White Rock Creek Data Report

July 2010

Prepared by:
Texas Stream Team
River Systems Institute
Texas State University – San Marcos

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Introduction

Water Body Location: White Rock Creek (Segment 827A) begins in southeast Frisco, TX and flows for 23.5 miles before emptying into White Rock Lake (Segment 827). On the opposite side of the lake, it flows for another eight miles before emptying into the Trinity River.

Water Body Description: It is called White Rock Creek because the substrate through which it flows is mostly Austin Chalk, a highly erodible, white bed rock. Vegetation mostly consists of Cedar Elm, Pecan, and Ash trees.[i] Surrounding land use is predominantly urban as the creek flows through the northern Dallas side of the metroplex. It is intermittent in its upper reaches but flows all year further downstream. The seven miles upstream of White Rock Lake are surrounded by parkland, which serves as a buffer zone for storm-water runoff from surrounding communities.

Texas Stream Team: Texas Stream Team is a volunteer based citizen water quality monitoring program. In alignment with Texas Stream Team's core mission, monitors collect surface water quality data that may be used in decision-making processes to promote and protect a healthy and safe environment for people and aquatic inhabitants. Citizen monitoring occurs at set monitoring sites roughly the same time of day once a month. Citizen monitoring data provides a valuable resource of information supplementing professional data collection efforts where resources are limited. The data may be used by professionals to identify water quality trends, target additional data collection, identify pollution events, identify sources and causes of pollution, and show effectiveness of management measures towards improving water quality.

Texas Stream Team volunteer data, however, is not used by the state to assess whether water bodies are meeting the designated surface water quality standards. The primary reason for this is that Texas Stream Team volunteers use different methods than the professional water quality monitoring community. Different methods are utilized due to higher equipment costs, training requirements, and stringent laboratory procedures that are required of the professional community. The Texas Stream Team methods have been chosen because of relative ease of performing the methods in the field, while providing reliable results at low costs. As a result, Texas Stream Team data does not have the same accuracy or precision as professional data and is therefore not directly comparable. However, Texas Stream Team data are valuable records often collected in portions of water body that professionals are not able to monitor or monitor as frequently. This long-term data set is available to and may be considered by the surface water quality professional community to facilitate management and protection of Texas' water resources. For additional information about water quality monitoring methods and procedures, see:

- Texas Stream Volunteer Water Quality Monitoring Manual
- Texas Commission on Environmental Quality (TCEQ) Surface Water Quality Monitoring Procedures for professional monitors

Information collected by Texas Stream Team volunteers is covered under a TCEQ approved quality assurance project plan (QAPP) to ensure a standard set of methods of known quality are used.

All data used in data reports are screened by the Texas Stream Team for completeness, precision and accuracy where applicable, and scrutinized with data quality objective and data validation techniques.

The purpose of this report is to provide analysis of data collected by Texas Stream Team volunteers. The data presented in this report should be considered in conjunction with other relevant water quality reports prepared by the following programs in order to provide a holistic view of water quality in this water body:

- Texas Surface Water Quality Standards;
- Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d);;
- Texas Clean Rivers Program partners' reports such as Basin Summary Reports and Highlight Reports;
- TCEQ surface water quality special studies;
- TCEQ Total Maximum Daily Load reports;
- TCEQ and Texas State Soil and Water Conservation Board Nonpoint Source Program funded reports, including Watershed Protection Plans.

The report results are intended to be used for education and research, local decision making, problem identification, and others uses as listed in the Texas Stream Team introductory paragraph Questions about this report should be directed to the Texas Stream Team at (512) 245-1346.

Water Quality Terminology

The following paragraphs under this section provide general information about types of data collected by Texas Stream Team volunteers, along with the importance of these parameters for aquatic and human health.

Water Temperature

Water temperature, one of the simplest water quality measurements, is one of the most important to the health of an aquatic ecosystem (*A Guide to Freshwater Ecology*, TCEQ GI-034, August 2005). Water temperature influences physiological processes of aquatic organisms, and each species has optimum temperatures for survival. High water temperatures increase oxygen-demand for aquatic communities and can become stressful for fish and aquatic insects. Water temperature variations are most detrimental when they occur rapidly, leaving the aquatic community no time to adjust. Additionally, the ability of water to hold oxygen in solution (solubility) decreases as temperature increases.

Natural sources of warm water are seasonal as water temperatures tend to increase during summer and decrease in winter. Daily (diurnal) water temperature changes occur during normal heating and cooling patterns. Man-made sources of warm water include power plant effluent after it has been used for cooling or hydroelectric plants which release warmer water. Citizen monitoring may not identify fluctuating patterns due to diurnal changes or events such as power plant releases. While citizen data does not show diurnal temperature fluctuations, it may demonstrate the fluctuations over seasons and years.

Dissolved Oxygen

Oxygen is necessary for the survival of organisms like fish and aquatic insects. The amount of oxygen needed for survival and reproduction of aquatic communities varies according to species composition and adaptations to watershed characteristics like stream gradient, habitat, and available stream flow. The TCEQ Water Quality Standards list daily minimum dissolved oxygen criteria for specific water bodies, and presume criteria according to flow status (perennial, intermittent with perennial pools, and intermittent), aquatic life attributes, and habitat. These criteria are protective of aquatic life and can be used for general comparison purposes.

Aquatic Life Sub-category	Daily Minimum Dissolved Oxygen (mg/L)
Exceptional	4.0
High	3.0
Intermediate	3.0
Limited	2.0
Minimal	1.5

Dissolved oxygen concentrations can be influenced by other water quality parameters such as nutrients and temperature. High concentrations of nutrients can lead to excessive surface vegetation growth, which may starve subsurface vegetation of sunlight and limit the amount of dissolved oxygen in water produced as a product of photosynthesis. This process, known as eutrophication, is enhanced when the subsurface vegetation dies and is decomposed by oxygen-consuming bacteria.

Low dissolved oxygen levels may also result from high groundwater inflows as groundwater is typically low in dissolved oxygen, high temperatures which reduce oxygen solubility, or water releases from deeper portions of dams where conditions are anoxic.

Conductivity

Conductivity is measured to determine the amount of dissolved solids in the water. Conductivity is a measure of the ability of water to conduct electricity. The more dissolved solids a body of water has, such as inorganic salts (Ex. magnesium, calcium, chloride, and sulfate), the more electricity it conducts, or the more conductive it is. Conductivity is measured in microSiemens per centimeter (µS/cm). To determine total dissolved solids (TDS) in water, the Texas Surface Water Quality Monitoring Procedures call for a conversion of specific conductance by 65%.Sources of TDS can include agricultural runoff, domestic runoff, discharges from wastewater treatment plants, groundwater inflows, or naturally saline conditions resulting from the local geology and arid climate.

High concentrations of salt can inhibit water absorption and limit root growth for vegetation, lead to an abundance of more drought tolerant plants, and cause dehydration of fish and amphibians.

pH

pH is a measure of acidity or alkalinity. The scale measures the concentration of hydrogen ions on a range of 0 to 14 and is reported in standard units (su). The range is logarithmic; every 1 unit change means the acidity increased or decreased 10-fold. A pH of 7.0 is considered neutral. Values less than 7.0 are considered acidic; those greater than 7.0 are alkaline (basic).

The local geology in a watershed determines the general pH of water bodies. Underlying rock such as limestone dissolves and weathers easily, releasing minerals that buffer the water and cause a slight increase in pH (*A Guide to Freshwater Ecology*, TCEQ GI-034, August 2005). Harder, igneous bedrock tend to have less mineral content and lower pH. A typical pH range for buffered water bodies is 6.5 and 9. Regions of East Texas, with naturally acidic waters, have typical pH ranges from 5.5 to 9. Acidic contributions, indicated by a low pH level, can include runoff from acid-laden soils and acid rain. Sources that emit nitrogen oxide and sulphur dioxide into the atmosphere, such as car exhaust and coal power plants, contribute to acid rain.

Water Clarity

Water clarity is the ability of sunlight to penetrate the water column, and is measured by a Secchi disk. The ability of light to reach submerged plants is impeded by reduced clarity, and can effect populations of beneficial phytoplankton, algae, and aquatic plants. This reduces the dissolved oxygen in the water due to reduced photosynthesis. Reduced visibility can also harm predatory fish or birds that depend on good visibility to find their prey.

Water clarity can be affected by natural as well as human activities. Watershed characteristics such as the potential for flooding, and loose soils contribute to reductions in water clarity through increasing sedimentation. Sedimentation can result from sediment washing away from construction sites, erosion of farms, mining operations, and waterway (riparian) disturbance. Reduced water clarity can also occur during algae blooms, which can be episodic or part of a longer term aging process, particularly in reservoirs.

Data Analysis

Volunteer water quality monitors have collected data at three sites on White Rock Creek and four sites on its tributaries from 1997-2009. White Rock Creek is an unclassified segment and therefore has presumed standards based on the standards for White Rock Lake. White Rock Creek does have a specific aquatic life use designation of "intermediate" with a site specific minimum dissolved oxygen standard of 4 mg/L in the portion of the creek from the City of Addison to White Rock Lake. It is important to note that Texas Stream Team data are compared to surface water quality standards as a general reference of the quality of water at these sites.

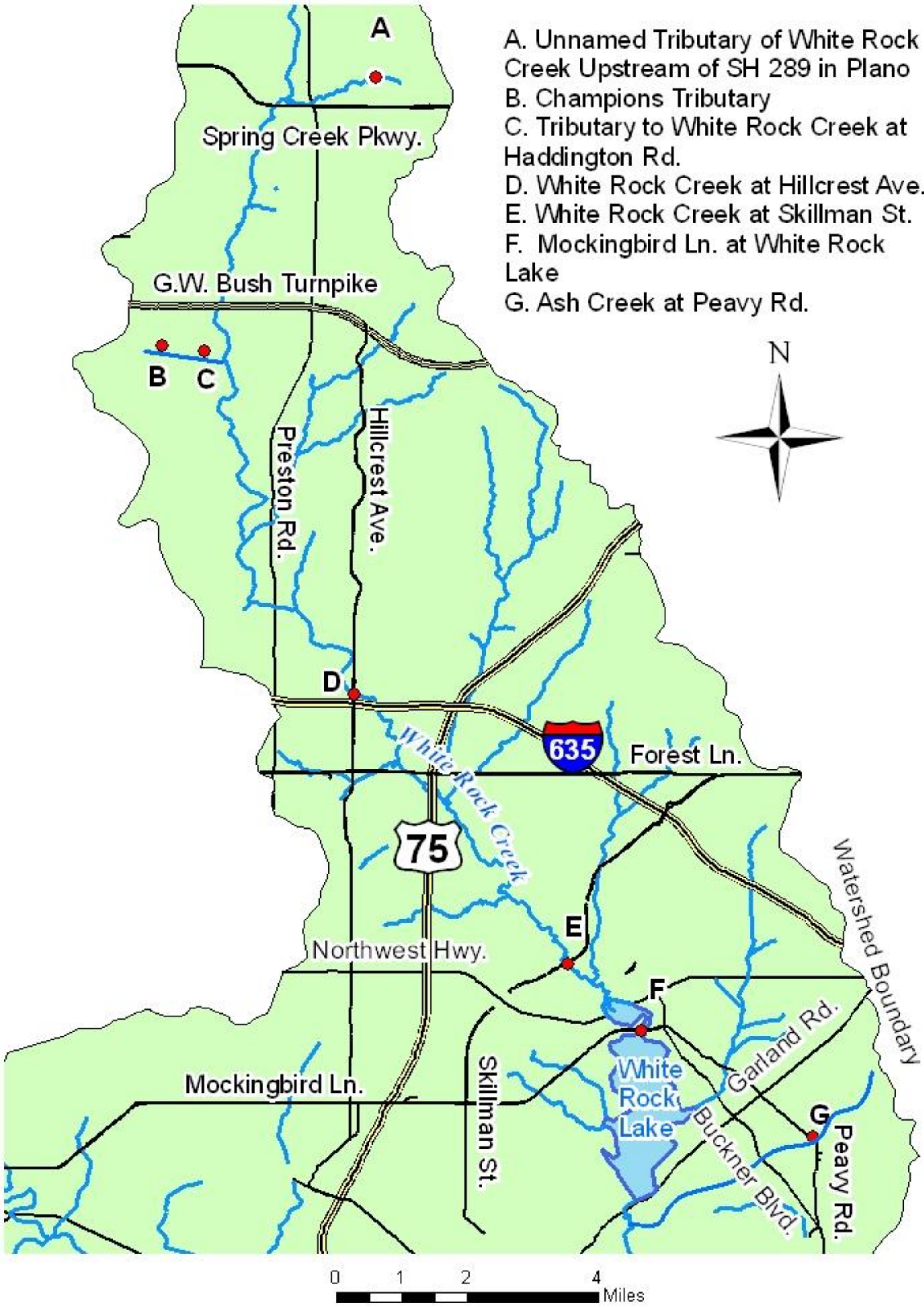
Assessment for meeting surface water quality standards is conducted by the TCEQ in the Texas Integrated Report and is based solely on data collected by professional monitors. For the Integrated Report, the TCEQ determines a water body to be impaired for core parameters if approximately 10% of at least ten samples taken over the last seven years exceed the standard for each parameter. If there are at least five samples in the seven year period, then it is acceptable to go back for more samples up to ten years.

When the observed value is over the standard, it is referred to as an exceedance. At least ten samples from the last seven years must be collected over at least two years with the same reasonable amount of time between samples for a data set to be considered acceptable for use in assessments. Similar rules exist for other standards to ensure that assessments are made using enough data to account for normal seasonal changes as well as variations in rainfall and other conditions from year to year.

The water temperature standard is a maximum amount. The red line shown for conductivity is the TDS standard after it has been converted and is a maximum average amount. The dissolved oxygen standard is a minimum amount, and the pH standards are a range. 96.33% of the 82 dissolved oxygen values observed on White Rock Creek meet the standard for exceptional aquatic life, which is 4 mg/L. The three values that were below 4 mg/L were observed at White Rock Creek and Skillman St. White Rock Creek at Hillcrest Dr. and at the confluence with White Rock Lake met the aquatic life use standard 100% of the time. The monitors at latter site consistently observed numerous waterfowl around the site.

All tributaries covered in this report exhibit characteristics suitable for the aquatic life use standard designated for White Rock Creek 100% of the time, except for Ash Creek. The monitors at the site entitled Unnamed Tributary of White Rock Creek Upstream of SH 289 Plano consistently report an abundance of frogs and minnows. Ash Creek at Peavy Rd. exhibited characteristics suitable for the White Rock Creek standard 76.9% of the time. However, the monitors consistently reported an abundance of turtles, minnows, fish, and birds.

White Rock Creek and Associated Tributaries Volunteer Monitoring Locations

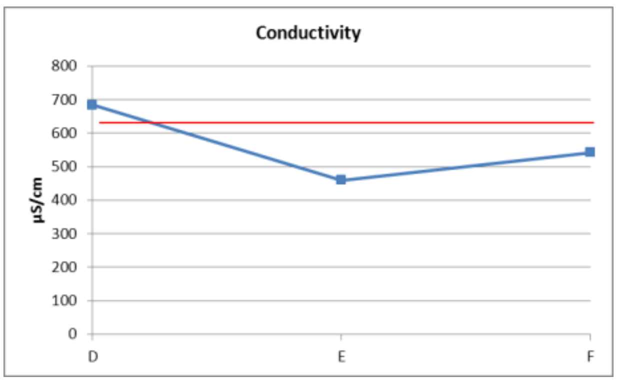


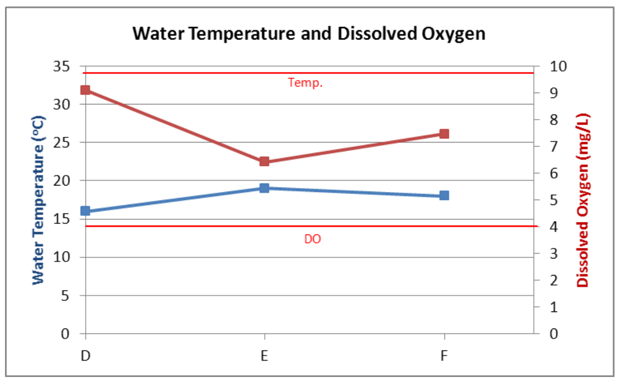
Watershed Analysis

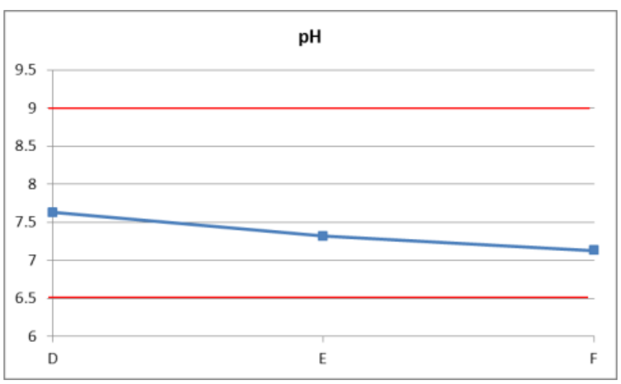
The following tables show statistics for all three sites on White Rock Creek. The following graphs show trends from upstream to downstream. The letters on the x-axis should be referenced to the map above.

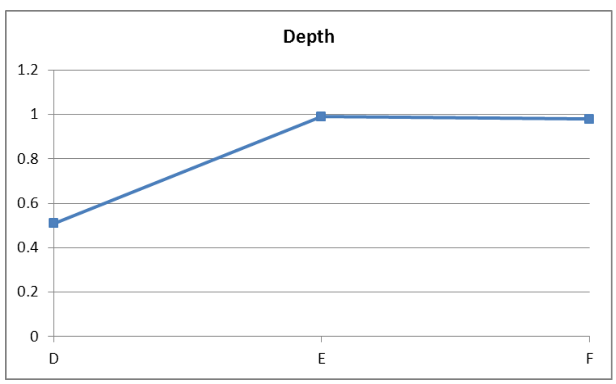
White Rock Creek						
	Conductivity (µS/cm)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH (su)	Secchi Depth (m)	Total Depth (m)
#	81	82	82	82	18	54
Minimum	340	5.5	2.9	4.5	0.1	0.03
Average	623.95	17.68	7.7	7.38	0.75	0.81
Maximum	870	30.5	12.8	8.25	3	4
Standard Deviation	125.47	7.72	2.4	0.56	0.65	0.76

	Conductivity (µS/cm)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH (su)
Standard	615	34	4	6.5-9
# Exceedance	45/81	0/82	3/82	2/82
% Exceedance	55.56	0	3.66	2.44

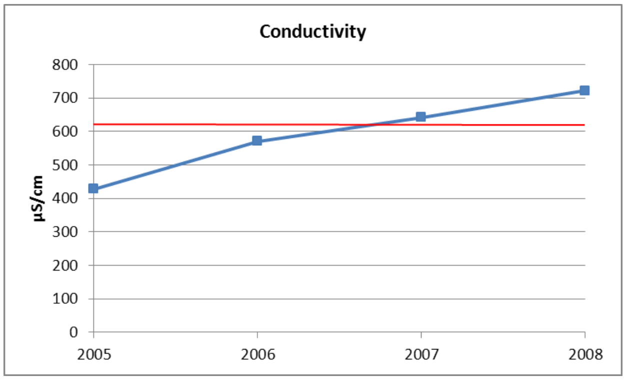


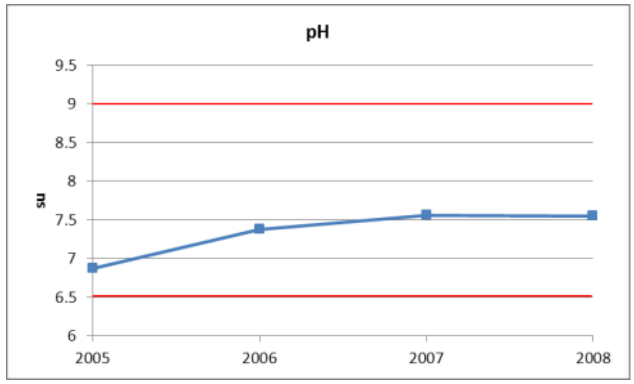


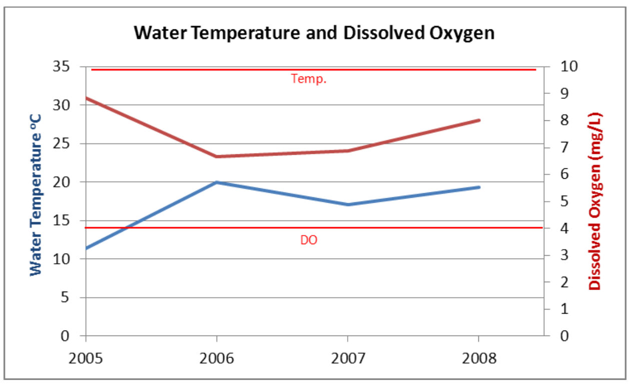


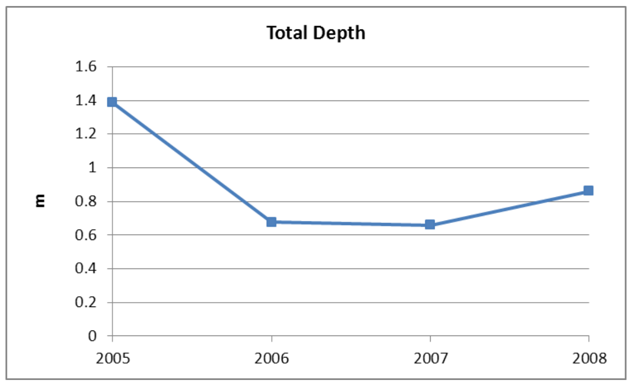


The following graphs show averages for each year for all three sites combined on White Rock Creek. 2008 is the cut-off because it was the last year with monthly sampling in our database. It can be seen here that the conductivity has increased with time. Dissolved oxygen has been increasing since 2006 as well, which is beneficial for aquatic life. Secchi depth is not shown because there are not enough regular observations from which to draw any conclusions.







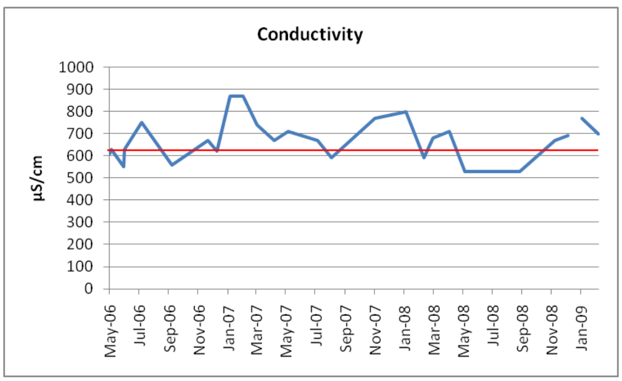


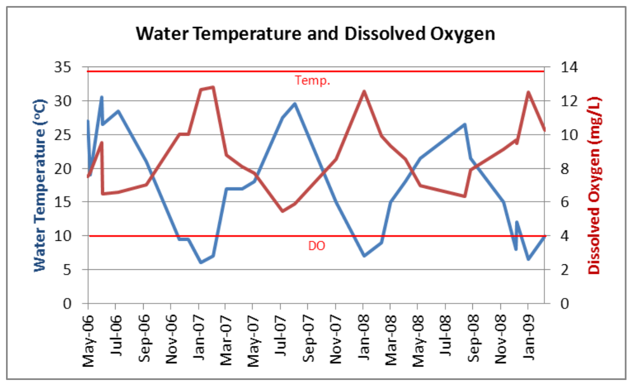
Site-by-Site Analysis

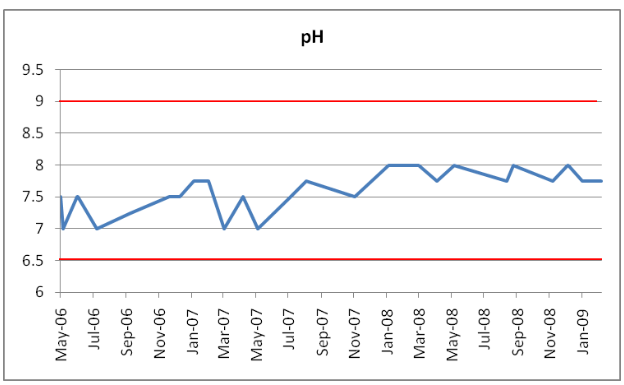
Site D: White Rock Creek at Hillcrest

Site D: White Rock Creek At Hillcrest						
Parameter	#	% Complete	Min.	Mean.	Max.	Std. Dev.
Sample Time	29	97	8:29	10:39	15:30	1:41
Specific Conductivity (µS/cm)	29	97	530	684.48	870	105.92
Total Depth (m)	20	67	0.05	0.51	1.5	0.4
Dissolved Oxygen (mg/L)	30	100	5.45	9.09	12.8	2.22
Secchi Depth (m)	5	17	0.1	0.64	1.5	0.52
Water Temperature (^{o}C)	30	100	6	16	30.5	8.11
pH (su)	30	100	7	7.63	8	0.32

	Conductivity (µS/cm)	Water Temperature (^{o}C)	Dissolved Oxygen (mg/L)	pH
Standard	615	34	4	6.5-9
# Exceedance	21/30	0/30	0/30	0/30
% Exceedance	70	0	0	0





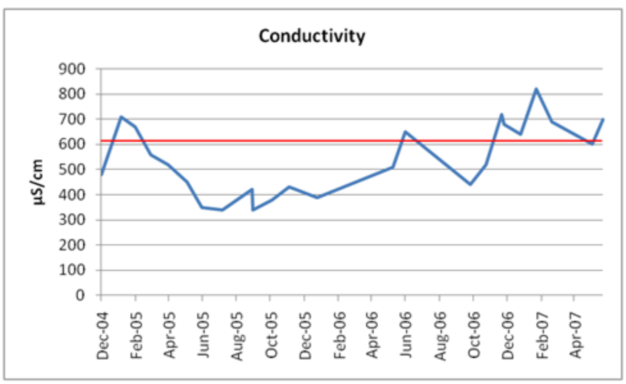


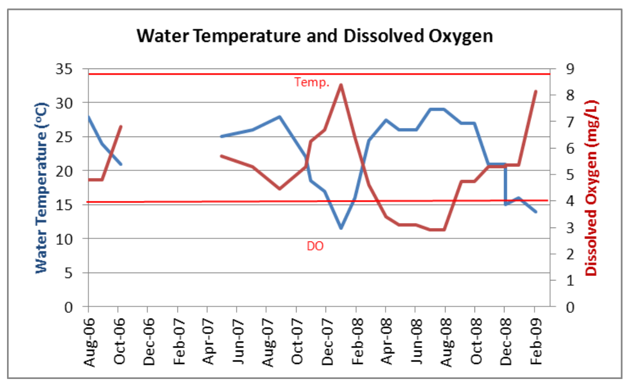
Data collected by Doug Frazier, Francis Bradshow, Tom Heath, and Gary Spence

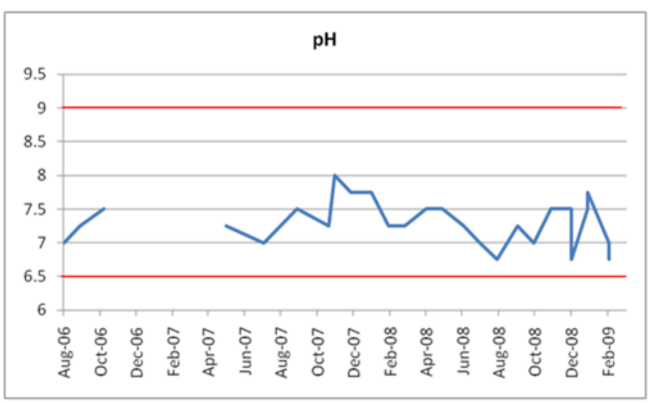
Site E: White Rock Creek at Skillman Street

Site E: White Rock Creek at Skillman Street						
Parameter	**#**	**% Complete**	**Min.**	**Mean.**	**Max.**	**Std. Dev.**
Sample Time	26	87	9:50	10:56	11:55	0:31
Specific Conductivity (µS/cm)	28	93	460	631.43	800	88.64
Total Depth (m)	18	60	0.5	0.99	4	0.82
Dissolved Oxygen (mg/L)	28	93	2.9	6.42	10.1	1.99
Secchi Depth (m)	12	40	0.27	0.61	1	0.24
Water Temperature (°C)	28	93	8	19	29	6.88
pH (su)	28	93	6.75	7.32	8	0.33

	Conductivity (µS/cm)	**Water Temperature (°C)**	**Dissolved Oxygen (mg/L)**	**pH (su)**
Standard	615	34	4	6.5-9
# Exceedance	15/28	0/28	3/28	0/28
% Exceedance	53.57	0	10.71	0





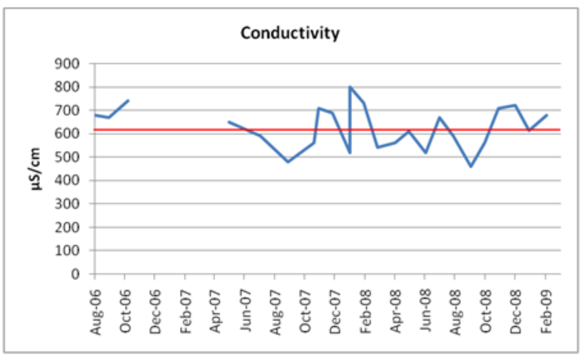


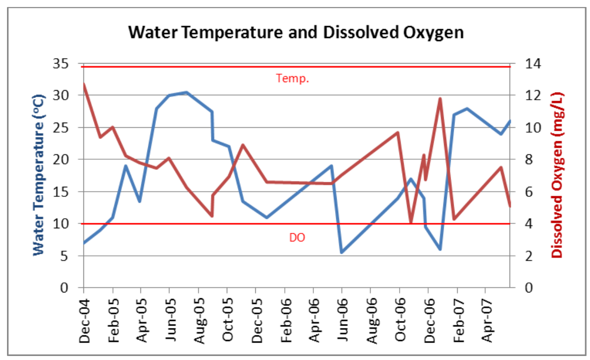
Data collected by Doug Frazier, Tom Heath, and Gary Spence

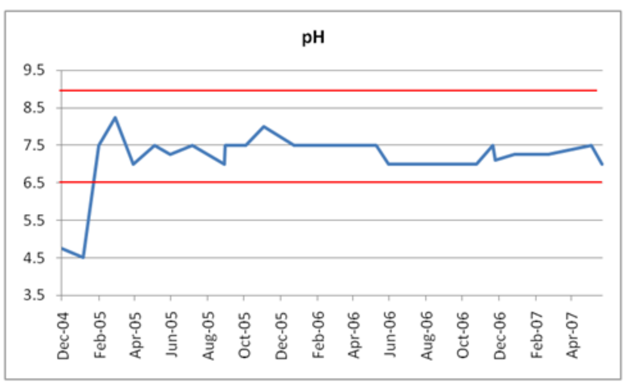
Site F: Mockingbrird Lane at White Rock Lake

Site F: Mockingbird Lane at White Rock Lake						
Parameter	#	% Complete	Min.	Mean.	Max.	Std. Dev.
Sample Time	24	100	7:00	8:51	10:50	1:24
Specific Conductivity (µS/cm)	24	100	340	542.08	820	142.10
Total Depth (m)	16	67	0.03	0.98	3	0.94
Dissolved Oxygen (mg/L)	24	100	4.1	7.46	12.7	2.22
Secchi Depth (m)	1	4	3	3	3	N/A
Water Temperature (^oC)	24	100	5.5	18	30.5	8.24
pH (su)	24	100	4.5	7.13	8.25	0.83

	Conductivity (µS/cm)	Water Temperature (^oC)	Dissolved Oxygen (mg/L)	pH
Standard	615	34	4	6.5-9
# Exceedance	9/24	0/24	0/24	2/24
% Exceedance	37.5	0	0	8.33





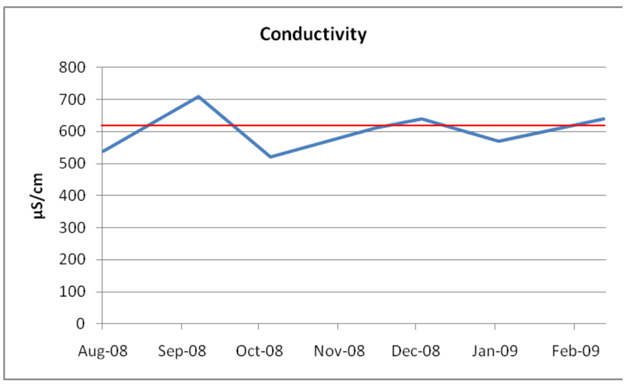


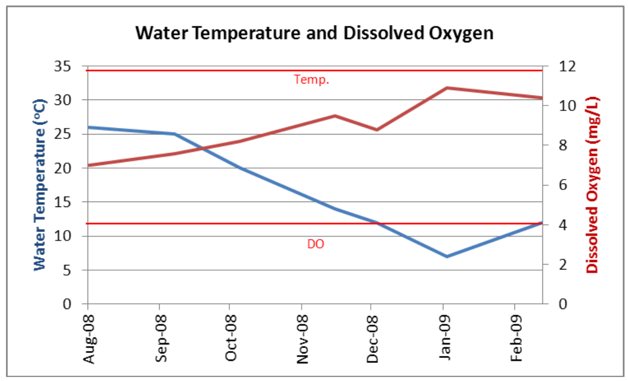
Data collected by Frank Korman, Ursula Branhill, Maria Richards, Mike Swope and Janet Smith with the City of Dallas

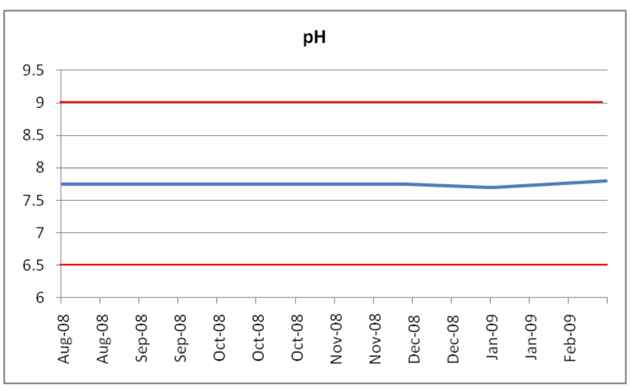
Site C: Tributary To White Rock Creek at Haddington Ln

Site C: Tributary To White Rock Creek at Haddington Ln						
Parameter	**#**	**% Complete**	**Min.**	**Mean.**	**Max.**	**Std. Dev.**
Sample Time	8	100	9:30	9:58	10:15	0:14
Specific Conductivity (µS/cm)	8	100	520	611.25	710	64.24
Total Depth (m)	8	100	0.06	0.15	0.2	0.05
Dissolved Oxygen (mg/L)	8	100	6.2	8.58	10.9	1.64
Secchi Depth (m)	8	100	0.06	0.15	0.2	0.05
Water Temperature (^{o}C)	8	100	7	18	26	7.46
pH (su)	8	100	7.7	7.75	7.8	0.03

	Conductivity (µS/cm)	Water Temperature (^{o}C)	Dissolved Oxygen (mg/L)	pH
Standard	615	34	4	6.5-9
# Exceedance	4/8	0/8	0/8	0/8
% Exceedance	50	0	0	0





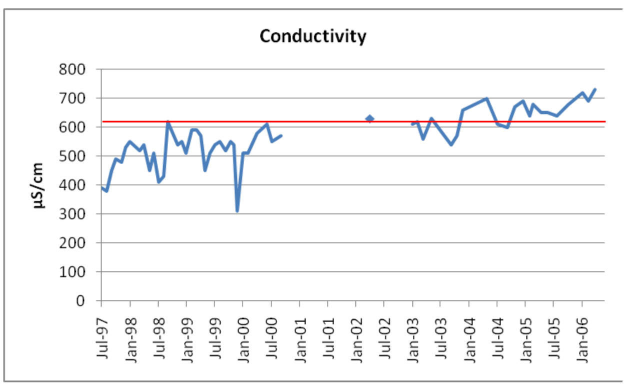


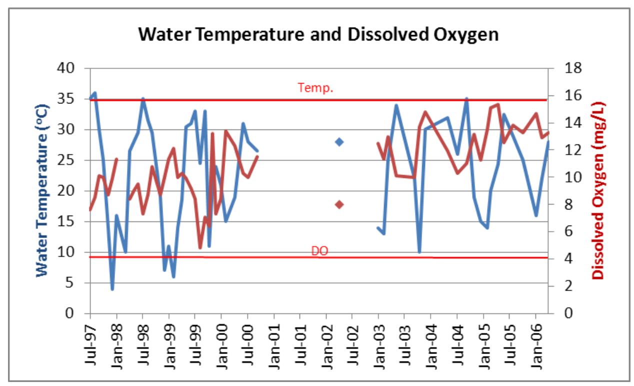
Data collected by Ruth Hewes with the Ecology Club at Robinson Middle School

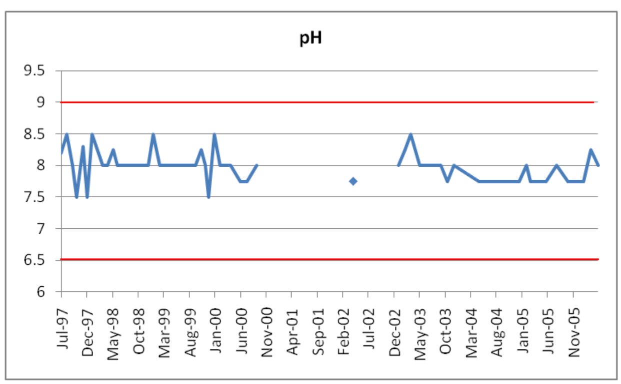
Site A: Unnamed Tributary Of White Rock Creek Upstream Of SH 289 Plano

Site A: Unnamed Tributary Of White Rock Creek Upstream Of SH 289 Plano						
Parameter	**#**	**% Complete**	**Min.**	**Mean.**	**Max.**	**Std. Dev.**
Sample Time	56	100	10:00	15:41	17:30	1:19
Specific Conductivity (µS/cm)	56	100	310	563.75	730	90.00
Total Depth (m)	55	98	0.04	0.18	0.78	0.13
Dissolved Oxygen (mg/L)	55	98	4.8	10.73	15.4	2.39
Secchi Depth (m)	35	63	0.04	0.16	0.45	0.11
Water Temperature (^{o}C)	56	100	4	23	36	8.52
pH (su)	56	100	7.5	7.98	8.5	0.24

	Conductivity (µS/cm)	**Water Temperature (^{o}C)**	**Dissolved Oxygen (mg/L)**	**pH**
Standard	615	34	4	6.5-9
# Exceedance	17/56	4/56	0/55	0/56
% Exceedance	30.36	7.14	0	0





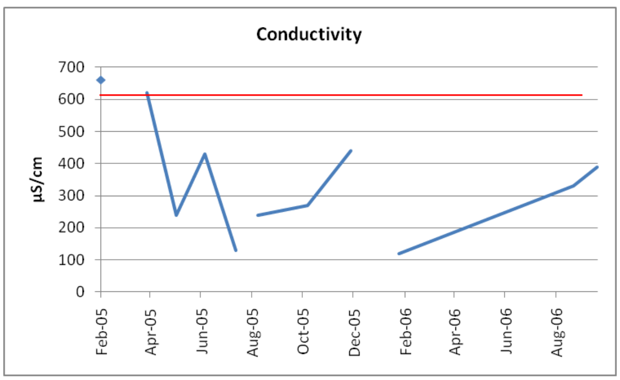


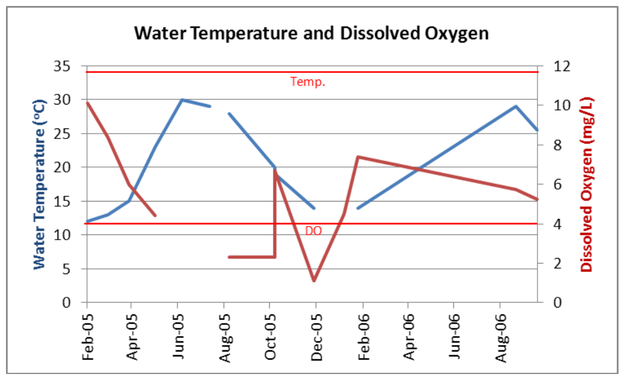
Data collected by Ruth Hewes with the Ecology Club at Robinson Middle School

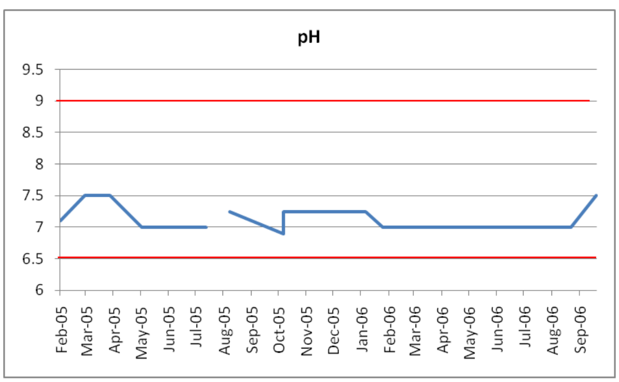
Site G: Ash Creek At Peavy Road

Site G: Ash Creek At Peavy Road						
Parameter	**#**	**% Complete**	**Min.**	**Mean.**	**Max.**	**Std. Dev.**
Sample Time	15	100	8:49	14:44	17:00	2:56
Specific Conductivity (µS/cm)	12	80	120	345	660	171.49
Total Depth (m)	11	73	0.15	0.71	2	0.61
Dissolved Oxygen (mg/L)	13	87	1.1	5.41	10.1	2.54
Secchi Depth (m)	8	53	0.01	0.43	0.77	0.26
Water Temperature (^{o}C)	13	87	12	21	30	6.87
pH (su)	14	93	6.9	7.18	7.5	0.21

	Conductivity (µS/cm)	**Water Temperature (^{o}C)**	**Dissolved Oxygen (mg/L)**	**pH**
Standard	615	34	4	6.5-9
# Exceedance	2/12	0/13	3/13	0/14
% Exceedance	16.67	0	23.08	0





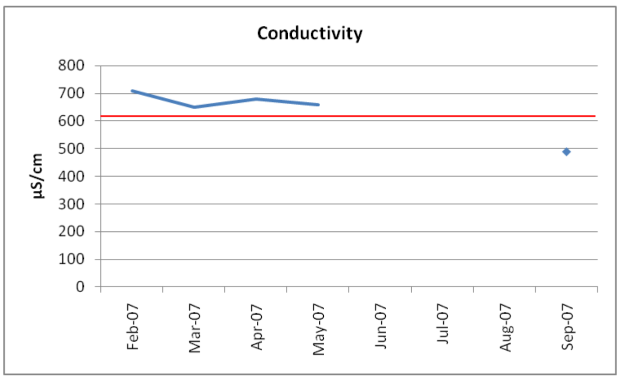


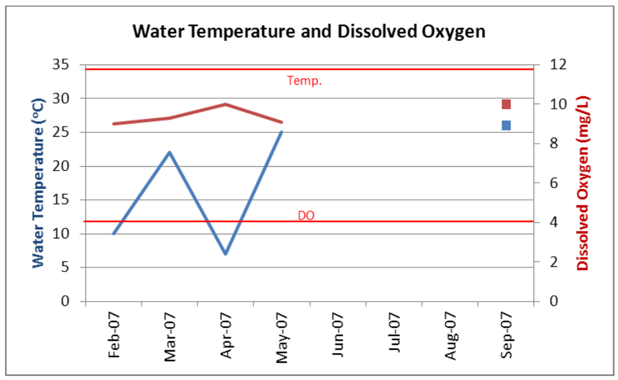
Data collected by Clint Miller, Melissa Gray, and Sherri Kelly

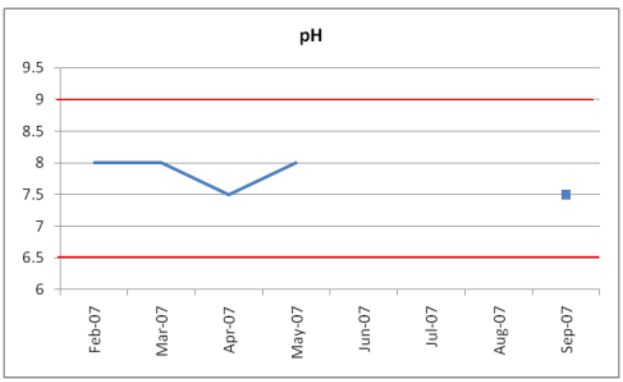
Site B: Champions Tributary

Site B: Champions Tributary						
Parameter	#	% Complete	Min.	Mean.	Max.	Std. Dev.
Sample Time	6	100	9:00	14:00	20:00	4:29
Specific Conductivity (µS/cm)	5	83	490	638	710	85.85
Total Depth (m)	4	67	0.5	0.75	1	0.29
Dissolved Oxygen (mg/L)	5	83	9	9.48	10	0.49
Secchi Depth (m)	0	0	0	N/A	0	N/A
Water Temperature (°C)	5	83	7	18	26	8.86
pH (su)	5	83	7.5	7.8	8	0.27

	Conductivity (µS/cm)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH
Standard	615	34	4	6.5-9
# Exceedance	4/5	0/5	0/5	0/5
% Exceedance	80	0	0	0







Data collected by Helen Arceneaux

[i] Texas State Historical Association, *White Rock Creek*, 30 May 2010, available from http://www.tshaonline.org/handbook/online/articles/WW/rbw74.html; accessed 17 June 2010.