# Lake Texana Data Report

## December 2010

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# Introduction


**Water Body Location:** Lake Texana spans 11,000 acres, has 125 miles of shoreline, and can store 170,000 acre-feet of water. Lake Texana (Segment 1604)is in the Lavaca River Basin, which drains 2,309 $mi^2$ (5,980 $km^2$) of coastal prairie north of San Antonio Bay and Matagorda Bay.[i] It is fed by the Navidad River, which originates in Fayette County and drains into the Lavaca River downstream of the lake before emptying into Lavaca Bay.

**Water Body Description:** Construction on Lake Texana began in the late 1960s and was completed in 1982 by the U.S. Bureau of Reclamation to supply municipal and industrial water to the cities in the region. Vegetation along the banks includes but is not limited to Live Oak, Pecan, Water Oak, American Elm, Cedar Elm, Texas Sugarberry, Red Mulberry, and Hawthorn trees.[ii] Vegetation in the lake consists of Water Hyacinth (in large quantities), Hydrilla, Coontail, Spikerush, Cattail, Pondweed, Bull's Tongue, Pickerel Weed, and Duckweed. An invasive species, Salvinia, has been causing problems, and management efforts have been put forth to mitigate the situation. The most abundant fish species are the Blue Catfish, Largemouth Bass, White Crappie, White Bass, and Sunfish.[iii] 15% of the surrounding land is used for urban and agricultural purposes.[iv] The addition of man-made contaminants is not likely due to such a minimal amount of land use. The lake is used for recreation purposes such as fishing, swimming, boating, and skiing.

**Texas Stream Team:** Texas Stream Team is a citizen 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 Texas Stream Team 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.

## Data Analysis

Data have been collected almost every month by Ken Barton and his Edna Junior High School students at “Lake Texana at Simmon’s Cove Dock” since 1997. This report picks up where the previous one left off: in July 2004. The previous report may be found on the Texas Stream Team website at http://txstreamteam.rivers.txstate.edu/Data/Data-Reports.html. Data from August 2004 to August 2009 are covered in this report.

The Texas Water Quality Standards for Lake Texana are shown in red on the graphs. The water temperature standard is a maximum level (approximately 34 degrees Celcius). The line shown on the conductivity graphs is the value for the total dissolved solids standard converted to conductivity (769 µS/cm). Conductivity is an indirect measurement of TDS. The dissolved oxygen standard is a minimum amount (4.0 mg/L), and the pH standards are a range (6.5 to 9.0 SU).

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 this site. 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.

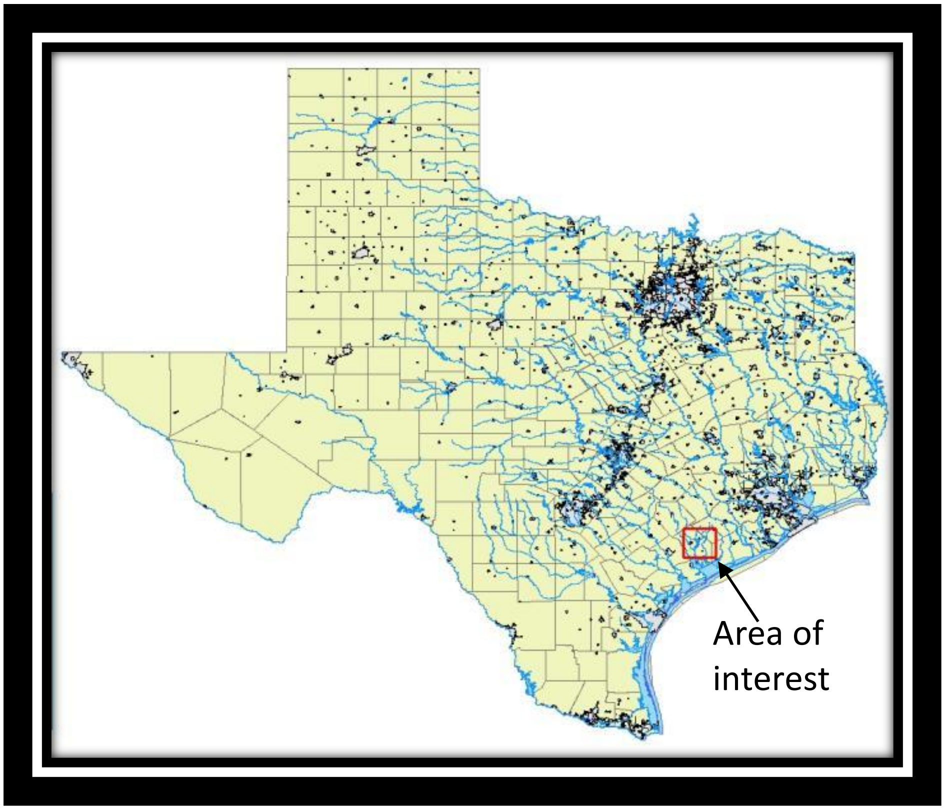
When the observed value is over the standard, it is referred to as an exceedance. At least ten samples from the last seven years must be collected over at least two years with the same reasonable amount of time between samples for a data set to be considered acceptable for use in assessments. Similar 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.

All of the data collected on Lake Texana by the volunteer water quality monitors stay within the state's designated standards except for one dissolved oxygen sample. Since 54/55 (98%) of dissolved oxygen observations stayed above the designated "high aquatic life use" standard, this is not considered as presenting a concern for aquatic habitat.

Trend lines are displayed on the graphs to assist with understanding changes over time. Conductivity has increased very slightly through time, but is overall very low, which is good. Water temperature has varied consistently with the seasons. Dissolved oxygen has increased very slightly. pH has been steadily increasing but not to a concerning level.

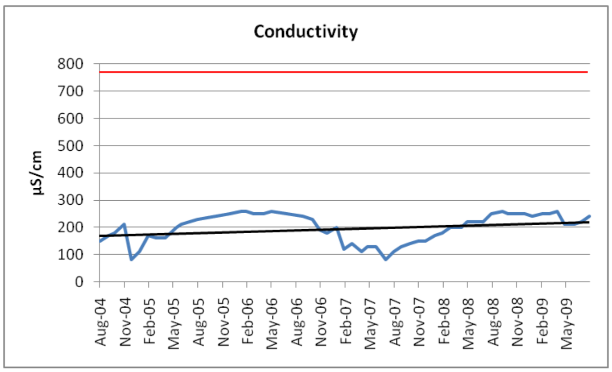
The total depth and Secchi depth graphs are displayed in a way that attempts to show the actual depth on the water. Zero on these graphs is the water level. The total depth graph shows an increase in depth around mid 2006 followed by a decrease in depth around mid 2008. Afterwards, the depth has stayed around 0.3 meters. This could be due to climatic variations. Overall, depth has been decreasing with time.

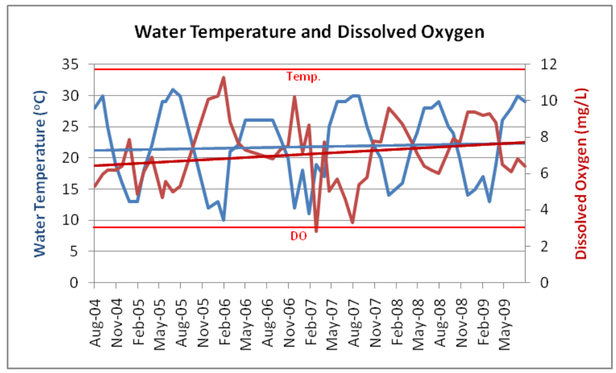
Monitors consistently noted an abundance of water hyacinth at the site until March of 2005, when they noted hyacinth to be sparse. They started commenting on the abundance of hyacinth again in April of 2006. Since water hyacinth is an invasive species in North America, an over-abundance of hyacinth in lakes can impact the native vegetation and aquatic habitat.

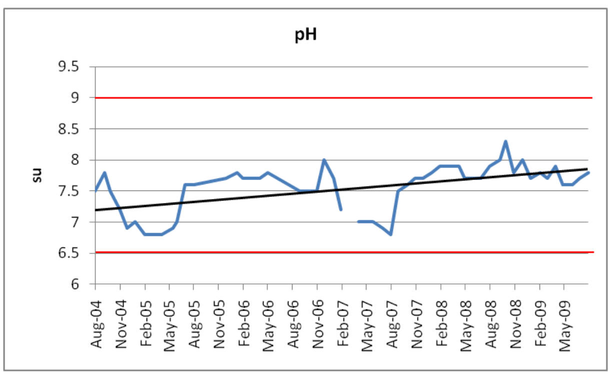

Area of
interest

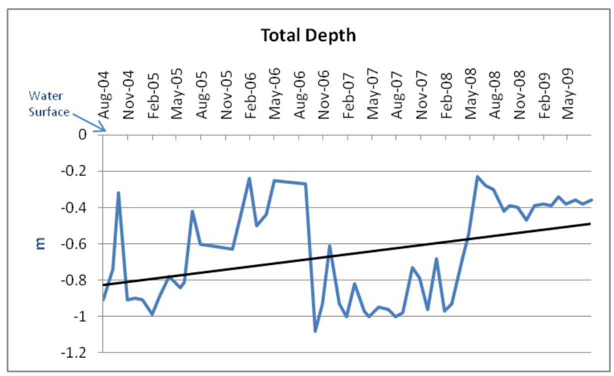

Lake Texana
at Simmon's
Cove Dock
Ganado
Jackson
County Airport
Edna
Lake Texana
State Park

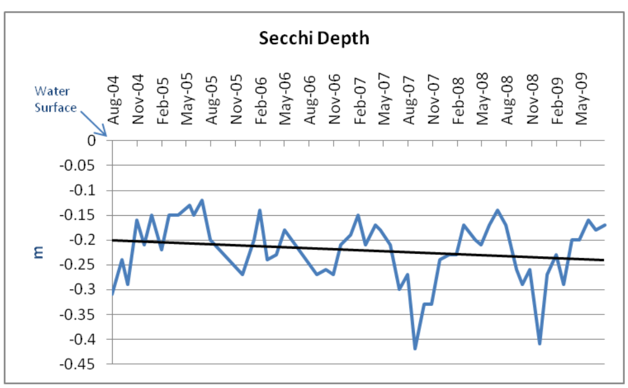
| Lake Texana At Simmon's Cove Dock | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **#** | **% Complete** | **Min.** | **Mean.** | **Max.** | **Std. Dev.** |
| Sample Time | 55 | 100 | 9:00 | 9:11 | 17:00 | 1:04 |
| Specific Conductivity (µS/cm) | 55 | 100 | 80 | 195.64 | 260 | 51.74 |
| Total Depth (m) | 55 | 100 | 0.23 | 0.65 | 1.08 | 0.27 |
| Dissolved Oxygen (mg/L) | 55 | 100 | 2.8 | 7.11 | 11.3 | 1.80 |
| Secchi Depth (m) | 55 | 100 | 0.12 | 0.22 | 0.42 | 0.07 |
| Water Temperature ($^{o}$C) | 55 | 100 | 10 | 22 | 31 | 6.29 |
| pH (su) | 54 | 98 | 6.8 | 7.53 | 8.3 | 0.38 |



[i] Texas Commission on Environmental Quality, *Colorado–Lavaca Coastal Basin (15), Lavaca River Basin (16), Lavaca–Guadalupe Coastal Basin (17), and Portion of Bays and Estuaries (24)*, available from http://www.tceq.state.tx.us/comm_exec/forms_pubs/pubs/gi/gi-316/gi-316_basin15-17.html/at_download/file; accessed 4 August 2010.

[ii]Texas State Historical Association, *Lake Texana*, available from http://www.tshaonline.org/handbook/online/articles/LL/rolan.html; accessed 4 August 2010.

[iii] Texas Parks and Wildlife, *Fishing Lake Texana*, available from http://www.tpwd.state.tx.us/fishboat/fish/recreational/lakes/texana/; accessed 4 August 2010.

[iv] Texas Commission on Environmental Quality, *Reservoir Land Use: Urban + Agriculture,* available from *http*://www.tceq.state.tx.us/assets/public/permitting/waterquality/attachments/stakeholders/0405reslanduse.pdf; accessed 4 August 2010.