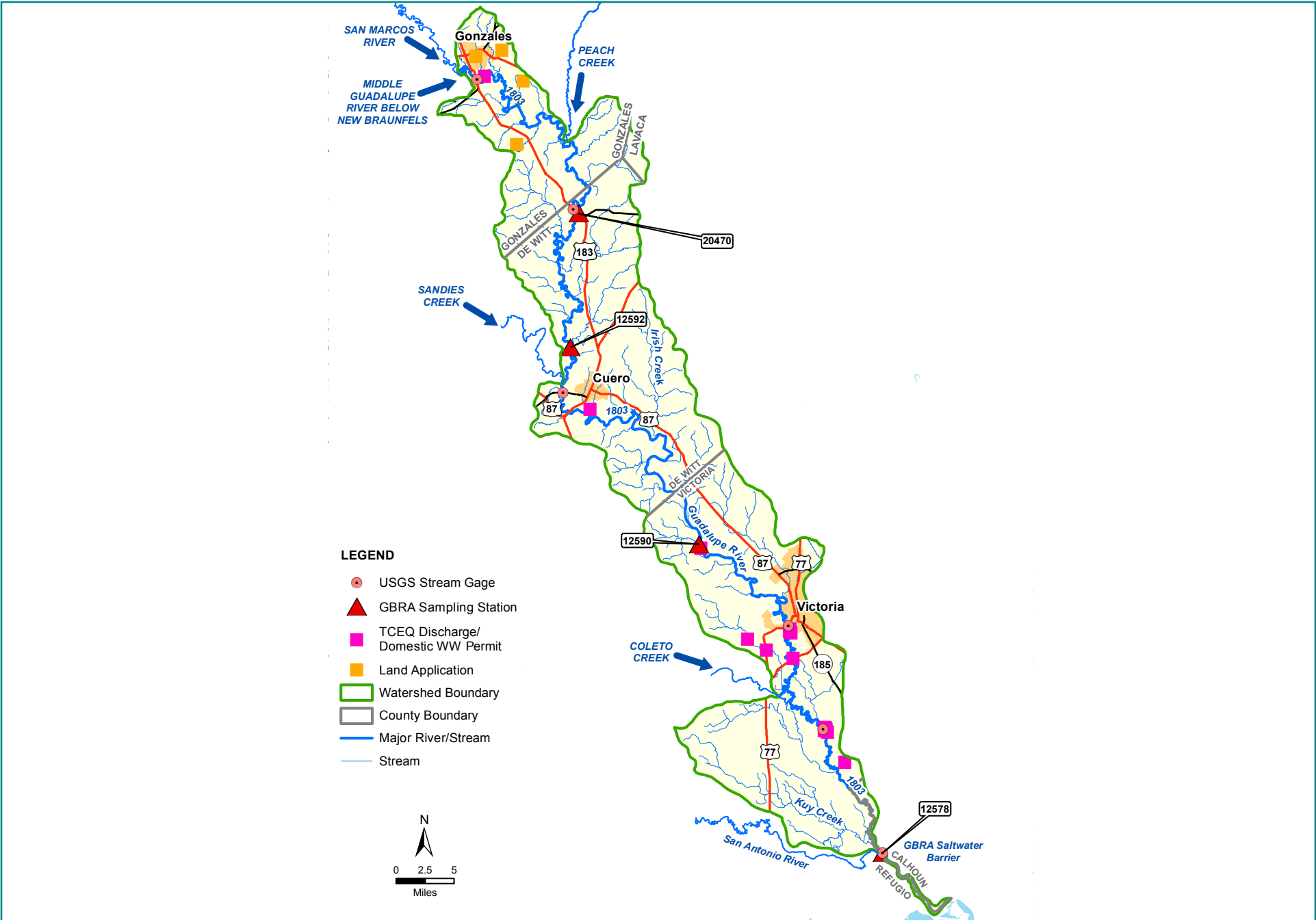


LOWER GUADALUPE RIVER



LOWER GUADALUPE RIVER

Lower Guadalupe River Below San Marcos River Segment 1803 (Guadalupe River below San Marcos River) begins at the confluence of the San Marcos River west of Gonzales, and travels 161.5 miles to the confluence with the San Antonio River. This portion of the Guadalupe River is a large, slow moving river with minimal elevation changes and a low stream gradient. Frequent twists and bends are common and rapids are greatly reduced from the upstream portions of the river. Segment 1803 flows south past the cities of Cuero in Dewitt County and Victoria in Victoria County, to immediately upstream of the confluence with the San Antonio River in Calhoun County. Numerous minor tributaries combine with the Guadalupe River in this portion of the watershed including Peach Creek and Sandies Creek. The Strahler Stream Order is a hydrological calculation used to estimate the complexity of a stream segment based upon the branching of its contributing tributaries. This stream segment transitions from a fifth order stream to a sixth order stream when it combines with Sandies Creek in Dewitt County. The river segment begins in the sandy soils of the Southern Post Oak Savannah ecoregion and flows through the moisture retaining clays of the southern Texas Blackland Prairie before it transitions to the sandy clay of the Gulf Coastal Plains ecoregion. Land use consists of cropland, hay pasture, rangeland and poultry farming with deciduous forests of live oak, elm and ash. Native grasses such as big bluestem, little bluestem and switchgrass are abundant in the rangeland prairies. Invasive tree species such as the Chinese Tallow and Chinese Privet have been found in many areas of the watershed.

Lower Guadalupe River Below San Antonio River Segment 1802 (Guadalupe River below San Antonio River) is the 0.4 mile long stretch between the confluence of the San Antonio and Guadalupe Rivers to the GBRA Salt Water Barrier. This segment is a typical slow moving coastal river. Following the confluence with the San Antonio River the watershed drainage expands from 5,979 square miles to 10,172 square miles and the average yearly flow of the Guadalupe River below this point increases by approximately 40%. This is the most downstream stream segment of the Guadalupe River that is not influenced by tidal waters. This portion of the western gulf coastal plain ecoregion is characterized by floodplains and low terraces comprised of alluvial sediments. Land cover typically includes lowland forests of elms, water oak and ash trees as well as grazed pasture and cropland.

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Lower Guadalupe River Watershed

Drainage Area: 488 square miles

Length: 167 miles

Tributaries: Kerr Creek, Cross Timber Creek, Cottle Creek, Black Creek, Peach Creek, Freeman Creek, Kokernot Creek, Rocky Creek, Boggy Creek, Fulcher Creek, Willow Branch, McCoy Creek, Cuero Creek, Sandies Creek (1803B), Lost Creek, Gohlke Creek, Oaxley Branch, Cattail Creek, Irish Creek, Reeds Branch, Carlisle Creek, Price Creek, Rocky Creek Mission Creek, Wright Creek, Spring Bayou, Blue Bayou, New River, Coletto Creek (1807), Black Bayou and Kuy Creek

Aquifer: Carrizo-Wilcox, Gulf Coast

River Segments: 1803, 1802, 1801, 1701

Cities and Communities: Gonzales, Hocheim, Cuero, Nursery, Victoria, Tivoli

Counties: Gonzales, Dewitt, Victoria, Calhoun, Refugio

EcoRegions: Texas Blackland Prairie, Post Oak Savannah, Gulf Coastal Plains, East Central Texas Plains

Climate: Average annual rainfall 44.22 inches, Average annual temperature 70.1°F

Vegetation Cover: Evergreen Forest 0.21%,

Deciduous Forest 5.88%, Shrubland 34.39%; Grassland 3.49%; Woody

Wetlands: 3.68% Cultivated Crops 6.89% ; Pasture Hay 39.16%

Land Uses: urban, suburban sprawl, heavy industry, agriculture, ranching

and recreational.

Development: Low Intensity 1.33% ; Medium Intensity 0.18%; High Intensity 0.03%; Open Space 3.41%

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

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

Permitted Wastewater Treatment Facilities: Domestic 6, Land Application 0, Industrial 3

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Guadalupe River Tidal Segment 1801 (Guadalupe River Tidal) comprises the 10 mile portion of the Guadalupe River from the GBRA Salt Water Barrier to the confluence with the Guadalupe Bay. This tidally influenced portion of the river is prone to frequent log jams. The logs that travel downstream catch on bridges, railroad crossings and other obstructions creating restrictions to water flow, changes in the river channel, and producing new ecosystems. The floodplain can often extend several miles outside of the stream banks.

Segment 1803 consists of five TCEQ assessment units (AUs) confluence with the San Marcos River to the confluence with the San Antonio River. This stream segment has three current routine monitoring stations that are sampled by the GBRA at FM 447 west of Nursery (12590), FM 766 west of Cuero (12592), and US 183 in Hochheim (20470). This segment is not currently impaired for any of its designated uses, although several of its contributing subwatersheds have been listed as impaired (1803A Elm Creek, 1803B Sandies Creek, 1803C Peach Creek). Water quality monitoring parameters are analyzed against water quality standards for each of the designated uses, in the AUs of this stream segment. A general use nitrate-nitrogen concern was identified in the 2014 Texas Integrated Report on assessment unit 1803_01, which includes the lower 25 miles of the segment. The average nitrate-nitrogen value was assessed at 8.47 mg/L, which was more than four times the General Use nutrient screening level of 1.95 mg/L. The elevated nitrate concentrations were not identified in any of the four other assessment units of the segment, which were all located upstream of the confluence with Coleta Creek. This concern was most likely due to contributions of data from a historical

monitoring station (16579). Monitoring at the historical station was discontinued in 2006 because it was found to be located within the mixing zone of an industrial wastewater discharge and therefore not representative of ambient conditions in this portion of the stream. An alternative station has never been monitored in this assessment unit due to site access concerns in this portion of the river. The 2014 Texas Integrated Report of Water Quality also removed a contact recreation concern for bacteria in assessment unit 1803_04, which included the portion of the segment 25 miles downstream of the Sandies Creek confluence. This concern was eliminated because the assessed mean of bacteria concentrations for this AU dropped below the 126 MPN/ 100 mL assessment criteria. The Texas Instream Flow Program (TIFP) was enacted by the legislature under Texas Senate Bill 2. In 2012, preliminary study design began on an in depth scientific study of the flows necessary to support a sound ecosystem on the Lower Guadalupe River. The Eagle Ford Shale Play, located in Dewitt and Gonzales counties, has become one of the richest oil and gas deposits in Texas because of the exploration technology called hydraulic fracturing or “fracking.” Fracking is the process to stimulate wells and recover natural gas and oil by creating

fractures that extend from a well bore into formations and allow the product to travel more easily. The fracking solution can be made of a proprietary mixture of organic chemicals, acids and bases. Concerns have been raised about the impacts that these activities will have on groundwater quality, surface water quality, the quantity of water needed in a water-limited area and the potential for spills and loss of containment of chemicals. The GBRA analyzed the water quality data from this stream segment to look for trends over time at all three monitoring stations in the segment.

Station 20470 is the most upstream station in this segment and is located at the crossing of State Highway 183 near the community of Hochheim. This station is located in stream segment 1803_05, which encompasses the portion of the watershed from 25 miles upstream of the Sandies Creek confluence to the confluence with the San Marcos River. This station was initiated by the GBRA in 2008 and is the station with the shortest data set available in the segment. No water quality parameters were found to be significantly changing over time at this station.

Station 12592 represents AU 1803_03 from the confluence with Sandies Creek to a point 25 miles

upstream. This station is located at the Farm to Market Road 766 road crossing upstream of the city of Cuero and has been routinely monitored by the GBRA since 1990 and was incorporated into the Clean Rivers Program in 1996. An analysis of the data from this station revealed a significant decrease in stream flow over time (Figure 1). This station also had a significant decrease in dissolved oxygen over time and a significant increase in chlorides over time (Figures 2 & 3). The changes over time in these two parameters were both likely due the effects of several years of drought and the effects of stream flow (Figure 4) on this longer data set.

Station 12590 is the most downstream monitoring station in this segment. This station is located at FM 447 near Nursery, upstream of the city of Victoria and has been monitored by the GBRA since 1999. The station represents AU 1803_04, which includes the portion of the watershed between the confluence with Coleta Creek and the Confluence with Sandies Creek. This AU also includes the three major discharges from the city of Victoria. Victoria has a WWTF located downstream of the city at US highway 59 that is permitted to discharge up to 9.6 million gallons per day (MGD). The city also operates a

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plant on Willow Street near the center of town that is permitted to discharge up to 2.5 MGD and new plant on Odem Street that is permitted to discharge up to 6.6 MGD. All three wastewater treatment facilities ensure that the effluent that is discharged into the Guadalupe River in this segment has a biochemical oxygen demand (BOD) that does not exceed 20 mg/L, a total suspended solids (TSS) concentration that does not exceed 20 mg/L and a geometric mean of *E. coli* that does not exceed 126 MPN/100 mL. This monitoring station is significantly decreasing in stream flow over time (Figure 5) similar to the upstream station 12592. This change in stream flow was accompanied by an increase in pH over time and a decrease in total hardness over time (Figures 6 & 7). The change in pH is most likely due to the effects of increased photosynthetic activity from plant and algae growth associated with the lower flow conditions.

Segment 1802 consists of one assessment unit that encompasses its entire length. The Texas Integrated Report assessed a mean concentration of 3.13 mg/L of nitrate-nitrogen for this segment, which exceeded the general use nutrient screening level criteria of 1.95 mg/L. Other assessed nutrient parameters such as total phosphorus, ammonia nitrogen showed no concern and the chlorophyll *a*. A single routine monitoring station (12578) is sampled monthly by the GBRA upstream of the saltwater barrier on Shultz Road. This station is also the closest station to the confluence with the

San Antonio River confluence and any changes in water quality from the San Antonio River are seen at this station. An analysis of the data from this station revealed that stream flow was decreasing over time (Figure 8). The nitrate nitrogen concentrations at this station were significantly increasing over time, while the dissolved oxygen concentrations were significantly decreasing over time. (Figures 9 & 10). These trends are most likely due to a greater influence of wastewater effluent influence during periods of diminished flow, as nitrate nitrogen is a common byproduct of a properly functioning wastewater facility, as it treats ammonia waste.

Segment 1801 is assessed as a single assessment unit, which includes the length of the entire segment. A routine station (12577) has been monitored quarterly at the state highway 35 tidal bridge by TCEQ region 14 staff and TCEQ predecessor agencies since 1970. The 2014 Texas Integrated Report assessed a mean concentration of 2.47 mg/L of nitrate-nitrogen for this segment, which exceeded the general use nutrient screening level criteria of 1.10 mg/L for tidal waterbodies. A total of 18 of the 25 measurements that were analyzed for the assessment exceeded these screening criteria. High nitrate-nitrogen levels may contribute to eutrophic conditions in the waterbody that can lead to low dissolved oxygen concentrations for the aquatic ecosystem. Although nitrate nitrogen levels appeared to be elevated in the last assessment, other nutrients such as

ammonia nitrogen, and total phosphorus were not concerns. Chlorophyll-*a* is a common response indicator for excessive algae and nutrient enrichment, but these concentrations were also below the assessed screening criteria. The TCEQ is currently evaluating possible ways to incorporate numerical nutrient criteria into water quality standards for freshwater and tidal streams. The GBRA found that the pH at station 12577 is significantly increasing over time (Figure 11), which may be an indication of additional photosynthetic activity during periods of low flow.

The Senate Bill 3 stakeholder process has recommended instream flows for the Guadalupe and San Antonio rivers and inflows into the bays and estuaries in the lower basin. TCEQ has since established environmental flow requirements for the Guadalupe and San Antonio rivers using stakeholder recommendations. The ongoing Senate Bill 2 Texas Instream Flow Program (TIFP) will provide additional scientific data to the TCEQ in order to further refine the environmental flow requirements for the future and facilitate adaptive management strategies.



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Table 1

Station 20470 – Guadalupe River at Hochheim 09/2008 – 09/2016					
AU 1803_05 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	22.9	32.7	9.6	34	33.90
pH	8.1	8.3	7.8	34	6.5 – 9.0
Chloride (mg/L)	30.4	44.2	14.8	34	100.00
Sulfate (mg/L)	31.9	40.0	19.7	34	100.00
Total Dissolved Solids (mg/L)	344	394	258	34	500.00
NH3-N (mg/L)	0.14	0.49	<0.10	34	0.33
Total Phosphorus (mg/L)	0.09	0.37	<0.02	34	0.69
Chlorophyll-a (µg/L)	3.2	12.8	<1.0	34	14.1
Nitrate Nitrogen (mg/L)	0.69	1.40	<0.05	34	1.95
TKN (mg/L)	0.39	0.87	0.20	34	N/A
AU 1803_05 Recreational Use					
<i>E. coli</i> (MPN/100 mL)	72 Geomean	2,000	5	34	126 Geomean
AU 1803_05 Aquatic Life Use					
Dissolved Oxygen (mg/L)	8.7	12.8	6.8	34	≥3.0 Minimum & ≥5.0 Average

Table 2

Station 12592 – Guadalupe River at FM 766 12/2002 - 11/2016					
AU 1803_03 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	22.8	33.4	9.4	163	33.90
pH	8.0	8.4	7.4	163	6.5 – 9.0
Chloride (mg/L)	28.5	46.4	7.2	164	100.00
Sulfate (mg/L)	31.5	45.8	12.6	164	100.00
Total Dissolved Solids (mg/L)	340	449	173	163	500.00
NH3-N (mg/L)	<0.10	0.69	<0.02	84	0.33
Total Phosphorus (mg/L)	0.10	0.91	0.02	163	0.69
Chlorophyll-a (µg/L)	4.36	50.0	<1.0	163	14.1
Nitrate Nitrogen (mg/L)	0.76	1.59	0.05	163	1.95
TKN (mg/L)	0.44	0.69	<0.02	84	N/A
AU 1803_03 Recreational Use					
<i>E. coli</i> (MPN/100 mL)	57 Geomean	>24,000	3	164	126 Geomean
AU 1803_03 Aquatic Life Use					
Dissolved Oxygen (mg/L)	9.1	13.9	5.0	163	≥3.0 Minimum & ≥5.0 Average

Table 3

Station 12590 – Guadalupe River at FM 447 near Nursery 01/2003 - 10/2016					
AU 1803_04 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	22.3	31.3	11.1	54	33.90
pH	8.0	8.5	7.4	54	6.5 – 9.0
Chloride (mg/L)	31.4	75.5	9.1	54	100.00
Sulfate (mg/L)	30.6	67.8	12.3	54	100.00
Total Dissolved Solids (mg/L)	346	447	196	54	500.00
NH3-N (mg/L)	<0.10	0.58	<0.02	54	0.33
Total Phosphorus (mg/L)	0.12	0.38	<0.04	54	0.69
Chlorophyll-a (µg/L)	4.0	11.9	<1.0	53	14.1
Nitrate Nitrogen (mg/L)	0.12	0.38	<0.02	54	1.95
TKN (mg/L)	1.07	8.13	<0.2	89	N/A
AU 1803_04 Recreational Use					
<i>E. coli</i> (MPN/100 mL)	124 Geomean	9,200	11	54	126 Geomean
AU 1803_04 Aquatic Life Use					
Dissolved Oxygen (mg/L)	8.8	11.9	5.9	54	≥3.0 Minimum & ≥5.0 Average

Table 4

Station 12578 – Guadalupe River at Salt Water Barrier 12/2002 - 11/2016					
AU 1802_01 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	23.0	32.2	9.5	163	33.90
pH	7.9	8.5	7.5	163	6.5 – 9.0
Chloride (mg/L)	64	163	16.7	163	150.00
Sulfate (mg/L)	55	139	17.2	163	100.00
Total Dissolved Solids (mg/L)	471	1008	220	163	700.00
NH3-N (mg/L)	0.13	0.88	<0.02	84	0.33
Total Phosphorus (mg/L)	0.33	0.86	<0.05	163	0.69
Chlorophyll-a (µg/L)	6.8	38.3	<1.0	163	14.1
Nitrate Nitrogen (mg/L)	2.13	6.56	0.22	162	1.95
TKN (mg/L)	0.66	2.98	<0.20	67	N/A
AU 1802_01 Recreational Use					
<i>E. coli</i> (MPN/100 mL)	77 Geomean	3,300	4	163	126 Geomean
AU 1802_01 Aquatic Life Use					
Dissolved Oxygen (mg/L)	7.5	12.7	2.6	163	≥3.0 Minimum & ≥5.0 Average

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Table 5

Station 12577 - Guadalupe River Tidal at SH 35 12/2002 - 03/2017					
AU 1801_01 General Use					
Parameter	Mean	Maximum	Minimum	# of Measurements	Screening Criteria
Temperature (°C)	24.1	31.9	8.9	91	35.00
pH	8.0	9.0	7.5	92	6.5 - 9.0
Chloride (mg/L)	81	908	29	55	100.00
Sulfate (mg/L)	55	191	25	55	100.00
Total Dissolved Solids (mg/L)	456	2308	260	92	500.00
NH3-N (mg/L)	<0.10	0.17	<0.02	52	0.46
Total Phosphorus (mg/L)	0.30	0.55	<0.06	48	0.66
Chlorophyll-a (µg/L)	12.2	48.6	3.0	36	21.00
Nitrate Nitrogen (mg/L)	2.24	5.72	0.06	52	1.10
TKN (mg/L)	0.75	2.13	0.31	49	N/A
AU 1801_01 Recreational Use					
<i>E. coli</i> (MPN/100 mL)	48 Geomean	722	3	21	126 Geomean
AU 1801_01 Aquatic Life Use					
Dissolved Oxygen (mg/L)	6.7	12.3	260	92	≥4.0 Minimum & ≥5.0 Average

Figure 1

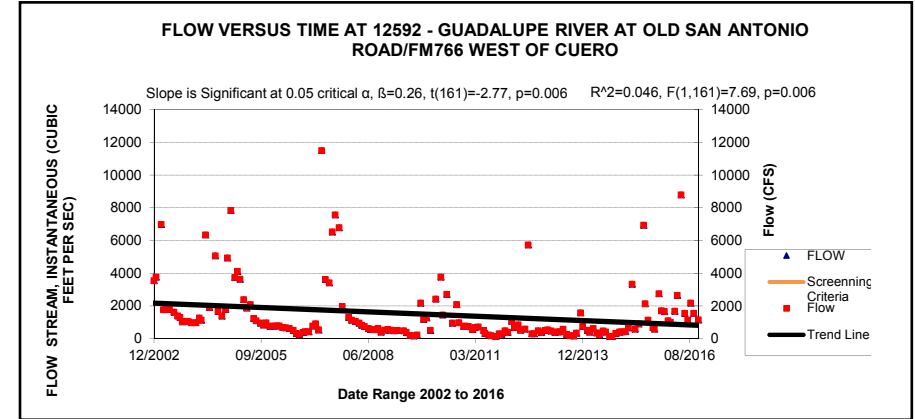


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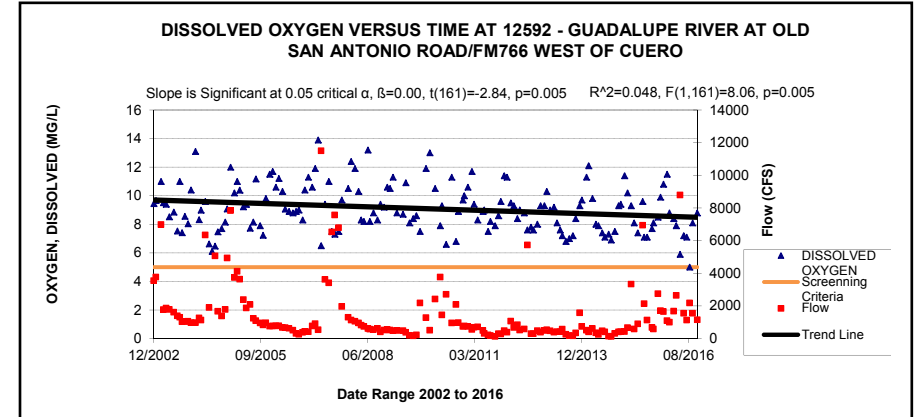
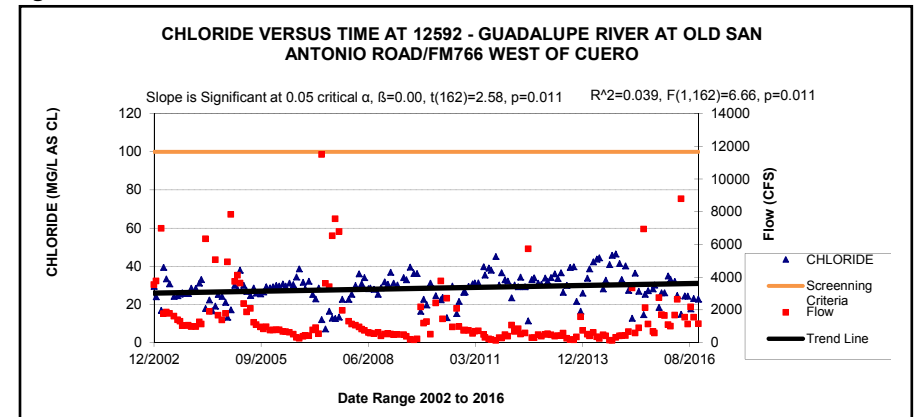


Figure 3



LOWER GUADALUPE RIVER

Figure 4

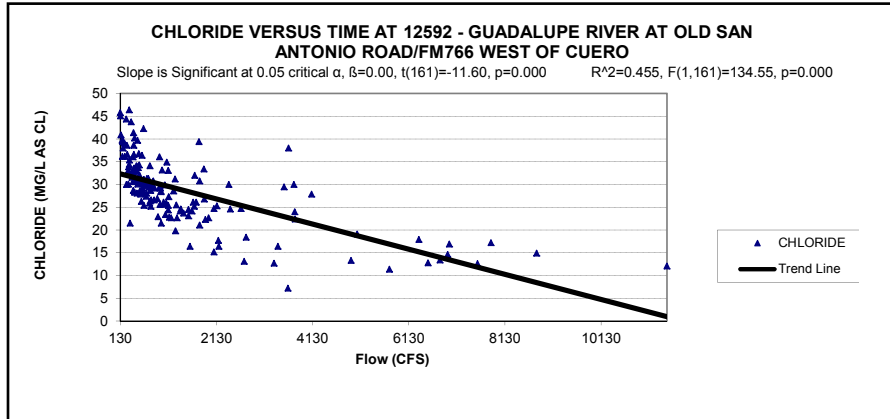


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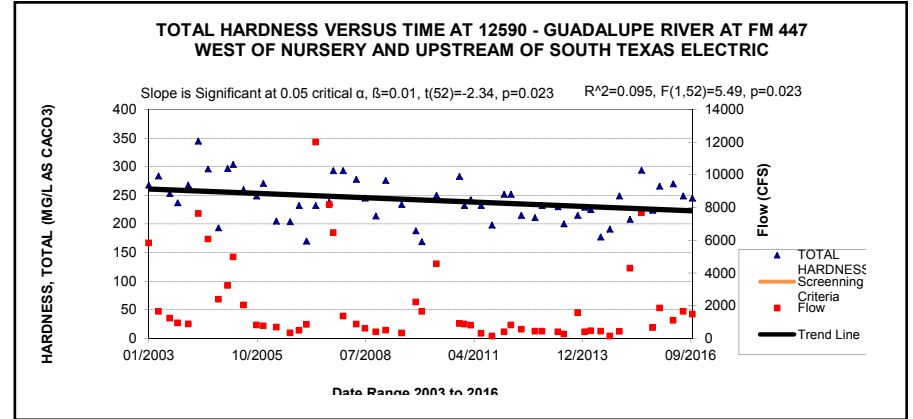


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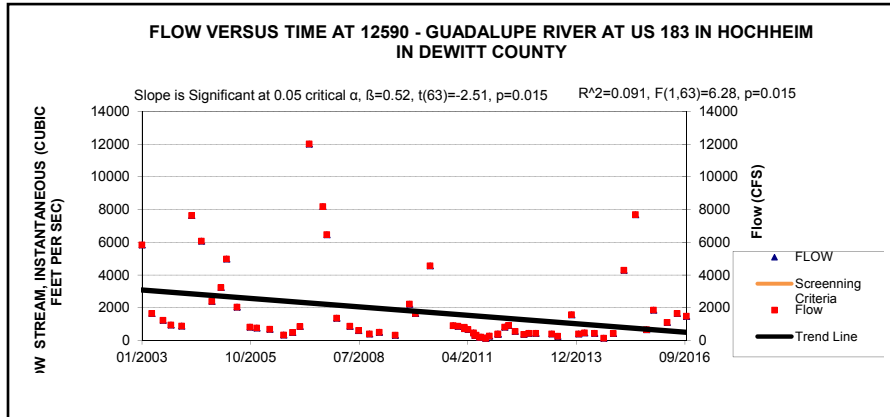


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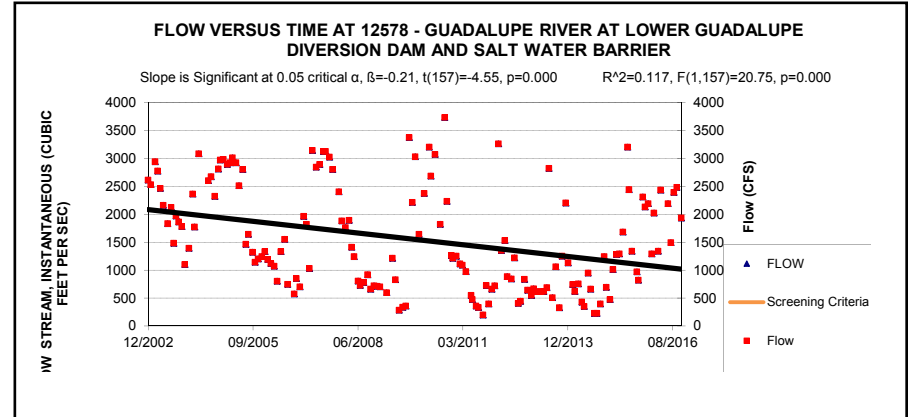


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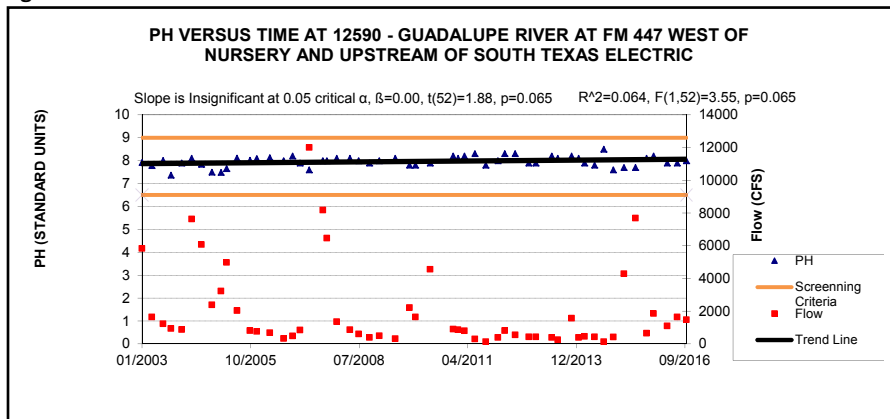
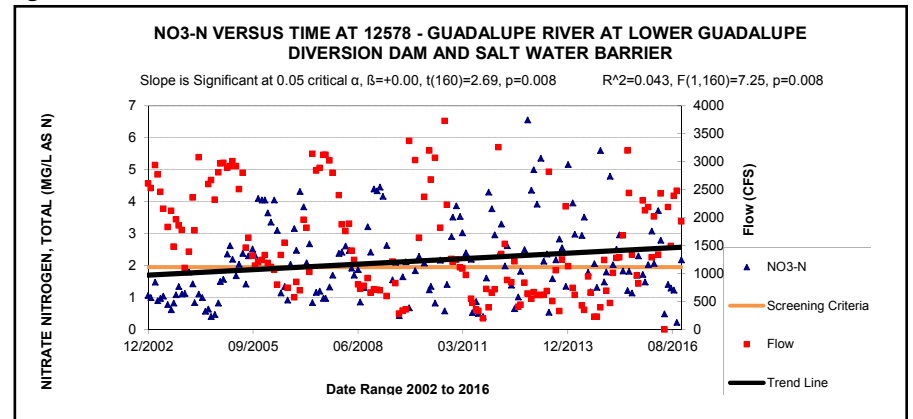


Figure 9



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Figure 10

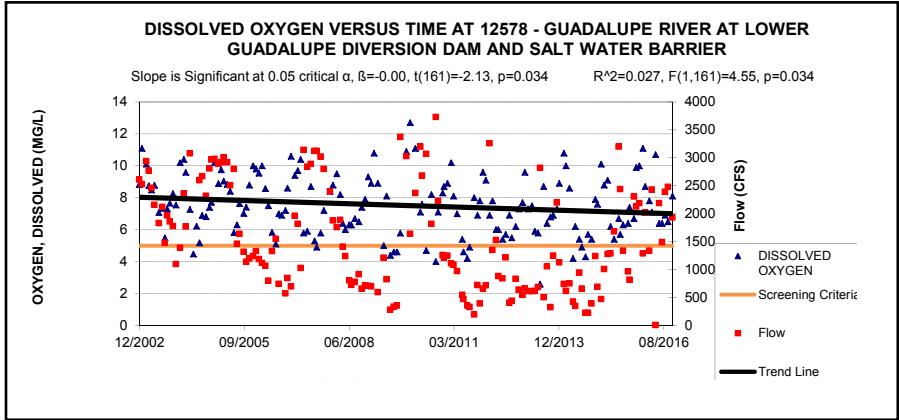


Figure 11

