The Regulation of Agricultural Practices to Protect Groundwater Quality: The Nebraska Model for Controlling Nitrate Contamination

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ARTICLES

THE REGULATION OF AGRICULTURAL PRACTICES TO PROTECT GROUNDWATER QUALITY: THE NEBRASKA MODEL FOR CONTROLLING NITRATE CONTAMINATION

*Susan A. Schneider**

INTRODUCTION

Groundwater usage in the United States is estimated to be approximately 74,000 million gallons per day.[1] Over fifty percent of the United States' population relies on groundwater resources for drinking water.[2] Rural areas are even more dependent on groundwater resources. Over ninety-seven percent of the rural population rely on groundwater as their source of drinking water.[3]

This national reliance on our groundwater resources underlies much of the recent concern about groundwater contamination. Because studies have found contaminants in the groundwater underlying every state, this concern is well founded.[4]

The link between agriculture and certain types of groundwater contamination is undeniable. Agricultural chemicals have been found in the well water in 44 different states.[5] Because nitrogen and other chemical applications are an integral part of modern crop farming, rural residents are faced with a serious conflict between protecting

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[1] Solley, Merk & Pierce, *The Estimated Use of Water in the United States in 1985*, U. S. Geol. Surv., Circ. 1004, 54 (1988) [hereinafter Solley].

[2] *Id.*

[3] *Id.*

[4] *National Water Summary 1986—Hydrological Events and Ground-Water Quality*, Water Supply Paper 2325, U.S. Geol. Surv. (D.W. Moody, J.E. Carr, E.B. Chase & R.W. Paulson eds. 1988).

[5] Nielsen & Lee, *The Magnitude and Costs of Groundwater Contamination from Agricultural Chemicals: A National Perspective*, 14-17 Agric. Econ. Rep. No. 576, Econ. Res. Serv., USDA (1987) [hereinafter Nielsen & Lee] (findings of risk for nitrate contamination based on present levels of contamination, physical vulnerability and surface chemical use).

their economic base, agriculture, and preserving their vital natural resource, groundwater.

Despite the potentially severe impact of widespread groundwater contamination, many of the agricultural practices which have been found to contribute to contamination remain largely unregulated. There is no federal scheme regulating potentially risky agricultural practices. Similarly, few states have considered the problem, and most that have considered it have chosen voluntary programs that stress education and awareness.

One notable exception is found in the state of Nebraska. For years, studies have shown nitrate contamination in varying levels in the groundwater underlying the state. As Nebraska is an agriculturally based state, much of this contamination was easily linked to farming and ranching activities. In response, the Nebraska legislature has given state officials, through local Natural Resources Districts (NRDs), the authority to regulate agricultural practices to control groundwater contamination.

This article focuses on nitrogen as an example of a contaminant, although much of the discussion is also applicable to other chemicals commonly used in agriculture. It presents an overview of the process of groundwater contamination and its link to agricultural practices. The article then explores the implementation of the Nebraska groundwater protection programs, examining this system as a model for use by other states and regions. Finally, the article addresses the dilemma: how to balance the protection of agricultural interests and the preservation of groundwater quality?

I. The Nitrogen Contamination Problem

A variety of different agricultural chemicals have been detected in the groundwater underlying farming regions. One such chemical is nitrate, the final chemical form of nitrogen fertilizer.[6]

A. Nitrate Contamination

Nitrogen contamination of drinking water has raised much public concern. Excessive levels of nitrates in drinking water can cause methemoglobinemia ("blue-baby" disease) in infants and is suspected to cause an increased incidence of cancer in the general population.[7]

[6] Bouwer, *Agricultural Chemicals and Groundwater Quality*, 45 J. Soil & Water Conserv. 184 (1990).

[7] Moody, *Groundwater Contamination in the United States*, 45 J. Soil & Water Conserv. 170, 173 (1990); *see also* Bouwer, *supra* note 6.

Heart and behavioral problems in laboratory animals exposed to nitrates have also been reported.[8]

Although naturally occurring nitrate deposits can produce groundwater contamination, this contamination is usually less than 3 parts per million of nitrate.[9] Higher concentrations are generally caused by human activities, usually related to livestock production and crop fertilization.[10]Although the amount of nitrogen fertilizer applied nationally peaked in the 1970's, as of 1987 it was estimated that over 19 million tons were applied to United States cropland.[11]

Pursuant to the Safe Drinking Water Act (SDWA),[12] the Environmental Protection Agency (EPA) has set the "maximum contaminant level" (MCL) for nitrate in drinking water at 10 parts per million (ppm).[13] This MCL requirement is an enforceable standard for all "public water system[s]."[14] Although it does not place any restriction on water obtained from private wells, it provides guidance regarding the safety of this well water.

A recently released national study conducted by the EPA showed that 56.8 percent of private wells tested contained some nitrate contamination. Fifty two percent of the public well systems contained nitrate contamination. Although the study showed that at the time of testing only 2.4 percent of the private wells and 1.2 percent of the community wells exceeded the MCL of 10 ppm, these results are clearly cause for concern.[15]

B. Focus on Nebraska

Nebraska was chosen as a focal point for this article for several reasons. It is a state deeply dependent upon groundwater. Nebraska residents and industries use a total of 5,590 million gallons of groundwater per day.[16] Recent studies reveal that groundwater sources meet

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[8] Bouwer, *supra* note 6, at 184.

[9] Moody, *supra* note 7, at 173.

[10] *Id.*; *see also* Hallberg, *When Agrichemicals and Groundwater Meet: Understanding the Connection*, 11 J. Freshwater 9 (1988).

[11] Moody, *supra* note 7, at 173.

[12] Safe Drinking Water Act, 42 U.S.C. §§ 300f - 300j-11 (1988).

[13] National Primary Drinking Water Regulations, 40 C.F.R. § 141 (1990).

[14] SDWA, 42 U.S.C. § 300g; *see also* 40 C.F.R. § 141.11(e) (1989).

[15] Approximately 20 percent of the wells tested showed nitrate contamination greater than 3 parts per million; the level that is presumed to have occurred naturally. The excess contamination is attributed to human activities, primarily agriculture. Madison & Brunett, *Overview of the Occurrence of Nitrate in Ground Water in the United States*, Water Supply Paper 2275, in *U.S. Geol. Surv., National Water Summary 1984—Hydrological Events, Selected Water Quality Trends, and Ground-Water Resources* 93 (1985).

[16] Solley, *supra* note 1, at 67.

the needs of almost all of Nebraska's 330,000 rural households and 84% of the state's public water systems.[17]

Unfortunately, much of this groundwater is vulnerable to contamination from extensive agricultural practices. In 1987, an estimated 755,000 tons of chemical nitrogen fertilizer were applied to Nebraska farmland. An additional 235,000 tons of nitrogen were produced in cattle and hog manure, although the percentage of this amount that was applied to crops is not known. These figures place Nebraska third in the nation for commercial nitrogen usage.[18]

Substantial water quality testing has been completed in Nebraska. Although more testing is clearly warranted, Nebraska is far ahead of many other states in terms of gaining knowledge about its groundwater resources. This testing has revealed extensive groundwater contamination, and predictably, the most serious problem identified has been nitrogen contamination attributable to agriculture.

Finally, Nebraska was chosen because it is presently experimenting with an innovative approach to its contamination problems. It is attempting to regulate agricultural practices through controls administered by local districts.

II. The Process of Groundwater Contamination

An extensive analysis of groundwater and the process by which it can be contaminated is beyond the scope and focus of this article. Nevertheless, it is important to emphasize certain basic features of groundwater as a foundation for the discussion of the agricultural groundwater contamination problem.[19]

A. Groundwater Basics

Although some groundwater exists in the form of an underground stream, most groundwater is found stored in the pores or interstices of below ground rock formations. This water storage occurs in varying amounts and with varying degrees of utility depending upon the rock

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[17] Exner & Spalding, *Occurrence of Pesticides and Nitrate in Nebraska's Ground Water*, 3 (Water Center, Institute of Agriculture and Natural Resources, University of Nebraska 1990).

[18] *Id.* at 3 (citing W.C. White, *Sources of Nitrogen and Phosphorus*, (Resource Washington, Inc., Washington D.C. 1989)).

[19] The explanation of the geological occurrence of groundwater is based upon general descriptions set forth in various water resources publications. *See generally* Barcelona, J. Keely, W. Pettyjohn, & A. Wehrmann, *Handbook of Groundwater Protection* 1-17, 73 (Hemisphere 1988); J. Davidson, *Farming and Groundwater: An Introduction*, Issues Booklet No. 1 (Agric. Law and Policy Institute 1988); D.H. Getches, *Water Law in a Nutshell*, 221-226 (West 1984); C.C. Travis & E.L. Etnier, *Groundwater Pollution Environmental and Legal Problems* 9-29 (AAAS Symposia Series 1984).

layer zone. The top zone is referred to as the *unsaturated zone*, also termed the vadose or zone of aeration. At the very top of this area, the soil or *root zone* occurs. Here, water is readily available to plant life. The unsaturated zone continues below the root zone, with excess water flowing downward to the *water table*. Water in this zone cannot be readily captured by pumping because it is held by molecular attraction and does not saturate the pores of the soil and rock formations.[20]

The term *water table* references the division between the unsaturated zone and the *saturated zone*. In the saturated zone, the groundwater completely saturates the pores or interstices of the rock formation and flows in response to gravity as opposed to molecular attraction. Thus, it can be easily withdrawn by pumping. Underlying the zone of saturation is the layer of impermeable rock termed *bedrock*.[21]

In some circumstances, groundwater in the saturated zone is contaminated directly as a result of leakage from an underground storage tank or through the malfunctioning of a chemigation operation.[22] This article does not address these direct sources of contamination. Rather, it focuses on leaching, the more insidious process by which groundwater is contaminated by chemicals applied to the surface of the soil to enhance crop production.

Chemicals applied to the surface of the soil are intended to be utilized by the plants or pests to which they are directed. When they are not, there is a risk that the chemical applied will attach to water particles and leach or percolate down through the soil, through the unsaturated zone, eventually reaching the water table and the unsaturated zone, contaminating the groundwater.[23] This leaching process is the cause of much of the contamination of groundwater by agricultural chemicals.

Nitrogen fertilizer applied to surface crops presents an unfortunate example of the leaching process.

> Very mobile in the underground environment, nitrate moves readily with deep percolation through the vadose zone to underlying groundwater. Thus, fertilizer nitrogen not used by crops and not denitrified or volatilized eventually reaches underlying groundwater. Nitrate-

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[20] *Id.*

[21] *Id.*

[22] Chemigation is the process by which agricultural chemicals are combined with irrigation water and applied as part of the irrigation process. For an example of a chemigation statute, see Neb. Rev. Stat. §§ 46-1101-46-1148 (1988).

[23] *See supra* note 19.

> nitrogen concentrations in vadose-zone water below agricultural fields typically are in the range of 5 to 100 parts per million with frequent detections of concentrations of 20 to 40 parts per million.[24]

As has been noted, the MCL for nitrate in drinking water is 10 ppm. Thus, many of the concentrations referenced above exceed this health limit. As has also been noted, however, the MCL guideline is only binding on public water systems. The estimated 40 million persons who drink from private wells are not protected by the Safe Drinking Water Act; therefore, their water may not have been tested.[25] Over six million of these persons dependent on private wells live in areas with an identified risk of nitrate contamination.[26] For them, nitrate groundwater contamination attributable to the leaching of agricultural fertilizers presents an invisible health risk.

B. Factors Influencing the Leaching of Agricultural Chemicals into Groundwater Resources

A variety of factors influence the leaching process. It is important to note these factors to understand both the complexity of the process and the role that agricultural practices play therein. The following discussion highlights these factors, placing particular emphasis on those factors most important to nitrogen fertilizer application.[27]

1. Timing of Application

Nitrogen fertilizer applied to the soil may attach itself to water particles and be transported down through the soil and out of the root zone before it can be utilized by the crop. If this occurs, not only is the nitrogen lost to the future crop, but also groundwater contamination will occur when the nitrogen reaches the water table. The greater the time period between application and planting, the greater the risk presented.

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[24] Bouwer, *supra* note 6, at 184.

[25] *Id.*

[26] Nielsen & Lee, *supra* note 5, at 17 (although the present article focuses on nitrate contamination, it is also important to note that the Nielsen & Lee study found there to be 17 million persons dependent on private well water in areas of potential contamination from pesticides).

[27] The analysis of the factors which influence the likelihood of groundwater contamination was derived from a variety of agricultural and water resource publications. *See generally* Gust, Klaseus, Buzicky, and Ripley, *Pesticides and Groundwater: A Health Concern for the Midwest* (Freshwater Foundation 1986); Moody, *supra* note 7, at 171; *A Guide for Safe, Profitable Fertilizer and Pesticide Use* (Soil and Water Conservation Society); *Nitrogen Management Program*, (Central Platte Natural Resource District, Nebraska 1989); *Protecting Our Groundwater: A Grower's Guide* (American Farm Bureau Federation, National Agric. Aviation Association, National Agric. Chemicals Association, U.S.D.A. Extension Service).

2. Quantity Applied

Nitrogen applications should be geared to both the needs of the crops planted and the nitrogen content of the soil prior to application. If more nitrogen is applied than the crop can utilize, it remains in the soil, thereby increasing the risk of leaching. The proper application quantity may be difficult to determine unless the soil is regularly tested for pre-existing or carryover nitrogen content.

3. Weather

Because water is the vehicle by which the potential contaminant is transported, snow and rainfall are important factors. Nitrogen applied in the fall, prior to snowfall, or just prior to a significant rainfall may leach down below the root zone before it can be utilized by the crop.

4. Soil Type

Again, because water is the transport vehicle, the period of time that the soil in the root zone can retain water is an important factor. In this regard, soil texture is critical. Coarse-textured (sandy) soil allows rapid water movement, increasing the risk of chemical contamination. In contrast, fine soils (silt and clay) slow water infiltration and contamination risk is comparatively decreased. The degree of organic matter in the soil is also a factor because organic matter increases the soil's capability to retain moisture, thus slowing the leaching process.

5. Soil Depth

The less soil through which the nitrogen has to pass before reaching the water table, the greater the risk of groundwater contamination. Soil depth, initially determined by geological and biological developments, can be decreased dramatically by soil erosion.

6. Chemical Factors

Several chemical factors are influential in assessing the risk of contamination. First, the chemical's *solubility*, that is, the ability of the chemical to dissolve in water, influences its contamination potential. The greater the solubility, the more likely that it will attach to water and leach downward, thus the greater the risk of contamination. Second, the *adsorption* rate of the chemical, that is, the tendency of bonding to the soil, can act to retard leaching. Third, the *persistence* of the chemical is influential. Persistence refers to the tendency of the chem-

ical to resist degradation, maintaining its same chemical characteristics. Although there are some exceptions, it is generally desirable for chemicals to degrade before they can be leached downward into the groundwater.

III. GROUNDWATER CONTAMINATION IN NEBRASKA

Groundwater testing in the highly agricultural south central region of Nebraska was conducted by the Nebraska Extension Service in the late 1950's and early 1960's. This testing revealed that groundwater underlying areas in the Central Platte Valley contained high levels of nitrates.[28] In the 1970's, the Central Platte NRD performed further testing which revealed many private wells with nitrate levels exceeding 10 ppm. This testing further showed that the public well water in several communities also exceeded this MCL level.[29]

Local, statewide, and regional testing continued, with each study producing alarming evidence of wide scale nitrate contamination. The results of the most recent and thorough Nebraska study were just released. This study provides an up to date assessment of the nitrate contamination level in Nebraska based on 5,826 state groundwater samples.[30] Data for their assessment was provided by the U.S. Geological Survey, the Nebraska Departments of Health and Environmental Control, Natural Resources Districts, and the Lincoln-Lancaster County Health Department.

The assessment resulted in the mapping of samples where nitrate contamination was found to exceed 7.4 parts per million. Within these samples, contamination levels were divided into three categories. The first category includes wells testing between 7.4 and 9.9 parts per million. The second category includes those between 10.0 and 19.9 parts per million. The final category includes wells with levels equal to or greater than 20 parts per million. The report's region by region analysis indicates that Nebraska has widespread nitrate contamination, much of which exceeds the 10 ppm MCL standard. The study also reveals that agriculture is the largest contributor, and in many areas, the only major contributor to the nitrate contamination problem.[31]

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[28] Moravek, *Central Platte Natural Resources District's Groundwater Management Program*, 1988 Agrichemical and Groundwater Protection Proceedings, Freshwater Foundation 301.

[29] *Id.* At the present time, at least 35 Nebraska municipalities have been issued administrative orders from the Nebraska Department of Health for violating the MCL for nitrate contamination. Others have been issued warnings for approaching this level. Telephone interview with Dick Ehrman, Unit Supervisor/Geologist, Ground Water Section, Water Quality Div., Neb. Dep't of Envtl. Control (July 23, 1990).

[30] Exner & Spalding, *supra* note 17.

[31] Exner & Spalding, *supra* note 17, at 25-30.

IV. LEGAL ANALYSIS OF CURRENT NEBRASKA GROUNDWATER QUALITY LEGISLATION

In response to political, economic, and public health pressures,[32] alternative mechanisms for confronting the groundwater contamination problem in Nebraska have emerged. Although the programs are separate and distinct, each seeks to control groundwater contamination from agriculture through the education of farmers and the regulation of farming practices. Both are contained in the Nebraska Ground Water Management And Protection Act (GMPA).[33]

These groundwater quality management programs are innovative in two respects. First, each authorizes the specific regulation of agricultural practices. This method is in direct contrast to the more traditional "carrot and the stick" approach characteristic of USDA farm policy conservation incentives.[34] Second, while most states administer pollution control programs on a statewide basis, Nebraska's approach places substantial control in the hands of local Natural Resources Districts (NRDs).[35]

In the discussion below, the function and role of the local NRDs is first presented. An understanding of these local units of government is essential to an understanding of Nebraska's overall water quality protection scheme. As is evidenced by an overview of the NRDs developing powers, two factors are central to this scheme: local control, and the interaction of groundwater quality with quantity regulation. Following this analysis, each of the specific mechanisms for controlling groundwater contamination contained in the Ground Water Management and Protection Act is presented.

A. Natural Resources Districts

In 1969, the Nebraska legislature enacted legislation that provided for the consolidation of over 150 water and resource related special

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[32] Early legislative efforts to address the issue of the chemical contamination of groundwater by regulating agricultural practices were unsuccessful. However, a 1986 initiative petition campaign to establish constitutional groundwater protection requirements helped to encourage the passage of legislation that same year. Aiken, *Agrichemical Regulation* 50 (March 1990) (unpublished manuscript) (copy on file with the Virginia Environmental Law Journal) [hereinafter Aiken, *Agrichemical Regulation*).

[33] Neb. Rev. Stat. §§ 46-673.01 - 46-674.20 (1988).

[34] Voluntary compliance with soil and water conservation measures, coupled with strong monetary incentives, have generally been favored by USDA. For example, under the Conservation Reserve Program, farmers are paid to take highly erodible land out of cultivation. *See* 16 U.S.C. §§ 3831-3836 (1988).

[35] Logan, *Agricultural Best Management Practices and Groundwater Protection*, 45 J. Soil & Water Conserv. 201, 205 (1990).

interest groups into multi-purpose NRDs.[36] This legislation declared that "[I]t is essential to the health and welfare of the people of the State of Nebraska to conserve, protect, develop, and manage the natural resources of this state."[37] It further declared that although "significant achievements have been made in the conservation, protection, development and management" of the state's natural resources, the creation of multi-purpose NRDs covering all areas of the state would be the "most efficient and economical method of accelerating these achievements."[38]

The Nebraska Natural Resources Commission was given the authority to determine the boundaries of the districts and the exact number established.[39] The statute provided, however, that the number of NRDs created be "not less than sixteen nor more than twenty-eight."[40] To best coordinate water resource use, the statute also provided that the districts should be determined "according to the hydrologic patterns," recognizing the river basin areas.[41] Under the provisions of the statute, the new NRDs became operational in 1972.[42] Although initially, 24 NRDs were created, a merger in 1989 reduced the number of NRDs to 23, the number in existence today.[43]

Consistent with the legislative intent, the NRDs serve as the primary, multi-purpose, local unit of government responsible for the management, development, and protection of the soil and water resources contained within the district. In this capacity, each district is responsible for soil and water conservation, flood control and damage reduction, management of overall water supply for beneficial uses, erosion control, drainage, fish and wildlife habitat management, development and management of resource recreation areas, forestry and range management, as well as protecting both quantity and quality of groundwater resources.[44]

Each NRD is governed by a locally elected board of directors.[45] This board can be made up of 5, 7, 9, 11, 13, 15, 17, 19, or 21 members. The Natural Resources Commission determines the number on

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[36] Neb. Rev. Stat. §§ 2-3201 - 3220, 2-3222 - 2-3250, 2-3272 (1987).

[37] *Id.* § 2-3201.

[38] *Id.*

[39] *Id.* § 2-3203.

[40] *Id.* § 2-3203(4).

[41] *Id.* § 2-3203(1),(2).

[42] *Id.* § 2-3206(1).

[43] *Natural Resource Districts: Unique, Progressive Leadership in Conservation*, (Nebraska Association of Resource Districts, 1327 "H" Street, Suite 102, Lincoln, Nebraska 68508).

[44] Neb. Rev. Stat. § 2-3229 (1987). *See also* Aiken, *Nebraska Ground Water Law and Administration*, 59 Neb. L. Rev. 917, 960 (1980) [hereinafter Aiken, *Ground Water Law*].

[45] Neb. Rev. Stat. §§ 2-3214 (1987).

each board, taking into consideration "the complexity of the foreseeable programs and the population and land area of the district."[46]

Directors are elected in nonpartisan elections held as part of the general election of the state. They are elected for four year terms. Elections can be at-large within the district, or an NRD Board can, subject to Natural Resources Commission approval, create subdistricts with approximately equal populations. Moreover, subdistrict boundaries must take into consideration "the location of works of improvement and the distribution of population and taxable values within the district."[47] If subdistricts are created, directors can be elected by the vote of the appropriate subdistrict. At-large directors, however, must be elected by district wide election.[48]

Each district is financed by local property taxes in the form of a levy administered by the NRD. The statutorily authorized levy is $0.045 per $100 actual value on all taxable property in the district, although this amount can be increased by popular vote.[49]

The first major expansion of NRD groundwater management powers came about largely as a result of concerns about water mining practices and groundwater depletion.[50] In 1975, the Nebraska legislature passed the Ground Water Management Act.[51] Under the provisions of this act, an NRD could request that the state Department of Water Resources (DWR) designate a particular area as a water "control area".[52] In assessing the NRD request, the DWR director would conduct a public hearing to determine whether the unregulated development and use of groundwater in the referenced area had caused or was likely to cause inadequate water supplies. Once a control area was designated, the NRD had the authority to regulate ground water development and use, subject to DWR approval.

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[46] *Id.* § 3-3213.

[47] *Id.* § 2-3214(1).

[48] *Id.* The statute is quite specific as to nomination and election procedures. There are not, however, any specific qualifications for office. In the context of soil erosion control, commentators have criticized programs that place district control in the hands of farmers. *See* Arts & Church, *Soil Erosion - The Next Crisis?* 1982 Wis. L. Rev. 535, 593 (1982) (discussing the ineffectiveness of the farmer controlled soil and water conservation districts). These concerns have led at least one state to strictly control board membership by specific category of representative. *Id.* at 614 (referring to Wisconsin's conservation district program). Under the Nebraska system, all citizens of the district, not just farmers, participate in the elections and can be nominated to serve on the board. To date, there has not been any apparent controversy regarding board composition.

[49] Neb. Rev. Stat. § 2-3225 (1987).

[50] Aiken, *Ground Water Law*, *supra* note 44, at 960.

[51] Nebraska Ground Water Management And Protection Act of 1975, 1975 Neb. Laws 577 (codified at Neb. Rev. Stat. §§ 46-656 - 46-674) (1988).

[52] Neb. Rev. Stat. § 46-658(3) (1988).

The process chosen for the designation of control areas indicates the political importance of local control to Nebraska water law. Water use has tremendous economic significance to Nebraska's agricultural industry. Much of this industry is dependent upon irrigation for successful crop production.[53] Thus, any attempt by the state to regulate water usage was viewed as a threat to local agricultural interests. For this reason, during the debate on the Ground Water Management Act, a provision allowing the state DWR to designate a control area on its own accord was deleted on the floor of the Nebraska legislature.[54]

The development of groundwater quantity controls as a precursor to quality controls is also demonstrated. Nebraska's dependency on irrigation water and the water market this created led to regulations on water quantity used which could then be modified to apply to groundwater quality concerns.[55] This tendency is evidenced by the control area designation process. Initially, designation was authorized only in response to the threat of inadequate water supplies.[56]

However, a further expansion of the role of the NRDs with regard to groundwater came in 1981 when the Ground Water Management Act was amended as the Ground Water Management and Protection Act (GWMPA).[57] As the amended title indicates, this act authorized control area status on the basis of groundwater quality concerns as well as quantity concerns. This expansion was largely in response to a previous denial of control area status to an area threatened by groundwater contamination.[58] Slowly, but surely, the groundwater

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[53] *See generally* Aiken, *Ground Water Law*, *supra* note 44, at 9 (development of groundwater law as irrigation use increased); *See also* Neb. Rev. Stat. § 46-656 (1988) (significance of groundwater resources to the economy of Nebraska noted in legislative statement of intent).

[54] Aiken & Supalla, *Ground Water Mining and Western Water Rights: The Nebraska Experience*, 24 S.D.L. Rev. 607, 620 (1979).

[55] This is an interesting aspect of the development of western groundwater quality regulation. States that do not have an elaborate legal tradition of water law may need to "start from scratch" in regulating water quality. While there are obvious advantages to regulation that is specifically targeted to quality issues, and legislation that is expanded to include quality concerns may be convoluted, nevertheless if water use regulations are in place, the psychological breakthrough of water regulation has been met. States regulating water for the first time do not have this advantage.

[56] Ground Water Management and Protection Act, *supra* note 51; The Lower Loup NRD was denied control area status, despite threatened groundwater contamination, and this denial served as the impetus for the expansion of control area designation to include water quality concerns. Aiken, *New Directions in Nebraska Water Policy*, 66 Neb. L. Rev. 8, 47 (1987) [hereinafter Aiken, *New Directions*].

[57] Ground Water Management and Protection Act, 1981 Neb. Laws 146 § 6 (codified at Neb. Rev. Stat. § 46-658(1)(b) (1984) *repealed* by 1986 Neb. Laws 894 § 22.

[58] Aiken, *New Directions*, *supra* note 56.

quality issue was invading Nebraska water law as a concern to be addressed by local NRDs.

B. Groundwater Management Areas

1. Introduction to the GMA Program

Another amendment to the GMPA further extended NRD authority over the groundwater contamination problem.[59] Enacted in 1982, this amendment created the Groundwater Management Area (GMA) program. This program was designed to allow NRDs to establish groundwater controls without having to obtain DWR approval for control area designation. Local NRDs were directed to prepare a groundwater management plan, after which a groundwater management area (GMA) could be designated. The NRD could then regulate within the designated area according to the terms of the plan in much the same way as if a control area had been established.

Initially, with the marked exception of the Central Platte NRD,[60] little was done with the new powers given to the NRDs under the GMA program. Recently, however, a second region, the Tri-Basin NRD, completed the GMA process, and several other NRDs have initiated GMA procedures.[61] The NRD authority exists under this program, and as public concern over nitrate levels in drinking water inevitably heightens, pressure for the NRDs to act will increase.[62]

2. The GMA Process

As noted above, the GMPA requires local NRDs to complete groundwater management plans which include provisions for the protection and preservation of both the quantity and the quality of their groundwater resources.[63] These plans, which were required to be submitted to the DWR prior to January 1, 1986, must include, to the extent possible, the following information about the proposed management area:

1) the proposed boundaries (geographic and stratigraphic);[64]

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[59] Neb. Rev. Stat. § 46-673.06 (1988).

[60] The groundwater protection program undertaken by the Central Platte NRD is discussed *infra* note 88 and the accompanying text.

[61] Telephone interview with Dick Ehrman, Unit Supervisor/Geologist, Ground Water Section, Water Quality Division, Neb. Dep't of Envtl. Control (July 23, 1990).

[62] Also contributing to the pressure on NRDs to take action is the new Special Protection Area program. See *infra* note 96 and accompanying text. As will be noted in the discussion of this program, the power of the NRDs is diminished in several ways.

[63] Neb. Rev. Stat. §§ 46-673.01 - 46-674.20 (1988).

[64] Many NRDs are underlain with deep aquifers containing highly mineralized water which is not presently used. The designation of the stratigraphic boundary of the area allows the

2) an analysis of ground water resources;
3) the local recharge characteristics;
4) the average annual precipitation and variations;
5) area crop water needs;
6) current ground water data collection programs;
7) past, present and potential ground water use;
8) ground water quality concerns;
9) proposed water conservation and supply augmentation programs;
10) the availability of supplemental water supplies;
11) opportunities to integrate and coordinate water use from different sources;
12) ground water management objectives, including a proposed ground water reservoir life goal;
13) controls proposed to achieve the life goal and the impact of such controls on the goal;
14) existing subirrigation uses; and,
15) the relative economic value of different uses of ground water, existing or proposed.[65]

During preparation of the management plan, public comments must be actively solicited by the NRD. Moreover, the NRD is directed to draw upon all existing data and information. The district is not required to initiate new studies or data collection efforts or to develop new computer models.[66]

In keeping with the dual function of the GMPA to manage and protect both the quantity and quality of groundwater resources, many of the controls available to the NRDs affect water use. However, as groundwater quality is the focus of this article, these powers are not discussed herein.[67] There are two broad types of controls that can be adopted as part of the management plan process for groundwater quality protection. The NRD can require "best management practices" or "educational programs designed to protect water quality."[68]

The GMPA provides a specific definition of "best management practices" as follows:

> Best management practices shall mean schedules of activities, maintenance procedures, and other management practices utilized to prevent or reduce present and future contamination of ground water

NRD to either include or exclude these aquifers from the management area. Aiken, *Agrichemical Regulation*, *supra* note 32, at 51.

[65] Neb. Rev. Stat. § 46-673.01 (1988).

[66] *Id.* § 46-673.02.

[67] Other provisions authorizing quantity protection controls on groundwater use can be found at Neb. Rev. Stat. §§ 46-673.08 - 46.673.11 (1988).

[68] Neb. Rev. Stat. § 46-673.09(4),(5)(1988).

> which may include irrigation scheduling, proper timing of fertilizer and pesticide application, and other fertilizer and pesticide management programs.[69]

Upon completion, the NRD must submit the plan to the DWR director. The director must review it, and issue findings, conclusions, and reasons for either approval or disapproval within 90 days. In reviewing the plan, the director will examine whether the best available information was utilized and considered, whether the plan is supported by that information, and whether the plan is a reasonable application of that information. In addition, if the primary purpose of the proposed management area is the protection of ground water quality, the director must consult with the Department of Environmental Control (DEC) regarding approval or disapproval of the plan.[70]

If the plan is not approved, the district must submit to the director an explanation of how the NRD will address the concerns raised by the director in the disapproval. This explanation may be part of a revised plan or it may reference the original plan.[71]

The next step in the process of creating a management area is the scheduling of a public hearing by the NRD.[72] Public notice of the hearing must be provided, and this notice must include a general description of the proposed plan as well as the area affected. In addition, the notice must contain the text of the controls proposed. All interested persons must be allowed to attend and to present testimony. The hearing is to include testimony from a DWR representative and an explanation of the results of any studies or investigations conducted by the district.[73]

Within 90 days of the hearing, the NRD must determine whether a management area should be designated. If it is determined that a management area is not to be designated, an order to that effect is issued by the NRD. Alternatively, if an area is to be designated, the district shall issue the designation in an order and adopt one or more of the controls specified in the plan to meet the life goal of the water

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[69] *Id.* § 46-657.

[70] *Id.* § 46-673.03.

[71] *Id.* § 46-673.04.

[72] Note that although the NRDs are each required to submit a management plan, they are not required to establish a management area. A hearing is not required unless the NRD wishes to proceed with the management area designation. This is a potential weakness in the groundwater management process, especially if local NRDs are lobbied by area residents to not continue the regulatory process. It once again represents, however, the importance of local control to the process.

[73] Neb. Rev. Stat. § 46-673.05 (1988).

reservoir of the area. The order must specify the geographic and stratigraphic boundaries of the designated area. Moreover, both the area designated and the controls imposed must take into account: 1) considerations raised at the hearing; and 2) administrative factors directly affecting the ability of the NRD to implement its management function. The NRD is limited to those controls set forth in the management plan and the areas described therein.[74]

If a management area is designated, the NRD is authorized to increase its mill levy funding up to $0.018 per $100 actual value on all taxable property within the management area to help pay its costs of administration. This levy is in addition to the general levy authorized to fund the NRD itself.[75]

The GMPA also gives the NRDs specific enforcement powers. An NRD can issue a cease and desist order for violations of the provisions of the GMPA, or violations of orders, or permits issued thereunder.[76] This would thus include any management area regulation. Violation of an NRD order is a class IV misdemeanor punishable by a fine of $100-500 upon conviction.[77]

In addition, NRDs are empowered to initiate suits to enforce the provisions of orders issued pursuant to the GMPA and to restrain the construction or use of illegal wells.[78]

3. *Action Taken Under the GMA Program: The Central Platte Experience*

Despite the groundwater management area authorities specified in the GMPA, only one NRD, the Central Platte Natural Resources District, took immediate action to issue regulations under its groundwater management plan powers. This action was taken as a result of significant nitrate groundwater contamination directly linked to agriculture. As noted, more recently, the Tri-Basin NRD also has completed the GMA process and now has regulations in force. These regulations are similar to those adopted by the Central Platte NRD, an indication of the important leadership role that Central Platte has assumed. Several other NRDs are now in the process of having regions within their boundaries designated as GMAs.[79] It is likely that regulations will be issued in these areas in the near future. The

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[74] *Id.* § 46-673.06.
[75] *Id.* § 46-673.
[76] *Id.* § 46-663(5).
[77] *Id.* § 46-663.02.
[78] *Id.* § 46-663(5).
[79] Telephone interview with Dick Ehrman, *supra* note 61.

Central Platte experience and the regulations that were issued by this NRD have been hailed as providing a model for other regions to follow.[80]

The Central Platte NRD covers over 2 million acres in South Central Nebraska.[81] Much of the soil in this region is coarse-textured alluvial soil that is underlain by a shallow, highly permeable unsaturated zone. Aquifers underlying this soil may be within 10 to 16 feet below the surface.[82] As such, it is an area highly susceptible to groundwater contamination from surface activities.

Moreover, the surface activities most prevalent in the Central Platte valley are agricultural activities, particularly the raising of corn. As part of this activity, it is estimated that each year an average of between 140 to 200 pounds of nitrogen fertilizer is spread on each acre of land devoted to corn in the valley.[83]

The risk that this nitrogen will leach into the groundwater below is heightened by the fact that most of the land in the Central Platte valley must be irrigated. The Central Platte NRD contains over 800,000 acres of irrigated land, with over 14,000 active irrigation wells in use.[84]

As early as the mid-1950s, increased nitrate levels in underlying groundwater were documented.[85] In response to contamination concerns, in 1979, a demonstration project involving the NRD, the University of Nebraska, the Soil Conservation Service and the Agricultural Stabilization and Conservation Service was begun in Hall County, within the Central Platte area. This demonstration project organized educational programs for farmers about irrigation and fertilization practices that could minimize groundwater contamination.[86]

By the mid-1980's, however, studies indicated that many of the wells tested in the Central Platte region had nitrate levels that exceeded 20 ppm, over twice the MCL standard established by the EPA.[87] In 1987, under the authorities granted to NRDs under the

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[80] *Id.*

[81] Moravek, *supra* note 28, at 301.

[82] Ferguson & Moravek, *Groundwater Quality Management in Nebraska's Central Platte Valley*, 45 J. Soil & Water Conserv. 265 (1990).

[83] *Id.* at 265.

[84] *Id.*; *See also* Moravek, *supra* note 28, at 301.

[85] Ferguson & Moravek, *supra* note 82, citing Olson, Seim & Muir, *Influence of Agricultural Practices on Water Quality in Nebraska: A Survey of Streams, Groundwater, and Precipitation*, 9 Univ. Neb. Water Resources Bull. 301 (1962).

[86] Ferguson & Moravek, *supra* note 82.

[87] Exner & Spalding, *supra* note 17, at 26.

GMA program, Central Platte NRD implemented a program to address this serious problem.[88] The NRD issued regulations restricting certain farming practices.[89]

Under the Central Platte regulations, areas within the management area are divided into three phases. A Phase I area is defined as one having an average groundwater nitrate level of between 0 and 12.5 ppm. A Phase II area averages between 12.6 and 20.0 ppm nitrate contamination. A Phase III area is one averaging 20.1 ppm or greater nitrate contamination.[90]

Under this scheme, agricultural practices are restricted in varying degrees according to the severity of the contamination. In a Phase I area, the only restriction relates to sandy soil fertilizer applications. On sandy soil areas, commercial fertilizer cannot be applied until after March 1 each year; fall and winter applications are prohibited.[91]

Phase II regulations include the Phase I restriction, adding that commercial fertilizer is permitted on heavy soils after November 1 (when the soil is 50 degrees or cooler) only if an approved inhibitor is used. In addition, all farm operators using nitrogen fertilizer must be certified applicators, water analysis on irrigation wells must be done annually, and annual reports must be filed with the District. The report required must provide specific information on farming practices and yields.[92]

Phase III regulations combine all Phase I and II regulations with additional restrictions. These restrictions affect spring application of commercial fertilizers, requiring split application (pre-plant and side-dress) and/or nitrogen inhibitors. In addition, deep soils analysis is required annually.[93]

Because the Central Platte program is so new, there is no indication as to its effect on the underlying groundwater. Given the delay inherent in surface activity and groundwater contamination, it may be some time before any results are shown. Representatives from the

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[88] It is interesting to note that the timing of the action taken by the Central Platte NRD coincides with the passage of the Special Protection Area powers discussed *infra*. The Projects Director, Milt Moravek, candidly admitted that "Farmers and fertilizer dealers in the district felt that if controls were necessary they would rather deal with a local unit of government rather than state government and so the board adopted a program." Moravek, *supra* note 28, at 302.

[89] *Central Platte NRD's Nitrogen Management Program*, Central Platte Natural Resources District (1989).

[90] *Id.*

[91] *Id.*

[92] *Id.*

[93] *Id.*

NRD indicate, however, that cooperation with the program has been generally good.[94] Preliminary evidence indicates that the average amount of fertilizer applied to Central Platte area corn fields still is considerably higher than that recommended by the University of Nebraska.[95] Thus, based on these preliminary results, it could be argued that the mandatory aspects of the program may be more successful than the voluntary recommendations stressed by the educational components.

C. Special Protection Area Designation

In addition to the powers given directly to the NRDs, the GMPA also established a new mechanism for the designation of "Special Protection Areas" (hereinafter SPAs) through the DEC.[96] As justification for this new mechanism, the Nebraska legislature relied on specific findings codified into the statute.[97] These findings include acknowledgement that groundwater contamination in certain areas of the state is increasing and that long term solutions should be implemented "to prevent the levels of ground water contaminants from becoming too high and to reduce high levels sufficiently to eliminate health hazards."[98]

1. Introduction to the SPA Program

This SPA program is similar in several respects to the GMA program. First, it attempts to regulate groundwater quality by placing certain controls on area farming practices, with the controls suggested including the imposition of "best management practices" (BMPs) and mandatory water user education programs.[99]

Moreover, as with the GMA program, the SPA program relies upon local NRDs for the implementation of the controls imposed. Its legislative findings include the statement that, "Natural resources dis-

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[94] Ferguson & Moravek, *supra* note 82, at 266, report that more than 90% of the farmers in the phase II areas properly completed and turned in reports, and almost 100% of the operators required to attend certification classes did so.

[95] *Id.*

[96] Neb. Rev. Stat. §§ 46-674.02 - 46-674.20 (1988). The Special Protection Area concept was part of a groundwater protection strategy devised by the Nebraska Department of Environmental Quality under funding by the U.S. Environmental Protection Agency as a National Water Quality Management ground water prototype project. *See* Neb. Dep't of Envtl Control, *Nebraska Ground Water Quality Protection Strategy: Final Report* (1985); *See also* Hutton, *Nebraska's Special Protection Area Program*, 1988 Proceedings on Planning Now for Irrigation & Drainage 98, IR Division/ASCE, Lincoln, Neb.

[97] Neb. Rev. Stat. § 46-674.02 (1988).

[98] *Id.* § 46-674.02(1),(2).

[99] Neb. Rev. Stat. § 46-674.09 (1988).

tricts have the legal authority to regulate certain activities and, as local entities, are the preferred regulators of activities which may contribute to ground water contamination in both urban and rural areas."[100]

The SPA program, however, is distinctive in other respects. First, it is designed specifically in response to groundwater contamination problems; thus water quality issues are not "tacked on" to quantity concerns.[101] Remedial measures are targeted to the contamination problem alone.[102]

Second, the state agency with primary authority is the DEC, not the DWR, again indicating its emphasis on environmental goals.[103] On this point the legislative findings state explicitly, "The Department of Environmental Control should be given authority to regulate sources of contamination when necessary to prevent serious deterioration of ground water quality."[104]

Third, the SPA program takes a first step away from NRD control. The local districts, although still essential to the SPA process, and acknowledged as the "preferred regulators,"[105] are not given the sole authority to initiate the designation process. The Act specifically provides that "each state agency and political subdivision" is charged with the responsibility of promptly reporting to the DEC "any information which indicates that contamination is occurring."[106] As such, in contrast to the groundwater management area program, entities other than the NRDs can initiate the involvement of the DEC.

2. *The SPA Process*

The SPA process begins with the report of a groundwater contamination problem to the DEC. As noted above, this report can be made by any state agency[107] or any political subdivision.[108] Moreover, any such entity is required to promptly notify the DEC of "any substantiated occurrence which indicates that ground water contamination is

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[100] *Id.* § 46-674.02(4).

[101] *Id.* § 46-674.02(6),(7).

[102] *Id.* § 46-674.09.

[103] *Id.* § 46-674.02(5),(6).

[104] *Id.* § 46-674.02(5).

[105] *See supra* note 100 and accompanying text.

[106] Neb. Rev. Stat. § 46-674.03 (1988).

[107] Apparently the phrase "any state agency" also includes the DEC itself. The regulations enacted to implement the SPA program provide, "If the Director [DEC] has reason to believe that contamination of ground water is occurring, or likely to occur in the reasonably foreseeable future, the Department shall identify the area as a potential problem area." Neb. Admin. R. & Regs. tit. 196, ch. 3, § 001 (1988).

[108] *Id.*

present."[109] The report itself need only be in letter form explaining the documented occurrence.[110]

Upon receipt of this report, the DEC will conduct a preliminary investigation, relying on existing information.[111] If, after this preliminary investigation, the DEC determines that groundwater contamination is either "occurring or likely to occur . . . in the reasonably foreseeable future,"[112] the DEC is then charged with conducting a study of the potential problem area.

The purpose of this study is to determine the source or sources of the contamination and the area affected.[113] It usually involves groundwater and surface water testing, deep soil coring, land use analysis, and geological characterization.[114] The study is to be undertaken with the cooperation of any appropriate state agency and is to take into account the water quality provisions of the water management plan submitted by the relevant NRDs. A written report must be issued by the DEC within one year of the initiation of the study.[115]

Budgetary and staffing shortfalls, combined with the complexity of the studies to be undertaken have caused the DEC to establish an elaborate priority system for the initiation of studies.[116] According to this system, potential problem areas are annually ranked according to the population affected, the pollution potential of the area, the existing water quality, and the availability of a second potable water source.[117]

If the DEC determines from its study that one or more of the causes of the contamination is a point source,[118] the procedures authorized in the Environmental Protection Act are to be invoked.[119]

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109 *Id.* § 002.

110 *Id.*

111 Neb. Rev. Stat. § 46-674.03 (1988); Neb. Admin. R. & Reg. tit. 196, ch. 3, § 002 (1988).

112 Neb. Rev. Stat. § 46-674.04 (1988).

113 *Id.*; Neb. Admin. R. & Regs. tit. 196, ch. 3, § 003 (1988).

114 Ehrman, Link & Gottula, *Special Protection Areas: A New Non-point Source Management Option in Nebraska*, 45 J. Soil & Water Conserv. 263 (1990).

115 *Id.*

116 The regulations acknowledge that, "Funds are limited for Special Protection Area development. It is essential they be utilized where they will achieve the greatest benefit." Neb. Admin. R. & Regs. tit. 196, app. A (1988). Low funding of the SPA program has been a point of criticism by Nebraska Water & Agricultural Law specialist, J. David Aiken. *See* Aiken, *Implementation Issues in Special Groundwater Quality Protection Areas*, 45 J. Soil & Water Conserv. 264 (1990) [hereinafter Aiken, *Implementation Issues*].

117 Neb. Admin. R. & Regs. tit. 196, app. A (1988).

118 The term "point source", originally referenced in the Federal Water Pollution Control Act, 33 U.S.C. § 1251 *et. seq.* (1988) [hereinafter Clean Water Act], is defined in the GMPA as "any discernible, confined, and discrete conveyance." Neb. Rev. Stat. § 46-657(20) (1988).

119 Neb. Rev. Stat. § 46-674.05 (1988), referencing Neb. Rev. Stat. § 81-1532 (1988).

If the study suggests non-point source contamination, the DEC must contact the appropriate NRD within thirty days to set a public hearing date and location. The hearing must be held within 120 days from the completion of the report, it must be open to the public, and it must be held in a location within reasonable proximity to the area considered in the report. Specific public notice requirements are set forth in the statute.[120]

All interested persons are allowed to attend the hearing and to present evidence. After the hearing, and after the completion of any additional studies conducted on behalf of the DEC, the director of the DEC will determine whether to designate the area as a Special Groundwater Protection Area (SPA).[121]

The GMPA sets out specific criteria for the determination of whether to designate an area as an SPA. Four factors are to be considered:

1) whether groundwater contamination has occurred or is likely to occur in the reasonably foreseeable future;
2) whether groundwater users are experiencing or will experience within the foreseeable future substantial economic hardships as a direct result of the activities contributing to the contamination;
3) whether methods are available to stabilize or reduce the contamination; and,
4) administrative factors directly affecting the ability to carry out regulatory activities.[122]

If the director determines that an SPA is not warranted, an order to that effect is issued.[123] If the director determines, however, that an SPA should be designated, the statute requires consultation with the relevant state agencies and NRDs. This consultation is directed at the critical decision of the boundaries of the SPA. These boundaries are to be established taking into consideration the effect on local political subdivisions and the "socioeconomic and administrative factors" affecting the ability to carry out local management.[124] Once the boundaries have been so determined, an order designating the area as an SPA can be issued by the director. This order must include both a geographic and stratigraphic map of the area.[125]

Within 180 days of SPA designation, the appropriate NRD (or

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[120] Neb. Rev. Stat. § 46-674.06 (1988).
[121] *Id.*
[122] *Id.* § 46-674.07(1).
[123] *Id.* § 46-674.07(2).
[124] *Id.* § 46-674.07(3).
[125] *Id.* § 46-674.07(4).

NRDs in overlapping or combined areas)[126] is required to prepare an action plan designed to stabilize or reduce present contamination and prevent the increase or spread of future contamination.[127] This plan must include details of an educational program to inform persons of the methods available to stabilize, reduce or prevent groundwater contamination, and it must include one or more of the following "protective measures": 1) a mandatory water user education program; 2) mandatory best management practices;[128] and 3) other reasonable requirements necessary to carry out the purpose of the SPA.[129] The statute acknowledges that climatic, hydrologic, geologic and soil conditions are likely to vary from one part of the SPA to another. On this basis, regulatory measures incorporated into the action plan need not be uniform throughout the SPA. To prevent discriminatory regulation, however, uniformity must exist in areas similar with regard to these features.[130]

Within thirty days after the plan is prepared, a public hearing to elicit comments on the proposed plan must be held. A general description of the SPA boundaries and a text of the proposed plan must be included in the requisite public notice of the hearing.[131] Within 30 days after the hearing, the NRD must submit its action plan to the DEC for its approval.[132]

In evaluating the action plan, the statute directs the DEC to consider whether the plan will mitigate or eliminate the contamination problem that led to SPA designation or will improve the administration of the area.[133] The statute allows 120 days for this DEC review and authorizes another public hearing at the director's discretion.[134]

If the DEC approves the action plan, it can then be implemented by the NRD. The NRD is authorized to increase its tax levy up to $0.02 per $100 actual value on property within the SPA for the purpose of administering the plan.[135] Each protective measure adopted as part of the approved action plan must be published once each week for three

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126 If the SPA designation includes area represented by more than one NRD, SPA responsibilities and authorities are to be shared jointly by agreement of the boards of each of the affected NRDs. Neb. Rev. Stat. § 46-674.08(1) (1988).

127 *Id.*

128 The same definition of the phrase "best management practices" is applicable to the SPA program as the GMA program, *supra* note 69 and accompanying text.

129 Neb. Rev. Stat. § 46-674.09 (1988); Neb. Admin. R. & Regs. tit. 196, ch. 5, § 002 (1988).

130 Neb. Rev. Stat. § 46-674.10(3) (1988).

131 *Id.* § 46-674.08(2).

132 *Id.* § 46-674.08(3).

133 *Id.* § 46-674.10(1).

134 *Id.*

135 *Id.* § 46-674.19.

consecutive weeks in a local newspaper. The last such publication must be at least ten days prior to the effective date of the protective measure.[136] If the DEC disapproves the action plan, an order is issued listing the reasons for disapproval. The NRD then is allowed 60 days within which to submit a revised plan.[137]

If the appropriate NRD fails to submit a plan within the 180 day initial period, if a revised plan is not submitted within the 60 day allowance, or if the revised plan is not approved, the power to specify protective measures vests in the director of the DEC.[138] Within 90 days, the director shall promulgate such regulations as are appropriate to carry out the intent of the GMPA. Before these regulations are adopted, another public hearing is required. Once adopted, enforcement is the responsibility of the DEC.[139] The protective measures enacted as part of an approved action plan are to remain in effect "for the period of time necessary to stabilize or reduce the level of contamination and prevent the increase or spread of ground water contamination."[140]

The statute provides that any person who violates any of the provisions of the SPA portions of the GMPA[141] is subject to a civil penalty of not more than $500 or is guilty upon conviction of a Class III misdemeanor.[142] The regulations provide that each day of continued violation constitutes a separate offense.[143] These violation provisions have been interpreted to apply to all SPA regulations.[144]

Each NRD in which an SPA has been designated is directed to work in cooperation with the DEC in establishing a groundwater quality monitoring program.[145] If necessary, the approved action plan can be amended by the same method as it was initially adopted.[146] The regulations authorize the DEC to request the NRD to amend its plan in the event that:

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[136] *Id.* § 46-674.11.

[137] *Id.* § 46-674.10(4).

[138] *Id.* § 46-674.12(1).

[139] *Id.* § 46-674.10(2).

[140] *Id.* § 46-674.13 (1988).

[141] *Id.* §§ 46-674.02 - 46-674.20.

[142] The penalty for a Class III misdemeanor under Nebraska law is up to 3 months imprisonment and/or up to a $500 fine. Neb. Rev. Stat. § 28-106(1) (1989).

[143] Neb. Admin. R. & Regs. tit. 196, ch. 13, § 001 (1988).

[144] Aiken, *Regulation of Agricultural Chemical Use in Nebraska*, 4 Agricultural Economics Staff Paper 5, Dep't of Agric. Econ., Inst. of Agric. and Nat. Resources, Univ. of Neb., Lincoln (1988) [hereinafter Aiken, *Staff Paper*]; Hutton, *Nebraska's Special Protection Program*, *supra* note 96, at 102.

[145] *Id.* § 46-674.18.

[146] *Id.* § 46-674.13.

1) Protective measures being implemented are not effectively stabilizing or reducing contamination or preventing the increase or spread of contamination;
2) New contamination problems are identified; or,
3) New best management practices have been developed that may be more effective.[147]

There is no specific provision, however, for the DEC to enforce this "request". Presumably, the DEC would have to attempt to reinitiate the entire SPA process.

An NRD can petition the director for the removal of SPA designation, and the director may order such removal if the area has "stabilized at or been reduced to a level which is not detrimental to beneficial uses of ground water."[148] Although this removal standard may be less stringent than the standard set forth in the legislative findings, "to reduce high levels sufficiently to eliminate health hazards,"[149] the statutory language makes it clear that removal is discretionary on the part of the director.[150]

3. Action Taken Under the SPA Program

Although there has not yet been an SPA that has completed the entire designation/action plan approval process, several areas are at various points in that process. A number of requests have triggered DEC involvement. Three studies were completed in 1988 with results released in early 1989.[151] Two studies were completed in 1989 with results released in March of 1990.[152] An informal request deadline of the end of the year has been established, thus allowing the DEC the

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147 Neb. Admin. R. & Regs. tit. 196, ch. 8, § 002 (1988).

148 Neb. Rev. Stat. § 46-674.14 (1988).

149 *Id.* § 46-674.02(2).

150 Aiken, *Staff Paper*, *supra* note 144.

151 Verstraeten, *A Study of Nonpoint Source Ground Water Contamination in Southern Dodge County, Nebraska: A Special Protection Area Report*, Neb. Dep't of Envtl Control, Water Quality Div., Ground Water Section (Feb. 1989) [hereinafter Dodge County Study]; Link, *A Study of Nonpoint Source Ground Water Contamination Northwest of Beatrice, Nebraska: A Special Protection Area Report*, Neb. Dep't of Envtl Control, Water Quality Div., Ground Water Section (Mar. 1989) [hereinafter Beatrice Study]; Ehrman, *A Study of Nonpoint Source Ground Water Contamination in Southern Nuckolls County, Nebraska: A Special Protection Area Report*, Neb. Dep't of Envtl Control, Water Quality Div., Ground Water Section (Mar. 1989) [hereinafter Nuckolls Study].

152 Gottula, *A Study of Nonpoint Source Ground Water Contamination in the Eastern Portion of the Upper Big Blue Natural Resources District: A Special Protection Area Report*, Neb. Dep't of Envtl Control, Water Quality Div., Ground Water Section (Mar. 1990) [hereinafter Upper Big Blue Study]; Link, *A Study of Nonpoint Source Ground Water Contamination Near Wilcox and Hildreth, Nebraska: A Special Protection Area Report*, Neb. Dep't of Envtl Control, Water Quality Div., Ground Water Section (Mar. 1990) [hereinafter Wilcox Study].

following year to complete its study.[153]

Of the five studies now completed, each was initiated at the request of an NRD. In at least two cases, a municipality was also influential. The NRD request for a study of the Beatrice area noted that the city of Beatrice had asked the NRD to make the request.[154] Similarly, the Upper Big Blue Study came at the joint request of the city of Seward and the Upper Big Blue NRD.

Several similarities in the subject areas can be observed. Each area is primarily in agricultural use.[155] Also, each was suggested for DEC study based on a similar NRD concern, i.e. wellhead protection of municipal wellfields.[156] Finally, each involves a very small geographic region, a fraction of the total NRD area, although the study areas undertaken in 1989 are markedly larger.[157]

a. The Southern Dodge County Study

The Southern Dodge County study recommended that no SPA be designated at this time and that no further action be taken.[158] The study reflects several interesting aspects of the SPA process regarding the non-point source nitrate contamination in this area. First, the study contested the high levels of contamination reported by the Lower Platte North NRD by challenging the scientific method used by the district in analyzing the water samples.[159] This criticism high-

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[153] Telephone interview with Dick Ehrman, Unit Supervisor/Geologist, Ground Water Section, Water Quality Div., Neb. Dep't of Envtl Control (July 18, 1990).

[154] The Lower Platte North NRD requested the Dodge County study, *supra* note 151, at Executive Summary; Lower Big Blue NRD requested the Beatrice study, at the request of the city of Beatrice, *supra* note 151, at 50; The Lower Republican NRD requested the Nuckolls County study, *supra* note 151 at 42. The same is true for the the 1989 studies. The Upper Big Blue NRD requested the Upper Big Blue Study, *supra* note 152, at 61, and the Tri-Basin NRD requested the Wilcox study, *supra* note 152, at 35.

[155] Dodge County Study, *supra* note 151, at 5; Beatrice Study, *supra* note 151, at 20; Nickolls County Study, *supra* note 151, at 9; Upper Big Blue Study, *supra* note 152, at 3; Wilcox Study, *supra* note 152, at 13.

[156] Dodge County Study, *supra* note 151, at 1; Beatrice Study, *supra* note 151, at 50; Nuckolls County Study, *supra* note 151, at 42; Upper Big Blue Study, *supra* note 152, at 1; Wilcox Study, *supra* note 152, at 39.

[157] The three studies undertaken in 1988 involved very small study areas. The Dodge County study involves approximately one half of Dodge County (179 square miles). Dodge County Study, *supra* note 151, at 4. The Beatrice Study covers the six townships surrounding Beatrice, involving a total of 216 square miles. Beatrice Study, *supra* note 151, at 2. The Nuckolls County Study covers the southern portion of Nuckolls County. This area totals 288 square miles. Nuckolls County Study, *supra* note 151, at 6. The 1989 study areas were larger, although still relatively small. The Upper Big Blue Study covers a 791 square mile area. Upper Big Blue Study, *supra* note 152, at 1; The Wilcox study covers a 711 square mile area. Wilcox Study, *supra* note 152, at 4.

[158] Dodge County Study, *supra* note 151, at 44.

[159] The Dodge County Study does not contain a copy of the request that triggered this

lights the scientific complexity as well as the controversy surrounding groundwater analysis.

Second, the Dodge County study revealed serious scientific limitations to the study process. Many unknowns remain. For example, the study was unable to conclude whether the contamination that exceeded 10 ppm documented in certain samplings was attributable to non-point source contamination.[160]

Third, the study revealed an interpretation of the designation criteria that seems more based upon contamination that has occurred as opposed to that which is "likely to occur in the reasonably foreseeable future."[161] It focused on its findings that present contamination is "generally less" than 7 ppm, noting that the extent of contamination exceeding the nitrate MCL is limited. Although it noted that a positive relationship did not exist between irrigation and contamination, it did find a correlation between contamination and soil leaching potential. It can be argued that this correlation, plus the elevated level of contamination,[162] should give rise to SPA designation and an action plan that seeks to prevent further contamination. Nevertheless, the study did not recommend SPA designation, nor did it recommend any further governmental action. It stated that landowners in areas with concentrations higher than 10 ppm could voluntarily use BMPs to prevent further deterioration.[163]

b. The Beatrice Area Study

An SPA was recommended for designation in the Beatrice study. Again, some interesting observations can be made from this study. First, as in the Dodge County study, it is apparent that this process cannot provide answers to all of the pertinent questions. For example, in the Beatrice area, four domestic sampling wells showed severely high nitrate levels ranging from 30.1 - 54.8 ppm. The study states that these high values are "probably due to point source contamination" but that without further investigation, an actual determi-

study. However, the study states that the Lower Platte North NRD supported its request with evidence of high nitrate contamination in sampled groundwater. The study then notes, "I believe the method used to analyze the LPNNRD samples, Ion Selective Electrode Method (APHA, 1975), instead of the Colorimetric Automated Cadmium Reduction method, used by the DEC, produced inaccurate results." Dodge County Study, *supra* note 151, at 44.

[160] Dodge County Study, *supra* note 151, at 32.

[161] Neb. Rev. Stat. § 46-674.07 (1988).

[162] Nitrate concentrations that exceed 3 ppm generally indicate contamination from human activities. Natural occurrences usually are below this amount. *Supra* note 15 and accompanying text.

[163] Dodge County Study, *supra* note 151, at 44.

nation of the source was not possible.[164]

Second, the issue of boundaries arises in the context of this study. Of the already small area studied, only three of the townships were recommended for designation. While the testing data clearly supports the greater need for designation in these townships, it can be argued that such a small SPA is inefficient. Moreover, drawing a line around a small area may place too much reliance on uncertain or variable test data. As the statute explicitly authorizes protective measures within an action plan that vary from area to area within the SPA, it can be argued that larger areas were contemplated.[165] Especially in light of the educational emphasis of the SPA program, an expanded area would seem both more practical and more productive.

However, the newness of the program may well explain the small sizes of the areas requesting study and the areas designated. Understandably, until the workings of the program and the degree of state intrusion are shown, local areas may be hesitant to participate. In this regard, it may be politically expedient for the DEC to move slowly. This theory is supported by the fact that the 1989-90 studies involve areas many times the size of the areas initially evaluated in the 1988-89 studies.

Despite the well documented and seemingly moderate decision to recommend designation of a portion of the area in the Beatrice study, this announcement met with local concern and opposition. As a compromise, and to allow time for educational efforts conducted by the NRD, the DEC agreed to put designation on hold for a three year period. During this period, the NRD has agreed to continue to monitor and study the problem and to conduct educational programs for area residents.[166]

c. The Nuckolls County Study

SPA designation was also recommended for a portion of the area in the Nuckolls County study. This area, the southeast and south-central region of the county, exhibited widespread, homogenous levels of nitrate contamination. Nitrate levels that substantially exceeded 10 ppm were found in domestic, irrigation and municipal wells. The distribution of the higher nitrate values was attributed to agricultural nonpoint source pollution and was found to correlate with the location of irrigated cropland. As such, the study recommended SPA

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[164] Beatrice Study, *supra* note 151, at 33.

[165] Neb. Rev. Stat. § 46-674.10(3) (1988).

[166] Interview with Dick Ehrman, *supra* note 153.

designation to allow the two affected NRDs, the Lower Republican NRD and the Little Blue NRD, to better manage the problem. As was the case in the Beatrice study, however, the entire area was not recommended for designation; the area recommended was only that where the highest contamination was found.[167]

Reaction to this recommendation, however, was much more favorable than that experienced in the Beatrice area. As such, the designation process has moved ahead steadily and generally on schedule. The DEC study was issued in March of 1989. Actual designation occurred on December 14, 1989. On March 8, 1990, the Lower Republican and Little Blue NRDs entered into a cooperative agreement "to provide for the orderly management of ground water quality" in the new SPA by working together in the development of an action plan "to stabilize, reduce, and prevent the increase or spread of ground water contamination."[168]

During the spring of 1990, a Local Action Committee was organized to compile information and develop a draft action plan. This committee worked with both of the NRD boards and presented a draft plan to the DEC.[169] A public hearing was scheduled within the SPA area.[170] This hearing was held, and those attending were positive about the plan, with no opposition voiced. The final action plan was then submitted to the DEC. As of this writing, it is under DEC consideration.[171]

d. Upper Big Blue Natural Resource District

The first of the 1989 studies involved a portion of the Upper Big Blue NRD. This study revealed significant nitrate contamination of at least the upper acquifer underlying a portion of the study area. Although some point source contamination is suspected, characteristics typical of nonpoint source contamination were present. As such, at least a significant portion of the contamination can be attributed to area agricultural activities.[172]

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[167] Nuckolls Study, *supra* note 151 at 30, 32.

[168] SPA: Not Just Another Acronym!, 11 Lower Republican Natural Resources District Newsletter 2 (1990) [hereinafter Newsletter].

[169] *Id.*

[170] *Id.* at 3; Note that this schedule interprets the SPA process as requiring the NRD to complete a draft plan within 180 days of designation. The public hearing can be scheduled subsequent to this submission, with the final plan submitted to the DEC within 60 days thereafter. The statute is not clear on this chronology, but this interpretation is consistent with that of the DEC. Interview with Dick Ehrman, *supra* note 153.

[171] Telephone interview with Dick Ehrman (November 16, 1990).

[172] Upper Big Blue Study, *supra* note 152, at 54.

The area of contamination, however, is suspected to extend beyond the study area. Moreover, the Upper Big Blue NRD has requested a study of additional areas within its district. This study is scheduled to be undertaken next year, and accordingly, a decision on SPA designation will not be made until the entire area is considered. In the meantime, the study suggests that the NRD begin to inventory land use practices and quantities of fertilizers and pesticides used.[173]

While this study indicates an appreciation for the importance of a broad based regional approach to the groundwater contamination problem, it also evidences the slow process inherent in the SPA program. After one year of testing, much remains unknown, exact sources of the contamination remain undetermined, and a solution has not yet been suggested.

e. Tri-Basin Natural Resources District

The study of the Wilcox area, a region bordering the Tri-Basin NRD and the Lower Republican NRD, was also completed in 1989 and released in March 1990. This study also revealed likely nonpoint source contamination from agriculture, in varying degrees of concentration. Different recommendations were made for different areas within the study, based on the levels of contamination observed.[174] One area, the Southeastern Kearney County area, evidenced good groundwater quality, so no action was recommended there.[175]

A second area, the portion of the study area that borders the Tri-Basin NRD, evidenced nitrate levels averaging 10.6 ppm. The study recommended that this area be annexed by Tri-Basin NRD, becoming part of its groundwater management area. SPA designation was not recommended as it was believed that it would duplicate other area efforts.[176]

The third area, parts of Harlan and Franklin Counties, showed a higher concentration of nitrates. Within this area is the village of Wilcox, whose municipal water supply has been in violation of the nitrate MCL since 1983.[177] The study revealed, however, that domes-

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[173] *Id.*

[174] Wilcox Study, *supra* note 152, at 29.

[175] *Id.*

[176] Wilcox Study, *supra* note 152, at 26, 29-30.

[177] Wilcox Study, *supra* note 152, at 39-40. Wilcox is one of approximately 35 municipalities in Nebraska that is under an "administrative order" for drinking water violations. Telephone interview with Dick Ehrman, Unit Supervisor/Geologist, Ground Water Section, Water Quality Div., Neb. Dep't of Envtl Control (July 24, 1990). The Department of Health issued an administrative order to Wilcox city officials citing its violation of nitrate drinking water standards in February of 1984. This order, issued under the Nebraska Safe Drinking Water

tic and irrigation wells in the surrounding region tested at an average of 7.4 ppm. The study indicated that the increase in the use of center pivot irrigation over the last 10-15 years may have increased the leaching potential in this area and stated that the area "seems to fit the description of nonpoint source contamination."[178] However, the study recommended that an SPA not be designated at this time. Rather, it suggested that the Lower Republican NRD continue its existing groundwater quality monitoring program to see if the problem worsens. If trends of increasing contamination are observed, SPA designation can be reconsidered.[179] As such, once again, the Tri-Basin study reveals a DEC that is cautious in its use of SPA designation powers. At least for now, the DEC seems to prefer a supportive role in guiding local NRDs along the path of gradual regulation.

4. Evaluation and Critique: The SPA Program

Although the program has received national attention as an innovative and positive approach to the problem of groundwater contamination from agriculture, several problems have been observed. Discussion of these problems is not to detract from the program or its administrators. In many ways, Nebraska has been remarkably successful in its initial attempts to devise a workable system for controlling groundwater contamination while balancing competing interests. However, it is helpful to examine criticisms that can be made to highlight possible areas of future improvement and to point out areas of inevitable difficulty.

First, lack of adequate funding is a major implementation problem for both the DEC and local NRDs. Groundwater and soil testing, as well as sophisticated scientific analysis of the data obtained, cost more

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Act, Neb. Rev. Stat. §§ 71-5301 - 71-5313 (1986, 1988 Supp. & 1989 Supp.), and the federal SDWA, directed that the city provide public notice to citizens at three month intervals, provide notice to health care providers, undertake an investigation as to alternative methods of providing public water to the community, provide low nitrate water as requested for infant feeding, and conduct monthly water testing at owner's expense. Another Administrative Order was issued by the Department of Health on September 30, 1988 ordering Wilcox to obtain an engineering report detailing necessary corrective action and to begin to undertake such action. According to the letter from the Director of the Nebraska State Department of Health, attached to the Wilcox study, the city requested an exemption from its requirements on the grounds that it would not be able to finance the capital improvements necessary for compliance. At the present time, it has received assistance from the Nebraska Department of Economic Development and has plans to have a new well drilled. Obviously, city officials are concerned that this well, too, will become contaminated. As such, they approached the Tri-Basin NRD to request SPA designation.

[178] Wilcox Study, *supra* note 152, at 26.

[179] Wilcox Study, *supra* note 152, at 26, 30.

than the present budget allows.[180] One observer has suggested that at current levels of funding, many areas with significant nitrate contamination will not be studied for SPA designation for several years.[181] Moreover, once studies have been completed and areas designated, implementation costs for NRDs will rise. Local residents, already faced with increased water costs due to both testing and remedial measures may not be able to afford to either administer or enforce regulations properly.

Second, the one year time limit on DEC studies may be unrealistic in areas with little or no prior groundwater testing.[182] This was emphasized in the studies by reference to the many unknowns. Unfortunately, however, this criticism is contrary to the urgency of the contamination problem in some areas.

Third, preliminary administrative interpretations of SPA authorities may have shifted the focus of the SPA program away from its prevention oriented objectives.[183] The legislative findings supporting the SPA program establish two general objectives, prevention of contamination and reduction of present contamination levels.[184]

Fourth, unanswered questions surround the controversial issue of SPA boundaries. As is suggested by one DEC official, these questions include:

1) Should SPA boundaries be based on the area contributing to the contamination or extended to areas that will benefit from the protection;
2) How far should SPA boundaries be extended (incorporating the prevention vs. present contamination debate);
3) Are very small SPAs appropriate;
4) Should the public and/or NRDs influence boundaries.[185]

Fifth, with regard to action plan implementation, it appears that neither the statute nor the regulations provide for a mechanism for the DEC to monitor the NRD's administration and enforcement of the approved action plan. Especially when confronted with unpopular restrictions on agricultural practices, local NRDs charged with enforcement may be reluctant. The GMPA has been criticized for

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[180] *Id.* at 264.

[181] Aiken, *Implementation Issues*, *supra* note 116, at 264. Mr. Aiken suggests a surcharge tax on pesticides and fertilizers similar to taxes applied in Iowa, Kansas, Minnesota and South Dakota to boost program revenues.

[182] Ehrman, Link & Gottula, *supra* note 114, at 264.

[183] Aiken, *Implementation Issues*, *supra* note 116, at 265.

[184] Neb. Rev. Stat. § 46-674.02(2) (1988). *See* Aiken, *Agrichemical Regulation*, *supra* note 32, at 46.

[185] Ehrman, Link & Gottula, *supra* note 114, at 264.

not giving the DEC more authority to supervise and take over enforcement if an approved action plan is not being properly implemented.[186]

Finally, the ultimate issue facing the SPA program is, will it work? Although it gives additional power to the state environmental agency, both the SPA program and the GMA programs at least initially rely upon the effectiveness of best management practices to remedy the contamination problem. Although other, more restrictive measures may be authorized, they would be highly controversial.

The GMPA legislative findings emphasize, "[A]griculture has been very productive and should continue to be an important industry to the State of Nebraska."[187] At the present time, the regulations and protective measures proposed in Nebraska respect this goal and do not intrude upon agricultural productivity. The question remains, however, what if these measures are not enough to protect fragile groundwater resources? This may present a direct conflict between groundwater protection and agricultural productivity. It remains to be seen whether the Nebraska DEC and/or the local NRDs will have the power, the wisdom, or the courage necessary to meet this challenge.

V. The Regulation Debate

Although still in its formative stages, Nebraska's approach to the groundwater contamination problem is characterized by the power of the state, through the local NRDs, to regulate specific, individual agricultural practices. This regulation has moved slowly, cautiously, and as of yet, has not appeared too controversial. Nevertheless, this concept, government regulation of the way that individual farmers farm, is a marked change from the voluntary controls, cost-sharing and incentives that have characterized U.S. farm policy since the New Deal.[188] As such, its very premise begs the question, should farming

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[186] Aiken, *Staff Paper*, *supra* note 144, at 7; Aiken, *Agrichemical Regulation*, supra note 32, at 49. Mr. Aiken suggests amendments to empower DEC to review NRD implementation, require plan amendments, and assume plan administration if necessary.

[187] Neb. Rev. Stat. § 46-674.02(3) (1988).

[188] The "farm program" in place today continues an elaborate scheme of commodity specific programs designed to achieve commodity price supports and farm income stability, as well as production control and adequate surplus commodity stocks. These farm programs, which initially arose as part of the New Deal, have always been marked by voluntary participation. The incentives offered to, and the controls placed on, farmers by the federal government have always been tied to the farmer's independent decision to "sign up" for the program. For general descriptions of these programs, see Econ. Res. Serv., USDA, Misc. Pub. No. 1479 *The Basic Mechanisms of U.S. Farm Policy* (Jan. 1990).

practices be regulated?

In sharp contrast to the voluntarism of traditional U.S. farm policy, pollution abatement has most often been achieved through direct controls. Regulation as both a remedy for, and prevention of, the problems of pollution has been the approach most often chosen by policymakers.[189]

Up to this point in time, however, the agricultural industry has escaped many of the pollution controls imposed on other industries. For example, under the Clean Water Act, specific restrictions were placed on forms of point source pollution, which is pollution frequently associated with industrial waste. At the same time, specific controls were not directed at non-point source pollution, the main pollution problem presented by the agricultural industry.[190]

Political pressure for the regulation of agriculture as it affects the environment may well be increasing. Studies indicate that the public's concern about the integrity of the environment and the impact of agriculture has risen sharply.[191] Indeed, the public mood has been characterized as one of fear, frustration and mistrust, with pressures mounting on elected officials to "do something."[192] In this atmosphere, the call for the regulation of agricultural practices has been raised.[193]

Thus, it is not surprising to observe a lively debate between agricultural policy makers, especially USDA officials, and environmentalists, as to the proper response to the problem of groundwater contamination. Acknowledging that a groundwater problem exists, and that agriculture is a contributor to the problem, the USDA has, nevertheless, opposed mandatory controls. Rather, the USDA prefers a solution which would combine research and education with cost-sharing and other incentives based on voluntary compliance.

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189 Batie & Diebel, *Key Policy Choices in Groundwater Quality Management*, 45 J. Soil & Water Conserv. 194, 197 (1990) [hereinafter Batie & Diebel]. Applying this issue specifically to groundwater pollution problems, Batie and Diebel stated:

> The fundamental policy choice of "who has the right to do what to whom" is a pivotal issue of governance. Over the last few decades, the answer to that pivotal question has become more restrictive to those who own and use natural resources as inputs into production processes. Increasingly, the beneficiaries of new policy initiatives are those who desire higher protection of groundwater quality.

Id. at 197. *See also*, Holmes, Nielsen & Lee, *Managing Groundwater Contamination in Rural Areas*, 5 Rural Dev. Persp. 35, 36 (1988).

190 The Clean Water Act, *supra* note 118.

191 Batie, *Agriculture as the Problem: The Case of Groundwater Contamination*, Choices, Third Quarter 1988 at 4 [hereinafter Batie, *Agriculture as the Problem*].

192 Bouwer, *supra* note 6, at 184-85.

193 Batie, *Agriculture as the Problem*, *supra* note 191, at 183.

By emphasizing voluntary action to control groundwater pollution, UDSA officials have attempted to slow down the move toward regulation of agricultural practices. As one senior USDA official reported to Farm Journal magazine, "We don't have to be Chicken Littles about this. We have time to adapt technology to help minimize the risks of chemical use. Hopefully, EPA and other regulatory agencies won't move too hastily."[194]

Consistent with this theme, the 1990 farm bill begins to address groundwater quality concerns.[195] Perhaps in an attempt to keep agricultural policies strictly within the USDA and to avoid the risk of EPA regulation, this bill contains numerous references to groundwater quality concerns within the title cited as the "Conservation Program Improvements Act". Included in this title is a water quality incentive program[196] and the establishment of an Agricultural Council on Environmental Quality.[197] Moreover, a subtitle cited as the "Agriculture and Water Policy Coordination Act" calls for "increased efforts by the Department of Agriculture in extension, technical assistance, and research on the relations between agricultural production and contamination of water."[198] An analysis of these and other attempts in the Farm Bill to address the groundwater contamination problem are beyond the scope of this article. Moreover, it would be premature to speculate as to how the USDA will handle all of its directives. It must be emphasized, however, that these measures, while indicating a sincere recognition of the seriousness of the problem, still rely upon research, education, and voluntary compliance.

Voluntary compliance does offer several specific advantages. Because this is both the traditional farm program approach and one that is favored by farmers, resistance should be minimal. Moreover, it has been suggested that a certain amount of flexibility could be built into the program.[199]

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[194] Taylor, *Water Quality Falls on Farmers' Shoulders*, Farm Journal 19, 20 (April 1989) (quoting USDA, Science and Education Agency official Robert Long).

[195] As of this writing, the 1990 Farm Bill, officially titled the "Food, Agriculture, Conservation, and Trade Act of 1990" has been approved by Congress and awaits the signature of the President. Text of the bill is found in the Conference Report on S.2830, 101 Cong., 2d Sess., 136 *Cong. Rec.* H11,1029 (1990).

[196] *Id.* at § 1439.

[197] *Id.* at § 1471.

[198] *Id.* at § 1481 (b) (2).

[199] Logan, *supra* note 35, at 205. However, flexibility has not been a characteristic of the current farm programs, despite their voluntary nature. To the contrary, compliance with ASCS guidelines for participation are frequently enforced with as much, if not greater, rigidity as a regulated farming practice. The voluntary aspect of the program relates only to the initial

Others argue, however, that education and voluntary measures will not be effective. They point to practices with known environmental advantages that have apparently been rejected by mainstream agriculture. For example, the split application of nitrogen, recognized as a more efficient fertilizer use, has not been widely accepted due to the increased time and management required as well as fears of yield reduction.[200] Similarly, although lack of agency encouragement may be to blame, farmers generally have not adopted BMPs absent high levels of cost-sharing and technical assistance.[201] Daberkow and Reichelderfer emphasize this point by arguing that the farmer has profit maximization as a strong motivator, while externality issues push for intervention. Hypothesizing that high demand for agrichemical use is consistent with profit maximization, they find voluntary change unrealistic. They suggest that the real debate is the form of intervention to best force internalization of the costs of pollution on the agricultural industry.[202]

This focus on the economic realities facing agriculture also raises a problem with the fundamental approach of tying conservation measures to the farm programs. In order to be subject to these conservation measures, the farmer must choose to participate in the applicable program. As program payments are cut and additional restrictions are tied to the receipt of benefits, the risk increases that it will not be economical for farmers to participate.[203]

Before farmers can be blamed for not adopting alternative agricultural practices designed to promote environmental integrity, however, certain aspects of the current farm program must be addressed. Farm policy analysts have criticized these programs as creating production incentives that are inconsistent with sound farming practices. They allege that these programs are detrimental to the environmental goals shared by society, since they force farmers to adopt policies that are harmful to the environment.

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sign-up decision. *See, e.g.*, the "Sodbuster/Swampbuster" provisions of the Food Security Act of 1985, Pub. L. No. 99-198, 99 Stat. 1354, 1494-18, (as codified at 16 U.S.C. §§ 3801-45 (1988)).

200 Logan, *supra* note 35, at 203.

201 *Id.*

202 Daberkow & Reichelderfer, *Low Input Agriculture: Trends, Goals, and Prospects for Input Use* 70 Amer. J. Agric. Econ. 1159 (1988).

203 This risk is apparent in the new farm bill, *supra* note 195, as it is adjusted by the Omnibus Budget Reconciliation Act of 1990 (OMBRA), Pub. L. No. 101-508, §§ 1001 - 1302, 104 Stat. 1388. Under OMBRA, the method of calculating the deficiency payments is changed and will result in smaller annual payments. *Id.* § 1102. In addition, the amount of crop acres eligible has been reduced by 15%. *Id.* § 1101.

As the National Academy of Sciences report, *Alternative Agriculture*, charges,

> Many federal policies discourage adoption of alternative practices and systems by economically penalizing those who adopt rotations, apply certain soil conservation systems, or attempt to reduce pesticide applications. Federal programs often tolerate and sometimes encourage unrealistically high yield goals, inefficient fertilizer and pesticide use, and unsustainable use of land and water. Many farmers in these programs manage their farms to maximize present and future program benefits, sometimes at the expense of environmental quality.[204]

Accepting this criticism skews the voluntarism-regulation debate. It can be argued that disincentives to change must be removed before the effectiveness of voluntary measures can be accurately assessed.

Fueled by this criticism and budgetary pressures, the Omnibus Budget Reconciliation Bill includes the "triple base option."[205] This authorizes support payments on only 85% of the participant's eligible crops. The remaining 15% can be planted in another crop and is termed "flexible" acreage.[206] Thus, although only a small percentage of crops are effected, farmers will not be totally locked into program crops. Additional economic stress is added, however, as program payments are decreased.

Even assuming that current policies are changed to remove disincentives and to provide incentives to adopt more environmentally sound farming practices, some regulation may still be required. In certain areas such as Nebraska, groundwater contamination may be so severe as to force immediate action. The risk of adverse health effects and profound economic consequences may totally override the USDA's "let's try this for a while" attitude.

If one is to accept the inadequacy of voluntary controls by themselves and to accept the necessity of some specific regulation, at least in high risk areas, serious regulatory problems must be addressed. First, the extent of our scientific knowledge about groundwater contamination remains incomplete. As is evidenced by the difficulties experienced by the Nebraska DEC conducting its SPA designation studies, the contamination process and the interaction of factors influencing contamination is extremely difficult to predict. This condition makes the cause difficult to determine and the solution difficult to pre-

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[204] OMBRA, *supra* note 203, at § 1101.

[205] For an excellent explanation of triple base, *see* Cong. Budget Off., *Farm Program Flexibility: An Analysis of the Triple Base Option* (Dec. 1989).

[206] National Research Council, *Alternative Agriculture* 10 (1989).

scribe. Moreover, the health effects of varying degrees of contaminants are frequently uncertain, making the impact of contamination difficult to assess. Nevertheless, since contaminant levels seem to be increasing, decisions must be made. As one author noted, "Unsettling as it may be, regulatory and management decisions will have to be made in the face of scientific uncertainty and ambiguity. Responsible decisions will have to be made based on the best information currently available."[207] This problem raises questions regarding the extent of contamination that is acceptable and the practices that will be required to maintain this level. Responsible decision-making will have to take into account public health risks, environmental integrity, and economics.[208]

In addition, groundwater contamination presents difficult cause and effect problems. Slow and uneven rates of groundwater movement, combined with the unpredictable travel time of contaminants from the surface of the soil to the groundwater below make it difficult to determine whether regulations have been effective. As such, groundwater testing may reveal inconsistent or delayed results. Consequently, ongoing program evaluation becomes extremely problematic.[209]

A third difficulty is presented by conflicting environmental objectives. Actions taken to prevent pollution of one sort may actually encourage another type of pollution. For example, measures designed to decrease erosion such as terracing and no-till farming may increase the risk of leaching.[210] Similarly, land set-aside programs, whether for supply control or erosion reduction, encourage farmers to work

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[207] Bouwer, *supra* note 6, at 185 (citing U.S. Water News (U.S. Water News, Inc.) 3(4) (1986) referencing the California Safe Drinking Water and Toxic Enforcement Act adopted in 1986 (Proposition 65)).

[208] For an excellent discussion of the economic costs of the groundwater contamination problem, see Nielsen & Lee, *supra* note 5. *See also* O'Neil & Raucher, *The Costs of Groundwater Contamination*, 45 J. Soil & Water Conserv. 180 (1990). For an excellent analysis of policy issues surrounding groundwater contamination, see Batie, *Agriculture as the Problem*, *supra* note 191. *See also* Batie & Diebel, *supra* note 189; Freshwater Foundation, *Economic Implications of Groundwater Contamination to Companies and Cities* (1989); Libby, *A Public Policy Perspective on Groundwater Quality*, 45 J. Soil & Water Conserv. 190, 191 (1990) [hereinafter Libby, *Public Policy*].

[209] Moody, *supra* note 7, at 171.

[210] Logan, *supra* note 35, at 202. However, this concern is based on the assumption that the chemicals have to go somewhere; the alternatives being runoff resulting in surface water contamination or leaching resulting in groundwater contamination. Chemical applications that are limited to the amount that is utilized by the present crop decreases the risk of both problems. Nevertheless, Mr. Logan's point is well taken. There is a danger in assuming that soil conservation measures or even surface water protection measures will necessarily provide protection for groundwater.

remaining land more intensively.[211]

Enforcement of agricultural practices regulations presents another formidable difficulty. Monitoring individual chemical and fertilizer application day-by-day is clearly impossible. More realistically, farmers could be required to submit a management plan that details proper applications.[212] In any event, enforcement efforts are greatly enhanced by local involvement such as that of Nebraska's NRDs.

Thus, regulation, even if it is the best or the only feasible alternative in some high risk areas, does not present an easy solution. Farmers, environmentalists, and policymakers must work together to confront these difficulties if regulation is to be effective.

VI. The Extent of Regulatory Powers: Potential Applications

Assuming a regulatory scenario, the issue of the extent and the severity of the regulations imposed must be addressed. Regulations that restrict the application of fertilizer and/or pesticides may impact agricultural productivity. Thus, a lost-profits cost will be imposed upon the farming economy. Although Nebraska has not yet dealt with this issue, it is likely to arise in the future. How far can the government go in controlling farming practices? What will the impact be upon individual farmers? The Nebraska legislature has acknowledged the importance of protecting its groundwater resources, but it also acknowledges the importance of agriculture to its state economy.[213] The remaining question, for Nebraska as well as for other agricultural states, is how to balance these two important goals.

Any costs to the agricultural sector from the restriction of farming practices to control groundwater contamination will be based on the severity of the restrictions. As such, a cost continuum is proposed. The least severe restrictions will have the least impact on farmers in terms of lost profits. In fact, as will be discussed, the imposition of requirements that mandate certain practices determined to be "best management practices" may result in increased profits by reducing input costs. Further along on the continuum, however, are restrictions that reduce annual productivity for the long term environmental benefit. Short term lost profits from decreased crop yields are likely to result. Finally, at the far end of the continuum are severe land use

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[211] Libby, *Public Policy*, *supra* note 208, at 191.

[212] Logan, *supra* note 35, at 203.

[213] *See supra* note 188 and accompanying text.

restrictions that may well make traditional crop farming of particular areas unprofitable on both a long and short term basis.

A. Traditionally Recommended Farming Practices

It has been estimated that only fifty percent of commercial nitrogen fertilizer applied in crop production is ever utilized by the crop planted.[214] The remaining fifty percent represents not only an environmental risk, but a loss to the farmer. Research indicates that much of this loss as well as the negative environmental consequences could be prevented through improved farming practices.[215] These practices include delayed application, soil testing, and in many cases simply applying less fertilizer.[216]

This approach suggests that it may be possible in some situations to develop a win-win strategy for agriculture and the environment. The farmer's input costs go down while yields are maintained. Thus, farm profits increase while groundwater receives additional protection.

The phrase "best management practices" referenced in the GMPA as a groundwater management tool and a suggested protective measure appears on its face to be consistent with this win-win strategy. In reality, however, this may not be the case, particularly under today's farm programs.

As noted previously, BMPs are defined in the GMPA as practices "utilized to prevent or reduce present and future contamination of groundwater."[217] Thus, the focus is on practices that promote water quality. These practices may not produce the highest crop productivity levels, at least in the short run.

Accentuating this potential conflict between practices designed to protect groundwater quality and practices designed to increase annual yields is the current price support program, which has been criticized as encouraging a drive toward unrealistic yield goals. Pointing out that the application of extra nitrogen is an inexpensive way to assure high volume production, one author noted that little incentive exists for a farmer to restrict inputs.[218] As long as a per unit price is main-

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[214] Conservation Technology Information Center, *Nitrogen Facts* (1988).

[215] *Id.*

[216] Bouwer notes that fertilizer application is frequently based on unrealistic yield expectations. He suggests that more realistic yield projections and an emphasis on long term profit maximization would result in less fertilizer being applied and consequently, less groundwater contamination. *See* Bouwer, *supra* note 6, at 188.

[217] *See supra* note 69 and accompanying text.

[218] Libby, *Public Policy*, *supra* note 208, at 191.

tained by the government, the incentive to produce more units is strong.

B. Low Input Sustainable Agriculture

As a partial response to the criticisms referenced above, many have argued that farm policy should reflect the long term sustainability of American agriculture as opposed to the short term maximization of production. This argument is based on the premise that current production emphasis is damaging to the long term quality of the soil as well as the groundwater. True "best management practices" for protecting groundwater quality would be compatible with agricultural practices designed to promote long term sustainable agricultural production.

Out of this movement, the much debated Low Input Sustainable Agriculture model (LISA) has emerged. This model combines various environmentally sound agricultural practices in an attempt to "bring more balance into our farming systems."[219]It combines farming practices such as integrated pest management, crop rotation, close monitoring of specific crop and soil needs and reduced inputs. The LISA model is perhaps the next step on the cost continuum.

Because the LISA model has only recently gained popularity, economic studies comparing it to the exceptional yields produced under current intensive farming are incomplete. Nevertheless, some preliminary studies appear positive. In Colorado, herbicide applications based on the number of weed seeds present in the subject corn field, combined with the decision to allow some weeds to grow in the field, reduced herbicide applications substantially and increased net profits.[220]

Similarly, early results from testing in Iowa have indicated that although yields may decline, net returns may increase. This study also emphasized, however, that profit maximization should not be the goal of LISA; rather, a sufficient level of profit allowing other goals to be met is desirable.[221] While this is a wholly appropriate goal for society, it may not be acceptable to the individual farmer, especially in times of financial stress.

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[219] Duffy, *Economic Considerations in Low-Input Sustainable Agriculture*, 3 J. Agric. Lending 34, 41 (1990).

[220] Bouwer, *supra* note 6, at 188 (citing Schweizer, *Weed-Free Fields Not Key to Highest Profits*, 37 Agric. Res. 14-15 (1989)).

[221] *Id.*

C. More Restrictive Measures

Some research suggests that even low input agricultural practices may not be sufficient to prevent nitrate groundwater contamination in particularly vulnerable areas.[222] In response, at least one author has suggested that the EPA standards for groundwater contamination may be unrealistic.[223] This suggestion illustrates the potential conflict between agricultural interests and environmental concerns presented by the groundwater contamination problem. If reasonably profitable agricultural practices in particular areas are inconsistent with the maintenance of the present MCL for nitrate contamination, only three resolutions seem feasible.

The first possible resolution would be to lower the MCL standard.[224] Theoretically, this lowering could be an overall revision of the nitrate MCL or a special variance or exception for particular areas. Although it is conceded that the scientific community is not unanimous in its view of the risks associated with nitrate contamination, this resolution would present serious political problems. As Batie has suggested, public concerns are focusing more and more on environmental integrity, especially with vital resources such as drinking water.[225] In this climate it is unlikely that the public would tolerate a lowered standard, especially when it is enacted to allow degradation by an industry heavily dependent on government subsidies.

The second possible resolution would be to limit agricultural practices severely, recognizing that farm profitability would suffer. This resolution would probably result in some farmland being retired from agricultural use and land values being reduced to adjust for decreased profits. Political efforts may be made to subsidize farmers hurt by the restrictions. Moreover, Constitutional issues regarding the possible "taking" of the farmers' use of the land would undoubtedly be addressed.[226]

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222 Magette, Weismiller, Angle & Brinsfield, *A Nitrate Groundwater Standard for the 1990 Farm Bill*, 44 J. Soil and Water Conserv. 491 (1989).

223 *Id.*

224 *Id.*

225 *Supra* note 191, at 4.

226 The Constitutional aspects of regulation are beyond the scope of this article. However, it is clear that under some circumstances, the loss of the economic use of private property as a result of governmental regulation can result in a compensable taking. For an analysis of the factors to be considered, see Penn Cent. Transp. Co. v. New York, 438 U.S. 104 (1978). This case and subsequent Supreme Court cases on this issue are discussed in Peterson, *Land Use Regulatory "Takings" Revisited: The New Supreme Court Approaches*, 39 Hastings L.J. 335 (1988).

The third possible resolution would be to prohibit agricultural practices in areas that are particularly vulnerable to contamination. This resolution would certainly trigger the much litigated concept of government taking and just compensation. Aside from the compensation issue, however, the state's authority to impose this type of restriction would have to be based on its police powers. This power, which incorporates the power to protect the public health, has been liberally upheld.[227] Previously, zoning ordinances have restricted urban development for the preservation of agricultural land, in the name of the public good.[228] From an analytical standpoint, by comparison, restricting activities to protect groundwater is clearly not a radical concept. However, given the independence that has characterized American farming to date, from that sector's perspective, it is truly radical indeed.[229]

VII. CONCLUSION

Although the extent of actual groundwater contamination from agricultural sources is currently unknown, certain specific problems have been recognized. As is emphasized by the recent EPA study, these problems are by no means unique to Nebraska. It is likely that almost four million Americans have a drinking water source that exceeds the health standard for nitrates.[230]

It is difficult to assess the magnitude of the effect of groundwater contamination and/or the regulation of its sources. Even with reasonable speculation, however, it is safe to assume that contamination represents a very costly problem to society. To the extent that it is caused by our present agricultural practices, reassessment of these practices must be undertaken by policymakers. Especially in light of

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[227] *See, e.g.*, Penn Central, 438 U.S. at 138. *But see* Nollan v. California Coastal Comm'n, 483 U.S. 825 (1987).

[228] *See generally* 3 P. Rohan, *Zoning and Land Use Controls* §§ 19.01-19.05 (1990).

[229] As evidence of farmers' strong feelings of independence regarding rural land use, it is interesting to note the public reaction to a proposed Wisconsin bill to control soil erosion. Regulatory powers were authorized by this bill, although the extent of these powers did not exceed existing regulatory authority. Such authority had not been previously exercised, and the general public apparently was unaware of its existence. The state senator who introduced the bill was subject to a nearly successful recall campaign as opponents argued that it was part of a governmental conspiracy to take control of private lands. Local newspapers recorded descriptions of the bill as "outright plunder and loss of property freedom," and "a scheme originated at the University of Chicago by a group of elitists headed by the Rockefellers." Despite all the furor, however, the bill eventually passed. *See* Arts & Church, *supra* note 48, at 610-611 n.306.

[230] *Millions Drink Water Containing Unsafe Chemical*, Proprietary to the United Press International, Nov. 14, 1990; *see supra* note 15.

commodity surpluses, it seems reasonable from both an economic and a public health standpoint to reevaluate practices that primarily focus on short term productivity. It is hard to defend agriculture's right to pollute as industrial point source pollution becomes increasingly regulated. The most positive answer to this complex problem appears to be a combination of education, voluntary measures with governmental incentives, the removal of disincentives, and some specific regulation. The Nebraska model provides the initial example of this approach.