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Coastal Federation

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Lake Mattamuskeet Watershed Restoration Plan

November 7, 2017 Public Meeting

Agenda Overview

7:00 p.m.	Welcome
7:05 p.m.	Update on Stakeholder Progress: Erin Fleckenstein
7:15 p.m.	Water Quality Trends and SAV in the Lake: Michelle Moorman
7:30 p.m.	Waterfowl Trends in the Lake: Doug Howell
7:45 p.m.	Results of Watershed Mapping and Survey Effort: Randall Etheridge
8:15 p.m.	Next Steps of Plan Development: Erin Fleckenstein
8:20 p.m.	Question and Comment Period
8:30 p.m.	Adjourn

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Update on Stakeholder Progress

Major Progress To Date

-January 31, 2017 Funding partners commit to developing a watershed restoration plan

-May 8, 2017 Funding partners contract with the N.C. Coastal Federation to develop a watershed restoration plan

- Stakeholder Team has met four times since the contract was signed

HYDE COUNTY SOIL & WATER CONSERVATION DISTRICT

NORTH CAROLINA Wildlife RESOURCES COMMISSION

U.S. FISH & WILDLIFE SERVICE

THE COUNTY OF HYDE AGRICULTURE SEAFOOD WILDLIFE RECREATION 1712

Stakeholders:

Team Members

Roles and Responsibilities

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Stakeholder Charge

Responsible for directing the development of the watershed restoration plan for the Lake and its surrounding watershed and representing the various viewpoints, uses and goals of the Lake watershed's many stakeholders. They will serve as a sounding board and advisory committee for the duration of the plan development and prioritize key action items for inclusion in the final plan.

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Stakeholder Team

Daniel Brinn- Hyde Drainage

Pete Campbell- U.S. Fish and Wildlife Service

Michael Cahoon- Farming Community

Doug Howell- N.C. Wildlife Resources Commission

Art Keeney- Residential Community

Bill Rich- Hyde County Manager

Ben Simmons- Farming Community/Fairfield Drainage

Pat Simmons- Hospitality Industry

J.W. Spencer- Hyde County Soil and Water Board

James Topping- Residential Community

Joey Ben Williams- Impoundments

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Draft Goals for Plan

Protect the **way of life in Hyde County,** including opportunities for fishermen, hunters, and other recreational users, promoting tourism, and enhancing agricultural and commercial fishing interests, **by supporting thriving populations of fish, waterfowl and other wildlife**.

Draft Goals for Plan

Manage lake levels to **reduce flooding** of residential, business, and farming properties in the watershed by implementing water level management strategies that improve the ability to move water from the lake to the sound and that mitigate other sources of flooding.

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Draft Goals for Plan

Implement management actions, based on identified sources of **water quality** impairments to Lake Mattamuskeet, **to restore** an aquatic system that maintains *low nutrient inputs, low sediment loads and resuspension of sediments, low salinity levels, high water clarity, abundant SAV coverage, and minimal levels of phytoplankton*.

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Goal- the ultimate desired result

Benchmark- Clearly Identified steps/progress points along the way leading to or helping to achieve the goal

Action- work that can be completed to move towards a benchmark or ultimate goal

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Next Steps of Plan Development-

Erin Fleckenstein

Watershed Restoration Plan Development Process

Assemble Planning Team

Determine Water Quality and Quantity Conditions and Impairments

Complete Watershed Characterization

Establish Plan Goals, Objectives and Action Items

Calculate Runoff Reduction or Volume Control Needed

Identify Stormwater Reduction or Water Management Techniques

Develop Management Plan

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Goal- the ultimate desired result

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Action- work that can be completed to move towards a benchmark or ultimate goal

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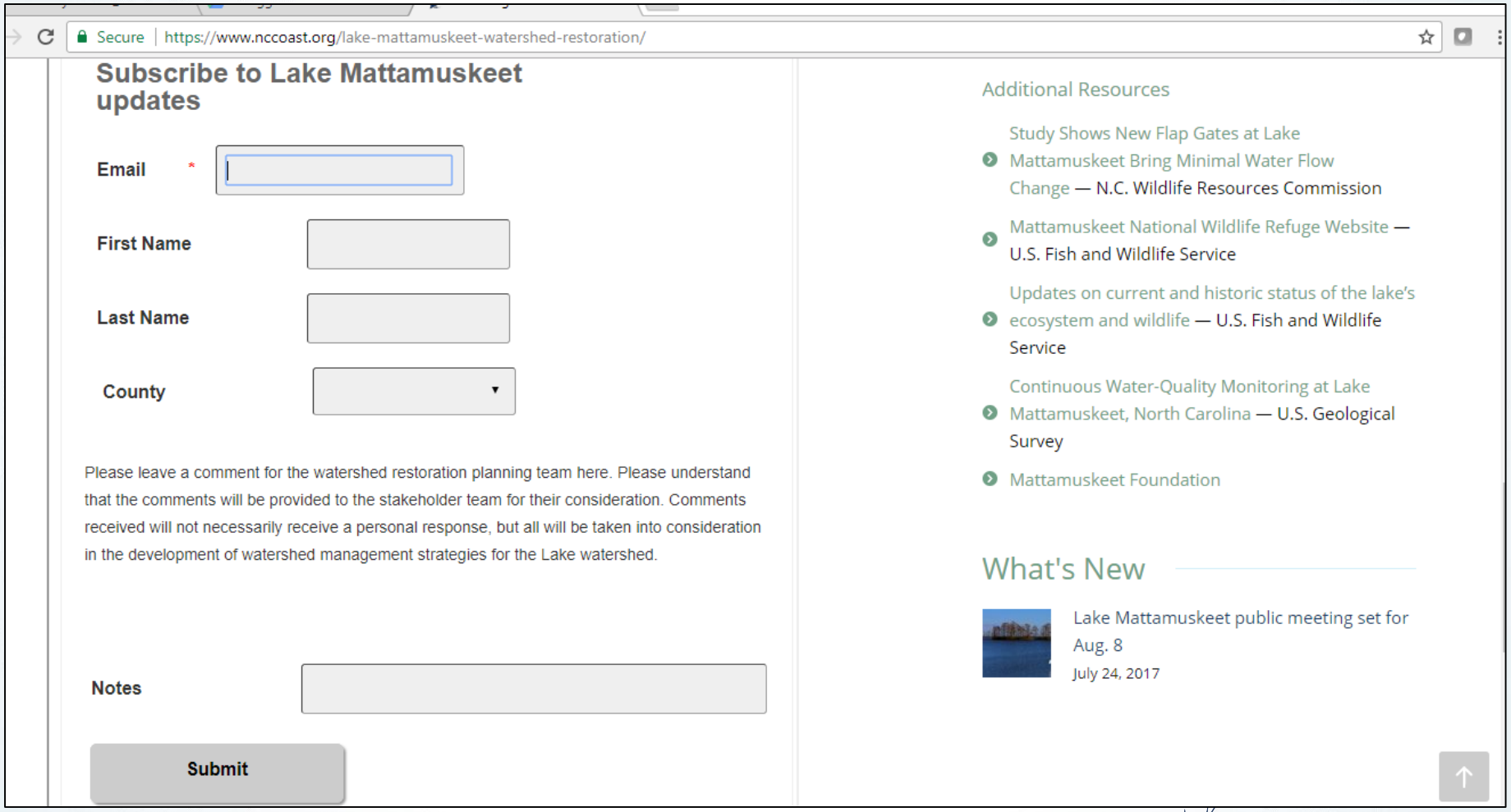
Comments Collected Online



Sign-up for emails and press releases;
Submit Comments

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Questions?

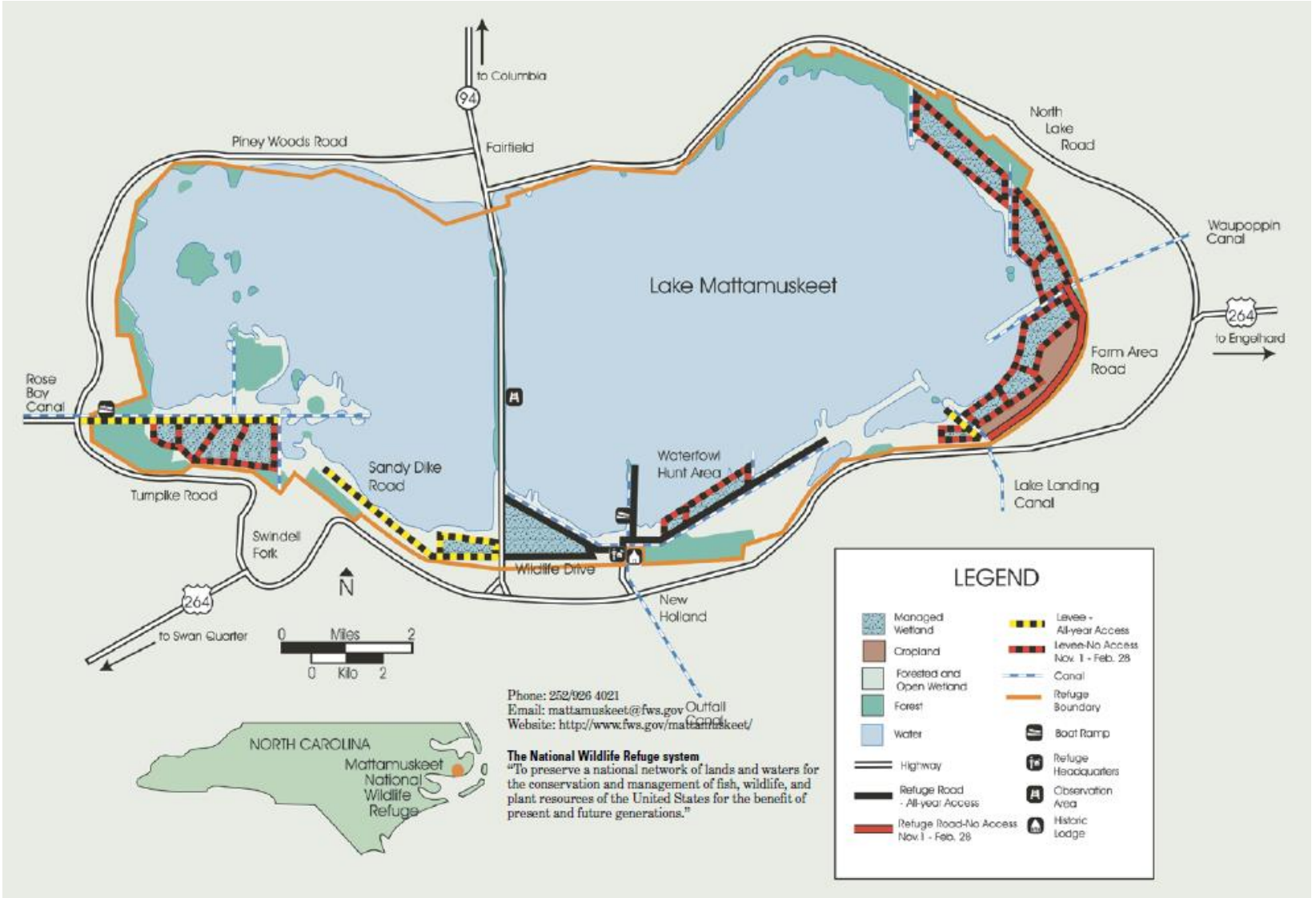
Management Concerns at Mattamuskeet National Wildlife Refuge

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

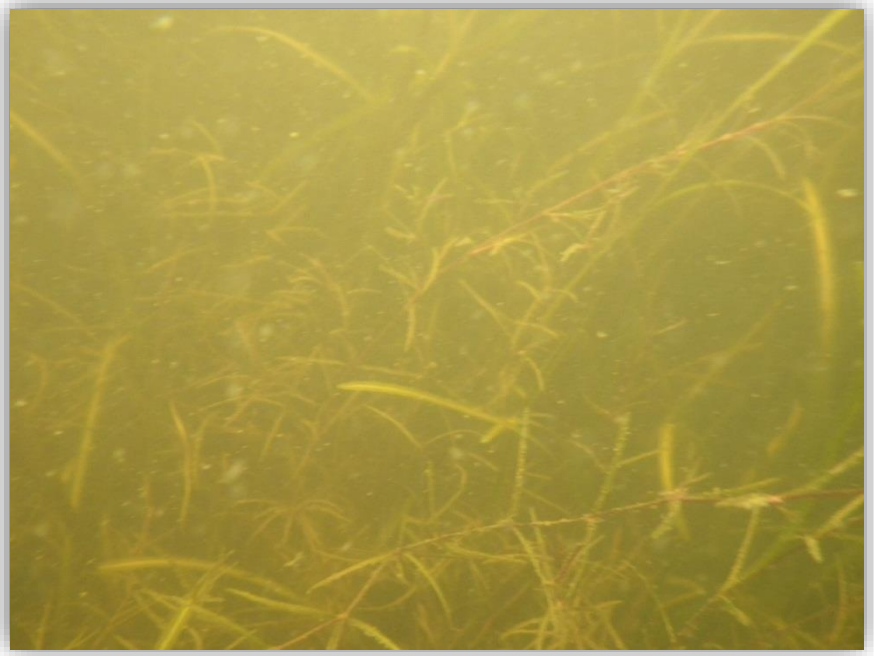
- **Vegetation management:** The Refuge wants to maintain appropriate water levels and water quality to support the growth of aquatic grasses and shoreline vegetation in Lake Mattamuskeet.
  - High water levels can cause lake grass die-offs due to shading.
  - Poor water quality causes harmful algal 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

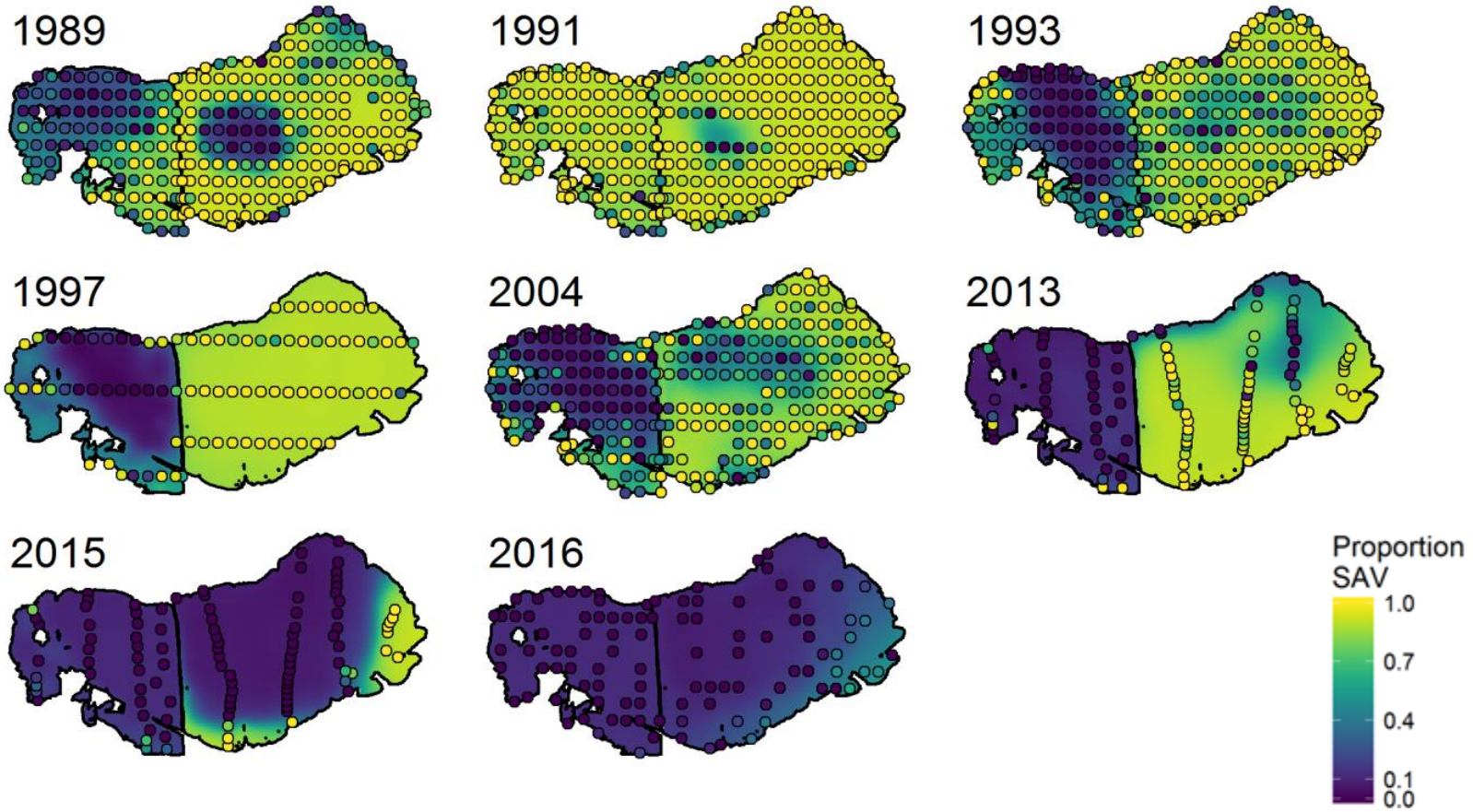
Turbid waters dominated lacking SAV



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

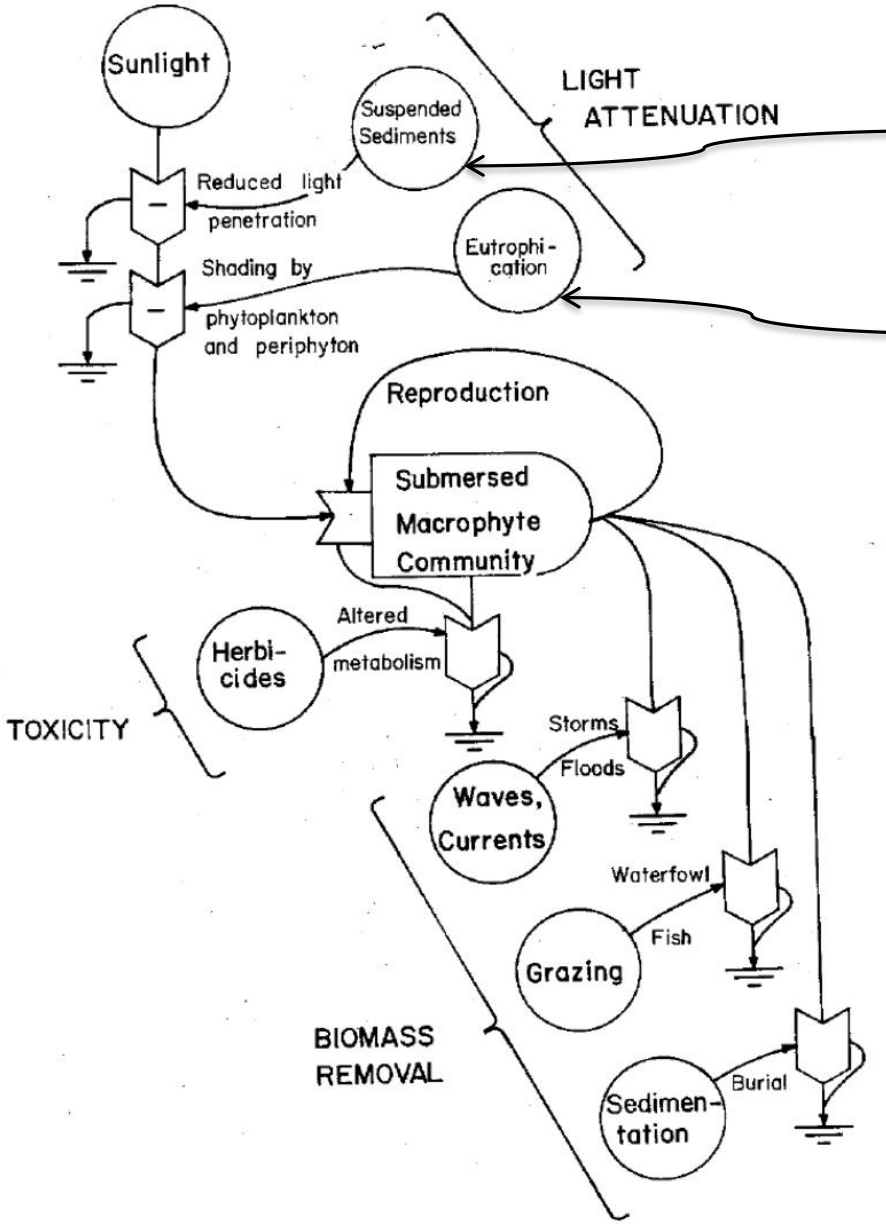
Known causes of grass declines at Lake Mattamuskeet

- 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

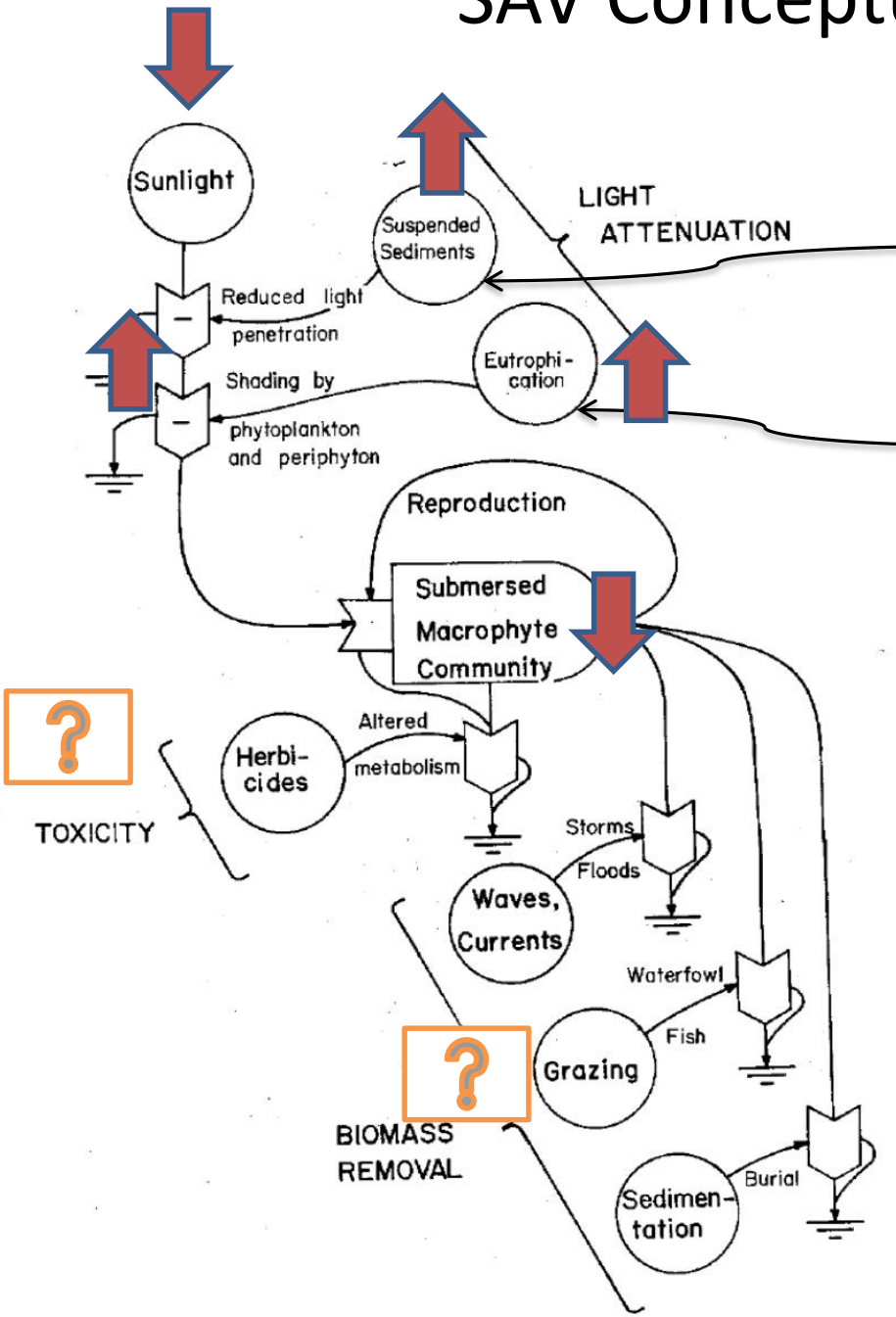


Excess sediment input, or re-suspension from wind, erosion, benthic foraging

Excess N and P

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



Excess sediment input, or re-suspension from wind, erosion, benthic foraging

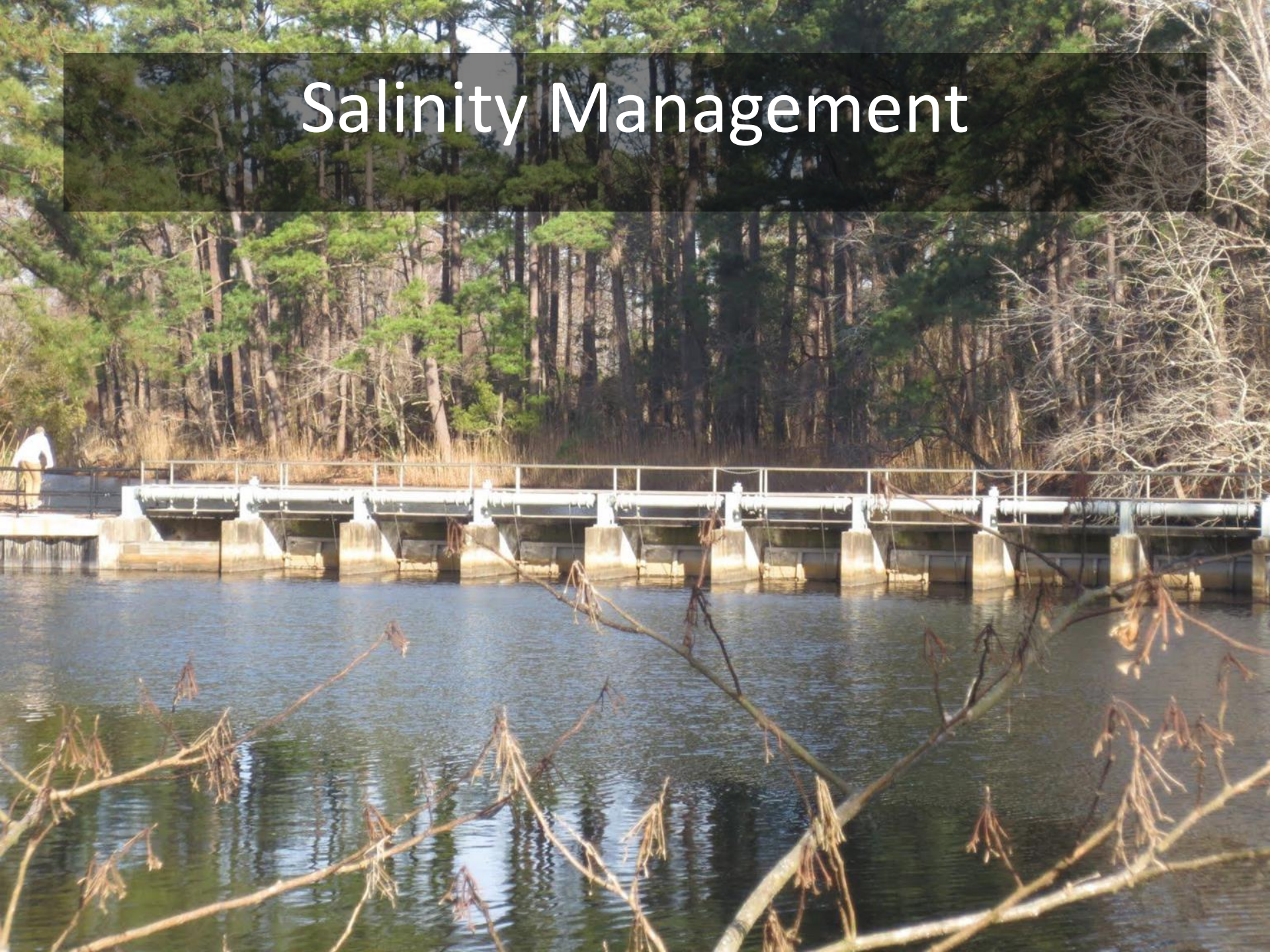
Excess N and P

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

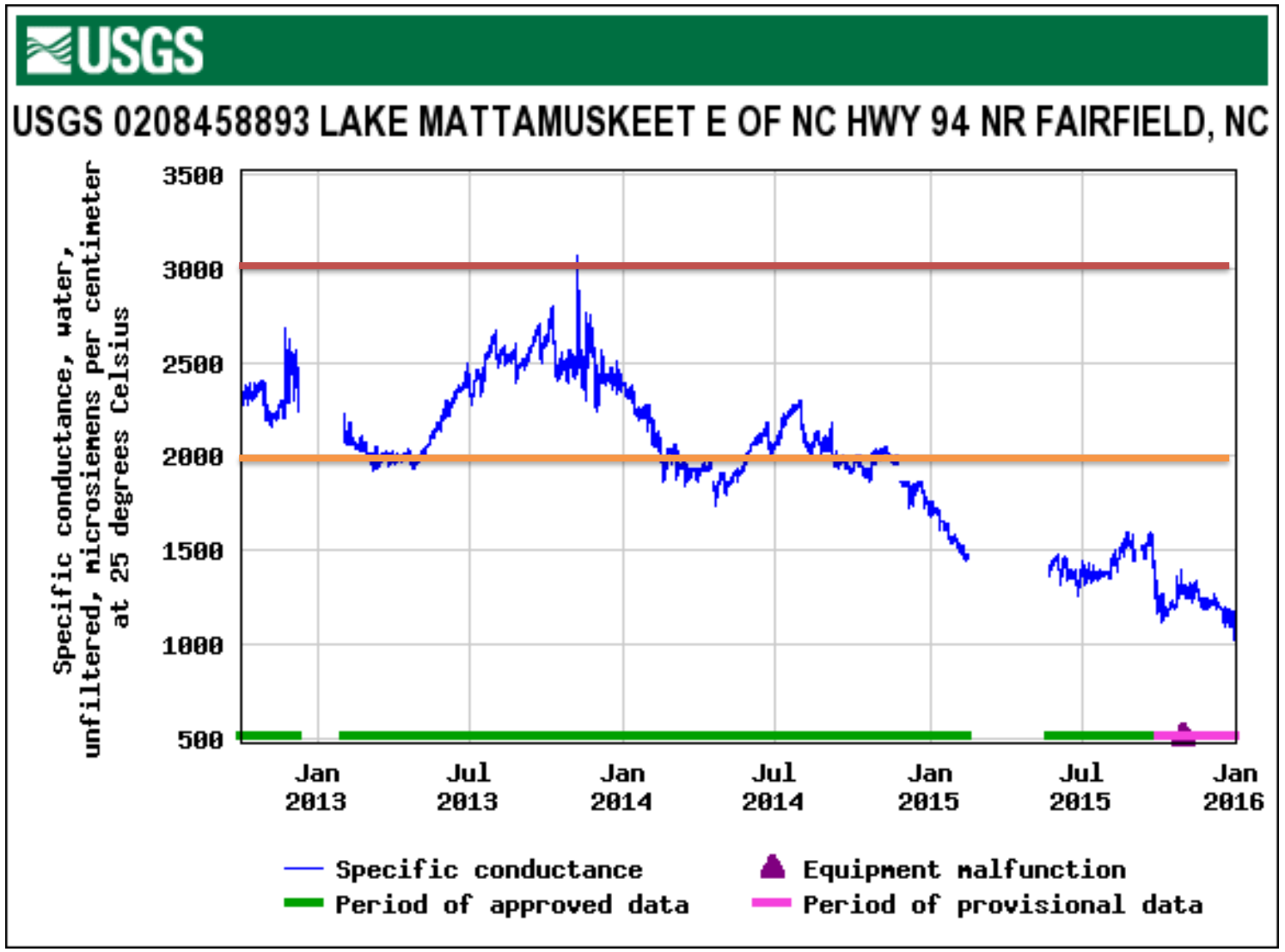
Refuge Steps for Restoring SAV

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.

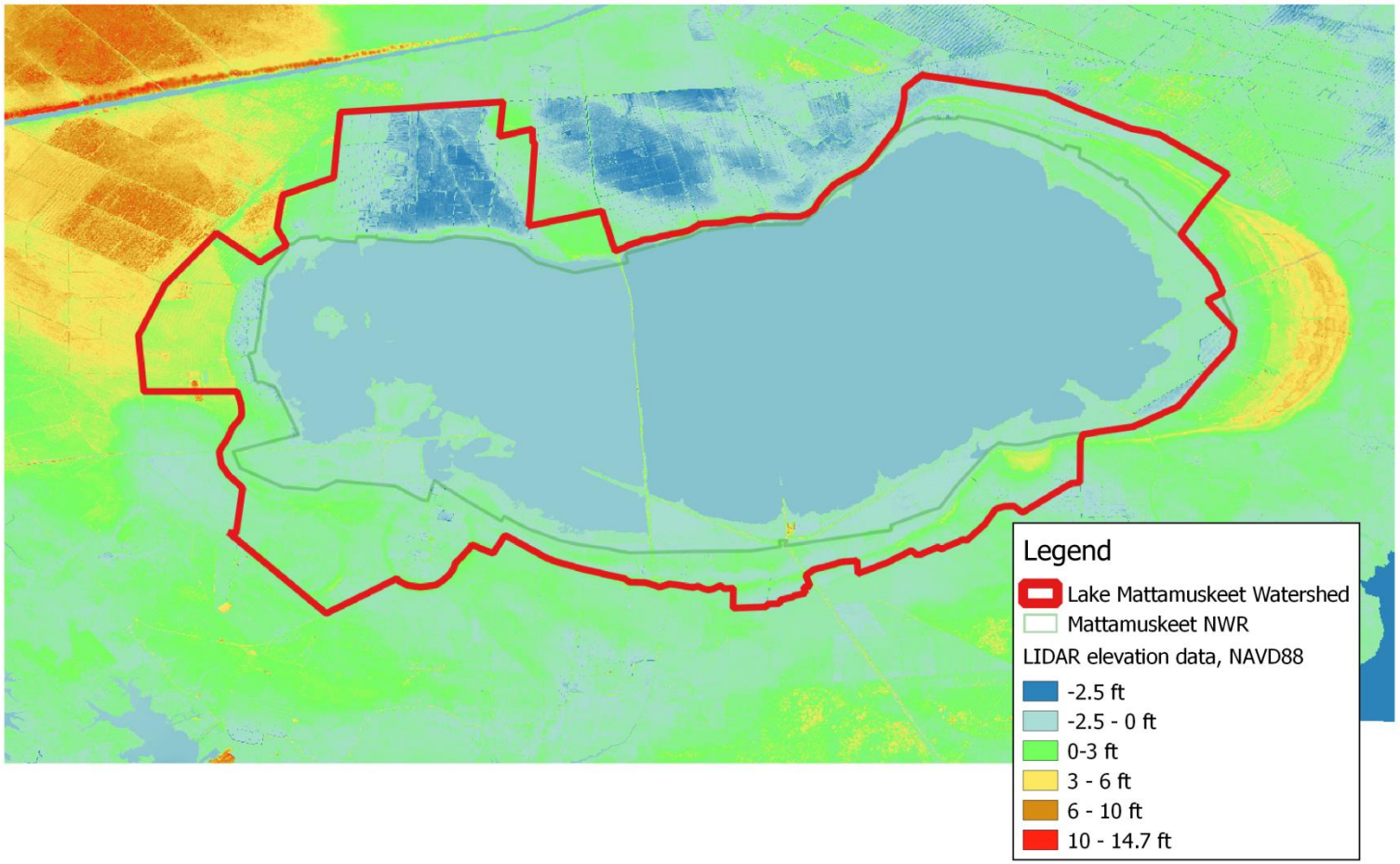
Salinity Management



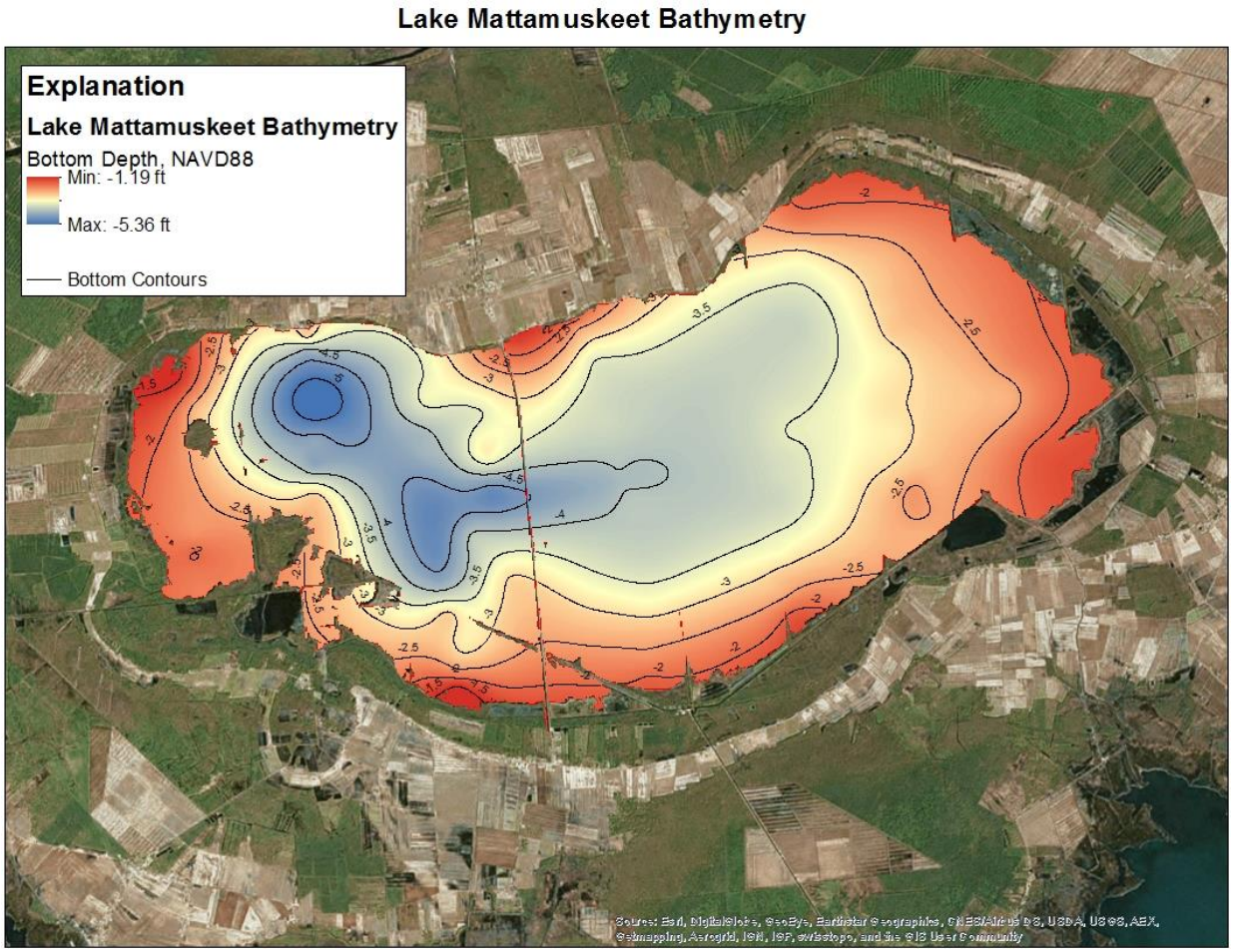
Salinities and Specific Conductance since 2012 are available on the USGS website



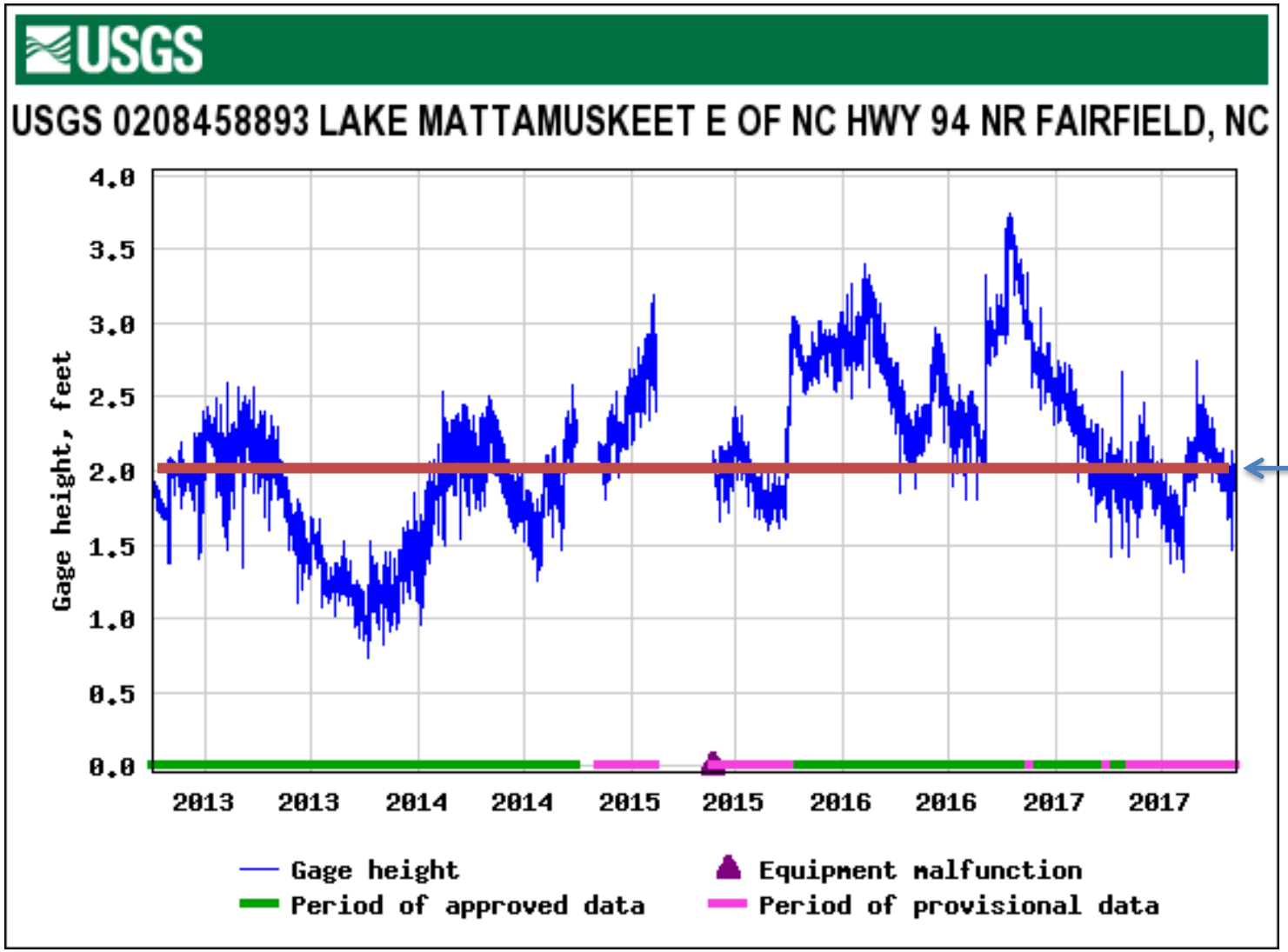
Water Management:
Land is low and drainage system is complex



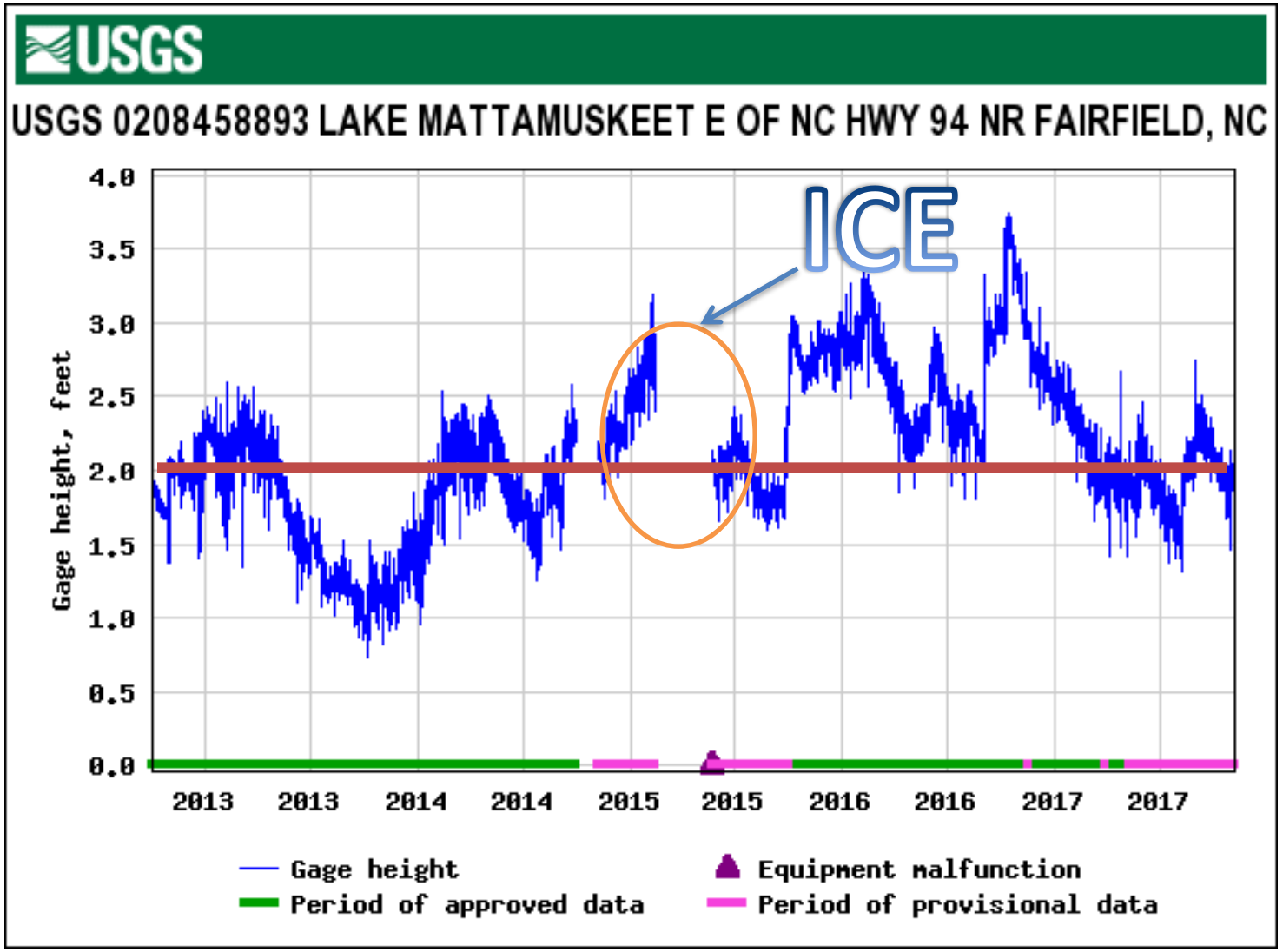
Lake Mattamuskeet bottom depths are lower than the Pamlico Sound



USFWS has been monitoring lake levels since 2012

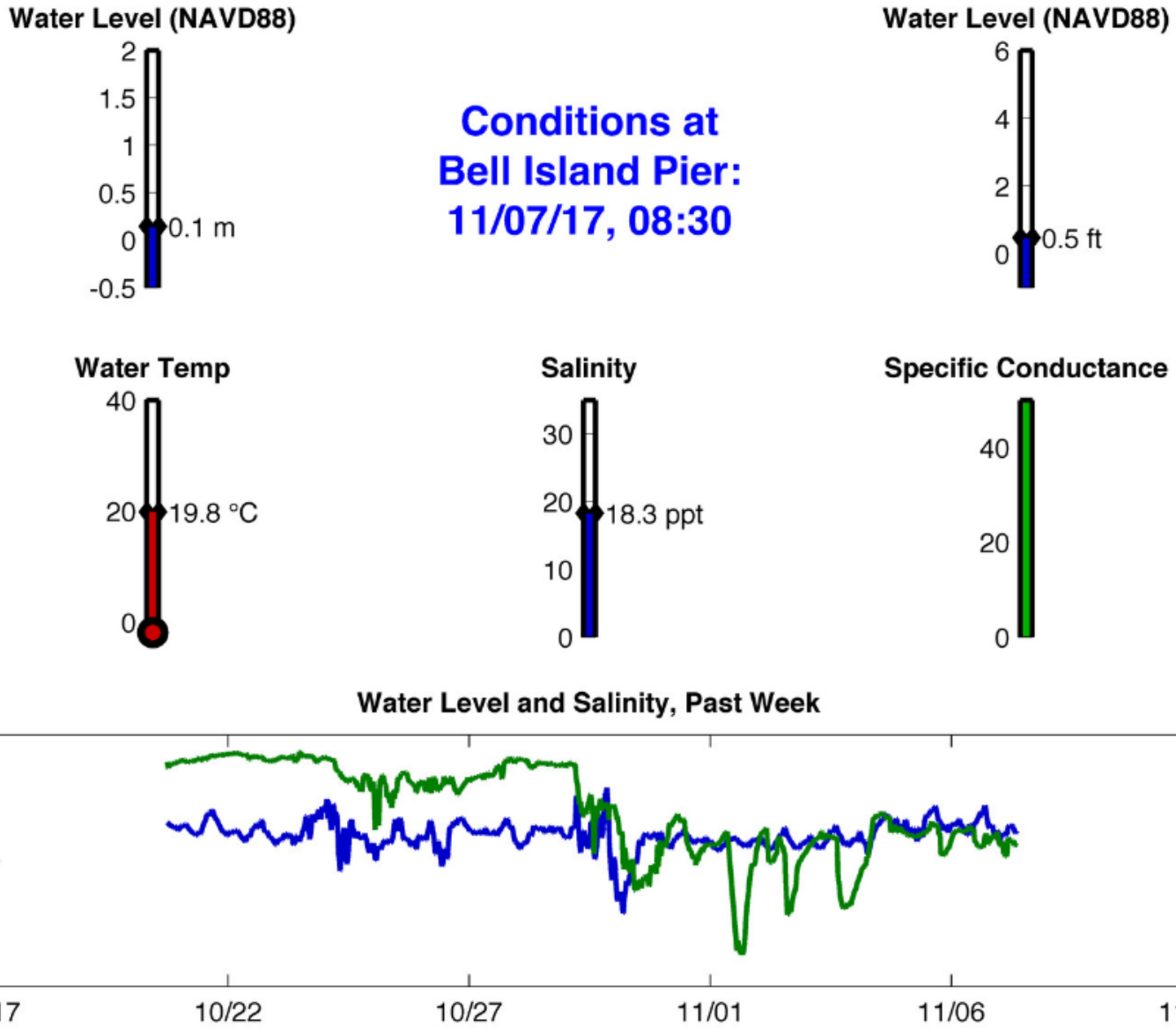


USFWS has been monitoring lake levels since 2012



Bell Island Pier website:

go.ncsu.edu/bellpier



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, 919-605-3980

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

It takes a village…

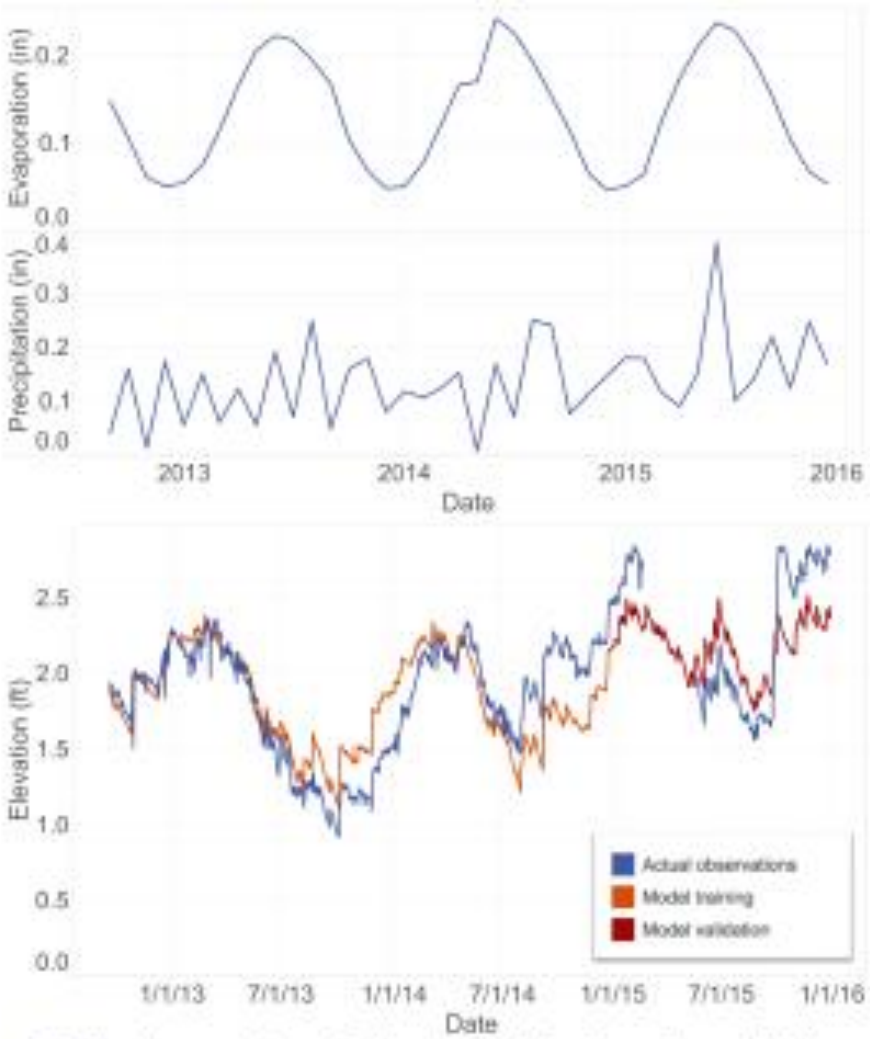
A team of partners is committed to restoring SAV at Lake Mattamuskeet because of the lake's cultural, economic, and environmental values

- 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

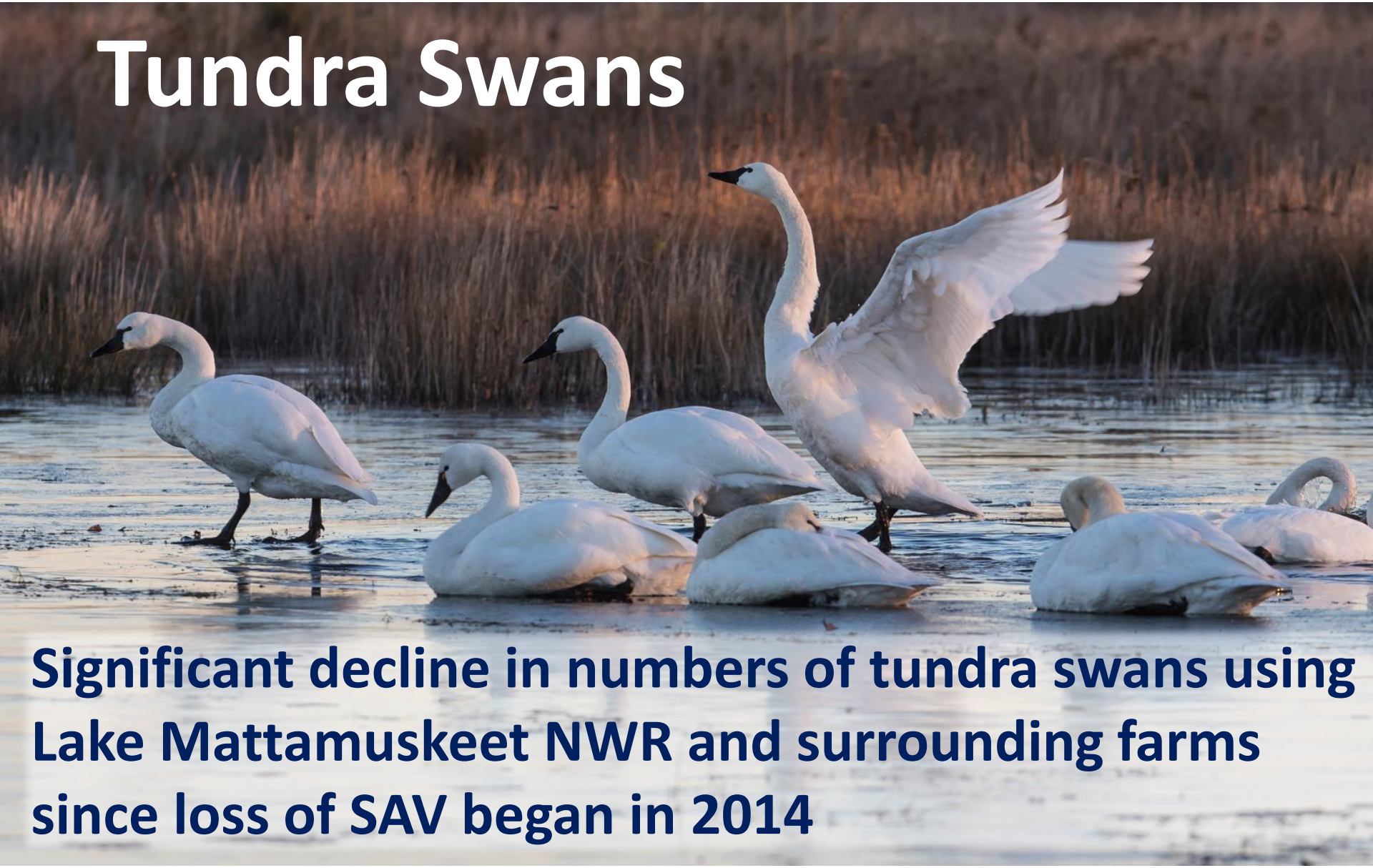
Constituent	Recommended median habitat requirement for SAV growth and survival (Batiuk and Others, 2004)	Summer 2011 median concentration		Summer 2012 median concentration		Summer 2013 median concentration		Summer 2014 median concentration	
		2011		2012		2013		2014	
		East	West	East	West	East	West	East	West
Chlorophyll *a*	< 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



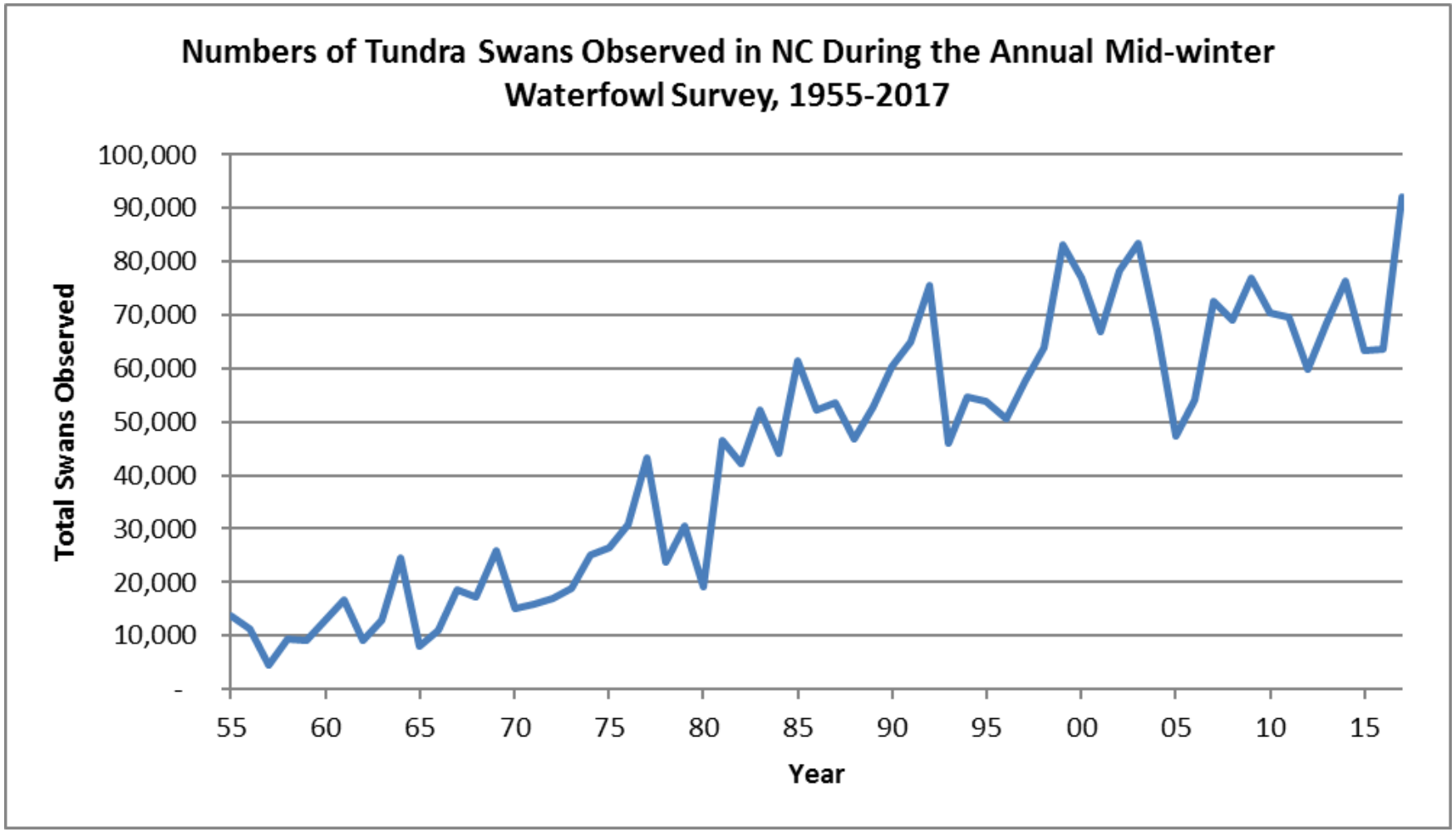
Daily time series of observed lake levels and lake levels predicted by validated hydrologic model.

Trends in Waterfowl Following the Loss of SAV on Lake Mattamuskeet

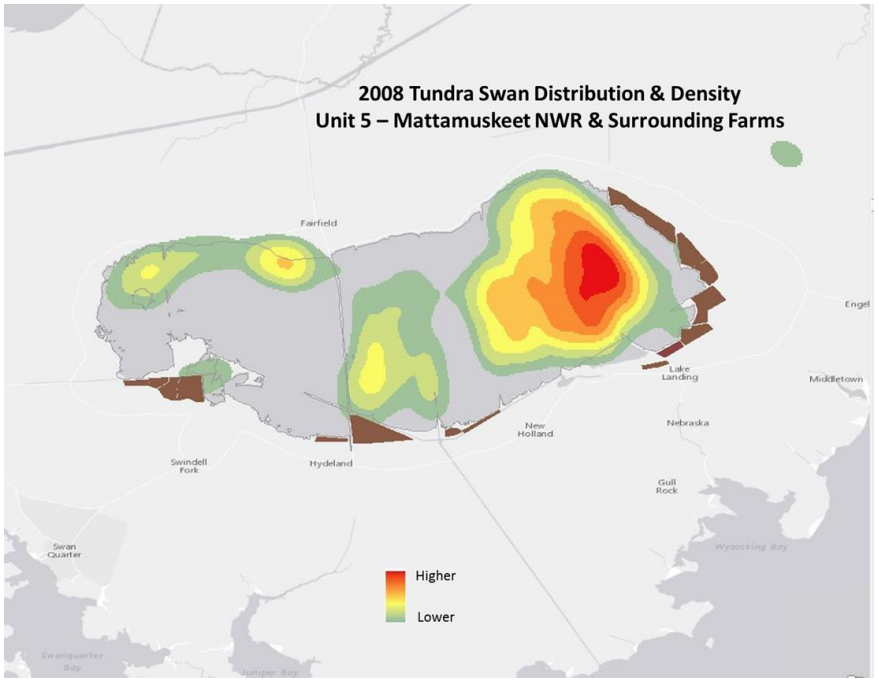

Tundra Swans
Significant decline in numbers of tundra swans using Lake Mattamuskeet NWR and surrounding farms since loss of SAV began in 2014

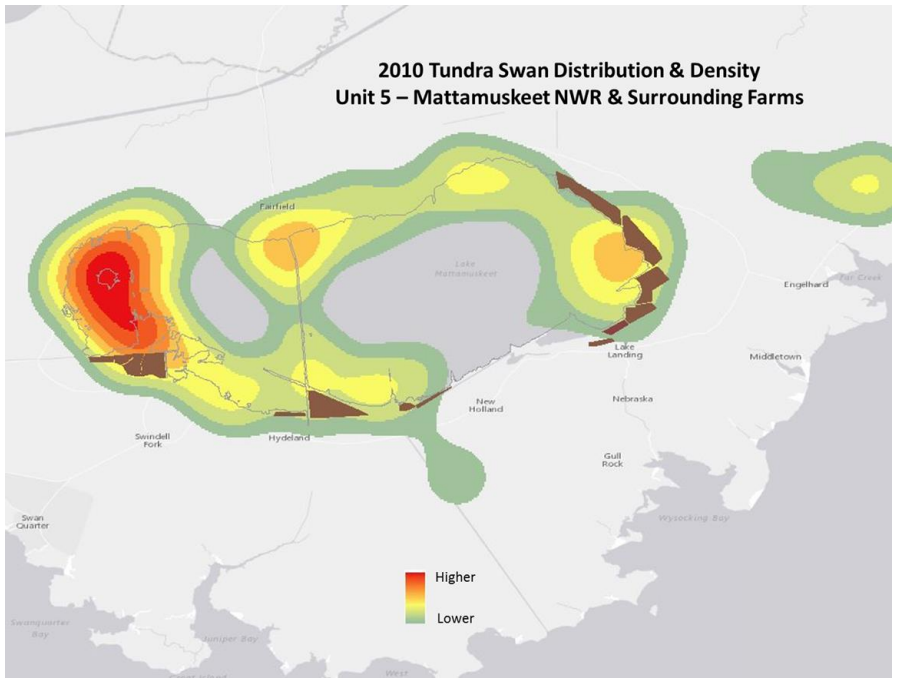
Record Numbers of Swans Observed During Annual Mid-Winter Waterfowl Survey in 2017

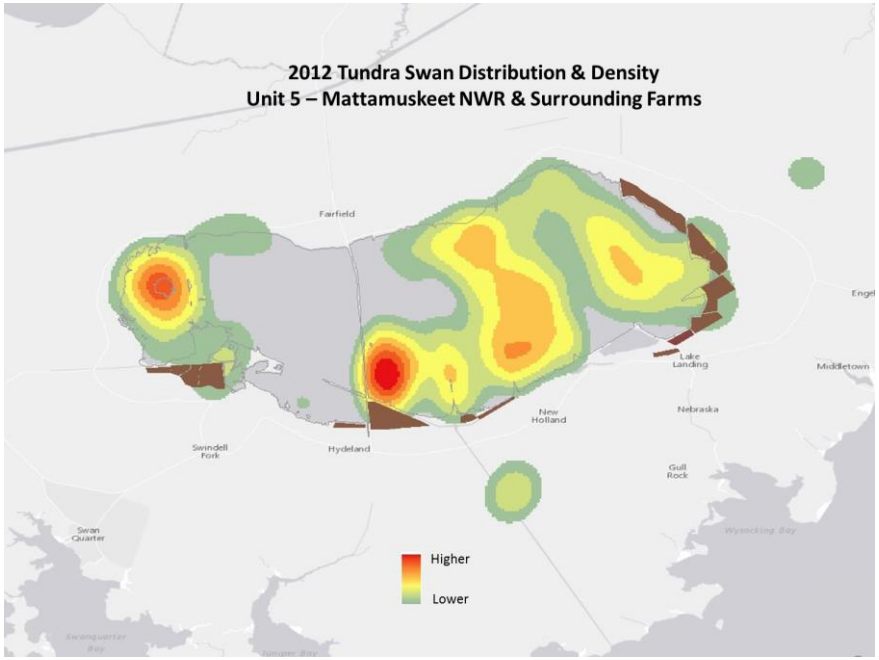
(44,000 Swans Observed on Pungo Lake)

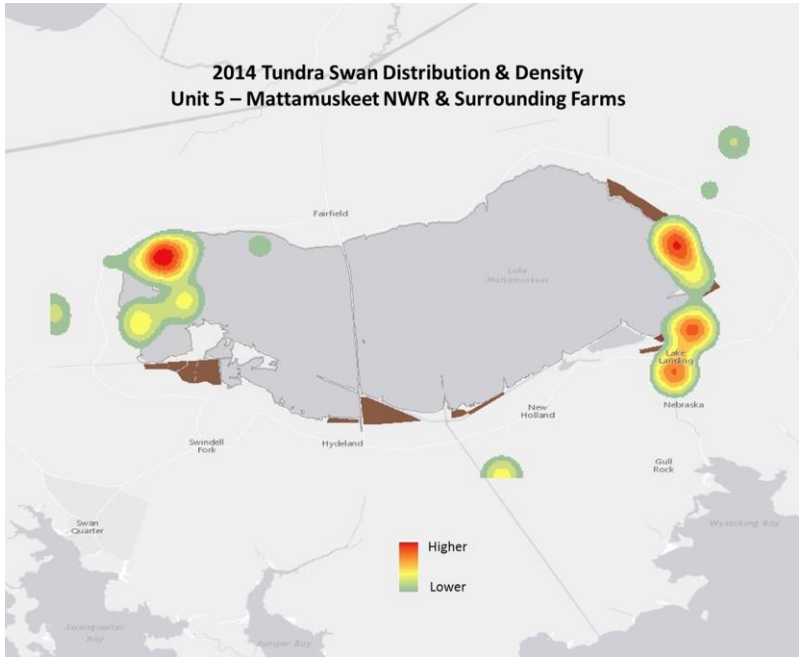


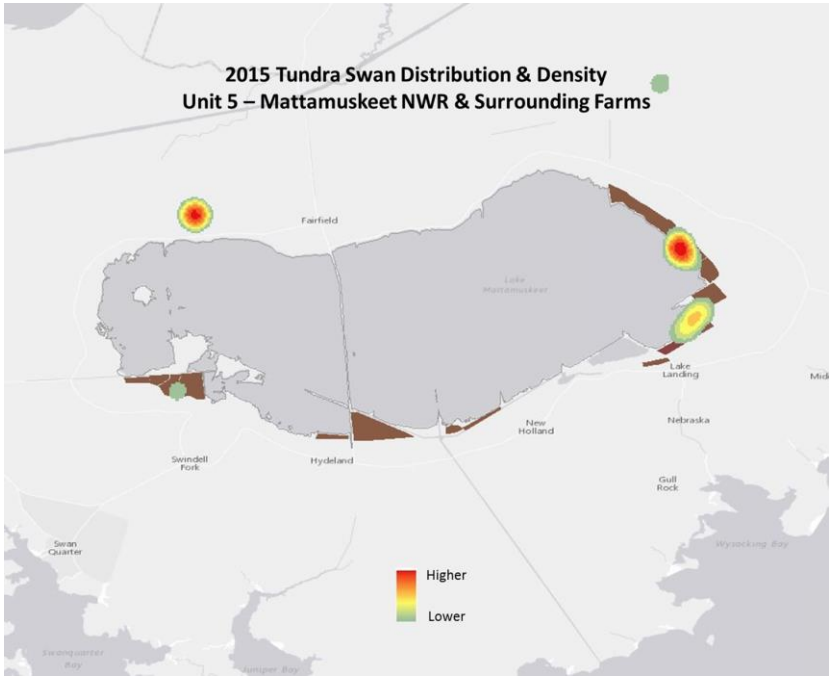
Annual Mid-Winter Waterfowl Survey
Unit 5 – Mattamuskeet NWR & Surrounding Farms

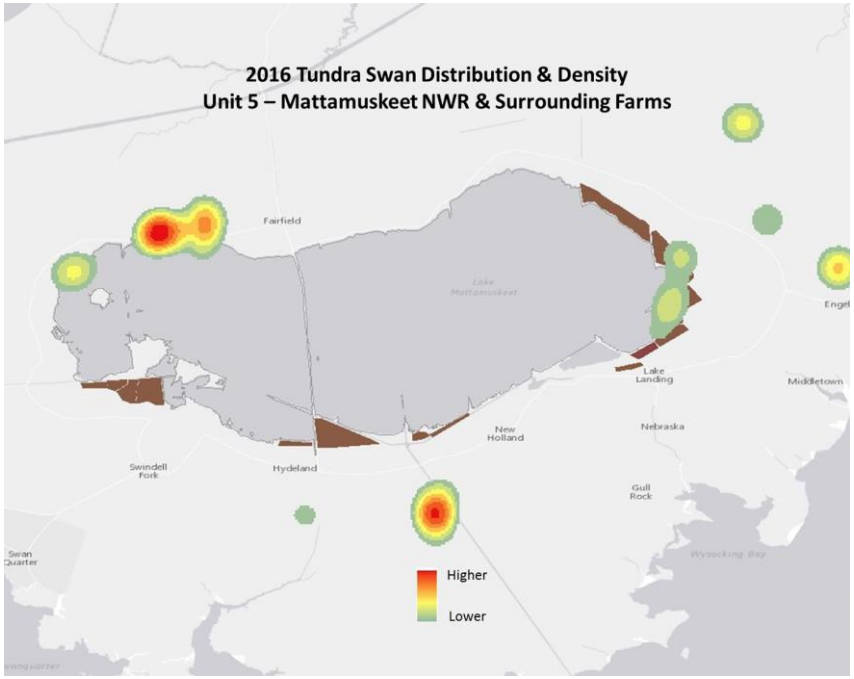

2008 Tundra Swan Distribution & Density
Unit 5 – Mattamuskeet NWR & Surrounding Farms
Fairfield
Lake Landing
Middletown
New Holland
Nebraska
Swindell Fork
Hydeland
Gull Rock
Swan Quarter
Higher
Lower

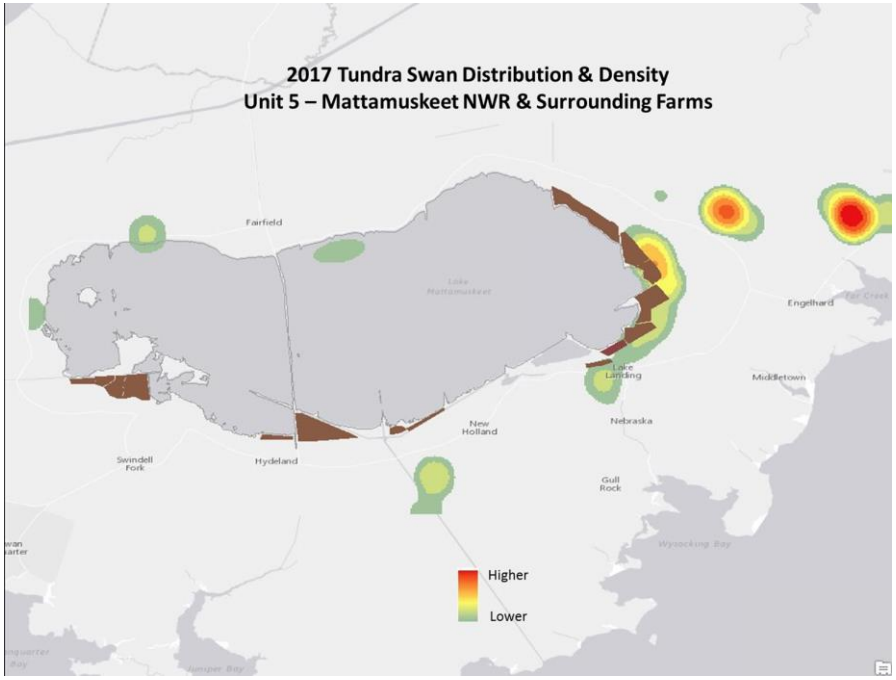

2010 Tundra Swan Distribution & Density
Unit 5 – Mattamuskeet NWR & Surrounding Farms
Fairfield
Engelhard
Lake Landing
Middletown
New Holland
Nebraska
Swindell Fork
Hydeland
Gull Rock
Swan Quarter
Higher
Lower


2012 Tundra Swan Distribution & Density
Unit 5 – Mattamuskeet NWR & Surrounding Farms
Fairfield
Lake Landing
Middletown
New Holland
Nebraska
Swindell Fork
Hydeland
Gull Rock
Swan Quarter
Higher
Lower


2014 Tundra Swan Distribution & Density
Unit 5 – Mattamuskeet NWR & Surrounding Farms
Fairfield
Lake Landing
New Holland
Nebraska
Swindell Fork
Hydeland
Gull Rock
Swan Quarter
Higher
Lower


2015 Tundra Swan Distribution & Density
Unit 5 – Mattamuskeet NWR & Surrounding Farms
Fairfield
Lake Mattamuskeet
Lake Landing
New Holland
Nebraska
Swindell Fork
Hydeland
Gull Rock
Swan Quarter
Wysocking Bay
Higher
Lower


2016 Tundra Swan Distribution & Density
Unit 5 – Mattamuskeet NWR & Surrounding Farms
Fairfield
Lake Mattamuskeet
Lake Landing
Middletown
New Holland
Nebraska
Swindell Fork
Hydeland
Gull Rock
Swan Quarter
Wysocking Bay
Higher
Lower


2017 Tundra Swan Distribution & Density
Unit 5 – Mattamuskeet NWR & Surrounding Farms
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Lake Mattamuskeet
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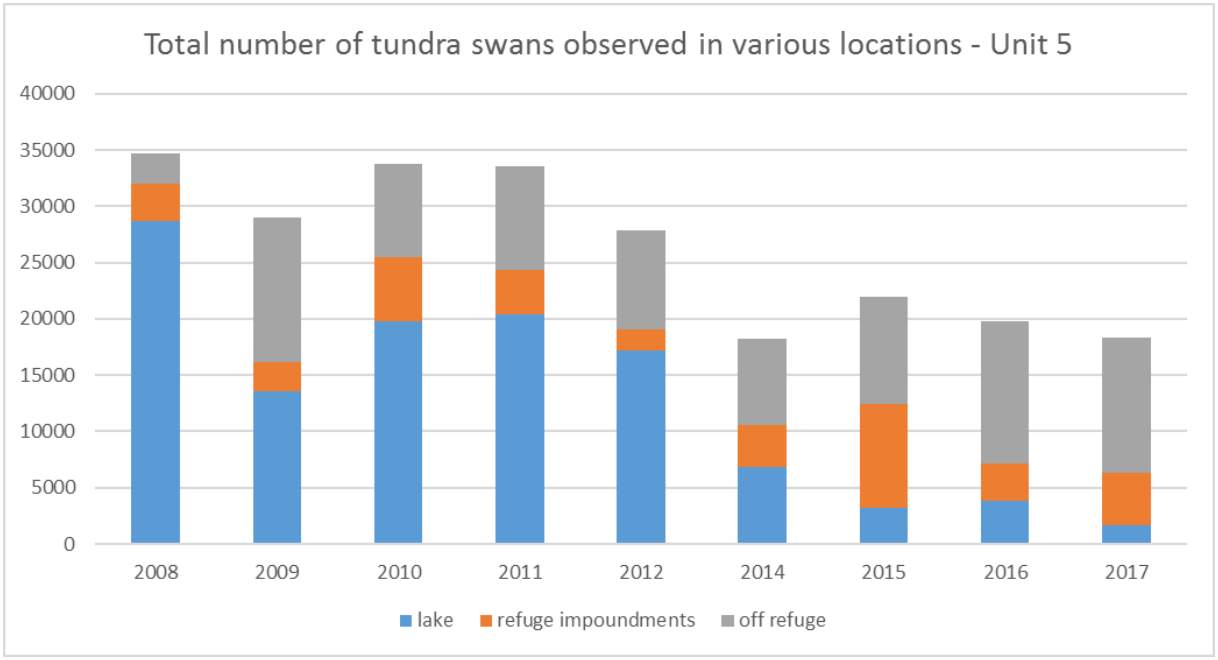
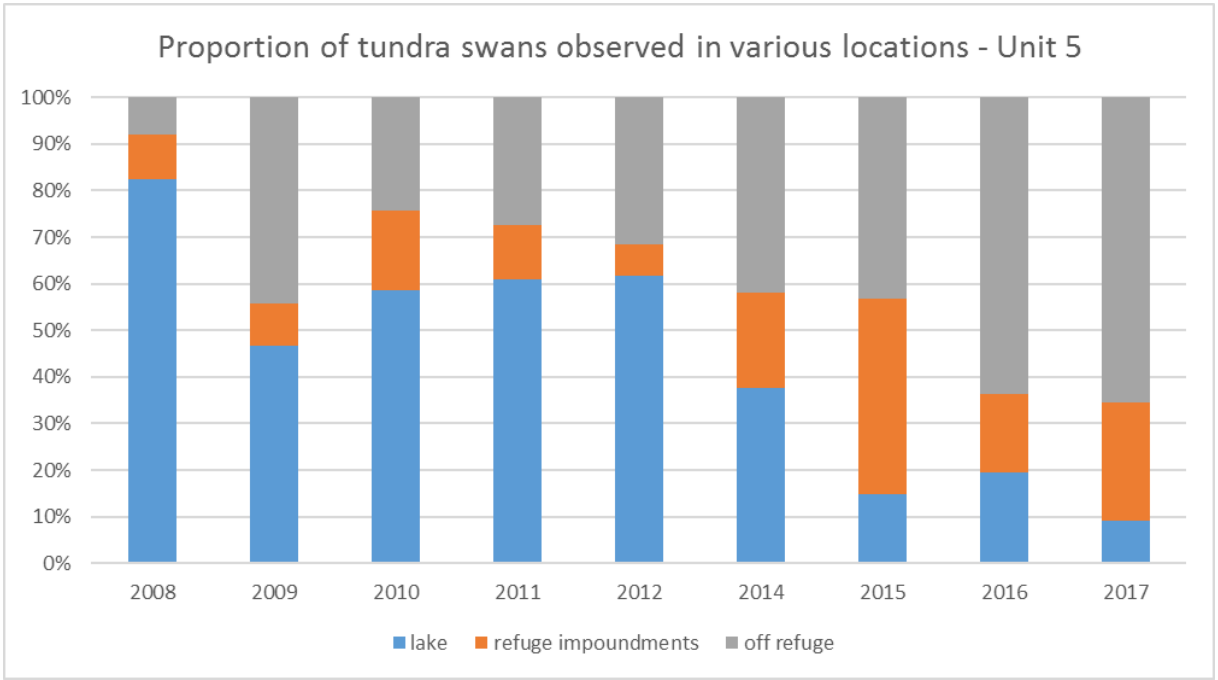
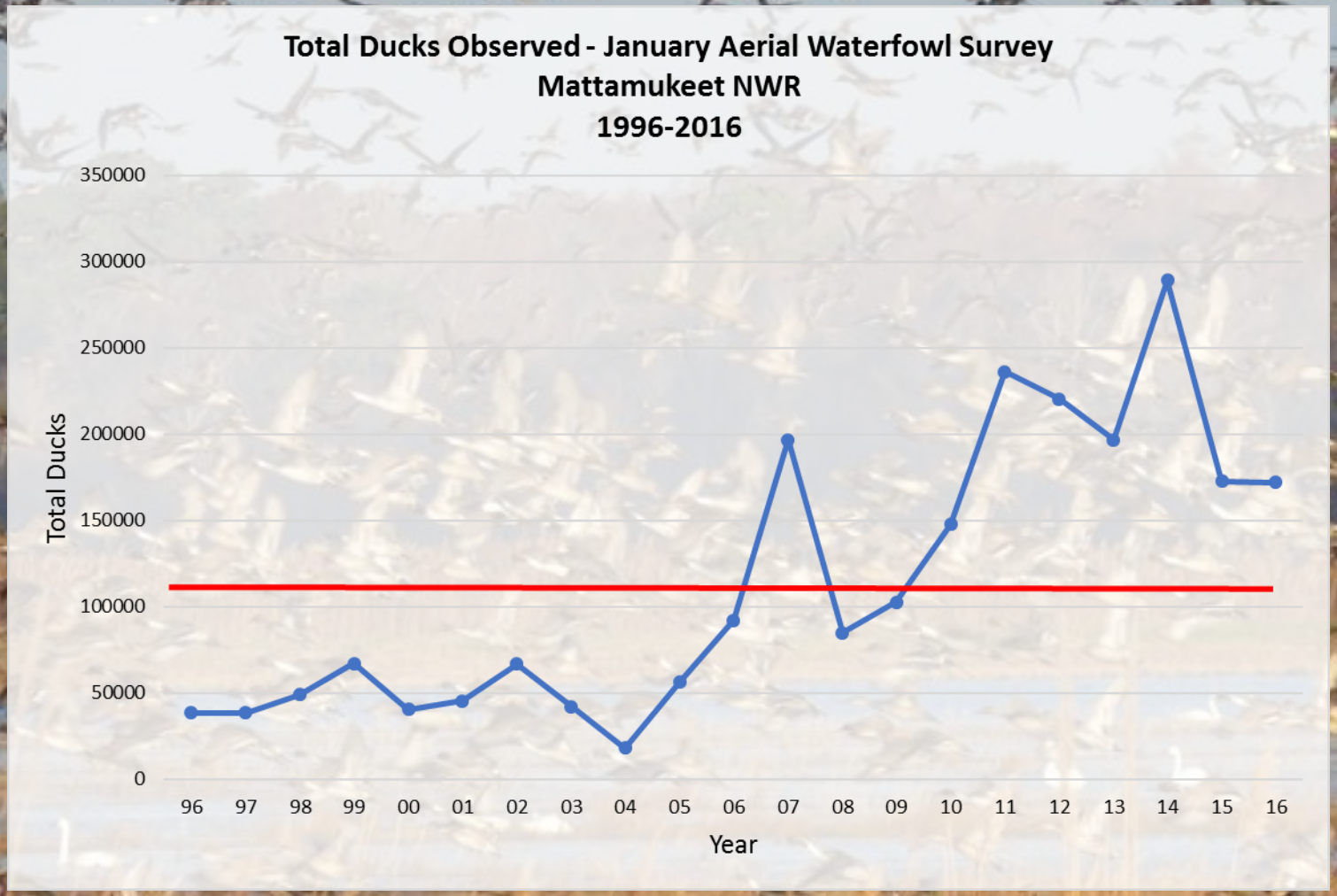
Lower


Total number of tundra swans observed in various locations - Unit 5
40000
35000
30000
25000
20000
15000
10000
5000
0
2008
2009
2010
2011
2012
2014
2015
2016
2017
lake
refuge impoundments
off refuge

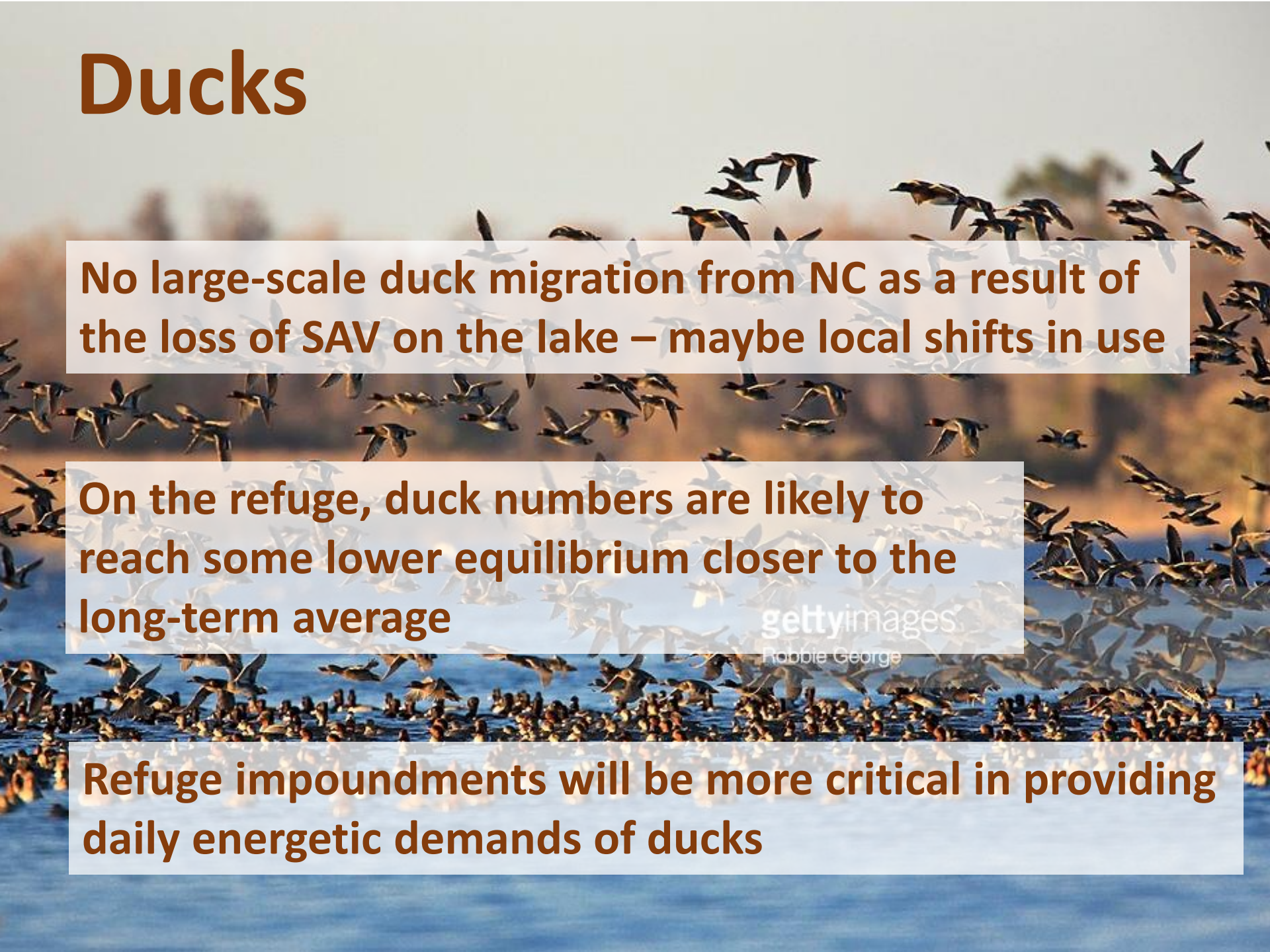

Proportion of tundra swans observed in various locations - Unit 5
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2008
2009
2010
2011
2012
2014
2015
2016
2017
lake
refuge impoundments
off refuge

Ducks

More difficult to attribute any trends in duck numbers on the refuge to the loss of SAV


Total Ducks Observed - January Aerial Waterfowl Survey
Mattamukeet NWR
1996-2016
350000
300000
250000
200000
150000
100000
50000
0
Total Ducks
96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16
Year

Ducks



No large-scale duck migration from NC as a result of the loss of SAV on the lake – maybe local shifts in use

On the refuge, duck numbers are likely to reach some lower equilibrium closer to the long-term average

Refuge impoundments will be more critical in providing daily energetic demands of ducks


Questions?
doug.howell@ncwildlife.org

Participatory Mapping of Surface Water Hydrology

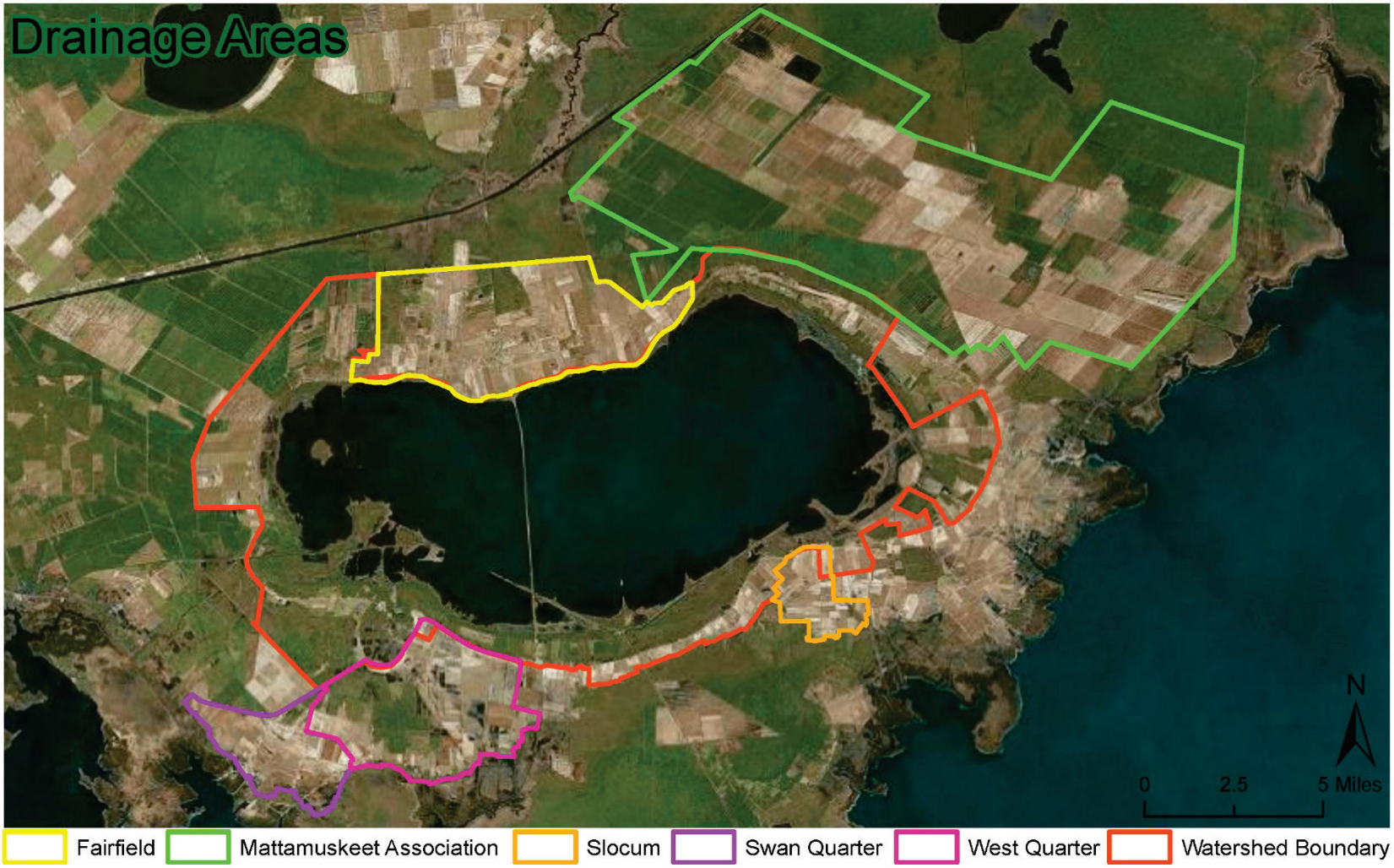
November 7, 2017

Randall Etheridge
East Carolina University
Department of Engineering, Center for Sustainability

Goals for study

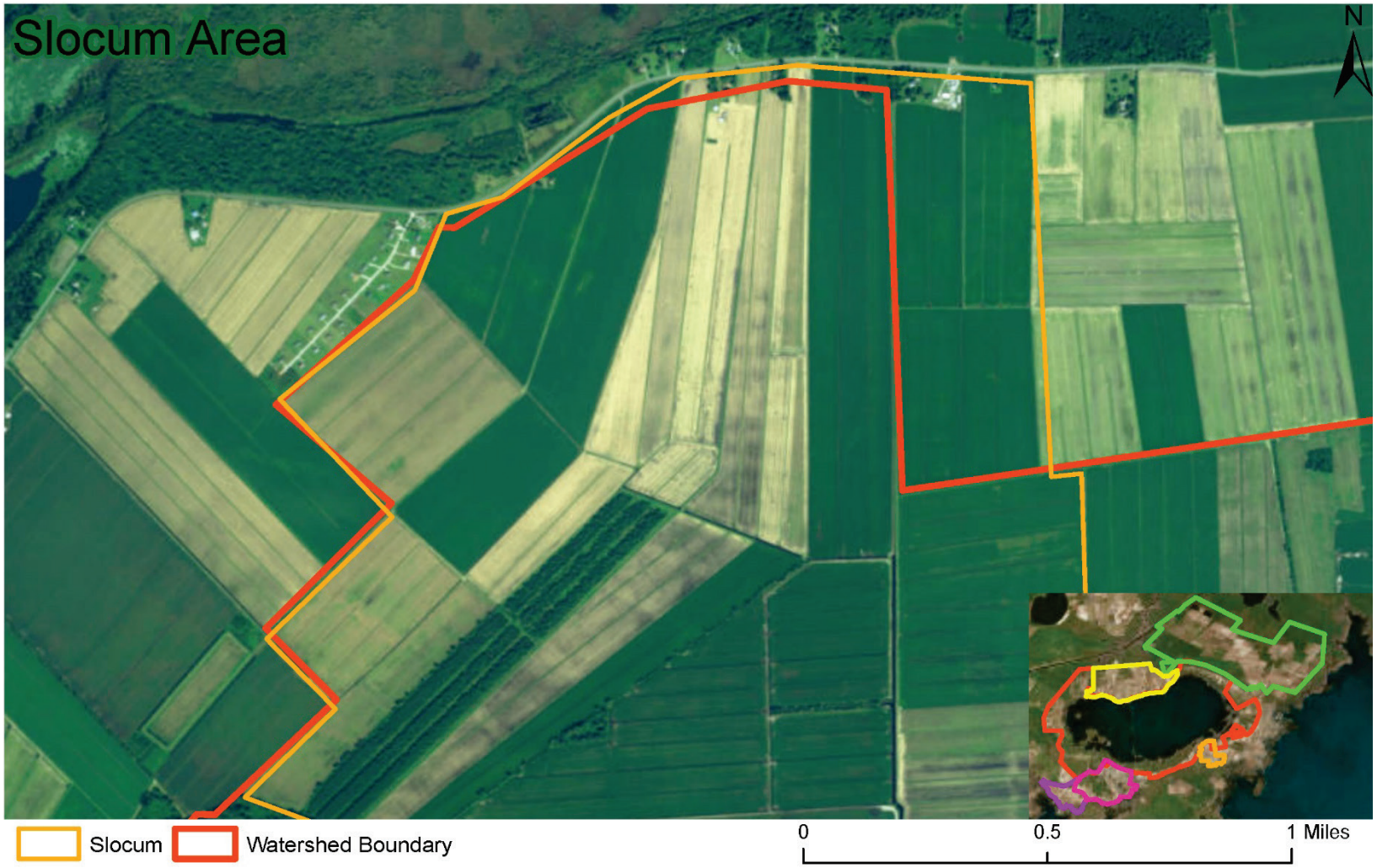
- Improve the understanding of the hydrology through mapping and community survey
- Identify the major problems facing Lake Mattamuskeet as viewed by members of the community
- Compile proposed solutions from community members

Watershed Mapping



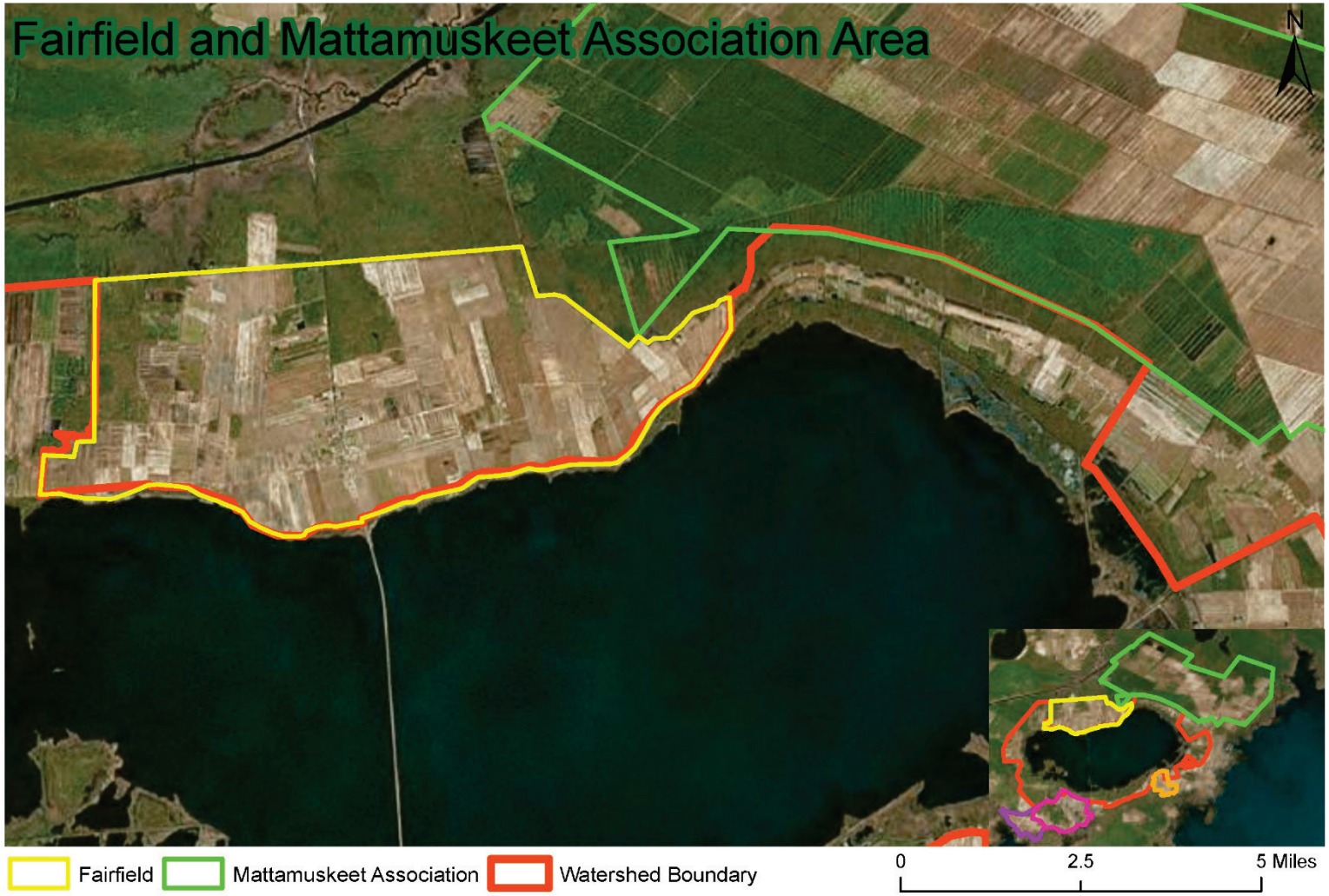
Drainage entity locations from Daniel Brinn

Watershed – Drainage Districts



Watershed – Drainage Districts

Watershed – Drainage Districts



Pumps


Pumping Stations
N
Pump Stations
Watershed Boundary
0
2.5
5 Miles

Survey – Greatest water problem

1. Water level/flooding (42%)
2. Water quality (27%)
3. Other (12%)

Survey – Impact on water quality

- Fertilizer application (22%)
- Pesticide application (19%)
- Stormwater (16%)

Survey Results

- Greater than 80% of participants are interested in economic and environmental sustainability
- More than 85% are concerned about the water quality in the lake and the lack of aquatic vegetation impacting waterfowl numbers
- Greater than 70% of participants would be willing to alter their behavior if it was shown to negatively affect Lake Mattamuskeet

Water Management

- Most pumps are surface water pumps
- Some groundwater pumps are used to fill waterfowl impoundments
- Impoundments are primarily flooded and drained based on hunting season and crop growth needs
  - May be some flexibility in timing
  - Some willingness to alter practices

Water Management Strategies

- Most impoundments (65%) have an average water depth of 1-2 feet
- Majority of pumps are managed manually (52%)
  - Varies based on weather
  - Some vary based on season
- Some settling basins and buffers already in place

Survey – Top Management Practices

- Address erosion (30%)
- Install automated equipment to manage water in agricultural fields (20%)
- Reduce the use of pesticides, fertilizers, or other chemicals (19%)

- Cost is the primary reason more of these practices are not implemented

Outreach - Ways to reach the people

- Read printed fact sheets, bulletins, or brochures (19%)
- Look at a website for information and tips (16%)
- Watch a video (12%)

Outreach – Topics of Interest

- Agricultural water management (13%)
- Watershed management (13%)
- Nutrient and pesticide management (11%)

Suggested Solutions from the Community

- Pump water out of the lake
- Keep tide gates clean
- Organic farming
- Changes in water management
- More research
- Settling ponds
- Use impoundments to store water
- Use wetlands to treat water

A few things to keep in mind…

- Unlikely that a single solution will fix this problem
- Solutions should be viable for 20+ years
- Solutions should not harm other industries

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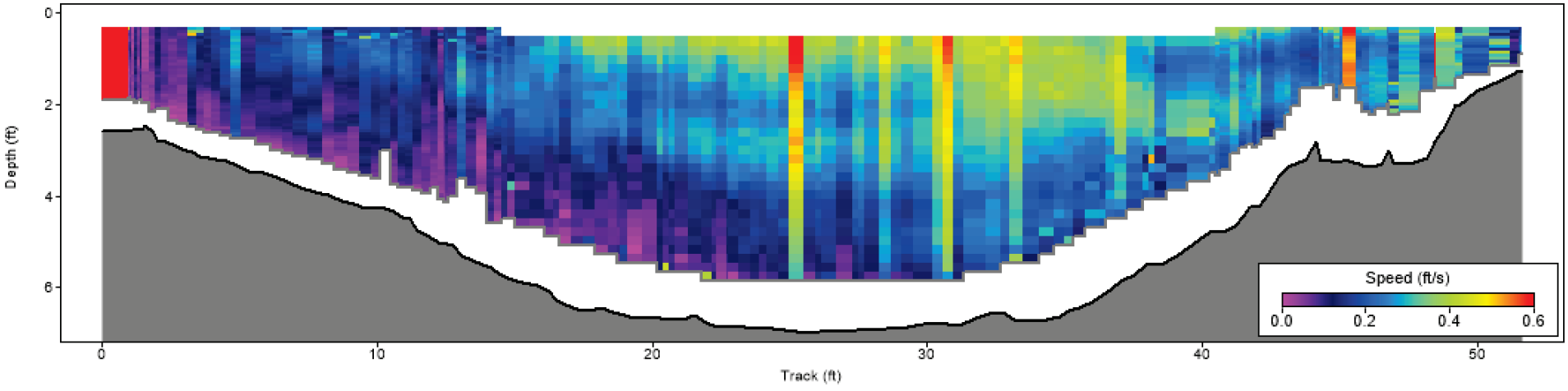
Ongoing research

- Research question: How much nitrogen and phosphorus is being exported by a waterfowl impoundment on the Refuge and an impoundment managed by a private landowner?
- Monitoring complete: Spring 2018

Ongoing research

- Research question: Is sea level rise or sedimentation the primary factor causing a reduction in flow in the four canals draining from Lake Mattamuskeet to the Pamlico Sound?
- Goal for project completion: Spring 2018



Questions?

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