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The Impact of a Major Hurricane on Hampton Roads

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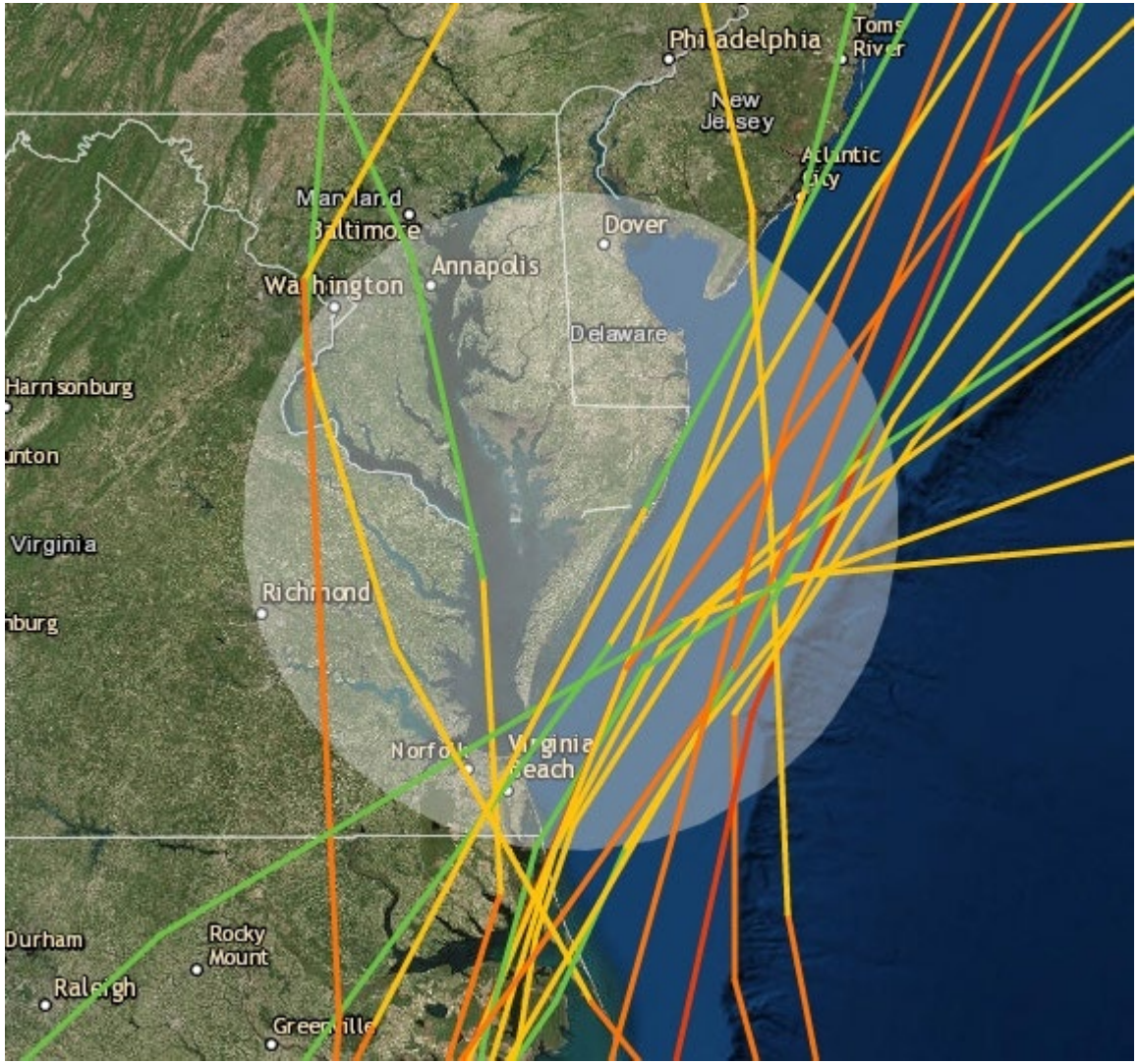
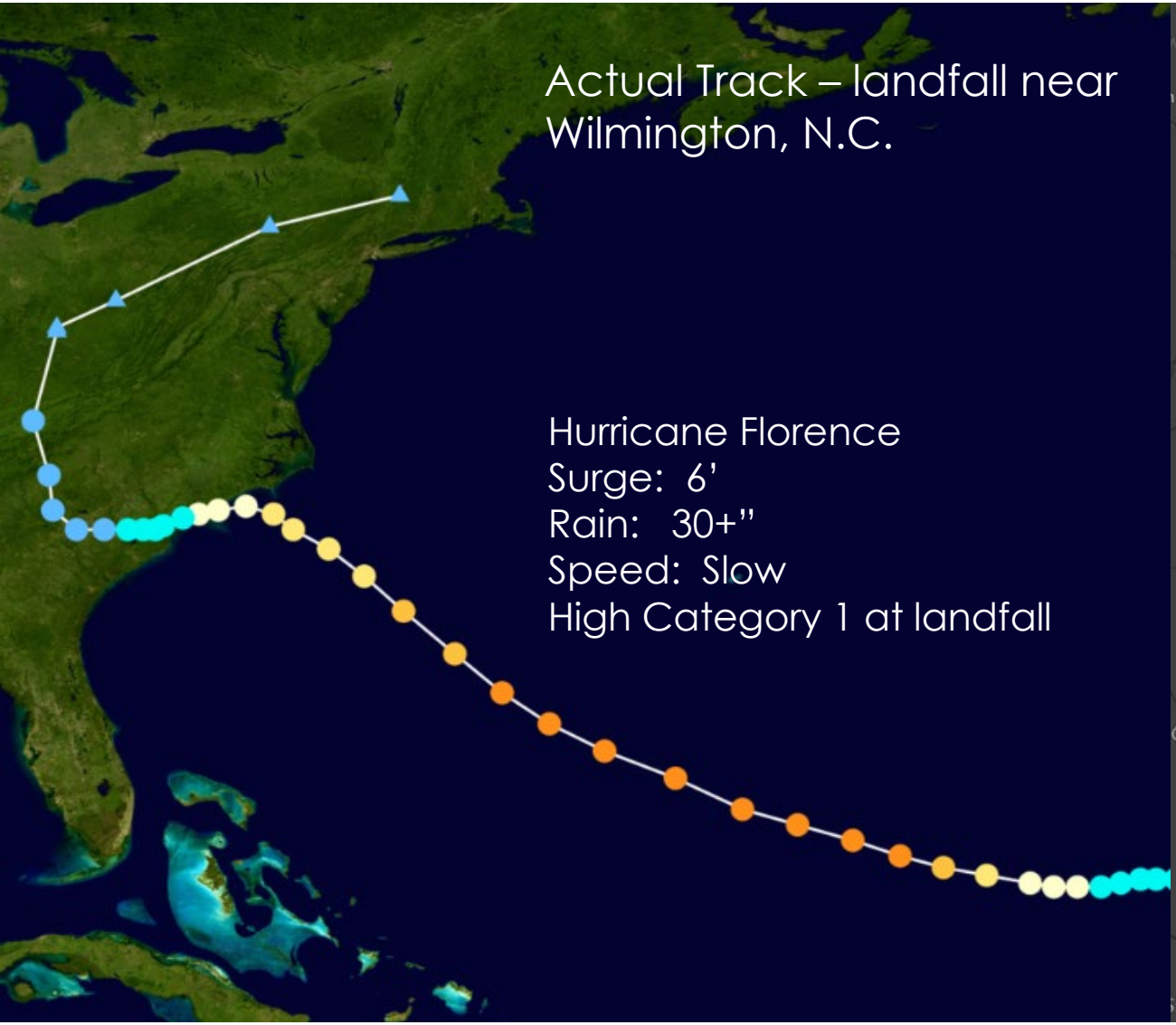
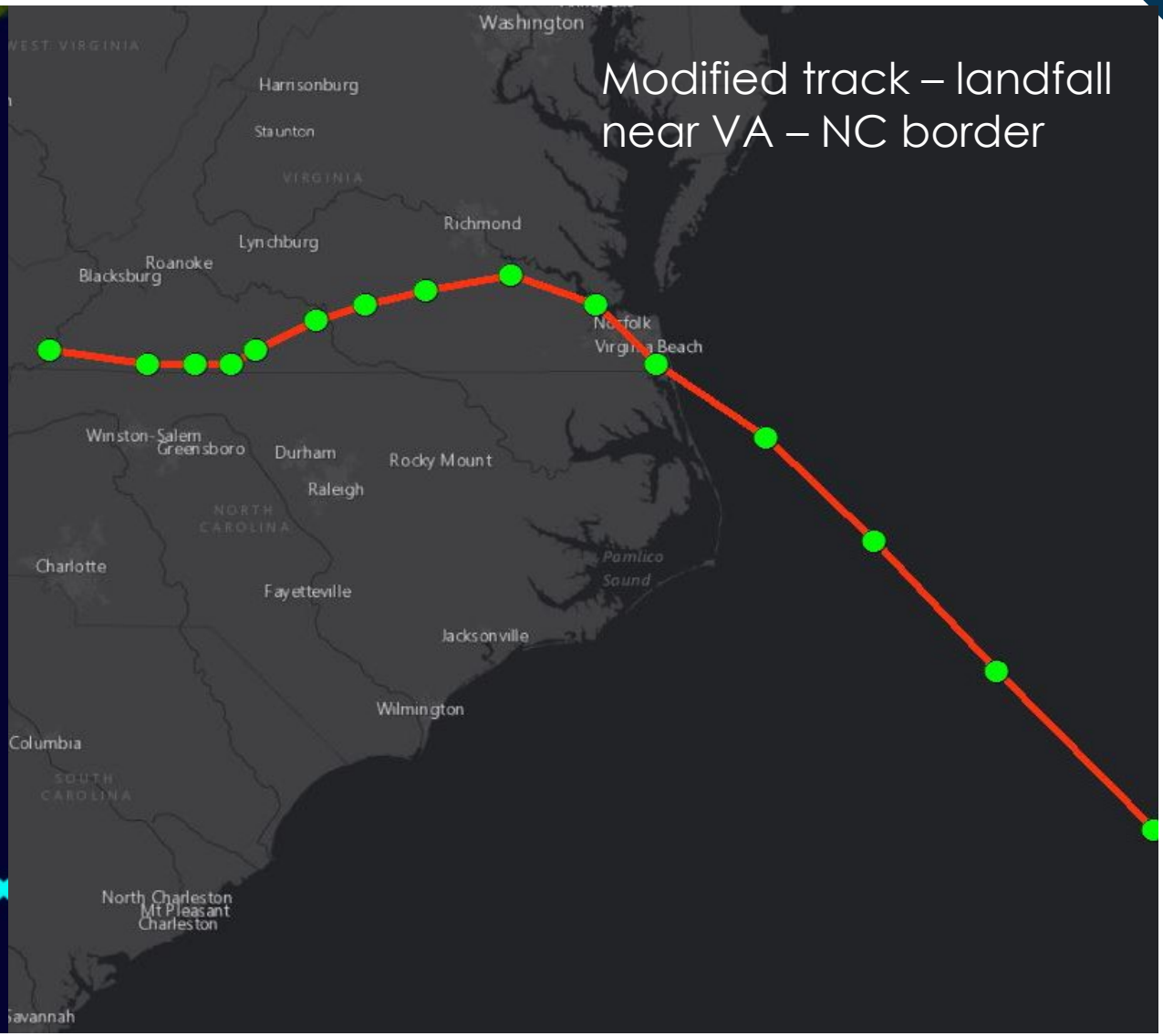
A Major Hurricane is Uncertain but Also Certain

- Numerous storms have tracked over or west of Hampton Roads since 1850.
- Climate change appears to affect hurricane formation and strength. Warmer seas are a harbinger of wetter storms.
- Demographic and economic change has increased economic activity, population density, and building density in the urban crescent.
- Hampton Roads is particularly challenged by topography and the number of viable evacuation routes.

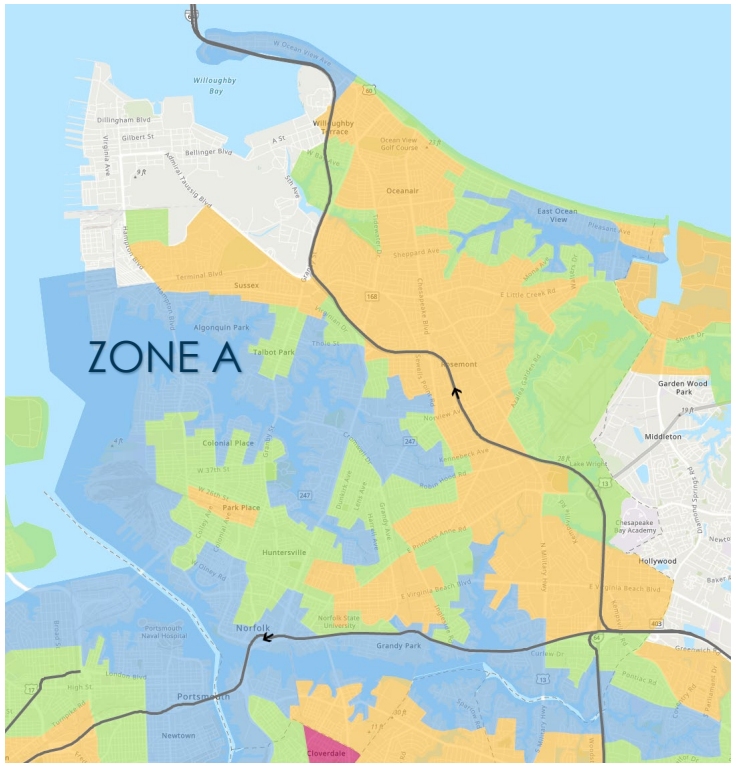


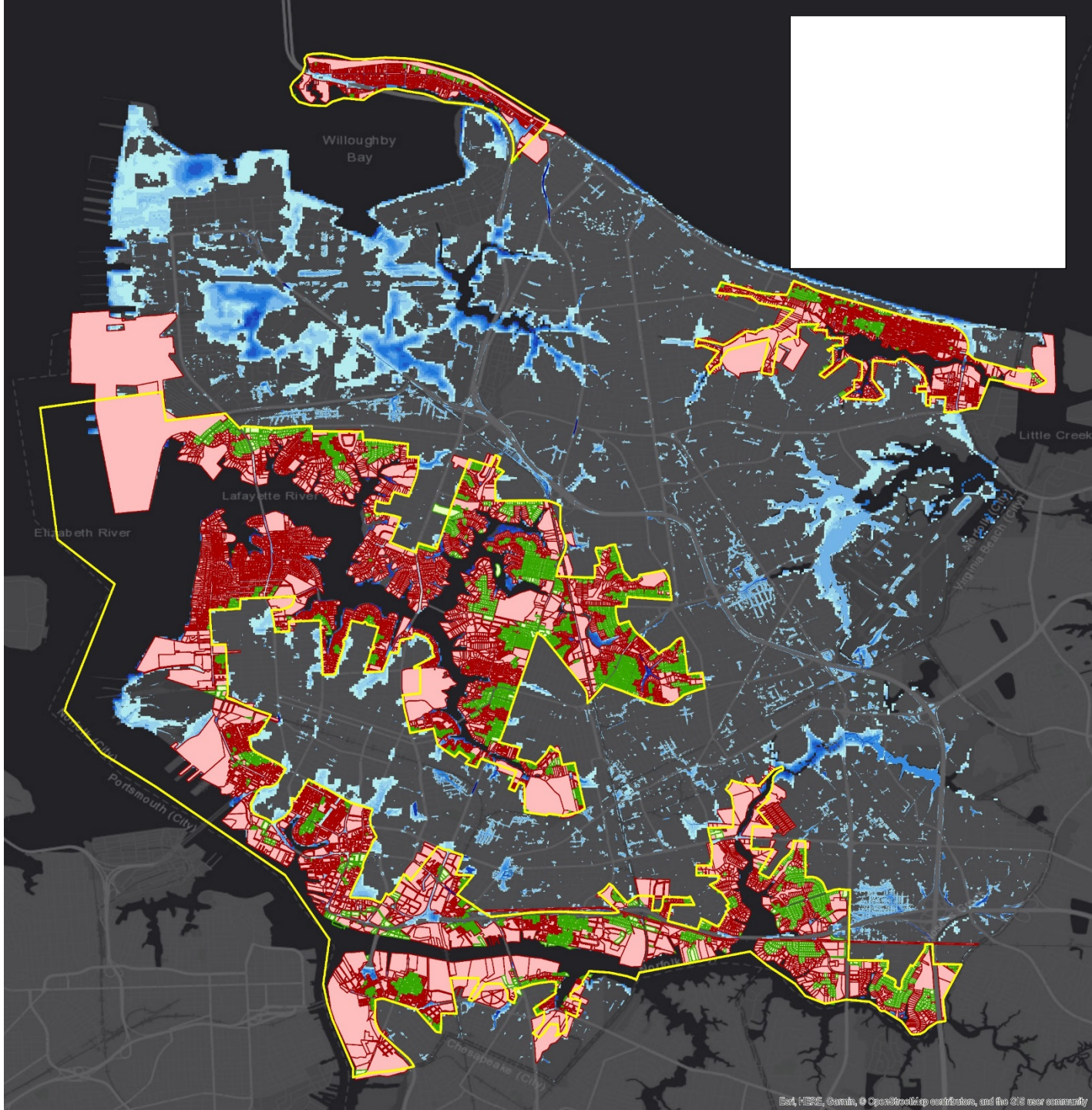
Source: Washington Post (2018). Tropical storms and hurricane tracks through the Mid-Atlantic since 1851. Green indicates tropical storm strength, yellow category one hurricane, orange category two hurricane, and red category three hurricane. https://www.washingtonpost.com/news/capital-weather-gang/wp/2017/07/13/why-a-single-hurricane-has-not-directly-hit-virginia-maryland-or-delaware-since-1851/?utm_term=.633f6356447a. Also available at: https://coast.noaa.gov/digitalcoast/tools/hurricanes

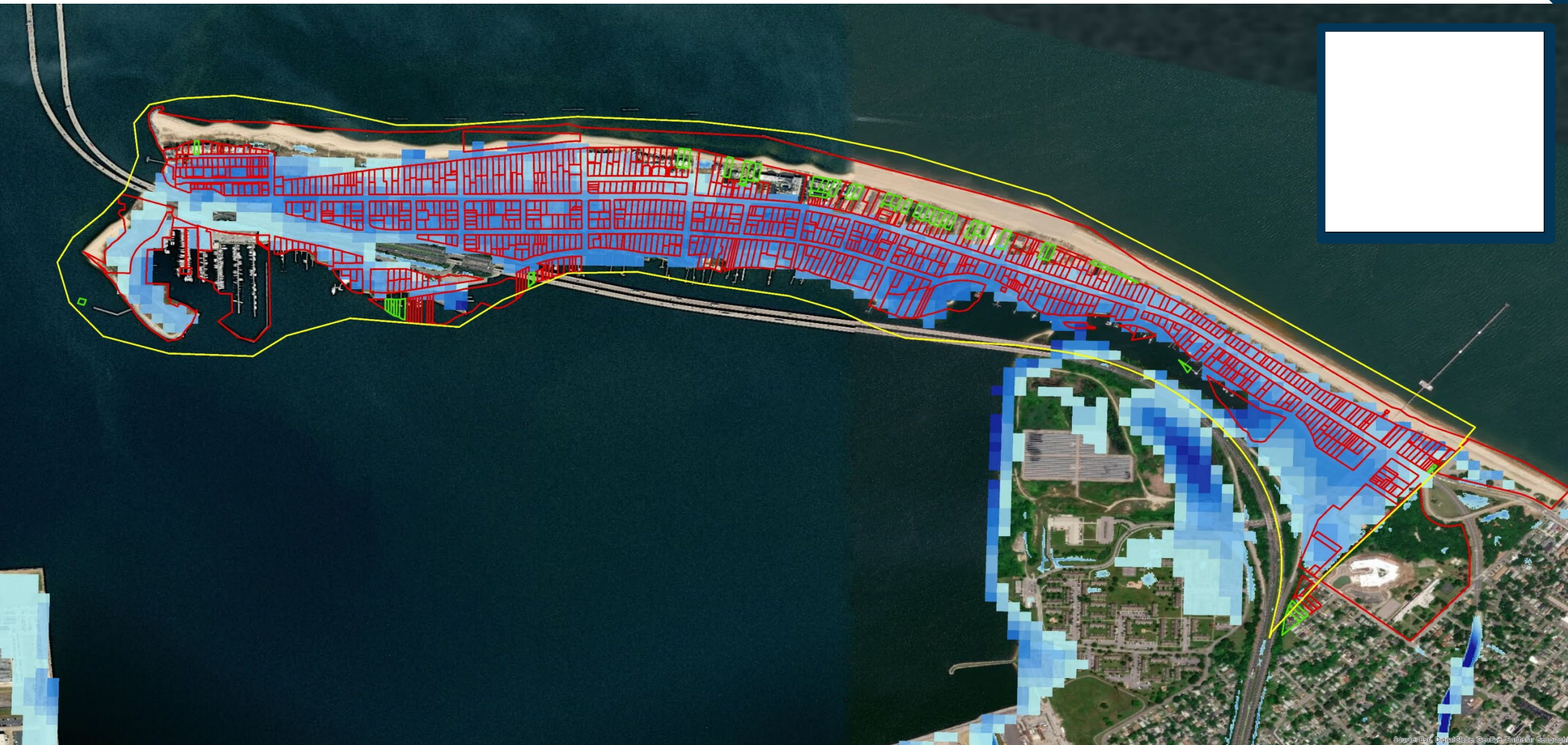


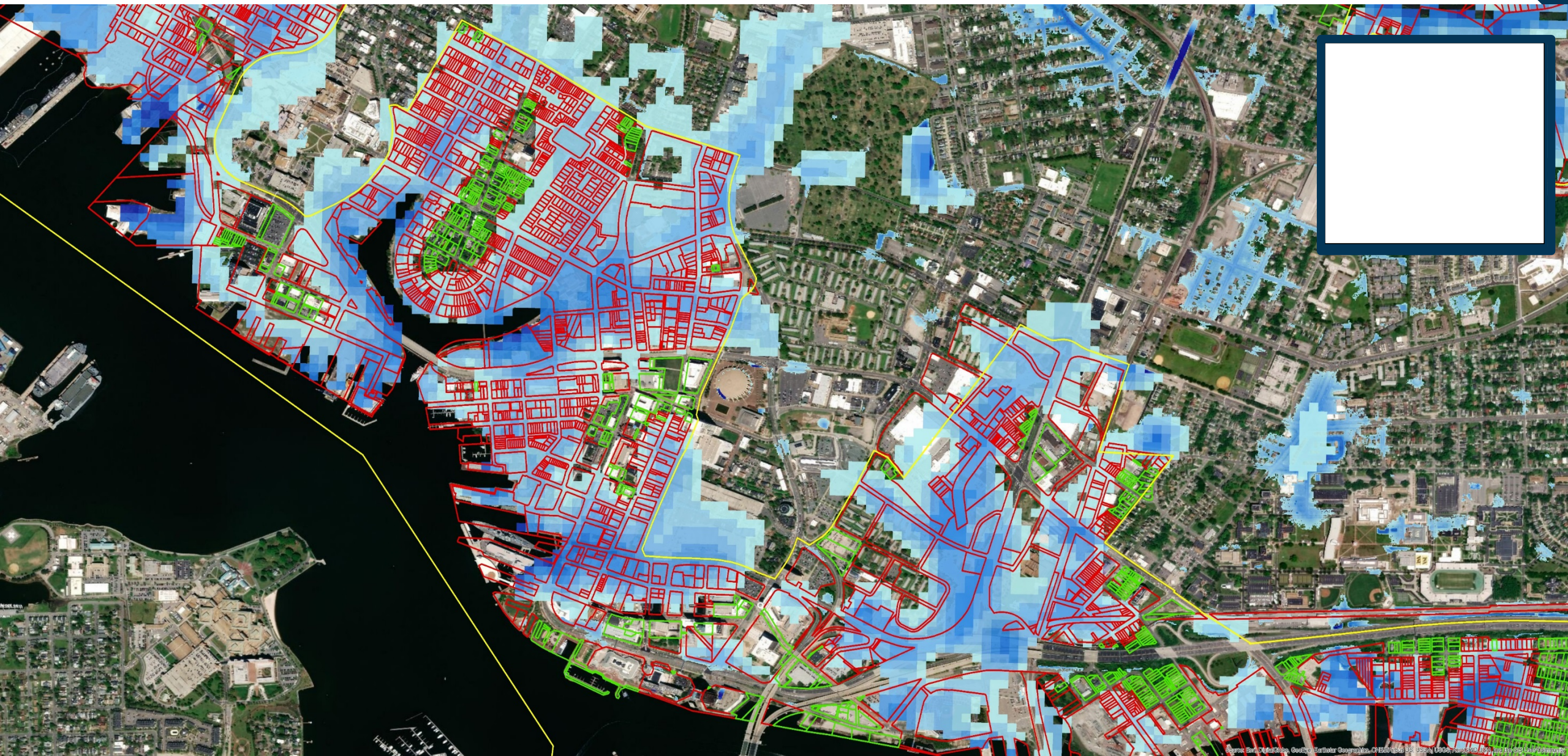


Rapid Modeling Assumptions & Limitations: Storm surge is visualized using CAT 2 data (MOM approach). Localized rainfall of 36" is modeled for the entire study region (City of Norfolk) without spatial variation. Water losses or gains from stormwater utility system are not considered.


ZONE A
Willoughby Bay
Oceanair
Sussex
Algonquin Park
Talbot Park
Colonial Place
Park Place
Huntersville
Norfolk
Grandy Park
Portsmouth
Newtown
Cloverdale
Garden Wood Park
Middleton
Hollywood


Willoughby Bay
Lafayette River
Elizabeth River
Little Creek
Portsmouth (City)
Chesapeake (City)
Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics



Estimating the Economic Impact of a Katrina-Class Event

- Hurricane Katrina was a Category 3 hurricane at landfall with sustained winds of 100 to 140 miles per hour.
- Jobs in the New Orleans metropolitan area declined by 17% in the first year after Katrina.
- We proportionally apply these job declines by sector to the Hampton Roads economy to model the economic impact.
- The post-Katrina declines in public employment translate into significant job declines in the public sector in Hampton Roads.

Source: United States Air Force (2012). Homestead Air Force Base after Hurricane Andrew.

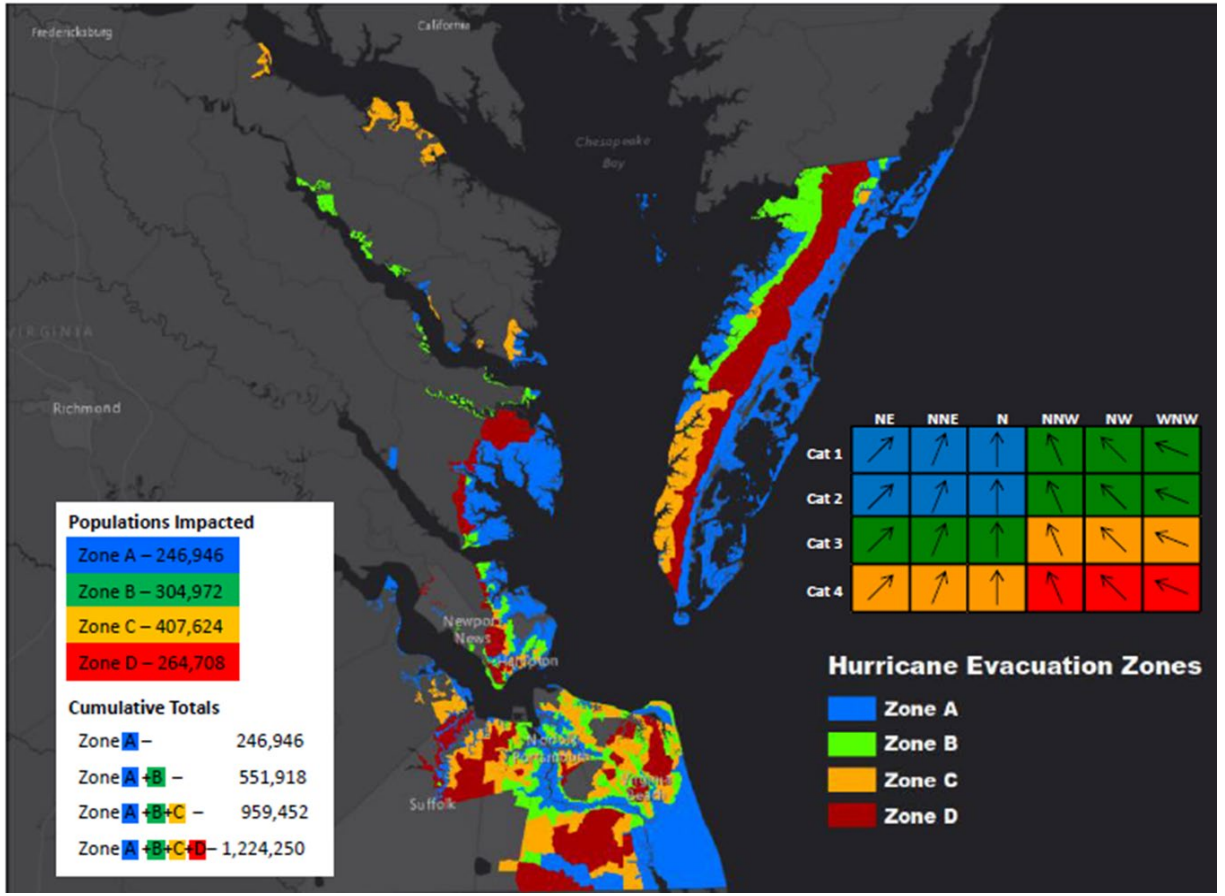
Summary of Physical and Economic Impacts
Katrina-Class Hurricane Striking Hampton Roads

	Buildings Affected (Destroyed)	Estimated Impact	Individuals Affected (Requiring Shelter)
Wind Damage	20,137 (1,114)	>$4 billion	1,500 (800)
Water Damage	18,427 (6,231)	>$13 billion	204,125 (15,000)
Employment Loss	--	--	>170,000
Output Loss	--	>$22 billion	--
Total	**>38,000 (>7,000)**	**>$40 billion**	**>380,000 (>15,000)**

Source: Quarterly Census of Employment and Wages (2019), Chmura Economics – JobsEq, and Dragas Center for Economic Analysis and Policy. Percentages from the New Orleans Metropolitan Statistical Area are applied to 2017 employment and wages in the Hampton Roads MSA. HAZUS model estimates using a track similar to Hurricane Florence. Table represented estimated 1-year impact. Some double counting may occur as some individuals may have residences physically damaged and have employment loss.

Evacuation is a Wicked Problem

- The nature of the problem prevents a solution being known with certainty until the event has passed.
- The correct decision made with uncertain information will appear to be the wrong decision when all the facts are in evidence.
- The costs of evacuation and a storm shifting should be compared with the costs of not evacuating and the storm making landfall in the unevacuated area.
- Even the “best” decision prior to landfall may have an adverse outcome because residents must take also take action.



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Hurricane Florence: Household Evacuation Perception & Behaviors

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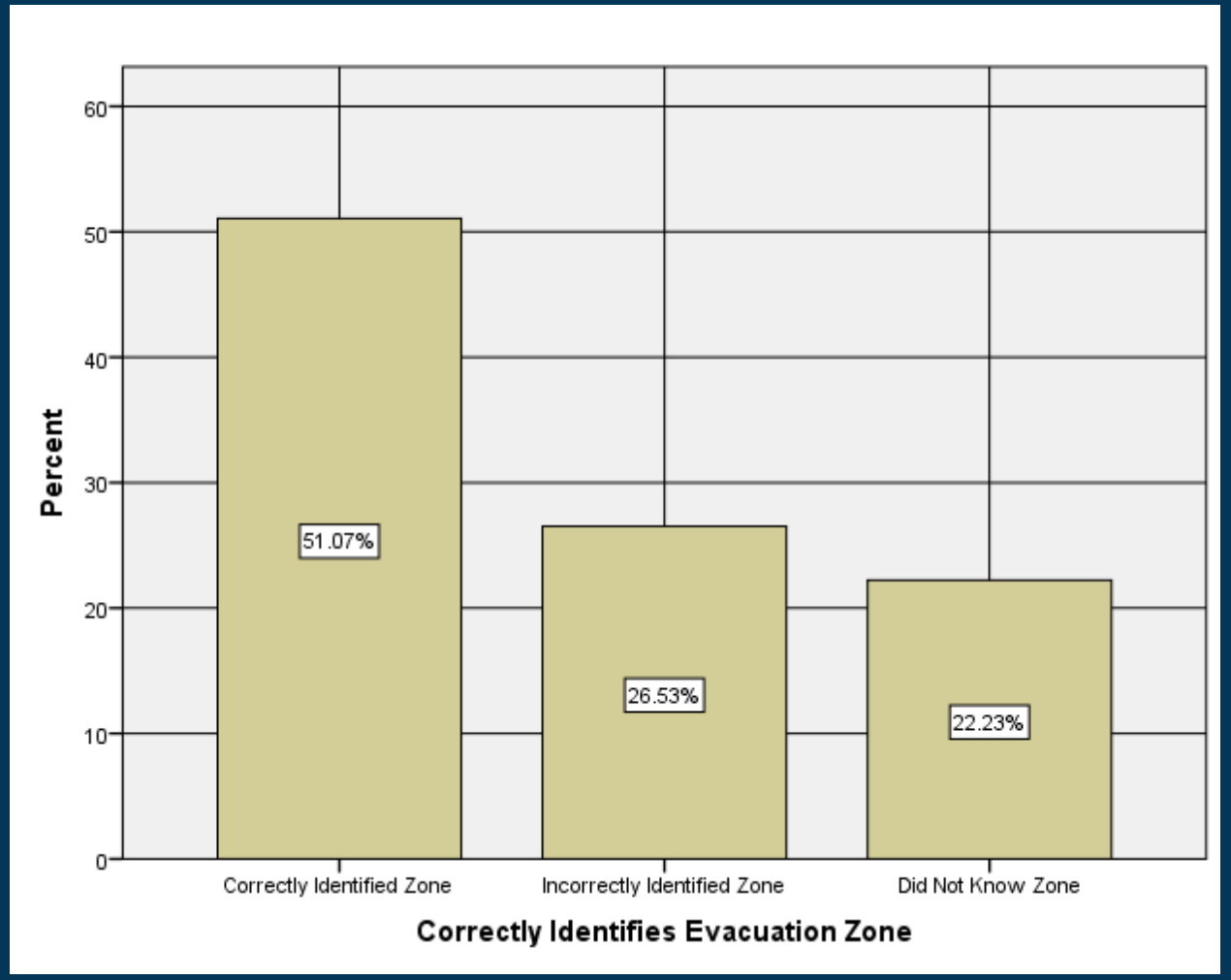
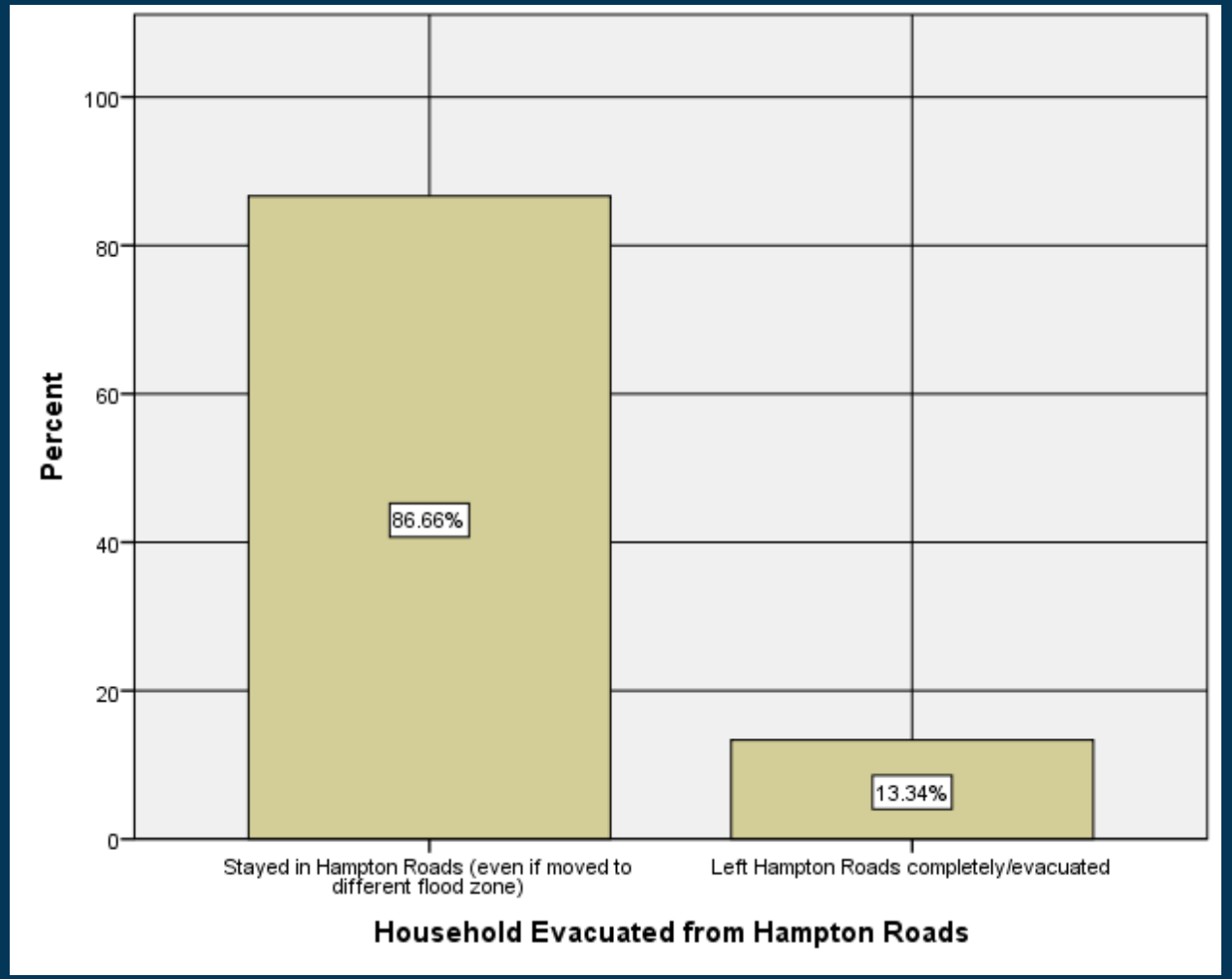
Household Evacuation Perception & Behaviors

- Random, stratified sampling of over 1,200 households conducted by ODU's Social Science Research Center in coordination with VMASC
- Households within Chesapeake, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, and Virginia Beach surveyed and geocoded
- Able to compare analysis of evacuation behaviors during Hurricane Irene (no Zones or mandatory evacuation order) with those during Hurricane Florence
- Preliminary data analysis presented here with report to follow

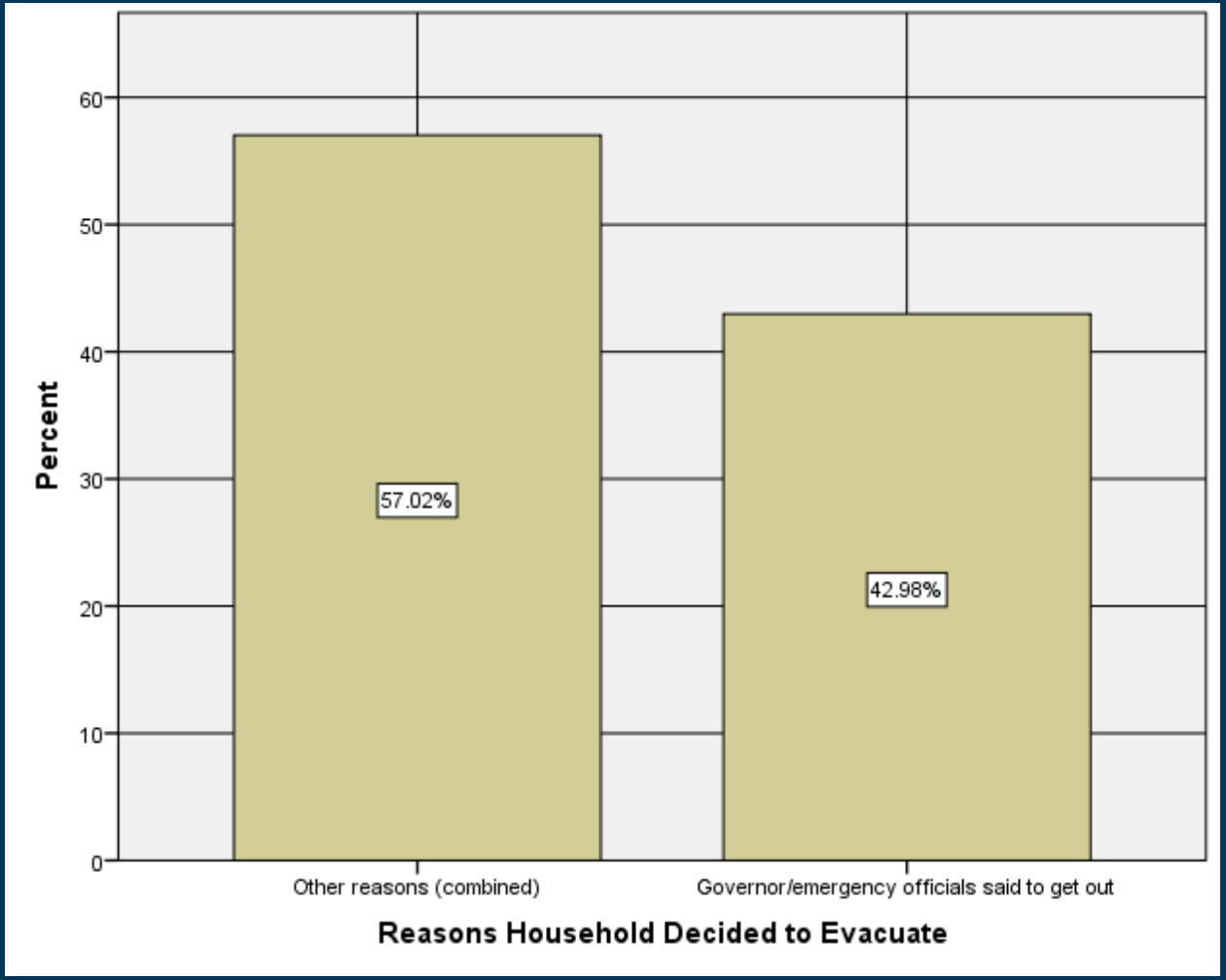
Correctly Identifies Evacuation Zone



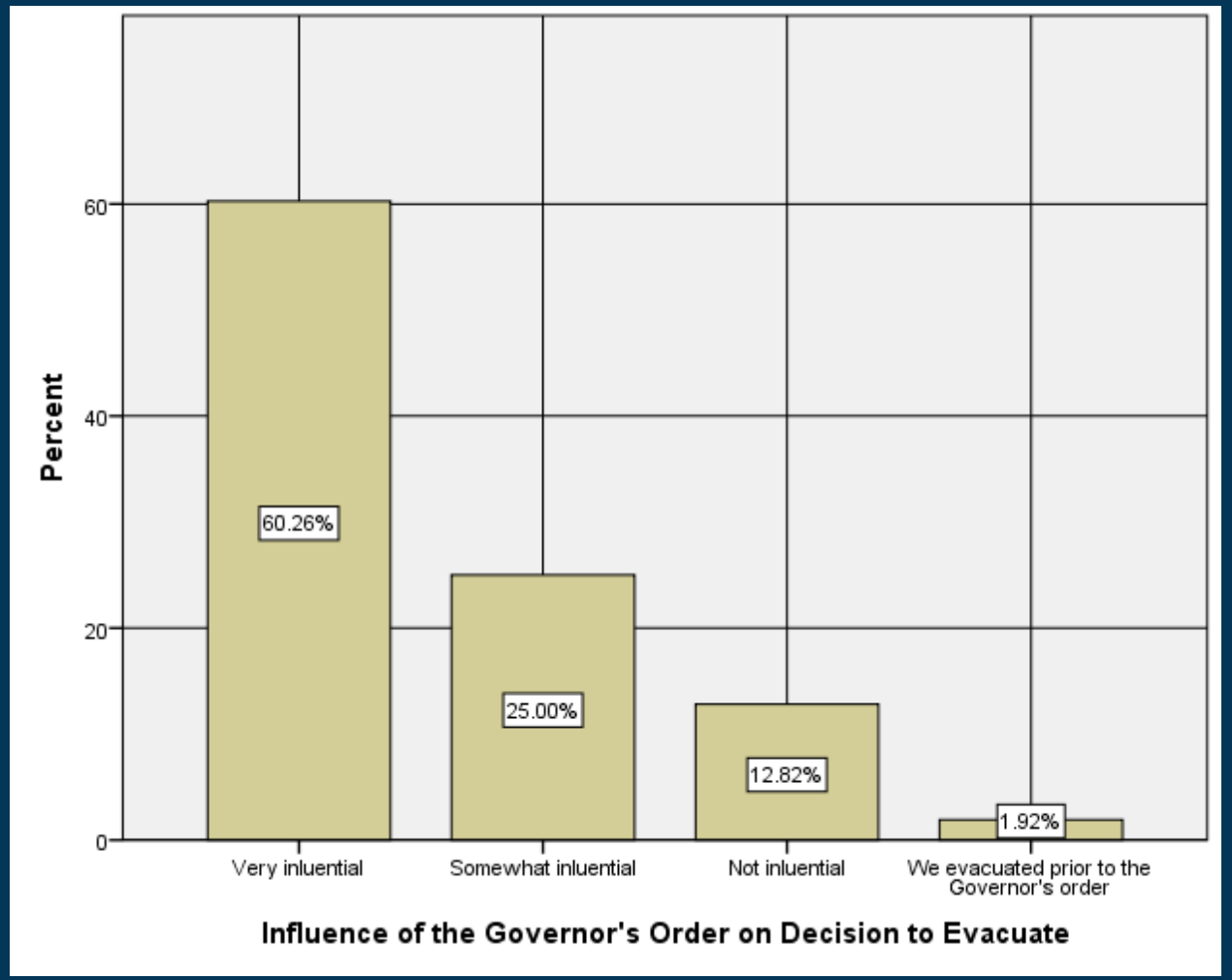
Household Evacuated from Hampton Roads



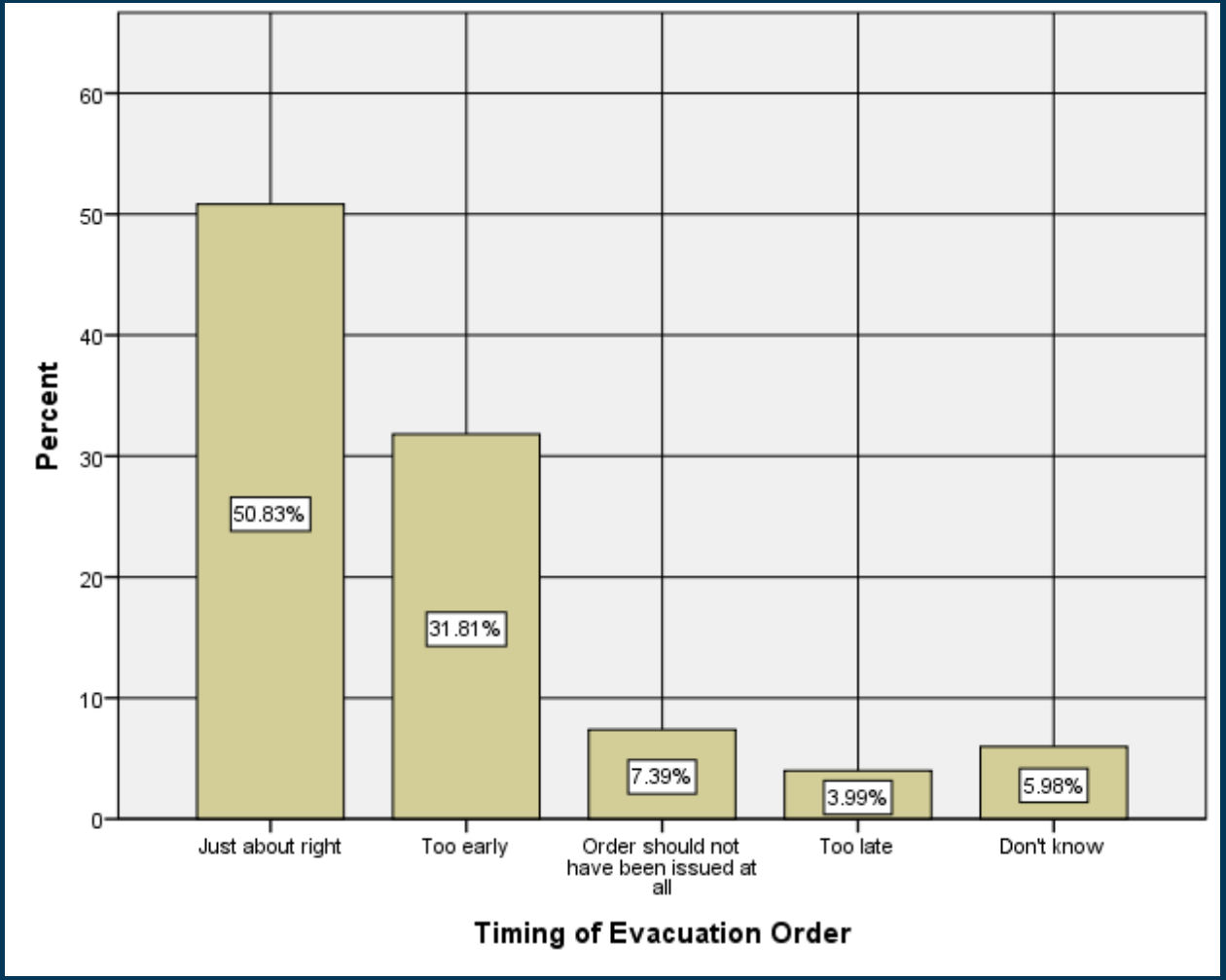
Reasons Household Decided to Evacuate



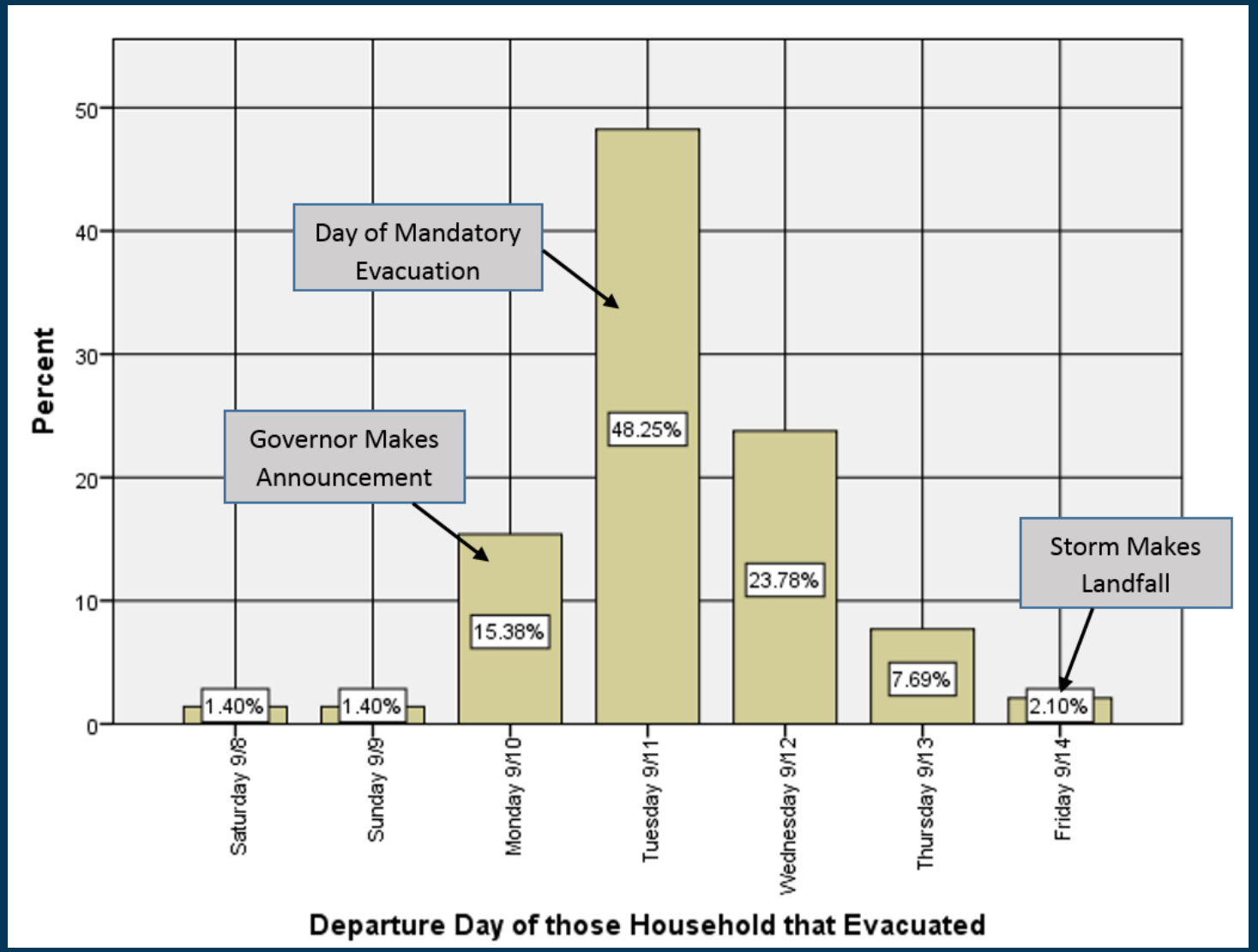
Influence of the Governor's Order on Decision to Evacuate



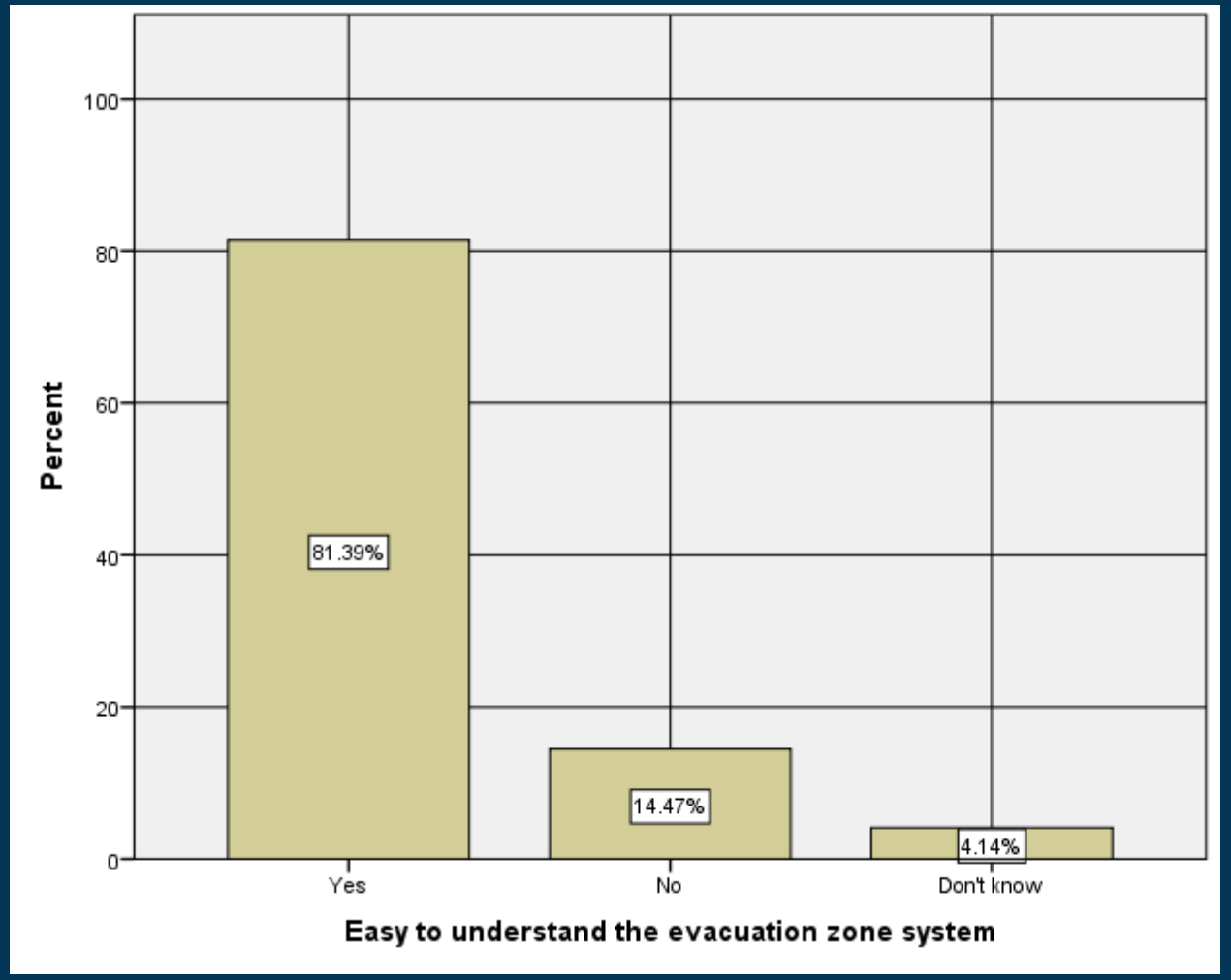
Timing of Evacuation Order



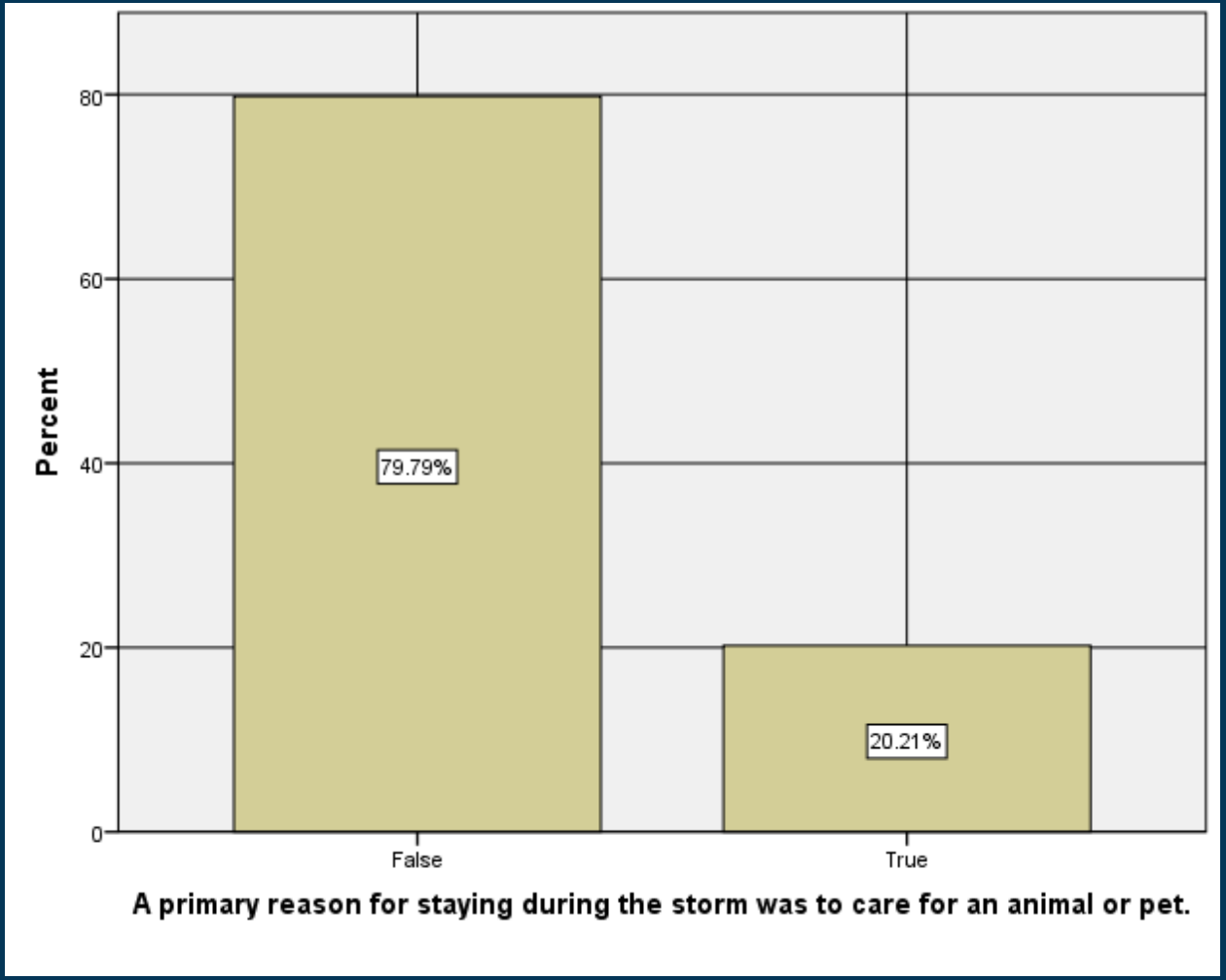
Departure Day of those Households that Evacuated



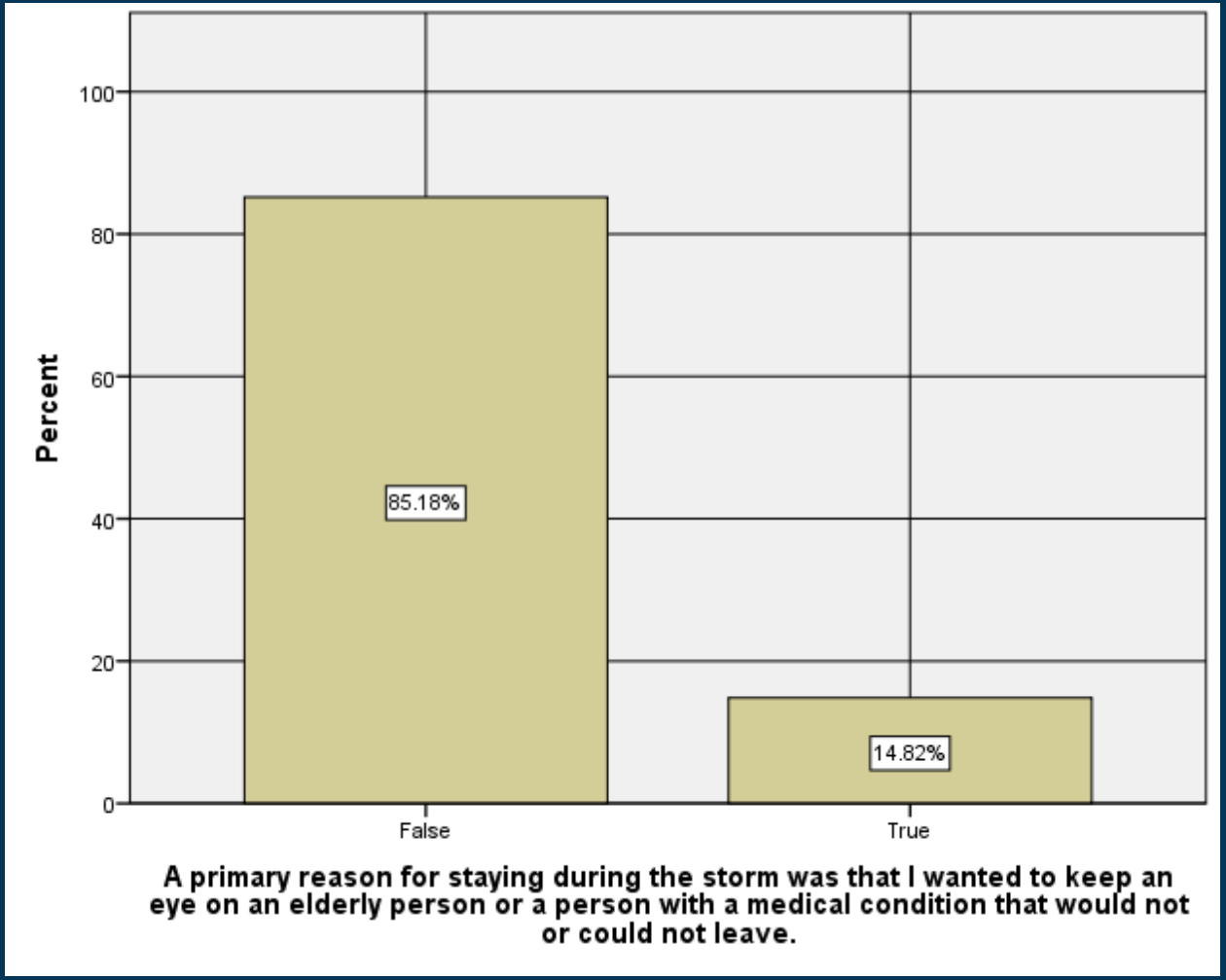
Easy to Understand the Evacuation Zone System



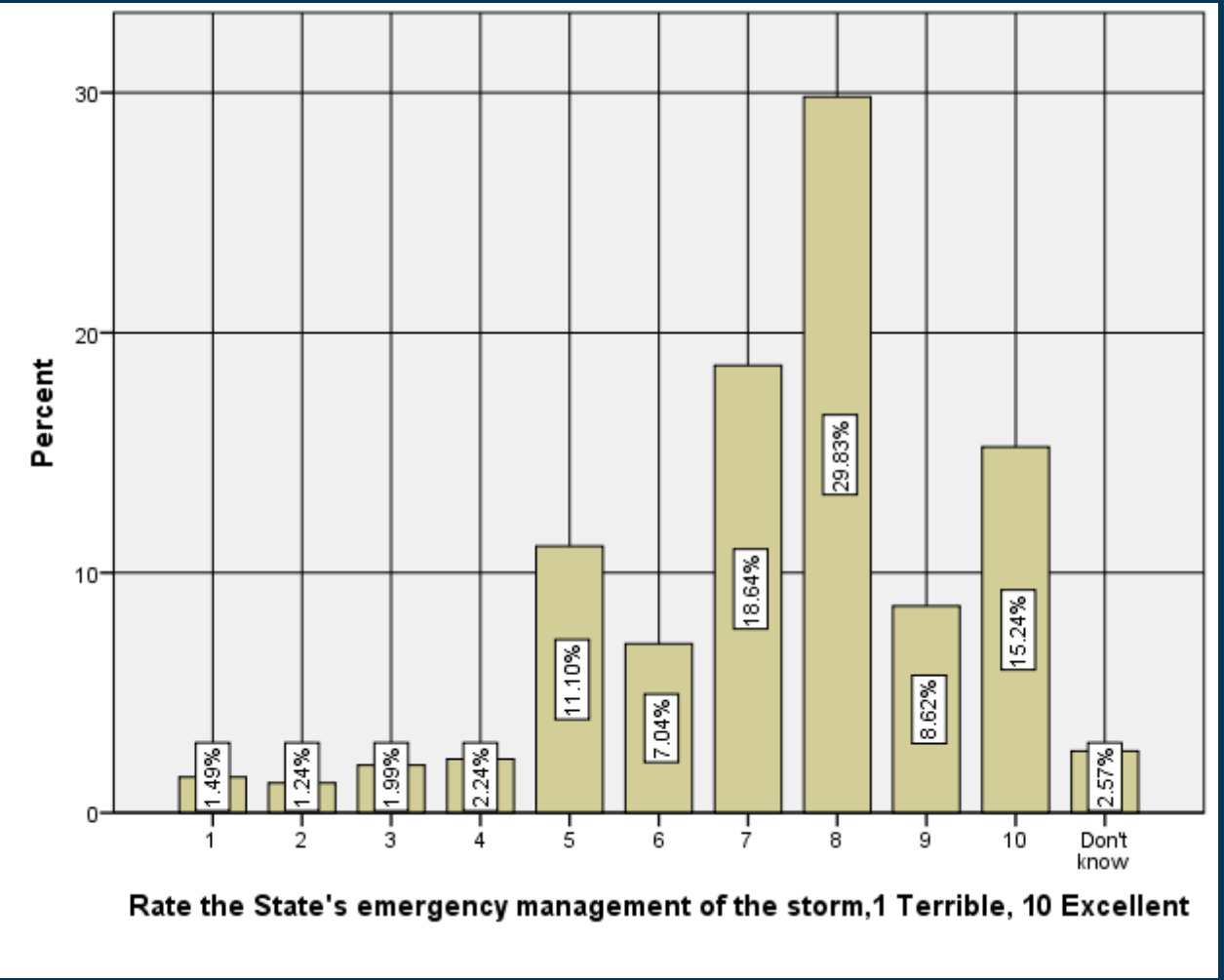
Primary Reason for Staying During Storm was Animal/Pet



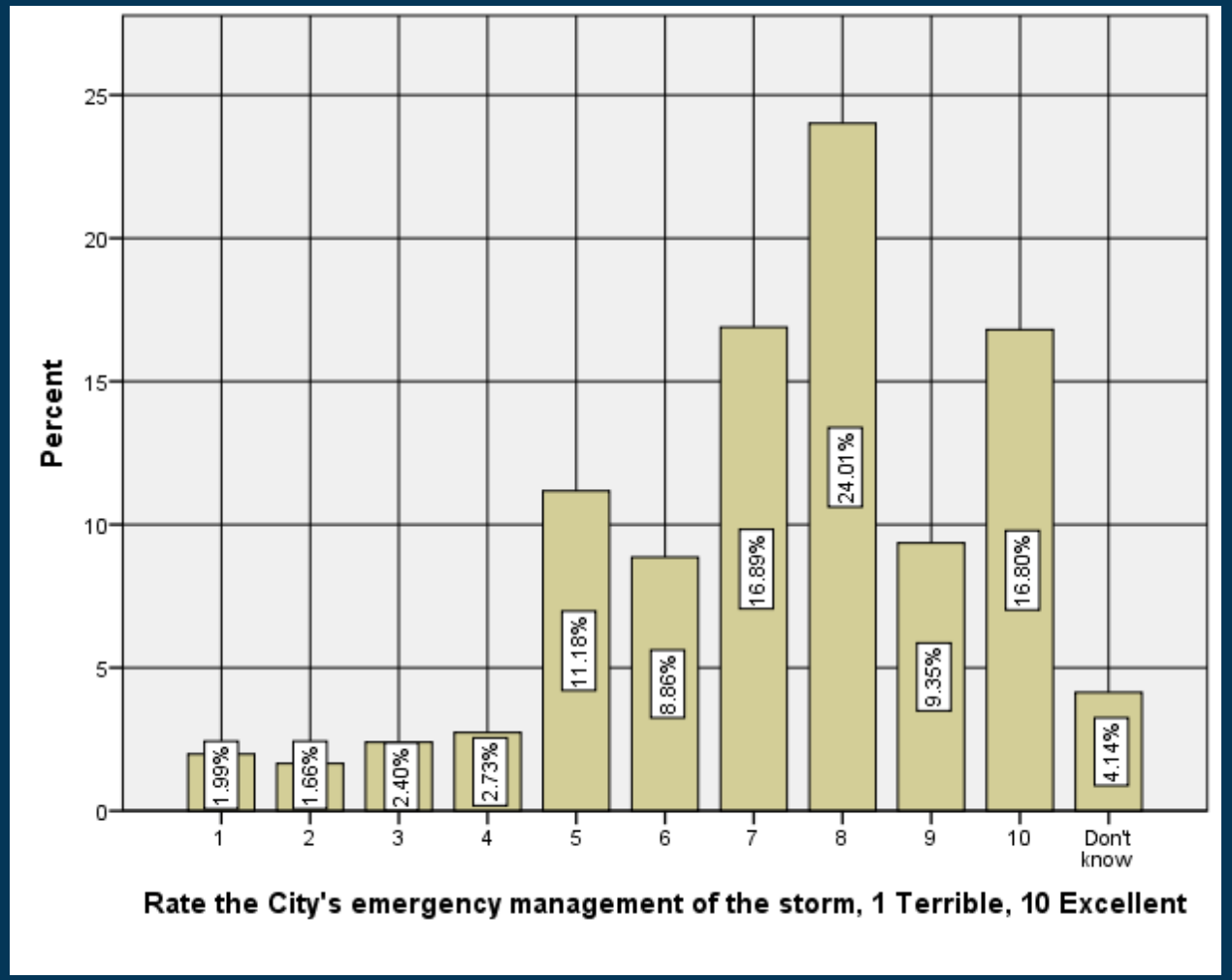
Primary Reason for Staying During Storm was Care for Elderly or Medically Fragile Person



Rate the State's Emergency Mgmt. of the Storm



Rate the City's Emergency Mgmt. of the Storm



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Contact Emily Steinhilber, esteinhi@odu.edu for more information.

CCRFR

COMMONWEALTH CENTER FOR RECURRENT FLOODING RESILIENCY

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Report & Slides Available:

www.floodingresiliency.org/florence