

REPORT ON GRACE CREEK SPECIAL STUDY – SUBWATERSHED 5.18

Sabine River Authority of Texas

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Prepared in Cooperation with the [Texas Natural Resource Conservation Commission](#)

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Grace Creek Special Study – Subwatershed 5.18

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INTRODUCTION

The Sabine River Authority (SRA) 1998 Summary Report of water quality in the Sabine River Basin reported some water quality concerns identified by the SRA systematic sub-watershed screening program. Concerns for ammonia, ambient toxicity, and rapid bio-assessment; possible concern for orthophosphate; and nonsupport of stream standards for dissolved oxygen, total dissolved solids, and fecal coliform were identified. The design of this study was tailored to examine the specific concerns identified by historic sampling. The Grace Creek Subwatershed is almost entirely urban and non-point runoff is the probable source of the water quality concerns. One set of samples for this study was taken during normal flow conditions to establish ambient or baseline conditions, and a rainfall event sample was taken to evaluate first-flush runoff from different areas of the watershed. Due to periodic toxicity in historic biomonitoring analyses, samples were taken for priority pollutants at all sites during normal and rainfall event flow. These samples were to be submitted for analysis only if biomonitoring indicated toxicity. Benthic macroinvertebrates and fish collections were made once during early summer and again during the late summer index period. Routine field and laboratory parameters, total and dissolved metals in water were collected at all sites. Biomonitoring and rapid bioassessments (RBA's) were also conducted at each site. Texas Watch volunteers who work for the City of Longview submitted additional data, which are also presented in this report. Rainfall event sampling utilized SRA, and Longview employees to take grab samples during the rain event. Participation and support also came from the TNRCC Region 5 office, the TPWD, and City of Longview employees.

SAMPLING METHODS

The following types of samples were employed at each of the six sites on Grace Creek and its tributary streams.

Ambient Sampling: Dry weather sampling included dissolved oxygen, pH, conductivity, temperature, total dissolved solids, chlorides, sulfates, nutrients, fecal coliform and streptococcal bacteria, total organic carbon, total and dissolved metals, metals in sediment, and stream flow.

Aquatic Life: Ambient toxicity samples were taken at all sites during the rainfall and dry weather sampling events in an effort to clarify the source and identity of toxicity observed in previous samples. In-stream rapid biological assessments of the fish and benthic communities were also done twice at each site, once during early summer and again during the late summer index period.

Priority Pollutants: In an effort to identify the toxic element indicated by biomonitoring, a priority pollutant scan was planned for any samples for which ambient toxicity indicated consistent lethality to laboratory organisms. One sample during the study, a rain event sample, showed lethality during one test and no toxicity during a subsequent test on the same sample. Due to the transient nature of the observed toxicity, priority pollutants were not run in any of the samples collected.

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Rainfall Event Sampling: A set of samples were collected during the first flush of one rain event that were analyzed for the same parameter list as for the ambient condition samples.

Texas Watch Data Collection: Several employees with the City of Longview are certified to collect water quality data using the Texas Watch volunteer citizen monitoring kits. The volunteers used a calibrated Hydrolab Minisonde to collect data for Texas Watch. This data is also included to supplement study data.

SAMPLE LOCATIONS

Sampling site locations were selected to evaluate different parts of the watershed by sampling most of the major tributaries of Grace Creek and to monitor cumulative downstream conditions with several sites on the main-stem of Grace Creek.

Grace Creek Sampling Sites

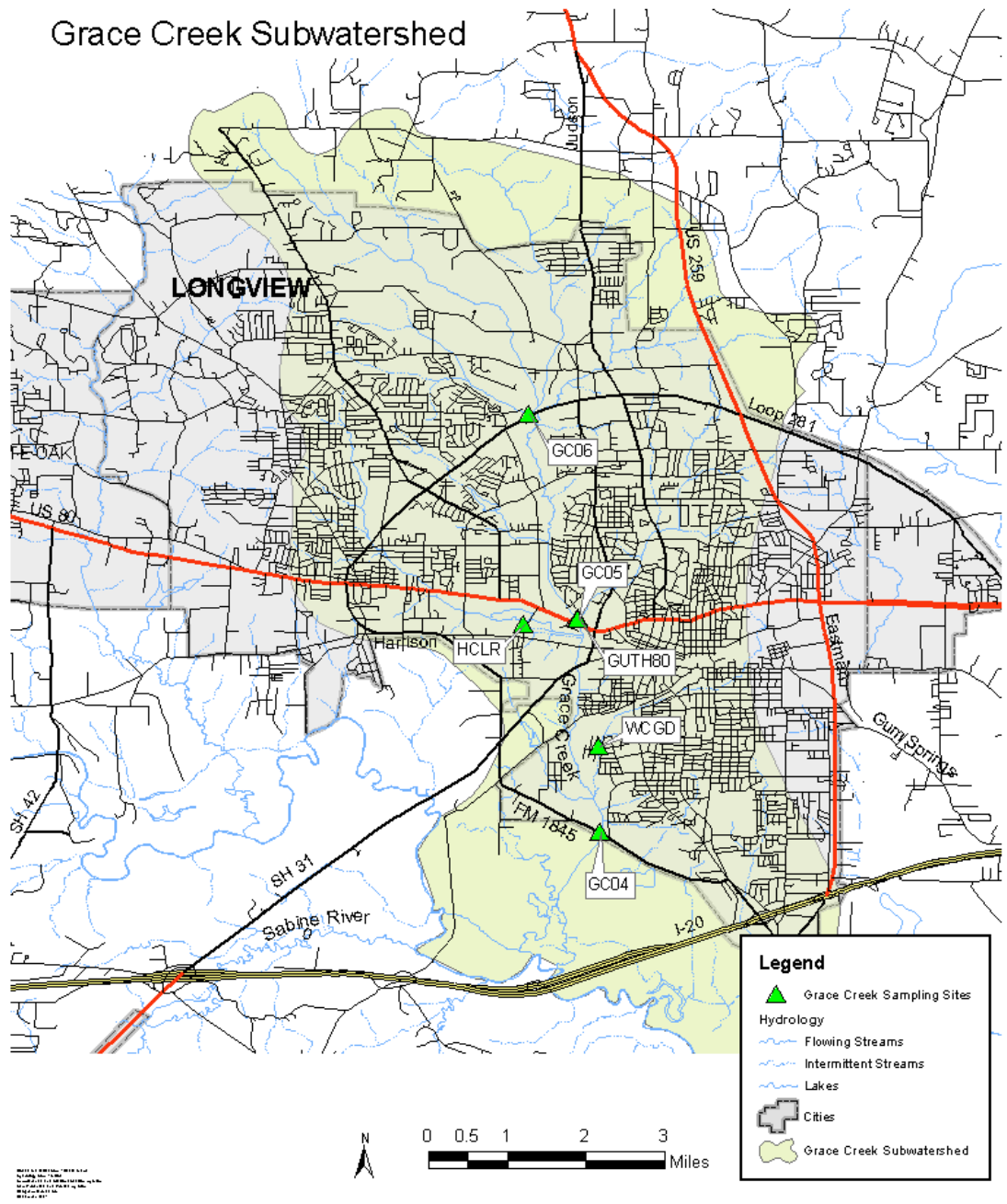
SRA ID	Description	TNRCC #	Parameter Set
GC04	Grace Creek at FM 1845	14499	AM, RF, AT, PP*
WCGD	Wade Creek at Garfield Drive	16685	AM, RF, AT, PP*
GC05	Grace Creek 100m upstream of US 80	16686	AM, RF, AT, PP*
GUTH80	Guthrie Creek 100m upstream of US 80	16687	AM, RF, AT, PP*
HCLR	Harris Creek at Lamond Road	16688	AM, RF, AT, PP*
GC06	Grace Creek at North Loop 281	16689	AM, RF, AT, PP*

Parameter Set Codes: AM = Ambient Sampling, RF = Rainfall Event, AT = Ambient Toxicity, PP = Priority Pollutants

* Note: A sample for priority pollutants was collected at each site but was to be submitted for analysis only if toxicity was indicated by the ambient toxicity sample.

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Grace Creek Subwatershed Map



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Grace Creek at North Loop 281 is the most upstream, site sampled. Four major tributaries with watersheds in northern Longview and partially outside the city limits have their confluence immediately upstream of this site. This watershed includes a large golf course and some street runoff but it has a lot more rural characteristics than the other sites.

Grace Creek 100 m upstream of US 80 is near the midpoint of the city and represents a large portion of the northern half of the watershed. This site is just upstream from the confluence of Guthrie Creek.

Guthrie Creek 100 m upstream of US 80 is a major tributary of Grace Creek and has the eastern portion of Longview as its watershed. This portion of the city is primarily residential. This site is just upstream of the confluence of Guthrie Creek with Grace Creek.

Harris Creek at Lamond Road is a tributary from the west side of Longview and has its confluence with Grace Creek near US 80. Harris Creek was sampled immediately downstream of Lake Lamond. Land use is largely industrial.

Wade Creek at Garfield Drive has its confluence with Grace Creek about 0.75 km upstream of FM 1845. This intermittent stream receives runoff from a railroad switching station.

Grace Creek at FM 1845 is a historical sampling site and is the most downstream public access to Grace Creek prior to its confluence with the Sabine River.

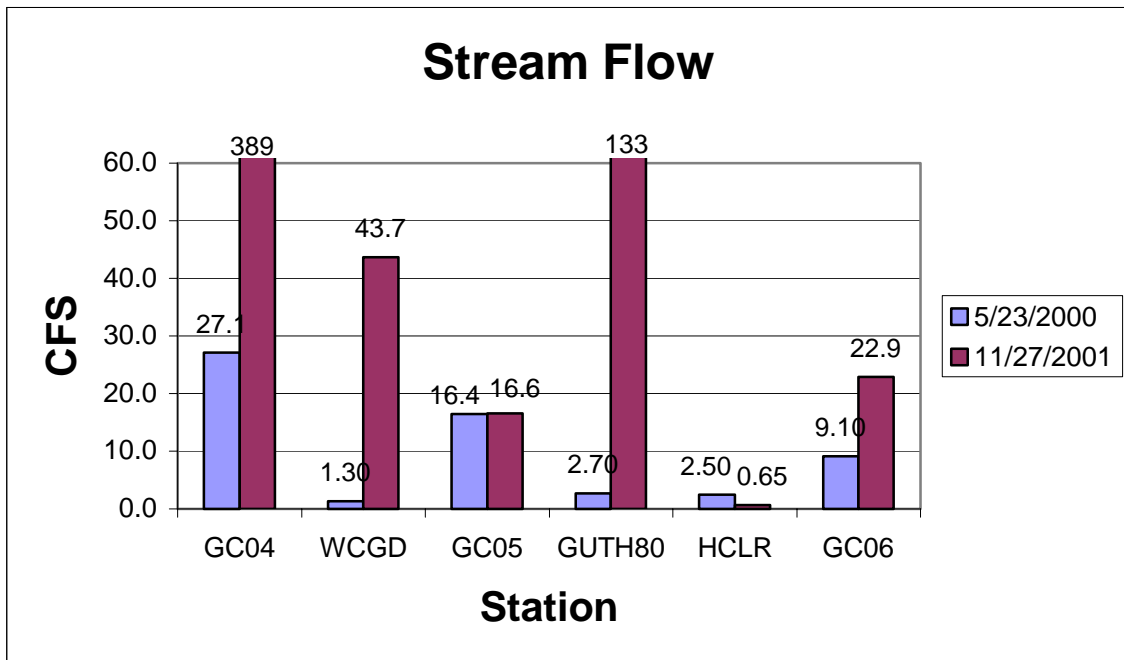
STREAM FLOW DATA

The design of the study called for normal or low flow sampling and for a first flush rain event sample set. The normal flow sample was collected on 5/23/00 and a rain event was sampled on 11/27/01. There were fourteen days with no rainfall runoff prior to the rain event. The City of Longview recorded 2.27 inches of rain during the night the rainfall event samples were taken. The rain appeared to have covered the entire study area although one site (GC05) had lower flow than was expected. Although the flow was lower than expected, the water level rose 18 inches at this site during the rain event. Several rain event collection methods were considered initially. Using auto-samplers has the advantage of requiring fewer people for sampling and less coordination obstacles in gathering equipment and staff before a storm and intercepting water samples at rising flow. Due to the short-term nature of this study, the large volume of water needed at each site for the desired tests, and security of unattended samplers in an urban setting, the decision was made to sample by hand. The rain event covered the entire watershed, was after at least a week of dry weather, and was heavy enough to provide a significant increase in flow. Water level elevations were measured the day before the rain event to establish pre- and post-rain stream level.

Flow was measured at all sites during the normal flow sample run and again during the rainfall runoff event. In May the highest flow was 27.1 cfs at the most downstream site,

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Grace Creek at FM 1845 (GC04). During the rain event this site was flowing at 389 cfs. Wade Creek at Garfield Drive (WCGD) was 1.3 cfs during normal flow sampling and up to 43.7 cfs during the rain event. Grace at US 80 (GC05) had about 16 cfs during both sample events. Guthrie Creek at US 80 (GUTH80) was 2.7 cfs during normal flow and up to 133 cfs during the rain event. During the rain event, sites downstream of US 80 would be more typical of the large amount of flow from Guthrie Creek than from Grace Creek above US 80. Grace Creek at North Loop 281 (GC06) had 9.10 cfs during normal flow and 22.9 cfs during the rain event. Harris Creek at Lamond Road (HCLR) had more flow during the normal flow event (2.5 cfs) than during the rain event (0.65 cfs). Due to the dry weather prior to the rain event, Lake Lamond, just upstream of this site, probably absorbed most of the runoff.



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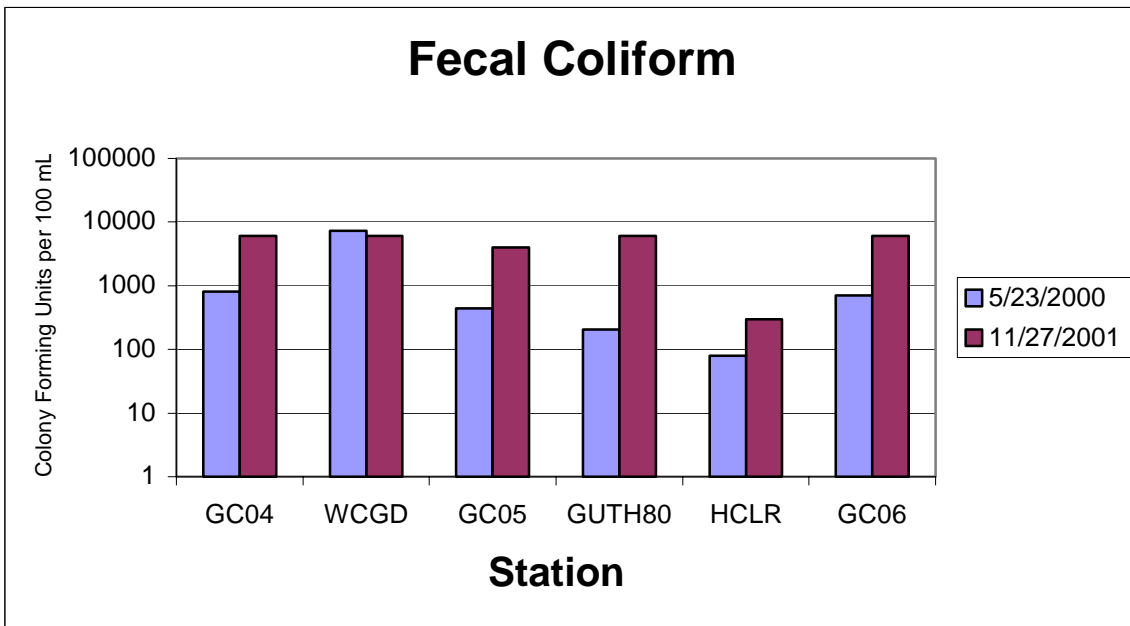
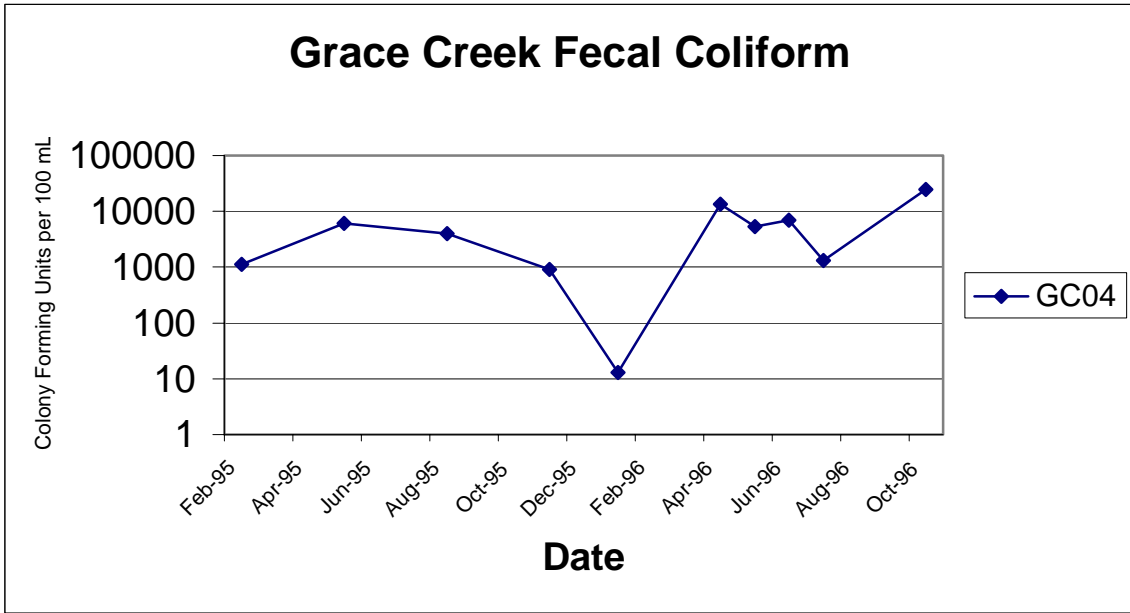
BACTERIOLOGICAL AND WATER CHEMISTRY DATA

Much of the water chemistry was predictable as a function of rainfall sampling vs. normal flow. Conductivity was generally low during the rainfall event and higher at normal flow. Dissolved oxygen was generally high in the rain event samples and the water lower. Turbidity was predictably elevated in the rain event samples. Bacteriological values were mostly in the thousands during the rain event and in the hundreds during normal flow.

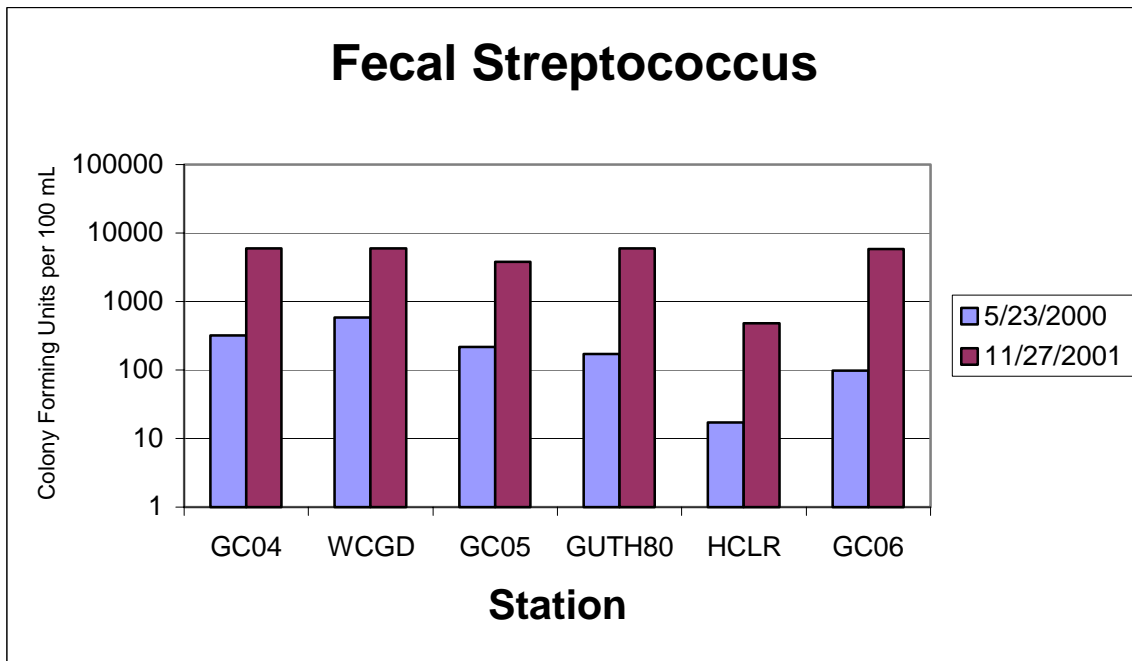
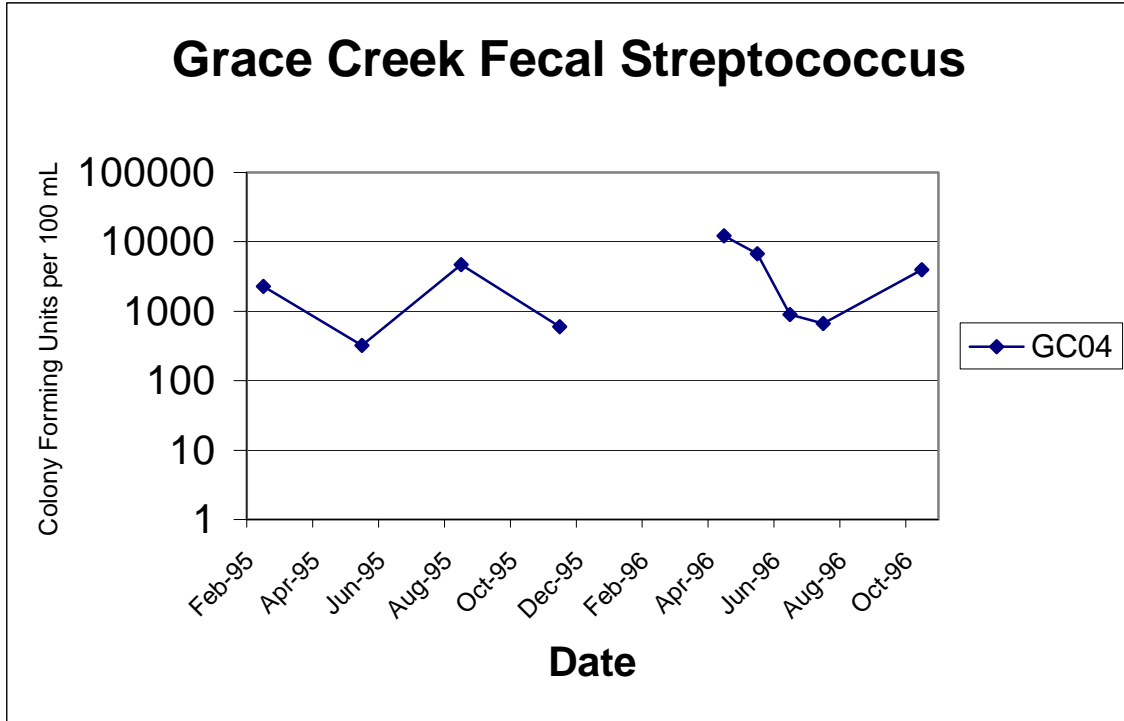
Bacteriological:

Fecal coliform and streptococcal bacteria have been above stream standards in most historical samples at GC04. Samples taken during this study were typical of historical values although samples taken during normal flow were much lower than the runoff event samples. Harris Creek at Lamond Road (HCLR) bacteriological values were relatively low in both sample events. Wade Creek at Garfield Drive (WCGD) had an unusually large number of coliform bacteria in the normal flow sample. Investigation upstream for a possible source was unsuccessful. The City of Longview took additional fecal coliform samples seven days later and found approximately one thousand CFU/100ml. In the normal flow samples, streptococcal bacteria numbers were less than half of the coliform bacteria at most sites. Low streptococcal to fecal ratios would imply the source of contamination was more likely from human waste than from animal feces.

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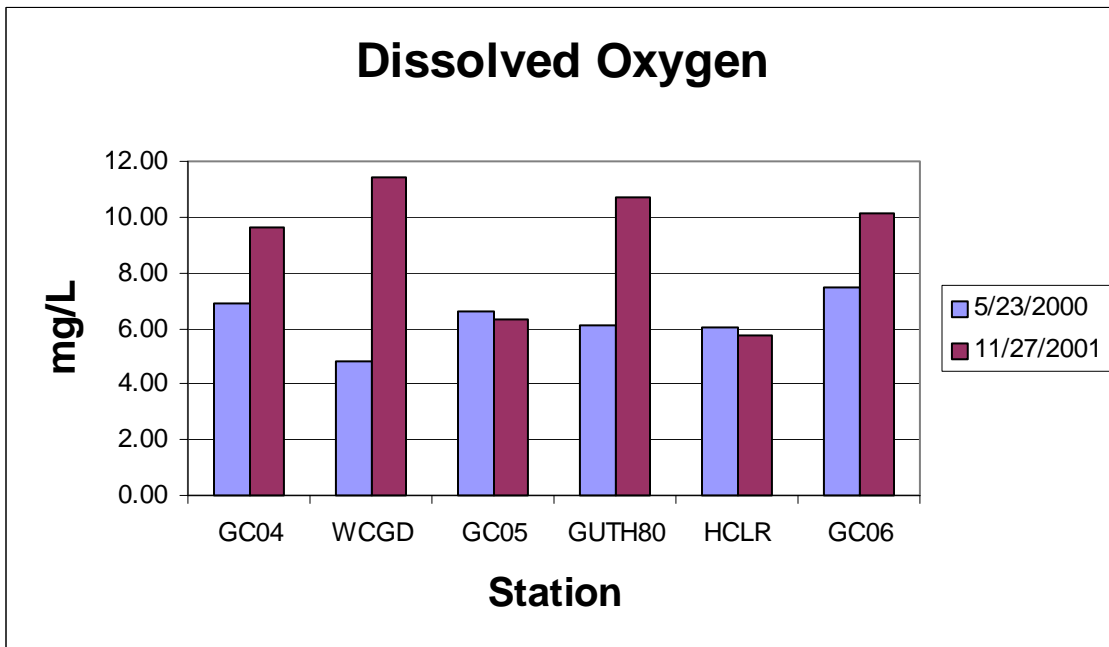
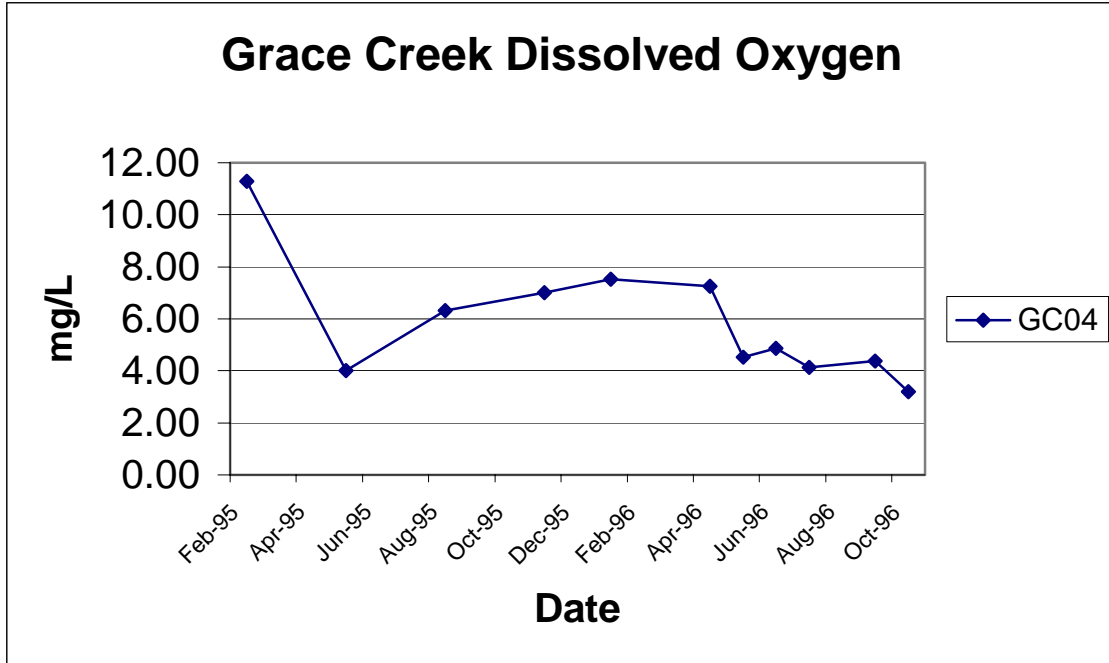
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Dissolved Oxygen:

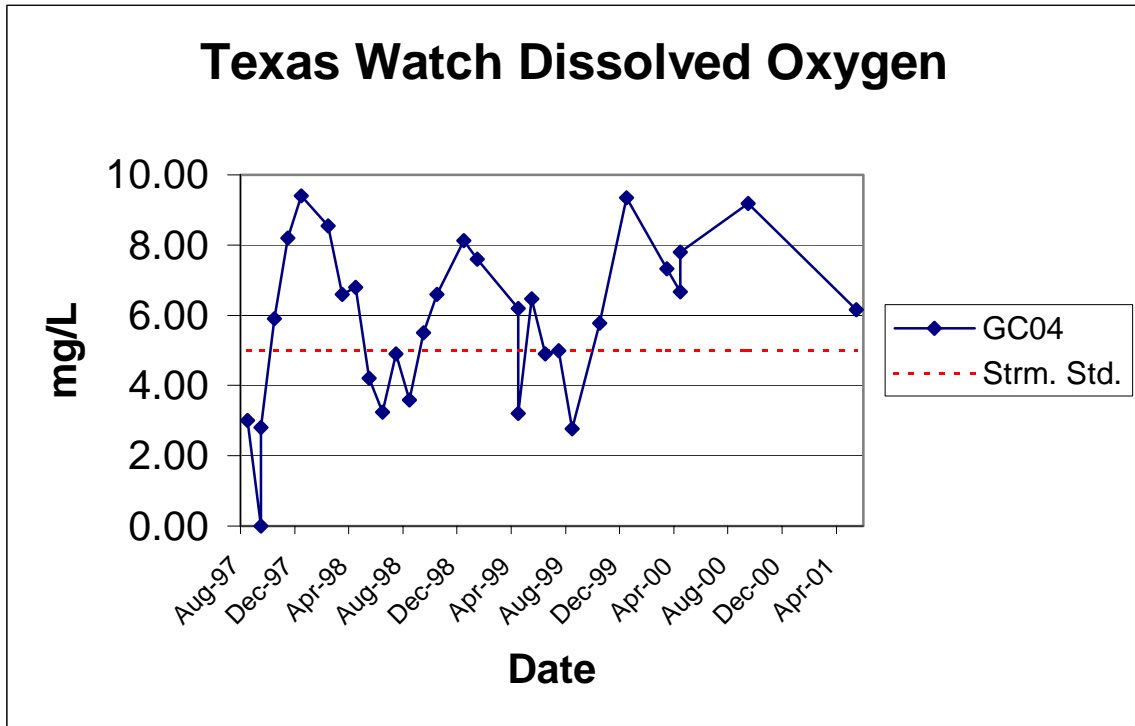
Historically, dissolved oxygen has occasionally fallen below stream standards at GC04 and some benthic samples indicated possible dissolved oxygen deficits. During this study dissolved oxygen met stream standards at all sites in all but one sample, WCGD, during normal flow. This site also had high fecal coliform at that time. The two lowest values for oxygen during the rain event were at sites with the lowest flow. Benthic and fish communities observed in this study did not indicate serious concerns for dissolved oxygen.



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Texas Watch Volunteer Monitoring Dissolved Oxygen

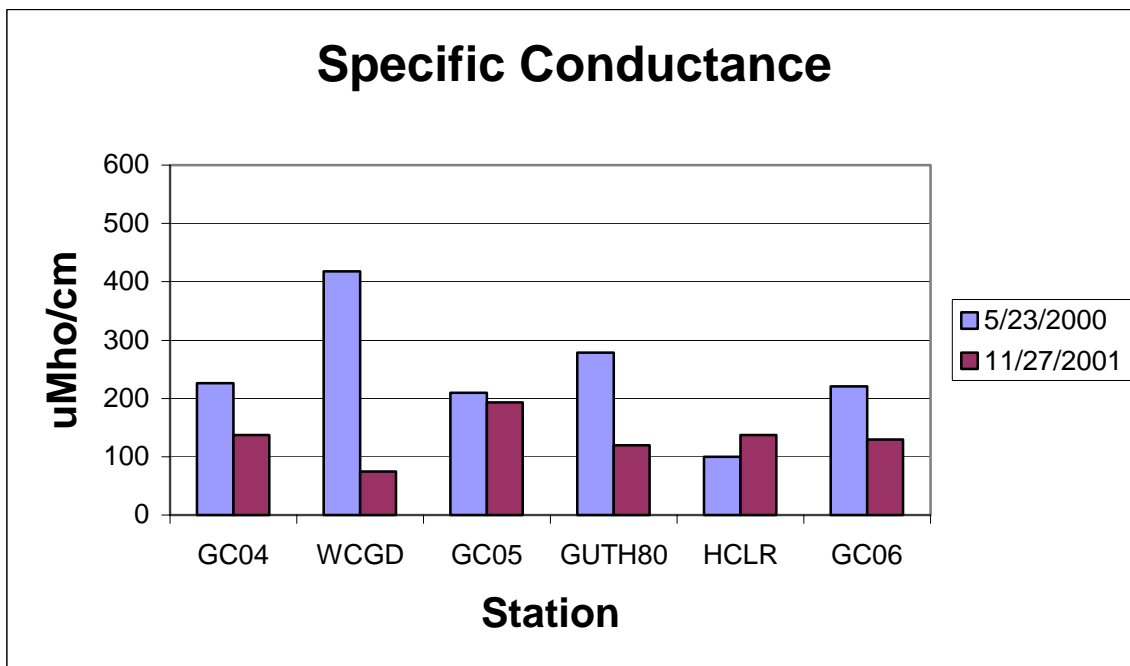
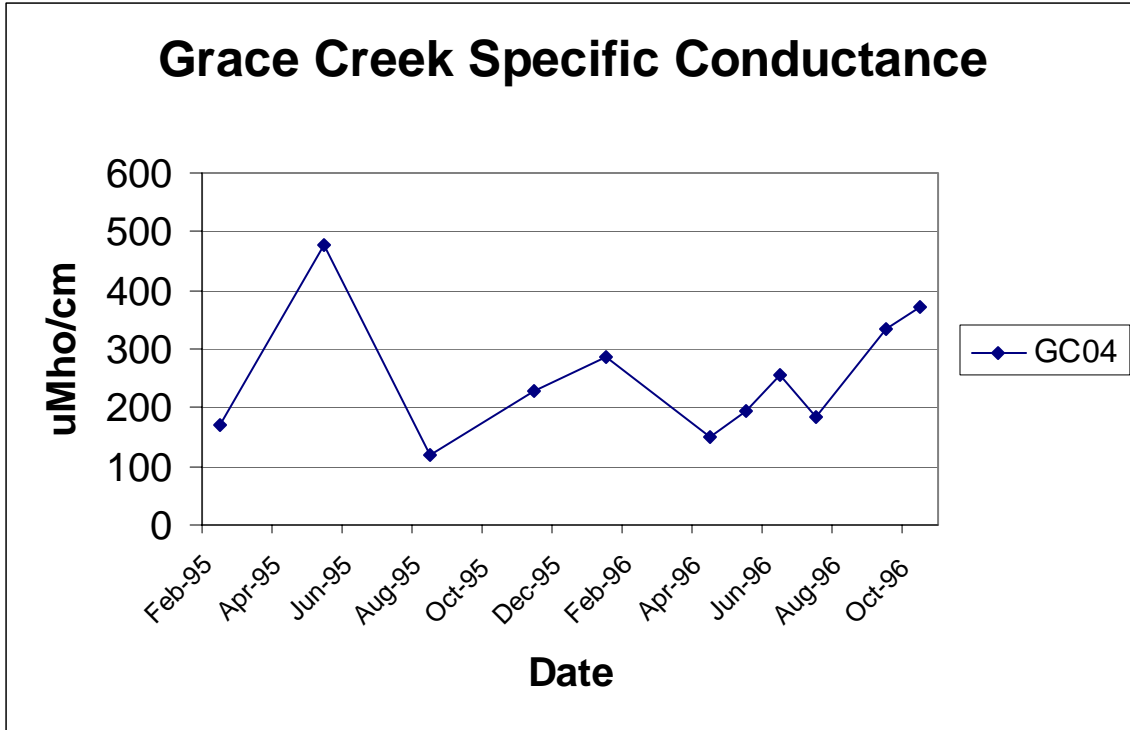
The City of Longview has several employees who have monitored Grace Creek at FM 1845 as a part of their Texas Watch volunteer monitoring program. This data is presented here to compliment other data collected during this study. The monitoring program detected a wastewater leak on 9/16/97. Programs such as this provide the city with more water quality data and early detection of any wastewater leaks that may occur.



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Specific Conductance:

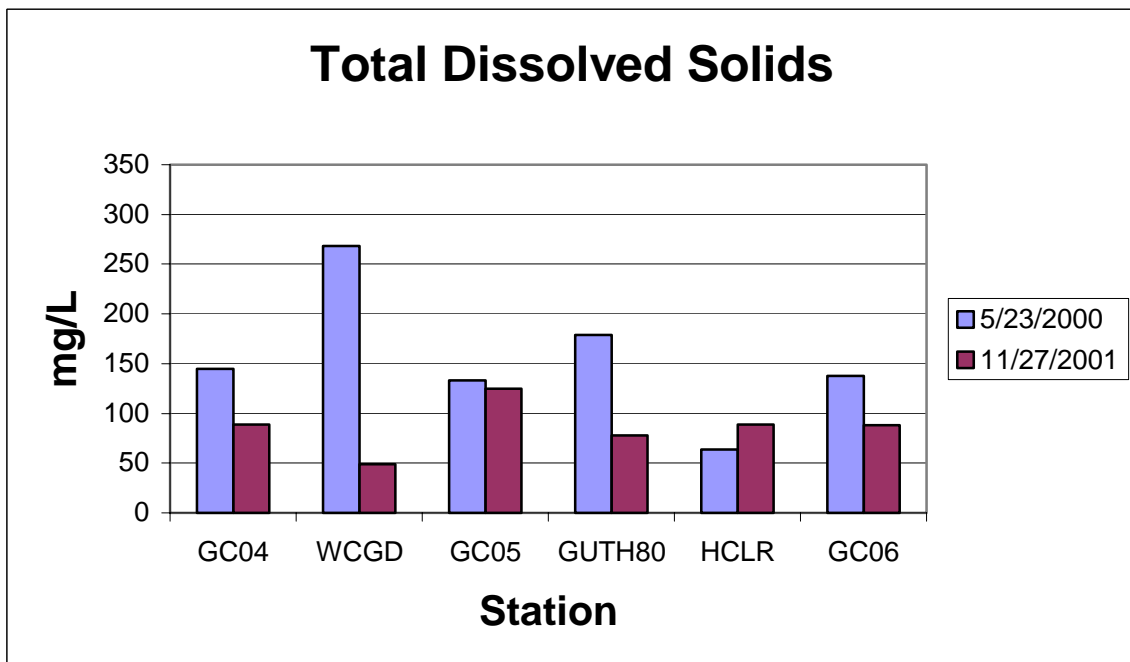
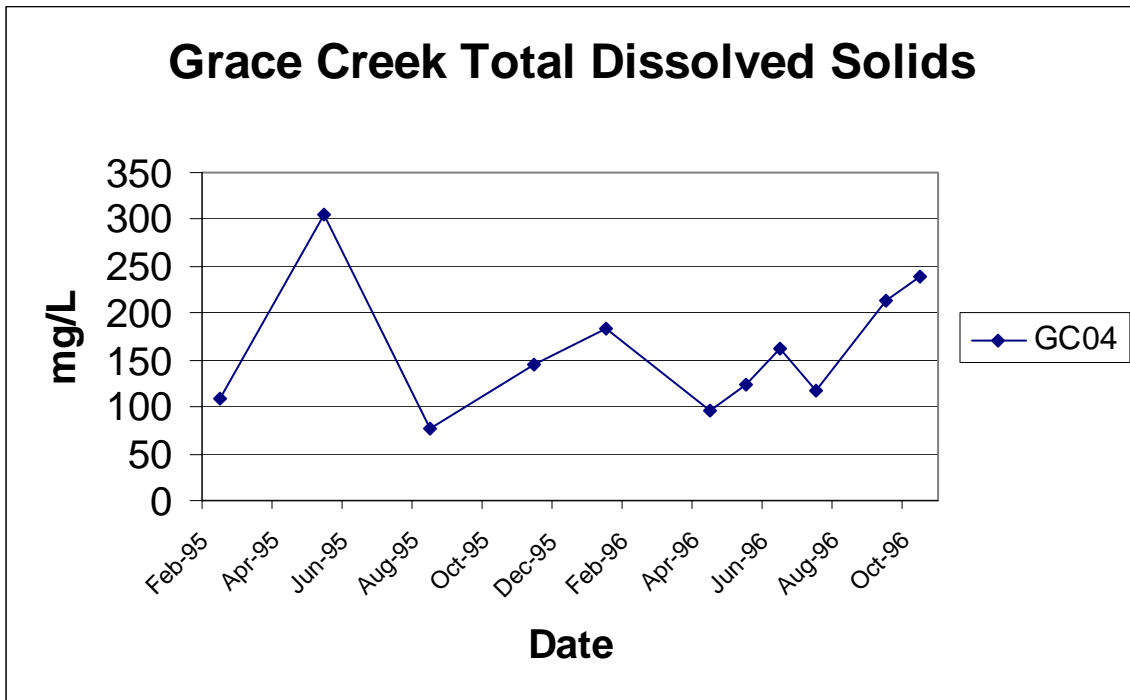
Specific conductance ranged from a low of 75 $\mu\text{Mhos/cm}$ at Wade Creek during the rain event to a high of 418 $\mu\text{Mhos/cm}$ at the same site during normal flow. These values are typical of normal water quality in the Sabine Basin.



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Total Dissolved Solids (TDS):

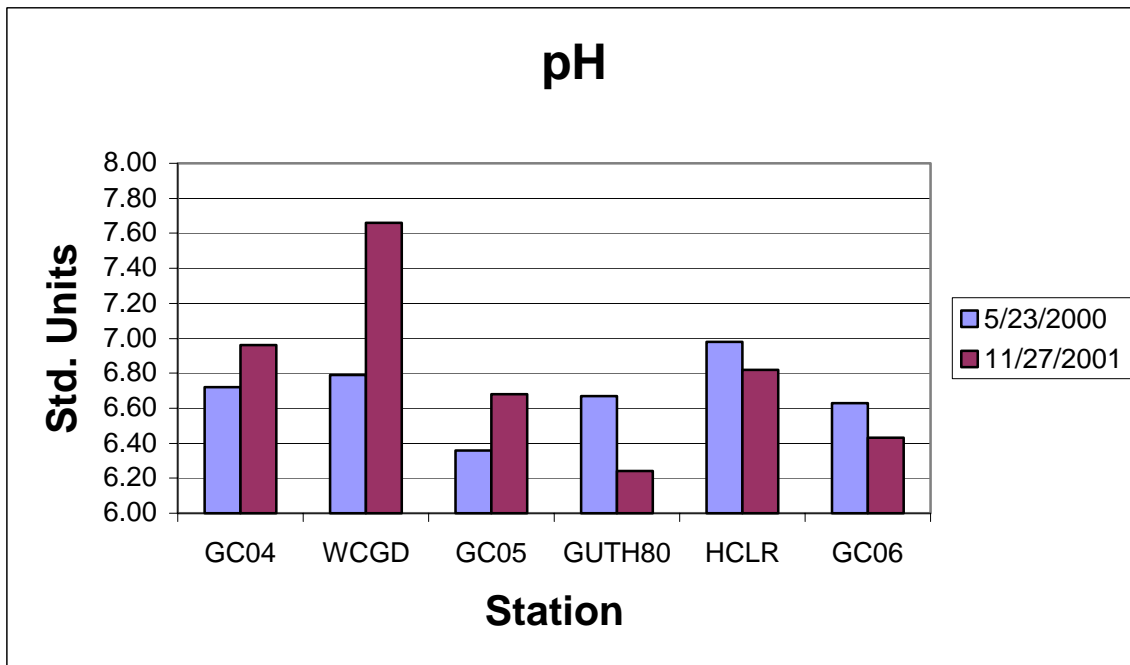
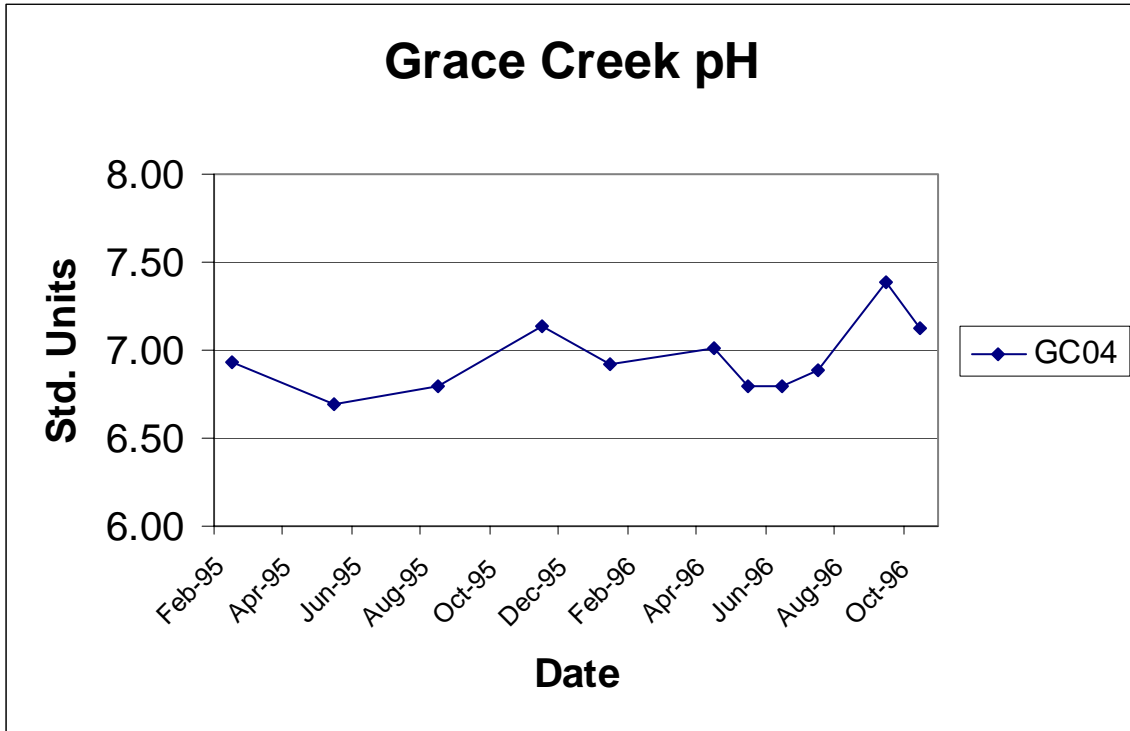
Total dissolved solids are calculated as a percentage of specific conductance so the same trends are followed. Stream standards have not been established for Grace Creek but the standard is 400 mg/l for the Sabine River Above Toledo Bend Reservoir. All samples were below that value. A review of historical data at GC04 does not indicate any concerns for TDS.



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pH:

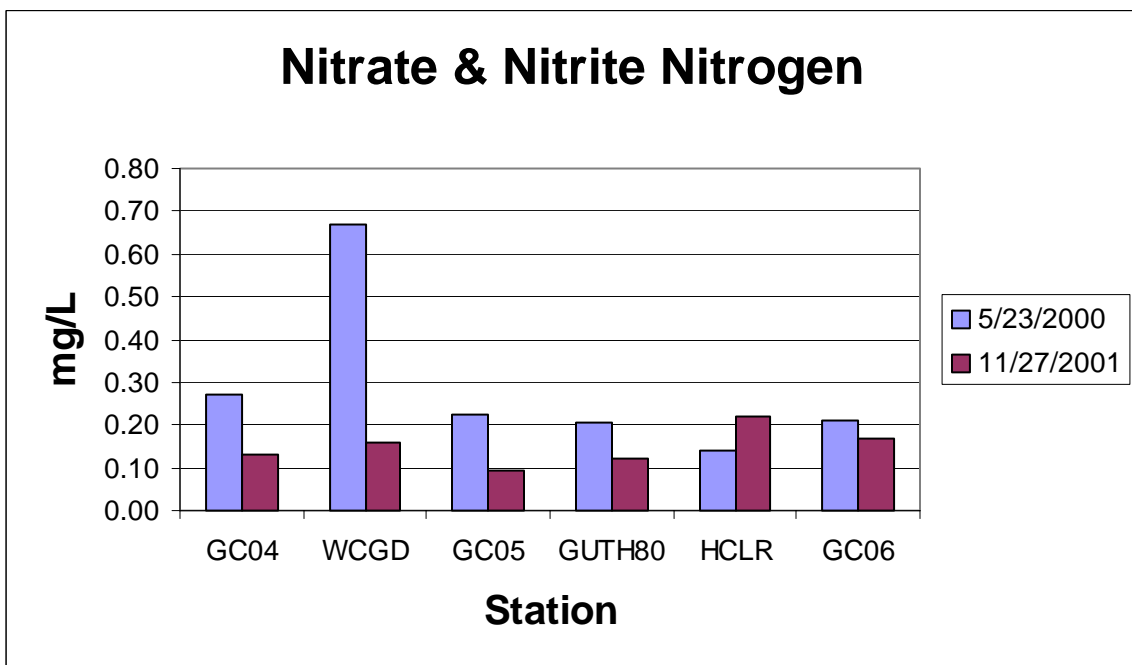
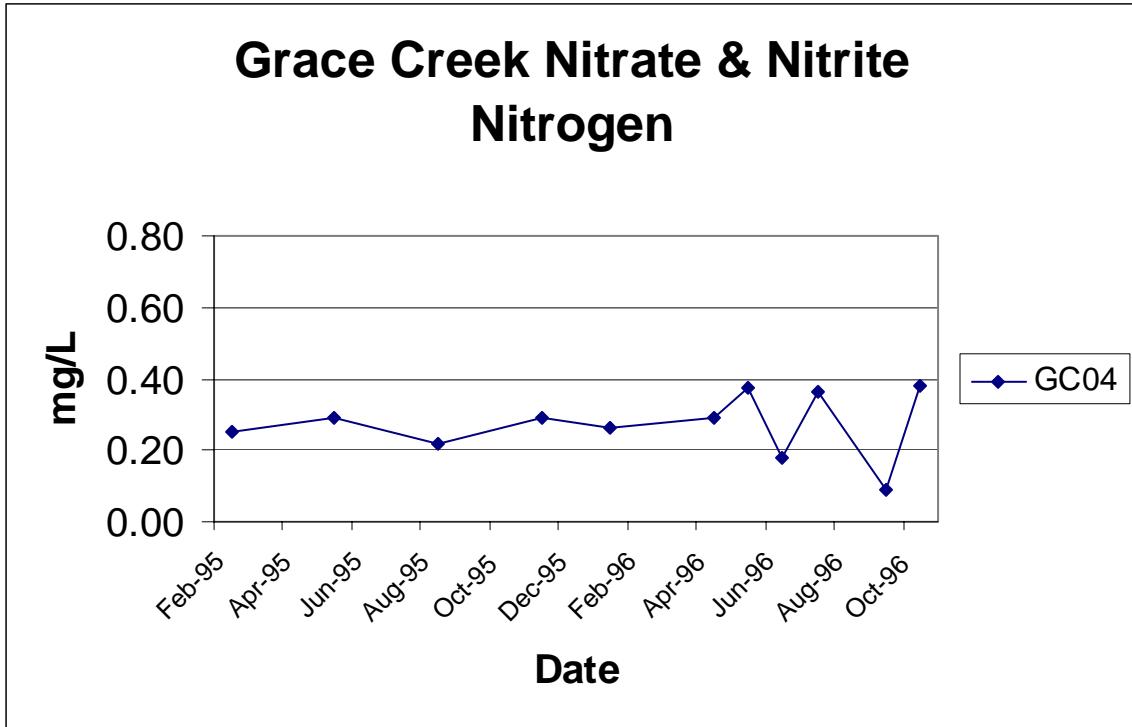
The pH was within limits for typical stream standards for all samples, ranging from 6.24 to 7.66. pH has ranged from 6.6 and 7.1 in historical sampling of GC04.



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Nitrate/Nitrite:

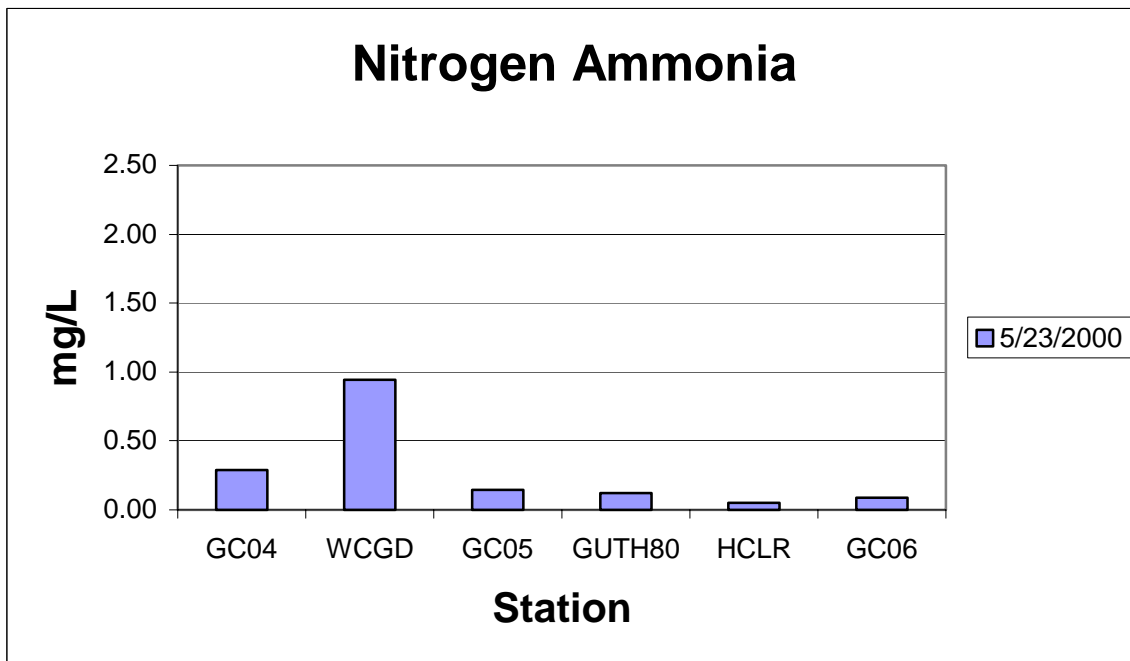
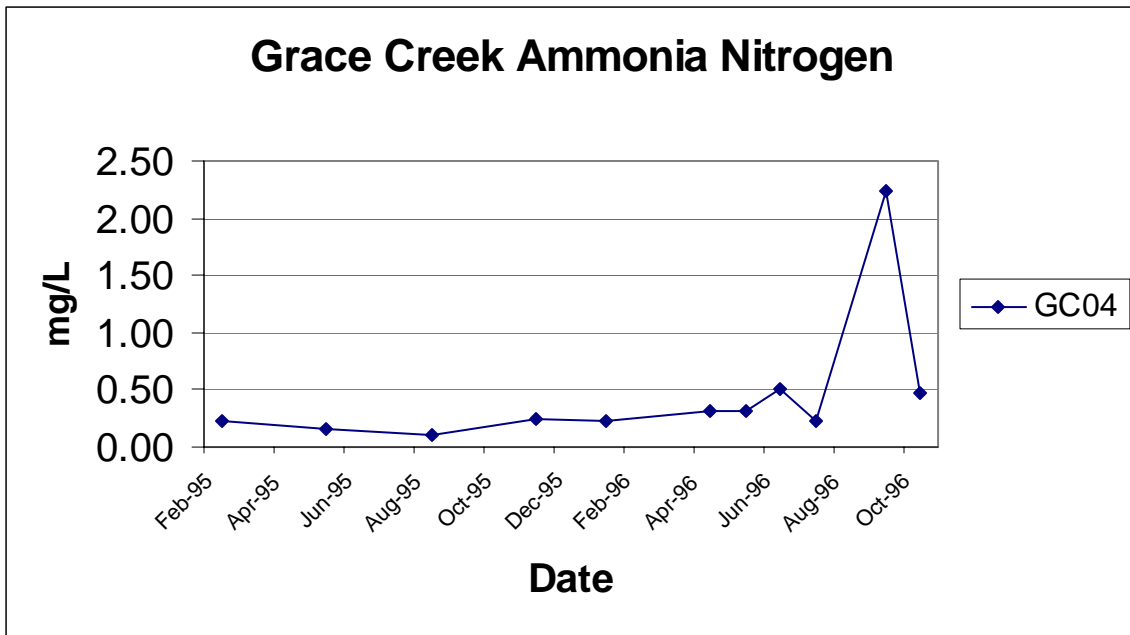
Guidance for screening nitrate/nitrite indicates values should fall below 3.50 mg/L. Historical data and study data indicate no concern for nitrate/nitrite. The highest level seen in this study was 0.67 mg/L at WCGD and 0.27 mg/L or less in other samples. The sample at WCGD also had elevated conductivity, bacteria, and lower dissolved oxygen.



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Ammonia:

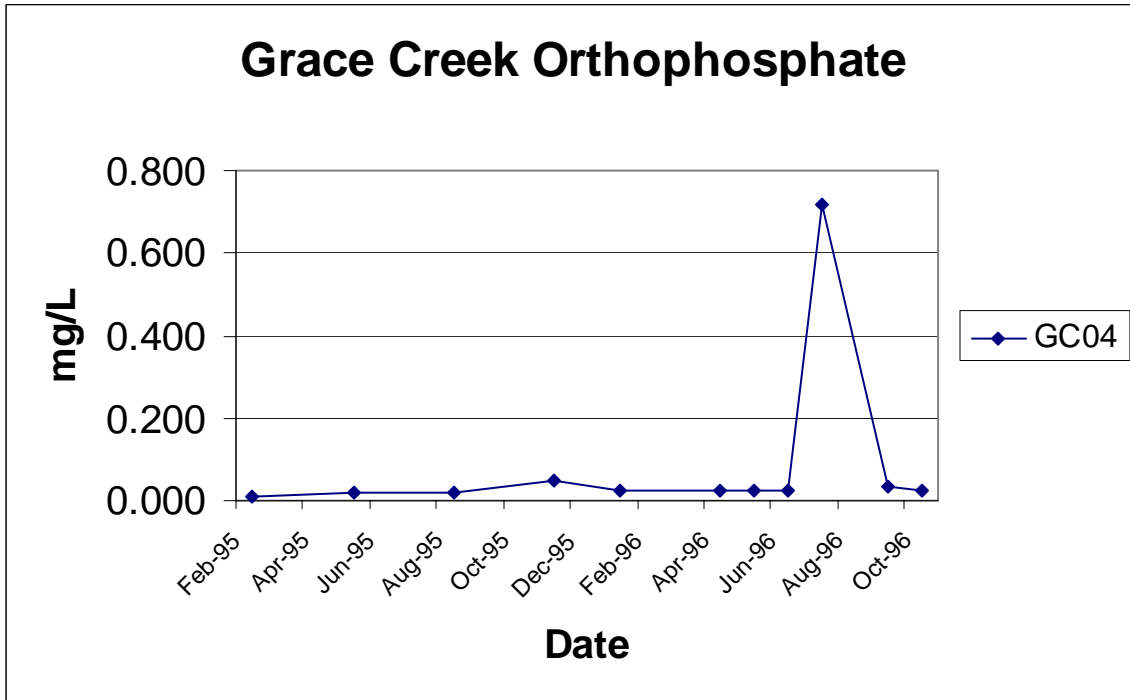
The screening level for ammonia nitrogen in freshwater streams is 0.16 mg/L. Historical samples from GC04 indicate concerns for ammonia. All but one historical value at GC04 has been above this level. The normal flow samples from GC04 and WCGD had elevated ammonia nitrogen with 0.29 and 0.94 mg/L respectively. CG05 and Guth80 were just under the screening level. Ammonia was not analyzed in the rain event sample.



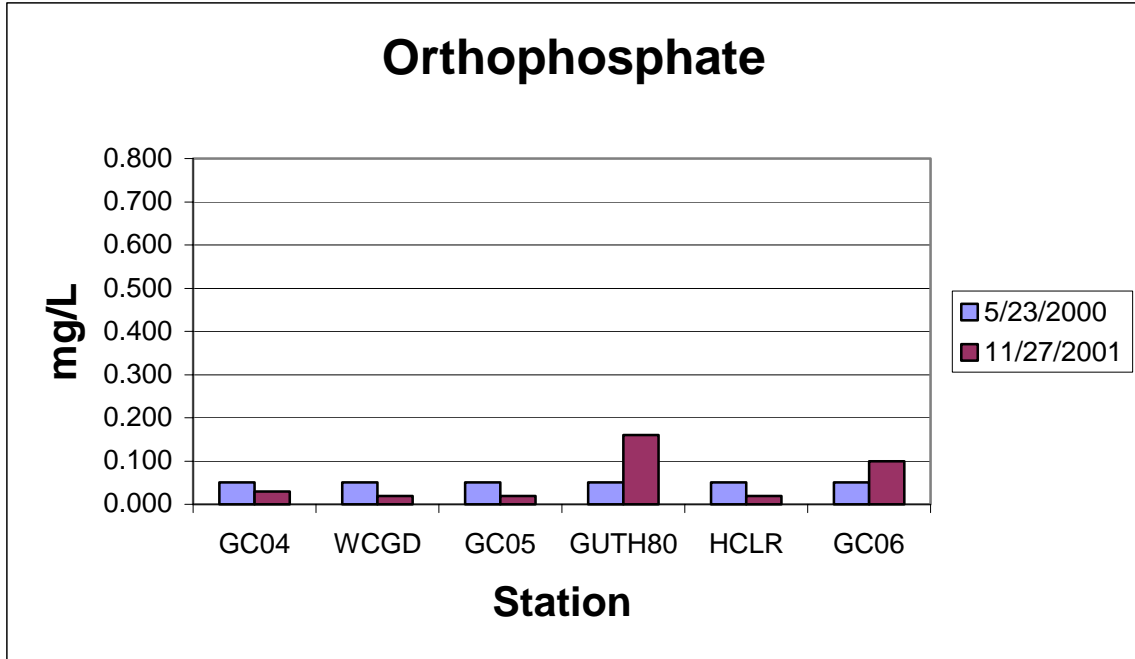
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Orthophosphate:

There have been no historical concerns for orthophosphate at GC04. Orthophosphate was less than detection limits (0.05 mg/L) 1 mg/L in all normal flow samples and less than the screening level (0.90 mg/L) in all of the rain event samples. The highest level was in Guthrie Creek (0.16 mg/L) and next highest at the most upstream Grace Creek site.



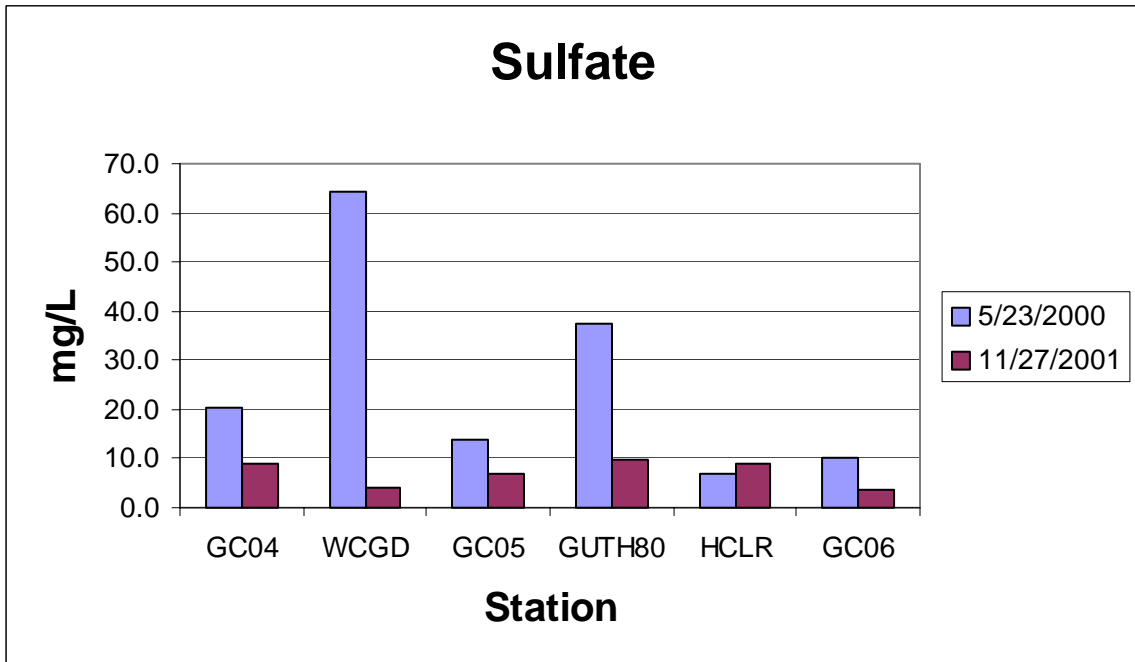
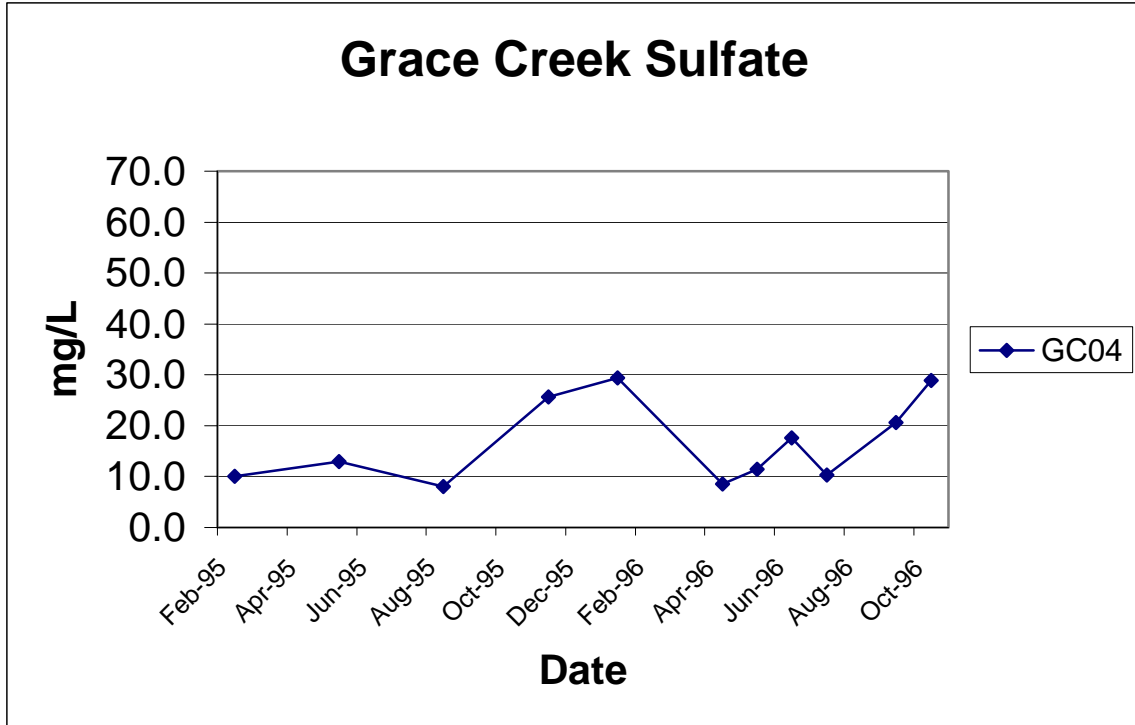
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Sulfates:

Stream standards for sulfates haven't been established for Grace Creek so the standard for the Sabine River Above Toledo Bend is used as a reference. The standard is 75 mg/L and all sites fell below this value. WCGD had the highest level with 64.5 mg/L in the normal flow sample. Historical levels at GC04 have ranged from 8.0-29.4 mg/L.

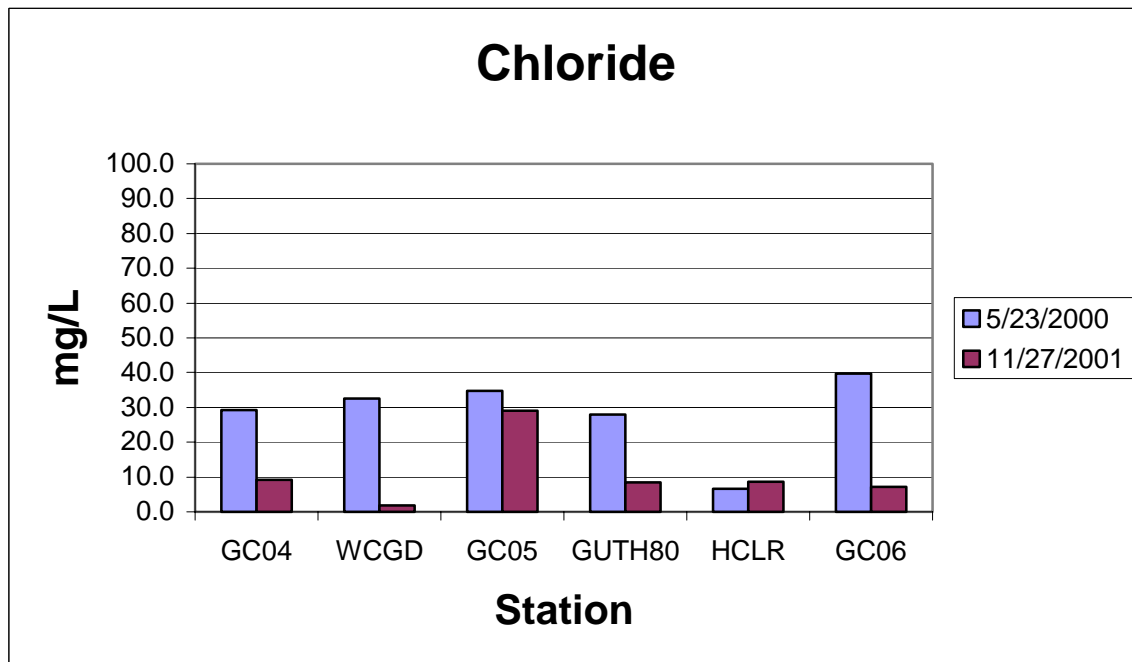
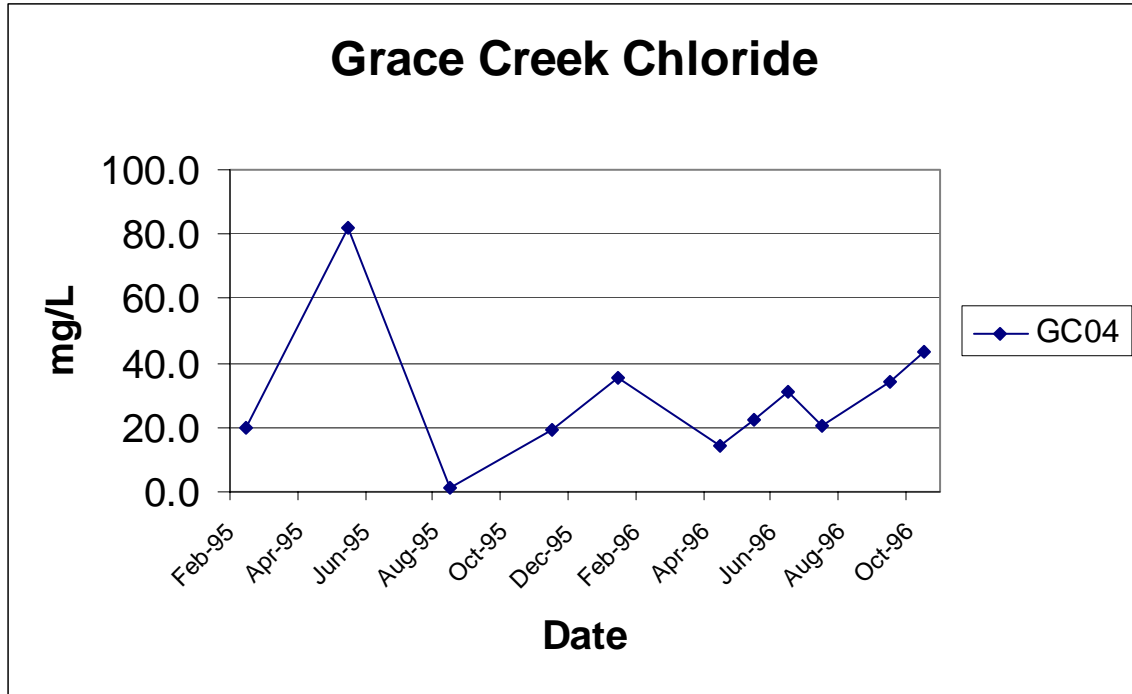
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Chlorides:

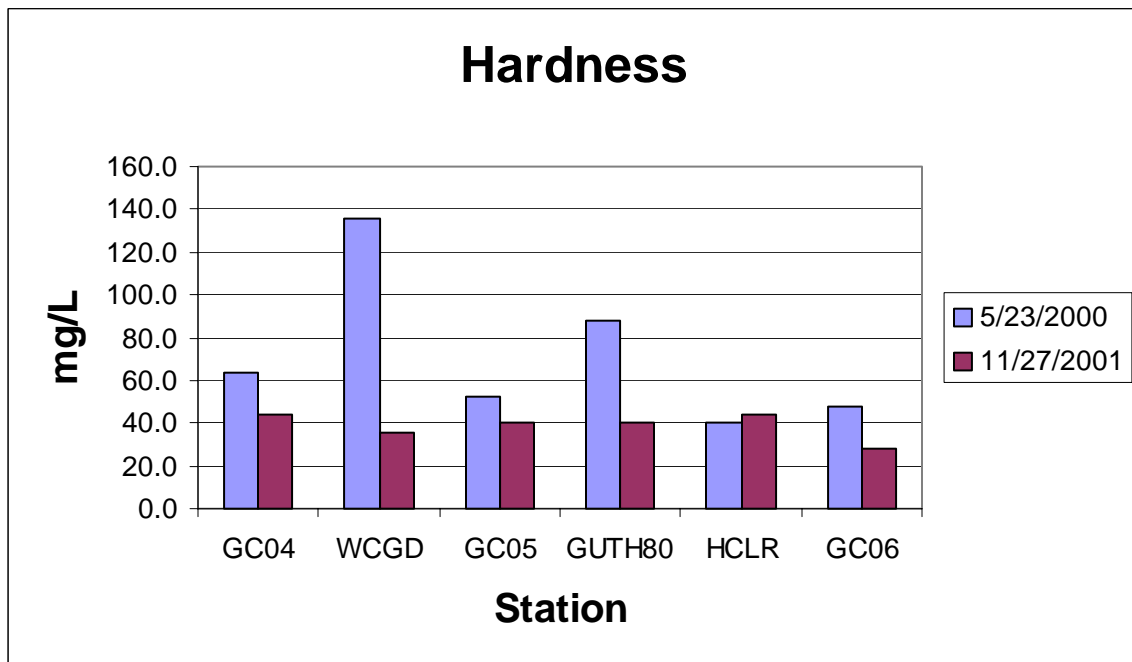
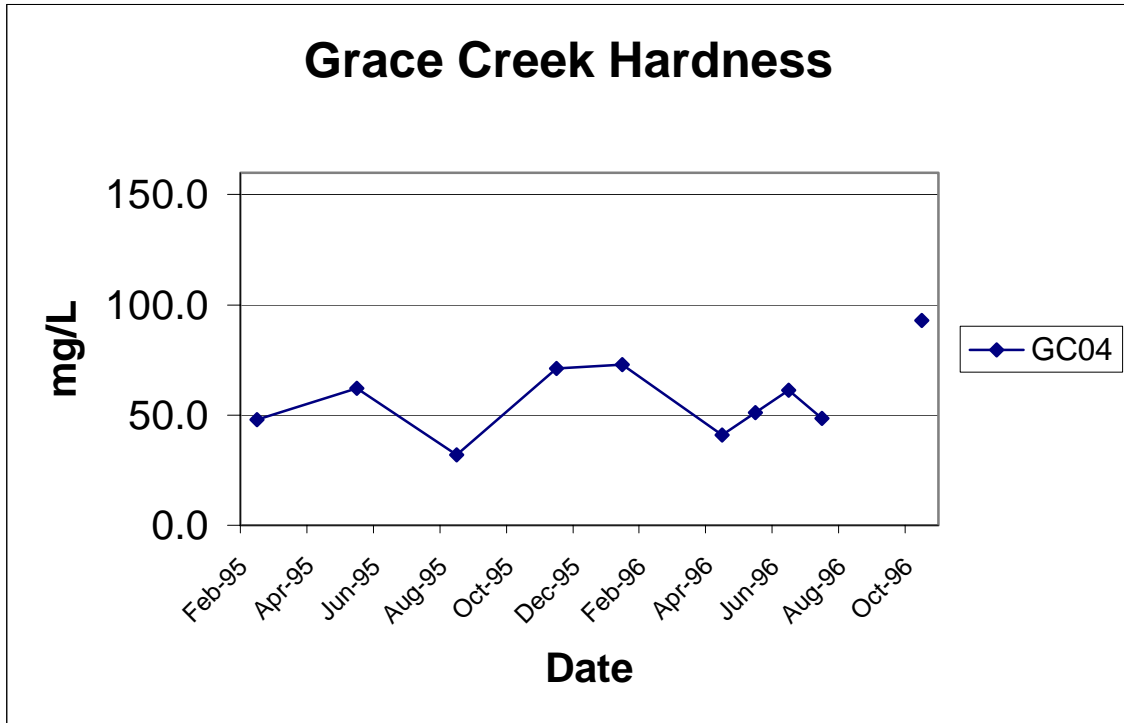
Stream standards for chlorides haven't been established for Grace Creek. The standard is 175 mg/L for the Sabine River Above Toledo Bend. Chlorides were generally higher during normal flow but well under typical stream standards. Historical values have ranged from <1.5-82 mg/L.



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Hardness:

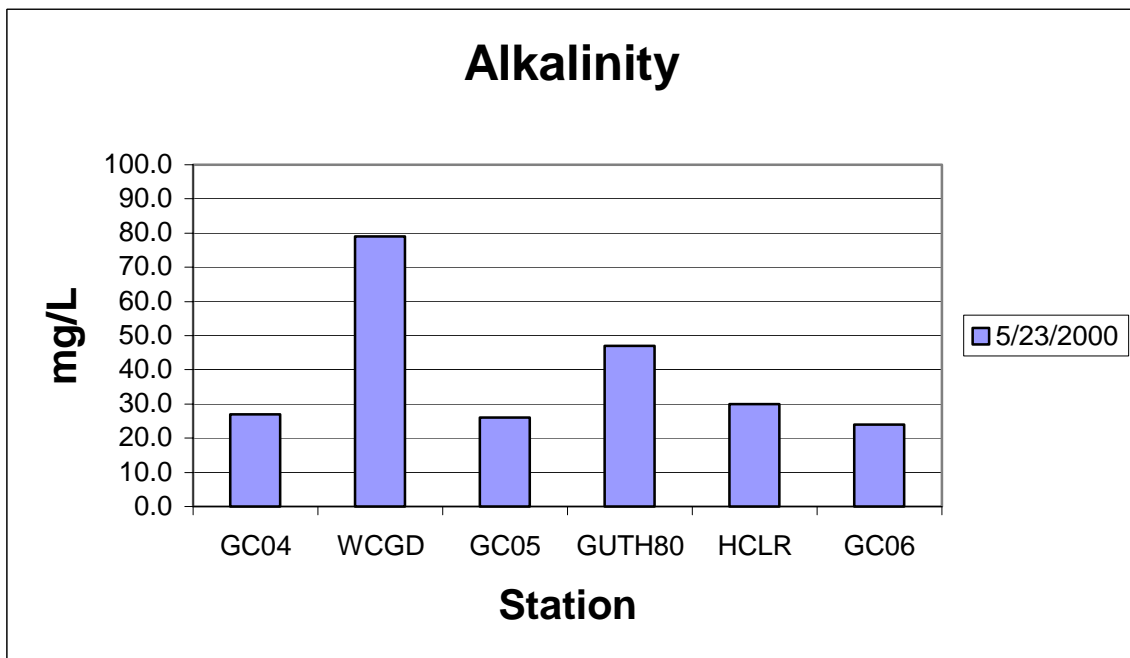
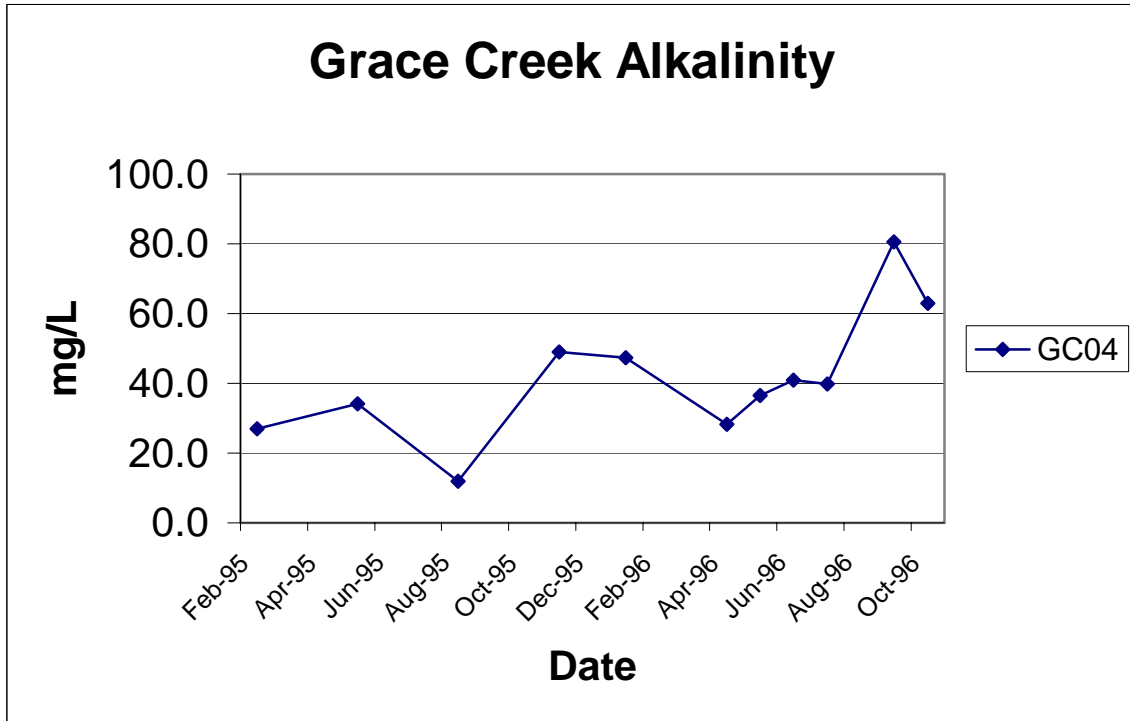
Historical hardness values at GC04 range from 32 to 92 mg/L. In this study, total hardness ranged between 28 and 88 mg/L at all but one site. Normal flow samples were generally higher than wet weather samples. WCGD was significantly higher than other sites with 136 mg/L. Although this level of hardness does not present a water quality problem, the value is unusual for the region and is indicative of an impact at this site.



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Alkalinity:

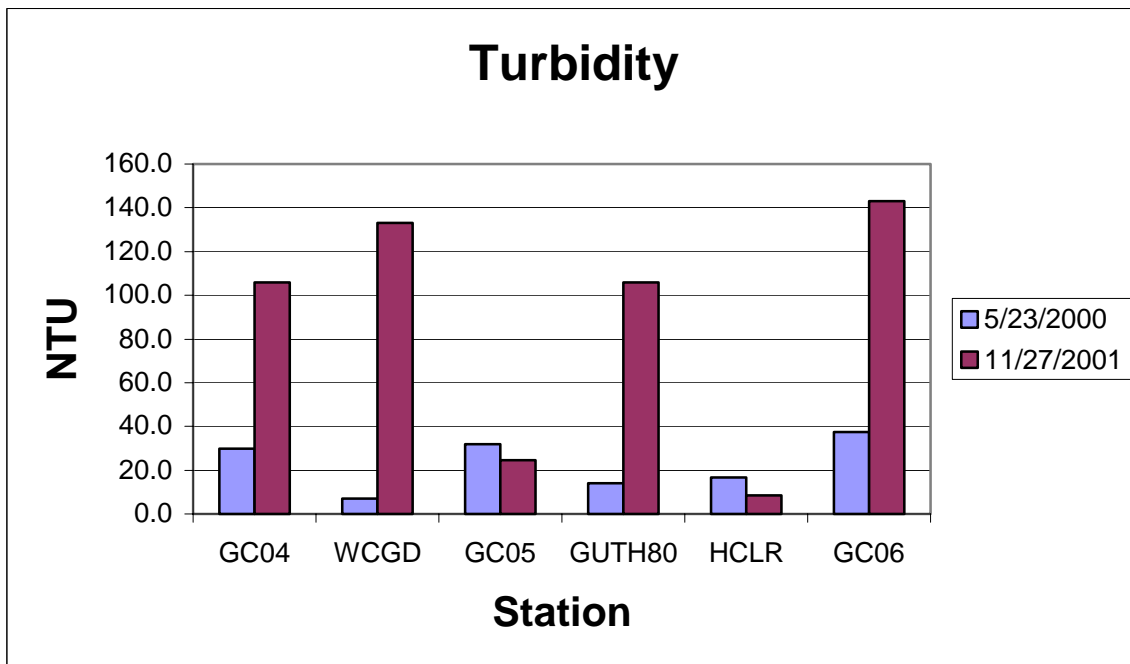
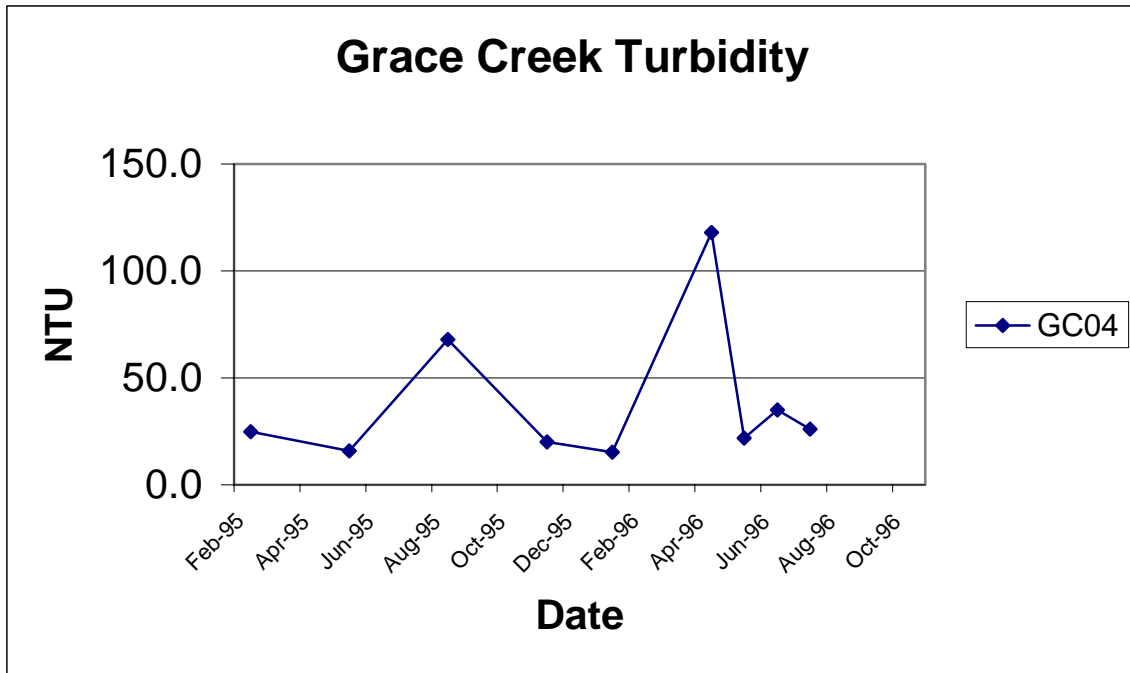
Historical alkalinity at GC04 ranges from 12-80 mg/L. In this study, alkalinity was only analyzed in normal flow samples and values fell within the historical range. WCGD was significantly higher than other sites with 79 mg/L. Alkalinity is considered to be representative of good pH buffering capacity but the value at WCGD is unusual and may be indicative of an impact at this site.



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Turbidity:

Historical turbidity values from GC04 range from 15.4 to 118 NTU. In this study, turbidity ranged from 7.1-37.5 NTU in dry weather samples and most rainfall event samples were at least 100 NTU. WCGD was very clear during the normal flow event. HCLR was quite clear during the rainfall event. This site is immediately downstream from Lake Lamond. GC05 had lower than expected flow during the rain event and turbidity was also relatively low.



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DISSOLVED METALS IN WATER DATA

Dissolved metals in water were analyzed in samples collected during the rainfall runoff event. The results were within acceptable levels for water of high quality.

Metal (µg/L)	GC04	WCGD	GC05	Guth80	HCLR	GC06
Arsenic	<2.33	<2.33	<2.33	<2.33	<2.33	<2.33
Barium	97.0	39.6	164	86.4	128	137
Cadmium	<1.08	<1.08	<1.08	<1.08	<1.08	<1.08
Chromium	<2.71	<2.71	<2.71	<2.71	<2.71	<2.71
Copper	1.5	1.6	<1.00	1.0	<1.00	<1.00
Lead	<1.00	1.3	<1.00	<1.00	<1.00	<1.00
Nickel	<2	<2	<2	<2	<2	<2
Silver	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Zinc	7	<5	<5	6	<5	9
Mercury	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Selenium	<2.62	<2.62	<2.62	<2.62	<2.62	<2.62

Metals tested did not appear to contribute to the ambient toxicity test that showed lethality at GC05. Copper could have been a contaminant since the field filter blank had 4.7 µg/L of copper.

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AMBIENT TOXICITY DATA

Ambient toxicity samples taken during past years (1995 and 1996) indicated some toxicity at Grace Creek at FM 1845 (GC04), the most downstream publicly accessible site in the watershed. Samples taken during this study did not identify any toxicity at that site. One site (GC05) showed lethality to *Ceriodaphnia* in the rainfall runoff sample. The test was repeated using the same water sample and no toxicity was seen. There was no toxicity to *Pimephales*.

Site	TNRCC#	Date Tested	<i>Ceriodaphnia dubia</i>	<i>Pimephales promelas</i>
Historical Data Review				
GC04	14499	02/15/95	SUBLETHAL	No toxicity
GC04	14499	05/17/95	No toxicity	SUBLETHAL
GC04	14499	08/02/95	LETHAL	No toxicity
GC04	14499	11/08/95	No toxicity	No toxicity
GC04	14499	01/18/96	No toxicity	No toxicity
GC04	14499	04/30/96	LETHAL	No toxicity
GC04	14499	05/08/96	LETHAL	Not Tested
GC04	14499	06/06/96	LETHAL	Not Tested
GC04	14499	07/31/96	No toxicity	No toxicity
GC04	14499	10/18/96	No toxicity	No toxicity
Normal Flow Sample Event				
GC04	14499	05/24/00	No toxicity	No toxicity
GC05	16686	05/24/00	No toxicity	No toxicity
GC06	16689	05/24/00	No toxicity	No toxicity
WCGD	16685	05/24/00	No toxicity	No toxicity
GUTH80	16687	05/24/00	No toxicity	No toxicity
HCLR	16688	05/24/00	No toxicity	No toxicity
First Flush Runoff Sample Event				
GC04	14499	11/27/01	No toxicity	No toxicity
GC05	16686	11/27/01	LETHAL	No toxicity
GC06	16689	11/27/01	No toxicity	No toxicity
WCGD	16685	11/27/01	No toxicity	No toxicity
GUTH80	16687	11/27/01	No toxicity	No toxicity
HCLR	16688	11/27/01	SUBLETHAL	No toxicity

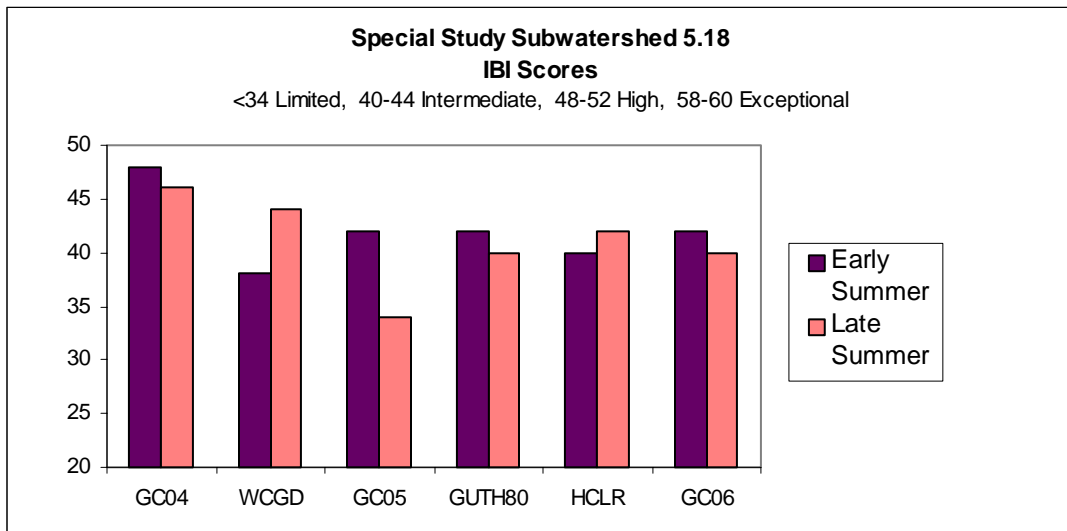
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BENTHIC MACROINVERTEBRATE AND FISH DATA

Fish and benthic macroinvertebrates were collected twice at each site, once in early summer and again in the late summer index period. The index of biological integrity (IBI) and the USEPA Rapid Bioassessment (RBA) Protocol II were applied to assess the health of each population. The IBI was used to analyze fish data and assign an aquatic life use for each site.

Index of Biological Integrity (IBI):

Most of the sampled streams scored "Intermediate" using the IBI. The average score for the five study sites that scored "Intermediate" was 41. GC05 scored "Limited/Intermediate" and the most downstream site on Grace Creek (GC04) scored Intermediate/High. "These scores are typical for most Upper Sabine Basin streams sampled by SRA. The lowest score at GC05 is thought to be due to difficulties collecting a good fish sample in the late summer sample. The habitat that was sampled during early summer was suitable for capturing fish but in late summer, this part of the stream was no longer inundated with water. The downstream site was deep (a little over a meter) and wide with a very irregular clay bottom that probably allowed fish to escape under the seine. Electroshocking had limited success but produced most of the fish caught.

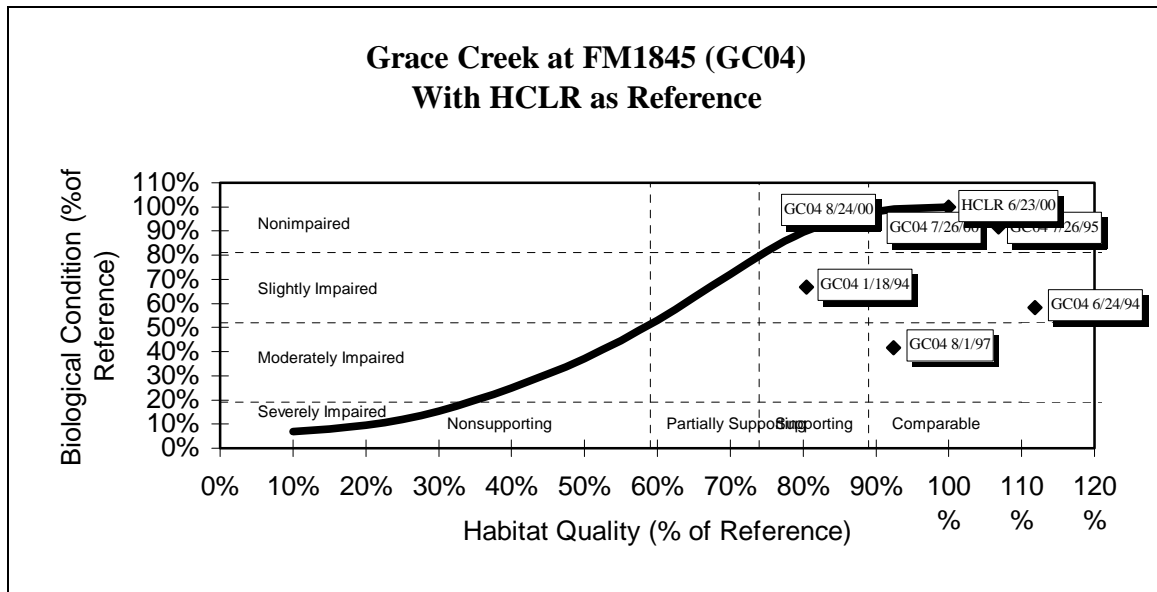


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Rapid Bioassessment (RBA):

The RBA is used to evaluate the benthic macroinvertebrate community and stream habitat and compare study sites against a relatively non-impacted reference site.

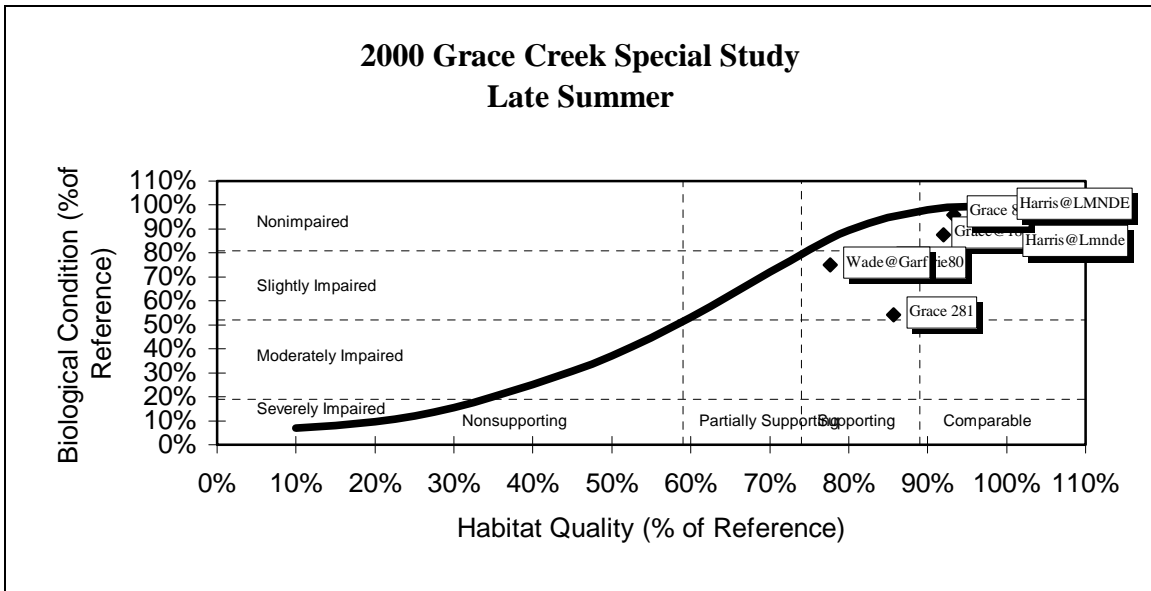
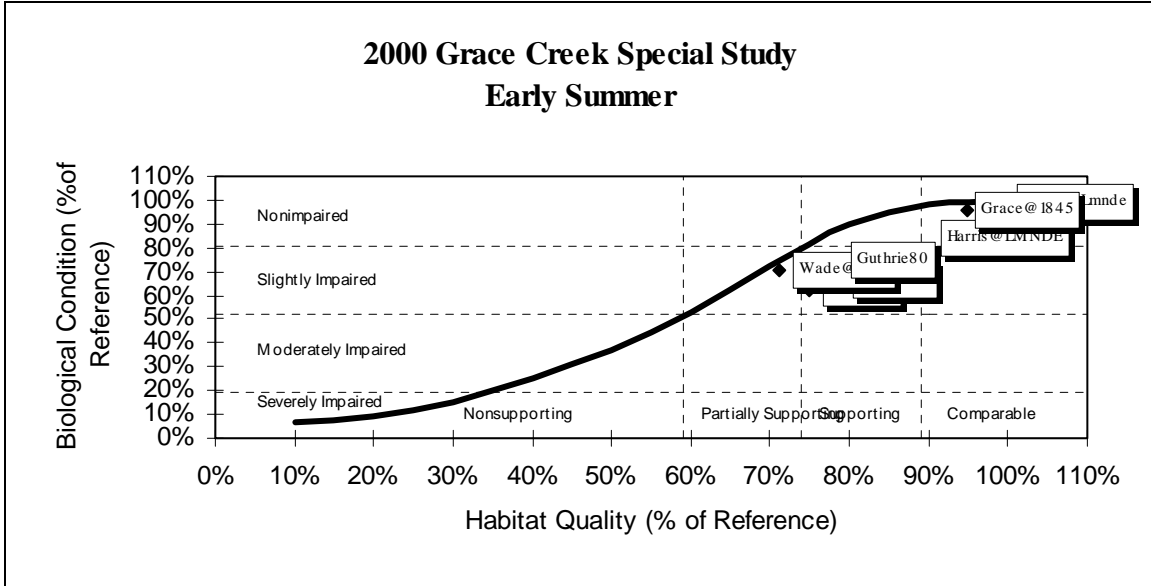
Historical RBA sampling indicated some concerns for Grace Creek at FM 1845 (GC04). Historical data and data from this study for GC04 is graphed below to show how benthic scores have been significantly lower in some samples than others. In this graph all points are of the same site but different sampling dates. The sample date with the best biological score is used as a reference and other sample dates graphed with it. Left and right variation indicates differences in habitat scores while vertical differences indicate change in biological scores. The 8/1/97 sample was markedly lower in benthic diversity than other dates. Dipteran (midge) larvae dominated the sample and very few organisms with high oxygen requirements were present. The 6/24/94 sample was also biologically limited when compared to the habitat availability. On other dates and during the study, a good variety of organisms were present.



The following graphs show study data only, with one site as a reference and the other five sites graphed for comparison of differences between sites. Harris Creek at Lamond Road was selected as a reference site since it appeared to have good species diversity and diverse habitat types. Both samples from the reference site are graphed on each chart for comparison. Sites that fall near the curve have benthic communities that are expected in the habitat that was available for colonization. Sites that fell significantly below the curve had a benthic community that was not as species rich as would be expected in the observed habitat. All sites had benthic communities that were reflective of their habitats. GC06, the most upstream site, was closest to showing some impairment in the late summer sample. There was no flow at that time and benthic macroinvertebrates were collected from non-flowing pools. GC04, which showed some benthic impairment in

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past samples, had a good benthic and fish community in both early and late summer samples during this study.



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SUMMARY AND RECOMMENDATIONS

This study does not indicate any significant biological toxicity or impairment at any of the selected sites. Fish and benthic communities were typical of the region. Although site GC04 showed benthic community impairments in 1995 and 1996, this study indicated it had excellent fish and benthic populations. Ambient toxicity tests using *Ceriodaphnia* and *Pimephales* did not establish any consistent toxicity patterns. The rainfall event sample from GC05 that contained some toxic element is of some concern. The toxicity apparently did not persist as evidenced by the second test on that sample failing to exhibit lethality. That could indicate a volatile constituent or one that was rapidly converted to a form that was less toxic through chemical or biological degradation. One site indicated significant impacts in water chemistry in the normal flow sample. This sample from Wade Creek at Garfield Drive (WCGD) was characteristic of wastewater impacts with elevated nutrients, lower oxygen, elevated conductivity, and high bacteriological counts. The water was quite clear at the time of this sample and did not have visible signs of impacts. Employees from the City of Longview investigated upstream and around the site and did not find evidence of a leak. A second bacteriological sample was much lower than the first sample but was still elevated at 1000 CFU/100 mL. Bacteriological testing at all but Harris Creek indicated exceedance of stream standards for fecal coliform. The normal flow sample was taken four days after a rainfall so elevated counts in that sample set could have been caused by runoff at that time. The rainfall event samples were in excess of 4000 CFU/100 mL at all sites except Harris Creek. The SRA routinely encounters similar values immediately after rain events in the main stem of the Sabine River. High fecal coliform counts are closely related to sediment loading (turbidity) so the Grace Creek watershed may not be significantly different from other local streams during rainfall runoff periods. Exceedances of screening values for ammonia in GC04 and WCGD in the normal flow samples are noteworthy but did not appear to adversely impact biological communities.

Grace Creek and its tributaries do not appear to be as significantly impacted as one might expect given that the watershed is almost entirely contained within the city. Only one site (WCGD) was channelized and it had a natural bottom. Fish and benthic communities reflect the good habitat and seem to indicate the water quality is also adequate for their growth and reproduction.