A policy brief from the
Institute for Public Administration | IPA

UNIVERSITY OF DELAWARE

Lewes Executive Committee on Resiliency: A Resilient Community Partnership

May 2022

SYNOPSIS

The City of Lewes is one of Delaware's most climate-vulnerable communities and is committed to developing and implementing climate resiliency policies and practices. In 2021, the Mayor and City Council empaneled an eleven-member Lewes Executive Committee on Resiliency (LECR) to identify, debate, and recommend resiliency measures that City Council could adopt.

The eleven members of the LECR represented a diverse range of stakeholders and interests and met twice per month for nine months. With the support of the Delaware Department of Natural Resources and Environmental Control (DNREC) and the Institute for Public Administration (IPA) at the Joseph R. Biden, Jr. School of Public Policy and Administration at the University of Delaware (UD), the LECR received technical expertise, policy analysis, and project management and meeting facilitation services. After identifying and debating an initial list of fourteen potential strategies, the LECR recommended two policies for adoption by Lewes City Council: a real estate disclosure to highlight a property's vulnerability to sea level rise and the creation of a municipal resiliency fund that will be used for an array of resiliency-building practices.

The remaining twelve policy options could be considered by Lewes City Council in the future. This brief provides details of the options and an analysis of their impacts.

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and

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THE LEWES EXECUTIVE COMMITTEE ON RESILIENCY

The City of Lewes is one of Delaware's most climate-vulnerable communities and is committed to developing and implementing climate resiliency policies and practices. In 2020, a subcommittee of the City's Planning Commission presented a draft resiliency ordinance to Council for consideration. The draft ordinance would have reduced maximum lot coverage ratios and increased freeboard, among other items. The ordinance faced criticism from the public before being withdrawn from consideration. Among other issues, public concerns focused on a lack of diverse viewpoints on the subcommittee. On July 12, 2021, the City Council and Mayor Ted Becker empaneled the LECR to identify, debate, and recommend resiliency measures that City Council could adopt. The eleven members of the LECR represented a diverse range of stakeholders with residential and commercial interests from several geographic areas of the city.

The LECR received technical expertise, research and policy analysis, and project management and meeting facilitation services through the combined efforts of the DNREC's Resilient Community Partnership and UD IPA.

Process and Outcomes

Prior to the LECR meetings, DNREC and IPA hosted three virtual listening sessions where the public was invited to share their views on the most important challenges facing the City. Among the top concerns were sea level rise and flooding. A full summary can be found at: https://documents.dnrec.delaware.gov/coastal/Documents/ResilientCommunityPartnership/Final-Lewes-LS-Survey-Summary.pdf

Starting in July 2021, the LECR met twice a month for nine months. The initial phase of the process focused on building a foundation of common knowledge and understanding regarding current scientific, technical, and regulatory aspects related to sea level rise and flooding. The following topics were covered at LECR meetings, and the presentations are included in the Appendices:

- Coastal Flooding and Community Resilience
- Future Sea Level Rise Planning Scenarios for Delaware
- What is a Flood?
- Delaware Flood Planning Tool
- FEMA, Floodplain Management, and the National Flood Insurance Program
- National, State, and Local Roles in relation to Potential Sea Level Rise mitigation strategies
- An Overview of the City of Lewes Ordinances
- Overview of Best Practices in relation to Sea Level Rise and Flooding

This overview and research resulted in the compilation of fourteen best practices that the LECR could consider for Lewes. Through a series of discussions and voting, the LECR narrowed the fourteen options down to six. IPA conducted a high-level policy analysis for each of these six options that weighed issues of equity, administrative feasibility, geography, and effectiveness. Based on this policy analysis, the LECR determined two preferred strategies: a real estate disclosure to highlight a property's vulnerability to sea level rise, and the creation of a municipal resiliency fund that will be used for an array of resiliency-building practices.

To fulfill its charge, the LECR needed to recommend a framework for each strategy that they believed to be feasible and reasonable for the City of Lewes. These frameworks were informed through a study of sample disclosures. In addition, guest speakers from Coral Gables, Florida and

Bethany Beach, Delaware, provided their experience designing and implementing similar resiliency funds.

NEXT STEPS

After making a final recommendation to City Council in April 2022, the LECR completed its tasks. The City will advance each recommendation by translating the frameworks into draft ordinances and proceeding through a public comment process. Given the City's continued commitment to resiliency, it is expected that the remaining policy options not advanced during the LECR will be revisited over time by various other City committees. To that end, the entire menu of policy options is provided in Table 1 below. The policy analysis for the top six options can be found in Appendix 1.

Table 1. Policy Options

Potential Strategy	Description
1. Raise the required freeboard in the 100-year floodplain (adjusting building height accordingly)	Existing requirement: 18" freeboard Consideration: Increase freeboard in the 100-year floodplain and allow for some flexibility in the maximum height regulations in order to offset the increased freeboard and maintain a similar overall building floor area.
2. Regulate the 500-year floodplain	Existing requirement: No current regulations Consideration: Regulate the 500-year floodplain in a similar manner as the 100-year (A/AE zone) including: foundations (pilings/columns); enclosure of lowest floors, construction standards, freeboard, raising of utilities, etc.
3. Apply VE Zone regulations to Coastal A Zone (The area between the VE and the LIMWA-limit of wave action over 1.5 feet)	Existing requirement: Coastal A Zone is currently regulated like the remainder of the 100-year floodplain. Consideration: Apply the Coastal VE Zone regulations to the A/AE Zone regarding foundations (pilings/columns); enclosure of lowest floors, construction standards for wind load, freeboard, raising of utilities, etc.
4. Require freeboard over fill	Existing requirement: A builder can use fill to elevate a structure to the required height, seek removal of the property from the floodplain, and not provide freeboard. Consideration: Require freeboard even when fill is provided and a property is removed from the floodplain.

Potential Strategy	Description
5. Require projected sea level rise (SLR) to be shown on a subdivision and land development application and considered part of application review	Existing requirement: SLR is not depicted on development plans Consideration: This recommendation requires picking a planning horizon as a reference for projected sea level rise and including that information on the review plan. It ensures SLR is a part of the conversation but does not necessitate additional regulations.
6. Encourage/require the increased use of permeable paving for various site-specific applications (patios, driveways, parking, etc.)	Existing requirement: The City uses such systems for streets where appropriate. No other incentives or requirements. Consideration: Contemplate where in the city this would be appropriate on individual sites and how to encourage its use as a part of the Zoning or Subdivision and Land Development Ordinances.
7. Reevaluate landscape standards in regard to tree protection/replacement; use of native, salt tolerant plants, etc. and consider adding regulations to zoning	Existing requirement: The City has a variety of landscape standards in the Subdivision and Land Development Ordinance. Consideration: Existing standards could be enhanced and expanded in a variety of ways that improve the City's green infrastructure. Application of such standards could also be expanded through reference in the Zoning Ordinance.
8. Increase amount of open space required in new developments	Existing requirement: Any new subdivision is required to set aside open space in the range of 10 to 15% of the total land area, per the Subdivision and Land Development Ordinance. Consideration: Revise the Subdivision and Land Development Ordinance to increase the amount of open space required for these when the subdivision is in a floodplain.
9. Lower maximum lot coverages (and potentially adjust front, side, and rear yard requirements, building heights, etc. accordingly)	Existing requirement: Maximum lot coverage in the City ranges up to 65% Consideration: Decrease the permitted lot coverages and provide offsets for green infrastructure practices (rain barrels, pervious pavement, native species, etc.) used on an individual property. Also consider adjustments to building heights and setbacks.
10. Increase wetland buffer widths	Existing requirement: 50 feet Consideration: Increase the required buffer width to 100 feet or more.

Potential Strategy	Description
11. Reevaluate the Stormwater Utility Fee to align with impervious coverage on a lot	Existing requirement: The Board of Public Works (BPW) currently collects a $5 flat fee per property. Consideration: Reevaluate the structure of the fee so that there is a direct correlation between impervious surface and the fee that is paid. This is because impervious surfaces have a direct correlation to stormwater runoff.
12. Create a Resiliency Fund/Storm Emergency Relief **(RECOMMENDED BY LECR)**	Existing requirement: No current regulations Consideration: Establish a fund that can be used in a variety of ways to support resilience efforts, recover from storm damage, etc. Committee must consider both funding options and guidance on the use of the funds.
13. Prepare and adopt a Storm Reconstruction Ordinance	Existing requirement: No current regulations Consideration: This ordinance would pause building and development after a storm to allow the City to plan for logical and orderly redevelopment and recovery.
14. Require Real Estate Disclosure of SLR **(RECOMMENDED BY LECR)**	Existing requirement: No current regulations Consideration: Similar to the flood disclosure requirements at the state level, this disclosure would alert potential buyers to potential sea level rise impacts on the subject property as part of a real estate transaction.

ABOUT THE INSTITUTE FOR PUBLIC ADMINISTRATION

The University of Delaware's Institute for Public Administration (IPA) addresses the policy, planning, and management needs of its partners through the integration of applied research, professional development, and the education of tomorrow's leaders.

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APPENDICES

1 Policy Analysis

2 Coastal Flooding and Community Resilience (Swallow: 08-10-21)

3 Future Sea Level Rise Planning Scenarios for Delaware (Callahan: 08-10-21)

4 What is a Flood? (Warga: 08-24-21)

5 Delaware Flood Planning Tool (Tonn: 08-24-21)

6 FEMA, Floodplain Management, and the National Flood Insurance Program (Warga: 09-14-21)

7 National, State, and Local Roles in relation to Potential Sea Level Rise Mitigation Strategies (DeCoursey: 09-28-21)

8 City of Lewes Ordinance Review (Cornwell: 10-12-21)

9 Overview of Best Practices in relation to Sea Level Rise and Flooding (Reitz: 10-12-21)

APPENDIX 1: POLICY ANALYSIS

(IPA: 12-9-2021)

Lewes Executive Committee on Resilience
Policy Analysis of Potential Strategies
December 9, 2021

Strategy	Geographic Area of impact	What is the impact?	Costs and benefits (Value and to Whom?)	Equity	Administrative Feasibility
Real estate disclosure • *Disclose SLR and flooding* • *Should also address access to the property* • *Include maps* • *Acknowledge if property is currently in compliance, including req. for cumulative substantial damage/improvement*	Unknown: Need to base on a particular model, time horizon, and scenario	Better informed owners/ intelligent decisions Will it protect the community?	Minimal costs Benefits potential landowners		Timing of information is important: need to provide before settlement Addressing access would be a challenge Education (real estate community) and enforcement
Resiliency fund • *Where does the money go? (buyouts/infrastructure investments/resiliency measures: wetland restoration, BPMs, free rain barrels, free tree plantings, etc.)* • *Where does the money come from? (Raise prop taxes/transfer tax/occupancy fees)*	Depends on application	Long-term impacts Increases resilience without restrictive ordinances	Potential increase in prop taxes/transfer tax/occupancy fees No negative impact on prop values Funds could be used to leverage other grants	Individual buy-outs/ investments have potential equity issues	Requires new program admin and accounting Committee oversight of expenditures Does it require a City charter amendment?

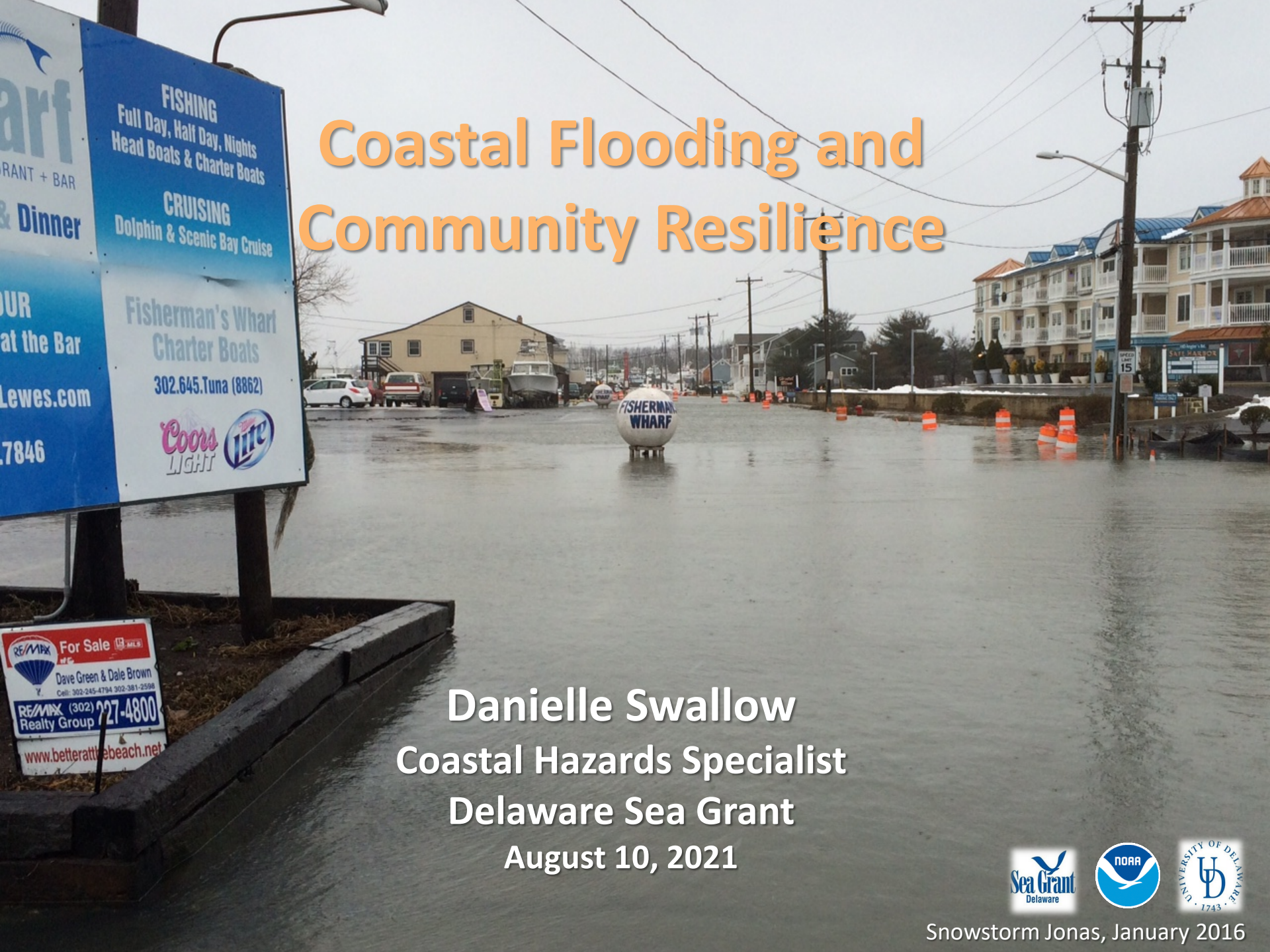
Strategy	Geographic Area of impact	What is the impact?	Costs and benefits (Value and to Whom?)	Equity	Administrative Feasibility
Revise landscape standards • *Mandate or encourage(existing)?* • *What are triggers? (redevelopment/renovation and what scale)* • *Consider rain gardens* • *Consider adding requirements to the zoning*	Entire City	Improving resilience of the landscape	More property owners affected than otherwise (if included in zoning) Benefits depend on the regulations Cost to developer/prop owners to comply Increased property values Reduced runoff/flooding		New plant lists (if not already in place) Additional review for building permits Inspections
Raise freeboard • *Increase by fixed number (6", 12", 18", 24"+)* • *Increase is related to SLR projection for a certain model, time horizon (thus changes over time)* • *Consideration of corresponding building height increase*	100 yr floodplain Could include 500 year floodplain If SLR: Need to base on a particular model, time horizon, and scenario	Risk/damage reduction Property protection Effectiveness depends upon # of permits in affected areas	Increased cost of compliance Lower flood insurance premium Increased property value		Inspections and uniform enforcement If includes SLR, could expand geographic area of impact and # of permits Requires ordinance changes

Strategy	Geographic Area of impact	What is the impact?	Costs and benefits	Equity	Administrative feasibility
Max lot coverage • *Reduce to 50%* • *Allowance for BMPs (Best Management Practices)*	Entire city: residential & nonresidential?	Improved infiltration of runoff Effectiveness depends upon # of permits in affected areas	Reduced runoff/flooding		Additional inspections Requires uniform enforcement
Increase OS in new subdivisions • *What counts as open space?* • *How much impervious is permitted/is SWM permitted, etc?*	Vacant land; annexations	More open space and its associated environmental and flood mitigation benefits	More open space and its associated benefits Potential decrease in number of homes permitted		Part of typical review process

Appendix 2: Coastal Flooding and Community Resilience

(Swallow: 08-10-21)

Coastal Flooding and Community Resilience

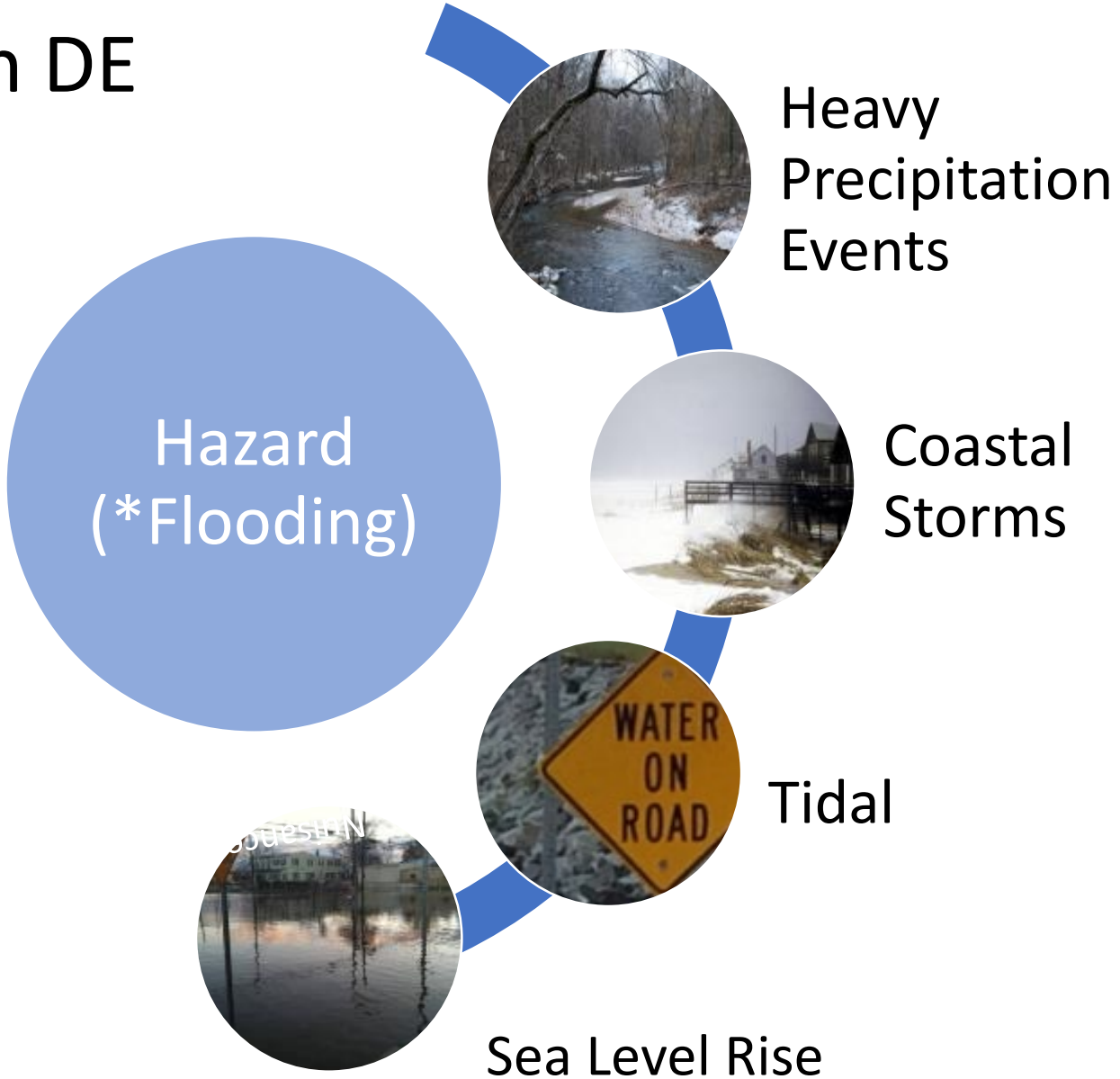


Danielle Swallow
Coastal Hazards Specialist
Delaware Sea Grant
August 10, 2021

Snowstorm Jonas, January 2016

The floodplain has natural functions that are beneficial to society

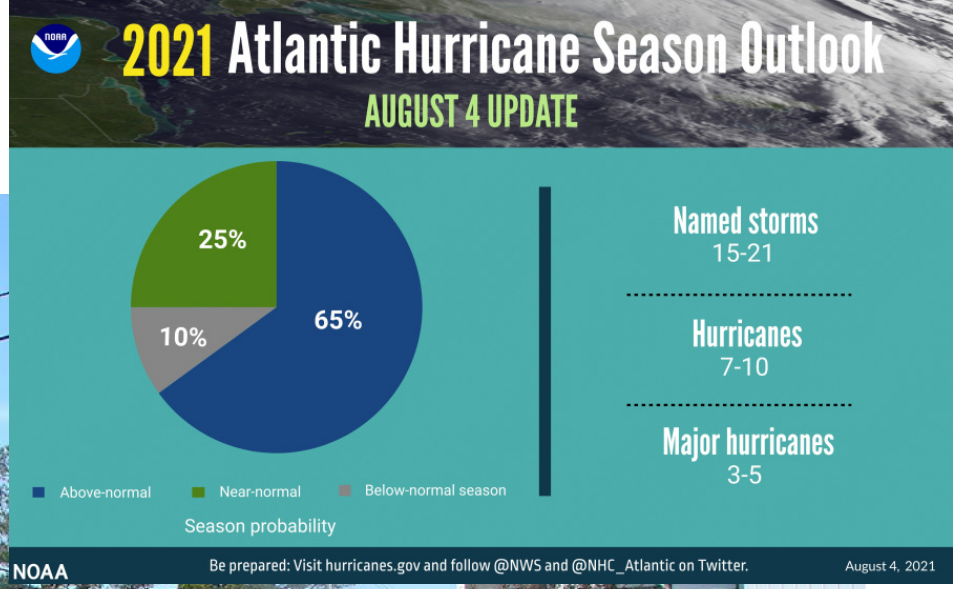
Flooding is the #1 Hazard in DE



Heavy Precipitation Events

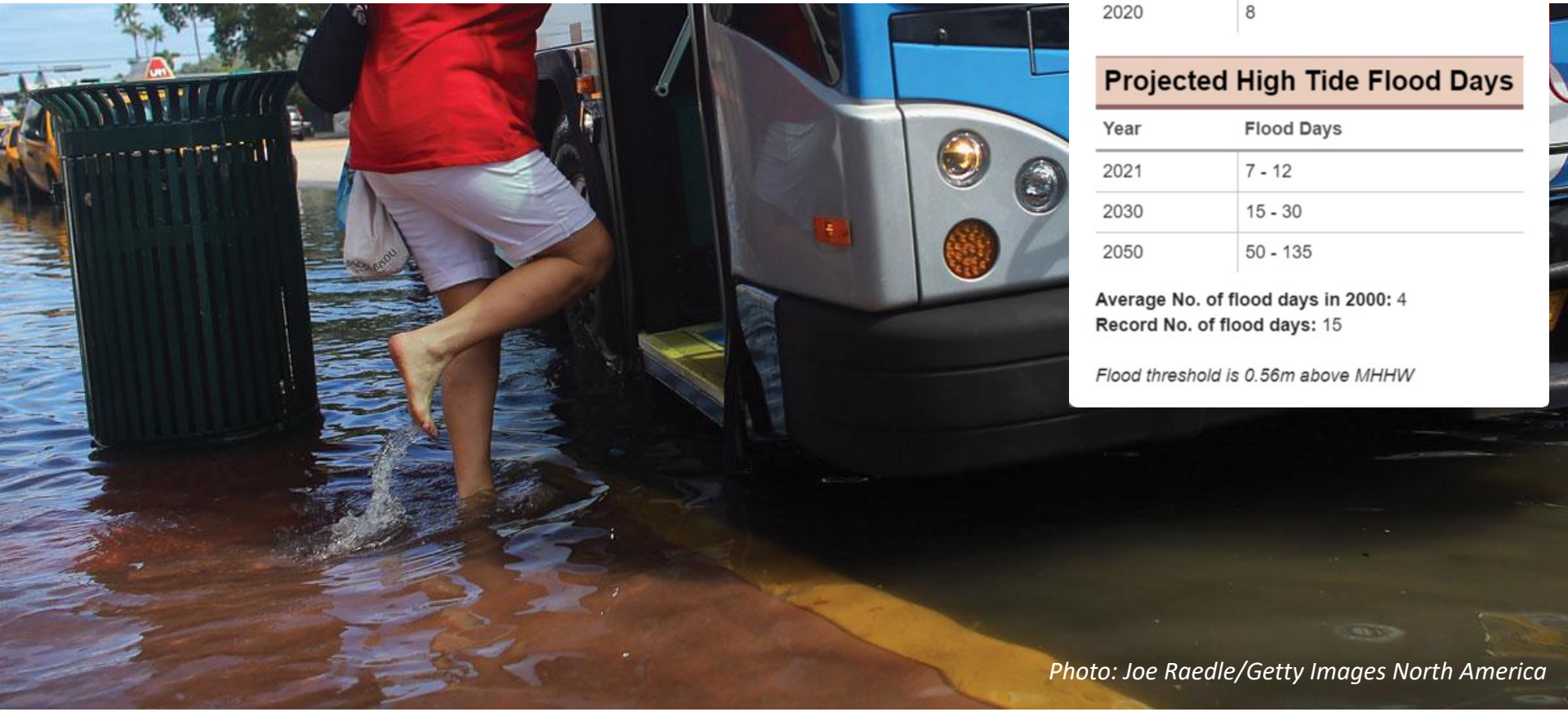
Source: Office of State Climatologist, Delaware Environmental Observing System (DEOS)

Coastal Storms



Subtropical Storm Melissa, Oct. 2019. South Bethany, DE.
Credit: Dave Wilson

Tidal Flooding



Lewes,DE

Year	Flood Days
2020	8

Projected High Tide Flood Days

Year	Flood Days
2021	7 - 12
2030	15 - 30
2050	50 - 135

Average No. of flood days in 2000: 4
Record No. of flood days: 15

Flood threshold is 0.56m above MHHW

Photo: Joe Raedle/Getty Images North America

*Source: NOAA State of High Tide Flooding and Annual Outlook

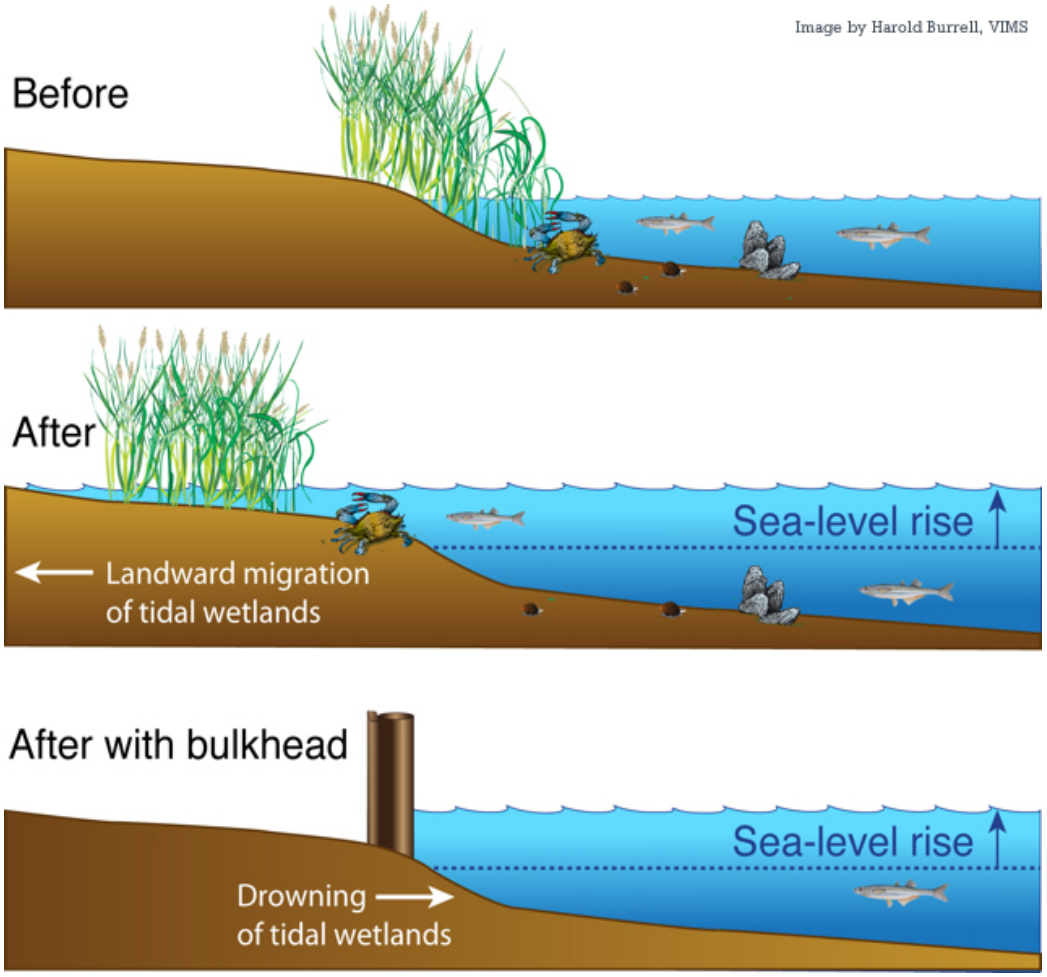
https://tidesandcurrents.noaa.gov/HighTideFlooding_AnnualOutlook.html

Sea Level Rise

Source: Massachusetts Audubon Center

Appears as an increase in average tide height over time

What Are the Implications for Lewes?



"Coastal Squeeze" occurs when wetlands cannot migrate landward

- More frequent tidal flooding
- Less viable land to build on
- More properties needing flood insurance?
- Wetlands needing room to migrate

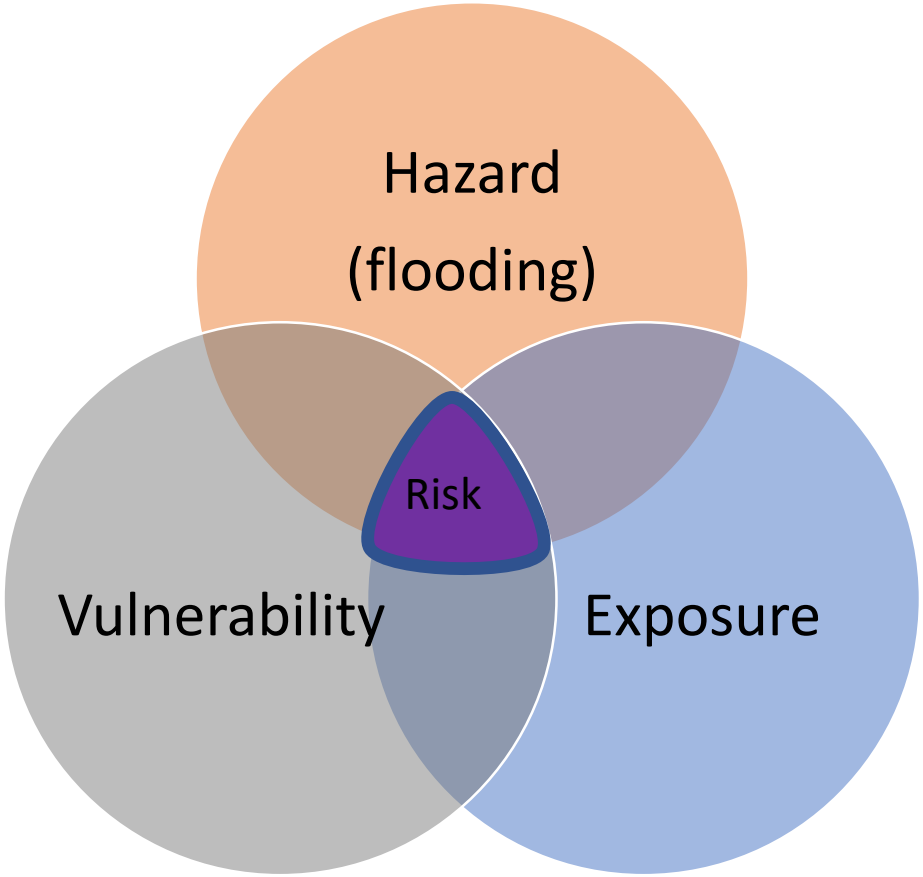
Continued…

- Damage to property and infrastructure
- Greater erosion and degradation of natural resources
- Interruptions to commerce and tourism
- Evacuation implications

Children's Beach House, 2012. Credit: Henry Evans/Cape Gazette

Rt. 5 in Sussex County. Credit: Dan Cook/Cape Gazette

Risk = Hazard + Exposure + Vulnerability



Adapted from FEMA, IS-393.A
Introduction to Hazard Mitigation

Exposure

People

Property

Natural & Built Infrastructure

Adapted from FEMA, IS-393.A
Introduction to Hazard Mitigation

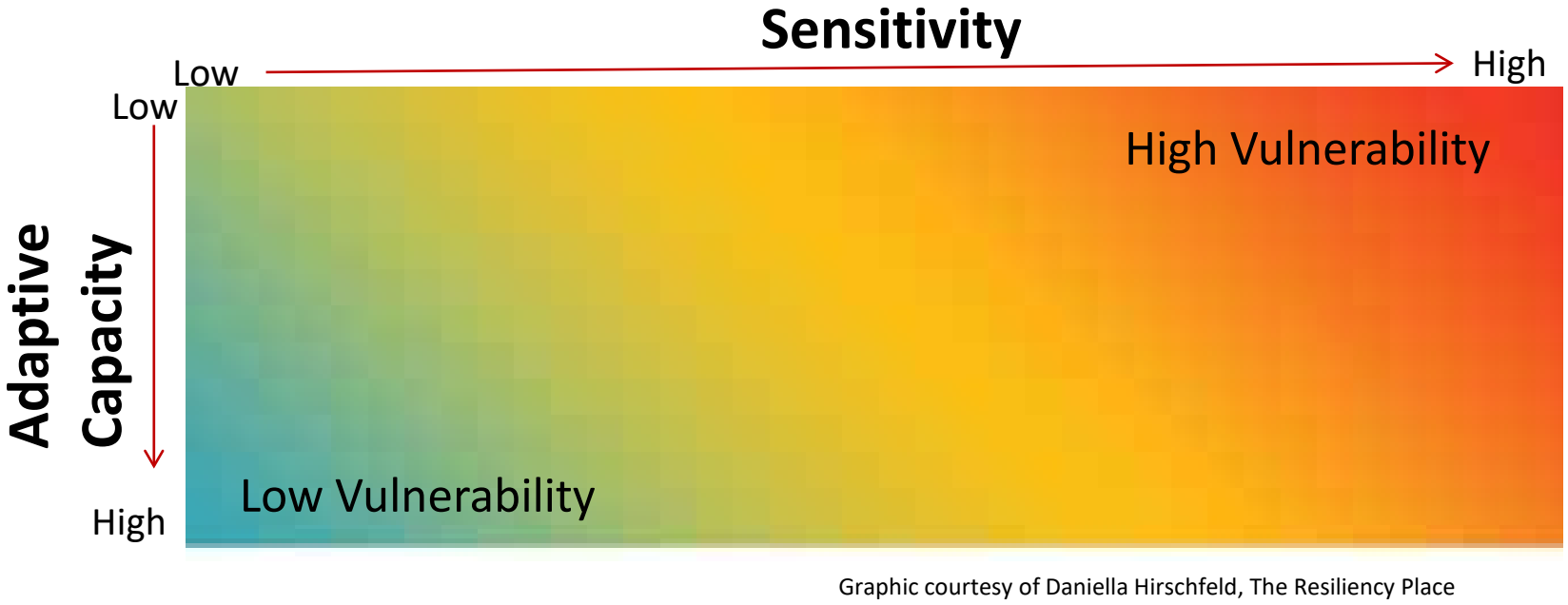
Vulnerability

At-Risk Populations

Land Use Practices and Building Codes

Condition of Natural and Built Infrastructure

Adapted from FEMA, IS-393.A
Introduction to Hazard Mitigation



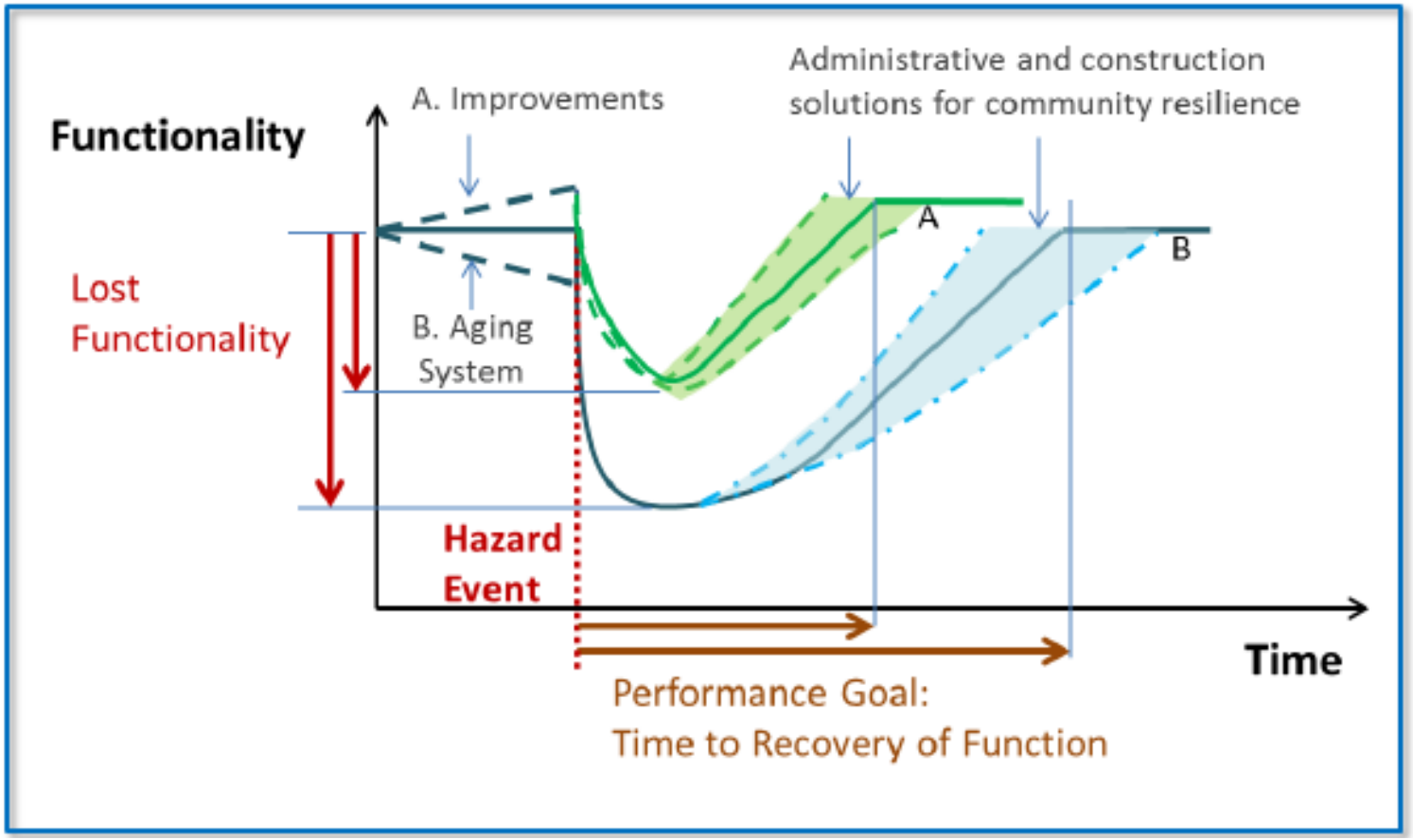
Graphic courtesy of Daniella Hirschfeld, The Resiliency Place

Sensitivity and Adaptive Capacity are important considerations for Vulnerability

Resilience:

The ability to bounce back after disruptive events

Resilience and the Built Environment



Condition A Experiences modest loss of functionality after the event	Condition B Increased vulnerability to the hazard relative to Condition 'A'
• Well maintained • Benefitted from good design and mitigation projects • Improved level of functionality before hazard event • Modest loss of functionality after event	• Degradation of functionality • Deterioration in the physical system • Lack of adequate maintenance

Source: NIST

Why Adopt a Resilience Framework?

Just one inch of water in a home could cost more than $25,000*

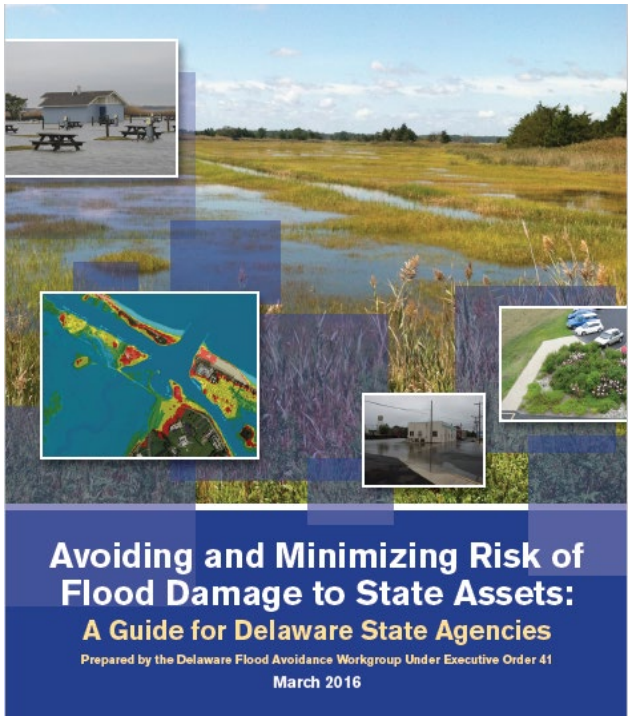
Every $1 invested in mitigation strategies saves $6 in future costs*

**FEMA, National Institute of Building Sciences*

Steps to Resilience:

1. Understand the hazard and what is most at risk
2. What is the timeframe you are planning to?
3. What is the community's tolerance for risk? Does this vary by group or section of town?
4. What are the community's values and needs vs. wants?

Steps to Resilience:



https://documents.dnrec.delaware.gov/energy/Documents/DE%20Flood%20Avoidance%20Guide%20For%20State%20Agencies.pdf

Act now.

Accept some uncertainty

Plan to higher standards

Look for co-benefits and opportunities

Build resilience into the city's social fabric along with its physical infrastructure

"Adapting to change is an incredibly hard thing to do when it comes into conflict with the very thing that caused so much success."

- Author unknown

It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change.

Charles Darwin

Thank you!

Appendix 3: Future Sea Level Rise Planning Scenarios for Delaware

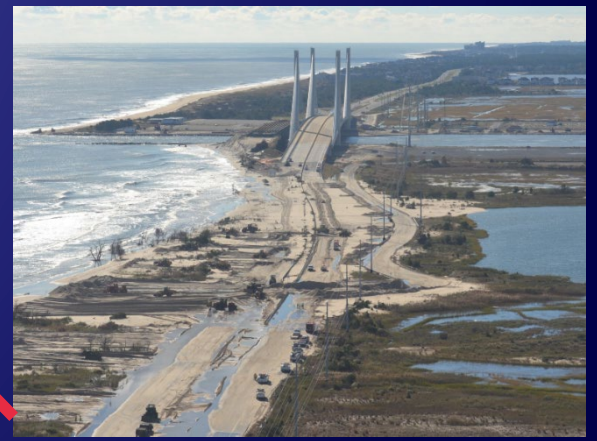
(Callahan: 08-10-21)

FUTURE SLR PLANNING SCENARIOS FOR DELAWARE

John A. Callahan
Delaware Geological Survey
University of Delaware

August 10, 2021
Lewes Executive Committee on Resiliency

Our region's complicated climate system….



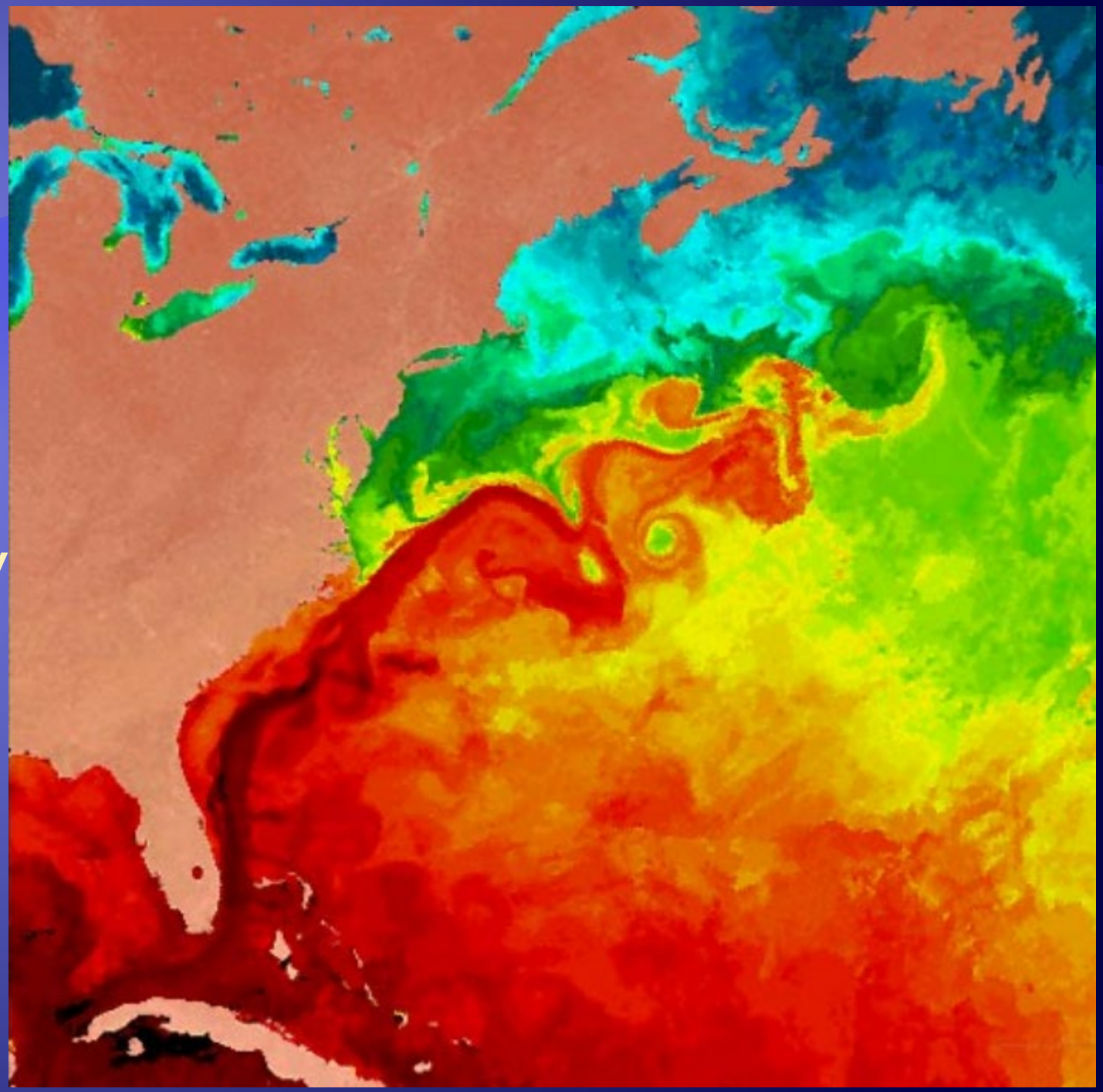
The Mid-Atlantic has a complicated climate…

1. Large continent and mountains to the west

The Mid-Atlantic has a complicated climate…

1. Large continent and mountains to the west

2. Large ocean, strong sea-surface temperature variability and unstable atmosphere

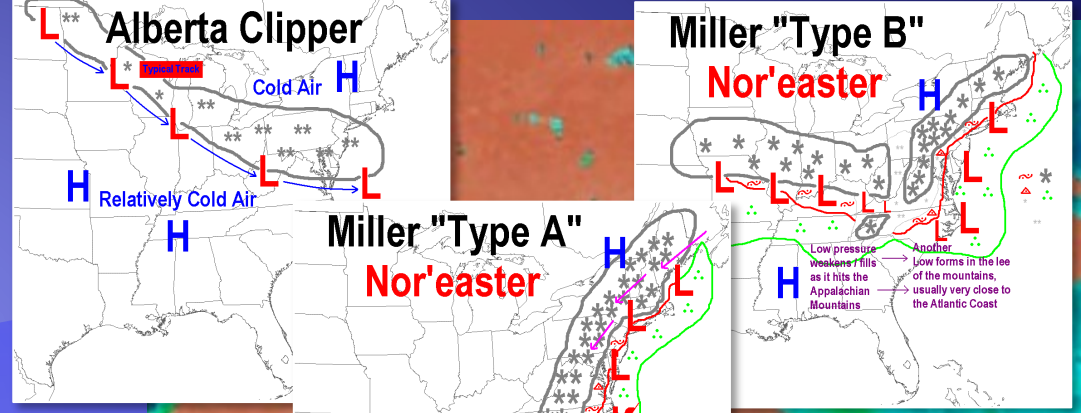


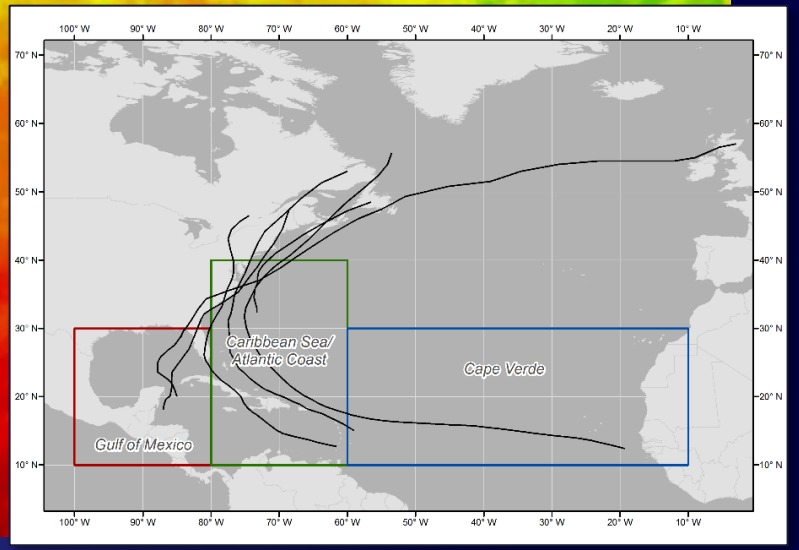
The Mid-Atlantic has a complicated climate…

1. Large continent and mountains to the west

2. Large ocean, strong sea-surface temperature variability and unstable atmosphere

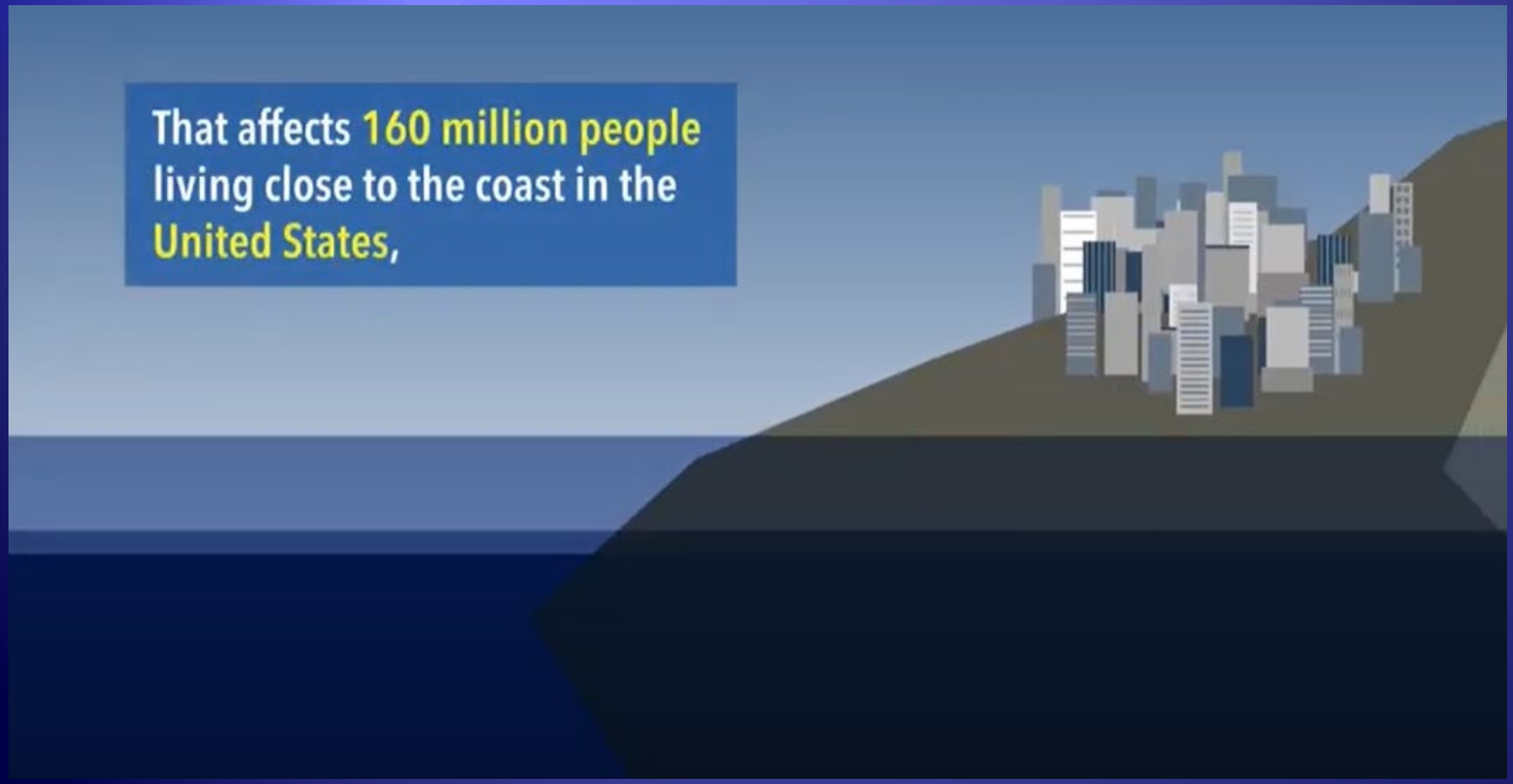
3. In the path of both tropical cyclones (TCs) AND extra-tropical cyclones (ETCs)

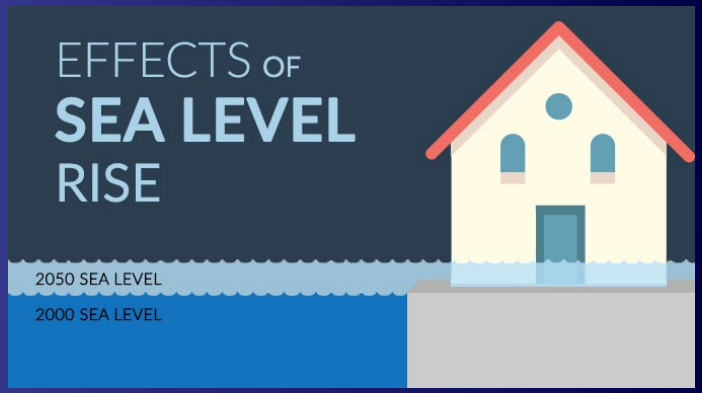




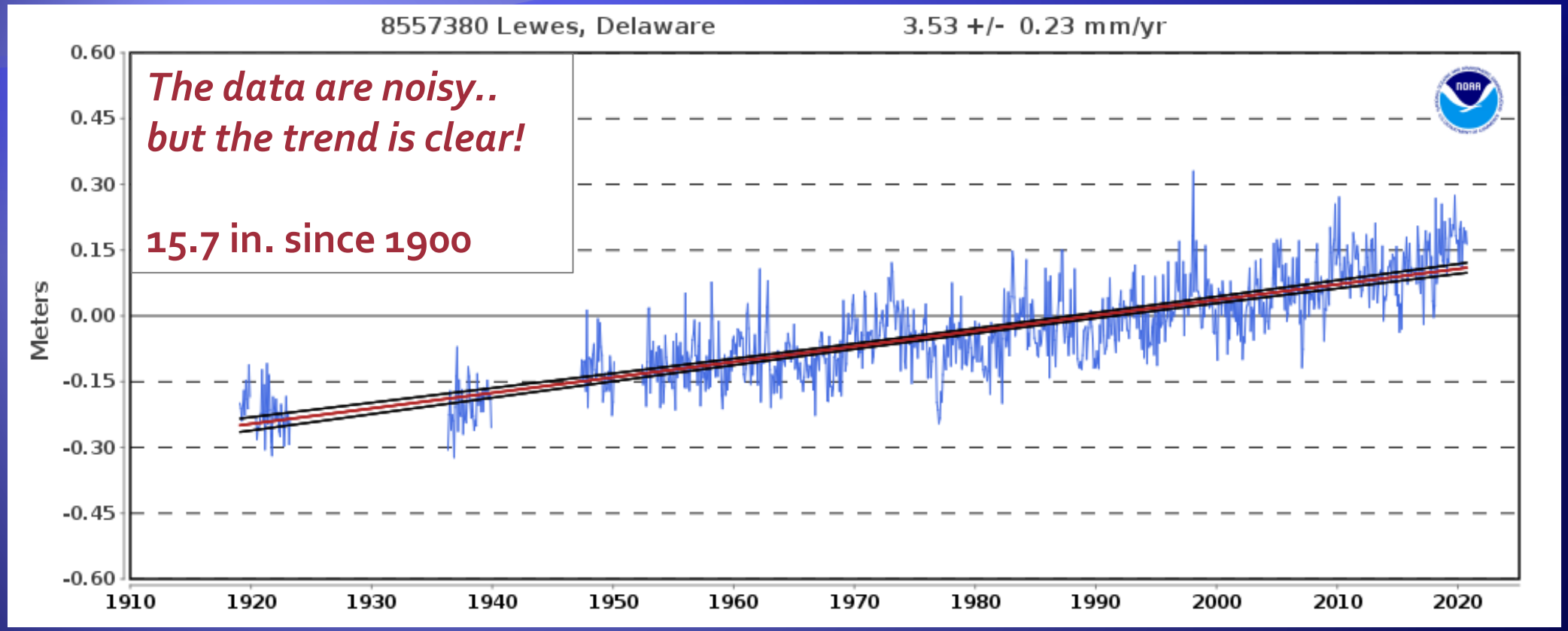
What is Sea-Level Rise?

- SLR is separate from weather; the change in mean sea level ***without*** storms!
- Long-term, gradual consequence of a warming world



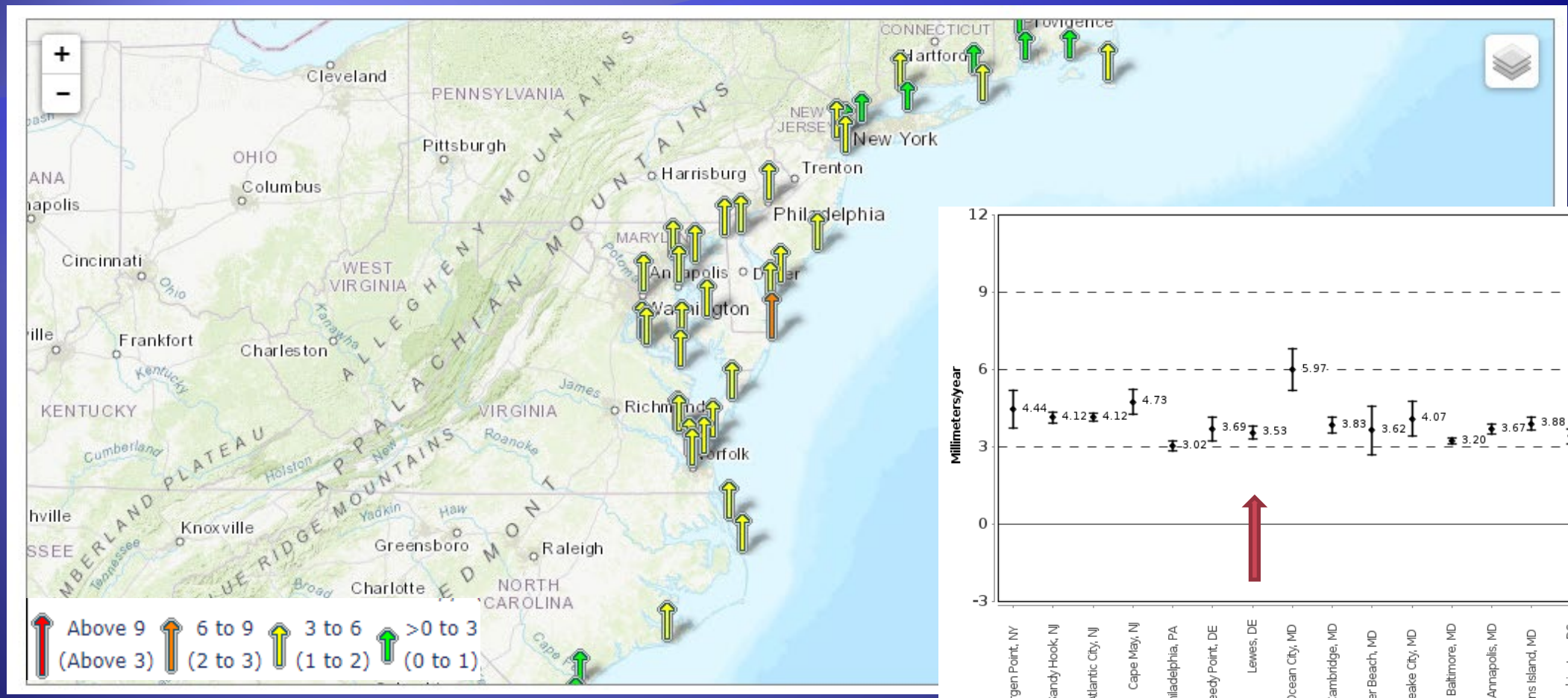


What have we seen in Delaware?



https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8557380

Mid-Atlantic "Hotspot" of SLR



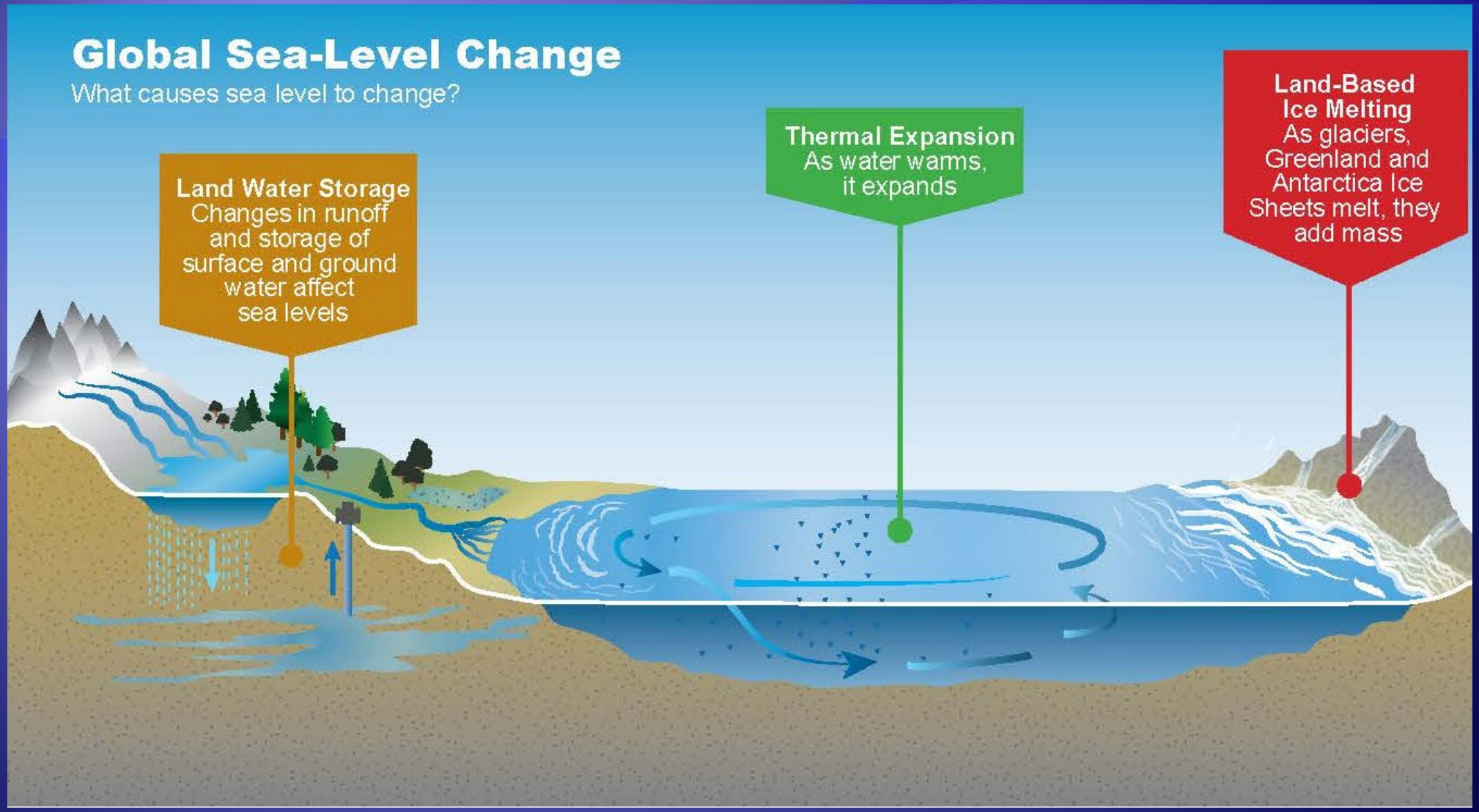
NOAA SLR Trends/Coastal Dashboard
https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8557380

Delaware SLR Technical Committee

- 13 members, scientists and planners
- Delaware Geological Survey and DNREC Delaware Coastal Programs
- Task: To update SLR projections for Delaware for planning activities

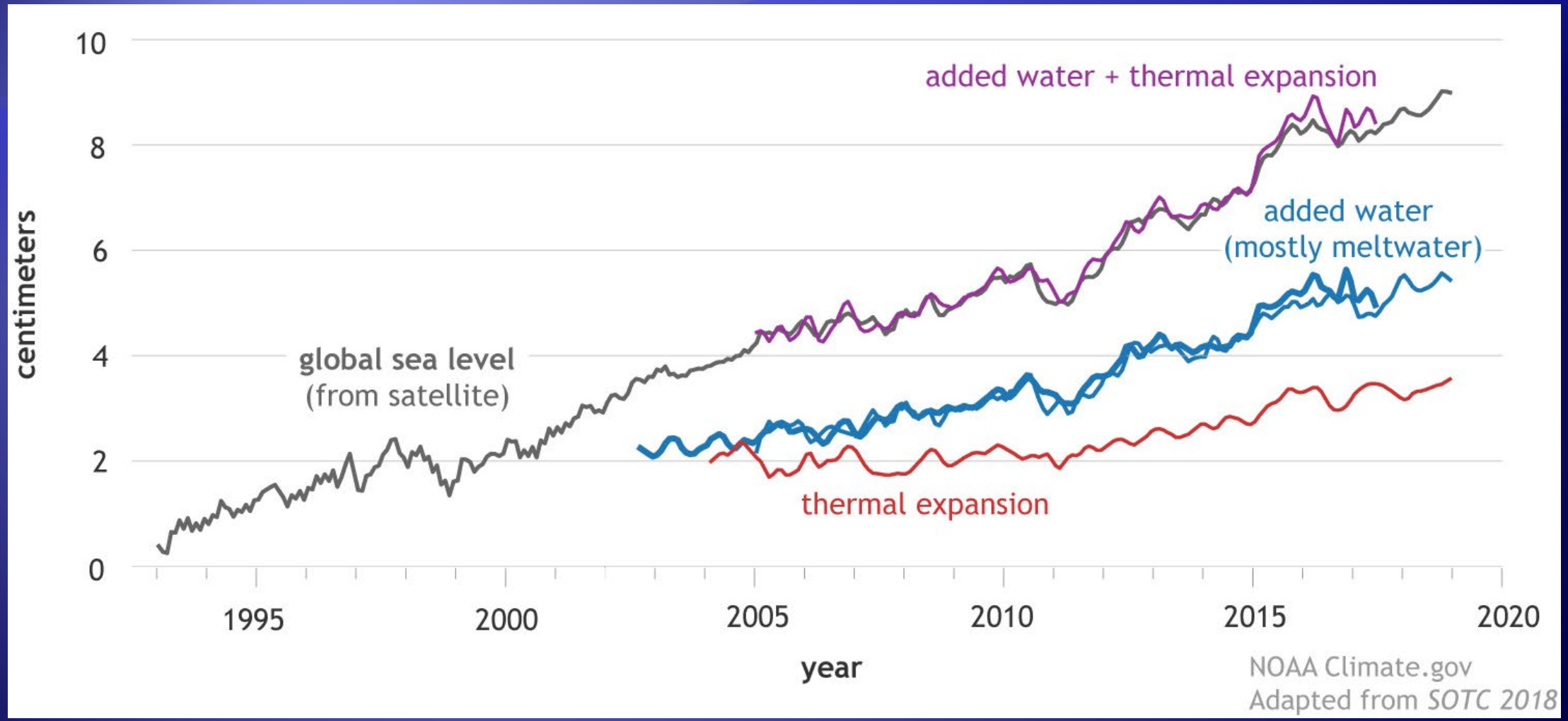
Delaware SLR = Global SLR + Regional Influences + Land Subsidence

Factors Contributing to SLR - Global

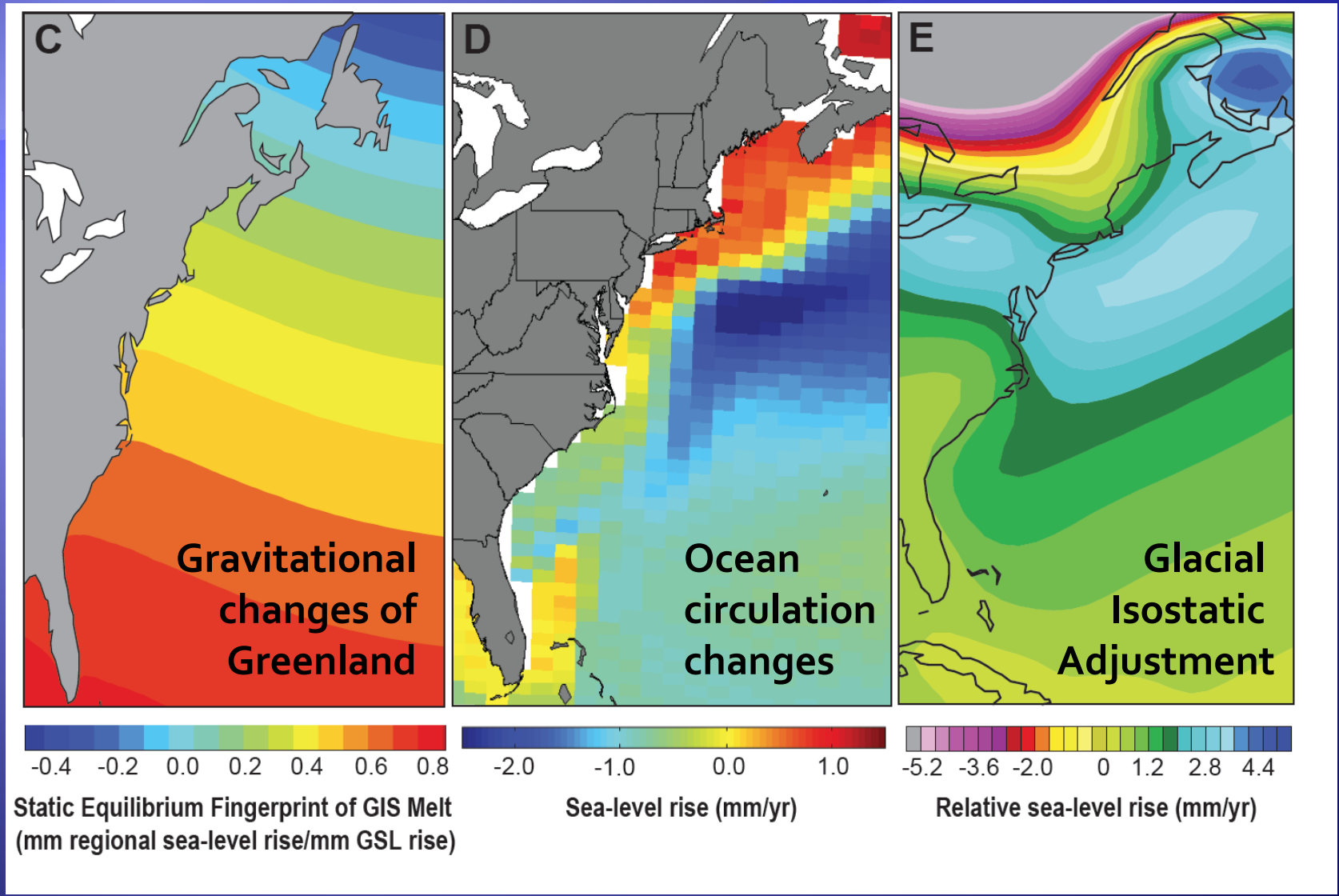


Hall et al. (2016), Regional Sea Level Scenarios for Coastal Risk Management

Factors Contributing to SLR - Global



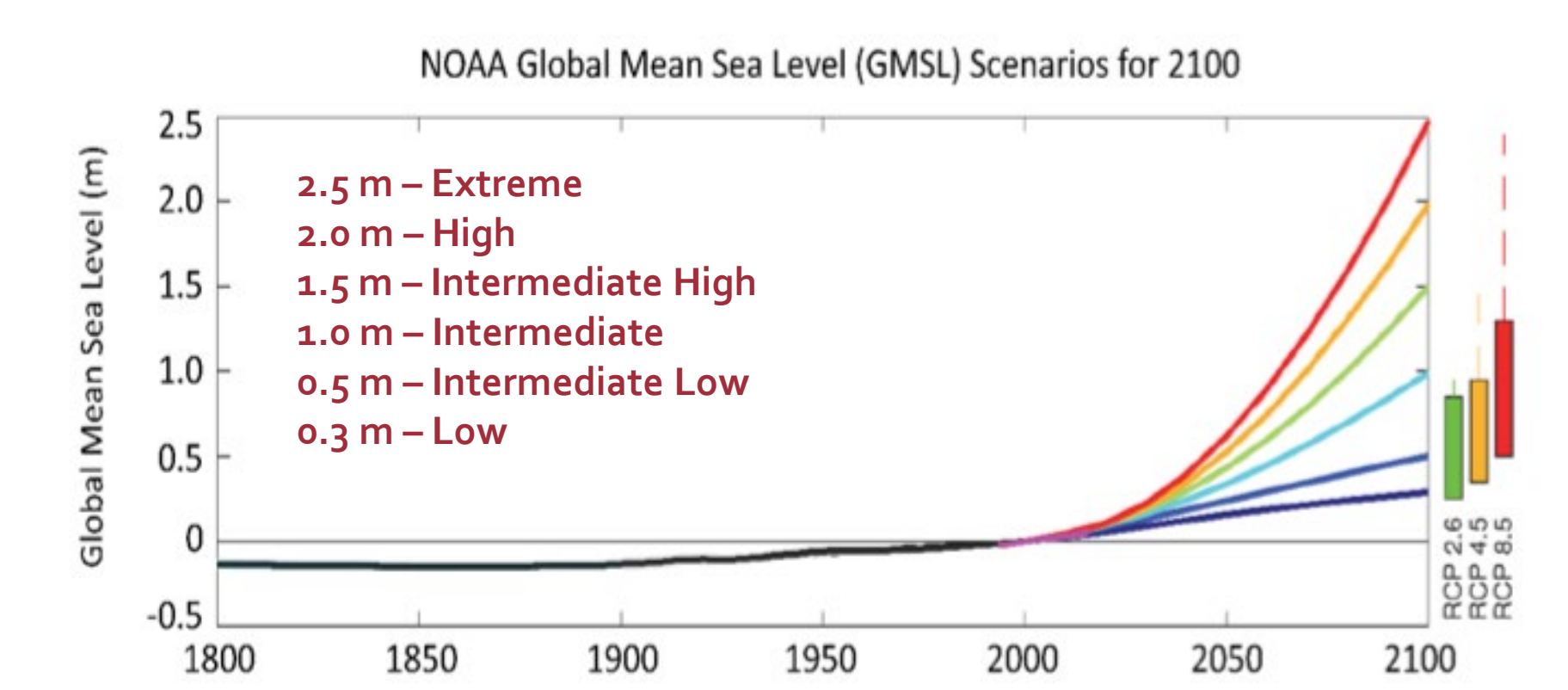
Factors Contributing to SLR – Regional + Land Subsidence



"Hotspot" of sea-level rise

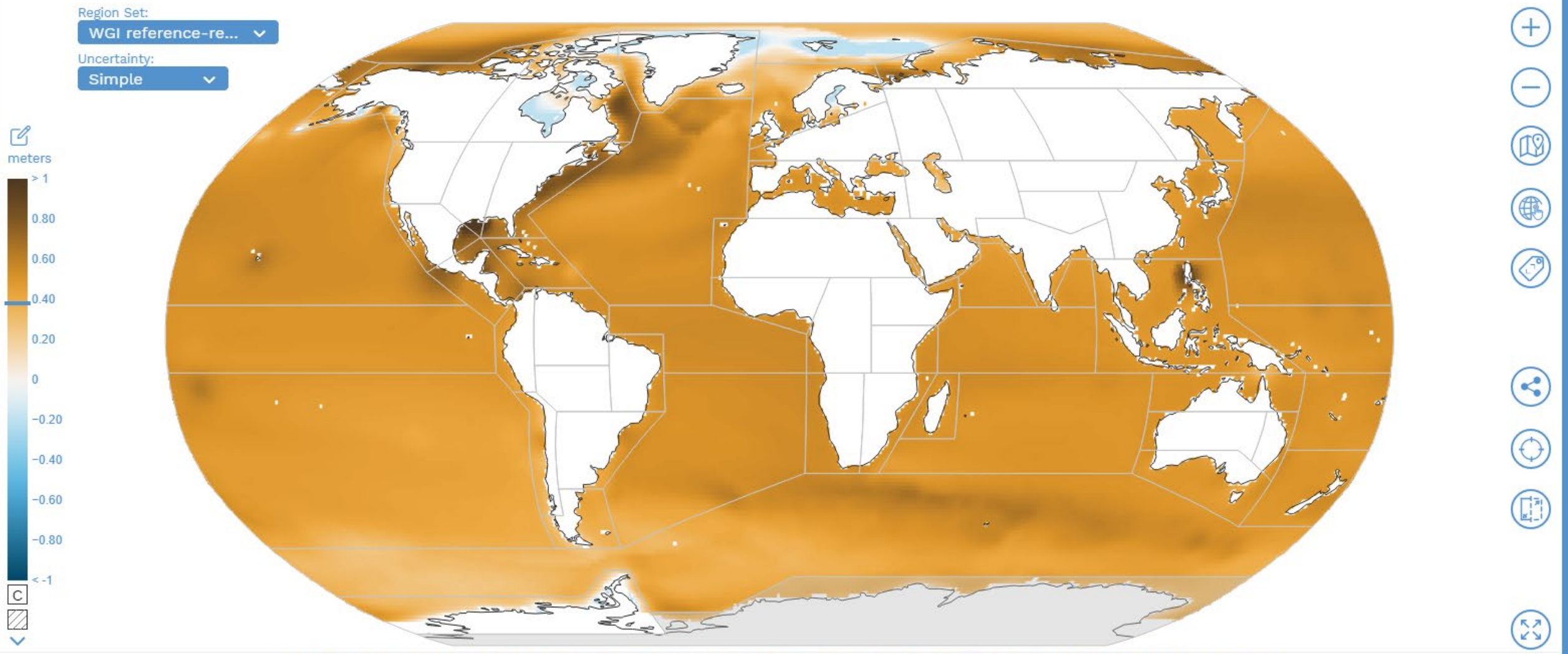
Kopp et al. (2015)

Future SLR Scenarios – National Climate Assessment



Scenario-driven (realistic range, no probabilities)

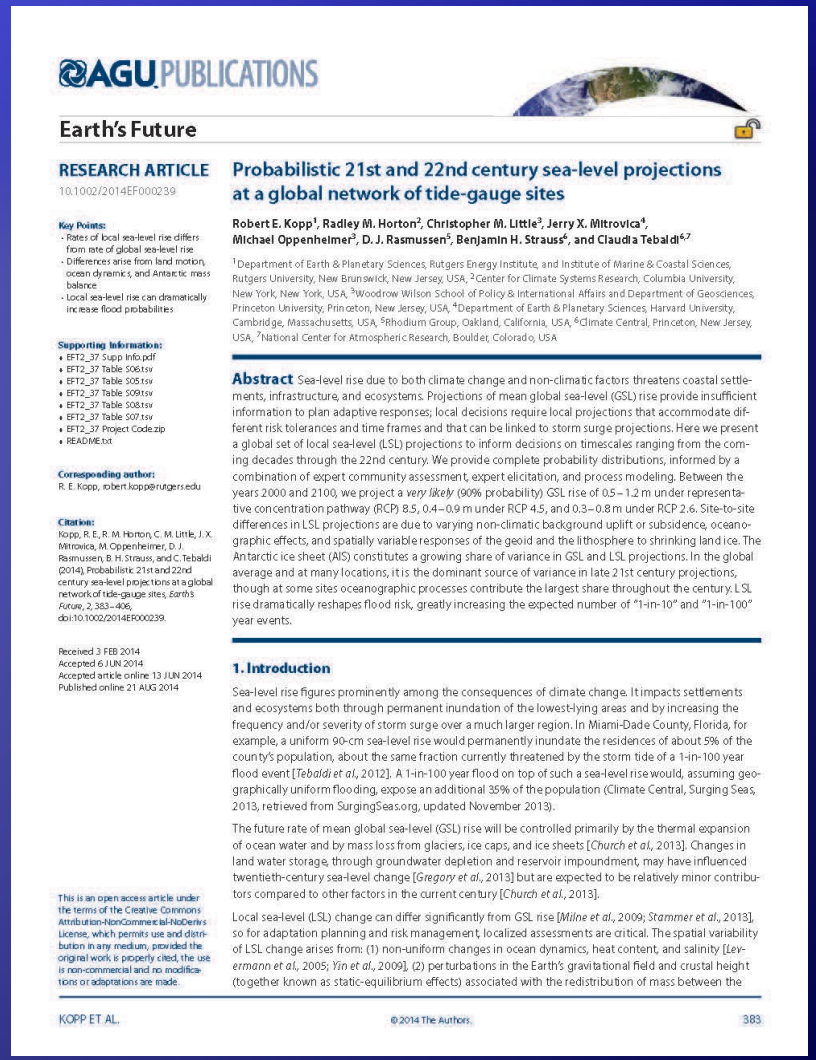
NOAA Tech Report 083 (Sweet et al., 2017)
Global and Regional SLR Scenarios for the U.S.



CMIP6 - Sea level rise (SLR) Change meters - Long Term (2081-2100) SSP2 4.5 (rel. to 1995-2014) - Annual

Delaware SLR Scenarios – Kopp et al (2014) Framework

- Incorporates IPCC AR5 process-based models, tide gauges, expert assessments
- Full probability distribution – *per RCP scenario*
- Relative contributions and uncertainty of each SLR factor
- Widely used by states and federal agencies



AGU PUBLICATIONS

Earth's Future

RESEARCH ARTICLE

10.1002/2014EF000239

Key Points:
- Rates of local sea-level rise differs from rate of global sea-level rise
- Differences arise from land motion, ocean dynamics, and Antarctic mass balance
- Local sea-level rise can dramatically increase flood probabilities

Supporting Information:
- EFT2_37 Supp Info.pdf
- EFT2_37 Table S06.tsv
- EFT2_37 Table S05.tsv
- EFT2_37 Table S09.tsv
- EFT2_37 Table S08.tsv
- EFT2_37 Table S07.tsv
- EFT2_37 Project Code.zip
- README.txt

Corresponding author:
R. E. Kopp, robert.kopp@rutgers.edu

Citation:
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Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites

Robert E. Kopp[1], Radley M. Horton[2], Christopher M. Little[3], Jerry X. Mitrovica[4], Michael Oppenheimer[3], D. J. Rasmussen[5], Benjamin H. Strauss[6], and Claudia Tebaldi[6,7]

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Abstract Sea-level rise due to both climate change and non-climatic factors threatens coastal settlements, infrastructure, and ecosystems. Projections of mean global sea-level (GSL) rise provide insufficient information to plan adaptive responses; local decisions require local projections that accommodate different risk tolerances and time frames and that can be linked to storm surge projections. Here we present a global set of local sea-level (LSL) projections to inform decisions on timescales ranging from the coming decades through the 22nd century. We provide complete probability distributions, informed by a combination of expert community assessment, expert elicitation, and process modeling. Between the years 2000 and 2100, we project a *very likely* (90% probability) GSL rise of 0.5–1.2 m under representative concentration pathway (RCP) 8.5, 0.4–0.9 m under RCP 4.5, and 0.3–0.8 m under RCP 2.6. Site-to-site differences in LSL projections are due to varying non-climatic background uplift or subsidence, oceanographic effects, and spatially variable responses of the geoid and the lithosphere to shrinking land ice. The Antarctic ice sheet (AIS) constitutes a growing share of variance in GSL and LSL projections. In the global average and at many locations, it is the dominant source of variance in late 21st century projections, though at some sites oceanographic processes contribute the largest share throughout the century. LSL rise dramatically reshapes flood risk, greatly increasing the expected number of "1-in-10" and "1-in-100" year events.

1. Introduction

Sea-level rise figures prominently among the consequences of climate change. It impacts settlements and ecosystems both through permanent inundation of the lowest-lying areas and by increasing the frequency and/or severity of storm surge over a much larger region. In Miami-Dade County, Florida, for example, a uniform 90-cm sea-level rise would permanently inundate the residences of about 5% of the county's population, about the same fraction currently threatened by the storm tide of a 1-in-100 year flood event [*Tebaldi et al.*, 2012]. A 1-in-100 year flood on top of such a sea-level rise would, assuming geographically uniform flooding, expose an additional 35% of the population (Climate Central, Surging Seas, 2013, retrieved from SurgingSeas.org, updated November 2013).

The future rate of mean global sea-level (GSL) rise will be controlled primarily by the thermal expansion of ocean water and by mass loss from glaciers, ice caps, and ice sheets [*Church et al.*, 2013]. Changes in land water storage, through groundwater depletion and reservoir impoundment, may have influenced twentieth-century sea-level change [*Gregory et al.*, 2013] but are expected to be relatively minor contributors compared to other factors in the current century [*Church et al.*, 2013].

Local sea-level (LSL) change can differ significantly from GSL rise [*Milne et al.*, 2009; *Stammer et al.*, 2013], so for adaptation planning and risk management, localized assessments are critical. The spatial variability of LSL change arises from: (1) non-uniform changes in ocean dynamics, heat content, and salinity [*Levermann et al.*, 2005; *Yin et al.*, 2009], (2) perturbations in the Earth's gravitational field and crustal height (together known as static-equilibrium effects) associated with the redistribution of mass between the

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Delaware SLR Scenarios – Kopp et al (2014) Framework

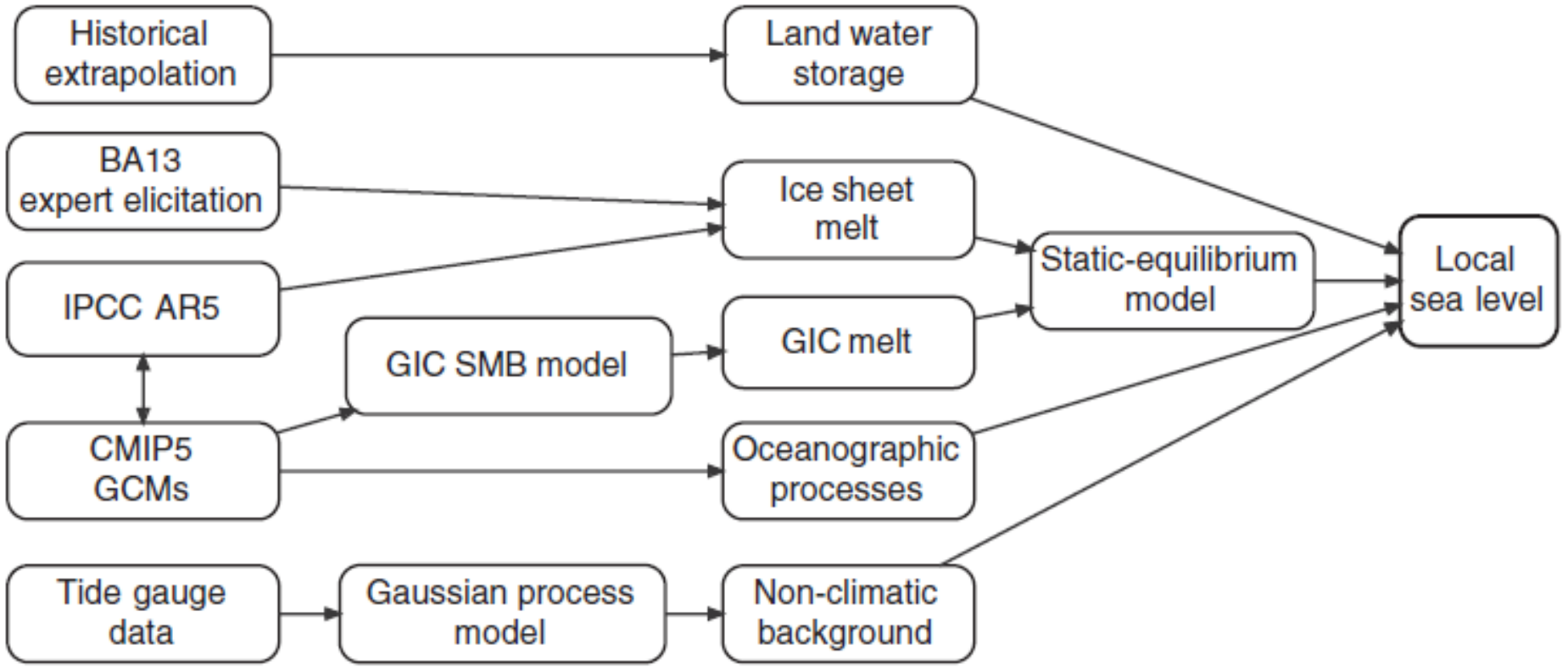
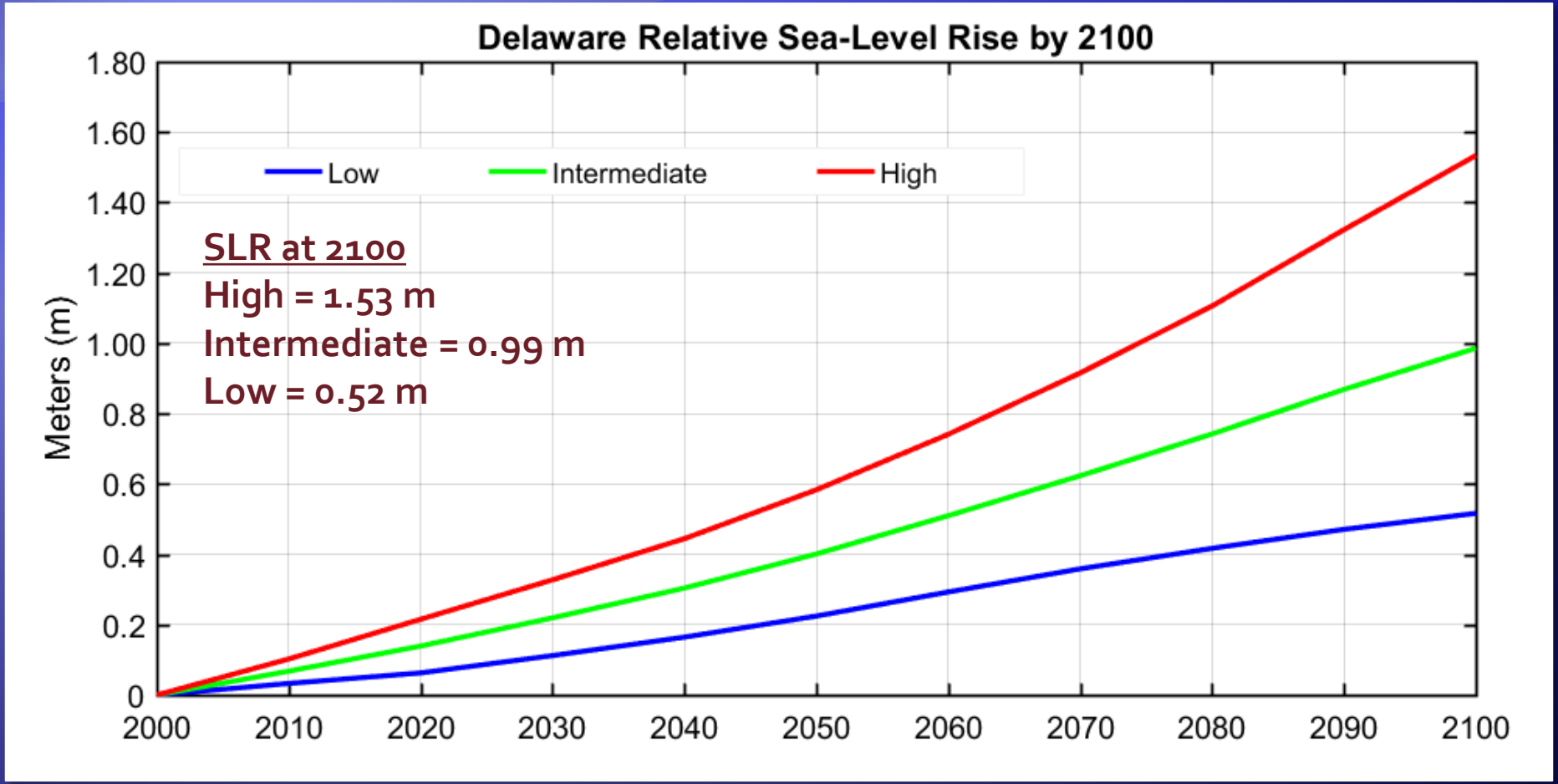


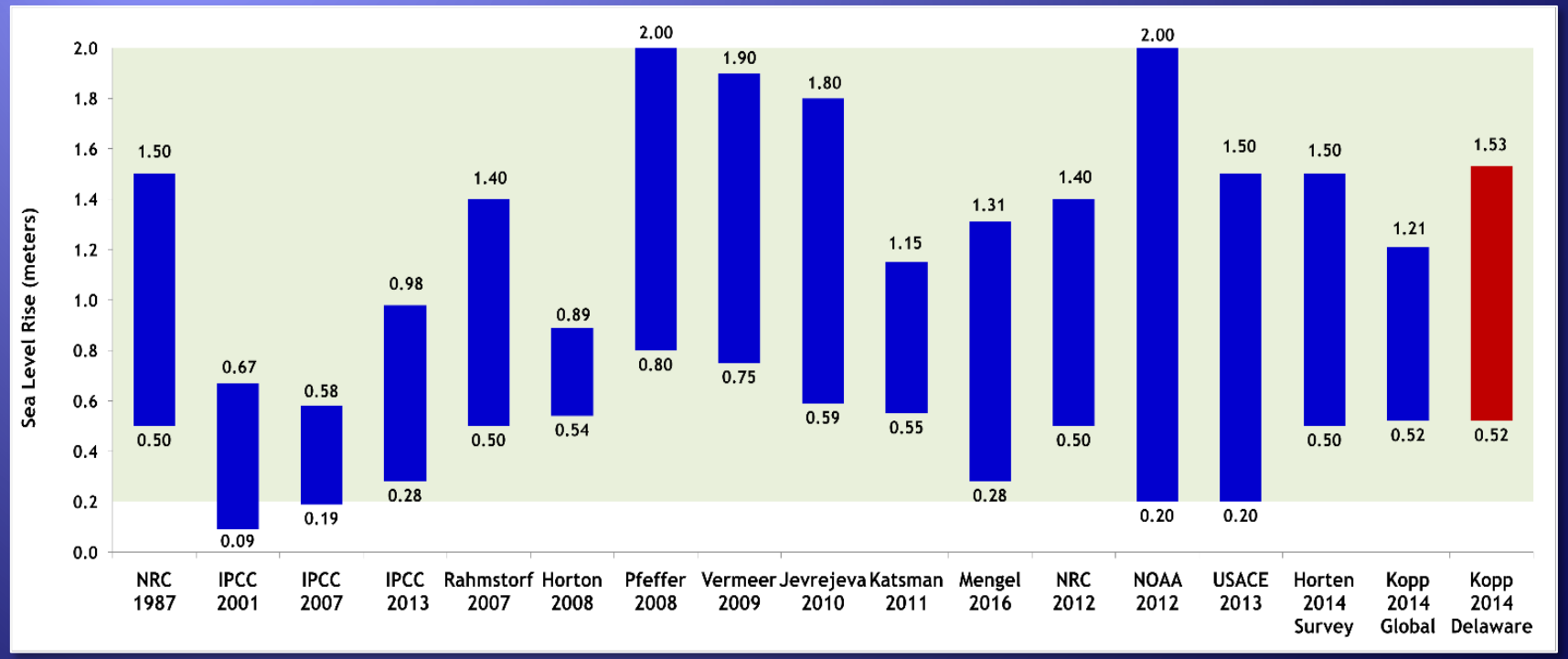
Figure 1. Logical flow of sources of information used in local sea-level projections. GCMs, global climate models; GIC, glaciers and ice caps; SMB: surface mass balance.

Delaware SLR Scenarios



Delaware SLR Scenarios

Delaware SLR Planning Scenario	Probability within RCP8.5	SLR by 2100
Low Scenario	5%	0.52 m
Intermediate Scenario	50%	0.99 m
High Scenario	95%	1.53 m



Upper Bound Uncertainty/Risk

	USGCRP NCA (2014) Max	NOAA SLR (2017) Max	NOAA SLR (2017) 99.9%	Miller et al (2013) Max	Jevrejeva et al (2014) Max	Jackson and Jevrejeva (2016) 99%	Kopp (2014) 99.0%	Kopp (2014) 99.5%	Kopp (2014) 99.9%
Global	2.00	2.50	2.40	2.70	1.90	2.22	1.55	1.76	2.47
Delaware		3.44	3.28				1.93	2.13	3.01

- "**Long tail**" effect of risk distribution
  - SLR > 95% is still 1:20 chance
  - Small odds vs severe consequences
- High uncertainty in **ice sheets**
  - Greenland and West Antarctica

Greenland Is Melting at Some of the Fastest Rates in 12,000 Years

If greenhouse gas emissions do not decline, melt rates could quadruple and further add to sea level rise

By Chelsea Harvey, E&E News on October 1, 2020

Antarctica's colossal Thwaites Glacier is melting fast -- and scientists may have discovered why

By Emma Reynolds, CNN

A view of the sea ice from the Nathaniel B. Palmer icebreaker on the way to Thwaites Glacier.

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Going, Going ... Gone: Greenland's Melting Ice Sheet Passed a Point of No Return in ...s

ng retreat and thinning of
ear ago is speeding the ice

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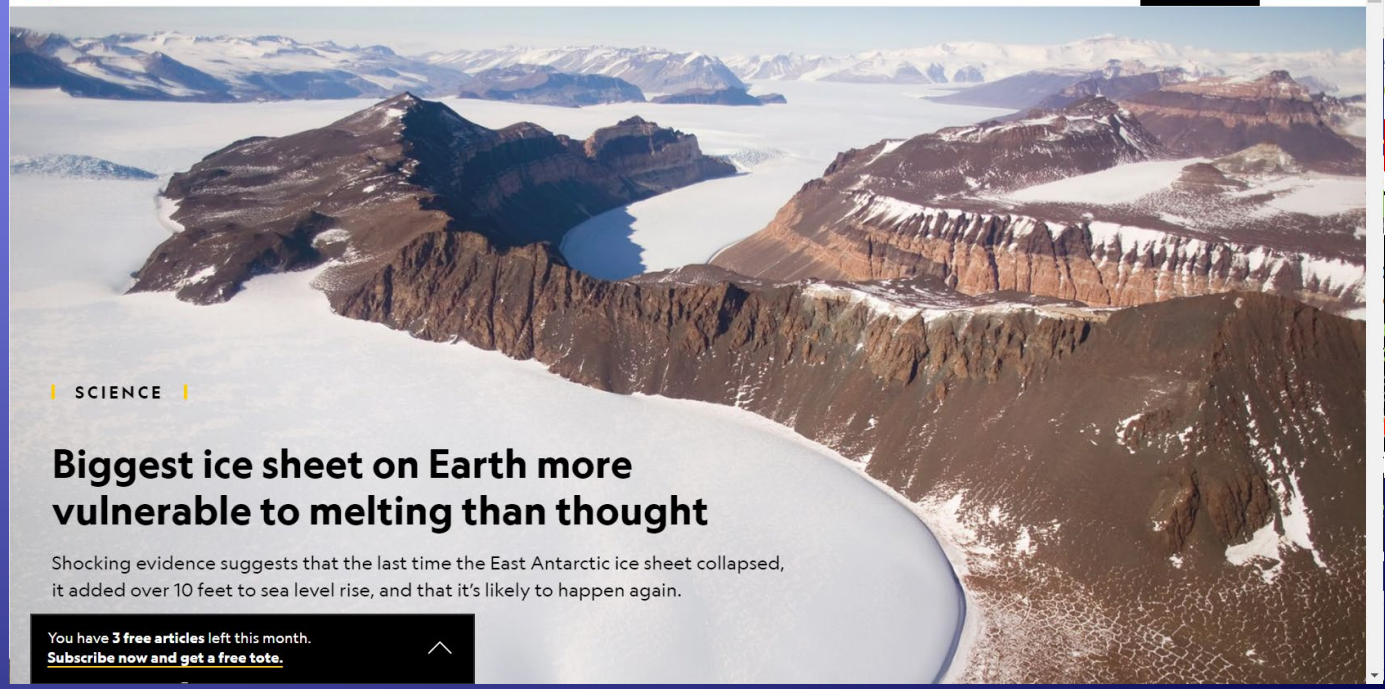

SCIENCE

Biggest ice sheet on Earth more vulnerable to melting than thought

Shocking evidence suggests that the last time the East Antarctic ice sheet collapsed, it added over 10 feet to sea level rise, and that it's likely to happen again.

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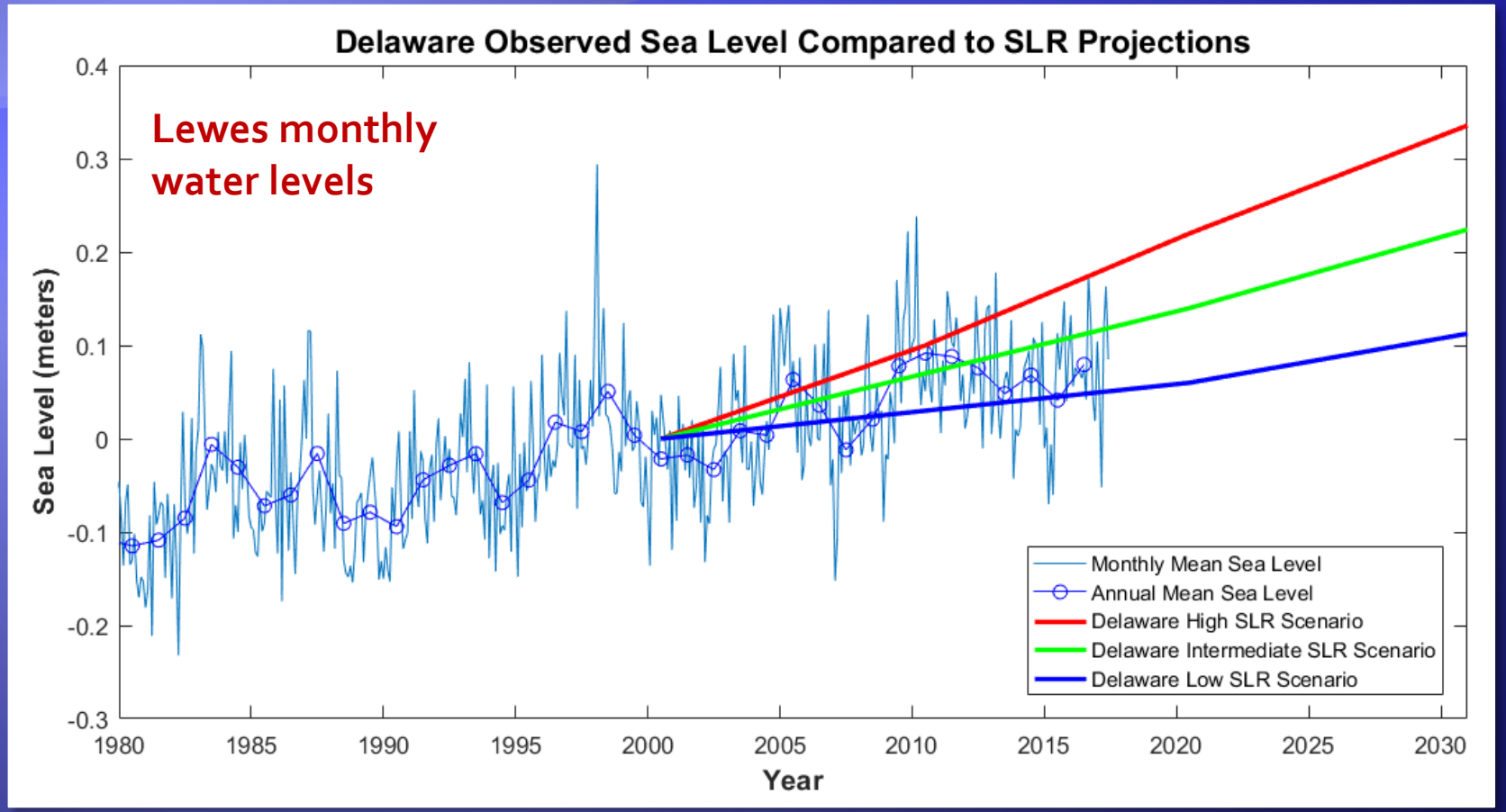
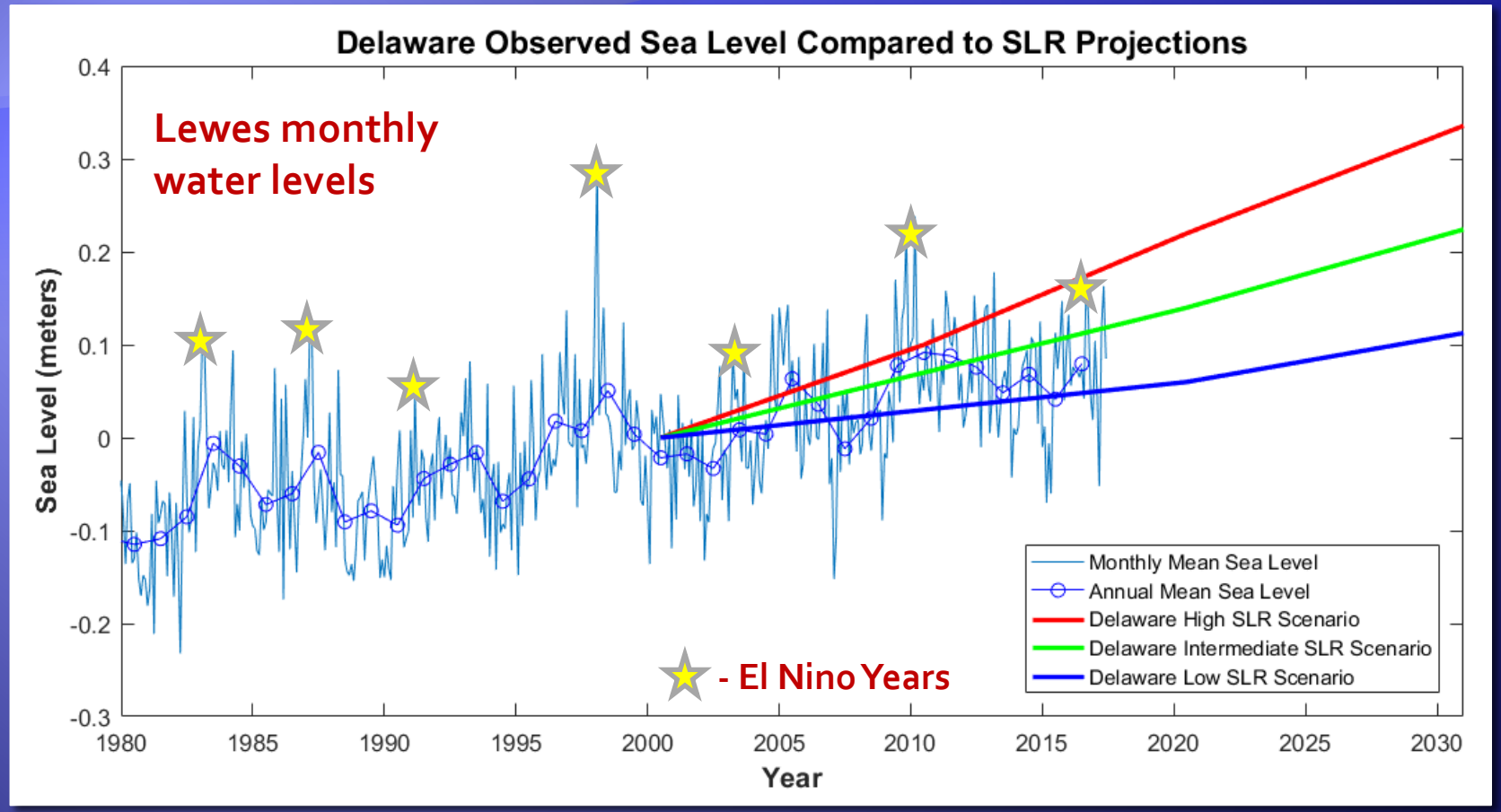
Note on SLR Variability vs Projections



Natural variability can be larger than signal/trend.

Projections are a baseline on which variability acts.

Note on SLR Variability vs Projections



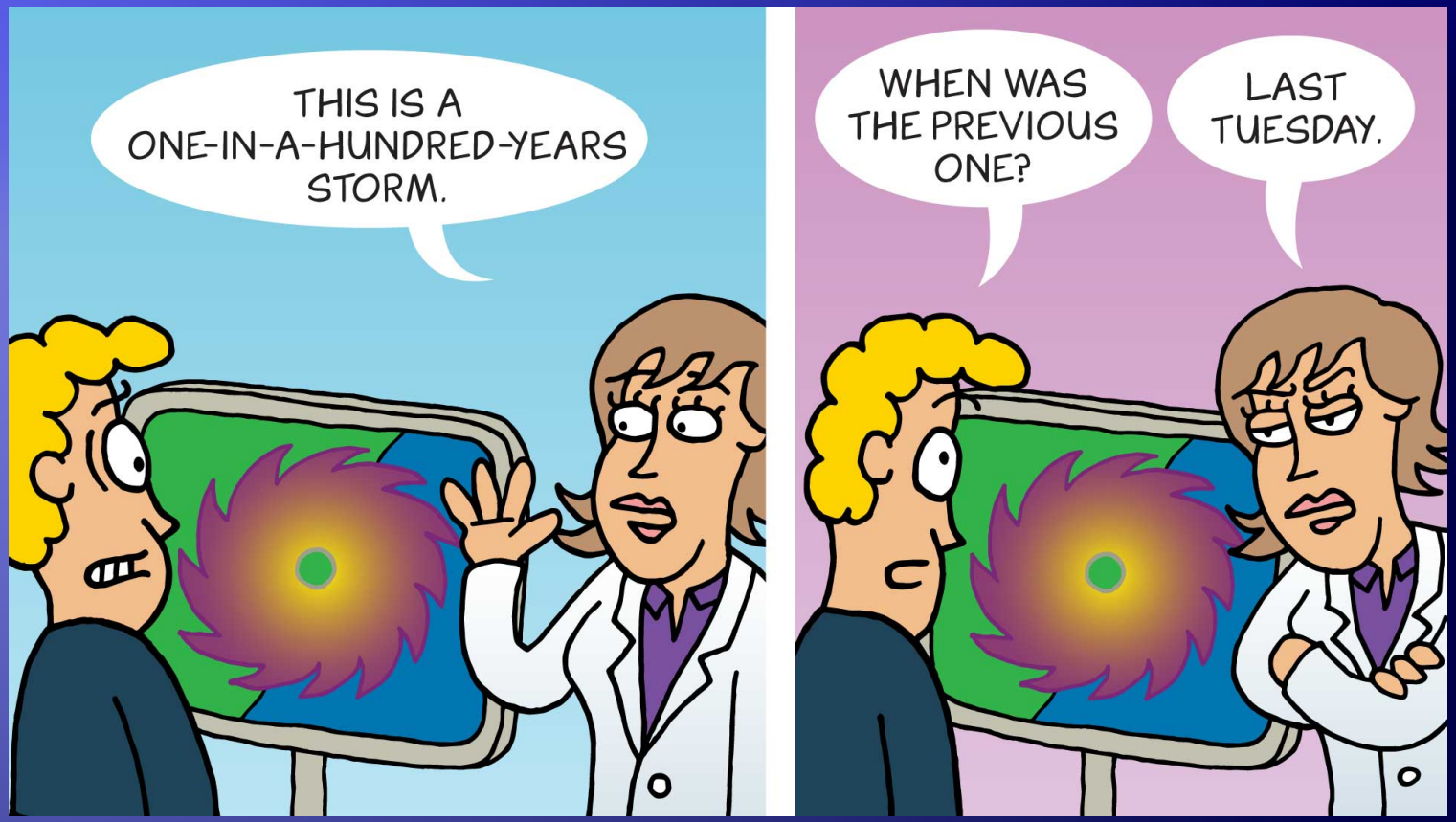
Natural variability is not completely random!

What about the future in DE?

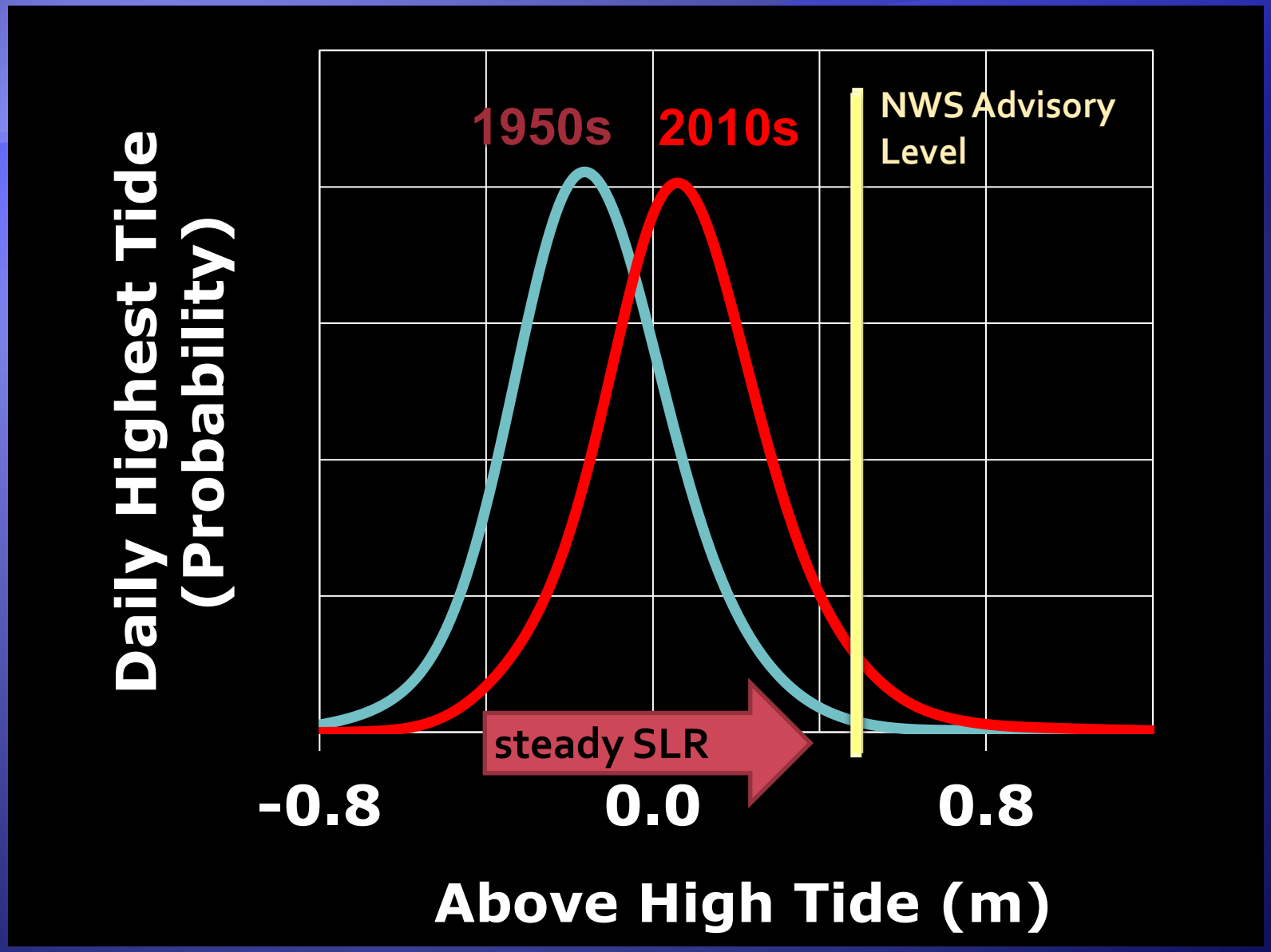
- In addition to SLR, two consequences of climate change particularly impactful to Delaware:

1) High-tide flooding

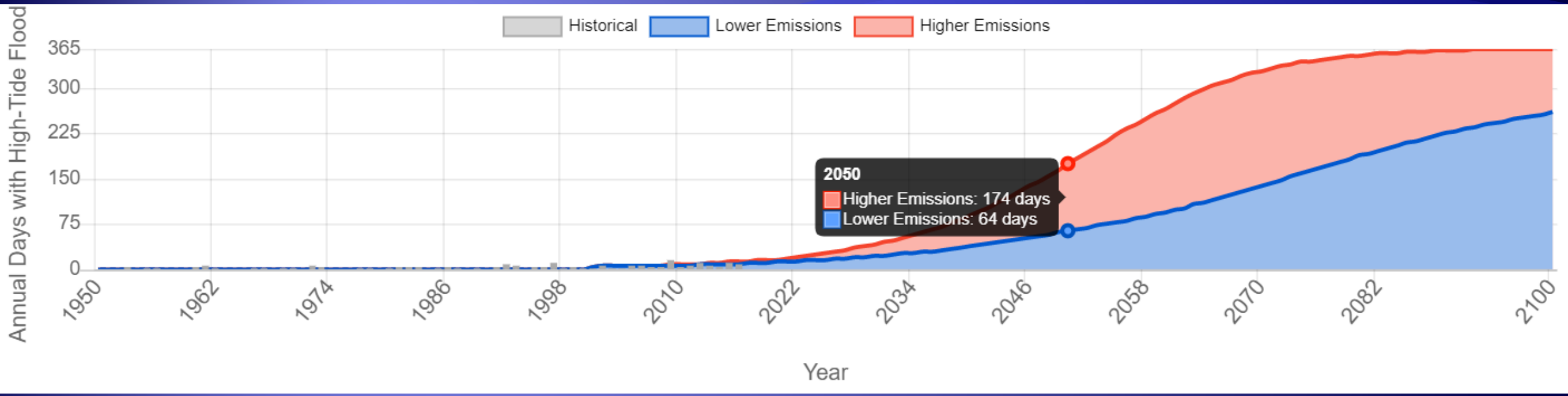
2) Hurricanes



What have we seen in Delaware?



High-Tide Flooding (Flood Frequency)



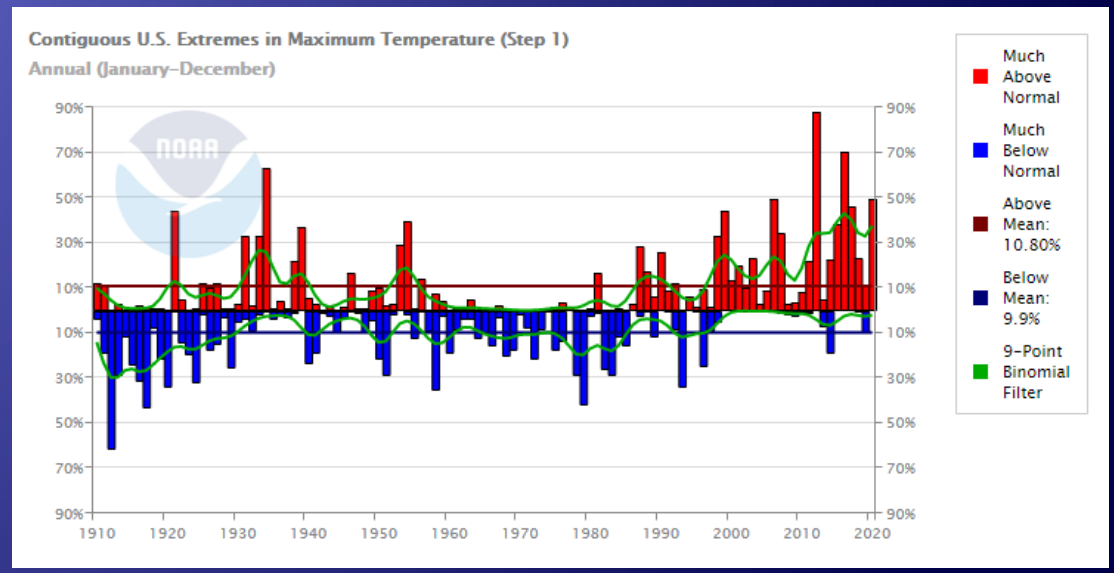
Hurricanes (and Coastal Storms)

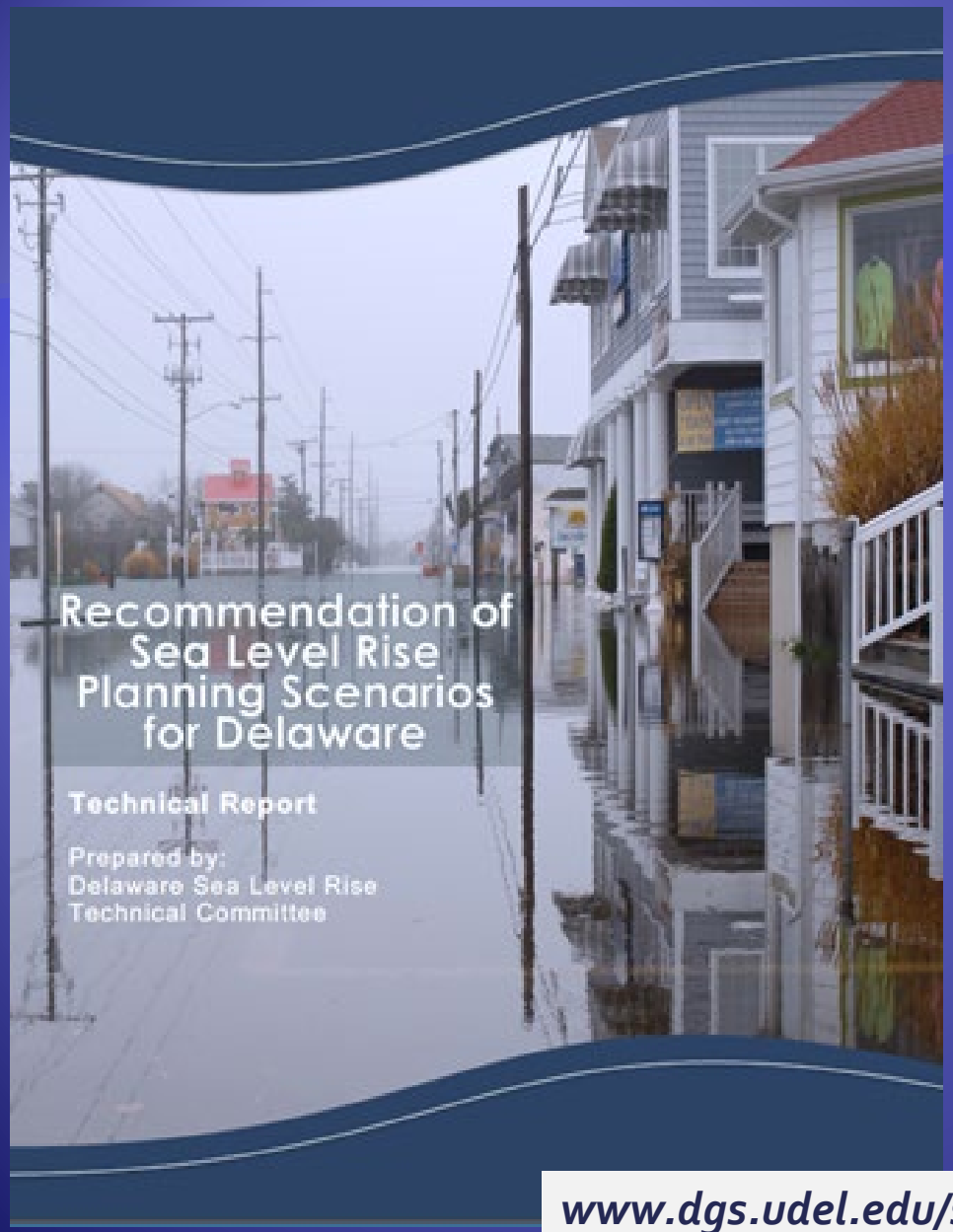
Union of Concerned Scientists, 2017

What about Extremes?

- Occurring more often
- Multi-hazard events
- Natural consequence of warming climate
- Difficult to quantify ("rare" by definition) and prepare for

Damages to infrastructure, ecosystems, public health from an extreme event are greater than the sum of its parts!





www.dgs.udel.edu/slr

Thank You!

John Callahan
Delaware Geological Survey
University of Delaware
john.callahan@udel.edu
http://www.dgs.udel.edu

CEMA

More information on Delaware's climate at http://cema.udel.edu/

Appendix 4: What is a Flood?

(Warga: 08-24-21)

What is a Flood?

Flooding in Delaware

David J. Warga, CFM
State Floodplain Manager
DNREC, Shoreline & Waterway Mgmt.

August 24, 2021

Flooding….it’s everywhere!
The Past

Flooding….it's everywhere!

The Present

Flooding in Delaware: Overview

Types of Flooding

Causes of Flooding

Impacts of Flooding

How is flooding defined?

- Merriam-Webster defines flood as:
  - a rising and overflowing of a body of water especially onto normally dry land, a condition of overflowing
  - the flowing in of the tide
  - an overwhelming quantity or volume
  - a state of abundant flow or volume or of greatest activity

How does FEMA define flooding?

- A general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of 2 or more properties (at least 1 of which is the policyholder's property) from:
  1. Overflow of inland or tidal waters; or
  2. Unusual and rapid accumulation or runoff of surface waters from any source; or
  3. Mudslides (i.e., mudflows) …
  4. Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Where does flooding occur?

- Everywhere!
- Every state and territory of the U.S. experiences flooding.
- A 2018 report by University of MD and Texas A&M University indicated that the U.S. has experienced an urban flooding event once every 2-3 days for the past 25 years.
- Flooding is the most frequent and common cause of weather dependent natural disasters.

Flooding in Delaware : Three Main Types

Riverine Flooding (Fluvial)

Coastal Flooding

Surface Flooding (Pluvial)

Riverine Flooding (Fluvial Flooding)

- When streams or rivers exceed their capacity by rainfall and runoff from upstream and overflow their banks inundating adjacent lands.

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Fluvial floods (river floods)

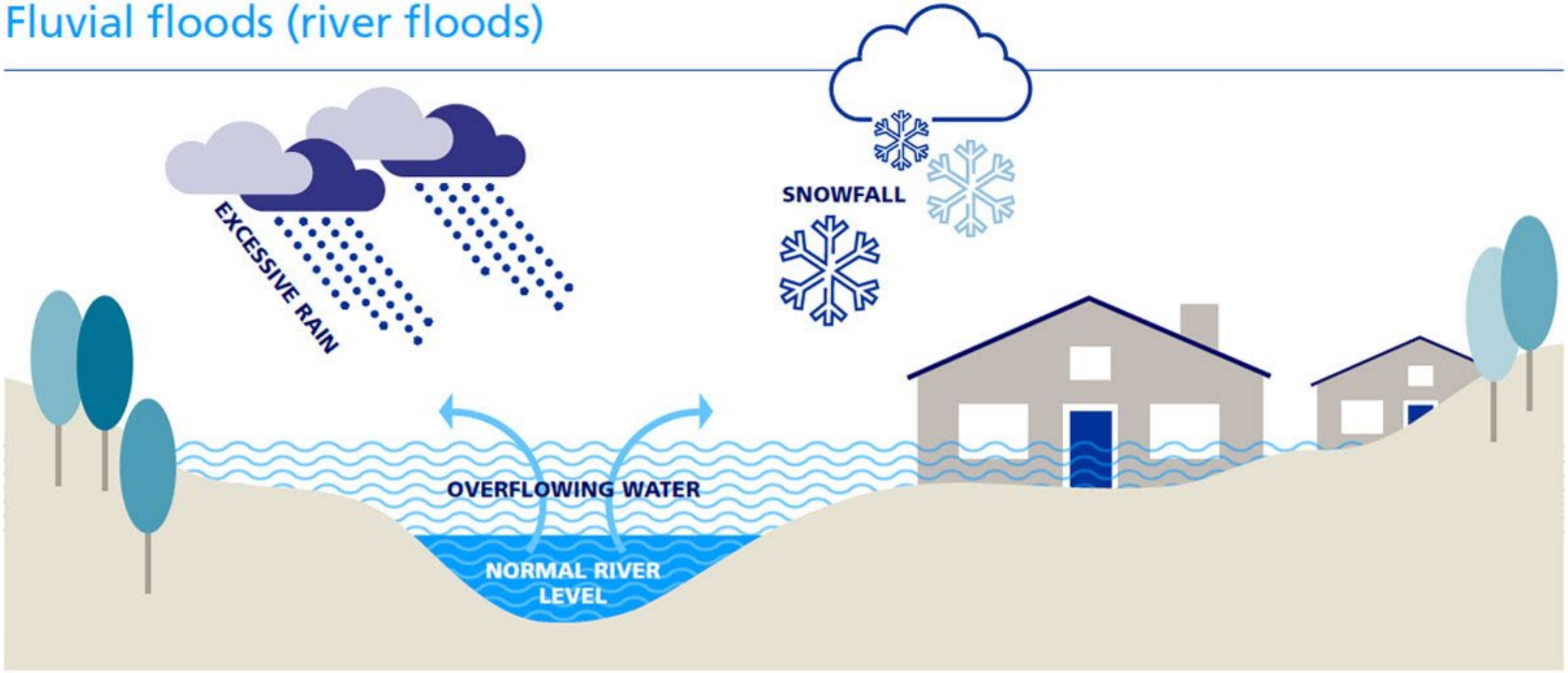

IMAGE: ZURICH.COM

Coastal Flooding

- High winds associated with tropical cyclones (hurricane) push water onshore; conditions worsened by high tides.
- “Storm Surge”, measured by rise of water level over normal astronomical tide. Not including waves.
- Storm surge in combination with waves can cause extensive damage.

Coastal flood (storm surge)

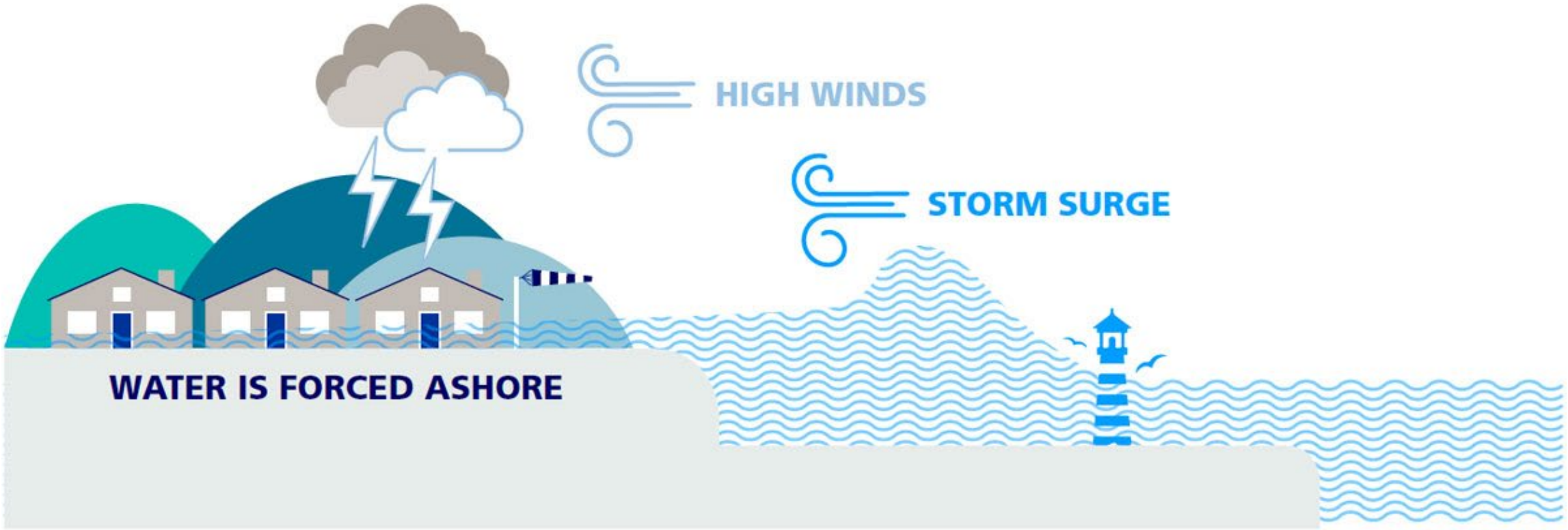

IMAGE: ZURICH.COM

Surface Flooding (Pluvial Flooding)

- Occurs when heavy rainfall exceeds the capacity of natural and urban drainage systems.
- Expected to increase due to impacts of over-development and climate change.

Photo: firststateupdate.com

Pluvial floods (flash floods and surface water)

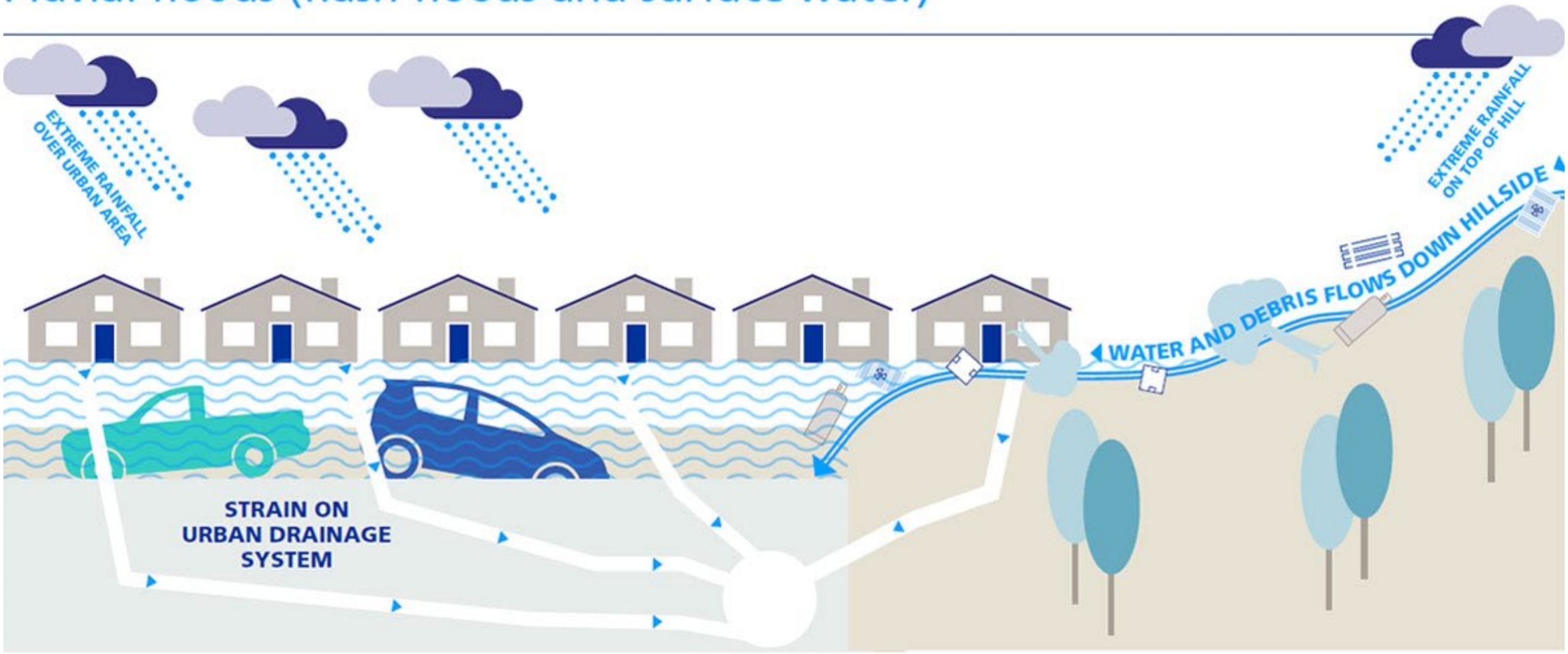

IMAGE: ZURICH.COM

Sea Level Rise and Flooding

- An estimated 40% of the U.S. population live in high-density coastal communities.
- NOAA estimates sea level is rising 1/8” annually on average based on observations including tide gauge data and satellite laser altimeter.
- Higher sea levels push water further inland, increase the amount of ground water and cause increased flooding in coastal communities.

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570

coastal cities are vulnerable to a sea-level rise of **0.5 meters by 2050**

(1.64 feet)

Source: The Global Risks Report 2019, World Economic Forum

IMAGE: ZURICH.COM

Video by FEMA

Some statistics to think about

Just 1 inch of water can cause $25,000 of damage to your home (FEMA)

It's estimated that up to $20 billion in flood losses occur annually in the United States

In Delaware since 1976 there have been 6,099 NFIP flood insurance losses claimed and $81,906,643.00 paid

Flooding is anticipated to increase with Climate Change and Sea Level Rise

26% chance of your home flooding once over a 30 year mortgage period

+20 percent of all NFIP claims come from outside the areas of highest risk

COMMENTS?

Appendix 5: Delaware Flood Planning Tool

(Tonn: 08-24-21)

Delaware Flood Planning Tool

Gina Tonn, PhD, PE, CFM
DNREC Division of Watershed Stewardship
Shoreline and Waterway Management

August 24, 2021

DELAWARE DEPARTMENT OF
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Key Takeaways

- Delaware Flood Planning Tool location: de.gov/floodplanning
- Navigation and use of the tool
- Interpretation of Flood Planning Tool mapping

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Overview

Floodplain mapping

- FEMA Flood Insurance Rate Maps
- Flood zones and floodplain mapping in Lewes
- Limitations to floodplain mapping

Delaware Flood Planning Tool

Floodplain Mapping

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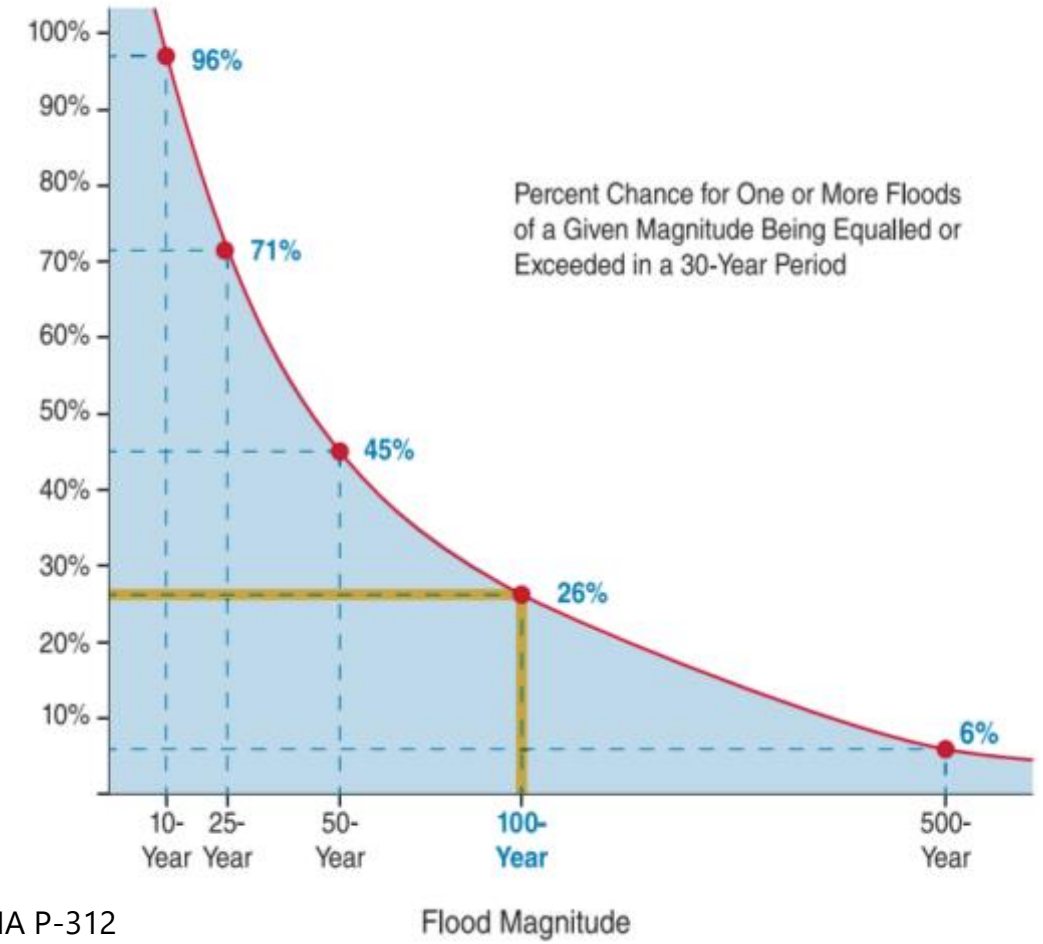
FEMA Floodplain Mapping

- National Flood Insurance Program (NFIP) was created in 1968 to provide flood insurance and reduce flood damages by restricting floodplain development
- Flood Insurance Rate Map (FIRM) shows mapping of flood zones for flood insurance rating purposes.
- Special Flood Hazard Area (SFHA) delineated; mandatory insurance purchase requirement
- Maps are updated periodically but not on a regular schedule
- Maps are typically used by communities in the regulation of land use

Probability of Risk

Special Flood Hazard Area: Area with a 1%-annual chance of flooding

Figure 3-1. This graph shows the relationship between flood recurrence intervals and the probability of an event occurring within a 30-year period.



Homeowners Guide to Retrofitting FEMA P-312

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Flood zones in Lewes

SFHA

Outside of SFHA

Flood Zone	Description
AE	1% annual chance floodplain elevations provided
VE	Coastal area subject to wave action (velocity hazard) elevations provided
X (shaded)	Area of moderate hazard 0.2% annual chance floodplain
X (unshaded)	Area of low hazard outside of 0.2% annual chance floodplain

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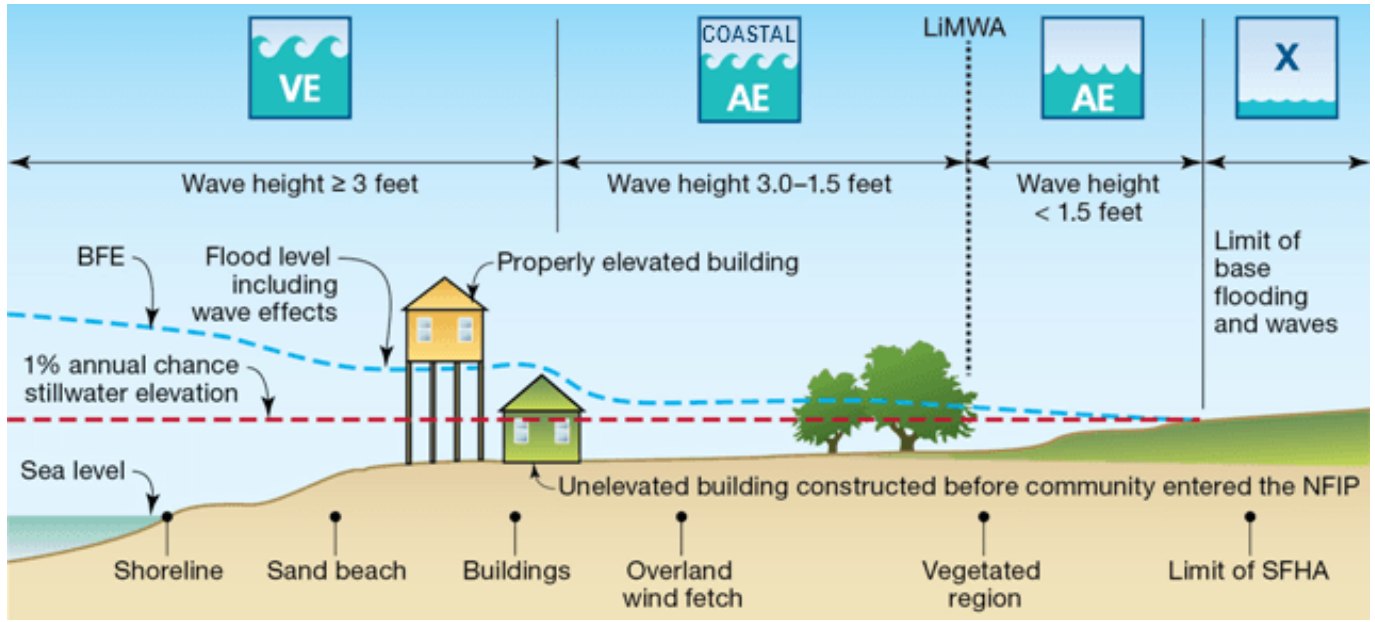
Coastal Floodplain Modeling and Mapping

- Storm surge analysis
  - Set of storms modeled
  - Stillwater elevations
  - Regional scale
- Overland wave modeling
  - Predicts height of waves
  - 1% storm only



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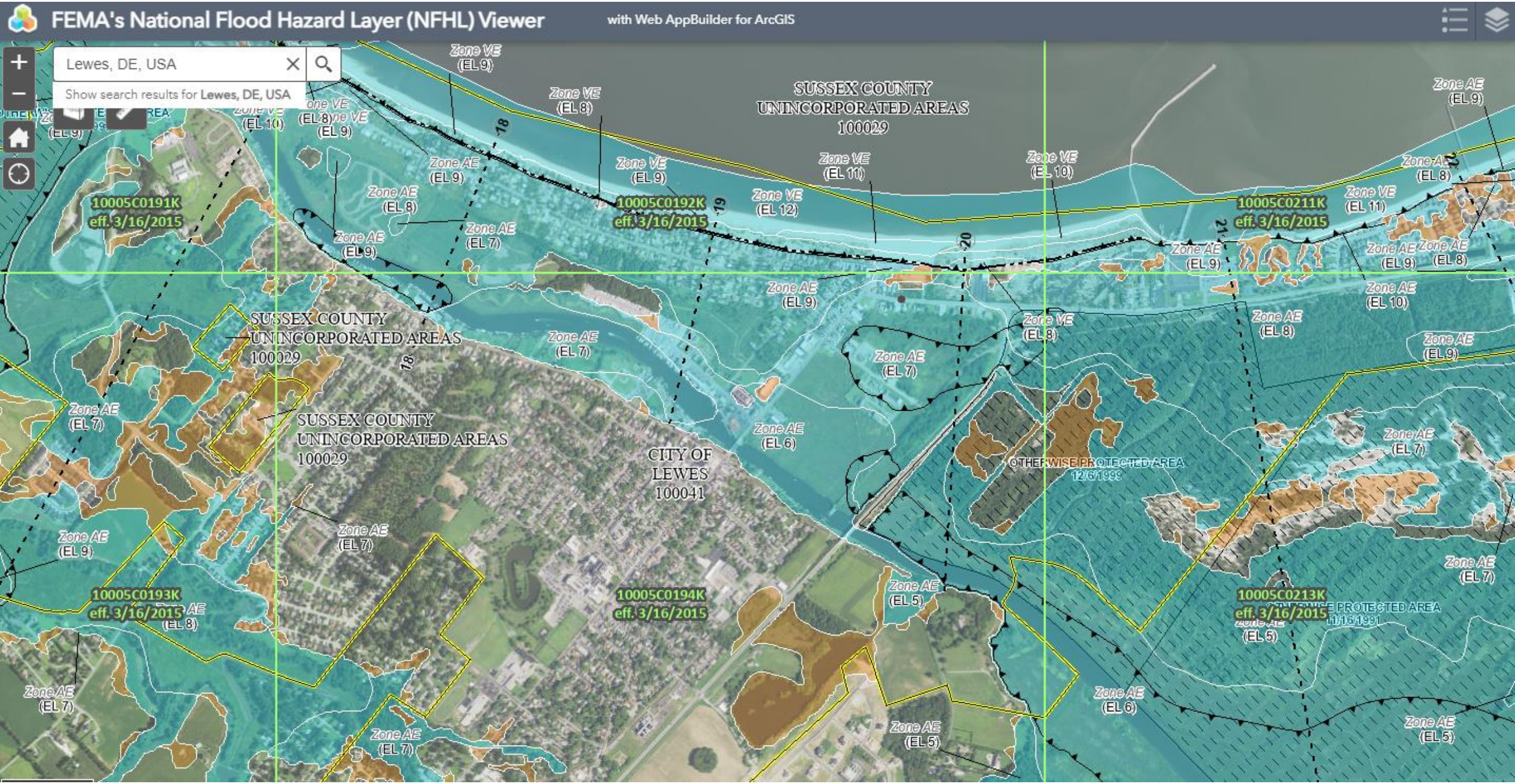
FEMA's National Flood Hazard Layer (NFHL) Viewer
with Web AppBuilder for ArcGIS
Lewes, DE, USA
Show search results for Lewes, DE, USA
SUSSEX COUNTY
UNINCORPORATED AREAS
100029
CITY OF
LEWES
100041
OTHERWISE PROTECTED AREA
12/6/1999
OTHERWISE PROTECTED AREA
11/16/1991
10005C0191K
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Limitations to FIRMs

- Based on conditions (topography, hydrology, etc.) at the time of the study
- Future conditions not considered - sea level rise, changes in storm climatology, wetland loss, shoreline erosion
- No consideration of back-to-back storms
- 500-year coastal floodplain is based on stillwater elevation only (no 500-year wave analysis for FIRM)

Delaware Flood Planning Tool

De.gov/floodplanning

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NATURAL RESOURCES AND
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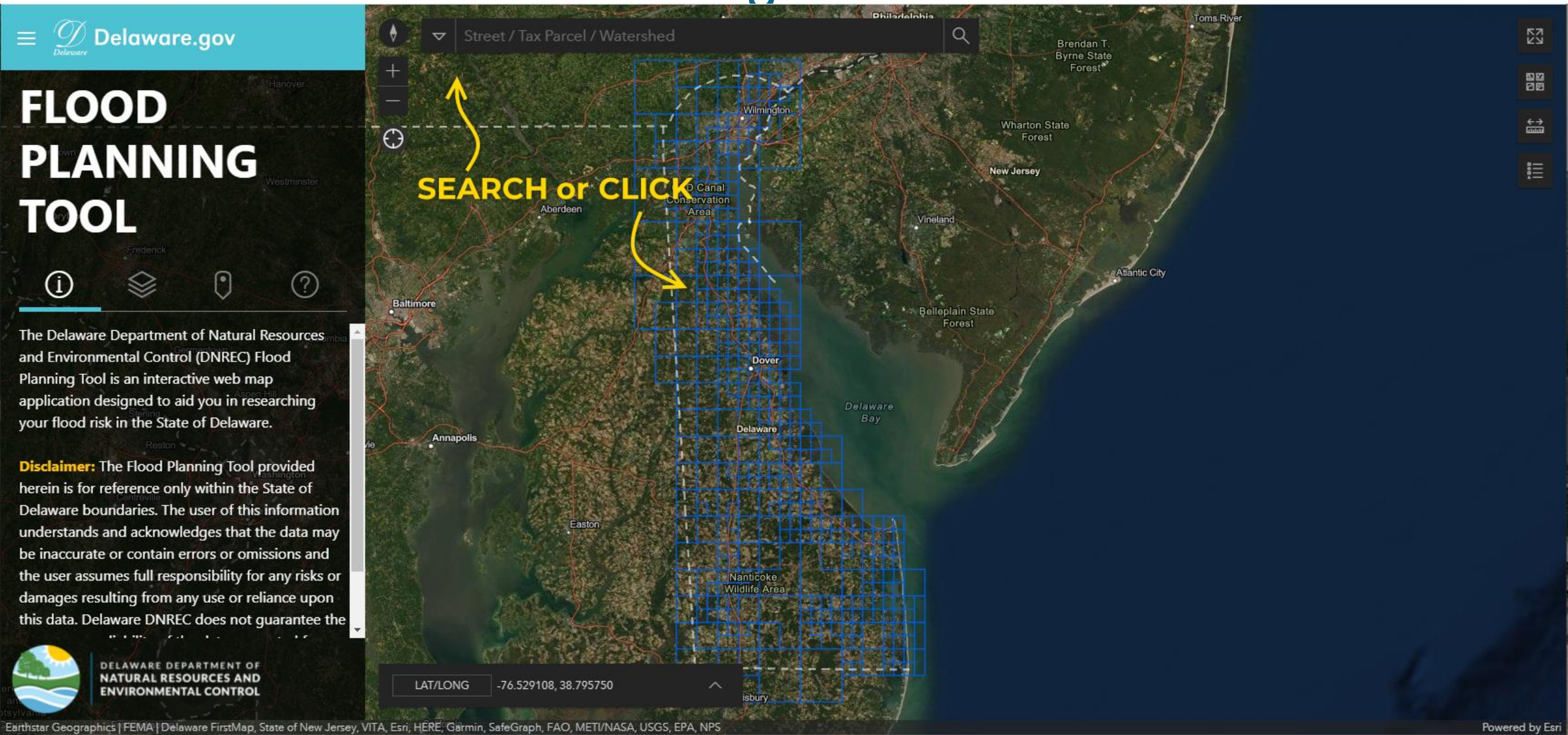
Delaware Flood Planning Tool



Purpose and Features

Purpose

- Enable viewing of FEMA floodplain mapping in Delaware along with additional resources

Features

- Location search
- Location-specific (parcel) results
- Layers
- Map printouts
- Hydraulic models

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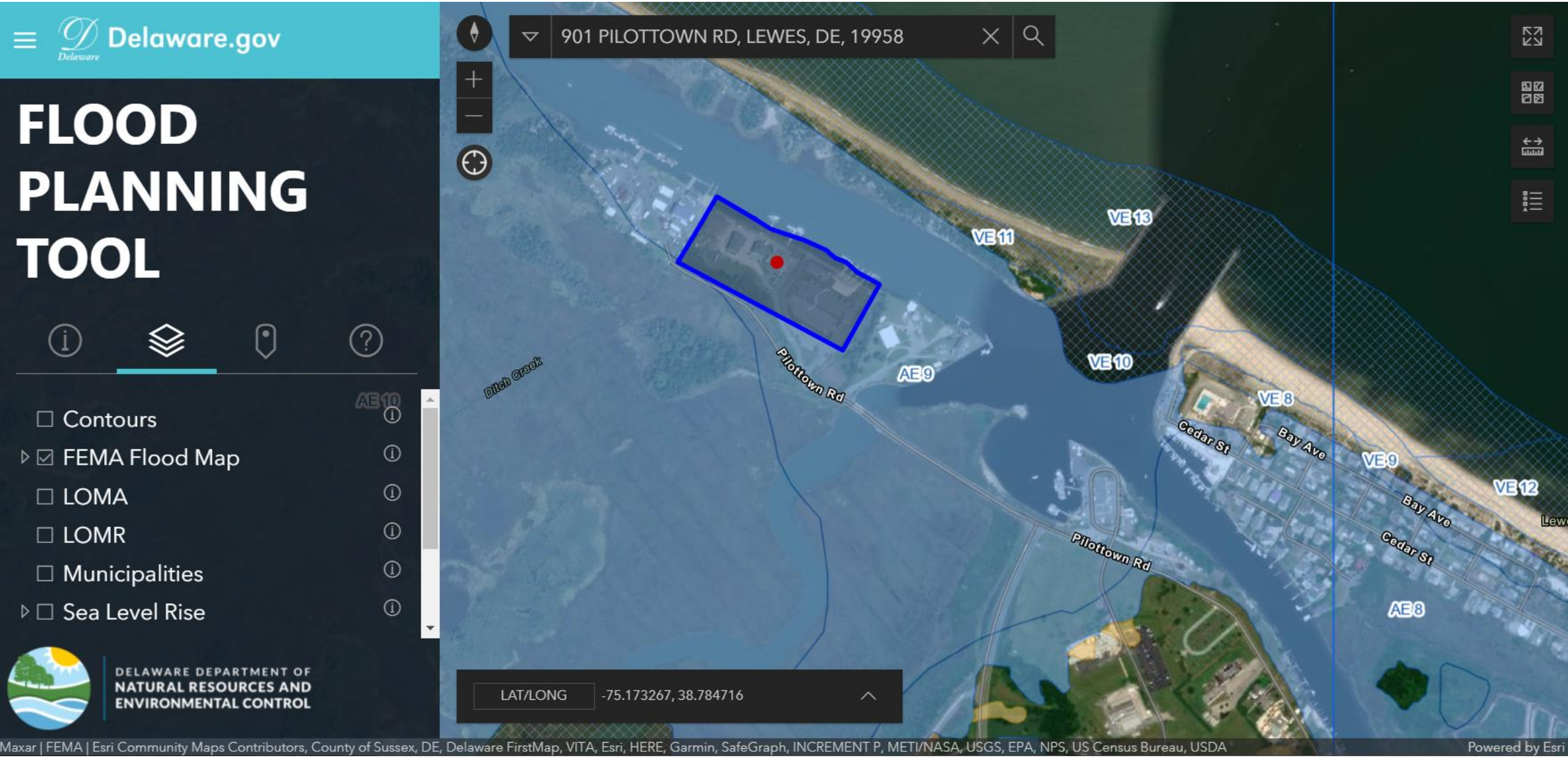
Delaware.gov
FLOOD PLANNING TOOL
Contours
FEMA Flood Map
LOMA
LOMR
Municipalities
Sea Level Rise
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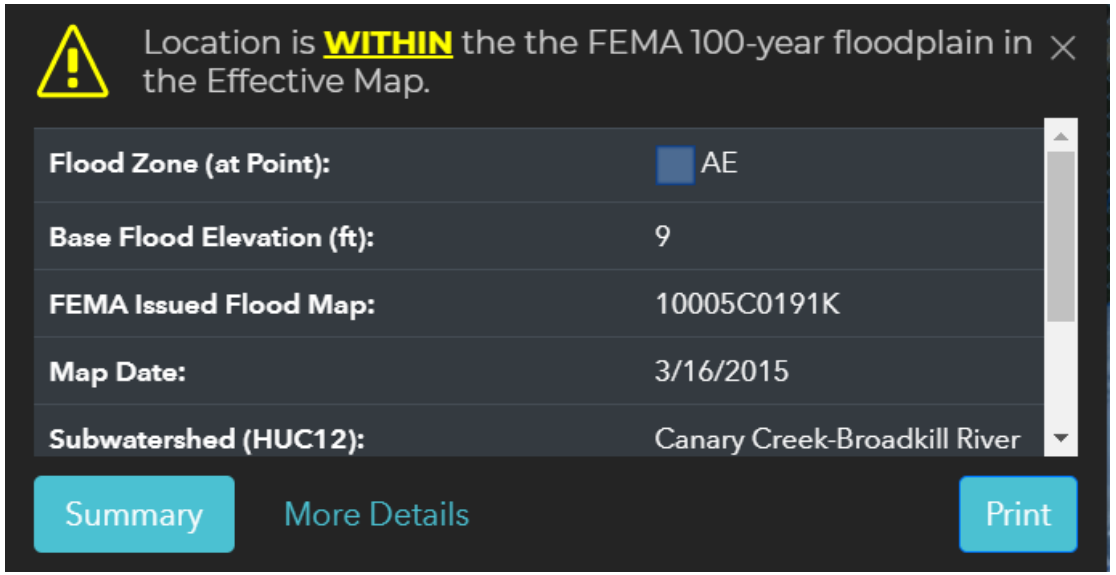
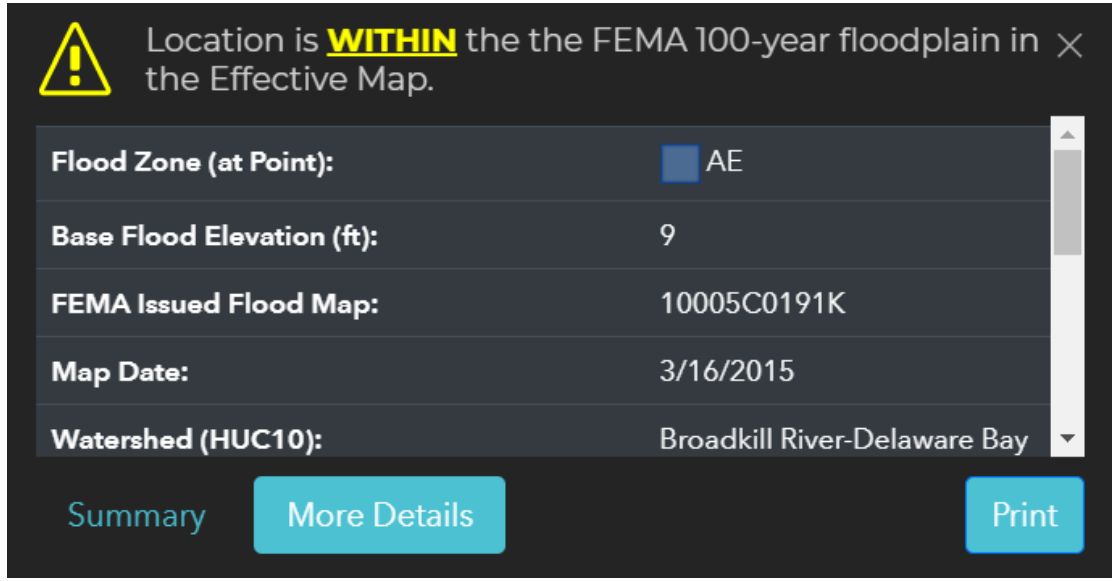
VE 13
VE 11
VE 10
VE 8
VE 9
VE 12
AE 9
AE 8
Ditch Creek
Pilottown Rd
Cedar St
Bay Ave
LAT/LONG
-75.173267, 38.784716
Maxar | FEMA | Esri Community Maps Contributors, County of Sussex, DE, Delaware FirstMap, VITA, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA
Powered by Esri

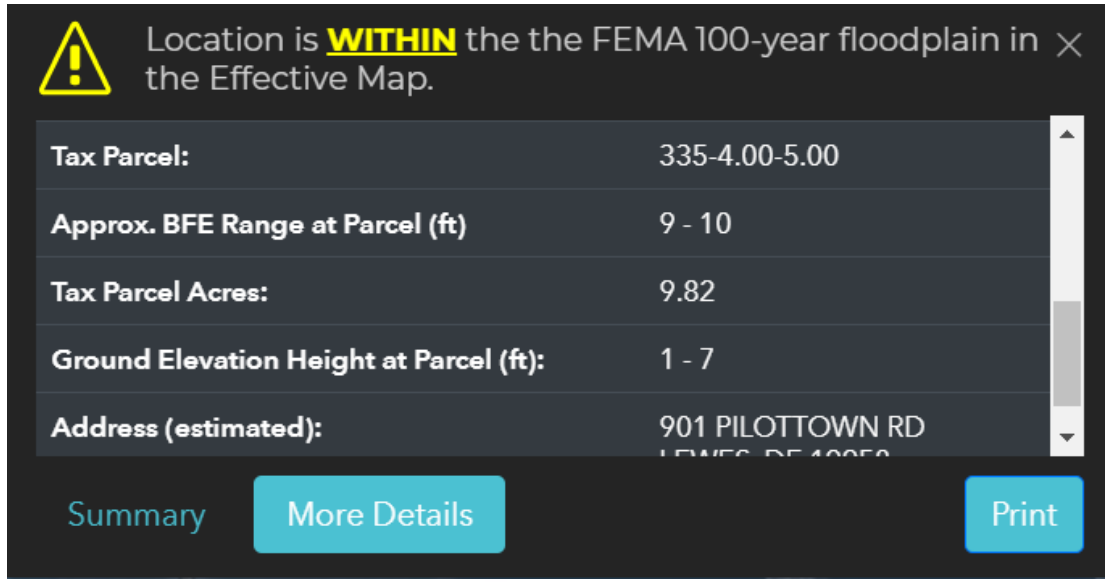
Parcel Results

Summary



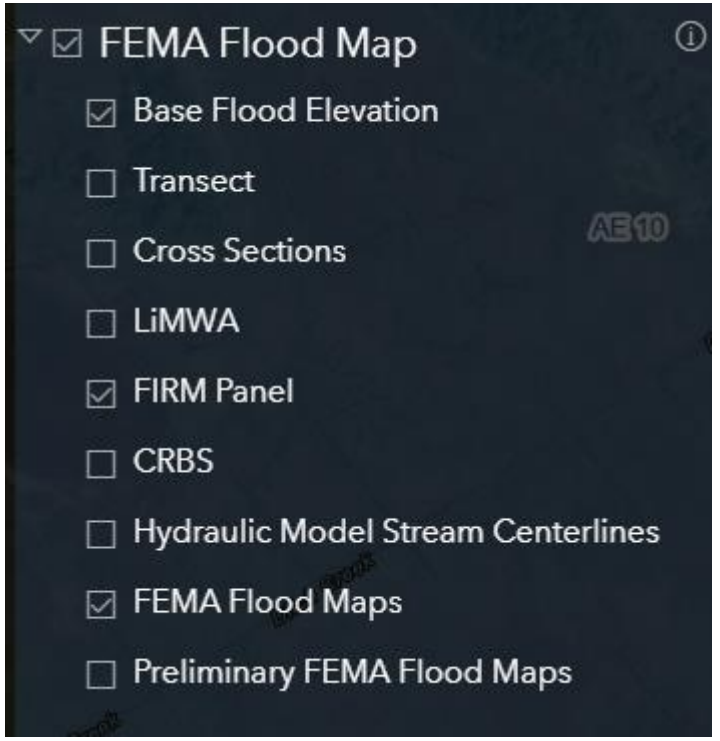
More details



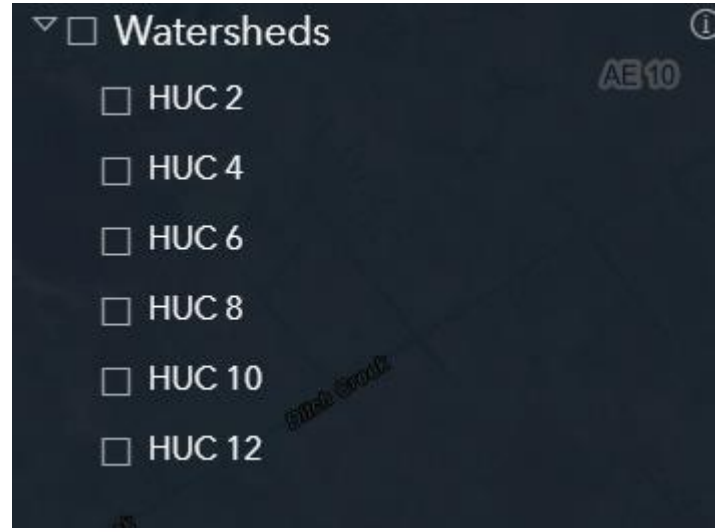


Layers

Contours
FEMA Flood Map
LOMA
LOMR
Municipalities
Sea Level Rise
Tax Parcels
Watersheds


FEMA Flood Map
Base Flood Elevation
Transect
Cross Sections
LiMWA
FIRM Panel
CRBS
Hydraulic Model Stream Centerlines
FEMA Flood Maps
Preliminary FEMA Flood Maps

Sea Level Rise
MHHW
MHHW + 1 ft
MHHW + 2 ft
MHHW + 3 ft
MHHW + 4 ft
MHHW + 5 ft
MHHW + 6 ft
MHHW + 7 ft


Watersheds
HUC 2
HUC 4
HUC 6
HUC 8
HUC 10
HUC 12

Map Printout

Hands-on Example

- Address: University of Delaware, Lewes, DE
- Click on highlighted parcel to bring up results box; more details for additional results; print button for map printout
- Change basemap; measure tool; legend
- Layers: turn on contours; turn on SLR

Gina Tonn
DNREC
Division of Watershed Stewardship
Shoreline and Waterway Management
Gina.Tonn@delaware.gov
302-739-9921

DELAWARE DEPARTMENT OF
NATURAL RESOURCES AND
ENVIRONMENTAL CONTROL

Appendix 6: FEMA, Floodplain Management, and the National Flood Insurance Program

(Warga: 09-14-21)

FEMA,
Floodplain Management and the
National Flood Insurance Program

September 14, 2021

David J. Warga CFM
State Floodplain Manager
DNREC, Shoreline and Waterway Mgmt.

DELAWARE DEPARTMENT OF
NATURAL RESOURCES AND
ENVIRONMENTAL CONTROL

NATIONAL FLOOD
INSURANCE PROGRAM

NFIP HISTORY: Realization of the problem

- Cost and shortcomings of flood control projects.
- Federal disaster assistance was not enough and increasingly expensive.
- Private flood insurance policies were unaffordable. Primarily High-Risk policies.
- Development was continually occurring in the floodplain.

FEMA

NATIONAL FLOOD INSURANCE PROGRAM

- Established by the National Flood Insurance Act of 1968 (NFIA; 42 U.S.C. §4001 et seq.)
- Enables property owners in participating communities to purchase flood insurance as protection against flood losses.
- Requires state and local governments to enforce floodplain management ordinances.
- Promotes reduction of flood risk.
- Administered by FEMA
- Participation is voluntary

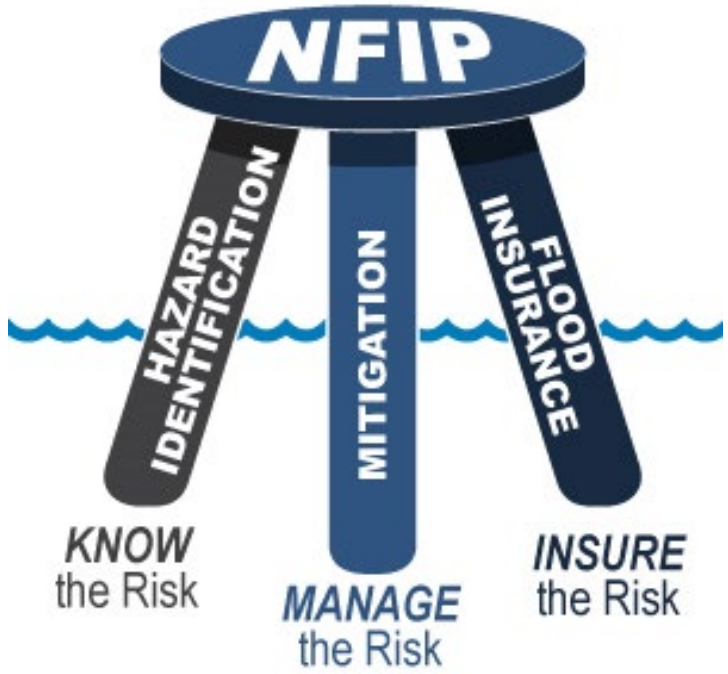
The “Three-Legged Stool”

Three related parts of the NFIP:

1. Flood Hazard Identification/Mapping
   - Flood Insurance Rate Maps(FIRM)
   - Flood Insurance Study(FIS)

2. Floodplain Management/Regulations
   - Minimum NFIP requirements
   - Local Floodplain Ordinance

3. Flood Insurance
   - Available to Homeowners, Renters, Business in the community



FEMA

Participation in the NFIP

- Voluntary
- Community must initially adopt a resolution of intent to participate and cooperate with FEMA.
- Community must adopt and enforce an approved floodplain management ordinance that meets or exceeds the minimum NFIP standards and requirements as outlined in 44 CFR 60.3.
- Community must adopt the current Flood Insurance Rate Map (FIRM).
- Communities encouraged to adopt more restrictive higher standards.
- FEMA agrees to make flood insurance available throughout the participating community.

Benefits of Participation in the NFIP

- Access to flood insurance
- Federal Grants and Loans
- Disaster Assistance
- Federally-backed mortgages

Establishes a partnership between the community and the Federal Government.

Minimum requirement categories identified in 44CFR 60.3

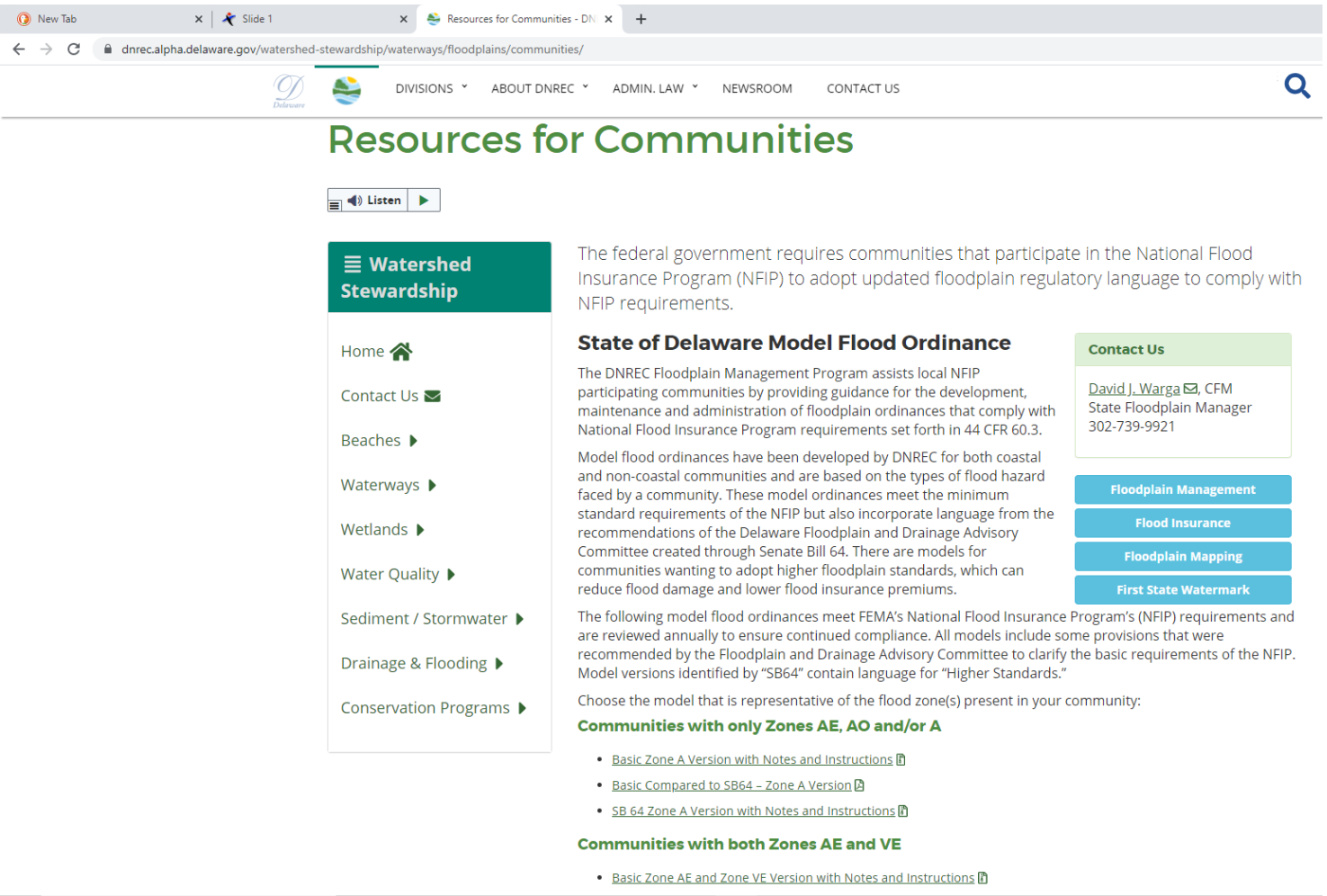
- Permit requirement for development in the floodplain.
- New Construction and Substantial Improvement design requirements.
- Subdivision Proposals and Other New Development
- Water Supply Systems
- Sanitary Sewer Requirements

Reasonably Safe From Flooding

The community must review all permit applications to determine whether the proposed building sites will be reasonably safe from flooding as one of the minimum National Flood Insurance Program (NFIP) floodplain management requirements established by NFIP regulations. If the community determines that a site is not reasonably safe from flooding, it must require mitigation actions be undertaken to reduce the structures flood damage potential.

…FEMA

Delaware Model Flood Ordinance



Delaware BASIC Model Floodplain Management Ordinance for Communities with Inland (Zone A) and Coastal High Hazard Areas (Zone V)

INSTRUCTIONS AND NOTES – May 14, 2014

ORDINANCE REVISION RESOURCES:

http://www.dnrec.delaware.gov/swc/Pages/Ordinance-Revision-Resources.aspx

TECHNICAL SUPPORT:

email: DE.FloodOrd@gmail.com (include community name in subject line)

Please use <track changes>

This document contains instructions and some explanatory notes for the Delaware Model Flood Damage Reduction Ordinance that includes provisions for all flood zones (Zone A & Zone V). The notes are keyed to the sections of the model ordinance. They are not intended to explain every provision, but to highlight those that clarify administration and enforcement and those that may be new to many communities.

The following are important aspects of the new model ordinance:

1. The model is written in regulatory language, rather than permissive and unenforceable language that appears in some local regulations.
2. The Floodplain Administrator's responsibilities are written to satisfy the community's commitment and responsibilities to the NFIP.
3. The model ordinance includes specific requirements for development other than buildings that may appear to be "new," but that are based on the overall performance expectation of the NFIP for any development, including activities other than buildings. The specific requirements come from FEMA guidance publications and ASCE 24 *Flood Resistant Design and Construction* (a standard referenced by the International Code Series). The specificity is intended to help both the local official and the applicant understand what constitutes resistance to flood damage for such activities.
4. The model ordinance includes requirements for all development, including buildings and structures. Communities that enforce building codes based on the 2009 or later editions of the International Code Series may rely on the flood provisions of those codes to meet the NFIP requirements. A list of communities and adopted codes posted by the Delaware Building Officials Association (www.deboa.org) indicates only a small number of communities use the 2009 or later edition. This list may be incomplete and it might not reflect the most recent edition of adopted codes. DNREC is preparing a separate, code-coordinated version of the model ordinance for consideration by these communities.
5. The basic model ordinance does not include "higher standards," which are provisions that exceed the NFIP minimum requirements. It does include some provisions that were

Delaware Participation in the NFIP

- Fifty (50) communities participate in the flood insurance program.
- Two (2) communities participating with no special flood hazard area.
- Five (5) communities not participating.
- 26,326 flood insurance policies in place.
- Over $7 Billion insured.

National Participation in the NFIP

- More than 22,100 communities participate in the NFIP
- Over 5.1 million flood insurance policies in force
- Over $1.25 Trillion in total coverage. ($1,325,186,968,218.00)

What if a community decides not to participate in the NFIP?

- Unavailability of a federally backed flood insurance policy for community residents.
- Existing flood insurance policies will not be renewed.
- No Federal grants or loans for development may be made in identified flood hazard areas under programs administered by Federal agencies such as HUD, EPA, and SBA;
- No Federal disaster assistance may be provided to repair insurable buildings located in identified flood hazard areas for damage caused by a flood.
- No Federal mortgage insurance or loan guarantees may be provided in identified flood hazard areas. this includes policies written by FHA, VA, and others.
- Federally insured or regulated lending institutions, such as banks and credit unions, must notify applicants seeking loans for insurable buildings in flood hazard areas that there is a flood hazard and that the property is not eligible for Federal disaster relief.

Having improved floodplain regulations and enforcement

- Lowers the cost of flood insurance
- Reduces flood damage and expensive drainage solutions.
- Creates more resilient communities.
- Decreases recovery time.
- Enforcement of flood regulations helps avoid NFIP probation.

Improved floodplain regulations result in quicker recovery time from a flood event.

Post Storm Damage

May 11, 2008

RECOVERY TIME
1,436 Days

NATIONAL FLOOD INSURANCE PROGRAM

Answers to Questions About the NFIP

https://www.fema.gov/sites/default/files/2020-05/f084_atq_11aug11.pdf

FEMA

NATIONAL FLOOD INSURANCE PROGRAM

FEMA

Flood Insurance Risk Rates

- Since 1968 flood insurance policy risk rating has been predominantly based on:

1. The amount and type of coverage being purchased.
2. Your location – Flood Zone designation on the FEMA Flood Insurance Rate Map
3. The design and age of your structure.
4. The elevation of the building in relation to the base flood elevation.
5. Doesn’t take climate change into consideration.

That’s all going to change…

Risk Rating 2.0

What is it?

- The National Flood Insurance Program's new risk rating methodology to utilize industry best practices and cutting-edge technology to enable FEMA to deliver rates that are actuarily sound, equitable, easier to understand and better reflect an individual property's flood risk.
- Beginning October 1, 2021 – All new policies and existing policyholders who are eligible for renewal will utilize new rating method.
- Beginning April 1, 2022 – All remaining policies will utilize new rating method.

more

Risk Rating 2.0

- Policy risk rating will be based on:

1. Flood frequency – Impacts of Climate Change
2. Flood sources and types - river overflow, storm surge, coastal erosion and heavy rainfall.
3. Distance to the coast or other flood source, size of nearest water body.
4. Property characteristics such as elevation.
5. Cost to rebuild.

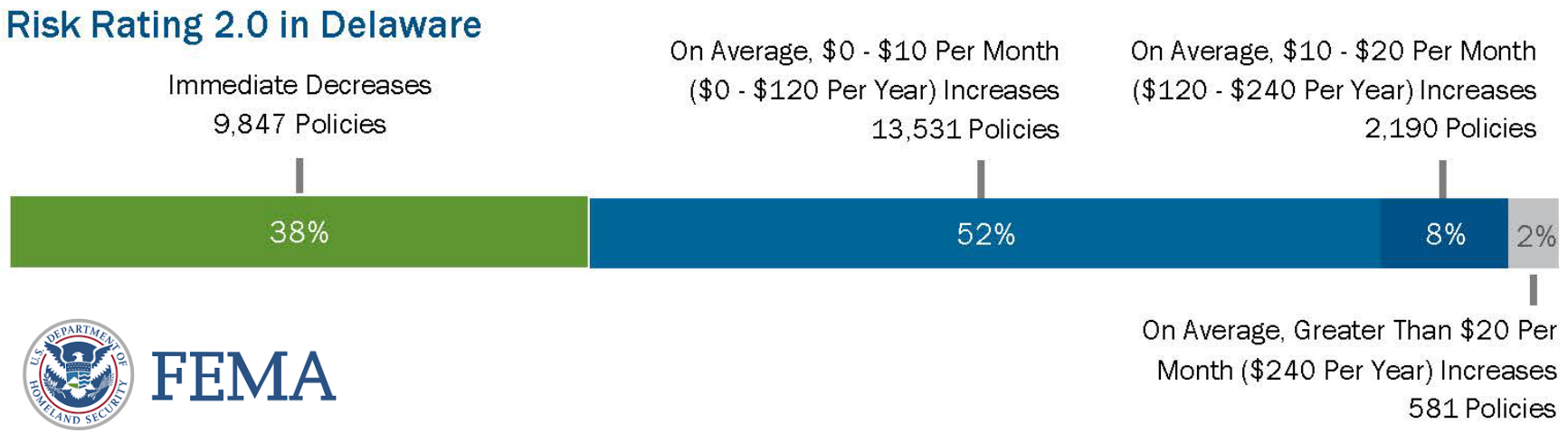
FIRMs and Elevations will no longer be used to calculate premiums.

Goal is that policies will represent an individual property's risk, not an average.

Risk Rating 2.0

- What does this mean for Delaware

NFIP Policies in Force in DE	Properties in DE Not Covered by NFIP Policy	Average NFIP Claim Payout in DE in the Past 10 Years	Average Individual Assistance Claim Payout in DE in the Past 10 Years
26,100	363,000	$11,700	$0



Risk Rating 2.0

- What does this mean for Lewes

Delaware

Average annual premium for single family homes in DE: $785.00

Table 1. Top 10 communities in Delaware that will see insurance price increases over $10/month.

			Number of Policies				
Rank	**Community**	**Zip Code**	**Total Policies**	**Increase $10+ per month**	**Increase $50+ per month**	**Decrease $10+ per month**	**Decrease $50+ per month**
1.	Bethany Beach	19930	5973	721	8	1114	497
2.	Rehoboth Beach	19971	3965	384	7	1230	349
3.	Selbyville	19975	2767	338	1	606	122
4.	Ocean View	19970	2560	215	0	537	81
5.	Lewes	19958	2038	194	1	602	151
6.	Fenwick Island	19944	1091	193	7	215	160
7.	Wilmington	19801	606	91	16	30	27
8.	Millsboro	19966	1016	84	0	317	72
9.	Dagsboro	19939	627	60	0	149	25
10.	Wilmington	19806	238	52	0	89	0

FEMA

Risk Rating 2.0

- What does this mean for Lewes

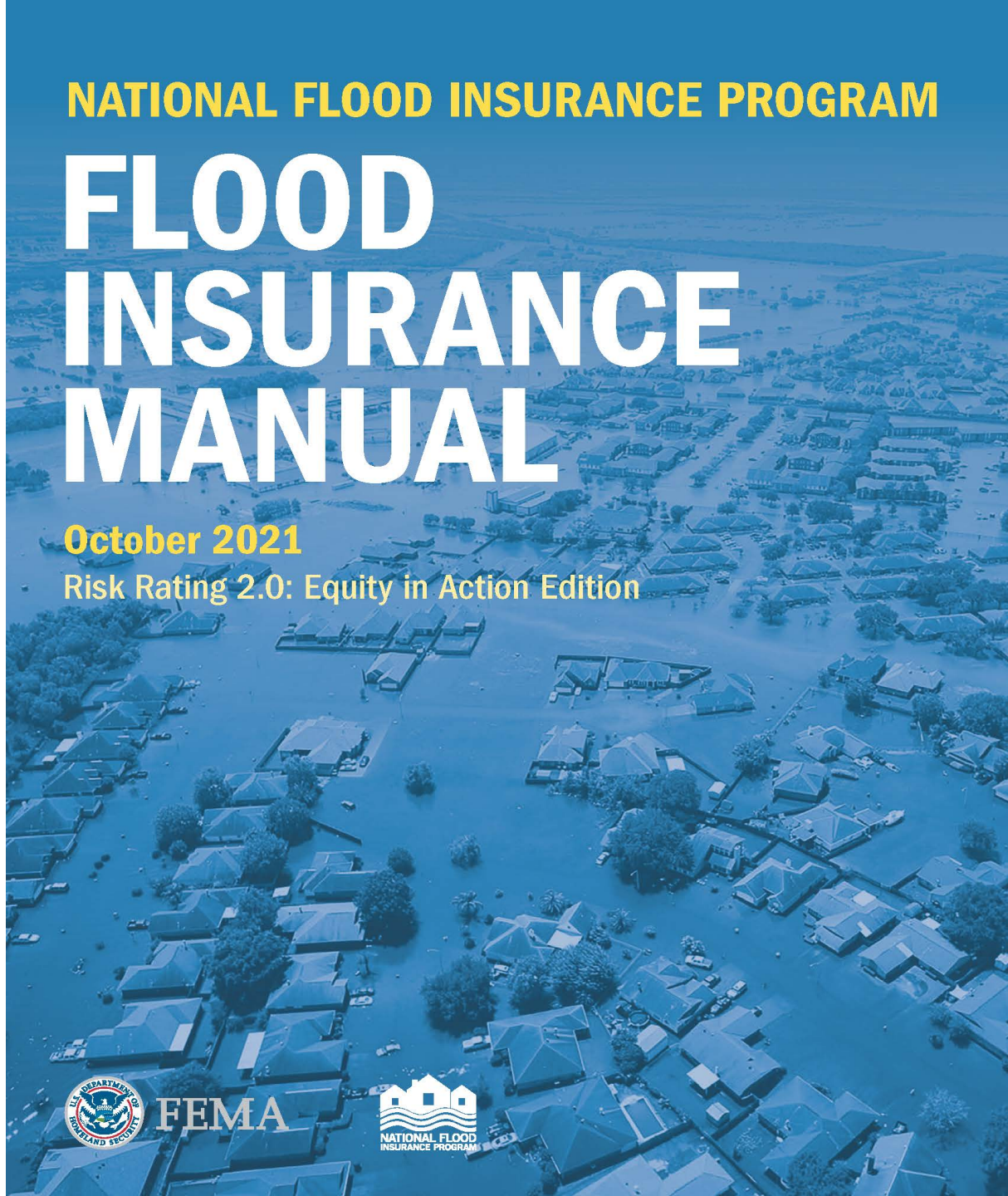
Table 2. Top 10 communities in Delaware that will see insurance price decreases.

			Number of Policies				
Rank	Community	Zip Code	Total Policies	Decreases	Decrease $50+ per month	Increase $10+ per month	Increase $50+ per month
1.	Bethany Beach	19930	5973	1906	497	721	8
2.	Rehoboth Beach	19971	3965	1695	349	384	7
3.	Lewes	19958	2038	1130	151	194	1
4.	Ocean View	19970	2560	1081	81	215	0
5.	Selbyville	19975	2767	952	122	338	1
6.	Millsboro	19966	1016	512	72	84	0
7.	Frankford	19945	463	288	28	11	0
8.	Dagsboro	19939	627	258	25	60	0
9.	Fenwick Island	19944	1091	232	160	193	7
10.	Millville	19967	253	209	1	721	8

FEMA

For More Information:

https://www.fema.gov/sites/default/files/documents/fema_nfip-flood-insurance-manual-sections-1-6_oct2021.pdf



Thankyou!

David Warga, CFM
State Floodplain Manager
DNREC
Shoreline and Waterway Mgmt.
david.warga@delaware.gov
302-739-9921

Appendix 7: National, State, and Local Roles in relation to Potential Sea Level Rise Mitigation Strategies

(DeCoursey: 09-28-21)

Regulate What?

National, State, and Local Roles

William (B.J.) DeCoursey
Institute for Public Administration
University of Delaware

9/28/2021

Introduction

City of Lewes
FIRST TOWN IN THE FIRST STATE

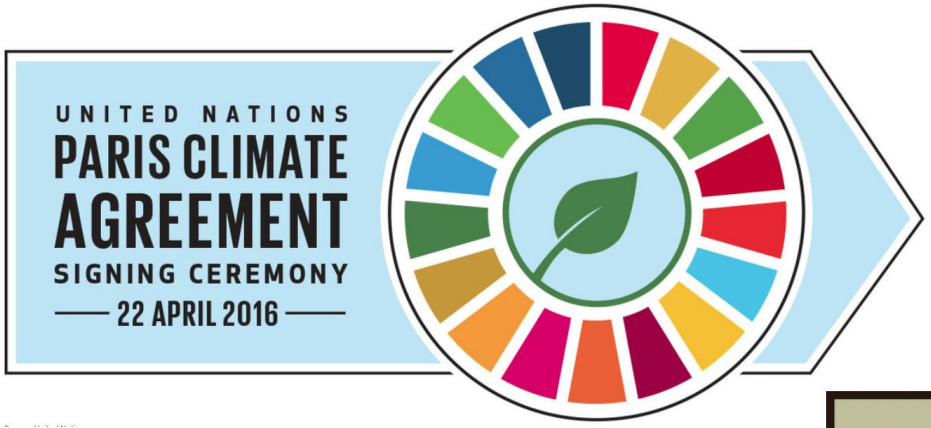
Who is in charge of what as it may relate to sea level rise?

Federal and international

Combatting climate change (fuel economy, GHGE, Transit, Highways, etc.)

- Shoreline protection and maintenance (WRDA 2000 & 2020) and the Army Corp
- NFIP standards (David Warga)
- Clean Water Act
- U.S. Army Corps Of Engineers projects
- Fuel economy standards
- Power grid and production
- Subsidies
- Greenhouse gas emission standards
- Transportation and infrastructure funding

Influence?



- Lobby/political activism
- Coordination with top-level state officials
- Continuous engagement with DNREC/DelDOT

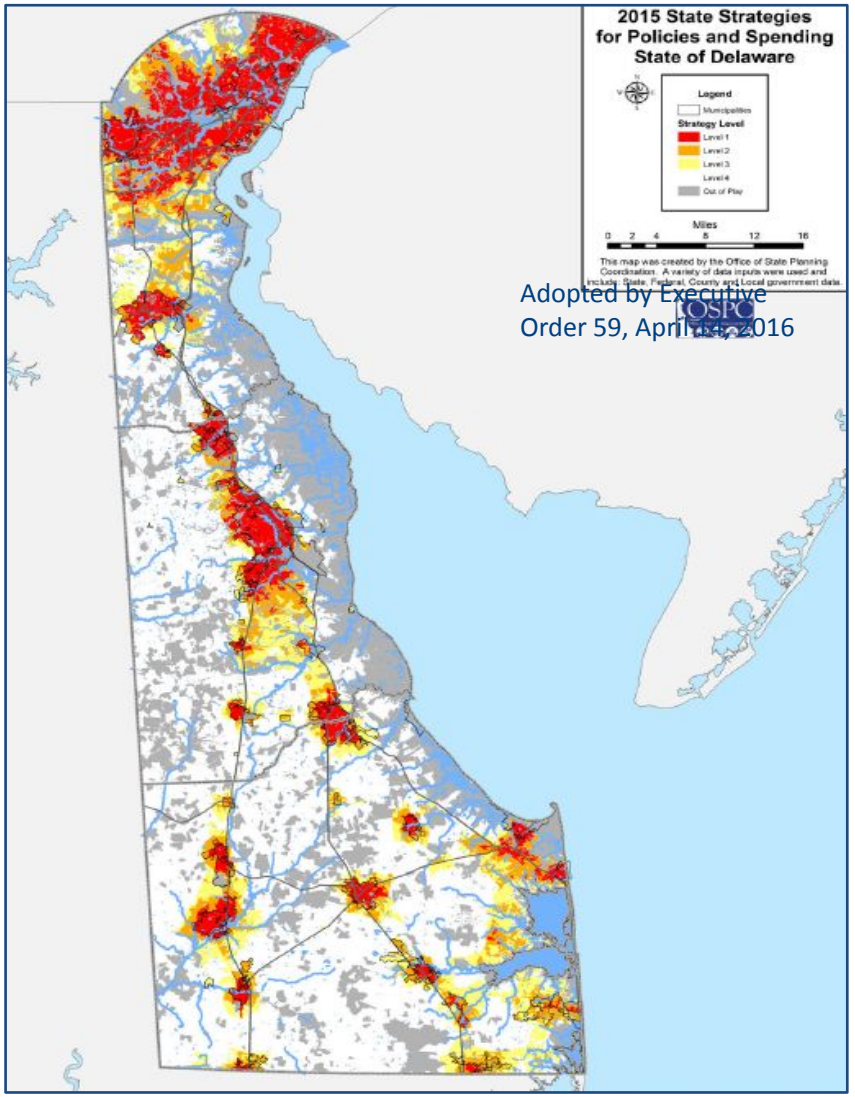
State of Delaware

State

- Protecting wetlands, floodplain, and sourcewater + agency oversight
  - Agency regulations and administrative policies (DNREC, DEMA, OSPC, SFMO, DelDOT….)
  - Plan and development review (PLUS)
  - Delaware Strategies for State Policies and Spending
  - Delaware Coastal Programs
  - Legislative requirements
    - 7 Del. Laws, c. 6082 – Sourcewater protection
    - 7 Del. Laws, c. 66 – Wetlands
    - 7 Del. Laws, c 70 – Coastal Zone Act
    - 7 Del. Laws, c 5101 – Stormwater and Sedimentation
    - 7 Del. Laws, c 4007 – Tie in to local stormwater regs.
      - Sussex Ch 90, Sediment Control and Stormwater Management (1991) requires Sussex Conservation District (SCD) approvals
      - Lewes BPW

State

- Classify State into areas based on degree of urbanization
- Guide State spending
- Do not trump local land use prerogatives; localities make own land use decisions as per Delaware law
- Must be considered in comprehensive plans
- History
  - 1999 adopted
  - Updated in 2004, 2011 & 2015
- Next Update: 2020 (ongoing)



Adopted by Executive Order 59, April 14, 2016

For additional information, log on to:
www.stateplanning.delaware.gov/strategies/

DNREC

Division of Climate, Coastal and Energy

Listen

The Division of Climate, Coastal and Energy uses an integrated approach of applied science, education, policy development, and incentives to address Delaware's climate, energy, and coastal challenges.

Mission and Goals

Clean Energy. Sustainable Coasts. Livable Climate.

Find the Information You Need

DELDOT

DEPARTMENT OF TRANSPORTATION

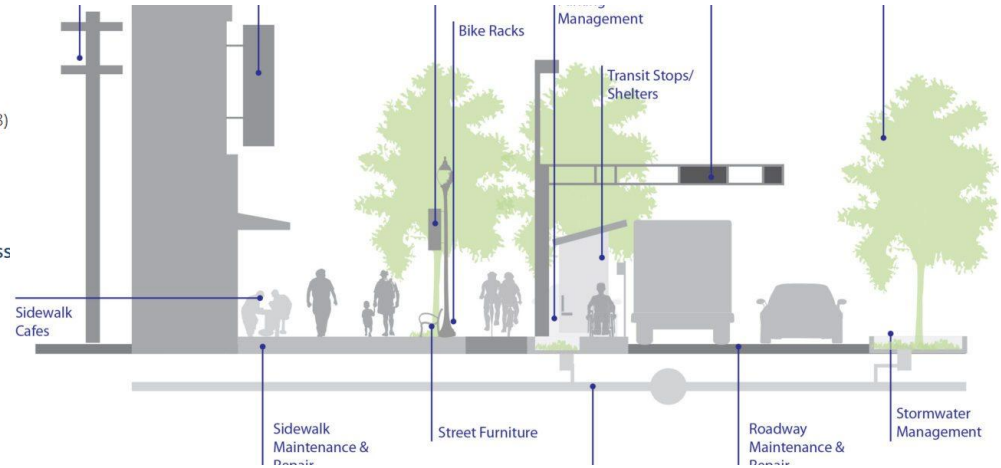
Division of Planning and Policy

Statutory Authority: 17 Delaware Code, Sections 131, 146 and 508 (17 **Del.C.** §§131, 146 & 508)
2 **DE Admin. Code** 2309

FINAL

ORDER

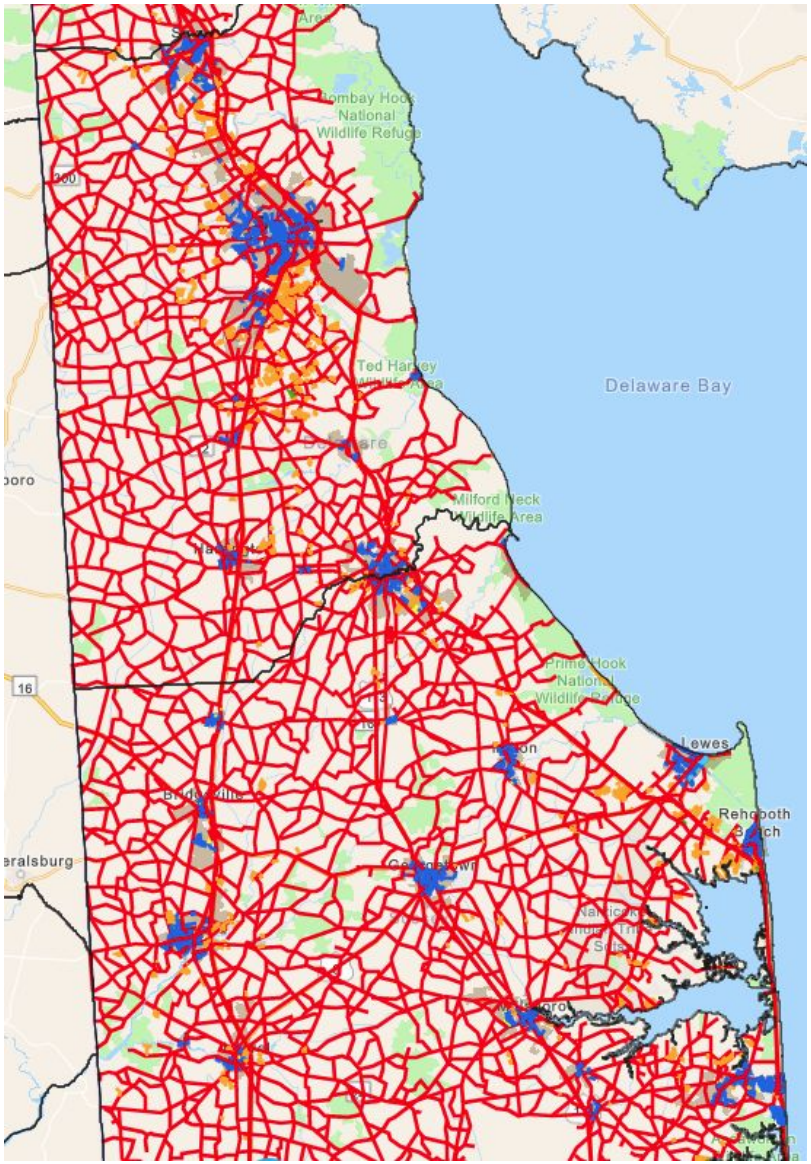
2309 Standards and Regulations for Subdivision Streets and State Highway Access



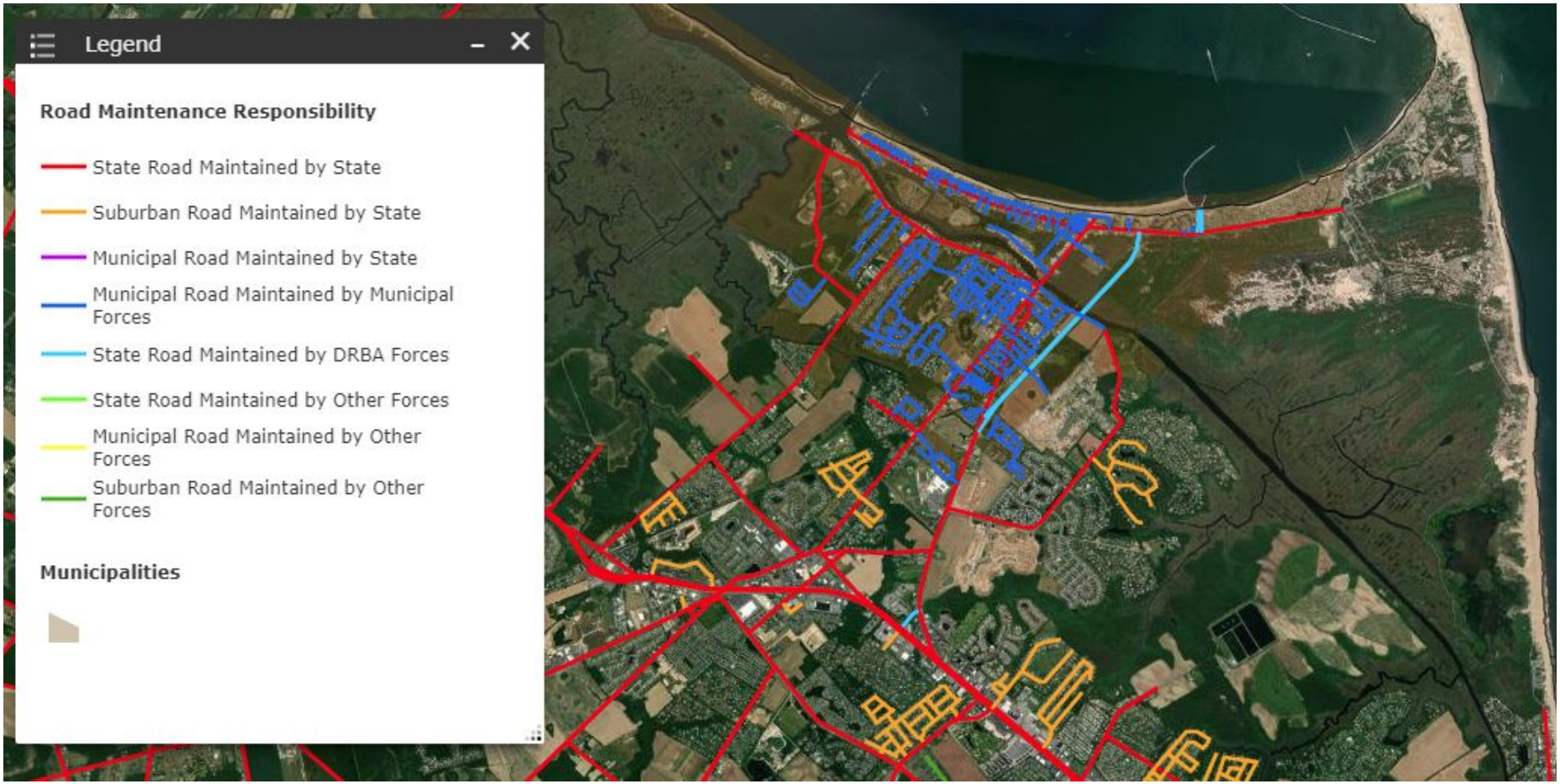
Streets

Currently, Delaware has **4689** centerline miles of roads, valued at over $5 billion, and the Delaware Department of Transportation is responsible for maintaining 89% of them. The national average of state-maintained roads is approximately 20%

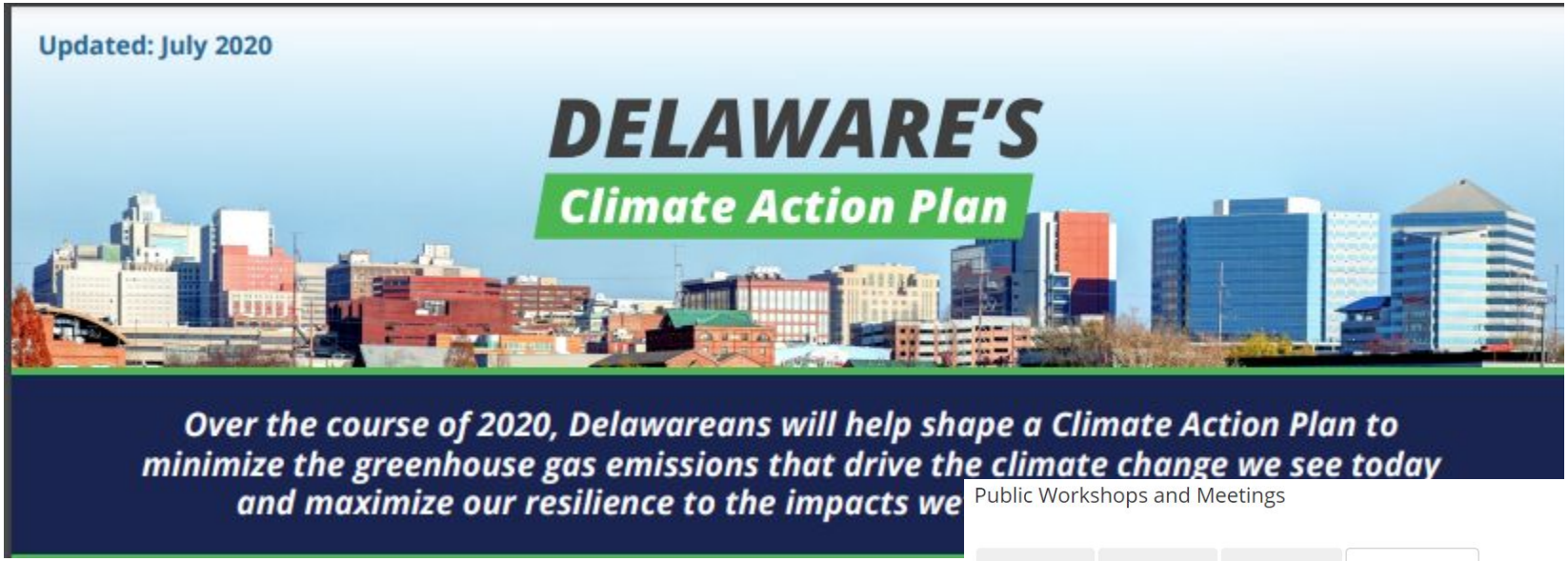
(2017)



STREETS


Legend
Road Maintenance Responsibility
State Road Maintained by State
Suburban Road Maintained by State
Municipal Road Maintained by State
Municipal Road Maintained by Municipal Forces
State Road Maintained by DRBA Forces
State Road Maintained by Other Forces
Municipal Road Maintained by Other Forces
Suburban Road Maintained by Other Forces
Municipalities

INFLUENCE?



Your Pathway to the Future

DELAWARE LEAGUE OF LOCAL GOVERNMENTS

Public Workshops and Meetings

Statewide | New Castle | Kent County | Sussex County

Public Workshop
Park Avenue Relocation Phase 2
Online Virtual Public Workshop: September 27 - October 26, 2021

When: 09/27/2021 04:00 PM - 09/27/2021 07:00 PM
Where: Virtual Only
Georgetown

Public Workshop
Baltimore and Wilmington Avenues Streetscape Concept
Open House with General Discussion - no form

When: 09/29/2021 09:00 AM - 09/29/2021 12:00 PM
Where: Rehoboth Beach Convention Center
229 Rehoboth Avenue
Rehoboth Beach

Public Meeting
Capital Transportation Program Meetings
Virtual Zoom meeting

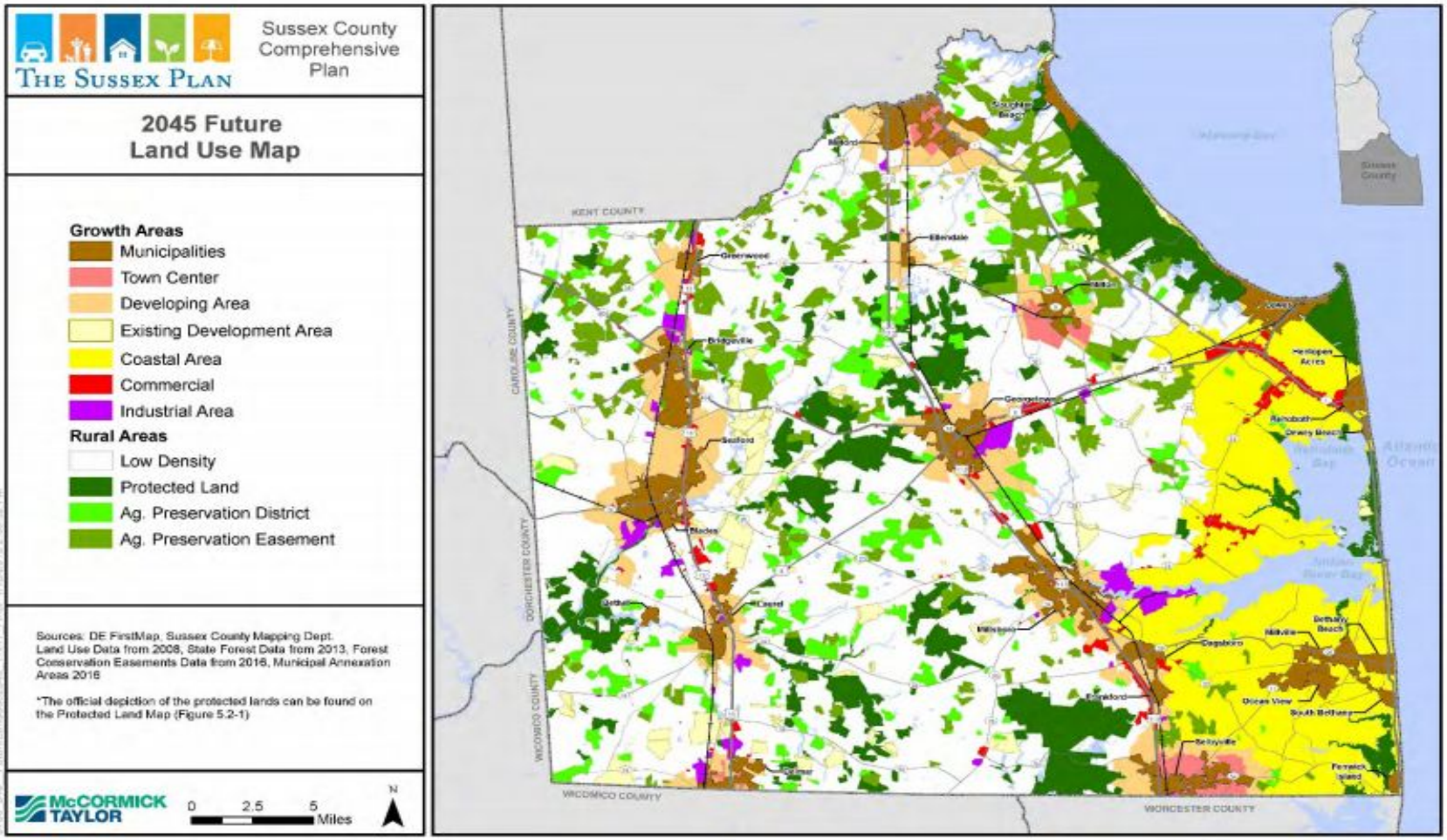
When: 09/29/2021 04:00 PM - 09/29/2021 06:00 PM
Where: Sussex County and Salisbury Wicomico MPO
Georgetown

Overview - Sussex

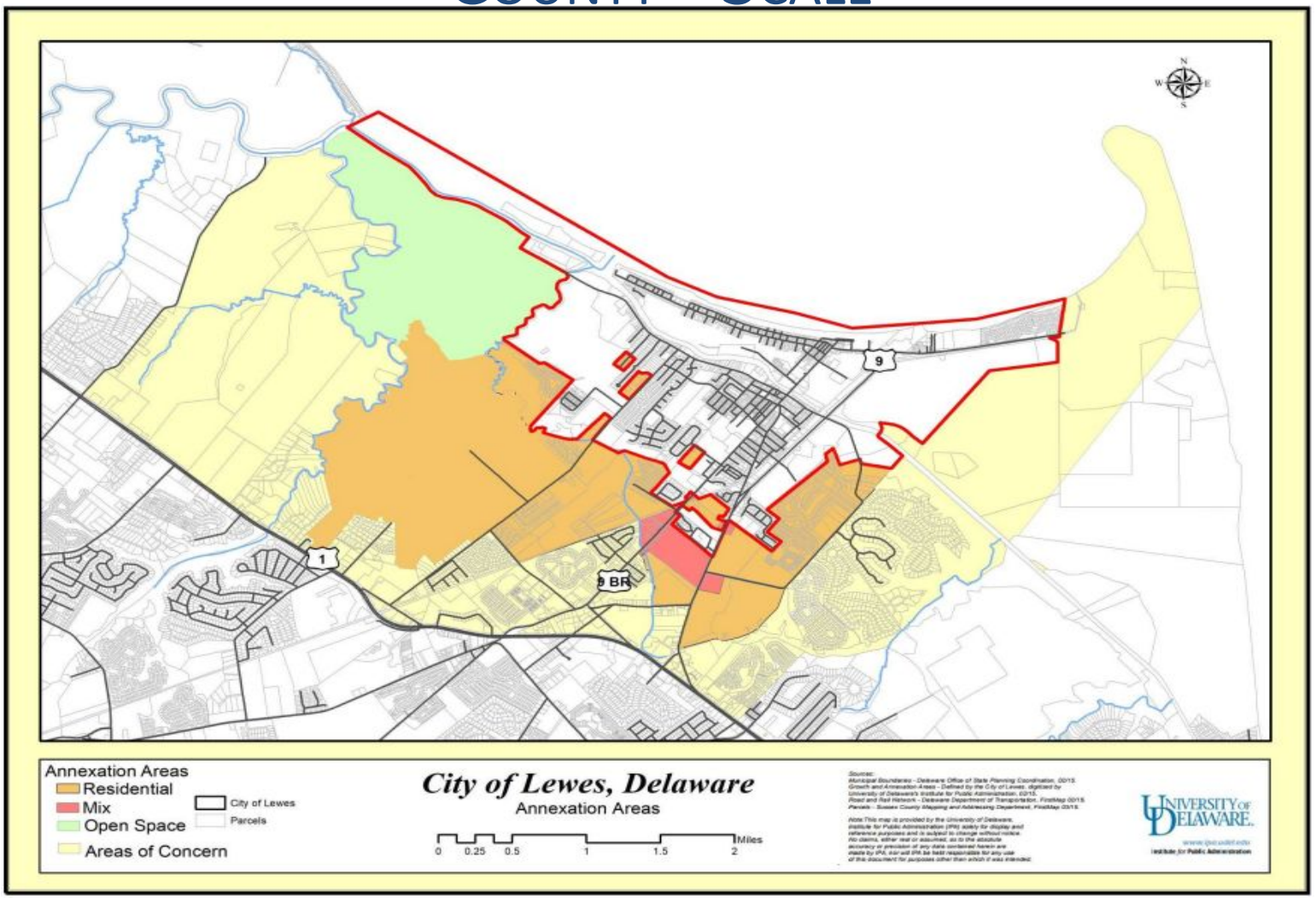
- Floodplain regs, stormwater programs, land-use control, building codes, wetlands, sourcewater (in unincorporated areas)
  - Ordinance No. 2384 (2015) – Consolidated previously scattered provisions into *Article XVIII, Flood Prone Districts,* and permits up to two additional feet of building height per foot of freeboard incorporated into a structure.
  - Ordinance No. 1979 (2008) – Sussex County's Sourcewater Protection Ordinance, adopted in accordance with 7 Del. C 60. Defines areas and protections for wellheads and excellent recharge areas. Impervious surface accepted up to 35%.
  - Chapter 90 Sediment Control and Stormwater Management (1991) – requires sediment control and stormwater plan approval by SCD prior to permitting.
  - *Sussex Conservation District (SCD) – tax ditches, sediment and stormwater administration, BMPs*
- *Land Use and Zoning and street standards*

County – Scale

Figure 4.5-1 Sussex County 2045 Future Land Use



County - Scale



Municipal Planning Overview

Local – Sensitive Areas

- Floodplain regs, stormwater programs, land-use control, building codes, wetlands(in incorporated areas)
- Building code (currently IEBC 2012)
- Floodplain delineation (FIRM as baseline); however, IEBC also allows for local designation of flood hazard area.
- Stormwater system design and function
- Stormwater regulations
  - 158-3 prohibits discharge to sanitary sewer
  - § 170-30 Stormwater management system.
- Buffers
- Sea level rise and resiliency

Sensitive Areas

City of Lewes, DE / Part II: General Legislation / Zoning

Article IX Environmental Protection Regulations

- ☐ § 197-72 **Purposes and applicability.**
- ☐ § 197-73 **Floodplains.**
- ☐ § 197-74 **Wetlands.**
- ☐ § 197-75 **Water resources protection areas; Source Water Protection Overlay.**
- ☐ § 197-76 **Drainage.**
- ☐ § 197-77 **Permanent stormwater management.**
- ☐ § 197-78 **Erosion and sediment control.**

☐ § 197-72 **Purposes and applicability.**

A. Purposes.

(1) Identify environmentally sensitive areas in the City.

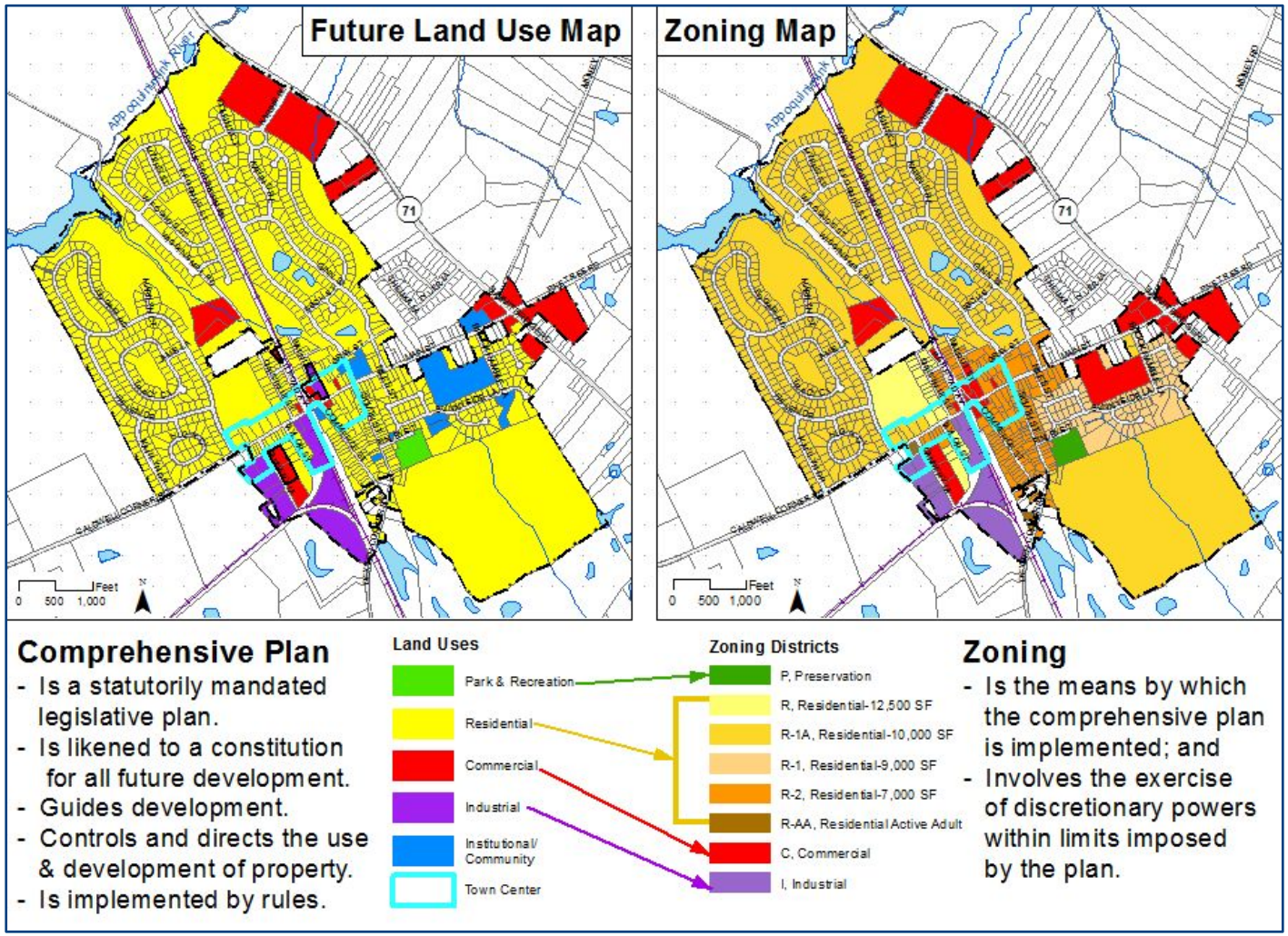
(2) Impose additional land development standards and practices in these environmentally s

B. Applicability: in all zoning districts of the City.

Local – All Areas

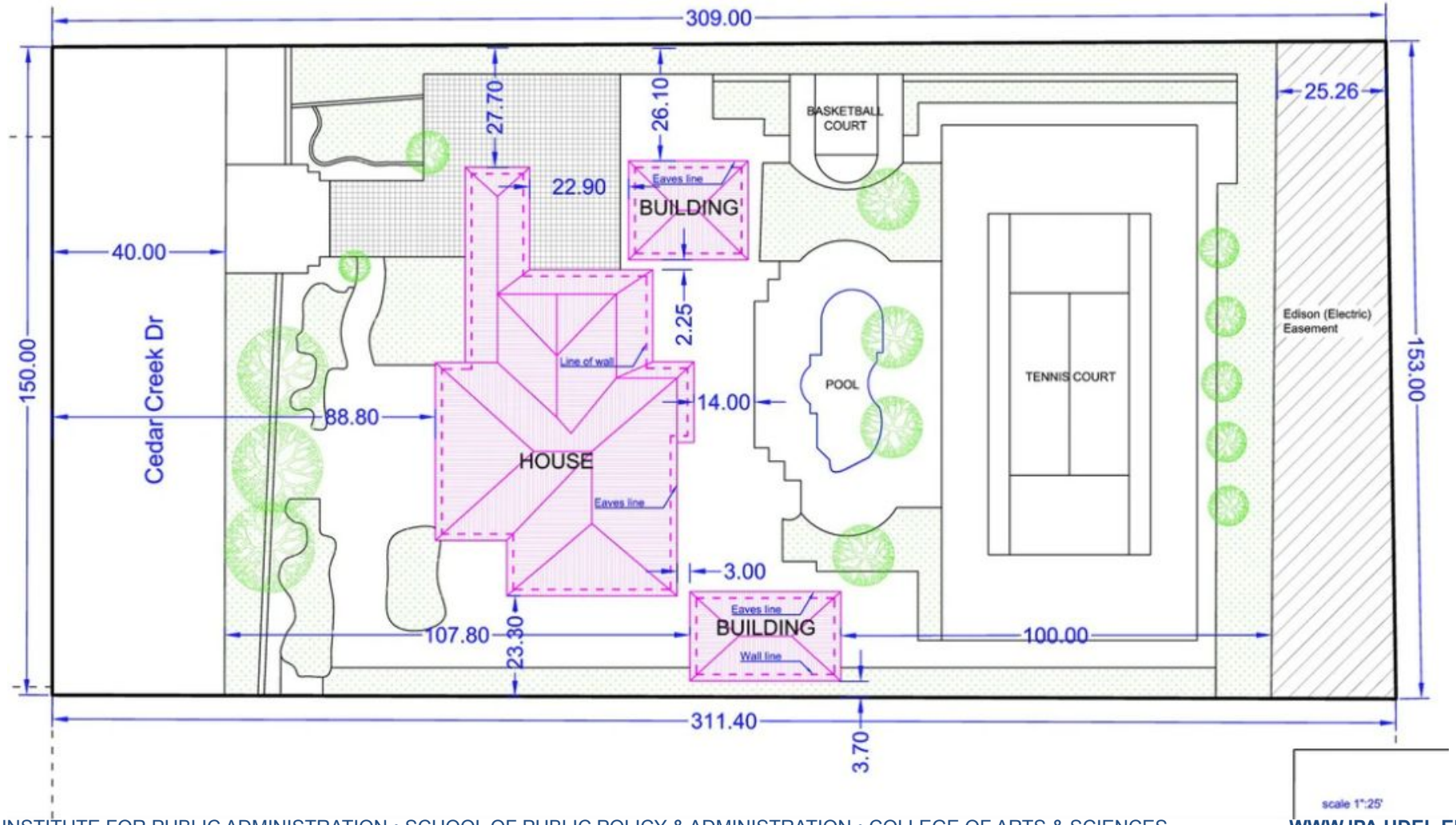
- Land Use Type (zoning)
- Dimensional characteristics
  - Street and subdivision standards (like Sussex, aligns w State)
  - Parking requirements
  - Side yards, setbacks, lot coverage
- Revenue, e.g. special assessment districts
- Annexation
  - To accept or pursue, or not… under what conditions?
- Public/Private initiatives and/or voluntary programs (much broader reach)
  - E.g., Grant funding for BMP's, homebuilder guides, expedited review

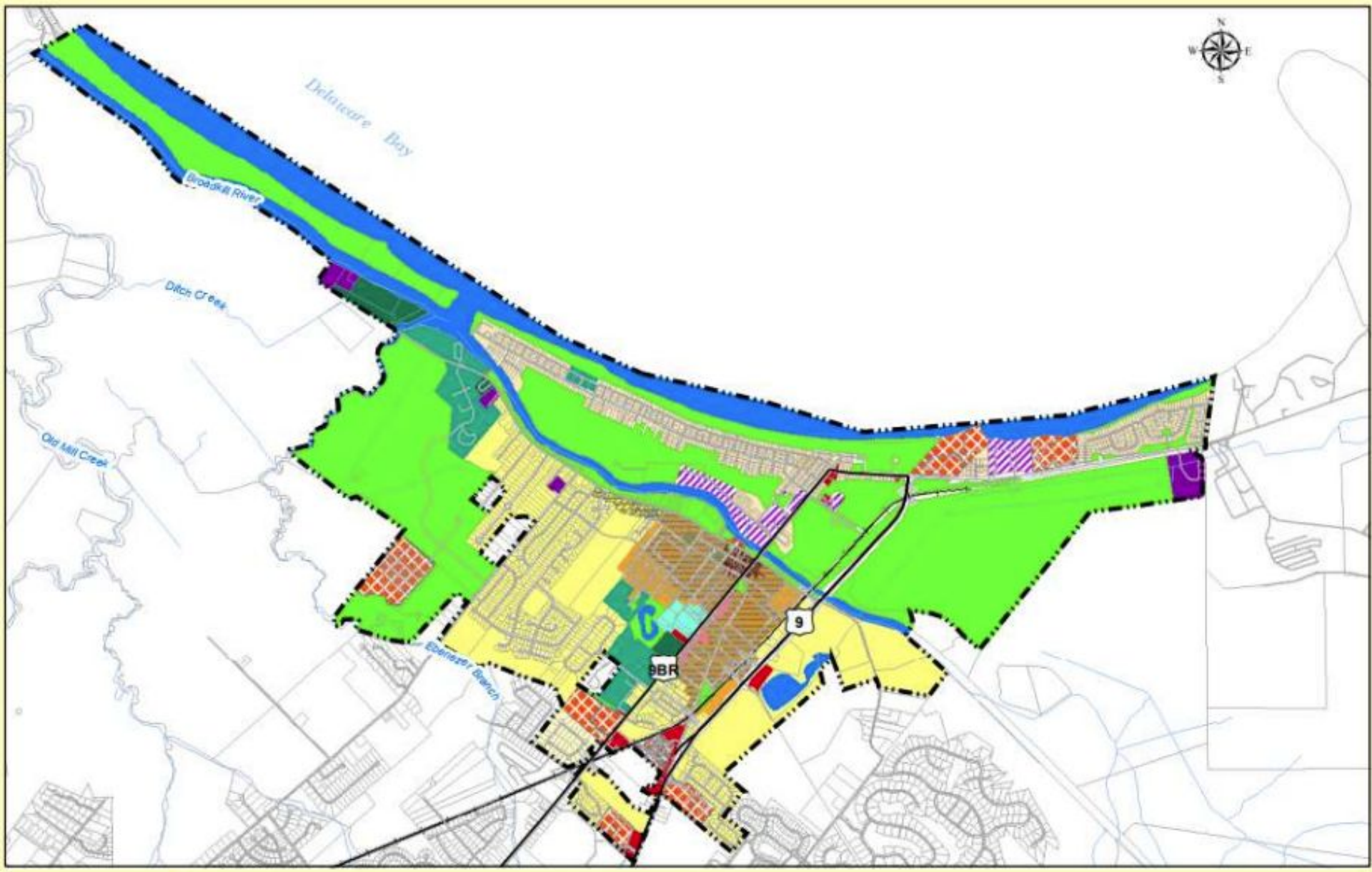
Land-Use & Zoning Link



***Friends of H. Fletcher Brown Mansion v. City of Wilmington*, 2013 WL 4436607 (Del. Super. Ct. July 26, 2013).**

Dimensional requirements





Zone2015
Open Space
Open Space (Water)
Suburban
Residential Low Density
Residential Low Density (Historic)
Residential Beach
Residential Beach (Historic)
Residential Medium Density
Residential Medium Density (Historic)
Mixed Residential
Limited Commercial (H)
Cultural/Historic
Community Facilities
Community Facilities (Educational)
Community Facilities (Health Care)
Town Center
Town Center (Historic)
Marine Commercial
General Commercial
Industrial
Municipalities
Major Routes
Parcel Boundaries
Centerline Roads
Railroads
Railroad Crossing
Rivers and Streams

City of Lewes, Delaware

Current Zoning

DRAFT - July 2015

0 0.125 0.25 0.5 0.75 1 Miles

Sources:
Municipal Boundaries - Delaware Office of State Planning Coordination, Finalday 2015.
Current Zoning - City of Lewes, Delaware 01/2015.
Road and Rail Network - Delaware Department of Transportation, Finalday 2015.
Parcels - Sussex County Mapping and Addressing Department, 2014.

Note:This map is provided by the University of Delaware, Institute for Public Administration (IPA) solely for display and reference purposes and is subject to change without notice. No claims, either real or assumed, as to the absolute accuracy or precision of any data contained herein are made by IPA, nor will IPA be held responsible for any use of this document for purposes other than which it was intended.

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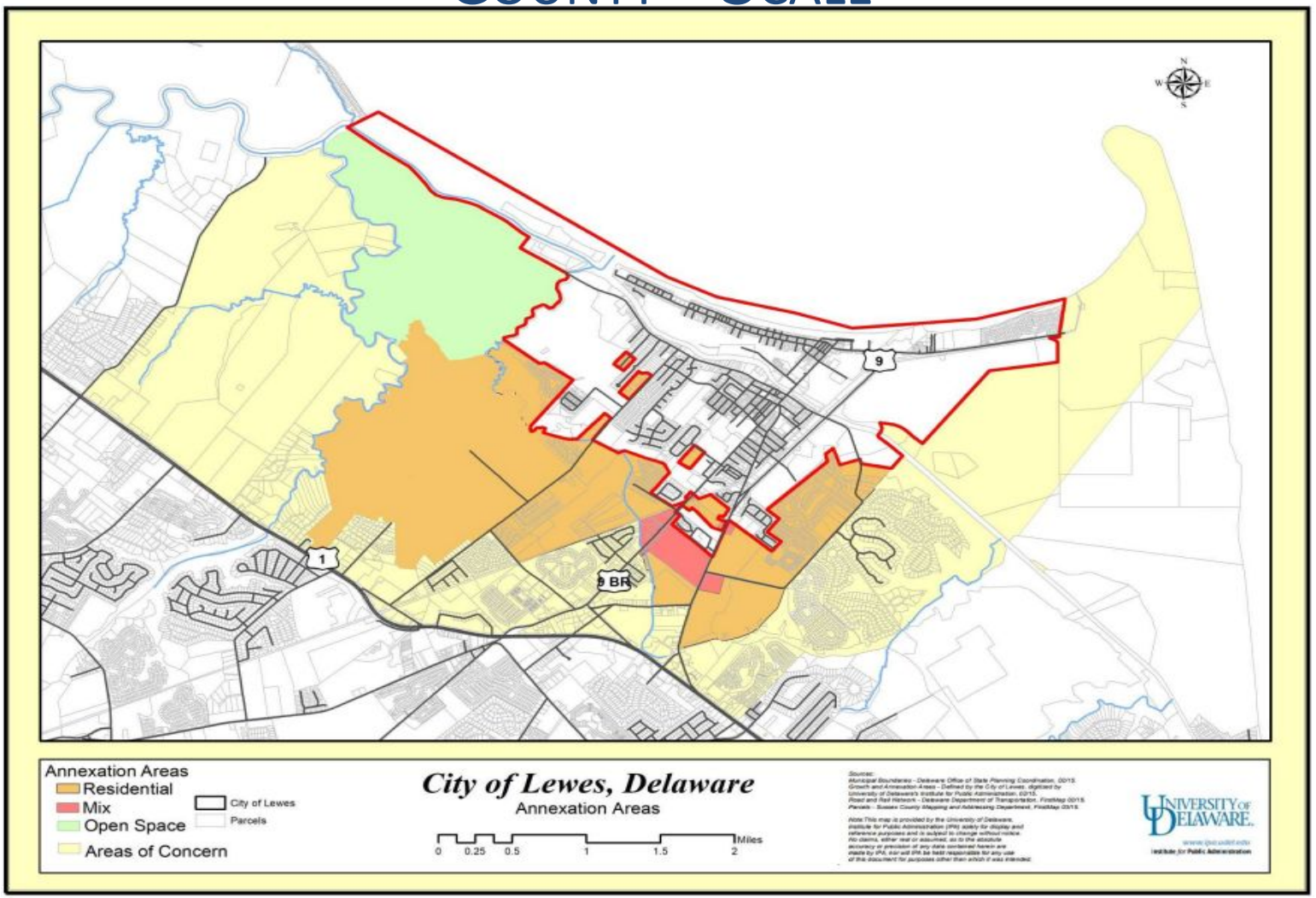
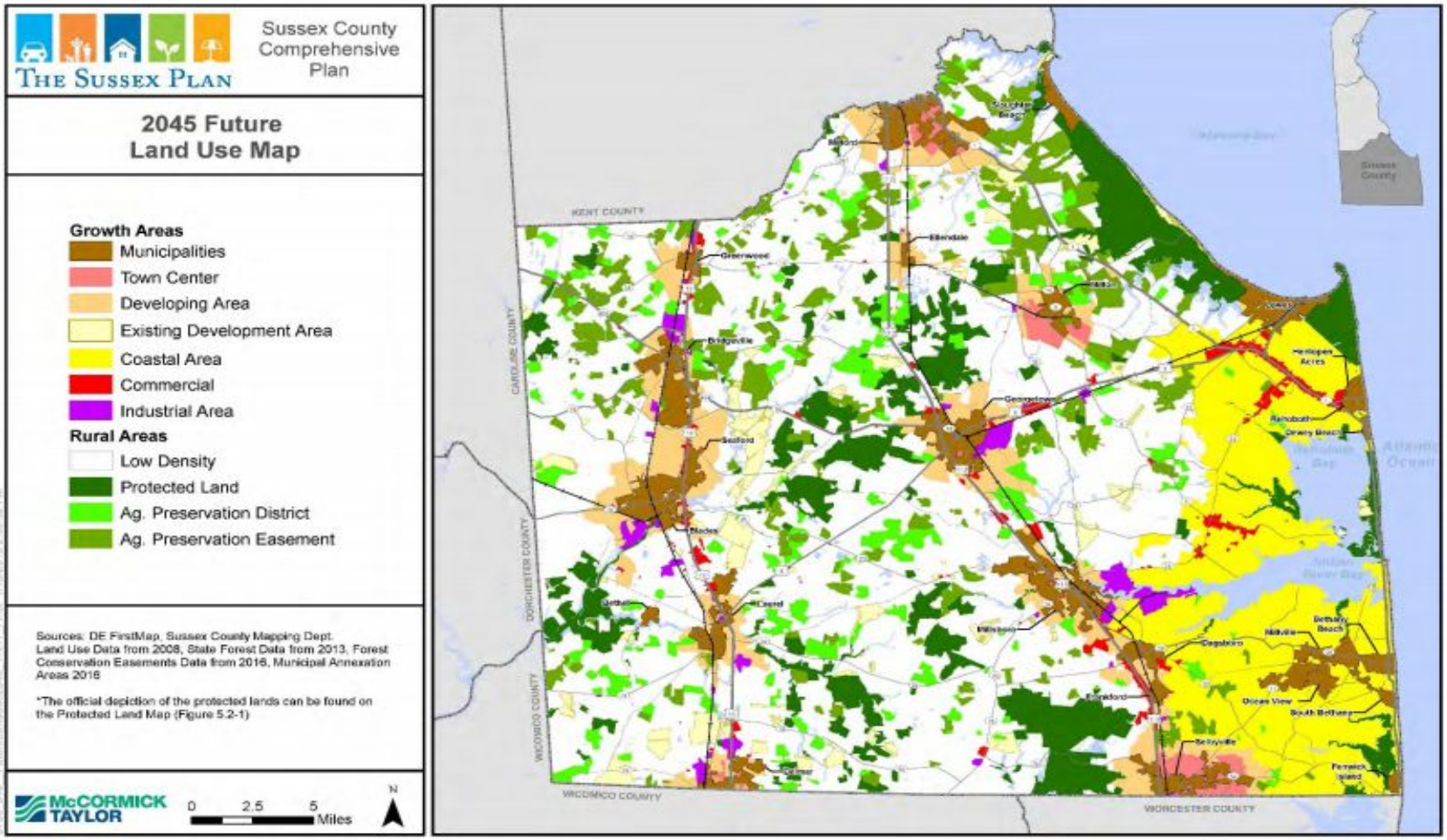
County - Scale



COUNTY – SCALE

Figure 4.5-1 Sussex County 2045 Future Land Use



SUMMARY- SO WHAT CAN LEWES CONTROL?

REGULATORY MEASURES

- Floodplain
- Wetland
- Buffers
- Building Code
- Land Use Type
- Dimensional Characteristics
- Annexation
- Review process

OTHER INNOVATIONS

- Revenue, e.g. special assessment districts
- Public/Private initiatives and/or voluntary programs
- ???

Summary

- Bright Line between Federal/State and County/Local
  - Land use is local
- National and state regulations may set standards (or minimums for funding/program participation), but municipalities may choose to exceed those standards
- Municipalities are not confined to exclusively regulatory approaches
- Room (and real need for) innovation

Appendix 8: City of Lewes Ordinance Review

(Cornwell: 10-12-21)

Local

- **§ 4007. Local sediment and stormwater programs.**
- (a) Pursuant to regulations promulgated by the Department, each conservation district, county, municipality or state agency may adopt, and submit to the Department for approval, 1 or more components of a sediment and stormwater program for the area within its jurisdiction.
- (b) Requests for delegation of program elements shall be submitted within 6 months of the promulgation of state regulations, and by January 1 of subsequent years if delegation is desired at a future date. The Secretary shall grant or deny such a request on or before April 1 of the year for which delegation is sought.
- (c) Delegation, once applied for, shall become effective on July 1 and shall not exceed 5 years, at which time delegation renewal is required.
- (d) A district, county, municipality or state agency may develop the program in cooperation with any other governmental subdivisions.
- (e) Initial consideration regarding delegation of program elements shall be given to the conservation districts, since the conservation districts, having unique capabilities and areawide responsibilities, are in an ideal position to coordinate and implement local sediment and stormwater programs.
- 61 Del. Laws, c. 522, § 1; 67 Del. Laws, c. 234, § 1; 81 Del. Laws, c. 316, § 4;

The City of Lewes

What the City is Doing

October 12, 2021

Examples of What the City is Doing

- Member of ACT – Association of Coastal Towns
- Collaborated with ACT on AECOM and KCI reports
  - Reports looked at BMP's that City's and Towns could implement
- Mitigation Planning Team
- Subdivision Code Subcommittee
- Annexation Zone Subcommittee
- Floodplain Subcommittee
- Pervious streets – where feasible
- Wetlands Buffer Ordinance – recently adopted
- Beach Parking Committee

The City of Lewes

City of Lewes - Ordinances Review

October 12, 2021

Overview of City of Lewes Codes

- An overview of current codes
- Starting point for any changes
- Environmental Codes, Subdivision and Land Development Code and Dimensional Requirements

Environmental Codes

- Floodplain
- Wetlands – recently adopted
- Source Water Protection Overlay – being addressed outside of committee
- Drainage - being updated with subdivision and land development code
- Stormwater Management – in roads (BPW regulations)
- Erosion and Sediment Control – jurisdiction is Sussex Conservation District (SCD)
- Open Space within new residential developments
- Landscaping

Floodplain

- Floodplain
  - The regulations on how to build within the floodplain.
  - Required to participate in NFIP
    - FEMA provides the minimum standards for the code
    - City code may be more restrictive then FEMA.
      - Items can affect CRS rating
    - Substantial damage – cumulative 10 year building permit timeframe
    - Substantial improvement – cumulative 10 year building permit timeframe
    - Freeboard - 18 inches

Wetlands

- Wetlands
  - Shall be shown on development plans
  - Limited activities within wetlands
    - Ex. roads, utilities, floating dock/boardwalk
      - Requires DNREC permit
  - Buffer requirement – adopted October 2020
    - The City has not had an application submitted needing the buffer.
    - Only applies to major subdivisions

Wetlands cont.

Wetlands buffer regulations

- 50 foot buffer from the edge of delineated wetland
- Within the 50 feet buffer has 2 distinct zones:
  - Zone A: 20 feet immediately adjacent to the wetland
  - Zone B: 30 feet beyond zone A
  - Buffer width averaging is permitted
- Permitted activities vary by buffer zone
  - Ex. docks, boardwalks, SWM, and trails. (i.e., no buildings)
- Neither wetland nor buffer may be on an individual private lot.

Figure 1- Wetlands Buffer Zones Ex. NTS

Drainage

- New residential houses require positive drainage
- Standards allow for discharge into the streets
- Proposal – Subdivision Code Subcommittee is proposing an individual lot drainage plan for new construction.

Stormwater Management

- Stormwater management in the Code is for Lewes BPW assets
  - Review for pipe specifications/slope
  - No review for ponds and management facilities.

Open Space and Landscaping Codes

- Open Space
  - Subdivisions are required to provide open space
    - 10% is required for a standard subdivision
    - Cluster development has a corridor buffer along certain streets.
      - Open space percentage has a range of 20% to 50% depending on the type of development.
- Landscaping
  - Street trees are required for residential developments.
  - Landscape buffers are required along certain roads and along agricultural areas.

Subdivision Codes

- Streets
  - Current street width is 32 ft. to 44 ft.
    - Waivers are required to go to 24 ft.
  - Road construction specifications do not allow for permeable/porous material
    - Subdivision Code Subcommittee is working on updating the code to reduce the street width and allow for permeable/porous material

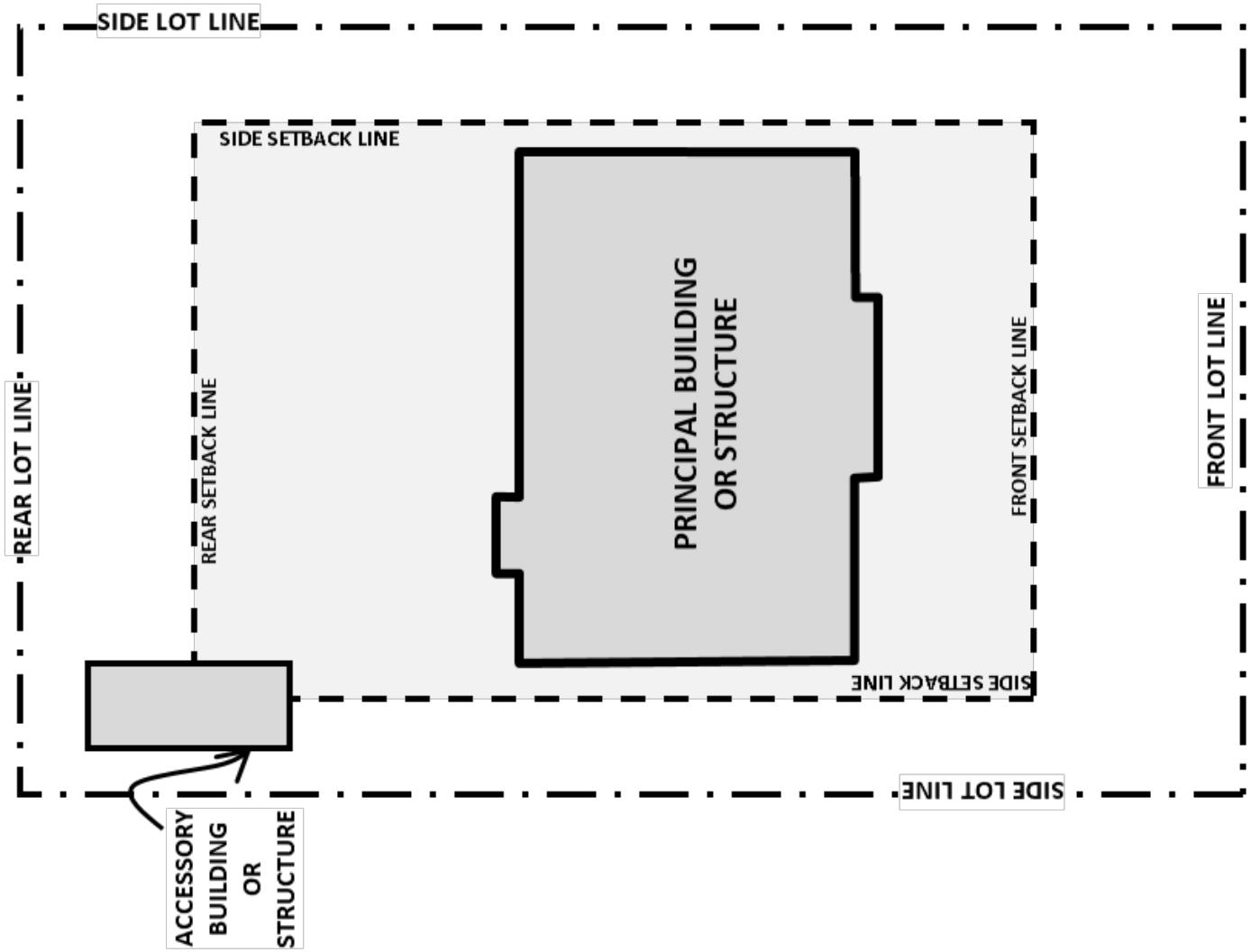
Stormwater Utility

- BPW manages a stormwater utility
- Typically they are based on impervious coverage
- Flat rate fee based on water meter.
  - $5 a month for residential per water meter
  - $10 a month for commercial per water meter
  - $20 a month for industrial/large use per water meter

Dimensional Requirements

- Setbacks – front yard, side yard, and rear yard
- Building Height
- Lot coverage/Impervious surface

Dimensional requirements



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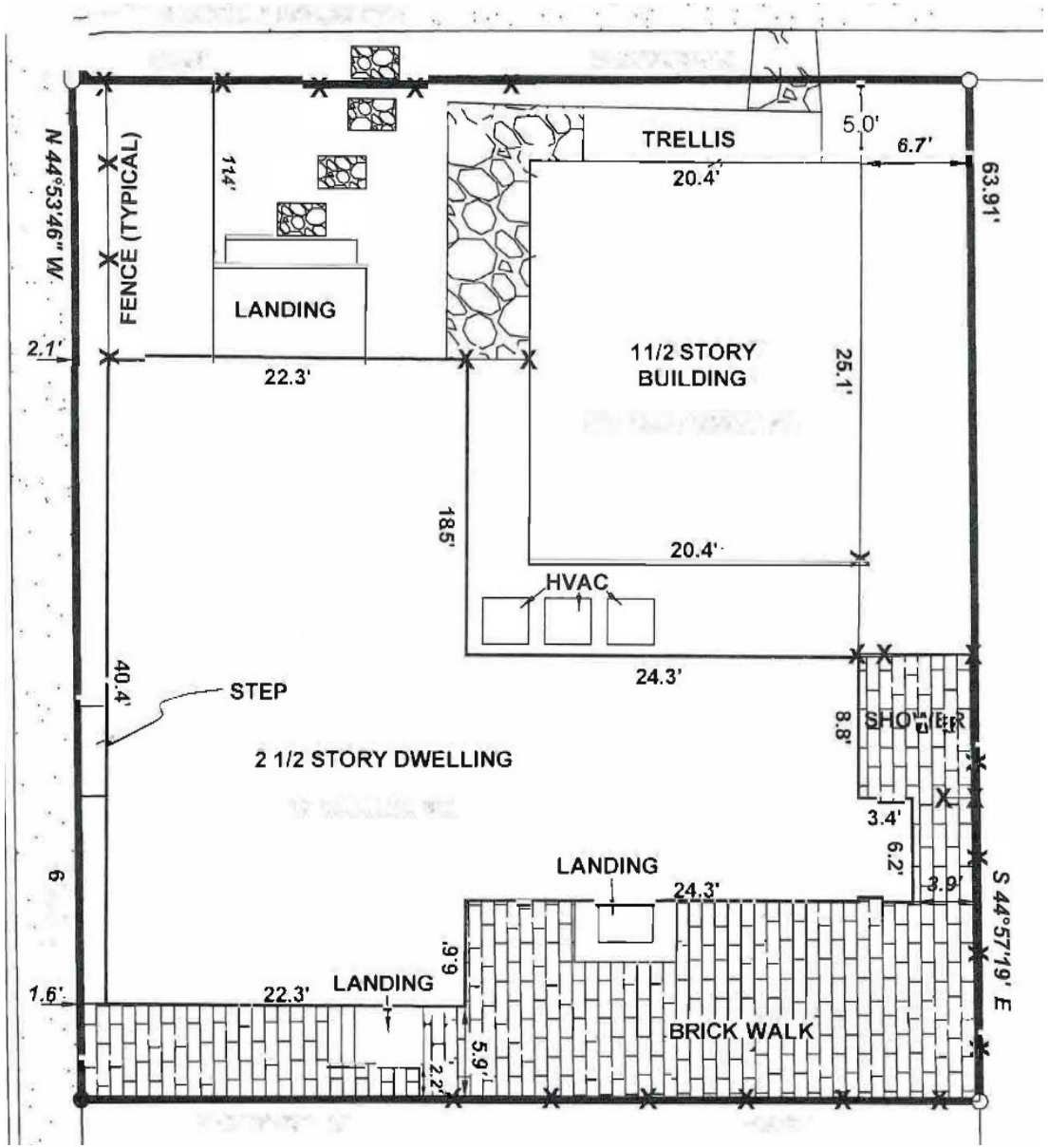

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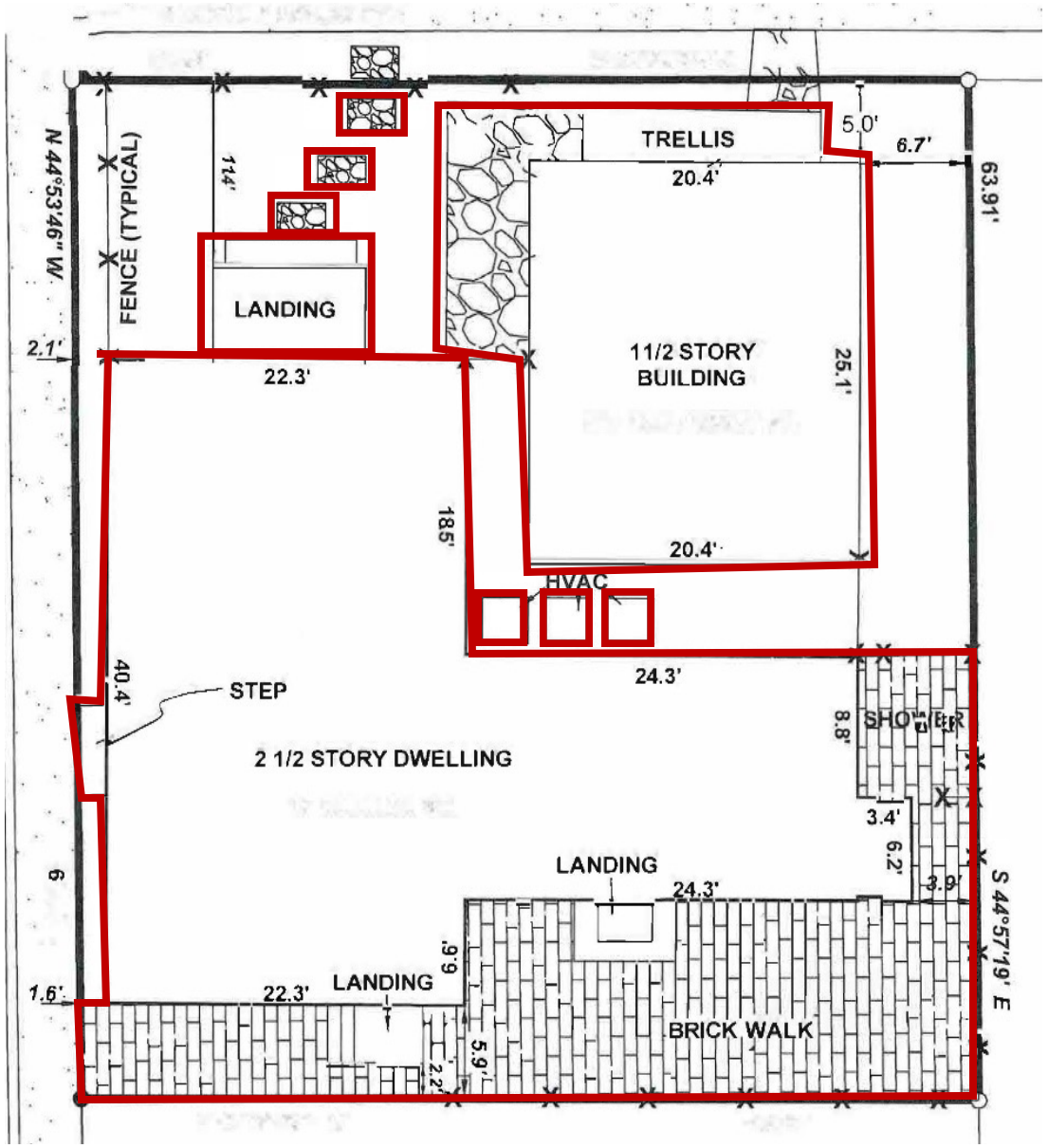

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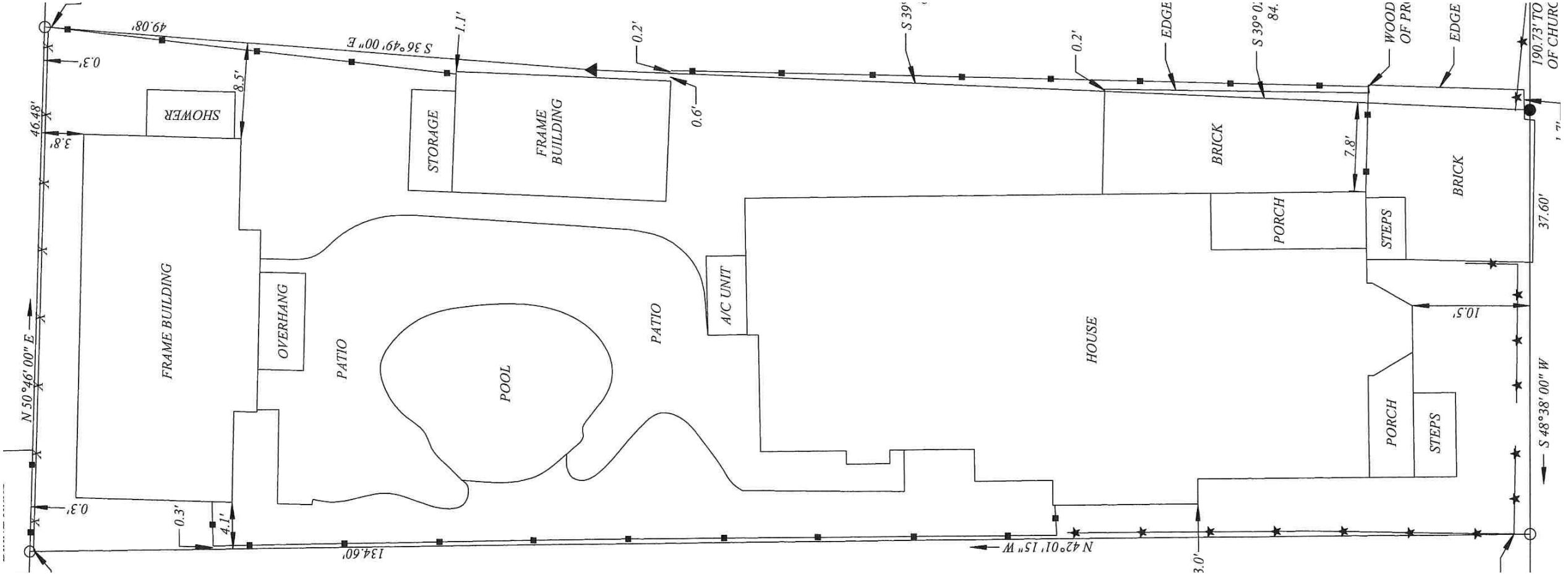

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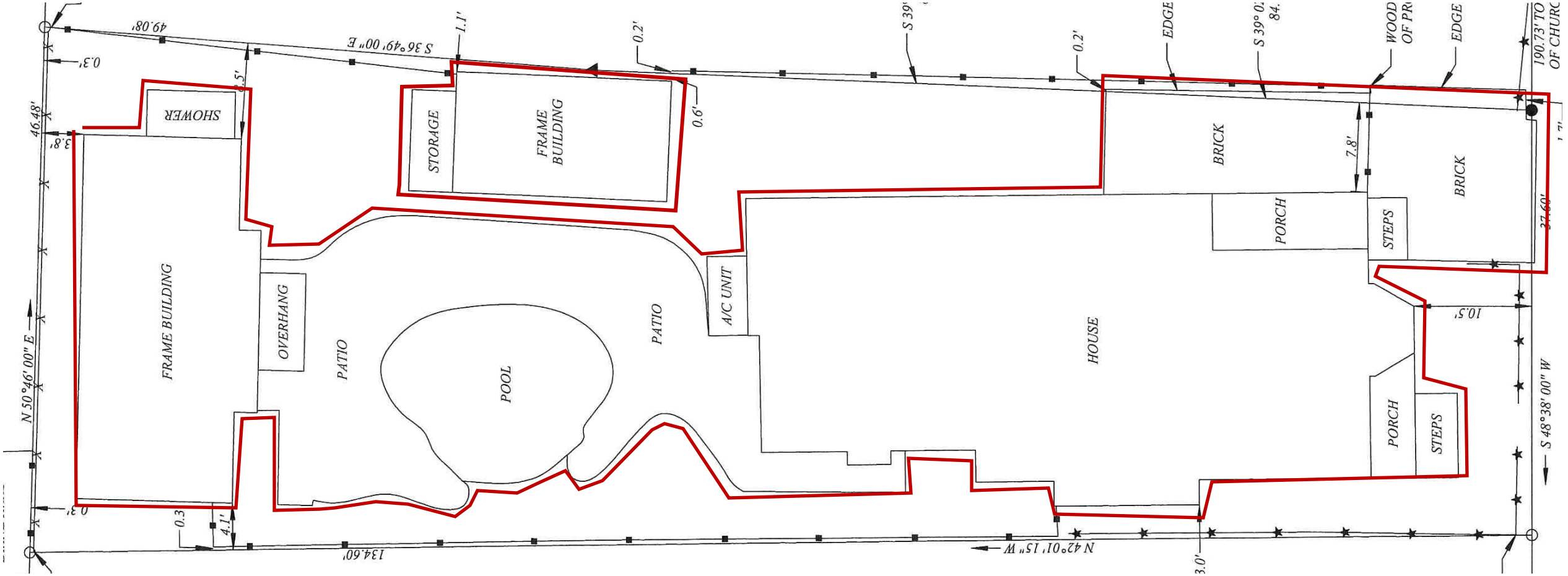

Dimensional requirements

Zoning Code	OS	R-1	R-2 and R-2(H)	R-3 and R-3(H)	R-4 and R-4(H)	
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Dwelling Unit Type	All Structures	All Structures	All Structures	All Structures	Dwelling, Detached	Dwelling, Two-Family
Setbacks (feet)						
Front yard	N/A	35	30 or EBL	25 or EBL	Minimum: EBL Maximum: EBL + 10 No EBL: 15	20
Side yard	N/A	15	8	8	8	10
Rear yard	N/A	25	15	15	15	15
Maximum building height (feet)						
FEMA flood zones AE and VE	N/A	34	34 or EBH	34 or EBH	34 or EBH	34
All other locations	N/A	30.5	30.5 or EBH	34 or EBH	30.5 or EBH	30.5
Maximum number of stories	N/A	3		3	3	3
Maximum lot coverage	N/A	60%	65%	65%	65%	60%
Main structure (up to)	N/A	50%	50%	50%	50%	50%

NOTES:

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Tract standards						
Tract area (square feet)	N/A	None	None	None	None	6,000
Street frontage (feet)	N/A	100	75	50	Burton Sub: 40 All others: 50	50
Lot standards						
Lot area (square feet)	N/A	20,000	10,000	5,000	Burton Sub: 4,000 All others: 5,000	6,000
Square feet per dwelling unit	N/A	20,000	10,000	5,000	Burton Sub: 4,000 All others: 5,000	3,000
Lot width (feet)	Along both Canal and street parallel to Canal: 75	100	75	50	Burton Sub: 40 All others: 50	
Lot depth (feet)	N/A	150	100	75	75	75

Dimensional requirements

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Questions?

Appendix 9: Overview of Best Practices in relation to Sea Level Rise and Flooding

(Reitz: 10-12-21)

What are Best Practices from Other Communities: SLR and Flooding Issues

An Overview of Regulations

October 12, 2021

Presented by: Jennifer Reitz, AICP

Principal Planner, IPA

UNIVERSITY OF DELAWARE

Overview

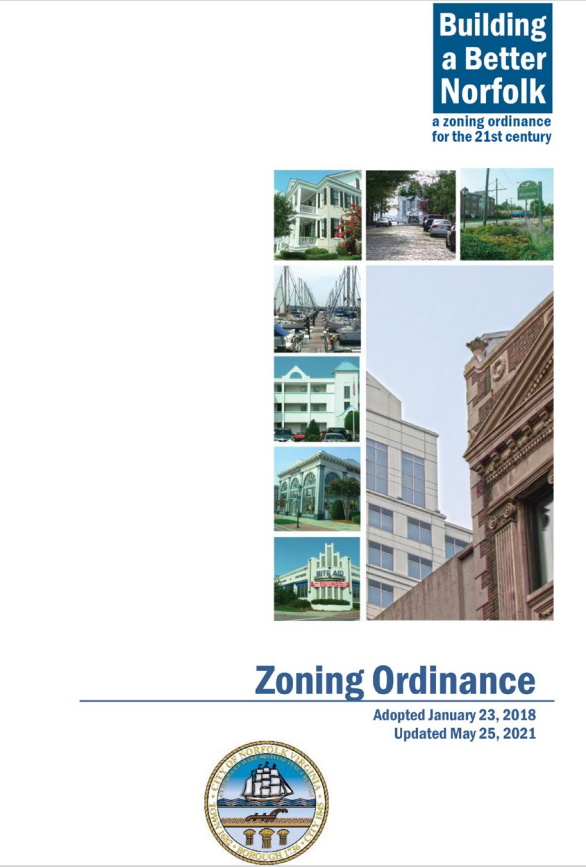
- Overview of Norfolk, VA's Zoning Ordinance
- Other communities with similar regulations
- Subdivision and Land Development Ordinance provisions
- Funding mechanisms
- Other considerations

Building a Better Norfolk:
A Zoning Ordinance for the 21st Century

- Adopted in 2018, the City of Norfolk's Zoning Ordinance is considered the current gold standard.

Key Strategies:

- *Floodplain Ordinance*
- *Resilience Quotient System*
- *Complimentary Overlay Districts:*
  - *Coastal Resilience Overlay (CRO) District*
  - *Upland Resilience Overlay (URO) District*



Norfolk Zoning Summary

Floodplain Ordinance provisions include:

- **100-year floodplain:** Requires 3 foot of freeboard
- **500-year floodplain:** Requires freeboard or floodproofing to 1.5 feet above the highest finished grade adjacent to the structure
- Incorporates **cumulative** substantial damage/repetitive loss, and substantial improvement
- **V zone regulations** are applied to the Coastal A Zone

Norfolk Zoning Summary

Resilience Quotient System - developers earn points for adopting different resilient measures that promote *flood risk reduction, stormwater management, and energy resilience*.

- Quotient applies to **all new development**, with limited exemptions
- Developments are required to meet different resilience point values based on the development type (e.g., residential, non-residential, mixed-use) and development size, unless the developer opts to meet specified standards for elevation and drainage.

TABLE 5.12.6: RESILIENT POINT SYSTEM FOR RESIDENTIAL DEVELOPMENT	
Resilient Development Activity	**Points Earned**
Component 1: Risk Reduction	
Construct building to meet 110-mile wind load design requirements of the VUSBC	2.00
Elevate the ground story finished floor and all significant electrical and mechanical equipment no less than 3 feet above highest adjacent grade	1.00, plus 0.50 per ft. above 3 ft.
Construct an impact-resistant (hail, tree damage) roof	0.50
Install impact (hurricane or wind) resistant windows	0.50
Install operable storm shutters	0.50
Establish operating procedures for how the project will handle loss of off-site or grid power, transition to a backup source of power, and transition back to normal operation	0.50
Component 2: Stormwater Management	
Install a green roof on at least 50 percent of the total roof area (25 percent for renovated buildings) and only plant materials permitted in Section 5.2, Landscaping Standards	2.00
Install a green roof on at least 25 percent of the total roof area and only plant materials permitted in Section 5.2, Landscaping Standards	1.00
Provide rain gardens, street-side swales, soil and turf management or other appropriate storm water infiltration system(s) to capture and infiltrate a minimum of 25 percent of site-generated stormwater	1.00

Norfolk Zoning Summary

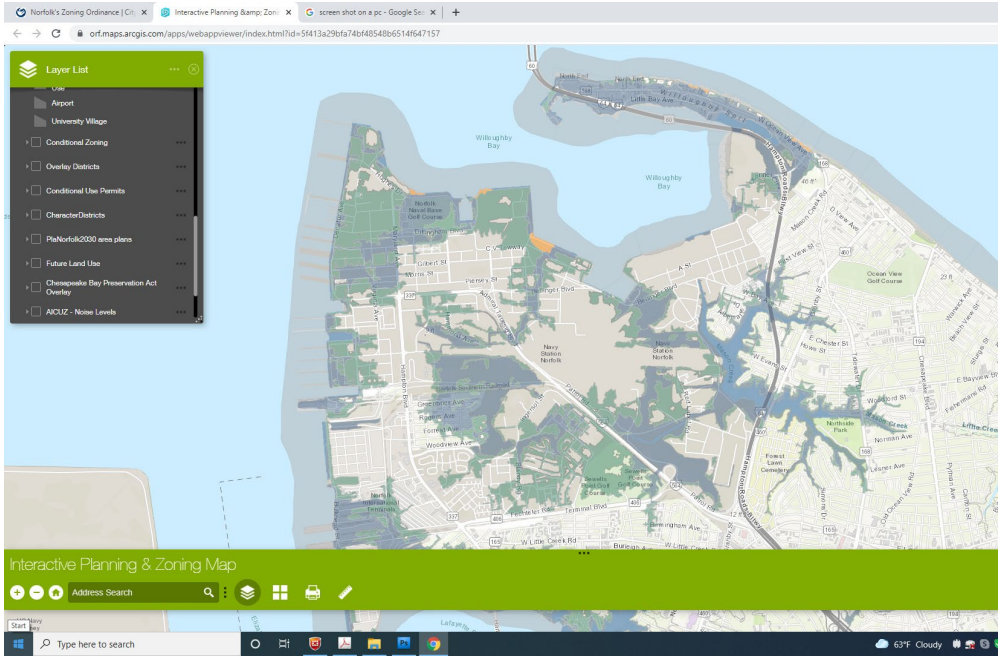
Key Strategies:

Coastal Resilience Overlay (CRO) District

Requires permeable surfaces for all new parking spaces. ** Onsite stormwater infiltration and storage requirements ** Requires salt tolerant plant species

Upland Resilience Overlay (URO) District

applied to areas outside of flood hazard zones ** Targets redevelopment to create transit-oriented, walkable, and bikeable neighborhoods ** Allowance of development rights to be transferred to the URO



Who else uses these types of regulations?

Regulation	Municipalities where it is currently used
3-foot freeboard	Baltimore; Ocean City, MD; Oxford, MD; Henlopen Acres, DE; Poquoson, VA; York County, VA;
2-foot freeboard	Cecil and Dorcester Counties, MD; Annapolis, MD; Virginia Beach and Newport News, VA, Chincoteague, Roanoke, VA; Cape May, NJ; Wildwood, NJ; Currituck County, NC
Regulate the 500-yr floodplain	Baltimore, MD; Miami Beach, FL; Ocean City, MD; Duck and Nags Head, NC; Hampton, VA (freeboard)
Apply V zone regulations to Coastal A zone	Kent County, MD; Chestertown, MD; Stone Harbor, NJ; Gloucester, VA

Other Regulations

Regulation	Municipalities where it is currently used
Building height allowance for freeboard	Islip, NY; New York City, NY; Nags Head, NC; Norfolk, VA
Freeboard required over fill	New Castle, DE; Henlopen Acres, DE
Deny rezoning requests in floodplain	Virginia Beach, VA

Subdivision Ordinance Considerations

- Build SLR projections into the application and review process
- Open Space in subdivisions: consider requiring cluster development over a certain acreage or increasing the open space requirements for standard subdivisions
- Street standards:
  - Permeable paving
  - Width standards
- Landscaping Standards:
  - Salt tolerant, native species;
  - Planting/restoration of wetland buffers
  - Tree protection standards

Funding Mechanisms

Fee	Purpose	Example
Stormwater Utility Fee	Concept: Fees charged based on the impervious coverage of a parcel	Utilized across 41 states; 36 in PA; 3 in DE (including Lewes); 16 in MD; and 30 in VA.
Fee-in-lieu of Mitigation	Funds designated for larger-scale resiliency projects that benefit the community rather than a single property	Oxford, MD
Property Tax increase	Resilience Fund	Bethany Beach, DE
Lodging tax	Revenue collected earmarked for projects and programs, such as beach nourishment, waterway dredging, and water quality/flood control.	Sussex County, DE (on hold)

Other Considerations

- **Storm Reconstruction Ordinance (Nags Head, NC)**- This is an ordinance that allows for a temporary pause on the issuance of building permits following a storm event. The pause is intended to allow time for an orderly and prioritized approach to redevelopment

- **Real Estate Disclosure (States of Hawaii and California; Port Royal, SC):** An ordinance that requires realtors to disclose potential sea level rise as a part of a real estate transaction

Additional Thoughts

Just to summarize these examples from other places fell into 3 categories:

- Ordinance Provisions:
  - Zoning Ordinance provisions
    - Use
    - Dimensional
    - Performance standards
  - Floodplain Ordinance provisions
  - Subdivision and Land Development Ordinance provisions
- Funding Mechanisms
- Other