Brazos River Authority

**Special points of interest:**

- TIAER's latest efforts in the watershed
- Dairy waste handling technologies subject of recent tour
- Anaerobic digestion turns waste into energy

TSSWCB
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# North Bosque Newsletter

PRESENTED BY THE AUTHORITY IN COOPERATION WITH THE TSSWCB

## Agency Highlight: Texas Institute for Applied Environmental Research

The Texas Institute for Applied Environmental Research (TIAER) at Tarleton State University was founded in 1991 to address emerging environmental concerns in the North Bosque Watershed. TIAER has worked to improve water quality in the North Bosque River while striving to maintain the economic vitality of agriculture in the region. Their approach balances the concerns of agricultural interests and environmentalists to help develop effective public policies and science-based solutions.

TIAER's multidisciplinary staff includes aquatic biologists, environmental engineers, rangeland managers, and soil scientists experienced in statistical analysis of soils and water quality data. The staff also includes research economists versed in agricultural costs and benefits. An experienced staff performs sampling of ambient water quality, biological, stormwater, and soils, as well as streamflow monitoring and data collection. The analytical laboratory performs water analyses for nutrients, sediments, fecal coliform, *E. coli*, and other waterborne constituents. TIAER's researchers with assistance from the Texas A&M Blackland Research and Extension Center developed the model for the North Bosque Watershed Total Maximum Daily Load (TMDL) for phosphorus.

TIAER has developed a strategy for watershed improvement that is supported by the US Environmental Protection Agency (EPA) and the US Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS). This program, known as the Planned Intervention Microwatershed Approach (PIMA), divides

The Goose Branch Microwatershed used to test the PIMA Model. (from TIAER's report titled *PIMA: An Alternative Approach to Watershed Management* online at: http://tiaer6.tarleton.edu/pdf/PR0203.pdf)

*(Continued on page 2)*

## Two Technologies Selected for Animal Waste Pollution Control Project

The Technical Committee for the Technologies for Animal Waste Pollution Control Project met on April 19 in Waco, TX to review solicited proposals (see May issue, pg. 3). The committee discussed and finalized the ranking of each technology based on individual scientific and technical merit. The two selected technologies were: 1) Electrocoagulation Technology proposed by Ecoloclean Industries, Inc., and 2) Removal of Phosphorus by Struvite Precipitation proposed by Organic Residual Reclamation.

Representatives from each selected technology provider have been contacted and requested to communicate with Dr. Saqib Mukhtar about a plan of action to implement technology and begin monitoring and collecting data.

The first draft of the Quality Assurance Project Plan (QAPP) has been completed and TAMU is communicating with laboratory personnel regarding sample analysis. Once the QAPP is submitted and approved by the EPA, the project can move forward and data collection may begin.

**Inside this issue:**

## Agency Highlight: TIAER (continued)

*(Continued from page 1)*

watersheds into small microwatersheds. This approach allows government agencies and agricultural producers to better manage water quality complexities. PIMA also affords an opportunity to improve water quality through producer-friendly programs. The process emphasizes the community's role in environmental stewardship by bringing federal programs down to the local level and fostering positive peer pressure among agricultural producers. PIMA was implemented and tested in the late 1990's on the Goose Branch Microwatershed, which lies in the Upper North Bosque Watershed. As a result of its experience in Goose Branch, TIAER learned how to deal with the concerns of producers interested in protecting natural resources while trying to remain competitive.

TIAER is currently involved in a number of projects in the North Bosque Watershed. The Dairy Manure Export Support (DMES) is a program funded by an EPA grant administered by the Texas State Soil and Water Conservation Board (TSSWCB). The program offers financial incentives to support the transport of raw manure to commercial composting operations. TIAER was contracted by TSSWCB to handle the everyday administrative activities associated with the DMES.

The USDA-NRCS is funding an annual water quality trends analysis performed by TIAER at various points along the North Bosque River from Stephenville to Valley Mills. This project is scheduled to last until 2007 and also involves a demonstration of commercial versus manure fertilization on three side-by-side one-half acre permanent pasture sites. These plots will provide a control receiving agronomic rates of commercial fertilizer and two plots managed by alternative manure application strategies.

Other monitoring efforts in the watershed include involvement in a compost effectiveness monitoring project to evaluate the effects of manure removal from the watershed. TIAER has also been contracted to provide edge-of-field monitoring for the Dairy Waste Management – Phosphorus Reduction Demonstration Project.

TIAER's extensive monitoring data sets are included as part of the Water Quality Data Coordination website, which features data collected by a number of agencies working in the North Bosque and Leon River Watersheds. These data will be available for viewing through the Brazos River Authority home page in June.

TIAER is also developing a refinement of the North Bosque TMDL. The goals of this project are to (1) refine the TMDL modeling, while incorporating new data and knowledge regarding model-simulation activities and features, and (2) reanalyze the TMDL allocation. The new TMDL is scheduled to be completed in August, 2006.

Lessons learned in the North Bosque River watershed evolved into an environmental dialogue known as Industry-Led Solutions. This series of regional and national workshops, held under a cooperating agreement with the U.S. Environmental Protection Agency, seeks to acquaint agricultural producers with objectives of the Clean Water Act. Among other things, Industry-Led Solutions participants are developing a program specifically for agriculture that protects the environment and continues the economic viability of the industry.

TIAER's experienced staff has made it a successful partner in efforts to improve water quality in the North Bosque Watershed. For more information about TIAER, see the website at: http://tiaer.tarleton.edu.

## Dairy Tour Provided Valuable Information

**New technologies have been implemented…but how do each of these systems work and how practical are they?**

Dairy producers are continually looking for more economical and efficient ways of managing waste from their dairies. New technologies have been implemented on various operations in previous years, but how do each of these systems work and how practical are they? That was the basis of a dairy tour that took place on April 15, 2004 with over 100 individuals attending.

Several technologies were observed or discussed on the tour. These included geotube and ecoloclean technologies, which are new to the area, and vacuum systems already in wide use. A geotube is a fabric tube that retains solids from dairy waste while allowing liquids to drain through. The ecoloclean system is an electrolysis process that uses electricity to take phosphorus out of the water. Vacuum technology has proven to be popular on a number of dairies and was also included on the tour. The dairies using the vacuum technology vacuum the waste from the freestalls and haul it directly to fields for application.

The tour also provided other interesting information. A new rotary parlor was observed. There was also a discussion concerning the construction of new facilities. Odor control is another concern that dairymen are addressing. Results from a national project sampling for air pollution were discussed. Another topic included on the tour was feed rations and how they can impact phosphorous levels in the waste stream.

The event was planned by the Erath and Comanche County dairy committees. Five hours of DOPA credit was provided to those producers attending the tour.

# Anaerobic Digestion Offers Alternative for Agricultural Waste Handling

**Brief History of Anaerobic Digestion**

In 1808, Sir Humphry Davy determined that methane is present in gases produced during the anaerobic digestion of cattle manure. Fifty-one years later, the first digestion plant for handling wastes was constructed in Bombay, India. By 1895, a sewage treatment plant was recovering biogas that was used to fuel street lamps in Exeter, England. It was not until the 1930's, however, that anaerobic bacteria and conditions that promote methane production were identified by scientists. This improved level of understanding, coupled with a need for new fuel sources, led to burgeoning interest in anaerobic digestion in Europe following World War II. Anaerobic digestion is well-suited to process manure associated with animal production, and, today, there are more than 600 farm-based digesters in Europe with more than 250 built in Germany in the last five years. In the United States, farm-based anaerobic digestion was first used on a swine farm in Mt. Pleasant, Iowa in the early 1970's. Most of the early digesters in the US were plagued by design problems and interest had waned by the late 1970's. There was a renewed interest in the process in the early 1980's, aided by government incentives and improved technology. Today, anaerobic digestion is being successfully applied on farms across the country and improvements continue to make the technology more efficient and, consequently, more economically viable.

**The Process of Anaerobic Digestion**

Anaerobic digestion (AD) reduces odors and greenhouse gas emissions by capturing gases generated by the biological decay of organic material found in animal waste. AD alone does not reduce the nutrient content or the volume of solids that entered the system; however, the resulting digested solids are low in odor and pathogens and are biologically stable when stored under normal conditions. AD is a three step process that involves: 1) liquefying bacteria that transform complex organic matter into liquefied soluble organic compounds, followed by, 2) acid-forming bacteria that use these compounds as an energy source and leave a simple organic acid by-product, and 3) methane-forming bacteria that break down the acids into a biogas made up of primarily methane and carbon dioxide with traces of ammonia and hydrogen sulfide.

**Use of Anaerobic Digestion in the North Bosque Watershed**

A project currently underway in Hamilton County titled Dairy Waste Management-Phosphorus Demonstration Project (profiled in April issue) utilizes anaerobic digestion as part of a multi-step process that ultimately will target an 80 percent reduction of phosphorus in the waste stream. As stated earlier, AD will not significantly reduce the nutrient content of the digester effluent. Therefore, an additional process called biological phosphorus removal is planned.

The anaerobic digester will consist of a sloped, lined, and covered lagoon. Incoming waste will pass through a solids separator before entering the digester. Biogas captured from the digester will be sent to an electricity generator. Through a cooperative agreement with the local electrical provider, the electricity generated on-site will be fed into the local grid and the equivalent amount will be credited to the dairy producer's account, effectively providing retail price for the electricity.

After digestion, the wastewater stream will then be fed to the biological phosphorus removal process where water will circulate between anoxic, anaerobic and aerobic zones to achieve bioaccumulation of phosphorus. The processed liquid will then be reused within the dairy operation or land applied in accordance with the producer's comprehensive nutrient management plan.

Solids from the separator, anaerobic lagoon, and phosphorus removal pond will be moved to a compost management area or hauled off-site to a local compost facility.

The project is funded by a number of agencies/entities that includes: the Environmental Protection Agency, Texas Farm Bureau, Texas Commission on Environmental Quality, Natural Resources Conservation Service, Texas State Soil and Water Conservation Board, US Department of Energy, Brazos River Authority, Altria, and United Cooperative Services.

Cascade Earth Sciences designed the facility. The Texas Institute for Applied Environmental Research will perform process monitoring, edge-of-field runoff monitoring, as well as providing on-site technical and coordination assistance as required. The Brazos River Authority is providing overall project management. TSSWCB has certified the comprehensive nutrient management plan for the dairy operation.

At present, the design has been completed, a construction contractor has been selected, and construction should begin in June, 2004.

## TSU Grad Students Work to Improve Water Quality

The Tarleton State University (TSU) College of Agriculture and Human Sciences (COAHS) has an enrollment of approximately 1300 students. Faculty members of the College engage in teaching and research in areas including agricultural economics, soil science, dairy waste management, and animal nutrition. Many graduate theses are currently addressing issues related to water quality in the North Bosque Watershed. Topics include phosphorus uptake by plants on fields where there has historically been excessive application of dairy manure, as well as fields whose productivity may be improved by the addition of phosphorus and organic materials found in dairy manure and compost. The goal of these projects is the sequestration of phosphorus and recycling of nutrients back into cattle and dairy operations.

A recent topic of study that could potentially improve hydrologic modeling efforts is the field truthing of USDA Soil Survey Geographic (SSURGO) data in Erath County. SSURGO data in Erath County are the digitized form of soil survey maps published in 1973. Verifying the accuracy of these data will allow modelers to better predict the response of areas studied in computer simulations.

TSU also boasts a state-of-the-art compost analysis laboratory. The compost analysis laboratory was created to support local analysis of the large number of composts generated in the area. Currently, TSU serves as a quality assurance provider to the Texas Department of Transportation (TxDOT) on composted products. Available testing includes standard physical and chemical analysis, maturity testing, and trace metal analysis via Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES).

For a more detailed description of TSU's projects and activities in the North Bosque Watershed, see the Agency and Project Fact Sheets on the North Bosque Watershed Coordination site www.brazos.org/NorthBosque/NorthBosqueHomepage.asp, or for more information about the COAHS, visit their homepage at: www.tarleton.edu/~ag/index.htm.


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**This newsletter is produced for the benefit of the North Bosque River Watershed Stakeholders. Its purpose is to inform the readers and to highlight positive activities taking place within the watershed. If you're involved in a project in the watershed or hosting an event related to pollution prevention or water quality enhancement and you'd like to see it in a future issue of this newsletter, please contact Gary Henry (ghenry@ brazos.org) or Kyle Headley (kheadley@brazos.org) by email or by phone at 254-761-3167.**

Issue 4 of the North Bosque Newsletter will highlight the Texas Farm Bureau and their efforts in the watershed

These newsletters, along with other aspects of the project, are now located on the Authority's website (www.brazos.org) under the tab labeled "North Bosque Watershed Coordination"