Toward the Development of Performance Criteria Beyond Best Management Practices

by

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TOWARD THE DEVELOPMENT OF PERFORMANCE CRITERIA BEYOND BEST MANAGEMENT PRACTICES

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Introduction

A watershed approach for preventing environmental degradation has garnered significant attention.[1] Agricultural pollution is particularly amenable to this comprehensive approach to environmental quality since polluted agricultural

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1. *See generally* U.S. ENVTL. PROTECTION AGENCY, THE WATERSHED APPROACH: AN OVERVIEW (1991). The EPA states:

> Numerous projects using the Watershed Protection Approach have been implemented, and many more are in various stages of planning.... While they differ widely in their objectives and methods, watershed protection projects have several characteristics in common that distinguish them from conventional water quality initiatives.
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> * They are discrete activities, often structured as a task force or work group, spearheaded by a State agency, an EPA regional office, or another authoritative environmental management organization.
>
> * They encompass all or most of the landscape in a well-defined watershed or other ecological, physiographic, or hydrologic unit, such as an embayment, an aquifer, or a mountain valley.
>
> * They provide a well-structured opportunity for meaningful participation by State, Federal, tribal, county, municipal and other government agencies, as well as private landowners, industry representatives, other interested parties, as well as the general public.
>
> * They identify the most significant threats to water quality, based on a comparative risk analysis of the human health, ecological, and economic impacts, and they target resources toward these high-risk problems.
>
> * They establish well-defined goals and objectives for the watershed, including objectives for:
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> — Chemical water quality ("conventional pollutants" and toxics)
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> — Physical water quality (e.g., temperature, flow, circulation)
>
> — Habitat quality (e.g., channel morphology, composition, and health of biotic communities)
>
> — Biodiversity (e.g., species number, range).
>
> * They devise and implement an integrated action agenda for achieving the objectives, incorporating all appropriate authorities and techniques (e.g., permit reissuance, education programs).

Id.

runoff — including pollution from livestock operations — is a diffuse and unpredictable phenomenon that directly implicates land use management issues over vast areas.[2] Over the past twenty-five years, much of the progress achieved in controlling water pollution in industrialized countries has been the result of technical effluent controls applied at the discharge pipes of municipalities and major industries.[3] The next generation of water quality programs will likely rely on the watershed concept since nonpoint source pollution cannot be effectively controlled by point source-specific effluent limitations.[4]

The great amount of nutrients produced by large, concentrated livestock production operations ensure that watersheds where several such operations locate will be among those initially targeted for programs to control polluted agricultural runoff. A nutrient budget study conducted in the 230,000-acre Upper North Bosque River watershed in North Central Texas estimated that approximately 48% of all nitrogen and 66% of all phosphorus circulating in the environment emanate from the watershed's ninety-four dairies.[5] These dairies contain approximately 31,000 cows, each producing annually over 175 pounds of total nitrogen potentially available for runoff to surface waters absent diligent producer management.[6] Intensive water quality analysis conducted by the Texas Institute for Applied Environmental Research involving some twenty-five sampling sites in the same watershed reveals a strong, positive correlation between elevated, instream phosphorus concentrations during storm events and the location of manure application fields in the watershed.[7] Thus, lessons learned in programs developed to control polluted runoff from concentrated livestock operations will be available for transfer to watersheds impaired by other polluted agricultural runoff problems.

Key Issue: Performance Criteria for Producers

As efforts proceed to implement agricultural pollution controls as part of a watershed approach, a number of important issues quickly come to the fore. One issue involves the determination of how the success of such efforts will be gauged over time. For decades conservation programs in the United States relied on the

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2. *See generally* LARRY FRAREY ET AL., WATERSHED SOLUTIONS (1994).

3. *See* PETER ROGERS, AMERICA'S WATER FEDERAL ROLES AND RESPONSIBILITIES 4 (1993); *see also* Gardner M. Brown, Jr. & Ralph W. Johnson, *Pollution Control by Effluent Charges: It Works in the Federal Republic of Germany, Why Not in the U.S.*, 24 NAT. RESOURCES J. 929, 930 (1984).

4. WATER QUALITY 2000, A NATIONAL AGENDA FOR THE 21ST CENTURY FINAL REPORT 11 (1992) ("Water Quality 2000 has found ample evidence that a new national water policy is needed to integrate surface and groundwater resources planning and management with related societal activities under a watershed framework.").

5. ROBERT NEAL ET AL., LIVESTOCK AND THE ENVIRONMENT: A NATIONAL PILOT PROJECT, UPPER NORTH BOSQUE RIVER WATERSHED MATERIALS BALANCE ANALYSIS 27 (1994).

6. *Id.* at 12.

7. ANNE MCFARLAND & LARRY HAUCK, LIVESTOCK AND THE ENVIRONMENT: SCIENTIFIC UNDERPINNINGS FOR POLICY ANALYSIS, REPORT NO. 1 (Tex. Inst. for Applied Envtl. Research Sept. 1995).

number of land treatment measures — often termed best management practices (BMPs) — implemented by agricultural producers as a principal indicator of program success.[8] Terraces represent one such BMP widely implemented to control soil erosion and associated water quality degradation. More recently, some policymakers have concluded that BMP implementation alone provides an inadequate indicator of progress toward water pollution prevention and abatement.[9] Many of the BMPs necessary to control polluted agricultural runoff from agricultural fields, including manure application fields, are managerial rather than structural in nature.[10] Manure application practices generally fall under the category of managerial BMPs.[11] The cause-effect relationship between managerial BMPs to control polluted runoff and improved water quality is often not as direct as the application of the best available control technology to traditional point source discharges.[12] Many variables may intervene to complicate the analysis, not the least of which are the time and space vagaries of precipitation and the extent of operator diligence in adhering to essential management measures. Moreover, as long as BMP implementation provides the gauge for progress toward pollution prevention and abatement, agricultural producers may be subject to increasing demands for improved water quality until a generally acceptable level of water quality is achieved.[13] Agricultural producers would benefit from a more direct and static indicator by which to judge the success of pollution prevention and abatement efforts on the farm.

Consequently, the development of more appropriate performance standards for polluted agricultural runoff represents a high priority for agricultural pollution prevention and abatement programs.[14] However, such performance criteria are problematic in terms of biophysical complexity and monitoring costs. During the 103d United States Congress, at least two unsuccessful Clean Water Act reauthorization bills provided for the development of instream criteria for nutrients and other nonpoint source pollutants.[15] However, no similar language appears in the Clean Water Act reauthorization bill reported out of the House of Representatives Committee on Transportation and Infrastructure on April 13, 1995.[16]

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8. *See* JOHN DEERE CO., MANAGING NONPOINT SOURCE POLLUTION IN AGRICULTURE 60 (1995).

9. *Id.*

10. *See* Terry J. Logan, *Agricultural Best Management Practices and Groundwater Protection*, J. OF SOIL & WATER CONSER., Mar.-Apr. 1990, at 201, 202.

11. Common manure application BMPs include application at the nitrogen agronomic rate, application on ground that is neither saturated nor frozen, application on fields with no more than moderate slope, and incorporation of solid manure into the soil. TEX. ADMIN. CODE tit. 30, § 321.37 (1994); TEX. ADMIN. CODE tit. 30, § 321.192 (1995); Texas Natural Resource Conservation Commission Dairy Permit No. 03773 (1995).

12. FRAREY, *supra* note 2, at 29.

13. *Id.* at 28.

14. JOHN DEERE, *supra* note 8, at 60.

15. *See* S. 2093, 103d Cong., 2d Sess. § 202 (1994); H.R. 2543, 103d Cong., 1st Sess. § 301 (1993).

16. *See* H.R. 961, 104th Cong., 1st Sess. § 307 (1995) ("Revision of Criteria, Standards, and Limitations").

Lessons from Two Watersheds

Work conducted to date in two predominantly agricultural watersheds provides significant insight into the development of producer performance criteria beyond BMPs.

Lake Okeechobee

Lake Okeechobee is the second largest fresh water lake in the United States, covering some 1890 km^2 in South Florida north of the Miami metropolitan area.[17] The lake is a premier fishing and recreational resource, and supplies drinking water to a burgeoning South Florida population, as well as water for diverse agricultural activities.[18] Since the late 1980s, a concerted nonpoint source pollution control program has been underway in the lake's principal drainage areas to stave off the hypereutrophic conditions that resulted in a 120 mi^2 algal bloom in 1986.[19]

Widespread concern over the long-term health of Lake Okeechobee crystallized throughout Florida in the early 1970s. A series of reports published over the course of the next decade documented the deteriorating environmental condition of the lake[20] and cited high-density dairy pastures and inadequate waste disposal practices as the cause of excessive phosphorus loading and resulting eutrophic conditions.[21] The Lower Kissimmee River and Taylor Creek-Nubbin Slough drainage basins lie directly above the lake, contributing approximately 35% of all water flowing into the lake.[22] Ranching and dairying represent the principal agricultural activities in the two watersheds.[23] The 120,000-acre Taylor Creek-Nubbin Slough watershed provides only 4% of the inflow to Lake Okeechobee while accounting for 27% of total phosphorus loading. The Lower Kissimmee River watershed provides an additional 20% of total phosphorus loading to the lake.[24] Feed and fertilizer purchases by agricultural operations in the two watersheds are responsible for 98% of the net phosphorus imports into the area.[25]

Early dairy farms in South Florida located south of Lake Okeechobee. Dairy farming began to transfer to areas north of the lake to escape urban sprawl in

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17. Mary Ellen Moore, *Revitalizing Lake Okeechobee*, CH2M HILL REP., Winter 1991, at 6, 6.

18. *Id.*

19. *Id.*

20. *Id.*

21. *Id.* at 7.

22. C.D. Heatwole et al., *Modeling Cost-Effectiveness of Agricultural Nonpoint Pollution Abatement Programs on Two Florida Basins*, WATER RESOURCES BULL., Feb. 1987, at 127, 127.

23. EPA, EVALUATION OF THE EXPERIMENTAL RURAL CLEAN WATER PROGRAM 121 (1993).

24. Kathy Osking & Boyd Gunsalus, *The Evolution of the RCWP Water Quality Monitoring Networks in the Taylor Creek/Nubbin Slough and Lower Kissimmee River Basins, in Proceedings*, in EPA, NATIONAL RCWP SYMPOSIUM 1, 2 (1992) (No. EPA/625/R-92/006).

25. W. Arthur Darling, *Status of Florida Regulation of Dairy Farm Waste Management*, in NATIONAL LIVESTOCK, POULTRY AND AQUACULTURE WASTE MANAGEMENT 67, 68 (John Blake et al eds., 1992).

1955 with the establishment of a 700-cow herd; by 1970, cow numbers had increased to nearly 20,000 on sixteen dairies, all discharging phosphorus-laden waste water directly into nearby streams.[26] Dairy operators began constructing wastewater containment structures in the early 1970s. By 1987, forty-nine large dairies operated above the lake.[27]

In 1986, the Lake Okeechobee Technical Advisory Committee reviewed all available information concerning the health of the lake — including evidence that phosphorus concentrations had doubled between 1973 and 1984 — and recommended that immediate steps be taken to control phosphorus loading to the lake from agricultural sources, particularly dairies.[28] Simultaneous regulatory and legislative action resulted. The Florida Department of Environmental Regulation (now the Department of Environmental Protection) promulgated the so-called Dairy Rule to expedite the implementation of waste management measures on the region's forty-nine dairies.[29] In 1987, the Florida Legislature enacted the Surface Water Improvement and Management Act (SWIM).[30]

The Dairy Rule required each dairy in the watershed to implement a comprehensive waste management plan, originally estimated to cost an average of $100,000 per dairy.[31] The actual implementation costs for the thirty plans completed by 1992 ranged from $188,163 to $1.5 million.[32] State and federal cost sharing defrayed a portion of these expenses.[33] The South Florida Water Management District (SFWMD)[34] intervened when implementation efforts stalled at several sights, contributing over $1.4 million toward the design and construction of dairy waste management systems.[35] To provide dairy operators an alternative to the implementation of comprehensive waste management plans, the state and the SFWMD purchased permanent easements on nineteen operations at a cost of $602 per head.[36] The easements prohibited future concentrated livestock production on those sites.[37] Nineteen dairies ceased production under this program, reducing cow numbers in the watershed by approximately 15,000.[38]

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26. *Id.* at 67.

27. Alan L. Goldstein & Gary J. Ritter, *A Performance-Based Regulatory Program for Phosphorus Control to Prevent the Accelerated Eutrophication of Lake Okeechobee, Florida*, 28 (No. 3-5) WAT. SCI. TECH. 13, 14 (1993).

28. *Id. See* LAKE OKEECHOBEE TECHNICAL ADVISORY COMM., FINAL REPORT: LAKE OKEECHOBEE TECHNICAL COMMITTEE (1986).

29. Goldstein & Ritter, *supra* note 27, at 14.

30. *Id.*; *see* FLA. STAT. ANN. §§ 373.451-.4595 (West Supp. 1995).

31. Darling, *supra* note 25, at 68.

32. *Id.*

33. Rodney L. Clouser et al., *The Economic Impact of Regulatory Decisions in the Dairy Industry: A Case Study in Okeechobee County, Florida*, 77 J. DAIRY SCI. 325, 326 (1994).

34. The South Florida Water Management District is one of five such districts created in the state under FLA. STAT. ANN. § 373.069 (West 1988) to protect and manage the region's water resources.

35. Brazos River Auth., Briefing Documents for the Bosque and Upper Leon Watersheds Watershed Protection Program (1994) (unpublished materials, on file with Brazos River Auth.).

36. *Id.*

37. Clouser, *supra* note 33, at 326.

38. *Id.*

The $8.5 million total cost for the buyout program was born equally by the state and the SFWMD.[39] Many of the dairy operators who accepted the buyout option transferred to North Florida or South Georgia.[40]

While the Dairy Rule was based on the premise that the implementation of structural and managerial pollution control measures necessarily results in improved water quality, the SWIM legislation went one important step further. The new law required the SFWMD to develop a management plan that would ensure a 40% reduction in total phosphorus loading to Lake Okeechobee.[41] This provision effectively transformed a traditional land treatment approach to water quality problems into a program based on measurable runoff performance standards, a unique concept in the United States. The 40% phosphorus load-reduction target was based on both water quality data for the basin collected over some fifteen years and the results of simulations conducted via a modified Vollenweider lake eutrophication model.[42]

To fulfill the SWIM directive, the SFWMD district conducted public hearings and developed a three-pronged management program that called for the following: (1) continued support for Department of Environmental Regulation efforts to implement best management practices under the Dairy Rule; (2) research and demonstration efforts to improve best management practices throughout the basin; and (3) implementation of a regulatory program to identify and limit phosphorus loadings from nonpoint sources.[43] The regulatory program designated a phosphorus limitation for each sub-basin draining into Lake Okeechobee. Moreover, "[t]o ensure that the limitations are met, this regulatory program permits all non-exempt land uses in these basins, monitors the parcels for compliance with the target limitations, and forces noncompliers to achieve compliance either voluntarily or through imposing civil penalties and fees."[44] The SFWMD officially adopted the regulatory program in September 1989 as Works of the District — Lake Okeechobee Basin.[45]

The wealth of historical water quality data available to the SFWMD permitted the District to prioritize sub-basins for intervention according to their relative phosphorus contributions. The rules adopted by SFWMD to implement the regulatory program called for land use permits to be issued for all plots one-half acre or larger.[46] Clearly, prioritization and targeting of District resources were

39. Brazos River Authority, *supra* note 3.

40. *Id.*

41. FLA. STAT. ANN. § 373.4595 (West 1988) ("The South Florida Water Management District shall immediately design and implement a program to protect the water quality of Lake Okeechobee [T]he program . . . shall be designed to result by July 1, 1992, in reductions of phosphorus loadings to the lake by the amount specified as excess in the South Florida Water Management District's Technical Publication 81-2.").

42. Goldstein & Ritter, *supra* note 27, at 15.

43. *Id.* at 15-16.

44. *Id.* at 14.

45. *Id.*; *see* FLA. ADMIN. CODE ANN. Rule 40E-61 (1989).

46. Goldstein & Ritter, *supra* note 27, at 17.

necessary since many small parcels and nonintensive land uses contributed minimal phosphorus loadings to the lake. Thus, the District targeted only fourteen of thirty-one sub-basins for the initial phase of the regulatory program.[47] These sub-basins contributed 66% of the historical annual phosphorus load to the lake.[48] Within these sub-basins, the District concentrated on permitting those parcels on which intensive land use associated with high phosphorus loading rates occurred, particularly dairies.[49]

Under SFWMD Rule 40E-61, the District established permissible offsite phosphorus discharge limitations for the various land uses in watersheds surrounding the lake.[50] The District determined that all sub-basins draining into the lake would be limited to average annual phosphorus concentrations of 0.18 mg/l, and that individual parcels within these sub-basins could not exceed average annual phosphorus discharge rates of from .18 to 1.20 mg/l, depending on land use.[51] At the outset of compliance monitoring efforts, District and contract personnel monitored some 300 discharge sites biweekly.[52] As the monitoring program matured, the number of routine compliance monitoring sites diminished to forty, virtually all at dairies.[53] Nonetheless, the current annual monitoring and analyses costs for the program total $800,000.[54]

In cases where targeted parcels exceed permissible phosphorus discharge rates, District personnel and other agencies assist agricultural producers in developing and implementing corrective action plans to reduce discharge concentrations. Mathematical modeling conducted by state university researchers and private consultants indicates the load reductions expected through the implementation of various management modifications.[55] SFWMD rules provide for the imposition of penalties of up to $10,000 per day for noncompliance with District directives.[56] While every effort is made to induce corrective action through mutual cooperation between District personnel and landowners, some enforcement actions have been pursued to require cooperation with the watershed program.[57]

To date, the statutorily mandated phosphorus loading target for Lake Okeechobee has not been achieved. However, monitoring data indicate that substantial loading reductions have occurred in the relatively brief period since formal adoption of the SFWMD management plan.[58] These results appear

47. *Id.*
48. *Id.*
49. *Id.* at 19.
50. *Id.*
51. *Id.* at 20.
52. *Id.*
53. Brazos River Authority, *supra* note 35.
54. *Id.*
55. Goldstein & Ritter, *supra* note 27, at 21; *see also* Heatwole, *supra* note 22 (detailing modeling efforts to determine preferred best management practices for dairies above Lake Okeechobee).
56. Goldstein & Ritter, *supra* note 27, at 21.
57. *Id.* at 22. At least three successful enforcement actions have been pursued against noncompliant landowners under the SFWMD regulatory program.
58. *Id.* at 23. A mere 32 months existed between formal adoption of SFWMD rules implementing

particularly promising in light of research from some areas of the United States indicating that high ambient phosphorus levels may persist for prolonged periods due to the tendency of phosphorus to be readily adsorbed by soil particles.[59]

Bosque River

The 230,000-acre, predominantly rural Upper North Bosque River watershed forms the headwaters of the Bosque River in north central Texas. The North Bosque River is an ephemeral waterway running through the City of Stephenville, population 15,000. Effluent from the City of Stephenville waste treatment plant provides the only constant flow in the North Bosque River during much of the year. The Bosque River flows southeasterly for some eighty miles and empties into Lake Waco, the drinking water source for approximately 140,000 people. In contrast to Lake Okeechobee, relatively little water quality data exist concerning Lake Waco.

The Upper North Bosque River watershed has been an important milk-production region for many decades.[60] Until the 1980s, most of the region's dairies were relatively small, traditional operations similar to those associated with Wisconsin and the northeastern United States. However, by the end of the decade, the character of dairies in the watershed changed significantly.[61] A variety of factors attracted many new, large dairies to the area and caused existing dairies in the watershed to increase in size.[62] Today, an estimated 31,000 cows exist in the watershed,[63] and more milk is produced in the region than in any other area of Texas.[64]

As cow numbers increased in the Upper North Bosque River watershed, evidence of the negative environmental effects of expanding milk production mounted. For example, an October 1992 assessment of the Upper North Bosque River by the Brazos River Authority (BRA)[65] cited elevated fecal, nutrient,

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the regulatory program and the statutorily mandated target date for achieving a 40% phosphorus load reduction. *Id.* at 16.

59. *See, e.g.*, John C. Clausen et al., *Estimation of Lag Time for Water Quality Response to BMPs in Proceedings*, *in* NATIONAL RCWP SYMPOSIUM, *supra* note 24, at 173.

60. *See generally* H.G. PERRY, GRAND OL' ERATH: THE SAGA OF A TEXAS WEST CROSSTIMBERS COUNTY (1974).

61. TEXAS INSTITUTE FOR APPLIED ENVTL. RESEARCH (TIAER), LIVESTOCK AND THE ENVIRONMENT 55 (1992) [hereinafter TIAER].

62. David J. Leatham et al., *Our Industry Today, Impact of Texas Water Quality Laws on Dairy Income and Viability*, 75 J. DAIRY SCI. 2846, 2856 (1992).

63. NEAL, *supra* note 5, at 8.

64. TEXAS DAIRY REVIEW, April 1995, at 3 (table of top milk-producing counties).

65. The Brazos River Authority is one of approximately 12 river authorities established in Texas to promote the wise use and quality of water in the state's rivers. The Brazos Basin consists of 1260 mainstem river miles and 2600 total stream miles. BRAZOS RIVER AUTH., 1994 FINAL REPORT REGIONAL ASSESSMENT OF WATER QUALITY 1-2 (1994).

chloride and sulfate levels, as well as high algal growth.[66] A November 1992 report from the Upper North Bosque River Hydrologic Unit Project observed that

> [t]he lack of adequate treatment and proper disposal of animal waste from dairies is a conspicuous problem in the watershed and adjacent areas. . . . The confinement of cattle, especially the larger dairies, has generally created conditions conducive to accumulation of large quantities of animal waste. . . . Application of manure and wastewater as a source of nutrients on cropland is also potentially a problem relative to excessive nitrogen and phosphorous and possibly insecticide contamination.[67]

Recent data collected at some twenty instream sampling sites and analyzed by the Texas Institute for Applied Environmental Research (TIAER) show elevated phosphorus levels at most monitoring sites throughout the watershed.[68] Moreover, a strong, positive correlation exists between elevated phosphorus levels, dairy cow concentrations and the extent of manure application land above sampling sites.[69]

Citizen opposition to perceived environmental degradation from expanding dairy activity organized rapidly in the watershed.[70] A subcommittee of the United States Congress Committee on Agriculture held hearings in Stephenville in June 1989 to investigate reports of pollution in the watershed.[71] In September 1989, the Texas Natural Resource Conservation Commission (TNRCC) levied fines totaling over $400,000 against nine area dairies.[72] In December 1989, TNRCC issued a special resolution establishing an expedited schedule for the construction of pollution control structures on all dairies with 250 milking head or more.[73] By September 1991, most of these dairies had complied with the

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66. BRAZOS RIVER AUTH., REGIONAL ASSESSMENT OF WATER QUALITY: BRAZOS RIVER BASIN INCLUDING THE OYSTER CREEK WATERSHED 78 (1992).

67. TEXAS AGRICULTURAL EXTENSION SERVICE ET AL., UPPER NORTH BOSQUE RIVER HYDROLOGIC UNIT PROJECT 2 (1992).

68. *See generally* MCFARLAND & HAUCK, *supra* note 7.

69. *Id.*

70. *See generally* LARRY C. FRAREY, OF "MOOLA" AND MANURE: THE CLASH OF DAIRY PRODUCTION AND ENVIRONMENTAL REGULATION IN ERATH COUNTY, TEXAS (1993). The Cross Timbers Concerned Citizens and the Sierra Club are the two most visible environmental groups active in the Upper North Bosque River watershed.

71. *Review of the U.S. Department of Agriculture's Fiscal Year 1990 Water Quality Initiative, Hearings Before the Subcomm. on Department Operations, Research, and Foreign Agriculture, Committee on Agriculture*, 101st Cong., 1st Sess. (June 21, 1989).

72. *Whopping Fines Levied Against Dairymen*, EMPIRE TRIBUNE (Stephenville, Tex.), Sept. 20, 1989, at 1. TNRCC eventually reduced the penalties during negotiations with the dairy operators.

73. Texas Water Comm'n, A Resolution Relating to Dairy Concentrated Feeding Operations (Dec. 12, 1989). The Texas Natural Resource Conservation Commission subsumed the Texas Water Commission and other state regulatory agencies on September 1, 1993. Currently, TNRCC requires a site-specific wastewater discharge permit for every dairy milking 250 head or more. TEX. ADMIN. CODE tit. 30, § 321.33 (1994). However, TNRCC will publish a final draft general permit for concentrated animal feeding operations by mid-1995 that will cover all dairies with less than 700 total head.

resolution by building lagoons and diversions for wastewater.[74] However, the majority of small dairies not requiring a TNRCC permit continued to operate without functional waste management plans in place.[75]

In April 1991, the Texas Legislature funded the Texas Institute for Applied Environmental Research (TIAER) at Tarleton State University in Stephenville. The Institute was immediately charged with helping to diffuse conflict among dairy interests and environmental advocates. TIAER organized local focus groups from both camps to solicit recommendations for minimizing the negative environmental impacts of milk production.[76] The focus groups observed that small dairies not subject to the TNRCC permitting program created significant polluted runoff but often had insufficient resources to implement adequate pollution controls.[77] The groups recommended that the Texas State Soil and Water Conservation Board (TSSWCB) assume responsibility for environmental compliance by these small dairies.[78]

The seventy-third Texas legislature adopted the TIAER focus group recommendations and enacted Senate Bill 503 in April 1993.[79] The new law reaffirmed TSSWCB as the lead state agency for controlling agricultural nonpoint source pollution[80] and included other important elements, as well.[81] TSSWCB is charged with establishing a water quality management plan certification program in areas experiencing polluted runoff problems from agricultural production operations.[82] To date, dairy operations have provided the focus for the program. Further, the legislature provided several million dollars in state cost share funding to assist producers in implementing waste management plans.[83] Complaints of polluted agricultural runoff directed to the agency can be resolved by local conservation districts under an alternative dispute resolution mechanism as provided in new TSSWCB rules.[84] The program also includes a "bad actor" provision requiring TSSWCB to refer producers refusing to cooperate with the

74. TEXAS WATER COMM'N, CONFINED ANIMAL FEEDING OPERATIONS, ERATH COUNTY DAIRY OUTREACH PROGRAM 1 (1993) (informal fact sheet distributed during public meeting Feb. 16, 1993).

75. *See id.*

76. TIAER, *supra* note 61, at 91.

77. *Id.* at 10.

78. *Id.* State conservation agencies and the local conservation districts these agencies coordinate have some 60 years of experience dealing with polluted agricultural runoff in the form of soil erosion. *See generally* Larry C. Frarey et al., *Conservation Districts as the Foundation for Watershed-Based Programs to Prevent and Abate Polluted Agricultural Runoff*, 18 HAMLINE L. REV. 151 (1994).

79. Texas Session Law, 73d Legislature, ch. 54, § 1 (1993).

80. Texas S.B. 503 (codified at TEX. AGRIC. CODE ANN. § 201.026 (West Supp. 1995). Section 201.026 initially designated TSSWCB as the lead agency for agricultural nonpoint source pollution programs in 1985. TEX. AGRIC. CODE ANN. § 201.026 (1982 & 1991 Supp.). Under both the Texas and EPA regulatory programs for concentrated livestock production operations, those operations not requiring a discharge permit are considered nonpoint sources of pollution.

81. For a detailed discussion of the elements of Senate Bill 503, see LARRY FRAREY & RON JONES, DIMENSIONS OF PLANNED INTERVENTION (1994).

82. TEX. AGRIC. CODE ANN. § 201.026 (West Supp. 1995).

83. TEX. ADMIN. CODE tit. 31, § 523.6 (West 1995).

84. *Id.* § 523.4.

agency's program to TNRCC for enforcement action under the state's water quality laws.[85]

Since passage of Senate Bill 503, TIAER has worked with TSSWCB and other agencies to refine a comprehensive watershed strategy for predominantly rural areas that integrates existing programs to control polluted runoff from concentrated livestock production facilities of all sizes. Based on an analysis of water quality data collected in the Upper North Bosque River watershed, TIAER has proposed a "planned intervention/micro-watershed" program.[86] The program calls for TSSWCB to target those micro-watersheds most significantly impaired by agricultural nonpoint source pollution. Targeting is based on available water quality data or biophysical process modeling employing EPIC, SWAT or similar models.[87] Micro-watersheds are subdrainage areas sufficiently small to permit all direct stakeholders in the area to meet face-to-face to collectively develop and recommend to appropriate agencies workable solutions to water quality problems.[88] Within the upper North Bosque River watershed, impaired micro-watersheds tend to be 2000 to 3000 acres in size. Local conservation districts take the lead in organizing the proposed stakeholder consortia.[89] These consortia are ideally situated to identify lingering pollution problems, to assist agencies in developing economically viable options for controlling polluted runoff, and to assume considerable responsibility for monitoring changes in water quality at the mouth of micro-watersheds once control measures are implemented.

TIAER recently presented a formal proposal to USDA personnel in Washington, D.C. that would establish the Bosque River basin as a national pilot project to refine a watershed-based strategy for use by USDA's Natural Resources Conservation Service (NRCS) in impaired drainage areas across the United States.[90] The Public Law 566 small watershed program should provide adequate existing authorization for the initiative.[91] The project would provide NRCS, local and state conservation personnel, and a variety of other agencies the opportunity to fine-tune their roles in comprehensive watershed programs. The Bosque River initiative would develop a total maximum phosphorus loading target for Lake Waco like that developed for Lake Okeechobee. Maximum phosphorus loading rates for targeted micro-watersheds would be based on the assimilatory capacity of Lake Waco. Project success would be gauged by both achievement of the

85. TEX. AGRIC. CODE ANN. § 201.026 (West Supp. 1995).

86. The program is detailed in FRAREY, *supra* note 2, at 109.

87. The Erosion-Productivity Impact Calculator (EPIC) and the Soil and Water Assessment Tool (SWAT) were developed by United States Department of Agriculture Agricultural Research Service personnel based at Blackland Research Center, Temple, Texas.

88. FRAREY, *supra* note 2, at v.

89. *Id.* at 113.

90. *See* MICRO-WATERSHEDS AS PART OF THE WHOLE: EMPLOYING LESSONS FROM THE NATIONAL PILOT PROJECT IN THE LAKE WACO/BOSQUE RIVER WATERSHED (TIAER draft, 1995); STACI PRATT ET AL., AGRICULTURE AND THE ENVIRONMENT: A WATERSHED PERSPECTIVE LINKING USDA AND EPA INITIATIVES (1995).

91. 16 U.S.C. §§ 1001-1010 (1988).

phosphorus loading targets and the extent to which the planned intervention/micro-watershed institutional approach is successfully transferred to other watersheds.

Analysis

Long-term Water Quality Data Are Essential

The Lake Okeechobee regulatory program was implemented in 1989 by the SFWMD and has been actively pursued since that time.[92] However, a variety of activities aimed at controlling pollutant loadings to the lake, particularly from agricultural sources, occurred for nearly two decades prior to the adoption of formal SFWMD rules.[93] Research activity to document the aquatic health of Lake Okeechobee began in the early 1970s and continues to this day.[94] Additional research and demonstrations to promote the implementation of best management practices under the federal Rural Clean Water Program[95] began in 1980 and continued throughout the decade.

In contrast, research efforts in the Bosque River basin have largely occurred since 1990 as part of research programs conducted by the Texas Institute for Applied Environmental Research and the United States Department of Agriculture's Upper North Bosque River Hydrologic Unit Project. Only recently have sufficient water quality data become available in the basin to support significant analysis.[96] Unfortunately, minimal water quality data from Lake Waco exist at this time.

Ample, long-term water quality data are crucial to support informed decision making in programs to prevent and abate polluted agricultural runoff. The 40% phosphorus load-reduction target for Lake Okeechobee mandated by the Florida Legislature was based on data and modeling results developed over some fifteen years.[97] While that target has not yet been achieved under the state's regulatory program, it remains a realistic goal.[98] The relatively short-term or inadequate data that exist for the Bosque River Basin and Lake Waco may hinder modeling efforts to create a realistic phosphorus loading targets for Lake Waco and impaired tributaries.

In attempting to understand the cause-effect relationship between the implementation of best management practices and improved water quality, pre-BMP water quality data are essential. Moreover, where phosphorus is the pollutant of primary concern, information on antecedent land use as well as long-term post-BMP water quality data are necessary since phosphorus may persist in

92. Goldstein & Ritter, *supra* note 27, at 14.

93. Moore, *supra* note 17, at 6.

94. *Id.*

95. *See generally* EPA, *supra* note 23.

96. *See* FRAREY, *supra* note 2, at 70-72.

97. Goldstein & Ritter, *supra* note 27, at 13-14.

98. Telephone Interview with Alan L. Goldstein, South Florida Water Management District (May 30, 1995).

some watersheds for decades. Efforts in the Upper North Bosque River watershed to judge the effectiveness of wastewater lagoons and other best management practices implemented by dairy producers have suffered since the operators of most large operations implemented these practices prior to the initiation of concerted water quality monitoring in the watershed.

Criteria for Program Success

Both the Lake Okeechobee and Bosque River programs have embraced the fundamental notion that program success must ultimately be measured by improved water quality and not the implementation of BMPs alone.[99] This realization represents a crucial step toward real water quality improvement in many watersheds. Unfortunately, few policymakers in the United States appear willing at this time to make the financial commitment necessary to fund the development of water quality criteria associated with polluted agricultural runoff.

The Lake Okeechobee Program has developed rigorous, edge-of-field performance standards that are monitored regularly and enforced through joint cooperation between producers and agencies participating in the program. However, the annual monitoring costs of $800,000 for an intensive program of this type may well prove prohibitive in the majority of impaired watersheds where polluted runoff control programs will ultimately occur. Moreover, agricultural producers in many areas of the country would adamantly oppose field-by-field monitoring as excessive intrusion on private property rights,[100] particularly in light of takings legislation recently introduced in state capitals and Washington, D.C. Producers in Florida may have become sensitized to extensive agency regulation after many years of exposure to the multilayered environmental protection and land use regulatory framework that has evolved in the state.[101] Further, Lake Okeechobee truly represents a unique resource, the protection of which might tend to elicit the cooperation of even the staunchest property rights advocates.

Reliance on instream water quality criteria for polluted agricultural runoff as proposed in the Bosque River initiative may avoid the steep monitoring costs and private property issues inherent in edge-of-field monitoring. Water quality monitoring at the mouth of a micro-watershed — particularly with automated, storm-activated sampling equipment — requires far less manpower than that

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99. *See generally* Goldstein & Ritter, *supra* note 27; FRAREY, *supra* note 2.

100. *See* Dana A. Rasmussen, *Enforcement in the U.S. Environmental Protection Agency: Balancing the Carrots and the Sticks*, 22 ENVTL. L. 333, 336 (1991) ("The widespread problem of nonpoint source pollution — runoff and deposition of air pollution to land and water — also underscores the limits of effective enforcement. Our society does not have the resources to police each citizen's behavior and lifestyle in order to prevent or punish our polluting habits. The lack of regulatory resources aside, an environmental police force is an affront to our concept of individual liberty.").

101. The political culture of many western states is quite different from that in Florida and many eastern states. *See, e.g.*, Kenneth E. Hendrickson, Jr., *The Texas River Authorities and the Water Question: A Case Study in Conservation, in* AGRICULTURAL HISTORY 167, 168 (1985) (discussing the peculiarities of the political culture of Texas "which demands independence from excessive state controls while at the same time it demands adequate state services").

employed in the Lake Okeechobee program. If micro-watershed stakeholders assume significant responsibility for the monitoring program the costs are reduced even more. Obviously, less detailed information is provided through instream micro-watershed monitoring concerning the actual location of continuing pollution problems. However, where problems persist, regular sampling above and below the property lines of suspected recalcitrant producers can isolate the problem.

Peer pressure within micro-watershed consortia will play an important role. As opposed to the operation-specific runoff data produced in the Lake Okeechobee program, several producers within a single micro-watershed will be held accountable[102] for the quality of water emanating from the micro-watershed. Producers who expend the effort and financial resources necessary to control polluted runoff from their operations will not likely sit idle in the event a less dedicated neighbor fails to pursue similar measures.

Recommendation: Develop Watershed-Specific, Instream Water Quality Indicators

Instream, watershed- or micro-watershed-specific performance criteria for polluted agricultural runoff must be developed to provide a realistic, static environmental compliance target for agricultural producers that goes beyond the mere implementation of BMPs. A total maximum annual load (TMAL) process for pollutants of primary concern, similar to that employed in the Lake Okeechobee area and proposed for the Bosque River basin should be employed. Field- or operation-specific performance criteria like those employed in the Lake Okeechobee SWIM regulator program should generally be reserved for establishing an enforcement action against recalcitrant polluters. Agency costs for monitoring polluted runoff from individual fields will prove prohibitive in most cases. Instream, micro-watershed criteria can indirectly influence siting decisions by livestock producers and other agricultural operations. Producers may avoid locating in micro-watersheds where maximum permissible pollutant loadings are already approached or exceeded.

102. Accountability in this case does not extend to joint legal liability among landowners within a micro-watershed, although at least one author has considered such an approach. *See* Nancy Bushwick Malloy, Ideas for the Livestock Compact 1 (1992) (unpublished draft on file with author).