

Hurricane Ian – Florida (DR-4673) Mitigation Assessment Team (MAT)



An Overview of the MAT Observations and Next Steps

April 12, 2023

Florida Floodplain Managers Association (FFMA)



FEMA

Building Science Branch

Agenda

- Hurricane Ian (DR-4673) Building Science Disaster Support (BSDS) Task
- Mitigation Assessment Team (MAT) Observations
- Proposed Next Steps
- Q&A Period

Preliminary observations based on site visits, initial assessments and collected data ... more analysis is needed



Building Science Disaster Support (BSDS) Task - Objectives

- Perform field work
- Develop and Provide Recovery Advisories and Fact Sheets
- Develop and Provide a Final Report
- Develop and Provide Training
- Develop and Provide SME Support

Designing for Flood Levels Above the BFE After Hurricane Sandy



HURRICANE SANDY RECOVERY ADVISORY

RA5, April 2013

Purpose and Intended Audience

Flooding in New York and New Jersey extended far beyond mapped Special Flood Hazard Areas (SFHA) and exceeded base flood elevations (BFEs) by several feet in some areas. Lessons learned from Hurricane Sandy can be used to guide repair and reconstruction efforts and design of new buildings to reduce susceptibility to future flood damage.

This Recovery Advisory reviews how coastal Flood Insurance Rate Maps (FIRMs) and BFEs are established and provides guidance on elevating buildings to minimize flood damage in cases where flood levels exceed the BFE. The intended audience for this advisory is primarily homeowners and designers, but it may be helpful to anyone involved in selecting lowest floor elevations for new construction and reconstruction of buildings in areas affected by Sandy.

Key Issues:

1. Elevating to the BFE does not provide complete protection against flooding. Storms more severe than the base flood can and do occur.
2. FIRMs are only as accurate as the topography, bathymetry, and technical information used, and the technical analyses performed, to create them. FIRMs are a snapshot in time and may become outdated as physical conditions, climate, and engineering methods change.
3. Once flood levels exceed the lowest floor of a building, the extent of damage increases dramatically, especially in areas subject to coastal waves (Figure 1).
4. Design and construction practices can minimize damage to buildings, particularly by elevating the building higher than the minimum required elevation.

This Recovery Advisory Addresses:

- FIRMs, FISs, and flood risk
- Building damage when flood levels rise above the lowest floor
- How high above the BFE a building should be elevated
- Effect of building elevation on flood insurance premiums
- Additional design considerations for mitigating flood damage, inside and outside mapped flood hazard zones

Terminology

Base flood elevation (BFE): Elevation of flooding, including wave height, having a 1 percent chance of being equaled or exceeded in any given year (also known as "base flood" and "100-year flood"). The BFE is the basis of insurance and floodplain management requirements and are shown on FIRMs.

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Flood Insurance Rate Map (FIRM): A map produced by FEMA to show flood hazard areas and risk zones. The SFHA and BFE are both shown on FIRMs.



Figure 1: Back wall failure due to flood level above the lowest floor of a house in Ortley Beach, NJ.



Building Science Disaster Support Program (BSDS)

- Building Science Disaster Support Program is managed by the Building Science Branch at FEMA Headquarters.
- BSDS provides building science technical support to FEMA's disaster operation as well as the affected communities.
- The work of the BSDS is performed by the Mitigation Assessment Team (MAT)

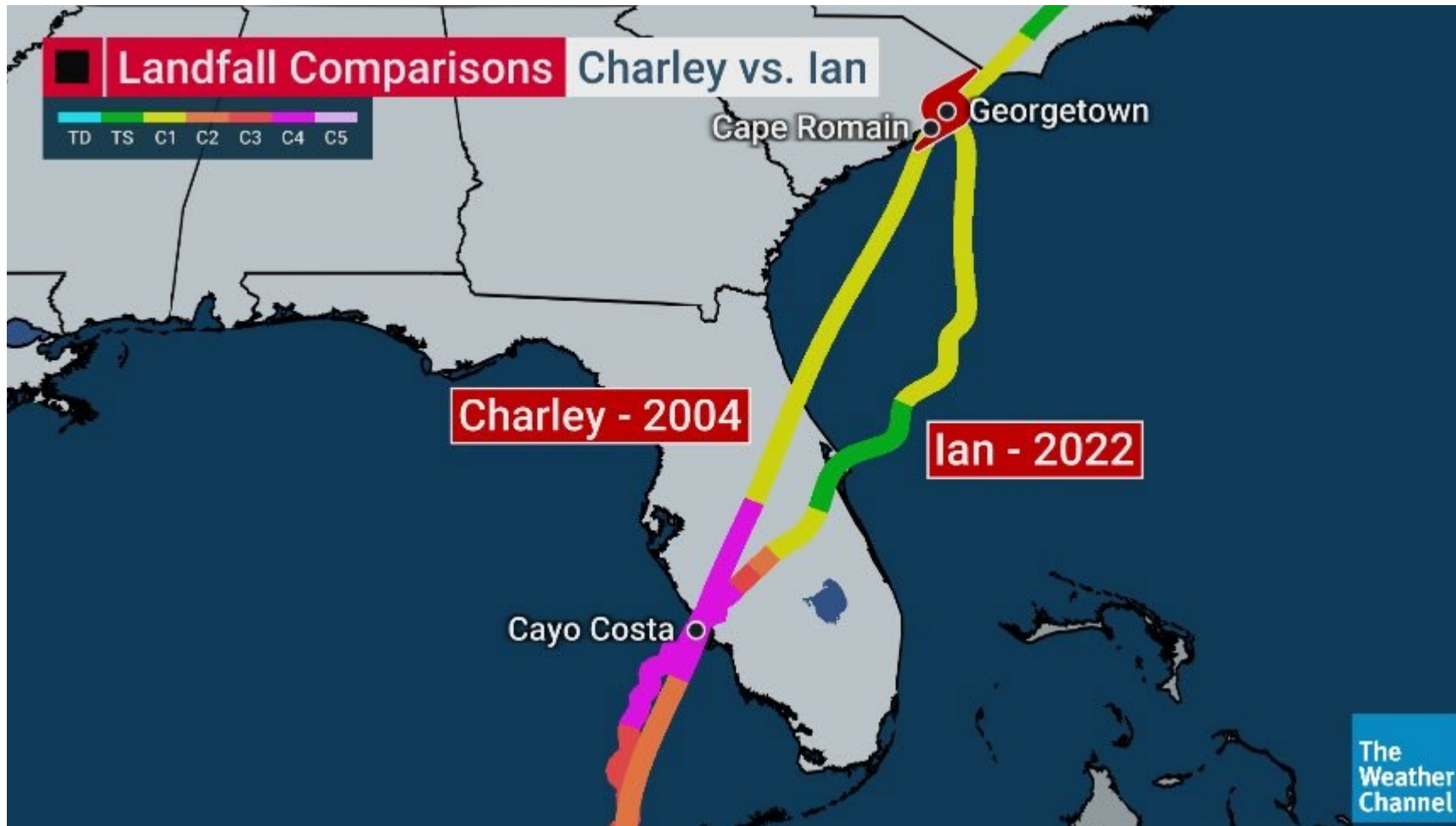


MAT Composition

- 34 field personnel - 15 Contract SME's, 9 FEMA, 8 FDEM, and 2 partner SME's
- Five “Teams”
 - Coastal
 - Critical Facility
 - Flood
 - Survey
 - Wind
- Other
 - Remote Support
 - Partner Collaboration
 - Communications



Hurricane Ian vs Charley - Paths

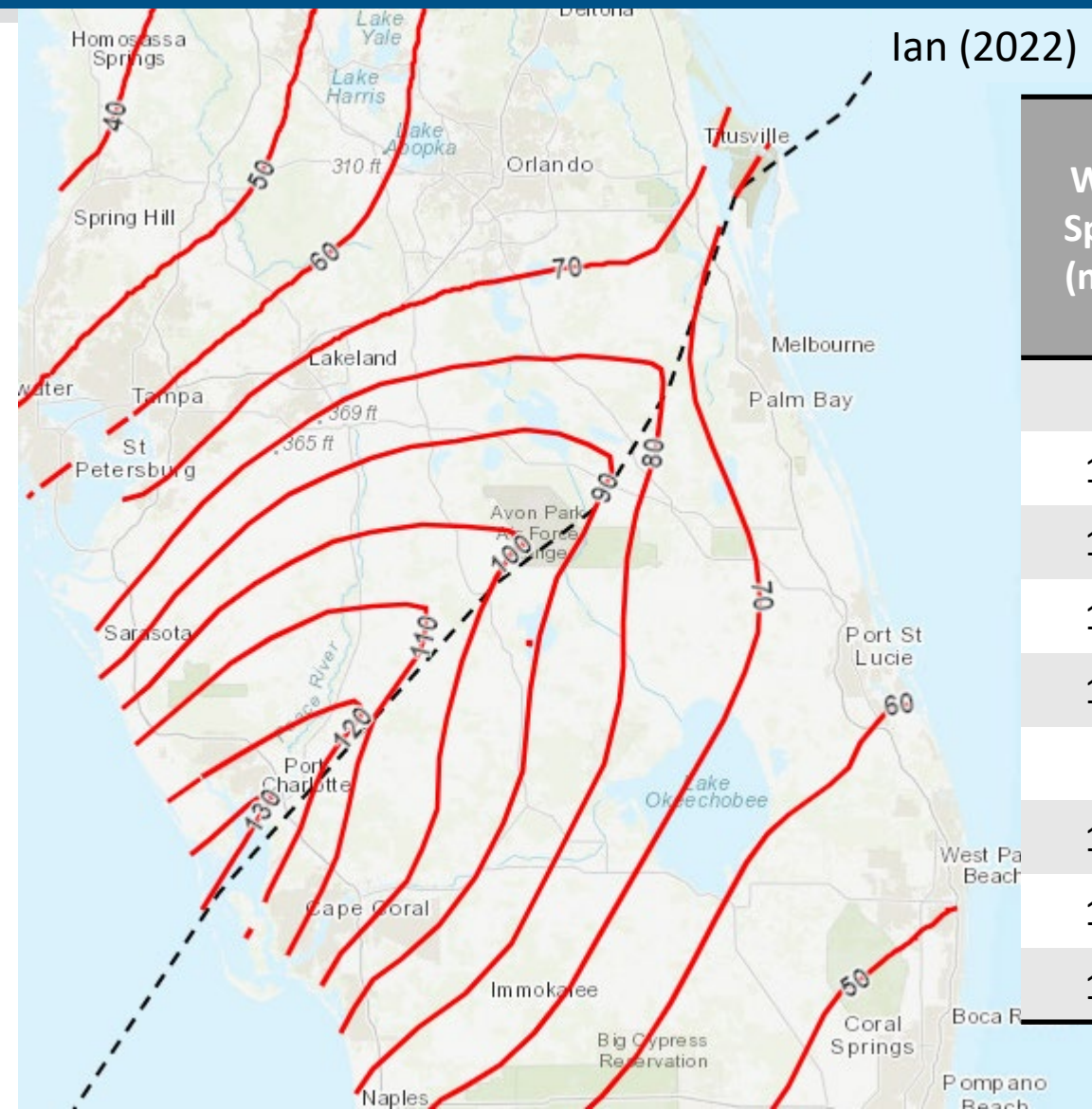
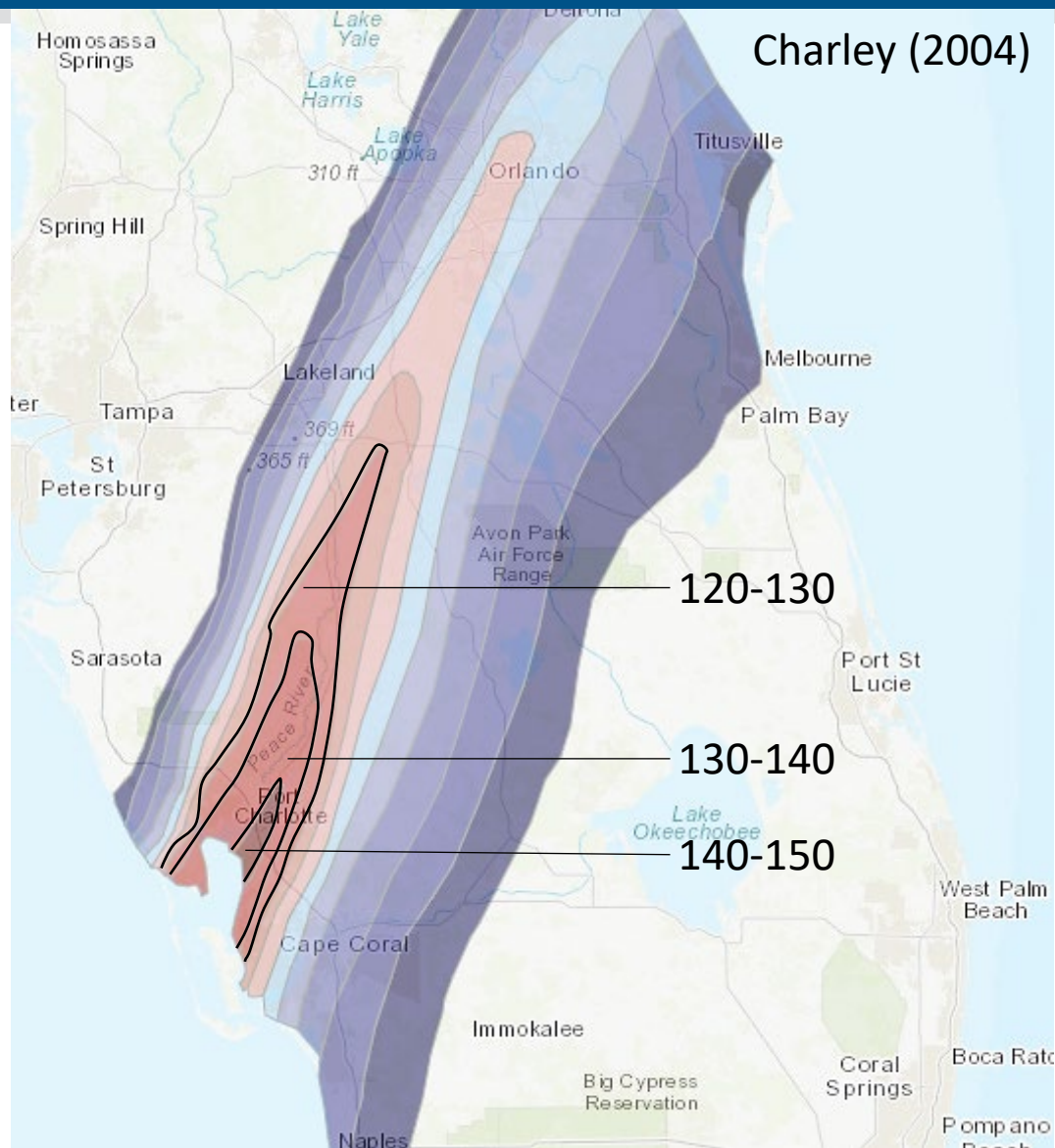


Hurricane Ian vs Charley - Overview

	Charley (2004)	Ian (2022)
Central pressure at landfall	941 mb	940 mb
Size at landfall, width of eye	14 miles	~26 miles
Forward speed at landfall	25 mph	9 mph
150 mph winds*	30+ miles	N/A
140 mph winds*	50+ miles	N/A
130 mph winds*	90+ miles	20 miles

* 3-second peak gusts at 33 ft height over flat, open terrain

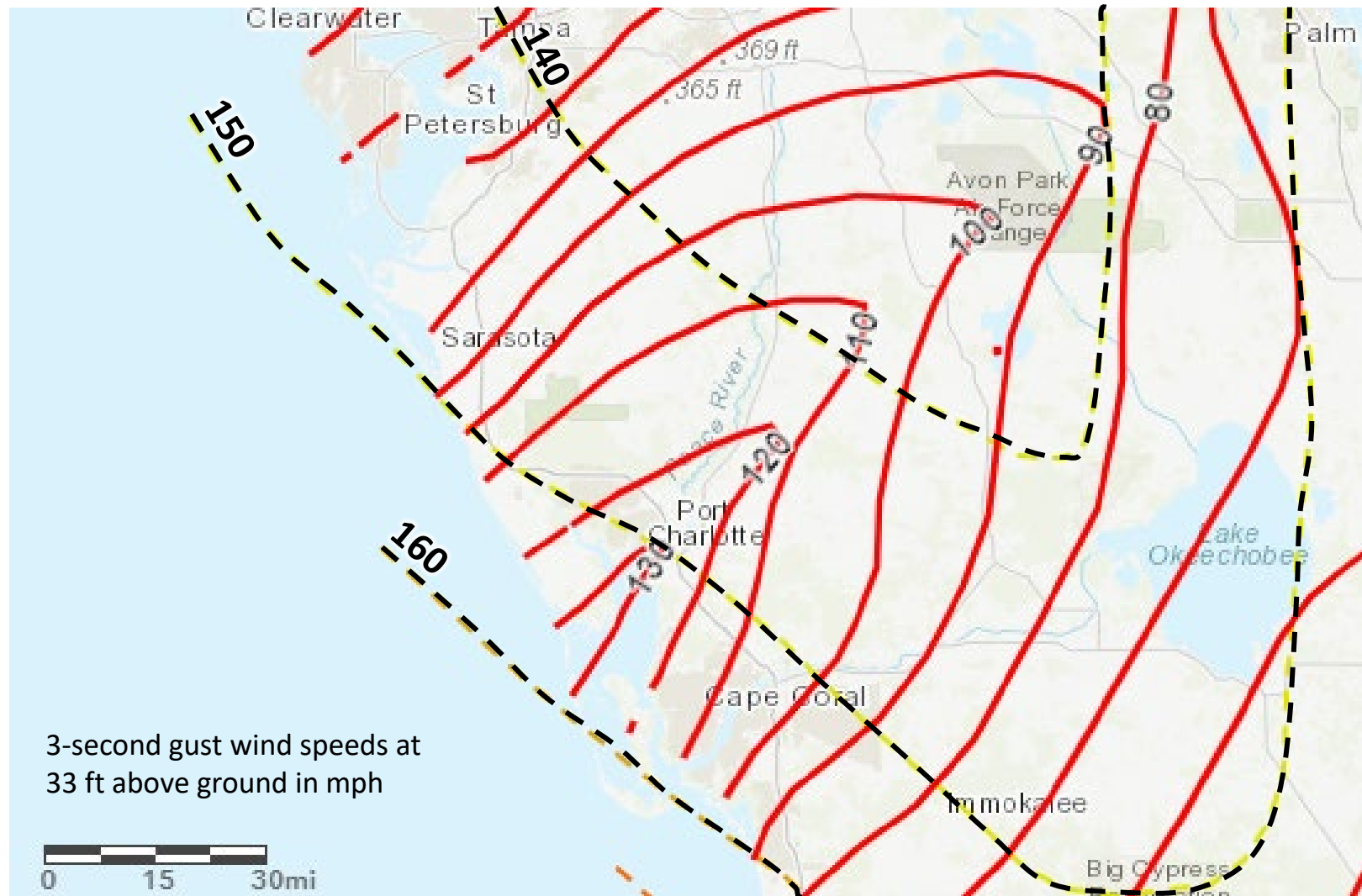
Hurricane Ian vs Charley - Peak Wind Gusts



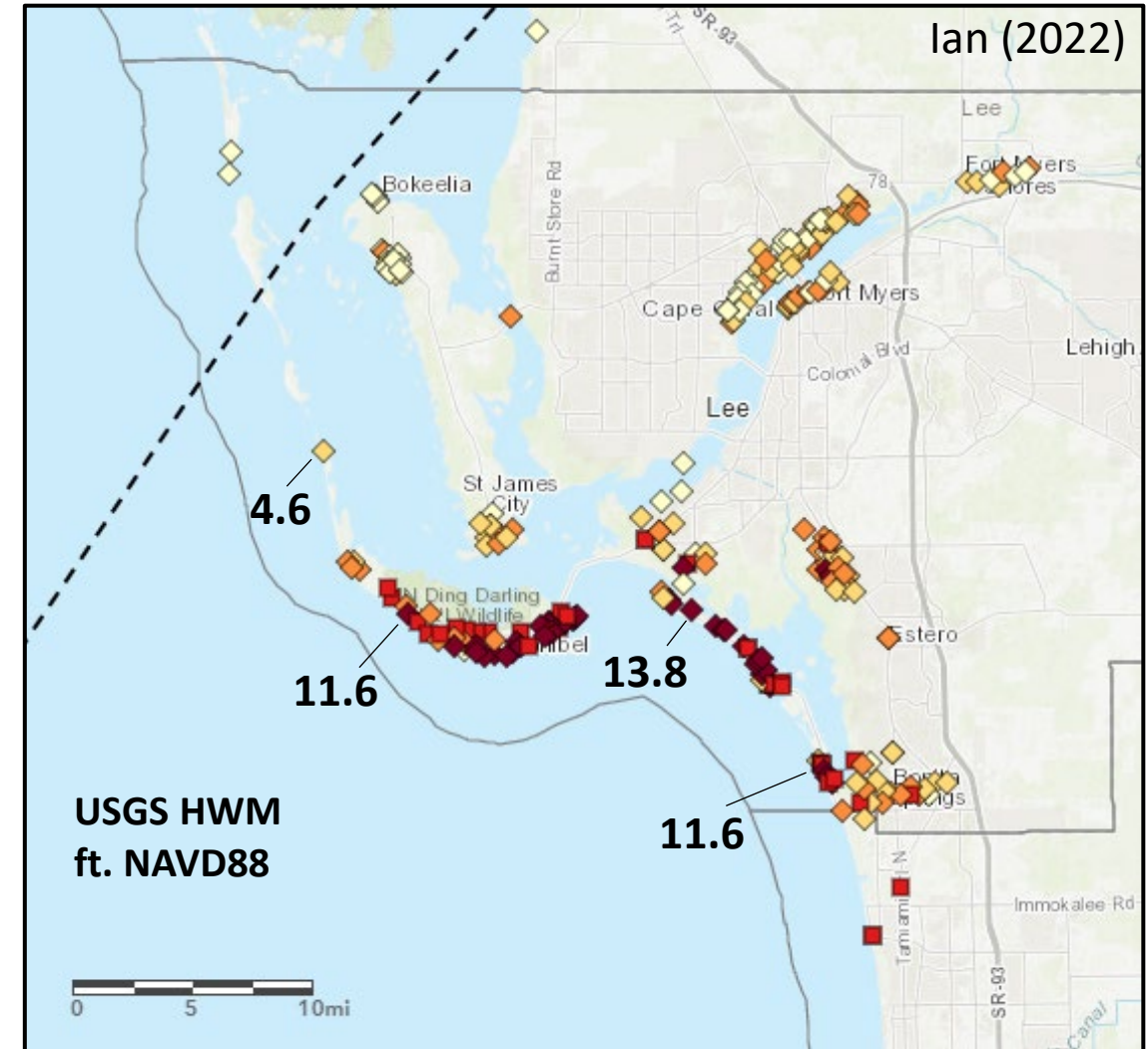
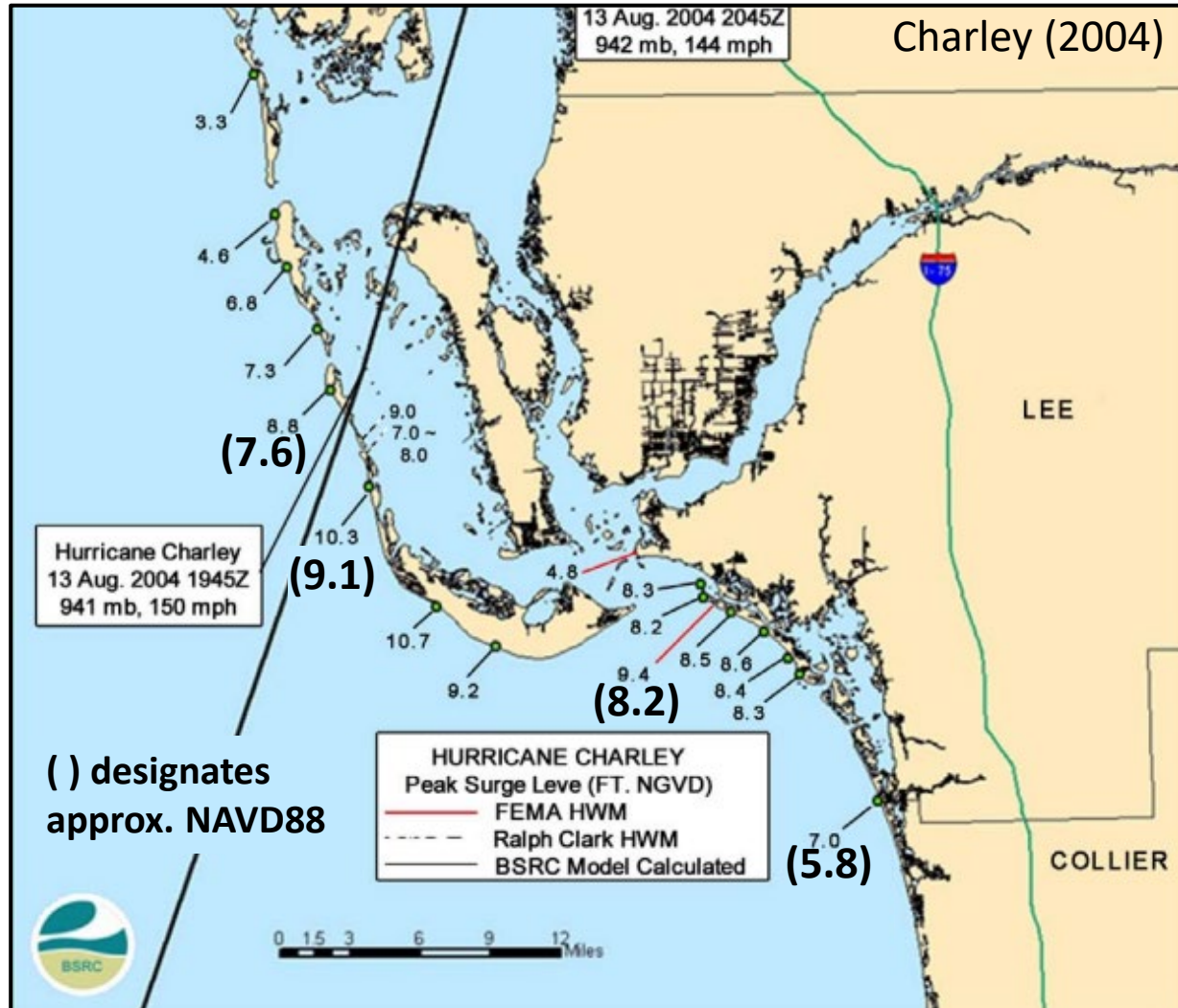
Wind Speed (mph)	Distance from West Coast (miles)
Ian	
130	20
120	43
110	63
100	84
Charley	
150	34
140	58
130	93

Design Wind Speed vs. Ian

- ASCE 7-10 & ASCE 7-16 Risk Category II
- Hurricane Ian Observed



Hurricane Ian vs Charley - Surge Elevations



Hurricane Ian - Surge Context



Fort Myers

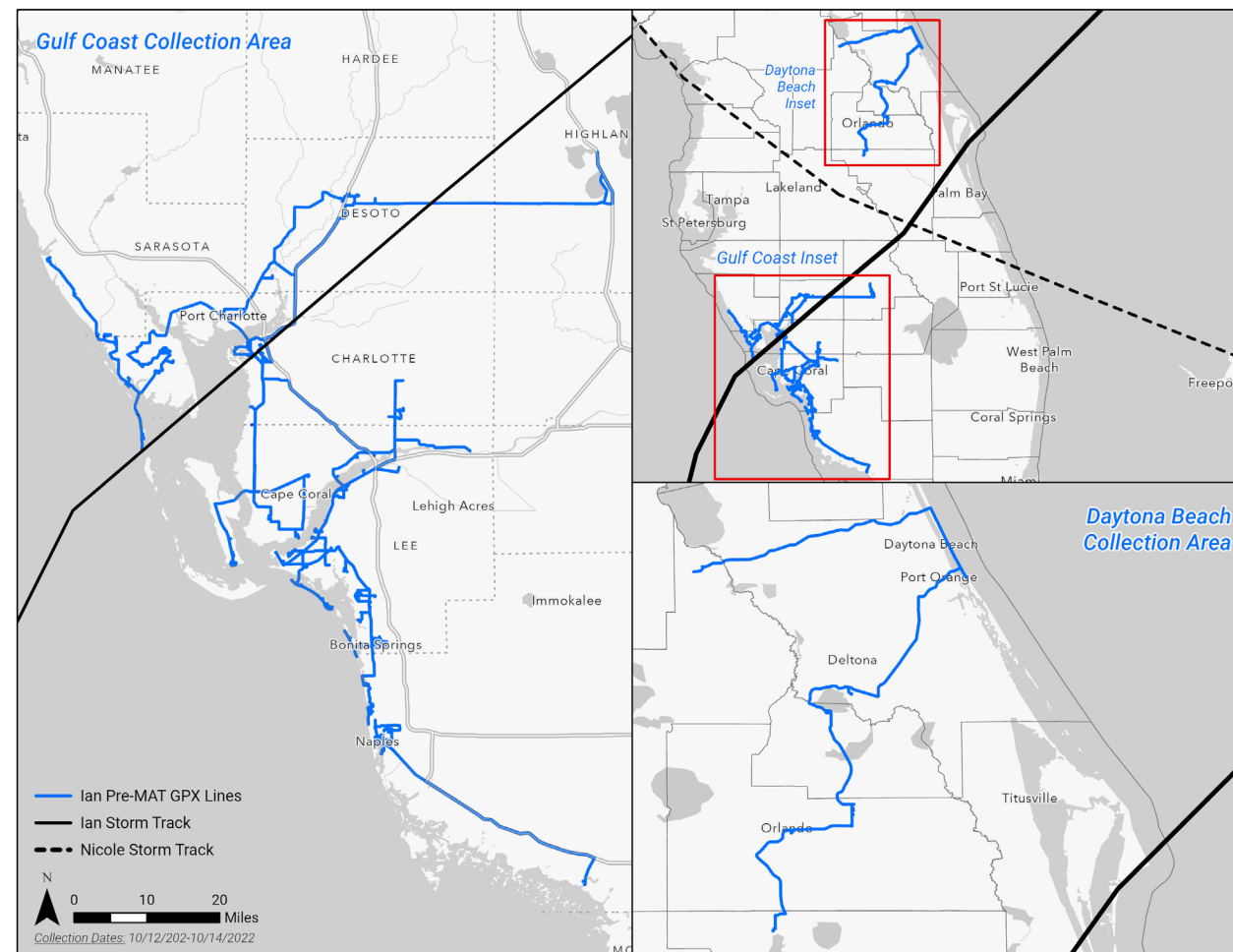


Hurricane Ian vs Charley - Overview

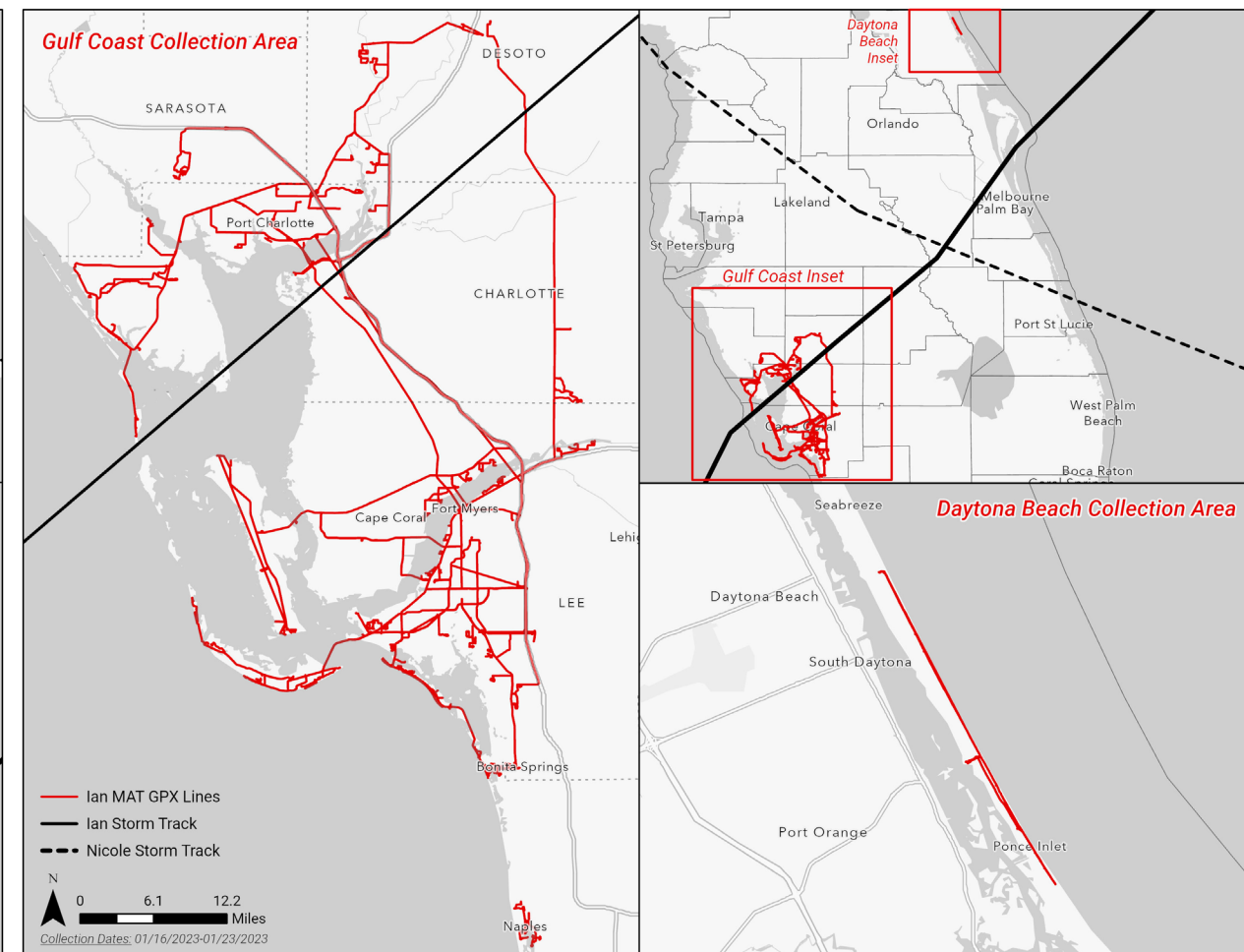
	Charley (2004)	Ian (2022)
Central pressure at landfall	941 mb	940 mb
Size at landfall, width of eye	14 miles	~26 miles
Forward speed at landfall	25 mph	9 mph
Estimated \$ in economic losses *	\$25 billion	\$113 billion
Estimated NFIP claims	\$50 million	\$3-5 billion
Fatalities	10 (in US)	148 (in FL)

* (CPI-Adjusted, January 2023)

Field Work – Areas visited (Approximately 700 sites across 3 Pre-MAT and 8 MAT field days)



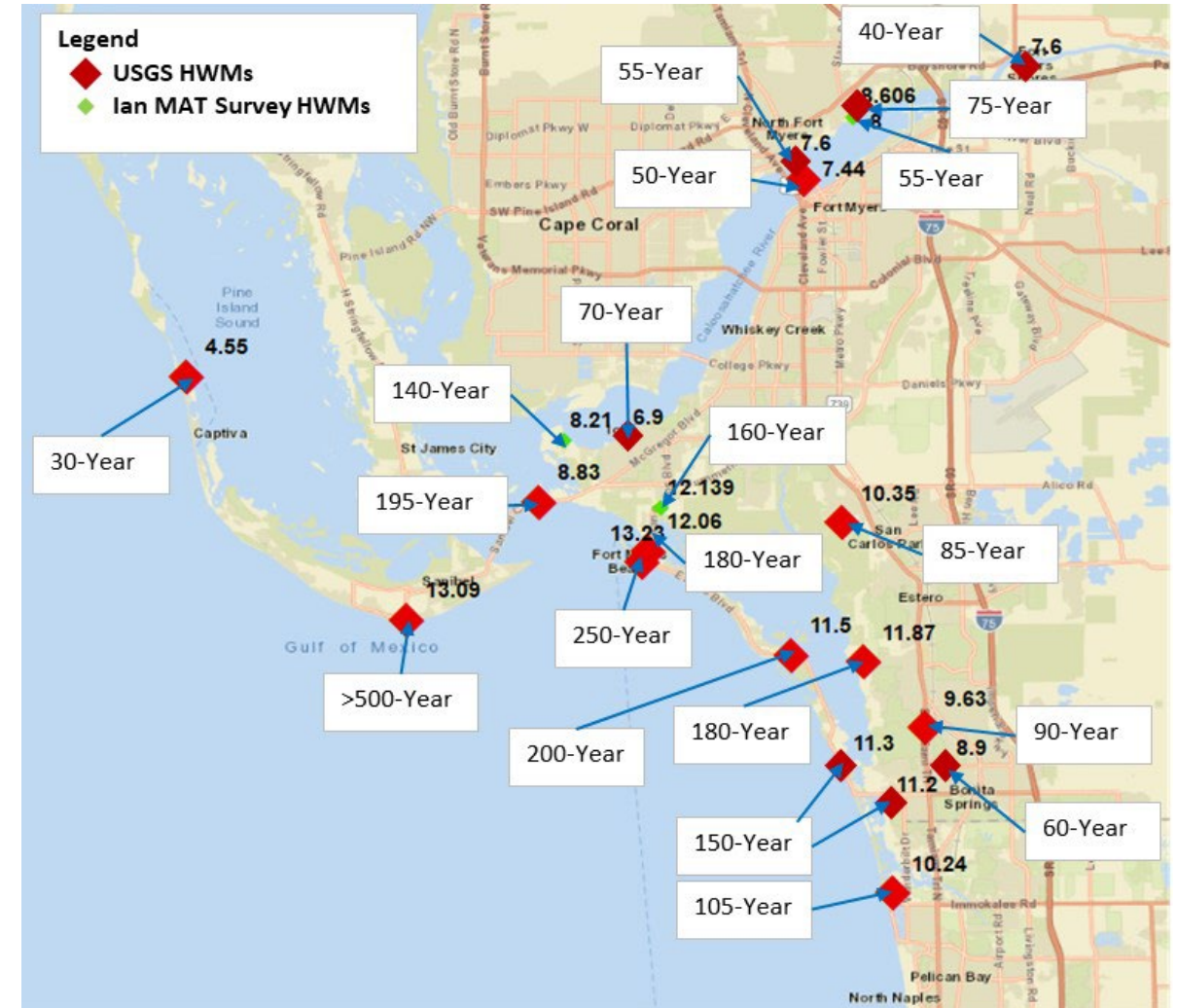
Pre-MAT October 12-14



MAT January 16-24

Preliminary Hurricane Ian Water Level Return Period Analysis

- FEMA Effective DFIRM countywide mapping data (Lee County dated 11/16/2022) was used to determine Hurricane Ian Annual Exceedance Probability (AEP).
- Observed USGS HWMs and Surveyed Ian MAT HWMs (ft NAVD88) were used for selected locations across study area.
- The Hurricane Ian water level return period was approximated to the nearest 5-year interval.
- The range in return period is a result of water level fluctuations (i.e., in riverine areas near Fort Myers). This may be due to joint riverine-storm surge effects, local topography, inland inundation, or survey methods.



Coastal

- Surge and wave impact on structures and utilities
 - Elevation matters, so does vegetation and siting
 - Foundation type and depth matter
 - Breakaway wall and deck performance
- West – scour behind seawall versus East – erosion of seawall
 - Preferred flow paths
- Finished enclosures/occupancy beyond parking, storage, and access below the lowest floor was prevalent



“Inland” Flooding

- Emphasis on new versus older construction
- Floodproofing
 - Dry floodproofing - measures consistently not deployed
 - Wet floodproofing – use of flood damage resistant materials
- DRRA 1206 with local officials
- Numerous successful examples of elevated vs non-elevated



Coastal – Elevation Matters



Coastal – Breakaway Walls



Fort Myers Beach



Bonita Beach



Bonita Beach

21.01.2023 12:25



Sanibel Island

17.01.2023 15:49

01.2023 11:38

Erosion Impacts to Atlantic Coast from Hurricanes Ian and Nicole

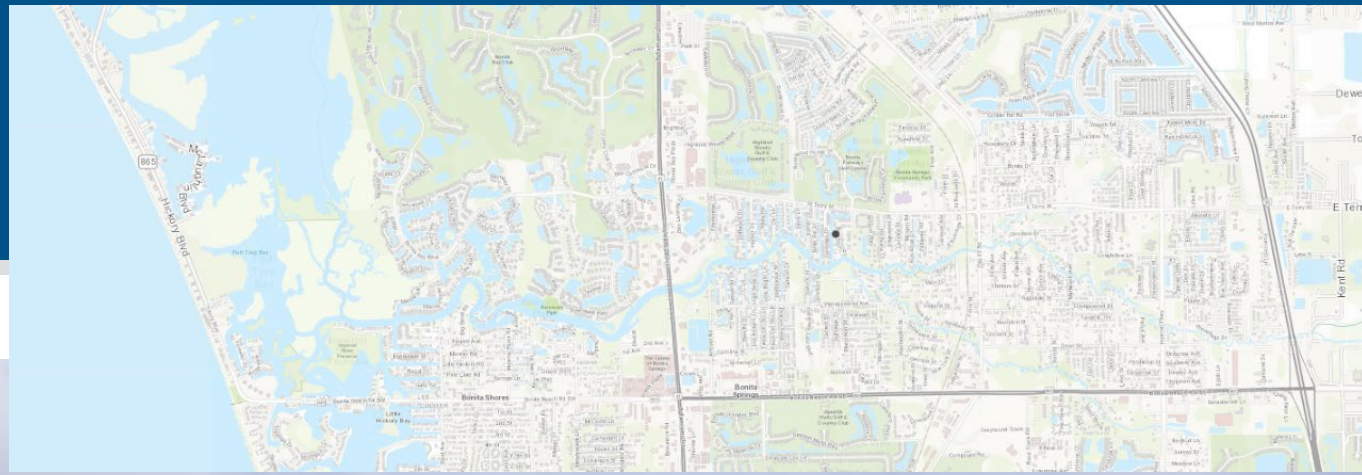
Port Orange
10/14/2022



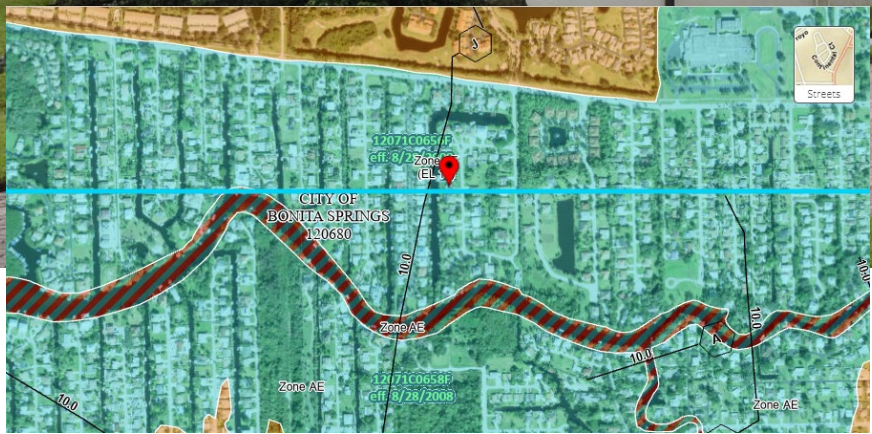
Port Orange
1/23/2023



Several 'side by side'



Bonita Springs



Analyzing 'Case Study' Neighborhoods

Decade Built	# of Single-Family Residential Policies	%	Average Total Claim	Average Building Claim	Average Content Claim	# Max Building Claim	# Max Content Claim
<1980	52	17%	\$178,081	\$155,749	\$22,332	12	2
1980-89	131	43%	\$112,147	\$100,434	\$11,713	8	1
1990-99	56	19%	\$50,235	\$42,918	\$7,316	1	0
2000-09	53	18%	\$53,312	\$47,495	\$5,817	3	1
>2010	10	3%	\$59,672	\$52,110	\$7,563	0	0
Total	302	100%	\$99,957	\$88,403	\$11,554	24	4

Analyzing 'Case Study' Neighborhoods

Type	# of Single-Family Residential Policies	%	Average Total Claim	Average Building Claim	Average Content Claim	# Max Building Claim	# Max Content Claim
Elevated	197	65%	\$51,269	\$44,792	\$6,477	3	2
Non-Elevated	105	35%	\$191,304	\$170,224	\$21,080	21	2
Total	302	100%	\$99,957	\$88,403	\$11,554	24	4

FIRM	# of Single-Family Residential Policies	%	Average Total Claim	Average Building Claim	Average Content Claim	# Max Building Claim	# Max Content Claim
Pre 1985	130	43%	\$170,656	\$151,154	\$19,501	19	3
Post 1985	172	57%	\$46,522	\$40,974	\$5,548	5	1
Total	302	100%	\$99,957	\$88,403	\$11,554	24	4

More than just single family...

Fort Myers



Arcadia



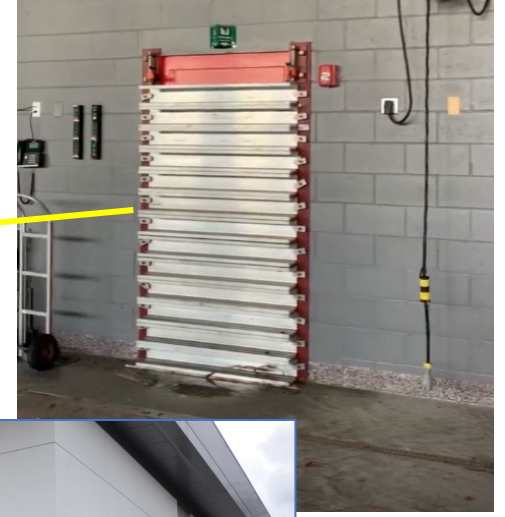
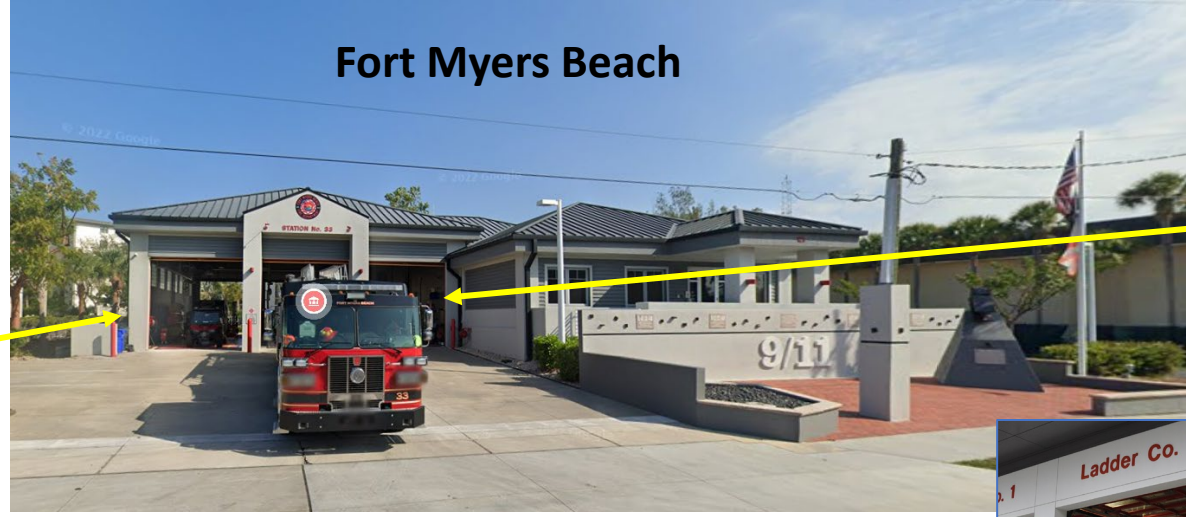
Naples



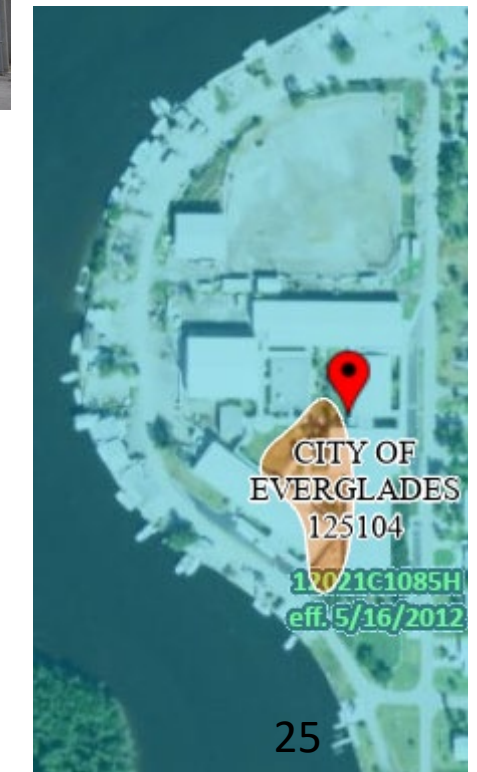
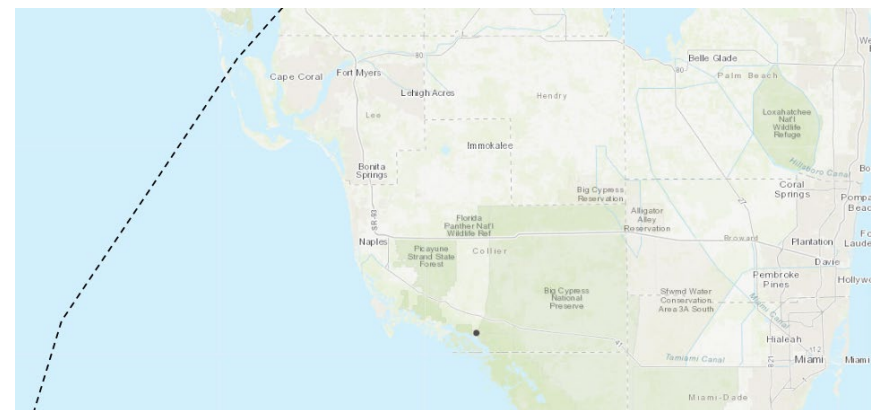
Naples



Fire Stations



Everglades City School



Overall MAT Field Work Summary

- Ian and Charley were much different events
 - Ian below design wind event, met or exceeded design flood event in many locations
- Elevation when paired with a proper foundation and materials, works
- Age and inventory of construction vulnerabilities
- Room for improvement
 - Loss of utility resulted in operational to Critical Facilities
 - Shelters at all levels (Federal, SLTT, etc.)
 - Flood resistant design and construction
 - Measures often **not** implemented
 - Building envelope
- Siting, zoning, planning, codes, etc. matter



Overall MAT Field Work Summary

- Post 1994 manufactured homes outperformed older and limited evidence of anchorage failures, keep in mind below design wind event
- Erosion
 - Seawall design and construction
 - Deep foundations
- Evacuation – many survivors trapped for several days
- Opportunity
 - Awareness/Outreach
 - Engineered Solutions
 - Behavioral changes
 - Offsetting activities
 - Minimal DRRRA 1206 Implementation
- More to follow as we process data and notes as well as develop materials

Recovery Advisories and Fact Sheets Topics

- Recovery Advisories (ongoing and will be completed **before** the MAT Report is published)
 - Designing for Flood Levels Above the DFE After Hurricane Ian
 - Reducing Loss of Utility Impacts in Critical Facilities
 - Understanding Performance Grade (PG) Ratings for Hurricane Windows and Doors
- Additional topic and content consideration is still **ongoing**...for example:
 - Charlie vs Ian – very similar tracks completely different impacts
 - Shelters 101 – differences between 361, ICC-500, EHPA, etc.
 - Performance/examples of “Elevated” Buildings – Manufactured Home, Single Family, Multifamily Apartments, Hotel, Non-Residential, Critical

Designing for Flood Levels Above the BFE After Hurricane Sandy



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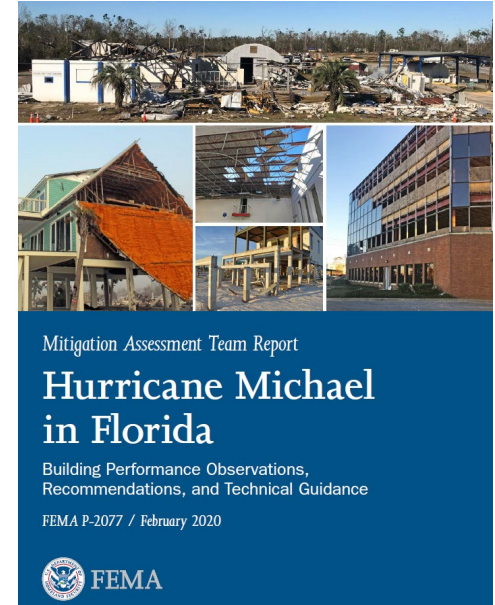
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MAT Collaboration and Outreach Opportunities

- Collaboration
 - DR 4673 Recovery
 - FEMA NFIP (Risk Rating 2.0, Minimum Standards RFI, etc.)
 - National Science Foundation
 - Florida Building Commission Hurricane Research Advisory Committee
 - ASCE 7 Flood Loads and ASCE 24 Flood Resistant Design and Construction
 - ...and more
- Outreach
 - National Hurricane Conference – 4/3-4/6
 - Florida Floodplain Managers Association (FFMA) – 4/11-14 ([Here today](#))
 - Building Officials Association of Florida (BOAF) – 6/11-14
 - Florida Manufactured Housing Association (FMHA) – 6/15-16
 - Potentially others....
- Additional Training Opportunities Possible

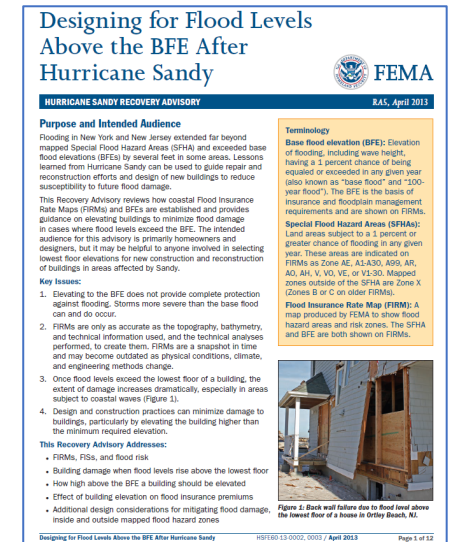
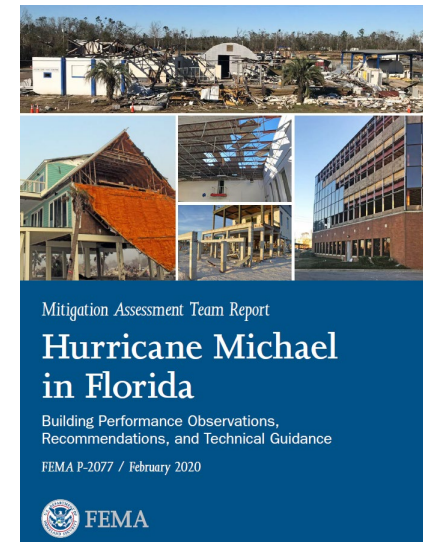
Anticipated Report Structure

- Final Report
 - Introduction/Event Background
 - Building Codes, Standards, and Regulations
 - Flood Related Observations
 - Wind Related Observations
 - Critical Facility Related Observations
 - Conclusions and Actionable Recommendations
 - Appendices
 - Recovery Advisories, Fact Sheets, Case Studies...
 - Specific topic and content determination is still **ongoing**
- Cite-able to support the SLTT's and others – impacts long term recovery and resilience
 - Land use planning and code/standard & FPM requirement changes
 - Potentially future Building Science guidance, FEMA Program changes and IBC/IRC code proposals



Approximate Timeline

- Recovery Advisories/Fact Sheets
 - 6 months post-fieldwork
- Report
 - Approximately 12 months
 - Conclusions and recommendations will be shared to support recovery operations



Questions?



FEMA Building Science Disaster Support Program email:
FEMA-BuildingScienceDisasterSupport@fema.dhs.gov
866-927-2104

<http://www.fema.gov/building-science>

