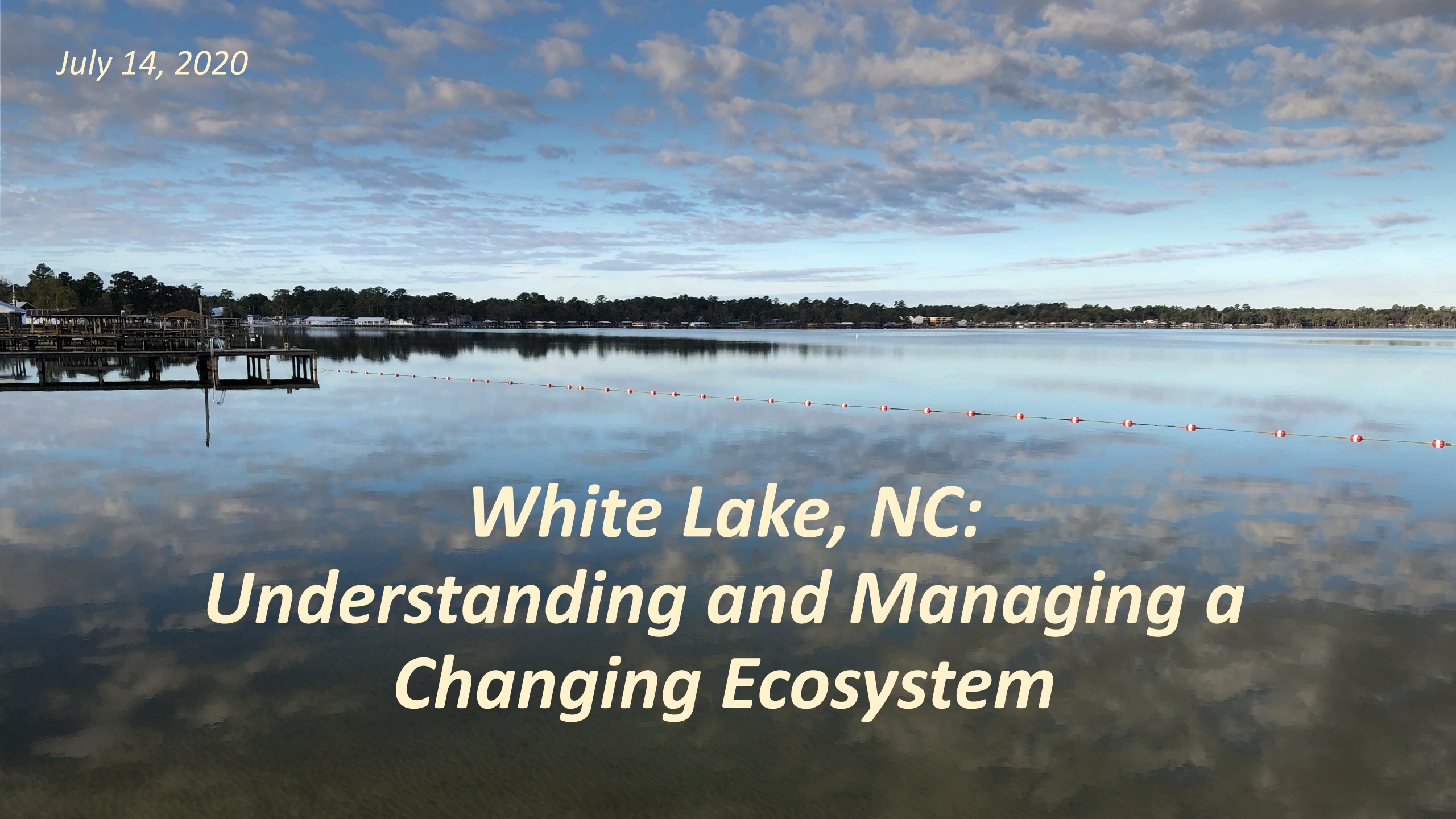


July 14, 2020



***White Lake, NC:
Understanding and Managing a
Changing Ecosystem***

Landscape Changes Over Time

White Lake in 1938

A shallow basin,
*“supplied by
precipitation on
the lake and by
groundwater flow
from the adjoining
area”*

R. Heath, District
Chief, US Geological
Survey, July 1969



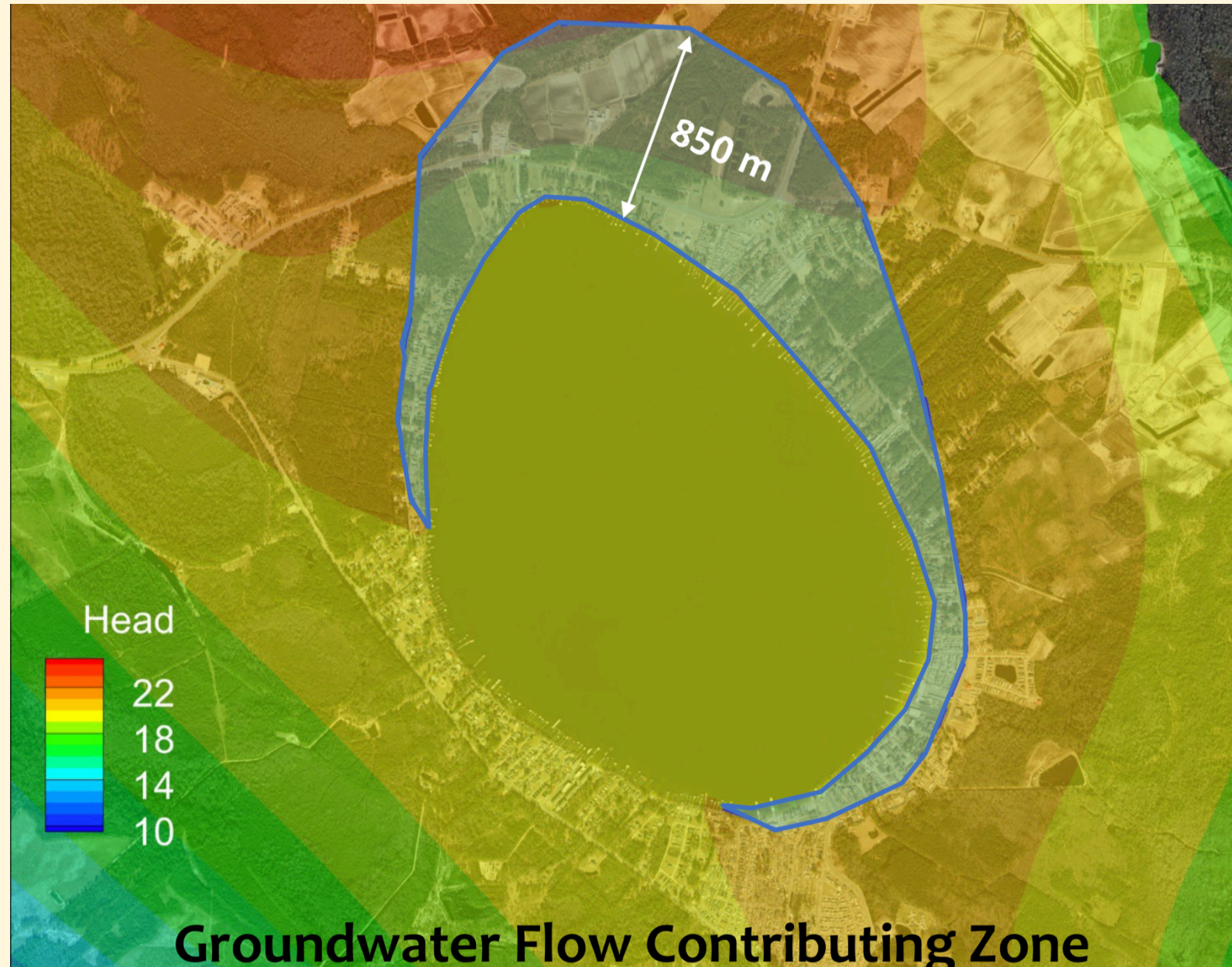
White Lake, Present Day

Groundwater flow from the adjoining area (Heath) = Groundwater Flow Contributing Zone (Shank and Zamora 2019)

Development around the lake has altered the natural hydrology

“Drainage of any area adjacent to the lake will ...stop ground-water inflow to the lake from that area”

R. Heath, District Chief, USGS,
July 1969



Groundwater Study by Shank and Zamora (2019)

No indications that deep
confined aquifer water is
entering lake—surficial aquifer
inputs only

On an annual basis, up to 6% of
lake volume contributed by
groundwater input—more flow
when water table is high

No indications that pumping
from blueberry farms is having
an impact on White Lake—most
are outside the groundwater
capture zone for the lake

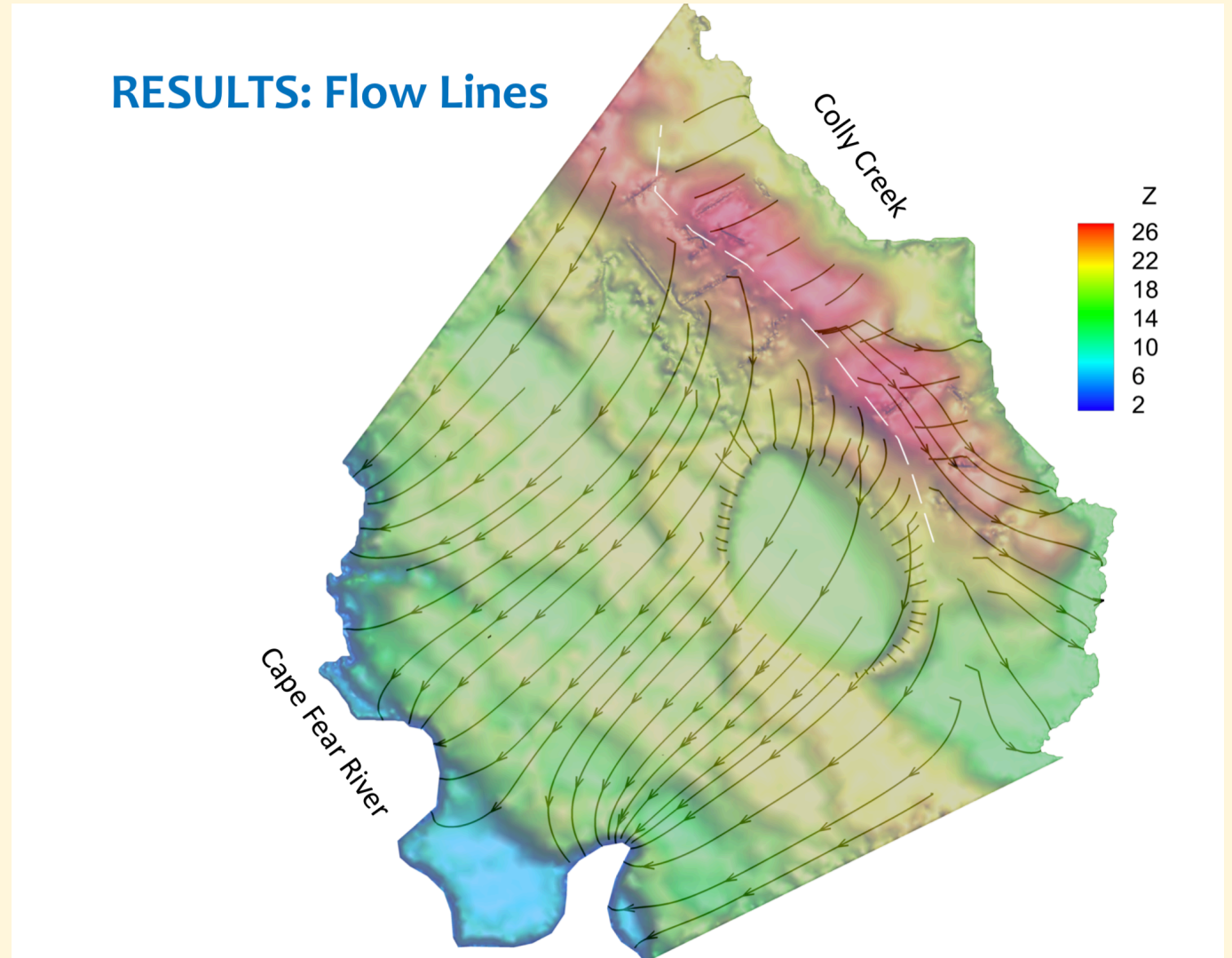


Figure by Shank and Zamora, April 2019

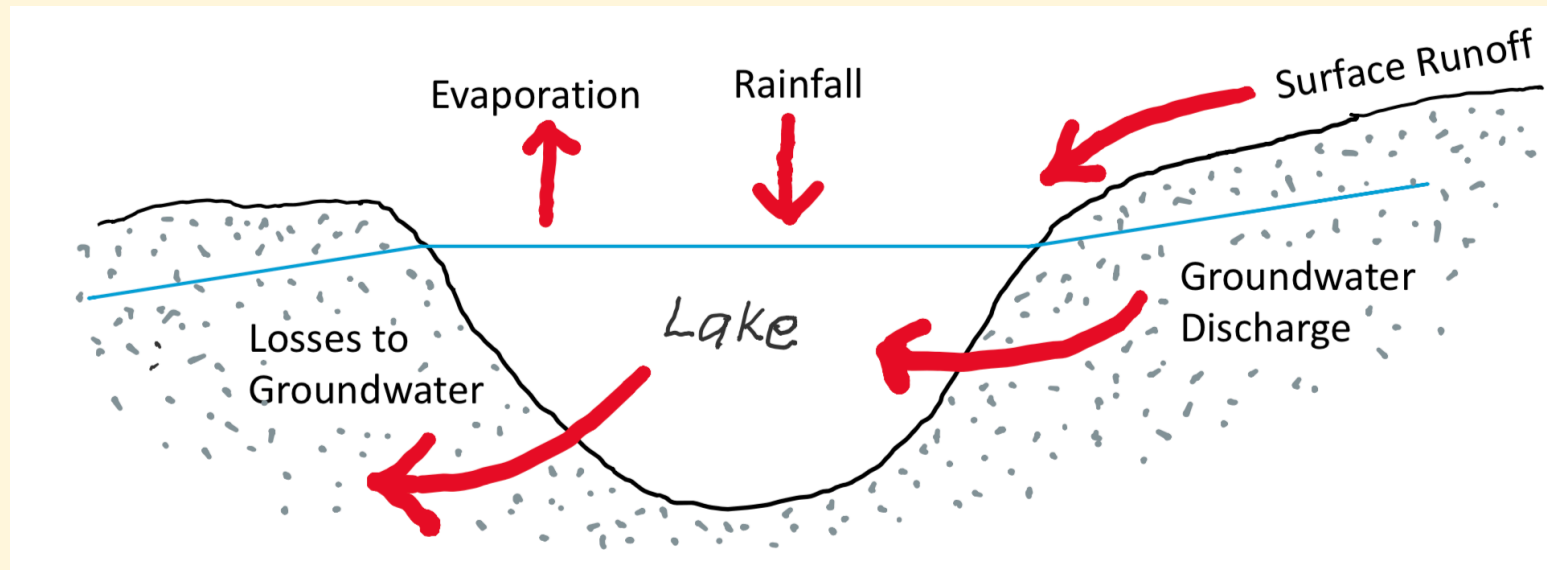
Water Loss from White Lake

Evaporation—highest in summer months

Loss to groundwater

Dr. Peter Zamora:

“White Lake is a giant groundwater recharge zone—water in the lake eventually goes into the deeper surficial aquifer or into nearby surface water”



Changing Climate, Changing Rainfall Patterns

More big rains, more
rapid onset of
drought conditions

39.4” of rain in first
six months of 2020,
equivalent to 1.14
Billion Gallons of
Water

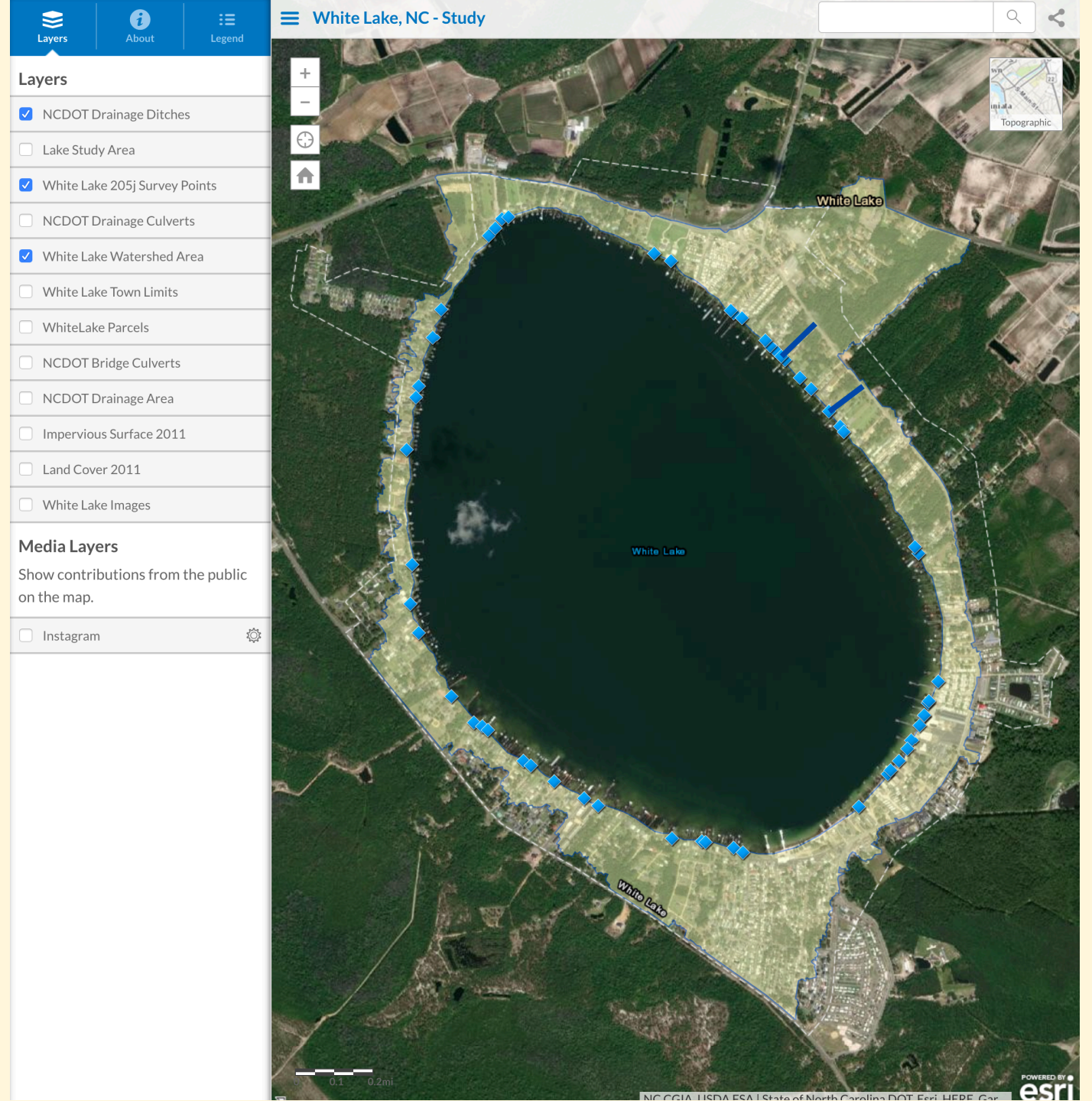
Monthly Rainfall (inches) for White Lake 2012-2020

Month	<u>2020</u>	<u>2019</u>	<u>2018</u>	<u>2017</u>	<u>2016</u>	<u>2015</u>	<u>2014</u>	<u>2013</u>	<u>2012</u>	Monthly Average for Region
January	4.5	2.75	4.20	7.0	3.0	2.5	2.0	1.75	2.75	3.81
February	6.7	2.25	2.00	1.5	10.7	5.5	1.5	2.5	4.0	3.44
March	3.7	3.25	3.95	3.7	1.55	4.15	ND	1.0	7.0	3.91
April	5.1	7.25	6.75	6.75	6.75	4.55	ND	1.75	2.25	3.12
May	12.25	1.20	7.70	2.7	4.5	4.20	ND	2.25	9.25	3.67
June	7.15	5.25	10.00	4.5	3.65	8.70	3.0	17.0	2.0	4.70
July		6.00	4.75	6.75	3.75	3.0	4.65	11.25	8.6	5.75
August		5.35	6.25	5.6	4.12	9.4	9.75	8.25	9.75	5.95
September		5.00	29.45	5.2	15.0	4.7	7.0	1.0	5.0	5.29
October		3.60	2.25	2.95	14.25	9.75	1.7	1.75	2.25	3.38
November		4.90	4.25	1.0	0.50	7.25	4.15	0	2.25	3.16
December		6.00	7.5	5.45	5.1	6.5	3.7	5.75	4.25	3.14
Total		52.80	89.05	52.8	72.87	70.20		54.25	59.35	49.32

White Lake Stormwater Outfalls

Less infiltration, more runoff

57 pipes and ditches drain directly into lake



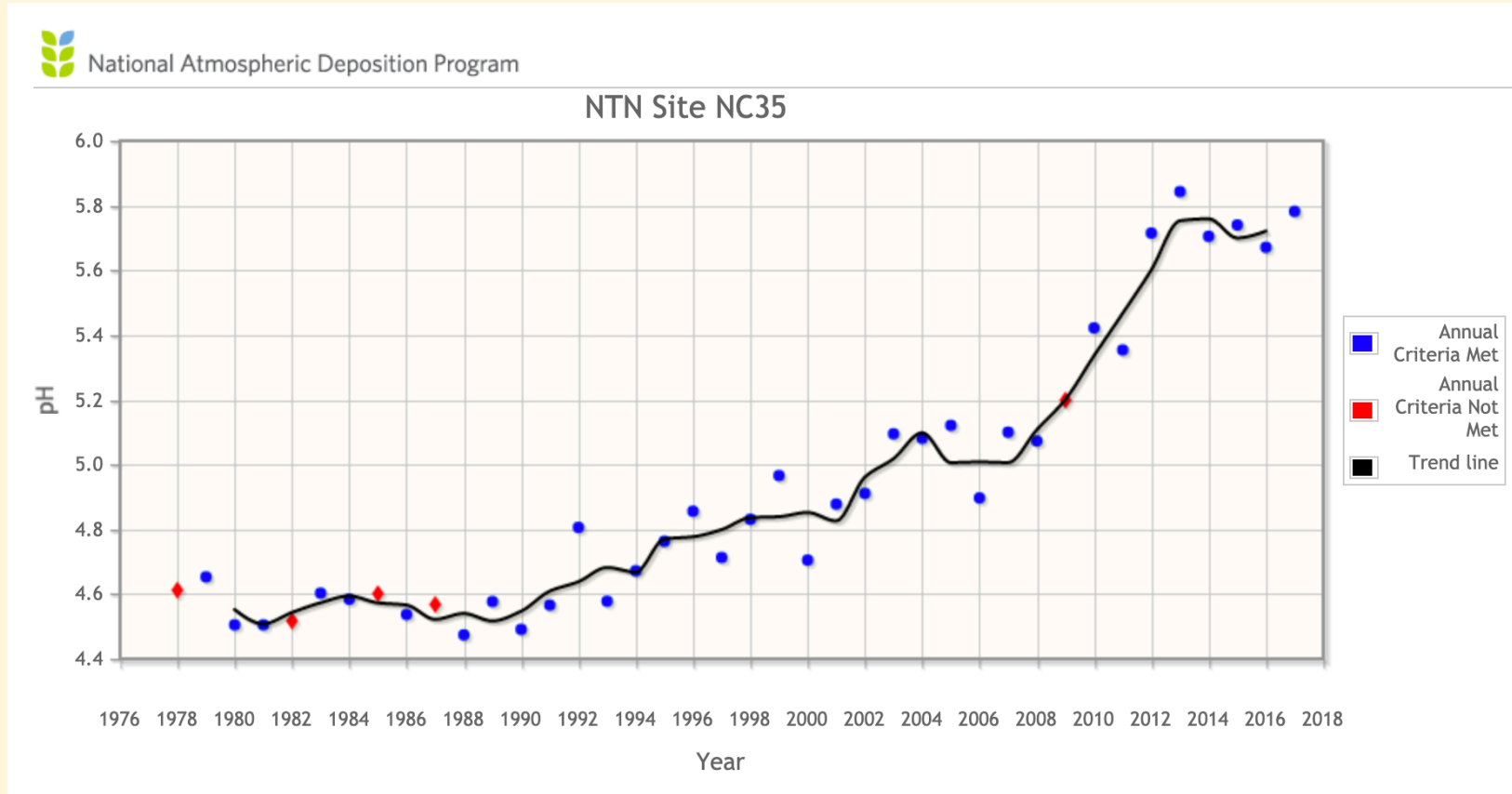
Atmospheric Changes Over Time

Rainfall Acidity Has Changed

Rainfall is primary source water for White Lake (> 90%)

Rainfall pH was 4.5, now near 6

Lake pH was 4.5, now > 6



Data from the National Atmospheric Deposition Laboratory in Clinton, NC

Rainfall Nitrogen Increasing

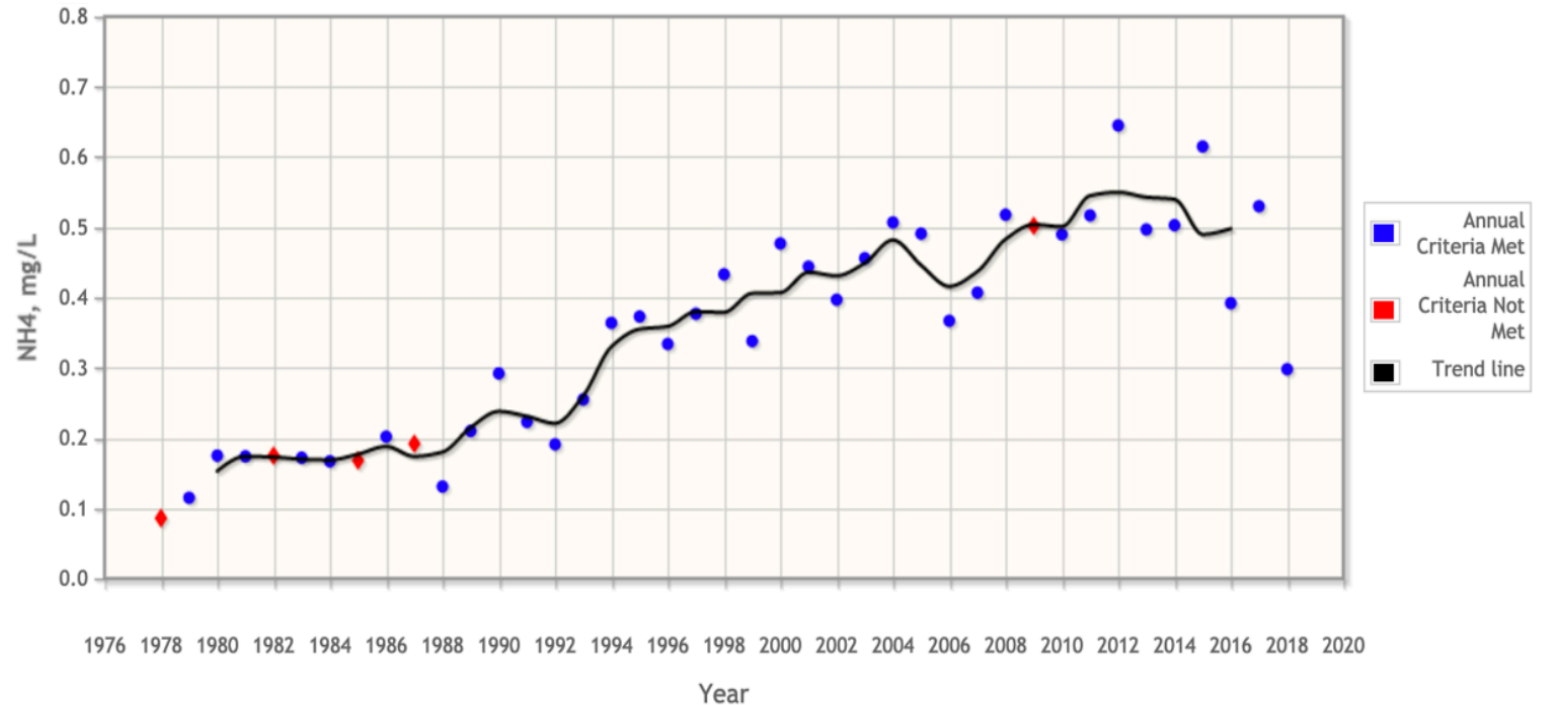
Higher ammonium
levels

Ammonia is
volatilized from
intensive agriculture
operations—it is a
nutrient, and can
also increase pH of
rain



National Atmospheric Deposition Program

NTN Site NC35



Increases in Nutrients: Algae Blooms



Environmental Topics

Laws & Regulations

About EPA

Search EPA.gov



Nutrient Pollution

CONTACT US

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Nutrient Pollution

The Problem

Sources and Solutions

The Effects

Where This Occurs

What You Can Do

Policy and Data

The Effects

The presence of excess nutrients in air and water can affect human health, the environment and the economy. Federal, state and local governments spend billions of dollars per year to minimize these effects.

Learn more about:

- [Human health effects](#)
- [Environmental effects](#)
- [Economic effects](#)



Nutrient pollution can have various effects on human health, the environment and the economy.

Nutrients Already in the Lake vs. Nutrients Entering the Lake

In the Lake:

Recycling of nutrients in plants and animals

Phosphorus in the sediments

Entering the Lake:

Nutrients in rainfall

Nutrients in groundwater

Nutrients in stormwater runoff

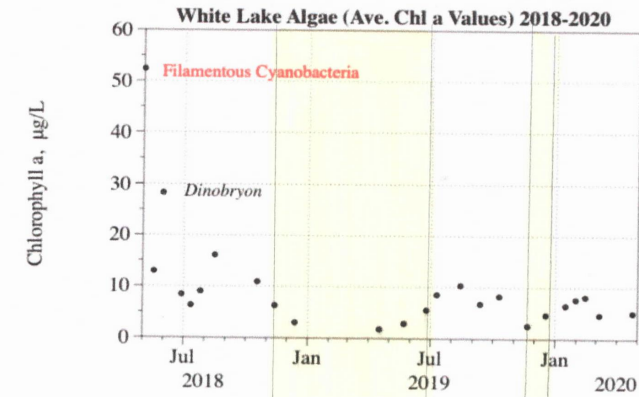
In animal waste (including birds)

Ongoing Monitoring of White Lake

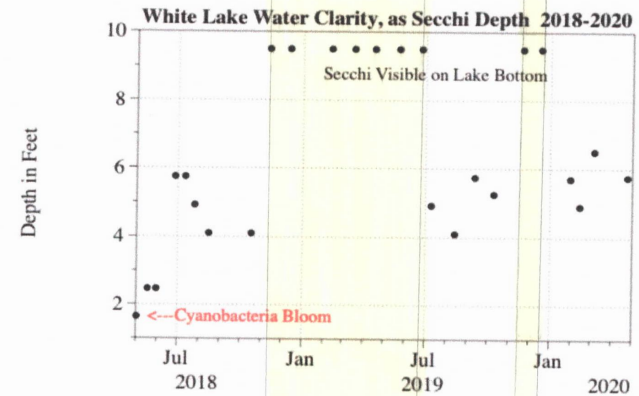
Critical to good management

Better able to identify trends, particularly with nutrients, algae, pH

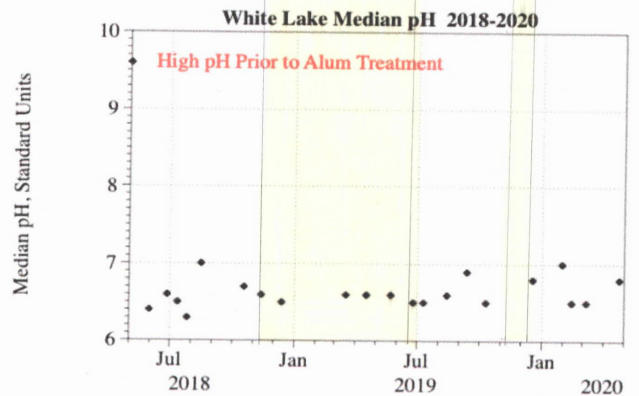
This is a unique system and still not well-understood



Algae responding to nutrients



Clear water periods in yellow



Not much change in pH

Effective Lake and Watershed Management

is based on understanding how lakes work, and how they change, particularly with respect to the changes that result from human activities

*Understanding comes from monitoring and assessments—
Data!*

Information/data can help identify management targets and goals

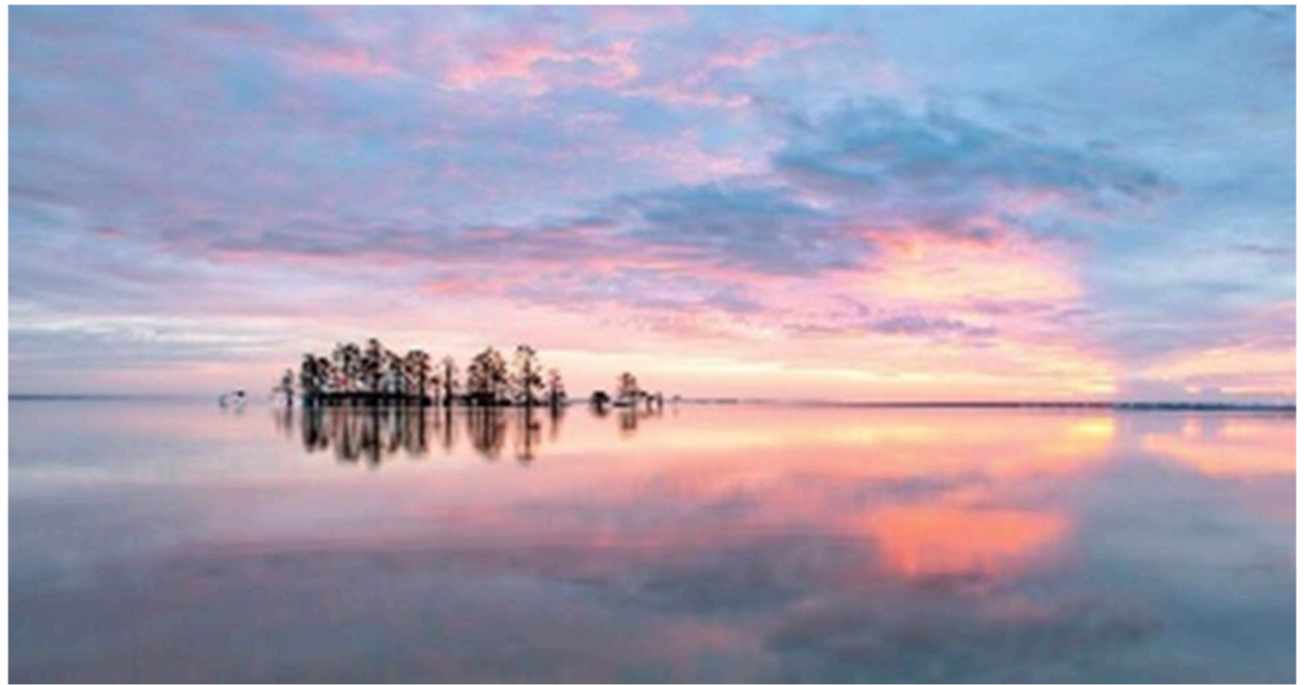
State Parks Responsible for Coordinating Plan Development

An Example of a Watershed Management Plan

Developed With a
Collaborative Planning
Process

Partners and Stakeholders
Develop Goals and Objectives

A Plan Also Defines Partner
Responsibilities and Funding
Needs



LAKE MATTAMUSKEET WATERSHED RESTORATION PLAN

An anchor to the past, a path to the future

OCTOBER 10, 2018

PREPARED BY: NORTH CAROLINA COASTAL FEDERATION

On behalf of: Hyde County, U.S. Fish and Wildlife Services, and N.C. Wildlife Resources Commission

What are the Objectives for Managing White Lake?

Meet Water Quality Standards

Maintain Desirable Aesthetic Conditions

Maintain Natural Ecological Functions

Maintain Ecosystem Resilience

Support Lake-Based Recreation and Tourism

How Do We Have a Healthy Lake for All?

Are there some uses of
the lake that are in
conflict?

How can visitors and
property owners
practice good
stewardship?

