of water from wave action on a shore barrier intercepting stillwater level
   - Wave runup elevation is the value exceeded by 2% of the runup events
   - RUNUP 2.0, ACES, and several others based on the site conditions



Beach Nourishment

- FEMA will consider beach nourishment if the project is significant and will be maintained for many years
  - Tall, large, and well-established with longstanding vegetation
- FEMA may include the project in the flood study if a community can demonstrate the commitment and resources to undertake long-term maintenance of a beach nourishment project
- Whether included in flood study or not, may receive credit through CRS
- More info: 44 CFR 65.11

Output: Flood Insurance Rate Map (FIRM)

- Mapping of Coastal Hazard Areas
  - Special Flood Hazard Area (SFHA)
    - Land area covered by the floodwaters of the base flood.
    - NFIP regulations are enforced and mandatory purchase of flood insurance applies
  - Zone VE
    - Inundated by the 1-percent-annual-chance flood
    - Areas subject to waves greater than 3 feet
    - The primary frontal dune
  - Zone AE
    - Inundated by the 1-percent-annual-chance flood
    - Wave height < 3 ft.
      - Area of Moderate Wave Action (MoWA)
        - 3 ft. > Wave height ≥ 1.5 ft.
      - Limit of Moderate Wave Action (LiMWA)
        - location of 1.5 foot wave height within coastal AE zone
      - Area of Limited Wave Action (MiWA)
        - Wave height < 1.5 ft.
  - Zone X
    - Areas above the 1-percent-annual-chance flood level

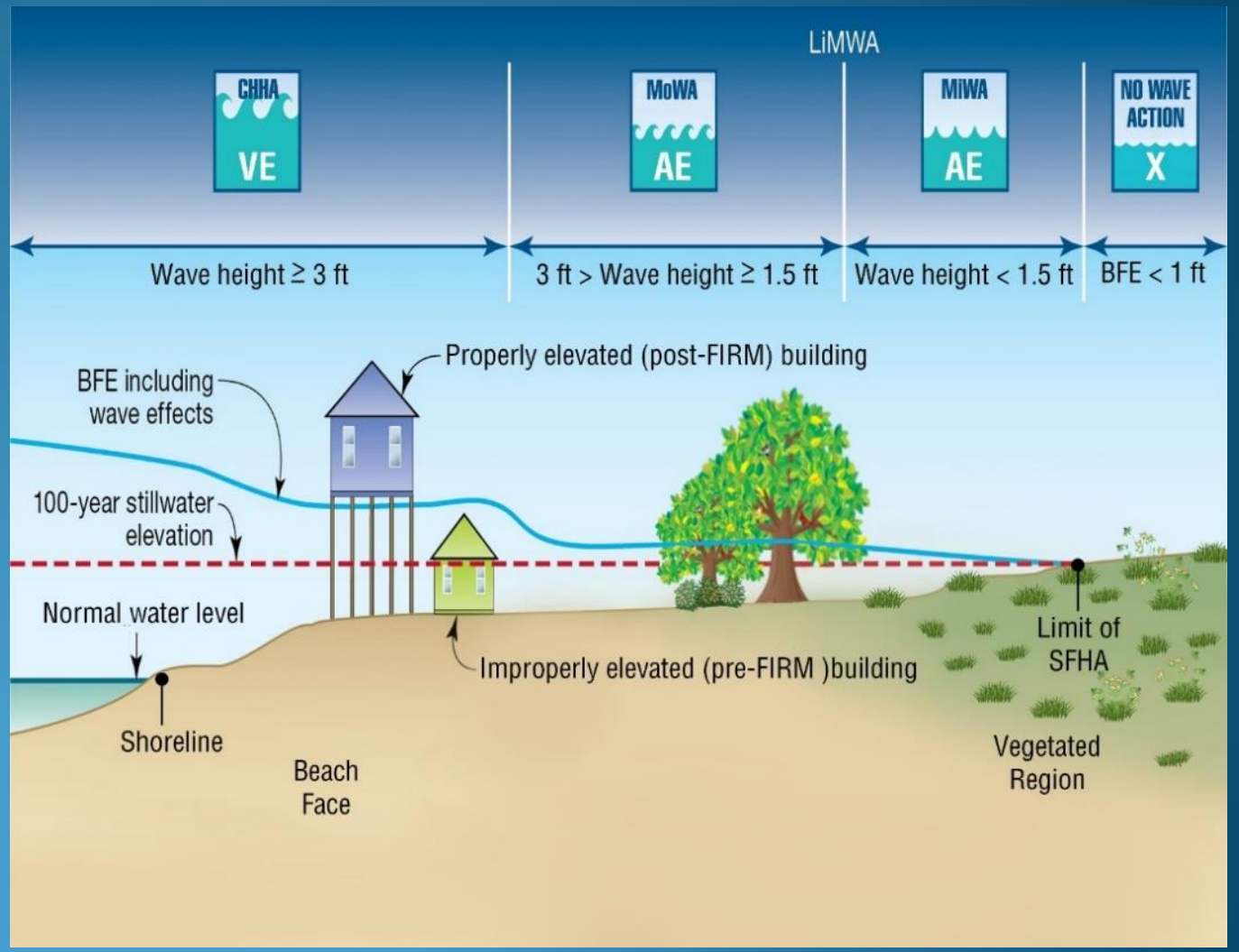


Image: FEMA

Coastal A Zone (CAZ)

Note that FEMA does not have a regulatory flood zone named the "Coastal A Zone"

- Two conditions for CAZ
  1. Water depth sufficient to support waves between 1.5 and 3.0 feet high
     - Requires stillwater depths of 2 to 4 feet at the site
  2. Expectation that wave heights between 1.5 and 3.0 feet will occur during the 1% chance storm
     - Requires wave heights at the shoreline greater than 1.5 feet, sufficient water depth between the shoreline and the building site and few, if any obstructions that may block or dampen the waves, between the shoreline and the site

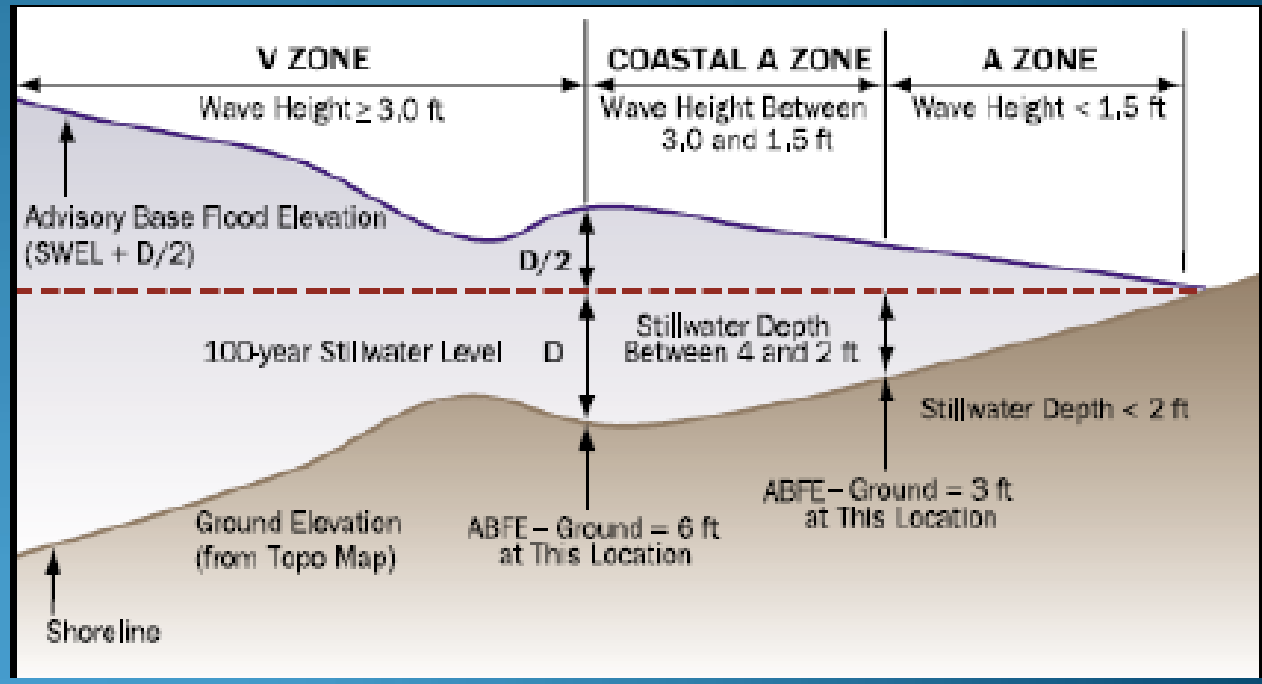


Image: FEMA

Construction Guidance

- 2010 FBC, Building
  - Reference to ASCE 7 (for loads) and to ASCE 24 require the designer to determine if CAZ conditions exist
  - ASCE 24: "Area within a special flood hazard, landward of a V Zone or landward of an open coast without mapped V Zones. In a CAZ, the principal source of flooding must be astronomical tides, storm surges, seiches, or tsunamis, not riverine flooding. During the base flood conditions, the potential breaking wave heights shall be greater than or equal to 1.5 ft."
  - **ASCE 24 requires buildings to be treated the same as buildings in coastal high hazard areas (Zone V), with one exception – openings are required in breakaway walls**

Image: FEMA

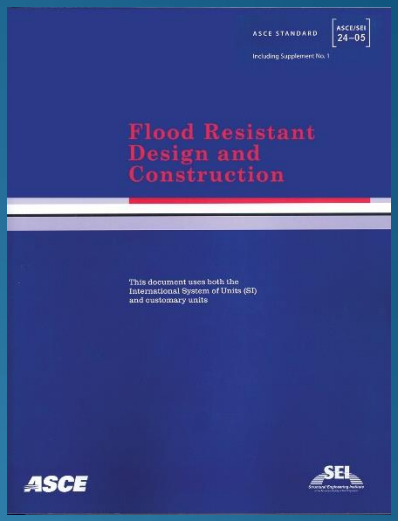
Construction Guidance

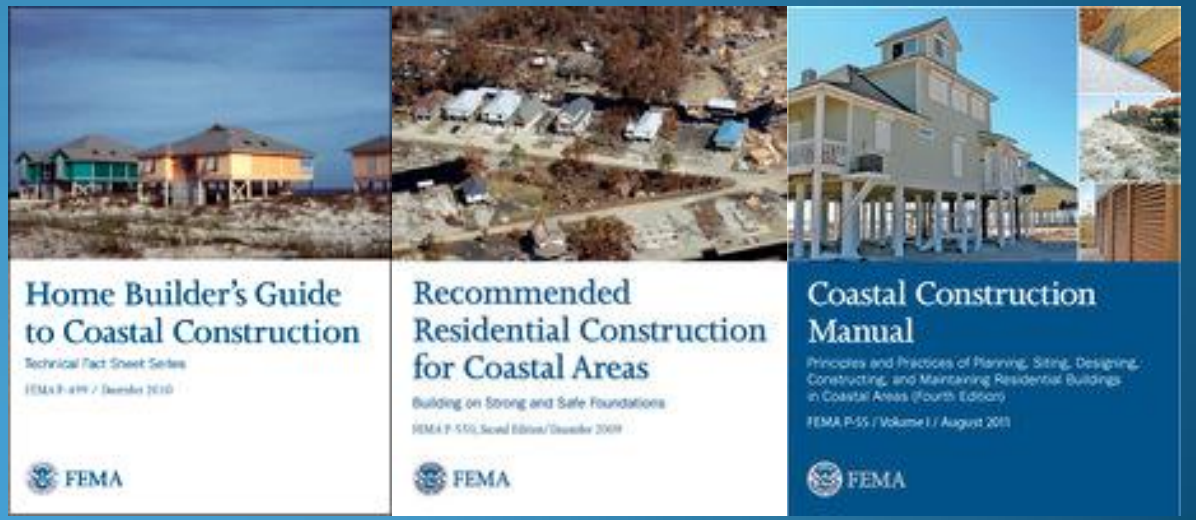
- 2010 FBC, Residential
  - R322.2 specifies that the CAZ applies only if a LiMWA is delineated on the FIRM or if a community otherwise designates an area as subject to 1.5 to 3 ft. wave conditions
  - **R322.2.1 specifies that if the CAZ has been designated, then lowest floors shall be elevated to or above the base flood elevation plus 1 foot, or the design flood elevation, whichever is higher**

Image: FEMA

Construction Guidance

- Additional References
  - ASCE 7
  - ASCE 24
  - FEMA P-499 Home Builder's Guide to Coastal Construction
  - FEMA P-550, Recommended Residential Construction for Coastal Areas: Building on Strong and Safe Foundations
  - FEMA P-55 Coastal Construction Manual





How to Lower Costs

- **Community Rating System**
- **Build Higher**
- **Map Amendments and Revisions via site specific analysis**

Community Rating System

How much discount property owners in your community can get

Rate Class	Discount SFHA*	Discount Non-SFHA**	Credit Points Required
1	45%	10%	4,500 +
2	40%	10%	4,000 – 4,499
3	35%	10%	3,500 – 3,999
4	30%	10%	3,000 – 3,499
5	25%	10%	2,500 – 2,999
6	20%	10%	2,000 – 2,499
7	15%	5%	1,500 – 1,999
8	10%	5%	1,000 – 1,499
9	5%	5%	500 – 999
10	0%	0%	0 – 499

** Special Flood Hazard Area*

*** Preferred Risk Policies are available only in B,C, and X Zones for properties that are shown to have a minimal risk of flood damage. The Preferred Risk Policy does not receive premium rate credits under the CRS because it already has a lower premium than other policies. Although they are in SFHAs, Zones AR and A99 are limited to a 5% discount. Premium reductions are subject to change.*

Image: FEMA

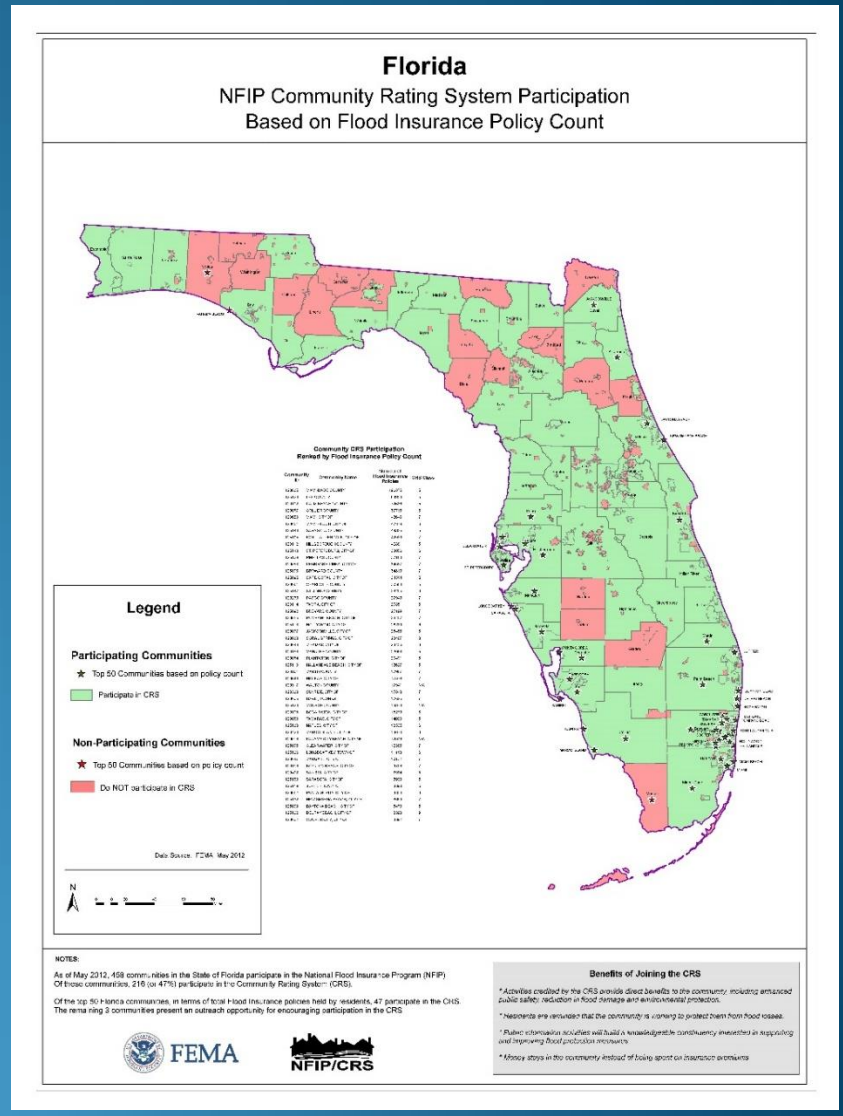
Goals

- Reduce flood losses
- Facilitate accurate insurance ratings
- Promote awareness of the importance of flood insurance

Community Rating System

- ~ 460 communities in FL participate in NFIP
- 47% of those participate in CRS

Rank by Flood Ins. Policy Count (as of May 2012)	Community Name	Number of Flood Insurance Policies	CRS Class
1	Miami-Dade County	196,875	5
2	Lee County	88,954	5
3	Palm Beach County	72,536	5
4	Collier County	57,718	6
5	City of Miami	48,646	7
6	City of Miami Beach	47,379	6
7	Sarasota County	44,935	5
8	City of Ft. Lauderdale	42,989	7
9	Hillsborough County	40,881	5
10	City of St. Petersburg	38,056	6



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Enhancing Coastal Life.

Community Rating System Credits

- CRS encourages local governments to adopt regulations that require the foundation design in a CAZ comply with the more stringent requirements applied to V Zones
- Up to 650 credit points are available for local governments that map CAZ and regulate these areas based on V Zone building standards
- Other points for engaging in any of 18 activities in four categories
  - Public info
  - Mapping and regulations
  - Flood damage reduction
  - Flood preparation

Coastal A Zone Regulation	Potential Points
Foundation Design	225
Engineers Certification	125
Reference Elevation	100
Landward of Mean High Tide	25
Protect Dunes and Mangroves	25
Prohibit Enclosures	150
CAZ Total	650

Image: FEMA

Build Higher

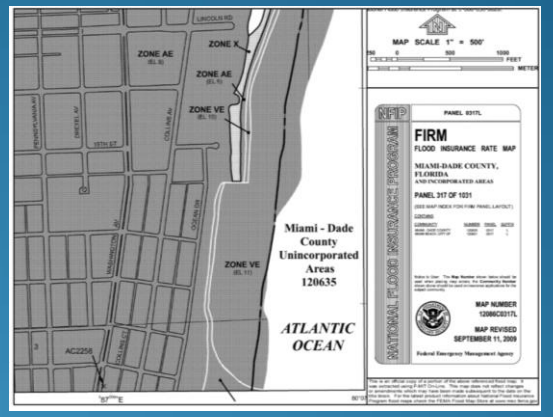
Image: FEMA

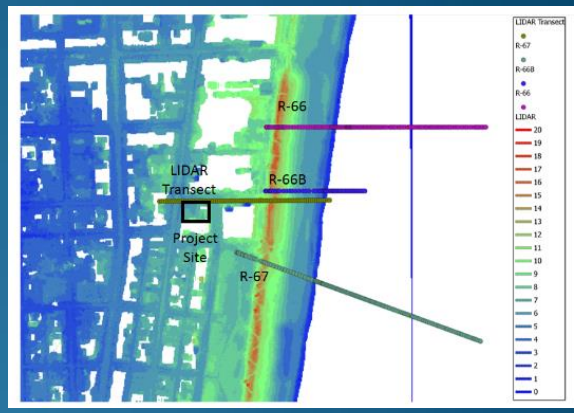
Map Revisions

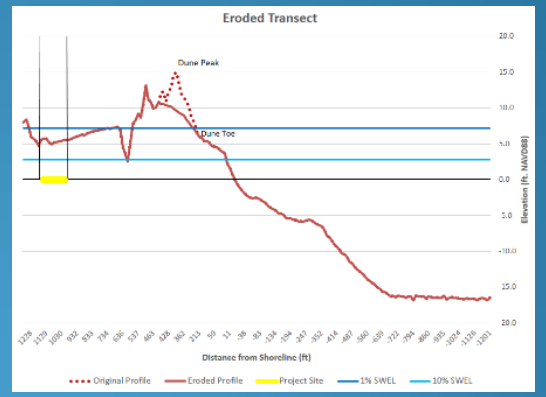
- LOMA – Letter of Map Amendment
  - An official amendment to the currently effective FIRM, which establishes that a subject building or structure is no longer located in a SFHA. Issued by FEMA, a LOMA removes a structure (not a property) from a SFHA
- LOMR – Letter of Map Revision
  - An official revision to the currently effective FIRM. Issued by FEMA, a LOMR changes flood zones, BFEs, and WCEs (wave crest elevations)
- LOMR-F – LOMR Based on Fill
  - Similar to a LOMA, except a LOMA-F is submitted for properties on which fill has been placed to raise a structure or lot to or above the BFE

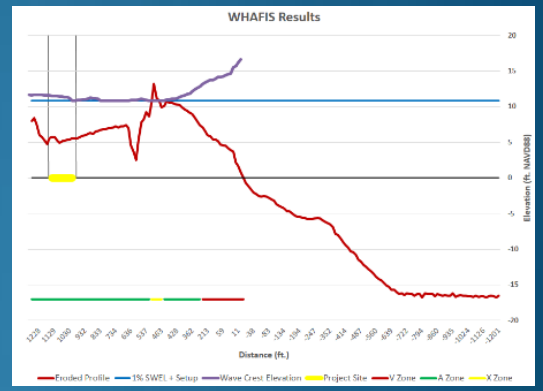
LOMR

- Typical project includes
  - Collecting and reviewing available data
  - Determining appropriate 100 year storm parameters
  - Site visits to determine conditions along transects
  - Modeling transects using FEMA CHAMP model
  - Drawing proposed new flood zones
- FEMA approved models
  - http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/numerical-models-meeting-minimum-requirement-0









Biggert – Waters Flood Insurance Reform Act of 2012 (BW-12)

- Calls for increases in rates of subsidized flood insurance policies to more accurately reflect the real flood risk to insured properties
- 5% fee for each policy will be assessed to contribute to the program's reserve fund
- Primary residences in SFHAs will be able to keep their subsidized rates unless or until
  - The property is sold
  - The policy lapses
  - You suffer severe, repeated, flood losses
  - A new policy is purchased

Biggert – Waters Flood Insurance Reform Act of 2012 (BW-12)

- January 1, 2013
  - Owners of subsidized policies on non-primary/secondary residences in a SFHA saw a 25% increase until rates reflect true risk
- October 1, 2013
  - Owners of subsidized policies on property that has experienced severe or repeated flooding saw a 25% rate increase annually until rates reflect true risk
  - Owners of subsidized policies on business/non-residential properties in a SFHA saw a 25% rate increase annually until rates reflect true flood risk
- Beginning Late 2014 at the earliest
  - Current grandfather procedure provides eligible property owners the option of using risk data from previous FIRMs if a policyholder maintained continuous coverage through a period of a FIRM revision or if a building was constructed "in compliance" with the requirements to the zone and BFE reflected on a previous FIRM
  - Upon a revised or updated flood map, BW-12 requires adjustment and phase in rates over 5 years "to accurately reflect the current risk of flood to such property."

Biggert – Waters 2012 (BW-12)

- Only 20% of NFIP policies receive subsidies
- FEMA analysis: 7% of policies in FL saw immediate rate increases under initial implementation
- FL Office of Insurance Regulation has approved two companies already selling private flood insurance
- Continues to be a dynamic situation

Take Home Points

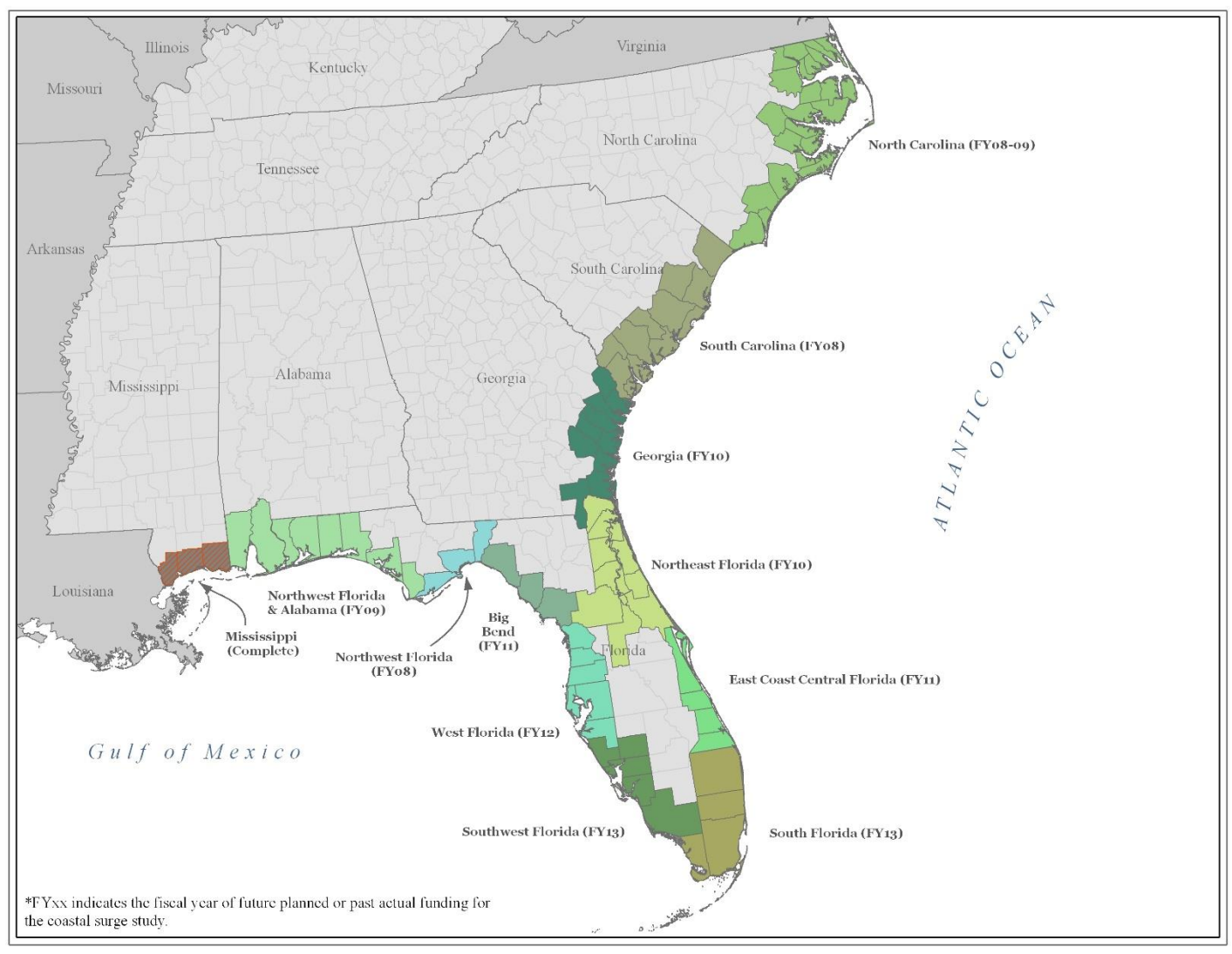
- Insurance rates will be going up
- New modeling / mapping efforts continue to evolve
- Coastal building code requirements will get more stringent
- There are ways to reduce premiums: CRS, building higher, LOMA/LOMR

Thank You

Special Thank You to Tucker Mahoney with FEMA for her input

COASTAL TECH
COASTAL TECHNOLOGY CORPORATION
Enhancing Coastal Life.

Funding History



FEMA Vocabulary Lesson

- **Area of Limited Wave Action (MiWA)** – An area of special flood hazard landward of the Area of Moderate Wave Action that is subject to wave heights less than 1.5 feet. These areas are designated Zone AE on a FIRM.
- **Area of Moderate Wave Action (MoWA)** – An area of special flood hazard landward of the Coastal High Hazard Area that is subject to wave heights that are less than 3 feet, but greater than or equal to 1.5 feet. These areas are designated Zone AE on a FIRM and area sometimes referred to as "coastal AE zones."
- **Base Flood Elevation (BFE)** – The elevation of a flood having a 1-percent chance of being equaled or exceeded in any given year.
- **Coastal BFEs** – The 1-percent-annual-chance flood elevations shown on a FIRM within the Coastal High Hazard Area.Coastal BFEs can be calculated using the following equation: Stillwater Elevation + Wave Height = Coastal BFE
- **Coastal High Hazard Area (CHHA)** – An area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high-velocity wave actions from storms or seismic sources.

FEMA Vocabulary Lesson

- **High-Velocity Wave Action** - A condition in which wave heights or wave runup depths are greater than or equal to 3.0 feet.
- **Limit of Moderate Wave Action (LiMWA)** – A line within the SFHA desidnated Zone AE on a FIRM that marks the inland limit of the area inundated by the 1-percent-annual-chance, 1.5-foot breaking wave. The LiMWA is provide on the FIRM, for informational purposes, because these moderate waves can cause damage to structures; the damage would not be as severe as the damage caused by the 1-percent-annual-chance, 3-foot breaking waves.
- **Preliminary BFEs** – The BFEs that are shown on the Preliminary FIRM and in the Preliminary FIS report before the 90-day appeal period begins.
- **Primary Frontal Dune (PFD)** – A continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the PFD occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

FEMA Vocabulary Lesson

- **Stillwater Flood Elevation (SWEL)** – Projected elevation that floodwaters would assume, referenced to NGVD29, NAVD88, or other datum, in the absence of waves resulting from wind or seismic effects.
- **Stillwater Flood Level (SWFL)** – Rise in the water surface above normal water level on the open coast due to the action of wind stress and atmospheric pressure on the water surface.
- **Storm Surge** – The water that is pushed toward land from the high winds of a major storm, such as a hurricane.
- **Transect** – Cross section taken perpendicular to the shoreline to represent a segment of coast with similar characteristics.
- **Wave** – A ridge, deformation, or undulation of the water surface.
- **Wave Height** – The vertical distance between the highest part of a wave (crest) and the lowest part of the wave (trough).

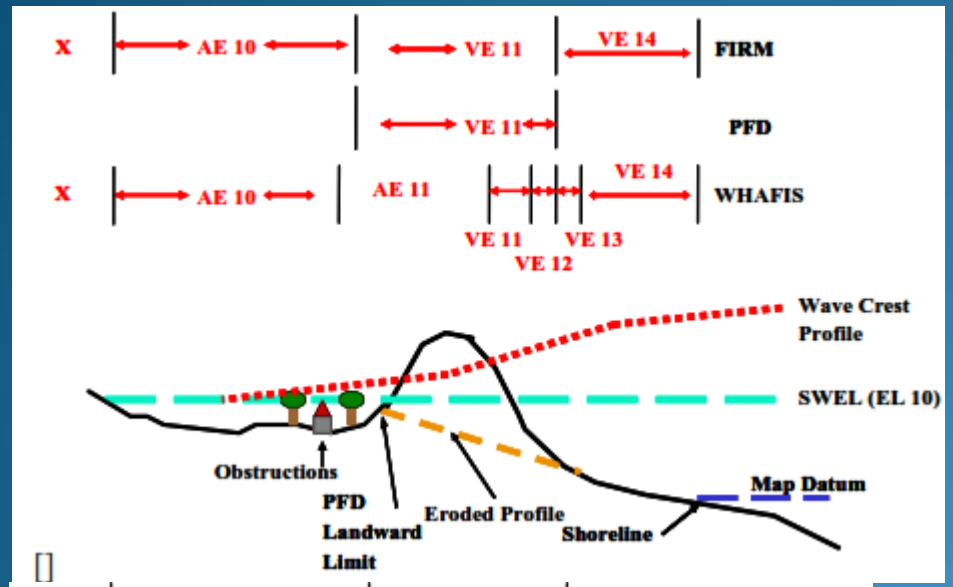
Flood Zones

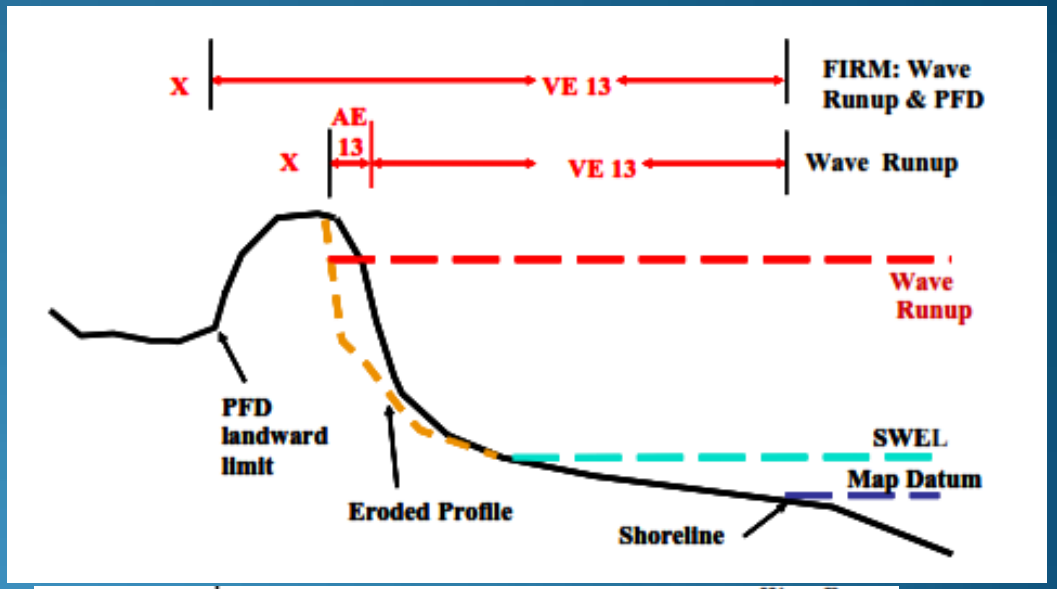
- Special Flood Hazard Area (SFHA)
  - The land area covered by the floodwaters of the base flood. Where NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies (Two primary zones: VE and AE)
- VE Zone
  - Coastal High Hazard areas where wave action and/or high-velocity water can cause structural damage during the base flood. Subdivided into elevation zones with BFEs assigned. Must meet one or more of the following criteria
    1. The *wave runup zone* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation
    2. The *wave overtopping splash zone* is the area landward of the crest of an overtopped barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more
    3. The *breaking wave height zone* occurs where the 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total Stillwater level)
    4. The *primary frontal dune zone*, as defined in 44 CFR Section 59.1 of the NFIP regulations
  - VE Zone boundary shown on the FIRM is defined as the farthest inland extent of any of the four criteria listed

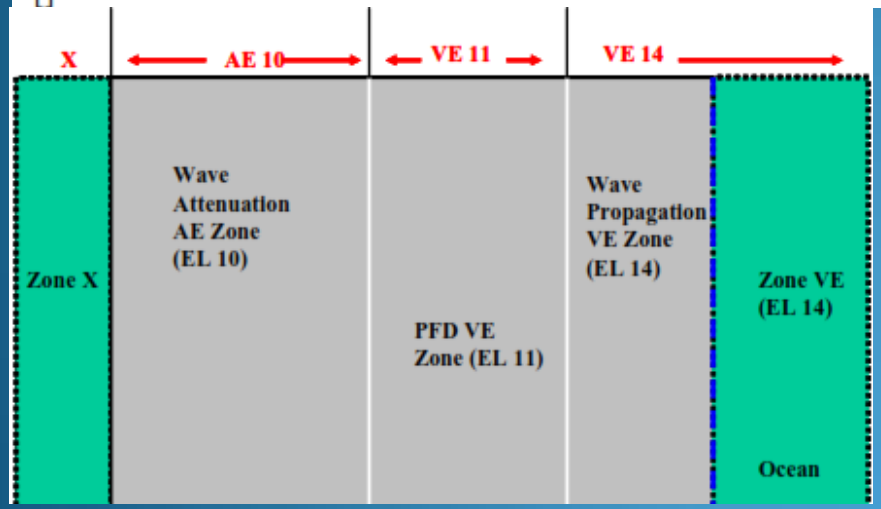
Flood Zones

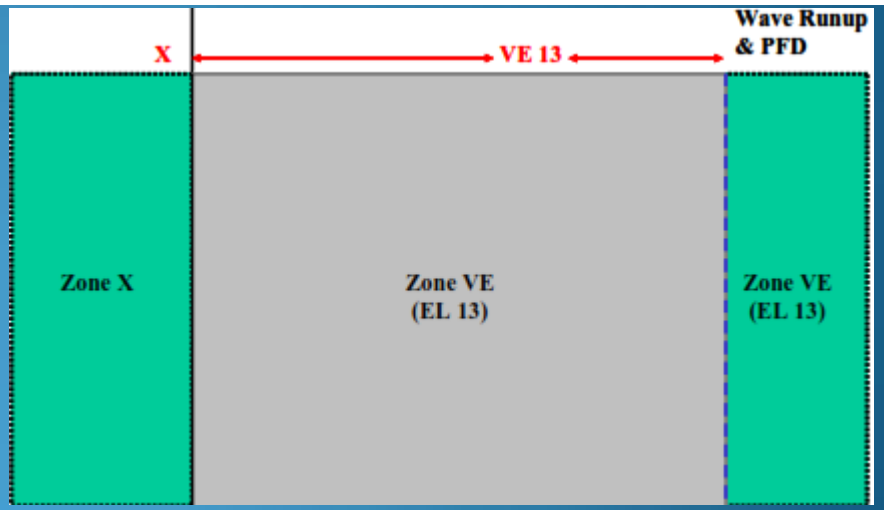
- AE Zone
  - Areas of inundation by the 1-percent-annual-chance flood, including areas with the 2-percent wave runup elevation less that 3.0 feet above the ground and areas with wave heights less than 3.0 feet. These areas are subdivided into elevation zones with BFEs assigned. The AE zone will generally extend inland to the limit of the 1-percent-annual-chance flood SWEL
- X Zone
  - Areas above the 1-percent-annual-chance flood level. On the FIRM, a shaded X zone area is inundated by the 0.2-percent-annual-chance flood and an unshaded X zone area is above the 0.2-percent-annual chance flood

Flood Zones: Examples



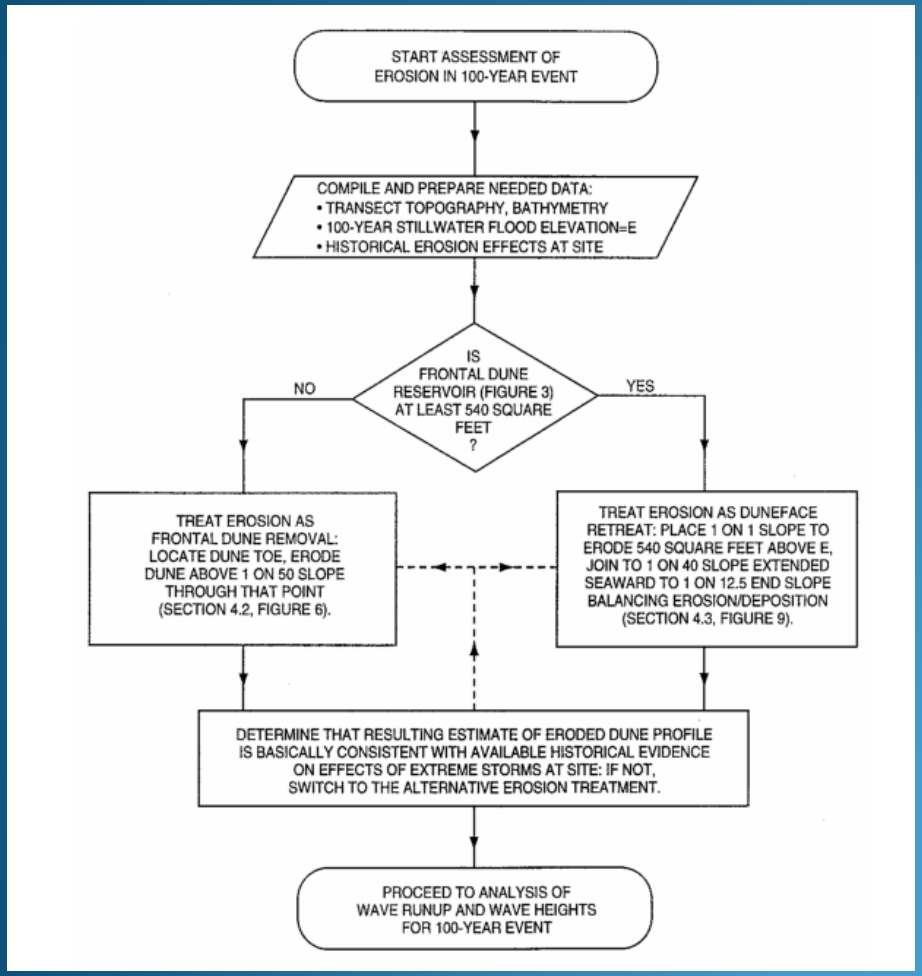


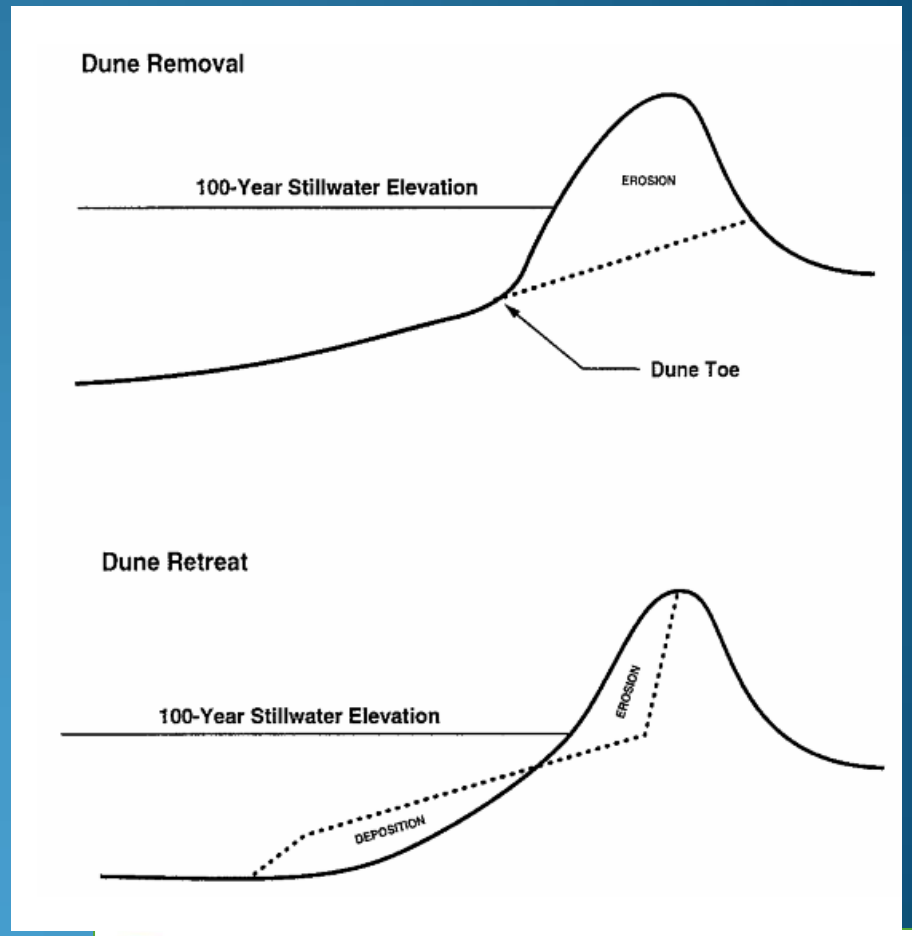




Step 4: Overland Wave Analysis

2. Performing storm induced erosion assessments and updating primary frontal dune (PFD) determinations





LOMA for an AE Zone

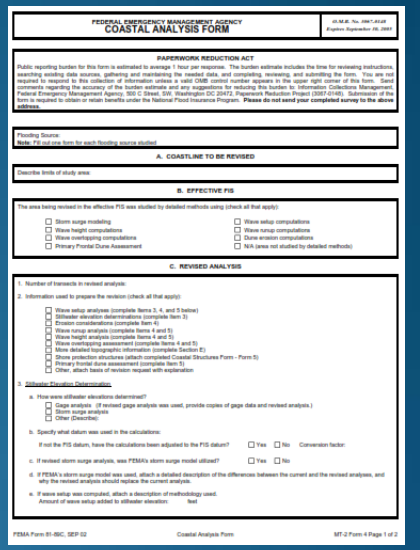
- For a LOMA to be issued to:
  - Remove a structure from the SFHA:
    - NFIP regulations require that the lowest adjacent grade be at or above the BFE To
  - Remove an entire lot from the SFHA:
    - NFIP regulations require the lowest point on the lot be at or above BFE
- Necessary Info to complete MT-EZ
  - A copy of the Plat Map for the property or a copy of the Deed for the property
  - A certified site plan showing the precise location of the structure
  - Copy of the FIRM panel and FIS report
  - Elevation Certificate

LOMR

- LOMRs change flood zones
  - Does not reduce risk, but does reduce how risk is reflected on a map
    → reduced premiums
- Necessary info to complete MT-2
  - Overview and Concurrence Form
  - Coastal Analysis Form
  - Coastal Structures Form
  - Payment Form
- Requester must:
  - Provide all of the data used in determining the revised floodplain boundaries, flood profiles, floodway boundaries, etc.
  - Provide all data necessary to demonstrate that the physical modifications to the floodplain meet NFIP regulations, have been adequately designed to withstand the impacts of the 1% annual chance flood event, and will be adequately maintained;
  - Demonstrate that the revised information (e.g., hydrologic and hydraulic analyses and the resulting floodplain and floodway boundaries) is consistent with the effective FIS information.

LOMR: Coastal Analysis Form MT-2

- Coastline to be Revised
- Effective FIS
  - Type of analyses used for the effective FIS (approximate or detailed wave parameter computations)
- Revised Analysis
  - Certified topographic info
  - Structure plans
  - Survey notes
  - Storm surge data
  - Meteorological data
  - All equations / models must be referenced
  - Descriptions / sketches of transect profiles for revised erosion, wave height, wave runup, and wave overtopping analyses
  - Wave runup and overtopping
- Results
  - Location of coastal high hazard area boundaries
  - Maximum wave height elevation
  - Maximum wave runup elevation
- Mapping Requirements
  - Certified topographic map showing the information indicated in t
  - Current FIRM annotated to show the revised 1% annual chance floodplain boundaries

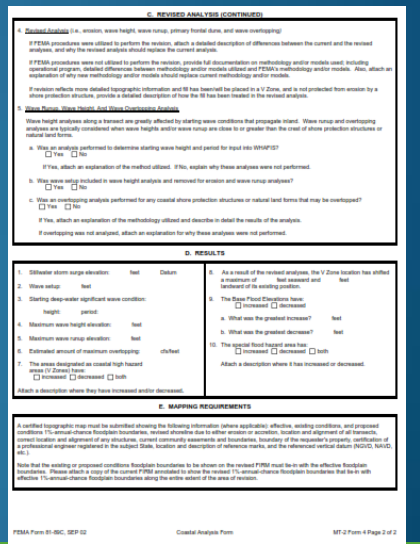

FEDERAL EMERGENCY MANAGEMENT AGENCY
COASTAL ANALYSIS FORM

PAPERWORK REDUCTION ACT

A. COASTLINE TO BE REVISED

B. EFFECTIVE FIS

C. REVISED ANALYSIS


C. REVISED ANALYSIS (CONTINUED)

D. RESULTS

E. MAPPING REQUIREMENTS

LOMR - F

- An official revision to an effective NFIP map stating FEMA's determination concerning whether a structure or parcel has been elevated on fill above the BFE and is, therefore, excluded from the SFHA
- When fill material has been placed after the first FIRM of the area was established

Typically a 2 – step process

1. A Conditional Letter of Map Revision based on Fill (CLOMR-F) is submitted to FEMA
   - Shows proposed grading plan with fill elevations, structure elevations, and existing flood elevations
   - FEMA determines if proposed fill is sufficient to remove structures from the floodplain
2. Once approved and fill is placed, a LOMR-F is submitted
   - Contains as-built info and elevations, which should be consistent with CLOMR-F

Construction Guidance

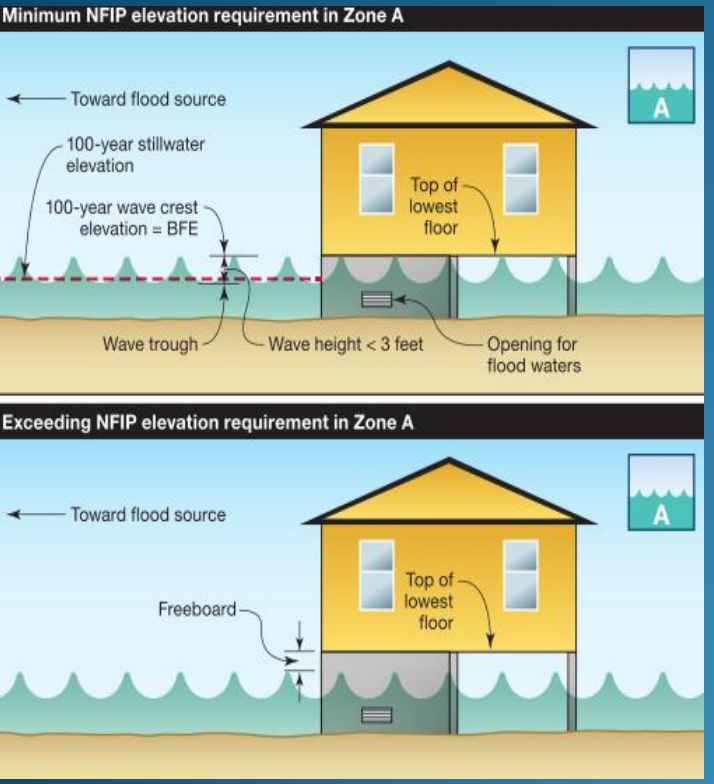


Image: FEMA

- NFIP minimum requirements for buildings do not recognize the risk associated with waves less than 3 ft. high
- Two alternatives to adopt CAZ provisions
  1. Application of Zone V standards within the CAZ if FEMA has delineated a LiMWA
  2. Application of Zone V standards within an area designated by the community as "Coastal A Zone." The community selects the area, which may be done by specifying a distance inland from shore, by identifying a specific geographic area, or by delineating specific areas on a map

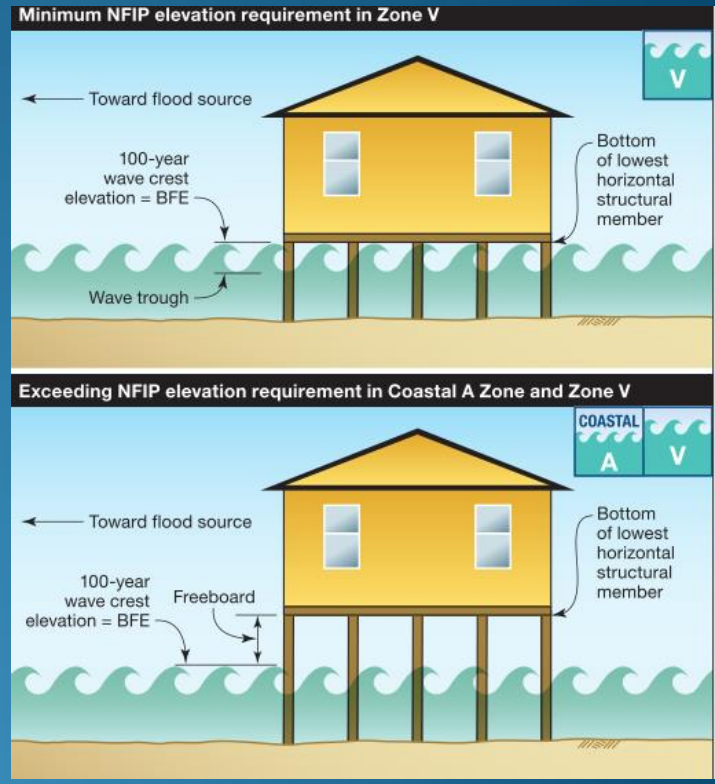


Image: FEMA

Step 4: Overland Wave Analysis

3. 1-Dimensional overland wave height modeling
   - WHAFIS Transect Considerations
     - Should be placed along any shoreline across which damaging waves may propagate during the base flood
       - All open coast shorelines and other shorelines along large sheltered bodies of water subject to storm surge flooding (bays, sounds, and estuaries)
     - Orientated in the direction that waves propagate across the 0.0 ft. contour (from water to land)
     - Balance between representing coastal flood and severe wave conditions in developed upland areas and study resources
   - WHAFIS Input Considerations
     - Typically the base (1%) SWEL + Setup and controlling wave height at the transect start
     - Special cases where more detailed study is needed exist (sheltered bays, islands, etc.)
     - Vegetation, Coastal Structures, Buildings must be specified