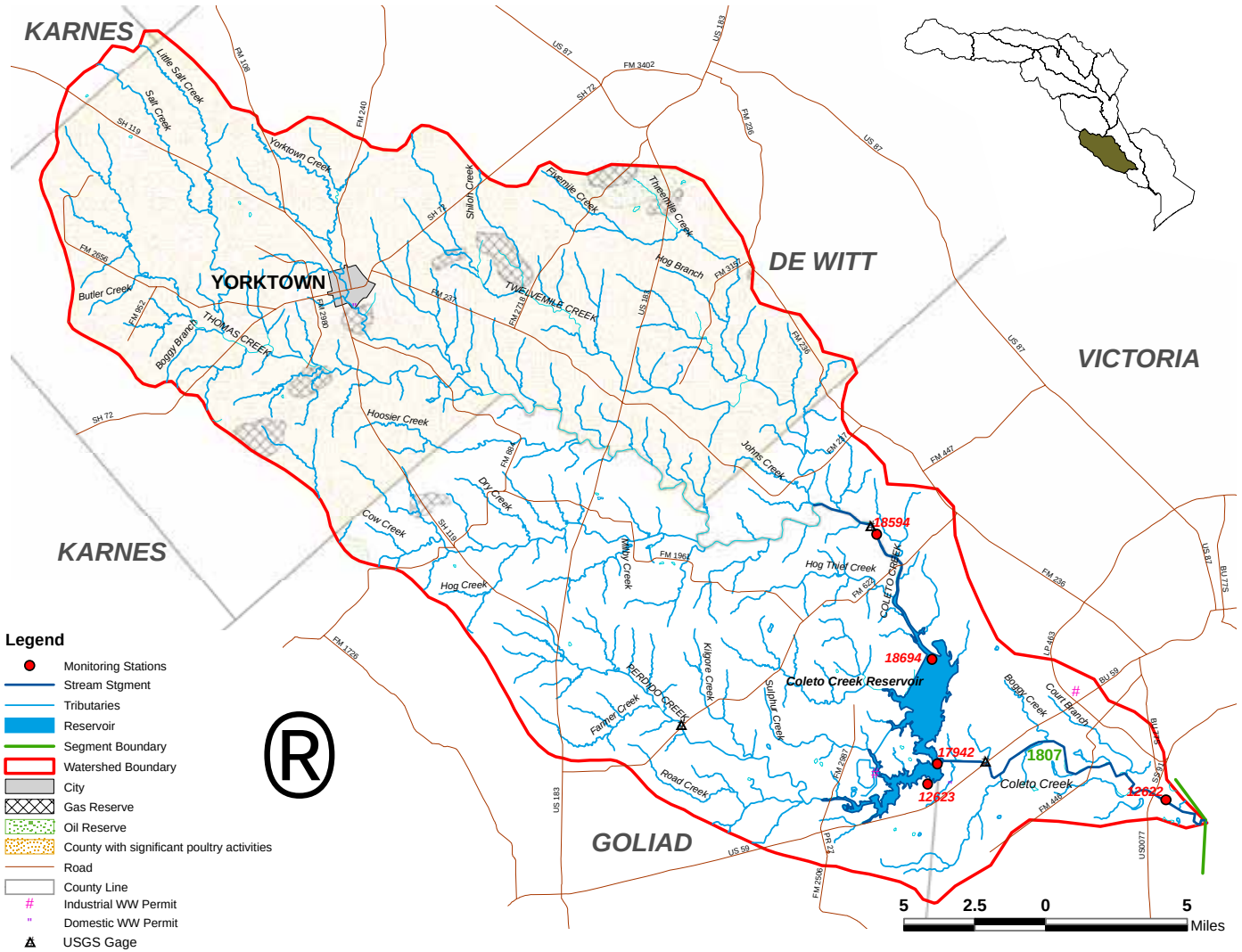
Coleto Creek Watershed



Legend

- Monitoring Stations
- Stream Stgment
- Tributaries
- Reservoir
- Segment Boundary
- Watershed Boundary
- City
- Gas Reserve
- Oil Reserve
- County with significant poultry activities
- Road
- County Line
- # Industrial WW Permit
- " Domestic WW Permit
- USGS Gage

Monitoring Stations – Coleto Creek and Reservoir

12622-T	Coleto Creek at US 77, downstream of reservoir
12623-G	Coleto Creek Reservoir at boat ramp in park
17942-T	Coleto Creek Reservoir in main pool at dam
18694-T	Coleot Creek Reservoir in arm of reservoir
18594-G	Coleto Creek at Arnold Road
18595-G	Perdido Creek at FM 622 near Fannin

Sampling sites are labeled in red followed by the letter G (GBRA), T (TCEQ), U (UGRA) or W (Wimberley) indicating who is the monitoring entity.

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%
Grass/Herbaceous - 33.2%
Row Crops - 5.0%
Shrublands - 9.7%,
Deciduous Forest - 18.7%

Climate:

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

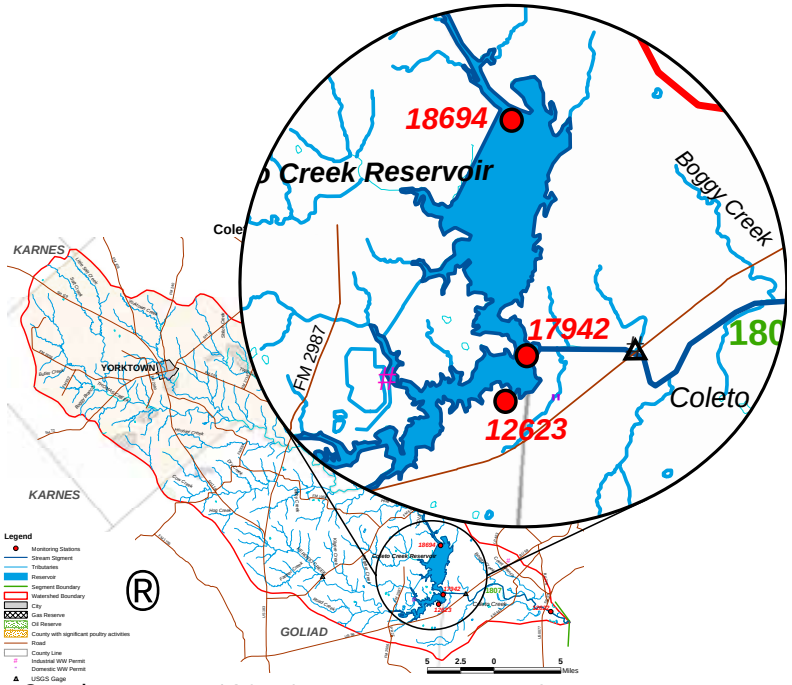
Land Uses: Agricultural Crops (sorghum, rice, cotton and corn), Beef, Hogs and Poultry Productions and Oil and Gas Production

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



The Coleto Creek, segment 1807, flows through DeWitt, Goliad and Victoria counties. The land uses in the watershed include farming and ranching, oil and gas production and recently, in-situ uranium mining. The only urbanized area is the small community of Yorktown located in DeWitt County in the upper watershed. The segment is divided into two assessment units: from the confluence with the Guadalupe River to the Coleto Creek Reservoir Dam; and, the remaining portion of the segment. The upper part of the segment includes Coleto Creek Reservoir. The segment summary will be separated into two sections, the reservoir and the creek.

Coleto Creek Reservoir

Coleto Creek Reservoir began impounding water in 1980, and is primarily used as a cooling pond for the coal-fired Coleto Creek power plant located in Goliad County. The power plant discharges 360,000 gallons per minute of water per year to the reservoir, after it has been pumped from the reservoir. through the facility for cooling. The temperature of the discharge cannot exceed 108°F. In addition to cooling capacity, the 3,100 surface acre reservoir is used for recreation, including swimming, boating, skiing and fishing. The reservoir is one of the best fishing sites in the Guadalupe River Basin because of the warm water and excellent fish habitat. The Texas Parks and Wildlife Department (TPWD) utilizes the reservoir as part of their fish stocking program. The reservoir has 61 miles of shoreline, with a sandy substrate and an average depth of eleven feet (2.5 meters).

The reservoir is fed by four major creeks, Coleto Creek, Perdido Creek, Turkey Creek and Sulphur Creek. The reservoir is maintained at a constant level. In times of drought, water can be pumped from the Guadalupe River to maintain lake levels, under a water right permit held by the power company. The last time the water right was called upon to bring water from the Guadalupe River was in 2006. The warm water creates ideal conditions for the growth of several species of aquatic vegetation, including non-native stands of Eurasian milfoil, waterhyacinth and the dominant species, hydrilla. These aquatic plants provide excellent fish habitat but have been known to grow to excessive amounts that can restrict cooling water flow and public access in several areas of the reservoir. GBRA, partnering with the TPWD and the US Corps of Engineers, has a program to maintain the appropriate level of vegetation by controlling the plants with biological, chemical and mechanical means. The park staff has established a lake stakeholder group that is consulted each year that a vegetation management treatment program is needed. The stakeholder group includes TPWD, fishermen, members of local landowner associations and representatives of the recreation industry.

GBRA has one historical monitoring station which is located at the park on the Coleto Creek Reservoir (site no. 12623). The surface water site was established in 1987 as part of the GBRA contact recreation water quality index. The nine parameter list was expanded in 1996 when the GBRA joined the Clean Rivers Program, and includes field parameters, *E. coli*, suspended solids, dissolved constituents, chlorophyll a and nutrients.

TCEQ has two quarterly monitoring sites located in the reservoir, one in the main pool near the dam (site no. 17942) and one in an arm of the reservoir (site no. 18694). The monitoring program includes depth profile samples but, since the sites were established in 2005 and were monitored only quarterly, the data set is very limited.

The depth at each location was approximately six (6) meters. Reviewing the limited data set that profiles the two sites on the reservoir, there was no thermal stratification at the dam or in the arm of the reservoir. The temperature change through the depth profile averaged less than 1°C change from surface to bottom at either sampling location. The conductivity changed less than 10 micromhos per centimeter from surface to bottom and, between sites, the median conductivities were different by less than 10 umhos/cm. One note to make was a 200 umhos/cm drop in the reservoir conductivity in March 2007, seen at both sampling locations, that was due to the large volume of rainfall runoff coming into the reservoir.

The difference in dissolved oxygen between the surface to bottom averaged 1.2 milligrams per liter (mg/L) at the dam and 1.5 mg/L in the reservoir arm. The greatest change in dissolved oxygen seen in the depth profile was during August 2006, a very dry year, at both locations, with 5.8 mg/L at the surface and dropping to 1.4 mg/L at the bottom at the dam, and going from 7.7 mg/L at the surface and dropping to 4.6 mg/L at the bottom in the reservoir arm. In the limited historical data set, there were no surface sites that dropped below the stream standard of 4.0 mg/L, and no depth samples except in August 2006, dropped below that standard.

The difference in pH from surface to bottom at both reservoir locations averaged a change of 0.15 pH units. No surface or profile sample fell outside the pH standard range of 6.5 to 9.0.

The TCEQ collected nutrients and dissolved constituents at the surface in both reservoir locations. The data set was too small to do trend analyses but the median concentrations can be calculated and compared between reservoir sites. The dissolved constituents' median concentrations for chloride and sulfate, were not significantly different between the sites, (chloride: dam – 93.5 mg/L and arm – 94.5 mg/L; sulfate: dam – 31 mg/L and arm – 32 mg/L). The median concentration of ammonia nitrogen and nitrate nitrogen were less than the method detection level, with no values in the very limited data set that exceeded the screening values of 0.11 mg/L and 0.37 mg/L, respectively.

The data set for chlorophyll a on Coleto Creek is very limited with only two data points at each reservoir location. The mean chlorophyll a values were high in comparison to sites in other parts of the river basin (14.4 micrograms per liter (ug/L) at the dam and 13.4 ug/L). Currently, TCEQ is developing standards for nutrients. Nutrient enrichment from nitrogen and phosphorus can cause excessive growth of macrophytes, algal blooms in the open waters as well as attached to the substrate and floating in mats. The Texas Water Quality Standards have narrative but not numerical nutrient criteria. TCEQ staff are developing and evaluating several alternatives for nutrient standards, one of which, is to express the nutrient criteria in terms of chlorophyll a. Coleto Creek is not listed on the draft Appendix F (Chapter 301.10) that lists site-specific nutrient criteria for reservoirs and lakes in Texas. The table lists the proposed chlorophyll a, total phosphorus and total nitrogen for each water body. Criteria formulations were based on selected sampling stations that represent the deep pool near the dam for each reservoir, represent average conditions with an allowance for statistical variability, and are calculated as the upper confidence interval of the mean with the assumption that a sample size of 10 is used. Based on these criteria, a nutrient standard cannot be calculated on Coleto Creek Reservoir because the data set collected at the TCEQ sampling station at the dam is not large enough. The GBRA site on the reservoir would have a sufficient amount of data but the site is not located in the main pool. The GBRA site is located at the boat ramp in a cove, very near a swimming site on the reservoir. The site was originally established to assess the water quality for contact recreation. The median chlorophyll a concentration at the GBRA site on the reservoir is 5.0 ug/L, with 5 data points that exceed the screening concentration. Other alternatives that TCEQ staff are considering when developing site-specific nutrient criteria include a use-based approach with uses such as aquatic recreation, fishing and drinking water. Another factor that may play into the development of nutrient criteria for Coleto Creek Reservoir will be if the reservoir will be designated as "impacted" due to the warm water discharge from the power plant that utilizes the water body for cooling purpose. There are no other domestic or industrial discharges to the reservoir or upstream tributaries.

The GBRA Coleto Creek Reservoir site at the boat ramp had a median temperature of 24.2°C, ranging from 11°C to 33°C; and, a median **specific** conductance of 401, ranging from 147 to 690 umhos/cm. At the GBRA site, the change in conductivity over time shows a positive trend (Figure 1). In addition to the positive trend in conductivity, possible fluctuations seen in Figure 1 may be attributable to both changes in season as well as periods of wet and dry weather conditions. An example of the impact of meteorological conditions can be seen in 2006. The reservoir received very little fresh water inflows, reaching one of its lowest elevation, and recording the highest conductivities in the data set. Seasonally, the evaporation rate on the reservoir, impacted by water temperature, wind and sunlight, increases during the warm summer months, causing the dissolved constituents to become more concentrated in the reservoir, showing an upward change in conductivity.

Substantiating both of these explanations for the upward trend in conductivity, are the changes in chloride concentrations over the same time period (Figure 2). The median chloride concentration during the period of record was 80.8 mg/L, ranging from 3.9 to 104 mg/L. Exacerbating the concentration of dissolved constituents is the level of chloride coming into the reservoir from the feeder streams. The GBRA monitoring site on the Coleto Creek at Arnold Road, located upstream of the reservoir, has a median concentration of chloride of 125.5 mg/L, ranging from 62.7 to 149 mg/L. The GBRA site on Perdido Creek, also a tributary to the reservoir, has a median chloride concentration of 170 mg/L, ranging from 55.7 to 216 mg/L. Without fresh water inflows of rain or water pumped from the Guadalupe River, the baseflow from the salty creeks, combined with the high evaporation rates, cause the chlorides in the reservoir to be elevated. Sulfates show a similar pattern but the concentrations in both the reservoir and in the tributaries are much lower. TCEQ has established a stream standard for chlorides of 250 mg/L and 100 mg/L for sulfates, for this segment, rather than the 50 mg/L seen in other parts of the Guadalupe River basin.

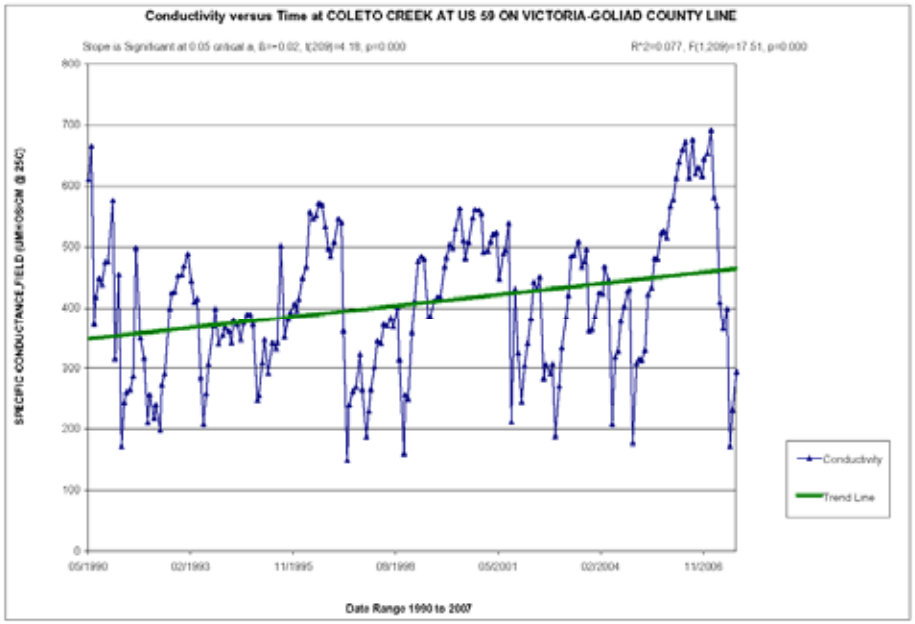


Figure 1. Specific conductance over time at the GBRA Coleto Creek Reservoir sampling site located at the boat ramp in the park (12623).

Figure 2. Chloride concentrations at the GBRA Coleto Creek Reservoir location (12623).

The dissolved oxygen ranged from 4.23 to 11.9 mg/L, with a median concentration of 8.25 mg/L. The site had no data points that fell below the dissolved oxygen grab minimum concentration of 4.0 mg/L and 14 out of 210 data points (6.7%) that fell below the dissolved oxygen grab screening level of 6.0 mg/L.

Ammonia nitrogen, nitrate nitrogen and total phosphorus were analyzed at the GBRA site at the boat ramp to the reservoir. The median concentration for ammonia nitrogen was 0.04 mg/L, ranging from less than the method detection to 0.34 mg/L. Looking at the trend in ammonia nitrogen over time, we see a significant drop in concentration in 2001. As mentioned in previous basin highlights and summary reports, the elimination of the distillation step from the ammonia nitrogen analytical procedure removed the contamination of the samples by the laboratory atmosphere and reduced the measured ammonia nitrogen in the samples (Figure 3).

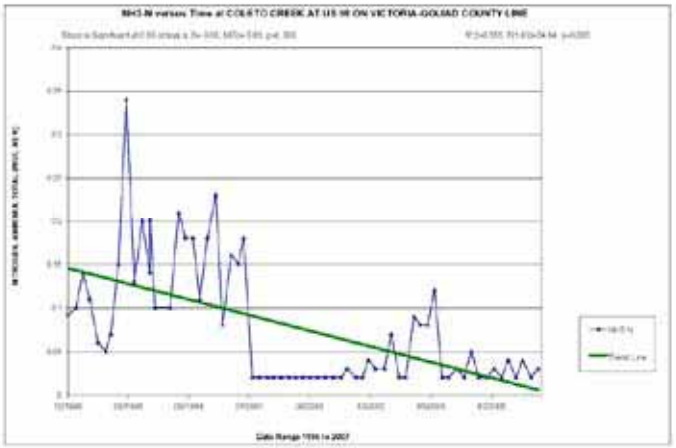


Figure 3. Ammonia nitrogen over time measured at the Coleto Creek Reservoir site at the boat ramp (12623). Drop in concentration in 2001 attributed to the removal of the distillation step from the analytical procedure.

This drop in ammonia concentration in 2001 is seen at the majority of other sites in the river basin but it is worthy of mention especially when looking at the Coleto Creek Reservoir data set because the concentrations prior to 2001 exceeded the screening concentration of 0.11 mg/L over 66% of the time and only one time out of 39 data points after 2001.

Nitrate nitrogen was analyzed and reported under three storet codes, alone and in combination with nitrite nitrogen. Nitrate nitrogen, combining all methods, had a median concentration of 0.09 and ranged from less than method detection to 0.94 mg/L, exceeding the screening concentration of 0.33 mg/L fourteen times out of 214 data points (6.5%). Total phosphorus concentrations ranged from less than method detection to 1.15 mg/L, with a median concentration of 0.074 mg/L. The historical data showed that the site only exceeded the screening concentration for total phosphorus three times, one being 1.15 mg/L which is atypical of the historical data for the site, being fifteen-fold higher than the median, and may be due to sample contamination.

Coleto Creek

The lower assessment unit is approximately 15 miles in length with a median flow of 5.6 cubic feet per second. Because very little of the watershed is below the Coleto Creek Reservoir, the flow in the lower assessment unit is dependent on releases from the reservoir. The upper assessment unit has the majority of the watershed for the Coleto Creek and its tributaries. Guadalupe River Basin stakeholders have voiced concerns about the impacts from oil and gas production and most recently, the possible impacts from the exploration and in-situ mining for uranium on the water quality in the Coleto Creek, upstream of the reservoir. In response to this concern GBRA established two stream sites upstream of the reservoir on Coleto Creek (site no. 18594) and Perdido Creek (site no. 18595) and sampled bimonthly for two years. The data sets for each site are very limited and not appropriate for trends over time analyses but the systematic monitoring does record baseline conditions for comparison in future years. Additionally, in 2007 and 2008, radiological samples are being collected at the Arnold Road site. The TCEQ has a stream monitoring location (site no. 12622) downstream of the reservoir that they have monitored two to four times per year since 1990.

Coleto Creek at Arnold Road (site no. 18594).

The median flow in the Perdido Creek is very low, only 0.2 cubic feet per second. The median flow in the Coleto Creek is 8 cubic feet per second. Looking at the small data set for Perdido Creek the only water quality parameters that raise concern is the elevated conductivity which is due to the elevated chloride concentration (median conductivity = 1066 umhos/cm; chloride = 170 mg/L). In the Coleto Creek at Arnold Road, the same is true. Again, it must be noted that these data sets are very small and not appropriate for use in stream assessments.

The TCEQ site below the reservoir has a very extensive data set, from 1991 to 2007. The median flow was 5.7 cubic feet per second. The median temperature was 25.3°C, ranging from 13 °C to 33.7 °C. The dissolved oxygen ranged from 4.8 mg/L to 12.5 mg/L, with a median concentration of 8.29 mg/L.

The conductivity was elevated, similar to the reservoir and upstream tributaries. The median specific conductance was 784 umhos/cm, ranging from 294 to 1354 umhos/cm. As seen upstream, the chloride contributes the most to the conductivity, with a median concentration of 115 mg/L but the stream did not exceed the stream standard of 250 mg/L in the historical data set. Where conductivity and chloride showed a positive, or increasing trend, at the GBRA site in the reservoir, these constituents showed the opposite trend or reducing concentrations downstream of the reservoir. Figures 5 and 6 show a negative trend which may be due to the contributions from tributaries to the Coleto Creek that are downstream of the reservoir.

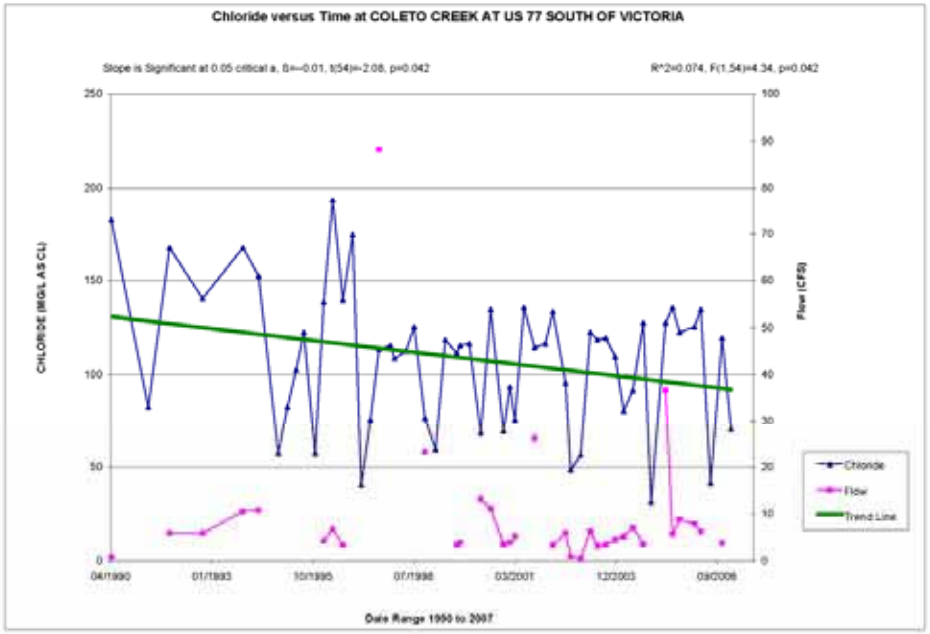


Figure 4. Negative trend in chloride concentration seen at the TCEQ site on Coleto Creek downstream of the reservoir (12622).

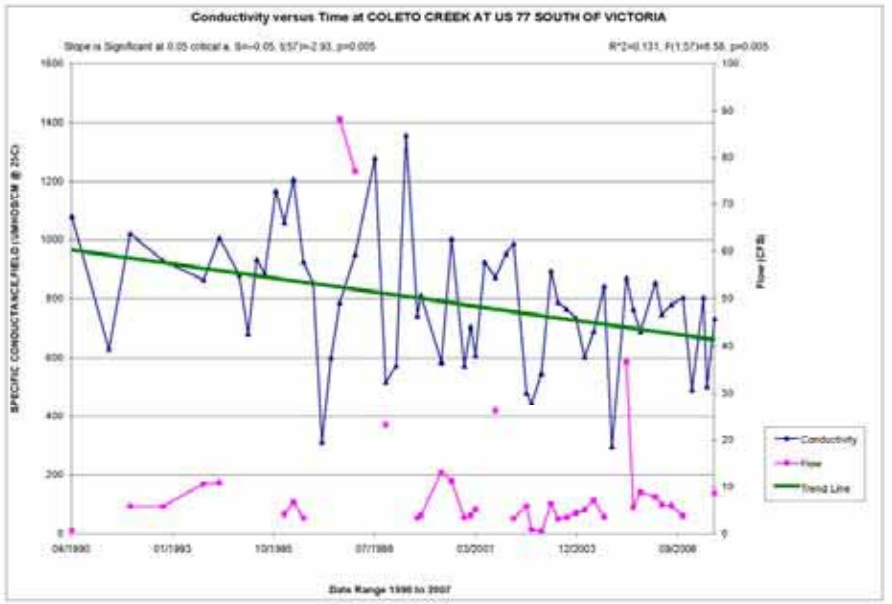


Figure 5. Negative trend in conductance seen at the TCEQ site on Coleto Creek downstream of the reservoir (12622).

E. coli and fecal coliform concentrations exceeded the respective contact recreation standard only two times in the historical data set. The nutrient concentrations, ammonia nitrogen, nitrate nitrogen and total phosphorus, never exceeded the stream screening concentrations for each respective nutrient.

Perdido Creek at FM 622 (site no. 18595).