



North Carolina
Coastal Federation
Working Together for a Healthy Coast



learnnc.org

Lake Mattamuskeet Watershed Restoration Plan

Virtual Public Meeting

August 26, 2020

Housekeeping

- Mics of attendees will be muted throughout the presentations
- Meeting will be recorded and made available for viewing on the project webpage
- Use Q&A feature throughout the meeting
- Question and Comment period at end of meeting
 - Use “Raise Hand” feature to request you mic be unmuted

Zoom Functionality



Please use the chat function if you need technical support.

Zoom Functionality



Please use the Q&A function to type questions or comments during the presentations.

Zoom Functionality



Use the raise hand function if you would like to speak during the question and comment period at the end of the meeting.

Agenda Overview

- 7:00 p.m. Welcome
- 7:05 p.m. Watershed Restoration Plan Overview
- 7:15 p.m. Meet the new Mattamuskeet NWR Manager
- 7:20 p.m. Memorandum of Understanding for LMWRP
- 7:25 p.m. Updates from Technical Working Group
- 7:35 p.m. Watershed Restoration Plan Implementation
- 8:15 p.m. Question and Comment Period
- 8:30 p.m. Adjourn



Welcome

Bill Rich, Hyde County Economic Development



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Lake Mattamuskeet Watershed Restoration Plan

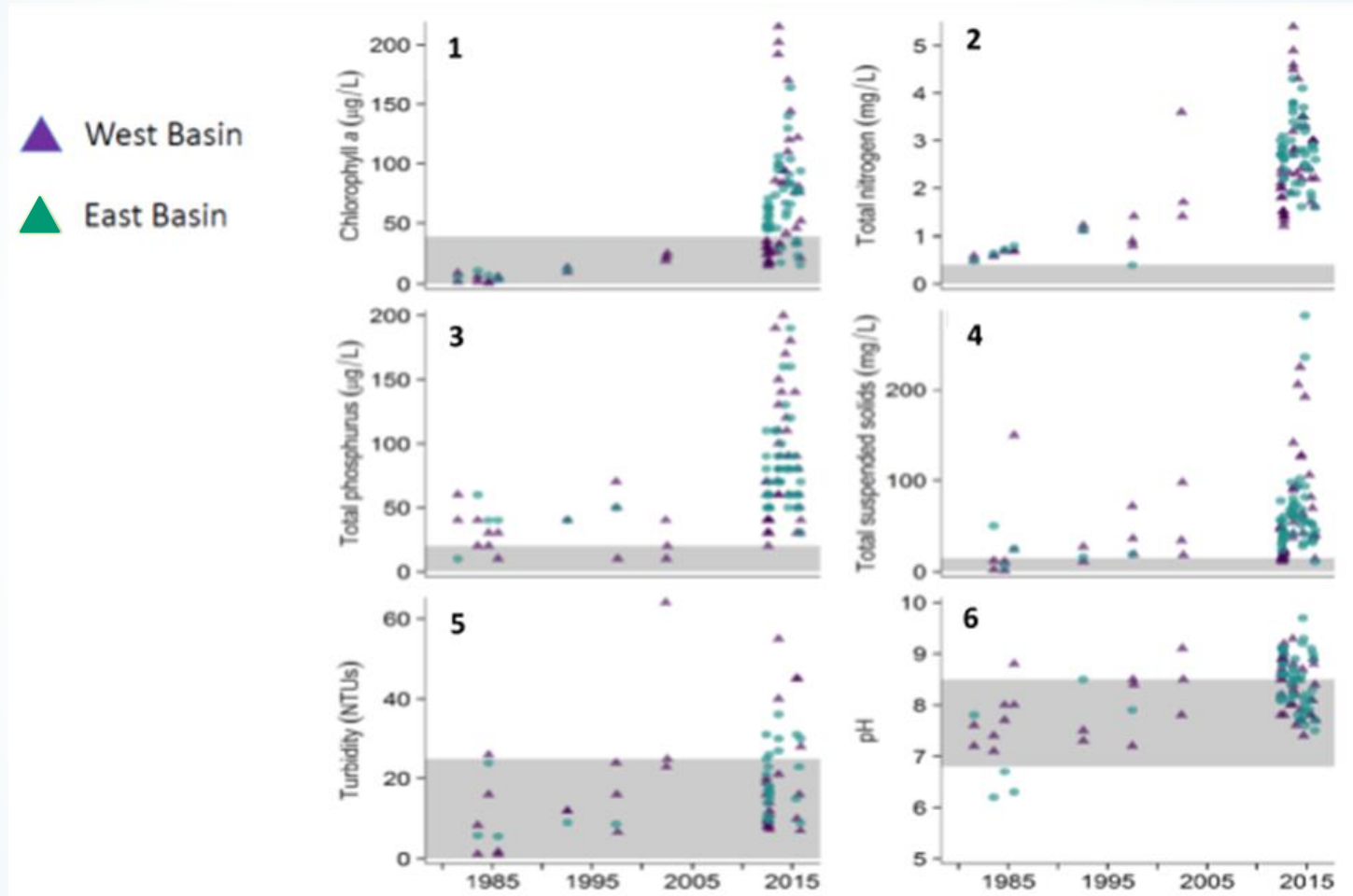
Michael Flynn, North Carolina Coastal Federation

Concerns about Lake Mattamuskeet



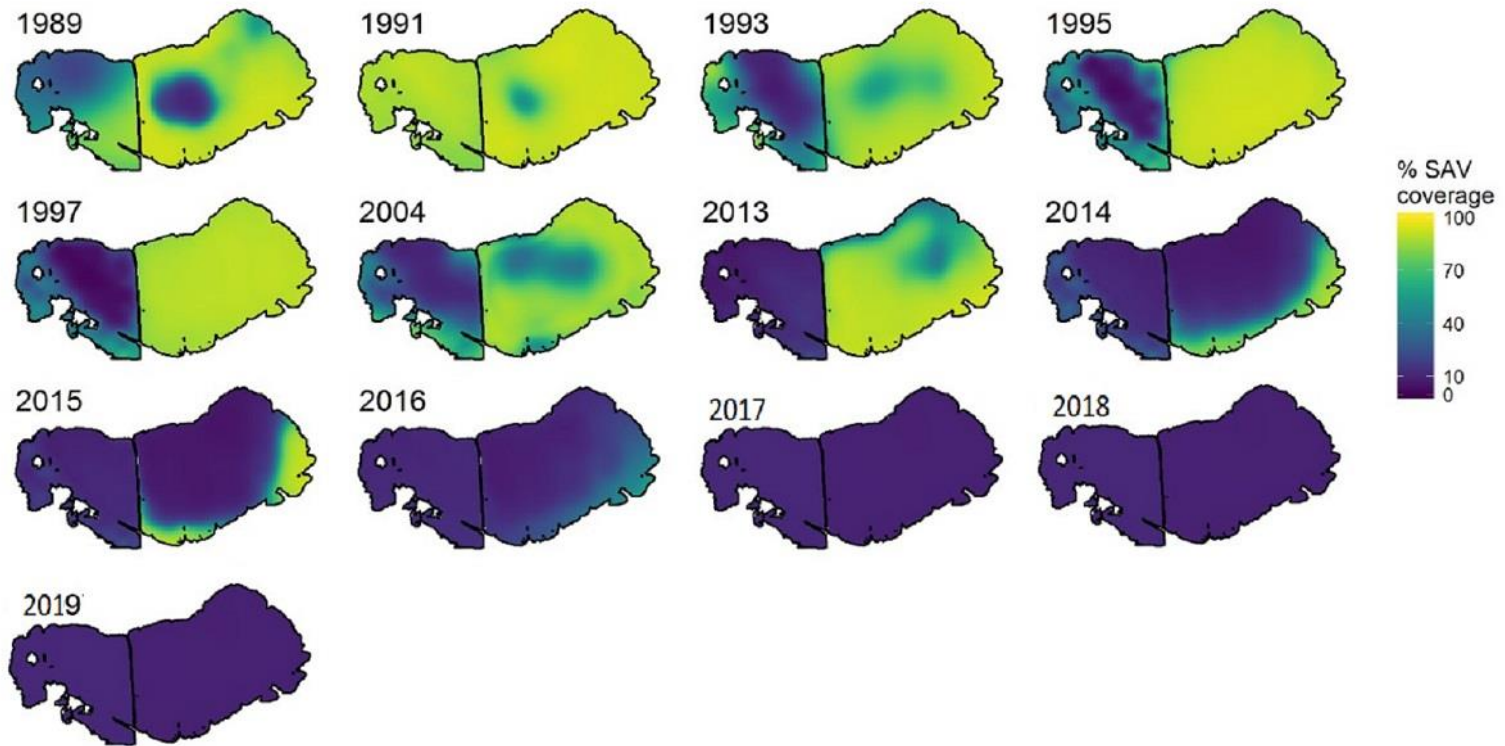
Flooding of Residential and Agricultural Lands

Concerns about Lake Mattamuskeet



Lake was listed on NC303(d) list of impaired waters in 2016 for elevated levels of pH and chlorophyll-*a*

Concerns about Lake Mattamuskeet



Loss of SAV from the Lake by 2017

In 2017, a partnership was formed



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to develop a watershed restoration plan

Working with Stakeholders and the Public

5 Public Meetings

14 Stakeholder Meetings

Webpage for updates and comments:

nccoast.org/lakemattamuskeet



Desired State of the Lake and Watershed

1. Active management of lake level in addition to tide gates
 - Less frequent flooding of residential property
 - Fewer septic system failures & adequate drainage of croplands
2. Clear and mesotrophic water (moderate nutrient levels)
 - Fewer phytoplankton & cyanobacteria blooms
3. Increased SAV abundance along lakebed
4. Increased emergent vegetation
5. Reduced common carp populations
6. Increased game fish and blue crab populations
7. Removal from the NC 303(d) list of impaired waters
 - Chl-*a* and pH within federal and state guidelines

Watershed Restoration Plan

Draft was made available for
public review on
October 16, 2018

Final draft presented at the
public symposium on
December 3, 2018



Plan Goals

Protect the way of life in Hyde County:

Maintain existing land uses and industries in the watershed (residential, farming, fishing and tourism) and enhance and maintain the health of the lake's natural resources (waterfowl and wildlife).

Plan Goals

Actively manage the lake water level:

Minimize flooding of residential, business, and farm properties. Allow for annual drawdowns as appropriate and in compliance with the Refuge's management objectives defined in its Comprehensive Conservation Plan to establish and maintain submerged aquatic vegetation within the lake, and to establish and maintain a zone of emergent vegetation around the lake periphery.

Plan Goals

Restore water quality and clarity:

Reduce nutrients, sediments, and phytoplankton blooms, promote the growth of submerged aquatic vegetation and remove the lake from the NC 303(d) list of impaired waters.

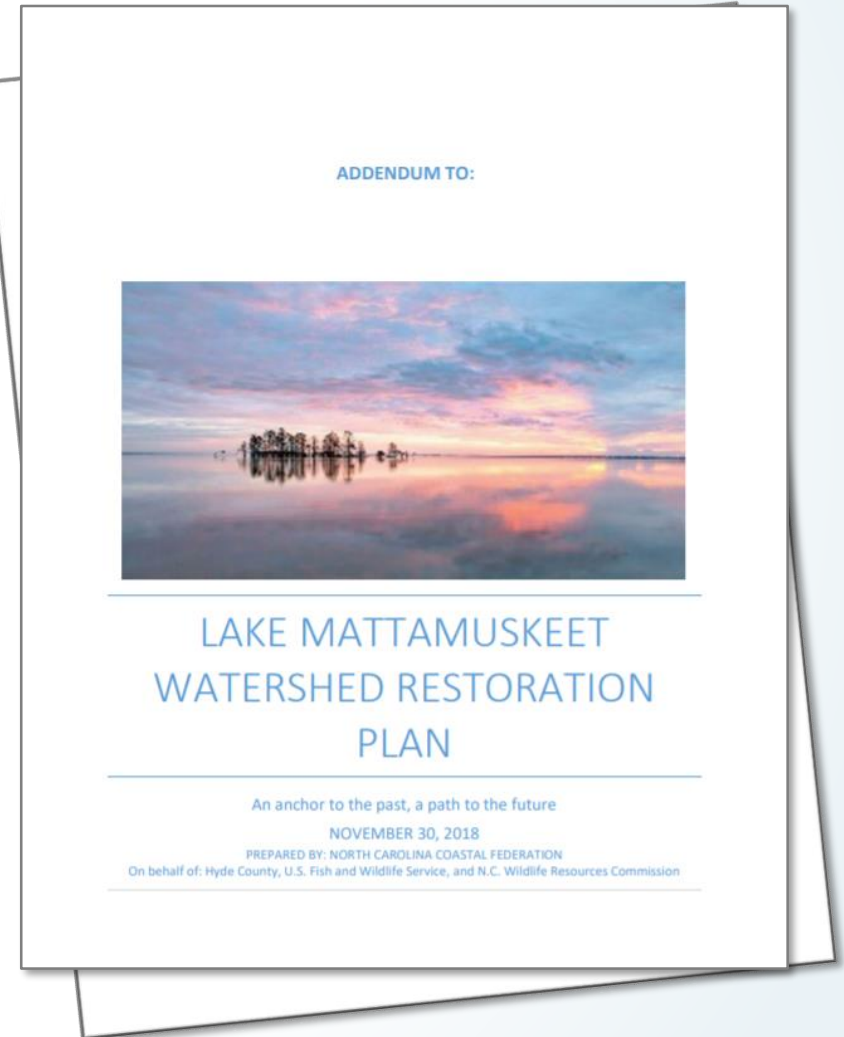
Priority Actions

- Create a formal body that provides managing authority for active water management within the watershed in close coordination with the Refuge, which would be excluded as party to the formal body since USFWS cannot cede management authority.
- Perform hydrologic study of the watershed.
- Design engineered plans for active water management within the lake watershed
 - Infrastructure Improvements
 - Additional Outlet Evaluation
 - Potential Sheet Flow Sites

Watershed Restoration Plan

Addendum submitted to N.C.
Division of Water Resources
July 22, 2019

Watershed Restoration Plan
officially approved
August 7, 2019



Review the Plan and Addendum

Restoring the Lake Mattamuskeet Watershed

Lake Mattamuskeet Watershed Restoration Plan

Lake Mattamuskeet, the largest lake in North Carolina, is a vital part of Hyde County's amazing natural and cultural heritage. Coastal residents and visitors alike value this national treasure.

However, declining water quality and elevated water levels are threatening the future of this natural wonder. In 2017, Hyde County, N.C. Wildlife Resources Commission, and the U.S. Fish and Wildlife Service formed a partnership and contracted the Coastal Federation to develop a watershed restoration plan. This plan aims to address both poor water quality within the Lake as well as chronic and persistent flooding on the surrounding landscape.

The partners embarked on an 18-month planning process that involved stakeholder and public engagement, and on August 7, 2019 the Lake Mattamuskeet Watershed Restoration Plan was officially approved by the N.C. Department of Environmental Quality. Since then the partners transitioned from developing the plan, to implementing the plan. In 2020, three grants were awarded from state and national funders to advance the implementation of the Lake Mattamuskeet Watershed Restoration Plan.

The goals of the plan are to:

- Protect the way of life in Hyde County;
- Actively manage the lake water level; and
- Restore water quality and clarity.

Upcoming Events

Public Meeting 8/26/2020

Resources

- Lake Mattamuskeet Watershed Restoration Plan
- Addendum
- Timeline of changes to the lake

Meeting Agendas and Presentations

- Aug. 26, 2020 Meeting Agenda
- Dec. 3 Public Symposium Presentations
- Dec. 3 Public Symposium Agenda



Subscribe for Updates/Submit Comments Online

Lake Mattamuskeet Watershed Restoration Plan

Lake Mattamuskeet, the largest lake in North Carolina, is a vital part of Hyde County's amazing natural and cultural heritage. Coastal residents and visitors alike value this national treasure.

However, declining water quality and elevated water levels are threatening the future of this natural wonder. In 2017, Hyde County, N.C. Wildlife Resources Commission, and the U.S. Fish and Wildlife Service formed a partnership and contracted the Coastal Federation to develop a watershed restoration plan. This plan aims to address both poor water quality within the Lake as well as chronic and persistent flooding on the surrounding landscape.

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The goals of the plan are to:

- Protect the way of life in Hyde County;
- Actively manage the lake water level; and
- Restore water quality and clarity.

The grant awards allow the partners to advance several of the priority management actions for the watershed. Throughout 2020 and 2021, the partners will host a series of public meetings and seek input on different implementation ideas.

Click on the link below to receive meeting announcements and ongoing updates regarding the watershed restoration plan.



[CLICK HERE TO SUBSCRIBE FOR UPDATES/SUBMIT COMMENTS](#)



Upcoming Events

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In The News

- **Lake Mattamuskeet Finalizes Restoration Plan:**
<https://www.publicradioeast.org/post/lake-mattamuskeet-finalizes-restoration-plan>
- "Restoring Lake Mattamuskeet In North Carolina" — June 29, 2017. U.S. Fish and Wildlife Service.
- "Secrets of Lake Mattamuskeet" — NC Science Now | UNC-TV
- "Where Has the Grass Gone?" — Wildlife in North Carolina, November/December 2016. Printed by N.C. Wildlife Resources Commission.



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nccoast.org/lakemattamuskeet

Stakeholder Team

Bill Rich - Hyde County Economic Development

Daniel Brinn - Hyde County Water and Flood Control

Rebekah Martin – U.S. Fish and Wildlife Service

John Stanton – U.S. Fish and Wildlife Service

Kendall Smith - U.S. Fish and Wildlife Service

Wendy Stanton – U.S. Fish and Wildlife Service

Doug Howell - N.C. Wildlife Resources Commission

Michael “Slim” Cahoon - Farming Community

Wilson Daughtry – Mattamuskeet Association

Andrea Gibbs – NC Cooperative Extension

Art Keeney - Residential Community

Ben Simmons - Farming Community/Fairfield Drainage

Pat Simmons - Hospitality Industry

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

James “Booboo” Topping - Residential Community

Joey Ben Williams - Impoundments



Meet the New Manager of Mattamuskeet NWR

Kendall Smith, U.S. Fish and Wildlife Service



Memorandum of Understanding

Hyde County

U.S. Fish and Wildlife Service

N.C. Wildlife Resources Commission

MEMORANDUM OF UNDERSTANDING

Between

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

And

COUNTY OF HYDE, NORTH CAROLINA

And

U.S. DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

I. Authority:

This Memorandum of Understanding (MOU) is entered into between the Department of the Interior, U.S. Fish and Wildlife Service (hereinafter referred to as the Service), the North Carolina Wildlife Resources Commission (hereinafter referred to as the Commission), and the County of Hyde, North Carolina (hereinafter referred to as the County) pursuant to the legal authorities vested to the agencies.

Specifically to the Service under the authority of the:

- **National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997.** This Act defines the National Wildlife Refuge System, establishes the responsibilities of the Secretary of the Interior for managing and protecting the System, and establishes the legitimacy and appropriateness of the six priority public uses.
- **Refuge Recreation Act of 1962 (16 U.S.C. § 460k et seq.).** This Act allows the use of refuges for recreation when such uses are compatible with the refuge's primary purposes and when sufficient funds are available to manage the uses.
- **Fish and Wildlife Act of 1956 (16 U.S.C. 742 et seq.).** This Act grants the Secretary broad authority to, "take such steps as may be required for the development, advancement, management, conservation, and protection of fish and wildlife resources. ..." The statute specifically authorizes the acceptance of gifts and the services of volunteers for programs and projects that benefit the mission of the U.S. Fish and Wildlife Service. Further, the act specifically authorizes the Secretary to enter into cooperative agreements for programs and projects to benefit specific units of the National Wildlife Refuge System.

Specifically to the Commission under the authority of North Carolina § 143-239 (1947) which enables the Commission to enter into cooperative agreements:

... the Commission is hereby authorized and empowered to enter into cooperative agreements pertaining to the management and development of the wildlife resources with federal, State, and other agencies, or governmental subdivisions.

Purpose

The Service, the Commission, and the County individually and collectively have major responsibilities for management and protection of the watershed surrounding Lake Mattamuskeet.

In consideration of the mutual benefits to be derived, the agencies agree to cooperate and collaborate to achieve mutual and individual agency goals and objectives identified in the Lake Mattamuskeet Watershed Restoration Plan.



Updates from Mattamuskeet Technical Working Group



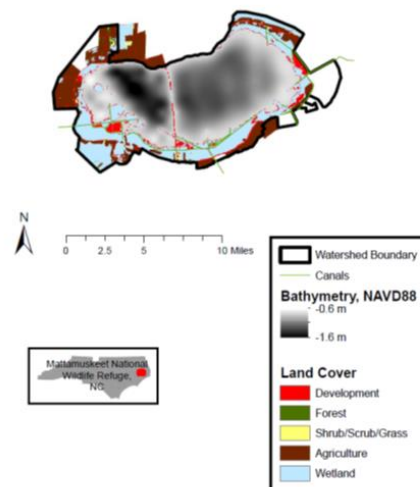
Wendy Stanton, U.S. Fish and Wildlife Service
Doug Howell, N.C. Wildlife Resources Commission

Research Results

Assessing the Transport, Fate and Effects of Agricultural Herbicides in the South Atlantic Coastal Plain

Anna Alicea, PhD Candidate, NC State University
(Under the direction of Dr. W. Gregory Cope)

The herbicides tested pose little to no risk to Submerged Aquatic Vegetation (SAV) restoration efforts at Lake Mattamuskeet



Research Results

Informing Common Carp Removal and Submerged Aquatic Vegetation Restoration in Lake Mattamuskeet

April Lamb, MS Candidate, NC State University
(Under the direction of Dr. Jessie Fisher)

SAV species can be successfully established when protected from herbivory and uprooting from common carp, despite high nutrient levels and turbidity



Grants Awarded for Invasive Common Carp Removal

USFWS Coastal Program Funds Grant: Restore a healthy aquatic and wetland ecosystem. \$180,000

- **Carp exclusion barriers**
- **Permanent pound nets and other nets to remove carp**



Grants Awarded for Invasive Common Carp Removal

USFWS National Large Invasive Species Grant: Remove 99% of common carp from Lake Mattamuskeet. \$1 million

- **Carp exclusion barriers**
- **Implement Modified Unified Method for carp removal and other techniques**
- **Monitoring/Ensuring biosecurity**



Next Steps

- **Complete all compliance processes (compatibility determinations, NEPA, etc...)**
- **Complete all contracting documentation**
- **Purchase carp exclusion barriers and nets**
- **Implement MUM carp removal during 2023**

*Many thanks to all our
partners and collaborators*





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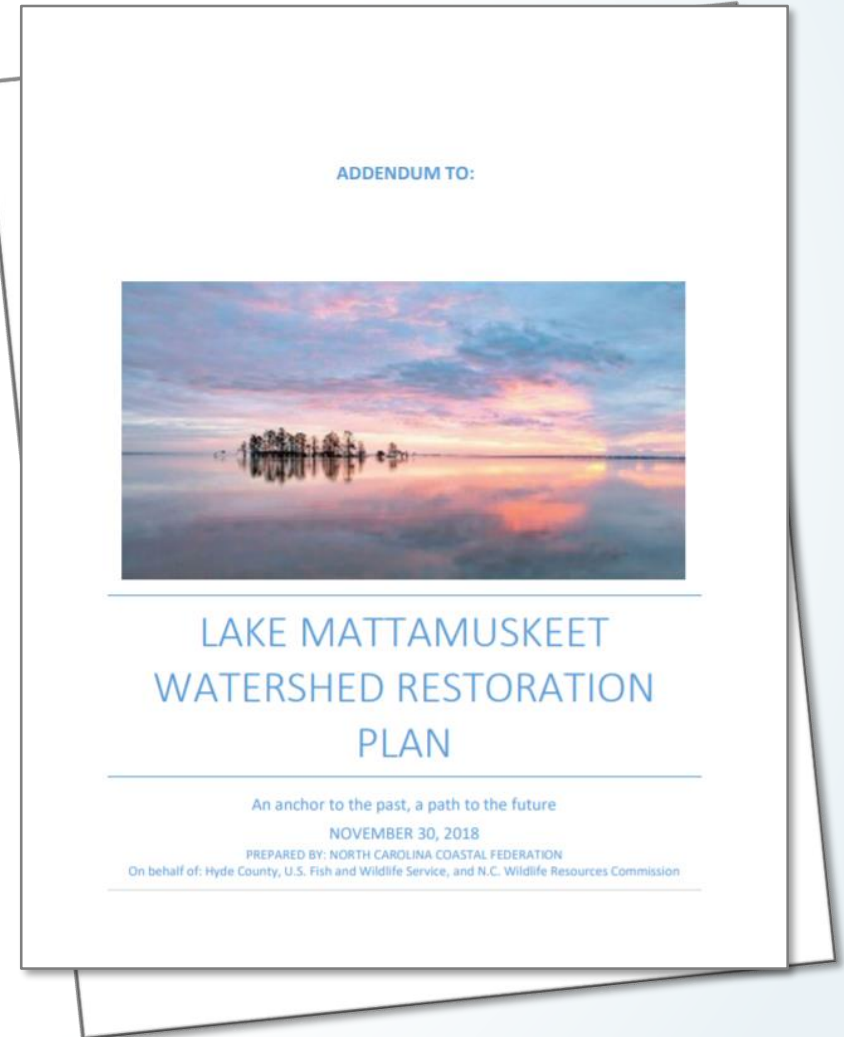


Lake Mattamuskeet Watershed Restoration Plan

Implementation

Implementing the Watershed Restoration Plan

- Pursuing funding to implement the priority management actions has been the focus of partners over the past year.
- **Funding awarded from:**
 - Clean Water Management Trust Fund
 - N.C. General Assembly
 - National Science Foundation





Engineering Active Water Management

Michael Flynn, North Carolina Coastal Federation



REQUEST FOR QUALIFICATIONS:

ENGINEERING ACTIVE WATER MANAGEMENT WITHIN THE LAKE MATTAMUSKEET WATERSHED

HYDE COUNTY, NORTH CAROLINA

Issued by the
NORTH CAROLINA COASTAL FEDERATION
in partnership with
HYDE COUNTY
and
EAST CAROLINA UNIVERSITY

APRIL 15, 2020



Geosyntec Consultants

and

**Coastal Protection
Engineering (CPE)**

**selected as the
engineering firm**

Engineering Team

Active Water Management



WADE BURCHAM, PE_(NC, + 7 OTHER STATES)

- Project Manager | Project Engineering Design | Stakeholder Engagement
- 23 Years of experience
- Project management
- Watershed planning
- Coastal & hydraulic engineering
- Construction administration inspection



ALESSANDRA BRASWELL, PHD, PE_(NC)

- Deputy Project Manager | Wetland Siting and Capacity Analysis | Consultation and Oversight | Stakeholder Engagement
- Instructed stormwater design workshops
- North Carolina State graduate who has previously worked on NCCF-facilitated projects



KEN WILLSON

- Technical Advisor and Stakeholder Engagement
- 17 Years of experience
- Oversaw design and permitting of 11 coastal restoration, inlet management, and navigation projects



LINDINO BENEDET, PHD

- Watershed-Scale H&H Model
- 19 Years of experience
- PhD in Hydraulic Engineering at Delft Institute of Technology in Delft, Holland
- Worked closely with the Developers of the Delft3D model



PETER DE HAVEN, PE_(GA, NC)

- Project Director
- 23 Years of experience
- Project management
- Data management
- Conceptual site model development, numerical modeling, and conceptual and final design for remediation

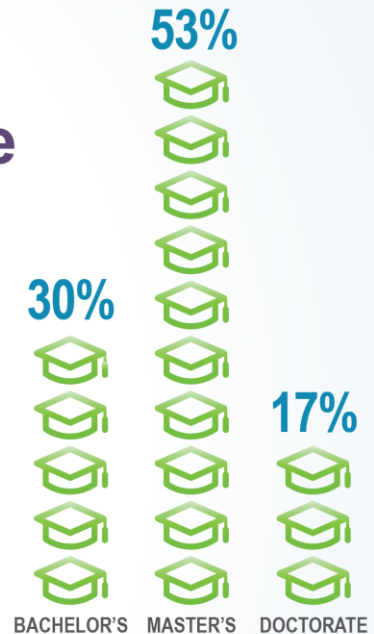
Geosyntec



1983



100%
Employee
Owned

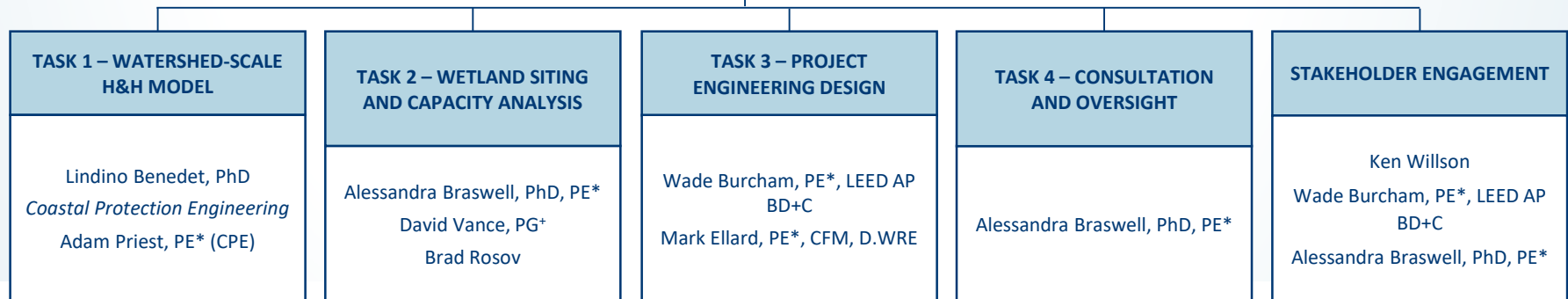
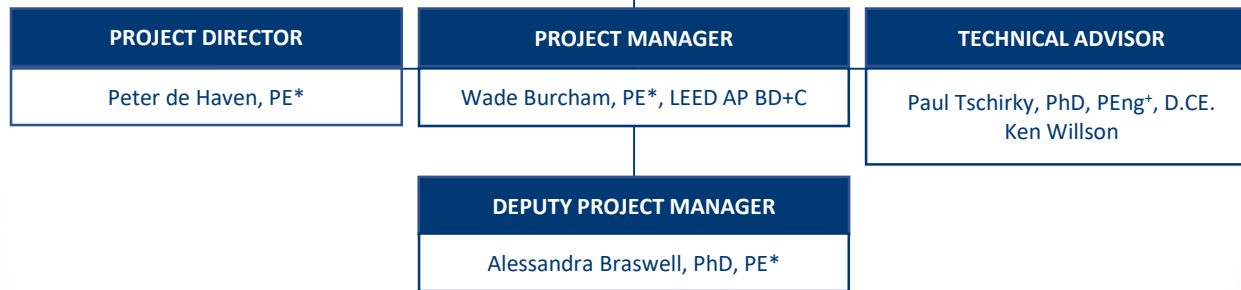


SAFETY
EMR 0.75 Industry Average 1.0

Coastal Protection Engineering of North Carolina (CPE)

- Highly specialized coastal consulting firm
- Staff of 17 (Engineers, Numerical Modelers, Environmental Scientists, Geologists, and Project Managers)
- Service local government clients throughout eastern North Carolina for nearly two decades
- Worked with 20 different local communities throughout eastern North Carolina
- Strong local knowledge of the Lake Mattamuskeet Restoration Plan and Hyde County Flooding Issues

Project Organizational Chart



* North Carolina License
+ Other State License

Starting siting evaluation
in October

Starting engineering
alternatives in
September

Currently estimating
storage capacity needs

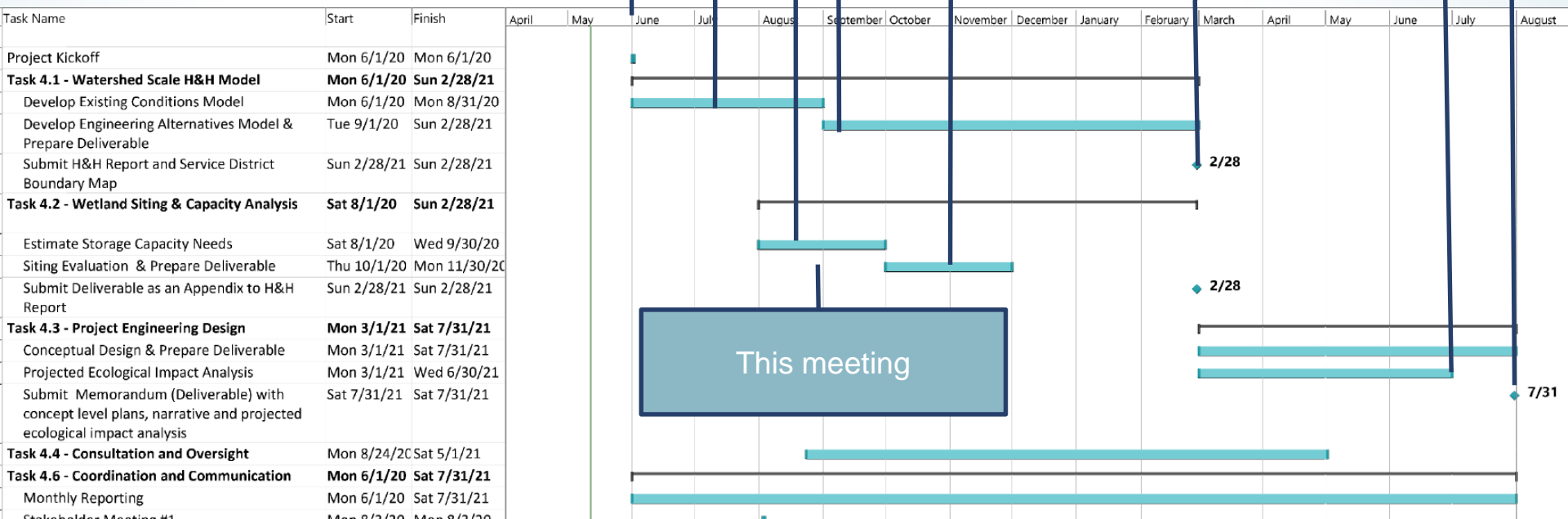
Currently building
existing conditions
model

Started project in June

Delivering Engineering
Concept in July

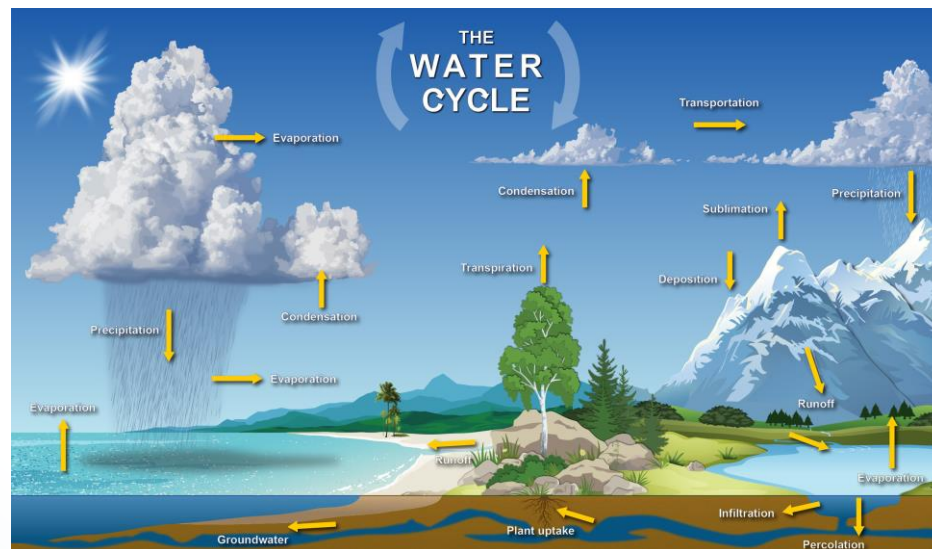
Delivering ecological
impact analysis in June

Delivering modeling
report in February



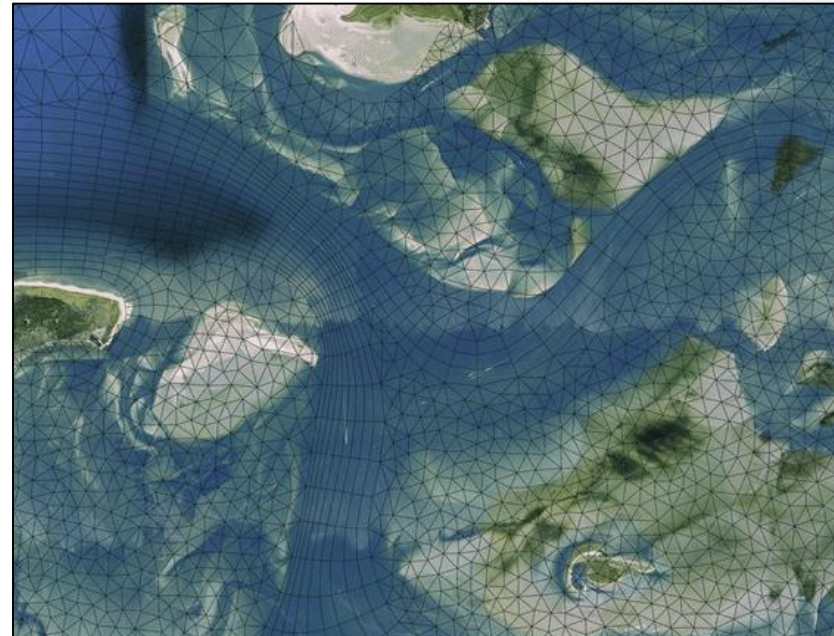
Lake Mattamuskeet Water Cycle

- Balance between input (precipitation, run-off, pumping from adjacent lands) and output (evaporation, discharge from the canals and groundwater).
- Models allow us to estimate how water levels in the lake will change under different rates of evaporation, precipitation, run-off, and discharge.



Delft3D Flexible Mesh

- Unstructured 1D-2D-3D grids, widely used in the coast, lakes and rivers.
- Allows for the simulation of the interaction of water, sediment, ecology, and water quality in time and space.
- Includes coastal hydrodynamics & hydrological processes (precipitation, infiltration and evaporation).
- Allows for implementation of hydrological structures such as weirs, gates, pumps and flow obstacles such as dams.
- Greater long-term applicability to the Watershed

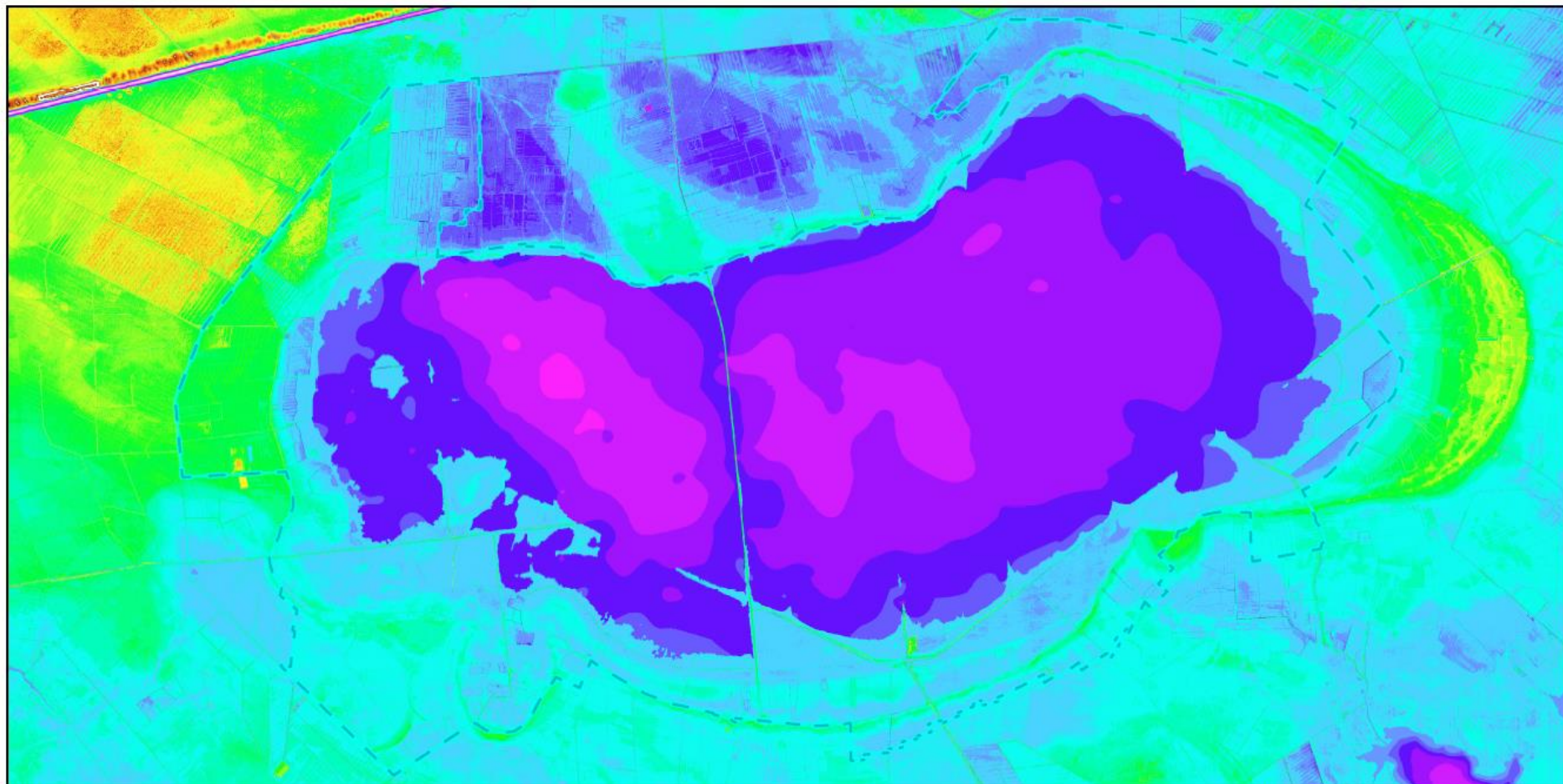


Model Domain



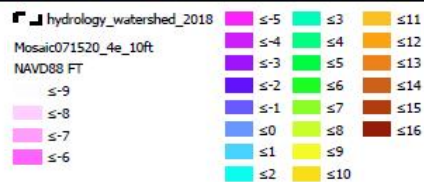
Data Sources

- Lidar Data from the North Carolina Floodplain Mapping Program collected between 2014 and 2015
- Bathymetric data provided by USGS, collected between 2013 and 2016
- USGS Water Level Stations at Lake Mattamuskeet
- Water Level data recorded by USGS at Ferry Terminal at Swan Quarter during Matthew / Data recorded by USGS at Bell Island Pier during Joaquin
- NOAA Atlas 14 Point Precipitation frequency Estimates for New Holland.
- NOAA SLR Estimates for Station (Beaufort or Oregon Inlet).
- Local data sources (hydraulic structures, detailed bathymetric surveys, cross section data of channels).
- Familiarization with existing datasets. No new data collection anticipated.
- Canal water levels and discharge data - Refuge



NOTES:

1. Bathymetry data were provided by USGS using tidally corrected soundings as NAVD88 feet at more than 500 locations in the lake collected over multiple surveys between 2013 and 2016. Bathymetry data for major waterways including the Intracoastal Waterway and Pamlico Sound were derived from NOAA NCEI Continuously Updated Digital Elevation Model (CUDEM) ninth arc second data downloaded from NOAA's Digital Coast on May 9, 2020.
2. The North Carolina statewide lidar data were downloaded from North Carolina's Spatial Data Download for Quality Level (QL) 2 lidar data collected between 2014 and 2015.
3. Coordinates are in feet based on the North Carolina State Plane Coordinate System, North American Datum of 1983 (NAD83).



0 5,000 10,000 Feet

TITLE:

Lake Mattamuskeet Digital Elevation Model



COASTAL PROTECTION ENGINEERING
OF NORTH CAROLINA, INC.
4038 Masonboro Loop Road
Wilmington, NC 28409
PH (910) 399-1905

Date: 08/14/20 By: WTV Comm No.: 2020044 Figure No.: T1

Modeling

- The model is being calibrated to reproduce Lake Water Levels at USGS Stations during Matthew and Joaquin.
- Modeling scenarios will investigate the efficiency of increasing water discharge (canal dredging, pumps at outlets to Pamlico sound, pumps to sheet flow sites etc.) to manage Lake water level and reduce flooding under different SLR scenarios.
- The same model can be used in the future to evaluate water quality in the Lake Mattamuskeet.

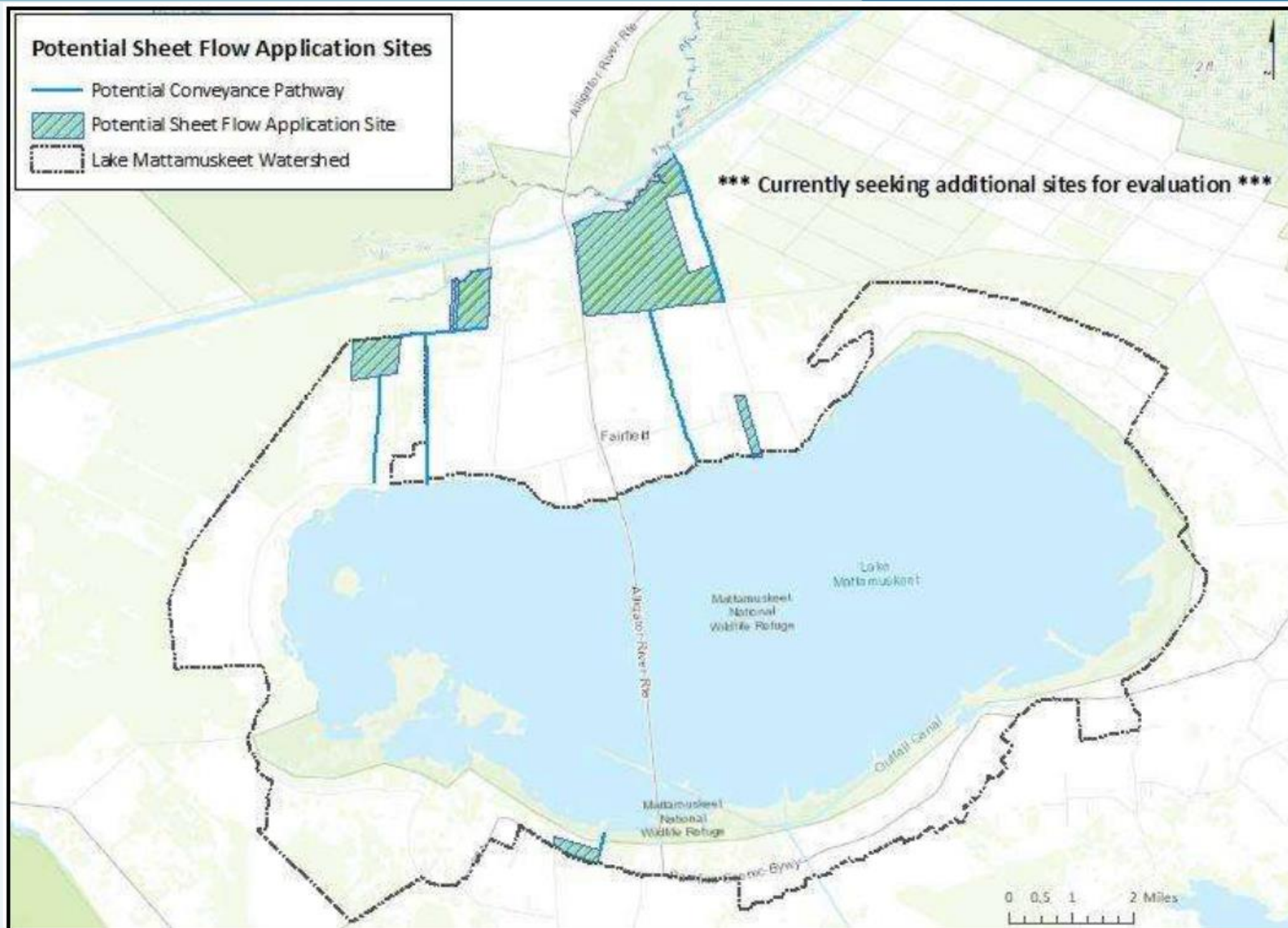


Figure 19: A map displaying the potential sheet flow application sites within and adjacent to the watershed.



Storm Recovery Act of 2019

Daniel Brinn, Hyde County Water and Flood Control

GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 2019

H

D

HOUSE BILL 200
Committee Substitute Favorable 3/19/19
Senate Appropriations/Base Budget Committee Substitute Adopted 10/31/19
Proposed Conference Committee Substitute H200-PCCS30539-MM-9

Short Title: 2019 Storm Recovery/Var. Budget Corrections. (Public)

Sponsors:

Referred to:

February 27, 2019

A BILL TO BE ENTITLED

AN ACT TO PROVIDE FUNDS FOR DISASTER RELIEF FROM HURRICANE DORIAN
AND OTHER NAMED STORMS, FUNDS FOR RESILIENCY MEASURES AGAINST
FUTURE STORMS, AND FUNDING FOR THE RURAL HEALTH CARE
STABILIZATION FUND; TO MAKE CORRECTIONS TO VARIOUS BUDGET
RELATED BILLS; AND TO ENACT CERTAIN BUDGET PROVISIONS FROM HOUSE
BILL 966, 2019 REGULAR SESSION.

The General Assembly of North Carolina enacts:

PART I. APPROPRIATIONS AND ALLOCATIONS

SECTION 1.1. State Match. – The State Controller shall transfer the sum of one
hundred twenty-one million five hundred eighty-five thousand five hundred ninety-four dollars
(\$121,585,594) from the Savings Reserve Account to the General Fund, and those funds are
hereby appropriated as follows:

- (1) \$70,812,336 to the Hurricane Florence Disaster Recovery Fund created in S.L.
2018-134 for the Department of Public Safety to be used to provide State
match for Hurricane Florence federal disaster assistance programs.
- (2) \$33,173,258 to the State Emergency Response and Disaster Relief Fund for
the Department of Public Safety, Division of Emergency Management to used
as follows:
 - a. \$11,197,013 to provide State match for federal disaster assistance
programs related to Hurricane Matthew.
 - b. \$4,176,245 to provide State match for federal disaster assistance
programs related to Hurricane Michael.
 - c. \$17,800,000 to provide State match for federal disaster assistance
programs and funding for equivalent State assistance programs related
to Hurricane Dorian.
- (3) \$17,600,000 to the Department of Environmental Quality to match additional
federal funds for the Clean Water State Revolving Fund and the Drinking
Water State Revolving Fund.

SECTION 1.2. Other Disaster Relief and Resiliency Appropriations/Nonrecurring
Funds. – In addition to any other funds appropriated during the 2019-2020 fiscal year, there is
appropriated from the unappropriated balance in the General Fund the sum of fifty-nine million

- (8) \$1,800,000 to the Office of State Budget and Management to provide a directed grant to Hyde County for construction of a pump station and related watershed restoration infrastructure for the Lake Mattamuskeet watershed.



Using Undergraduate Engineers and Community Engagement

Dr. Randall Etheridge, East Carolina University

Concept Designs



Leadership Team

Linda D'Anna – Coastal Studies Institute

Randall Etheridge – Department of
Engineering, Center for Sustainable
Energy and Environmental Engineering

Cindy Grace-McCaskey – Department of
Anthropology, Coastal Studies Institute

Raymond Smith – Department of
Engineering

Design Projects

Goal: Develop concept plan for 3 projects that reduce flooding and/or improve water quality in the lake

The concept plans will include estimates of cost and effectiveness for reducing flooding so the community can decide which plan to pursue

We want your input on the design

Completion of a concept plan does not mean the project will be constructed

Concept designs will be completed in April 2021

Design Projects

Projects were selected based on:

- Support from the community

- Greatest potential to reduce flooding on residential property and farms in the watershed

- Landowners willingness to grant access

- Meet the educational objectives for the students

- Not duplicating the work of Geosyntec/CPE

Project ideas that were not selected should be examined in the future if funding is available

What is learned through these projects can be applied to future projects

Project 1: Canal Dredging



— Rose Bay Canal — Outfall Canal — Lake Landing Canal — Waupoppin Canal

Project 1 Team



Natalie
Martinez



Brianna
Hamilton

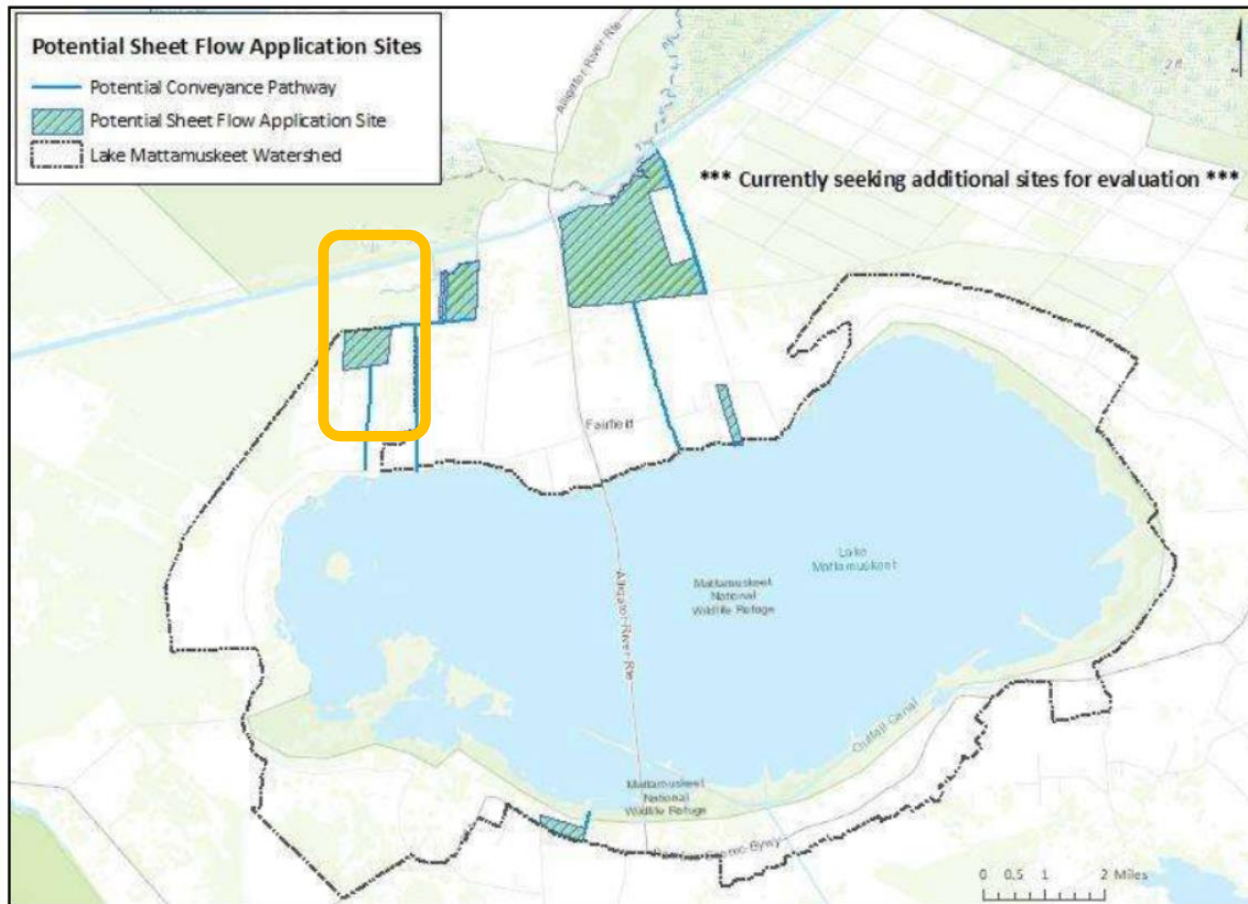


Joseph Huss



Branson
Rogers

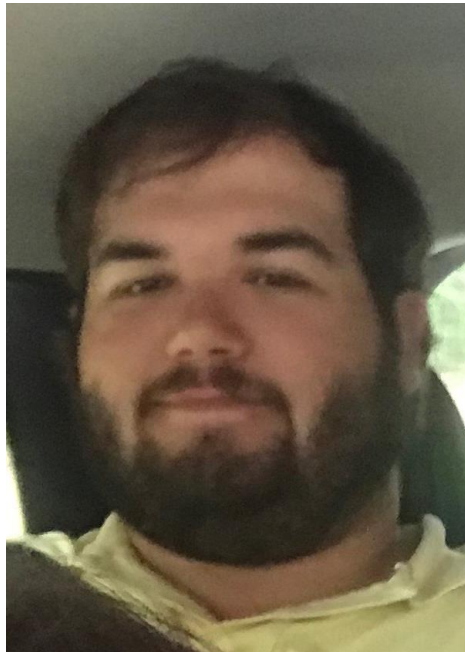
Project 2: Pat Simmons Property Sheet Flow



Map Credit: Watershed Restoration Plan

Project 2 Team

Not pictured:
Ahmad
Abdeljawad



Dustin Holland

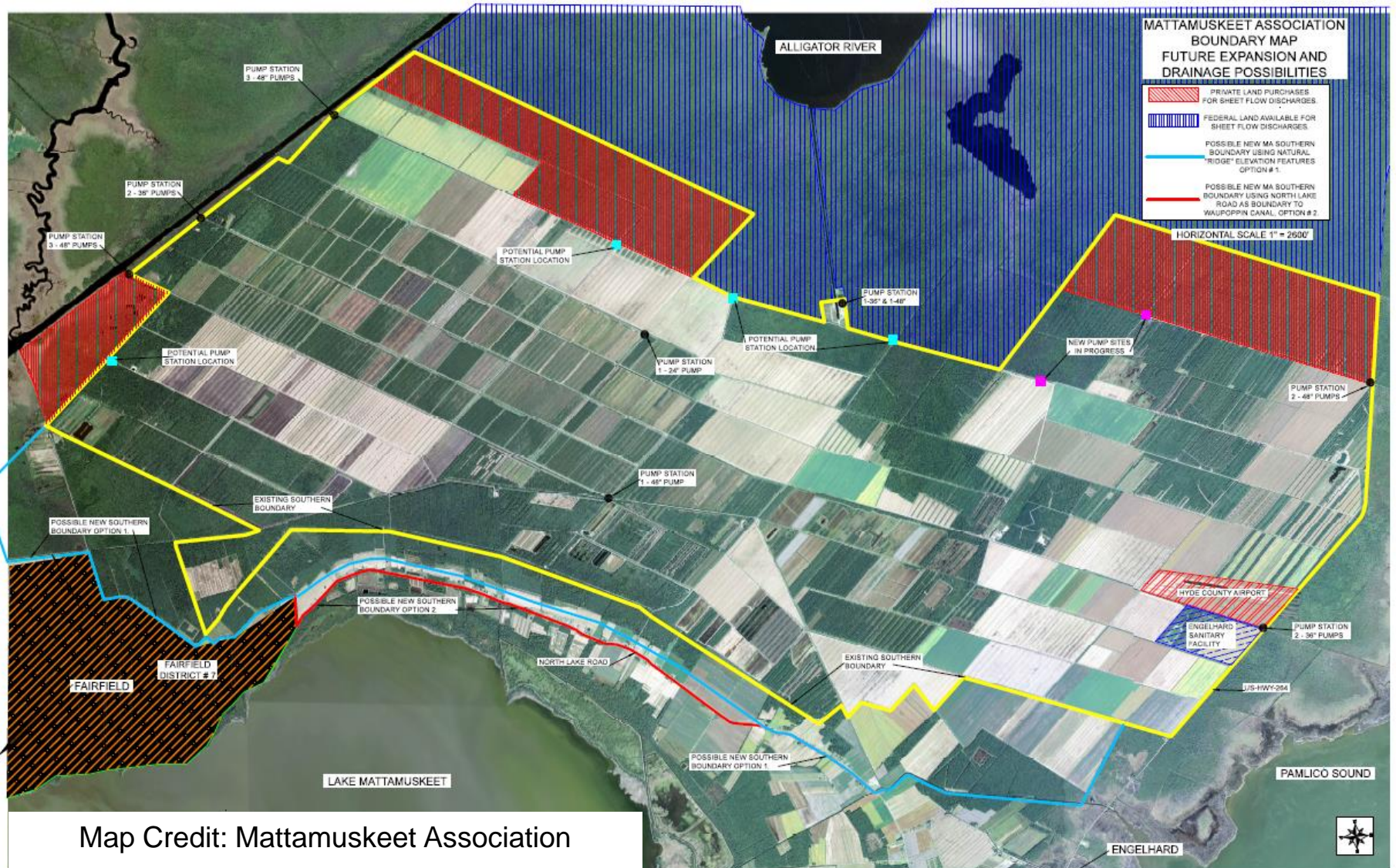


Loring
Penna-Welch



Shelby
Wiggins

Project 3: Mattamuskeet Association Sheet Flow



Project 3 Team



Carlo Ablan



Ashley Miller



Olivia
Sessoms



CJ Shaw

Engage with the Project Teams

- Are you willing to share your knowledge and perspective about these designs?
- We are looking for individuals to discuss the projects with the student design teams! (compensation is available)
- Please get in touch one of these ways
 - Email
 - Call
 - Send a chat message during this meeting

Linda D'Anna
dannal15@ecu.edu
252-475-5457

Cindy Grace-McCaskey
gracemccaskeyc15@ecu.edu
252-328-9443

Questions or Feedback

Linda D'Anna
dannal15@ecu.edu
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Cindy Grace-McCaskey
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Randall Etheridge
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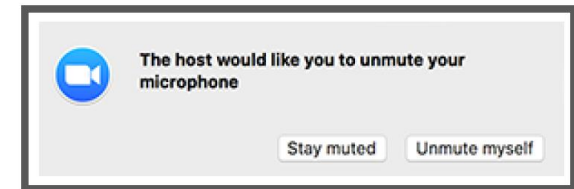
Question and Comment Period

Zoom Functionality



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or comments**

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Mute/Unmute

Use the raise hand function if you would like to speak during the question and comment period at the end of the meeting.



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Question and Comment Period



North Carolina Coastal Federation

Working Together for a Healthy Coast



Thank you for attending!

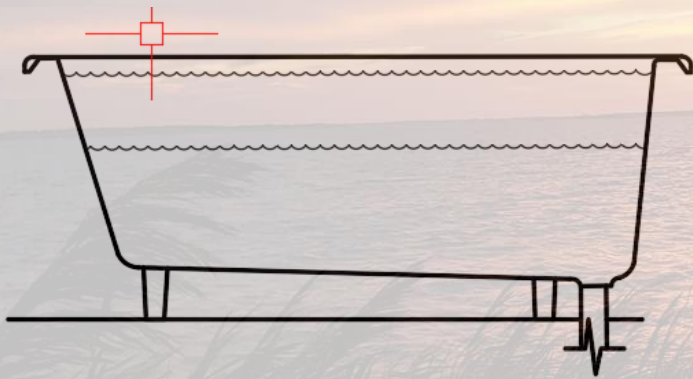


North Carolina
Coastal Federation

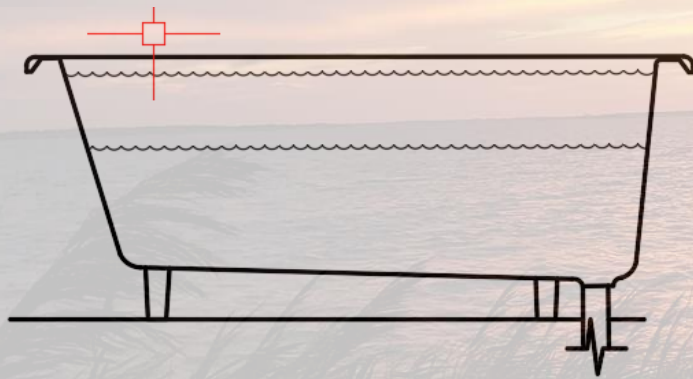
Working Together for a Healthy Coast



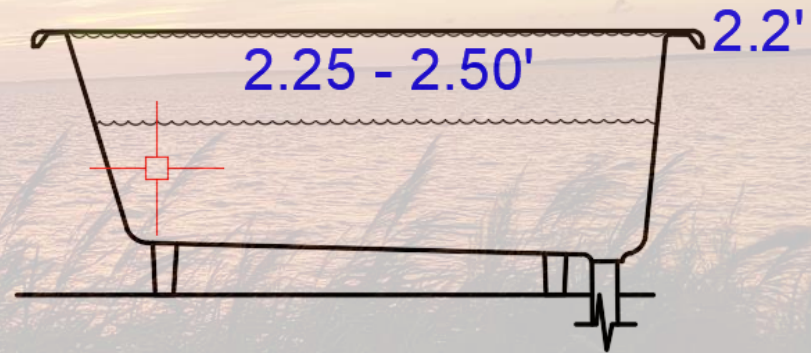
Supplemental Material



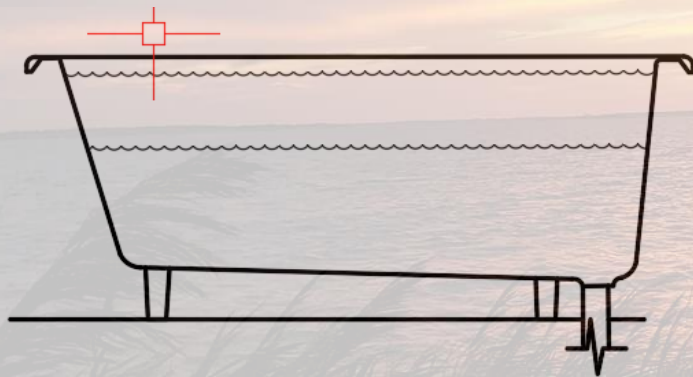
If we envision Lake
Mattamuskeet as a bath tub



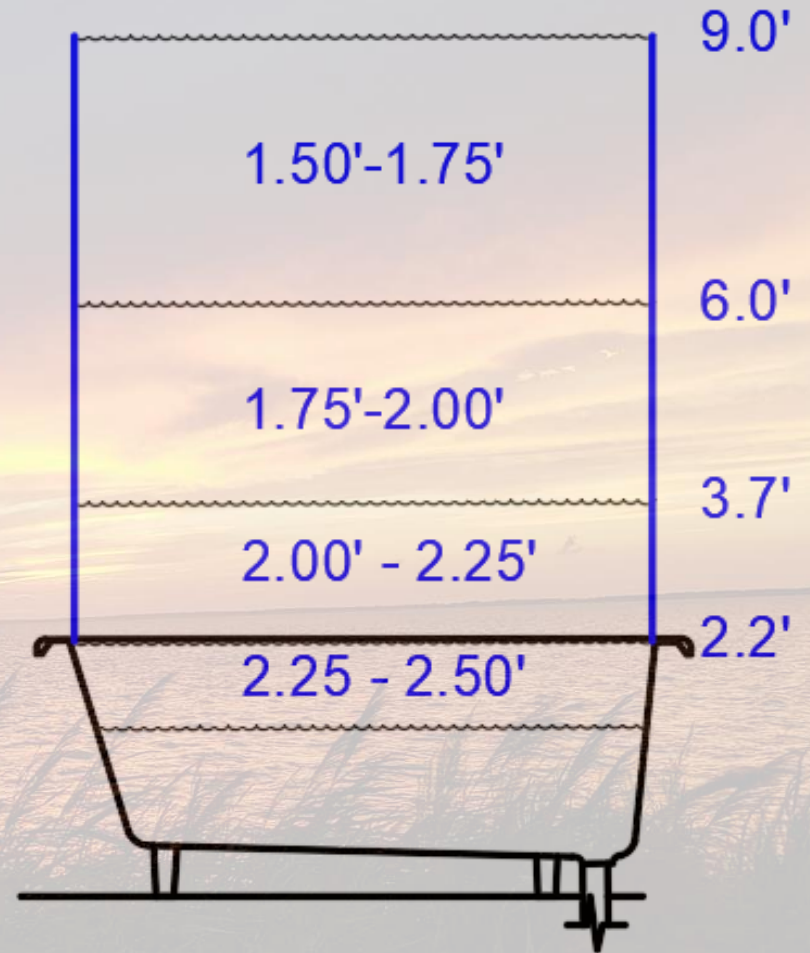
If we envision Lake
Mattamuskeet as a bath tub



If we transfer 3" of the volume
of the Lake to the overland flow
sites, it will result in 2-feet in the
overland flow area.

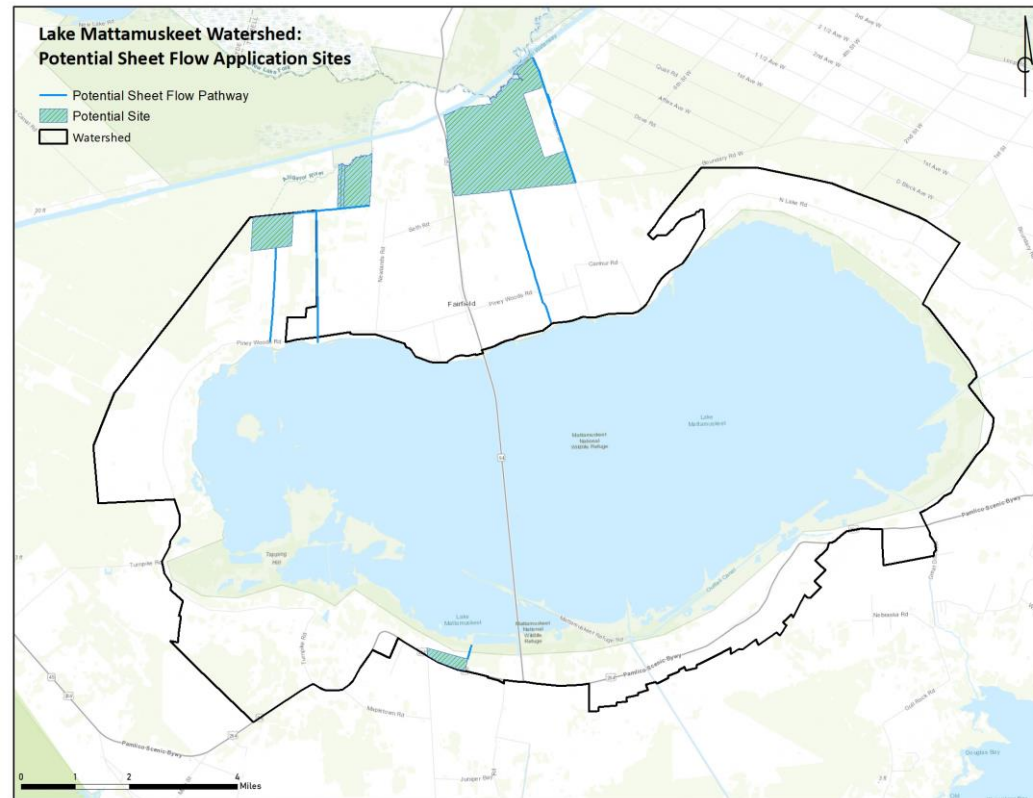


If we envision Lake
Mattamuskeet as a bath tub



If we transfer 12" of the volume of the Lake
to the overland flow sites, it will result in 9-feet in
the overland flow areas.

Potential Sheet Flow Sites



378 acres within
watershed

2,477 acres outside
watershed

**Currently seeking
additional sites for
evaluation.**

**Lake Mattamuskeet Watershed:
Potential Sheet Flow Application Sites**

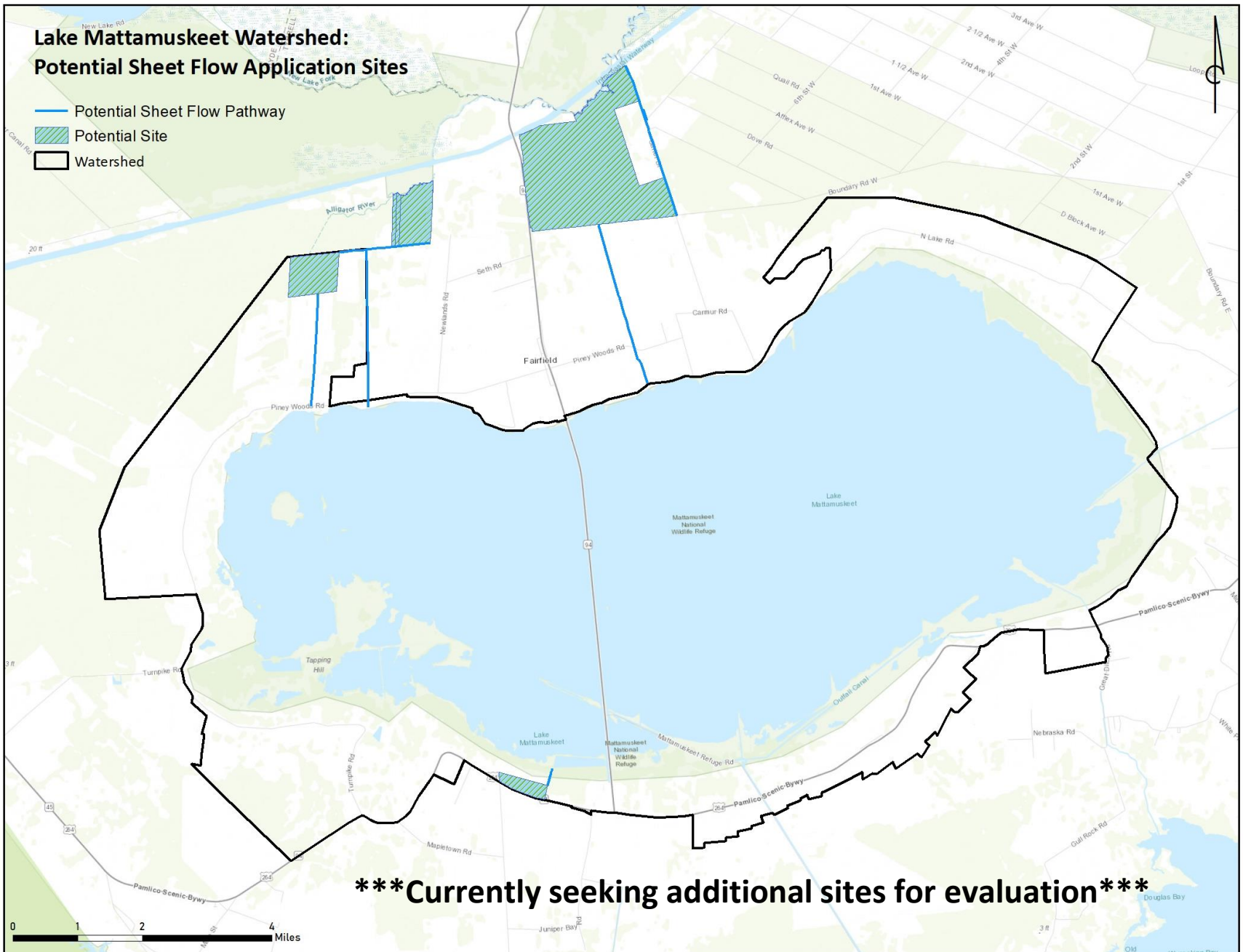
— Potential Sheet Flow Pathway
 Potential Site
 Watershed

The map displays the Lake Mattamuskeet Watershed, outlined in black. The lake itself is a large blue area in the center. Surrounding the lake are various roads and land parcels. Several areas are highlighted with green hatching, indicating potential sheet flow application sites. Blue lines trace potential sheet flow pathways from these sites towards the lake. A legend in the top left corner defines the symbols used. A scale bar at the bottom left indicates distances up to 4 miles. A north arrow is located in the top right corner. The map also shows the Mattamuskeet National Wildlife Refuge and the Mattamuskeet National Wildlife Management Area.

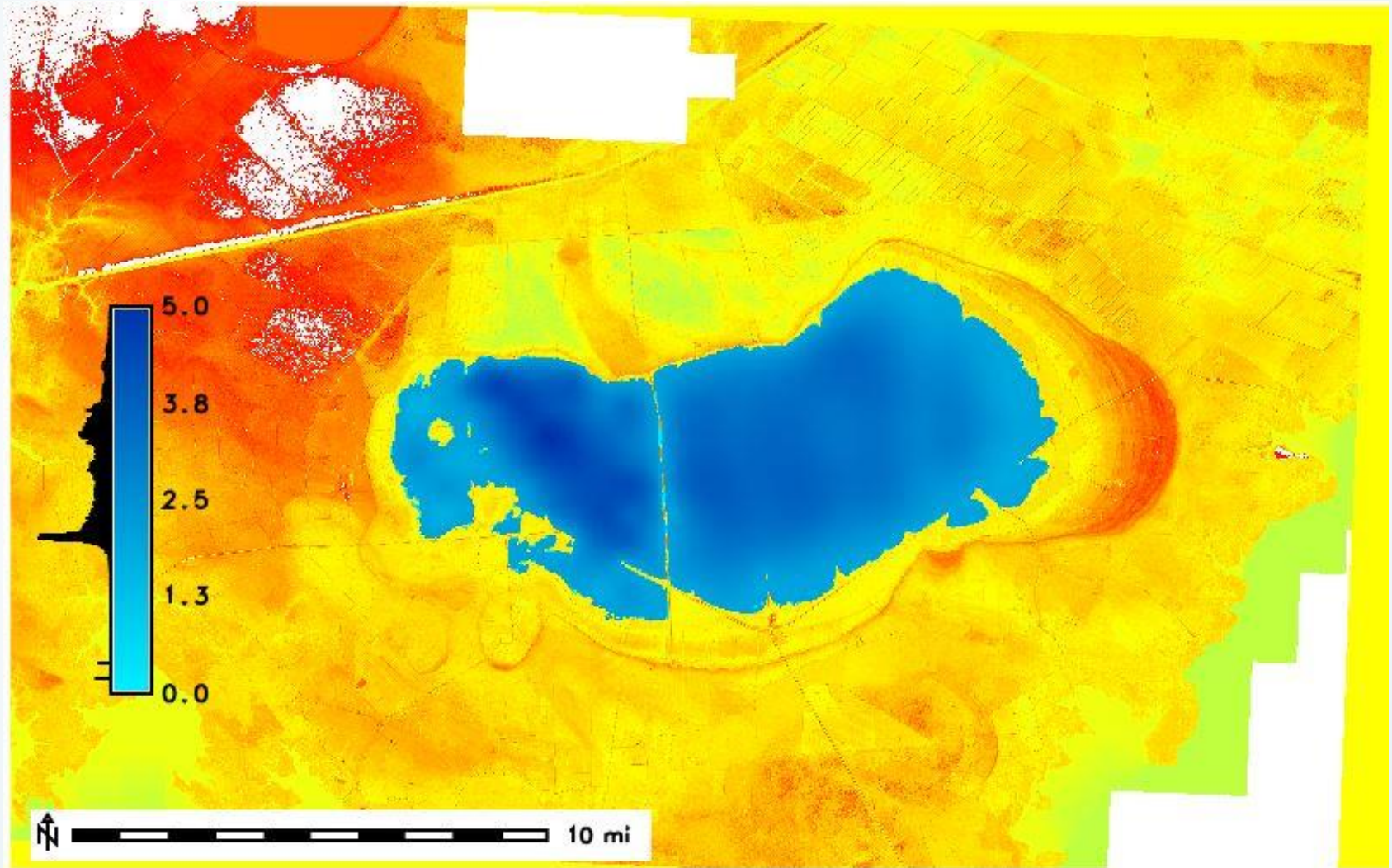
- Water quality treatment
- Restoring the natural hydrology
- Reduction of water volume draining to the lake

Lake Mattamuskeet Watershed: Potential Sheet Flow Application Sites

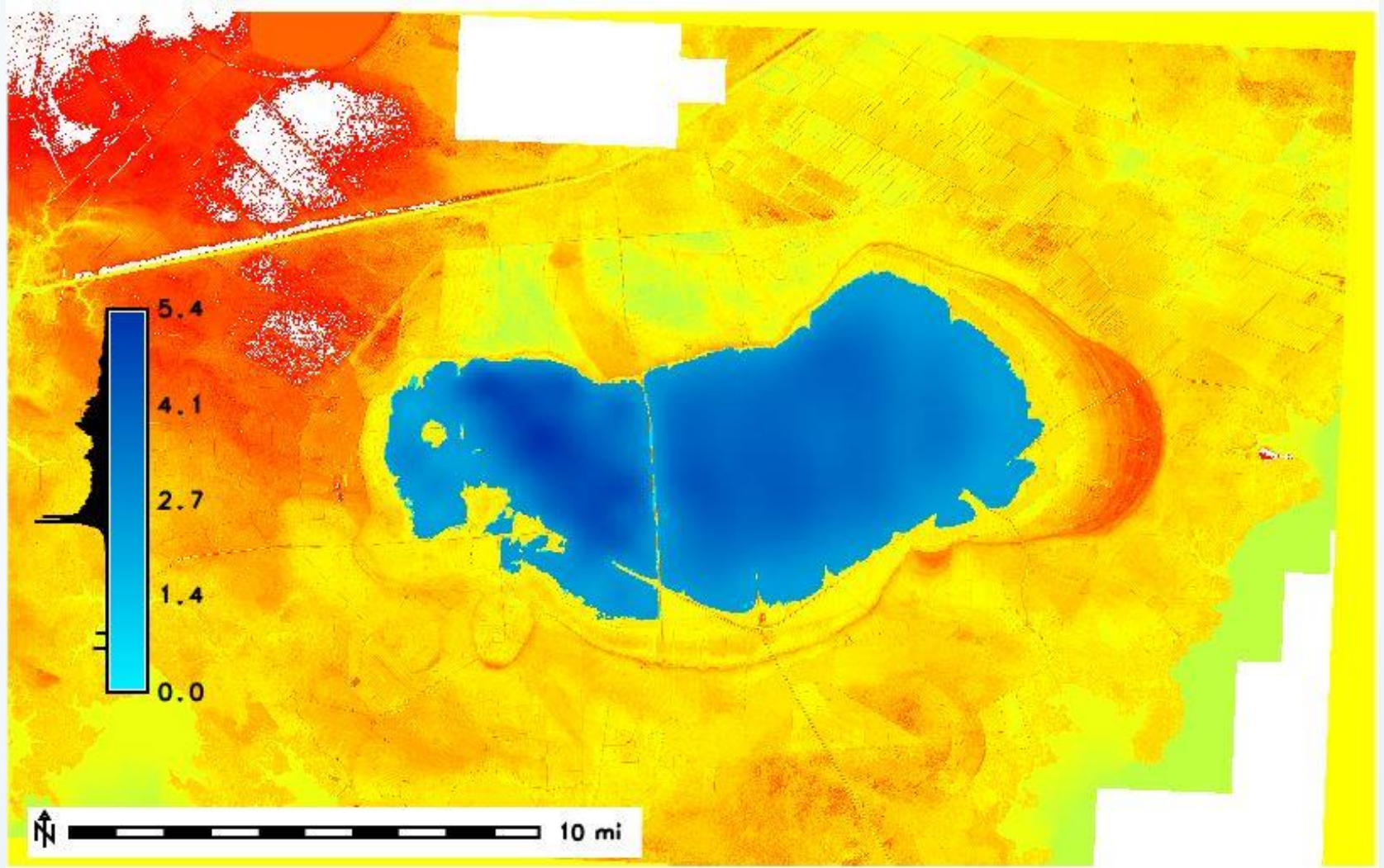
- Potential Sheet Flow Pathway
- ▨ Potential Site
- ▭ Watershed



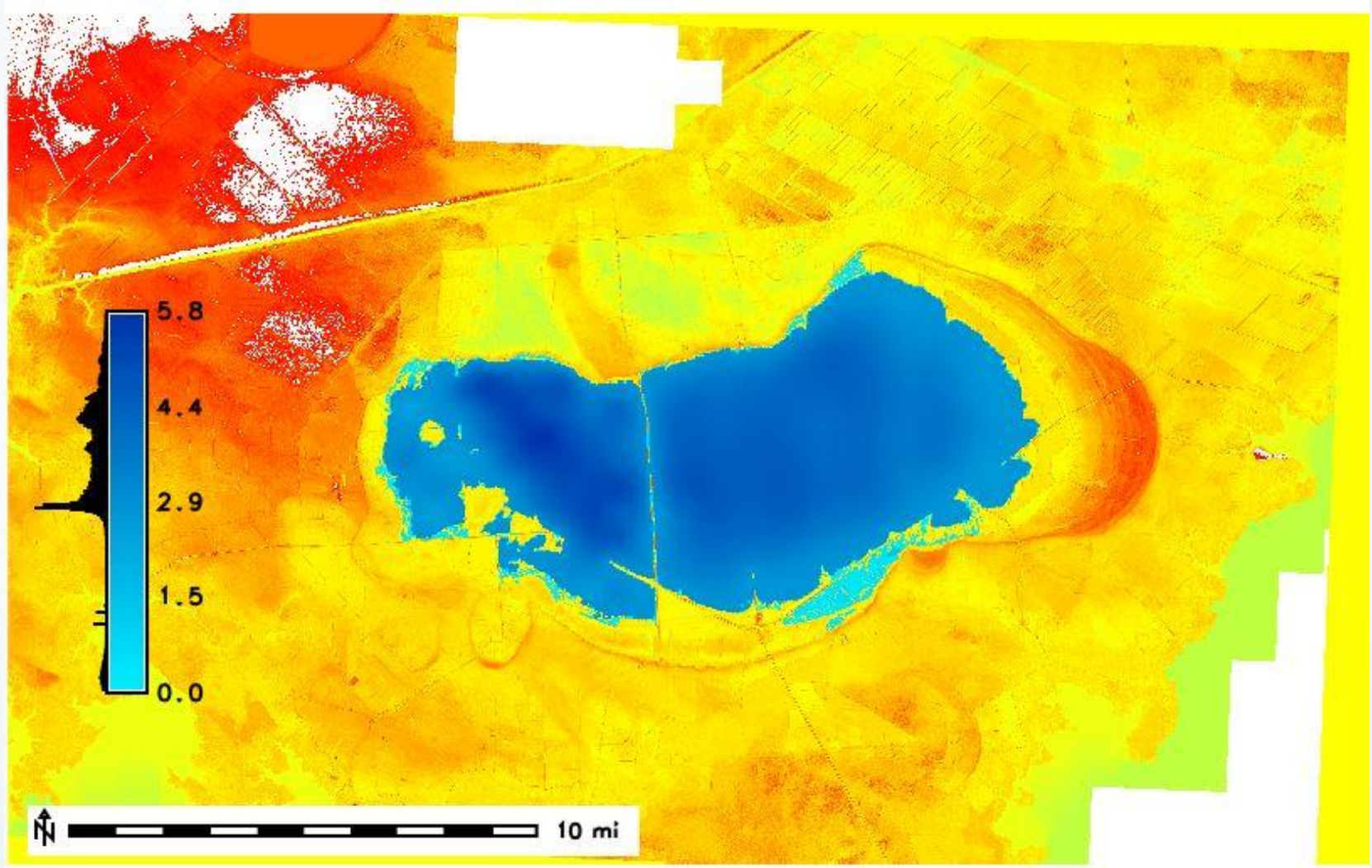
Water Level = -0.3 ft (MSL)



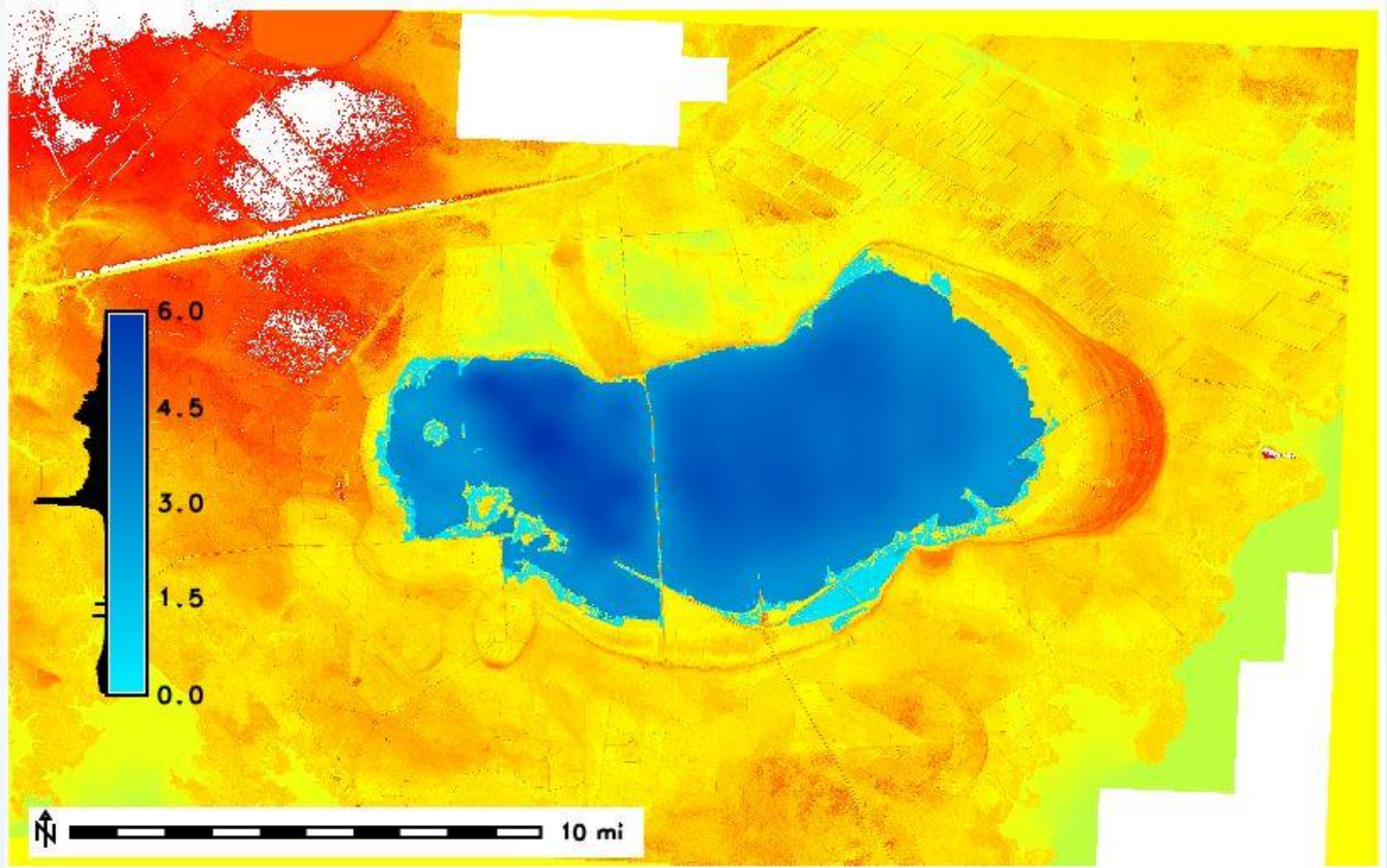
Water Level = 0.1 ft (MSL)



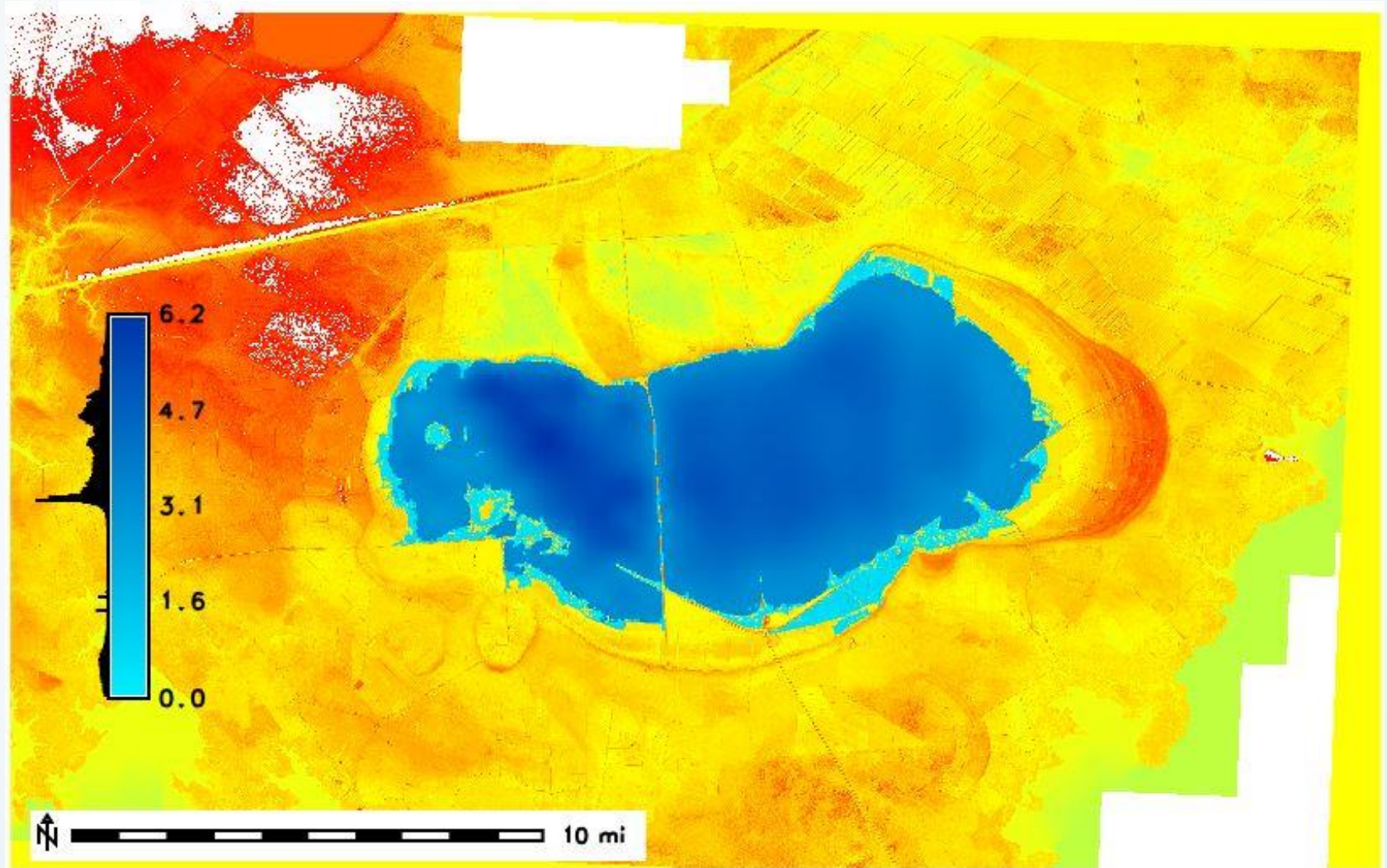
Water Level = 0.5 ft (MSL)



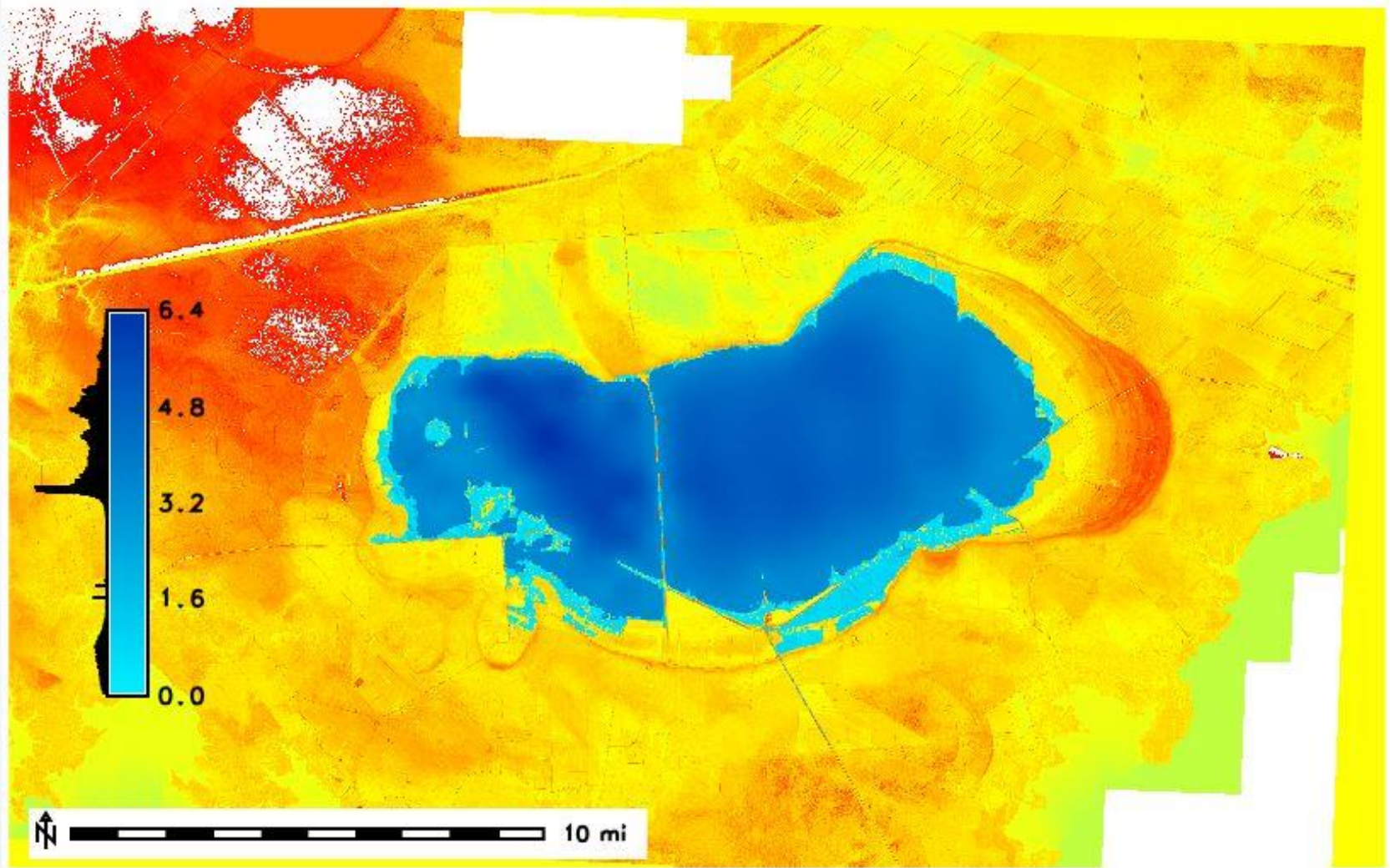
Water Level = 0.7 ft (MSL)



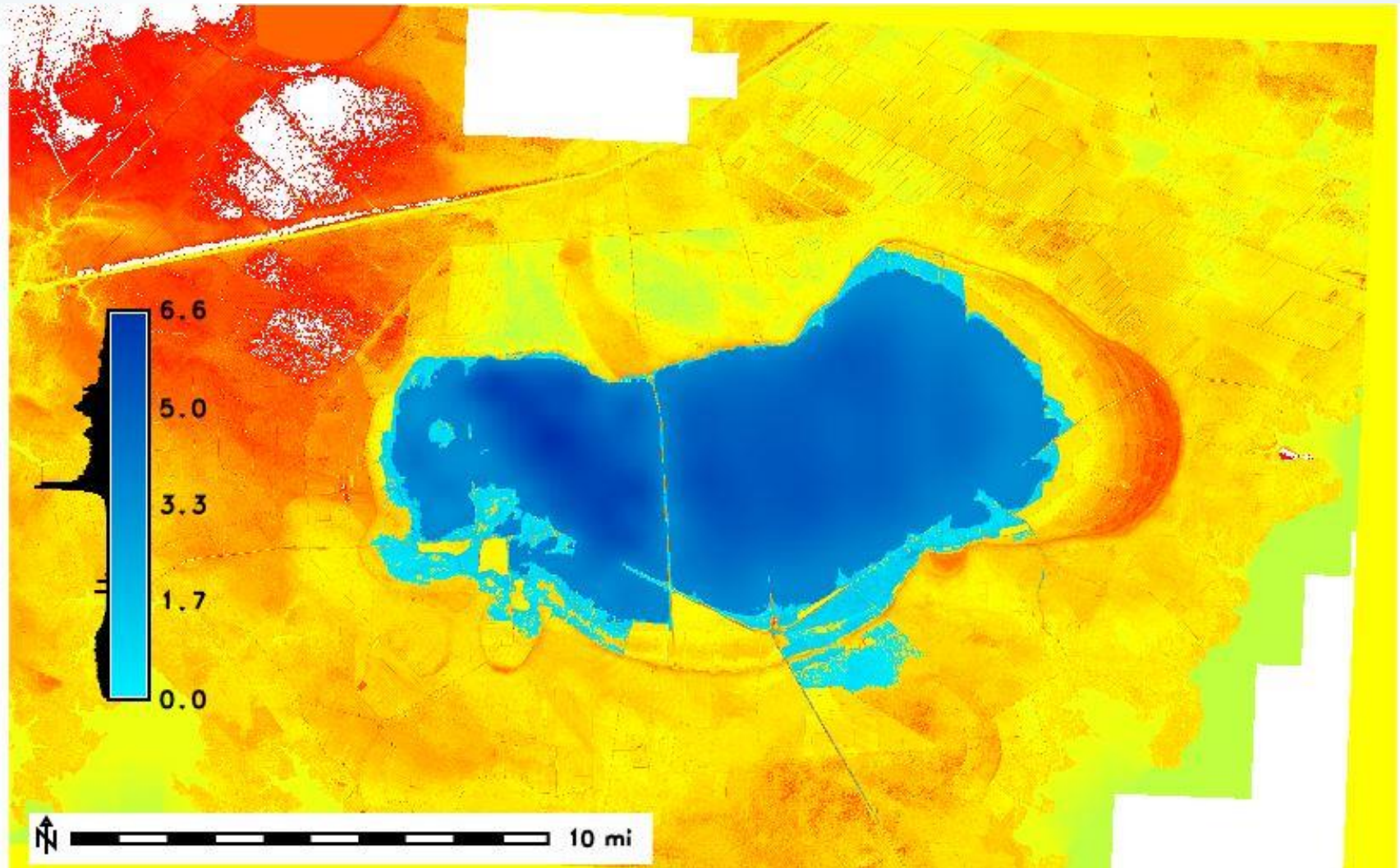
Water Level = 0.9 ft (MSL)



Water Level = 1.1 ft (MSL)



Water Level = 1.3 ft (MSL)



Water Level = 1.5 ft (MSL)

