Pilot Program
for
Inspection
of
Animal Waste Management Systems

2005 Final Report

N.C. Division of Soil and Water Conservation

Contents

EXECUTIVE SUMMARY

The six years of data from the animal waste management pilot are inconclusive regarding its ability to improve compliance at swine farms. Wide fluctuations in rainfall from 1999 – 2004, combined with weather's natural influence on compliance, only compound the difficulties 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 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 lower order inspection items compared to non-pilot farms. (Figs. D and G, pp.10 and 12)
- When farms are deficient, DSWC is more likely to identify it. (Fig. F, p.12)
- It reduced staff availability for non-pilot assistance. (p.13)
- Per-*visit* costs for pilot farms are less than non-pilot. (Tab. 3, p.14)
- Per-*farm* costs are more for pilot farms than non-pilot. (Tab. 3, p.14)
- The cost of pilot-related review 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 Senate Bill 357, is to see if inspections conducted by the DSWC review teams can improve compliance performance in waste management when used to supplement existing Division of Water Quality (DWQ) inspection processes. 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 inevitable evolution 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 lagoon waste can be applied to fertilize field 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 an undesirable excess of nutrients in the soil.

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 and 2004, providing generally favorable weather conditions for animal waste management.

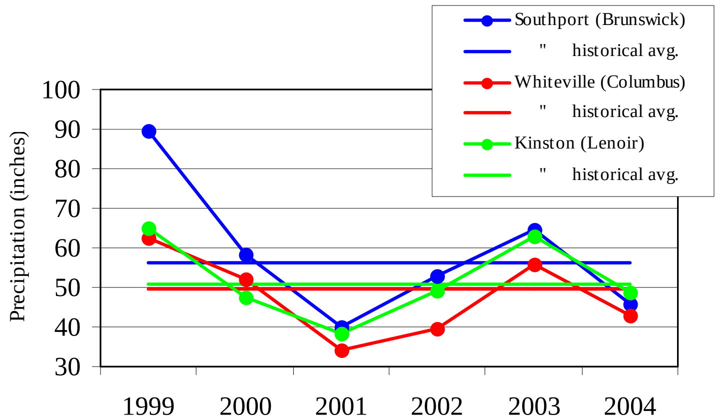

Figure A. Annual precipitation measured at weather stations in or adjacent to the three pilot counties. *Source: State Climate Office, annual figures; Southeast Regional Climate Center, Columbia, S.C., historical averages.*

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 the division to more effectively target technical assistance 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, the two divisions 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 inspection 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 or best management practices. 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 impact categories within which farms might fall.

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

Table 1. Operational indicators observed and recorded by DSWC during inspection of waste handling 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.

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 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 impact groups are subject to routine reviews by DSWC. When a farm receives high impact 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 inspection there, 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 administrative strengths more appropriately, as indicated by the particular compliance and environmental considerations of the waste handling operation.

PILOT ASSESSMENT

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

- effectiveness of the inspection process;
- 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 have 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.

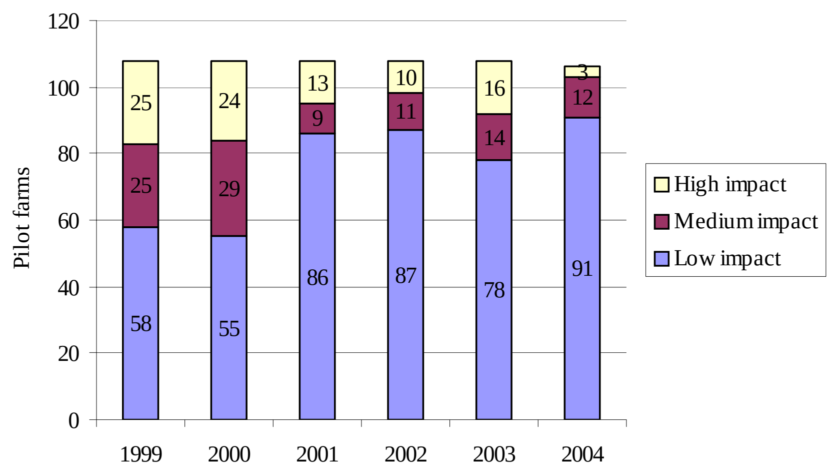

Figure B. Distribution of all 108 pilot farms within low, medium, and high impact category rankings based upon individual waste management performance. *Note: two farms were dropped from the program in 2004.*

During 2004, DSWC and DWQ targeted high impact farms for joint compliance auditing while transferring routine inspection responsibility from DSWC to DWQ for farms with chronic noncompliance. The low 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 a dry 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 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 lower order indicators.

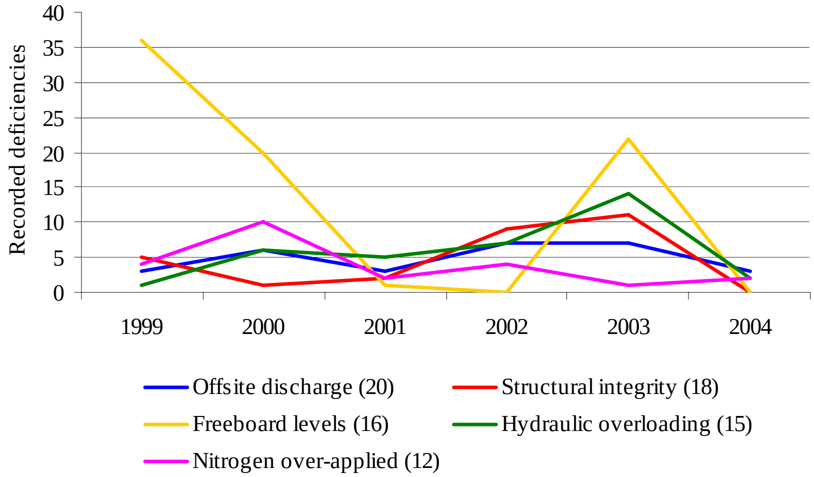

Figure C. Waste management performance of all pilot farms for "immediate" environmental threats. Numbers in parentheses are the operational indicator values. *Note: data may include duplication because of joint DSWC / DWQ reporting requirements.*

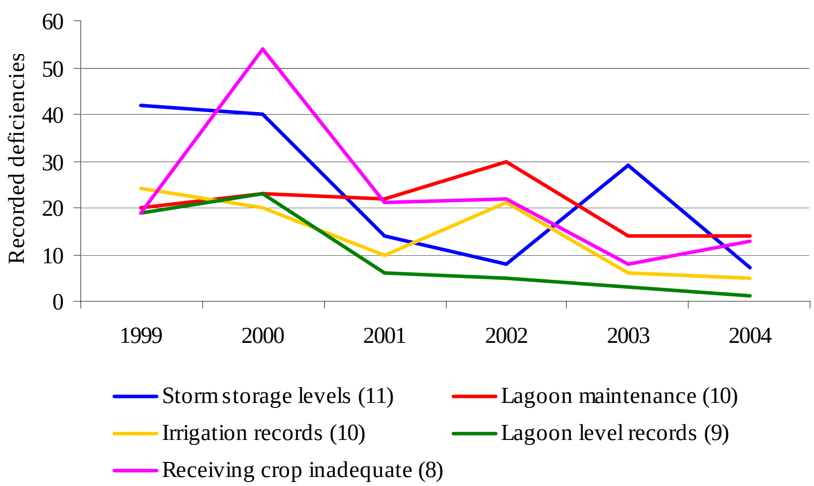

Figure D. Waste management performance of all pilot farms for "potential" environmental threats. Numbers in parentheses are the operational indicator values. *Note: data may include duplication because of joint DSWC / DWQ reporting requirements.*

Further assessment was made by comparing waste management performance on pilot farms with those across the state. ***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, and DWQ inspections statewide.

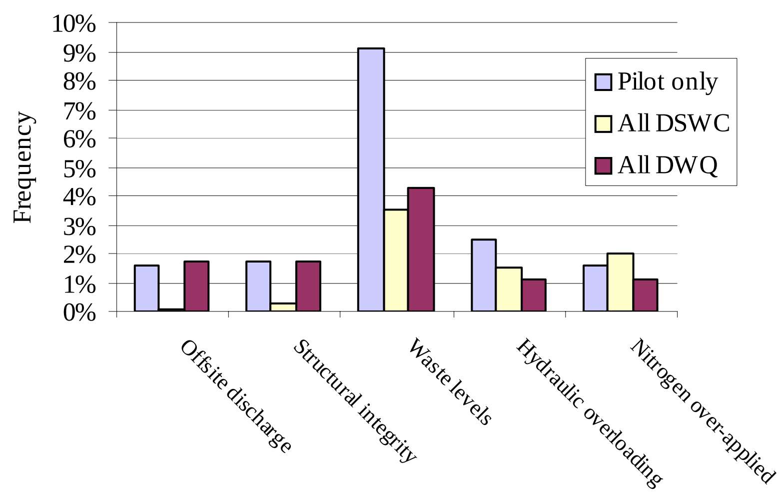

Figure E. Comparison of pilot and non-pilot noncompliance rates for five "immediate" threat indicators during 2003/04.

With respect to the three most serious threat indicators, DSWC is consistently more likely to identify noncompliance on pilot farms than elsewhere, a phenomenon probably explained by heightened scrutiny. 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.

Figure F *(see next page)* compiles data for the frequency of occurrence of four lower level indicators during 2003/04. Frequencies were calculated for only two different groups here: pilot farms receiving DSWC technical assistance and all farms receiving DSWC assistance. Pilot participants tend to perform slightly better than non-pilot ones on these indicators.

Figure G *(see next page)* 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 technical assistance and *all* farms (including pilot

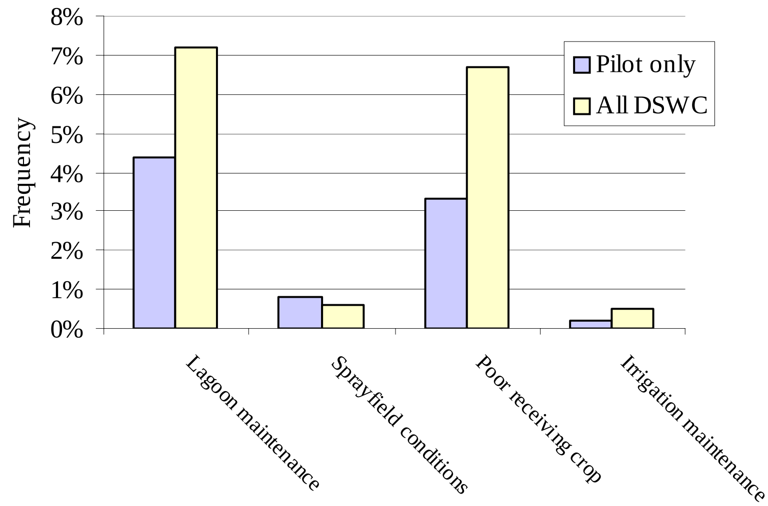

Figure F. Comparison of pilot and non-pilot noncompliance rates for four lower level indicators during 2003/04.

farms) receiving DSWC assistance. This data shows that pilot participants do a better job of maintaining records than other farms.

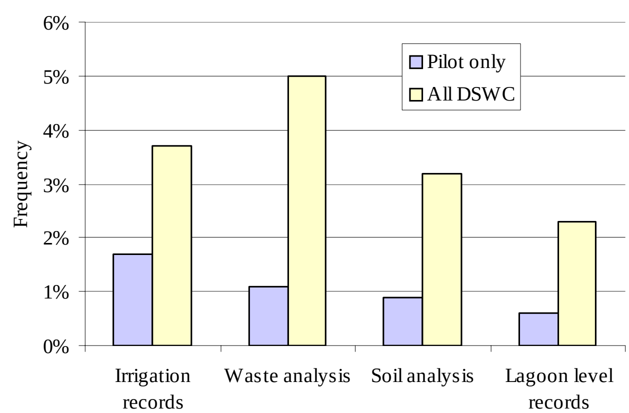

Figure G. Comparison of pilot and non-pilot noncompliance rates for four records-related indicators during 2003/04.

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, DENR 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 chance 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 which 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 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. Surprisingly, *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 sites.

Key Comparisons (2004)	
Pilot Farms	**Non-pilot Farms**
$132 per visit	$200 per 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

Much of the data presented here is inconclusive in the question of whether the pilot program can increase the animal waste management compliance of swine producers. Anecdotal testimony from some participating farmers suggests a favorable reception. If nothing else, the pilot has 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 forms a framework that enhances the delivery of DSWC's strongest asset: the means to achieve compliance through technical assistance. Although it can't offer a guarantee against the vagaries of nature, the data offer convincing evidence that the pilot model can collectively mitigate much of the environmental risks, and do it in an increasingly cost-effective manner.

As long as the program garners support from farmers, local Soil and Water Conservation Districts, and other stakeholders, DSWC staff stands committed to the pilot's continuation. The division also recommends that river basins be used to guide decision-making whenever expansion is considered. However, as this report reinforces, DSWC's role in the program is time-intensive. Operation and expansion of the pilot cannot be maintained without proportionally balanced allocations of staff and operating funds. Otherwise, natural resource conservation and quality in other counties will suffer.

Appendix I

Glossary

CAWMP, Certified Animal Waste Management Plan, the approved plan for managing waste at a particular farm.

freeboard, in waste lagoon construction, a zone measured from the top of the lagoon down, below which waste levels should remain under normal operating conditions.

hydraulic overloading, excessive application of lagoon waste to a crop field designated for that purpose, resulting in standing pools of liquid or surface runoff.

nitrogen over-application, application of lagoon waste to a field which exceeds the expected nitrogen requirements of the surrounding plant matter

receiving crop, grass, hay, or food crop planted for the purpose of absorbing the nitrogen content of lagoon waste.

sprayfield, a field or grazing pasture designated to receive lagoon waste.

storm storage, in waste lagoon construction, a zone or combination of zones of varying thicknesses in the lagoon cross-section, intended to temporarily hold precipitation during intense or prolonged rainfall.

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