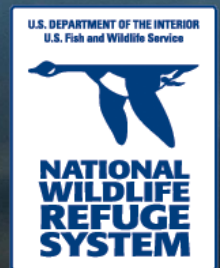
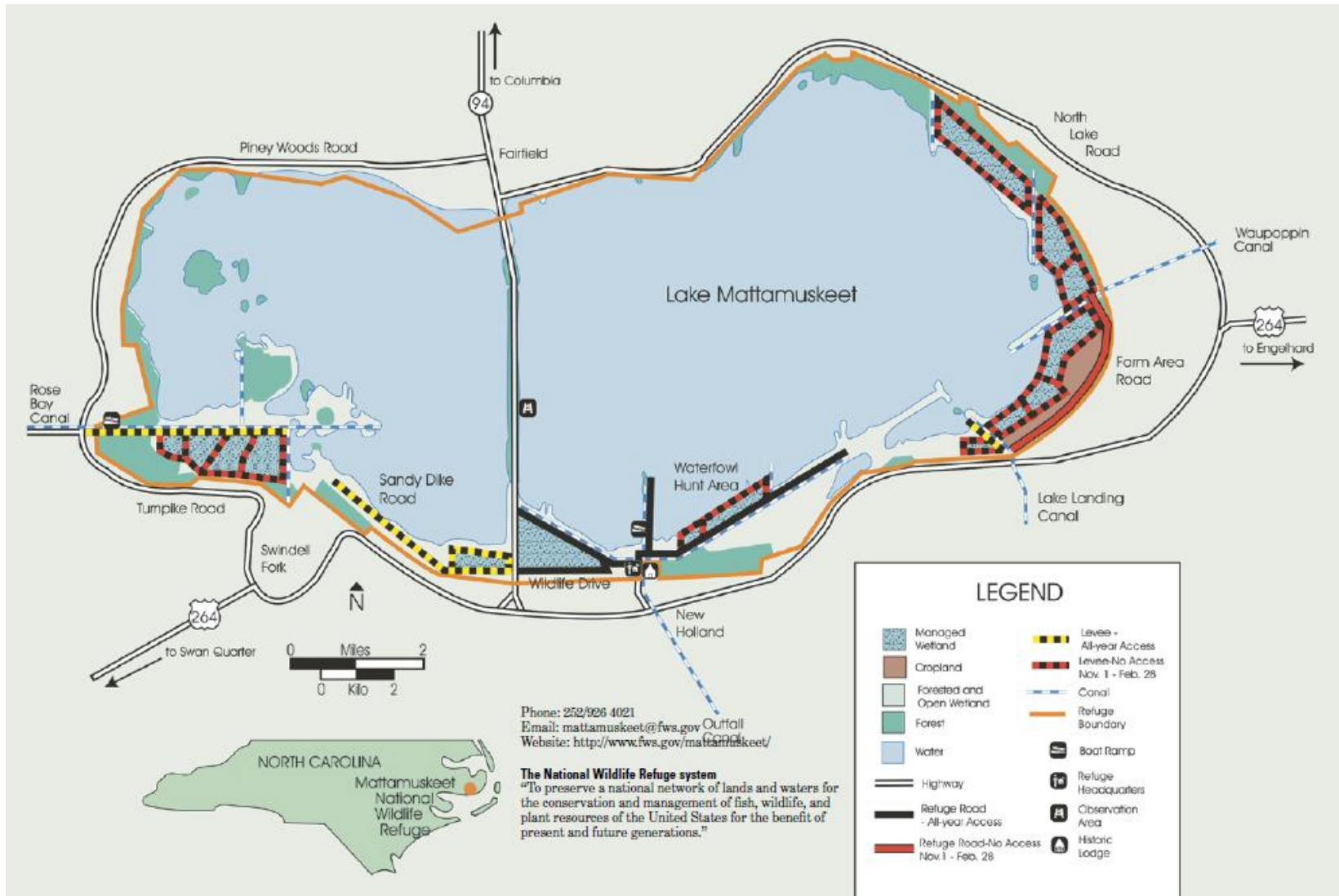


# *Management Concerns at Mattamuskeet National Wildlife Refuge*

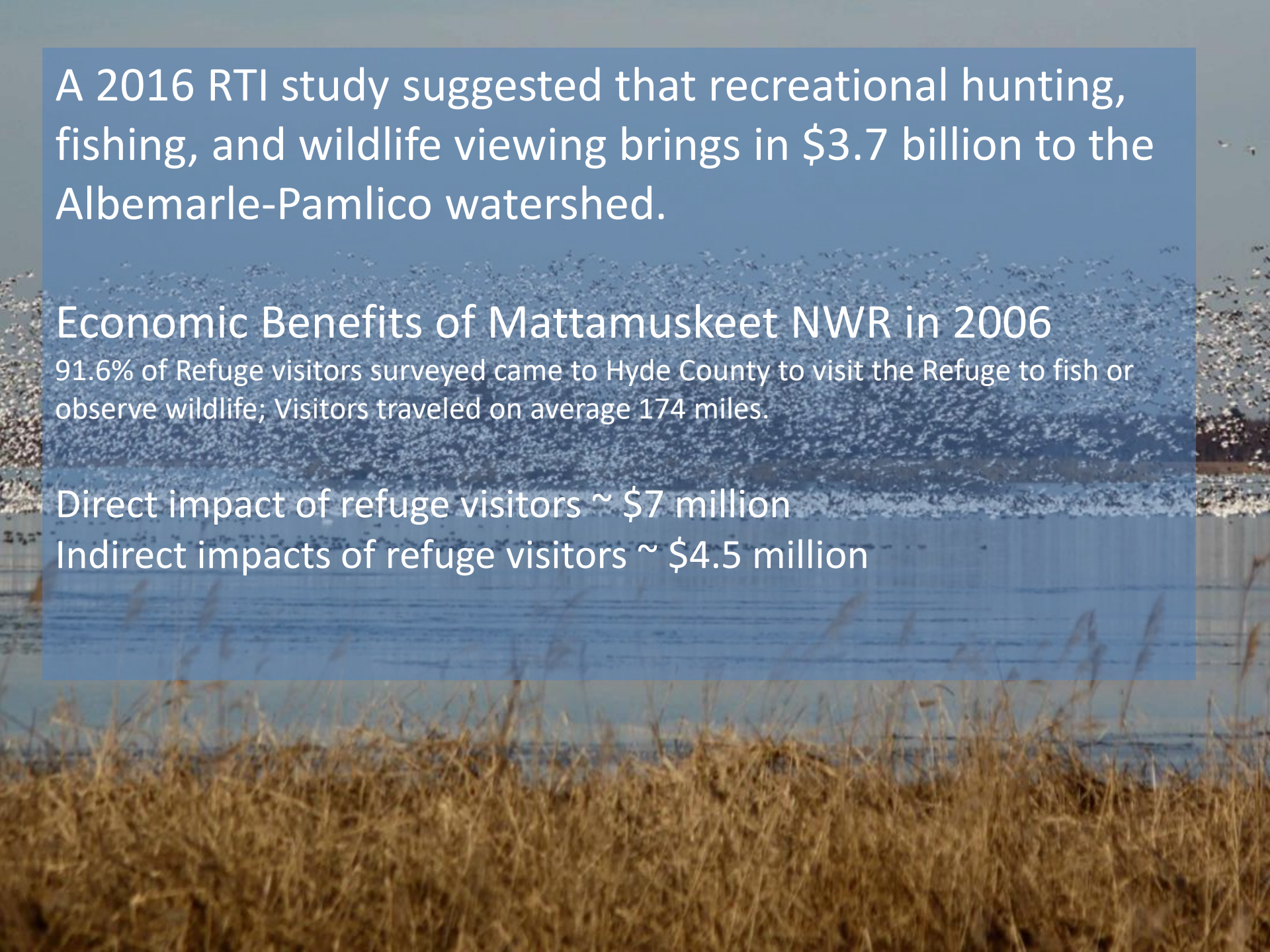
Michelle Moorman and  
Pete Campbell  
U.S. Fish and Wildlife Service



The purpose of Mattamuskeet NWR is to protect and conserve migratory birds and other wildlife resources through the protection of wetlands.







A 2016 RTI study suggested that recreational hunting, fishing, and wildlife viewing brings in \$3.7 billion to the Albemarle-Pamlico watershed.

## Economic Benefits of Mattamuskeet NWR in 2006

91.6% of Refuge visitors surveyed came to Hyde County to visit the Refuge to fish or observe wildlife; Visitors traveled on average 174 miles.

Direct impact of refuge visitors ~ \$7 million

Indirect impacts of refuge visitors ~ \$4.5 million

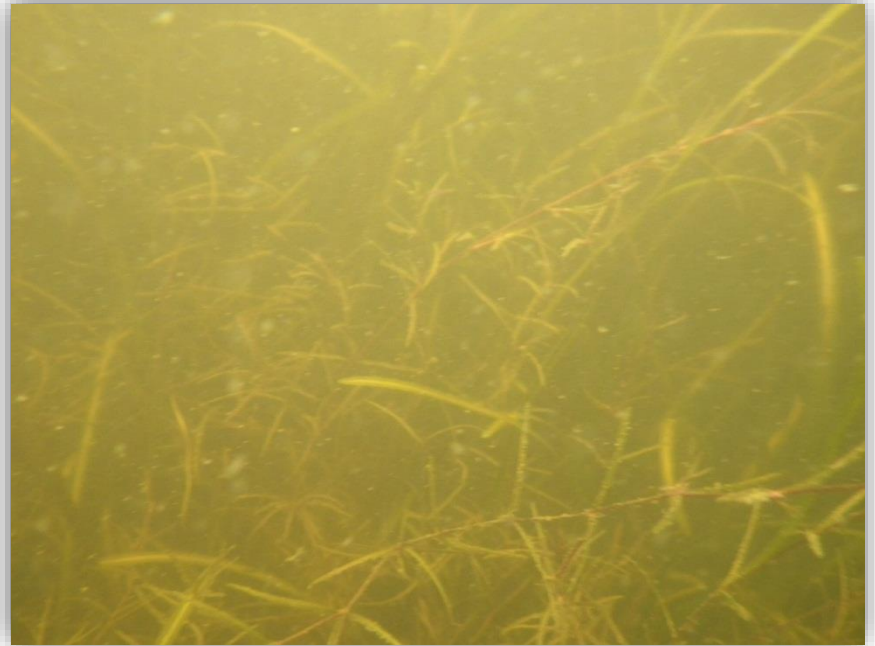
# Three management concerns for Mattamuskeet NWR

- **Vegetation management:** The Refuge wants to maintain appropriate water levels and water quality to support the growth of aquatic grasses and shoreline vegetation in Lake Mattamuskeet.
  - High water levels can cause lake grass die-offs due to shading.
  - Poor water quality causes harmful algal blooms in the lake.
- **Salinity management:** The Refuge wants to minimize saltwater intrusion through the use of four tide gates located in the canals that connect Lake Mattamuskeet to the Pamlico Sound.
- **Water management:** The Refuge does not want to flood landowners in the watershed, but the Refuge currently has limited ability to move water in wet years from the lake to the sound.

Water quality in Lake Mattamuskeet is bad, we have lost our grass beds (SAV) which provide important habitat for fish and wildlife



Turbid waters dominated lacking SAV

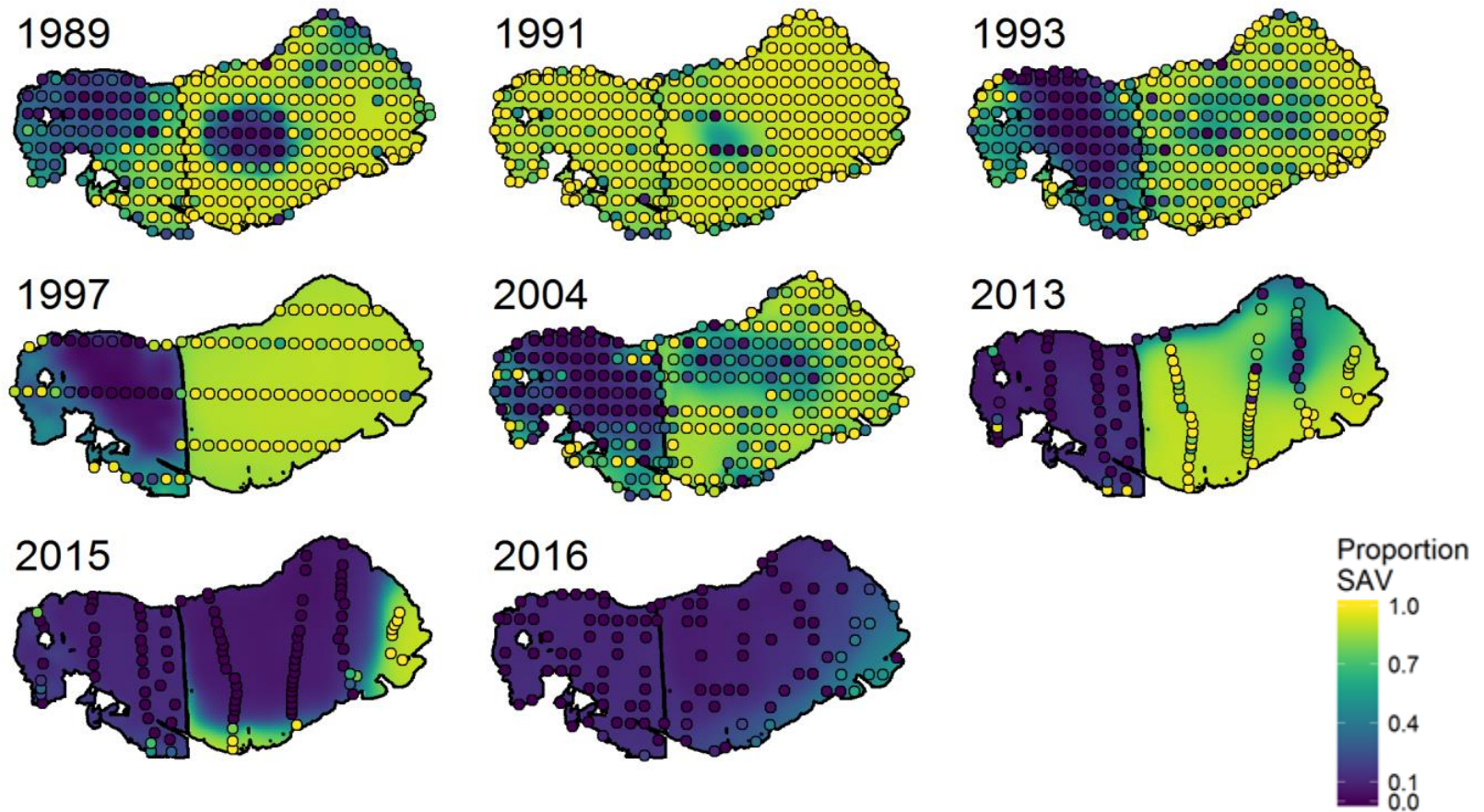


Heathy SAV community with clear water

**SAV = Submerged aquatic vegetation or aquatic grasses**



# SAV Trends through Time



Survey results from 2017:

**NO SAV**

in Lake Mattamuskeet

# Why is there no SAV?

## There are multiple reasons

### **Known causes of grass declines at Lake Mattamuskeet**

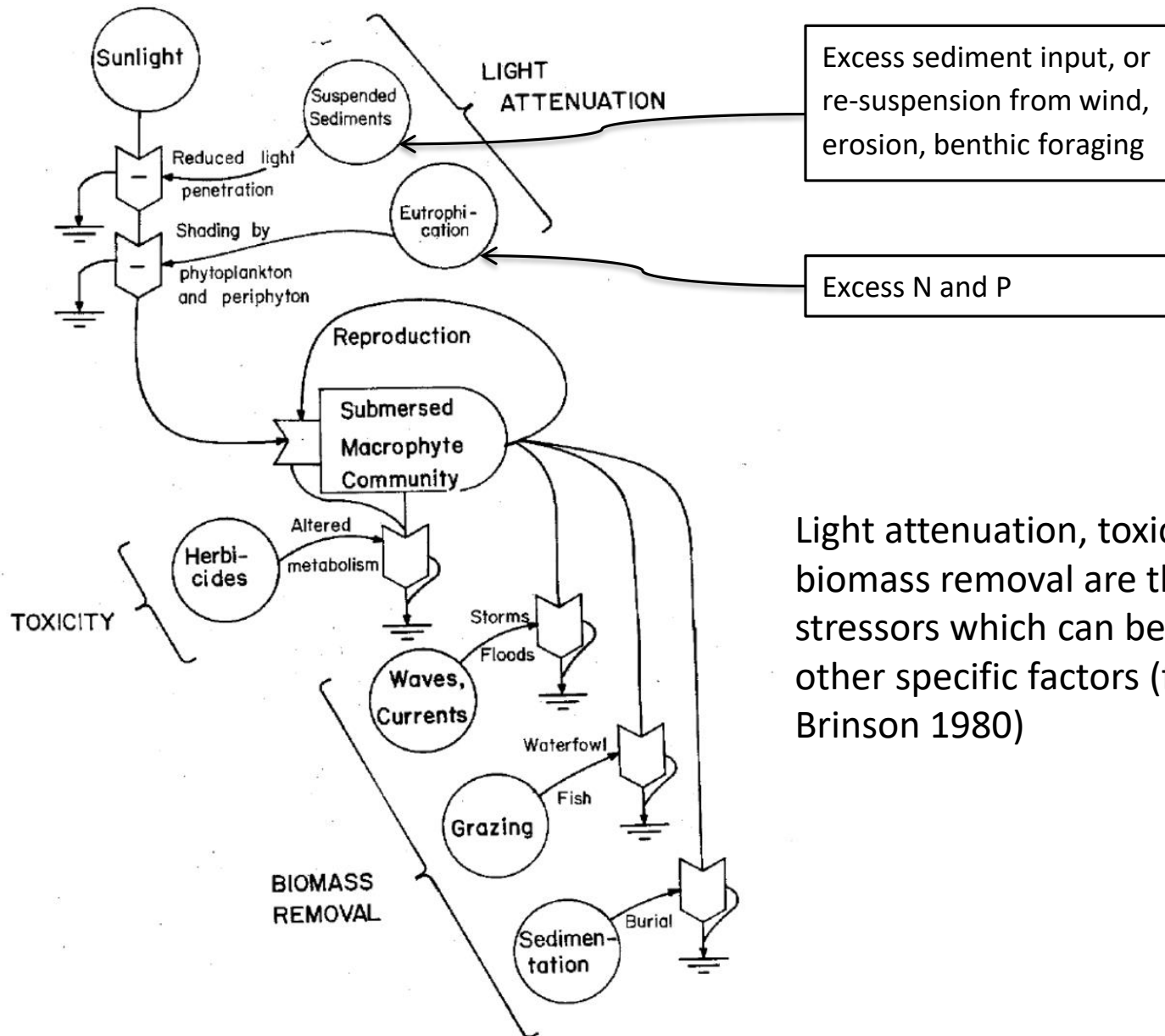
- Not enough light
- High water levels
- Too much suspended sediment
- Too many nutrients and algae from:
  - Septic
  - Rainfall
  - Farming
  - Waterfowl impoundments and Waterfowl
  - Recycled nutrients in the lake

### **Potential additional causes we are investigating at Lake Mattamuskeet**

- Wave Action?
- Carp?
- Pesticides?
- Burial?
- Lake salinities too low?
- Something else

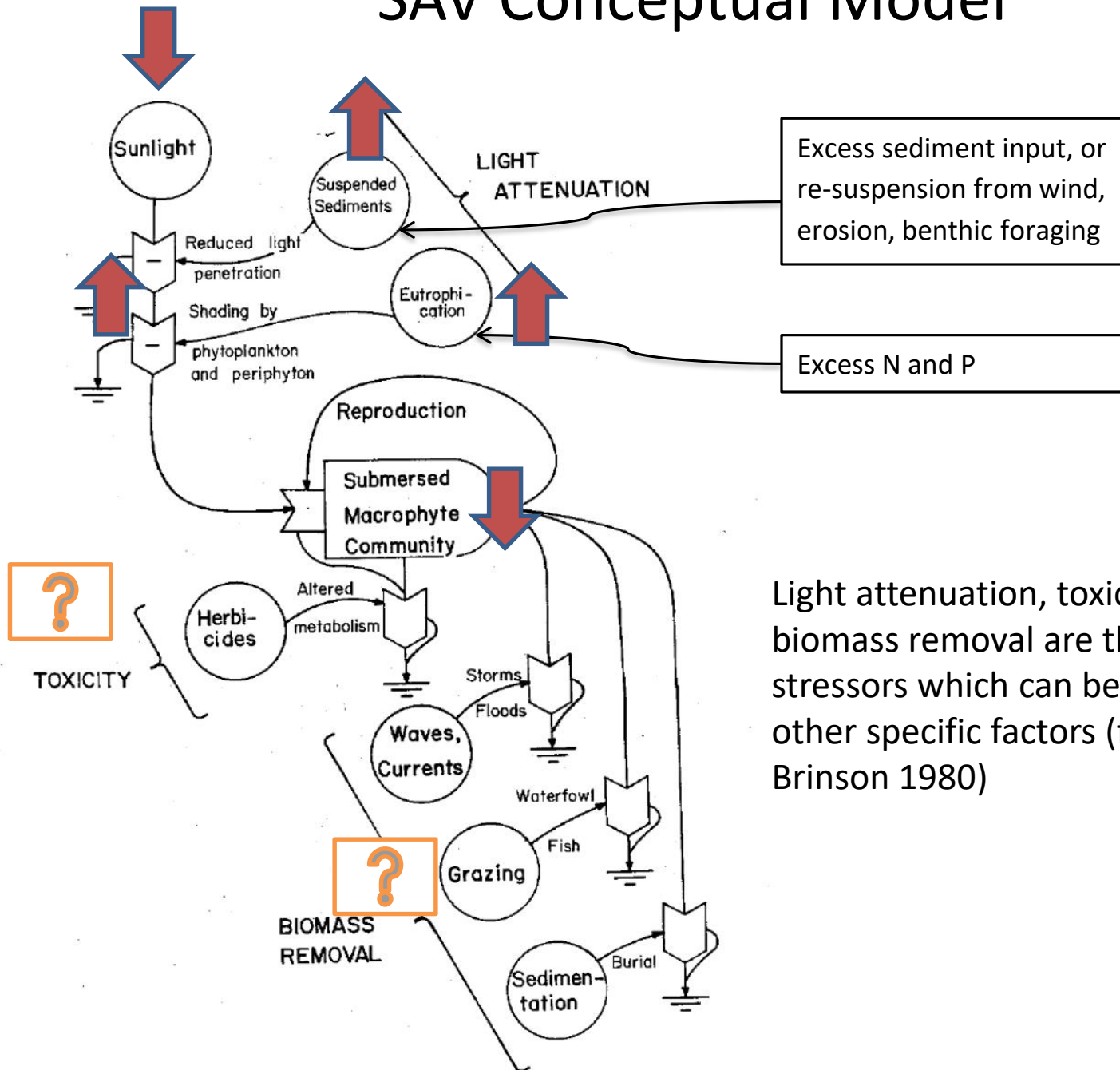


# SAV Conceptual Model



Light attenuation, toxicity, and biomass removal are three general stressors which can be influenced by other specific factors (from Davis and Brinson 1980)

# SAV Conceptual Model



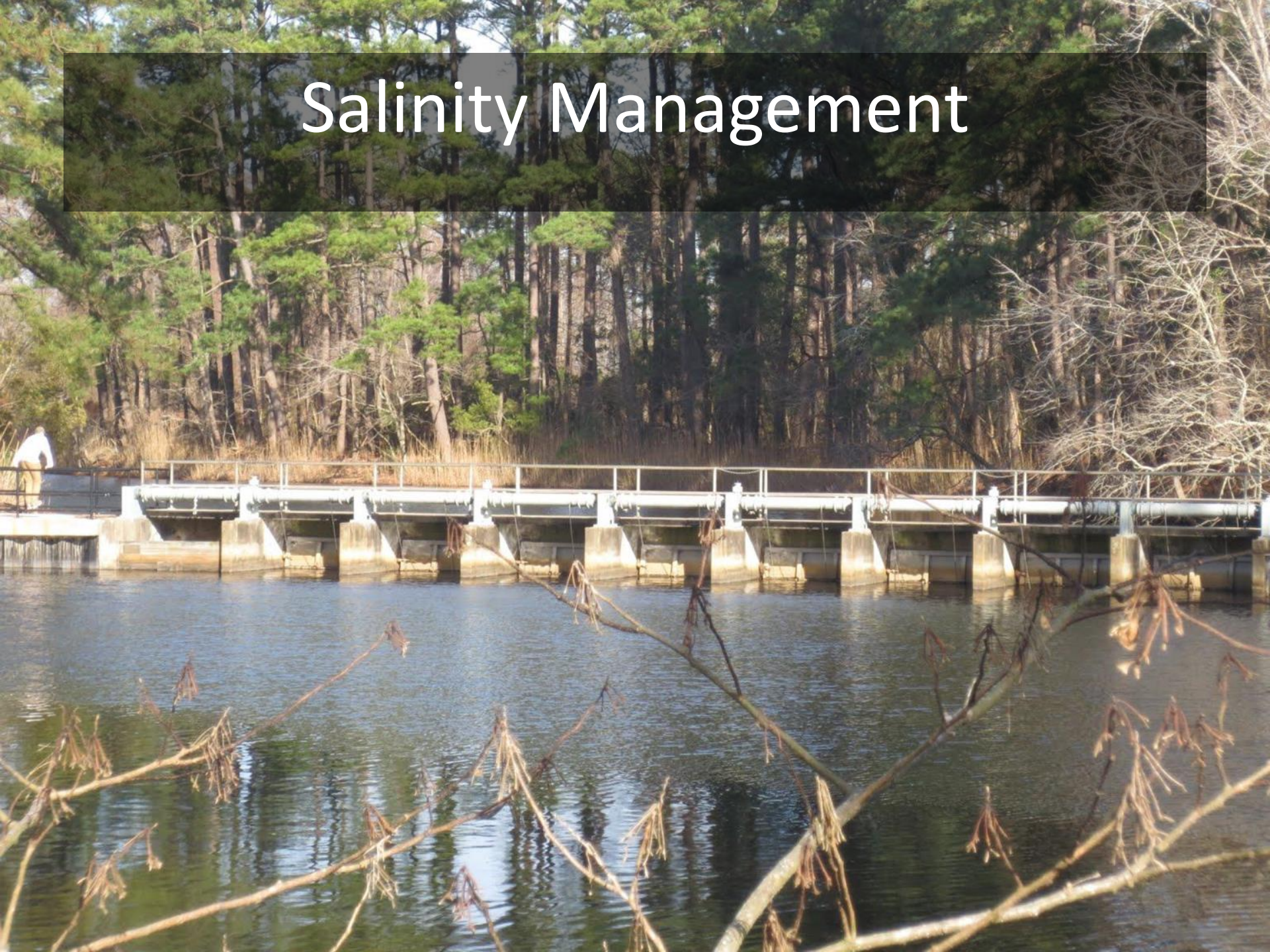
Light attenuation, toxicity, and biomass removal are three general stressors which can be influenced by other specific factors (from Davis and Brinson 1980)

# Refuge Steps for Restoring SAV

1. USFWS and NC WRC will work with our partners to help determine the causes of SAV declines.
2. USFWS will participate in the development of a watershed management plan led by the NC Coastal Federation which will be designed to improve water quality and water level management at Lake Mattamuskeet.
3. USFWS will work with others to help implement strategies from the watershed restoration plan and monitor Lake Mattamuskeet to determine the effectiveness of management actions.

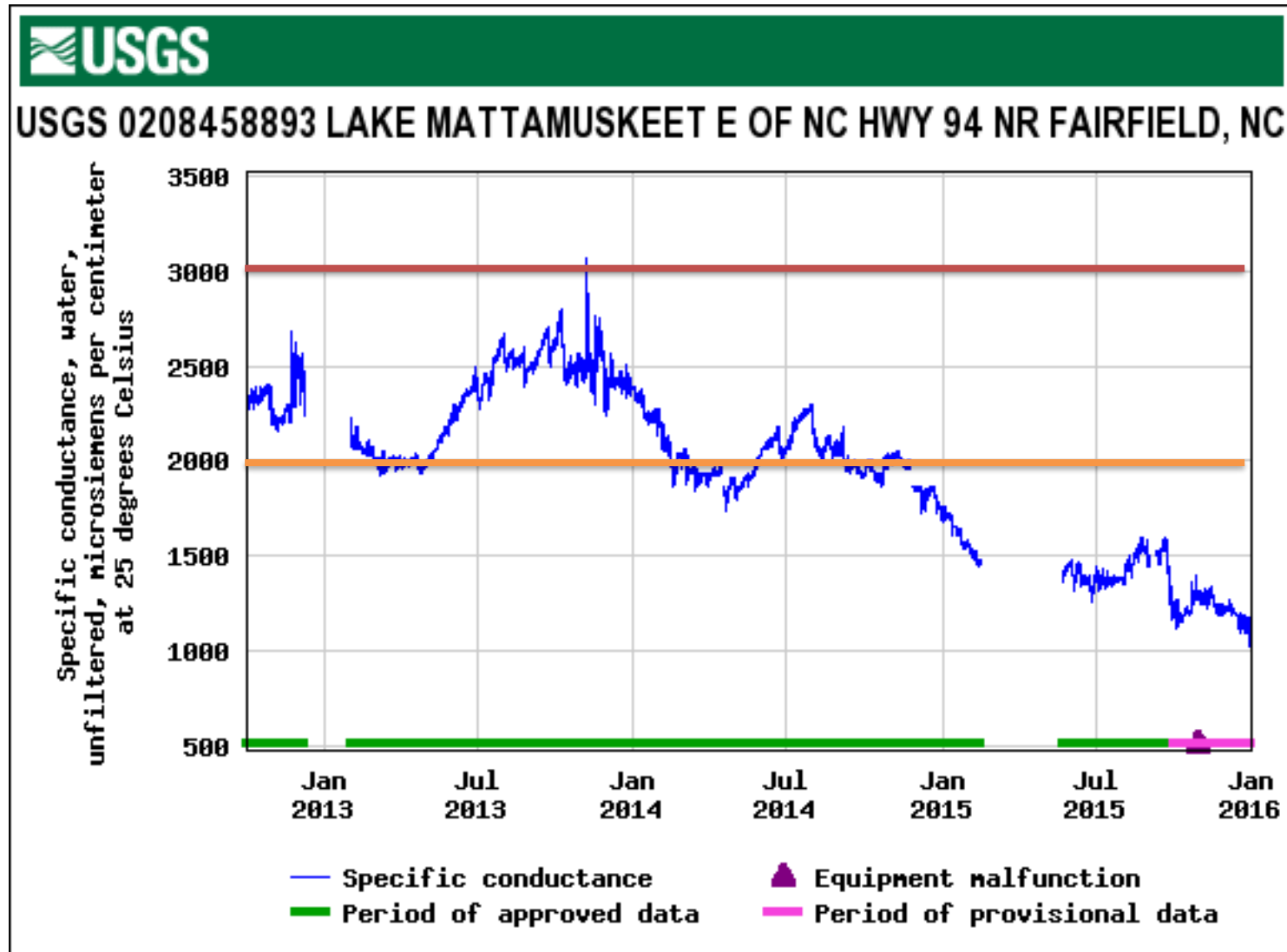


# Salinity Management



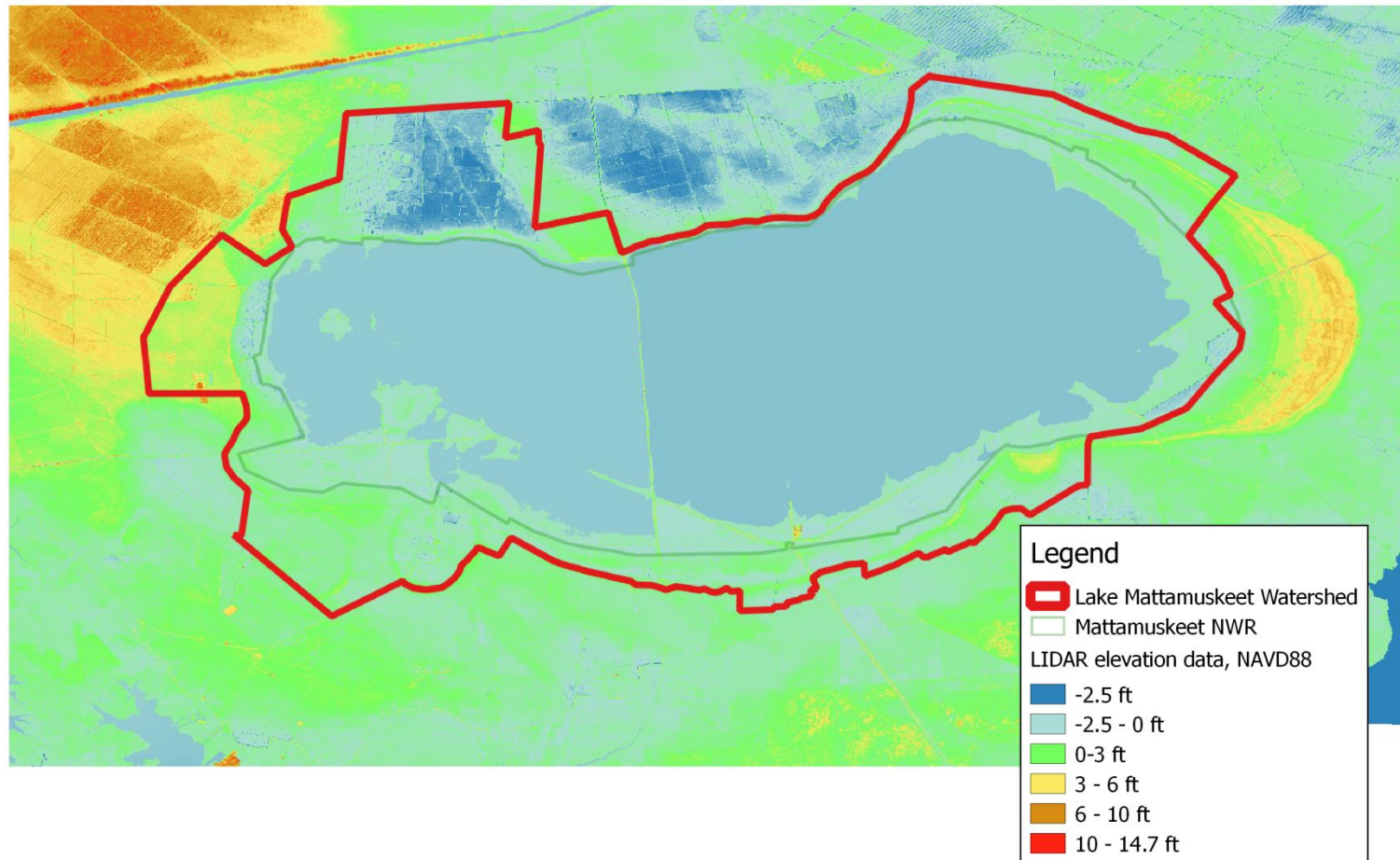


# Salinities and Specific Conductance since 2012 are available on the USGS website



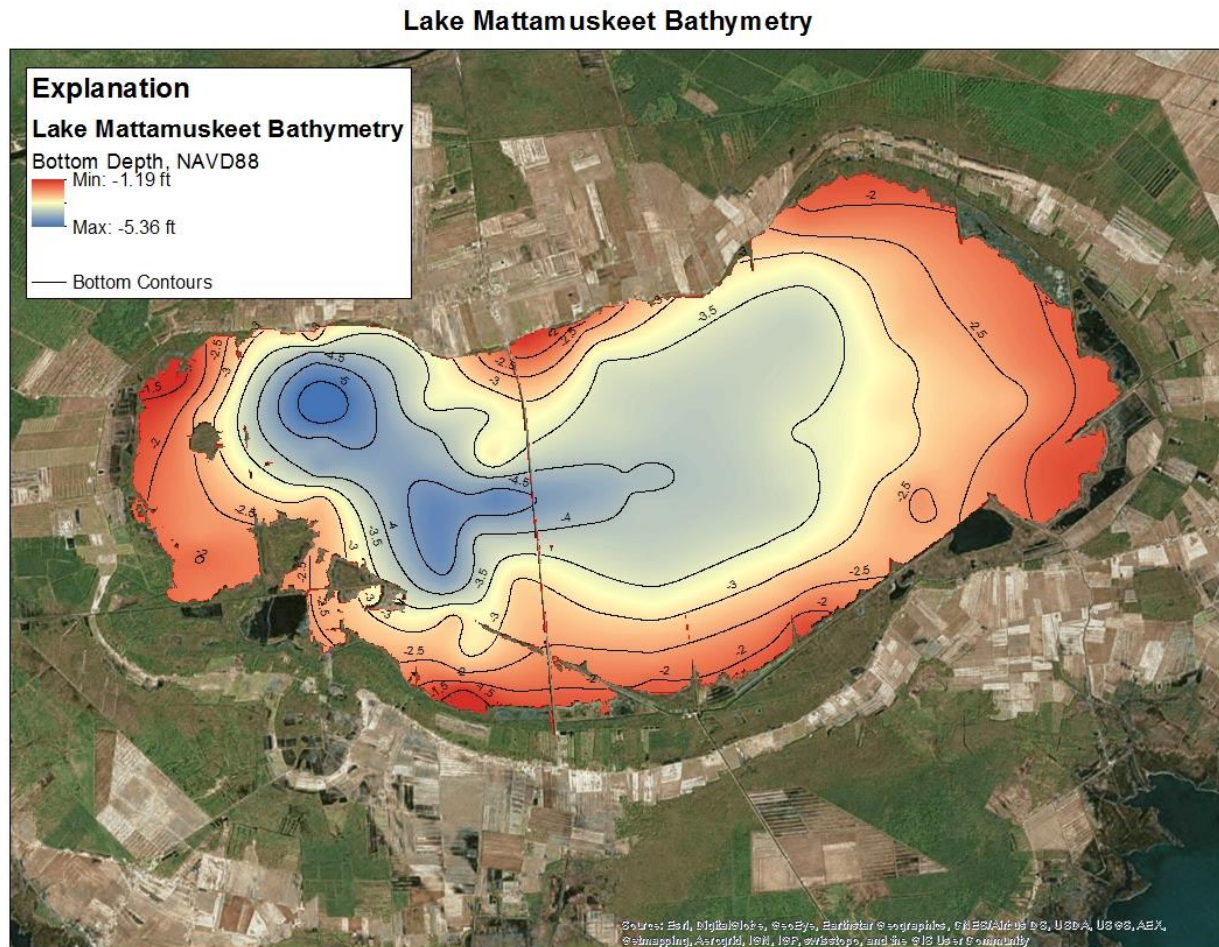
# Water Management:

## Land is low and drainage system is complex

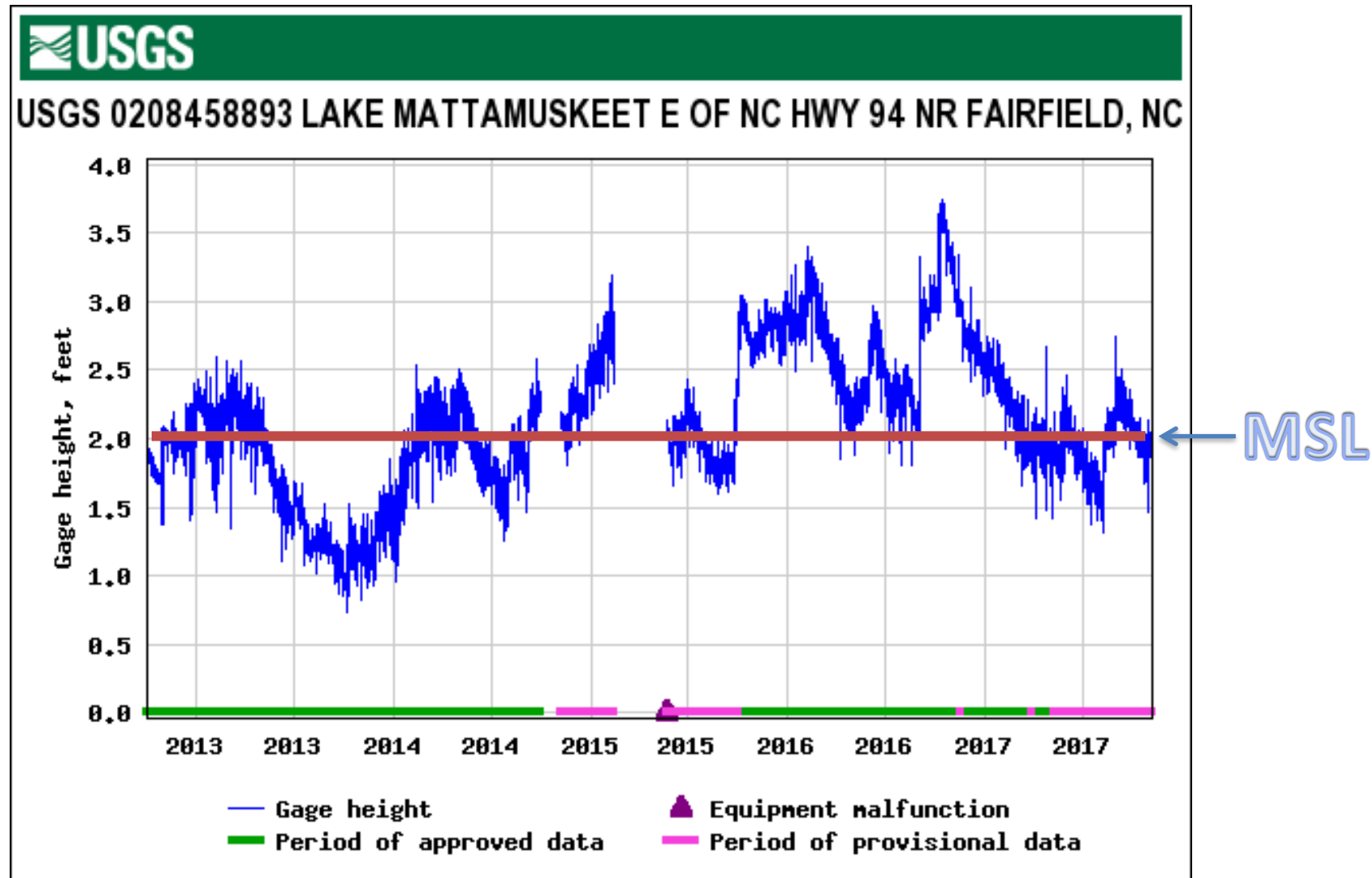




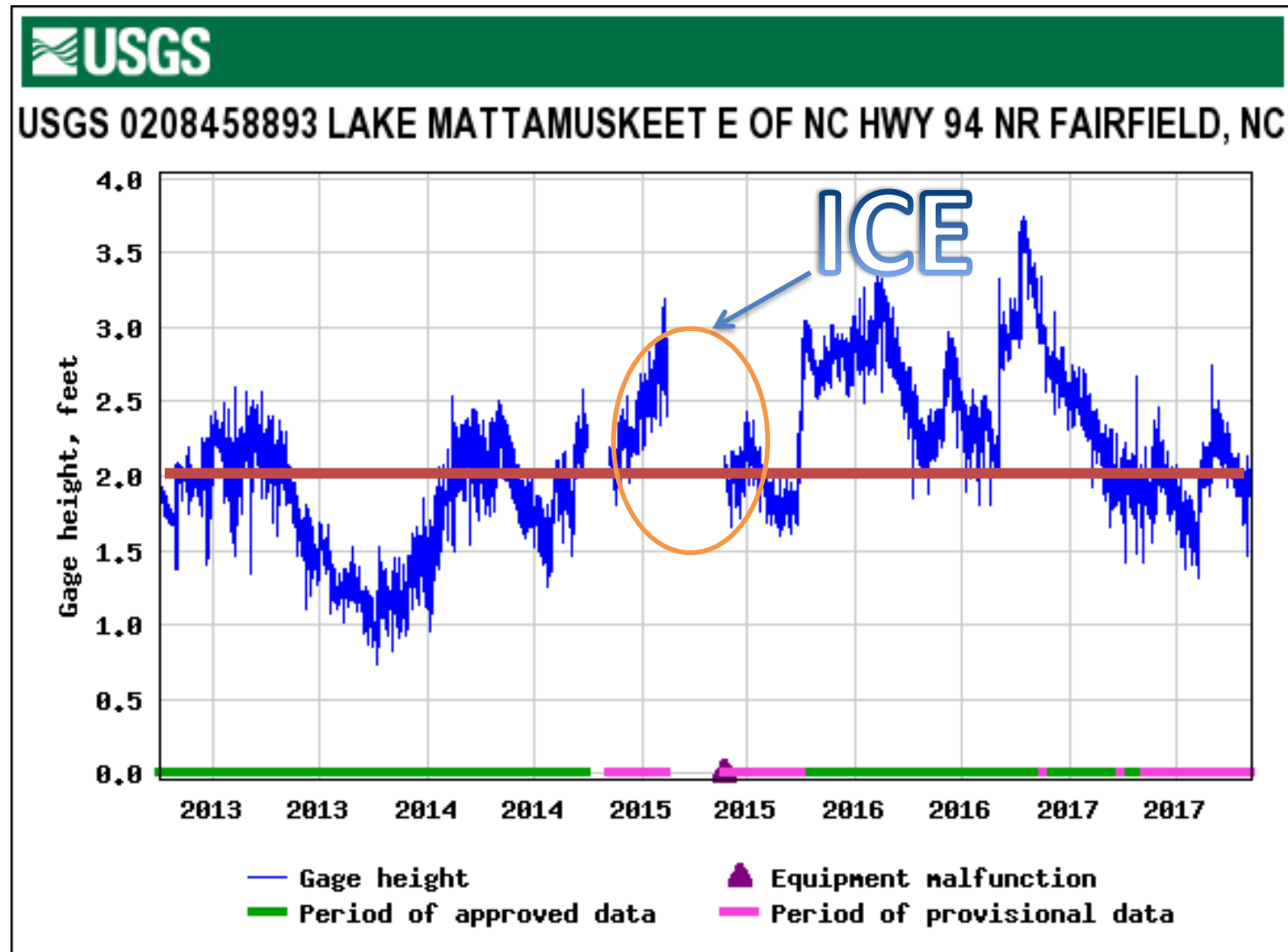
# Lake Mattamuskeet bottom depths are lower than the Pamlico Sound



# USFWS has been monitoring lake levels since 2012



# USFWS has been monitoring lake levels since 2012

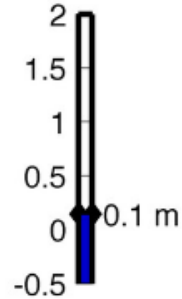




# Bell Island Pier website:

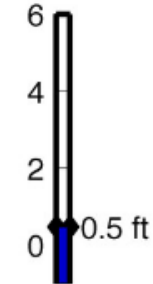
[go.ncsu.edu/bellpier](http://go.ncsu.edu/bellpier)

Water Level (NAVD88)

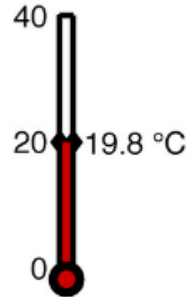


**Conditions at  
Bell Island Pier:  
11/07/17, 08:30**

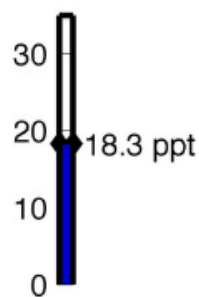
Water Level (NAVD88)



Water Temp



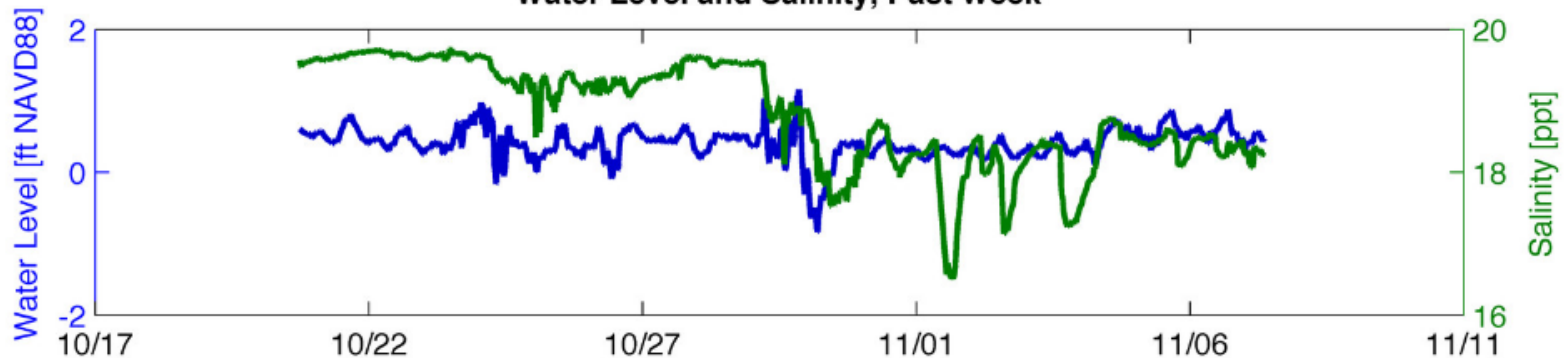
Salinity



Specific Conductance



Water Level and Salinity, Past Week





Questions?

Contact your steering committee members:  
Pete Campbell, Mattamuskeet NWR Refuge

Manager  
252-944-6495

or

Michelle Moorman, Refuge Biologist and USFWS/NCWRC co-  
Technical Working Group co-chair  
[michelle\\_moorman@fws.gov](mailto:michelle_moorman@fws.gov), 919-605-3980

Working part-time on Wednesday and Thursday while on  
maternity leave through February

## *It takes a village...*

A team of partners is committed to restoring SAV at Lake Mattamuskeet because of the lake's cultural, economic, and environmental values



- Hyde County Citizens
- APNEP
- NC Division of Water Resources
- North Carolina State University
- East Carolina University
- UNC-Chapel Hill
- Duke University
- USGS
- Representatives from Senators Richard Burr and Thom Tillis, and Congressman Walter Jones

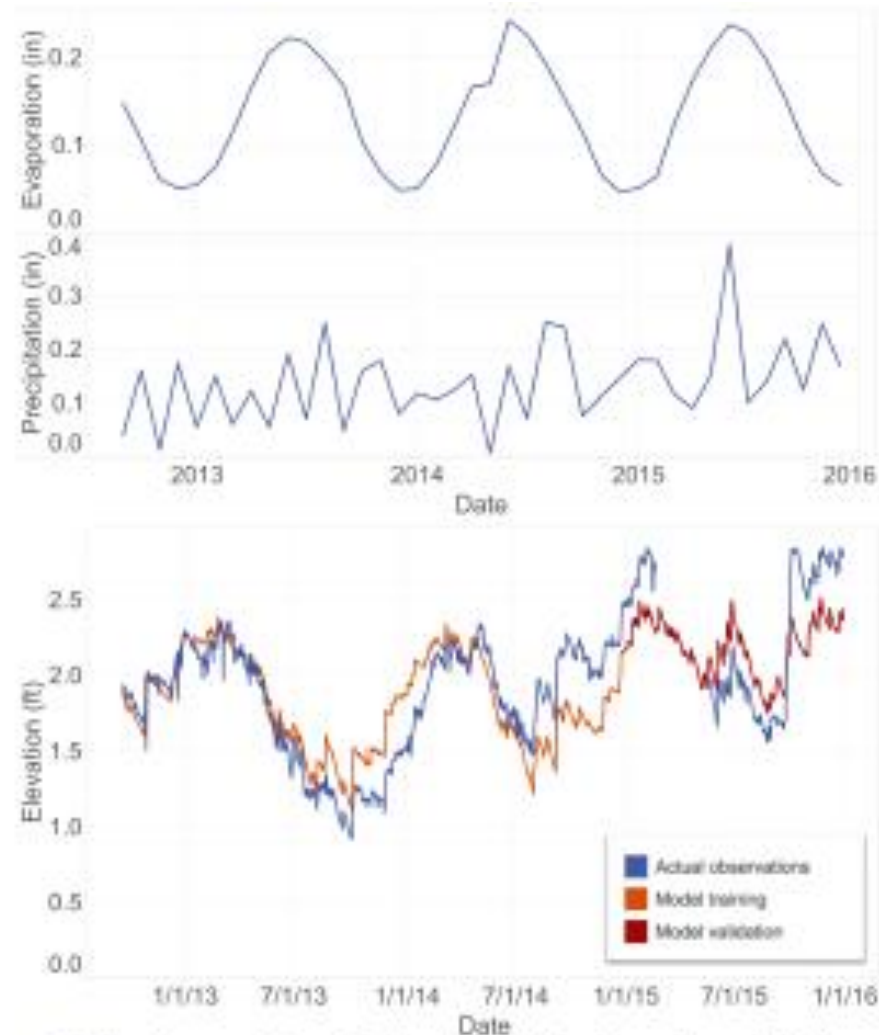


# Lake currently does not meet Chesapeake Bay SAV guidelines

Constituent	Recommended median habitat requirement for SAV growth and survival (Batiuk and Others, 2004)	Summer 2011 median concentration		Summer 2012 median concentration		Summer 2013 median concentration		Summer 2014 median concentration	
		2011		2012		2013		2014	
		East	West	East	West	East	West	East	West
Chlorophyll <i>a</i>	< 15 µg/L	No Data	No Data	26	54	59.5	95	102	91
Orthophosphate as P or DIP	<0.02	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Suspended solids, total	<15	No Data	No Data	20	42	60	67	95	61
Min Light requirement	> 9%			0.72 m	0.68 m	0.31 m	0.55 m	0.25 m	0.44 m
Secchi depth	0.5 m	0.56	0.33	0.4	0.3	0.38	0.3	0.22	0.29
% SAV coverage		No Data	No Data	No Data	No Data	73.1	12.6	29	12.4



Initial hydrologic models have been built by NCSU based on local precipitation, evapotranspiration, and estimates of outflows at the gates and inputs from adjacent lands



Daily time series of observed lake levels and lake levels predicted by validated hydrologic model.