I. Abstract

In its first phase the project showed that third-party assessment and assistance (through the Minnesota Milk Producers' Environmental Quality Assurance Program, or EQA) is roughly comparable to a delegated county feedlot program in terms of assessing farms' regulatory compliance status and identifying *the type of* corrective actions necessary. Both EQA and the county/state feedlot program lean heavily on federal or state cost-share programs and their approval of specific corrective projects. The project's first phase also showed that EQA technician assistance produces valuable improvement in nutrient management planning and unregulated environmental aspects of agriculture and farmsteads which are beyond the scope of state and county programs.

Because of failures in the project's partnership approach, the Minnesota Pollution Control Agency (MPCA) could not generate data to establish the accuracy of the third-party technician's assessments to produce a compliance determination that would be trusted by stakeholders. This failure and the continued reliance of this model of assessment on the additional public/private expense of assistance, compliance assessment and engineered correction led MPCA staff to develop a second phase of the project to test a simpler, less costly model of self-assessment (Environmental Results Program, or ERP) audited directly by MPCA.

In this second phase the project adopted ERP's self-assessment/inspector verification model (as implemented in other states with other sectors) and the focus was shifted to counties *not* delegated for the state feedlot program. Through an ERP self-assessment workbook and baseline/post-assessment inspections, producers made changes in significant areas even though Phase 2 was a short 18-months. Producers improved management of manure stockpiles, adopted setbacks for manure application, and upgraded household septic systems and milkhouse waste management. Because farm-specific assistance took place during the two rounds of inspections, MPCA project staff were unable to separate the impact of the self-assessment/workbook from the impact of the inspector's assistance. Therefore, MPCA has not yet been able to establish the relative value of a self-assessment/workbook as a stand-alone tool.

Since the project could not establish that a self-assessment/workbook would produce results similar to conventional inspection *without* significant MPCA program resource inputs, no changes to the existing state feedlot program or its priorities are intended at this time. With state rule applying to small animal agriculture operations focused primarily on BMP implementation instead of definitive structural or control equipment requirements, it is possible that small farms are not as good a fit for ERP tools as other sectors in other states have been. As the project closes, ERP tools (primarily its self-assessment/ workbook) are being evaluated for use in TMDL watershed implementation projects.

II. Summary

Minnesota's feedlot Environmental Results Program (ERP) pilot hypothesized that tools other than the feedlot regulatory program could be effective in improving whole-farm environmental performance (including feedlot rule compliance) where rules and overseeing agencies might be missing opportunities to do so.

The MPCA tested EQA and ERP as whole-farm approaches to improving environmental performance, focusing not only on the basic water quality protection and land application management aspects of Minnesota's feedlot rules but also on ancillary and maintenance operations, feed crop production and household septic systems.

Background

The Minnesota Pollution Control Agency (MPCA) has responsibility to regulate the management of animal manure for the prevention and abatement of water, air, and land pollution. In manure, the constituents most impacting water quality include phosphorus, nitrogen, biological oxygen demand, and disease-causing organisms (pathogens). Various types of gaseous compounds emanating from manure are an additional human health and environmental concern.

Regulations cover the collection, transportation, storage and processing of manure at feedlots, barns, above-ground stockpiles and in-ground storage, plus the rate, location and timing of land application of manure. The primary purpose of regulation is to prevent the contaminants in manure from migrating from the animal holding areas and manure storage areas as well as from land application areas.

Figures vary, but even with substantial attrition for economic reasons or because sons and daughters are not taking over for parents, there are still well over 20,000 regulated animal manure sites in Minnesota. A substantial majority of farms manage less than 300 AU and are unlikely to have any National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) operating permits or to be inspected as frequently as larger animal operations. This is particularly true in the 13 counties with fairly significant animal agriculture which are not delegated for oversight of compliance with state feedlot rules.

Through a transfer of regulatory authority from the MPCA to a county, county feedlot programs become responsible for the implementation of feedlot rules and regulations, with the exception of large feedlots that require federal permits. The accompanying map (page 3) shows Minnesota counties, their delegation status and registered feedlot numbers, and those involved in this project.

Through the Total Maximum Daily Load (TMDL) process, MPCA and many county and local partners are involved in assessing aquatic conditions, understanding sources of pollutants, and developing implementation plans to reduce these common bacteria, nutrient (low dissolved oxygen), and turbidity impairments.

State feedlot rules were designed to cover the issues of feedlot runoff and the collection and storage of manure and they have driven improvement. Improvement involving significant design and construction has been facilitated by the efforts of various public and private assistance and funding providers. However, research shows that other agricultural activities threaten water quality at least as much as feedlot-related activities: over-application of nutrients (whether manure or commercial fertilizers), suboptimal cultivation, inadequate crop residue or cover crops, and insufficient vegetative buffer strips or nutrient application setbacks next to surface water or other sensitive features. In addition, many farm homestead sewage treatment (septic) systems are old, don't function properly, and are a threat to release pathogens to surface or ground water.

This range of issues has led to tools (e.g., Farm*A*Syst, environmental management systems such as EQA sponsored by animal or crop producer associations) which take a unified "whole-farm" (including homestead) approach to managing impacts.

Phase 1 of the Minnesota pilot (2005-2006)

In its original concept, the Minnesota ERP pilot was to adapt the Minnesota Milk Producers Association's (MMPA) assessment program, Environmental Quality Assurance (EQA), to the ERP self-assessment approach. However, stakeholders resisted the idea of trying mandatory self-assessment because of apparent distrust by regulators and their stakeholders or because the association was skeptical that producers could assess themselves and make improvements on their own. This led MPCA to shift the project's approach to one of evaluating voluntary EQA use through ERP methods. The project would test whether the EQA program could be used on a more widespread basis to promote whole-farm compliance and improvement without the typical level of MPCA and county effort, supported by public and private assistance and funding. The producer association (MMPA) aided recruitment of volunteers in Stearns (#1 on the map following) and Winona (#2) counties, which have large numbers of dairies (in 2005, 837 and 226 dairies, respectively) and are delegated to oversee compliance with Minnesota's state feedlot rules. MPCA attempted to use ERP's statistical design to draw conclusions about compliance/performance rates in various sized dairies, and to guide targeting of compliance assistance and inspections.

Coordinating with MPCA project staff to conform to the project plan, MMPA technicians (supported by a contract with MPCA using State Innovation Grant funds from EPA) worked their normal baseline and

1 and 2 are Phase 1 counties

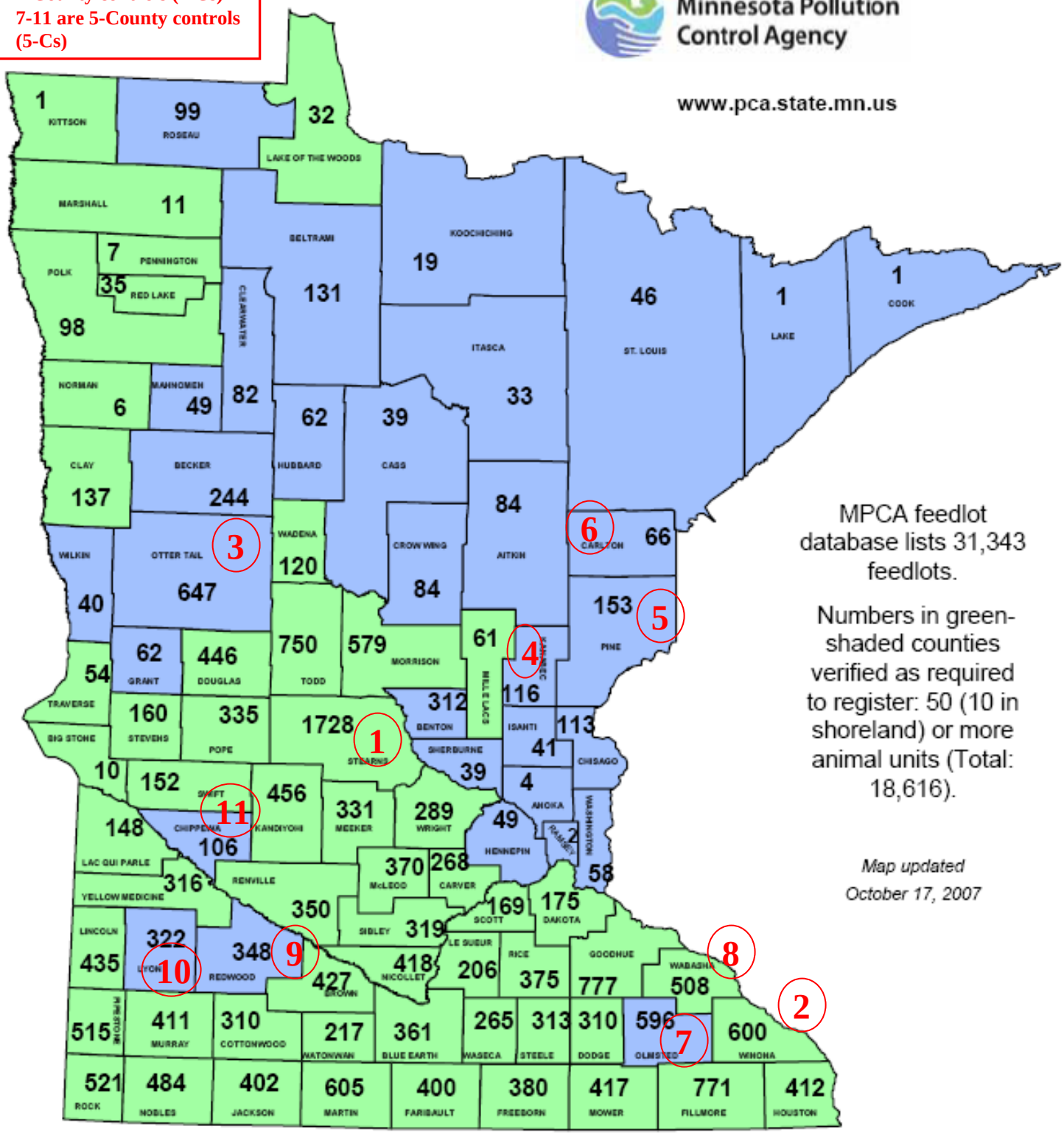
3 thru 11 are Phase 2 counties:

- **3-6 are volunteers (Vs) and 4-County controls (4-Cs)**
- **7-11 are 5-County controls (5-Cs)**

Feedlot Registrations by County

Minnesota Pollution Control Agency

www.pca.state.mn.us



MPCA feedlot database lists 31,343 feedlots.

Numbers in green-shaded counties verified as required to register: 50 (10 in shoreland) or more animal units (Total: 18,616).

Map updated October 17, 2007

Green shaded counties in MPCA County Feedlot Program

wq-f4-09

follow-up assessment of the volunteers, while providing them with assistance in between assessment rounds. Stearns and Winona county feedlot officers (CFOs) were assigned to accompany EQA technicians in both rounds of volunteer assessments to verify compliance rates as assessed by the technicians, and to do baseline/follow-up compliance assessment of randomly selected control farms.

The incentive offered was waiving the standard $100 sign-up fee. 37 volunteers (3.5% of the 1063 dairies in Stearns and Winona) participated in the project to Phase 1's conclusion. Contrary to the expectations of some stakeholders, the bulk of these volunteers turned out to be operators of smaller dairies, generally with less than 300 animal units. Other unexpected events and challenges presented by working through multiple independent partners with shifting or competing duties (particularly the county programs) resulted in MPCA not being able to compile full control group data. Volunteers did receive full baseline and follow-up rounds of assessment from EQA technicians with reasonable completion of compliance assessment by the CFOs in one of the counties. For the 37 farms completed:

- 15 received certification to Five Star dairy status;
- 22 increased overall performance from baseline to follow-up;
- 10 farms' performance decreased slightly;
- technicians provided 316 hours of assistance (35 events).

Based on data from the volunteers but with no basis of comparison to the dairies in the control group, MPCA's Phase 1 conclusion was that the EQA tool was solid enough that the agency could continue to support MMPA's use of the EQA tool, and that ERP project staff could use EQA's whole-farm, preventive approach as the basis of subsequent self-assessment work. However, there were a variety of factors constraining participation in or acceptance of EQA: lack of funding, reliance on volunteerism, length and complexity, cost, inconclusive compliance determination, lack of trust by regulators and some other stakeholders. With roughly 150 participants and 40 Five-Star dairies at that point, it was clear that the EQA program in its current form and level of funding was not going to be used by the number or percentage of small farmers MPCA wanted to reach with alternative tools.

Phase 2 of the Minnesota pilot (2007-2008)

Since the multi-partner EQA approach could not deliver the ERP methodology committed to in the MPCA's cooperative agreement with EPA's State Innovation Grant (SIG) program and the project still had EPA salary funds remaining, MPCA project staff and program management decided to shift gears to the more conventional ERP approach envisioned in the original SIG workplan: self-assessment, education, and statistical analysis of baseline and post-certification data.

Having observed during Phase 1 that at least two delegated counties were doing an adequate job of working with smaller producers on improvement, project staff decided to deploy a Phase 2 in non-delegated counties where small farms had little contact with MPCA regulators and the project could work more directly through MPCA inspectors. This redeployment matched a MPCA program need since MPCA has minimal resources to work with small producers in non-delegated counties.

MPCA offered the self-assessment/workbook to the 628 dairies under 500 AU in Otter Tail (#3 on the map on page 3), Kanabec (#4), Pine (#5), and Carlton (#6) counties. In this case, the incentive offered was waiving enforcement for noncompliance found during the life of the project. In the 2007 baseline year, 45 producers (7.2%) volunteered and 23 (3.7%) ended up completing self-assessments and undergoing verification inspections. At the same time, project staff inspected a randomly-chosen sample of control farms in the 4-county group above (21 farms) and in an additional 5-county group in Olmsted (#7), Wabasha (#8), Redwood (#9), Lyon (#10), and Chippewa (#11) counties (23 farms). In 2008, project staff repeated the cycle of self-assessment and inspections of all the 2007 volunteers and control farms who were still dairying and would agree to participate (20 volunteers; 19 in the 4-county control group;18 in the 5-county control group). Most of the inspections in both the baseline and follow-up rounds were conducted by a single staff person hired using State Innovation Grant program funds from U.S. EPA.

Project staff found that producers interact best when the self-assessment questions are paired with distilled (shortened, plain-English) educational material included right next to the question. Additionally there was a steep drop-off in the use of lengthier, more technical reading material provided (only 4 farmers), and virtually no proactive seeking of new reading material on their own. However, 9 farmers are seeking out technical assistance; consulting University of Minnesota Extension Service, Natural Resources Conservation Service, co-ops or other sources.

Although some questions were reworded, dropped or added from Year 1 to Year 2, there were many questions common to both years. These common questions were tracked for year-to-year (paired sample) changes. For both year-to-year (change) and single year data, project staff compared:

- Question-by-question and in aggregate;
- Self-assessed results compared to inspector's results for accuracy;
- Volunteers compared to the 4-county and 5-county groups separately;
- The 4-county and 5-county groups to each other.

The short time frame (about 18 months for each of the two phases, EQA and ERP) limited the number of major structural changes producers could make in the course of the project, but they *were* able to accomplish changes in awareness, practice, and low-cost physical modifications which the project quantified.

III. Conclusions

1. Effectiveness in improving performance - At its most effective, EQA or ERP tools can reduce the manure stockpile, manure application, and septic impacts of small producers over time. While the project period for testing each tool was short, producers made changes in significant areas (such as manure application setbacks from water) even in the course of 18 months. Compared to other sectors using voluntarily-adopted tools such as EQA or ERP, farm improvement may not be as quick and significant. But it is nonetheless improvement, and measurable improvement at that. Graph 1 on page 6 shows the Phase 1 EQA farms' aggregate improvement in 14 of 18 sub-topic areas; Graph 2 (page 7) shows performance at higher-level question groupings. Graph 3 on page 8 shows Phase 2 ERP volunteers holding steady or improving on 8 of 10 "easy fix" (labeled "EF") key metrics and 13 of 16 key metrics overall. Graph 4 on page 8 shows all Phase 2 farms' year-to-year improvement in aggregate achievement rates for Compliance questions, and the volunteers' improvement on Key questions, which are a mix of compliance and beyond-compliance.

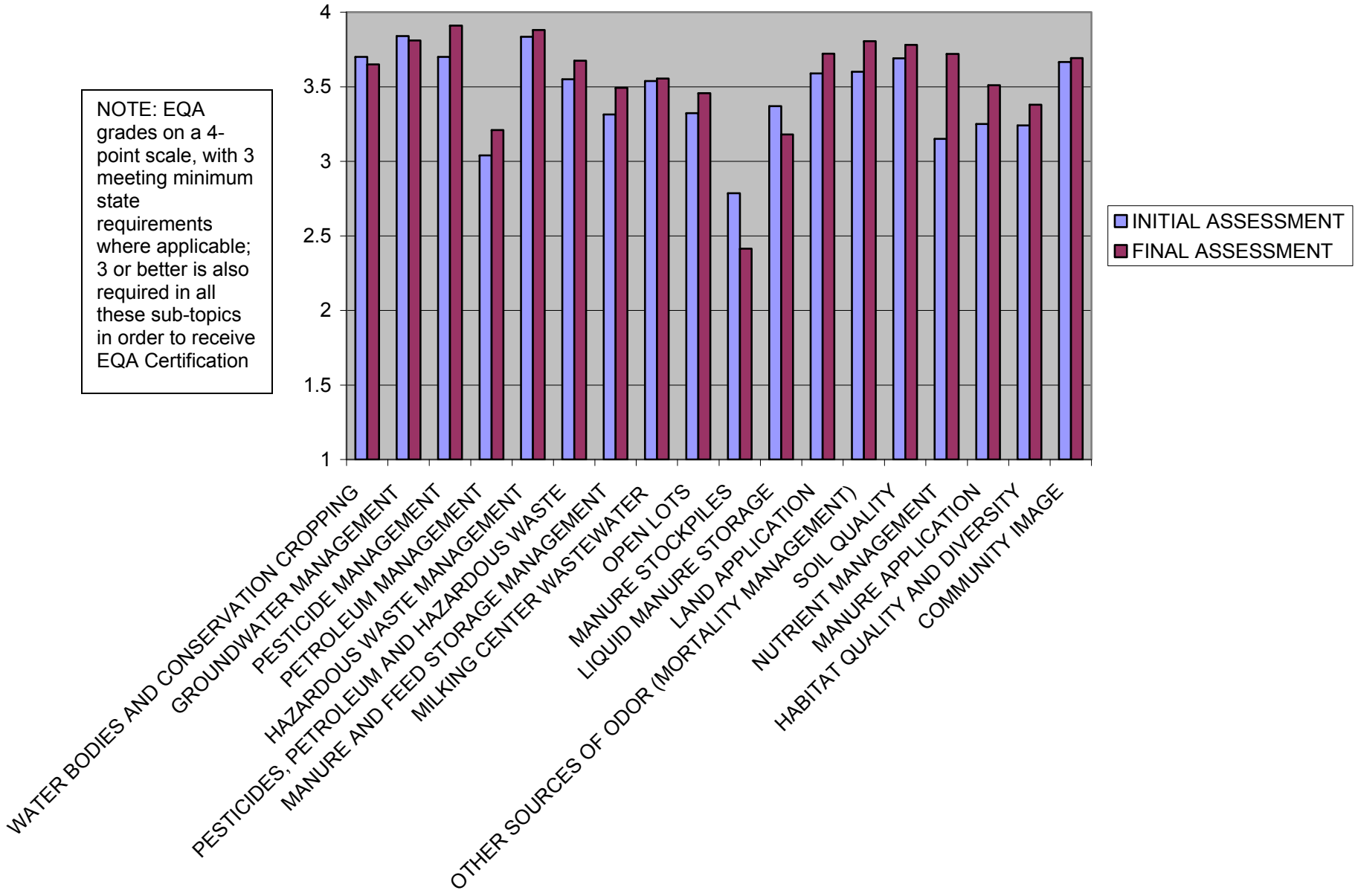
2. Use across programs - At a minimum, both EQA and ERP can fill in gaps in MPCA's understanding of feedlot performance. MPCA has not been able to systematically track the potential impacts that small feedlots may be having, plus the agency needs much better understanding of their nutrient management practices and a range of other impacts. This information strengthens both the feedlot and TMDL programs.

   Data collection on farms under 300 AU under the pilot project methods (either EQA or ERP) would be much more uniform and widespread than it is now, and more useful for analysis, management response, and reporting to stakeholders. Graph 1 and Graph 3 (page 8) demonstrate how assessment data can reveal what issues may need the most attention or may be most amenable to improvement.

3. Limitations
   a. Money - An obvious limitation to full implementation through ERP is the farmers' cost of correcting problems. The very same limitation exists for the conventional inspection program. While project staff cannot say for sure the degree or speed with which producers would spend money to make structural changes to lots to reduce impacts, staff do know that manure application setbacks from water and nutrient management improvements can be (and were) made with next to no capital outlays.

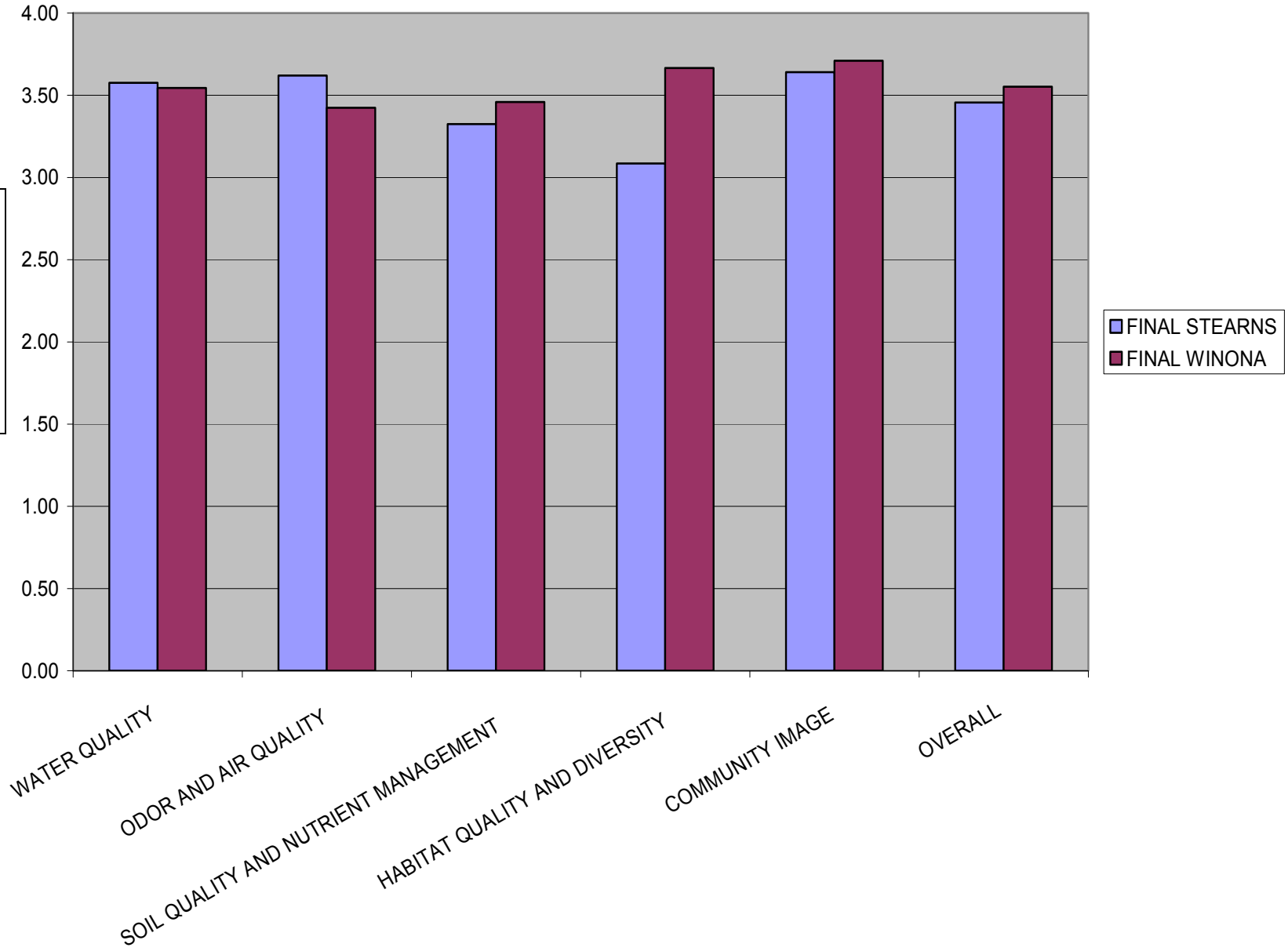
Graph 1. EQA Sub-Topics - Average Progress ALL PHASE 1 FARMS

NOTE: EQA grades on a 4-point scale, with 3 meeting minimum state requirements where applicable; 3 or better is also required in all these sub-topics in order to receive EQA Certification



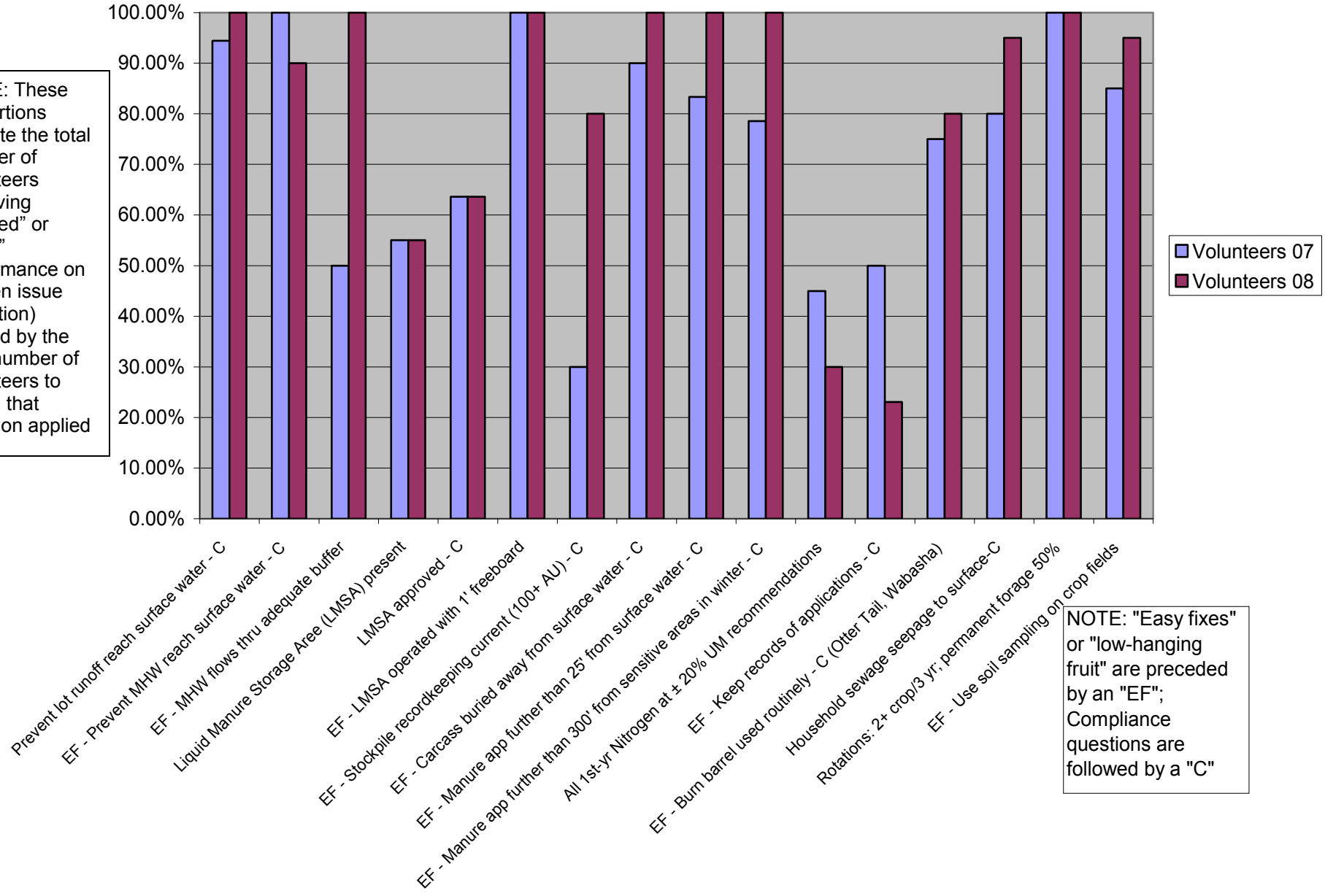
Graph 2. EQA Major Topics - Average Final Assessment Scores BY PHASE 1 COUNTY

NOTE: EQA grades on a 4-point scale. To receive EQA Certification; 3.5 or better is required in each of these 5 major topic areas



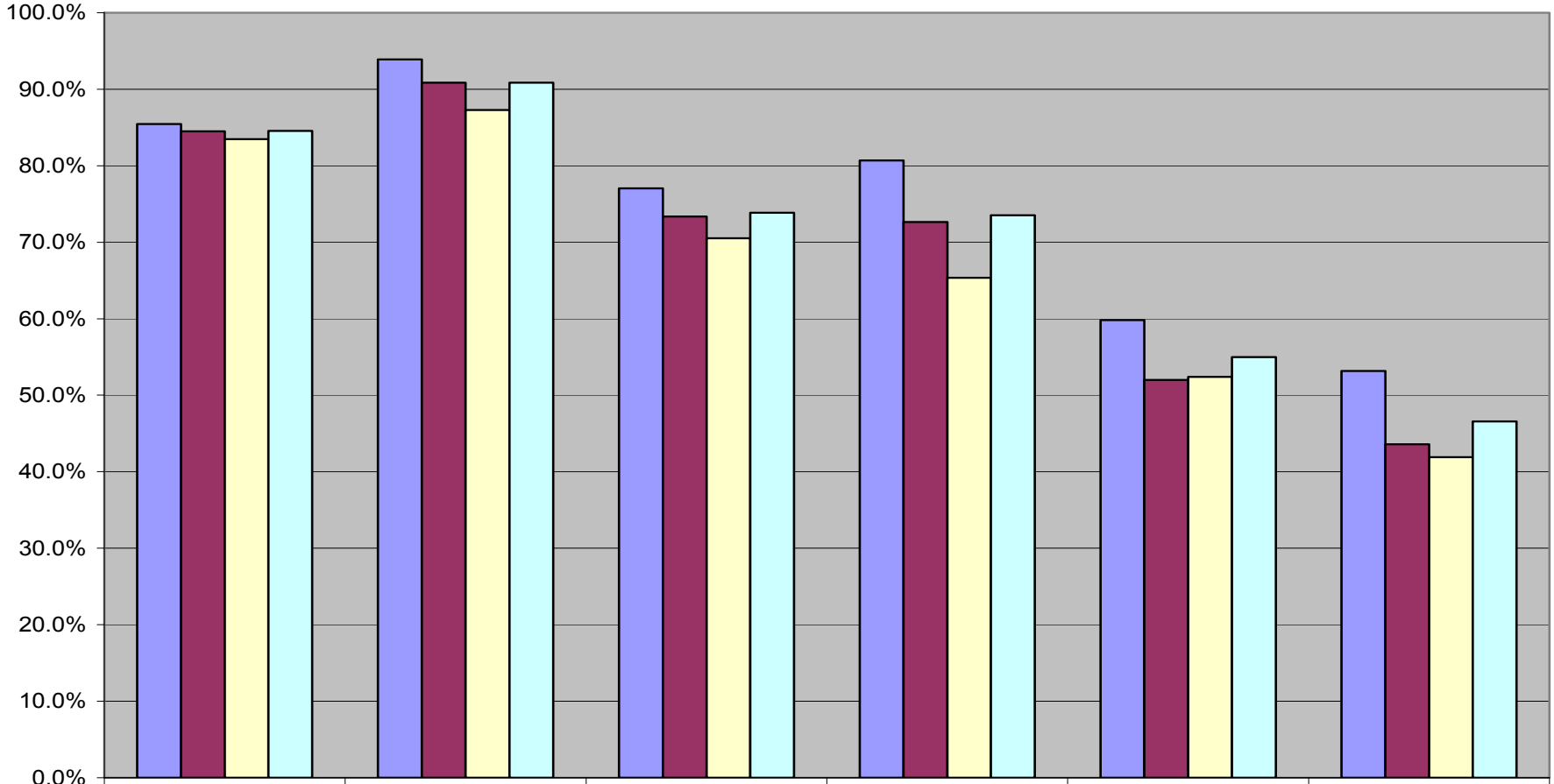
Graph 3. **SELF-ASSESSMENT - 2007-2008 Proportions for Key (or EBPI) PHASE 2 Questions, FOR VOLUNTEERS**

NOTE: These proportions indicate the total number of volunteers achieving "desired" or "good" performance on a given issue (question) divided by the total number of volunteers to whom that question applied



NOTE: "Easy fixes" or "low-hanging fruit" are preceded by an "EF"; Compliance questions are followed by a "C"

Graph 4. SELF-ASSESSMENT - Change in Aggregate Achievement Rates from 2007 to 2008, by Question Group



	Compliance-2007	Compliance-2008	Key (or EBPI)-2007	Key (or EBPI)-2008	Voluntary-2007	Voluntary-2008
Volunteers	85.5%	93.9%	77.1%	80.7%	59.8%	53.2%
4-County	84.5%	90.8%	73.4%	72.6%	52.0%	43.6%
5-County	83.5%	87.3%	70.5%	65.4%	52.4%	41.9%
All farms	84.6%	90.9%	73.9%	73.5%	55.0%	46.6%

	Change in Compliance questions	Change in Key (or EBPI) questions	Change in Voluntary questions
Volunteers	+8.4%	+3.6%	-6.6%
4-County	+6.3%	-0.8%	-8.4%
5-County	+3.8%	-5.1%	-10.5%
All farms	+6.3%	-0.4%	-8.4%

b. Complexity – It is difficult to establish comprehensive nutrient management planning as a continual practice with small producers, but given the water quality impact of over-application of manure and nutrients and its priority with MPCA's TMDL and watershed protection programs, investment in additional education-based tools like ERP or EQA makes sense. Learning from the project suggests that if MPCA uses self-assessment/workbook tools in the future, it should:
   - pare self-assessed data collection down to a smaller number of the top environmental impact issues and practices to focus producers and ourselves in the most important areas; and
   - accompany those questions with condensed, straight-forward educational material to allow producers to complete self-assessments accurately and empower them to initiate changes to their operations.

c. Assistance versus self-motivation - Because of the content and timing of inspections, project staff were unable to determine in Phase 2 whether increases in performance were due to learning through the printed material provided, the on-site assistance given, or a combination. Therefore, MPCA was unable to establish whether a self-assessment/workbook would be effective as an alternative to inspector-based oversight and assistance. There is some anecdotal evidence that a small number of lot changes made were more closely tied to assistance. Regardless, any level of independent (and low cost) behavior change associated with the self-assessment/workbook alone would be an advance for the under-300 AU group in nondelegated counties.

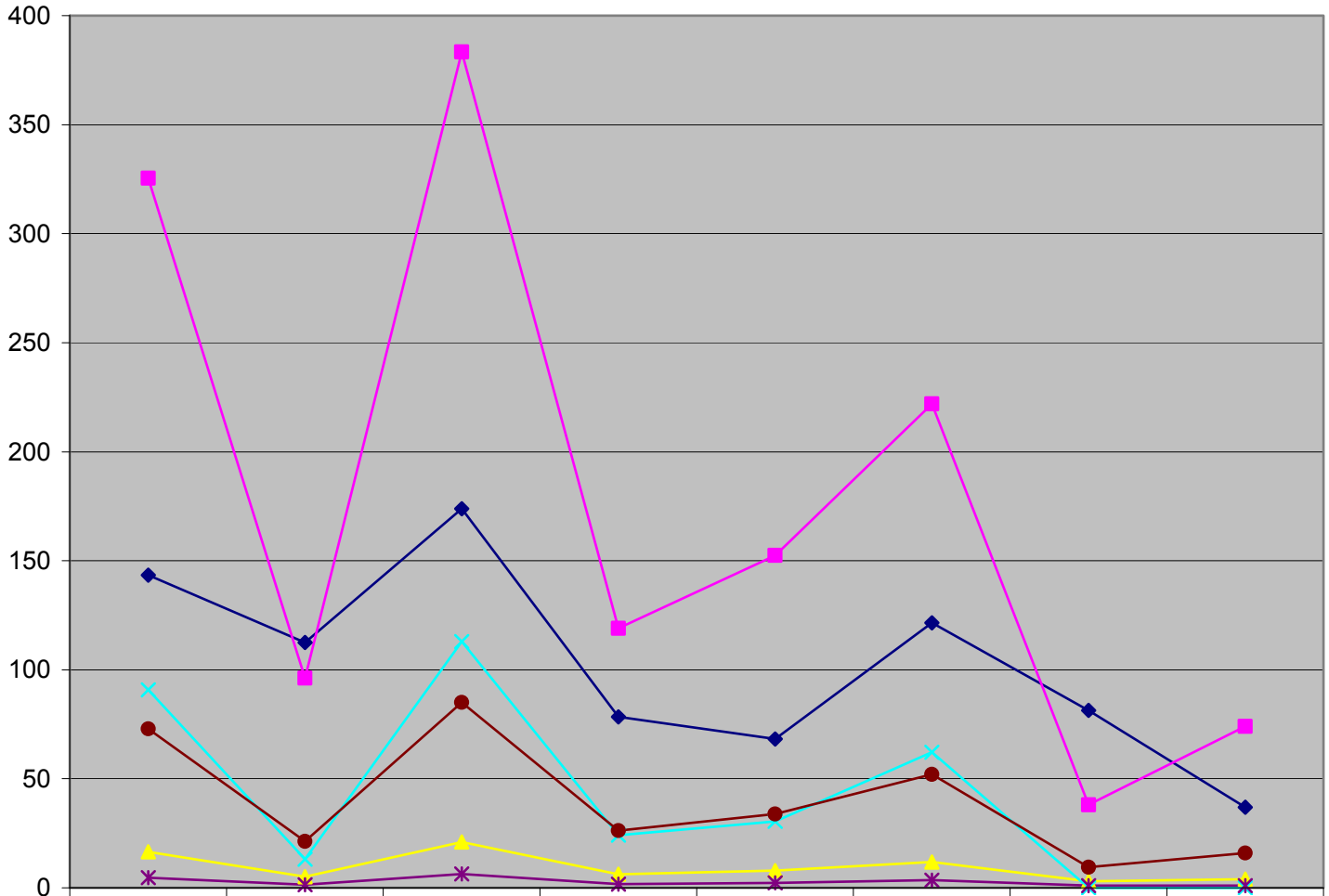
   MPCA recognizes that continuing resource constraints will not allow for full ERP deployment or for wide support of EQA's use in non-delegated counties. For future implementation, MPCA could use self-assessment data from non-delegated counties to mobilize and target its own assistance, as well as the assistance provided by partner organizations. For the foreseeable future, the data from third-party assessments (EQA) or self-assessments and from tracking the various types of follow-up contacts could be sufficient to communicate progress by the under 300 AU group to stakeholders. Use of either EQA or self-assessment or both would be a relatively low-cost alternative ($500 to $1000 per assisted farm and much less for those completing the self-assessment without assistance) that would produce data on current practices and begin improvement.

4. Preventive approach to loadings – Typically compliance and BMP implementation observed during inspections is used as a surrogate for open lot run-off monitoring. At EPA's urging, however, project staff also conducted MinnFarm modeling on most of the volunteers and controls in Phase 2 (ERP). Results are summarized on the following pages in Graph 5 and Graph 6: Graph 6 also includes a compliance score line. Project staff compared several inspection-based scores (performance, compliance, compliance specific to manure and nutrient management by year, by group, by county and by farm) but could find none which displayed a strong correlation with MinnFarm scores.

   As other MinnFarm users have reported, project staff sometimes found its loading numbers to be lower than they expected based on the lot conditions they observed, so we could speculate we are underestimating open lot loadings. We don't fully understand loadings of nutrients from manure application areas and crop fields in general. These uncertainties plus the existence of continuing agriculture-related water quality impairments in spite of efforts to eliminate them through current regulatory and voluntary programs suggests that a more whole-farm, preventive approach to nonpermitted farms could be more protective than focusing only where we are now.

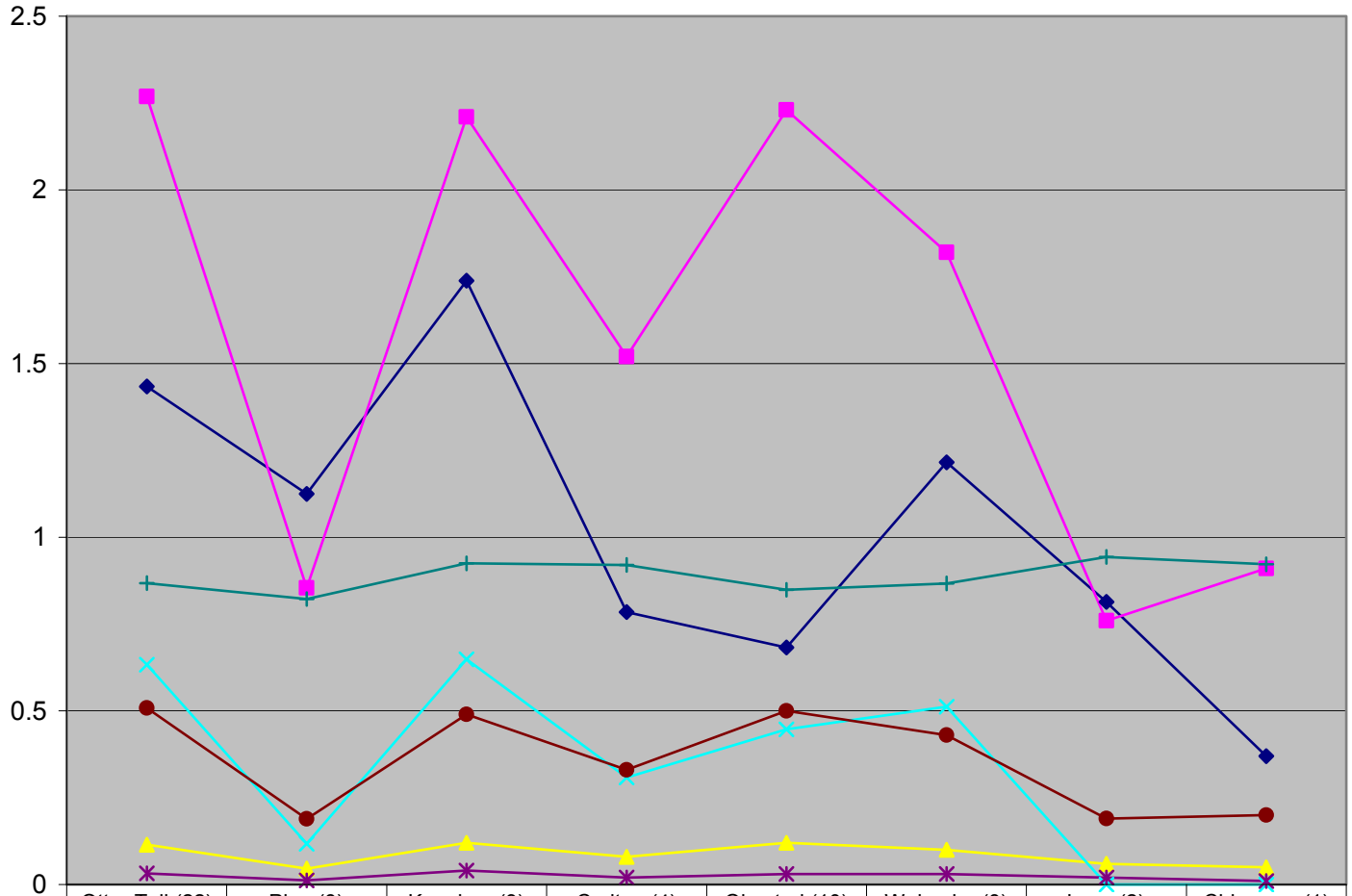
5. Optimal conditions for use - State and county programs have more contact and influence with feedlots over 300 AU, and the project's limited data collection from >300 AU producers shows higher levels of performance in that group. Therefore, the project team concluded that EQA and ERP tools are best suited to farms under 300 AU and to non-delegated counties. An exception would be if a delegated county were to invite use of ERP or EQA tools to address a program gap or weakness.

Graph 5. **SELF-ASSESSMENT - Modeled Pollutant Loading BY PHASE 2 COUNTY (annual per farm)**



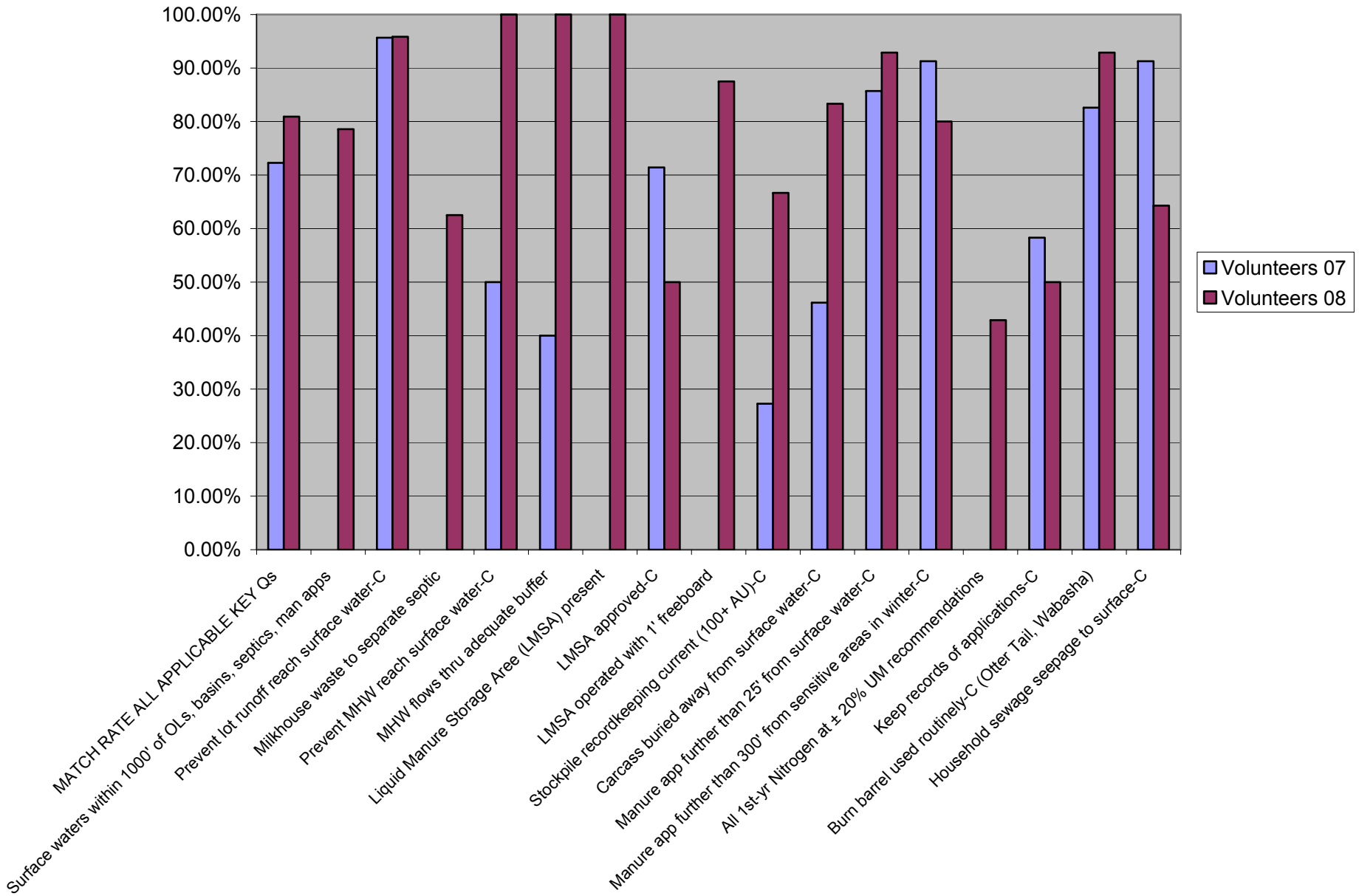
	Otter Tail (22)	Pine (8)	Kanabec (3)	Carlton (4)	Olmsted (10)	Wabasha (8)	Lyon (2)	Chippewa (1)
Average AU (MinnFarm farms only)	143.42	112.5	173.83	78.4	68.25	121.59	81.4	37
Per-Farm Average COD (lb/yr)	325.41	96.13	383.33	119	152.4	221.88	38	74
Per-Farm Average Nitrogen (lb/yr)	16.5	5.13	21	6.25	7.9	11.88	3	4
Per-Farm Average Fecal (E+12 CFU/yr)	90.77	13.17	112.90	24.16	30.52	62.22	0	0
Per-Farm Average Phosphorus (lb/yr)	4.64	1.38	6.33	1.75	2.2	3.5	1	1
Per-Farm Average BOD5 (lb/yr)	72.96	21.25	85	26.25	33.8	52	9.5	16

Graph 6. **SELF-ASSESSMENT - Modeled Pollutant Loading BY PHASE 2 COUNTY (annual per animal unit)**



	Otter Tail (22)	Pine (8)	Kanabec (3)	Carlton (4)	Olmsted (10)	Wabasha (8)	Lyon (2)	Chippewa (1)
Average AU (X100, MinnFarm farms only)	1.4342	1.125	1.7383	0.784	0.6825	1.2159	0.814	0.37
Per-AU Average COD (lb/yr)	2.2689	0.8544	2.2100	1.5200	2.2300	1.8200	0.7600	0.9100
Per-AU Average Nitrogen (lb/yr)	0.1150	0.0456	0.1200	0.0800	0.1200	0.1000	0.0600	0.0500
Per-AU Average Fecal (E+12 CFU/yr)	0.6329	0.1171	0.6490	0.3080	0.4470	0.5120	0.0000	0.0000
Per-AU Average Phosphorus (lb/yr)	0.0323	0.0122	0.0400	0.0200	0.0300	0.0300	0.0200	0.0100
Per-AU Average BOD5 (lb/yr)	0.5087	0.1889	0.4900	0.3300	0.5000	0.4300	0.1900	0.2000
Compliance questions	86.83%	82.20%	92.47%	92.03%	84.82%	86.72%	94.29%	92.16%

Graph 7. SELF-ASSESSMENT - Match (Agreement) Rate Between Inspector and Self-Assessment on Key Questions



6. Mandatory vs. voluntary - MPCA concluded that use of voluntary tools (whether ERP or EQA as they were rolled out in the pilot) would be limited to a small minority (<10% - see page 4) of farmers. Nevertheless, low-cost voluntary self- or third-party assessment is still worth pursuing in nondelegated or otherwise underserved counties because it will get improvement started.

   It should be pointed out that as a group, small farms were slow to comply with the requirement in Minnesota's feedlot rule that they register any open feedlots or manure storage sites. Only the application of additional resources and effort following the first four-year registration cycle pushed compliance with the registration requirement well into the majority. "Mandating" completion of a self-assessment would therefore be no guarantee that even a majority of the intended audience would in fact respond without the application of extra effort (and cost) by MPCA and regulatory partners.

   Since the self-assessment tools will not be made mandatory at the state level for the foreseeable future, MPCA will be testing whether an appeal for volunteers will work better on a more micro scale: at the watershed or sub-watershed level. Based on results from adjoining states, it is likely that appealing for contributions to improve a backyard stream or lake alongside one's neighbors will increase the rate of participation in voluntary programs such as the self-assessment or EQA.

7. Trust - As other states' ERPs have done repeatedly, the dairy pilot project demonstrated the respondents' willingness to self-assess and disclose non-compliance accurately at around 70% to start, and with feedback, to increase accuracy over time (the dairies increased to over 80% accuracy after one year). See Graph 7, page 13.

8. Cost-effectiveness - The pilot project was an intensive research experience that pushed MPCA far up the ERP/self-assessment learning curve. This will buy down the cost of MPCA's future use of self-assessment tools. Data from other states also suggest that once the learning curve is past, the cost of permanent ERP implementation can be significantly lower than conventional compliance approaches. However, MPCA's ability to project reduced cost in future implementation is limited. While MPCA purposely left the workshops which typify the ERP process out of the pilot to test a lower-cost approach (and for the practical reason that few farmers would turn out for such workshops), on-site assistance became part of the project inspection routine, adding costs while muddying self-motivation conclusions (see 3c above). MPCA does not have the data necessary to quantify the extra increment of cost associated with the on-site assistance, and to project that cost into future implementation.

9. Apparent year-to-year deterioration of performance – With both the EQA and ERP tools, performance on individual questions sometimes dropped off year-to-year while category, area, or overall aggregate performance was generally increasing. There are a variety of factors accounting for that drop-off, one of which is of course backsliding by the producer.

   There were other deterioration factors specific to Phase 2 (ERP) which may pertain to Phase 1 as well but haven't been directly observed by MPCA project staff. For instance, while Phase 2 performance on compliance issues improved, the project team concluded that the apparent deterioration of some beyond-compliance performance could often be attributed to project staff, not the farmers. For some questions in the group, responses are neutral (neither positive or negative), e.g., do you have a permanent manure stockpile, do you bury carcasses, do you hire a licensed pesticide applicator. Resources permitting, staff would remove those questions from this group and performance would increase substantially.

   The other downward pressure on beyond-compliance questions in Phase 2 came in some of the crop nutrient and soil conservation questions, where in the second year (2008) inspectors got more detailed information and concluded that positive practices were not in place as they were thought to be in 2007. This also could be corrected for, time and resources permitting.

IV. Future Implementation

Option A: Integrate ERP and self-assessment into the mandatory registration process for all feedlots <300 AU in non-delegated counties.

This option was not deemed feasible by the feedlot program for 3 primary reasons:

1. The project team could not guarantee improvement using the self-assessment without much on-site assistance;
2. The program could not staff the ERP implementation process or the requests from producers for assistance that it might generate;
3. The program does not believe that current rule will allow integration into the registration requirement, and due to budget/staffing constraints the program does not at this time intend to pursue a rule change to make aspects of the ERP approach mandatory.

Option B. Implement ERP as a feedlot compliance tool that stands alone from the existing registration process.

MPCA has not pursued this option since the barriers to Option A would also apply to Option B.

Option C.

Recommended
With partners, put more effort into education and technical assistance to small producers in underserved or priority watershed/TMDL areas, focusing on low-cost fixes for facility and field compliance and BMP issues. Investigate where use of the EQA or self-assessment/workbook tools combined with assistance would add value to TMDL/watershed programs or projects under way or anticipated.

Discussion
A myriad of people and organizations (including many at MPCA) are already engaged in planning for clean-up of impaired water and protection of clean water in Minnesota's 81 major watersheds, and more will be involved as the state's new sales tax revenue dedicated to water quality comes into the pipeline in 2009. Many federal, state and local government planning, funding, and programmatic efforts aim to improve small feedlot operations, application of manure, nutrients, or pesticides, soil conservation practices, homestead septics, or buffering of surface waters. With support from the Minnesota Department of Agriculture, MMPA has broadened the scope of the dairy EQA tool to apply to either dairy or beef cattle, renaming it the Livestock EQA (or LEQA).

Yet with all this effort and attention, impairments related to agriculture and farmsteads persist. MPCA is looking for missed opportunities or gaps in program coverage or between programs or organizations. Gaps may involve lack of coordination, geographic areas, sectors, or audiences with unmet needs where expansion or redirection of MPCA's current effort can lead to measurable improvement. TMDL planning can point out the highest-priority gaps to fill.

The pilot project team is therefore pursuing specific LEQA and self-assessment/workbook deployment possibilities with MPCA's TMDL and watershed management programs. If there are significant gaps, for instance open lot issues have been well addressed but manure application, septics and soil conservation need more attention, then there may be opportunities to use the self-assessment experience gained from the pilot project. MPCA and partners could modify the LEQA or self-assessment/workbook tools to focus on the "gap" issues and get them into the field in relatively short order. The focus of and resources for follow-up would have to be worked out with the host county or counties, MPCA programs, NGOs, producer associations, the University of Minnesota Extension Service, SWCD, NRCS and other partners.

Under any currently-foreseeable implementation scenario, MPCA would probably *not* use random-sample inspections of a predetermined number. Instead, it is likely that MPCA (and partners if they agree) will collect a full data set only when invited out to assist, and that such assistance will be parsed out carefully based on priority and opportunity. This will make use of the third-party or self-assessment/education approach more cost-effective. Cost-effective or not, if this approach stops producing change beyond the early adopters and the low-hanging fruit, it would be re-evaluated. There is still much skepticism of how many farmers will make changes – or how much change they will make – without significant on-site assistance or cost-share dollars.

At this writing, exploratory conversations are under way with coordinators of the Little Cannon River project in Goodhue County (bacteria and turbidity impairments) and the excess nutrients TMDL for Lake St. Croix, between Minnesota's Washington County and Wisconsin's St. Croix County. Two adjoining ERP project counties (both nondelegated) are in the upper reaches of the Lake St. Croix watershed: Kanabec County has several rivers with fecal impairment and some lakes with excess nutrient/eutrophication that have TMDLs under way, while neighboring Pine County has lakes issues.

In an attempt to identify other watersheds where this approach could be applied, MPCA has cross-referenced maps of nondelegated counties with fairly large numbers of feedlots with maps showing impairments relating at least in part to agriculture (see the maps on pages 3, 17 and 18). Areas so identified include:

- Becker County (northwestern Minnesota, with three lakes with nutrient/eutrophication impairments) – is not delegated for the feedlot program and has around 250 feedlots;
- Clearwater County (northwestern Minnesota, has rivers with fecal, turbidity, and low dissolved oxygen) has some TMDL development under way and one of the impairments (the Clearwater River) goes into neighboring Beltrami County – neither county is delegated and together they are home to over 200 feedlots;
- Redwood county (an ERP project control group county in southwestern Minnesota, with several rivers with fecal and turbidity impairments relating in part to the over 300 feedlots in the county) – is not delegated for the feedlot program and has one approved TMDL in place and several other TMDL development projects under way.

MPCA is working not only to address identified impairments but also to protect clean water. Some of the new sales tax money will go to clean water protection. Among nondelegated counties with few impairments characterized as of this writing are:

- Beltrami County has few impairments (see Clearwater County bullet above);
- Benton and Olmsted counties have relatively few impairments; Olmsted has a few turbid rivers.

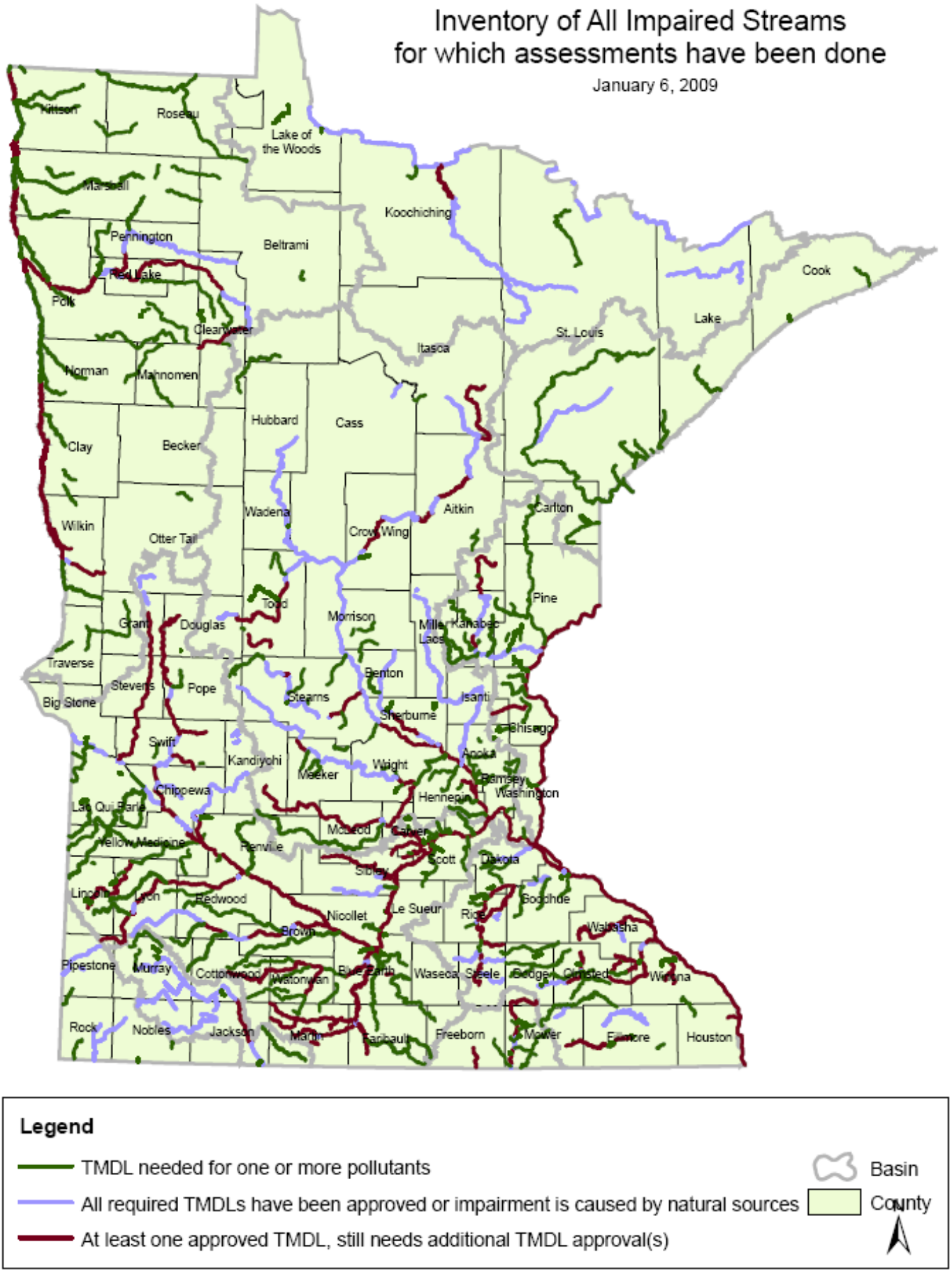
Otter Tail, the main ERP project county with around 600 open lots but only 1 impairment (a lake) currently being addressed, is currently working towards delegation of the feedlot program. Even if the county completes delegation, their staff might be interested in using the third-party or self-assessment approaches during the transition and perhaps beyond.

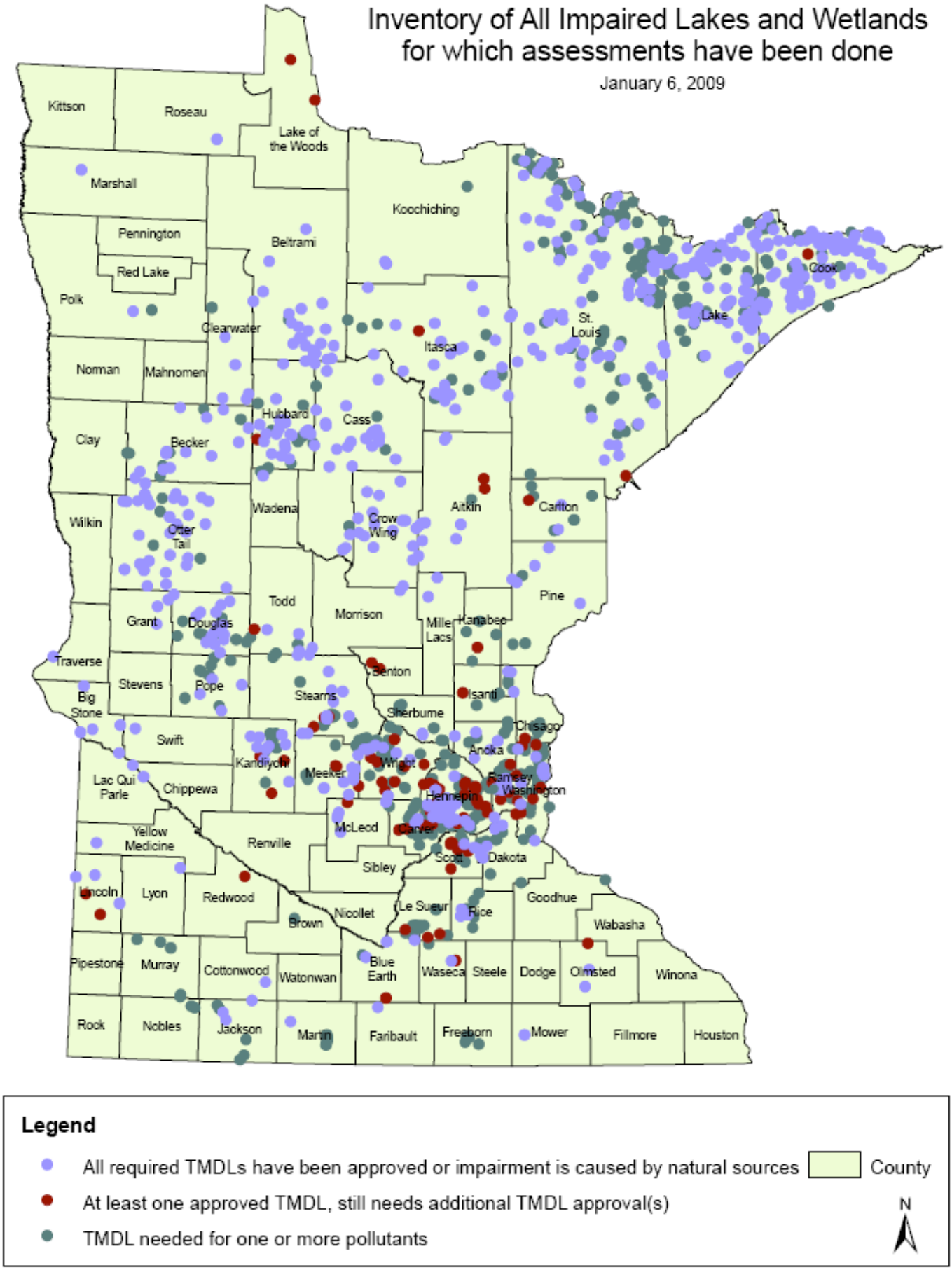
Other Needs

1. Using survey techniques, attempt to isolate the impact of on-site assistance by inspector from the impact of the workbook;

2. Determine why the MinnFarm model did not generate data on fecal coliform runoff for lots which had relatively high phosphorus, nitrogen and/or BOD5 runoff amounts;

3. Find ways to model runoff from crop fields or perennials where manure is applied.





V. Final Budget Summary

Following is the final budget summary based on the most current numbers available to the project team. The MPCA's fiscal staff have submitted the most accurate and final financial reports to EPA separately. Those would have reflected account adjustments necessary to eliminate negative balances indicated below (in parentheses).

1	2	July through September 2008 3	4	5	6
	TOTALS: PREVIOUS PERIOD	FEDERAL	STATE	TOTAL	TOTALS for PROJECT
	73,004.58	0.00	0.00	0.00	73,004.58
	108,892.12	8,501.52	0.00	8,501.52	117,393.64
Total Direct Expenditures	181,896.70	8,501.52	0.00	8,501.52	190,398.22
Total Indirect Expenditures	38,950.74	1,240.38	656.72	1,897.10	40,847.84
Quarter Dollars spent	220,847.44	9,741.90	656.72	10,398.62	231,246.06
Through Previous Period		132,775.83	88,148.73		
Total Dollars spent		142,440.61	88,805.45		231,246.06
Total Award/Match Amounts		140,306.00	88,512.00		228,818.00
BALANCE		(2,134.61)	(293.45)		(2,428.06)
Unpaid Obligations		0	0		0
Balance Available		(2,134.61)	(293.45)		(2,428.06)

Contact: Al Innes (651-757-2457) alister.innes@state.mn.us

VI. Appendices

1. Phase 1 data summary
2. Phase 2 data summary - 2007
3. Phase 2 data summary – 2008
4. Phase 2 data summary – Change from 2007 to 2008
5. Phase 2 data summary - MinnFarm and manure application rate data
6. Detailed discussion of main Phase 2 data points
7. Review of major milestones from the original proposal and logic model
8. Analysis approach to the Phase 2 Minnesota Dairy ERP inspection data (Crow Environmental)
9. States ERP Consortium/EPA Core Measures report for Phase 2

NOTES:

- "Volunteers" or "Vs" are self-assessment participants: those producers located in Otter Tail, Pine, Kanabec and Carlton counties who volunteered to complete self-assessments and undergo verification inspections.
- "4-Cs" refers to the control group farms in those same counties.
- "5-Cs" refers to the control group farms in Olmsted, Wabasha, Lyon, Chippewa and Redwood counties.
- Control group farmers did not participate in the self-assessment but did undergo inspections collecting data on the same questions and indicators covered in the self-assessments.
- "EBPI" (Environmental Business Practice Indicator) is an ERP term equivalent to what we have been calling "Key" questions or measures, and refers to a smaller group of the most important environmental indicators.
- Most of the inspections in both the baseline and follow-up rounds were conducted by a single staff person hired using State Innovation Grant program funds from U.S. EPA.

Appendix 1. Phase 1 data summary

FARM ID	Last Contact	Water Quality	Odor & Air	Soil Quality /Nutrients	Habitat Quality	Community Image	Change in Overall Score	Last Contact Date	Assistance Hours	Certification Walkthrough	Amount Paid
Stearns County											
3032	Final FERP Assessment (FA)	0.18	0.43	0.40	0.25	-0.11	0.23	07/13/07	15	07/13/07	1020
3043	Final FERP Assessment (FA)	0.03	-0.09	0.13	1.25	0.07	0.28	08/28/07	15		950
3044	Final Assessment + CW	0.74	0.21	0.06	0.10	0.13	0.25	08/30/07	9.5	08/30/07	880
3045	Final FERP Assessment (FA)	-0.24	0.03	0.63	1.00	-0.21	0.24	08/28/07	13.5		1040
3046	Certification Walkthrough (CW)	0.01	0.05	0.32	0.00	0.28	-0.05	08/28/06	6	08/21/06	730
3049		No final	No	longer	milking	-	-	09/17/07	20		1170
3056	Final FERP Assessment (FA)	-0.21	0.28	-0.30	0.15	-0.05	-0.03	08/27/07	0		500
3057	Certification Walkthrough (CW)	0.07	0.00	0.00	0.00	0.00	0.01		1	08/21/06	540
3058	Final FERP Assessment (FA)	0.03	0.14	0.41	-1.92	0.35	-0.20	08/20/07	0		500
3059	Final Assessment + CW	-0.24	0.20	-0.07	0.00	0.15	0.01	08/20/07	0	08/20/07	500
3060	Final FERP Assessment (FA)	0.25	-0.20	0.42	-0.75	0.00	-0.05	08/21/07	0		500
3061	Final FERP Assessment (FA)	-0.05	-0.05	-0.16	-0.17	-0.38	-0.16	09/26/07	0		570
3062	Initial Assessment (IA)	No final	“Low	priority”				08/02/06	0		320
3063	Final FERP Assessment (FA)	-0.15	0.20	-0.17	-0.75	0.28	-0.12	09/20/07	0		500
3064	Certification Walkthrough (CW)	-0.08	0.00	0.00	0.00	0.00	-0.02		3	08/21/06	690
3065	Final Assessment + CW	0.12	-0.05	0.31	1.00	0.13	0.30	05/09/07	20	05/09/07	1160
3066	Certification Walkthrough (CW)	0.00	0.00	0.72	0.08	0.03	0.17		15.5	08/25/06	955
3067	Final FERP Assessment (FA)	0.22	-0.18	0.40	0.17	0.17	0.16	08/23/07	20		1300
3068	Final FERP Assessment (FA)	0.04	0.15	0.74	0.50	-0.11	0.26	07/11/07	15		1020
3069	Final Assessment + CW	0.08	0.15	0.08	0.50	0.00	0.16	08/21/07	15	08/21/07	950
3070	Final FERP Assessment (FA)	0.05	-0.03	0.52	0.50	0.41	0.29	08/28/07	15		950
3071	Final Assessment + CW	0.67	-0.14	0.90	0.30	-0.25	0.29	08/24/07	15	08/24/07	950
3072	Final FERP Assessment (FA)	-0.13	0.28	0.30	-0.50	-0.13	-0.04	09/20/07	15		950

FARM ID	Last Contact	Water Quality	Odor & Air	Soil Quality /Nutrients	Habitat Quality	Community Image	Change in Overall Score	Last Contact Date	Assistance Hours	Certification Walkthrough	AMT.PD.
Stearns County											
3073	Final FERP Assessment (FA)	0.12	0.33	0.79	-1.83	0.28	-0.06	07/11/07	11		900
3074	Final FERP Assessment (FA)	0.05	0.38	0.47	0.83	0.00	0.35	07/12/07	15		1020
3075	Final Assessment + CW	0.14	-0.02	0.74	1.00	-0.13	0.35	07/12/07	15	07/12/07	1020
3076	Final FERP Assessment (FA)	-0.03	0.24	0.40	-0.25	-0.50	-0.03	07/13/07	15		1020
3077		No final	No	longer	milking			09/17/07	15		950
3079	Final FERP Assessment (FA)	0.36	0.02	0.99	0.50	-0.32	0.31	08/23/07	15		950
Winona County											
6027	Final FERP Assessment (FA)	0.15	-0.03	0.36	0.33	0.33	0.23	08/21/07	1.25		550
6029	Initial Assessment (IA) + CW							08/16/05	0	08/16/05	250
6030	Certification Walkthrough (CW)	0.19	0.40	0.66	0.00	0.00	0.25		0.75	07/20/06	520
6031	Final FERP Assessment (FA)	0.15	-0.25	0.21	0.60	0.20	0.18	08/22/07	1.22		567
6032	Certification Walkthrough (CW)	Same	as	IA				09/15/05	0	05/10/06	490
6033	Certification Walkthrough (CW)	0.00	0.47	0.00	0.00	0.00	0.09	08/16/06	0.75	08/16/06	520
6034	Final FERP Assessment (FA)	0.10	-0.08	0.09	0.00	0.00	0.02	09/18/07	0.75		530
6035	Final FERP Assessment (FA)	-0.11	0.60	-0.11	0.00	0.00	0.08	08/27/07	4.5		665
6036	Initial Assessment (IA) + CW							08/15/05	3	08/15/05	400
6037	Final FERP Assessment (FA)	1.07	0.60	0.67	0.33	0.00	0.53	08/16/07	4.5		665
6039	Final FERP Assessment (FA)	0.20	0.33	-0.03	1.00	0.40	0.38	08/31/07			500
	• 29 Stearns + 11 Winona = 40 total • 15 Certification Walkthroughs • 22 Final FERP Assessments • 2 No longer milking • 1 Low priority						• 3 Initial Assessments only • 10 decreasing scores • 3 >0.10 drop • 22 increasing • 17 >0.10 increase		316.22 hours		$30,162

Appendix 2. Phase 2 data summary – 2007

NOTE that Key or EBPI questions are shaded blue-green		Volunteers	4-county	5-county	All	Statistically-significant difference?			
Aggregate Facility-Based data		23	21	23	67	V diff 4	V diff 5	4 diff 5	
All common applicable		73.34%	68.54%	69.13%	70.41%	Yes			
Common compliance applicable		85.27%	85.00%	84.34%	84.89%				
Common EBPI or key applicable		76.96%	72.52%	69.92%	73.26%		Yes		
Common voluntary or beyond-compliance applicable		59.30%	51.57%	51.63%	54.30%	Yes	Yes		
Match rate all common applicable		72.30%							
Match rate common compliance applicable		70.70%							
Return to Compliance plans all complete		5.60%							
Some completion dates given		27.80%							
Certifications complete		78.30%							
Average AU		151.99	113.42	102.73	122.99				
Questions common to both years – **NOTE: "C" in next column indicates a compliance question.**	C?								**07 match**
100% Compliant		20.00%	5.26%	0.00%	8.77%	--	Yes	--	
Waters within 1000' of OLs, basins, septics, man apps		80.00%	68.42%	94.44%	80.70%	--	--	Yes	
Prevent reach road ditch/Prevent reach other surf water	C	94.44%	83.33%	88.89%	88.89%	--	--	--	95.65%
to surface tile	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
surface feature	C	100.00%	100.00%	100.00%	100.00%	--	--	--	75.00%
separate septic		100.00%	100.00%	100.00%	100.00%	--	--	--	
Prevent MHW reach road ditch, other surf water	C	100.00%	90.00%	100.00%	95.65%	Yes	--	--	50.00%
MHW thru adequate buffer	C	50.00%	60.00%	100.00%	75.00%	--	Yes	--	40.00%
basin or pit		10.00%	15.79%	5.56%	10.53%	--	--	--	
LMSA present		55.00%	42.11%	16.67%	38.60%	--	Yes	--	
LMSA approved	C	63.64%	75.00%	100.00%	73.91%	--	--	--	71.43%
MHW storage overflow	C	87.50%	100.00%	100.00%	93.75%	--	--	--	50.00%
1' freeboard		100.00%	100.00%	100.00%	100.00%	--	--	--	
vegetation clear		80.00%	57.14%	75.00%	71.43%	--	--	--	
upslope divert		100.00%	0.00%	100.00%	83.33%	Yes	--	--	
short-term pile to surf water	C	90.00%	90.91%	100.00%	92.86%	--	--	--	63.64%
pile slope <6%	C	100.00%	90.91%	85.71%	92.86%	Yes	Yes	--	72.73%
short pile dist	C	70.00%	100.00%	57.14%	78.57%	Yes	--	Yes	54.55%
permanent stockpile		15.00%	5.26%	11.11%	10.53%	--	--	--	
Impervious pad	C	100.00%	100.00%	100.00%	100.00%	--	--	--	50.00%
Record-keeping current (100+ AU)	C	30.00%	18.18%	0.00%	18.52%	--	--	--	27.27%
feed leachate to water	C	100.00%	100.00%	100.00%	100.00%	--	--	--	95.65%
compost carcasses		10.00%	10.53%	22.22%	14.04%	--	--	--	
bury carcasses		50.00%	73.68%	55.56%	59.65%	Yes	--	--	
render remove 72 hrs	C	93.33%	92.31%	100.00%	95.00%	--	--	--	88.89%
IF render/O-S: scavenger-proof	C	92.86%	83.33%	100.00%	91.18%	--	--	--	37.50%
liquid from compost	C	100.00%	100.00%	66.67%	85.71%	--	Yes	--	0.00%

NOTE that key or EBPI questions are shaded blue-green	C?	Volunteers	4-county	5-county	All	Statistically-significant difference?			
compost impervious pad	C	0.00%	0.00%	25.00%	12.50%	--	Yes	--	0.00%
7-10 day cycle/130+	C	0.00%	0.00%	25.00%	12.50%	--	Yes	--	0.00%
Carcass compost finish free of tissue	C	50.00%	100.00%	50.00%	62.50%	--	--	--	0.00%
Carcass buried >5' over high water table	C	70.00%	60.00%	100.00%	78.26%	--	--	--	38.46%
Carcass buried away from surf water	C	90.00%	100.00%	100.00%	95.65%	--	--	--	46.15%
cover immediately with 3' soil	C	70.00%	60.00%	100.00%	78.26%	--	--	--	38.46%
Carcass burial avoid sand/gravel	C	70.00%	80.00%	100.00%	82.61%	--	--	--	38.46%
>10' over bedrock	C	80.00%	60.00%	100.00%	82.61%	--	--	--	46.15%
Manure app further than 25' from surface water	C	83.33%	100.00%	88.89%	90.24%	--	--	--	85.71%
incorporate in 24hrs w/in 300'	C	73.33%	36.36%	28.57%	51.52%	Yes	Yes	--	64.71%
apply w/in 50' of feature	C	100.00%	100.00%	100.00%	100.00%	--	--	--	71.43%
Manure app > 300' from sensitive areas in winter	C	78.57%	100.00%	90.91%	89.74%	Yes	--	--	91.30%
crop total N ≤ UM recommendations		45.00%	47.37%	44.44%	45.61%	--	--	--	
all 1st-yr N ± 20% UM		45.00%	36.84%	38.89%	40.35%	--	--	--	
clean manure spill road	C	100.00%	100.00%	100.00%	100.00%	--	--	--	77.27%
100+ in 1 pile-N,P 4 yrs	C	66.67%	40.00%	60.00%	57.89%	--	--	--	63.64%
Keep records of applications	C	50.00%	14.29%	33.33%	34.78%	--	--	--	58.33%
P test application area once/4yr	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
apply on high P w/in 300' w/ no permit or strategy	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
apply on extra-high P w/ no permit or approved strategy	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
test new storage annually	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
>300 - application records retained for 3 yrs (6)	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
burn barrel used routinely	C	75.00%	57.89%	22.22%	52.63%	--	Yes	Yes	82.61%
well casing up/grout/cap	C	100.00%	100.00%	94.44%	98.25%	--	Yes	--	100.00%
wells upslope or protected	C	100.00%	100.00%	94.44%	98.25%	--	Yes	--	100.00%
antibackflow faucet w hose	C	100.00%	89.47%	87.50%	92.73%	Yes	Yes	--	82.61%
unused wells sealed, doc	C	100.00%	100.00%	66.67%	83.33%	--	Yes	--	83.33%
sewer straight-pipes	C	100.00%	100.00%	100.00%	100.00%	--	--	--	95.65%
seepage to surface	C	80.00%	94.74%	83.33%	85.96%	--	--	--	91.29%
hire licensed pest applicator		63.16%	82.35%	66.67%	70.37%	--	--	--	
records of all applications	C	90.00%	80.00%	100.00%	90.91%	--	--	--	72.73%
store pest in original container	C	100.00%	100.00%	83.33%	95.24%	--	Yes	--	88.89%
3-wash/recycle or per label	C	100.00%	100.00%	100.00%	100.00%	--	--	--	88.89%
USTs >1100 gallons		100.00%	100.00%	94.44%	98.25%	--	Yes	--	
if yes, coated/monitored	C	0.00%	0.00%	0.00%	0.00%	--	--	--	0.00%
2+ crop/3 yr; per forage 50%		100.00%	94.44%	77.78%	90.91%	Yes	Yes	--	
GPS		15.00%	10.53%	11.11%	12.28%	--	--	--	
soil sampling		85.00%	68.42%	61.11%	71.93%	--	Yes	--	
combine yield monitors		30.00%	5.26%	55.56%	29.82%	Yes	Yes	Yes	
30% residue or strip till 2/3		73.68%	52.94%	55.56%	61.11%	--	--	--	
	47					10	17	4	69.54%

Appendix 3. Phase 2 data summary – 2008

NOTE that key or EBPI questions are shaded blue-green		Volunteers	4-county	5-county	All	Statistically-significant difference?			
Aggregate Facility-Based data		20	19	18	57	V diff 4	V diff 5	4 diff 5	
All common applicable		73.23%	65.33%	65.61%	68.19%	Yes	Yes		
Common compliance applicable		93.37%	91.04%	86.66%	90.47%		Yes		
Common EBPI or key applicable		79.63%	72.35%	64.80%	72.52%	Yes	Yes		
Common voluntary or beyond-compliance applicable		52.73%	43.30%	41.91%	46.17%	Yes	Yes		
Match rate all common applicable		80.90%							
Match rate common compliance applicable		83.46%							
Return to Compliance plans all complete		6.67%							
Some completion dates given		53.33%							
Certifications complete		93.33%							
Average AU		163.89	112.58	102.69	127.46	Yes	Yes		
Questions common to both years – **NOTE: "C" in next column indicates a compliance question.**	C?					V diff 4	V diff 5	4 diff 5	**08 match**
100% Compliant		25.00%	26.32%	16.67%	22.81%	--	--	--	
Waters within 1000' of OLs, basins, septics, man apps		60.00%	26.32%	50.00%	45.61%	Yes	--	--	78.57%
Prevent reach road ditch/Prevent reach other surf water	C	100.00%	78.57%	92.31%	89.74%	Yes	Yes	--	95.83%
to surface tile	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
surface feature	C	0.00%	100.00%	0.00%	100.00%	--	--	--	#DIV/0!
separate septic		18.18%	40.00%	33.33%	30.00%	--	--	--	62.50%
Prevent MHW reach road ditch, other surf water	C	90.00%	77.78%	87.50%	85.19%	--	--	--	100.00%
MHW thru adequate buffer	C	100.00%	100.00%	0.00%	100.00%	--	Yes	--	100.00%
basin or pit		58.33%	63.64%	11.11%	46.88%	--	Yes	Yes	100.00%
LMSA present		55.00%	42.11%	17.65%	39.29%	--	Yes	--	100.00%
LMSA approved	C	63.64%	75.00%	100.00%	72.73%	--	--	--	50.00%
MHW storage overflow	C	100.00%	87.50%	100.00%	95.45%	Yes	--	--	100.00%
1' freeboard		100.00%	87.50%	100.00%	95.45%	Yes	--	--	87.50%
vegetation clear		77.78%	75.00%	50.00%	73.68%	--	--	--	71.43%
upslope divert		80.00%	100.00%	100.00%	92.86%	--	--	--	66.67%
short-term pile to surf water	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
pile slope <6%	C	66.67%	100.00%	100.00%	91.67%	--	--	--	66.67%
short pile dist	C	66.67%	100.00%	100.00%	91.67%	--	--	--	66.67%
perm stockpile		20.00%	5.26%	0.00%	8.77%	--	Yes	--	78.57%
impervious pad	C	100.00%	100.00%	0.00%	100.00%	--	Yes	--	50.00%
Record-keeping current (100+ AU)	C	80.00%	20.00%	0.00%	35.71%	Yes	Yes	--	66.67%
feed leachate to water	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
compost carcasses		0.00%	5.26%	0.00%	1.75%	Yes	--	--	92.86%
bury carcasses		55.00%	26.32%	52.94%	44.64%	Yes	--	--	85.71%
render remove 72 hrs	C	100.00%	100.00%	100.00%	100.00%	--	--	--	80.00%
IF render/O-S: scavenger-proof	C	100.00%	100.00%	100.00%	100.00%	--	--	--	50.00%
liquid from compost	C	0.00%	0.00%	0.00%	0.00%	--	--	--	#DIV/0!

NOTE that key or EBPI questions are shaded blue-green	C?	Volunteers	4-county	5-county	All	Statistically-significant difference?			
compost impervious pad	C	0.00%	0.00%	0.00%	0.00%	--	--	--	#DIV/0!
7-10 day cycle/130+	C	0.00%	0.00%	0.00%	0.00%	--	--	--	#DIV/0!
Carcass compost finish free of tissue	C	0.00%	0.00%	0.00%	0.00%	--	--	--	#DIV/0!
Carcass buried >5' over high water table	C	100.00%	100.00%	100.00%	100.00%	--	--	--	83.33%
Carcass buried away from surf water	C	100.00%	100.00%	100.00%	100.00%	--	--	--	83.33%
cover immediately with 3' soil	C	72.73%	80.00%	100.00%	84.00%	--	--	--	66.67%
Carcass burial avoid sand/gravel	C	100.00%	100.00%	100.00%	100.00%	--	--	--	83.33%
>10' over bedrock	C	100.00%	100.00%	100.00%	100.00%	--	--	--	83.33%
Manure app further than 25' from surface water	C	100.00%	100.00%	75.00%	92.31%	--	Yes	Yes	92.86%
incorporate in 24hrs w/in 300'	C	100.00%	90.91%	75.00%	87.80%	Yes	Yes	--	63.64%
apply w/in 50' of feature	C	100.00%	75.00%	33.33%	58.33%	Yes	Yes	--	100.00%
Manure app > 300' from sensitive areas in winter	C	100.00%	100.00%	63.64%	89.19%	--	Yes	Yes	80.00%
crop total N ≤ UM recommendations		60.00%	26.32%	27.78%	38.60%	Yes	Yes	--	50.00%
all 1st-yr N ± 20% UM		30.00%	21.05%	33.33%	28.07%	--	--	--	42.86%
clean manure spill road	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
100+ in 1 pile-N,P 4 yrs	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
Keep records of applications	C	23.08%	66.67%	25.00%	34.78%	Yes	--	--	50.00%
P test application area once/4yr	C	100.00%	100.00%	100.00%	100.00%	--	--	--	#DIV/0!
apply on high P w/in 300' w/ no permit or strategy	C	100.00%	100.00%	100.00%	100.00%	--	--	--	#DIV/0!
apply on extra-high P w/ no permit or approved strategy	C	100.00%	100.00%	0.00%	100.00%	--	Yes	--	#DIV/0!
test new storage annually	C	100.00%	100.00%	100.00%	100.00%	--	--	--	#DIV/0!
>300 - retain application records 3 yrs (6)	C	100.00%	100.00%	50.00%	80.00%	--	Yes	--	#DIV/0!
burn barrel used routinely	C	80.00%	68.42%	22.22%	57.89%	--	Yes	Yes	92.86%
well casing up/grout/cap	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
wells upslope or protected	C	100.00%	100.00%	100.00%	100.00%	--	--	--	100.00%
antibackflow faucet w hose	C	100.00%	84.21%	93.75%	92.73%	Yes	Yes	--	85.71%
unused wells sealed, doc	C	100.00%	100.00%	83.33%	92.86%	--	Yes	--	100.00%
sewer straight-pipes	C	100.00%	94.74%	100.00%	98.25%	Yes	--	--	85.71%
seepage to surface	C	95.00%	94.74%	94.44%	94.74%	--	--	--	64.29%
hire licensed pest applicator		64.71%	86.67%	72.22%	74.00%	--	--	--	90.91%
records of all applications	C	100.00%	100.00%	100.00%	100.00%	--	--	--	83.33%
store pest in original container	C	100.00%	100.00%	100.00%	100.00%	--	--	--	83.33%
3-wash/recycle or per label	C	100.00%	100.00%	100.00%	100.00%	--	--	--	83.33%
USTs >1100 gallons		90.00%	100.00%	100.00%	96.49%	--	--	--	78.57%
if yes, coated/monitored	C	100.00%	0.00%	0.00%	100.00%	Yes	Yes	--	0.00%
2+ crop/3 yr; per forage 50%		100.00%	100.00%	94.44%	98.25%	--	Yes	--	
GPS		15.00%	10.53%	11.11%	12.28%	--	--	--	
soil sampling		95.00%	78.95%	55.56%	77.19%	Yes	Yes	--	
combine yield monitors		30.00%	5.26%	22.22%	19.30%	Yes	--	--	
30% residue or strip till 2/3		20.00%	15.79%	38.89%	24.56%	--	--	--	
	47					16	20	4	83.08%

Appendix 4. Phase 2 data summary – Change from 2007 to 2008

NOTE that key or EBPI questions are shaded blue-green		Volunteers	4-county	5-county	Statistically-significant difference?			
Aggregate Facility-Based data					V diff 4	V diff 5	4 diff 5	
All common applicable		0.85%	-4.23%	-4.95%	Yes	Yes		
Common compliance applicable		8.64%	1.81%	-0.22%	Yes	Yes		
Common EBPI or key applicable		2.35%	-4.22%	-6.33%				
Common voluntary or beyond-compliance applicable		-5.57%	-8.85%	-9.72%				
Match rate all common applicable		8.60%						
Match rate common compliance applicable		12.76%						
Return to Compliance plans all complete		1.07%						
Some completion dates given		25.53%						
Certifications complete		15.03%						
Average AU		10.35	-2.23	-4.60	Yes	Yes		
Questions common to both years – **NOTE: "C" in next column indicates a compliance question.**	C?				V diff 4	V diff 5	4 diff 5	**Change**
100% Compliant		5.00%	21.05%	16.67%	--	--	--	
Waters within 1000' of OLs, basins, septics, man apps		-20.00%	-42.11%	-44.44%	--	--	--	
Prevent reach road ditch/Prevent reach other surf water	C	10.00%	-15.38%	0.00%	--	--	--	0.18%
to surface tile	C	0.00%	0.00%	0.00%	--	--	--	0.00%
surface feature	C	0.00%	0.00%	0.00%	NA	NA	NA	
separate septic		-77.78%	-40.00%	-75.00%	--	--	--	
Prevent MHW reach road ditch, other surf water	C	0.00%	0.00%	-50.00%	--	--		50.00%
MHW thru adequate buffer	C	0.00%	0.00%	0.00%	NA	NA	NA	60.00%
basin or pit		50.00%	45.45%	0.00%	--	Yes	--	
LMSA present		0.00%	0.00%	0.00%	--	--	--	
LMSA approved	C	0.00%	0.00%	0.00%	--	--	--	-21.43%
MHW storage overflow	C	12.50%	-14.29%	0.00%	--	--	--	50.00%
1' freeboard		0.00%	-14.29%	0.00%	--	--	--	
vegetation clear		0.00%	14.29%	0.00%	--	--	--	
upslope divert		0.00%	100.00%	0.00%	--	--	--	
short-term pile to surf water	C	33.33%	0.00%	0.00%	--	--	--	36.36%
pile slope <6%	C	0.00%	0.00%	0.00%	--	--	--	-6.06%
short pile dist	C	50.00%	0.00%	50.00%	Yes	--	--	12.12%
perm stockpile		5.00%	0.00%	-11.11%	--	--	--	
impervious pad	C	0.00%	0.00%	0.00%	--	NA	NA	0.00%
Record-keeping current (100+ AU)	C	66.67%	0.00%	0.00%	Yes	Yes	--	39.40%
feed leachate to water	C	0.00%	0.00%	0.00%	--	--	--	4.35%
compost carcasses		-10.00%	-5.26%	-22.22%	--	--	--	
bury carcasses		5.00%	-47.37%	0.00%	Yes	--	--	
render remove 72 hrs	C	0.00%	0.00%	0.00%	--	--	--	-8.89%
IF render/O-S: scavenger-proof	C	0.00%	0.00%	0.00%	--	--	--	12.50%
liquid from compost	C	0.00%	-100.00%	0.00%	NA	NA	NA	

NOTE that key or EBPI questions are shaded blue-green	C?	Volunteers	4-county	5-county	Statistically-significant difference?			
compost impervious pad	C	0.00%	0.00%	0.00%	NA	NA		
7-10 day cycle/130+	C	0.00%	0.00%	0.00%	NA	NA		
Carcass compost finish free of tissue	C	0.00%	-100.00%	0.00%	NA	NA		
Carcass buried >5' over high water table	C	33.33%	50.00%	0.00%	--	Yes	--	44.87%
Carcass buried away from surf water	C	11.11%	0.00%	0.00%	--	--	--	37.18%
cover immediately with 3' soil	C	0.00%	25.00%	0.00%	--	--	--	28.21%
Carcass burial avoid sand/gravel	C	22.22%	0.00%	0.00%	--	Yes	--	44.87%
>10' over bedrock	C	22.22%	25.00%	0.00%	--	Yes	--	37.18%
Manure app further than 25' from surface water	C	11.76%	0.00%	-12.50%	Yes	--	--	7.15%
incorporate in 24hrs w/in 300'	C	33.33%	40.00%	33.33%	--	--	--	-1.07%
apply w/in 50' of feature	C	0.00%	0.00%	-50.00%	--	--	--	28.57%
Manure app > 300' from sensitive areas in winter	C	21.43%	0.00%	-27.27%	Yes	Yes	--	-11.30%
crop total N ≤ UM recommendations		15.00%	-21.05%	-16.67%	--	Yes	--	
all 1st-yr N ± 20% UM		-15.00%	-15.79%	-5.56%	--	--	--	
clean manure spill road	C	0.00%	0.00%	0.00%	--	--	--	22.73%
100+ in 1 pile-N,P 4 yrs	C	0.00%	66.67%	0.00%	--	--	--	36.36%
Keep records of applications	C	-20.00%	50.00%	-25.00%	Yes	--	--	-8.33%
P test application area once/4yr	C	0.00%	0.00%	0.00%	--	--	--	
apply on high P w/in 300' w/ no permit or strategy	C	0.00%	0.00%	0.00%	--	--	--	
apply on extra-high P w/ no permit or approved strategy	C	0.00%	0.00%	0.00%	--	NA	NA	
test new storage annually	C	0.00%	0.00%	0.00%	--	--	--	
>300 - retain application records 3 yrs (6)	C	0.00%	0.00%	-50.00%	--	--	--	
burn barrel used routinely	C	5.00%	10.53%	0.00%	--	--	--	10.25%
well casing up/grout/cap	C	0.00%	0.00%	5.56%	--	--	--	0.00%
wells upslope or protected	C	0.00%	0.00%	5.56%	--	--	--	0.00%
antibackflow faucet w hose	C	0.00%	-5.26%	0.00%	--	--	--	3.10%
unused wells sealed, doc	C	0.00%	0.00%	0.00%	NA	--	NA	16.67%
sewer straight-pipes	C	0.00%	-5.26%	0.00%	--	--	--	-9.94%
seepage to surface	C	15.00%	0.00%	11.11%	--	--	--	-27.00%
hire licensed pest applicator		5.88%	6.67%	5.56%	--	--	--	
records of all applications	C	11.11%	0.00%	0.00%	--	--	--	10.60%
store pest in original container	C	0.00%	0.00%	16.67%	--	--	--	-5.56%
3-wash/recycle or per label	C	0.00%	0.00%	0.00%	--	--	--	-5.56%
USTs >1100 gallons		-10.00%	0.00%	5.56%	Yes	--	--	
if yes, coated/monitored	C	0.00%	0.00%	0.00%	NA	NA	NA	
2+ crop/3 yr; per forage 50%		0.00%	5.56%	16.67%	--	--	--	
GPS		0.00%	0.00%	0.00%	--	--	--	
soil sampling		10.00%	10.53%	-5.56%	--	--	--	
combine yield monitors		0.00%	0.00%	-33.33%	--	Yes	--	
30% residue or strip till 2/3		-52.63%	-35.29%	-16.67%	--	--	--	
	47				7	8	0	13.54%

Appendix 5. Phase 2 data summary - MinnFarm and manure application rate data – NOTE that no MinnFarm data was collected in Redwood County.

The numbers on this page include all farms for which project staff completed MinnFarm estimates. The following page shows means/medians after outliers are eliminated.

BY COUNTY (see Graph 4, p. 9)	Otter Tail (22)	Pine (8)	Kanabec (3)	Carlton (4)	Olmsted (10)	Wabasha (8)	Lyon (2)	Chippewa (1)
Aggregate COD (lbs/year)	7159.00	769.00	1150.00	476.00	1524.00	1775.00	76.00	74.00
Aggregate N (lbs/year)	363.00	41.00	63.00	25.00	79.00	95.00	6.00	4.00
Aggregate Fecal	1.99697E+15	1.0539E+14	3.3859E+14	9.664E+13	3.0517E+14	4.98E+14	0	0
Aggregate P (lbs/year)	102.00	11.00	19.00	7.00	22.00	28.00	2.00	1.00
Aggregate BOD5 (lbs/year)	1605.19	170.00	255.00	105.00	338.00	416.00	19.00	16.00
Per-Farm Average COD (lb/year)	325.41	96.13	383.33	119.00	152.40	221.88	38.00	74.00
Per-Farm Average N (lbs/year)	16.50	5.13	21.00	6.25	7.90	11.88	3.00	4.00
Per-Farm Average Fecal (CFU/yr)	9.07713E+13	1.3174E+13	1.12863E+14	2.416E+13	3.0517E+13	6.22E+13	0	0
Per-Farm Average P (lbs/year)	4.64	1.38	6.33	1.75	2.20	3.50	1.00	1.00
Per-Farm Average BOD5 (lbs/yr)	72.96	21.25	85.00	26.25	33.80	52.00	9.50	16.00
Per-AU Average COD (lbs/year)	2.2689	0.8544	2.2052	1.5179	2.2330	1.8248	0.7585	0.9091
Per-AU Average N (lbs/year)	0.1150	0.0456	0.1208	0.0797	0.1158	0.0977	0.0599	0.0491
Per-AU Average Fecal (CFU/yr)	6.32902E+11	1.171E+11	6.493E+11	3.08163E+11	4.4713E+11	5.1169E+11	0	0
Per-AU Average P (lbs/year)	0.0323	0.0122	0.0364	0.0223	0.0322	0.0288	0.0200	0.0123
Per-AU Average BOD5 (lbs/year)	0.5087	0.1889	0.4890	0.3348	0.4952	0.4277	0.1896	0.1966
Average AU	143.42	112.50	173.83	78.40	68.25	121.59	81.40	37.00

BY PROJECT GROUP	Volunteers (18)	4-county (19)	5-county (21)	All (58)
Aggregate COD (pounds/year)	5654.00	3900.00	3449.00	13003.00
Aggregate Nitrogen (pounds/year)	288.00	204.00	184.00	676.00
Aggregate Fecal Coliform (colony-forming units/year)	1.6929E+15	8.4468E+14	8.02885E+14	3.34047E+15
Aggregate Phosphorus (pounds/year)	87.00	52.00	53.00	192.00
Aggregate BOD5 (pounds/year)	1270.19	865.00	789.00	2924.19
Per-Farm Average COD (pounds/year)	314.11	205.26	164.24	224.19
Per-Farm Average Nitrogen (pounds/year)	16.00	10.74	8.76	11.66
Per-Farm Average Fecal (colony-forming units/year)	9.40503E+13	4.4457E+13	3.82326E+13	5.75944E+13
Per-Farm Average Phosphorus (pounds/year)	4.83	2.74	2.52	3.31
Per-Farm Average BOD5 (pounds/year)	70.57	45.53	37.57	50.42
Per-Animal Unit Average COD (pounds/year)	2.0936	1.7811	1.8777	1.9329
Per-AU Average Nitrogen (pounds/year)	0.1066	0.0932	0.1002	0.1005
Per-AU Average Fecal (colony-forming units/year)	6.26849E+11	3.8575 E+11	4.3711 E+11	4.96565E+11
Per-AU Average Phosphorus (pounds/year)	0.0322	0.0237	0.0289	0.0285
Per-AU Average BOD5 (pounds/year)	0.4703	0.3950	0.4296	0.4347
Average AU (only those farms with complete MinnFarm)	150.04	115.25	87.47	115.99

To eliminate the influence of outlying performers, staff threw out farms with MinnFarm per-animal unit results outside the standard deviation from the mean of all farms' data. As it turned out, this only eliminated farms above the upper standard deviation: there were none below the lower standard deviation.

BY PROJECT GROUP	Volunteers – Mean	Volunteers – Median	4-county – Mean	4-county – Median	5-county – Mean	5-county – Median
Per-AU Average COD (lbs/year)	1.3046	0.8817	1.0099	0.6627	1.0590	0.9922
Per-AU Average N (lbs/year)	0.0644	0.0270	0.0420	0.0291	0.0567	0.0598
Per-AU Average Fecal (CFU/yr)	1.97E+11	3.40E+10	9.2898E+10	6.0142E+10	8.7563E+10	5.9401E+09
Per-AU Average P (lbs/year)	0.0182	0.0108	0.0125	0.0071	0.0160	0.0158
Per-AU Average BOD5 (lbs/year)	0.2929	0.1935	0.2236	0.1344	0.2480	0.2188
Average AU (only MinnFarm farms)	141.52		117.84		91.89	

The per-animal unit ranges for all groups prior to eliminating those outside the standard deviation varied widely.

BY PROJECT GROUP	Volunteers – maximum	Volunteers – minimum	4-county – maximum	4-county – minimum	5-county – maximum	5-county – minimum
Per-AU Average COD (lbs/year)	17.3186	0.0515	20.9421	0.2024	30.3216	0.0336
Per-AU Average N (lbs/year)	0.9317	0.0000	1.0909	0.0000	1.6374	0.0000
Per-AU Average Fecal (CFU/yr)	9.25E+12	0.00E+00	5.2893E+12	0.0000E+00	1.32E+13	0.00E+00
Per-AU Average P (lbs/year)	0.2774	0.0000	0.2810	0.0000	0.4971	0.0000
Per-AU Average BOD5 (lbs/year)	3.8478	0.0074	4.6612	0.0456	6.7544	0.0074
AU (only MinnFarm farms)	307.00	50.20	282.00	16.60	471.00	5.60

We therefore conclude that the MinnFarm numbers are of little use in predicting the impact of individual feedlots (or of very small groups) prior to site assessment. However, where one is interested in working with groups similar to those in the project (self-selected or randomly selected groups of smaller farms which have not had much contact from regulators), the means and medians from the project groups could be applied to total animal units in an area to predict the potential for pollutant loading from lots.

Interestingly, the per-AU averages for the self-selected volunteers were higher than the randomly-selected controls. Expectations were that the self-selected volunteers would be performing better, and by some metrics, they were. In others such as the per-AU MinnFarm performance, they were not. One could speculate that this is due to the larger average size of the volunteers' herds and the likelihood that those larger herds were more densely packed onto their feedlots. However, the 5-county group had the lowest average herd size but slightly higher per-AU loadings than the 4-county control group. Since the 5-county group was mostly Olmsted and Wabasha for MinnFarm purposes, its poorer MinnFarm performance might be due in part to steeper average slope or it might simply be worse management.

As has been noted, MPCA does not have models or data sources for manure-related run-off from manure application acres. However, project staff did collect data on annual acres manure was applied to in a typical year and calculated tonnages of manure to arrive at a general application rate. See more on this at #9 on page 32. If we also collected data on vegetation on manure application acres, we could project removal rates. We did not, so we can only speculate where probable over-application occurred. However, the following table displays the percentage of farms at or below various removal rates, and indicates that close to 30% are applying manure at excessive rates for just about any vegetation type. A simple message on manure application rates on various vegetations types can be included in future self-assessments.

	Volunteers	4-county	5-county	All
Percentage applying manure: at 16 tons per acre (100% phosphorus removal on row crops)	40.00%	31.58%	55.56%	42.11%
at 23 tons per acre (100% phosphorus removal on cover crops)	65.00%	36.84%	61.11%	54.39%
at 30 tons per acre (100% phosphorus removal on permanent grass)	70.00%	73.68%	72.22%	71.93%

Appendix 6. Detailed discussion of main Phase 2 data points

Following is a more detailed discussion of results in aggregate and for individual questions common to both years of data gathering (2007 and 2008). Data used in this analysis has undergone review and statistical analysis by the Crow Environmental team under contract to EPA. Also included are some qualitative observations by the project inspectors in the course of their field work.

Aggregate

1. All common applicable

Among the 66 questions common to both Round 1 and Round 2, the largest mutually-exclusive sub-group is compliance questions (47), compared to 17 beyond-compliance or voluntary questions. One might expect significant differences between Vs, 4-Cs and 5-Cs for all questions to parallel differences for compliance questions. However, the disparity between the Vs and 4-Cs high compliance performance and their low voluntary performance served to drag down their overall performance on all common applicable questions.

Because of the preceding factor, the all-farm mean for all common applicable questions (about 69%) was lower and the spread between highest (Vs: 74%) and lowest (5-Cs:66%) performance was narrower than it might have been otherwise.

If one looks only at the number of good responses divided by the number of applicable questions instead of accounting for responses not changing and changes from bad to good and good to bad, the rate of year-to-year change appears to be considerably higher. For instance, using only the "good divided by applicable" approach, two-thirds of all farms increased performance on questions common to both 2007 and 2008.

Here, however, we report the more conservative change numbers which do account for all shifts. With those more conservative numbers, the volunteers were the only ones to make a slight overall improvement in all common applicable questions. The control groups actually "deteriorated" by 4 to 5%. Project staff suspect this is less often to do with actual regression, and more to do with shifts in presentation of questions and the stance of the inspector in year 2 (2008). This effectively reset the baseline for several questions, so should we continue to collect the same data in the same manner, we would expect performance to rise to a greater extent.

2. Common compliance applicable

This question group was both the highest-performing and the most-improving (or least-deteriorating) of all types of questions. Vs were significantly better-complying than 5-Cs for both in aggregate score and in

year-to-year change, and significantly better than 4-Cs for year-to-year change. The apparent reason for there not being significant difference between Vs and 4-Cs in aggregate facility scores is that that Vs underperformed on the compliance questions. In turn, the cause of this underperformance appears to be the fact that the highest proportion of Vs were in the mid-range of farms (100-299 AU), which have more compliance requirements applicable to them. This contrasts with both 4-Cs and 5-Cs where the highest proportion of farms was under 100 AU.

Although not a statistical analysis, project staff compared V, 4-C and 5-C total applicable numbers for each common question, looking for a "substantial" difference of more than 5 or 200%. This turned up 20 questions which applied to "substantially" more Vs than one or more of the other groups. By comparison, there was only one question which applied to substantially more 4-Cs, and one question to substantially more 5-Cs. Of these 20 questions more applicable to Vs, 17 were compliance-related, constituting 55% of all Vs compliance-applicable responses. The Vs' facility score for these 17 questions was about 1 percentage point lower than their score for all compliance questions and about 3.5 percentage points lower than their score for the other 30 compliance questions. By contrast, both the 4-Cs and the 5-Cs scored about 2 percentage points higher on these 17 questions than their overall compliance score, and about 5 percentage points higher than the other 40 compliance questions.

3. Common EBPI or key applicable

This is a group of 18 questions which cover proximity of farm activity to water, high-level outcomes of preventing runoff from reaching surface water, key liquid manure storage design approvals, carcass and waste disposal, and representative BMPs in cropping and the storage, stockpiling and land application of manure. 11 of the 18 EBPI questions are compliance-related, and 7 of them were in the group described above which applied to substantially more Vs than controls. 5 of these 7 relate to compliance.

Vs scored about 80% on EBPIs, significantly higher than both 4-Cs (73%) and 5-Cs (65%). When facilities were weighted equally regardless of how many responses were applicable to each facility, the 4Cs also scored significantly higher than the 5-Cs. The influence of the 7 EBPI questions applying to "substantially" more Vs is evident: the Vs scored lower than their overall EBPI performance, while the both control groups scored higher.

4. Common voluntary or beyond-compliance	The spread between best-performing (Vs) and worst-performing (5-Cs) for voluntary questions is about 11 points. Vs perform significantly better than both 4-Cs and 5-Cs. This group of questions appears to be the weakest (all farms averaging about 46% positive performance), however some questions in the group are not a true good/bad division (do you have a permanent manure stockpile, do you bury carcasses, do you hire a licensed pesticide applicator) so if those questions were removed, this question group's performance would increase substantially.
5. Match rate common compliance applicable	This indicator uses only data developed by the MPCA project team, since Crow Environmental did not analyze the "match rate," meaning the rate of agreement between the volunteers' self-assessments and the inspector's observation. Compared to the inspector's assessment of compliance-related issues common to both years, volunteers using the self-assessment achieved a 70.8% accuracy rate in Year 1 and an 83.5% accuracy rate in Year 2. This indicates not only increasing accuracy but a high rate of honest disclosure of noncompliance where it existed. For the 36 common compliance questions for which group proportions were not zero or undefined: • 22 showed improvement in self-assessment accuracy from 2007 to 2008, with an average improvement of 27%; • 10 dropped off in accuracy, losing an average of 11%; • 4 saw no change form year to year (3 of these stayed at 100% match rate). Improvement of self-assessment accuracy came in some important areas: • whether lot, milkhouse, or manure stockpile runoff is getting to surface water or sensitive features; • proper carcass burial. Drop-off in accuracy came in some important areas as well: • whether liquid manure storage areas are properly documented; • recordkeeping of manure applications (a small decline, probably not statistically significant); • residential sewage straight-piped or seeping to surface (small numbers). Change in self-assessment accuracy was mixed in two areas:

- whether manure is applied with appropriate setback from surface water and sensitive features – this improved for the universal 25-foot requirement, but declined for the 300-foot requirement on frozen soils (neither change was likely to be statistically significant);
- recordkeeping – there was a significant jump in accuracy of reporting on stockpile recordkeeping (in part because there was so little understanding in Year 1 of what records were required), but a slight decline in reporting on completeness of manure applications records.

For applicable compliance questions common to both years, the proportion of compliance questions to which volunteers responded "good" when the inspector's response was "bad" was 5.38% in 2007 and 4.72% in 2008. No questions stand out as particular weak points. The two worst performers in 2007 had 7 and 8 instances of this mismatch issue. The first one reduced these mismatches to 1 in 2008; the second was working with the MPCA through an interim permit and had left the project. Other changes were fluctuations of 1 or 2 either in the bad or good direction. These would not be high priority for follow-up unless they were repeating their mistakes.

6. Return to Compliance plans all complete

100% completeness of Return to Compliance plans continues to be a problem for the volunteers (the only group required to complete them). The proportion of 100% completeness rose a percentage point to almost 7% in 2008. A brighter spot was that the number providing completion dates for corrections rose from 27% to 53%.

- 1 farm is now in an interim permit, a standard return-to-compliance tool used by MPCA's feedlot program – this farm was therefore not inspected in Round 2

7. Certifications complete

The proportion of complete certification statements went from about 78% in 2007 to over 93% in 2008.

8. MinnFarm runoff model

We found our application of MinnFarm to be useful. While we recognize its limitations (it uses many assumptions, plus the model does not compute amounts running off manure application areas) and that our application did not completely match its intended purpose, we nevertheless believe our findings are instructive.

- A group of about 20 farms averaging 100 AU on a sub-watershed can each year as a group contribute around 50 pounds of phosphorus, 200 pounds of

nitrogen and 750 pounds of BOD5 (five-day biochemical oxygen demand, using the arithmetic mean of all samples taken during any calendar month) from their open lots;
- A group of 20 farms averaging 150 AU can as a group contribute 85 pounds phosphorus, 290 pounds of nitrogen and 1,200 pounds of BOD5;
- On a wider scale we found slight differences in per-AU discharge between volunteer and control groups, but the differences were more marked at the county level. Of the 5 counties with at least 4 farms inspected in 2008, Olmsted, Wabasha and Otter Tail farms performed worst. Kanabec performed worst overall in MinnFarm outputs but had only 3 farms inspected and modeled.

For comparison purposes, at 1 mg/L of phosphorus in discharge, point source facilities:
- discharging 1 million gallons per day (a major Municipal Treatment System) will discharge 3,046 pounds of phosphorus per year;
- discharging 100,000 gallons per day (a minor Municipal Treatment System) will discharge 305 pounds of phosphorus per year;
- discharging 25,000 gallons per day (a Significant Industrial User) will discharge 76 pounds of phosphorus per year.

Only a handful (3 of 32 volunteer lots; 9 of 56 control lots) of lots were found to exceed a modeled BOD5 limit and only one of the exceeding lots could obviously deliver runoff to surface water under typical conditions. Nevertheless, we observed that even 1-2 inch rain events under an hour in duration can significantly move resident pollutants into intermittent streams or flush out pollutants in ditch/stream sediments and subsoil. Therefore, FERP's preventive and quantifiable approach may be quite useful, particularly in a context of watershed protection and climate change where rainfall is more likely to occur in more intense events.

On an aggregate, county-by-county basis, good performance on compliance/BMP questions was a reasonable but not fail-safe predictor of good MinnFarm values. For the 5 counties with at least 4 farms inspected in 2008, Otter Tail, Carlton, Olmsted and Wabasha ranked similarly in MinnFarm and question performance; Pine ranked high in MinnFarm and low in question performance. For all 9 counties, 6 correlated well, 2 did not, and 1 had no MinnFarm data available for its participating farms. The overall worst-performing counties were Olmsted, Wabasha and Otter Tail (3 of the

4 largest county samples). Kanabec also performed poorly on MinnFarm but had a small sample size (3).

Looking at Graph 3 on page 8, there is also some correlation between larger herd sizes and higher MinnFarm values (poorer performance). This correlation is backed up by the observations of staff running the MinnFarm model that reducing animal density on lots is one of the easiest ways to improve MinnFarm performance. Thought of in another way, if farmers do not expand their open lot area as they add animals over the years (and lot size does tend to be limited by adjacent buildings, farmsteads, crop fields or pastures), then their MinnFarm performance will very likely decline.

Exceptions to this correlation were:

- on the poor side, Olmsted, which had relatively low average herd size but disproportionately high MinnFarm values (this might make it a target for improvement efforts);
- on the good side, Pine, with average herd size close to Wabasha's but better overall MinnFarm performance (due in part, perhaps, to its flatter topography).

Other MinnFarm notes:

- 3 volunteers with MinnFarm BOD5 limit exceedances (1 of these also was assessed to have surface water impacts in both 2007 and 2008)
    - No lot-related corrections indicated to be under way

- 9 controls with MinnFarm BOD5 limit exceedances (0 assessed to have surface water impact)
    - 2 sold cows
    - 1 unresponsive to follow-up
    - 6 no lot-related corrections

9. Average AU

Consolidation and attrition (in large part, generational) continues. While average herd size changed little (slight increase for volunteers, slight decreases for control farms), 3 control farms sold their livestock and 12 others are selling stock or no longer milking. On the plus side, one volunteer was considering expansion.

In 2008 we collected both herd data and annual manure application acres. Using the formula [100 lbs manure/day/cow>1000 lbs X 1.5 for other animals X 365 / 2000] to calculate annual manure production, we've figured the tons of manure applied to be:

- For volunteers, an average of 19 tons/acres, ranging from a minimum of 1.5 tons/acre to a maximum of 79.8 tons/acre;
- For the 4-county control group, an average of 20 tons/acres, ranging from a minimum of 3.1 tons/acre to a maximum of 55.4 tons/acre;
- For the 5-county control group, an average of 17 tons/acres, ranging from a minimum of 4.7 tons/acre to a maximum of 52.6 tons/acre.

This is presented as a possible means to flag potential over-appliers, and for them to assess themselves.

10. Differences based on herd size

There are differences between farm group performance based on their herd size. These differences are due in part to the increasing number of applicable compliance requirements as herd size increases, and to increasing resources, sophistication, stability, long-range viability, potential for growth, access to technical assistance, and attention paid by regulators.

The main strata pertinent to this project are under 100 AU, 100-299 AU, and 300 to 979 AU. All of these are AFOs. For dairy, above 979 AU is a CAFO, and will be regulated and inspected every two years under an NPDES permit.

Of the 57 farms inspected both years of this project, 5 were above 300 AU. For the remaining participants, 61% of volunteers were in the 100-299 AU stratum while 39% were under 100 AU. This was significantly different than the 4-C and 5-C groups which were distributed:

- 4-C - 28% 100-299 AU, 72% under 100 AU;
- 5-C – 13% 100-299 AU, 87% under 100 AU.

In general, project data (and program experience) show that performance in the 4 major areas of all, compliance, EBPI and voluntary (numbers 1 through 4 above) increases steadily as herd/farm size increase. The differences between average group performance and the spread between best and worst are smallest for compliance questions. In addition, average performance for all groups is highest in compliance areas.

Based on our project data, the sole exception to this rule is the 100-299 AU stratum. Their performance is slightly lower for compliance questions than both the under 100 AU and the 300+ strata. Their spread in each performance area is also wider than the under 100s and similar to spreads in the 300+ group. This preliminary look suggests that among these “larger” farms there is

more variability in performance and more farms further towards the extremes of performance (low and high).

A more detailed look at the 100-299 AU stratum (18: eleven Vs, five 4-Cs, two 5-Cs) backs this up. For instance, ranking the 100-299 stratum by unweighted compliance proportion shows:

- compared with only 1 farm performing better than the upper standard deviation, there are 3 farms performing worse than the lower standard deviation, and the range from mean (90.15%) and median (90.70%) to the bottom performers is greater than the range to the top ones;
- 4 of 18 (22%) are outside of the standard deviations;
- the Vs, 4-Cs, and 5-Cs in the 100-299 stratum all perform worse than those county groups do overall.

This compares to the under 100 AU group (34: seven Vs, thirteen 4-Cs, fourteen 5-Cs) ranked by unweighted compliance proportion:

- the mean (90.05%) is well below the median (93.33%), and the only farms outside the margin of error (4 of them) are on the low-performing end
- 4 of 34 (12%) are outside the margin of error.

This indicates the need for targeting information and follow-up to individual farms, particularly for compliance issues in the 100-299 stratum.

It's difficult to draw conclusions about geographic differences across the project (based on county) because some counties had very small samples. For counties with at least 5 farms participating, however, compliance performance in the under 100 stratum breaks out this way:

- Olmsted – 81%;
- Pine – 90%;
- Otter Tail – 94%;
- Wabasha – 96%.

In the 100-299 stratum, the only county which had more than two participants was Otter Tail, which had group compliance performance of 92%.

11. Statistically significant differences

The project's smaller sample or group sizes (Vs, 4-Cs, 5-Cs) contributed *in part* to relatively small numbers of statistically significant differences in performance between groups, even at a 90% confidence interval. Only 27 of 66 metrics common to both 2007 and 2008 showed significant differences between groups.

- 14 of the significant differences were Vs outperforming 4Cs (5 on EBPIs); 2 were 4Cs outperforming Vs (1 on an EBPI);
- 12 of the significant differences were Vs outperforming 5Cs (9 on EBPIs); there were no instances of 5Cs outperforming Vs;
- 8 of the significant differences were Vs outperforming both 4Cs and 5Cs;
- For 4 metrics (3 of them EBPIs), both Vs and 4Cs performed significantly better than 5Cs;
- 1 of the 16 significant differences was 4-Cs outperforming the Vs, in this case on an EBPI.

For some metrics, one or more of the groups has fewer than 5 farms to which the metric applies or the difference between groups is less than 5. If one cuts out these very small samples or differences, this reduces significant differences even further, to 12 "super-significant" differences:

- Vs outperform 4Cs on this scale 4 times;
- Vs outperform 5Cs on this scale 8 times;
- 4Cs outperform 5Cs on this scale 4 times;
- 4Cs outperform Vs on this scale 1 time.

For all 66 common metrics and considering all differences between groups (statistically significant or not), Vs performed better than either control group 52 times and worse than either control group 14 times.

Individual Questions

100% Compliant

This is a weak indicator, given where these smaller farms are at on the learning/contact curve. Not surprising that all score low on this all-or-nothing metric. We prefer the proportion that shows their progress overall. Interesting that controls improved more than volunteers, no matter how small the difference. One factor may be the size distribution. With 65% of volunteers greater than 100 AU (compared to 28% for the 4-Cs and 19% for the 5-Cs), they are subject to more compliance requirements. See the discussion under Common compliance applicable on page 2 above.

Surface waters within 1000' of farm activity

Surprised at the amount of change. Obviously, the features aren't moving, and one wouldn't expect farmers to relocate lots, barns, etc significantly in one year. All groups got "worse" (although volunteers less than controls), so this may be only a data-gathering change on the part of the inspector from one year to the next. Looking only at 2008 data, because Vs have generally larger herds are they more likely to locate further from

water? Or to have expanded over the years because they had more room to grow, being away from water? Comparing Vs to 4-Cs (the same counties), does the inverse hold true for smaller (perhaps less wealthy or profitable) farmers closer to water and on more marginal land?

Interestingly, experienced MPCA staff can require multiple desktop sources and possibly repeat site visits to determine proximity to "waters of the state," "protected waters or wetlands," "sensitive features" and other site conditions. This is clearly not a workable, transparent, communicable, or empowering system of definitions. Simplification is essential to getting more producers motivated to action.

Controls (smaller farms; not volunteers) in Otter Tail, Kanabec, Pine or Carlton are significantly more likely to be within 1000 feet of surface water.

In any county, for those within 1000 feet of surface water, 75-80% were farther than 300 feet.

Prevent lot runoff from reaching surface water

High levels for Vs (100%) and 5-Cs, but still Vs were significantly different than both C groups. 10% increase for Vs is good, but 15% decrease for 4-Cs is disturbing and hard to explain - a data gathering change? 96% match rate says a lot for the Vs.

Two-thirds saw no evidence of manure leaving their open lots, matching the inspector's assessment 77% of the time.

1 farmer reduced his cow lot size to reduce runoff and impact.

Other notes:

- 5 controls assessed to have surface water impact in 2007
  - All 50-100 AU
  - No manure-related corrections indicated to be under way
  - 4 assessed not to impact surface water in 2008
  - 1 unresponsive to follow-up

- 2 volunteers assessed to have surface water impact in 2008 (1 also assessed in 2007)
  - 160-195 AU
  - Both with BOD5 exceedance in 2007
  - One now working with NRCS

	• 4 controls assessed to have surface water impact in 2008 o 55-275 AU o 3 (possibly 4-Nordrum) with BOD5 exceedance in 2007 o 1 considering lot correction
Lot runoff to surface tile	Nothing getting to surface tile inlets within reach of feedlots. Only 4 answers to this question present among ALL farms, and 100% prevention. For future ERP use, this question could be discontinued (but not the similar question about manure application setbacks from crop field surface tile intakes).
Lot runoff to surface feature	Only 1 farm has a sinkhole, quarry or mine (and that farm is not in the southeast) and 100% prevention. For future ERP, this question could be discontinued or include it for education only.
Use separate septic for milkhouse waste (MHW)	The project team had labeled use of separate septics a "good" for purpose of analysis. However, the response of farmers upon learning of the probably inadequacy of their milkhouse septic systems was not to maintain or upgrade separate systems. The primary response was to switch to holding tanks for daily or weekly storage combined with daily or weekly pumping of the tanks for application on fields (a legal practice if basic manure spreading guidelines are followed). Although none of the actual numbers are large, the biggest decline and lowest percentage using septics was with Vs, which may indicate they are recognizing inadequacy of septics and moving to other options more quickly.
Prevent MHW from reaching surface water	Small declines in compliance (related to the point immediately above), but still reasonably high (78 to 90%) compliance proportions overall. Other notes: • 1 farmer installed milk-house waste holding tanks (and 1 other is considering) • 1 farmer installed functioning VTA/spreaders • 1 farmer changed runoff route to pit • 1 farmer is minimizing wash water volume
MHW runs off through adequate buffer	This situation applies to only 2 Vs and 2 4-Cs, all of whom are in compliance. Significant differences are therefore not meaningful. Milkhouse waste (MHW) does not appear to be a significant issue. While many have separate septic systems for MHW, most of these are not adequately designed or maintained but still are not threatening surface water. Common practices are to direct MHW to LMSAs where they exist or increasingly to use septic or

	newer tanks to hold MHW temporarily until it can be pumped out and land-applied.
A basin or pit receives run-off	Data here suggests positive changes in routing of lot run-off and MHW by Vs (6) and 4-Cs (5), significantly different than the 5-Cs which had 1 positive change offset by one negative one.
Liquid Manure Storage Area (LMSA) present	No changes here, as we would expect in only one year. Over half of Vs have LMSAs (again, as we would expect with 65% of Vs greater than 100 AU). Unexpectedly, given only 28% are greater than 100 AU), just under half of the 4-Cs have LMSAs. This may become more of a negative when one considers other performance weaknesses (and proximity to water) of the 4-Cs. A question for follow-up: Will they maintain LMSAs properly?
LMSA is approved by engineers or regulators	Not much change here. On the positive side, 5 farms had located documentation on their LMSAs. Others thought they had documentation and were given the benefit of the doubt in Round 1, but had been unable to actually locate documentation by Round 2 so became a negative. MPCA approval or documentation rates for those LMSAs are reversed: (63% for volunteers versus 100% for the 5-county controls). Other LMSA notes: • 1 farmer secured cost share for LMSA improvement • 1 farmer secured cost share for pit closure
MHW storage overflows on occasion	Not much change; very positive. Follow-up on one facility in the 4-Cs.
LMSA is operated with 1' freeboard	This is a BMP directly relating to the stable and positive performance in the immediately preceding question (overflow). Follow-up on one facility in the 4-Cs (the same facility as in the overflow question immediately above). LMSA freeboard or examination practices are generally used about 90% of the time or more. One farmer with 223 AU was not examining his LMSA regularly.
Keep vegetation clear of LMSA	Another LMSA BMP. 3 farmers had removed vegetation rooted on their LMSA. Small numbers in all 3 groups (two Vs, two 4-Cs, and one 5-C) are still failing to carry out, although none of these are over 160 AU – education in follow-up letter.
Diversion of clean water around manure piles	Low numbers in all 3 groups, so no significant differences. Follow up on one V without diversion. There's some question as to why there are different

	(slightly fewer) numbers of farms in the change analysis than there are in the overall 2008 proportions, especially since the inspector found some farmers eliminating temporary stockpiles in 2008. Overall positive, though. Why not a requirement? Suggest a rule change.
Short-term manure pile run-off to surface water	Again, 2008 and change numbers don't quite match, but for the few with stockpiles, 100% compliance. Compared to permanent stockpiling, several more farms use short-term manure stockpiling with good runoff outcomes, although 8 farmers discontinued stockpiling. Several of the smallest producers keep manure piled on lots.
Manure pile is on land with slope <6%	Similar story. Follow up on one V not compliant.
Short-term manure pile separation from water	Follow up on one V (the same as in the immediately preceding question) is not compliant.
Permanent manure stockpile present	20% or less of each group (4 volunteers and 1 control farm) uses permanent stockpiling, and NOT using a stockpile is not on its face "bad". ("Good" and "bad" is hard to define in this case.) Poor design, maintenance or sampling/recordkeeping of a stockpile would turn it to a negative. Vs have the highest number of permanent stockpiles (still only 20%), while 5-Cs now have none (2 were removed), making this significant difference meaningless. Most have proper practices in place and all are preventing stockpile runoff from reaching surface water.
Impervious pad under permanent pile	Positive: all who have permanent stockpiles have impervious pads under them. 2 farms are now installing slabs for permanent piles.
Stockpile record-keeping current (100+ AU)	Although not widespread since only 5 or less in each group are stockpiling, recordkeeping is a weakness, most importantly in knowing nutrient value and when/where applied. Two Vs adopting recordkeeping versus no controls suggests an attitudinal difference on this metric, particularly since, while inexpensive, this takes time and effort. Need to make the economic case better and stress the most important parts of the recordkeeping process first and foremost.
Feed leachate flows to water	100% compliant in all groups for both years. Future ERP usage could include only as an educational note.
Compost carcasses	Only one 4-C (a larger farm in a county without rendering service) out of all 57 farms inspected is composting, improperly. Not common at large-animal

	(difficult to compost) operations. Could deemphasize except in counties where rendering is not available. MPCA needs to work with partners on providing options for carcass management in counties where rendering service has disappeared.
Bury carcasses	Another question for which responses are difficult to label "good" or "bad." Some movement towards using burial was good where farmers had been dragging carcasses out for scavengers. Movement away from burial in favor of rendering was also good, particularly if topsoil or groundwater clearance was insufficient for proper burial practice. These kinds of factors rather than attitudes account for differences among groups.
Rendering carcasses - remove within 72 hrs	100% compliance among all groups. Discontinue question. Larger farms use rendering for carcass disposal where it is available. Virtually everybody else uses good burial practices, except in north central counties where rendering and sufficient vertical clearance or topsoil doesn't exist. There, the smaller producers will leave carcasses for scavengers. As was mentioned above, MPCA should work to support rendering service in those counties (this may be a growing problem). NOTE: Because of new bovine tuberculosis control rules, rendering will not be available for cattle older than 30 months as of April 2009. This will shift more carcasses to burial, composting or incineration.
If rendering, off-site storage is scavenger-proof	100% compliance among the few for whom the rendering pick-up site was far enough away to be thought of as "off-site." Most get quick pick-up straight out of their yard (not "off-site"). Discontinue.
Liquid flows from carcass composting	Follow up on the lone noncompliant farm.
Carcass composting is on impervious pad	Follow up on the lone noncompliant farm.
Carcass composting with 7-10 day cycle/130+	Follow up on the lone noncompliant farm.
Carcass composting finishes free of tissue	Follow up on the lone noncompliant farm.
Carcasses buried >5' over high water table	100% compliance in 2008, with 3 Vs and 2 4-Cs moving into compliance. 100% 5-C compliance in 2007 accounts for significant difference. For this series of questions on carcass burial, there are small discrepancies between the total farms in the 4-C and 5-C groups in 2008 and the total of the categories of

	changes made from 2007 to 2008. The categories of change are: 1) bad-to-bad; 2) bad to good; 3) good to bad, and; 4) good to good. The discrepancies are there because some farms only began burying carcasses in 2008, so they can't appear in the change numbers because they weren't using the practice in 2007.
Carcasses are buried away from surface water	100% compliance in 2008, with 1 V moving into compliance.
Carcasses are covered immediately with 3' soil	Only one 4-C out of compliance in 2008, with 1 4-C moving into compliance.
Carcass burial avoids sand/gravel soils	100% compliance in 2008, with 2 Vs moving into compliance. 100% 5-C compliance in 2007 accounts for significant difference.
Carcass burial >10' over bedrock	100% compliance in 2008. Two Vs and one 4-C moved into compliance. 100% 5-C compliance in 2007 accounts for significant difference.
Manure applied further than 25' from water	100% compliance by Vs and 4-Cs in 2008, with 2 Vs moving into compliance. Four 5-Cs (25%) were out of compliance with one moving in and 2 moving out. Geography likely plays a leading role in explaining significant differences since both Vs and 4-Cs are in 4 flatter, wetter counties which means there's more marginal farmland around features which dictates a greater setback for manure application.
Manure incorporated in 24 hrs within 300 feet of a surface tile intake	Very similar to previous, with exception of one 4-C out of compliance. A positive is that four Vs, two 4-Cs and three 5-Cs moved into compliance in 2008. While one might expect the number of surface tile intakes present as indicated by this question to match the number indicated by question 1.08, the response refers to different intakes. 1.08 asks about intakes in or near lots while this question is asking about crop field intakes.
Manure applied within 50' of sensitive feature	One in 4-Cs and four in 5-Cs (a significant difference, however no change for Vs and 4-Cs so no credit for FERP) – follow up required in cases like these, particularly in southeast counties.
Manure applied >300'/sensitive areas in winter	100% compliance by Vs and 4-Cs in 2008, with 3 Vs moving into compliance (a significant difference compared to 5-Cs and a plus for the self-assessment and volunteers even with the geographical difference explained in question 2.04 – 300' versus 25' would be more likely to be outside marginal land adjacent to features). Four 5-Cs (25%) were out of compliance with one moving in and 4 moving out.

Nutrient application: crop total nitrogen is at or below University of Minnesota recommendations	While there are good nutrient management materials available, they are not read and little actual tracking of crop nutrient needs and availability is done at this level. We propose to try new more low-tech ways of getting manure application information out, based simply on amount of manure applied, annual application acres, and vegetation manure is applied to or in support of. Our observations of small producers lead us to believe that nutrient management remains one of the least-understood and possibly higher-impacting activities on these smaller farms, and that the FERP model and our learning offer ways to get information out and affect manure and nutrient application behavior. Very clear differences between Vs and both control groups, both in raw 2008 numbers (60% positive vs.~27% negative) and in year-to-year change (15% positive vs.~20% negative). The controls change for the negative can be attributed more to the inspector giving them the benefit of the doubt the first year but using a series of sub-questions that brought to light the farmers actual awareness of nitrogen inputs and credits rather than letting them off easy with a simple yes/no to the main question. This tougher stance makes the Vs positive change all the more impressive. Overall, 8 farms are now applying below recommended rates.
Nutrients: all first-year N ± 20% UM	Closely related to the preceding question (2.08), this one is a higher degree of difficulty, which would account for the poor performance across the board. It is unexpected that the 5-Cs would perform better (although not in a statistically significant sense) in both 2008 and year-to-year categories. This might be explained by smaller herd sizes and lower overall nutrient inputs to crops. Two farms did reduce their rates of N application.
Clean up any manure spilled on roads	100% compliance among all groups. Discontinue question.
If the manure of 100+ AU is in 1 stockpile, must test nitrogen and phosphorus every 4 yrs	100% compliance among all groups, but only 8 affected in total. We should consider discontinuing the question.
Keep records of applications (100+ AU farms)	Interesting that 4Cs were significantly higher in compliance than Vs for both raw numbers (4 of 6 vs. 3 of 13) and year-to-year (3 positives/0 negatives vs. 0 positives/2 negatives). Looking not at county groups but at farms of 100 or more AU (those required to keep records), the 100-299 stratum had 4 compliant and 14

	noncompliant, while the 300+ stratum had only one (5-C) of 5 farms noncompliant on this question. Need to make farmers care first about the data components that go into recordkeeping rather than the act of recordkeeping itself. We need to get out the same message for farmers <100 AU who are not required to keep manure application records.
Phosphorus test application area once/4yr (300+ AU farms)	100% compliance, but very small numbers affected (two Vs, one 4-C, two 5-Cs), so significant differences are meaningless.
Apply on high P soil w/in 300' w/out approval (300+ AU farms)	100% compliance, but very small numbers affected (one V, one 4-C, one 5-C), so significant differences are meaningless.
Apply on extremely-high P soils w/out approval (300+ AU farms)	100% compliance, but very small numbers affected (one V, one 4-C, zero 5-Cs), so significant differences are meaningless.
Test new manure storage annually (300+ AU farms)	100% compliance, but very small numbers affected (two Vs, one 4-C, two 5-Cs), so significant differences are meaningless.
Keep application records 3 yrs (6 if adjacent) (300+ AU farms)	High compliance, but very small numbers affected (two Vs, one 4-C, two 5-Cs), so significant differences are meaningless. One 5-C moved out of compliance in 2008.
Burn household waste used routinely	Volunteers performed significantly better than both control groups. Some noncompliance was found in Otter Tail (three of fourteen Vs and five of twelve 4-Cs). Poor performance in 5-C, a compliance issue in Wabasha where five of seven 5-Cs were still burning. Year to year change is mixed.
Well casing above grade/grouted/capped	100% compliance after one 5-C moved into compliance in 2008. Recommend this question be discontinued since milk inspectors seem to have this covered.
Wells upslope or protected from pollutants	100% compliance after one 5-C moved into compliance in 2008. Recommend this question be discontinued since milk inspectors seem to have this covered.
Anti-backflow faucet on wells with hoses	Small amounts of noncompliance in control groups, mostly due to this not being a requirement for Grade B dairy certification.
Unused wells are sealed and documented	Follow up on the lone 5-C out of compliance.
Household sewage straight-pipes	One 4-C out of compliance, discovered since last year – follow up.

Sewage seepage to surface	Positive: only one farm out of compliance in each group, with 7 corrections since 2007. In general, household septics are frequently old or not well-maintained or documented: typically over 40% of systems were built before 1980. Other notes: • 8 farmers now aware of probable household septic violation • 3 farmers installed household septic in 2008 • 1 was referred to enforcement staff for septic violations
Hire licensed pesticide applicator	Hiring a licensed applicator was labeled "good," but applying oneself is not necessarily bad if all requirements are followed (which they were). Not clear how much restricted use pesticides is actually used (several don't use at all).
Keep records of all pesticide applications	100% compliance where applicable.
Store pesticides in original container	100% compliance where applicable.
Triple-wash/recycle or dispose per label	100% compliance where applicable.
Underground storage tanks (USTs) >1100 gal	It appears there is only one regulated fuel UST present in the FERP groups. "Negative" movement in change data is actually new installation of polypropylene tanks for temporary storage of milkhouse waste prior to land application. No negative groundwater impacts are expected from this practice, and it is viewed as a positive if it is a correction of improper septic treatment and/or runoff of milkhouse waste. Instances of this installation should be removed from response data for this question.
USTs >1100 gallons, are coated/monitored	The one fuel UST is compliant. Discontinue question.
Rotations: 2+ crops/3 yr; permanent forage 50%	2008 data for this series is from the inspector only because it was not included in the self-assessment this year. What is largely a continuation of existing rotation practice is good to see, given the increasing price of grains (particularly corn and soybeans) and the decreased farmers' low use of expensive synthetic inputs. Also encouraging given these influences away from rotations, one 4-C and four 5-Cs moved into rotational practice. Only one 5-C moved out.
Use GPS to target nutrients	Perhaps not surprising that smaller farmers would be less likely to use newer technology to identify need for or target nutrients.
Use soil sampling to target nutrients	Although further questioning would be required to see how extensively soil sampling is used on each farm, its

	use by over 75% of all farms is quite positive. Perhaps even more telling is the percentage of farms using sampling consistently year to year: 85% of Vs, 58% of 4-Cs, and 50% of 5-Cs.
Use combine yield monitors to target nutrients	Perhaps not surprising that smaller farmers would be less likely to use newer technology to identify need for or target nutrients.
Soil conservation: 30% residue or strip till 2/3	The drops in conservation tillage practices from 2007 to 2008 are due to a tougher line of sub-questions used by the inspector, which also indicates farmers think they conserve soil better than they actually do. With the counties in the Vs/4-C groups being more northern, the use of deep tillage is predictable (and hard to move away from) when farmers need soil temperatures to rise more - and more quickly. Need to look at the southern counties in the 5-C group to weigh who is using what tillage where, with the most benefit. Even residue percents may be a challenge to keep up with this group, which is more likely to take crop residue off fields to use as bedding.

List of unfinished business

1. Remove questions for which responses are difficult to classify as strictly “good” or “bad” from the voluntary question group and rerun performance analysis for all groups of farmers;

2. Run a farm-level change analysis (bad-to-bad, bad-to-good, good-to-bad, and good-to-good) to facilitate follow-up;

3. Check for significant differences in the year-to-year changes within each group (V, 4-C, 5-C);

4. Follow-up with mailing and high-priority assistance.

Appendix 7. Review of major milestones from the original proposal and logic model

Following is a review of major deliverables, milestones and measures. Since the project went through a Phase 1 which departed significantly from the original project workplan, this review (with exceptions noted) applies to Phase 2 which more closely matched these original major milestones and measures.

1. Stakeholder Process

1.1. Milestones:

a. With partners, develop EBPIs needed for inspector checklist, trainings, database	Complete - With partners, completed list of questions for self-assessment, but MPCA's feedlot program wasn't able to move towards a smaller set of the most important metrics until after Round 1. The process of winnowing down to absolutely key questions continues as we reach the Phase 2 endpoint.
b. Project-specific enforcement policy to act as incentive must be in place before program materials and marketing	Completed – mailed out in volunteer recruitment materials. Provided relief from enforcement for the life of the project unless egregious and willful violations were involved.
c. Plan for long-term measurement of environmental impacts of project results available for final report to EPA, state stakeholders	Not completed – this is being discussed with partners and stakeholders within the context of priority TMDLS/impaired watersheds or clean-water areas that are priorities for preventive protection.

1.2. Measures:

a. Partners understand project goals – indicated by consensus and satisfaction coming out of external partner meetings.	Poor – While major partner MMPA participated in Phase 1, they never supported the idea of trying the self-assessment model (as opposed to their third-party assessment tool, EQA). Now that MPCA has reasonable results, MMPA concedes there may be a place for self-assessment among other tools. County programs were not a part of Phase 2, and presentations at their annual meetings have not produced widespread awareness or support.
b. Partners' willingness to market on MPCA's behalf – indicated by consensus and partners delivering the product and level of effort identified in marketing strategy.	Not applicable – MPCA did its own marketing and recruitment in Phase 2.

2. Facility ERP database

2.1. Milestones:

a. All EBPIs and facility data points known before developing database	Complete – for facility data points
b. Certification forms adaptable to web interface	Not applicable – never attempted a web interface, in part because of resource/time constraints but also because few of the small farms in the project reported use of e-mail and internet.

c. QAPP (and staff) in place	Complete – Finalized prior to Phase 1, but couldn't be applied at that point. QAPP was revised to reflect new counties and farm/sample distributions prior to Phase 2 and was revisited via consultation with Crow Environmental and Region 5 prior to Phase 2's follow-up round. No changes of methodology were made (although some staff changes had occurred), so no revisions were made to the QAPP. Most processes in QAPP were adhered to with the most major exception being that after data plan was OKed by Region 5, data review was carried out by Crow Environmental without the involvement of Region 5 as had been planned for the follow-up round.
d. Universe data available for sample generation	Complete
e. Program staff trained	Mostly complete – MPCA feedlot program desired to use existing staff time in the 4 nondelegated counties. Training of those 3 staff and their supervisors was completed, however they all changed jobs as the time for baseline inspections approached. Program managers were persuaded to make a temporary hire under SIG funds to be dedicated to project inspections. Unfortunately, these staffing delays meant baseline inspections happened AFTER volunteers completed their first self-assessments. Also, one existing staff who supplied a couple of control group inspections was not trained with the group; instead, that inspector was trained by the new hire.
f. If possible, report functions developed or easily provided by substitute function (i.e. download electronically to existing statistical package like Minitab)	Partial – Database functioned for basic data management and analysis, but was never sophisticated enough at MPCA to complete all statistical analysis and reporting. That function was effectively transferred to Crow Environmental, so whatever costs Crow incurred in supporting Minnesota's project in 2007 and 2008 could be thought of as the amount Minnesota's project was underfunded by SIG or matching budget.
g. Final database ready for use	Complete – Database set up for data entry, initial analysis, and transfer to Crow Environmental for complete statistical analysis. Attempted to purchase JMP software to enable use of the MA-developed Performance Analyzer after the follow-up inspections, but that purchase was delayed, necessitating use of the Excel workbook developed in the baseline year. Both years' data were initially managed in MPCA's project Excel workbook.

2.2. Measures:	
a. Universe of dairies well-documented statewide and in participating counties – indicated by number of dairies missed and later located by CFOs or MPCA staff.	Good - Through its connection to MMPA and through MMPA, to Dept of Agriculture dairy inspection data, the project was able to identify dairy operators who had not registered their feedlot with MPCA (and did not appear in the MPCA program database). No additional dairies were found after that cross-reference by the project.
b. MPCA users able to input, use, analyze – indicated by training post-test, longer-term satisfaction, and documented error rate.	Fair – The limited number of MPCA users (2: one for input; one for QA and analysis) were able to use the Excel workbook effectively over the course of 2 years. No error rate was documented, as a major part of QA and final analysis was exported to Crow Environmental.
3. Electronic interchange *(NOTE: This task may be delayed depending on MPCA priority-setting)*	Not applicable – As noted in 2.1.b above, MPCA never initiated electronic interchange of data.
4. Statistical design/sampling	
4.1. Milestones	
a. Optimize Crow Environmental's time with assistance by MPCA staff proficient in statistical analysis	Not accomplished – Never matched up with any MPCA staff who had both expertise and the necessary time available. Note that statistical analysis of behavior change is not a core activity or experiential skill set among MPCA staff.
b. Be prepared for recruiting results, when known	Completed – With Crow support.
c. Coordinate with stakeholders, EBPIs, and workplan development	Completed with partners, but not stakeholders – The level of statistical design and analysis undertaken by this project was unfamiliar to the experience and needs of project stakeholders. Project staff felt involving them routinely in these matters would be viewed as a waste of their time.
d. Volunteer pool completion required before method finalized	Completed
e. QAPP final before sampling begins	Completed
f. Samples ready for data entry when database development allows	Completed

4.2. Measures:

a. Study design maximizes insights into research questions (see Objective #4 under Goal 3), within policy and resource constraints.	Fair for design, poor for implementation – The biggest question in project staffs' minds is whether this project could ever produce sufficient (persuasive) insight or evidence given the sector and the project's reliance on a voluntary (small-sample) test group and a short time-frame (1 year between baseline and follow-up) – hence the "fair" for design. Staff rate themselves and partners a poor for implementation for allowing implementation requirements wander from original design. The chief problems were not getting a dedicated inspector hired (lack of program buy-in?) and not clarifying/insisting that the inspector should resist providing significant on-site assistance. The first factor messed up the timing of the baseline inspections, and the second limited our ability to ascribe progress to the self-assessment and printed materials versus the inspector's assistance.
b. Feasibility overlay – representative samples can be processed without drawing significantly on program staff not already assigned to the project.	Fair – Poor for the inspection function (see above).

5. Inspector checklist

5.1. Milestones

a. Identify inspectors	Complete – But the entire team of 3 went to other jobs or on leave within the course of about 3 weeks. Lesson learned: a temporary hire would have been more predictable and stable.
b. EBPIs and compliance goals drafted with stakeholders	Complete – Feedlot program insiders were slow to commit to focusing on a smaller set of the most important environmental or compliance issues.
c. Stakeholder support before next step.	Complete – For internal MPCA stakeholders only. Not sure that external input would have changed the initial round's questions/data. Project staff used volunteer and control feedback during Round 1 inspections to revise the Round 2 workbook and checklists (which met approval).
d. EBPIs must be finalized before inspector checklists – stakeholder support before "dry run"	Partially complete – As mentioned, self-assessments and checklists were completed, but EBPIs were not.
e. Initial data informs checklist, database development, and other areas of the project	Partially complete – As above

f. Checklist with EBPIs and project metrics integrated	Complete – Except for the EBPI part. Inspector checklists contained all project metrics, but there were too many for inspectors to collect during Round 1 in a reasonable period (1-2 hours) on-site. This got better in Round 2. Pretty clearly, having a smaller set of priorities up-front would have helped in getting a more complete and well-matched data set in both rounds.
5.2. Measures:	
a. Combines multiple programs and issues in maximum half-day visit – results of dry runs	Poor Round 1/Good Round 2 – Inspections stayed under 2 hours in Round 1 but inspectors could/would not collect all information desired. This got better in Round 2.
b. Inspectors accept the checklist – attitudinal survey following completion	Good – The dedicated inspector took ownership of the checklist, particularly in Round 2. Did not perform any attitudinal surveys – only 1 inspector.
c. Checklist helps communicate project issues to dairies – survey of dry run dairies	Good – During dry runs and both rounds of inspections, farmers reported learning a lot through the interaction.
6. ERP outreach/participation	
6.1. Milestones	
a. Policies stated in outreach	Complete
b. Customer-test of brochure	Complete – Used MMPA staff input, one of whom lived on a farm.
c. Final brochures printed	Complete – As an invitation letter and return mailer.
d. 1,600-piece mailing and 2 presentations per county	1,100 invitations in Phase 1 (through MMPA) 628 invitations in Phase 2
e. Reach 50 volunteers	40 volunteers Phase 1 43 volunteers Phase 2
6.2. Measures:	
a. Number of mailings (minus number of returns)	About 1700 total (minus returns)
b. Web site hits	Not applicable
c. Requests for further information (either MPCA or MMPA)	Not available
d. Number of brochures and information requests managed by Dept of Ag Dairy inspectors	Not applicable – did not use them as partners for this function
e. Sign-ups	82 total

f. MMPA membership increased	Unknown

7. Training inspectors

7.1. Milestones

a. Complete basic project awareness training for MPCA, county feedlot staff, Dept of Agriculture dairy inspectors, and MMPA technicians before recruitment	Completed for most (did not end up involving or training dairy inspectors at this level) – 1 EQA technician and 1 MPCA inspector received non-standardized training
b. Technicians co-trained so they're aware of inspection protocol	Completed except for 1 EQA technician who received non-standardized training

7.2. Measures:

a. Number of county and MPCA staff, MMPA technicians trained	3 county staff 6 MPCA staff 4 MMPA technicians
b. Hours in development - timetracking records	Year 1 of Phase 2: Basic development – 199 hours Materials development – 727 hours Hire/train inspectors – 352 hours Inspections – 550 hours Data entry – 89 hours Data analysis – 177 hours (3 core; 1 noncore inspector; 2 support staff; 6 supervisors and managers)
c. Inspector satisfaction – training evaluations	Not carried out
d. MMPA techs work effectively with dairies – MPCA survey calls to dairies	Surveys not carried out Good – Based on completion of farm plans by EQA technicians and overall level of improvement by Phase 1 farms
e. MPCA, county inspectors' effectiveness in working with dairies – MPCA (third-party) calls to dairies	Calls not carried out Good in one county/Poor in the second – Based on completion rate for CFO inspections
f. High-quality data collection (longer-term) – accuracy of certifications, data reported	Could not carry out comparisons in Phase 1. Phase 2 – Inspector completeness was not specifically tracked. More generally, clarification of inspector's Round 1 data took 7 hours, while Round 2 clarification only required 2 hours. Volunteers using the self-assessment achieved a 70% accuracy rate in Year 1.

8. Year 1 inspections/analysis (including data entry)

8.1. Milestones

a. All inspections complete before harvest	Round 1 – No. Some inspections took place after harvest, but all were complete before permanent snow cover (around Thanksgiving that year).
b. Complete baseline data set	Complete – January 2008
c. Completed analysis of compliance and performance levels	Complete – March 2008, although required some adjustment by Crow Environmental in 2009.
d. Initial conclusions on reliability of sample	Reliable from a QA/QC standpoint during analysis in 2008, although inspector's approach changed ("toughened", or didn't provide benefit of the doubt) for some questions in 2008. This was the cause of most apparent decreases in performance in 2008, so more adjustment of the 2007 baseline would be required to get the most reliable estimate of baseline performance and year-to-year change.

8.2. Measures:

a. Time investment relative to standard dairy inspections – from timetracking records, relative to historical average for this type of dairy	550 hours for 67 farms in 2007, or just above 8.2 hours per farm, counting preparation, travel and documentation. Not sure how this compares to average for standard inspections – estimate about 30% higher. Some of the extra may be ascribed to travel and lodging of inspector located in the southeast going to northwest and north central counties. Inspectors usually travel just within their regions.
b. Inspectors able (not able) to cover material projected in checklist – inspector records	Inspectors were not able to cover all material projected in their checklists. They WERE able to cover what the volunteers did in their self-assessments.
c. Response of operators during inspectors – qualitative, from inspector records	Mostly positive – 17 of 20 (85%) were positive, with one mixed response.
d. Number of operators requesting assistance during inspections – inspector records	Some on-the-spot assistance was given during virtually all inspections. 5-10 farmers requested specific follow-up material or assistance. All farmers received follow-up letters; materials relating to priority weaknesses were enclosed.
e. Compliance rates – inspector records	100% compliance rate: Volunteers: 20.0% 4-County controls: 5.3% 5-County controls: 0% All: 8.7%

	Minnesota's preferred compliance metric - Group compliance proportion: Volunteers: 85% 4-County controls: 85% 5-County controls: 84%
f. BMPs in place – inspector records	See discussion above.
g. Data sufficient to run baseline MinnFarm models	60 of the 61 farms which had open lot runoff.
h. Number of enforcement actions required (after any amnesty period) – longer term	Short-term – One control referred for failing septic system; one control referred for significant basin weakness. While they are priorities for follow-up, other "red flags" were not so imminent as to require enforcement in this project or in standard situations.
i. Percentage of facilities that certify every year – long term	Short-term: 15 certifiers in Year 2 divided by 23 certifiers in Year 1 = 65.2%

9. Post-Baseline Assistance

9.1. Milestones

a. Feedback from baseline inspections integrated into workbook	Complete
b. MMPA feedback on workbook	Complete
c. MMPA and dairy feedback	Complete
d. Effort and roles as designed with stakeholders	Complete – Follow-up was later than hoped – not as much time elapsing between follow-up and second self-assessment as hoped (only 2 months). 3-6 months elapsed before Round 2 inspections (June to September).
e. Final package and workshop syllabus	Final package complete; no time (nor, staff felt, farmer interest) for workshops. All MPCA assistance was on-site or through mailed printed materials. Some farmers sought out other assistance providers.
f. 2 workshops completed; timed to balance inspections, harvest, cert. deadline	No workshops provided. This was done by design for two reasons: • project team wanted to test the lowest-cost model • project team felt very few farmers would turn out

9.2. Measures:

a. Workshop attendance – operators in attendance	No workshops provided.

b. Phase 2 Workbooks distributed	67
c. Number (percentage) of facilities claiming to have used assistance materials, but did not certify – MPCA survey of those not completing certification, others.	Did not generate this data.

10. Certification

10.1. Milestones

a. Print and mail certification package	Complete – packages sent to 43 volunteers in mid-February 2007.
b. Mailed to coincide with end of baseline inspections	Not done – As mentioned above, had to mail in February-April timeframe when farmers would have time to complete the self-assessment. Inspector was not hired until June.
c. Set deadline with stakeholder input	Complete – Short deadline (2 weeks) was decided on.
d. Self-cert data entry	Complete – By June.
e. RTC forms completed	Incomplete (very) – Only 6% of the RTC plans required were fully complete in Year 1; 10% in Year 2.
f. Final analysis of self-certification data	Complete – In September prior to entry of inspection data.
g. Communication and understanding among inspectors – consensus on conclusions	Complete but again, not timed as planned – Analysis of self-assessments came slightly before full analysis of first round of inspections.

Measures:

a. Time spent in managing data electronically vs. what it would have been had the entire process been manual – from time-tracking records, based on data submittals similar to certifications	Unknown – Never could afford development of electronic data submittal, in part because of the pilot nature of the project (compared to other priorities, IS staff were unwilling to commit resources to what might be a temporary initiative) and because there were relatively few farms in the project (67 volunteers and controls in Year 1).
b. Number (percentage) of baseline operations completing certification	23 of 43 (53.5%) 18 of 22 (81.8%) responding to the question said the self-assessment form was easy to use and understand.
c. Number of return to compliance submittals	Only 6% of farms had 100% complete RTC plans in Year 1; 10% in Year 2. 47 of 118 noncompliance issues were addressed.

d. Number reporting compliance vs. non-compliance	22 of 23 reported one or more noncompliance issues; the 23rd was found to have noncompliance. One reporting noncompliance was found to be compliant.
e. Overall accuracy of certification forms – (longer-term) waits for post-certification inspector records	In Year 1, 71% match rate on compliance questions common to both Year 1 and Year 2; 84% for Year 2. 72% in Year 1 and 81% in Year 2 for all common questions.
f. Return to compliance forms submitted and RTC plans implemented – requires post-certification or other inspection records	The project team hasn't analyzed implementation data that fully yet, but given that there was such a low rate of RTC plan completeness in both years, they are not the best source of data on individual or group progress. On a group level, the volunteers (the only ones developing RTC plans) improved about 8% (to about 93.5%) on compliance: a net of 25 improvements out of 272 possible. For 20 volunteers, this averages to around 1 improvement each.

11. Post-certification inspections

11.1. Milestones

a. Final statistical methodology (if revised)	See Appendix 3.
b. Inspector protocol/ checklist modified (if necessary to improve data collection and if possible without skewing earlier data)	Complete – In both the self-assessment and inspector checklist, the project team revised the wording and order of many questions for readability and clarity; added some questions and eliminated others; changed numbering; changed so that most "bad" responses were "No." All of these moves created extra work during analysis after Year 2 inspections.
c. QAPP would determine if starting one month earlier than baselines is OK (i.e., does not introduce substantial seasonal bias)	Unsure if QAPP clarified this – Although baseline inspections followed after the first self-assessments by as much as 5 months, project staff believe few changes would have been accomplished during the busy summer months.
d. All post-cert inspections complete by harvest	Round 2 – Yes. All inspections completed by September 30.
e. Enforcement actions	Not applicable
f. Analysis completed	Completed in February, 2009; some final tweaking will occur after the submittal of this final report. Changes after the final report will be reflected in final project data and aggregate SIG project data.

11.2. Measures:

a. Number of inspections completed vs. number needed for sample	Mixed – Numbers of inspections completed in Round 2 dropped from 67 to 57 for a number of reasons not related to staffing or workload: Volunteers #7: Now involved with the standard program in implementing an Interim Permit to return to compliance #16: Never returned call #19: Depressed 4-County Controls #7: Sold livestock #17: Could never contact 5-County Controls #2: Sold livestock #4: Didn't return calls #8: Sold livestock #14: Said no (had received enforcement action on deficient septic) #19: Said no This undoubtedly reduced our ability to distinguish statistically-significant differences in performance between groups or over years exactly to what extent is unknown). This also meant that Crow Environmental had to revise Year 1 data to eliminate the 10 farms that didn't appear in Year 2 inspection data.
b. Time elapsed to complete all planned inspections	June to September (4 months) – a significant improvement over Year 1. It would have been difficult to do them quicker with only one inspector doing all project inspections across the state.
c. Time/cost per post-cert inspection vs. standard and vs. baseline – timetracking records	465 hours for 57 farms in 2008, or just below 8.2 hours per farm, counting preparation, travel and documentation. Not sure how this compares to average for standard inspections – estimate about 30% higher. Some of the extra may be ascribed to travel expense of inspector located in the southeast going to northwest and north central counties.
d. Hours in development - timetracking records	Year 2 of Phase 2: (1473 hours total) Materials development – 868 hours Inspections – 465 hours Data entry – 50 hours Data analysis – 90 hours (3 core; 1 support staff; 6 supervisors and managers) Wrap-up: Final analysis and reporting – 150 hours

e. Accuracy of self-certifications – baseline and post-cert inspector records	In Year 1, 71% match rate on compliance questions common to both Year 1 and Year 2; 84% for Year 2. 72% in Year 1 and 81% in Year 2 for all common questions.
f. Compliance rates – inspector records	100% compliance rate: 2008 (2007) Volunteers: 25% (20%) 4-County controls: 26% (5%) 5-County controls: 17% (0%) Group compliance proportion: Volunteers: 94% (85%) 4-County controls: 93% (85%) 5-County controls: 96% (84%)
g. Progress on whole farm issues – inspection records and longer-term MPCA follow-up	Discussed in more detail in *Appendix 1*.
h. Number (percentage) of farmers adopting recommended NM practices – inspection records and longer-term MPCA follow-up	Discussed in more detail in *Appendix 1*.
i. Performance of certifying facilities vs. others – longer-term (site visits)	Discussed in more detail in *Appendix 1*.
j. (Increased) use of soil testing and other site assessment tools – longer-term (site visits)	Discussed in more detail in *Appendix 1*.
k. Use of P2 and BMPs reported – annual reports	Discussed in more detail in *Appendix 1*.
l. Number (percentage) of farmers with approved manure management plans – follow-up submittals, inspections?	Not a valid measure as it turns out, since few project participants are required to maintain approved manure management plans because of their small herd sizes (most have fewer than 300 AU).
m. Estimated pollutant reductions based on MinnFarm model	Discussed in more detail in Aggregate #8 of *Appendix 1*. Project staff only had time and saw the utility of one MinnFarm model run, since few farms made substantive changes which would affect MinnFarm model outputs. More tracking will be done if resources permit.

12. Reporting

12.1. Milestones

a. QAPP approvals	Complete
b. Quarterly reports; web-site, e-mail distribution to stakeholders	Complete. No web site was established.
c. Raw data from baselines being tabulated	Complete
d. Present at County Feedlot Officers conferences	Complete

e. Informational item for MPCA Citizens Board	Never done – It was always too time-consuming a process for the amount of definitive information the project team felt it could deliver to the Citizens Board.
f. First round inspection data available	Complete
g. Raw data from early certifications	Complete
h. Potential program changes by rule or legislative action	Unlikely that rule or statute will be changed. Implementation future appears to be voluntary.
12.2. Measures:	
b. Reports delivered on time to EPA	Two were late. Note that the project was extended without additional federal cost twice (and amended to add $10,000 in 2008). These extensions effectively doubled the number of quarterly reports.
c. Interest from other states – program staff phone logs	Wisconsin and Utah; Region 5 and EPA Chesapeake Bay efforts; one Minnesota county commissioner.
d. Interest from other MPCA program managers – program records (staff training)	Small Business Environmental Assistance Program management – multi-state auto body ERP proposal; RCRA program – Non-Hospital Health Care Facility ERP proposal.
e. Interest from other livestock sectors	Minnesota Cattlemen's Association
f. Adaptation by other states (long term) – EPA records	TBA
g. Adaptation by other MPCA programs (long term) – MPCA records	Under way
13. Prospects for long-term measurement	
a. Leverage as much existing lake and stream monitoring effort and data as possible	This was explored early in the project through the work of a student intern. The project team found no monitoring stations which had both sufficient history and proximity to individual farms to draw conclusions about impacts. Project staff will review data again to see if there were any sub-watersheds with enough project farms on them to make it worth monitoring long-term group impact. This could be tracked through the MPCA's new 10-year rotation for monitoring the state's 80+ major watersheds.
b. Extended use of MinnFarm model on project farms	This will depend on Feedlot Program (or Prevention and Assistance Division) resource availability. Prevention and Assistance will try to make this happen.
c. Continued surveys of project farms	MPCA's Prevention and Assistance Program will attempt to make this happen.

Short-term metrics for Phase 1 – EQA (third-party) assessment, assistance and certification

- 29 Stearns County + 11 Winona County farms = 40 total participants
- 15 Certification Walkthroughs (received certification to Five Star status)
- 22 Final FERP Assessments (no certification yet)
- 3 farms got Initial Assessments only (2 No longer milking; 1 Low priority)
- 10 received slightly decreased scores (3 >0.10 decrease)
- 22 received increased scores (17 >0.10 increase)
- 316.22 hours of assistance provided by technicians to the participating farms (35 events)
- 10 Certification Walkthroughs and 9 Final FERP Assessments were done by technicians with no County Feedlot Officer (CFO) – all 37 completed farms need follow-up with CFOs for their data; 18 are currently assumed to have been found compliant by the CFO
- $30,162 paid to technicians by MMPA

Appendix 8. Analysis approach to the Phase 2 Minnesota Dairy ERP inspection data (Crow Environmental)

The Minnesota Pollution Control Agency (MPCA) completed two rounds of inspections of 67 farms with animal feedlots located in 9 counties. The farms are divided into three groups: 1) 23 feedlots that volunteered to participate in the program, 2) 21 farms in a 4-county control group, and 3) 23 farms and 5-county control group. The inspectors collected data on a large number of check list items. These items are yes/no questions. They also collected data on the number of farms and, in the second round, the number of acres farmed and the number of acres of manure applied. Ten farms did not provide data in the second round of inspections, leaving 57 farms with complete data from both rounds.

1. Description of the Data

The data from the two rounds of inspections were provided by MPCA. The two rounds of data used different conventions for naming variables. In some cases, the questions were slightly different. A consolidated data base was created that combined the data from the two rounds in a consistent format. Only farms that participated in both rounds of inspections and questions that were included in both checklists are included in the analysis.

The data from the first round of inspections are from the Excel file "FERB DB transposed 2.xls." The data were imported into Stata for the analysis. The file contained the actual responses to questions, i.e, yes or no to the check list items and the counts of animals. The file indicated which response was considered "good" for each check list item. Using these data, a new variable was created the indicated if the response was "good" or "bad." The data were in the "wide" format: there was one record for each farm and one variable for each question. To facilitate comparison of questions across rounds, the data were reshaped. Each farm has multiple rows in the new data set, one row for each question. The responses to the questions are shown in a single field, and a new field indicates which question each response corresponds to.

The second round of data was provided in the Excel file "MN Dairy ERP Round 2 Data v3.xls." Rather than "yes" or "no" responses to each question, these data contained a "good" or 'bad" response for each check list item. The data were imported into Stata and reshaped, as with the first round data.

The questions were numbered differently in the second round than they were in the first. MPCA provided a crosswalk between the two rounds. For example, question B8 in round 1 became question 1.9 in round 2. In general, the question numbers from the second round were used to identify each question in the combined dataset. Questions D3, D4 (a, b, and c) and D5 from round 1 did not have labels in round 2. The labels from round 1 were used in those cases. Exhibit 1 shows the fields in the combined dataset.

Some items that appeared as a single question in the first round were split into more than one question in the second round. To compare the results for the two rounds, these questions were rolled up. Questions 1.6 and 1.7 were rolled up, as were questions 1.13 and 1.14. A farm receives a "good" response if it has a good response to each individual question; otherwise, it gets a bad response.

Exhibit 1: Contents of Dataset used in Analysis of Minnesota ERP

Field	Descriptions
id	Unique farm identifier
group	County group identifier
name	Farm name
county	County name
countycode	County code
size07	Size of farm in 2007 (number of animal units)
size08	Size of farm in 2008 (number of animal units)
q08	Question number from 2008 checklist
q08 code	Code for 2008 check list question number (used by programs)
answer07	Response in 2007
answer08	Response in 2008
flag_all	Flag indicates that measure is included in overall score
flag comp	Flag indicates that measures is included in compliance score
flag_vol	Flag indicates that measures is included in voluntary score
flag_ebpi	Flag indicates that measures is included in EBPI score

In other cases, questions that were single questions in the second round were several questions in the first round. Questions B20a, B20b, B20c, and B20d from round 1 were rolled up and compared to question 1.36 in round 2. Questions B23b and B24c from round 1 were rolled up and compared to question 1.16 in round 2. Questions C2 and C3 from round 1 were rolled up and compared to question 3.16 in round 2. Exhibit 2 lists the questions included in the analysis of each round of inspections and the difference between the two rounds:

Exhibit 2. Questions included in the Analysis of the Minnesota ERP Data

2008 Question Number	Content
N/A	Compliance score (Based on responses to other check list items)
1.2	Surface waters within 1000' of OLs, basins, septics, man apps
1.6 & 1.7	Prevent reach ditch or other surface water
1.8	To surface tile
1.9	surface feature
1.12	To septic designed for MHW
1.13 & 1.14	Prevent reach ditch or other surface water
1.16	Absorbed in VTA without discharge
1.17	MHW or OLRo to storage basin
1.18	LMSA present
1.22	LMSA approved
1.23	Operate LMSA without overflow
1.24	1' freeboard
1.25	vegetation clear
1.27	Keep clean water flowing around or away
1.28	Prevent stockpile Ro to water
1.32	pile slope <6%
1.33	short pile dist
1.34	perm stockpile
1.35	imperv pad
1.36	Record-keeping current (100+ AU)
1.38	feed leachate to water
1.40	If checked, are river, stream, ditch within 300' of facility
1.41	Burying

Exhibit 2. Questions included in the Analysis of the Minnesota ERP Data

2008 Question Number	Content
1.43	render remove 72 hrs
1.44	IF render/O-S: scavenger-prf
1.45	Liquids stay in
1.46	compost imperv pad
1.47	7-10 day cycle/130+
1.48	finish free of tissue
1.49	>5' over high water tbl
1.50	away from surface water
1.51	cover immed w/ 3' soil
1.52	avoid sand/gravel
1.53	>10' over bedrock
2.4	Further than 25'
2.5	W/in 300' of STIs manure incorp in 24 hrs
2.6	Further than 50' from well, mine, etc
2.7	Further than 300' from sensitive areas in winter
2.8	Follow basic NM guidelines
2.9	Know UMES N recommendations
2.11	clean manure spill road
2.14	100+ in 1 pile-N,P 4 yrs
2.17	Keep records of applications
2.18	P test appl area once/4yr
2.19	Have permit or strategy to apply on high P w/in 300' water
2.20	Apply on extr-high P w/ permit
2.21	test new storage annually
2.23	>300 - appl recs 3 yrs (6)
3.1	All trash recycled or picked up
3.11	well casing up/grout/cap
3.12	wells upslope or protected
3.13	antibackflow faucet w hose
3.14	unused wells sealed, doc
3.15	Disconnected from pipe or ag drainage
3.16	Corrected any systems which allow surf seep or back-up
3.19	hire licensed pest applicator
3.20	records of all applications
3.21	store pest in orig container
3.22	3-wash/recycle or per label
3.23	USTs >1100 gallons
3.24	if yes, coated/monitored
D3	2+ crop/3 yr; per forage 50%
D4.a	GPS
D4.b	soil sampling
D4.c	combine yield monitors
D5	30% residue or strip till 2/3
1.1a	Mature>1000
1.1b	Mature<1000
1.1c	Heifer/Bull
1.1d	Calf
1.1e	Steer/Cow
1.1f	Feeder/Heifer
1.1g	Cow/Calf pair

Exhibit 2. Questions included in the Analysis of the Minnesota ERP Data

2008 Question Number	Content
1.1h	Calf
1.1i	Nursery pigs
1.1j	Wean/finish
1.1k	Breeder pigs
1.1l	Other 1 – Sheep
1.1m	Other 2 – Lambs
1.1n	Other 3 – Horses
1.1o	Other 4
1.1p	Other 5
1.1	Total AU

2. Analysis of Results

Four sets of analyses were conducted on each round of data and of the difference between the two rounds. The first analysis examines the proportion of farms with good responses to the yes/no check list items. The second analysis looks at a set of facility-based scores that are developed using the responses to the yes/no questions. The third analysis looks at aggregate achievement rates, again based on the yes/no questions. The final analysis summarizes the continuous data.

The analysis of each round of data and of the difference between the two rounds included estimates of 90 percent confidence intervals. It also included a number of tests of differences among responses. The analysis was conducted using Stata, version 10.0. The results were exported to Excel for presentation. The results for the first round of inspections are in the file MinnesotaRound1Results(*version number*).xls. The results for the second round are in the file MinnesotaRound2Results(*version number*).xls. The results for the analysis of the difference between the two rounds are in MinnesotaChange(*version number*).xls. The analyses are contained in separate tabs within each workbook, as described below.

2.1. Analysis of Each Round of Inspections

2.1.1. Analysis of Proportional Data

For each of the two rounds of data, the number of farms with good and bad responses in the three county groups is shown for each question. Non-applicable responses are excluded. We show the proportion with good responses for each county group. We also calculate the 90 percent binomial exact confidence intervals for the 4-county and 5-county control groups. (Clopper and S. E. Pearson.) No confidence interval is calculated for the volunteers because the data represent a census of the volunteer farms. Due to the small sample sizes within groups, Fisher's exact test (Snedecor and Cochran, p. 127.) is used to indicate whether there is a difference in responses to each question among the three groups. The test is run on a 3-by-2 table for each question where the rows are the three groups and the columns are the responses to each question. For the Fisher exact test, we treat the volunteers and the two control groups as if they were drawn from infinite populations. It provides an indication of whether there are differences among the three groups of

farms. It also can allow inference to future groups of volunteers or to the same volunteers at different points in time. For other analyses, we continue to treat the volunteers as a census.

To determine whether the difference between the 4-county group of farms and the volunteers is statistically significant, we compare the volunteers' proportions to 4-county 90 percent confidence interval. We indicate that the difference is statistically significant if the proportion of volunteers with a good response is outside the 4-county 90 percent confidence interval. We do the same comparison for the 5-county farms. To compare the results for the 4- and 5-county farms, we calculate a Fisher exact test. The rows of the 2-by-2 table are the two groups of farm and the columns are the farms' responses to the questions. We note when the test is significant at the 10 percent level.

To summarize, conducted several comparisons: Fisher's exact test of differences among the three groups, the comparison of the volunteers to the 4-county group, a comparison of the volunteers to the 5-county group, and the comparison of the 4-and 5-county groups. We note if Fisher's exact test of differences among the three groups is significant for a question when the other comparisons are not. We also note when at least one of the other comparisons is significant when Fisher's exact test across the three groups is not.

The analysis is conducted for each yes/no question on the inspector checklist. A compliance measure also is created for each farm. It is set to "good" if the response to each yes/no question is good; it is "bad" otherwise.

The analysis was conducted for three sets of farms: for all farms in the sample, for farms with less than 300 animal units, and farms with less than 100 animal units. The results for these analyses are shown in tabs 1.1 (for all farms), 2.1 (for farms with less than 300 animal units), and 3.1 (for farms with less than 100 animal units) in the round 1 and round 2 spreadsheets.

2.1.2. Analysis of Facility-Based Scores

Four sets of facility-based scores are constructed, based on each farm's responses to the yes/no questions.

1. **All measures**. The score for all measures is equal to the number of good responses to each question divided by the total number of questions. Three questions on the checklist are excluded because of changes in the way farms responded when the question was not applicable. The three excluded are questions 1.8, 1.17, and 1.38.

2. **Compliance measures**. The score for compliance measures is equal to the number of good responses on compliance questions divided by the total number of compliance questions. The compliance questions are:

1.6 & 1.7	1.47	2.19
1.9	1.48	2.20
1.13 & 1.14	1.49	2.21
1.16	1.50	2.23
1.22	1.51	3.01
1.23	1.52	3.11

1.28	1.53	3.12
1.32	2.04	3.13
1.33	2.05	3.14
1.35	2.06	3.15
1.36	2.07	3.16
1.43	2.11	3.20
1.44	2.14	3.21
1.45	2.17	3.22
1.46	2.18	3.24

3. **Voluntary measures**. The score for voluntary measures is equal to the number of good responses on voluntary measure questions divided by the total number of voluntary measure questions. The voluntary measure questions are:

1.2	1.40	D3
1.12	1.41	D4.a
1.18	2.08	D4.b
1.24	2.09	D4.c
1.25	3.01	D5
1.27	3.19	
1.34	3.23	

4. **EBPI measures**. The score for EBPI measures is equal to the number of good responses on EBPI measure questions divided by the total number of EBPI measure questions. The EBPI measure questions are:

1.2	1.48	3.16
1.6 & 1.7	1.50	D3
1.13 & 1.14	2.04	D4.b
1.16	2.07	
1.22	2.09	
1.24	2.17	
1.36	3.01	

The 10th percentile, 25th percentile, median, 75th percentile, 90th percentile, and mean are presented for each score. The score is a continuous variable and a standard confidence interval is computed for the 4- and 5-county groups. (Snedecor and Cochran, p. 55.) To test if the volunteers are different from the 4- and 5-county control groups, their mean score is compared to the 90 percent confidence interval for the two control groups. The 4- and 5-county groups are compared and a 90 percent confidence interval is constructed for the difference (Snedecor and Cochran, p. 89). If this interval includes zero, the difference is not significant. Significant differences are noted. The analysis was conducted on all farms, farms with less than 300 animal units, and farms with less than 100 animal units. The results are shown in the same spreadsheets that show the results of the analysis of the yes/no questions. The results for all the farms are in tab 1.2. The results for farms with less than 300 animal units are in tab 2.2. Tab 2.3 shows the results for farms with less than 100 animal units.

2.1.3 Analysis of aggregate achievement rates

Four aggregate achievement rates are constructed: (1) all measures, (2) compliance measures, (3) voluntary measures, and (4) EBPI measures. The same questions used to build the facility-based scores are used for to develop these achievement rates. Each achievement rate is the ratio of the good responses to all responses, across all farms, for each score. The ratios—and for the 4- and 5-county groups, 90 percent confidence intervals—were computed. (Cochran, p. 153.) The ratio for the volunteers is compared to the 90 percent confidence intervals for the 4- and 5-county groups to determine whether the differences are statistically significant. The 4- and 5-county groups are compared and a 90 percent confidence interval is constructed for the difference. If this interval includes zero, the difference is not significant. Significant differences are noted.

Separate estimates are produced for all farms, farms with less than 300 animal units, and farms with less than 100 animal units. The results are shown in the same spreadsheets, in tab 1.3 for all farms, 2.3 for farms with less than 300 animal units, and 3.3 for farms with less than 100 animal units.

2.1.4 Analysis of continuous data

In addition to the yes/no questions, the checklists included several questions about the number of animals. The median and mean of the responses are calculated. For the 4- and 5-county groups, standard 90 percent confidence intervals also are calculated. (Snedecor and Cochran, p. 55.) Some questions had 4 or fewer respondents in each group. Confidence intervals were not calculated in these cases. The mean for the volunteers is compared to the 90 percent confidence intervals for the 4- and 5-county groups to determine if the volunteers are statistically significantly different from the control groups. The 4- and 5-county groups are compared as well. If the 90 percent confidence interval of the difference includes zero, the difference is not statistically significant. Statistically significant differences are noted. Tab 1.4 of the spreadsheet for each round shows the results for all farms, tab 2.4 shows the results for farms with less than 300 animal units, and tab 3.4 shows the results for farms with less than 100 animal units.

2.2 Analysis differences between the two rounds of inspections

2.2.1 Analysis of changes in proportions

Each farm can have a good or bad response to each question in each round. Therefore, each farm can have four possible outcomes: 1) a bad response in round 1 and a bad response in round 2, 2) a bad response in round 1 and a good response in round 2, 3) a good response in round 1 and a bad response in round 2, and 4) a good response in round 1 and a good response in round 2. The following table shows the cross-tabulation of response in the two rounds to item 1.2, "Surface waters within 1000' of OLs, basins, septics, man apps." for volunteers of all size farms.

		2007 Response		
		Bad	Good	All
2008 Response	Bad	1) 3	3) 5	8
	Good	2) 1	4) 11	12
	All	4	16	20

For volunteers, 3 farms had bad responses in 2007 and 2008, 5 farms had bad responses in 2008 and good responses in 2009, 1 farm had a good response in 2007 and a bad response in 2008, and 11 farms had good responses in both rounds. A similar cross-tabulation is shown for each question the volunteers, the 4-county group, and the 5-county group.

The change in the percentage of farms with good responses is given by:

$$1) \qquad C = \frac{BG - GB}{T}$$

Where:

C is the percentage change in farms with good responses.
BG is the number of farms with bad responses in 2007 and good responses in 2008.
GB is the number of farms with good responses in 2007 and bad responses in 2007.
T is the total number of farms with applicable responses in both rounds.

For question 1.2, BG is 1, BG is 5, and T is 20. C, the change in the percent of farms with good responses, is -0.2. Within each group, McNemar's exact significant probability indicates whether the change in response is significant. (Snedecor and Cochran, pp. 121-122. We do not make the continuity correction.) While the volunteers are a census, this analysis treats them like a sample drawn from an infinite population. This provides an indication of whether or not the change is significant and may be observed among a new set of volunteers or among the same volunteers in the future. A 90 percent confidence interval also is shown for the 4- and 5-county group samples. (Snedecor and Cochran, p. 123. Again, we do not make the continuity connection.)

We compare the volunteer change in the proportion of good responses for the volunteers to the confidence intervals for the 4- and 5-county groups. If the change in proportion is outside the confidence interval, the change is noted as being significant. To compare the two control groups, we compare the two confidence intervals. If they do not overlap, the difference is noted as being significant.

The analysis is conducted for each yes/no question on the inspector checklist and the overall compliance measure. The analysis was conducted for three sets of farms: for all farms in the sample, for farms with less than 300 animal units, and farms with less than 100 animal units. The results are shown in the file MinnesotaChange(*version number*).xls in tabs 1.1 (for all farms), 2.1 (for farms with less than 300 animal units), and 3.1 (for farms with less than 100 animal units.

2.2.2 Analysis of changes in facility based scores

The differences in facility based scores are calculated for each farm. The 10th percentile, 25th percentile, median, 75th percentile, 90th percentile, and mean are presented for the change in each score. The difference is a continuous variable and a standard confidence interval is computed for the 4- and 5-county groups. (Snedecor and Cochran, p. 55.) To test if the changes in the scores for the volunteers are different from that of the 4- and 5-county groups, the changes in the volunteers' mean scores are compared to the 90 percent confidence interval for the changes in the mean scores of the two control groups. The changes for the 4- and 5-county groups are compared and a 90 percent confidence interval is constructed for the difference. If this interval includes zero, the difference is not significant. Significant differences are noted. The analysis is conducted on all farms, farms with less than 300 animal units, and farms with less than 100 animal units. The results are shown in the MinnesotaChange.xls spreadsheet. The results for all the farms are in tab 1.2. The results for farms with less than 300 animal units are in tab 2.2. Tab 2.3 shows the results for farms with less than 100 animal units.

2.2.3 Analysis of changes in aggregate achievement rates

To compare the changes in the four aggregate achievement rates, the total number of farms with good and bad responses to the component questions in each round is counted. For each group of farms and each score, a 2-by-2 table is constructed the total number of farms with each response in each round. For example, for all measures, the 2-by-2 table for all volunteer farms was:

		2007 Response		
		Bad	Good	Total
2008 Response	Bad	1) 122	3) 46	168
	Good	2) 52	4) 423	475
	Total	174	469	643

The change in the percentage of responses that are good is given by equation 1, above. As before, the exact McNemar's significance probability indicates whether the change is significant. If the probability is less than 0.10, the change is significant at the 10 percent level. The 90 percent confidence interval of the change in the ratio is constructed for the 4- and 5-county groups. (Cochran, p. 153.) The change for the volunteers is compared to the confidence interval for the 4- and 5-county groups. If the change in proportion for the volunteer is outside the interval, the change is statistically significant. The 4-and 5-county groups are compared directly. If the confidence interval of the difference between the two groups does not include zero, the difference in the changes is statistically significant.

The results for all farms are in tab 1.3. Tab 2.3 shows the results for farms with less than 300 animal units and tab 3.3 shows the results for farms with less than 100 animal units.

2.2.4 Analysis of changes in continuous data

The median and mean change in the number of animals is reported for each question. For the 4- and 5-county groups, standard 90 percent confidence intervals also are calculated. (Snedecor and

Cochran, p. 55.) Some questions had 4 or fewer respondents in each group. Confidence intervals were not calculated in these cases. The change in mean for the volunteers is compared to the 90 percent confidence intervals for the 4- and 5-county groups to determine if the changes for the volunteers are statistically significantly different from that of the control groups. The changes for the 4- and 5-county groups are compared as well. If the 90 percent confidence interval of the difference includes zero, the difference is not statistically significant. Statistically significant differences are noted. The results of the analysis are shown in the spreadsheets. Tab 1.4 shows the results for all farms, tab 2.4 shows the results for farms with less than 300 animal units, and tab 3.4 shows the results for farms with less than 100 animal units.

3. References

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Appendix 9. States ERP Consortium/EPA Core Measures report for Phase 2

Row #	Measure Name	Year 1	Year 2	Info Reported by State
Measures of Group Actions during ERP				
1.	✸**Final certification rate**	• 23 volunteers/4 counties • 628 dairies 700 AU and smaller in the 4-county group • 23/628 = 3.7%	• 15 volunteers/628 dairies = 2.4%	# of facilities submitting self-certifications (by itself, and as a percentage of the final universe)
2.	✸**Rate of "high-concern" discrepancies with regard to facility certifications on EBPIs**	• 5.4% on compliance questions common to both years • 31.1% "mismatch" or discrepancy rate for all compliance-related questions	• 4.7% on compliance questions common to both years (8 farms) • 16.5% "mismatch" or discrepancy rate for all compliance-related questions	Percentage of EBPI responses on which an inspector, during random inspections, determined non-achievement of the EBPI but the facility reported something else (i.e., facility reported achieving the EBPI or that the EBPI was not applicable to the facility, or the facility simply did not provide a valid answer)
3.	✸**Rate of self-disclosed noncompliance**	• 16 • 16/23 = 69.6%	• 10 • 10/15 = 66.7%	Number of facilities self-disclosing one or more instance of noncompliance (provided by itself and as a percentage of all certifiers)
4.	✸**Rate of return-to-compliance plan submission**	• 10 submitted at least one • 10/23 = 43.5%	• 9 submitted at least one • 9/15 = 60.0%	Number of facilities submitting one or more return-to-compliance plans (reported by itself and as a percentage of all certifiers)
5.	Rate of self-disclosing facilities submitting one or more return-to-compliance plans	• 10/16 = 62.5% • However, only 3/16 = 18.8% of self-disclosers submitted RTCs for every noncompliance they identified ("RTC completeness" metric)	• 8/10 = 80% • 1/10 = 10.0% of self-disclosers submitted complete RTC plans	Percentage of self-disclosing facilities submitting one or more return-to-compliance plans

Row #	Measure Name	Year 1	Year 2	Info Reported by State
Measures of Group Performance on Environmental Business Practices				

6. **✸Achievement rate for each EBPI**

Dichotomous variables – inspection proportions – EBPIs common to both years - Percentage of randomly sampled facilities achieving each EBPI

		2007				2008			
		Vols	4-C	5-C	All	Vols	4-C	5-C	All
1.	Surface waters within 1000' of OLs, basins, septics, man apps	80.00%	68.42%	94.44%	80.70%	60.00%	26.32%	50.00%	45.61%
2.	Prevent reach road ditch/Prevent reach other surf water	94.44%	83.33%	88.89%	88.89%	100.00%	78.57%	92.31%	94.29%
3.	separate septic	100.00%	100.00%	100.00%	100.00%	18.18%	40.00%	33.33%	30.00%
4.	Prevent MHW reach road ditch/Prevent MHW reach other surf water	100.00%	90.00%	100.00%	95.65%	90.00%	77.78%	87.50%	93.33%
5.	MHW thru adequate buffer	50.00%	60.00%	100.00%	75.00%	100.00%	100.00%	0.00%	100.00%
6.	LMSA present	55.00%	42.11%	16.67%	38.60%	55.00%	42.11%	17.65%	39.29%
7.	LMSA approved	63.64%	75.00%	100.00%	73.91%	63.64%	75.00%	100.00%	72.73%
8.	1' freeboard	100.00%	100.00%	100.00%	100.00%	100.00%	87.50%	100.00%	95.45%
9.	Record-keeping current (100+ AU)	30.00%	18.18%	0.00%	18.52%	80.00%	20.00%	0.00%	35.71%
10.	Carcass buried away from surf water	90.00%	100.00%	100.00%	95.65%	100.00%	100.00%	100.00%	100.00%
11.	Manure app further than 25' from surface water	83.33%	100.00%	88.89%	90.24%	100.00%	100.00%	75.00%	100.00%
12.	Manure app further than 300' from sensitive areas in winter	78.57%	100.00%	90.91%	89.74%	100.00%	100.00%	63.64%	100.00%
13.	all 1st-yr N ± 20% UM	45.00%	36.84%	38.89%	40.35%	30.00%	21.05%	33.33%	28.07%
14.	Keep records of applications	50.00%	14.29%	33.33%	34.78%	23.08%	66.67%	25.00%	34.78%
15.	burn barrel used routinely	75.00%	57.89%	22.22%	52.63%	80.00%	68.42%	22.22%	57.89%
16.	seepage to surface	80.00%	94.74%	83.33%	85.96%	95.00%	94.74%	94.44%	94.74%
17.	2+ crop/3 yr; per forage 50%	100.00%	94.44%	77.78%	90.91%	100.00%	100.00%	94.44%	98.25%
18.	soil sampling	85.00%	68.42%	61.11%	71.93%	95.00%	78.95%	55.56%	77.19%

Row #	Measure Name	Year 1	Year 2	Info Reported by State
7.	✸ **Summary of EBPI performance changes**	Number of EBPIs worsening/improving/not changing, and for those worsening/ improving, number of each that are statistically significant. Analysis looks at each facility's performance on each question common to both years, and categorizes change into good-to-good, bad-to-bad, good-to-bad, and bad-to-good, and totals only the last two which were actual changes in metrics. MN did not analyze whether changes from year to year were statistically different within a group. Instead, we analyzed significant differences between groups (V vs. 4-C, V vs. 5-c, 4-C vs. 5-C).			

		Vols	4-Cs	5-Cs	V diff 4	V diff 5	4 diff 5
1.	Surface waters within 1000' of OLs, basins, septics, man apps	-20.00%	-42.11%	-44.44%	--	--	--
2.	Prevent reach road ditch/Prevent reach other surf water	10.00%	-15.38%	0.00%	--	--	--
3.	separate septic	-77.78%	-40.00%	-75.00%	--	--	--
4.	Prevent MHW reach road ditch/Prevent MHW reach other surf water	0.00%	0.00%	-50.00%	--	--	
5.	MHW thru adequate buffer	0.00%	0.00%	0.00%	NA	NA	NA
6.	LMSA present	0.00%	0.00%	0.00%	--	--	--
7.	LMSA approved	0.00%	0.00%	0.00%	--	--	--
8.	1' freeboard	0.00%	-14.29%	0.00%	--	--	--
9.	Record-keeping current (100+ AU)	66.67%	0.00%	0.00%	Yes	Yes	--
10.	Carcass buried away from surf water	11.11%	0.00%	0.00%	--	--	--
11.	Manure app further than 25' from surface water	11.76%	0.00%	-12.50%	Yes	--	--
12.	Manure app further than 300' from sensitive areas in winter	21.43%	0.00%	-27.27%	Yes	Yes	--
13.	all 1st-yr N ± 20% UM	-15.00%	-15.79%	-5.56%	--	--	--
14.	Keep records of applications	-20.00%	50.00%	-25.00%	Yes	--	--
15.	burn barrel used routinely	5.00%	10.53%	0.00%	--	--	--
16.	seepage to surface	15.00%	0.00%	11.11%	--	--	--
17.	2+ crop/3 yr; per forage 50%	0.00%	5.56%	16.67%	--	--	--
18.	soil sampling	10.00%	10.53%	-5.56%	--	--	--

Row #	Measure Name	Year 1	Year 2	Info Reported by State
8.	✸**Aggregate achievement rate for all EBPIs**	Inspections of volunteers: 77.1% Controls: 4-County: 73.4% Controls: 5-County: 70.5% All farms: 73.9%	Inspections of volunteers: 80.7% Controls: 4-County: 72.6% Controls: 5-County: 65.4% All farms: 73.5%	Percentage of all relevant EBPIs being achieved, across all randomly sampled facilities
9.	✸**Achievement rate across all compliance-related measures** (commonly called a traditional compliance rate)	• 100% compliance rate: Volunteers: 20.0% 4-County controls: 5.3% 5-County controls: 0%	• 100% compliance rate: Volunteers: 25.0% 4-County controls: 26.3% 5-County controls: 16.7%	The percentage of randomly sampled facilities that are achieving all relevant compliance-related measures
10.	Average facility score for all EBPIs	Inspections of volunteers: 77.0% Controls: 4-County: 72.5% Controls: 5-County: 69.9% All farms: 73.3%	Inspections of volunteers: 79.6% Controls: 4-County: 72.3% Controls: 5-County: 64.8% All farms: 72.5%	The percentage of all relevant EBPIs being achieved, on average, by randomly sampled facilities
11.	Distribution of facility scores for all EBPIs	V: 10th 56.1%, 25th 66.7%, Med 77.5%, 75th 90.6%, 90th 96.4 4-C: 10th 50.0%, 25th 66.7%, Med 75.0%, 75th 80.0%, 90th 90.9 5-C: 10th 40.0%, 25th 62.5%, Med 75.0%, 75th 77.8%, 90th 92.3 All: 10th 50.0%, 25th 66.7%, Med 75.0%, 75th 80.0%, 90th 92.3	V: 10th 64.6, 25th 73.9, Med 80.0, 75th 83.3, 90th 100.0 4-C: 10th 54.5, 25th 63.6, Med 75.0, 75th 81.8, 90th 83.3 5-C: 10th 40.0, 25th 54.5, Med 66.7, 75th 78.6, 90th 88.9 All: 10th 54.5, 25th 63.6, Med 75.0, 75th 81.8, 90th 88.9	Distribution of facility scores for all EBPIs among randomly sampled facilities (showing each decile and median score)
12.	Average facility score for compliance-related EBPIs	Not available.		The percentage of all relevant compliance-related EBPIs being achieved, on average, by randomly sampled facilities
13.	Distribution of facility scores for compliance-related EBPIs	Not available.		Distribution of facility scores for all compliance-related EBPIs among randomly sampled facilities

<table>
<tr><th>Row #</th><th>Measure Name</th><th>Year 1</th><th>Year 2</th><th>Info Reported by State</th></tr>
<tr><td>14.</td><td>Average facility score for all compliance-related measures</td><td>Minnesota prefers this compliance metric over #9 above.<table><tr><td>Inspections of volunteers</td><td>85.3%</td></tr><tr><td>Controls: 4-County</td><td>85.0%</td></tr><tr><td>Controls: 5-County</td><td>84.3%</td></tr><tr><td>All farms</td><td>84.9%</td></tr></table></td><td><table><tr><td>Inspections of volunteers</td><td>93.4%</td></tr><tr><td>Controls: 4-County</td><td>91.0%</td></tr><tr><td>Controls: 5-County</td><td>86.7%</td></tr><tr><td>All farms</td><td>90.5%</td></tr></table></td><td>The percentage of all relevant compliance-related measures being achieved, on average, by randomly sampled facilities</td></tr>
<tr><td>15.</td><td>Distribution of facility scores for all compliance-related measures</td><td><table><tr><td></td><td>10th</td><td>25th</td><td>Med</td><td>75th</td><td>90th</td></tr><tr><td>V</td><td>68.7</td><td>73.5</td><td>86.1</td><td>96.2</td><td>100.0</td></tr><tr><td>4-C</td><td>68.0</td><td>80.0</td><td>84.2</td><td>93.3</td><td>96.6</td></tr><tr><td>5-C</td><td>63.6</td><td>78.9</td><td>87.8</td><td>93.3</td><td>94.1</td></tr><tr><td>All</td><td>68.2</td><td>78.6</td><td>86.7</td><td>94.1</td><td>96.8</td></tr></table></td><td><table><tr><td></td><td>10th</td><td>25th</td><td>Med</td><td>75th</td><td>90th</td></tr><tr><td>V</td><td>88.2</td><td>89.7</td><td>93.5</td><td>97.4</td><td>100.0</td></tr><tr><td>4-C</td><td>80.0</td><td>86.7</td><td>91.3</td><td>94.7</td><td>100.0</td></tr><tr><td>5-C</td><td>62.5</td><td>84.6</td><td>91.4</td><td>94.1</td><td>100.0</td></tr><tr><td>All</td><td>80.0</td><td>87.5</td><td>93.3</td><td>94.7</td><td>100.0</td></tr></table></td><td>Distribution of facility scores for all compliance-related measures among randomly sampled facilities</td></tr>
<tr><td colspan="4">Measures of Group Impact on Selected Environmental and Public Health Issues (aspirational)</td><td></td></tr>
<tr><td>16.</td><td>✧ Rate of managing/controlling certain environmental aspects</td><td>1. Manure managed 100% properly
Volunteers:
5 of 23 = 21.7%
25, 431 tons/year of 49,500 tons/yr total = 51.4%
Controls:
6 of 44 = 13.6% (3 in 4-cty; 3 in 5-cty)
21,572 tons/year of 54,300 tons/yr total = 39.7%
2. Acres in crop rotation (2+ crops/3 years):
Vols - 7,915 total/440 ave/18 of 23 farms use this regime
Controls - 13,879 total/347 ave/38 of 44 farms use this regime</td><td>In 2008 we collected total and annual manure application acres. Using some cited manure generation rates and AUs, and comparing to rules of thumb of 16 tons manure/acre for row crop P removal and 30 tons/acre for perennials P removal, anywhere from 28% to 58% of all farms are applying manure too heavily. With a little work, this metric could be improved and presented as a quick and easy calculation for producers to do. We could also attempt assumptions about how much of the pollutants above the benchmarks might impact waters.</td><td>Amounts of emissions/waste/discharges or chemicals/materials used that are properly controlled/managed (reported as a raw number and as percentage of total)</td></tr>
</table>

<table>
<tr><th>Row #</th><th>Measure Name</th><th>Year 1</th><th>Year 2</th><th>Info Reported by State</th></tr>
<tr><td>17.</td><td>✧ Level of group emissions/waste/ discharges/ chemical usage related to certain environmental aspects</td><td>1. Manure generated (estimated)
• Volunteers: 49,500 tons/year total
• Controls: 54,300 tons/year total</td><td colspan="2">CFU= colony-forming units
<table>
<tr><td></td><td>Vols</td><td>4-C</td><td>5-C</td><td>All</td></tr>
<tr><td>MinnFarm</td><td>18</td><td>19</td><td>21</td><td>58</td></tr>
<tr><td>Aggregate COD (lbs.)</td><td>5654.00</td><td>3900.00</td><td>3449.00</td><td>13003.00</td></tr>
<tr><td>Aggregate Nitrogen (lbs.)</td><td>288.00</td><td>204.00</td><td>184.00</td><td>676.00</td></tr>
<tr><td>Aggregate Fecal (CFU)</td><td>1.6929E+15</td><td>8.4468E+14</td><td>8.02885E+14</td><td>3.34047E+15</td></tr>
<tr><td>Aggregate Phosphorus (lbs.)</td><td>87.00</td><td>52.00</td><td>53.00</td><td>192.00</td></tr>
<tr><td>Aggregate BOD5 (lbs.)</td><td>1270.19</td><td>865.00</td><td>789.00</td><td>2924.19</td></tr>
<tr><td>Per-Farm Average COD (lbs.)</td><td>314.11</td><td>205.26</td><td>164.24</td><td>224.19</td></tr>
<tr><td>Per-Farm Average Nitrogen (lbs.)</td><td>16.00</td><td>10.74</td><td>8.76</td><td>11.66</td></tr>
<tr><td>Per-Farm Average Fecal (CFU)</td><td>9.40503E+13</td><td>4.4457E+13</td><td>3.82326E+13</td><td>5.75944E+13</td></tr>
<tr><td>Per-Farm Average Phosphorus (lb)</td><td>4.83</td><td>2.74</td><td>2.52</td><td>3.31</td></tr>
<tr><td>Per-Farm Average BOD5 (lbs.)</td><td>70.57</td><td>45.53</td><td>37.57</td><td>50.42</td></tr>
<tr><td>Per-AU Average COD (lbs.)</td><td>1.62</td><td>1.78</td><td>1.88</td><td>1.73</td></tr>
<tr><td>Per-AU Average Nitrogen (lbs.)</td><td>0.08</td><td>0.09</td><td>0.10</td><td>0.09</td></tr>
<tr><td>Per-AU Average Fecal (CFU)</td><td>4.84274E+11</td><td>3.8575E+11</td><td>4.37111E+11</td><td>4.44078E+11</td></tr>
<tr><td>Per-AU Average Phosphorus (lbs.)</td><td>0.02</td><td>0.02</td><td>0.03</td><td>0.03</td></tr>
<tr><td>Per-AU Average BOD5 (lbs.)</td><td>0.36</td><td>0.40</td><td>0.43</td><td>0.39</td></tr>
<tr><td>Average AU - 2007</td><td>151.99</td><td>113.42</td><td>102.73</td><td>122.99</td></tr>
</table></td></tr>
<tr><td>18.</td><td>✧ Ecological, occupational and public health impacts related to certain environmental aspects of the group</td><td>Monitoring data was in most cases not available and would be difficult to use definitively anyway.</td><td colspan="2"></td><td>Impacts of the group on measures of ecological, occupational and public health</td></tr>
<tr><td colspan="4">Measures of Costs of Implementing ERP (aspirational)</td><td></td></tr>
<tr><td>19.</td><td>✧ Agency level of effort, first cycle</td><td>Year 1 of Phase 2: (2094 hours total)
Basic development – 199 hours
Materials development – 727 hours
Hire/train inspectors – 352 hours
Inspections – 550 hours
Data entry – 89 hours
Data analysis – 177 hours
(3 core; 1 noncore inspector; 2 support staff;</td><td colspan="2">Year 2 of Phase 2: (1473 hours)
Materials development – 868 hours
Inspections – 465 hours
Data entry – 50 hours
Data analysis – 90 hours
(3 core; 1 support staff; 6 supervisors and managers)
Wrap-up:</td><td>Total number of staff hours expended in developing and implementing the first ERP cycle</td></tr>
</table>

<table>
<tr><th>Row #</th><th>Measure Name</th><th>Year 1</th><th>Year 2</th><th>Info Reported by State</th></tr>
<tr><td></td><td></td><td>6 supervisors and managers)</td><td>Final analysis and reporting – 150 hours</td><td></td></tr>
<tr><td>20.</td><td>✧ Agency level of effort, subsequent cycles</td><td>None for sure yet.</td><td></td><td>Total number of staff hours expended in developing and implementing later ERP cycles being reported</td></tr>
<tr><td colspan="4">Measures of Other Benefits of ERP</td><td></td></tr>
<tr><td>21.</td><td>✸Other benefits of ERP</td><td></td><td>The experience with the pilot has led to two new proposed ERP projects (finite, not indefinite programs) in auto body and non-hospital health care.</td><td>Are there any other benefits of ERP -- to your agency, to the public, to business etc. -- that you would like to share?</td></tr>
<tr><td colspan="4">Other Key Measures Chosen by the State</td><td></td></tr>
<tr><td>22.</td><td>✸Other key measures you have identified</td><td>Herd size change trends:</td><td colspan="2">
<table>
<tr><td>VOLS</td><td>Number</td><td>% of N</td><td>Ave Change</td><td></td><td></td><td></td></tr>
<tr><td>08 N=</td><td>21</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Increase</td><td>10</td><td>47.62%</td><td>30.21 AU</td><td></td><td></td><td></td></tr>
<tr><td>Decrease</td><td>5</td><td>23.81%</td><td>-27.64 AU</td><td>Sold</td><td>0</td><td>0.00%</td></tr>
<tr><td><1 change</td><td>6</td><td>28.57%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Overall</td><td></td><td></td><td>10.35 AU</td><td></td><td></td><td></td></tr>
</table>
<table>
<tr><td>4-C</td><td>Number</td><td>% of N</td><td>Ave Change</td><td></td><td></td><td></td></tr>
<tr><td>08 N=</td><td>20</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Increase</td><td>5</td><td>25.00%</td><td>11.54</td><td></td><td></td><td></td></tr>
<tr><td>Decrease</td><td>10</td><td>50.00%</td><td>-17.47</td><td>Sold</td><td>1</td><td>5.00%</td></tr>
<tr><td><1 change</td><td>5</td><td>25.00%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Overall</td><td></td><td></td><td>-2.23 AU</td><td></td><td></td><td></td></tr>
</table>
<table>
<tr><td>5-C</td><td>Number</td><td>% of N</td><td>Ave Change</td><td></td><td></td><td></td></tr>
<tr><td>08 N=</td><td>20</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Increase</td><td>6</td><td>30.00%</td><td>11.5</td><td></td><td></td><td></td></tr>
<tr><td>Decrease</td><td>12</td><td>60.00%</td><td>-23.15</td><td>Sold</td><td>2</td><td>10.00%</td></tr>
<tr><td><1 change</td><td>2</td><td>10.00%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Overall</td><td></td><td></td><td>-4.60 AU</td><td></td><td></td><td></td></tr>
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</td></tr>
</table>