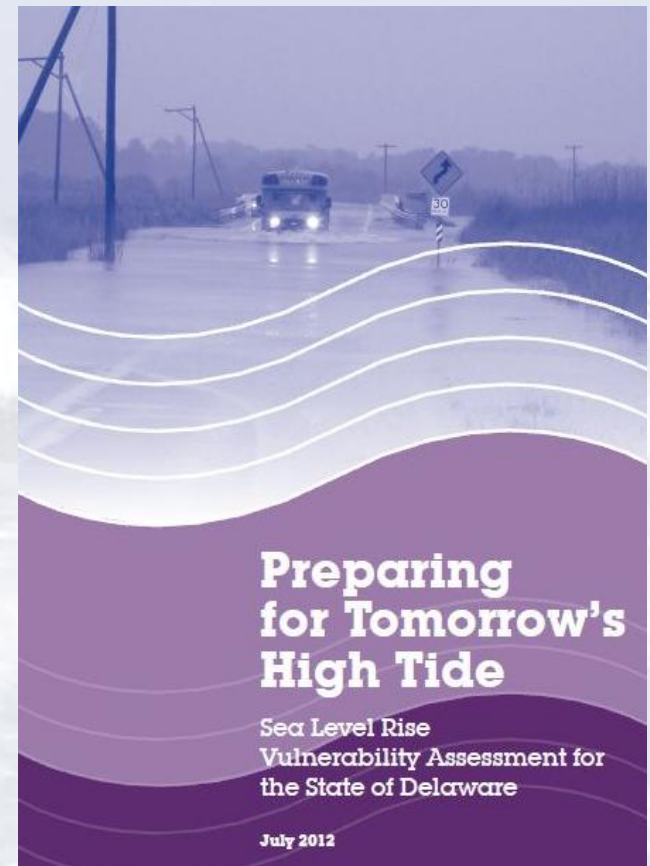


Challenging Tides: Results of Delaware's Sea Level Rise Vulnerability Assessment

Presentation for Delaware Estuary Science Conference
January, 2013



Potential Impacts of Sea Level Rise

- Permanent inundation of land and infrastructure
- Increased extent & severity of periodic flooding from storms
- Saltwater intrusion to surface water and groundwater
- Secondary economic, environmental & social impacts

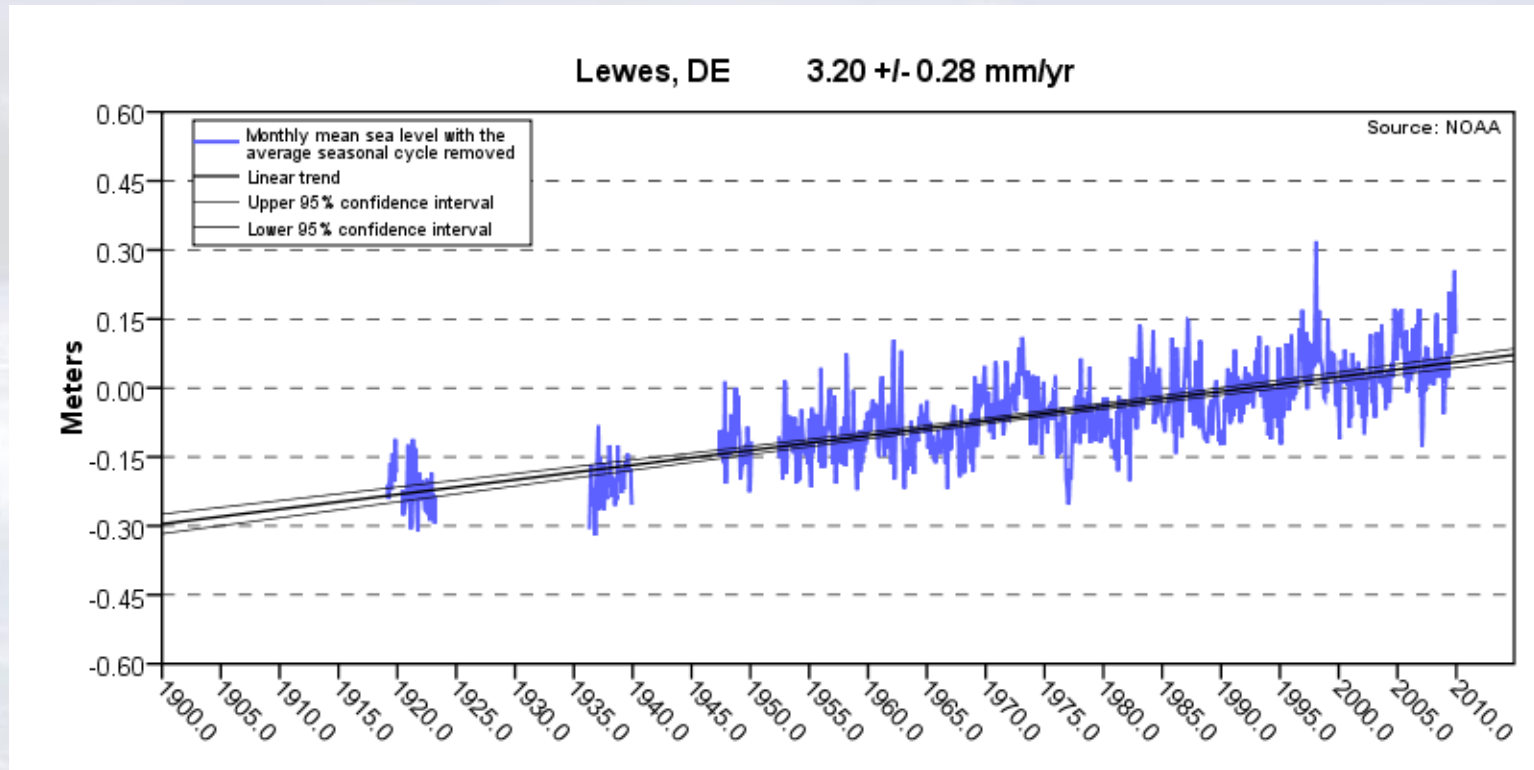


Odessa, October 16, 2009

Measured Sea Level Increase @ Lewes, DE

Global rate = 1.7 mm/yr (6.7 inches/100 years)

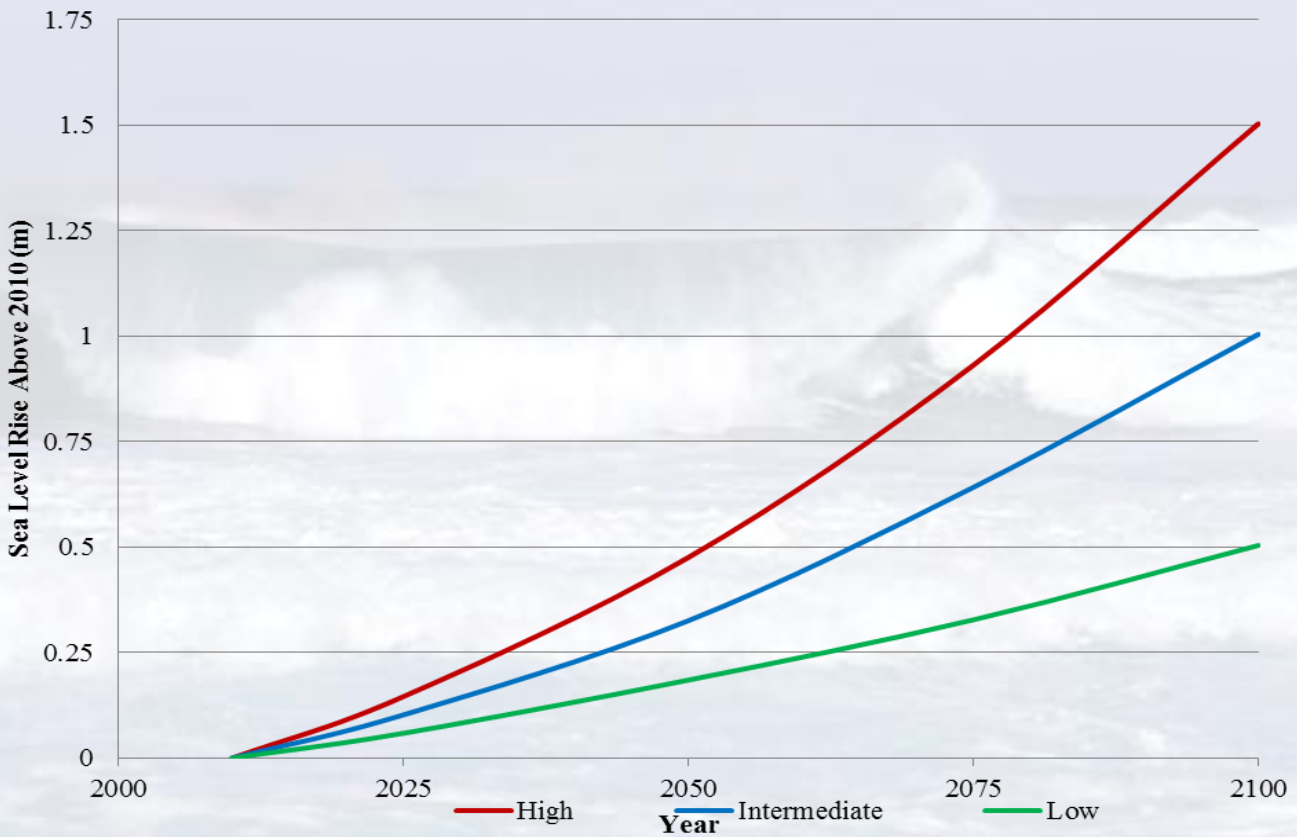
Delaware rate (averaged) = 3.35 mm/yr (13 inches/100 years)



Rates of SLR are very likely to accelerate in the future



DNREC Sea Level Rise Scenarios



Delaware's Sea Level Rise Advisory Committee

The goal of the Sea Level Rise Advisory Committee is to assess Delaware's vulnerability to current and future inundation problems that may be exacerbated by sea level rise and to develop a set of recommendations for state agencies, local governments, businesses and citizens to enable them to adapt programs, policies, business practices and make informed decisions.

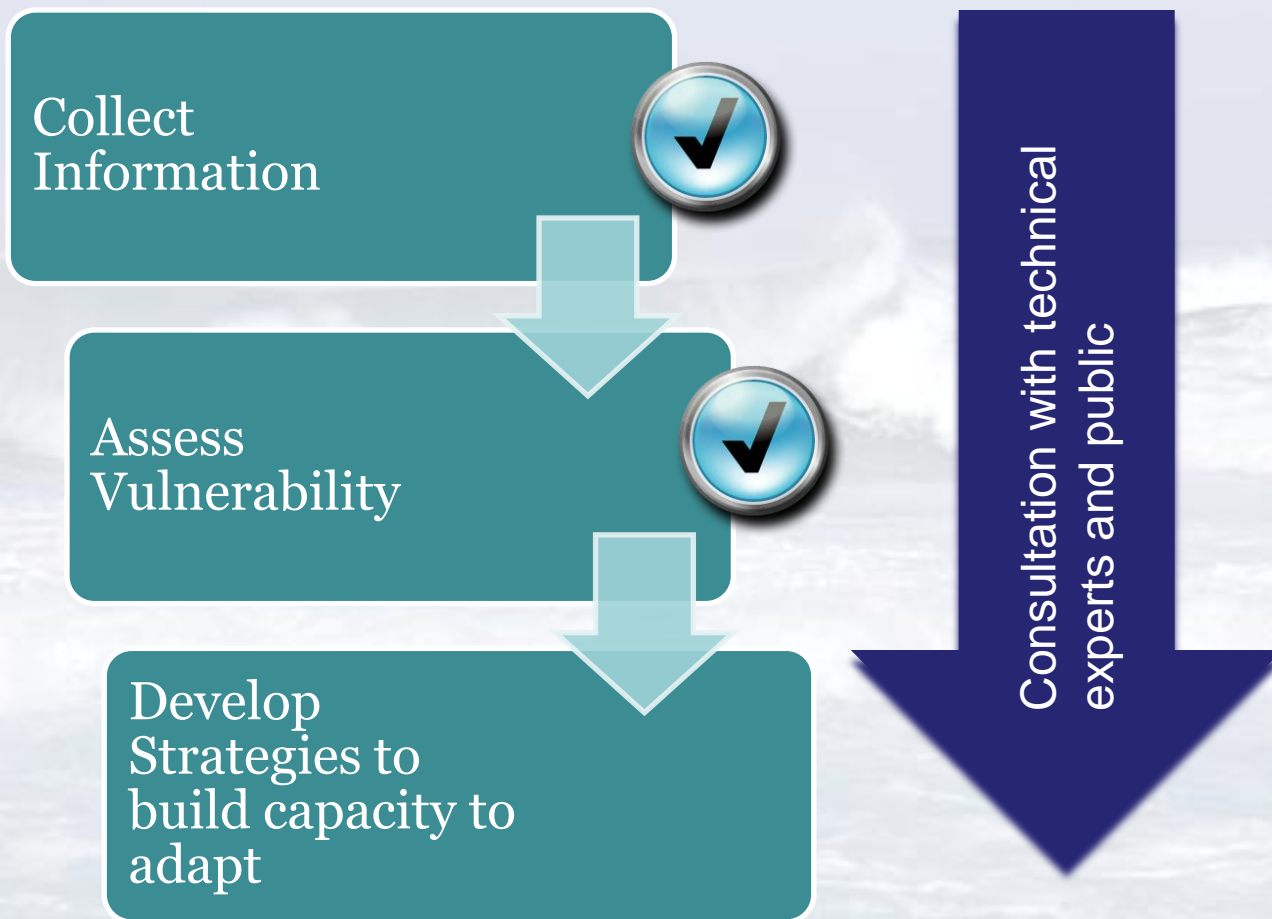


A SLR Adaptation Plan for Delaware

- A call to Action
- A document that explains, informs and guides adaptation responses
 - ✓ Guiding Principles
 - ✓ Case Studies
 - ✓ Build in Flexibility
- Outlines recommendations to to build capacity to adapt to sea level rise



Steps to an Adaptation Plan



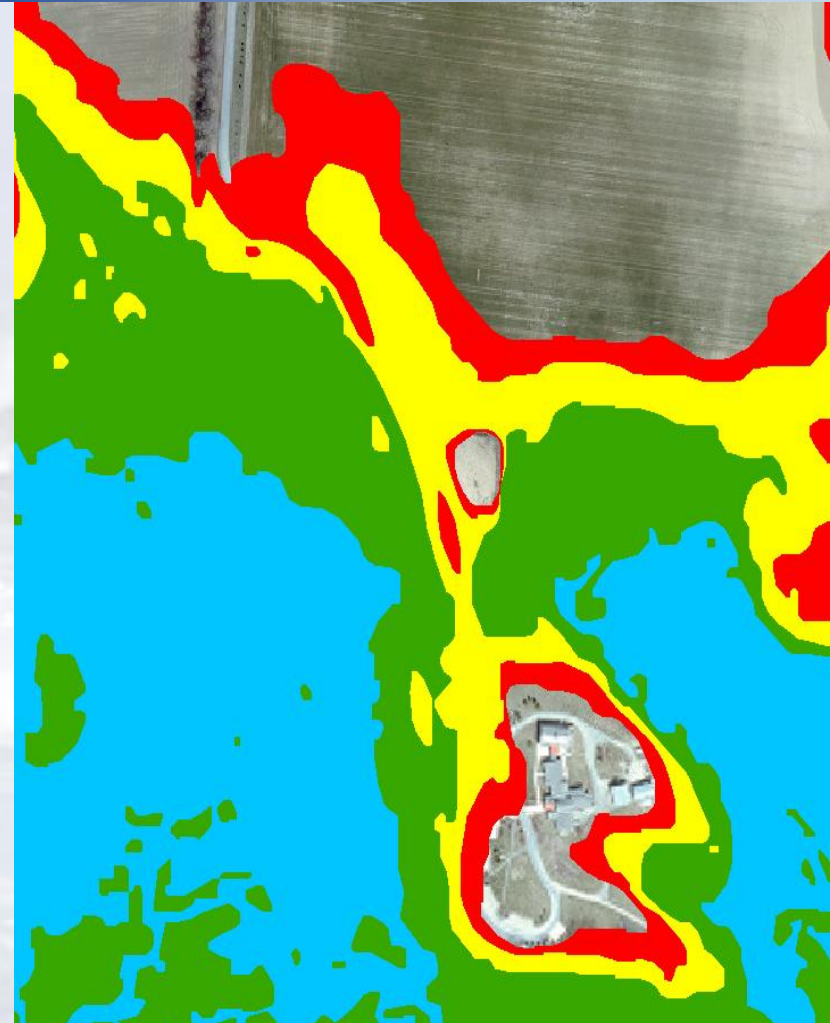
Adapted from NOAA (2010). Adapting to climate change: a planning guide for coastal managers



Sea Level Rise Scenario Maps

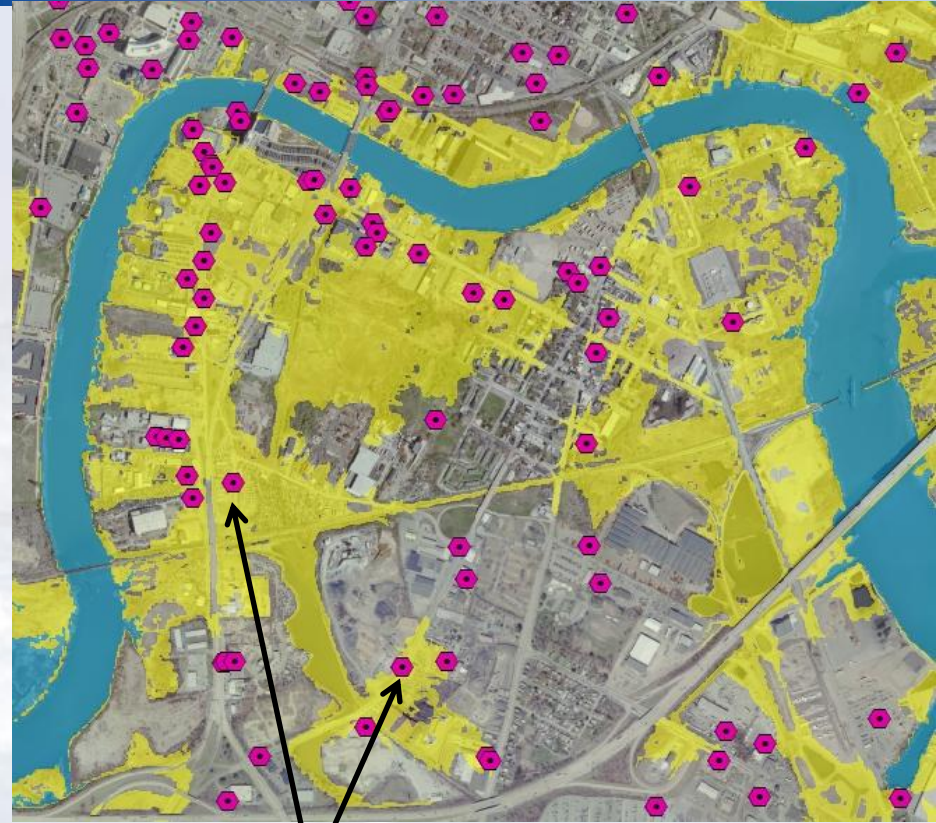
DNREC Planning Scenario Maps

- ✓ Bath-tub Model – does not account for future changes in shoreline or elevation
- ✓ High resolution aerial photography (LiDAR)
- ✓ For planning purposes only



Vulnerability Assessment

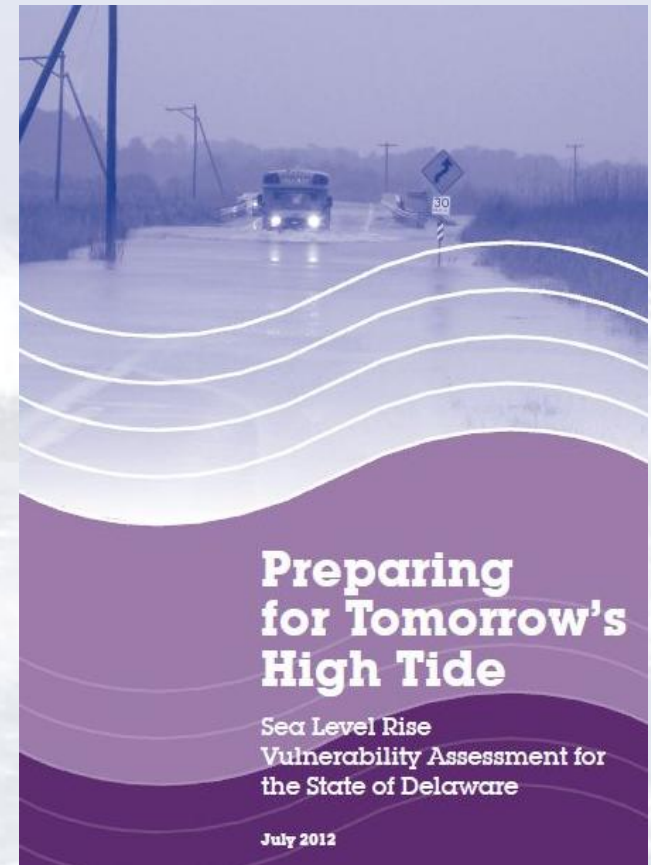
- 79 resource assessments
 - ✓ Description
 - ✓ Exposure assessment
 - ✓ Impact assessment
 - ✓ Map (where possible)
- All resources ranked
 - ✓ High & medium concern resources being considered for adaptation phase



Potential Exposure of Underground Storage Tanks at 1.0 meter sea level rise

Vulnerability Assessment: Results

- Potentially Inundated
 - ✓ 8-11% Total Land Area
 - ***Tax assessed value \$1.5 B***
 - ✓ Direct effects in all counties and 31 towns
- Of highest concern statewide:
 - ✓ Industrial Areas and Port
 - ✓ Railroads, roads and evacuation
 - ✓ Dams and Dikes
 - ✓ Future development areas
 - ✓ Tourism/coastal recreation
 - ✓ Habitats and protected lands
 - ✓ Wells



Information you can use

- Description of potential impacts
- Exposure data tables
- Statewide exposure maps
- Potential secondary social, economic and environmental impacts



Chris Bennett

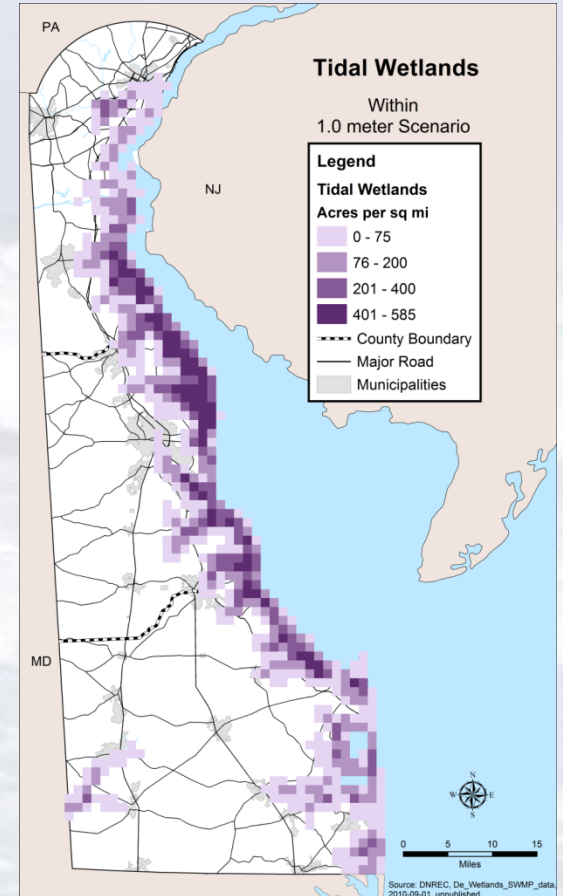
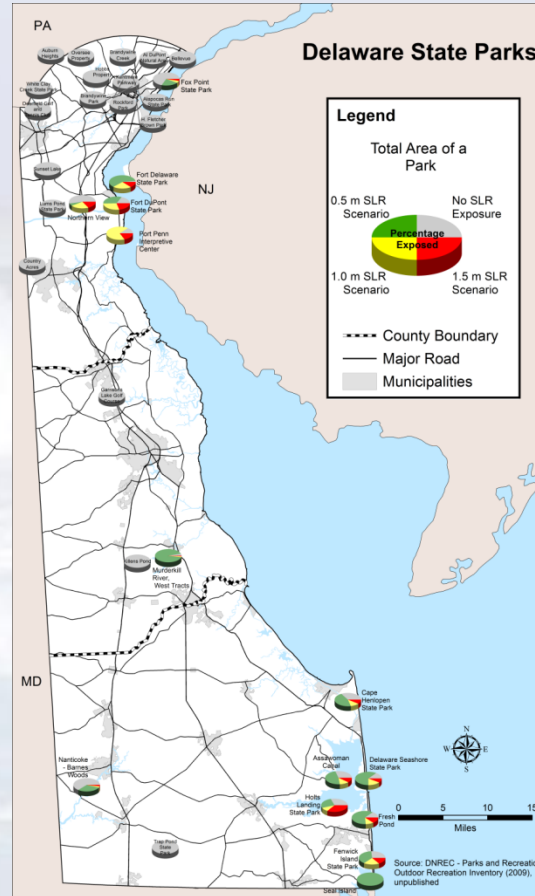
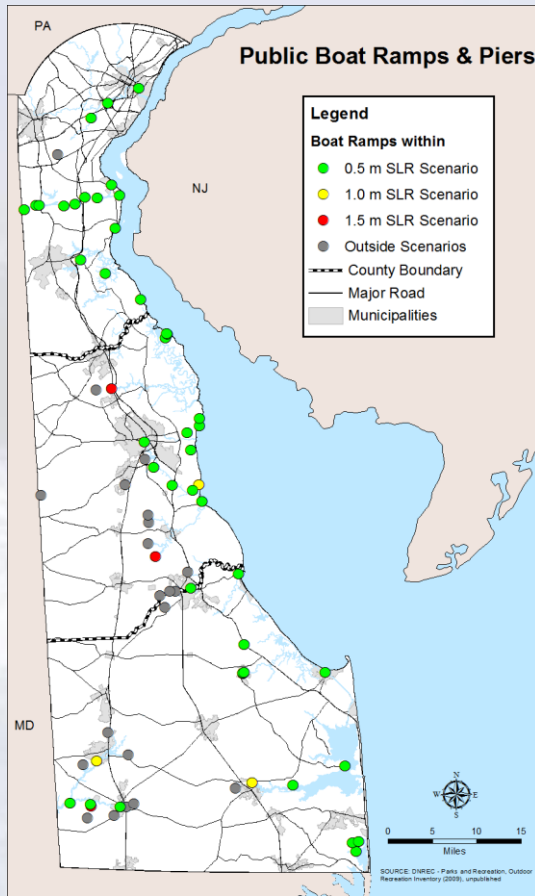
Example Data Table

Land Area							
County	Total Acres	Acres Inundated by SLR Scenarios			Percent of Total Inundated by SLR Scenarios		
		0.5 m	1.0 m	1.5 m	0.5 m	1.0 m	1.5 m
State	1,385,495	110,497	133,531	151,528	8%	10%	11%
New Castle	278,754	25,179	29,916	33,148	9%	11%	12%
Kent	510,428	50,095	57,784	63,269	6%	11%	12%
Sussex	596,314	35,223	45,831	55,111	6%	8%	9%

Source: USGS and Delaware Geologic Survey, State Outline (Area), 2007-04-01

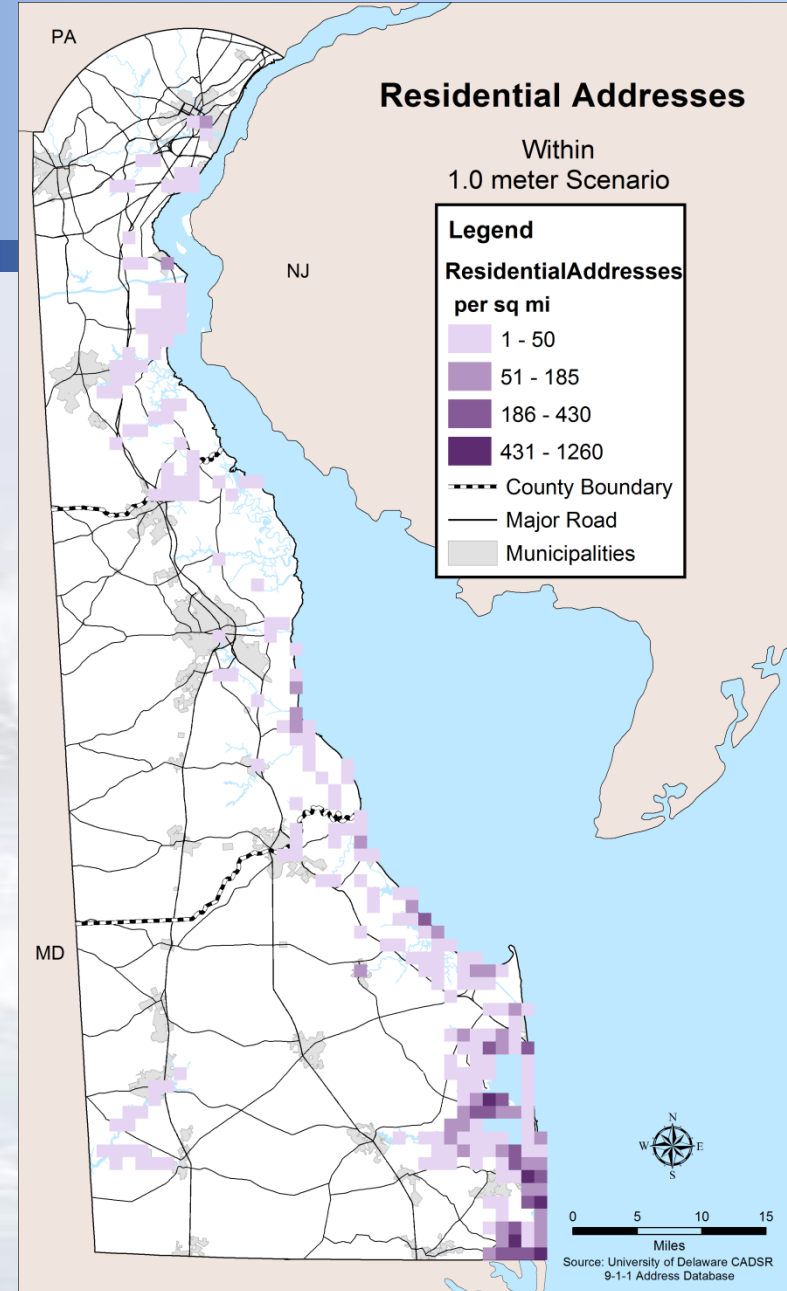


Example Point and Grid Maps



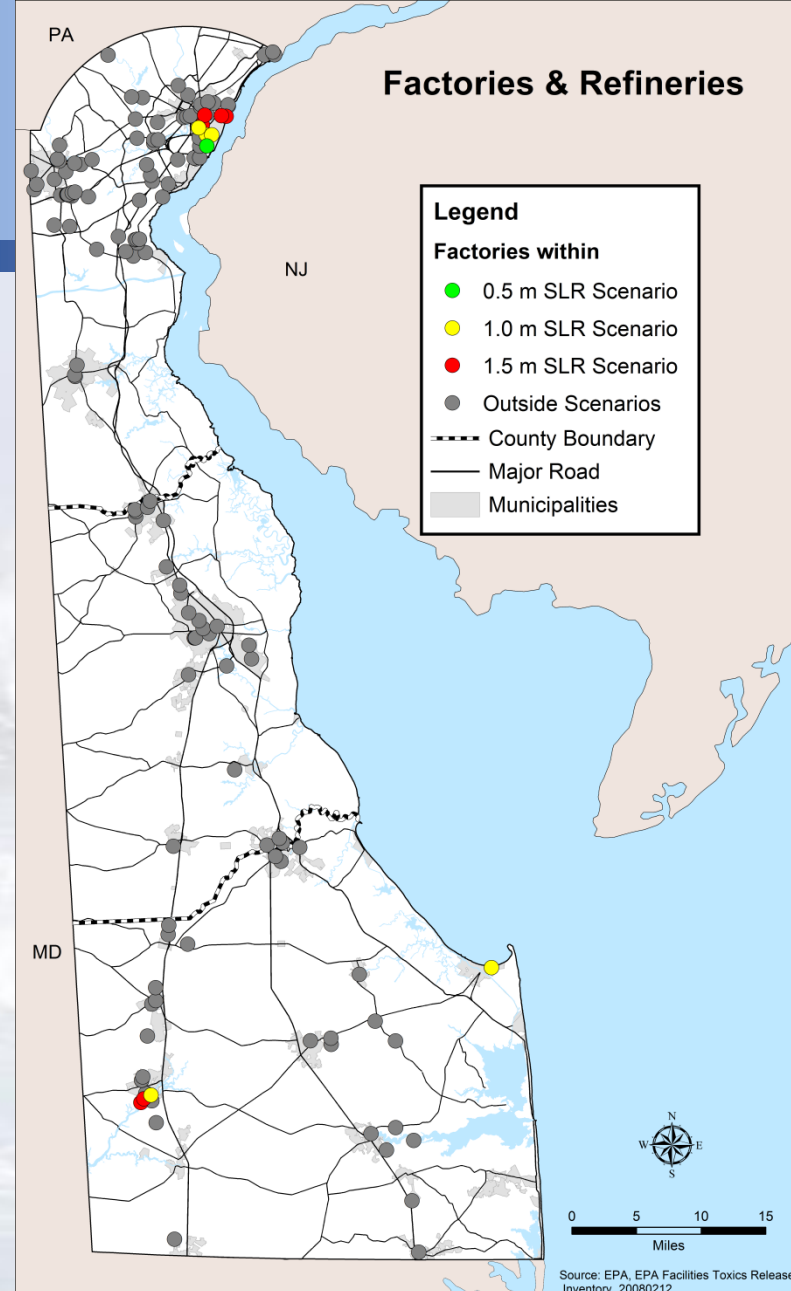
Residential

- 1%-5% of 346,000 addresses potentially inundated
 - ✓ Up to 32% of manufactured homes in Sussex
 - ✓ Up to 13% (15,000) homes in Sussex
- Impacts
 - ✓ Flood damage, insurance costs, access, community
- Varying ability to adapt
- Primarily County level impact
- Ranked as moderate



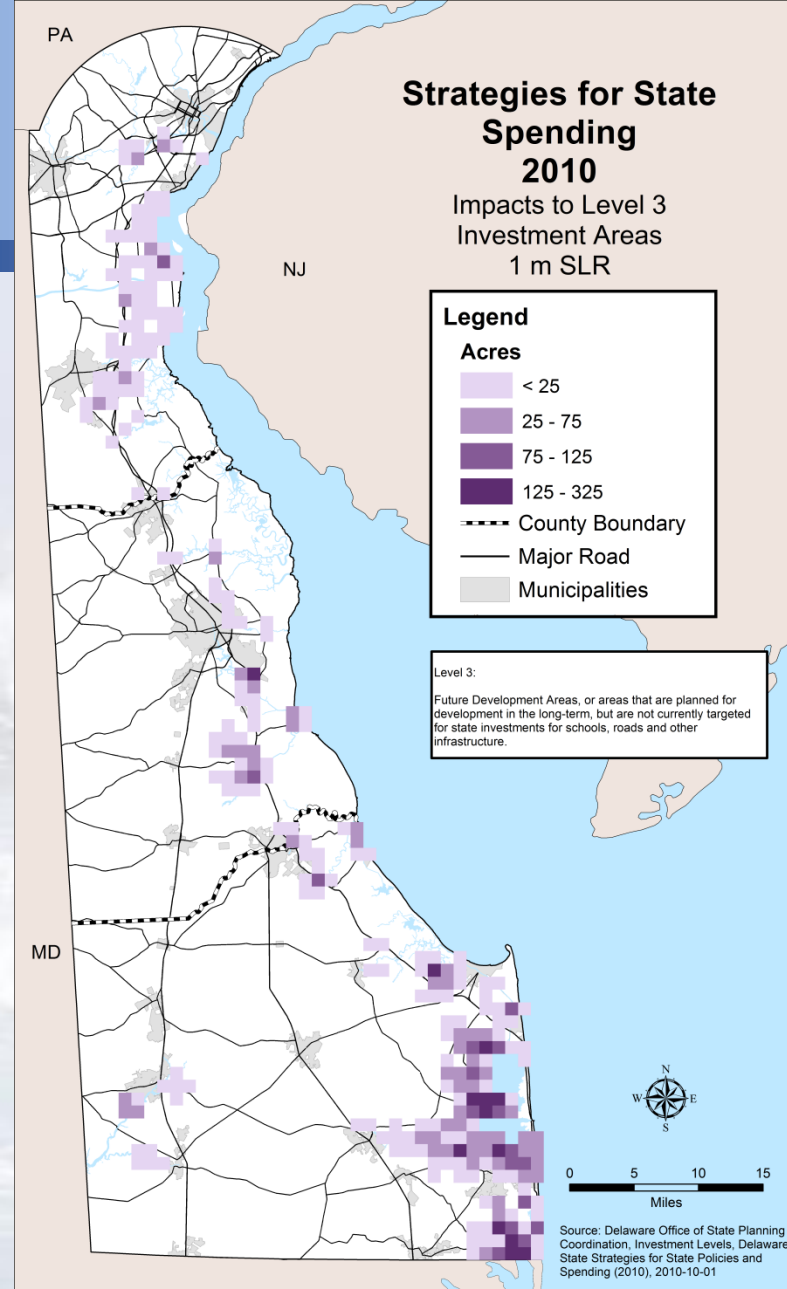
Industrial Areas

- 16%-25% of 4,000 acres permitted by CZA potentially inundated
 - ✓ Primary NCCo
- Impacts
 - ✓ Inundation of associated structures
 - ✓ Limited ability to relocate within state
- Statewide economic impact
- Ranked as high



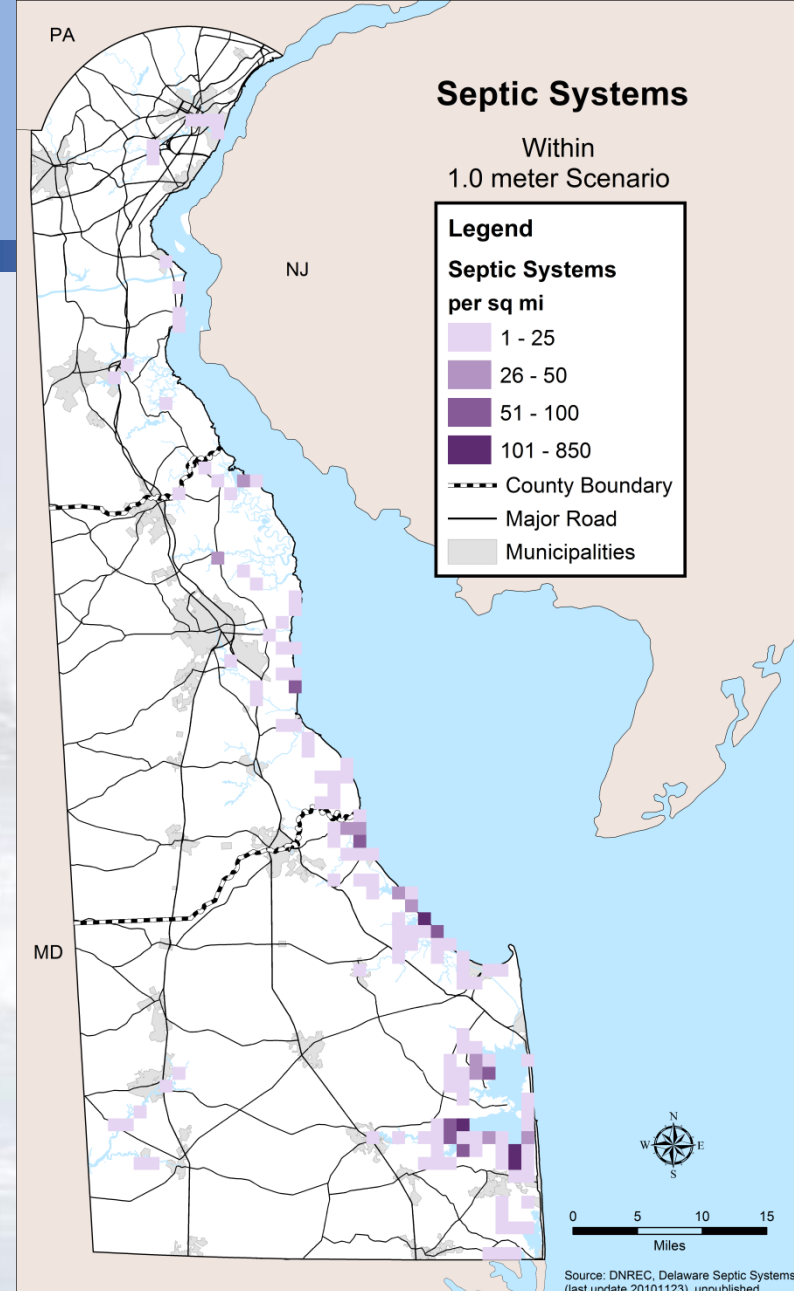
Future Development Areas

- 3%-7% of 152,000 acres of Level 3 areas potentially inundated
 - ✓ 4/5 in Sussex County
- Impact
 - ✓ Reduced growth zones
 - ✓ Challenge to redirect growth without limiting choice
- Statewide potential impacts for state funding, legal concerns.
- Ranked as high



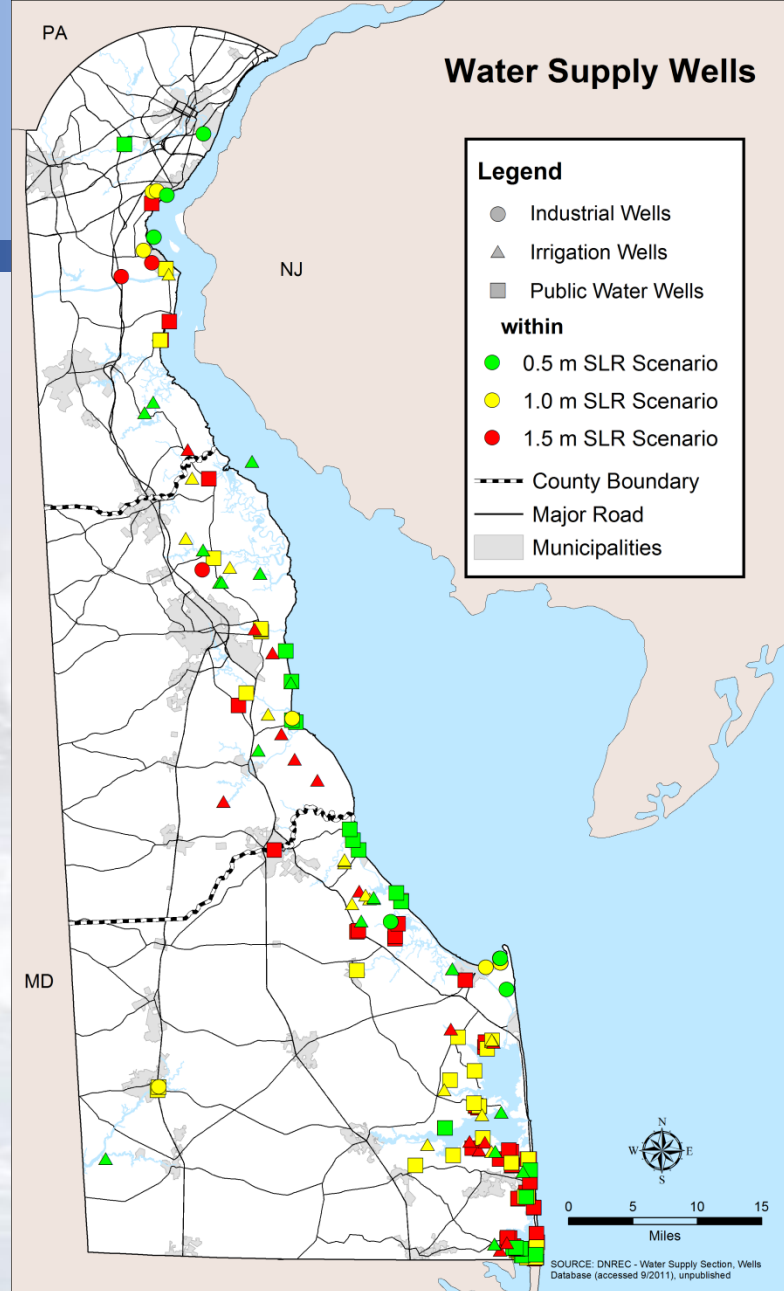
Septic Systems

- 1% - 4% of 78,000 potentially inundated
- Greatest exposure found in Sussex
 - ✓ High concentration along Inland Bays
- Functionality concerns before inundation
 - ✓ Rising water tables
- Ranked as moderate



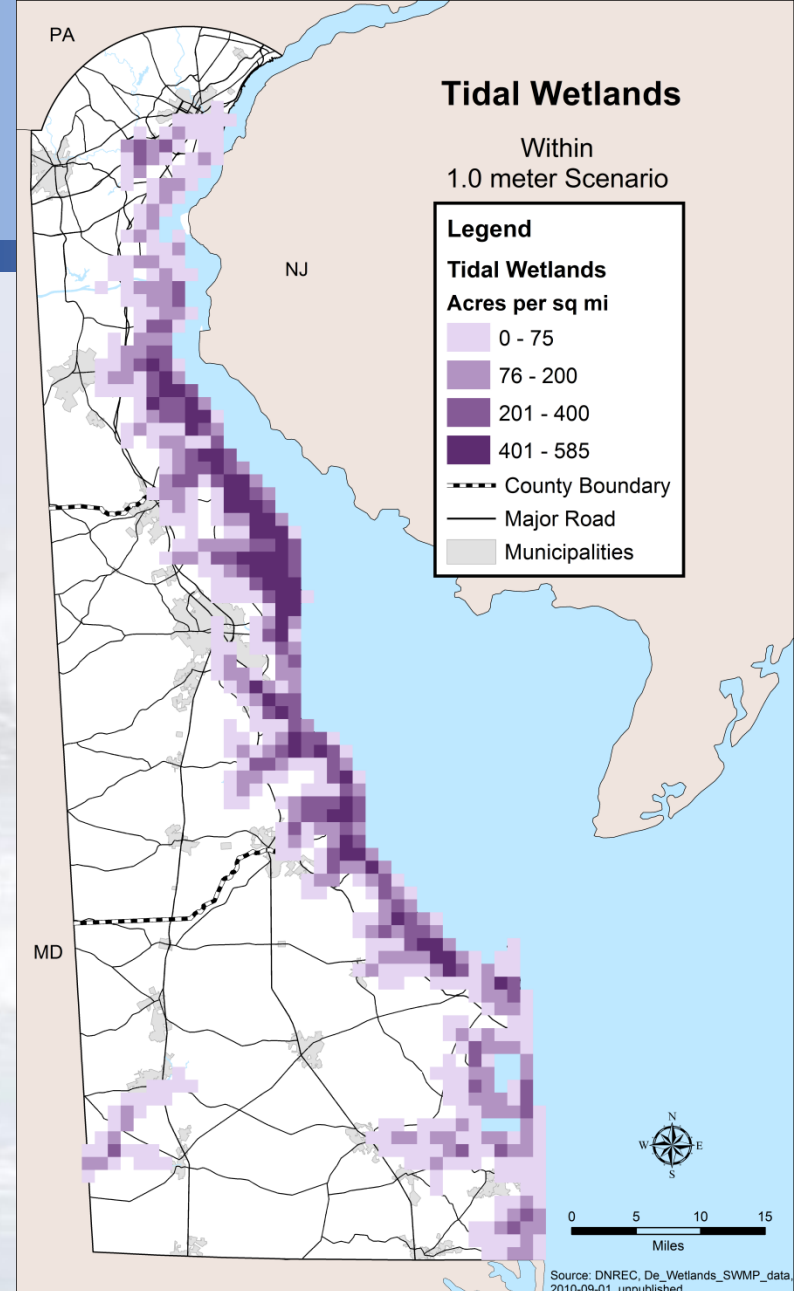
Wells

- Potentially inundated
 - ✓ Domestic wells: 3% - 7%
 - ✓ Industrial wells: 3% - 7%
 - ✓ Irrigation wells: 1% - 2%
 - ✓ Public wells: 2% - 10%
- Water supply concerns
- Saltwater intrusion may impact inland wells
 - ✓ Statewide concern
- Ranked as high



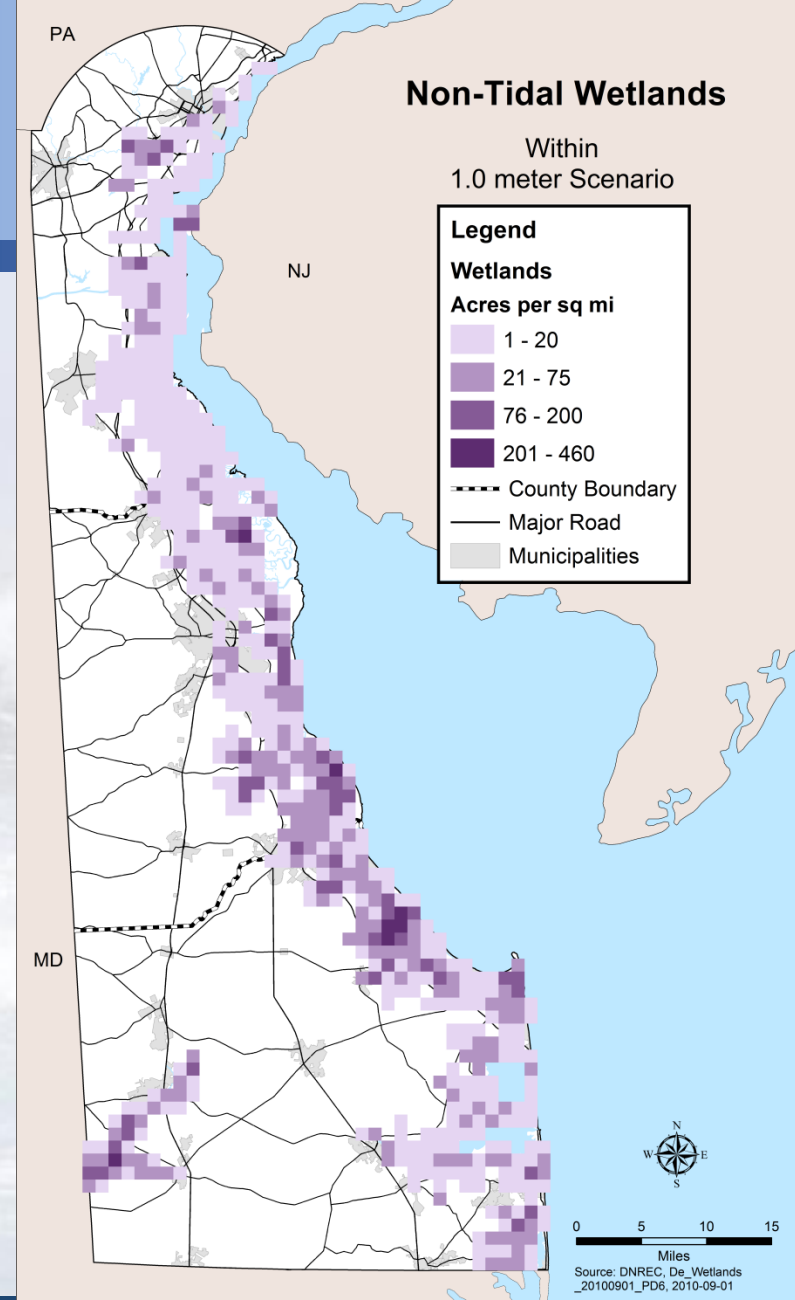
Tidal & Freshwater Tidal Wetlands

- Tidal
 - ✓ 97% to 99% potentially inundated
- Freshwater Tidal
 - ✓ 84% to 98% statewide
- Highly productive systems
- Absorb storm surges and flooding
- Recreational value
- Future salinity changes potential issue for tidal fresh



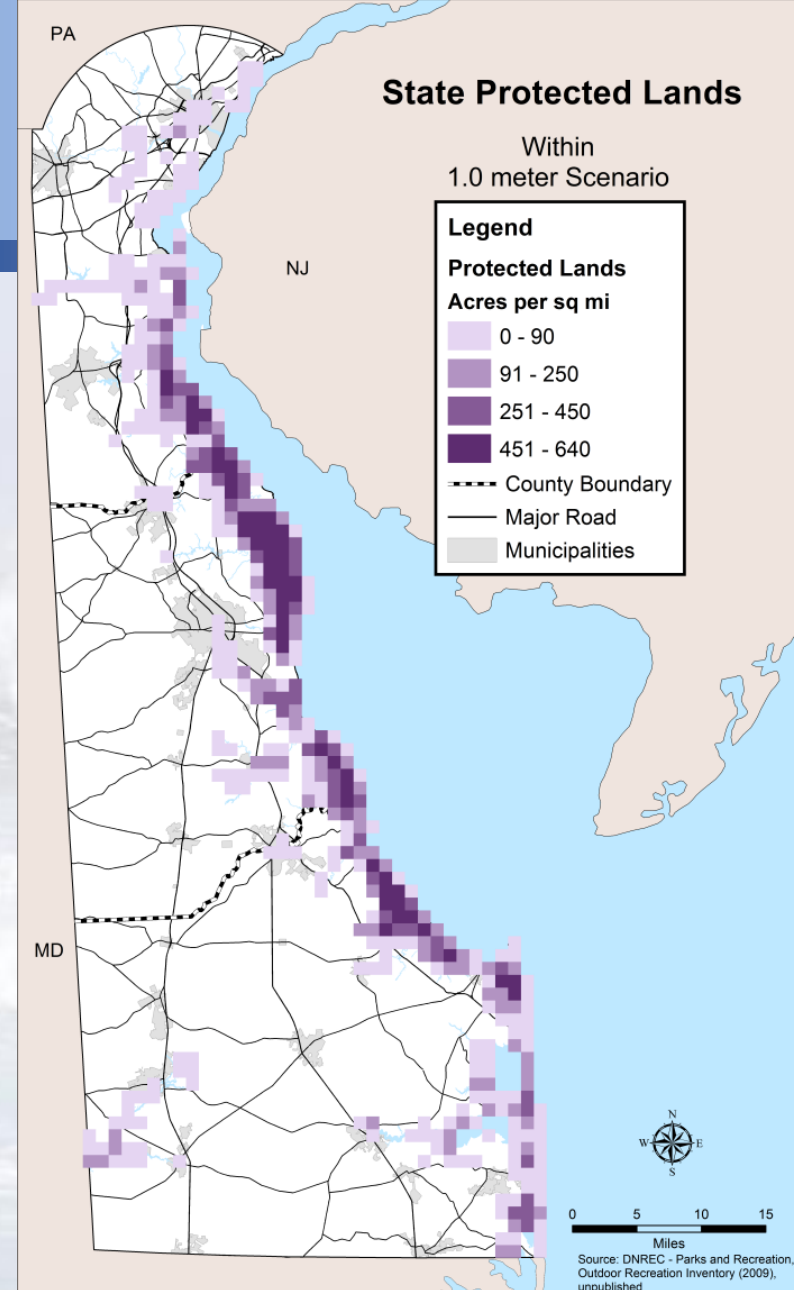
Non-tidal Wetlands

- 8% to 12% of 163,000 acres potentially inundated
 - ✓ Add'l impacts may result from saltwater intrusion
- Relatively limited acreage inundated by SLR
 - ✓ Development and Ag thought to be a more important driver of loss
- Ranked as low



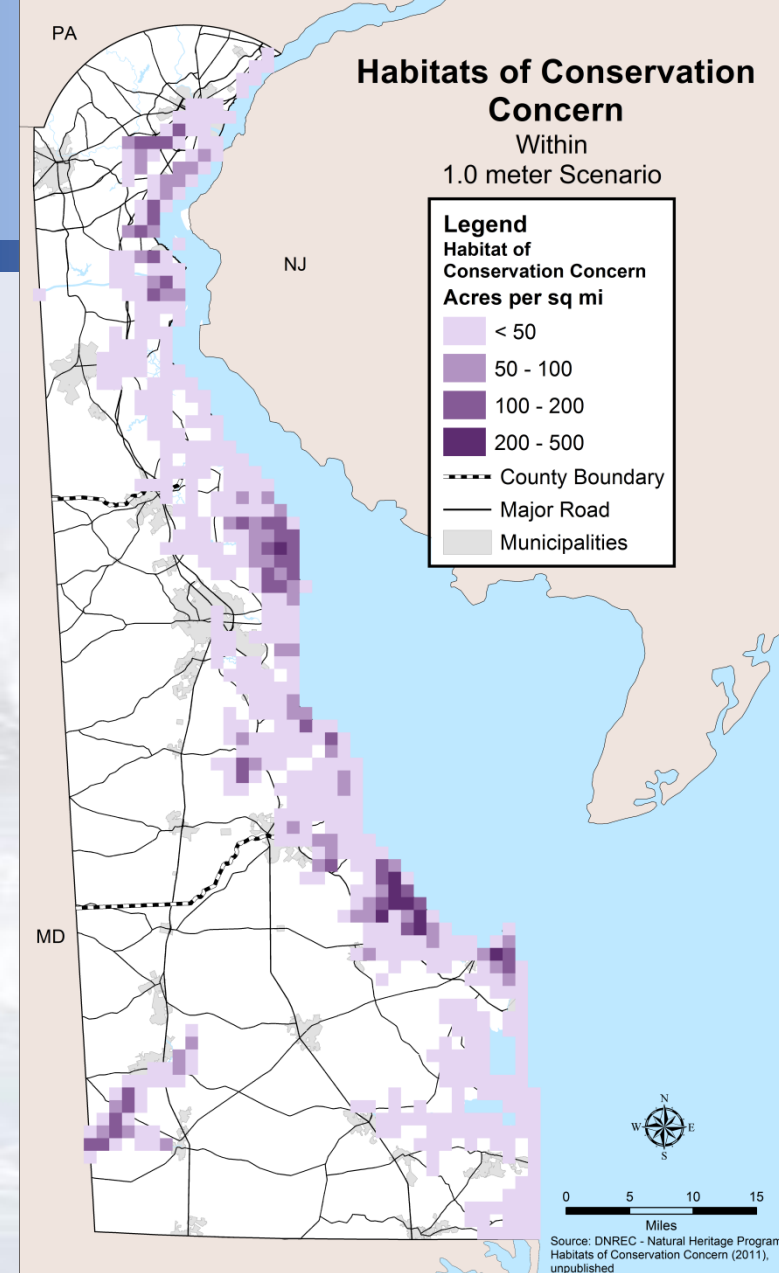
Protected Lands Statewide

- 37% to 44% statewide potentially inundated
- Includes
 - ✓ State owned lands
 - ✓ federal refuges
 - ✓ municipal holdings
 - ✓ public and private conservation easements
- Represent a variety of habitat types and outdoor recreation opportunities



Habitats of Conservation Concern

- Unique habitat types identified in the DE Wildlife Action Plan
- 15 of 27 HCC's exposed to SLR
- Of those, 55% to 65% of 31,000 acres potentially inundated
- HCCs have high diversity, sensitive to disturbance, harbor rare species
- Ranked as 'high'



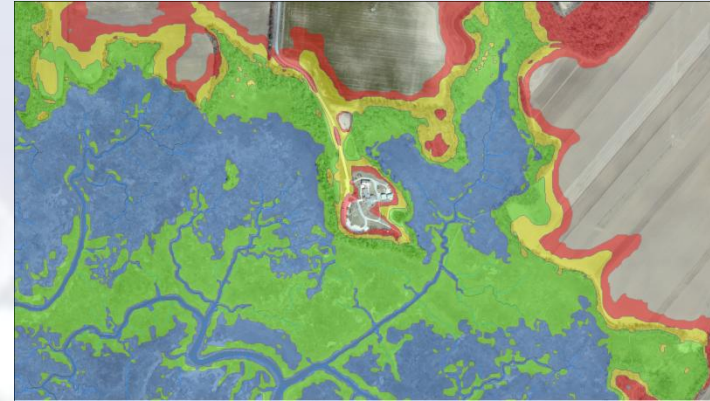
Intensive effort, worth the reward?

- Impacts from SLR can be tallied and visualized, then used to spur action
 - ✓ Press
 - ✓ Citizens
 - ✓ Legislators
 - ✓ Researchers
- SLRAC focusing adaptation efforts on high and moderate concern resources
- Can be duplicated



Useful Websites & Tools

- Statewide SLR Scenario Maps
 - ✓ Online Viewer & GIS layers
 - ✓ <http://de.gov/slrmap>
- Statewide Vulnerability Assessment
 - ✓ <http://de.gov/slrva>
- Digital Coast Website
 - ✓ How tos, data downloads
 - ✓ www.csc.noaa.gov/digitalcoast
- Grants and Technical Assistance
 - ✓ Sign up for notices



Join us for Sea Level Rise Public Engagement Sessions next month!

February 13 – Lewes, DE

February 19 – New Castle, DE

February 25 – Dover, DE

<http://de.gov/adaptationengagement>



Questions?

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