Joe’s Creek Data Report

Elm Fork Trinity River Watershed

November 2010

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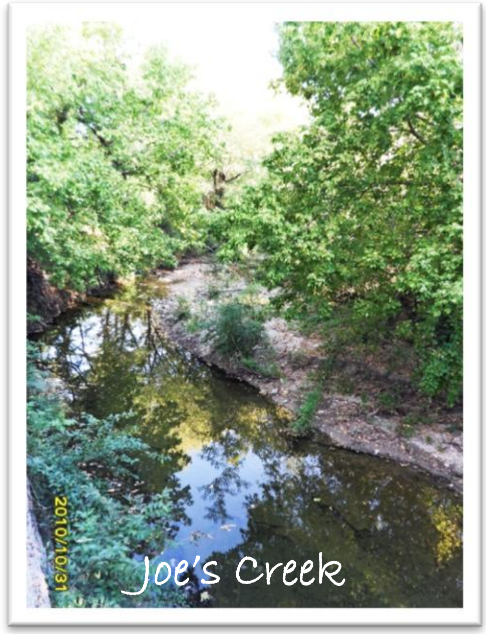
Introduction



Water Body Location: Joe's Creek is a small tributary of the Elm Fork Trinity River (Segment 0822) which flows through residential and industrial areas in northwest Dallas, TX for roughly 5 miles. It originates as a freshwater spring and is primarily fed by storm-water runoff from many storm-water outfalls present along the creek. See the map created by the City of Dallas at http://www.wheredoesitgo.com/watershed_maps/JoesCreekWatershed.pdf for a detailed look at the stormwater outfalls. The picture to the right was taken by Citizen Water Quality Monitor, Walt Kelly, at his site "Joe's Creek at Marsh and Merrell."

Texas Stream Team: Texas Stream Team is a volunteer based 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 by Texas Stream Team 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)(or Texas Integrated Report; formerly the Texas Water Quality Inventory and 303(d) List);
- 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.

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

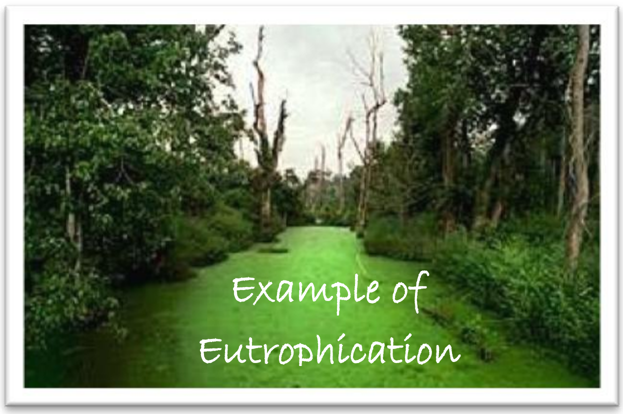
Water temperature, one of the simplest water quality measurements, is one of the most important to the health of an aquatic ecosystem (*A Guide to Freshwater Ecology*, TCEQ GI-034, August 2005). Water temperature influences physiological processes of aquatic organisms, and each species has optimum temperatures 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.

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.

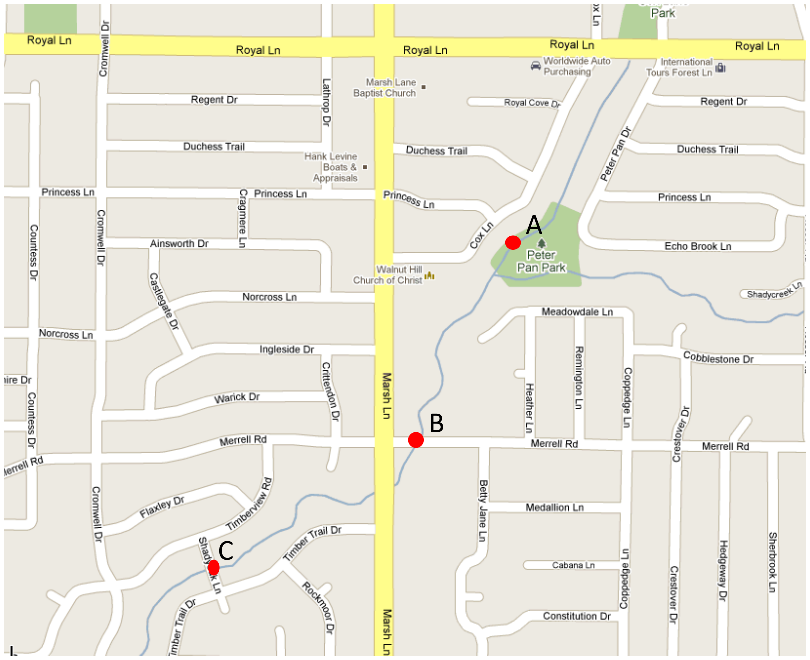
Water Clarity

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.

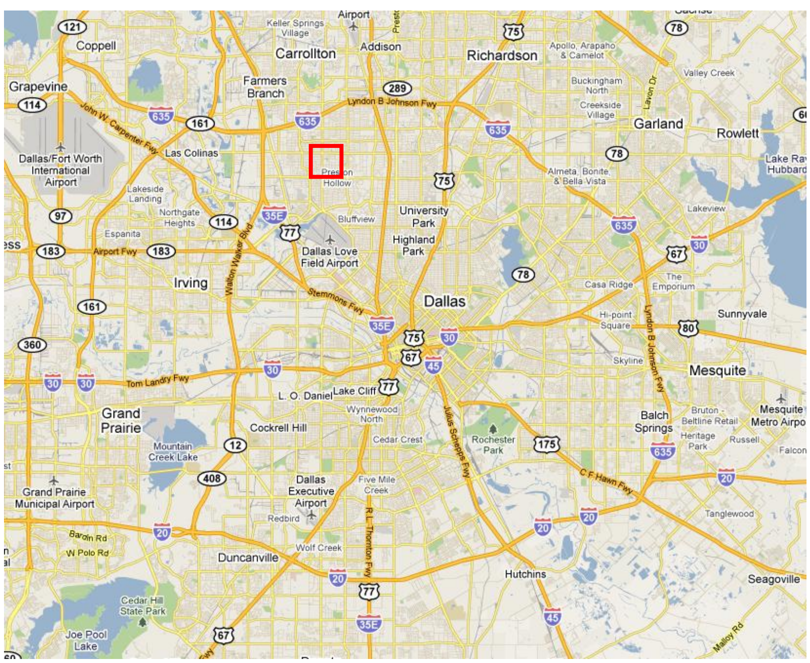
Water clarity can be affected by natural as well as human activities. Watershed characteristics such as the potential for flooding, and loose soils contribute to reductions in water clarity through increasing sedimentation. Sedimentation can result from sediment washing away from construction sites, 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.

Joe's Creek Citizen Water Quality Monitoring Locations

A: JOES CREEK @ 3802 ECHO BROOK DALLAS
B: JOES CREEK @ MARSH AND MERRELL
C: JOES CREEK @ SHADY OAK LN



Map Extent



Data Analysis

Joe's Creek All Sites						
Parameter	**#**	**% Complete**	**Min.**	**Avg.**	**Max.**	**Std. Dev.**
Water Temperature	26	100	7	21.18	28.5	6.1
Dissolved Oxygen	26	100	5.4	8.57	13.45	2.14
Conductivity	26	100	400	728.46	870	126.89
pH	26	100	7.25	7.60	8.25	0.32
Total Depth	6	23	0.3	1.01	2	0.56
Sample Time	26	100	6:57	15:22	19:30	0.18

Joe's Creek is being monitored by five citizens in the residential reach of its flow near Marsh Ln. and Merrell Rd., which are only about a half a mile apart. Data in this report span from September 2007 through August 2009 where data is available. During this time period, most of the data exhibit characteristics suitable for aquatic life. The water temperature and dissolved oxygen data show seasonal trends, which indicate the lack of another source of changes. All of the 26 dissolved oxygen observations were above the 24-hour minimum criteria of 4 mg/L to support exceptional aquatic life use. This standard is not applied to this water body, but it is referenced to enhance the readers' understanding of the data. The presumed aquatic life use for Joe's Creek is high based on flow severity data indicating that the creek is perennial.

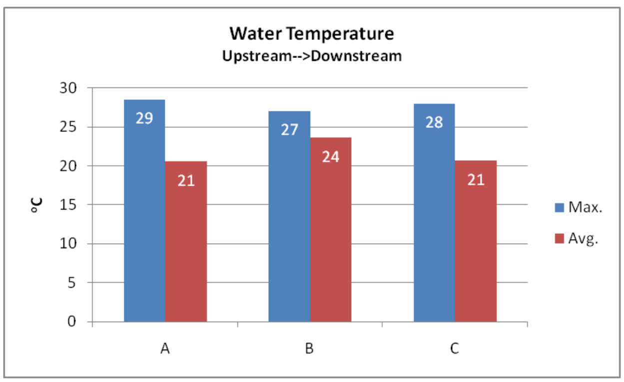
All pH observations stayed within the range most suitable for aquatic life (6.5-9) in alkaline waters, and all temperature readings stayed below values where it may become detrimental (≈32^{o}C).

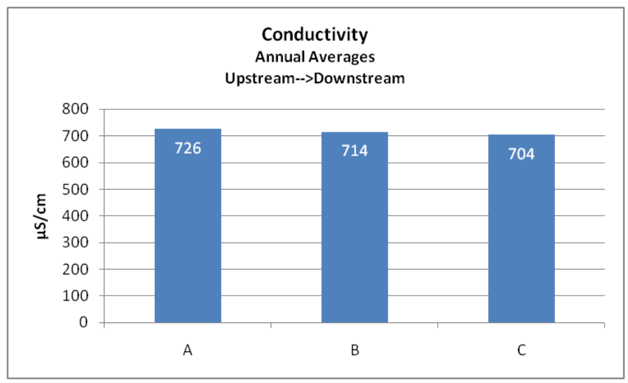
Conductivity measurements vary widely between water bodies due to natural conditions such as surrounding soils and rocks or proximity to the coast. Conductivity is an indirect measurement of total dissolved solids (TDS), for which the TCEQ designates standards. The TCEQ does not designate standards for conductivity, so these values are compared to the TDS Standard after being multiplied by a conversion factor of 0.65. The conversion of the TDS standard to conductivity for the water body into which Joe's Creek discharges, Elm Fork Trinity Below Lake Lewisville, is 769 µS/cm. This value applies specifically to an annual average of conductivity readings. It is provided as a reference point for particular observations. Since Joe's Creek is a tributary to the Elm Form Trinity River, the standards for the Elm Fork Trinity River are referenced to enable the reader to determine any potential influence Joe's Creek may present. Although the annual averages of conductivity did not exceed the Elm Fork Trinity River standard for the sites collected, 54% of the 26 observations included in this report are above that standard. 27% occurred at Site A. 4% occurred at Site B, and 23% occurred at Site C.

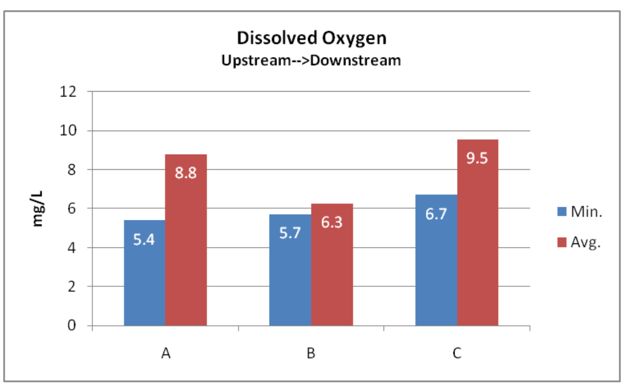
The portion of the Elm Fork Trinity River into which Joe's Creek discharges, Elm Fork Trinity River Below Lewisville Lake, has been identified in the *Texas Integrated Report* for a concern for high levels of chlorophyll-a since 2006. High levels of cholorphyll-a is generally a response to elevated nutrients or low flow conditions. Nutrients can originate in fertilizers, organic matter such as lawn clippings, or fecal matter and are transported to the water body via storm-water runoff. Texas Stream Team monitors do not analyze water samples for cholorphyll-a. However, algae cover standardized field observations provided by the citizens monitors in Joe's Creek have shown.

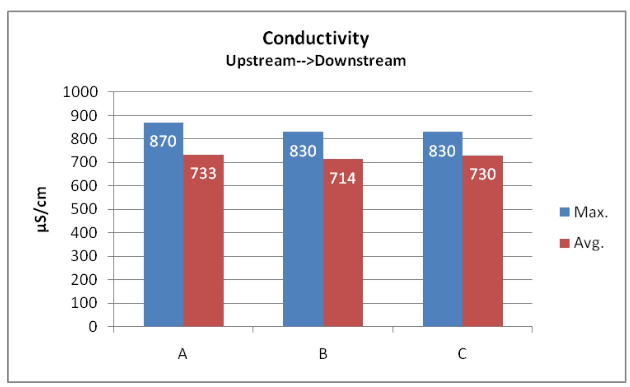
Upstream to Downstream Trends

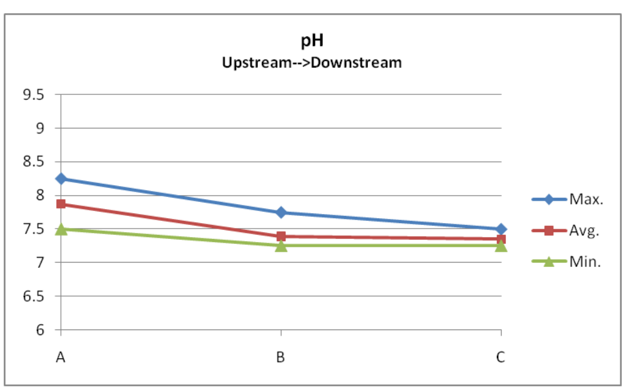
These sites are only roughly half a mile apart, so trends from upstream to downstream should not be very significant. There are no discernable trends for water temperature, dissolved oxygen, or conductivity. The minimum value for dissolved oxygen increases from upstream to downstream, but the average amounts do not back up this trend. Annual averages of conductivity show a very slight decrease, but conductivity readings vary over hundreds to thousands. A decrease of 22 µS/cm is not significant. The pH decreases from upstream to downstream but not in a way that poses a threat to aquatic life.





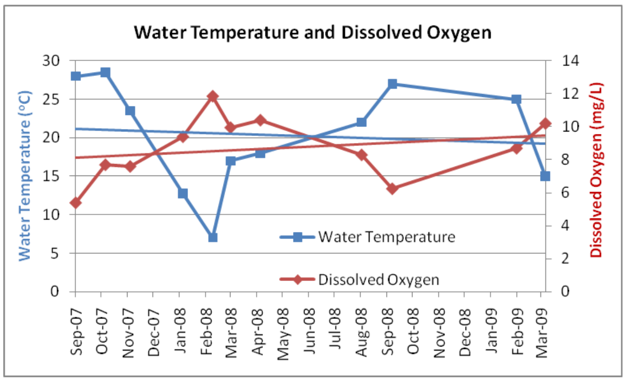


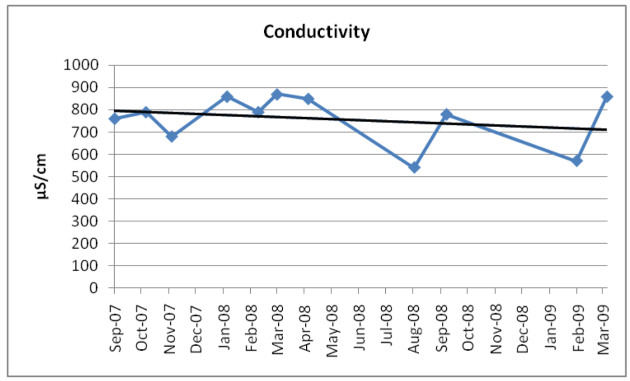


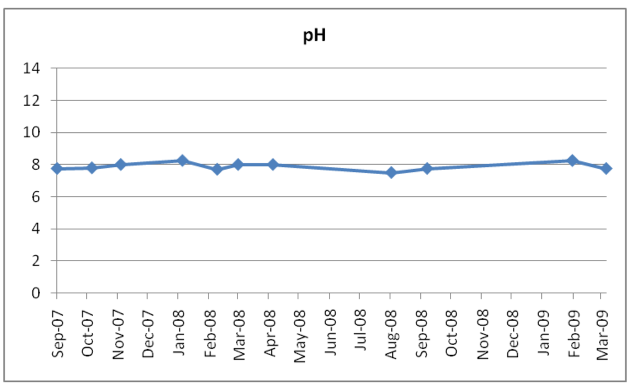


Site A: Joe's Creek at 3202 Echo Brook, Dallas

Site A: Joe's Creek @ 3802 Echo Brook Dallas						
Parameter	**#**	**% Complete**	**Min.**	**Avg.**	**Max.**	**Std. Dev.**
Water Temperature	12	100	7	20.56	28.5	6.68
Dissolved Oxygen	12	100	5.4	8.8	11.85	1.85
Conductivity	12	100	450	733.33	870	141.70
pH	12	100	7.5	7.87	8.25	0.23
Sample Time	12	100	16:00	17:40	18:30	0:46



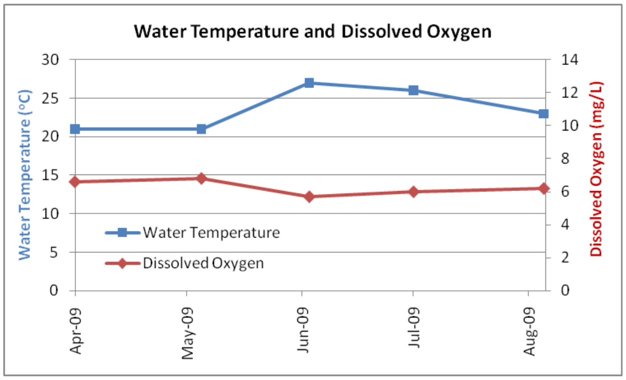


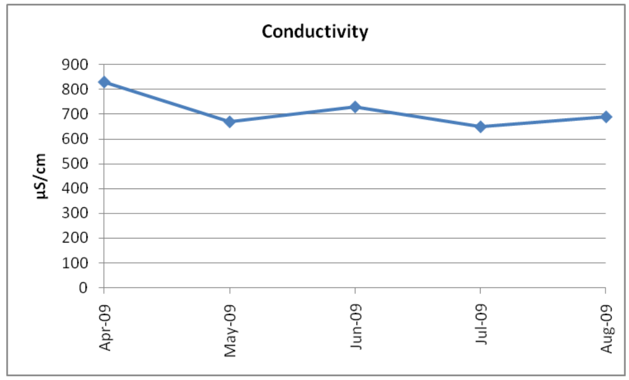


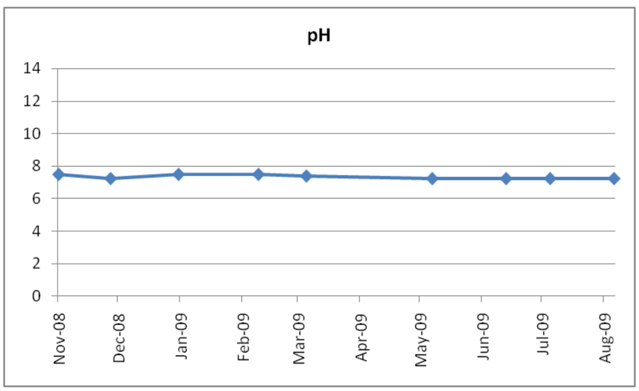
Data at this site were collected by Linda Hannigan and Paul Taylor of the Aquatic Alliance, a part of the North Texas Master Naturalists. This site is in Peter Pan Park under the footbridge where the creek is only about 8-10 ft. wide. The trend lines on the water temperature of dissolved oxygen graph show water temperature decreasing and dissolved oxygen increasing since 2007. The conductivity appears to be decreasing as well, but the annual averages show an increase. The annual average in 2007 was 670 µS/cm and was 782 µS/cm in 2008. There were not enough sampling events in 2009 to justify taking an average.

Site B: Joe's Creek at Marsh and Merrell

Site B: Joe's Creek @ Marsh and Merrell						
Parameter	**#**	**% Complete**	**Min.**	**Avg.**	**Max.**	**Std. Dev.**
Water Temperature	5	100	21	23.6	27	2.79
Dissolved Oxygen	5	100	5.7	6.26	6.8	0.44
Conductivity	5	100	650	714	830	71.27
pH	5	100	7.25	7.39	7.75	0.21
Sample Time	5	100	6:57	7:21	7:45	0:18





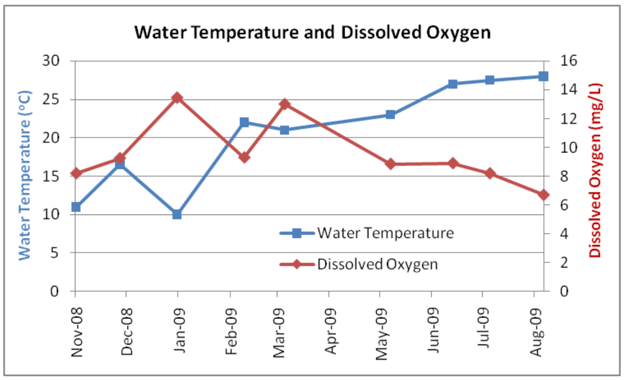


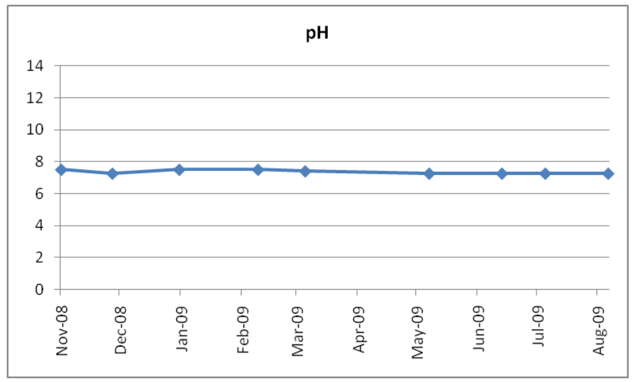
Data at this site were collected by Walter Kelly. The data show steady, healthy conditions. He started monitoring in November of 2008 after he witnessed the creek turning milky white. He called the City of Dallas. Someone came out, put on waders, walked upstream, and found a concrete truck being washed out. Monitors at the downstream site noted concrete residue on the banks on November 18th, 2008. The responsible party was fined, and Mr. Kelly wanted to make sure he had data to show the conditions of the creek to the neighborhood association in order to identify any illegal dumping that would not be as obvious.

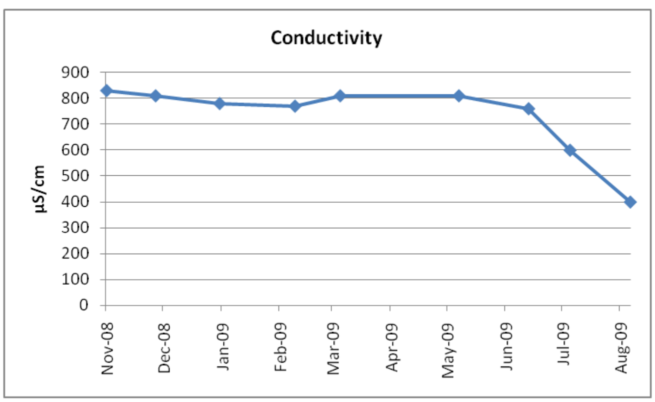
Over the years he has noticed a variety of wildlife including large birds, a bobcat, a turtle, catfish up to 12-14 in. long, and fish nesting. He has noted clear water on the data form and has noticed the color change colors many times. In July 2009, he commented that there was construction happening at a bridge below the site, and they were pumping the creek to keep their construction site dry. Then in August 2009, he noticed the water was cloudy. It had been 6 days since any significant precipitation. He also witnessed a fish kill in September 2010.

Site C: Joe's Creek at Shady Oak Lane

Site C: Joe's Creek @ Shady Oak Ln.						
Parameter	**#**	**% Complete**	**Min.**	**Avg.**	**Max.**	**Std. Dev.**
Water Temperature	9	100	10	20.67	28	6.82
Dissolved Oxygen	9	100	6.7	9.54	13.45	2.23
Conductivity	9	100	400	730	830	141.42
pH	9	100	7.25	7.35	7.5	0.12
Total Depth	6	67	0.3	1.01	2	0.56
Sample Time	9	100	10:20	16:46	19:30	0.11







Data at this site were collected by Garland and Daphne Head, members of Friends of Joes Creek. All data show normal, healthy conditions. A drop in conductivity starting in June of 2009 continuing through August of 2009 (when data collection stopped) was observed and the cause unknown. The monitors noted this site is downstream from a spring and from a storm-water drain. The observation in May of 2009 showed a value consistent with previous observed values, and the monitor commented that cloudy water from a storm drain entered the bucket used while sampling.

Monitors have noted regular cover of leaves and algae as well as wildlife and aquatic life use including ducks, small fish (under 2"), turtles, and a hawk. They have also noted a presence of trash such as plastic bags and a television. Concrete residue on the banks was noted following the event detected by the upstream monitor.