# Pilot Program for Inspections of Animal Waste Management Systems

## 2005 Annual Report

For Calendar Year 2004


N.C. Division of Soil and Water Conservation

# Contents

## EXECUTIVE SUMMARY

The six years of data from the animal waste management pilot program provides better insight and feedback of DENR's efforts to improve overall compliance at swine farms. Wide fluctuations in rainfall from 1999 – 2004, combined with weather's natural influence on compliance, compounded the difficulties in interpreting results.

The Division of Soil and Water Conservation (DSWC) can confidently assert a number of observations and conclusions about the pilot.

- The program generated a significant shift of farms from high to low potential environmental impact classifications. (Fig. B, p.8)
- It offers "smart" delivery of DENR resources that make the impact shift possible. (p.9)
- The pilot shows measurable compliance improvements in selected potential threat operational indicators compared to non-pilot farms. (Figs. D and G, pp.10 and 12)
- DENR staff is more likely to identify immediate threat problems on pilot farms. (Fig. E, p.11)
- It reduced staff availability for non-pilot assistance. (p.13)
- DSWC per-*visit* costs for pilot farms are less than non-pilot. (Tab. 3, p.14)
- DSWC per-*farm* costs are more for pilot farms than non-pilot. (Tab. 3, p.14)
- The DSWC cost of pilot-related site visits declines over time through efficiency gains. (Tab. 3, p.14)

DSWC supports the pilot's inspection model, provided support remains strong among farmers and other stakeholders, and that DSWC's ability to provide technical assistance to non-pilot farmers isn't sacrificed to make expansion possible.

# BACKGROUND

The objective of the Animal Waste Management Inspection Pilot (hereinafter the pilot), as inferred from Section 12.7(b) of S.L. 2005-276, is to determine if operation reviews and inspections conducted by the DSWC staff can improve compliance performance in waste management when used to replace Division of Water Quality (DWQ) routine inspection processes. Even more importantly, the program serves as a test bed to try inspection approaches that may be more effective; improve response times to discharges, complaints and reported problems; identify violations and take corrective actions earlier; and improve communications between farmers and DENR employees. This report comprises six years of data collected at 108 pilot farms in Brunswick, Columbus and Jones counties.

Several factors are relevant in assessing the pilot's effectiveness at this or any point in time. They represent variables outside human control as well as changes reflecting the refinement of pilot administration. They include:

- annual variations in precipitation;
- changes in data collection;
- introduction of environmental "impact" categories.

## Precipitation

Precipitation has an unavoidable effect on livestock waste management. Most notably, it contributes to the volume of a lagoon's contents. But it also influences the timing and frequency at which waste can be applied to receiving crops. If significant rainfall occurs at critical stages during a receiving crop's growth cycle, interrupting or delaying the application of the waste to the crop, then the window of opportunity to fully utilize the waste's nutrient value (principally, nitrogen and phosphorous) may be lost. And poor synchronization between receiving crop growth cycles and waste application may ultimately result in the discharge of nutrients to surface and ground waters.

Conversely, less precipitation usually allows more days for waste application. These facts lead to an inverse relationship between precipitation and compliance with waste management rules. As precipitation increases, compliance declines; the reverse being that compliance improves as rainfall drops off. The relationship influences numerous factors in the performance standards, but most especially in those that pose the greatest threat to the environment.

***Figure A*** shows available precipitation data at weather stations in or adjacent to pilot program counties for the years 1999 through 2004. Precipitation measured at each station fell below the annual average during 2001, 2002 and 2004, providing generally favorable weather conditions for animal waste management.

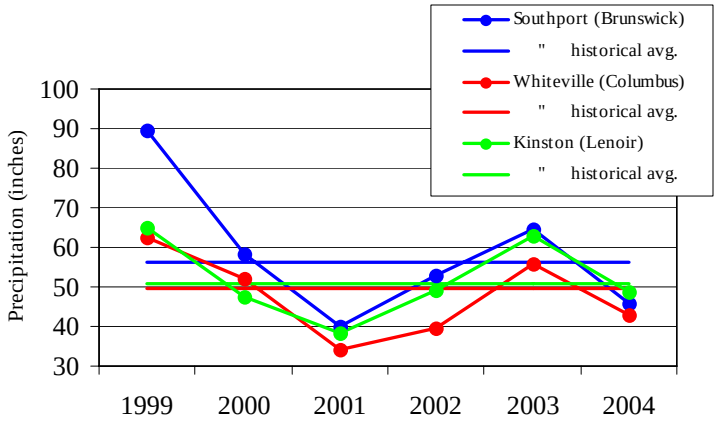


**Figure A. Annual precipitation measured at weather stations in or adjacent to the three pilot counties.** *Source: State Climate Office, annual figures; Southeast Regional Climate Center, Columbia, S.C., historical averages.*

## Data handling

Based on lessons learned during earlier years of the pilot program, DSWC has refined the sorts of data it gathers during reviews and inspections. These process improvements enable DSWC and DWQ to more effectively target technical assistance and regulatory resources to swine producers.

## "Impact" categories

Formulating inspection protocols during the early years of the pilot program, DSWC and DWQ developed a list of operational indicators to objectively score waste management compliance. Then, starting in 2001, DSWC further refined the process by introducing additional distinctions between farms falling within different ranges of compliance scores. This latter step allowed for even more systematic, prioritized delivery of regulatory and technical assistance where it was most needed.

***Table 1*** lists the operational indicators used to assess animal waste management system on the pilot farms, with points assigned to each commensurate with the degree of threat any compliance deficiencies would pose to the environment. The 17 indicators identified are ranked here in descending order according to relative point values. For reporting and assessment purposes, twelve of the items have been further grouped into "immediate threat" and "potential threat" rankings. This table is the basis for distinguishing the three potential impact categories within which farms might fall.

| Operational Indicators | Point Value |
|---|---|
| *Offsite discharge* | 20 |
| *Structural integrity compromised* | 18 |
| *Structural freeboard levels* | 16 |
| *Hydraulic overloading* | 15 |
| *Nitrogen over-applied ≥ 10%* | 12 |
| Waste spill contained on site | 12 |
| Storm storage levels | 11 |
| Irrigation system maintenance deficiency | 11 |
| Structural maintenance deficiency | 10 |
| Receiving crop inconsistent with waste plan | 10 |
| Irrigation records deficient | 10 |
| Sprayfield conditions | 9 |
| Lagoon level records deficient | 9 |
| Nitrogen over-applied <10% | 8 |
| Receiving crop inadequate | 8 |
| Waste analysis deficient | 8 |
| Soil analysis deficient | 7 |

**Table 1. Operational indicators observed and recorded by DSWC and DWQ during inspection of animal operations. Items in italics represent "immediate threat" indicators.**

***Table 2*** presents the point ranges that define the three impact categories. Each range represents points totaled for deficiencies in any operational indicator for a farm over the course of its annual inspection history.

| Potential Impact Group | Noncompliance points |
|---|---|
| Low impact farms | 0 – 12 points per year |
| Medium impact farms | 13 – 30 points per year |
| High impact farms | 31 or more points per year |

**Table 2. Low, medium, and high farm potential impact categories listed with their corresponding noncompliance point ranges.**

As previously mentioned, these groupings guided the development and implementation of inspection protocols. Farms demonstrating scores consistently in the low and medium potential impact groups are subject to routine site visits by DSWC. When a farm receives high scores, the protocol directs DSWC to notify DWQ, and joint compliance audits by both divisions commence. If that same facility continues to score in the high range, DWQ assumes full responsibility for routine inspections, while DSWC's role falls back solely to technical assistance when requested. The consequence of these protocols is that both divisions apply their respective technical and regulatory resources more appropriately, as indicated by the particular compliance and environmental considerations of the waste handling operation. It should be noted that DWQ continues to retain its enforcement authority in the pilot counties and may conduct additional compliance inspections of any farm at any time, regardless of its potential impact rating.

# PILOT ASSESSMENT

Evaluation of pilot outcomes is organized here under three overlapping topics:

- effectiveness of the operation review and inspection processes;
- waste management compliance;
- other consequences of pilot administration.

## Inspection efficacy

Because weather is the single greatest independent influence upon waste handling in swine operations, DSWC staff has proven themselves especially qualified to quickly provide farmers onsite technical assistance for managing its challenges. Whereas compliance data, considered in isolation, might suggest weaker performance in pilot farms during 2003, the trends in distribution of farms across the relative impact categories described above may be a better indicator of this technical assistance advantage.

***Figure B*** combines compliance performance data based on operational indicators for 108 pilot farms over a six-year period, in order to illustrate trends in the distribution of farms among the three impact categories. The chart indicates a noticeable shift away from the number of farms categorized as high impact to those with a low impact rating.

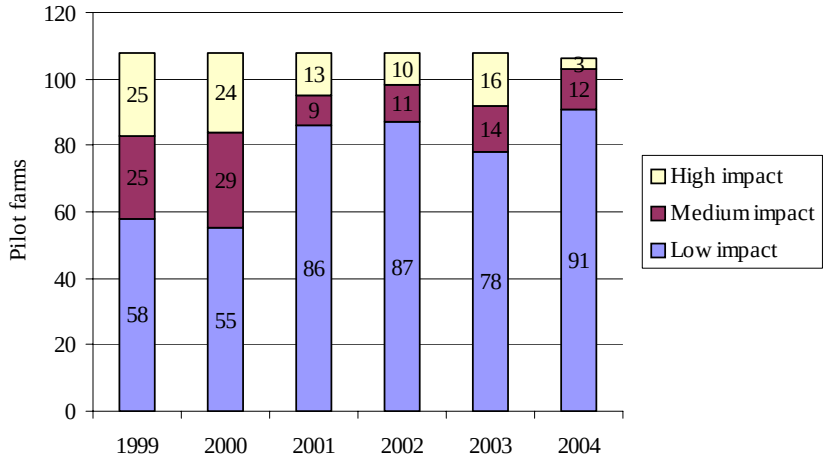


**Figure B. Distribution of all 108 pilot farms within low, medium, and high impact category rankings based upon individual waste management performance.** *Note: three farms were combined into one resulting in a total of 106 pilot farms in 2004*

During 2004, DSWC and DWQ targeted high potential impact farms for joint compliance auditing while transferring routine inspection responsibility from DSWC to DWQ for farms with chronic noncompliance. The low potential impact group reached its greatest size in 2004, and of that number, 67 received perfect compliance scores of zero. This significant shift is due, in part, to the favorable weather conditions that year. But the trend's origins are also surely rooted in prioritized delivery of department resources that, while unable to alter the vagaries of weather, appear to provide long-term mitigation of impact where it is most effective.

The data presented in ***Figure B*** offer an illustration of this strategic "return on investment." DSWC staff attribute the similar rate of compliance during the relatively wet year 2003, as compared to an average rainfall year like 2000, to farm improvements and greater waste management knowledge arising from the technical assistance provided to farmers through the pilot.

Another by-product of DSWC's technical assistance process, collected through its *Technical Assistance Site Visit Reporting Form* ***(Appendix III)***, is a more precise understanding of the waste compliance issues confronting swine producers. The details of ***Appendix I*** (*Top 10 Technical Assistance Needs*) may be useful in guiding future improvements in waste management performance.

In assessing effectiveness, it is fair to conclude that the context of the pilot study has created an organizational environment conducive to this "smart" delivery of departmental resources for improved management of livestock waste. Indeed, this validates one of the underlying premises that gave rise to the pilot program at its conception.

## Compliance

The pilot's performance in waste management compliance is assessed here in several ways:

- trends in compliance across key indicators;
- pilot farm compliance versus non-pilot compliance;
- trends in farm movement from high to low impact categories.

***Figure C*** *(see next page)* displays compliance deficiencies for "immediate" threat indicators from 1999 through 2004. Compared to the previous year, 2004 showed considerable improvements in four of five immediate environmental threats. However, most of this improvement is directly attributable to precipitation. In that context, generalizations about trends within the most serious environmental threats become increasingly elusive.

***Figure D*** *(see next page)* displays compliance deficiencies for five "potential" threat indicators from 1999 through 2004. In this case, the data does reflect a noticeable trend toward improvement in these indicators.

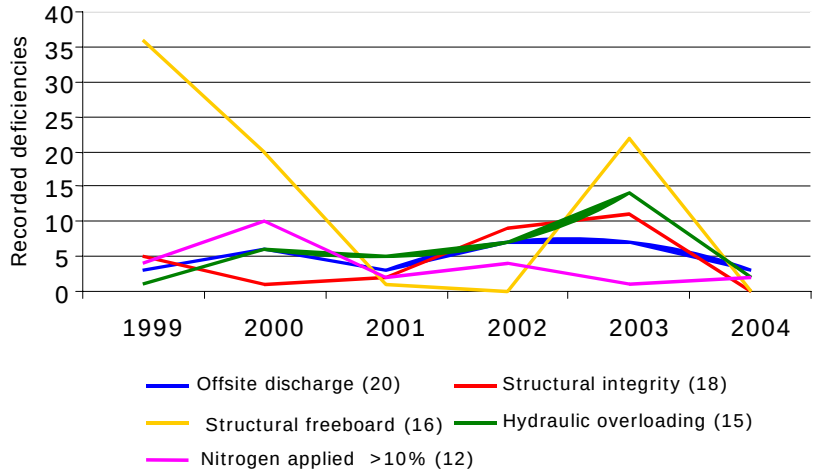


**Figure C. Waste management performance of all pilot farms for "immediate" environmental threats. Numbers in parentheses are the operational indicator values.** *Note: data may include duplication because of joint DSWC / DWQ reporting requirements.*

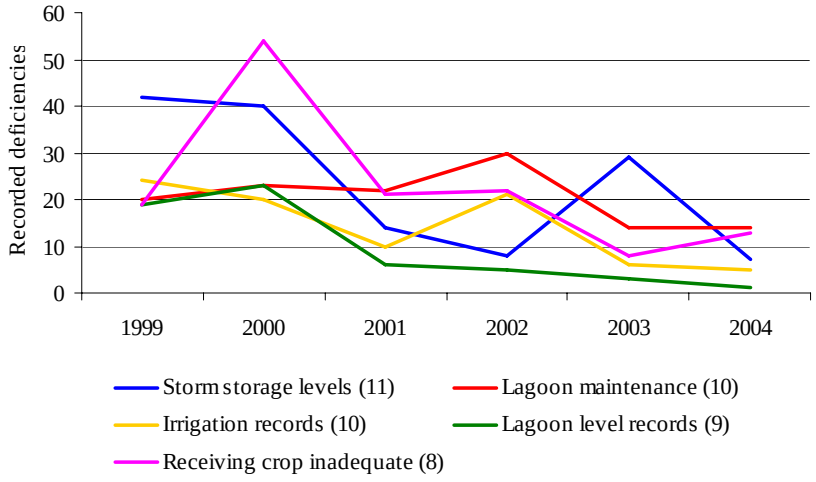


**Figure D. Waste management performance of all pilot farms for "potential" environmental threats. Numbers in parentheses are the operational indicator values.** *Note: data may include duplication because of joint DSWC / DWQ reporting requirements.*

Further assessment was made by comparing waste management performance on pilot farms with those across the state. The *DSWC Technical Assistance Site Visit Reporting Form* was implemented in 2003/04 to allow for better comparisons between pilot and non-pilot farms. ***Figure E*** compiles data for the frequency of occurrence of immediate threats during 2003/04. Frequencies were calculated for three different groups: combined DSWC/DWQ inspection of pilot farms, DSWC inspections statewide including pilot farms, and DWQ inspections statewide including pilot farms.

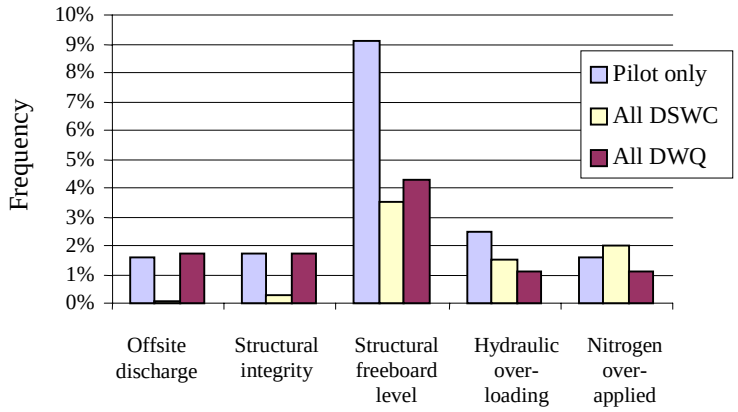


**Figure E. Comparison of pilot and non-pilot noncompliance rates for five "immediate" threat indicators during 2003/04.**

With respect to the three most serious threat indicators, DSWC is consistently more likely to identify noncompliance on pilot farms than elsewhere because of DSWC's increased familiarity with the farms and its ability to identify problems that lead to noncompliance. For DWQ, the likelihood of differences between inspection findings on pilot versus non-pilot farms is more remote, with waste levels being the main exception due to self-reporting requirements of the farms' permits.

***Figures F*** and ***G*** *(see next page)* are based on data generated from the *Technical Assistance Site Visit Reporting Form*, allowing for more detailed segregation of information. ***Figure F*** *(see next page)* compiles data for the frequency of occurrence of four selected operational indicators during 2003/04. Frequencies were calculated for only two different groups here: pilot farms receiving DSWC operation reviews and compliance inspections and all farms receiving DSWC site visits. Pilot participants tend to perform slightly better than non-pilot ones on these indicators.

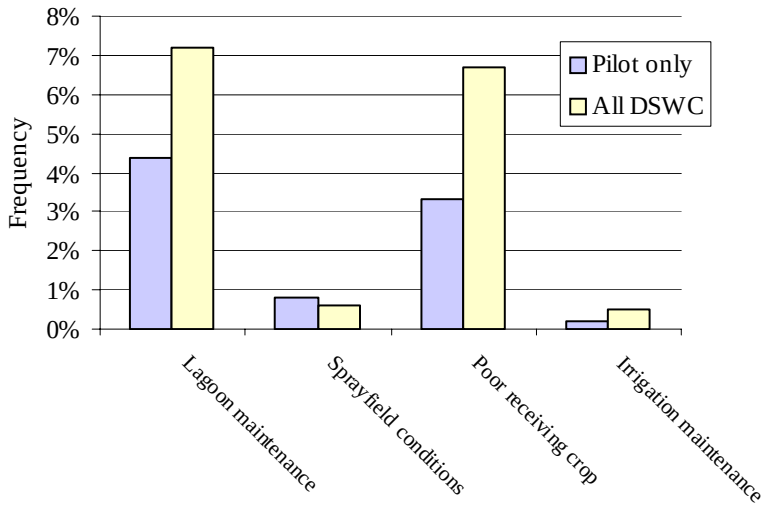


**Figure F. Comparison of pilot and non-pilot noncompliance rates for four potential threat indicators during 2003/04.**

***Figure G*** compiles data for the frequency of occurrence of four records-related deficiencies during 2003/04. Again, frequencies were calculated for two intersecting data sets: pilot farms receiving DSWC operation reviews and compliance inspections and *all* farms (including pilot farms) receiving DSWC site visits. This data shows that pilot participants do a better job of maintaining records than other farms.

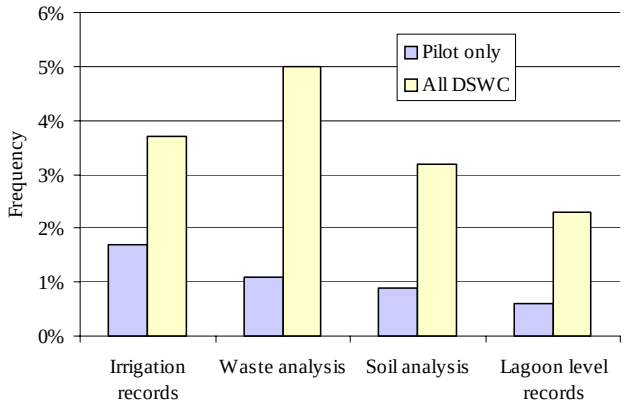


**Figure G. Comparison of pilot and non-pilot noncompliance rates for four records-related indicators during 2003/04.**

## Other consequences

Chief among the pilot's impacts is that swine producers in the region are generally more experienced and knowledgeable about waste management and compliance expectations. In similar fashion, DSWC personnel have gained valuable insights concerning the management of existing waste handling systems, which can enhance their effectiveness as technical specialists.

The pilot has afforded DSWC the opportunity to test and improve reporting methods that facilitate more robust performance assessment of livestock operations across the state. In turn, DSWC staff is sharing these advancements with other local and federal technical specialists through special training sessions.

One negative effect of the pilot program arises from the fact that, prior to 2005, no additional resources were allocated to DSWC for the pilot's administration. The increased attention given to waste operations in pilot counties necessarily diverts time that field staff would otherwise devote to providing similar services in non-pilot counties.

## COST & LABOR COMPARISONS

DSWC's hourly operating cost for site visits ($26 per hour unit cost and rising) is the same for pilot and non-pilot farms alike. Instead, differences between pilot versus non-pilot costs arise as a result of the frequency and duration of visits.

***Table 3*** shows key cost and labor comparisons. The division's *per-visit costs are less* for pilot farms than non-pilot, a fact offset by the *greater per-farm cost* due to a higher frequency of visits to pilot farms.

| Key Comparisons (2004) | |
|---|---|
| **Pilot Farms** | **Non-pilot Farms** |
| $132 per DSWC visit | $200 per DSWC visit |
| 2.4 visits per farm | 1 visit per farm |
| 12 hours total per farm | 7.9 hours total per farm |
| $316 per farm | $208 per farm |

Interestingly, DSWC's average per-visit costs for pilot farms have declined since 2001. The same holds true of its annual costs per pilot farm, which have declined by 19 percent. This is a direct result of efficiency gains as review staff become more familiar with each operation's waste system and compliance challenges, and spend less time per visit on orientation and evaluation of compliance history. In fact, DSWC has *reduced by 25 percent the average time it spends visiting pilot farms* now as compared with 2001.

## RECOMMENDATIONS

While the data presented here is inconclusive on the question of whether the pilot program can increase the overall animal waste management compliance of swine producers, it does show increasing compliance with animal waste management plans and permit conditions. Anecdotal testimony from some participating farmers suggests a favorable reception. The pilot has also forged more effective coordination among producers and DENR personnel, and fostered dialogue towards constructive cooperation in a number of compliance areas—outcomes all supported by the available data.

Without a doubt, the pilot has demonstrated the success of a framework that enhances the delivery of DENR's resources: the means to achieve compliance primarily through DSWC's technical assistance, with the use of DWQ's enforcement tools as needed. Although it can't offer a guarantee against the vagaries of nature, the data offer convincing evidence that the pilot model can improve compliance and reduce environmental risks, and do it in an increasingly cost-effective manner based on DSWC's operating costs.

In accordance with Section 12.7(c) of S.L. 2005-276, DENR recommends the pilot program be continued in Brunswick, Columbus, Jones and Pender counties. Further expansion of the pilot program should only occur in conjunction with additional personnel and resources to expand the program.

# Appendix I

## Glossary

**CAWMP**, Certified Animal Waste Management Plan, the farm's plan, as approved by a designated technical specialist, for the proper collection, storage, treatment and land application of animal waste.

**freeboard**, the top zone in the waste structure that must be maintained clear of waste to ensure structural integrity and adequate storm storage.

**hydraulic overloading**, the application of animal waste to a sprayfield in excess of the limits prescribed in the CAWMP, or results in excessive ponding or surface runoff of waste.

**nitrogen over-application**, , application of animal waste in excess of the agronomic rates prescribed in the CAWMP.

**receiving crop**, a crop or forage designated to receive and utilize waste nutrients.

**sprayfield**, a field or pasture designated to receive animal waste

**storm storage**, the required storage within the waste structure to contain one 25-year, 24-hour rainfall event as defined by the National Weather Service. Structures, designed after September 1996, must have the storage capacity to contain two 25-year, 24-hour rainfall events.

**structural freeboard**, measured from the top of the dike elevation to the top of the storm storage elevation that must be maintained clear of waste to ensure structural integrity.

# Appendix II

## Top Ten Technical Assistance Needs

What follows is a list of the most important technical assistance needs as determined by DSWC staff through 2003–2004 site visits for pilot and non-pilot farms.

1) Waste operator education
2) Assistance with waste plan revisions or amendments
3) Irrigation recordkeeping assistance
4) Evaluation and/or recheck of wettable acre determination
5) Identification and gathering of missing components in farm records
6) Crop evaluation and/or improvement recommendations
7) General recordkeeping education
8) Review and evaluation of waste plan with producer
9) Irrigation system calibration
10) Soil and/or waste sampling education