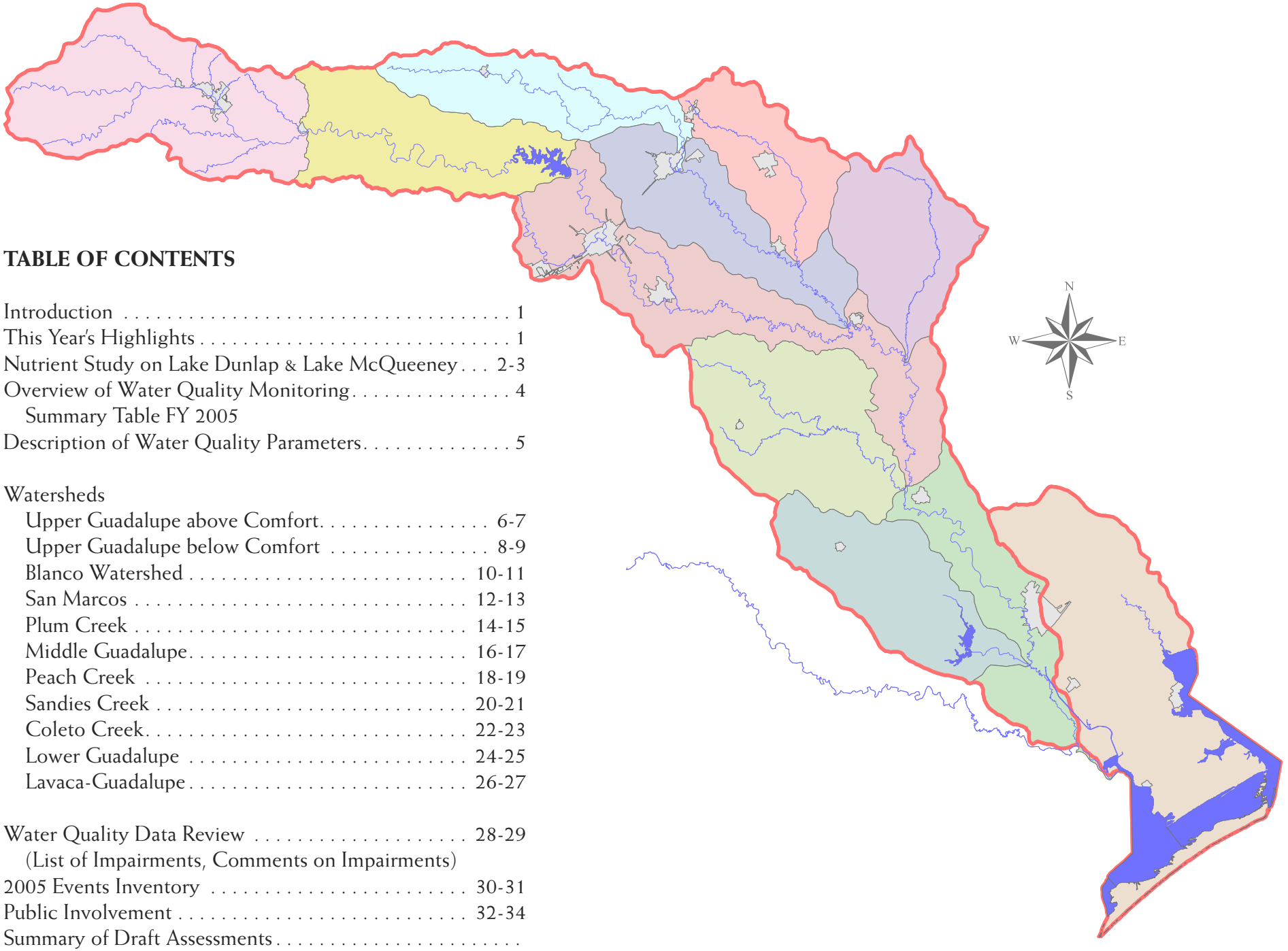
Guadalupe River Basin

Basin Highlights Report - Spring 2006

GBRA



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Front and back cover photographs by Drew C. Engelke

INTRODUCTION

This report
(CRP). The CRP is managed by the Texas Commission on Environmental Quality (TCEQ), and funded entirely by fees assessed to wastewater discharge
(UGRA) car
include water quality monitoring, a review of water quality data, and public communication efforts.

THIS YEAR'S HIGHLIGHTS

2005 was one of the driest years on record, leading to a year of low stream flows and lake levels. The GBRA and the UGRA have not noted any significant changes in agricultural operations, reservoir management, or recreational activities that might impact water quality.

In the last year the major focus of the CRP in the basin has been in monitoring and public involvement and outreach. Of these, the monitoring efforts represent the largest component. These monitoring efforts, described in detail in the following sections, provide the raw data and information needed to address a number of significant water quality issues in the basin.

In November 2004, the TCEQ revised its draft 2004 Clean Water Act (CWA) Section 305(b) water quality inventory and 303(d) list of water bodies that are not meeting water quality standards. The 2004 inventory provides an update on the status of 195 targeted water bodies (out of the 732 assessed in 2002). The assessments were conducted for water quality samples collected between March 1, 1998 and February 28, 2003. While water quality in the basins is generally good, a number of locations have been identified with water quality issues:

- Elevated nitrate-N level in the Guadalupe River below the San Antonio River confluence.
- High nitrate-N concentrations in Geronimo Creek.
- Concern of nutrient and *chlorophyll a* levels in Lakes Dunlap and McQueeney.
- Elevated bacteria and depressed dissolved oxygen levels at a number of smaller streams in the basin with Total Maximum Daily Load (TMDL) studies underway.
- A new TMDL study for bacteria initiated for Guadalupe River above Canyon Lake in the Kerr County area.

A more detailed discussion of these issues is provided in the Water Quality Data Review section of this report.

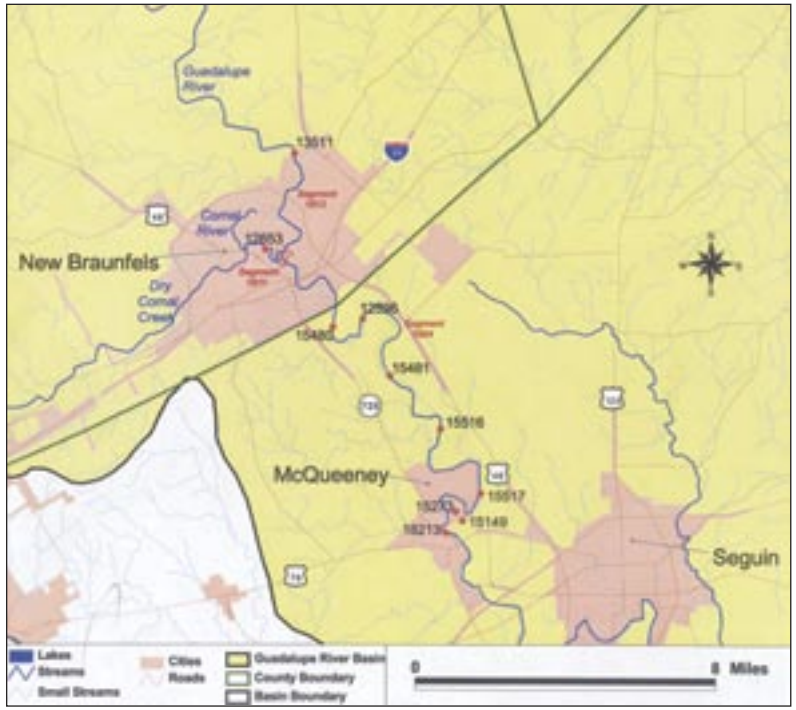
Portions of the basin continue to experience rapid urbanization. For example, Eastern Hays County, located in the upper Plum Creek Watershed, has seen a population increase of 108% between 1990 and 2000. A water quality issue of urban development is nonpoint source (NPS) pollution. Urbanization tends to change the characteristics of runoff from the land and also introduces wastewater disposal issues.

A major issue facing the region is the water supply for the San Antonio area, allowing compliance with restrictions on Edwards Aquifer pumping and thus protecting the Comal Springs and San Marcos Springs that are a major component of the Guadalupe River. GBRA has been an active member of the Region L Water Planning effort.

NUTRIENT STUDY ON LAKES DUNLAP AND MCQUEENEY

A nutrient study was undertaken to determine if there is a spatial relationship as the water moves downstream through Lakes Dunlap and McQueeney, run-of-river impoundments located between New Braunfels and Seguin (Figure 1). Additionally, the study was to determine if the relationship between flow and *chlorophyll a* seen in the historical data was supported in the study period. The study did not clearly identify sources of nutrients, but the spatial analysis of the water quality conditions moving downstream did show nutrient concentrations sufficient to promote algal photosynthetic activity in both reservoirs (Figure 2). Most notably, during the two months that had the most prolonged period of low flow conditions, there was a definite spike in *chlorophyll a* at downstream stations in each impoundment.

Most studies on the hydro lakes and the results of the current study have one aspect in common: water quality conditions are contingent on flow in the system. The flow creates conditions, i.e. temperature regime, stratification, and residence times that impact the productivity of the impoundments. Conversely, high flows or storm water inflows contribute solids and nutrients to the system.



A high flow event that occurred in July 2004 showed how concentrations of total phosphorus changed from upstream to downstream during or just following a period of high release rates from Canyon Reservoir. One possible explanation for this rise in phosphorus could be the suspension of dissolved phosphorus associated with sediments by the increased flows. The lack of an associated rise in suspended solids and turbidity would indicate that the phosphorus would be in the dissolved form. A possible source of the dissolved phosphorus could be its release in the low oxygen conditions at the sediment/water interface.

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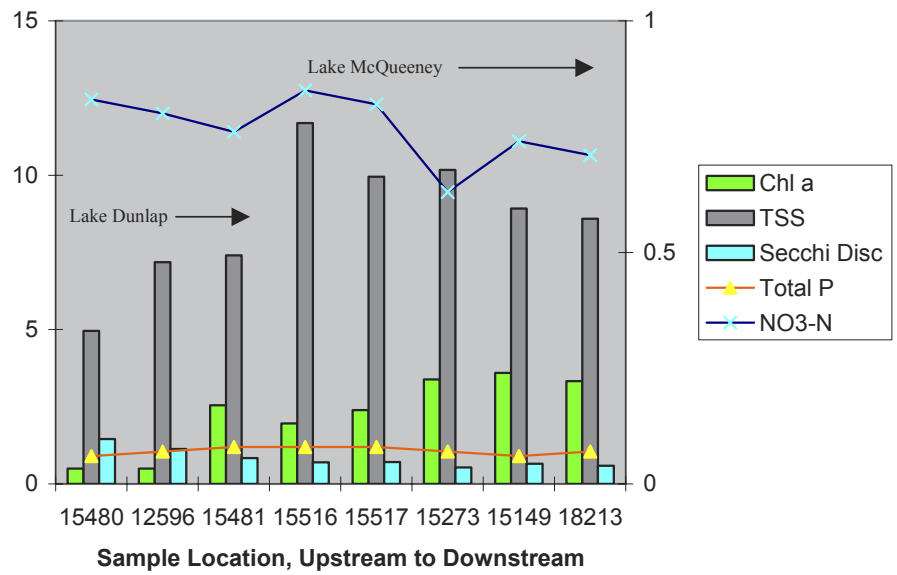
When the development of nutrient standards are considered for streams, one of the challenges will be to address the functionality of run-of-river impoundments, like Lakes Dunlap and McQueeney, because of the high variability in flow conditions. It should be recognized that in most years of normal to high flow, the impoundments are streams with constant throughput of nutrient and sediment loads. But, during years of low flow, and/or drought conditions, the water bodies will respond to nutrient contributions as would a reservoir. TCEQ nutrient and *chlorophyll a* screening levels and future considerations of criteria should take into consideration the unique conditions of these run-of-the river impoundments. Current screening levels for streams may allow too much algae to grow and current screening levels for reservoirs may be too restrictive, considering the ability of these impoundments to act more like

Figure 2. Spatial Distribtution of Constituents



slow moving streams. The relationship between algae growth, nutrient concentrations and flow in these impoundments should be used to develop screening levels and future criteria in deference to statewide percentages based on all reservoirs in Texas.

Residents living on the lakes have found that their use(s) of the lakes have been restricted in the past due to growth of rooted aquatic plants and other macrophytes. This study, and historical studies have attempted to quantify the relationship between nutrients and plant growth (albeit algae). This study has shown that there are many mitigating factors that increase and decrease plant growth. However the source of nutrients from the New Braunfels area (both from point and nonpoint sources) can, in some low flow periods, exacerbate the plant growth. It would be advantageous to investigate wastewater management practices that could be put in place to divert wastewater flows to irrigation during periods of low flow. In addition, certain storm water controls could be put in place to reduce the loading associated with storm flows. This would also help reduce the effect of storm water runoff during possible flood conditions.

In order to verify the extent of contributions from area septic tanks, a dye study of different types, ages and sizes of septic tanks could be done. This study would require differing weather conditions and possibly weekend study due to the increased use of homes during those time periods. This study could be coordinated with the area homeowners' associations to ensure their involvement in and cooperation with the study.

The anthropogenic impacts on these water bodies cannot be minimized. As populations grow in the area, the impact of that growth will continue to be felt in several ways. The failing septic tank impacts will need to be addressed, as well as the need for nutrient limitations in wastewater permits. In addition, the pressure that will be exerted by the growing population on water resources, as cities call upon more and more ground and surface water, will increase the frequency of lower flow conditions. Couple the increase in demand on water sources with the increase in impervious cover that reduces ground water recharge, and the base flow of these impoundments will diminish.

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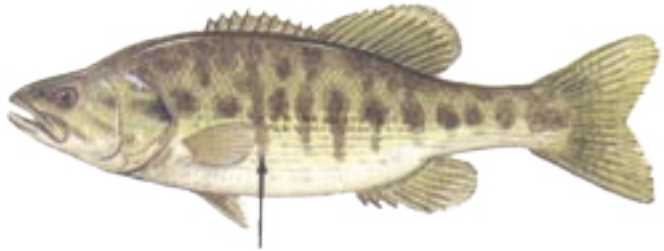
To view the entire study and monitoring data, refer to the GBRA Clean Rivers Program website, http://www.gbra.org/?datapage=crp.asp#ss.

OVERVIEW OF WATER QUALITY MONITORING

One of the key roles of the CRP is fostering coordination and cooperation in monitoring efforts. Coordinated monitoring meetings are held once a year to bring all the monitoring agencies and entities together to discuss streamlining and coordinating efforts. The table below outlines the types and amounts of water quality monitoring conducted in the Guadalupe River Basin and the Lavaca-Guadalupe Coastal Basin under a TCEQ-approved Quality Assurance Project Plan for September 2004 through August 2005.



Guadalupe Bass

The Wimberley Valley Watershed Association (WVWA) is conducting the Blanco River-Cypress Creek Water Quality Monitoring Study. The goals of this study include establishing a baseline of the water quality data; identifying potential pollution problems; documenting spatial and temporal changes; determining impacts of point and nonpoint source pollution; and assessing compliance with water quality standards. The study will also provide recommendations for local planning efforts to protect water quality. The GBRA is providing technical assistance and oversight of monitoring activities in addition to the laboratory analysis and quality assurance support.

The complete monitoring schedule is updated frequently on the GBRA web page at www.gbra.org. The following sections show, by watershed, the distribution of the monitoring sites plus activities that may affect water quality, such as major communities where wastewater discharges are located, areas with a concentration of poultry activity, and the locations of major oil and gas fields.

FY 2005 (September 2004 through August 2005) Summary of Sampling for the Guadalupe & Lavaca-Guadalupe Basins

Sampling Entity	Field	Conventional	Bacteria	Biological and Habitat	24 Hr DO	Metals in Water	Metals in Sediment	Organics in Water
GBRA	18 sites monthly; 1 site bimonthly; 7 sites quarterly; 1 site semi-annually; 5 sites (8 times)	18 sites monthly; 1 site bimonthly; 7 sites quarterly; 5 sites (8 times)	18 sites monthly; 1 site bimonthly; 7 sites quarterly; 5 sites (8 times)	2 sites semi-annually; 3 sites annually	1 site (4 times); 1 site (2 times)	6 sites annually		2 sites annually
UGRA (Kerr Co.)	10 sites quarterly	10 sites quarterly	10 sites quarterly 19 sites weekly (May - August)	2 sites semi-annually		2 sites annually		
TCEQ	13 sites quarterly	13 sites quarterly	13 sites quarterly		1 site (4 times)	1 site semi-annually	1 site semi-annually	
WVWA	6 sites monthly	6 sites monthly	6 sites monthly		1 site (12 times)			

DESCRIPTIONS OF WATER QUALITY PARAMETERS

FIELD PARAMETERS are those water quality constituents that can be obtained on-site and generally include: dissolved oxygen (DO), conductivity, pH, temperature, stream flow (not in reservoirs), and secchi disc depth (reservoirs only).

Dissolved Oxygen indicates the amount of oxygen available in the stream to support aquatic life. DO can be reduced by the decomposition of organic matter.

Conductivity is a measure of the water body's ability to conduct electricity and indicates the approximate levels of dissolved salts, such as chloride, sulfate and sodium in the stream. Elevated concentrations of dissolved salts can impact the water as a drinking water source and as a suitable aquatic habitat.

pH is a measure of the hydrogen ion concentration in an aqueous solution. It is a measure of the acidity or basic property of the water. Chemical and biological processes can be affected by the pH. pH can be influenced by dissolved constituents, such as carbon dioxide and by point and nonpoint source contributions to the stream.

Temperature of the water affects the ability of the water to hold dissolved oxygen. It also has an impact on the biological functions of aquatic organisms.

Stream Flow is an important parameter affecting water quality. Low flow conditions common in the warm summer months create critical conditions for aquatic organisms. Under these conditions, the stream has a lower assimilative capacity for waste inputs from point and nonpoint sources.

Secchi Disc transparency is a measure of the depth to which light is transmitted through the water column, and thus the depth at which aquatic plants can grow.

CONVENTIONAL PARAMETERS are typical water quality constituents that require laboratory analysis and generally include: nutrients, *chlorophyll a*, total suspended solids, turbidity, hardness, chloride, and sulfate.

Nutrients include the various forms of nitrogen and phosphorus. Elevated nutrient concentrations may result in excessive aquatic plant growth and can make a water body unfit for its intended use(s).

Chlorophyll a is a plant pigment whose concentration is an indicator of the amount of algal biomass and growth in the water.

Total Suspended Solids indicate the amount of particulate matter suspended in the water column.

Turbidity is a measure of the water clarity or light transmitting properties. Increases in turbidity are caused by suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, plankton and other microscopic organisms.

Hardness is a composite measure of certain ions in the water, primarily calcium and magnesium. The hardness of the water is critical due to its effect on the toxicity of certain metals. Typically, higher hardness concentrations in the receiving stream can result in reduced toxicity of heavy metals.

Chloride and Sulfate are major inorganic anions in water and wastewater. Numeric stream standards for chloride and sulfate have been set on all of the classified stream segments in the basin. Both of these inorganic constituents can impact the designated uses and can come from point and nonpoint sources, such as wastewater discharges, oil field activities, and abandoned flowing wells from groundwater with elevated concentrations of dissolved solids.

Bacteria The *E. coli* test is now used as an indicator of the possible presence of disease-causing organisms.

Biological and Habitat assessment includes collection of fish community data, benthic macroinvertebrate (insects) data, and measurement of physical habitat parameters. This information is used to determine whether the stream adequately supports a diverse and desirable biological community. The physical, chemical and biological data are used together to provide an integrated assessment of aquatic life support.

24 Hr DO studies perform measurements of DO in frequent intervals (e.g. one hour) in a 24-hour period. The average and minimum concentrations in the 24-hour period are compared to corresponding criteria. This type of monitoring takes into account the diurnal variation of DO and avoids the bias in samples taken only at certain times of the day.

Metals in Water, such as mercury or lead, typically exist in low concentrations, but can be toxic to aquatic life or human health when certain levels are exceeded. To obtain accurate data at low concentrations, the GBRA uses special clean methods that minimize the chance for sample contamination and provide high quality data.

Metals in Sediment could be a source of toxicants for the overlying water, though currently there are no numeric sediment standards.

Organics in Water, such as pesticides or fuels, can be toxic to aquatic life or human health when certain levels are exceeded.

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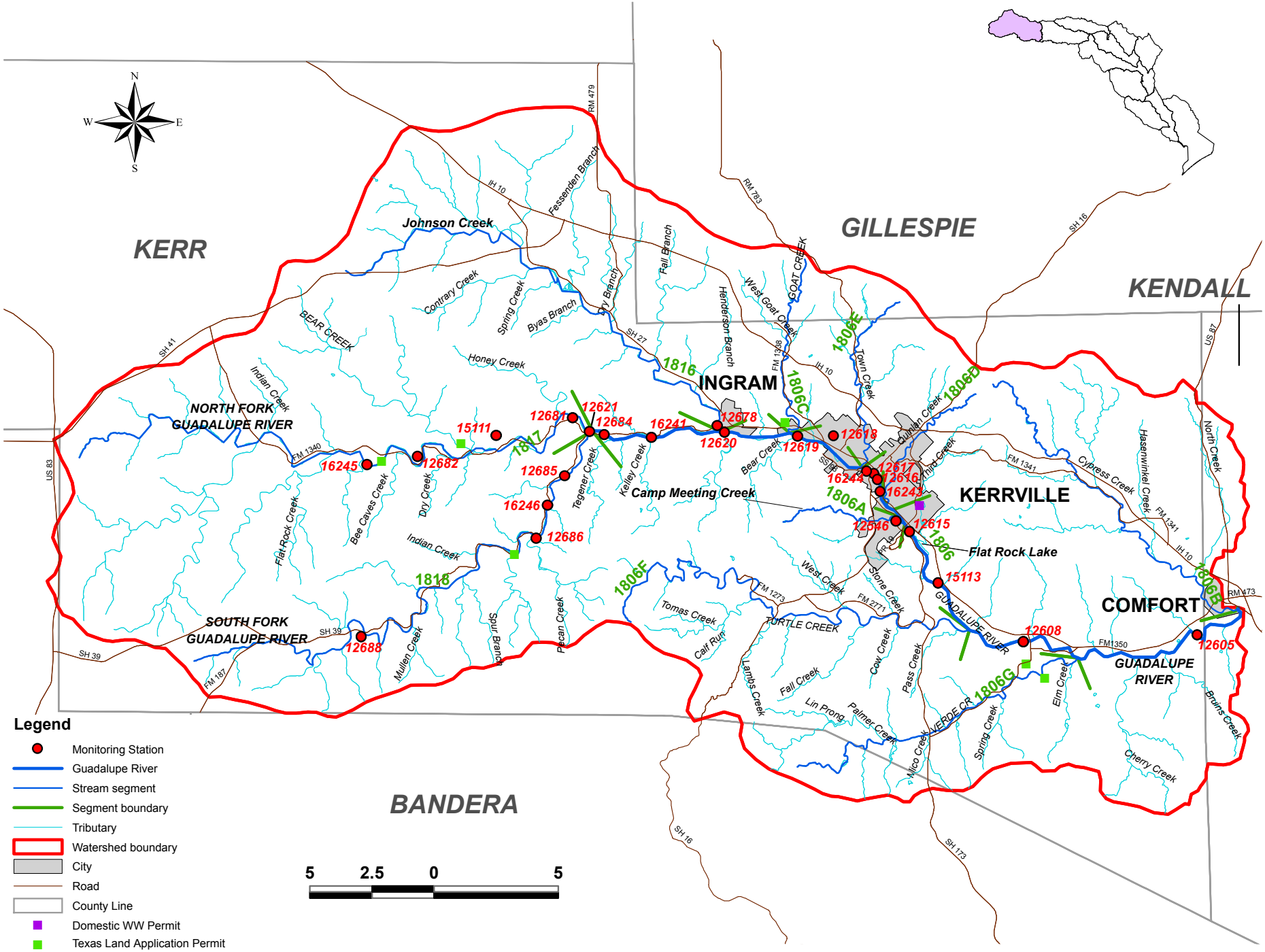
Upper Guadalupe River Watershed Above Comfort



Upper Guadalupe Above Comfort Watershed

Drainage Area: 850 square miles

Streams and Rivers: North Fork and South Fork of the Guadalupe River, Johnson Creek, Quinlin Creek, Flat Rock Lake, Camp Meeting Creek, Town Creek, Cypress Creek, Goat Creek, Turtle Creek, Verde Creek, Bear Creek

Aquifer: Trinity

River Segments: 1816, 1817, 1818, 1806A-G

Cities: Center Point, Ingram, Kerrville, Comfort

Counties: Kerr, Gillespie, Bandera, Kendall

EcoRegion: Edwards Plateau

Vegetation Cover:
Evergreen Forest - 46.9% Grass/Herbaceous - 14.4%
Shrublands - 28.8%

Climate:
Average annual rainfall: 30 inches
Average annual temperature: January 32° July 94°

Land Uses: Ranching, Farming, Tourism, Light Manufacturing

Water Body Uses: Aquatic Life Use, Contact Recreation Use, General Use, Fish Consumption Use, Public Water Supply Use

Soils: Dark and loamy over limestone; to the south and east soils are variable with light colored brown to red soils in some areas and dark loamy or loamy soils over clayey subsoils elsewhere

Permitted Wastewater Treatment Facilities:
Domestic: 1 Land Application: 6
Industrial: 0

RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

Segment 1816 *(Johnson Creek)*: This spring-fed 21 mile segment consisting of Johnson Creek to its confluence with the Guadalupe River in Kerr County has good water quality. Intermittent in stages, the stream crosses an area characterized by steep slopes. The generally shallow, stony soils support grasses and open stands of live oak and Ashe juniper.

Segment Concerns: None

Segment 1817 *(North Fork Guadalupe River)*: The spring-fed 29 mile North Fork of the Guadalupe River is clean; water quality is good. River flow is swift but shallow. Typical vegetation are baldcypress, live oak and Ashe juniper trees.

Segment Concerns: None

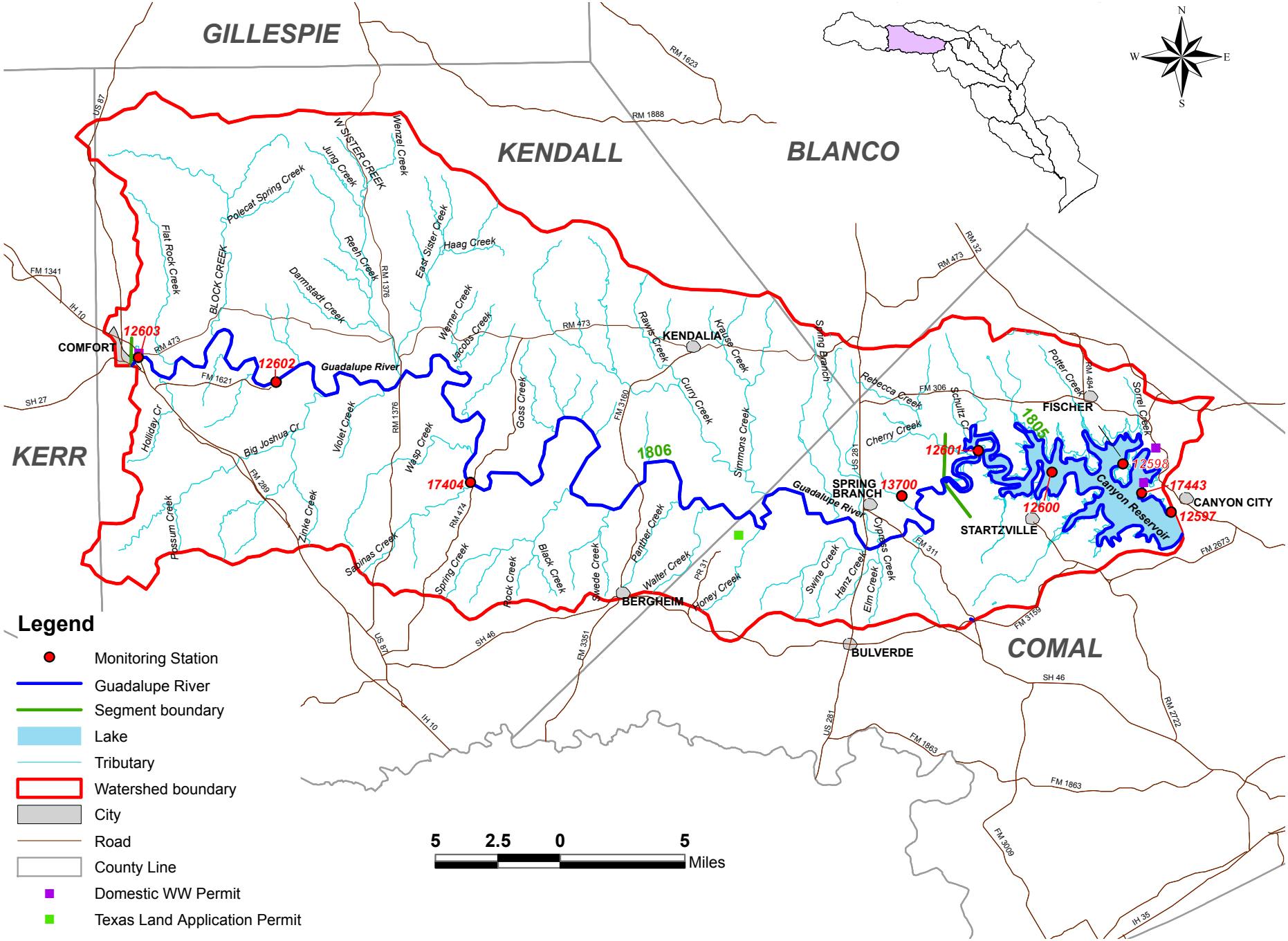
Segment 1818 *(South Fork Guadalupe River)*: The spring-fed 27 mile South Fork of the headwaters of the Guadalupe River is clear moderately flowing water, quality is excellent, a very scenic river with baldcypress lined banks. The river is narrow and shallow.

Segment Concerns: None

Segment 1806A *(Guadalupe River Above Canyon Lake)*: This 18-mile portion of the Guadalupe River from the confluence of Flat Rock Lake in Kerrville has few concerns for contact recreation and aquatic life. The Guadalupe is a very scenic river having crystal clear water between baldcypress lined banks. The shallow riffle areas, punctuated with deep pools create high quality habitat and ecosystems.

Segment Concerns: The segment has been listed as impaired due to high bacteria counts, which poses a concern for contact recreation. A TMDL project is underway on this segment. A possible source of high bacteria could be the population of barn swallows and other birds that nest under the bridges over river crossings in the area. Data from the upper 9 miles indicates depressed dissolved oxygen readings. This is due to low springflow creating a slow moving stream. Other concerns recently noted were possible impacts from gravel mining operations as well as potential impacts from a shooting range.

Upper Guadalupe River Watershed Below Comfort



Upper Guadalupe Below Comfort Watershed

Drainage Area: 596 square miles

Streams and Rivers: Guadalupe River from Comfort to Canyon Lake, Joshua Creek, Flat Rock Creek, Rebecca Creek, Block Creek, West Sister Creek

Lake: Canyon Lake

Aquifer: Trinity

River Segments: 1805, 1806

Cities: Comfort, Kendalia, Bergheim, Bulverde, Canyon City, Spring Branch, Startzville

Counties: Kerr, Comal, Kendall, Blanco

EcoRegion: Edwards Plateau

Vegetation Cover:
Evergreen Forest - 43.6% Shrublands - 11.0%
Grass/Herbaceous - 31.3%

Climate:
Average annual rainfall: 32 inches
Average annual temperature: January 38° July 95°

Land Uses: Urban, Unincorporated Suburban Sprawl, Cattle, Goat and Sheep Production, Light and Heavy Industry, and Recreational

Water Body Uses: Aquatic Life Use, Contact Recreation Use, General Use, Fish Consumption Use, and Public Water Supply Use

Soils: Dark and loamy over limestone to loam with clay subsoils

Permitted Wastewater Treatment Facilities:
Domestic: 3 Land Application: 1
Industrial: 0

RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

Segment 1806 *(Guadalupe River above Canyon Lake)*: From a point (1.7 miles) downstream of Rebecca Creek Road in Comal County to the confluence of North Fork Guadalupe River and the South Fork of Guadalupe River in Kerr County.

Segment Concerns: Suburban growth (large lot housing developments) along the 281 corridor between San Antonio and Blanco is a growing concern.

Segment 1805 *(Canyon Lake)*: From Canyon Dam in Comal County to a point (1.7 miles) downstream of Rebecca Creek Road in Comal County, including Canyon Reservoir. Canyon Reservoir is a flood control and water supply reservoir, impounding the Guadalupe River with a normal pool elevation of 909 feet mean sea level (msl).

Segment Concerns: Explosive suburban growth in the Canyon Reservoir region.

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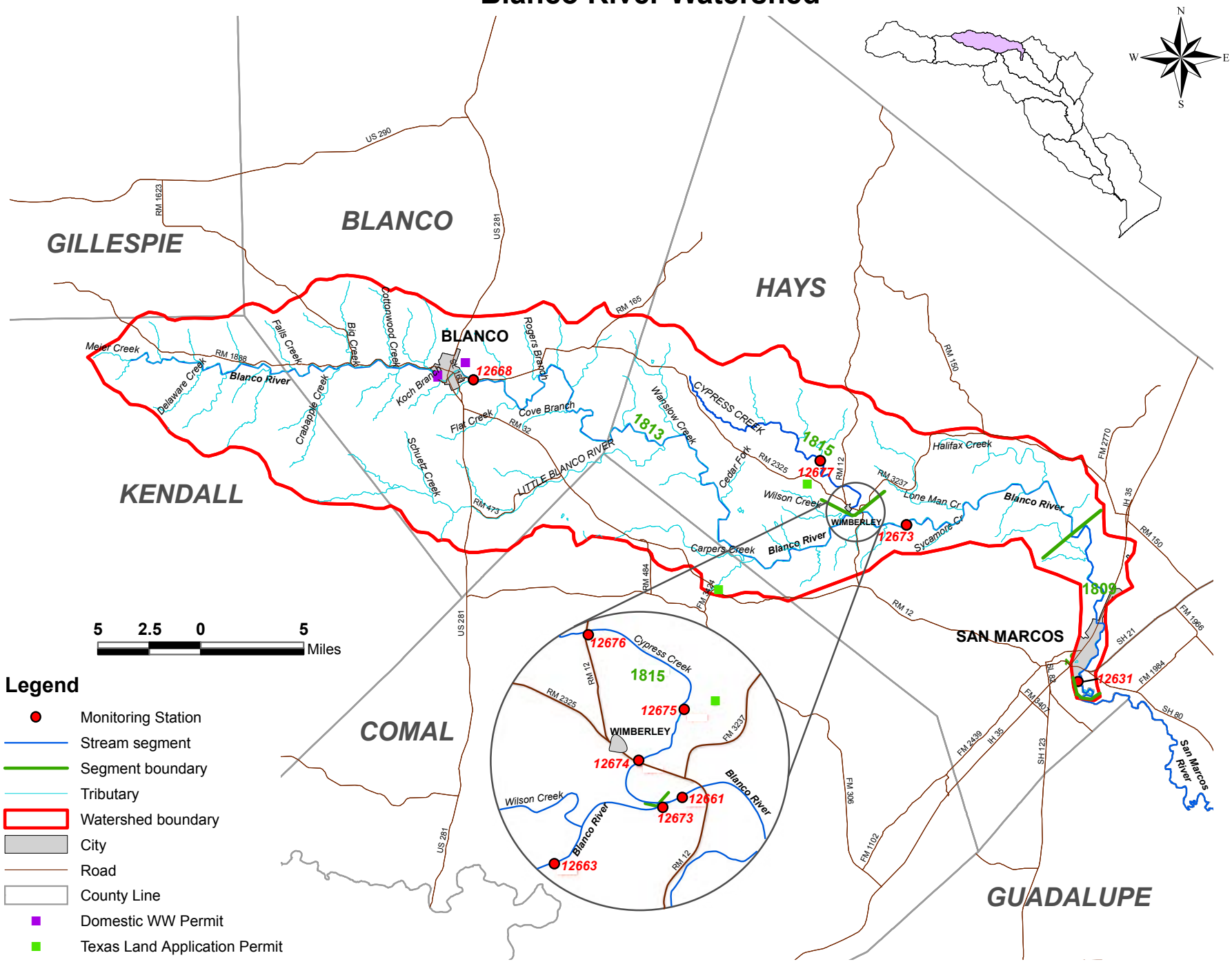
Blanco River Watershed



Blanco River Watershed

Drainage Area: 440 square miles

Streams and Rivers: Guadalupe River, Lower Blanco River, Upper Blanco River, Cypress Creek, Meier Creek, and Sycamore Creek

Aquifers: Edwards-Trinity, Trinity

River Segments: 1813, 1815, 1809

Cities: Blanco, Fisher, Wimberley, Kyle, San Marcos

Counties: Kendall, Comal, Blanco and Hays

EcoRegion: Edwards Plateau

Vegetation Cover:

Evergreen Forest - 42.9%	Shrublands - 11.0%
Grass/Herbaceous - 32.2%	Deciduous Forest - 7.7%

Climate:

Average annual rainfall: 31 inches
Average annual temperature: January 34° July 94°

Land Uses: Urban, Agricultural Crops (wheat, hay, oats, peaches & pecans), Sheep, Cattle, Goats and Turkey Productions; Light Manufacturing and Recreation

Water Body Uses: Aquatic Life Use, Contact Recreation Use, General Use, Fish Consumption Use, and Public Water Supply Use

Soils: Varies from thin limestone to black, waxy, chocolate, and grey loam, calcareous, stony, and clay loams

Permitted Wastewater Treatment Facilities

Domestic: 2 Land Application: 3
Industrial: 0

RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

Segment 1813 *(Upper Blanco River)*: Flowing 71 miles from northern Kendall County until Lime Kiln Road in Hays County, the upper Blanco is a spring-fed stream. Cypress Creek joins the river in the village of Wimberley. The steep sloped, intermittent, meandering stream is lined with bald cypress, oak and Ashe juniper.

Segment Concerns: Suburban growth (large lot housing developments) along the 281 corridor between San Antonio and Blanco is a growing concern because of the potential for nonpoint source pollution. Water quantity and quality are problems during times of drought.

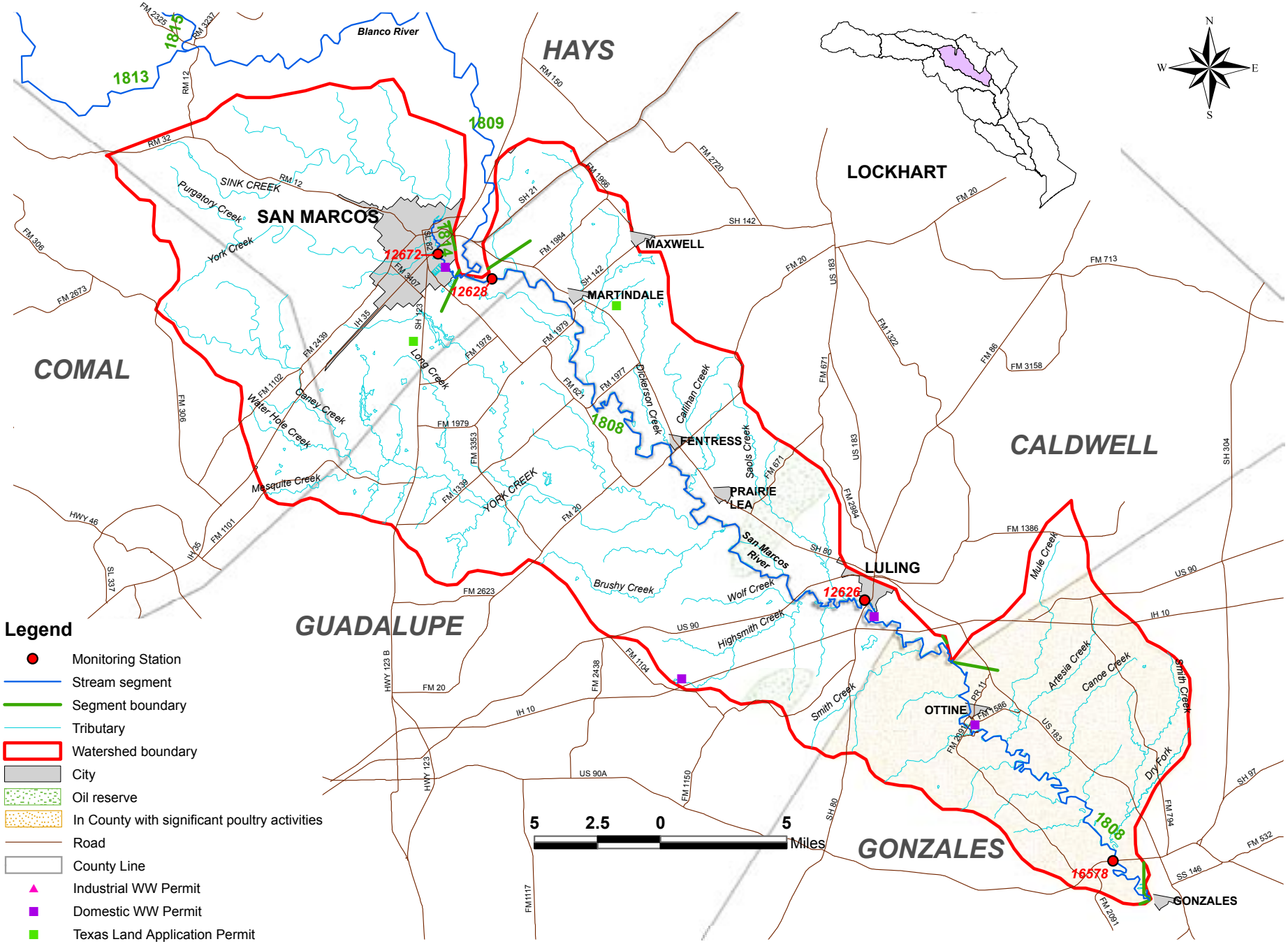
Segment 1815 *(Cypress Creek)*: The spring-fed creek flows 14 miles into the village of Wimberley where it merges with the Blanco River in Hays County. A picturesque creek, lined with bald cypress trees, with good water quality.

Segment Concerns: The segment is experiencing tremendous residential and commercial suburban growth. Occasional high levels of *E coli* bacteria, likely due to faulty septic tanks.

Segment 1809 *(Lower Blanco River)*: This 15-mile lower stretch of the Blanco River from Limekiln Road until the confluence with the San Marcos River varies from a rapid moving stream as it crosses the Balcones Fault Zone to a shallow, slow moving stream, lined with scrub oaks as it enters the Blackland Prairies.

Segment Concerns: Located in the middle of the IH-35 corridor - forming the northern boundary of the growing city of San Marcos and the southern border for the city of Kyle. One concern for the segment is increased population growth, which could lead to nonpoint source pollution.

San Marcos River Watershed



San Marcos Watershed

Drainage Area: 522 square miles

Streams and Rivers: Lower San Marcos River, Upper San Marcos River, Sink Creek, York Creek

Aquifers: Edwards-Balcones Fault Zone, Carrizo-Wilcox

River Segments: 1814, 1808

Cities: San Marcos, Maxwell, Martindale, Fentress, Prairie Lea, Luling, Ottine, Gonzales

Counties: Hays, Guadalupe, Caldwell, Gonzales

EcoRegion: Edwards Plateau
East Central Texas Plains
Texas Blackland Prairies

Vegetation Cover:

Pasture/Hay- 27.0%	Evergreen Forest - 12.8%
Grass/Herbaceous - 16.3%	Shrublands - 12.2%
Deciduous Forest - 19.0%	Row Crops - 8.6%

Climate:
Average annual rainfall: 33 inches
Average annual temperature: January 40° July 96°

Land Uses: Urban, Industry, Agricultural Crops (corn, sorghum, hay, cotton, wheat, pecans), Cattle & Hog Production, Poultry Production, Oil Production, and Recreation

Water Body Uses: Aquatic Life Use, Contact Recreation Use, General Use, Fish Consumption Use, and Public Water Supply Use

Soils: Varies from thin limestone to black, waxy, chocolate, and grey loam

Permitted Wastewater Treatment Facilities:
Domestic: 4 Land Application: 2
Industrial: 0

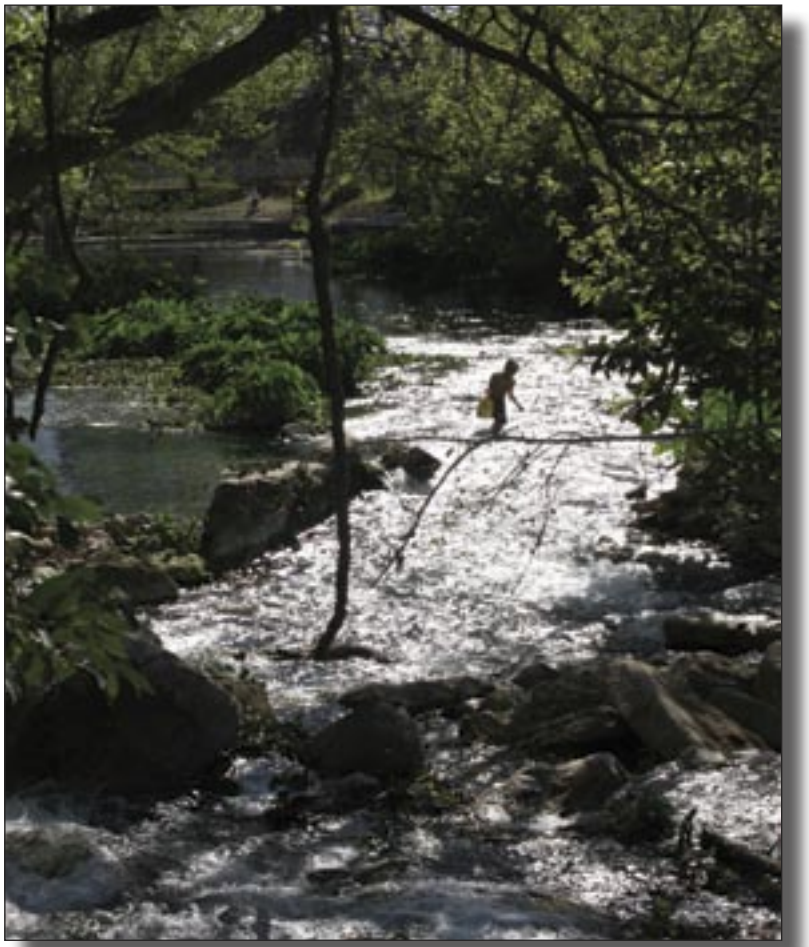
RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

Segment 1814 *(Upper San Marcos River)*: Beginning at the San Marcos Springs that are fed by the Edwards Aquifer in Hays County, the five mile stretch of river continues through to the confluence with the Blanco River east of San Marcos. The headwaters of the San Marcos River are clear flowing and a constant temperature year long.

Segment Concerns: The spring-fed stream, sometimes referred to as an island ecosystem, is the home to a number of endangered species that are dependent upon the constancy of clean springflow for their survival. Springflow is a concern during times of drought. Population growth is also a concern in this stream, which is located in the IH 35- growth corridor. Recreation use of the river is high during summer months.

Segment 1808 *(Lower San Marcos River)*: From the confluence of the San Marcos River with the Blanco River continuing about 75 miles until the point of confluence with the Guadalupe River outside the city of Gonzales. Includes the confluence with Plum Creek. The lower San Marcos River is a lazy, smooth flowing river during normal flow.

Segment Concerns: Protecting spring flow is a concern during times of drought. Recreational use of the river is rising. Activities related to the production and transportation of petroleum are potential threats to the watershed. An additional threat includes activities related to poultry production.



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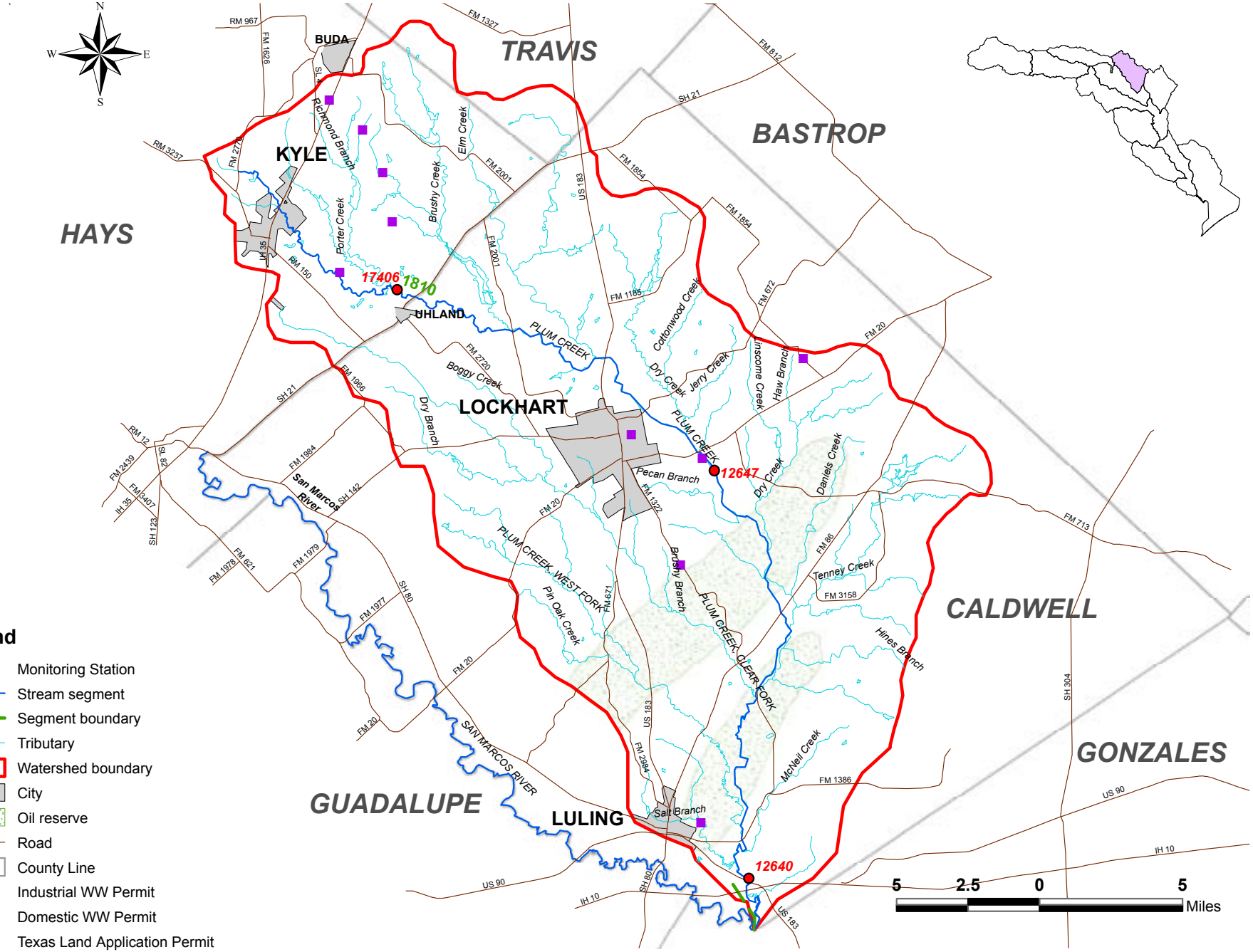
Plum Creek Watershed



Legend

- Monitoring Station
- Stream segment
- Segment boundary
- Tributary
- Watershed boundary
- City
- Oil reserve
- Road
- County Line
- Industrial WW Permit
- Domestic WW Permit
- Texas Land Application Permit

Plum Creek Watershed

Drainage Area: 397 square miles

Streams and Rivers: San Marcos River, Plum Creek, Clear Fork Creek

Aquifers: Edwards-Balcones Fault Zone, Carrizo Wilcox

River Segments: 1810

Cities: Kyle, Buda, Uhland, Luling, Lockhart

Counties: Hays, Travis, Caldwell

EcoRegion: Texas Blackland Prairies
East Central Texas Plains

Vegetation Cover:

Deciduous Forest - 23.6%	Row Crops - 14.4%
Pasture/Hay- 22.9%	Shrublands - 11.4%
Grass/Herbaceous - 22.4%	

Climate:
Average annual rainfall: 33 inches
Average annual temperature: January 40° July 95°

Land Uses: Industry, Urban, Oil & Gas Production, Cattle, Hog and Poultry Productions, Agriculture Crops (sorghum, hay, cotton, wheat and corn)

Water Body Uses: Aquatic Life Use, Contact Recreation Use, General Use, Fish Consumption Use

Soils: Black, waxy soil to sandy soil, limestone to black waxy chocolate and grey loam

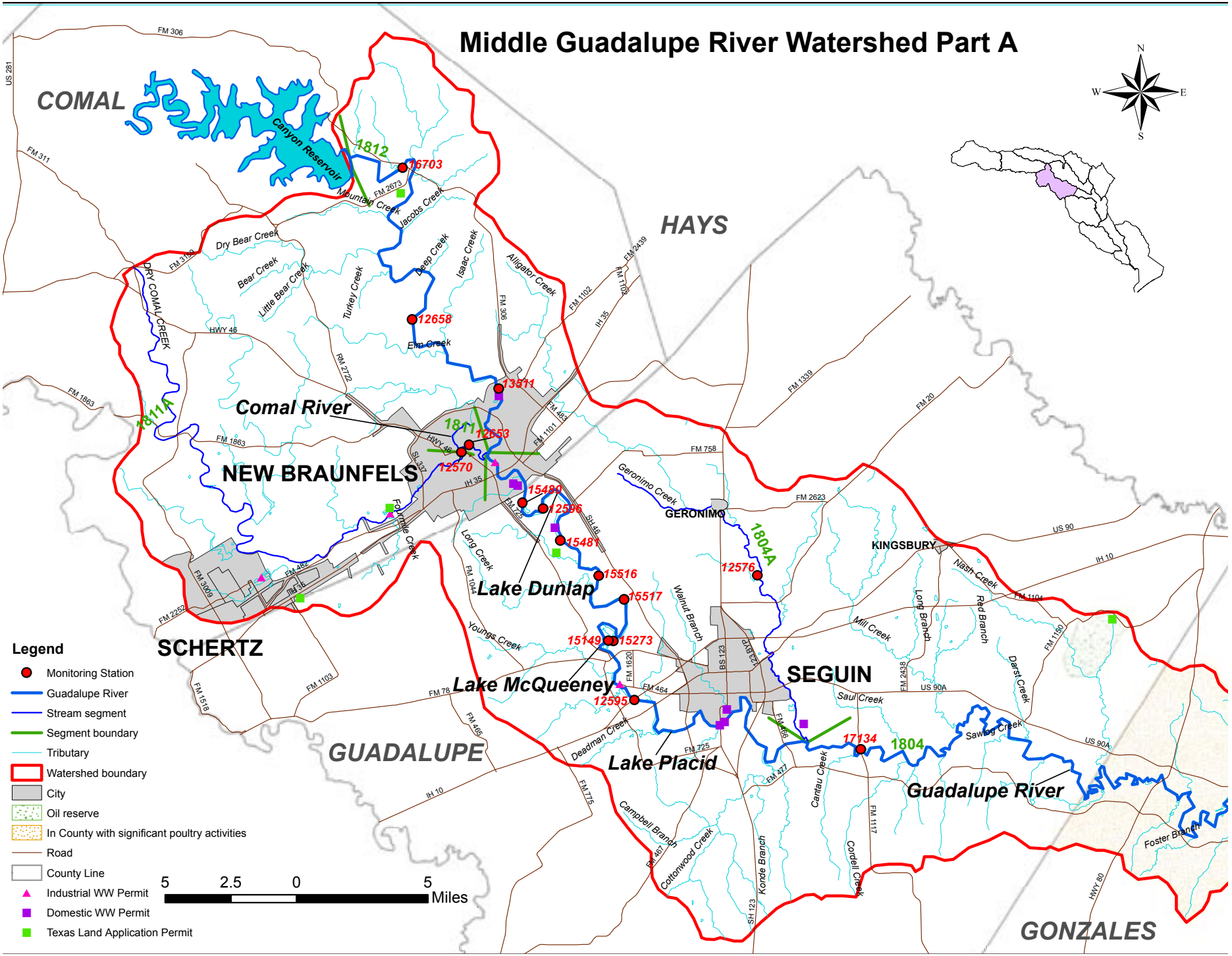
Permitted Wastewater Treatment Facilities:
Domestic: 10 Land Application: 0
Industrial: 0

RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

Segment 1810 *(Plum Creek)*: Plum Creek begins in northeastern Hays County at about FM 2770 and continues 52 miles to the confluence with the San Marcos River south of Luling in Caldwell County. Plum Creek is typically a shallow, slow moving stream flowing through gently rolling hills lined with agricultural fields and scrub oak trees.

Segment Concerns: Nutrient Enrichment is a concern, likely due to high number of wastewater treatment plants contributing effluent. This segment also has some higher bacteria observations. The upper part of the segment has been listed as impaired due to elevated bacteria counts. The southern part of the watershed in Caldwell County has a history of oil and gas activities, leading to concerns for chloride and sulfate that may be contributed by improperly plugged oil and gas wells. Another concern is its location. The segment is in an area that is being developed very rapidly as a suburb of the Austin metropolitan area. This could lead to problems with nonpoint source pollution.

Special Project: The Texas State Soil and Water Conservation Board (TSSWCB) has selected the Plum Creek Watershed for the development of a Watershed Protection Plan (WPP). A WPP is a proactive, voluntary strategy for protecting and improving water quality that identifies appropriate best management practices, needed education and awareness programs, and other measures necessary to ensure the long-term health of the watershed. TSSWCB has partnered with Texas Cooperative Extension to facilitate development and implementation of a WPP through the Plum Creek Watershed Partnership (PCWP), a collaboration between local citizens and regional entities, including GBRA, Plum Creek Conservation District, Caldwell-Travis Soil and Water Conservation District, and Hays County Soil and Water Conservation District. Local stakeholders are vital to the success of the PCWP and to protecting the region's water resources now and into the future. For more information, please visit <http://pcwp.tamu.edu/>.


Middle Guadalupe River Watershed Part A
COMAL
HAYS
GUADALUPE
GONZALES
NEW BRAUNFELS
SCHERTZ
SEGUIN
GERONIMO
KINGSBURY
Canyon Reservoir
Lake Dunlap
Lake McQueeney
Lake Placid
Comal River
Guadalupe River
1812
1811A
1811
1804A
1804
16703
12658
13311
12653
12570
15480
12596
15481
15516
15517
15149
15273
12595
12576
17134
Legend
Monitoring Station
Guadalupe River
Stream segment
Segment boundary
Tributary
Watershed boundary
City
Oil reserve
In County with significant poultry activities
Road
County Line
Industrial WW Permit
Domestic WW Permit
Texas Land Application Permit
5 2.5 0 5
Miles

Middle Guadalupe Watershed (Part A)

Drainage Area: 939 square miles

Streams and Rivers: Guadalupe River below Canyon Dam, Dry Comal Creek, Comal River, Geronimo Creek

Lakes: Lake Dunlap, Lake McQueeney, Lake Placid

Aquifers: Edwards Trinity, Edwards Balcones Fault Zone, Carrizo Wilcox

River Segments: 1804, 1811, 1812

Cities: Sattler, New Braunfels, Schertz, Seguin, Geronimo, Kingsbury

Counties: Comal, Guadalupe, Gonzales

EcoRegions: Texas Blackland Prairies
East Central Texas Plains

Vegetation Cover:

Pasture/Hay- 25.5%	Grass/Herbaceous - 15.1%
Evergreen Forest - 18.0%	Shrublands - 12.0%
Deciduous Forest - 15.5%	Row Crops - 8.1%

Climate:
Average annual rainfall: 29 inches
Average annual temperature: January 35° July 95°

Land Uses: Urban, Light Manufacturing, Heavy Manufacturing, Farming, Cattle Ranching, Poultry, Petroleum Production, Gravel Mining

Water Body Uses: Aquatic Life, Contact Recreation, Fish Consumption, General, Public Water Supply, Hydroelectricity , Agricultural, Industrial

Soils: Dark, calcareous clay, sandy loam, loam with clay subsoils; dark red sandstone, light tan and gray sandstone

Permitted Wastewater Treatment Facilities:
Domestic: 8 Land Application: 5
Industrial: 4

MIDDLE GUADALUPE A - RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

Segment 1812 *(Guadalupe River Below Canyon Dam)*: As the Guadalupe River flows from Canyon Dam to the confluence with the Comal River, the river is considered to be one of the finest white-water stretches in the state. The rapids are attributed to the change in elevation as the river cuts through the Balcones Fault Zone. The river is scenic, with limestone bluffs, bald cypress, pecan and elm trees. Trout Unlimited takes advantge of the cold-water releases from the bottom of Canyon Dam and sponsors the stocking of rainbow trout in the tailrace.

Segment Concerns: Water quality is good. Releases from Canyon Reservoir can become anoxic in late summer and early fall but the stilling basin and weirs aerate the water to above the standard for aquatic life use. The area is subject to intense water recreation activities during summer months. One area of concern for the future is population growth and accelerating development, which could lead to nonpoint source pollution.

Segment 1811 *(Comal River)*: The 2 ½ mile long Comal River, spring-fed from the Edwards Aquifer, has no water quality concerns but has developed large stands of aquatic macrophytes. The clean, clear, fast moving water is a constant temperature all year, and supports a number of endangered species as well as intensive recreational uses. Dry Comal Creek is also included in this segment.

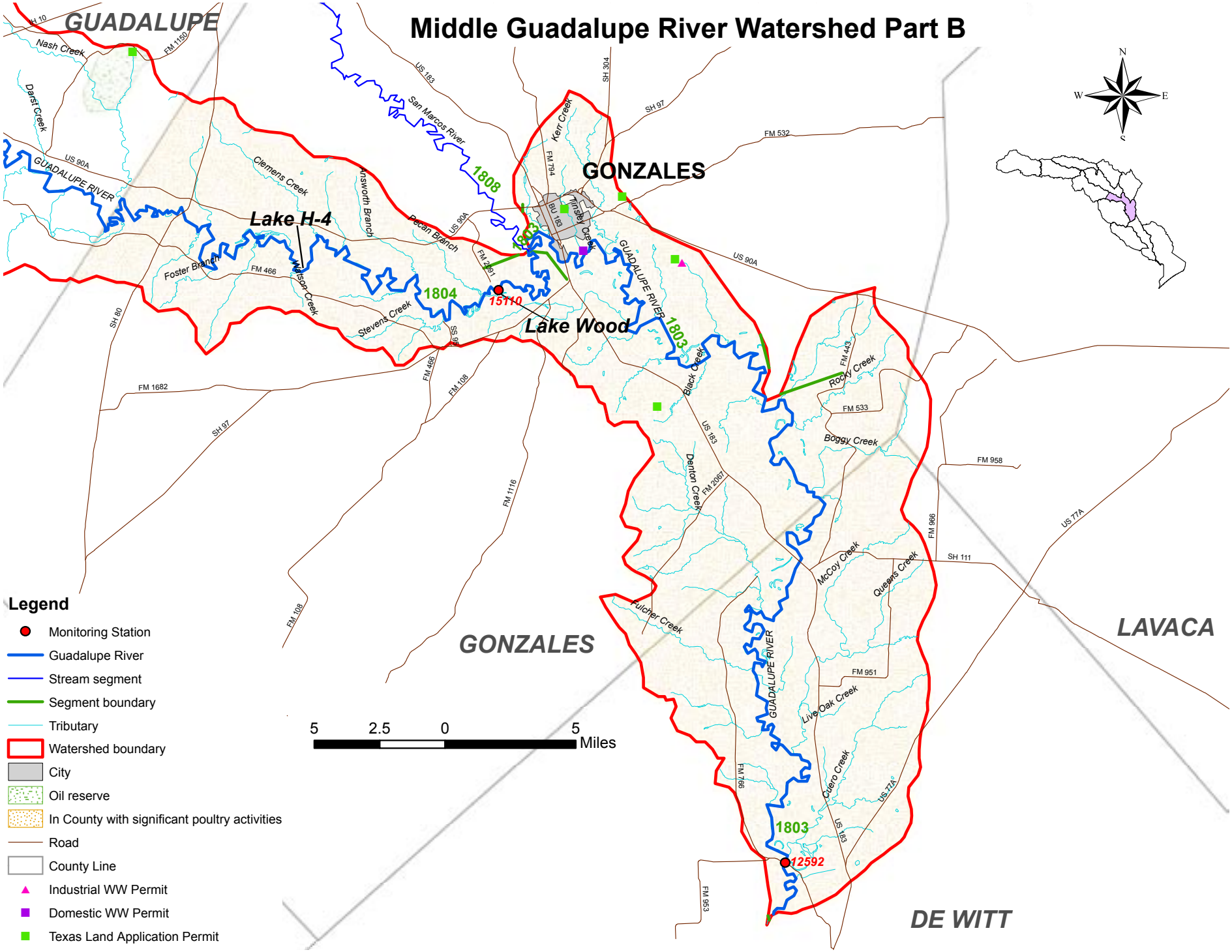

Drew C. Engelke

Segment Concerns: No water quality concerns at present, but population growth and associated problems such as faulty wastewater collection systems in the city of New Braunfels and the surrounding region are something to monitor in the future.

Segment 1804 *(Guadalupe River Below Comal River)*: This stretch of the Guadalupe River between the confluence with the Comal River in New Braunfels to the confluence of the San Marcos River in Gonzales is a beautiful flowing river. Seven GBRA hydroelectric facilities utilize the elevation changes, creating small lakes that are widely used for recreation in Guadalupe County. Lake elevations are managed by GBRA. From New Braunfels to below Seguin, the banks of the hydroelectric lakes are lined with private residences, primarily on septic tanks.

Segment Concerns: Data from Stations 15149 and 15273 indicate a concern for excessive algal growth (see Nutrient Study pp 2-3). Data from Station 14932 on Geronimo Creek indicates a concern for nutrient enrichment, likely due to agricultural activity - fertilizers seeping into groundwater and caught up in creek runoff. Another concern in the watershed is population growth. The hydroelectric lakes have a history of problems created by non-native invasive aquatic macrophytes such as water hyacinth and hydrilla.

Special Study: In 2005, a nutrient study on Lakes Dunlap and McQueeney was undertaken to determine if there is a spatial relationship as the water moves downstream through Lakes Dunlap and McQueeney. Additionally, it was to determine if the relationship between flow and *chlorophyll a* as seen in the historical data was supported in the study period. See pages 2-3 in this report for details of the study.


Middle Guadalupe River Watershed Part B
GUADALUPE
GONZALES
LAVACA
DE WITT
Lake H-4
Lake Wood
1808
1807
1804
1803
15110
12592
Nash Creek
Darst Creek
Clemens Creek
Ainsworth Branch
Pecan Branch
Foster Branch
Watson Creek
Stevens Creek
Kerr Creek
Tinsley Creek
Black Creek
Rocky Creek
Boggy Creek
Denton Creek
McCoy Creek
Queens Creek
Fulcher Creek
Live Oak Creek
Cuero Creek
San Marcos River
GUADALUPE RIVER
US 90A
US 183
SH 97
SH 304
FM 532
FM 794
BU 183
FM 2091
FM 466
SH 80
FM 1682
FM 109
FM 1116
FM 443
FM 533
FM 2067
FM 958
FM 966
SH 111
US 77A
FM 951
FM 766
FM 953
N
W
E
S
Legend
Monitoring Station
Guadalupe River
Stream segment
Segment boundary
Tributary
Watershed boundary
City
Oil reserve
In County with significant poultry activities
Road
County Line
Industrial WW Permit
Domestic WW Permit
Texas Land Application Permit
5 2.5 0 5
Miles

Middle Guadalupe Watershed (Part B)

Drainage Area: 939 square miles

Streams and Rivers: Guadalupe River below Canyon Dam, Guadalupe River from confluence with the San Marcos River

Lakes: Lake H-4, Lake Wood

Aquifers: Carrizo Wilcox

River Segments: 1803, 1804

Cities: Gonzales

Counties: Guadalupe, Gonzales, Lavaca, DeWitt

EcoRegions: Texas Blackland Prairies
East Central Texas Plains

Vegetation Cover:

Pasture/Hay- 25.5%	Grass/Herbaceous - 15.1%
Evergreen Forest - 18.0%	Shrublands - 12.0%
Deciduous Forest - 15.5%	Row Crops - 8.1%

Climate:
Average annual rainfall: 29 inches
Average annual temperature: January 35° July 95°

Land Uses: Urban, Light Manufacturing, Heavy Manufacturing, Farming, Cattle Ranching, Poultry, Petroleum Production, Gravel Mining

Water Body Uses: Aquatic Life, Contact Recreation, Fish Consumption, General, Public Water Supply, Hydroelectricity , Agricultural, Industrial

Soils: Dark, calcareous clay, sandy loam, loam with clay subsoils; dark red sandstone, light tan and gray sandstone

Permitted Wastewater Treatment Facilities:
Domestic: 1 Land Application: 4
Industrial: 1

MIDDLE GUADALUPE B - RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

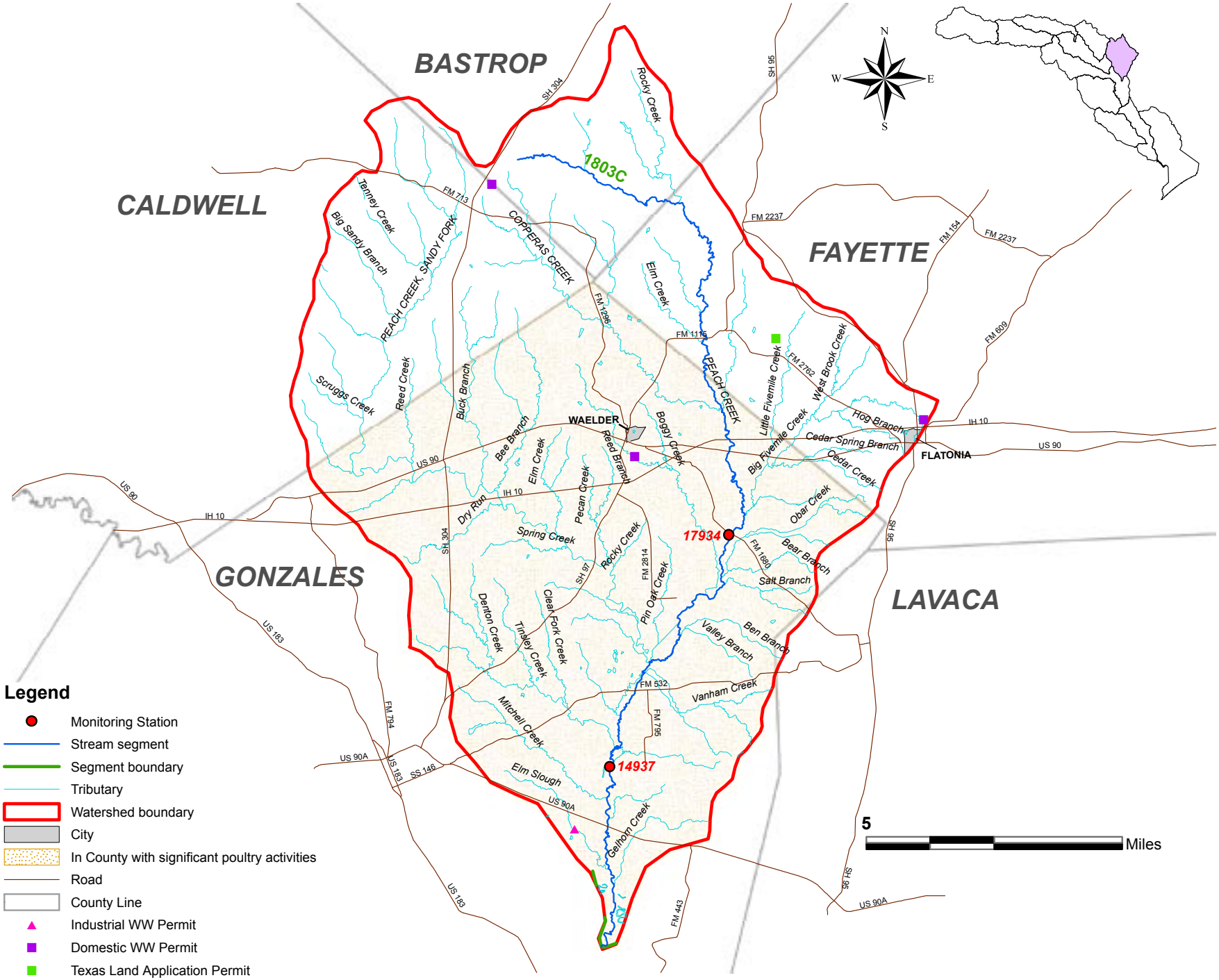
Segment 1804 *(Guadalupe River Below Comal River):* This stretch of the Guadalupe River between the confluence with the Comal in New Braunfels to the confluence of the San Marcos River in Gonzales is a beautiful flowing river. Seven GBRA hydroelectric facilities utilize the elevation changes, creating small lakes that are widely used for recreation in Guadalupe County. Lake elevations are managed by GBRA.

Segment Concerns: Data from Stations 15149 and 15273 indicate a concern for excessive algal growth (see Nutrient Study pp 2-3). Data from Station 14932 on Geronimo Creek indicates a concern for nutrient enrichment, likely due to agricultural activity - fertilizers seeping into groundwater and caught up in creek runoff. Another concern in the watershed is population growth. The hydroelectric lakes have a history of problems created by non-native invasive aquatic macrophytes such as water hyacinth and hydrilla.

Segment 1803 *(Guadalupe River Below San Marcos River):* From the point of confluence of the San Marcos River, the Guadalupe becomes a much larger, slower moving stream as it flows toward the coast. Elevation changes are minimal.

Segment Concerns: A number of large poultry farms and cattle ranches are located in this area. To date, there have been no problems in the main segment associated with these land uses, although subwatersheds have been listed as impaired (1803B Sandies Creek and 1803C Peach Creek). See website for links to information on TMDL studies on these streams.

Peach Creek Watershed



Legend

- Monitoring Station
- Stream segment
- Segment boundary
- Tributary
- Watershed boundary
- City
- In County with significant poultry activities
- Road
- County Line
- Industrial WW Permit
- Domestic WW Permit
- Texas Land Application Permit

Peach Creek Watershed

Drainage Area: 480 square miles

Streams and Rivers: Guadalupe River, Peach Creek, Copperas Creek

Aquifers: Carrizo-Wilcox

River Segments: 1803C

Cities: Waelder, Flatonia

Counties: Caldwell, Bastrop, Fayette, Gonzales

EcoRegion: Texas Blackland Prairies
East Central Texas Plains

Vegetation Cover:

Pasture/Hay- 21.1%	Shrublands - 13.9%
Grass/Herbaceous - 23.4%	Deciduous Forest - 34.1%

Climate:
Average annual rainfall: 31 inches
Average annual temperature: January 39° July 94°

Land Uses: Recreation, Extensive Cattle and Poultry Productions, Light Industry

Water Body Uses: Aquatic Life Use, Contact Recreation Use, Fish Consumption Use

Soils: Dark red sandstone and tan and grey sandstone

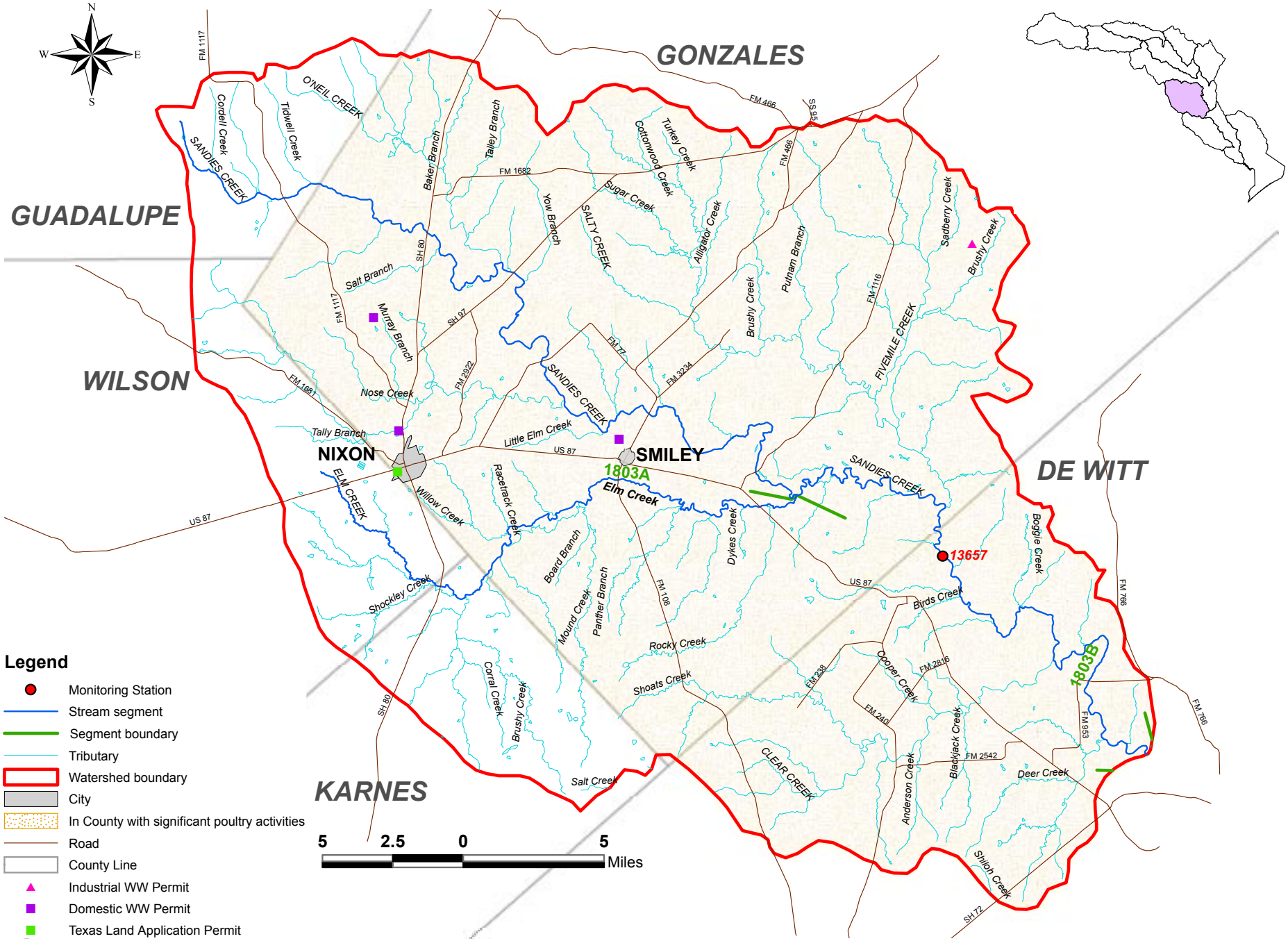
Permitted Wastewater Treatment Facilities:
Domestic: 3 Land Application: 2
Industrial: 1

RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

Segment 1803C *(Peach Creek) (Unclassified water body)*: A small system, Peach Creek flows east and south through gently rolling hills for 64 miles from Bastrop and Fayette counties northeast of Waelder into the Guadalupe River in eastern Gonzales County.

Segment Concerns: Contact recreation use is a concern due to bacteria. Peach Creek was included in a TMDL project conducted by the TCEQ. See the GBRA website for links to information on the TMDL study on this watershed.

Sandies Creek Watershed



Legend

- Monitoring Station
- Stream segment
- Segment boundary
- Tributary
- Watershed boundary
- City
- In County with significant poultry activities
- Road
- County Line
- Industrial WW Permit
- Domestic WW Permit
- Texas Land Application Permit

Sandies Creek Watershed

Drainage Area: 711 square miles

Streams and Rivers: Guadalupe River, Elm Creek, and Sandies Creek, Five Mile Creek, Salty Creek, Clear Creek, O'Neil Creek

Aquifers: Carrizo-Wilcox, Gulf Coast

River Segments: 1803A, 1803B

Cities: Smiley, Nixon

Counties: Guadalupe, Karnes, Wilson, Gonzales, DeWitt

EcoRegion: Texas Blackland Prairies
East Texas Central Plains

Vegetation Cover:

Pasture/Hay- 24.9%	Deciduous Forest - 19.6%
Grass/Herbaceous - 24.3%	Evergreen Forest - 5.3%
Shrublands - 21.1%	Row Crops - 3.4%

Climate:
Average annual rainfall: 31 inches
Average annual temperature: January 39° July 94°

Land Uses: Light Manufacturing, Extensive Cattle Production and Poultry Production; Agricultural Crops (hay, sorghum, etc.)

Water Body Uses: Aquatic Life Use, Contact Recreation Use, Fish Consumption Use

Soils: Dark red sandstone, light tan and gray sandstone

Permitted Wastewater Treatment Facilities
Domestic: 3 Land Application: 1
Industrial: 1

RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

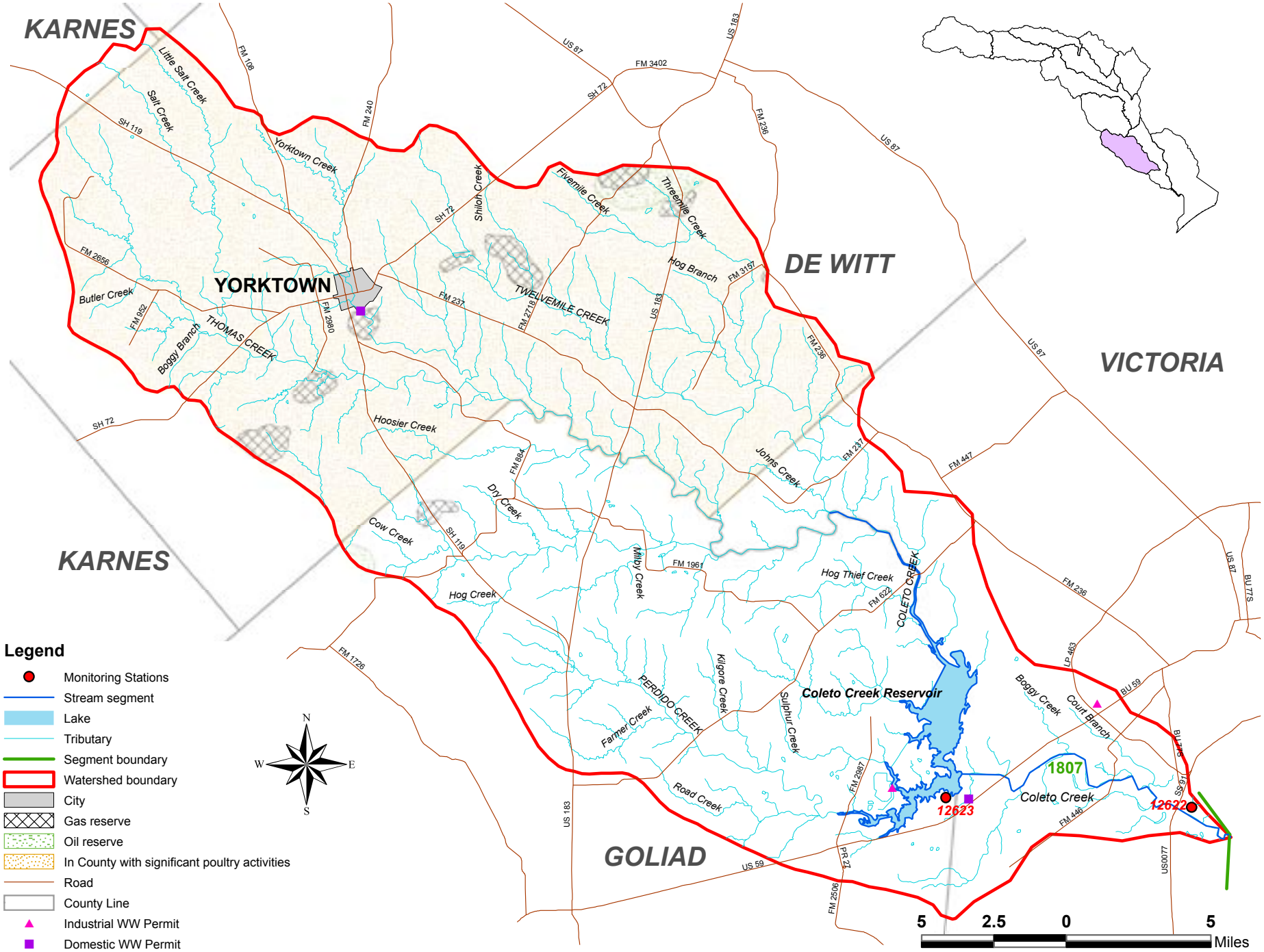
Segment 1803A *(Elm Creek) (Unclassified water body)*: Elm Creek flows 24.3 miles before it confluences with Sandies Creek, east of Smiley in Gonzales County.

Segment Concerns: Entire water body listed as impaired for aquatic life use due to depressed dissolved oxygen; also impaired for contact recreation use due to bacteria. The CRP study done by GBRA and PBS&J in 2001, *Unique Challenges Posed by Small Streams in Determining DO and Bacteria Water Quality Criteria Compliance,* showed that the smaller the stream, the more non-attainment was observed. This is to be expected because the criteria for the streams in Texas were developed for large rivers, not for creeks a few inches deep. Several obvious physical conditions exist: shallow water in close contact with high bacteria and low dissolved oxygen, and more shaded area than large rivers with higher temperature variations. An effort is needed to account for stream size and conditions and develop criteria appropriate to the higher natural variation and physical conditions of smaller streams.

Segment 1803B *(Sandies Creek) (Unclassified water body)*: Sandies Creek is a 65 mile long stream originating in Guadalupe County northwest of Nixon to the confluence of the Guadalupe River west of Cuero in DeWitt County.

Segment Concerns: Impaired for aquatic life use due to depressed dissolved oxygen; impaired for contact recreation uses due to bacteria; concerns for nutrient enrichment due to ammonia levels.

Coleto Creek Watershed



Coleto Creek Watershed

Drainage Area: 558 square miles

Streams and Rivers: Guadalupe River, Coleto Creek, Perdido Creek, Twelve Mile Creek, Thomas Creek

Aquifer: Gulf Coast

River Segments: 1807

Cities: Yorktown

Counties: DeWitt, Goliad, Victoria

EcoRegion: Texas Blackland Prairies
Gulf Coastal Plains

Vegetation Cover:

Pasture/Hay- 15.3%	Shrublands - 9.7%
Grass/Herbaceous - 33.2%	Deciduous Forest - 18.7%
Row Crops - 5.0%	

Climate:
Average annual rainfall: 30 inches
Average annual temperature: January 41° July 95°

Land Uses: Agricultural Crops (sorghum, rice and corn), Beef, Hogs and Poultry Productions and Oil and Gas Production

Water Body Uses: Aquatic Life Use, Contact Recreation Use, Fish Consumption Use, Public Water Supply Use and Power Plant Cooling

Soils: Sandy, sandy loam and clay loam

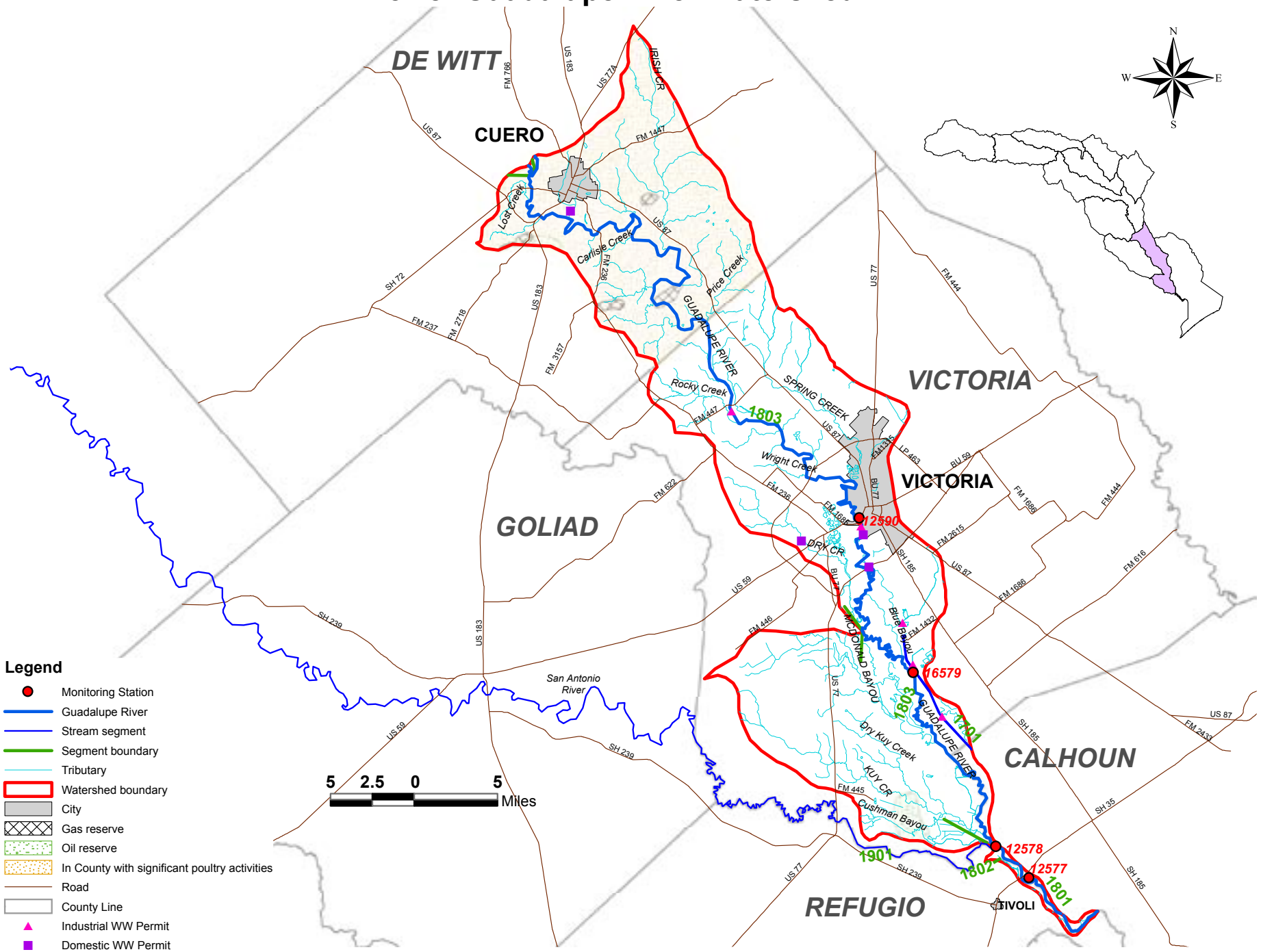
Permitted Wastewater Treatment Facilities:
Domestic: 2
Industrial: 2

RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

Segment 1807 *(Coleto Creek)*: Coleto Creek extends 27miles beginning in DeWitt County, through Goliad and Victoria Counties, including the 3,100 acre Coleto Creek Reservoir to the confluence with the Guadalupe River in Victoria County. Because of the size of Coleto's drainage basin, this normally slow moving creek can become a fast, flowing river during a typical South Texas rainstorm. Much of the creek bottom is made up of sand with typical vegetation ranging from mesquite and huisache to large live oaks and anaque trees. Because of its rural sitting and limited development you can still find a wide range of Texas wildlife along its shores ranging from turkey and deer, to red fox and bobcats; and with the completion of the Coleto Creek Reservoir it now supports over 100 different species of birds with the most noted being the Southern Bald Eagle, Osprey, and Roseate Spoonbills.

Segment Concerns: Coleto Creek Reservoir is used for cooling water which may impact aquatic life (temperature, dissolved oxygen, excessive aquatic macrophyte growth). Oil field activities may be impacting water quality. Increasing numbers of subdivision developments and land clearing on existing ranches along the creek which may impact water quality. Introduction of non-native aquatic plant species into the Coleto Creek system which may have an impact of water quality.

Lower Guadalupe River Watershed



Lower Guadalupe Watershed

Drainage Area: 488 square miles

Streams and Rivers: Guadalupe River Tidal, Guadalupe River Below San Antonio River, and Guadalupe River Below San Marcos River, Sandies Creek, Elm Creek, Coleto Creek, Spring Creek, McDonald Bayou

Aquifers: Carrizo-Wilcox, Gulf Coast

River Segments: part of 1803, 1802, 1801, 1701

Cities: Cuero, Victoria, Tivoli

Counties: Calhoun, Refugio, Victoria, DeWitt

EcoRegion: Gulf Coastal Plains
East Central Texas Plains

Vegetation Cover:

Pasture/Hay- 14.8%	Shrublands - 21.1%
Grass/Herbaceous - 22.6%	Evergreen Forest - 5.7%
Row Crops - 4.2%	Wetlands - 10.2%
Deciduous Forest 14.8%	

Climate:
Average annual rainfall: 37.4 inches
Average annual temperature: January 53° July 84°

Land Uses: Urban, Agricultural Crops (cotton, corn, wheat, rice, hay, grain sorghum), Cattle and Hog Productions, Industrial (plastics, chemicals, petrochemicals)

Water Body Uses: Aquatic Life Use, Contact Recreation Use, General Use, Fish Consumption Use, Heavy Industrial Use, Public Water Supply Use

Soils: Cracking clayey subsoil, sandy, sandy and clay loam

Permitted Wastewater Treatment Facilities:
Domestic: 4
Industrial: 5

RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

Segment 1803 (*Guadalupe River Below San Marcos River*): From the point where the San Marcos River confluences with the Guadalupe River in Gonzales, segment 1803 becomes a twisting, slow-moving coastal river, lined with pecan bottoms, with no rapids of any consequence. This portion of segment 1803 begins to the west of the city of Cuero, flowing to the west of the city of Victoria, to immediately upstream of the confluence with the San Antonio River.

Segment Concerns: Log jams after big rain events. Sandies and Elm Creeks (listed as impaired for low dissolved oxygen and elevated bacteria) flow into this segment.

Segment 1802 (*Guadalupe River Below San Antonio River*): This 0.4 mile long stretch between the confluence of the San Antonio and Guadalupe Rivers to the GBRA Salt Water Barrier is a typical slow moving coastal river.

Segment Concerns: There is concern for the entire segment because of nutrient enrichment (nitrate +nitrite nitrogen) from the San Antonio River.

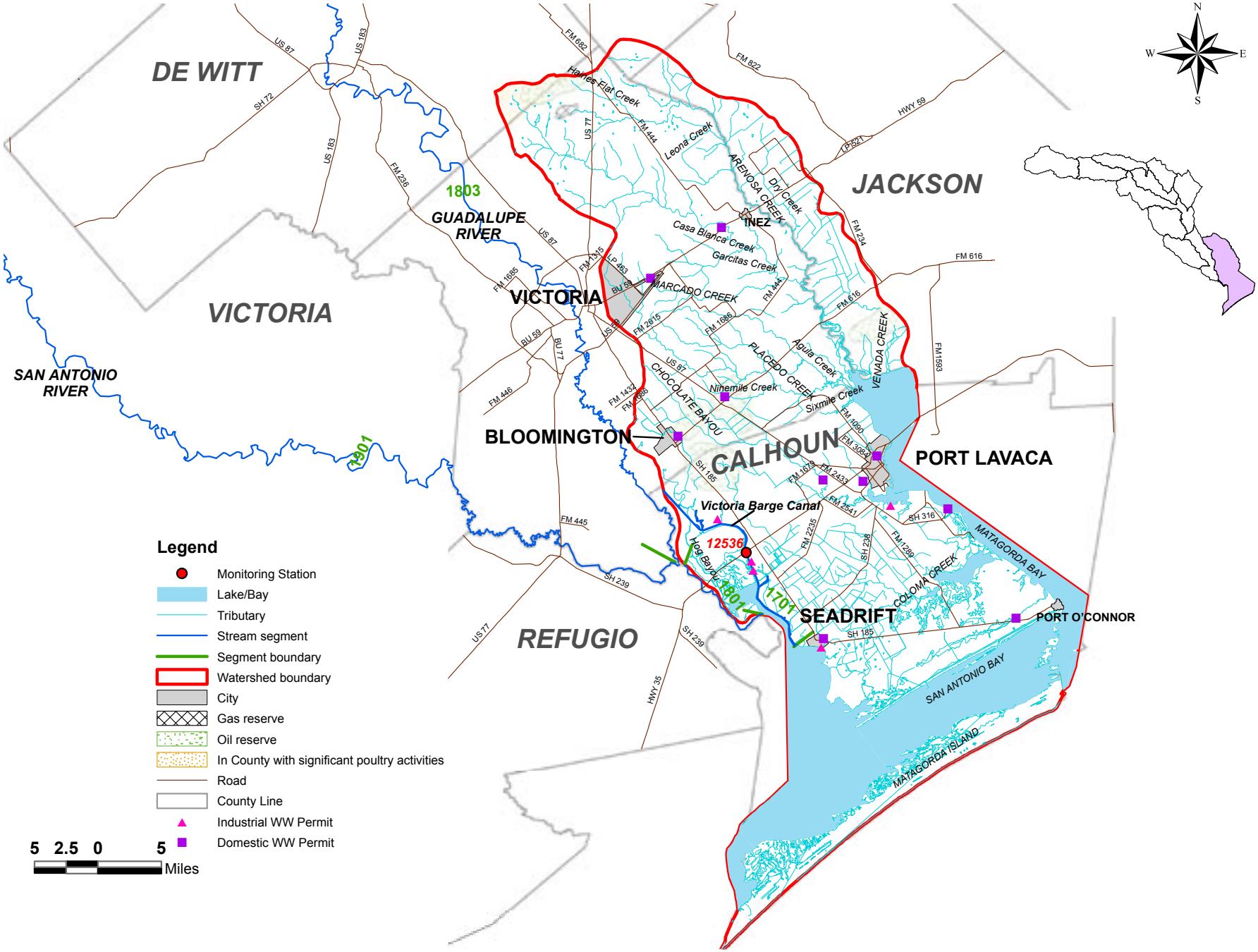
Segment 1801 (*Guadalupe River Tidal*): From ½ mile downstream of the GBRA Salt Water Barrier to the confluence with Guadalupe Bay in Calhoun/Refugio County, this eleven mile stretch is a typical marshy tidal river.

Segment Concerns: The entire segment is impaired for aquatic life use because of depressed dissolved oxygen. There are also nutrient enrichment concerns (nitrate +nitrite nitrogen) coming from the San Antonio River.

Segment 1701
(*Victoria Barge Canal*): From the Victoria Turning Basin in Victoria County to the confluence with San Antonio Bay in Calhoun County.

Segment Concerns:
There is an aquatic life use concern for the entire segment due to depressed dissolved oxygen.

Guadalupe-Lavaca Coastal Basin



Guadalupe-Lavaca Coastal Basin

Drainage Area: 998 square miles

Streams and Rivers: Guadalupe River, Garcitas Creek, Victoria Barge Canal, Marcado Creek, Arenosa Creek

Aquifer: Gulf Coast

River Segments: 1701

Cities: Victoria, Seadrift, Bloomington, Inez, Port O'Connor, Port Lavaca

Counties: Calhoun, Victoria, Jackson

EcoRegion: Gulf Coastal Plains

Vegetation Cover:

Pasture/Hay- 15.1%	Shrublands - 16.9%
Grass/Herbaceous - 13.7%	Deciduous Forest - 8.4%
Row Crops - 21.4%	Wetlands - 17.2%

Climate:
Average annual rainfall: 42 inches
Average annual temperature: January 44° July 93°

Land Uses: Agriculture Row Crops (cotton, corn, rice and grain sorghum), Urban, Recreation, Oil & Gas Production, Cattle, Hog and Poultry Production, Industry (plastics, chemicals, petrochemicals)

Water Body Uses: Aquatic Life Use, Non-contact Recreation Use, Fish Consumption Use, Industrial Cooling

Soils: Clayey subsoils, deep black soil, sandy clay, dark clay loam, clay

Permitted Wastewater Treatment Facilities:
Domestic: 10
Industrial: 5

RIVER SEGMENTS DESCRIPTIONS/CONCERNS:

Segment 1701 *(Victoria Barge Canal):* From the Victoria Turning Basin in Victoria County to the confluence with San Antonio Bay in Calhoun County.

Segment Concerns: There is an aquatic life use concern for the entire segment due to depressed dissolved oxygen.

WATER QUALITY DATA REVIEW

While water quality in the two basins (Basin 18-Guadalupe and Basin 17-Lavaca-Guadalupe) is generally good, a number of water bodies have been assessed by the TCEQ to have water quality issues due mainly to nutrient enrichment, elevated bacteria levels, or depressed dissolved oxygen. The TCEQ assesses the state's water

Drew C. Engelke

bodies every two years under Clean Water Act Section 305(b). The resulting listing is called the Water Quality Inventory. The 2004 Water Quality Inventory (revised in November 2004) is based on water quality samples collected between March 1, 1998 and February 28, 2003 and provides an update on the status of 195 targeted water bodies.

All water bodies that were assessed and found to not meet water quality standards are listed on the 303(d) List of Impaired Waterbodies (see p. 31). Attachment A of this report (pp 38-39) is a summary of all segments as listed in the 2004 305(b) Water Quality Inventory for the Guadalupe River Basin. The draft inventory and the methodology for assessment are available on the TCEQ web page. (www.tnrcc.state.tx.us/water/quality/305_303.html).

The box below is a description of the different types of categories used by the TCEQ to describe water quality conditions. These categories are typically based upon whether a certain percentage of measurements do not meet the surface water quality criteria or screening levels set by the TCEQ.

Categories of Water Quality Conditions

The term ***Impairment*** is assigned by TCEQ to a portion of a water body when certain water quality constituents reach threshold concentrations (as specified in the Texas Surface Water Quality Standards or screening procedure documents) for a minimum number of times over a period of five years. This designation indicates that TCEQ believes the uses of the water body (drinking water supply, recreation, aquatic life, etc.) may have been *impaired*. In other words, the fish may not be able to get enough oxygen to survive, the water may not be suitable for swimming, or the water may not be fit to be used as a public drinking water supply. Streams that are shown to have an *Impairment* for one or more constituents are placed on the TCEQ's CWA Section 303(d) list.

Once a portion of a stream is placed on the list, a series of actions may be taken by the TCEQ, including but not limited to: denial of increases in wastewater permit effluent limits; a Total Maximum Daily Load (TMDL) study to allocate pollutant loads to certain sources; and instituting a strategy for reducing loads from all sources.

Some water bodies are identified with ***Concerns for Use Attainment (primary concerns)***. These concerns are identified for parameters such as dissolved oxygen which are directly tied to support of designated uses and criteria adopted in the Texas Surface Water Quality Standards.

Use Concerns-Limited Data are identified for parameters where less than 10 samples were available for assessment and some exceedances of the water quality criteria were identified.

Use Concerns are identified for parameters that support the designated use as determined by an adequate number of samples, but a few reported exceedances of the water quality criteria indicated a potential water quality problem.

Water Quality or Secondary Concerns are identified for parameters 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.

The reader should be aware that most of the waters so identified are small creeks, many of which are not designated water quality segments and therefore do not have water quality criteria developed for their unique hydrological conditions. They are assessed using the criteria applied to the nearest downstream designated segment. The nearest downstream segment is often the Guadalupe River, which is significantly different in physical conditions from a small stream. Moreover, a small stream may be dry most of the time so that monitoring may be dominated by runoff samples. It is unclear how small streams should be assessed but, at the current time, the method used does not appear to reflect actual stream conditions.

G. Michael Smith

2004 Clean Water Act Section 303(d) List of Impaired Water Bodies for the Guadalupe River Basin

Segment Number	Area	Parameter of Impairment
1801	Guadalupe River Tidal (entire segment)	DO
1803A	Elm Creek (entire water body)	DO, Bacteria
1803B	Sandies Creek (from the confluence with Elm Creek of upper end of water body)	DO
1803B	Sandies Creek (from the confluence with Elm Creek to upper end of water body)	Bacteria
1803B	Sandies Creek (from the confluence with the Guadalupe River to the confluence with Elm Creek)	DO
1803B	Sandies Creek (from the confluence with the Guadalupe River to the confluence with Elm Creek)	Bacteria
1803C	Peach Creek (lower 25 miles)	Bacteria
1806	Guadalupe River above Canyon Lake (from 1 mile upstream of Flat Rock Dam to the confluence with Camp Meeting Creek)	Bacteria
1806	Guadalupe River above Canyon Lake (from RR 394 1 mile downstream)	Bacteria
1806A	Camp Meeting Creek (entire waterbody)	DO
1810	Plum Creek (from approximately 1 mile downstream of Caldwell CR 202 to upper end of segment)	Bacteria

2005 INVENTORY OF EVENTS THAT COULD IMPACT WATER QUALITY (entire historial listing available on www.gbra.org)

Date	Event	Subwatershed/ Waterbody/ River Segment	Comments
Feb 2005	Major natural gas pipeline exposed in Guadalupe River south of Victoria	1803	Changing currents in the Guadalupe River south of Victoria have exposed a 30-foot portion of a major natural gas pipeline running beneath the river. The 26″ diameter pipeline is owned by Transco and was installed in 1950. The pipeline extends from South Texas to New York City and supplies 10 percent of the natural gas consumed in the U.S. There is no immediate safety risk. It will be repaired in early spring or summer and will not need to be taken out of service during the repairs.
Feb 2005	Leaking oil field storage tanks located on Hog Creek in Goliad County	1807	Oil tanks belonging to the KEBO Oil Co. had been leaking approximately two weeks when located because of a hydrocarbon smell in Hog Creek, a creek in the Coleto Creek watershed. The spill was contained before any contaminants reached Coleto Creek or the reservoir. Samples were taken downstream and in the reservoir for oil-related organic compounds and none were detected. The Railroad Commission was in charge of the response and clean-up.
April 2005	Shooting range to open in Kerr County, along Cypress Creek	1806	The Hill Country Shooting Sports Center, located near Kerrville, in Kerr County, has opened and has been selected as the venue for several major competitions in the coming years. Concern has been voiced on the impact the range will have on the water quality of the intermittent stream, Cypress Creek, and the Guadalupe River. Both GBRA and UGRA will periodically visit the stream and if necessary take samples to determine if impacts are occurring.
May 2005	Hydraulic fluid spill flows into San Marcos River	1814	Hydraulic fluid spilled from a garbage truck and then was washed into a storm drain early on the morning of May 9, 2005. Firefighters installed absorbent booms and sand bags to contain the fluid. No dead fish or wildlife were found. The volume lost was unknown.
June 2005	Permit to land apply WWTP sludge on Arenosa Creek Ranch in Victoria County	2453	A public meeting was held to discuss Land Application Permit no. WQ0004666000, a site that could be permitted to accept water and wastewater treatment plant sludge. The land is located 10 miles NW of Inez, Texas, Victoria County, in the Lavaca-Guadalupe Coastal Basin. The site will be managed by Beneficial Land Management, Jesse Mayfield, operator.
June 9, 2005	Lift station overflow on Geronimo Creek releases approximately 800,000 gallons of raw wastewater into the creek	1804	The City of Seguin lost power to the lift station serving the Geronimo Creek WWTP that resulted into the release of 800,000 gallons of untreated waste-water into the Geronimo Creek and then into the Guadalupe River. GBRA visited the creek and at FM 1117 on the Guadalupe River and took water samples and observed no impairment to fish and wildlife. Power was restored by 11:30 p.m. (10 hours without power).

Date	Event	Subwatershed/ Waterbody/ River Segment	Comments
Sept. 1 2005	Small leak in PVC pipe carrying salt water from oil well near San Marcos River near Luling	1808	A small leak developed in a pipe carrying salt water associated with oil field activities. The pipe is owned by Vintage Petroleum Co. Vintage built a berm to contain the spill which amounted to less than 1,000 gallons and used a vacuum truck to remove the liquid. The leak occurred near the town of Stairtown and was potential threat to the San Marcos River.
Sept. 2005 - Jan. 2006	Citizens voice concerns about quarry operations in Kerr County	1806	Residents of Kerr County are concerned about quarry and rock crushing operations near the Guadalupe River. They are concerned about impacts to water and air quality as well as impacts to water flow and river banks.
Oct. 2005	Complaints continue on plant material coming from Landa Lake	1811	Large mats of vegetative material made up of leaves from the aquatic plant Vallisneria (described as long, thin strands, dark green and ribbon-like) have been reported on the Comal River and Lake Dunlap, and originating in Landa Lake. The leaves appear to be cut immediately above the roots of the plant. The New Braunfels Parks Department is not cutting the plants. The probable causes of the mats of broken or cut plant material could be homeowners along the lake clearing their waterfront or the Giant Ram's Horn Snail that was introduced to Landa Lake in 1983.
Oct. 2005	Statewide Survey of Golden Alga includes Coleto Creek Reservoir	1807	*Prymnesium parvum*, golden algae, can produce blooms that are highly toxic and have caused large fish kills in some Texas reservoirs. The Texas Parks and Wildlife Department is conducting a study across the state, looking for the alga, and the water quality conditions that may prompt its blooms. The Coleto Creek Reservoir in Goliad County has been included in the study. Water quality data, cell count and bioassays are being collected and the final report should be available in August 2006.
Nov. 2005	Oil spill on Guadalupe River near Domino Five, Guadalupe County	1804	A large film of oil was reported on the Guadalpe River but diminished within a week of the first sighting. The report stated that a steady, thick oily film was seen coming down the center of the river. Neighbors report that there have been two oil-drilling companies working in close proximity to the river. At least seven oil wells were operating at the time of the investigation and there was evidence of earth moving activities.
Nov. 2005	New Texas Watch monitoring group forms in Kerr and Gillespie Counties - Will monitor water leaving Old Tunnel, home to over 3 million Mexican free-tailed bats	1806	A monitoring group has formed to monitor the water flowing through the abandoned railroad tunnel that is home to over 3 million Mexican free-tailed bats. The Old Tunnel is located south of Grapetown and west of Luckenbach, on the Balcones Escarpment. The unnamed tributary flows into Block Creek and then into the Guadalupe River in Kendall County. GBRA is helping with training of the new group.

PUBLIC INVOLVEMENT AND OUTREACH ACTIVITIES

The CRP in the Guadalupe Basin strives to maintain active communication with the public to pursue the goals of public involvement and education in water quality issues. The GBRA and UGRA maintain a number of communication mechanisms to support this CRP effort. GBRA develops opportunities for direct public participation to ensure that community concerns are addressed. These include quarterly *Water Resource's* newsletters, web sites, issuing press releases regarding various water topics, making public presentations to schools and other interested groups, and providing teacher workshops. The UGRA has a similar level of public outreach on water quality issues.

The Guadalupe River Basin Steering Committee

A major communication vehicle for the CRP is the Basin Steering Committee. This group, composed of community leaders and interested citizens from throughout the basin, meets annually to review activities and advise the program on priorities for monitoring and special studies. The Steering Committee membership includes: representation from municipalities, counties, industries, homeowner organizations, Texas Soil and Water Conservation Board, Texas Parks and Wildlife Department, Texas Department of Agriculture, Texas Railroad Commission, League of Women Voters and chambers of commerce, local and regional environmental organizations. Steering Committee meetings are OPEN TO THE PUBLIC with the primary purpose of reviewing and approving achievable basin water quality objectives and priorities, considering available technology and economic impacts, and guiding work plans and the allocation of available resources. Notice of the Steering Committee meetings is made available by mailed notices, as well as on the meeting page of the GBRA website (www.gbra.org).

HOW CAN YOU GET INVOLVED? Send an email addressed to dmagin@gbra.org or write a letter to Ms. Debbie Magin, 933 East Court Street, Seguin, Texas 78155. Indicate what topics you are interested in and provide enough information so that you can receive mailed notices of meetings and reports. In addition, the information you provide will help us develop sub-watershed groups that have specific interests and may become involved in designing and providing input on special studies. We highly encourage all participation in our meetings and input on water quality issues in the basin.

Special Sub-committees for Local Water Quality Issues

In addition to the Basin Steering Committee for the CRP, the GBRA has established the Hydroelectric Lake Citizens Advisory Committee and the Coleto Creek Reservoir Advisory Committee. These groups are given the opportunity to hear, question and give input on activities to control nuisance, non-native aquatic vegetation each year as well as lake operations and safety. The committees have representatives from homeowners associations, potable water systems, bass clubs, boating sales companies, industries, as well as the Texas Parks and Wildlife Department and Texas Department of Agriculture. These committees also receive invitations to the CRP steering committee meetings.

Public Education and Volunteer Monitoring Activities

GBRA's *Journey Through the Guadalupe River Basin* 4th grade program was revised for school year 2005-2006. Changes include a heavier emphasis on watersheds and water quality. Teachers have provided positive feedback and voiced appreciation for the new content.

Two watershed models are available for GBRA staff to take to schools to demonstrate how a watershed works, and the impact of nonpoint source pollution to the watershed. One model represents the Hill Country and one represents coastal land. Use of the model provides an opportunity to discuss best management practices within a watershed. The science curriculum of fifth grade science is the best fit to incorporate use of the model. GBRA continues to offer teacher training for its middle school curriculum *River of Life* that includes discussion on the Clean Rivers Program, water quality, and water and wastewater treatment. The curriculum was distributed to all middle schools in the basin. Teacher training is also provided.

Other outreach activities include presentations to groups and classes, contributions of laboratory equipment to the Seguin Outdoor Learning Center to support water quality investigations by school groups, and the training of volunteer monitoring groups.

PUBLIC INVOLVEMENT AND OUTREACH ACTIVITIES (Cont.)

UGRA has initiated a very active volunteer monitoring program. Last year over 15 volunteers monitored 18 locations on a weekly basis for E.coli. The additional data provided valuable information, especially those close to the TMDL-sites. The volunteers were again called upon to assist with the Creeks, Springs & Seeps project which UGRA initiates every fall.

For the past 2 years, UGRA has distributed the *Major Rivers* curriculum to all the 4th grade classes in the Kerr County. Feedback from the teachers has been very positive. UGRA plans to distribute a middle school curriculum to all the Kerr County middle schools.

Future plans include UGRA staff to educate area students on water quality issues. Last year over 600 students were taught the basics of water quality. The presentations are done for a wide range of audiences, from pre-K to Schreiner University students. The presentations consist of a 1-hour course/talk (usually done on the River) emphasizing water quality, TCEQ/UGRA efforts, and what the students can do to make a difference in their community.

UGRA staff go live on the local channel 10 (TV Station) about every other month to discuss water-related issues. The monitoring activities and water quality issues are almost always discussed.

This year, UGRA has scheduled a "Community Water Quality" event in August. This meeting is to better educate the public/stakeholders on the UGRA/TCEQ water quality activities and receive community input. It will be held at the Guadalupe Basin Natural Resources Center in Kerrville.

Other major UGRA Water Quality Related Projects include:

- Bank Stabilization Re-vegetation (Cypress Tree) Project
- Watershed Demonstration Project
- Annual River Clean-up
- Low Water Crossing Weekly Clean-up @ 14 locations
- Guadalupe Bass (State Fish) restocking program
- HAZMAT boom VFD project
- Reservoir Monitoring

As part of UGRA's *Trash Free River Initiative,* they have initiated two programs:

- Water Crossing Clean-up: UGRA has contracted with a Historically Underutilized Business (HUB) to clean 14 of the popular/visible water crossings in Kerr County. The objective is to remove all rubbish/trash from these sites twice a week from May-September and twice a month from October-April. This has been a very successful program. UGRA has also been able to conduct a local Annual River Clean-up. Last year's clean-up effort was very successful. Volunteer groups and co-sponsors included Hill Country Fly Fishermen, Ameri-Corp, Boy Scouts of America, Master Naturalists, Big Brothers and Big Sisters, Hill Country Paddlers, City of Kerrville and Kerr County. About 10 cubic yards of trash was collected (30% was recycled). This year UGRA will expand the cleanup to include more paddlers to cover all sections of the River in Kerr County. TCEQ's *Keep Texas Beautiful Program* provided assistance with supplies and guidance.

Wimberly Valley Watershed Association (WVWA) The WVWA is a non-profit organization with the mission to protect the water quality and quantity of the Wimberley Valley by promoting sustainable watershed management through community education, conservation and land protection. WVWA is a CRP partner in the Blanco River-Cypress Creek Water Quality Monitoring Study. This monitoring effort has the following objectives for 2005-2006:

- Establish USGS Gauging Station at Jacob's Well - CRP participation
- Conduct Dye Trace Study – University of Texas, Edwards Aquifer Authority (EAA), Texas Water Development Board (TWDB), Hays-Trinity Groundwater Conservation District (HTGCD), WVWA
- Develop a localized Groundwater Availability Model with an isotope study – TWDB funding sought
- Expand HTGCD Well Monitoring Program

TEXAS WATCH

Texas Watch is a cooperative program of monitoring and communication about the environment. It includes volunteers, the TCEQ and Texas Watch partners. GBRA and UGRA are partners in the Texas Watch program in the basin. The goals of the Texas Watch program are to collect information needed to make environmentally-sound decisions.

GBRA and UGRA support Texas Watch in the Guadalupe River Basin by:

- Providing informational sessions to promote and help establish monitoring groups.
- Providing training to monitors.
- Providing quality control sessions.
- Providing technical expertise to support, expand and maintain monitoring groups.
- Providing chemical reagents and equipment to established groups.

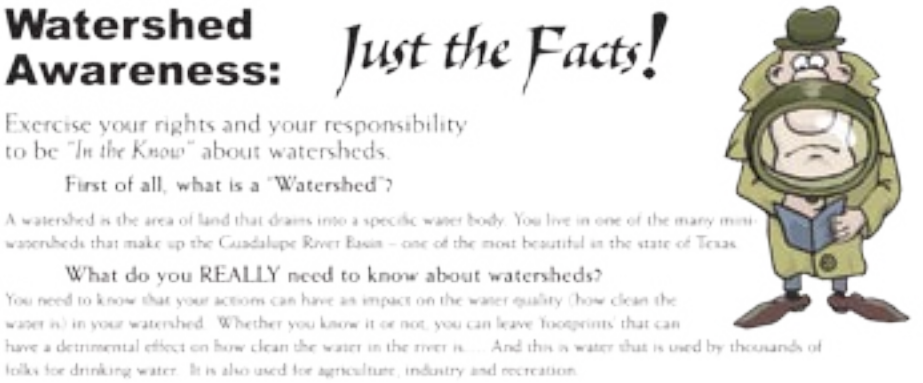
For information or scheduling contact:
Lee Gudgell (GBRA) lgudgell@gbra.org.
(UGRA) ugrasl@ugra.org
www.texaswatch.geo.tx.state.edu

Drew C. Engelke

WHATS COMING UP

GBRA is developing a brochure for adult homeowners that addresses nonpoint source pollution and household hazardous waste.

The target audience for this brochure will be new homeowners living outside the area of municipal services such as trash pick up, municipal wastewater collection systems and public water supplies.



Watershed Awareness: *Just the Facts!*

Exercise your rights and your responsibility to be *"In the Know"* about watersheds.

First of all, what is a "Watershed"?

A watershed is the area of land that drains into a specific water body. You live in one of the many mini-watersheds that make up the Guadalupe River Basin – one of the most beautiful in the state of Texas.

What do you REALLY need to know about watersheds?

You need to know that your actions can have an impact on the water quality (how clean the water is) in your watershed. Whether you know it or not, you can leave footprints that can have a detrimental effect on how clean the water in the river is..... And this is water that is used by thousands of folks for drinking water. It is also used for agriculture, industry and recreation.

WEB SITES

Another mechanism used to keep the public informed is the Internet. Both river authorities have Internet web pages (www.gbra.org and www.ugra.org) that provide information to the public on topics of interest in the basin.

The GBRA web page provides links to a range of information on river flows and quality conditions, including:

- Water quality data
  Data of water quality samples collected by GBRA.
  These files can be easily downloaded in pdf format.

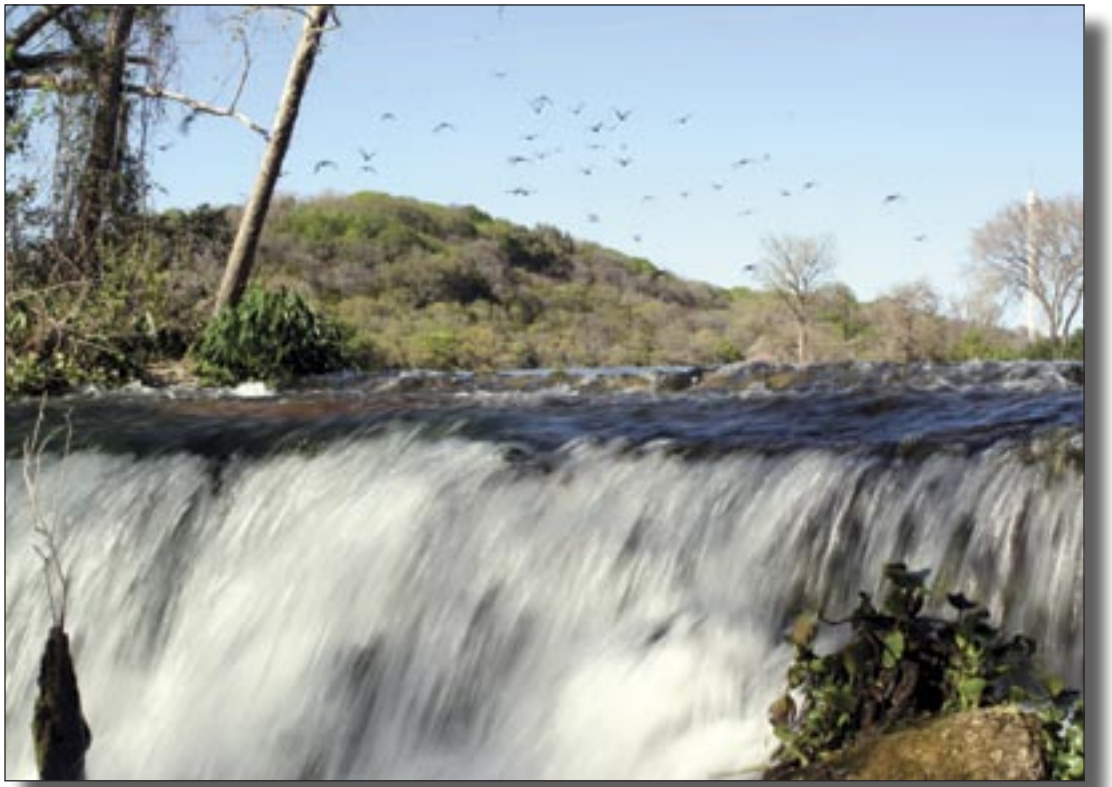
- Special Studies Reports
  Available for download in pdf format.

- Schedule of Monitoring Activities
  A list of all the monitoring sites under a TCEQ-approved QAPP.

- Interactive Map of the Monitoring Sites
  Click on each site and find out which information is being collected for that location.

- Quality Assurance Information
  Detailed information on the type of constituents (pollutants) collected by the river authorities.

- Events Inventory
  A listing of events related to water quality in the Guadalupe and Lavaca-Guadalupe Basins.



Drew C. Engelke

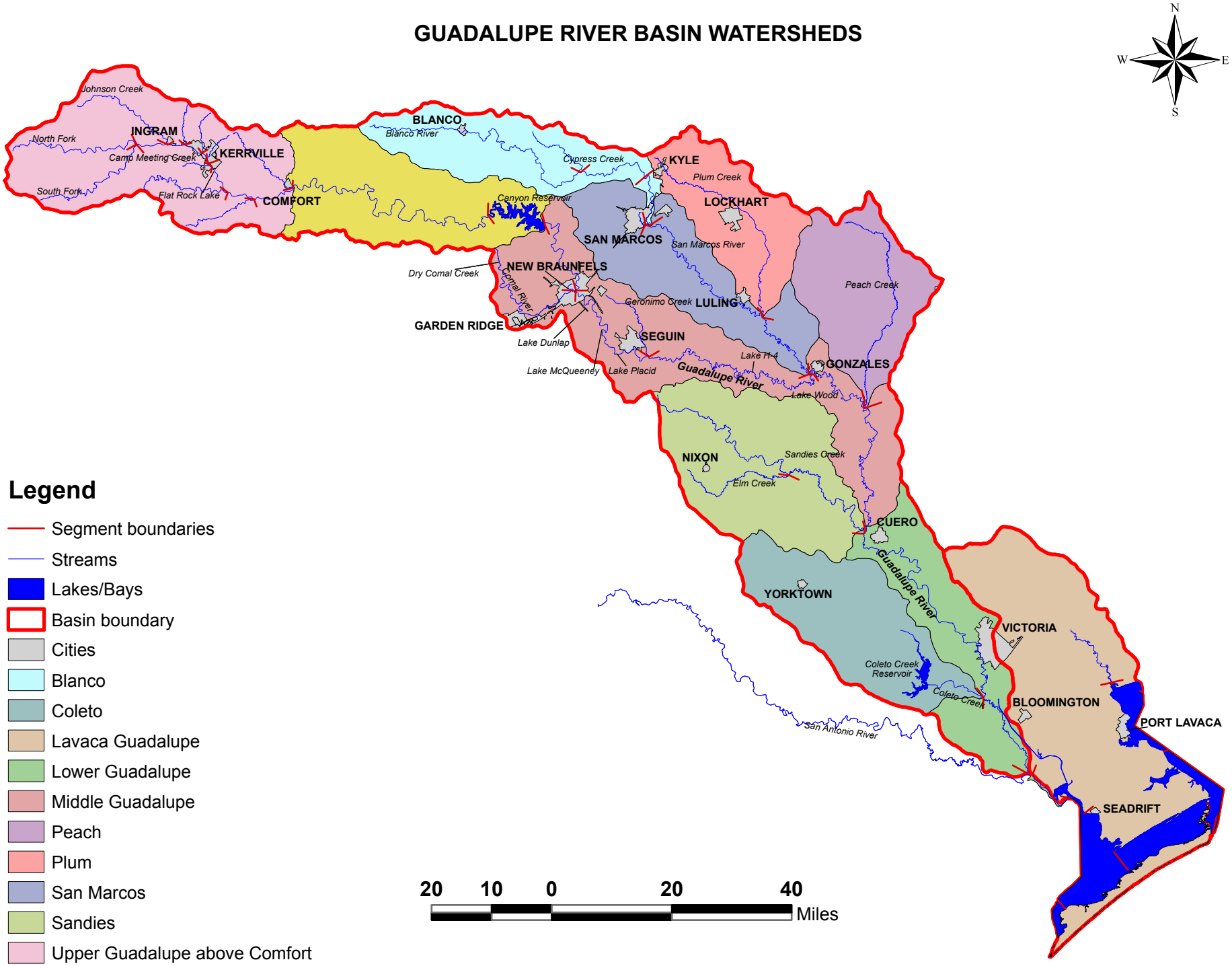
ATTACHMENT A
SUMMARY OF 2004 305(b) ASSESSMENT OF GUADALUPE RIVER BASIN AND LAVACA-GUADALUPE COASTAL BASIN

Water Body ID	Water Body Name	Impairment/Concern Location	Use/Water Quality Conern	Impairment/ Concern	Parameter of Impairment/Concern	Criterion Exceedence
1701	Victoria Barge Canal	Entire Segment	Aquatic Life Use	Use Concern-Limited Data	Depressed Dissolved Oxygen	1 of 8 exceed criterion.
1801	Guadalupe River Tidal	Entire Segment	Aquatic Life Use	Impaired	Depressed Dissolved Oxygen	Listed on 2000 303(d). Insufficient number of 24-hr DO values to determine if criterion supported.
1801	Guadalupe River Tidal	Entire Segment	Nutrient Enrichment Concern	Concern	Nitrate+Nitrite Nitrogen	11 of 20 exceed criterion.
1801	Guadalupe River Tidal	Entire Segment	Aquatic Life Use	Use Concern-Limited Data	Depressed Dissolved Oxygen	1 of 4 exceed criterion (24-hr avg).
1802	Guadalupe River Below San Antonio River	Entire Segment	Nutrient Enrichment Concern	Concern	Nitrate-Nitrite Nitrogen	17 of 64 exceed criterion
1803A	Elm Creek (unclassified water body)	Entire Water Body	Aquatic Life Use	Impaired	Depressed Dissolved Oxygen	Listed on 2000 303(d). Insufficient number of 24-hr DO values to determine if criterion supported.
1803A	Elm Creek (unclassified water body)	Entire Water Body	Contact Recreation Use	Impaired	Bacteria	Listed on 2000 303(d). Insufficient data to evaluate changes in water.
1803A	Elm Creek (unclassified	Entire Water Body	Narrative Criteria Concern	Concern	Depressed Dissolved Oxygen	
1803B	Sandies Creek (unclassified water body)	From the confluence with Elm Creek to upper end of water body	Aquatic Life Use	Impaired	Depressed Dissolved Oxygen	5 of 7 exceed criterion (24-hr avg), 4 of 7 exceed criterion (24-hr min).
1803B	Sandies Creek (unclassified water body)	From the confluence with Elm Creek to upper end of water body	Contact Recreation Use	Impaired	Bacteria	GM: EC=131, FC=336. 10 of 25 single FC samples exceed criterion.
1803B	Sandies Creek (unclassified water body)	From the confluence with Elm Creek to upper end of water body	Aquatic Life Use	Use Concern	Depressed Dissolved Oxygen	10 of 26 exceed criterion. Stream is perennial. High ALU.
1803B	Sandies Creek (unclassified water body)	From the confluence with Elm Creek to upper end of water body	Nutrient Enrichment Concern	Concern	Ammonia	12 of 19 exceed criterion.
1803B	Sandies Creek (unclassified water body)	From the confluence with the Guadalupe River to the confluence with Elm Creek	Aquatic Life Use	Impaired	Depressed Dissolved Oxygen	Listed on 2000 303(d). Insufficient number of 24-hr DO values to determine if criterion supported.
1803B	Sandies Creek (unclassified water body)	From the confluence with the Guadalupe River to the confluence with Elm Creek	Contact Recreation Use	Impaired	Bacteria	GM: EC=174, FC 311.
1803B	Sandies Creek (unclassified water body)	From the confluence with the Guadalupe River to the confluence with Elm Creek	Contact Recreation Use	Use Concern	Bacteria	7 of 25 single FM samples exceed criterion.
1803B	Sandies Creek (unclassified water body)	From the confluence with the Guadalupe River to the confluence with Elm Creek	Aquatic Life Use	Use Concern	Depressed Dissolved Oxygen	16 of 46 exceed criterion. Stream is perennial. High ALU.
1803B	Sandies Creek (unclassified water body)	From the confluence with the Guadalupe River to the confluence with Elm Creek	Nutrient Enrichment Concern	Concern	Ammonia-Nitrogen	5 of 13 exceed criterion.

ATTACHMENT A - Continued
SUMMARY OF 2004 305(b) ASSESSMENT OF GUADALUPE RIVER BASIN AND LAVACA-GUADALUPE COASTAL BASIN

Water Body ID	Water Body Name	Impairment/Concern Location	Use/Water Quality Conern	Impairment/ Concern	Parameter of Impairment/Concern	Criterion Exceedence
1803C	Peach Creek (unclassified water body)	Lower 25 miles of water body	Contact Recreation Use	Impaired	Bacteria	GM: EC=135, FM=266. 17 of 54 single FC samples exceed criterion.
1803C	Peach Creek (unclassified water body)	Lower 25 miles of water body	Nutrient Enrichment Concern	Concern	Ammonia	15 of 29 exceed criterion.
1804	Guadalupe River Below Comal River	From McQueeney Dam upstream approximately 7 miles	Algal Growth Concern	Concern	Excessive Algal Growth	12 of 41 exceed criterion.
1804A	Geronimo Creek (unclassified water body)	Entire water body	Nutrient Enrichment Concern	Concern	Nitrate+Nitrite Nitrogen	54 of 54 exceed criterion.
1806	Guadalupe River Above Canyon Lake	From 1 mile upstream Flat Rock Dam to confluence with Camp Meeting Creek	Contact Recreation Use	Impaired	Bacteria	GM: EC=231, FC-363. 18 of 46 single FC samples exceed criterion.
1806	Guadalupe River Above Canyon Lake	From RR 394 1 mile downstream	Contact Recreation Use	Impaired	Bacteria	GM: EC=193, FC=333. 49 of 127 single FC samples exceed criterion.
1806A	Camp Meeting Creek (unclassified water body)	Upper 9 miles	Aquatic Life Use	Impaired	Depressed Dissolved Oxygen	3 of 8 exceed criterion (24-hr min).
1806A	Camp Meeting Creek (unclassified water body)	Upper 9 miles	Aquatic Life Use	Use Concern-Limited Data	Depressed Dissolved Oxygen	3 of 8 exceed criterion (24-hr min).
1806A	Camp Meeting Creek (unclassified water body)	Upper 9 miles	Contact Recreation Use	Use Concern	Bacteria	6 of 20 exceed criterion (EC single sample).
1810	Plum Creek	From approximately 1 mile downstream of Caldwell CR 202 to upper end of segment	Contact Recreation Use	Impaired	Bacteria	GM: EC=183.
1810	Plum Creek	Confluence with San Marcos River to confluence with Clear Fork Plum Creek	Nutrient Enrichment Concern	Concern	Ammonia	6 of 22 exceed criterion.
1810	Plum Creek	Confluence with San Marcos River to confluence with Clear Fork Plum Creek	Nutrient Enrichment Concern	Concern	Nitrate+Nitrite Nitrogen	12 of 40 exceed criterion
1810	Plum Creek	From confluence Clear Fork Plum Creek to approximately 1 mile downstream of Caldwell CR 202.	Nutrient Enrichment Concern	Concern	Nitrate+Nitrite Nitrogen	11 of 16 exceed criterion
1810	Plum Creek	From confluence Clear Fork Plum Creek to approximately 1 mile downstream of Caldwell CR 202.	Nutrient Enrichment Concern	Concern	Total Phosphorus	8 of 16 exceed criterion

GUADALUPE RIVER BASIN WATERSHEDS



Legend

- Segment boundaries
- Streams
- Lakes/Bays
- Basin boundary
- Cities
- Blanco
- Coleto
- Lavaca Guadalupe
- Lower Guadalupe
- Middle Guadalupe
- Peach
- Plum
- San Marcos
- Sandies
- Upper Guadalupe above Comfort
- Upper Guadalupe below Comfort

Prepared in Cooperation with the Texas Commission on Environmental Quality Under the Authorization of the Texas Clean Rivers Act.
May 2006

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