

**Mills County Nitrate Education and Remediation Program
2003 Soil and Water Conservation Grant
Final Report**

I. Background

The homeowners in the City of Mullin in Mills County rely almost exclusively on private water wells for domestic water use. During the Spring of 2002, nitrate concentrations above the maximum contaminate level of 10 mg/L in the school's water supply well raised concerns of possible high nitrate concentrations in all private water wells in the city and surrounding area. This concern was documented during a private water well screening program conducted in May 2002 by the Mills County Extension Office and the City of Mullin. Following this event, a reconnaissance trip was taken to ground truth the location of high nitrate water wells in relation to the boundary of the city. During this trip, it was determined that the vast majority of the high nitrate concentration wells were located inside the actual limits of the City of Mullin.

II. Project Design

Following the water well tracking trip, Stan Dykes, then CEA-Ag/NR for Mills County, Richard Spinks, Mullin City Mayor, and Monty Dozier, TCE water resources specialist, met and made plans to determine ways to resolve this water quality issue. It was decided to submit the nitrate remediation project for consideration funding from a Soil and Water Conservation grant. With the funding secured, a three-fold approach to addressing the issue was designed. This approach included providing a water screening event for Mills County in 2003, locating and plugging several abandoned water wells within the city limits of Mullin, and supplying under-the-sink reverse osmosis(RO) units for citizens of Mullin with high nitrate water wells.

III. Results and Discussion

A water screening event was held on June 3 at the Mullin Community Center. Twenty four private water wells were sampled and screened for the presence of fecal coliform bacteria. Additionally, water samples were screened to determine nitrate and salinity concentrations in mg/L or parts per million (ppm).

Of the samples screened, three had bacteria present in the water. This represents 12.5% of all samples screened. The average nitrate concentration for all samples was 12.2 ppm and average salinity was recorded at 824 ppm.

An educational program following the screening effort was conducted to review findings and to provide instruction on reducing the risk of bacterial and reducing nitrate contamination in private water wells. The principals of wellhead protection outlined in the Tex*A*Syst program were also presented. Pre and post tests to measure the success of information transfer were also conducted. This information is included in the outcome section of this report.



On-site water well screening provides water quality information to private water well owners related to bacteria, nitrate, and salinity in a quick and efficient manner.

The water well plugging event was conducted to provide educational information on plugging abandoned water wells for the citizens of Mullin. During a 2002 scouting trip, several abandoned water wells were identified as potential sources of bacteria and nitrate contamination. Several of these wells were in close proximity to livestock feeding areas and were at high risk to animal waste related contamination. Working in cooperation with Dr. Bruce Lesikar, TCE Biological and Agricultural Engineering, and the new CEA-AG/NR for Mills County, Tom Guthrie, a private water well closure day was held on the 26th of August. During this event, four abandoned water wells were closed including three within in 50 yards of livestock feeding areas. All wells were plugged by sealing the well from its bottom to within three feet of the surface using bentonite chips. The final three feet of each well was then sealed using Portland cement. The four wells sealed were all located inside the city limits of Mullin and thus eliminates four potential sources of bacterial and nitrate contamination.



This is an open, abandoned water well in located in a goat pasture in Mullin. This open hole provided direct access of contaminants to the aquifer below and served as a potential risk to small children and young livestock to injury.



This is the same water well after it was properly plugged. This well is no longer a potential site of groundwater contamination or risk to small children or animal that way come into contact with it.

The last part of this program centered on the distribution of water treatment (RO) units to citizens of Mullin previously identified as having water wells with high nitrates. Units were distributed to the identified well owners with the assistance of leaders of Mullin. An installation training was conducted by Monty Dozier and Tom Guthrie for some of the well owners, as well as, volunteers who were recruited to assist individuals in unit installation. The water treatment units installed were 5 stage Reverse Osmosis units. Two on the installed units were sampled to determine % reduction of nitrate and salinity associated with use of the RO units for human consumption.



Monty is shown working with a volunteer from Mullin to install one of the RO units at Kathy Henry's residence during a hands-on training session for citizens getting RO units and others who will assist in RO unit installation.

IV. Program Outcomes

By attending the Tex*A*Syst wellhead protection educational seminar associated with this effort, participants demonstrated a measured increase in knowledge gained from 63.5% correct responses (questions related to the information presented) to 74.5%. This is based on results recorded from a pre and post test used for this program. This pre and post test was designed for use in wellhead protection programming efforts with the assistance of Scott Cummings of TCE Extension Education.

According to the TCE "Plugging Abandoned Water Wells – Facilitator Guide", abandoned water wells are a threat to personal safety and to the quality of groundwater. The guide documents 17 cases of children and adults falling into abandoned water wells with some suffering injury or even death. With the closure of four water wells inside the city limits of Mullin, this risk has been reduced. Further, the quality of the water supply located in the aquifer below Mullin has also been protected from potential contamination

from surface pollutants. An abandoned well serves as a direct conduit from the soil surface to the aquifer below. Contaminants entering abandoned water wells can flow directly into the aquifer. This direct access eliminates the natural filtration and protection of soils and geologic materials. Small amounts of a contaminant flowing directly into groundwater can contaminate large quantities of water. For example, one gallon of gasoline can render 1,000,000 gallons of water unsuitable for human consumption. It has also been estimated that a single gallon of the herbicide 2,4-D can contaminate 3 to 4 million gallons of water and that level of contamination would effect approximately the entire water held in the upper three feet of an aquifer over a 20 acre area. By closing four water wells in Mullin, the risk of personal injury and groundwater contamination associated with abandoned water wells has been reduced.

To determine the effectiveness of the 5 stage RO units secured and distributed to wellowners in Mullin, pre and post RO unit samples were collected and screened for nitrates and salinity. The results were as follows:

Sample ID	Nitrate Conc. (ppm)	Salinity Conc. (ppm)
Hart Well Pre PO	11.6	617
Hart Well Post RO	1.5	100
Henry Well Pre RO	27.0	819
Henry Well Post RO	7.2	166

As you can see, the RO units significantly reduced the concentration of both contaminants from levels above the US-EPA public drinking water standards (10 ppm, nitrate and 500 ppm, salinity) to much more safe levels below the EPA standards. Therefore, according to this screening information, water concentration levels for nitrate and salinity for the Hart and Henry water wells are acceptable for human consumption.

V. Acknowledgements

Special thanks is extended to the Texas Water Resource Institute for funding this project and to Kathy Henry and Richard Spinks, both of Mullin, for coordinating events and information distribution to the citizens of Mullin.