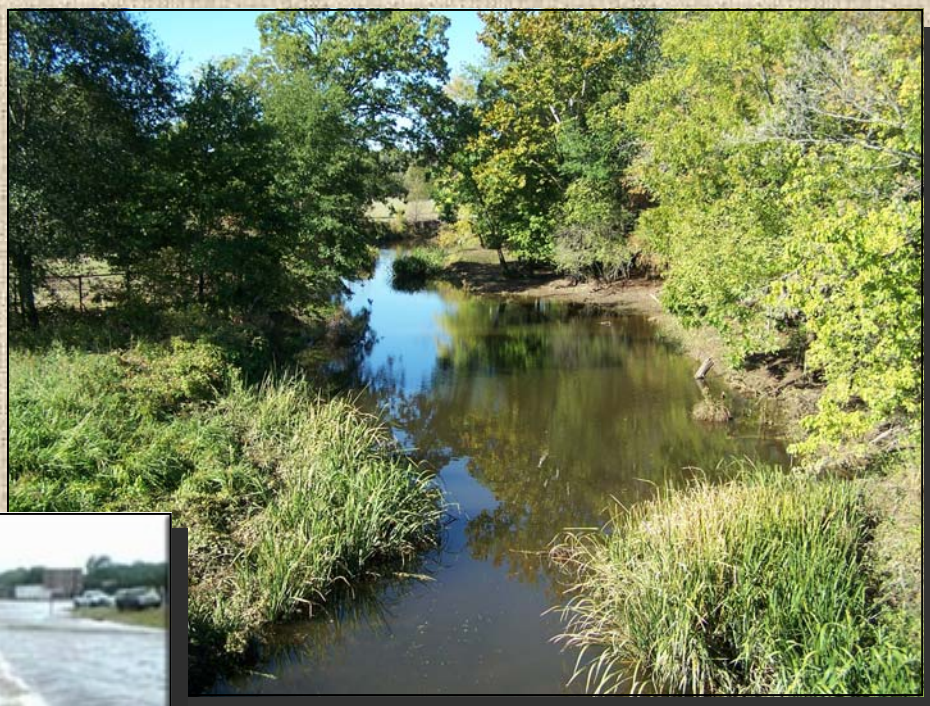

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Red River Basin Highlights Report 2008

THE TEXAS CLEAN RIVERS PROGRAM

The Red River Basin Highlights Report was Prepared with and Financed through Grants from the Texas Commission on Environmental Quality

INTRODUCTION

In 1991, the Texas Legislature passed the Texas Clean Rivers Act (Senate Bill 818). The Act was intended to move Texas toward comprehensive water resources planning and management to ensure the integrity of the state's water supply over the long term.

The Act established the Texas Clean Rivers Program or CRP under the Texas Water Commission (now the Texas Commission on Environmental Quality or TCEQ, after TWC's merger with the Texas Air Control Board in 1992).

The CRP is a state fee–funded program for water quality monitoring, assessment, and public outreach. The CRP provides the opportunity to approach water quality issues within a watershed or river basin locally and regionally through coordinated efforts among diverse organizations.

The CRP has proven to be a huge success as it has evolved into an ongoing, systematic, quality-controlled monitoring system that helps protect and improve the surface water quality in Texas. It began by contracting with 15 partner agencies, which included twelve river authorities, one water district, one federal agency, and one council of government. For nearly 17 years, this group has successfully managed the surface water quality in Texas by developing monitoring programs and assessing the results of the monitoring.

The goals of CRP parallel those of the Red River Authority of Texas and the TCEQ and their mutual efforts to share this expertise with the public. Responding to the stakeholders, focusing on priority issues, and keeping abreast of regulatory mandates enables the Authority and the TCEQ to reach the CRP goals.

These goals are updated periodically through a collaborative effort of the TCEQ, the partner agencies, and stakeholders throughout the state to ensure the program maintains a contemporary focus on water quality. The program's Long Term Plan outlines the major objectives and strategies for how the program will achieve its goal. Implementation of the Long Term Plan is manifested in the guidance document developed by TCEQ project management staff with input from the partner agencies.

RED RIVER BASIN WATERSHED MANAGEMENT PROGRAM

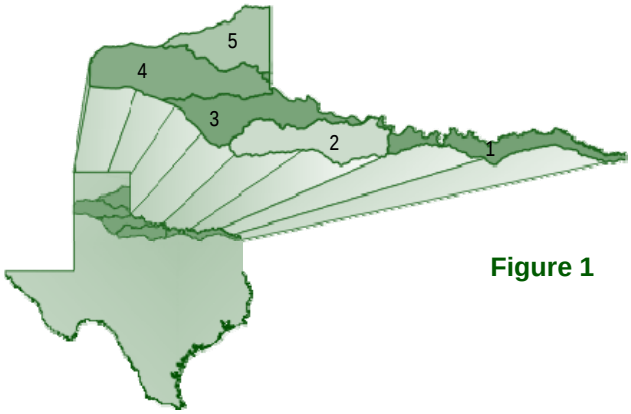


Figure 1

To assist in planning, monitoring, geographically analyzing, and disseminating data, the Authority divided the basin into five reaches (see **Figure 1**). A five-year rotational approach was developed to effectively monitor the aquatic health of the basin. This rotational approach provides emphasis to be given to a different reach each year. Therefore, the entire basin receives intensive coverage over a five-year time span. The reach of focus for 2007 was **Reach 3**, however discussion of the water quality in each reach is included later in this report.

WATER QUALITY IN THE RED RIVER BASIN

The water quality in the Red River Basin is generally good and the majority of the basin supports adequate aquatic life and recreational uses. The issues that do affect the water quality are the excessive levels of chloride and sulfate or salts that are found in the western portions of the watershed. Although these salty water bodies are seemingly diluted with large inflows of contributing streams and creeks as the waters flow downstream, the impact or dilution is not enough to allow the waters of the Red River to be used as a drinking water source without first undergoing costly treatment to remove or reduce these salts. An increasing number of rivers and water bodies in the Red River Basin have seen increased chloride and sulfate levels due to evaporation. The above average rainfall in 2007 did little to resolve the problem.

Floods of Record

By the end of December 2006, most of the basin was in the grip of what seemed like a water catastrophe. Area cities were implementing drought contingency plans by declaring Stage 1 water restrictions and asking the general public to reduce non-essential usage. In the Wichita Falls area, water supply lakes such as Lake Arrowhead and Lake Kickapoo had reached an approximate combined low of 65.5 percent. Further west, Greenbelt Lake was also feeling the impact of the drought. Lakes in the eastern portion of the basin were affected to a lesser degree.

In the first quarter of 2007, most of Texas had started receiving increased rainfall. Although not enough to fill area lakes, the rains did replenish dry stock tanks and lake levels began to rise.

Above average rainfall in June and July of 2007 fell across the majority of the Red River Basin, filling area lakes to capacity. Lake Arrowhead, located on the Little Wichita River, which had not gone over the spillway in over a decade, spilled over for days. In late June, the Wichita River rose to its highest level on record of 24.4 feet, flooding parts of downtown Wichita Falls and several neighborhoods located along the river on the east and west sides of the city. The previous record of 24 feet was recorded in October 1941. As the rains continued to fall across the Red River Basin, other cities downstream in the basin were also subjected to flooding. Gainesville and the Sherman- Denison areas were some of the hardest hit with floods similar to that of the Wichita Falls area. Lake Texoma topped its spillway for only the third time since the dam was completed in 1944.

The rains turned dusty dry pastures into lush green fields of grass. After the floods in July, rainfall in the basin came to a halt. Once abundant vegetation began to wither and die from a lack of rain, leaving the potential for wildfires that could exceed those experienced in the early part of 2006. Those

wildfires scorched and blackened over 50,000 acres in the Ringgold area and over 750,000 acres in the Texas Panhandle.

Figure 2 shows a comparison of precipitation for 2006 and 2007. As shown, some portions of the Red River Basin received approximately ten inches more rainfall in 2007 as compared to the 2006 totals. This increase has helped ease the drought conditions in the basin, as well as providing additional water in the basin's major reservoirs. **Table 1** shows the capacity of major reservoirs in the Red River Basin versus the current percentage of capacity as of December 2007.

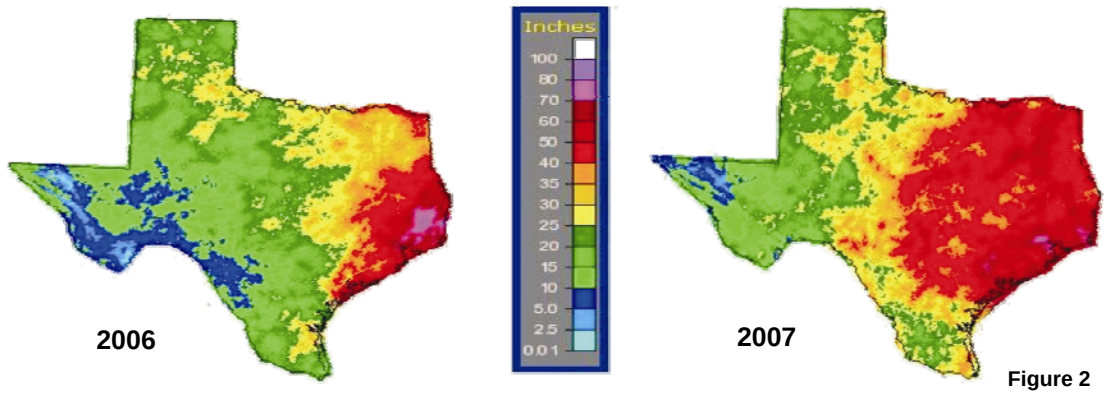


Figure 2

Courtesy of the Southern Regional Climate Center

Table 1 — Reservoir Capacities

	Conservation Storage Capacity	
Reservoir	**Total Ac/Ft**	**% Ac/Ft**
Lake Arrowhead	235,997	88%
Greenbelt Reservoir	59,500	36%
Lake Kemp	245,308	100%
Lake Kickapoo	85,825	71%
Lake Mackenzie	46,429	15%
Pat Mayse Lake	118,100	100%
Lake Texoma	2,525,281	96%

* as of December 2007—Texas Water Development Board

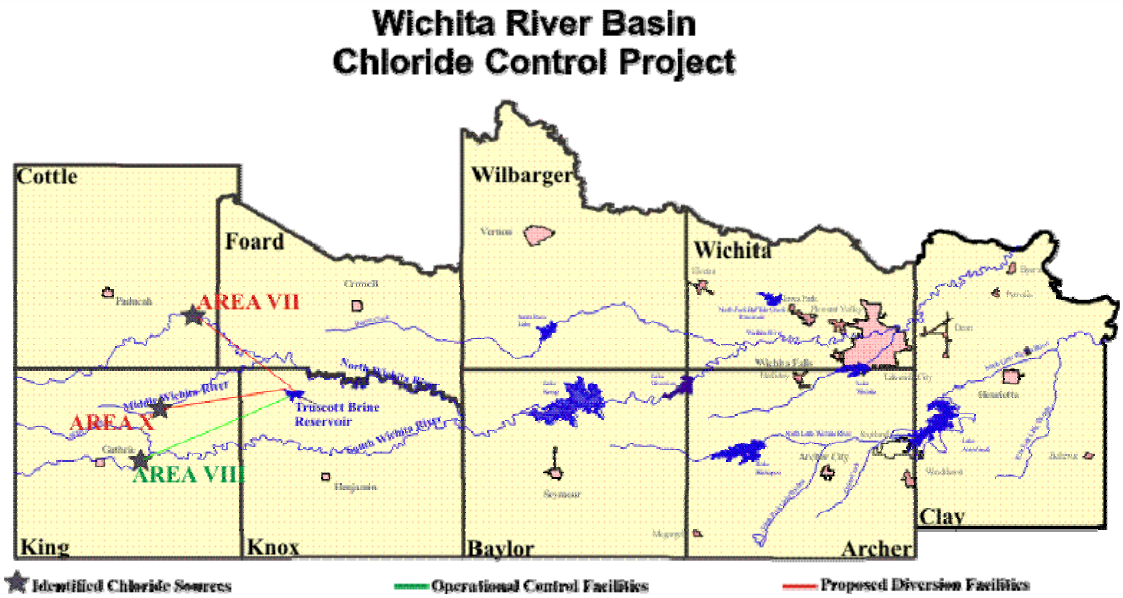


Figure 3

Elevated chloride levels in the Red River Basin have been an ongoing issue in water quality. Historically, the Red River Basin was once part of an ancient inland sea. However, through geologic processes, this ancient sea became isolated and slowly evaporated over time. The salts from the prehistoric sea continue to plague the basin today. They occur naturally either through salt springs and seeps or from manmade events. As a result, the waters of the Red River, Wichita River, and Pease River systems contain excessive concentrations of chloride and sulfate.

In 1957, the federal government initiated a study which identified ten natural salt source areas located in the Red River Basin. These sources contribute a daily average of over 2,360 tons of the 3,540 tons per day of chloride that flow downstream and enter Lake Texoma in Grayson County. This equates to an amount greater than that consumed by every human and animal in the United States each year. The higher concentrated areas are located in **Reaches 2** and **3** of the basin.

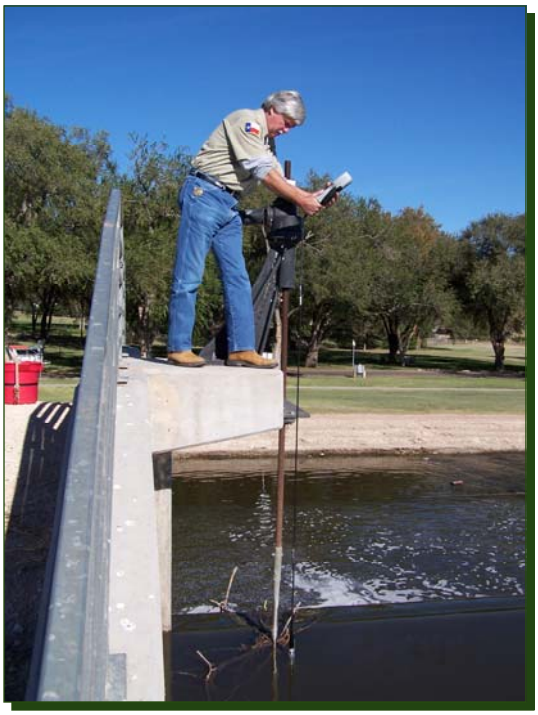
The Authority and the United States Army Corps of Engineers (USACE) have worked together since 1959 through the implementation of the Chloride Control Project to reclaim the water for beneficial uses for all living things. Since its beginning, this project has controlled more than 405 tons per day of chloride entering the river system without harming the environment. Three of the natural chloride sources are located in the Wichita River Basin (refer to **Figure 3**). To date, only one of the proposed chloride control facilities in the Wichita River Basin has been constructed and is operational. This low-flow dam structure on the South Wichita River retains low flows that are high in salts and diverts them via a pump station and pipeline to Truscott Brine Reservoir. Low-flow diversion dams were also planned several years ago for the Middle and North Wichita Rivers. If constructed, water high in chloride that would normally flow to Lakes Kemp and Diversion would be diverted to the Truscott Brine Reservoir. For additional information on the Chloride Control Project and/or the Wichita River Basin Chloride Control Project, please review the Authority's website at **www.rra.dst.tx.us** or the USACE's website at **www.swt.usace.army.mil**. In September 2007, both the House and the Senate overturned the President's veto of the Water Resources Development Act (WRDA). This Bill directs the U.S. Army Corps of Engineers to provide operations and maintenance funding for the Red River Chloride Control Project. Although the Bill was approved, construction funds were not allocated.

While regional activities impact the local watersheds, site specific problems are intensified by the larger scale influences of naturally occurring and man-made pollution to receiving waters. Watershed run-off from urban and agricultural activities are also major contributors of pollution. Control programs, such as storm water run-off monitoring and the inclusion of more stringent requirements in livestock permits, are being implemented to reduce adverse impacts to watersheds from these types of pollution.

SURFACE WATER QUALITY MONITORING

The collection, management, and assessment of water quality data within the Red River Basin are integral components of the Clean Rivers Program. Water quality can be difficult to measure, since it consists of an immense network of branching rivers, springs, creeks, lakes, etc. Each water body can contain dramatically different levels of pollution. Water quality issues influence human and environmental health, so the more we monitor our water the better we will be able to recognize and prevent contamination problems.

The Authority holds a Coordinated Monitoring Meeting annually. This allows for the coordination of sites, parameters of concern, and frequency of collection with other agencies and program participants that assist in planning, data collection, and analysis. This meeting allows for the development of a monitoring schedule that reduces duplicative efforts, which in turn maximizes the funds available for sampling. It is an essential element in the successful planning process of the basin and is open to any interested group or entity that would like to attend and/or participate in monitoring in the Red River Basin. A summary of the monitoring schedule for 2007 is listed in **Table 2** or a more detailed Coordinated Monitoring Schedule for the Red River Basin can be found at **http://cms.lcra.org**.



*Selected **physical, chemical** and **biological** parameters collected by the Environmental Services Division (ESD) of the Authority are analyzed either in the field or at the Authority's environmental laboratory. The results of the analyses are entered into the data repository, which contains years of quality-assured water resource information in the Red River Basin.*

Table 2 — Overview of Coordinated Monitoring Schedule - 2007

Agency	Reach	Cont Flow	24-Hr DO	Metals Water	Organ Water	Metals Sed	Organ Sed	Conv	Ind Bact	Instant Flow	Field	RT	IS	DI	SS
RRA	I							56	56	36	56	14			
TCEQ	I							34	58	44	34	9			2
Sherman	I								72	72	72	6			
USGS	I	730						4	4		4	2			
Total Reach I		730						94	190	152	166	31			2
RRA	II							32	96	84	96	4	4		
TCEQ	II		7	24		4		42	42	32	42	13		2	2
Sherman	II														
USGS	II	5,475						9			3,285	15			
Total Reach II		5,475	7	24		4		83	138	116	3,423	32	4	2	2
RRA	III							8	8	8	8	2			
TCEQ	III			2		2		20	20	20	20	5			1
Sherman	III														
USGS	III	1,095									365	3			
Total Reach III		1,095		2		2		28	28	28	393	10			1
RRA	IV							8	8	8	8	2			
TCEQ	IV			4				14	14	8	14	4			
Sherman	IV														
USGS	IV	1,460										4			
Total Reach IV		1,460		4				22	22	16	22	10			
RRA	V							20	20	20	20	5			
TCEQ	V					2		8	8	4	8	2			1
Sherman	V														
USGS	V	1,460										5			
Total Reach V		1,460				2		28	28	24	28	12			1
Basin Total		10,220	7	30	0	8	0	255	406	336	4,032	95	4	2	6

Cont Flow	Continuous Flow	Organ Water	Organics in Water	Ind Bact	Indicator Bacteria	RT	Routine Sampling
24-Hr DO	24-Hour Dissolved Oxygen	Metals Sed	Metals in Sediment	Instant Flow	Instantaneous Flow Measurements	IS	Intensive/Systematic Sampling
Metals Water	Metals in Water	Conv	Conventional Parameters	Field	Field Parameters	DI	Diurnal Sampling
						SS	Special Studies

**Continuous flow measurements by the USGS are recorded on an hourly basis.*

Regular monitoring is necessary to collect quality-assured data to complete an assessment of water quality conditions and impairments. There are **four** types of monitoring in the Red River Basin performed by the Authority, the City of Sherman, the TCEQ and the USGS.

1. **Routine** monitoring is the traditional type of monitoring conducted at regular intervals every year at key sites.

2. **Systematic Watershed** (Intensive) monitoring is conducted at specific sites on the annual reach of focus.

3. **Permit Support** monitoring identifies specific areas where additional information on water quality and quantity is needed for the permitting process.

4. **Special Studies** on priority watersheds are conducted where special attention is required.

There are two primary types of data collected at each sampling site: ***field and conventional***. Field parameters are collected and utilized as real time indicators of the water quality at each site. Conventional parameters are collected, preserved, and taken back to the laboratory for processing and analysis. **Table 3** provides a list of some of the field and conventional parameters that are currently being collected in the Red River Basin. In addition, the quality-assured data collected by the Authority are entered into the Authority's database and made available on the Authority's website at **www.rra.dst.tx.us**.

Table 3 — Collected Water Quality Parameters	
FIELD PARAMETERS ***Collected and processed in the field laboratory. Results are expressed in mg/L except as noted.***	
Temperature	The temperature of water at the time of collection. An important physical relationship exists between the amount of dissolved oxygen in a body of water and its temperature. Simply put, the warmer the water, the less dissolved oxygen.
pH	The hydrogen-ion activity of water caused by the breakdown of water molecules and the presence of dissolved acids and bases. pH determines whether a water body is acidic, neutral, or basic. The pH of the water can affect the toxicity of many substances.
DO	Dissolved Oxygen (DO) – The oxygen that is freely available in water. DO is vital to fish and other aquatic life and the prevention of odors. Traditionally, adequate ranges of dissolved oxygen levels have been accepted as the single most important indicator of a water body's ability to support desirable aquatic life.
Conductivity	A measurement of the electrical current carrying capacity of water. Dissolved substances, such as salts, have the ability to conduct electrical current. Conductivity is a measure of how salty the water is. Salty water has a high conductivity. This can be used as an indicator of how much dissolved solids are polluting the water.
Turbidity	A measure of clarity of a water sample expressed in NTU's (Nephalometric Turbidity Units). The higher the turbidity, the muddier the water.
Flow	The velocity of the water body at the time of sampling, expressed in CFS (cubic feet per second) or how fast the water is moving. Flow combined with other parameters can be a good indicator of water quality.
Flow Measurement Method	The manner in which flow is measured, usually by gage or electrical device.
E. coli	The current indicator bacteria to determine if the water body is suitable for contact recreation. It is expressed in MPN (most probable number) per 100 mL of water. High results on the *E. coli* test can indicate a potential pollution problem. *E. coli* is used as an indicator because it can be potentially harmful to people.
Water Clarity	Clearness of the water as it appears in the water body at the time of sampling.
Water Odor	Odor of the water, if any. Odors can aid in discovering problems in a water body.
Weather	Listing of basic weather conditions at the time of sampling. This information is useful if a problem is weather related.
Days Since Last Significant Precipitation	The number of either estimated or actual days since the last beneficial rainfall event.
CONVENTIONAL PARAMETERS ***Processed by the Authority's ESD and subcontract laboratories. Results are expressed in mg/L except as noted.***	
Alkalinity	A measure of the acid-neutralizing capacity of water.
Ammonia	Naturally occurring in surface and wastewater, and is produced by the breakdown of compounds containing organic nitrogen. Elevated ammonia levels are a good indicator of organic pollution.
Calcium	Dissolved metal associated with chloride, sulfate, and alkalinity.
Chloride	One of the major inorganic ions in water and wastewater. Concentrations can be increased by industrial processes. High chloride concentrations can affect metallic objects, growing plants, and make water unsuitable for drinking. Chloride compounds, often known as salts, can be an indicator of natural or manmade pollution, as in the case of oil field brines.
Chlorophyll a	A photosynthetic pigment which is found in all green plants. The concentration of chlorophyll a is used to estimate phytoplankton biomass in surface water. Results are expressed in µg/L (micrograms per liter).
COD	Chemical Oxygen Demand (COD) — A measure of the amount of oxygen required to oxidize all compounds in the water. COD is an indicator of how much organic load is placed on the oxygen in a water body.
Nitrate+Nitrite Nitrogen	Naturally occurring nutrient compounds that algae use for growth. In elevated concentrations can be used as an indicator of human caused pollution
Orthophosphorus	Is a soluble form of phosphorus (PO_4) that is applied to urban and agricultural land as fertilizers and is often found in storm water run-off.
Pheophytin	An important degradation product of chlorophyll a and interferes with the measurement of chlorophyll a. It is used to determine a more accurate measure of chlorophyll a. Results are expressed in µg/L (micrograms per liter).
Sulfate	Usually dissolved into waters from rocks and soils containing gypsum, iron sulfides, and other sulfur compounds. Sulfides are widely distributed in nature and in high concentrations, sulfate can affect drinking water.
TOC	Total Organic Carbon (TOC) is all of the organic carbon portions, in a water body.
TDS	Total Dissolved Solids (TDS) – A measure of solids, both organic and inorganic, dissolved in water.
Total Phosphorus	An essential nutrient to the growth of organisms and can be the nutrient that limits the primary productivity of water. In excessive amounts from wastewater, agricultural drainage, and certain industrial wastes, it also contributes to the eutrophication of lakes and other water bodies. Phosphorus is commonly known as a man made pollutant.
TSS	Total Suspended Solids (TSS) – A measure of the total suspended solids in water, both organic and inorganic.
VSS	Volatile Suspended Solids (VSS) – A portion of the TSS that is lost after cooking at high temperatures. This represents the organic part of the TSS.

National Environmental Laboratory Accreditation Conference (NELAC)

Red River Authority's new facilities located at 3000 Hammon Road in Wichita Falls

In 2001, the 77th Texas Legislature passed HB 2912, requiring that all data used by the TCEQ for commission decisions regarding permits or other authorizations, compliance matters, enforcement actions, or corrective actions be from an accredited environmental laboratory.

HB 2912 also transferred authority for environmental laboratory accreditation and drinking water certification from the Texas Department of Health to the TCEQ and required that the state's environmental testing laboratory accreditation program be consistent with NELAC. This transfer of authority became effective on September 1, 2001.

Prior to NELAC, the existing state programs varied widely in scope and requirements. The NELAC Standard provides uniform requirements for accreditation of environmental laboratories to ensure that decisions being made are based on data that is scientifically accurate.

The deadline for all environmental laboratories that submit data to the TCEQ to become NELAC accredited is June 1, 2008. Since April of 2005, the Authority has been working diligently on obtaining its NELAC accreditation. To assist the Authority's Environmental Laboratory in becoming NELAC accredited, the Authority relocated its laboratory to its new facilities in Wichita Falls. The new facility expanded the capabilities of the Authority's Laboratory to meet the NELAC requirements. In addition, the Authority enlisted a consulting firm to conduct a NELAC-Readiness audit of the facilities. Laboratory personnel are continuing to attend NELAC training workshops to prepare for the NELAC accreditation. The Authority's Environmental Services Laboratory has completed the application process and is awaiting notification of an on-site assessment by the TCEQ.

Water Quality Data Assessment

The water quality data collected by the Authority, its partners and the TCEQ are assessed every two years in even numbered years, as required by law. This review is designed to compare water quality conditions in classified stream segments against established water quality standards, (see **Table 4** for a complete list of stream segments in the Red River Basin). Water quality standards are set by the TCEQ in an effort to ensure water in Texas is safe for public use, able to adequately protect aquatic life, and yet allow for urban and economic growth. Information and a list of surface water quality standards for all water bodies in Texas can be found at the TCEQ website at www.tceq.state.tx.us./nav/eq/eq_swqs.html.

Table 4 — Red River Basin Segment Descriptions

Segment	Detailed Description
0201	Lower Red River - From the Arkansas State Line in Bowie County to the Arkansas-Oklahoma State Line in Bowie County.
0201A	Mud Creek (unclassified water body) - From the confluence of the Red River to the upstream perennial portion of the stream northwest of De Kalb in Bowie County.
0202	Red River Below Lake Texoma - From the Arkansas-Oklahoma State Line in Bowie County to Denison Dam in Grayson County.
0202A	Bois D' Arc Creek (unclassified water body) - From the confluence of the Red River to the upstream perennial portion of the stream southwest of Bonham in Fannin County.
0202C	Pecan Bayou (unclassified water body) - From the confluence with the Red River in northeast Red River County to the upstream perennial portion northeast of Clarksville.
0202D	Pine Creek (unclassified water body) - From the confluence of the Red River to the upstream perennial portion of the stream west of Paris in Lamar County.
0202E	Post Oak Creek (unclassified water body) - From the confluence of Choctaw Creek southeast of Sherman to the upstream perennial portion of the stream northwest of Sherman in Grayson County.
0202F	Choctaw Creek (unclassified water body) - From the confluence with the Red River east of Denison to the upstream perennial portion near the intersection of SH 56 and SH 289 in Grayson County.
0202G	Smith Creek (unclassified water body)- From the confluence with Pine Creek north of Paris to the upstream portion of the stream in north Paris in Lamar County.
0203	Lake Texoma - From Denison Dam in Grayson County to a point immediately upstream of the confluence of Sycamore Creek in Cooke County, up to the normal pool elevation of 617 feet (impounds Red River).
0203A	Big Mineral Creek (unclassified water body) - From the confluence of Lake Texoma to the confluence of North/Middle/South Big Mineral Creeks north of Whitesboro in Grayson County
0203C	Mustang Creek (unclassified water body)- From the confluence with Big Mineral Creek upstream to headwaters approximately 3.3 km southeast of Whitesboro.
0203D	Deaver Creek (unclassified water body)- From the confluence with Big Mineral Creek upstream to headwaters approximately 6.5 km WSW of Southmayd
0204	Red River Above Lake Texoma - From a point immediately upstream of the confluence of Sycamore Creek in Cooke County to the confluence of the Wichita River in Clay County.
0204B	Moss Lake (unclassified water body) - From Fish Creek Dam to spillway elevation of 715 feet (impounds Fish Creek).
0205	Red River Below Pease River - From the confluence of the Wichita River in Clay County to the confluence of the Pease River in Wilbarger County.
0206	Red River Above Pease River - From the confluence of the Pease River in Wilbarger County to a point immediately upstream of the confluence of Buck Creek in Hardeman County.
0206A	Groesbeck Creek (unclassified water body) - From the confluence of Prairie Dog Town Fork Red River north of Quanah in Hardeman County to the upstream perennial portion of the stream east of Childress in Childress County.
0206B	South Groesbeck Creek (unclassified water body) - From the confluence of Groesbeck Creek NNW of Quanah in Hardeman County to the upstream portion 7.8 miles (12.6 Km) southwest of Childress
0207	Lower Prairie Dog Town Fork Red River - From a point immediately upstream of the confluence of Buck Creek in Hardeman County to a point 100 meters (110 yards) upstream of the confluence of Salt Fork Creek in Armstrong County.
0207A	Buck Creek (unclassified water body) - From Oklahoma State Line east of Childress in Childress County to the upstream perennial portion of the stream west of Wellington in Collingsworth County.
0208	Lake Crook - From Lake Crook Dam in Lamar County up to the normal pool elevation of 476 feet (impounds Pine Creek).
0209	Pat Mayse Lake - From Pat Mayse Dam in Lamar County up to the normal pool elevation of 451 feet (impounds Sanders Creek).
0210	Farmers Creek Reservoir (Lake Nocona) - From Farmers Creek Dam in Montague County up to the normal pool elevation of 827 feet (impounds Farmers Creek).
0211	Little Wichita River - From the confluence with the Red River in Clay County to Lake Arrowhead Dam in Clay County.
0212	Lake Arrowhead - From Lake Arrowhead Dam in Clay County up to the normal pool elevation of 926 feet (impounds the Little Wichita River).

Table 4 — Red River Basin Segment Descriptions (continued)	
Segment	**Detailed Description**
0213	Lake Kickapoo - From Kickapoo Dam in Archer County up to the normal pool elevation of 1045 feet (impounds North Fork Little Wichita River).
0214	Wichita River Below Diversion Lake - From the confluence with the Red River in Clay County to Diversion Dam in Archer County.
0214A	Beaver Creek (unclassified water body) - From the confluence of the Wichita River west of Wichita Falls in Wichita County to the upstream perennial portion of the stream south of Vernon in Wilbarger County.
0214B	Buffalo Creek (unclassified water body) - From the confluence of the Wichita River west of Wichita Falls in Wichita County to the upstream perennial portion of the stream east of Electra in Wichita County.
0214C	Holliday Creek (unclassified water body) - From the confluence of the Wichita River in Wichita Falls in Wichita County to the Lake Wichita dam.
0215	Diversion Lake - From Diversion Dam in Archer County to a point 1.5 kilometers (0.9 mile) downstream of the confluence of Cottonwood Creek in Baylor County, up to the normal pool elevation of 1051 feet (impounds Wichita River).
0216	Wichita River Below Lake Kemp - From a point 1.5 kilometers (0.9 mile) downstream of the confluence of Cottonwood Creek in Baylor County to Lake Kemp Dam in Baylor County.
0217	Lake Kemp - From Lake Kemp Dam in Baylor County to a point 9.4 kilometers (5.8 miles) downstream of the confluence of Crooked Creek in Baylor County, up to the normal pool elevation of 1144 feet (impounds Wichita River).
0218	Wichita/North Fork Wichita River - From a point 9.4 kilometers (5.8 miles) downstream of the confluence of Crooked Creek in Baylor County to a point 8.5 kilometers (5.3 miles) downstream of the most upstream crossing of FM 193 in Dickens County.
0218A	Middle Fork Wichita River (unclassified water body) - From the confluence of the North Wichita River southwest of Crowell in Foard County to the upstream perennial portion of the stream northeast of Guthrie in King County.
0219	Lake Wichita - From Lake Wichita Dam in Wichita County up to the normal pool elevation of 980.5 feet (impounds Holliday Creek).
0219A	Holliday Creek above Lake Wichita - From the headwaters of Lake Wichita to the upstream perennial portion of the stream southwest of Holliday in Archer County.
0220	Upper Pease/North Fork Pease River - From the confluence with Canal Creek at the Hardeman-Foard county line to 6.0 kilometers (3.7 miles) upstream of the confluence of Dick Moore Canyon in Floyd County.
0221	Middle Fork Pease River - From the confluence with the North Fork Pease River in Cottle County to the confluence of Boggy Creek and Mott Creek in Motley County.
0222	Salt Fork Red River - From the Oklahoma State Line in Collingsworth County to Greenbelt Dam in Donley County.
0222A	Lelia Lake Creek (unclassified water body) - From the confluence of the Salt Fork Red River north of Hedley in Donley County of the upstream perennial portion of the stream west of Hedley.
0223	Greenbelt Lake - From Greenbelt Dam in Donley County up to the normal pool elevation of 2664 feet (impounds Salt Fork Red River).
0224	North Fork Red River - From the Oklahoma State Line in Wheeler County to a point 4.0 kilometers (2.5 miles) upstream of FM 2300 in Gray County.
0225	McKinney Bayou - From the Arkansas State Line in Bowie County to a point 100 meters (110 yards) upstream of the most upstream crossing of FM 1397 near King Lake in Bowie County.
0226	South Fork Wichita River - From the confluence with the North Fork Wichita River in Knox County to a point 15.0 kilometers (9.3 miles) upstream of US 82 in Dickens County.
0227	South Fork Pease River - From the confluence with the Middle Fork Pease River in Cottle County to the confluence of Wolf Creek and Rustler Creek in Motley County.
0228	Mackenzie Reservoir - From Mackenzie Dam in Briscoe County up to the normal pool elevation of 3100 feet (impounds Tule Creek).
0229	Upper Prairie Dog Town Fork Red River - From a point 100 meters (110 yards) upstream of the confluence of Salt Fork Creek in Armstrong County to Lake Tanglewood Dam in Randall County.
0229A	Lake Tanglewood (unclassified water body) - From Randall County Dam up to normal pool elevation south of Amarillo (impounds Prairie Dog Town Fork Red River).
0229B	Tierra Blanca Creek (unclassified water body) - From the confluence with Palo Duro Creek in Randall County to the New Mexico State Line in Deaf Smith County.
0230	Pease River - From the confluence with the Red River in Wilbarger County upstream to the confluence with Canal Creek at the Hardeman-Foard county line.
0230A	Paradise Creek (unclassified water body) - From the confluence with the Pease River east of Vernon to the upstream perennial portion near Thalia in Foard County.
0299A	Sweetwater Creek (unclassified water body) - From the Oklahoma State Line in Wheeler County to the upstream perennial portion of the stream northwest of Wheeler in Wheeler County (tributary of North Fork Red River).

The TCEQ publishes the biennial assessment on its web site as the ***Texas Water Quality Inventory (TWQI)*** and ***303 (d) List***. In the past, Texas published two different reports, often referred to as the ***305(b) Report*** and ***303(d) List***. Since 2002, EPA has required that both reports be published as one document which still has essentially two main parts: the ***TWQI*** and the ***303(d) List*****,** both of which must be approved by the EPA before being considered final. The ***2006 TWQI*** and the ***2006 303(d) List*** can be found on the TCEQ website at **http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/06twqi/twqi06.html** The ***2006 TWQI*** and ***303(d) List*** are composed of a set of integrated documents which collectively include the:

- 2006 Water Bodies Evaluated
- 2006 Water Body Assessments by River Basin
- 2006 Index of Water Quality Impairments
- 2006 Concerns
- 2006 Sources of Pollution for Impairments and Concerns
- 2006 New Listings
- 2006 Delistings

What is pollution? Pollution is the introduction of contaminants into an environment that cause harm to human health, other living organisms and the environment.

What causes pollution? In water, pollution can come from various sources such as industry, agriculture, urban development, and ranching. Pollution can even come from an unlikely source such as wildlife populations, which include feral hog, deer and turkey.

The sources of water pollution fall into two main categories called ***point source*** and ***nonpoint source***.

- ***Point source*** pollution in water bodies can be traced to a specific location and point of discharge, such as a regulated industrial operation or a wastewater treatment facility. Pollution from most point sources is controlled through regulations that require treatment of a facility's wastewater before it is discharged into a nearby water body.

- ***Nonpoint source*** pollution in water bodies can come from multiple locations, carried primarily by rainfall runoff. For example in cities, pollutants may wash off lawns, construction areas and busy city streets. In rural areas pollutants may come from runoff from farms or highways during a heavy rain and be carried to a nearby creek or river. Nonpoint source pollutants are more difficult to control because they often come from everyday activities and/or natural sources.

Most water bodies are affected by both **point** and **nonpoint sources** of pollution. These types of pollutants, including metals, pesticides, organic compounds, and treated human waste, are regulated by the TCEQ permitting process. For example, high levels of bacteria indicate that disease-causing microorganisms may be present in a water body. The bacteria may be originating from point sources, such as inadequately treated sewage or improperly managed animal waste from permitted livestock operations. This type of bacteria can also come from nonpoint sources, such as animal wastes from rangeland, wildlife and aquatic birds congregating near a water body, or aged and failing septic systems.

How are our source waters protected? The TCEQ issues permits that control discharges of wastewater into the surface waters of the state. Many types of discharges are regulated, such as the effluent from industries, domestic wastewater from city treatment facilities, discharges from certain agricultural operations, and even the storm water that runs off cities and large urban areas.

Surface water quality is reviewed in accordance with the ***2006 Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data.*** The data are then analyzed and evaluated for the assessment utilizing the previous five year's data. These reports describe the status of Texas waters based on historical data on surface-water and identify water bodies that are not meeting standards set for their use. For the purpose of the assessment, use support is reported for both segments and sub areas of segments. Sub areas are known as Assessment Units (AU). Each area of an AU is defined as the smallest geographic area of use support reported in the assessment. Segments can be made up of more than one AU and given a number such as AU_01. Support of criteria and uses are examined for each with regulatory decisions applying to the entire AU. Water quality standards and criteria are set to protect the attainable uses for each water body.

Texas Water Quality Inventory and 2006 303(d) List

The ***2006 303(d) List*** describes the status of water quality in all surface water bodies of the state that were evaluated for a given assessment period. The TCEQ uses data collected during the most recent five-year period in developing its assessment. The data are gathered by many different organizations that all operate according to approved quality control guidelines and sample collection procedures. The quality of waters described in the report represents a snapshot of conditions during the specific time period considered in the assessment. In most circumstances, the period of record for water quality data and information used in preparing the *2006 Texas Water Quality Inventory* is December 1, 1999 through November 30, 2004.

Water bodies that have been assessed and do not meet one or more standards are included on the ***2006 303(d) List***. Water bodies included on the list located in the Red River Basin are shown on **Table 5**.

Table 5
2006 Texas 303(d) List

Segment	Water Body	Parameters	Year First Listed
0201A	Mud Creek	bacteria depressed dissolved oxygen	2002 2006
202G	Smith Creek	bacteria	2006
0206B	South Groesbeck Creek	bacteria	2006
0207	Lower Prairie Dog Town Fork Red River	bacteria	2006
0207A	Buck Creek	bacteria	2000
0211	Little Wichita River	depressed dissolved oxygen	1996
0214	Wichita River Below Diversion Lake Dam	bacteria	2006
0214A	Beaver Creek	bacteria depressed dissolved oxygen	2006 2000
0226	South Fork Wichita River	chloride	2006
0229	Upper Prairie Dog Town Fork Red River	pH	2006
0230	Paradise Creek	bacteria	2006
0299A	Sweetwater Creek	bacteria	2002

Water quality standards and criteria are segment-specific and set by the state based on a water body's designated *uses* and their associated *criteria. Uses* provide for a suitable environment for fish and other aquatic life. Since there is usually more than one *use* applied to a segment, water quality may be adequate to support one *use*, but not another. *Criteria* are expressed in terms of desirable conditions, or as a measurable value and a parameter. If *criteria* are not attained, the *use* may be impaired. The combination of one particular parameter and one impaired *use* is called an impairment. If nonattainment of the water body's *criteria* is impending, the *use* may be considered threatened. In some cases, a *concern* is identified where there are not enough data to determine if the standard was attained, but may show the water quality declining.

Water bodies with pollutants or water quality conditions which assessment procedures indicate are at or near exceeding concerns for use attainment and screening levels are listed in the *2006 TWQI*. Water bodies in the Red River Basin which are included on this summary are:

2006 Texas Water Quality Inventory
Water Bodies with Concerns for Use Attainment and Screening Levels

Segment	Water Body	Parameter	Level of Concern
0201	Lower Red River	chlorophyll-a	CS
0201A	Mud Creek	depressed dissolved oxygen chlorophyll-a	CS CN CS
0202	Red River Below Lake Texoma	chlorophyll-a	CS
0202C	Pecan Bayou	chlorophyll-a	CS
0202D	Pine Creek	chlorophyll-a orthophosphorus	CS CS
0202E	Post Oak Creek	chlorophyll-a orthophosphorus	CS CS
0202F	Choctaw Creek	nitrate orthophosphorus	CS CS
0202G	Smith Creek	depressed dissolved oxygen total phosphorus orthophosphorus ammonia depressed dissolved oxygen	CN CS CS CS CS
0203	Lake Texoma	chloride chloride in finished drinking water Orthophosphorus chlorophyll-a	CS CS CS CS
0203A	Big Mineral Creek	ammonia orthophosphorus	CS CN CS
0205	Red River Below Pease River	chlorophyll-a	CS
0206B	South Groesbeck Creek	bacteria nitrate	CN CS
0207	Lower Prairie Dog Town Fork Red River	orthophosphorus bacteria chlorophyll-a	CS CN CS
0207A	Buck Creek	nitrate	CS CN
0209	Pat Mayse Lake	manganese in sediment	CS
0211	Little Wichita River	chlorophyll-a	CS
0212	Lake Arrowhead	orthophosphorus total phosphorus	CS CS
0214	Wichita River Below Diversion Lake Dam	chlorophyll-a nitrate orthophosphorus total phosphorus bacteria	CS CS CS CS CN
0214A	Beaver Creek	chlorophyll-a depressed dissolved oxygen	CS CS
0219	Lake Wichita	chlorophyll-a orthophosphorus total phosphorus	CS CS CS
0226	South Fork Wichita River	ammonia	CS
0229	Upper Prairie Dog Town Fork Red River	orthophosphorus total phosphorus nitrate chlorophyll-a	CS CS CS CS
0229A	Lake Tanglewood	chlorophyll-a nitrate orthophosphorus total phosphorus	CS CS CS CS

Level of Concern: **CN** - Concern for near-non-attainment of the Water Quality Criteria
CS - Concern for water quality by screening levels

Reach 1 of the Red River Basin begins at Texarkana in Bowie County and ends upstream inside Clay County, east of Wichita Falls. This area consists of several communities including the Sherman and Denison area, which has recently become one of the fastest growing areas in the state due to the expansion of the Dallas/Fort Worth Metroplex. Other cities within **Reach 1** include Bonham, Bowie, Clarksville, Nocona, Texarkana, Paris, and Gainesville.

Reach I contains 42 municipal and industrial waste water dischargers, including 42 solid waste disposal sites, of which eight sites are currently active. Additionally in this reach, there are over 1,200 groundwater wells and two hazardous waste sites. Also, based on recent permit data, there are no permitted concentrated animal feeding operations in this reach.

Farms and ranches in this reach produce mainly wheat, hay, soybeans, corn, milo, cotton, sorghum, turf grasses, wholesale nursery greenery, plus pecans, peaches, melons, peanuts, beef cattle, poultry, goats, dairy cattle, and horses. Mining of limestone, gravel, lignite, bituminous coal, sand, and gravel is also conducted in this reach of the basin.

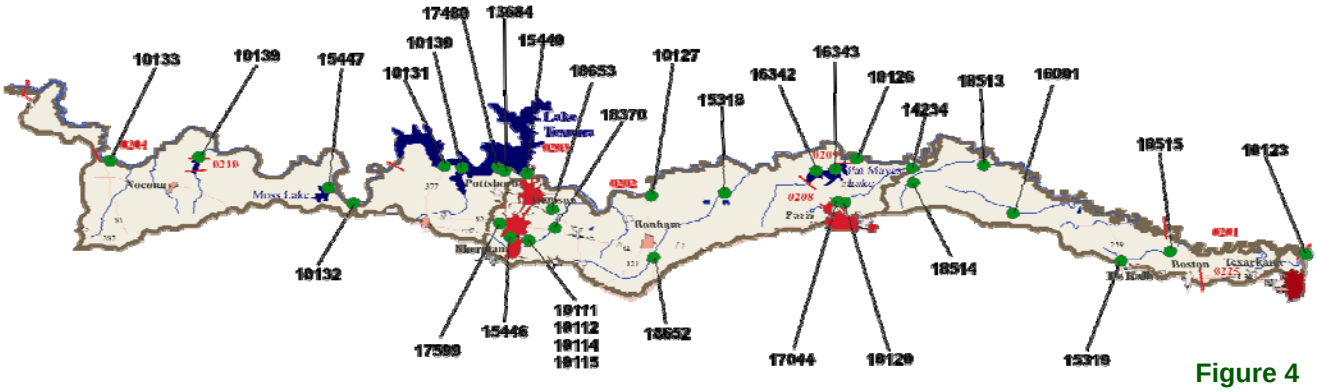


Figure 4

During the reference period of September 1, 2006 through August 31, 2007, the Authority conducted 56 monitoring events and collected approximately 1,648 parameters from 14 water quality monitoring stations. The TCEQ conducted 58 monitoring events and collected about 870 parameters from 11 water quality monitoring stations and the City of Sherman conducted 72 monitoring events and collected approximately 1,080 parameters from six water quality monitoring stations. In addition, the USGS monitored two stations in **Reach 1**. **Figure 4** illustrates the monitoring coverage of **Reach 1**, where each monitoring station is designated by a five digit numeric code.

Segments contained in **Reach 1** include:

0201 - Lower Red River
0201A - Mud Creek
0202 - Red River below Lake Texoma
0202A - Bois D' Arc Creek
0202C - Pecan Bayou
0202D - Pine Creek
0202E - Post Oak Creek
0202F - Choctaw Creek
0203 - Lake Texoma
0203A - Big Mineral Creek
0204 - Red River above Lake Texoma
0204B - Moss Lake
0208 - Lake Crook
0209 - Pat Mayse Lake
0210 - Farmers Creek Reservoir
0225 - McKinney Bayou

Segment 0201, Lower Red River, is the lowest segment in the drainage of the Red River Basin. The *2006 Texas Water Quality Inventory* lists this segment as fully supporting its overall uses, but having a concern for chlorophyll *a*. The Authority's review of the current data agreed with this assessment. Elevated chlorophyll *a* levels could possibly lead to a nutrient enrichment concern for excessive algal growth. Since the main stem of the Red River receives drainage from both Texas and Oklahoma, this segment is influenced by factors from both sides of the river. Coordination and cooperation from regulatory agencies of both states is recommended to manage the water quality in the main stem.

Segment 0201A, Mud Creek is a minor tributary of the Red River and is listed on the *2006 Texas Water Quality Inventory* for having a concern for chlorophyll *a* and on the *2006 Texas 303(d) List* for elevated bacteria and depressed oxygen levels. The Authority's review of the data agreed with the inventory and also found that Mud Creek has experienced elevated levels of ammonia. Normally when high levels of ammonia are found in natural waters, it is an indication of sanitary pollution, animal waste byproducts, or fertilizer run-off. Mud Creek was recently reclassified as intermittent with perennial pools, likely as a result of the ongoing drought and increasing beaver activity in the creek. The sampling site for Mud Creek is located in a small stagnant pool that has become covered with duck weed. Only the return of normal seasonal rainfall would improve the condition of this water body.

Segment 0202, Red River below Lake Texoma, is currently fully supporting its overall uses, but is listed on the *2006 Texas Water Quality Inventory* as having a concern for chlorophyll *a*. The Authority's review of the current data also revealed elevated chlorophyll *a* levels which exceeded the screening criteria. Since the watershed of the Red River Basin is not just in Texas, but includes a large portion in Oklahoma, a cooperative effort will be required from both states to resolve this issue.

Segment 0202A, Bois D'Arc Creek, is listed on the *2006 Texas Water Quality Inventory* as meeting its overall uses and criteria. The Authority's review of the data agreed with the inventory. However, additional data should be collected to continue the assessment of this water body, since this segment is the site of a proposed water supply/flood control lake.

Segment 0202C, Pecan Bayou is currently fully supporting its overall uses, but is listed on the *2006 Texas Water Quality Inventory* for having a concern for chlorophyll *a*. The Authority's review of the current data agreed with this assessment. Since the Authority started monitoring Pecan Bayou in early 2001, it has used this water body as a reference stream (one that has few or no known water quality problems). However, review of the current data by the Authority has indicated that Pecan Bayou is now experiencing depressed dissolved oxygen levels and elevated bacteria levels. Run-off from sporadic rainfall events and animals and wildlife congregating near the creek could be the cause of these elevated values.

Segment 0202D, Pine Creek was removed from the *2002 303(d) List* for bacteria. It is now fully supporting its overall uses and meeting its criteria. In previous assessments, data from Smith Creek (now Segment 0202G) was causing the exceedances for the bacteria issue. However, it is now listed on the *2006 Texas Water Quality Inventory* for having a concern for chlorophyll *a* and orthophosphorus. The Authority's review of the data agreed with the TCEQ's assessment. In addition, the Authority's review also revealed depressed oxygen levels.

Segment 0202E, Post Oak Creek was removed from the *2004 Texas 303(d) List* for bacteria, but it is listed on the *2006 Texas Water Quality Inventory* for excessive algal growth and orthophosphorus. In the Authority's review of the most recent data, these parameters are indicating an improvement in water quality. The Authority and its cooperating partner, the City of Sherman, are continuing to work together to effectively monitor the health of Post Oak Creek.

Segment 0202F, Choctaw Creek, is currently fully supporting its overall uses, but is listed on the *2006 Texas Water Quality Inventory* for having a concern for nitrate and orthophosphorus. The Authority's review of the data revealed that Choctaw Creek has experienced elevated total phosphorus as well. The elevated nutrients may be a result of treated wastewater effluent from a wastewater treatment plant located in the upper portions of the creek. Although the wastewater treatment plant is discharging within its permitted guidelines, the effluent is still higher than the criteria and standards set for this creek. This situation is not unusual and is the case for most wastewater treatment plants.

Segment 0202G, Smith Creek— Although the Authority has been monitoring on Smith Creek for a number of years, Smith Creek was not officially recognized for assessment purposes until the 2006 assessment. Smith Creek is listed on the *2006 Texas 303(d) List* for elevated bacteria levels and on the *2006 Texas Water Quality Inventory* with concerns for depressed oxygen levels, elevated ammonia, orthophosphorus and total phosphorus levels. Smith Creek, a tributary and a major contributor to Pine Creek, receives run-off from the watershed of the northwest section of the City of Paris' industrial district.

Segment 0203, Lake Texoma, is listed as supporting its overall uses. The *2006 Texas Water Quality Inventory* lists the lake as having concerns for chloride, orthophosphorus and chlorophyll *a.* Additionally, the lake is listed as having overall public water supply concerns for increased costs due to demineralization for elevated levels of chloride in finished drinking water. The Authority agreed with this assessment.

These public water supply concerns for Lake Texoma will not be resolved without full cooperation of both Texas and Oklahoma, Federal environmental agencies, and any other interest groups in this project. Until the Chloride Control Project is completed and the rivers and the lake are flushed of the chloride and sulfate components, Lake Texoma will continue to be listed as having an overall public water supply concern on the *Texas Water Quality Inventory*.

Segment 0203A, Big Mineral Creek, was delisted on the *2006 Texas 303(d) List* for bacteria and the *2006 Texas Water Quality Inventory* for ammonia and orthophosphorus. The Authority's reviews of the limited data sets agreed with this assessment. More data is needed to discern the nature of the problem in this creek.

Segment 0203C, Mustang Creek and **Segment 0203D, Deaver Creek,** are both newly designated unclassified water bodies listed on the *2006 Texas Water Quality Inventory* for this assessment period. According to the *2006 TWQI* and *303(d) List*, both segments are shown as meeting all uses and having no concerns.

Segment 0204, Red River above Lake Texoma — According to the *2006 Texas Water Quality Inventory* and *303(d) List* this segment is shown as meeting all uses and having no concerns. The Authority's review of the data with this assessment was limited. The review of the available data indicated there were elevated total phosphorus, orthophosphorus and nitrate levels. Since the data sets were limited, additional data will be needed to assess this portion of the Red River main stem properly.

As stated earlier without having data and physical observations from the Oklahoma side of the watershed, it is difficult to form any findings or postulate any theories as to the nature of the elevated nutrient levels.

Segment 0204B, Moss Lake, According to the *2006 Texas Water Quality Inventory*, Moss Lake is listed as meeting all uses and having no concerns. The Authority's review of the data agreed with this assessment.

Segment 0208, Lake Crook, According to the *2006 Texas Water Quality Inventory* , Lake Crook is listed as meeting all uses and having no concerns. With the limited amount of data collected, the Authority's review of the data agreed with this assessment.

Segment 0209, Pat Mayse Lake, is listed on the *2006 Texas Water Quality Inventory* as fully supporting its public water supply uses but having a concern for manganese in sediment. The Authority's review of the data agreed with this assessment.

Segment 0210, Farmers Creek Reservoir, or locally called Lake Nocona, is listed as meeting all uses and having no concerns, according to the *2006 Texas Water Quality Inventory*.

Segment 0225, McKinney Bayou, is listed on the *2006 Texas Water Quality Inventory* as assessed only for drinking water, the other uses were not assessed.

Choctaw Creek at US 82

Choctaw Creek at US 82

Post Oak Creek at FM 1417

Lake Texoma at Denison Dam

Reach 2 represents the Wichita River and Little Wichita River watersheds from the confluence of the Red River to their headwaters, which begins in Clay County and continues westward to Dickens County. The largest city within this reach is Wichita Falls, with a population of 104,200. It is a large, diverse area with most of the large population centers located in the eastern portion, while the western portion contains some of the largest ranches in the state, including the W.T. Waggoner Estate, the Four Sixes Ranch, and several others.

Segments contained in **Reach 2** include:

0211 - Little Wichita River
0212 - Lake Arrowhead
0213 - Lake Kickapoo
0214 - Wichita River below Diversion Lake
0214A - Beaver Creek
0214B - Buffalo Creek
0214C - Holliday Creek
0215 - Diversion Lake
0216 - Wichita River below Lake Kemp
0217 - Lake Kemp
0218 - Wichita/North Fork Wichita River
0218A - Middle Fork Wichita River
0219 - Lake Wichita
0219A - Holliday Creek above Lake Wichita
0226 - South Fork Wichita River

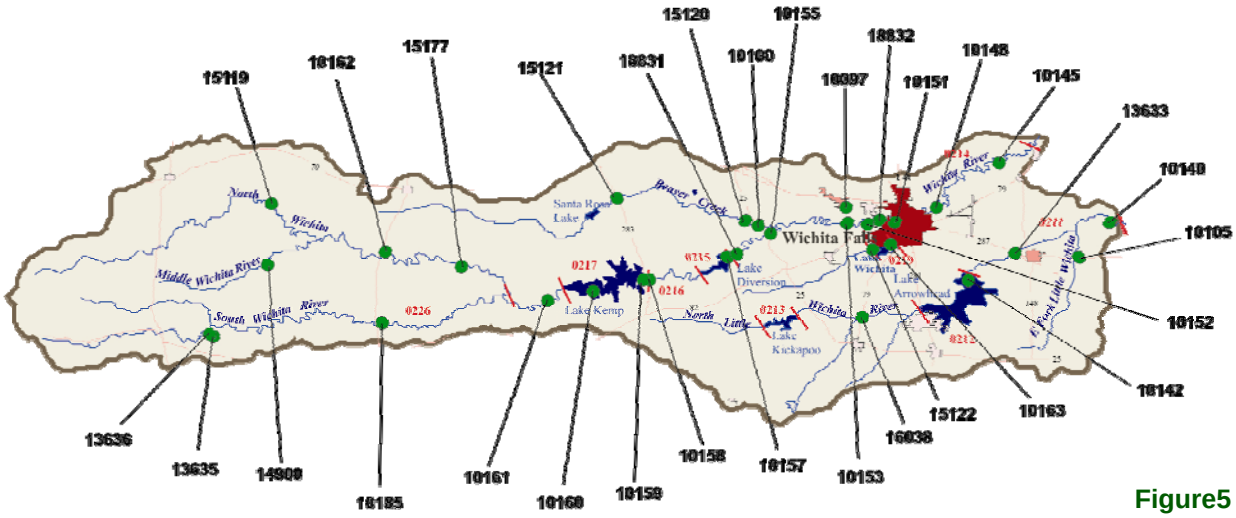


Figure5

There are approximately 1,600 groundwater wells in **Reach 2,** located primarily in the Seymour and Trinity Aquifers. However, in the far western portion of the reach, the Ogallala Aquifer is the primary supply. There are 18 wastewater outfalls, six permitted concentrated animal feeding operations, including 45 solid waste disposal sites, of which seven sites are active. Farming and ranching within the ten-county area include wheat, grains, hay, alfalfa, sorghum, cotton, pecans, peanuts, peaches, watermelons, beef cattle, cow/calf operations, dairies, horses, and some swine and goats.

In portions of **Reach 2**, oil and gas fields dominate the landscape. In other areas of the reach, farming or pasture lands are predominate. Natural resource industries include some surface mining for copper, building stone, sand, gravel, volcanic ash, bituminous coal, and components for tile and ceramics.

During the reference period of September 1, 2006 through August 31, 2007, the Authority conducted 96 monitoring events and collected approximately 1,896 parameters from eight water quality monitoring stations. The TCEQ conducted 42 monitoring events and collected around 1065 parameters from 13 water

quality monitoring stations. In addition, the USGS monitored 15 sites. **Figure 5** illustrates the monitoring coverage of **Reach 2**, where each monitoring station is designated by a five digit numeric code.

Little Wichita River at FM 2332

Segment 0211, Little Wichita River, is located below the dam of Lake Arrowhead to the confluence of the Red River. The *2006 Texas 303(d) List* and the *2006 Texas Water Quality Inventory* removed the Little Wichita River for elevated total dissolved solids levels. However, it is still listed on the *1996 303(d) List* for depressed dissolved oxygen with a concern for chlorophyll *a*. The Authority's review of the data agreed with this assessment. The City of Henrietta has a contract with the City of Wichita Falls to release water from Lake Arrowhead into the river so that Henrietta can capture the flow, with a low water dam, and pump it, into a small city lake, for drinking water purposes. During other times, the only inflow into the river is from seepage from the lake, small creeks and springs. The nature of the Little Wichita River, with the absence of a sustainable flow, protracted periods of little or no rainfall, are factors that that most likely influence the nature of this water body's issues.

Segment 0212, Lake Arrowhead, is listed on the *2006 Texas Water Quality Inventory* as having concerns for both orthophosphorus and total phosphorus. The Authority's recent data review agreed with this assessment. Although the criteria for nutrients are more stringent on lakes than river systems, the exceedances on Lake Arrowhead may be attributed to run-off from fertilized fields, dairies, and farms located in the watershed. In most reservoirs, total phosphorus is the nutrient that is generally elevated, but in Lake Arrowhead, orthophosphate is also elevated. Lake Arrowhead is one of two major sources of drinking water for the City of Wichita Falls.

Segment 0213, Lake Kickapoo, is located up river of Lake Arrowhead and is another primary source of drinking water for the City of Wichita Falls. Although recent data are limited on this segment, the *2006 Texas Water Quality Inventory* lists Lake Kickapoo as fully supporting its overall uses and meeting its criteria. Additional data are needed on Lake Kickapoo to conduct a complete assessment on this water body.

Wichita River at FM 810

Segment 0214, Wichita River below Lake Diversion, is listed on the *2006 Texas 303(d) List* for bacteria and on the *2006 Texas Water Quality Inventory* for concerns for chlorophyll *a*, nitrate, orthophosphorus, total phosphorus and bacteria. This segment of the Wichita River meanders from the dam of Lake Diversion to its confluence with the Red River. The Authority's review of the available data agreed with this assessment. The elevated bacteria levels, the nutrient enrichment, and the concerns for chlorophyll *a*, which occur up and down the river, are most likely a result of runoff from the more densely populated areas of the watershed. Possible sources include; a large fish hatchery, some mid-sized cattle ranching operations, five permitted dischargers, thousands of acres of farm land, urban runoff and numerous septic tanks of undetermined age and condition which could leach and/or drain directly into the river. More intensive monitoring to identify and locate the sources of the bacteria and nutrients is the first step in resolving these issues.

Segment 0214A, Beaver Creek, is listed on the *2006 Texas 303(d) List* for bacteria and depressed dissolved oxygen. The *2006 Texas Water Quality Inventory* lists Beaver Creek as having concerns for chlorophyll *a* and depressed dissolved oxygen. Although recent data indicate an improvement, Beaver Creek will remain on the *303 (d) List* until a sufficient number of 24-hour DO measurements are available to demonstrate support of the criteria. The Authority's review of the data from Beaver Creek agreed with this assessment. The area surrounding the creek is open pasture with oilfield activities. The farmland is mainly dry-land with a few irrigated fields. Although stock tanks scatter the landscape, livestock and wildlife still use the creek as a water source. Run-off from the fields and pastures are likely the source of these problems.

Beaver Creek at 25

Segment 0214B, Buffalo Creek, was not assessed in 2006 due to lack of sufficient data because if there are fewer than 3 samples collected during the assessment period the segment is usually not assessed. Most of time the period of record for water quality data used in preparing the 2006 Report is December 1, 1999 through November 30, 2004. Since there have been no data collected on this water body since early 1999 the Authority added Buffalo Creek in 2006 to its water quality monitoring schedule. A preliminary look at the data collected by the Authority indicates that Buffalo Creek is similar to that of most creeks that receive treated waste water effluent.

Segment 0214C, Holliday Creek, situated in Wichita County, flows from the Lake Diversion Dam through the City of Wichita Falls to its confluence with the Wichita River. Although there are no recent data to assess, the *2006 Texas Water Quality Inventory* lists Holliday Creek as fully supporting its overall uses and meeting its criteria.

Segment 0215, Lake Diversion, is listed on the *2006 Texas Water Quality Inventory* as fully supporting its overall uses and meeting its criteria. The Authority's review of the data agreed with this assessment.

Many features of Lake Diversion are unique in that it was constructed as a source for irrigation and drinking water supply. When work on the lake was completed, the vast network of irrigation canals and ditches that crisscrossed Archer and Wichita Counties were able to supply landowners with a low cost irrigation source. Since its impoundment, Lake Diversion has slowly been rendered practically useless as viable potable water supply. Reduction of the naturally occurring high chloride levels in Lake Diversion would revitalize the watershed and allow the reservoir to be utilized as a water supply without some form of pre-treatment.

Segment 0216, Wichita River below Lake Kemp, is listed on the *2006 Texas Water Quality Inventory* as meeting all uses and having no concerns. The Authority's review of the data agreed with this assessment.

Segment 0217, Lake Kemp, is listed on the *2006 Texas Water Quality Inventory* as fully supporting its overall uses and meeting its criteria. The Authority's recent review of the data revealed no exceedances in Lake Kemp. Lake Kemp was built as a public water supply and flood control lake and is operated and maintained by the Wichita County Water Improvement Water District Number Two. Like Lake Diversion, the high chloride inflow from the Wichita River make the lake almost useless as a water supply. Only a permanent reduction of the chloride levels in the Wichita River would allow the reservoir to be utilized as a water supply. The implementation of the Chloride Control Project would be advantageous for the Wichita River and Lakes Kemp and Diversion.

Segments 0218 - Wichita/North Fork Wichita River and **0218A - Middle Fork Wichita River** have been listed on the 303(d) Lists since 2000 due to elevated selenium (chronic) in water. Selenium is an essential trace element that is required in human and animal nutrition. The average Selenium levels found in these two forks of the Wichita River are well above the established criteria for fresh waters. Conductivity of these water bodies is very comparable to that of sea water and makes the water brackish (a mixture of salty and fresh water). These two segments were removed this year from the *2006 303(d) List*. The Selenium problem was re-described as a naturally occurring impairment not caused by a pollutant thus the water quality conditions cannot be changed through a Total Maximum Daily Load (TMDL). "*Natural brine springs with ambient concentrations of selenium greater than the water quality standards criterion contribute to the stream"*.[1]

Segment 0219, Lake Wichita, The *2006 Texas Water Quality Inventory* lists Lake Wichita as having concerns for chlorophyll *a*, orthophosphorus and total phosphorus. The Authority's review of the current data agreed with this assessment. Leaking septic system, new urban growth, and/or runoff from fertilized fields are possible sources of these pollutants.

Segment 0219A, Holliday Creek above Lake Wichita, was not assessed in 2006 due to lack of sufficient data. If there are fewer than 3 samples the segment is usually not assessed. Holliday Creek is the headwaters of Lake Wichita. Since there have been no data collected on this water body since August of 1997, the Authority included it in its 2007 Water Quality Monitoring Schedule. Early sampling attempts at this site were discouraging as this site was dry. The attempts that were successful found exceedances that were similar to that of Lake Wichita. Two of the three sampling events were collected after significant rainfall events, possibly exacerbating the situation.

Holliday Creek at FM 2650

Holliday Creek at FM 2650

Segment 0226, South Fork Wichita River, is listed on the *2006 Texas Water Quality Inventory* with a concern for elevated ammonia levels. The Authority's review of the data agreed with this assessment. The source of the ammonia is most likely the result of naturally occurring salt springs in this watershed.

[1] *2006 Texas Water Bodies and Parameters Removed from the 303(d) List*

Reach 3 begins in northern Wichita County and proceeds westward toward Floyd and Briscoe Counties, involving the Pease River watershed from the confluence of the Red River to its headwaters. It includes the Red River main stem from the confluence of Cache Creek upstream to the confluences of Buck Creek and the Red River. The cities of Childress, Vernon and Burkburnett with populations of 6,778, 11,700 and 11,000, respectively, are the largest within the reach. The reach's total population is near 30,000.

Reach 3 contains 14 wastewater dischargers, including 25 solid waste disposal sites, six of which are active. Based on recent permit data, there are no permitted concentrated animal feeding operations in this reach. Additionally, approximately over 3,600 groundwater wells utilize water from the Seymour, Blaine, and Ogallala Aquifers.

Comprised mainly of agribusiness and oil and gas production, **Reach 3** is predominately rural in nature. The farms and ranches in the area produce cotton, wheat, hay, feed products, guar, alfalfa, soybeans, sorghum, peanuts, sunflowers, beef cattle, horses, hogs, poultry, and sheep.

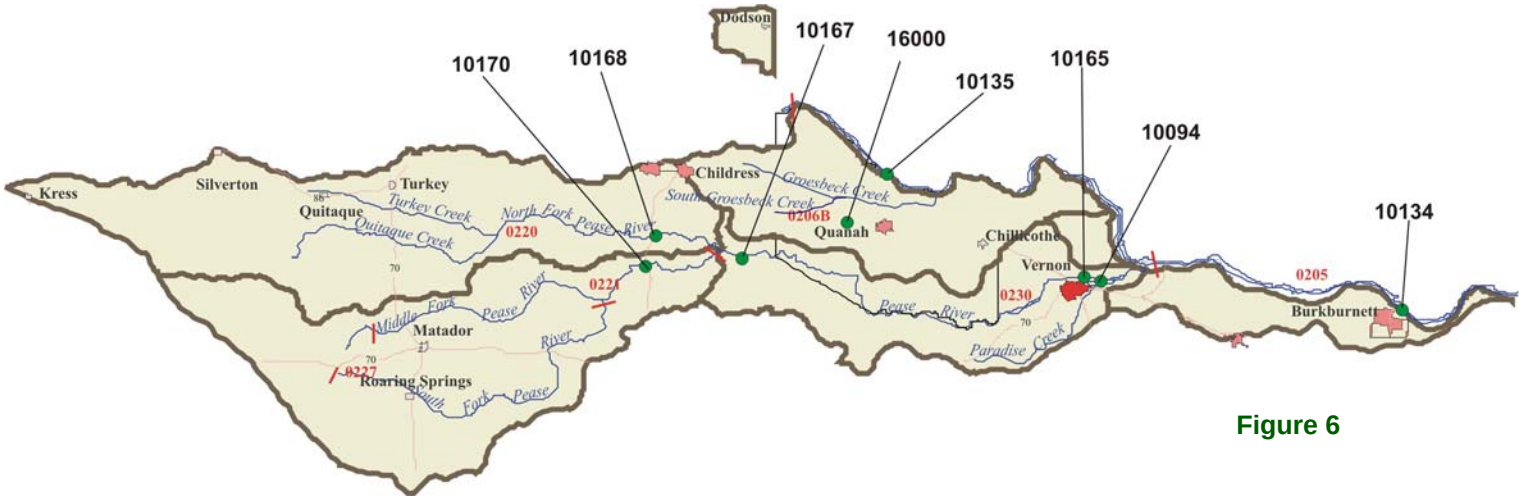


Figure 6

Segments contained in **Reach 3** include:

0205 - Red River below Pease River
0206 - Red River above Pease River
0206B - South Groesbeck Creek
0220 - Upper Pease/North Fork Pease River
0221 - Middle Fork Pease River
0227 - South Fork Pease River
0230 - Pease River
0230A - Paradise Creek

During the reference period from September 1, 2006 through August 31, 2007, the Authority conducted eight monitoring events and collected approximately 240 parameters from two water quality monitoring stations. The TCEQ conducted 20 monitoring events and collected around 504 parameters from five monitoring stations. In addition, the USGS monitored three sites in the reach. **Figure 6** illustrates the monitoring coverage of **Reach 3**, where each monitoring station is designated by a five digit numeric code.

Segment 0205, **Red River below Pease River,** is listed on the *2006 Texas Water Quality Inventory* for having a concern for chlorophyll *a*. The Authority's review of the current data agrees with this assessment. This is indicative of what is found up and down the main stem of the Red River. Since the watershed of the Red River Basin is not just in Texas, but includes a large portion in Oklahoma, a cooperative effort will be required from both states to resolve this issue.

Segment 0206, Red River above Pease River, is listed on the *2006 Texas Water Quality Inventory* as fully supporting its overall uses and meeting its criteria. The Authority's review of the data agreed with this assessment.

Segment 0206B, South Groesbeck Creek, is listed on the *2006 Texas 303(d) List* for bacteria and is listed on the *2006 Texas Water Quality Inventory* for having a concern for nitrate. The Authority's review of the data agreed with this assessment. The pastures and fields surrounding the creek are utilized by local ranchers as a place to graze cattle. Increased farming, ranching and natural wildlife activity are likely causes of the elevated bacteria levels. The elevated nitrate could be from naturally occurring sources in the area that are upwelling into the creek through springs.

South Groesbeck Creek at US 287

Segment 0220, the Upper Pease/North Fork of the Pease River, is listed on the *2006 Texas Water Quality Inventory* as fully supporting its overall uses and meeting its criteria. Although much of the area is cultivated, many areas along and near the river are rugged, broken, and largely inaccessible. Although this portion is not suitable for agriculture, it is suitable for ranching as the river can supply the necessary water for livestock. Recent investigations in similar other areas found that concentrated numbers of wildlife such as wild hogs, deer and turkey can contribute to the elevated bacterial problems.

Segments 0221-Middle Fork of the Pease River and **0227-South Fork of the Pease River,** were not assessed in 2006 due to lack of sufficient data. With the extended drought compounded by the naturally arid nature of the region, these segments of the Pease River have not had sustained flows for a long time.

Segment 0230, Pease River, is listed on the *2006 Texas Water Quality Inventory as* fully supporting its overall uses and meeting its criteria. The Authority's review of the current data agreed with this assessment.

Pease River at FM 104

Reach 4 begins in Childress County at the Texas/Oklahoma state line and continues through the Texas Panhandle to Deaf Smith and Parmer Counties at the New Mexico state line. It encompasses the Prairie Dog Town Fork of the Red River from the confluence of Buck Creek. The uppermost part of the reach dissects the City of Amarillo, which is also the largest city in the Red River Basin. The towns of Hereford and Canyon have populations of over 14,600 and 12,900, respectively. Approximately 66 other towns and communities are located in **Reach 4** including Dimmitt, Friona, Tulia, Wellington, and Claude.

Segments contained in **Reach 4** include:

0207 - Lower Prairie Dog Town Fork of the Red River
0207A - Buck Creek
228 - Mackenzie Reservoir
0229 - Upper Prairie Dog Town Fork of the of the Red River
0229A - Lake Tanglewood

The Ogallala Aquifer lies below the western area of this reach, and provides water for over 5,600 groundwater wells. Included in this watershed are seven wastewater outfalls, including 30 solid waste disposal sites, seven of which are active. In addition, **Reach 4** includes one industrial hazardous waste site, and 63 permitted concentrated animal feeding operations.

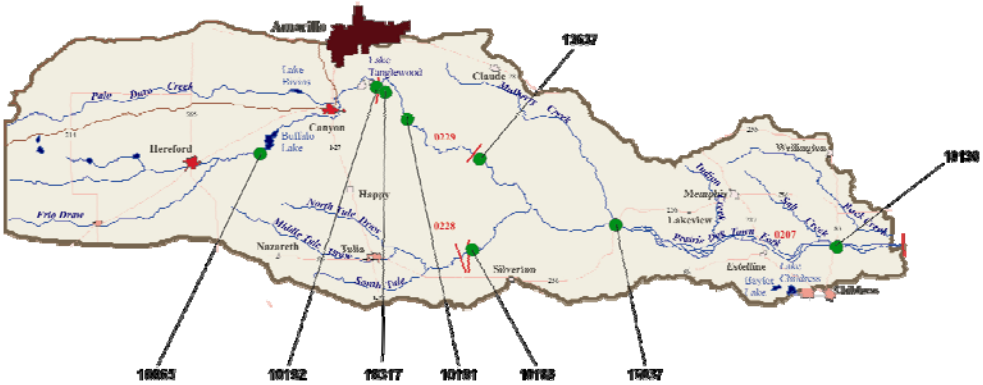


Figure 7

Estelline Salt Springs are a group of natural brine springs located less than a mile east of Estelline, Texas in east-central Hall County on the flood plain of the Prairie Dog Town Fork of the Red River. The springs became active in the late 1800's and washed out a funnel in the alluvium. In 1964 the United States Army Corps of Engineers (USACE) built a dike around the springs to contain the flow and prevent the salt from entering the river system. Since that time the water in Estelline Springs has become hyper-saline.

Cattle ranching plays a significant role in this area of the state. **Reach 4** contains many farms and ranches that produce beef cattle, cotton, wheat, corn, sugar beets, soybeans, sorghum, and potatoes.

During the reference period from September 1, 2006 through August 31, 2007, the Authority conducted eight monitoring events and collected approximately 240 parameters from two water quality monitoring stations, while the TCEQ conducted 14 monitoring events and collected around 342 parameters from four monitoring sites. In addition, the USGS monitored four sites in this reach. **Figure 7** illustrates the water quality monitoring coverage of **Reach IV**, where each monitoring station is designated by a five digit numeric code.

Segment 0207, **Lower Prairie Dog Town Fork of the Red River**, is listed on the *2006 Texas 303(d) List* for bacteria and is listed on the *2006 TWQI* as having concerns for orthophosphorus, bacteria and chlorophyll *a*. The Authority's review of recent data revealed elevated bacteria and chlorophyll *a* levels. This portion of the river flows through some very broken, rough country and is largely uninhabited. Although this region is not very suitable for agriculture, it is suitable for ranching as the river can supply the necessary water for the livestock. Run-off from fields and pastures can contribute to the elevated nutrient and bacterial levels. Additionally, recent field investiga-

tions have found that the elevated bacteria levels may also be attributed to large numbers of wildlife such as feral hogs, deer and turkey that are typically found throughout the basin. It is also possible that flow from the upstream Segment 0229, Upper Prairie Dog Town Fork (UPDTF) of the Red River, could have an influence on water quality in this segment.

Segment 0207A, Buck Creek, is listed on the *2006 Texas 303(d) List* for bacteria. It is also listed on the *2006 TWQI* as having concerns for nitrate. The Authority's review of the data agrees with this assessment. Currently, a *Bacterial Monitoring Study* on Buck Creek is being conducted by the Texas State Soil and Water Conservation Board (TSSWCB), in conjunction with Texas *Agri*Life Research, the local partner, to ascertain the nature and origin of the elevated bacteria levels found in the creek. The Authority's data review also revealed elevated nitrate levels in Buck Creek. This, in conjunction with the elevated bacteria levels, could be a result of runoff after rainfall events. It could also be an indication of an interference or activity resulting from inadvertent human pollution activities. Another possibility of the elevated nitrate levels in the creek, is natural springs feeding into the creek. The Seymour Aquifer, which underlies portions of the Buck Creek watershed, has been recognized as a possible source of the high nitrates. Analysis of these results, along with the ongoing study by Texas *Agri*Life Research and TSSWCB, will aid in developing viable Best Management Practices as part of the Buck Creek Watershed Protection Plan that is currently under development.

Since the TSSWCB's study includes genotyping of the elevated bacterial levels, it is possible the results of their study will reveal the source of pollution in this stream. Recent field investigations have found that the elevated bacteria levels may be attributed to large numbers of wildlife, such as feral hogs, deer and turkey that cohabitate in the watershed. The Texas Water Resources Institute (TWRI) maintains a website containing information about the project and can be viewed at **http://twri.tamu.edu/buckcreek** .

Segment 0228, Lake Mackenzie, is listed on the *2006 Texas Water Quality Inventory* as meeting all its standards and criteria. Lake Mackenzie, like other lakes in this part of the country, is suffering from the effects of low rainfall.

Segment 0229, Upper Prairie Dog Town Fork of the Red River, was taken off of the *2004 303(d) List* for bacteria and depressed dissolved oxygen, but is listed on the *2006 Texas 303(d) List* for pH. It is also listed on the *2006 Texas Water Quality Inventory* with concerns for nitrate, orthophosphorus, total phosphorus and chlorophyll *a*. Possible sources for these concerns could be from Lake Tanglewood and/or from treated effluent from a local municipal wastewater treatment plant.

Segment 0229A, Lake Tanglewood, is listed on the *2006 Texas Water Quality Inventory* with concerns for nitrite, orthophosphorus, total phosphorus and chlorophyll *a*. The Authority's review of the current data from Lake Tanglewood agrees with this assessment. In addition, recent assessment by the Authority also revealed elevated pH and chloride levels. Lake Tanglewood is an unclassified segment, which means that specific standards do not apply. The chloride data is used for trends, not for assessment purposes.

Possible sources of the nutrients and chlorophyll *a* could be the result of treated effluent from a local municipal wastewater treatment plant, rainfall runoff events, or from leaks in the aging septic tanks located in the community that surrounds the lake. The pH issues will likely linger as long as the excessive algal growth concerns remain, due to the diurnal connection. Generally, high levels of phosphorus are an indication of some type of man-made pollution and in combination with high levels of nitrogen, is usually an indication of sanitary pollution, animal waste by-products or fertilizer run-off. The elevated chloride levels could be the result of evaporation and concentration of water in the lake or an inflow that is higher in chloride than what is found below the lake.

Reach 5 of the Red River Basin begins at the eastern edge of the Texas Panhandle in Hemphill, Wheeler, and Swisher Counties and extends westward to Amarillo for about 100 miles. The reach contains the North Fork of the Red River upstream to the headwaters of McClellan Creek, including the headwaters of the Salt Fork of the Red River, Elm Fork of the Red River, and the Washita River. The eastern edge of the City of Amarillo is located in **Reach 5.** In addition, the towns of Panhandle, Clarendon, Wheeler, and White Deer are located in this reach. The largest reservoir in the reach is Greenbelt Lake located in Donley County. Lake McClellan, also in the reach, is underlain by the Ogallala Aquifer in the northern and western areas.

Segments contained in **Reach 5** include:

0222	-	Salt Fork of the Red River	0224	-	North Fork of the Red River
0222A	-	Lelia Lake Creek	0299A	-	Sweetwater Creek
0223	-	Greenbelt Lake			

Reach 5 contains four wastewater outfalls, 17 solid waste disposal sites, of which five sites are active. There are14 permitted concentrated animal feeding operations, one superfund site, and four industrial hazardous waste sites. In addition, there are more than 3,100 groundwater wells located in this reach.

Farms and ranches dominate **Reach 5** primarily raising cattle, while the farming consists of cotton, grain sorghum, wheat, corn, oats, barley, and alfalfa.

During the reference period from September 1, 2006 through August 31, 2007, the Authority conducted 20 monitoring events and collected approximately 600 parameters from five water quality monitoring stations. The TCEQ conducted eight monitoring events and collected approximately 194 parameters from two water quality monitoring stations. In addition, the USGS monitored five sites in this reach. **Figure 8** illustrates the monitoring coverage of **Reach 5**, where each monitoring station is designated by a five digit numeric code. Water quality conditions have improved in **Reach 5.** The increase of precipitation has helped the region by providing increased pasture and watering for livestock.

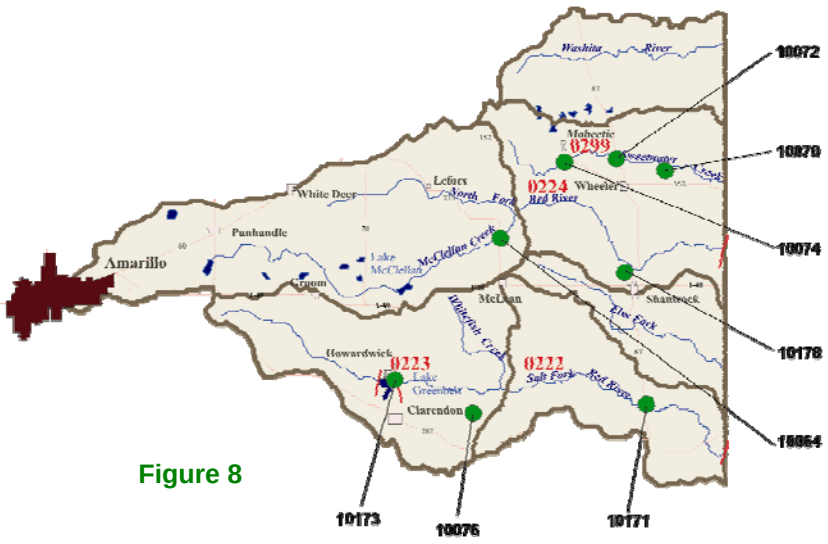


Figure 8

Segment 0222-Salt Fork of the Red River, Segment 0224-North Fork of the Red River, Segment 0222A-Lelia Lake Creek and **Segment 0223-Greenbelt Lake,** are all listed on the *2006 Texas Water Quality Inventory, May 13, 2005* as fully supporting their overall uses and criteria. The Authority's review of the data agreed with the assessment of these water bodies.

Sweetwater Creek, Segment 0299A, is listed on the *2006 Texas 303(d) List* for elevated bacterial levels. Although one specific source is not known, possible sources of the bacteria include the numerous concentrated animal feeding operations in the watershed of the creek and/or it could be due to wild animals living along the creek. Increased rainfall and run-off into the creek have likely increased the concentrations. More data needs to be collected to ascertain the nature of this problem. Optimistically in the near future, the results of the research being conducted by the Texas State Soil and Water Conservation Board along Buck Creek will aid in identifying non-point sources of bacteria.

PUBLIC PARTICIPATION AND OUTREACH

One very successful component of the Clean Rivers Program is **public participation**. This enables the general public to broaden their awareness of water quality conditions, share knowledge and expertise of many, and cooperatively pursue avenues to rectify problems. The reflection of service with an emphasis on good science is fundamental to the Authority's purpose.

A Stakeholder, as defined by the CRP, is any individual or entity that has a vested interest in the basin's waters, and includes the general public, institutions, government, industry, fee payers, and other interested parties. Stakeholder involvement in helping determine the direction of each basin's CRP activities is crucial and will be accomplished through the Steering Committee process, and other public participation, outreach, and education activities.

Who Are Our Stakeholders?

Our Stakeholders include all individuals or organizations with an interest in the watershed that have one or more of these attributes:

- *They are significant contributors of pollutant loadings or otherwise significantly impact water quality.*
- *They are significantly affected by water quality problems.*
- *They are directly affected by project outcomes or decisions.*
- *They may be required to undertake control measures because of statutory or regulatory requirements.*
- *They have statutory or regulatory responsibilities closely linked to water quality—for example, flood control.*
- *They can help develop or implement actions to remedy water quality problems.*
- *The live in the watershed or use the water resource.*

As stated in the TAC rules, Basin Planning Agencies must develop a public participation process to include a Basin Steering Committee that provides for meaningful input and comments by private citizens and organizations in the local watersheds. As one of the most important components of the CRP, the active participation of a strong CRP Steering Committee is also one of the best opportunities for expanding stakeholder participation.

Originally conceived as a grass-roots project, the Clean Rivers Program established a format for the citizens of Texas to participate in effective statewide watershed planning activities. Each Clean Rivers Program partner developed a steering committee which set priorities within its own individual basin. These committees bring together the diverse and unique interests within each basin. Steering committee participants include representatives from the public, municipal, county, state, and federal government, industry, business, agriculture, environmental, education, civic organizations, and others.

PUBLIC PARTICIPATION AND OUTREACH

As one of the most successful components of the Clean Rivers Program within the Red River Basin, the Steering Committee has guided this program through the years. The committee provides valuable assistance and guidance concerning water quality issues.

The Steering Committee and Basin Advisory Committee are one and the same. When originally formed, the Steering Committee was created to meet when it was not been possible for the entire Basin Advisory Committee to meet. However, through the years, the two committees have evolved into one, which serves its purpose very well.

Basin Advisory Committee Meetings are held at least once per year and are designed to be open, friendly, casual, and informative. In addition, they provide in-depth technical information regarding quality assurance, work plans, monitoring schedules, reports, and more. Committee members are encouraged to participate, ask questions and voice their ideas and opinions., not only at the meetings, but throughout the year, as they feel necessary.

Volunteer Environmental Monitoring

The Texas Rivers Project, developed over 17 years ago, provided an opportunity for area students from junior high through high school to actively collect and analyze samples from their own unique monitoring sites. More than 12 schools have participated in the program since it was initiated. However, due to budget restrictions and time restraints, educators are not able to participate in the Texas Rivers Project as they have done in the past. The Authority is currently exploring ways to revitalize the program.

Earth Day

The Authority is always proud to be associated with local Earth Day celebrations. However this year, the Authority was not able to be a part of the local Earth Day celebrations due to previous commitments. In previous years the Authority has partnered with the River Bend Nature Center, an environmental educational center located in Wichita Falls to provide hands-on environmental programs to children and adults. In previous events the Authority's Environmental Services Division staff provided presentations on water quality and conservation to the students. Teachers were also provided with environmental educational materials for their students.

Education

Authority personnel also provide presentations to various organizations, clubs, and civic groups to spark interest and awareness in local natural resource issues. Additionally, the Authority provides information and articles that appear regularly in newspapers throughout the basin.

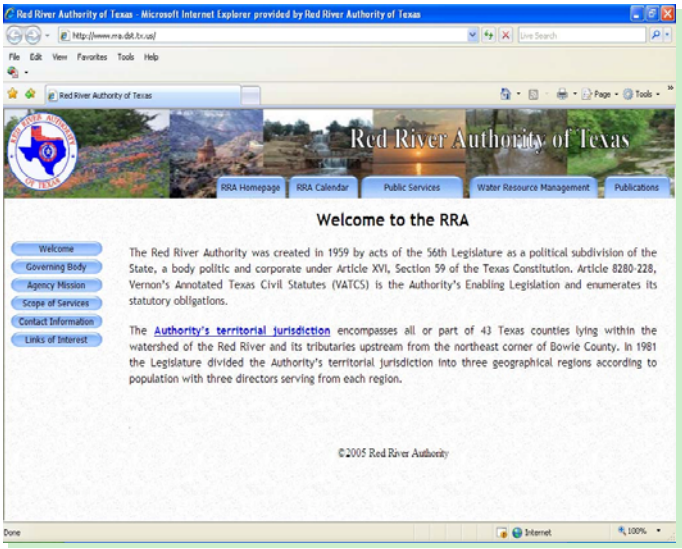
Members of the Environmental Services Division have assisted yearly in judging entries in the Red River Regional Science and Engineering Fair held at Midwestern State University. This annual event is held for students from Texas Region IX school districts who are in fifth grade through high school and covers entries in 18 categories, including environmental, chemistry and biology.

Another program sponsored by the Authority is the distribution of educational materials to schools within the basin. The Major Rivers and Think Earth curricula are provided to all schools upon request. These two publications are favored by teachers and students alike.

As an agency of the state, and in compliance with its mission, the Authority provides financial assistance as much as possible to alleviate some of the budget shortfalls, and also contributes to the Clean Rivers Program by payment of fees assessed to fund TCEQ's water programs. The Authority supports itself through contractual agreements with governmental and non-governmental entities, limiting the additional funding required to adequately monitor the basin's many water resources. Nevertheless, the Authority will continue to work toward full attainment of the Clean Rivers Program goals.

RRA
ON THE WEB

The Authority maintains an enthusiastic commitment to provide up-to-date scientifically correct information on the Authority's website at **www.rra.dst.tx.us**. The website provides information covering all aspects of Authority operations, as well as Clean Rivers Program Data and Publications.



One of the popular features found on the Authority's website is the **Public Information Repository**. Facts and data on almost any aspect of the Red River Basin and the Red River Authority are just a few clicks away. Other information available include: data inventories, digital mapping, general information, legislation, environmental sites, and historical weather data. The Authority also maintains an online **Publication Library** that includes reports and studies prepared by the Authority.

SUGGESTIONS FOR FUTURE WORK IN THE RED RIVER BASIN

The Authority continues to monitor sites, analyze the data collected, determine trends, and assist in the development of Best Management Practices to maintain and/or improve the water quality in the Red River Basin.

The Clean Rivers Program has not received an increase in program fees since its beginning in 1991. With rising costs for services, supplies, and the skyrocketing price of fuel, monetary restrictions have been implemented. This has forced Clean Rivers Program partner agencies to rethink and refocus, re-identify, and reduce sampling events and parameters collected. Since the number of monitoring sites and parameters needed to meet the Clean Rivers Program goals are far more than can actually be sampled, an increase of continuous monitoring stations should be implemented to provide a constant, reliable source of water quality data. In addition, it is the Authority's opinion that water bodies associated with the greatest risks of not attaining their water quality standards should receive the greatest attention. In December 2007, the TCEQ installed two continuous water monitoring stations on the Wichita River. These two stations are being operated in cooperation with the City of Wichita Falls and the USGS in anticipation of the discharge of the new reverse osmosis plant that the City of Wichita Falls plans to put into operation.