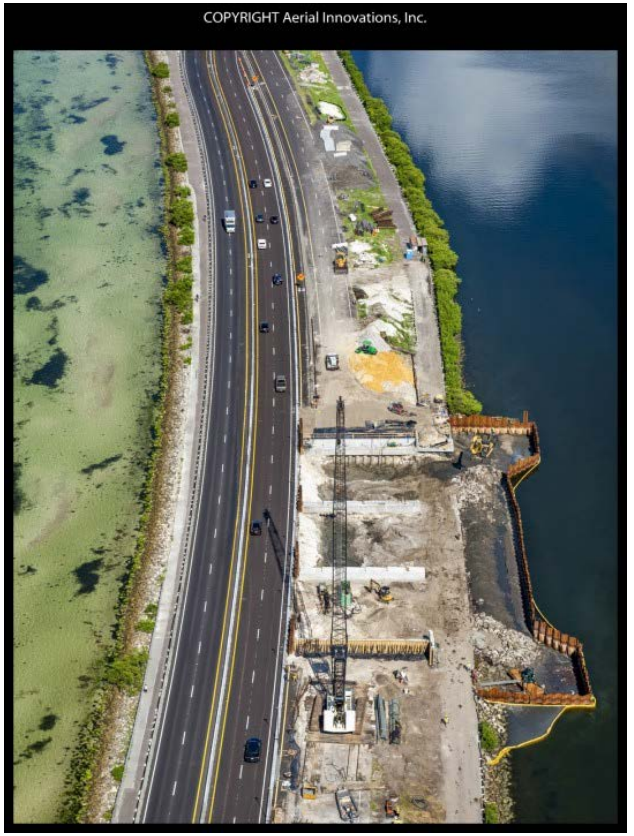
Ecosystem Restoration Via Reestablishing Historical Tidal Patterns



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Topics

- Ecosystem restoration can involve direct physical actions
  - Planting marsh grass
  - Placement of oyster reefs, etc.
- Or, acting upon pollutant sources to restore water quality to allow for system recovery
  - Seagrass increases in Chesapeake Bay and SW Florida estuaries
- Hydrologic restoration is a hybrid of the two
  - Direct physical manipulation to reconfigure landscape
  - Water quality responses that allow for ecosystem recovery

Examples

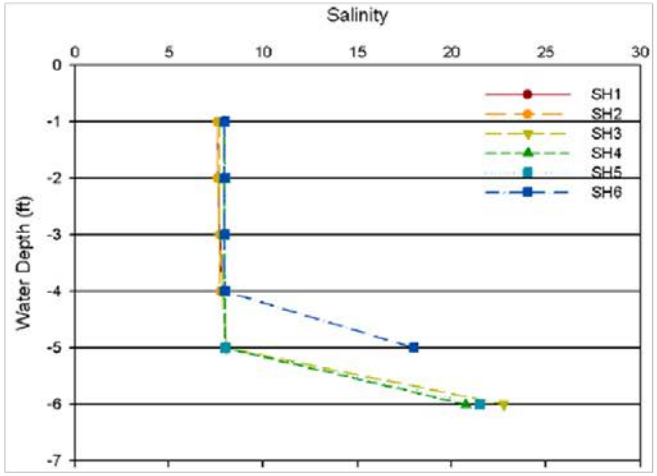
- San Juan Bay
  - Project benefits identified in 2000
  - PEIS completed 2017, but on hold
- Naples Bay / Rookery Bay
  - Project benefits identified in 1980s
  - RESTORE funds being used for permitting and final design
- Old Tampa Bay
  - Project benefits identified in 2015
  - Under construction
- Lake Surprise
  - Completed

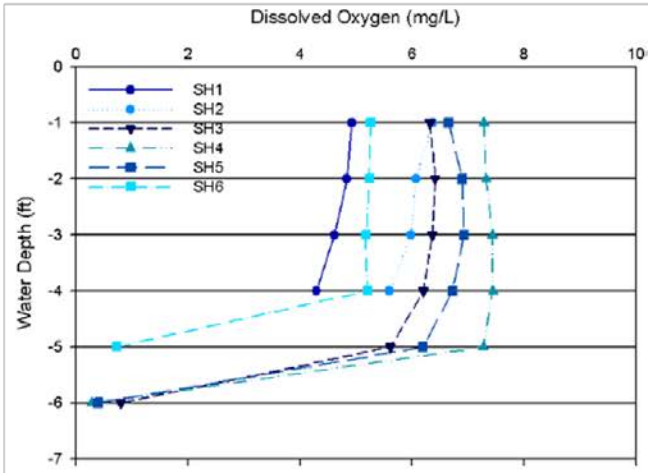
San Juan Bay


Canal San Antonio
Océano Atlántico
N
TOA
BAJA
Laguna del Condado
Laguna la Torrecilla
Laguna
los Corozos
CATAÑO
LOIZA
Laguna
de Piñones
Caño Martín Peña
Bahía
de San Juan
BAYAMON
Canal Suárez
Laguna
San José
CAROLINA
SAN JUAN
Río Grande de Loíza
TRUJILLO
ALTO
GUAYNABO
CANOVANAS
Represa Carraizo
6
0
6
12 Miles

Historical changes in Caño Martín Peña

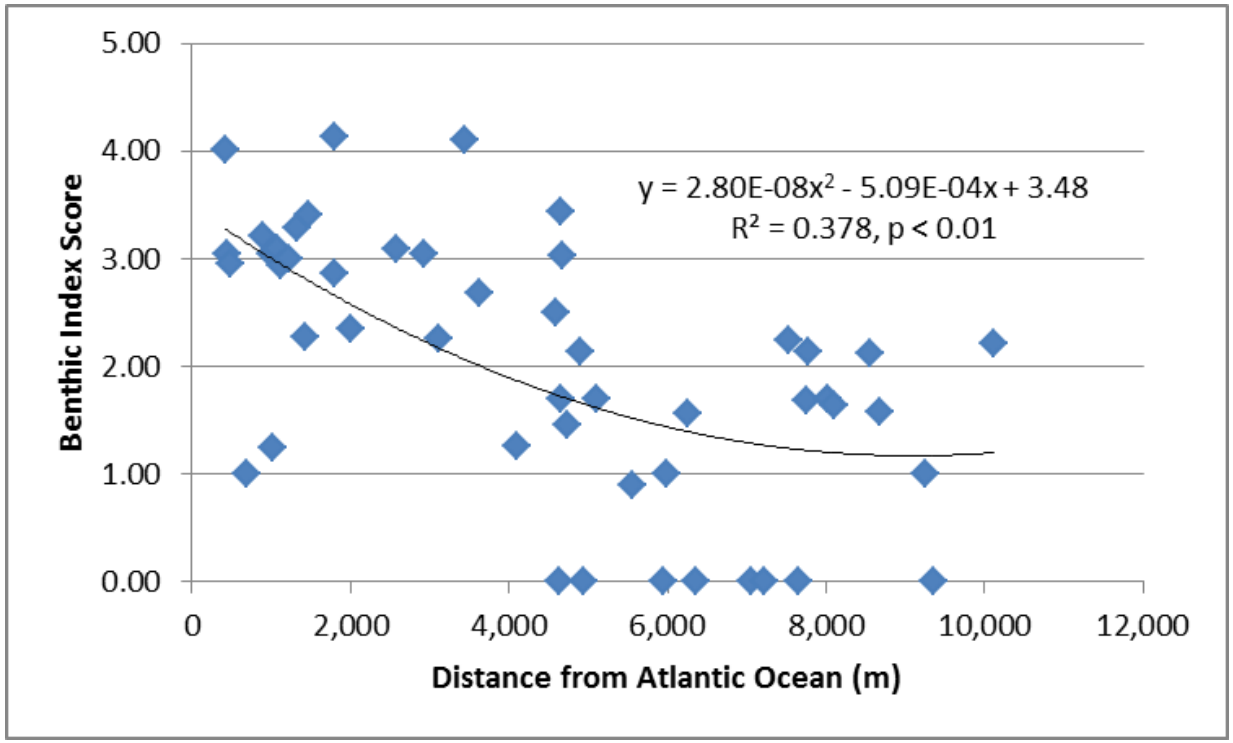
Hypoxia driven by salinity stratification



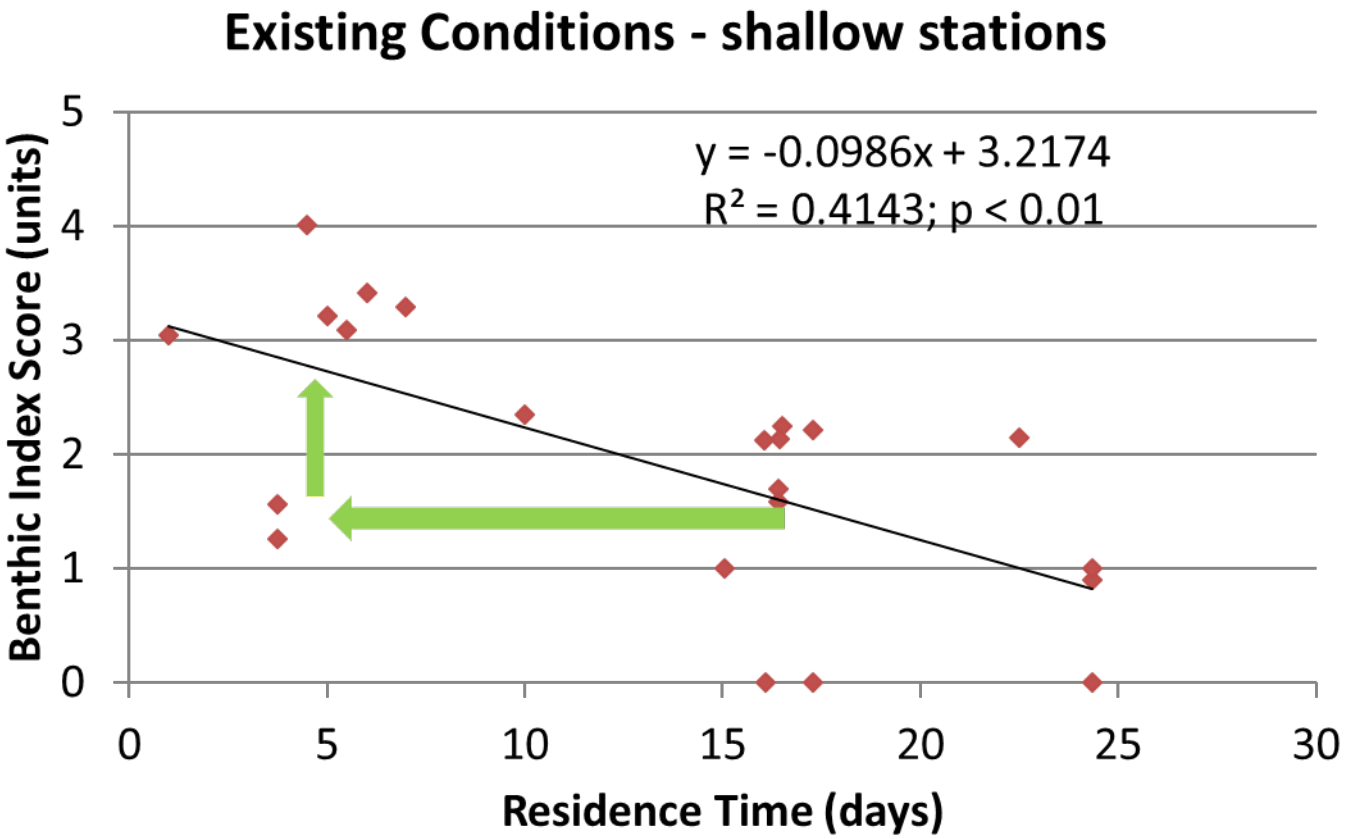


Earlier work…distance from open water as a surrogate for tidal flushing

$$H = -\sum_{i=1}^{S} (Pi * LnP_i)$$



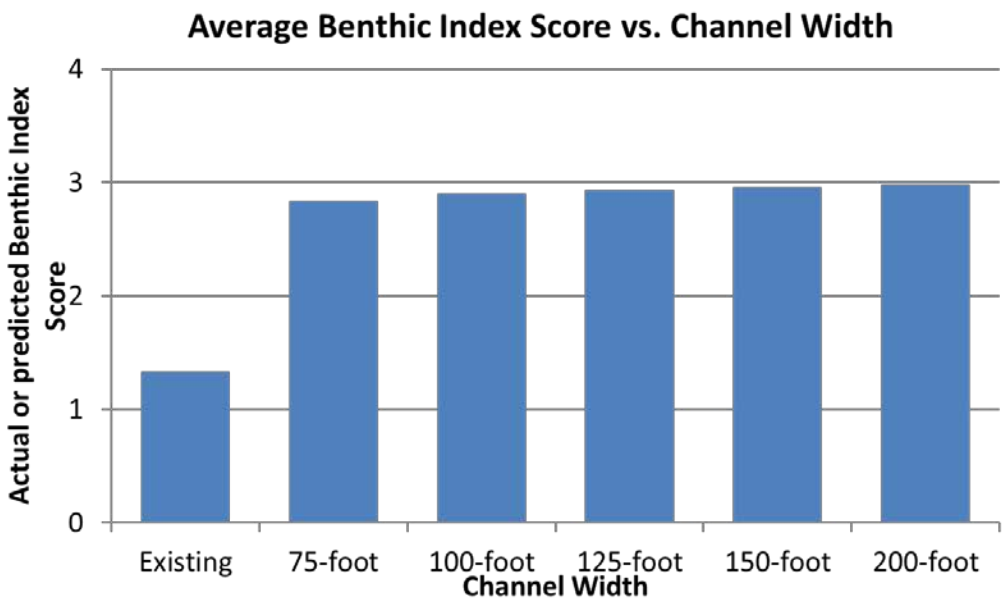
Ecological uplift associated with reestablished historical tidal connections

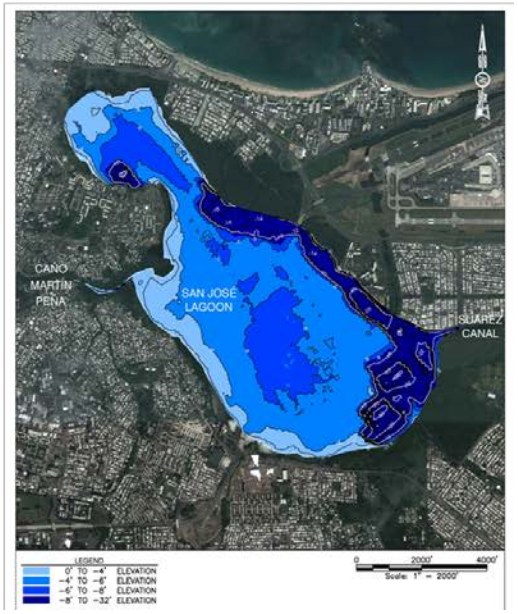


$$H = -\sum_{i=1}^{S} (Pi * LnP_i)$$

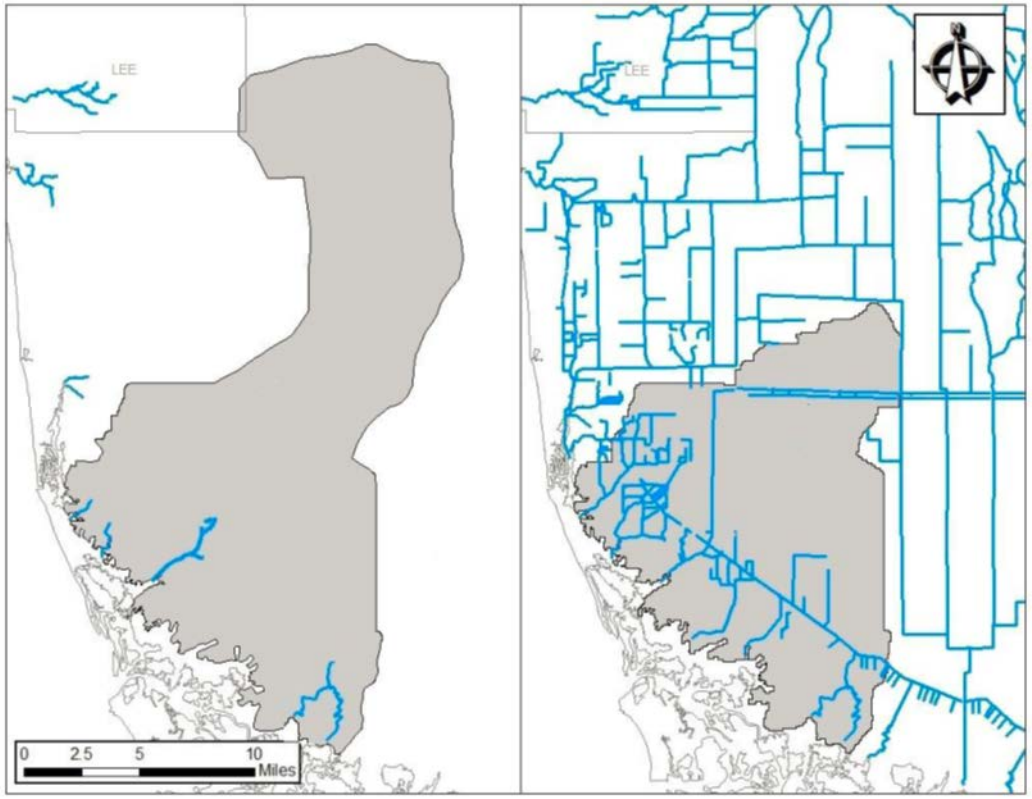
ESA

Ecological uplift quantified and used in cost-benefit analysis

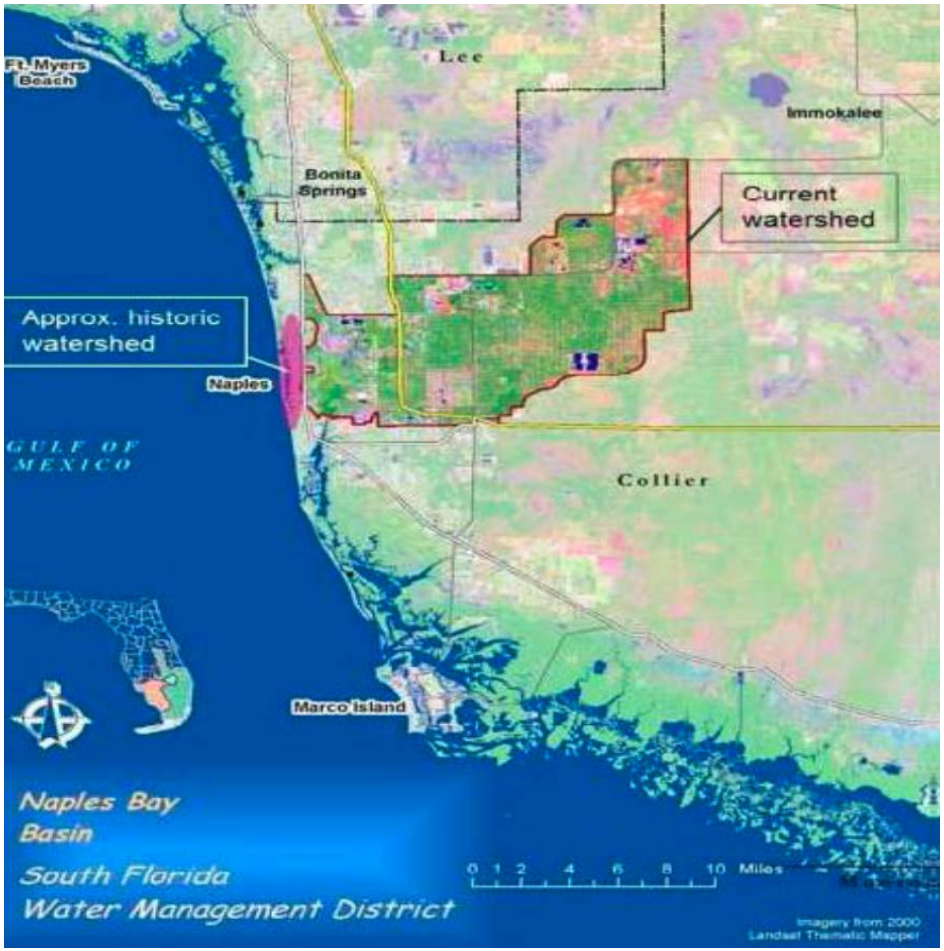




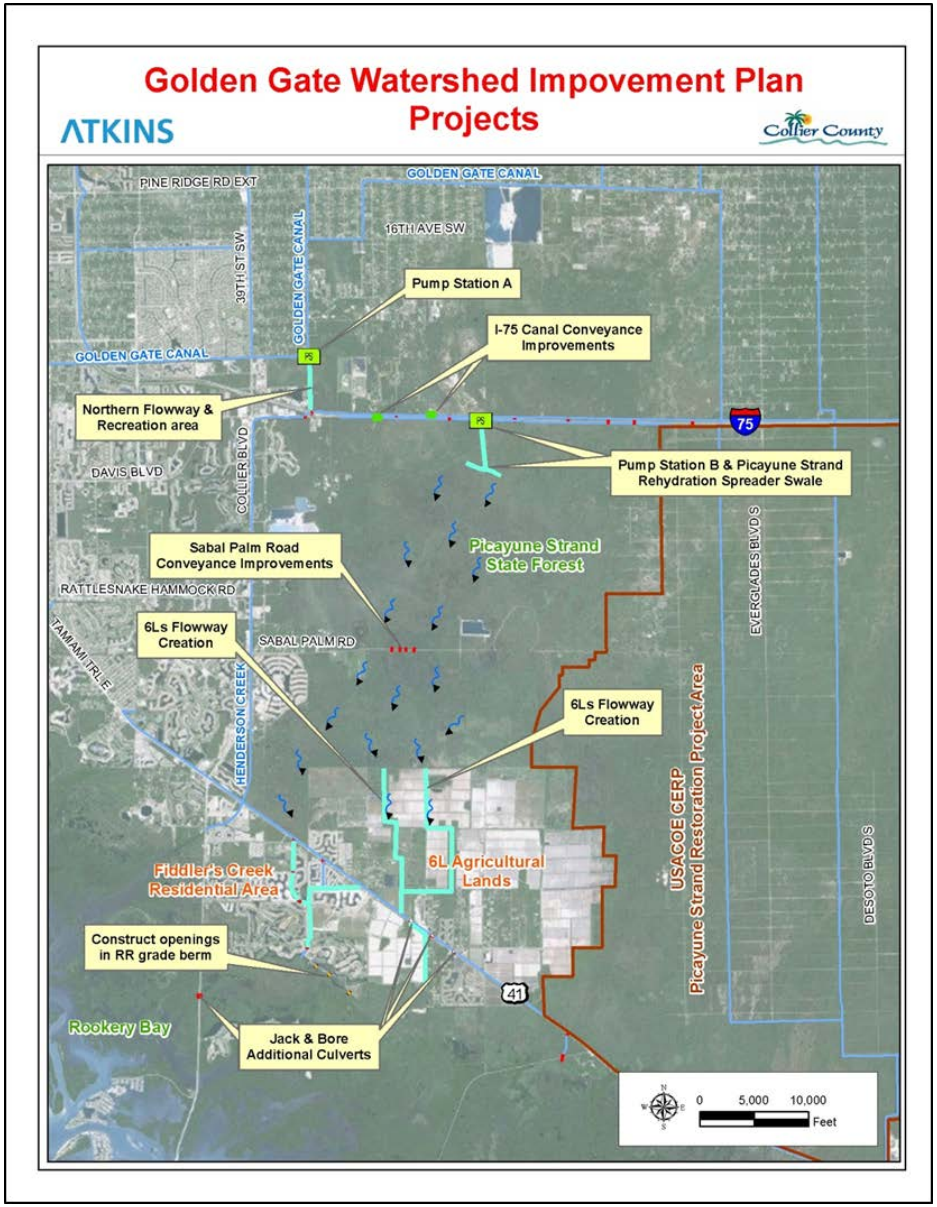
Rookery Bay watershed reduced by 80 square miles



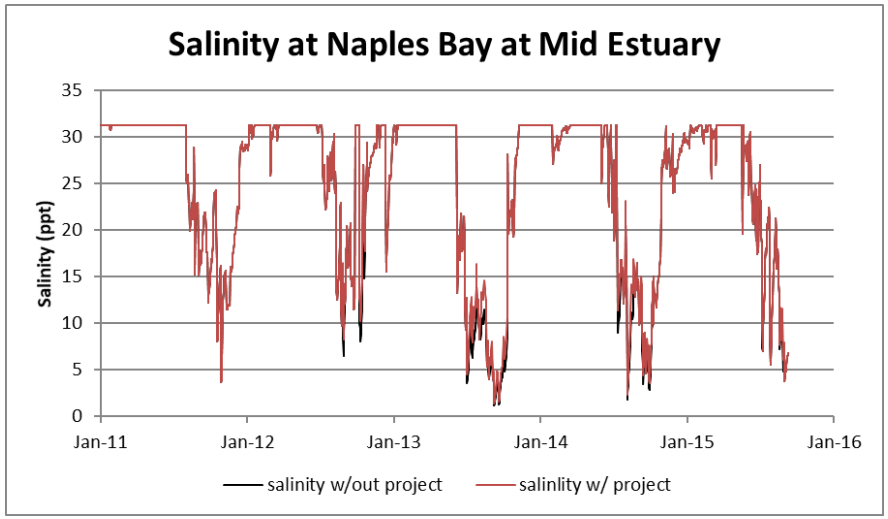
Naples Bay increased 10-fold

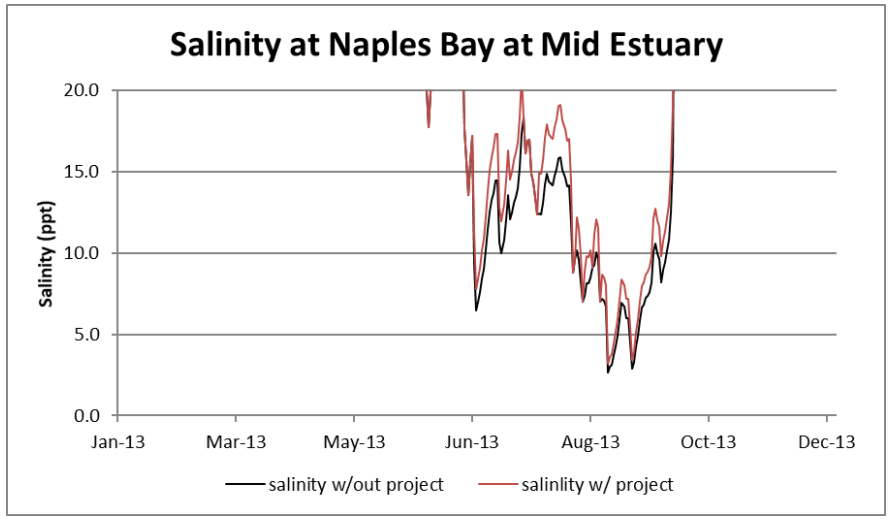


Proposed project

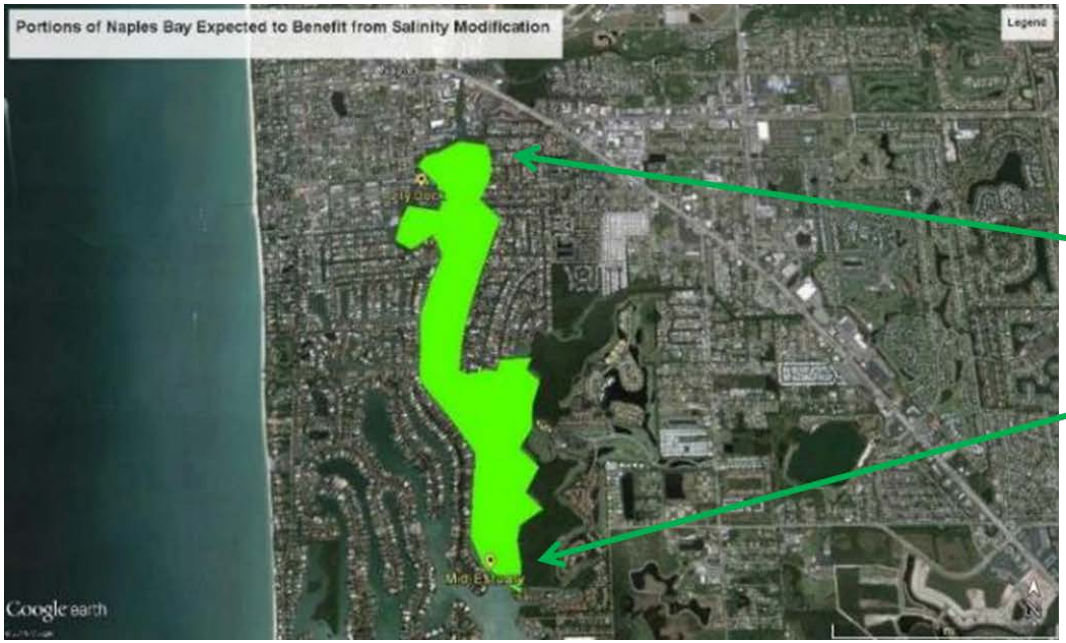


Quantifying salinity benefits to Naples Bay



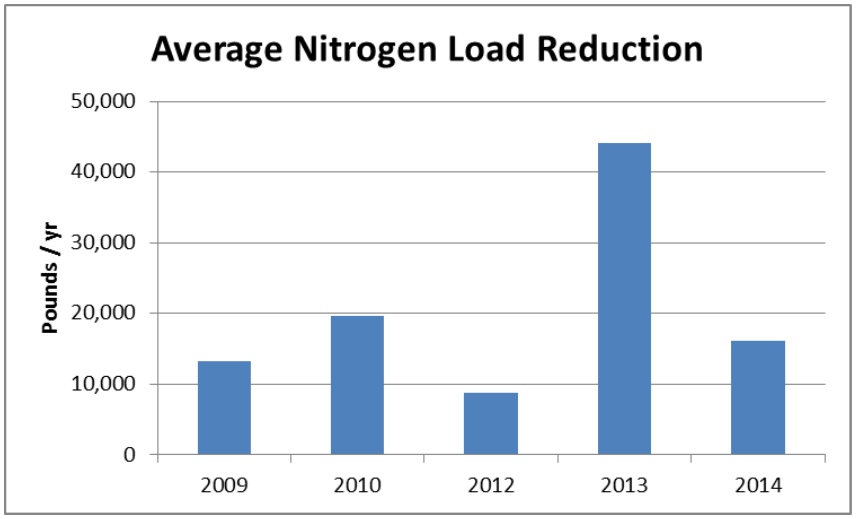


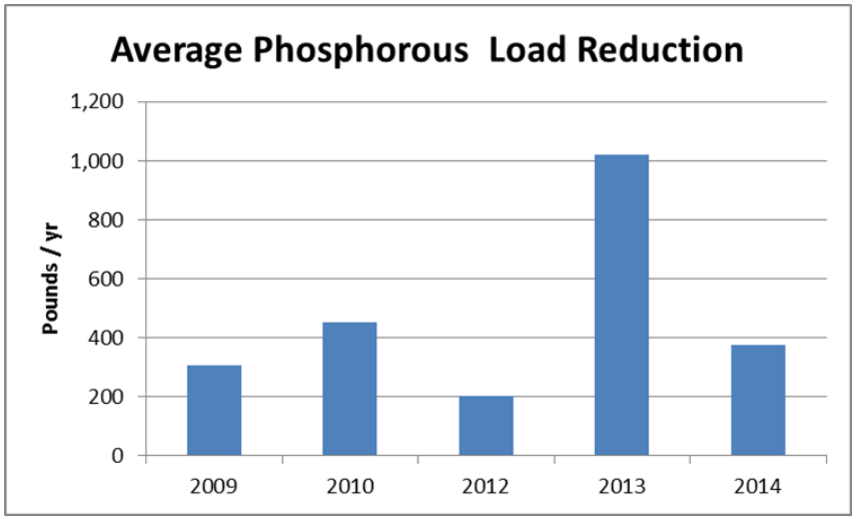
Ecological uplift used for cost-benefit analysis



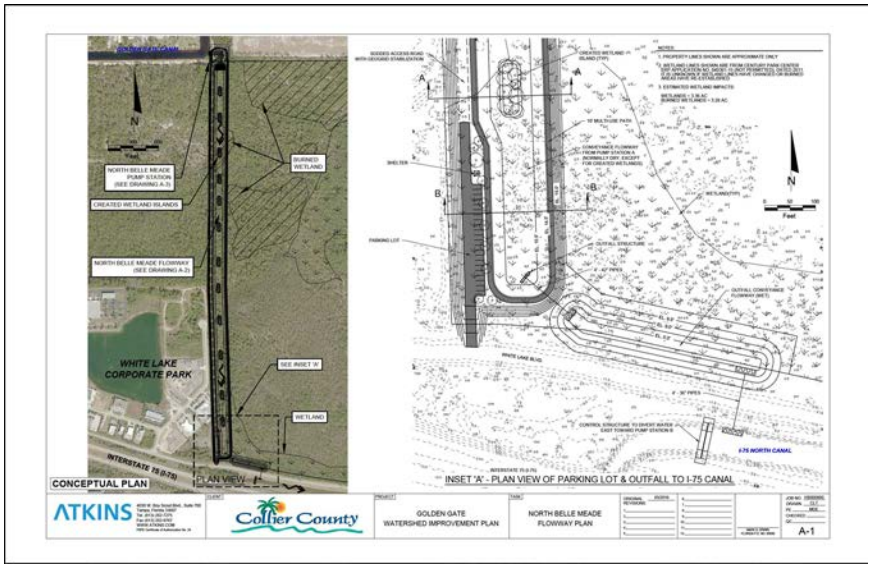
After diversions implemented, potential locations for "jump starting" restoration via seagrass transplanting and oyster reef deployment

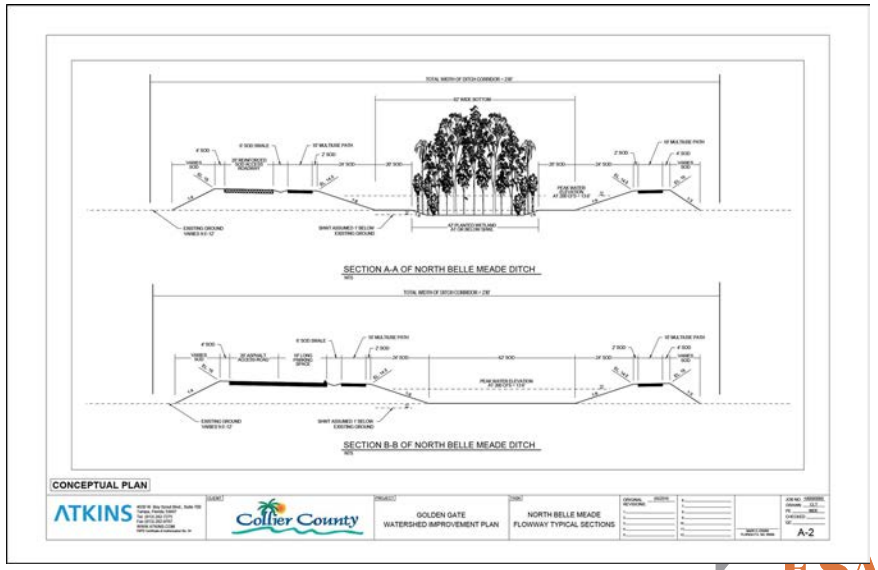
Additional benefits to Naples Bay





Careful planning to protect Rookery Bay



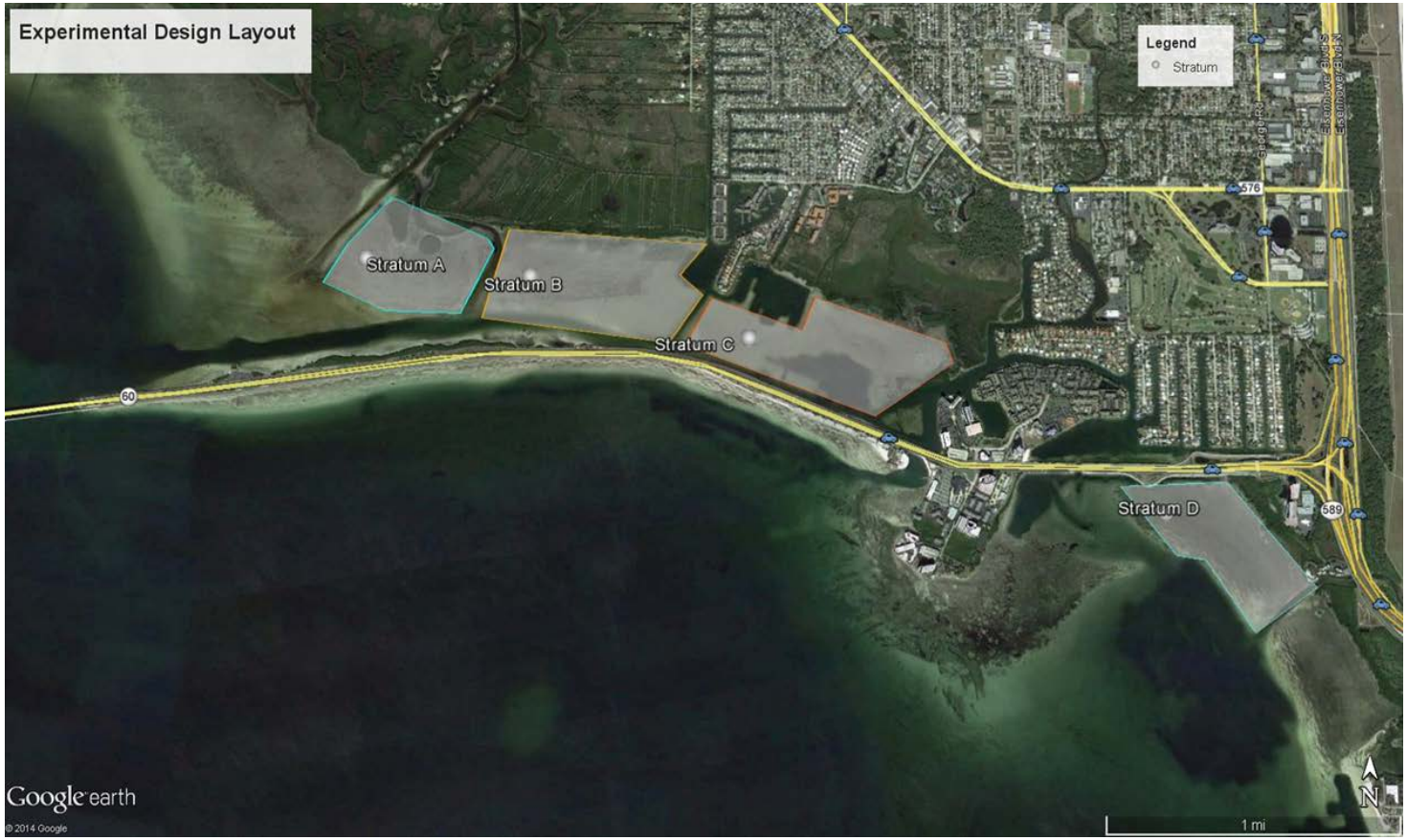


Old Tampa Bay – healthy seagrasses in late 1940s

But not everywhere…

What was wrong back in the 1940s?

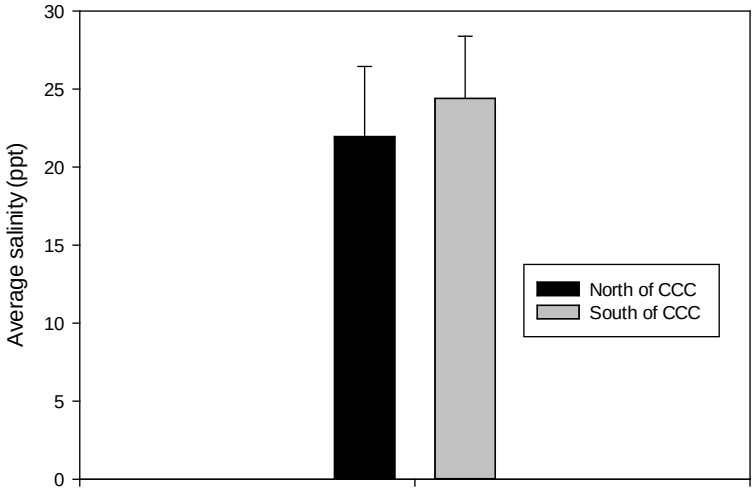
Experimental design based on stratified random data collection effort

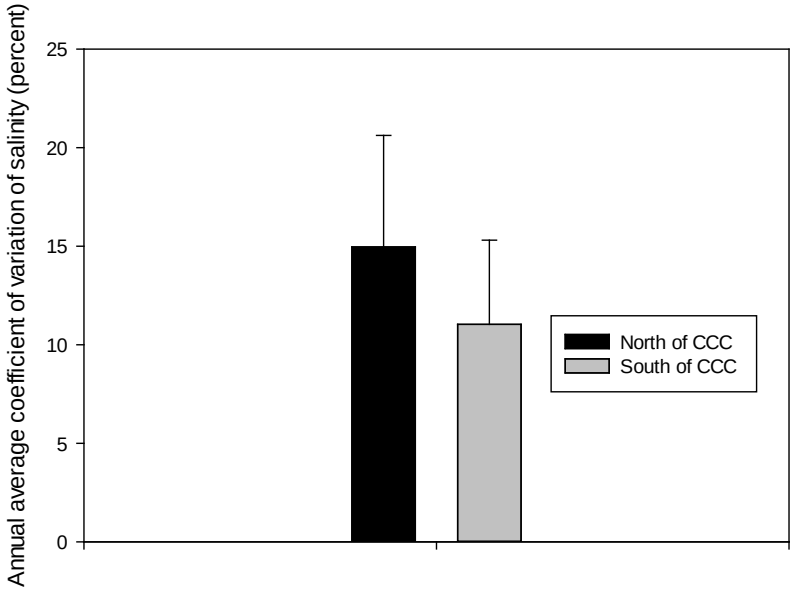


Seagrass status and trends

Species changes associated with the causeway

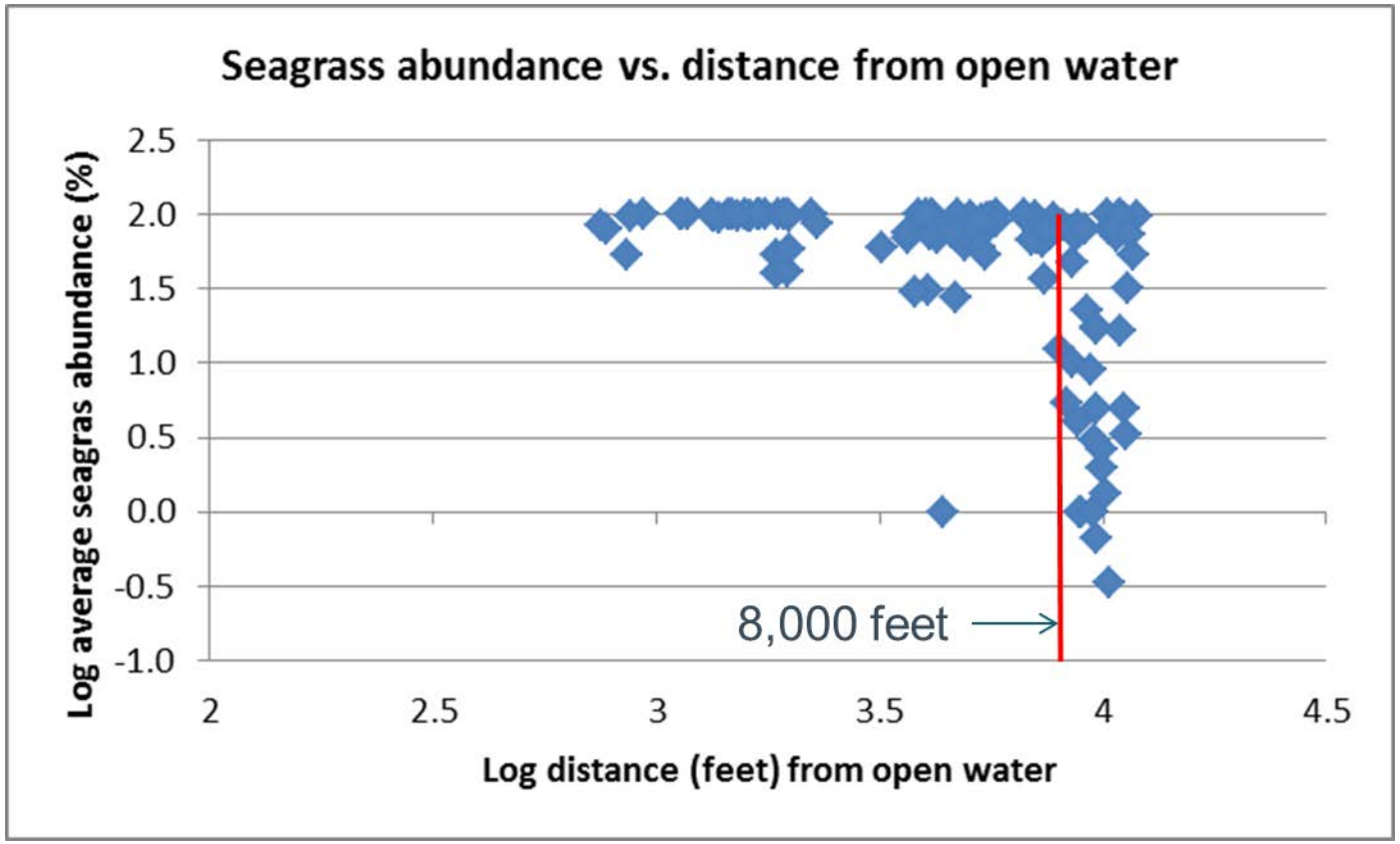
Salinity lower and more variable north of the causeway



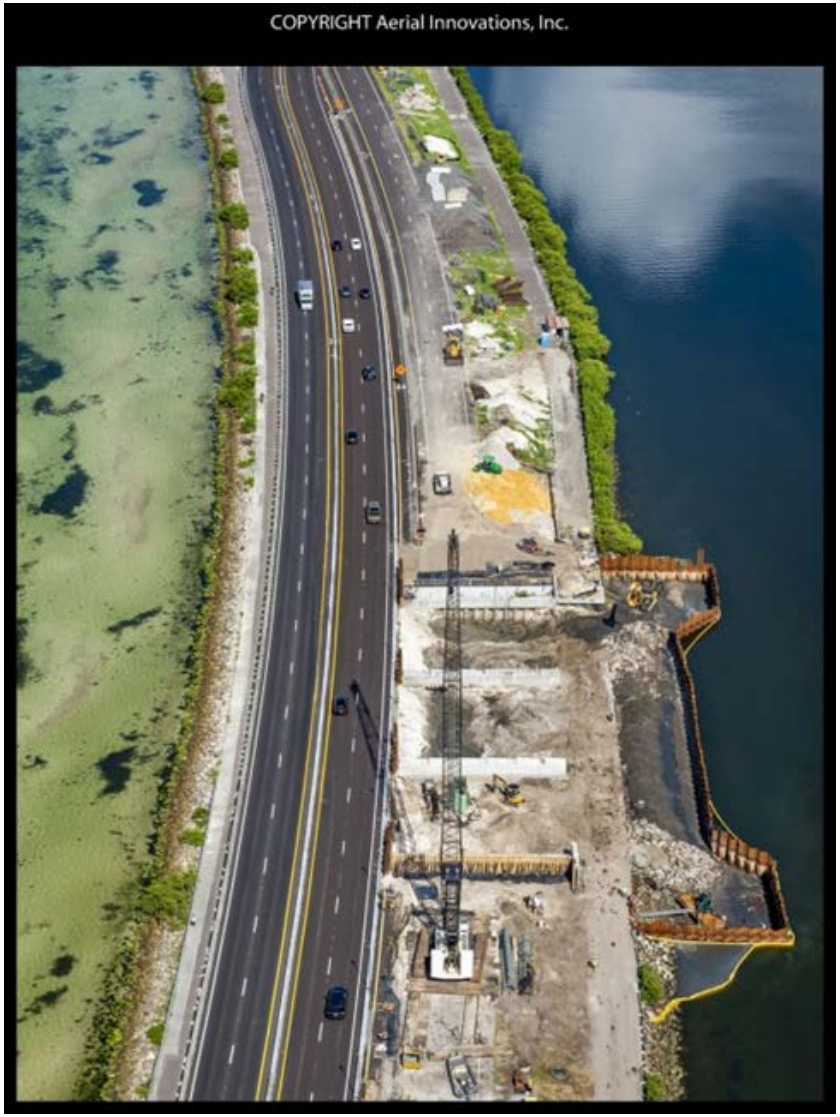


Distance from open water as a surrogate for tidal flushing

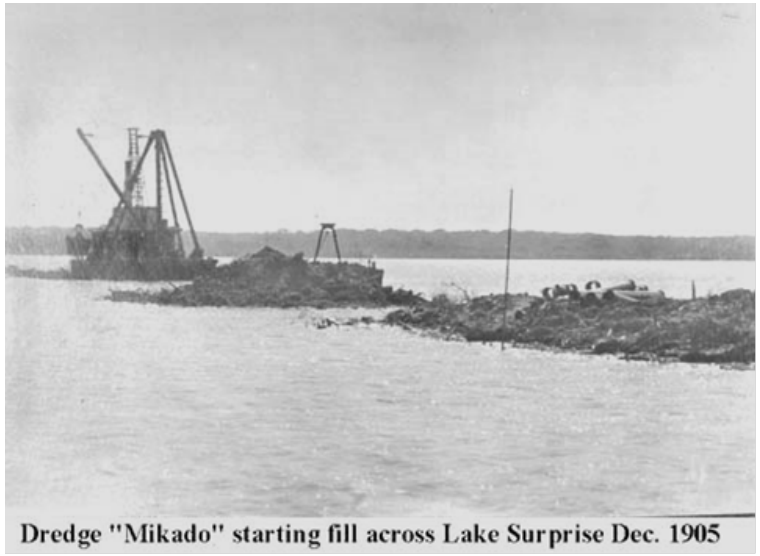
Calculating a threshold target for “distance”



Project under construction

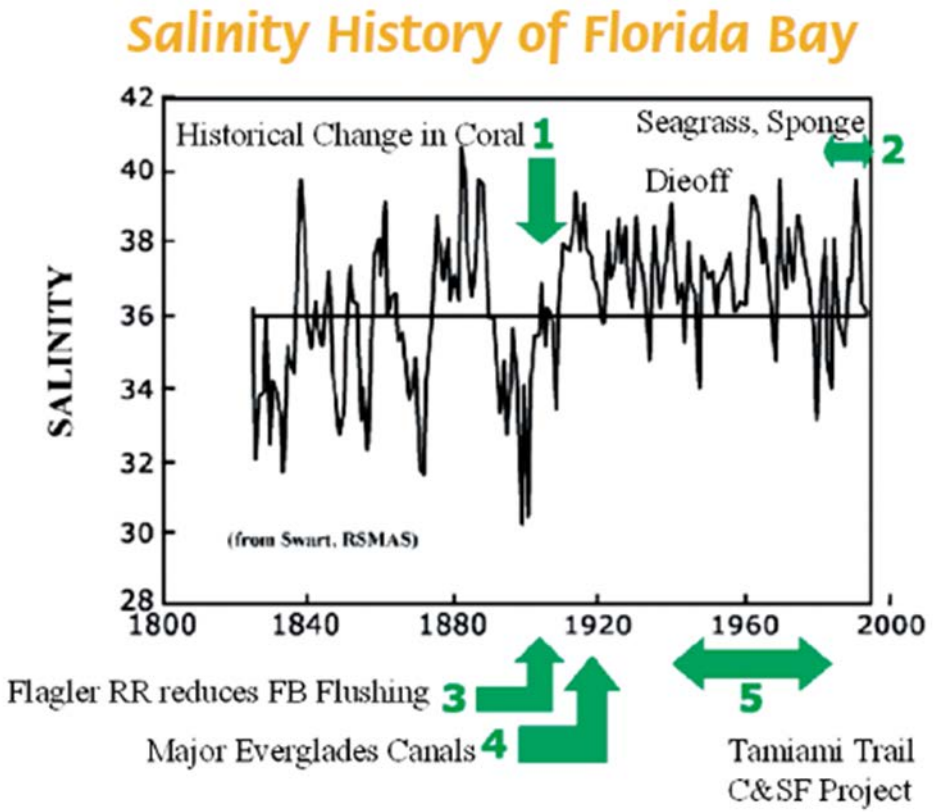


Lake Surprise causeway removal (Key Largo)



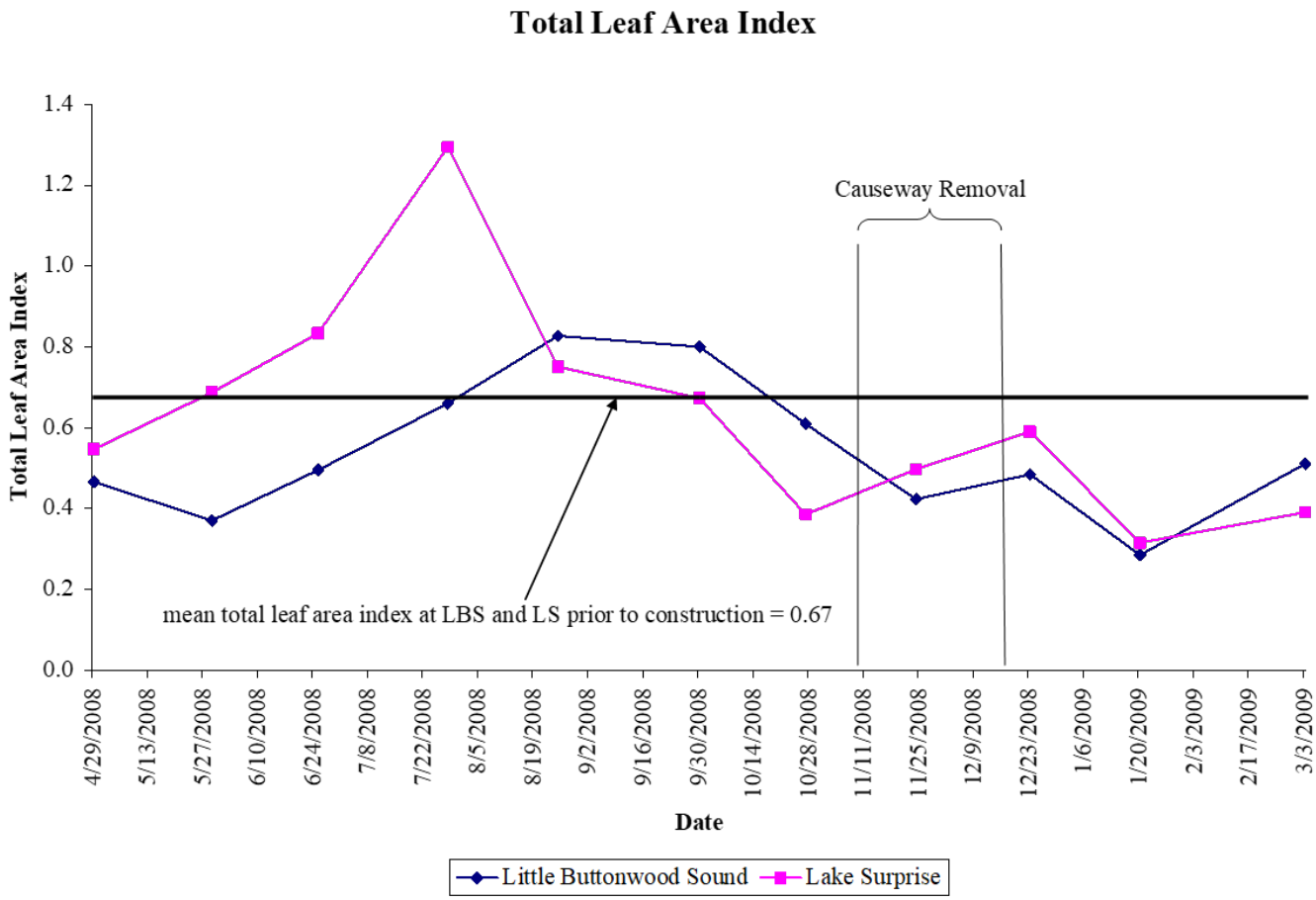
Dredge "Mikado" starting fill across Lake Surprise Dec. 1905

Flagler's railroad had large impact on Florida Bay

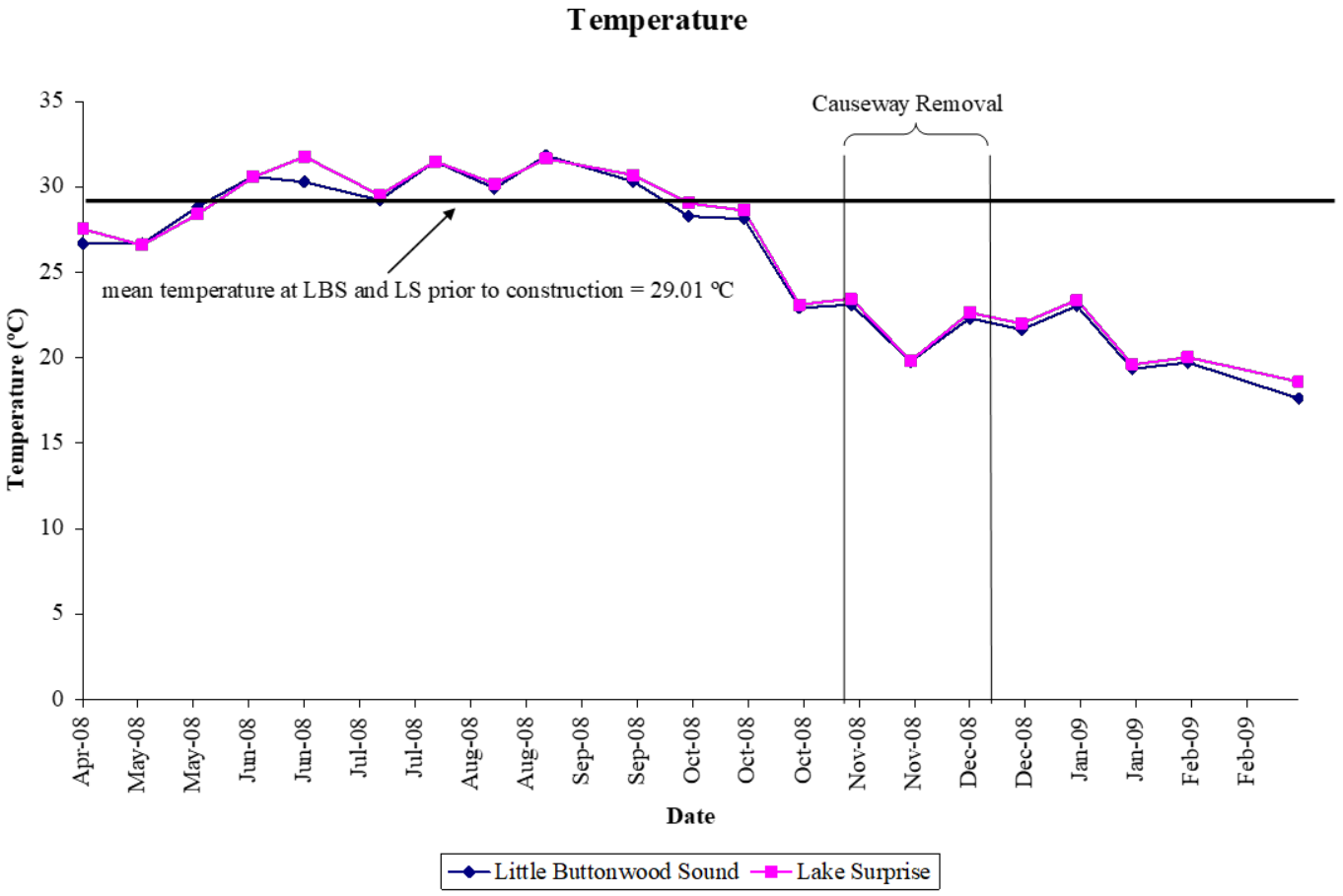


BACI design accompanied causeway removal

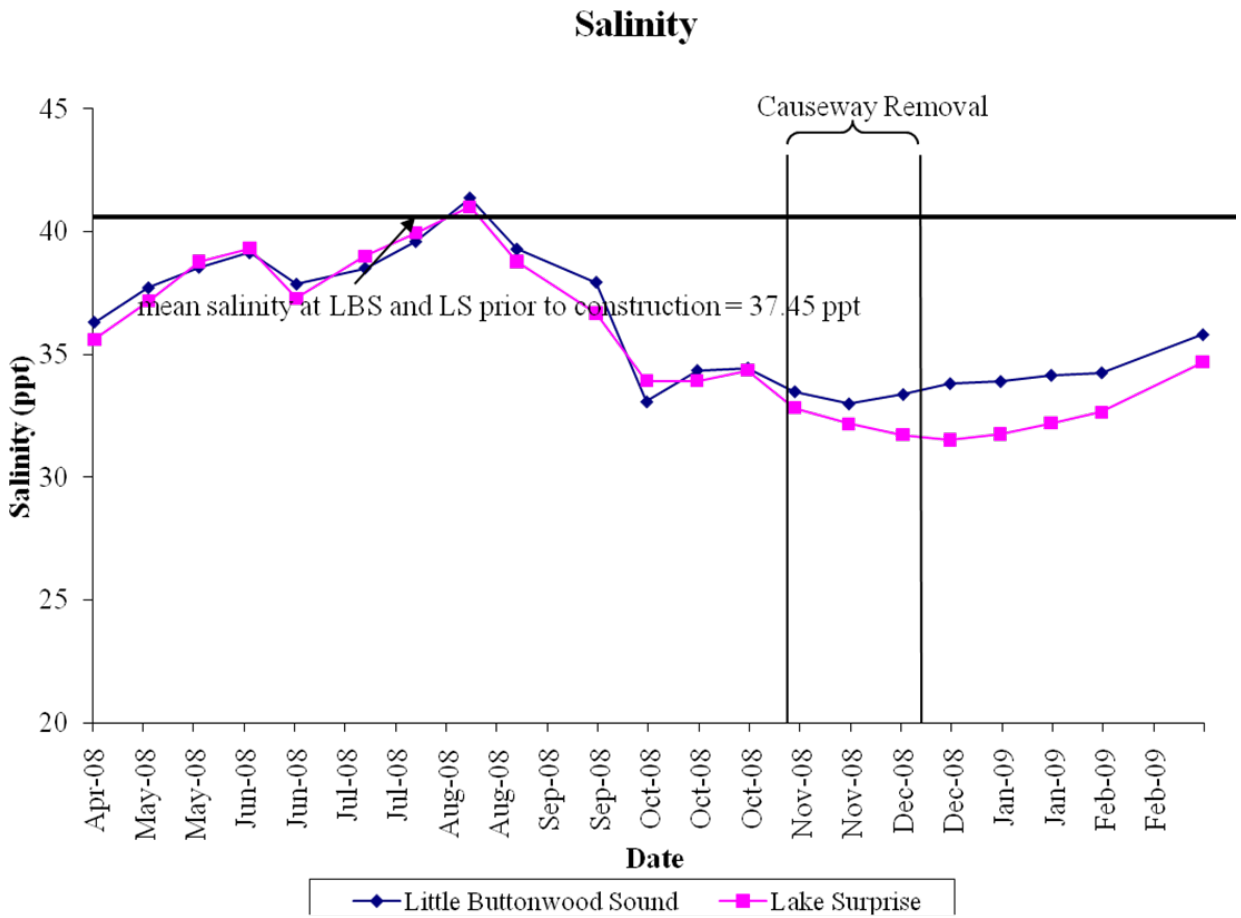
Construction had no adverse impact on seagrass



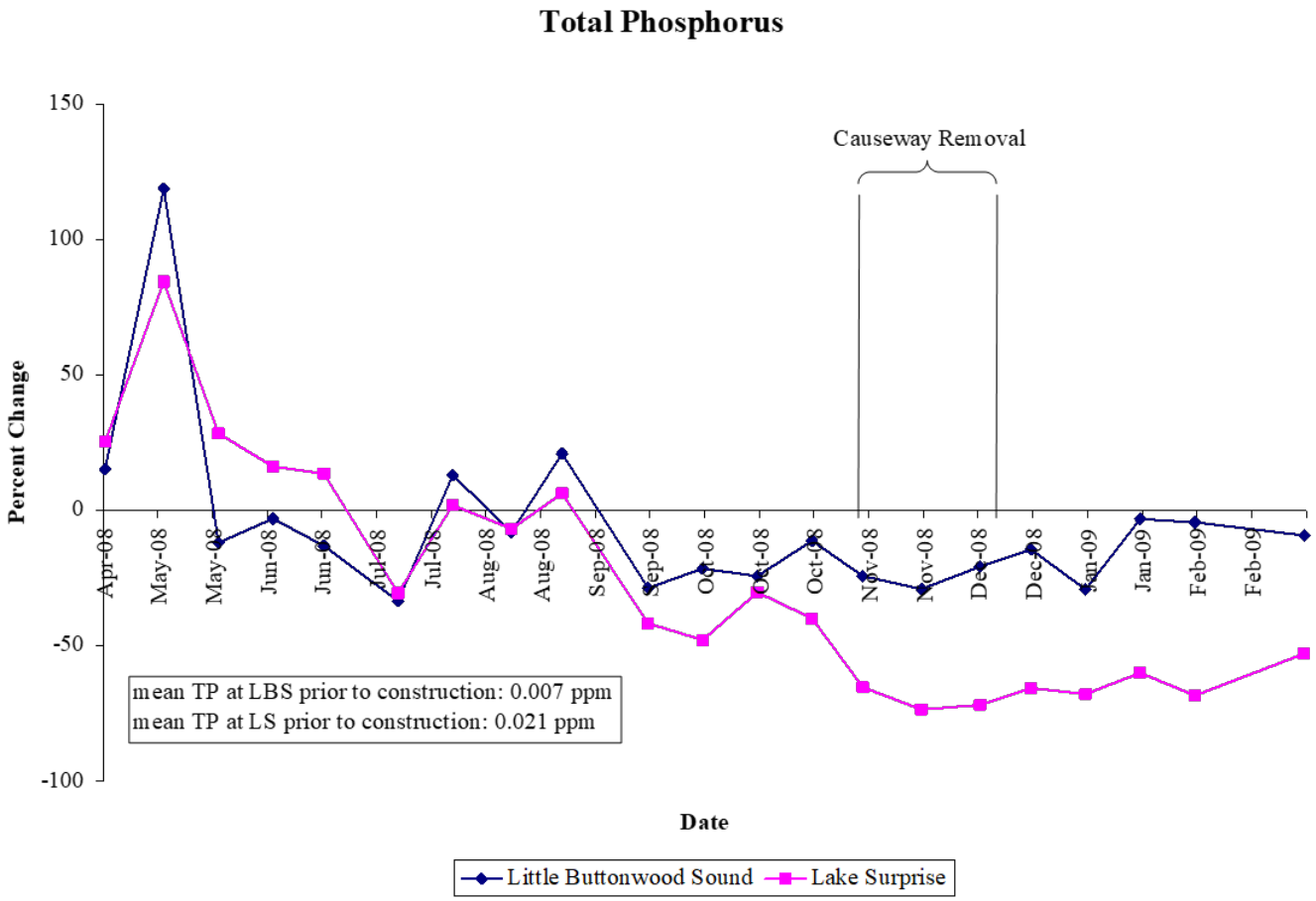
No effect on temperature



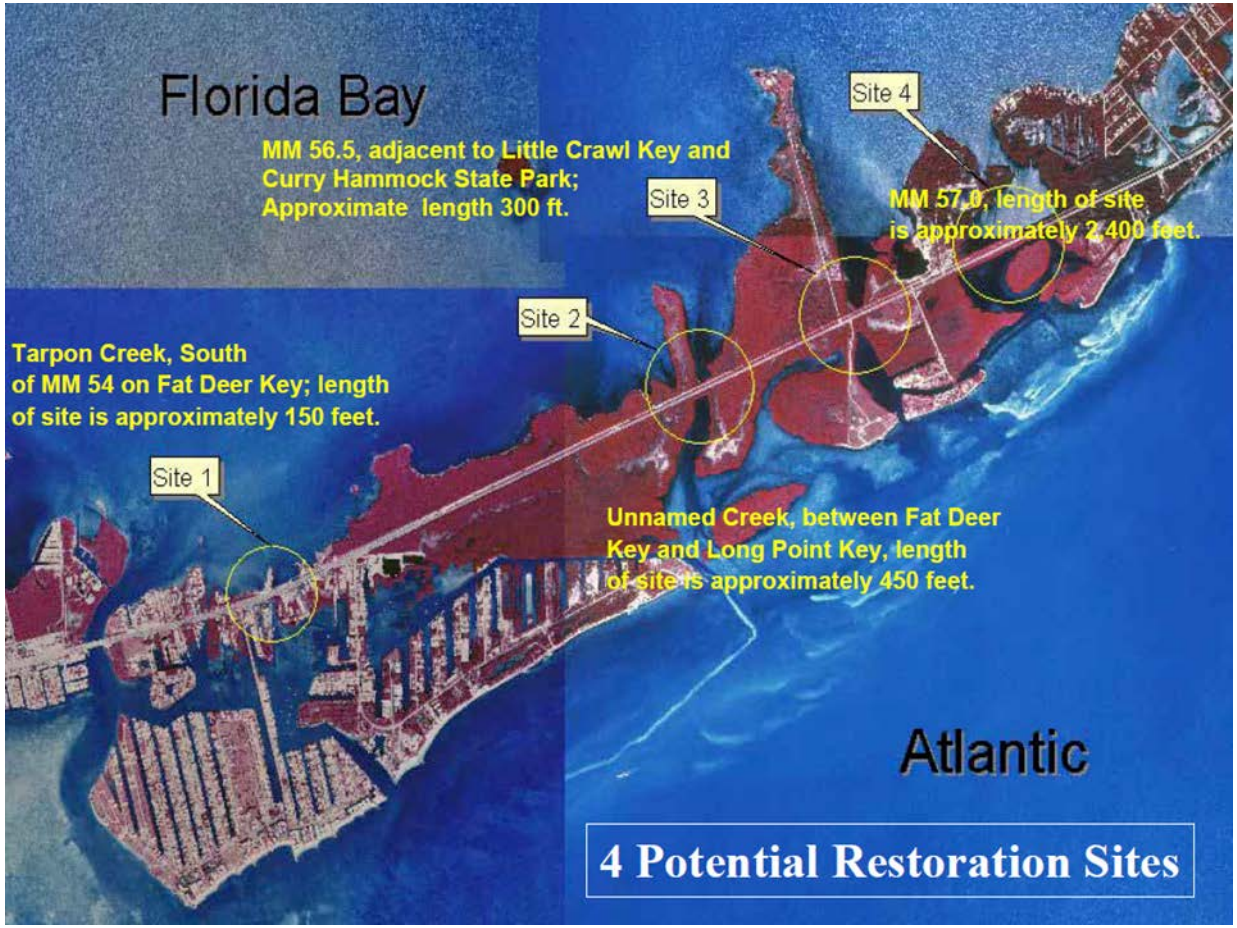
Salinity benefit



Reduced phosphorus – the limiting nutrient in eastern Florida Bay and the Keys



Other sites in the Keys?



Summary

- Hydrologic restoration is not easy
- But…cheaper and faster responses than nutrient abatement
- Where it's the problem, find creative ways to implement
  - RESTORE Funds
  - State transportation agencies
- Should be equally the focus of state and federal agencies as TMDLs, NPDES, MS4 permits, etc.

Questions?