

**CONSERVATION INNOVATION GRANTS  
Final Report**

<b>Grantee Name:</b>	
<b>Project Title:</b> Innovative Drainage Water Management in North Carolina	
<b>Project Director:</b> R. Wayne Skaggs	
<b>Contact Information:</b> Department of Biological and Agricultural Engineering North Carolina State University Box 7625 Raleigh, NC 27695-7625	<b>Phone Number:</b> (919) 515-7625 <b>E-Mail:</b> skaggs@eos.ncsu.edu
<b>Period Covered by Report:</b> October 1, 2007 through May 15, 2012	
<b>Project End Date:</b> May 15, 2012 (with extension)	

**Summarize the work performed during the project period covered by this report:**

Management and data collection commenced and ended on the three field demonstration sites. The data collection ceased on September 30, 2010 in fulfillment on the grant requirements for the original three year time period. The first site located at the Tidewater Research Station (TRS) in Washington County, North Carolina has been continuously monitored for flow data, water table data, and yield information. Three crops were grown at this site during the grant period, corn, wheat, and soybean. Controlled drainage was set at 50 cm below soil surface.

The second demonstration site, using open ditch systems, on the Poole Farm in Beaufort County, NC, was continuously monitored for water table depth since the summer of 2008. Flow monitoring stations were set up on the site and data acquisition started on March 30, 2009. Grab samples of drainage outflow and shallow ground water are being collected. New instrumentation was installed at this site to facilitate the collection of flow proportional water quality samples. The site had ditch maintenance procedures and final surface grading in April 2010 to eliminated low areas that exist due to surface settling from the initial grading two years ago. Two corn crops and one soybean crop was harvested at this site during the project.

The third field demonstration site utilized in line control structures on subsurface tile lines. The site is located on Eric Pierce's farm in Farmville, NC. Four Agri-Drain structures were installed on the site. There are four field plots on the farm. Two were managed in controlled drainage and two in conventional drainage. Flow monitoring equipment has been installed at the site. The site was planted to kenaf in June 2009 and 2010 and the control level was set at 50 cm below soil surface. This site doesn't have any automated water quality sampling equipment. Water quality samples are collected as grab samples taken from the outlets of the mains. However, due to limited rainfall during the

grant period, there were only a few samples from this site. Yield data were collected from this site, but not reported. Kenaf was an experimental crop in North Carolina and was not part of the cropping sequence that was promised when the producer's site was selected. The site was used during the study as a demonstration site for the inline control structures and field day visits. Figure 1, shows the locations of the demonstration sites utilized during the grant period. Figure 2, 3, and 4 shows the infrastructure layout at TRS, BATH, and Pierce demonstration sites, respectively.

Figure 1. Location of demonstration sites.

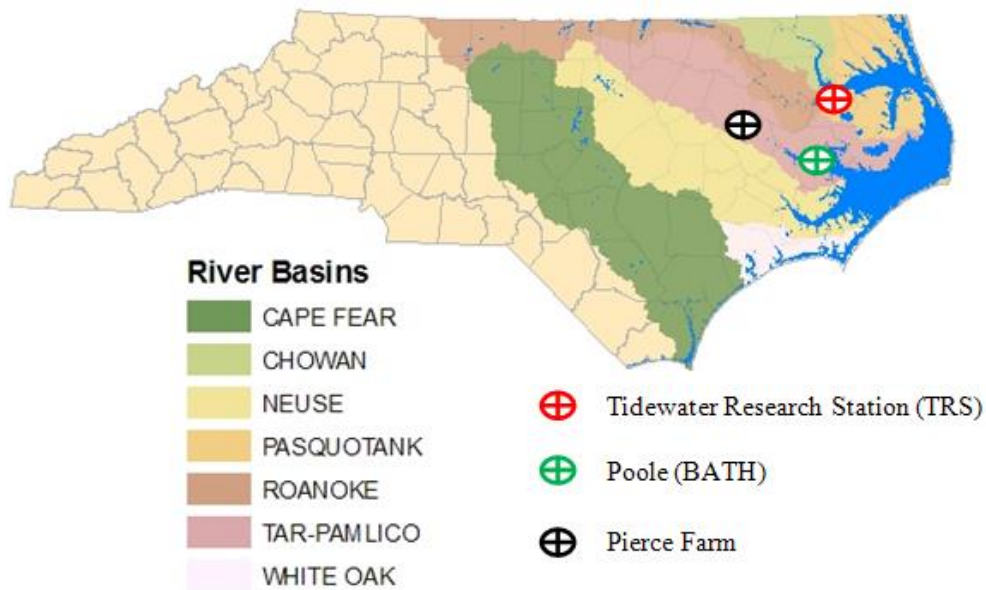
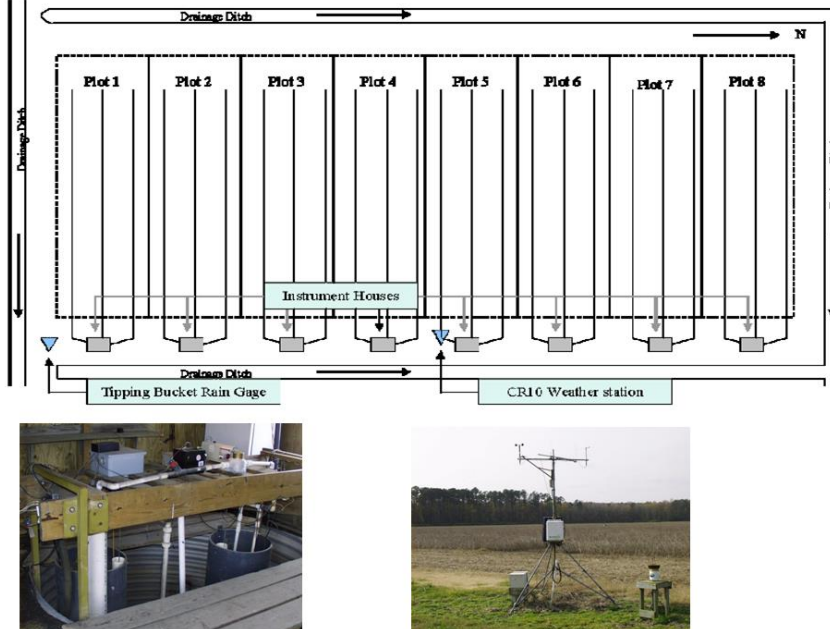
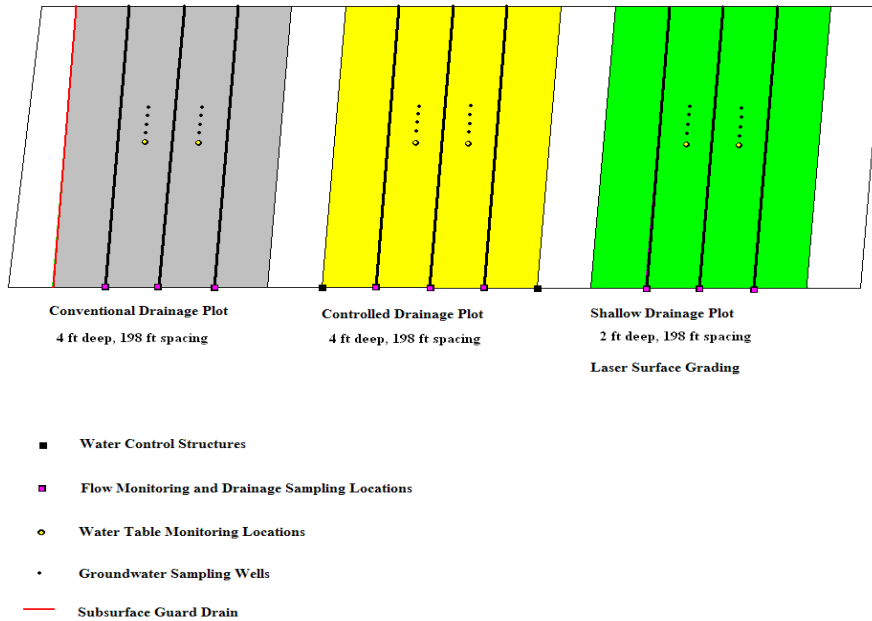


Figure 2. Layout at TRS



**Figure 3. Layout at BATH**



**Figure 4. Layout at Pierce**

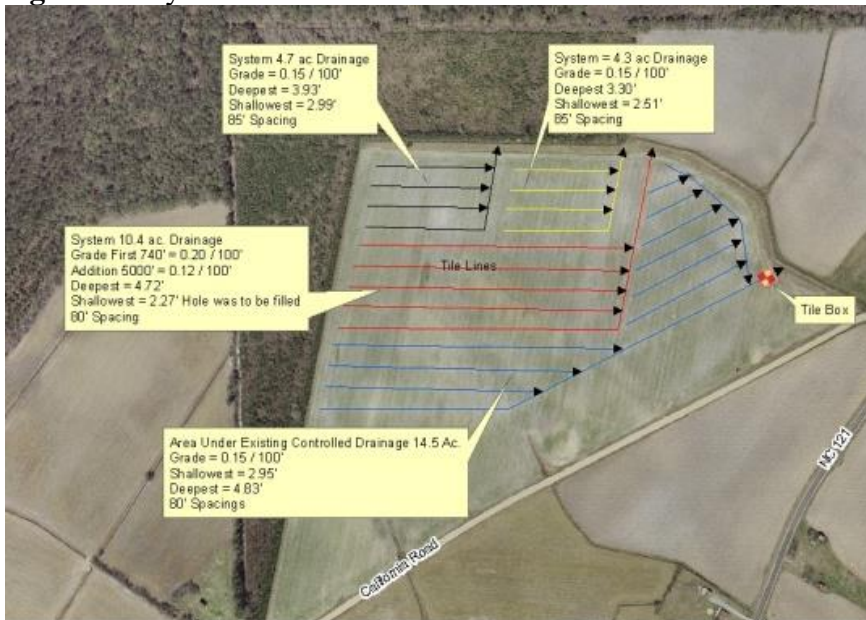


Table 1 below, summarizes the yield and rainfall data collected from the research site between 2008 and 2010. Table 2 gives the water table elevations for each crop growing season. Although, the water table was slightly higher in all but one of the crop seasons for controlled drainage the difference is small. This likely implies that crop yield impacts maybe tied to the timing of rainfall events during the growing season. There was a net 10% yield increase in the three corn crops and a 4.5% yield increase in two soybeans crops. There was a slight decrease in wheat yields with the one harvested crop at the Tidewater Research station, but the difference was less than one bushel per acre. The highest yield increases occurred in years with below normal precipitation.

**Table 1.** Crop Yields and Rainfall from TRS and BATH

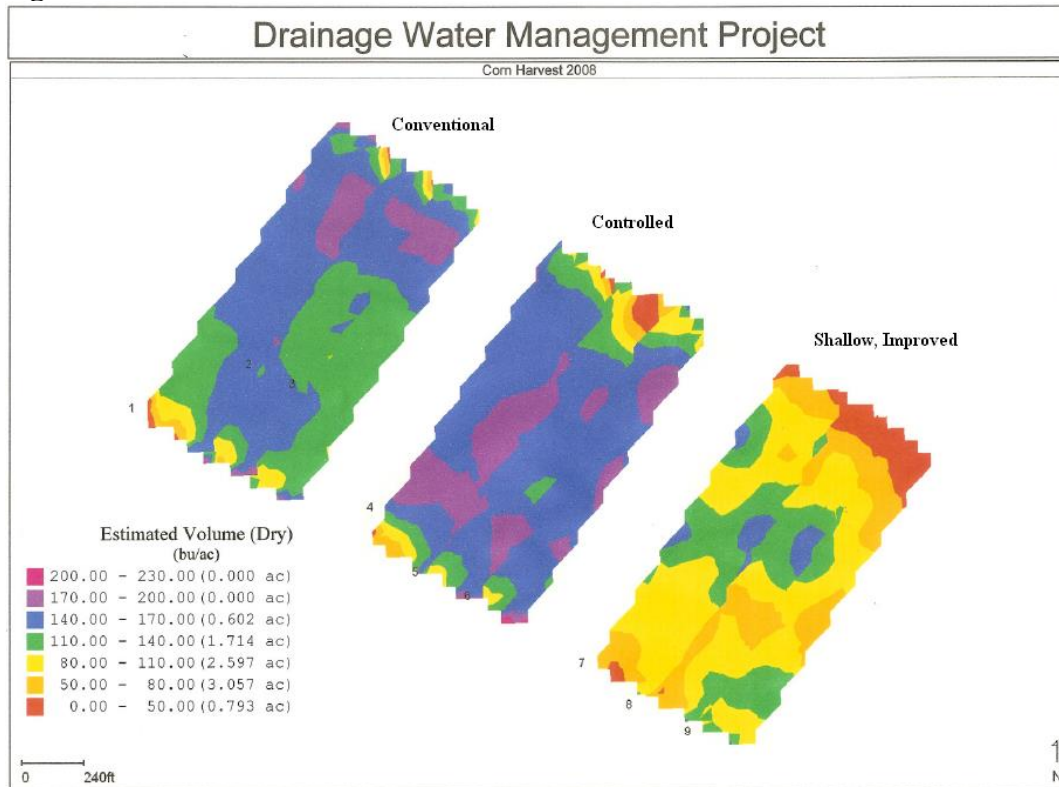
Crop	Year	Location	FD Yield (Mg/ha)	CD Yield (Mg/ha)	FD Yield (bu/ac)	CD Yield (bu/ac)	% Yield Increase	Rain (mm)	Long-term Average	Difference (mm)
									Rain (mm)	
Corn	2008	BATH	9.15	9.60	145.5	152.6	4.9	342.6	538	-195.4
Corn	2009	TRS	8.81	9.16	140.1	145.6	3.9	645.4	538	107.4
Corn	2010	BATH	6.57	8.08	104.5	128.4	22.9	414.4	538	-123.6
		AVG	8.18	8.94	130.0	142.2	10.6			
Wheat	2008	TRS	3.48	3.42	51.7	50.8	-1.9	422.0	587	-165.0
		AVG	3.48	3.42	51.7	50.8	-1.9			
Soybeans	2008	TRS	2.88	3.08	42.8	45.7	6.8	350.0	515	-165.0
Soybeans	2009	BATH	3.39	3.46	50.3	51.4	2.2	835.0	515	320.0
		AVG	3.14	3.27	46.5	48.5	4.5			

**Table 2.** Water Table Elevation Data during the cropping seasons

Crop	Year	Location	Average Conventional	Average Controlled	Net Change
			WT (cm)	WT (cm)	
Corn	2008	BATH	-1.68	-1.66	-0.02
Corn	2009	TRS	-0.71	-0.64	-0.07
Corn	2010	BATH	-1.42	-1.45	0.03
Wheat	2008	TRS	-0.91	-0.83	-0.08
Soybeans	2008	TRS	-0.72	-0.69	-0.03
Soybeans	2009	BATH	-1	-0.83	-0.17

Figure 5 is a yield map produced from the corn harvest at the BATH demonstration site in 2008 that was utilized to promote drainage water management at various field days throughout the project.

**Figure 5.** GPS Yield Data from the treatments at the BATH Demonstration Site.



### Installation of In-Line Control Structures by Soil and Water Conservation

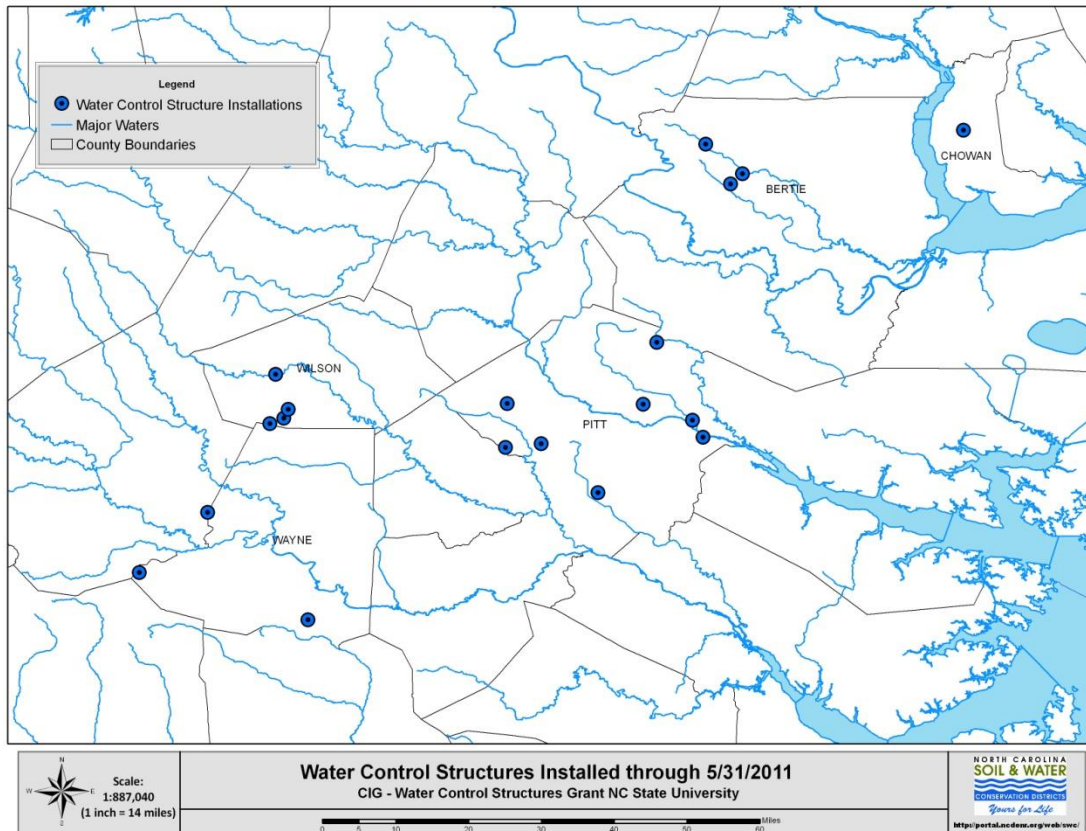
The NCDENR Division of Soil and Water Conservation directed the installation of 19 control structures on subsurface drains (tiles or drain tubes). The contract period for the grant was extended to allow the Division of Soil and Water Conservation to contract more of the structures within the state.

Two additional systems slated for Wilson County were not installed due to the death of the owner of the farm. The heirs were unable to continue with the contract. Figure 4 below is a map showing all the in-line control structures that have been installed. Below are the realized effects of the SWCS portion for the entire grant period:

<b>Acres Affected</b>	<b>525</b>	<b>Acre</b>
<b>Nitrogen Saved</b>	<b>11,035</b>	<b>Pounds</b>
<b>Phosphorus Saved</b>	<b>984</b>	<b>Pounds</b>
<b>Soil Saved</b>	<b>220</b>	<b>Tons</b>



**Figure 6.** Locations of SWCS in-line control structure installations during the grant period.



## Extension and Outreach Activities

A brochure highlighting drainage water management and the on-line advisory system was designed, printed, and distributed at all the field days discussed below. Furthermore, the brochures were delivered to multiple soil and water extension offices in NC to be distributed to producers. A copy of the brochure is at the end of this report.

This project featured multiple field days during the grant period. A field day in December of 2008 was used to introduce the project to NRCS agents, extension agents, Certified Crop Advisors, and producers from throughout the eastern part of the state. Presentations were given to explain the water management systems available to them, the management scenario of each system, the purposes of the demonstration sites, and the goal to develop the online-advisory system and a history of the yield data that was available for the area. The field day was utilized along with a brochure to help the DSWC and the NC State group to identify cooperating producers for the creation and implementation process of the online-advisory. Over 73 individuals attended the field day on Dec. 16, 2008. The event included a morning session in which presenters from NCSU and DSWC offered information on Drainage Water Management issues relevant to NC producers. There was also an afternoon session where attendees visited several producer operated sites near Plymouth, NC and the demonstration site at the Tidewater Research Station.

The project was featured in four outreach events in July and August of 2009. The first event was a Corn Field Day & Tour conducted on July 28 by the Beaufort County Cooperative Extension Center. The Poole Farm demonstration site was featured and topics including drainage system design, yield benefits of drainage water management, and laser leveling affects on soils compaction were discussed by Dr. Wayne Skaggs, Chad Poole, and Alan Meijer. The event was attended by 55 people. On July 29, Chad Poole made a presentation about Drainage Water Management and the Online Drainage Water Management Advisory at the Certified Crop Advisors training session in Burgaw, NC. Four people attended this training session. Chad Poole made a presentation on the Drainage Water Management and the Advisory System on the Pamlico-Craven Farm Tour on July 30. This presentation was made on the farm of Owen Peele, who is a cooperating producer with the advisory. This event was attended by 76 participants. On August 12, Chad Poole made a classroom presentation about the Drainage Water Management Project and the Advisory System at the Northeast Ag Expo Field Day in Camden County. The attendance at this event was 122.

The project was featured at the Agricultural Drainage Management Field Day on December 14, 2009. This field day was attended by over 75 producers, agents, and crop consultants from throughout Eastern North Carolina. Speakers from North Carolina State University and the NCDENR Division of Soil and Water Conservation gave talks on crop yield and water quality benefits of agricultural drainage management, cost share programs, water reuse and recycling efforts, irrigation, land shaping and ditch depth alternatives. The field day also had an open-forum farmer panel that was a huge success. Producers that had participated in the advisory took part in the panel and discussed their experiences with controlled drainage and the advisory system. Three farm visits were included on the field day tour. One of those visits was on the Poole Farm in Bath, North Carolina. The second event in early 2010 was the Pamlico-Craven winter meeting. The project and the benefits of controlled drainage and the online advisory were highlighted at this meeting which was attended by over 65 participants.

The final producer outreach event during the grant period was the Blacklands Farm Managers tour on August 4, 2010 held at the Tidewater Research Station in Washington County, NC. This field day was attended by over 290 producers, agents, and crop consultants from throughout Eastern North Carolina. Speakers from North Carolina State University and the Tidewater Research Station gave presentations on the various projects that have been initiated at the station. The on-line web advisory and the TRS water management demonstration site was a stop on the tour. The yield information, water conservation, and water quality information collected from the demonstration sites were presented to the groups. The on-line advisory system was also discussed and highlighted.

### **On-line Web Advisory**

The web-site that has been developed served as the host-site for the water-management online advisory. The site has been designed to serve as a home page for individual producers on their personal computers. The primary objective of the new site was to promote the benefits of drainage water management. In addition to promoting conservation, the page has links for producers to relevant agricultural resources. The

idea was to develop a site that would be utilized for producers as a home page that contains pertinent information used by them on a day to day basis as a draw for continual use of the site. Important information to producers, such as the Chicago Board of Trade, local commodity prices, weather, and news was made available to them on the web-page. By including this information on the web page, we increased producer participation in the online advisory system on a routine basis.

General recommendations on riser management were uploaded to the site as the initial part of the online-advisory system. The current system allows cooperators to log into their accounts and specify the location of their water management structure as well as relevant information necessary to run a site specific DRAINMOD analysis for their farm. The system uses GIS to help identify the soil types present on a producer's farm. Producers must provide the type of drainage system installed (tile or ditch), the drain spacing, drain depth, surface drainage (rough, fairly level, or smooth and crowned), the crop to be planted, typical tillage dates, their maximum yield potential, and their long term historic average. Personnel from NCSU used this information to generate a riser management scenario that will enhance or maintain yields, while providing a water quality and water conservation benefit based on long term weather data available for a location near the producer.

The primary objective of the site is to promote the benefits of drainage water management and to allow cooperating producers to enter their site specific information and receive advice tailored to their system and location. Nineteen cooperating producers worked with NCSU to test the site and improve it. Six of the nineteen have the Agri-Drain structures and the remaining producers have the tradition flashboard riser systems on open ditches. Their feedback on the system and their use of the information was pertinent to advisory development. The following link can be used to access the advisory.

<http://www.bae.ncsu.edu/topic/drainageadvisory/>

The advisory system was modified with new questions that were needed to improve the accuracy of the system. Furthermore, the system gave recommendations for the producer's crop rotations starting in 2010 instead of one single crop. The advisory operated in 2010 with the participating producers. Each was given their system recommendations based on the information provided by the producers about their cropping practices and drainage systems. The participating producers signed up approximately 2500 acres during 2010. The average predicted water conservation for the systems was 4.75 in and the predicted nitrate load reduction about 16,800 lbs (from the 2500 ac??)for the year. Given these predicted reductions, the next step in the development process is to offer the system to more producers in Eastern North Carolina.

Producers that participated in the online-advisory system were asked to answer a series of questions related to their drainage water management system. Figure 5, is a series of screen shots from the advisory system including the GIS system for showing the location of their farms and the general questions that they answered and the recommendation for riser management that was generated and delivered to them.



Figure 7. Screen shots from the Online Drainage Advisory System.

NORTH CAROLINA STATE UNIVERSITY

Drainage Water Management Online Advisory

COLLEGE OF AGRICULTURE & LIFE SCIENCES  
ACADEMICS • RESEARCH • EXTENSION

HOME BACKGROUND USE THE ADVISORY GENERAL GUIDELINES FAQ ANNOUNCEMENTS

**WHAT IS DRAINAGE WATER MANAGEMENT (DWM)?**


- ▶ 40% of North Carolina cropland requires improved drainage
- ▶ Drainage Water Management
  - Conserves water
  - Increases yield
  - Improves drainage water quality
  - Decreases losses of Nitrogen and Phosphorus to environment
- ▶ [Learn more](#)

**ABOUT THIS ADVISORY:**


- ▶ Describes drainage water management
- ▶ Gives general guidelines on how to manage drainage outlets
- ▶ Answers frequently asked questions
- ▶ Presents a tool for determining soil and site specific recommendations for DWM
- ▶ [Use the Online Advisory](#)

**DEMONSTRATION SITES:**

- ▶ [Tile Drainage in Roper, NC](#)
- ▶ [Open Ditch System in Bath, NC](#)
- ▶ [Tile Drainage System in Pitt County](#)



**Recent Announcements**

 [2009 Field Days](#)

**7/28/2009 Beaufort County Corn and Drainage Water Management Field Tours**  
**Time** - 4:00 pm  
**Where** - Poole Farm (Open Ditch Drainage Management Demonstration Site)  
[View Map](#) - Peoples Rd, 0.5 miles West of Bayview Ferry  
  
**Time** - 5:00 pm  
**Where** - Burbage Farm (Blount Midgett Farm) Corn Varieties and Production  
[View Map](#) - Jackson Swamp Rd  
  
**7/30/2009 Pamlico/Craven Field Tour**  
  
Begins at 8:30 am  
[Read More](#)  
  
**8/12/2009 Northeast Ag Expo**

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HOME BACKGROUND USE THE ADVISORY GENERAL GUIDELINES FAQ ANNOUNCEMENTS

**USER LOGIN**

Username: \*

Password: \*

**LOG IN**


[Request new password](#)

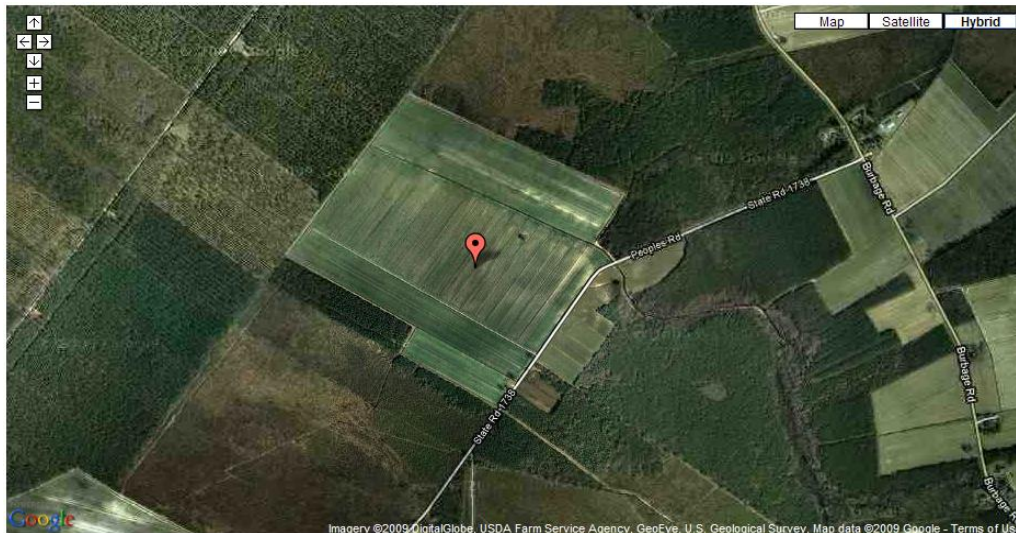
**Use the Online Drainage Advisory**

**How Will the Producer Benefit From the Advisory?**

Producers have historically been innovators in production agriculture. Given the current economic situation when production costs are volatile and commodity prices are on a roller coaster ride, there has never been a more appropriate time to use risk management strategies to minimize yield losses. [CLICK HERE TO READ MORE](#)

**What You Will Do**





Fields marked (\*) are required

Your Email:\*   
 Farm or Tract Name:\*   
 Latitude:\*   
 Longitude:\*

**SUBMIT STEP 1 AND CONTINUE**

**Drainage Design**

Do you use open ditches or tile drainage: \*

If tile drainage, what is pipe size:

Estimated Drain Depth (ft): \*

Estimated Drain Spacing (ft): \*

Surface Drainage: \*

- ☐ Rough  
☐ Fairly Level  
☐ Smooth and Crowned

**Drainage Outlet**

Estimated Width (ft):

Estimated Depth (ft):

**Soil**

If you know your soil type enter it here:

If you do not know your soil type, you may enter Unknown

**Crop Type and Yield**

Crop Cycle:

Upcoming Crop:

**Crop 1**

Type: \*

Estimated Maximum Yield: \*

Estimated Average Yield: \*

Other Crop 1 Information:

**ADVISORY  
SYSTEM**

- » [Start Page](#)
- » [Your Personal Information](#)
- » [Submit Your Farm](#)
- » [Make Changes](#)
- » [Your Management Recommendation](#)
- » [Ask a Question](#)
- » [Webform](#)
- » [Administer](#)
- » [Logout](#)

[VIEW](#) [EDIT](#)**Recommendations for Example Farm**

## System Info

Farm Name: Example Farm

1. Tile, (Ditch or Tile)
2. Portsmouth, (Soil Type)
3. 4.1, (Drain Depth, ft)
4. 72, (Drain Spacing, ft)
5. Fairly level, (Surface Type: Rough, Fairly level, Smooth & Crowned)

Crop: Corn, (Corn, Wheat, Soybeans, or Cotton)

## \*Recommendations:

Date:, Activity:, Riser Setting (in):

1/1-3/15, Fallow, 18

3/15-4/15, Tillage/Planting, 36

4/15-5/15, Early Growth, 30

5/15-8/15, Development, 24

8/15-11/30, Harvesting, 36

11/30-12/31, Fallow, 18

\* Maximum Yield Potential for the site specified by user: 200 bu/ac

\* Average Predicted Long-term Yield using recommendations: 164.5 bu/ac

\* Average Predicted Long-term Yield no management: 161.2 bu/ac

\* Average Water Conserved per year using the recommendations: 12 (in)

\* These are predicted values based on historic long term rainfall, temperature, available general soil files, and

Another part of the advisory system was a series of email alerts that was generated by NCSU personnel based on forecasted precipitation events. The alerts were emailed to a list serve of individuals that showed an interest in the project, agency personnel, and all participating producers. An example of one of the alert is given in Figure 6. Feedback indicated the alerts were well received by all the cooperating producers.

There were 14 cooperating producers working with the advisory in 2009 and 19 producers during 2010. The following 19 producers participated in the evaluation of the online system: Alston Spruill (Arapohoe, NC), Clay Respass (Terra Ceia, NC), Danny Respass (Wenona, NC), Doug Boyd (Lake Phelps, NC), Eric Pierce (Farmville, NC), Joey Byrum (Ayden, NC), Keith Respass (Terra Ceia, NC), Michael Gray (Elizabeth City, NC), Owen Peele (Bay City, NC), Robert Evans (Edenton, NC), Sam Davis (Pollocksville, NC), Stacy Dail (Farmville, NC), Steve Harris (Elizabeth City, NC), Steve Poole (Bath, NC), Todd Boyd (Pinetown, NC), Charles Davenport (Pactolus, NC), Creston Mills (Ayden, NC), Mike Tyson (Ayden, NC) and Will Congleton (Stokes, NC).

**Figure 8.** Email Advisory Alert from 11/11/09

All,

Please view the attached forecasted precipitation map from NOAA.

Given the circumstances surrounding the development of this coastal storm, management of all drainage systems is imperative.

Currently, the water table elevations at all demonstrations sites are around 5 feet deep. We have a good amount of soil storage available throughout eastern NC to deal with this pending rainfall. Be cautious of high rainfall amounts and manage riser levels carefully.

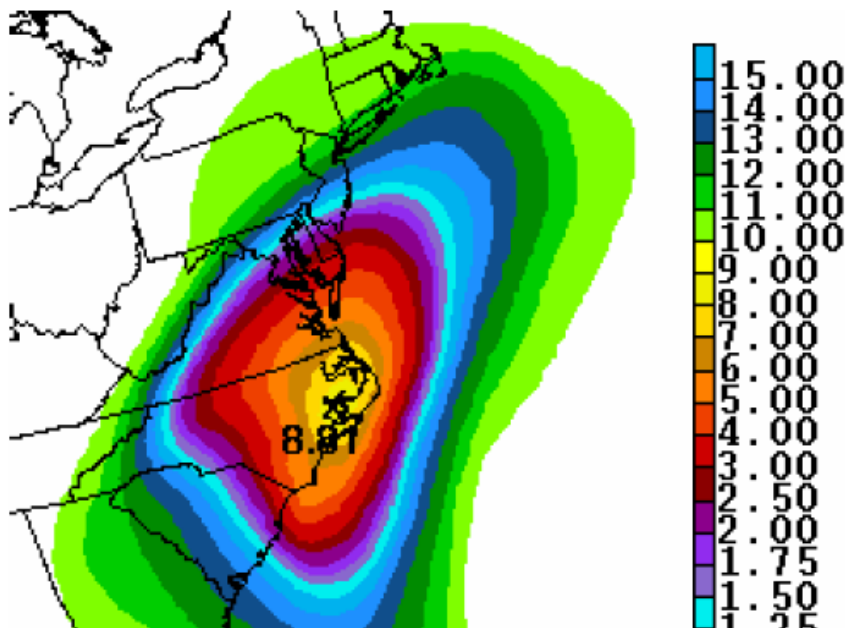
If you have harvested and are not planting winter wheat to your fields under control drainage, keep riser levels high to capture and store the rainfall.

Producers who have planted wheat or are intending to plant wheat, and those who are trying to harvest both cotton and soybeans should have riser levels very low in anticipation of this event.

Hope all goes well and that the harvest will be able to resume shortly.

Chad

Chad A. Poole, M.S., E.I.  
Research Associate  
Department of Biological and Agricultural Engineering  
North Carolina State University



The pilot scale advisory was a benefit to the participating producers, but it requires a lot of time consuming, hands on data processing and modeling by personnel maintaining the system. This type of system would need to become more automated in the future if it is to be feasible for use on a wide scale by producers. The information gained from this project by interacting with producers and using the system has identified the need for such a system and, more importantly, has identified the problems and the possible solutions to correct these issues. The primary need would be to develop an automated system that would give accurate site specific recommendations to the



producers in a timely matter on a large scale. This project has identified the pertinent information that is necessary to make the appropriate riser management recommendation on a site specific basis. It has developed the initial framework for maintaining and managing the advisory, and has tested the pilot scale version. The stage is now set to continue to the next phase of development of a fully automated system that could be utilized in North Carolina, the Midwest, and other areas by producers interested in drainage water management.

**Describe significant results, accomplishments, and potential for transferability.**

A primary goal was to identify three demonstration sites where producers could observe the management and measured the effectiveness of controlled drainage on a continuing basis. Three sites were identified and managed. The selection and establishment of these three sites along with the collected data was a significant achievement in reaching this goal. The development of the online advisory system also helped in meeting the needs of the overall project goals. Setting the framework for the website and implementing the online-advisory is a significant achievement. Major modifications were made to the advisory system in the past year that improved the accuracy of the system and makes the use of the system more efficient for the end user. The project has identified the needed information necessary to give reliable site specific recommendation to producers. The next stage of development would require the system to become fully automated by utilizing the information learned during this three year project period.

Our participation in multiple field days and training sessions gave the project the excellent exposure needed to meet the objectives. This has led to the identification and collaboration with nineteen cooperating producers. Perhaps more importantly, agency personnel, who work with producers on a daily basis, were exposed to and became familiar with the available technology. The cooperating producers were very valuable to the project since they helped evaluate, modify, and fine tune the web advisory. Hopefully in the future they will form the core group that will practice and promote Drainage Water Management and the development of an automated system for recommendations in NC in the future.

The NCDENR Division of Soil and Water Conservation have directed the installation of 19 control structures on subsurface drains (tiles or drain tubes). They have promoted the adoption of drainage water management in the upper coastal plain and on tile systems in the lower coastal plain through the installation of these structures. Producers in North Carolina have been exposed to in-line controlled drainage system because of this grant. These types of systems have not existed in North Carolina in the past.

The most important accomplishment in this grant was the demonstration that corn and soybean yields could be increased when producers properly manage drainage systems with only minimal capital investment. The realization of this is that the producers have visually observed the increase in yields from the demonstration site through presentation of the data collected at farm field days. This project has helped to renew producer participation in managing drainage water. The result of increased producer management is a net reduction in offsite nitrogen and phosphorus losses to



ground and surface waters. Furthermore, the use of the online system has demonstrated that site specific recommendations can be used to increase crop yields while reducing N and P losses and conserving water. The system needs to be fully automated for future use and is certainly transferable to other parts of the country and world. The long-term benefits of producers managing drainage systems to promote crop yields is enhanced nutrient up-take by plants and the reduction of offsite drainage losses. Promotion of the practice through this grant has had a significant impact on the interest in DWM in NC and on nutrient losses to our surface waters.

## Conclusions

1. The project was successful in assisting with the installation of 19 new in-line control structures throughout Eastern North Carolina. This was the first introduction of these types of structures in North Carolina. The predicted impact of the installation of these structures during the grant period was the reduction of N and P losses to surface waters of 11,035 lbs and 983 lbs, respectively.
2. A web-based advisory system was established and successfully tested in North Carolina. The system utilized GIS, and user inputs to make site specific recommendations to enhance yields and maximize water quality benefits. It will need to be fully automated to be feasible for agency use, which is the logical next step in the application of this innovation. The project established the needed inputs and the pathway necessary to make the system successful. It is a system, once automated, that could make a significant contribution to conservation efforts nationwide.
3. Nineteen producers enrolled in the pilot system. The use of the system through these producers had a predicted conservation savings of an average of 4.75 in of drainage water with an estimated annual savings among the producers of 16,800 lbs of nitrogen.
4. Crops produced at the demonstration site gained on average 10% yield increases in corn and 4.5% yield increases in soybean under drainage water management.
5. Producers were notified about the project, the advisory, and observed the yield and conservation benefits of the practices through the demonstration sites. These sites allowed producers to see first-hand the yield benefits of the practice.

## Funding Received and Expended

Description	Budget	Expenses
Salaries	\$75,000.00	\$75,728.71
Fringe Benefits	\$18,750.00	\$23,024.78
Supplies and Materials	\$18,000.00	\$14,570.91
Domestic Travel	\$ 2,000.00	\$ 425.60
Subcontracts (SWCS)	\$48,500.00	\$35,808.60
Budget Pool	(\$7,204.40)	
Total Direct Cost	\$155,045.60	\$149,558.60
Total Indirect Cost	\$ 27,365.55	\$ 27,365.55
Total Cost	\$182,411.15	\$176,924.15

## Brochure

Quick Guide		
Period	Activity	Setting (inches)
<b>CORN</b>		
1/1-3/15	Fallow	12-18
3/15-4/15	Tillage/Planting	20-36
4/15-5/15	Growth/Sidedress	24-36
5/15-6/15	Corn Growth/Maturity	18-24
6/15-11/15	Harvesting/Tillage/Planting	20-36
<b>WHEAT</b>		
11/15-3/1	Wheat Establishment	18-24
3/1-3/15	Sidedressing	20-36
3/15-6/1	Wheat Growth/Maturity	18-24
6/1-7/1	Harvest/Planting Soybeans	20-36
<b>DOUBLE CROP SOYBEANS</b>		
7/1-11/1	Soybean Growth/Maturity	18-24
11/1-12/15	Harvesting	20-42
12/15-3/15	Fallow	12-18

### Contacts:

#### WEBSITE ASSISTANCE

- Brian Phillips, M.S. E.I.,  
Research Associate, BAE, NCSU  
1-919-515-6750  
[brian\\_phillips@ncsu.edu](mailto:brian_phillips@ncsu.edu)
- Chad Poole, M.S. E.I.,  
Research Associate, BAE, NCSU  
1-919-515-6750  
[chad\\_poole@ncsu.edu](mailto:chad_poole@ncsu.edu)

Support Provided by a  
Conservation Innovation  
Grant (CIG)



NRCS Natural Resources  
Conservation Service



## DRAINAGE WATER MANAGEMENT & ADVISORY SYSTEM

### Additional Support:



In cooperation with:

Department of Soil Science  
College of Agriculture and Life Sciences

NC COOPERATIVE  
EXTENSION  
Extending People's Power Knowledge to Work

North Carolina Department  
of Environment and  
Natural Resources



NC STATE UNIVERSITY



## DRAINAGE WATER MANAGEMENT (DWM)

- Tile and Open Ditch Drainage
- Controlled Drainage
- Subirrigation
- Surface Smoothing

### System Types/Components:

### ONLINE ADVISORY TOOL



#### BY BENEFITS:

- WATER CONSERVATION
- CROP YIELD
- WATER QUALITY



### Drainage Water Management Online Advisory

HOME BACKGROUND USE THE ADVISORY GENERAL GUIDELINES FAQ ANNOUNCEMENTS

#### WHAT IS DRAINAGE WATER MANAGEMENT (DWM)?

- 40% of North Carolina cropland requires improved drainage
- Drainage Water Management
  - Conserves water
  - Increases yield
  - Improves drainage water quality
  - Decreases losses of Nitrogen and Phosphorus to environment
- [Learn More](#)

#### ABOUT THIS ADVISORY:

- Describes drainage water management
- Gives general guidelines on how to manage drainage outlets
- Answers frequently asked questions
- Presents a tool for determining soil and site specific recommendations for DWM
- [Use the Online Advisory](#)

#### A COLLABORATIVE EFFORT

A special thanks to all of the various people and organizations who



#### Recent Announcements

##### Upcoming Field Day

This line will have information about the field day, links to calendar, signing up, pictures, brochure, etc.

##### Your Local Weather Forecast

Raleigh, NC

##### Get weather information from the NC State Climate Office

NC Extension Headlines

2014/15: Double Crop Soybeans

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- Controlled Drainage**  
Water control structures, such as a flashboard riser, are installed in the drainage outlet, allowing the water to be raised or lowered with drainage and rainfall. Proper management allows timely drainage but maximizes water storage within the field.



- Subirrigation**  
Water control structures are installed in the drainage outlet allowing the water to be raised or lowered as needed. Water is pumped into the system to maintain desired levels for irrigating.

- Surface Smoothing**  
The land surface is graded to allow for even distribution of surface water flow and to minimize surface ponding.

Available ONLINE at:

[www.bae.ncsu.edu/topic/drainageadvisory](http://www.bae.ncsu.edu/topic/drainageadvisory)