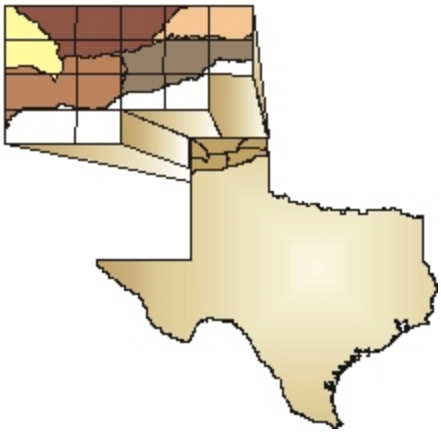


BASIN HIGHLIGHTS REPORT CANADIAN RIVER BASIN 2006

Since its inception in 1959, the mission of the Red River Authority of Texas has been to conserve, reclaim, protect, and develop water resources within the Red and Canadian River Basins for the benefit of the public. In 1991 the Texas Legislature adopted Senate Bill 818, which addressed the newly adopted rules under Chapter 320 of the Texas Water Code. Thus, the Texas Clean Rivers Program (CRP) was created. The Authority played a key role in ensuring a solid foundation for the Clean Rivers Program and this charge has been enhanced through cooperative efforts with the Texas Commission on Environmental Quality (TCEQ), other state and federal agencies, local entities, and the public. Cooperative efforts of all entities involved have resulted in positive impacts on water quality, conservation, and development of the water resources within the basin.

OVERALL APPROACH TO WATER QUALITY

To assist in planning, monitoring, geographically analyze, and disseminate data, the Authority divided the basin into five reaches. A five-year rotational approach was developed to adequately monitor the aquatic health of the basin. This rotational approach provides emphasis to be given to a different reach per year, ultimately intensively covering the entire basin over the five-year time span. A detailed discussion of the water quality in each reach is included later in this report.

WATER QUALITY ISSUES WITHIN THE CANADIAN RIVER BASIN

From a basinwide perspective the water quality in the Canadian River Basin is generally good and the vast majority of the basin supports aquatic life and recreational uses. Two major issues that affect the water quality is the continued *drought* conditions and excessive levels of *chloride*.

Rainfall was not as abundant as the previous year in the Canadian River Basin. This not only impacts the water quality for the people of the basin, but also affects the quantity of water available in Lake Meredith, which supplies water to eleven West Texas cities: Amarillo, Borger, Brownfield, Lamesa, Levelland, Lubbock, O'Donnell, Pampa, Plainview, Slaton, and Tahoka. **Table 1** shows the capacity of the major reservoirs versus the current percentage of capacity.

Table 1 – Major Reservoirs*
Total Capacity versus Current Capacity Percentage

Reservoir	County(s)	Conservation Storage Capacity (Ac/Ft)	Conservation Storage (Ac/Ft)
Lake Meredith	Potter, Moore, Hutchinson	500,000	18%
Palo Duro Reservoir	Hansford	60,897	5%

** as of January 2006 - Texas Water Development Board*

The Palo Duro Reservoir, located in Hansford County, was completed in 1991 by impounding the waters of Palo Duro Creek. The reservoir reached capacities within the range of 50% to 60% during 1999, but has since fallen drastically due to the continued drought conditions, as well as high evaporation rates.

Although the Authority does not monitor the ground water beneath the Canadian River Basin, it is an important aspect of the lives of many of the citizens that live and work in the basin. Fortunately, most of the counties within the Canadian River Basin are heavily underlain by the vast Ogallala Aquifer. However, there are a few areas where it is not as abundant. Ground water availability in some areas is less due to the fact that the Canadian River has eroded through the Ogallala formation. An observation well located in southwest Castro County provides information concerning the depth of the Ogallala Aquifer on a monthly basis. In October 2005, the aquifer level was recorded 265 feet below land surface[1], which is well below the 150 feed mark in 1970. This drastic drop over the 35 year period is testimony to the drought conditions that plague the basin.

The *Lake Meredith Salinity Control Project* is designed to intercept the flow with wells drilled along the river, and then dispose the brine by deep well injection or other means. The purpose of this project is to decrease the elevated concentration of chloride in Lake Meredith, which is the primary surface water supply for a large portion of the Texas Panhandle. The effectiveness of the Salinity Control Project is a means of reclaiming full benefit of the resource. Treated discharges are monitored closely to ensure the impact to receiving waters is compatible with the ecosystem and maintains balance with natural habitats.

[1]United States Geological Survey

While regional activities impact the local watersheds, site specific problems are intensified by the larger scale influences of naturally occurring and anthropogenic pollution to receiving waters. Watershed run-off from urban and agricultural activities are also major contributors of pollution. Control programs, like stormwater 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.

IMPACT AND RESPONSE TO WATER QUALITY ISSUES

With the larger urbanized areas of the Canadian River Basin developing rapidly and the seemingly endless drought depleting the ever dwindling water resources of the Canadian River Basin, the Panhandle Water Planning Group Region A (PWPG-A) was tasked with developing plans and strategies to meet the water needs of the citizens of the Panhandle of Texas.

In an effort to reduce the affects of the drought conditions in the basin, strategies have been identified. Overall strategies include conservation and reuse of water, expansion and enhancement of existing supplies or acquiring new supplies, brush control, and control of naturally occurring salts. Irrigation strategies specifically identified for farming in the basin include: precipitation enhancement, an evapotranspiration network for scheduling irrigation, installation of low energy precision application equipment, changes in crop variety, and implementation of conservation tillage methods, as well as aquifer management. The PWPG-A has posted their 2006 Regional Water Plan, detailing the strategies to meet the needs for the next 50 years at http://www.panhandlewater.org/.

In response to the salinity problems within the Canadian River and Lake Meredith, the Canadian River Municipal Water Authority (CRMWA) continues to work toward controlling the chloride that enter the river. Disposing of the excess brine into the injection wells has proven to be a successful method of eliminating the salt by the CRMWA. Their goal is to provide additional injection wells to use for this purpose, while searching for other alternatives. Additional information on the CRMWA's *Salinity Control Project* can be found at www.crmwa.com/lmscp2.htm.

OVERVIEW OF WATER QUALITY MONITORING

The collection, management, and assessment of water quality data within the Canadian River Basin are integral components of the Clean Rivers Program. The Authority holds a Coordinated Monitoring Meeting annually to coordinate 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 Canadian River Basin. A summary of the monitoring schedule for the fiscal year 2005 is listed in **Table 2** or a more detailed Coordinated Monitoring Schedule for the Canadian River Basin can be found at http://cms.lcra.org.

Regular monitoring is necessary to collect quality-assured data to complete an assessment of water quality conditions and impairments. Assessing the data determines whether or not a water body meets its standards. There are four types of monitoring in the Canadian River Basin performed by the Authority, CRMWA, TCEQ, and USGS.

Regular monitoring is necessary to collect quality assured data.

1. **Fixed Station** (Routine, Baseline) monitoring is conducted every year at key sites.
2. **Systematic Watershed** (Intensive) monitoring is conducted at specific sites on the annual reach of focus.
3. **Targeted** 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.

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. Within days of collection, the results of the analyses are entered into the data repository, which contains years of quality-assured water resource information in the Canadian River Basin.

Table 2 – Overview of Water Quality Monitoring - 2005															
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							16	16	16	16		4		
TCEQ	I			4	2			8	8	8	8	2			
CRMWA	I														
USGS	I	365										1			
Total Reach I		**365**	**—**	**4**	**2**	**—**	**—**	**24**	**24**	**24**	**24**	**3**	**4**	**—**	**—**
RRA	II							4	8	8	8	2			
TCEQ	II					4	2	12	12	8	12	4			1
CRMWA	II							36	120			11			
USGS	II	365						6			365	1			
Total Reach II		**365**	**—**	**—**	**—**	**4**	**2**	**58**	**140**	**16**	**385**	**18**	**—**	**—**	**1**
RRA	III														
TCEQ	III							4	4		4	1			
CRMWA	III														
USGS	III														
Total Reach III		**—**	**—**	**—**	**—**	**—**	**—**	**4**	**4**	**—**	**4**	**1**	**—**	**—**	**—**
RRA	IV														
TCEQ	IV		2					2	2		2	1		1	
CRMWA	IV														
USGS	IV	365										1			
Total Reach IV		**365**	**2**	**—**	**—**	**—**	**—**	**2**	**2**	**—**	**2**	**2**	**—**	**1**	**—**
RRA	V							8	8	8	8	2			
TCEQ	V							4	4		4	1			
CRMWA	V														
USGS	V	365										1			
Total Reach V		**365**	**—**	**—**	**—**	**—**	**—**	**12**	**12**	**8**	**12**	**4**	**—**	**—**	**—**
Basin Total		**1,460**	**2**	**4**	**2**	**4**	**2**	**100**	**182**	**48**	**427**	**28**	**4**	**1**	**1**

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

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

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 Canadian 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/data/swqm.

While the Authority is well equipped with its own environmental laboratory, samples collected by the CRMWA, TCEQ, and USGS are processed by their own in-house laboratories. All sampling entities are required to adhere to a Quality Assurance Project Plan approved by the TCEQ. This ensures that all data collected by the entities sampling within the Canadian River Basin are quality-assured and verified prior to its entry into the statewide data collection system administered by the TCEQ known as TRACS (Texas Regulatory Activity and Compliance System).

Samples collected by the Authority are analyzed in the Authority's Environmental Services Division Laboratory

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.

FIELD PARAMETERS (continued) *Collected and processed in the field laboratory. Results are expressed in mg/L except as noted.*	
Water Clarity:	Clearness of the water as it appears in the water body at the time of sampling. Clarity ranges from excellent to poor. Clarity is a visual indicator of a water body.
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 as an aid in determining if a particular 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 in the Authority's ESD Laboratory and our contract laboratory. Results are expressed in mg/L except as noted.***	
Alkalinity:	A measure of the acid-neutralizing capacity of water. Bicarbonate, carbonate, and hydroxide are the primary causes of alkalinity in natural waters. Alkalinity is a measurement of the buffering capacity of water and its capability to neutralize acids.
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.
Hardness:	The sum of the calcium and magnesium concentrations in water and is expressed as calcium carbonate.
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.
COD:	Chemical Oxygen Demand (COD) – A measure of the amount of oxygen required to oxidize all compounds in the water, both organic and inorganic. COD is an indicator of how much organic load is placed on the oxygen in a water body.
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.
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.
TDS:	Total Dissolved Solids (TDS) – A measure of solids, both organic and inorganic, dissolved in water.
TSS:	Total Suspended Solids (TSS) – A measure of the total suspended solids in water, both organic and inorganic.
TOC:	Total Organic Carbon (TOC) is all of the carbon portions, both organic and inorganic, in a water body.
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).
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).
Nitrate plus Nitrite:	Most of the time, it is a good indicator of the level of human caused pollution in a waterbody.
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.

WATER QUALITY DATA REVIEW

The regular program of monitoring and assessment is designed to compare conditions in Texas surface waters to established *water quality standards* and to determine which water bodies are meeting the standards set for their use, and which ones are not. They are fundamental building blocks used to manage the quality of surface water. Information and a list of surface water quality standards can be found at the TCEQ website at www.tceq.state.tx.us./nav/eq/eq_swqs.html.

Water quality standards were established based on historical hydrological data for each classified water body. In the assessment, current water quality data are screened against the appropriate standard in accordance with the *Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data*. The results are then analyzed and evaluated for the assessment. The assessment occurs every two years utilizing the previous five year's data. The results are then published periodically in the *Texas Water Quality Inventory and 303(d) List*, as required by Sections 305(b) and 303(d) of the Federal Clean Water Act. In addition, the reports are available online at www.tceq.state.tx.us/compliance/monitoring/water/quality/data/04twqi/04_summary.html.

There are three main aspects of the water quality assessment performed by the TCEQ:

1. The ***Draft 2004 Texas 303(d) List*** identifies water bodies for which effluent limitations are not stringent enough to implement water quality standards. The TCEQ also develops a schedule identifying Total Maximum Daily Loads (TMDLs) that will be initiated in the next two years for priority impaired waters. Water quality permitting in 303(d)-listed water bodies is described in the TCEQ regulatory guidance document *Procedures to Implement the Texas Surface Water Quality Standards*. Water bodies in the Canadian River Basin which are listed on the *Draft 2004 Texas 303(d)* List include:

Segment	Water Body	Parameter(s)
0101A	Dixon Creek	Bacteria, Depressed Dissolved Oxygen
0102	Lake Meredith	Mercury in Walleye
0105	Rita Blanca Lake	Total Dissolved Solids
0199A	Palo Duro Reservoir	Depressed Dissolved Oxygen

2. The ***Draft 2004 Water Quality Inventory Summary of Water Bodies with Concerns for Use Attainment Report*** lists water bodies with concerns identified for indicators, such as dissolved oxygen. These indicators are directly tied to support of designated uses and criteria adopted in the *Texas Surface Water Quality Standards.* Water bodies in the Canadian River Basin which were identified with use attainment concerns include:

Segment	Water Body	Use Concern	Parameter(s) of Concern
0101B	Rock Creek	Contact Recreation Use	Bacteria
0103	Canadian River Above Lake Meredith	Contact Recreation Use	Bacteria
0103A	East Amarillo Creek	Contact Recreation Use	Bacteria
0104	Wolf Creek	Contact Recreation Use	Bacteria
0105	Rita Blanca Lake	General Use	Total Dissolved Solids, pH

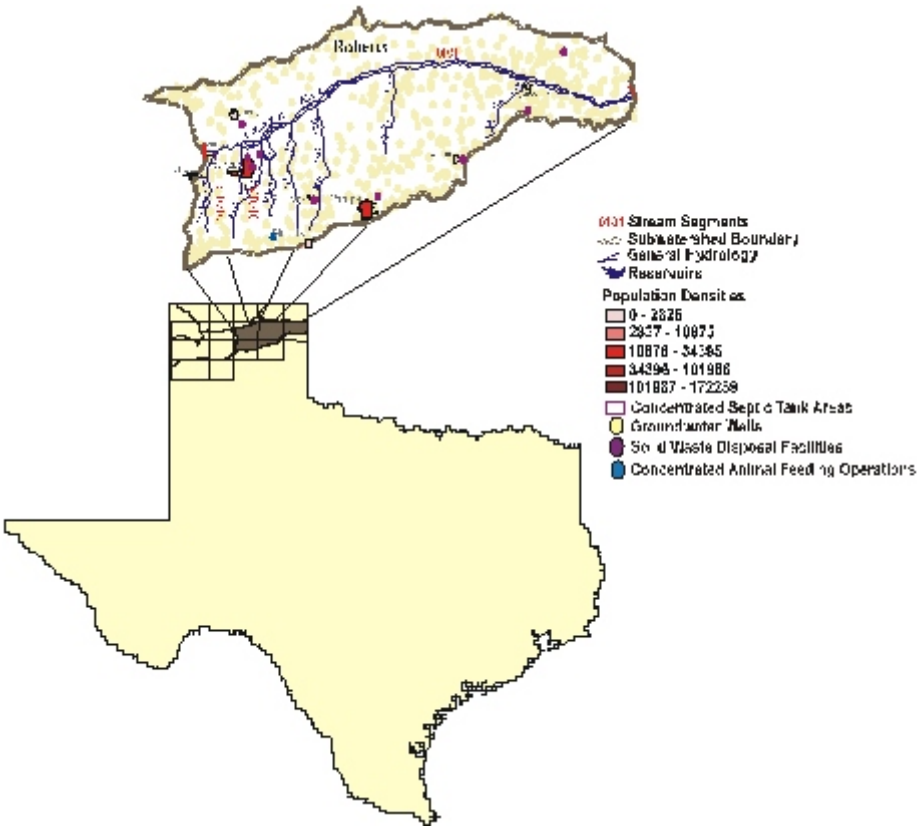
3. The ***Draft 2004 Water Quality Inventory Summary of Water Bodies with Water Quality Concerns*** identifies water quality concerns in water bodies with indicators such as nutrients that are not tied to support of a designated use with a quantitative criterion. Screening levels used to identify these concerns have generally not been adopted as standards with the exception of secondary drinking water standards. Water bodies in the Canadian River Basin which are included on the summary of water bodies with water quality concerns are:

Segment	Water Body	Use Concern	Parameter(s) of Concern
0101	Canadian River Below Lake Meredith	Nutrient Enrichment Concern	Ammonia
0102	Lake Meredith	Public Water Supply Concern	Chloride, Sulfate, Total Dissolved Solids
0103A	East Amarillo Creek	Nutrient Enrichment Concern	Nitrate+Nitrite Nitrogen
0199A	Palo Duro Reservoir	Nutrient Enrichment Concern	Ammonia, Nitrate+Nitrite Nitrogen, Orthophosphorus, Total Phosphorus

For more information about the evaluation of water quality data for the Texas Water Quality Inventory Assessment, please see the TCEQ's *Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data, 2004* at www.tceq.state.tx.us/assets/public/compliance/monops/water/04twqi/04_guidance.pdf.

Reach I of the Canadian River Basin encompasses an area about 90 miles long and 40 miles wide. It is located on the main stem of the Canadian River and represents a watershed from the Texas-Oklahoma state line upstream to the Sanford Dam on the Canadian River where it encompasses the northern portion of Hemphill County and the southernmost section of Lipscomb County. The largest cities within the reach are Pampa and Borger with populations of 17,887 and 14,302, respectively. Other towns include Canadian, Stinnett, Skellytown, Miami, and Sanford.

There are many farms and ranches in **Reach I** that produce cattle, swine, poultry, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. Although there is some irrigated farm land, the majority of farm land consists of either dryland farming or pasture land for cattle. The soils range from sandy alluvial to dark and reddish clay loams over flat plains to broken rocky valleys where the plains break into the Canadian River Valley.



Included in **Reach I** are 23 permitted municipal and industrial discharges, five active permitted solid waste disposal sites, and four concentrated animal feeding operations. In addition, there are more than 1,200 ground water wells which utilize water from the Ogallala Aquifer.

Segments located in **Reach I** include:

0101 – Canadian River below Lake Meredith
0101A – Dixon Creek
0101B – Rock Creek

During the reference period of September 1, 2004 through August 31, 2005, the Authority conducted 16 monitoring events and collected approximately 464 parameters from four water quality monitoring stations. The TCEQ conducted eight monitoring events and collected around 206 parameters from two water quality monitoring stations during the same reference period. In addition, the United States Geological Survey (USGS) took continuous flow measurements from one monitoring station. **Figure 1** illustrates the monitoring coverage of **Reach I** in 2005, where each monitoring station is designated by a five digit numeric code.

Figure 1

Elevated nutrients and bacteria (*E. coli*) are the main water quality issues in **Reach I.** Most of the elevated bacterial issues arise from run-off from pastures and fields or from animals congregating around available water sources. Additionally, run-off can increase nutrients in the waters. This is the case in the Canadian River below Lake Meredith **Segment 0101** where concerns for elevated nutrient levels can be found. Most of the terrain surrounding this portion of the Canadian River is fairly rugged and sparsely populated. The flood plain of the river is generally very sandy and supports large numbers of cattle on the native grasses and scrubby trees that are found there.

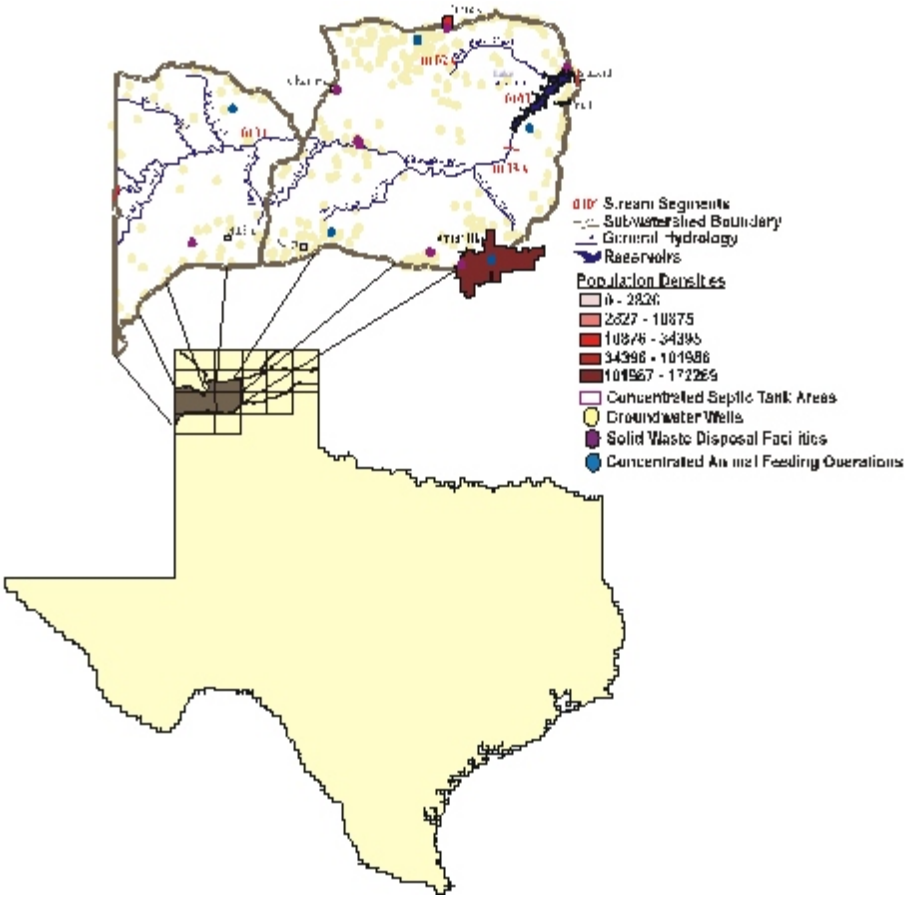
Dixon Creek, Segment 0101A a tributary of the Canadian River near Borger is listed on the *TCEQ's Draft 2004 Texas Water Quality Inventory Status and Category of All Waters (May 13, 2005)* for not meeting contact recreation and aquatic life use standards. Reviews of recent data by the Authority indicate that the issue of low dissolved oxygen in the creek has been alleviated, but the problem with the bacteria remains. Additionally, the Authority's review of the data has found concerns for excessive algal growth. This can be a result of livestock, which are dependent on the creek as a source of water. Without flow from the industrial discharger, Dixon Creek would be an intermittent water body. The field work from the Aquatic Life Assessment has been completed by the TCEQ and the results are pending.

Rock Creek 0101B is also located near Borger and receives treated effluent discharge from a local municipality. It flows through areas of the Panhandle that could be called tortuous. As the creek winds its way to the flood plain of the Canadian River it weaves through steep walled arroyos. Recent review of the water quality data by the Authority indicates elevated bacterial levels may be originating from pasture run-off, as well as livestock. The higher than normal ammonia nitrogen levels that have been found in the upper portion of this unclassified segment could possibly be attributed to a seep or leaching from a fertilizer manufacturing plant located in the upper reaches of Rock Creek. This plant is permitted for underground disposal. With all of the oilfield drilling, both recent and historic, it is possible that an unknown pathway is providing a way for contaminants to enter this watershed. It is well known that the older practices of drilling and closing old oil wells can be a major contributor to salt leach, seeps, or scalds. Additionally, the highly corrosive nature of oil field brines is well known.

Rock Creek at Electric City Bridge

As one of two major contributors to the flow of the Canadian River in this portion of the segment, it is likely that the nutrient enrichment problems originate in Rock Creek. The results of the recent Aquatic Life Assessment on Dixon Creek will yield valuable information that could lead to rectification of the water quality problems in Rock Creek.

REACH II is located from the Sanford Dam at Lake Meredith to the Texas-New Mexico state line and up to Oldham and Hartley Counties. Amarillo, the largest city in the Canadian River Basin, has a total population of over 174,000, and is dissected by both the Red and Canadian River Basins. **Reach II** encompasses about a fourth of the northwestern portion of the city. The total population of the reach is approximately 120,000. The economics of the majority of the reach consist of agribusiness and oil and gas production. Amarillo is also home to a large refinery that produces copper, selenium, nickel, and tellurium. Also found only in this reach is the unique resource of free gaseous helium.



The reach contains 12 permitted municipal and industrial discharges, seven active permitted solid waste disposal sites, and four concentrated animal feeding operations. In addition, there are more than 550 ground water wells in this reach that use water from the Ogallala and Dockum Aquifers.

Reach II contains many farms and ranches which produce principally cattle, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. The majority of the area is irrigated farm land, with some dryland farming or pasture land for cattle.

Segments located in **Reach II** are:

0102 – Lake Meredith
0102A – Big Blue Creek
0103 – Canadian River above Lake Meredith
0103A – East Amarillo Creek
0103B – Punta de Agua Creek

During the reference period of September 1, 2004 through August 31, 2005, the Authority conducted eight monitoring events and collected approximately 232 parameters from two water quality monitoring stations. The TCEQ conducted 14 monitoring events and collected around 306 parameters from four water quality monitoring stations. The Canadian River Municipal Water Authority (CRMWA) conducted 132 monitoring events and collected approximately 1,320 parameters from 11 water quality monitoring stations on Lake Meredith. In addition, the USGS monitored one station collecting continuous flow measurements. **Figure 2** illustrates the monitoring coverage of **Reach II** for 2005, where each monitoring station is designated by a five digit numeric code.

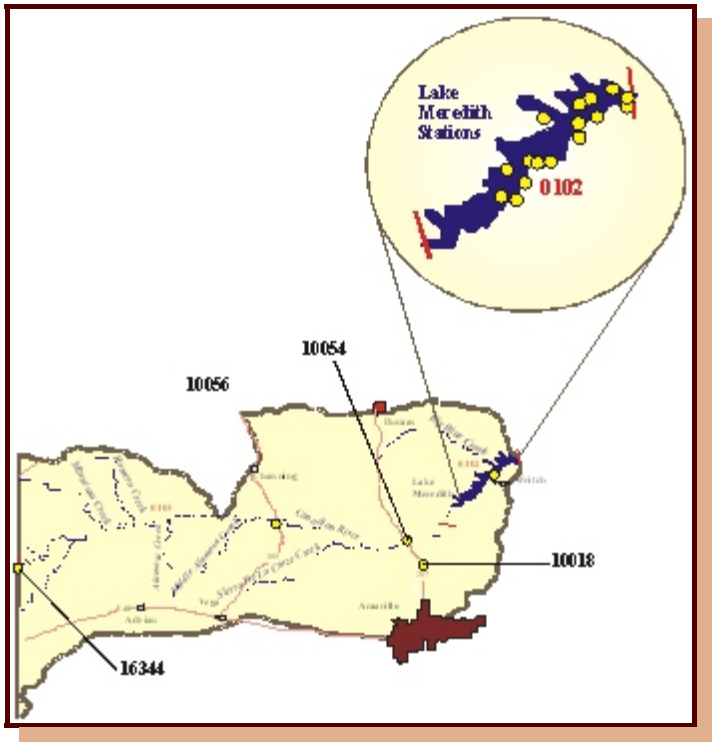


Figure 2

The largest reservoir in the Canadian River Basin is Lake Meredith with a total flood pool storage capacity of 1,569,800 acre-feet and a surface area of 21,640 acres at an elevation of 3,011 feet above mean sea level. Water is pumped from Lake Meredith to eleven area cities located within parts of the Canadian, Red, and Brazos River Basins.

The *TCEQ's Draft 2004 Texas Water Quality Inventory Status and Category of All Waters (May 13, 2005)* lists **Lake Meredith, Segment 0102** as having a public water supply concern for chloride, sulfate, and total dissolved solids in the lake and in finished drinking water. These elevated parameters are most likely due to inflow of highly saline waters from the Canadian River into the lake. Previous studies have determined that a major contributor of the saline water originates from a shallow brine aquifer under artesian pressure that filters into the river channel. In September 2001, the CRMWA implemented the Lake Meredith Salinity Control Project, which has greatly improved the salinity problem in the lake. Additional information on the project can be found on the CRMWA website at www.crmwa.com/lmscp2.htm.

Lake Meredith is also listed as on the *Draft 2004 Texas 303(d) List (May 13, 2005)* for partially supporting its fish consumption use because of elevated mercury levels found in walleye. Mercury forms toxic compounds, such as methyl-mercury, that are known to accumulate in fish at the top of the food chain. Walleye, being a longer lived creature, is the cool-water predator sport fish that predominates the food chain in Lake Meredith. As walleye grow and mature, they consume smaller,

shorter-lived contaminated prey species, thus accumulating the methyl-mercury in its tissues over time. The Environmental Protection Agency (EPA) has stated that consumption of mercury contaminated species like walleye may cause health problems in pregnant women, infants, and young children. The source of the mercury is questionable, however the EPA has speculated that such sources are most likely coming from the exhaust of refineries and coal fired power plants. These exhaust fumes travel the prevailing winds, settling in water bodies, and contaminating the food chains. The EPA is currently implementing nationwide, intensive surveys on affected water bodies to scientifically ascertain the mercury sources. For information regarding mercury emission rules, see the EPA's website at www.epa.gov/mercury/control_emissions/decision.htm.

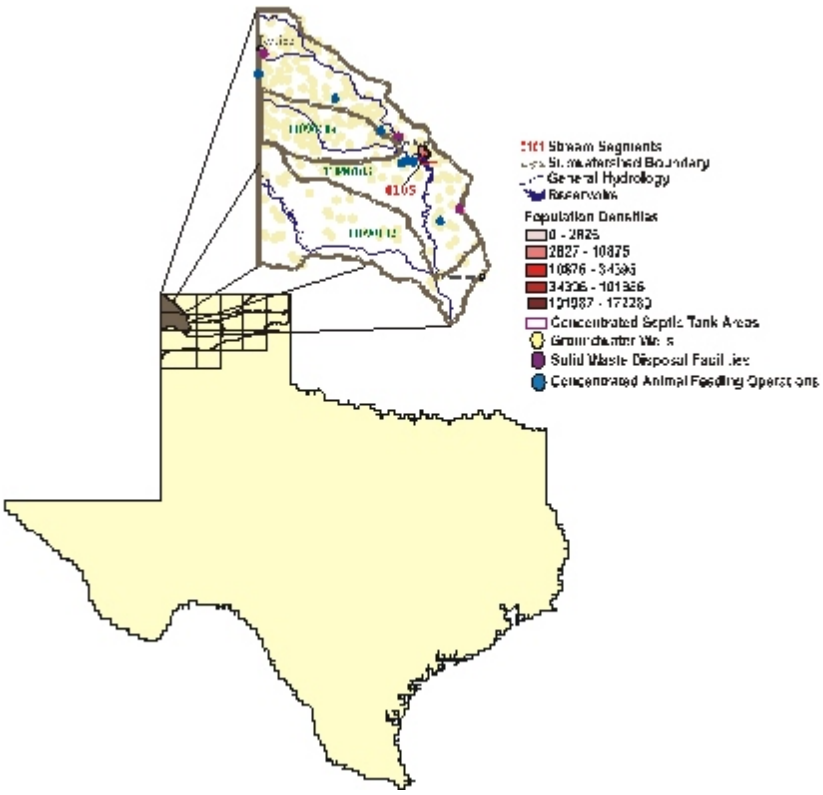

East Amarillo Creek

Overall water quality in the **Canadian River, Segment 0103** above Lake Meredith is good, however, the Authority's most recent screening of the data found chloride to exceed the standard.

Also included in **Reach II** is **East Amarillo Creek, Segment 0103A**. It originates in northern Amarillo where the city has impounded the headwaters of the creek into a series of small impoundments collectively known as Thompson Park Lake. Stormwater run-off and natural drainage from the City of Amarillo supply the creek with flow. Overall water quality conditions in East Amarillo Creek have been generally good, however, in the recent screening of data, exceedances of bacteria and nutrients have been revealed. The creek receives run-off from urban areas, as well as from rural areas of northern Amarillo and Potter County. The Authority's preliminary observations of new data from Thompson Park Lake indicates that the bacteria and elevated nutrients enter the creek somewhere below that site. Additional data and more research are needed to identify actual sources of these problems.

Data were not available for the Authority to screen for **Segments 0102A, Big Blue Creek** and **0103B, Punta de Agua Creek** for the reference period. Big Blue Creek is a tributary of Lake Meredith, and like many of the creeks in the area, it becomes an intermittent stream. The Authority is currently monitoring Big Blue Creek as part of its intensive systematic program. Punta de Agua Creek was determined to be dry and efforts were utilized elsewhere to maximize program resources.

Reach III represents the Rita Blanca Creek watershed upstream to the Texas-New Mexico state line encompassing Hartley and Dallam Counties. The three subwatersheds contained in this reach include approximately 3,600 square miles, of which an estimated 1,500 square miles are contributing drainage.



Dalhart is the largest city in **Reach III** with a population of 7,200; more than 9,000 persons populate this reach. There are five other small towns including Texline and Channing. The economy of the reach is basically agribusiness, oil and gas production, and hunting. Rainfall averages from 16 inches to a little over 17 inches annually.

Within the reach are 16 concentrated animal feeding operation permits, one active permitted solid waste disposal site, and more than 350 ground water wells that use water from the Ogallala and Dockum Aquifers in **Reach III**.

There are many farms and ranches that produce cattle, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. As described in the preceding reaches, only a small portion is irrigated. The soils range from sandy alluvial soils to dark and reddish clay loams over flat plain to broken rocky valleys where the plains break into the Canadian River Valley.

The only segment located in **Reach III** is: 0105 – Rita Blanca Lake

During the reference period of September 1, 2004 through August 31, 2005, the TCEQ conducted four monitoring events and collected about 100 parameters from one water quality monitoring station on Rita Blanca Lake. **Figure 3** illustrates the monitoring coverage of **Reach III**, where each monitoring station is designated by a five digit numeric code.

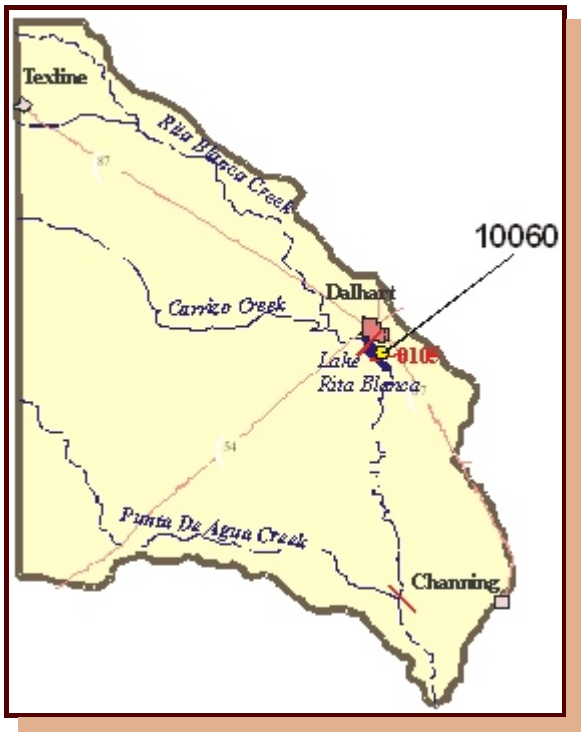


Figure 3

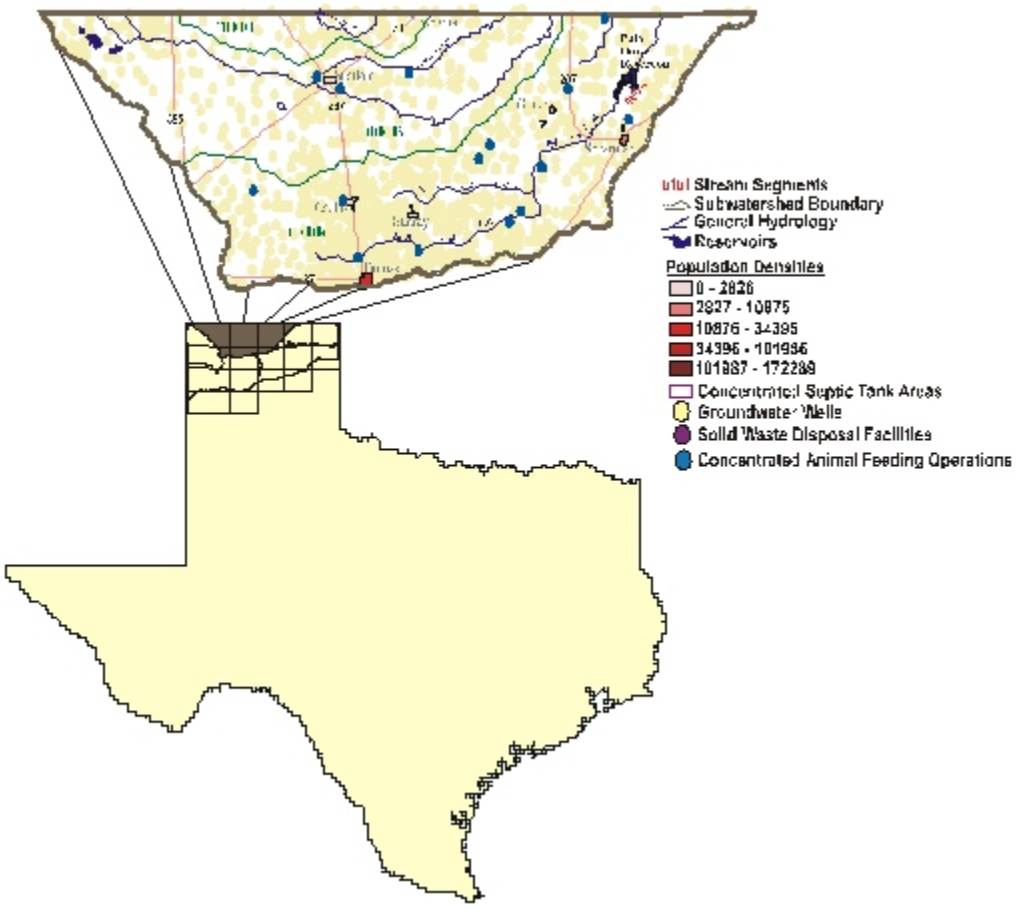
Rita Blanca Lake is unique in that it is the only segment in the Canadian and Red River Basins to be classified as a noncontact recreation segment. Even with this categorization, Rita Blanca Lake is listed on the *Draft 2004 Texas 303(d) List (May 13, 2005)* as not supporting the general use due to total dissolved solids. The only steady inflow Rita Blanca Lake receives is treated effluent from the City of Dalhart's wastewater treatment plant and occasional rainfall. Without a steady inflow, Rita Blanca Lake has become a shallow, marshy wetland.

The Texas Parks and Wildlife Department has designated Rita Blanca Lake as a high quality water fowl habitat since it is located in the flyway of migratory waterfowl. This causes an unusually heavy organic load on Rita Blanca Lake, which results in the elevated total dissolved solids and pH levels.

The Texas Parks and Wildlife Department has designated Rita Blanca Lake as a high quality water fowl habitat since it is located in the flyway of migratory waterfowl.

Reach IV includes Palo Duro Creek from the northern Texas-Oklahoma state line upstream to its headwaters including portions of Coldwater Creek, Frisco Creek, and Lower Beaver River. It contains three subwatersheds with 6,500 square miles of which 3,500 are contributing drainage in Texas.

Major cities located in **Reach IV** include Dumas, Spearman, Cactus, Stratford, Sunray, and Gruver. Rainfall averages from 19 to 20 inches annually. The area contains many farms and ranches that produce cattle, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. Soils range from sandy alluvial to dark and reddish clay loams over flat plain to broken rocky valleys.



There are nine permitted municipal and industrial dischargers, four active permitted solid waste disposal sites, about 45 concentrated animal feeding operations, and one superfund site. In addition, **Reach IV** includes more than 1,450 ground water wells that utilize water from the Ogallala and Dockum Aquifers.

The only segment located in **Reach IV** is 0199 – Palo Duro Reservoir.

Palo Duro Reservoir has a total storage capacity of 60,900 ac/ft with a drainage area of about 614 square miles. Total surface acres are 2,413 with an approximate shore line of 48 miles. The recent drought conditions combined with the naturally arid nature of this region has slowed the filling of Palo Duro Reservoir.

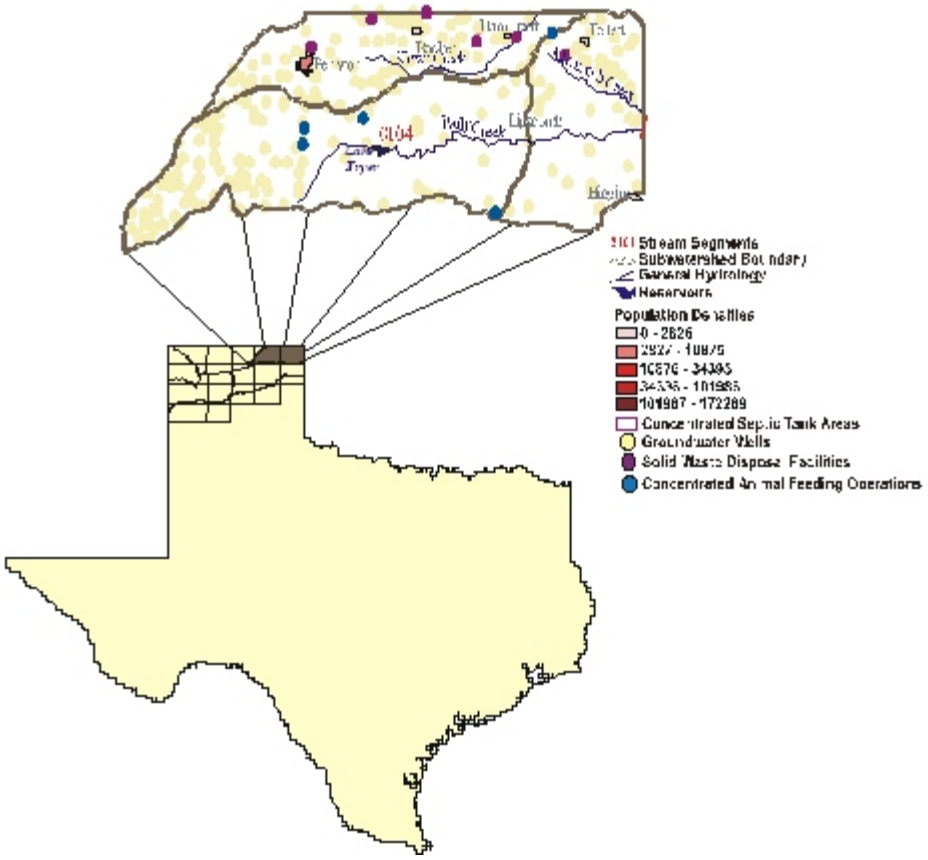
Figure 4

During the reference period of September 1, 2004 through August 31, 2005, the TCEQ conducted four monitoring events and collected approximately 100 water quality parameters from one water quality monitoring station on Palo Duro Reservoir. In addition, the USGS monitored continuous flow from one monitoring station. Refer to **Figure 4** for surface water monitoring coverage of **Reach IV**, where each monitoring station is designated by a five digit numeric code.

Palo Duro Reservoir is listed on the *Draft 2004 Texas 303(d) List (May 13, 2005)* for the partial support of aquatic life use due to depressed dissolved oxygen. In the 2002 assessment of Palo Duro Reservoir there were an insufficient number of 24-hour dissolved oxygen values available for proper analysis for the Aquatic Life Use Assessment. The TCEQ has also noted Palo Duro Reservoir as having nutrient enrichment concerns. The Authority's review of the recent data revealed elevated chlorophyll *a* levels. Palo Duro Reservoir will remain on the *Draft 2004 Texas 303(d) List* until a sufficient number of 24-hour dissolved oxygen measurements are available to demonstrate its support of the aquatic life use criteria. Like Rita Blanca Lake, Palo Duro Reservoir is also in the flyway for migratory waterfowl. It is speculated that the heavy organic load from the waterfowl causes the elevated nutrient and algal growth concerns.

Palo Duro Reservoir

Reach V comprises the Wolf, Mammoth, and Kiowa Creek watersheds from the Texas-Oklahoma state line upstream to the headwaters of each. It encompasses the upper eastern section of the Panhandle in Lipscomb and Ochiltree Counties. The largest city in **Reach V** is Perryton, which has a population of 7,800. Other towns include Booker, Higgins, Follett, and Darrouzett. The total population of the reach is approximately 11,000. Economics of the area are based on agribusiness, oil and gas production, and hunting. Farms and ranches in this reach produce cattle, wheat, oats, corn, sorghum, hay, and barley. There are two permitted municipal and industrial dischargers, three active permitted solid waste disposal sites, 17 concentrated animal feeding operations, and one superfund site. In addition, more than 375 ground water wells within the reach utilize water from the Ogallala Aquifer.



The only segment located in **Reach V** is 0104 – Wolf Creek.

Wolf Creek is naturally spring-fed, therefore it flows year round. Local ranchers utilize Wolf Creek as a valuable watering source for their livestock. Consequently, run-off from rainfall events causes the bacterial levels to rise sharply, then decrease during drier periods.

During the reference period of September 1, 2004 through August 31, 2005, the Authority conducted eight monitoring events and collected approximately 464 water quality parameters from two monitoring stations. The TCEQ conducted four monitoring events and collected about 100 water quality parameters from one water quality monitoring station at Lake Fryer. In addition, the USGS continuously monitored flow at one monitoring station in this reach. Refer to **Figure 5** for an illustration of the monitoring coverage for **Reach V**, where each monitoring station is designated by a five digit numeric code.

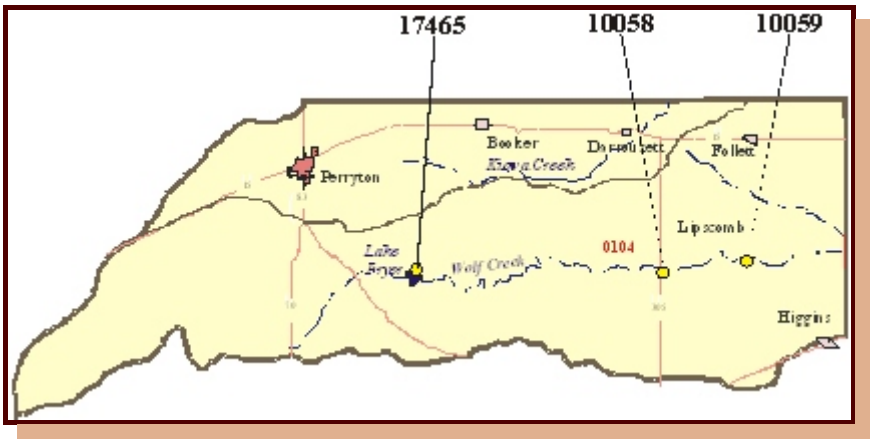


Figure 5

According to the *Draft 2004 Texas Water Quality Inventory Status and Category of All Waters (May 13, 2005)*, the two sites located on Wolf Creek monitored by the Authority have no water quality issues at this time. Although this area has received much needed rainfall, there has not been enough to significantly end the drought that has plagued the area for many years. Wolf Creek is currently meeting all of its water body use criteria. The precipitation received over the past year in the Texas Panhandle was greatly needed for farmers and ranchers alike, but even more so in **Reach V** as some dry land fields have not made a crop in years. Continued rain and snow are needed to keep soil moisture levels high enough to sustain crops to maturity.

Wolf Creek at State Highway 305

Monitoring began in 2002 on Lake Fryer, therefore, limited data have been available to assess any water quality parameters from this water body. As the number of data sets have increased, the Authority has been able to review the data and evaluate its water quality. This preliminary assessment has revealed a possible excessive algal growth issue for Lake Fryer. Since this is a small reservoir, heavy rainfall and subsequent inflows into the lake could have significantly increased the nutrient levels causing the excessive algal growth.

PUBLIC PARTICIPATION AND OUTREACH

One 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.

✯Steering Committee

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 agencies developed a steering committee to set priorities within its own individual basin. These committees bring together diverse interests within the basin. Steering committee participants include representatives from the public, municipal, county, state, and federal government, industry, business, agriculture, environmental, education, civic organizations, and others.

As one of the most successful components of the Clean Rivers Program within the Canadian River Basin, the Steering Committee has guided this program over 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 together when it may not have 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 set up to be open, friendly, casual, and informative. They are designed to provide in-depth technical information regarding project work plans, monitoring schedules, reports, and any other relevant topics. Committee members are encouraged to ask questions and present their ideas at the meetings, as well as throughout the year.

✯Volunteer Environmental Monitoring

The Texas Rivers Project, in its 15th year, provides 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 proud to be associated with local Earth Day celebrations. Earth Day is celebrated in cooperation with River Bend Nature Works, an environmental educational center located in Wichita Falls that provides hands-on environmental programs to children and adults. Last year's event was held in April, with more than 750 school children participating. 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 all types of information and articles that appear regularly in newspapers throughout the basin.

Another program sponsored by the Authority is the distribution of educational materials. The *Major Rivers* and *Think Earth* curricula are provided to all schools upon request. These two publications are favored by teachers and students alike. Last year over 110 boxes of water quality educational material was provided to schools in the Red and Canadian River Basins.

✯Red River Authority of Texas Website

The Authority maintains a compelling commitment to provide up-to-date scientifically correct information on the website at www.rra.dst.tx.us. The website provides a virtual on-line encyclopedia of information and resources. The home page allows the user to locate information about the Authority and historically research the Canadian River Basin, and much more.

A popular feature on the Authority's website is the *Public Information Repository* which guides one to a wealth of information. Facts and data on almost any aspect of the Canadian River Basin 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.

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

SUGGESTIONS FOR FUTURE WORK IN THE CANADIAN 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 Canadian River Basin.

The Clean Rivers Program has not received an increase in program fees since its beginning in 1991. With rising costs for services and supplies, monetary restrictions have been implemented. This has forced Clean Rivers Program partner agencies to 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 stream segments associated with the greatest risks of not attaining its water quality standards should receive the highest precedence.

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.

The Authority receives its guidance from the TCEQ, but also listens and responds to the needs provided and directed by the Basin Advisory Committee.

BECOME INVOLVED

Active involvement is vital in the watershed management in the Canadian River Basin for the Clean Rivers Program. There are many ways to become involved in the planning of the basin's water quality and environmental health. For information on becoming involved in the Basin Advisory Committee or other public outreach activities, please contact the Authority or refer to the Authority's website at **www.rra.dst.tx.us**.