City of Fort Worth

Co-Permittee
Tarrant Regional Water District

# 2021 Annual Report

TPDES Permit # WQ0004350000
Permit Year 4: March 8, 2021-March 7, 2022
2018 – 2023 Permit Term

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**List of Acronyms**

| | |
|---|---|
| BMP | Best Management Practice |
| CCTV | Closed Circuit Television |
| CFR | Code of Federal Regulation |
| CFW | City of Fort Worth |
| COD | Chemical Oxygen Demand |
| DWFS | Dry Weather Field Screening |
| ECC | City of Fort Worth Environmental Collection Center |
| EPA | Environmental Protection Agency |
| EPCRA | Emergency Planning and Community Right to Know Act |
| ETJ | Extra-Territorial Jurisdiction |
| EQD | Environmental Quality Division |
| FEMA | Federal Emergency Management Agency |
| FWFD | Fort Worth Fire Department |
| HazMat | Hazardous Materials |
| HID | High-Intensity Discharge (light) |
| I/I | Inflow and Infiltration |
| *i*SWM | *integrated* Stormwater Management |
| MBAS | Methylene blue active substances |
| MCM | Minimum Control Measure |
| MEP | Maximum Extent Practicable |
| MS4 | Municipal Separate Storm Sewer System |
| MSGP | Multi-Sector General Permit |
| NCTCOG | North Central Texas Council of Governments |
| NHD | National Hydrographic Dataset |
| NOI | Notice of Intent |
| NOT | Notice of Termination |
| NOV | Notice of Violation |
| NPDES | National Pollutant Discharge Elimination System |
| PCB | Polychlorinated Biphenyl |
| RWWCP | Regional Wet Weather Characterization Program |
| ROW | Right of Way |
| SPCC | Spill Prevention, Control and Countermeasures |
| SOP | Standard Operating Procedure |
| SSCA | Sanitary Sewer Condition Assessment Program |
| SWMP | Stormwater Management Plan |
| SWPPP | Stormwater Pollution Prevention Plan |
| TCEQ | Texas Commission on Environmental Quality |
| TPDES | Texas Pollutant Discharge Elimination System |
| TPW | City of Fort Worth Transportation and Public Works Department |
| TRWD | Tarrant Regional Water District |
| TxDOT | Texas Department of Transportation |
| USACE | United States Army Corps of Engineers |
| USEPA | United States Environmental Protection Agency |
| USDA | United States Department of Agriculture |
| USGS | United States Geological Survey |

**Certification Statement**

TPDES Permit No. WQ0004350000
Review of Stormwater Annual Report
Permit Year: March 8, 2021–March 7, 2022

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations.

Valerie Washington
Assistant City Manager
Authorized Representative

May 16, 2022
Date

## Municipal Separate Storm Sewer System (MS4) Overview

The City of Fort Worth Stormwater Management Program was fully implemented during the first MS4 permit term (NPDES permit No. TXS000901). The City has continued to implement the program during the current permit term for permit WQ0004350000, as renewed by the Texas Commission on Environmental Quality (TCEQ); including changes to the program as indicated in the permit renewal application and subsequent revisions, and incorporating changes necessitated by additional or changed requirements of the renewed permit. This report is for the second permit year under the current permit, issued March 8, 2018. Annual expenditures are detailed in Appendix A and the Minimum Control Measure Summary can be found in Appendix B. Attachment 1 contains the Rapid Bioassessment Report for spring and fall 2021. Attachment 2 contains the annual report for co-permittee Tarrant Regional Water District (TRWD).

## Minimum Control Measures (MCM)

### 1.0 MS4 Maintenance Activities

#### 1.1 Structural Controls

The stormwater collection system's operation was maintained by the following actions for the reporting period of March 8, 2021–March 7, 2022:

| | | |
|---|---|---|
| Storm drain inlet cleaning: | 7,196 | inlets |
| Culverts cleaned: | 388 | culverts |
| Channels maintained: | 1,990 | acres |

#### 1.2 Floatables

The City's Code Compliance Department is responsible for citywide solid waste collection, including household garbage and single stream recycling of household paper, plastics, glass, and metals. The Code Compliance Department organizes volunteer activities such as the Cowtown Great American Cleanup and coordinating Keep Fort Worth Beautiful. The Code Compliance Department also conducts illegal dumping investigations, initiates appropriate enforcement, and ensures that outdoor accumulations of trash, debris, and garbage are cleaned up. These activities reduce the discharge of floatables (litter and other human-generated solid waste). The following are some examples of the reduction effort:

| | |
|---|---|
| 4,018 | tons of debris removed from illegal dumps |
| 37 | tons of dead animals removed |
| 6,052 | volunteers for litter cleanup events |
| 93 | number of litter clean up events |
| 291,688 | total pounds of litter collected at all clean up events |
| 63,991 | tons of material, including paper, plastics and aluminum collected by curbside recycling program |

Code Compliance kicked off a series of staff volunteer litter cleanups in February 2022, which accounts for 68,189 pounds of the litter collected at clean up events. The Presbyterian Night Shelter's UpSpire program, in cooperation with the City of Fort Worth installed six Watergoat devices in strategic locations on area streams during mid-January 2022. These devices are nets that collect litter as it floats downstream. UpSpire staff remove litter from the devices every two weeks and following rain events. As they were installed in mid-January 2022, they were only serviced twice during the permit year. However, 405 pounds of floatable litter was removed from the Watergoats during that time.

Fort Worth Code Department worked on a Lake Como Neighborhood Improvement Project during this reporting period. During November 2021, Lake Como was drawn down to complete some repairs on the dam. When the water level was lowered, much trash was exposed. A collaborative cleanup effort with several City crews as well as a private partner took full advantage of the lower water level to remove over 7,000 pounds of debris from the lake and shoreline. Debris collected included drums, tires, shopping carts, floatables and much more. These efforts along with daily litter collections with the private partnership have significantly improved the Lake Como area and community.

Using a grant that the City helped secure, Downtown Fort Worth, Inc. (DFWI) implemented a downtown recycling program (Recycle on the Go) in 2013, using 68 dual-use containers. Weekly recyclables from this project continue to fill a three-yard dumpster. In 2019, an additional 11 dual-use containers were added at each of the downtown bicycle rental stations (B-cycle) within the DFWI area.

The City of Fort Worth began fundraising to purchase and install two Waterwheels on the Trinity River in December 2021. These machines will capture floatable litter and place in dumpsters for proper removal from the River.

Additionally, co-permittee TRWD has active litter cleanup programs. TRWD sponsors annual creek/lake cleanups and manages the regional Reverse Litter campaign. See Attachment 2 for TRWD programs.

### 1.3 Roadways

The City's Stormwater Management Plan describes four roadway Best Management Practices (BMPs). They address deicing/sanding operations, limited street sweeping, inlet cleaning, and roadway spill cleanup. The information below is for the reporting period of March 8, 2021 to March 7, 2022.

In January 2017, the City of Fort Worth begin operating two regenerative sweepers and two parking lot sweepers to remove litter and grit from the streets along arterial roadways. From March 8, 2021 – March 7, 2022 these sweepers swept 7,158 road miles, which removed 178.5 tons of debris.

Approximately 1,000 gallons of deicer were applied to streets in preparation for freezing conditions during the reporting period. Roadways were swept following the weather events that called for deicer application.

Downtown Fort Worth Inc. (DFWI) employs contractors to mechanically sweep streets, power wash sidewalks, as well as manually sweep sidewalks using the pan and broom method in the downtown Fort Worth area daily and prior to special events. DFWI also contracts for vacuuming the curb and gutter line of streets using both vacuum trucks and walk-behind sweepers. These efforts in the downtown area alone contribute 8,400 additional gutter miles of street sweeping and approximately 1,820 acres of sidewalks power washed annually.

## 2.0 Post-Construction Stormwater Control Measures

### 2.1 Areas of New Development and Significant Redevelopment

In 2002, 55 local governments kicked off a regional effort through the North Central Texas Council of Government (NCTCOG) to address stormwater issues through the integrated Stormwater Management program (iSWM). The City of Fort Worth first adopted the iSWM Stormwater Management Design Manual for Site Development on May 1, 2006. The City's iSWM manual was last updated on September 15, 2015. The iSWM manual emphasizes the integration of post construction with construction runoff control with respect to both design and development review processes. The manual includes structural and non-structural best practices for storm water quantity and quality. The City of Fort Worth received a "silver" tiered certification in 2017 from the NCTCOG in recognition of implemented iSWM practices.

In June 2012, Fort Worth City Council adopted a Grading Ordinance to control earth-disturbing activities within the city to address the requirements of this MCM. The ordinance applies to land disturbing activities exceeding 1 acre and contains measures to better ensure proper grading and drainage from all construction projects.

### 2.2 Hazardous Roadway Overtopping Mitigation Projects/Flood Control Projects

The Stormwater Utility sold $53 million in revenue bonds in 2020 to accelerate the delivery of high priority capital projects. New project efforts have focused primarily on life safety such as Hazardous Roadway Overtopping Mitigation (HROM) at flood prone locations. Bond funding is also spent to rehabilitate aging drainage pipes and restore drainage channels that have a significant impact to infrastructure. The City is collaborating with the TRWD and the United States Army Corps of Engineers (USACE) to fund relocating existing drainage pipes within the City jurisdiction for the Central City Flood Control Project.

The list of projects below highlights key HROM and other drainage projects in the Utility's Capital Improvement Program (CIP):

- Lebow Channel 28$^{th}$ Street at Decatur HROM: This project involves channel improvements for Lebow channel upstream and downstream of 28th Street at Decatur Avenue as part of the Lebow Channel master plan improvements. Project addresses roadway overtopping of 28th Street crossing and reduces flooding at the railroad sump just west of Decatur Avenue. Self-mitigation will be performed in accordance with USACE individual permit. Project will be constructed in 2022-23.

- Comanche Trail HROM: Comanche Trail between Marina Drive and Malaga Drive has experienced multiple documented overtopping events. Project is increasing culverts to mitigate hazardous roadway overtopping. Project will install riprap and construct concrete pavement, sidewalks, pedestrian rails, and decorative headwalls and wing walls to mimic native on-site rock. This is a partnership with the City of Lake Worth. Project is planned to start construction in 2023.

- Greenfield Acres Phase 3 Drainage Improvements: The Greenfield Acres neighborhood has county-type roads with an existing barrow ditch drainage system. An undersized existing channel with a mapped floodplain runs through the neighborhood creating numerous historic drainage problems. This project will mitigate flooding of properties and right-of-way during significant storm events. This project provides a new storm drain system in North Hill Lane and Greenfield Road to mitigate flooding of residential properties and roadway overtopping in the Greenfield Acres neighborhood. The project was completed in 2022.

- Greenfield Acres Drainage Improvements Phase 4: This is the final phase of the Greenfield Acres Drainage Improvements. This project will mitigate flooding of properties and right-of-way during significant storm events. This project involves a new storm drain system in Greenfield Road, Tee Head Road, North Ridge Road and borrow ditch improvements in Cindy Lane to complete storm drain improvements in the Greenfield Acres neighborhood.

- Cravens Road HROM: South Cravens Road between Oakdale Drive and Baylor Street has experienced multiple documented roadway overtopping events with at least one fatality due to a vehicle being swept off the road. Project is increasing culvert capacity to mitigate hazardous roadway overtopping and construct a concrete pavement section with curb, gutter and sidewalks. Project is planned to be constructed in 2023.

- Fort Worth Central City Project (FWCC) Bazaar Outfall: Project is a partnership with TRWD and USACE and includes installation of a new storm main to capture and redirect flow of an existing catchment basin in order to allow for future by-pass channel. Scope also includes the installation of a new outfall to the Trinity River. The City is working with the USACE to determine schedule.

- FWCC Main St Outfall & 8th St: Project is a partnership with TRWD and USACE for the Central City Project. Project includes the design and construction of relocated storm main and outfall structure to the Trinity River to allow for future by-pass channel. Scope will also include the abandonment of an existing outfall structure and existing storm main. City is working with the USACE to determine schedule.

- FWCC University: Project is a partnership with TRWD and USACE for the Central City Project. It includes adjustment of existing roadway grades and replacement, expansion,

and relocation of the existing storm infrastructure. The City is working with the USACE to determine a schedule.

- FWCC Viola: Project is a partnership with TRWD and USACE for the Central City Project. It includes construction of a new outfall to the Trinity River and abandonment of existing storm infrastructure to allow for future by-pass channel. City is working with the USACE to determine schedule.

- TRV Greenleaf Sump: Project is a partnership with TRWD and USACE for the Central City Project. It includes construction of storm drain line connected to the current Greenleaf storm drain system and will connect to the bypass channel north of White Settlement Road. City is working with the USACE to determine schedule.

- Westcreek Channel Improvements: There is channel degradation and streambed scour throughout the channel. Project includes the stabilization and repair of concrete-lined streambank, side slope concrete panels and streambed. Project will be constructed in 2022-23.

- Loving Avenue Channel and Culvert Improvements: Project addresses erosion and home and roadway flooding along Loving Avenue due to inadequate channel capacity and undersized culverts. Improvements include upsizing existing culverts at Loving Ave and channel capacity improvements. Project was completed in 2021.

- Shoreview Culvert Improvements: The Shoreview Culvert Replacement project is located at a roadway channel crossing on Shoreview Drive west of Bomber Road near the Lockheed Martin facilities. This location has a history of high-water rescues and roadway overtopping events. Culvert size was increased and the roadway was raised to provide a 100-year level of service. Project was completed in 2022.

- Westcliff Phase 1: The Westcliff neighborhood has existing undersized drainage systems. This is the final phase to address neighborhood flooding. The project includes installation of storm drain and inlets. The outfall will be located on property owned by Parks and Recreation Department. The project will be constructed in 2022-23.

- Westcliff Phase 2B: This project includes installation of storm drain and inlets. The project was completed in 2021.

**City Open Space Initiative:**

The mission of the Open Space Conservation Program is to conserve high quality natural areas as the City grows to provide environmental benefits and recreational opportunities that support economic development and enhance the livability and desirability of Fort Worth. This program is collaborative initiative of multiple city departments and partners, including the NCTCOG, Streams and Valleys, Inc., and TRWD. In June of 2020, the city made its first

acquisition under the program, approximately 50 acres of native prairie on a property known as Broadcast Hill.

In August of 2020, the city contracted with the Trust for Public Land (TPL) to engage the public around the Open Space Conservation Program, perform a benchmarking survey of other cities, and develop a GIS-based decision support tool to prioritize open space across Fort Worth for preservation based on criteria in seven goal areas:

- Recreation
- Community Health
- Equitable Access to Natural Spaces
- Flood Control
- Stream, River, and Lake Health
- Economic Development
- Ecosystem Preservation

TPL and the city have engaged the public on this program through an online survey, public meetings and stakeholder meetings. In June of 2021, TPL provided the city with the public-facing decision support tool, a story map, and report on funding and policy recommendations.

Conserved Lands by time frame:

- June 2020, Broadcast Hill: 50 acres of native prairie
- October 2021, Patino Rd: 24 acres of Eastern Cross Timbers and Post Oak Savanna
- October 2021, Rock Creek Park: 40 acres of prairie and riparian ecosystem
- February 2022, Fort Worth Nature Center: 30 acres of native prairie

**Erosion Mapping:**

Stormwater Management (SWM) program in collaboration and coordination with stakeholders involved in the 10-year Master Plan Update identified “Private Property Channel Erosion Policy” as a Level 1 (high) priority area. In order to evaluate the extent of erosion problems and physical parameters that may be involved in the policy development, SWM procured the services of Stantec Inc. in February 2020 to refine the methodology for erosion mapping. The Weight of Evidence (WoE) methodology was selected, tested, and validated for mapping erosion areas during 2021-2022. The next phase of this effort will involve applying the methodology City-wide, which is planned for 2022-2023.

## 2.3: Private Maintenance Agreements

Stormwater Facility Maintenance Agreements (SWFMA) are legal conveyance instruments between the City and land owners, including property management associations, committing land owners to perpetually maintain Stormwater facilities constructed according to City approved drainage plans. The SWFMA “runs with the land” and is “recorded” in the Deed Records by the respective County Clerk Office. There were seventy (70) SWFMA agreements ‘recorded’ during the permit reporting period.

## 3.0 Illicit Discharge Detection and Elimination

### 3.1 Illicit and Allowable Discharges

The City of Fort Worth listed all allowed non-stormwater discharges in the Environmental Protection and Compliance Chapter of City Code. The Environmental Code was formally adopted by the City Council on November 28, 1995 and continues to be updated as necessary. Chapter §12.5, Article III, Stormwater Protection, describes what constitutes a stormwater violation and what enforcement actions can be taken and can be found online at http://library.amlegal.com/nxt/gateway.dll/Texas/ftworth_tx/cityoffortworthtexascodeofordinances?f=templates$fn=default.htm$3.0$vid=amlegal:fortworth_tx. USEPA made this code available as a model ordinance for use by other cities by publishing it on their national web page. A list of 17 prohibited non-stormwater discharges can be found in Chapter §12.5-302 of the City Code.

### 3.2 TRWD Program

See Attachment 2 for TRWD Illicit discharge detection and elimination programs.

### 3.3 Detection and Elimination of Illicit Discharges

During the permit year, the following illicit discharge detection and elimination activities were accomplished:

| | |
|---|---|
| 475 | Dry weather field screens |
| 53 | Wet weather field screens |
| 55 | Spill or abandoned waste responses |
| 125 | Complaint responses |
| 6,292 | Inspections |
| 719 | Verbal notices of violation issued |
| 101 | Written notices of violation issued |
| 3 | Citations issued |

The City of Fort Worth, as per the permit, requires a discharger to eliminate an illicit discharge or stop the improper disposal practice as soon as possible. If is it not possible within 30 days to eliminate the discharge, a schedule or plan to eliminate the discharge must be submitted by the discharger. Until the discharge is eliminated, the discharger shall take all reasonable measures possible to minimize the pollutant discharge to the MS4.

#### 3.3.1 Status of Complying with New Requirements

The SWMP includes a list of techniques used for detecting illicit discharges which includes dry weather and wet weather field screening as well as complaint investigations and inspections. Appropriate actions and enforcement procedures for removing the source of an illicit discharge are outlined in the SWMP as well. These include corrective notices and issuance of criminal citations.

### 3.4 Overflows and Infiltration

The City's Water Department participates in TCEQ's voluntary Sanitary Sewer Overflow Initiative (SSOI) program. All sanitary sewer overflows (SSOs) are reported to the TCEQ. The goals of the initiative are to reduce the number of SSOs that occur each year in the sewer collection system and to address SSOs before they harm human health, safety, or the environment and before they become enforcement issues. In general, a significant overflow contains a large volume of sanitary sewer discharge (>50,000 gallons or more) that could adversely affect a public or private source of drinking water or the environment.

The following SSOs were reported for the permit year:

| | | |
|---|---|---|
| 7 | Significant overflows | 1,882,701 gallons |
| 106 | Total overflows | 2,060,609 gallons |

The Water Department continues a proactive preventative sewer cleaning and maintenance program. The program includes routine city-wide inspections, cleaning, repair, oil and grease removal, utility access point inspections, long-term sewer line rehabilitation and public outreach activities. There are 29 active flow meters in the collection system that are maintained. There are two distinct programs for investigating the condition of the existing sanitary sewer collection system.

The Sanitary Sewer Condition Assessment Program (SSCA) involves the cleaning and inspection of small diameter sanitary sewer lines (less than 24-inches in diameter) throughout the City. The SSCA program uses closed-circuit television (CCTV) to inspect the sanitary sewer collection system for pipe defects, blockages, and line capacity. The lines are thoroughly cleaned as part of the process. As problems in the sanitary sewer collection system are identified, field operations staff recommends repairs, replacement, and/or schedules future maintenance.

The program is a comprehensive investigation of all sanitary sewer lines 24-inches in diameter and above. The program consists of simultaneous sonar/laser/CCTV investigation of the large diameter sewer lines to identify segments requiring cleaning and those requiring repair. Lines requiring cleaning are cleaned immediately while segments requiring repair are identified for rehabilitation or replacement.

The Water Department responds to sewer collection system discharges or other problems on a seven-day per week, 24-hour per day basis as generated by customer complaints. In an area where a sanitary sewer discharge has occurred, wastewater is removed by impoundment and/or by-pass pumping into the sewer collection system. The area is cleaned and disinfected to lessen or eliminate the impact of wastewater discharge to the environment and public health.

The Water Department aggressively attempts to determine sanitary sewer collection system defects such as cracked pipes or offset joints that allow seepage of wastewater from the sanitary sewer collection system. Joint repairs are conducted as problems are identified. Additionally, recommendations are made for replacement or trenchless rehabilitation. Any potential seepage into the stormwater system is monitored and repairs made as necessary.

### 3.5 Household Hazardous Waste and Used Motor Vehicle Fluids

In 1997, the City of Fort Worth established a permanent Household Hazardous Waste (HHW) collection facility, the Environmental Collection Center (ECC), to serve residents of Fort Worth and other participating neighboring municipalities. In addition to waste drop off by residents at the ECC, personnel also conduct mobile collection events throughout the year. Acceptable wastes include acids, aerosol cans, batteries, antifreeze, brake fluid, craft and hobby chemicals, degreasers, drain cleaners, fertilizer, fluorescent and other light bulbs, cooking oil, herbicides, pesticides, motor oil, paint, stain, paint thinner, photo chemicals, and pool chemicals.

During the first year of operation, Fort Worth established interlocal agreements with 17 other municipalities and served 7,118 households from residents of Fort Worth and the participating cities. Between March 2021 and February 2022, the program served 31,678 households from Fort Worth and 51 other participating entities, collecting approximately 3.3 million pounds of household chemicals and waste. Table 1 shows disposal, recycling, and reuse of materials collected at the ECC during the reporting period. Table 2 illustrates total number of households served for participating cities.

**Table 1 - HHW from Fort Worth residents, disposal, recycling, and reuse of waste (in pounds) collected from Fort Worth residents at the ECC and mobile events during the 2020-21 permit year (March 8, 2021-March 7, 2022).**

| Type of Waste | Pounds of Waste collected March 8, 2021 - March 7, 2022 |
|---|---|
| **Antifreeze** | 35,914 |
| **Batteries (Lead):** | 17,720 |
| **Motor Oil:** | 194,678 |
| **Oil Filters:** | 7,789 |
| **Pesticides:** | 178,667 |
| **Paint Products:** | 232,7885 |
| **Aerosols:** | 92,324 |
| **Solvents/Thinners:** | 11,0951 |
| **Household Cleaners:** | 59,050 |
| **Flammables:** | 110,706 |
| **Household Batteries:** | 63,104 |
| **Pharmaceuticals:** | 699 |
| **Cooking Oil:** | 76,421 |
| **Light Bulbs:** | 35,508 |
| **Corrosives:** | 28,034 |
| **Miscellaneous:** | 33,695 |
| **Total:** | 3,373,145 |

**Table 2 - Households served by the ECC (including mobile events) during the 2021-22 permit year.**

| Households Served, March 2021-February 2022 | | | | |
|---|---|---|---|---|
| **Municipality** | **Households** | | **Municipality** | **Households** |
| Alvarado | 5 | | Lakeside | 3 |
| Arlington | 5,411 | | Lake Worth | 43 |
| Aurora | 0 | | Midlothian | 91 |
| Azle | 45 | | North Richland Hills | 533 |
| Bedford | 492 | | Oakleaf | 1 |
| Benbrook | 499 | | Pantego | 7 |
| Burleson | 403 | | Parker County | 130 |
| Cedar Hill | 24 | | Richland Hills | 130 |
| Cleburne | 102 | | River Oaks | 93 |
| Colleyville | 761 | | Roanoke | 204 |
| Crowley | 48 | | Saginaw | 318 |
| Dalworthington Gardens | 0 | | Sansom Park | 0 |
| Decatur | 0 | | Sherman | 0 |
| Euless | 539 | | Southlake | 624 |
| Fort Worth | 16,271 | | Stephenville | 41 |
| Grand Prairie | 1,982 | | Tarrant County | 57 |
| Grapevine | 1,086 | | Trophy Club | 87 |
| Haltom City | 279 | | Upper Trinity Regional Water District | 151 |
| Haslet | 0 | | Waxahachie | 0 |
| Hood County | 36 | | Weatherford | 15 |
| Hurst | 903 | | Westover Hills | 0 |
| Johnson County | 48 | | Westlake | 17 |
| Joshua | 7 | | Westworth Village | 1 |
| Justin | 1 | | White Settlement | 106 |
| Kennedale | 84 | | **Total households, all participating cities** | **31,678** |

### 3.6 Dry Weather Field Screening

The permittees have implemented Dry Weather Screening Programs, as described in Section 8.1 of this annual report, to locate portions of the MS4 with suspected illicit discharges and improper disposals. Results of screening efforts during this permit term as well as a more complete description of the program may also be found in Section 8.1 of this report. The entire MS4, but not necessarily each individual outfall, will be screened at least once during the five-year permit term.

### 3.6.1 Priority Areas

During spring 2016, the Environmental Quality Division (EQD) began an effort to determine priority areas likely to have illicit discharges. Initial efforts defined outfalls within industrial areas, or outfalls that were within 0.25 miles of industrial areas that drained industrial areas that were more likely to have illicit discharges. Initially, 407 outfalls were identified as high priority and would be screened a minimum of twice per permit term. As new outfalls are added to the City, they are screened to determine if they are considered major end of system outfalls, and if they meet the current criteria for priority outfalls. Additional outfalls that are not necessarily within an industrial drainage criteria area are added to the priority list if they have been shown to have water quality complaints, are within a TMDL area, or have had past illicit discharges. Outfalls may be eliminated as accessibility changes or as they are removed due to reconstruction of the storm drain system. For permit year 4, there were a total of 544 priority outfalls, with 9 outfalls removed from sampling due to accessibility, or no longer existing.

## 3.7 NPDES and TPDES Permittee List

The City of Fort Worth maintains an industrial and a construction database containing a list of operators and construction sites that are located within the city limits. This database contains the name, location and permit number issued by the TCEQ that authorizes stormwater discharges from construction activities.

## 3.8 MS4 Map

All MS4 assets have been mapped from schematics (drawings/plans) and have been field verified. The field survey was completed in 2013. Waters of the U.S. are encompassed in the National Hydrography Dataset (NHD) as maintained by the United States Geological Survey (USGS). Currently, stormwater infrastructure data are maintained by the Stormwater Management Division within the Transportation/Public Works Department. MS4 assets are mapped in any newly developed areas, annexations or redevelopments.

## 3.9 Spill Prevention and Response

Spill Prevention is addressed by the Fort Worth Fire Department's (FWFD) Fire Prevention Bureau. The City of Fort Worth has two primary programs to address spills that may impact the MS4. The FWFD has a hazardous materials (HazMat) squad to address major incidents and EQD has a response team to address minor incidents.

### 3.9.1 FWFD Prevention Program

The City of Fort Worth provides spill response via FWFD's five HazMat squads strategically located throughout the city. For most small motor vehicle accidents, FWFD remediates any spills and transports waste absorbent and other materials to the fire station. On a regular basis, the EQD picks up collected waste from the fire stations for proper disposal.

### 3.9.2 Environmental Quality Division Spill Response

Environmental Quality staff are on-call to assist FWFD in remediating small spills such as those generated in motor vehicle accidents. They also routinely address incidents such as abandoned waste drums and large chemical spills in or threatening waterways.

During the reporting year, March 8, 2021-March 7, 2022, this group responded to 55 spill incidents and disposed of approximately 1,020 gallons of waste (primarily auto fluids from motor vehicle accidents) collected by the FWFD. Large scale spill clean-up and remediation is conducted through three contracts with third party companies.

## 4.0 Pollution Prevention and Good Housekeeping for Municipal Operations

Because the City of Fort Worth has been under continuous MS4 permit coverage since 1996, some of the components of this MCM, such as reduction of pollutants from road repair and from pesticide, herbicide, and fertilizer applications, were requirements of previous permit terms and were established prior to the current term. Waste handling procedures to ensure proper disposal of waste, although not a previous permit requirement, were in place prior to the current permit term. For the remaining new requirements, programs were developed or existing programs were enhanced to ensure compliance as discussed in this section.

### 4.1 Pollution Prevention and Good Housekeeping Program

Current street maintenance practices and street sweeping activities are described in MCM 1. Discharge of pollutants from road repair disturbing an area of one acre or more or a common plan of development that is an acre or greater is controlled through BMPs established as part of the required construction permit (TXR150000). Contracts for road repair and maintenance or other projects that may result in soil disturbance, such as building demolition, include requirements to maintain stormwater permit coverage and stormwater BMPs as necessary. For municipal facilities subject to this MCM, BMP guides have been designed to reduce pollutants to the maximum extent practicable.

For the City's airports and wastewater treatment plant, industrial stormwater permit training is used to satisfy the training requirement of this MCM. For facilities with established Spill Prevention, Control, and Countermeasures (SPCC) plans, stormwater training is incorporated into the required SPCC training. For other facilities, stormwater training is either presented as a stand-alone unit or incorporated as part of safety training, or other established training programs, using videos and other materials developed by NCTCOG and delivered by individual departments.

During this permit year, initiated assessing municipal facilities through internal compliance inspections. These internal inspections focused on good housekeeping and pollution prevention control measures used at each facility. The City of Fort Worth has 135 municipal facilities throughout the City, and each facility is ranked on a risk-based approach from low risk to high risk, based on the operations at each facility. Overall, there are twenty (20) City facilities that are considered high risk. During this fourth permit year, thirty (30) facilities were inspected, of which ten (10) were considered high risk facilities. Only minor items were

observed during the inspections and were addressed by providing education to resolve these issues.

The City of Fort Worth continues to participate in internal recycling. During the previous permit term, internal recycling was increased from just paper to include plastics (including plastic bags) and metals. One hundred and ten facilities operated by the City of Fort Worth now participate in single-stream recycling efforts. Individual facilities choose the recycling program that works best for their building. A few facilities still haul their own recycling due to logistical issues or lease restrictions. The City recycled approximately 22,000 pounds (lbs.) of metals, 10,765 lbs. of electronics, and 1,153 lbs. of used batteries.

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## 4.2 Waste Handling

For a discussion of management practices associated with MS4 maintenance, refer to the report Section 1.0 MS4 Maintenance Activities.

The City maintains a contract for recycling of used oil and other fluids collected as a result of equipment maintenance activities. Contracts are also held with waste disposal contractors for proper disposal of wastes including, but not limited to hazardous, non-hazardous, special, and solid wastes; a variety of lights including high pressure sodium high intensity discharge (HID) lamps, incandescent bulbs, fluorescent lamps and tubes, vapor lamps, and metal halide HID lamps, light ballasts that may or may not contain PCBs, e-waste, USDA regulated garbage, and biohazardous materials. Staff from the EQD oversee these waste disposal activities and ensure that wastes are properly stored to prevent discharge of pollutants prior to collection and disposal.

Table 3 provides the waste amounts (in pounds) that were collected and disposed of properly from March 8, 2021-March 7, 2022.

**Table 3. Waste materials collected and disposed of during the 2021-22 permit year.**

| Category | Amount (Pounds) | Notes |
|---|---|---|
| Hazardous Waste | 46,070 | Waste oils and other hazardous waste |
| Non-Hazardous Waste | 46,986 | Used oil and other non-hazardous waste |
| Special (Bio-hazardous) Waste | 5,352 | Sharps containers |
| Universal Waste | 11,918 | Paint, batteries, and universal waste items |
| Recycled/Reused Material | 10,765 | This amount now only reflects recycled electronics and lamp ballasts. |
| **Total** | **121,091** | |

### 4.3 Pesticide, Herbicide, and Fertilizer Application

City staff from the Park and Recreation Department apply pesticides, herbicides, and fertilizers on City owned property. In addition, the City has an herbicide spraying program to minimize vegetative growth in storm drainage channels. Selected ditches are sprayed once or twice per year. Plants such as cattails and young willow trees are specifically targeted, as they are especially disruptive to stormwater flow. To prevent contamination of these storm drains, only products that are Environmental Protection Agency (EPA) approved for application in and around waterways are used. The main cause of pesticide/herbicide/fertilizer problems in waterways concerns proper use and disposal of the products. To assure that these products are used correctly, City staff and contractors must be properly licensed by the State of Texas Structural Pest Control Board to participate in any spraying program. Twenty eight City of Fort Worth employees maintain pesticide applicator's licenses. Pros in the Parks training for maintenance planning and weed control was conducted during the permit term for the following divisions: Botanic Gardens Operations, Athletics, Parks Operations, Mowing Operations, the Water Gardens Operations, and Code Compliance.

### 4.4 List of Municipal Facilities

The City maintains a list of all city-owned or leased properties. Twenty facilities have been identified as being subject to the requirements of the Pollution Prevention and Good Housekeeping for Municipal Operations Minimum Control Measures. The two airports and the wastewater treatment facility are covered under the TPDES Multi-Sector General Permit for stormwater discharges associated with industrial activity.

## 5.0 Industrial & High Risk Runoff

The City of Fort Worth has an established Industrial and High Risk Runoff program to identify and evaluate facilities with a higher potential to negatively impact stormwater quality. A majority of the facilities identified in this section are governed by the monitoring, reporting, and inspection requirements of their own TPDES or NPDES stormwater permits. The stormwater leaving these sites ultimately reaches the City of Fort Worth's storm drain system and as such, the quality of this water must be in compliance with the goals contained in the City's MS4 TPDES stormwater permit. To ensure that this is the case, the plan outlined below details the priorities and procedures for inspections and for establishing and implementing control measures for these facilities by the City of Fort Worth.

During the permit term, the City of Fort Worth conducted one Industrial Stormwater Permit Workshop. In this workshop, the Industrial Stormwater team provided an overview of the TPDES Multi-Sector General Permit (MSGP) renewal and Stormwater Pollution Prevention Plan (SWPPP) requirements. There were 54 attendees at the workshop on September 2, 2021, and the workshop is available at CFW Industrial Stormwater Permit Workshop MSGP Renewal 09092021-YouTube .

### 5.1 Priorities & Procedures for Inspecting and Monitoring High Risk Runoff Facilities

Notification data, investigations, inspections, and resulting enforcement actions conducted by the industrial inspection program during the reporting period of March 8, 2021-March 7, 2022 are summarized in the tables below. The Industrial Stormwater Multi-Sector General Permit

TXR050000 was renewed and effective on August 14, 2021. Notification data below represents both new facilities and facilities that the City of Fort Worth has received renewal information from. The City of Fort Worth continues to work with facilities to receive a copy of their renewal documents.

**Notification Data**

| All Industrial Sites | Notices of Intent | No Exposure Certifications |
|---|---|---|
| 50 | 37 | 13 |

**Inspection Data**

| Investigation Type | Number of Investigations |
|---|---|
| NOI inspection | 95 |
| SWPPP review | 73 |
| NEC inspection | 49 |
| Follow-up inspection | 90 |
| Educational visits | 4 |

**Enforcement Data**

| Verbal Notice of Violation | Written Notice of Violation | Citations Written | Total |
|---|---|---|---|
| 96 | 17 | 2 | 115 |

### 5.2 Industrial & High Risk Monitoring Program

To avoid duplication of effort, the City of Fort Worth uses benchmark monitoring data required by the MSGP of certain industries covered under this authorization. As 2021 was considered the fifth year of the MSGP, benchmark sampling analysis was not required by covered industries.

Results of analysis are indicators that modifications of the SWP3 may be necessary. The facility's pollution prevention team must investigate the cause for each exceedance and document results of this investigation in the SWP3 within 90 days following the sampling event. EQD staff review these plan modifications during normal site inspections.

## 6.0 Construction Site Stormwater Runoff

The City of Fort Worth and its co-permittees have established Construction Site Stormwater Runoff programs designed to reduce the discharge of pollutants into the MS4 from construction sites that are one or more acre(s) in size or that are part of a larger common plan of development or sale that is one or more acre(s) in size. Section §12.5-302(a) of the City Code prohibits discharges of pollutants into the MS4 from all sources, including construction sites. EQD has an active TPDES

construction site inspection program utilizing multiple inspectors. Enforcement of control measure requirements is through Section §12.5-334 of the City Code giving inspectors the ability to enforce NPDES/TPDES regulations.

**a. Activities operated by the City of Fort Worth or its contractors**

**i. Inspection of Construction Sites and Enforcement of Requirements**

The City's permit requires implementation of a construction site runoff program that includes the inspection of construction sites and enforcement of control measure requirements. The program, incorporating the above requirement, has been in operation since May 1999.

Notification data, investigations, inspections, and resulting enforcement actions conducted by the construction inspection program during the reporting period of March 8, 2021-March 7, 2022 are summarized in the tables below.

**Notification data**

| All Construction Sites | Large Construction Sites | Small Construction Sites |
|---|---|---|
| 532 | 346 | 186 |

**Inspection Data**

| Investigation Type | Number of Investigations |
|---|---|
| Construction Inspection | 5,981 |

**Enforcement Data**

| Verbal Notice of Violation | Written Notice of Violation | Citations Written | Total |
|---|---|---|---|
| 618 | 63 | 1 | 682 |

**ii. Education and Training of Construction Site Operators**

The City of Fort Worth participated with the cities of Dallas, Arlington, Irving, Garland, Mesquite, and Plano in assisting NCTCOG in designing a NPDES Construction Inspection Training Program. The final program consists of a one-day workshop offered by NCTCOG. The course has evolved to cover topics including how to read and interpret a Stormwater Pollution Prevention Plan, how to identify improperly installed BMPs, methods to prevent stormwater pollution, regulatory requirements, techniques for

conducting site inspections, and record keeping requirements for site operators. New EQD water quality staff are required to complete the training.

Site specific and regulatory process training is provided to operators during the grading permit process and during site inspections. During the grading permit process operators are educated on the administrative requirements of the Construction General Permit. During and as follow ups to monthly site inspections, operators are provided with education about observations made on their sites.

#### iii. Notification of Requirements to Construction Site Operators

EQD inspectors continue to be a part of the City's plan review process and provide information to developers and builders as requested during predevelopment conferences and on-site once construction activities have commenced to ensure operators are aware of TCEQ compliance requirements related to construction.

The adopted grading ordinance incorporates the evaluation of planned construction stormwater controls (BMPs) to ensure sites meet TPDES requirements related to construction as well as locally adopted requirements in the Fort Worth *i*SWM manual. This provides another avenue to ensure construction site operators are aware of regulatory requirements and have designed adequate controls to manage stormwater runoff during construction.

Checklists have been developed and placed in the City of Fort Worth's permitting center to inform permit applicants of the permitting requirement for construction site operators.

Environmental Quality web pages contain information and links providing guidance to construction site operators on the TPDES requirements related to construction and links to the necessary information and resources to ensure compliance.

#### iv. List of Construction Sites

The City of Fort Worth maintains a database of operators and construction sites located within the Fort Worth city limits. During the reporting period of March 8, 2021-March 7, 2022, an average of approximately 532 active construction sites were regularly inspected.

### 6.2 Activities operated by TRWD or its contractors

See Attachment 2 for TRWD activities.

## 7.0 Public Education, Outreach, Involvement, and Participation

The City implements a multi-faceted outreach and education program to fulfill permit requirements to promote, publicize, and facilitate the public reporting of the presence of illicit discharges or improper disposal of materials into the MS4; the proper management and disposal of used oil and household hazardous waste; and the proper use, application, and disposal of pesticides, herbicides, and fertilizers by public, commercial, and private applicators and distributors.

To meet these requirements, the City uses interdepartmental and interagency cooperation. Several departments, divisions, and sections within Fort Worth are tasked with promoting stormwater education messages and raising awareness of the issues and providing information on steps that can be taken to improve water quality in addition to providing multiple opportunities for meaningful public engagement.

The City also partners with the NCTCOG and co-permittee TRWD to amplify local and regional campaigns focused on stormwater quality education and outreach.

### 7.1 Public Education and Outreach

The goal of the City's public education and outreach efforts is to improve stormwater quality by promoting greater awareness of issues related to stormwater management. This includes topics related to basic water quality, illicit discharges and proper waste disposal, pest management and composting promotion, proper household hazardous waste and used oil disposal, pet waste and yard debris disposal, and correct recycling, litter and trash disposal. Program effectiveness is measured by participation at outreach events, educational items distributed, and overall general public feedback on the education efforts.

The program uses the City's Community Engagement Office to distribute information to residents and provide training information. Distribution numbers are down from previous years because the COVID-19 pandemic continued to limit the number of in-person presentations during the reporting period, especially in spring and summer 2021.

**Table 4 - Summary of public education and outreach collateral by permit requirement.**

| **Topic** | **Numbers distributed** |
|---|---|
| Public reporting of illicit discharges or improper disposal of materials | 2,021 |
| Proper management and disposal of used oil and household hazardous wastes | 3,570 |
| Pest management and composting promotion | 1,103 |
| Environmental Stewardship | 7,013 |
| General stormwater quality | 3,153 |
| **Total pieces distributed**<br>**Some collaterals contain more than one message.* | **15,744*** |

**Table 5 - Education and outreach events and presentations.**

| **Litter, Stormwater & Water Quality Events** | | |
|---|---|---|
| **Type** | **Number** | **Participants** |
| Neighborhood Associations | **46** | **1,008** |
| School & After-School Presentations | **29** | **2,049** |
| Community Events | **13** | **1,245** |
| Other adults – civic, faith-based, etc. | **4** | **67** |
| **Total** | **92** | **4,461** |

### 7.1.1 Public reporting of illicit discharges or improper disposal of materials, including floatables, into the MS4.

The City has a multi-pronged approach to encourage the public to report illicit discharges and promote proper disposal of floatables.

- Environmental hotline information is displayed prominently at the upper right-hand position on the Code Compliance page of the City's website. During this permit year, there were 766 complaints or concerns received and addressed through the hotline, chat, web and email reporting system. These complaints and concerns included stormwater drainage issues, standing water, safety issues, erosion, clogged inlets, channel maintenance, flooding, and stormwater and surface water pollution concerns.
- A bilingual environmental hotline card for reporting illicit discharges and instances of stormwater pollution includes telephone and online options for reporting. Cards are distributed by Environmental Quality, TPW Stormwater Management, Code Compliance, and Community Engagement staff. Cards are also available in the Planning and Development Department permit center.
- Hotline reporting information is also included on the Environmental Collection Center brochure and other stormwater printed materials.
- Environmental Quality, TPW – Stormwater Management, and Code Compliance – Solid Waste partner with TRWD for a regional marketing campaign, Reverse Litter. Reverse Litter increases awareness about litter and the effects on the environment and public spaces. The campaign includes marketing material, radio spots, billboards, teacher resources, and give-away items with anti-litter messaging.
- The marketing logo, "Still littering, seriously?" is used as part of a campaign to help reduce litter and other pollutants in the watershed.
- The Community Engagement team delivers several presentations and curricula educating about proper disposal and reporting of illicit discharge. Adult presentations include: Civics 101, City Hall 101, Keeping Lake & Rivers Clean. Youth presentations include: Captain Crud & the Cruddies, My Government & Me, Freddie the Fish, Journey of a Water Drop, PAWS: Pets Are Worth It, Keeping Lakes & Rivers Clean.
- Rack cards explaining procedures for construction stormwater permits, industrial permits, and power washing permits are distributed through Planning & Development, Code Compliance, Environmental Quality, and Stormwater Management employees.
- A drop-off site for dropping off brush, trash, household chemicals, recyclables and donated items, was opened in Northeast Fort Worth last permit year to serve the citizens of North Fort Worth.
- The city sponsors a host of adopt-a-park, street, waterway, etc. programs to help with litter prevention and general beautification. Several departments help promote and organize these programs. Keep Fort Worth Beautiful continues its efforts with the Green Schools program, volunteer recognitions, and neighborhood clean ups.

### 7.1.2 Proper management and disposal of used oil and household hazardous wastes.

- The location, participation levels, and public feedback are annually analyzed to determine the following year's HHW mobile collection locations. Seventeen mobile

events were held within Fort Worth and an additional 72 for participating cities during the reporting period.

- All participating cities' mobile collection events with the Crud Cruiser are posted on the City of Fort Worth website.
- Updated information regarding the ECC and Crud Cruiser is sent periodically to the city call center and Community Engagement educators.
- Bilingual tri-fold brochures containing information about the ECC and Crud Cruiser mobile HHW collection events are distributed at city and regional events, the City's four drop-off stations, community centers, and facilities with high levels of walk-in customer traffic.
- An annual newsletter is sent to participating cities. It contains items of interest, notices, collection statistics, and information in an inviting, graphic format.
- Web banners, print-ready banners, posters, and event signage are available for use by the City of Fort Worth and participating cities to advertise the ECC and Crud Cruiser events.
- The Community Engagement team uses a Conquer Your Crud tabletop display board at community events and hands out bilingual brochures about the ECC.
- Two Captain Crud videos, created through the Regional Stormwater Management Program, are part of a presentation by Community Engagement to teach both younger and older students about the effects of pollutants on stormwater and environmental stewardship.
- Stormwater related videos online include, with the number of views during this permit year in parenthesis:

  Safe Lawn Care (6) https://youtu.be/NUqrFfw5C6A
  Get Rid of Chemicals at the ECC (301) https://youtu.be/0NURlJz-E9Y
  Flood Warning System (150) https://youtu.be/PiMmmXZXTHk

### 7.1.3 Proper use, application, and disposal of pesticides, herbicides, and fertilizers by public, commercial, and private applicators and distributors.

- A composting presentation was made to local community members at University Christian Church teaching the basics of composting, its benefits, and diverting food waste through the City of Fort Worth Residential Food Scraps Composting Pilot Program.
- Presentations about the impact of food waste, how to reduce it, and how to divert food waste through the City of Fort Worth Residential Food Scraps Composting Pilot Program were made to Texas Christian University students, and via a webinar to Tarrant County College students and members of the local community.
- A food waste composting presentation was made to Food Waste Collection Networks in Dallas-Fort Worth (DFW).
- Shared a NCTCOG Organic Waste to RNG Roundtable Webinar with businesses and individuals interested in sustainable practices.
- The City Food Scraps Composting Pilot Program, originally launched in April 2019, added two new collection sites (from 13 to 15), increased subscriptions by 28% to serving 1,700 households, and collected almost 63 tons of food waste that was diverted from the landfill to composting. During this time period, the program maintained a record low contamination rate of 1%. Additionally, the program

applied for and was awarded a $90,000 grant from the US Department of Agriculture (USDA) to be applied toward the extension of the program.

- The Community Engagement Team delivers several presentations educating about proper use and disposal of pesticides and fertilizer, including: Keeping Lakes & Rivers Clean, What's Wrong With This Picture and Conquer Your Crud display.
- Code Compliance EQD Water Quality staff are members of the NCTCOG Stormwater Public Education Task Force. The task force created an education program of videos and brochures for lawn care companies regarding disposal of lawn debris, proper use of pesticides and fertilizers, and proper watering techniques. The Task Force continues to work on programs and educational materials to target residential and commercial landscapers.
- The Water Department sponsored a series of water-saving seminars that focused on water conservation issues, including sessions on landscape design, landscape basics, new home owner association landscape rules and regulations, container gardening, and proper irrigation operation. All of these sessions promote water conservation which reduces nutrient pollution runoff.

### 7.2 Public Involvement and Participation

The City engages the community in stormwater related activities to encourage the protection and enhancement of stormwater quality. These activities include opportunities for a wide variety of people who live, work, and recreate in Fort Worth.

- The TPDES Stormwater Permit is posted in easy-to-read, searchable pdf format on the Environmental Quality web page.
- Four email addresses are posted on the Environmental Quality web page and in print materials to increase public involvement. Each address has a specific distribution list to ensure timely, professional responses to questions and complaints from residents and businesses.

  1. environmental@fortworthtexas.gov
  2. constructionstormwater@fortworthtexas.gov
  3. industrialstormwater@fortworthtexas.gov
  4. hhw@fortworthtexas.gov

- A city-wide app called MYFW has been developed for citizens to reach out to the City with various complaints and concerns. During this permit year, there were 593 complaints and concerns received and addressed regarding stormwater issues, including clogged drains/inlets, flooding, maintenance, stormwater and water pollution, water conservation issues, health hazards and hazardous material spills.
- Collateral items, including adult and student take-home handouts distributed by Community Engagement liaisons, are printed in both English and Spanish.
- The stormwater quality pages on City of Fort Worth's website are regularly spot-checked and updated (includes all permitting information, HHW pages, pollution hotline information/form, general stormwater education, and HHW information contained on ECC participating cities websites) to improve information, navigation, and functionality.
- Updates are provided to the call center and Community Engagement to make sure that all residents have access to current and accurate information.

- Code Compliance EQD Water Quality staff, and the public education program coordinators for Stormwater Management, and a Water Department conservation specialist are members of the NCTCOG Stormwater Public Education Task Force. Regional efforts on stormwater pollution prevention are vital to clean water in North Texas.

### 7.3 TRWD Activities

See Attachment 2 for co-permittee activities.

## 8.0 Monitoring, Evaluation, and Reporting

### 8.1 Dry Weather Screening Program

The objectives of this program are to continue efforts to detect the presence of illicit discharges and assess dry weather water quality changes. Analyses performed include air and water temperature, pH, color, turbidity, copper, ammonia, phenols, chlorine, specific conductivity, and detergents. Observational characteristics including odor, oil sheen, surface scum, sewage, and flow are also noted. A colorimetric meter that measures pollutants in parts per million is used for the analysis of copper, phenols, ammonia and chlorine. The phenol test has not provided reliable results and frequently indicates interference in the test. In at least ten years of sampling, it has not assisted in defining a discharge. As such, it will be eliminated from the testing. An additional test for potassium will be included as needed to assist with discharge identification.

The methylene blue active substances (MBAS) method is used for detergent analysis. The test method results in a measurement given as less than a numerical value (<0.1, <0.2), which indicates the range of the value. Portable meters are used to measure pH, specific conductivity, and turbidity. Tests and observations are performed twice in a 24-hour period, separated by a minimum of four hours, to increase the potential to detect illicit flows. Also, sampling and analyses are only conducted when there has been no significant precipitation (less than 0.10 inch) within 48 hours.

Detections are those cases where the parameter tested was found above the established trigger level for source tracking in the City or outside the standard range. Standard range used for pH is between 6 s.u. and 9 s.u.; trigger levels for specific conductivity are $\geq$1500 µS/cm; turbidity > 15 NTUs, and ammonia $\geq$ 1.0 mg/L. The trigger level for detergents, chlorine, copper, and phenols is $\geq$ 0.20 mg/L. Water temperature is presented without an established trigger level. If water temperature is unusually high or low, further investigation is initiated.

TPDES Permit WQ0004350000 requires that, “All areas of the MS4 must be screened at least once during the permit term.” Between March 8, 2021 and March 7, 2022, 475 sites were visited for the purpose of dry weather field screening (Figure 1).

Of the 475 outfalls screened, 229 (48.2%) were considered priority area outfalls. Three of the priority area outfalls sampled (PUR1B, HP1A, and MCP1B) had flow that was sampled at least once.

### 8.1.1 Pollutant Traceback

When screening results indicate the possible presence of illicit discharge, field staff begin a trace back investigation of the pollutants of concern within the MS4. A variety of investigative tools such as:  additional DWFS, watershed reconnaissance, videotaping the storm drain lines, dye tracing, and tunnel entries may be used in follow-up activities as appropriate for each situation. If a responsible party is found, appropriate actions are taken to ensure the discharge is eliminated.

One outfall tested above trigger levels for chlorine during both site visits, and was turned over to the Water Department for a line repair. Two separate outfalls tested above trigger levels for turbidity during the first site visit but not the second visit; this increased turbidity was attributed to the sampler scraping sediment from the bottom while collecting the sample.

**Figure 1. Dry weather field screen locations sampled during the 2021-22 permit year.**

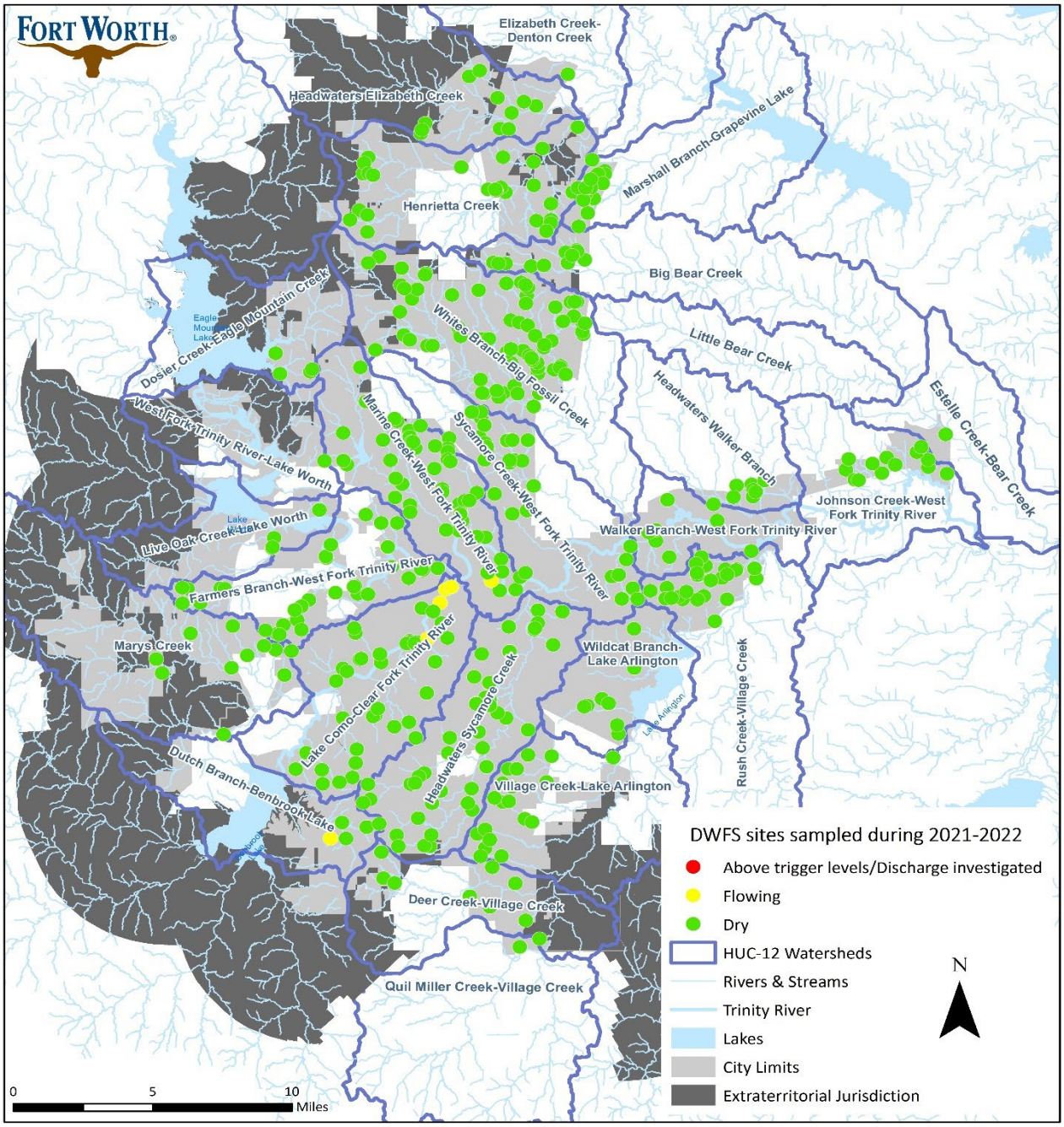


**Table 6 - Summary of dry weather field screen data collected during the 2021-22 permit year.**

| | pH, s.u. | Conductivity, µm/cm | Turbidity, NTU | Water Temp, ° C |
|---|---|---|---|---|
| **N of samples** | 13 | 12 | 13 | 13 |
| **Detections** | --- | --- | 2* | --- |
| **Minimum** | 7.32 | 300 | 0.13 | 24.3 |
| **Maximum** | 8.34 | 850 | 22.9 | 31.5 |
| **Median** | 7.74 | 720 | 1.66 | 27.9 |
| **Mean** | 7.80 | 683.33 | 4.33 | 27.8 |
| **Std. Dev.** | 0.371 | 161.602 | 6.970 | 2.33 |

*Sediment on two samples was disturbed during sample collection, increasing the turbidity.

| | Detergent, mg/L | Chlorine, mg/L | Copper, mg/L | Phenol, mg/L | Ammonia, mg/L |
|---|---|---|---|---|---|
| **N of samples** | 13 | 13 | 13 | 5~ | 13 |
| **Detections** | --- | 2^ | --- | --- | --- |
| **Minimum** | 0.1 | -0.01 | 0 | 0 | 0 |
| **Maximum** | 0.2 | 0.78 | 0.14 | 0.18 | 0.47 |
| **Median** | 0.1 | 0.02 | 0.04 | 0.09 | 0.13 |
| **Mean** | 0.1 | 0.12 | 0.06 | 0.08 | 0.19 |
| **Std. Dev.** | 0.04 | 0.253 | 0.055 | 0.077 | 0.178 |

^One site, sampled twice, was turned over to the Water Department for repair.
~The remaining samples indicated interference upon addition of the reagents. Phenol test will be discontinued.

### 8.2 Wet Weather Screening Program

The purpose of the Wet Weather Screening Program is to address areas that may be contributing excess levels of pollutants to the MS4 during storm events. Each year, at least 50 runoff samples are collected and analyzed. Locations are selected based on past or previous history, information gathered during dry weather field screens, or other field reconnaissance, industrial monitoring data, information obtained from industrial or construction inspections, or other program emphases. Samples may be collected in-stream, from outfalls, curbs, open ditches, pipes, sheet flow, or other appropriate locations. Sample locations may be clustered within small sub-watersheds to thoroughly characterize the runoff and isolate areas of particular concern, or may be individual locations scattered throughout the City. Samples are collected from runoff resulting from a rain event that is greater than 0.10 inch in magnitude and that occurs at least 72 hours after the last measurable rain event. The greater than 0.10 inch rainfall guideline may be waived during drought conditions. Sample analyses will consist of, at a minimum, pH, specific conductivity, and turbidity. Additional analyses which may be performed include, but are not limited to ammonia-nitrogen, nitrate-nitrogen, phosphate, chromium, copper, zinc, total coliform, and *E*. coli bacteria. The selection of additional analyses to be performed will be determined by senior personnel on a case-by-case basis based upon land use and potential pollutants present in the sampling area. The data will be reviewed to determine what follow-up activities, if any, should be conducted. Summary statistics for each parameter are included below.

During the period of March 8, 2021-March 7, 2022, 53 runoff samples were collected during five rain events in six watersheds (Table 7). Figure 2 shows the sample site locations and watersheds sampled within the permit year. Results of chemical analyses are provided in Table 8 and summary statistics of the chemical analyses is provided in Table 9.

**Table 7 - Wet weather field screen sample locations sampled during the 2021-22 permit year.**

| Site ID | Site Location Description | Latitude | Longitude |
|---|---|---|---|
| HWSYC1 | 401 Conner Ave, E side | 32.74025195 | -97.28671173 |
| HWSYC2 | 400 Conner Ave, W side | 32.74026148 | -97.28681061 |
| HWSYC3 | 2701 Ludelle St, Ste 101, E side | 32.74067376 | -97.28660386 |
| HWSYC6 | 2244 E Lancaster Ave, W inlet | 32.74527627 | -97.29421433 |
| HWSYC7 | 3100 Yuma Dr, E side | 32.70334064 | -97.30719034 |
| HWSYC8 | 3100 Yuma Dr, W side | 32.70336808 | -97.30705856 |
| HWSYC13 | 127 Thelin St, N box | 32.66628415 | -97.32757372 |
| HWSYC15 | NW corner of E Berry St and S Riverside, Texaco station | 32.705957 | -97.304695 |
| HWSYC16 | 1800 Glen Garden Dr at Cobb Park Dr W, N side | 32.710515 | -97.300884 |
| HWSYC17 | Sycamore Creek in Sycamore Park | 32.7349 | -97.29391 |
| HWSYC18 | Dead end of Scott St. west of Beach St. (RWW Site-SYC3) | 32.7475 | -97.2949 |
| HWSYC19 | E Devitt Ave, S side | 32.703948 | -97.305066 |
| LCCFTR1 | South Dr west of Trail Lake Dr in Foster Park (RWW Site-OVR1) | 32.6823 | -97.3739 |
| LCCFTR4 | Suffolk Dr at Stadium Dr | 32.6875 | -97.365 |
| LCCFTR8 | 2901 E Suffolk Dr | 32.68733647 | -97.35812852 |
| LCCFTR17 | Across from 3030 W Pafford St | 32.692182 | -97.361915 |
| LCCFTR18 | Suffolk Ct E at Cockrell Ave | 32.6875 | -97.358056 |
| LCCFTR19 | Near 3771 Cockrell | 32.693056 | -97.358889 |
| LCCFTR20 | W Pafford St at Cockrell Ave | 32.69222 | -97.35889 |
| LCCFTR21 | 3801 Cockrell Ave | 32.69233095 | -97.35850456 |
| LCCFTR23 | 4600 Bellaire Dr S. west of Hulen St (RWW Site-OVR3) | 32.704 | -97.392 |
| LCCFTR24 | W Pafford St at Cockrell Ave, opposite LCCFTR20 | 32.69222 | -97.35889 |
| LCCFTR25 | 3700 block of Cockrell Ave, opposite LCCFTR19 | 32.69305 | -97.35861 |
| LCCFTR26 | Stadium Drive at W Bolt St | 32.68944 | -97.36528 |
| MCWFTR16 | N end of Packers St, before Stockyards Blvd, S side | 32.79195 | -97.34441 |
| MCWFTR17 | Packers St, W side | 32.791122 | -97.344144 |
| MCWFTR19 | NE 23rd St, E of RR tracks | 32.785962 | -97.34439 |
| MCWFTR22 | Packers Ave and NE 23rd St, NW side | 32.786071 | -97.344115 |
| MCWFTR26 | N Grove St, E side | 32.782195 | -97.344846 |
| MCWFTR27 | N Grove St, W side | 32.782185 | -97.344953 |

**Table 7 - Wet weather field screen sample locations sampled during the 2021-22 permit year, continued.**

| Site ID | Site Location Description | Latitude | Longitude |
|---|---|---|---|
| MCWFTR30 | W of the FW livestock exchange | 32.79004856 | -97.34728828 |
| MCWFTR32 | Across from 2112 N Calhoun St | 32.783567 | -97.34688 |
| MCWFTR33 | 301 Stockyards Blvd | 32.7922 | -97.347457 |
| MCWFTR40 | W 10th St & Monroe St/ W on Monroe St | 32.749852 | -97.331217 |
| MCWFTR41 | W 10th St & Monroe St/ S on W 10th St | 32.749891 | -97.331259 |
| MCWFTR42 | Texas & Monroe St/ NW Corner | 32.748804 | -97.331267 |
| MCWFTR43 | Texas & Monroe St/ SW Corner | 32.748667 | -97.33126 |
| WBBFC2 | E side of Riverbend West Dr | 32.79158014 | -97.22744718 |
| WBWFTR1 | W side of Riverbend West Dr | 32.79282601 | -97.22761704 |
| WBWFTR2 | E side of Riverbend West Dr | 32.79282251 | -97.22744765 |
| WBWFTR3 | W side of Riverbend West Dr | 32.78912 | -97.22772 |
| WBWFTR4 | E side of Riverbend West Dr | 32.79 | -97.22748 |
| WILDLA3 | 4700 Edgewood Terrace, W side | 32.69329718 | -97.25347344 |
| WILDLA6 | Across from 4615 Fairlane Ave | 32.69367293 | -97.25430666 |
| WILDLA8 | 5100 Martin St, N side | 32.68898 | -97.246 |
| WILDLA9 | 5000 Martin St, N side | 32.689037 | -97.247175 |
| WILDLA10 | Village Creek Rd at Martin St | 32.692075 | -97.251074 |
| WILDLA11 | 4800 Martin, S side | 32.68893 | -97.251103 |

**Figure 2 - Wet weather field screen locations sampled during the 2021-22 permit year.**

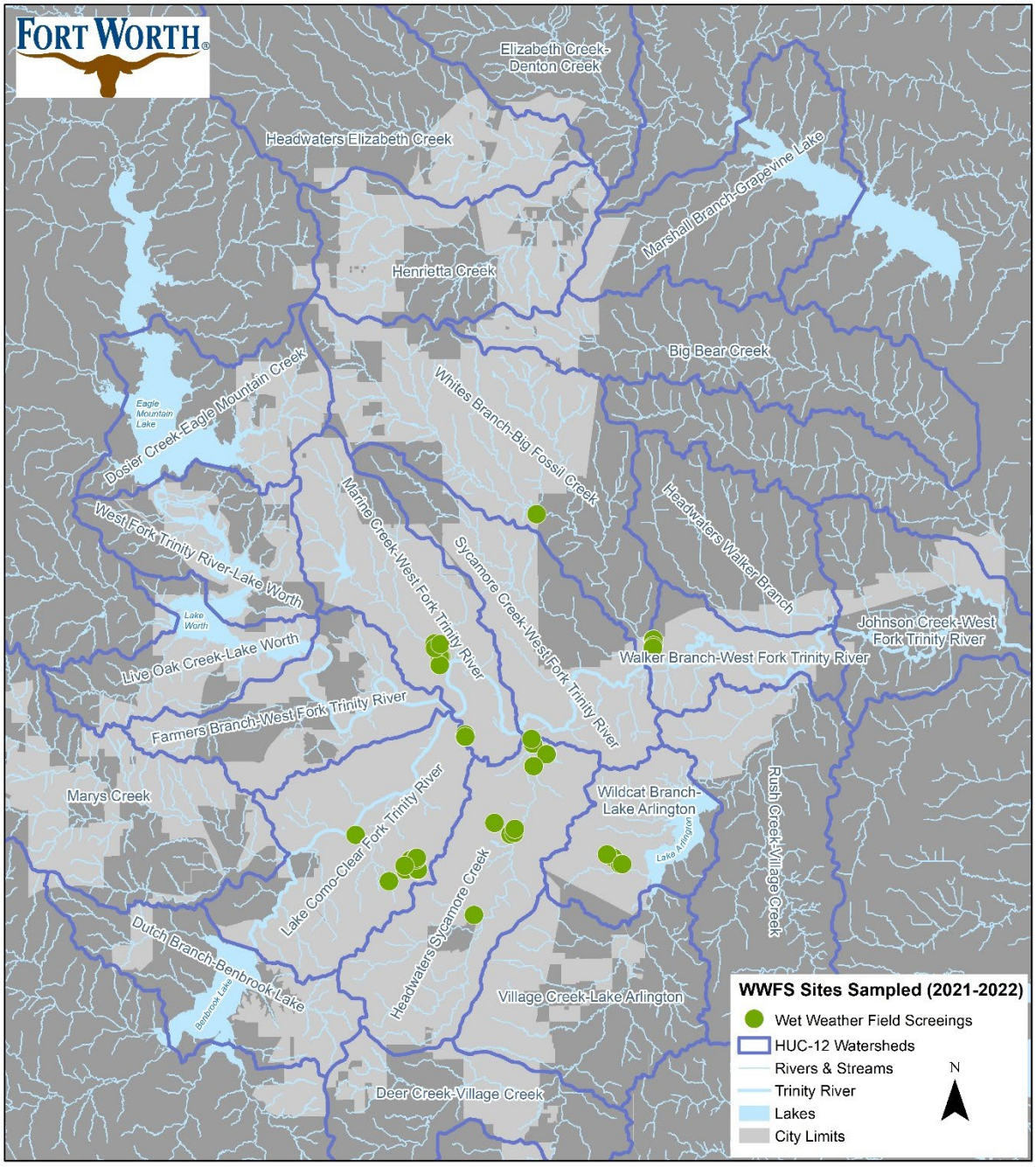


**Table 8 - Wet weather field screen sample results during the 2021-22 permit year.**

| Site ID | Date | pH, SU | Conductivity, µs/cm | Turbidity, NTU | Total coliforms, MPN/100 mL | E. coli, MPN/100 mL |
|---|---|---|---|---|---|---|
| HWSYC1 | 4/29/2021 | 6.16 | 560 | 52.5 | | |
| HWSYC2 | 4/29/2021 | 7.07 | 170 | 42.8 | | |
| HWSYC3 | 4/29/2021 | 7.81 | 270 | 58 | | |
| HWSYC6 | 4/29/2021 | 8.69 | 80 | 85.8 | | |
| HWSYC7 | 4/29/2021 | 7.28 | 800 | 12.1 | | |
| HWSYC8 | 4/29/2021 | 7.29 | 480 | 109.9 | | |
| HWSYC13 | 4/29/2021 | 7.88 | 120 | 37.8 | | |
| HWSYC15 | 4/29/2021 | 7.24 | 220 | 75.6 | | |
| HWSYC16 | 4/29/2021 | 7.57 | 140 | 26.3 | | |
| HWSYC17 | 2/17/2022 | 8.54 | 670 | 8.6 | | |
| HWSYC18 | 2/17/2022 | 8.15 | 670 | 8.17 | | |
| HWSYC19 | 4/29/2021 | 7.82 | 100 | 34.9 | | |
| LCCFTR1 | 3/17/2021 | 7.82 | 640 | 3.11 | | |
| LCCFTR4 | 4/29/2021 | 8.09 | 50 | 4.14 | | |
| LCCFTR8 | 4/29/2021 | 7.71 | 110 | 10.29 | | |
| LCCFTR17 | 4/29/2021 | 7.75 | 140 | 985 | | |
| LCCFTR18 | 4/29/2021 | 8.37 | 40 | 26 | | |
| LCCFTR19 | 4/29/2021 | 7.58 | 160 | 12.2 | | |
| LCCFTR20 | 4/29/2021 | 8.39 | 70 | 740 | | |
| LCCFTR21 | 4/29/2021 | 7.78 | 160 | 51.9 | | |
| LCCFTR23 | 3/17/2021 | 8.39 | 610 | 1.09 | | |
| LCCFTR24 | 4/29/2021 | 7.85 | 120 | 824 | | |
| LCCFTR25 | 4/29/2021 | 7.59 | 180 | 146 | | |
| LCCFTR26 | 4/29/2021 | 7.35 | 290 | 32.4 | | |
| MCWFTR16 | 4/29/2021 | 8.07 | 200 | 1948 | | |
| MCWFTR17 | 4/29/2021 | 7.42 | 390 | 91 | | |
| MCWFTR19 | 4/29/2021 | 7.69 | 510 | 27 | | |
| MCWFTR22 | 4/29/2021 | 7.32 | 130 | 15.8 | | |
| MCWFTR26 | 4/29/2021 | 7.35 | 190 | 20.5 | | |
| MCWFTR27 | 4/29/2021 | 7.45 | 310 | 2616 | | |
| MCWFTR30 | 4/29/2021 | 7.54 | 470 | 66 | | |
| MCWFTR32 | 4/29/2021 | 6.76 | 200 | 14.6 | | |
| MCWFTR33 | 4/29/2021 | 7.69 | 110 | 21.6 | | |

**Table 8 - Wet weather field screen sample results during the 2021-22 permit year, continued.**

| Site ID | Date | pH, SU | Conductivity, µs/cm | Turbidity, NTU | Total coliforms, MPN/100 mL | E. coli, MPN/100 mL |
|---|---|---|---|---|---|---|
| MCWFTR40 | 4/23/2021 | 8.77 | 50 | 54 | | |
| MCWFTR41 | 4/23/2021 | 8.15 | 30 | 15.1 | | |
| MCWFTR42 | 4/23/2021 | 8.26 | 40 | 49.8 | | |
| MCWFTR43 | 4/23/2021 | 8.24 | 50 | 41.7 | | |
| WBBFC2 | 4/29/2021 | 6.89 | 130 | 18.2 | >2420 | 3 |
| WBBFC2 | 11/11/2021 | 8.55 | 110 | 47.6 | >2420 | 10 |
| WBWFTR1 | 11/11/2021 | 8.68 | 70 | 54.2 | | |
| WBWFTR1 | 4/29/2021 | 7.7 | 70 | 29.5 | | |
| WBWFTR2 | 11/11/2021 | 9.19 | 50 | 27.9 | | |
| WBWFTR2 | 4/29/2021 | 7.56 | 290 | 7.35 | | |
| WBWFTR3 | 4/29/2021 | 8.13 | 310 | 29.9 | >2420 | 4 |
| WBWFTR3 | 11/11/2021 | 9.3 | 60 | 23.3 | >2420 | 4 |
| WBWFTR4 | 4/29/2021 | 8.29 | 170 | 42.7 | | |
| WBWFTR4 | 11/11/2021 | 8.52 | 100 | 73 | >2420 | 5 |
| WILDLA3 | 4/23/2021 | 7.42 | 560 | 6.3 | | |
| WILDLA6 | 4/23/2021 | 7.61 | 550 | 6.3 | | |
| WILDLA8 | 4/23/2021 | 7.81 | 590 | 7.8 | | |
| WILDLA9 | 4/23/2021 | 7.82 | 560 | 8.7 | | |
| WILDLA10 | 4/23/2021 | 7.87 | 570 | 8.3 | | |
| WILDLA11 | 4/23/2021 | 7.87 | 560 | 8.3 | | |

**Table 9 - Summary of wet weather field screen data collected during the 2021-22 permit year.**

| | pH, SU | Conductivity, µs/cm | Turbidity, NTU | Total coliforms, MPN/100 mL | E. coli, MPN/100 mL |
|---|---|---|---|---|---|
| **N value** | 53 | 53 | 53 | 5 | 5 |
| **Min** | 6.16 | 30 | 1.1 | 2420 | 3 |
| **Max** | 9.30 | 800 | 2616.0 | 2420 | 10 |
| **Median** | 7.81 | 170 | 29.5 | 2420 | 4 |
| **Mean** | 7.85 | 269 | 165.5 | 2420 | 5 |
| **St Dev** | 0.584 | 219 | 469.97 | 0 | 3 |

*****Total coliform and *E. coli* are geometric means

### 8.3 Industrial and High Risk Runoff Monitoring Program

For sites that are determined to be high risk, the industrial inspection frequency is twice per permit term. High-risk is defined as municipal landfills, treatment, storage, and disposal facilities, hazardous waste treatment storage, disposal and recovery facilities, facilities that are subject to Emergency Planning and Community Right to Know Act (EPCRA) Title III Section 313, facilities with poor compliance history, and those that are determined to be contributing a substantial pollutant loading to the MS4. Facilities located within the City of Fort Worth are organized in an online inspection and facility tracking software, or other similar program. Facilities can be marked as high-risk and inspections are scheduled accordingly and assigned to an investigator. The City of Fort Worth reviews data collected by these facilities as part of their TPDES TXR050000 permit.

The City receives and maintains a database of benchmark monitoring reports each spring from industries that are required by the MSGP to conduct benchmark monitoring. The permit requires operators to initiate monitoring in the first full six month monitoring period. Sampling must be conducted once per monitoring period for a total of up to four years, or eight periods depending on when a facility obtained coverage (unless a waiver is obtained after the first two years). As this was year five of the MSGP, only one benchmark sampling result was received. The benchmark for the facility did not exceed the benchmark values for the parameters tested. As the testing this year was not required by the permit, it is not included in this report.

### 8.4 Storm Event Discharge Monitoring

The City of Fort Worth and its co-permittee, TRWD, have chosen to comply with Permit Part IV.A 1. monitoring requirements through the North Central Texas Regional Wet Weather Characterization Program (RWWCP) including the Representative Rapid Bioassessment (RBA) Monitoring option, and sampling is underway in accordance with the fourth term of the approved sampling plan. Four sites were sampled during storm events for the RWWCP during the 2021-22 permit year. RBA monitoring sites were sampled during spring (May) and fall (October) 2021. Results from 2021 regional wet weather sampling are provided in Table 10 below. Rapid bioassessment results are provided as Attachment 1.

**Table 10 - Storm Event Data collected under RWWCP during the 2021-22 permit year.**

| Station ID | Sampling Date | Rainfall Total (in) | Ambient Air Temp (°F) | pH (su) | Spec. Cond. (uS/cm) | TDS (mg/L) | TSS (mg/L) | BOD (mg/L) | COD (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| OVR1* | 21/Oct/21 | 0 | 21.1 | 7.91 | 500 | 282 | ND | ND | ND |
| OVR3* | 15/Sep/21 | 0 | 22.6 | 8.4 | 410 | 230 | ND | 4.52 | ND |
| OVR1 | 17/Mar/21 | 0.1 | 12.8 | 7.82 | 640 | 169 | 75.2 | 11.7 | 97.1 |
| OVR3 | 17/Mar/21 | 0.1 | 12.8 | 8.39 | 610 | 282 | 94.4 | 5.3 | 50 |
| SYC1* | 26/Oct/21 | 0 | 24.3 | 8.09 | 420 | 219 | ND | 10.4 | ND |
| SYC3* | 26/Oct/21 | 0 | 22.9 | 8.31 | 490 | 252 | 3.6 | 1.37 | ND |
| SYC1 | 17/Feb/22 | 0.08 | 7.2 | 8.54 | 670 | 388 | 5.56 | 1.72 | ND |
| SYC3 | 17/Feb/22 | 0.08 | 7.2 | 8.15 | 670 | 373 | 2.9 | 1.96 | ND |

| Station ID | Nitrogen Total (mg/L) | Ammonia Nitrogen (mg/L) | Phosphorus Dissolved (mg/L) | Phosphorus Total (mg/L) | Atrazine (ug/L) | Nitrate (mg/L) | Nitrite (mg/L) | Orthophosphate (mg/L) |
|---|---|---|---|---|---|---|---|---|
| OVR1* | 1.190 | ND | ND | 0.0513 | <0.10 | 0.71 | ND | ND |
| OVR3* | 0.422 | ND | ND | ND | <0.097 | ND | ND | ND |
| OVR1 | 1.700 | 0.22 | 0.100 | 0.33 | 1.5 | 0.47 | ND | 0.098 |
| OVR3 | 1.600 | ND | ND | 0.11 | 0.8 | 0.21 | ND | ND |
| SYC1* | 0.263 | ND | ND | ND | <0.10 | 0.058 | ND | ND |
| SYC3* | 0.328 | ND | ND | ND | <0.10 | 0.0999 | ND | ND |
| SYC1 | 0.992 | ND | 0.065 | ND | <0.10 | 0.148 | 0.0561 | ND |
| SYC3 | 0.635 | ND | ND | ND | <0.10 | ND | ND | ND |

| Station ID | Arsenic Total (mg/L) | Chromium Total (mg/L) | Copper Total (mg/L) | Lead Total (mg/L) | Zinc Total (mg/L) | Oil and Grease (mg/L) | Total coliforms (MPN/100mL) | E. coli (MPN/100 mL) |
|---|---|---|---|---|---|---|---|---|
| OVR1* | ND | ND | ND | ND | ND | ND | >2420 | 461 |
| OVR3* | 0.00252 | ND | ND | ND | ND | ND | >2420 | 67 |
| OVR1 | 1.5 | 3.2 | 11.3 | 6.3 | 63 | ND | >2420 | 461 |
| OVR3 | 1.6 | ND | 5.6 | 3.6 | 27 | ND | 1733 | 60 |
| SYC1* | 0.00261 | ND | ND | ND | ND | ND | >2420 | 6.3 |
| SYC3* | 0.00169 | ND | 0.00212 | 0.0005 | ND | ND | >2420 | 142 |
| SYC1 | 0.00134 | ND | ND | 0.0005 | 0.00560 | ND | >2420 | 147 |
| SYC3 | 0.00123 | ND | 0.00273 | 0.0005 | 0.00516 | ND | 1410 | 74 |

*Ambient stream sample

## 8.5 Floatables Monitoring

Permit Part IV.B requires co-permittees to establish and maintain two monitoring locations for removal of floatable material in discharges to or from the MS4. In compliance with this requirement, TRWD established and maintained two floatables collection devices on the Clear Fork Trinity River.

The floatable debris collectors were established in 2006 at two separate locations along the Clear Fork Trinity River. Two net collectors were initially installed across from the Clear Fork Pump Station under Rosedale Street. The nets were unable to stay intact due to rodent activity and have since been replaced with a boom to trap floatables in the river collection. The boom has been removed temporarily while a new location for it is evaluated. A second set of collectors was installed at the outfall of Sump #19. The collectors consist of metal mesh boxes that trap floating debris as the water passes through. The boxes can be hoisted from the structure in order to empty the debris.

The trash collectors are included in the TRWD routine floodway maintenance program that is triggered into effect with a ½ inch storm event. After such an event, the trash collectors are visually inspected for capacity and damage. The cleaning schedule for the nets is dictated by the frequency of storms. For information regarding the floatable collections made during the 2021 permit year, refer to Attachment 2, the TRWD annual report.

Additional debris collection efforts began during this permit term via a pilot project using Watergoat trash collection nets at six stream locations through a public-private partnership between the UpSpire program of the Presbyterian Night Shelter and the City of Fort Worth. UpSpire purchased and installed the Watergoats, and maintains them every two weeks and after rain events. Five of the Watergoat devices were placed within the same watershed, while one was placed just upstream of a stream confluence with Lake Worth. The Watergoats were installed in mid-January 2022; between installation and the end of the permit year, 405 pounds of litter and debris was collected from them.

## 8.6 Impaired Water bodies and Total Maximum Daily Load (TMDL) Requirements

### 8.6.1 Monitoring and assessment of progress within the TMDL areas

As discussed in Section 3.4, the Water Department participates in the SSO initiative program through TCEQ and also reports all SSOs to the TCEQ as well as several other measures, including Supplemental Educational Projects (SEP) that address preventative maintenance on the sanitary sewer system. These items will assist in meeting the chosen option of WLA of 1,920 billion MPN/day as the benchmark for AU 0841_02.

#### 8.6.1.1 Village Creek Bacteria TMDL:

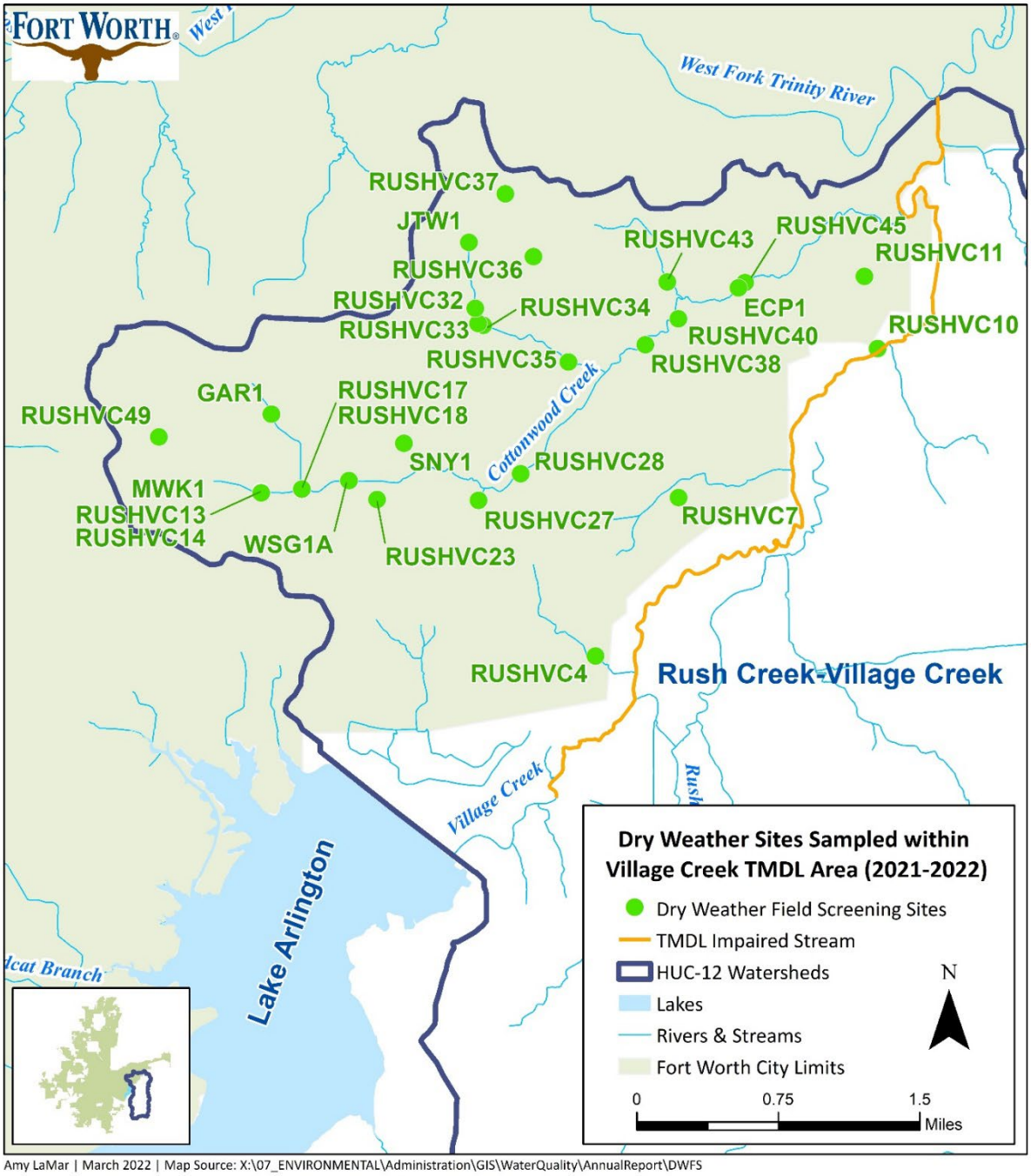
Although only a small portion of the Village Creek TMDL is within the Fort Worth city limits, there are several creeks that discharge into the Village Creek within the Rush Creek-Village Creek sub watershed. Twenty eight (28) outfalls within the watershed were screened for

illicit discharges with dry weather field screening during the fourth permit year (Table 11, Figure 3). None of the outfalls had flow during screening. No wet weather samples were collected in the Village Creek TMDL area during the permit term.

**Table 11. Dry weather field screening locations sampled within the Village Creek TMDL area during 2021-22 permit year.**

| ID Number | Date Sampled | Latitude | Longitude |
|---|---|---|---|
| ECP1 | 08/26/21 | 32.7617789 | -97.1673792 |
| GAR1 | 09/07/21 | 32.75250896 | -97.21001504 |
| JTW1 | 08/26/21 | 32.76555596 | -97.19185533 |
| MWK1 | 09/07/21 | 32.74646362 | -97.21103602 |
| RUSHVC10 | 08/26/21 | 32.75697606 | -97.15478625 |
| RUSHVC11 | 09/07/21 | 32.76253857 | -97.15589911 |
| RUSHVC13 | 07/29/21 | 32.74647322 | -97.21106629 |
| RUSHVC14 | 07/29/21 | 32.74652535 | -97.21106537 |
| RUSHVC17 | 09/07/21 | 32.74672084 | -97.20735631 |
| RUSHVC18 | 07/29/21 | 32.74672513 | -97.20733209 |
| RUSHVC23 | 09/07/21 | 32.74583947 | -97.20049284 |
| RUSHVC27 | 09/07/21 | 32.74567511 | -97.19126929 |
| RUSHVC28 | 09/07/21 | 32.74769471 | -97.18739993 |
| RUSHVC32 | 08/26/21 | 32.7604683 | -97.19135457 |
| RUSHVC33 | 08/26/21 | 32.75930365 | -97.19111766 |
| RUSHVC34 | 08/26/21 | 32.75915172 | -97.19064295 |
| RUSHVC35 | 08/26/21 | 32.75624648 | -97.18293179 |
| RUSHVC36 | 08/23/21 | 32.76438853 | -97.18600345 |
| RUSHVC37 | 07/28/21 | 32.76925781 | -97.18848372 |
| RUSHVC38 | 08/26/21 | 32.75750617 | -97.1759192 |
| RUSHVC4 | 09/07/21 | 32.73358428 | -97.18080017 |
| RUSHVC40 | 08/26/21 | 32.75946597 | -97.17288234 |
| RUSHVC43 | 08/26/21 | 32.76231329 | -97.17385272 |
| RUSHVC45 | 08/26/21 | 32.76217956 | -97.16676404 |
| RUSHVC49 | 09/07/21 | 32.750861 | -97.220284 |
| RUSHVC7 | 09/07/21 | 32.74569492 | -97.17305704 |
| SNY1 | 09/07/21 | 32.7501362 | -97.19799398 |
| WSG1A | 09/07/21 | 32.74732332 | -97.20304734 |

**Figure 3. Dry weather locations sampled within the Village Creek TMDL area during the 2021-22 permit year.**




Amy LaMar | March 2022 | Map Source: X:\07_ENVIRONMENTAL\Administration\GIS\WaterQuality\AnnualReport\DWFS

#### 8.6.1.2 Sycamore Creek Bacteria TMDL:

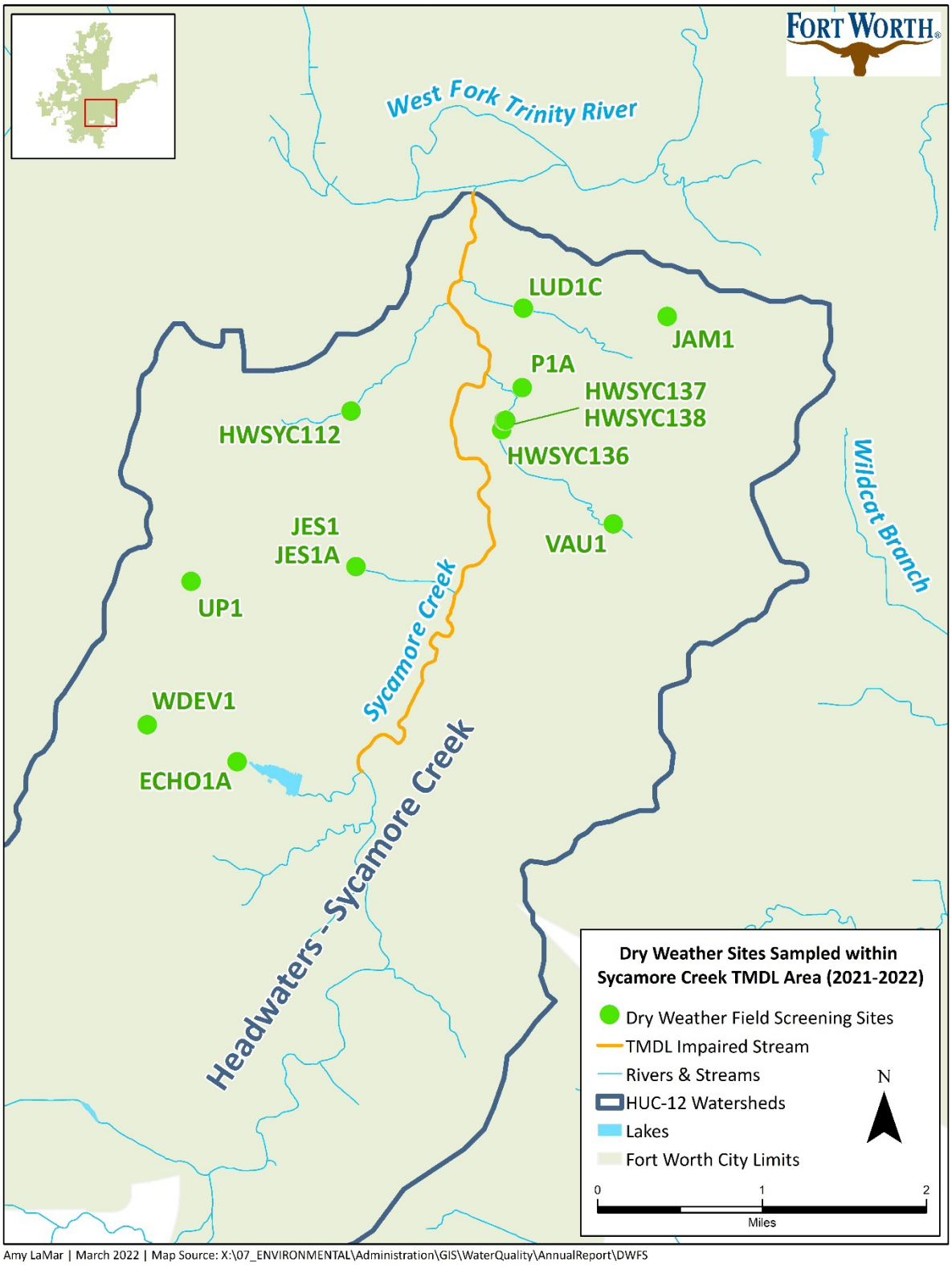
In 2018, the City of Fort Worth hired a contractor to analyze potential bacteria sources within Sycamore Creek and to develop a Bacteria Management Plan. This study and management plan was developed in anticipation of the Bacteria TMDL adoption for Sycamore Creek (finalized January 16, 2019).

During the 2021 permit year, thirteen (13) outfalls were screened within the Sycamore Creek TMDL area during dry weather conditions for potential illicit discharges (Table 12; Figure 4). None of the outfalls had flow during sampling. One of the outfalls was determined to be no longer accessible.

**Table 12. Dry weather field screen sites sampled within the Sycamore Creek TMDL area during the 2021-22 permit year**.

| ID Number | Date Performed | Latitude | Longitude |
|---|---|---|---|
| ECHO1A | 8/24/21 | 32.701018 | -97.320123 |
| HWSYC112 | 7/26/21 | 32.731883 | -97.307878 |
| HWSYC136 | 7/28/21 | 32.684250 | -97.315371 |
| HWSYC137 | 8/9/21 | 32.730901 | -97.291828 |
| HWSYC138 | 7/28/21 | 32.730890 | -97.291669 |
| JAM1 | 7/28/21 | 32.739923 | -97.274701 |
| JES1 | 7/26/21 | 32.718107 | -97.307487 |
| JES1A | 7/26/21 | 32.718107 | -97.307485 |
| LUD1C | 8/9/21 | 32.740798 | -97.289667 |
| P1A | 7/28/21 | 32.733741 | -97.289901 |
| UP1 | 7/26/21 | 32.717859 | -97.324525 |
| VAU1 | 7/29/21 | 32.721633 | -97.280560 |
| WDEV1 | 7/26/21 | 32.704360 | -97.329450 |

**Figure 4. Dry weather field screening sites sampled within the Sycamore Creek TMDL area during the 2021-22 permit year.**




Amy LaMar | March 2022 | Map Source: X:\07_ENVIRONMENTAL\Administration\GIS\WaterQuality\AnnualReport\DWFS

Wet weather samples were collected at 12 sites within the Sycamore Creek TMDL area (Table 13 and Figure 5) during the permit term. Sample results are shown in Table 14; sample summary statistics are shown in Table 15.

**Table 13. Wet weather field screen sites sampled within the Sycamore Creek TMDL area during the 2021-22 permit year**.

| Site ID | Site Location Description | Latitude | Longitude |
|---|---|---|---|
| HWSYC1 | 401 Conner Ave, E side | 32.74025195 | -97.28671173 |
| HWSYC2 | 400 Conner Ave, W side | 32.74026148 | -97.28681061 |
| HWSYC3 | 2701 Ludelle St, Ste 101, E side | 32.74067376 | -97.28660386 |
| HWSYC6 | 2244 E Lancaster Ave, W inlet | 32.74527627 | -97.29421433 |
| HWSYC7 | 3100 Yuma Dr, E side | 32.70334064 | -97.30719034 |
| HWSYC8 | 3100 Yuma Dr, W side | 32.70336808 | -97.30705856 |
| HWSYC13 | 127 Thelin St, N box | 32.66628415 | -97.32757372 |
| HWSYC15 | NW corner of E Berry St and S Riverside, Texaco station | 32.70595700 | -97.30469500 |
| HWSYC16 | 1800 Glen Garden Dr at Cobb Park Dr W, N side | 32.71051500 | -97.30088400 |
| HWSYC17 | Sycamore Creek in Sycamore Park | 32.73490000 | -97.29391000 |
| HWSYC18 | Dead end of Scott St. west of Beach St. (RWW Site-SYC3) | 32.74750000 | -97.29490000 |
| HWSYC19 | E Devitt Ave, S side | 32.70394800 | -97.30506600 |

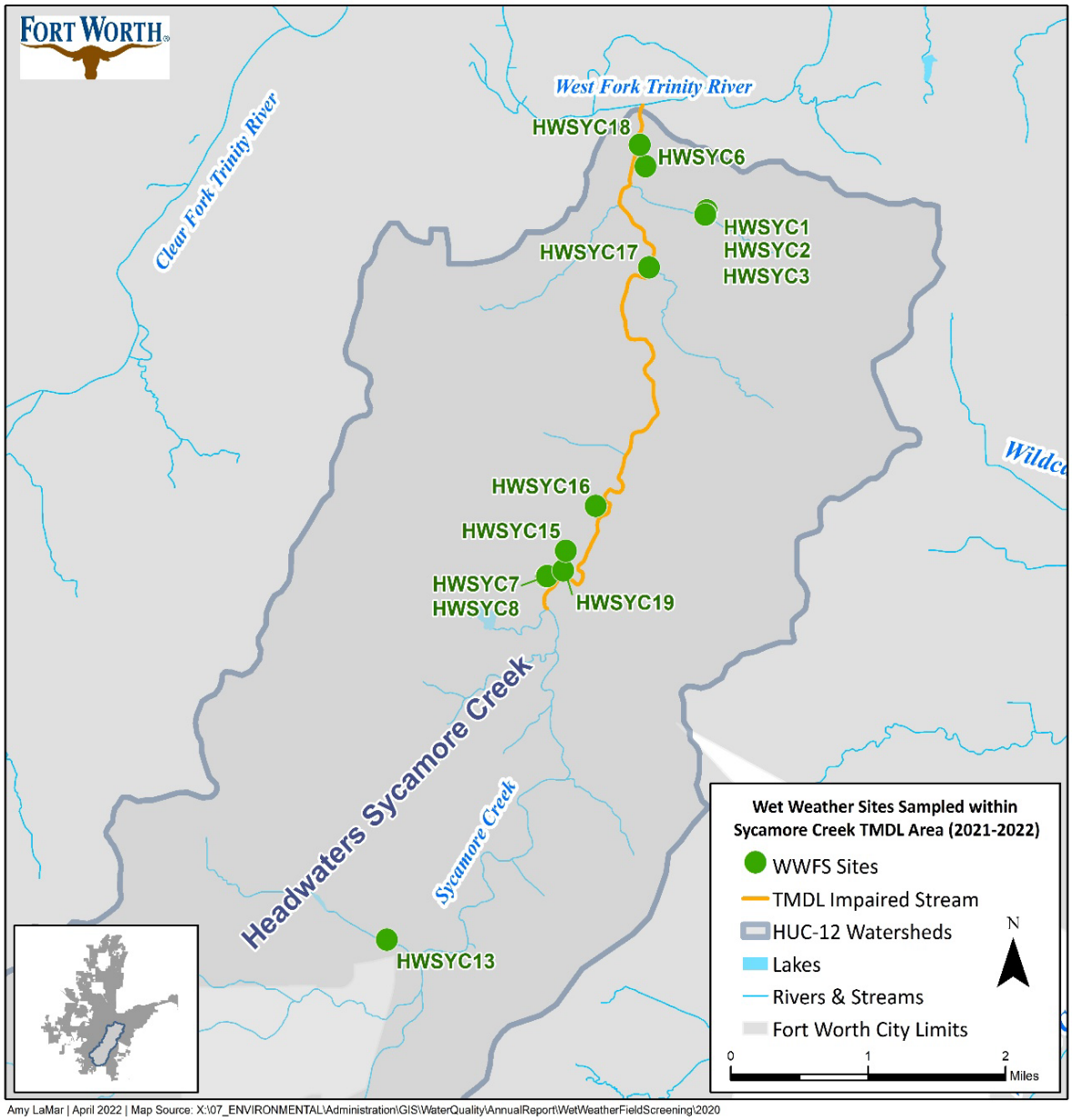
**Table 14. Sample results for wet weather field screens done within the Sycamore Creek TMDL area during 2021-22 permit year.**

| Site ID | Date | pH, SU | Conductivity, µs/cm | Turbidity, NTU |
|---|---|---|---|---|
| HWSYC1 | 4/29/2021 | 6.16 | 560 | 52.5 |
| HWSYC2 | 4/29/2021 | 7.07 | 170 | 42.8 |
| HWSYC3 | 4/29/2021 | 7.81 | 270 | 58 |
| HWSYC6 | 4/29/2021 | 8.69 | 80 | 85.8 |
| HWSYC7 | 4/29/2021 | 7.28 | 800 | 12.1 |
| HWSYC8 | 4/29/2021 | 7.29 | 480 | 109.9 |
| HWSYC13 | 4/29/2021 | 7.88 | 120 | 37.8 |
| HWSYC15 | 4/29/2021 | 7.24 | 220 | 75.6 |
| HWSYC16 | 4/29/2021 | 7.57 | 140 | 26.3 |
| HWSYC17 | 2/17/2022 | 8.54 | 670 | 8.6 |
| HWSYC18 | 2/17/2022 | 8.15 | 670 | 8.17 |
| HWSYC19 | 4/29/2021 | 7.82 | 100 | 34.9 |

**Table 15. Summary of wet weather field screen data collected within the Sycamore Creek TMDL area during the 2021-22 permit year.**

| | pH, SU | Conductivity, µs/cm | Turbidity, NTU |
|---|---|---|---|
| **N** | 12 | 12 | 12 |
| **Min** | 6.16 | 80 | 8.2 |
| **Max** | 8.69 | 800 | 109.9 |
| **Median** | 7.69 | 245 | 40.3 |
| **Mean** | 7.63 | 357 | 46.0 |
| **St Dev** | 0.689 | 262 | 32.05 |

**Figure 5. Wet weather field screen sites sampled within the Sycamore Creek TMDL area during the 2021-22 permit year.**



### 8.6.2 Assessment of progress

The total number of sanitary overflows, the number of significant overflows (SSOs, >50,000 gal), as well as the number of gallons associated with each, has decreased throughout the first through fourth permit years (Figures 6 and 7). This is an important BMP tracked towards decreasing bacteria entering the creeks and working toward the WLA goal number. Additionally, there were only a total of 4 SSOs within the TMDL watersheds, with three considered to be significant overflows (Figure 8). Improvements to the sanitary sewer along Sycamore Creek are currently in progress and are planned to be completed this year.

**Figure 6. Number of sanitary sewer overflows during permit years 1-4.**

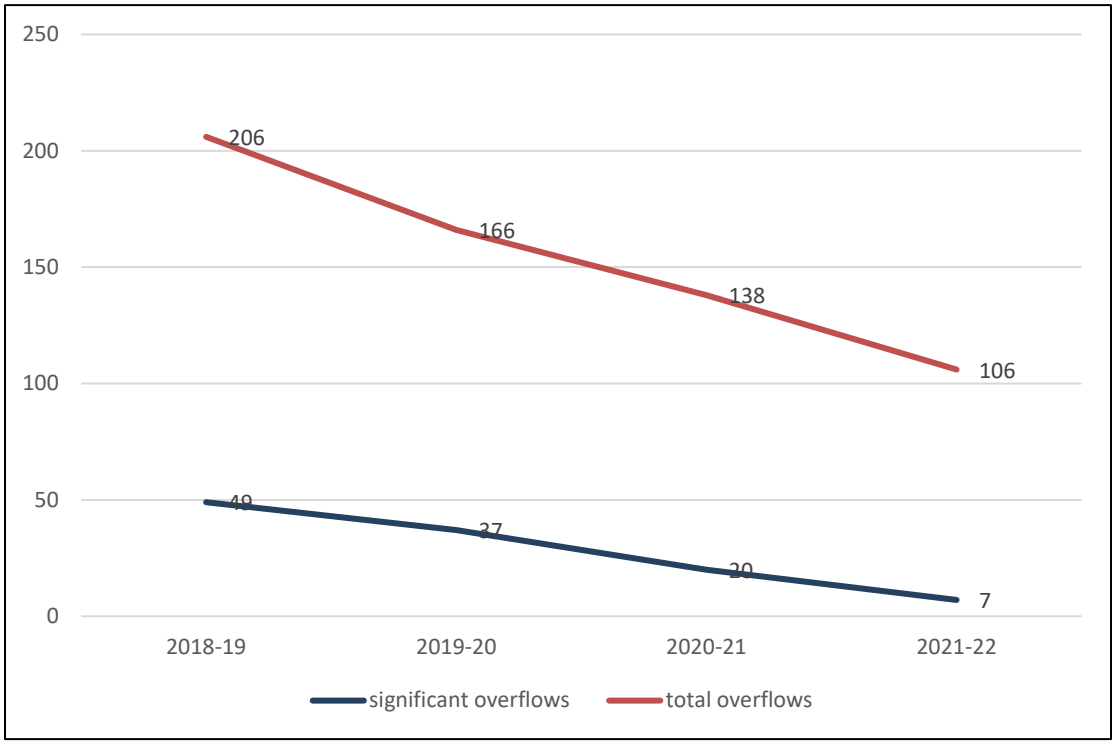


**Figure 7. Sanitary sewer overflows in gallons during permit years 1-4.**

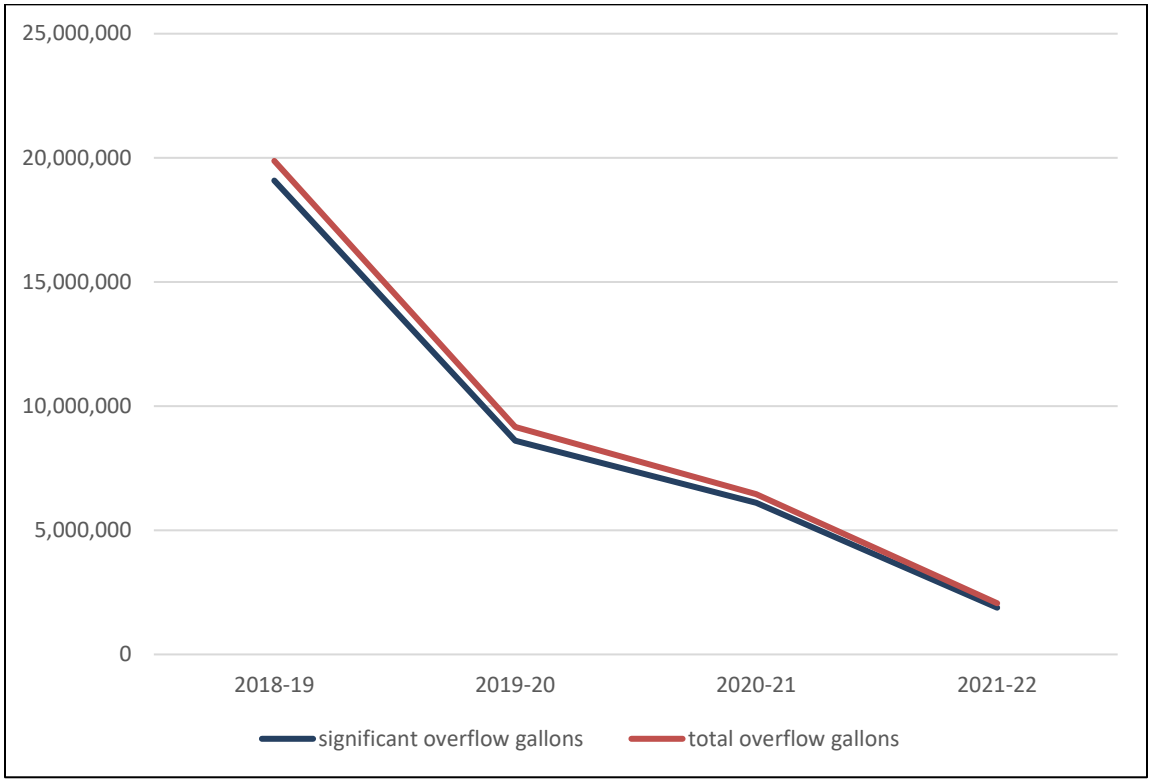
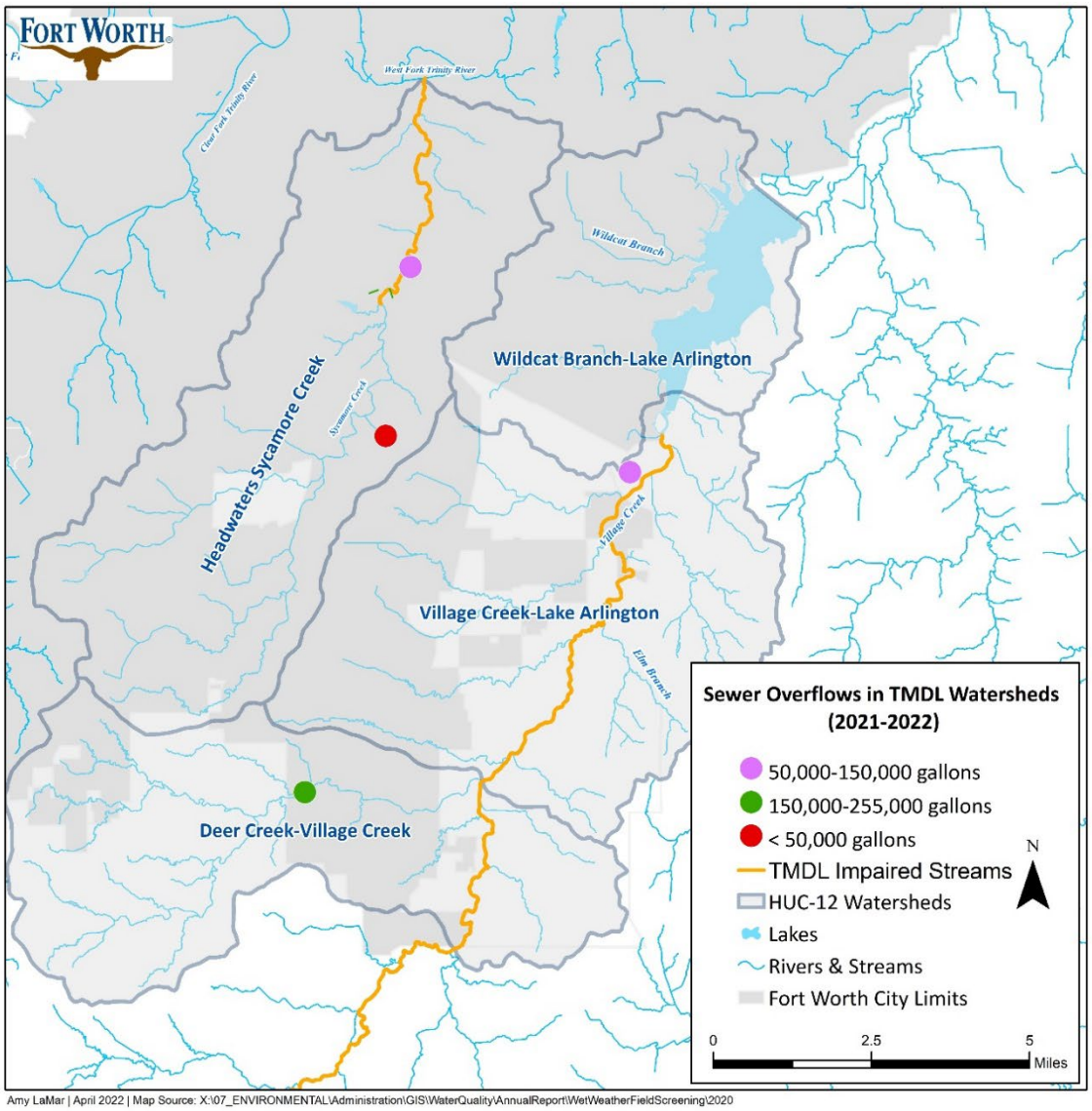
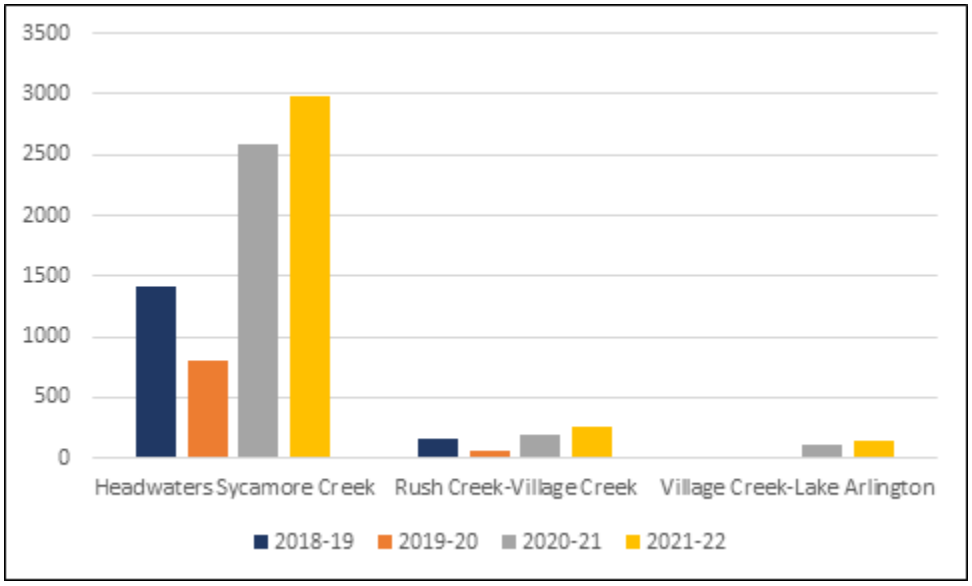


**Figure 8. Sanitary sewer overflows within TMDL watersheds during the2021-22 permit year.**




This permit year, the Code Compliance Department collected 8,313 illegal dumps at 4,018 total tons. That's an increase of 7.5% total tons from last year's collection of 3,736. As indicated in Figure 9, there was also an increase in the number of collected illegal dumps in the Headwaters Sycamore Creek, Rush Creek-Village Creek, and Village Creek-Lake Arlington watersheds.

**Figure 9. Illegal dump sites in Headwaters Sycamore Creek, Rush Creek-Village Creek, and Village Creek-Lake Arlington watersheds TMDL Areas.**




### 8.6.3 Additional efforts for bacteria related TMDLs:

Fort Worth Animal Care and Control (FWACC) manages feral hogs by trapping nuisance hogs on a complaint basis, and removed 27 feral hogs during the permit year. The majority of these feral hogs were eliminated near the Village Creek TMDL area by the Village Creek Wastewater Treatment Plant.

Additionally, FWACC attended numerous neighborhood association meetings to discuss animal laws and the pet waste ordinance. The “pooper scooper” ordinance was enacted in June of 2018, targeting pet waste controls. The ordinance language can be found in Chapter 6, Article IX, § 6-61 of the City of Fort Worth municipal code. In 2019 FWACC created educational handouts to spread the message to “scoop the poop”. In 2020 FWACC promoted pet waste pickup using the NCTCOG “Doo the Right Thing” Campaign on social media.

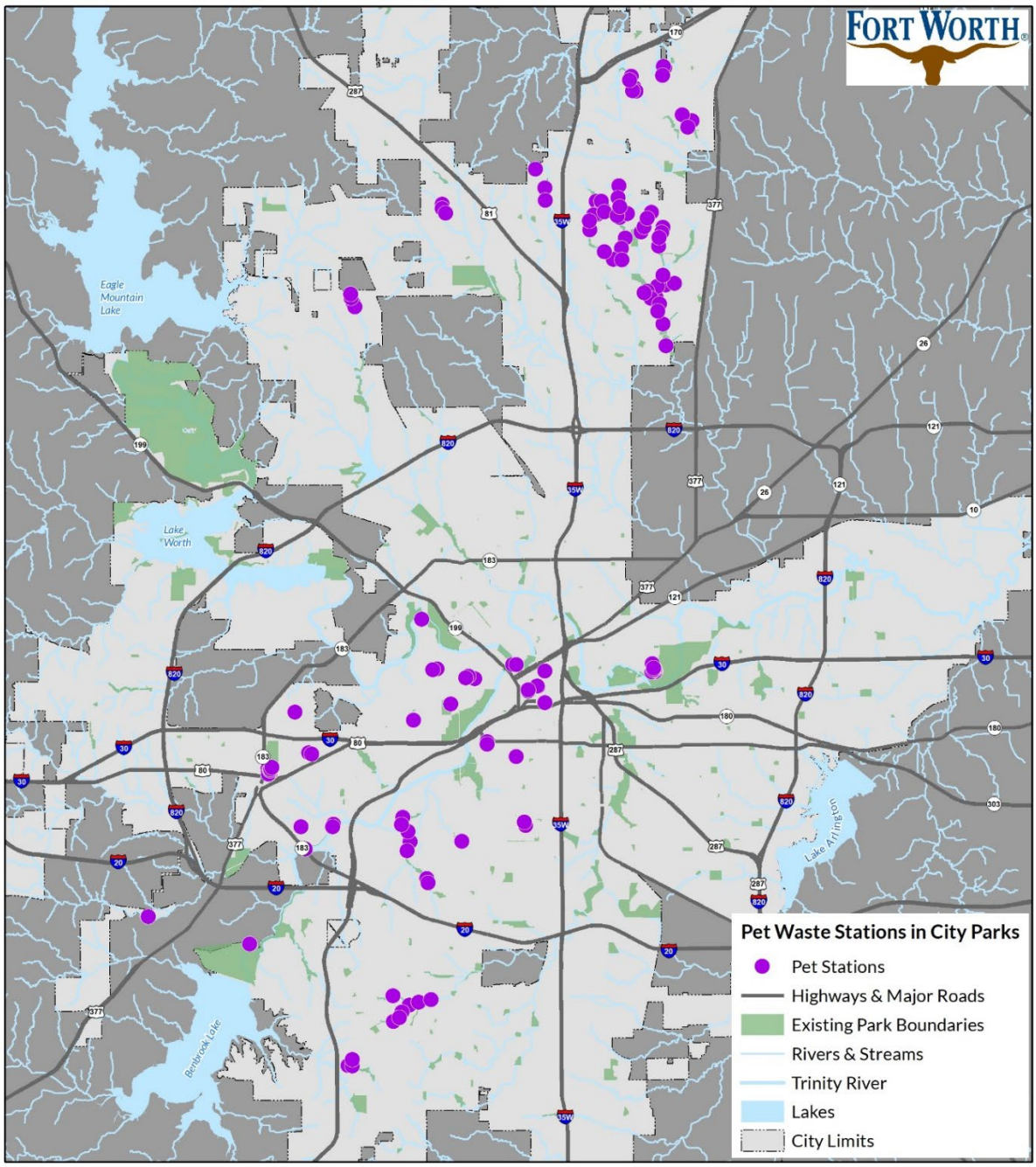
FWACC also enforces the existing ordinance that addresses livestock waste accumulation, such as horse manure, on private property by investigating complaints and requiring removal of the waste.

FWACC actively works with residents and neighborhood associations during the pre-nesting season to identify birds and discourage nesting egrets. In 2020 the Code Compliance Department applied for and received a permit from the U.S. Fish and Wildlife Service that gives City staff increased methods for nonlethal avoidance and minimization measures which should help in displacing nuisance birds. After receiving the permit, FWACC took in 947 egrets that fell out of nests and either transported them to partner rehabilitation facilities or euthanized them depending on the severity of injury. FWACC also launched a public

information campaign through social media posts and emails to residents, and maintains a page on migratory birds on the Fort Worth website to educated citizens.

Fort Worth Park and Recreation Department installed a total of 14 new pet waste stations in city parks during the permit year. As many city parks are adjacent to streams, this assists in keeping bacteria out of the waterways, especially in bacteria TMDL areas. A complete map of all pet waste stations is included in Figure 10 below.

**Figure 10. Pet waste collection stations throughout Fort Worth city parks, 2021-22.**



This permit term the City of Fort Worth focused efforts on adoption of green infrastructure (GI) and low impact development (LID) standards. Environmental staff met with Park and Recreation Department (PARD) on April 23, 2021, September 8 & 22, 2021 and January 26, 2022 regarding the development of a citywide Natural Resource Management Plan to include the protection of riparian areas, and to continue discussions specifically regarding the implementation of riparian buffer zones in the future conversion of the Sycamore Creek Golf Course to Sycamore Park. PARD hopes to receive approval for their new plan and begin implementation of a pilot project later this year by limiting mowing around creeks in trial parks throughout the City of Fort Worth.

Fort Worth Environmental staff continue to conduct routine sampling in the Sycamore Creek TMDL area as part of the Clean Rivers Program. This data is provided to the TRA and TCEQ for use in water quality decision-making. Additional routine bacteria sampling occurs within Sycamore Creek as a part of the biannual rapid bioassessment sampling, and is reported in the NCTCOG Regional Wet Weather Characterization Program annual report and the City of Fort Worth/TRWD annual MS4 report to the TCEQ (Attachment 1 in this report).

Fort Worth Environmental staff actively participate in the NCTCOG Monitoring Coordination Forum, and attended the most recent meetings on September 28, 2021 and March 3, 2022.

Fort Worth participates in the Fats, Oils and Greases (FOG) Program to keep grease and oil out of sewers, which can cause overflows and lead to sewage entering nearby waterbodies. During this year's Holiday Grease Roundup, regional participants collected over 8,445 gallons of grease.

**8.7 Proposed changes to the SWMP in the coming reporting year**

One minor change is proposed to the SWMP this next permit year. We request to remove the phenol test from the Dry Weather Field Screening analysis. The phenol test has not provided reliable results and frequently indicates interference in the test. In at least ten years of sampling, it has not assisted in defining a discharge. As such, it will be eliminated from the testing. An additional test for potassium will be included as needed to assist with discharge identification.

**Appendix A – City of Fort Worth Annual and Projected Expenditures**

The following expenditure information addresses the major elements of the stormwater management program conducted by Environmental Quality. The information for FY21 represents most of the actual expenditures during the fiscal year (October 1, 2020-September 30, 2021) that encompasses part of the permit year. The FY21 data is Environmental Quality's current operational budget for the TPDES program.

| Program | FY21 expenditures Oct 1, 2020-Sept 30, 2021 | FY22 budget Oct 1, 2021-Sept 30, 2022 |
|---|---|---|
| Water Quality Program<br>Pollution investigations<br>Monitoring<br>Spill response<br>Industrial/construction inspections | $896,496.08 | $1,094,802 |
| Household hazardous waste | $1,320,370.15 | $1,397,778 |
| Administration & GIS section | $1,533,461.3 | $2,179,078 |
| Education/outreach | $451,321.78 | $512,234 |
| **Total** | $4,201,649.31 | $5,183,892 |

A Stormwater Utility fee was implemented in Fort Worth in 2006 as a way to provide a dedicated and focused revenue stream to protect people and property from harmful stormwater runoff. The Utility works to reduce flooding, preserve streams, minimize water pollution and operate the stormwater system in a more effective manner. The numbers for FY21 reflect actual expenditures (unaudited) of the Stormwater Utility Fund in the categories noted. The FY22 numbers are projections based on the Stormwater Utility Fund's adopted budget.

| Program | Sum of FY21 Actuals October 1, 2020-Sept 30, 2021 | Sum of FY22 Budget October 1, 2021-Sept 30, 2022 |
|---|---|---|
| Program Administration | $898,401.72 | $1,276,047.45 |
| Customer Billing & Public Outreach | $1,682,443.09 | $1,558,209.00 |
| Corporate Support | $5,678,284.00 | $3,542,365.00 |
| Debt Financing | $11,196,552.00 | $7,727,896.00 |
| Development Review | $2,425,415.61 | $3,364,773.20 |
| Hazard Warning | $2,099,859.48 | $2,592,764.70 |
| Hazard Mitigation | $9,266,645.25 | $15,410,080.15 |
| System Maintenance | $10,691,988.34 | $12,783,900.50 |
| Fort Worth Central City | $0.00 | $1,775,000.00 |
| **TOTAL** | **$43,939,589.50** | **$50,031,036.00** |

**Appendix B –2021 TPDES Stormwater Permit Annual Report Minimum Control Measures Summary Table**

| MCM | Description | Requirements | Status | 2021 Annual Report Page |
|---|---|---|---|---|
| 1 | *MS4 Maintenance Activities* | Description of the portion of the current program that the permittees have implemented for each SWMP element | MCM has been fully implemented | 7-9 |
| | | Status of implementing the SWMP (status of compliance with any schedules established under this permit) | N/A | -- |
| | | Any proposed changes to the SWMP in the coming reporting year | None at this time. | -- |
| | | A summary describing the number and nature of enforcement actions and inspections | N/A | -- |
| 2 | *Post-Construction Stormwater Control Measures* | Description of the portion of the current program that the permittees have implemented for each SWMP element | MCM has been fully implemented | 9-13 |
| | | Status of implementing the SWMP (status of compliance with any schedules established under this permit) | | -- |
| | | Any proposed changes to the SWMP in the coming reporting year | None at this time. | -- |
| | | A summary describing the number and nature of enforcement actions and inspections | N/A | -- |
| 3 | *Illicit Discharges Detection and Elimination* | Description of the portion of the current program that the permittees have implemented for each SWMP element | MCM has been fully implemented | 13-19 |
| | | Status of implementing the SWMP (status of compliance with any schedules established under this permit) | Fully implemented | -- |

| MCM | Description | Requirements | Status | 2021 Annual Report Page |
|---|---|---|---|---|
| | | Any proposed changes to the SWMP in the coming reporting year | None at this time. | -- |
| | | A summary describing the number and nature of enforcement actions and inspections | N/A | |
| 4 | *Pollution Prevention / Good Housekeeping for Municipal Operations* | Description of the portion of the current program that the permittees have implemented for each SWMP element | MCM has been fully implemented | 19-21 |
| | | Status of implementing the SWMP (status of compliance with any schedules established under this permit) | Because the City of Fort Worth has been under continuous MS4 permit coverage since 1996, some of the components of this MCM, such as reduction of pollutants from road repair and from pesticide, herbicide, and fertilizer applications, were requirements of previous permit terms and were already established prior to the current term. Waste handling procedures to ensure proper disposal of waste, although not a previous permit requirement, were already in place prior to the current permit term. For the remaining new requirements, new programs were developed or existing programs were enhanced to ensure compliance as discussed in this section. | 19-21 |
| | | Any proposed changes to the SWMP in the coming reporting year | None at this time. | -- |
| | | A summary describing the number and nature of enforcement actions and inspections | N/A | -- |

| MCM | Description | Requirements | Status | 2021 Annual Report Page |
|---|---|---|---|---|
| 5 | *Industrial & High Risk Runoff* | Description of the portion of the current program that the permittees have implemented for each SWMP element | MCM has been fully implemented | 22-23 |
| | | Status of implementing the SWMP (status of compliance with any schedules established under this permit) | N/A | -- |
| | | Any proposed changes to the SWMP in the coming reporting year | None at this time. | -- |
| | | A summary describing the number and nature of enforcement actions and inspections | Summary data from inspections and resulting enforcement action has been provided. | 22-23 |
| 6 | *Construction Site Stormwater Runoff* | Description of the portion of the current program that the permittees have implemented for each SWMP element | MCM has been fully implemented | 23-25 |
| | | Status of implementing the SWMP (status of compliance with any schedules established under this permit) | Fully implemented | |
| | | Any proposed changes to the SWMP in the coming reporting year | None at this time. | -- |
| | | A summary describing the number and nature of enforcement actions and inspections | Summary data from inspections and resulting enforcement action has been provided. | 24 |
| 7 | *Public Education and Outreach /Public Involvement and Participation* | Description of the portion of the current program that the permittees have implemented for each SWMP element | MCM has been fully implemented | 25-29 |
| | | Status of implementing the SWMP (status of compliance with any schedules established under this permit) | The City uses multiple avenues for education, outreach and participation with residents. Items that are promoted through these messaging methods are identified throughout this report. | 25-29 |

| MCM | Description | Requirements | Status | 2021 Annual Report Page |
|---|---|---|---|---|
| | | Any proposed changes to the SWMP in the coming reporting year | None at this time. | -- |
| | | A summary describing the number and nature of enforcement actions and inspections | N/A | -- |
| 8 | *Monitoring, Evaluation and Reporting* | Description of the portion of the current program that the permittees have implemented for each SWMP element | MCM has been fully implemented | 30-54 |
| | | Status of implementing the SWMP (status of compliance with any schedules established under this permit) | N/A | -- |
| | | Any proposed changes to the SWMP in the coming reporting year | A minor change to DWFS testing, eliminating the phenol attest and adding the phosphorus test for use when applicable. | 54 |
| | | A summary describing the number and nature of enforcement actions and inspections | N/A | -- |

**ATTACHMENT 1. RAPID BIOASSESSMENT CHARACTERIZATIONS OF SIX WATERSHEDS WITHIN THE CITY OF FORT WORTH, SPRING AND FALL 2021.**

**Rapid Bioassessment Characterizations of Six Monitored Watersheds within the City of Fort Worth, Spring and Fall 2021.**

## Introduction

The City of Fort Worth's TPDES stormwater permit contains a monitoring component. To satisfy part of the monitoring requirements, Fort Worth participates in the Regional Wet Weather Characterization Program through the North Central Texas Council of Government (NCTCOG). Fort Worth's monitoring program includes performing rapid bioassessments on representative creeks within six watersheds twice per year, at a minimum of two sites per creek. The watersheds selected for monitoring include Mary's Creek, White's Branch-Big Fossil Creek, Headwaters Sycamore Creek, Marine Creek-West Fork Trinity River, Lake Como-Clear Fork Trinity River, and Sycamore Creek-West Fork Trinity River. On each monitored creek within the watershed, three sites were selected for sampling: an upper reach site (1), a mid-reach site (2), and a lower reach site (3) (Table 1).

Additional sites not included in the NCTCOG Regional Wet Weather Characterization Program were sampled during 2021. These sites provide information about other watersheds partially within the City of Fort Worth. Most of these sites are located at the furthest accessible downstream area of the main stream within the watershed and within the City, which incorporates the effects of stormwater runoff from areas in the City. One site further upstream on Mary's Creek (MRY0), is outside the City of Fort Worth's city limits and doesn't receive discharge from the city's MS4 system. This site was sampled during spring 2021; however, during fall 2021 the stream was dry with very shallow puddles and was not sampled. One site within the Farmer's Branch watershed (FAR3), one within Henrietta Creek watershed (HEN3) and one site within Headwaters Elizabeth Creek watershed (ELI3) was sampled during spring and fall 2021 (Table 1). Further sites within additional watersheds may be sampled in future years as resources allow.

**Table 1: Bioassessment Sampling Site Names and Locations within nine Fort Worth Watersheds.**

| SITE NAME | LOCATION DESCRIPTION | STREAM NAME | HUC12 WATERSHED |
|---|---|---|---|
| MRY1 | 3900 block of Longvue crossing, FM 2871 | Mary's Creek | Mary's Creek |
| MRY2 | Loop IH-820 SW crossing, north of Team Ranch Rd | Mary's Creek | Mary's Creek |
| MRY3 | At Winscott Road (Vickery Blvd.) crossing | Mary's Creek | Mary's Creek |
| BFC1 | West of and parallel to Pepperidge Lane | Big Fossil Creek | White's Branch-Big Fossil Creek |
| BFC2 | IH-35Wcrossing, north of Western Center Blvd | Big Fossil Creek | White's Branch-Big Fossil Creek |
| BFC3 | Beach St. N crossing, north of Paula Ridge | Big Fossil Creek | White's Branch-Big Fossil Creek |
| SYC1 | Intersection of IH-20 and IH-35W | Sycamore Creek | Headwaters Sycamore Creek |
| SYC2 | Cobb Park West south of US-287 at low water crossing | Sycamore Creek | Headwaters Sycamore Creek |
| SYC3 | End of Scott Avenue west of Beach Street | Sycamore Creek | Headwaters Sycamore Creek |
| MAR1 | West of Angle Avenue in Buck Sansom Park | Marine Creek | Marine Creek-West Fork Trinity River |
| MAR2 | Lincoln Park, north of 28th Street crossing | Marine Creek | Marine Creek-West Fork Trinity River |
| MAR3 | Saunders Park north of NE 23rd, along Mule Alley | Marine Creek | Marine Creek-West Fork Trinity River |
| OVR1 | NW of Granbury Rd and Trail Lake Dr intersection in Foster Park | Unnamed Tributary in Overton Park | Lake Como-Clear Fork Trinity River |
| OVR2 | East of 3808 Overton Park West, near Tanbark Trail intersection | Unnamed Tributary in Overton Park | Lake Como-Clear Fork Trinity River |
| OVR3 | Overton Park West south of intersection with Bellaire Dr. S | Unnamed Tributary in Overton Park | Lake Como-Clear Fork Trinity River |
| LFC1 | 2200 block Cantrell Sansom | Little Fossil Creek | Sycamore Creek-West Fork Trinity River |
| LFC2 | upstream of IH35W crossing, south of Getsemani Baptist Church | Little Fossil Creek | Sycamore Creek-West Fork Trinity River |
| LFC3 | West and southwest of Beach St. N and Long Ave. intersection | Little Fossil Creek | Sycamore Creek-West Fork Trinity River |
| MRY0+ | FM3325 crossing | Mary's Creek | Mary's Creek |
| FAR3^ | South of 9716-9748 Francesca Dr, along the creek | Farmer's Branch | Farmer's Branch |
| HEN3^ | South of the Litsey Road crossing, east of the roundabout with Cleveland Gibbs Rd | Henrietta Creek | Henrietta Creek |
| ELI3^ | East of the Cleveland Gibbs Rd crossing | Elizabeth Creek | Headwaters Elizabeth Creek |

**+Potential new reference site, non-regulatory site**

**^ Non-regulatory site**

## Methods

Rapid bioassessment elements include evaluation of chemical and physical water quality parameters, habitat assessment, and sample collection and analysis of benthic aquatic macroinvertebrate communities. Sampling was conducted during spring (May) and fall (October) 2021.

Habitat Assessments and Physico-chemical Sampling

Habitat assessments were performed at each site following guidelines for high gradient streams in Chapter 5 of USEPA's *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers, Second Edition*[1]. This assessment includes scoring 10 different habitat factors with available scores ranging from 0 to 20, with 0 representing poor conditions and 20 representing optimal habitat. Parameters evaluated in habitat assessments include bottom substrate and available cover suitability for colonization, embeddedness, flow regimes present, bottom scouring and sediment deposition, channel alteration, channel flow status, frequency of riffles or bends, stream bank stability, vegetative protection, and riparian vegetative zone width. Individual scores for these 10 factors are totaled for the overall habitat score.

Physical and chemical parameters collected and analyzed with portable meters include pH, dissolved oxygen (D.O.), turbidity, specific conductance, and water and air temperature. Colorimetric test kits were used to analyze nutrient concentrations of ammonia-nitrogen, phosphate, and nitrate-nitrogen. *Escherichia coli* (*E. coli*) bacteria analysis was included at all monitored sites during both spring and fall 2021 sampling events. *E. coli* samples were processed in-house by experienced storm water quality monitoring staff using approved Colilert® procedures and in accordance with City of Fort Worth Standard Operating Procedures (SOP). Physical characterization includes an estimated flow calculation. This calculation is made using the averages of five depth and velocity profiles across one measured stream width as well as a correction constant based on a rough or smooth stream bottom. The estimated flow calculation smooth/rough correction factor is based on the guidance for flow estimates found in TCEQ's Surface Water Quality Monitoring, Volume 1[2].

Biological Sample Collection

Aquatic benthic macroinvertebrates were collected at twenty two (22) stream sites during spring (May) 2021 and at 21 sites during fall (October) 2021. Macroinvertebrates were collected using a D-frame kick net with a 550 µm mesh from riffle areas. If there was no riffle area, samples were taken within run/glide areas or pools. Bottom substrate in front of the net opening was disturbed to dislodge organisms, which were collected in the net along with bottom material. Intermittent stream sites with pools were collected sampling available habitat by gathering rock substrate and washing them into the D-frame net or into a sieve bucket, and sweeping root banks. Collected samples were transferred from the D-frame net or sieve bucket

[1] Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

[2] TCEQ, revised August 2012. Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods. TCEQ RG-415. August 2012.

to sample containers and preserved in the field with 100% isopropyl alcohol. Following transport to the in-house laboratory, macroinvertebrates in the samples were separated from debris and identified. Samples which appeared to have more than 175 (+ or -20%) were subsampled according to SOPs, and similar to those found in TCEQ's Surface Water Quality Monitoring, Volume 2[3]. Most organisms were identified to family level with a few noted exceptions. In accordance with the current City of Fort Worth SOP, Chironomidae was identified to sub-family, Turbellaria and Hirudinea were identified to class, and Nematoda was identified to phylum.

Aquatic Macroinvertebrate Data Analysis

The TCEQ macroinvertebrate Statewide Texas Index of Biotic Integrity (TX-IBI) for kick net samples was used to analyze the data. The Statewide TX-IBI methodology is found in the TCEQ's *Surface Water Quality Monitoring Procedures, Volume 2*[4] and applies 12 macroinvertebrate community structural and functional metrics for the assessment of biotic integrity. This TX-IBI method used is designed for macroinvertebrate samples collected with a D-frame kick net sampler. Biological metrics are calculated with the resulting macroinvertebrate identification data, an interim score is assigned to each individual metric, and the individual metric scores are summed to produce an overall score for each individual site. Scores generated at each site are compared to values in TCEQ guidelines to determine an aquatic life use rating. The values for the aquatic life use ratings found in the TCEQ guidelines were developed based on data collected from reference sites. This method gives an individual value for each site without a direct comparison to a specific reference site, but to values from TCEQ reference sites. Individual sites may also be compared to themselves year to year on a seasonal basis (spring to spring and fall to fall) to demonstrate biological community changes within each reach.

Results and Discussion

Sampling conditions prior to and during spring sampling were considered to be typical with regular weather patterns. Prior to fall sampling, the area experienced little to no rainfall during September which led to moderate to severe drought conditions. By October, many streams had lower flows than normal, some were intermittent with pools, and one site was not sampled as it was dry with very shallow puddles.

Habitat Assessments and Physico-chemical Sampling

Habitat assessment scores for spring and fall 2021 are shown in Table 2. Habitat assessment scores for MRY0 and BFC1 were ranked in the optimal category during the spring sampling event. During fall sampling MRY0 was not sampled as it was dry with very shallow puddles only, and BFC1 was rated with having sub-optimal habitat. The remaining sites were ranked as either sub-optimal or marginal categories during both sampling events, with more indicating sub-optimal ratings in the spring than in the fall.

[3] TCEQ, revised May 2014. Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data. TCEQ RG-416. May 2014.
[4] ibid

Spring and fall 2021 chemical water quality parameter ranges across all sampled sites are listed in Table 3. Physico-chemical data measurements taken during spring and fall 2021 sampling events are presented in Tables 4 through 7.

Any site which indicates probable sewage infiltration by visual and olfactory observation, elevated *E. coli* test results (>10,000 MPN/100mL) along with elevated ammonia-nitrogen (>1.0 mg/L) results are referred to the Fort Worth Water Department for investigation. There were no sites sampled during either sampling event that indicated the presence of sewage infiltration. If any sample results were >2420 MPN/100 mL, the sites were retested with sample dilutions added to determine a more accurate number.

**Table 2. Habitat Scores Collected for Mary's Creek, Big Fossil Creek, Sycamore Creek, Marine Creek, Overton Park, Little Fossil Creek, and Farmer's Branch in Spring and Fall 2021.**

| Site | Spring 2021 | Fall 2021 | Habitat Rating | Score |
|---|---|---|---|---|
| MRY0+ | 164 | NS | Optimal | 160-200 |
| MRY1 | 145 | 114 | Sub-optimal | 110-159 |
| MRY2 | 139 | 98 | Marginal | 60-109 |
| MRY3 | 153 | 112 | Poor | <60 |
| FAR3^ | 130 | 130 | | |
| BFC1 | 172 | 154 | | |
| BFC2 | 148 | 117 | | |
| BFC3 | 147 | 133 | | |
| SYC1 | 110 | 97 | | |
| SYC2 | 135 | 143 | | |
| SYC3 | 122 | 122 | | |
| MAR1 | 141 | 116 | | |
| MAR2 | 134 | 103 | | |
| MAR3 | 152 | 139 | | |
| OVR1 | 118 | 93 | | |
| OVR2 | 128 | 128 | | |
| OVR3 | 124 | 110 | | |
| LFC1 | 152 | 130 | | |
| LFC2 | 157 | 151 | | |
| LFC3 | 128 | 85 | | |
| HEN3^ | 101 | 126 | | |
| ELI3^ | 115 | 130 | | |

**NS= not sampled**
**+=Potential new reference site, non-regulatory site**
**^= Non-regulatory site**

**Table 3. Minimum and Maximum Values of Water Quality Parameters in Spring and Fall 2021 Bioassessment Sampling.**

| | Spring 2021 | | Fall 2021 | |
|---|---|---|---|---|
| **Parameter** | **Minimum** | **Maximum** | **Minimum** | **Maximum** |
| **Water temperature, ºC** | 16.6 | 30.4 | 16.7 | 25.7 |
| **pH, s.u.** | 7.66 | 8.60 | 7.3 | 8.45 |
| **Conductivity (µS)** | 450 | 730 | 350 | 770 |
| **DO (mg/L)** | 5.94 | 9.43 | 2.53 | 8.7 |
| **Turbidity (NTUs)** | 0.71 | 5.40 | 0 | 21.30 |
| **NO3-N (mg/L)** | 0.01 | 1.70 | 0.00 | 1.15 |
| **NH3-N (mg/L)** | 0.00 | 3.65 | 0 | 0.68 |
| **PO4 (mg/L)** | 0.00 | 0.83 | 0.00 | 0.09 |
| **E. coli (MPN/100mL)** | 32 | 2420 | 9 | 2420 |

**Table 4. Physico-chemical Results for Samples Collected during Bioassessments from Mary's Creek, Farmer's Branch, Big Fossil Creek, and Sycamore Creek in Spring 2021.**

| | STATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PARAMETER** | **MRY0+** | **MRY1** | **MRY2** | **MRY3** | **FAR3^** | **BFC1** | **BFC2** | **BFC3** | **SYC1** | **SYC2** | **SYC3** |
| Width (ft) | 11 | 39.0 | 35.0 | 66.0 | 9.0 | 16.0 | 82.0 | 64.0 | 31.0 | 57.0 | 26.0 |
| Avg. depth (ft) | 0.18 | 0.58 | 0.52 | 0.12 | 0.28 | 0.32 | 0.16 | 0.16 | 0.28 | 0.56 | 0.38 |
| Avg. Velocity (ft/s) | 0.210 | 0.316 | 0.520 | 0.460 | 0.088 | 0.534 | 0.132 | 0.358 | 0.534 | 0.078 | 0.378 |
| Estimated flow (cfs) | 0.374 | 6.433 | 8.520 | 3.280 | 0.204 | 2.187 | 0.385 | 2.933 | 3.708 | 1.992 | 2.99 |
| Water Temperature (ºC) | 29.1 | 21.5 | 20.6 | 19.7 | 25.9 | 23.0 | 23.2 | 25.3 | 18.7 | 19.2 | 18.2 |
| pH (s.u.) | 7.84 | 8.05 | 8.05 | 8.03 | 7.87 | 8.04 | 8.60 | 8.04 | 8.15 | 8.07 | 8.00 |
| Conductivity (µS) | 660 | 510 | 520 | 550 | 730 | 550 | 560 | 550 | 530 | 550 | 610 |
| DO (mg/L) | 6.25 | 8.36 | 7.96 | 6.92 | 6.76 | 8.51 | 8.37 | 8.75 | 7.13 | 6.28 | 7.12 |
| Turbidity (NTUs) | 1.36 | 2.44 | 2.00 | 2.54 | 0.71 | 5.16 | 1.88 | 4.4 | 0.75 | 1.90 | 1.99 |
| $NO_3$-N (mg/L) | 0.09 | 0.03 | 0.01 | 0.07 | 1.70 | 0.31 | 0.18 | 0.18 | 0.04 | 0.06 | 0.10 |
| $NH_3$-N (mg/L) | 1.97 | 0.06 | 0.02 | 0.1 | 0.11 | 0.07 | 0.09 | 0.84 | 0.19 | 0.40 | 0.54 |
| $PO_4$ (mg/L) | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.10 | 0.04 | 0.03 | 0.00 |
| *E. coli* (MPN/100mL) | 32 | 34 | 43 | 126 | 770 | 74 | 88 | 93 | 111 | 146 | 326 |

**+=Potential new reference site, non-regulatory site**

**^= Non-regulatory site**

**Table 5. Physico-chemical Results for Samples Collected during Bioassessments from Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek in Spring 2021.**

| | STATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PARAMETER** | **MAR1** | **MAR2** | **MAR3** | **OVR1** | **OVR2** | **OVR3** | **LFC1** | **LFC2** | **LFC3** | **HEN3^** | **ELI3^** |
| Width (ft) | 14.0 | 28.0 | 14.0 | 10.0 | 18.0 | 22.0 | 9.0 | 22.0 | 15.0 | 24 | 22 |
| Avg. depth (ft) | 0.66 | 0.30 | 0.86 | 0.16 | 0.16 | 1.14 | 0.26 | 0.48 | 0.66 | 0.36 | 0.58 |
| Avg. Velocity (ft/s) | 0.520 | 0.530 | 0.498 | 0.046 | 0.134 | 0.044 | 0.342 | 0.092 | 0.104 | 0.450 | 0.474 |
| Estimated flow (cfs) | 3.843 | 3.561 | 4.797 | 0.059 | 0.309 | 0.883 | 0.720 | 0.777 | 0.824 | 3.110 | 4.797 |
| Water Temperature (ºC) | 16.6 | 18.8 | 20.1 | 22.5 | 22.3 | 21.3 | 19.2 | 19.1 | 17.8 | 30.4 | 29.0 |
| pH (s.u.) | 8.35 | 8.18 | 8.16 | 7.97 | 7.87 | 7.66 | 7.83 | 7.95 | 7.81 | 7.85 | 7.91 |
| Conductivity (µS) | 450 | 520 | 530 | 700 | 670 | 660 | 650 | 590 | 640 | 670 | 580 |
| DO (mg/L) | 8.49 | 7.48 | 6.92 | 8.72 | 9.43 | 7.26 | 7.46 | 7.06 | 7.90 | 5.94 | 7.73 |
| Turbidity (NTUs) | 3.19 | 1.80 | 2.68 | 1.58 | 0.8 | 1.24 | 2.33 | 2.4 | 1.73 | 5.40 | 2.20 |
| $NO_3$-N (mg/L) | 0.08 | 0.07 | 0.26 | 1.42 | 0.56 | 0.51 | 0.32 | 0.18 | 0.42 | 1.11 | 0.01 |
| $NH_3$-N (mg/L) | 0.94 | 1.56 | 0.12 | 0.42 | 0.47 | 1.14 | 0.10 | 0.17* | 0.15 | 3.65 | 0.00 |
| $PO_4$ (mg/L) | 0.00 | 0.00 | 0.00 | 0.10 | 0.07 | 0.01 | 0.06 | 0.12 | 0.06 | 0.83 | 0.00 |
| *E. coli* (MPN/100mL) | 126 | 435 | 411 | 2420 | 158 | 189 | 135 | 161 | 93 | 582 | 38 |

**^= Non-regulatory site**

***= LCF2 ammonia was over range during initial sampling on May 6; resampling indicated results of 0.17 mg/l; most likely operator error during field analysis on May 6.**

**Table 6. Physico-chemical Results for Samples Collected during Bioassessments from Mary's Creek, Farmer's Branch, Big Fossil Creek, and Sycamore Creek in Fall 2021.**

| | STATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PARAMETER** | **MRY0+** | **MRY1** | **MRY2** | **MRY3** | **FAR3^** | **BFC1** | **BFC2** | **BFC3** | **SYC1** | **SYC2** | **SYC3** |
| Width (ft) | NS | 40.0 | 23.0 | 68.0 | -- | 12.0 | 50.0 | 60.0 | 26.0 | 50.0 | 22.0 |
| Avg. depth (ft) | NS | 0.28 | 0.34 | 0.10 | -- | 0.56 | 0.26 | 0.34 | 0.42 | 1.12 | 0.2 |
| Avg. Velocity (ft/s) | NS | 0.022 | 0.032 | 0.052 | -- | 0.006 | 0.022 | 0.030 | 0.072 | 0.202 | 0.200 |
| Estimated flow (cfs) | NS | 0.222 | 0.225 | 0.318 | -- | 0.032 | 0.229 | 0.551 | 0.629 | 9.050 | 0.871 |
| Water Temperature (ºC) | NS | 19.4 | 18.3 | 18.2 | 16.7 | 22.8 | 23.6 | 22.7 | 24.2 | 23.8 | 25.7 |
| pH (s.u.) | NS | 8.45 | 8.30 | 8.27 | 8.14 | 7.64 | 7.92 | 7.78 | 7.69 | 7.49 | 7.53 |
| Conductivity (µS) | NS | 350 | 360 | 510 | 670 | 680 | 610 | 570 | 490 | 440 | 420 |
| DO (mg/L) | NS | 8.36 | 7.35 | 5.42 | 6.87 | 6.36 | 8.04 | 6.45 | 7.55 | 4.96 | 6.89 |
| Turbidity (NTUs) | NS | 0.97 | 0.91 | 0.54 | 0.00 | 1.61 | 0.24 | 2.71 | 0.00 | 0.76 | 0.29 |
| $NO_3$-N (mg/L) | NS | 0.00 | 0.00 | 0.09 | 0.76 | 0.02 | 0.16 | 0.11 | 0.05 | 0.09 | 0.00 |
| $NH_3$-N (mg/L) | NS | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.68 | 0.37 | 0.00 | 0.00 | 0.00 |
| $PO_4$ (mg/L) | NS | 0.00 | 0.02 | 0.01 | 0.00 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| *E. coli* (MPN/100mL) | NS | 9 | 117 | 15 | 124 | 12 | 687 | >2420* | 31 | 70 | 291 |

**FAR3 was intermittent with pools only during fall sampling. Pools varied from 6" to >2.5'.**

***BFC3-original test was Oct 6; rained on Oct 10, retested Oct 21 with a result of 2420.**

**+=Potential new reference site, non-regulatory site**

**^= Non-regulatory site**

**NS=not sampled, site was dry with shallow puddles**

**Table 7. Physico-chemical Results for Samples Collected during Bioassessments from Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek in Fall 2021.**

| | STATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PARAMETER** | **MAR1** | **MAR2** | **MAR3** | **OVR1** | **OVR2** | **OVR3** | **LFC1** | **LFC2** | **LFC3** | **HEN3^** | **ELI3^** |
| Width (ft) | 10.0 | 15.0 | 14.0 | 13.0 | 18.0 | 16.0 | 7.0 | 22.0 | 22.5 | 21 | 24 |
| Avg. depth (ft) | 0.2 | 0.12 | 0.38 | 0.52 | 0.20 | 0.20 | 0.48 | 0.42 | 0.08 | 0.34 | 0.76 |
| Avg. Velocity (ft/s) | 0.000 | 0.016 | 0.068 | 0.024 | 0.022 | 0.028 | 0.010 | 0.006 | 0.002 | 0.172 | 0.070 |
| Estimated flow (cfs) | 0.000 | 0.023 | 0.310 | 0.146 | 0.063 | 0.072 | 0.030 | 0.050 | 0.003 | 1.105 | 1.149 |
| Water Temperature (ºC) | 20.4 | 20.7 | 20.7 | 22.4 | 21.8 | 21.7 | 21.0 | 19.0 | 18.8 | 18.3 | 20.1 |
| pH (s.u.) | 7.37 | 7.72 | 8.03 | 7.30 | 7.57 | 7.92 | 7.30 | 7.94 | 8.01 | 8.14 | 7.57 |
| Conductivity (µS) | 640 | 600 | 770 | 500 | 430 | 450 | 630 | 500 | 410 | 450 | 630 |
| DO (mg/L) | 3.47 | 3.43 | 6.04 | 4.69 | 7.55 | 7.00 | 2.53 | 5.05 | 5.24 | 8.52 | 8.7 |
| Turbidity (NTUs) | 0.00 | 0.00 | 0.96 | 1.91 | 12.10 | 8.89 | 3.43 | 1.02 | 1.01 | 21.3~ | 1.06 |
| $NO_3$-N (mg/L) | 0.14 | 0.38 | 1.15 | 0.18 | 0.02 | 0.00 | 0.01 | 0.05 | 0.04 | 0.00 | 0.17 |
| $NH_3$-N (mg/L) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.47 | 0.18 | 0.07 | 0.00 | 0.00 |
| $PO_4$ (mg/L) | 0.06 | 0.07 | 0.07 | 0.03 | 0.00 | 0.00 | 0.00 | 0.09 | 0.02 | 0.00 | 0.00 |
| *E. coli* (MPN/100mL) | 133 | 308 | 122 | 1553 | 687 | 76 | 13 | 96 | 34 | 187 | 184 |

**^= Non-regulatory site**

**NS=not sampled**

**~HEN3 had an ongoing discharge from an adjacent construction site, which was being addressed at the time of sampling**

Biological Data Analysis

Spring 2021 TX-IBI metric calculations (Table 8 and Figure 1) returned a score of “high” aquatic life use for two sites (MRY0 and BFC1). Twelve sites (MRY1, MRY2, MRY3, FAR3, BFC3, SYC1, SYC3, MAR2, OVR2, OVR3, LFC1, HEN3) indicated scores with “intermediate” life use and the remaining eight sites (BFC2, SYC2, MAR1, MAR3, OVR1, LFC2, LFC3, and ELI3) showed “limited” aquatic life use. TX-IBI macroinvertebrate metric calculations for spring samples are displayed in Tables 9-12. Spring macroinvertebrate abundance data are shown in Tables 17-18.

TX-IBI analysis for the fall 2021 macroinvertebrate data (Table 8 and Figure 2) indicated five sites (MRY1, BFC2, SYC1, SYC2, and MAR1) were rated with “high” aquatic life use and fourteen sites (MRY2, MRY3, FAR3, BFC1, BFC3, SYC3, MAR2, MAR3, OVR2, OVR3, LFC2, LFC3, HEN3 and ELI3) were rated with “intermediate” aquatic life use. The remaining two sites (OVR1 and LFC1) indicated a “limited” aquatic life use. Results for the individual metric calculations are included in Tables 13-16. Macroinvertebrate abundance data for fall are presented in Tables 19-20.

Comparison of each site’s scores will be made on a seasonal basis at the end of the monitoring or permit term.

**Table 8. Texas Macroinvertebrate Index of Biotic Integrity Scores (TX-IBI) for Mary's Creek, Farmer's Branch, Big Fossil Creek, Sycamore Creek, Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek in Spring and Fall 2021.**

| Site | Spring 2021 | Fall 2021 | Aquatic Life Use | Score |
|---|---|---|---|---|
| MRY0+ | 32 | NS | Exceptional | >36 |
| MRY1 | 26 | 31 | High | 29-36 |
| MRY2 | 24 | 27 | Intermediate | 22-28 |
| MRY3 | 26 | 28 | Limited | <22 |
| FAR3^ | 24 | 25 | | |
| BFC1 | 33 | 28 | | |
| BFC2 | 21 | 31 | | |
| BFC3 | 24 | 25 | | |
| SYC1 | 25 | 36 | | |
| SYC2 | 21 | 30 | | |
| SYC3 | 23 | 28 | | |
| MAR1 | 21 | 30 | | |
| MAR2 | 26 | 26 | | |
| MAR3 | 21 | 23 | | |
| OVR1 | 16 | 21 | | |
| OVR2 | 22 | 26 | | |
| OVR3 | 23 | 23 | | |
| LFC1 | 26 | 21 | | |
| LFC2 | 16 | 25 | | |
| LFC3 | 20 | 28 | | |
| HEN3^ | 23 | 26 | | |
| ELI3^ | 19 | 24 | | |

**+=Potential new reference site, non-regulatory site**
**^ =Non-regulatory site**

## Conclusion

Rapid bioassessments were performed on stream sites within nine watersheds in Fort Worth during spring and fall 2021. Four new sites were sampled, increasing the coverage of the city's watersheds from the required six to nine watersheds. Spring habitat assessment scores for most sampled sites were classified in the sub-optimal category, except for one site (HEN3) rated with marginal habitat, and two sites (MRY0 and BFC1) rated as having optimal habitat. Five sites (MRY2, SYC1, MAR2, OVR1, and LFC3) were rated as having marginal habitat during fall sampling, with the remaining sites rated with sub-optimal habitat. Physico-chemical test results were within normal range for all sampled sites during both sampling events, except for the elevated turbidity at HEN3 during fall sampling, which was attributable to an adjacent construction site. Corrective action for the turbid runoff was taken with the construction contractor at the time of sampling.

Texas IBI calculations for the spring 2021 macroinvertebrate data indicated two sites (MRY0 and BFC1) rated with high aquatic life use, twelve sites rated with intermediate aquatic life use, and

eight sites rated with limited aquatic life use. Fall 2021 data analysis indicated more sites rated with high aquatic life use (five), more sites rated with intermediate aquatic life use (fourteen) and fewer sites rated with limited aquatic life use (two).

**Table 9. TX-IBI Metric Calculations for Macroinvertebrate Community Samples Collected from Mary's Creek, Farmer's Branch, Big Fossil Creek, and Sycamore Creek in Spring 2021.**

| TX-IBI Metrics | MRY0+ | MRY1 | MRY2 | MRY3 | FAR3^ | BFC1 | BFC2 | BFC3 | SYC1 | SYC2 | SYC3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa Richness | 16 | 17 | 14 | 14 | 14 | 22 | 14 | 18 | 18 | 14 | 15 |
| EPT taxa richness | 6 | 6 | 4 | 4 | 4 | 8 | 6 | 6 | 4 | 3 | 5 |
| HBI biotic index | 3.96 | 4.60 | 4.78 | 4.88 | 4.33 | 4.51 | 4.90 | 4.39 | 5.30 | 4.99 | 5.66 |
| % Chironomidae | 13.12 | 40.00 | 47.97 | 43.22 | 16.09 | 27.44 | 20.47 | 23.89 | 47.80 | 32.91 | 50.00 |
| % dominant taxon | 39.63 | 36.19 | 44.31 | 40.70 | 35.36 | 24.19 | 49.12 | 27.07 | 39.56 | 31.01 | 33.91 |
| % dominant FFG | 49.87 | 58.57 | 66.26 | 82.41 | 50.92 | 49.82 | 83.63 | 46.82 | 59.34 | 70.25 | 74.71 |
| % Predators | 5.25 | 8.10 | 4.88 | 7.54 | 2.11 | 11.91 | 2.92 | 3.82 | 8.24 | 4.43 | 9.77 |
| Ratio of intolerant:tolerant taxa | 5.25 | 1.28 | 1.05 | 1.19 | 4.57 | 2.11 | 1.71 | 2.49 | 0.72 | 1.08 | 0.51 |
| % of total Trichoptera as Hydropsychidae | 60.47 | 57.14 | 45.45 | 25.00 | 45.58 | 73.49 | 15.00 | 87.32 | 97.67 | 100.00 | 33.33 |
| # of non-insect taxa | 4.0 | 5.0 | 3.0 | 4.0 | 3.0 | 7.0 | 4.0 | 8.0 | 9.0 | 6.0 | 5.0 |
| % collectors-gatherers | 42.52 | 58.57 | 66.26 | 82.41 | 50.92 | 49.82 | 83.63 | 45.22 | 59.34 | 70.25 | 74.71 |
| % of total number as Elmidae | 1.05 | 1.90 | 3.66 | 1.51 | 0.26 | 4.69 | 0.00 | 0.00 | 1.65 | 15.19 | 0.00 |

**+=Potential new reference site, non-regulatory site**

**^ =Non-regulatory site**

**Table 10. TX-IBI Scores for Macroinvertebrate Community Samples Collected from Mary's Creek, Farmer's Branch, Big Fossil Creek, and Sycamore Creek in Spring 2021.**

| TX-IBI Scores | MRY0+ | MRY1 | MRY2 | MRY3 | FAR3^ | BFC1 | BFC2 | BFC3 | SYC1 | SYC2 | SYC3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa Richness | 3 | 3 | 2 | 2 | 2 | 4 | 2 | 3 | 3 | 2 | 3 |
| EPT taxa richness | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 2 |
| HBI biotic index | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 1 | 2 | 1 |
| % Chironomidae | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| % dominant taxon | 2 | 2 | 1 | 1 | 2 | 3 | 1 | 3 | 2 | 3 | 2 |
| % dominant FFG | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 |
| % Predators | 4 | 4 | 4 | 4 | 1 | 4 | 1 | 1 | 4 | 1 | 4 |
| Ratio of intolerant:tolerant taxa | 4 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 1 | 1 | 1 |
| % of total Trichoptera as Hydropsychidae | 2 | 2 | 3 | 4 | 3 | 2 | 4 | 1 | 1 | 1 | 3 |
| # of non-insect taxa | 3 | 3 | 2 | 3 | 2 | 4 | 3 | 4 | 4 | 4 | 3 |
| % collectors-gatherers | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % of total number as Elmidae | 4 | 4 | 4 | 4 | 1 | 4 | 1 | 1 | 4 | 3 | 1 |
| **Total Score** | 32 | 26 | 24 | 26 | 24 | 33 | 21 | 24 | 25 | 21 | 23 |
| **Aquatic Life Use Rating** | High | Intermediate | Intermediate | Intermediate | Intermediate | High | Limited | Intermediate | Intermediate | Limited | Intermediate |

**+=Potential new reference site, non-regulatory site**

**^ =Non-regulatory site**

**Table 11. TX-IBI Metric Calculations for Macroinvertebrate Community Samples Collected from Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek in Spring 2021.**

| TX-IBI Metrics | MAR1 | MAR2 | MAR3 | OVR1 | OVR2 | OVR3 | LFC1 | LFC2 | LFC3 | HEN3^ | ELI3^ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa Richness | 10 | 16 | 12 | 14 | 19 | 18 | 19 | 9 | 15 | 13 | 11 |
| EPT taxa richness | 3 | 5 | 5 | 1 | 4 | 5 | 6 | 2 | 4 | 4 | 6 |
| HBI biotic index | 4.23 | 4.92 | 5.35 | 7.65 | 5.97 | 5.59 | 5.01 | 5.80 | 4.89 | 4.88 | 4.37 |
| % Chironomidae | 18.33 | 36.13 | 43.56 | 44.98 | 62.92 | 53.27 | 35.88 | 87.10 | 46.19 | 39.29 | 29.53 |
| % dominant taxon | 54.44 | 29.68 | 27.61 | 33.62 | 35.15 | 30.65 | 31.33 | 73.39 | 40.95 | 31.12 | 38.86 |
| % dominant FFG | 86.11 | 63.23 | 82.21 | 92.14 | 71.88 | 64.82 | 73.41 | 93.95 | 67.14 | 69.39 | 56.48 |
| % Predators | 4.44 | 1.94 | 0.00 | 4.37 | 11.25 | 13.57 | 20.04 | 4.03 | 4.29 | 10.71 | 3.11 |
| Ratio of intolerant:tolerant taxa | 3.86 | 1.01 | 0.68 | 0.02 | 0.25 | 0.44 | 1.25 | 0.13 | 1.10 | 1.39 | 2.39 |
| % of total Trichoptera as Hydropsychidae | 75.00 | 42.86 | 66.67 | No Trich | 96.00 | 55.56 | 69.23 | No Trich | 83.33 | 91.18 | 93.75 |
| # of non-insect taxa | 2.0 | 6.0 | 3.0 | 5.0 | 10.0 | 4.0 | 8.0 | 1.0 | 3.0 | 2.0 | 1.0 |
| % collectors-gatherers | 86.11 | 63.23 | 82.21 | 92.14 | 71.88 | 64.82 | 73.41 | 93.95 | 67.14 | 69.39 | 37.82 |
| % of total number as Elmidae | 16.11 | 6.45 | 6.13 | 0.00 | 0.00 | 0.50 | 4.01 | 1.21 | 0.95 | 2.04 | 0.00 |

**^ =Non-regulatory site**

**Table 12. TX-IBI Scores for Macroinvertebrate Community Samples Collected from Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek in Spring 2021.**

| TX-IBI Scores | MAR 1 | MAR2 | MAR3 | OVR1 | OVR2 | OVR3 | LFC1 | LFC2 | LFC3 | HEN3^ | ELI3^ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa Richness | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| EPT taxa richness | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 |
| HBI biotic index | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 3 |
| % Chironomidae | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % dominant taxon | 1 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 1 | 2 | 2 |
| % dominant FFG | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % Predators | 1 | 1 | 1 | 1 | 4 | 4 | 3 | 1 | 1 | 4 | 1 |
| Ratio of intolerant:tolerant taxa | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| % of total Trichoptera as Hydropsychidae | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| # of non-insect taxa | 2 | 4 | 2 | 3 | 4 | 3 | 4 | 1 | 2 | 2 | 1 |
| % collectors-gatherers | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| % of total number as Elmidae | 3 | 4 | 4 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 1 |
| **Total Score** | 21 | 26 | 21 | 16 | 22 | 23 | 26 | 16 | 20 | 23 | 19 |
| **Aquatic Life Use Rating** | Limited | Intermediate | Limited | Limited | Intermediate | Intermediate | Intermediate | Limited | Limited | Intermediate | Limited |

**^ =Non-regulatory site**

**Table 13. TX-IBI Metric Calculations for Macroinvertebrate Community Samples Collected from Mary's Creek, Farmer's Branch, Big Fossil Creek, and Sycamore Creek in Fall 2021.**

| TX-IBI Metrics | MRY0+ | MRY1 | MRY2 | MRY3 | FAR3^ | BFC1 | BFC2 | BFC3 | SYC1 | SYC2 | SYC3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa Richness | NS | 21 | 18 | 24 | 10 | 21 | 17 | 20 | 22 | 16 | 17 |
| EPT taxa richness | NS | 7 | 7 | 7 | 1 | 9 | 7 | 6 | 7 | 7 | 7 |
| HBI biotic index | NS | 5.57 | 5.27 | 5.57 | 8.02 | 5.23 | 4.49 | 5.94 | 4.88 | 4.56 | 4.86 |
| % Chironomidae | NS | 18.88 | 59.47 | 40.22 | 14.29 | 43.11 | 13.99 | 43.48 | 29.28 | 38.94 | 38.91 |
| % dominant taxon | NS | 16.78 | 57.27 | 31.84 | 61.90 | 20.00 | 21.76 | 24.84 | 27.25 | 38.44 | 30.55 |
| % dominant FFG | NS | 42.66 | 63.88 | 69.27 | 71.43 | 47.11 | 41.97 | 53.42 | 34.78 | 46.23 | 56.27 |
| % Predators | NS | 22.38 | 9.25 | 23.46 | 9.52 | 24.00 | 17.62 | 26.09 | 12.17 | 6.28 | 13.18 |
| Ratio of intolerant:tolerant taxa | NS | 0.74 | 0.52 | 0.77 | 0.15 | 0.80 | 2.51 | 0.44 | 1.10 | 1.30 | 1.25 |
| % of total Trichoptera as Hydropsychidae | NS | 0.00 | 22.41 | 16.67 | No Trich | 48.21 | 4.00 | 0.00 | 24.20 | 15.05 | 31.40 |
| # of non-insect taxa | NS | 5.0 | 2.0 | 4.0 | 4.0 | 7.0 | 3.0 | 7.0 | 9.0 | 4.0 | 2.0 |
| % collectors-gatherers | NS | 42.66 | 63.88 | 69.27 | 17.46 | 47.11 | 41.97 | 53.42 | 34.78 | 45.48 | 56.27 |
| % of total number as Elmidae | NS | 7.69 | 1.76 | 5.59 | 1.59 | 0.00 | 0.52 | 0.00 | 1.16 | 1.26 | 0.96 |

**+=Potential new reference site, non-regulatory site**

**^ =Non-regulatory site**

**Table 14. TX-IBI Scores for Macroinvertebrate Community Samples Collected from Mary's Creek, Farmer's Branch, Big Fossil Creek, and Sycamore Creek in Fall 2021.**

| TX-IBI Scores | MRY0+ | MRY1 | MRY2 | MRY3 | FAR3^ | BFC1 | BFC2 | BFC3 | SYC1 | SYC2 | SYC3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa Richness | NS | 3 | 3 | 4 | 2 | 3 | 3 | 3 | 4 | 3 | 3 |
| EPT taxa richness | NS | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 3 |
| HBI biotic index | NS | 1 | 2 | 1 | 1 | 2 | 3 | 1 | 2 | 2 | 2 |
| % Chironomidae | NS | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 |
| % dominant taxon | NS | 4 | 1 | 2 | 1 | 4 | 4 | 3 | 3 | 2 | 3 |
| % dominant FFG | NS | 3 | 1 | 1 | 1 | 2 | 3 | 2 | 4 | 2 | 1 |
| % Predators | NS | 3 | 4 | 3 | 4 | 3 | 3 | 2 | 4 | 4 | 4 |
| Ratio of intolerant:tolerant taxa | NS | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| % of total Trichoptera as Hydropsychidae | NS | 4 | 4 | 4 | 1 | 3 | 4 | 4 | 4 | 4 | 3 |
| # of non-insect taxa | NS | 3 | 2 | 3 | 3 | 4 | 2 | 4 | 4 | 3 | 2 |
| % collectors-gatherers | NS | 1 | 1 | 1 | 4 | 1 | 1 | 1 | 2 | 1 | 1 |
| % of total number as Elmidae | NS | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 4 | 4 | 4 |
| Total Score | NS | 31 | 27 | 28 | 25 | 28 | 31 | 25 | 36 | 30 | 28 |
| Aquatic Life Use Rating | NS | High | Intermediate | Intermediate | Intermediate | Intermediate | Intermediate | High | Intermediate | High | High | Intermediate |

**+=Potential new reference site, non-regulatory site**

**^ =Non-regulatory site**

**Table 15. TX-IBI Metric Calculations for Macroinvertebrate Community Samples Collected from Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek in Fall 2021.**

| TX-IBI Metrics | MAR1 | MAR2 | MAR3 | OVR1 | OVR2 | OVR3 | LFC1 | LFC2 | LFC3 | HEN3^ | ELI3^ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa Richness | 19 | 16 | 16 | 20 | 16 | 18 | 19 | 18 | 15 | 18 | 21 |
| EPT taxa richness | 7 | 5 | 5 | 3 | 5 | 6 | 2 | 6 | 4 | 4 | 7 |
| HBI biotic index | 5.52 | 5.05 | 4.90 | 6.81 | 4.84 | 5.10 | 7.74 | 5.78 | 7.34 | 5.16 | 5.63 |
| % Chironomidae | 11.25 | 42.18 | 42.63 | 61.03 | 31.33 | 36.44 | 12.41 | 46.01 | 16.85 | 13.25 | 58.06 |
| % dominant taxon | 35.63 | 40.82 | 42.31 | 56.81 | 27.90 | 33.90 | 60.15 | 41.31 | 26.40 | 22.52 | 54.84 |
| % dominant FFG | 56.88 | 57.82 | 66.35 | 77.93 | 57.94 | 66.67 | 70.30 | 62.91 | 39.33 | 60.26 | 67.34 |
| % Predators | 13.75 | 11.56 | 4.49 | 7.51 | 13.30 | 13.28 | 13.91 | 21.13 | 20.22 | 13.25 | 11.69 |
| Ratio of intolerant:tolerant taxa | 0.80 | 0.86 | 1.09 | 0.04 | 1.51 | 1.19 | 0.03 | 0.50 | 0.09 | 1.48 | 0.39 |
| % of total Trichoptera as Hydropsychidae | 0.00 | 34.15 | 46.43 | 66.67 | 49.21 | 30.00 | 100.00 | 43.33 | 0.00 | 86.96 | 28.57 |
| # of non-insect taxa | 6.0 | 5.0 | 4.0 | 7.0 | 6.0 | 3.0 | 10.0 | 6.0 | 6.0 | 8.0 | 6.0 |
| % collectors-gatherers | 56.88 | 57.82 | 66.35 | 77.93 | 57.94 | 66.67 | 70.30 | 62.91 | 39.33 | 60.26 | 67.34 |
| % of total number as Elmidae | 1.88 | 2.04 | 3.21 | 0.00 | 0.00 | 0.85 | 0.38 | 3.29 | 0.00 | 22.52 | 0.00 |

**^ =Non-regulatory site**

**Table 16. TX-IBI Scores for Macroinvertebrate Community Samples Collected from Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek in Fall 2021.**

| TX-IBI Scores | MAR1 | MAR2 | MAR3 | OVR1 | OVR2 | OVR3 | LFC1 | LFC2 | LFC3 | HEN3^ | ELI3^ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa Richness | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| EPT taxa richness | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 3 |
| HBI biotic index | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 |
| % Chironomidae | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| % dominant taxon | 2 | 1 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 1 |
| % dominant FFG | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 |
| % Predators | 4 | 4 | 1 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 |
| Ratio of intolerant:tolerant taxa | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % of total Trichoptera as Hydropsychidae | 4 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 4 | 1 | 3 |
| # of non-insect taxa | 4 | 3 | 3 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 |
| % collectors-gatherers | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 |
| % of total number as Elmidae | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 4 | 1 | 2 | 1 |
| Total Score | 30 | 26 | 23 | 21 | 26 | 23 | 21 | 25 | 28 | 26 | 24 |
| Aquatic Life Use Rating | High | Intermediate | Intermediate | Limited | Intermediate | Intermediate | Limited | Intermediate | Intermediate | Intermediate | Intermediate |

**^ =Non-regulatory site**

**Table 17. Macroinvertebrate abundances collected at each sample site along Mary's Creek, Farmer's Branch, Big Fossil Creek, and Sycamore Creek in Spring 2021.**

| Common Name | Order | Family | MRY0+ | MRY1 | MRY2 | MRY3 | FAR3^ | BFC1 | BFC2 | BFC3 | SYC1 | SYC2 | SYC3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flatworms | Turbellaria | | 3 | 14 | 4 | 2 | 0 | 24 | 0 | 5 | 2 | 2 | 0 |
| Nematodes | Nematoda | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Worms | Oligochaeta | Lumbriculidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | | Tubificidae | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 2 | 3 | 6 |
| | | Naididae | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 2 | 12 | 15 |
| Leeches | Hirudinea | | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 5 | 3 | 4 |
| Snails | Gastropoda | Physidae | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 4 | 1 | 0 | 2 |
| | | Planorbidae | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 1 |
| | | Lymnaeidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Hydrobiidae | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | Ancylidae | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 |
| Clams | Bivalvia | Corbiculidae | 0 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 2 | 1 | 0 |
| | | Sphaeridae | 2 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 | 5 | 0 |
| Crawfish | Decapoda | Cambaridae | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scuds | Amphipoda | Hyallelidae | 0 | 4 | 0 | 4 | 0 | 2 | 22 | 6 | 1 | 0 | 0 |
| Mayflies | Ephemeroptera | Baetidae | 115 | 30 | 39 | 81 | 134 | 46 | 84 | 58 | 16 | 20 | 31 |
| | | Caenidae | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 5 | 5 | 2 | 3 |
| | | Heptageniidae | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Leptophyphidae | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| Caddisflies | Trichoptera | Brachycentridae | 0 | 0 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 0 | 2 |
| | | Helicopsychidae | 0 | 0 | 0 | 0 | 0 | 3 | 14 | 5 | 1 | 0 | 4 |
| | | Hydropsychidae | 26 | 4 | 25 | 3 | 67 | 61 | 3 | 62 | 42 | 7 | 3 |
| | | Hydroptilidae | 6 | 1 | 0 | 0 | 78 | 7 | 0 | 2 | 0 | 0 | 0 |
| | | Leptoceridae | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | | Philopotamidae | 11 | 0 | 29 | 9 | 0 | 6 | 3 | 0 | 0 | 0 | 0 |
| | | Odontoceridae | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**+=Potential new reference site, non-regulatory site**

**^ =Non-regulatory site**

**Table 17. Macroinvertebrate abundances collected at each sample site along Mary's Creek, Farmer's Branch, Big Fossil Creek, and Sycamore Creek in Spring 2021, continued.**

| Common Name | Order | Family | MRY0+ | MRY1 | MRY2 | MRY3 | FAR3^ | BFC1 | BFC2 | BFC3 | SYC1 | SYC2 | SYC3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Damselflies | Zygoptera | Coenagrionidae | 6 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| True Water Bugs | Hemiptera | Corixidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Saldidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Veliidae | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Beetles | Coleoptera | Carabidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Elmidae | 4 | 4 | 9 | 3 | 1 | 13 | 0 | 0 | 3 | 24 | 0 |
| | | Hydrophilidae | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Staphylinidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dobsonflies | Megaloptera | Corydalidae | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Butterflies and Moths | Lepidoptera | Crambidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Midges and flies | Diptera | Ceratopogonidae | 0 | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | | Empididae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Psychodidae | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Simuliidae | 151 | 59 | 16 | 6 | 28 | 16 | 2 | 85 | 7 | 27 | 15 |
| | | Stratiomyidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Tipulidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Chironominae | 41 | 76 | 109 | 69 | 53 | 67 | 14 | 67 | 72 | 49 | 59 |
| | | Tanypodinae | 9 | 2 | 5 | 11 | 6 | 2 | 5 | 6 | 8 | 2 | 12 |
| | | Orthocladiinae | 0 | 6 | 4 | 6 | 2 | 7 | 16 | 2 | 7 | 1 | 16 |
| | **Number of Individuals** | | 381 | 210 | 246 | 199 | 379 | 277 | 171 | 314 | 182 | 158 | 174 |

**+=Potential new reference site, non-regulatory site**

**^ =Non-regulatory site**

**Table 18. Macroinvertebrate abundances collected at each sample site along Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek in Spring 2021.**

| Common Name | Order | Family | MAR1 | MAR2 | MAR3 | OVR1 | OVR2 | OVR3 | LFC1 | LFC2 | LFC3 | HEN3^ | ELI3^ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flatworms | Turbellaria | | 0 | 0 | 0 | 1 | 8 | 9 | 102 | 0 | 5 | 4 | 4 |
| Nematodes | Nematoda | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Worms | Oligochaeta | Lumbriculidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Tubificidae | 0 | 6 | 0 | 30 | 16 | 0 | 3 | 0 | 0 | 0 | 0 |
| | | Naididae | 0 | 1 | 0 | 77 | 30 | 19 | 12 | 0 | 1 | 0 | 0 |
| Leeches | Hirudinea | | 3 | 1 | 0 | 3 | 40 | 8 | 0 | 0 | 0 | 0 | 0 |
| Snails | Gastropoda | Physidae | 1 | 0 | 1 | 7 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| | | Planorbidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Lymnaeidae | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Hydrobiidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Ancylidae | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Clams | Bivalvia | Corbiculidae | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 4 | 1 | 1 | 0 |
| | | Sphaeridae | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 |
| Crawfish | Decapoda | Cambaridae | 0 | 2 | 5 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Scuds | Amphipoda | Hyallelidae | 0 | 9 | 25 | 0 | 1 | 1 | 28 | 0 | 0 | 0 | 0 |
| Mayflies | Ephemeroptera | Baetidae | 98 | 14 | 21 | 0 | 14 | 6 | 145 | 13 | 43 | 61 | 17 |
| | | Caenidae | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 7 | 0 | 0 | 0 |
| | | Heptageniidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | Leptophyphidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Caddisflies | Trichoptera | Brachycentridae | 0 | 3 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 0 |
| | | Helicopsychidae | 0 | 0 | 1 | 0 | 0 | 0 | 4 | 0 | 2 | 1 | 4 |
| | | Hydropsychidae | 3 | 3 | 4 | 0 | 48 | 5 | 18 | 0 | 45 | 31 | 75 |
| | | Hydroptilidae | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 0 |
| | | Leptoceridae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Philopotamidae | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 1 |
| | | Odontoceridae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**^ =Non-regulatory site**

**Table 18. Macroinvertebrate abundances collected at each sample site along Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek in Spring 2021, continued.**

| Common Name | Order | Family | MAR1 | MAR2 | MAR3 | OVR1 | OVR2 | OVR3 | LFC1 | LFC2 | LFC3 | HEN3^ | ELI3^ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Damselflies | Zygoptera | Coenagrionidae | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | 0 |
| True Water Bugs | Hemiptera | Corixidae | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Saldidae | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Veliidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Beetles | Coleoptera | Carabidae | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Elmidae | 29 | 10 | 10 | 0 | 0 | 1 | 22 | 3 | 2 | 4 | 0 |
| | | Hydrophilidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Staphylinidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| Dobsonflies | Megaloptera | Corydalidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Butterflies and Moths | Lepidoptera | Crambidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Midges and flies | Diptera | Ceratopogonidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 |
| | | Empididae | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| | | Psychodidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Simuliidae | 12 | 43 | 22 | 1 | 38 | 33 | 6 | 1 | 4 | 4 | 33 |
| | | Stratiomyidae | 0 | 0 | 0 | 2 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | Tipulidae | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | Chironominae | 22 | 46 | 45 | 29 | 200 | 61 | 172 | 182 | 86 | 60 | 54 |
| | | Tanypodinae | 5 | 2 | 0 | 3 | 16 | 7 | 7 | 6 | 2 | 6 | 2 |
| | | Orthocladiinae | 6 | 8 | 26 | 71 | 142 | 38 | 18 | 28 | 9 | 11 | 1 |
| | **Number of Individuals** | | 180 | 155 | 163 | 229 | 569 | 199 | 549 | 248 | 210 | 196 | 193 |

**^ =Non-regulatory site**

**Table 19. Macroinvertebrate abundances collected at each sample site along Mary's Creek, Farmer's Branch, Big Fossil Creek and Sycamore Creek during Fall 2021.**

| Common Name | Order | Family | MRY1 | MRY2 | MRY3 | FAR3^ | BFC1 | BFC2 | BFC3 | SYC1 | SYC2 | SYC3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flatworms | Turbellaria | | 0 | 1 | 3 | 0 | 1 | 2 | 2 | 3 | 0 | 0 |
| Worms | Oligochaeta | Lumbriculidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Tubificidae | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 0 | 0 |
| | | Naididae | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Leeches | Hirudinea | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 9 | 7 |
| Snails | Gastropoda | Physidae | 8 | 0 | 3 | 39 | 4 | 0 | 12 | 4 | 0 | 2 |
| | | Planorbidae | 1 | 0 | 1 | 0 | 2 | 3 | 4 | 6 | 1 | 0 |
| | | Lymnaeidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Hydrobiidae | 0 | 0 | 0 | 6 | 0 | 0 | 7 | 0 | 0 | 0 |
| | | Ancylidae | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 9 | 1 | 0 |
| Clams | Bivalvia | Corbiculidae | 24 | 2 | 0 | 0 | 1 | 0 | 2 | 5 | 1 | 0 |
| Scuds | | Sphaeridae | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 |
| | Amphipoda | Hyallelidae | 0 | 0 | 3 | 2 | 4 | 6 | 17 | 0 | 0 | 0 |
| Mayflies | Ephemeroptera | Baetidae | 15 | 6 | 35 | 0 | 13 | 15 | 9 | 15 | 29 | 70 |
| | | Caenidae | 1 | 1 | 6 | 1 | 1 | 0 | 5 | 0 | 2 | 0 |
| | | Heptageniidae | 7 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 6 |
| | | Leptophyphidae | 9 | 1 | 5 | 0 | 27 | 42 | 7 | 1 | 0 | 3 |
| Caddisflies | Trichoptera | Brachycentridae | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 5 | 2 | 0 |
| | | Helicopsychidae | 0 | 1 | 1 | 0 | 8 | 38 | 6 | 50 | 0 | 6 |
| | | Hydropsychidae | 0 | 13 | 1 | 0 | 27 | 3 | 0 | 38 | 28 | 27 |
| | | Hydroptilidae | 2 | 0 | 0 | 0 | 10 | 21 | 2 | 17 | 3 | 10 |
| | | Leptoceridae | 0 | 0 | 0 | 0 | 6 | 1 | 7 | 0 | 0 | 0 |
| | | Philopotamidae | 1 | 43 | 4 | 0 | 3 | 12 | 0 | 47 | 153 | 43 |
| | | Odontoceridae | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dragonflies | Anisoptera | Gomphidae | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Libellulidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**MRY0 was not sampled**

**Table 19. Macroinvertebrate abundances collected at each sample site along Mary's Creek, Farmer's Branch, Big Fossil Creek and Sycamore Creek during Fall 2021, continued.**

| Common Name | Order | Family | MRY1 | MRY2 | MRY3 | FAR3^ | BFC1 | BFC2 | BFC3 | SYC1 | SYC2 | SYC3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Damselflies | Zygoptera | Coenagrionidae | 18 | 12 | 19 | 0 | 9 | 19 | 5 | 33 | 6 | 8 |
| | | Calopterygidae | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| True water bugs | Hemiptera | Belostomatidae | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Hebridae | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Mesoveliidae | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| | | Naucoridae | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Veliidae | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Beetles | Coleoptera | Elmidae | 11 | 4 | 10 | 1 | 0 | 1 | 0 | 4 | 5 | 3 |
| | | Hydrophilidae | 4 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Dobsonflies | Megaloptera | Corydalidae | 1 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Butterflies and moths | Lepidoptera | Crambidae | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Midges and flies | Diptera | Ceratopogonidae | 2 | 2 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | | Culicidae | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Empididae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Ephydridae | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Psychodidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Simuliidae | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Stratiomyidae | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | | Tipulidae | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Chironominae | 23 | 130 | 57 | 4 | 45 | 15 | 40 | 94 | 137 | 95 |
| | | Tanypodinae | 4 | 2 | 9 | 5 | 42 | 11 | 30 | 4 | 10 | 22 |
| | | Orthocladiinae | 0 | 3 | 6 | 0 | 10 | 1 | 0 | 3 | 8 | 4 |
| | **Number of Individuals** | | 143 | 227 | 179 | 63 | 225 | 193 | 161 | 345 | 398 | 311 |

**MRY0 was not sampled**

**Table 20. Macroinvertebrate abundances collected at each sample site along Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek during Fall 2021.**

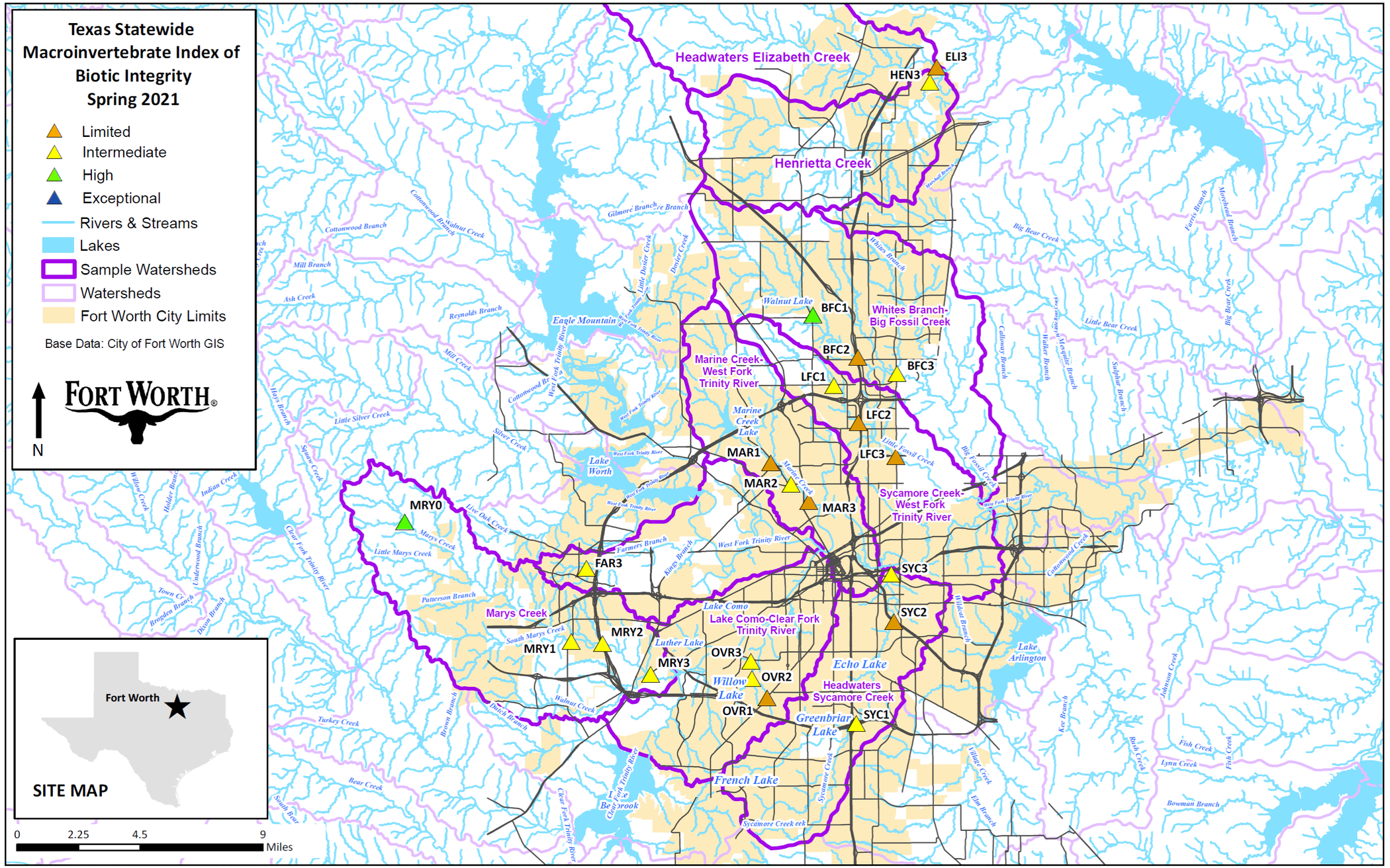
| Common Name | Order | Family | MAR1 | MAR2 | MAR3 | OVR1 | OVR2 | OVR3 | LFC1 | LFC2 | LFC3 | HEN3^ | ELI3^ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flatworms | Turbellaria | | 0 | 1 | 0 | 0 | 12 | 14 | 2 | 5 | 0 | 9 | 7 |
| Worms | Oligochaeta | Lumbriculidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 |
| | | Tubificidae | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 11 | 0 |
| | | Naididae | 0 | 2 | 0 | 18 | 1 | 6 | 5 | 1 | 0 | 0 | 5 |
| Leeches | Hirudinea | | 2 | 1 | 0 | 1 | 8 | 0 | 12 | 0 | 8 | 0 | 0 |
| Snails | Gastropoda | Physidae | 2 | 0 | 3 | 19 | 0 | 0 | 25 | 1 | 40 | 1 | 2 |
| | | Planorbidae | 1 | 1 | 1 | 1 | 0 | 0 | 11 | 0 | 13 | 0 | 13 |
| | | Lymnaeidae | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| | | Hydrobiidae | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Ancylidae | 1 | 1 | 0 | 2 | 1 | 0 | 1 | 2 | 2 | 1 | 0 |
| Clams | Bivalvia | Corbiculidae | 1 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 16 | 8 | 0 |
| Scuds | | Sphaeridae | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 0 |
| | Amphipoda | Hyallelidae | 57 | 0 | 0 | 15 | 7 | 9 | 160 | 3 | 47 | 4 | 1 |
| Mayflies | Ephemeroptera | Baetidae | 4 | 20 | 64 | 3 | 60 | 72 | 0 | 25 | 8 | 20 | 19 |
| | | Caenidae | 6 | 0 | 0 | 0 | 2 | 26 | 2 | 2 | 1 | 0 | 0 |
| | | Heptageniidae | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| | | Leptophyphidae | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 2 |
| Caddisflies | Trichoptera | Brachycentridae | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Helicopsychidae | 38 | 22 | 0 | 0 | 0 | 7 | 0 | 6 | 1 | 0 | 1 |
| | | Hydropsychidae | 0 | 14 | 39 | 2 | 31 | 21 | 1 | 13 | 0 | 20 | 10 |
| | | Hydroptilidae | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 2 |
| | | Leptoceridae | 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | Philopotamidae | 3 | 4 | 43 | 1 | 31 | 39 | 0 | 11 | 0 | 3 | 21 |
| | | Odontoceridae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dragonflies | Anisoptera | Gomphidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | Libellulidae | 1 | 0 | 0 | 3 | 0 | 2 | 2 | 0 | 0 | 0 | 0 |

**^ =Non-regulatory site**

**Table 20. Macroinvertebrate abundances collected at each sample site along Marine Creek, Overton Park Creek, Little Fossil Creek, Henrietta Creek, and Elizabeth Creek during Fall 2021, continued.**

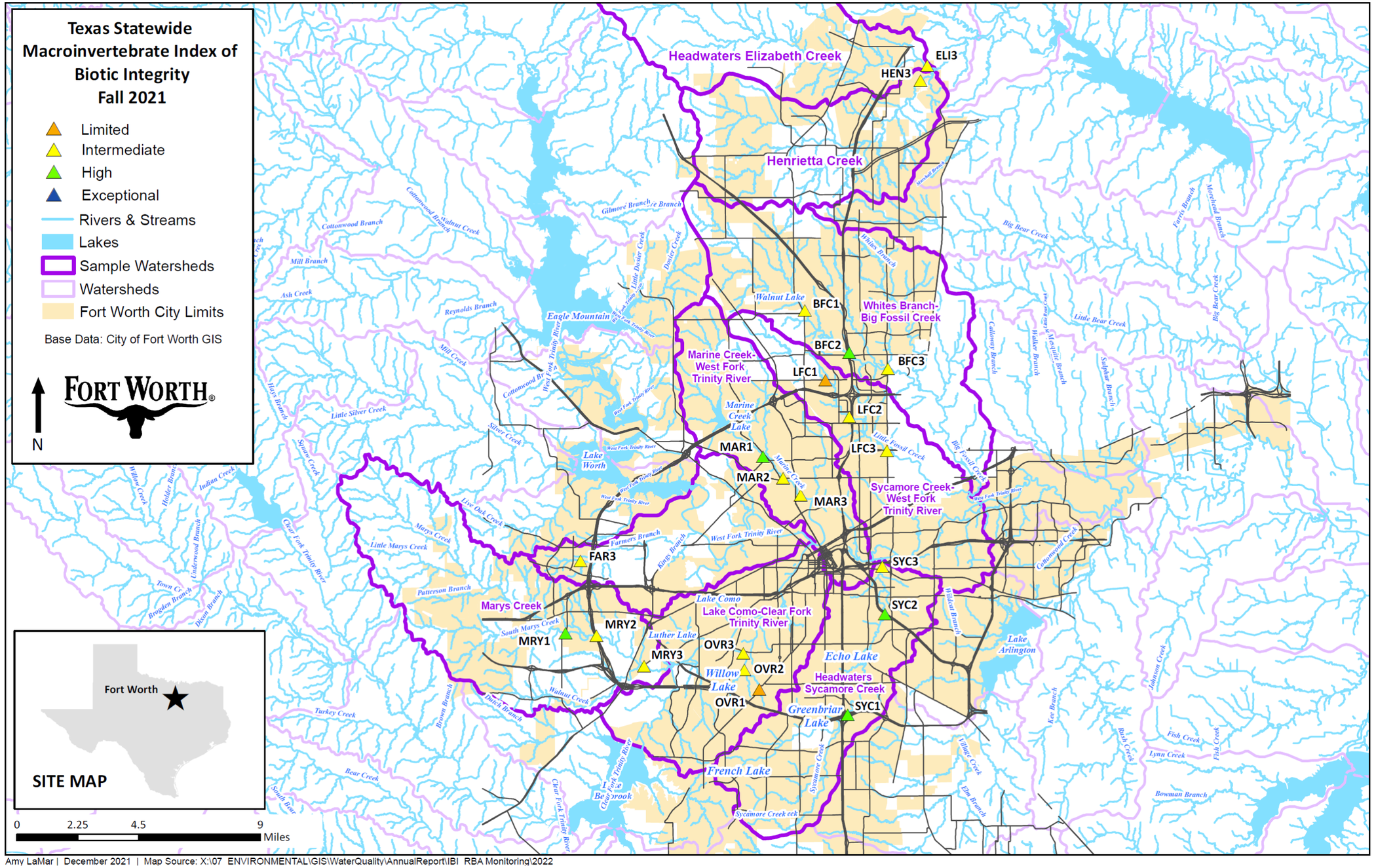
| Common Name | Order | Family | MAR1 | MAR2 | MAR3 | OVR1 | OVR2 | OVR3 | LFC1 | LFC2 | LFC3 | HEN3^ | ELI3^ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Damselflies | Zygoptera | Coenagrionidae | 6 | 12 | 9 | 7 | 2 | 16 | 4 | 36 | 7 | 9 | 11 |
| | | Calopterygidae | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| True water bugs | Hemiptera | Belostomatidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Hebridae | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | | Mesoveliidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Naucoridae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Veliidae | 0 | 0 | 3 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 2 |
| Beetles | Coleoptera | Elmidae | 3 | 3 | 10 | 0 | 0 | 3 | 1 | 7 | 0 | 34 | 0 |
| | | Hydrophilidae | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| Dobsonflies | Megaloptera | Corydalidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Butterflies and moths | Lepidoptera | Crambidae | 0 | 2 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| Midges and flies | Diptera | Ceratopogonidae | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 3 |
| | | Culicidae | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Empididae | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Ephydridae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Psychodidae | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Simuliidae | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| | | Stratiomyidae | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Tipulidae | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Chironominae | 7 | 60 | 132 | 121 | 65 | 120 | 16 | 88 | 9 | 17 | 136 |
| | | Tanypodinae | 11 | 2 | 1 | 2 | 8 | 9 | 16 | 4 | 18 | 1 | 5 |
| | | Orthocladiinae | 0 | 0 | 0 | 7 | 0 | 0 | 1 | 6 | 3 | 2 | 3 |
| | **Number of Individuals** | | 160 | 147 | 312 | 213 | 233 | 354 | 266 | 213 | 178 | 151 | 248 |

**^ =Non-regulatory site**




Amy LaMar | December 2021 | Map Source: X:\07_ENVIRONMENTAL\GIS\WaterQuality\AnnualReport\IBI_RBA Monitoring\2022

**Figure 1. TX Statewide Macroinvertebrate IBI Aquatic Life Use Ratings, Spring 2021.**




Amy LaMar | December 2021 | Map Source: X:\07 ENVIRONMENTAL\GIS\WaterQuality\AnnualReport\IBI RBA Monitoring\2022

**Figure 2. TX Statewide Macroinvertebrate IBI Aquatic Life Use Ratings, Fall 2021.**

**ATTACHMENT 2. TARRANT REGIONAL WATER DISTRICT 2021 MS4 ANNUAL REPORT**


# *Tarrant Regional Water District*
# *Annual Report*
## *March 8, 2021-March 7, 2022*

## *TPDES PERMIT No.*
## ***WQ0004350000***

# Stormwater Permit Annual Report

## TPDES Permit No. WQ0004350000

## March 8, 2021 - March 7, 2022

1. **Annual Expenditures for the Reporting Period with a Breakdown for the Major Elements of the Storm Water Management Program and the Budget for the Year Following each Annual Report**

   The Fiscal Analysis shows a floodway system total budget for FY2021 of $2,613,681with $2,145,250 documented in actuals for the year. The budgeted expenses are similar for FY2022 with a total budget of$2,889,910. The floodway projects and maintenance budgets are similar to previous budget costs.

   Additional funds outside the floodway budget were utilized in this reporting period for assessing water quality impacts. $22,533 was used for the sampling expenses associated with routine monitoring of the river at five locations, the six additional bacteria sites, and the stormwater passive sampling program. $1500 is budgeted for sediment testing on the Trinity River that continues to be done as needed for TCLP metals and organics on major dredging activities. The same budgets for all programs are included in the FY2022 budget for monitoring water quality within the Floodway. Additionally, the District contributed $181,503 for support of USGS stream gauges on the West Fork Trinity in this reporting period. This includes support for a gauge downstream of the confluence near Nutt Dam. This gauge measures and records water quantity and quality as well as supporting a weather station. It measures flow, stage, water temperature, pH, DO, SpC, and turbidity in the river. The weather station records air temperature, wind speed and direction, precipitation, barometric pressure and relative humidity. The District spent $33,948 in this reporting period for refinement of the river model used to help evaluate water quality through The Floodway. Current efforts are focusing on improving water quality calibration. The District has $25,000 budgeted in FY22 for continued support of the modeling effort. Additionally, $50,000 is budgeted for development and deployment of an educational program for developers in order to assist with their understanding of design elements and water quality goals of the stormwater BMP program required for new developments and re-development in the Floodway.

## 2. Minimum Control Measures (MCM)

### 1.0 MS4 Maintenance Activities

For this reporting period, the District held two in-person cleanup events and two virtual challenges. The Spring Trash Bash event was held April 17, 2021. Approximately 1800 volunteers registered to clean up 8 Trinity River locations plus Marine Creek Lake. An estimated 12,000 pounds of trash were collected at the event. The District contributed $9,759 for sponsorship of the event. Additionally, a Fall Trash Bash event was held September 18-19, 2021. The reservoir community cleanups are now aligned with the Trinity River fall cleanup event to make one large area wide effort. There were approximately 200 volunteers at the Bridgeport Lake event and 500 at the Eagle Mountain Lake event. The combined effort from these lakes netted about 2,000 pounds of trash. These events were funded with $4354. Nearly 800 volunteers came out for the event at Cedar Creek Lake with a District cost of $6323. For the Trinity River event, close to 4,000 volunteers came out and collected about 18,000 pounds of trash from the river and Marine Creek Lake. The District contributed $20,802 to the community event. In an effort to expand awareness of litter issues past the annual events, TRWD has utilized the Litterati app to create some virtual cleanup challenges. Participants can upload pictures of trash to the app to be part of the events. The virtual Trash Bash Challenge logged 1,484 pieces of litter from April-September 2021. The Adopt-A-River program documented 2,304 pieces of litter removed from April 2021-February 2022.

The District has maintained two floatables collectors on the Clear Fork since 2006, as well as routinely removing debris and trash from the 14 low water dams within The Floodway. There has been one collector setup just upstream of Rosedale Street that uses a boom across the river to trap floatables. This would work with small runoff events, but large events cause the boom to break free. Additionally, because of the width of the river, there is not an efficient manner in which to remove the trash. Therefore, this collector is no longer in place. The trash collector installed at Sump #19 is functional. The collectors on the sump outfall are rigid baskets that collect trash and debris and allow the water to pass through. 13,800 pounds of floatables were removed from the river at this location.

The trash collectors have been included in the routine floodway maintenance program that is triggered into effect with a ½ inch storm event. After such an event, all the dams and the trash collector are visually inspected for maintenance and debris accumulation. For this reporting period, a total of 50 tons of debris was removed from the Floodway. See Figure 1 for the quantity removed by location. The majority of the debris was removed from the Clear Fork arm of the Trinity. Most of the removal was done in Spring of 2021, since there has not been much rainfall for the remainder of the reporting period.

**Figure 1**
**Floodway Debris Removal Sites (Tons)**
March 2021-February 2022

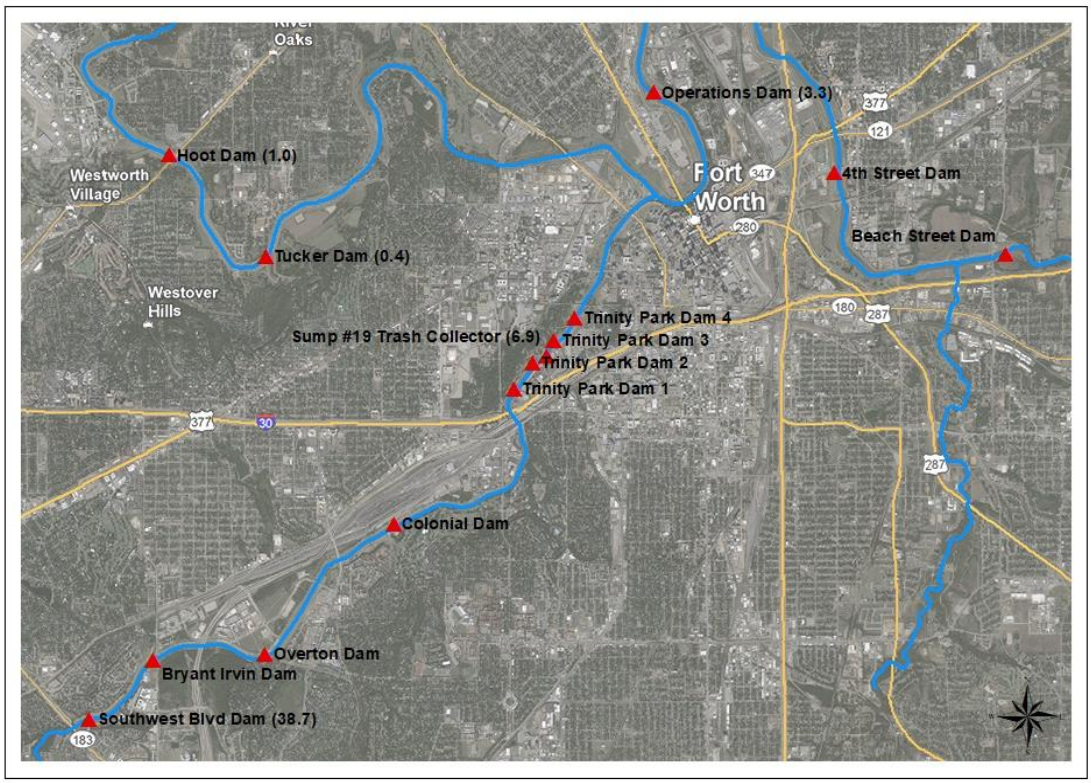



Figure 1 – Floodway Debris Removal by Location

## 2.0 Post-Construction Stormwater Control Measures

In accordance with the requirements of the MS4 Post-Construction Storm Water Control Measures, The District has implemented standards for development and redevelopment within the Floodway of the District's MS4 boundaries that will remove pollutants prior to entering the Trinity River. Historically, the District has required measures for reduction of sediment and floatables. More recently, the District has increased the standards for developments within the Floodway by implementing a permitting program that requires stormwater treatment plans to address nitrogen, phosphorus and bacteria removal in addition to sediment and floatables.

Stormwater treatment plans must be approved by the District prior to a building permit for the site being issued by the City of Fort Worth. Additionally, the stormwater treatment plans must be accompanied by a signed copy of the Stormwater Facility Maintenance

Agreement that has been reviewed and filed with the City of Fort Worth. The Water Quality Guidance Manual is available on the Stormwater page of the TRWD website:

https://www.trwd.com/wp-content/uploads/2019/04/TRWD-WQ-Guidance-Manual_June-2018-Updated-Sept.-2018-Compressed.pdf

For this reporting period, Clifton Riverside Development is the only development with an approved post-construction water quality treatment design that meets District criteria.

As an additional measure to provide education on best management practices available, an ArcGIS storymap has been developed. The storymap called "Best Management Practices along the Trinity River" includes background information on why BMPs are important and provides visual examples of what installed BMPs can look like. Ideally, the storymap will be a resource for developments near the floodway that need to include stormwater treatment on site.

The District continues to refine a Ce-Qual-W2 model for the Trinity River. Work on the model done within this reporting period focused on review of the kinetic values in the model in reference to literature values and other existing models of Texas systems. Additionally, sensitivity analysis was done in order to see what kinetics and inputs to the model have the most effect on the model outcome.

## 3.0 Illicit Discharge Detection and Elimination

The District responded to 35 environmental complaints within the West Fork Trinity Basin. The main complaints are in regard to sewage spills, fuel spills, and construction site runoff. Within this reporting period, there were several incidents investigated:

- May 13, 2021 there was a report of standing water from an unknown source near the boat ramp at Marine Creek Lake. It was determined to be a water leak from the irrigation system.
- December 2, 2021, a Complaint was received regarding hazardous materials barrels located near the Floodway. It was determined to be non-hazardous soil and trash removed from a construction site.
- February 8, 2022 there was a report of oil barrels dumped in Big Sandy Creek. Two barrels were located with a small amount of oily substance in each. No sheen could be located downstream in the creek.

4.0 Pollution Prevention and Good Housekeeping for Municipal Operations

In order to promote effective stormwater practices and minimized pollution within TRWD projects and facilities, the TRWD University education system was utilized. Videos are available for refreshing good stormwater practices. The video titled "Stormwater Pollution Prevention Plan (SWPP): Development: Selecting Good Housekeeping BMPs" is available to all employees.

5.0 Industrial and High Risk Runoff – Not Applicable

6.0 Construction Site Stormwater Runoff

The Floodway Construction Pamphlet criterion continues to be utilized to review and approve construction activities in the Floodway. The District approves new projects, monitors the progress on projects underway, and inspects completed projects. Post-construction stormwater control criteria are addressed in the Floodway Construction Pamphlet under the sections for vegetation establishment and erosion control. This is the summary of projects reviewed in this reporting period:

- MCI Bores – Clear Fork
- Trinity Trail Improvements – Old University Drive
- Harrold Street Trail Connection
- Tilley Bridge Project
- Oak Forest Drive Sewer Repair
- Rooftop Ventures
- Oncor Transmission Lines – North Main
- Riverside Park Improvements
- Rivercrest Country Club
- Art Gallery – Red Bud Lane
- Greystar Overture Development
- Colonial Country Club Renovation
- White Settlement Road Bend Strengthening Project
- Clear Fork Lift Station
- Churchill Road utility work
- Clifton Riverside

7.0 Public Education, Outreach, Involvement and Participation

- The District continued its rainbow trout stocking program on the Trinity River in FY2022 for the 35th year. In a partnership with Texas Parks and Wildlife, TRWD stages

several trout releases throughout the winter. Trout Stockings occurred on the Clear Fork Trinity at River Park and Trinity Park on December 16, 2021, January 11, 2022, and February 8, 2022. $26,567 was spent on the stocking program in FY2022. The program is based on approximately 2200 fish at each release.

- TRWD was able to resume the annual Flyfest festival on the Clear Fork Trinity River on March 13, 2021. This marked the 6th annual event to bring people out to enjoy the river. The festival brings out avid fishermen as well as beginners who want to learn the sport. The family friendly event has activities for kids and many vendors and educational displays to visit along the bank of the river. The District contributed $58,303 for the event.

- Tarrant Regional Water District has a very active community relations group that participates in Save Tarrant Water and Water is Awesome. Although in person presentations were not available this year, the online platforms for each program continued to educate and promote water conservation.

- The District has three trailers the watershed team uses for educational demonstrations. In this reporting period, the trailers were used for 18 events with approximately 4,113 total participants.

- Improvements were made to the campus wide RainScape Initiative located at the TRWD office complex. The main project for this reporting period is to update the landscape and replace some vegetation. Many of the plants were from the original installation in 2015 and needed some refreshment. $40,000 was put towards updating the vegetation. On October 6, 2021, the watershed team hosted a TRWD staff Weed-n-Feed. Employees from all departments were invited out for lunch in the RainScape garden to learn about the design features. Also, the staff were encouraged to help with garden maintenance by pulling weeds from the RainScape areas. The watershed team utilizes the RainScape for education and outreach through both in-person tours and online information and presentations. In total, it was featured in 14 events for a total of 2,858 contacts.

- The District continues to encourage recreation and utilize the river for the natural resource it is by expanding the Trinity Trails system. Within this reporting period, $78,121 has been spent on resurfacing a portion of the Lower West Fork Trail. In addition, complete trail replacement work has been done between Riverside Drive and Sycamore Creek at a cost of $109,771. TRWD has put $35,005 into ongoing maintenance at the Airfield Falls trailhead and an additional $27,336 has been spent on trailhead maintenance at 7 other trailhead locations along the Floodway.

- Summer fun events returned to the river for 2021. Rockin' The River was back with a full schedule of summer concerts for people to enjoy while tubing the river. 6 Rockin' the River concerts were held between July 3, 2021 and August 7, 2021 with a total count of 14,750 participants. Recreational activities were also available as part of Sunday Funday events through the summer. 10 Sunday Fundays were sponsored from June 27, 2021 to September 5, 2021 with approximately 2500 total participants. The District contributed $84,282 to the popular summer events.

- Fort Worth's Fourth was still held at Panther Island in 2021. The event was able to return to in-person this year, but on a more limited basis than in the past. Approximately 92,000 attended the event.

- There were approximately 39 other events that brought approximately 193,242 people to the river for a variety of festivals and activities.

## 8.0 Monitoring, Evaluation, and Reporting

TRWD began quarterly sampling at the 4th Street Dam in September 2000 and it is ongoing. Quarterly sampling at Beach St. Dam began in December 2001. Parameters for both impoundments include Temperature, Dissolved Oxygen, Conductivity, pH, Nitrogen series, Phosphorus series, *E. coli*, Sulfate, Chloride, Chlorophyll 'a', Cadmium, Chromium, Lead and Arsenic (all metals are dissolved). For this reporting period, the average E. coli values for 4th Street and Beach Street are 28 and 33.7, respectively. For the entire period of record, the geomeans are 37.4 and 48.1, respectively.

Routine monitoring of the Trinity River involves 3 primary river sites and one major tributary site where a full suite of parameters is collected. One new site was added to this program during the reporting period. The first section of canal was completed and a sampling station has been established to monitor the water quality with the same parameters as the river. The parameter suite includes Chlorophyll 'a', TSS, TDS, Nitrogen series, Phosphorus series, TOC, Chlorides, CBOD, *E. coli,* Silica, and Phytoplankton Enumeration. There are 5 additional sampling locations that are E. coli only, for a total of 9 monthly sampling locations. In-situ field measurements are recorded for temperature, pH, dissolved oxygen, specific conductance, and turbidity at all 9 monitoring stations. See Figures 2-7 for charts for a comparison of the major river sites. The data collected under this program is intended to capture a variety of hydrologic conditions. It is collected on a scheduled monthly basis and is not targeted towards high runoff events specifically.

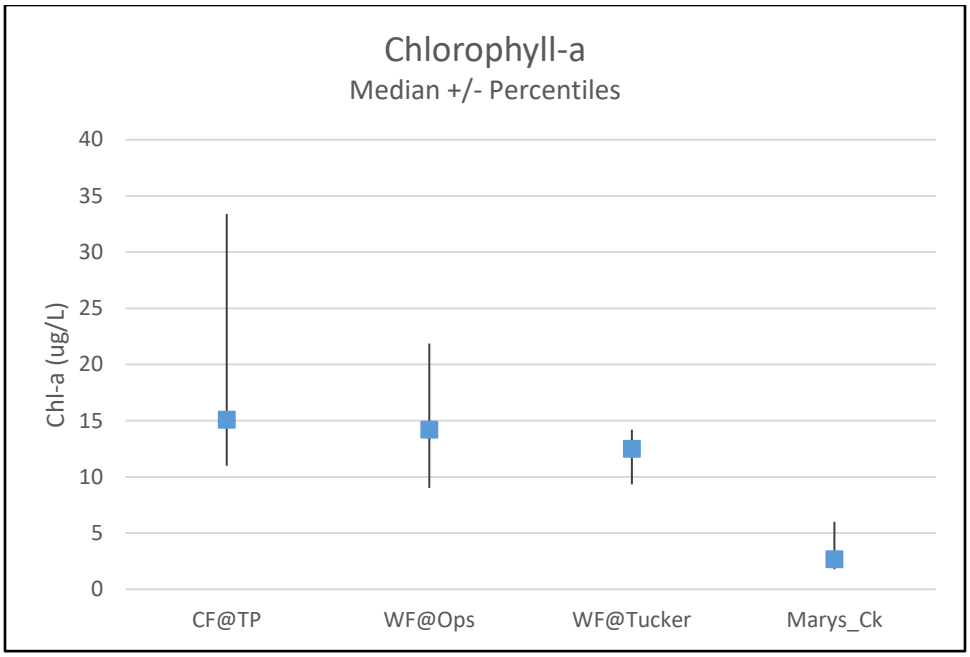



Figure 2 – Chlorophyll-a Medians and Percentiles for Primary River Sites

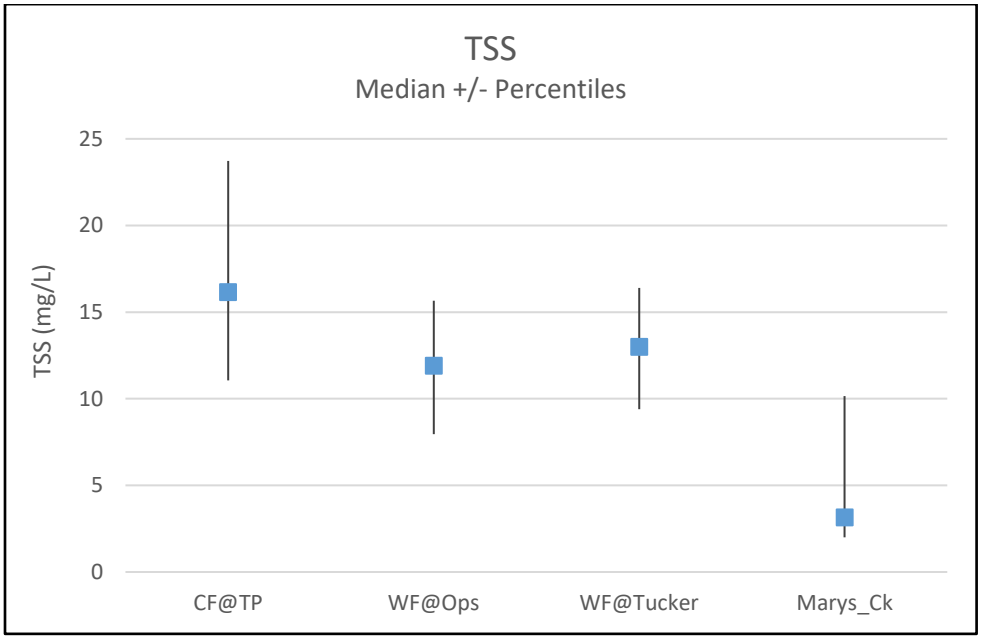



Figure 3 – TSS Medians and Percentiles for Primary River Sites

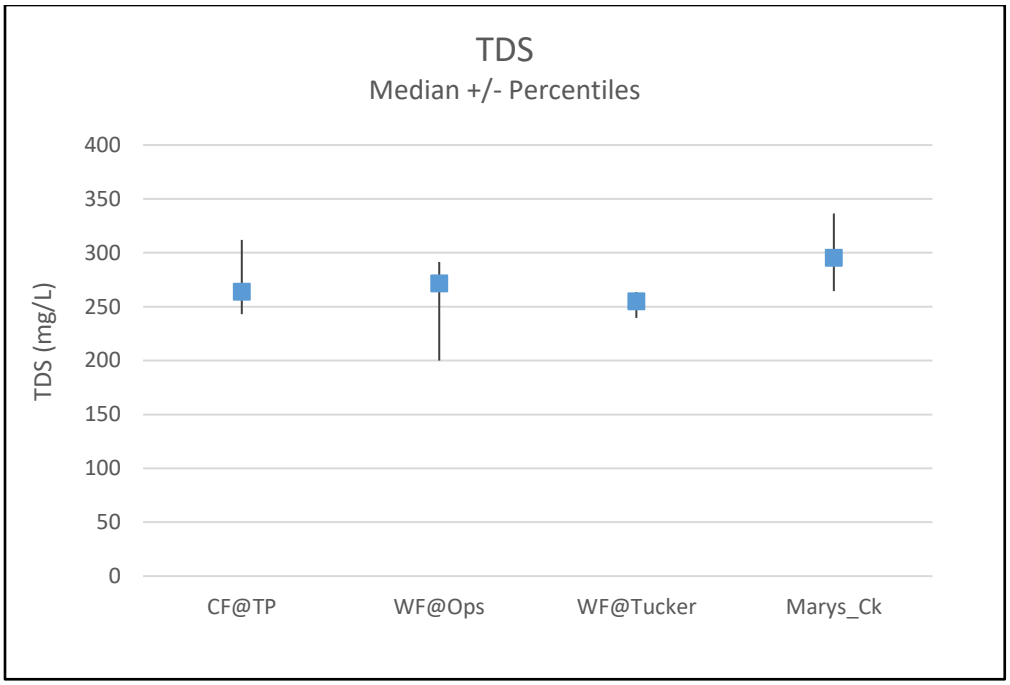


Figure 4 – TDS Medians and Percentiles for Primary River Sites

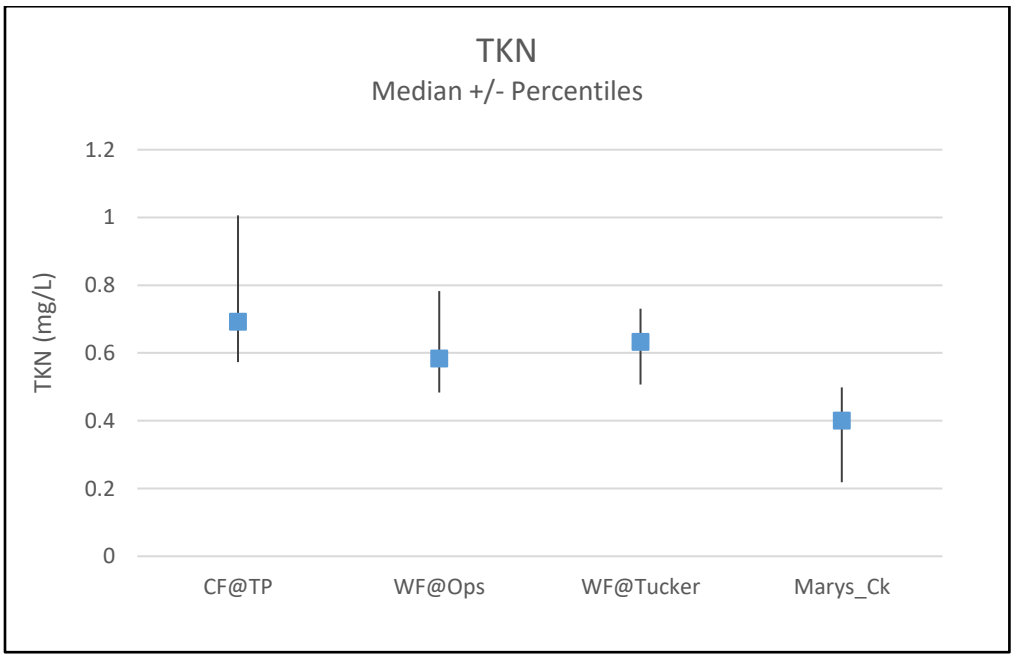


Figure 5 – TKN Medians and Percentiles for Primary River Sites

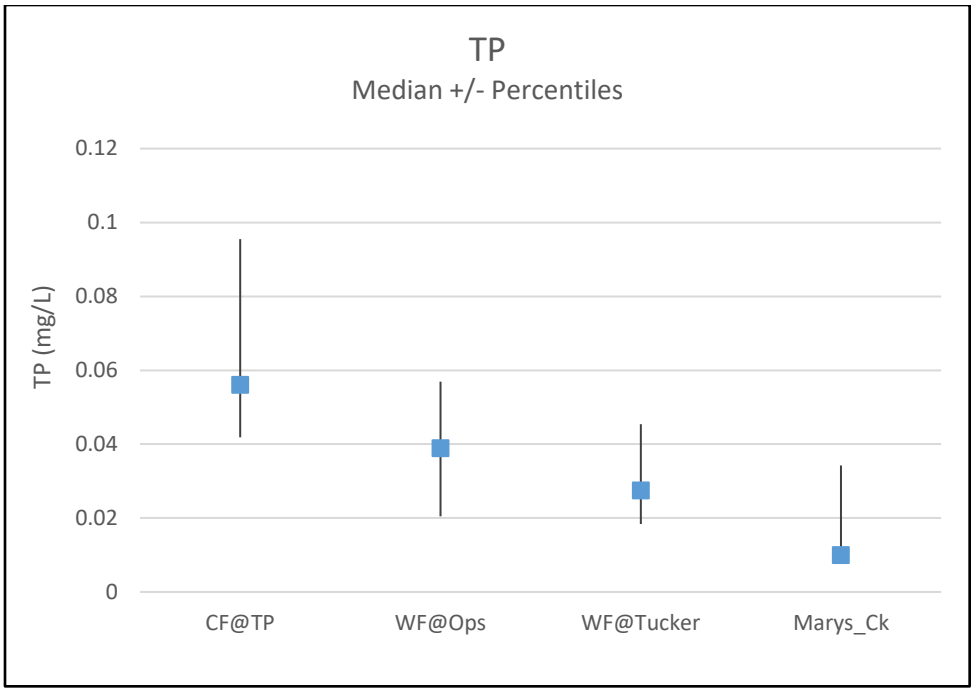


Figure 6 – TP Medians and Percentiles for Primary River Sites

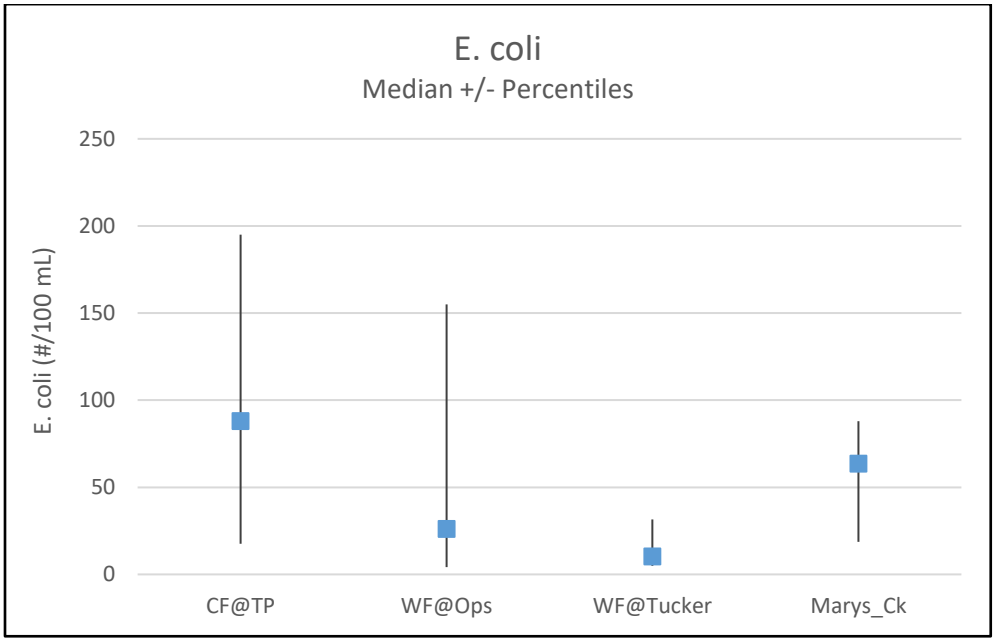


Figure 7 – E. coli Medians and Percentiles for Primary River Sites

There are two programs setup with the goal of measuring stormwater concentrations. The first sampling program characterizes the quality of stormwater runoff going to the Trinity River. An ISCO automated sampler is installed in a storm drain to collect water

quality samples from sump 17 during a runoff event. The runoff from this sump will characterize storm water quality from a multi-family residential landuse. For a given event, the ISCO is programmed to collect a first flush and 23 flow weighted samples. The storm flow information is logged to the ISCO. Each of the 24 sample bottles is analyzed for turbidity and specific conductance, and then collected samples are composited with the exception of the first sample bottle collected. The first flush sample and the composited sample are sent to the lab for analysis of total suspended solids and total phosphorus. For this reporting period, there were 4 sample sets collected at Sump 17. The average concentration for TSS is 264 mg/L for the first flush sample and 54 mg/L for the composite sample. The average concentration for TP is 0.49 mg/L for the first flush and 0.283 for the composite sample.

The second program is aimed at collecting data on river concentrations at 2 different points during a storm event. There are passive samplers deployed at 3 locations on the river and one tributary to the Clear Fork (Purcey Creek). The samplers are intended to sample the river when it rises 1 foot in elevation and again at 2 feet in elevation during storm events. The timing and conditions of storm events make it difficult to capture samples while the river is on the rise from receiving stormwater runoff. The passive samplers allow samples to be collected at consistent points in the hydrograph, which make for a more comparable dataset. In this reporting period, samples were captured from two separate storm events at all sampling stations. Based on the samples collected this year, Purcey Creek has a significantly higher TSS, TN, and TP concentration than the main river and a significantly lower chloride and TDS concentration than the main river during storm flows.

The third focus of the District's monitoring program is contact recreational usage. E. coli is the indicator parameter for contact recreation, and therefore the District collects bacteria samples at a higher frequency during the warmer months. Weekly bacteria sampling on the Trinity River at areas of high recreation have been in place since 2014. The weekly program runs from May-August, when the water temperatures are suitable for contact recreation. There are currently 4 stations sampled weekly. The sites are listed below with their current annual geomean:

- Clear Fork at Kayak Chute #4
    - 1-year Geomean = 181 MPN/100 mL
- West Fork at Hwy 199
    - 1-year Geomean = 183 MPN/100 mL
- West Fork at Confluence
    - 1-year Geomean = 90 MPN/100 mL
- West Fork at TRWD Operations
    - 1-year Geomean = 40 MPN/100 mL

The *E. coli* samples are collected and the resulting values are posted on the TRWD website within two days of sample collection. Both the grab sample values and the cumulative geomean are posted for public information. The geomean value for each site is calculated from all data collected for the period of one year prior to the current sample collection date. 114 weekly *E. coli* samples were collected from the recreational sites and an additional 92 samples were collected from routine sampling that were all posted to the website to track the water quality of the river. This year, more of the sample collection days fell after a rainfall event, which caused the annual geomean values to be higher than last year. Each week during the summer when there is an event planned, the recreational *E. coli* sample results are used to assign a safety rating is given to the Confluence based on bacteria levels and water discharge. The simplified format is intended to make it easy for the public to make informed decisions regarding water quality. A summary of the rating system:

| Rating | River Conditions | Recreation |
|---|---|---|
| Green | E. coli Levels are suitable for contact recreation (<399 MPN/100 mL) water flows are normal. | All recreation is allowed. |
| Yellow | E. coli levels are not suitable for contact recreation (>399 MPN/100 mL) and water flows are normal. | Only non-primary contact recreation activities are allowed. |
| Red | High water velocities | No recreational activities are allowed. |

In this reporting period, there were 6 weeks during the recreational season in which the E. coli exceeded the grab sample standard, however only one week had an event planned. A follow up set of samples collected the following day after the first set of samples confirmed that bacteria levels had dropped below the standard and allowed the event to go on. No events had to be canceled in the 2021 summer season.

# CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Woody Frossard
Environmental Director
Tarrant Regional Water District

May 10, 2022
Date