2021 BASIN HIGHLIGHTS REPORT

AN OVERVIEW OF WATER QUALITY THROUGHOUT THE CANADIAN AND RED RIVER BASINS

Red River at SH 6

The preparation of this report was
financed through and in cooperation with
the Texas Commission on Environmental Quality

Lake Arrowhead

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INTRODUCTION

In 1991, the Texas Legislature enacted the Texas Clean Rivers Act (Senate Bill 818) in order to assess water quality for each river basin in the state. From this, the Clean Rivers Program (CRP) was created and has become one of the most successful cooperative efforts between federal, state, and local agencies and the citizens of the State of Texas. It is implemented by the Texas Commission on Environmental Quality (TCEQ) through local partner agencies to achieve the CRP's primary goal of maintaining and improving the water quality in each river basin. The Red River Authority of Texas (Authority) is the partner agency for both the Canadian and Red River Basins.

A watershed management approach was selected as the best method to manage the State's diverse surface water resources. In order to achieve this, the Authority subdivided the Red River Basin into 5 reaches and Canadian River Basin into 5 reaches, or sub-watersheds, divided by natural hydrology and composed of classified segments and unclassified water bodies. The TCEQ identifies each of these classified segments in the Texas Surface Water Quality Standards (TSWQS). Data resulting from the collection and analysis of water samples is used in the development of and compliance with these standards.

An integral part of the CRP is the Basin Highlights Report (BHR). This report is based on quality assured data as utilized in the *Texas Integrated Report* (*IR*). The *IR* is an assessment of historical water quality data and is prepared by the TCEQ every two years, as required under the Federal Clean Water Act (CWA), Sections 305(b) and 303(d), as administered by the Environmental Protection Agency (EPA).

In 2019, the Authority produced the *Basin Summary Report for the Canadian and Red River Basins*, which included an extensive review of technical data and trend analyses based on information from the final *2016 Texas Integrated Report* (*IR*). This year's Basin Highlights Report (BHR) is brief in comparison to the *2019 Basin Summary Report for the Canadian and Red River Basins*, and serves to highlight ongoing environmental phenomena and projects impacting water quality within the Canadian and River Basins. Results from the *2018 IR* are also presented for both basins. Therefore, it is strongly suggested that the reader should view the *2019 Summary Report of the Canadian and Red River Basins* for more in depth information. The summary report may be found on the Authority's website at: **www.rra.texas.gov**.

Middle Wichita River

Sweetwater Creek at US 83

WHAT IS WATER QUALITY AND HOW IS IT EVALUATED?

Water quality is a combination of the physical, chemical, and biological characteristics of water. It is a measure of the condition of water relative to the requirements of one or more biotic species and/or to any human need or purpose. It is most frequently used as a comparator to a set of standards from which compliance can be monitored and assessed, the most common being those regulations governing the quality of drinking water.

Industrial and municipal dischargers must seek permission from the TCEQ prior to discharging any treated effluent into a surface water body. These entities are regulated through National Pollution Discharge Elimination System (NPDES) permits that set limits for various water quality parameters. Not all dischargers are similar; there are countless systems and treatment methods that vary depending on a number of different factors. This being said, the requirements and stringency of a NPDES permit also vary depending on such factors. When setting permitting requirements and limitations, it is also important to consider the use of the water body accepting the discharge. If, for example, a water body was classified as a drinking water source, the NPDES requirements would be much more stringent compared to a non-drinking water source.

The TCEQ evaluates the water quality of the state's water resources on a regular basis under provisions outlined in the CWA Sections 303(d) and 305(b). These results are compiled and published by the TCEQ through the IR. The *2020 IR* is the most current version and was approved by the EPA on November 19, 2015. Water bodies that do not meet the criteria determined by the TCEQ are identified with one of three classifications: impaired, having a concern for near non-attainment of standards, or concern for screening level violations. The following describes the classifications:

Impaired (NS)
Parameter has exceeded water quality standard set by the TCEQ. Once listed, this water body is scheduled for additional monitoring or a special study.

Concern for Near Non-Attainment of Standards (CN)
Parameter is close to exceeding the water quality standard set by the TCEQ. These sites require additional monitoring.

Concern for Screening Level Exceedance (CS)
Not all parameters have water quality standards, for example nutrients in streams. Instead, a narrative criteria exists. In cases where there is no segment-specific numeric criteria, the TCEQ developed screening levels based on the 85th percentile of nutrient values in the Surface Water Quality Monitoring Information System (SWQMIS) database. If a nutrient parameter exceeds this screening criteria more than 20% of the time, it is considered as having a CS.

WATER QUALITY ASSESSMENT OVERVIEW

When reading through the specific water body information presented over the next several pages of this year's report, please remember that this data is merely a snapshot of a water body, and that the overall health can and does vary tremendously over the course of weeks, months, years, and seasons. Equally important is to keep in mind that while two water bodies may receive the same rank, this does not mean that they have similar impairments or concerns. Rankings are solely based on the frequency of impairments (NS), concerns for screening level exceedances (CS), concerns for near non-attainment of water quality standard (CN), or a combination thereof.

RANK	NS	CS	CN	DESCRIPTION
💧💧💧💧💧	0	0	0	Water body has no impairments or concerns
💧💧💧💧	0	1	0	Water body has no impairments and one concern for screening level exceedance or,
	0	0	1	Water body has no impairments and one concern for near non-attainment of the water quality standard
💧💧💧	1	0	0	Water body has one impairment and no concerns
	0	>1	0	Water body has more than one concern for screening level exceedance
	0	0	>1	Water body has more than one concern for near non-attainment of the water quality standard
	0	1	1	Water body has one concern for both screening level exceedances and near non-attainment of the water quality standard
💧💧	>1	0	0	Water body has more than one impairment but no concerns
	1	≥1	0	Water body has a single impairment and concern(s) for screening level exceedances or concern(s) for near non-attainment of the water quality standard
	1	0	≥1	
	0	≥1	≥1	Water body has no impairments but more than one concern for both screening level exceedances and near non-attainment of the water quality standard
💧	≥1	≥1	≥1	Water body has one or more impairments and multiple concerns for both screening level exceedances and near non-attainment of the water quality standard
	>1	≥1	0	Water body has more than one impairment and multiple listings for either concerns for screening level exceedances or near non-attainment of the water quality standard
	>1	0	≥1	

PARAMETER	IMPACT	POTENTIAL CAUSE(S)
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 and can adversely affect fish and invertebrate reproductive capacity and reduced growth of the young.	Ammonia is excreted by animals and is produced during the decomposition of plants and animals. It is an ingredient in many fertilizers and is also present in sewage, storm water runoff, certain industrial wastewaters, and runoff from animal feedlots.
Alkalinity	A measure of the acid-neutralizing or buffering capacity of water. The presence of calcium carbonate ions to the buffering system. Alkalinity is a measure of how much acid can be added to a liquid without causing a large change in pH. Alkalinity is important for fish and aquatic life because it protects or buffers against rapid pH changes. Living organisms, especially aquatic life, function best in a pH range of 6.0 to 9.0.	Alkalinity is often related to hardness because the main source of alkalinity is usually the result from dissolved carbonate rock formation.
Chloride	One of the major inorganic ions in water and wastewater. Chloride is an essential element for maintaining normal physiological functions in all organisms. Elevated chloride concentrations can disrupt osmotic pressure, water balance, and acid/base balances in aquatic organisms which can adversely affect survival, growth, and/or reproduction.	Chloride compounds, often known as salts, can be an indicator of natural or manmade pollution, as in the case of oil field brines. Natural weathering and leaching of sedimentary rocks, soils, and salt deposits can release chloride in to the environment. Other sources can be attributed to oil exploration and storage, sewage and industrial discharges, runoff from dumps and landfills, and saltwater intrusion.
Chlorophyll-*a*	Increased nutrients in water bodies create diurnal swings that can stress aquatic life. In the presence of sunlight and abundant food sources photosynthesis increases, DO levels rise and pH levels fall. At night respiration begins and oxygen is consumed. DO levels fall and then pH levels rise.	Chlorophyll-*a*, is a photosynthetic pigment, that is found in all green plants and algae. The concentration of chlorophyll *a* is used to estimate phytoplankton biomass in surface water. Results are expressed in µg/L (micrograms per liter).
Conductivity	A measurement of the electrical current carrying capacity of water. Dissolved substances, such as salts, have the ability to conduct electrical current. Salty water has a high conductivity. This can be used as an indicator of how much dissolved solids are contained in the water.	Conductivity is present to in all water bodies. However, primary sources of excess Conductivity includes agricultural activities, storm water runoff, leaching of soil contamination, and point source water pollution from industrial or sewage treatment plants. Naturally occurring conductivity levels arise from weathering and dissolution of rocks and soils.
Dissolved Oxygen (DO)	The amount of DO that is freely available in water. Aquatic life needs oxygen to live. DO is vital to fish and other aquatic life. DO levels have been accepted as the single most important indicator of a water body's ability to support desirable aquatic life.	Excessive or unusual quantities of organic material combined with bacteria and large algal blooms may cause DO levels to fluctuate. Large fluctuations in DO can create environmental conditions not suitable for aquatic life.
***Escherichia coli* (*E. coli*)**	The current indicator bacteria to determine if the water body is suitable for contact recreation. Potentially harmful to human health. Their presence, expressed in MPN (most probable number) per 100 mL of water, is an indicator of fecal matter contamination which may contain other pathogens.	Elevated concentrations of *E. coli* can indicate a potential pollution problem. Although *E. coli* is used as an indicator, it can be potentially harmful. *E. coli* is present in all warm bodied animals and comes from poorly maintained or ineffective septic systems, overflow of domestic wastewater plants and/or runoff from feedlots.
Enterococcus	A subgroup of fecal streptococci bacteria (mainly *Streptococcus faecalis* and *Streptococcus faecium*) that is present in the intestinal tract of warm-blooded animals. It is used as an indicator of the potential presence of pathogens.	Elevated concentrations of *Enterococcus* indicate a potential pollution problem. Present in the intestine of all warm-blooded animals, *Enterococcus* is a good indicator of pollution coming from the same sources as *E. coli*.
Flow	The volume of water that moves over a designated point over a fixed period of time, often expressed in CFS (cubic feet per second). Flow, related with other parameters, can be a good indicator of water quality.	Changes in flow can be natural or man made. Natural changes include beavers building dams, overgrowth of vegetation in times of low flow. Manmade changes include new bridges restricting flow, new construction altering landscapes and runoff.

PARAMETER	IMPACT	POTENTIAL CAUSE(S)
Nitrates	Nitrate additions to surface waters can lead to excessive growth of aquatic plants. Elevated nitrate levels can be toxic to human health, especially in infants and young children. In elevated concentrations can be used as an indicator of human caused pollution.	Nitrates are used as fertilizers to supply a nitrogen source for plant growth. The presence of nitrates occurs from the conversion of nitrogenous matter into nitrates by bacteria and represents the process whereby ammonia in wastewater, is oxidized to nitrite and then to nitrate by bacterial or chemical reactions.
Nitrites	High levels of nitrates and nitrites can produce Nitrite Toxicity, or "brown blood disease," in fish. This disease reduces the ability of blood to transport oxygen throughout the body.	Nitrites are found in effluent released from wastewater treatment plants, fertilizers, and agricultural runoff carrying animal waste from farms and ranches.
pH	The pH determines whether a water body is acidic, neutral, or basic. The pH of the water can affect the toxicity of many substances. Most aquatic life is adapted to live within a specific pH range. Changes in the pH can control toxic effects of other substances that may be in runoff.	The pH of natural waters is typically between 6.5-9.0 standard units. Industrial and wastewater discharge, runoff, accidental spills, nonpoint sources and human activity that causes increases in organic matter and bacteria, and over abundant algae can alter the pH.
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.	Due to abundance of elemental and organic sulfur; and sulfide mineral, soluble sulfate occurs in almost all natural water. Other sources are the burning of sulfur containing fossil fuels, steel mills, and fertilizers.
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.	Changes in water temperature can be caused by alteration of the riparian zone encroachment of invasive species (plant and/or animal), drought, soil erosion, or changes in ambient temperatures in lakes, as a result of industrial byproducts such as electrical generation.
Total Dissolved Solids (TDS)	An important use of the measure of the quality of drinking water. TDS is a quantification of the material dissolved in water, typically the chloride, and sulfate anions which form salts.	Causes are the same as for Conductivity.
Total Phosphorus	Total Phosphorus is the measure of all forms of phosphorus, dissolved and/or particulate. It is an essential nutrient to an organism's metabolism and therefore, can limit the primary productivity of a water body.	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.
Total Suspended Solids (TSS)	Total Suspended Solids (TSS) is the measure of the total suspended solids in water (organic and inorganic). Increased turbidity can reduce the amount of light to plants, which decreases the oxygen production. Additionally, too much sediment can cover habitat, smother benthic organisms, eggs or even clog fish gills.	TSS can have origins from multiple point and nonpoint sources, but the most common source is soil erosion. A good measure of the upstream land use conditions is how much TSS rises after a heavy rainfall.
Turbidity	A measure of clarity of a water sample expressed in NTU's (Nephalometric Turbidity Units). The higher the turbidity, the less clear the water. Water that is turbid can adversely affect plant and fish populations .	Erosion of soil in the riparian zone, point source water pollution from industrial or sewage treatment plants, and stormwater runoff can adversely affect turbidity.

AQUATIC LIFE MONITORING

BACKGROUND

For many years, the Authority has focused on the collection of water chemistry samples to help characterize the conditions of the aquatic systems in the Red and Canadian River Basins. Recently the Authority conducted Biological Sampling in both the Red and Canadian River Basins in cooperation with the Texas Commission on Environmental Quality (TCEQ), Texas Parks and Wildlife (TPWD) and the Environmental Institute of Houston (EIH).

Aquatic Life Monitoring (ALM) is an assessment of a stream reach that includes a habitat assessment of the stream, collection of freshwater benthic macroinvertebrates and collection of freshwater fish. Additionally, an instantaneous discharge , 24-hour dissolved oxygen and water chemistry sample are collected at each site. Collectively, this information is used to help evaluate biological community dynamics and the health of the aquatic system. In turn, the information is used to provide baseline data to help determine whether a particular stream is meeting its designated aquatic life use (ALU).

In order to help determine ALUs or to evaluate existing ones, the TCEQ has developed specific protocols that require monitoring be done in the index period of the same calendar year. The index period was established to:

- Minimize year-to-year variability resulting from natural events
- Maximize gear efficiency
- Maximize accessibility of targeted assemblages
- Allow adequate time to complete required tasks
- Make the most efficient use of available resources
- Ensure that a portion of the samples is collected during critical low-flow and temperature conditions.

The index period represents the warmer seasons of the year and runs from March 15 to October 15. The critical period within the index period occurs from July 1 to September 30 and represents the time of the year in Texas where you expect to see minimum streamflows, maximum water temperatures, and minimum dissolved oxygen levels. Collecting samples during these critical conditions will determine if the criteria set for the aquatic life uses are being met. It is the assumption that if the criteria is being met under these extreme conditions, it would be met in other seasons of the year where you see lower water temperatures and higher streamflows.

RECAP

- Index Period: March 15 - October 15
- Non-Critical Period: March 15 - June 30 , and Oct 1 - 15
- Critical Period: July 1 - September 30

BIOLOGICAL ASSESSMENTS

There are different types of biological monitoring in freshwater ecosystems and each serves a different regulatory purpose. Data gathered using these different assessment methods help our state develop water quality standards and ensure the surface water in Texas is of high quality. They are as follows:

- **Aquatic Life Use-Attainability Analysis** - Serve as an assessment of the physical, chemical and economical factors effecting attainment of use. Used to determine if the existing criteria are being met and appropriate, or to determine the cause as to why the criteria is not being met.

- **Receiving Water Assessment** - Used to assess unclassified streams and to obtain data so an appropriate ALU can be applied

- **Aquatic - Life Monitoring** - Assesses routine monitoring sites and provides baseline data on the environmental conditions to determine if the ALU and dissolved oxygen criteria are being supported. This assessment also includes ecoregion monitoring.

- **Aquatic - Life Assessments** - Conducted on unclassified water bodies that are not included in Appendix D of the Texas Surface Water Quality Standards (TSWQS) and have been found not to support the presumed ALU.

Biological Assessments are conducted over a reach of a stream rather than at a specific location as one does in routine water quality collections. Once fish, benthic macroinvertebrates and habitat data are collected they are given a score that correlates to different levels of aquatic life uses, such as Exceptional, High Intermediate and Limited.

Longnose Gar- Wichita River at FM810

Right Bank - Wichita River at FM 810

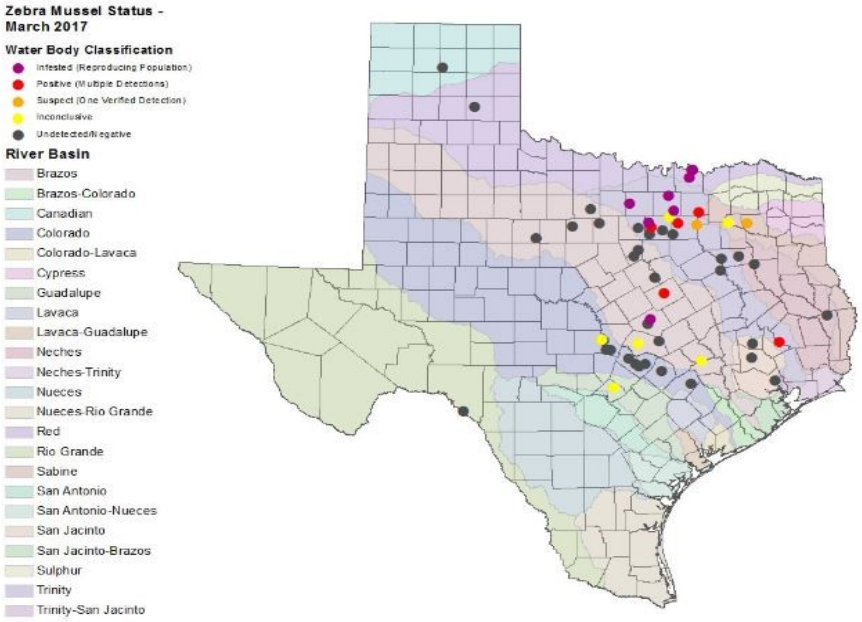
ZEBRA MUSSELS

ORIGIN

Native to Russia, the zebra mussel (*Dreissena polymorpha*) was first introduced into North American waters as seemingly innocent hitch-hikers in the ballasts of ships entering Lake St. Clair, Michigan in the late 1980's. Once established, the species quickly spread throughout the Great Lakes, eventually infiltrating some thirty (30) states, and more than 600 lakes and reservoirs to date, according to recent data from the United States Geological Survey. In the beginning it was thought that southern waters were too warm for the zebra mussel to survive and reproduce, but this highly adaptive species has found a way.

TRANSPORTATION

The infestation is thought to have been carried to Texas waters via boats and other aquatic recreational equipment. Once attached, zebra mussels can be transported to other water bodies unknowingly, as adults can survive out of water for several days. Additionally, zebra mussel larvae are microscopic, free floating organisms easily transported through dams, utility pipelines and even boat live wells.



Map courtesy of Texas Parks and Wildlife

TEXAS BOUND

In April 2009, the first established colonies were reported in Lake Texoma in the Red River Basin. Soon after the Lake Texoma discovery, colonies were also reported in Sister Grove Creek in the Trinity River Basin, which feeds Lake Lavon. Finally, on July 17, 2012, zebra mussel colonies were also confirmed in Lake Ray Roberts.

CURRENT POPULATIONS AND STUDIES

Zebra mussels grow to a diameter of approximately two inches, and are identified by their triangular shape. Although they commonly have a stripe-like pattern, they can be solid white to dark brown in color. Due to their filtration eating habits, they can easily out-compete native algae and other aquatic plants by rapidly depleting any and all available nutrients within the water column. In turn, native species of fish and other aquatic life, which would have fed on this aquatic vegetation, are out-competed. Zebra mussels can spawn in water temperatures above 54°F, and can produce over one million eggs in a spawning season. Their colonization traits make the zebra mussel highly destructive to water lines and pipes. They are notorious for colonizing in water intake structures and piping, which can disrupt or even stop the flow of water.

Zebra mussels have been documented within and considered Infested in the following Texas lakes:

Texas Lake/Reservoir

1. Lake Texoma
2. Lake Ray Roberts
3. Lake Lewisville
4. Lake Bridgeport
5. Lake Belton
6. Lake Austin
7. Lake Canyon
8. Lake Dean Gilbert
9. Lake Granger
10. Eagle Mountain Lake
11. Lake Georgetown
12. Lady Bird Lake
13. Lake Livingston
14. Lyndon B. Johnson Lake
15. Marble Falls Lake
16. Lake Pflugerville
17. Lake Randell
18. Stillhouse Hollow Lake
19. Lake Travis

In 2010, the United States Geological Survey (USGS) began an intensive zebra mussel monitoring program to help document the spread of this highly invasive species. As of 2012, the USGS is currently monitoring nine (9) Texas Lakes (Lake Texoma, Ray Roberts Lake, Lake Lewisville, Grapevine Lake, Lavon Lake, Ray Hubbard Lake, Lake Tawakoni, Lake Fork Reservoir, and Lake Palestine). The monitoring program consists of four key components, which include:

1. SCUBA diving
2. Water sample collection
3. Artificial substrate sampling
4. Water quality sampling

In addition to the routine water quality sampling, the USGS also has water-quality sondes to measure and record temperature, dissolved oxygen concentration, specific conductance and pH, as well as loggers to monitor and record the temperature every 15 minutes at 5-foot depth intervals.

IMPACT

Zebra mussels may have a rather innocent appearance, but established populations have grave impacts. In addition to out-competing native aquatic vegetation and fish species, zebra mussels negatively affect recreational activities and public and private properties.

Boats, piers, buoys, and practically anything with a hard substrate in a water body is a prime spot for zebra mussels to colonize. Zebra mussels have been seen inside boat engines and cooling systems, clogging lines and causing engines to malfunction. Once encrusted on the bottom of a boat or other recreational water craft, their removal can be expensive, if even possible.

TEXAS LEGISLATIVE ACTION

To limit further outbreaks of this highly invasive species, the Texas Legislature has created multiple control measures through the Texas Parks and Wildlife Department (TPWD). TPWD has focused on public outreach programs and publications to help prevent the transportation of the zebra mussel to other water bodies. TPWD lists preventative measures on their website, **http://www.tpwd.state.tx.us/fishboat/boat/protectwater/**. TPWD's focus is on **cleaning**, **draining**, and **drying**.

1. **Cleaning** - involves a thorough process for decontaminating watercraft and water equipment with water over 140°F to kill any mussels and larva (veligers) that may have become attached.

2. **Draining** - requires all boats to thoroughly drain all water from cooling systems and bilge pumps. This step also suggests emptying all bait buckets and live wells.

3. **Drying** - it is recommended to leave all compartments on your boat open and your gear left out to dry. Additionally, let your boat dry for a week or more before visiting another lake.

To date, many attempts have been made to eradicate this species, including chemicals and manual cleaning, but nothing has had a substantial impact.

Canadian River at US 70

CANADIAN RIVER BASIN

REACH I (Refer to map on page 35)

Canadian River Below Lake Meredith (Segment 0101) 🩸
Stations 10032, 10033, 10035, 20702
The Canadian River Below Lake Meredith has concerns for screening level exceedances for ammonia, nitrate, depressed DO, and chlorophyll-*a*. It is likely that the elevated levels of chlorophyll-*a* continue to play a role in the depressed dissolved oxygen values observed during routine monitoring.

Dixon Creek (Segment 0101A) 🩸
Stations 10016, 17045
This unclassified water body appears in the *2020 IR* with depressed dissolved oxygen, and selenium in water impairments. Additionally, there are concerns for both chlorophyll-*a*, total phosphorus, and nitrate.

Until recently, Dixon Creek has been plagued with little to no flow and pools of shallow water due to the drought conditions witnessed in the Canadian River Basin. The area ranges drastically from underdeveloped to moderately developed with both agricultural and industrial uses. Increased nutrient input from the surrounding agricultural land is most likely the cause for the elevated nutrient and bacteria levels, which could be responsible for the low dissolved oxygen levels observed during routine monitoring. Additionally, the Authority will schedule to deploy field instruments to conduct 24-hour dissolved oxygen studies which will provide much needed data to help determine the potential causes of the low dissolved oxygen levels being captured within the segment.

Rock Creek (Segment 0101B) 🩸🩸🩸
Station 10024
Rock Creek has a bacteria impairment that has returned in the *2020 IR*. Additionally, it does remain listed for nitrate, total phosphorus, and chlorophyll-*a* concerns. This segment is primarily effluent dominated and exhibits low flow conditions during routine monitoring trips. Point source contributions to the concerns we see in the segment may be traced back to permitted dischargers in the segment. Additional monitoring within the segment may help determine the location of these potential point source influences, however additional monitoring sites scouted by the Authority's field staff have concluded that none of the potential sites have had consistent flow. It is recommended that the Authority continues to seek additional, accessible monitoring locations.

White Deer Creek (Segment 0101C) 🩸🩸🩸🩸🩸
Station 21174
White Deer Creek currently has no impairments or concerns. This segment continues to be monitored and assessed by the Authority as a reference site for the area to provide baseline data on how other segments in the area relate to the water quality in Segment 0101C. The Authority believes this water body to be spring fed. In May 2016, the Authority teamed up with the TCEQ and the TPWD and performed a Least Disturbed Stream study.

REACH II (Refer to map on page 36)

Lake Meredith (Segment 0102) ♦♦
Station 10036
While there are no concerns within Segment 0102, Lake Meredith does have four impairments including mercury in edible fish tissue (2002), chloride, sulfate and TDS (2006). According to data generated by the Texas Water Development Board, Lake Meredith was 0% percent full from May 2011 until June 2014. While it is likely that increased rainfall and an influx of water into Lake Meredith will address the chloride, sulfate and TDS impairments over time, the same is unfortunately not true for the mercury in edible fish tissue impairment. At the present time, there has not been adequate funding to conduct another fish survey to either confirm and remove this impairment.

Big Blue Creek (Segment 0102A) ♦♦♦♦♦
Station 15270
Big Blue Creek exhibits no impairments or concerns per the *2020 IR*. The segment continues to be monitored and assessed by the Authority as a reference site for the area to provide baseline data on how other segments in the area relate to the water quality in Segment 0102A.

Canadian River Above Lake Meredith (Segment 0103) ♦♦
Stations 10054, 10056, 16344
The Canadian River Above Lake Meredith has an impairment for chloride in the 2020 IR This can be attributed primarily to naturally occurring salt deposits along the banks of the Canadian River, although the ever increasing abundance of salt cedar certainly has not helped matters. These salt deposits can then be transferred into the stream contributing to larger concentrations of chlorides. Canadian River Municipal Water Authority (CRMWA) has actively been removing salt cedar since 2004, treating some 26,000 plus acres during that time. CRMWA has had success in controlling salt cedars along the river and has seen a reduction in the population. While recent rains have helped, chloride concentrations are not likely to substantially improve unless ample, consistent annual rainfall returns to the area.

Big Blue Creek at FM 1913

East Amarillo Creek (Segment 0103A) ♦♦♦
Stations 10017, 10018, 15775, 21024
This unclassified water body has an impairment for bacteria and identified with concerns for both chlorophyll-*a* and nitrate. At its headwaters, it is heavily influenced by stormwater runoff from highly urbanized areas, further downstream by treated wastewater effluent from a permitted discharger, and finally by agricultural runoff. Nutrient rich runoff and wastewater effluent are most likely the source of the nitrate as elevated concentrations are not typically observed in the headwater portion of East Amarillo Creek. It is also very likely that, since a significant portion of the stream travels through unpopulated cropland, wildlife have a significant impact on the water quality, as well. It is important to note that Thompson Park Lake, which marks the headwaters of East Amarillo Creek, has had the highest mean chlorophyll-*a* values within the entire Canadian Basin. During normal and high flow conditions, when water from Thompson Park Lake flows over the spillway into East Amarillo Creek, it is a likely source of chlorophyll-*a* as well. Additional monitoring locations have been added to address these concerns.

Unnamed Tributary to West Amarillo Creek (Segment 0103C) 🩸🩸🩸🩸
Stations 10021, 17056
Unnamed Tributary to West Amarillo Creek is listed in the *2020 IR* with a concern for chlorophyll-*a*. Additional monitoring further upstream has yielded no additional information regarding this concern.

REACH III (Refer to map on page 37)

Rita Blanca Lake (Segment 0105) 🩸
Station 10060
Rita Blanca Lake appears in the *2020 IR* with pH and depressed DO impairments. Rita Blanca Lake has been a well-known migratory bird refuge. Rita Blanca Lake is shown as a hypereutrophic reservoir and was the most impacted reservoir in the state. Recently collected data continued to support these findings. Compared to over 135 reservoirs, Rita Blanca Lake had the highest chlorophyll-*a* concentration, highest total phosphorus level, and the poorest water clarity of any reservoir in Texas. The high nutrient concentrations supported the elevated algal production which decreased water clarity.

REACH IV (Refer to map on page 38)

Palo Duro Reservoir (Segment 0199A) 🩸🩸🩸🩸
Stations 10005, 10007
Palo Duro Reservoir has no concerns or impairments. Monitoring in this segment is addressed every year to discuss any concerns.

REACH V (Refer to map on page 39)

Wolf Creek (Segment 0104) 🩸🩸🩸🩸
Stations 10058, 10059, 17465
Wolf Creek has an impairment for temperature in water and a concern for chlorophyll-*a* in the *2020 IR*. This concern was likely due to the low flow nature of the stream and the lack of tree canopy along much of the stream reach. A small reservoir, Lake Fryer, is located in the upper portion of the watershed. The *2020 IR* identified a screening level concern due to elevated chlorophyll-*a* in the reservoir. Chlorophyll-*a* was well-correlated to Total Kjeldahl Nitrogen. Most of the chlorophyll-*a* values were reported above the screening level of 14.1 µ/L. These results indicate that the source of nutrients, which ultimately leads to excessive algae, were agricultural fertilizers which may run off due to over irrigation, or from small rain events during the drought periods.

Kiowa Creek (Segment 0199B) - Not assessed in *2020 IR*
Station 10009
Until the TCEQ resumed monitoring in 2013, Kiowa Creek had not been monitored in almost a decade. The Authority has recently taken over the monitoring duties of this water body. Kiowa Creek appears in the *2020 IR* with concerns for chlorophyll-a and bacteria in water. Unfortunately, monitoring on this segment has been characterized by minimal events and dry stations

Wolf Creek at FM 1454

Canadian River Basin
2020 Texas Integrated Report Summary Table

Reach	Segment Number	Segment Description	303(d) Impairments	Year First Listed	305(b) Concerns	Level of Concern
1	0101	Canadian River Below Lake Meredith	N/A	N/A	Chlorophyll-*a* / Ammonia / Depressed DO / Nitrate	CS / CS / CS / CS
1	0101A	Dixon Creek	Depressed DO / Selenium in Water	2000/2010	Chlorophyll-*a* / Nitrate / Total Phosphorus	CS / CS
1	0101B	Rock Creek	Bacteria	2006	Nitrate / Chlorophyll-*a* /	CS / CS
1	0101C	White Deer Creek	N/A	N/A	N/A	N/A
2	0102	Lake Meredith	Mercury in Edible Tissue / Chloride / Sulfate / TDS	2002 / 2006 / 2006 / 2006	N/A	N/A
2	0102A	Big Blue Creek	N/A	N/A	N/A	N/A
2	0103	Canadian River Above Lake Meredith	Chloride	2006	N/A	N/A
2	0103A	East Amarillo Creek	Bacteria	2018	Chlorophyll-*a* / Nitrate	CS / CS
2	0103C	Unnamed Tributary to West Amarillo Creek	N/A	N/A	Chlorophyll-*a*	CS
5	0104	Wolf Creek	Temperature in water	2018	Chlorophyll-*a*	CS
3	0105	Rita Blanca Lake	pH / Depressed DO	2006 / 2018	N/A	N/A
4	0199A	Palo Duro Reservoir	N/A	N/A	Total Phosphorus	CS
5	0119B	Kiowa Creek	N/A	N/A	Bacteria / Chlorophyll-*a*	CN / CS

RED RIVER BASIN

REACH I LOWER (Refer to map on page 40)

Lower Red River (Segment 0201) ♦♦♦♦
Station 10123
Like the other Red River segments (0202, 0203, 0204 and 0205), the Lower Red River is listed in the *2020 IR* with a concern for chlorophyll-*a*. While the exact source is unknown, it is likely influenced by segments preceding it to the west. Water Quality information from the Oklahoma Department on Environmental Quality could also help determine whether or not there are influences from Oklahoma tributaries.

Mud Creek (Segment 0201A) ♦
Station 15319
Mud Creek is listed in the *2020 IR* with impairments for bacteria and depressed dissolved oxygen. Chlorophyll-*a* and depressed dissolved oxygen grab screening levels are also listed as concerns. This is primarily because much of the creek runs through privately owned property and the creek itself is littered with beaver dams that prevent consistent flow. Low or no flow, coupled with agricultural nutrient-rich runoff, create an environment favorable for bacterial growth. The Authority has monitored Mud Creek in the past in an attempt to isolate the source of bacteria, with unsuccessful results. Therefore, the Authority has plans to conduct 24-hour dissolved oxygen studies to better understand DO fluctuations in this segment. However, unless consistent flow resumes, these studies cannot be completed and it's unlikely that water quality will improve.

Barkman Creek (Segment 0201D) - ♦♦♦
Station 15059
Barkman Creek has no impairments but has concerns for depressed DO and bacteria in the *2020 IR*. The highest *E. coli* values were reported during periods of high and flood flows suggesting that the concern was due to runoff events. At this time it is unclear what the cause of low oxygen is being that low values are recorded across normal flows and high flows. Additional monitoring will be required.

Red River Below Lake Texoma (Segment 0202) ♦♦♦♦
Stations 10125, 10126, 10127, 13684, 21031
Concerns for chlorophyll-*a* and depressed DO are currently in the *2020 IR* for the Red River Below Lake Texoma. All segments above Segment 0202 (Red River Below Pease River - 0205, Red River Above Lake Texoma - 0204 and Lake Texoma - 0203) and several unclassified segments also have a concern for chlorophyll-*a*. This is to note that this concern appears in several segments throughout the Red River Basin, and the Red River itself.

Bois D' Arc Creek (Segment 0202A) ♦♦♦♦♦
Stations 15036, 18652, 20167, 21029
Bois D' Arc Creek has an impairment for bacteria and concerns for chlorophyll-a, total phosphorus, and nitrate in the *2020 IR*. Bois d' Arc Creek is being impounded in order to develop Bois d' Arc Lake. The impoundment is located downstream of Bonham near Telephone. The pattern of higher nutrient concentrations at low flow and lower concentrations at high flow are typical of effluent-dominated streams. Portions of the segment are primarily dominated by effluent discharge.

Corneliason Creek (Segment 0202B) ♦♦♦♦
Station 10117
Corneliason Creek has no impairments and one concern for bacteria in the *2020 IR*. Corneliason Creek is an intermittent stream with perennial pools and the watershed above station 10117 contains both wooded areas and grazing land; therefore, the most likely source of bacteria was wildlife and livestock.

Pecan Bayou (Segment 0202C) ♦♦♦
Station 14472
Pecan Bayou has an impairment for bacteria and no concerns in the *2020 IR*. Pecan Bayou has little to no flow, although water is always present during monitoring events. The water body travels through undisturbed, privately owned land for most of its length. Results indicate that high bacteria were a result of runoff events with wildlife and livestock as the likely sources.

Pine Creek (Segment 0202D) 🩸🩸🩸🩸

Station 10120

Pine Creek has no impairments but is identified for a chlorophyll-*a* concern in the *2020 IR*. Additional monitoring within the water body may be needed to determine the source of the elevated concentrations. However, this may be rather difficult to isolate due to the majority of the water body being located on private property.

Smith Creek (Segment 0202G) 🩸🩸🩸

Stations 17044, 21026, 21027

Smith Creek is listed in the *2020 IR* for a bacteria impairment, along with concerns for ammonia and total phosphorus. Smith Creek is considered to be a perennial stream due to the significant effluent contributions of a permitted discharger. As a primarily effluent dominated stream, the creek characteristically has elevated nutrient levels (concerns). Although portions of the creek and several small tributaries in the upstream portion of the segment may influence the lower portion of the segment, current monitoring efforts have yet to find elevated bacteria levels there. It has been hypothesized that during heavy rainfall events, significant urban runoff does influence bacteria loading downstream, however this has not been demonstrated. Additional monitoring conducted by the Authority during the past several years has not shown bacteria levels upstream to be consistent with those found below the permitted discharger. It is recommended that Authority continues to work with TCEQ and other entities to help address the water quality concerns and impairments for this segment.

Big Pine Creek at FM 410

Big Pine Creek (Segment 0202H) 🩸🩸🩸🩸

Station 18513

Big Pine Creek is not listed with any impairments. There are concerns for chlorophyll-*a* and bacteria in the *2020 IR*. The segment was not monitored in FY 2015, but was picked up by the Authority in 2016 to be monitored on a quarterly basis. Little to no flow has been recorded at this site on every trip by the Authority's field staff, but there has always been water present here with an average depth of two feet across the station. Continued monitoring of this segment will give us more insight on the overall water quality and help in future assessments.

Little Pine Creek (Segment 0202I) 🩸

Station 18514

Little Pine Creek is currently listed in the *2020 IR* with an impairment for depressed dissolved oxygen grab minimum, as well as a concern for chlorophyll-*a*. Additional monitoring within the water body will be required to determine causation for increased chlorophyll-*a* and depressed DO.

Honey Grove Creek (Segment 0202L) 🩸🩸

Station 21030

Honey Grove Creek is listed in the *2020 IR* with a bacteria impairment and concerns for chlorophyll-a and total phosphorus. Elevated levels of *E. coli* were analyzed at low flows indicating that livestock and wildlife were visiting the stream for watering; and elevated levels were analyzed at high flows suggesting that bacteria were being introduced through runoff from the surrounding grazing lands and wooded areas.

Lake Bonham (Segment 0202M) 🩸🩸🩸🩸🩸

Station 21032

Lake Bonham is not listed with any impairments or concerns in the *2020 IR*. North Texas Municipal Water District is currently monitoring monthly at this location. This should provide much needed data to analyze to determine any correlations between routine water quality parameters and elevated nutrient concentrations. However, it should be noted that elevated concentrations of chlorophyll -*a* are present in several water bodies flowing into Lake Bonham.

Hicks Creek (Segment 0202N) - ♦♦
Stations 10121, 10122
Hicks Creek is listed in the *2020 IR* with a bacteria impairment and concerns for total phosphorus, nitrate, and total phosphorus. *E. coli* levels were correlated with flow, indicating that runoff from livestock in the surrounding pastures were a likely source of bacteria. The concerns for nitrate and total phosphorus appear to be related to effluent from the City of Paris treated wastewater discharge.

Six Mile Creek (Segment 0202P) - ♦♦♦
Station 21298
Six Mile Creek is listed in the *2020 IR* with concerns for bacteria, depressed dissolved oxygen, nitrate, and total phosphorus. The water body is currently being monitored by the Authority at one site. Bacteria were well-correlated to flows suggesting that the bacteria sources were non-point sources such as wildlife, livestock, and failing septic systems.

Lake Crook (Segment 0208) ♦♦♦♦♦
Station 10137
Lake Crook is not listed with any impairments nor concerns in the *2020 IR.* The segment is currently being monitored by the TCEQ.

Pat Mayse Lake (Segment 0209) ♦♦♦
Stations 16342, 16343
Located 15 miles north of Paris, Texas in Lamar County, Pat Mayse Lake is currently listed in the *2020 IR* with a concern for manganese in sediment. This segment is currently being monitored and evaluated by TCEQ regional staff.

REACH I UPPER (Refer to map on page 41)

Post Oak Creek (Segment 0202E) ♦♦♦
Stations 10114, 10115, 17599, 21130
Post Oak Creek is listed in the *2020 IR* with a bacteria impairment and concerns for nitrate, depressed DO, chlorophyll-*a*, and total phosphorus. The watershed for this AU contains row crop agriculture, pasture, and a residential area at the headwaters. Sources of nutrients could include failing septic systems; waste from wildlife, pets, and livestock; and agricultural fertilizers.

Choctaw Creek (Segment 0202F) ♦♦
Stations 10111, 10112, 18370
Choctaw Creek is located in a semi-urbanized area of Grayson county. There is an impairment for bacteria, along with concerns for nitrate and total phosphorus. This could be related to urban runoff and/or influenced from Post Oak Creek. Additional monitoring will help identify potential sources contributing to the elevated concentrations. Due to the limited access, an RUAA was conducted to help determine if assigned bacteriological standards are appropriate based on the assigned use. The study has been completed and submitted to TCEQ.

Hicks Creek at US 271

Iron Ore Creek (Segment 0202K) 🩸🩸🩸
Station 18653
Iron Ore Creek is listed with a bacteria impairment in the *2020 IR*. The creek meanders through privately owned property for much of its length. Factors like this made the water body a prime candidate for a recent RUAA project to help determine whether or not assigned bacteriological standards are appropriate based on the assigned use. The study has been completed and submitted to TCEQ for review.

Pickens Lake (Segment 0202O) - Not assessed in *2020 IR*
Station 16945
Pickens Lake was not assessed during the *2020 IR* due to insufficient data. The water body is currently being monitored by the City of Sherman.

Lake Texoma (Segment 0203) 🩸🩸
Stations 10130 10131, 15388, 17480, 20545
Lake Texoma has no current impairments, but has two concerns including chlorophyll-*a* and harmful algal blooms - golden alga. Chlorophyll-*a* concentrations observed during routine monitoring are most likely influenced by segments upstream, specifically Segment 0204, which has similar concerns. It is important to note the ongoing zebra mussel infestation at Lake Texoma which is being monitored by the USGS.

Big Mineral Creek (Segment 0203A) 🩸🩸🩸
Station 17505
Big Mineral Creek influences Lake Texoma and was found to have no impairments when assessed in the *2020 IR*. The segment does have a concerns for nitrate and total phosphorus. This is currently being monitored and evaluated by TCEQ regional staff.

Red River Above Lake Texoma (Segment 0204) 🩸🩸🩸🩸
Stations 10132, 10133, 20168
The Red River Above Lake Texoma has a concern for chlorophyll-*a*. It is difficult to identify a source of the concern, considering how many tributaries flow into segment 0204 from both the Texas and Oklahoma side of the Red River. The amount of agricultural runoff that the Red River and its tributaries receive may be contributing to increased chlorophyll-*a* concentrations. Nutrient–rich agricultural runoff would promote chlorophyll-*a* concentrations within the water body. Increased monitoring of tributaries, along with a push to receive and review data from the Oklahoma Department on Environmental Quality, may shed light on causes of the chlorophyll-*a* concentrations.

Moss Lake (Segment 0204B) 🩸🩸🩸🩸🩸
Station 15447
Moss Lake is not listed with any impairments or concerns in the *2020 IR*. The segment is currently being monitored by the Authority.

Farmers Creek Reservoir (Segment 0210) 🩸🩸🩸🩸🩸
Station 10139
Farmers Creek Reservoir, more commonly referred to as Lake Nocona, is formed by a dam on Farmers Creek, northeast of Nocona, in Montague County. It was constructed for municipal water supply and recreation in 1961. It is not listed with any impairments nor concerns in the *2020 IR*. The Authority has been monitoring the reservoir on a quarterly basis since 2011.

REACH II **(Refer to map on page 42)**

Little Wichita River (Segment 0211) 🩸
Stations 10140, 13633,
A depressed dissolved oxygen impairment has plagued this segment since 1996. Increasing concentrations of chloride, sulfate and total dissolved solids (TDS) led to additional impairments in the *2010/2012 IR*. These impairments carry over into the *2020 IR*. Additionally, there are concerns for both chlorophyll-*a* and bacteria. While portions of the Wichita River are affected by naturally occurring salt deposits, these issues were magnified during the drought which had troubled much of the basin through May 2015. Conditions have drastically improved with the recent rains the area received during the second half of 2015. The Authority will continue to monitor this segment and its tributaries to collect enough data to potentially have these impairments removed during future assessments.

East Fork Little Wichita River (Segment 0211A) ♦♦♦
Station 10105
The East Fork Little Wichita River is not listed with any impairments but has concerns for bacteria and chlorophyll-*a* in the *2020 IR*. It is currently being monitored by TCEQ and the USGS.

Lake Arrowhead (Segment 0212) ♦♦♦♦♦
Station 10142
Located 14 miles southeast of Wichita Falls, Lake Arrowhead covers approximately 524 acres in Clay County and serves as a public water supply for the City of Wichita Falls. It is not listed for any impairments or concerns in the *2020 IR*. Despite reaching record lows during the drought, the lake did receive enough inflow during May 2015 to reach 100% capacity and flow over the spillway.

Little Wichita River Above Lake Arrowhead (Segment 0212A)
♦♦♦ **Station 16038**
The Little Wichita River Above Lake Arrowhead is listed in the *2020 IR* with a bacteria impairment. The water body is currently being monitored by TCEQ and the USGS.

Lake Kickapoo (Segment 0213) ♦♦♦♦♦
Station 10143
Lake Kickapoo is located 30 miles southwest of Wichita Falls. It currently has no impairments or concerns in the *2020 IR*. It has been used by the Authority as a reference water body for this area of the basin. Torrential rains occurring during May 2015 helped Lake Kickapoo reach 100% capacity and flow over its spillway, ultimately flowing into Lake Arrowhead further downstream to help it reach 100% capacity as well.

Wichita River Below Lake Diversion Dam (Segment 0214) ♦♦
Stations 10145, 10148, 10150, 10151, 10154, 10155
The Wichita River below Lake Diversion Dam is listed in the *2020 IR* for a bacteria impairment and concerns for total phosphorus, nitrate, and chlorophyll-*a*. While there is no bacteria impairment for Lake Diversion, Segment 0215, there are bacteriological impairments on Segment 0214A (Beaver Creek) and Segment 0214B (Buffalo Creek), both of which have confluences with segment 0214. The Wichita River Below Lake Diversion Dam also has concerns for chlorophyll-*a*, nitrate and total phosphorus. These elevated nutrient levels can also be attributed to the two sub-segments, as well as agricultural run-off from the countryside it travels through before flowing through the City of Wichita Falls.

Beaver Creek (Segment 0214A) ♦
Stations 15120, 15121
Beaver Creek is listed in the *2020 IR* for a bacteria impairment, along with a single concern for chlorophyll-*a*. The creek flows primarily through uninhabited countryside used for agricultural purposes. Nutrient-rich runoff may be contributing to the elevated chlorophyll-*a* values observed during routine monitoring. Nutrient-rich runoff could create an ideal environment to support various types of aquatic vegetation. This aquatic vegetation would explain the elevated concentrations of chlorophyll-*a*, and may also account for the low dissolved oxygen levels. Low dissolved oxygen levels can be heavily influenced by established communities of aquatic vegetation using it for respiration. Additionally, the low flows observed during the drought would not have promoted good dissolved oxygen concentrations either. Either one of these situations, or a combination thereof, could help explain the low dissolved oxygen concentrations. The Authority is planning to conduct 24-Hour dissolved oxygen studies to better assess the situation.

Buffalo Creek (Segment 0214B) ♦♦
Stations 10097, 16036, 20162, 17947
Buffalo Creek has historically been monitored by the Authority at one location, Station 10097. Additional monitoring was added upstream at Station 16036 to address a previous bacteria impairment and has been monitored ever since. This segment was changed from primary contact recreation to secondary contact recreation 1 as a result of a recreational use attainability analysis that eliminated the previous bacteria impairment. Although is there no current impairments, there are four concerns for ammonia, chlorophyll-*a*, nitrate, and total phosphorus. The return of rain fall to the area has promoted a steady flow at 16036. The additional flow upstream could potentially minimize the elevated nutrient levels showing up downstream. Lake Iowa Park (17947) and Lake Buffalo (20162) are two new sites in Iowa Park, TX the Authority has picked up that will be placed in their own segment in the future when they are assessed.

Holliday Creek (Segment 0214C) 🩸🩸🩸🩸
Stations 10095, 21025
Holliday Creek is not listed with any impairments but has a concern for chlorophyll-*a* in the *2020 IR*. It is currently being monitored at two different sites by the Authority and the USGS.

Wichita Valley Irrigation Project (Segment 0214E) 🩸🩸🩸🩸
Station 18831
The Wichita Valley Irrigation Canal originates just below the Lake Diversion Spillway. The segment is listed in the *2020 IR* with a concern for chlorophyll-*a*. Ironically, this concern is not found in Diversion Lake. One possible explanation could be the lack of water being released from Lake Diversion into the irrigation canal. With the onset and persistence of the most recent drought, the Wichita Falls Irrigation District was forced to stop providing water through the canal system. Thus, the regular release of water which flooded the canal was not available to scour it and keep aquatic vegetation at bay. This may have allowed aquatic vegetation to bloom when it would not have had the opportunity during "normal" conditions. This segment has benefitted from recent rains which should help address the concern that has formed. The Authority will continue to monitor in this segment to help assess this concern.

Unnamed Trib. to Buffalo Creek (Segment 0214F) 🩸🩸
Station 21172
The Unnamed Tributary to Buffalo Creek is listed in the *2020 IR* with an impairment for bacteria and concerns for nitrate, total phosphorus, ammonia, and depressed DO. The water body was originally monitored in response to the long standing bacteriological impairment observed in Buffalo Creek (0214B). Monitoring in this small tributary to Buffalo Creek has shown a strong correlation between both bacteriological and nutrient concentrations between the two water bodies. The Authority will continue to monitor this segment in an effort to better evaluate the impact this water body has on other streams in the area.

Diversion Lake (Segment 0215) 🩸🩸🩸🩸🩸
Station 10157
Located 30 miles from Wichita Falls on the Archer/Baylor County line, Diversion Lake is listed in the *2020 IR* with no impairments or concerns. The most recent drought took a toll on the Lake Diversion. Although not listed as concerns, elevated concentrations of naturally occurring chloride and sulfate flowing through the Lake Kemp system have created an environment well-suited for the algae that have recently plagued Diversion Lake and could explain why golden alga blooms have become more common. Another future issue that can cause monitoring difficulties is the recent sale of the land that surrounds the lake making access more difficult.

Wichita River Below Lake Kemp (Segment 0216) 🩸🩸🩸🩸
Station 10158
This segment is currently being monitored by the USGS and the Authority. It is listed in the *2020 IR* with a concern for bacteria and no impairments.

Lake Diversion

Lake Kemp (Segment 0217) 💧💧💧💧💧
Station 10159
Lake Kemp has been used by the Authority as a reference water body for this area of the basin. The lake has been monitored for several years due to its importance as a drinking water reserve for the City of Wichita Falls' wholesale and municipal customers. The *2020 IR* lists no impairments nor concerns for Lake Kemp.

Wichita/North Fork Wichita River (Segment 0218) 💧💧💧💧
Stations 10161, 10162, 15119
The *2020 IR* lists concerns for bacteria, depressed DO, and selenium in this segment. The majority of Segment 0218 is located on privately owned property in rural areas, limiting the number non-point and/or point sources of bacteria inputs. Continued monitoring will be needed to further evaluate this concern.

Middle Fork Wichita River (Segment 0218A) 💧💧💧💧
Station 14900
The *2020 IR* lists a concern for selenium in water. This is thought to be naturally occurring and the USGS is investigating this in hopes of a delisting during a future assessment and no additional selenium in water samples are being collected by the Authority at this time.

Lake Wichita (Segment 0219) 💧
Station 10163
Lake Wichita was found to have three impairments in the *2020 IR* including chloride, sulfate and TDS. Lake Wichita has been a great place for locals to enjoy several forms of primary contact recreation. However, past flood control issues led to a dam modification that has reduced the turnover rate of the lake significantly. This resulted in continuous siltation of Lake Wichita, leading to depths as shallow as three feet in several areas, including mid-lake. During the drought, concentrations of dissolved solids and other analytes skyrocketed to concentrations never before observed. A local stakeholder group, the Lake Wichita Revitalization Committee, is working to raise funds to dredge Lake Wichita in an effort to restore the water body back to its original state. This, along with continued rain, could reduce the dissolved solids concentrations and may reduce nutrient assimilation and golden algae blooms that have been observed over the recent years. Once these issues are resolved, Lake Wichita has the potential to be the gem of North Texas.

Holiday Creek Above Lake Wichita (Segment 0219A) 💧💧💧💧💧
Station N/A
The Holiday Creek Above Lake Wichita is not listed with any impairments nor concerns in the *2020 IR*. The segment is currently not being monitored.

South Fork Wichita River (Segment 0226) 💧💧💧💧
Stations 10185, 13636
Segment 0226 is listed with a chloride impairment and concerns for ammonia and bacteria. While there is no known point source identified for the excess ammonia within the segment, it is most likely a combination of wildlife and runoff originating from the predominantly agricultural land in the region. The Authority added an additional monitoring site, 13636, to help identify locations where ammonia concentrations are elevated.

South Wichita River

Groesbeck Creek at SH 6

REACH III (Refer to map on page 43)

Red River Below Pease River (Segment 0205) ♦♦♦♦
Stations 10134, 16733
Like the other Red River Segments (0201, 0202, 0203, and 0204), the Red River below the Pease River is troubled with a concern for chlorophyll-*a*. Like its counterparts, the most likely causes stem from runoff along the banks of the Red River and its several tributaries. Information regarding water quality from tributaries originating in Oklahoma could be beneficial when determining the best method for remediating this segment and other segments of the Red River.

Wildhorse Creek (Segment 0205A) ♦♦♦♦♦
Station 10096
Wildhorse Creek is listed in the *2020 IR* with a bacteria impairment and concerns for total phosphorus, nitrate, chlorophyll-a, and depressed DO. The water body is currently being monitored by the Authority.

Red River Above Pease River (Segment 0206) ♦♦♦♦♦
Station 10135
The Red River Above the Pease River is not listed with any impairments. Concerns for bacteria and total phosphorus are listed in the *2020 IR*. The segment is currently being monitored by the Authority.

Groesbeck Creek (Segment 0206A) ♦♦♦♦
Station 20166
Groesbeck Creek was not listed with any impairments but has a concern for chlorophyll-*a* in the *2020 IR*. The water body is currently being monitored by the Authority and the USGS.

South Groesbeck Creek (Segment 0206B) ♦♦
Station 16000
South Groesbeck Creek is a slow-moving stream that travels through privately owned property used for agricultural purposes. The segment is listed in the *2020 IR* with a bacteria impairment and a concern for nitrate. The likely culprit for these water quality issues is runoff occurring along the segment during rainfall events. The Authority is currently conducting additional monitoring at Station 20166, located upstream of the current monitoring station at SH 6 north of the City of Quanah, in an effort to better identify point sources of pollution contributing to the water quality issues.

North Groesbeck Creek (Segment 0206C) ♦♦♦
Station 21297
North Groesbeck Creek was not listed with any impairments but has concerns for bacteria and chlorophyll-*a* in the *2020 IR*. The water body is currently being monitored by the Authority.

Upper Pease/North Fork Pease River (Segment 0220) ♦♦♦♦♦
Station 10167
The Upper Pease/North Fork Pease River is not listed with any impairments but has a concern for bacteria in the *2020 IR*. The segment is currently being monitored by the Authority.

Middle Fork Pease River (Segment 0221) 💧💧💧💧💧
Station 10169, 10170
The Middle Fork Pease River is listed with impairments for chloride, sulfate, and TDS in the *2020 IR*. The segment is currently being monitored by the Authority as a result of discussions from the annual Coordinated Monitoring Meeting in 2016.

Pease River (Segment 0230) 💧💧💧💧💧
Stations 10165, 10166
The Pease River is currently listed for bacteria, chlorophyll-*a*, and total phosphorus concerns in the *2020 IR*. However, it is important to note that several portions of the segment were dry for extended periods of time during the most recent drought. In response, the Authority has begun monitoring at additional locations within Segment 0230 and its unclassified water bodies. A better assessment of water quality throughout the segment's entirety will help ensure water quality issues are identified before they become concerns, and/or impairments in the future.

Paradise Creek (Segment 0230A) 💧💧
Station 10094
Paradise Creek is listed in the *2020 IR* with a concern for chlorophyll-*a*. The recent drought is likely responsible. This segment also has varying degrees of development and is influenced by both urban and agricultural runoff. Thus, when rainfall occurs, nutrient and bacteria-rich runoff significantly impact the stream leading to increased bacteria values and a water column loaded with nutrients that benefit algal growth. The return of constant flow may remediate some of these issues, and will allow current water quality data to be collected and assessed.

REACH IV (Refer to map on Page 44)

Lower Prairie Dog Town Fork Red River (Segment 0207) 💧💧
Stations 10136, 13637, 16037
The Lower Prairie Dog Town Fork Red River (LPDTF) is listed in the *2020 IR* for a bacteriological impairment and has concerns for chlorophyll-*a* and nitrate. LPDTF has extremely low flows and high naturally occurring salt. Segment 0207 was assigned the bacteriological impairment from E. coli data, despite having *Enterococcus* listed as the indicator bacteria. Research has shown that E. coli may not be a good indicator of fecal contamination in high-saline water bodies. *Enterococcus* data has been collected at this station since 2015 for assessment, in hopes that collecting the appropriate bacteria species for the water body will provide data invalidating the impairment.

Buck Creek (Segment 0207A) 💧💧💧💧
Stations 15811, 20366
Buck Creek is listed in the *2020 IR* with a concern for nitrate. Since groundwater in this area has some of the highest median nitrate values in the state, there is a possibility that naturally occurring springs may be contributing to the elevated nitrate concentrations. With the availability of water in this segment during recent monitoring trips, the Authority hopes that the collection of data will help address the concern for nitrate.

Middle Pease River at US 83

Mackenzie Reservoir (Segment 0228) ♦♦♦

Station 10188

Mackenzie Reservoir is listed for a TDS and sulfate impairment in the *2020 IR*. The persistence of the most recent drought is likely the culprit for the progressive increase in TDS observed during routine monitoring events. As regular rainfall returns to the area, a decrease in TDS and other dissolved solid concentrations should be observed.

Upper Prairie Dog Town Fork Red River (Segment 0229) ♦

Stations 10191, 20801

The Upper Prairie Dog Town Fork Red River (UPDTF) is listed in the *2020 IR* with a pH impairment, bacteria, and depressed DO. Additionally, it is listed with concerns for chlorophyll-*a*, depressed dissolved oxygen, nitrate and total phosphorus. A change in the monitoring location of this segment has led to much lower pH values during routine monitoring events. TCEQ field staff decided to move the site further downstream from the Lake Tanglewood dam due to thoughts that the dam had a leak that was affecting the pH values. Should this trend continue, there will be enough data during the *2016 IR* to remove the pH impairment. As for the concerns, it is likely that since the headwaters of this segment originate from Lake Tanglewood, that no change will be seen until improvements are made in Segment 0229A.

Lake Tanglewood (Segment 0229A) ♦♦

Station 10192

Lake Tanglewood has an impairment for bacteria according to the *2020 IR*. Although a point source has not been identified, research does indicate that the nearby housing community was constructed before current standards for septic systems were in place. It is a possibility that some antiquated septic systems are now failing and contributing to the concerns listed in the *2020 IR*. Additional research and monitoring will be required to identify the source of elevated contamination concentrations before remediation can occur.

Tierra Blanca Creek (Segment 0299B) - Not assessed in *2020 IR*

Station 10065

Tierra Blanca Creek was not assessed during the *2020 IR* due to insufficient data. The water body is not currently being monitored. Until regular rainfall returns to this area, it is likely that there will not be enough water to determine water quality at this location.

LPDTF Red River at SH 207

REACH V (Refer to map on page 45)

Salt Fork Red River (Segment 0222) 🩸🩸🩸
Stations 10171, 10172
The Salt Fork of the Red River is listed in the *2020 IR* with a concern for nitrate. The Authority and the TCEQ both monitor in this segment. 10171 is located near a county public park which is visited frequently during the summer time. With a bacteria impairment in the past in this segment and frequent visitors, the Authority will continue to monitor this segment in the future. Some potential causes that affect this segment could be the local wildlife and the natural nitrate concentrations that exist in the groundwater in the area.

Lelia Lake Creek (Segment 0222A) 🩸🩸🩸🩸🩸
Station 10076
Lelia Lake Creek has a concern for depressed DO in the *2020 IR*. The segment is currently being monitored by both the TCEQ and the USGS.

Greenbelt Lake (Segment 0223) 🩸🩸🩸🩸🩸
Station 10173
Greenbelt Lake is listed with an impairment for excessive algal growth in the *2020 IR*. The segment is currently being monitored by the TCEQ.

North Fork Red River (Segment 0224) 🩸🩸🩸🩸🩸
Stations 10178, 10179
The North Fork of the Red River is not listed with any impairments nor concerns in the *2020 IR*. The segment is currently being monitored by the Authority.

McClellan Creek (Segment 0224A) 🩸🩸🩸
Station 10064
McClellan Creek is not listed with any impairments nor concerns in the *2020 IR*. The segment is primarily located on privately owned land with relatively no public access. During routine monitoring, Authority staff have observed wildlife in the area, which may be associated with the elevated bacteria levels.

Sweetwater Creek (Segment 0299A) 🩸🩸🩸🩸🩸
Stations 10070, 10072
Sweetwater Creek's bacteria impairment was removed in the *2020 IR* and now has no impairments or concerns. This creek primarily flows through privately owned countryside used to varying degrees for agricultural production. There is little to no influence from industry or urbanized areas. Factors like this made the water body a prime candidate for a recent RUAA project to help determine whether or not assigned bacteriological standards are appropriate based on the assigned use.

North Fork Red River at FM 2473

Red River Basin
2020 Texas Integrated Report Summary Table

Reach	Segment Number	Segment Description	303(d) Impairments	Year First Listed	305(b) Concerns	Level of Concern
Lower 1	0201	Lower Red River	N/A	N/A	Chlorophyll-*a*	CS
Lower 1	0201A	Mud Creek	Bacteria / Depressed DO	2002 / 2006	Chlorophyll-*a* / Depressed DO	CS / CS
Lower 1	0201D	Barkman Creek	N/A	N/A	Bacteria / Depressed DO	CN / CS
Lower 1	0202	Red River Below Lake Texoma	N/A	N/A	Chlorophyll-a / Depressed DO	CS / CS
Lower 1	0202A	Bois D' Arc Creek	Bacteria	2010	Bacteria / Chlorophyll-*a* / Nitrate / Total Phosphorus	CN / CS / CS / CS
Lower 1	0202B	Corneliason Creek	N/A	N/A	Bacteria	CN
Lower 1	0202C	Pecan Bayou	Bacteria	2018	N/A	N/A
Lower 1	0202D	Pine Creek	N/A	N/A	Chlorophyll-*a* / Depressed DO	CS / CS
Lower 1	0202G	Smith Creek	Bacteria	2006	Total Phosphorus	CS
Lower 1	0202H	Big Pine Creek	N/A	N/A	N/A	N/A
Lower 1	0202I	Little Pine Creek	Depressed DO	2014	Chlorophyll-*a* / Depressed DO	CS / CS
Lower 1	0202L	Honey Grove Creek	Bacteria	2016	Chlorophyll-*a* / Total Phosphorus / Bacteria	CS / CS / CN
Lower 1	0202M	Lake Bonham (Bonham City Lake)	N/A	N/A	Chlorophyll-*a*	CS
Lower 1	0202N	Hicks Creek	Bacteria	2020		
Lower 1	0202P	Six Mile Creek	N/A	N/A	N/A	N/A
Lower 1	0202Q	Pickens Lake	N/A	N/A	N/A	N/A
Lower 1	0208A	Lake Crook	N/A	N/A	N/A	N/A
Lower 1	0209A	Pat Mayse Lake	N/A	N/A	Chlorophyll-*a* / Manganese in Sediment	CS / CS
Upper 1	0202E	Post Oak Creek	Bacteria	2016	Nitrate / Total Phosphorus / Chlorophyll-*a* / Depressed DO	CS / CS / CS / CS
Upper 1	0202F	Choctaw Creek	Bacteria	2010	Nitrate / Total Phosphorus	CS / CS
Upper 1	0202J	Sand Creek	N/A	N/A	N/A	N/A
Upper 1	0202K	Iron Ore Creek	N/A	N/A	N/A	N/A
Upper 1	0203	Lake Texoma	N/A	N/A	Chlorophyll-*a* / Harmful Algal Bloom-Golden Alga	CS / CN
Upper 1	0203A	Big Mineral Creek	N/A	N/A	Nitrate / Total Phosphorus	CS / CS
Upper 1	0203C	Mustang Creek	N/A	N/A	N/A	N/A
Upper 1	0203D	Deaver Creek	N/A	N/A	N/A	N/A
Upper 1	0204	Red River Above Lake Texoma	N/A	N/A	Chlorophyll-*a*	CS
Upper 1	0204B	Moss Lake	N/A	N/A	N/A	N/A
Upper 1	0210	Farmers Creek Reservoir	N/A	N/A	N/A	N/A
2	0211	Little Wichita River	Depressed DO	1996	Chlorophyll-*a* / Bacteria	CS / CN
2	0211A	East Fork Little Wichita River	N/A	N/A	N/A	N/A
2	0212	Lake Arrowhead	N/A	N/A	N/A	N/A
2	0212A	Little Wichita River Above Lake Arrowhead	Bacteria	2020	N/A	N /A
2	0213	Lake Kickapoo	N/A	N/A	N/A	N/A
2	0214	Wichita River Below Diversion Lake Dam	Bacteria	2006	Chlorophyll-*a* / Total Phosphorus / Nitrate	CS / CS / CS
2	0214A	Beaver Creek	Bacteria	2006	Chlorophyll-*a* / Depressed DO	CS / CN

Red River Basin
2020 Texas Integrated Report Summary Table (continued)

Reach	Segment Number	Segment Description	303(d) Impairments	YearFirst Listed	305(b) Concerns	Level of Concern
2	0214B	Buffalo Creek	N/A	N/A	Ammonia / Chlorophyll-*a* / Nitrate Total Phosphorus	CS / CS / CS / CS
2	0214C	Holliday Creek	N/A	N/A	N/A	N/A
2	0214E	Wichita Valley Irrigation Project	N/A	N/A	Chlorophyll-*a*	CS
2	0214F	Unnamed Tributary to Buffalo Creek	Bacteria	2016	N/A	N/A
2	0215	Diversion Lake	N/A	N/A	Harmful Algal Bloom-Golden Alga	CN
2	0216	Wichita River Below Lake Kemp	N/A	N/A	N/A	N/A
2	0217	Lake Kemp	N/A	N/A	N/A	N/A
2	0218	Wichita/North Fork Wichita River	N/A	N/A	Bacteria	CN
2	0218A	Middle Fork Wichita River	N/A	N/A	Selenium in Water	CN
2	0219	Lake Wichita	Chloride / Sulfate / TDS	2014 / 2014 / 2014	Chlorophyll-*a* / Harmful Algal Bloom-Golden Alga / Total Phosphorus	CS / CN / CS
2	0219A	Holiday Creek Above Lake Wichita	N/A	N/A	N/A	N/A
2	0226	South Fork Wichita River	Chloride	2020	Ammonia	CS
3	0205	Red River Below Pease River	N/A	N/A	Chlorophyll-*a*	CS
3	0205A	Wildhorse Creek	Bacteria	2018	N/A	N/A
3	0206	Red River Above Pease River	N/A	N/A	N/A	N/A
3	0206B	South Groesbeck Creek	Bacteria	2006	Nitrate	CS
3	0220	Upper Pease/North Fork Pease River	N/A	N/A	N/A	N/A
3	0221	Middle Fork Pease River	Chloride / Sulfate / TDS	2020 / 2020 / 2020	N/A	N/A
3	0230	Pease River	N/A	N/A	N/A	N/A
3	0230A	Paradise Creek	N/A	N/A	Chlorophyll-*a*	CS
4	0207	Lower Prairie Dog Town Fork Red River	Bacteria	2006	Chlorophyll-*a*	CS
4	0207A	Buck Creek	N/A	N/A	Nitrate	CS
4	0228	Mackenzie Reservoir	TDS / Sulfate	2014 / 2016	N/A	N/A
4	0229	Upper Prairie Dog Town Fork Red River	pH / Bacteria / Depressed DO	2006 / 2018 / 2018	Bacteria / Chlorophyll-*a* / Nitrate Total Phosphorus / Depressed DO	CN / CS / CS / CS / CS
4	0229A	Lake Tanglewood	N/A	N/A	Ammonia / Chlorophyll-*a* / Depressed DO / Nitrate / Total Phosphorus	CS / CS / CS / CS / CS
5	0222	Salt Fork Red River	N/A	N/A	Nitrate	CS
5	0222A	Lelia Lake Creek	N/A	N/A	N/A	N/A
5	0223	Greenbelt Lake	Harmful Algal Growth	2020	N/A	N/A
5	0224	North Fork Red River	N/A	N/A	N/A	N/A
5	0224A	McClellan Creek	N/A	N/A	N/A	N/A
5	0299A	Sweetwater Creek	Bacteria	2002	N/A	N/A

PUBLIC INVOLVEMENT AND OTHER INFORMATION

BASIN ADVISORY COMMITTEE

The Basin Advisory Committee (BAC), also known as the Steering Committee, is the driving force that assists in determining the water quality priorities of the CRP in the Canadian and Red River Basins. Representatives from the public, municipal, county, state and federal government, industry, business, agriculture, fee payers, environmental, education, civic organizations, and others comprise the membership of the BAC. Annual meetings are held in Amarillo and Wichita Falls and are open, friendly, casual, and informative.

RED RIVER VALLEY WATER RESOURCE CONFERENCE

The Red River Valley Water Resource Conference is hosted by the Authority in cooperation with the Red River Valley Association and comprises representatives from Texas, Oklahoma, Arkansas and Louisiana. The focus of the conference is water quality and quantity issues that affect everyone within the Red River Basin, in all four states. More information on the Red River Valley Water Resource Conference can be found at **www.rrva.org**.

EDUCATION

An important program sponsored by the Authority is the distribution of the *Major Rivers* educational program to schools within both basins. *Major Rivers* is a water education curriculum designed by the Texas Water Development Board and the Lower Colorado River Authority and teaches students about Texas' major water resources. Since 1998, the Authority has provided this curriculum to over 10,000 students in the Canadian and Red River Basins.

Since 2010, Midwestern State University students enrolled in environmental science courses were invited to the Authority's Environmental Services Laboratory for a tour and to witness real-world application of topics they had covered in both lecture and labs. This is a good opportunity to promote interest in the environmental sciences and to get the word out about the Clean Rivers Program.

COORDINATION WITH OTHER BASIN ENTITIES

The Authority coordinates collection and monitoring efforts with other basin entities by holding annual Coordinated Monitoring Meetings (CMM). Entities that have been included in these meetings are the TCEQ, USGS, CRMWA, City of Sherman, TPWD, Texas State Soil and Water Conservation Board, the North Texas Municipal Water District and the U.S. Army Corps of Engineers. Goals of this meeting are to coordinate sites, parameters of concern, and data collection frequency. The CMM solicits input from all entities involved in monitoring in order to create monitoring schedules that reduce duplicative efforts. This, in turn, maximizes the funds available for the program.

ENVIRONMENTAL SERVICES LABORATORY

The Authority's laboratory achieved official NELAP accreditation in 2008. This insures that all samples tested comply with national standards of acceptance. NELAP quality assured data is used by the TCEQ in developing and revising water quality standards and evaluating whether those standards are met. Since the laboratory's initial accreditation, it has been audited by TCEQ in 2010, 2012, 2015, 2017, 2019, and 2021 and has continued to maintain NELAP accreditation.

The Authority's laboratory participated in an Extended Holding Time Study for *E. coli* bacteria in the spring and summer of 2009, as well as the most recent study, which took place during 2011-2012. The aim of the on-going bacteria project is to help regulators determine the effects of an extended holding time when making quantitative determinations of indicator bacteria like *E. coli*. Extended holding times are occasionally used during surface water quality monitoring events, since it is not always feasible to return samples to the laboratory and meet the required eight (8) hour holding time. Results of this study helped get EPA's approval of a thirty (30) hour holding time for *E. coli* beginning in August 2014. The Authority is also interested in contributing to TCEQ studies into the development of nutrient standards.

RECOMMENDATIONS

The following recommendations are based upon the evaluations presented in this report and the *2019 Basin Summary Report of the Canadian and Red River Basins*. Comments received through public participation have also influenced these recommendations and conclusions. They are as follows:

COORDINATION/SPONSORSHIP

- Continue to promote and build upon the already successful annual Coordinated Monitoring Meeting to develop strategic monitoring plans for both basins. This reduces duplication of effort, ensures the efficient use of available financial resources and increases the number of sites monitored. In addition, it enables the impairments and concerns, as defined in the *IR*, to be adequately addressed, so that all segments and water quality uses can be assessed.
- Continue to build upon the Watershed Action Planning process. This process emphasizes and promotes a cooperative effort to pursue monitoring based efforts to aid in both the identification of problems and/or sources of long-time 303(d) impairments and 305(b) concerns and their subsequent delisting and/or removal from such lists.
- Continue to increase the number of monitoring partners, such that non-monitored locations or locations needing additional monitoring receive coverage. Increased coverage will provide additional data, useful in determining potential cause(s) for both impairments and concerns.
- Continue to encourage the State of Oklahoma environmental and water quality agencies to attend the Coordinated Monitoring and Basin Advisory Committee Meetings in order to further a cooperative effort in the improvement of water quality for both basins.
- Continue as the State Sponsor of the Red River Chloride Control Project, pressing for the project's funding and completion so that previously unusable water sources can be utilized without excessive treatment costs.

EDUCATION

- Continue to work with the agriculture and ranching industry and municipal entities toward the improvement of water quality through effective planning strategies and the implementation of Best Management Practices (BMPs).
- Continue educating students and other interested citizens and stakeholders about the importance of water quality monitoring.

Sweetwater Creek at US 83

- Continue to publicly present new information regarding invasive plant and animal species, such as salt cedar and the zebra mussel. Through continued education efforts, we can take strides to reduce the transfer of these invasive species throughout Texas.

- Continue to participate in local initiatives, such as the annual Earth Day Program, to promote water conservation and stewardship of water quality resources within both the Canadian and Red River Basins.

ANALYTICAL

- Continue to work with TCEQ and other data submitters to develop methodologies that support reducing the percentages of censored data submitted to TCEQ's Surface Water Quality Monitoring Database (SWQMIS).

- Continue to support TCEQ in its efforts to expand conventional monitoring through the analyses of additional parameters, especially those pertinent to the development of numeric nutrient criteria, including total kjeldahl nitrogen (TKN), nitrate+nitrite, ammonia and chlorophyll-*a*.

- Continue to promote and collect *Enterococcus* data to better assess the bacteriological quality in high saline water bodies throughout the Canadian and Red River Basin. Of all the 303(d) impaired water bodies assessed during the *2020 IR*, approximately 20+% of those have been identified as utilizing *Enterococcus*, in lieu of *E. coli*, as the indicator bacteria for that segment. Once enough data is available, and these water bodies can be more accurately assessed, it may be determined that some of the original listings were made in error and those water bodies can be removed from future *IRs*.

STANDARDS

- Continue to support the development of new standards, such as those seen in the *2020 Texas Surface Water Quality Standards*, that more accurately define criteria for contact recreation.

- Continue to support the completion of Recreational Use Attainability Analysis (RUAA) throughout the Canadian and Red River Basins. The completion of these studies helps determine whether or not established use categories are actually appropriate for the said water body. In cases where the use classification is not appropriate, it can be reclassified which can lead to a less stringent bacteria standard, potentially leading to that water body being removed and delisted for a bacteriological (*E. coli* or *Enterococcus* MPN) impairment.

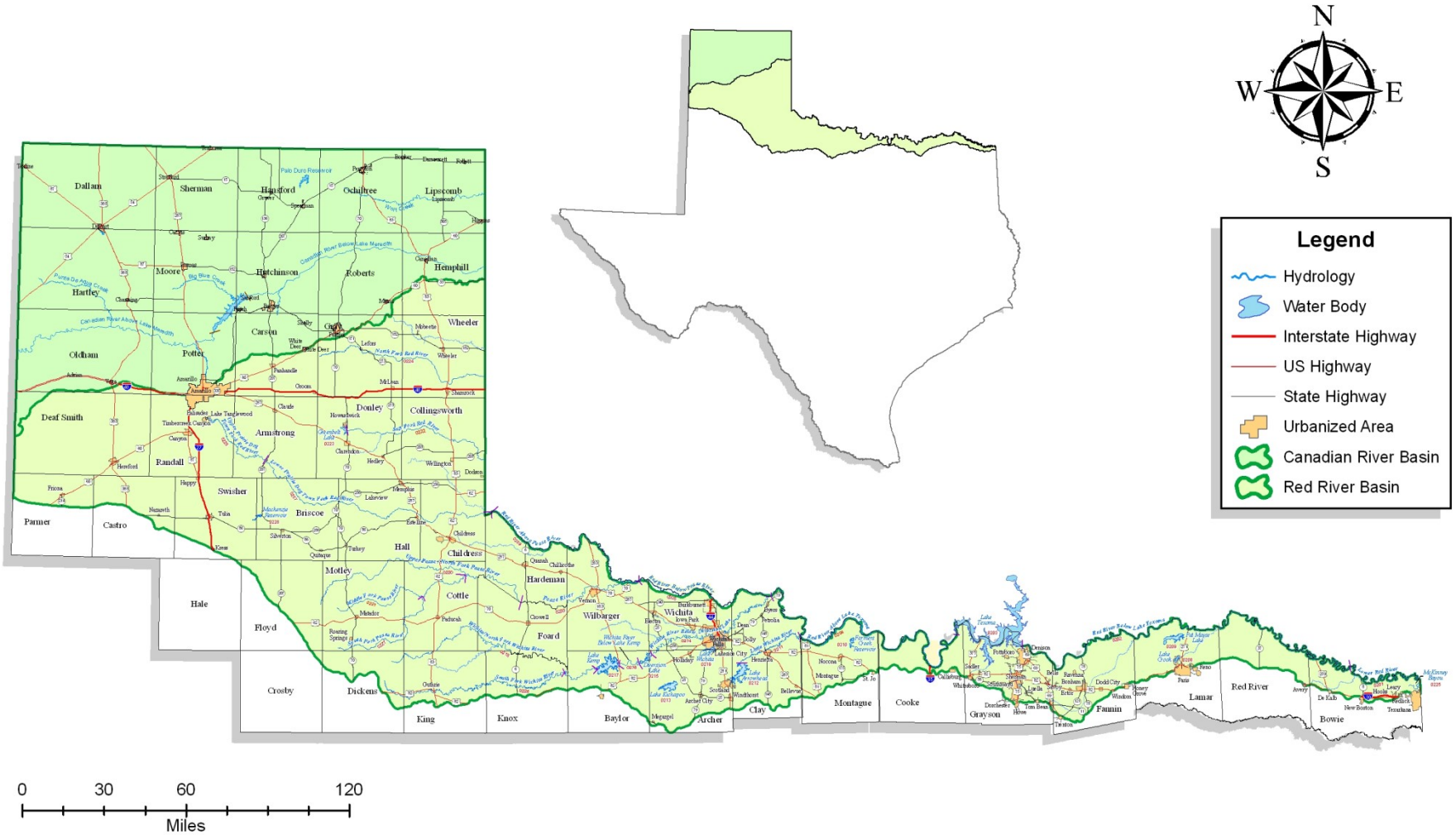
- Continue to support the development of achievable numeric nutrient criteria that encompass the best interests of both the stakeholders and permittees.

MONITORING

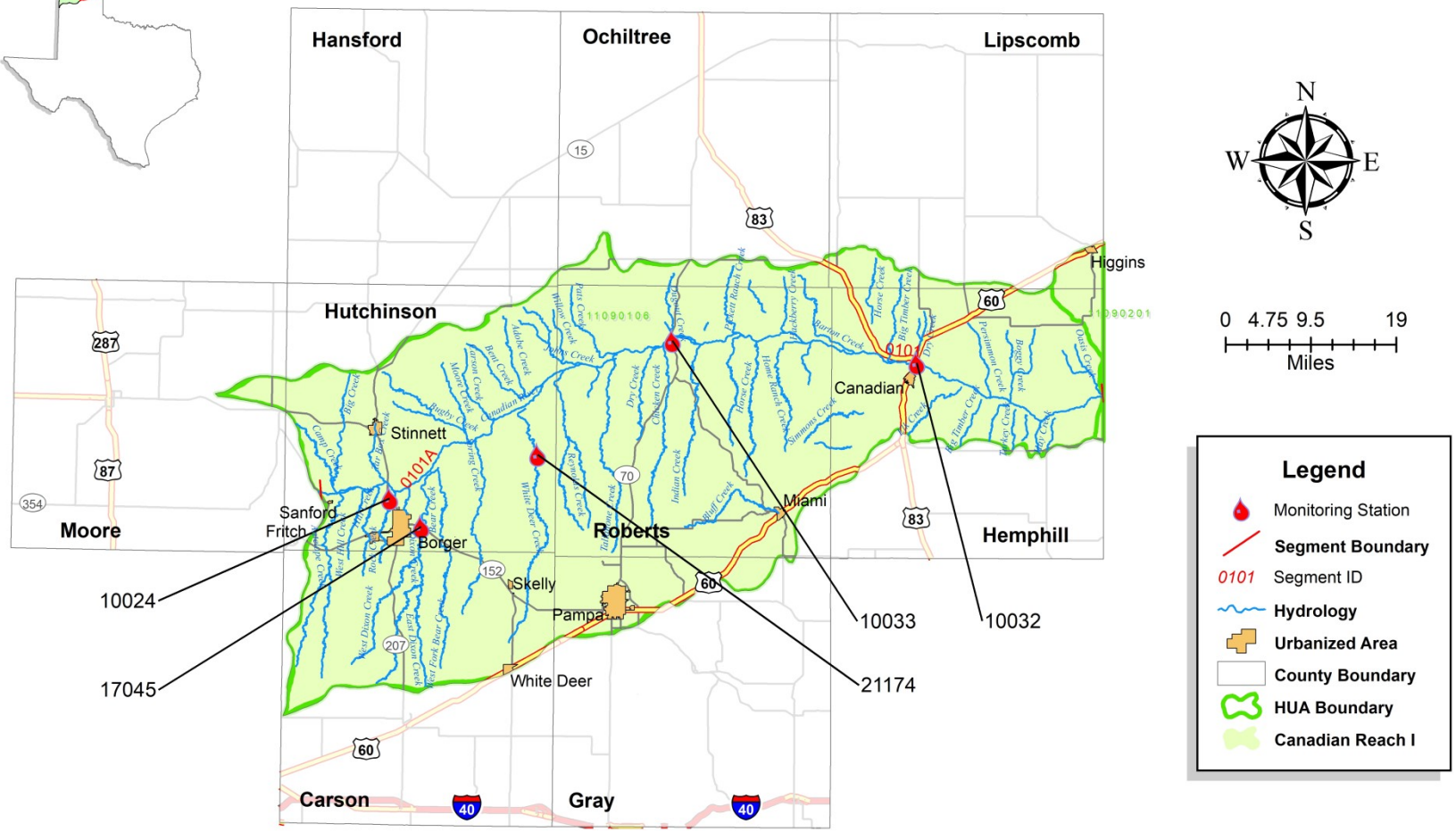
- Increase the number of monitoring partners in order for non-monitored locations to receive additional coverage, thereby increasing the amount of data available for future water quality inventories. Increased coverage will allow for more spatially representative data to investigate the cause(s) of impairments and concerns.
- Increase the number of monitoring locations throughout the Canadian and Red River Basins to provide TCEQ with more data to aid in the evaluation of watersheds throughout both basins.
- Increase the number of biological monitoring events throughout the Canadian and Red River Basins to provide TCEQ with enough data to assess during future *IR's*. This data is also essential to aid in the evaluation and development of regionalized biotic integrity indexes for both basins.
- Implement biological monitoring in both the Canadian and Red River Basins to help provide a broader view of water quality in the basins. In addition, biological monitoring can be used to determine the level of aquatic life use the system can sustain as well as the associated standards that are appropriate for the system.
- Support the TCEQ's efforts to more accurately document and assess the need for Recreational Use Attainability Analyses by increasing the amount of information documented during routine field monitoring.

Pease River at FM 104

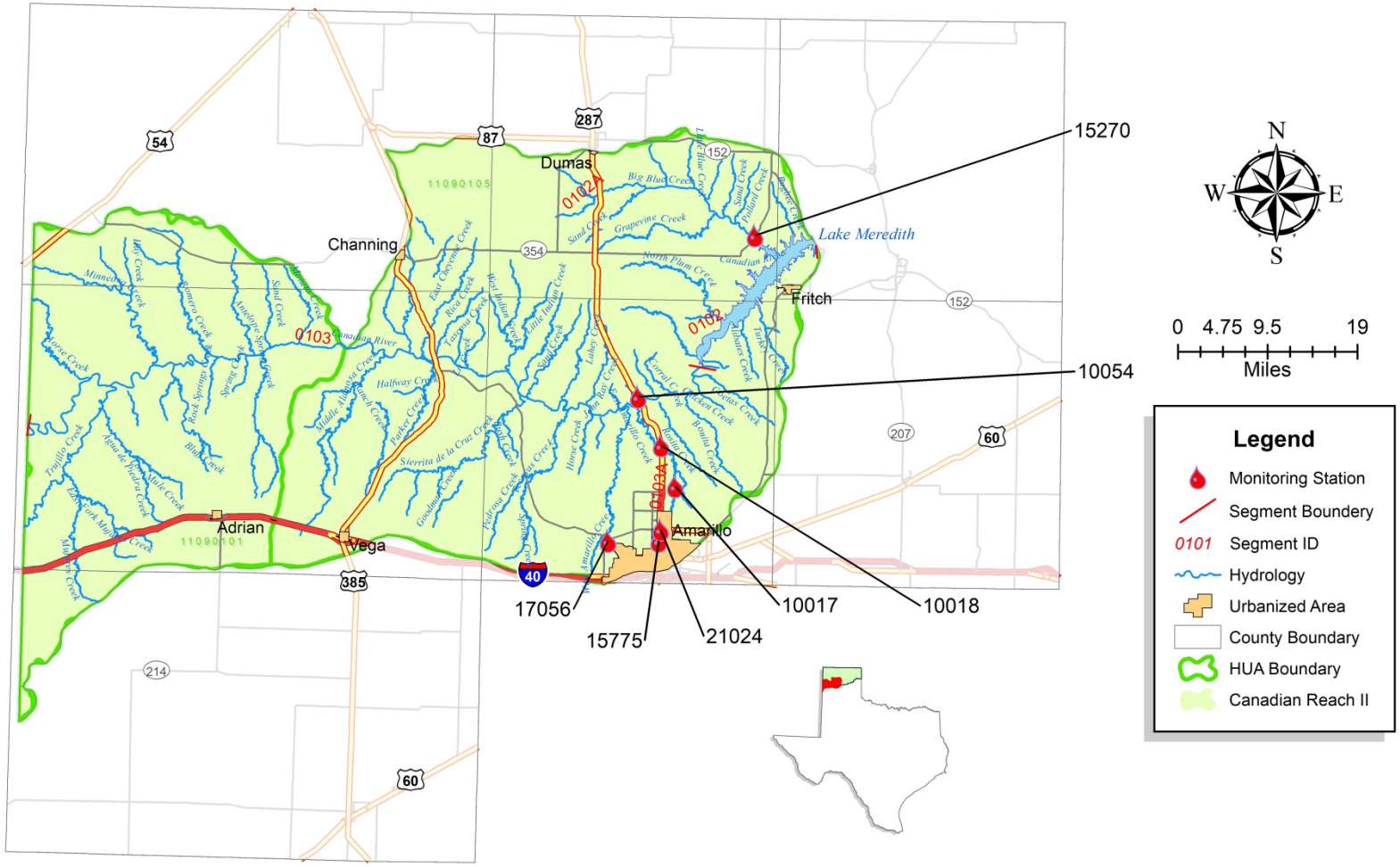
Red and Canadian River Basins
Vicinity Map



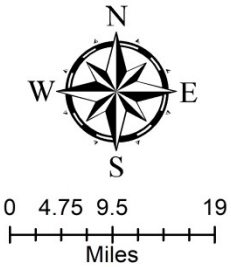
Canadian River Basin
Reach I
FY2021



Canadian River Basin
Reach II
FY2021



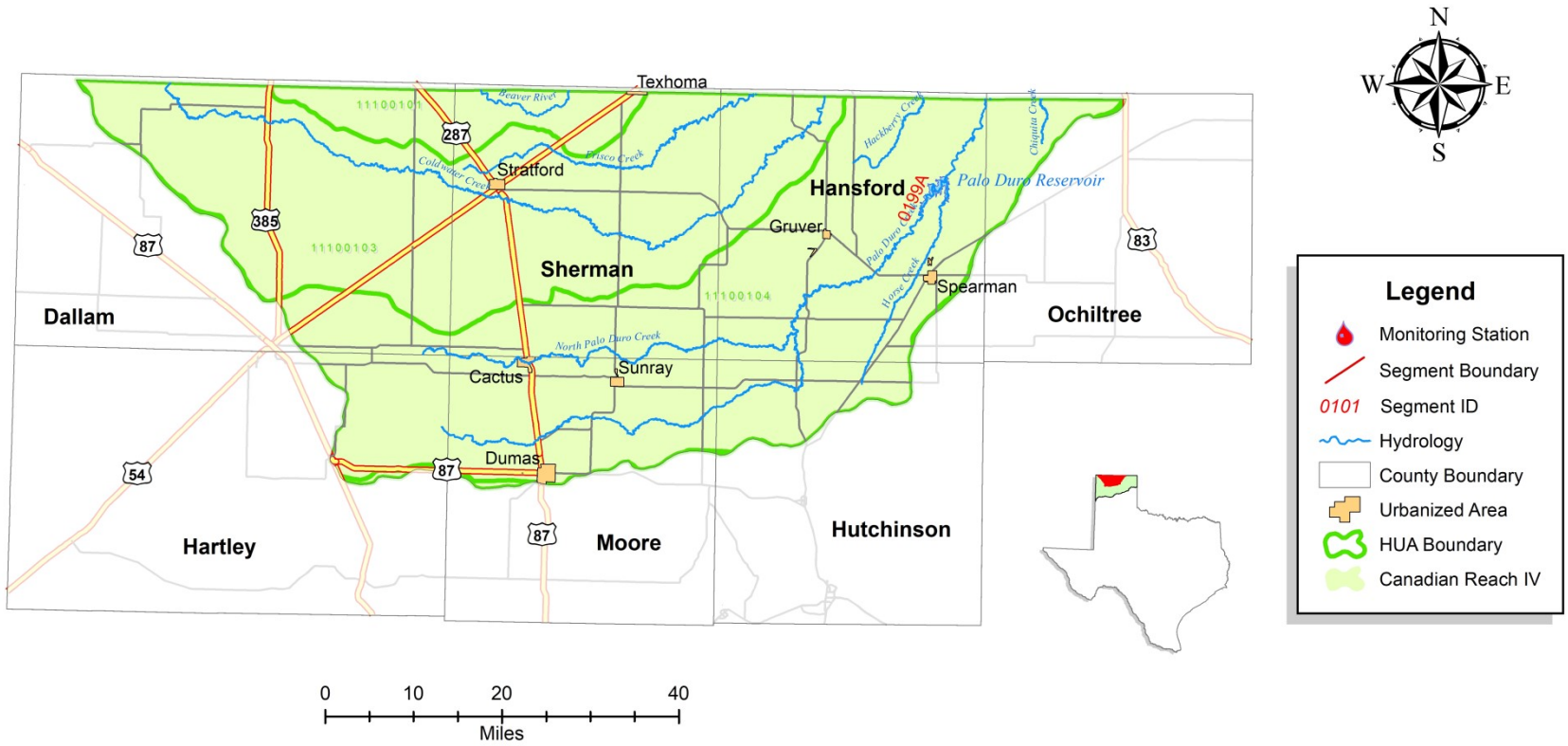
Canadian River Basin
Reach III
FY2021



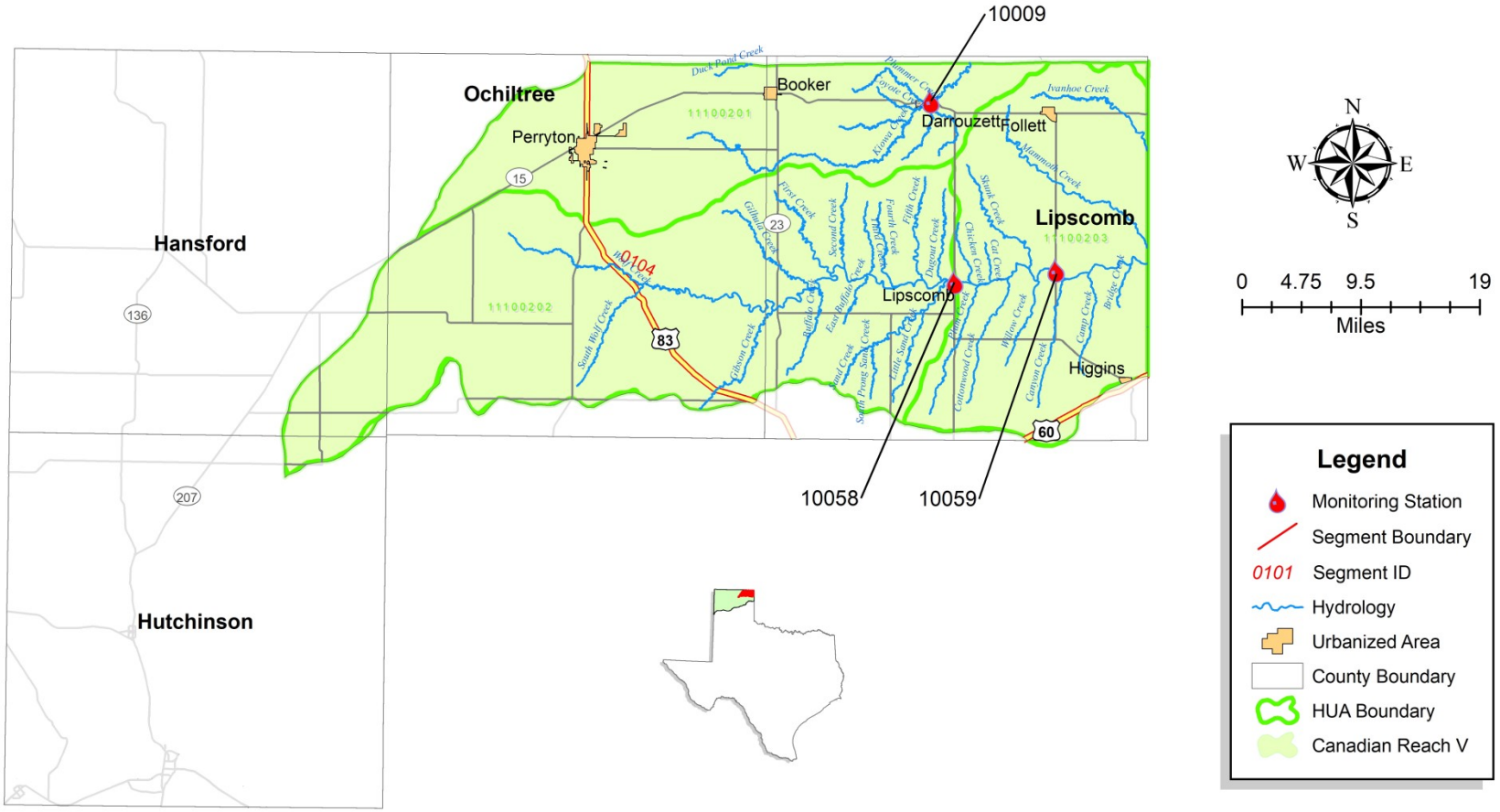
Legend

- Monitoring Station
- Segment Boundary
- 0101 Segment ID
- Hydrology
- Urbanized Area
- County Boundary
- HUA Boundary
- Canadian Reach III

Canadian River Basin
Reach IV
FY2021



Canadian River Basin
Reach V
FY2021



Red River Basin
Lower Reach I
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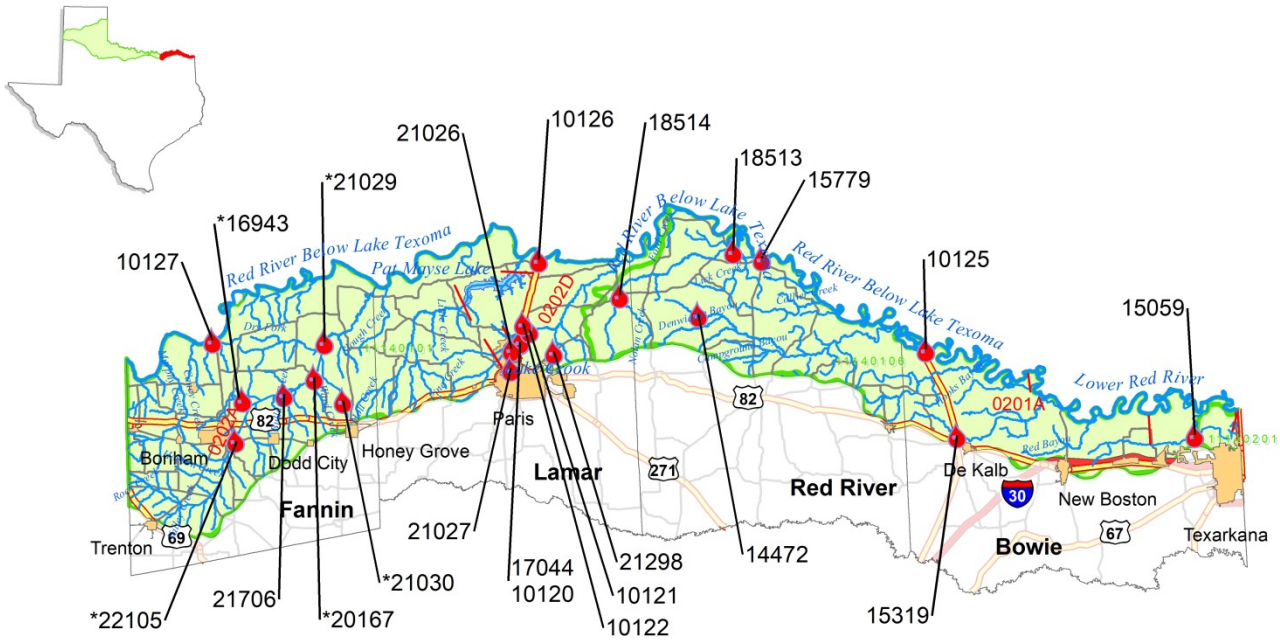
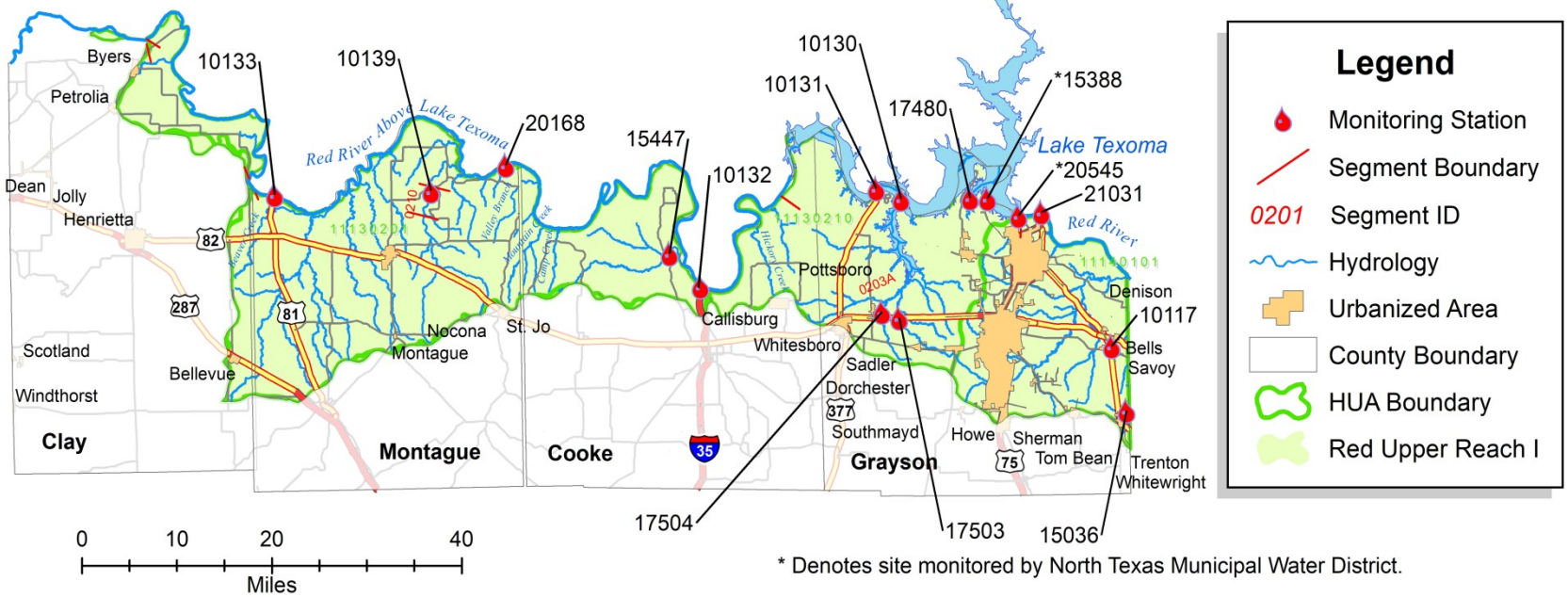


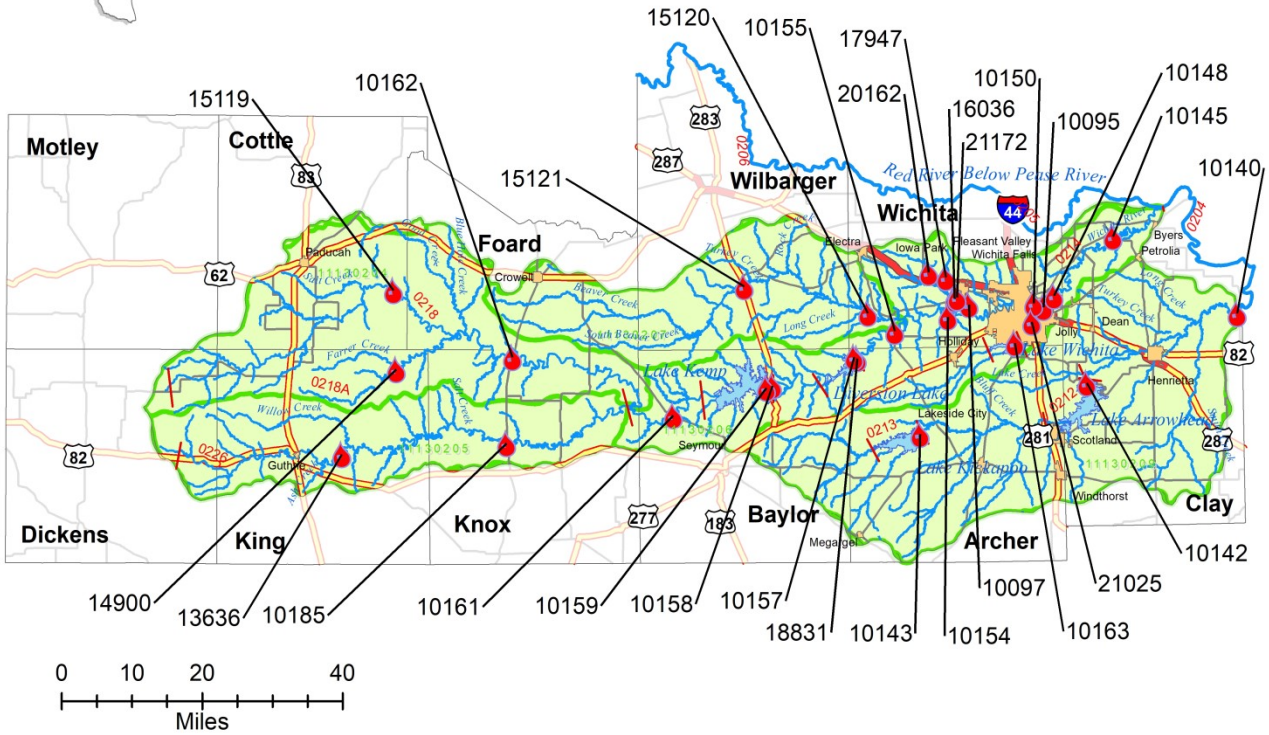
* Denotes site monitored by North Texas Municipal Water District.

Red River Basin
Upper Reach I
FY2021



* Denotes site monitored by North Texas Municipal Water District.

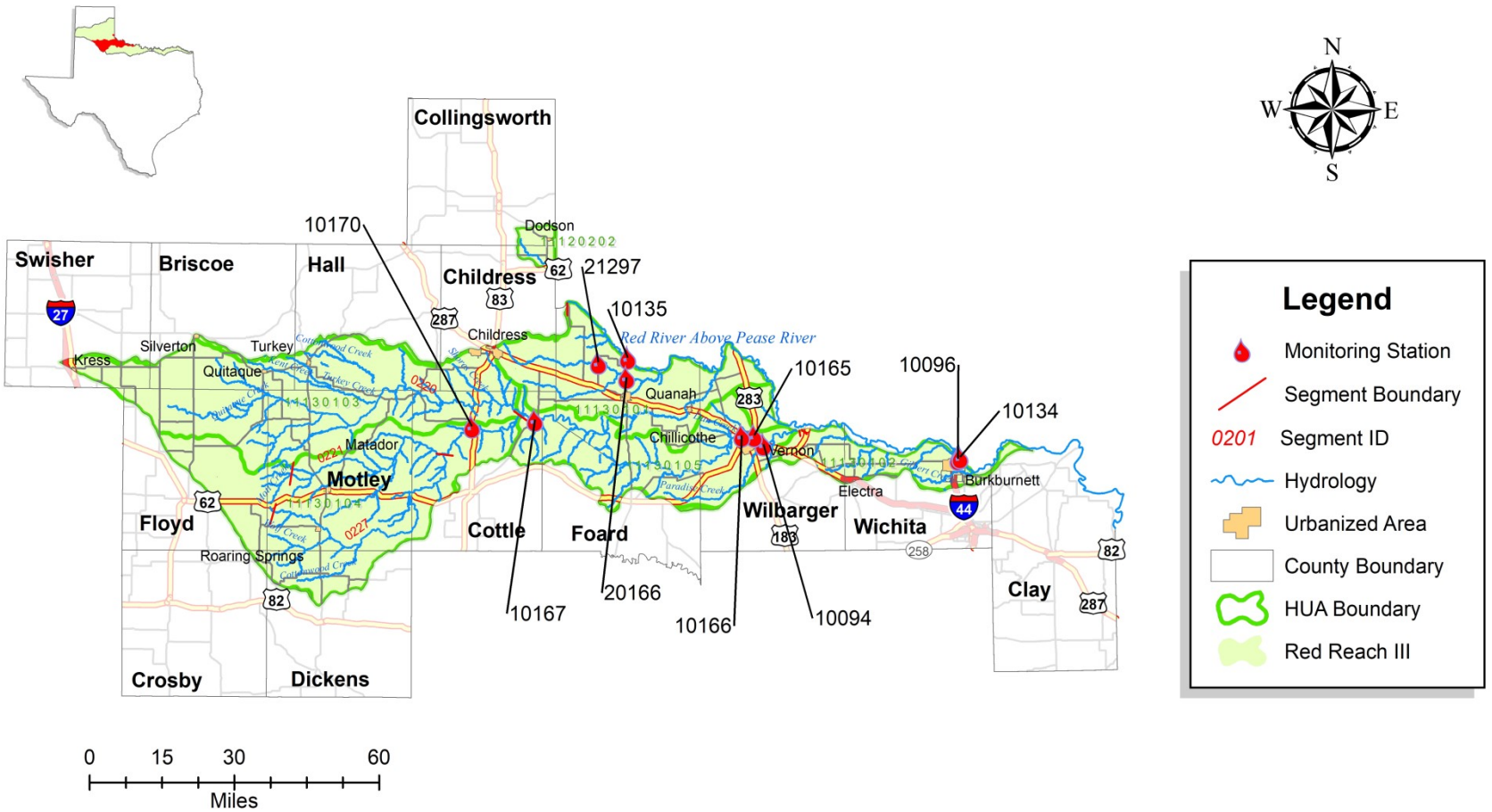
Red River Basin
Reach II
FY2021



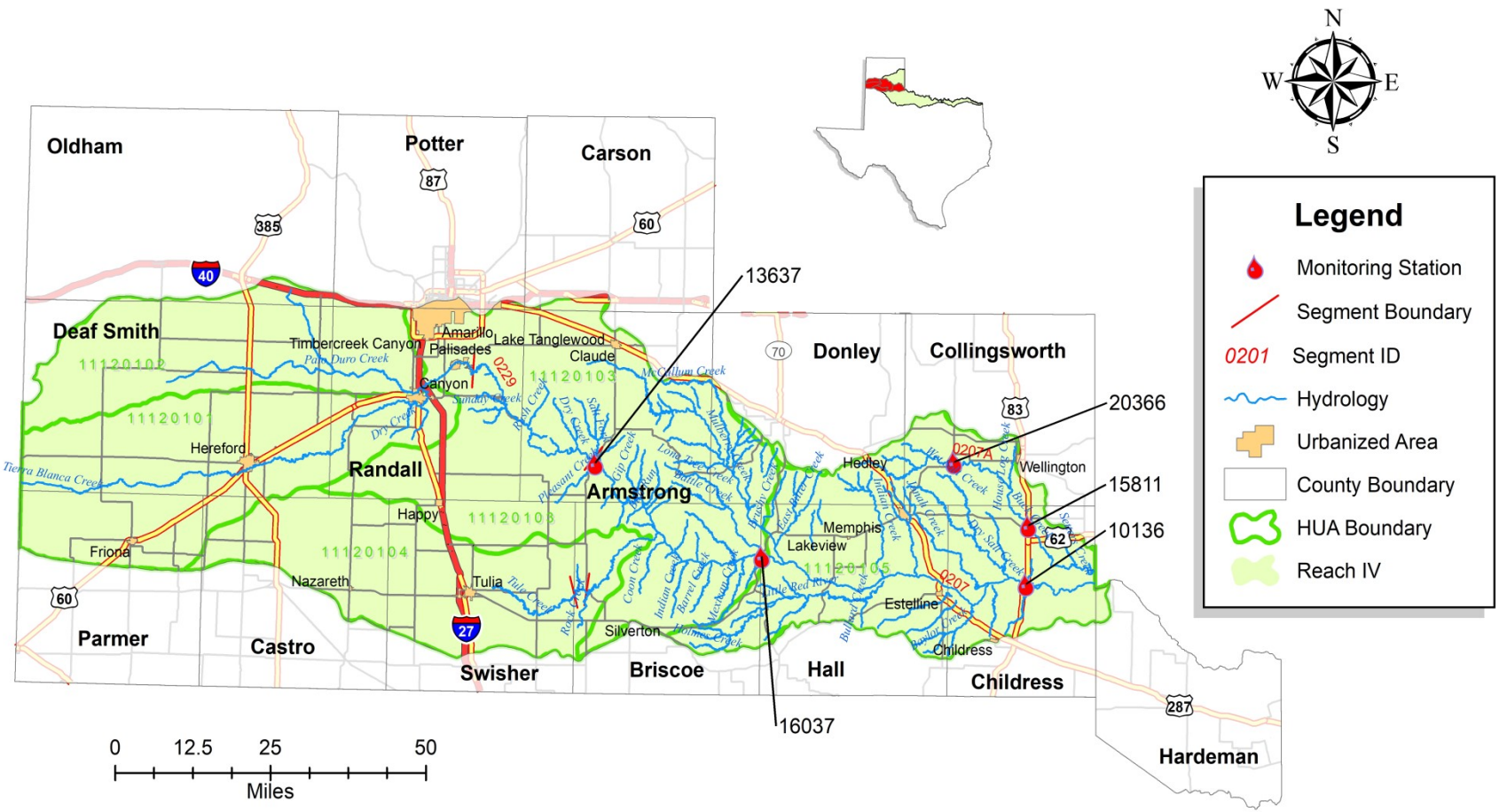
Legend

- Monitoring Station
- Segment Boundary
- 0201 Segment ID
- Hydrology
- Urbanized Area
- County Boundary
- HUA Boundary
- Red Reach II

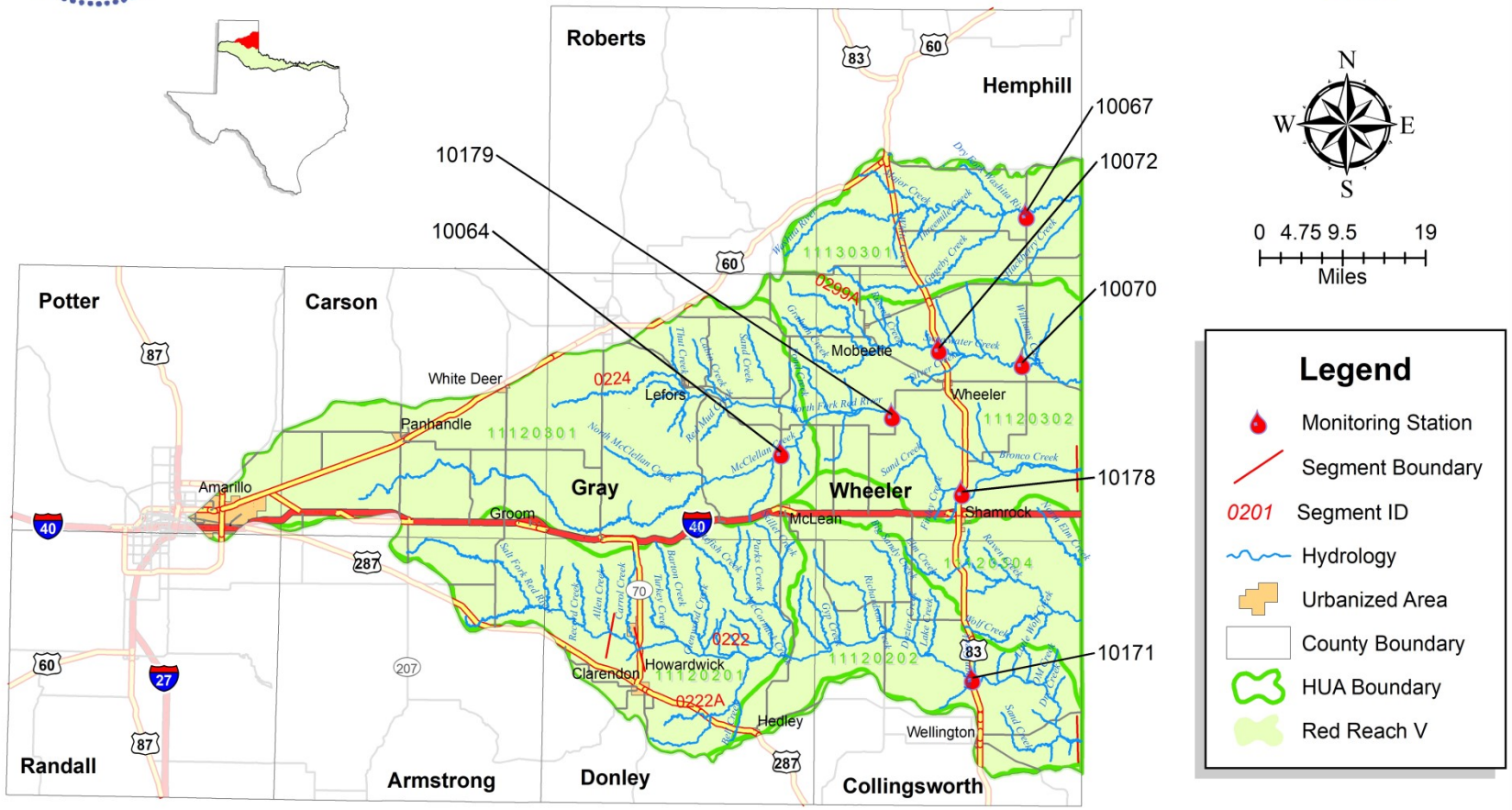
Red River Basin
Reach III
FY2021



Red River Basin
Reach IV
FY2021



Red River Basin
Reach V
FY2021



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