

Resilient Community Partnership



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DNREC's Delaware Coastal Programs
October 8, 2016

Presentation Overview:

- What is coastal resilience?
- Objectives of the Resilient Community Partnership
- Characterizing risks for extreme heat and flooding
- Minimizing risks through adaptation and mitigation
- Responsibilities for adaptation and mitigation



Resilient Community Partnership

An illustration of a community scene. In the foreground, there are four orange houses of varying sizes. The houses on the left and right have cars parked in their driveways. A stylized tree with a circular top is in the center. The background is a light blue sky with a large blue rainbow arching over the scene and several white clouds. The ground is represented by a brown and grey dotted pattern.

GOAL: To help communities undertake the necessary planning to enhance their capacity to become *resilient* to coastal hazards



RESILIENCE MEANS *BOUNCING BACK*



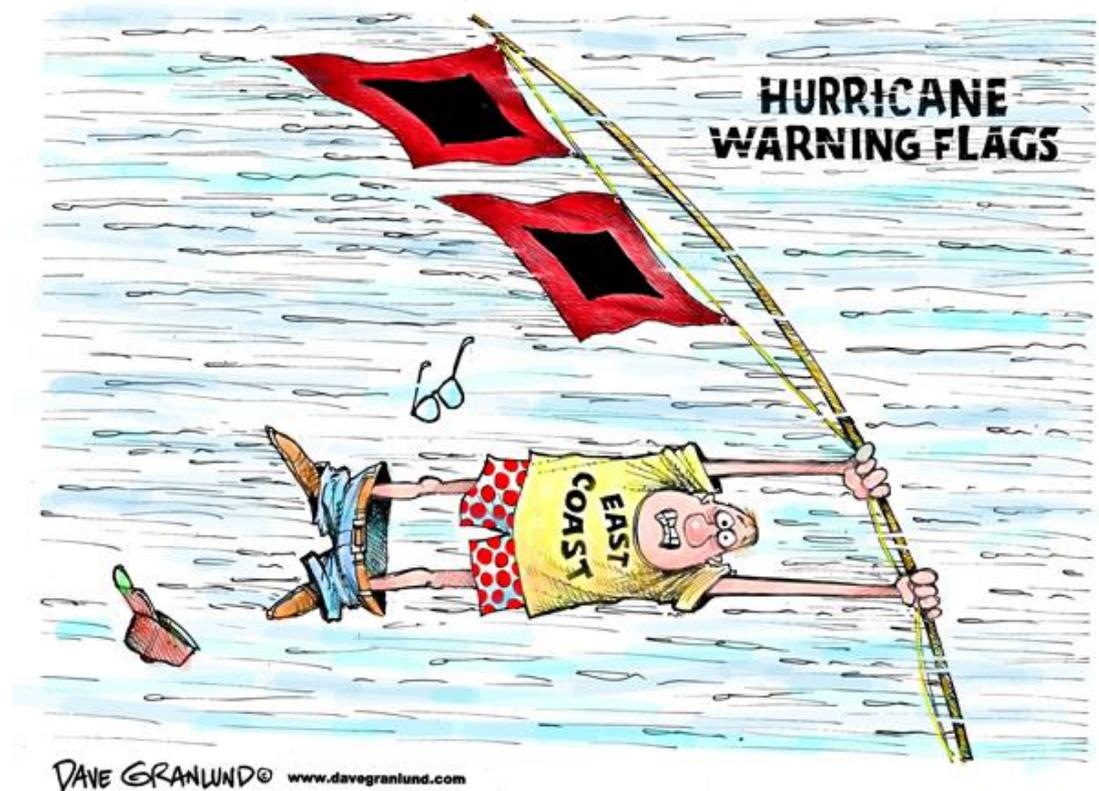
Coastal resilience planning is ...“*anticipatory, conscious, and intentional in its outlook**”

*Timothy Beatley, “Planning for Coastal Resilience: Best Practices for Calamitous Times,” 2009

Resilient Community Partnership

Scope of Project

- 20 Years
- Extreme Heat
- Flooding caused by:
 - Hurricanes
 - Tropical Storms
 - Nor'easters
 - Extreme Tides
 - Sea Level Rise
 - Heavy Precipitation Events



Resilient Community Partnership

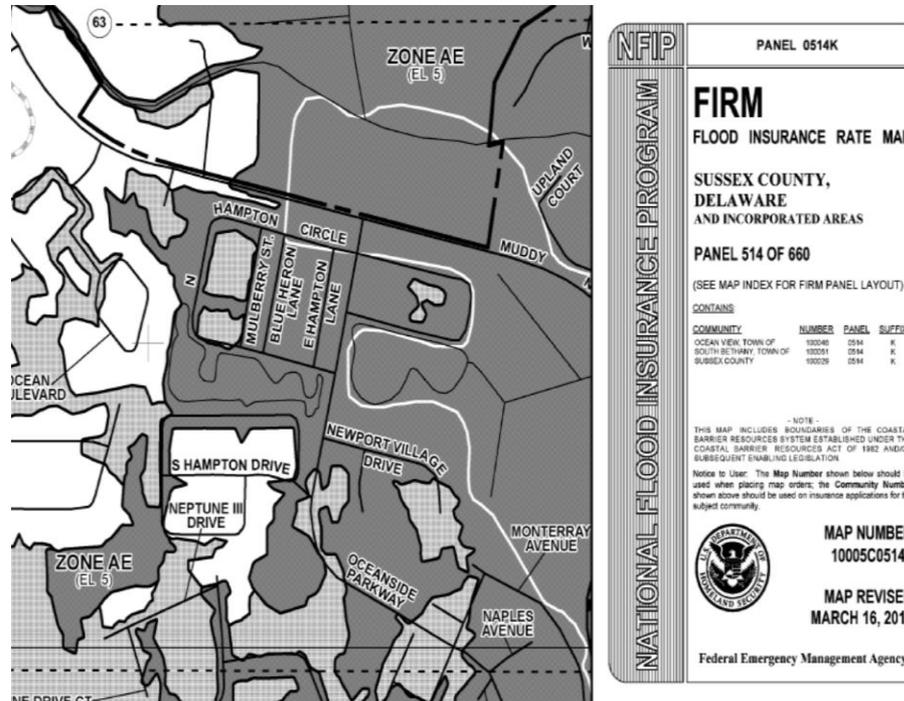
Steps to Date –

- Inventoried community infrastructure, assets, and values
- June workshop collected resident and stakeholder data
- Data analysis and risk characterization
 - Past history, recent history, and future trends



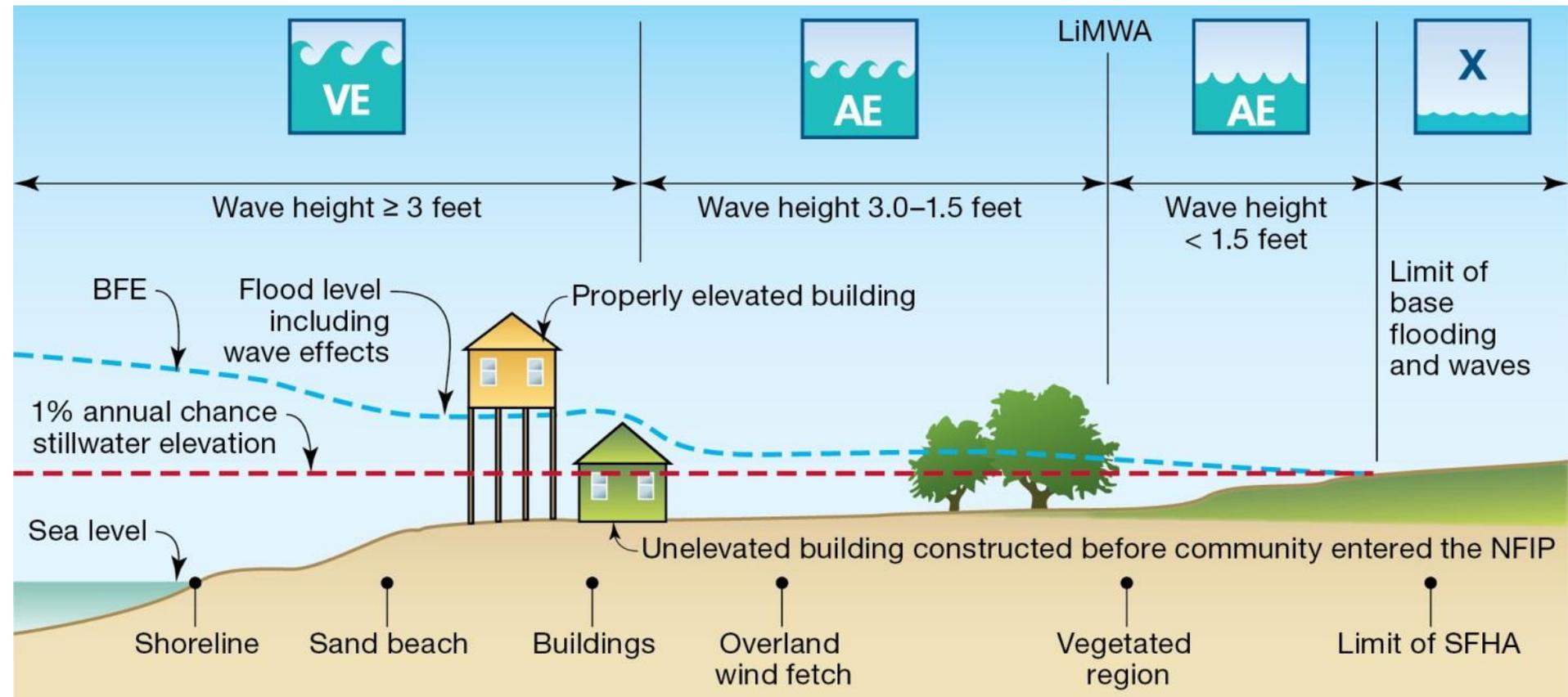
(Past History)

FEMA Flood Insurance Rate Map (FIRM)



Indicates areas of high, moderate, low risk based on an analysis of past flooding events

Profile of FEMA Flood Insurance Rate Map (FIRM)



Zone AE
(EL 11 Feet)

PANEL
10005C0070K
eff. 3/16/2015

Zone VE
(EL 12 Feet)

Zone AE
(EL 10 Feet)

LOMA 16-03-0497A
eff. 12/24/2015



PANEL
10005G0070K
eff. 3/16/2015

Zone AE
(EL 10 Feet)

Zone VE
(EL 12 Feet)

Zone AE
(EL 11 Feet)

FIRMs do not account for:

- Future conditions such as changes in storm climatology and sea level rise
- Shoreline erosion, wetland loss, subsidence
- Upland development or topographic changes
- Degradation or settlement of levees and floodwalls
- The effects of multiple storm events

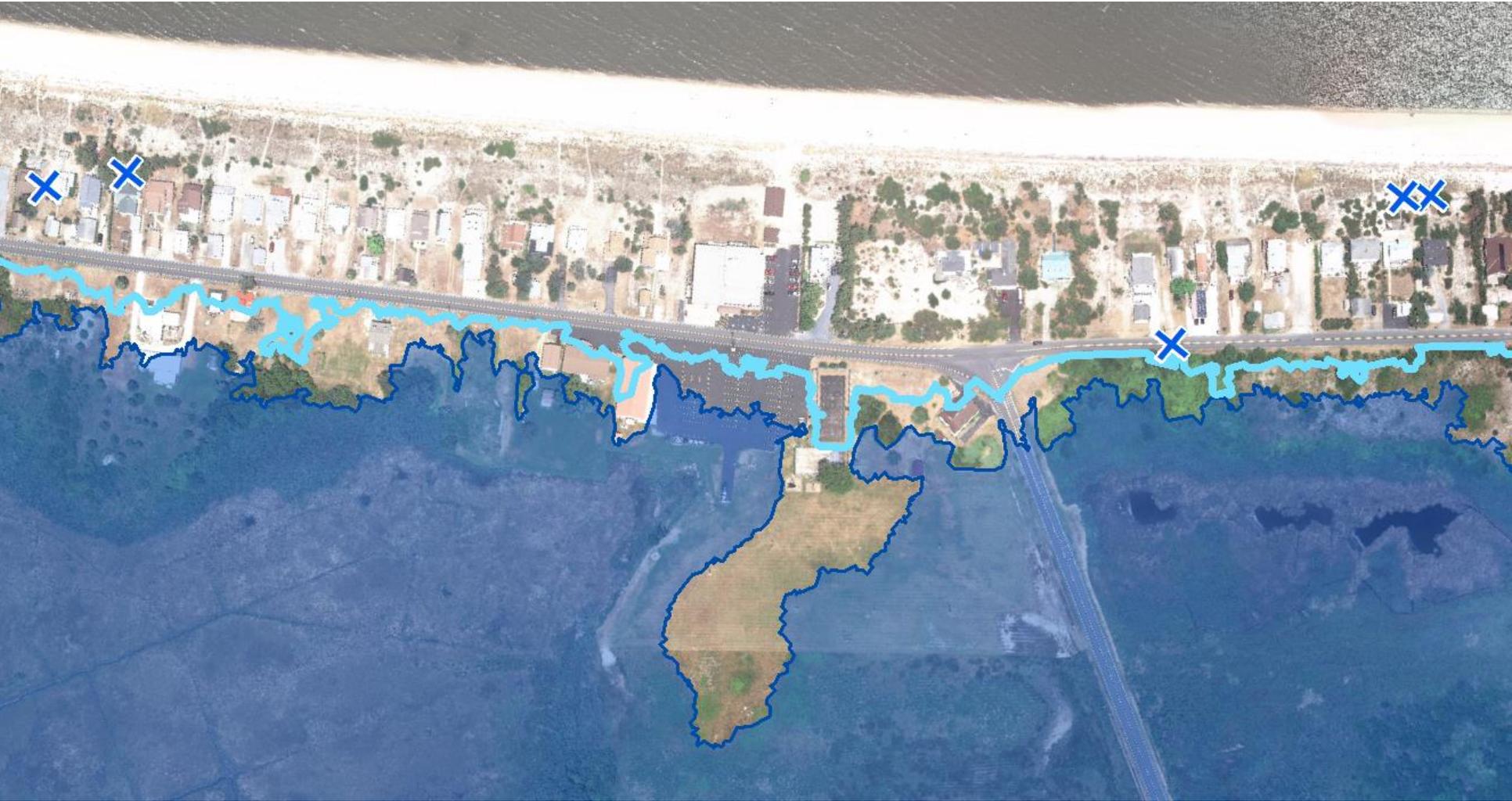
One map will not suffice

(Present History)

Flood Contour Mapping

- Based on feedback from first public workshop
- Depicts average extent of flooding as recorded by YOU
- Mainly depicts recent events such as Snowstorm Jonas and the October 2015 storm
- More marsh-side flooding reported as compared to Bay-side flooding
- Sufficient data to build a flood contour line for marsh side

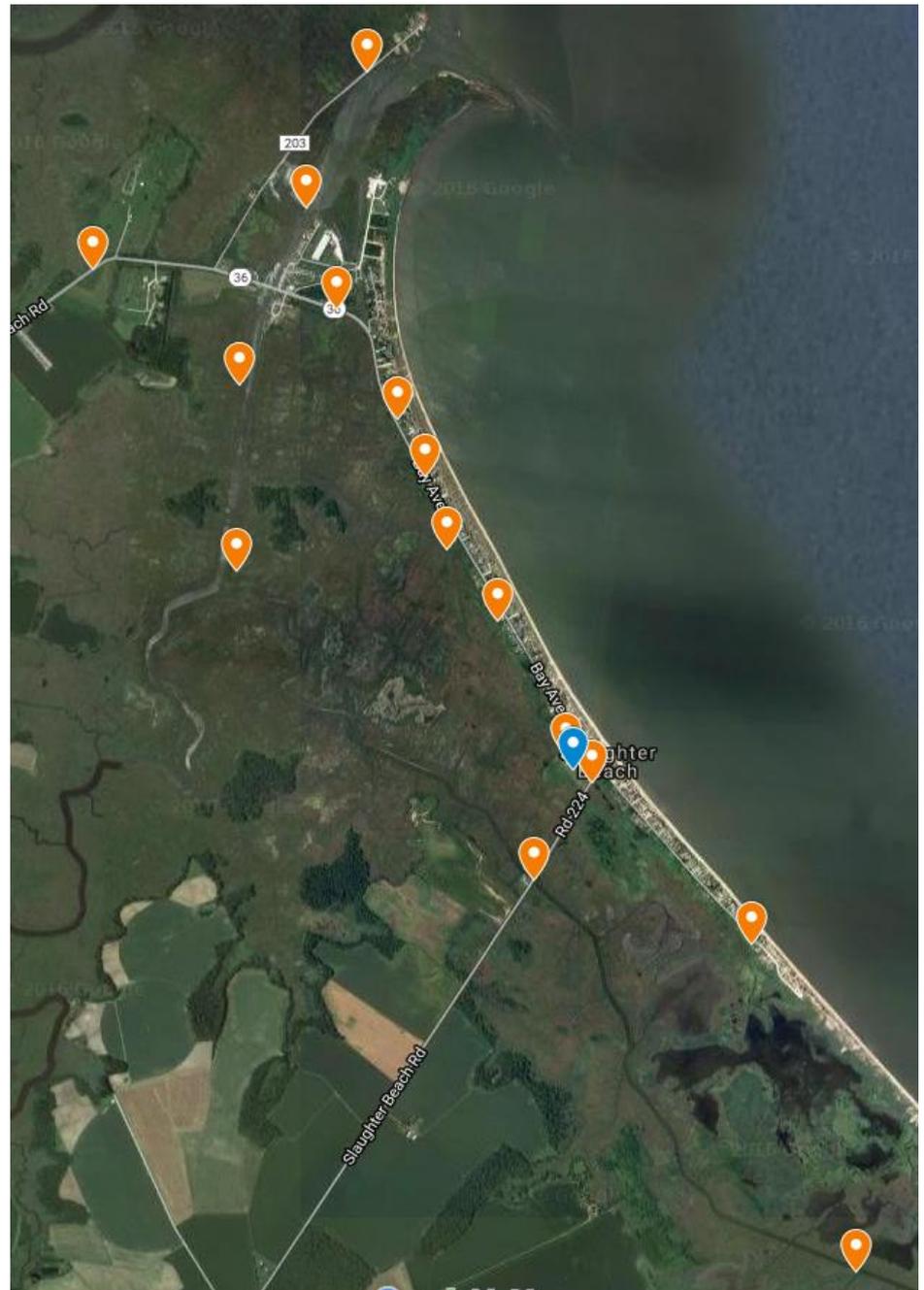
Flood Contour Map: Intersection of Slaughter Beach Road and Bay Avenue



Dark Blue Line = Average extent of flood risk from marsh side, based on recent events. Light Blue Line will be discussed shortly. Blue X = locations of Bay flooding based on recent events.

University of Delaware Project

- Installed water sensors at key points in Town this week
- Minimum of one year of data gathering
- Project will aid understanding of marsh hydrodynamics

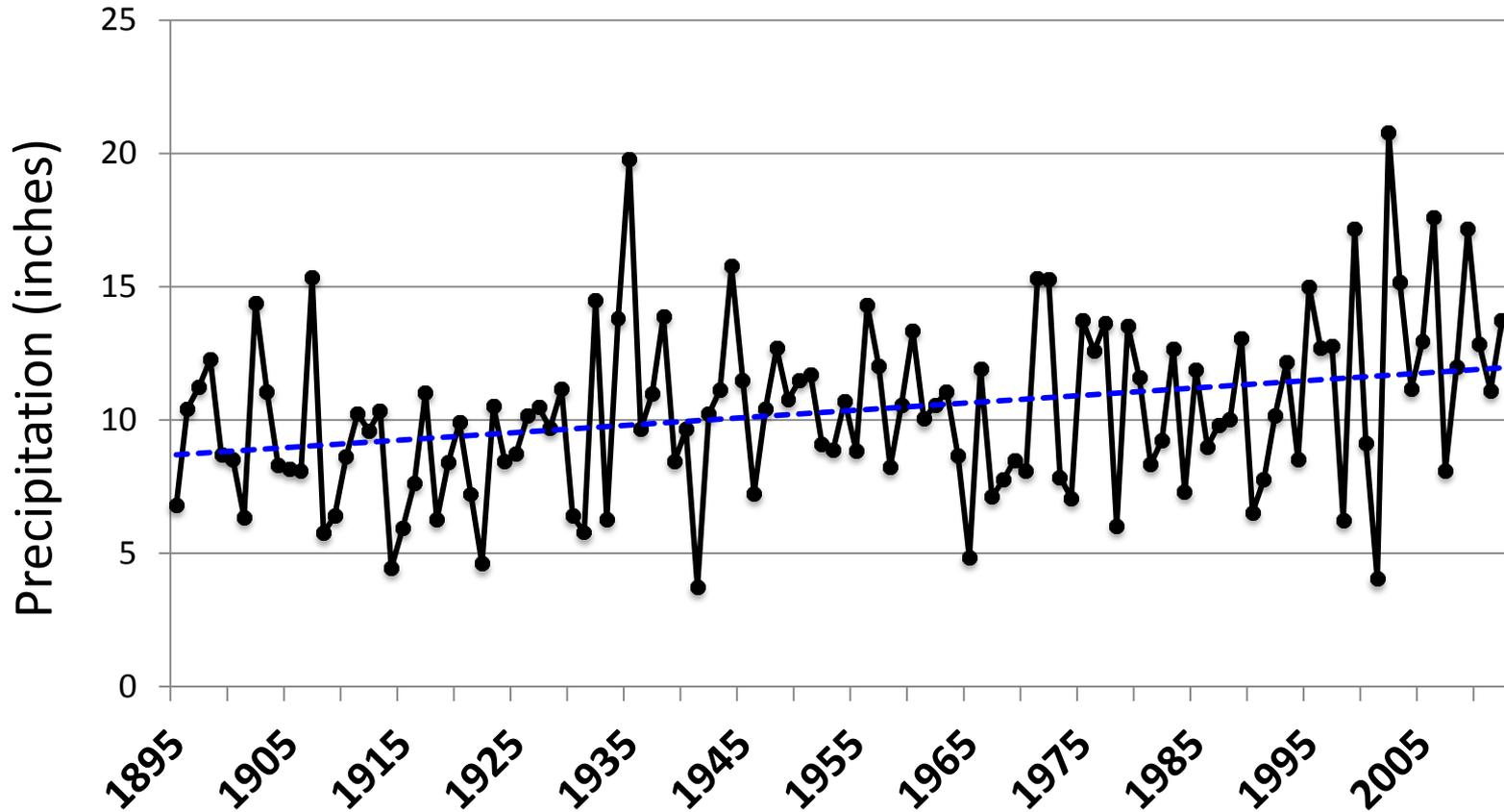


(Future Trends)

Climate Trends

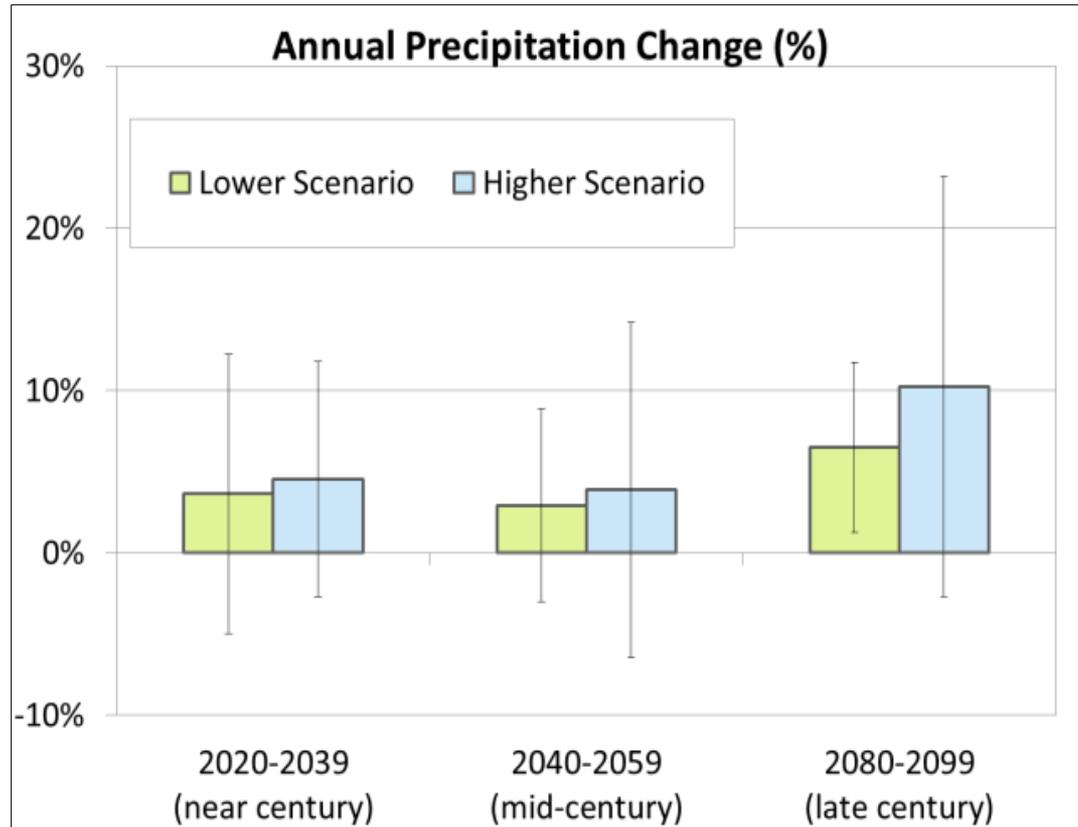
Upward trend in autumn precipitation since 1895.... +0.27"/decade

Delaware Statewide Autumn (SON) Precipitation 1895 - 2012



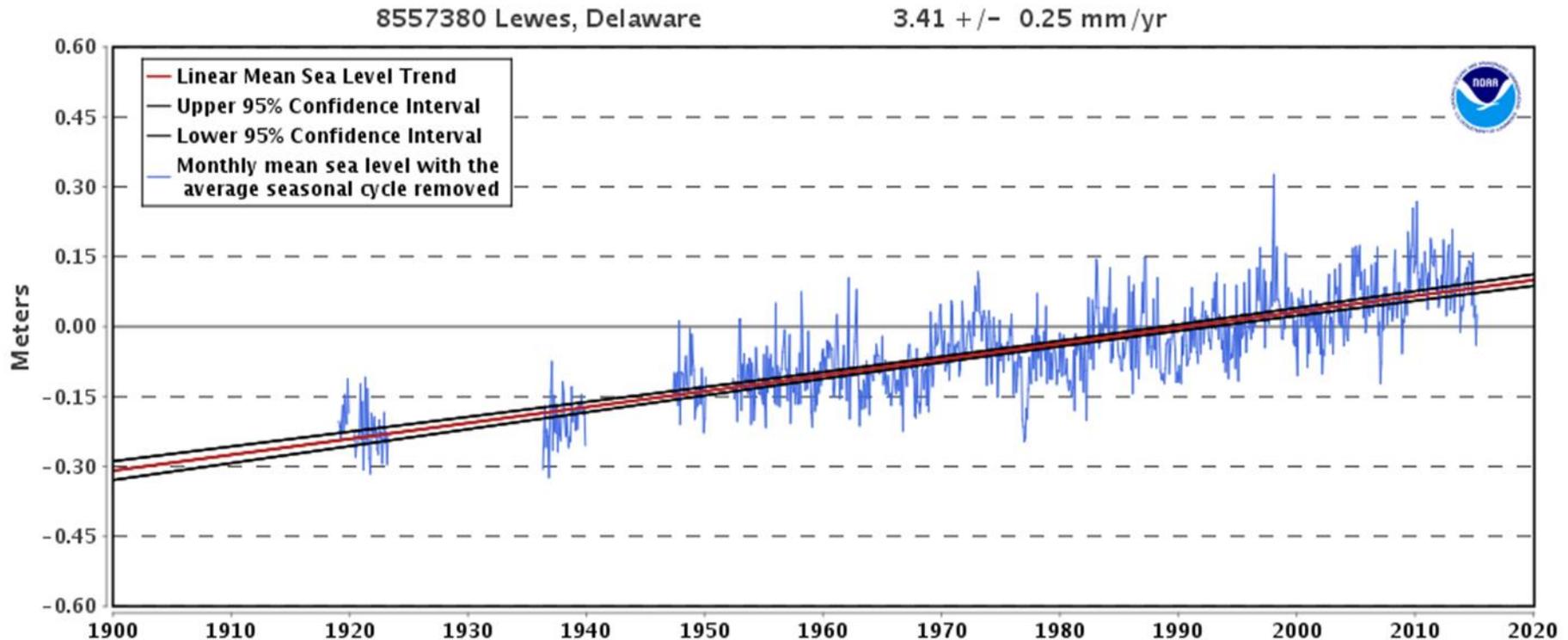
Source: Dr. Dan Leathers, Delaware State Climatologist

Annual precipitation is projected to increase



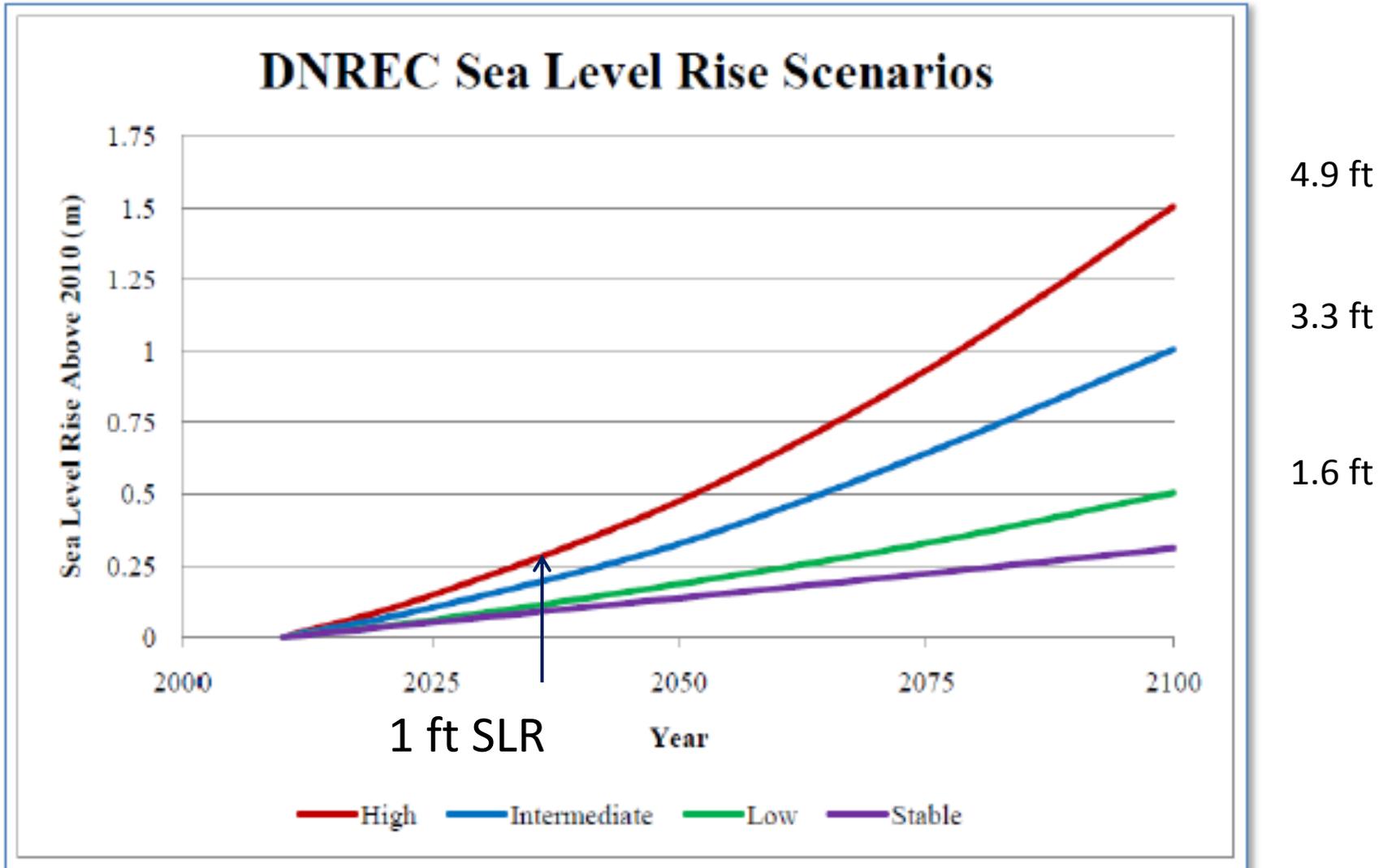
The increases are primarily in winter and fall. Little to no change in the average # of dry days is expected, meaning there will be greater precipitation intensity.

Local sea levels are rising at twice the global average



Global rate = 1.7 mm/yr
Lewes, DE rate = 3.41 mm/yr

The rate of sea level rise is very likely to accelerate in the future



Sea Level Rise will exacerbate risks and impacts from flooding and storm surge



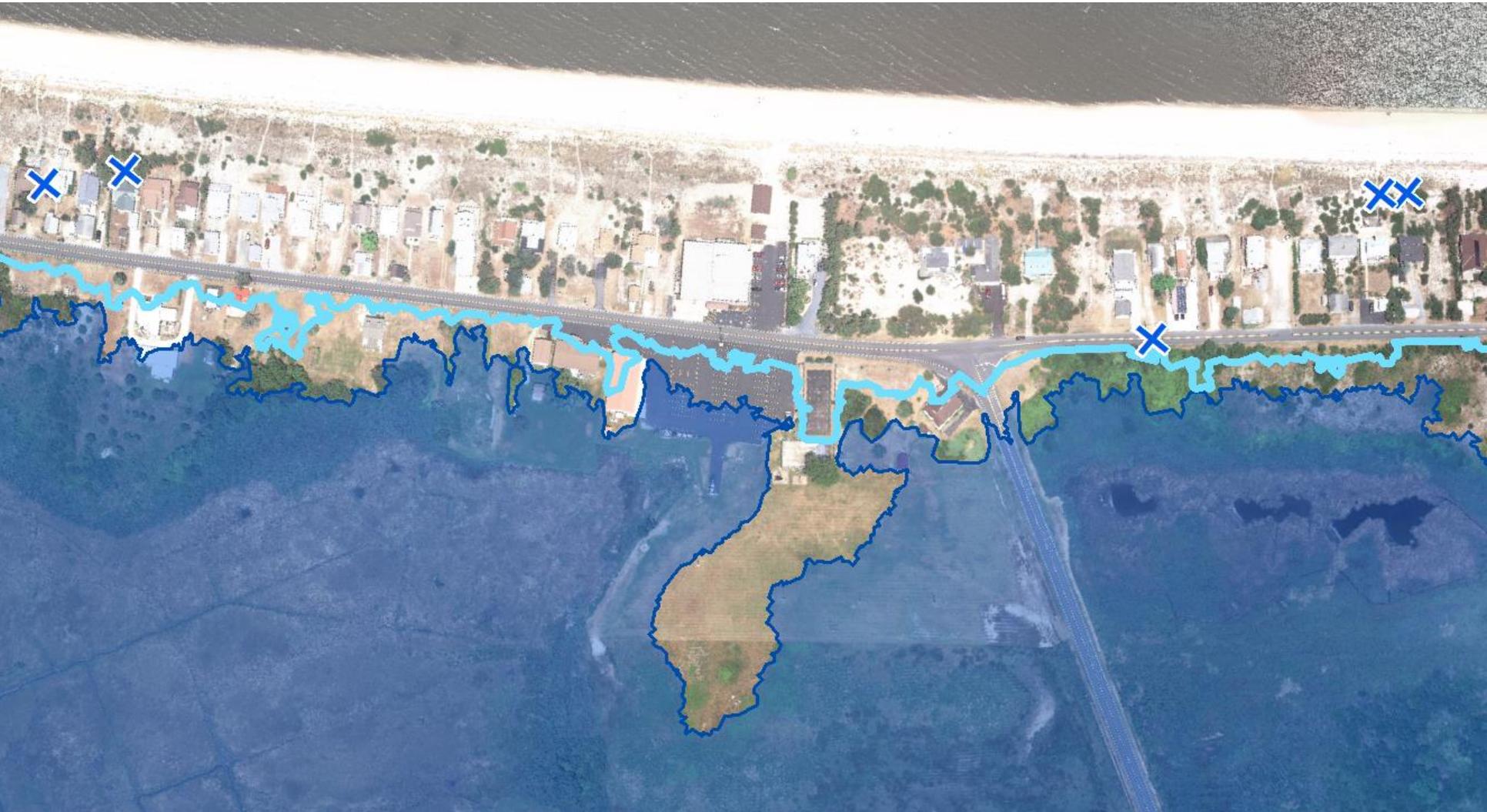
Nuisance Flooding



Heavy precipitation events



Flood Contour Map: Intersection of Slaughter Beach Road and Bay Avenue



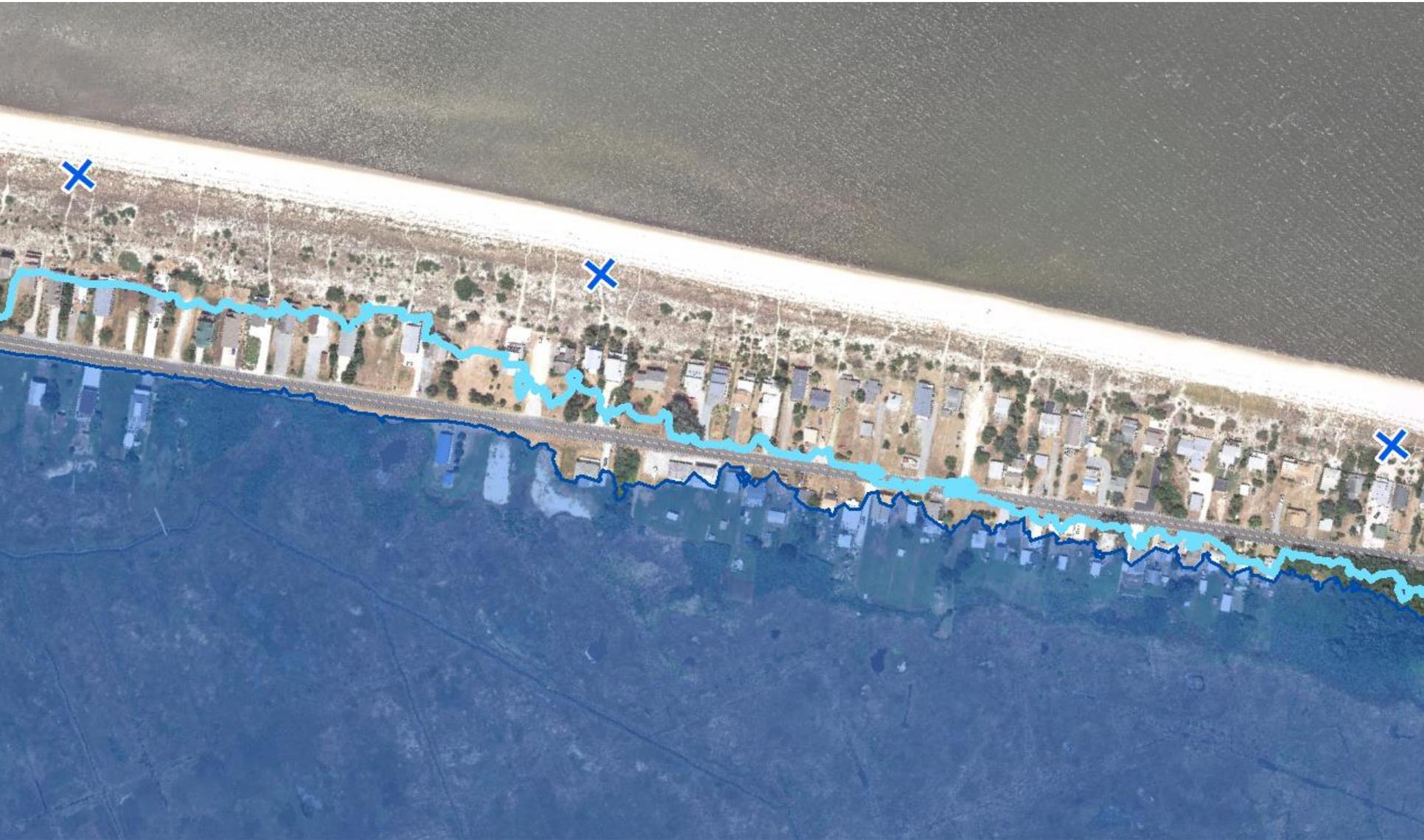
Dark Blue Line = Average extent of flood risk from the marsh, based on recent events. Light Blue Line = 1 ft of sealevel rise added to flood line on marsh side. Blue X = locations of Bay flooding

Flood Contour Map: South End of Slaughter Beach



Dark Blue Line = Average extent of flood risk from the marsh, based on recent events. Light Blue Line = 1 ft of sea level rise added to flood line on marsh side. Blue X = locations of Bay flooding

Flood Contour Map: Central Bay Avenue



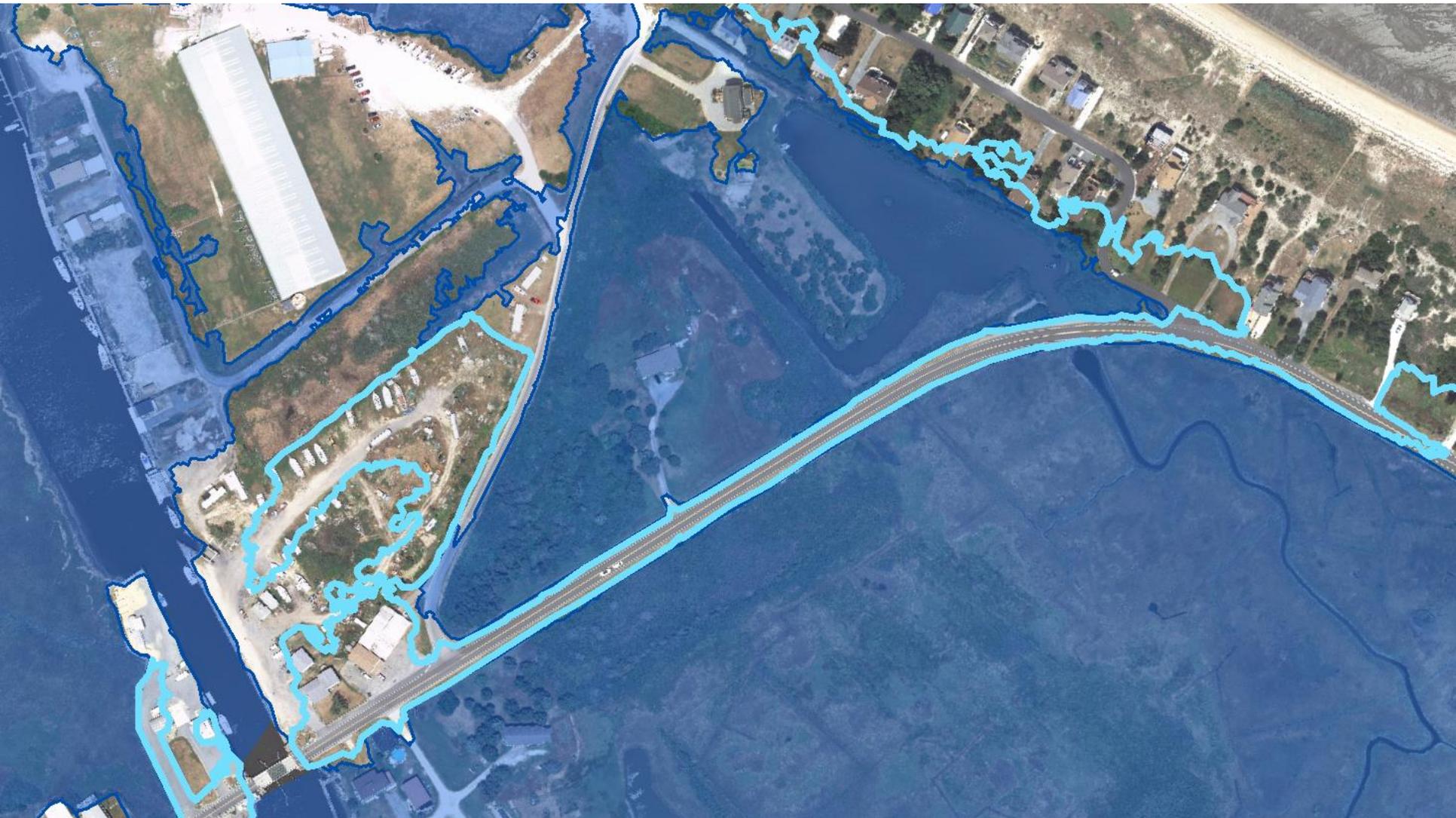
Dark Blue Line = Average extent of flood risk from the marsh, based on recent events. Light Blue Line = 1 ft of sea level rise added to flood line on marsh side. Blue X = locations of Bay flooding

Flood Contour Map: North Bay Avenue



Dark Blue Line = Average extent of flood risk from the marsh, based on recent events. Light Blue Line = 1 ft of sea level rise added to flood line on marsh side. Blue X = locations of Bay flooding

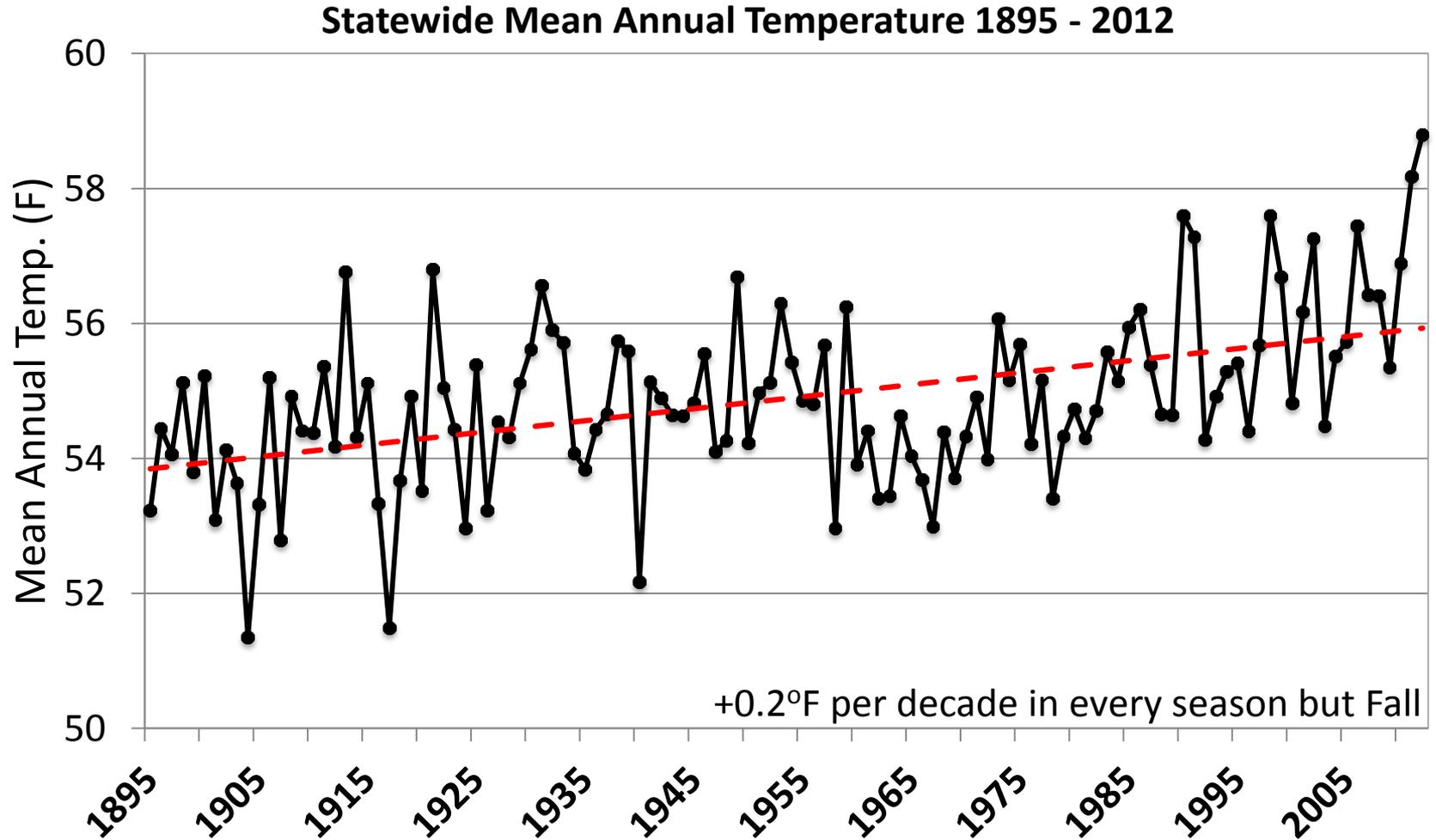
Flood Contour Map: Bay Avenue to Cedar Beach Road



Dark Blue Line = Average extent of flood risk from the marsh, based on recent events. Light Blue Line = 1 ft of sea level rise added to flood line on marsh side. Blue X = locations of Bay flooding

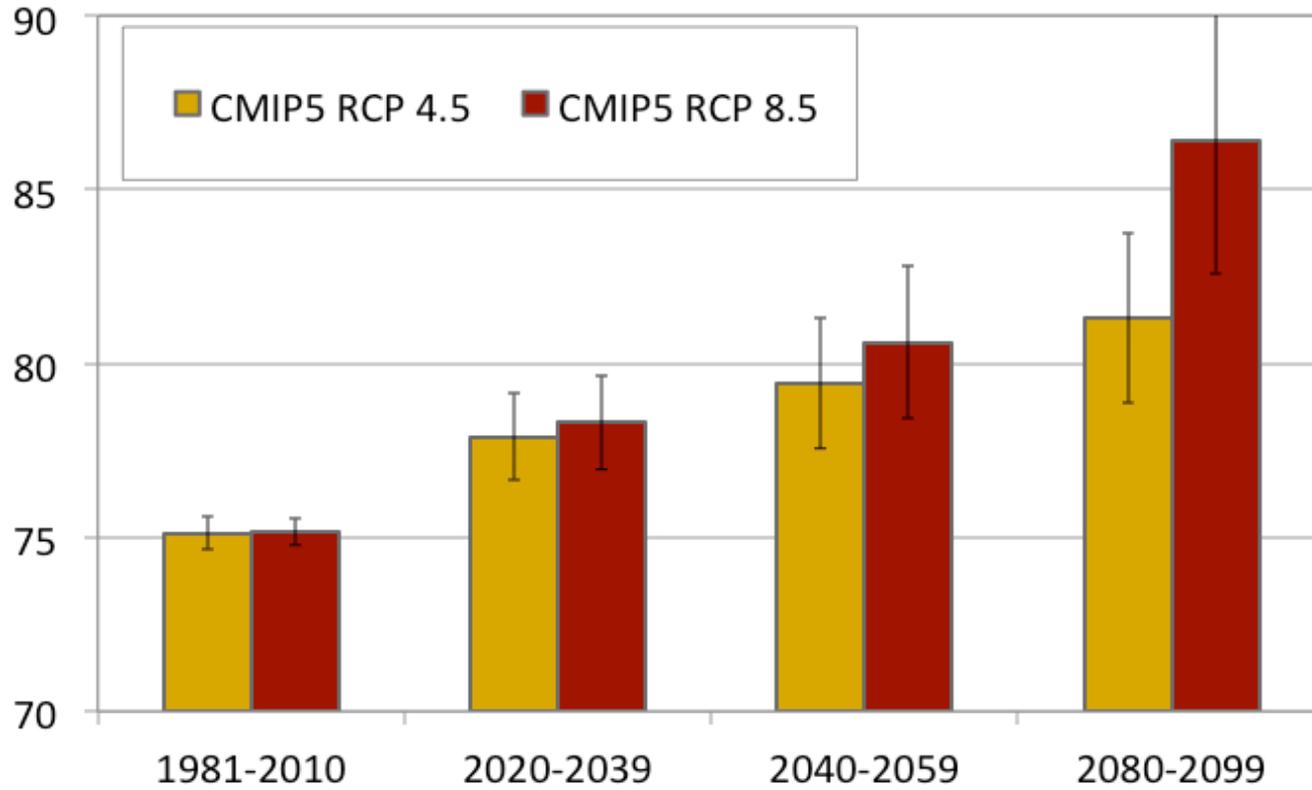
Let's Talk Heat...

Average temperatures are increasing in Delaware



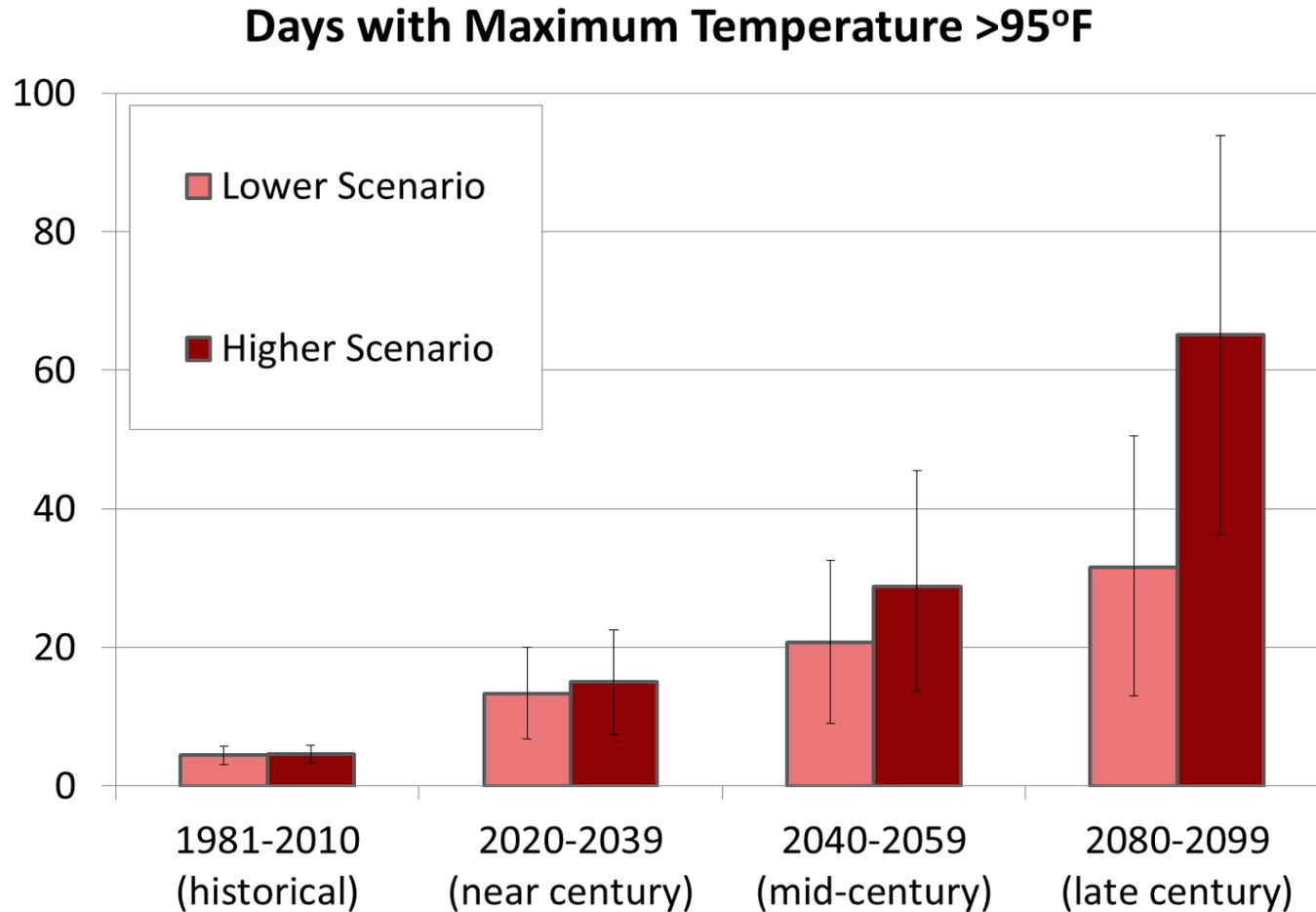
Source: Dr. Dan Leathers, Delaware State Climatologist

Summer Average Temperature (oF)



SUMMER (JUN-JUL-AUG)

...more extremely hot days are projected in summer



Source: Dr. Katharine Hayhoe, et al

2015

JUNE

JULY

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

25 Days Above
90°

AUGUST

SEPTEMBER

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

2016

JUNE

JULY

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

24 Days Above
90°

10 Days Above
95°

AUGUST

SEPTEMBER

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

1 Day Above
100°

2039 PROJECTED

JUNE

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

JULY

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

45 Days Above
90°

AUGUST

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

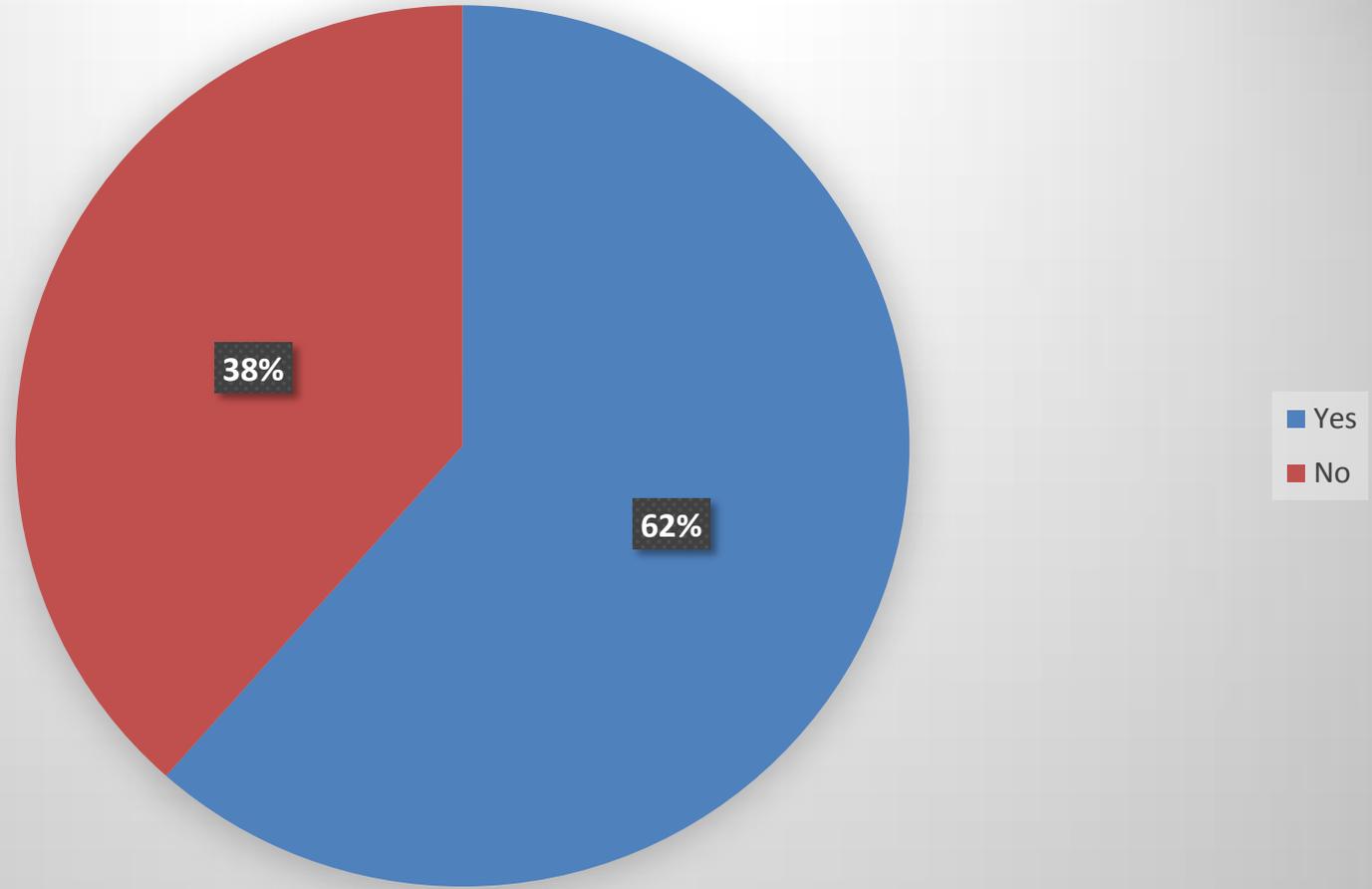
SEPTEMBER

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

15 Days Above
95°

3 Days Above
100°

Have you or anyone you know been impacted by excessive heat in Slaughter Beach?



Adaptation and Mitigation Options Fall Into 4 Main Categories



Avoid



Protect



Accommodate

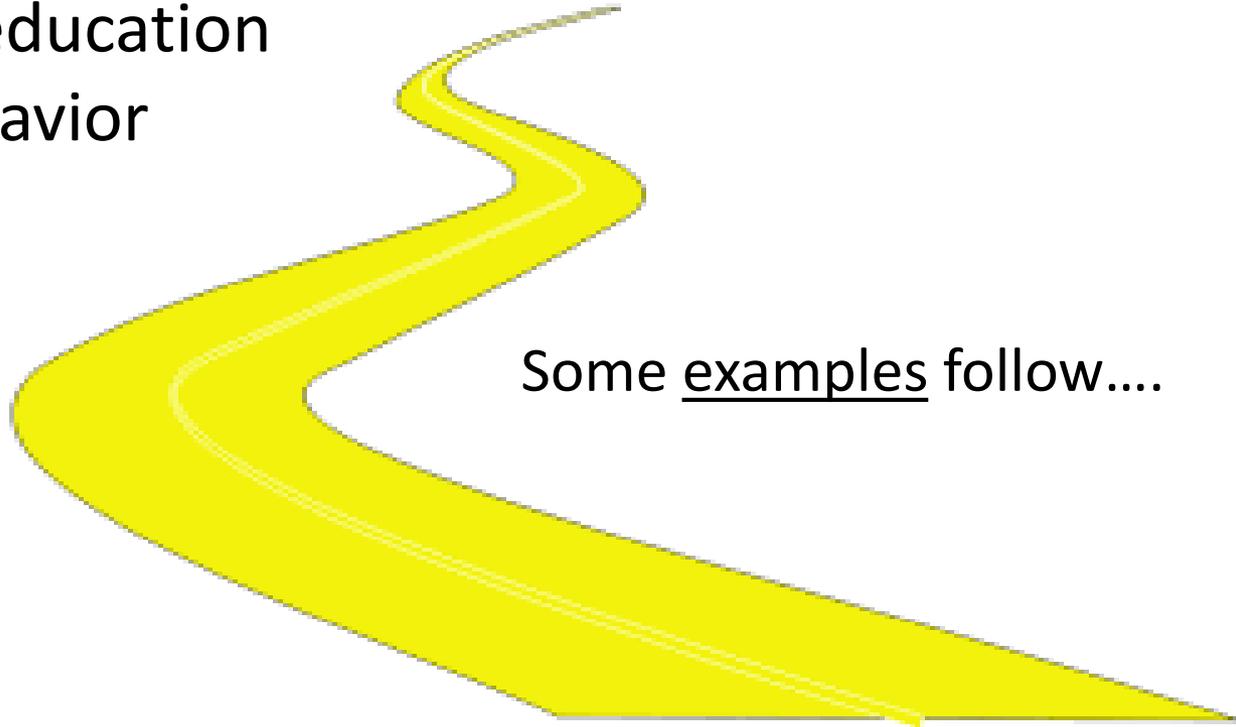


Retreat

And are implemented in different ways...

- Comprehensive Plan updates
- Town codes and ordinances
- Zoning designations
- Design and engineering projects
 - “Grey” and “Green” infrastructure
- Outreach and education
- Changes in behavior

Some examples follow....



- Dunes and beach grass provide effective protection from waves and storm surge
- Structures built too closely to the shoreline:
 - Undermine dune stability
 - Inhibit landward movement of dune in response to sea level rise
- Northerly transport of sediment at Slaughter Beach leads to loss of sand at the southern end and accretion of sand at the northern end



Beach Nourishment cont...



- Slaughter Beach's beach and dunes have been a state-maintained dune system since the 1970s
- State funding for beach nourishment is limited and often fully utilized to meet cost sharing requirements for other projects
- Absent funding for large-scale projects, truck-hauled sand and beach grass can fill in spots
- Good dune stewardship will help protect existing dunes

Protect

Flood barriers



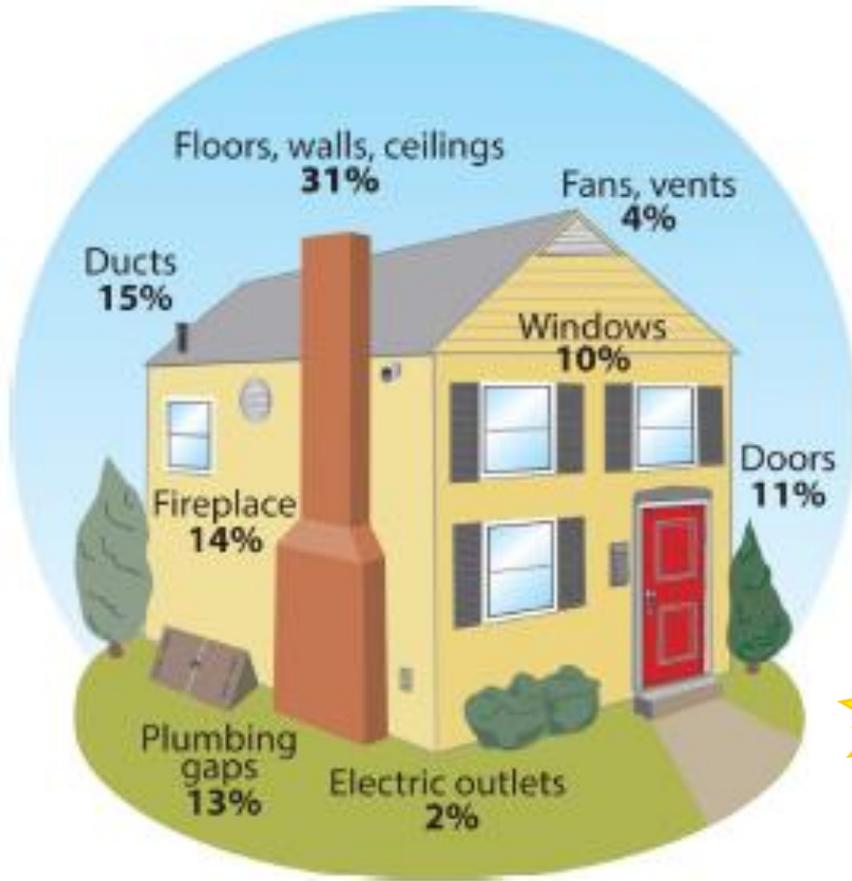
Property owners can create barriers that help keep water out

Flood barriers



- Berms and floodwalls offer protection but at a higher cost
- Periodic maintenance required
- Local drainage can be affected
- Avoid designs and practices that benefit one property at the expense of another

Construction & Weatherization



Common air leaks in the home

- More protective construction standards
- Energy audits
- Modernization of cooling and heating systems



*Weatherization
Works*

Elevate Homes and Buildings

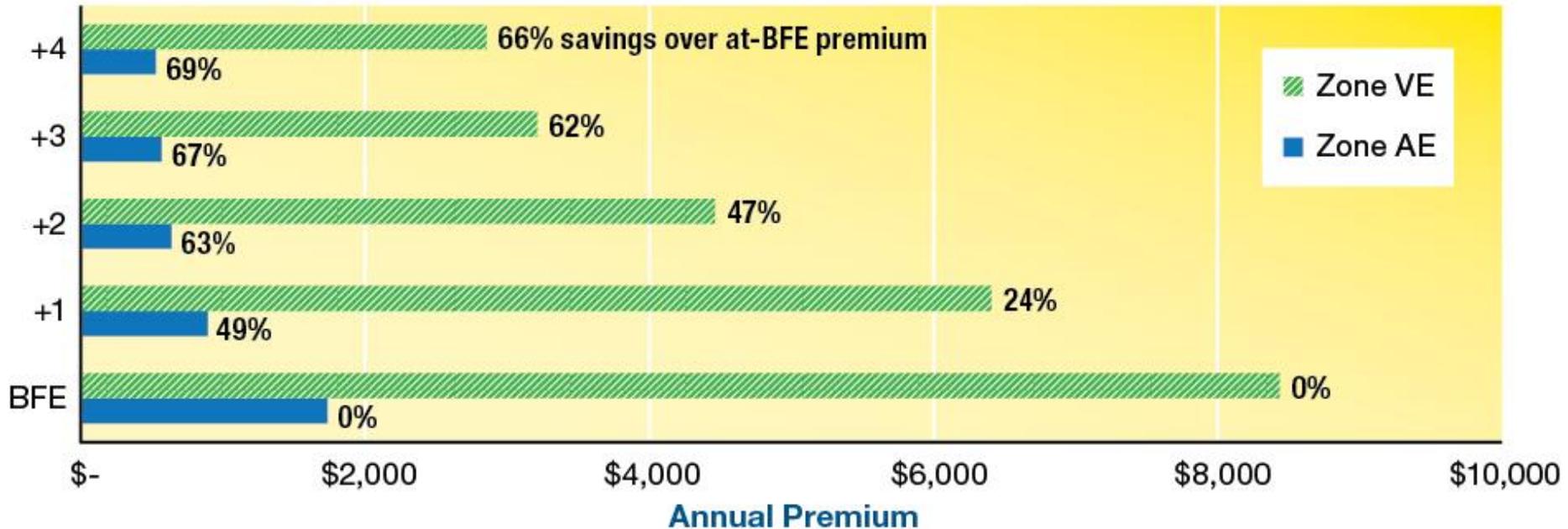


No freeboard = damage

Freeboard = no damage

- Known as freeboard, it provides a safety margin
- Town ordinance of 1 foot above Base Flood Elevation (BFE)
- Lowers cost of flood insurance

Lowest Floor Elevation Relative to BFE



Note: Annual premiums calculated using the *NFIP Flood Insurance Manual*, October 3, 2013, for a one-story single-family home with no basement, no enclosure, and full replacement coverage. Premiums are based on the maximum available coverage of building coverage of \$250,000 for building and \$100,000 for contents coverage. Zone V building is assumed to be free of obstructions.

Accommodate

Elevate and Secure Utilities

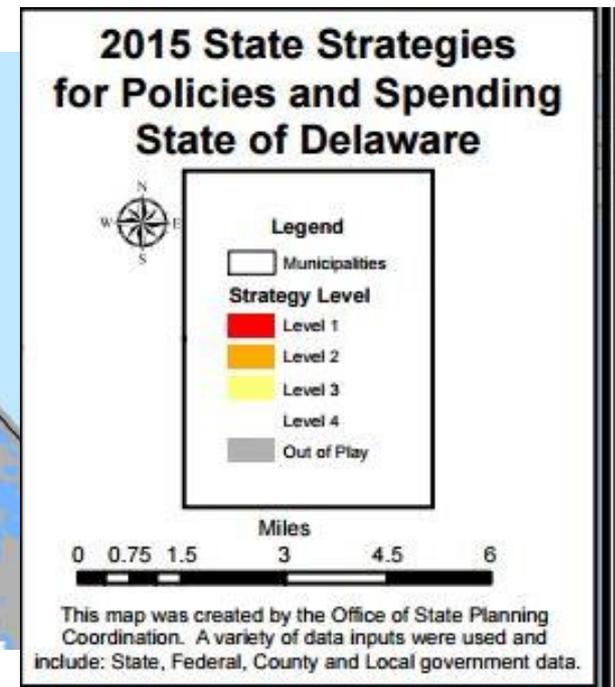


Minimize debris, safety risks, and collateral damage by elevating and securing units

Accommodate

Elevate Roads

- Elevating critical evacuation routes based on sea level rise supports public safety
- Options include adding a few inches of asphalt to existing roadbed or constructing a viaduct
 - Important risk, cost, and engineering considerations



Accommodate

Elevate Roads

Rt54 East in Fenwick Island needed a viaduct constructed over wetlands because raising the roadbed would create adjacent wetland impacts



**Cost =
\$16M in
2001**

Total Cost Estimates to Raise All DelDOT- Owned Assets

<i>COUNTY</i>	<i>Roads</i>	<i>Bridges</i>	<i>TOTAL</i>
New Castle	\$293,142,890	\$51,670,169	\$344,813,059
Kent	\$207,867,192	\$11,583,599	\$219,450,792
Sussex	\$838,394,344	\$51,155,453	\$889,549,798
<i>TOTAL</i>	\$1,339,404,428	\$114,409,222	\$1,453,813,650

Accommodate

Real-Time Warning Systems

Protect lives and property via real-time warning systems that equip residents with the information they need to make smart decisions



Accommodate

Stormwater Management

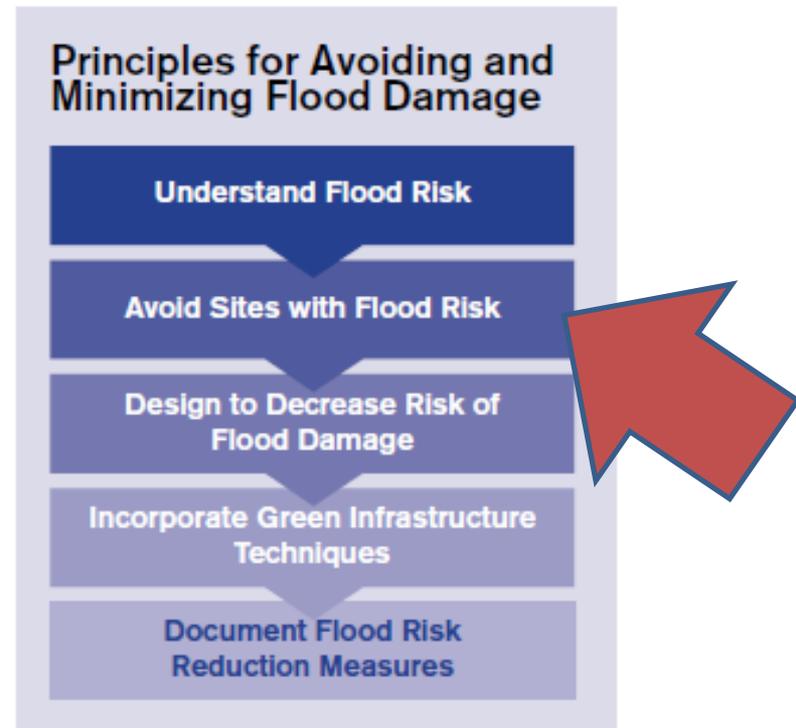
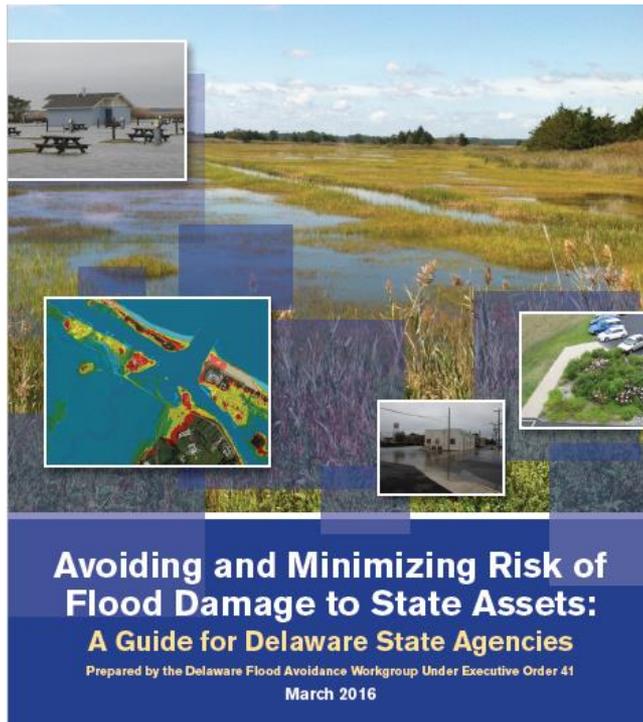
- Grey infrastructure (Examples: catch basins, ditches, and culverts)
- Green infrastructure (Examples: rain gardens, bioswales)



- Designate Cooling Centers and Emergency Shelters
 - For example, fire station serves as a cooling center, supplying air conditioning, water and electricity plus transportation to station if necessary
 - Spending time in air-conditioning is one of the most effective means of reducing overheating
- Develop household emergency plans
 - Evacuation procedures
 - Communication protocols
 - Pets
 - Prescriptions
 - Secure valuables

“Avoid project sites within areas of existing and future flood risk.” This policy can be implemented via:

- Ordinances and codes
- Comprehensive plan updates
- Case by case siting decisions



- DelDOT is considering abandoning Old Corbitt Road in Odessa
- Overtops daily during high tide
- Low # of vehicle trips and alternate route nearby
- Is it in the taxpayer's interest to maintain this road?



Adaptation and Mitigation Projects are carried out at different scales:

Federal
State
County

Community
Property Owner



SLAUGHTER





Community resiliency begins with **YOU**:
Know Your Risks
Plan for the future
Act NOW

**“Floods are an act of God,
but flood losses are largely
an act of man.”**

-Gilbert F. White

Questions/Comments?

- Please visit our tables and experts
- Interested in being in a focus group in December or January? Sign in sheet at the lunch ticket table
- Inventory of first floor elevations, a/c units, and propane tanks – please visit Adaptation table