

Reducing Phosphorus in the North Bosque River

Taking Action to Improve Water Quality

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A Joint Publication of the Texas Commission on Environmental Quality and the Texas State Soil and Water Conservation Board

The North Bosque River contains high concentrations of nutrients, including phosphorus, which are reducing the quality of the water in the river. Working together, the Texas Commission on Environmental Quality (TCEQ) and the Texas State Soil and Water Conservation Board (TSSWCB) have developed a plan to reduce phosphorus in the North Bosque River.

But these state agencies need help. Much of the work of implementing the plan must fall to those in the watershed whose activities most directly affect phosphorus concentrations in the river—primarily agricultural producers and city wastewater treatment plant operators. While these people work hard to run their operations in a way that safeguards the environment, there is more work to be done to improve conditions in the river.

This booklet provides an overview of the water quality concerns for the North Bosque River. It also outlines the activities that the state is asking agricultural producers, wastewater treatment plant operators, and other residents to implement in order to improve water quality. Some of the measures in the plan are required under permit rules; others are voluntary.

Where Does the Pollution Come From?

The sources of water pollution fall into two main categories, called point and nonpoint sources. Pollution from *point sources* can be traced to a specific location, such as an industrial operation, a city wastewater treatment plant, or pens and barns of large animal feeding operations. Facilities that are point sources typically collect and manage their wastewater before discharging it to streams. Pollution from most point sources is controlled through permits or other regulations that require treatment of a facility's wastewater before it is discharged into a nearby lake or stream.

Nonpoint source pollution comes in large and small amounts, carried by rainfall runoff. For example, pollutants may wash off lawns, construction areas, farms, or highways during a heavy rain, and then be carried to a nearby creek. Nonpoint source pollutants are more difficult to control because they are not easily collected for treatment, and because they often come from the everyday activities of many different people.

The North Bosque River is affected by both point sources and nonpoint sources of pollution. Water quality concerns in

the watershed are largely associated with animal feeding operations, though discharges from other agricultural uses and urbanized areas also contribute.

While discharges from city wastewater treatment plants appear to be a small percent of the problem in comparison to the entire watershed, these discharges are constant, and they are the primary source of nutrients in areas of the streams immediately below their discharge points. This is especially true when natural flows in the river are low for lengthy periods.

Why Are Nutrients a Concern?

Nutrients are substances, such as nitrogen or phosphorus, that are essential to the growth of plants. However, an overabundance of nutrients can cause problems. In the North Bosque River, high levels of nutrients have contributed to excessive growth of algae and other aquatic plants in the river. This condition may cause taste and odor problems in drinking water, can impair the river's aesthetic value, and under certain circumstances can result in fish kills.

To address the high level of nutrients, total maximum daily loads (TMDLs) for phosphorus were established for the Upper North Bosque River and the North Bosque River. The TMDLs determined the amount (or load) of phosphorus that the streams can receive and still remain healthy. Responsibility for reducing phosphorus loading was then allocated among the major controllable sources. After that, an implementation plan was developed, which identifies measures necessary to reduce phosphorus loads.

Bacteria levels are also occasionally elevated in some tributaries of the North Bosque River, indicating a potential health risk to people who swim or wade in those streams. Management measures for control of phosphorus loading will also have some effect on reducing bacteria concentrations, since the nutrient and bacteria loads in the watershed largely originate from the same sites and materials, and are transported via the same processes and pathways.

Why Focus on Phosphorus?

Phosphorus, like other nutrients, is pervasive in the environment and is consequently a common constituent in animal waste and in discharges from wastewater treatment

plants. Phosphorus was chosen as the nutrient to reduce because it is the *limiting nutrient* for controlling algal and aquatic plant growth in the watershed. In order to grow, algae and other plants need multiple nutrients (like phosphorus, nitrogen, and carbon) in various quantities. If an essential nutrient is not available in sufficient quantity, plant growth can be limited—slowed, or sometimes stopped.

In various tests performed on water samples from the North Bosque River, phosphorus was shown to be the nutrient that would most effectively limit algal growth if reduced in quantity. Phosphorus is also generally easier to control than nitrogen, the other most available nutrient in the river.

Phosphorus has fewer sources, making it easier to achieve smaller concentrations. Also, it is easier to make phosphorus insoluble in water, thus making it less available to plants for their growth. In addition, phosphorus sources are more often from human activities that we may be able to control more easily than natural sources.

Algal blooms, or high concentrations of algae, can still occur when phosphorus is limited. But because the growth time may be slower, there will be fewer times in a year that algae growth in the river reaches high concentrations. Slower growth rates may also give time for natural processes in the river to limit overgrowth of algae.

Who Must Take Action to Improve Water Quality?

It is important for managers of animal feeding operations and city wastewater treatment plants to take specific steps to reduce phosphorus loads in the river. Other residents in the watershed can also help, even though their contribution of phosphorus to the river is less.

For example, cities may choose to improve the treatment of storm water discharges. Agricultural operations other than dairies can adopt practices that reduce phosphorus contributions from row crops or range management. Urban residents can contribute by not overfertilizing, and by not fertilizing before a rain, when fertilizers can wash off into storm drains.

Some measures in the state's plan for agricultural operations are included in current permit requirements; others are voluntary. Mandatory requirements or rule changes may be proposed if voluntary efforts are not adequate. Maximum phosphorus loads that will be allowed from wastewater treatment plants have been allocated for each of the cities in the watershed.

Individual animal feeding operations are categorized as either *concentrated animal feeding operations (CAFOs)* or *animal feeding operations (AFOs)*. Both CAFOs and AFOs must comply with rules set out in Chapter 321, Subchapter B, of the Texas Administrative Code. CAFOs must be authorized by registrations or individual permits, while AFOs operate without registration or individual permit.

In the North Bosque River watershed, AFOs and CAFOs are virtually all dairies, but other types of animal production fall into these categories. For dairies, AFOs are facilities with 200 head of cattle or fewer, while CAFOs are those facilities with more than 200 head.

What Are the Key Pollution Control Measures?

The implementation plan for the North Bosque watershed calls for a mix of regulatory and voluntary measures. The plan is also divided into two phases. If the voluntary efforts and regulatory requirements implemented in Phase I are not sufficient to improve the North Bosque River, the state will move to a second phase that includes changes in rules and regulations governing agricultural operations. Specific Phase II measures will be developed if and when the activities in Phase I fail to achieve the water quality goal of reducing phosphorus.

This booklet discusses the measures covered under Phase I. The key measures below are described in more detail later in this booklet.

For wastewater treatment plants:

- amended permits to address allocated loads for phosphorus in discharges.

For CAFOs and AFOs:

- adherence to current agriculture permit requirements (CAFOs) and regulations (both);
- development and implementation of comprehensive nutrient management plans (CAFOs) or water quality management plans (AFOs);
- participation in the compost program (removes dairy manure from the watershed);
- participation in educational programs; and
- taking part in microwatershed councils.

What Role Do Wastewater Treatment Plant Operators Play?

The implementation plan affects the wastewater treatment plants (WWTPs) of seven cities in the North Bosque watershed. The affected cities are Stephenville, Hico, Iredell, Meridian, Clifton, Valley Mills, and Cranfills Gap. Depending on the city, WWTPs in the watershed will either receive amended permit limits for phosphorus discharges, or will be required to monitor and report their discharges of phosphorus. The TCEQ will initiate permit amendments for all WWTPs that do not currently have phosphorus limits consistent with the loads allocated in the implementation plan. These initial amendments will be minor for most cities.

The affected cities have several options for meeting the allocations in the plan. For example, they may choose to upgrade the plant's technology, or they may choose to apply wastewater to land under an appropriate authorization. Unless there is significant population growth, the smallest WWTPs may be able to stay within the initial allocations indefinitely.

WWTP operators will be required to monitor discharges of phosphorus and report the results to the TCEQ. If data indicate that the discharge from a plant has reached 100

percent of the allowable load, based on the daily average for three consecutive months, the plant operator will have to formulate a plan to:

- achieve compliance with the load limit on total phosphorus, **or**
- achieve an effluent concentration of 1 milligram/liter of total phosphorus.

The plan must be submitted to the TCEQ within 90 days from the date that the permit limit was exceeded for three consecutive months. TCEQ staff will make a minor amendment to the affected permit to incorporate the final effluent limits and compliance period. After an amendment is processed and approved, the chosen option becomes a regulatory permit limit subject to enforcement if it is exceeded. WWTPs may be allowed a *maximum* of three years for construction of any new or improved facilities needed to comply with the amended permits.

To get more detailed information about the permit requirements, contact the Wastewater Permitting Section, listed under “For More Information” at the end of this booklet.

What Role Do Agricultural Producers Play?

A variety of voluntary measures are planned for implementation by agricultural producers. The local Soil and Water Conservation Districts (SWCDs) that are affiliated with the TSSWCB—the Upper Leon SWCD and the Cross-Timbers SWCD—will take the lead in assisting producers to implement their part of the plan. Field representatives of the federal Natural Resources Conservation Service (NRCS) and the state’s Texas Cooperative Extension (TCE) will provide technical support. Some state and federal funds may be available to producers to share the cost of implementing new management practices.

Nutrient management planning will be encouraged for all CAFOs and AFOs in the watershed. Agricultural producer councils will be formed to coordinate implementation at the local microwatershed level. Microwatersheds are management areas defined to be as small as practically possible, based on factors like commonality of land use, ease and cost of monitoring water quality, or geographic conditions. Educational programs, some required and some voluntary, will be provided by the TCEQ and the TSSWCB.

Permit Requirements for Dairies

New or expanding dairy CAFOs in the Bosque River watershed are now required to obtain individual permits from the TCEQ, rather than registrations. These CAFOs will be required to manage waste under nutrient management plans in the following ways:

- remove certain wastes from the watershed;
- haul wastes to authorized composting operations; and
- apply wastes to land according to an approved pollution prevention plan or a nutrient utilization plan approved by a certified nutrient management specialist.

Existing dairy CAFOs that continue to operate without expansion may operate under their existing permits or registrations. However, these operations will be required to update and implement any elements missing from their pollution prevention plans or nutrient utilization plans. When appropriate, these CAFOs may be required to develop some form of phosphorus-based waste management plan.

Existing dairy CAFOs that voluntarily modify their facilities, without any change in authorized herd size or dairy site plan:

- may not be required to obtain amendments of permits or authorizations to correct deficiencies of existing waste ponds, or other aspects of CAFO management; **or**
- may be required to obtain minor amendments under some circumstances if authorization is required to improve the operation or maintenance of waste ponds, or other aspects of CAFO management.

Permittees should discuss such plans with TCEQ Wastewater Permitting Section staff before beginning work, to determine if authorization is needed and to coordinate the work with the regulatory system.

Any *existing dairy AFO* that plans to expand its authorized herd to more than 200 head is required to apply for an individual permit and operate under CAFO regulations.

Nutrient Management Planning

Nutrient management planning supports both agricultural production and environmental protection. For example, nutrient management plans define the rates and schedules for application of animal wastes to land that meet goals to reduce phosphorus in the river.

The plans also include feed management practices, which can reduce the amount of phosphorus in dairy wastes without adversely affecting milk production or herd health. Nutrient management planning will be addressed by the TSSWCB in the North Bosque watershed through two types of plans:

- comprehensive nutrient management plans for CAFOs; and
- water quality management plans for AFOs.

The Comprehensive Nutrient Management Plan program was developed by the TSSWCB specifically to address water quality problems in the North Bosque watershed. *Comprehensive nutrient management plans* (CNMPs) are similar to *water quality management plans* (WQMPs). Each is a total resource management plan; both address more than nutrient management. However, WQMPs are broader in scope than CNMPs, covering all lands, whether contiguous or noncontiguous, that constitute an operating unit for agricultural or silvicultural purposes. A CNMP also addresses all functions of the operation, but only for production areas and waste application fields.

Comprehensive Nutrient Management Plans

CAFOs in the North Bosque watershed will be encouraged to develop comprehensive nutrient management plans. Much more than a traditional nutrient management plan, the CNMP provides a comprehensive natural resource plan in one coherent document. CNMPs look at the entire farm system to protect water quality by implementing practices related to:

- nutrient management,
- manure and wastewater handling and storage,
- land treatment,
- record keeping,
- feed management, and
- other utilization activities, like participation in the compost program.

While the CNMP program is based on NRCS practices, the state's program is separate and distinct from federal requirements. A CNMP is not the same as an NRCS 590 nutrient management plan; it is much more comprehensive. But the NRCS 590 plan will always be a component of the CNMP.

Special CNMP requirements include:

- certification by a professional engineer that all wastewater retention ponds meet or exceed the holding capacities required by the producer's permit; and
- soil sampling specifically targeted to the requirements of the CNMP.

For more detailed information about developing CNMPs, see the TSSWCB's Web site at www.tsswcb.state.tx.us/programs/cnmp.html, or contact one of the state agricultural agencies listed in the section "For More Information."

During development of a CNMP, a CAFO operator may determine that some aspects of the current operation are no longer feasible under an existing permit. For example, developing a nutrient management strategy may result in the need for additional land application acreage to meet the requirements for concentration of phosphorus per acre. Contact the TCEQ Wastewater Permitting Section for questions about situations that may or may not require amendments to permits.

Water Quality Management Plans

AFOs will be encouraged to develop WQMPs. These plans must be certified by the TSSWCB. A WQMP is a whole-farm conservation plan, of which a nutrient management plan is one component. No changes have been made to the existing WQMP program for the North Bosque watershed.

Certification of Plans and Financial Assistance

The TSSWCB certifies both CNMPs and WQMPs. While dairy operators are not required to implement a certified CNMP, they are encouraged to participate in the program and to take a proactive approach to improving water quality.

If certified by the TSSWCB, the CNMP meets the TCEQ permit requirements for both the *nutrient utilization plan (NUP)* and the *pollution prevention plan (PPP)*. However, the act of possessing a certified CNMP does not excuse the producer from maintaining the document in such a way that it continues to meet the requirements of a PPP. The producer ultimately bears that responsibility. Without a certified CNMP, a CAFO must still submit a PPP and an NUP to the TCEQ to comply with its permit.

CNMPs must be developed under TSSWCB criteria to be eligible for certification. The criteria are adapted from the

NRCS's *Field Office Technical Guide*, but are specialized to address concerns in the Bosque watershed. Producers who receive certification of CNMPs or WQMPs may be eligible for cost-sharing payments through the local SWCD. Financial assistance may also be available from some Texas universities and institutes, and from the NRCS Environmental Quality Incentive Program (EQIP).

Compost Program

The goal of the composting program is the removal of about 50 percent of the manure generated by CAFOs from the North Bosque River watershed in order to reduce nutrient loads to the river. Participation in the compost program is voluntary, but may provide the most efficient way for some dairies to meet new requirements for manure management (see "Permit Requirements for Dairies").

The composting facilities will provide dairies with an alternative to land application for the disposal of manure. The goal of the TCEQ portion of the program is to create a sustainable market for manure-derived compost, so that private commercial composting facilities can be established and remain economically viable in the long term. The Texas Department of Transportation (TxDOT) is expected to be the largest governmental purchaser of compost over the next few years. TxDOT has already bid projects slated to use more than 149,000 cubic yards of compost from the Bosque watershed.

The TSSWCB's portion of the program, the Dairy Manure Export Support (DMES) project, provides financial incentives to support the transport of surplus manure from dairy farms in portions of the North Bosque River watershed to compost facilities. Agricultural operations that use compost at their sites may also qualify to receive assistance from the TSSWCB under long-standing agricultural assistance programs. This assistance is available to those who develop and implement nutrient management plans that include compost.

When manure is transferred to composting facilities in the watersheds, it must be properly treated and contained, and must not worsen existing water quality problems. The compost facilities operate by permit under design, operating, and reporting requirements established by the TCEQ.

There is also an educational component of the compost program, which is described later in this booklet under "Educational Programs and Materials."

Microwatershed Councils

Agricultural producer councils grouped by microwatersheds will be formed by the TSSWCB for the purposes of disseminating information, discussing development and implementation issues and cost-share opportunities, and promoting peer involvement. The councils will include landowners and agricultural producers from within each microwatershed.

The Cross-Timbers SWCD and the Upper Leon SWCD will provide technical and financial assistance to the councils. The SWCD staff will work closely with the TSSWCB Regional Office in Dublin, Texas.

The Texas Institute for Applied Environmental Research (TIAER) will monitor the watershed to determine the

reduction in pollution resulting from agricultural management measures. TIAER will also provide data to inform microwatershed councils of their contribution to that pollution and to improvements.

Monitoring sites will be set up at targeted areas within each microwatershed. TIAER will conduct a monitoring demonstration so that each microwatershed council will be able to see local evidence of nutrient losses from waste application fields.

Educational Programs and Materials

CAFO operators must complete an eight-hour course on animal waste management within 12 months of being authorized to operate. An additional eight hours of training in animal waste management is required in each subsequent 24-month period. Continuing education is periodically provided for agricultural producers in the North Bosque River area by the Texas Cooperative Extension and the TSSWCB.

Class instruction is designed to meet the needs of dairy operators. Topics sometimes include aspects of phosphorus-based waste management, such as proper management of waste application fields, development of nutrient management plans, and the methods and benefits of reducing phosphorus levels in animal feed.

The composting program also provides a training and technical assistance program. It is available for compost facility operators, TxDOT staff and contractors, and staff of other state agencies. The training is delivered by the TCEQ Small Business and Environmental Assistance Division (SBEA). Compost operators receive training and technical assistance in best management practices for their sites. State agency staff and their contractors can enroll in workshops and receive technical assistance in the use of compost products for nonpoint source pollution control, revegetation, and soil improvement. The Texas Cooperative Extension (TCE) is also developing a training program on the proper application of compost. They will offer it first to county extension agents, before developing it for a broader audience.

Dairy operators are also encouraged to participate in the independent Agriculture Producer Certification Option, being coordinated by the Texas Association of Dairymen, the Dairy Farmers of America, the Texas Cooperative Extension, and TIAER. Operators who participate in this third-party assessment program are eligible for continuing education credits.

To get more detailed information about educational opportunities, visit one of the Web sites or contact one of the government agencies listed in the section "For More Information" at the end of this booklet.

When Will We See Improvement?

Nutrient concentrations in the North Bosque River and its tributaries are highly variable, depending on weather conditions, as is true of most stream systems. Short-term improvements due to control actions or management measures are difficult to distinguish from the natural

variability due to weather. Short-term adverse impacts due to operational failures may also obscure improvements.

The success of the TMDLs and the implementation plan must be assessed based on long-term, watershed-wide trends and conditions. That assessment must recognize that operational failure at a specific site does not constitute failure of the implementation plan or inadequate progress towards its goals. It is likely that five or more years worth of stream monitoring data will be needed to determine with reasonable confidence whether the long-term watershed trend indicates improvement. The TCEQ will conduct a mid-course review in 2006 to evaluate progress in implementing the plan.

How Will Success Be Measured?

Water quality will be the primary and ultimate measure by which success of the North Bosque River TMDL implementation plan is assessed. Water quality improvements will be evaluated based on measured concentrations of two forms of phosphorus—soluble reactive phosphorus or orthophosphate-phosphorus. Average annual soluble phosphorus concentrations at each of five sites along the North Bosque River will be assessed, using a method based on comparing stream monitoring data to model results and historical data.

In addition, the TCEQ and the Brazos River Authority (BRA) are developing a monitoring strategy for the North Bosque and the neighboring Leon River watershed to measure water quality improvements attributable to the removal and composting of manure. The TSSWCB has executed a contract with TIAER to perform microwatershed monitoring that will help identify specific tributaries and subwatersheds that may need additional, more intensive implementation of management practices. Microwatershed monitoring will also aid in measuring water quality improvements that result from the composting program.

In addition to measuring water quality improvement, the TCEQ and the TSSWCB will track activities and steps taken towards implementing the measures outlined in the plan. For example, the TSSWCB will track how many dairies adopted CNMPs or WQMPs. The TCEQ will track the number of water-related permit actions, such as new and amended permits, or violations of permit conditions.

If environmental data eventually indicate that there has not been sufficient change in water quality, these programmatic measures may indicate whether implementation efforts have been incomplete or erratic. That appraisal will provide insight on appropriate measures for Phase II, if Phase I activities are insufficient to meet the plan's water quality goal.

For More Information

More details about the implementation plan and the legal authority of the state to administer it are available in *An Implementation Plan for Soluble Reactive Phosphorus in the North Bosque River Watershed*. The plan is available on the TCEQ Web site, www.tceq.state.tx.us; in the Site Search

box on the main page, enter “North Bosque River,” then follow the link to the “North Bosque TMDL Project.”

TCEQ

TMDL Program

Call the TCEQ at 512/239-4900 to speak with a staff member of the TMDL Program, or write to:

Texas Commission on Environmental Quality
Total Maximum Daily Load Program
MC 203
P.O. Box 13087
Austin, Texas 78711-3087

Regional Offices

Contact the TCEQ’s Special Project Office in Stephenville at 254/965-9200 or 800/687-7078; or the TCEQ Dallas Regional Office at 817/588-5800.

Wastewater Permitting

Call the TCEQ Wastewater Permitting Section at 512/239-4671, or write to the previously listed address, MC-148.

Small Business and Environmental Assistance

For training and assistance with compost practices, call the TCEQ *Small Business and Environmental Assistance Division* at 512/239-6774, or write to the previously listed address, MC-112.

TSSWCB and SWCDs

Texas State Soil and Water Conservation Board

Visit the TSSWCB Web site at www.tsswcb.state.tx.us. Call the TSSWCB at 254/773-2250 or 800/792-3485, or write to:

Texas State Soil and Water Conservation Board	Dublin Regional Office
311 N. 5th	611 East Blackjack
P.O. Box 658	Dublin, Texas 76446-2321
Temple, Texas 76503	254/445-4814

Soil and Water Conservation Districts

Cross Timbers SWCD	Upper Leon SWCD
239 East McNeil	301 Hwy 3381
Stephenville, Texas 76401	Comanche, Texas 76442
254/965-3715, ext. 3	915/356-5186, ext. 3

U.S. Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS), Texas Office

USDA-NRCS	Stephenville Field Office
101 South Main	239 East McNeil
Temple, Texas 76501	Stephenville, Texas 76401
254/742-9800	254/965-3715

www.tx.nrcs.usda.gov

The NRCS’s *Field Office Technical Guide* is available on their Web site at www.nrcs.usda.gov/technical/efotg/.