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Provide Assistance to Improve Water Quality in Hood County Final Report



By

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Provide Assistance to Improve Water Quality in Hood County

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Texas AgriLife Extension Service
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INTRODUCTION

The overall goal for this project was to provide a mechanism to educate local stakeholders about water quality issues that affect Lake Granbury. This project provided an assessment of existing and potential water quality threats related to on-going non-point source (NPS) water pollution within the Lake Granbury Watershed. The Texas Water Resources Institute (TWRI) and Texas AgriLife Extension Service assisted the Brazos River Authority (BRA) and Texas Commission on Environmental Quality (TCEQ) to develop a Watershed Protection Plan (WPP) aimed to improve and protect water quality within the Brazos River Basin. Educational information developed during this project provided Federal, State and local decision makers with a variety of mechanisms that can be employed to prevent additional degradation of water quality in the watershed.

PROJECT BACKGROUND

Lake Granbury is a critical water supply in North Central Texas, providing water for over 250,000 people in more than 15 cities. It provides water for industrial use, including cooling water for a natural gas-fired steam electric power plant and the Comanche Peak nuclear power plant. It is also a recreation haven for local water enthusiasts. Declining water quality in Lake Granbury has begun to negatively affect the use of the lake. The economy in Hood County is closely tied to Lake Granbury and the environmental condition of the lake is crucial to the county's residents.

Recent studies by the BRA have detected contamination of fecal coliform bacteria in several areas of the lake, primarily in coves with poor water circulation. As a result, BRA worked with the TCEQ and a consortium of local entities and federal and state agencies to implement an integrated WPP designed to reduce bacterial contamination. This project is funded by the U.S Environmental Protection Agency (EPA) under CWA Section 319.

One source of fecal coliform bacteria is on-site wastewater treatment systems. While there are eight permitted wastewater treatment plants in Hood County, a substantial portion of the developed area around Lake Granbury, which lies wholly within Hood County, is unincorporated subdivisions that do not have sewage collection systems and centralized sewage treatment facilities. The population served by the existing permitted wastewater treatment plant facilities is estimated to be less than 50 percent of the current county population. There are an estimated 9,000 septic tanks located around Lake Granbury, with absorption fields installed on small lots in close proximity to the lake. Most of the inhabited areas around the lake exist on man-made coves. The coves are shallow, dead-end bodies of water with little mixing or interaction with the main body of the reservoir. Many of these systems were installed before the 1997 On-Site Sewage Facility (OSSF) rule changes. The 1997 rule changes required a site and soil evaluation to determine the site's capacity to treat wastewater. An on-site wastewater treatment system was

then selected based on the ability to effectively treat the wastewater. New development in areas without centralized collection and treatment systems rely on individual on-site wastewater treatment systems for their wastewater infrastructure.

In 1993 a cooperative study between the Texas Water Commission, the BRA and the Hood County Health Unit first identified an increase in fecal coliform levels in the lake. The *On-site Wastewater Treatment Units at Lake Granbury and the Possible Impact Upon the Water Quality of the Lake Study* identified the most notable area of concern to be in the man-made coves.

In 1995 a study titled, *Survey of Conditions and Impact of Septic Tank Pollution on the Water Quality in Lake Granbury*, indicated that the soils in which septic tanks are installed around Lake Granbury are generally not well-suited for septic tanks and absorption fields. Another finding was that almost all on-site systems around the lake include absorption fields that do not provide a capacity that would comply with current State criteria.

The combination of previous studies indicate a concern for water quality from on-site sewage systems and forecasts show that Hood County's population will likely increase from its current level of about 42,000 persons to more than 78,000 persons by the year 2030. With this information in mind, the development of a feasibility study to bring a regional sewage system to Hood County and eliminate the on-site sewage facilities was completed in 2000. The *Hood County Regional Sewerage System Feasibility Study* was a cooperative effort between BRA and the Hood County Intergovernmental Coalition. The estimated capital costs for this regional wastewater facility was estimated to be approximately \$149,900,000 with annual operation and maintenance costs estimated to be approximately \$16,231,000.

Beginning in May 2001, BRA began collecting water quality samples on a monthly basis at over 50 cove locations. Some of the locations showed no elevated concentrations of *E. coli* and were later discontinued. Other locations were added after a year of monitoring as new information was acquired on possible source locations. The data generated from this effort indicates that many of the canals on Lake Granbury are impacted by *E. coli* issues that raise concern for public health and contact recreation. The data also indicates that the water quality in the coves is most influenced by the surrounding land use, rather than by the main body of the lake.

PROJECT ACCOMPLISHMENTS

In order to help correct existing water problems and protect the future of Lake Granbury, the residents and lake users need a better understanding of lake water quality issues and applicable best management practices. Therefore, the objectives of this project were to:

- Hold public meetings to educate stakeholders and clients within the watershed about water quality and its protection.
- Provide public educational programs to help achieve improved water quality.
- Conduct training events on proper operation and maintenance of on-site wastewater treatment systems and collective facilities.

Overall Summary

Since January 2007, a team of Texas AgriLife Extension Service educators led by Dr. Bruce Lesikar, Professor and Associate Department Head in the Department of Biological and Agricultural Engineering at Texas A&M University, have developed more than 20 generalized and watershed-specific fact sheets about various topics including fecal coliform contamination and sources, on-site wastewater treatment, collective wastewater treatment systems, graywater systems, pet waste management, nutrient and sediment loading, landscape chemicals, and management practices to minimize loadings, including urban and agricultural NPS.

As a result of project funding numerous courses have been held regarding various topics relating to on-site wastewater treatment systems. A wastewater practitioner training describing the design, installation, operation, maintenance, and trouble-shooting of on-site wastewater treatment systems was held. Three short courses reaching 46 individuals were conducted that increased awareness of the impacts that malfunctioning wastewater treatment systems have on water quality. Three educational programs reaching 91 key stakeholders were conducted that discussed proper operation and maintenance of septic and graywater systems to limit the risk of bacterial contamination in the lake.

A protocol was developed to determine the effectiveness of wastewater treatment systems utilizing dye testing and site and soil evaluation methods. Intensive evaluations of three on-site wastewater treatment systems located on canals were conducted. Septic system performance for removal of bacterial contaminants was assessed and an evaluation protocol was used to evaluate additional subdivisions around the lake.

Public education to increase awareness of water quality impacts due to stormwater has been conducted. Fact sheets, presentations and posters describing contaminant sources and water conservation management techniques to minimize contaminant transport to the lake have been developed and delivered. Three Master Gardener Specialist trainings on rainwater harvesting were held reaching approximately 30,000 people and resulting in numerous public education activities utilizing direct and indirect educational methods. Demonstration sites showing various stormwater best management practices have also been implemented near the Hood County Extension Office and Acton Nature Center.

Past Year

During the past year, several presentations were made to more than 65 individuals at public meetings and educational programs to homeowners and practitioners, on topics including water quality standards, on-site wastewater treatment system maintenance, regional collection systems, identification of malfunctioning on-site wastewater treatment system, rainwater harvesting, stormwater management and groundwater management. The on-site wastewater treatment systems program addresses the needs of both practitioners and homeowners. Marty Vahlenkamp, Texas AgriLife Extension Service agent in Hood County, was instrumental in hosting educational programs and sharing information with the public, such as discussing watershed management, bacterial sources and best management practices (BMPs) on a local television station. Along with these presentations, team members worked with the North Central Texas Council of Governments and the Hood County Extension agent to distribute water quality information through Public Service Announcements and the local media. A new informational

fact sheet on designing raingardens for stormwater abatement was written and published through AgriLife Communications for distribution in Hood County. A rainwater harvesting demonstration site was planned and installed, including a 1,500 gallon collection tank, at the Acton Nature Center in Hood County. Pet waste stations and signage were developed and installed in a three-part visual at the Granbury Hike and Bike Trail.

On-site Wastewater Treatment Systems

Wastewater practitioners participated in a training program describing the available advanced treatment options titled, *OWTS 201: Overview of Advanced Wastewater Treatment Systems*. To advertise the course, a brochure was mailed to OSSF practitioners in Hood and surrounding counties (Appendix A). The response rate to the evaluation survey was 92 percent (12 of 13). However, not all questions were answered by each participant. Of the 12 individuals responding to the survey, 12 reported that they gained knowledge through participation in the course and 12 stated that they would recommend this course to other wastewater professionals. Table 1 below shows the assessment of the participants’ increased level of understanding about course topics presented in the training. Another important item to assess regarding training programs is the willingness of participants to adopt BMPs as a result of participating in the training. Table 2 details the number of those participants reporting who indicated that they definitely will adopt a discussed practice from the course.

Table 1. Percent of respondents who increased their understanding of the course topics.

Course Topic:	% respondents who increased in understanding
Understanding of hydraulic loading to an OSSF	58.3
Understanding of organic loading to an OSSF	41.7
Understanding of operation and maintenance criteria for OSSF function	25.0
Understanding flow equalization to improve OSSF performance	83.3
Understanding of wastewater treatment technologies	50.0
Understanding of how wastewater source can impact OSSF function	58.3

Table 2. Assessment of willingness to adopt practices as a result of participation in the course.

Indicate your intentions regarding adoption of the following practice(s), or indicate whether you have already adopted them:	Will not adopt	Undecided	Probably will adopt	Definitely will adopt	Adopted already	Not applicable	Total number of responses
Specify hydraulic loading rate for an OSSF	0	0	3	4	5	0	12
Specify organic loading rate for an OSSF	0	2	0	4	5	0	11
Specify operation and maintenance activities for an OSSF	0	0	3	3	5	0	11
Utilize flow equalization component in an OSSF treatment train	0	0	2	6	3	1	12

Additionally, two general homeowner trainings on septic system maintenance were held on April 19, 2011, and July 12, 2011. These classes were 1-2 hour informational classes held for homeowners wanting to understand more about their on-site wastewater treatment system. These classes were designed to present base information on the function and maintenance of on-site wastewater treatment systems. Seventeen people attended the April 19th training, and eight attended the July 12th class. No class evaluations were distributed during these trainings. Another such class is planned for September 19, 2011.

Rainwater Harvesting

On July 13th and 14th, 2011, a Master Gardener Specialist Course on Rainwater Harvesting was held in Hood County. The topic of rainwater harvesting is used to convey messages about water and stormwater management, pollution control and the importance of educating others. The course was comprised of both classroom instruction and field demonstrations. These rainwater harvesting systems are a stormwater management BMP that teaches basic hydrology and water management. Many participants increased their water literacy through implementing a rainwater harvesting project. They learned about the quantity of water running off a surface and the contaminants that can be absorbed by the water as it runs across a surface. They learned how the volume of water generated during a rainfall event is quantified. In addition, the amount available for capture from a specific size surface was calculated. Ultimately, the participants learned valuable information that will assist them in making informed decisions regarding management and protection of critical water resources. Tables 3 and 4 detail the percent of individuals whom reported gaining knowledge on various topics presented in the course and the percent of participants who will definitely adopt various practices covered throughout the course.

Table 3. Percent of respondents who definitely will adopt the practices introduced throughout the course.

Introduced practice	% who will adopt
Rainwater harvesting system to capture water for irrigating plants	77.8
Rainwater harvesting system to capture water for wildlife	77.8
Soil management methods to capture water on the landscape	55.6
Rain garden	44.4
Soil infiltration and storage rainwater harvesting system	37.5
Landscape nutrient management to reduce potential for runoff	22.2

Table 4. Percent of individuals who reported knowledge gained on the retrospective pre-post evaluation on various topics (out of 11 responses).

Topics	% Knowledge Gain
Understanding of a watershed and how water moves through it	88.9
Understanding of how rainwater harvesting reduces potable water demand	88.9
Understanding of how rainwater harvesting reduces water runoff from your property	77.8
Understanding how rainwater harvesting impacts the water quality in the watershed	100.0
Understanding components of simple and/or complex harvesting systems	100.0
Understand how to estimate rainwater yield based on rainfall and catchment size	88.9
Understand how to estimate plant water needs and reduce plant water needs	77.8
Understand methods to manage the soil to improve water capture	88.9
Understand how wildlife RWH considerations affect habitat and wildlife numbers	88.9
Understand how rain gardens capture water for plant needs and reduce runoff	100.0

Raingarden Design Class

On September 20, 2010, a raingarden design class was held at the Hood County AgriLife Extension Office. In association with that class, a demonstration raingarden was built at the demonstration garden located behind their office to control stormwater runoff from the location.

Pet Waste Demonstration

In July 2011, three pet waste stations were installed along the Granbury Hike and Bike Trail. In addition to the stations, informational signs were created by the Texas AgriLife Extension Service and attached to the stations. These signs explain the negative impacts of pet waste on local water quality. Pictures of the sign and full pet waste station can be found in Appendix B.

Printed and Distributed Fact Sheets

In order to facilitate dissemination of information and educational materials developed in cooperation with this project, copies of multiple fact sheets were printed for distribution. The fact sheets printed include: *What is the Fate of Your Rainfall*; *What is the Fate of Your Rainfall: Leader Guide*; *What is the Fate of Your Rainfall: Flip Chart*; *Lawn Fertilization and Environmental Impacts*; and *Living on the Water's Edge*.

The publication series titled, *What is the Fate of Your Rainfall?*, explains what happens to rainwater in a watershed and discusses practices that can help prevent excess runoff, avoid erosion, increase forage or plant production and protect water quality. The goal for this training program is to increase the audience knowledge about water movement through the landscape so they are prepared to adopt practices to enhance and protect water resources. Specific learning objectives for this educational program include:

- Understand the movement of water through the water cycle
- Understand the concept of a watershed
- Understand how land cover and management determine the path of rainwater
- Understand practical implementation of rainwater harvesting for water storage in the soil, groundwater and surface reservoirs
- Understand the effect that increased impervious areas have on water movement in the watershed
- Understand the water and land management options that decrease runoff and promote infiltration

The leader guide and flip chart associated with the *What is the Fate of Your Rainfall?* fact sheet helps guide users of the rainfall simulators that have been distributed throughout the area. The rainfall simulator is a demonstration aid consisting of a frame to hold landscape trays, rain trays and water collection containers. The landscape trays represent various land uses present in our watersheds. The rain trays simulate rainfall on the landscape bins. The water collection containers collect surface runoff and percolated groundwater thus allowing a visual evaluation of rainfall distribution between surface water and groundwater.

The publications titled, *Lawn Fertilization: Environmental Impacts* and *Living on the Water's Edge*, were also printed this past year to facilitate educational programs. The *Living on the Water's Edge* fact sheet explains steps that people living near streams or lakes should take to minimize their environmental impact and improve water quality. The *Lawn Fertilization: Environmental Impacts* fact sheet explains how to fertilize and manage your lawn while minimizing risk for harming the environment. In addition to the previously mentioned publications, fact sheets regarding pet waste management and on-site wastewater treatment systems were distributed by Marty Vahlenkamp to homeowners educating them on the importance of the proper waste management from all potential sources of bacteria and nutrients. These publications can be found on the project website at lakegranbury.tamu.edu.

Watershed Protection Planning

The Lake Granbury WPP was approved by the Environmental Protection Agency on April 27, 2011. The project will provide assistance to stakeholders to implement the prescribed management measures presented in the plan. The project will also track and measure the

progress of the various management measures during the implementation period. The project is expected to begin work in September of 2011. Texas AgriLife Research and Extension will continue to assist the BRA and TCEQ in the accomplishing the goals of the WPP.

Administration

The administrative task of this project was managed by the Texas Water Resources Institute (TWRI), part of Texas AgriLife Research, the Texas AgriLife Extension Service and the College of Agriculture and Life Science and Texas A&M University. Besides reviewing and submitting quarterly and final reports and conducting meetings, TWRI created and maintains a website that contains copies of all the fact sheets, other educational publications and reports. The website can be accessed at lakegranbury.tamu.edu. TWRI also assisted BRA and TCEQ with developing a stakeholder group for the development of a WPP for the Lake Granbury Watershed.

FUTURE WORK/CONCLUSION

The educational programs provided through this project will lead to a change in behavior and create a sense of ownership of Lake Granbury and ultimately lead to improved water quality. The materials developed during this project are easily accessible and can be used with other programs in the county to further educate the public on what they can do to help their water quality. In looking forward, the Texas AgriLife Extension Service will continue to work with BRA, TCEQ, the Hood County Extension agent and local watershed stakeholders as possible to present information on how to protect and improve water quality. In addition, information from this project will be advantageous in terms of WPP education and implementation.

APPENDIX A

Sharing information about the OWTS 201 Course


The training brochure was distributed to OSSF practitioners in Hood County, Somervell County, Tarrant County, Johnson County, Erath County, Parker County and Palo Pinto County. A mailing list was developed using the Texas Commission on Environmental Quality (TCEQ) website page titled “TCEQ Search Licensing or Registration Information” – www5.tceq.state.tx.us/lic_dpa/. The website was searched using the “Group Search Criteria” and the following choices:

Program: ON-SITE SEWAGE FACILITY LICENSING (OSSFOL)

Type and Level: OSSF DESIGNATED REPRESENTATIVE; INSTALLER I; INSTALLER II; OSSF MAINTENANCE PROVIDER; OSSF MAINTENANCE TECHNICIAN; or OSSF SITE EVALUATOR

County: Each county was selected individually. The contact information was cut and pasted into a WordPerfect file to create labels for a mailing list. A total of 345 brochures were mailed.

Figure A-1. First page of tri-fold brochure advertising the July 15, 2011, *Overview of Advanced Wastewater Treatment Systems* course.



ONSITE WASTEWATER TREATMENT SYSTEMS EDUCATIONAL PROGRAM:
These educational courses are being provided to increase participants knowledge concerning possible approaches for managing domestic wastewater.

For more information contact:

Ryan Gerlich
Extension Assistant
Phone: 979-458-4185
E-mail: ragerlich@ag.tamu.edu

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Educational programs of the Texas AgriLife Extension Service are open to all people without regard to race, color, sex, disability, religion, age or national origin.

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Onsite Wastewater Treatment Systems 201:

**OVERVIEW OF
ADVANCED
WASTEWATER
TREATMENT
SYSTEMS**

July 15, 2011
Hood County Extension Office
1410 West Pearl Street
Granbury, Texas



This course is approved by TCEQ for
8 hours of OSSF CEUs

Figure A-2. Second page of tri-fold brochure advertising the July 15, 2011, *Overview of Advanced Wastewater Treatment Systems* course.

<p style="text-align: center;">COURSE INFORMATION</p> <p>DATE AND TIME</p> <p>Friday, July 15, 2011 8:00am to 5:00pm</p> <p>LOCATION</p> <p>Hood County Extension Office Hood County Annex I 1410 West Pearl Street Granbury, TX 76048 (817) 579-3280</p> <p>COST: \$135.00</p> <p>PURPOSE:</p> <p>Present information on hydraulic loading rates to soils and how water moves through the soil profile. Methods to site, layout and construct on-site water treatment systems.</p> <p>COURSE APPROVED:</p> <p>This course is approved for eight hours of Onsite Wastewater Continuing Education Credit by the Texas Commission on Environmental Quality. (for Installer I and II, Site Evaluators, Maintenance Providers, and Designated Representatives.)</p> <p>AUDIENCE:</p> <p>Installers I & II, Site Evaluators, Designated Representatives, Maintenance Providers, and Designers</p> <p>TEACHING METHODOLOGY:</p> <p>This course is designed for classroom instruction, it will consist of a lecture with demonstration aids.</p>	<p style="text-align: center;">OWTS 201: OVERVIEW OF ADVANCED WASTEWATER TREATMENT SYSTEMS JULY 15, 2011, 8:00 A.M. TO 5:00 P.M.</p> <p style="text-align: center;">REGISTRATION FEE: \$135.00</p> <p style="text-align: center;">Register On-Line: http://agrilifevents.tamu.edu Keyword Search: Wastewater</p> <p>Name: _____</p> <p>Organization: _____</p> <p>Address: _____</p> <p>City/State/Zip: _____</p> <p>Telephone: _____</p> <p>E-mail address: _____</p> <p>_____ Check / Money Order (payable to Texas AgriLife Extension Service) _____ VISA _____ Master Card _____ Discover</p> <p>Card Number: _____</p> <p>Expiration Date: _____ Billing Zip Code: _____</p> <p>3-Digit Security Code: _____</p> <p>Total Amount (\$): _____</p> <p style="text-align: center;">Texas AgriLife Extension Conference Services 2139 TAMU College Station, TX 77843-2139 Office: 979/845-2604 Fax: 979/862-4511</p> <p style="text-align: center;">Registration questions: 979/845-2604 or agrilifevents@ag.tamu.edu</p>
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APPENDIX B
Pet Waste Stations

Figure B-1. Image of informational sign used on pet waste stations along the Granbury Hike and Bike Trail.

**Keep Lake Granbury Clean:
Clean up after your pet!**

Every dog poops, so don't forget to scoop.



When pet waste is left on the ground, it can be washed into rivers and streams during rain events. These rivers and streams eventually carry that waste to Lake Granbury.

Why is pet waste a problem?

- It contains harmful bacteria that can make water unsafe for human contact.
- It carries nutrients that cause excessive algae growth.


Texas A&M System

This demonstration is brought to you by the Texas AgriLife Extension Service as part of the Water Quality Program for Lake Granbury. See <http://lakegranbury.tamu.edu/> for more info.

Funding provided by the USDA Natural Resource Conservation Service (NRCS) through the Texas Water Resource Institute

Figure B-2. Picture of the pet waste station installed along the Hike and Bike Trail near downtown Granbury.

