Lake Mattamuskeet Watershed Restoration Plan

October 16, 2018 Public Meeting
Agenda Overview

7:00 p.m. Welcome
7:05 p.m. Update on Plan Development: Erin Fleckenstein
7:10 p.m. Priority Actions as agreed upon by CST: Michael Flynn
7:20 p.m. Technical Presentations and Research Updates
    - Carp removal study: April Lamb
    - Conditions of outlet canals: Dr. Randall Etheridge
    - Hydrologic modeling of Lake Mattamuskeet: Dr. Randall Etheridge
    - Facilitating active water management: Daniel Brinn
8:10 p.m. Next Steps: Michael Flynn
8:15 p.m. Question and Comment Period: Panel
8:30 p.m. Adjourn
Developing a Watershed Restoration Plan
Concerns about Lake Mattamuskeet

Flooding of Residential and Agricultural Lands
Concerns about Lake Mattamuskeet

Loss of SAV from the Lake by 2017
Concerns about Lake Mattamuskeet

Lake was listed on NC303(d) list of impaired waters in 2016 for elevated levels of pH and chlorophyll-α.
What is a watershed restoration plan?

• A voluntary plan for a specific waterbody
• Identifies pollutants and causes of impairment
• Provides the framework and guidance to restore an impaired waterbody and outlines future action
• Recommends management strategies devised by all stakeholders
• Adaptive plan that can be updated over time
• Once approved, it can be used to secure grant funds for implementation
Key Steps in Developing a Watershed Restoration Plan

Assemble Planning Team

Engage stakeholders and the public in the plan development

Determine Water Quality and Quantity Conditions and Impairments
  • Summarize research on the current status and trends of the lake water quality
  • Capture oral and written history of changes to or improvements in hydrology around the lake

Complete Watershed Characterization

Establish Plan Goals, Objectives and Action Items

Identify Stormwater Reduction or Water Management Techniques

Analyze impact of solutions

Develop Management Plan including priorities and next steps
Major Progress to Date

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  • Summarize research on the current status and trends of the lake water quality
  • Capture oral and written history of changes to or improvements in hydrology around the lake
Complete Watershed Characterization
Establish Plan Goals, Objectives and Action Items
Identify Stormwater Reduction or Water Management Techniques
Analyze impact of solutions
Develop Management Plan including priorities and next steps
Stakeholder Team

Daniel Brinn - Hyde Drainage
Pete Campbell - U.S. Fish and Wildlife Service
Michael “Slim” 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 “Booboo” Topping - Residential Community
Joey Ben Williams - Impoundments
Working with Stakeholders and the Public

5 Public Meetings
13 Stakeholder Meetings
Webpage for updates and comments: nccoast.org/lakemattamuskeet
Press Releases
E-mail update after Public Meetings
Watershed Restoration Plan

DRAFT

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
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).
Actively manage the lake water level:

Minimize flooding of residential, business, and farm properties. Allow for annual drawdowns 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.
Review the Draft Plan

Restoring the Lake Mattamuskeet Watershed

The next Public Meeting for the Lake Mattamuskeet Watershed Restoration Plan is Oct. 16.

Lake Mattamuskeet is a vital part of the Hyde County's amazing natural and cultural heritage. County residents and visitors treasure this natural resource.

However, the lake faces declining water quality and changing lake levels. In order to address these concerns, Hyde County, the N.C. Wildlife Resources Commission, and the U.S. Fish and Wildlife Service have come together to support the development of a watershed restoration plan. In developing this plan, the county and its partners will seek public input to identify issues facing the lake and begin identifying possible management solutions.

When completed, the watershed management plan will explain how the lake should and does function, its current status and health, and identify various practical management options for the lake that help address water quality and flooding issues. These goals, and the actions necessary to achieve them, will be informed by past and ongoing scientific studies as well as local knowledge and experiences.

To work toward identifying management solutions, the North Carolina Coastal Federation will help the county and its partners develop the plan. The federation has previously worked with Hyde County landowners to develop a watershed restoration plan for about 42,000 acres of farmland and wetlands situated north of Engelhard. That plan has worked well in helping to address both drainage and environmental needs for the property owners.

As part of plan development, there will be six quarterly public meetings that will allow the public to discuss long-term solutions. The public meetings will be held in the multipurpose room at the Hyde County Government Complex in Swan Quarter at 7 p.m.

The next public meeting will be held on Oct. 16. Click here to read the agenda.

Upcoming Events

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 16</td>
<td>Public Meeting for Lake Mattamuskeet Watershed Restoration Plan</td>
</tr>
<tr>
<td>Oct 16 @ 7:00 pm - 9:00 pm</td>
<td></td>
</tr>
</tbody>
</table>

View More...

Resources

1. Draft watershed restoration plan
2. Want to get more involved in the planning process? Click here.
3. Draft goals for the watershed restoration plan, updated December 2017
4. Information about the stakeholder group for the watershed restoration plan
5. Timeline of changes to the lake

nccoast.org/lakemattamuskeet
Submit Comments Online

Submit Comments and Subscribe to Lake Mattamuskeet updates

Email

First Name

Last Name

County

Please leave a comment for the watershed restoration planning team here. Please understand that the comments will be provided to the stakeholder team for their consideration. Comments received will not necessarily receive a personal response, but all will be taken into consideration in the development of watershed management strategies for the Lake watershed.

Notes

Submit

In The News

- “Secrets of Lake Mattamuskeet” — NC Science Now | UNC-TV

Additional Resources

- Study Shows New Flap Gates at Lake Mattamuskeet Bring Minimal Water Flow Change — N.C. Wildlife Resources Commission
- Mattamuskeet National Wildlife Refuge Website — U.S. Fish and Wildlife Service
- Updates on current and historic status of the lake’s ecosystem and wildlife — U.S. Fish and Wildlife Service
- Mattamuskeet Foundation

nccoast.org/lakemattamuskeet
Lake Mattamuskeet Watershed Restoration Plan

Priority Actions
Current State of the Lake and Watershed

1. No active management of lake level other than tide gates
   - Flooding of residential property, septic system failures, & inadequate drainage of croplands
2. Turbid and hypereutrophic water (excessive nutrient levels)
   - Frequent phytoplankton & cyanobacteria blooms
3. SAV coverage is absent along lakebed
4. Minimal emergent vegetation
5. Abundance of common carp
6. Listed on NC 303(d) list of impaired waters
   - Chl-α (40 μg/l, AL, NC)
   - pH (8.5, AL, SW)
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-α and pH within federal and state guidelines
Priority Actions

• Create a governing body that provides managing authority and a process for active water management.
• Perform hydrologic study of the watershed.
• Engineer for active water management of the lake watershed.
  ▪ Infrastructure Improvements
  ▪ Additional Outlet Evaluation
  ▪ Potential Sheet Flow Sites
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Potential Sheet Flow Sites

378 acres within watershed

2,477 acres outside watershed

Currently seeking additional sites for evaluation.
Potential Sheet Flow Sites

Benefits include:

- Water quality treatment
- Restoring the natural hydrology
- Reduction of water volume draining to the lake
Lake Mattamuskeet Watershed: Potential Sheet Flow Application Sites

***Currently seeking additional sites for evaluation***
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)
Lake Mattamuskeet Watershed Restoration Plan

Technical Presentations and Research Updates
Evaluating the Feasibility of Common Carp Exclusion and Targeted Vegetation Restoration in Lake Mattamuskeet

April D. Lamb and Jesse R. Fischer
North Carolina State University, Department of Applied Ecology
April D. Lamb
M.S. student in Applied Ecology
NSF Graduate Research Fellow

Dr. Jesse R. Fischer
Assistant Professor in Applied Ecology
Common Carp vs. other "carps"

- **Not** to be confused with **Grass Carp**, which eat living aquatic vegetation
- Or **Crucian Carp**, which are essentially goldfish that have been introduced into systems
- Or **Silver Carp**, **Bighead Carp**, or other Asian “carp” which are invasive in the US

None of these fish are in Lake Mattamuskeet
How do Common Carp impact shallow lakes?

- Affect both “top-down” (predator abundance) and bottom-up (phytoplankton levels) biological processes

  + Turbidity and sediment resuspension
  + Nutrients
  + Blue-Green Algae

  - Macrophytes
  - Sportfish Biomass
  - Benthic Invertebrates
The history of Common Carp in Lake Mattamuskeet

COMMERCIAL CARP REMOVAL AT LAKE MATTAMUSKEET, NORTH CAROLINA

Willie G. Cahoo 1

U. S. Fish and Wildlife Service, New Holland, North Carolina

Lake Mattamuskeet is famous as a National Wildlife Refuge for a wintering concentration of swans, Canada geese and ducks. The 50,000-acre lake is located in Hyde County, North Carolina, seven miles north of Pamlico Sound. Prior to 1915 the lake was an open body of water with no obstructions to mar the surface. The marsh was limited to a narrow band of low flats on the south shore. There was only one small outlet canal draining this vast area.

In 1915 the lake was purchased by a stock company and the largest pumping plant in the world, at that time, was installed. The lake was drained and approximately 20,000 acres were reclaimed for farm lands. Except for short periods, these lands were cultivated until the fall of 1932, when the lake refilled after financial failure of the drainage project.

On October 30, 1934 the Federal Government purchased the lake as a wintering ground for migratory waterfowl. After the refuge was established improvements were begun to manage the area for the purpose desired. More canals were constructed to secure drainage by gravity, not only for the purpose of influencing plant life in the marsh, but also to assist crop production on adjacent private farm lands. An earthen causeway, with five bridges, constructed in 1941-42, more or less divides the lake in halves.

At present, levels are controlled by gates on six canals draining into Pamlico Sound. The lake receives no creek or river drainage, being fed by runoff and agricultural drainage from the surrounding watershed. The open water consists of approximately 30,000 acres, bordered by 20,000 acres of marsh and upland. It is the practice to lower the lake water level during the growing season to expose shorelines as early in the spring as possible for proper growth of native emergent waterfowl food-plants. The number of waterfowl utilizing the area has increased substantially as a result of this drawdown.

Until 1949 the lake water was so turbid that submerged aquatic plants could not exist. Secchi disk visibility in the lake proper was approximately six inches in waters that averaged three feet deep. The salt content of the open lake for the past five years averaged 875 p.p.m. chlorides, or 2.45% sea strength. After the first agricultural drainage the fish population naturally was reduced to a minimum; but, subsequent to the 1932 water rise, there developed a tremendous population of largemouth bass, crappie and white perch, which provided excellent sport-fishing. Since 1937 the lake fishery

1 Appreciation is expressed to W. P. Baldwin, U. S. Fish and Wildlife Service, for assistance in the preparation of this article.
Is removal an option?

- Common Carp removal has been shown to increase water clarity and facilitate the re-emergence of aquatic vegetation.

- **But is this a “one and done” fix?**
  - If not **enough** carp are removed, they may bounce back even stronger, because Common Carp are excellent at surviving and producing offspring.

- A carp management plan is critical to ensuring that population numbers remain at a manageable level.
This project aims to investigate the role of Common Carp in the regime shift observed at Lake Mattamuskeet and assess the feasibility of Common Carp removal as a restoration strategy for submerged aquatic vegetation.
Large-scale Common Carp Removal Experiment
Prototype carp fence (Oct 2017 – March 2018)

- Constructed using galvanized steel cattle panels
- Panels attached using wire connectors and overlaid with chicken wire using zip-ties
- Left standing overwinter to test structural integrity of materials
Site selection

- Location of Pilot
- Rose Bay Canal
Construction the full-scale carp fence
Public notices

• Signs are posted at the Rose Bay Boat Ramp and the Osprey Nest Campground Boat Ramp
• Restricted area signs are placed at each fenced off entrance to the control bay
Carp fence post Hurricane Florence
How many carp are in the bay?

- Simple mark-recapture to estimate population density
- 200 fish captured from outside experimental bay
- Fish were marked via a caudal, or tail, fin clip
- Fish were held for 24 hours before being released in NE, NW, SE, SW corners of the bay
- Then given a 48 hour adjustment period before recapture attempt
Density Estimate

- Three days
- Five electrofishing boats
- Seven WRC biologist from five districts
- 15+ volunteers from NC State, Mattamuskeet NWR, and Pocosin Lakes NWR
- 33 Total hours of “pedal-down” time
Density Estimate - Results

- Length, weight, and DNA sample taken for all individuals
- Using the Lincoln-Peterson Index (left) we estimate there to be **3,200** individuals, or 10/ha, present in the embayment.

<table>
<thead>
<tr>
<th>Day</th>
<th>Effort (hours)</th>
<th>Captures</th>
<th>Average Weight (kg)</th>
<th>Average Length (mm)</th>
<th>Recaptures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.01</td>
<td>78</td>
<td>2.07</td>
<td>538.2</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>11.25</td>
<td>68</td>
<td>2.09</td>
<td>545.0</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>12.22</td>
<td>61</td>
<td>2.13</td>
<td>545.0</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>33.48</td>
<td>207</td>
<td>2.09</td>
<td>542.4</td>
<td>12</td>
</tr>
</tbody>
</table>

\[
\hat{N} = \frac{MC}{R}
\]

N = true population size  M = marked  C = total capture  R = total recaptures
Complications

- 3,200 is a lot of Common Carp
- Electrofishing shown to be **inadequate** for large-scale removal
- Potential complications during sampling
  - Weather conditions (> 90 degree F)
  - Carp are sensitive to sound
  - Difficult to reach all areas of the embayment due to phragmites coverage
• Currently, we’re baiting “carp traps” with deer corn to specifically target Common Carp
  • Two traps to date, but more will be built
  • Only Common Carp and catfish will eat corn
  • Will be modifying to limit corn loss and chance of an encounter from unwanted predators (e.g. alligators)
  • Alternative bait options: dog food, soybean cake
Water Quality Monitoring

- Sampling sites chosen randomly in ArcGIS under given constraints
  - 50 m from documented osprey nests
  - 10 m from shore
- Water samples will be taken monthly and will be analyzed for the following parameters

<table>
<thead>
<tr>
<th>Physical and Chemical Water Quality Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorophyll a</td>
</tr>
<tr>
<td>Total Phosphorous</td>
</tr>
<tr>
<td>Orthophosphorous</td>
</tr>
<tr>
<td>Nitrate</td>
</tr>
<tr>
<td>Nitrite</td>
</tr>
<tr>
<td>Ammonia</td>
</tr>
<tr>
<td>Turbidity</td>
</tr>
<tr>
<td>Suspended Solids</td>
</tr>
<tr>
<td>Temperature</td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
</tr>
<tr>
<td>pH</td>
</tr>
<tr>
<td>Salinity</td>
</tr>
<tr>
<td>Conductivity</td>
</tr>
</tbody>
</table>

Temperature and light attenuation will be measured continuously using Hobo™ data loggers
Vegetation Revegetation Experiment

• Species chosen based on
  • ecosystem value
    • *Vallisneria americana* – Wild celery
  • biological characteristics – increased survival in turbid system
    • *Nymphaea odorata* – White waterlily

• Plots will be fully caged to help vegetation establish easier
  1. Prevents Common Carp from uprooting
  2. Prevents turtles and birds from snacking

• Plant health and growth will be measured monthly using a combination of destructive and non-destructive sampling techniques
Vegetation Restoration Experiment

- 12 total revegetation “clusters”
  - 6 in bay with reduced carp biomass (fence)
  - 6 in control bay (no fence)

- 72 total cages planned with vegetation

- Cages are being built this fall

- Planting will be in early Spring 2019
  - If you’re interested in volunteering to help us transplant and plant vegetation please see me after the meeting.
Vegetation Restoration Experiment
Public Notices

• Additional signage (shown here) will be placed at each vegetation cluster in the control bay

• We kindly ask that people do not interfere or tamper with these plots in any way.
Special thanks to our supporters and collaborators from:

- Funding for this project has been provided by:

  NSF Graduate Research Fellowship Program
  Mattamuskeet National Wildlife Refuge
  USFWS Inventory and Monitoring Fund
  USFWS Migratory Bird Fund
Flow Reduction of Lake Mattamuskeet Outlet Canals

October 16, 2018

Randall Etheridge
East Carolina University
Department of Engineering, Center for Sustainable Energy and Environmental Engineering

In partnership with:
Hyde County Soil & Water Conservation District
Sedimentation

When constructed

Now
Sea Level Rise

When constructed  Now

ECU ENGINEERING
Tide Gates

• Flow occurs only when water level in the lake is above water level in the sound

• Dredging will have minimal impact on when tide gates are open
Goals for study

• Use a model to determine how much sedimentation has reduced the flow in the four outlet canals

• Use a model to determine how much sea level rise has and will continue to reduce flow in the outlet canals

• Simulate the impact of dredging the canals on lake water levels during Hurricane Joaquin (2015) and Hurricane Matthew (2016)
Methods

• Current canal dimensions - surveying
• Original canal dimensions – Drainage Record Book 1 for Outfall and soil probe for others
• Only takes into account portion of canal between tide gate and sound
Methods

• Current canal dimensions - surveying
• Original canal dimensions – Drainage Record Book 1 for Outfall and soil probe for others
• Only takes into account portion of canal between tide gate and sound
Methods

- Current flow rates – acoustic Doppler profiler
- Model: HEC-RAS from U.S. Army Corps of Engineers
- Hurricane simulation: Water balance
Results - Outfall

Maximum flow rate to maintain the water level below 1.5 ft at the tide gate.

<table>
<thead>
<tr>
<th>Downstream Water Level (ft)</th>
<th>Original Canal Dimensions Flow (cfs)</th>
<th>Current Canal Dimensions Flow (cfs)</th>
<th>Sedimentation Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>2230</td>
<td>332</td>
<td>85%</td>
</tr>
<tr>
<td>0</td>
<td>1830</td>
<td>309</td>
<td>83%</td>
</tr>
<tr>
<td>1</td>
<td>1120</td>
<td>217</td>
<td>81%</td>
</tr>
</tbody>
</table>
Sea Level Rise

When constructed  Now
Results - Outfall

49% Reduction in flow due to 2 ft rise in sea level even if canals are dredged

<table>
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<tr>
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</table>
Results – All Canals

- Percent reduction in flow for sedimentation and sea level rise are independent of each other and not additive.
- Dredging the canals will not result in full restoration of flow due to sea level rise.

<table>
<thead>
<tr>
<th>Canal</th>
<th>Original Canal Flow (cfs)</th>
<th>Sedimentation Reduction</th>
<th>2 ft Sea Level Rise Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outfall</td>
<td>2230</td>
<td>85%</td>
<td>49%</td>
</tr>
<tr>
<td>Lake Landing</td>
<td>1260</td>
<td>80%</td>
<td>45%</td>
</tr>
<tr>
<td>Rose Bay</td>
<td>864</td>
<td>66%</td>
<td>48%</td>
</tr>
<tr>
<td>Waupoppin</td>
<td>631</td>
<td>76%</td>
<td>44%</td>
</tr>
</tbody>
</table>
Results – Hurricane Joaquin

The graph shows the water level changes over time. The solid line represents the current situation, while the dotted line indicates the dredged scenario. The x-axis represents the dates from September 30, 2015, to October 30, 2015, and the y-axis indicates the water level in feet (NAVD 88). The graph highlights the impact of Hurricane Joaquin on water levels during the specified period.
Results - Hurricanes

• Hurricane Joaquin – number of days before water level drops below 0.7 ft
  • Current canals: 22 days
  • Simulated dredged canals: 17 days

• Hurricane Matthew – number of days before water level drops below 0.9 ft
  • Current canals: 47 days
  • Simulated dredged canals: 21 days
Summary

• Flow in the canals does not occur when the water level in the sound is higher than the water level in the lake

• Dredging the canals will increase the flow in the four outlet canals

• Dredging the canals could reduce the duration of flooding

• Sea level rise will continue to reduce the flow in the canals whether they are dredged or not
Questions?

Randall Etheridge
etheridgej15@ecu.edu
252-737-1930
The Hydrological Modeling of Lake Mattamuskeet

Raymond Smith$^1$
Randall Etheridge$^{1,2}$
East Carolina University
$^1$Department of Engineering
$^2$Center for Sustainable Energy and Environmental Engineering
Why Model Lake Mattamuskeet?

• Develop an understanding of lake stage level in response to variations in input.

• Provide a resource to support decision-makers and stakeholders in pursuit of watershed restoration goals.

• Provide a resource to explore identified scenarios, management policies, and what-if’s leading to improved water management.
What is a Hydrologic Model?

• A simplification of a real-world system that aids in the understanding, predicting, and managing water resources.

• Hydrologic analyses are performed to quantify the flow rate of water draining from the watershed over time.

Hydrologic Balance of a Lake

Hydrologic Balance of Lake Mattamuskeet
“A Water Budget”

- Precipitation
  - Land-Use
  - Land-Use & Impoundments
- Evaporation
- Basin Drainage Flow
- Tide Gate Flows
- Water Transfer Flow
- Lake Volumetric Change ($\Delta V/\Delta t$)
- Groundwater Exchange
- Reported Stage Level
- Pamlico Sound
Steps of the Modeling Process

1. Articulate the goals
2. Perform appropriate data collection
3. Build and calibrate the model
4. Validate the built model
5. Policy design and evaluation
6. Conduct simulation experiments
7. Analyze results and report findings

Iterative
Preliminary Model Dynamics
(unvalidated model 8/1/2018)

Lake Mattamuskeet - Stage Level (feet)

Hurricane Matthew
October 9-10, 2016
Next Steps

1. Secure research funding resources
2. Enhancement of the model:
   a) Incorporate surrounding land-use types and interactions
   b) Incorporate water transfers *into* and *out of* impoundments
   c) Evaluate impact of wind
   d) Obtain additional observational data
3. Perform model calibration
4. Conduct a rigorous model validation

*Then ...*

5. Study identified scenarios, management policies, and *what-if* questions through experimentation and report findings.
Questions

Raymond Smith

smithraym17@ecu.edu
252-328-9722
Facilitating Active Water Management

Lake Mattamuskeet Watershed

Daniel Brinn
Historic Water Management Activities

• Lake Landing Canal
  – Earliest efforts in 1773, Constructed in 1837

• Hyde County Drainage District #1
  – Public Law 509
  – The creation of the Mattamuskeet Drainage District set in motion a plan that eventually drained Lake Mattamuskeet three times—in 1916, 1920 and in 1926.

• Rose Bay Canal
The Need for Active Management

• Preserving the way of life within the watershed
• Water Quantity issues
• Water Quality concerns
Making it Happen

- Plan
- Engineering
- Infrastructure
- Funding
- Continued Operation
Establishing a Service District for the Lake Mattamuskeet Watershed

- NCGS 153
- Process
- Boundaries
- Responsibilities
- Governance
- Funding
Lake Mattamuskeet Watershed Restoration Plan

Next Steps
Next Steps

- Review the Draft Plan at nccoast.org/lakemattamuskeet
- Please submit comments by Friday, November 2
- Incorporate feedback
- Finalize the plan by the end of November
- Public Symposium on December 3, 2018 at Martelle’s Feed House in Engelhard
- Initiate implementation of management actions and BMPs
Questions and Comments