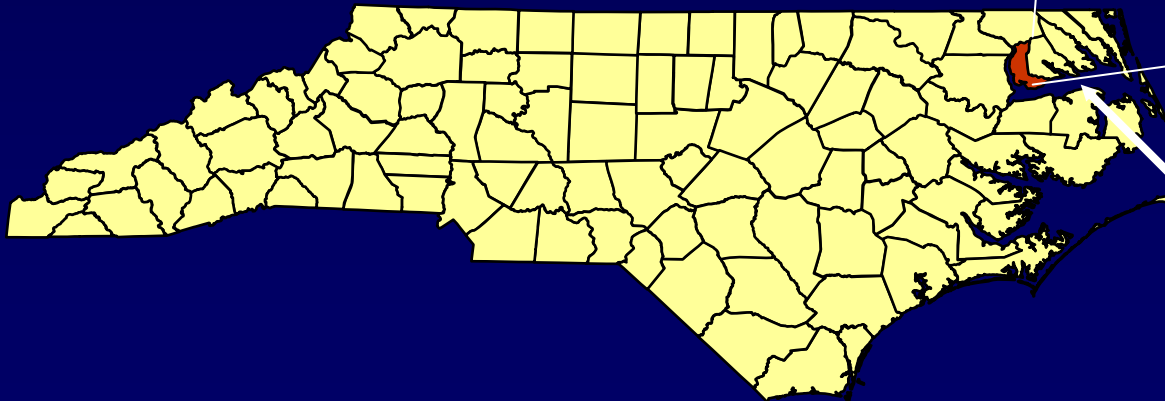


Golf Course Project Chowan (Cho-wahn) County

- Population 14,382.
Edenton 5,359.
- Agribusiness, marine fisheries, and light manufacturing.
- 35,000 tourist/year.
- Chowan River/Albemarle Sound



Albemarle Sound Estuary

Chowan County Golf Course





Chowan Golf Club Drainage Outlets Pre- BMP Project





Chowan Golf Course
Built early 40s,
Military base



Chowan Golf Course Drainage Problems August 2001.

Chowan River/Albemarle Sound Summer 1972



Recurring Blooms in 1976 and 1978



The Atlantic
Division of Environmental Management

ESTIMATED ANNUAL NITROGEN LOAD EXERCISED AT NEW BURN

This picture illustrates the nutrient load exerted on the waterway in the New Burn area. The water is green and the vegetation is dense.

Source	Load (kg/day)	Percentage
Point Sources	1,000,000	20%
Non-Point Sources	4,000,000	80%
Total	5,000,000	100%

TOTAL NITROGEN

TOTAL PHOSPHORUS

*Based on data from the Department of Environmental Management, New Burn area.

Nutrients: too much of a good thing

By Steve Bunn
1/15/94

But it's not just the amount of nutrients that's the problem. It's the timing. The waterways in the New Burn area are flooded for most of the year. This means that the nutrients that are washed into the waterways are not being used by the plants and animals that live there. Instead, they are being carried down the waterway to the ocean. This is where they can cause the most damage.

The waterways in the New Burn area are also being used for agriculture. This means that there is a lot of fertilizer being used. This fertilizer is being washed into the waterways, where it can cause the same damage as the nutrients from the sewage treatment plant.

The Department of Environmental Management is working to reduce the amount of nutrients that are being washed into the waterways. This is being done by installing a nutrient management plan for the agriculture in the area. This plan will help to reduce the amount of fertilizer that is used, and will also help to reduce the amount of nutrients that are washed into the waterways.

The Department of Environmental Management is also working to improve the sewage treatment plant. This will help to reduce the amount of nutrients that are being discharged into the waterways. This is being done by installing a new treatment stage, which will help to remove more of the nutrients from the sewage.

The Department of Environmental Management is also working to improve the waterways. This is being done by installing a new waterway, which will help to reduce the amount of nutrients that are being washed into the waterways. This is being done by installing a new waterway, which will help to reduce the amount of nutrients that are being washed into the waterways.

Objectives of Chowan Golf Club Water Quality Improvement Project

- Improve drainage and playability of course
- Provide storm water storage and retention
- Nutrient reduction through use of nutrient management
 -
- Create buffers and constructed wetlands along and within drainage network and protect with conservation easement
- Improve overall management of fertilizers, chemicals, and water (irrigation)

Partners



Chowan Golf Course Project Partnership

- Albemarle RC&D – project and grant coordination
- NRCS – design technical assistance
- CES – design, monitoring and evaluation
- Country Club – donated land and agreed to constraints of conservation easements, 20% BMP
- County – Legal and administrative support
- NC Clean Water Management Trust Fund \$417K for WQ BMPs
- 319 provided \$127K for monitoring

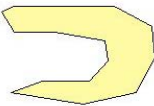


Identifying Locations for Constructed Wetlands





Wetland Creation
in Pond



Wetland Creation



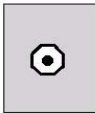
Pond



Bridge



Water Control
Structure



Observing playability of proposed wetland locations



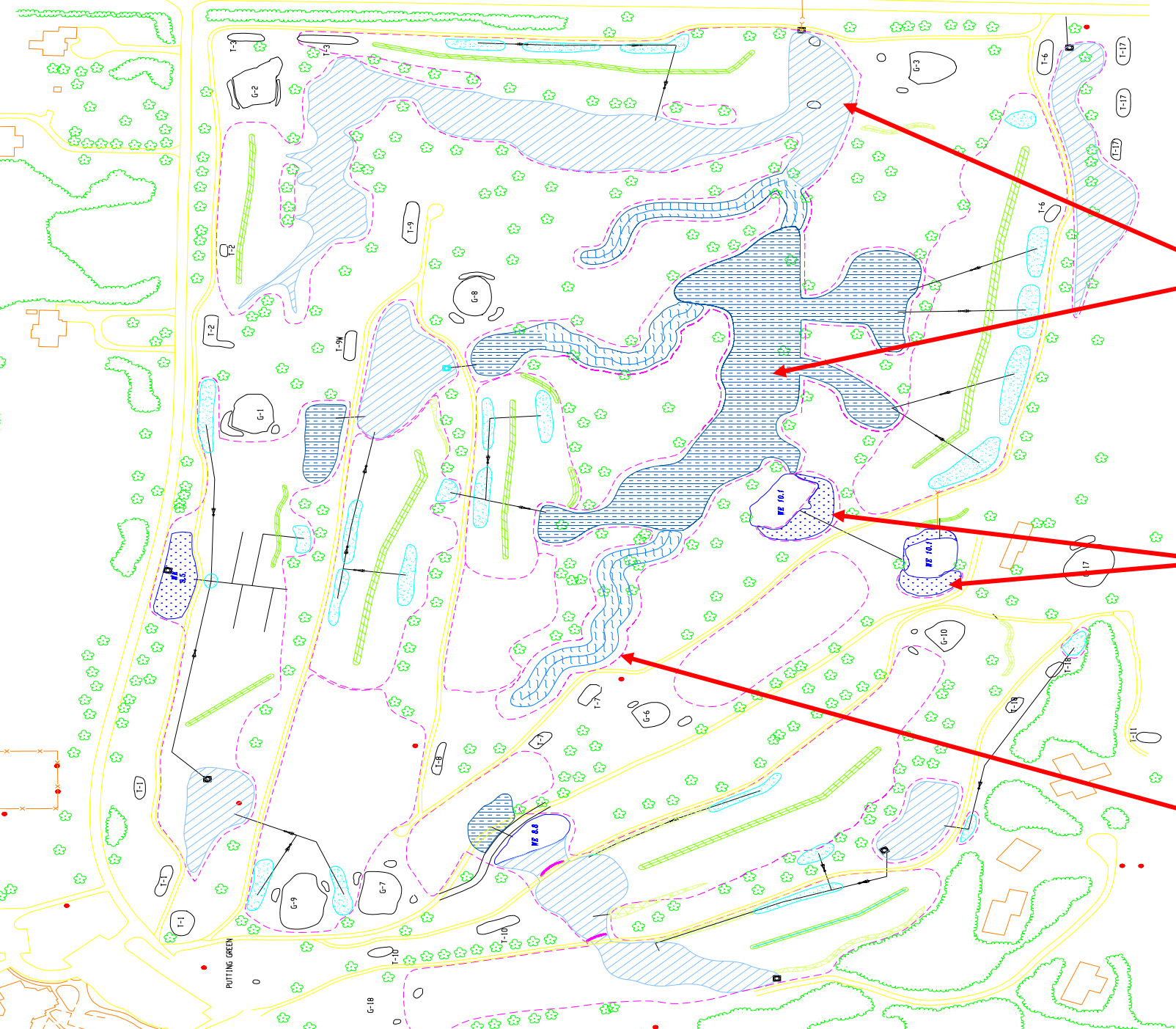


**Hinson and Evans
evaluate soils and
location of water table
to determine potential
for holding water in
the proposed
wetlands. (August 02)**



Design Objectives and Procedures

- Improve drainage and playability of course
- Peak and total discharge to less than existing
- Minimize earth moving
- Balance cut and fill
- Achieve contract wetland¹ conservation easement area
- Detention designed for 3-7 day draw downs
- 2-8'' normal pool depths, 1-2' channels
- Incorporate natural channel design into drainage network



Design Schematic

detention wetlands

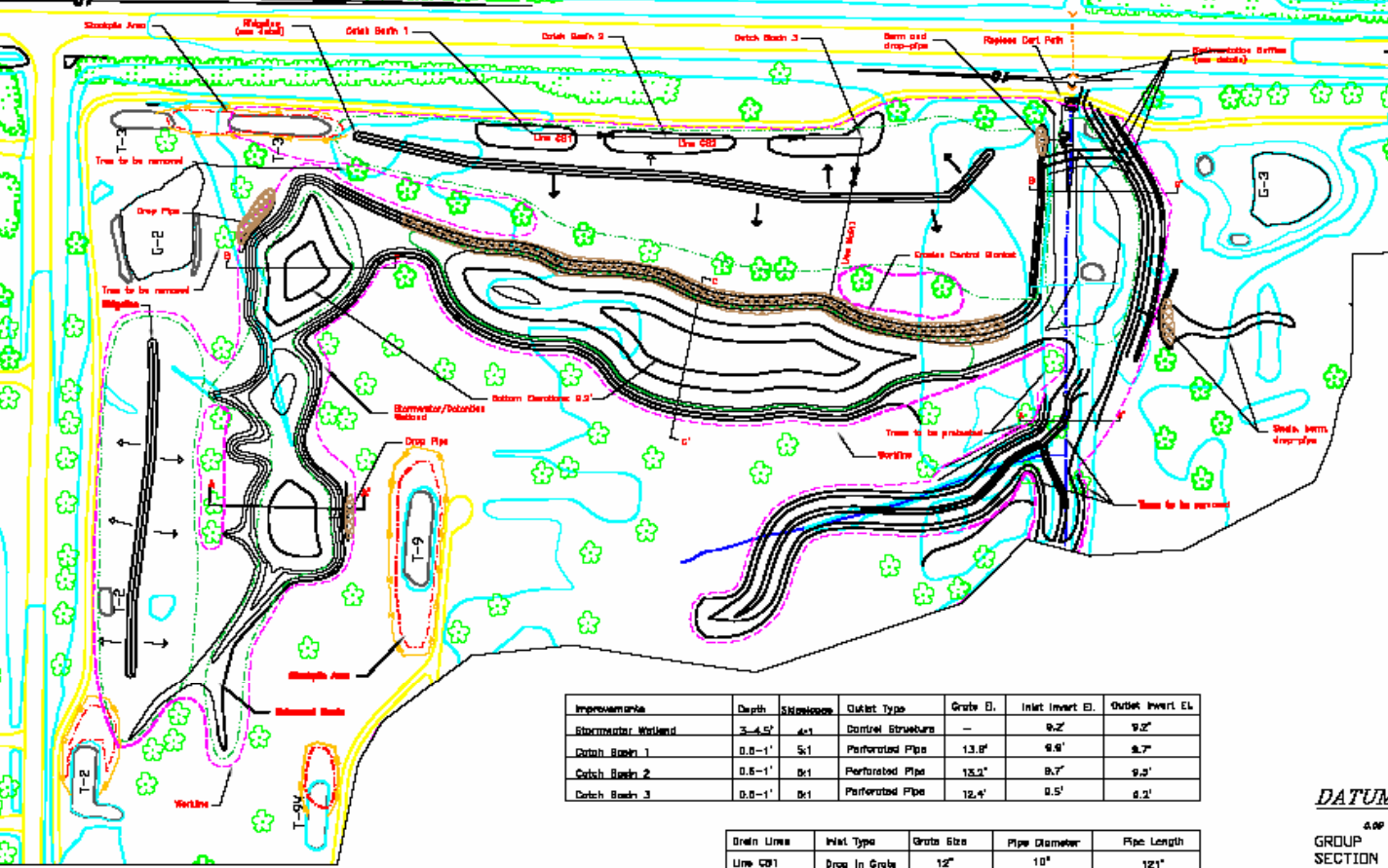
enhanced ponds

Natural channels



Planning meetings with local Board and County Manager





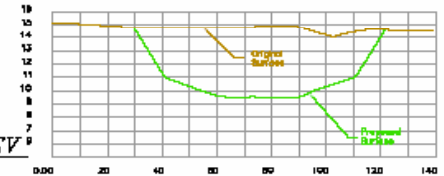
- MAP LEGEND**
- Located Pole
 - Culvert
 - Fence
 - 47 + Control Point
 - 763.55
 - Existing Catch Basin
 - Tree
 - Shrub
 - Sign
 - Woods
 - Toss
 - Sand Trap
 - Drains
 - Approx. Contour
 - Drain Lines
 - Water Control Structure
 - Workline/Disturbance Limits
 - Topsoil Strip and Replant
 - Silt Fence



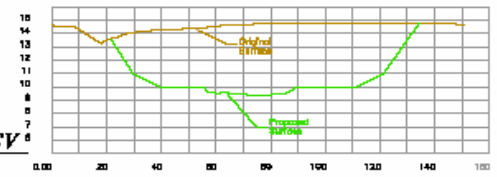
SPECIAL GRADING NOTE:
 The soils at the designated wetland bottom elevations for these holes may not be suitable to limit vertical seepage and support wetland hydrology in some locations. If this is found this to be the case, excavate an additional six inches below the designated depth, and replace with suitable soil as directed by the Project Engineer.

Improvement	Depth	Structure	Outlet Type	Grate E.	Inlet Invert E.	Outlet Invert E.
Stormwater Workland	3'-6.5'	4x1	Control Structure	—	9.2'	9.2'
Outlet Basin 1	0.8'-1'	S1	Perforated Pipe	13.6'	9.6'	9.7'
Outlet Basin 2	0.8'-1'	B1	Perforated Pipe	15.2'	9.7'	9.3'
Outlet Basin 3	0.8'-1'	B1	Perforated Pipe	12.4'	9.5'	9.2'

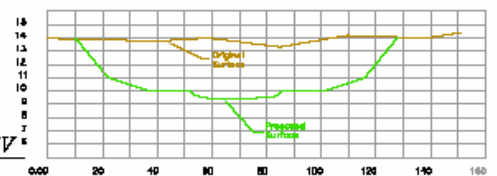
Drain Lines	Inlet Type	Grate Size	Pipe Diameter	Pipe Length
Line CB1	Drop In Grate	12"	10"	121'
Line CB2	Drop In Grate	12"	10"	176'
Line M-1	Drop In Grate	12"	12"	236'
Drop Pipes (4)			12"	30' each



GROUP SECTION A-W



GROUP SECTION 1-1'



GROUP SECTION A-W

NOTES
 The locations and extent of improvements shown are approximate. Exact locations and line of disturbance will be identified and marked by the Project Engineer prior to construction.

All trees not marked for removal shall be protected from impacts due to traffic and construction activities. Replacements for any damage to existing trees as a result of the reconstruction activities shall be the responsibility of the contractor.

Proposed contouring is shown for information only. Erosion improvements and grade regrade to the depth, slope, and grades indicated, and as stated and directed by the Project Engineer.

Strip and stockpile topsoil from indicated areas for replacement and fine grading. All weeds should be removed to a depth 4-6 inches below the finished surface to allow for seed replacement.

Stockpile all suitable dense soil in the indicated stockpile areas and as directed by the Project Engineer. Surround any stockpile areas with silt fence to prevent sediment transport.

All drain pipe shown for this hole, unless otherwise indicated, shall be perforated high density polyethylene (HDPE).

All drain pipe shall be installed according to the attached details and to the manufacturer's recommendations. Install with recommended drain sock or filter cloth. Outlets of all drop pipes shall be protected with 10 feet of solid PVC sleeve and an animal guard.

Drop in grates and drain basins shall meet the specifications and approvals of AIS. All grate products of the same size, type, joints, couplings, or other items shall be produced by the same manufacturer and installed according to manufacturer's specifications.

Ridge lines shall be crowned and graded at a 1-2% slope to facilitate surface drainage in directions indicated.

Water control structures will be manufactured and delivered to the site by Cohoon Bros. Install according to standard procedures and as directed by the Project Engineer.

DATUM ELEV

GROUP SECTION A-W

DATUM ELEV

GROUP SECTION A-W



Surveying and layout for constructed wetland cell.

A photograph showing the early stages of wetland construction. In the foreground, there is a muddy, excavated area with several small, shallow pools of water. A yellow front loader is parked on the left side of the site. In the background, there are several houses and a line of tall pine trees under a clear sky. The ground is uneven and appears to be recently worked.

**Early construction of wetland on number 18
Construction began March, 2004**



Construction of number 6 wetland

A photograph showing a downstream view of a completed wetland. The foreground is dominated by a wide, muddy path with distinct tire tracks, leading towards a large, shallow body of water. The water is murky and reflects the overcast sky. In the background, there is a line of trees, some of which are bare, and a few vehicles, including a red car and a yellow tractor, are visible on a dirt road. The overall scene suggests a recently completed construction or restoration project in a natural setting.

Downstream view of completed number 6 wetland

A photograph showing a natural channel section connecting wetland areas. The channel is a narrow, winding stream of water flowing through a sandy and gravelly landscape. The banks are composed of light-colored sand and gravel, with some darker, possibly organic material visible in the water. The surrounding area is a mix of open, sandy ground and clusters of tall, thin trees, likely pines, with green foliage. The sky is clear and blue. The overall scene depicts a natural waterway in a semi-undisturbed or recently restored wetland environment.

**Natural channel section connecting
number 2 wetland to number 3 wetland**



**Completed number 8 wetland with
natural channel section.**



Top soil was removed, stockpiled and replaced in the bottom of all wetlands to provide good growth media for plants.



Top soil spread in bottom of number 9 wetland.





**About half of the plants
planted in the constructed
wetland cells were
transplanted from nearby
agricultural ditches.**



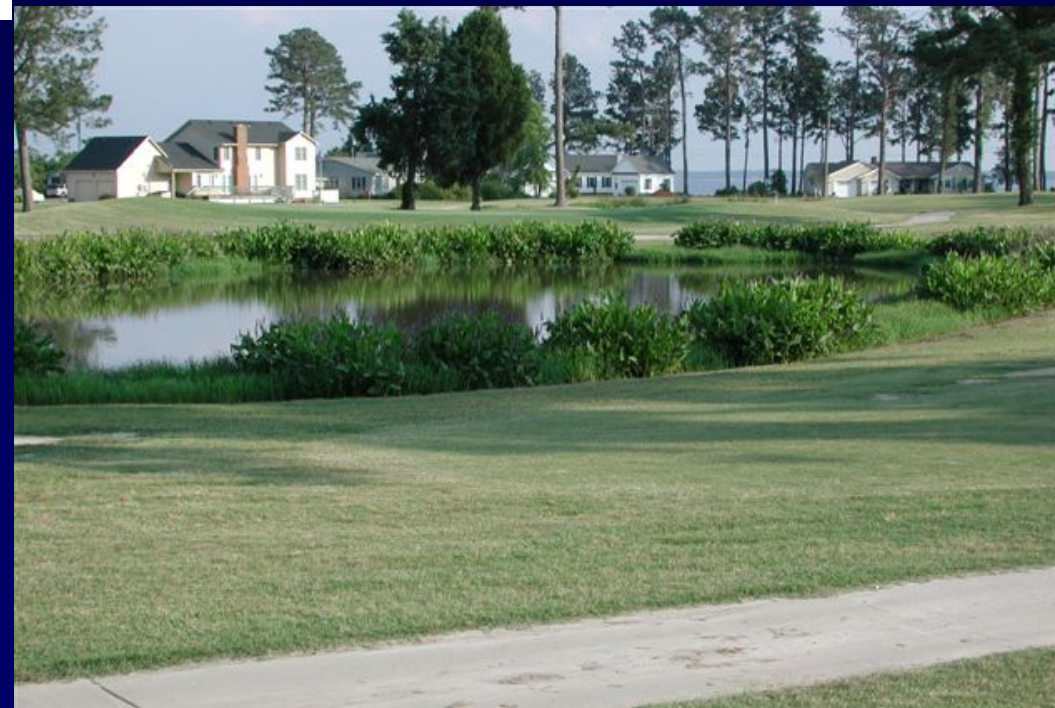
3 weeks after planting, June 2004



September 2004



June 2005





October, 2005

Perpetual Conservation Easement

- Pesticide, nutrient, irrigation and drainage management plan developed by NRCS and CES
- Management plan is condition of permanent conservation easement protecting 26 acres of constructed wetlands and riparian zones
- Conservation easement held by County. Modifications must be approved by county commissioners upon recommendation of county NRCS and CES.



Improved playing areas



Unimproved playing areas



Objectives of 319 Monitoring Project

- Demonstrate practicality of incorporating characteristics of natural stream and wetland systems into golf course design and water management. ■
- Monitor and evaluate hydrology and water quality treatment effectiveness of storm water wetlands and riparian buffer BMPs.



**Background monitoring at
the 4 outlet stations with
automatic samplers
installed July, 03**





**10 monitoring stations
with automatic
samplers and stage
recorders after
construction**

**Automatic sampler:
time based sample
only when flow**

Stage Recorder





Number 9 fairway two weeks after sprigging



One week after planting (early June, 2004)



September 2004

Catch Basins: Inflow to Wetlands



- The remaining discussion included data slides for research in progress. These data have been removed and are not being distributed until the data have been reviewed and published.









V-notch weir



3



Runoff being stored soon after hurricane charley. Note the are in the picture center is not normally ponded. Over 1 inch of runoff can be stored in the wetlands.



Temporary storage
during 3.5 inch storm



A photograph of a wetland area. In the foreground, there is a dense patch of tall, green grasses. A corrugated metal barrel is partially visible among the grasses. The background shows a well-maintained golf course with several large, mature trees. In the distance, a white car and a white van are parked near a building. The sky is clear and blue.

Number 1 tee wetland, August 2004

Number 1 fairway wetland



Number 3 wetland (main outlet)



Special Inside: Handy Pull-Out on Pesticide Storage



NORTH CAROLINA
Turfgrass

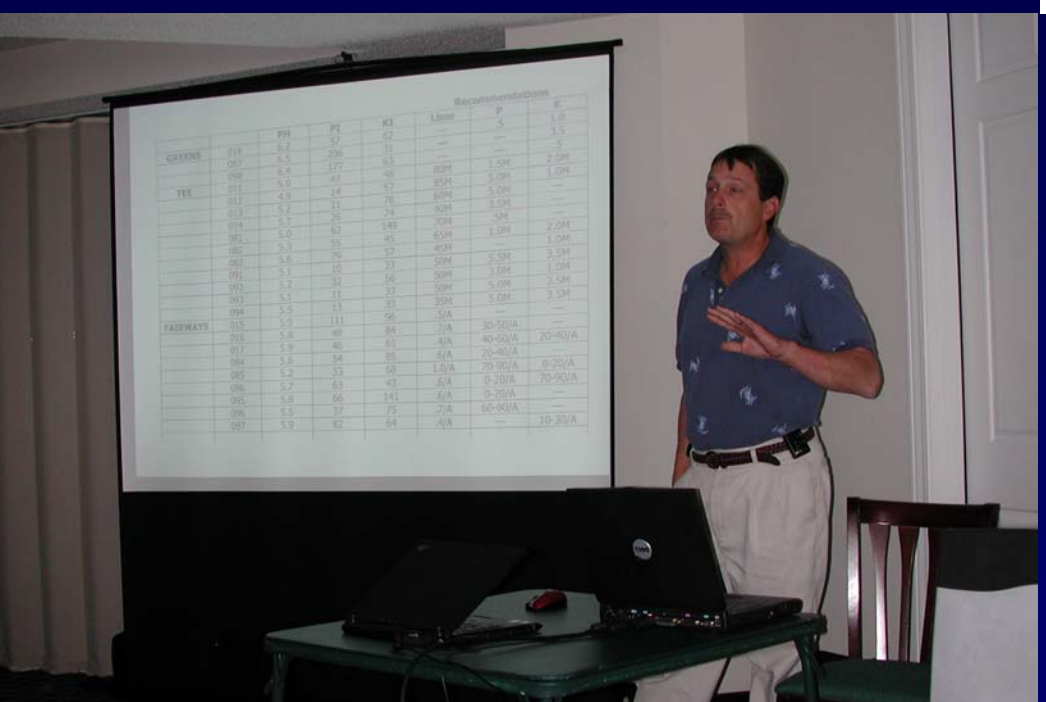
January/February 2005

A Publication of the Turfgrass Council of North Carolina

**Water-Quality Project
Pays BIG Dividends at
Chowan Country Club**



Northeast Superintendents Workshop



Questions

