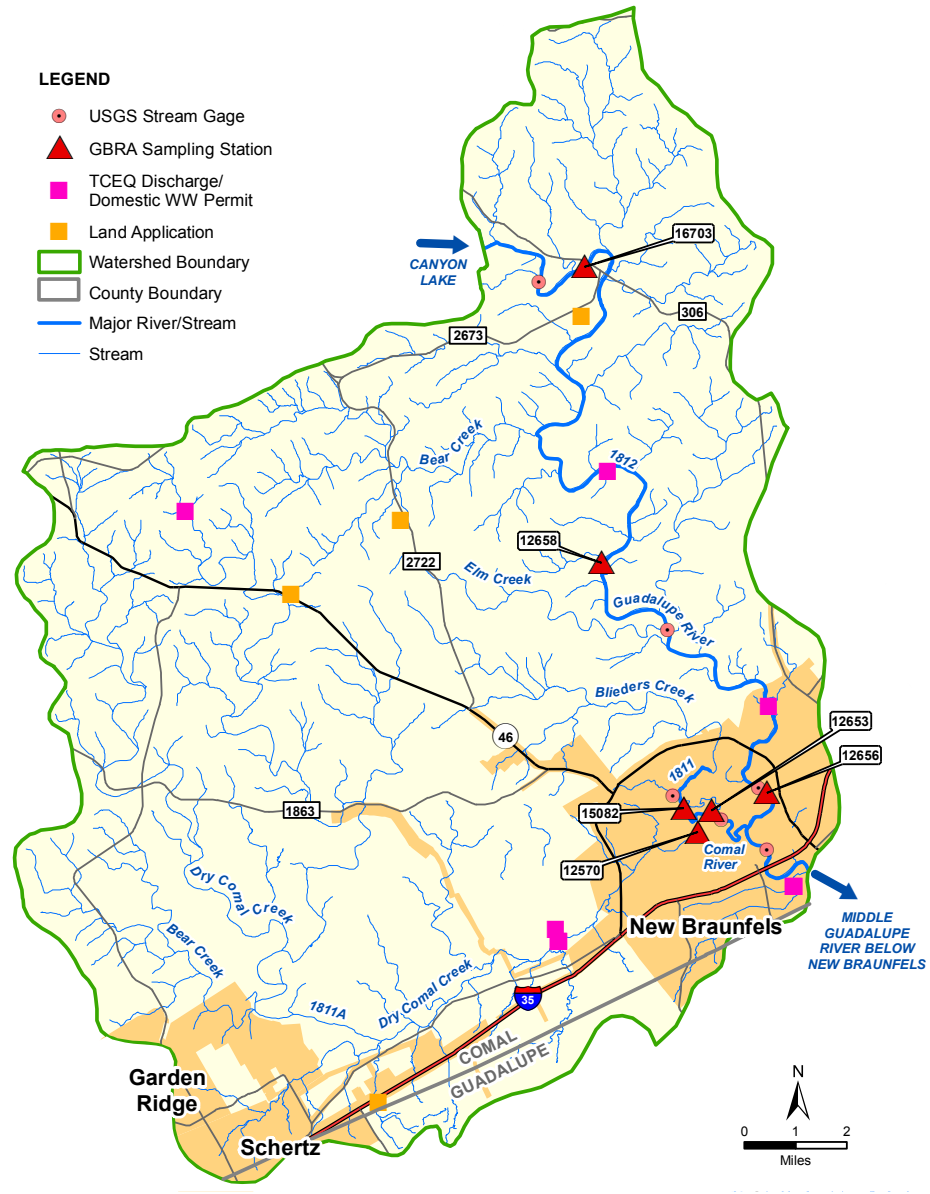


# GUADALUPE RIVER BELOW CANYON DAM



## GUADALUPE RIVER BELOW CANYON DAM

*Segment 1812 represents the Guadalupe River below Canyon Lake to the Comal River confluence. This heavily recreated stream segment receives the majority of its stream flow from regulated discharges from the bottom Canyon Dam. Several underground springs from the Edwards Aquifer contribute to the river as it travels 23 miles down the limestone substrates of the Edwards Plateau to the confluence with the Comal River.*

Segment 1812 represents the Guadalupe River below Canyon Lake to the Comal River confluence. This heavily recreated stream segment receives the majority of its stream flow from regulated discharges at the bottom Canyon Dam. Several underground springs from the Edwards Aquifer contribute to the river as it travels 23 miles down the limestone substrates of the Edwards Plateau to the confluence with the Comal River.

The segment of the Guadalupe River below Canyon Dam is extensively used for seasonal contact recreation. The cold water that is released from the bottom of the dam and the limestone substrate create clear, slow river runs and contrasting whitewater rapids. The area is a popular destination for tubers,

rafters, kayakers and swimmers. The cold and clear water also create a unique environment for sport fishing. The Texas Parks and Wildlife Department (TPWD) and Trout Unlimited release rainbow trout and brown trout below Canyon Dam at multiple dates throughout the winter. The land use in this area of the Guadalupe River is mostly limited to recreational businesses, campgrounds and private homes. There is very little agricultural land use due to the rocky soils and limestone hills associated with this portion of the Edwards plateau.

The only wastewater treatment facility (WWTF) in this segment is operated by the New Braunfels Utilities (NBU). This plant was designed to release up to 1.1 million gallons per day (MGD) of

treated wastewater at a discharge point downstream of Gruene Road. This facility treats the wastewater to ensure that the Carbonaceous Biochemical Oxygen Demand (CBOD), which controls for oxygen depletion from nitrogenous bacteria, does not exceed 5 mg/L, the Total Suspended Solids (TSS) does not exceed 10 mg/L, the Ammonia Nitrogen (NH3-N) does not exceed 3 mg/L and the E. coli does not exceed 126 MPN/100 mL. This current WWTF is located within the 100 year flood plain and experienced damage from flooding in 2010. NBU is working with the TCEQ in order to relocate the facility outside of the floodplain in a new location near Loop 337. The proposed new facility will have expanded treatment capacity up to 4.9 MGD. The

permitted effluent after completion of the expansion will include a new CBOD limit of 10 mg/L, a new TSS limit of 15 mg/L and will now include a tertiary treatment of total phosphorus to concentrations below 0.5 mg/L. This proposed expansion should help to serve the proposed 5,000 home Veramendi development that will be located along 1.7 miles of river frontage in this segment, immediately upstream of the plant.

The water releases from Canyon Lake are dictated by contractual agreements between the United States Army Corp of Engineers (USACE), the GBRA, the Federal Regulatory Energy Commission and Trout Unlimited. If the water level

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### **Guadalupe River below Canyon Lake**

**Drainage Area:** 87.79 square miles

**Length:** 23.1 miles

**Tributaries:** Mountain Creek, Jacob's Creek, Bear Creek, Turkey Creek, Isaac Creek, Deep Creek, Elm Creek,

**Aquifer:** Trinity, Edwards Trinity

**River Segments:** 1812

**Cities:** New Braunfels, Gruene, Canyon City

**Counties:** Comal

**EcoRegion:** Edwards Plateau

**Climate:** Average annual rainfall 34.98 inches, Average annual temperature 19.58 °C

**Vegetation Cover:** Evergreen Forest 60.92%, Deciduous Forest 8.70%, Shrubland 11.61%; Grassland 9.44%; Woody Wetlands: 1.19% Cultivated Crops 0.29% ; Pasture Hay 0.68%

**Land Uses:** urban, suburban sprawl, light industry, and recreational.

**Development:** Low Intensity 0.158% ; Medium Intensity 0.38%; High Intensity 0.15%; Open Space 4.25%

**Water Body Uses:** aquatic life, contract recreation, general use, fish consumption, and public water supply.

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

**Permitted Wastewater Treatment Facilities:** 1 Domestic

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of Canyon Lake rises to above 909 msl, the USACE controls releases of water from the flood pool of the reservoir. The rates of release are a function of the head pressure from the elevation of the reservoir and these typically range from 5,000-5,600 cfs at levels greater than 911 msl. The Corp of Engineers release water at rates up to 1,500 cfs when the reservoir level is between between 909 msl and 911 msl. When the water level of Canyon Lake falls below the level 909 msl, GBRA takes control of the releases from the dam. The Federal Regulatory Energy Commission licensing agreement ensures that releases from the GBRA are at least 100 cfs, unless drought conditions cause the amount of inflow into the lake is less than that threshold. If the minimum amount of water entering the lake upstream is less than 100 cfs then the GBRA will release water from the dam at a rate greater than or equal to the inflow. A secondary agreement between the GBRA and Trout Unlimited ensures that at least 150 cfs is released from the dam from May 16th to September 30th, so long as the water level of Canyon Lake is at least 909 msl on May 16th. The Trout Unlimited agreement is designed to ensure that the river maintains thermal tolerance ranges suitable for the Rainbow Trout that are seasonally stocked in the Guadalupe River by the TPWD.

### WATER QUALITY

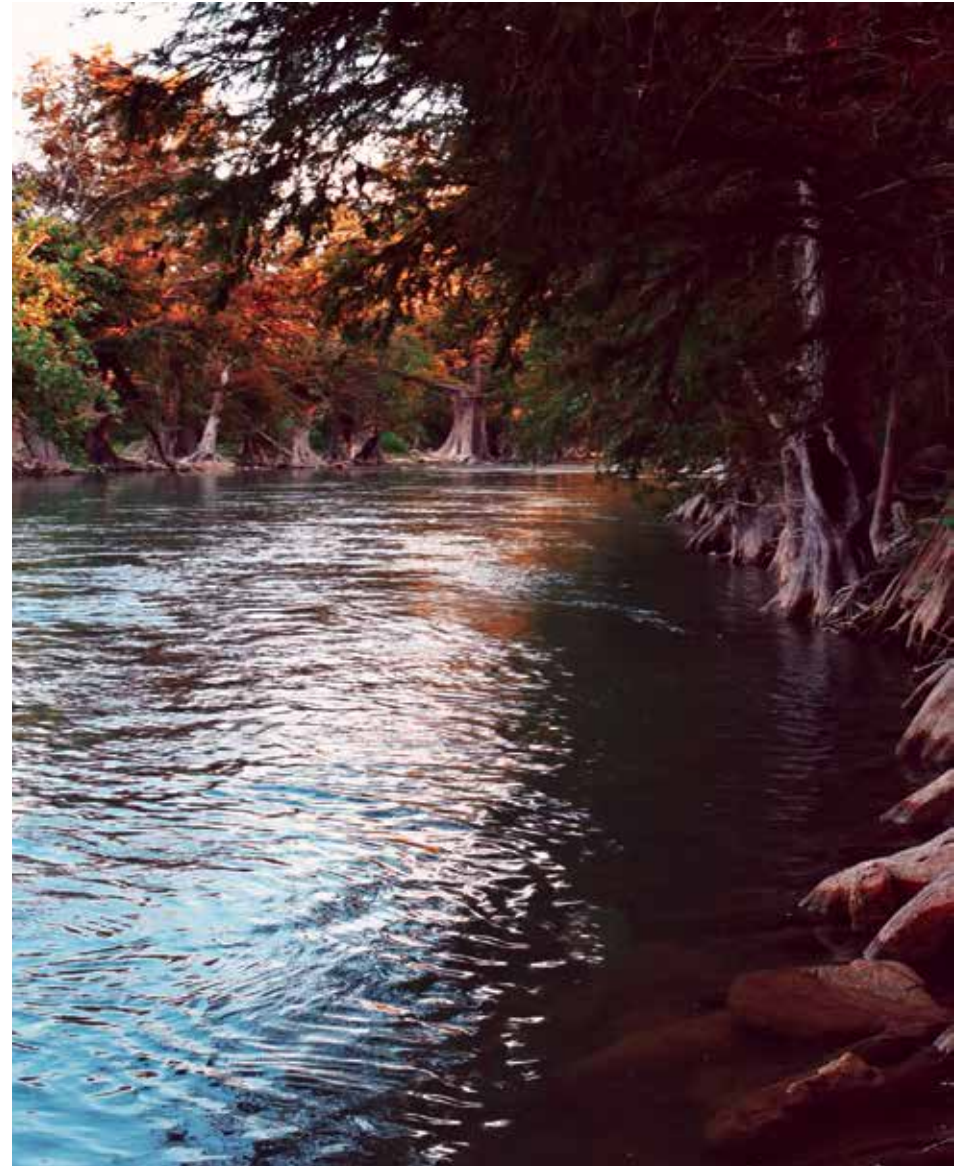
The latest approved 2014 Texas Integrated Report of Surface Water

Quality does not identify any water quality impairments or concerns in this segment. The stream segment has been divided by the TCEQ into three assessment units (AUs). The GBRA routinely samples one surface water quality monitoring station in each TCEQ assessment unit. The historical data from all three active TCEQ monitoring stations were reviewed for statistical trends, comparing each monitoring parameter against time and stream flow for the period between December of 2002 and November of 2016. The stream flows for segment 1812 did not show any statistical trends over time at any of the stations analyzed. The geometric mean of E. coli in all three assessment units of this segment was well below the contact recreation standard of 126 MPN/100 mL, but no statistical trends were observed. The observed E. coli geometric means of 62 MPN/100 mL at station 16703 (AU 1812\_03), 63 MPN/100 mL at station 12658 (AU1812\_02) and 71 MPN/100 mL at station 12656 (AU1812\_01), all preliminarily appear to support a designated contact recreational use.

AU 1812\_03 is the 9 mile portion of the segment from the confluence with Bear Creek up to the discharge from Canyon Dam station 16703 is located on the uppermost assessment unit 1812\_03, off Farm to Market Road 306 immediately below Canyon Dam. This station has been monitored on a quarterly basis since it was initiated by the TCEQ in 1999. Monitoring duties for

this station were transferred to the GBRA in 2012. This AU has a significantly lower average temperature of 16.4°C than the downstream AUs (19.5°C & 19.7°C)

because of its proximity to the releases of Canyon Dam. chloride and sulfate levels were both significantly increasing over time at station 16703 (Figures 1 &



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2). The increased concentrations in salt anions may be due to diminished stream flow as a result of years of drought, but no statistically significant correlation was found between these parameters and stream flow.

AU 1812\_02 is the middle portion of the segment from the confluence with Elm Creek upstream to the confluence of the Bear Creek tributary. This AU is in the middle of stream segment and has been monitored by the GBRA at station 12658 on a monthly basis since 1990. This station is located on the second road crossing of River Road upstream from the City of New Braunfels. Station 12658 is representative of one of the most heavily recreated portions of the segment. This station showed statistically significant increases in chloride and sulfate concentrations similar to the upstream AU1812\_03 (Figures 3 & 4) and a statistically significant inverse correlation with stream flow was observed for both parameters (Figures 5 & 6). The dissolved oxygen at station 12658 also showed a statistically significant decline over time (Figure 7), but the average concentration of 10.0 mg/L is well above the aquatic life standard average of 6.0 mg/L and the lowest value ever recorded at this station was 6.3 mg/L.

AU 1812\_01 is the lower 4 mile long portion of the river from the confluence with the Comal River (Segment 1811) to just upstream of the confluence with the Elm Creek. This AU is also heavily recreated and receives the discharge from the only domestic wastewater

facility in the segment. AU 1812\_01 has been historically monitored at two stations. Station 13511 was established in 1999 and monitored quarterly at the Gruene Road crossing of the river by the TCEQ. This station was discontinued in 2012 because the location was in the mixing zone of a wastewater treatment outfall operated by New Braunfels Utilities (NBU). A second monitoring station, 12656 at Cypress Bend Park in New Braunfels, was monitored quarterly by the TCEQ from 1983 until 2012 when monitoring was transferred to GBRA. The most downstream station in the segment, station 12656, is located in a public park in the City of New Braunfels. A significant decline in dissolved oxygen over time was observed at this station (Figure 8), but average dissolved oxygen concentrations at this station were a very high 10.1 mg/L with a minimum recorded value of 7.4 mg/L, which are values indicative of strong support for aquatic life uses.

Table 1

Station 16703 - Guadalupe River at FM 306 12/2002 - 11/2016					
AU 1812_03 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	16.4	24.7	9.2	55	32.2
pH (S.U.)	8.0	9.4	6.9	54	6.5 - 9.0
Chloride (mg/L)	16.3	24.8	11.0	55	50.00
Sulfate (mg/L)	23.4	50.1	14.0	55	50.00
Total Dissolved Solids (mg/L)	280	440	233	54	400.00
NH3-N (mg/L)	<0.10	0.31	<0.05	54	0.33
Total Phosphorus (mg/L)	<0.06	0.07	<0.02	53	0.69
Chlorophyll-a (µg/L)	4.2	<10.0	<1.0	54	14.10
Nitrate Nitrogen (mg/L)	0.21	0.59	<0.05	55	1.95
TKN (mg/L)	0.29	0.52	<0.2	52	N/A
AU 1812_03 Recreational Use					
<i>E. coli</i> (MPN/100 mL)	62 Geomean	440	7.3	48	126 Geomean
AU 1812_03 Aquatic Life Use					
Dissolved Oxygen (mg/L)	10.1	12.9	5.7	48	≥4.0 Minimum & ≥6.0 Average

Table 2

Station 12658 - Guadalupe River at Second Crossing 12/2002 - 11/2016					
AU 1812_02 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	19.5	30.4	8.3	162	32.2
pH (S.U.)	8.1	8.5	6.8	162	6.5 - 9.0
Chloride (mg/L)	15.6	23.1	6.2	163	50.00
Sulfate (mg/L)	21.7	30.1	8.7	163	50.00
Total Dissolved Solids (mg/L)	284	343	195	162	400.00
NH3-N (mg/L)	<0.10	0.37	<0.02	83	0.33
Total Phosphorus (mg/L)	<0.04	0.38	<0.02	162	0.69
Chlorophyll-a (µg/L)	<1.0	<5.0	<1.0	161	14.10
Nitrate Nitrogen (mg/L)	0.20	1.78	<0.02	162	1.95
TKN (mg/L)	0.31	1.35	<0.20	66	N/A
AU 1812_02 Recreational Use					
<i>E. coli</i> (MPN/100 mL)	63 Geomean	1100	11	162	126 Geomean
AU 1812_02 Aquatic Life Use					
Dissolved Oxygen (mg/L)	10.0	13.8	6.3	161	≥4.0 Minimum & ≥6.0 Average

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Table 3

Station 12656 - Guadalupe River at Cypress Bend Park 12/2002 - 11/2016					
AU 1812_01 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	19.7	30.4	10.2	40	32.2
pH (S.U.)	8.0	8.5	7.0	40	6.5 - 9.0
Chloride (mg/L)	17.9	27.0	10.5	40	50.00
Sulfate (mg/L)	22.9	29.8	12.2	41	50.00
Total Dissolved Solids (mg/L)	306	343	241	40	400.00
NH3-N (mg/L)	<0.10	0.25	<0.02	40	0.33
Total Phosphorus (mg/L)	<0.04	0.07	<0.02	39	0.69
Chlorophyll-a (µg/L)	<3.0	5.2	<1.0	39	14.10
Nitrate Nitrogen (mg/L)	0.58	1.37	0.06	40	1.95
TKN (mg/L)	0.27	0.45	<0.20	38	N/A
AU 1812_01 Recreational Use					
<i>E. coli</i> (MPN/100 mL)	71 Geomean	770	10	38	126 Geomean
AU 1812_01 Aquatic Life Use					
Dissolved Oxygen (mg/L)	10.1	14.0	7.4	40	≥4.0 Minimum & ≥6.0 Average

Figure 1

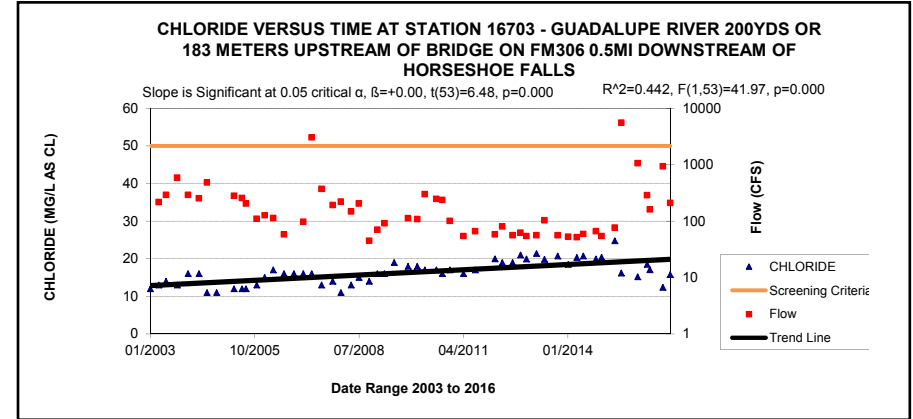


Figure 2

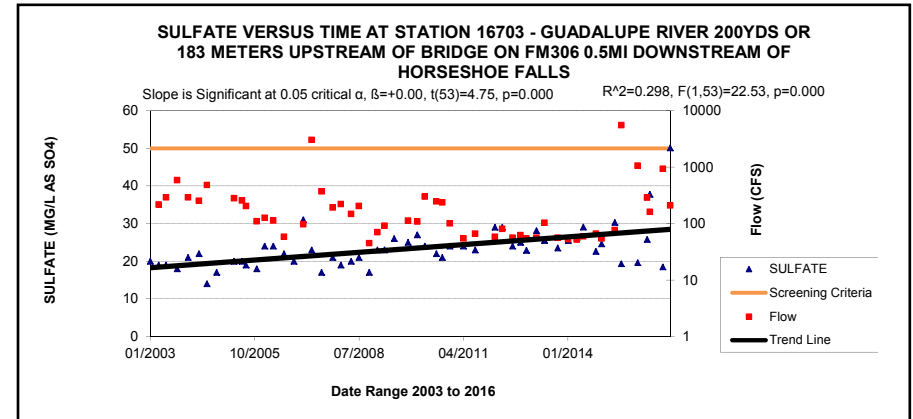
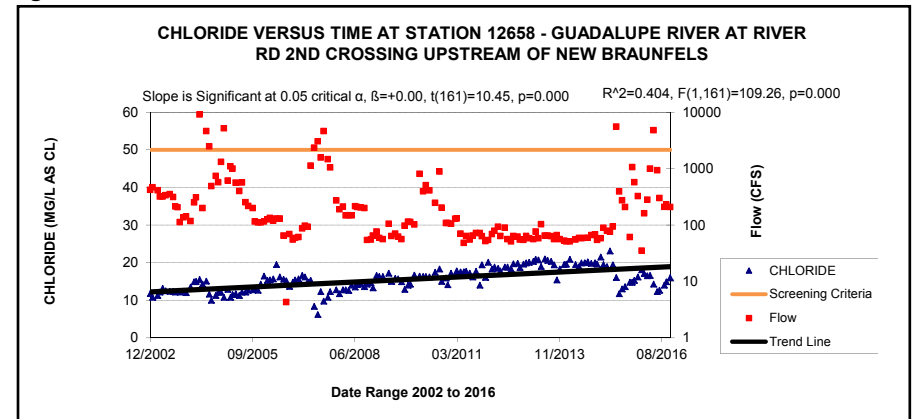


Figure 3



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Figure 4

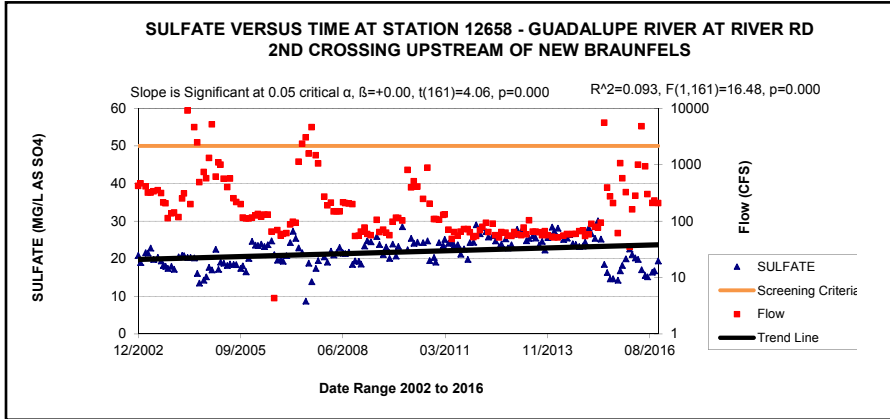


Figure 7

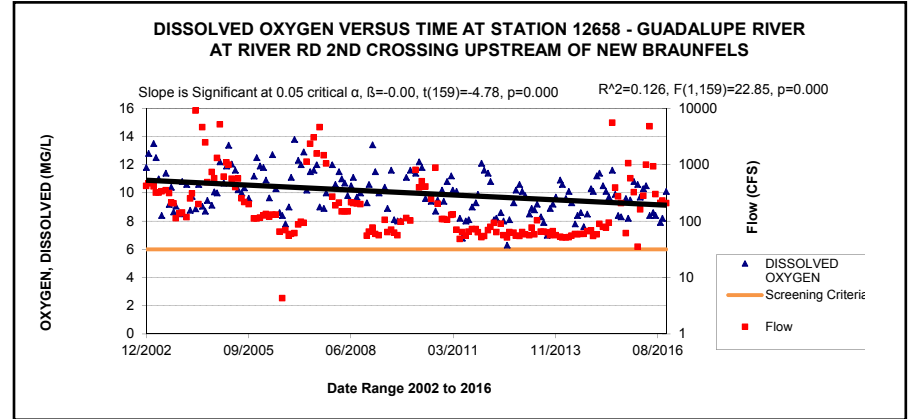


Figure 5

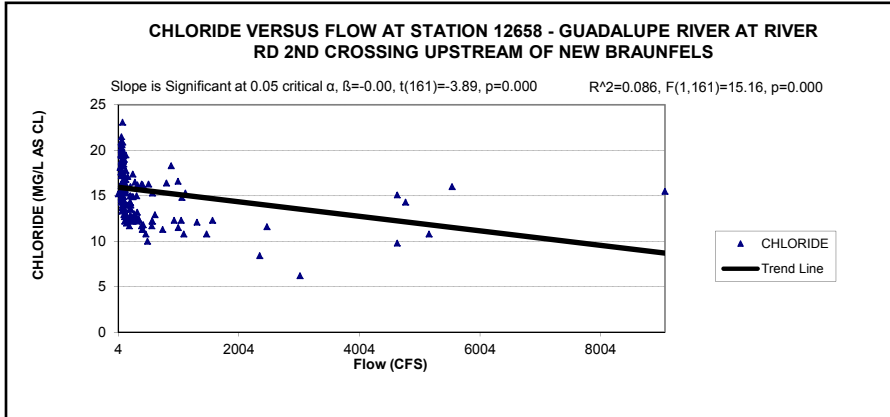


Figure 8

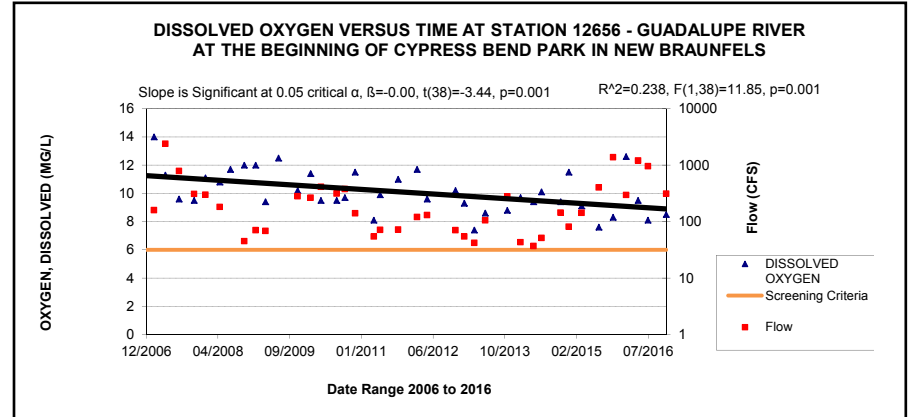


Figure 6

