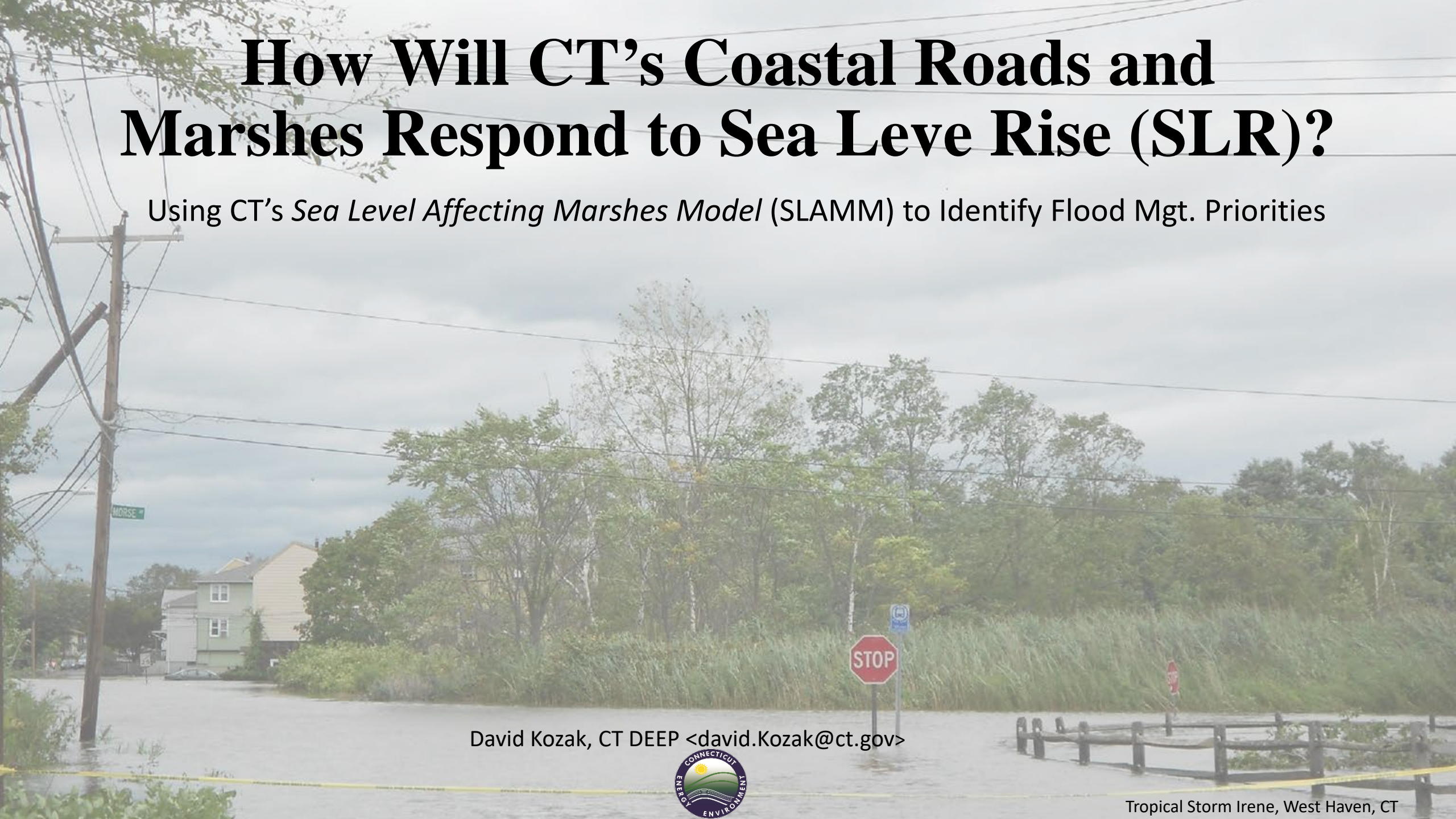


How Will CT's Coastal Roads and Marshes Respond to Sea Level Rise (SLR)?

Using CT's *Sea Level Affecting Marshes Model* (SLAMM) to Identify Flood Mgt. Priorities



David Kozak, CT DEEP <david.kozak@ct.gov>



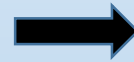
Tropical Storm Irene, West Haven, CT

Saltmarsh Unable to Keep Pace with SLR

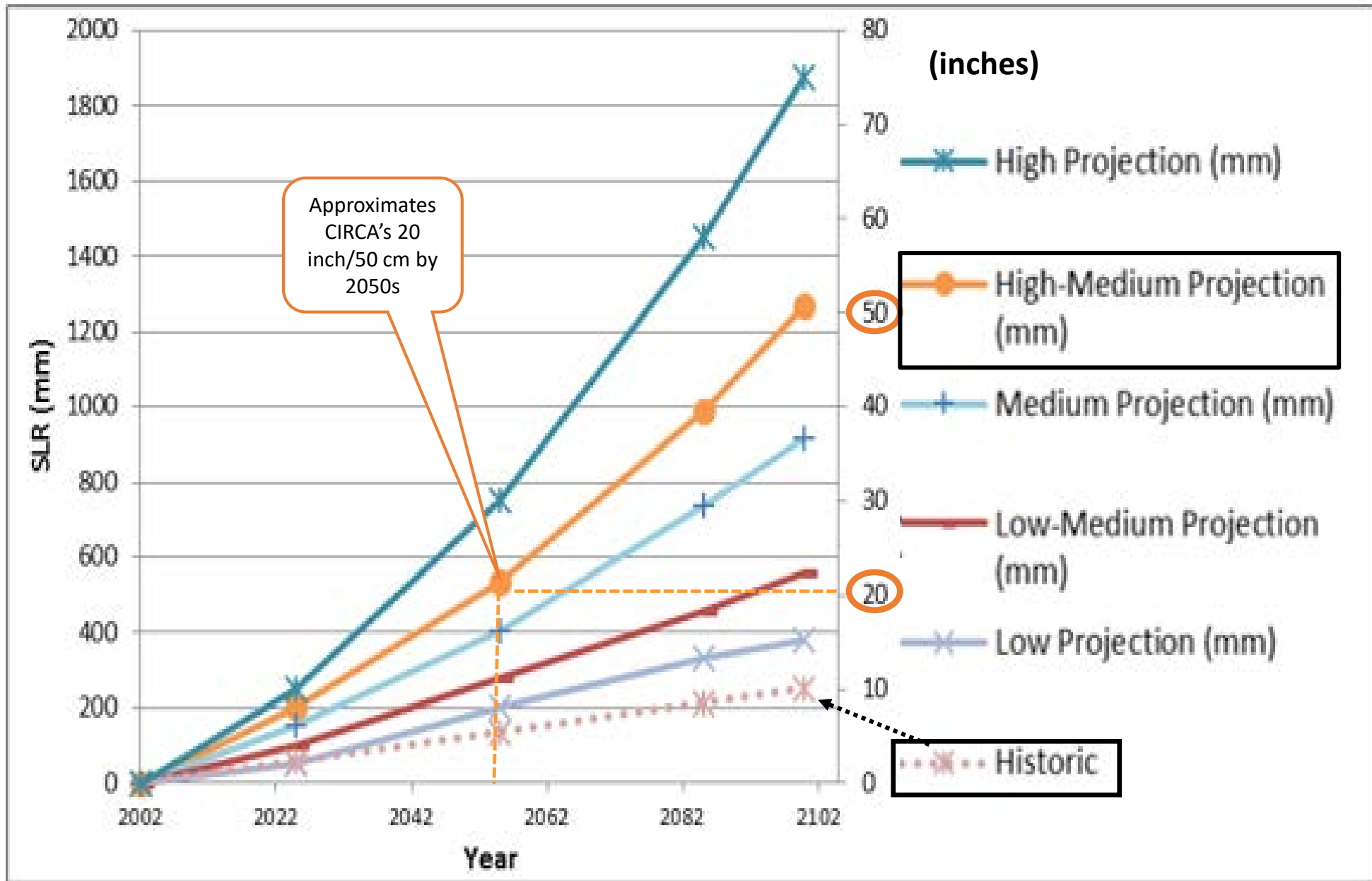


Changing
wetland type &
> open water

More Frequent 'Sunny Day' High Tide Flooding



LIS Projected vs. Historic Sea Level Rise



Key Questions

- How will CT's coastal marshes change with SLR-- implications?
- How will coastal road flood change in respond to SLR
- Which coastal area roads are most flood-prone and how should intervention (\$) assistance be prioritized?
- What frequency of coastal road flooding triggers intervention?
- How will we manage road reconstruction/elevation affecting marshes?
- Where are the best marsh migration area conservation opportunities and marsh creation/restoration through road reconstruction?

I. The Context-CT's Embayment-dominated Shoreline



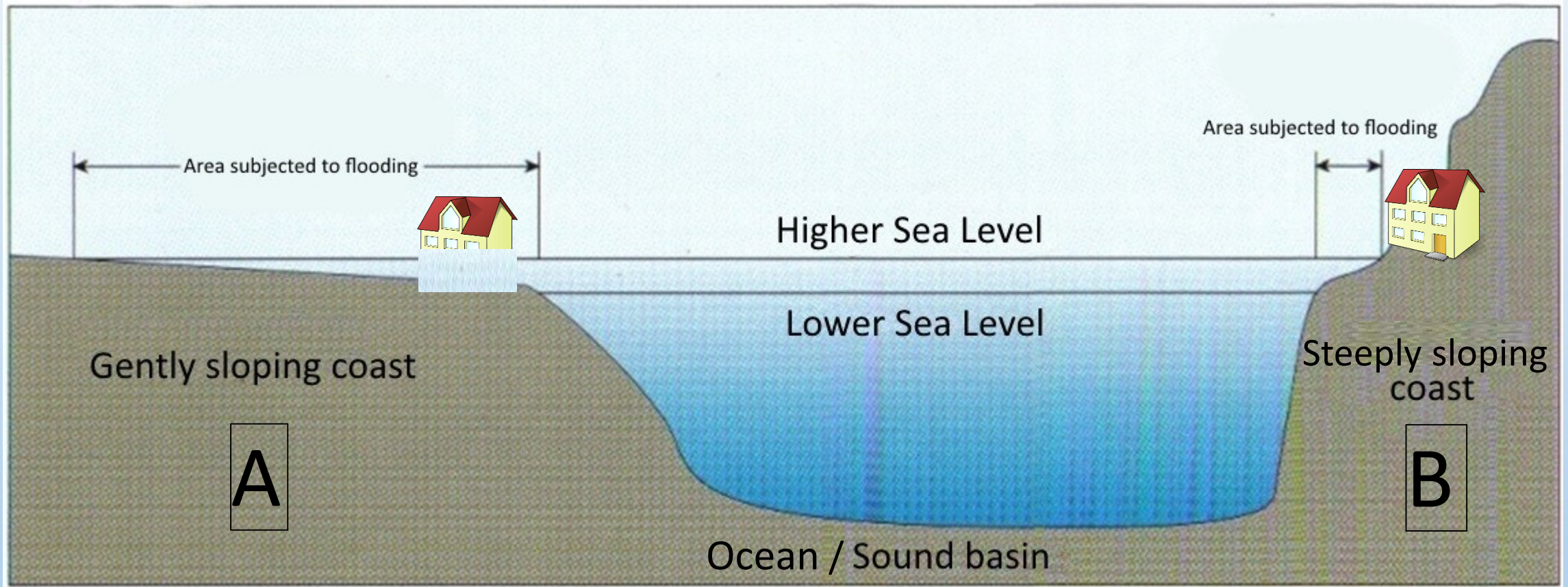
~ 23, 000 Calendar Years Before Present



A 'Typical' CT Coastal Embayment



CT's Coast: A. or B. ?

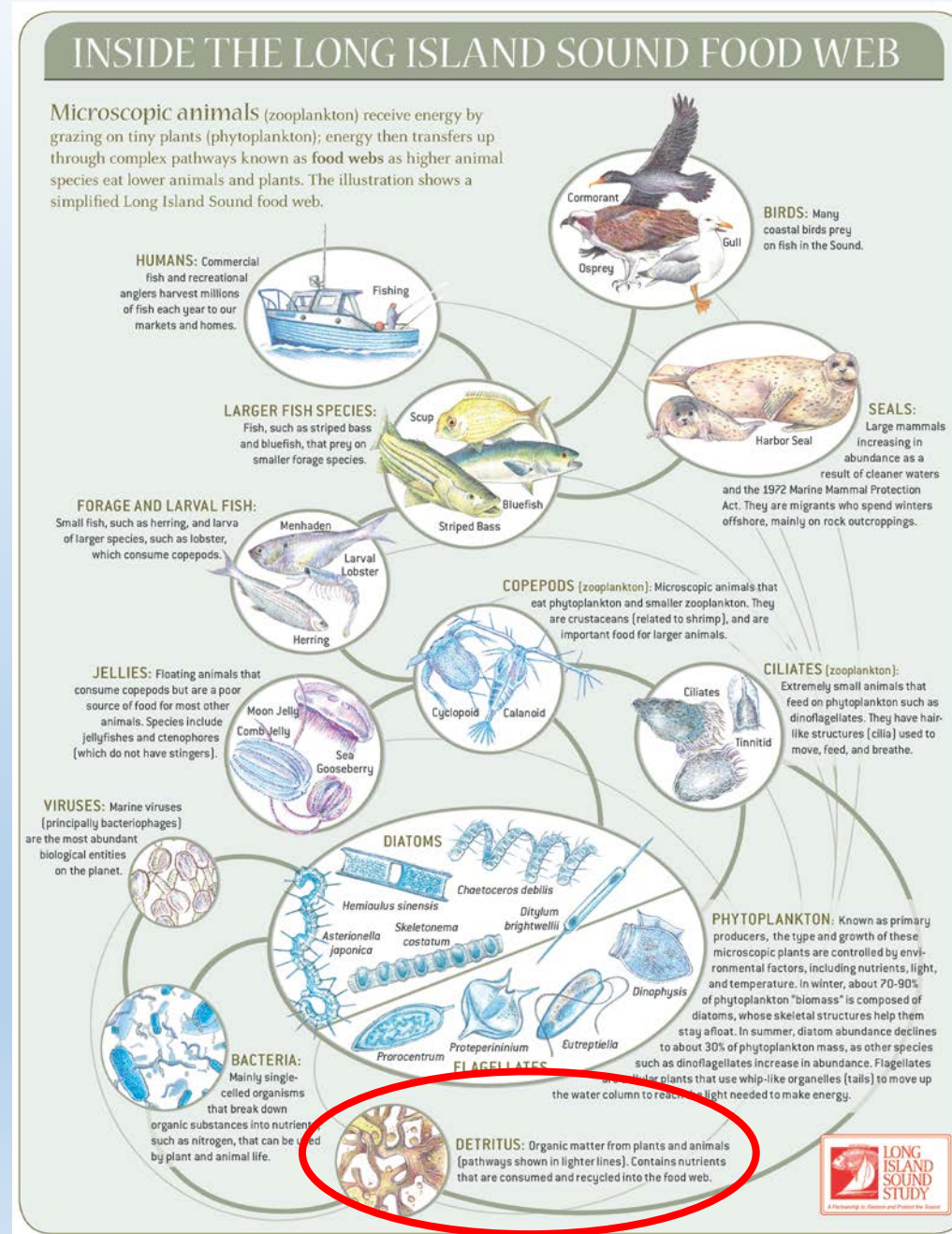


II. CT Marshes: A Steeply Sloping Coast's Response to SLR



Source: *Nature Climate Change*, volume 6, pages 253–260 (2016)

Why Care About the Future of CT's Saltmarshes?





Live marsh grasses

Salt marsh in growing season

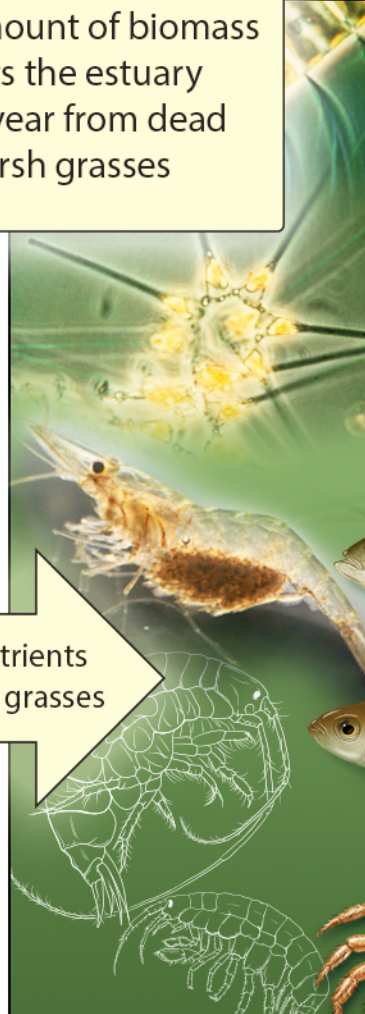


Dead marsh grasses

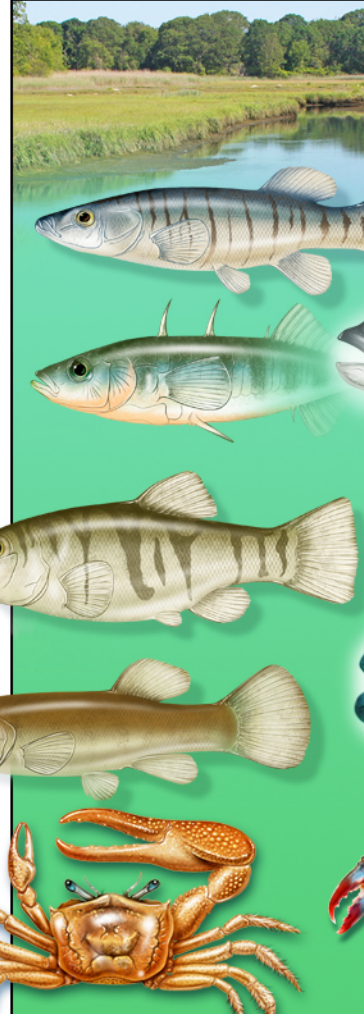
Salt marsh in winter

Huge amount of biomass enters the estuary every year from dead marsh grasses

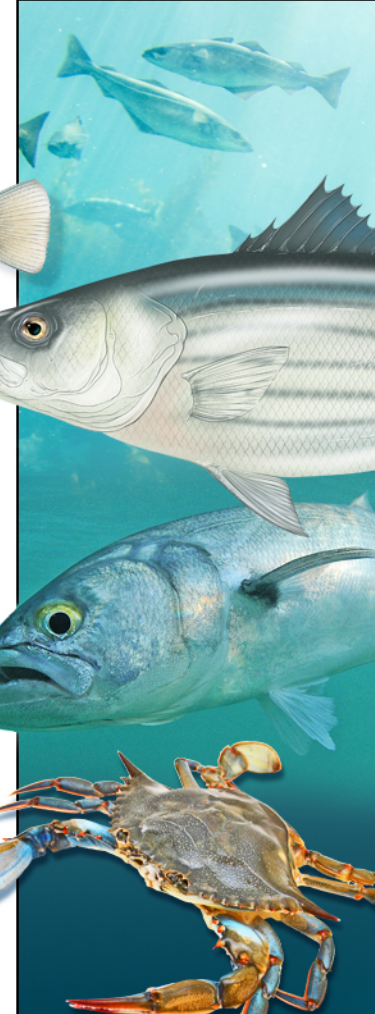
Flow of nutrients from marsh grasses



Primary breakdown by microfauna

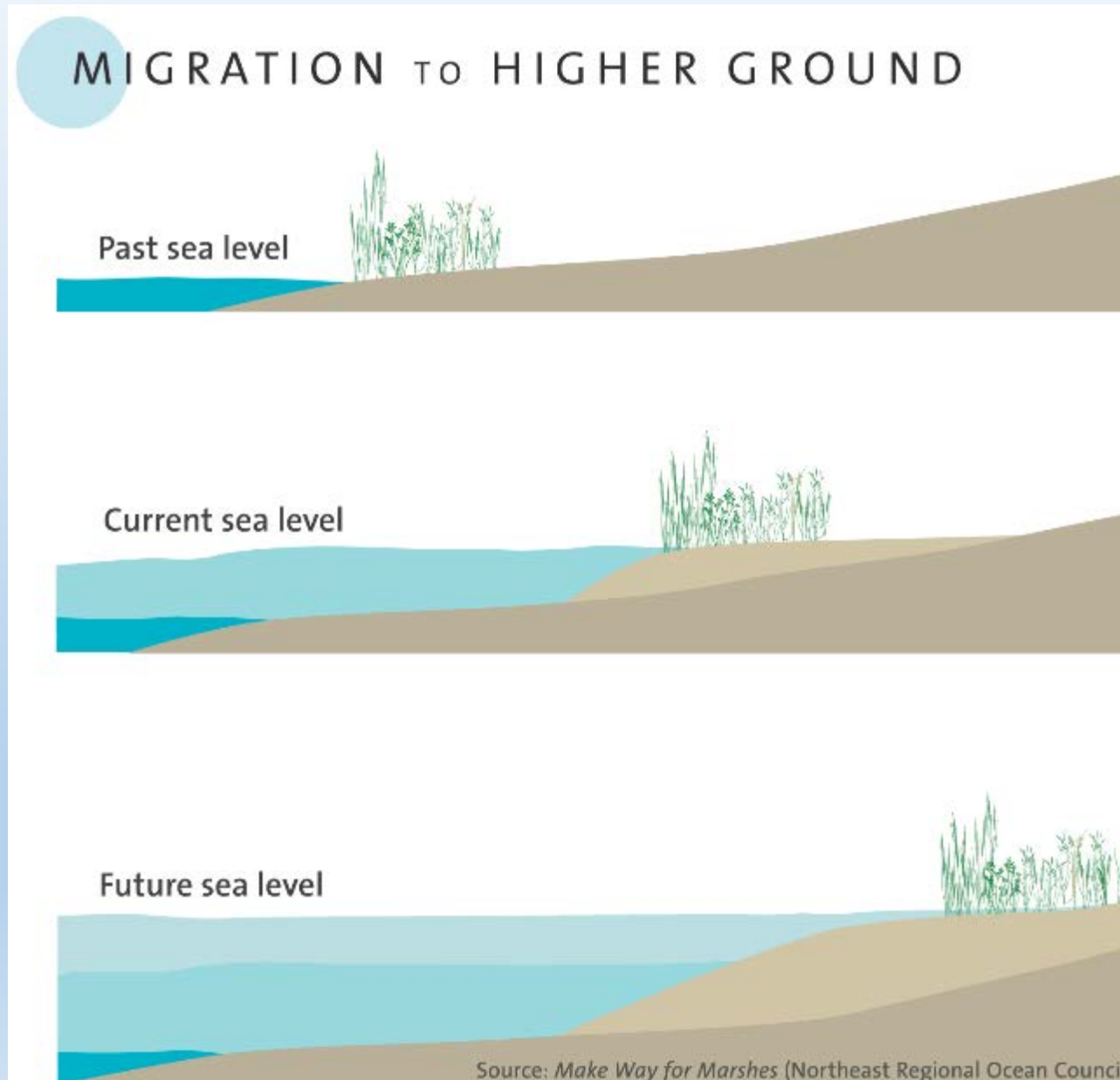


Small vertebrates and invertebrates



Larger predators (sport fish, crabs)

Coastal Marsh Response to SLR

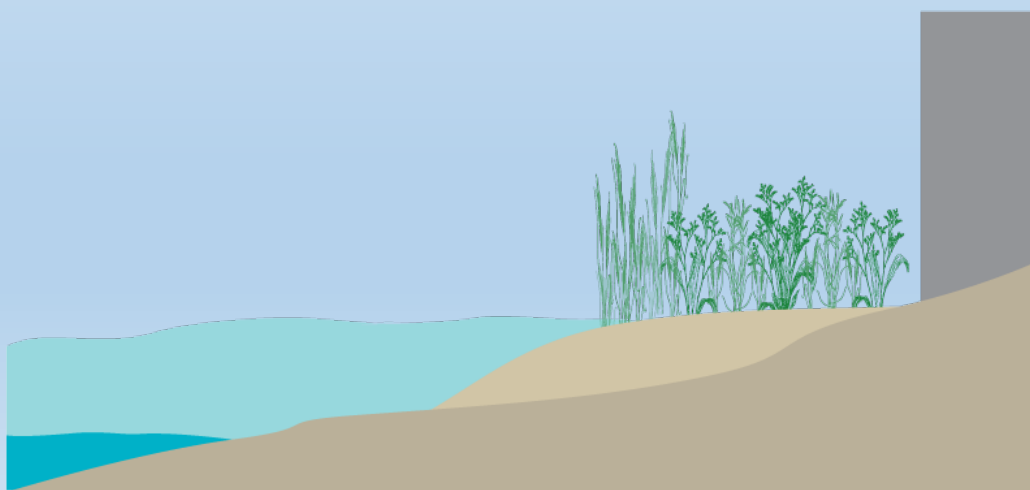
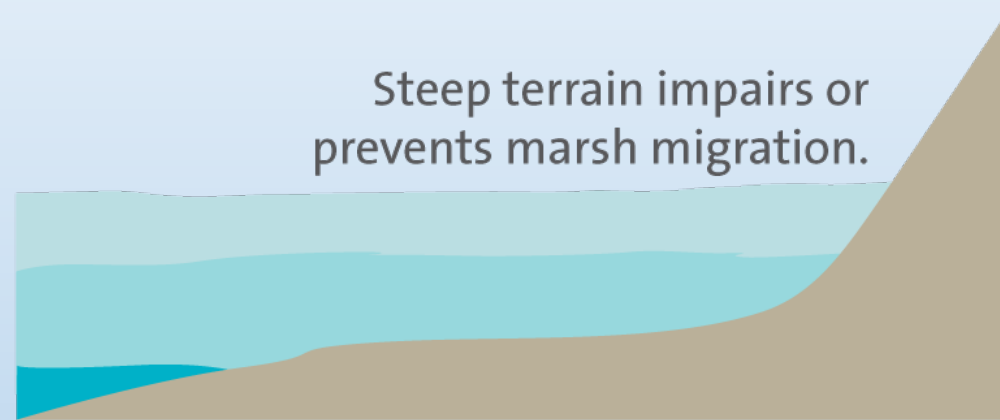
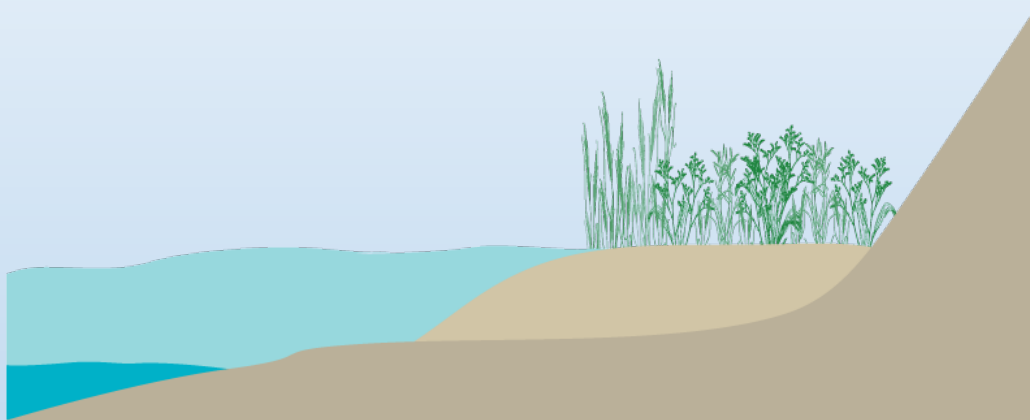


BARRIERS TO MARSH MIGRATION

Current Sea Level



Future Sea Level



Source: *Make Way for Marshes* (Northeast Regional Ocean Council)

A Saltmarsh with Nowhere to Go/Grow



Shoreline Protection Value of Coastal Marshes

- **Significant wave energy attenuation and erosion control <2 foot waves**
- **~ 50% of wave attenuation within first 30 feet of marsh (?) - highly variable**
- **Vegetation density**, height, stiffness, **width** greatest determinants effectiveness
- **Less effective** when storm waves accompanied **with large surge?**
- **Benefits vary** with bathymetry, marsh health and hydrology
- **Unaltered marshes best -**
- **Flood storage value?**

Sources: Christine Shepard, et al., *The Protective Role of Coastal Marshes*, A Systematic Review and Meta-analysis, in PLoS ONE 6(11):e27374 (2011) and Shepard et al., 2011* < PLoS ONE 6(11): e27374. doi:10.1371/journal.pone.0027374>; NRC, 2014* <Reducing coastal risk on the East and Gulf Coasts, The National Academies Press, Washington, D.C., 208 pp.>

Marshes Effectively Reduce Low Wave Height Wave Energy



Photo: Jennifer O'Donnell

Effects of Shoreline Hardening- What's lost?

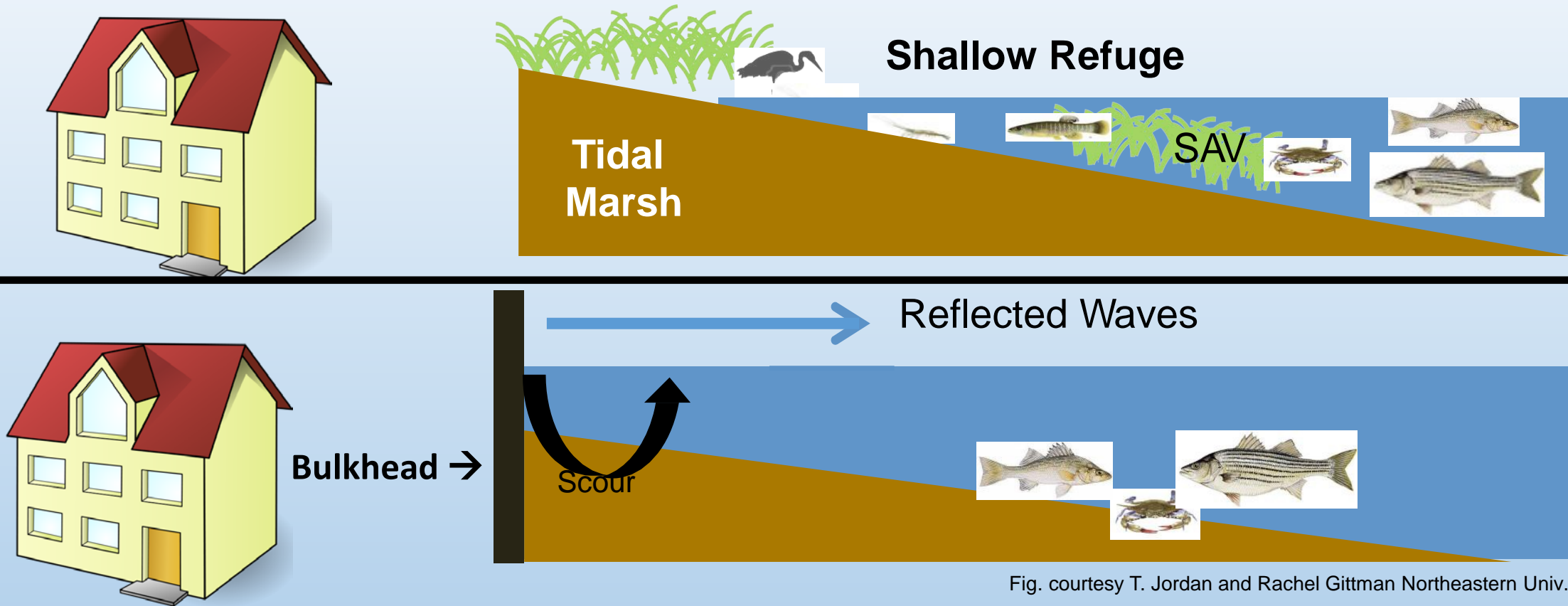


Fig. courtesy T. Jordan and Rachel Gittman Northeastern Univ.

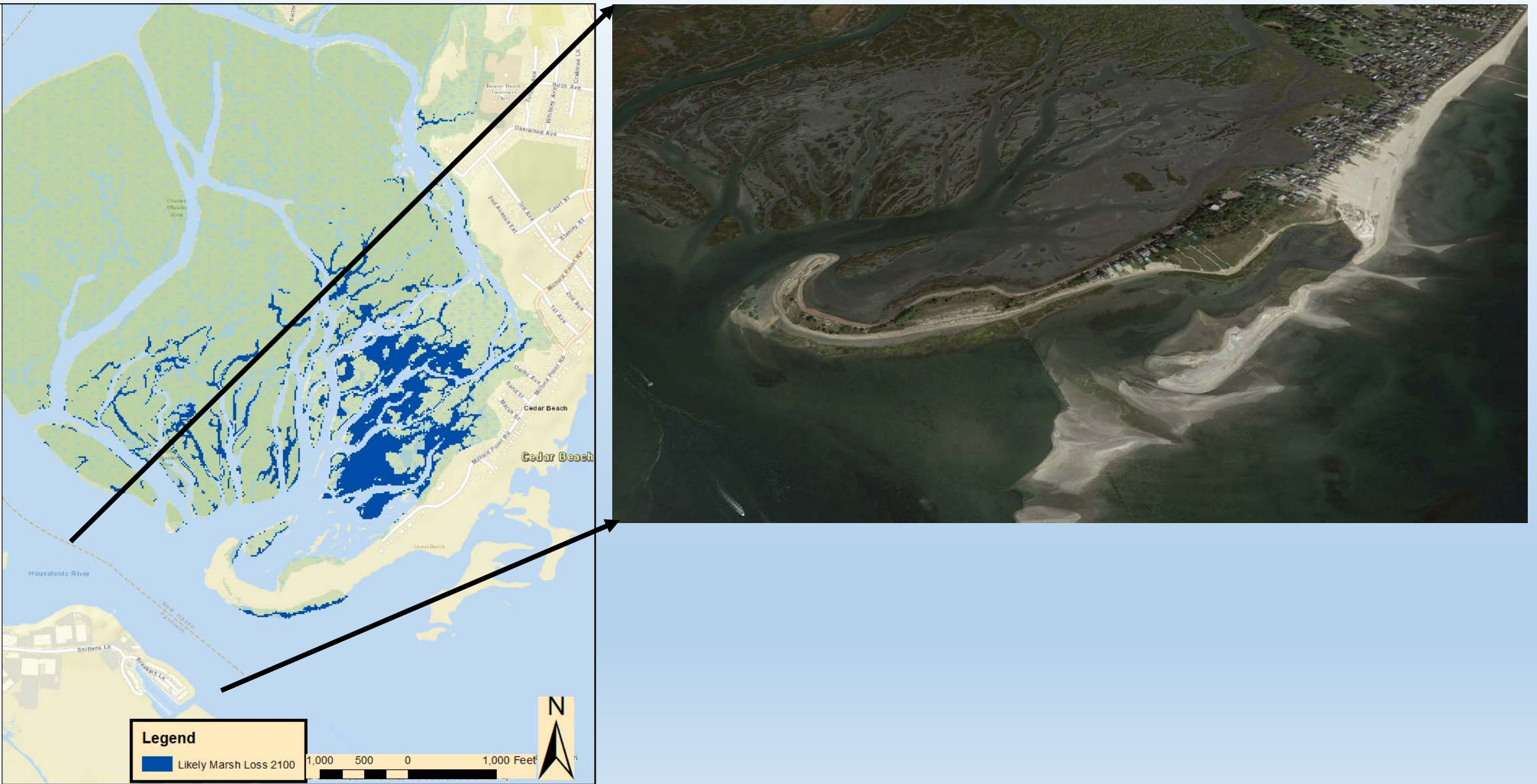
Changes **BELOW** the MHW line:

- Sediment transport & particle-size change
- Vegetation loss
- Benthic Fauna, Birds, Fish abundance reduced
- Denitrification capacity reduced

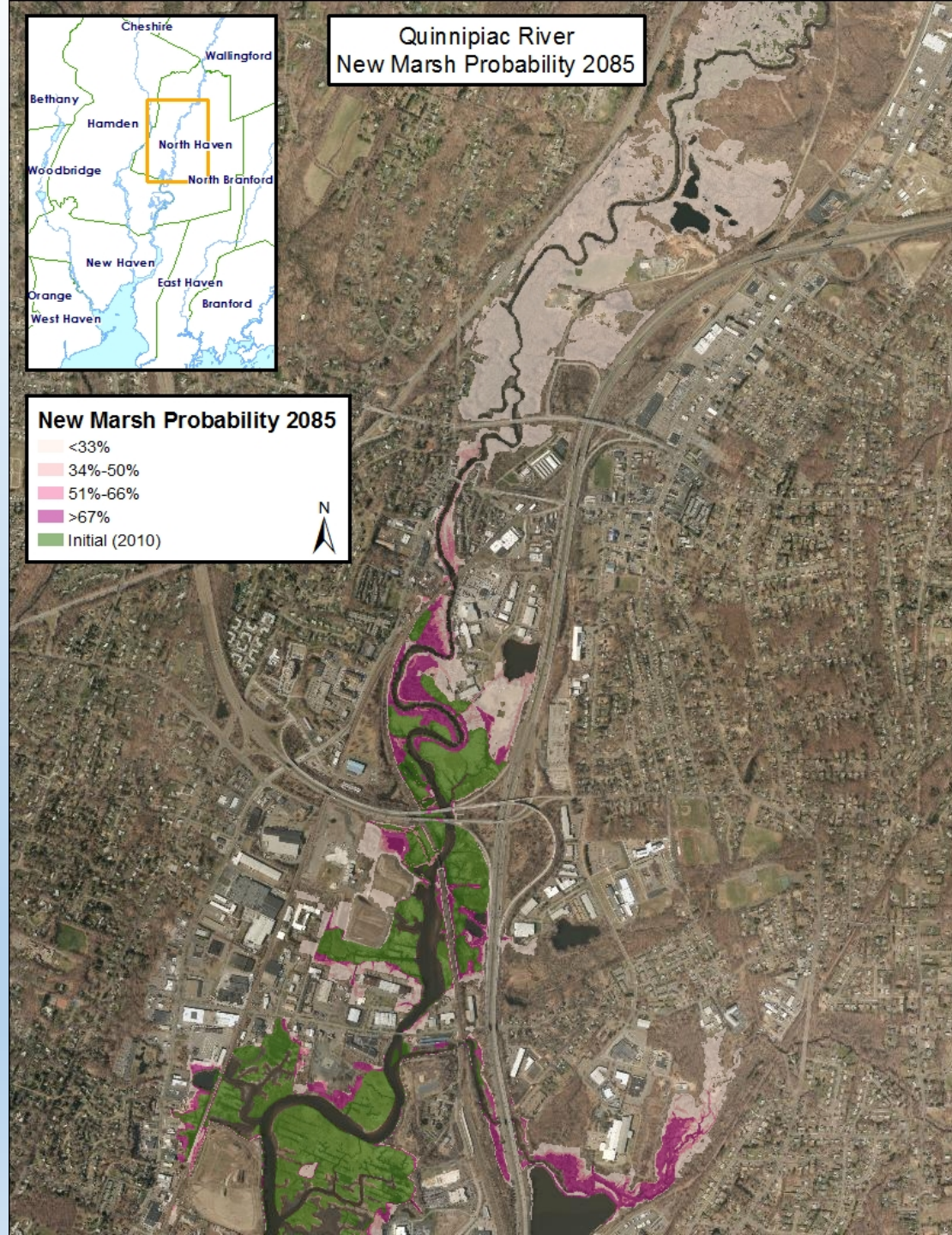
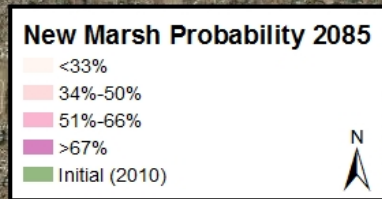
Bulkheads vs. Saltmarsh for Erosion Control



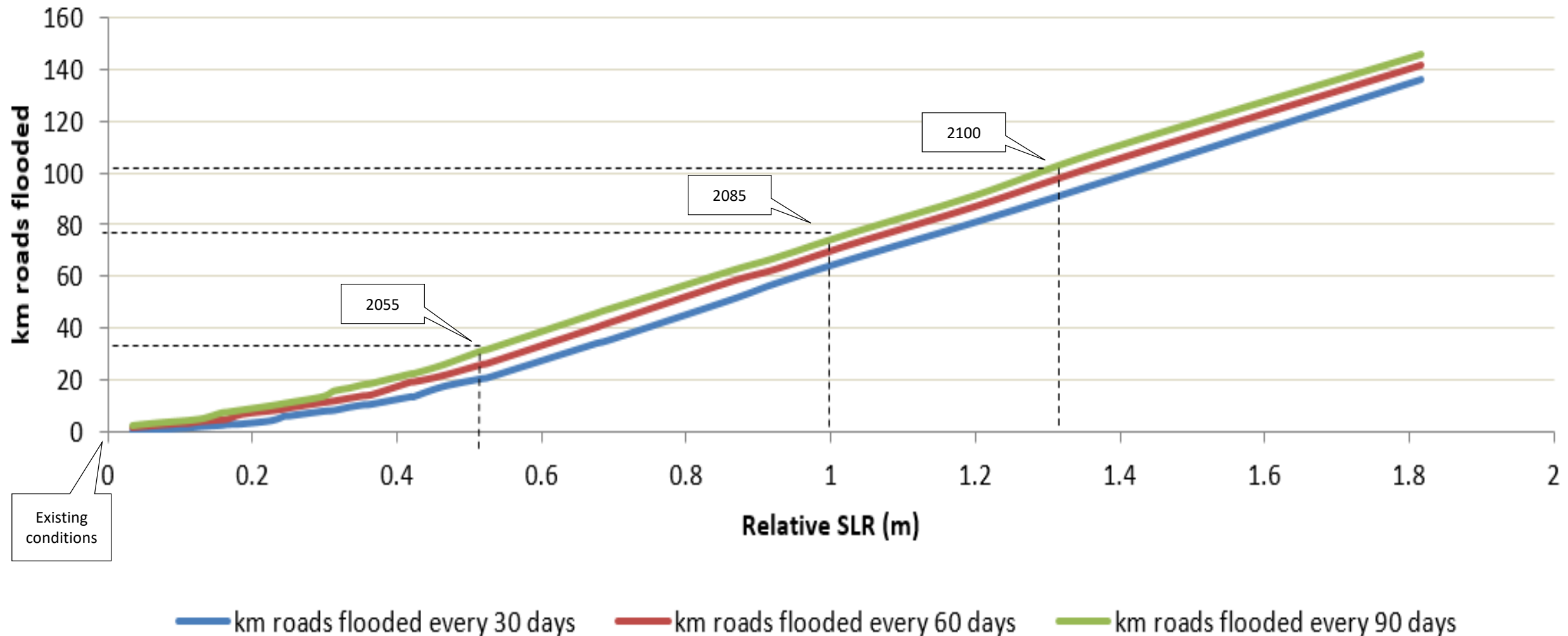
Coastal Marsh Loss -----> ↑ Erosion + ↓ Flood Storage



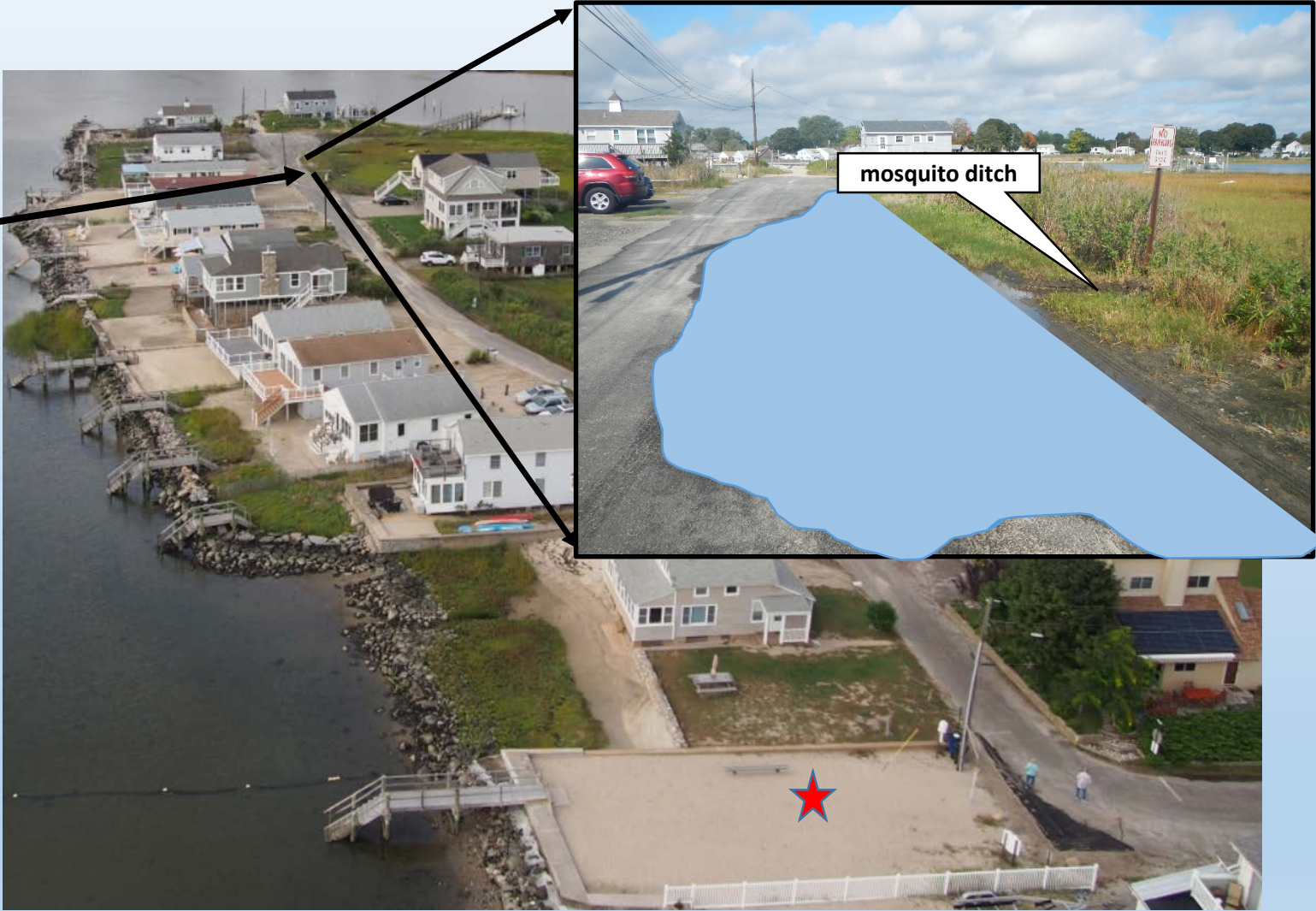
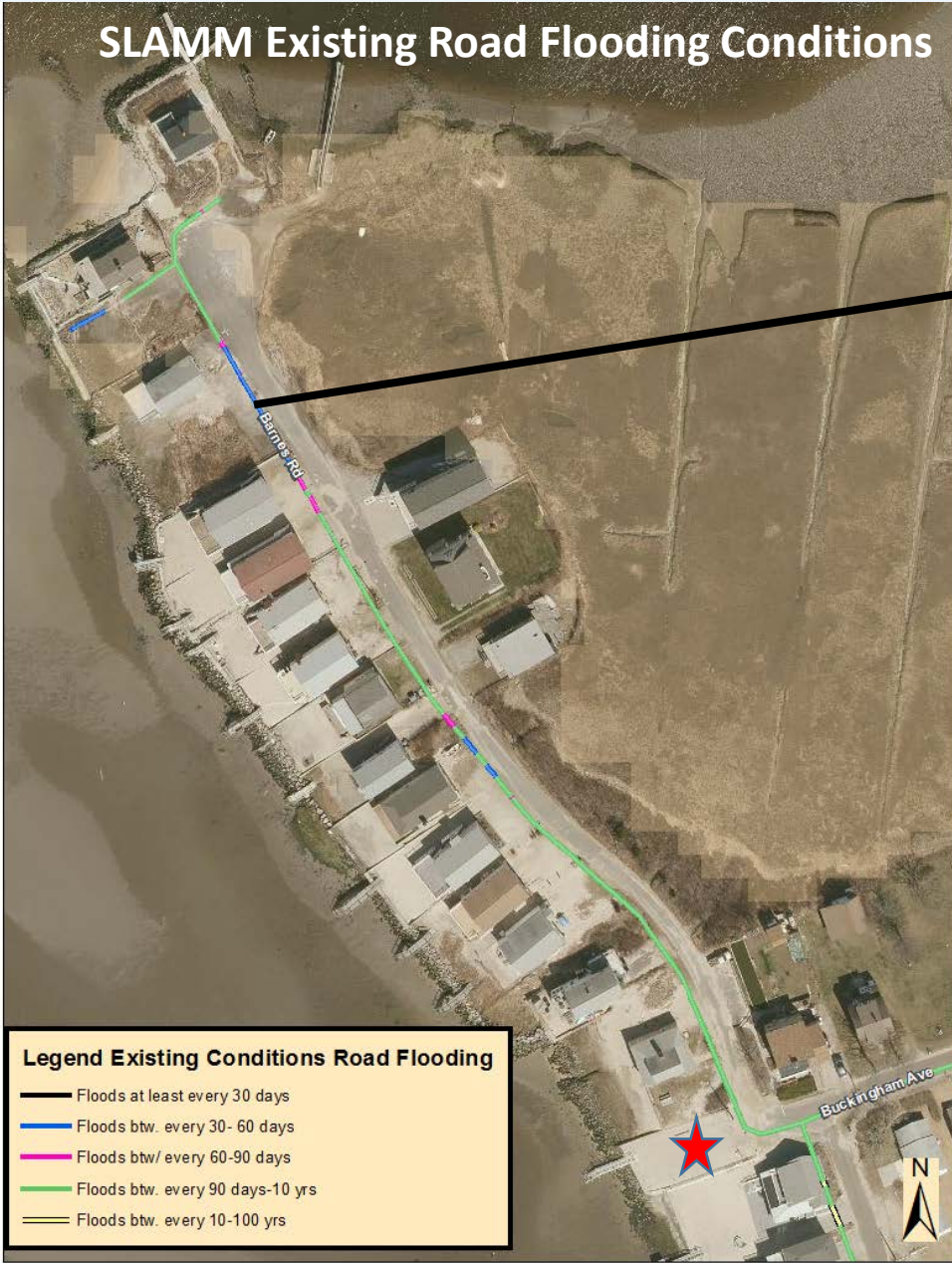
Quinnipiac River
New Marsh Probability 2085



III. CT Coastal Roads Flooding (CIRCA Recommended SLR Rate)



Ground-truthing SLAMM's Existing Tidal Flooding Frequencies



SLAMM Predicted Road Flooding Frequency Change



Beach Communities Isolated by Road Flooding



Lessons Lost on Developing Coastal Area?

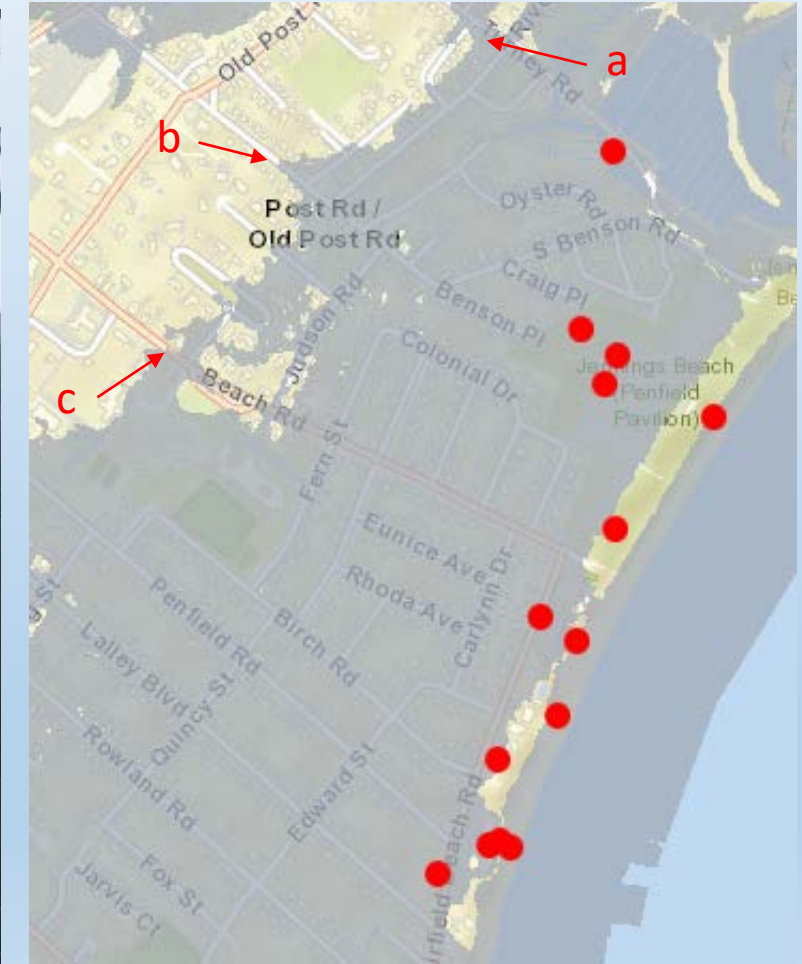
1934



1965

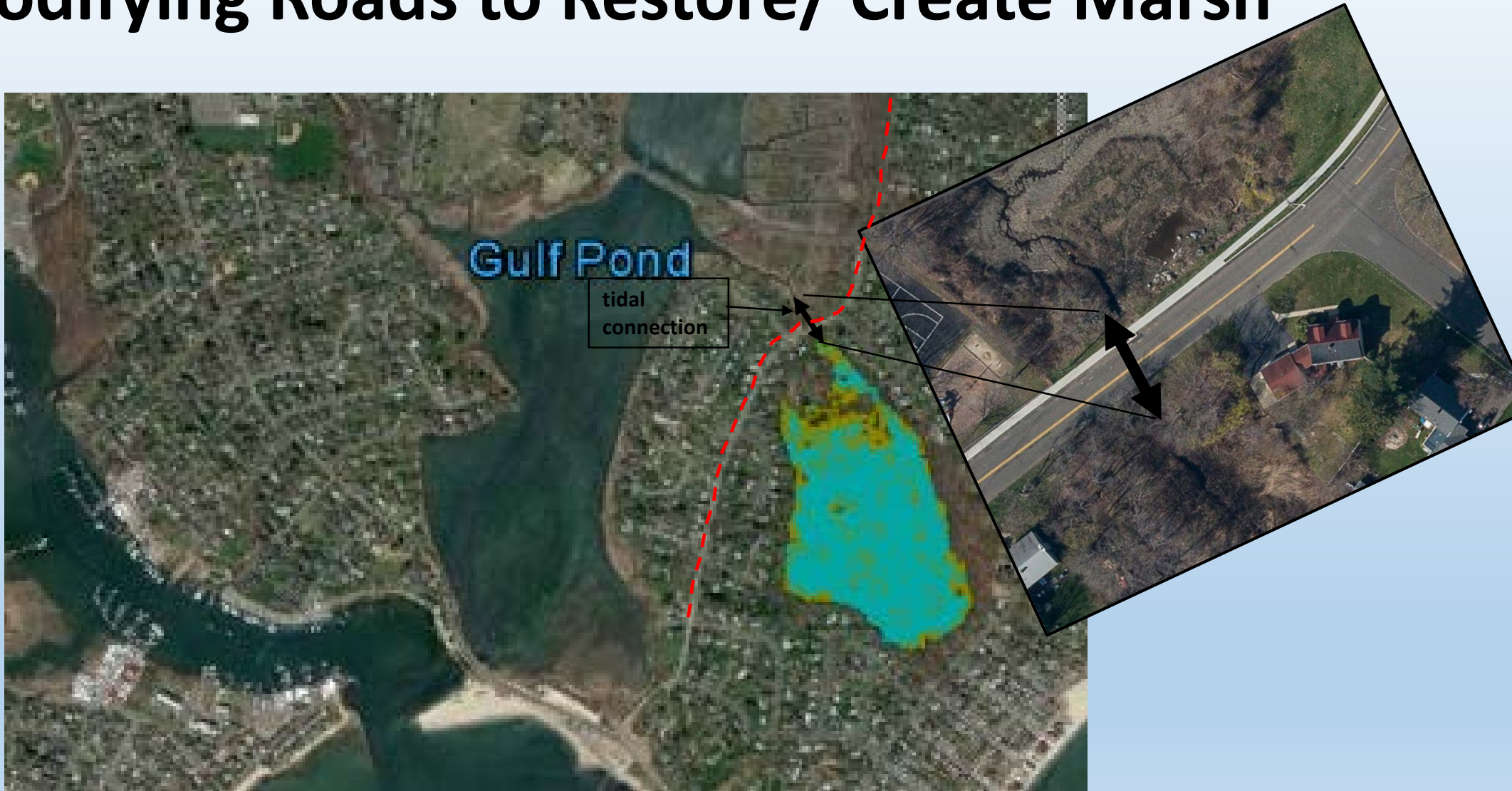


Storm Sandy flooding (shaded) 2012



Sources: Jennifer O'Donnell, Coastal/Ocean Analytics; UCONN MAGIC; NOAA/National Geodetic Survey 'T'opographic Sheets; CT Coastal Resilience Project, CT TNC

Road Flooding Mgt. → Marsh Mgt. Modifying Roads to Restore/ Create Marsh



Coming ~March 2019 to CT ECO


SLAMM Road and Marsh Data



Featured:

 MS4 & Impervious

 2016 Imagery & Lidar

 Lidar (elevation)

 Fish

 2012 Imagery

 Bears



MAP VIEWERS

view and explore maps



MAP CATALOG

printable static pdf maps by town



MAP SERVICES

connect to data with GIS software



GUIDES

information about map layers



DOWNLOAD

where to download GIS files



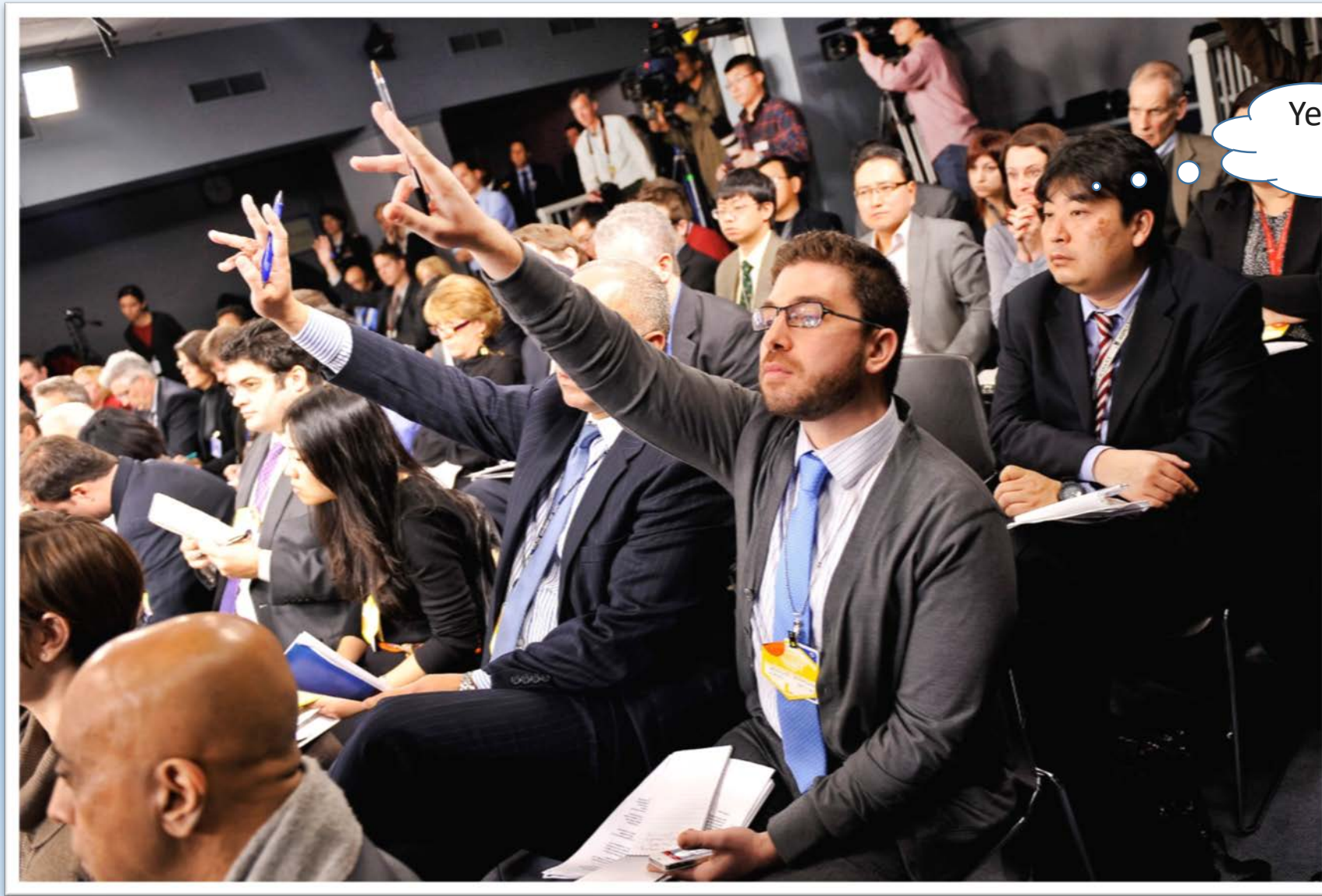
HELP

FAQs, instructions and tips

So What ?

- CT's embayment-dominant 'drowned' shoreline is different
- Marshes nature's 'infrastructure'
- CT's marshes are changing in type (and extent?)
- Marshes are the flood pathways
- Coastal road flooding increases dramatically
- If you think you've got flooding problems now
- Elected officials facing increasingly difficult flood mgt. decisions

Questions?



Yes. Can we go now?

Difficult Questions

- How many times/year can road flood before residents revolt?
- Public support \$ private beach community road reconstruction?
- When will towns abandon a chronically flooding road serving few?
- What's an acceptable SLR planning horizon? (35 years?)
- What are the most effective flood haz. communication practices ?

Long Island Sound at Night



