WHITE ROCK LAKE WATERSHED DATA REPORT

September 2024

The Meadows Center for Water and the Environment
Texas State University

Texas Stream Team

Photo Credit: Sue Benner

United States Environmental Protection Agency

Texas Commission on Environmental Quality

Texas State University
The rising STAR of Texas

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ACKNOWLEDGEMENTS

The Texas Stream Team encourages life-long learning about the environment and people's relationship to the environment through its multidisciplinary community science programs. We also provide hands-on opportunities for Texas State University students and inspire future careers and studies in natural resource related fields. Preparation of this report fulfills a contract deliverable for the granting entity, but it also serves as a valuable educational experience for the students that assisted in preparing the report. The Texas Stream Team staff values the student contributions and recognizes each individual for their role. The following staff and student workers assisted in the preparation of this report and are acknowledged for their contributions:

Delaney Hankins, Student GIS Assistant
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INTRODUCTION

Texas Stream Team

Texas Stream Team is a volunteer community science water quality monitoring program. Community scientist water quality monitoring occurs at predetermined monitoring sites, at approximately the same time of day each month. Information collected by Texas Stream Team community scientists is covered by a Texas Commission on Environmental Quality-approved Quality Assurance Project Plan to ensure a standard set of methods is used. Community scientist data may be used to identify surface water quality trends, target additional data collection needs, identify potential pollution events and sources of pollution, and to test the effectiveness of water quality management measures. Texas Stream Team community scientist data are not used by the state to assess whether water bodies are meeting the designated surface water quality uses and standards. Data collected by Texas Stream Team provide valuable information, often collected in water bodies professionals are not able to monitor frequently or monitor at all.

For additional information about water quality monitoring methods and procedures, including the differences between professional and volunteer community science monitoring, please refer to the following sources:

- Texas Stream Team Core Water Quality Community Scientist Manual
- Texas Stream Team Advanced Water Quality Community Scientist Manual
- Texas Stream Team Program Volunteer Water Quality Monitoring Program Quality Assurance Project Plan
- Texas Commission on Environmental Quality Surface Water Quality Monitoring Procedures

The purpose of this report is to provide a summary of the data collected by Texas Stream Team community scientists. The data presented in this report should be considered in conjunction with other relevant water quality reports for a holistic view of water quality in the Wichita River watershed within the Red River Basin. Such sources may include, but are not limited to, the following:

- Texas Surface Water Quality Standards
- Texas Water Quality Inventory and 303(d) List (Integrated Report)
- Texas Clean Rivers Program partner reports, such as Basin Summary and Highlight Reports
- Texas Commission on Environmental Quality Total Maximum Daily Load reports

- Texas Commission on Environmental Quality and Texas State Soil and Water Conservation Board Nonpoint Source Program funded reports, including watershed protection plans

To get involved with Texas Stream Team or for questions regarding this watershed data report contact us at TxStreamTeam@txstate.edu or at 512-245-1346. Visit our website for more information on our programs at www.TexasStreamTeam.org.

Recognition of Field Contributions

This report would not have been possible without the dedicated efforts of the Aquatic Alliance monitoring group, in collaboration with Dallas Water Utilities. Both have played pivotal roles in collecting water quality data for the White Rock Lake watershed. These community scientists have consistently monitored sites across the watershed, contributing valuable data that underpins the analysis presented in this report.

The Aquatic Alliance began with a small group of monitors affiliated with the North Central Texas Chapter of the Texas Master Naturalist prior to 2009 and has since grown significantly, expanding to include several dozen members, including non-chapter community participants. By 2012-2013, the group added a Core and Advanced Trainer to broaden its monitoring efforts. Partnering with Dallas Water Utilities, Aquatic Alliance successfully advocated for regular Core Training classes as part of their outreach program. Since 2014, these classes have been held at the Trinity River Audubon Center, training hundreds of new monitors. White Rock Creek, a major focus for these groups, has faced significant pollution challenges.

Their ongoing commitment to monitoring over the past decade has provided crucial insights into water quality trends and potential issues in the area. The Texas Stream Team deeply appreciates their efforts, which have not only made this report possible but also contributed to the larger goal of preserving and protecting our water resources. The data they have gathered is an indispensable resource for understanding water quality in the White Rock Lake watershed and will continue to guide conservation efforts and policy decisions in the future.

WATERSHED DESCRIPTION

Location and Climate

White Rock Lake watershed (the watershed) is a sub-watershed covering approximately 35 square miles, located within Dallas County (Figure 1). White Rock Lake, a man-made lake built in 1911, was originally constructed to provide water for the residents of Dallas, Texas. This lake is fed by White Rock Creek, which eventually flows into the Trinity River (Texas State Historical Association, 1995/1996). This area is a popular recreation spot for Dallas County residents, offering bike paths, running trails, and picnic areas, and is one of the busiest parks in Dallas (Dallas Parks and Recreation, n.d.).

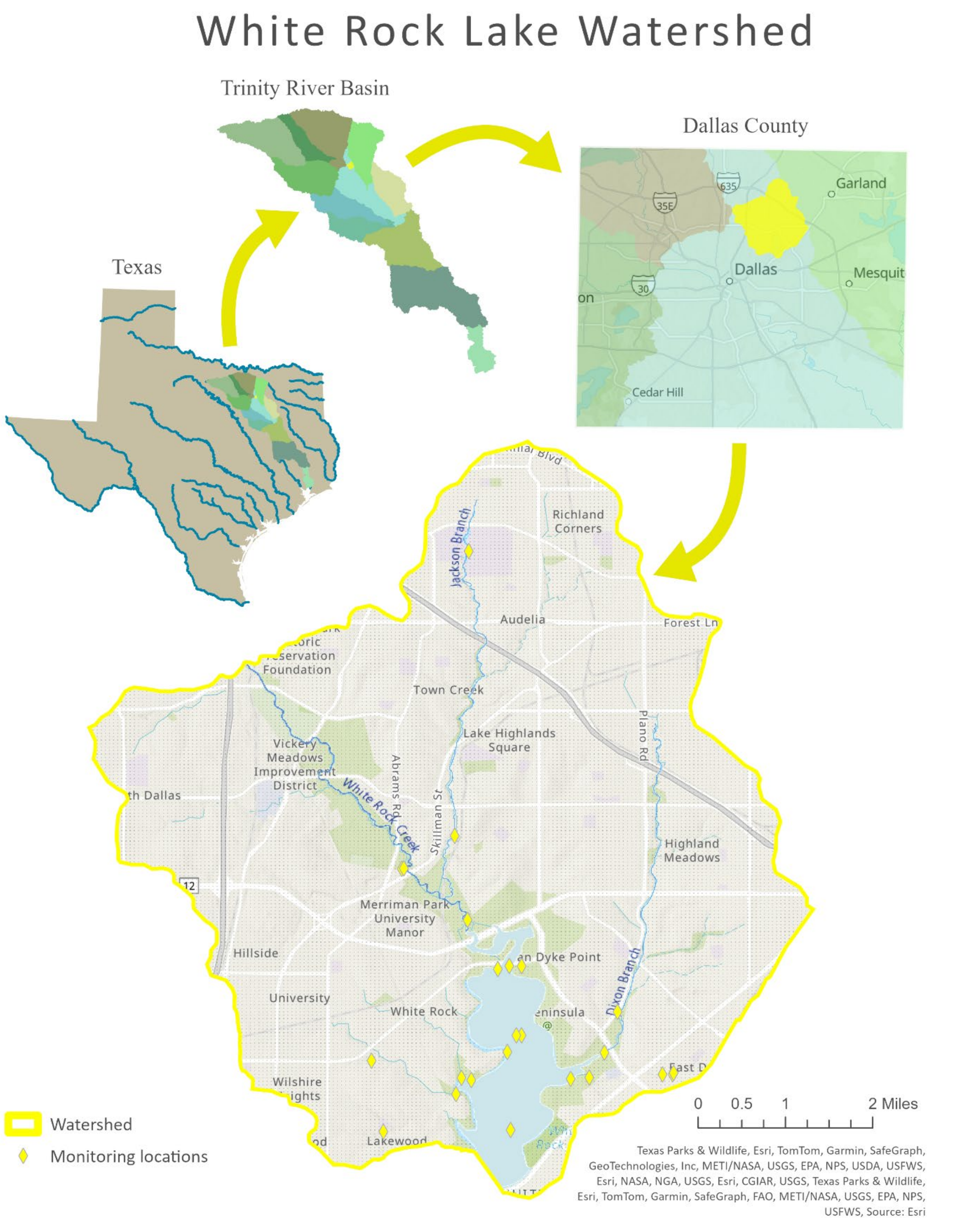

Figure 1. White Rock Lake watershed in Dallas County, Texas.

White Rock Creek, a tributary of the Trinity River, derives its name from an escarpment of white rocks that line a portion of the creek. White Rock Lake inherited this name as the creek feeds into it (Texas State Historical Association, 1996). Throughout the 19th and 20th centuries, agriculture, livestock, and goods production were the main drivers of economic growth for Dallas County, transforming the county from a rural area to a county with many prosperous cities (Texas State Historical Association, 2021).

The Texas Commission on Environmental Quality designates classifications for streams, rivers, lakes, and bays throughout Texas, including those within the watershed (Table 1). One classified reservoir and one unclassified stream within the sub-watershed were monitored by Texas Stream Team community scientists and are included in this summary report. White Rock Lake (Segment 0827) is a classified reservoir and arises from White Rock Dam in Dallas County up to the normal pool elevation of 458 feet, impounding White Rock Creek. As such, White Rock Lake, recognized as both a classified reservoir and a freshwater lake, is the focus of this report. White Rock Creek above White Rock Lake (Segment 0827A) is an unnamed perennial stream that flows from the headwaters of White Rock Lake and is a tributary within the Trinity River Basin.

Table 1. Texas Commission on Environmental Quality segment classifications (Texas Commission on Environmental Quality, 2002).

Segment Number	Segment Name	Segment Description
0827	White Rock Lake	From White Rock Dam in Dallas County up to the normal pool elevation of 458 feet (impounds White Rock Creek).
0827A	White Rock Creek above White Rock Lake	Perennial stream from the headwaters of White Rock Lake upstream to the headwaters at Hilcrest Road in Frisco.

The climate in this area is described as semi-humid subtropical, characterized by hot summers and cool winters (Köppen-Geiger climate classification). Climate data from the National Oceanic and Atmospheric Administration, collected at the Dallas Love Field Airport weather station was acquired from the National Data Center (National Oceanic and Atmospheric Administration, 2021). The average annual precipitation is 38.32 inches and typically occurs year-round (Figure 2). Long-term monthly average precipitation shows a bimodal distribution, with peaks occurring in May and October, averaging 4.68 inches of rainfall during these months. The least amount of rainfall (1.71

inches) occurs in July. The warmest and coldest months of the year are July/August (30.7°C) and January (8.7°C), respectively.

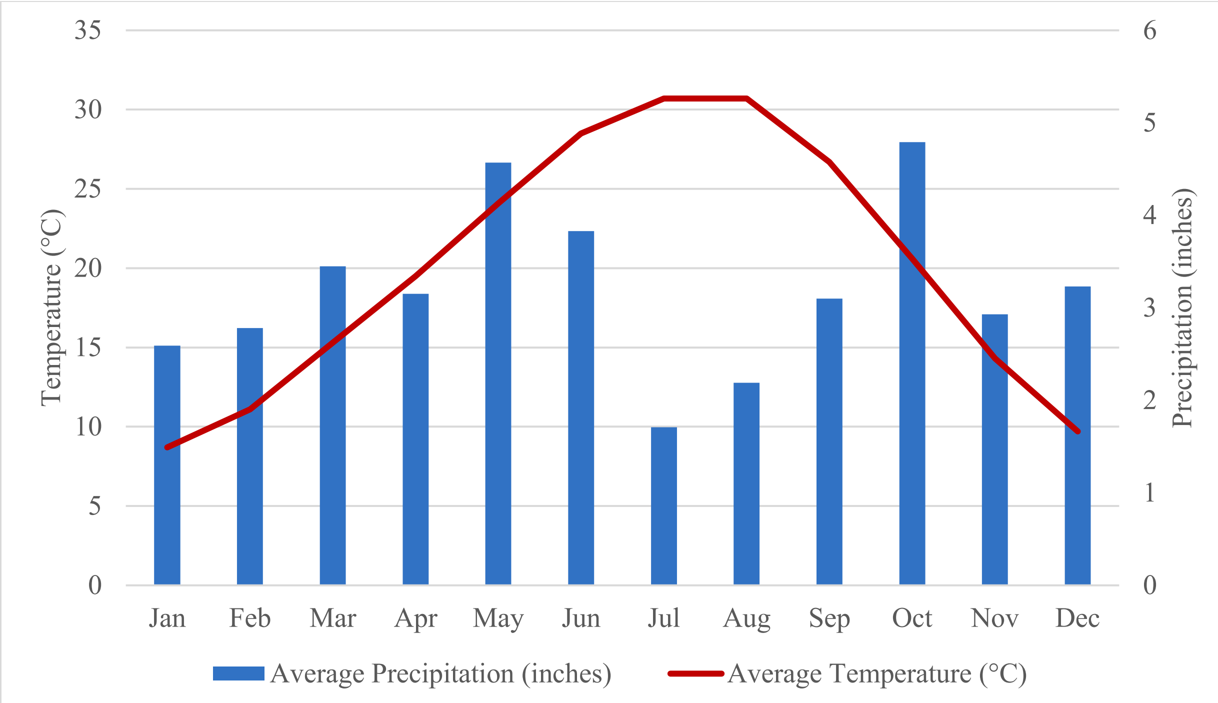

Figure 2. Long-term (1991-2020) monthly average precipitation (inches) and air temperature (°C) from Dallas Love Field Airport, Texas (National Oceanic and Atmospheric Administration Climate Data, 2021).

Physical Description

The watershed is located in Dallas County, within a landscape described as a southwestern Blackland Prairie and forage region. The vegetation in this region includes grasses such as bluestem, Indiangrass, and switchgrass; trees such as pecan, cedar, and elm; and wildflowers such as the Texas bluebonnet, Indian paintbrush, and Turk's cap. Prominent minerals within the watershed include limestone and marine chalks, contributing to the development of black, calcareous, alkaline, heavy clay soils in this region. Wildlife in this area includes white-tailed deer, game animals, songbirds, and waterfowl/shorebirds (Texas Parks and Wildlife Department, n.d.).

Land Use

Land cover types were determined from spatial datasets processed in geographic information systems for the watershed (Figure 3).

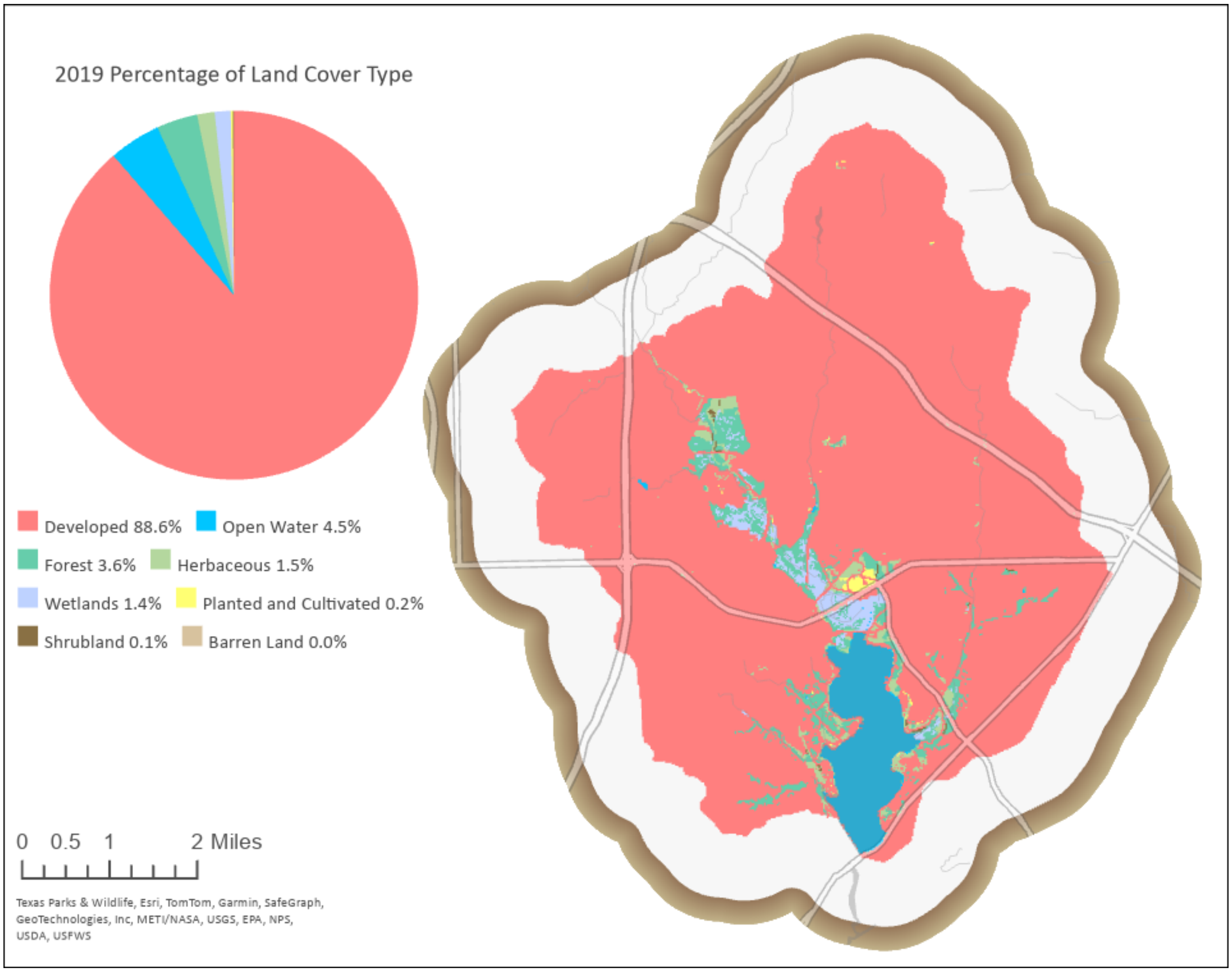

Figure 3. Land cover for the White Rock Lake watershed Dallas County, Texas (National Land Cover Data, 2019).

Nearly 89% of the land cover in the watershed is developed. The remaining area consists of open water (5%), forest (4%), herbaceous (2%), and 1% or less of wetlands, planted and cultivated land, shrubland, and barren land.

Land use change between 2019 and 2001 was less than 1% for all use types, except forest land, which decreased 1.5%. Herbaceous land use also decreased (0.3%). All other land use types increased. Shrubland and barren land use classifications were not present in the 2001 data.

Table 2. White Rock Lake watershed in Dallas County, Texas (National Land Cover Data, 2019).

Land Use	Total Acreage	Total Hectares	Percentage
Open Water	1030.47	417.02	4.53
Developed	20144.28	8152.10	88.65
Barren Land	2.44	0.99	0.01
Forest	817.67	330.90	3.60
Shrubland	18.21	7.37	0.08
Herbaceous	349.19	141.31	1.54
Planted & Cultivated	45.09	18.25	0.20
Wetlands	316.54	128.10	1.39
TOTAL	**654020.64**	**264673.17**	**100%**

History

The land on which Dallas County sits was first inhabited by a group of Caddoan peoples called the Anadarko. However, after a long history of conflict between the Native Americans and the Anglo settlers, the Republic of Texas claimed the land east and west of the Trinity River as Dallas County (Maxwell, 2021). The city of Dallas was later founded on that land in 1841 and become known for its factories, craftsmen, and agriculture, acting as a service center for neighboring towns and rural communities (Hazel & McElhaney, 2023). Today, Dallas is recognized for its technology, manufacturing, financial, and food industries, which are the main sources of its economic prosperity and reflect the economic principles on which the city of Dallas was founded (Dallas Regional Chamber, n.d.).

Endangered Species and Conservation Needs

The common names of 13 species listed as threatened or endangered (under the authority of Texas state law and/or the United States Endangered Species Act) within the watershed are included in Appendix A. A summary of the number of species per taxonomic group listed as state or federally endangered, threatened, G1 or G2 (critically imperiled or imperiled), species of greatest conservation need, and/or endemic is provided in Table 3.

Table 3. State and federally listed species in the White Rock Lake watershed Dallas County, Texas.

Taxon	Endangered (Federal or State)	Threatened (Federal or State)	G1 or G2 (Critically Imperiled/	Species of Greatest	Endemic Total Count

	LE/E	LT/T	Imperiled)	Conservation Need (TPWD) (S1 or S2)	
Amphibians	0	0	0	0	0
Birds	1	5	1	6	0
Fish	0	0	0	0	0
Mammals	0	0	0	4	0
Reptiles	0	2	0	5	1
Insects	0	0	1	1	1
Mollusks	0	5	4	5	2
Plants	0	0	2	4	5
Total	**1**	**12**	**8**	**25**	**9**

Texas Water Quality Standards

The Texas Surface Water Quality Standards establish explicit goals for the quality of streams, rivers, lakes, and bays throughout the state. The standards are developed to maintain the quality of surface waters in Texas to support public health and protect aquatic life, while being consistent with the state's sustainable economic development. Water quality standards identify appropriate uses for the state's surface waters, including aquatic life, recreation, and sources of public water supply as drinking water. The criteria for evaluating support of these uses at monitoring sites on the White Rock Lake (Segment 0827), included in this report, are provided in Table 4. Unclassified water bodies are not defined in the state's standards but are associated with a classified water body because they are in the same watershed. The dissolved oxygen criteria are for dissolved oxygen means at any site within the segment; the minimum and maximum values for pH apply to any site within the segment; the *E. coli* indicator bacteria for freshwater is a geometric mean; and the temperature criteria are a maximum value at any site within the segment.

Table 4. State water quality criteria for the White Rock Lake watershed in Dallas County, Texas (Texas Commission on Environmental Quality, 2022).

Segment	Dissolved Oxygen (mg/L)	pH Range (s.u.)	Total Dissolved Solids (mg/L)	*E. coli* Bacteria (#/100 mL)	Temperature (°C)
White Rock Lake (0827)	Grab screening level: 5.0 Grab min.: 4.0	6.5-9.0	400	Primary Contact Recreation 1: 126 geometric mean, 399 single sample	33.8

The Texas Surface Water Quality Standards also include narrative criteria (verbal descriptions) that apply to all waters of the state and are used to evaluate support of applicable uses. Narrative criteria include general descriptions such as excessive aquatic plant growth, foaming of surface waters, taste- and odor-producing substances, sediment build-up, and toxic materials. These criteria are evaluated using screening levels, if available, and other information, including water quality studies, existence of fish kills or contaminant spills, photographic evidence, and local knowledge. Screening levels serve as a reference to indicate when water quality parameters may be approaching levels of concern.

Water Quality Impairments

The *Draft 2024 Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d)* (Integrated Report) includes an index of water quality impairments. Of the one classified reservoir and the unclassified stream, only White Rock Creek above White Rock Lake (0827A) has impairments for bacteria in water (Recreation Use). White Rock Creek above White Rock Lake is listed as Category 5c, indicating that available data/information shows at least one designated use is not being supported or is threatened. Additional data and information will be collected or evaluated before a management strategy is selected.

WATER QUALITY PARAMETERS

Water Temperature

Water temperature influences the physiological processes of aquatic organisms, and each species has an optimum temperature 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. This effect is exacerbated in coastal water bodies influenced by tidal, saline waters.

Warm water temperatures occur naturally with seasonal variation, as water temperatures tend to increase during summer and decrease in winter in the Northern Hemisphere. 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 that discharge warm water. Community scientist monitoring may not identify fluctuating patterns due to diurnal changes or events such as power plant releases because of the monthly sampling frequency. While community scientist data may not show diurnal temperature fluctuations, they could demonstrate the fluctuations over seasons and years when collected consistently at predetermined monitoring sites and monthly frequencies.

Specific Conductance and Salinity

Specific conductance is a measure of the ability of a body of water to conduct electricity. It is measured in microsiemens per centimeter (μS/cm). A body of water is more conductive if it has more total dissolved solids such as nutrients and salts, which indicates poor water quality if they are overly abundant. High concentrations of nutrients can lead to eutrophication, which results in lower levels of dissolved oxygen. High concentrations of salt can inhibit water absorption and limit root growth for vegetation, leading to an abundance of more drought tolerant plants, and can cause dehydration of fish and amphibians. Sources of total dissolved solids can include agricultural runoff, domestic runoff, or discharges from wastewater treatment plants.

Salinity is a measure of saltiness or the dissolved inorganic salt concentration in water. Salinity is often measured in ocean, estuarine, or tidal influenced waters, but in Texas there are some inland streams that have a high salt content due to the local geology and require salinity measurements. Some common ions measured as salinity include sodium, chloride, magnesium, sulfate, calcium, and potassium. Seawater typically has a salt content of 35 parts per thousand (ppt or ‰). Like other water quality parameters, salinity affects the homeostasis or the balance of water and solutes within both plants and animals. Too much or too little salt can affect plant and animal cell survival and growth, therefore salinity is an important measurement.

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 streamflow.

The 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 and algae growth, which may starve subsurface vegetation of sunlight and, therefore, reduce the amount of oxygen they produce via photosynthesis. This process is known as eutrophication. Low dissolved oxygen can also result from high groundwater inflows (which have low dissolved oxygen due to minimal aeration), high temperatures, or water releases from deeper portions of dams where dissolved oxygen stratification occurs. Supersaturation typically occurs underneath waterfalls or dams with water flowing over the top where aeration is abundant.

pH

The pH scale measures the concentration of hydrogen ions in a range from zero to 14 and is reported in standard units (s.u.). The pH of water can provide information regarding acidity or alkalinity. The range is logarithmic; therefore, every one-unit change is representative of a 10-fold increase or decrease in acidity or alkalinity. Acidic sources, indicated by a low pH level, can include acid rain and runoff from acid-laden soils. Acid rain is predominantly caused by coal powered plants with minimal contributions from the burning of other fossil fuels and other natural processes, such as volcanic emissions. Soil-acidity can be caused by excessive rainfall leaching alkaline materials out of soils, acidic parent material, crop decomposition creating hydrogen ions, or high-yielding fields that have drained the soil of all alkalinity. Sources of high pH (alkaline) include geologic composition, as in the case of limestone increasing alkalinity and the dissolving of carbon dioxide in water. Carbon dioxide is water soluble, and as it dissolves it forms carbonic acid. A suitable pH range for healthy organisms is between 6.5 and 9.0 s.u.

Water Transparency and Total Depth

Two instruments can be used by Texas Stream Team community scientists to measure water transparency, a Secchi disc or a transparency tube. Both instruments are used to measure water transparency or to determine the clarity of the water, a condition known as turbidity. The Secchi disc is lowered into the water until it is no longer visible, then raised until it becomes visible, and the average of the two depth measurements is recorded. A transparency tube is filled with sample water and water is released until the Secchi pattern at the bottom of the tube can be seen. The tube is marked with two-millimeter increments and is used to measure water transparency. Transparency measurements less than the total depth of the monitoring site are indicative of turbid water. Readings that are equal to total depth indicate clear water. Highly turbid waters pose a risk to wildlife by clogging the gills of fish, reducing visibility, and carrying contaminants. Reduced visibility can harm predatory fish or birds that depend on good visibility to find their prey. Turbid waters allow less light to penetrate deep into the water, which, in turn, decreases the density of phytoplankton, algae, and other aquatic plants. This reduces the dissolved oxygen in the water due to reduced photosynthesis. Contaminants are mostly transported in sediment rather than in the water. Turbid waters can result from sediment runoff from construction sites, erosion of farms, or mining operations.

E. coli and Enterococci Bacteria

E. coli bacteria originate in the digestive tract of endothermic organisms. The United States Environmental Protection Agency has determined *E. coli* to be the best indicator of the degree of pathogens in a freshwater system. A pathogen is a biological agent that causes disease.

Enterococci bacteria are a subgroup of fecal streptococci bacteria (mainly *Streptococcus faecalis* and *Streptococcus faecium*) that are present in the intestinal tracts and feces of warm-blooded animals. It is used by the Texas Commission on Environmental Quality as an indicator of the potential presence of pathogens in tidally-influenced saltwater along the Texas Gulf Coast.

The standard for a bacteria impairment is based on the geometric mean (geomean) of the bacteria measurements collected. A geometric mean is a type of average that incorporates the high variability found in parameters such as *E. coli* and enterococci which can vary from zero to tens of thousands of colony forming units per 100 milliliters (CFU/100 mL). The standard for contact recreational use of a water body is 126 CFU/100 mL for *E. coli* in freshwater or 35 CFU/100 mL for enterococci in saltwater. A water body is considered impaired if the geometric mean is higher than the corresponding water quality standard.

Texas Stream Team does not currently monitor water quality for enterococci in coastal waters. Instead, community scientists can get certified in *E. coli* bacteria monitoring, the indicator used by the Texas Commission on Environmental Quality for freshwater streams.

Nitrate-Nitrogen

Nitrogen is present in terrestrial or aquatic environments as nitrate-nitrogen, nitrites, and ammonia. Nitrate-nitrogen tests are conducted for maximum data compatibility with the Texas Commission on Environmental Quality and other partners. Just like phosphorus, nitrogen is a nutrient necessary for the growth of most living organisms. Nitrogen inputs into a water body may be from livestock and pet waste, excessive fertilizer use, failing septic systems, and industrial discharges that contain corrosion inhibitors. The effect excess nitrogen has on a water body is known as eutrophication and is described previously in the "Dissolved Oxygen" section. Nitrate-nitrogen dissolves more readily than orthophosphate, which attach to sediment, and, therefore, can serve as a better indicator of possible sewage or manure pollution during dry weather.

Phosphate

Phosphorus almost always exists in the natural environment as phosphate and continually cycles through the ecosystem as a nutrient necessary for the growth of most organisms. Testing for phosphate in the water excludes the phosphate bound up in plant and animal tissue. There are other methods to retrieve phosphate from the material to which it is bound, but they are too complicated and expensive to be conducted by community scientists. Testing for phosphate provides an idea of the degree of phosphorus in a water body. It can be used for problem identification, which can be followed up with more detailed professional monitoring, if necessary. Phosphorus inputs into a water body may be caused by the weathering of soils and rocks, discharge from wastewater treatment plants, excessive fertilizer use, failing septic systems, livestock and pet waste, disturbed land areas, drained wetlands, water treatment, and some commercial cleaning products. The effect excess phosphate has on a water body is known as eutrophication and is described above in the "Dissolved Oxygen" section.

DATA COLLECTION, MANAGEMENT, AND ANALYSIS

Data Collection

The field sampling procedures implemented by trained community scientists are documented in the Texas Stream Team Core Water Quality Community Scientist Manual and the Texas Stream Team Advanced Water Quality Community Scientist Manual. The sampling protocols in the manuals adhere closely to the Texas Commission on Environmental Quality Surface Water Quality Monitoring Procedures Manual, Volume 1 (August 2012). Additionally, all data collection adheres to Texas Stream Team's Texas Commission on Environmental Quality-approved Quality Assurance Project Plan.

Procedures documented in Texas Stream Team Water Quality Community Scientist Manuals or the Texas Commission on Environmental Quality Surface Water Quality Monitoring Procedures Manual, Volume 1 (August 2012) outline the necessary steps to prevent contamination of samples, including direct collection into sample containers, when possible. Field quality control samples are collected and analyzed to detect whether contamination has occurred and to ensure data accuracy and precision.

Field sampling activities are documented on Environmental Monitoring Forms. The following items are recorded for each field sampling event: station ID, location, sampling time, date, depth, sample collector's name/signature, group name, meter calibration information, and reagent expiration dates. Specific conductance values are converted to total dissolved solids using a conversion factor of 0.65 and are reported as mg/L.

Values for measured parameters are recorded. If reagents or media are expired, it is noted, and data are flagged and communicated to Texas Stream Team staff. Sampling is not permitted with expired reagents or bacteria media; the corresponding values will be flagged in the database and excluded from data reports. Detailed observational data recorded include water appearance, weather, field observations (biological activity and stream uses), algae cover, unusual odors, days since last significant rainfall, and flow severity. Comments related to field measurements, number of participants, total time spent sampling, and total round-trip distance traveled to the sampling site are also recorded for grant reporting and administrative purposes.

Data Management

The community scientists collect field data and report the measurement results to Texas Stream Team, by submitting a hard copy of the Environmental Monitoring Form, entering the data directly into the online Waterways Dataviewer database, or by using the electronic Environmental Monitoring Form. All data are reviewed to ensure they are representative of the samples analyzed and locations where measurements were made. The measurements and associated quality control data are also reviewed to ensure they conform to specified monitoring procedures and project specifications as stated in the approved Quality Assurance Project Plan.

Data review and verification is performed using a quality control checklist and self-assessments, as appropriate to the project task, followed by automated database functions that validate data as the information is entered into the database. The data are verified and evaluated against project specifications and are checked for errors, especially errors in transcription, calculations, and data input. Potential errors are identified by examination of documentation and by manual and computer-assisted examination of corollary or unreasonable data. Issues that can be corrected are corrected and documented. Once entered, the data can be accessed publicly through the online Texas Stream Team Datamap.

Data Analysis

Data were compiled, analyzed, summarized, and compared to state water quality standards and/or criteria to provide readers with a reference point for parameters that may be of concern. The statewide, biennial assessment performed by the Texas Commission on Environmental Quality involves more stringent monitoring methods and oversight than those used by community scientists and staff in this report. The Texas Stream Team community scientist water quality monitoring data are not currently used in the Texas Commission on Environmental Quality assessments mentioned above. However, the Texas Stream Team data is intended to inform stakeholders about general characteristics and assist professionals in identifying areas of potential concern to plan future monitoring efforts.

All data collected by community scientists in the study watersheds were exported from the Texas Stream Team database and grouped by site. Sites with 10 or more monitoring events were maintained in the dataset for analysis. Sites with fewer than 10 monitoring events were excluded from the analysis for this report but may be used in future data summary reports. Once compiled, data were sorted, summary statistics were generated and reviewed, and results were graphed in JMP Pro 14.0.0 (SAS Institute Inc., 2018) using standard methods. Best professional judgement was used to verify outliers. Outlier box or scatter plots were prepared to provide a compact view of the distribution of the data for each parameter and site(s). The horizontal line within the box plot represents the median sample value, while the ends of the box represent the 25^{th} and 75^{th} quantiles or the interquartile range. The lines extending from each end of the box, or whiskers, are computed using the $25^{th}/75^{th}$ quartiles ± 1.5 x (interquartile range). Outliers are plotted as points outside the box plot.

DATA RESULTS

Water quality data from 22 Texas Stream Team monitoring sites in the watershed were acquired for this report (Figure 4).

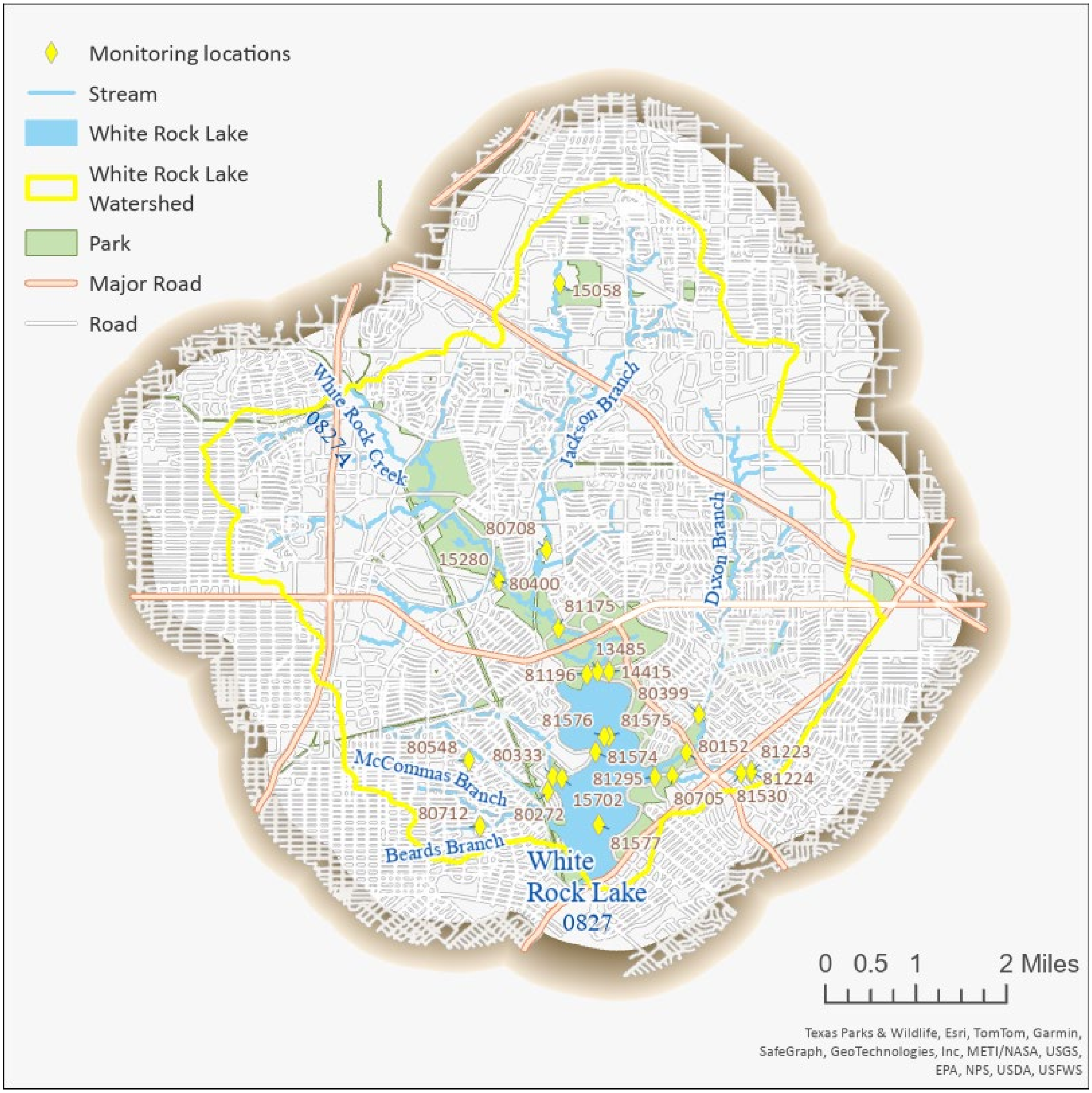

Figure 4. Texas Stream Team monitoring sites in White Rock Lake watershed in Dallas County, Texas.

Nineteen of the 22 sites had 10 or more monitoring events and were monitored sporadically from February 1993 through July 2024 (Table 5). Trained community scientists conducted between 2 and 212 monitoring events at each site, for a total of 1,381 events. The period of record for the sampling events ranged from November 1992 through July 2024, with most sites experiencing temporal intermittent sampling over time.

Table 5. Texas Stream Team monitoring sites in White Rock Lake watershed in Dallas County, Texas.

Site ID	Description	Number of Events	Period of Record
13485	MOCKINGBIRD LANE @ WHITE ROCK LAKE	84	Jan 2005 – Jun 2007, Feb 2012 – Oct 2016, Feb 2018 – June 2018
14415	WHITE ROCK LAKE @ MOCKINBIRD LANE NEAR THE WEST BANK ON SOUTH SIDE OF ROAD	35	Feb 1993 – Jun 1996, Jul 1998 – Dec 2001
15280	WHITE ROCK CREEK @ SKILLMAN STREEET	212	Jul 2006 – Jul 2024
15702	WHITE ROCK LAKE @ LOWTHER DRIVE IN DALLAS	9	Nov 1992 – Dec 1992, Jul 1995 – Jun 1997
80152	DIXON BRANCH @ LAWTHER ROAD, WEST OF BUCKNER BLVD	78	Jan 2005 – Aug 2010, Apr 2012 – Sep 2013, Oct 2015 – Mar 2019, Nov 2023
80272	WILLIAMSON CREEK @ W. LAWTHER BRIDGE ON WHITE ROCK LAKE	118	Jan 2005 – Mar 2015, Dec 2021 – Jul 2024
80333	RUSH CREEK @ FISHER/BRANCHFIELD NEAR WHITE ROCK LAKE	57	Jun 2005 – Jun 2013, Mar 2015 – Feb 2017
80399	DIXON BRANCH @ PEAVY	83	Jul 2006 – May 2007, Apr 2011 – Oct 2017, Jan 2020 – Jul 2024
80400	VILLAGE CREEK @ SKILLMAN/WHITE ROCK CREEK	197	Jul 2008 – Jul 2024
80548	BLUE FAIR LAKE (6709 LAKEFAIR CIR)	16	Oct 2008 – Jun 2010
80705	REINHART BRANCH @ SUNSET BAY ON WHITE	164	Feb 2012 – Jul 2024
80712	MCCOMMAS BRANCH @ LAKEWOOD ELEMNTARY - UPPER	29	Dec 2011 – Sep 2012, Sep 2014 – Dec 2017
81175	WHITE ROCK CREEK @ W. LAWTHER	82	Aug 2015 – Apr 2024
81196	WHITE ROCK LAKE @ MOCKINBIRD LANE DOG PARK	112	Feb 2016 – Jul 2024

81223	REDONDO SPRINGS	2	Jul 2016
81224	REINHARDT BRANCH ABOVE REDONDO SPRINGS	2	Jul 2016
81295	SUNSET BAY-PELICAN POINT @ WHITE ROCK LAKE	42	Dec 2017 – Jan 2021
81530	REINHARDT BRANCH @ 9714 LOSA DR.	11	Jan 2019 – Dec 2019
81574	JACKSON POINT @ WHITE ROCK LAKE	12	Oct 2019 – Feb 2021
81575	WHITE ROCK BOAT CLUB @ WHITE ROCK LAKE	12	Oct 2019 – Feb 2021
81576	CREEK CHANNEL NORTH @ WHITE ROCK LAKE	12	Oct 2019 – Feb 2021
81577	CREEK CHANNEL SOUTH @ WHITE ROCK LAKE	12	Oct 2019 – Feb 2021
	TOTAL	**1,381**	

Site Analysis

Water quality monitoring data from sites with 10 or more sampling events were analyzed and summarized including the number of samples, mean, standard deviation, and range of values (Table 6A and Table 6B). Community scientists monitored the sites for standard core parameters, including air and water temperature, specific conductance, total dissolved solids, dissolved oxygen, pH, Secchi disc transparency, transparency tube, and total depth. Four out of the 19 sites were monitored for nitrate-nitrogen sporadically from 2012 through 2024, including Village Creek at Skillman/White Rock Creek (site 80400), White Rock Creek at Skillman Street (site 15280), Dixon Branch at Lawther Road (site 80152), and Williamson Creek at West Lawther Bridge (site 80272) However, site 80152 was only monitored for nitrate-nitrogen on two separate occasions. Due to the limited number of sampling events for this parameter at site 80152, the site was excluded from the nitrate-nitrogen analysis. Additionally, 11 out of the 19 sites were monitored for *E. coli* sporadically from 2012 through 2024. However, three of the 11 sites were monitored for *E. coli* fewer than 10-times. Therefore, they were removed from the analysis.

Due to the extensive number of sites included within the watershed, some of the data has been divided up into sections to ensure graphs and tables are legible. The sites have been divided into two sections, sites that are located directly on White Rock Lake and sites that are located around White Rock Lake. These two sections were utilized to display the averages, standard deviations, and ranges found in Table 6A and Table 6B, as well as the water temperature displayed on Figure 5 and Figure 6.

Table 6A. Texas Stream Team data summary for sites on White Rock Lake in the White Rock Lake watershed in Dallas County, Texas. (Feb 1993 to July 2024).

Parameter	13485	14415	80333	81196	81295	81574	81575	81576	81577
Number of Events	n = 84	n = 35	n = 57	n = 112	n = 42	n = 12	n = 12	n = 12	n = 12
Water Temperature (°C)	19.9 ± 8.3 (35.0)	20.4 ± 9.2 (31.7)	15.7 ± 8.1 (30.0)	19.6 ± 7.5 (27.0)	20.1 ± 7.6 (24.6)	20.5 ± 7.5 (18.7)	20.9 ± 7.8 (21.3)	20.5 ± 7.1 (19.1)	20.2 ± 6.7 (17.7)
Air Temperature (°C)	19.4 ± 8.2 (35.9)	19.6 ± 9.5 (35.0)	17.5 ± 8.3 (31.5)	19.6 ± 6.8 (29.5)	21.6 ± 7.9 (33.2)	22.2 ± 6.3 (20.0)	21.9 ± 7.3 (22.0)	22.2 ± 6.0 (19.0)	20.7 ± 5.3 (15.0)
Specific Conductance (uS/cm)	527.6 ± 143.3 (520.0)	433.3 ± 114.5 (430.0)	626.0 ± 212.9 (780.0)	417.2± 101.9 (490.0)	491.6 ± 127.2 (550.0)	369.0 ± 80.3 (220.0)	376.7 ± 58.8 (170.0)	366.7 ± 73.4 (210.0)	355.8 ± 69.3 (220.0)
*Total Dissolved Solids (mg/L)	342.9 ± 93.1 (338.0)	281.7 ± 74.4 (279.5)	406.9 ± 138.4 (507.0)	271.2 ± 66.2 (318.5)	319.6 ± 82.7 (357.5)	239.9 ± 52.2 (143.0)	244.8 ± 38.2 (110.5)	238.3 ± 47.7 (136.5)	231.3 ± 45.1 (143.0)
Dissolved Oxygen (mg/L)	7.2 ± 2.6 (15.6)	8.8 ± 1.4 (4.3)	6.9 ± 2.5 (9.9)	7.2 ±2.0 (11.3)	5.4 ±1.9 (7.8)	8.2 ± 2.9 (10.5)	8.1 ± 3.2 (10.7)	7.8 ± 2.7 (8.9)	8.1 ± 2.9 (11.0)
pH (s.u.)	7.2 ± 0.6 (4.0)	7.9 ± 0.3 (1.0)	7.5 ± 0.4 (2.0)	7.5 ± 0.4 (1.7)	7.7 ± 0.5 (2.0)	7.9 ± 0.4 (1.2)	8.1 ± 0.4 (1.5)	8.1 ± 0.3 (0.9)	8.3 ± 0.2 (0.8)
Secchi Disk Transparency (m)	0.2 ± 0.7 (3.0)	0.1 ± 0.0 (0.1)	0.2 ± 0.3 (1.0)	ND	0.3 ± 0.1 (0.2)	0.3 ± 0.1 (0.2)	0.4 ± 0.2 (0.7)	0.4 ± 0.1 (0.2)	0.4 ± 0.2 (0.8)
Transparency Tube (m)	0.4 ± 0.2 (1.1)	ND	1.1 ± 0.2 (0.4)	0.2 ± 0.1 (0.4)	0.4 ± 0.2 (1.1)	0.2 ± 0.1 (0.2)	0.2 ± 0.1 (0.2)	0.2 ± 0.1 (0.3)	0.3 ± 0.2 (0.6)
Total Depth (m)	0.6 ± 0.5 (3.0)	0.2 ± 0.1 (0.2)	0.2 ± 0.2 (1.0)	0.6 ± 0.1 (0.6)	0.4 ± 0.2 (0.9)	1.8 ± 0.3 (1.0)	1.6 ± 0.9 (3.8)	2.0 ± 0.2 (0.6)	4.1 ± 1.1 (4.9)
Nitrate-Nitrogen (ppm or mg/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND
E. coli (CFU/100 mL)	ND	ND	ND	129.8 (1106.5)	189.4 (4906.7)	ND	25.6 (112.5)	ND	ND

*Total dissolved solids were calculated from specific conductance (TDS = specific conductance * 0.65).
**The geometric mean was calculated for E. coli bacteria.
ND = no data available.

Table 7B. Texas Stream Team data summary for sites located off White Rock Lake in the White Rock Lake watershed in Dallas County, Texas. (Feb 1993 to July 2024).

Parameter	15280	80152	80272	80399	80400	80548	80705	80712	81175	81530
Number of Events	n = 212	n = 78	n = 118	n = 83	n = 197	n = 16	n = 164	n = 29	n = 82	n = 11
Water Temperature (°C)	19.4 ± 7.1 (26.4)	19.9 ± 7.3 (29.0)	19.0 ± 7.5 (33.0)	19.0 ± 6.2 (22.0)	19.5 ± 7.0 (26.6)	18.3 ± 6.7 (22.0)	18.7 ± 7.2 (27.3)	17.1 ± 5.9 (22.5)	20.4 ± 7.0 (27.0)	18.3 ± 8.0 (22.0)
Air Temperature (°C)	20.9 ± 7.3 (33.5)	21.3 ± 7.1 (34.0)	20.8 ± 7.5 (34.0)	19.9 ± 7.0 (34.8)	21.1 ± 7.3 (34.0)	18.1 ± 6.9 (21.0)	19.4 ± 7.8 (34.2)	19.6 ± 7.0 (24.5)	21.6 ± 7.5 (30.0)	19.6 ± 8.3 (23.0)
Specific Conductance (uS/cm)	618.3 ± 120.1 (681.0)	498.9 ± 145.0 (570.0)	484.1 ± 138.1 (679.0)	596.9 ± 109.6 (570.0)	611.2 ± 104.7 (590.0)	383.1 ± 60.2 (180.0)	541.0 ± 135.5 (650.0)	786.2 ± 176.1 (930.0)	585.4 ± 115.0 (500.0)	542.7 ± 134.1 (440.0)
*Total Dissolved Solids (mg/L)	401.9 ± 78.1 (442.7)	324.3 ± 94.3 (370.5)	314.7 ± 89.8 (441.4)	388.0 ± 71.2 (370.5)	397.3 ± 68.0 (383.5)	249.0 ± 39.1 (117.0)	351.6 ± 88.1 (422.5)	511.0 ± 114.4 (604.5)	380.5 ± 74.7 (325.0)	352.8 ± 87.2 (286.0)
Dissolved Oxygen (mg/L)	7.0 ± 2.2 (10.4)	4.9 ± 2.4 (11.3)	5.3 ± 2.3 (9.8)	6.1 ± 2.3 (10.8)	7.4 ± 2.0 (10.6)	8.3 ± 3.7 (11.5)	5.8 ± 2.5 (10.7)	6.8 ± 2.2 (8.3)	5.4 ± 2.0 (8.8)	8.4 ± 1.8 (5.0)
pH (s.u.)	7.6 ± 0.4 (1.7)	7.0 ± 0.3 (1.5)	7.3 ± 0.2 (1.2)	7.3 ± 0.3 (1.5)	7.6 ± 0.4 (1.8)	7.3 ± 0.3 (1.0)	7.2 ± 0.3 (1.3)	7.1 ± 0.3 (1.4)	7.2 ± 0.4 (1.8)	8.0 ± 1.1 (2.2)
Secchi Disk Transparency (m)	0.6 ± 0.3 (1.6)	0.5 ± 0.6 (2.2)	1.0 ± 2.7 (15.6)	0.3 ± 0.2 (0.7)	0.6 ± 0.2 (1.1)	ND	0.8 ± 0.6 (0.9)	0.7 ± 0.8 (2.8)	1.0 ± 1.4 (7.1)	2.0 ± 1.4 (2.0)
Transparency Tube (m)	0.6 ± 0.3 (1.1)	0.8 ± 0.3 (0.9)	0.8 ± 0.3 (1.2)	1.1 ± 0.2 (1.1)	0.9 ± 0.3 (1.1)	ND	0.8 ± 0.3 1.1 (1.1)	1.2 ± 0.1 (0.3)	0.6 ± 0.2 (1.1)	0.8 ± 0.4 (1.1)
Total Depth (m)	0.9 ± 0.4 (2.3)	0.8 ± 0.7 (3.0)	1.4 ± 2.2 (15.6)	0.3 ± 0.6 (5.0)	0.7 ± 0.3 (3.7)	ND	0.4 ± 0.1 (0.6)	0.7 ± 0.5 (3.0)	3.4 ± 1.8 (6.0)	0.4 ± 0.4 (0.9)
Nitrate-Nitrogen (ppm or mg/L)	0.8 ± 0.7 (2.0)	ND	1.0 ± 0.0 (0.0)	ND	0.6 ± 0.6 (1.5)	ND	ND	ND	ND	ND
E. coli (CFU/100 mL)	244.8 (4490.0)	ND	244.7 (783.3)	ND	358.3 (7316.7)	ND	242.2 (1109.9)	ND	ND	158.0 (766.9)

*Total dissolved solids were calculated from specific conductance (TDS = specific conductance * 0.65).
**The geometric mean was calculated for E. coli bacteria.
ND = no data available.

Air and Water Temperature

Average air temperature for all sites ranged from 17.5 to 22.2°C (Table 6A and Table 6B). The lowest mean air temperature (17.5°C) was observed on Rush Creek at Fisher/Branchfield near White Rock Lake (site 80333), while the highest mean air temperature (22.2°C) was observed at Jackson Point at White Rock Lake (site 81574) and Creek Channel North at White Rock Lake (site 81576).

Average water temperature for all sites ranged from 15.7 to 20.9°C (Table 6A and Table 6B). The lowest mean water temperature (15.7°C) was observed at Rush Creek at Fisher/Branchfield near White Rock Lake (site 80333), while the highest mean water temperature (20.9°C) was observed at the White Rock Boat Club (site 81575). Discreet water temperature measurements from all sites met the water quality standard (33.8°C) throughout the period of record of this report, except for five separate sampling events (Figure 5). Two of the five occurred at site 81175 (August 10, 2019, and August 6, 2023), while the other three occurrences took place at sites 14415 (July 23, 2001), 13485 (June 27, 2018), and 81295 (July 20, 2019) (Figure 5 and Figure 6).

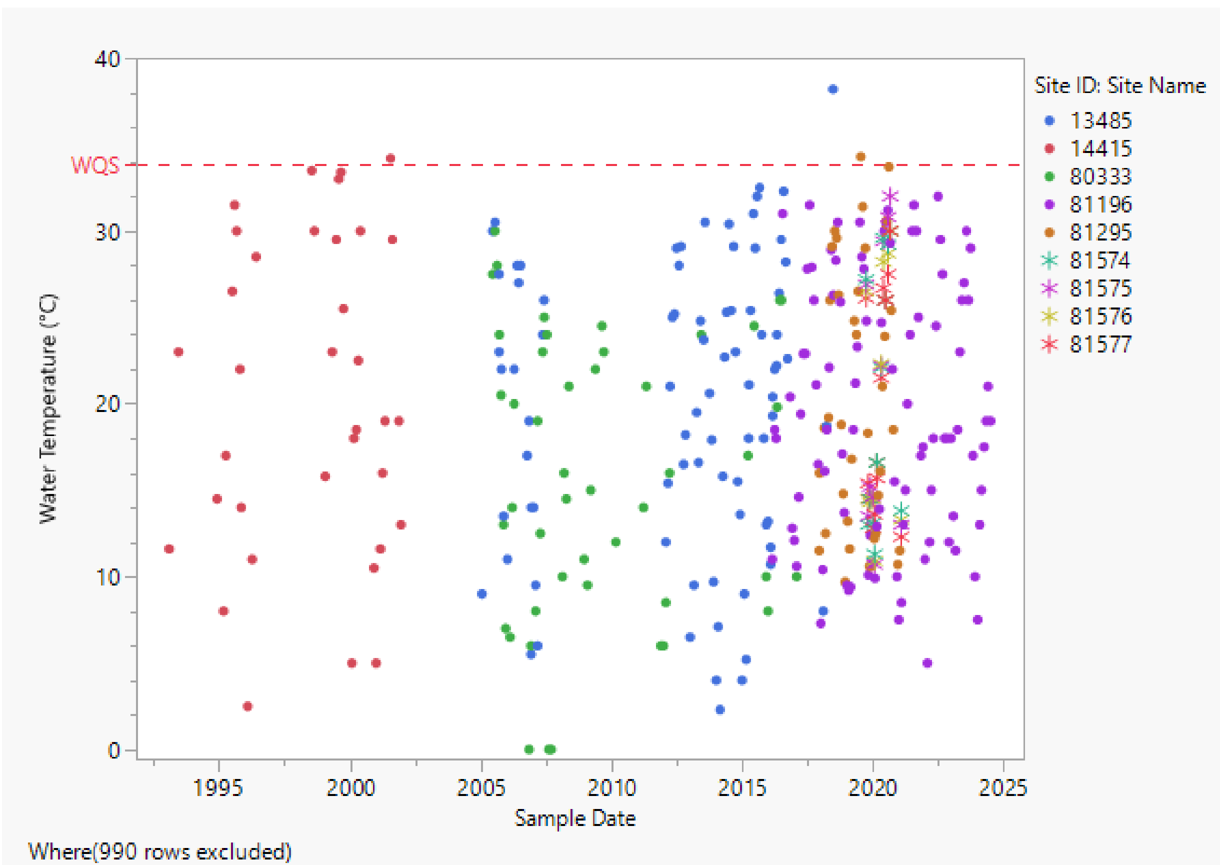

Figure 5. Water temperature for sites located on White Rock Lake in the White Rock Lake watershed in Dallas County, Texas (February 1993 to July 2024). WQS = Water Quality Standard.

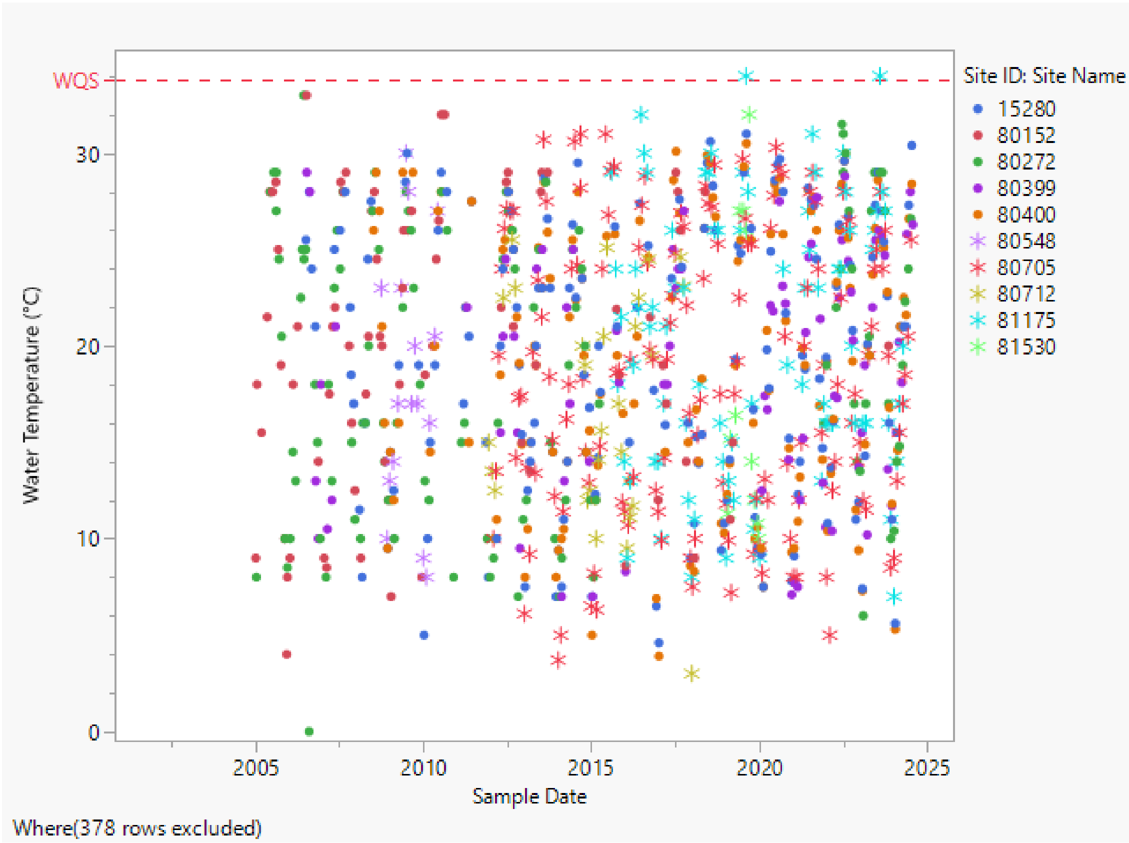

Figure 6. Water temperature for sites located around White Rock Lake in the Whtie Rock Lake watershed in Dallas County, Texas (January 2005 to July 2024). WQS = Water Quality Standard.

Specific Conductance and Total Dissolved Solids

Total dissolved solid values were calculated from specific conductance measurements. The average total dissolved solids from all sites ranged from 231.3 mg/L to 511.0 mg/L (Table 6A and Table 6B). The lowest mean total dissolved solids value (231.3 mg/L) was observed at Creek Channel South at White Rock Lake (site 81577). The highest mean total dissolved solids value (511.0 mg/L) was observed on McCommas Branch at Lakewood Elementary (site 80712). This value exceeded the water quality standard of 400 mg/L. Additionally, the average total dissolved solids values on White Rock Creek on Skillman Street (site 15280) and on Rush Creek at Fisher/Branchfield (site 80333) exceeded the water quality standard as well, with averages of 401.9 mg/L and 406.9 mg/L respectively. Discreet measurements exceeded the water quality standard of 400 mg/L at 14 out of the 19 sites at least once (Figure 7).

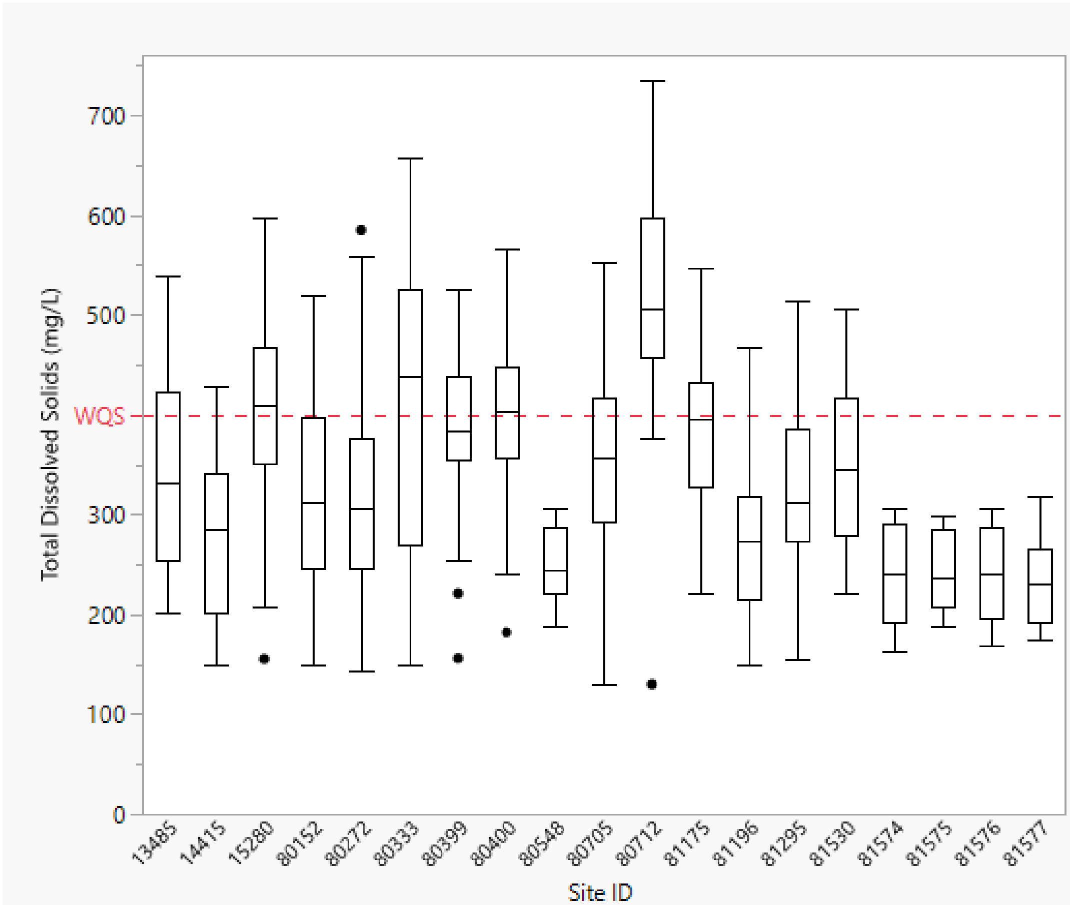

Figure 7. Total dissolved solids (mg/L) for sites in the White Rock Lake watershed in Dallas County, Texas. (February 1993 to July 2024). WQS = Water Quality Standard.

Dissolved Oxygen

The range of average dissolved oxygen values for all sites spanned from 4.9 to 8.8 mg/L (Table 6A and Table 6B). The highest average dissolved oxygen value was at White Rock Lake at Mockingbird Lane (site 14415). The lowest average dissolved oxygen value (4.9 mg/L) was on Dixon Branch at Lawther Road (site 80152), which was below the average water quality standard of 5.0 mg/L. Although the average water quality standard was maintained at the remaining 18 sites, only three of the sites maintained discreet measurements above the minimum water quality standard for grab samples (4.0 mg/L) for the period of record for this report (Figure 8). These sites were located on White Rock Lake at Mockingbird Lane (site 14415), Reinhards Branch at 9714 Losa Dr. (site 81530), and Jackson Point at White Rock Lake (site 81574).

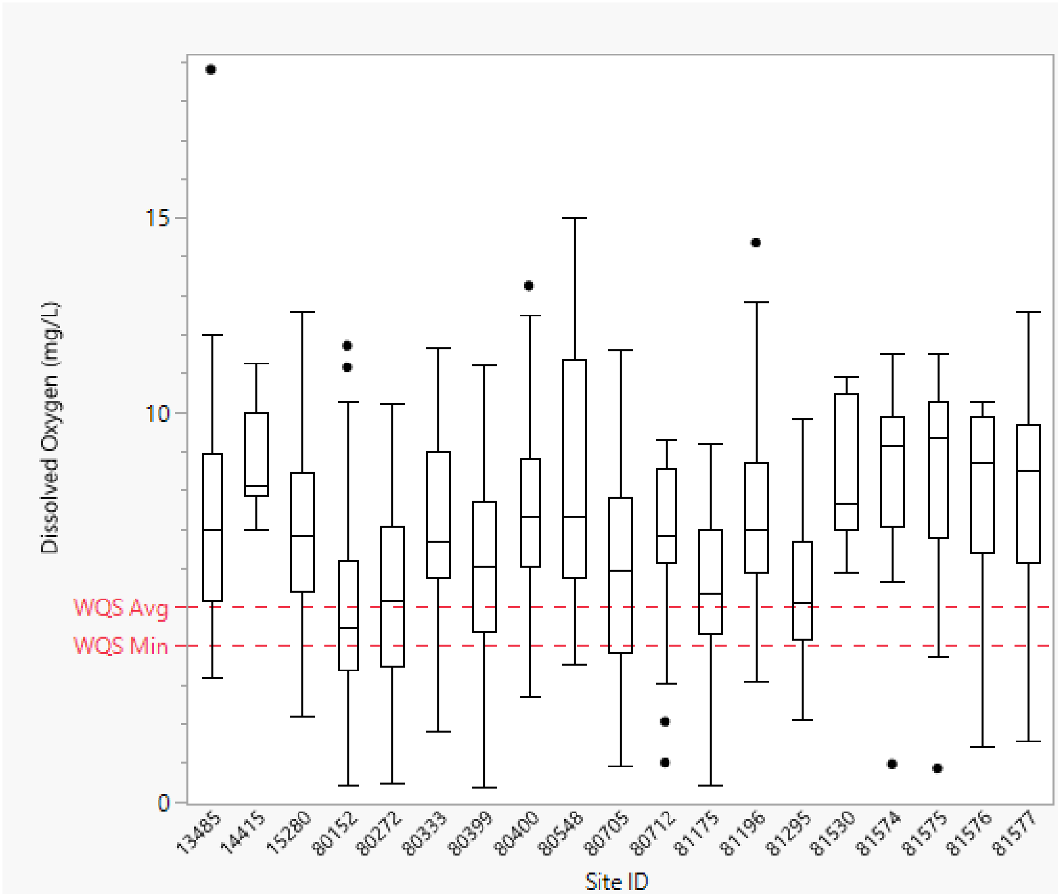

Figure 8. Dissolved oxygen for sites in White Rock Lake watershed in Dallas County, Texas (February 1993 to July 2024). WQS Min = Minimum Water Quality Standard; WQS Avg = Average Water Quality Standard.

pH

The average pH range of values at all sites was between 7.0 and 8.3 s.u. The highest average pH value was on Creek Channel South at White Rock Lake (site 81577) whereas the lowest was on Dixon Branch at Lawther Road (site 80152). Average pH values at all sites were within the range of the minimum and maximum WQS (6.5 to 9.0 s.u.) (Table 6A and Table 6B). However, discreet measurements below the range were measured on White Rock Lake at Mockingbird Lane (site 13485), Dixon Branch at Lawther Road (site 80152), Dixon Branch at Peavy (site 80399), and McCommas Branch at Lakewood Elementary (site 80712). Additionally, discreet measurements above the range were measured at Reinhardt Branch at 9714 Losa Dr. (site 81530) (Figure 9).

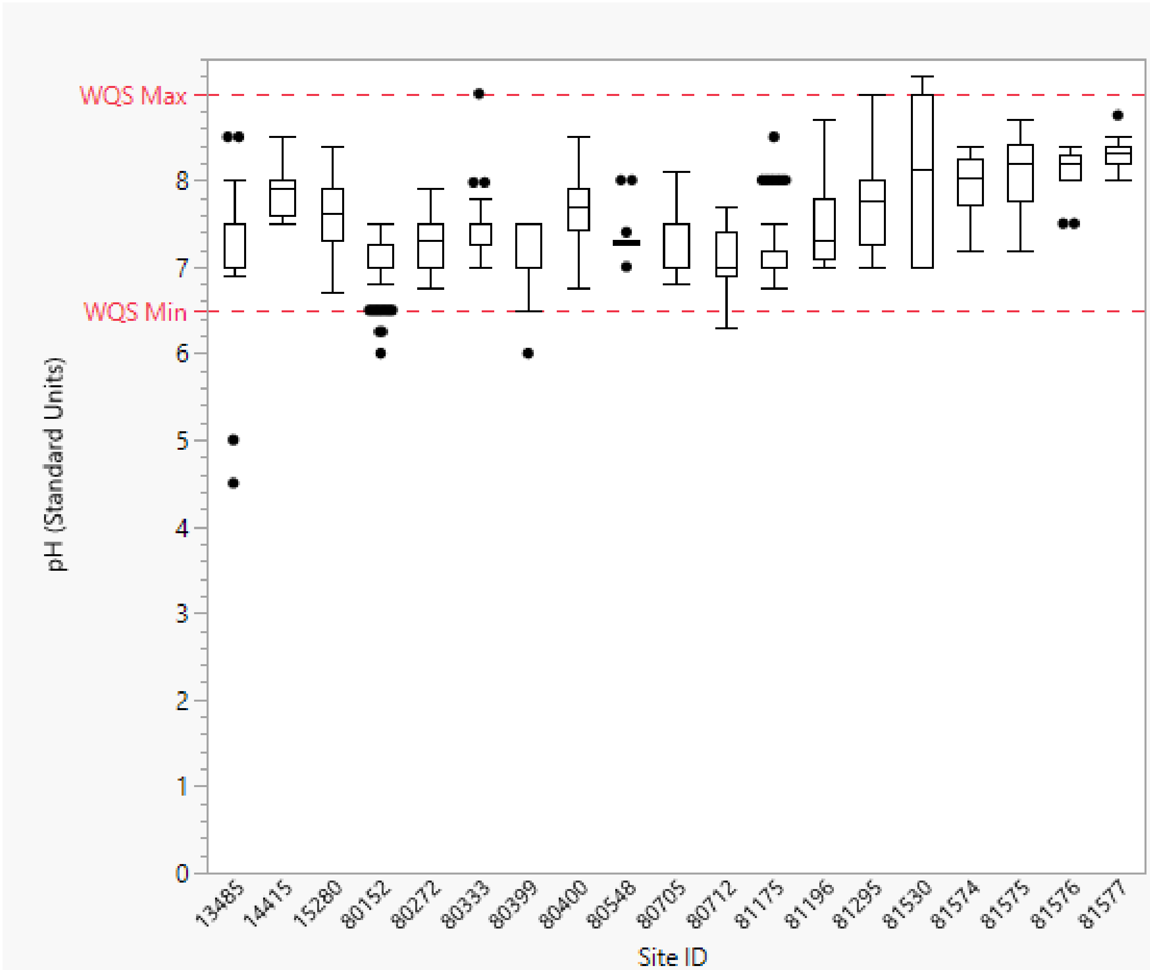

Figure 9. pH (s.u.) for sites in the White Rock Lake watershed in Dallas County, Texas (February 1993 to July 2024). WQS Max= Maximum pH Water Quality Standard; WQS Min = Minimum pH Water Quality Standard.

Transparency and Total Depth

Secchi disks and/or transparency tubes were used to measure transparency at all monitoring sites within the watershed. However, due to discrepancies between total depth and the transparency measurement, the transparency data for Blue Fair Lake (site 8054) could not be used for analysis. The average Secchi disk transparency values measured at 17 out of 19 sites ranged from 0.1 to 2.0 meters, while the average tube values measured at 17 out of 19 sites ranged from 0.2 to 1.2 meters (Table 6A and Table 6B). In terms of average values, the largest variability in Secchi disk and transparency tube measurements was observed at Reinhardt Branch at 9714 Losa Dr. (site 81530) (Figure 10).

Total depth was measured at all monitoring sites (Table 6A and Table 6B) except at Blue Fair Lake (site 80548). The average range of depths for all sites was 0.2 to 4.1 meters.

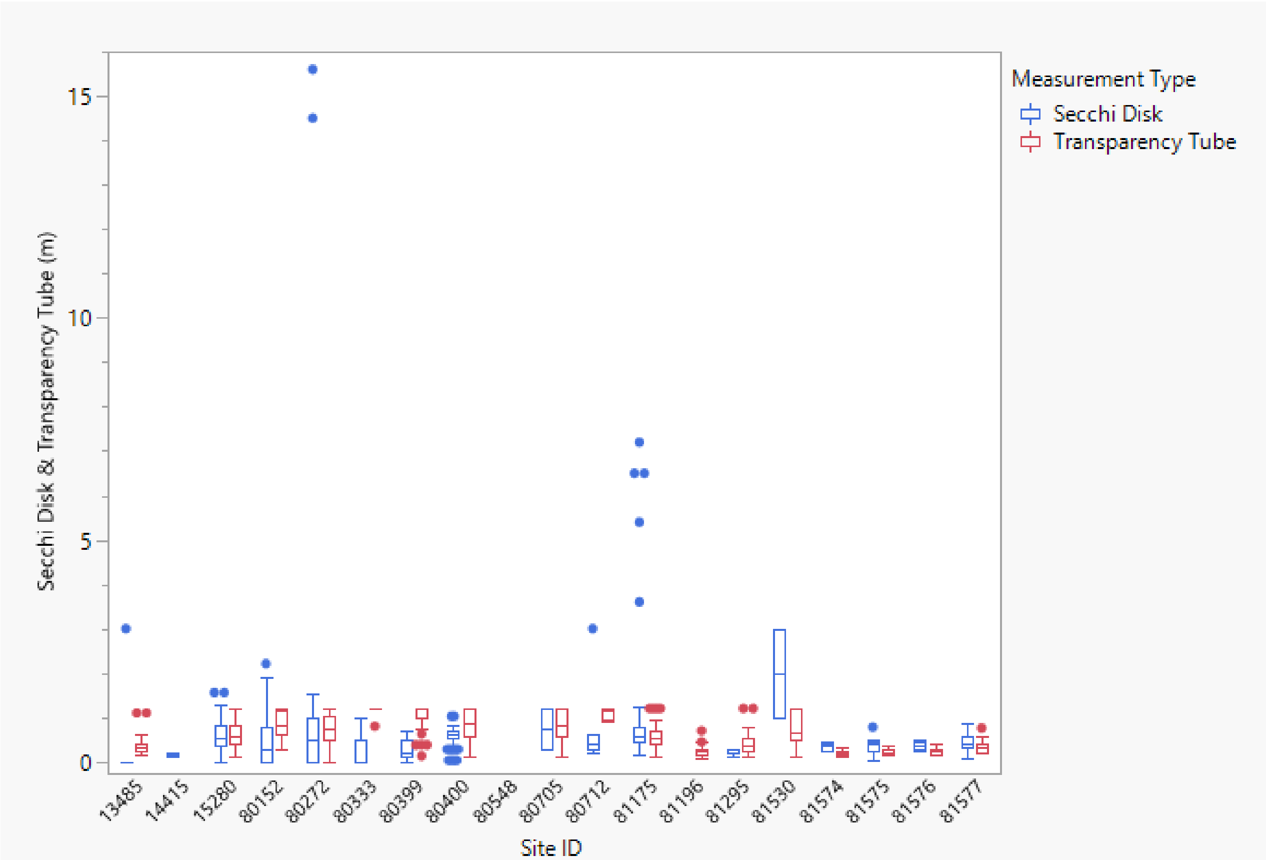

Figure 10. Transparency measurements for sites in the White Rock Lake watershed in Dallas County, Texas (February 1993 to July 2024).

Nitrate-Nitrogen

Nutrients, including nitrate-nitrogen and phosphate, are measured as parameters for the advanced monitoring type. Nitrate-nitrogen was monitored in the watershed at three sites (site 15280, 80272, and 80400) sporadically from 2012 to 2024. The lowest average nitrate-nitrogen value (0.6 mg/L) was at Village Creek at Skillman/White Rock Creek (site 80400) whereas the highest value (1.0 mg/L) was at Williamson Creek at W. Lawther Bridge on White Rock Lake (site 80272). Water quality standards have not been established for freshwaters streams, rivers, bays, or estuaries. As a result, the Texas Commission on Environmental Quality uses a freshwater screening level of 1.95 mg/L. All average measurements were below this screening level.

E. coli

E. coli is a measured parameter part of the bacteria monitoring type. *E. coli* was monitored in the watershed at 8 of the 19 sites and the geometric mean was calculated for the entire period of record. The lowest geometric mean (25.6 CFU/100mL) was observed at White Rock Boat Club (site 81575) whereas the highest (358.3 CFU/100mL) was observed at Village Creek at Skillman/White Rock Creek (site 80400). Site 80400 also had the greatest variability in *E. coli* measurements with a range of 7316.7 CFU/100 mL (Table 6A and Table 6B). Overall, out of the 8 sites monitored for *E. coli*, site 81575 was the only one to have a geometric mean below the water quality standard of 126 CFU/100 mL. Additionally, site 81575 was the only site where discreet measurements remained below the water quality standard for grab samples (399 CFU/100 mL) (Figure 11).

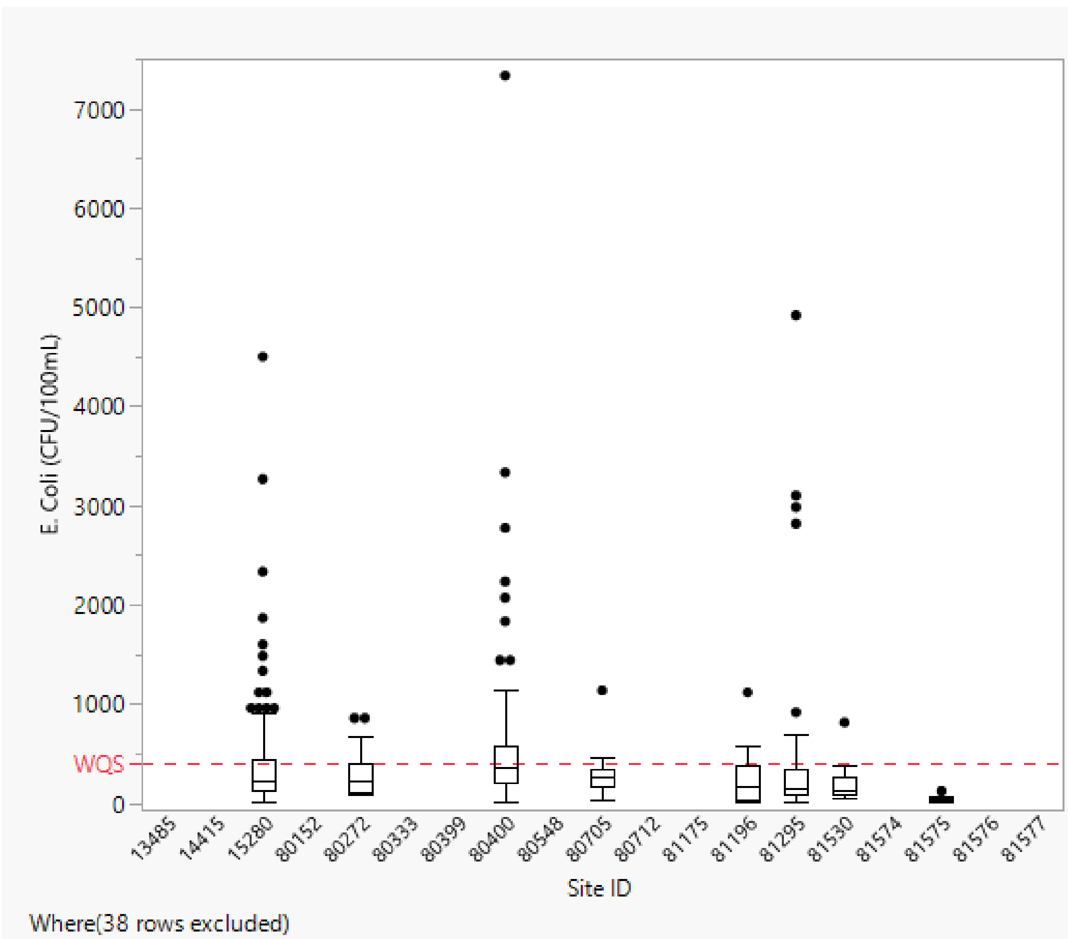

Figure 11. *E. coli* measurements for sites in the White Rock Lake watershed in Dallas County, Texas (February 1993 to July 2024). WQS = Water Quality Standard.

WATERSHED SUMMARY

The White Rock Lake watershed consists primarily of developed land, covering 89% of the area. The remaining land includes open water (5%), forest (4%), herbaceous (2%), and 1% or less of wetlands, cultivated land, shrubland, and barren land. According to the Draft 2024 Integrated Report by the Texas Commission on Environmental Quality, White Rock Creek above White Rock Lake (0827A) is listed as impaired for *E. coli* bacteria in water (Recreation Use). This segment is categorized as 5c, meaning that while data indicate one or more designated uses are not being supported or are threatened, further data collection or evaluation is required before selecting a management strategy. Bacteria impairments for this watershed were first listed in 2016.

Texas Stream Team community scientists intermittently monitored 22 sites within the watershed from November 1992 to July 2024, recording a total of 1,381 monitoring events. Nineteen of these sites had 10 or more monitoring events, allowing for a thorough analysis of water quality, including the number of samples, mean, standard deviation, and range of values (Table 6A and Table 6B). Core parameters, such as air and water temperature, specific conductance, total dissolved solids, dissolved oxygen, pH, Secchi disk transparency, transparency tube, and total depth were monitored at these sites. Additionally, four sites were monitored for nitrate-nitrogen sporadically from 2012 through 2024 and 11 sites were monitored for *E. coli* during the same period. All sites included in this report were monitored by Texas Stream Team trained community scientists.

Water quality standards for designated uses in the watershed were compared to the results of this analysis to evaluate overall water quality. Major findings include: the mean water quality standard for total dissolved solids (400 mg/L) was not met at sites 80712, 15280, and 80333; dissolved oxygen levels were below the standard (5.0 mg/L) at site 80152; and seven sites (15280, 80272, 80400, 80705, 81196, 81295, and 81530) exceeded the geometric mean (126 CFU/100 mL) for *E. coli* bacteria. Discrete measurements showed the total dissolved solids standard was exceeded at 14 sites, dissolved oxygen at 15 sites, and *E. coli* bacteria at seven sites. While the watershed is not classified as impaired for aquatic life use concerning total dissolved solids or dissolved oxygen, these findings raise concerns.

Additional discrete measurements failed to meet the water quality standard for temperature (32.2°C) at five monitoring locations (81175, twice; 14415; 13485; and 81295) and pH levels (6.5–9.0 s.u.) were outside of the acceptable range at five sites (13485, 80152, 80399, 80712, and 81530). Although the average water quality standards were met, these periodic exceedances may be cause for concern if they continue to occur.

Texas Stream Team community scientists are encouraged to maintain core and *E. coli* monitoring while expanding efforts to include consistent advanced parameters such as nutrients (both nitrate-nitrogen and phosphate) at all sites. Given the *E. coli* bacteria impairment in the watershed, continued bacteria monitoring is essential to better understand the sources over time and to prevent further degradation. Establishing consistent monitoring of nitrate-nitrogen and phosphate is also crucial for assessing nutrient loadings. This ongoing monitoring is vital for building long-term data sets, tracking changes in water quality over time, and addressing potential impacts from population growth and development.

This report would not have been possible without the dedicated efforts of the Aquatic Alliance monitoring group and Dallas Water Utilities. Both have played pivotal roles in collecting water quality data for the White Rock Lake watershed. These community scientists have consistently monitored sites across the watershed, contributing valuable data that underpins this report. Texas Stream Team will continue to support these efforts by providing technical support. We look forward to training new community scientists to expand, grow, and sustain the water quality monitoring efforts in this area and beyond. For more information about Texas Stream Team and upcoming trainings contact us at TxStreamTeam@txstate.edu or visit the calendar of events on our website at www.TexasStreamTeam.org.

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Appendix A.

Table 8. Endangered species located within the White Rock Lake watershed in Dallas County, Texas.

Species Type	Common Name	Federal/State Listing
Birds	Whooping Crane	Federally Listed as Endangered, State Listed as Endangered

Table 8. Threatened species located within the White Rock Lake watershed in Dallas County, Texas.

Species Type	Common Name	Federal/State Listing
Birds	White-faced Ibis	State Listed as Threatened
	Wood Stork	State Listed as Threatened
	Black Rail	State Listed as Threatened
	Piping Plover	State Listed as Threatened Federally Listed as Threatened
	Rufa Red Knot	State Listed as Threatened Federally Listed as Threatened
Reptiles	Texas Horned Lizard	State Listed as Threatened
	Alligator Snapping Turtle	State Listed as Threatened
Mollusks	Sandbank Pocketbook	State Listed as Threatened
	Louisiana Pigtoe	State Listed as Threatened Federally Listed as Threatened
	Texas Heelsplitter	State Listed as Threatened
	Trinity Pigtoe	State Listed as Threatened
	Texas Fawnsfoot	State Listed as Threatened Federally Listed as Threatened