Mapping Limit of Moderate Wave Action and its Impact on NFIP Participant Communities

Nader Mahmoudpour, Ph.D., P.E.
Chris Jones, P.E.

June 12, 2013
Purpose

• LiMWA and Coastal A Zone Definition
• History of CAZ
• How LiMWA is related to the Building Codes
• CRS and LiMWA
• Issues with current PM-50
• Solutions offered
What is LiMWA?

LiMWA is Limit of Moderate Wave Action or Landward limit of waves 1.5 feet in height.

FEMA Procedure Memorandum No. 50 – Policy and Procedures for Identifying and Mapping Areas Subject to Wave Heights Greater than 1.5 feet as an Informational Layer on Flood Insurance Rate Maps (FIRMs)

LiMWA determines the landward limit of Coastal A Zone (CAZ) as ASCE 24 and building codes refer to it.
History of CAZ Term

CCM (1981, 1986) mention portions of the A zone where damaging wave effects and high velocity can occur.
History of CAZ Term

The initial (?) use of “CAZ” in 1989 post-Hugo report by FEMA:

“Velocity damage in Coastal A-Zones:
While a V-zone ends where wave heights drop below 3 feet, wave damage can extend into adjacent A zones. The NFIP does not differentiate between riverine and coastal A-zones. However, not all construction techniques permitted in riverine A-zones are appropriate in coastal areas, and more restrictive building requirements are needed. This issue can be addressed by either: 1) revising the V-zone definition by using a more restrictive criteria, such as a two foot wave, or 2) designating a “Coastal A Zone,” with building requirements that meet certain V-zone standards, such as use of a pile of column foundation.”
Pre-2005 FEMA Depiction Coastal A Zone
Post-2005 FEMA Depiction Coastal A Zone

- **VE**: Wave height ≥ 3 feet
- **COASTAL AE**: Wave height 3.0–1.5 feet
- **LiMWA**: Wave height < 1.5 feet
- **AE**: Limit of base flooding and waves

- **Flood level including wave effects**
- **100-year or elevation**
- **Shoreline**
- **Sand beach**
- **Buildings**
- **Overland wind fetch**
- **Vegetated region**
- **Limit of SFHA**

**Properly elevated building**

**Unelevated building constructed before community entered the NFIP**
Inland limit of mapped A/AE Zones or 1% stillwater elevation (SWEL) where mapping not available.

Riverine A/AE Zones

Coastal and Riverine A/AE Zones separated to define inland limit of MiWA Zone and Coastal AE Zone

MoWA Zone (inland limit at 1.5-ft wave)

MoWA Zone

VE Zone (inland limit at 3-ft wave)

VE Zone

LiMWA @ 4-ft below 1% SWEL

LiMWA @ 2-ft below 1% SWEL
If a coastal community receives a draft Flood Insurance Rate Map (FIRM) that delineates the Limit of Moderate Wave Action (LiMWA), the community must agree to show the LiMWA on its final published FIRM. Although showing a LiMWA on a FIRM is voluntary for non-CRS communities, it is a prerequisite for CRS participation. The LiMWA delineation is for informational purposes only. There is no CRS requirement to regulate the area differently, but the series of International Codes has special construction requirements in areas subject to breaking waves of 1.5 feet or higher. Communities are encouraged to meet the criteria for coastal A Zone credit (CAZ) in Activity 430 (Higher Regulatory Standards).
Why LiMWA is important?

LiMWA is getting increased visibility from the States and the communities that are utilizing LiMWA as a regulatory tool in floodplain management.

LiMWA is tied closely to the definition of Coastal A Zone in the Building Codes.

FEMA is the only agency to have guidance on defining, mapping and officiating the LiMWA
LiMWA: Non-Regulatory or Regulatory?

PM 50 defines LiMWA as **Informational Layer**
LiMWA: Non-Regulatory or Regulatory?

ASCE 24-05 defines “Coastal A Zone” as having “potential for breaking wave heights $\geq 1.5$ ft” and mandates VE design and construction requirements in CAZ.

IBC requires compliance with ASCE 24.

Some jurisdictions require use of ASCE 24 for all structures.
Currently Covered in PM 50

PM 50 calls for the LiMWA to be a continuous and a separate line.

PM 50 is recommending the LiMWA for these situations:
Based on WHAFIS results where the wave crest elevation is approximately 1.0 foot (0.7 x 1.5 feet) above the mean water elevation

When width of Zone AE is too narrow to be subdivided, LiMWA will be placed immediately seaward of the limit of the base floodplain boundary

In the presence of a primary frontal dune or wave overtopping, the LiMWA will be placed immediately landward of the mapped VE/AE Zone Boundary

Immediately landward of the mapped VE/AE Zone boundary where RUNUP is dominating
Tools Available

WHAFIS is the only tool that can determine where the 1.5-foot wave limit is on the transects.

According to PM 50 the location of VE/AE gutter can be utilized as a guide for LiMWA location. This VE/AE gutter can be result of RUNUP calculations or from PFD analysis.
**Issues**

In cases that PM 50 calls for LiMWA to be just landward or seaward of a gutter, how far the LiMWA should be placed to be legible (~25 ft) but this distance does not have scientific justification just graphical improvement.

Based on PM 50, back bay areas and locally generated/regenerated short period waves are treated like open coast and development in these areas are subject to Building Codes for LiMWA which might not be necessary.

For high velocity flow zones where $hV^2$ is greater than or equal to 200 ft$^3$/sec$^2$ no guidance is provided in PM 50.

Would presenting LiMWA as a line be a good practice or polygons can be a better representative of LiMWA areas. Might not show up well with the flood zone areas. Is this mapping Coastal A Zone?
Solutions Offered

On work maps, the LiMWA should be mapped according to and at the same time as the WHAFIS results. LiMWA interpolation between transects should be done in a manner which is consistent with methods used to map overland wave height BFE lines and zone break lines. At this stage, the LiMWA should not be modified or relocated based on other mapping considerations. The work map LiMWA should be continuous to the extent that wave height mapping allows, but need not be continuous.

On the FIRM, the LiMWA should not be shown in areas where the inland VE limit is delineated based on the Primary Frontal Dune (PFD) or wave runup or wave overtopping (in which case the work map LiMWA would pass through the VE zone). The LiMWA should not be shifted so as to be immediately landward of the mapped VE/AE Zone boundary. This guidance supersedes guidance in PM-50 which states it may be advantageous to continue the LiMWA across runup-dominated areas, and which states the LiMWA should be delineated immediately landward of the VE/AE Zone boundary in PFD and wave overtopping VE zones.
Solutions Offered

The LiMWA should be delineated only in conjunction with a wave height VE zone. If the wave height at a shoreline is less than 3 feet, no LiMWA should be drawn inland of that shoreline. For transects that originate on the open coast and pass over land, across a water body, and onto another land mass, etc., multiple LiMWAs may be delineated, but only where there is a wave height VE zone associated with a shoreline.

Only one LiMWA should be associated with each wave height VE zone. If the VE zone exists only near the shoreline, and if inland wave heights remain below 3.0 ft but fluctuate above and below 1.5 ft (due to regeneration and dissipation), only one LiMWA should be drawn -- closest to the VE zone limit. Special cases involving overland wave regeneration on long transects should be discussed with FEMA to establish best practice for those cases.
Solutions Offered

The use of non-regulatory products to assist communities with understanding wave hazards and enforcing Coastal A Zone building standards is highly recommended.

Requests for changes to the LIMWA symbology should obtain prior approval from the FEMA Project Officer. For example, a line with tick marks along the line that point in the direction of the Coastal A Zone could be used to show which side of the line higher standards should be applied.
Contact Info

Mamhmodupour, Ph.D., P.E., CFM

Address:
CDM Smith 3201 Jermantown Rd. Suite 400
Fairfax VA, 22030

Email: mahmoudpoursg@cdmsmith.com
Phone: 703 691-6436
Questions?