

Continued Statewide Delivery of the Texas Well Owner Network (TWON)

FINAL REPORT

TSSWCB Contract #17-56

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Well Owner
NETWORK




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make every drop count

Funding provided through a state nonpoint source grant from the Texas State Soil and Water Conservation Board

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List of Acronyms

BAEN	Department of Biological and Agricultural Engineering, Texas A&M University
BMPs	Best management practices
EPA	U.S. Environmental Protection Agency
MCL	Maximum Contaminant Level
SCSC	Department of Soil and Crop Sciences, Texas A&M University
TMDL	Total maximum daily load
TSSWCB	Texas State Soil and Water Conservation Board
TWON	Texas Well Owner Network
TWRI	Texas Water Resources Institute
WPP	Watershed protection plan
USGS	U.S. Geological Survey

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- Groundwater conservation districts for presenting information on local groundwater conditions and challenges

Executive Summary

The Texas A&M AgriLife Extension Service (AgriLife Extension), through the Departments of Soil and Crop Sciences (SCSC) and Biological and Agricultural Engineering (BAEN) and the Texas Water Resources Institute (TWRI), conducted 9 well owner trainings and 12 well owner screenings throughout the state of Texas through the Texas State Soil and Water Conservation Board (TSSWCB) project 17-56 *Continued Statewide Delivery of the Texas Well Owner Network* funded through a state nonpoint source grant from the TSSWCB.

Private well owners are independently responsible for monitoring the quality of their well water, and they are frequently at greater risk for exposure to compromised water quality. Since management and protection of private, domestic and irrigation water sources are under the control of the landowner, they depend primarily on education rather than regulation to protect their well water.

In 2010, TWRI, SCSC and BAEN, parts of AgriLife Extension at Texas A&M, developed the Texas Well Owner Network (TWON), with funding and support from TSSWCB and EPA, to help educate landowners about well water quality testing, protection and management. TWON was designed to deliver science-based, community-responsive education curriculum and focused on protecting groundwater quality and aquifer integrity. *Continued Statewide Delivery of the Texas Well Owner Network* is a continuation of the original 2010 program with state nonpoint funds from TSSWCB.

TWON trained Texans regarding water quality and best management practices for protecting wells and surface waters, which will avert off-site transport of contaminants (bacteria and nutrients) to surface waters, prevent contamination of underlying aquifers and safeguard the water quality and health of landowners and their families.

TWON is also an effective tool used to support watershed protection planning and total maximum daily load implementation efforts where investigations indicate bacterial and nutrient contributions.

This was achieved by (1) delivery of TWON educational materials and trainings; and (2) evaluation and assessment of the program so needed modifications and improvements could be made. This project continued the work originally conducted under the *Preventing Water Quality Contamination through the Texas Well Owner Network* project #10-04 and *Statewide Delivery of the Texas Well Owner Network* project #13-08.

Introduction

More than 1,000,000 private water wells in Texas provide water to citizens in rural areas and, increasingly, to those living on small acreages at the burgeoning rural-urban interface. Public drinking water supplies are generally of good quality and are monitored through requirements of the federal Safe Drinking Water Act; however, private well owners are independently responsible for monitoring the quality of their wells and frequently at greater risk for exposure to compromise water quality. Management and protection of private, domestic and irrigation water sources are under the control of the landowner, and therefore, depend primarily on education rather than regulation.

The U.S. Geological Survey (USGS, DeSimone et al. 2009) reported that nitrate was the most common contaminant in private wells derived from man-made sources at concentrations greater than EPA's Maximum Contaminant Levels (MCL) for public water supplies. A second finding, potentially affecting a greater portion of the population, was that total coliform bacteria, a broad group that includes bacteria from soil, water and animal feces, was detected in 34% of sampled wells. The MCL goal for coliform bacteria, including *Escherichia coli*, in drinking water is zero because this group is a predictor of the probable presence of pathogenic bacteria.

These broad findings of the USGS study are similar to those reported in Texas. For 2003–2008, Texas Water Development Board reported that for the 3,861 private water wells sampled, the percentage of wells exceeding the nitrate MCL varied from 2% to 50% each year, depending on which regions of Texas were targeted for sampling (www.twdb.state.tx.us/mapping/). Moreover, results of well screenings conducted by AgriLife Extension from 2003–2009 indicate that about 33% of Texas' private wells contained fecal coliform bacteria.

The two categories of the most common private well pollutants, fecal coliform bacteria and nutrients, also are the most frequent cause of stream impairment or concern in Texas. It is likely that in many cases, local release of fecal coliform bacteria and nutrients is not limited to contamination of the property owner's private well and these contaminants are transported off-site and contribute to pollutant loadings in surface waterbodies.

To address these issues affecting both surface water and groundwater, the Texas Water Resources Institute (TWRI) and the Departments of Soil and Crop Sciences (SCSC) and Biological and Agricultural Engineering (BAEN), parts of AgriLife Extension at Texas A&M University, developed the Texas Well Owner Network (TWON) designed to deliver a science-based, community-responsive education curriculum. TWON focused on protecting groundwater quality and aquifer integrity, but also complemented the successful Texas Watershed Stewards program by emphasizing best management practices (BMPs) addressing potential contamination of surface water by sources also contaminating private domestic and irrigation wells and jeopardizing aquifer integrity.

With state nonpoint source grant funding from the Texas State Soil and Water Conservation Board (TSSWCB), the *Continued Statewide Delivery of the Texas Well Owner Network* program trained Texans regarding water quality and BMPs for protecting their wells and surface waters, which will avert off-site transport of contaminants (bacteria and nutrients) to surface waters, prevent contamination of underlying aquifers, and safeguard the water quality and health of

landowners and their families. As a result, this program supported ongoing watershed protection planning (WPP) efforts conducted by TSSWCB and others by expanding the reach of these programs to additional audiences and resulting in greater awareness, knowledge and implementation of BMPs for water quality improvement and protection.

Improved understanding of water quality, human impacts and management practices to improve well and surface water quality help to forestall off-site transport of coliform bacteria and nutrients to surface waters. Therefore, TWON is an effective tool for supporting WPP and total maximum daily load (TMDL) implementation efforts where investigations indicate bacterial and nutrient contributions. This was achieved by (1) delivery of TWON educational materials and trainings; and (2) evaluation and assessment of the program so that needed modifications and improvements could be made.

TWON Materials

The TWON team continued use of the TWON handbook, developed under the original *Preventing Water Quality Contamination through the Texas Well Owner Network* program to create a science-based, community-responsive TWON education curriculum, which is used to train private well owners.

The TWON handbook, *Texas Well Owner Network: Well Owner's Guide to Water Supply (SC-029)* is located [on the TWON website](#), or a hard copy can be ordered [through the AgriLife Extension Bookstore](#).

To increase delivery of these educational materials to a greater audience, the educational materials were transformed into an online format that is more readily available to the public. These materials are on the TWON website at <http://twon.tamu.edu/fact-sheets/>.

TWON Trainings and Screenings

SCSC worked with TSSWCB and other state and local organizations to select locations for well water screenings (*Well Informed*) and trainings (*Well Educated*) to be conducted during this project. SCSC coordinated efforts with organizations already involved in WPP/TMDL processes or that are planning future WPP/TMDL processes.

Through this project, 21 events were conducted with a total of 1,324 participants. Nine *Well Educated* trainings were conducted with more than 651 private well owners who attended to become familiar with groundwater resources, septic system maintenance, well maintenance, water conservation, water quality and water treatment. In addition, 12 *Well Informed* events were delivered throughout the course of the project to provide wellhead protection information and recommendations for remediating well contamination. Participants could also collect and bring their own well water for analysis. More than 670 water samples were analyzed through the *Well Informed* events.

SCSC, working with BAEN, TWRI, TSSWCB and others, selected priority locations for these events. SCSC coordinated these efforts with state agencies and organizations already involved in WPP/TMDL processes or that are planning future WPP/TMDL processes in specific watersheds.

Implementation

Programs were held in the priority watersheds selected by the TWON team and TSSWCB. With assistance from SCSC, TWRI developed and disseminated informational materials to actively market *Well Informed* water screenings and *Well Educated* TWON trainings, including news releases, social media postings, newsletter announcements, public/conference presentations, flyers, etc. TWRI also included information on the TWON program in their *txH₂O* magazine, *Conservation Matters* email newsletter and helped distribute news releases to the media through *AgriLife Today* as well as through the TWRI Facebook page and Twitter. In addition, a TWON *Well Read* email newsletter was sent out occasionally with updates and links to resources regarding groundwater and wells. As a result of these materials, popular media in the watersheds where these programs were held also published some of these news releases. The list of TWON articles that were published can be found in Table 1.

Nine *Well Educated* 4- to 6-hour TWON trainings ranging from 4 to 6 hours were delivered through this project to a total of 651 participants to increase local understanding of the factors that can adversely impact well water quality and provide access to the knowledge and tools that can be employed to prevent and/or resolve them. Trainings were delivered by the TWON Coordinator and a combination of the BAEN and SCSC Program Specialists and the SCSC Assistant Professor and Extension Specialist. The TWON handbook was distributed to all participants, the standardized presentations were delivered, well water samples were collected and analyzed and additional resources such as the TWON Fact Sheets were available in print as well as online. Attendees at *Well Educated* programs are shown in Figure 1.

Figure 1. Attendees at the *Well Educated* program learned how to protect their well water and



were able to have their well water analyzed.

Well Informed water screening events were delivered to provide wellhead protection information and recommendations for remediating well contamination, as needed. Screenings were delivered by the SCSC Assistant Professor and Extension Specialist, TWON Coordinator and/or the SCSC Program Specialist, as appropriate. While 10 well screening events were in the original scope of work, 12 screening events were delivered during this project with 673 water samples analyzed. These *Well Informed* screening events included an overview of the topics discussed in more detail during the comprehensive *Well Educated* TWON trainings.

Both the *Well Informed* screening and *Well Educated* training events, participants arrived with private well water samples, collected using the Soil, Water and Forage Testing Laboratory water collection procedures (<http://soiltesting.tamu.edu/files/waterweb1.pdf>), which were screened for fecal coliform bacteria, nitrate and salinity concentrations. The participants' cost for the screenings was typically around \$5–\$15 per sample. For those with positive results, remediation instructions and/or a recommendation and instructions were given for sending follow-up samples to an accredited National Environmental Laboratory Accreditation Conference laboratory to perform drinking water analyses.

Well screening events were scheduled for watersheds where county Extension agents anticipated that greater attendance would result from short and extremely focused events not lasting more than two hours. In areas where water bodies are listed as impaired for bacteria, where WPP work groups or TSSWCB requested it, or where residents were experiencing a high frequency of well-related issues, the project team encouraged scheduling of more comprehensive, 4- to 6-hour *Well Educated* TWON trainings.

During most of the trainings, results of bacterial screenings are not available before the training is completed. Bacterial screening results and, as appropriate, remediation instructions or recommendation for additional testing are forwarded to the participants, which allows participants to receive bacterial screening results privately. As a result of the *Well Educated* training, participants more clearly understand the relationships between practices in or near the well and the quality of water available for drinking and irrigation by their families and by other families pumping from the same formation.

The list of watersheds, dates and locations for the completed TWON *Well Educated* trainings and *Well Informed* screenings are in Tables 2 and 3. In addition, a map showing attendee volumes at each location is in Figure 2.

Table 1. List of news releases and articles published about TWON *Well Educated* and *Well Informed* Programs, totaling 36 media mentions.

Media Source	Title	Date
Port Lavaca Wave	Well owner workshop slated for Tuesday	1/21/2017
Tyler Morning Telegraph	AgriLife water well education program scheduled for March 2	2/7/2017
wn.com	Water well owner training set for March 2 in Tyler (Texas A&M AgriLife Extension Service)	2/10/2017
AgriLife Today	Water well owner training set for March 2 in Tyler	2/10/2017
Topix.com	Water well owner training set for March 2 in Tyler	2/10/2017
AgriLife Today	Texas Well Owner Network to screen water for Mills, Llano and Lampasas counties in March	2/14/2017
Bryan, College Station.net	Texas Well Owner Network to screen water for Mills, Llano and Lampasas counties in March	2/14/2017
NavBug	Texas Well Owner Network to screen water for Mills, Llano and Lampasas counties in March	2/14/2017
NewsDump	Texas Well Owner Network to test water samples in Lampasas	2/28/2017
Lampasas Dispatch Record	Texas Well Owner Network to test water samples in Lampasas	2/28/2017
Lampasas Dispatch Record	Water well screening offered at Farm Bureau building	3/3/2017
AgriLife Today	Water well trainings and screenings set for April in the Pandhandle	3/20/2017
Glen Rose Reporter	Local well water screenings set April 17	3/28/2017
Mineral Wells Index	Private water well screening set for April 18 in Palo Pinto	4/4/2017
AgriLife Today	Water well owner training set for April 28 in Brenham	4/7/2017
Austin County News Online	Water well owner training set for April 28 in Brenham	4/11/2017
KWHI.com	Free Texas Owners Network workshop April 28	4/12/2017
Public Now	Water well screening campaign set for June in Burleson, Milam counties	5/31/2017

Media Source	Title	Date
DailyTimes.com	Training on tap for water well owners	7/6/2017
AgriLife Today	Water well owner training set for July 26 in Fredericksburg	7/7/2017
College Station Bryan Texas	Water well owner training set for July 26 in Fredericksburg	7/7/2017
AgriLife Today	Well Educated" training for well owners set for July 27 in Wimberley	7/8/2017
Texas Tribune	Event: Texas Well Owner Workshop	7/11/2017
Citizens Environmental Coalition	Texas Well Owner Network: Water Well Screening	7/15/2017
AgriLife Today	Private water well screenings set for San Jacinto, Liberty, Chamber counties	7/17/2017
Public Now	Private water well screenings set for San Jacinto, Liberty, Chambers counties	7/17/2017
Liberty Vindicator	Private water well screenings set for Liberty, Chambers, San Jacinto counties	7/18/2017
The Texas A&M AgriLife Extension Service	Private water well screenings set for San Jacinto, Liberty, Chambers counties	7/20/2017
AgriLife Today	Water Well owner training set for Aug. 23 in Conroe	7/21/2017
Herald Zeitung	Free seminar for water well owners set for Sept. 26	9/17/2017
Radio NB	Extension Office hosting fruit conference, rain barrel workshop, well owner training	9/18/2017
AgriLife Today	Water well owner training set for Sept. 26 in New Braunfels	9/19/2017
Seguin Gazette-Enterprise	Water well training set Sept. 26	9/19/2017
AgriLife Today	Fisher County area well water screening Oct. 2 in Roby	9/26/2017
The Killeen Daily Herald	Clearwater ready for 17th annual Water Symposium	11/13/2017
AgriLife Today	Water well owner training set for Nov. 14 in Junction	10/26/2017

Table 2. Through the TWON program, 9 *Well Educated* 6-hour trainings were conducted in watersheds selected by the TWON team and TSSWCB.

Watershed	Major Aquifer	Date	City	County	Attendees
Lavaca	Gulf Coast	January 24, 2017	Port Lavaca	Calhoun	93
Upper Neches	Carrizo-Wilcox	March 2, 2017	Tyler	Smith	20
Statewide	Statewide	March 14, 2017	College Station	Brazos	21
Upper North Fork Red	Ogallala	April 11, 2017	Canyon	Randall	37
Mill Creek	Gulf Coast	April 28, 2017	Brenham	Washington	90
Pedernales	Edwards-Trinity Plateau	July 26, 2017	Fredericksburg	Gillespie	182
Cypress Creek	Trinity/Edwards BFZ	July 27, 2017	Wimberley	Hays	48
San Jacinto River	Gulf Coast	August 23, 2017	Conroe	Montgomery	40
Geronimo/Alligator Creeks	Carrizo-Wilcox	September 26, 2017	New Braunfels	Comal	120
TOTAL ATTENDEES					651

Table 3. Through the TWON program, 12 *Well Informed* water screenings were conducted in watersheds selected by the TWON team and TSSWCB.

Watershed	Major Aquifer	Date	City	County	Attendees/ Samples
Lampasas	Trinity	March 7, 2017	Goldthwaite	Mills	87
Llano	Trinity	March 8, 2017	Llano	Llano	81
Lampasas	Trinity	March 9, 2017	Lampasas	Lampasas	102
Lake Granbury	Trinity	April 18, 2017	Glen Rose	Somervell	17
Lake Granbury	Trinity	April 18, 2017	Granbury	Hood	35
Upper West Fork Trinity	Trinity	April 19, 2017	Weatherford	Parker	85
Upper West Fork Trinity	Trinity	April 20, 2017	Montague	Montague	51
Little River	Carrizo - Wilcox	July 14, 2017	Milano	Milam	63
San Jacinto River	Gulf Coast	August 2, 2017	Shepherd	San Jacinto	22
Cedar Bayou	Gulf Coast	August 2, 2017	Mont Belvieu	Chambers, Liberty	78
Double Bayou	Gulf Coast	August 3, 2017	Anahuac	Chambers	10
Upper Clear Fork Brazos	Seymour	October 3, 2017	Roby	Fisher	42
TOTAL ATTENDEES					673

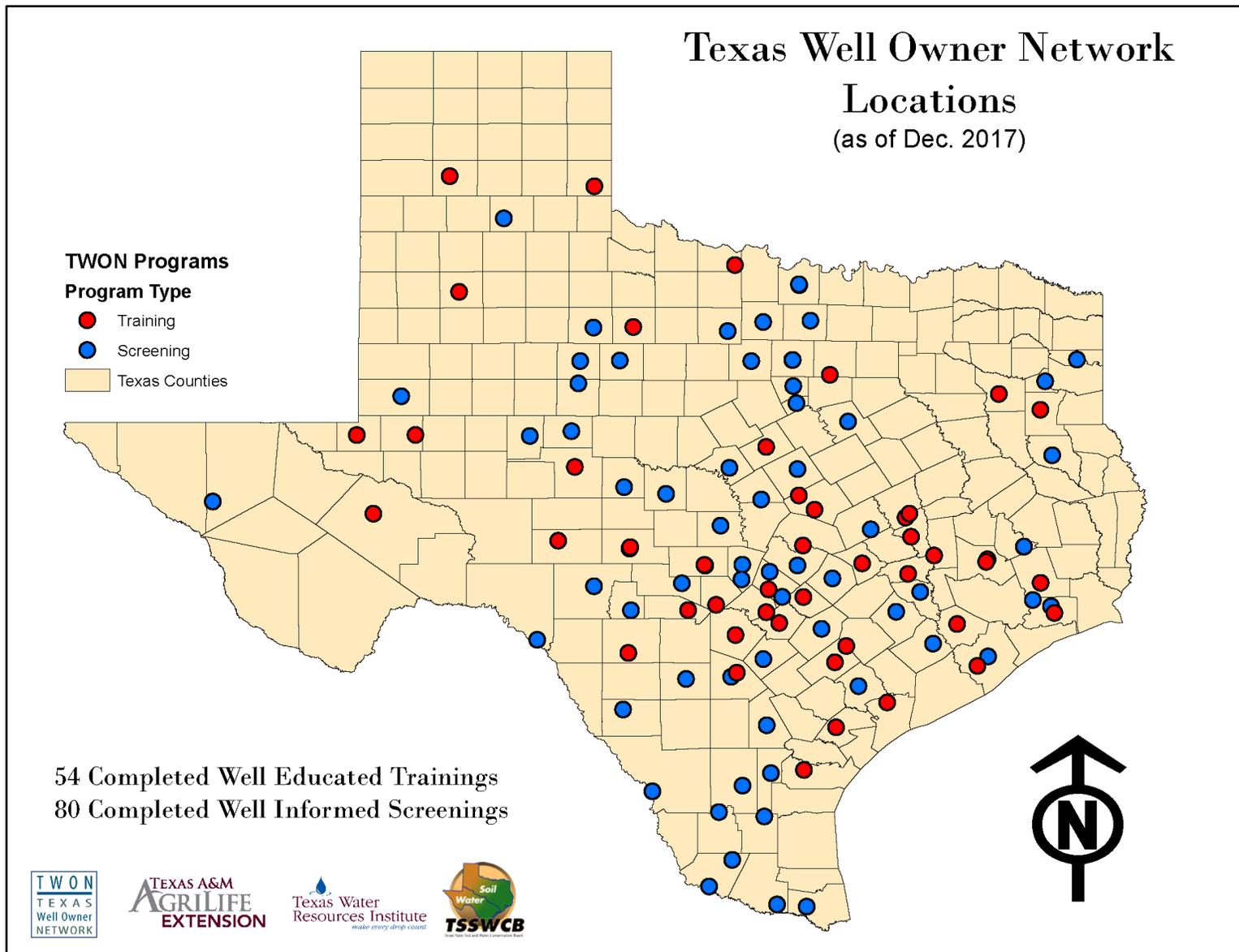


Figure 2. Map of TWON *Well Informed* screenings and *Well Educated* trainings.

Evaluation

To measure both knowledge and behavior changes of individuals participating in the program, evaluations were developed and delivered. SCSC developed and delivered pre-test/post-test evaluations to evaluate increased knowledge by participants at TWON trainings regarding program principles, appropriate BMPs and other activities; to address proper private well management; to evaluate participant satisfaction with the program; and to evaluate participant's intentions to change their behavior as a result of the TWON training. Outcomes for the programs are shown below:

Knowledge gained as measured by pre/post-tests administered at the trainings: pre-test scores averaged 54% correct answers, while post-test scores averaged 84% correct.

- Post-training evaluation:
 - 99% of participants were satisfied with the *Well Educated* training.
 - The value of participating in the program as estimated by attendees was an average of \$849 or a total of \$1,144,452 for all 2017 participants.
- Intentions to adopt behavior change:
 - 84% of participants will test their well annually.
 - 80% of participants will pump their septic system regularly.
 - 91% of participants will remove hazards from their well house.
 - 85% of participants with a deteriorated or open well will plug or cap the well.

In addition, a 6-month follow-up survey was developed and delivered online to assess behavior changes adopted and other activities, such as the number of neighbors contacted, by TWON training participants. The online survey link is emailed to past participants 6 months after attending the training. SCSC analyzes the results using descriptive, correlational and analysis of variances statistical procedures. Outcomes from the 6-month follow-up are shown below:

- Six-month follow-up survey results:
 - 75% shared the resources/materials with others who were not at the training.
 - 90% of those needing to clean out hazards from their well house had done so.
 - For participants with septic tanks that needed pumping, 55% had pumped their septic tanks within 6 months following the program. An additional 29% were planning to have their tanks pumped soon.
 - 35% of participants who needed to had plugged or capped their unused/deteriorated wells following the program. An additional 38% were planning to have their wells plugged soon.
 - 74% of participants who had wells near contamination sources (pet shelters, livestock yards, etc.) moved the sources following the program, and another 20% had plans to move sources soon.

Conclusion

The continued implementation of the TWON *Well Educated* trainings and *Well Informed* screenings was and continues to be highly successful. The materials continue to be used for trainings and screenings to help educate landowners on how to protect and manage their well water.

Through this continuation project, *Well Educated* and *Well Informed* events were delivered to nearly 1,324 participants to increase local understanding of factors that can adversely impact well water quality and provide access to the knowledge and tools that can be employed to prevent and/or resolve them. The TWON handbook was distributed to all participants, standardized presentations were delivered, water well samples were collected and analyzed and additional resources such as the TWON Fact Sheets are available in print or online. As a result of the *Well Educated* and *Well Informed* programs, participants have the ability to clearly understand the relationships between practices in or near the well and the quality of water available for drinking and irrigation by their families and by other families pumping from the same formation.

Evaluations were given to all participants to measure both knowledge and behavior changes of individuals participating in the programs. A pre-test/post-test was developed and delivered. Outcomes showed that most participants were satisfied with the events and the majority of participants intend to adopt behavior changes, such as testing their well water annually, pumping their septic system regularly, removing hazards from their well house and plugging or capping deteriorated or open wells.

In addition, 6-month follow-up surveys showed that 75% of participants had shared the resources and materials with others who were not at the training. Also, most of those participants (90%) needing to clean out hazards from their well house had already done so. For participants with septic tanks needing to be pumped, 55% had them pumped within the 6 months, and an additional 29% were still planning to have them pumped soon.

The efforts above are continuing and expanding through TSSWCB project 17-10 *Continued Statewide Delivery of the Texas Well Owner Network*.