

TABLE OF CONTENTS

Introduction	1
Groundwater Monitoring Network	1
Monitoring Results and Discussion	2
Pesticide Scans	5
Vadose Zone Coring and Analysis	6
Central Blue Valley Hydrologic Unit Area-	6
Proposed Special Protection Area	8
Potential Pollution Sources	10
Current Problem Areas	13
Groundwater Quality Goals	14
Groundwater Quality Management	16
Groundwater Quality Management Approach	17
Groundwater Sampling Results 1987 through 1994	19
Sampling Locations Outside Proposed SPA (Gage County)	29
Sampling Locations Outside Proposed SPA (Jefferson County)	30
Sampling Locations Outside Proposed SPA (Saline County)	31
Summary Nitrate Monitoring Outside Proposed SPA	32
Locations of Sampling in Central Blue Valley HUA (Blakely Township)	33
Locations of Sampling in Central Blue Valley HUA (Grant Township)	34
Locations of Sampling in Central Blue Valley HUA (DeWitt Township)	35
Locations of Sampling in Central Blue Valley HUA (Plymouth Township)	36
Results of Sampling in Central Blue Valley HUA	37
Nebraska Scan Components	45
Pesticide Scan Sampling Locations	46
Locations of Vadose Zone Sampling Sites	47
1990 Vadose Zone Sampling Summary	48
1991 Vadose Zone Sampling Summary	49
1992 Vadose Zone Sampling Summary	50
Blakely, Grant, and DeWitt Townships Nitrate Results	51
Chemigation Permits Summary	52
City of Beatrice Municipal Wells Nitrate Levels	53
Beatrice SPA Final Report and Recommendations from DEQ	54
Legal Notices	71
1988 DEQ Special Protection Area Report	S PA-1

GROUNDWATER MANAGEMENT PLAN UPDATE

Introduction

This addendum to the Lower Big Blue NRD Groundwater Management Plan is in response to LB 51, enacted by the Nebraska Legislature in 1991, requiring NRD's to amend their groundwater management plans to identify levels and sources of groundwater contaminants within the area, groundwater quality goals, long-term solutions necessary to prevent the levels of groundwater contamination from becoming too high and reduce levels sufficiently to eliminate health hazards, and procedures recommended to stabilize, reduce, and prevent the occurrences, increase, or spread of groundwater contamination.

Since the groundwater management plan was approved in 1986, the district has taken action to accomplish the objectives stated in the plan. By increasing its efforts in the area of groundwater quality programs and projects, all objectives have been completed. Additional staff were added in 1987 to oversee expanding groundwater programs and increasing regulatory responsibilities mandated by the state legislature. A district-wide groundwater monitoring network was established in 1987 to provide baseline data on groundwater quality. Rules and regulations have been adopted by the district pertaining to the Nebraska Chemigation Act and the Nebraska Sediment and Erosion Control Act.

The Lower Big Blue NRD was one of the first NRD 's to request the Nebraska Department of Environmental Quality (NDEQ) to conduct a Special Protection Area (SPA) study in an area northwest of the city of Beatrice. The district believes that education is the key to dealing with groundwater quality problems and has increased its educational efforts towards the adoption of best management practices by participation in nitrogen management demonstrations, work in Blakely-Grant Project and the continuing Central Blue Valley Hydrologic Unit Area. The district has completed a three-year vadose zone study to evaluate the distribution of nitrate-nitrogen in the soil profile under various cropping situations. A program has been implemented to provide financial assistance for materials used to properly seal abandoned wells in the district. Groundwater information is currently being computerized, providing data that is more easily accessed, making comparison and analysis of information more complete.

GROUNDWATER MONITORING NETWORK

The Lower Big Blue NRD established a groundwater monitoring network in 1987 focusing on the sampling of irrigation wells. The wells are sampled during the irrigation season with analysis for nitrate-nitrogen being the major parameter of concern. The district contracts with the Nebraska Department of Health Laboratory (NDOH) for 5-10 pesticide scans a year. Yearly water quality testing results provide the district with baseline information to evaluate and detect changes in groundwater quality. Personnel obtaining water samples are certified Water Well Monitoring Supervisors.

Irrigation wells are sampled instead of domestic wells because irrigation wells are thought to be better indicators of overall groundwater quality because of better construction and the generally greater depths they are drilled. Irrigation wells are also believed to be less likely influenced by point sources of contamination such as septic tanks and wastes from livestock operations that are common near rural domestic wells. The irrigation wells are sampled during the irrigation season, generally in the months of July and August. Laboratory analysis for nitrate-nitrogen is conducted by a private laboratory using EPA approved methods, and the pesticide scans are done by the Department of Health Laboratory.

The groundwater monitoring network has expanded from 50 wells sampled in 1987 to 275 sampled in 1994. Three hundred sixty-five different irrigation wells have been tested since 1987 in the district. Wells selected in the network are located approximately three miles apart. Monitoring of wells in an area recommended for a SPA by the NDEQ is an important element in the monitoring network and accounts for the majority of samples taken during the year. Groundwater monitoring results for all wells sampled by the NRD from 1987 through 1994 can be found in the Appendix on pages 19 - 28. Maps showing sampling locations of irrigation wells outside of the proposed Special Protection Area (SPA) can be found in the Appendix on pages 29 - 31. A summary of nitrate-nitrogen sampling results of irrigation wells located outside of the SPA can be found on page 32 of the Appendix. Numbered location maps for sampling sites for townships in the Central Blue Valley Hydrologic Unit Area (CBV HUA), that also includes the proposed SPA, can be found in the Appendix on pages 33 - 36. Corresponding numbered sampling results to these townships are in the Appendix on pages 37 - 44.

MONITORING RESULTS AND DISCUSSION

1987

The Lower Big Blue NRD began a groundwater quality monitoring program in 1987. Water samples were obtained from fifty irrigation wells across the district. The Nebraska Department of Health Laboratory analyzed the samples for nitrate-nitrogen. Eight of these wells were also analyzed for fifteen commonly used pesticides. Samples were obtained after reviewing proper sampling protocol with Department of Health personnel. The water samples were collected in July by NRD personnel when the irrigation wells were operating.

Results from the nitrate analysis ranged from 0 to 14 mg/l (milligrams per liter). Thirty-seven of the fifty wells sampled were less than 5 mg/l. Eleven wells had nitrate concentrations from 5 to 9.9 mg/l. Only two wells had nitrate levels greater than the safe drinking water standard of 10 mg/l. The average nitrate-nitrogen content of the fifty wells sampled was 3.47 mg/l.

The average nitrate-nitrogen content in fourteen wells sampled in Gage County was 4.45 mg/l. Twenty-one wells tested in Saline County averaged 3.89 mg/l. Jefferson County had an average of 1.95 mg/l in fifteen wells sampled. The eight pesticide scans taken in 1987 showed no detectable traces of pesticides.

1988

In 1988 the district obtained water samples from fifty-two irrigation wells across the district. The Nebraska Department of Health performed the nitrate-nitrogen analysis and also conducted seven pesticide scans.

Nitrate analysis showed a range from 0 to 11.60 mg/l. Forty-one samples had nitrate concentrations less than 5.0 mg/l. Eight wells ranged between 5.0 and 9.9 mg/l. Three wells were above the safe drinking water standard of 10.0 mg/l. The average for all fifty-two irrigation wells tested was 2.86 mg/l. The irrigation wells were sampled in July and August in 1988.

The average nitrate-nitrogen content in thirteen wells sampled in Gage County was 3.33 mg/l. Twenty-two wells tested in Saline County averaged 3.25 mg/l. Jefferson County had an average of 1.99 mg/l in seventeen wells sampled.

1988 was the year the Nebraska Department of Environmental Quality conducted a SPA study in an area northwest of the city of Beatrice at the request of the Lower Big Blue NRD. The NDEQ studied a six-township region in Gage, Jefferson, and Saline Counties. Water samples were obtained from both domestic and irrigation wells in this study. The NDEQ recommended that a SPA be established in approximately a seventy-three square mile area in Gage and Saline Counties. The townships involved in Gage County are Blakely and Grant. Saline County has most of DeWitt Township within this area. Nitrate-nitrogen content in twenty-two domestic wells and twenty-four irrigation wells sampled in the proposed SPA by NDEQ, had an average of 7.46 mg/l. This average did not include wells that were sampled that had probable point-source contamination problems. The NDEQ sampled sixty domestic wells and one hundred three irrigation wells in this study area. The complete SPA study report is included at the end of the Appendix, beginning on page SPA-1. The SPA report pages are labeled SPA-1 through SPA-67.

Following testimony received at a public hearing on July 13, 1989, and after conferring with the NRD, this proposed SPA area was recommended for three years of additional studies to be conducted by the NRD with assistance from DEQ in 1990. This three-year work plan included groundwater quality monitoring, soil vadose zone coring, and increased educational emphasis on "best management practices" dealing with nitrogen and irrigation water management. This three-year plan has been extended an additional two years, to the end of 1994 due to inadequate sampling conditions in 1992 and 1993.

1989

Sixty-five irrigation wells were sampled in the district in 1989. Nitrate readings ranged from less than 1.0 mg/l to 56.20 mg/l. Forty-five of these wells had nitrate-nitrogen concentrations of 5.0 mg/l or less. Twelve wells ranged between 5.0 and 9.9 mg/l. Eight wells were found to be above the safe drinking standard of 10 mg/l. The average nitrate content in the 65 wells sampled was 4.86 mg/l. The Nebraska Department of Health conducted the analysis of these samples along with seven pesticide scans. No detectable pesticide levels were found in 1989. The average nitrate-nitrogen content in twenty-seven wells sampled in Gage County was 8.0

mg/l. Twenty-three wells tested in Saline County averaged 3.67 mg/l. Jefferson County had an average of 1.05 mg/l in fifteen wells sampled.

1990

The Lower Big Blue NRD in 1990 began the first year of additional study in the proposed SPA. The district sampled forty-nine wells in Blakely, Grant, and DeWitt Townships. The average nitrate content was 9.44 mg/l in these wells. The nitrate average of twenty wells sampled in Blakely Township was 11.07 mg/l. Grant Township had an average of 9.22 mg/l in sixteen wells sampled. The average of DeWitt Township was 7.20 mg/l in thirteen wells. These readings included wells influenced by point sources of contamination.

The district also sampled wells outside the proposed SPA in 1990. Sixty-two wells sampled across the district averaged 3.01 mg/l. Nitrate averages ranged from less than 1.0 mg/l to 10.50 mg/l. Forty-eight of the sixty-two irrigation wells sampled had less than 5.0 mg/l nitrate. Ten wells had nitrate reading between 5.0 mg/l and 9.90 mg/l nitrate. Four wells had nitrate concentrations above 10.0 mg/l. Outside of the proposed SPA in Gage County, sixteen wells averaged 3.59 mg/l. In Saline County, outside of DeWitt Township, twenty-seven wells had nitrate averages of 3.81 mg/l. Nineteen wells tested in Jefferson County averaged 1.38 mg/l.

The Nebraska Department of Health again provided analysis for the nitrate testing and also conducted eight pesticide scans. As in previous years testing, no traces of pesticides were found in the wells sampled.

1991

Outside of the proposed SPA , sixty-one irrigation wells were sampled for nitrate- nitrogen in 1991. These wells averaged 3.28 mg/l. Nitrate results ranged from less than 1.0 mg/l to 13.70 mg/l. Seventeen wells sampled in Gage County averaged 4.12 mg/l. Saline County had a nitrate average of 4.07 mg/l in twenty-four wells. Jefferson County averaged 1.62 mg/l in twenty wells. Forty-eight of the sixty-one wells sampled had nitrate levels below 5.0 mg/l and nine wells were between 5.0 and 9.9 mg/l. Four wells tested above 10 mg/l.

Testing in the proposed SPA continued in 1991 with ninety-three irrigation wells sampled for nitrate. The average nitrate content in these wells was 8.87 mg/l. Wells influenced by point sources of contamination were not excluded in these totals. Blakely Township averaged 11.04 mg/l nitrate in forty-six irrigation wells sampled. Grant Township had an average of 6.55 mg/l in twenty-eight wells. In DeWitt Township, nineteen wells sampled averaged 7.03 mg/l nitrate.

1992 and 1993

Extremely wet summers in 1992 and 1993 prohibited the district from obtaining water samples from irrigation wells.

1994

The Lower Big Blue NRD sampled two-hundred seventy-five irrigation wells across the district in 1994 for nitrate-nitrogen content. The nitrate-nitrogen average in these wells was 6.56 mg/l.

The three year Special Protection Area study was completed in 1994. The NRD sampled one hundred thirty irrigation wells in the three township area. Those wells averaged 10.15 mg/l. Forty-nine wells sampled in Blakely township had an average nitrate-nitrogen content of 13.33 mg/l. The average in forty wells in Grant township was 9.88 mg/l. Forty-one wells in Dewitt township averaged 6.64 mg/l.

One hundred forty-five irrigation wells were sampled outside of the proposed SPA in 1994. The nitrate-nitrogen content in these wells averages 3.37 mg/l. Twenty-seven wells sampled in Gage county averaged 4.11 mg/l. The Saline county average in forty-one wells was 4.71 mg/l. Jefferson county had a nitrate-nitrogen average of 2.40 mg/l in seventy-seven wells sampled.

PESTICIDE SCANS

Beginning in 1987, the Lower Big Blue NRD has sampled selected irrigation wells for the presence of pesticides. The Nebraska Department of Health Laboratory conducts a Nebraska scan for twelve selected pesticides and a carbamate scan of two pesticides. The Nebraska scan for organophosphates is analyzed by gas chromatograph. The carbamate screen of two pesticides is analyzed by high performance gas chromatography. A listing of the common and chemical names of the fourteen pesticides is located in Appendix on page 45.

Forty-four irrigation wells have been tested across the district for pesticides. Twenty-four wells have been sampled in Gage County since 1987. Saline County has had twelve wells tested and Jefferson County has had eight wells sampled. The high cost of this type of analysis limits the number of wells the district samples. Legal descriptions of the irrigation wells sampled can be found on page 46 of the Appendix.

Results of the pesticide scans indicate that groundwater contamination from pesticides at this time is not a serious problem across the district. Of the forty-four wells sampled for pesticides since 1987, four irrigation wells have been shown to have traces of the pesticide atrazine. Two wells tested in 1991 had 0.30 parts per billion atrazine. This level is ten times less than the safe drinking standard of 3.0 parts per billion. Two wells tested in 1994 had atrazine traces of 0.40 parts per billion and 1.0 parts per billion.

VADOSE ZONE CORING AND ANALYSIS

The Lower Big Blue NRD has completed a three-year vadose zone study to evaluate the distribution of nitrates in soil profiles of fields under typical farming practices. Soil cores were taken to depths of thirty feet. The study was focused in an area of the district that was recommended for a special protection area designation by the Department of Environmental Quality. Information gained from the study is being used to: 1) quantify nitrate-nitrogen in individual soil profiles; 2) evaluate nitrate distribution within soil profiles under different cropping situations and 3) estimate the potential impacts of accumulated soil nitrate on groundwater quality.

This study was started in 1990 and completed in 1992. A private laboratory was contracted to do the coring and analysis. NRD personnel were responsible for site selection. Soil cores were taken at each location using a hydraulic core sampler. The cores measured approximately 1.75 inches in diameter and were collected to depths from 15 to 30 feet.

The cores were divided into separate depth increments to obtain samples. In the surface 12 inches, the core was divided into 6-inch increments. From one to ten feet, the core was divided into one-foot increments. Below ten feet, the core was divided every two feet. Samples were collected in plastic zip-lock bags and placed in coolers until they were transported to the laboratory for analysis.

Forty different sites were sampled for the study, with a total of forty-six cores obtained. A total of twenty different gravity irrigated fields were sampled, twelve pivot irrigated fields, eight dryland fields, five pasture or native grass fields, and one wooded area. Six gravity irrigated sites were sampled at the upper and lower ends of the fields. Results ranged from a high of 988 pounds per acre of nitrogen to a low of eighteen pounds per acre. A map showing the numbered core locations can be found in the Appendix on page 47. A summary of each year of testing can be found beginning on page 48 of the Appendix. A report for each year of the study can be obtained at the NRD office.

CENTRAL BLUE VALLEY HYDROLOGIC UNIT PROJECT

The Central Blue Valley Water Quality Hydrologic Unit (CBVHUA) is a cooperative effort involving the Lower Big Blue NRD, Soil Conservation Service, University of Nebraska Extension, and the Agricultural Stabilization and Conservation Service. Approved in 1991, it is one of thirty-seven hydrologic units funded nationwide to provide assistance to producers for installing water quality practices in areas affected by non-point source groundwater contamination. Part of the HUA was also involved in the Blakely-Grant Water Quality Special Project. This project was an ASCS Special Water Quality Project for financial assistance only and was completed in 1990.

The CBVHUA is made up of 92,160 acres in four townships. Blakely and Grant Townships located in Gage County, DeWitt Township in Saline County and Plymouth Township in Jefferson County. These four townships were included in the Nebraska Department of Environmental Quality Special Protection Area study in 1988.

The objectives of the Central Blue Valley Hydrologic Unit are:

- 1) Conserve groundwater and promote the efficient use of water resources.
- 2) Improve the quality of surface and groundwater by preventing or reducing pollution of water from non-point sources.
- 3) Promote the efficient use of nitrogen fertilizer to impede leaching of nitrates into the aquifer from excess fertilizer applications.
- 4) Demonstrate and educate the proper use of best management practices for water, fertilizer, and pesticide applications.
- 5) Improve management and utilization of animal waste facilities in the total nutrient management system.
- 6) Provide and utilize accurate weather information to assist farmers in irrigation scheduling.
- 7) Increase public awareness of water quality problems and actions being taken to address those problems.

The objectives and goals of the project will be achieved by the installation and application of best management practices. Best management practices that are being applied are irrigation water management, irrigation reuse systems, surge irrigation systems, land leveling, underground pipelines, animal waste holding ponds, anaerobic lagoons, pest management, and nutrient management.

The best management practices are being applied through the use of Long Term Agreements, utilizing cost-share funds provided by the Agricultural Conservation Program (ACP). The ACP practices that are being effectively used are WC-4 Irrigation Water Management, WP-4 Animal Waste Facilities, and SP-53 Integrated Crop Management.

A more detailed description of this project and its accomplishments can be found in the 1991, 1992, 1993, or 1994 ANNUAL REPORT OF THE CENTRAL BLUE VALLEY HYDROLOGIC UNIT PROJECT, available from the Lower Big Blue NRD office.

Township maps showing the location of irrigation wells and sampling results in the project area can be found in the Appendix, beginning on page 33.

PROPOSED SPECIAL PROTECTION AREA

A six- township area northwest of Beatrice, Nebraska, has been studied by the Nebraska Department of Environmental Quality (NDEQ) for possible designation as a Special Protection Area (SPA) under the authority of the Ground Water Protection and Management Act, Nebraska Revised Statute 46-674.02-46-674.20 (Cum. Supp. 1986) and NDEQ's Title 196. This study was initiated by a request from the Lower Big Blue Natural Resources District in November of 1987. The district believed that studies conducted by the NRD and state agencies indicate nitrate-nitrogen levels in groundwater near the city of Beatrice well field have increased over the years and that there is a potential for further contamination in the area. A two-part water well sampling plan was carried out in 1988, taking samples from domestic wells in March and from irrigation wells in August.

The major aquifer in the area is a buried paleovalley filled with sand and gravel. It varies from 0 to 200 feet in thickness. Most irrigation and many domestic wells are completed in these sand and gravel layers. Irrigated cropland is the dominant land use in the central part of the study area. Dry land farming and pasture are prevalent on the northwest side of the Big Blue River and in the western part of the study area.

Several locations with probable nitrate-nitrogen point source contamination were discovered during the well sampling portion of the study. When these high concentrations were omitted from the data, a clear pattern of nitrates higher than 7 mg/l nitrate-nitrogen emerged in parts of the northeast, southeast, and north central townships studied. A Special Protection Area designation is proposed for parts of these townships. The Special Protection Area study report by the NDEQ can be found at the end of the Appendix, beginning on page SPA-1.

Following a public hearing on July 13, 1989, the Lower Big Blue NRD and NDEQ entered into a Memorandum of Agreement for the purpose of a three-year work plan to conduct further studies in the proposed SPA. The work plan is designed to:

1. Further define the source(s) of non-point source (NPS) contamination, as well as identify any point sources of contamination which may affect groundwater quality monitoring.
2. To better define the extent of the NPS contamination in order to establish more sound and defensible SPA boundaries.

The work plan emphasizes three areas of activities that the NRD should direct actions toward; groundwater monitoring, vadose zone sampling, and information and educational programs. This agreement has been extended an additional year until the end of 1994 due to usually wet summers in 1992 and 1993 that limited irrigation well water sampling.

In 1990, the Lower Big Blue NRD began an intensive groundwater sampling program within the boundaries of the proposed Special Protection Area. The district sampled 49 irrigation wells in Blakely, Grant, and DeWitt Townships. The irrigation wells were sampled by NRD personnel in July and August of 1990. Laboratory analysis was conducted by the Nebraska Department of Health Laboratory. All forty-nine wells were tested for nitrate-nitrogen, with fourteen also tested for chloride. Four wells were selected for the Nebraska Scan, an analysis for fourteen commonly used pesticides.

Nitrate content in the irrigation wells ranged from less than 0.1 mg/l to a high of 66.1 mg/l. Blakely Township had an average of 11.07 mg/l in twenty wells tested. The Grant Township average was 9.22 mg/l in sixteen wells. DeWitt Township nitrate average was 7.2 mg/l in thirteen wells. These results include wells influenced by probable point sources of contamination. Chloride sampling results ranged from 12 mg/l to 70 mg/l in the fourteen wells sampled. In Blakely Township, eight wells sampled with three sampled in Grant Township and three in DeWitt Township.

Testing in the proposed SPA continued in 1991 with ninety-three irrigation wells sampled for nitrate. The average nitrate content in these wells was 8.87 mg/l. Wells influenced by point sources of contamination were not excluded in these totals. Blakely Township averaged 11.04 mg/l nitrate in forty-six irrigation wells sampled. Grant Township had an average of 6.55 mg/l in twenty-eight wells. In DeWitt Township, nineteen wells sampled averaged 7.03 mg/l nitrate.

Groundwater monitoring in 1992 and 1993 was limited by wet weather conditions throughout the irrigation season. 1994 was a much better summer to obtain water samples from irrigation wells. A total of one hundred thirty wells were sampled in the project area. The average nitrate-nitrogen in those wells was 10.15 mg/l. Forty-nine wells were sampled in Blakely township. The average nitrate-nitrogen content averaged 13.33 mg/l. In Grant township, forty wells averaged 9.88 mg/l. Dewitt township averaged 6.64 mg/l in forty-one wells.

A summary of sampling results from irrigation wells since 1987 in Blakely, Grant, and DeWitt Townships can be found on page 51 of the Appendix.

The Nebraska Scan is the pesticide screen performed by the Nebraska Department of Health Laboratory. This test looks for fourteen commonly used pesticides in Nebraska. Since 1987, twenty irrigation wells have been sampled in the study area. Laboratory analysis in 1991 showed detectable levels of atrazine at 0.3 parts per billion in two wells. These detections were the first traces of pesticides found since monitoring began. The maximum contaminant level (MCL) for atrazine is 3.0 parts per billion. 1994 testing resulted in detections in two wells of 0.40 parts per billion and 1.0 parts per billion. A listing of pesticide scan locations can be found in the Appendix on page 46.

POTENTIAL POLLUTION SOURCES

The number of potential groundwater pollutants in the district are many and varied. Many everyday activities can have direct and indirect affects on groundwater quality. Land use and population centers all can impact groundwater quality. Sources of pollution are usually identified as either point sources or non-point sources. An example of a point source of contamination would be a leaking underground storage tank. Non-point sources of contamination in Nebraska are generally related to agricultural production practices. Non-point source pollutants are carried over and through the ground by precipitation, or seepage, and can affect both surface water and groundwater. It is quite possible that certain contamination problems are the result of both point and non-point source influences.

The potential of areas in the district to contamination can be evaluated using a DRASTIC map. DRASTIC is an acronym for the seven hydrologic factors that are evaluated to determine the pollution potential of an aquifer. A colored map can be produced that looks at 1) depth to water, 2) net recharge, 3) aquifer media, 4) soil type, 5) topography, 6) vadose zone, 7) and hydraulic conductivity. The DRASTIC map can be used to evaluate the potential or vulnerability to contamination of different areas of the district. The NRD has a DRASTIC map of an area of the district that is being considered for special protection area designation by the NDEQ. Areas showing the potential of high vulnerability were irrigated land with shallow depths to groundwater. DRASTIC allows for comparisons of different areas to possible contamination. Knowing what areas are more at risk to contamination can be used to help make decisions on such things as landfill sites or where to target groundwater monitoring efforts.

The NDEQ administers the Well Head Protection Program in Nebraska. This voluntary program is designed to help protect municipal well fields from contamination. The NDEQ has developed a time- of-travel map for many well fields in the state. In the LBB NRD, maps have been completed for Beatrice and Swanton. The maps delineate ten and twenty year time-of-travel zones of groundwater to reach the well fields. With this information, an inventory of potential contaminants can be completed in this zone to assess future risks to the well field. For example, if a municipal well happens to be located in town, the inventory could list the number of gas stations with underground storage tanks or industries generating hazardous waste in these time-of-travel zones. Also, better decisions can be made regarding land use in areas surrounding well fields.

Another tool to be used to educate and create awareness of potential contamination problems in rural areas is the Farm*A*Syst: Farmstead Assessment System. This program is designed to help farmers and rural residents voluntarily assess well water pollution risks by looking at their homes, farm buildings, farm practices, and the land around them. Through the CBV HUA funds, the Extension Service contracted with a biology teacher during the summer of 1994 to revise five facts developed in Wisconsin to Nebraska conditions. These fact sheets deal with drinking water wells, livestock waste, hazardous materials, petroleum products, and household waste water. A facilitator will be hired to meet with individuals at their homes to go through the fact sheets with them. By reviewing the fact sheets, rural residents can see

where they can make improvements in their everyday activities to decrease the chances of contaminating their water supply.

POINT SOURCES

Potential point source contaminants in the district include waste water treatment facilities, underground storage tanks, feedlots, confinement operations, septic tanks, industrial sites, abandoned wells, and landfills. There are several documented accidental releases of contaminants in the district that fall under the supervision of state agencies for proper clean up. The Federal Clean Water Act designates the states with the responsibility for monitoring many point source contamination problems. Some of these sites have adversely affected groundwater quality in localized areas. One town in the district has taken one of its wells out of production because of a point source contamination problem.

Many activities that have the potential for causing point source contamination must follow state guidelines for construction and have proper permits from state regulatory agencies. The Nebraska Department of Environmental Quality oversees many of these activities. Some of these responsibilities include the licensing of livestock facilities and landfills, and monitoring the installation of underground storage facilities. Recent changes in regulations have reduced the chances of accidental spills, however many activities have taken place prior to the time regulation was required. Leaking underground storage tanks pose problems for nearly all towns in the district. Unregulated landfills also are a threat to water quality.

The Nebraska Chemigation Act requires that a permit be obtained from the Natural Resources District before any fertilizer or pesticide is applied through an irrigation system. These permits are approved following an on site inspection for required safety equipment and operation of the system to insure the equipment is working properly. The Lower Big Blue NRD requires an annual inspection for chemigation permits. The number of chemigation permits for irrigation systems has increased every year since the program began in 1987. No accidents have been reported that have caused any groundwater contamination problems. A summary of chemigation permits issued by year in the NRD is found in the Appendix on page 52.

Abandoned wells represent a significant hazard as a point source of potential groundwater contamination. They provide a direct link from the land surface for contaminants to enter the underground aquifer. It is estimated that there are over six thousand abandoned wells in the NRD. Many of these wells would now be impossible to locate but a significant number are still visible and need to be properly sealed.

The Lower Big Blue NRD initiated a cost-share program in 1992 for the proper sealing of abandoned wells in the district. Cost-share is intended to provide assistance to landowners for materials used to properly seal their old wells. Cost-share assistance has increased every year in the amount of money budgeted for the program and in the maximum amount of cost-share allowed per well. In addition, the number of wells being properly sealed has increased each year.

The NRD in FY 1994-95 qualified for the Water Well Decommissioning Fund administered by the Nebraska Natural Resources Commission. This fund reimburses NRDs for cost-share money used to decommission wells when required procedures for decommissioning are

followed. This program allows the Lower Big Blue NRD to provide more dollars and at a higher rate than otherwise could be done by the district.

Listed below is a summary of the NRDs well decommissioning program, indicating the number of wells properly sealed and the amount of cost-share funds budgeted for this program:

LBB NRD WELL DECOMMISSIONING BUDGET

	FY 1992-93	FY 1993-94	FY 1994-95	FY 1995-96
WELLS SEALED	16	36	40	--
BUDGETED AMOUNT	\$1,000	\$2,500	\$4,300	\$5,000

NON-POINT SOURCES

Non-point source contamination of groundwater is usually the the result of actions related to human activities. In the Lower Big Blue NRD, the potential for non-point source pollution is greatest from agricultural activities because the major land use is production agriculture. The application of agricultural chemicals and fertilizers on large areas of land in the district has the potential to become sources of contamination by over application or from runoff that occurs from heavy precipitation.

The major concern of non-point pollution in Nebraska and the Lower Big Blue NRD deals with the levels of nitrate-nitrogen in groundwater. The districts previously described groundwater monitoring program currently focuses on nitrate-nitrogen as the primary contaminate of concern. Increasing levels of nitrate-nitrogen in the city of Beatrice well field was a factor in the decision made by the district board of directors to request a Special Protection Area study to be conducted by the Nebraska Department of Environmental Quality in 1988. Three other towns in the NRD have been cited by the NDOH for violating the safe drinking water standard for nitrate-nitrogen. Nitrate-nitrogen levels in the Beatrice city wells can be found page 53 of the Appendix.

CURRENT PROBLEM AREAS

The Lower Big Blue NRD has a four-township area where nitrate-nitrogen levels have become a concern of the district and area residents. This area is Blakely and Grant Townships in Gage County, DeWitt Township in Saline County and Plymouth Township in Jefferson County. This area is divided by the Big Blue River, which runs northwest to southeast. Major creeks are Swan, Turkey, Clatonia, Dry, and Cub. The 92,160 acres contained in this area is primarily cropland. Irrigated crop land comprises 41%, or 38,000 acres in this area. Main irrigated crops are corn and soybeans. There are 384 irrigation wells which provide water for gravity irrigation on 25,000 acres. Another 60 wells provide water for center pivot irrigation on 8,000 acres.

Approximately 51% of the area, or 47,000 acres is dry land crop land. Crops on dry land acres are grain sorghum, wheat, soybeans, and alfalfa. About 7,100 acres consist of farmsteads, roads, and urban areas.

There are 189 livestock operations in the area ranging from beef, dairy, swine, and sheep, to poultry. The size of these operations varies greatly, with the majority being beef, swine, and dairy.

Groundwater resources in this area serve as the principal drinking water supply for some 14,400 residents in the towns of Beatrice, Filley, Plymouth, and DeWitt as well as 1,100 rural residents. The towns of Plymouth and DeWitt are located in this area. All municipal wells have experienced increases in the nitrate-nitrogen levels.

The main aquifer in this area is a paleovalley which was cut into bedrock by a major stream in pre-glacial times. Depth to groundwater varies from less than 20 feet along the river valley to 200 feet on lands above the valley.

There are two commercial fertilizer manufacturing plants in this area. Both of these facilities have documented accidental releases of chemicals that have impacted water quality in the immediate area. Remediation actions are currently in progress at these sites under the supervision of NDEQ.

This area has been the focus of several groundwater studies over the years. A three-year study by the Conservation and Survey Division-UNL, in 1981 sampled 136 groundwater samples for nitrate-nitrogen, chloride, and conductivity. This study indicated that wells with nitrate-nitrogen greater than the safe drinking standard of 10 mg/l were the result of localized point sources of contamination.

Further study in this area was begun in 1985 when the district again contracted with the Conservation and Survey Division-UNL to determine nitrate concentrations in soil profiles to determine whether nitrate movement is occurring below crop root zones under different cropping patterns. This study concludes that nitrate-nitrogen is moving through soil profiles to the groundwater table.

In 1987, the Lower Big Blue NRD requested that a Special Protection Area study in this area by the Nebraska Department of Environmental Quality. The NDEQ study in 1988 resulted in a recommendation for a Special Protection Area for part of this area.

Following the SPA study, the NRD was approved by NDEQ to continue studies in this area for three additional years to better define the sources and the extent of contamination. Due to delays in obtaining water samples, this study concluded in 1994. The NDEQ has reviewed the data of this study and believes the information confirms the findings of the 1988 SPA study. The NDEQ has recommended to the NRD board that a Special Protection Area be designated in parts of Dewitt, Blakely, and Grant Townships. A copy of the final Beatrice SPA report and recommendations is found in Appendix, beginning on page 54.

GROUNDWATER QUALITY GOALS

The Lower Big Blue NRD recognizes that the potential for groundwater contamination exists in the district and is, in fact, occurring in some locations. Efforts by the district in the area of groundwater monitoring have been in establishing baseline data to evaluate trends and problem areas. Monitoring for nitrate-nitrogen has indicated that certain areas of contamination are the result of both point and non-point source contamination. More study needs to be completed to better identify the sources of these contaminants and their combined influences in these areas. The threat of groundwater contamination from chemicals other than nitrate-nitrogen does not currently appear to be a problem in the district. The NRD will continue to use pesticide scans to monitor groundwater for the presence of other contaminants.

Vadose zone studies indicate that nitrate-nitrogen found below crop rooting depths has the potential for moving into groundwater aquifers. The fate of other possible contaminants besides nitrate-nitrogen in the vadose zone is not well understood. The district realizes that its efforts to change habits and reduce inputs of nutrients and pesticides will not show measured changes in groundwater quality in the short term. The use of best management practices will certainly reduce the loading potential of nitrate-nitrogen and other possible contaminants below crop rooting depths and in the long term result in improved water quality.

The district believes that education is the key to dealing with groundwater contamination problems. Educational efforts come from many sources and is the reason the district supports and is involved with several different agencies that are addressing water quality. Cooperation among all agencies is vital to the success of efforts in dealing with groundwater contamination.

The district believes the following goal and objectives will provide direction to the board and staff as decisions are made to address groundwater quality problems in the future.

GROUNDWATER QUALITY GOAL

It shall be the goal of the Lower Big Blue Natural Resources District to reduce the potential of groundwater contamination across the district and improve groundwater quality to acceptable standards appropriate to its use forever.

Objective 1:

.The Lower Big Blue NRD will continue its groundwater monitoring network to obtain the most accurate results possible.

- 1) Groundwater monitoring network will be continued with yearly evaluation of testing parameters and need for expansion as data indicates.
- 2) Incorporate other sources of groundwater monitoring information into district data base when available and appropriate.
- 3) Information obtained from monitoring will be reviewed with appropriate sources, for guidance in interpretation and evaluation of results.

Objective 2:

Increase public awareness and understanding of groundwater quality problems in the district.

- 1) The district will continue its involvement and support in the Central Blue Valley Hydrologic Unit.
- 2) Provisions of the work plan being implemented in the proposed Special Protection Area will be continued.
- 3) Continue participation in " Earth Festival " and Southeast Nebraska Environmental Education Seminar.
- 4) Develop with Cooperative Extension a demonstration program addressing proper lawn nutrients/water practices in 1996.
- 5) Assist Cooperative Extension on development and utilization of Farm Assessment Program.
- 6) Continue to provide the public, through news items, newsletters, and other educational means, information on best management practices, monitoring results, and issues related to groundwater quality.

Objective 3:

The district will continue current programs and projects that result in reduced potential for groundwater contamination and improve overall water quality.

- 1) Continue enforcement of the Nebraska Groundwater and Protection Act, the Nebraska Chemigation Act, and the Nebraska Sediment and Erosion Control Act.
- 2) Continue participation in the Nebraska Soil and Water Conservation Program and PL-566 Watershed Program.
- 3) Continue funding of soil and water conservation land treatment practices as budget allows.
- 4) Continue well decommissioning cost-share program in the district.
- 5) Continue cost-share program for irrigation surge valves in 1993.

GROUNDWATER QUALITY MANAGEMENT

The district has several options available to it for dealing with non-point source contamination of groundwater. Non-regulatory actions are currently being used, and are the preferred method for dealing with contamination, but other actions may be needed in the future in some areas.

The Nebraska Groundwater Management and Protection Act provide NRD's with two approaches in dealing with groundwater contamination. One approach is a Groundwater Quality Management Area (GQMA) and the other is a Special Protection Area (SPA) designation. Both of these special areas have similar regulatory options that the NRD can use to deal with non-point source contamination. At the present time the district is completing additional studies in a proposed SPA that will determine what actions the NRD takes regarding contamination in the area. The NRD will continue to work closely with the NDEQ on this study that will end with a public hearing in 1995.

GROUNDWATER QUALITY MANAGEMENT APPROACH

The NRD sees advantages in both the GQMA and SPA, and believes that the preferred alternative should be used based on the nature and extent of the contamination. A public hearing was held by the district on August 26, 1993, to receive public comments, questions, and input for this addendum to the district's groundwater management plan. Copies of the published legal notices can be found in Appendix D, beginning on page 73. The Extension Service held a meeting September 1, 1993, for landowners and operators who live in the area of the proposed Special Protection Area. This meeting was held at the Homestead National Monument, and topics discussed were proposed additions to the district's groundwater management plan and an explanation of Groundwater Quality Management Areas and Special Protection Areas.

The district believes a three-phase approach, based on the Safe Drinking Water Standards established by the U.S. E.P.A., that keeps levels of contaminants below the MCL standards, can be implemented to address groundwater quality problems in the future. The district will initiate action to create a GWMA over the entire Lower Big Blue NRD. The district will continue efforts of information and education of producers on best management practices to prevent and reduce groundwater contamination, both urban and rural, in areas where monitoring indicates levels less than 60 % of MCL. Using the district's groundwater monitoring network to provide data on groundwater quality, levels of contaminants can be monitored. The district will expand its monitoring network to include a representative number of domestic wells in areas of the district that do not have irrigation wells. The three-phases are described below.

Phase I Area defined as having an average groundwater contamination level of less than 60 % of the MCL.

1. Encompass entire NRD
2. Voluntary Best Management Practices
3. Information and Education programs for BMPs.

Phase II Area defined as having an average groundwater contamination level of between 60% and less than 90 % of the MCL.

1. District's groundwater monitoring program provides information on groundwater quality.
2. When monitoring indicates an area at or near the 60 % MCL, additional monitoring will be done in the area for a minimum of two years on 30 % of the registered irrigation wells in the area. If irrigation wells are not available, a representative sample of domestic wells will be monitored. Every effort will be made to eliminate point source influences when evaluating monitoring results. Nitrogen isotope analysis may be used to determine sources of nitrate contamination. If monitoring results indicate an area of at least 36 contiguous square miles with elevated MCLs of between 60 % and 90 % of the MCL, it will become a Phase II area. A phase II area will be re-evaluated every five

years for boundary changes. A minimum change of twelve square miles would be needed to expand or decrease boundaries.

Requirements in Phase II area:

- a. Operator Certification - certification every four years for operators in nutrient/water management. Urban and non-farm rural residents will be targeted for educational programs for proper lawn/nutrient management targeted for their needs.
- b. Deep soil sampling for residual nitrate (3-4 ft.)
- c. Irrigation Scheduling
- d. Irrigation Well Sampling
- e. Fall Application of fertilizer prohibited before November 1st .
- f. Analysis of manure applications
- g. Annual reporting to NRD of sampling results, water use, with UNL recommendations for yield goals based on sampling results.
- h. Other "best management practices" that have been proven effective.

Phase III Area defined as having an average groundwater contamination level above 90% of the MCL.

Same requirements as in Phase II with the addition of:

- a. Fall and winter application of fertilizer prohibited until after March 1st.
- b. Require split application of fertilizer and the use of nitrification inhibitors

A Phase III area will be re-evaluated every five years for boundary changes. A minimum change of twelve square miles would be needed to expand or decrease boundaries.