Final Report for the West Lake Houston Basin Implementation Project (West Fork San Jacinto River, Lake Creek, Cypress Creek, and Spring Creek Watersheds)

September 2025

This document was prepared by the Houston-Galveston Area Council for the stakeholders of the West Lake Houston Basin. It was prepared in cooperation with the Texas Commission on Environmental Quality and the United States Environmental Protection Agency.

This project has been funded wholly or in part by the U.S. Environmental Protection Agency under assistance agreement 582-23-40223 to the Texas Commission on Environmental Quality. The contents of this document do not necessarily reflect the views and policies of the U.S. Environmental Protection Agency nor does the U.S. Environmental Protection Agency endorse trade names or recommend the use of commercial products mentioned in this document.

Houston-Galveston Area Council

Texas Commission on Environmental Quality

EPA United States Environmental Protection Agency

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Abbreviations List

AU	Assessment Unit
CFU	Colony Forming Units
CRP	Clean Rivers Program
E. coli	*Escherichia coli*
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
EPA	United States Environmental Protection Agency
H-GAC	Houston-Galveston Area Council
MGD	Millions of Gallons per Day
mg/L	Milligrams Per Liter
mL	Milliliters
SAS	Statistical Analysis Software
SSO	Sanitary Sewer Overflow
SWQMIS	Surface Water Quality Monitoring Information System
TCEQ	Texas Commission on Environmental Quality
Texas Integrated Report	Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d)
TSS	Total Suspended Solids
WPP	Watershed Protection Plan
WWTF	Wastewater Treatment Facility

SECTION 1: INTRODUCTION

The West Lake Houston basin area is comprised of watersheds for Lake Creek, West Fork San Jacinto River, Spring Creek, and Cypress Creek. The total drainage area covers approximately 1,250 square miles of Harris, Waller, Montgomery, and Grimes counties. Lake Creek, Spring Creek, and Cypress Creek each form a confluence with the West Fork San Jacinto River which drains into Lake Houston (**Figure 1**).

Land cover in the basin area varies. In the watershed area for the West Fork of the San Jacinto River, land is characterized by developed areas especially near the Interstate 45 corridor and around the city of Conroe. These developed areas are surrounded by forest. In the Lake Creek watershed, developed areas hemmed in by forest persist south of Lake Conroe, but give way to a mix of forest and pasture/grassland toward the western edge of Montgomery County and into Grimes County. The Spring Creek watershed is characterized by highly developed areas surrounding the Woodlands Township and stretching along the Interstate 45 corridor. West of State Highway 249, the Spring Creek watershed land cover is more of a mix of forest and pasture/grassland. The Cypress Creek watershed is the most heavily developed of all the watersheds as it overlaps with urban areas in north Harris County. West of State Highway 290, there is a sudden shift to rural land cover such as pasture/grassland and some cultivated cropland. Development is expected to expand as growing populations push north from the Houston area along the major transportation corridors. Smaller cities such as Cut and Shoot, Magnolia, Oak Ridge North, Panorama Village, Pinehurst, Prairie View, Porter Heights, Shenandoah, Stagecoach, Waller, Willis, and Woodloch intersect or are completely contained within the basin area. Larger cities that intersect or are contained within the basin area include Conroe, Houston, Humble, Spring, The Woodlands Township, and Tomball.

Surface water quality in the water bodies of the West Lake Houston basin is impacted by point source pollutants such as improperly managed discharge from wastewater treatment facilities (WWTFs) and nonpoint source pollutants such as waste entering waterways through stormwater runoff. To improve water quality and address other concerns related to water resources, watershed protection plans (WPPs) have been developed by the stakeholders of each of the four watersheds in the West Lake Houston Basin[1]. As part of the WPP development process, water quality data analyses were conducted for each of the West Lake Houston basin watersheds to provide stakeholders with an understanding of water quality conditions. To understand the current status of surface water quality in the West Lake Houston basin area, the Houston-Galveston Area Council (H-GAC) has analyzed the most recent monitoring and report data and summarized the results of these analyses herein. These assessments will highlight any short-term changes in water quality observed in recent years.

This document includes:

- A summary of the design and purpose of each analysis
- A description of the data sources considered for each analysis which include ambient water quality monitoring data, discharge monitoring report (DMR) data from WWTFs, and reports of sanitary sewer overflows (SSOs).
- An overview of the implications of the results of the analyses.

[1] For more information, see the project websites for the West Fork Watersheds Partnership (www.westfork.weebly.com), Cypress Creek Partnership (www.cypresspartnership.weebly.com), and Spring Creek Partnership (www.springcreekpartnership.weebly.com).

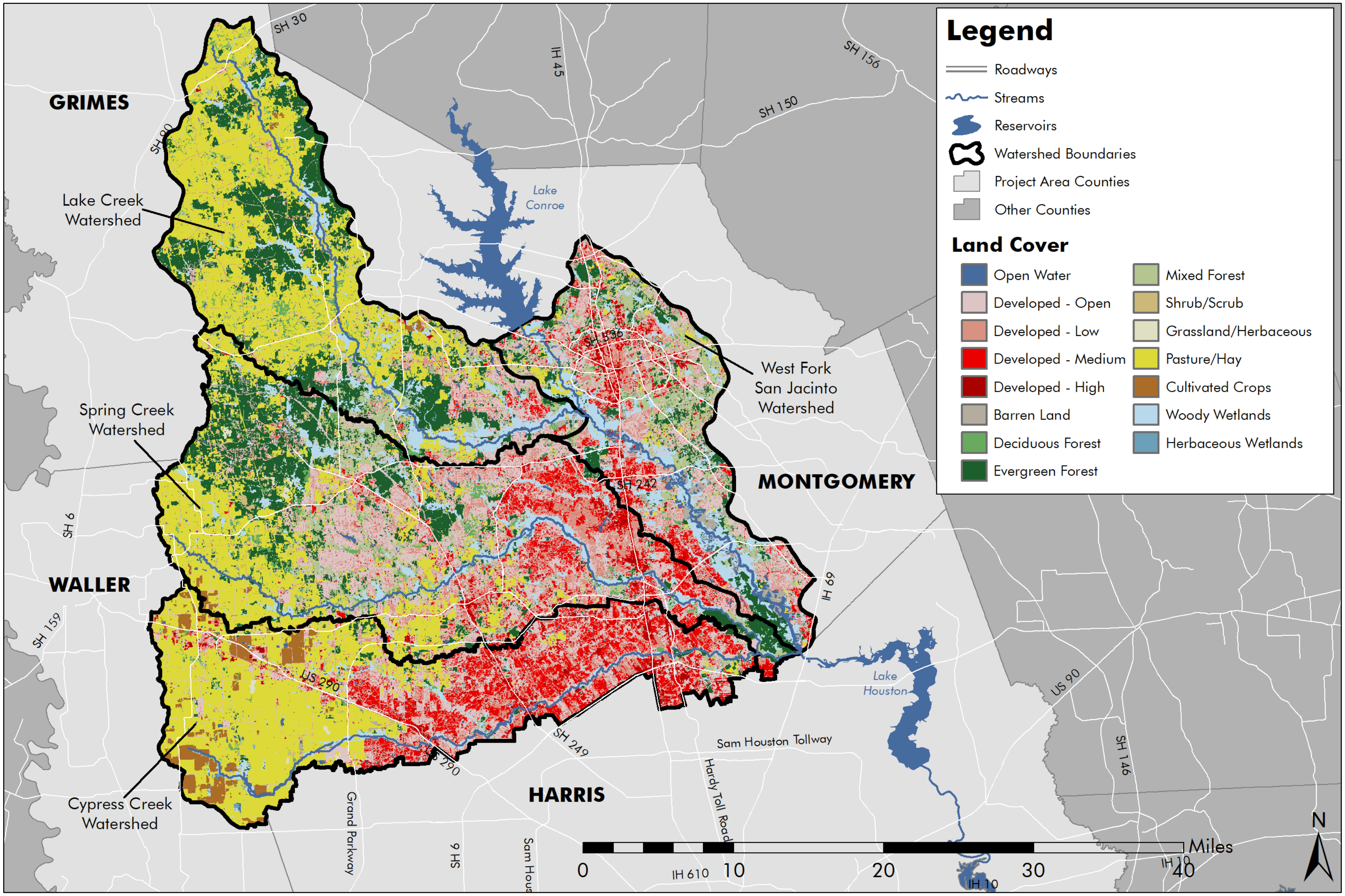


Figure 1. Regional Context and Land Cover in the West Lake Houston Basin

Section 2: Assessing the Basin

2.1 Water Quality Data

Based on findings from the *2024 Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d)* (Texas Integrated Report)[2] produced by the Texas Commission on Environmental Quality (TCEQ), multiple stream segments throughout the West Lake Houston basin watersheds of Spring Creek, Cypress Creek, Lake Creek, and the West Fork of the San Jacinto River are listed as impaired for contact recreation due to the frequent exceedance of state water quality standards for fecal indicator bacteria, *Escherichia coli* (*E. coli*). Additionally, low levels of dissolved oxygen (DO) and high levels of nutrients and other parameters were noted in the *2024 Texas Integrated Report* as concerns for other surface water uses.

2.2 Project Design

To form a more current understanding of the condition of surface water quality in stream segments throughout the West Lake Houston basin, the following analyses were designed to address the needs outlined below.

- General Understanding
    - Describe the extent of the challenges impacting water quality in the watershed.
    - Visualize whether water quality is spatially variable, and if so, identify focus areas.
- Source Identification
    - Conduct field surveys of each segment in the basin to document potential sources of pollution.
    - Analyze DMR data from Texas Pollutant Discharge Elimination System permitted WWTFs to verify whether their discharges comply with permit limits.
    - Quantify the frequency, distribution and causes of SSOs in the watershed.

To answer these requirements data were acquired and evaluated according to the standards below.

- Data Acquisition
    - The most recent data available collected between January 2020 and December 2024 from monitoring stations throughout the watershed area will be retrieved from the Surface Water Quality Monitoring Information System (SWQMIS) to characterize ambient conditions.
    - The most recent data available collected between January 2020 and December 2024 from DMR and SSO reports from within the watershed will be used to characterize wastewater quality.
    - Individual parameters from the aforementioned sources that will be included in the analysis are indicated in **Table 1**.
- Data Evaluation
    - Ambient (SWQMIS) Data
        - Evaluate the relative character of water quality of segments.
        - Identify trends for parameters of concern, by segment.

[2] The State of Texas assesses its waterways every two years, based on seven-year sets of SQMIS data. These assessments form the basis by which segments (defined portions of waterways) and their tributaries are classified as having impairments (inability to meet a state water quality standard for which a numerical or other specific limit exists) or concerns (levels of parameters which exceed screening levels or other criteria, but for which numerical or specific limits do not exist).

        - Describe observations recorded during field surveys.
    - DMR Bacteria Data
        - Evaluate the primary parameter of concern for compliance with WWTF permit limits.
        - Evaluate the general level of compliance for WWTFs.
    - SSO Report Data
        - Evaluate the frequency, volume, and causes of SSOs by stream segment.

Table 1. *Acquired Data Sources for Parameters of Concern*

Parameter of Concern	SWQMIS Data	DMR Data	SSO Data
Ammonia Nitrogen	X		
Dissolved Oxygen (DO)	X		
Escherichia coli (*E. coli*)	X	X	
Nitrate-Nitrite	X		
pH	X		
SSO Cause			X
SSO Frequency/Volume			X
Temperature	X		
Total Phosphorous	X		
Total Suspended Solids (TSS)	X		

The latest available data from SWQMIS, DMR, and SSO databases, Statistical Analysis Software (SAS) and the spatial analysis platform ArcGIS Pro v.3.0.3 were used to generate statistical results and evaluate geographical trends and variations in the data. The results of all analyses conducted for this report were reviewed by project staff, and pertinent outcomes were selected for the focus of discussion in this document. The full data and evaluation worksheets for these efforts are available on request but are not included in this report for sake of brevity.

2.3 Ambient Data

Ambient water quality data are collected at over 400 sites in the 13-county Houston-Galveston region by H-GAC, local partners, and TCEQ as part of the Clean Rivers Program (CRP). In general, most monitoring stations are sampled by CRP partners on a quarterly frequency for a suite of field, bacteriological, and conventional parameters. Waterways are inherently dynamic systems, and water quality at any given time can vary greatly dependent on conditions at the time. However, a history of samples provides a more representative view of the range of conditions that may be present in that waterway. Ambient data are important for characterizing waterways because they represents a range of conditions and have a historical aspect that allows for the identification of trends over time. The final determination of the regulatory status of each segment is based primarily on these ambient data. The goals and decisions for the WPPs were established in part due to the regulatory status, and therefore ambient data are important sources of information for informing stakeholder decisions.

Data collected by CRP partners and incorporated into SWQMIS include several parameters characterizing conventional, bacteriological, and other field conditions of surface water at each site. Based on parameters commonly identified as impairments or concerns for each of the water bodies in the West Lake Houston basin such as fecal indicator bacteria, DO, and nutrients, a subset of the SWQMIS dataset for stations throughout the watershed areas was selected. Other parameters were added to provide context for environmental conditions such as temperature, pH, instantaneous flow, and TSS. The parameters focused on in this analysis include:

- Ammonia Nitrogen – a measure of specific nitrogenous compound that can impact aquatic life and is an indicator of nutrient levels and potentially of improperly treated sewage effluent.
- DO, grab – an indicator of the ability of the waterway to support aquatic life.
- *E. coli* – bacteria common in the intestines of all warm-blooded animals used as an indicator of the presence of fecal wastes. Due to this relationship, it may also be used as a proxy indicator of the safety of waterways for human recreation as fecal waste can be a vector for human pathogens. The state water quality geomean standard for *E. coli* concentrations is 126 colony forming units per 100 milliliters (CFU/100 mL) and the single sample standard is 399 CFU/100 mL.
- Instantaneous Flow – a measure of water volume over time.
- Nitrate and Nitrite – a measure of nitrogenous compounds and indicator of nutrient levels.
- pH – an indicator of the acidity or basicness of water, which may affect aquatic life and other uses.
- Temperature – an indicator of a waterway's ability to hold oxygen, and a means for correlating other indicators to conditions in the waterways.
- Total Phosphorus – an indicator of nutrient levels, especially in relation to potential for algal blooms and depressed DO in elevated levels.
- TSS – a measure of the number of suspended particles in water that indicates the potential of light infiltration in the water column and the presence of particulate matter on which bacteria may seek shelter.

For all the ambient water quality data analyses, statistical significance is defined as a p-value of 0.0545 or less. Any significance not based on this statistical review (e.g., seasonal trends, qualitative comments) will be specifically described as not being related to this significance threshold. The quantitative analysis for the ambient conditions was conducted using SAS. Statistical analyses in the graphs of Appendix A are based on a LOESS curve rather than a straight regression curve to better indicate change in trend over time for disparate stations.

2.3.1 Monitoring in the Spring Creek Watershed

The Spring Creek watershed has 25 active water quality monitoring stations (**Figure 2**). Data from the 807 sampling events conducted between 2020 and 2024 were used to assess water quality of each stream segment (**Table 2**). This dataset captures the recent water quality conditions before the implementation of the Spring Creek WPP. Trend analyses of the acquired data for each parameter within each segment were performed and visualized with a series of graphs (Error! Reference source not found.).

Table 2. *Spring Creek Watershed Segments, Stations, and Samples, 2020 to 2024*

Segment Number	Segment Name	Stations	Sample Number	Earliest Event	Latest Event
1008	Spring Creek	11312, 11313, 11315, 11323, 17489, 18868	172	1/22/2020	11/18/2024
1008A	Mill Creek	21957	20	2/11/2020	11/6/2024
1008B	Upper Panther Branch	16629, 16630	113	1/20/2020	11/21/2024
1008C	Lower Panther Branch	16422, 16627	116	1/21/2020	11/21/2024
1008E	Bear Branch	16631	57	1/21/2020	11/26/2024
1008F	Lake Woodlands	16481, 16482, 16483, 16484	228	1/21/2020	11/21/2024
1008H	Willow Creek	11185, 20730	62	2/11/2020	11/18/2024
1008I	Walnut Creek	20462	19	2/11/2020	11/6/2024
1008J	Brushy Creek	20463	20	2/11/2020	11/6/2024

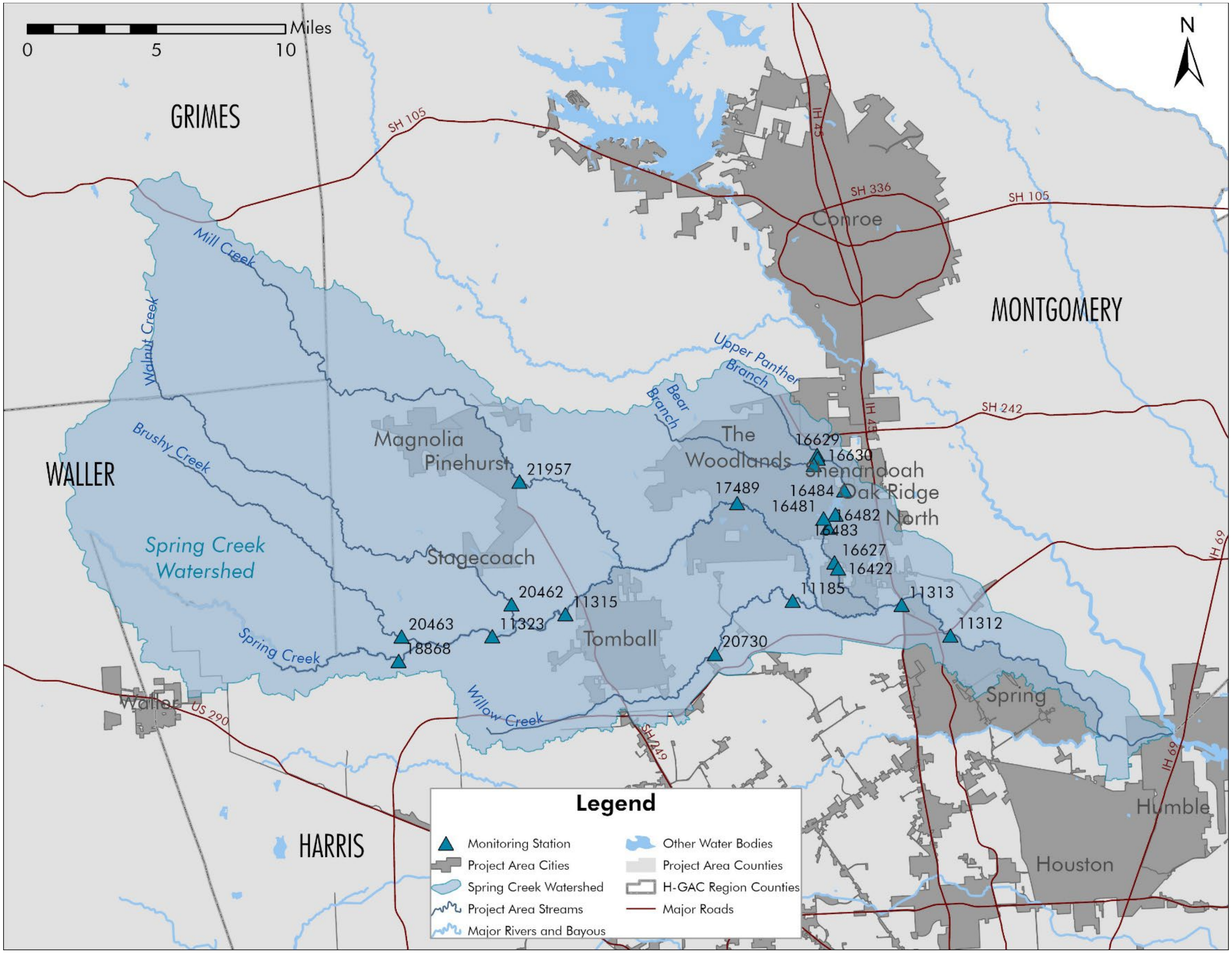


Figure 2. Active Monitoring Sites in the Spring Creek Watershed

Sub-sections of each stream segment classified as assessment units (AUs) are the basic unit of analysis for the Texas Integrated Reports produced by TCEQ. The *2024 Texas Integrated Report* deemed several AUs in the Spring Creek watershed impaired for recreation use due to high levels of fecal indicator bacteria (*E. coli*). These AUs and others within the watershed were also flagged as concerns for aquatic life and general use due to high nutrient levels and depressed oxygen (**Table 3**).

Table 3. *2024 Texas Integrated Report Status of Spring Creek Waterways*

Impairments			
Segment	**AU(s)**	**Parameter**	**Use**
Spring Creek, 1008	02, 03, 04	*E. coli*	Recreation
Mill Creek, 1008A	01	*E. coli*	Recreation
Willow Creek, 1008H	01	*E. coli*	Recreation
Walnut Creek, 1008I	01	*E. coli*	Recreation
Brushy Creek, 1008J	01	*E. coli*	Recreation
Concerns			
Segment	**AU(s)**	**Parameter**	**Use**
Spring Creek, 1008	02	Fish Community	Aquatic Life
Spring Creek, 1008	03, 04	Nitrate	General
Spring Creek, 1008	03, 04	Total Phosphorus	General
Upper Panther Branch, 1008B	01	Cadmium	Aquatic Life
Upper Panther Branch, 1008B	01	Nitrate	General
Upper Panther Branch, 1008B	01	Total Phosphorus	General
Upper Panther Branch, 1008B	02	*E. coli*	Recreation
Lower Panther Branch, 1008C	01	Nitrate	General
Lower Panther Branch, 1008C	01, 02	Total Phosphorus	General
Lower Panther Branch, 1008C	02	Depressed DO	Aquatic Life
Lake Woodlands, 1008F	01	Depressed DO	Aquatic Life
Willow Creek, 1008H	01	Nitrate	General
Willow Creek, 1008H	01	Total Phosphorus	General
Brushy Creek, 1008J	01	Depressed DO	Aquatic Life

Spring Creek Watershed Monitoring Results

A summary of ambient data for each segment of the Spring Creek watershed, represented as the geomean of each parameter for data collected between 2020 and 2024 (**Table 4**), found that there were 11 instances of geomeans exceeding criteria or screening levels (dark grey shading), while most instances (light grey shading) were either in compliance with criteria or better than the screening level. Temperature, flow, and TSS are parameters for which the data are not compared to criteria or screening levels (no shading).

Table 4. Spring Creek Watershed Monitoring Results by Segment, 2020 to 2024 Geomean

Parameter	Criteria	Unit	Spring Creek, 1008	Mill Creek, 1008A	Upper Panther Branch, 1008B	Lower Panther Branch, 1008C	Bear Branch, 1008E	Lake Woodlands, 1008F	Willow Creek, 1008H	Walnut Creek, 1008I	Brushy Creek, 1008J
Ammonia Nitrogen	0.33	mg/L	0.07	0.08	0.15	0.18	0.12	0.13	0.19	0.10	0.08
DO, grab	Various	mg/L	7.25	6.87	7.79	7.10	8.15	9.25	7.59	6.65	5.86
E. coli	126	CFU/ 100mL	347.28	214.59	84.18	187.17	96.41	30.77	788.56	282.49	209.42
Instantaneous Flow	NA	Cubic Feet Per Second	23.08	5.41	No Data	No Data	3.26	No Data	109.00	1.62	0.95
Nitrate Nitrogen	1.95	mg/L	1.01	0.12	2.27	2.26	0.14	1.47	4.57	0.43	0.12
pH	9 (high) 6.5(low)	NA	7.37	7.37	7.01	7.46	7.44	8.26	7.63	7.45	7.06
Temperature	NA	Degrees Celsius	21.17	20.12	22.94	21.42	22.68	22.54	22.34	20.17	20.71
Total Phosphorus	0.69	mg/L	0.27	0.04	0.58	0.79	0.10	0.68	1.59	0.14	0.06
TSS	NA	mg/L	20.93	41.64	8.22	14.61	10.69	14.83	20.54	20.06	10.48

Spring Creek Watershed Trends

Trends in the data were determined by examining all parameters collected from surface water samples in the Spring Creek watershed and how measurements for those parameters have changed over time. The results indicate significant improvements for dissolved oxygen, and *E. coli* in Lower Panther Branch and Lake Woodlands, though nutrients and other parameters demonstrated worsening trends in several other segments (**Table 5**). Results for parameters with stable trends over time are not represented, however, graphs depicting the results of all analyses can be found in Error! Reference source not found.. Consequently, parameter measurements that remained consistently above water quality standards (such as *E. coli*) throughout the study period are not captured by this summary.

Table 5. Spring Creek Watershed Water Quality Trends by Segment, 2020 to 2024

Segment	Parameter	Trend
Spring Creek, 1008	Nitrate-N	Deteriorating
Upper Panther Branch, 1008B	pH	Deteriorating
Lower Panther Branch, 1008C	Dissolved Oxygen (Grab Screening Level)	Improving
Lower Panther Branch, 1008C	*E. coli*	Improving
Bear Branch, 1008E	pH	Deteriorating
Lake Woodlands, 1008F	Dissolved Oxygen (Grab Screening Level)	Improving
Lake Woodlands, 1008F	*E. coli*	Improving
Lake Woodlands, 1008F	Nitrate-N	Improving
Willow Creek, 1008H	Instantaneous Flow	Improving
Willow Creek, 1008H	Total Suspended Solids	Deteriorating
Walnut Creek, 1008I	Total Phosphorus	Deteriorating
Brushy Creek, 1008J	Nitrate-N	Deteriorating

Spring Creek Watershed Water Quality Analysis Summary

Of the ambient water quality parameters observed, geomean values for fecal indicator bacteria levels measured between 2020 and 2024 exceeded state water quality standards most frequently. Only Upper Panther Branch (1008B), Bear Branch (1008E) and Lake Woodlands (1008F) showed geomean values for *E. coli* within criteria levels. In the trend analysis of data collected between 2020 and 2024, significant improvements for *E. coli* were observed in Lower Panther Branch and Lake Woodlands (1008C and 1008F). As mentioned previously, because *E. coli* levels exceeded the standard at a consistent level in the other segments of the Spring Creek watershed, no other improving or deteriorating trends were observed.

Nutrients continue to pose a challenge to water quality in the Spring Creek watershed. Total phosphorous and nitrate nitrogen geomeans exceeded screening levels on Lower Panther Branch (1008C) and Willow Creek (1008H). Nitrate nitrogen also exceeded the standard at Upper Panther Branch (1008B). Spatially, these exceedances occur in the eastern third of the watershed where developed areas are most prevalent. Over the period of 2020 to 2024, nitrate nitrogen showed significantly worsening trends in Spring Creek and Brushy Creek (1008 and 1008J). However, trends in nitrate nitrogen improved significantly on Lake Woodlands (1008F). Significant worsening of total phosphorous was observed on the western side of the watershed in Walnut Creek (1008I).

2.3.2 Monitoring in the Cypress Creek Watershed

The Cypress Creek watershed has 11 active monitoring stations (**Figure 3**). Data from 302 sampling events conducted between 2020 and 2024 were used to assess water quality in each of the stream segments (**Table 6**). This dataset captures the recent character of water quality before the implementation of the Cypress Creek WPP.

Table 6. *Cypress Creek Watershed Segments, Stations, and Samples, 2020 to 2024*

Segment Number	Segment Name	Stations	Sample Number	Earliest Event	Latest Event
1009	Cypress Creek	11324, 11328, 11330, 11331, 11332, 11333, 20457	197	1/4/2018	12/14/2022
1009C	Faulkey Gully	17496	35	1/31/2018	9/22/2022
1009D	Spring Gully	17481	35	1/31/2018	9/22/2022
1009E	Little Cypress	14159, 20456	55	1/31/2018	10/11/2022

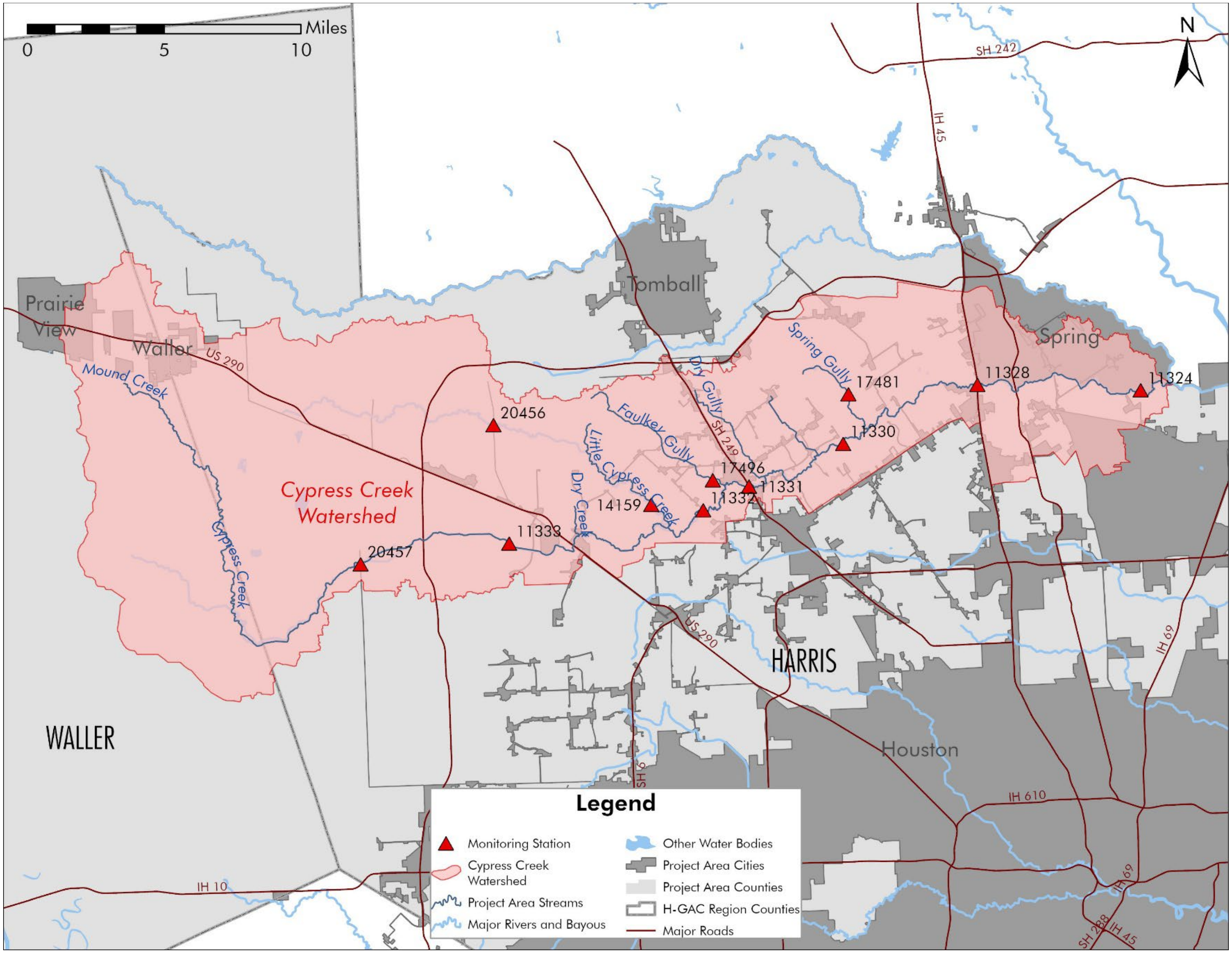


Figure 3. *Active Monitoring Sites in the Cypress Creek Watershed*

The *2024 Texas Integrated Report* deemed all AUs in the Cypress Creek watershed impaired for recreation use due to high levels of fecal indicator bacteria (*E. coli*). These AUs and others within the watershed were also flagged as concerns for aquatic life and general use due to high nutrient levels and depressed oxygen (**Table 7**).

Table 7. *2024 Texas Integrated Report Status of Cypress Creek Waterways*

Impairments			
Segment	**AU(s)**	**Parameter**	**Use**
Cypress Creek, 1009	01, 02, 03, 04	*E. coli*	Recreation
Faulkey Gully,1009C	01	*E. coli*	Recreation
Spring Gully, 1009D	01	*E. coli*	Recreation
Little Cypress Creek, 1009E	01	*E. coli*	Recreation
Concerns			
Segment	**AU(s)**	**Parameter**	**Use**
Cypress Creek, 1009	01	Depressed DO	Aquatic Life
Cypress Creek, 1009	01, 02, 03, 04	Nitrate	General
Cypress Creek, 1009	01, 02, 03, 04	Total Phosphorus	General
Cypress Creek, 1009	02	Habitat	Aquatic Life
Cypress Creek, 1009	02	Macrobenthic Community	Aquatic Life
Cypress Creek, 1009	04	Chlorophyll-*a*	General
Faulkey Gully,1009C	01	Ammonia	General
Faulkey Gully,1009C	01	Nitrate	General
Faulkey Gully,1009C	01	Total Phosphorus	General
Spring Gully, 1009D	01	Nitrate	General
Spring Gully, 1009D	01	Total Phosphorus	General
Little Cypress Creek, 1009E	01	Nitrate	General
Little Cypress Creek, 1009E	01	Total Phosphorus	General

Cypress Creek Watershed Monitoring Results

A summary of ambient data for each segment of the Cypress Creek watershed, represented as the geomean of each parameter for data collected between 2020 and 2024 (**Table 8**), found that fecal bacteria criteria and nutrient screening levels for nitrate nitrogen and total phosphorous were exceeded in every segment (dark grey shading). Ammonia nitrogen also exceeded the screening level on Faulkey Gully. Dissolved oxygen, and pH were in compliance with criteria or better than the screening level (light gray shading). Temperature, instantaneous flow, and TSS data were not compared to criteria or screening levels (no shading).

Table 8. Cypress Creek Watershed Monitoring Results by Segment, 2020 to 2024 Geomean

Parameter	Criteria	Unit	Cypress Creek, 1009	Faulkey Gully, 1009C	Spring Gully, 1009D	Little Cypress Creek, 1009E
Ammonia Nitrogen	0.33	mg/L	0.15	0.49	0.14	0.10
DO, grab	Various	mg/L	6.86	8.23	9.02	6.95
E. coli	126	CFU/ 100mL	650.58	736.53	603.47	524.06
Instantaneous Flow	NA	Cubic Feet Per Second	23.54	No Data	No Data	4.93
Nitrate Nitrogen	1.95	mg/L	2.30	2.90	4.33	2.38
pH	9 (high) 6.5(low)	NA	7.60	7.78	8.15	7.54
Temperature	NA	Degrees Celsius	22.44	23.02	25.03	22.00
Total Phosphorus	0.69	mg/L	1.03	1.62	1.73	0.87
TSS	NA	mg/L	36.01	16.57	9.26	21.21

Cypress Creek Watershed Trends

Trends in the data were determined by examining all parameters collected from surface water samples in the Cypress Creek watershed and how measurements for those parameters have changed over time. The results indicate significant improvements in dissolved oxygen and pH on Faulkey Gully but a significantly worsening trend in TSS on Cypress Creek (**Table 9**). Results for parameters with stable trends over time are not represented, however, graphs depicting the results of those assessments can be found in Error! Reference source not found.. Consequently, parameter measurements remained consistently above water quality standards throughout the study period (such as *E. coli*) are not captured by this summary.

Table 9. Cypress Creek Watershed Water Quality Trends by Segment, 2020 to 2024

Segment	Parameter	Trend
Cypress Creek, 1009	Total Suspended Solids	Deteriorating
Faulkey Gully, 1009C	Dissolved Oxygen (Grab Screening Level)	Improving
Faulkey Gully, 1009C	pH	Improving

Cypress Creek Watershed Water Quality Analysis Summary

Of the ambient water quality parameters observed, geomean values for *E. coli*, nitrate nitrogen, and total phosphorous measured between 2020 and 2024 exceeded state water quality standards on every segment. Of the segments with geomeans that exceeded *E. coli* criteria, none were found to be improving.

2.3.3 Monitoring in the Lake Creek Watershed

The Lake Creek watershed has three active monitoring stations (**Figure 4**). Data from 54 sampling events conducted between 2020 and 2024 were used to assess water quality in each of the stream segments (**Table 10**).

Table 10. Lake Creek Watershed Segments, Stations, and Samples, 2020 to 2024

Segment Number	Segment Name	Stations	Sample Number	Earliest Event	Latest Event
1015	Lake Creek	11367, 18192	38	2/13/2020	11/7/2024
1015A	Mound Creek	17937	16	2/13/2020	11/7/2024

The *2024 Texas Integrated Report* noted impairments on both Lake Creek and Mound Creek for recreation use due to high levels of fecal indicator bacteria (*E. coli*). Other concerns including depressed oxygen, and poor conditions for the macrobenthic community were also noted (**Table 11**).

Table 11. *2024 Texas Integrated Report Status of Lake Creek Waterways*

Impairments			
Segment	**AU(s)**	**Parameter**	**Use**
Lake Creek, 1015	02	*E. coli*	Recreation
Mound Creek, 1015A	01	*E. coli*	Recreation
Concerns			
Segment	**AU(s)**	**Parameter**	**Use**
Lake Creek, 1015	02	Depressed DO	Aquatic Life
Lake Creek, 1015	01	Macrobenthic Community	Aquatic Life

Lake Creek Watershed Monitoring Results

A summary of ambient data for each segment of the Lake Creek watershed, represented as the geomean of each parameter for data collected between 2020 and 2024 (**Table 12**) found that fecal bacteria criteria were exceeded in both segments (dark grey shading). Ammonia nitrogen, dissolved oxygen, nitrate nitrogen, pH, and total phosphorous were in compliance with criteria or better than the screening level (light gray shading). Temperature, instantaneous flow and TSS data were not compared to criteria or screening levels (no shading).

Table 12. *Lake Creek Watershed Monitoring Results by Segment, 2020 to 2024 Geomean*

Parameter	Criteria	Unit	Lake Creek, 1015	Mound Creek, 1015A
Ammonia Nitrogen	0.33	mg/L	0.08	0.08
DO, grab	Various	mg/L	6.03	7.68
E. coli	126	CFU/ 100mL	148.02	359.03
Instantaneous Flow	NA	Cubic Feet Per Second	0.53	3.71
Nitrate Nitrogen	1.95	mg/L	0.14	0.51
pH	9 (high) 6.5(low)	NA	7.42	7.35
Temperature	NA	Degrees Celsius	20.32	19.80
Total Phosphorus	0.69	mg/L	0.11	0.03
TSS	NA	mg/L	28.82	17.57

Figure 4. *Active Monitoring Sites in the Lake Creek Watershed*

Lake Creek Watershed Trends

Trends in the data were determined by examining all parameters collected from surface water samples in the Lake Creek watershed and how measurements for those parameters have changed over time. The results indicate a significant improvement in pH for Lake Creek (1015) (**Table 13**). Results for parameters with stable trends over time are not represented, however, graphs depicting the results of those assessments can be found in Error! Reference source not found.. Consequently, parameter measurements remained consistently above water quality standards throughout the study period (such as *E. coli*) are not captured by this summary.

Table 13. *Lake Creek Watershed Water Quality Trends by Segment, 2020 to 2024*

Segment	Parameter	Trend
Lake Creek, 1015	pH	Improving

Lake Creek Watershed Ambient Analysis Summary

Consistent with the results of the *2024 Texas Integrated Report,* which indicated geomean values exceeding the standard on both Lake Creek and Mound Creek (1015 and 1015A), ambient data collected between 2020 and 2024 showed *E. coli* on both Lake Creek (1015) and Mound Creek (1015A) exceeded state water quality standards. No significant trends in *E. coli* were identified in the trends analysis.

While DO concerns were observed in the *2024 Texas Integrated Report* for Lake Creek (1015), analyses of ambient data collected between 2020 and 2024 did not capture similar results.

All nutrient geomean data collected between 2020 and 2024 indicated that nutrient levels in the Lake Creek watershed are within screening levels.

2.3.4 Monitoring in the West Fork of the San Jacinto River

The West Fork San Jacinto watershed has seven active monitoring stations (**Figure 5**). Data from 168 sampling events conducted between 2020 and 2024 were used to assess water quality in each of the stream segments (**Table 14**).

Table 14. *West Fork San Jacinto River Watershed Segments, Stations, and Samples, 2020 to 2024*

Segment Number	Segment Name	Stations	Sample Number	Earliest Event	Latest Event
1004	West Fork San Jacinto River	11243, 11250, 11251	74	1/8/2020	12/11/2024
1004D	Crystal Creek	11181, 16635	37	1/8/2020	11/13/2024
1004E	Stewarts Creek	16626	37	1/8/2020	11/13/2024
1004J	White Oak Creek	20731	20	2/13/2020	11/7/2024

The *2024 Texas Integrated Report* deemed several AUs in the West Fork San Jacinto River watershed impaired for recreation use due to high levels of fecal indicator bacteria (*E. coli*). These AUs and others within the watershed were also flagged as concerns for aquatic life and general use due to high nutrient levels and depressed oxygen (**Table 15**).

Table 15. *2024 Texas Integrated Report Status of West Fork San Jacinto River Waterways*

Impairments			
Segment	**AU(s)**	**Parameter**	**Use**
West Fork San Jacinto River, 1004	01, 02	*E. coli*	Recreation
Crystal Creek, 1004D	01	*E. coli*	Recreation
Stewarts Creek, 1004E	02	*E. coli*	Recreation
White Oak Creek, 1004J	01	*E. coli*	Recreation
Concerns			
Segment	**AU(s)**	**Parameter**	**Use**
West Fork San Jacinto River, 1004	02	Macrobenthic Community	Aquatic Life
West Fork San Jacinto River, 1004	02	Chlorophyll-*a*	General
White Oak Creek, 1004J	01	Nitrate	General

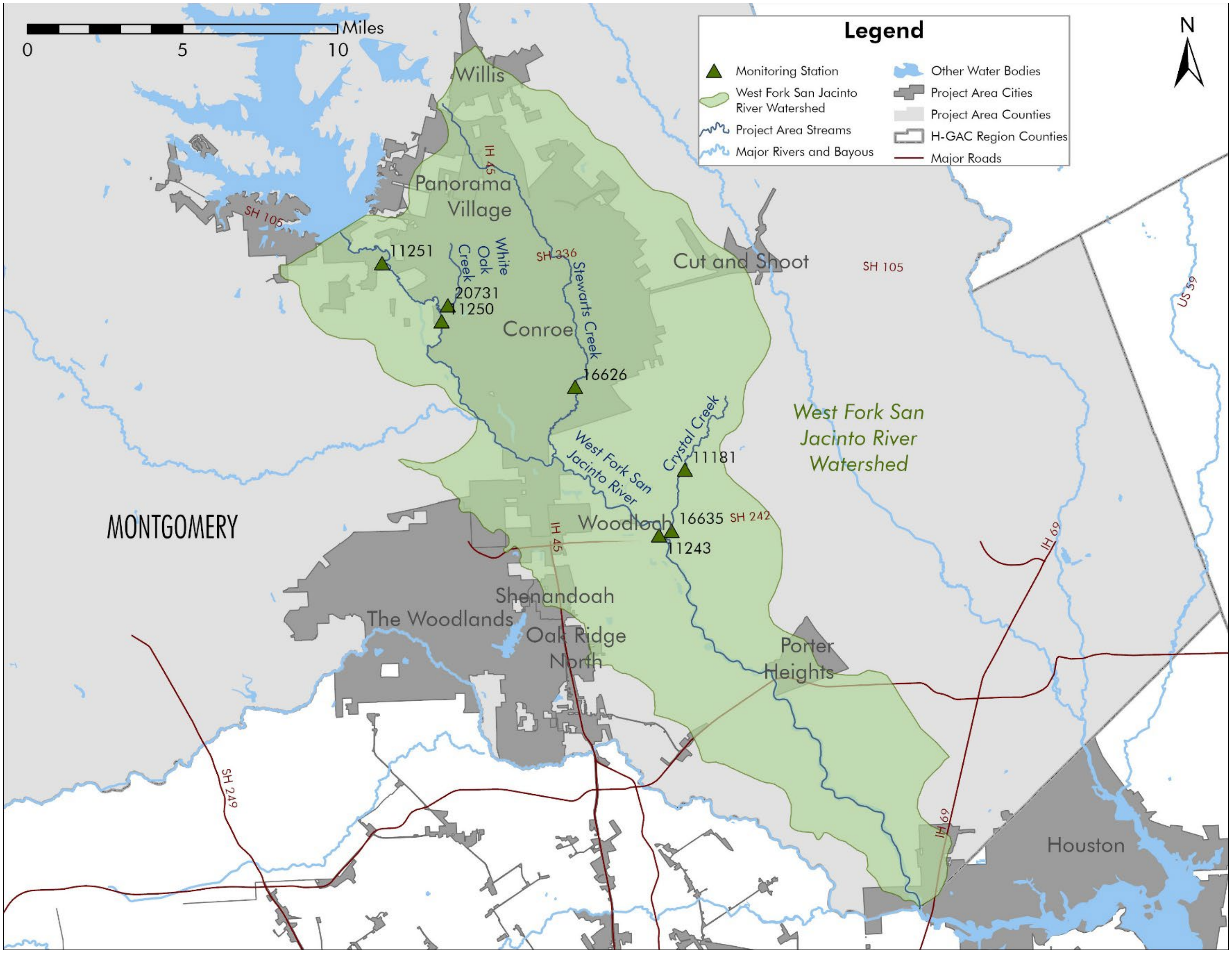


Figure 5. *Active Monitoring Sites in the West Fork San Jacinto River Watershed*

West Fork San Jacinto River Watershed Monitoring Results

A summary of ambient data for each segment of the West Fork San Jacinto River watershed, represented as the geomean of each parameter for data collected between 2020 and 2024 (**Table 16**) found that fecal bacteria criteria were exceeded in every segment but Crystal Creek (dark grey shading). Ammonia nitrogen, dissolved oxygen, nitrate nitrogen, pH, and total phosphorous were in compliance with criteria or better than the screening level (light gray shading). Temperature, instantaneous flow and TSS data were not compared to criteria or screening levels (no shading).

Table 16. *West Fork San Jacinto River Watershed Monitoring Results by Segment, 2020 to 2024 Geomean*

Parameter	Criteria	Unit	West Fork San Jacinto River, 1004	Crystal Creek, 1004D	Stewarts Creek, 1004E	White Oak Creek, 1004J
Ammonia Nitrogen	0.33	mg/L	0.05	0.05	0.07	0.06
DO, grab	Various	mg/L	7.88	10.50	8.10	8.63
E. coli	126	CFU/100mL	155.69	104.00	314.68	1339.37
Instantaneous Flow	NA	Cubic Feet Per Second	33.86	6.40	1.77	6.46
Nitrate Nitrogen	1.95	mg/L	0.37	0.45	0.52	1.84
pH	9 (high) 6.5(low)	NA	7.61	7.60	7.68	7.44
Temperature	NA	Degrees Celsius	20.54	9.40	20.85	21.10
Total Phosphorus	0.69	mg/L	0.17	0.08	0.34	0.12
TSS	NA	mg/L	18.91	12.00	10.95	19.02

West Fork San Jacinto River Watershed Trends

Trends in the data were determined by examining all parameters collected from surface water samples in the West Fork San Jacinto River watershed and how measurements for those parameters have changed over time. The results indicate significant improvements in ammonia nitrogen in Crystal Creek, but other nutrients (nitrate nitrogen and total phosphorous) showed significantly worsening trends in several of the segments (**Table 17**). Results for parameters with stable trends over time are not represented, however, graphs depicting the results of those assessments can be found in Error! Reference source not found.. Consequently, parameter measurements remained consistently above water quality standards throughout the study period (such as *E. coli*) are not captured by this summary.

Table 17. *West Fork San Jacinto River Water Quality Trends by Segment, 2020 to 2024*

Segment	Parameter	Trend
West Fork San Jacinto River, 1004	Instantaneous Flow	Improving
Crystal Creek, 1004D	Ammonia-N	Improving
Crystal Creek, 1004D	Total Phosphorus	Deteriorating
Crystal Creek, 1004D	pH	Deteriorating
Stewarts Creek, 1004E	Nitrate-N	Deteriorating
Stewarts Creek, 1004E	Temperature	Deteriorating
Stewarts Creek, 1004E	Total Phosphorus	Deteriorating
White Oak Creek, 1004J	*E. coli*	Improving
White Oak Creek, 1004J	Nitrate-N	Improving

West Fork San Jacinto River Watershed Ambient Analysis Summary

Geomean values for fecal indicator bacteria levels measured between 2020 and 2024 exceeded state water quality standard on each segment. Of the four segments, West Fork San Jacinto River (1004) had the lowest geomean of 155.69 CFU/100 mL. White Oak Creek (1004J) had the highest geomean at 1,339.37 CFU/100 mL. This segment is part of an ongoing targeted monitoring assessment to investigate sources of bacteria leading to such great exceedances of the standard. A significant improving trend was observed for *E. coli* on this segment.

All nutrient geomean data collected between 2020 and 2024 indicated that nutrient levels in the West Fork San Jacinto River watershed were within screening levels. Trend analysis showed a significant improvement in ammonia nitrogen in Crystal Creek (1004D) however nitrate nitrogen and total phosphorous levels are worsening significantly in Stewarts Creek (1004E). Total phosphorus is also worsening in Crystal Creek (1004D).

2.4 Field Surveys

To provide more insight into potential pollutant source pressures impacting the West Lake Houston Basin, H-GAC conducted field surveys of priority stretches of each segment and unclassified tributary in the project area. Due to the results of modeling analyses for each of the WPPs developed for the basin which indicated human-related sources of pollution were of greatest concern to water quality, priority was given to urban areas or areas with prominent water quality exceedances observed at existing CRP monitoring stations. This approach was chosen based on applicability to the project questions, level of precision needed for implementation of WPPs, and through discussions with TCEQ project staff.

H-GAC first conducted a desk review using Google Earth to identify survey locations on each of the segments and unclassified tributaries in the basin. During the desk review, accessibility of each site (i.e., safe distance from roadway, ability to access water body on foot, absence of obstructions such as fencing) was considered for representative site selections. Ultimately, the sites described in **Table 18** and shown in **Figure 6** were selected to represent each of the segments and unclassified tributaries in the basin.

Table 18. *West Lake Houston Basin Field Survey Sites*

Survey Site	Segment ID	Segment Name	Watershed
11243	1004	West Fork San Jacinto River	West Fork San Jacinto River
11181	1004D	Crystal Creek	West Fork San Jacinto River
16626	1004E	Stewarts Creek	West Fork San Jacinto River
20731	1004J	White Oak Creek	West Fork San Jacinto River
11323	1008	Spring Creek	Spring Creek
21957	1008A	Mill Creek	Spring Creek
16630	1008B	Upper Panther Branch	Spring Creek
16627	1008C	Lower Panther Branch	Spring Creek
16631	1008E	Bear Branch	Spring Creek
11185	1008H	Willow Creek	Spring Creek
20462	1008I	Walnut Creek	Spring Creek
20463	1008J	Brushy Creek	Spring Creek
11324	1009	Cypress Creek	Cypress Creek
17496	1009C	Faulkey Gully	Cypress Creek
17481	1009D	Spring Gully	Cypress Creek

Survey Site	Segment ID	Segment Name	Watershed
20456	1009E	Little Cypress Creek	Cypress Creek
11367	1015	Lake Creek	Lake Creek
17937	1015A	Mound Creek	Lake Creek

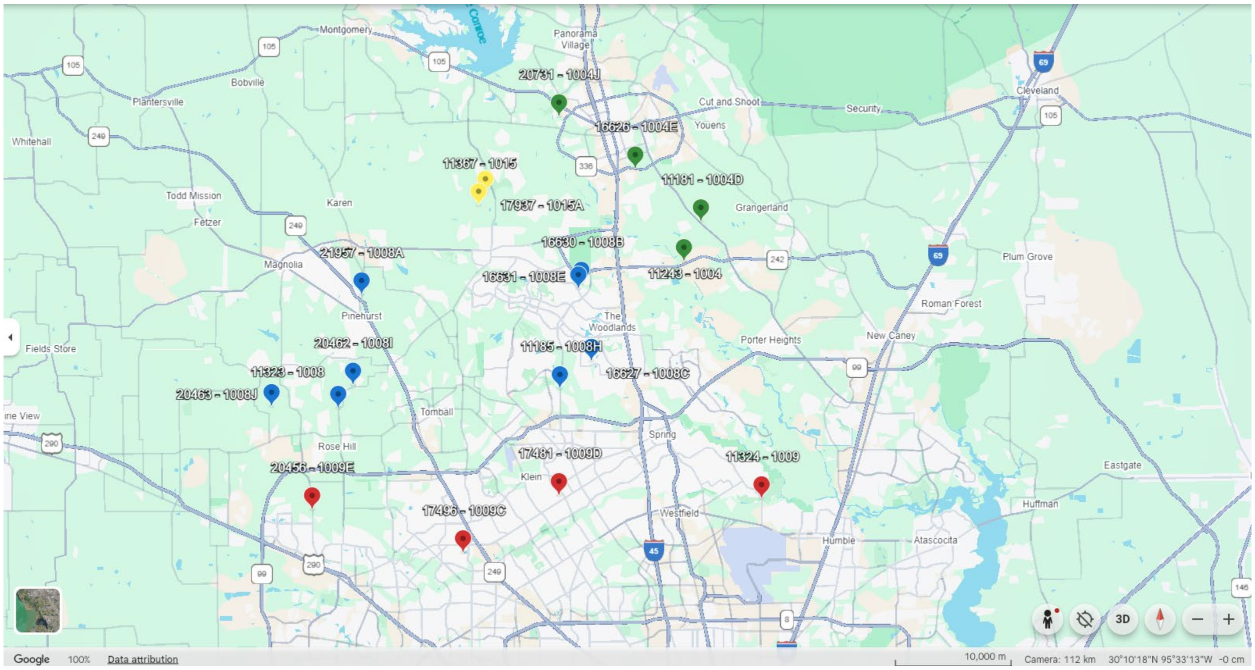


Figure 6. Google Earth View of Selected Field Survey Sites

Next, H-GAC developed a form-centric application in ArcGIS Survey 123 to record and geolocate observations. The application is hosted on mobile phones and tablets which offered an easily portable solution for recording data in the field. This form was programed to have required fields, meaning that data such as the date, time, staff, and necessary observations had to be completed before the field collector could save the data and progress to the next site. For qualitative observations, drop down choices limited responses to those listed in the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012*[3]. The application also offered mapping functions and the ability to attach and view photos, videos, and audio files. An example of the form layout and records flow is shown in **Figure 7**.

[3] See the full document at https://www.tceq.texas.gov/publications/rg/rg-415.

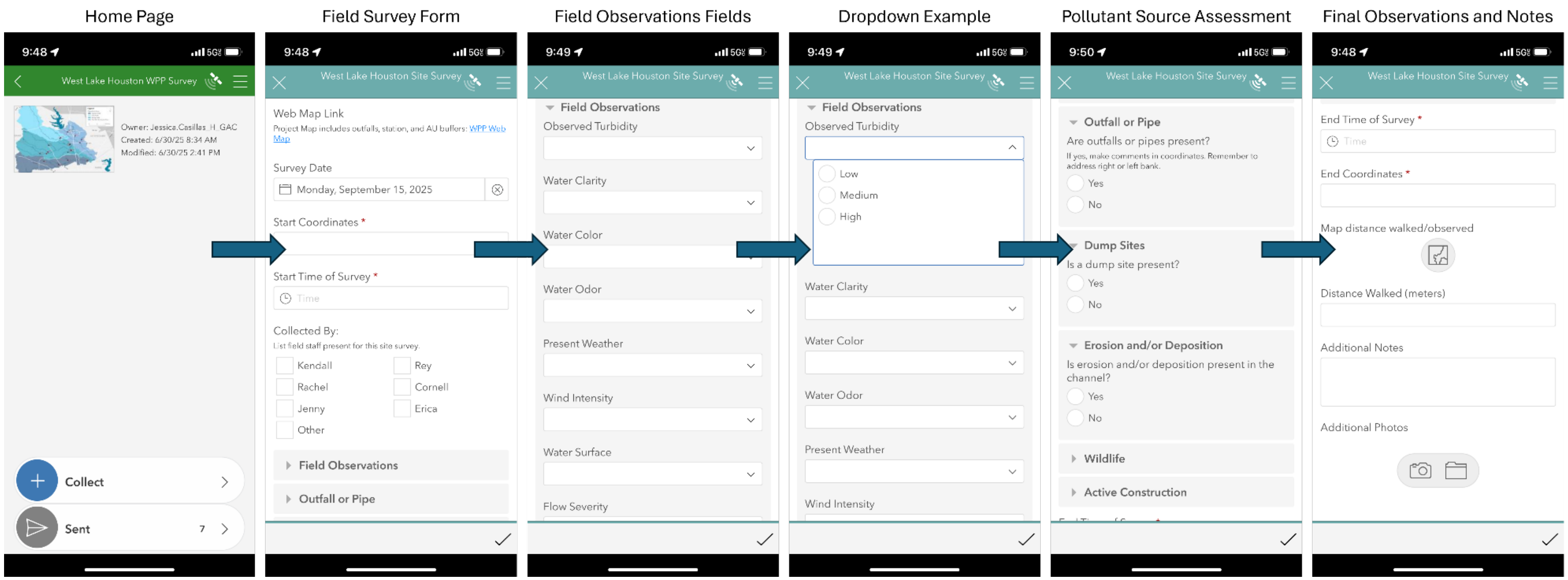


Figure 7. *ArcGIS Survey 123 Field Survey Form Example*

On July 1, 2025, three teams of two staff members each conducted surveys on a total of 18 segments (six sites per team). Field surveys involved visual identification of potential sources of contamination (e.g., leaking pipes, dump sites, illicit connections), hydrologic change (e.g., visual evidence of erosion and/or deposition in the channel), or other exacerbating factors for water quality (e.g., presence/concentration of wildlife, developmental change) by staff walking or otherwise traversing the waterway. Observations, corresponding notes and coordinates were recorded using the ArcGIS Survey 123 application. Coordinates were determined by the location sensors built into the device supporting the ArcGIS Survey 123 application. While the results are summarized for each watershed in the following subsections, the output from each ArcGIS Survey 123 form for each segment observed during the survey can be viewed in **Appendix B: Field Survey Data**.

2.4.1 West Fork San Jacinto River Watershed Field Survey Observations

Segments in the West Fork San Jacinto watershed were characterized by their sandy, eroded banks. Wildlife tracks were observed at all sites though the only active wildlife observed were birds nesting under overpasses located near the sites. Specific to site 20731 on White Oak Creek (1004J), signs of human recreation were observed around the banks. This site was located in a quiet, residential area. Though no dump sites were observed, general trash accumulation was widespread throughout the watershed. The unifying observation for all sites in this watershed was the presence of construction and growing development of residential areas and roadway expansion (**Figure 8**).

Figure 8. *Roadway Construction on Stewarts Creek*

2.4.2 Spring Creek Watershed Field Survey Observations

Like the West Fork San Jacinto River segments, segments in the Spring Creek watershed were largely sandy and eroded leading to frequent observations of sediment deposition which impeded flow. Some of this sedimentation may be naturally occurring, but much of it is likely the result of construction efforts in the watershed. Despite this, signs of wildlife were observed throughout the watershed. Evidence of regular dumping was recorded at site 11323 on Spring Creek (1008) (**Figure 9**). Invasive species such as elephant ear and apple snails were also noted at points throughout the watershed (**Figure 10**).

Figure 9. *Dump Site on Spring Creek (1008)*

Figure 10. *Apple Snail Eggs at Bear Branch (1008E)*

2.4.3 Cypress Creek Watershed Field Survey Observations

Similar to segments in the Spring Creek watershed, segments in the Cypress Creek watershed were characterized by sandy banks and frequent observations of sedimentation and deposition. Multiple notes were made about debris, and the riparian forest at site 11324 on Cypress Creek (1009) appeared to have been trimmed back or cleared in some areas. Another observation recorded at site 11324 included the presence of horses near the waterway and evidence of a trail riding business (**Figure 11**). One other notable observation was recorded at site 17496 on Faulkey Gully regarding a manhole cover with a broken cap ring (**Figure 12**).

Figure 11. *Horses on Cypress Creek (1009)*

Figure 12. *Broken Manhole Cover at Faulkey Gully (1009C)*

2.4.4 Lake Creek Watershed Field Survey Observations

Segments in the Lake Creek watershed are among the least developed areas relative to other watersheds in the West Lake Houston Basin. However, as seen in other watersheds, development is on the rise on Lake Creek segments as well. Wildlife or their tracks were observed at both sites. Residents near site 11367 shared anecdotes of an alligator that has been observed in Lake Creek (1015) near their neighborhood, but it was not sighed by H-GAC staff during the survey. The most likely source pressures in this watershed included development and potentially effluent from the RV park located at the Lake Creek site (**Figure 13**).

Figure 13. *Outfall Signage at Site 11367 on Lake Creek (1015)*

2.4.5 West Lake Houston Basin Field Survey Observations Summary

Most of the field survey observations made about potential stressors to water quality in the West Lake Houston Basin were related to flow impediments such as sedimentation, possibly as a result of increased development in all four watersheds. While this isn't indicative of a bacteria source, it does run parallel to assessments of water quality in that disrupted flows could exacerbate, or further complicate water related issues. Sedimentation was also a primary concern brought up by stakeholders during the development of each WPP within the West Lake Houston Basin.

2.5 DMR Bacteria Data

Discharges from wastewater treatment plants are regulated by water quality permits from TCEQ which require stringent limits for effluent quality. Generally, wastewater treatment plants in the Houston region are able to meet their permits. However, because human waste has an appreciable pathogenic potential, identifying trends in permit exceedances for indicator bacteria by WWTFs is important in understanding overall impacts to waterways. Discharges from WWTFs are monitored on a regular basis (with a frequency dependent on plant size and other factors). The data from these required sampling events are submitted to and compiled by TCEQ as DMRs. As with any self-reported data, there is an expectation that some degree of uncertainty or variation from conditions may occur, but these DMRs are the most comprehensive data available for evaluating WWTFs in the watersheds.

Discharge from WWTFs is assessed for compliance with state water quality standards, which in the case of *E. coli*, the permitted geomean standard for bacteria concentrations is 126 CFU/100 mL, whereas the grab sample standard is 399 CFU/100 mL. For this project, staff evaluated bacteria data associated with WWTF permits, from the same time period as the most recently available ambient water quality data, January 2020 through December 2024, and compliance with permit limits for bacteria were compared across segments, plant types, years, and seasons.

Of the 303 permitted outfalls in the West Lake Houston Basin, 216 submitted DMRs, and the majority of WWTFs are in compliance over 97% of the time (**Table 19**). The disparity between the number of samples exceeding the geomean standard compared to samples exceeding the grab standard could indicate high variability in the data. Higher rates of exceedance from specific sites may be overshadowed by the broad scope of this analysis.

Table 19. *West Lake Houston Basin DMR* E. coli *Exceedance Statistics, 2020 to 2024*

Parameter	Number of Plants	Percent of Reports
Plants Reporting Bacteria	216	
Total Records	18,716	
Exceedances of Geomean	46	0.5%
Exceedances of Single Grab	267	2.9%
Total Exceedances	313	1.7%

Looking at the number of annual exceedances show that the highest frequency of exceedances occurred in 2024 (**Table 20**).

Table 20. *West Lake Houston Basin DMR* E. coli *Exceedances by Year*

Exceedances	2020	2021	2022	2023	2024	Total
By Geomean	7	8	4	9	18	46
By Grab	31	41	46	63	86	267
Total	38	49	40	72	104	313

The rate of exceedance by plant size was also considered as part of this analysis (**Table 21**). Plant size refers to the amount of volume in millions of gallons per day (MGD) that each WWTF is permitted to discharge. From the data analyzed, grab samples generally exceed the standard at a higher rate than geomeans. The exceptions are at the <0.1 MGD level where exceedance rates for both types were equal, and the 5-10 MGD and Variable/Intermittent Discharge levels which reported no exceedances. The highest prevalence of exceedance by plant size occurred at the >10 MGD level for grab samples at 16.7%.

Table 21. *West Lake Houston Basin Bacteria Exceedance Rates by Plant Size, 2020 to 2024*

Relative Plant Size	Number of Plants	Rate of Exceedance of the Geometric Mean	Rate of Exceedance of the Grab Sample
0.1-0.5 MGD	69	0.5%	1.3%
0.5-1 MGD	41	0.4%	3.3%
1-5 MGD	28	0.5%	6.5%
5-10 MGD	2	-	7.6%
< 0.1 MGD	61	0.8%	1.4%
> 10 MGD	1	-	16.7%
Variable/Intermittent Discharge	14	0.1%	2.2%

2.5.1 Summary of DMR Bacteria Data

Overall, the results of the analyses of DMR *E. coli* data indicated that the total number of exceedances reported was small relative to the total number of DMR reports submitted for the period of 2020 to 2024 (313 out of 18,716 records). While WWTFs may be appreciable contributions under certain conditions, in localized areas, the DMR analysis indicates that they are not likely a significant driver of segment bacteria impairments due to the comparatively few exceedances. However, due to the relatively higher risk of pathogens from human waste, and proximity to developed areas, WWTF exceedances are likely still a point of concern for stakeholders.

2.6 SSOs

Though SSOs occur episodically, they represent a high-risk vector for bacteria contamination because they can have concentrations of bacteria several orders of magnitude higher than treated effluent. Untreated sewage can contain large volumes of raw fecal matter, making it a significant health risk where SSOs are sizeable and/or chronic issues. The causes of SSOs vary from human error to infiltration of rainwater into sewer pipes. Data used for these analyses are self-reported and may vary in quality. Even in the best of circumstances, the ability to accurately gauge SSO volumes or even occurrences in the field are limited by several factors. Actual SSO volumes and incidences are generally expected to be greater than reported due to these fundamental challenges. Known causes of SSOs were broken into four broad categories with several subcategories each, to reflect the breakdown in the TCEQ SSO database. It should be noted, however, that this categorization depends on the accuracy of the data reported by the utilities. Additionally, while a single cause is typically listed on the SSO report, many SSOs are caused by a combination of factors.

This study considered five years of TCEQ SSO violation data from January 2020 through December 2024. There were 474 SSO records from 104 plants considered for the West Lake Houston basin area, which were broken down by year and cause, for number and volume.

There was not a strong trend in number of SSOs over time for the five years examined (**Table 22** and **Figure 14**). In terms of cause by number, the general category of malfunctions and operational issues accounted for 44.3%, blockages accounted for 31.6%, weather-related issues accounted for 22.6% of the overall total, and 1.5% were listed as unknown causes.

Table 22. *Number of Annual SSO Events in the West Lake Houston Basin*

CAUSE	2020	2021	2022	2023	2024
Weather	**16**	**15**	**5**	**30**	**41**
Rain / Inflow / Infiltration	15	11	5	30	32
Severe Weather/Natural Disaster	1	4			9
Malfunctions	**46**	**31**	**39**	**49**	**45**
WWTF Operation or Equipment Malfunction	14	9	21	10	15
Power Failure				1	
Lift Station Failure	18	14	13	30	23
Collection System Structural Failure	14	8	4	8	6
Human Error			1		1
Blockages	**33**	**28**	**31**	**38**	**20**
Blockage in Collection System-Other Cause	24	16	9	16	11
Blockage in Collection System Due to Fats/Grease	7	9	19	19	7
Blockage Due to Roots/Rags/Debris	2	3	3	3	2
Unknown Cause		**2**	**3**	**2**	
Total	**95**	**76**	**78**	**119**	**106**

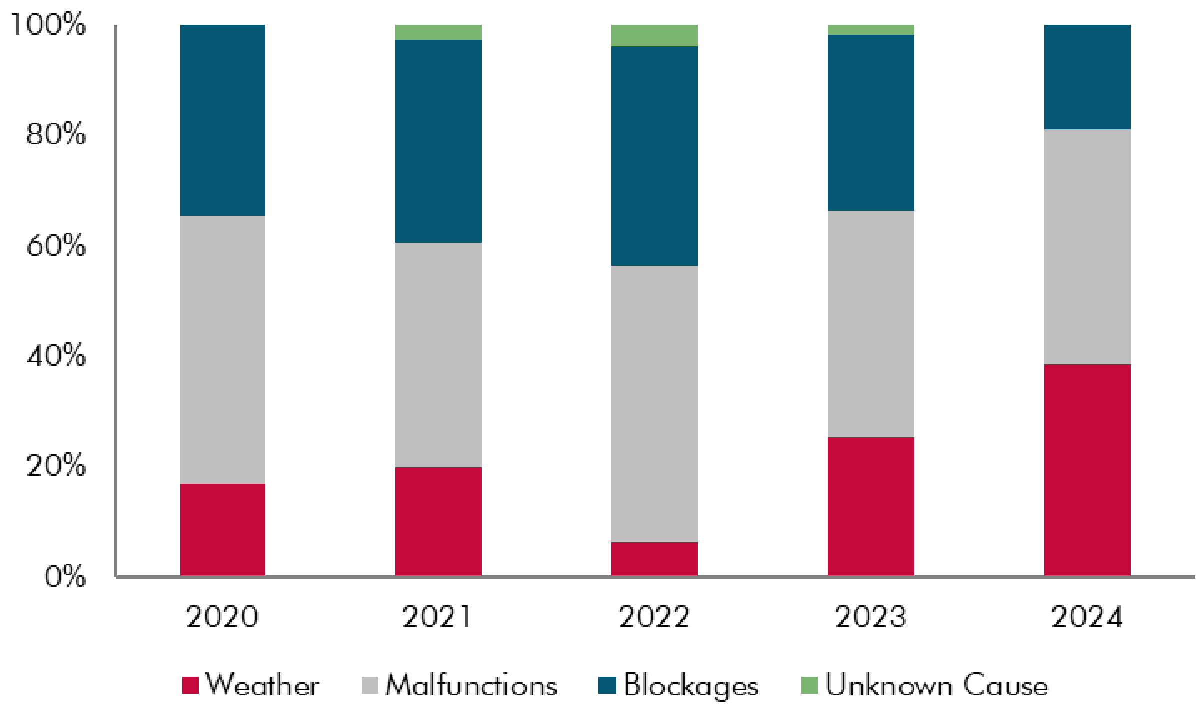


Figure 14. *Percent Total Annual SSO Events in the West Lake Houston Basin*

While numbering SSO events informs how frequently these overflows impact the basin, volume of overflow is an indicator of the magnitude of impact. Of the total volume of overflows reported from 2020 to 2024, malfunctions were responsible for 16.7%, weather contributed 54.8%, blockages comprised 9.4%, and unknown causes led to the remaining 19.1% (**Table 23** and **Figure 15**). These overall contributions are important to consider in a general sense for estimating impacts to the basin area.

Table 23. *Annual SSO Events by Volume (in Thousands of Gallons) in the West Lake Houston Basin*

CAUSE	2020	2021	2022	2023	2024
Weather	**55.41**	**66.15**	**51.91**	**278.72**	**2,417.80**
Rain / Inflow / Infiltration	55.34	53.41	51.91	278.72	243.20
Severe Weather/Natural Disaster	0.08	12.74			2,174.60
Malfunctions	**134.09**	**140.59**	**178.96**	**316.47**	**104.30**
WWTF Operation or Equipment Malfunction	33.05	9.06	101.46	8.91	24.08
Power Failure				3.00	
Lift Station Failure	23.66	85.75	74.64	163.35	72.12
Collection System Structural Failure	77.38	45.78	2.77	141.22	7.62
Human Error			0.10		0.48
Blockages	**52.34**	**31.97**	**229.29**	**109.79**	**67.61**
Blockage in Collection System-Other Cause	43.33	24.83	11.65	20.07	56.89
Blockage in Collection System Due to Fats/Grease	8.39	4.18	217.38	88.50	2.02
Blockage Due to Roots/Rags/Debris	0.63	2.96	0.26	1.23	8.70
Unknown Cause		**0.00**	**1.00**	**1,000.00**	
Total	**241.84**	**238.70**	**461.16**	**1,704.98**	**2,589.71**

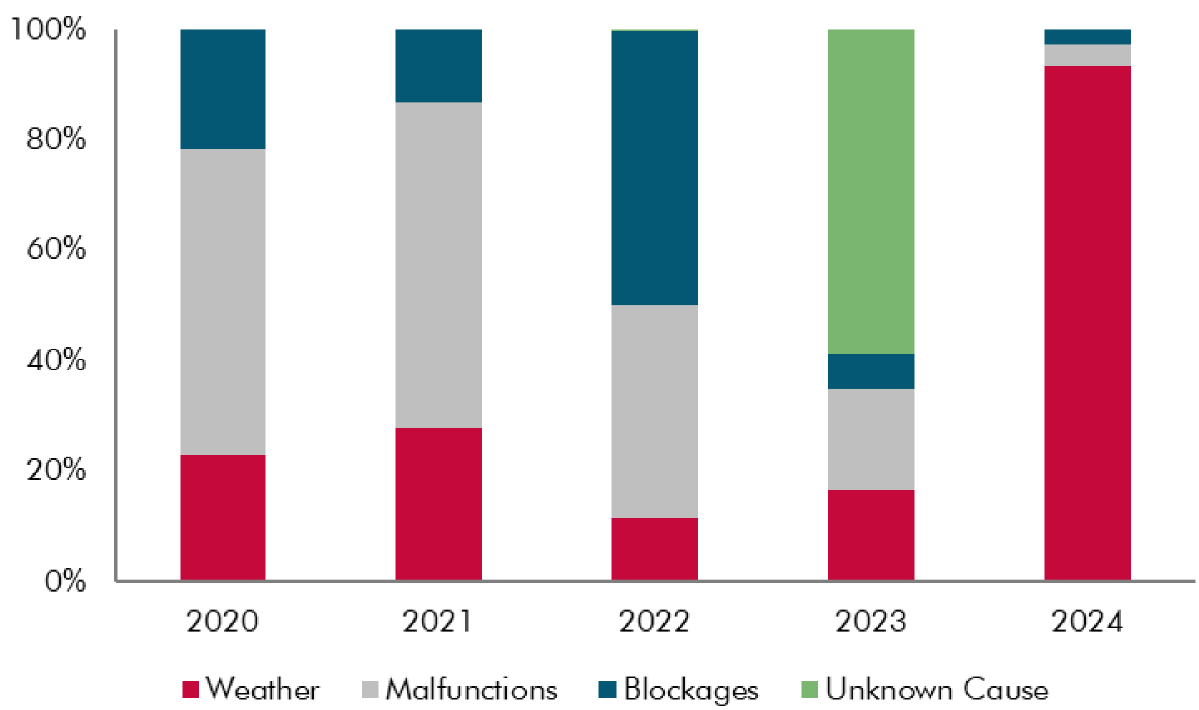


Figure 15. *Percent Total Annual SSO Volume in the West Lake Houston Basin*

2.6.1 Summary of SSO Analyses

The highest volume of flows relative to other years occurred in 2024, and there appears to be a pattern of increasing number and volume of events over the five year period. In terms of general cause, malfunctions accounted for the highest number of events respective to the other general categories of weather, blockages, and unknown causes. In terms of volume, weather contributed over half of the total overflow observed between 2020 and 2024. The greatest number and highest volumes of overflows related to weather occurred in 2024 as a result of an area-wide freeze, a derecho, and Hurricane Beryl.

While these data are useful, it should be noted that they are also self-reported and may vary in quality. Overflow volumes and numbers of events may be greater than the values recorded in the report data, and causes may be overgeneralized due to multiple factors ultimately resulting in SSOs.

In watersheds where bacteria and nutrient loading are of particular concern, the impacts of SSOs are important to understand due to their concentrations of untreated human waste. These events pose a high risk to human health especially due to their proximity to urban populations. Further, despite their episodic occurrences, SSOs can be extreme loading sources in the sense of volume introduced in a short time frame. Though SSOs do not have the same potential to cause chronic impacts on waterways as effluent from high volume WWTFs, for the aforementioned reasons, it is still critical to consider SSO management among the best management practices selected to improve water quality in the West Lake Houston basin and other surrounding watersheds.

SECTION 3: OUTCOMES AND IMPLICATIONS

This analysis of ambient, DMR, and SSO report data contributes to the continued characterization of water quality concerns in the West Lake Houston Basin. Findings from this report can be used to inform stakeholders as they work to implement best management practices outlined in the WPPs for West Fork San Jacinto River and Lake Creek, Cypress Creek, and Spring Creek.

Data collected between January 2020 and December 2024 were used to determine what parameters of water quality are of greatest concern and the extent to which their impacts have been observed throughout the area waterways. As indicated in the *2024 Texas Integrated Report* results for this basin, an analysis of the SWQMIS dataset identified high levels of the fecal indicator bacteria *E. coli* as the most pervasive impact to water quality throughout all four watersheds. Further, elevated nutrient (nitrate nitrogen and total phosphorous) levels observed in the highly developed areas of the Cypress Creek watershed and the eastern third of the Spring Creek watershed present challenges to water quality. Depressed DO levels were also highlighted as concerns in segments of the Spring Creek and Lake Creek watersheds in the *2024 Texas Integrated Report*, but comparable results were not captured in this analysis. This is most likely due to the incomplete overlap of datasets observed for each report with the analysis described herein including more recent data where increasing trends in DO have been observed.

Field survey observations in the West Lake Houston Basin generally highlighted flow impediments such as sedimentation, possibly as a result of increased development in all four watersheds. Though not a direct source of bacteria, disrupted flows could exacerbate, or further complicate water related issues. Sedimentation was also a primary concern brought up by stakeholders during the development of each WPP within the West Lake Houston Basin.

Permitted wastewater effluent was unlikely to be a widespread or chronic water quality issue but requires further investigation on limited spatial scales and timeframes. However, understanding these discharges is still critical to the development of this project as WWTFs without permit limits for certain nutrients act as source loads—particularly in effluent-dominated streams. Further, as treatment facilities for human waste, improper treatment indicators identified in DMR analyses can have greater implications for risk to human health.

An analysis of SSO reports from the four watersheds indicated that for number of SSO events, malfunctions were among the most common for the general cause categories. Extreme weather, especially events occurring during 2024, led to the majority of reported overflow volume. However, it is important to note that while only one cause is usually listed on the report, multiple compounding factors can lead to SSOs. Ultimately, causes listed in SSO reports are prone to a degree of subjectivity as opposed to more quantitative measurements. While the episodic overflow volumes reported during these events are relatively small compared to the scale of effluent produced by WWTFs, SSO inputs are of particular concern due to the untreated nature of the sewage associated with them and the subsequent risk to human health.

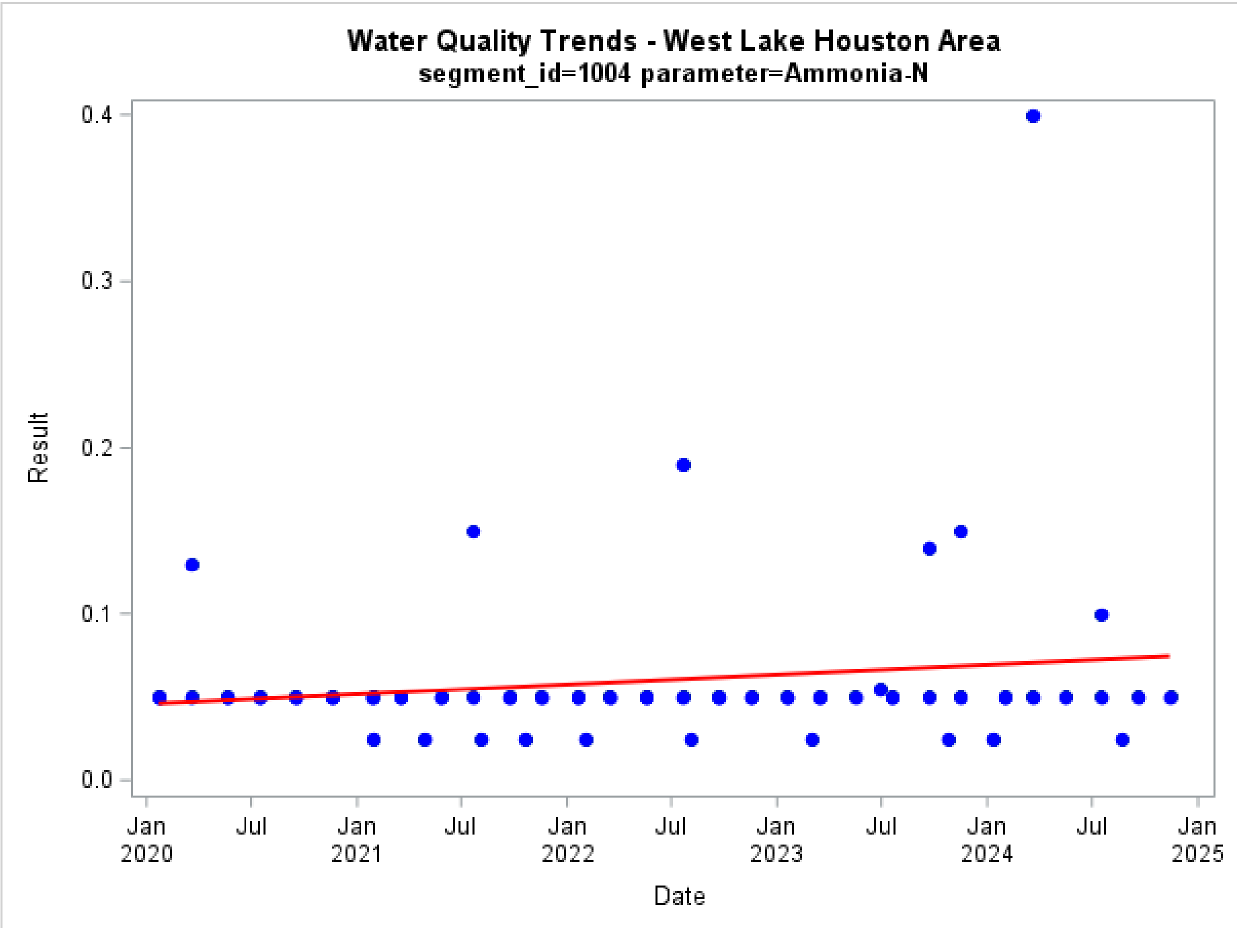
As future growth projections indicate that increased development in this basin area is likely, the balance of pollutant sources and current hydrologic processes could be altered significantly in the coming years. These changes could result in further water quality impacts without intervention. Subsequent efforts should be made to identify causes and sources of the primary parameter of concern (indicator bacteria), and to characterize nutrient sources further to identify areas within the project watersheds most vulnerable to pollutant loadings and/or best suited for the implementation of management strategies.

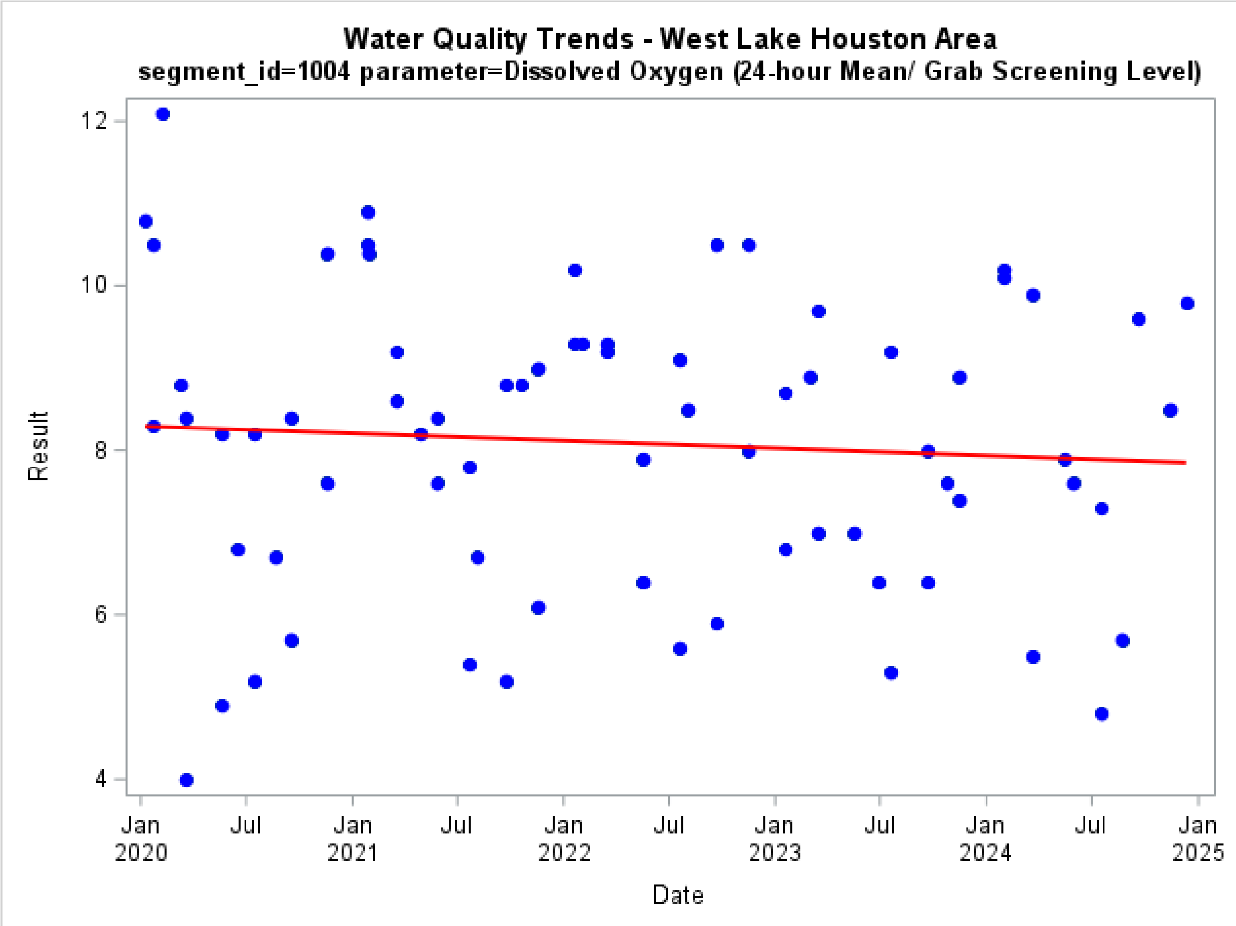
Appendix A: Ambient Monitoring Data

The following figures represent the results, by segment, for all parameters evaluated. The period of observation is 2020 through 2024, although data may vary as indicated in the charts. The regression analyses for ambient conditions were conducted using SAS.

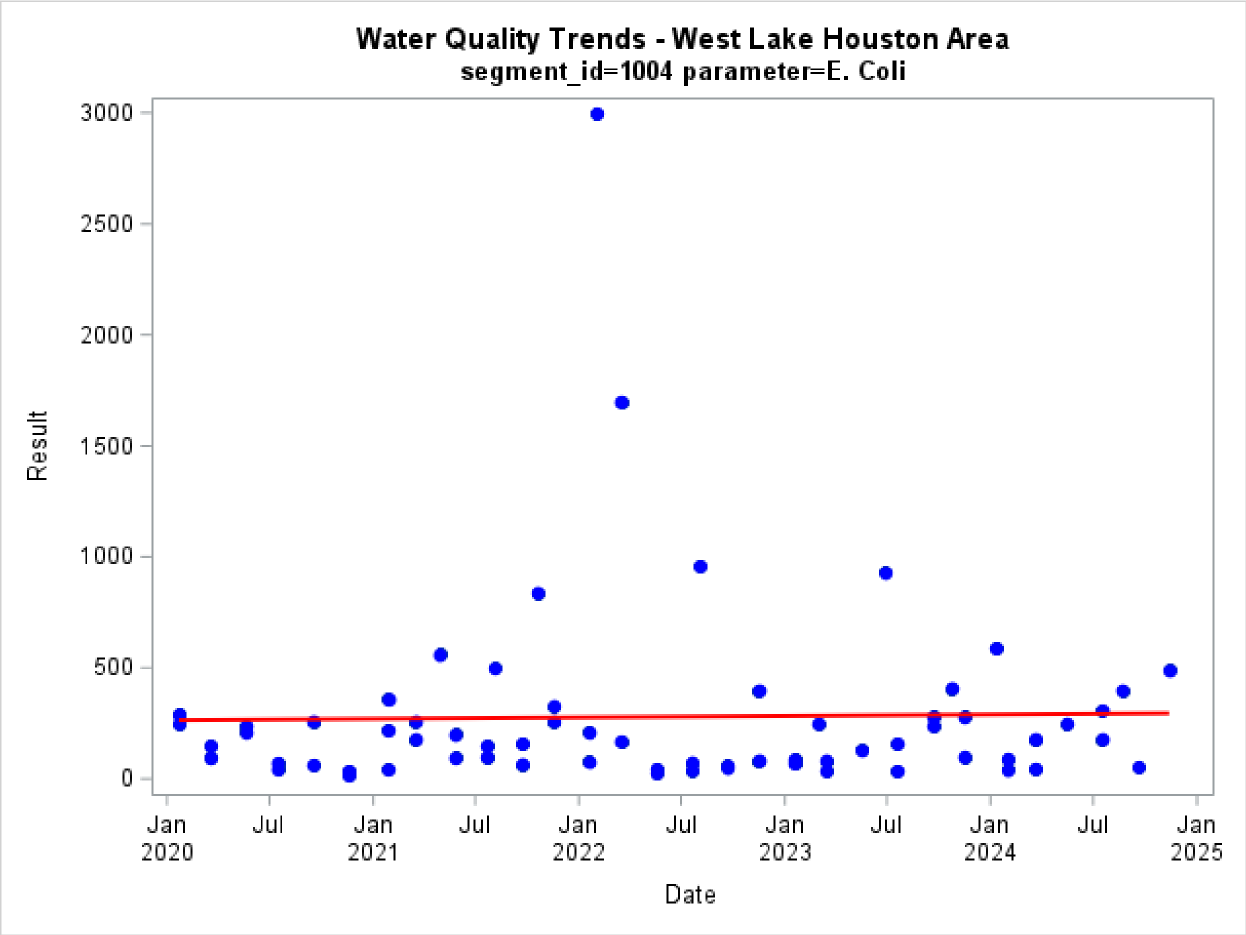
West Fork San Jacinto River Watershed

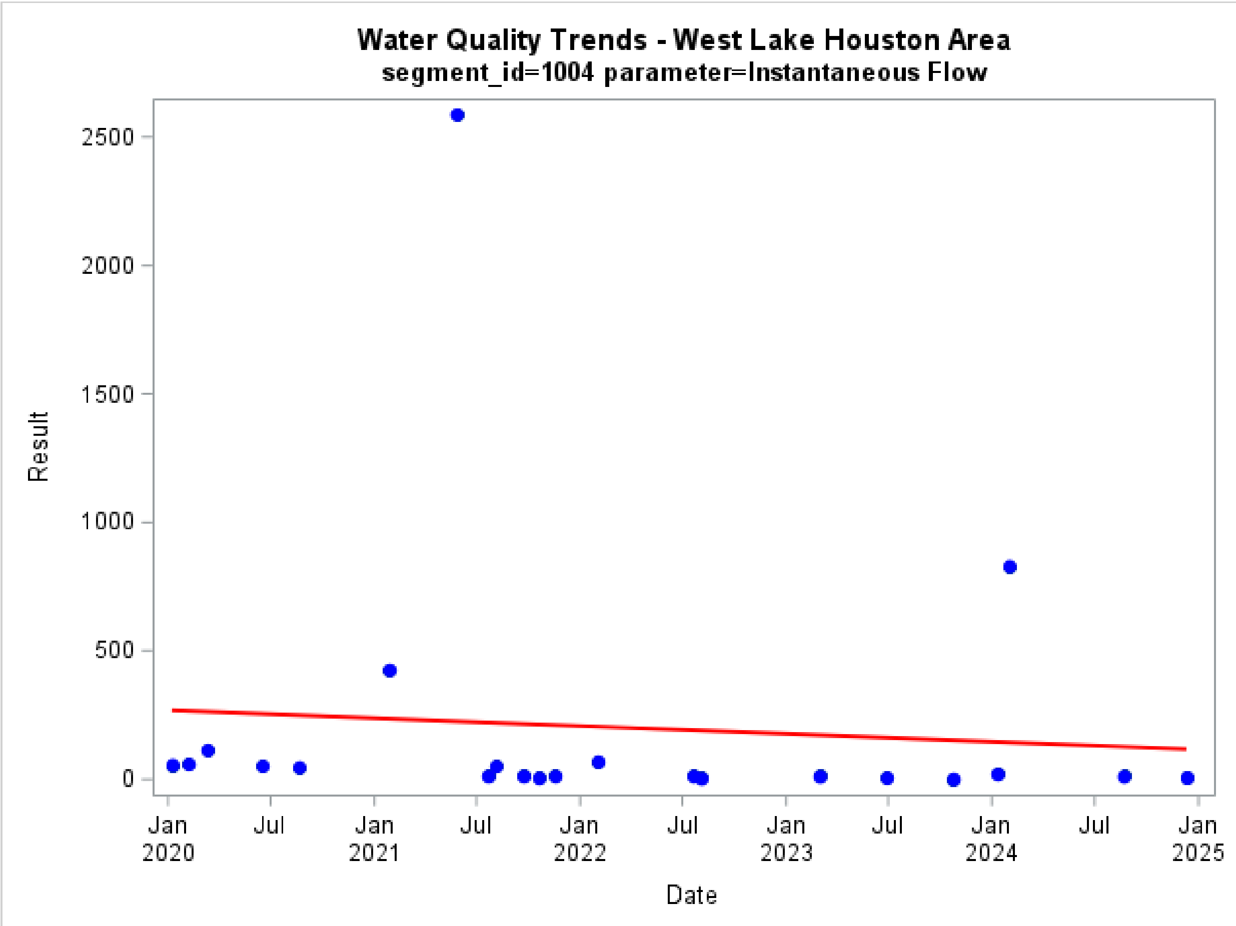
West Fork San Jacinto River (1004)

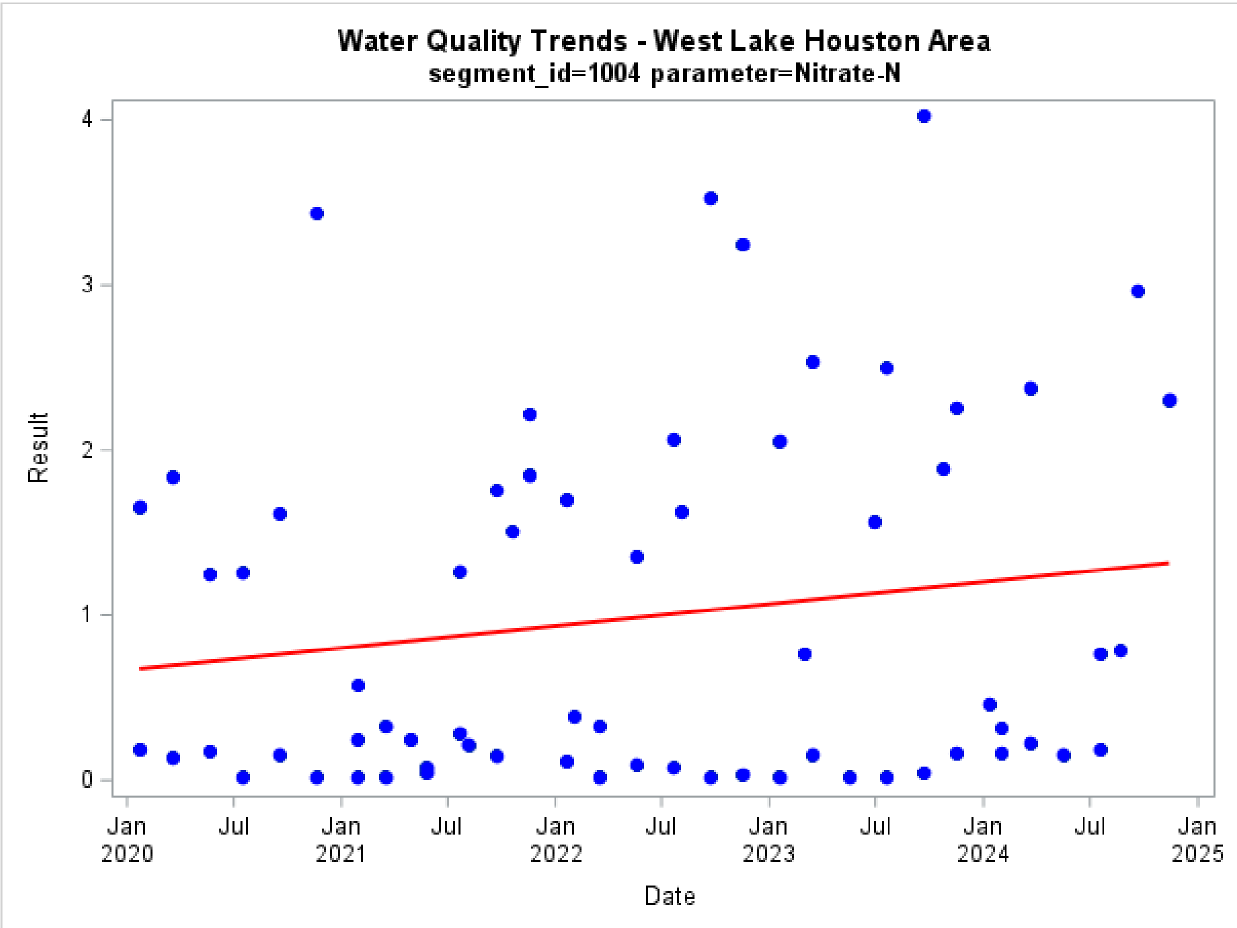


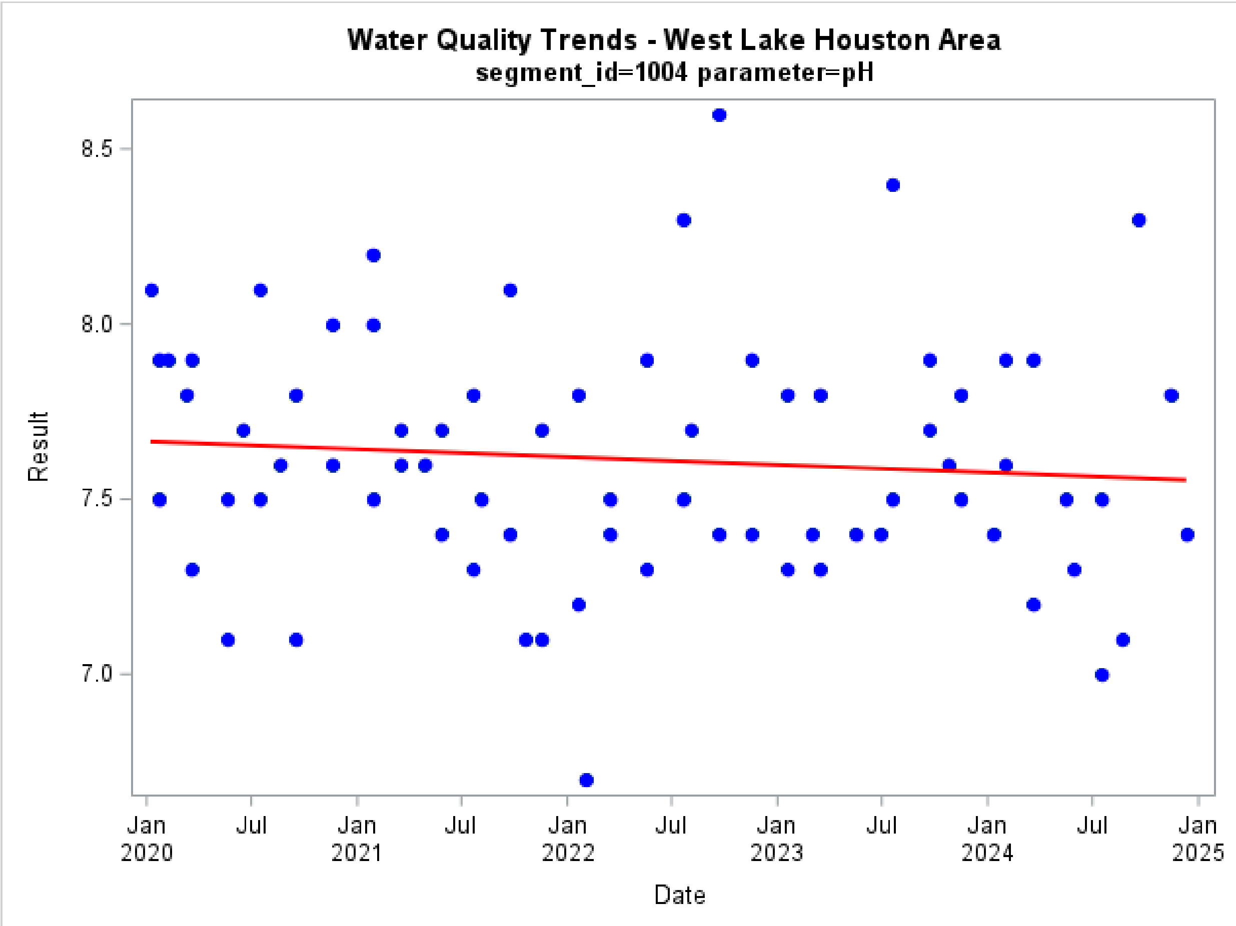


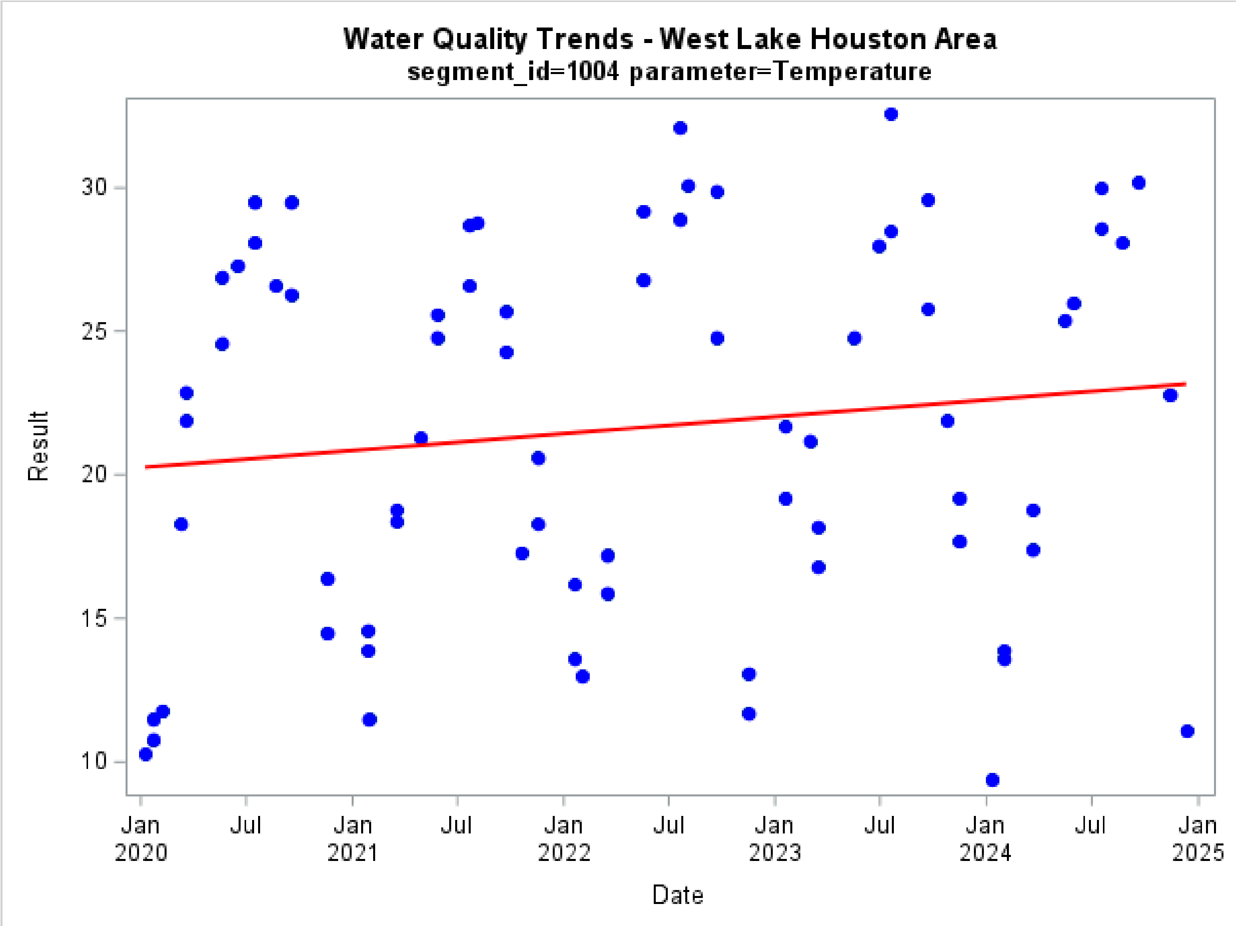
Water Quality Trends - West Lake Houston Area
segment_id=1004 parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
12
10
8
6
4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

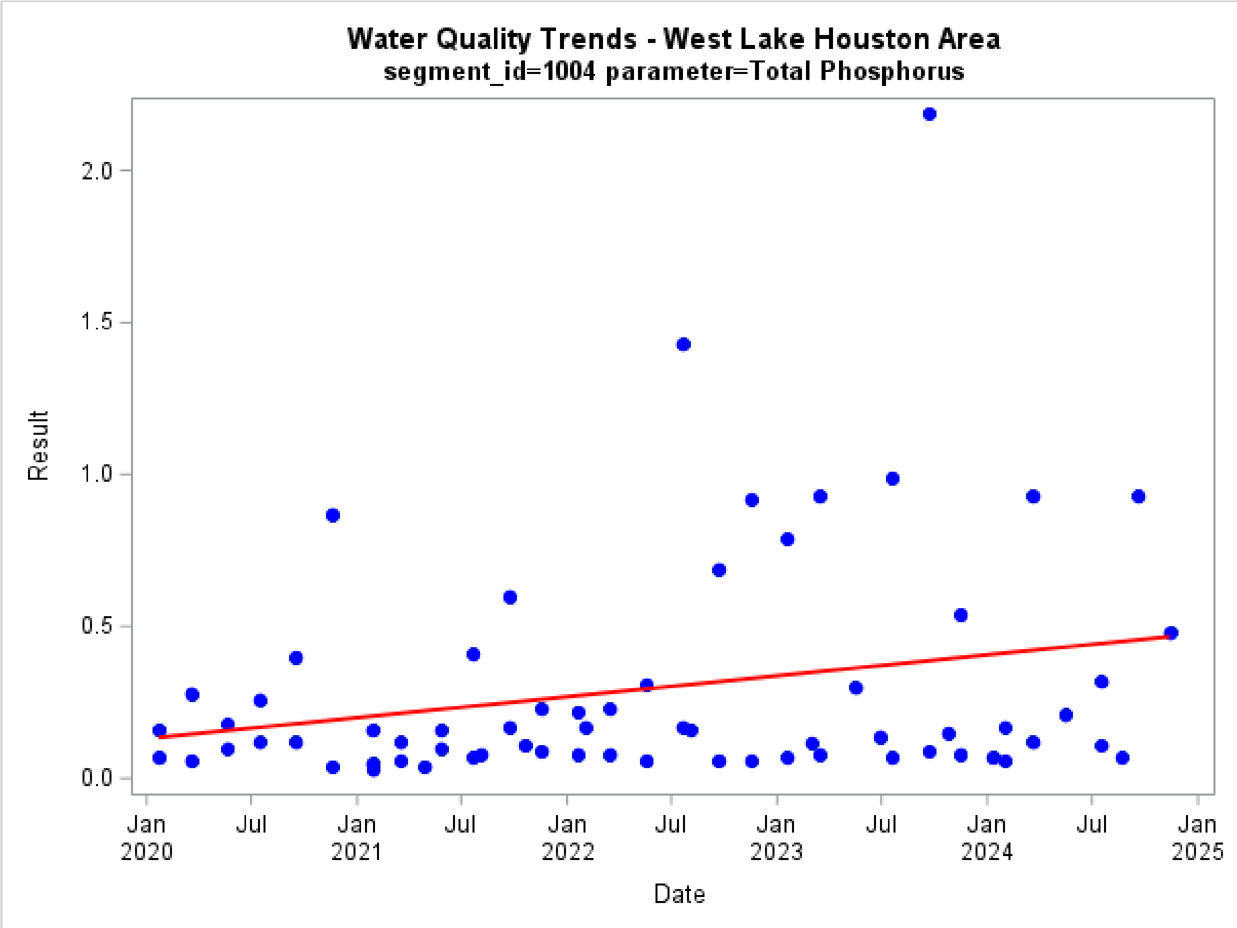

Water Quality Trends - West Lake Houston Area
segment_id=1004 parameter=E. Coli
Result
3000
2500
2000
1500
1000
500
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

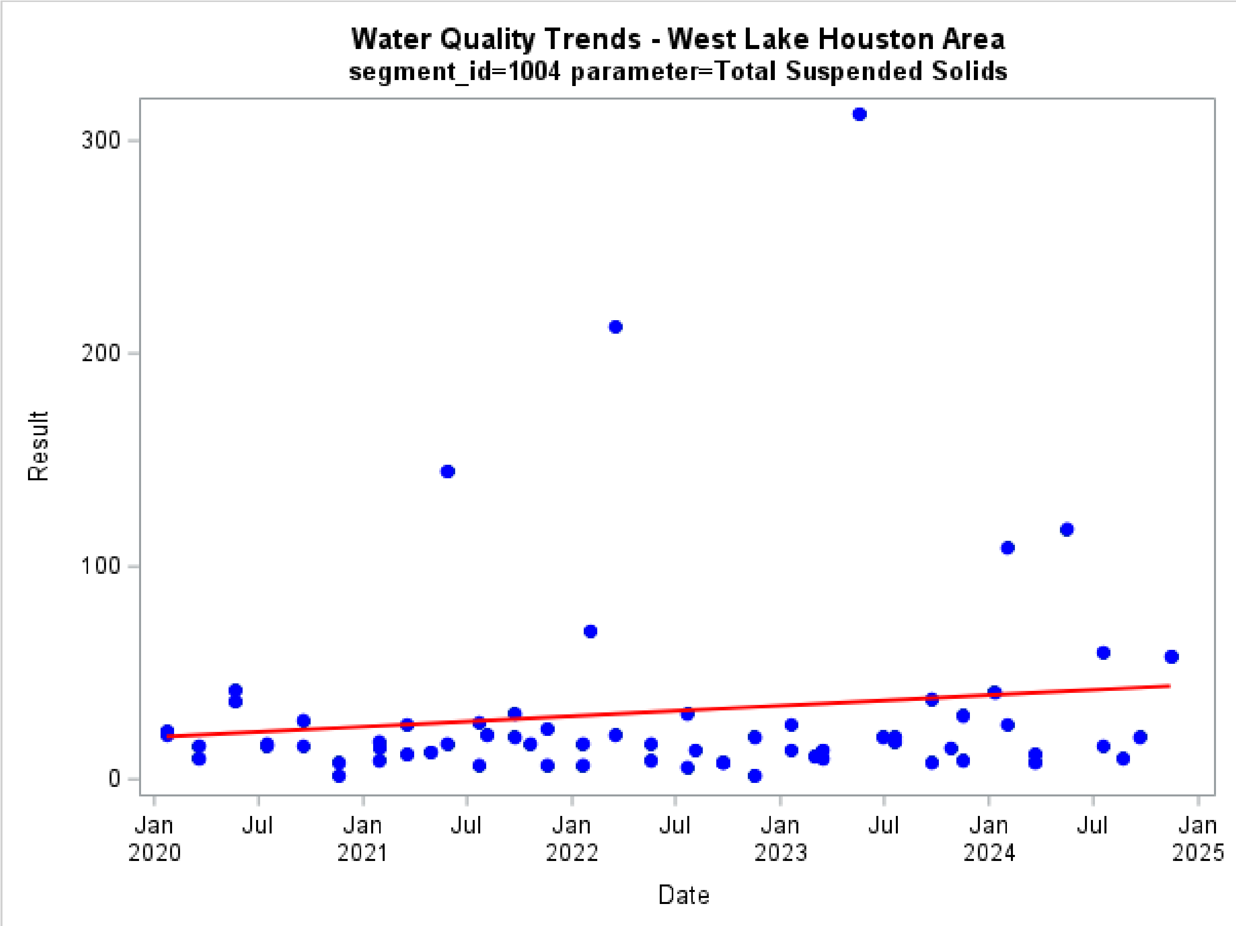

Water Quality Trends - West Lake Houston Area
segment_id=1004 parameter=Instantaneous Flow
Result
2500
2000
1500
1000
500
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1004 parameter=Nitrate-N
Result
0
1
2
3
4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

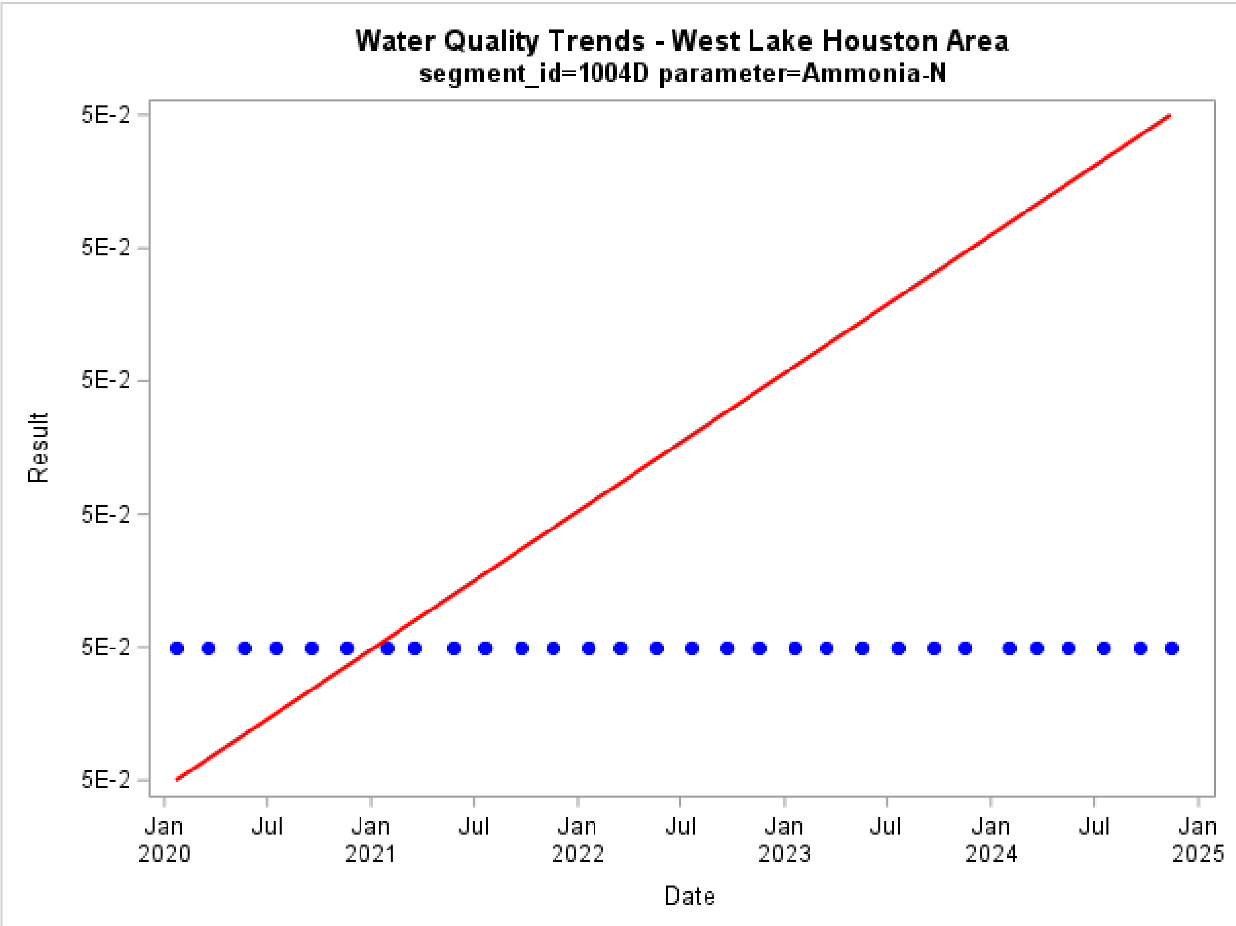

Water Quality Trends - West Lake Houston Area
segment_id=1004 parameter=pH
8.5
8.0
7.5
7.0
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

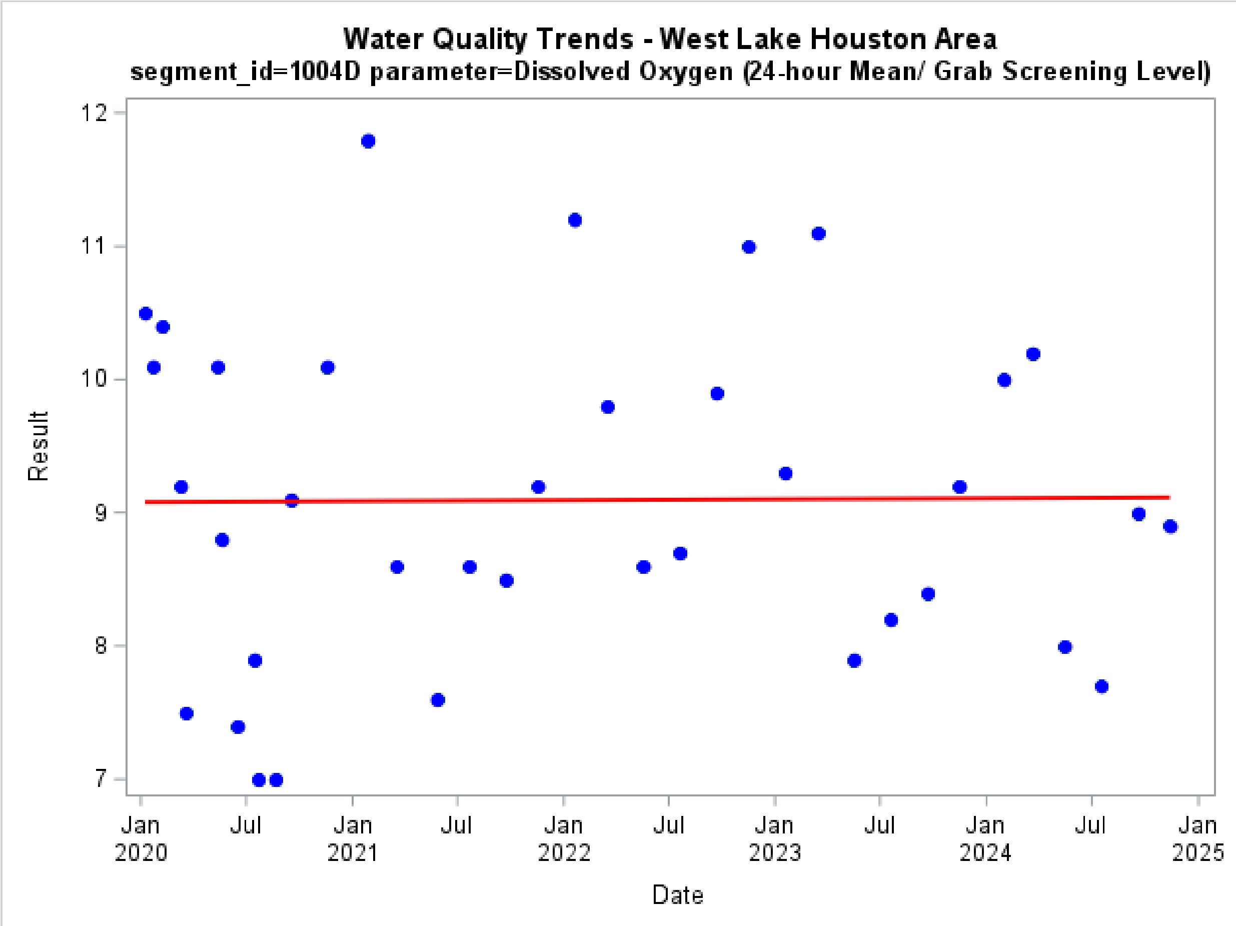

Water Quality Trends - West Lake Houston Area
segment_id=1004 parameter=Temperature
Result
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

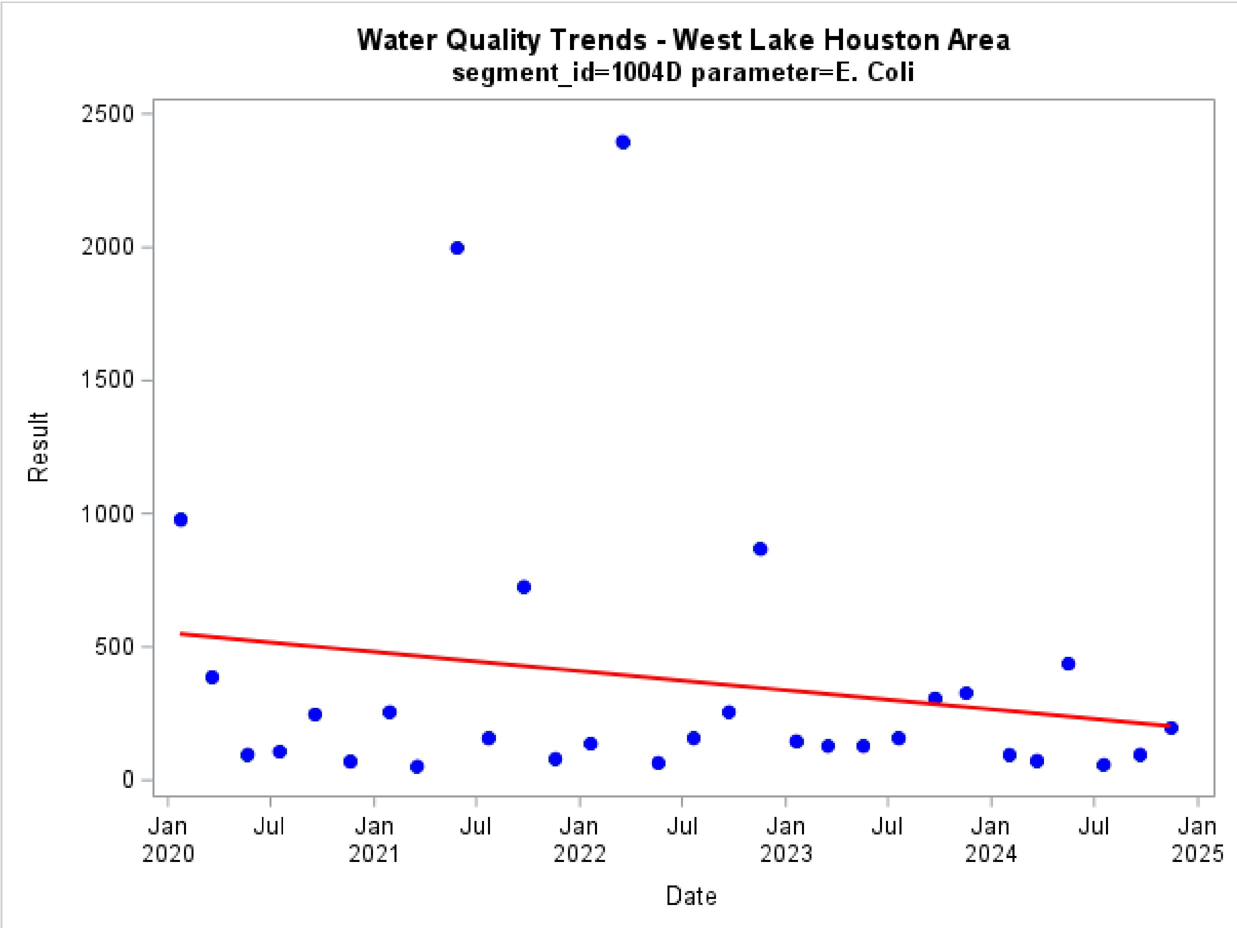

Water Quality Trends - West Lake Houston Area
segment_id=1004 parameter=Total Phosphorus
Result
0.0
0.5
1.0
1.5
2.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

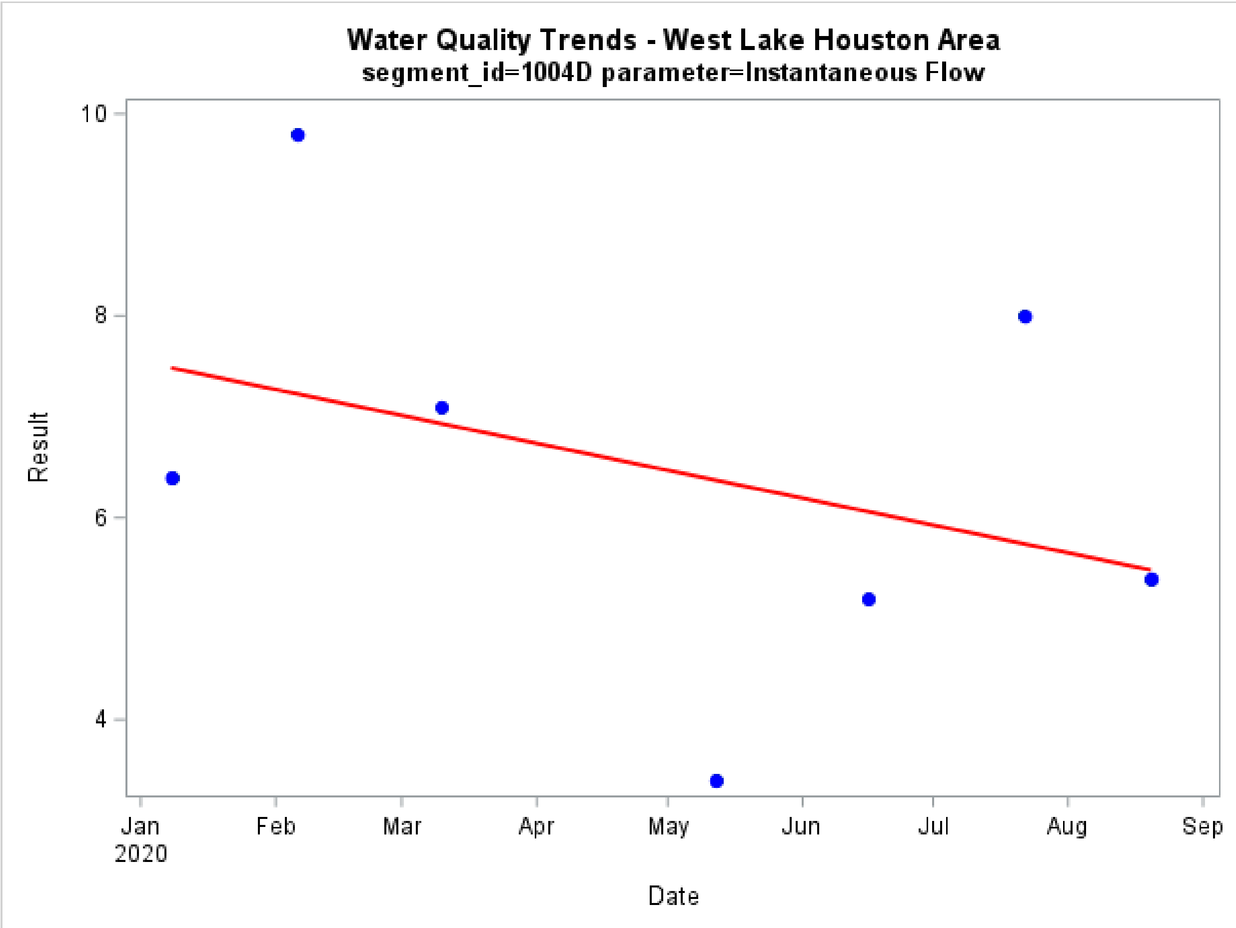

Water Quality Trends - West Lake Houston Area
segment_id=1004 parameter=Total Suspended Solids
300
200
100
0
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

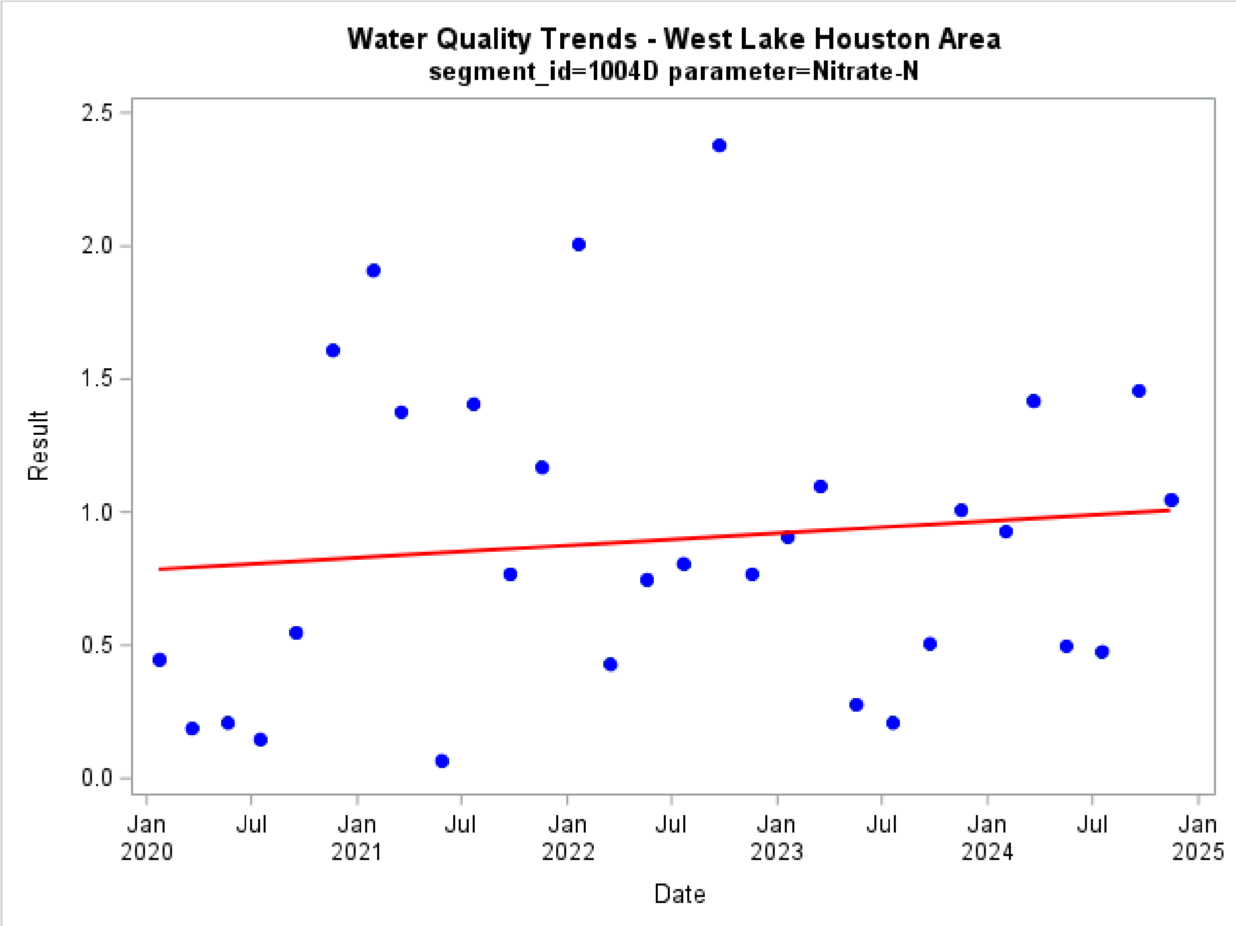
Crystal Creek (1004D)

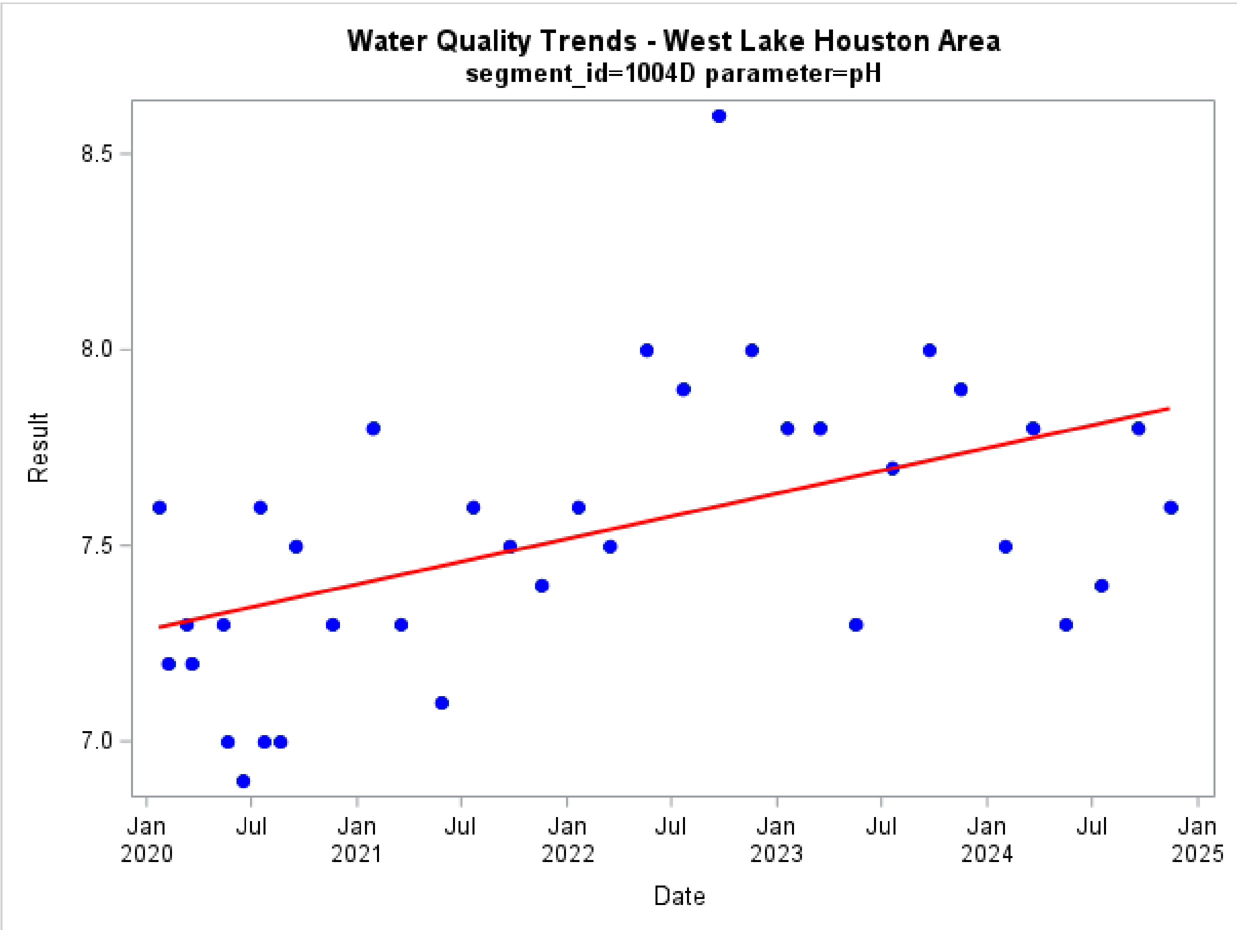


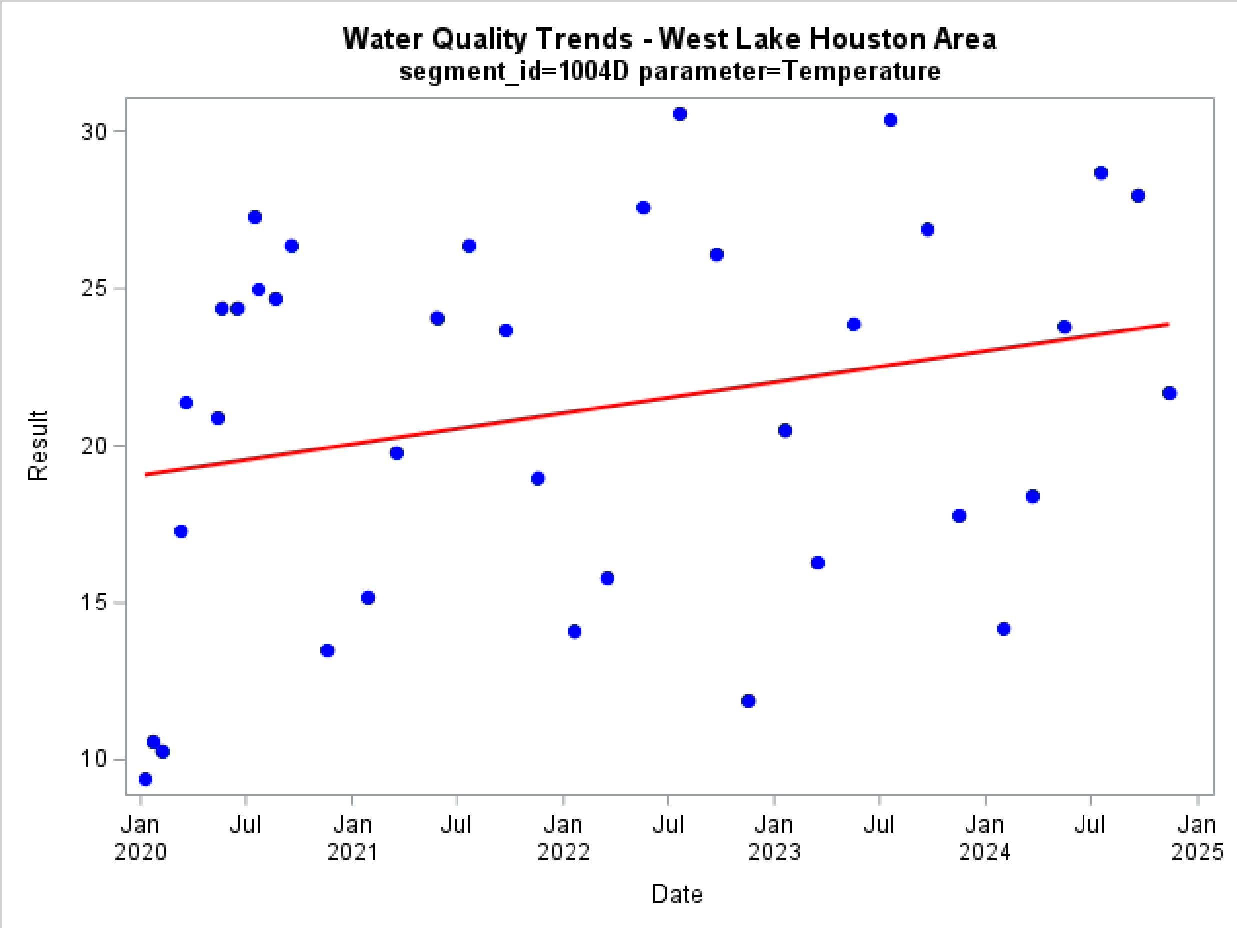

Water Quality Trends - West Lake Houston Area
segment_id=1004D parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
12
11
10
9
8
7
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

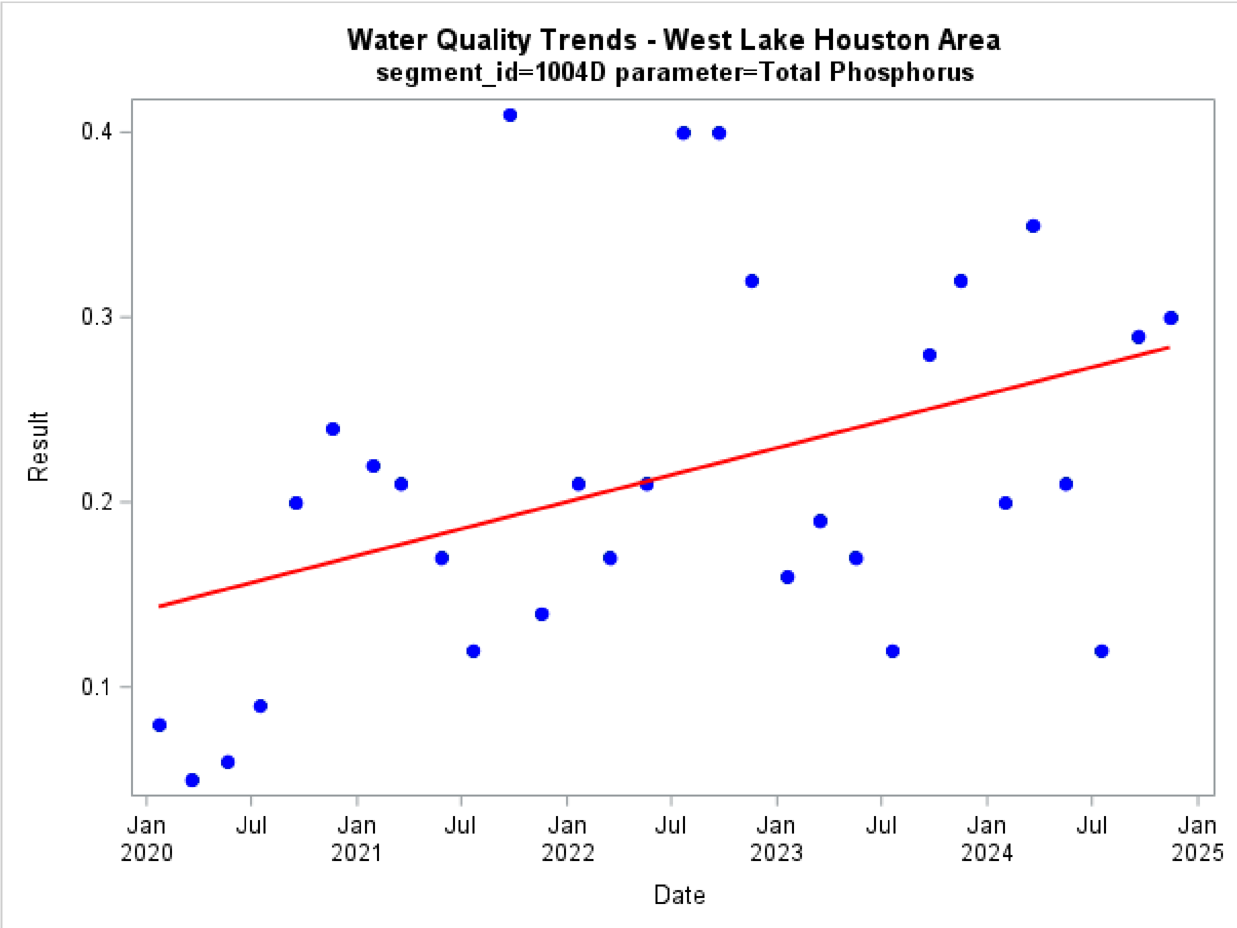

Water Quality Trends - West Lake Houston Area
segment_id=1004D parameter=E. Coli
Result
2500
2000
1500
1000
500
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

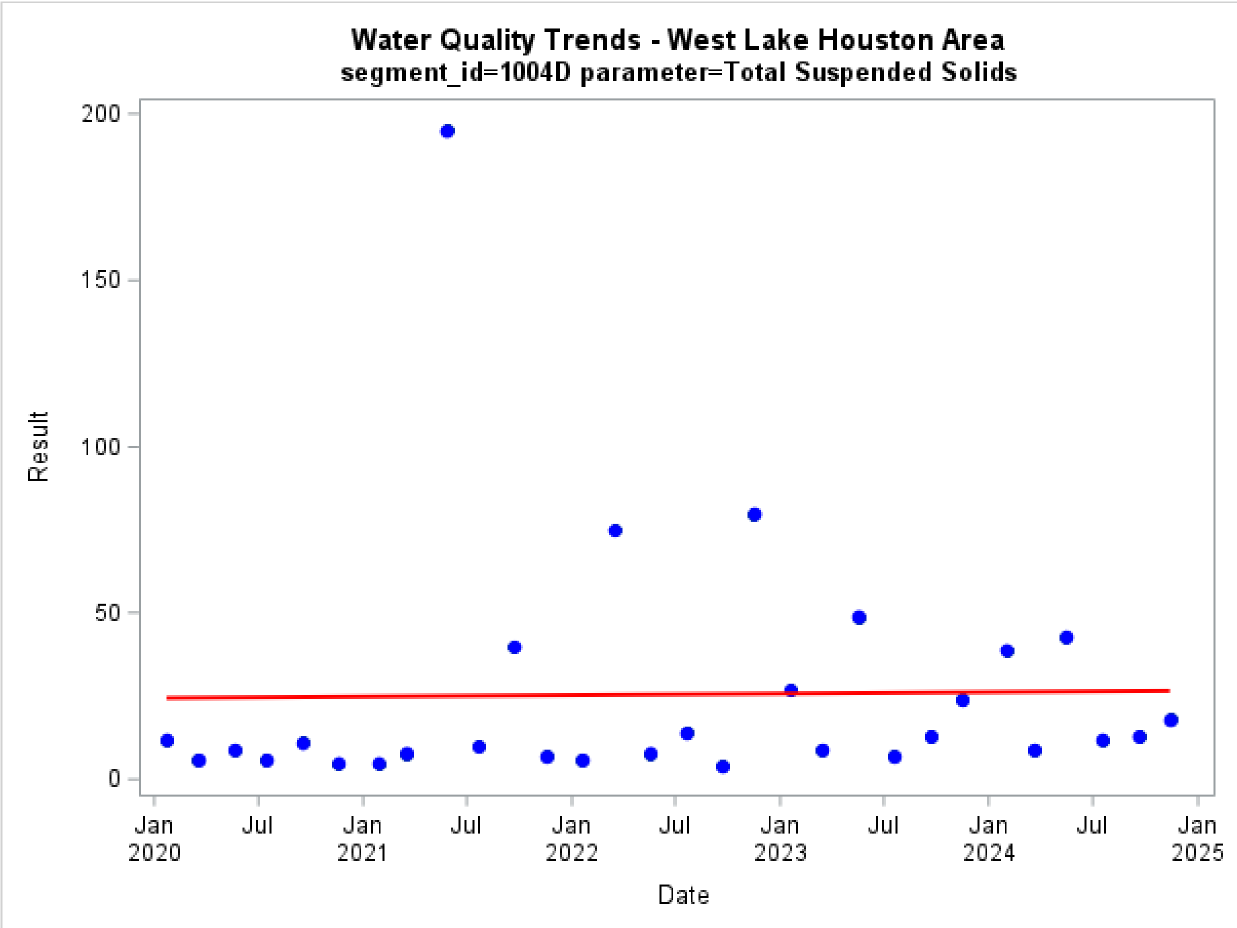

Water Quality Trends - West Lake Houston Area
segment_id=1004D parameter=Instantaneous Flow
Result
10
8
6
4
Jan 2020
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Date


Water Quality Trends - West Lake Houston Area
segment_id=1004D parameter=Nitrate-N
Result
0.0
0.5
1.0
1.5
2.0
2.5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

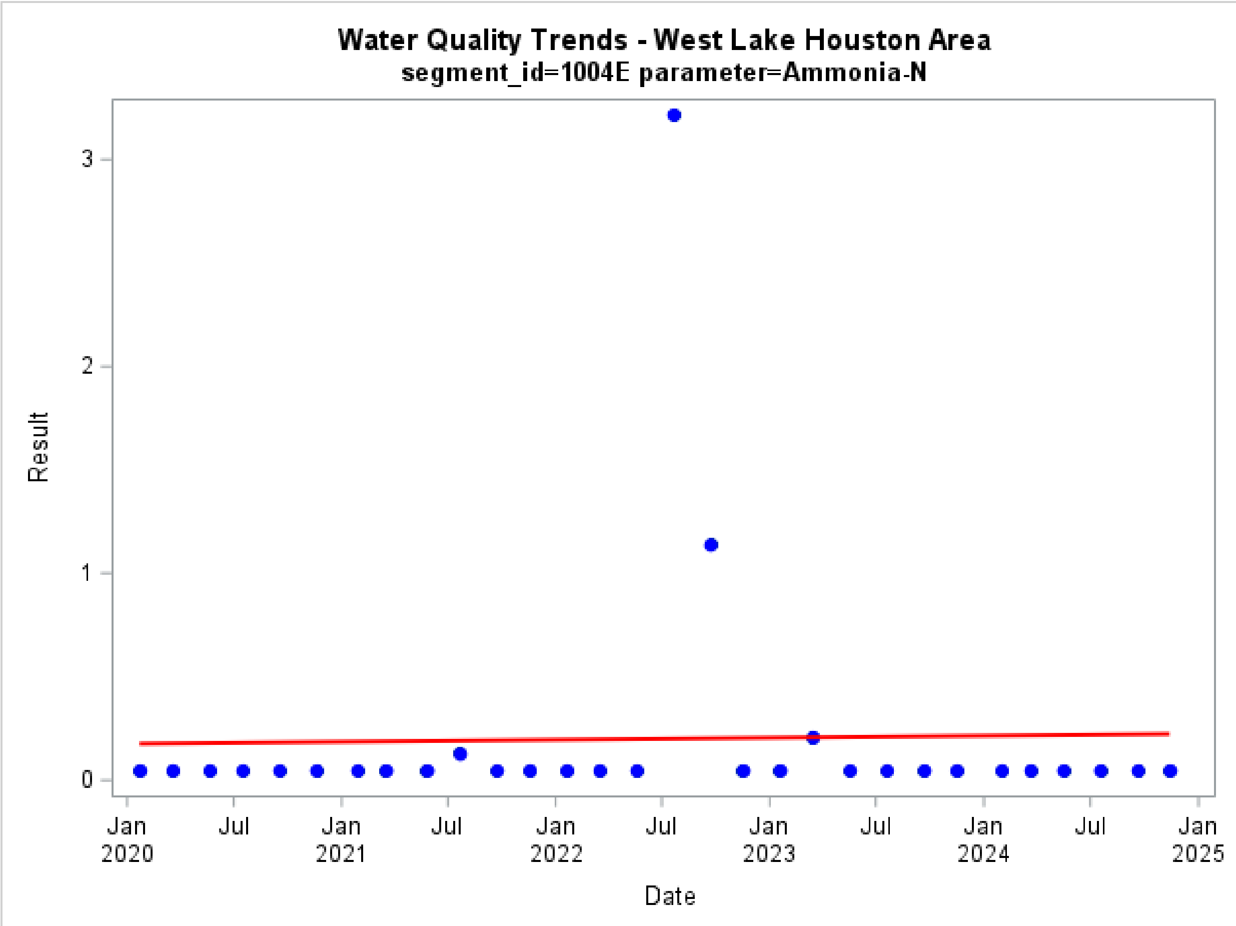

Water Quality Trends - West Lake Houston Area
segment_id=1004D parameter=pH
Result
8.5
8.0
7.5
7.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

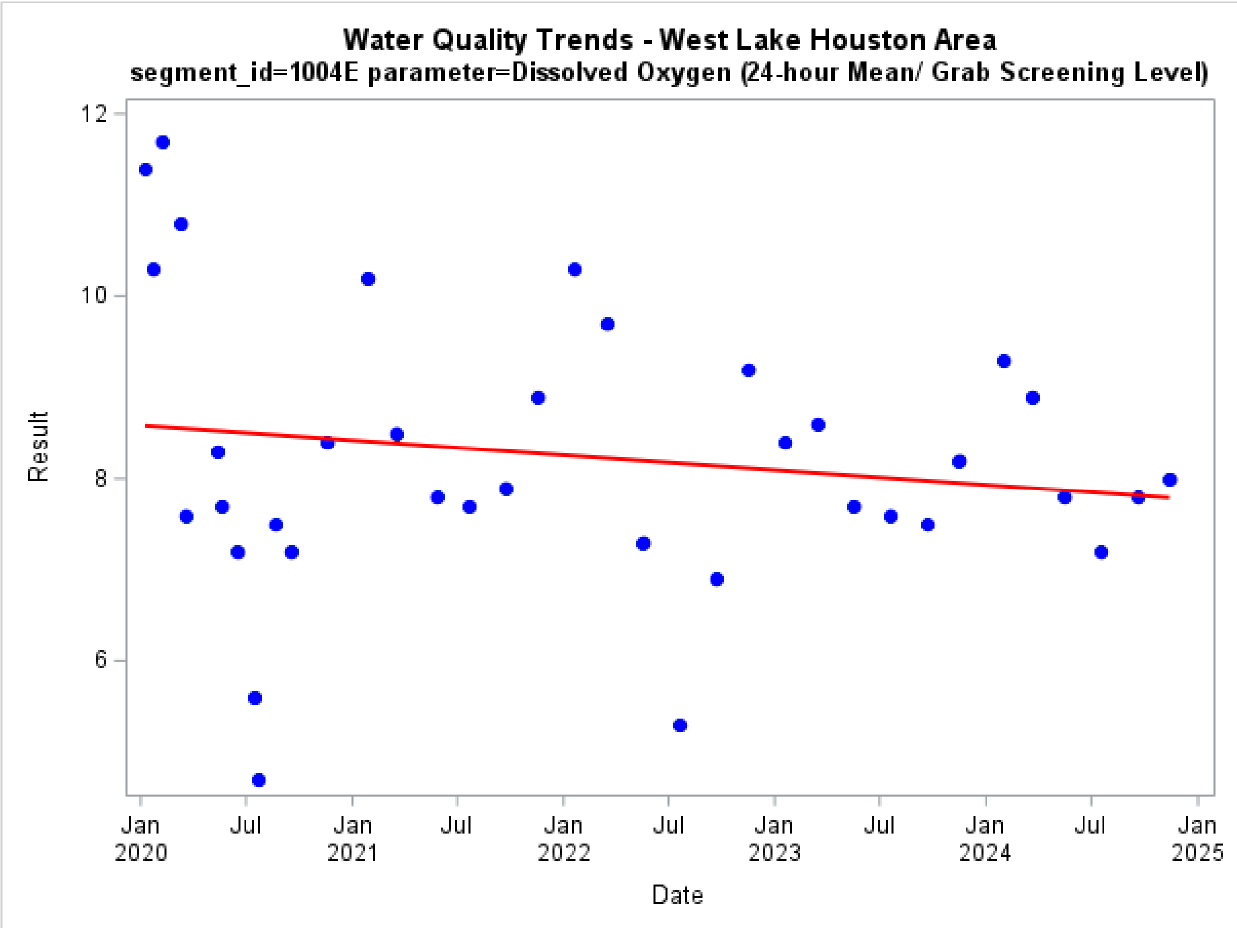

Water Quality Trends - West Lake Houston Area
segment_id=1004D parameter=Temperature
Result
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

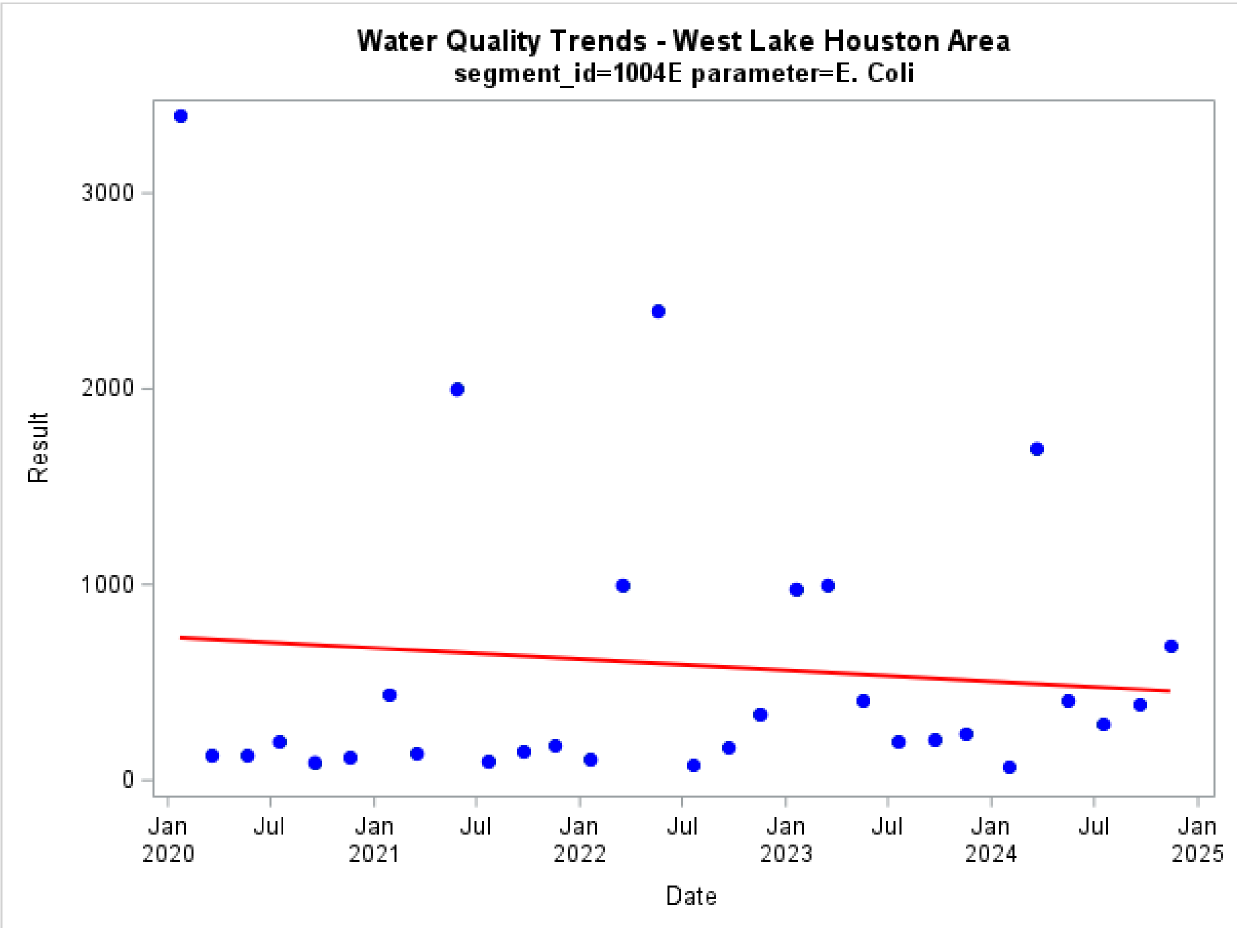

Water Quality Trends - West Lake Houston Area
segment_id=1004D parameter=Total Phosphorus
Result
0.4
0.3
0.2
0.1
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

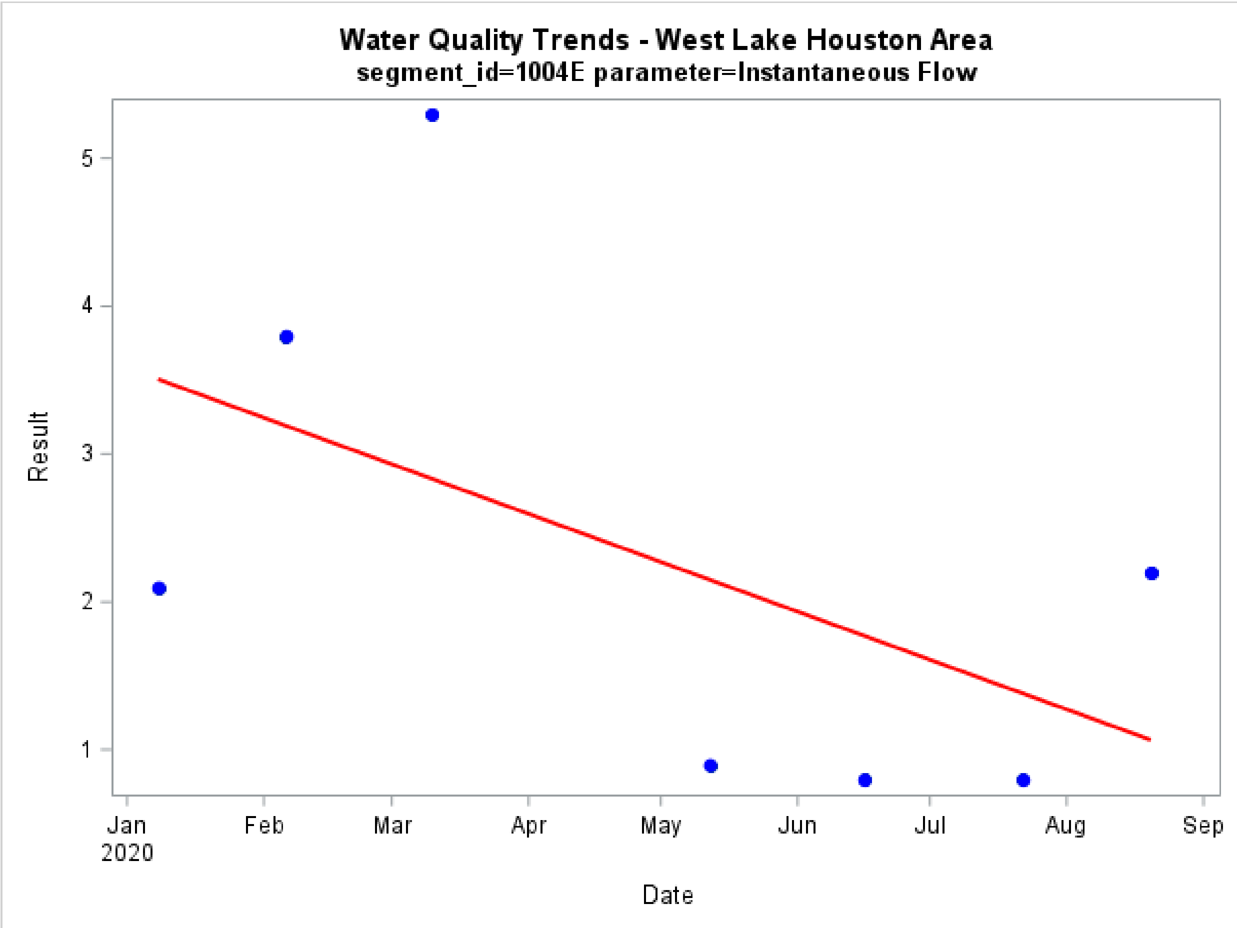

Water Quality Trends - West Lake Houston Area
segment_id=1004D parameter=Total Suspended Solids
Result
200
150
100
50
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

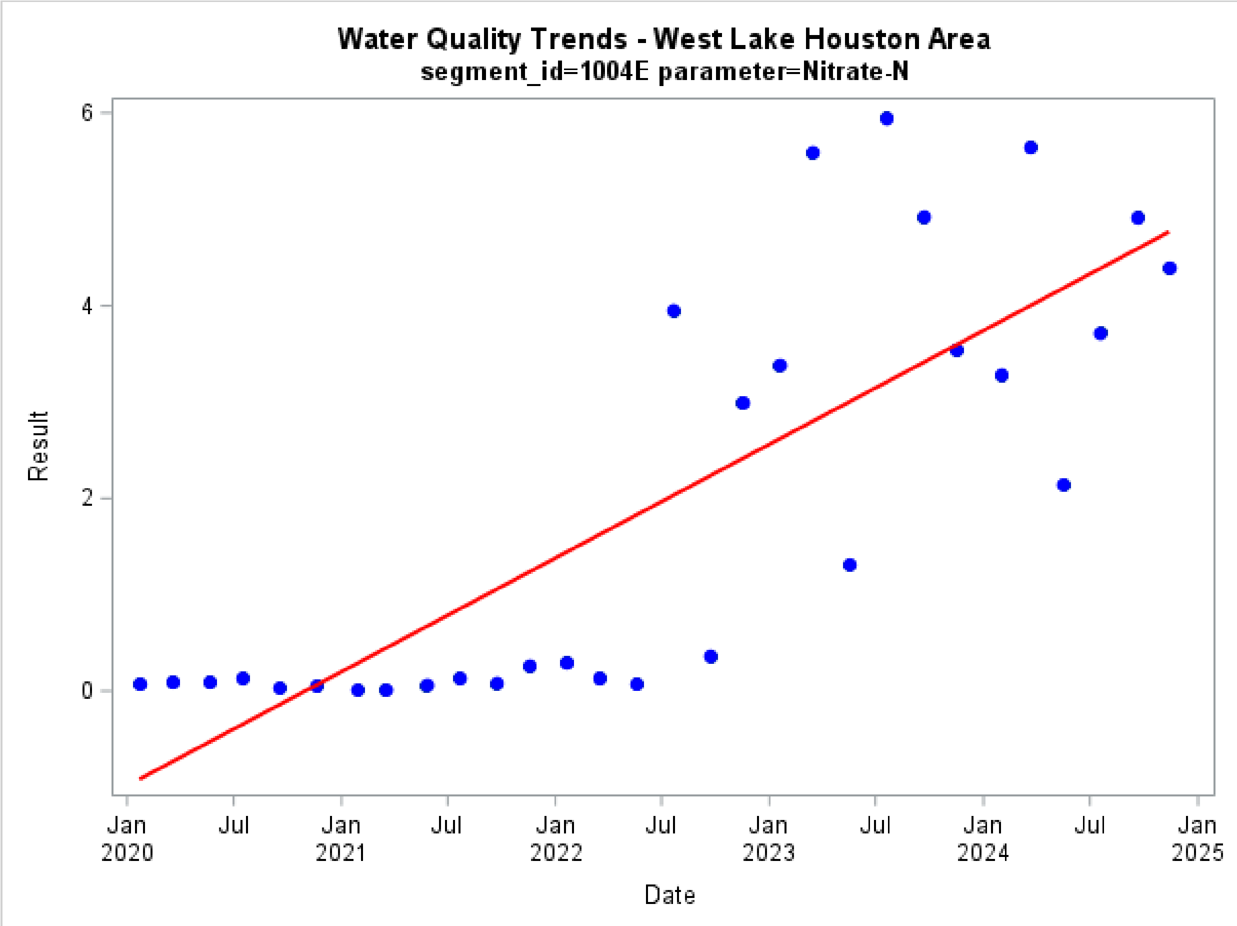
Stewarts Creek (1008E)

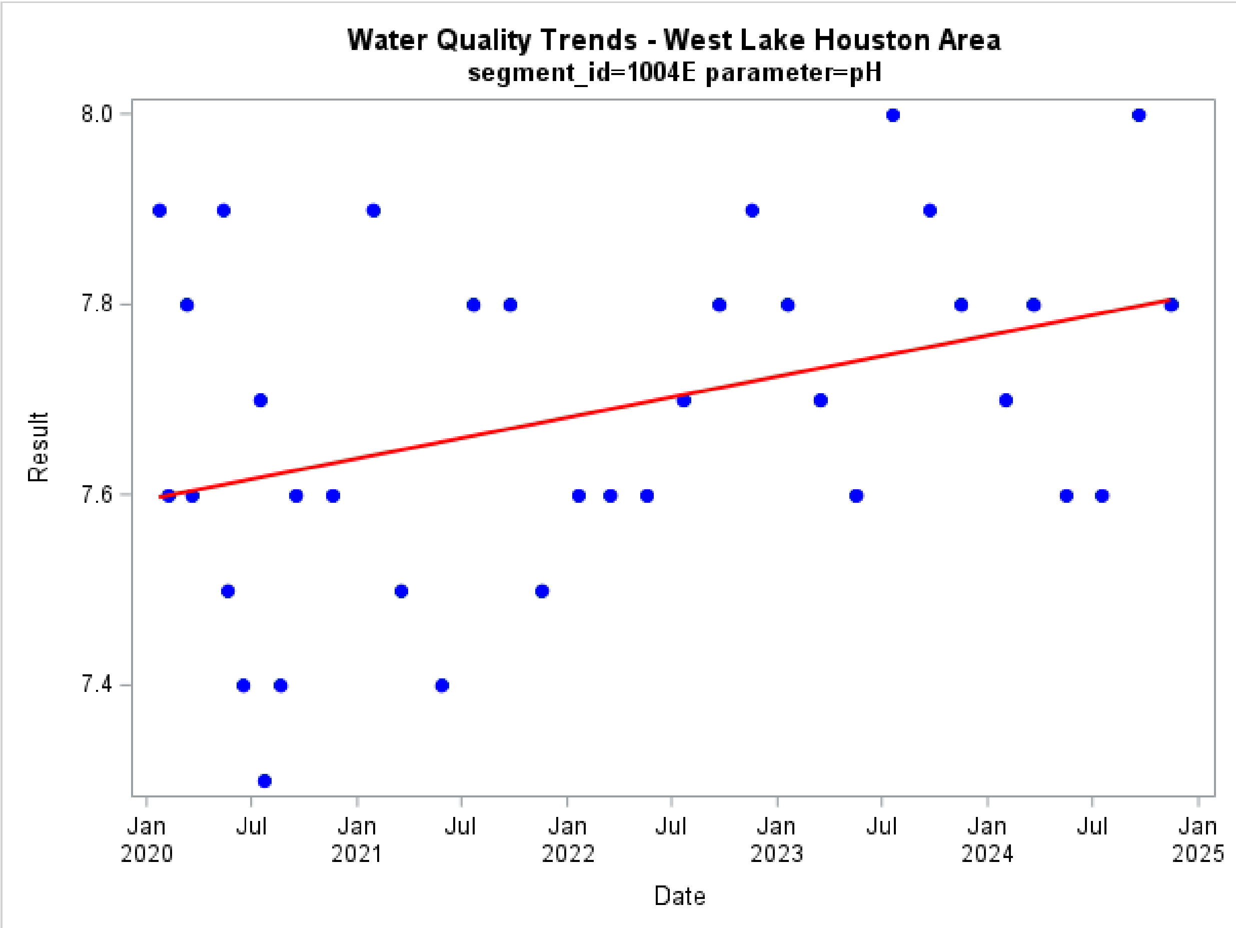



Water Quality Trends - West Lake Houston Area
segment_id=1004E parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
12
10
8
6
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

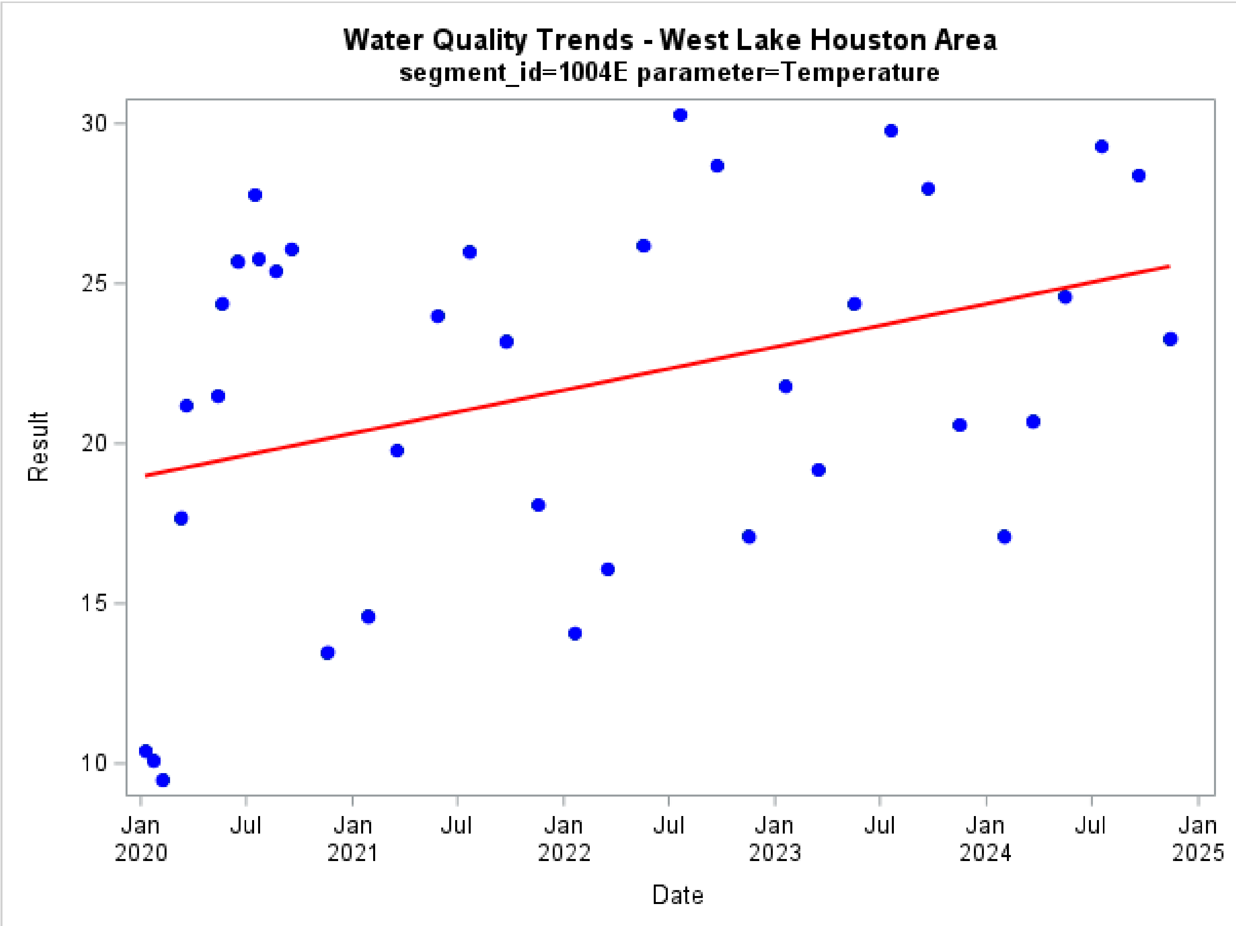

Water Quality Trends - West Lake Houston Area
segment_id=1004E parameter=E. Coli
Result
3000
2000
1000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1004E parameter=Instantaneous Flow
Result
5
4
3
2
1
Jan 2020
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Date

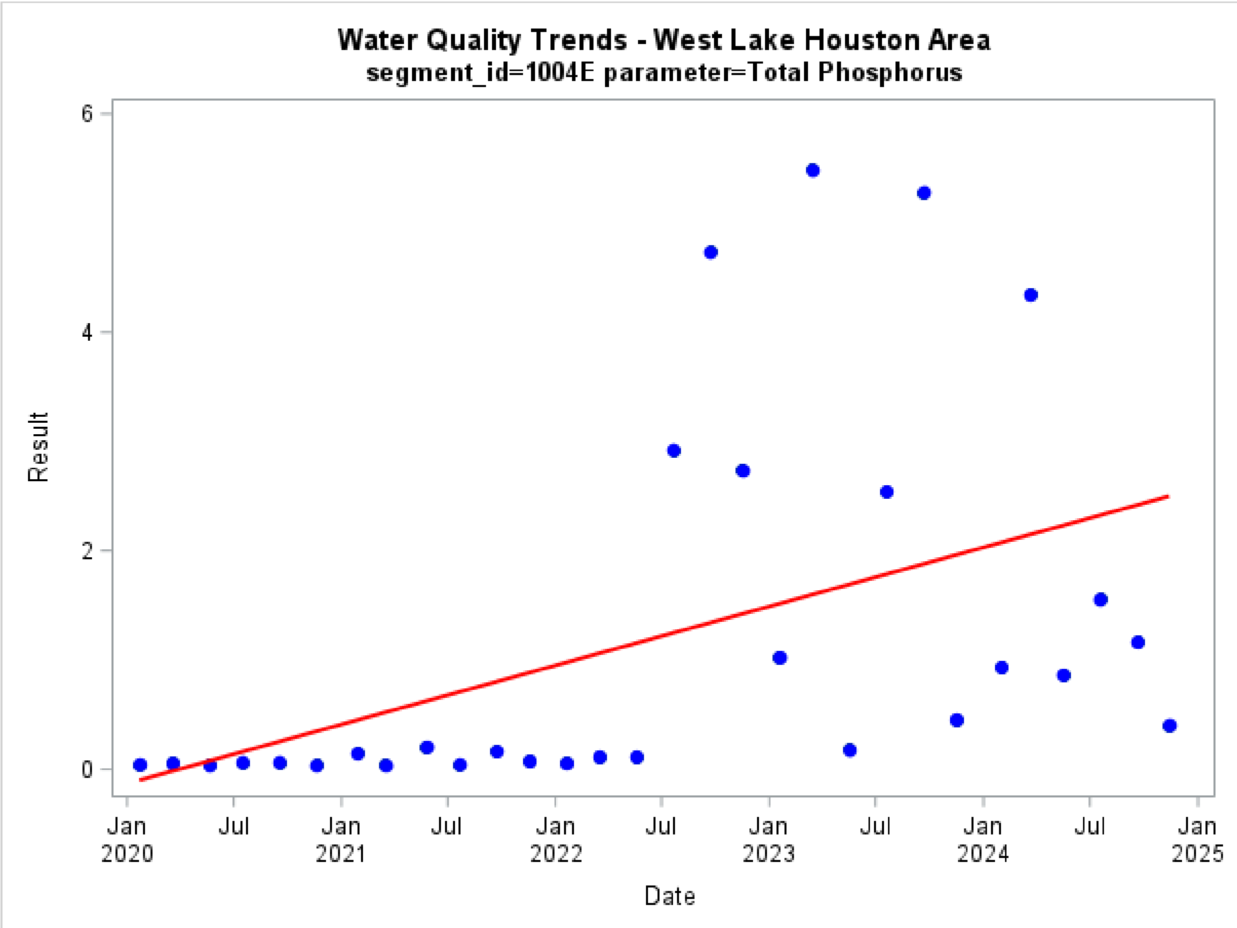

Water Quality Trends - West Lake Houston Area
segment_id=1004E parameter=Nitrate-N
Result
6
4
2
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

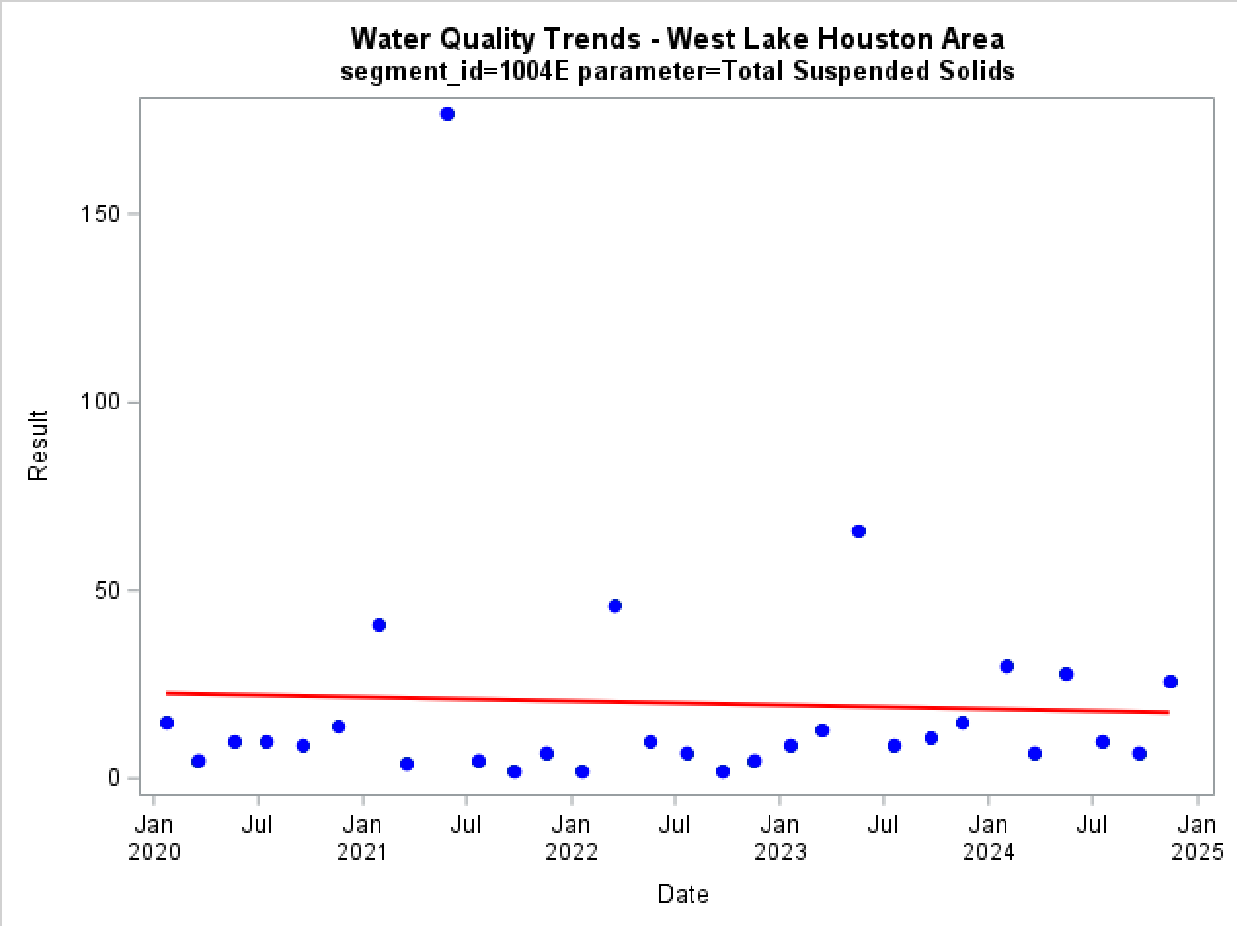


Water Quality Trends - West Lake Houston Area
segment_id=1004E parameter=pH
Result
8.0
7.8
7.6
7.4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

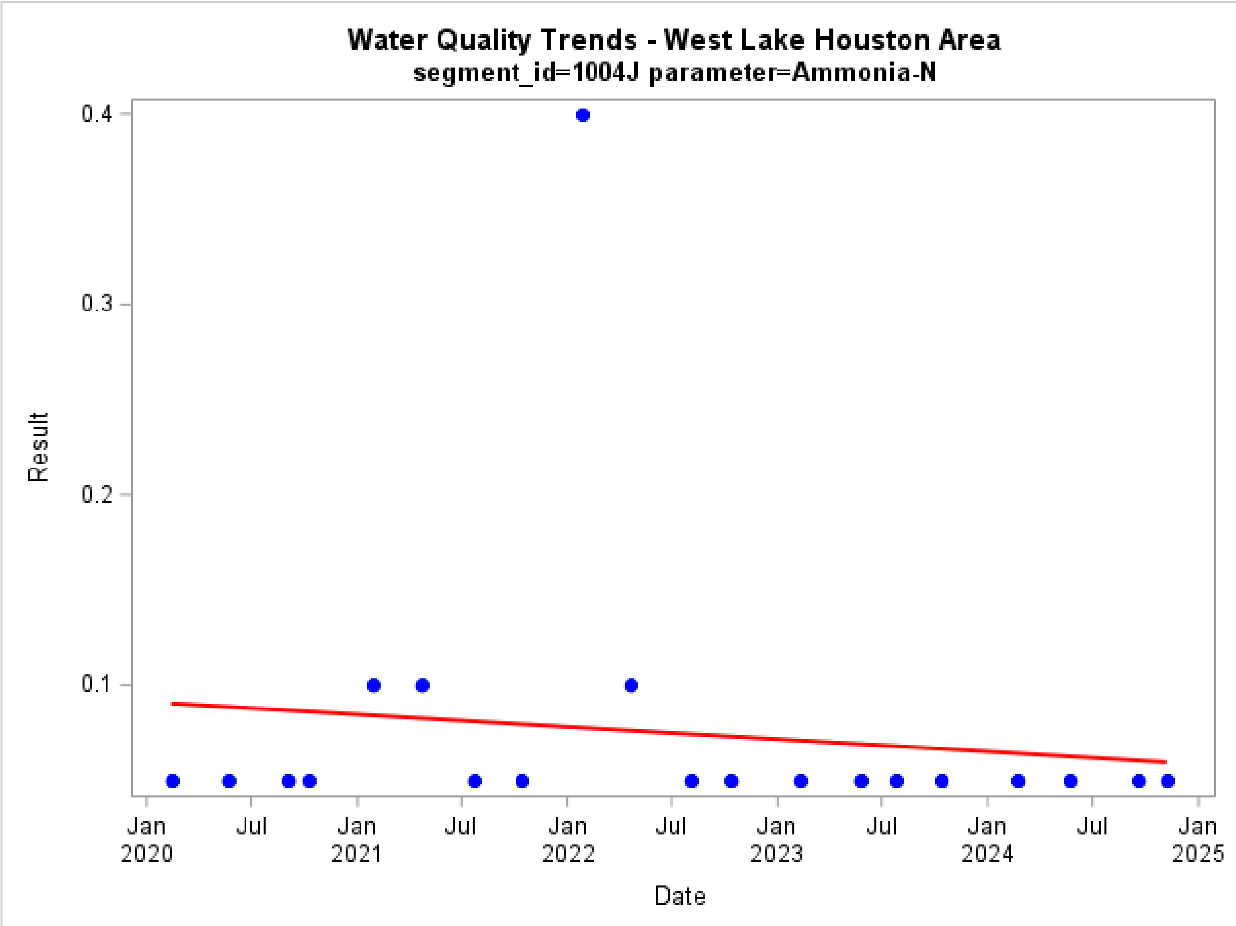


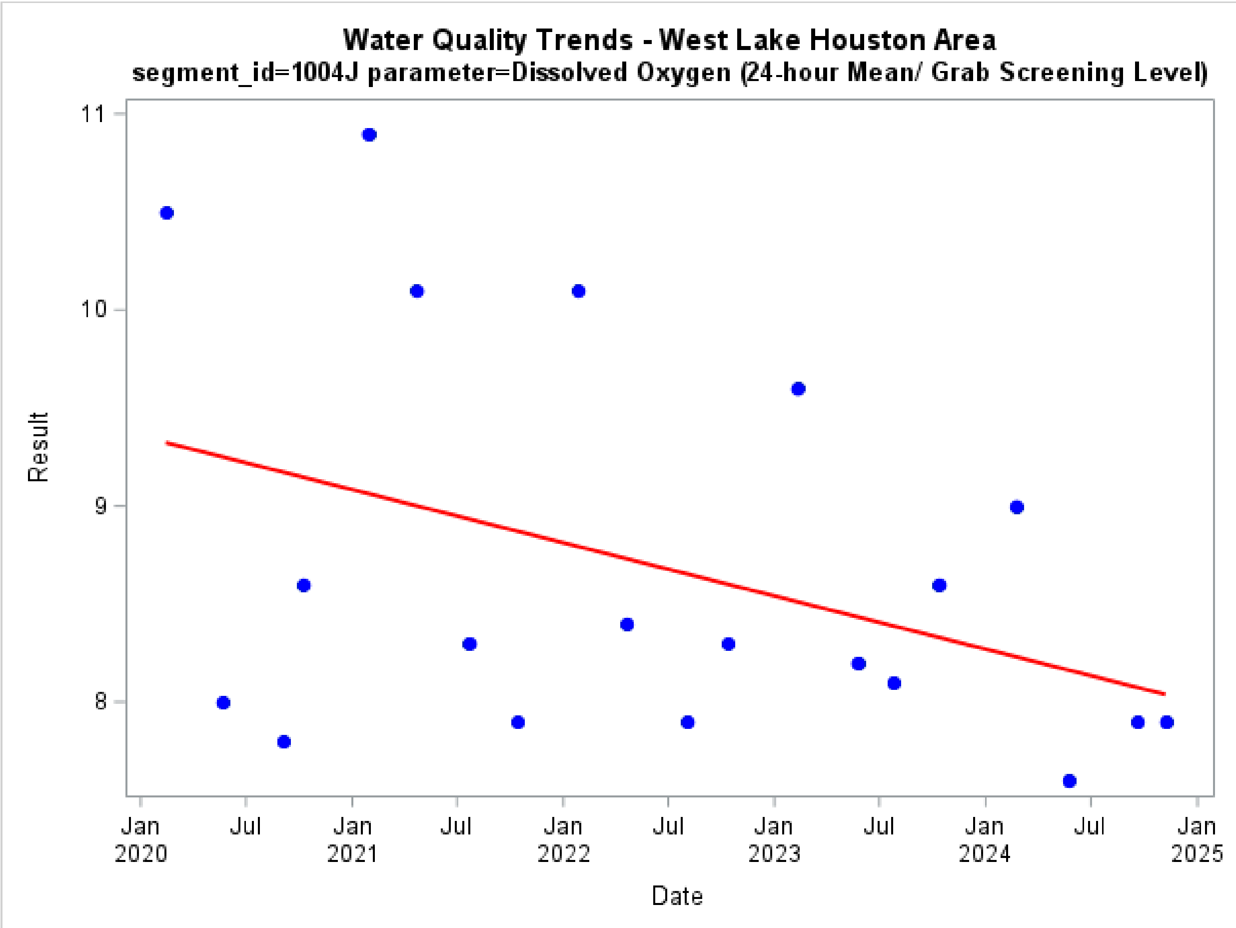
Water Quality Trends - West Lake Houston Area
segment_id=1004E parameter=Temperature
Result
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1004E parameter=Total Phosphorus
Result
Date
0
2
4
6
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025

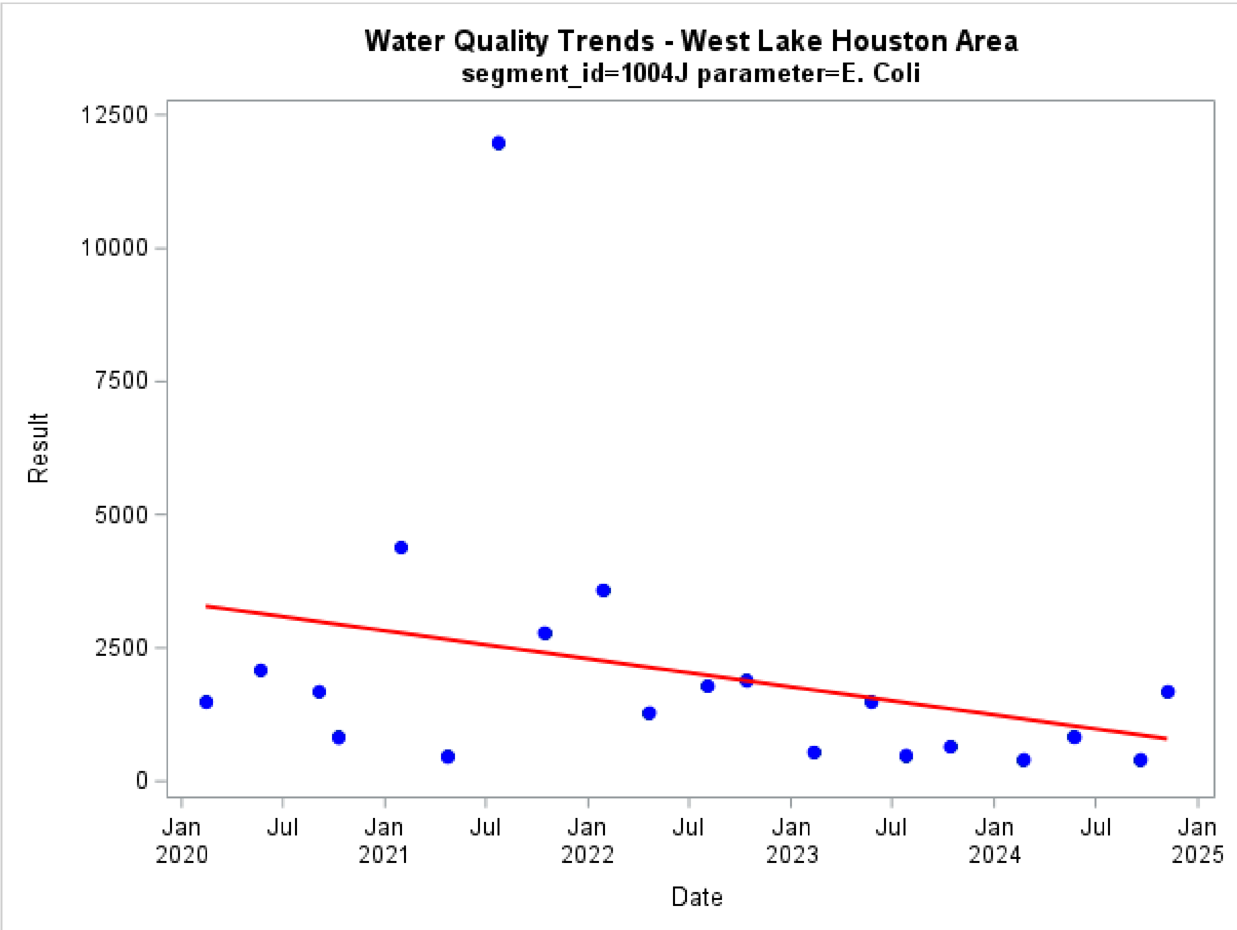

Water Quality Trends - West Lake Houston Area
segment_id=1004E parameter=Total Suspended Solids
Result
150
100
50
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

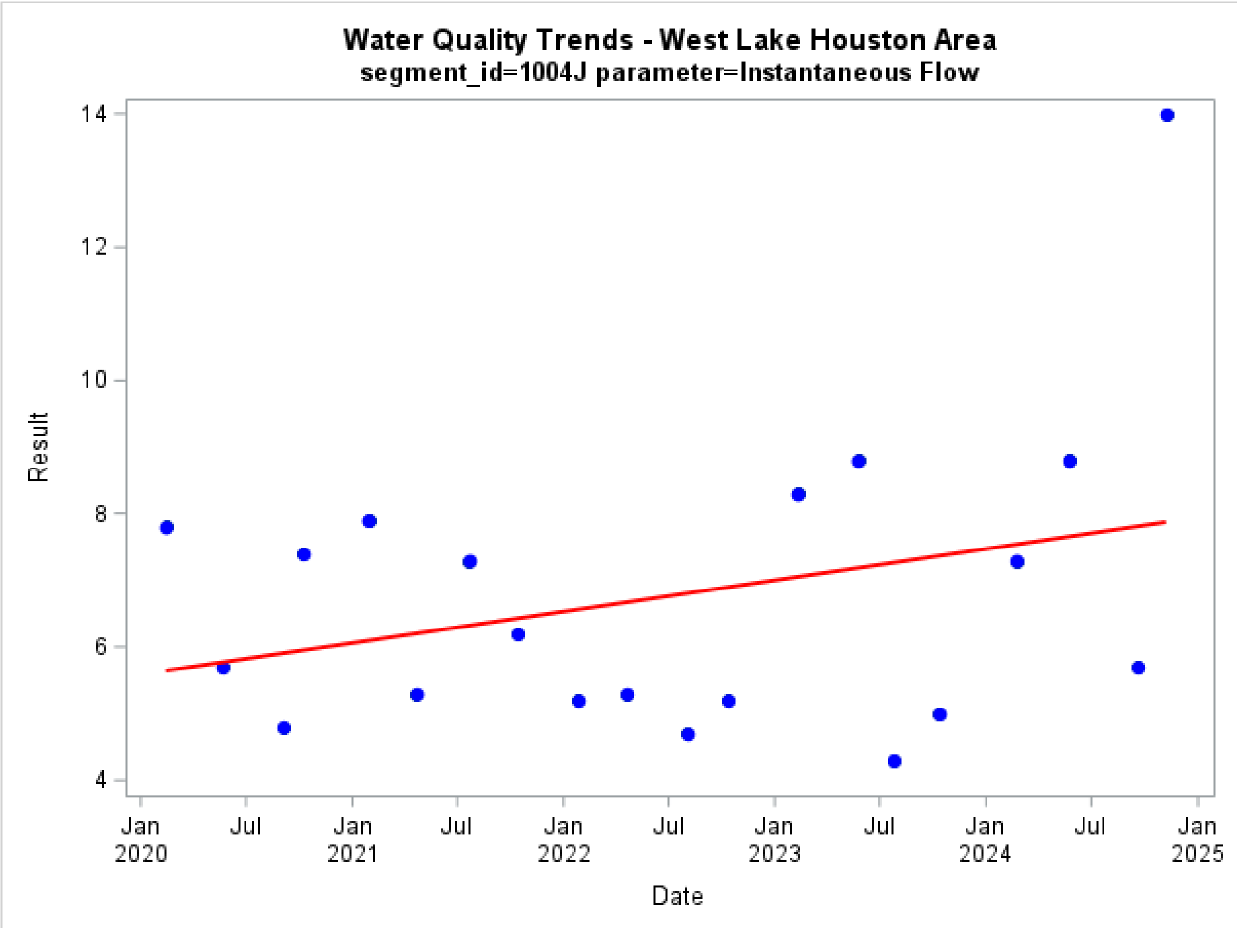
White Oak Creek (1004J)



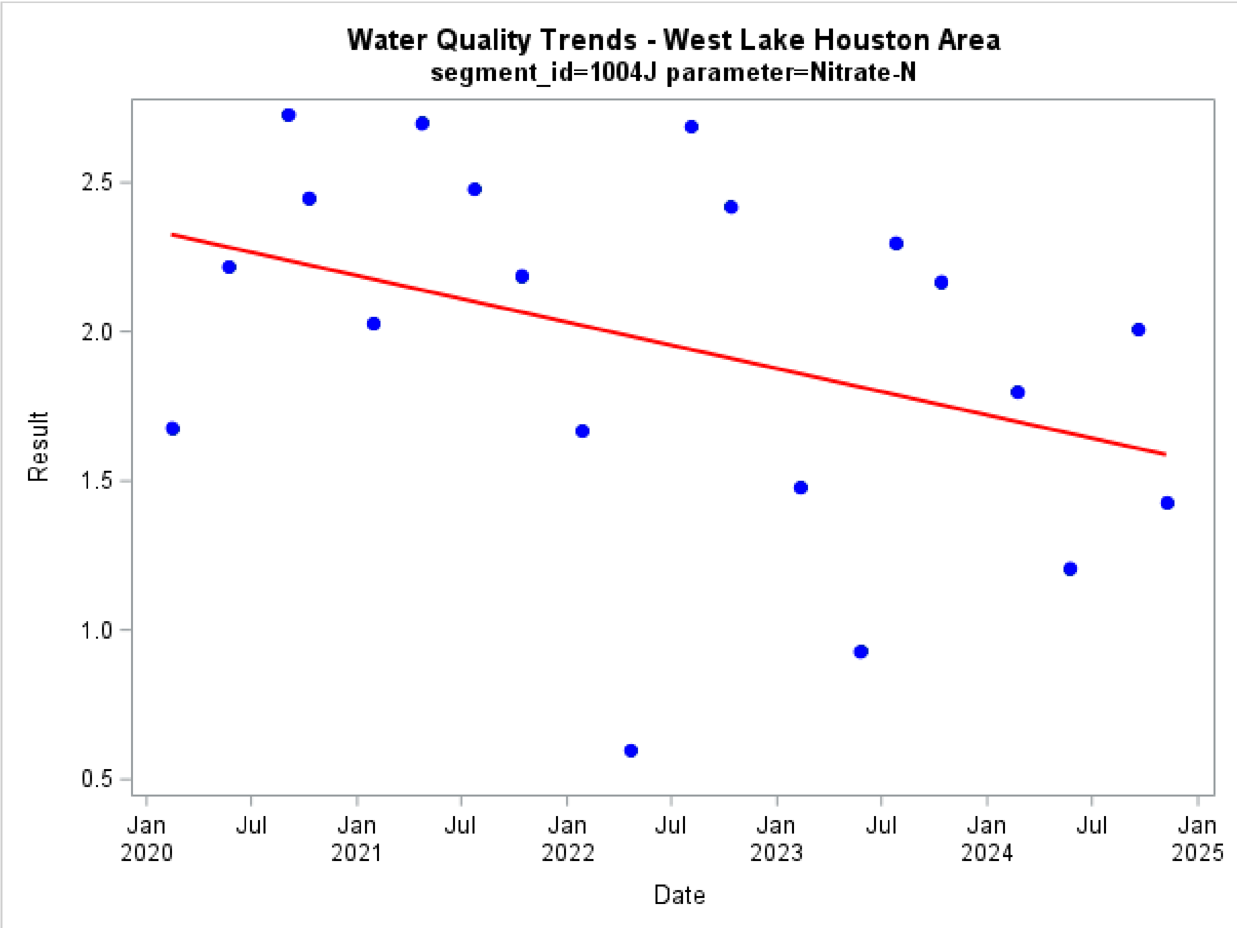


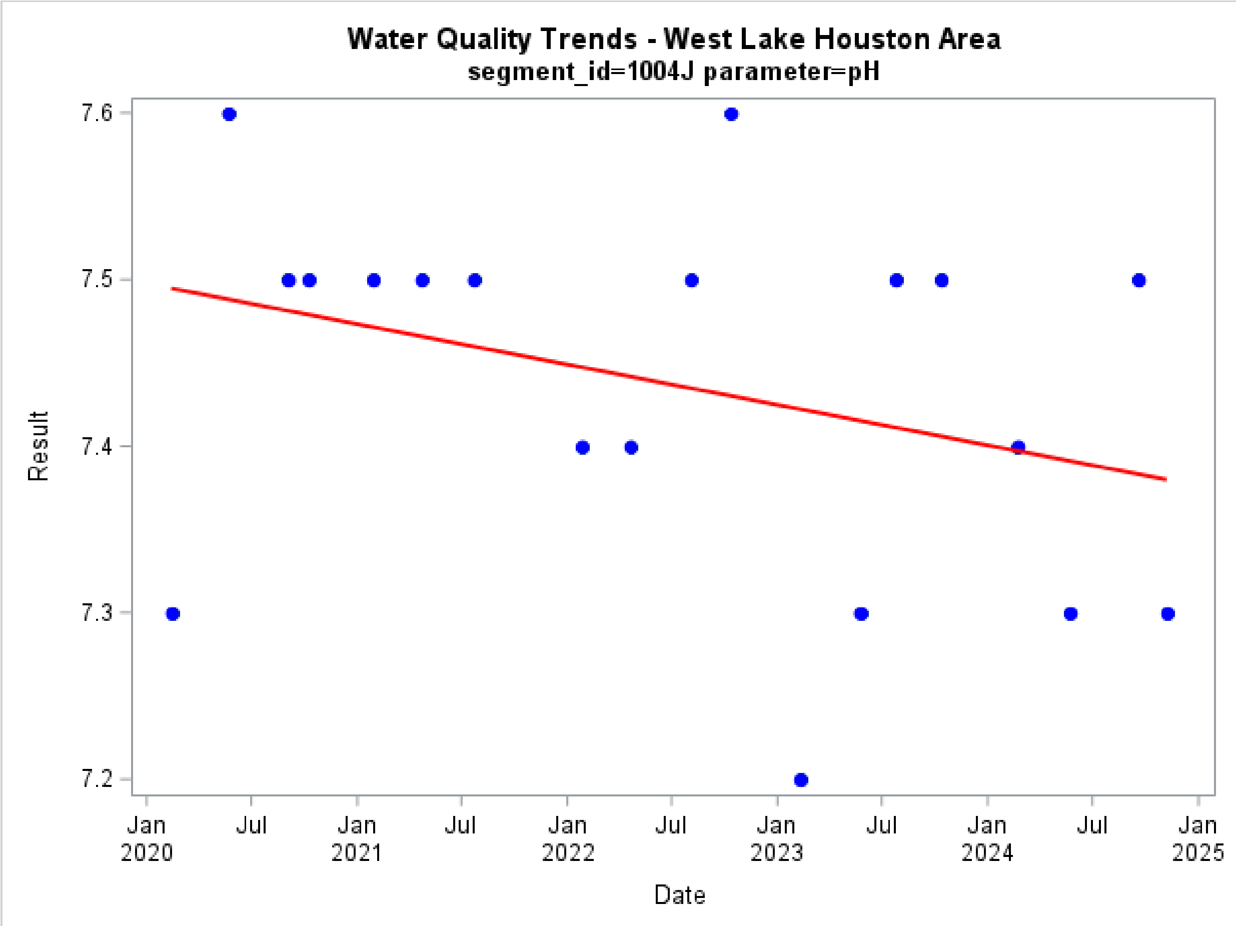
Water Quality Trends - West Lake Houston Area
segment_id=1004J parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
11
10
9
8
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

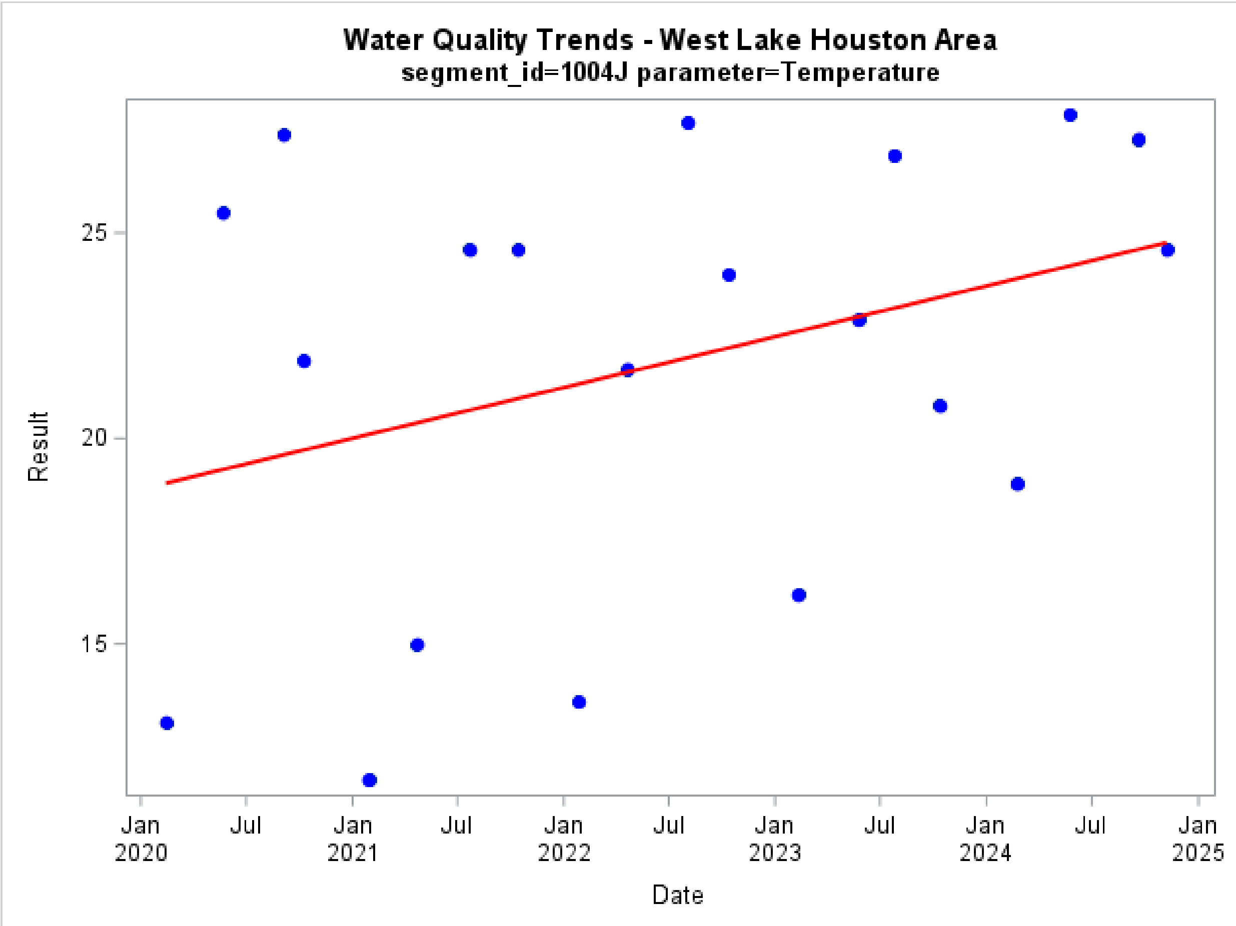

Water Quality Trends - West Lake Houston Area
segment_id=1004J parameter=E. Coli
12500
10000
7500
5000
2500
0
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

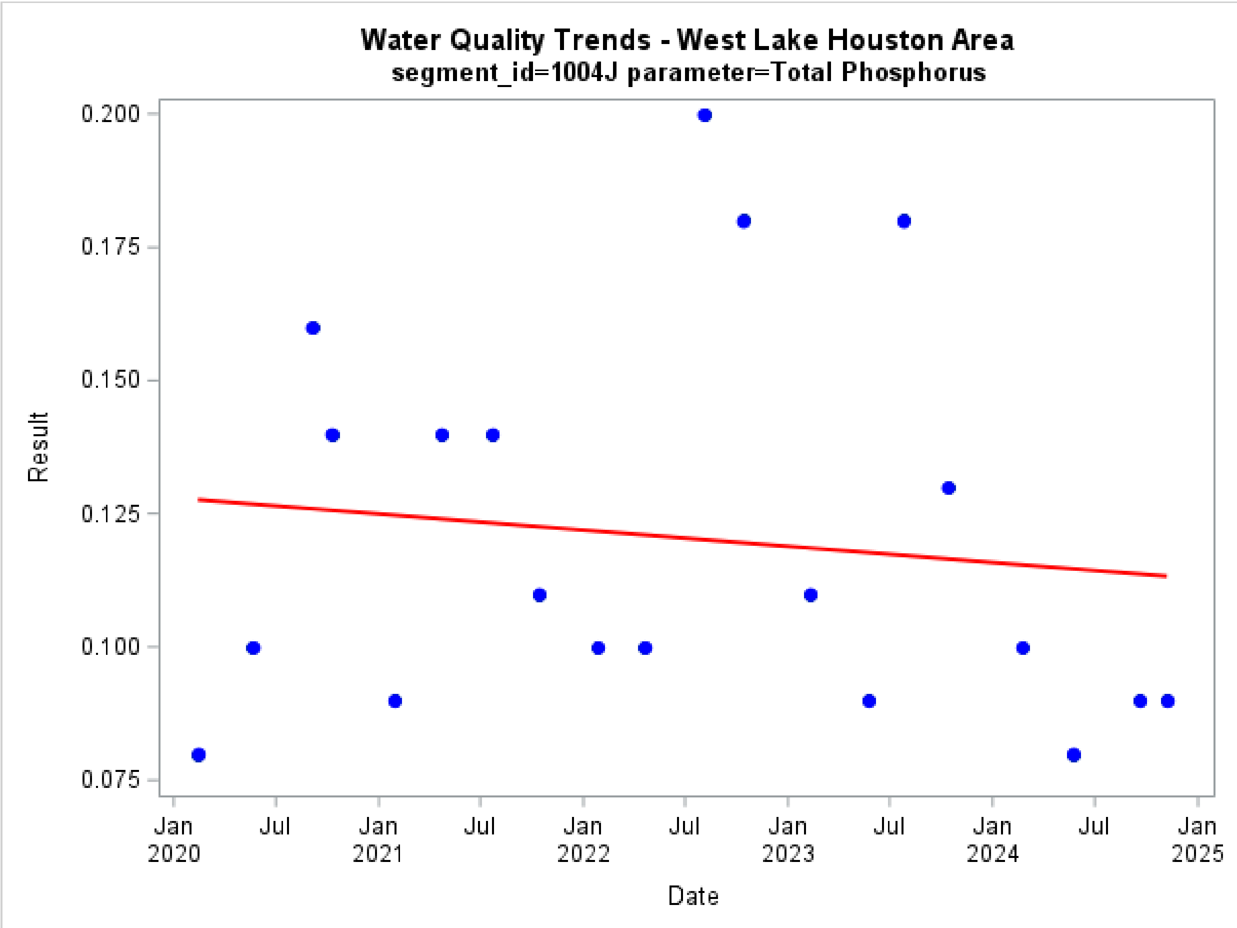


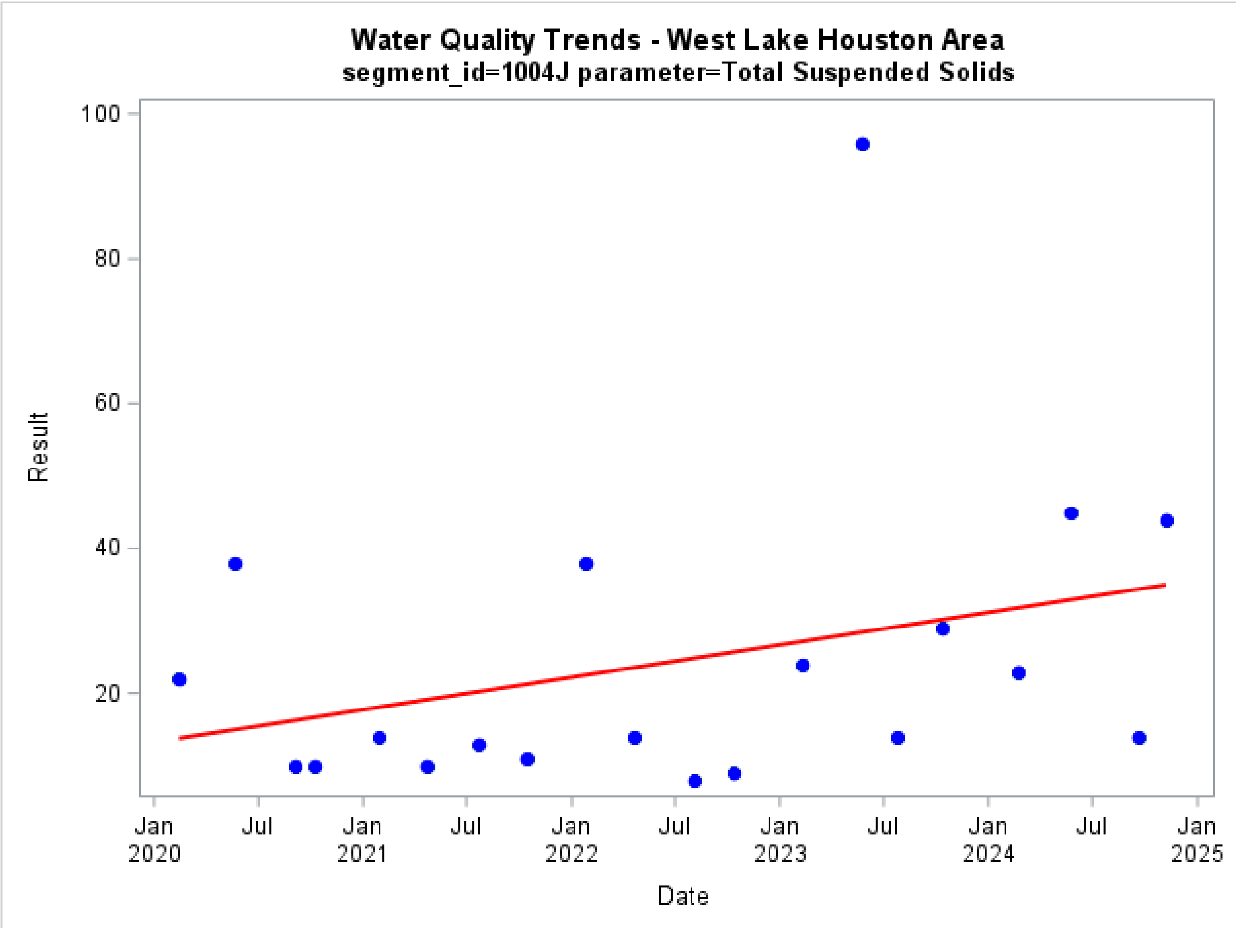
Water Quality Trends - West Lake Houston Area
segment_id=1004J parameter=Instantaneous Flow
Result
14
12
10
8
6
4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1004J parameter=Nitrate-N
Result
2.5
2.0
1.5
1.0
0.5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1004J parameter=pH
Result
7.6
7.5
7.4
7.3
7.2
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1004J parameter=Temperature
Result
25
20
15
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

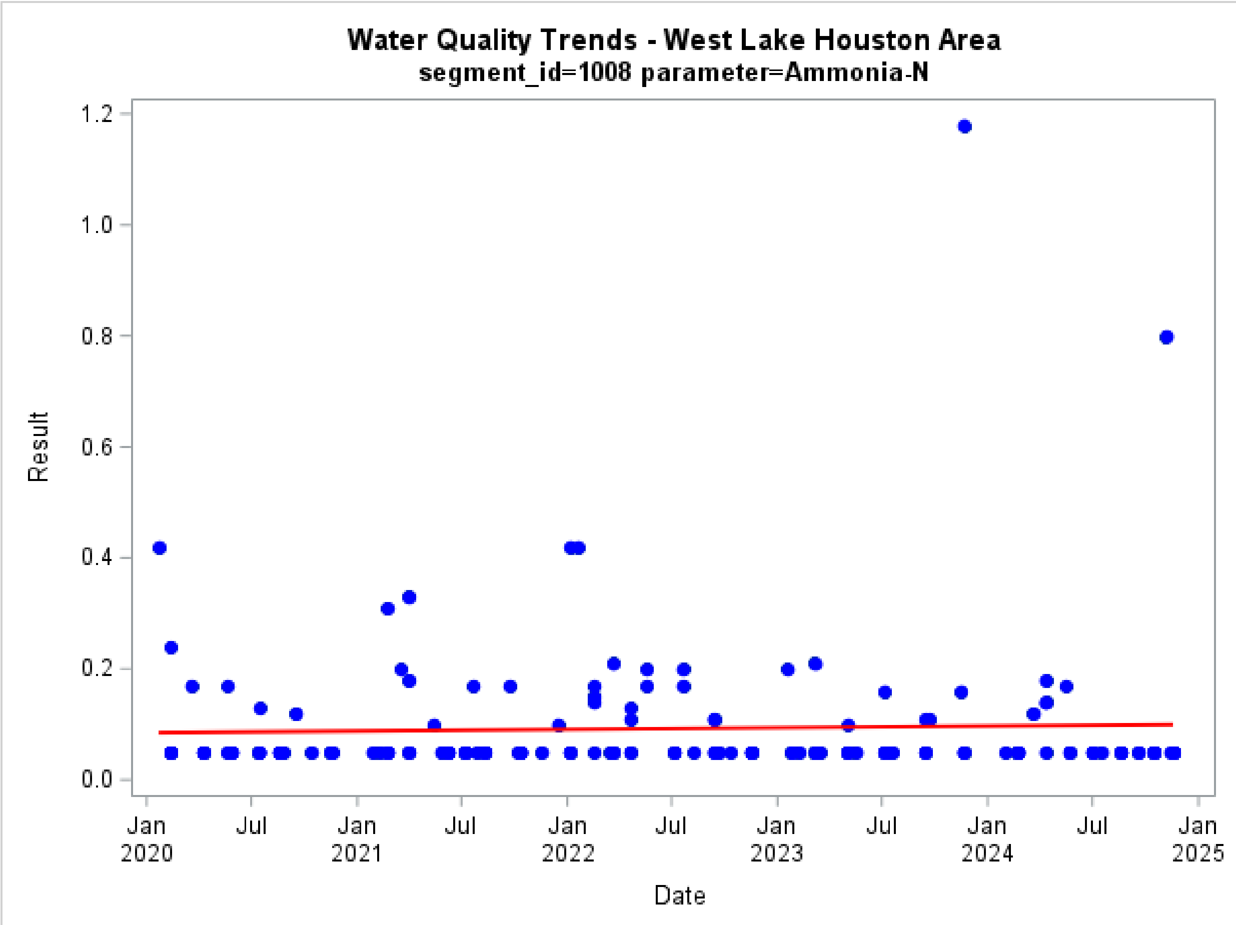

Water Quality Trends - West Lake Houston Area
segment_id=1004J parameter=Total Phosphorus
Result
0.200
0.175
0.150
0.125
0.100
0.075
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

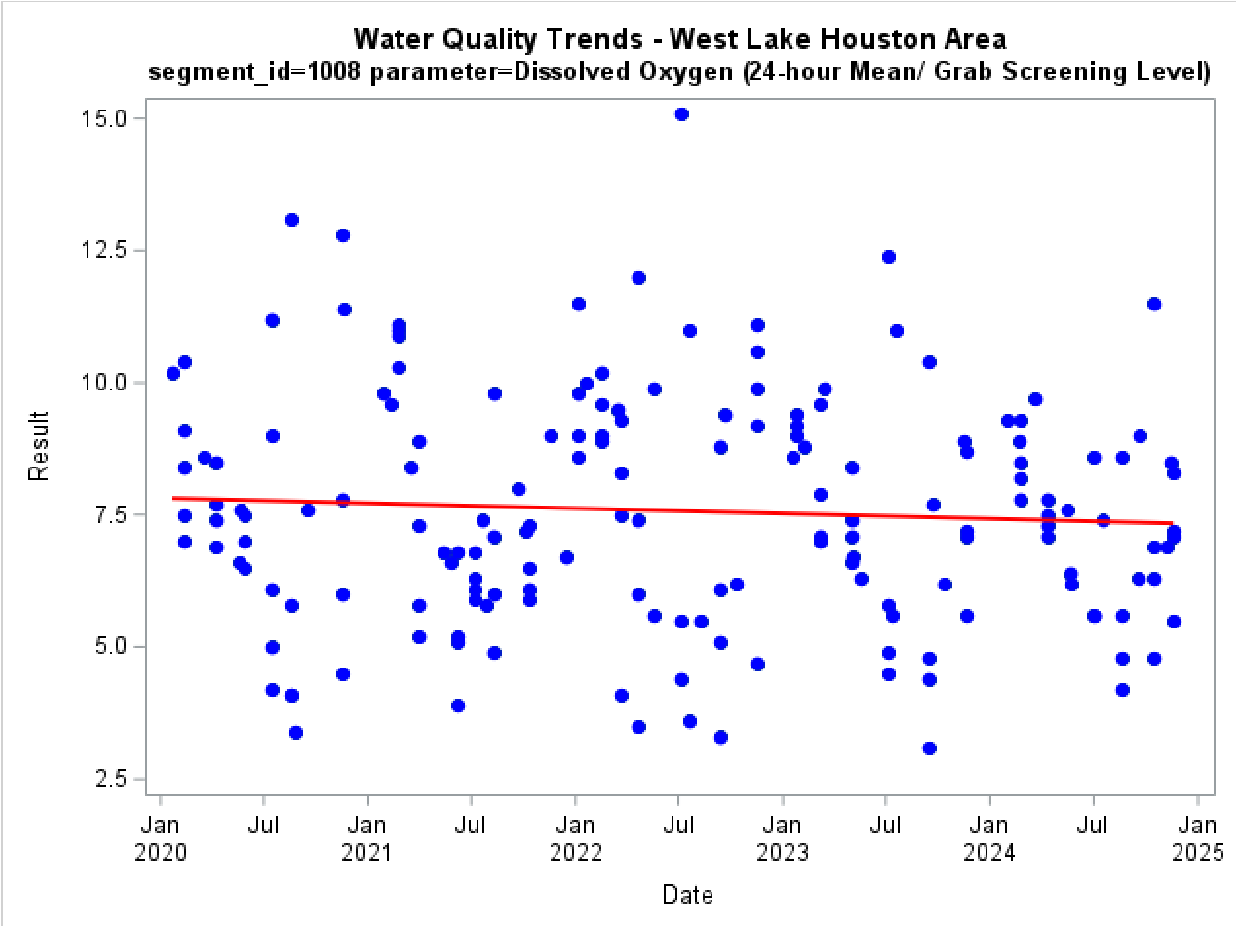


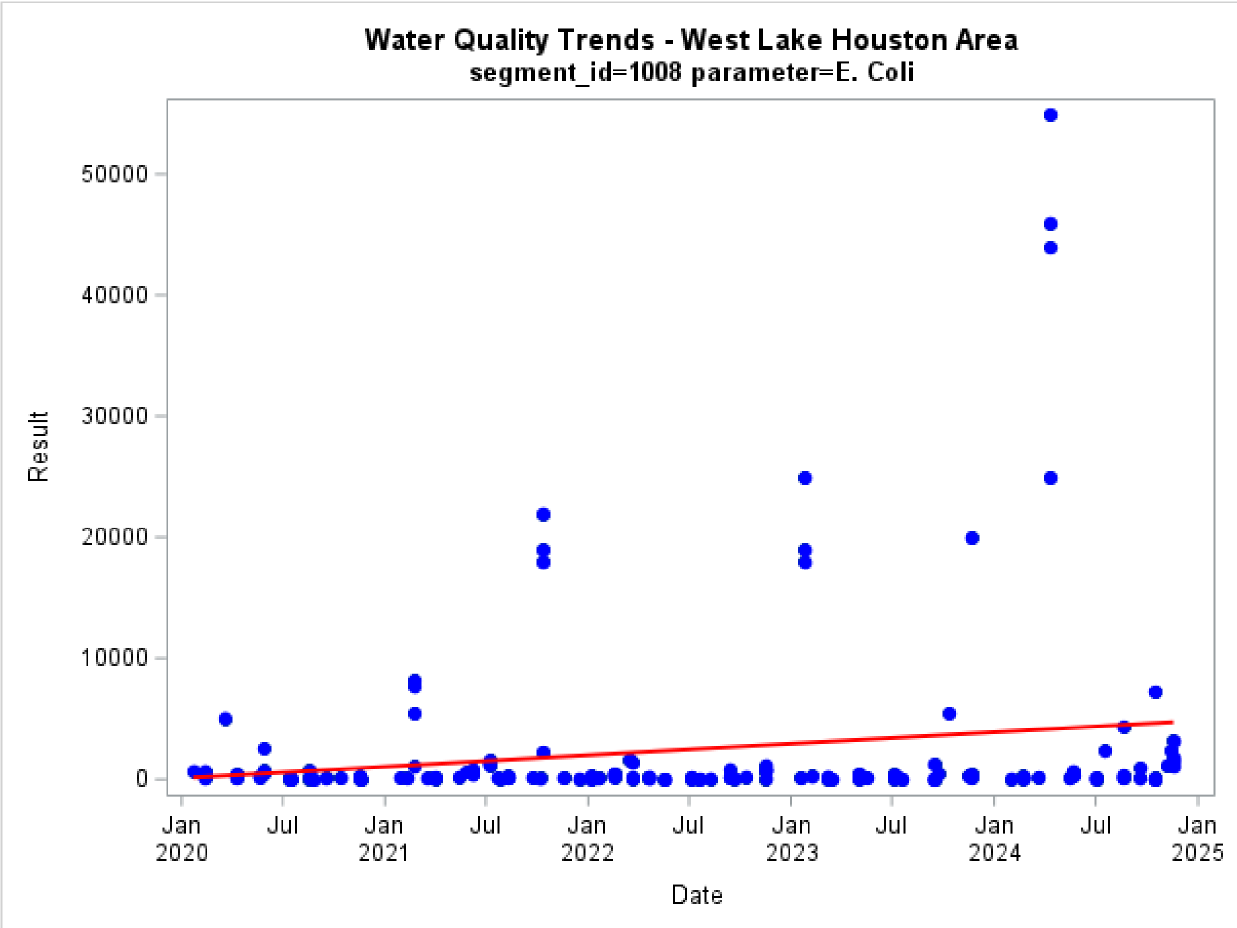
Water Quality Trends - West Lake Houston Area
segment_id=1004J parameter=Total Suspended Solids
100
80
60
40
20
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

Spring Creek Watershed

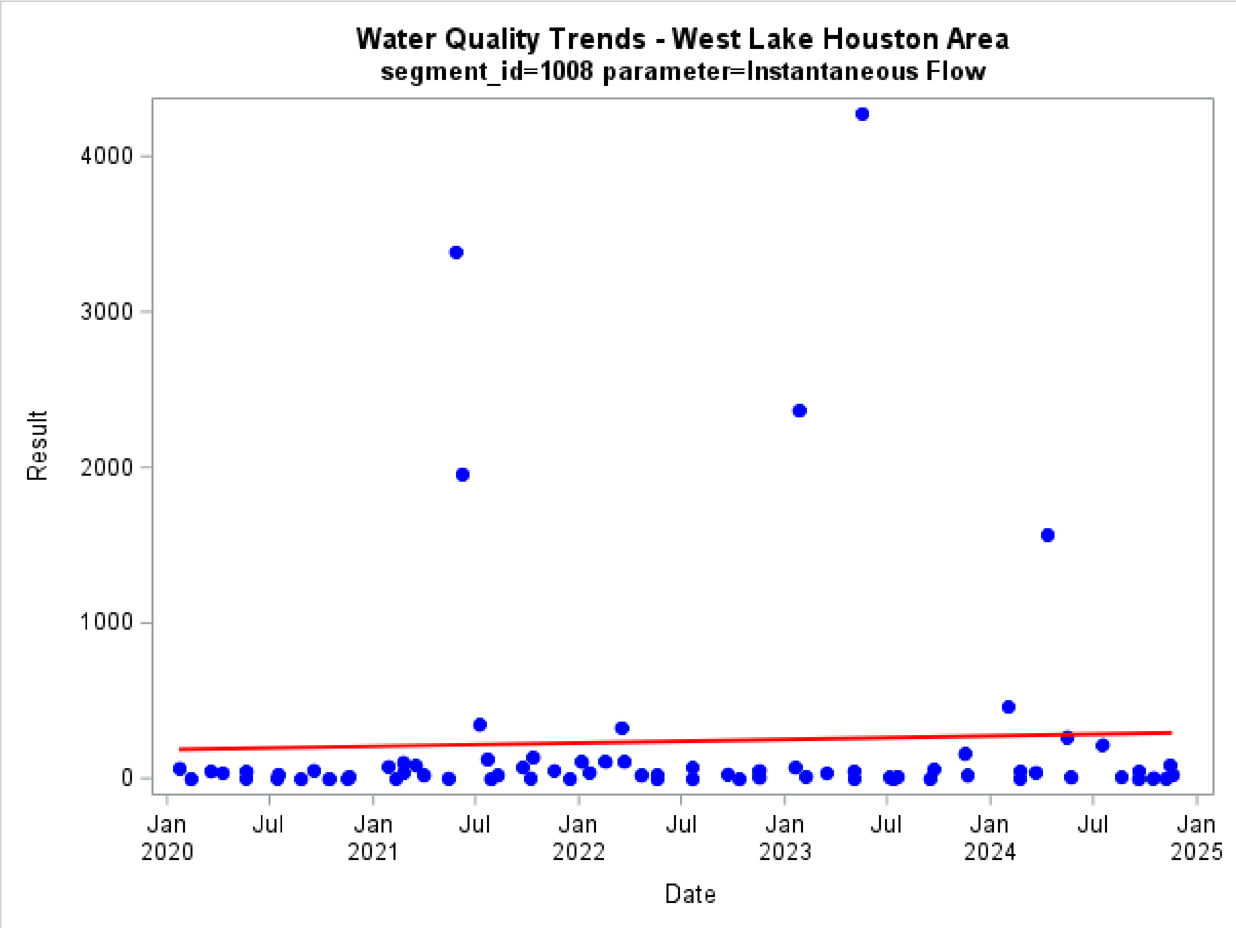
Spring Creek (1008)

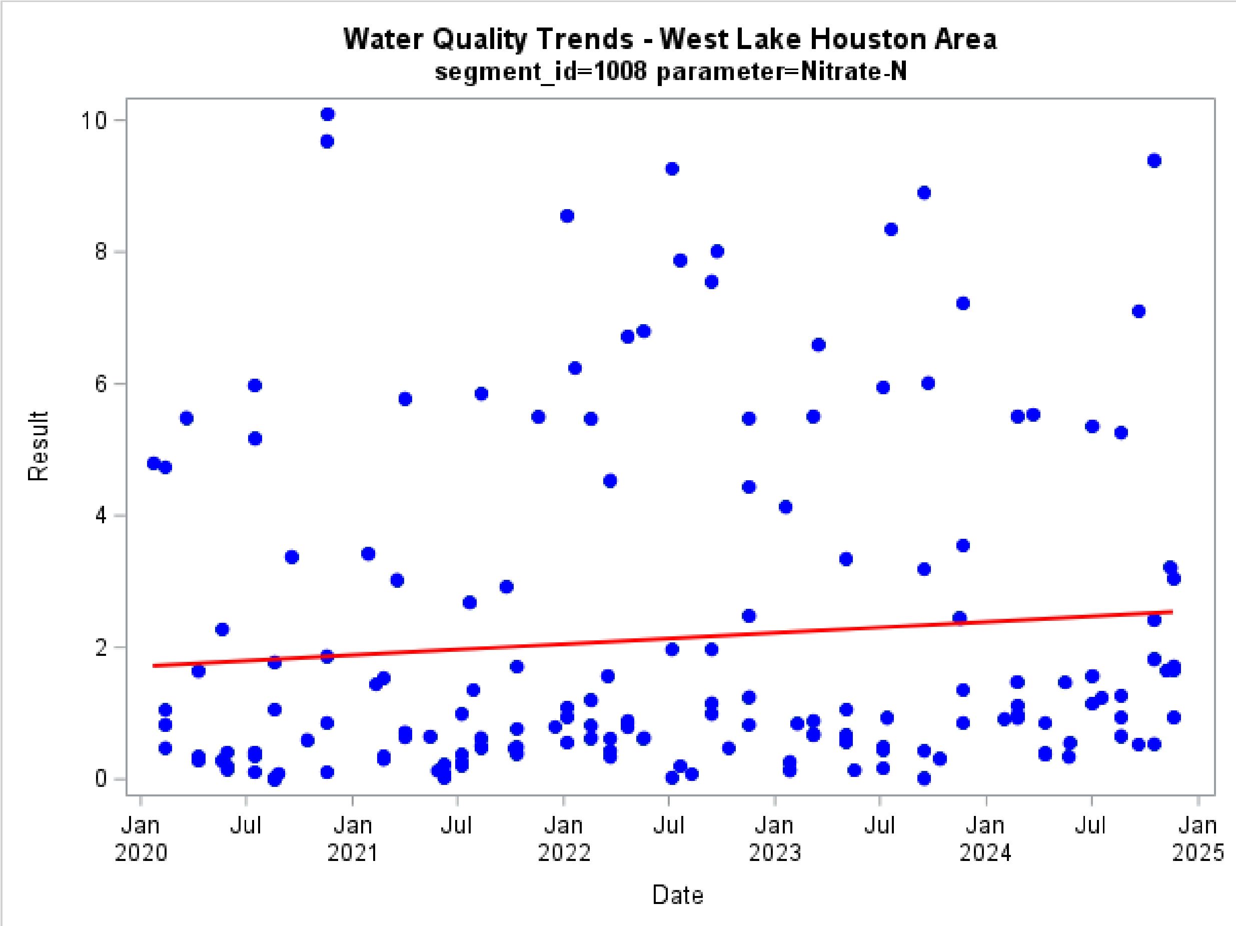



Water Quality Trends - West Lake Houston Area
segment_id=1008 parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
15.0
12.5
10.0
7.5
5.0
2.5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

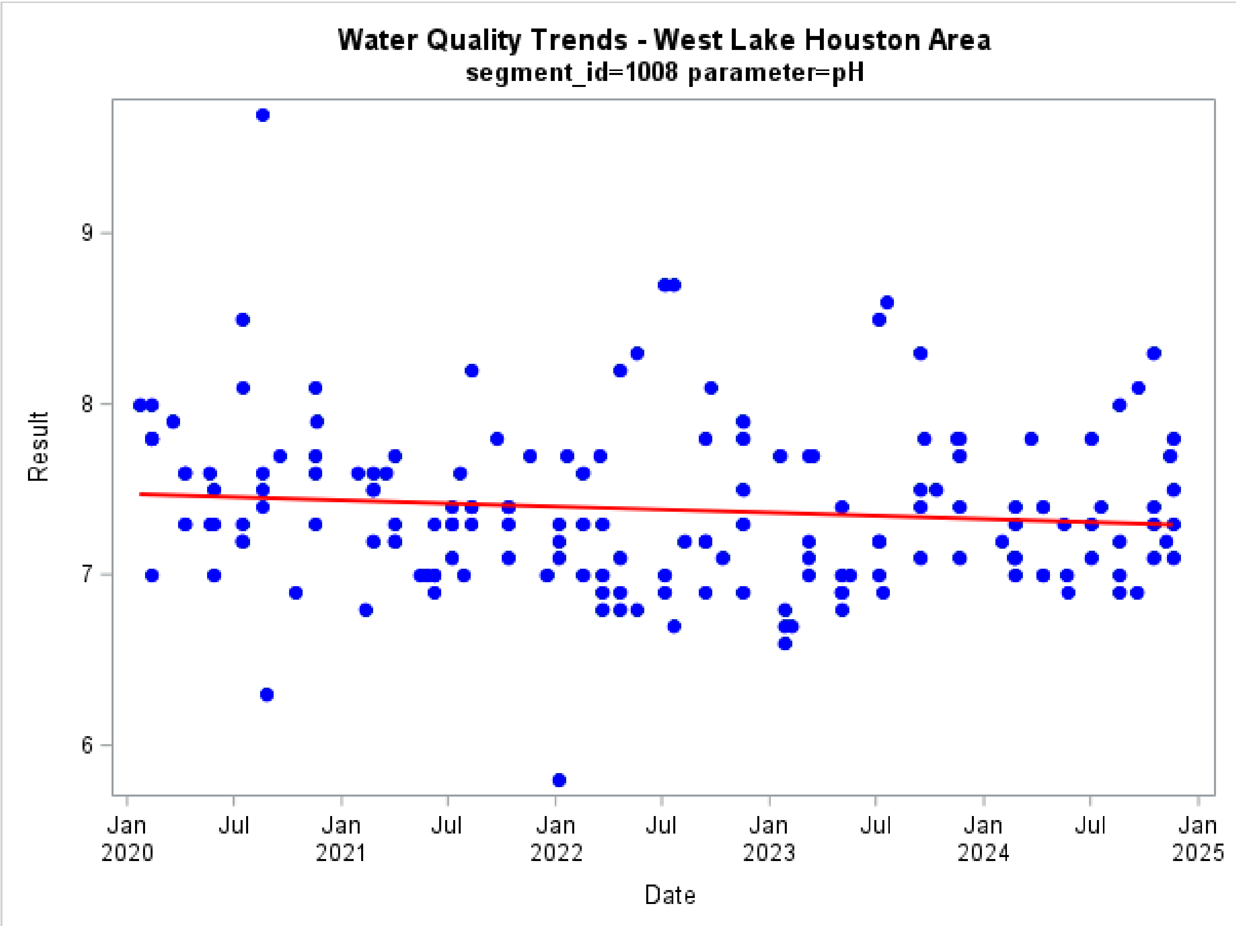


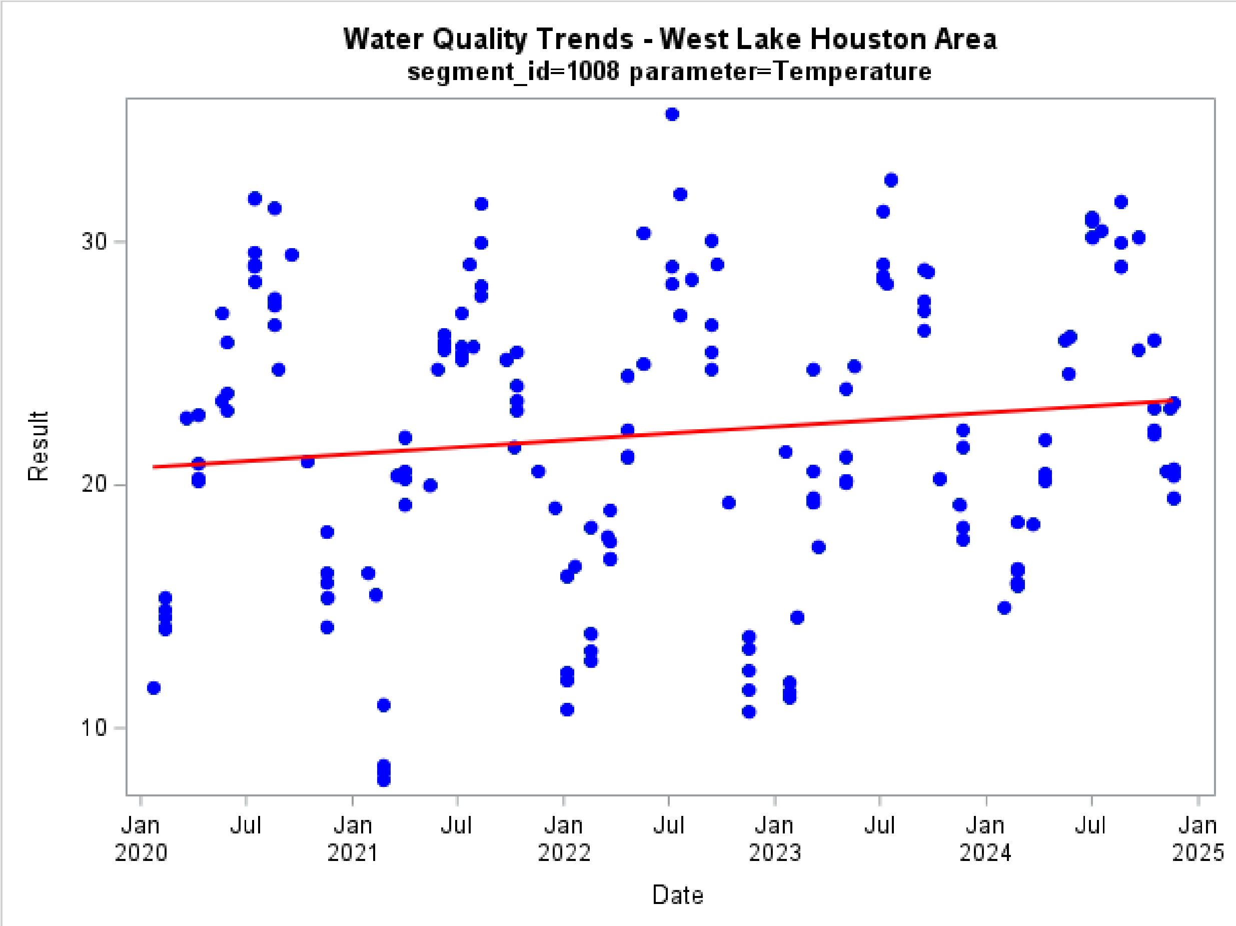
Water Quality Trends - West Lake Houston Area
segment_id=1008 parameter=E. Coli
Result
50000
40000
30000
20000
10000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

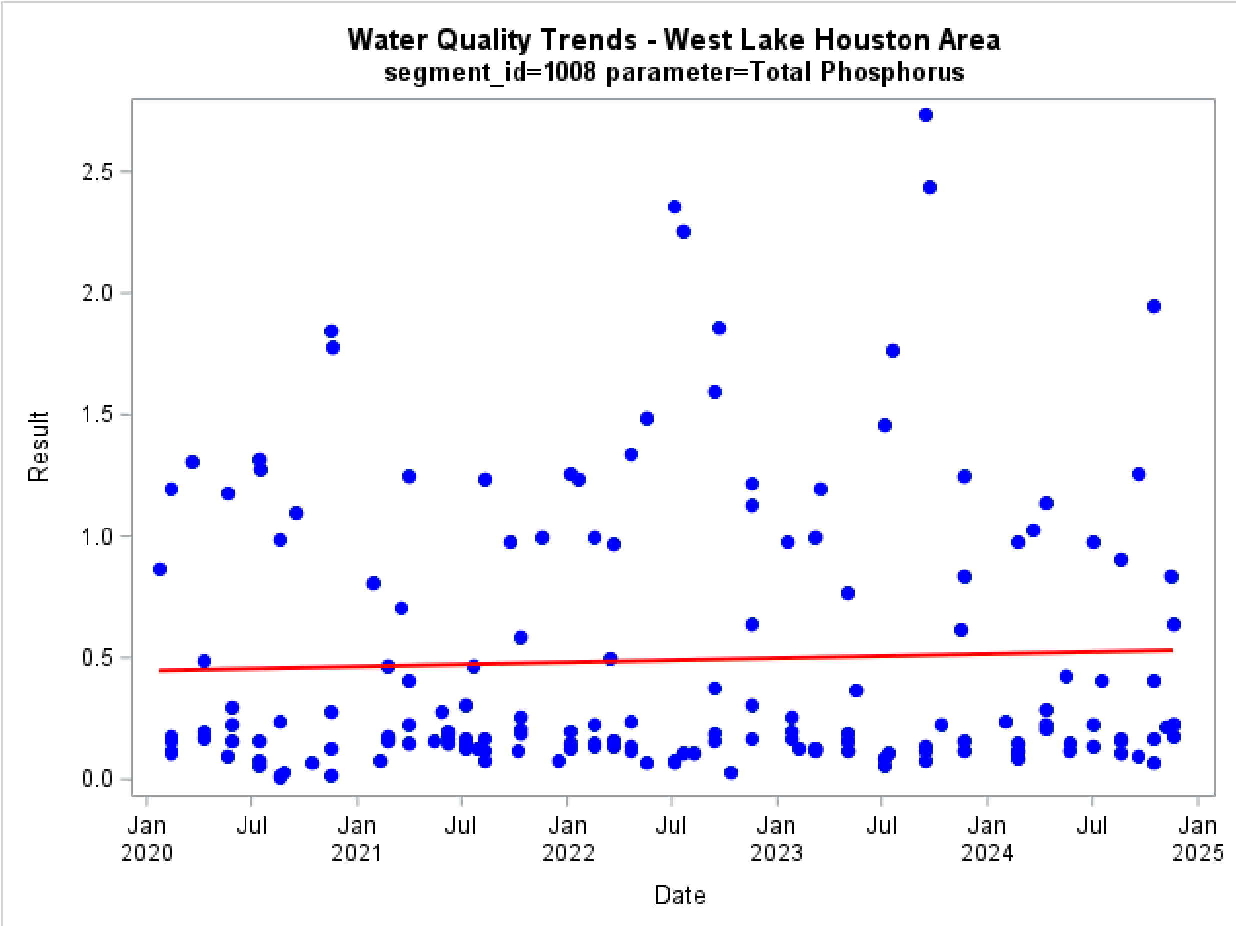

Water Quality Trends - West Lake Houston Area
segment_id=1008 parameter=Instantaneous Flow
Result
4000
3000
2000
1000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

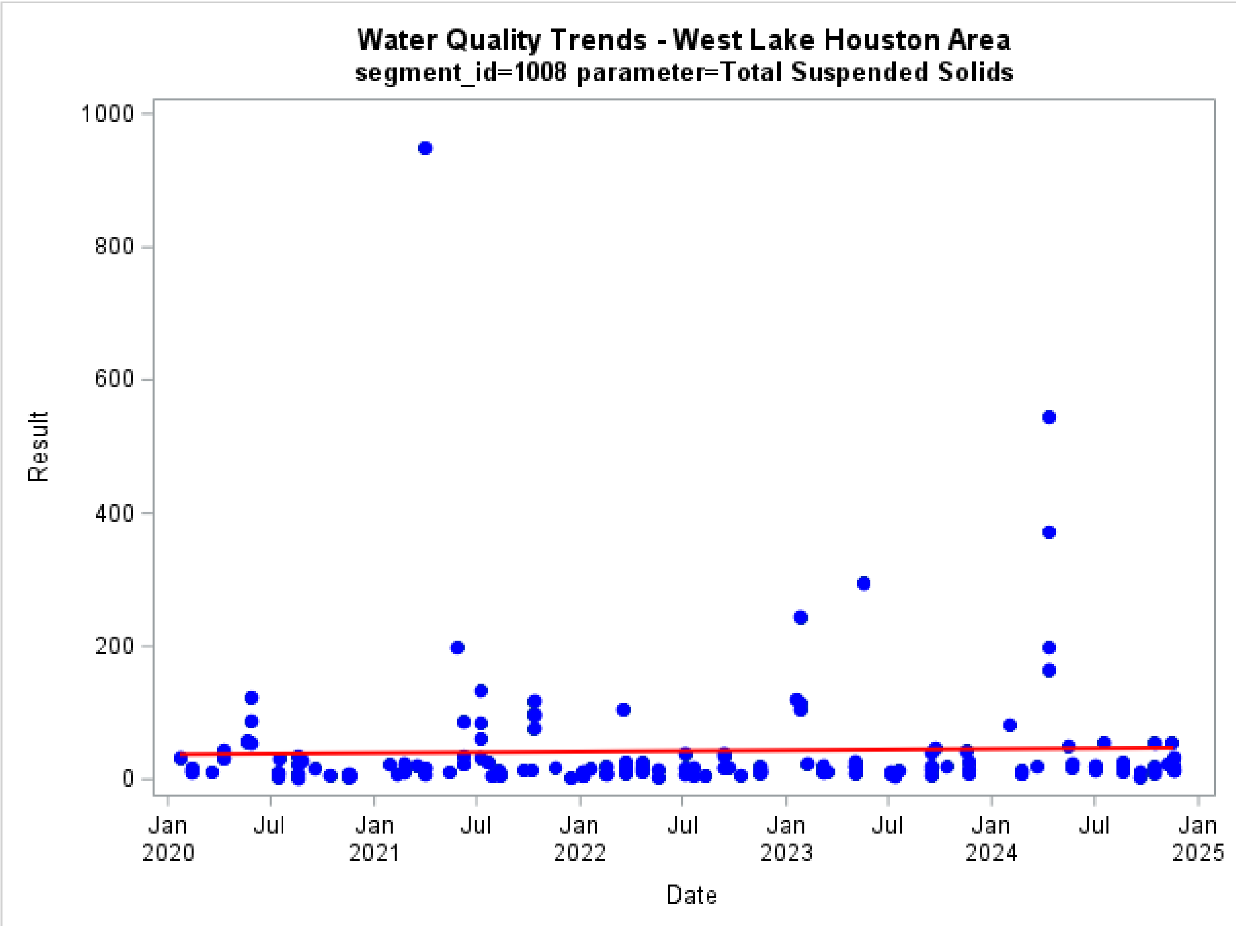


Water Quality Trends - West Lake Houston Area
segment_id=1008 parameter=Nitrate-N
Result
0
2
4
6
8
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1008 parameter=pH
Result
9
8
7
6
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

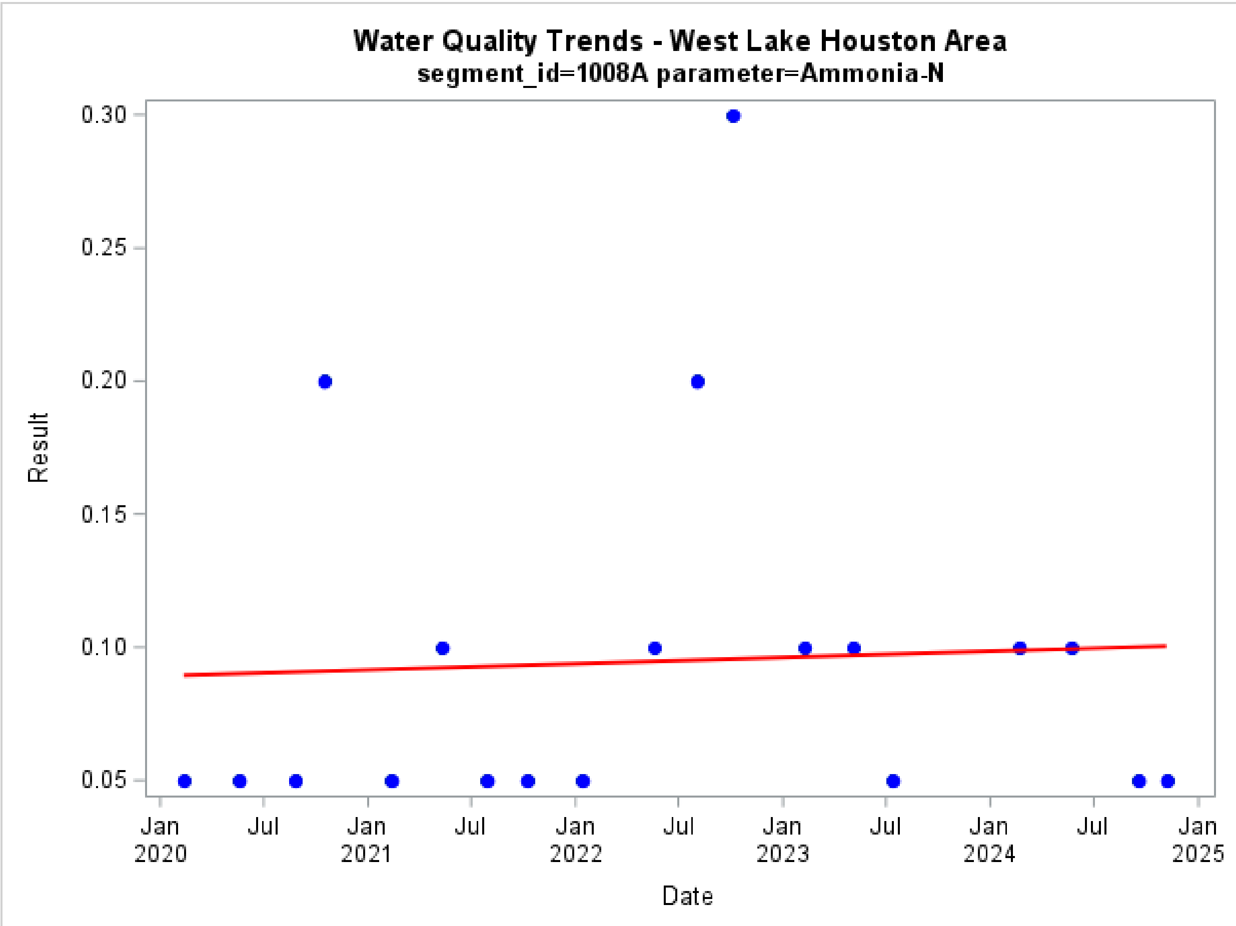

Water Quality Trends - West Lake Houston Area
segment_id=1008 parameter=Temperature
Result
30
20
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

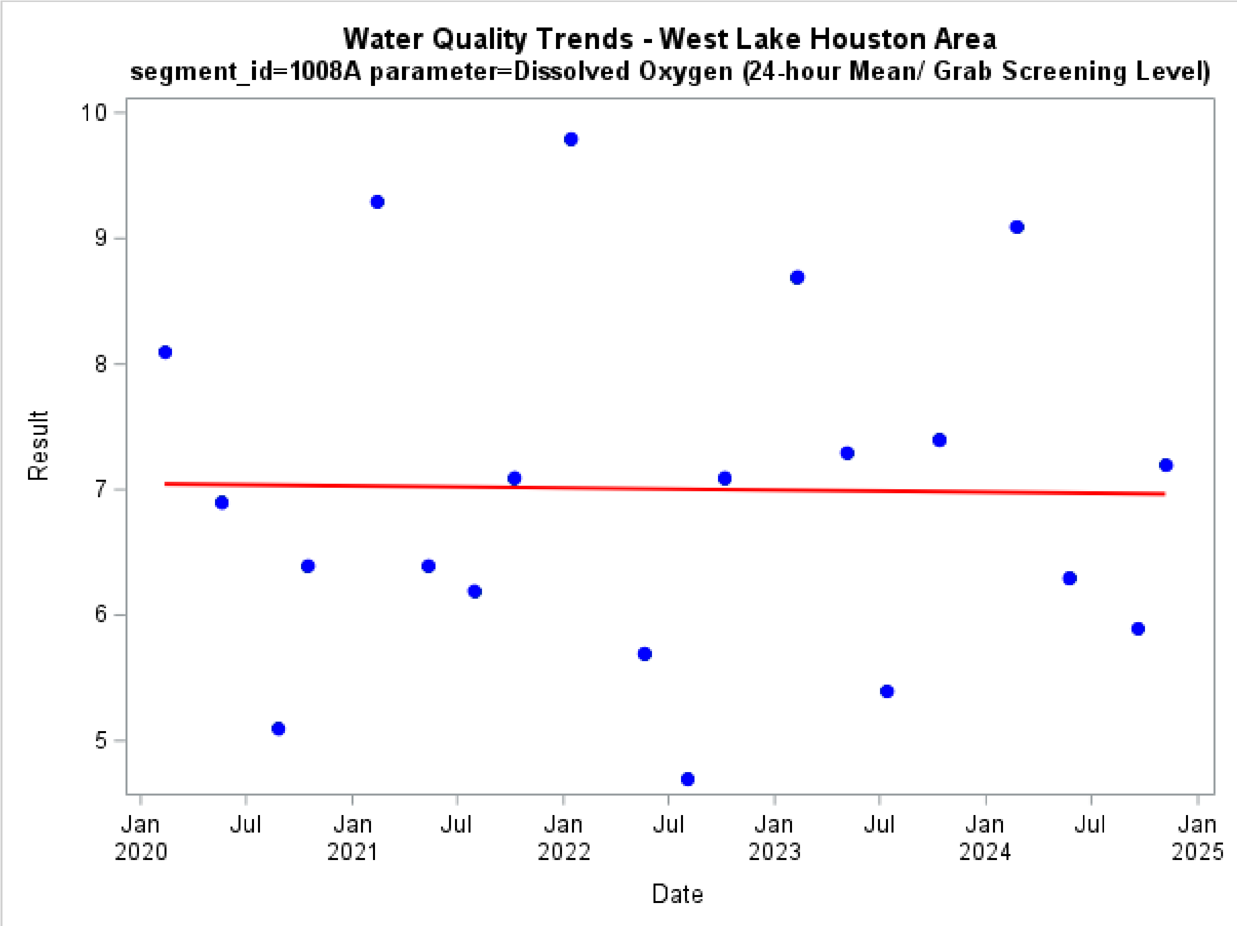

Water Quality Trends - West Lake Houston Area
segment_id=1008 parameter=Total Phosphorus
Result
0.0
0.5
1.0
1.5
2.0
2.5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



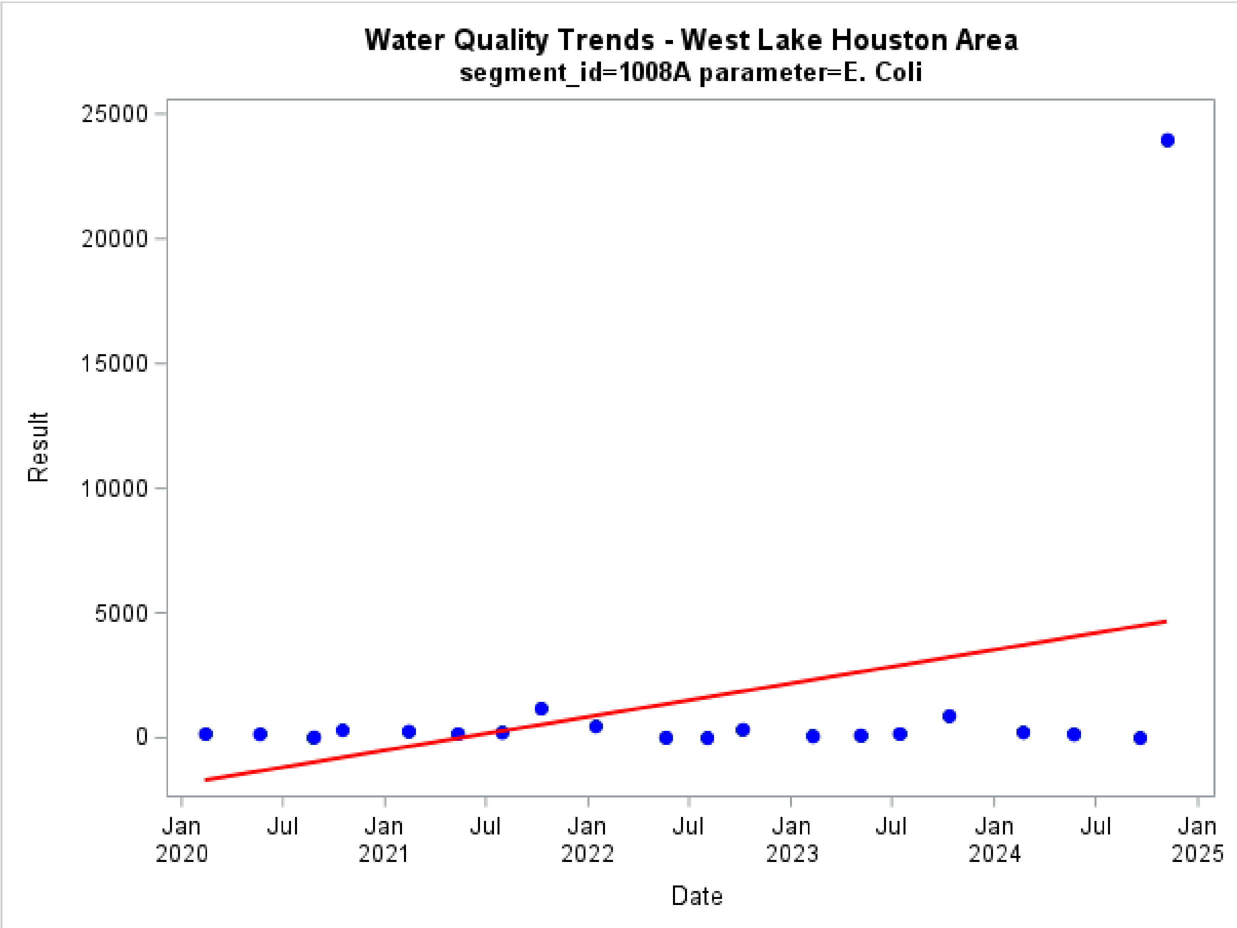
Water Quality Trends - West Lake Houston Area
segment_id=1008 parameter=Total Suspended Solids
Result
1000
800
600
400
200
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

Mill Creek (1008A)

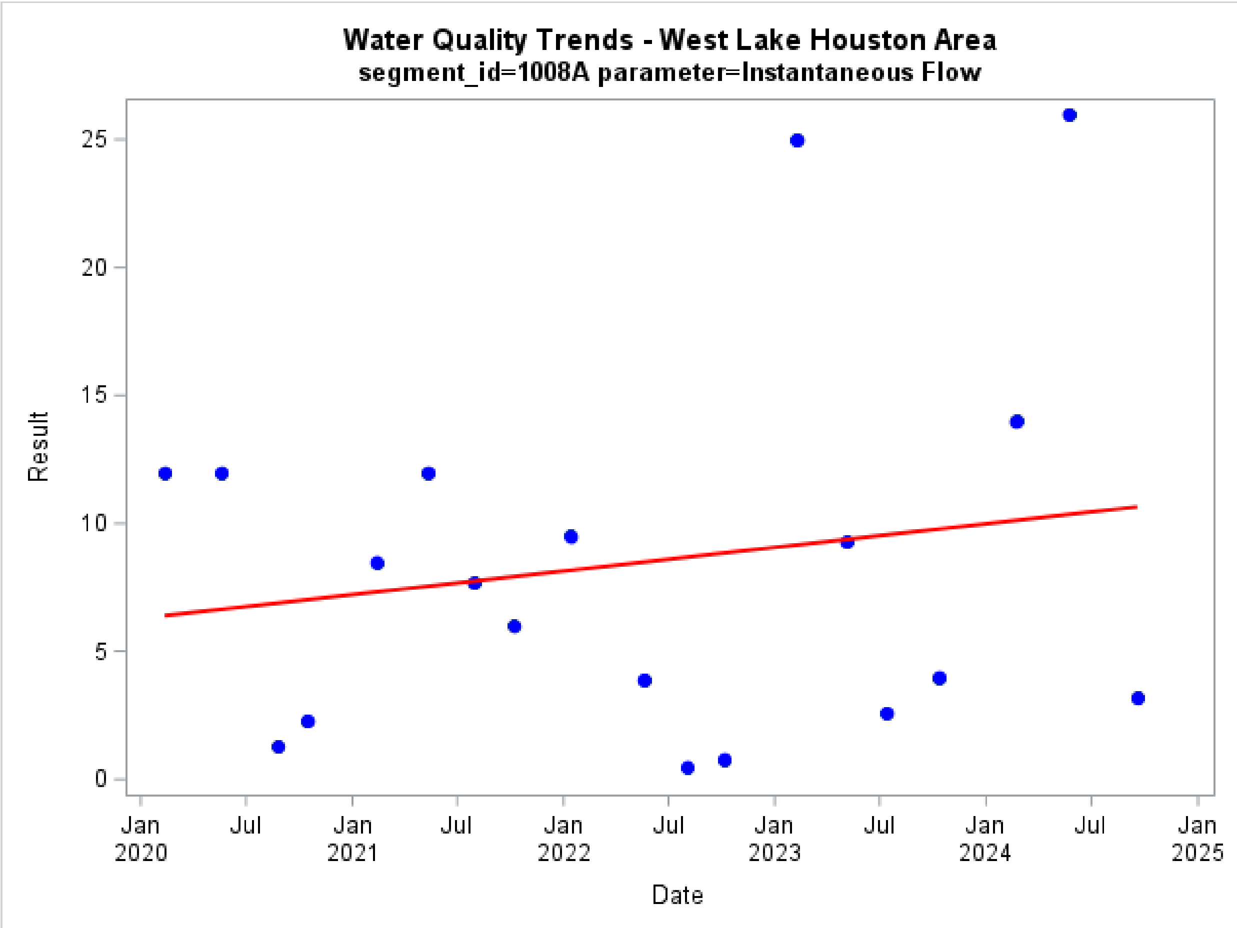


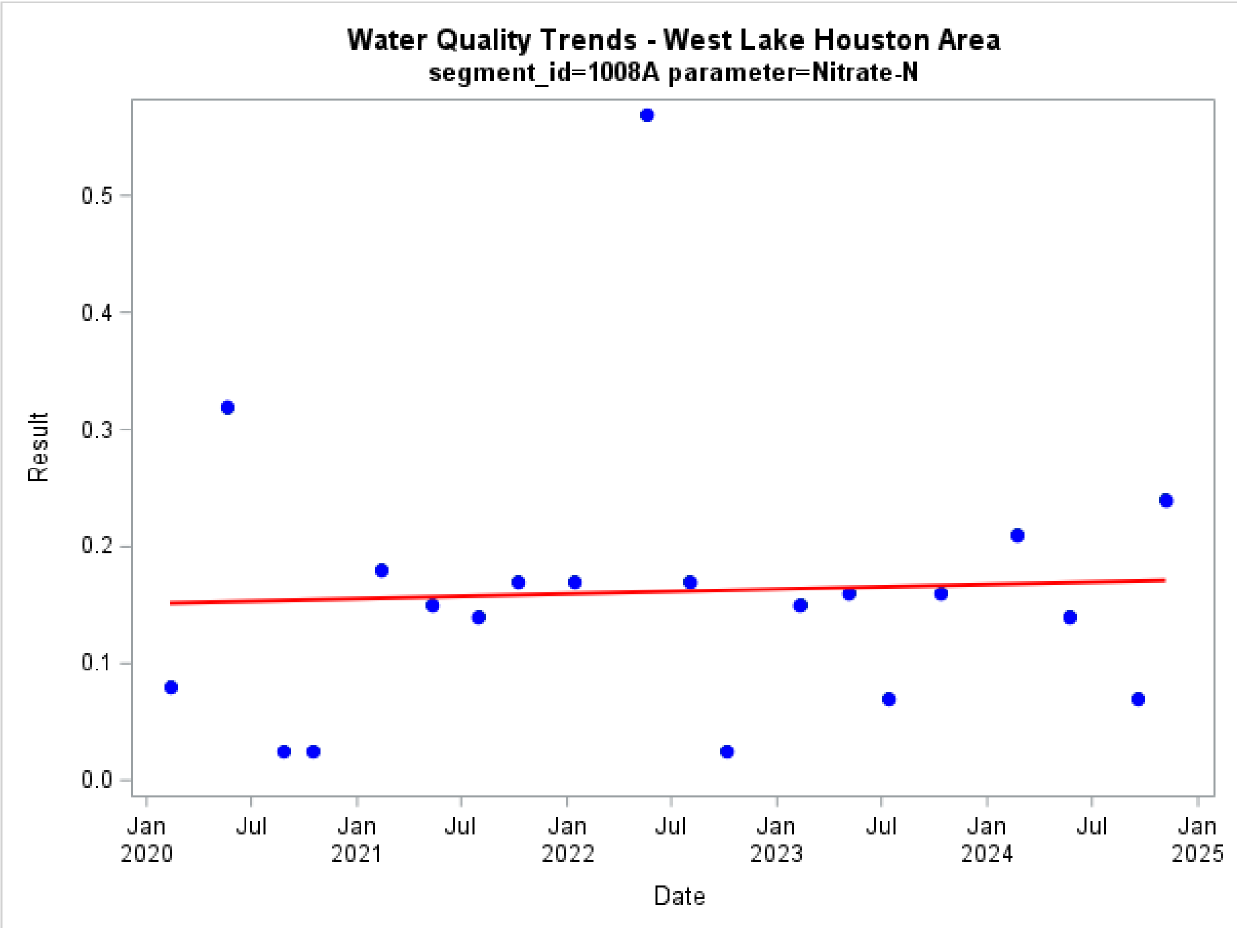


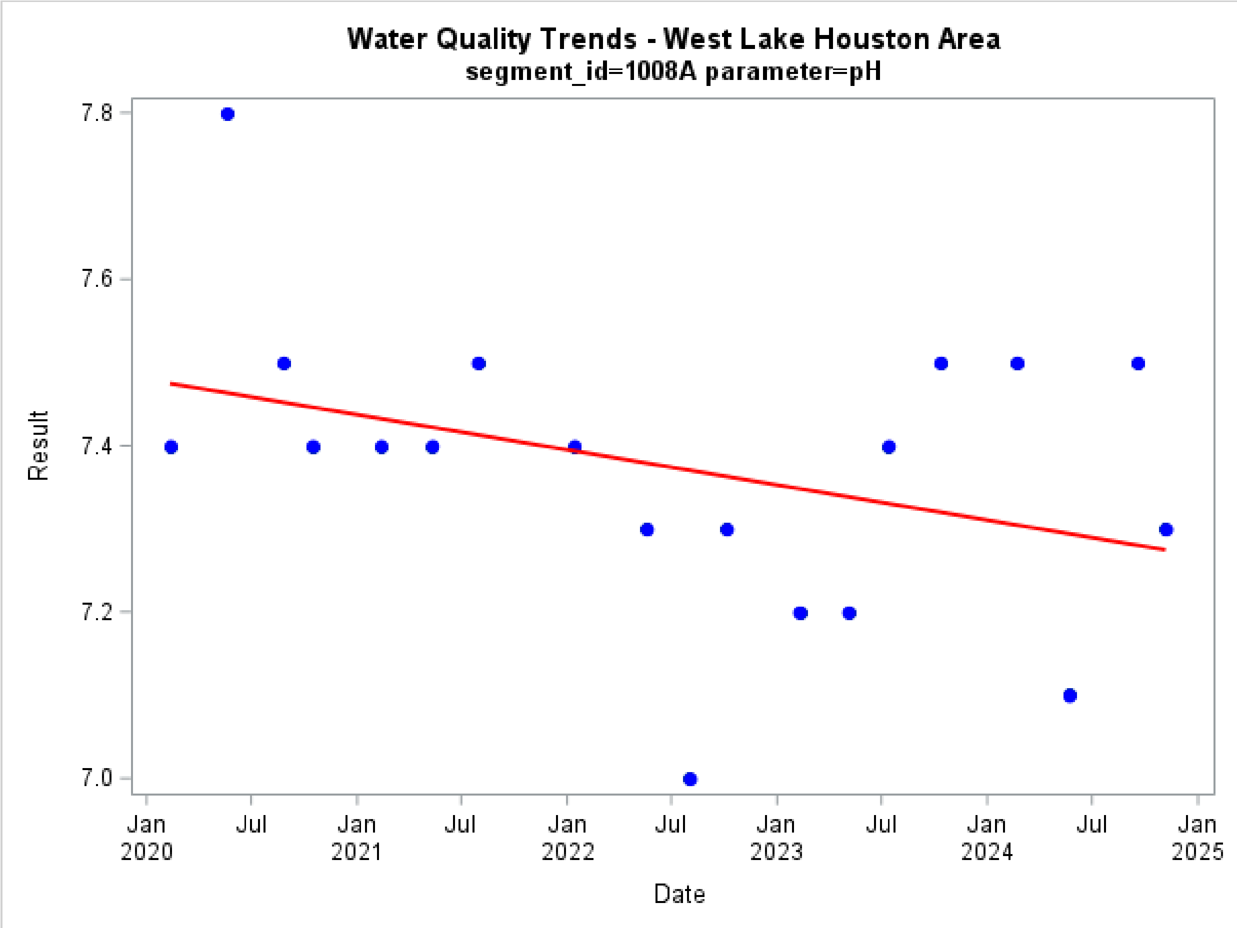
Water Quality Trends - West Lake Houston Area
segment_id=1008A parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
10
9
8
7
6
5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

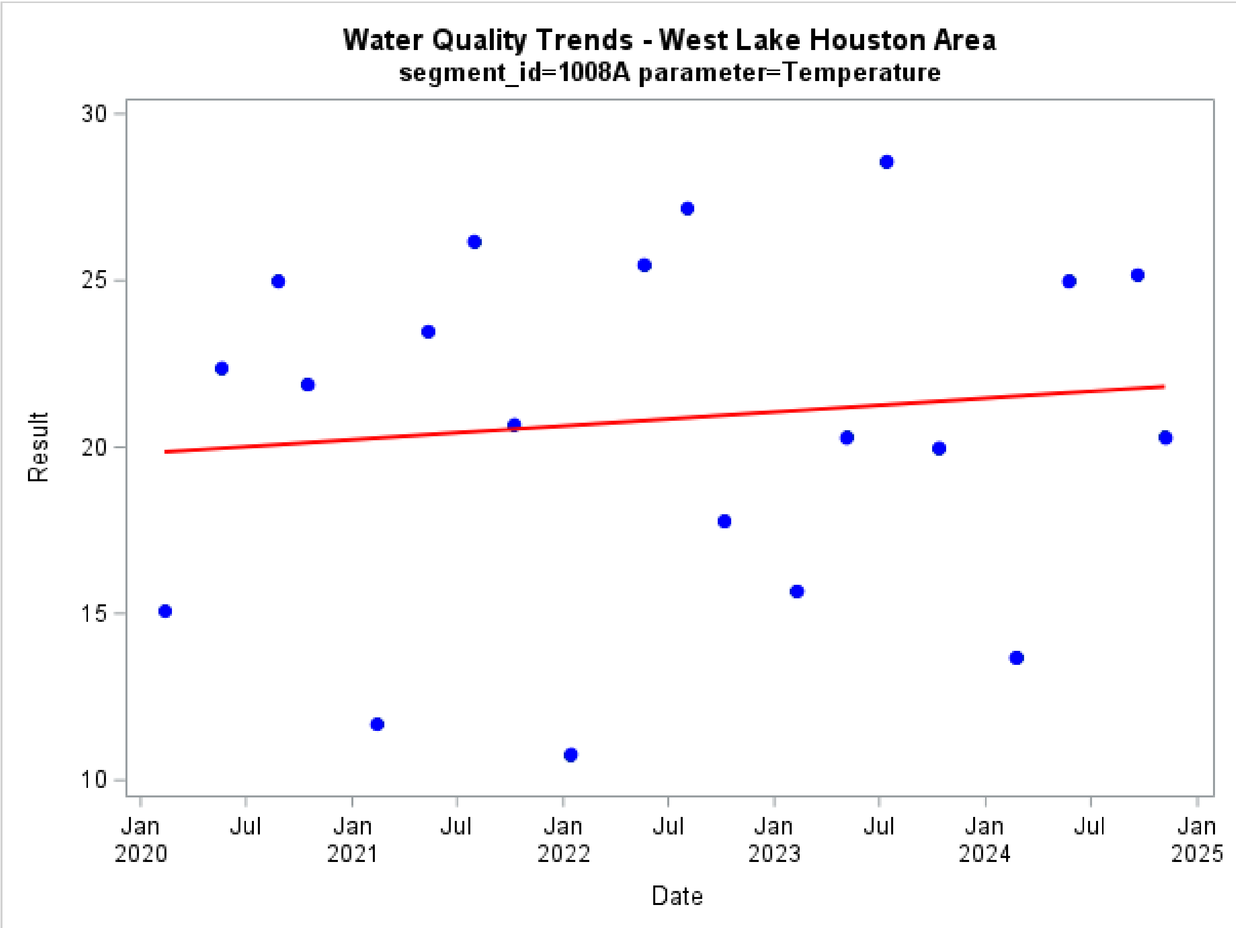


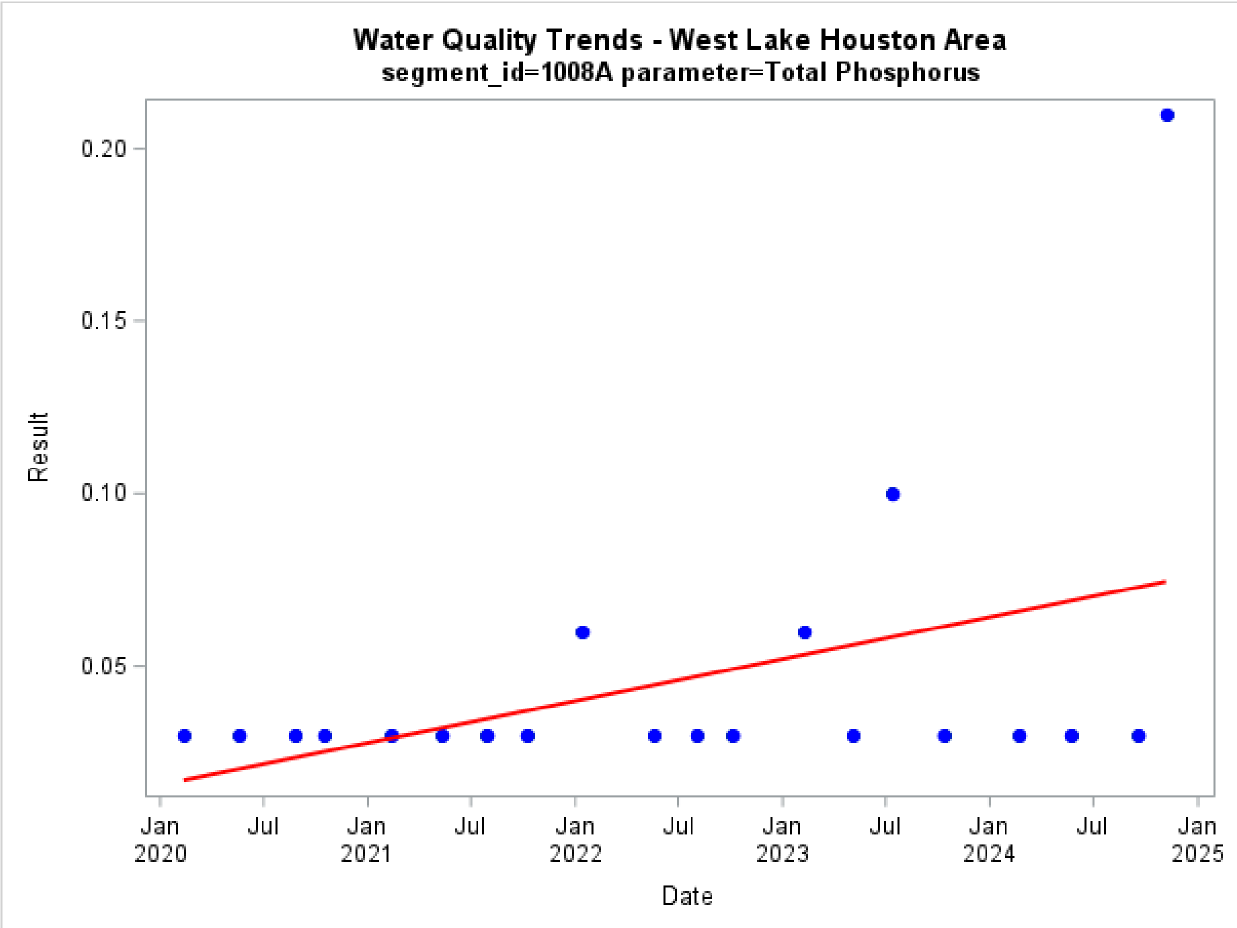
Water Quality Trends - West Lake Houston Area
segment_id=1008A parameter=E. Coli
Result
25000
20000
15000
10000
5000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

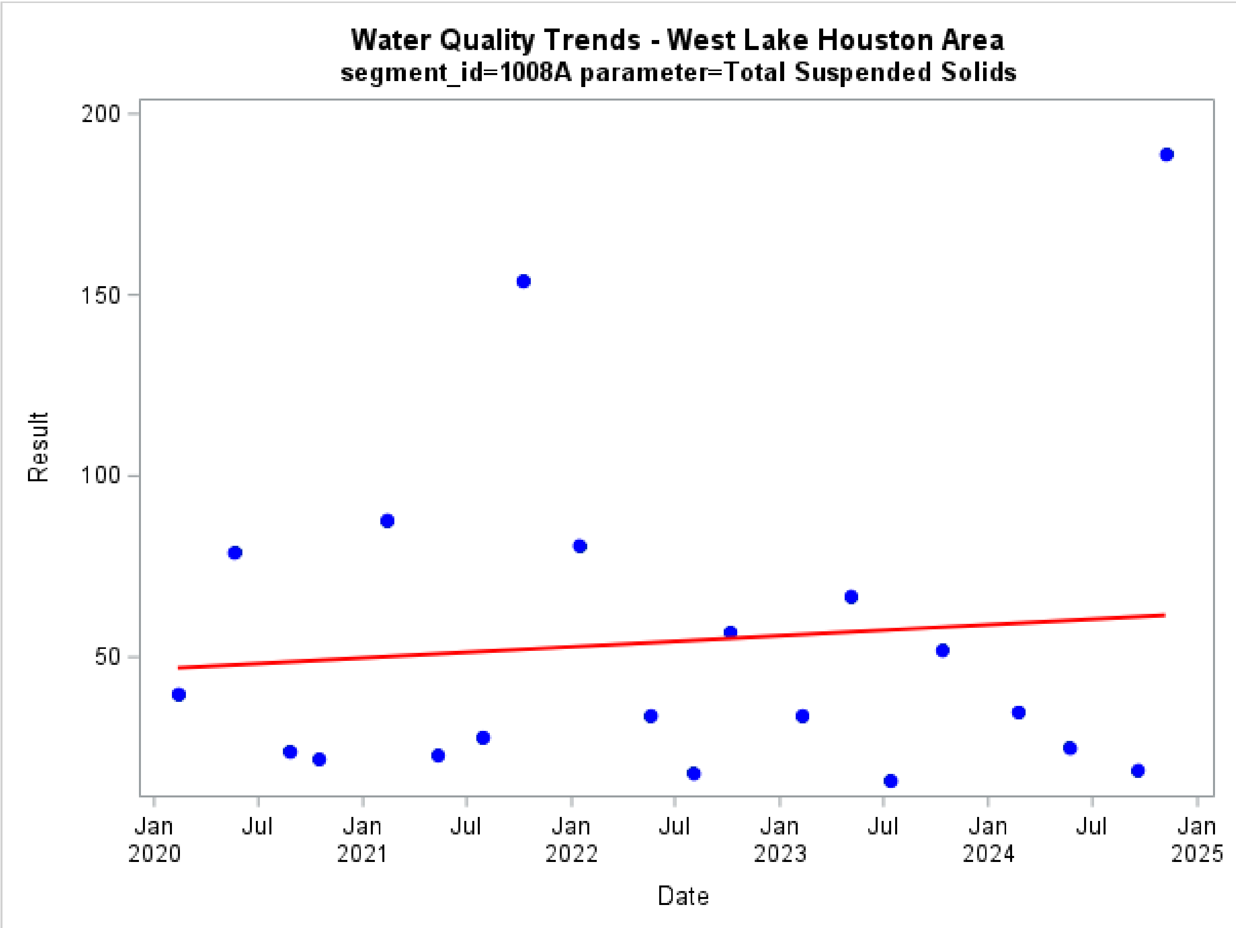

Water Quality Trends - West Lake Houston Area
segment_id=1008A parameter=Instantaneous Flow
Result
25
20
15
10
5
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1008A parameter=Nitrate-N
Result
0.0
0.1
0.2
0.3
0.4
0.5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

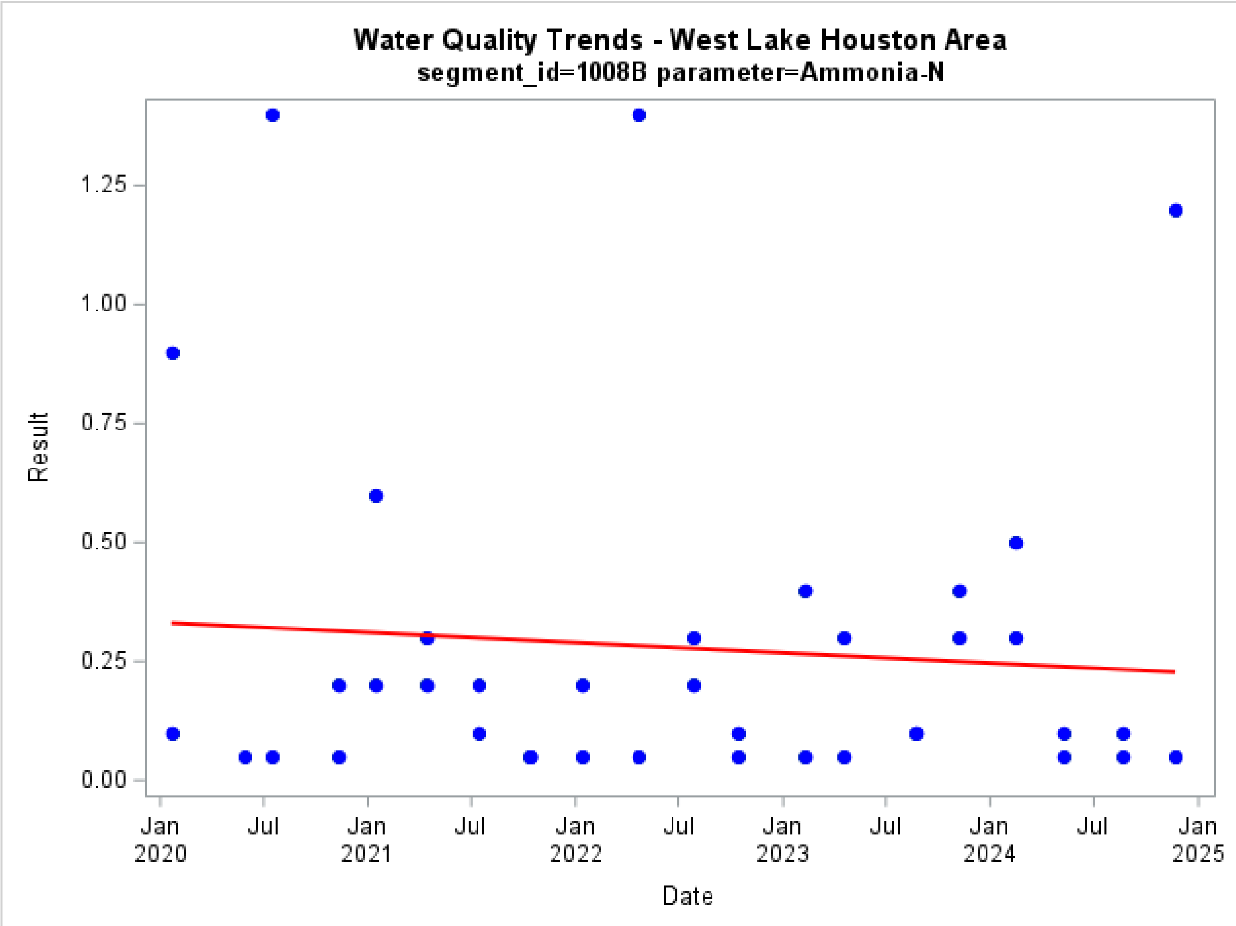

Water Quality Trends - West Lake Houston Area
segment_id=1008A parameter=pH
Result
7.8
7.6
7.4
7.2
7.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

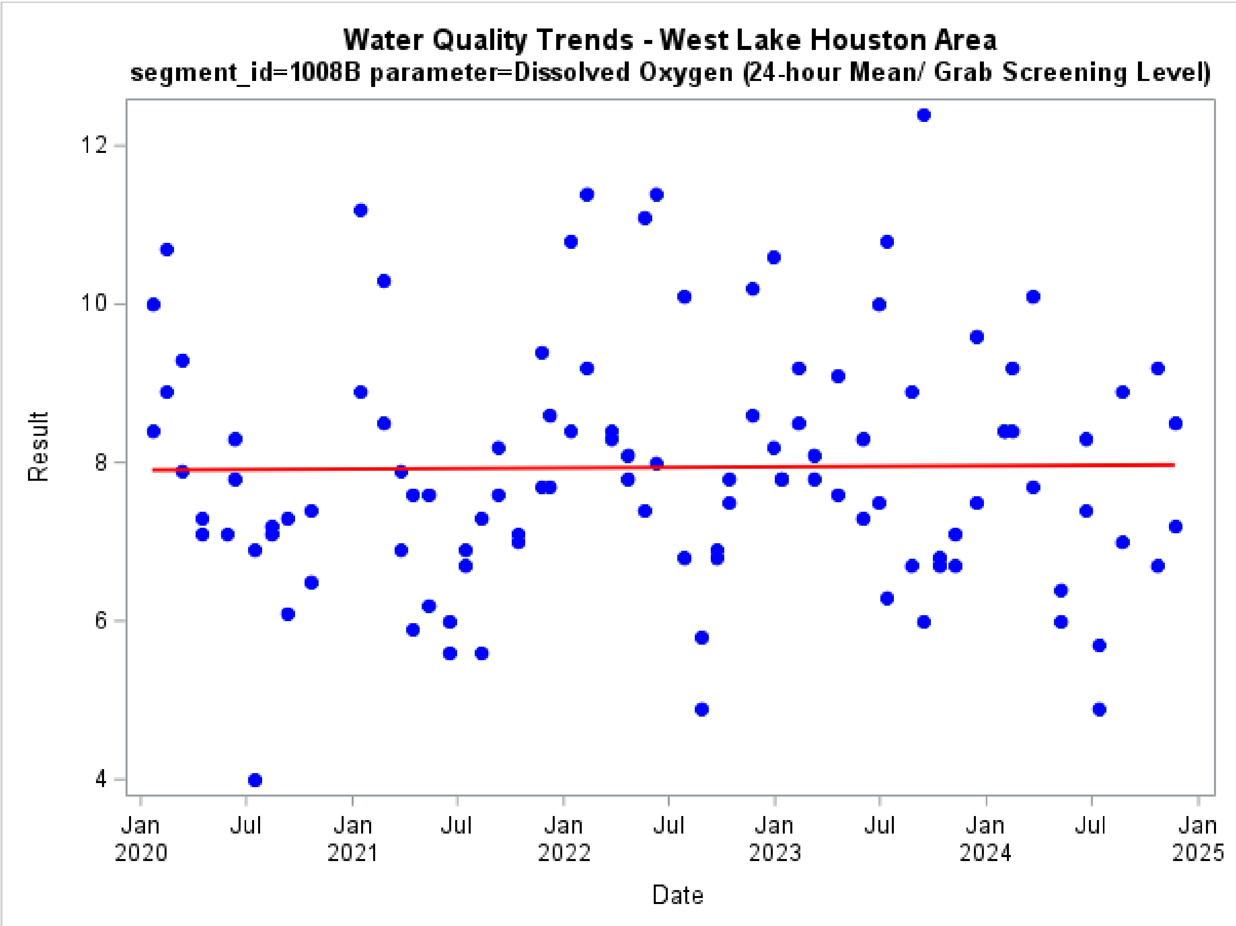

Water Quality Trends - West Lake Houston Area
segment_id=1008A parameter=Temperature
Result
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

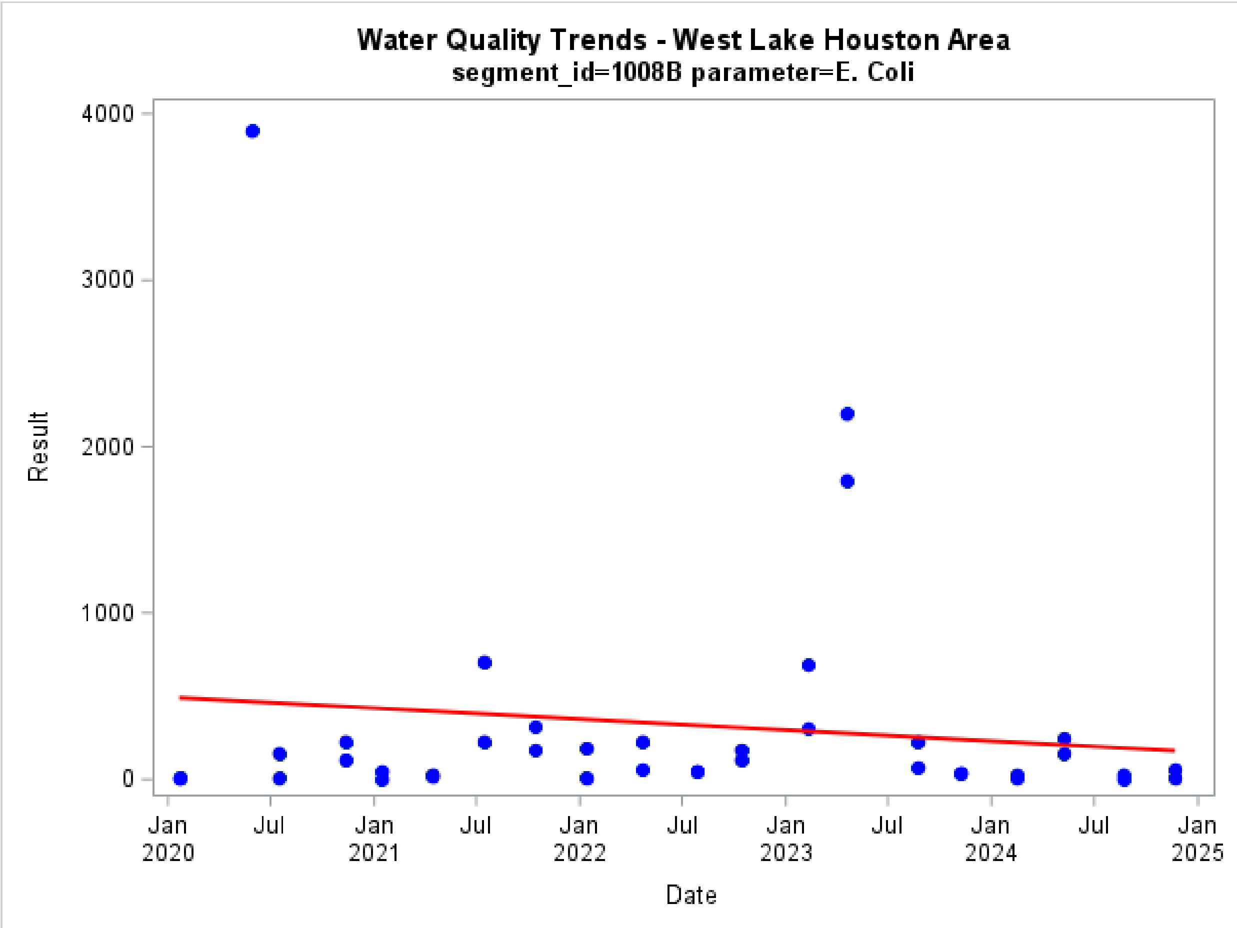

Water Quality Trends - West Lake Houston Area
segment_id=1008A parameter=Total Phosphorus
Result
0.20
0.15
0.10
0.05
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

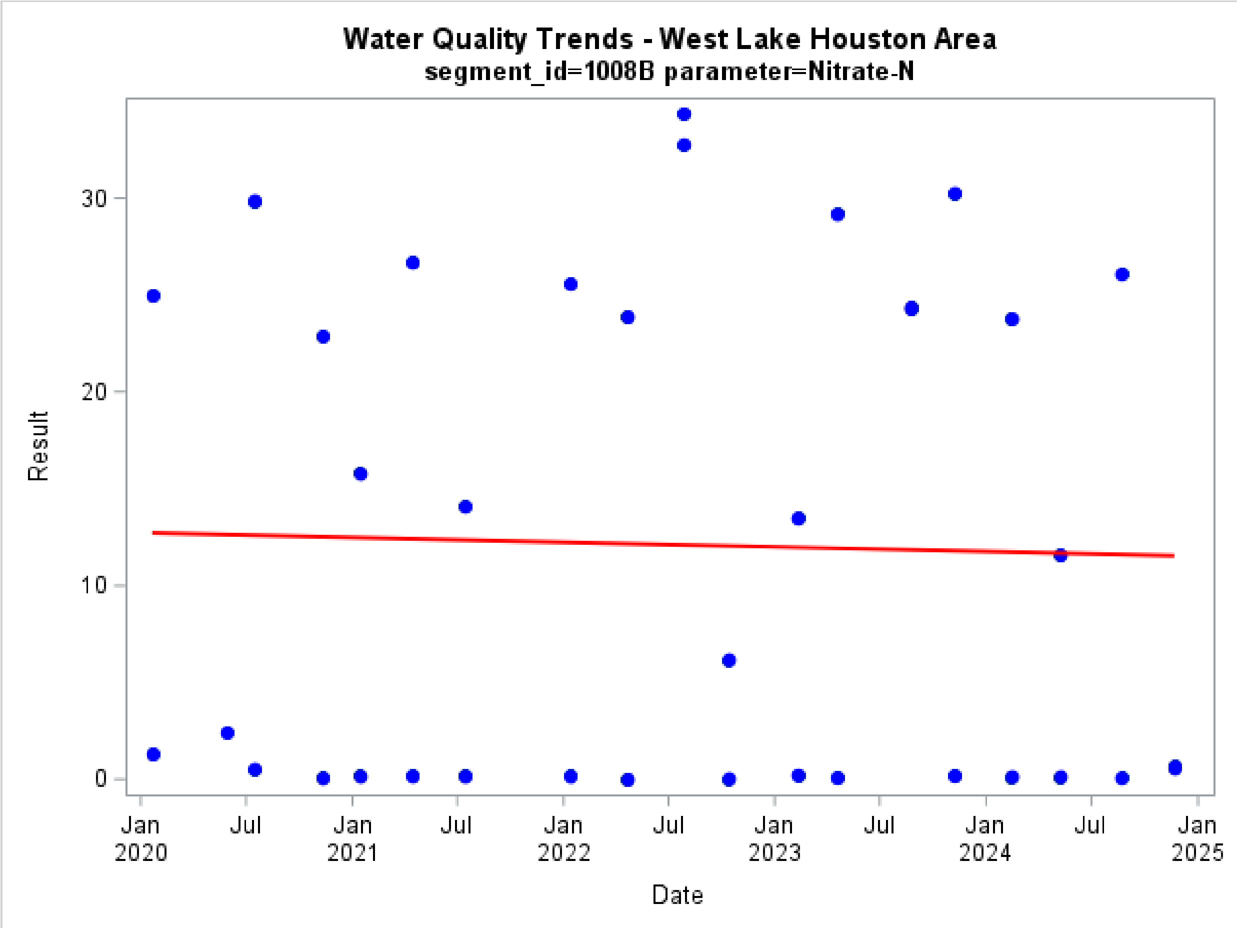

Water Quality Trends - West Lake Houston Area
segment_id=1008A parameter=Total Suspended Solids
Result
200
150
100
50
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

Upper Panther Branch (1008B)

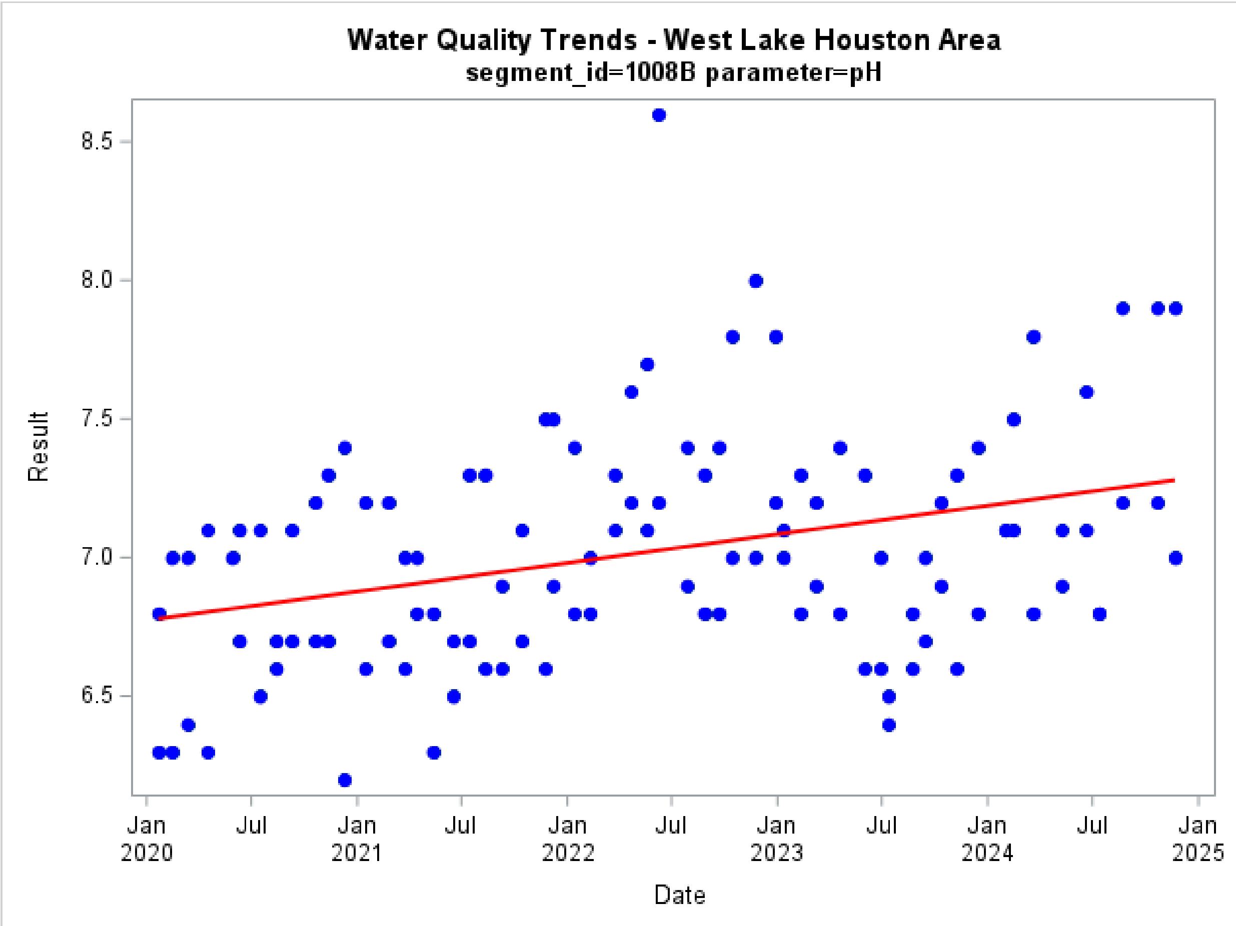



Water Quality Trends - West Lake Houston Area
segment_id=1008B parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
12
10
8
6
4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

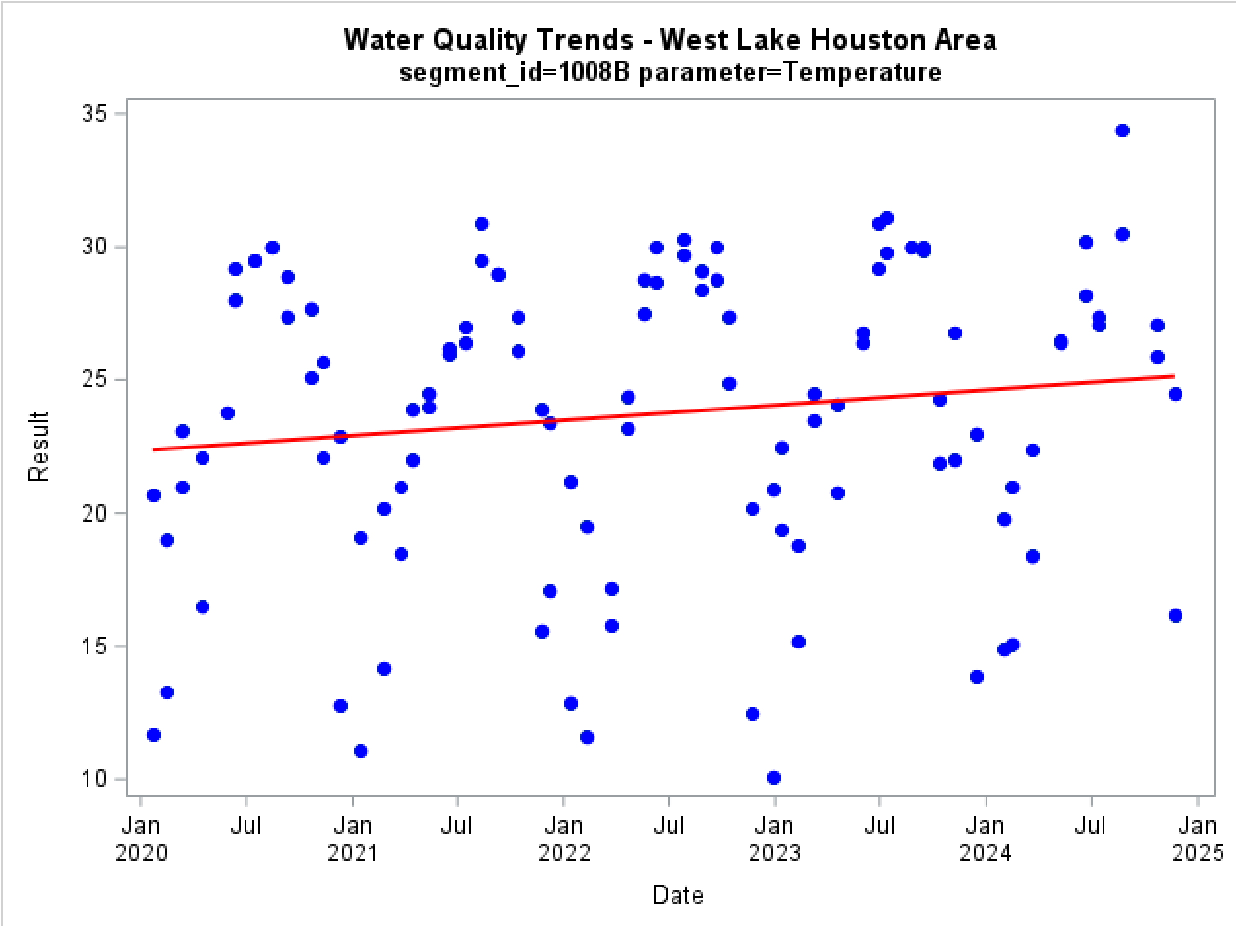

Water Quality Trends - West Lake Houston Area
segment_id=1008B parameter=E. Coli
Result
4000
3000
2000
1000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

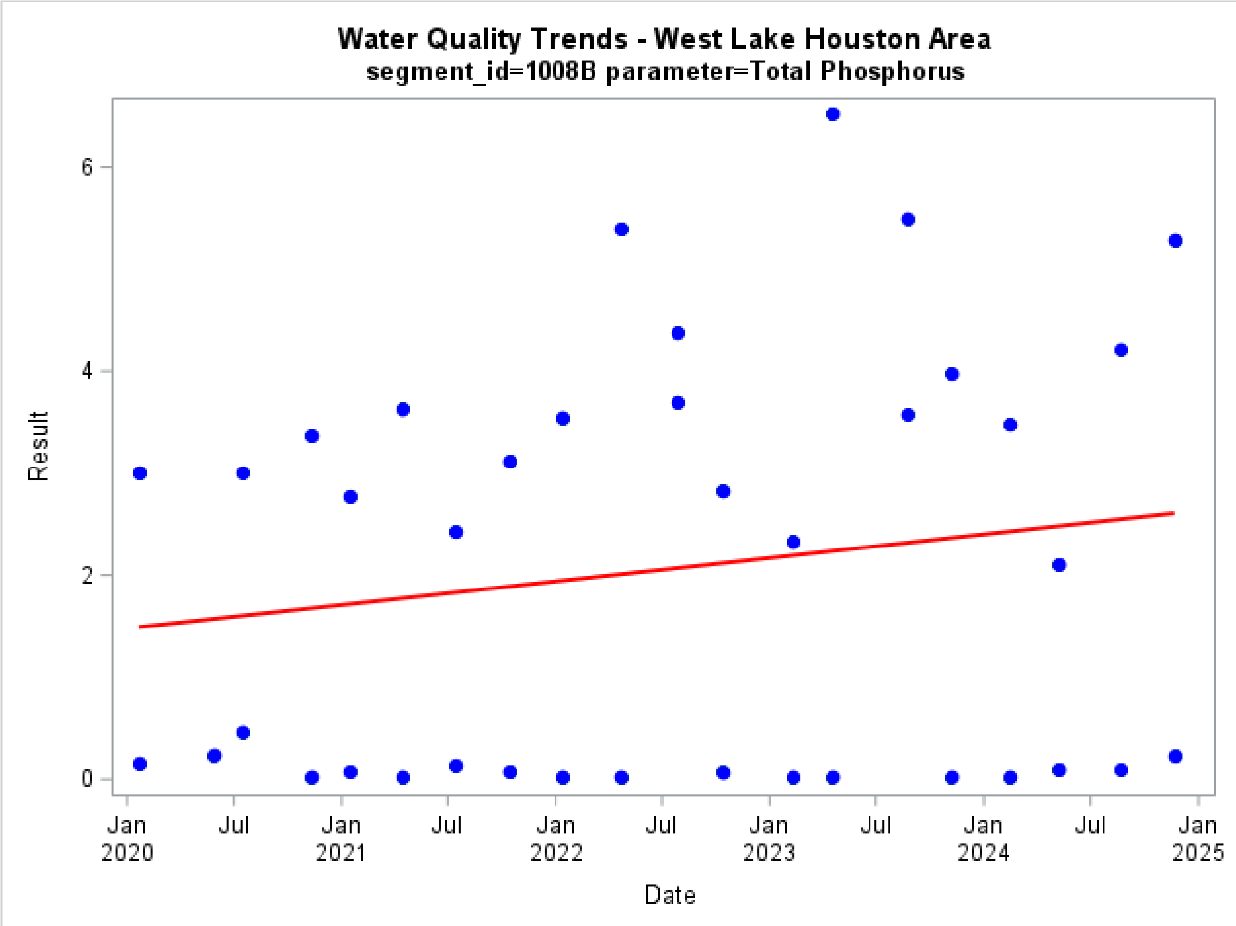


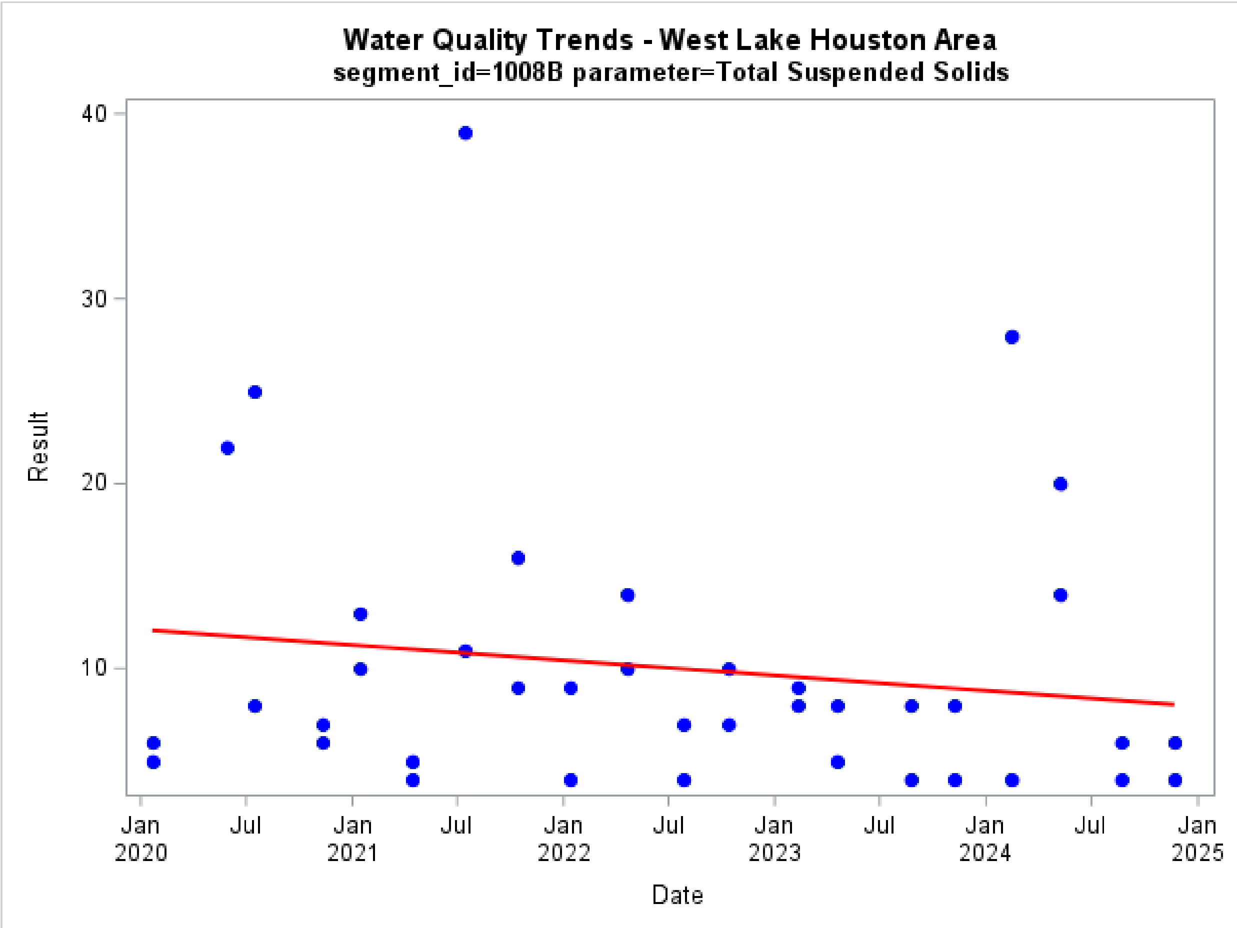
Water Quality Trends - West Lake Houston Area
segment_id=1008B parameter=Nitrate-N
Result
30
20
10
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



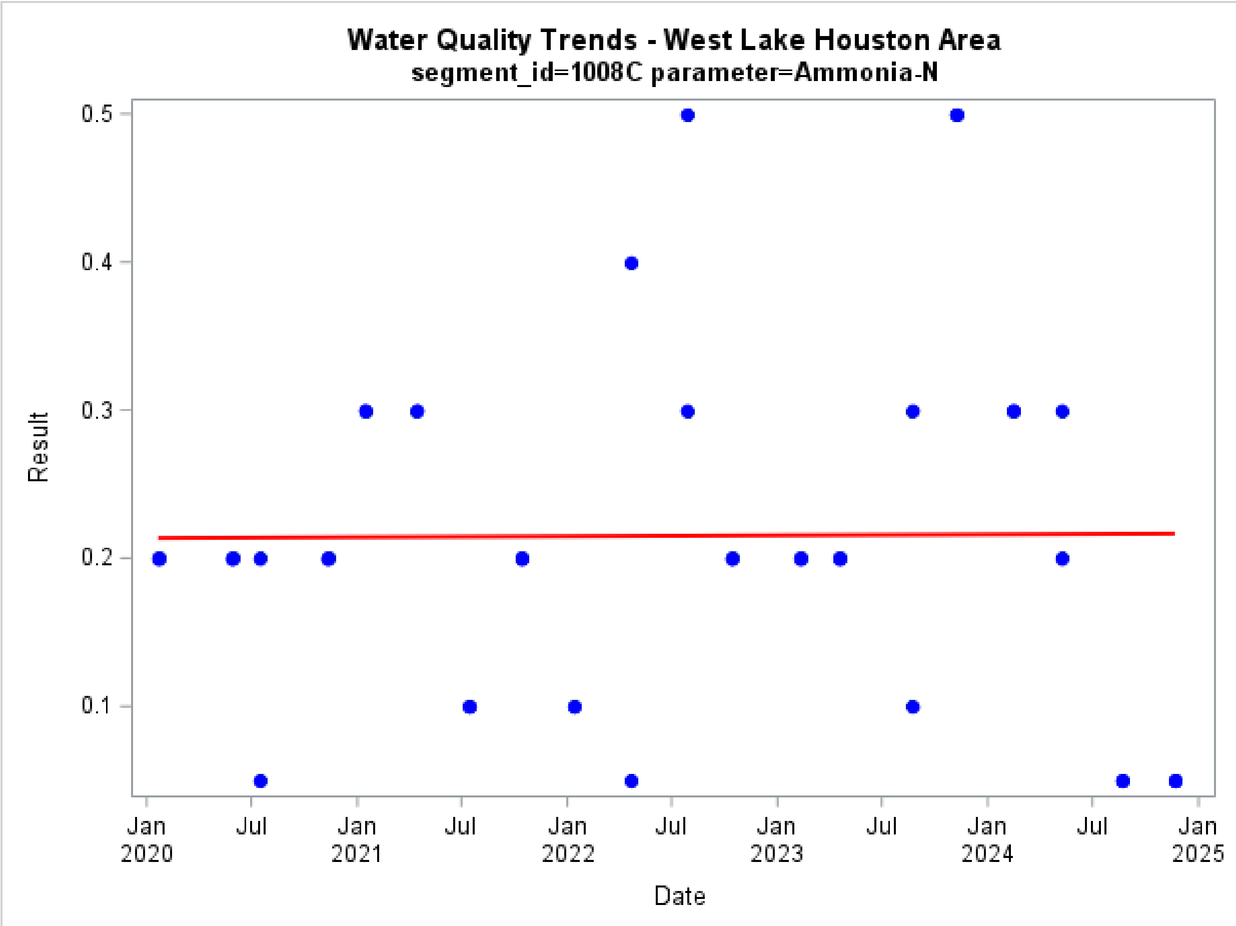
Water Quality Trends - West Lake Houston Area
segment_id=1008B parameter=pH
Result
8.5
8.0
7.5
7.0
6.5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

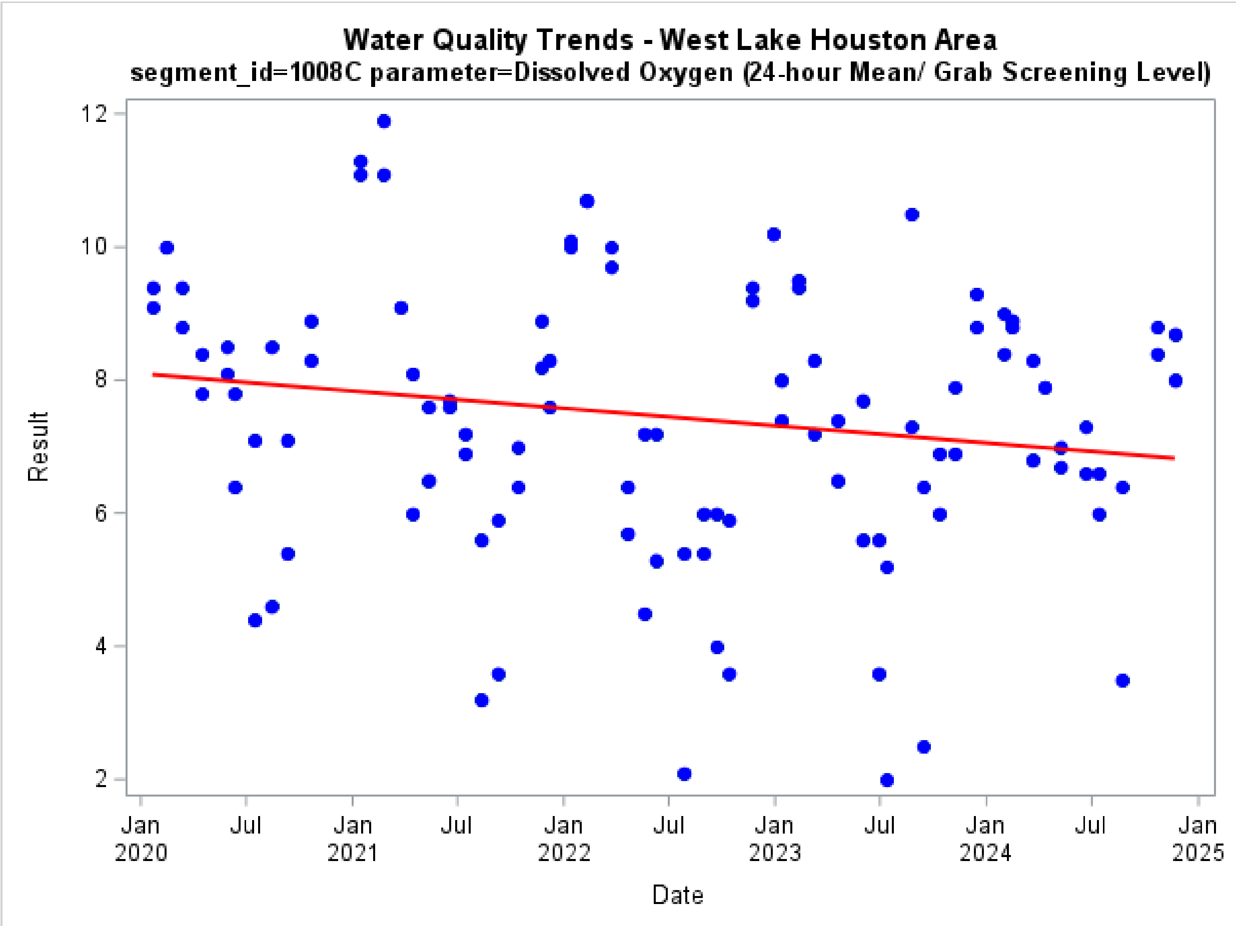

Water Quality Trends - West Lake Houston Area
segment_id=1008B parameter=Temperature
Result
35
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

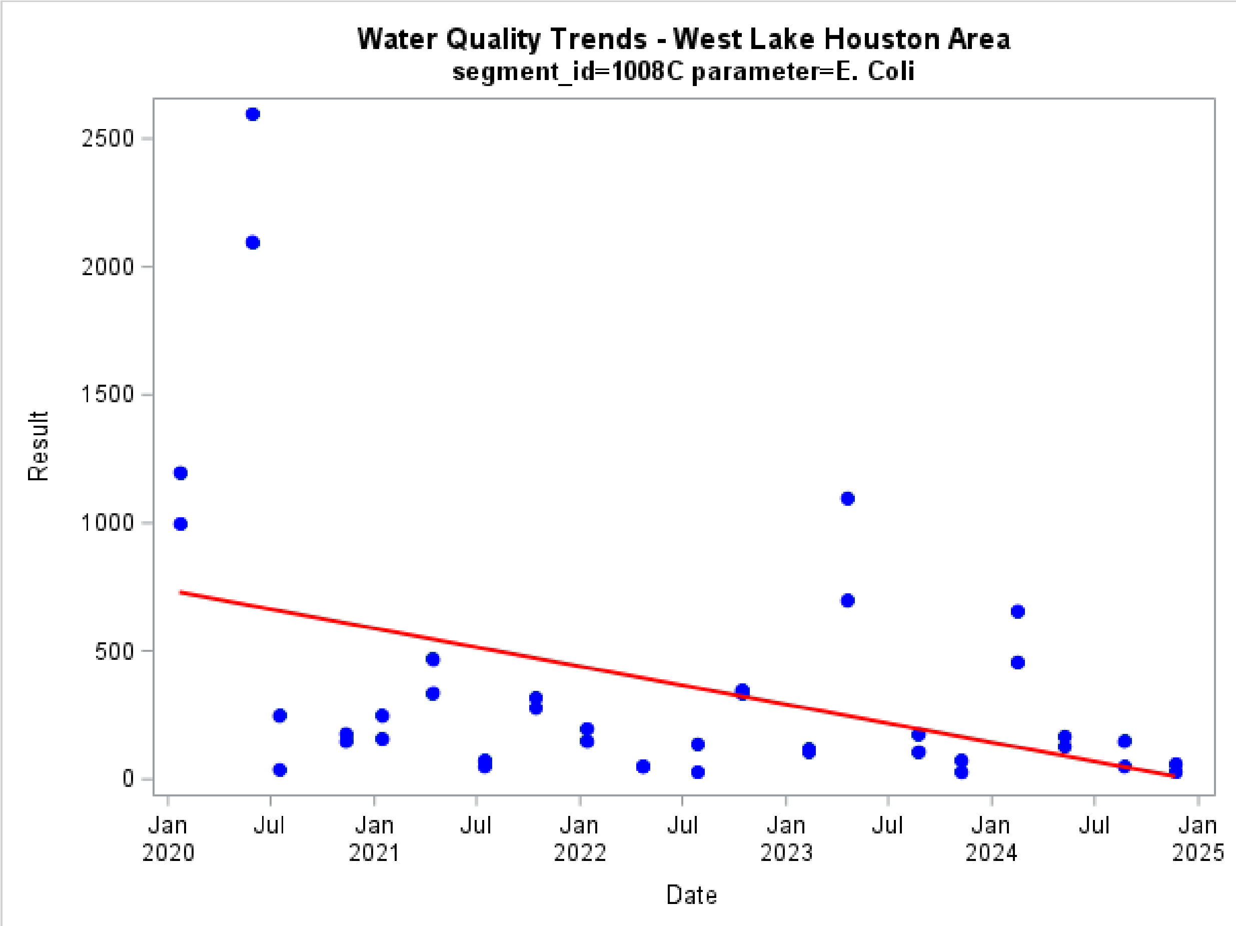

Water Quality Trends - West Lake Houston Area
segment_id=1008B parameter=Total Phosphorus
Result
0
2
4
6
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

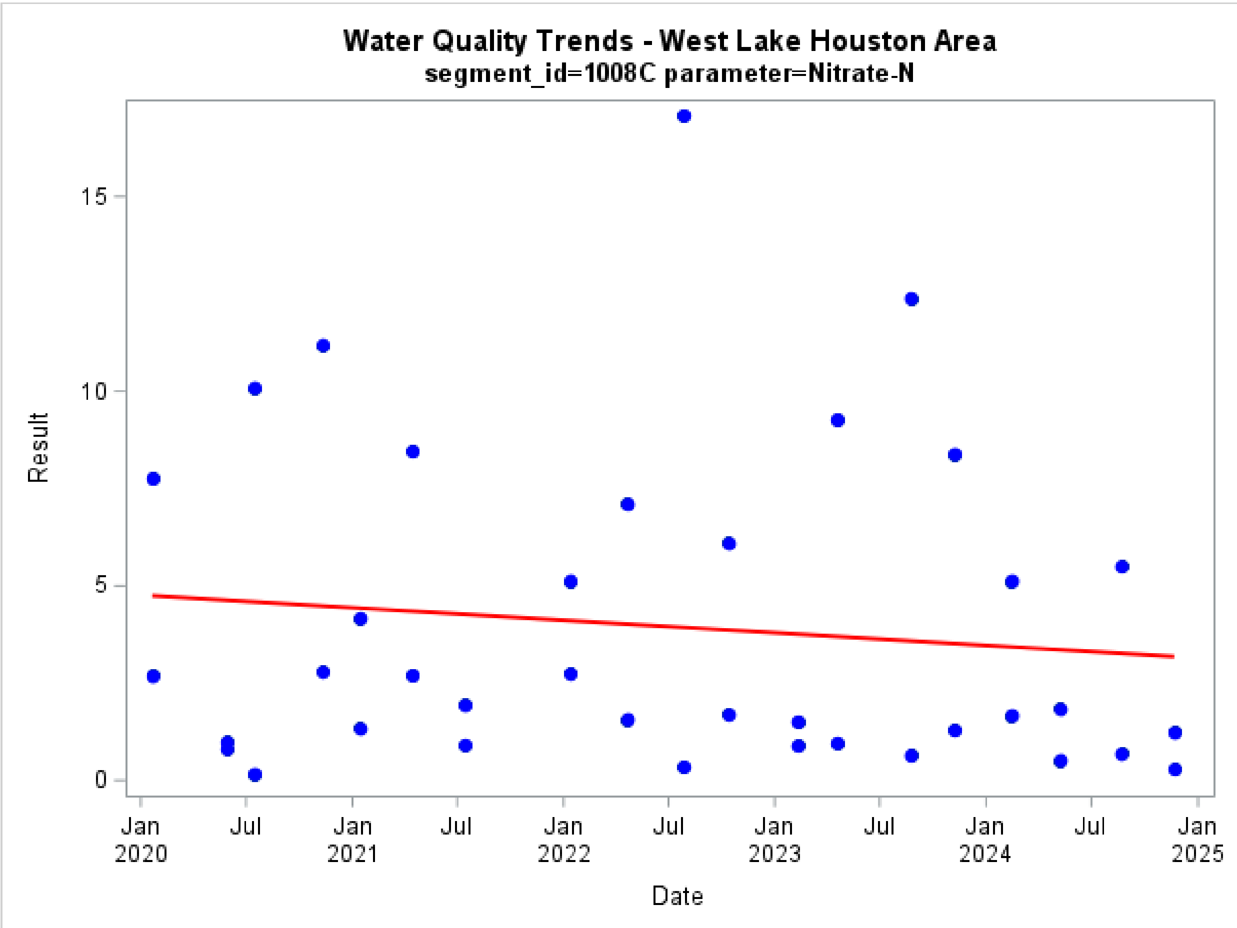

Water Quality Trends - West Lake Houston Area
segment_id=1008B parameter=Total Suspended Solids
Result
40
30
20
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

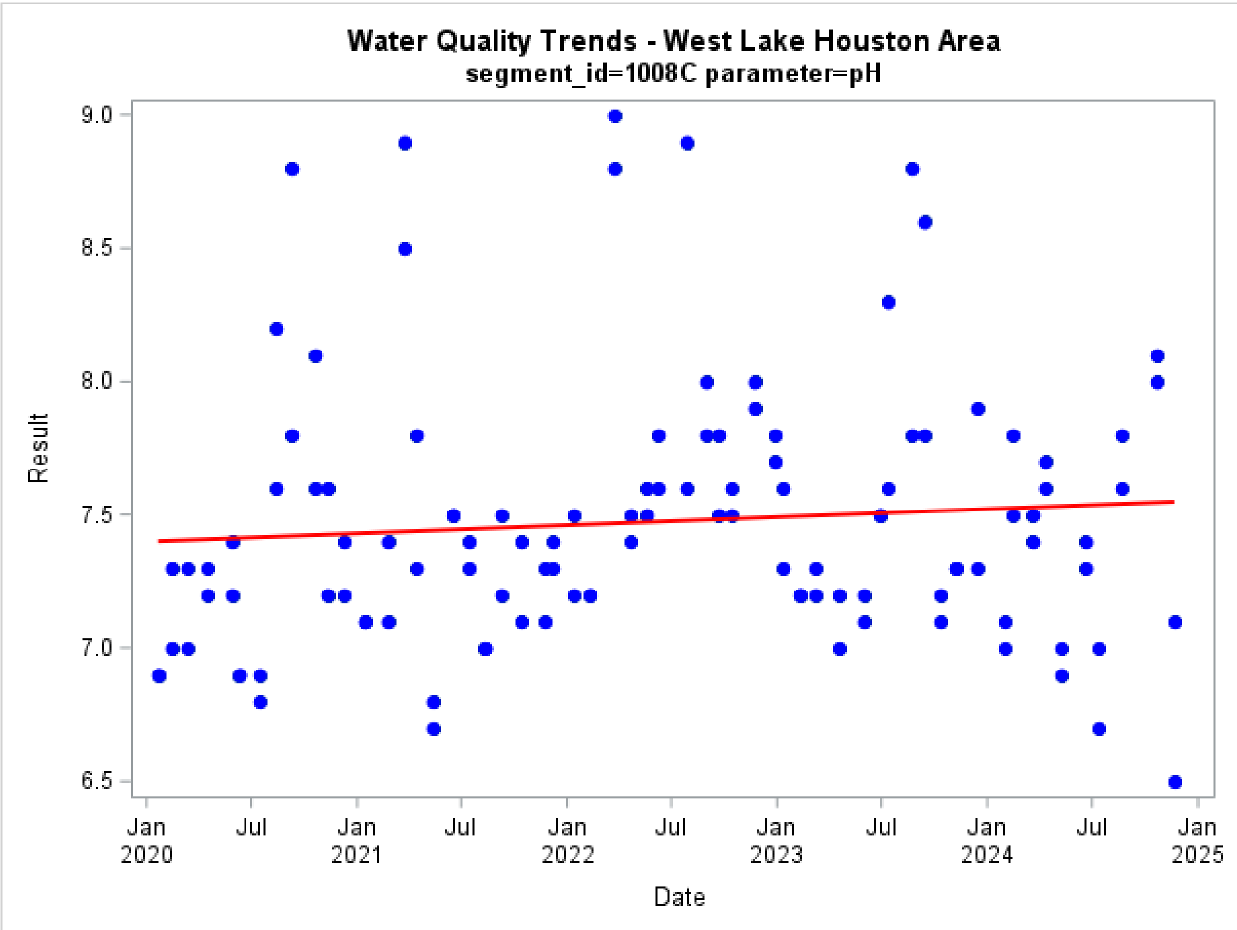
Lower Panther Branch (1008C)

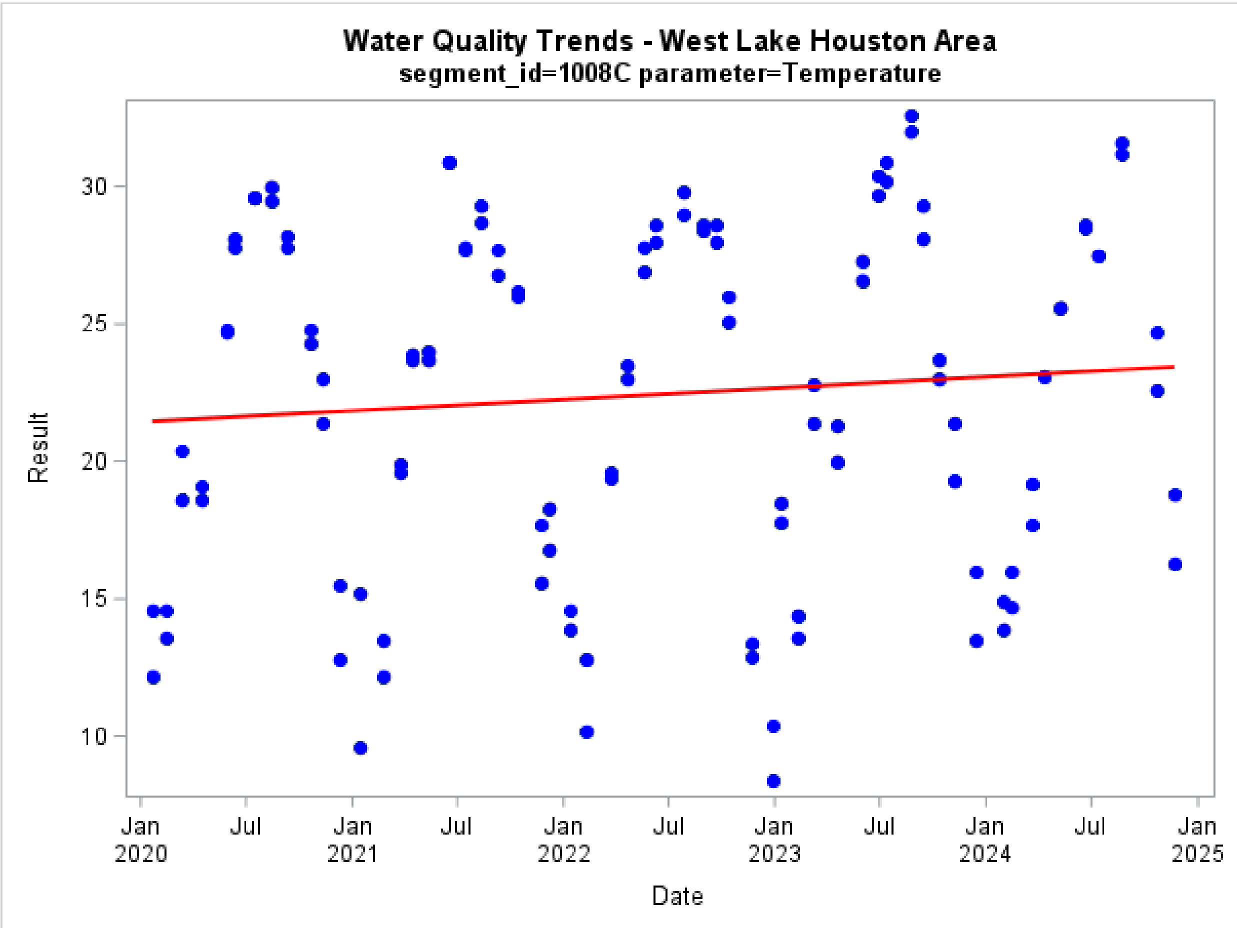


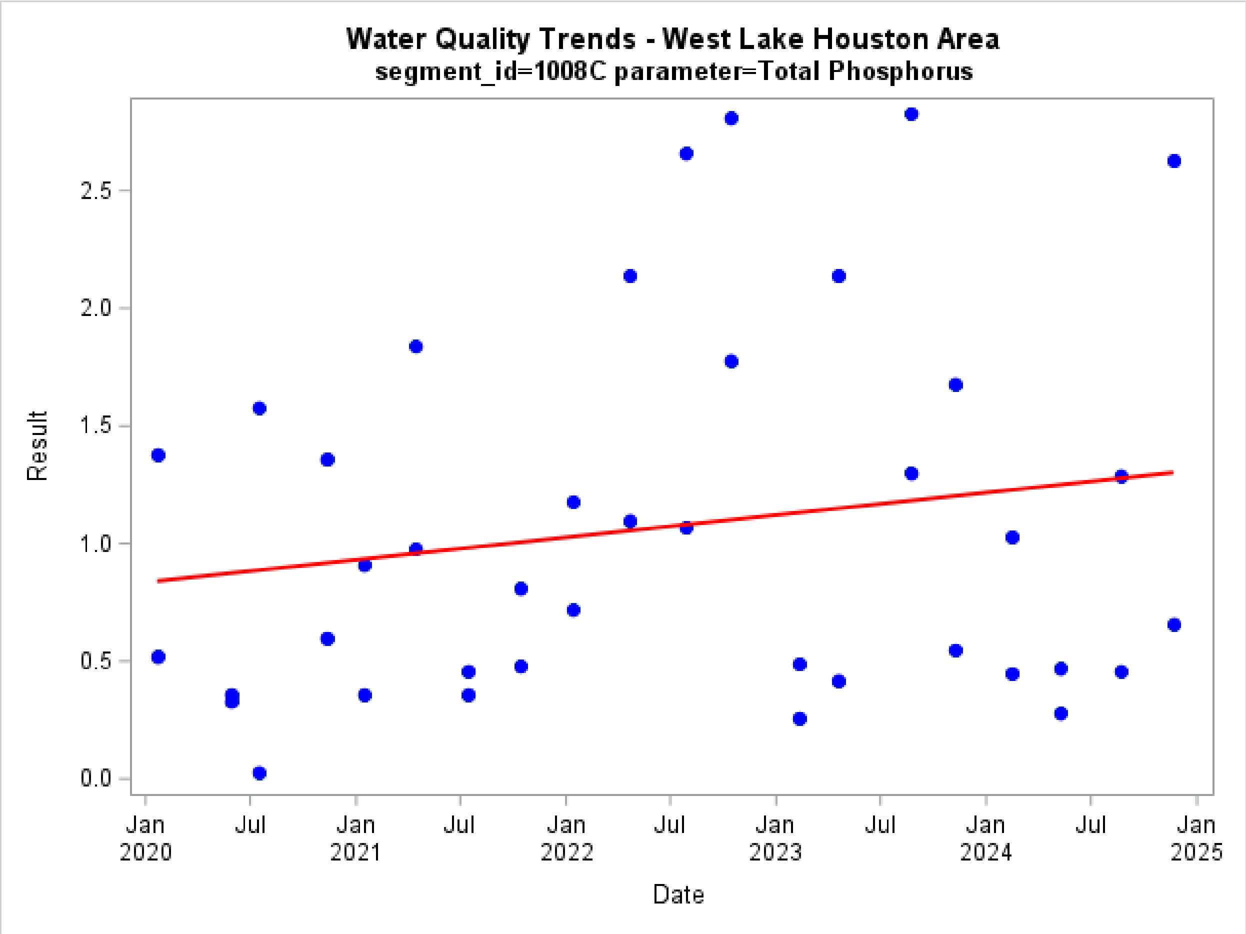

Water Quality Trends - West Lake Houston Area
segment_id=1008C parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
12
10
8
6
4
2
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1008C parameter=E. Coli
Result
2500
2000
1500
1000
500
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

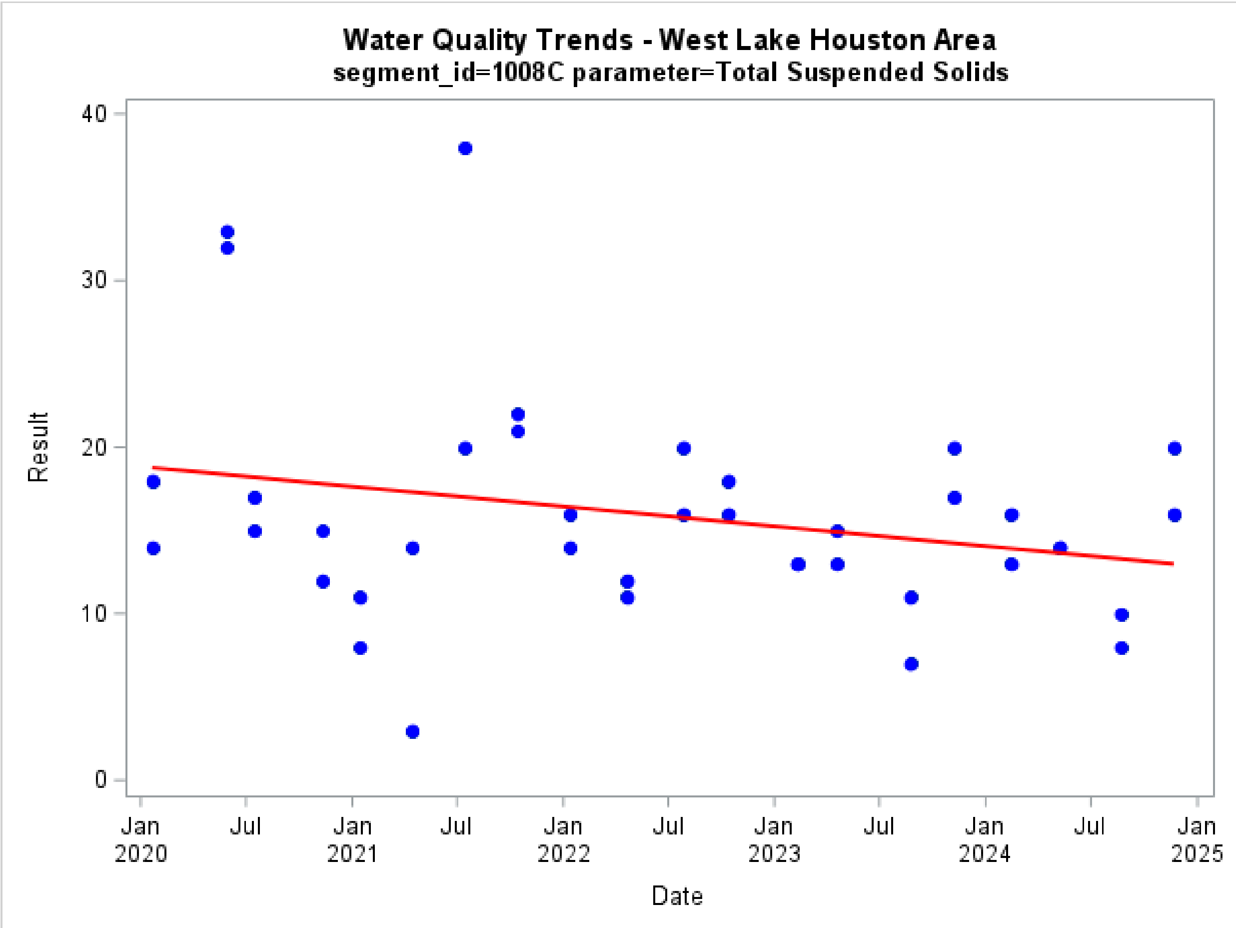

Water Quality Trends - West Lake Houston Area
segment_id=1008C parameter=Nitrate-N
Result
15
10
5
0
Jan
2020
Jul
Jan
2021
Jul
Jan
2022
Jul
Jan
2023
Jul
Jan
2024
Jul
Jan
2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1008C parameter=pH
9.0
8.5
8.0
7.5
7.0
6.5
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

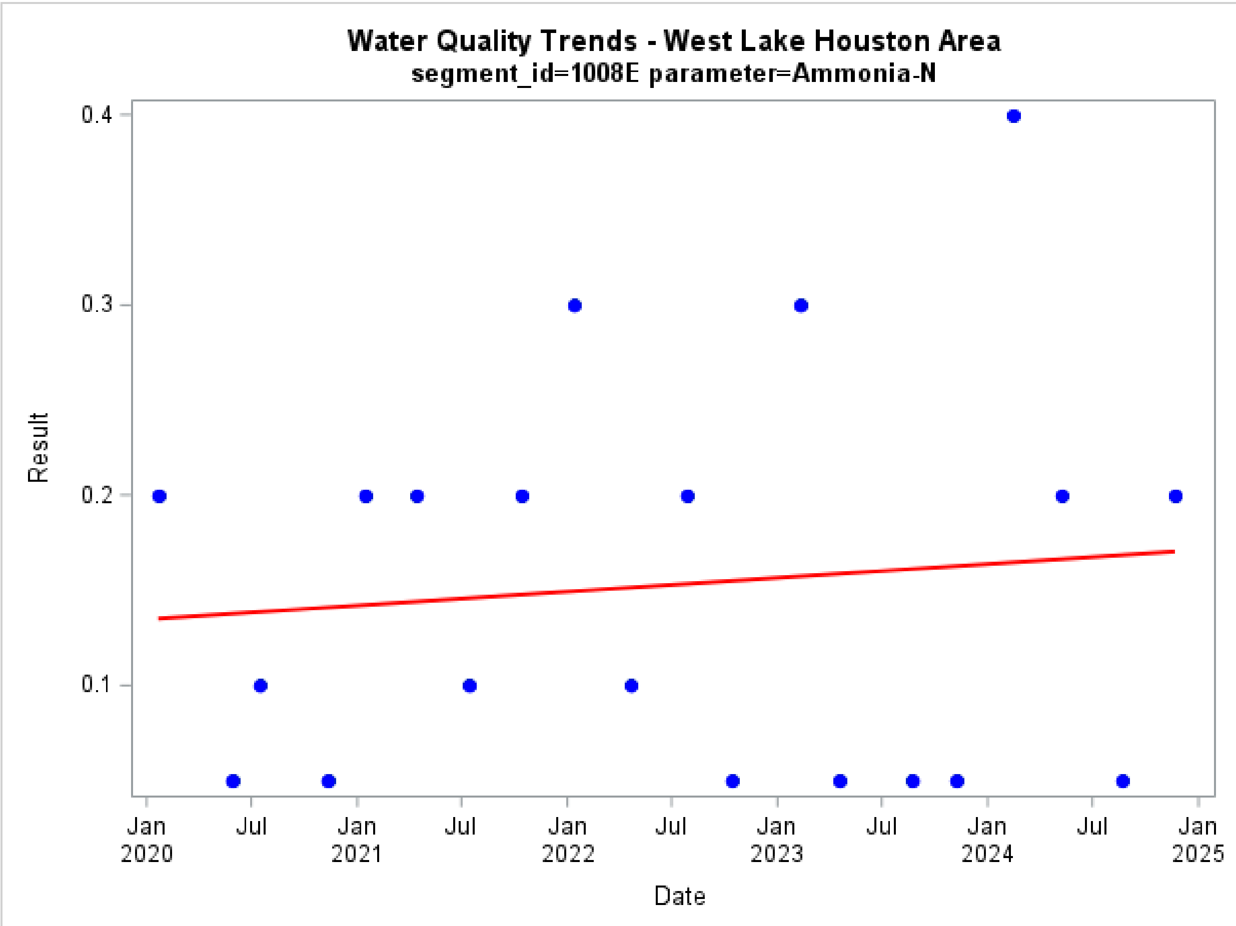

Water Quality Trends - West Lake Houston Area
segment_id=1008C parameter=Temperature
Result
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

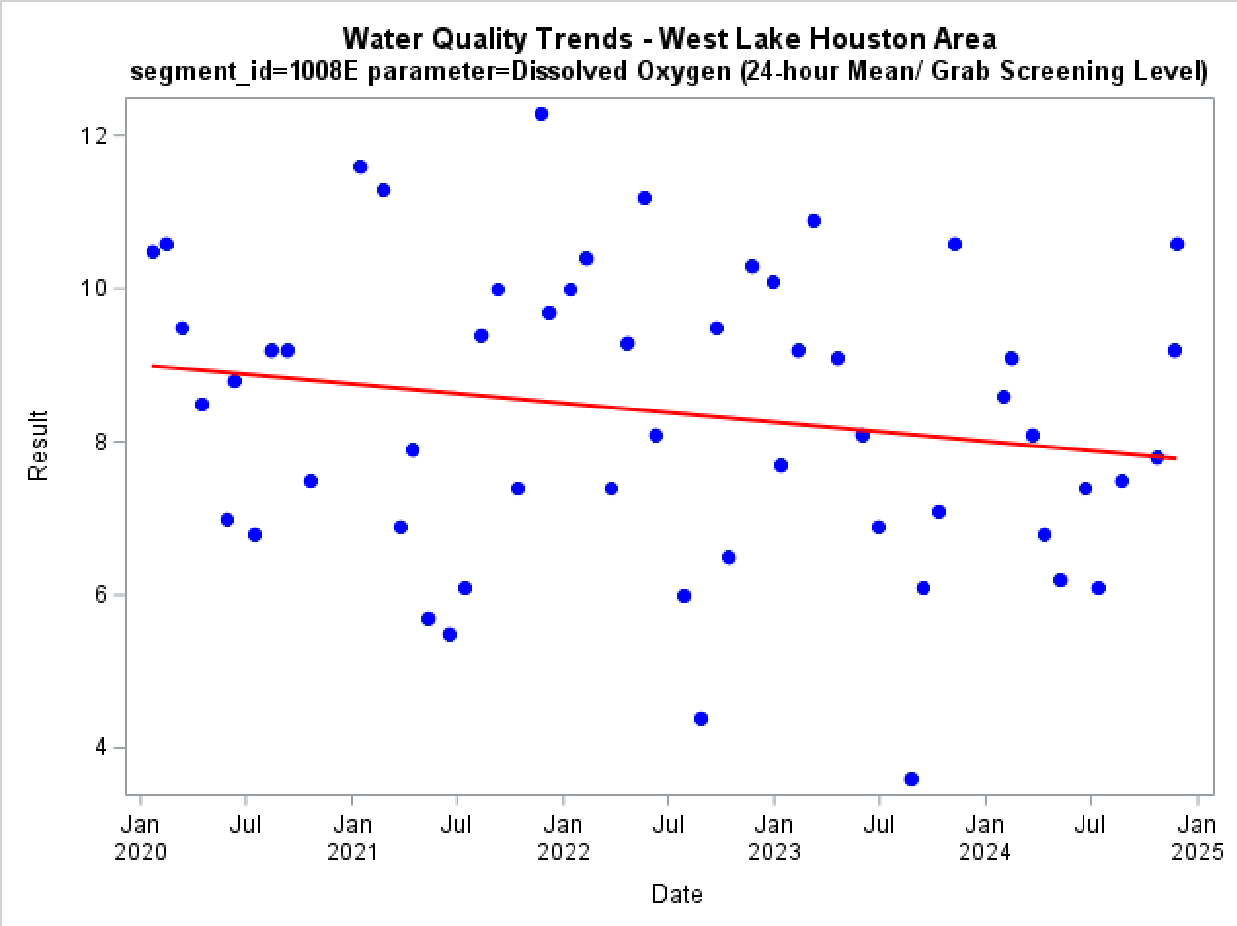


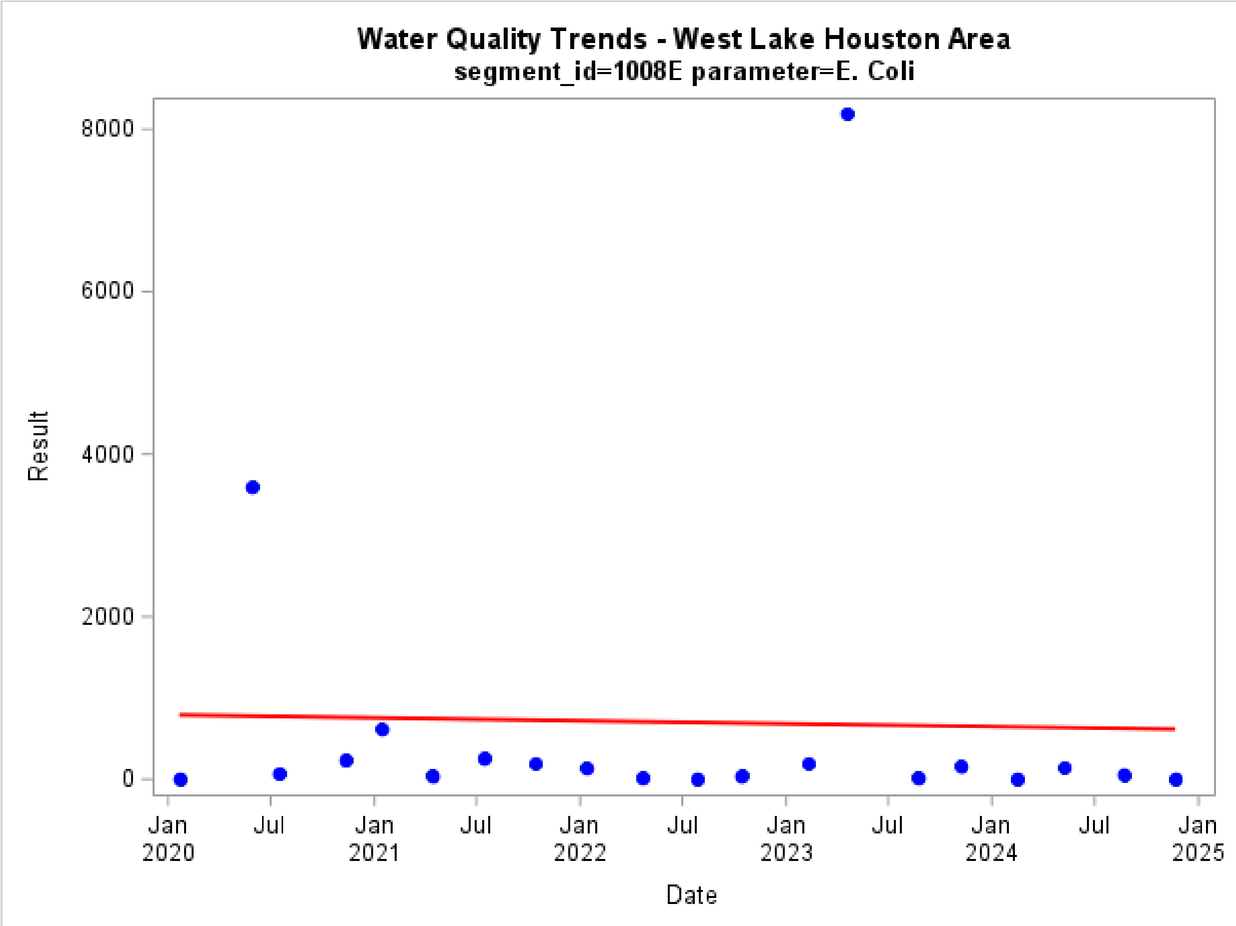
Water Quality Trends - West Lake Houston Area
segment_id=1008C parameter=Total Phosphorus
Result
0.0
0.5
1.0
1.5
2.0
2.5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1008C parameter=Total Suspended Solids
Result
40
30
20
10
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

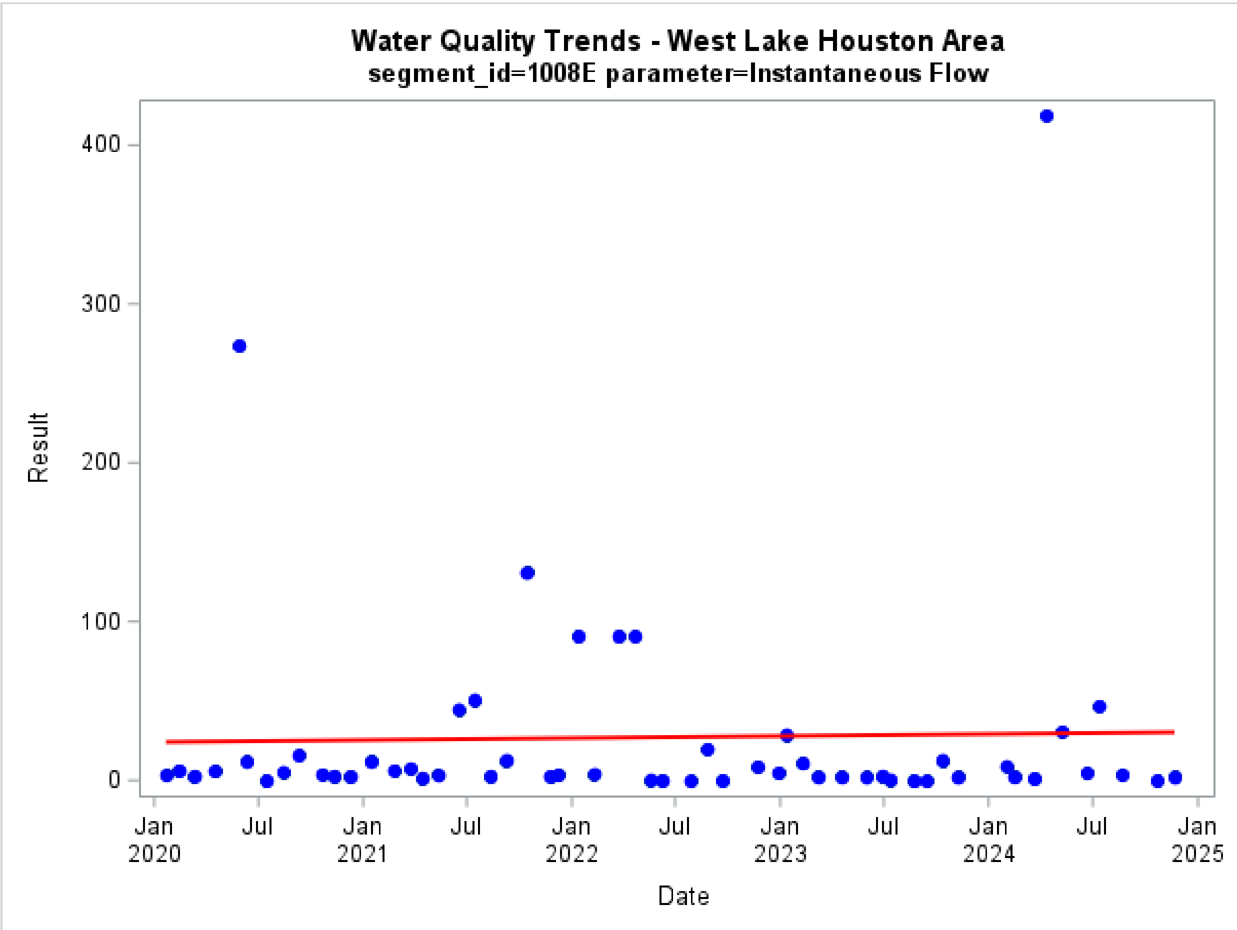
Bear Branch (1008E)



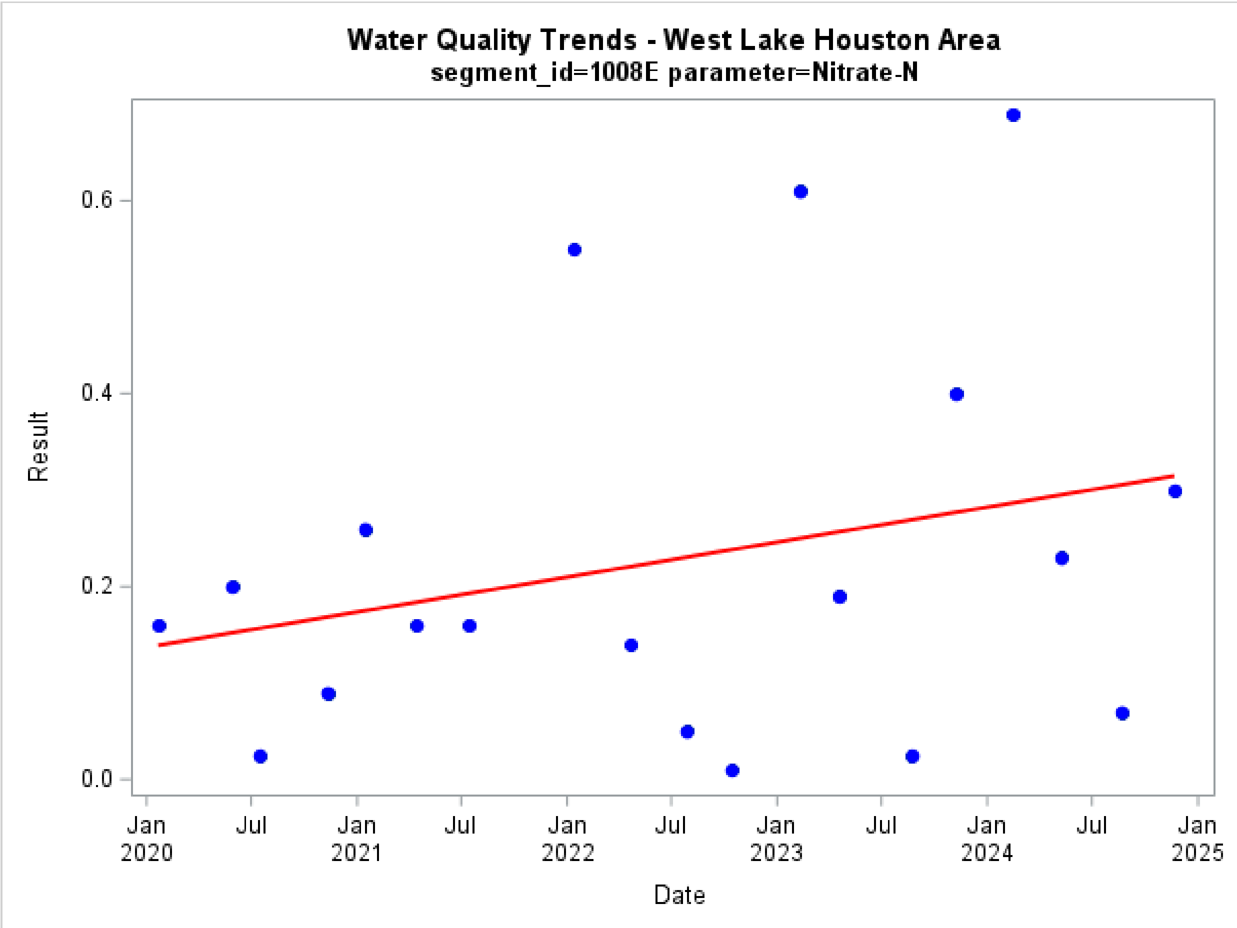

Water Quality Trends - West Lake Houston Area
segment_id=1008E parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
12
10
8
6
4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

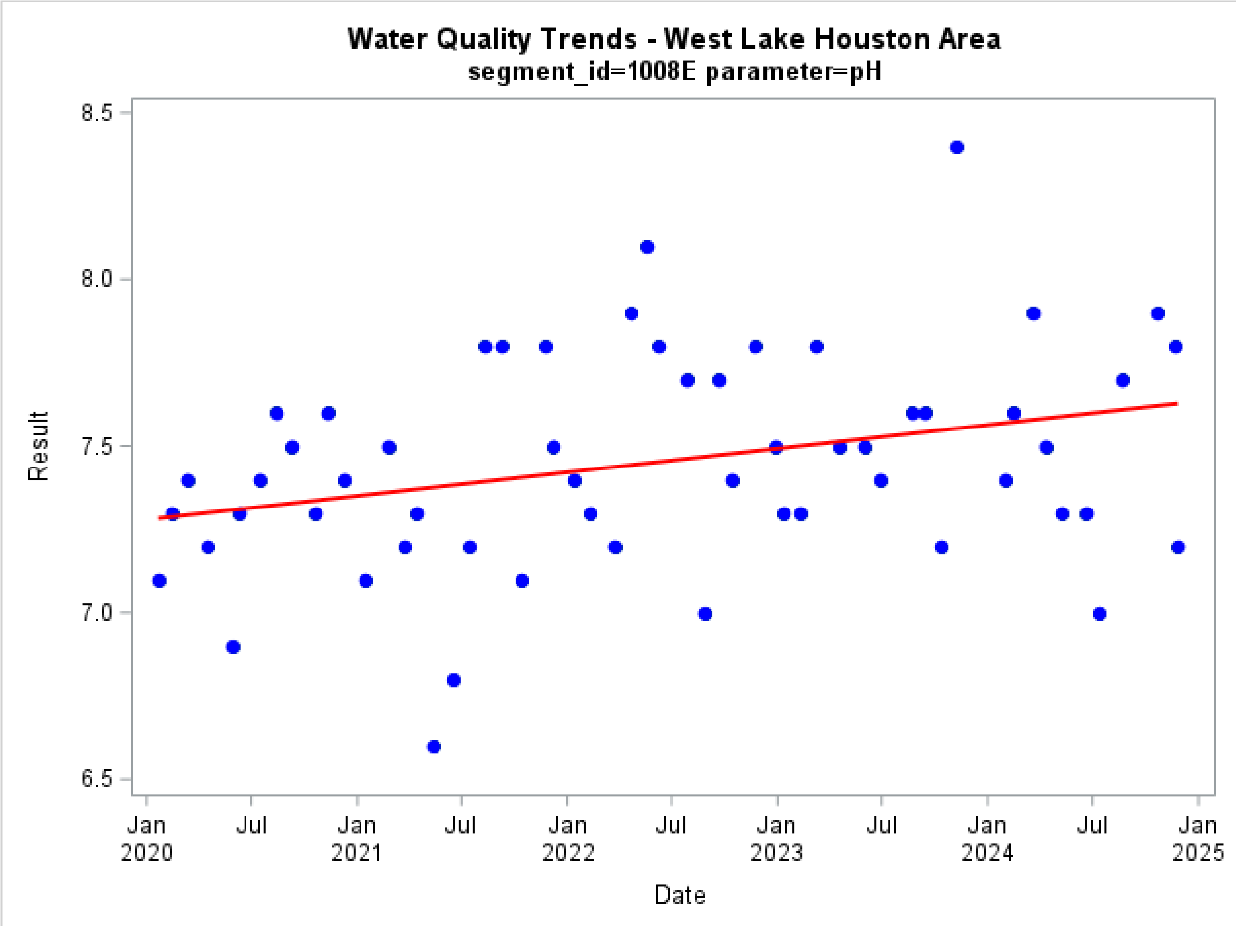


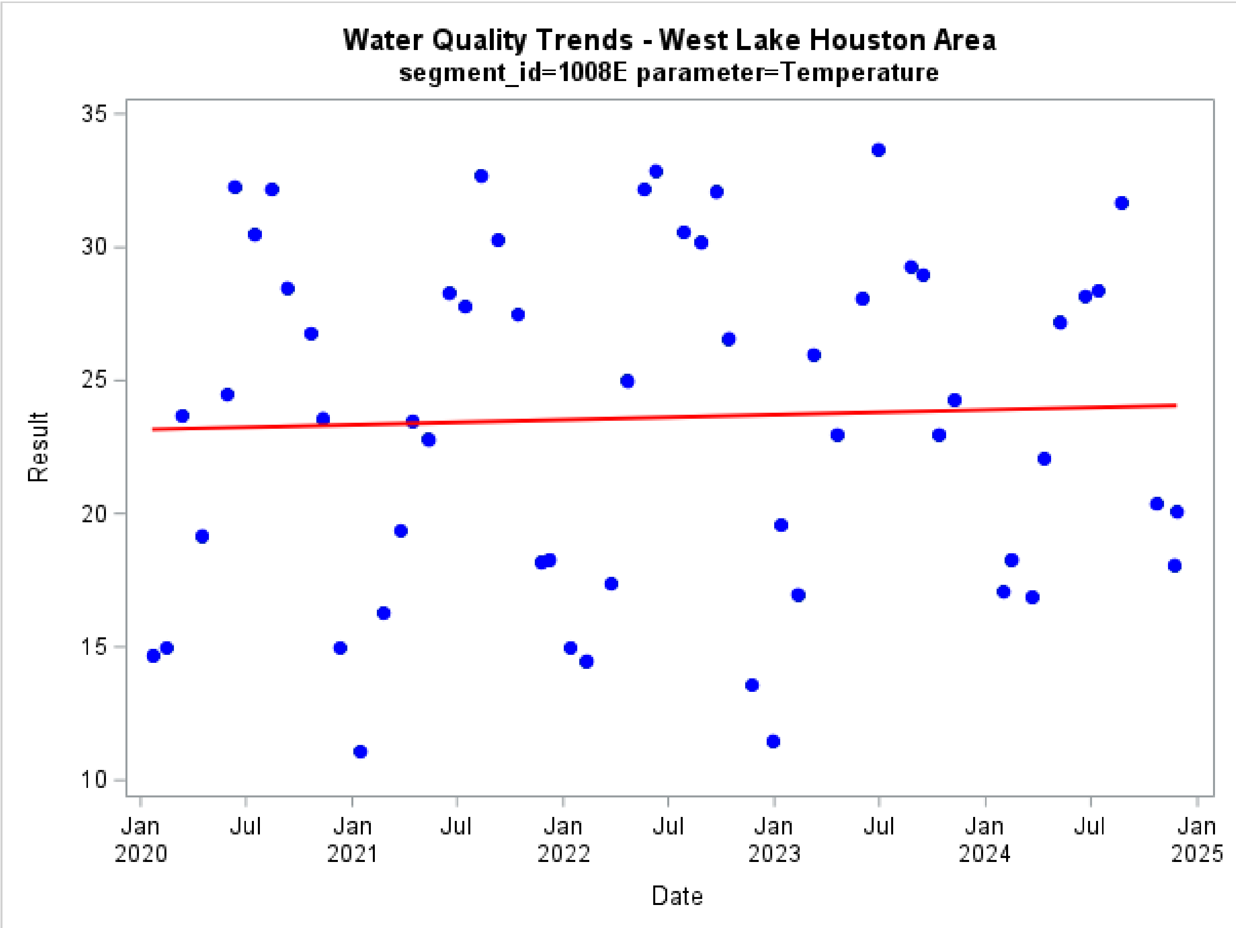
Water Quality Trends - West Lake Houston Area
segment_id=1008E parameter=E. Coli
Result
8000
6000
4000
2000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

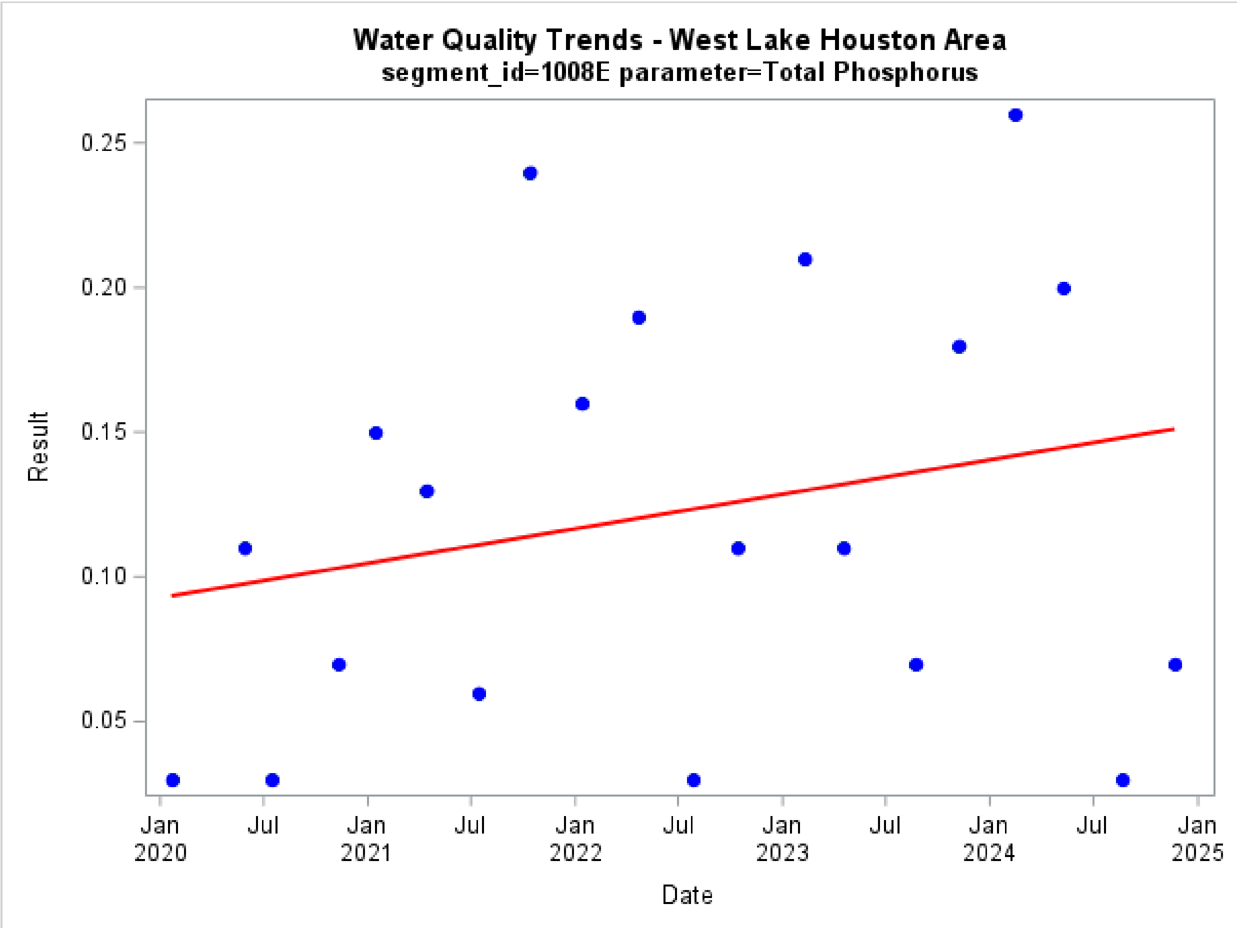


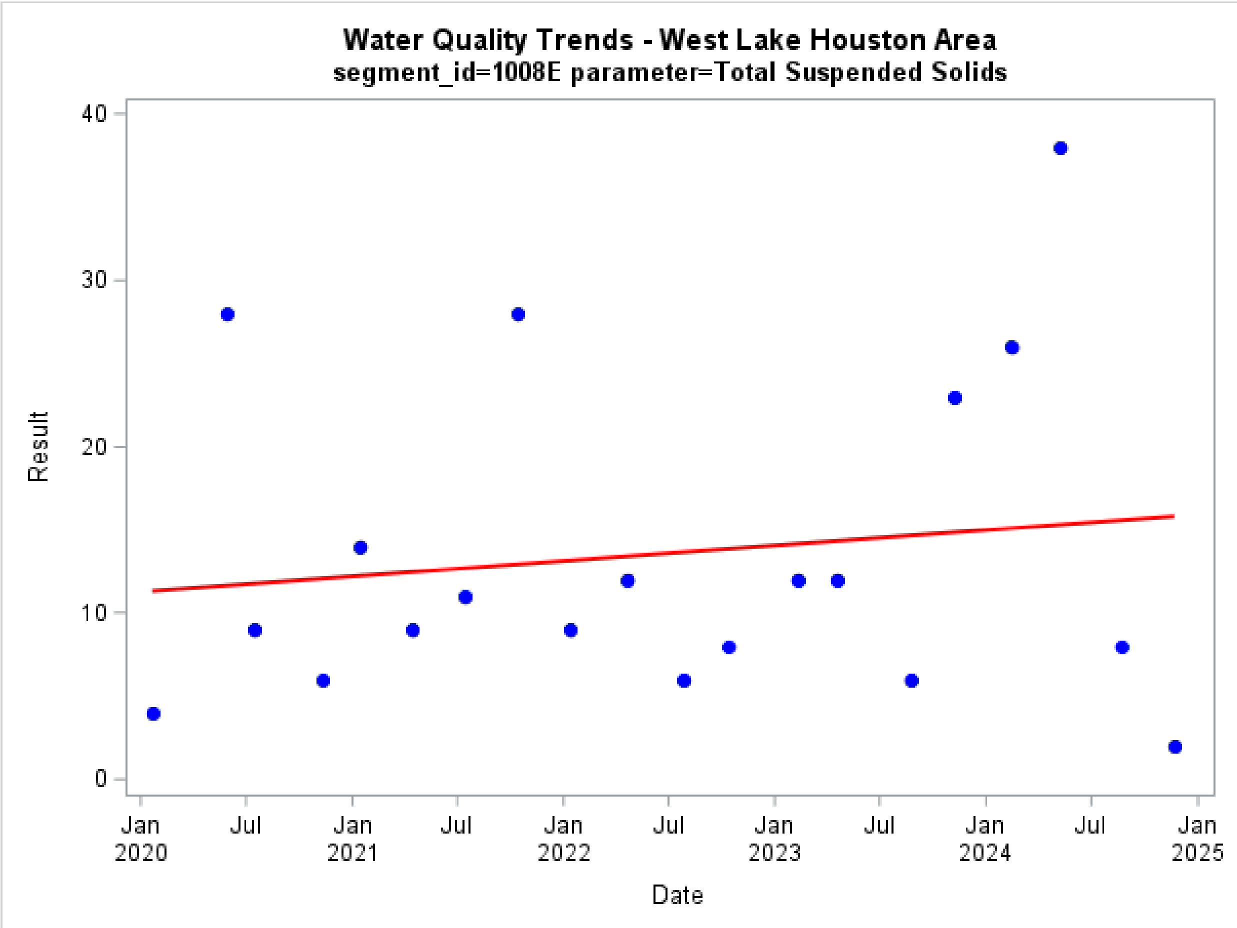
Water Quality Trends - West Lake Houston Area
segment_id=1008E parameter=Instantaneous Flow
Result
400
300
200
100
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1008E parameter=Nitrate-N
Result
0.0
0.2
0.4
0.6
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

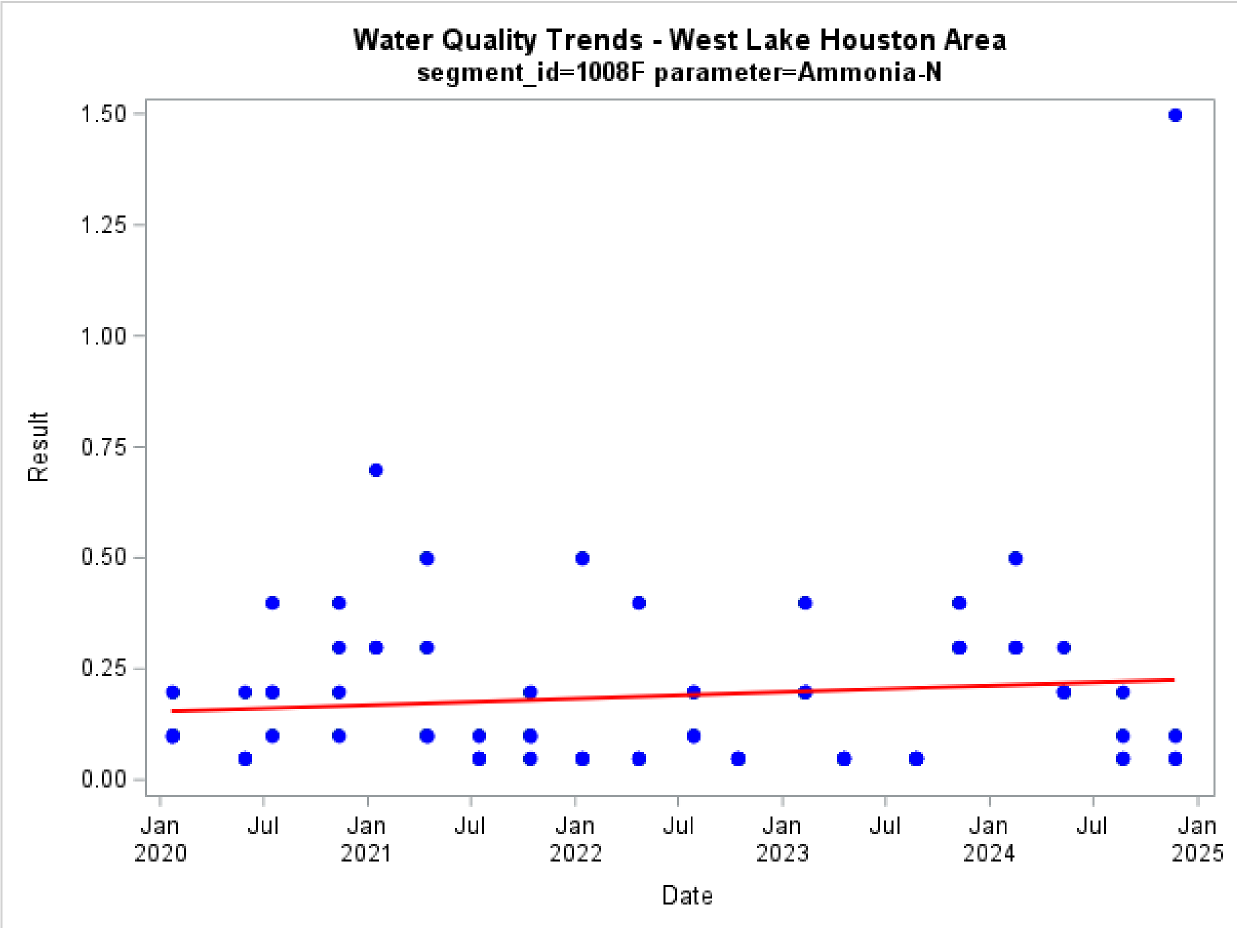

Water Quality Trends - West Lake Houston Area
segment_id=1008E parameter=pH
8.5
8.0
7.5
7.0
6.5
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

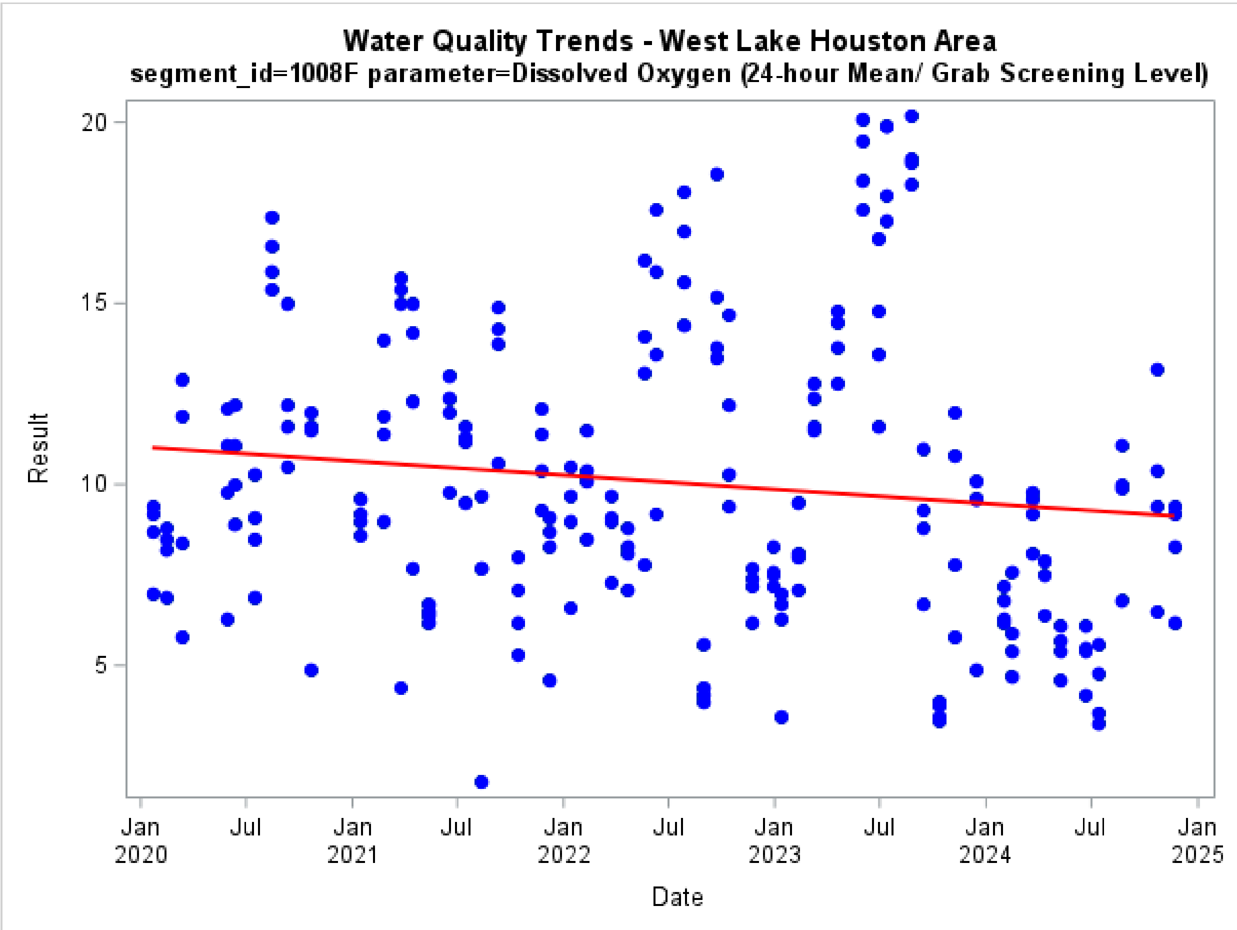

Water Quality Trends - West Lake Houston Area
segment_id=1008E parameter=Temperature
Result
35
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1008E parameter=Total Phosphorus
0.25
0.20
0.15
0.10
0.05
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

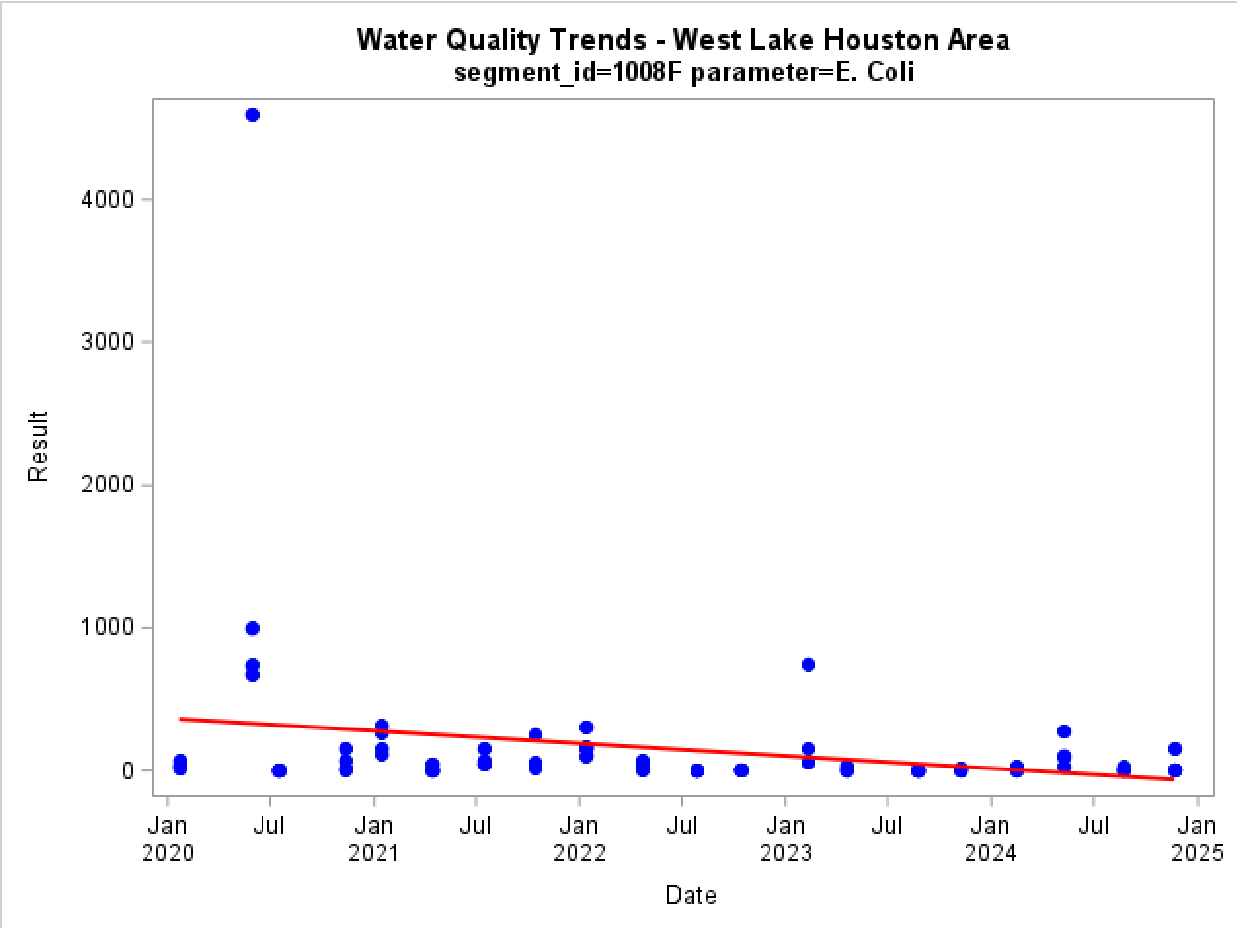

Water Quality Trends - West Lake Houston Area
segment_id=1008E parameter=Total Suspended Solids
Result
0
10
20
30
40
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

Lake Woodlands (1008F)

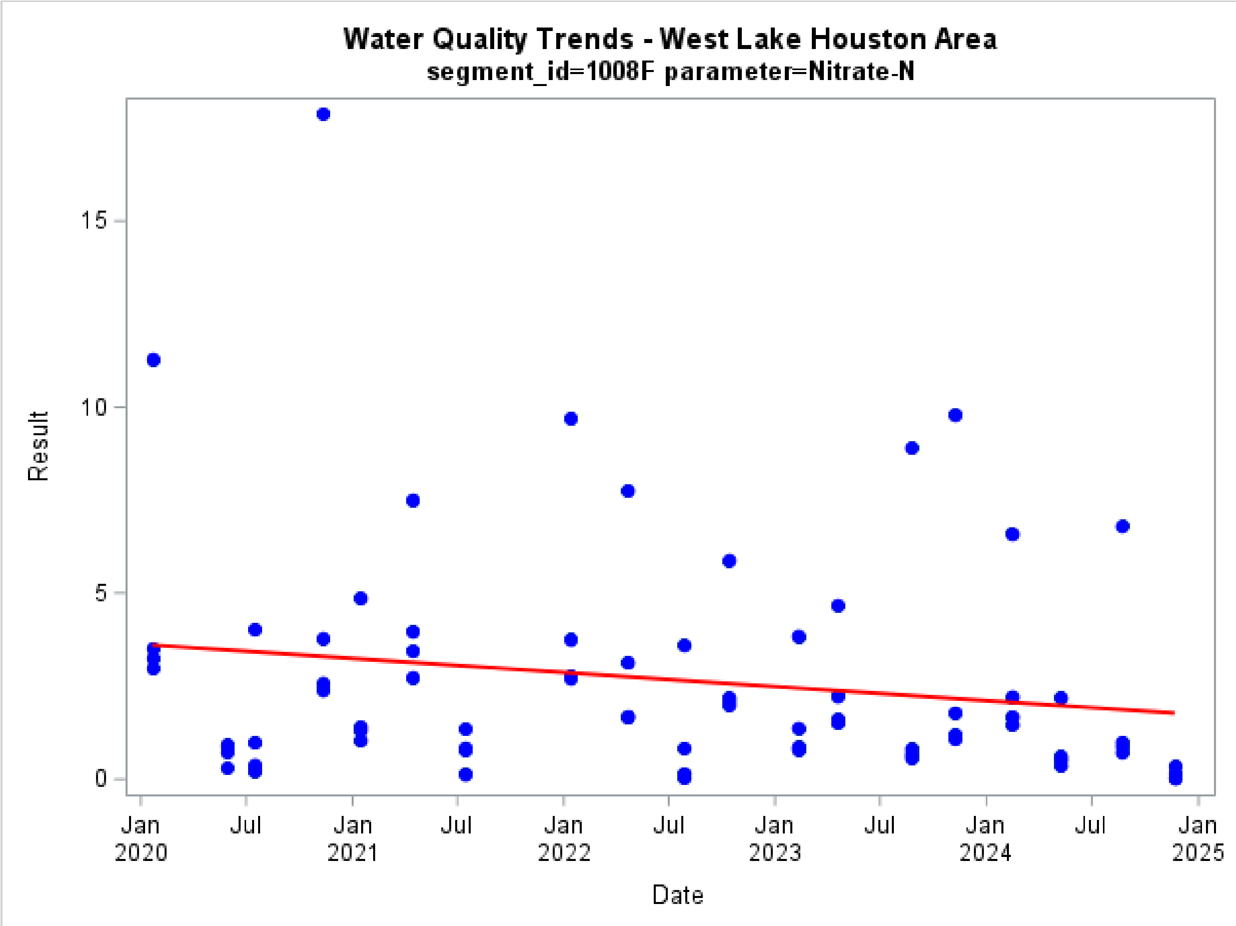


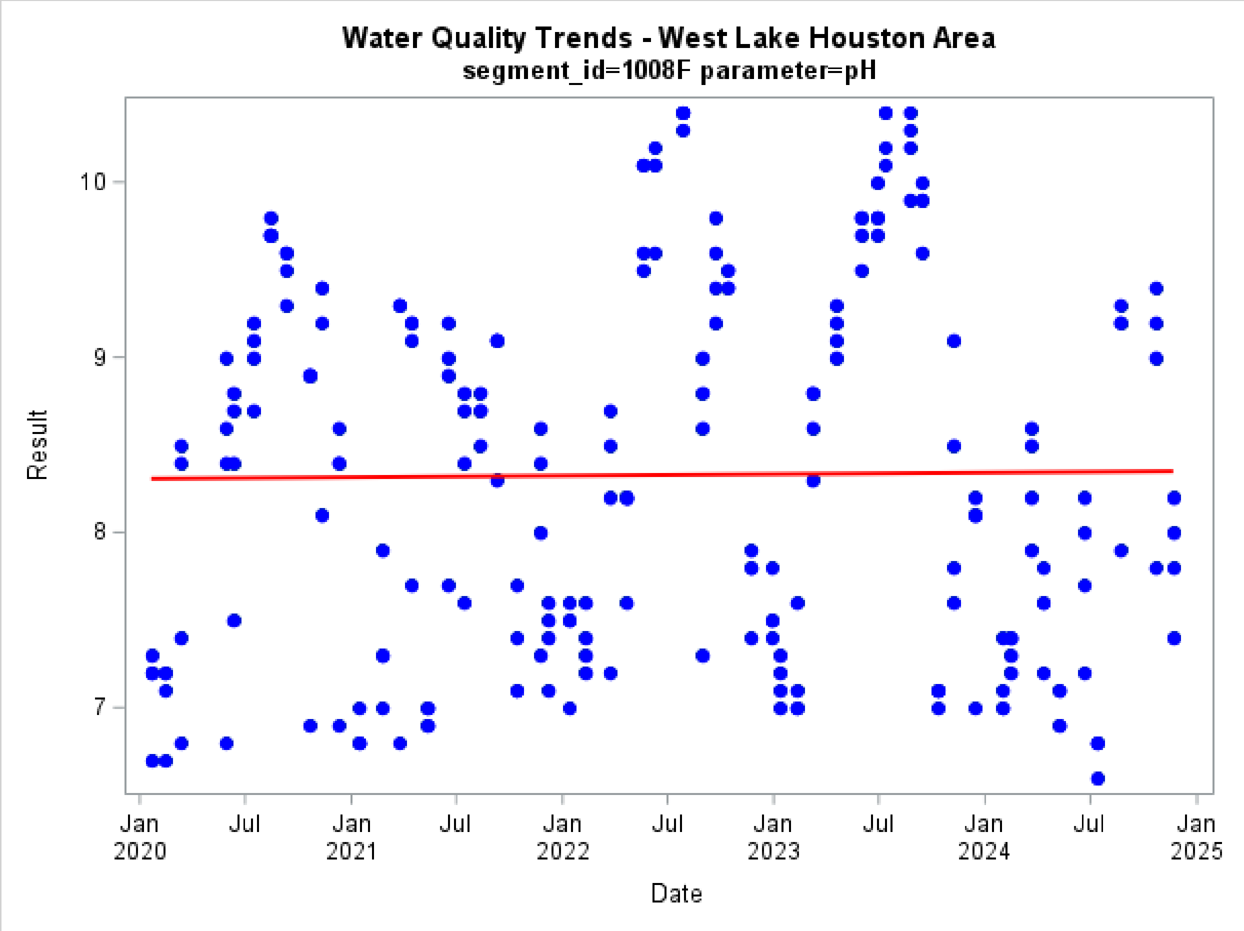


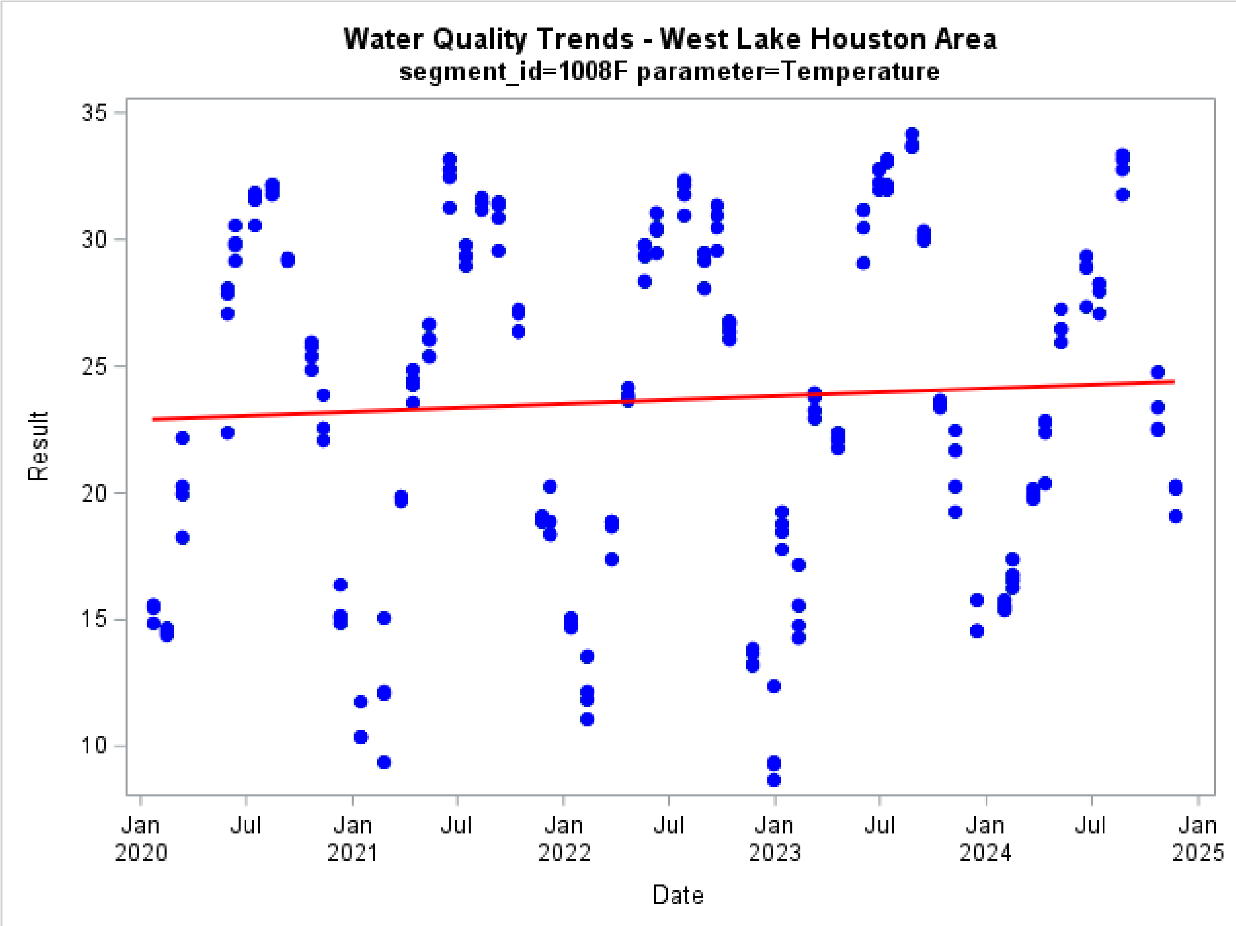
Water Quality Trends - West Lake Houston Area
segment_id=1008F parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
20
15
10
5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

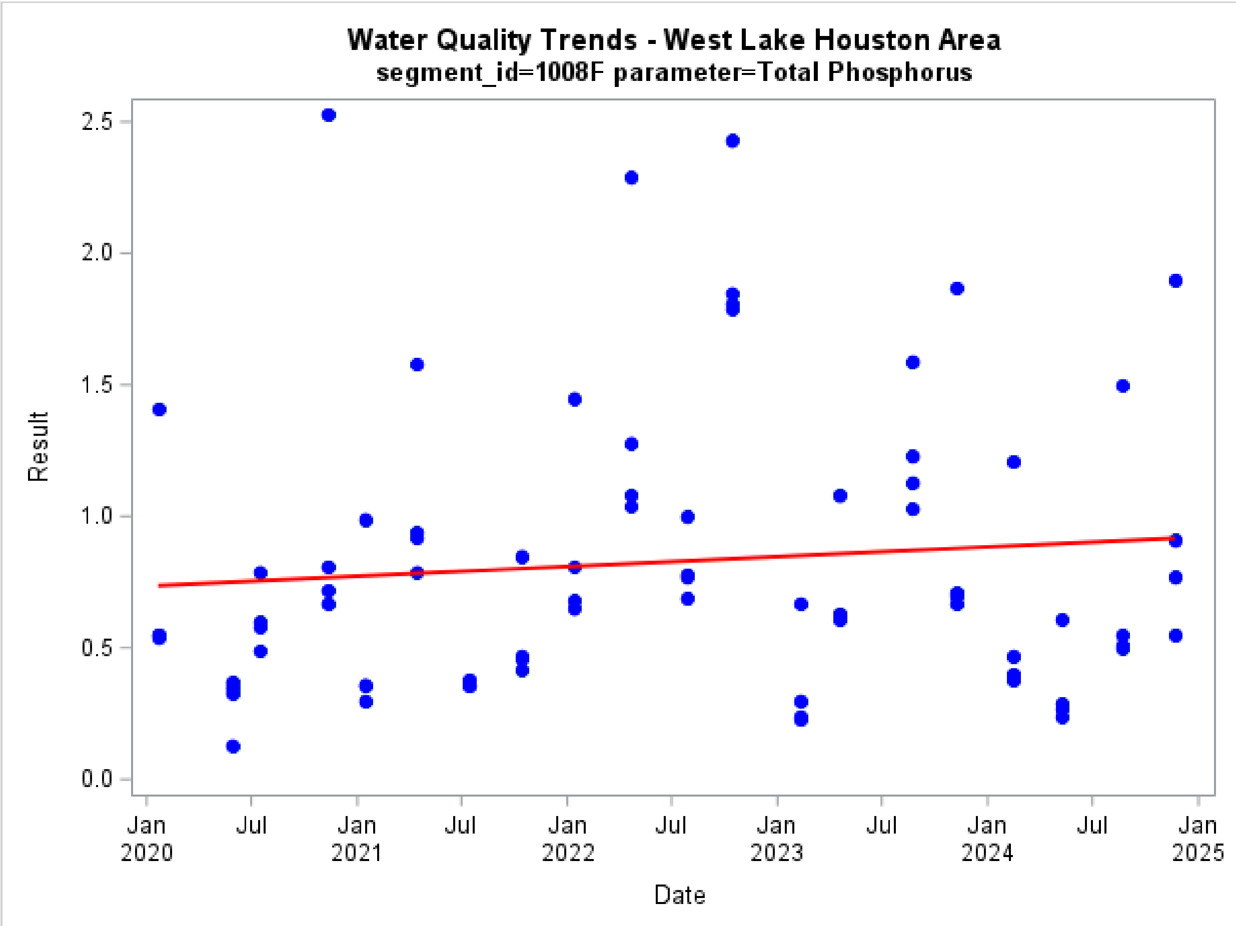


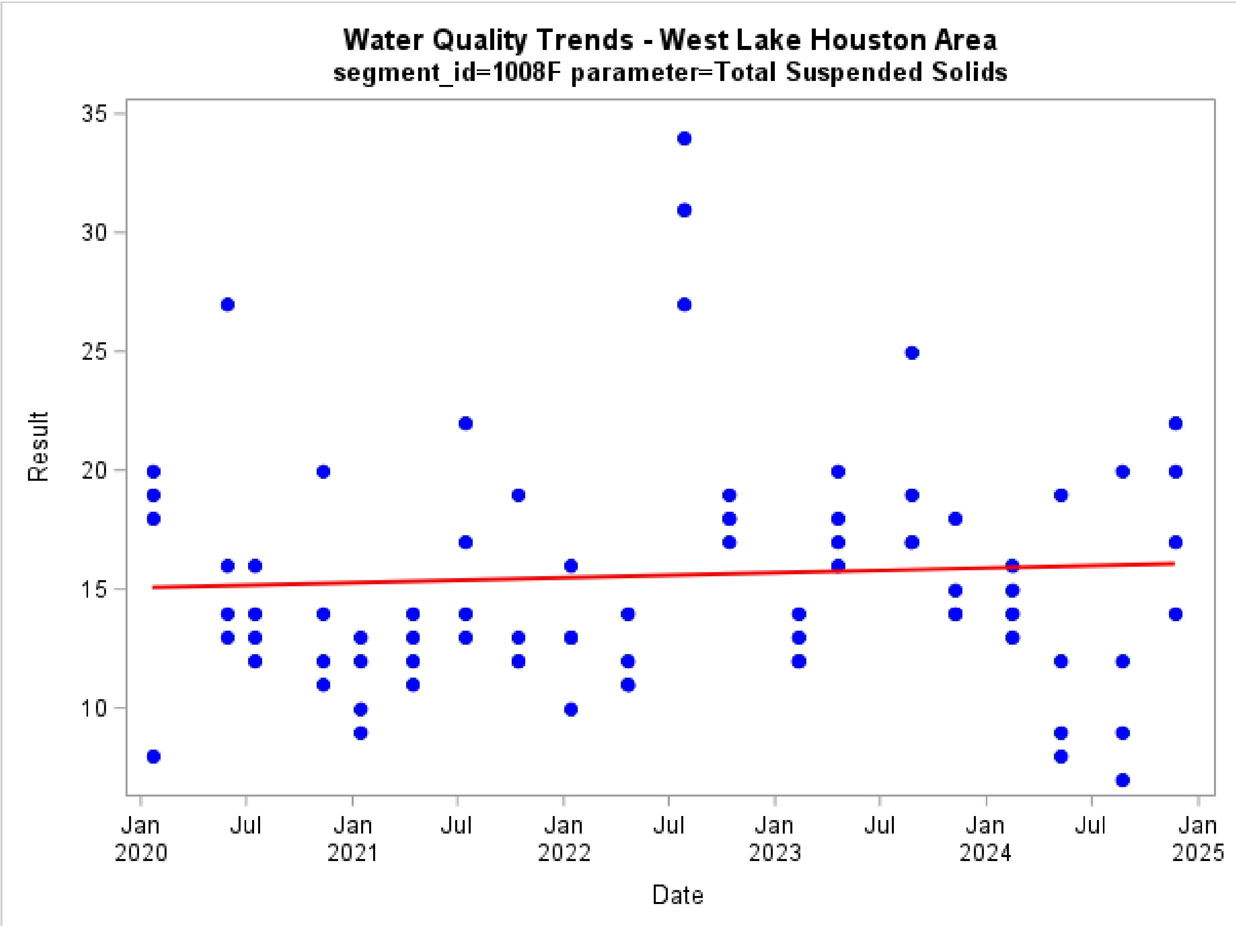
Water Quality Trends - West Lake Houston Area
segment_id=1008F parameter=E. Coli
Result
4000
3000
2000
1000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1008F parameter=Nitrate-N
Result
15
10
5
0
Jan
2020
Jul
Jan
2021
Jul
Jan
2022
Jul
Jan
2023
Jul
Jan
2024
Jul
Jan
2025
Date

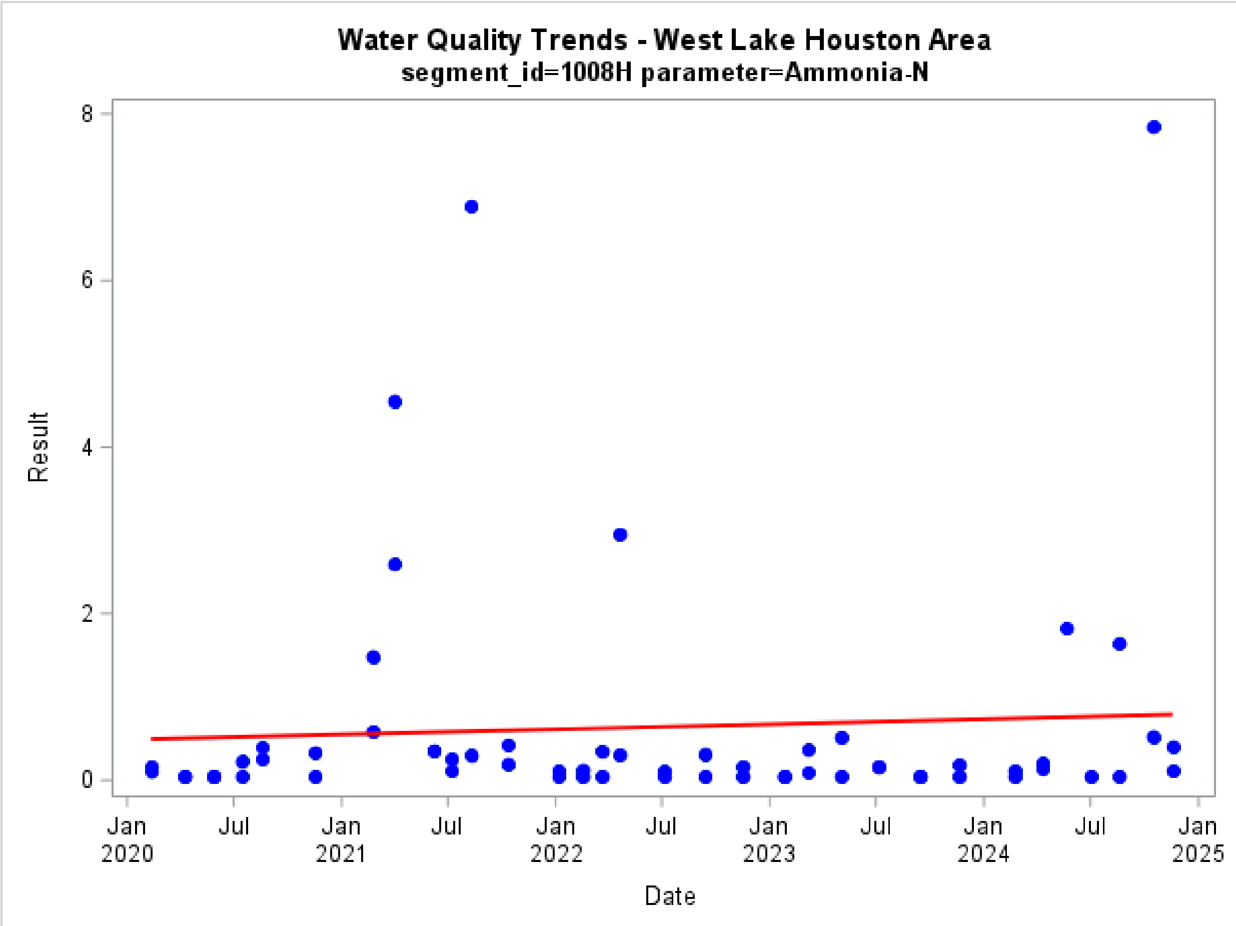

Water Quality Trends - West Lake Houston Area
segment_id=1008F parameter=pH
10
9
8
7
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

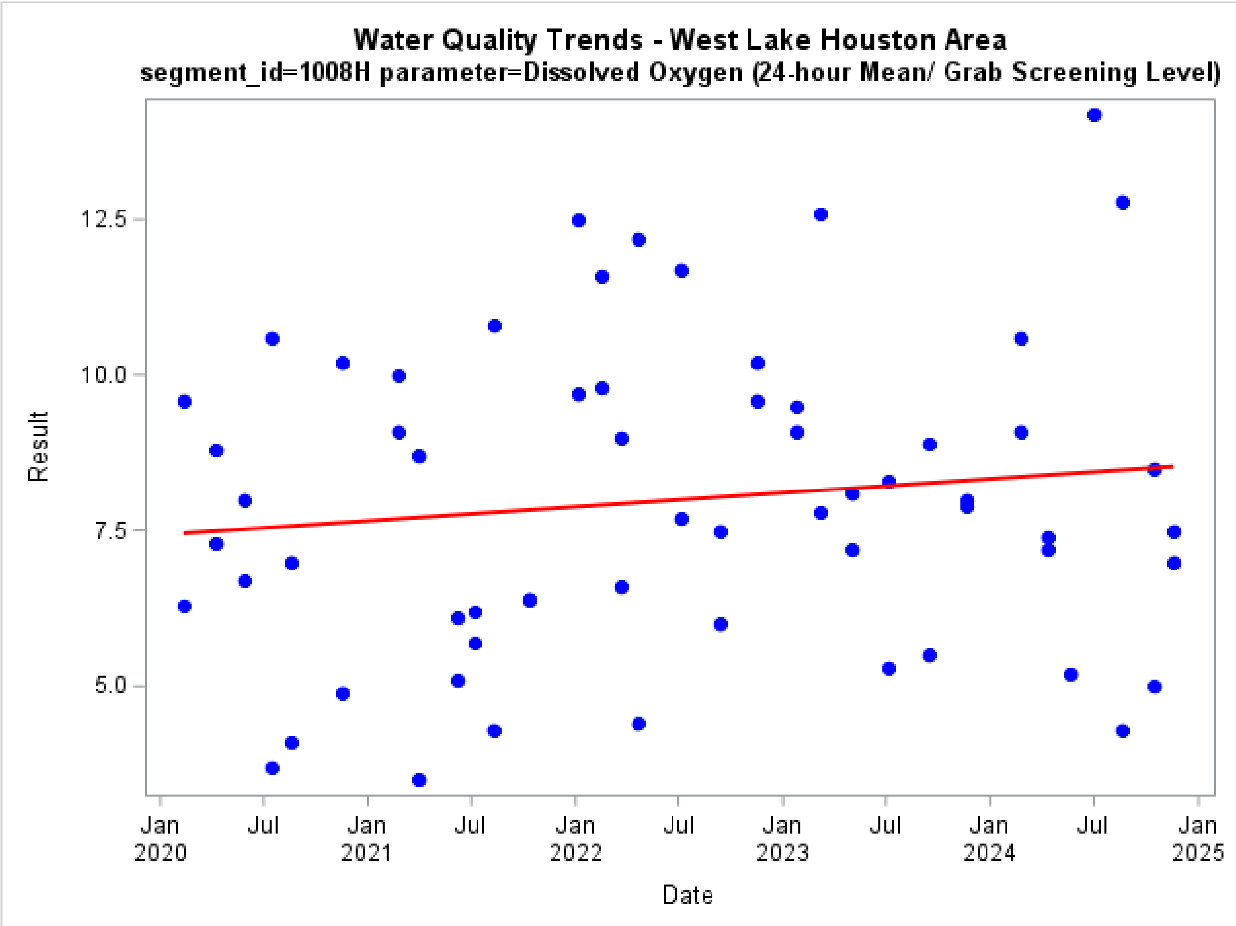

Water Quality Trends - West Lake Houston Area
segment_id=1008F parameter=Temperature
Result
35
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

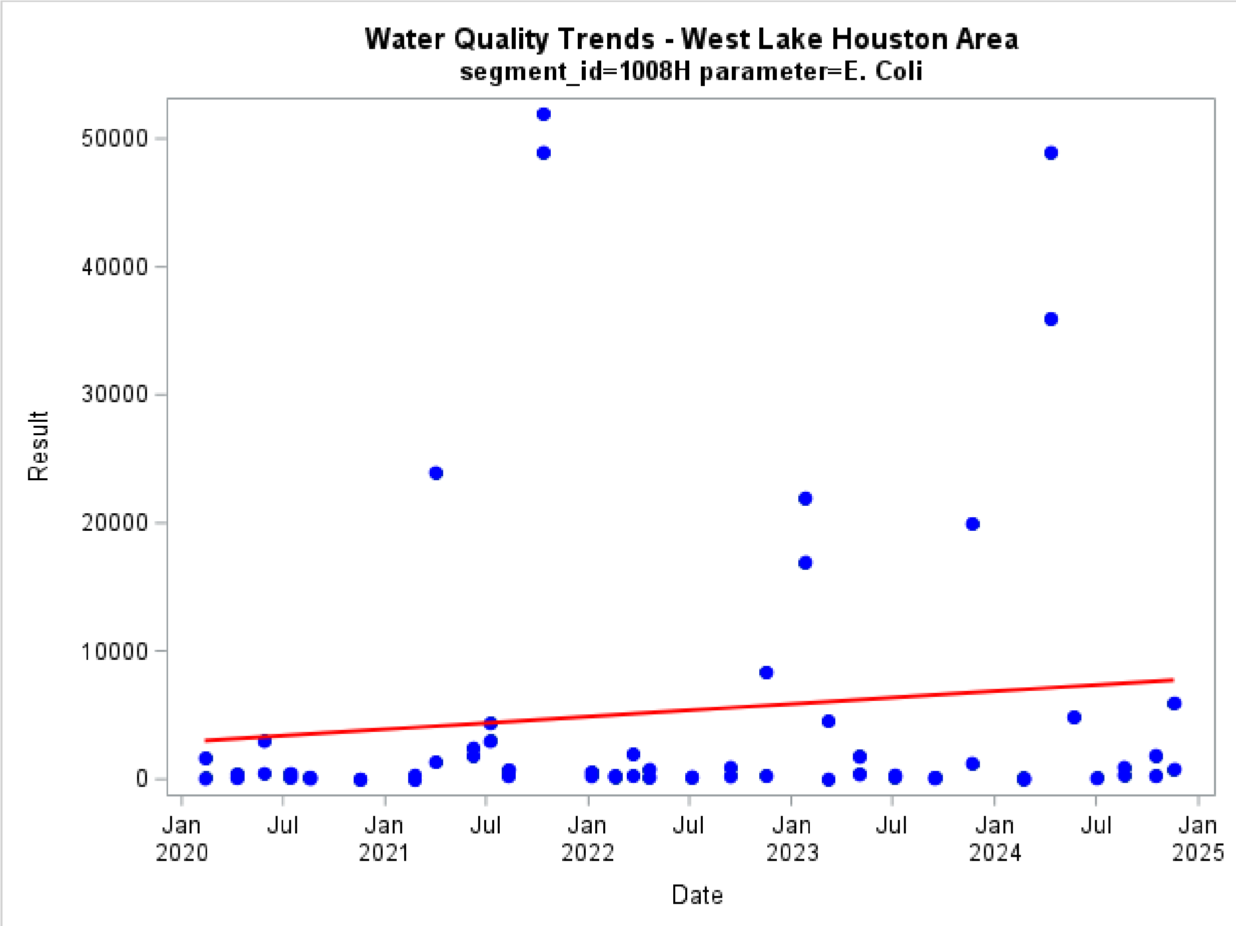

Water Quality Trends - West Lake Houston Area
segment_id=1008F parameter=Total Phosphorus
Result
2.5
2.0
1.5
1.0
0.5
0.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

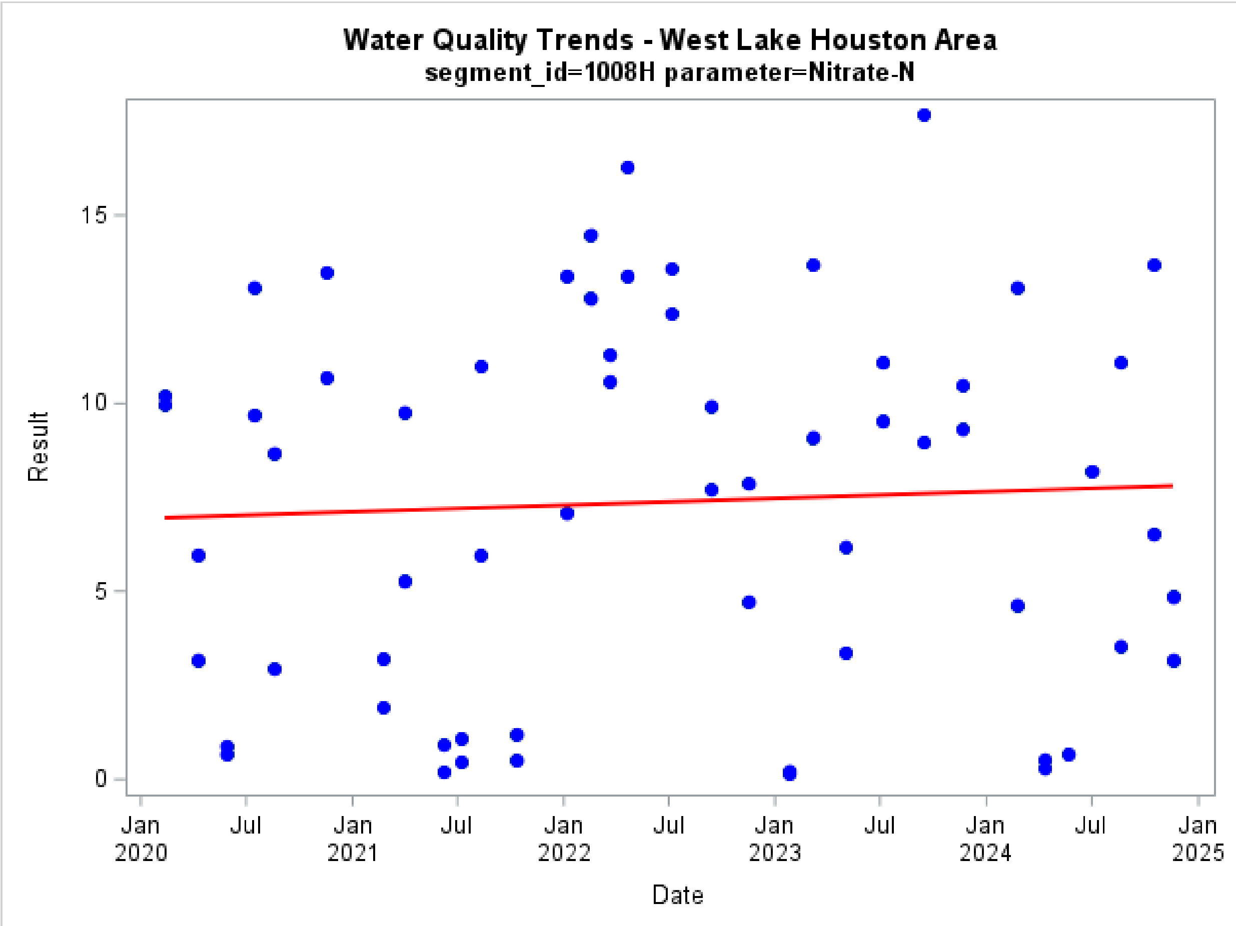

Water Quality Trends - West Lake Houston Area
segment_id=1008F parameter=Total Suspended Solids
Result
35
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

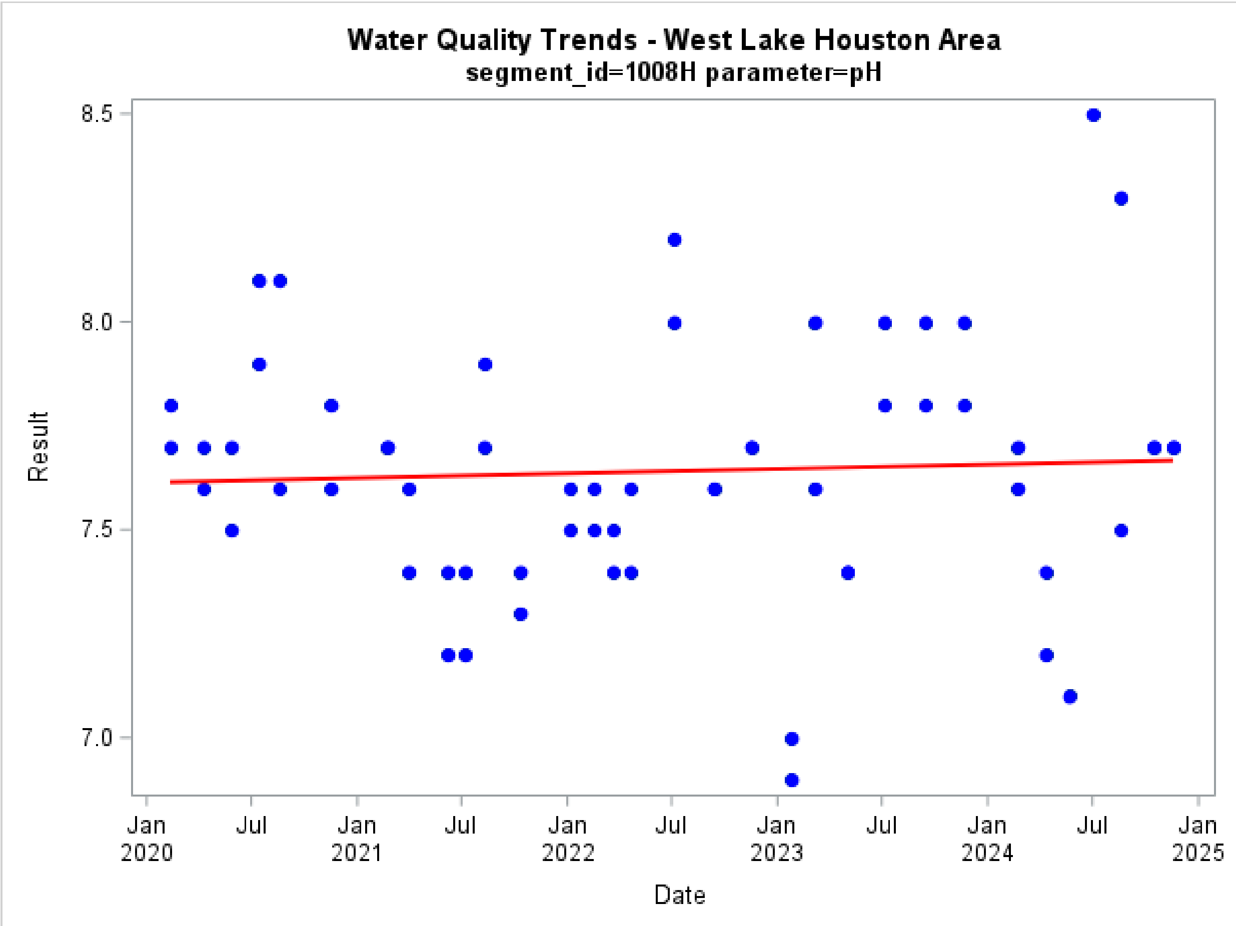
Willow Creek (1008H)



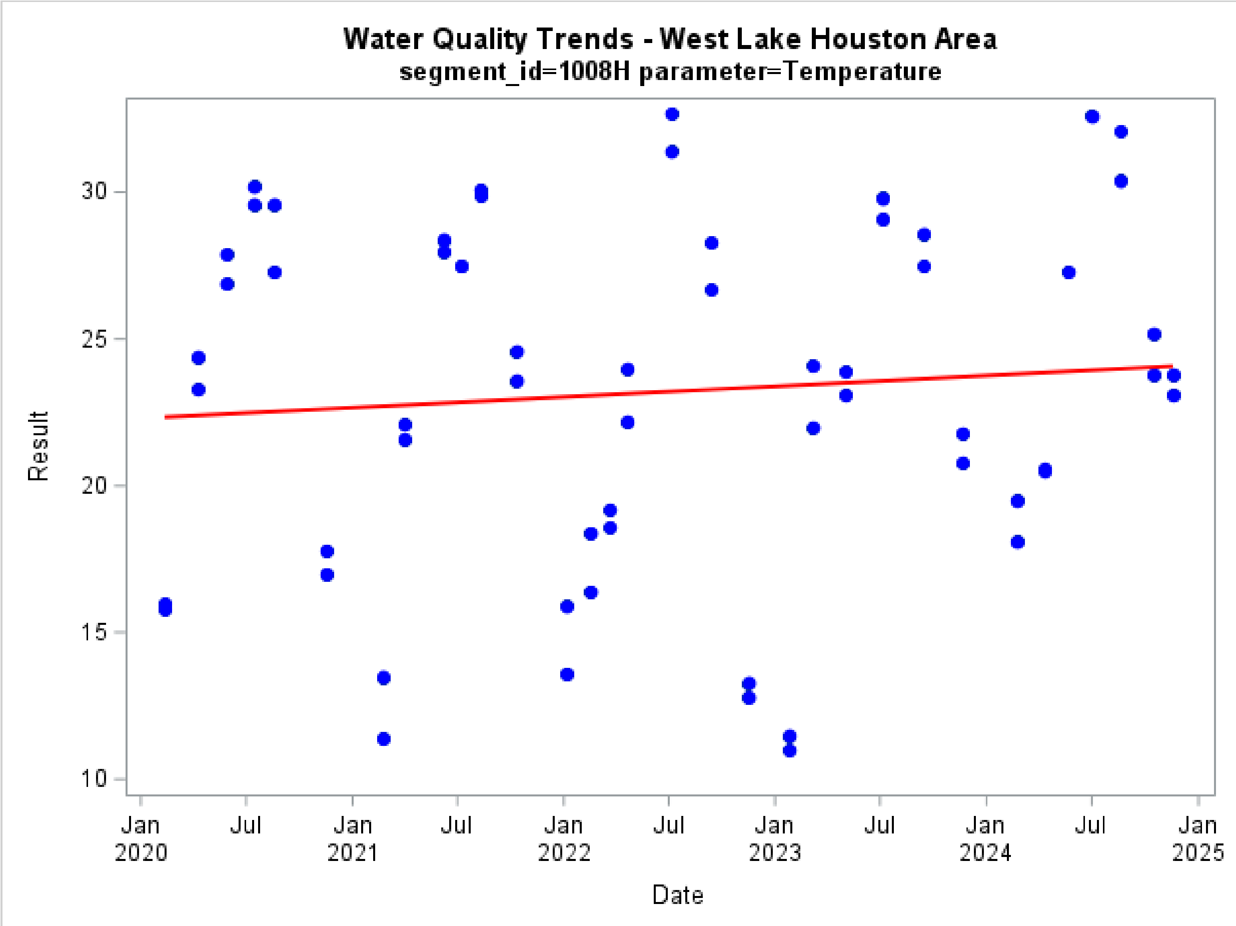

Water Quality Trends - West Lake Houston Area
segment_id=1008H parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
12.5
10.0
7.5
5.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

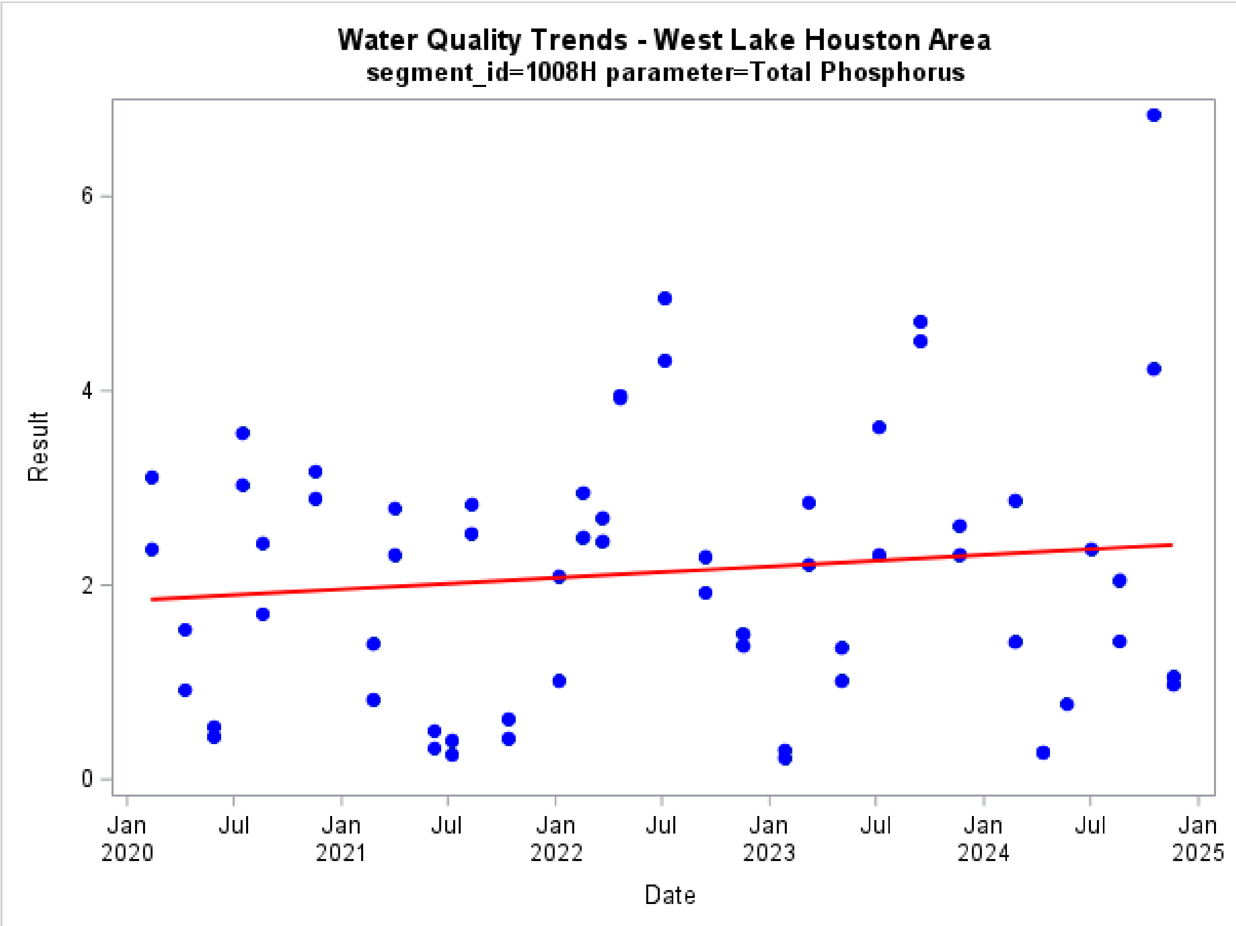

Water Quality Trends - West Lake Houston Area
segment_id=1008H parameter=E. Coli
Result
50000
40000
30000
20000
10000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

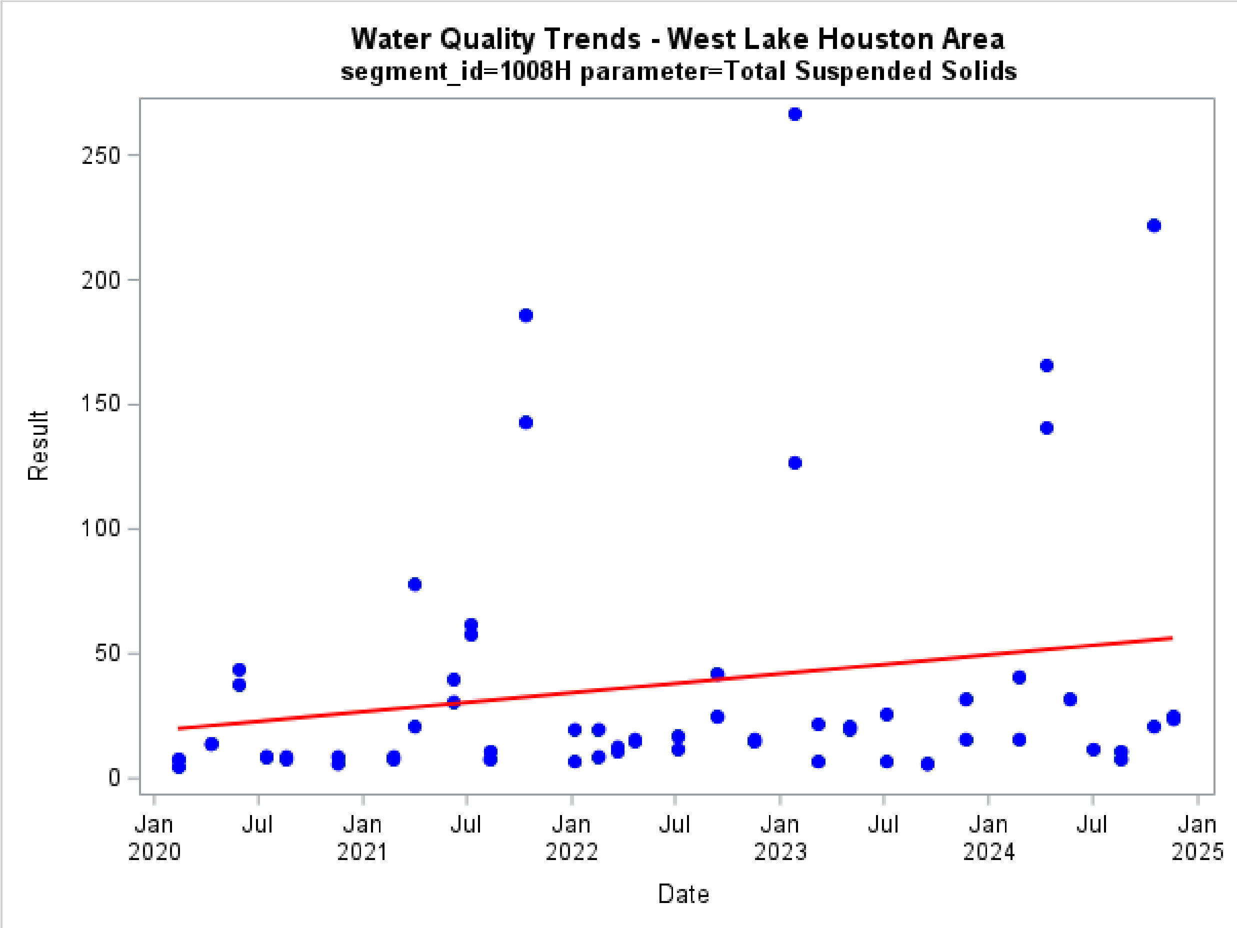

Water Quality Trends - West Lake Houston Area
segment_id=1008H parameter=Nitrate-N
Result
15
10
5
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



Water Quality Trends - West Lake Houston Area
segment_id=1008H parameter=pH
Result
8.5
8.0
7.5
7.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

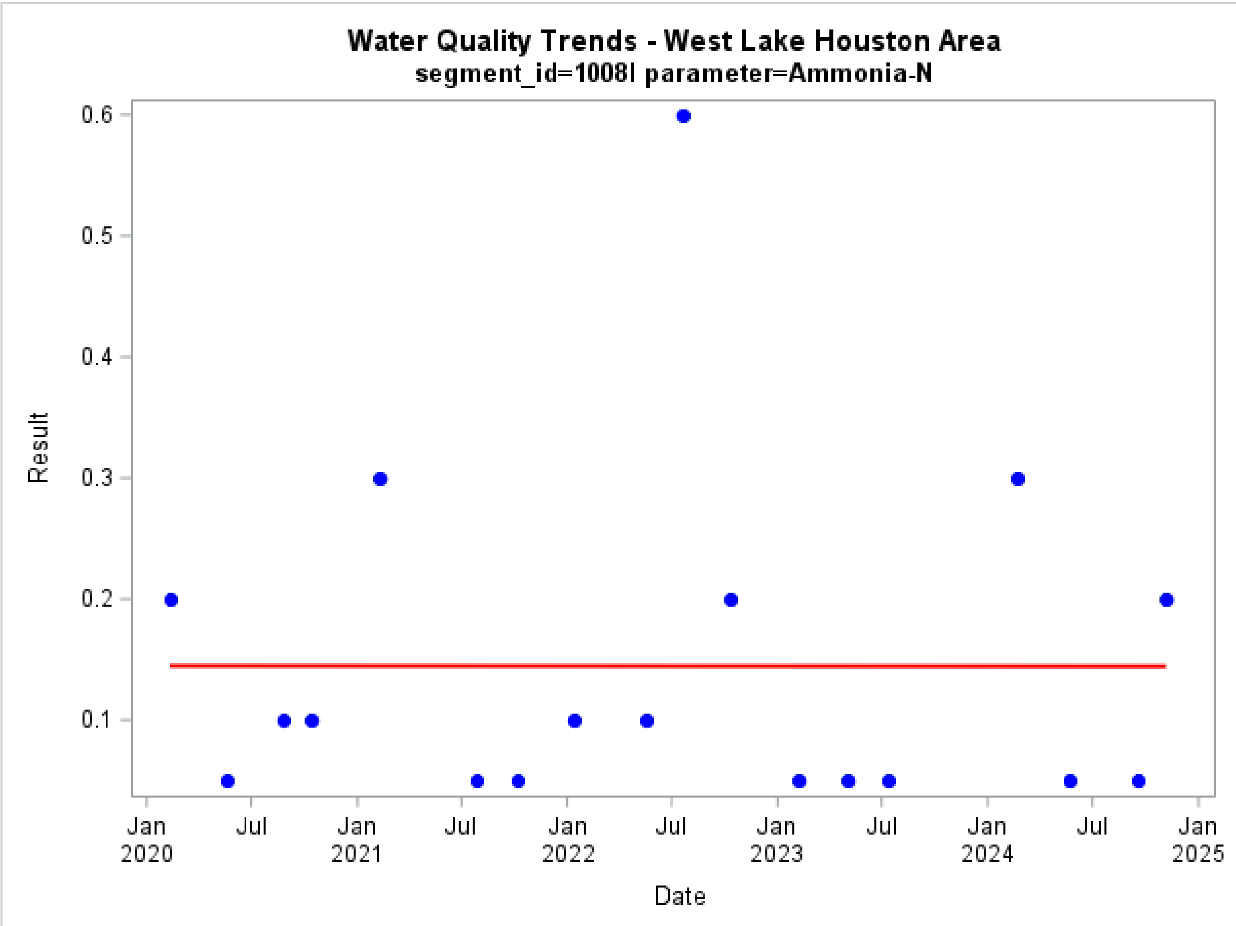

Water Quality Trends - West Lake Houston Area
segment_id=1008H parameter=Temperature
Result
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

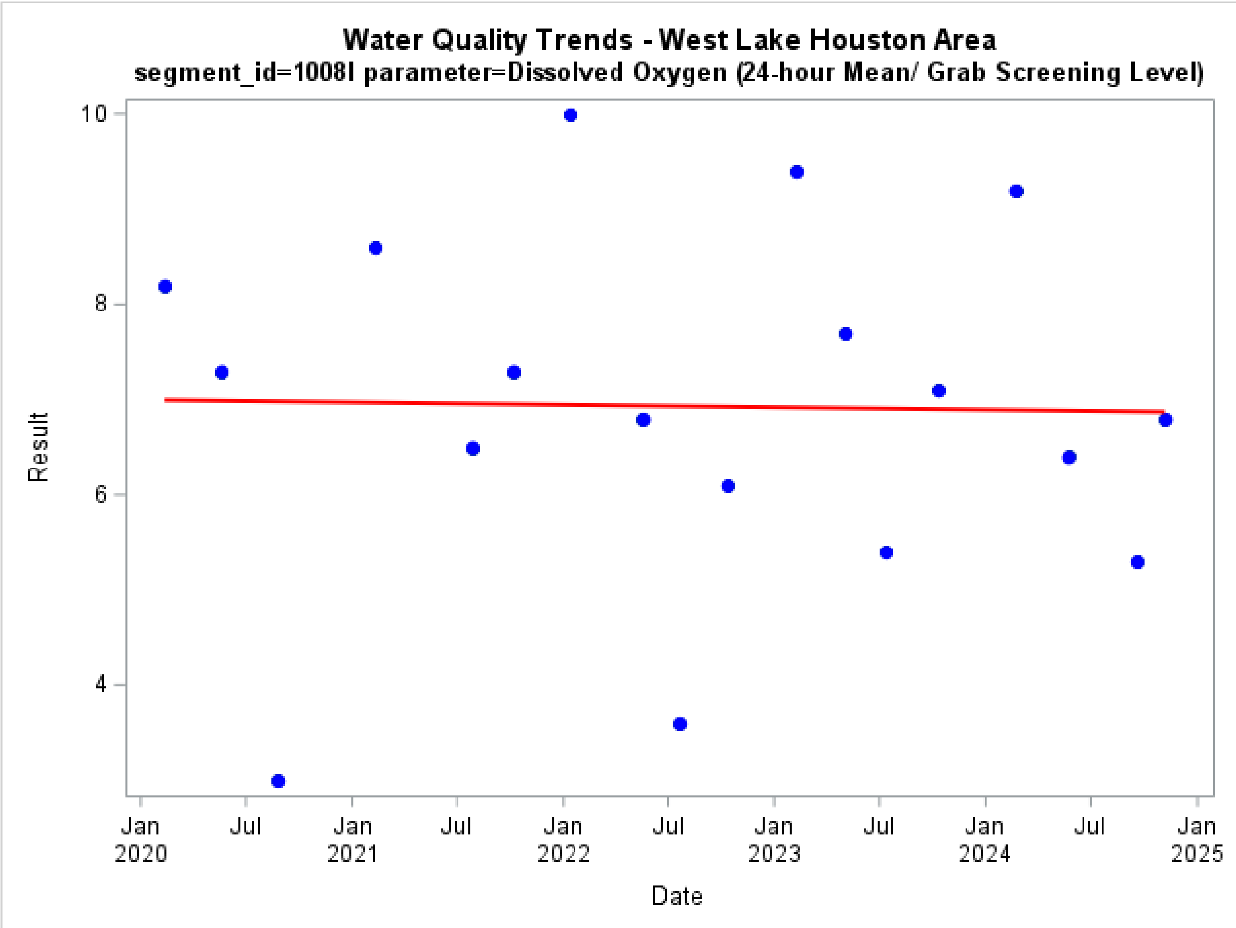

Water Quality Trends - West Lake Houston Area
segment_id=1008H parameter=Total Phosphorus
Result
0
2
4
6
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



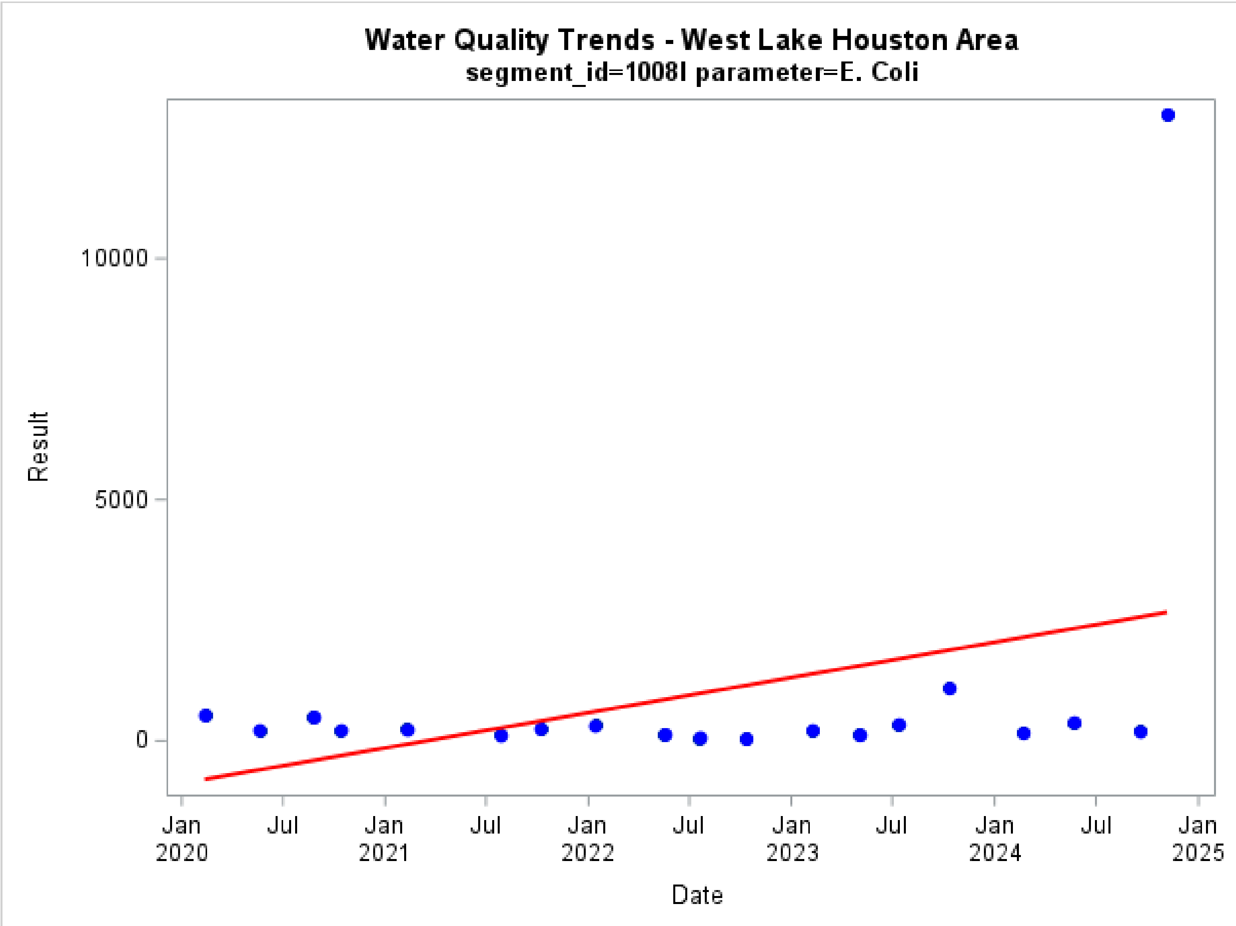
Water Quality Trends - West Lake Houston Area
segment_id=1008H parameter=Total Suspended Solids
Result
250
200
150
100
50
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

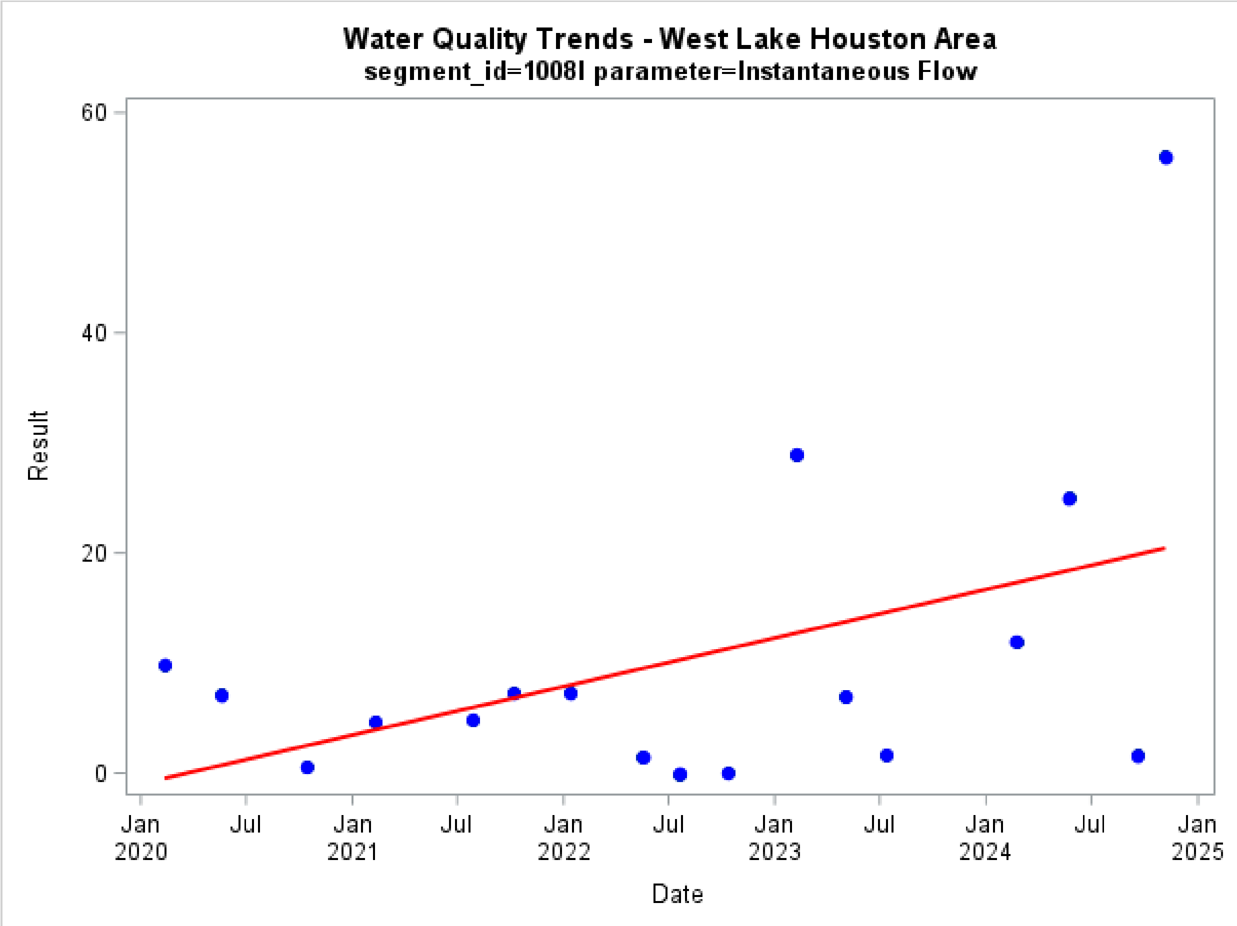
Walnut Creek (1008I)



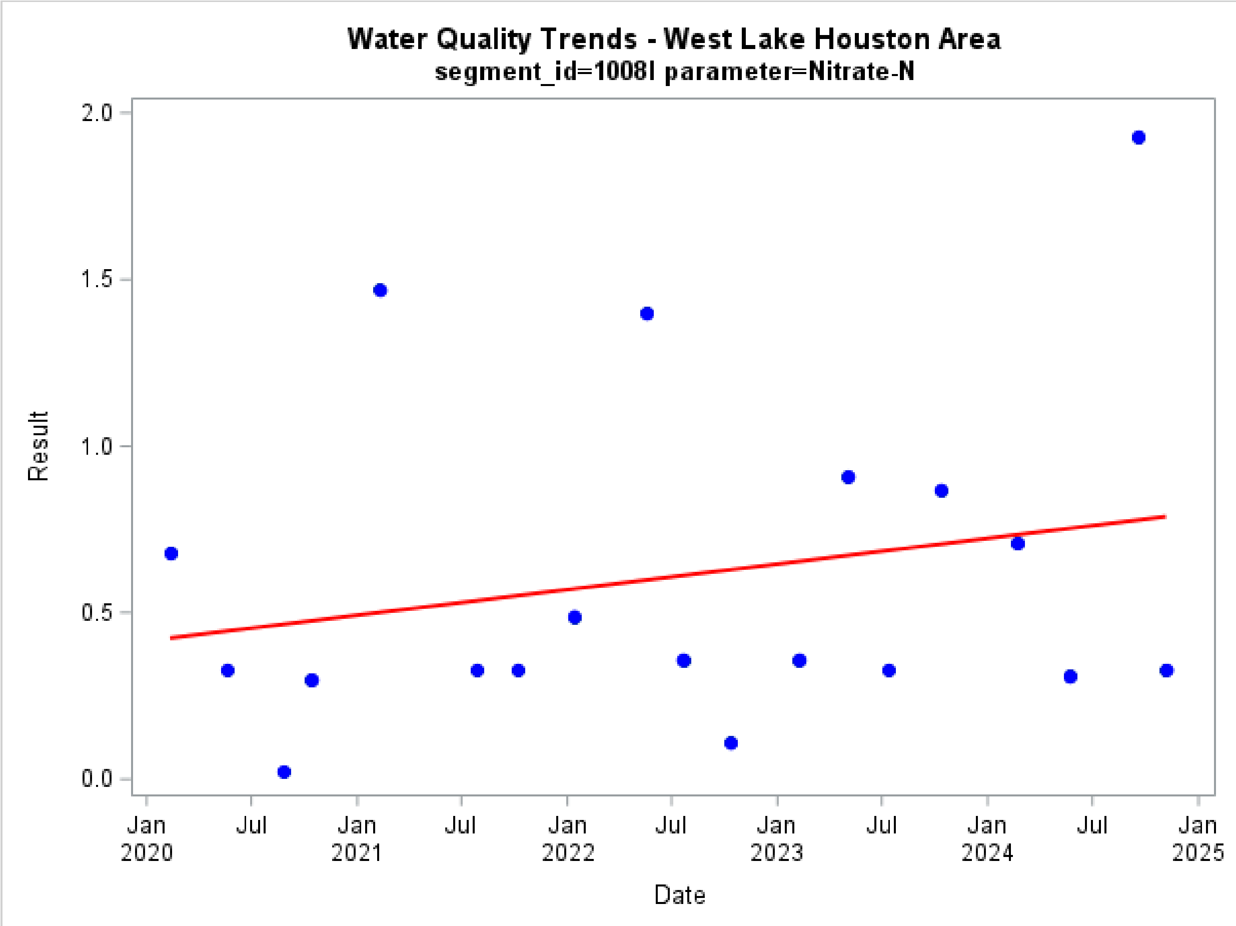


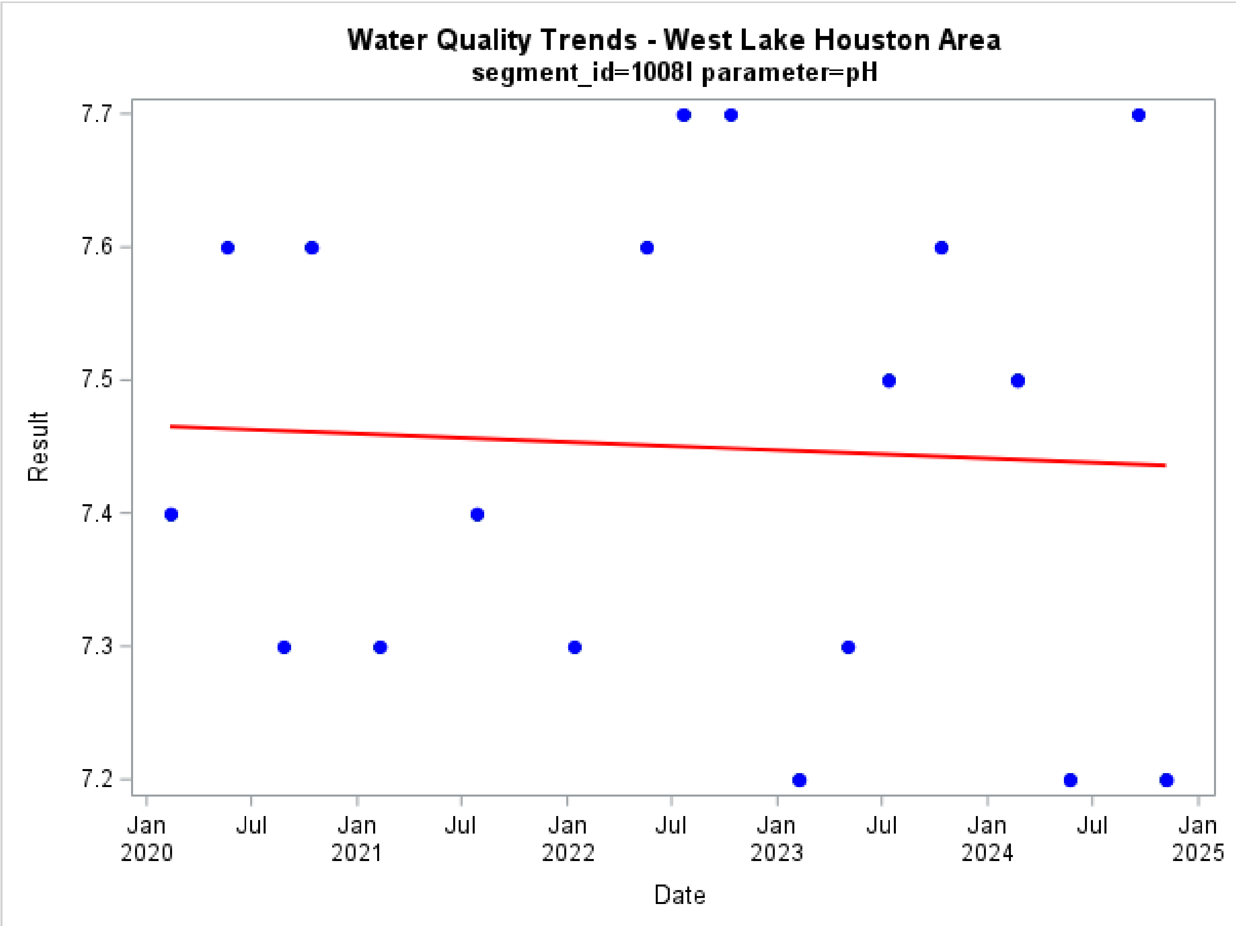
Water Quality Trends - West Lake Houston Area
segment_id=1008I parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
10
8
6
4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

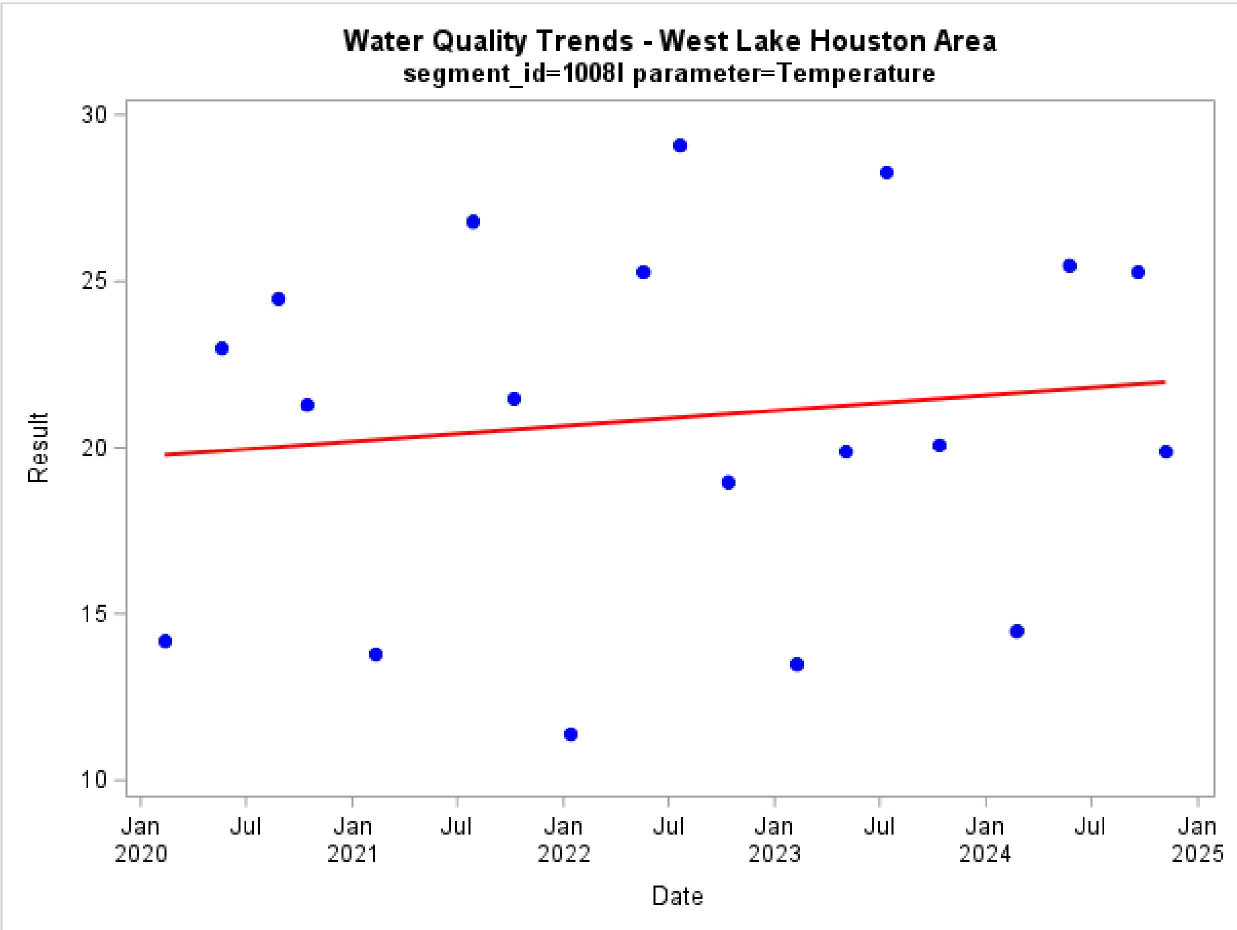

Water Quality Trends - West Lake Houston Area
segment_id=1008I parameter=E. Coli
Result
10000
5000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

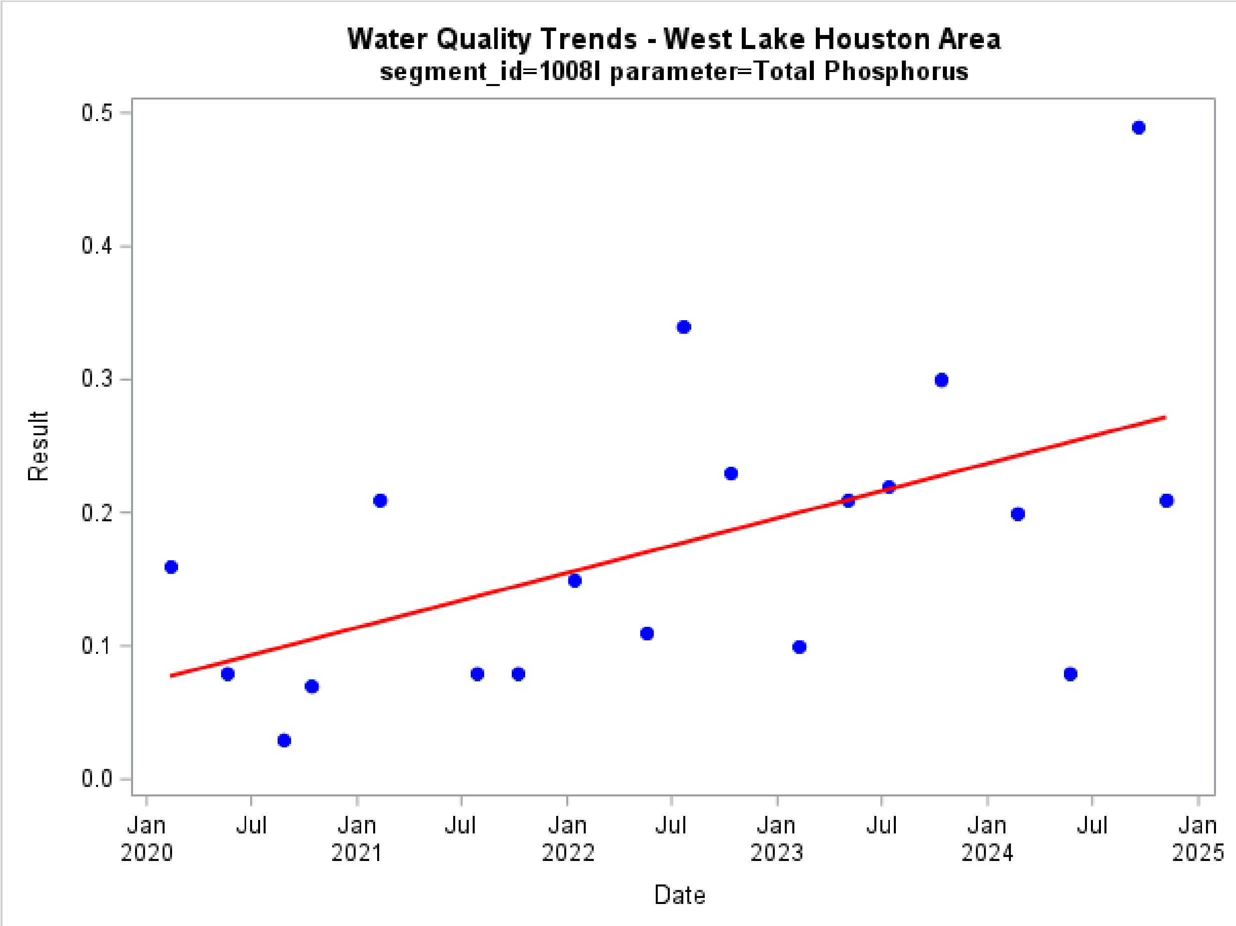


Water Quality Trends - West Lake Houston Area
segment_id=1008I parameter=Instantaneous Flow
Result
60
40
20
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

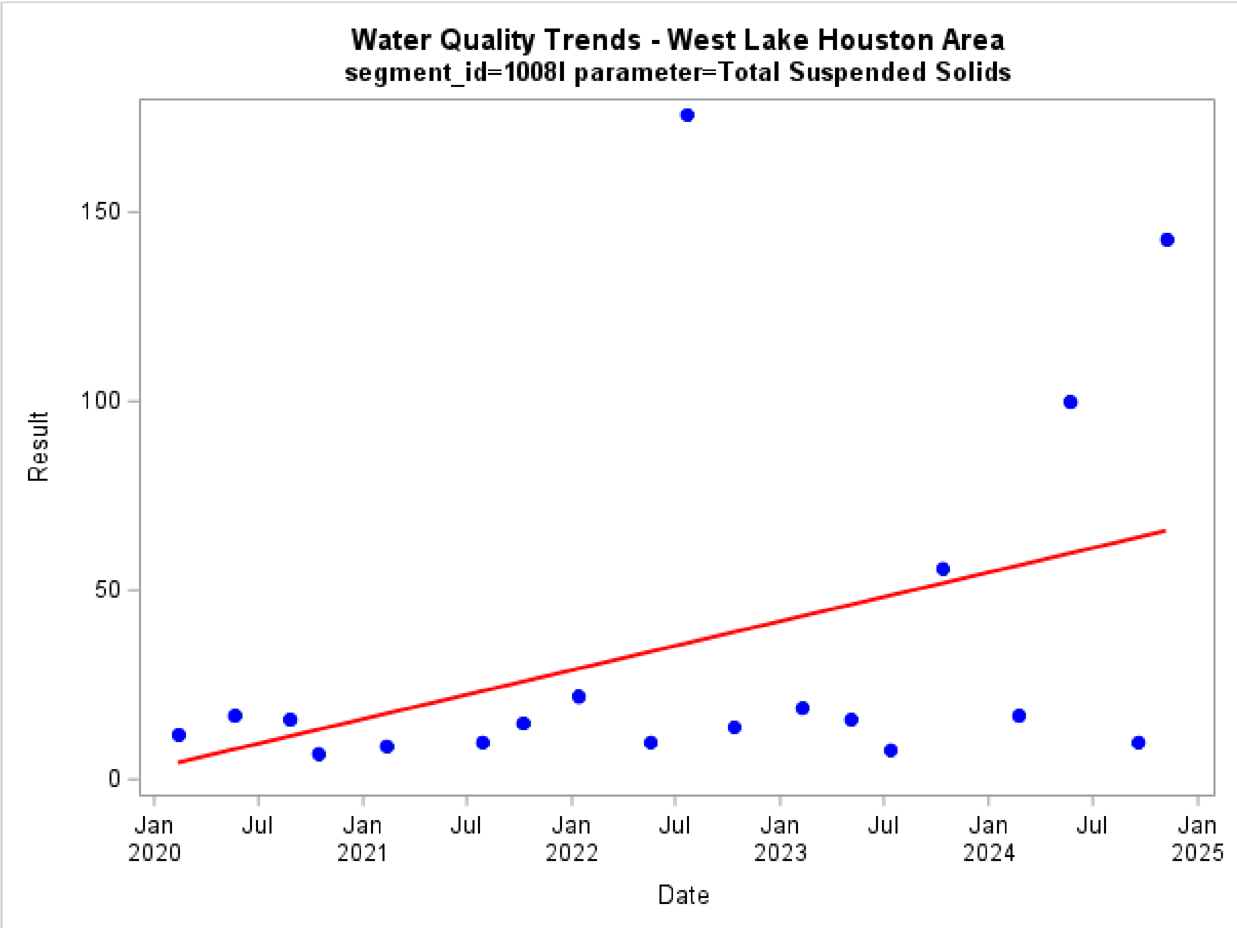

Water Quality Trends - West Lake Houston Area
segment_id=1008I parameter=Nitrate-N
Result
2.0
1.5
1.0
0.5
0.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1008I parameter=pH
7.7
7.6
7.5
7.4
7.3
7.2
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

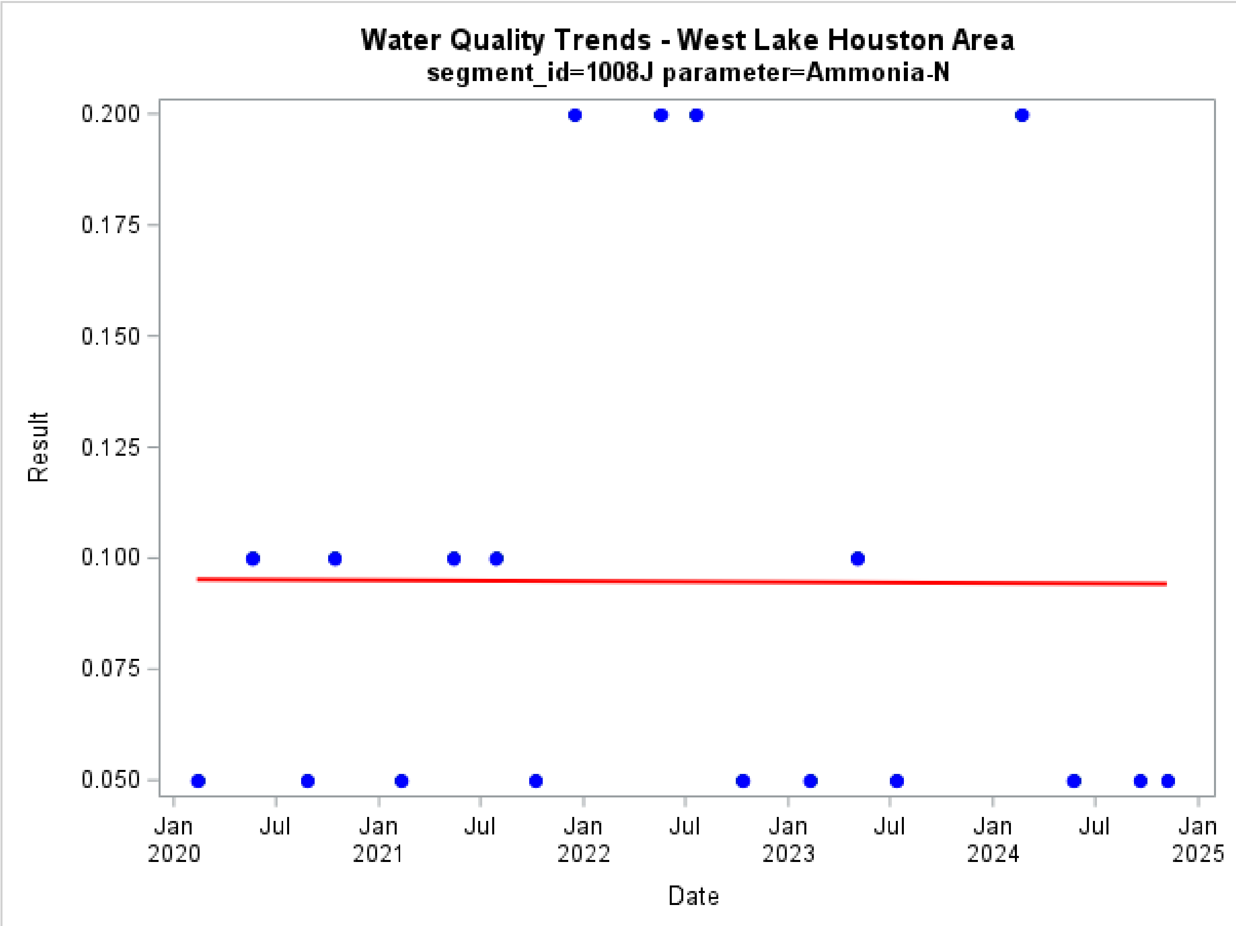

Water Quality Trends - West Lake Houston Area
segment_id=1008I parameter=Temperature
Result
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

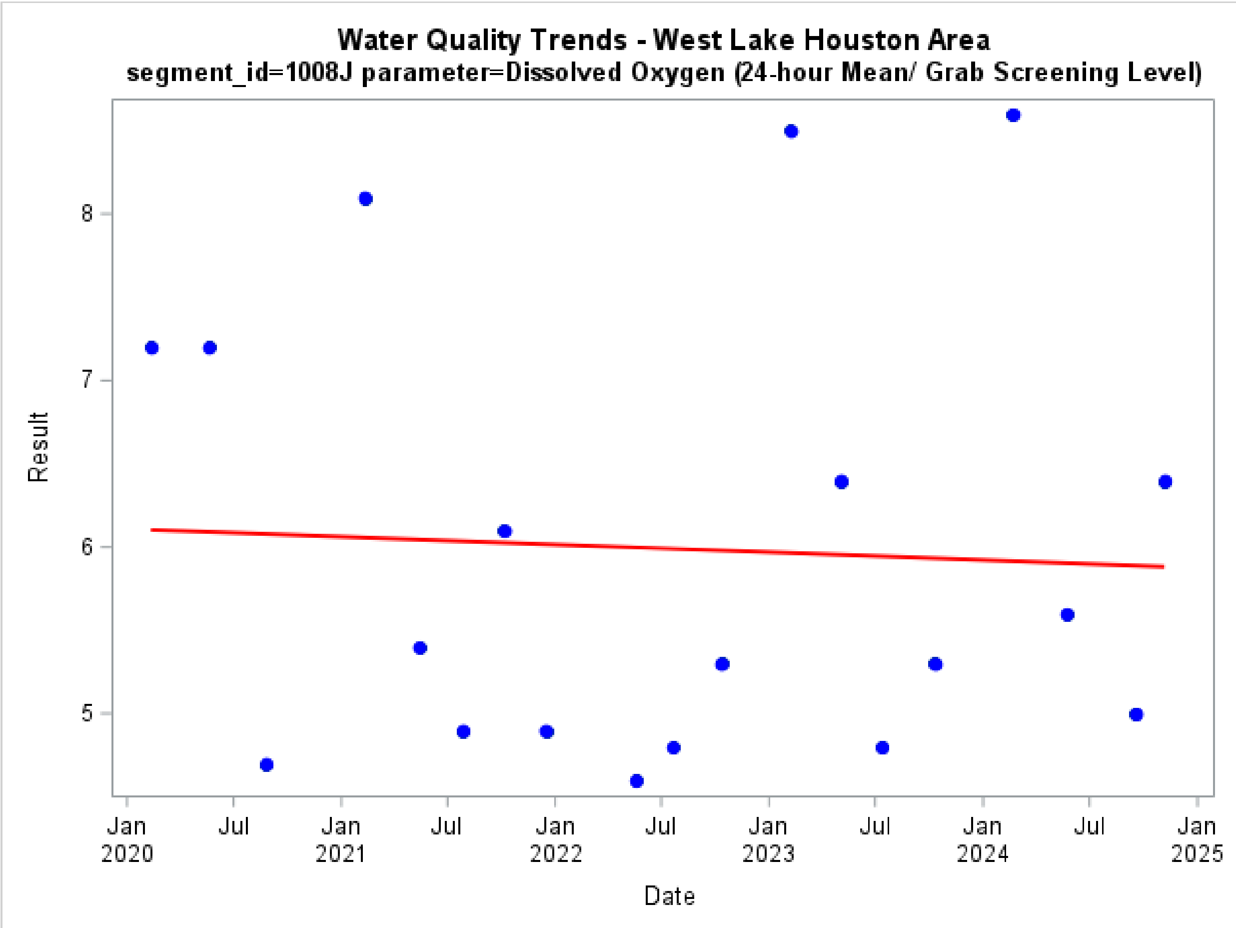


Water Quality Trends - West Lake Houston Area
segment_id=1008I parameter=Total Phosphorus
Result
0.0
0.1
0.2
0.3
0.4
0.5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

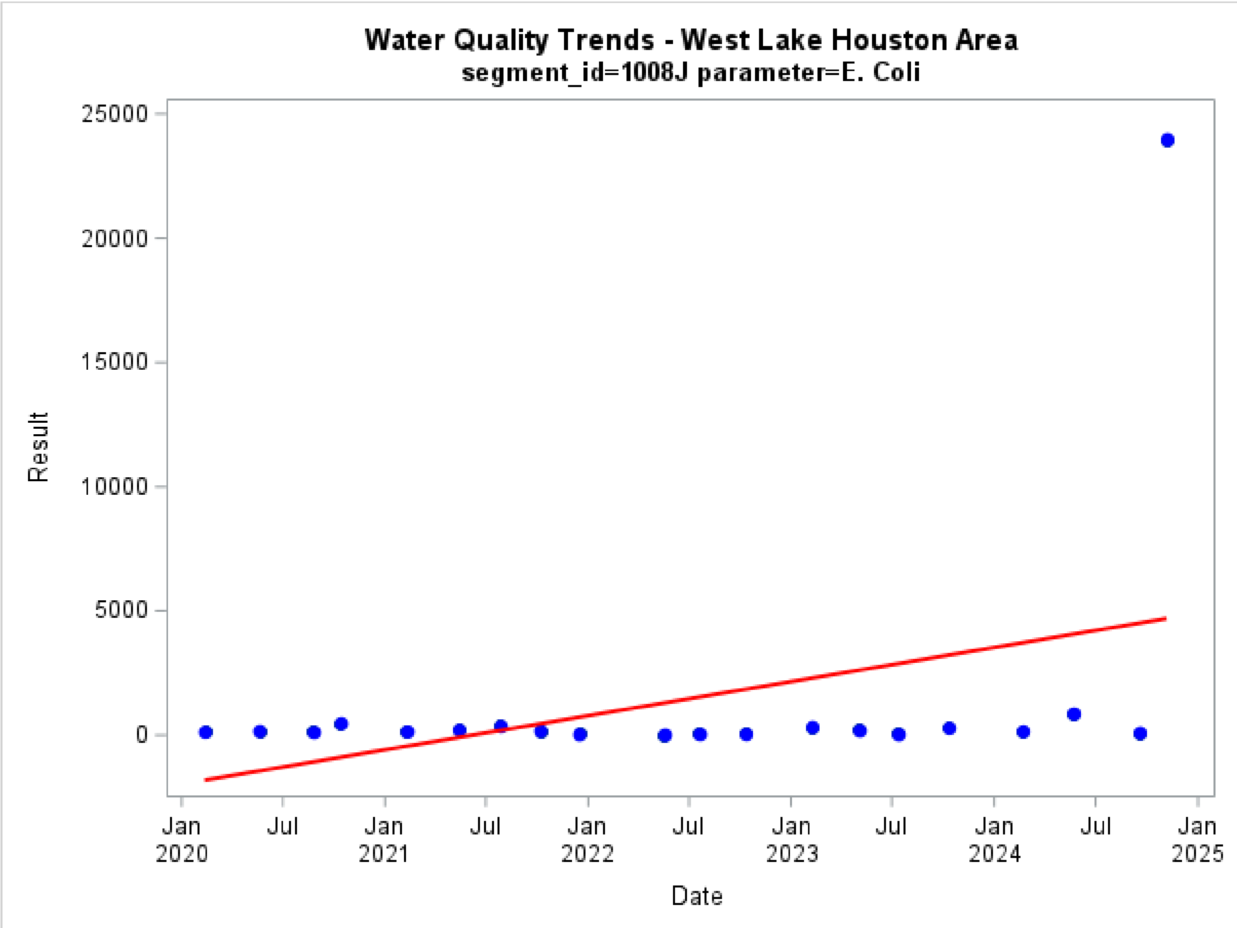

Water Quality Trends - West Lake Houston Area
segment_id=1008I parameter=Total Suspended Solids
Result
150
100
50
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

Brushy Creek (1008J)

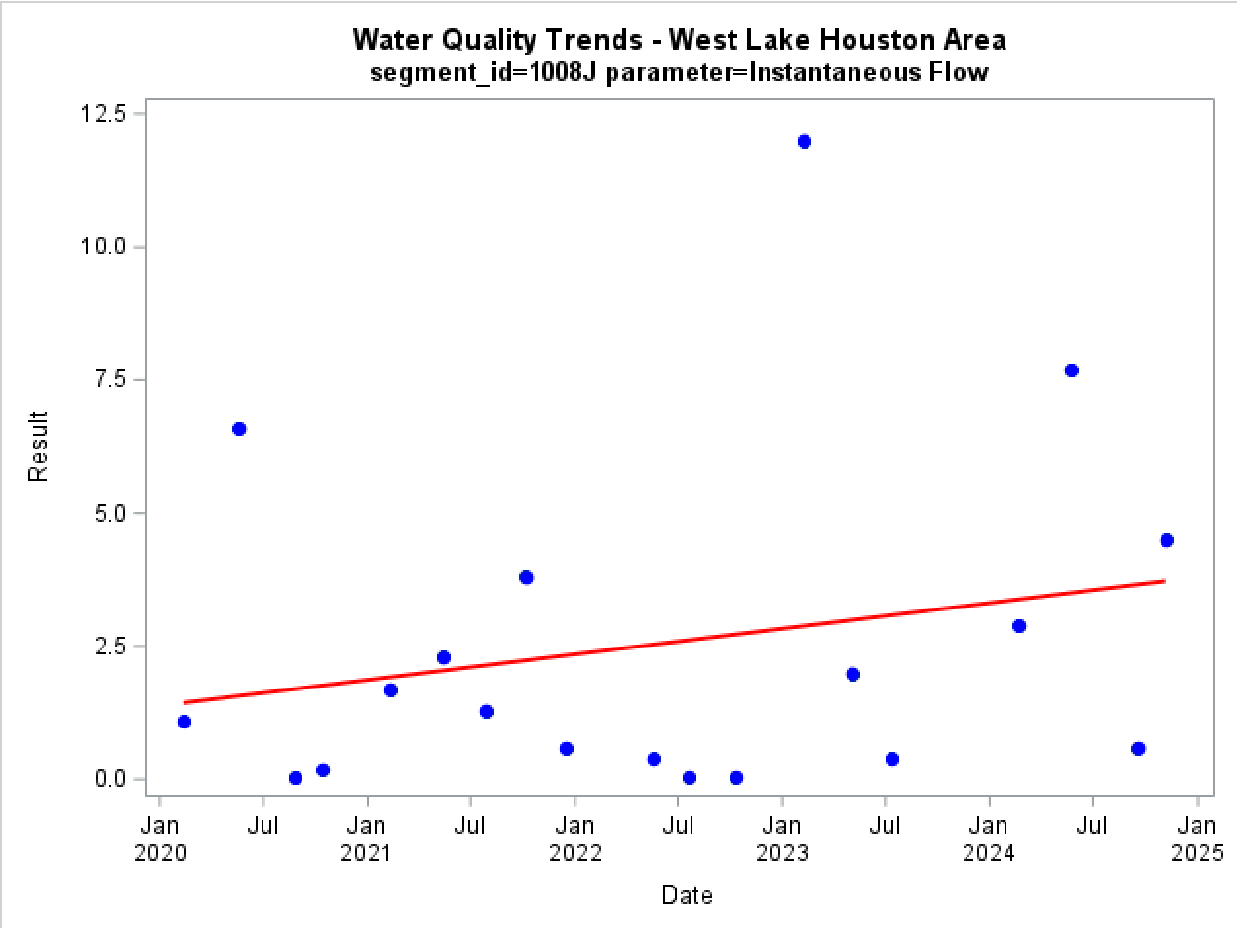


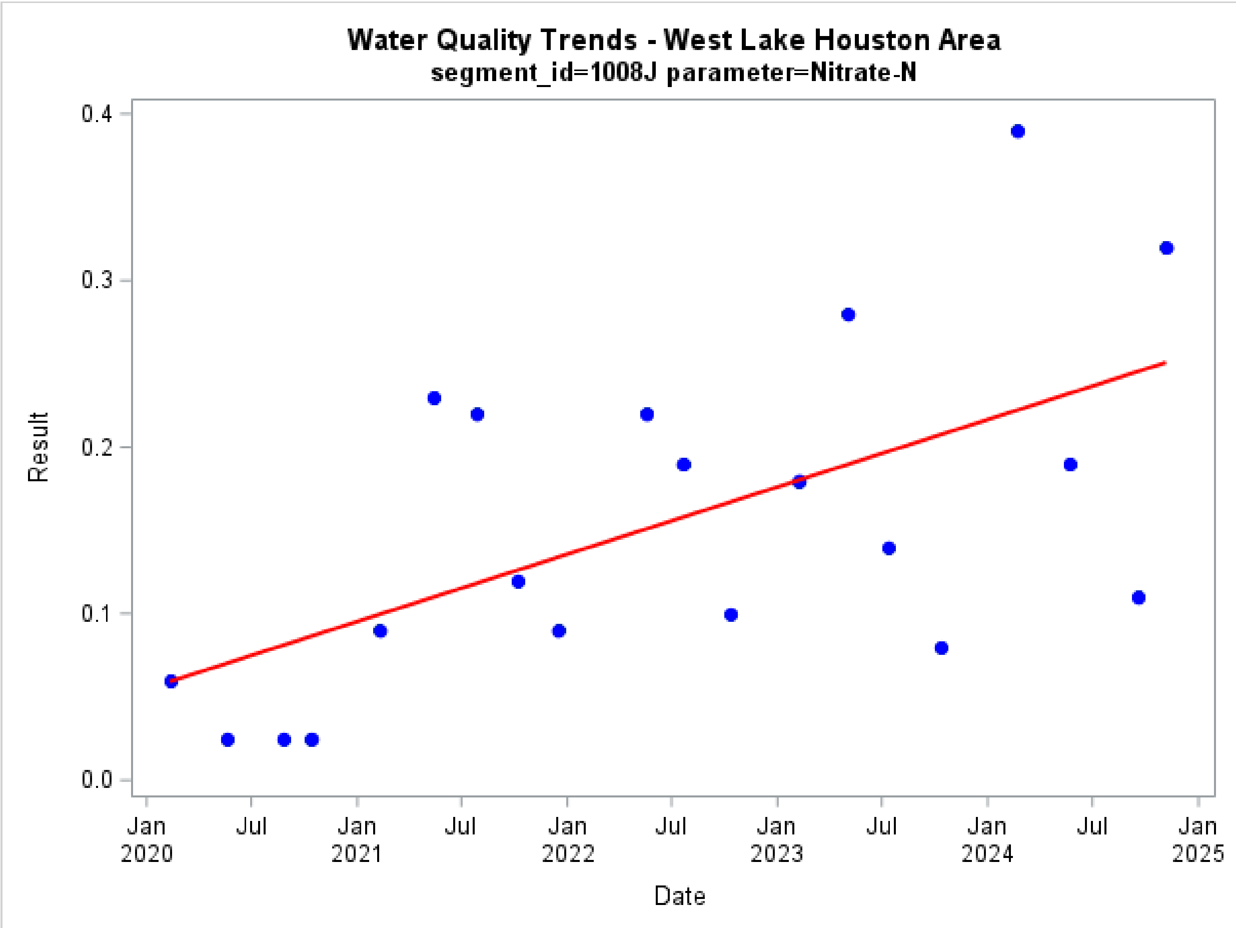


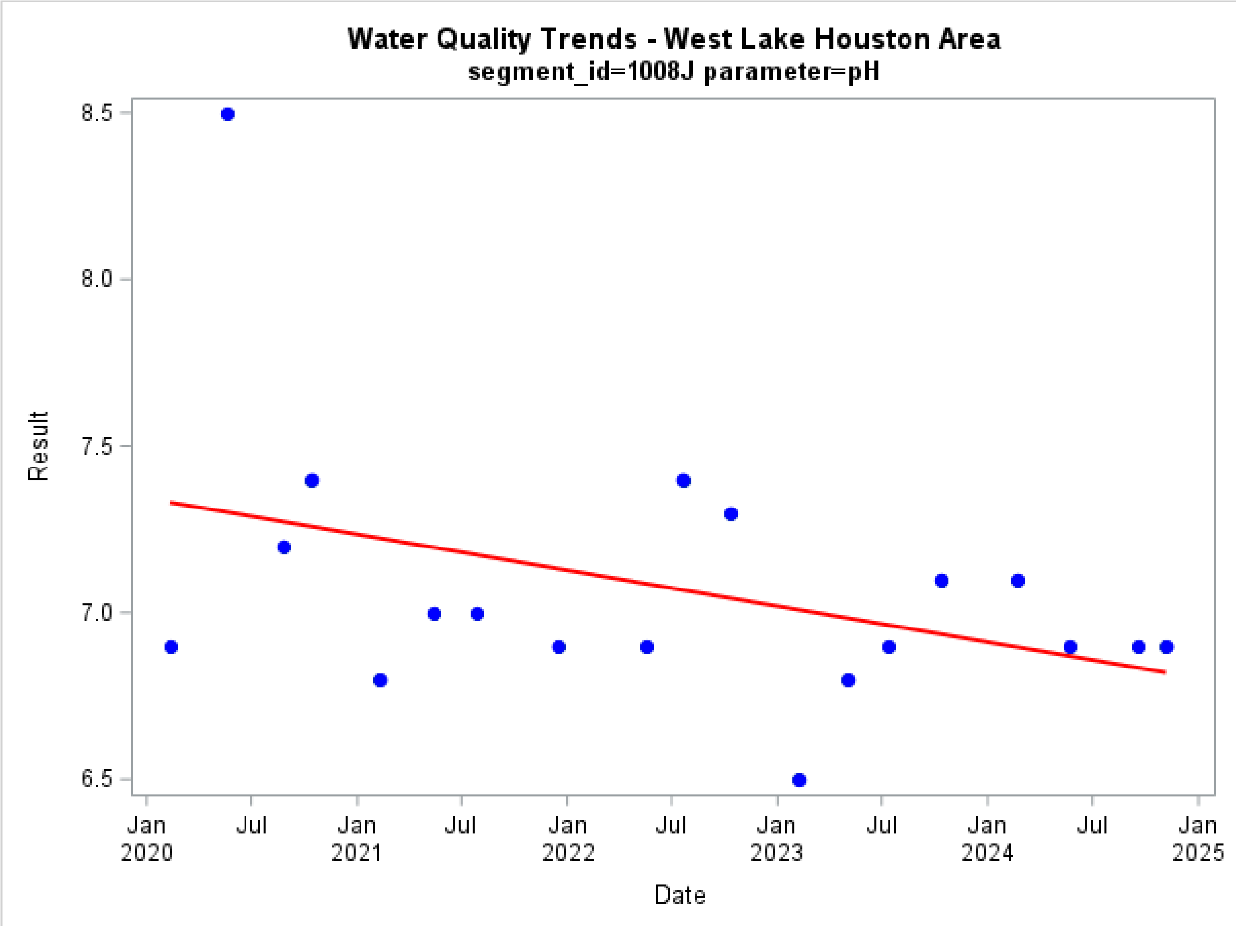
Water Quality Trends - West Lake Houston Area
segment_id=1008J parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
8
7
6
5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



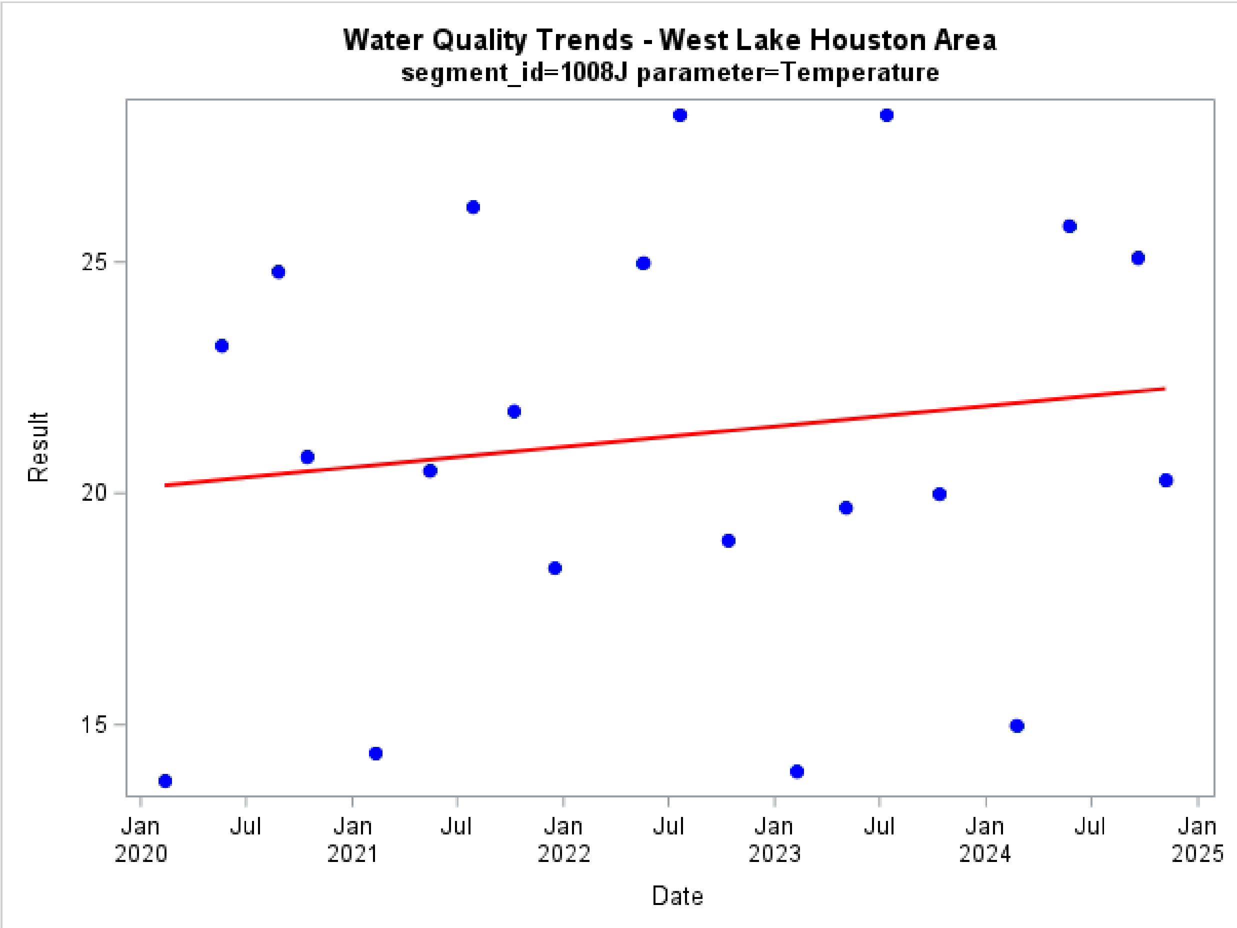
Water Quality Trends - West Lake Houston Area
segment_id=1008J parameter=E. Coli
Result
25000
20000
15000
10000
5000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1008J parameter=Instantaneous Flow
Result
12.5
10.0
7.5
5.0
2.5
0.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

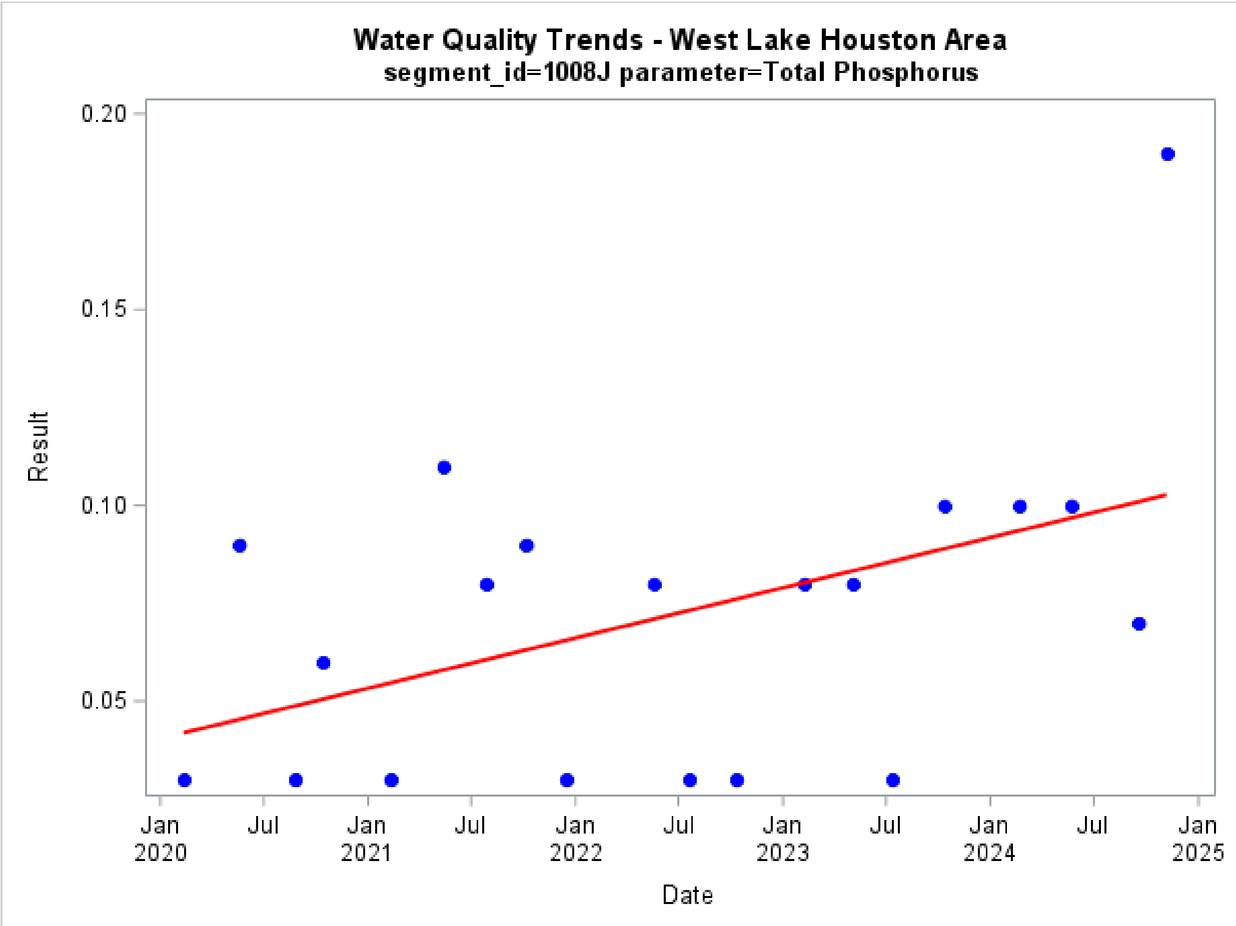

Water Quality Trends - West Lake Houston Area
segment_id=1008J parameter=Nitrate-N
Result
0.0
0.1
0.2
0.3
0.4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

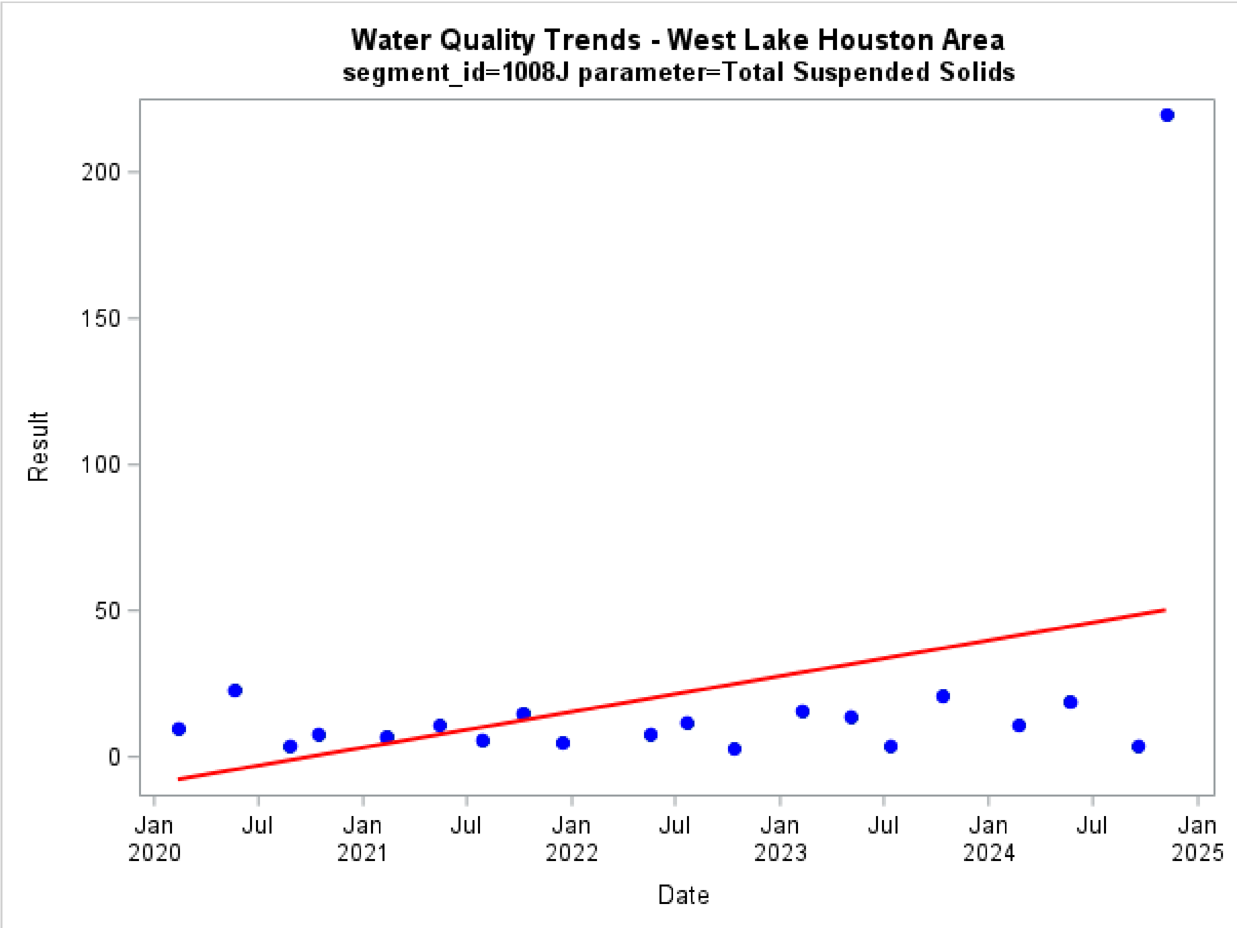


Water Quality Trends - West Lake Houston Area
segment_id=1008J parameter=pH
8.5
8.0
7.5
7.0
6.5
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



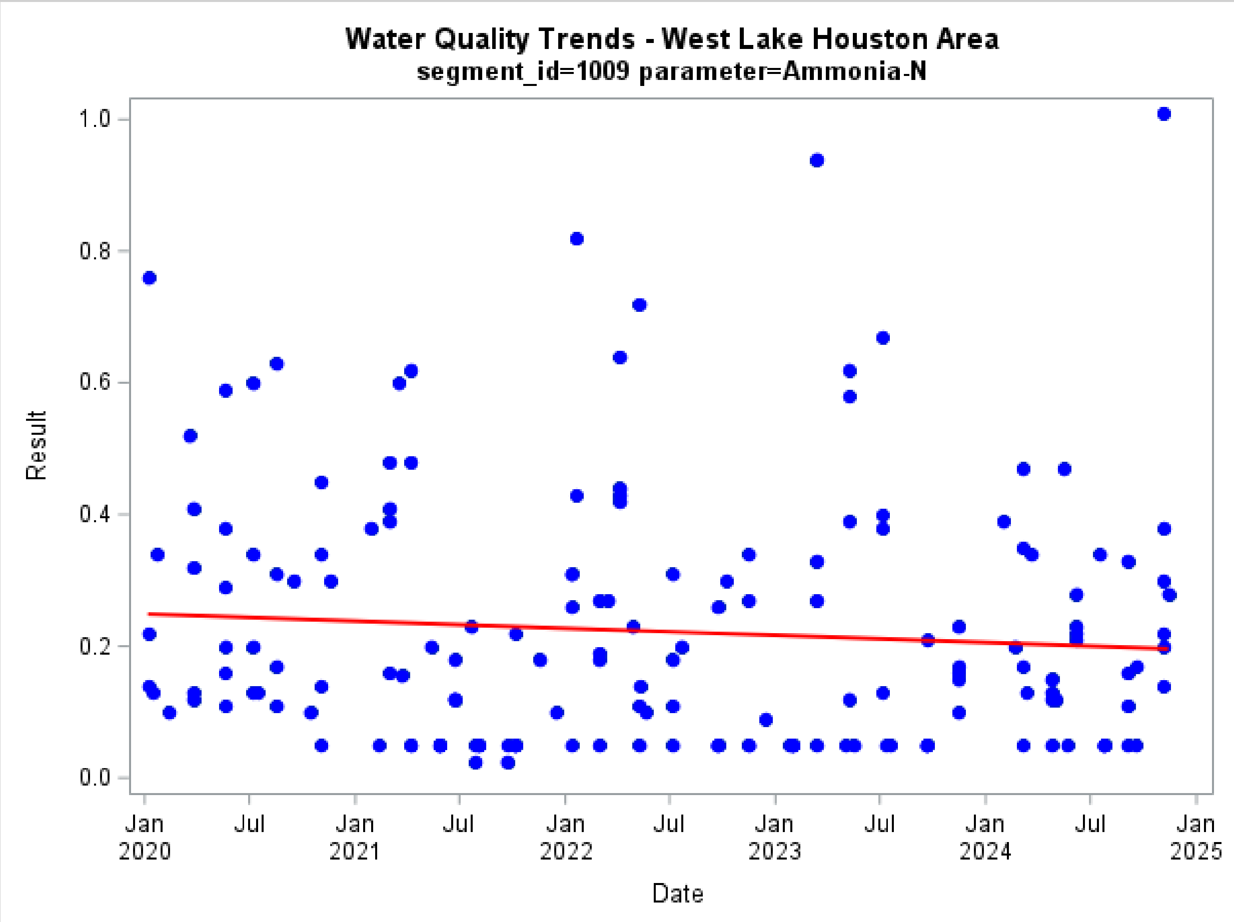
Water Quality Trends - West Lake Houston Area
segment_id=1008J parameter=Temperature
Result
25
20
15
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

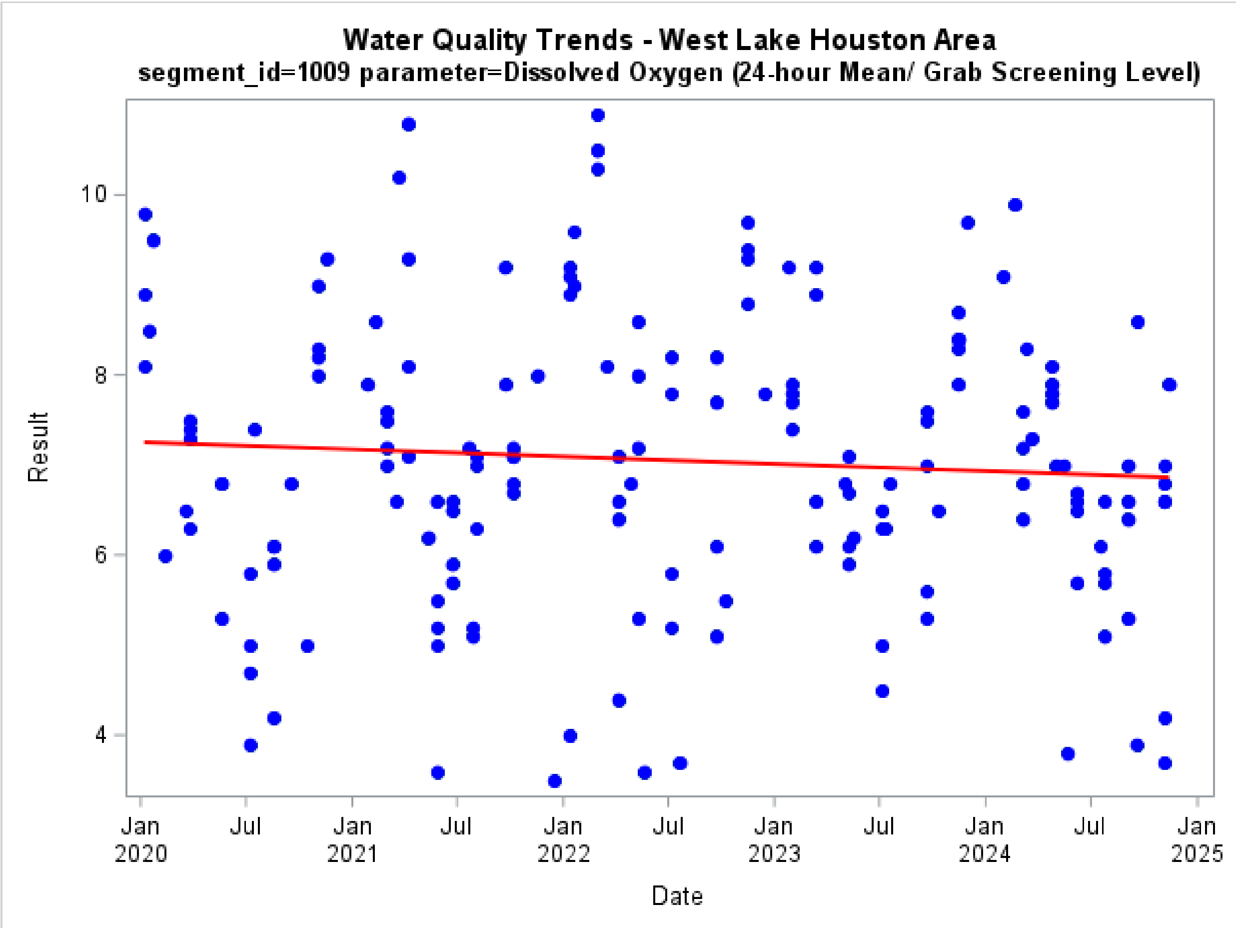

Water Quality Trends - West Lake Houston Area
segment_id=1008J parameter=Total Phosphorus
0.20
0.15
0.10
0.05
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

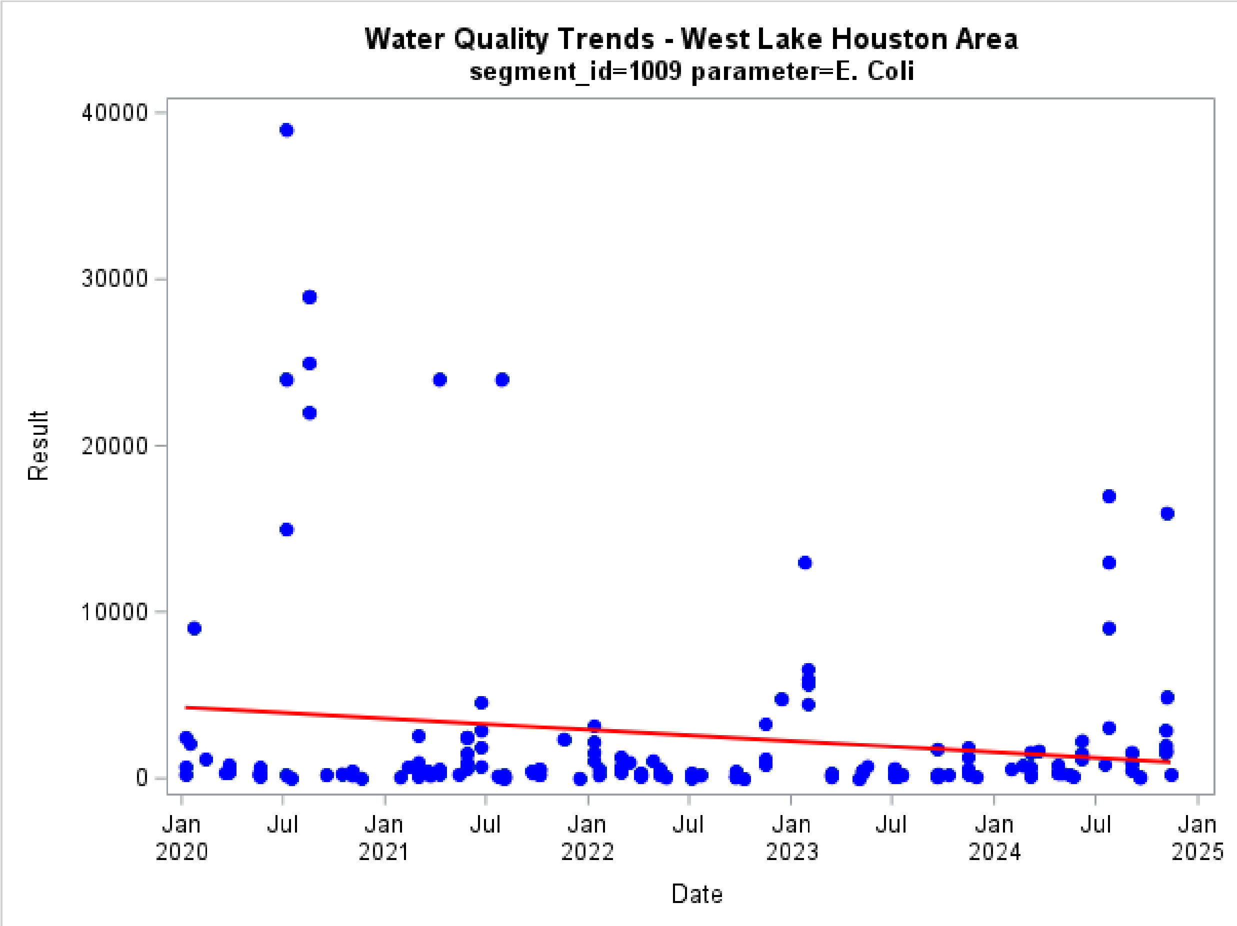

Water Quality Trends - West Lake Houston Area
segment_id=1008J parameter=Total Suspended Solids
Result
200
150
100
50
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

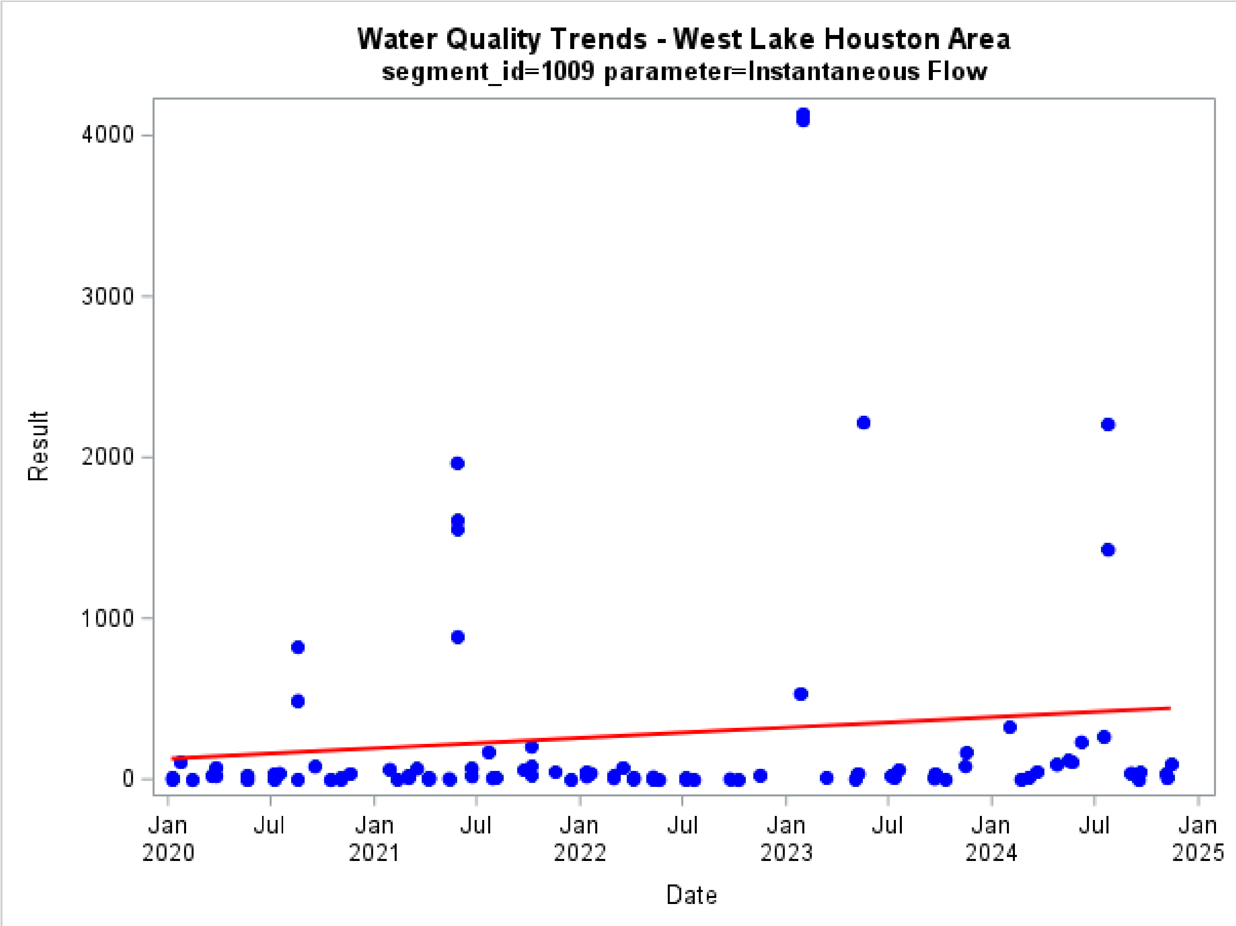
Cypress Creek Watershed

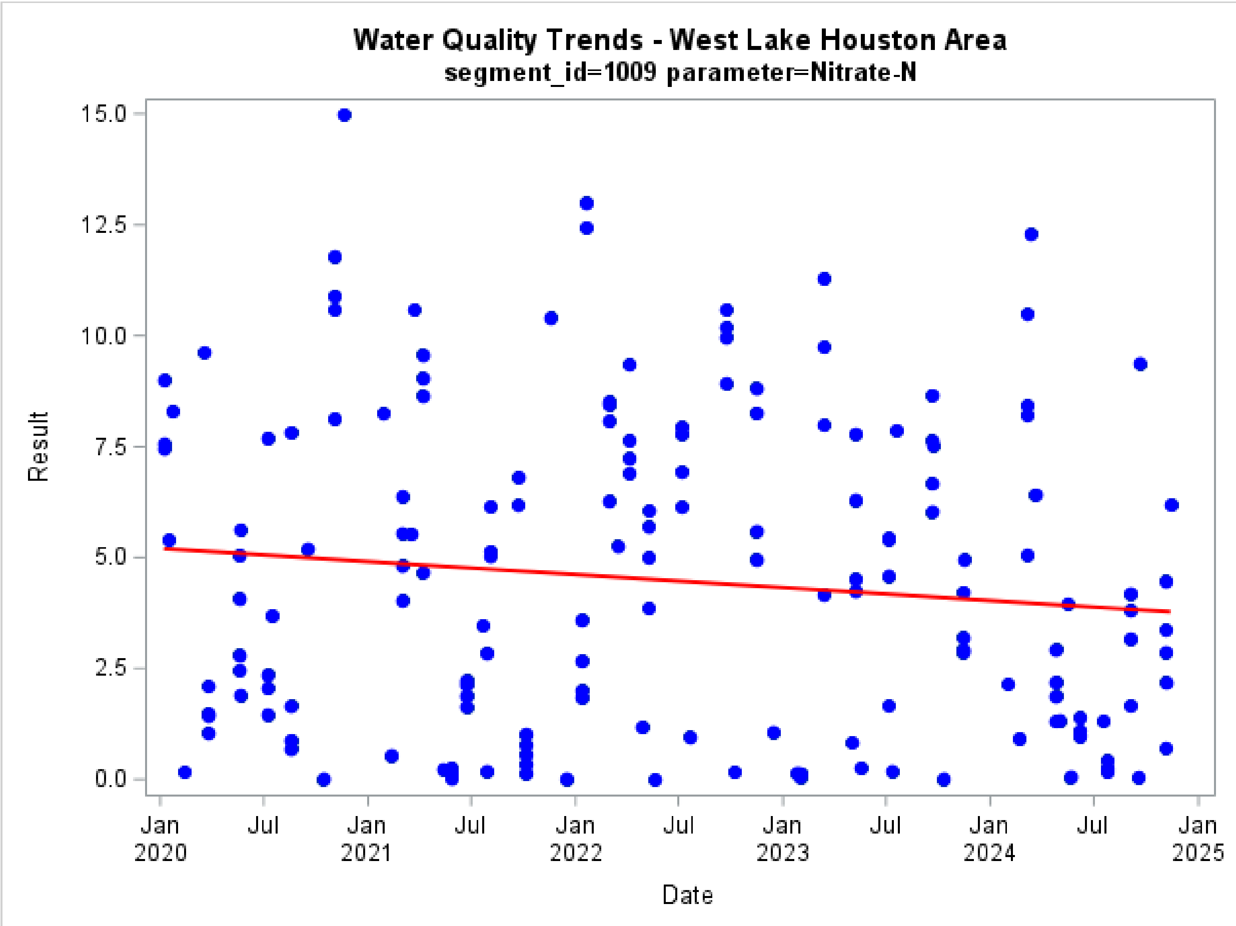
Cypress Creek (1009)

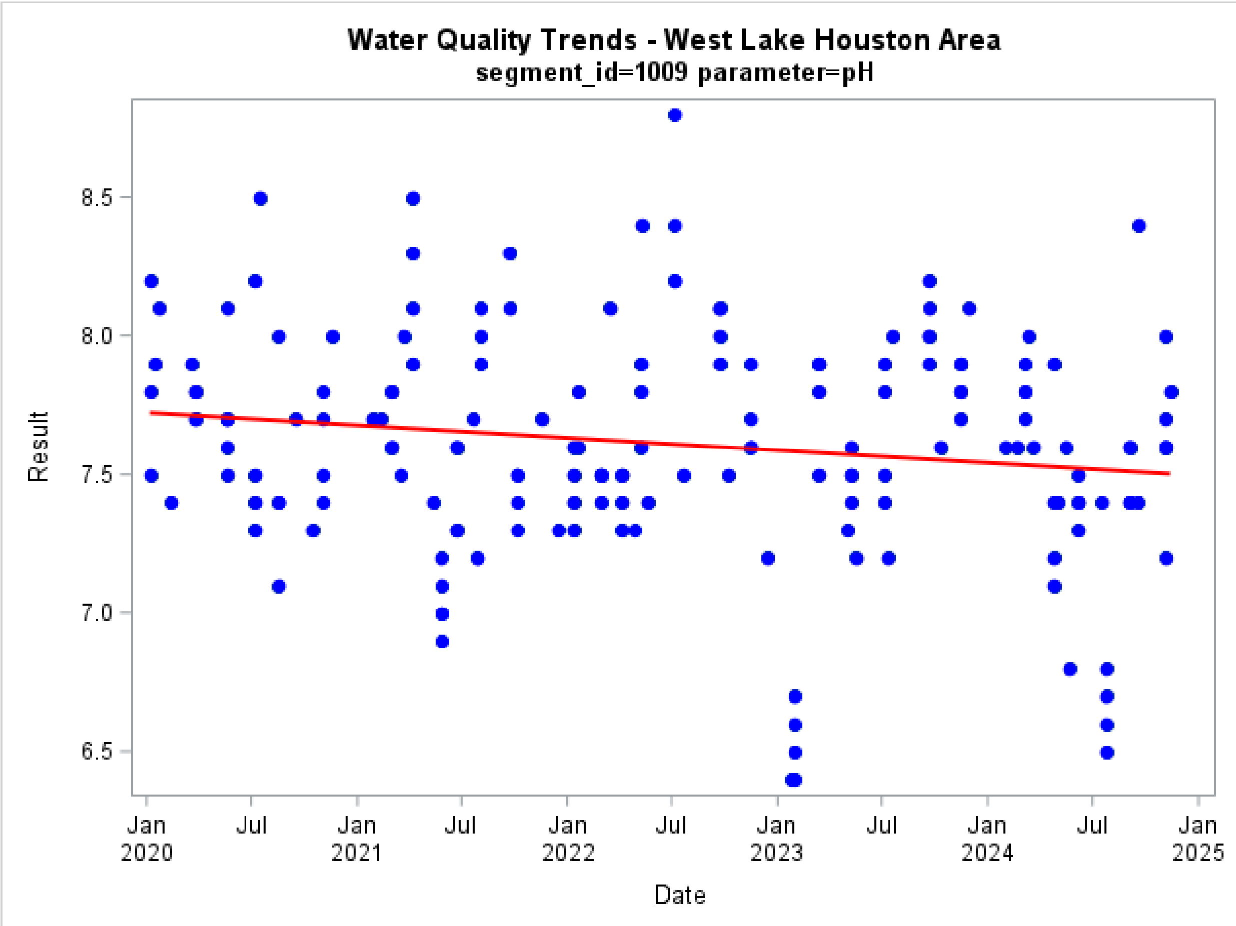



Water Quality Trends - West Lake Houston Area
segment_id=1009 parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
10
8
6
4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

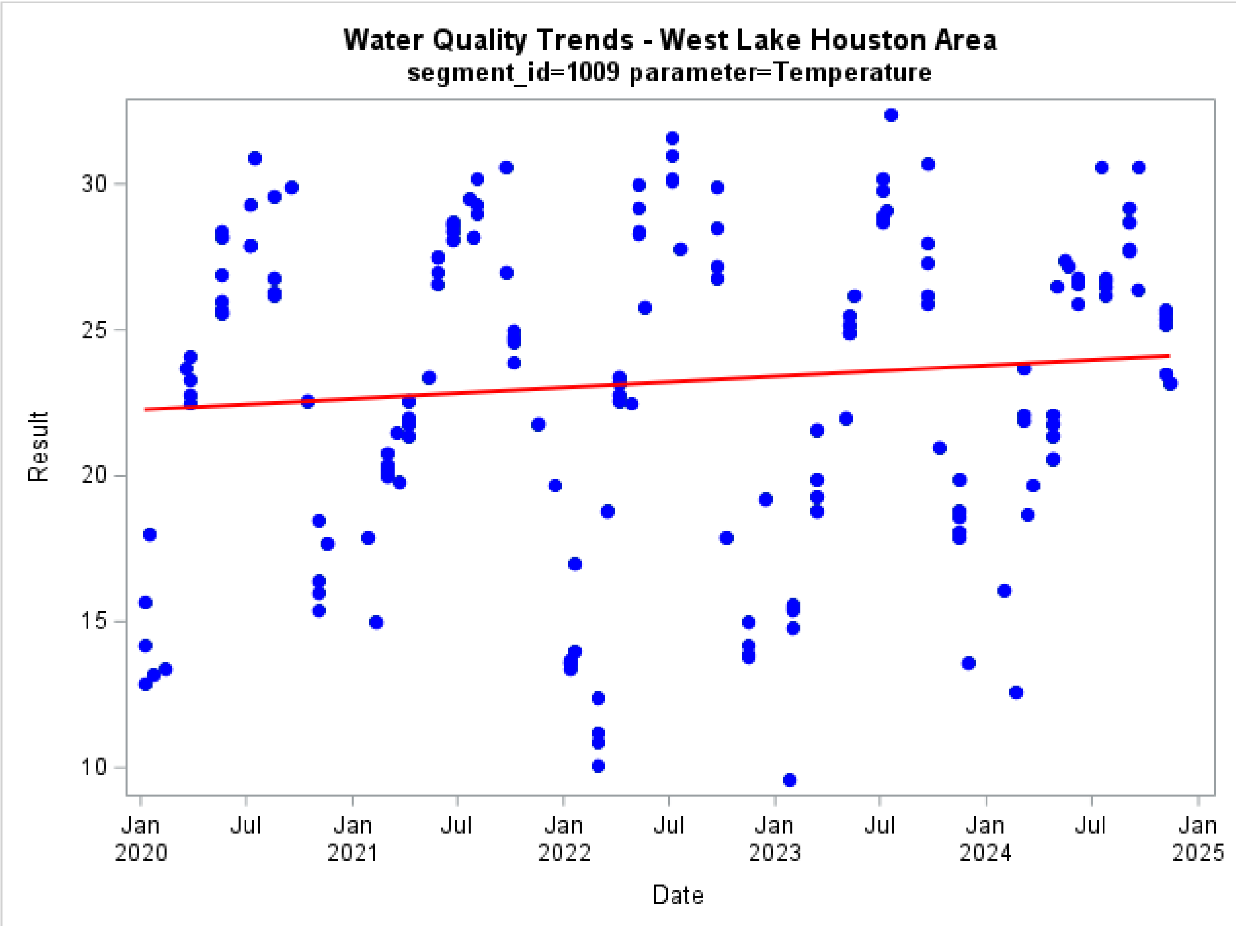

Water Quality Trends - West Lake Houston Area
segment_id=1009 parameter=E. Coli
Result
40000
30000
20000
10000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1009 parameter=Instantaneous Flow
Result
4000
3000
2000
1000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

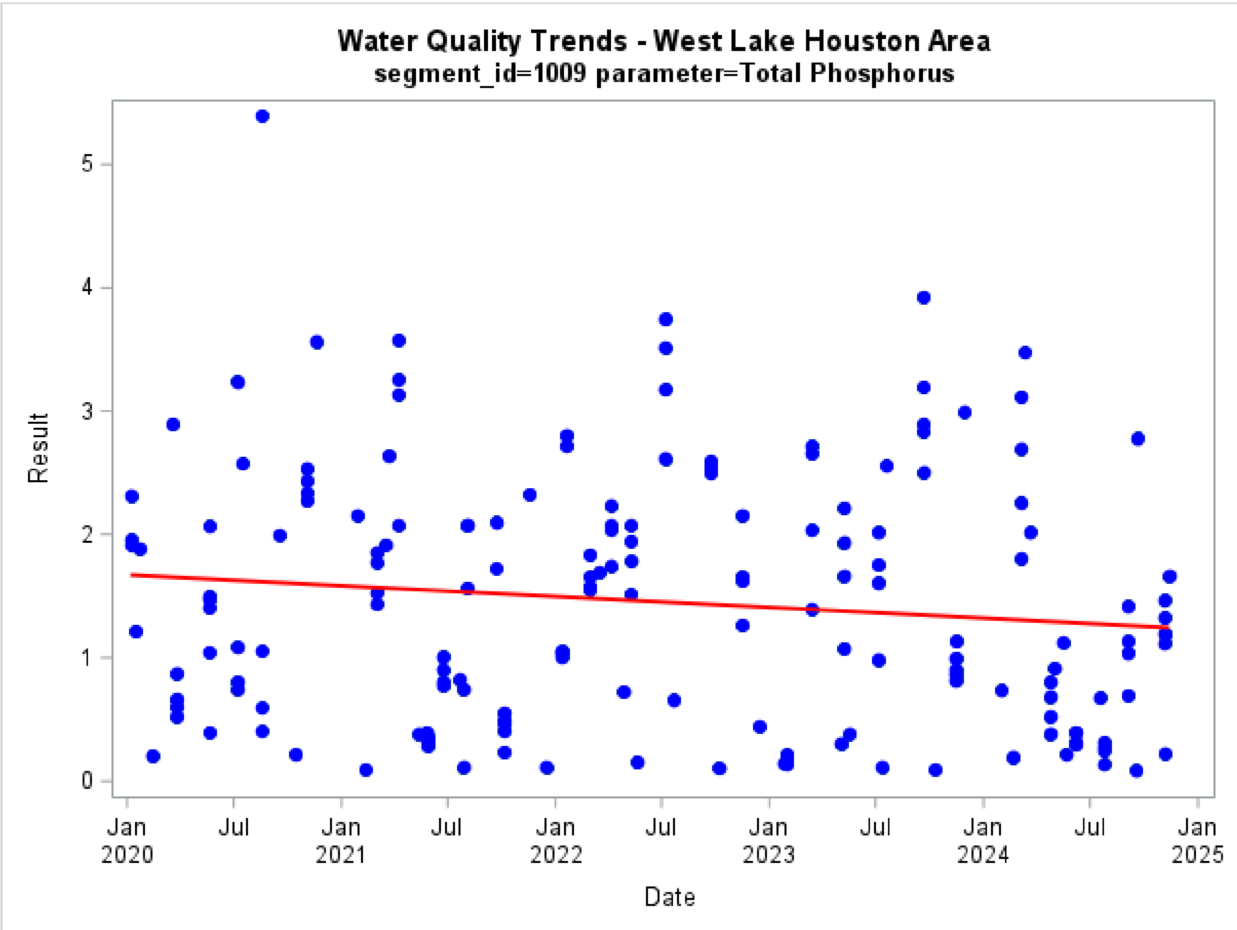

Water Quality Trends - West Lake Houston Area
segment_id=1009 parameter=Nitrate-N
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



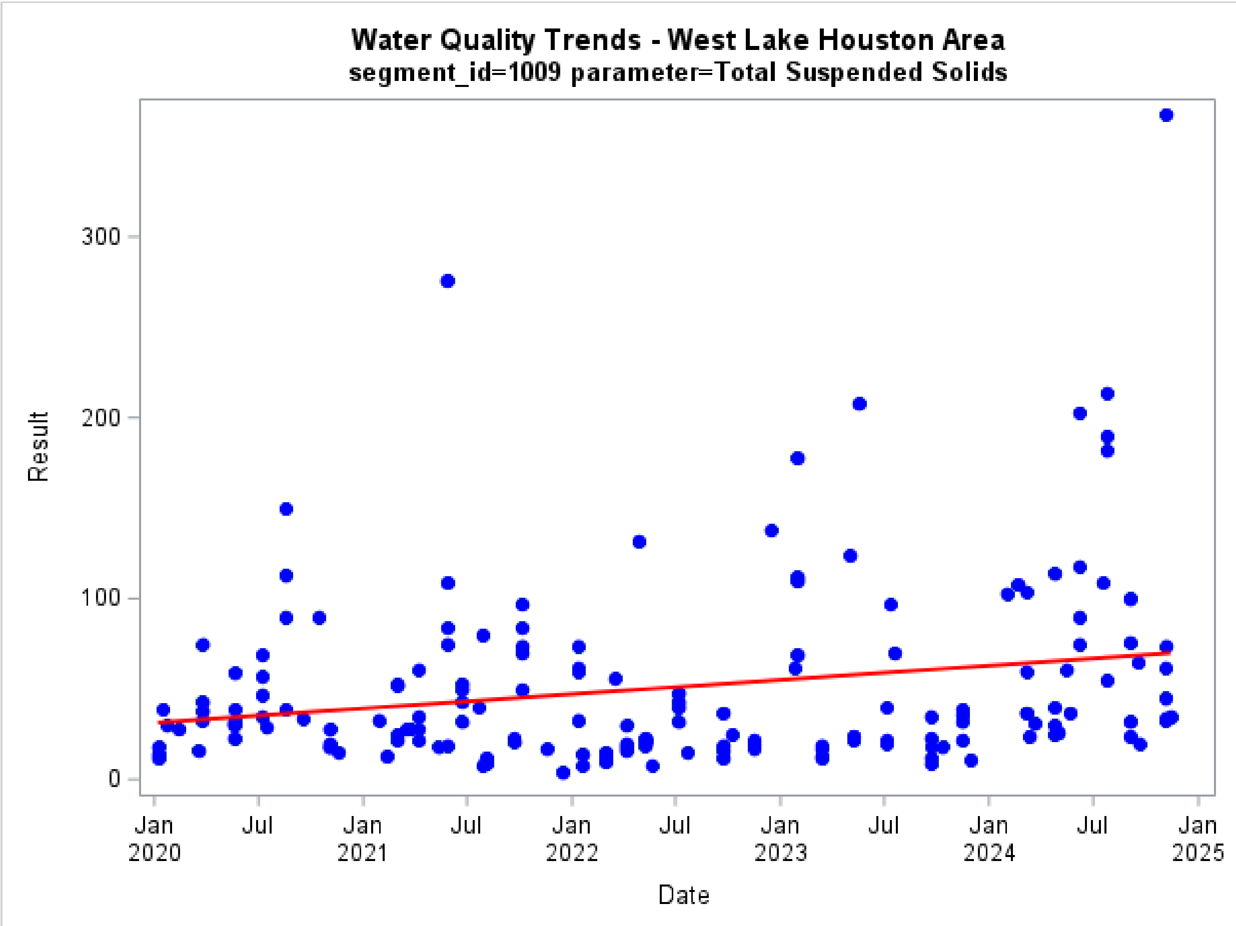
Water Quality Trends - West Lake Houston Area
segment_id=1009 parameter=pH
Result
8.5
8.0
7.5
7.0
6.5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



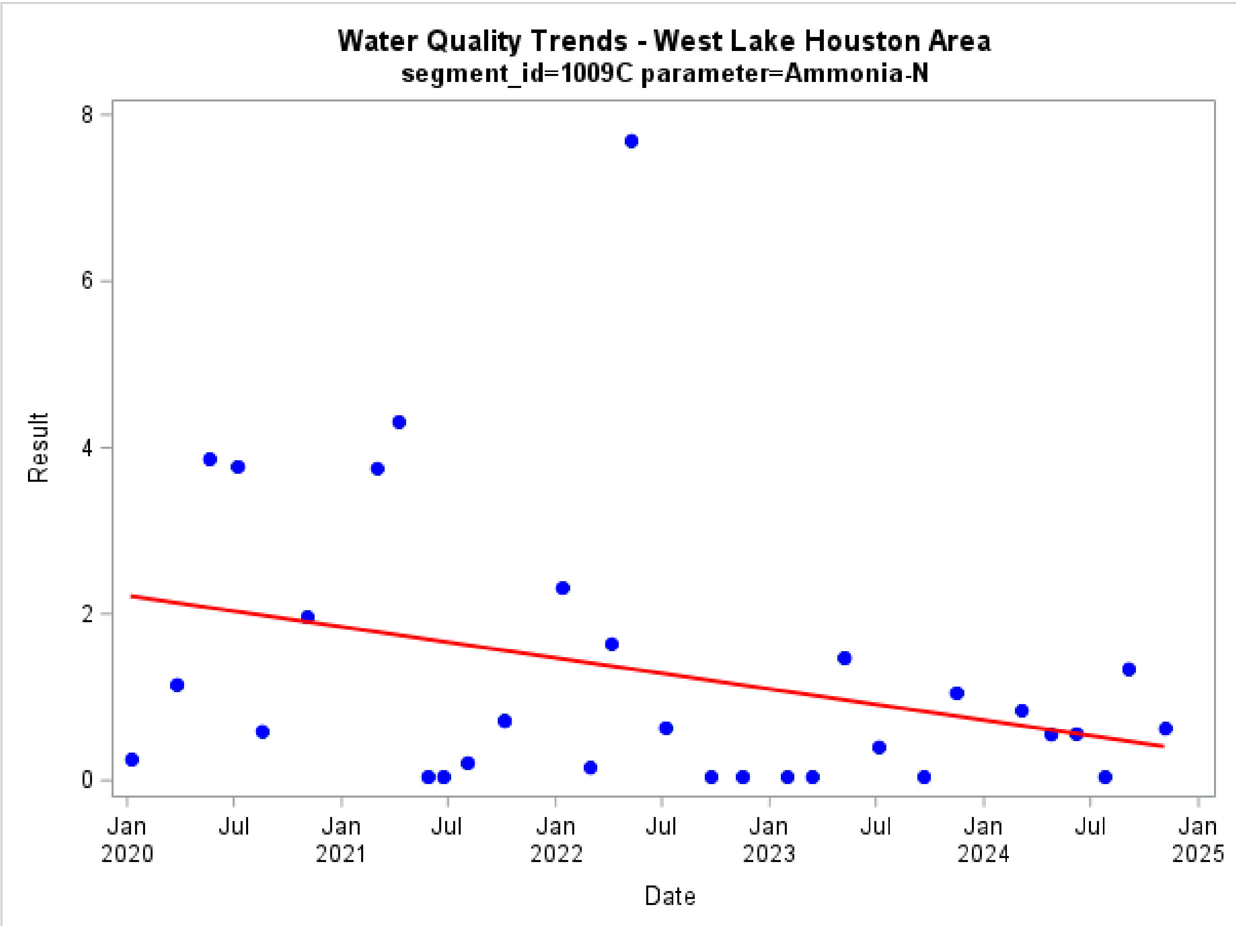
Water Quality Trends - West Lake Houston Area
segment_id=1009 parameter=Temperature
Result
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

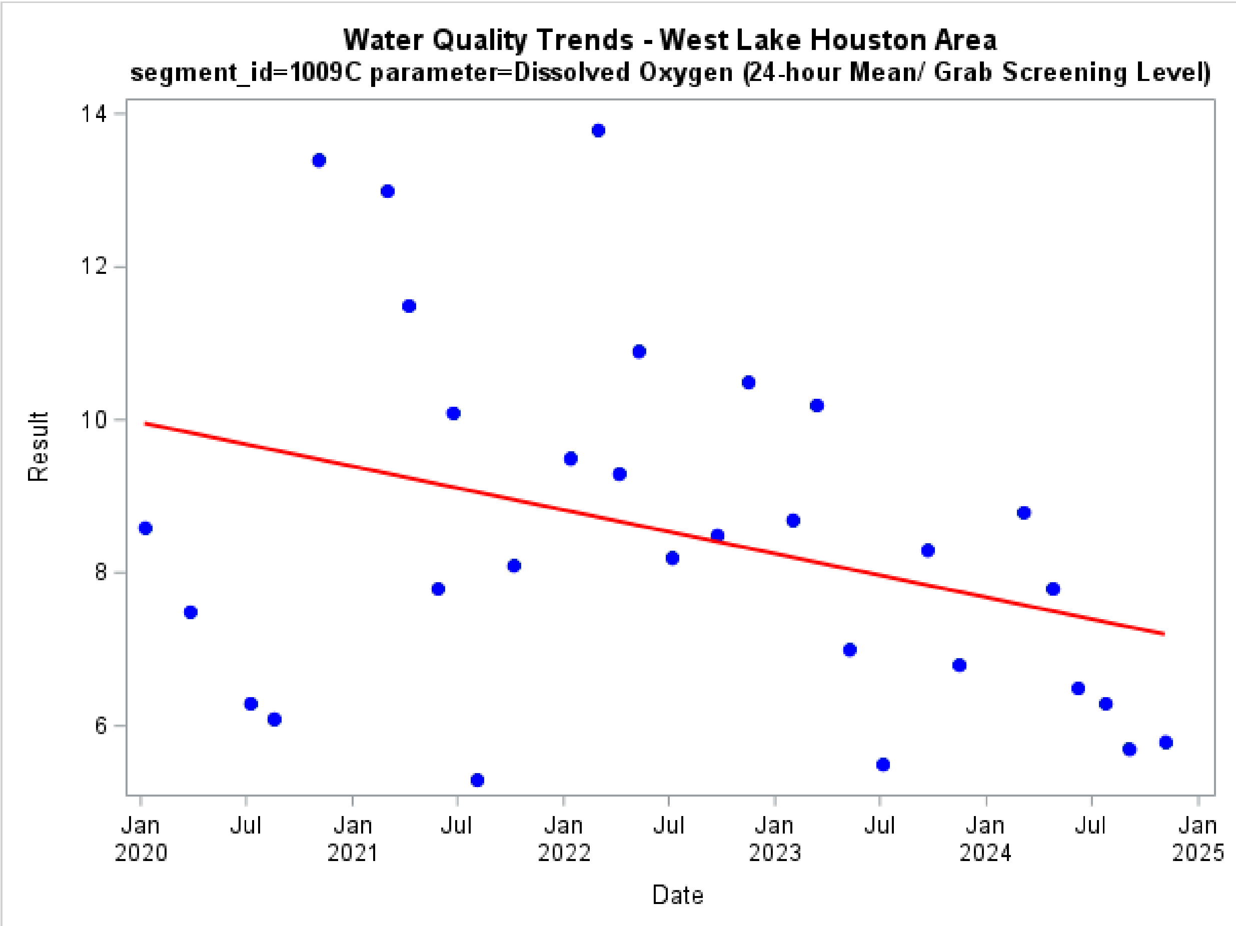


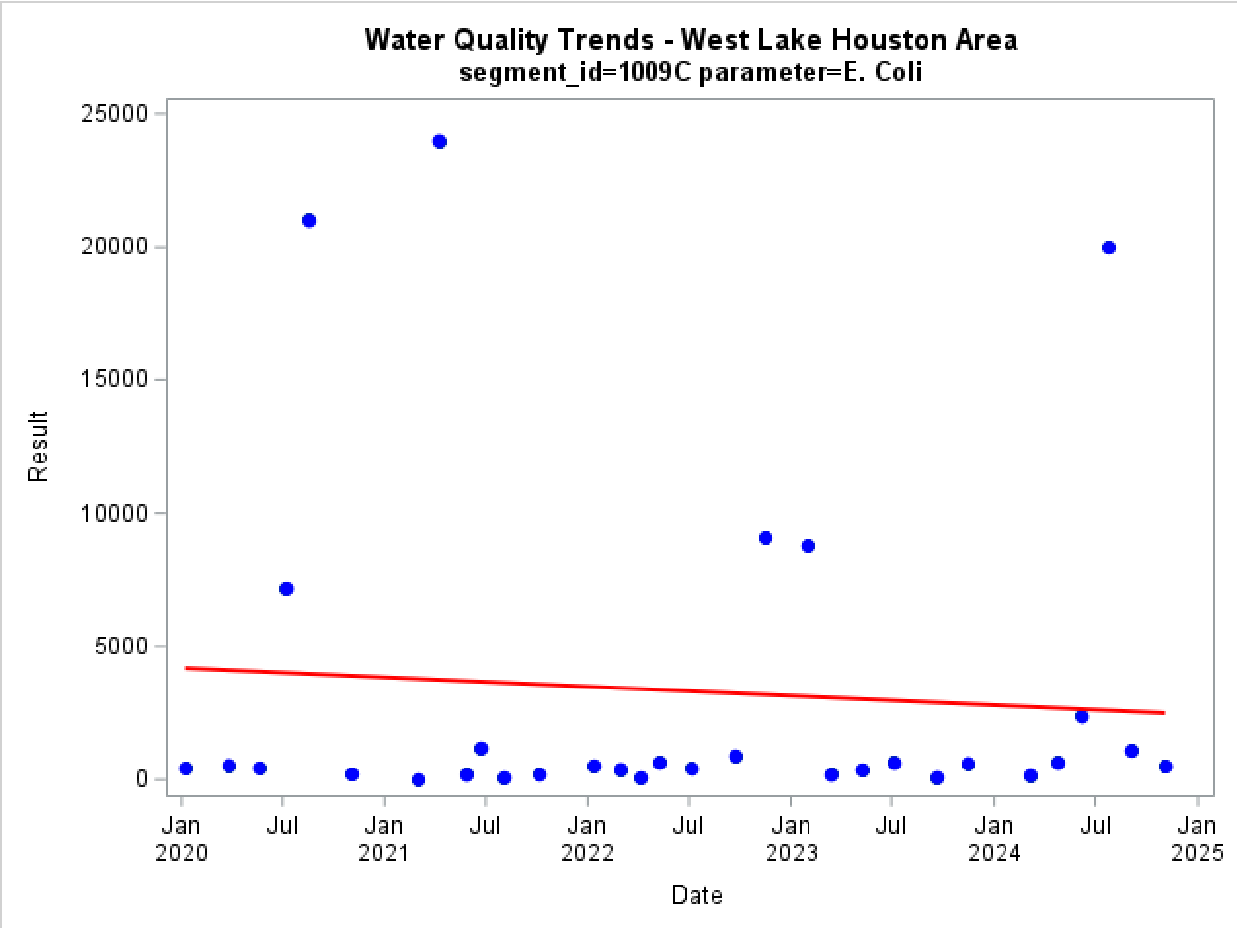
Water Quality Trends - West Lake Houston Area
segment_id=1009 parameter=Total Phosphorus
Result
0
1
2
3
4
5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

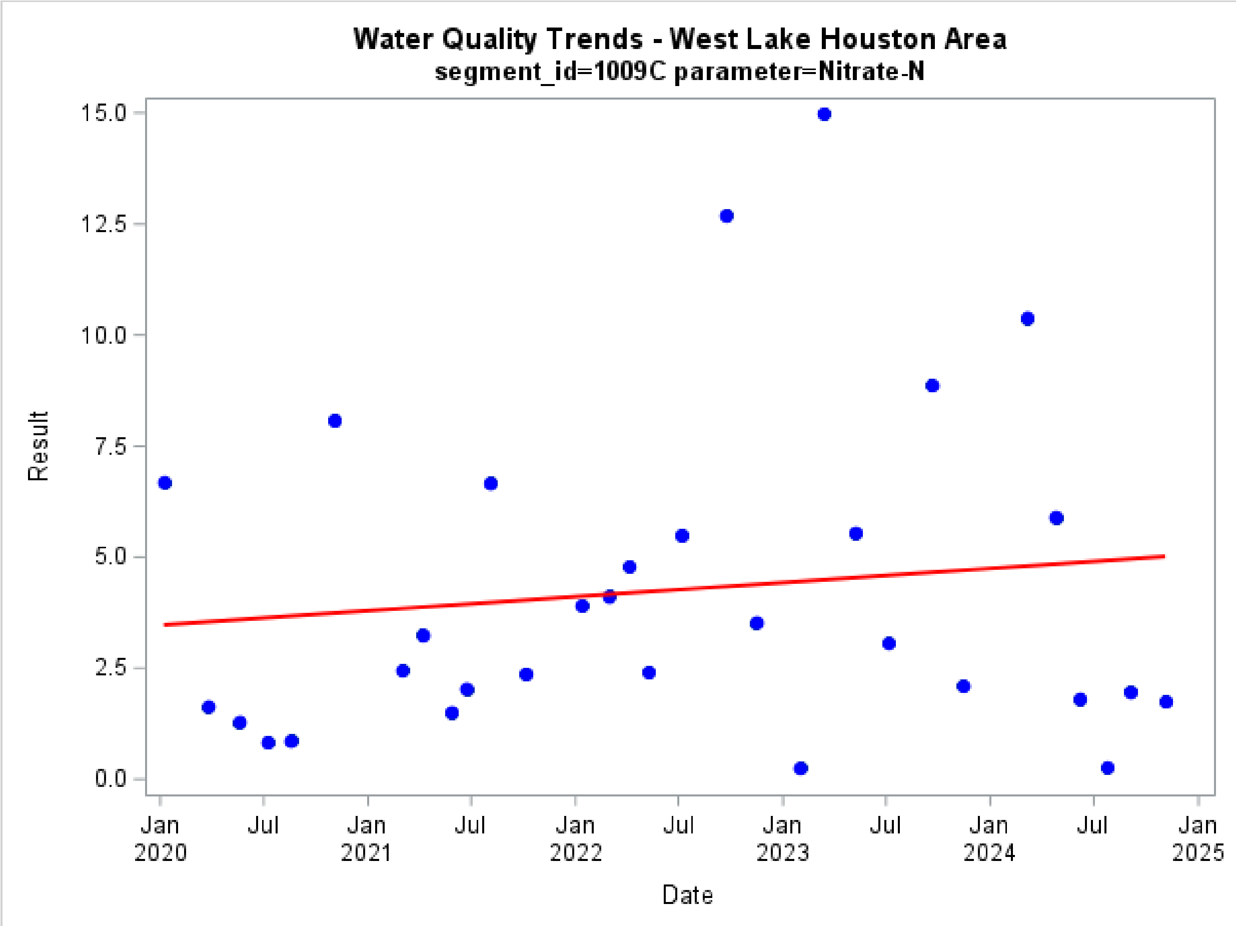

Water Quality Trends - West Lake Houston Area
segment_id=1009 parameter=Total Suspended Solids
Result
300
200
100
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

Faulkey Gully (1009C)

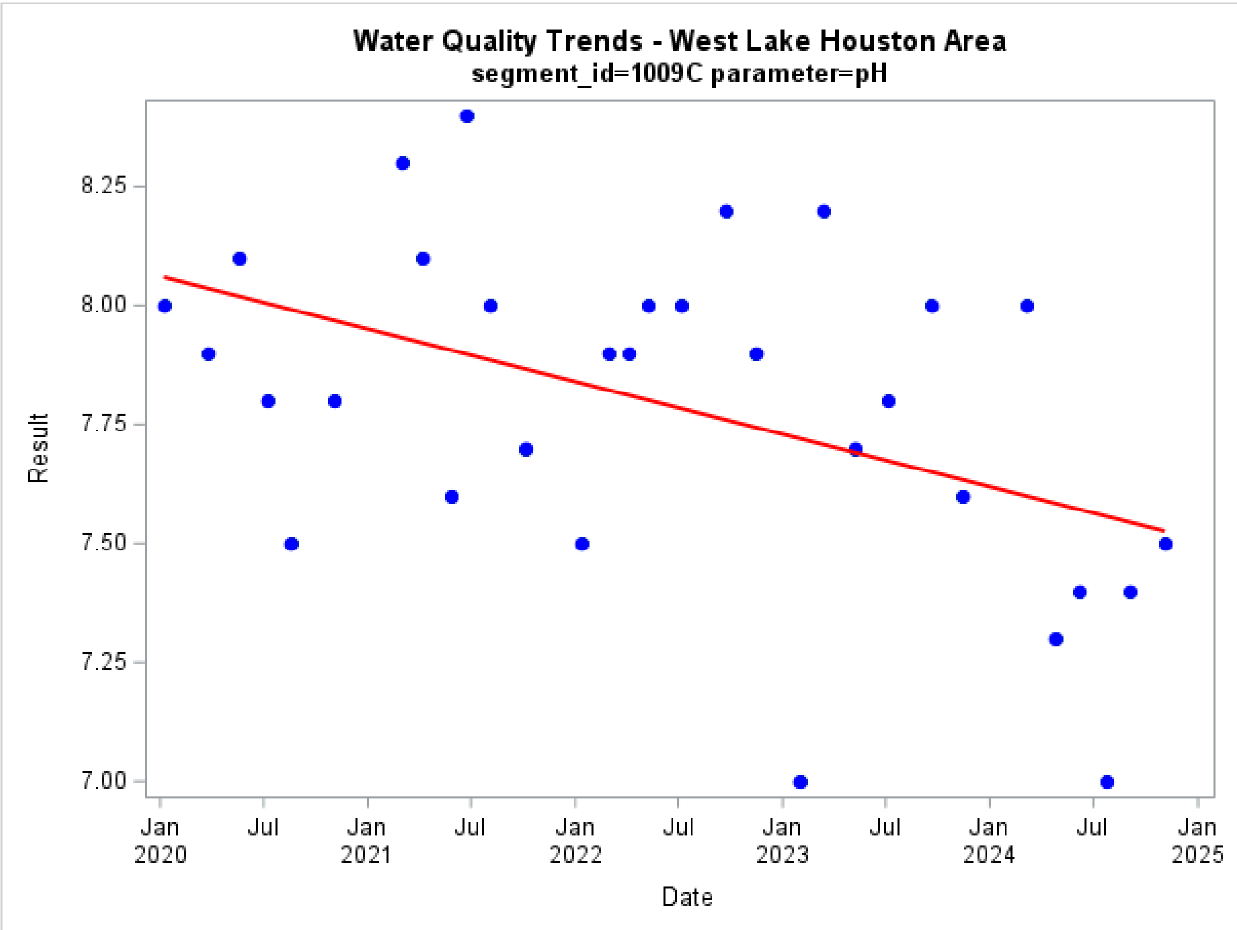



Water Quality Trends - West Lake Houston Area
segment_id=1009C parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
14
12
10
8
6
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

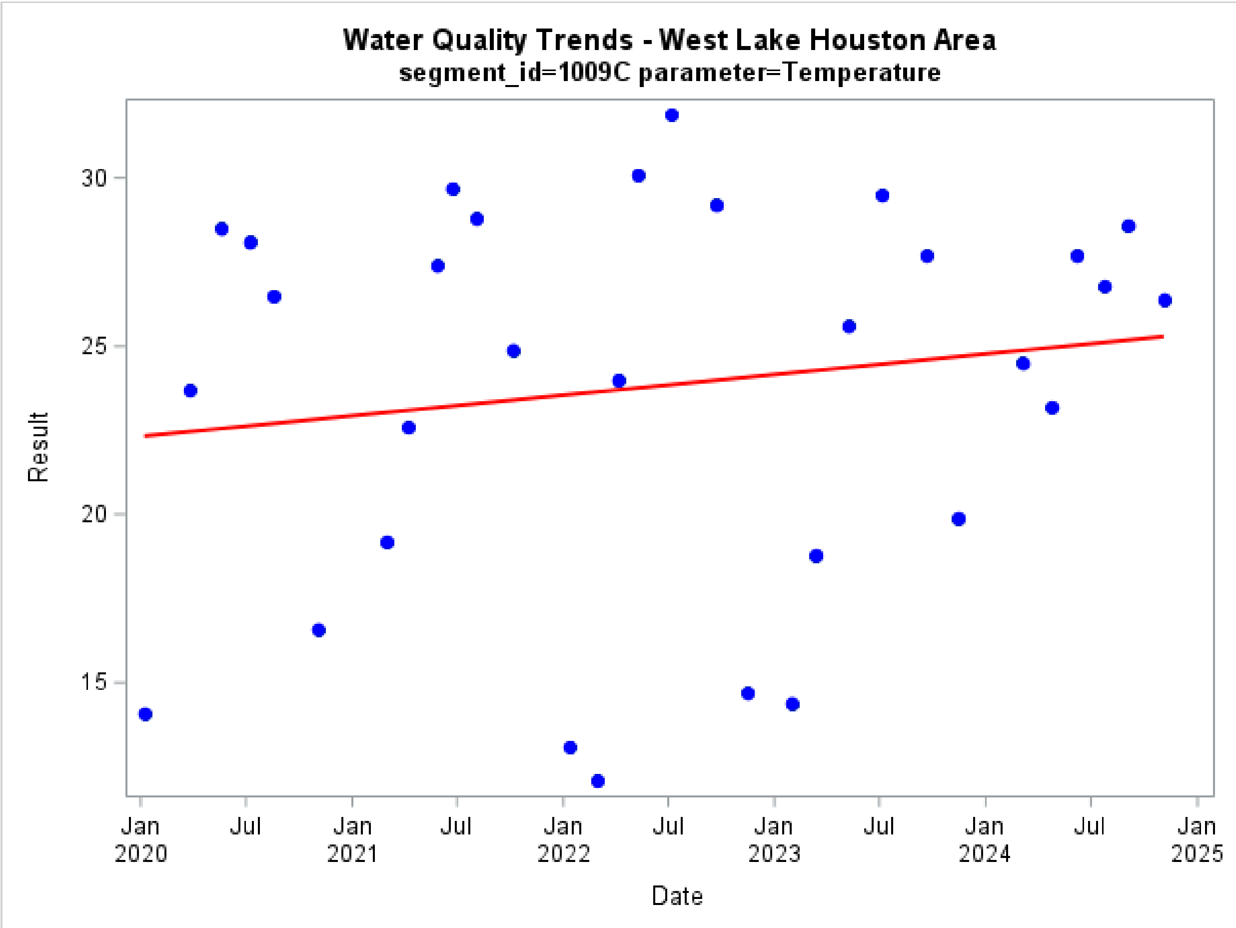

Water Quality Trends - West Lake Houston Area
segment_id=1009C parameter=E. Coli
Result
25000
20000
15000
10000
5000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



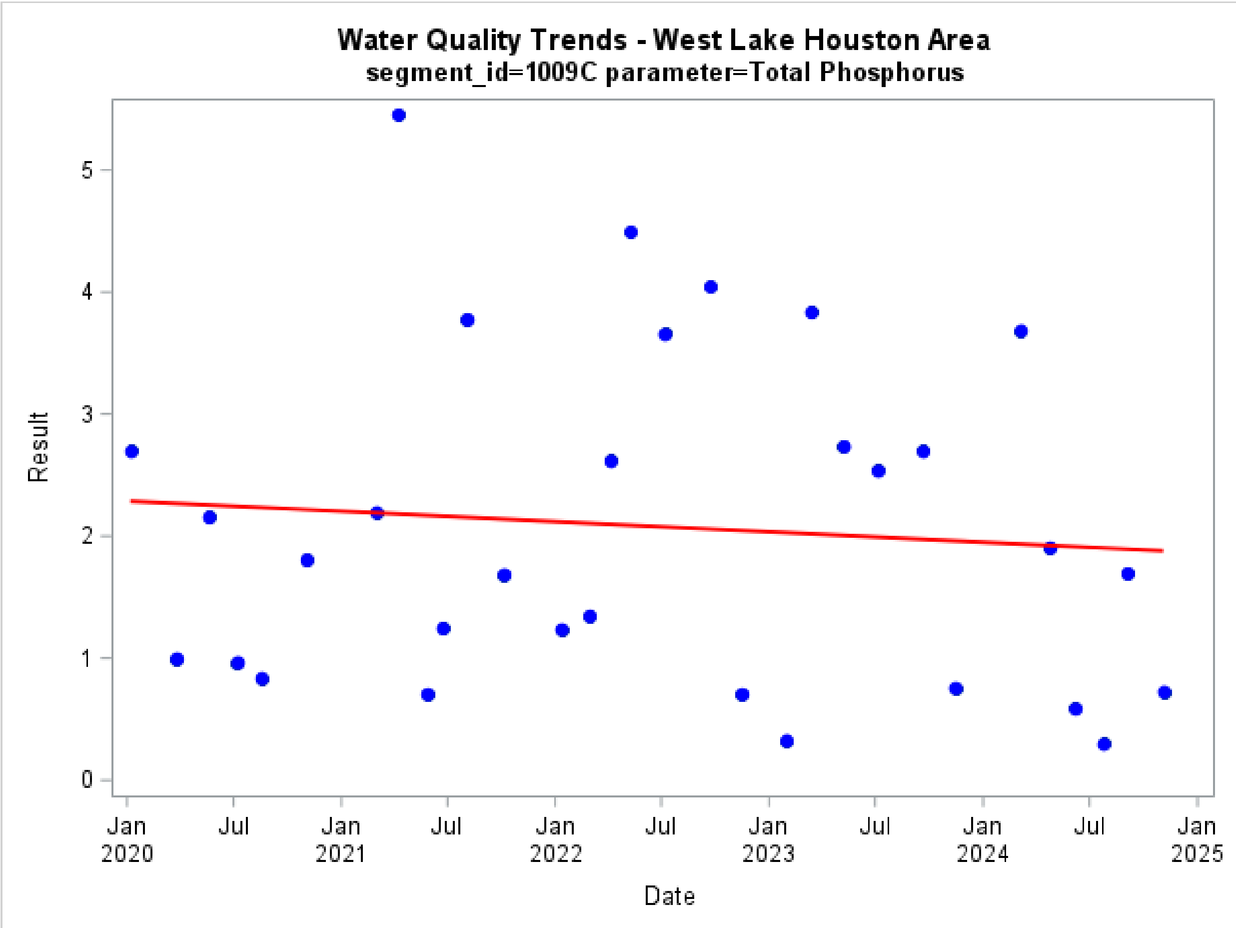
Water Quality Trends - West Lake Houston Area
segment_id=1009C parameter=Nitrate-N
Result
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

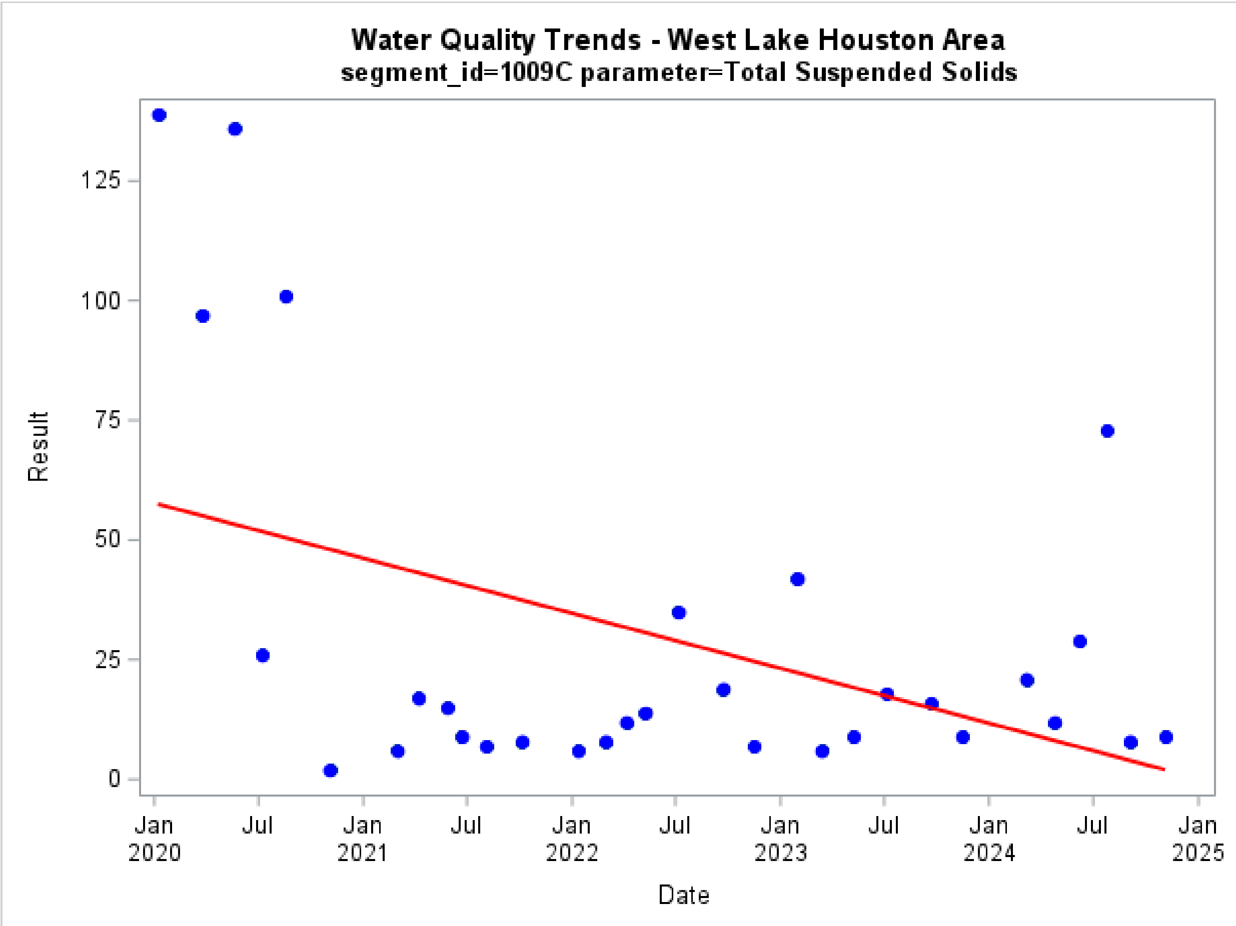


Water Quality Trends - West Lake Houston Area
segment_id=1009C parameter=pH
Result
8.25
8.00
7.75
7.50
7.25
7.00
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

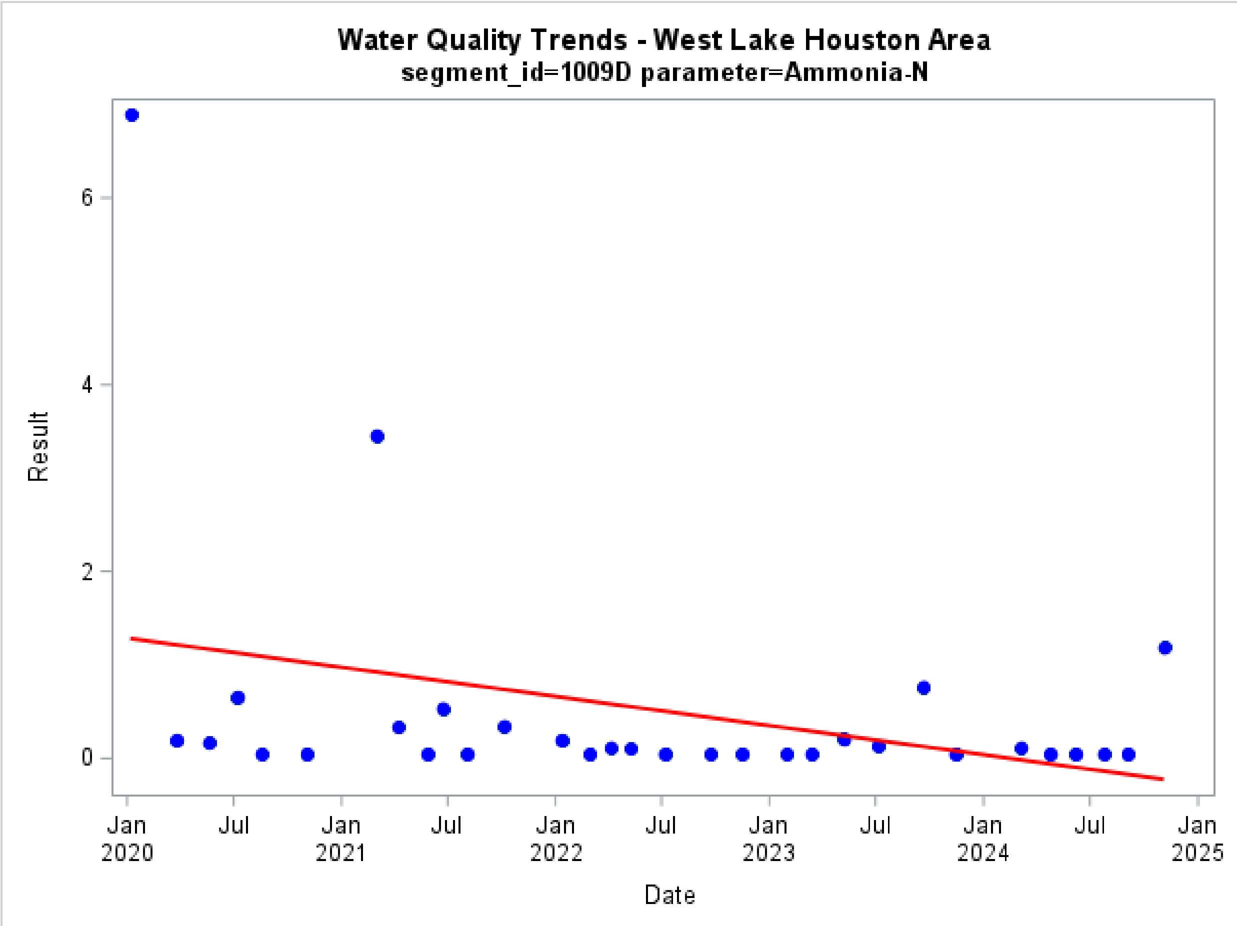


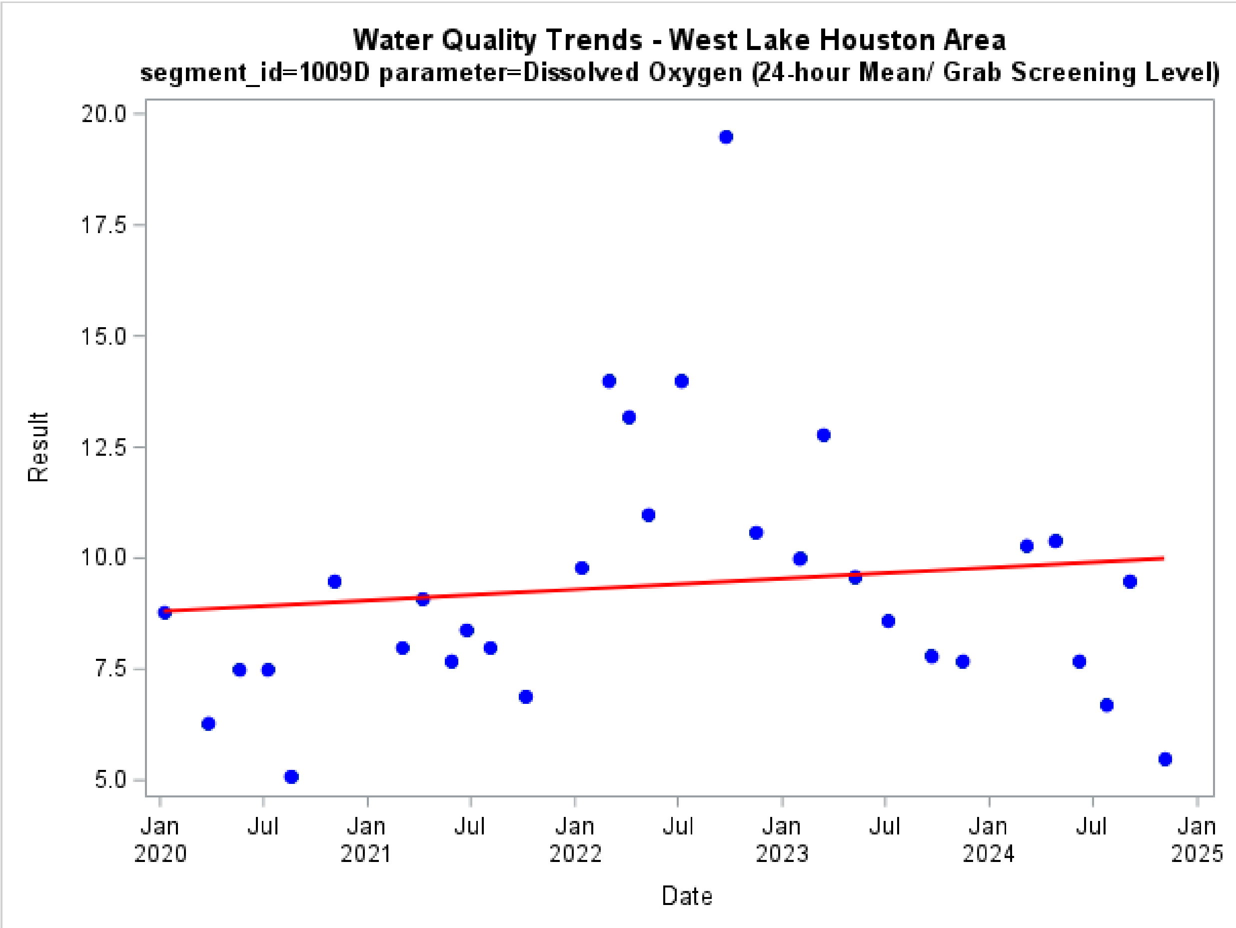
Water Quality Trends - West Lake Houston Area
segment_id=1009C parameter=Temperature
Result
30
25
20
15
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

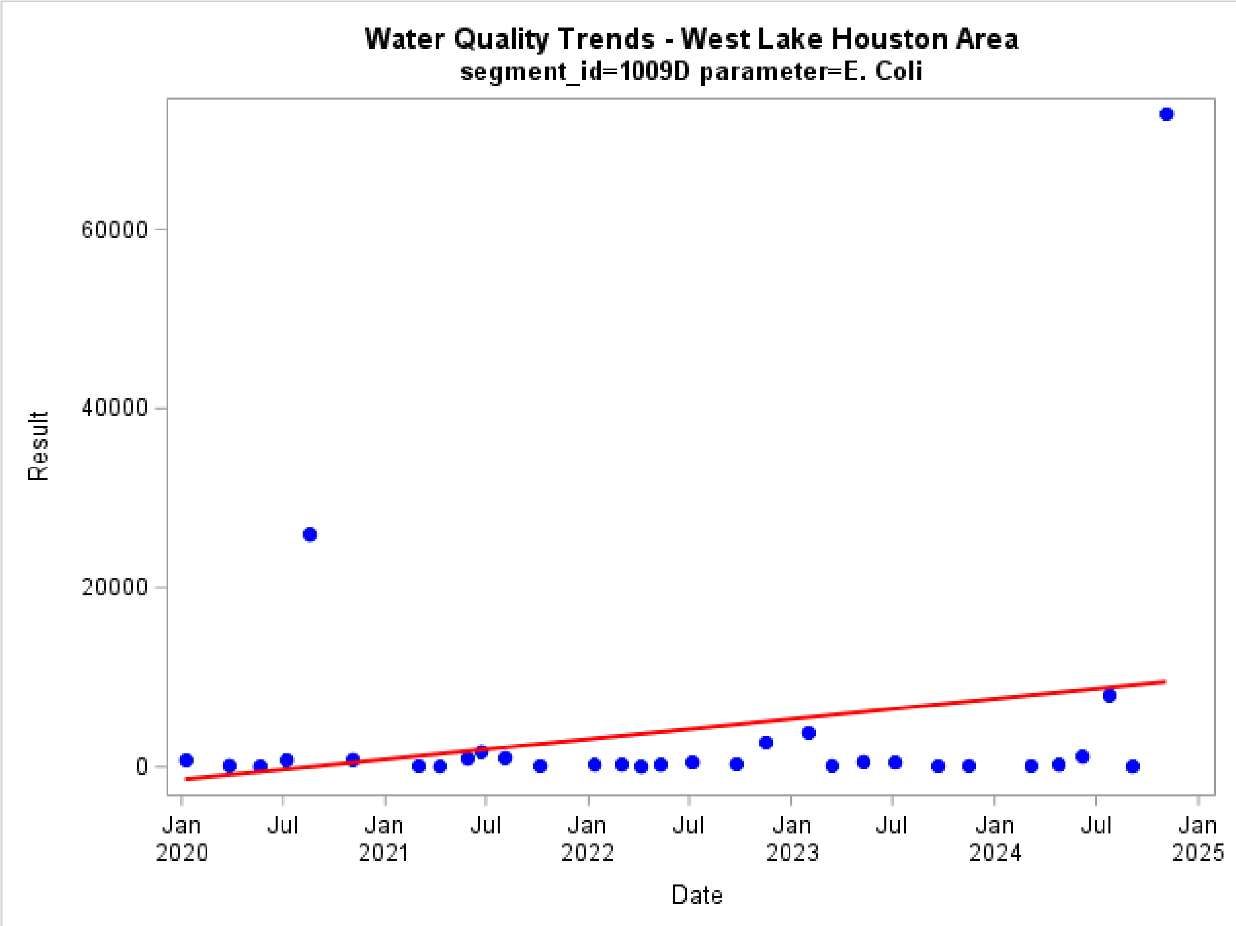

Water Quality Trends - West Lake Houston Area
segment_id=1009C parameter=Total Phosphorus
Result
0
1
2
3
4
5
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

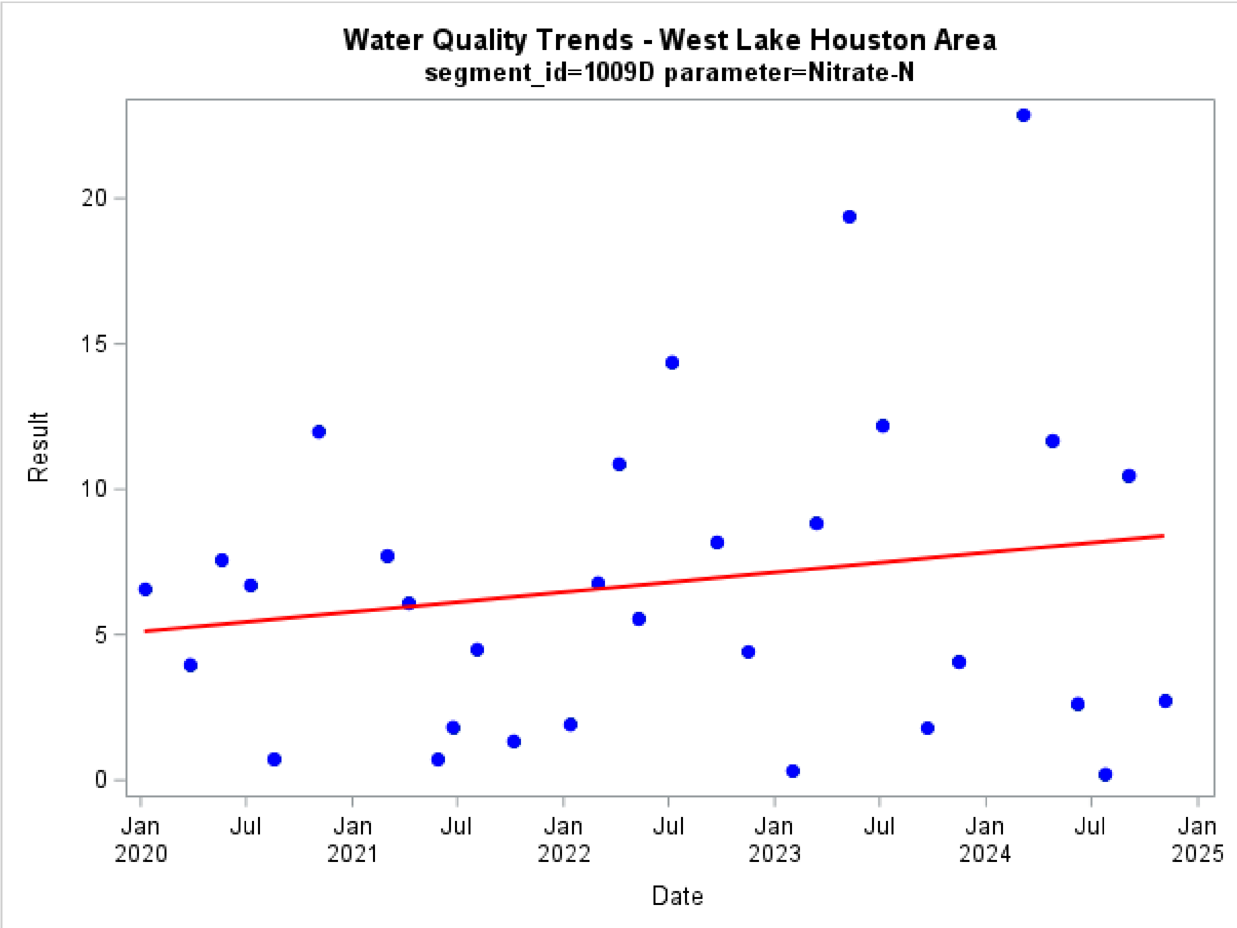

Water Quality Trends - West Lake Houston Area
segment_id=1009C parameter=Total Suspended Solids
Result
0
25
50
75
100
125
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

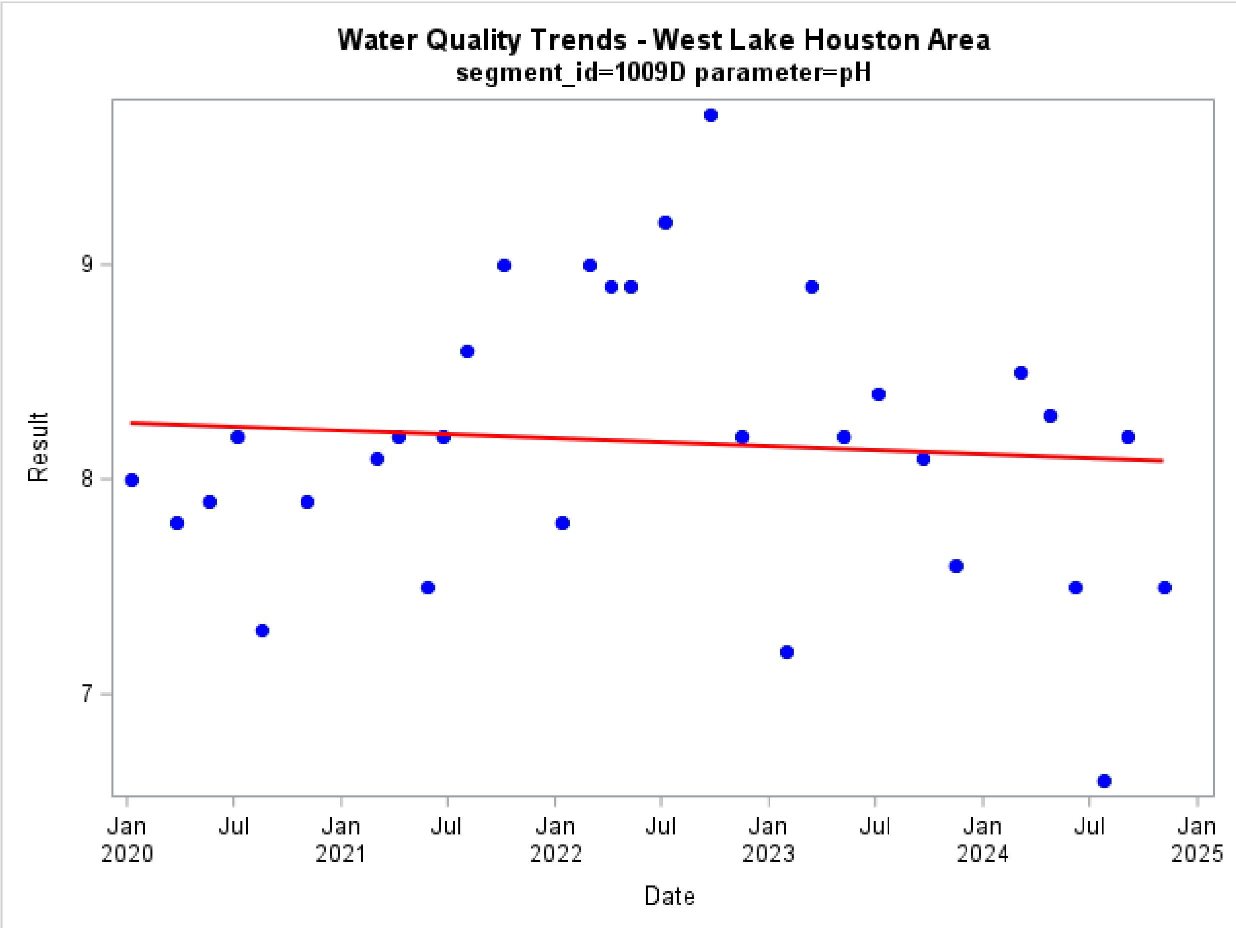
Spring Gully (1009D)

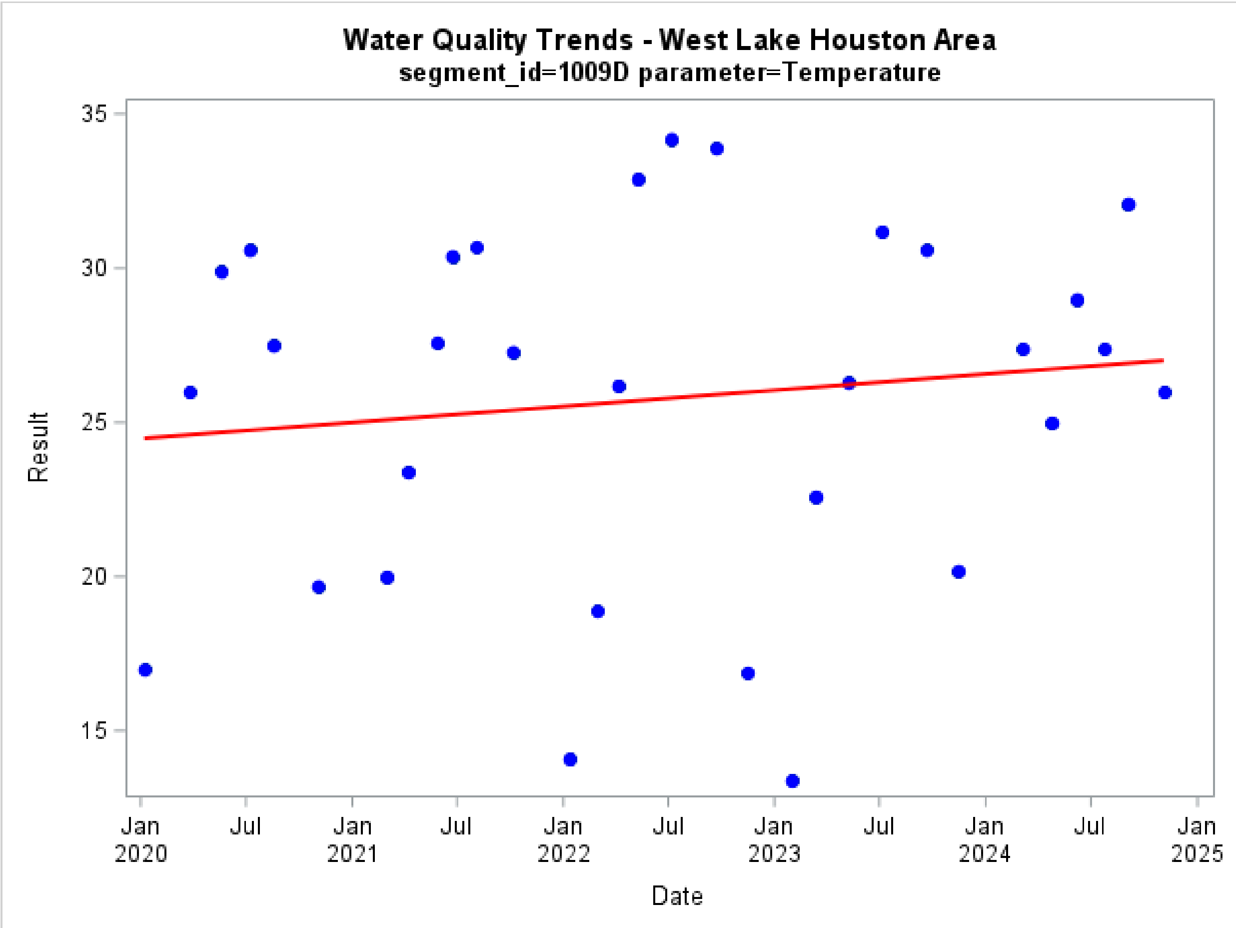


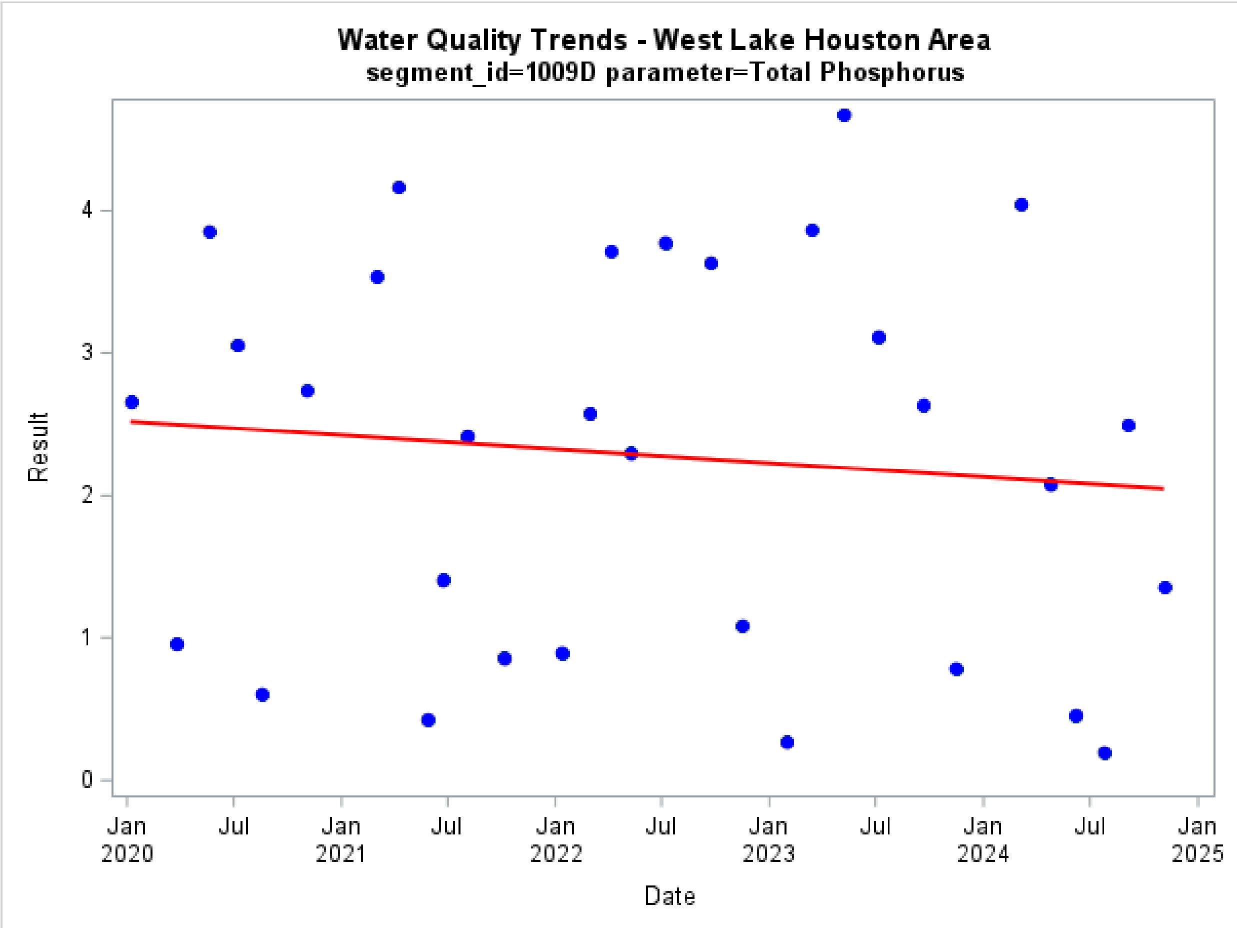

Water Quality Trends - West Lake Houston Area
segment_id=1009D parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
20.0
17.5
15.0
12.5
10.0
7.5
5.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1009D parameter=E. Coli
Result
60000
40000
20000
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

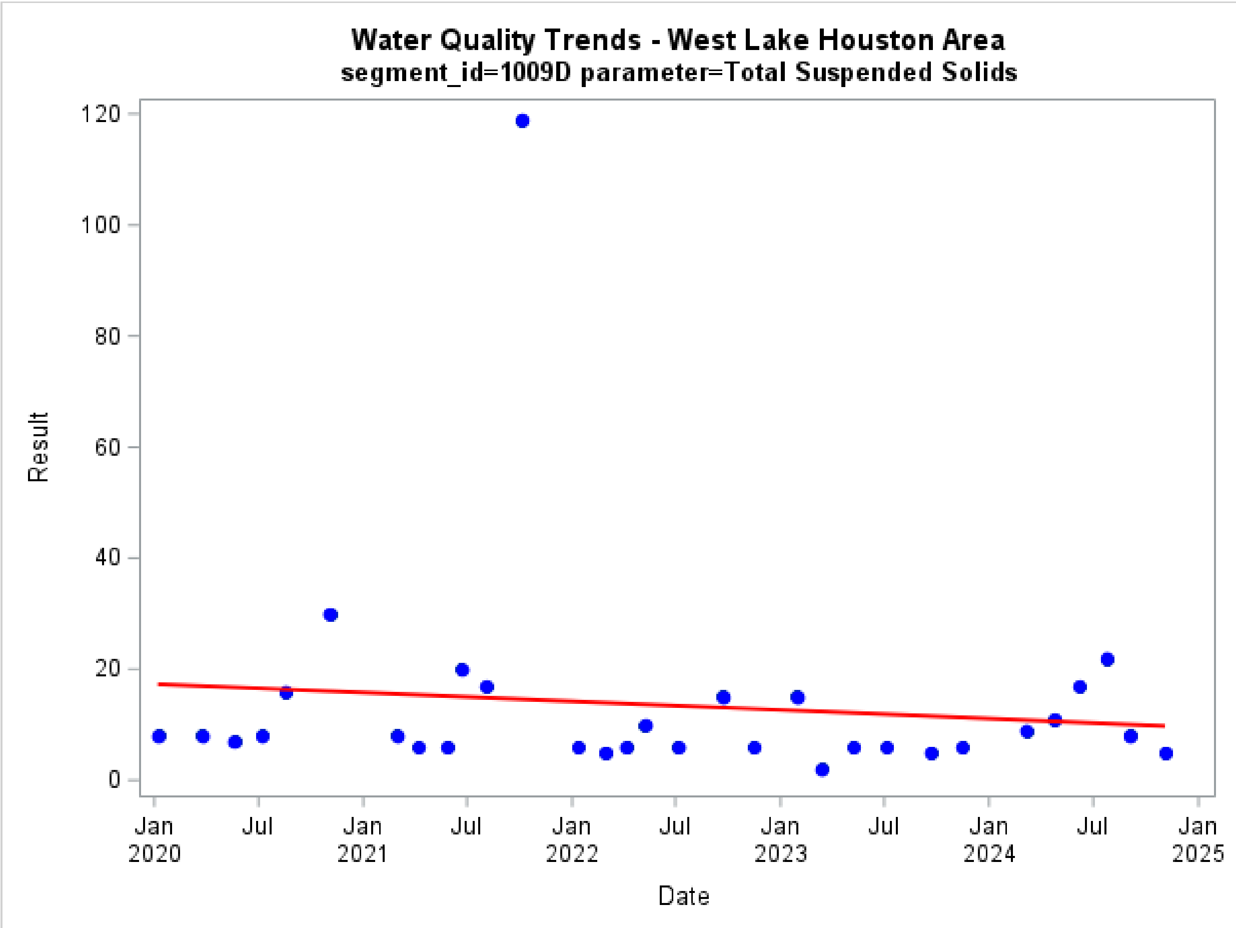

Water Quality Trends - West Lake Houston Area
segment_id=1009D parameter=Nitrate-N
Result
20
15
10
5
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1009D parameter=pH
Result
9
8
7
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

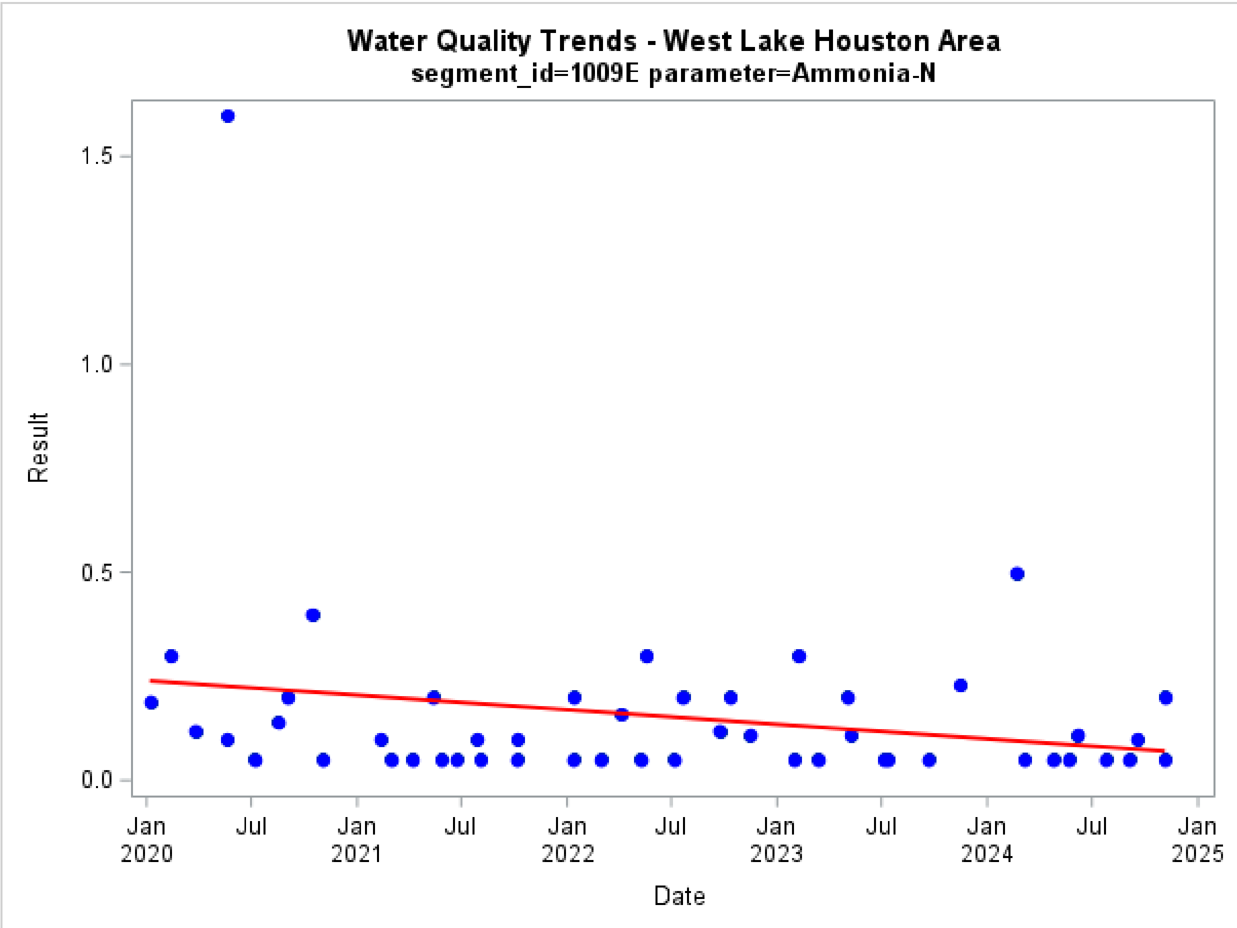

Water Quality Trends - West Lake Houston Area
segment_id=1009D parameter=Temperature
Result
35
30
25
20
15
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

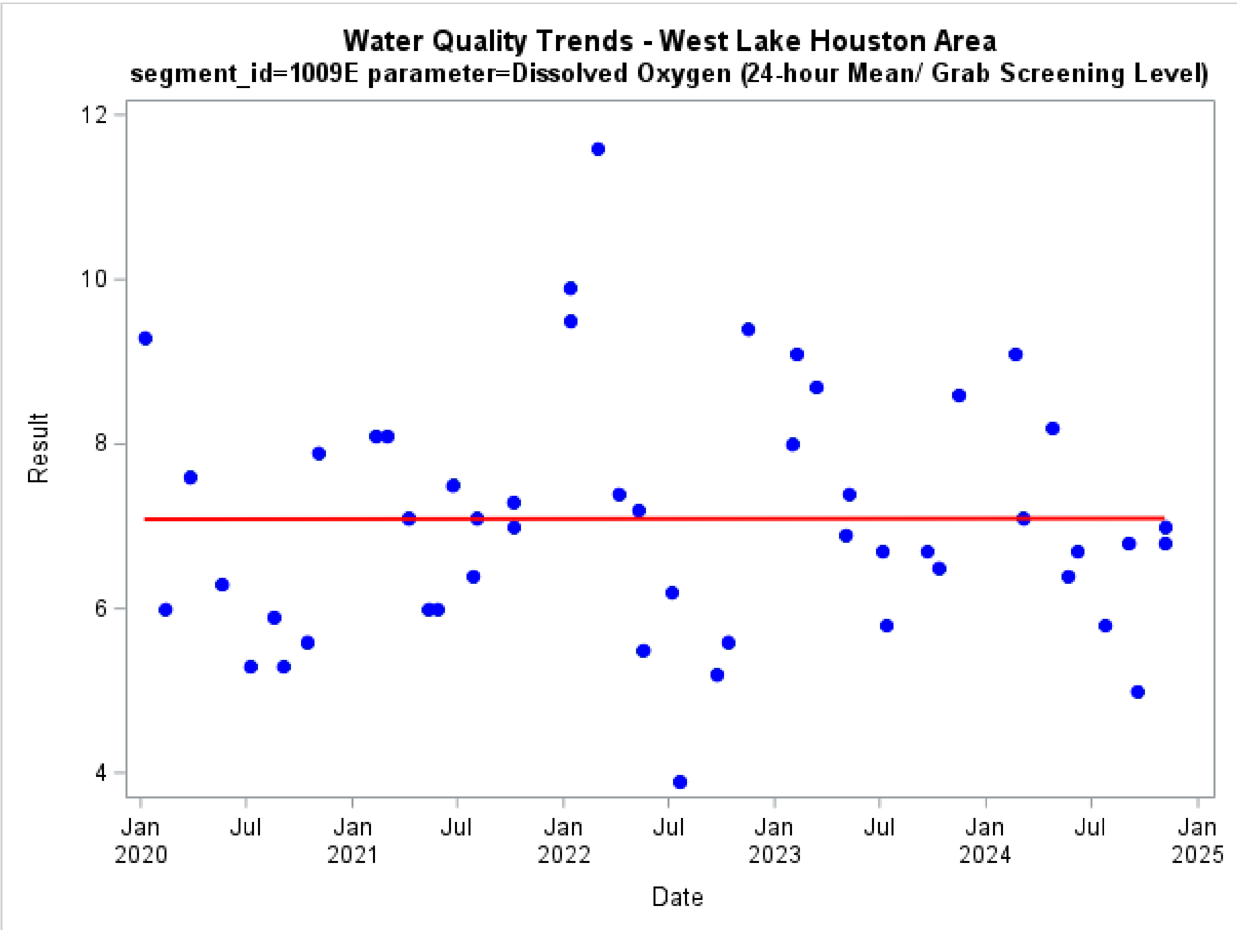


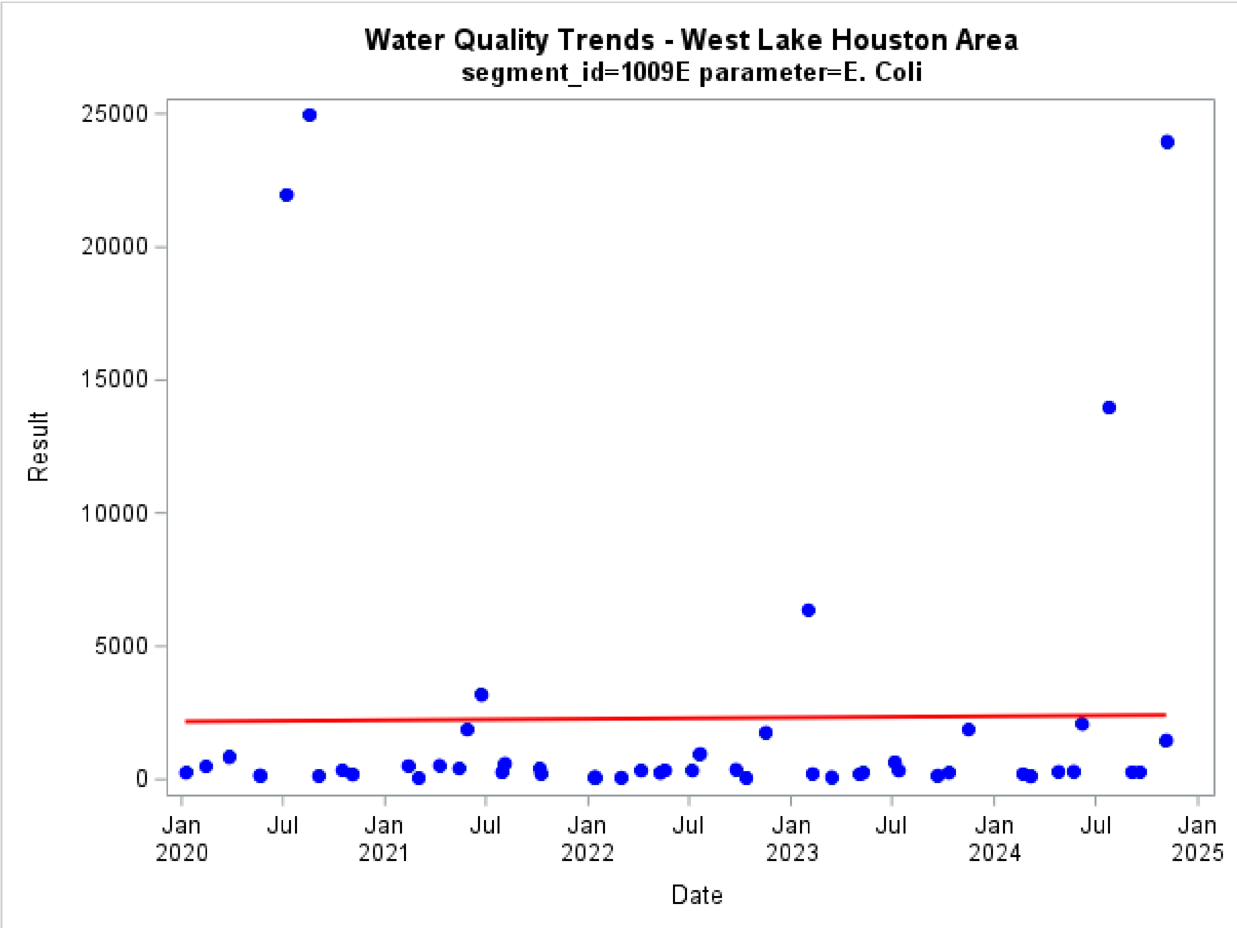
Water Quality Trends - West Lake Houston Area
segment_id=1009D parameter=Total Phosphorus
Result
0
1
2
3
4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1009D parameter=Total Suspended Solids
Result
120
100
80
60
40
20
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

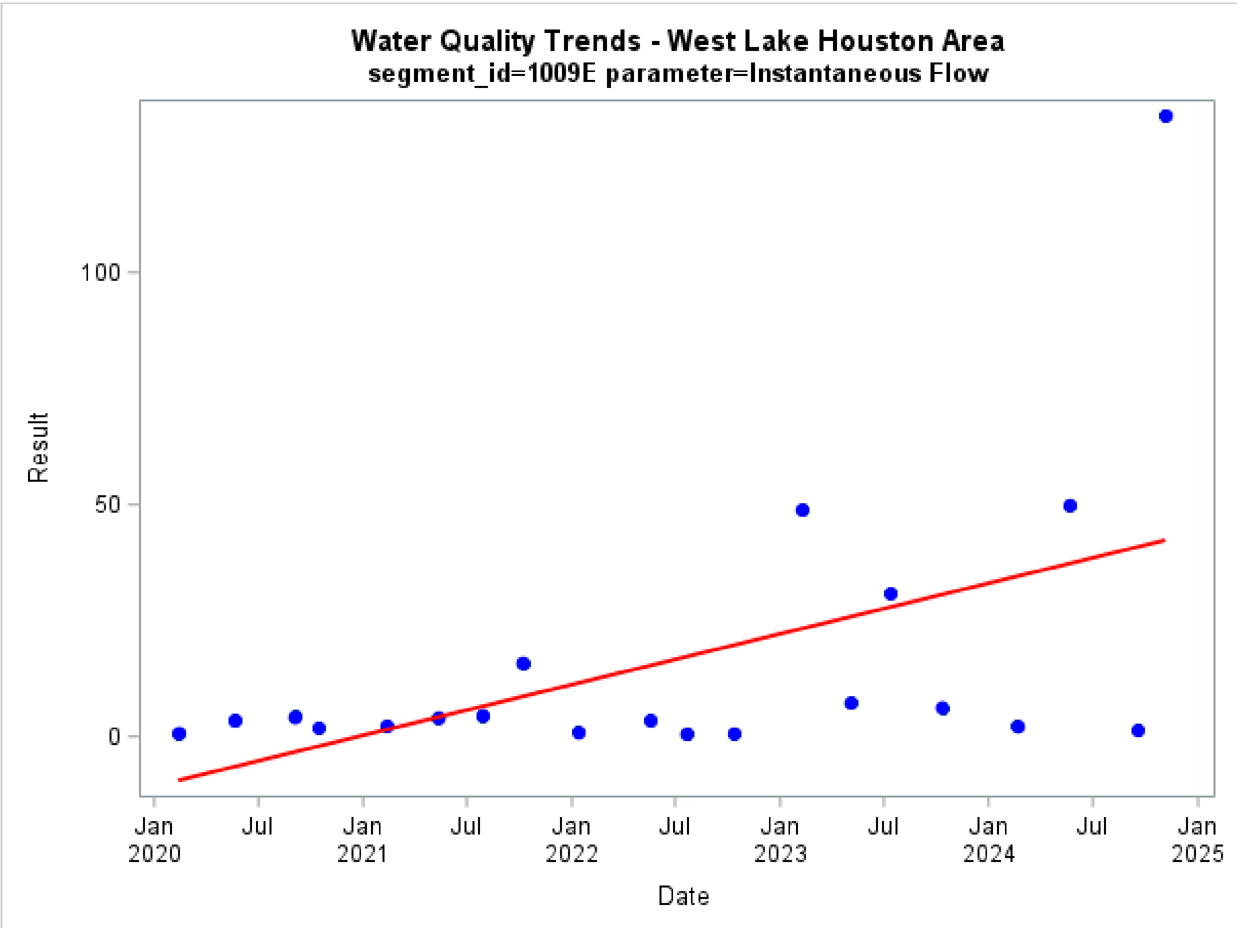
Little Cypress Creek (1009E)



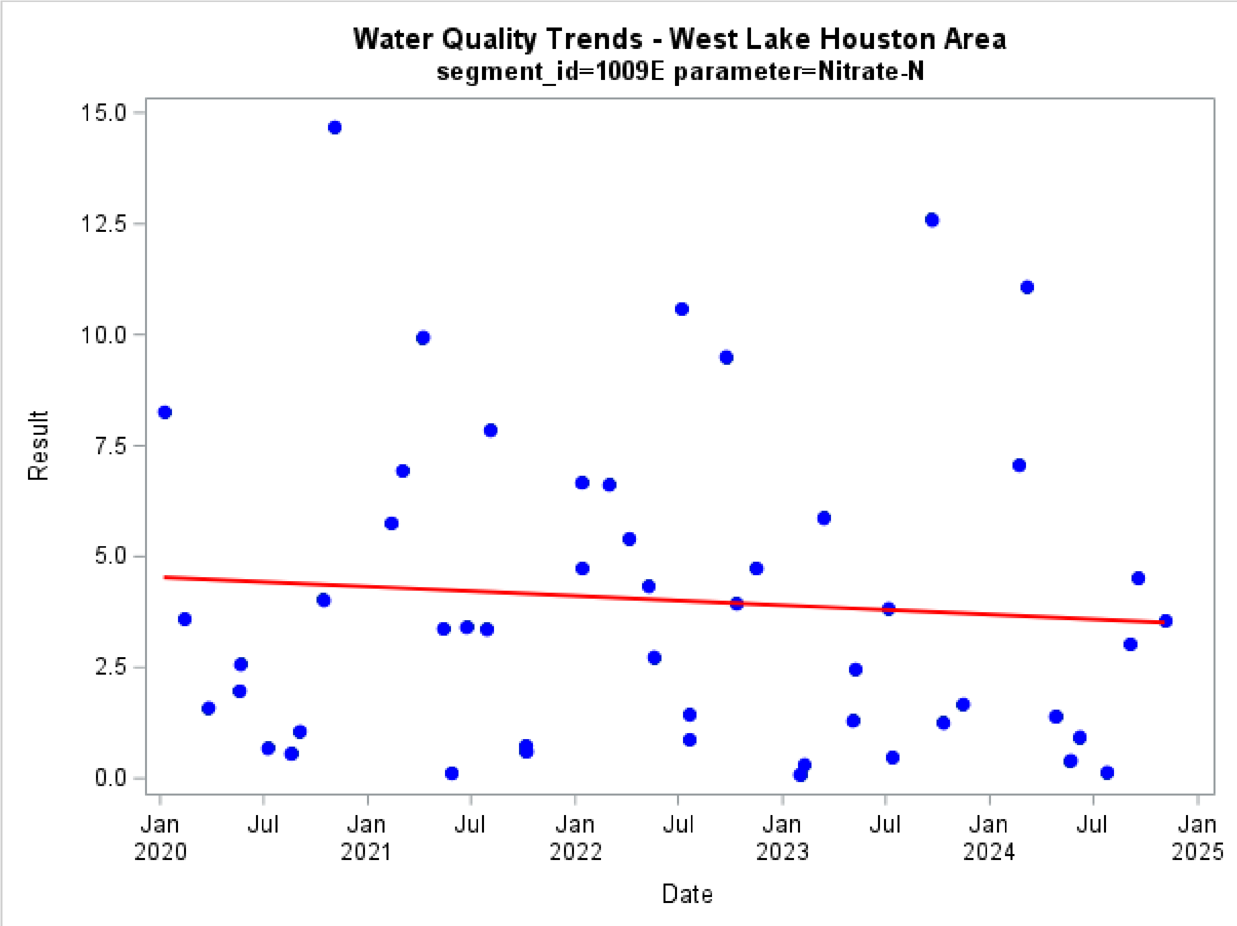

Water Quality Trends - West Lake Houston Area
segment_id=1009E parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
12
10
8
6
4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



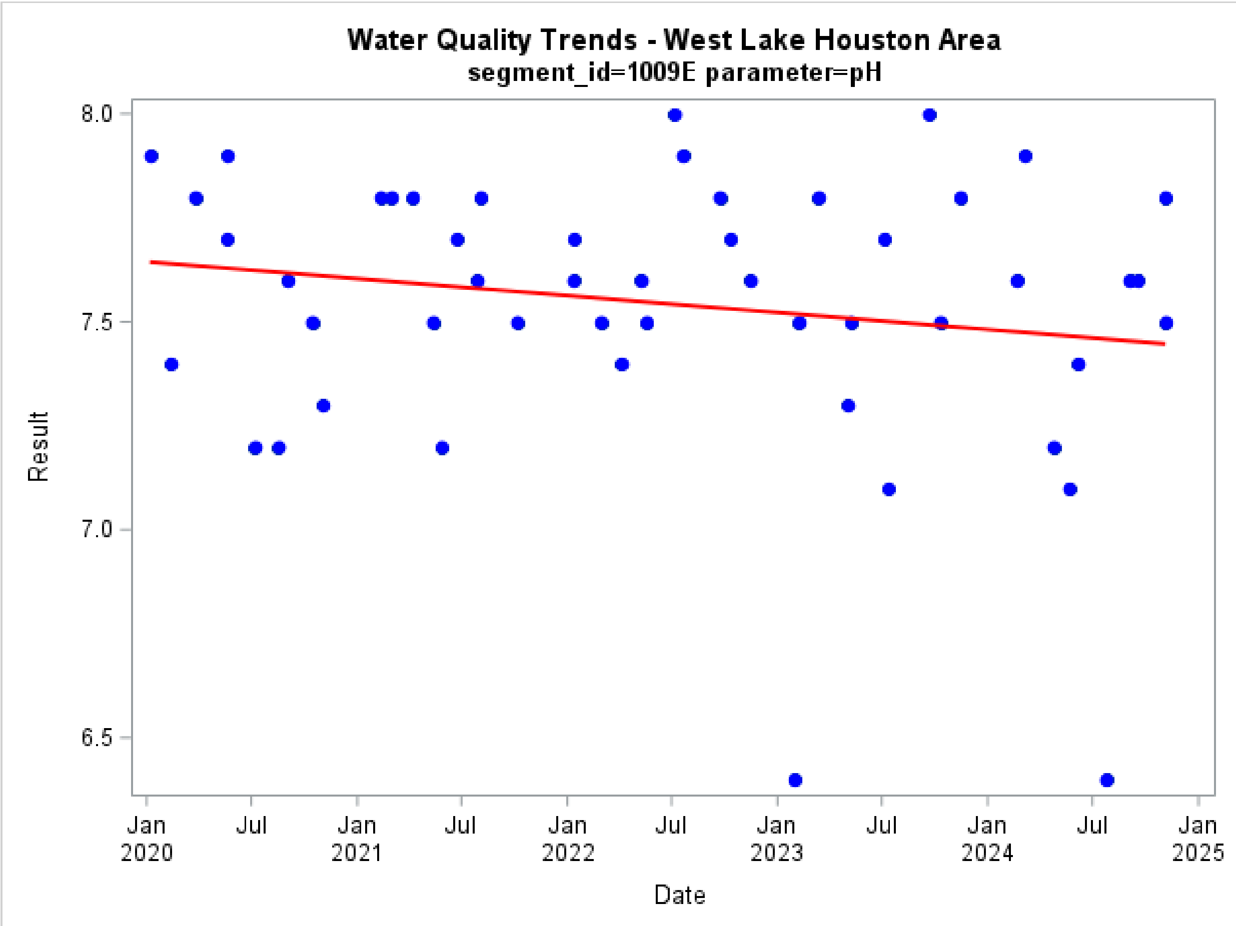
Water Quality Trends - West Lake Houston Area
segment_id=1009E parameter=E. Coli
25000
20000
15000
10000
5000
0
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

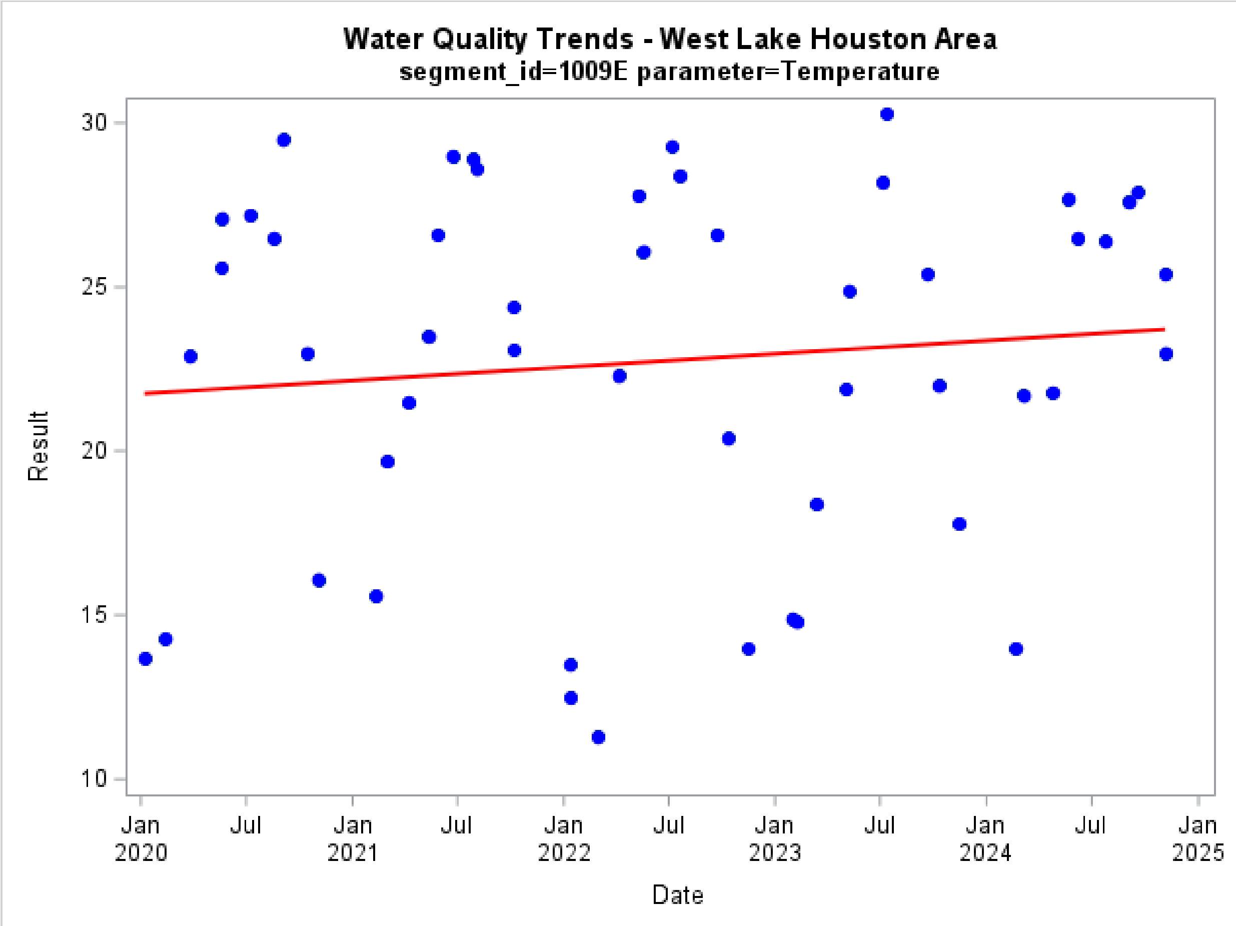


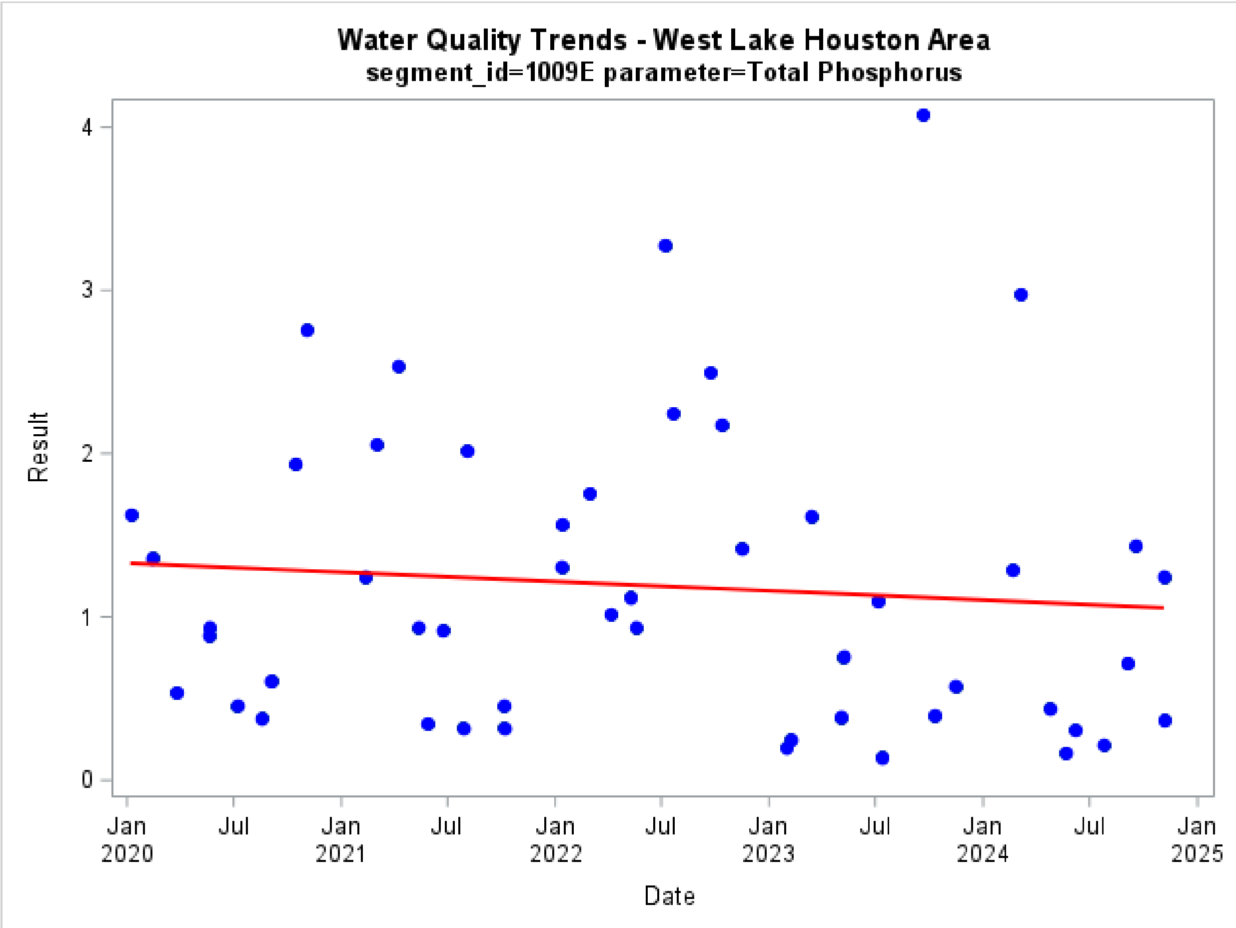
Water Quality Trends - West Lake Houston Area
segment_id=1009E parameter=Instantaneous Flow
Result
100
50
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



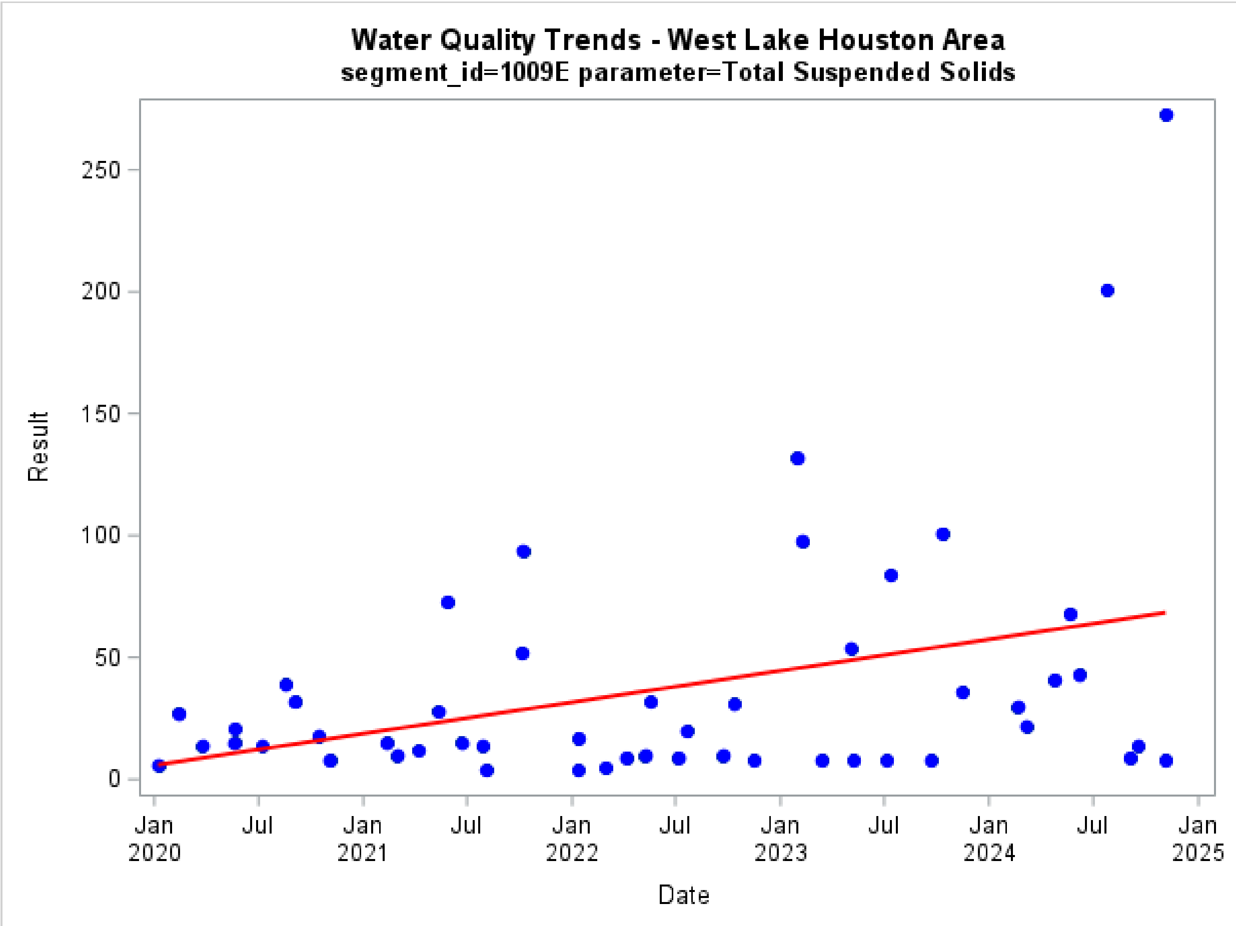
Water Quality Trends - West Lake Houston Area
segment_id=1009E parameter=Nitrate-N
Result
0.0
2.5
5.0
7.5
10.0
12.5
15.0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1009E parameter=pH
8.0
7.5
7.0
6.5
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1009E parameter=Temperature
Result
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date



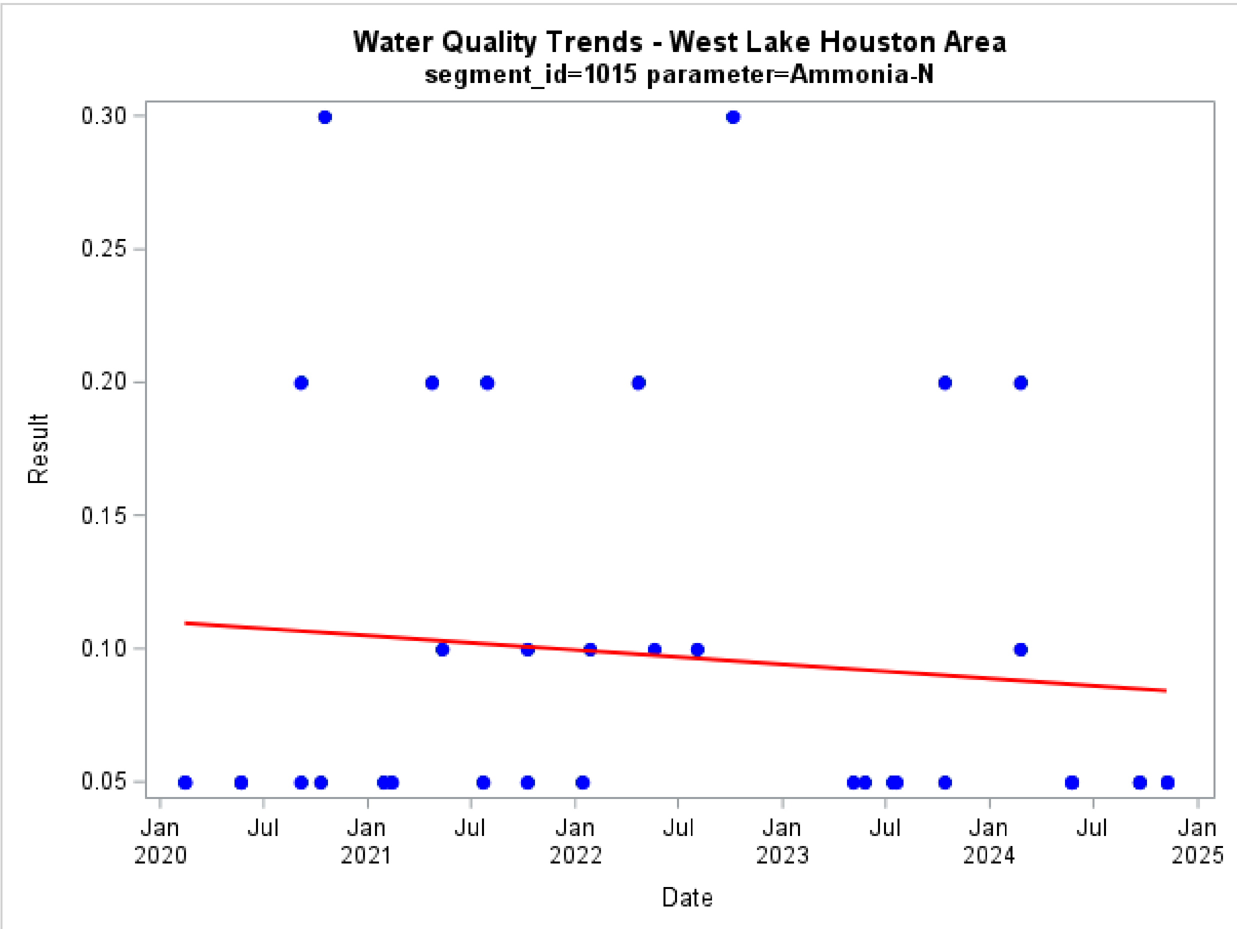
Water Quality Trends - West Lake Houston Area
segment_id=1009E parameter=Total Phosphorus
Result
0
1
2
3
4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

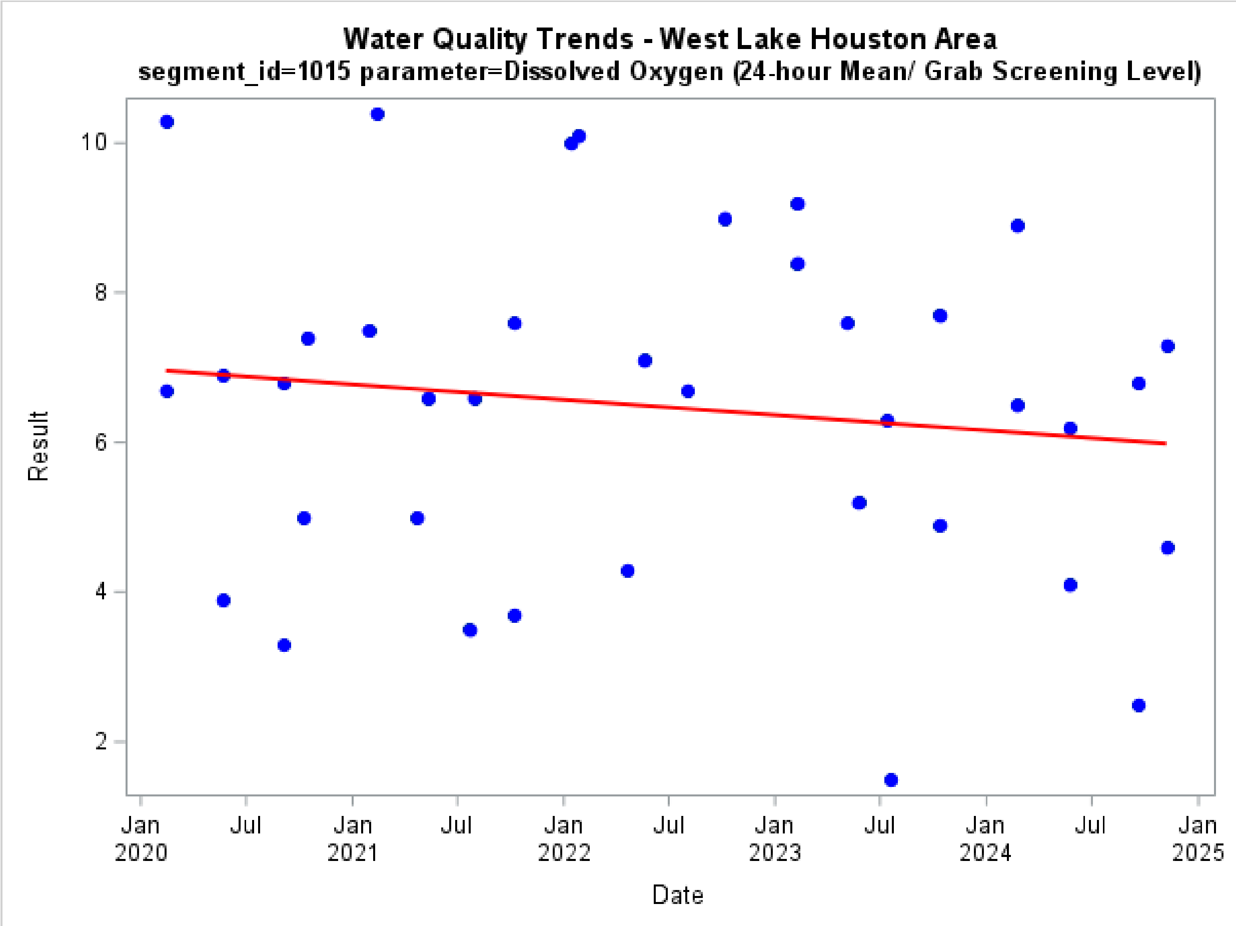


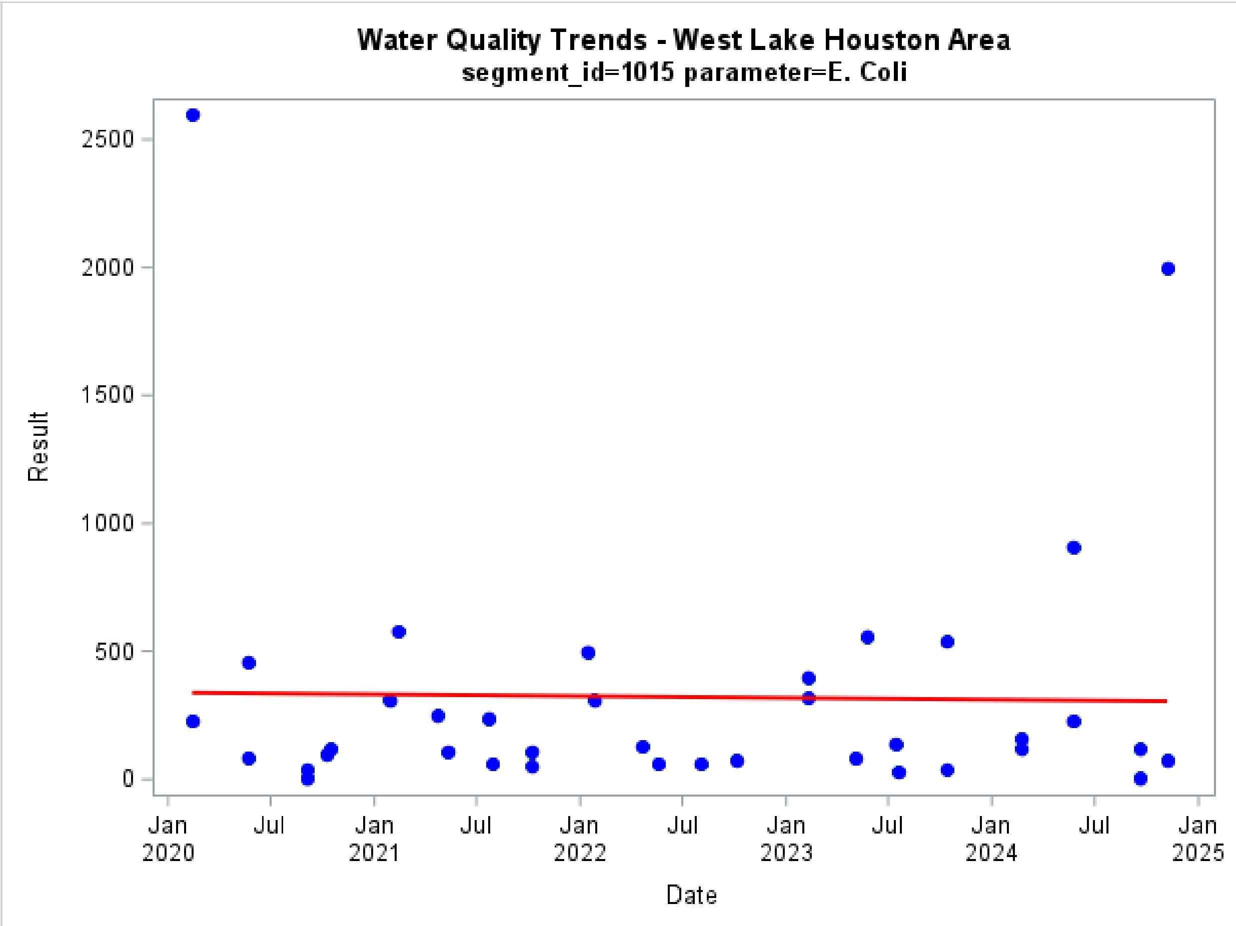
Water Quality Trends - West Lake Houston Area
segment_id=1009E parameter=Total Suspended Solids
Result
250
200
150
100
50
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

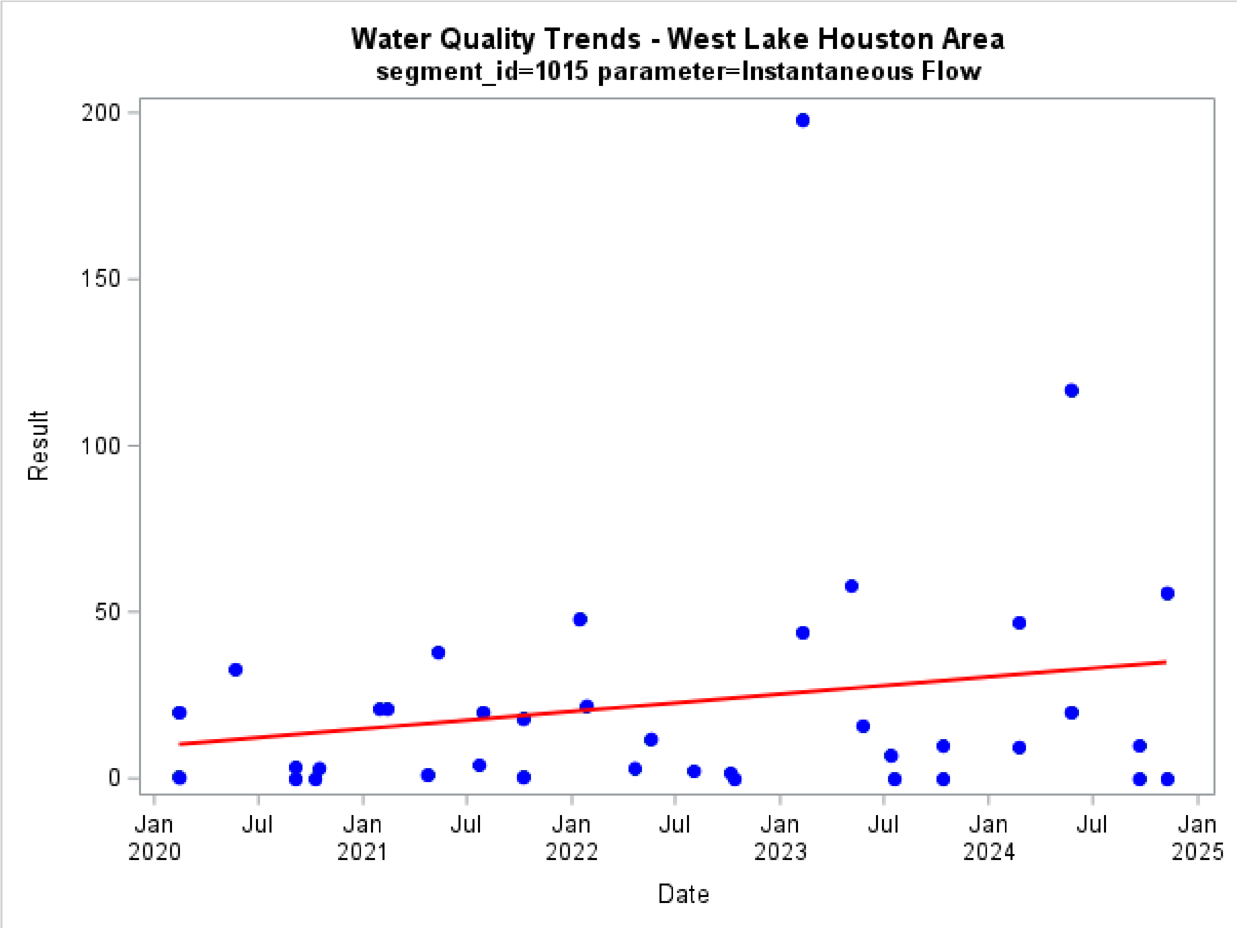
Lake Creek Watershed

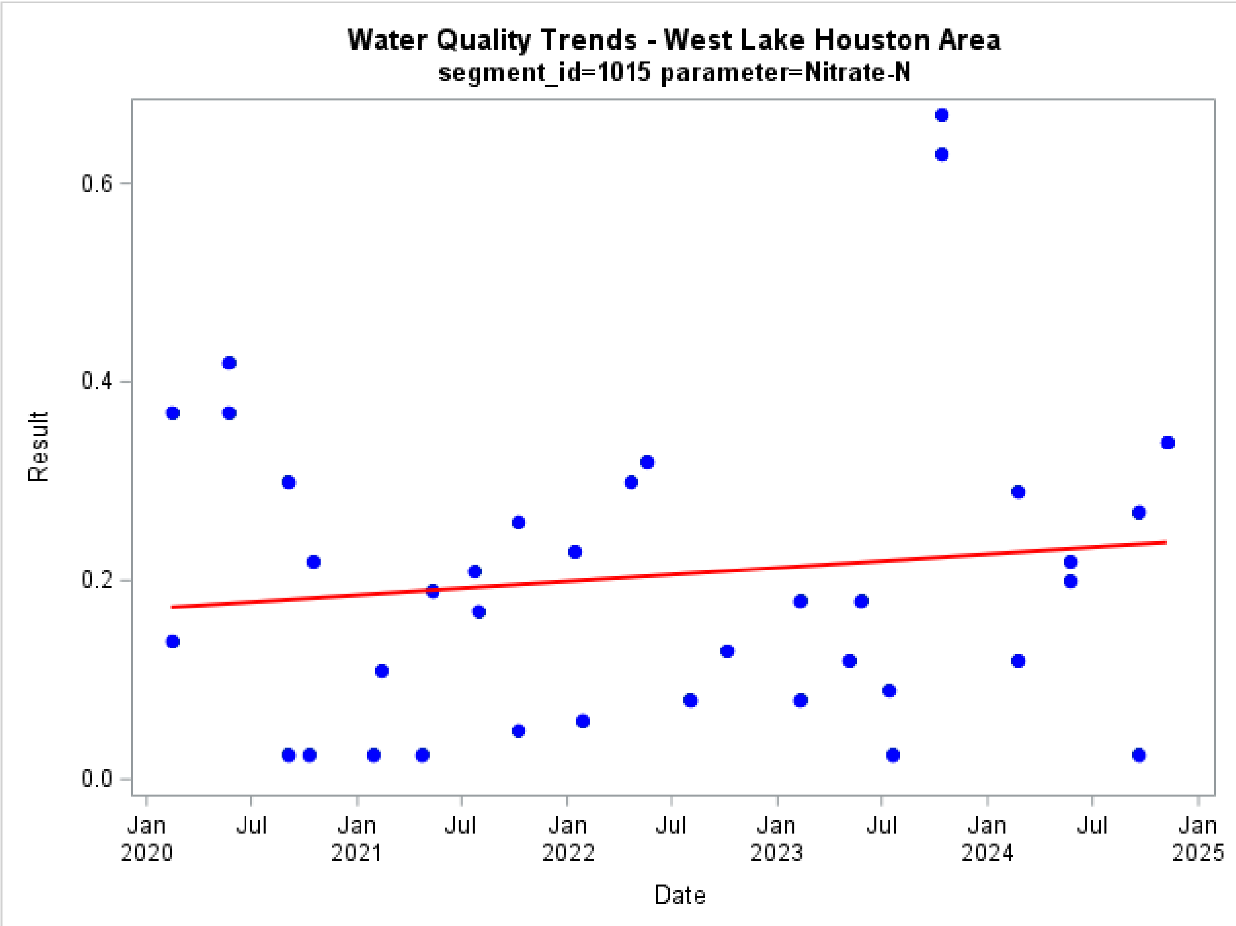
Lake Creek (1015)

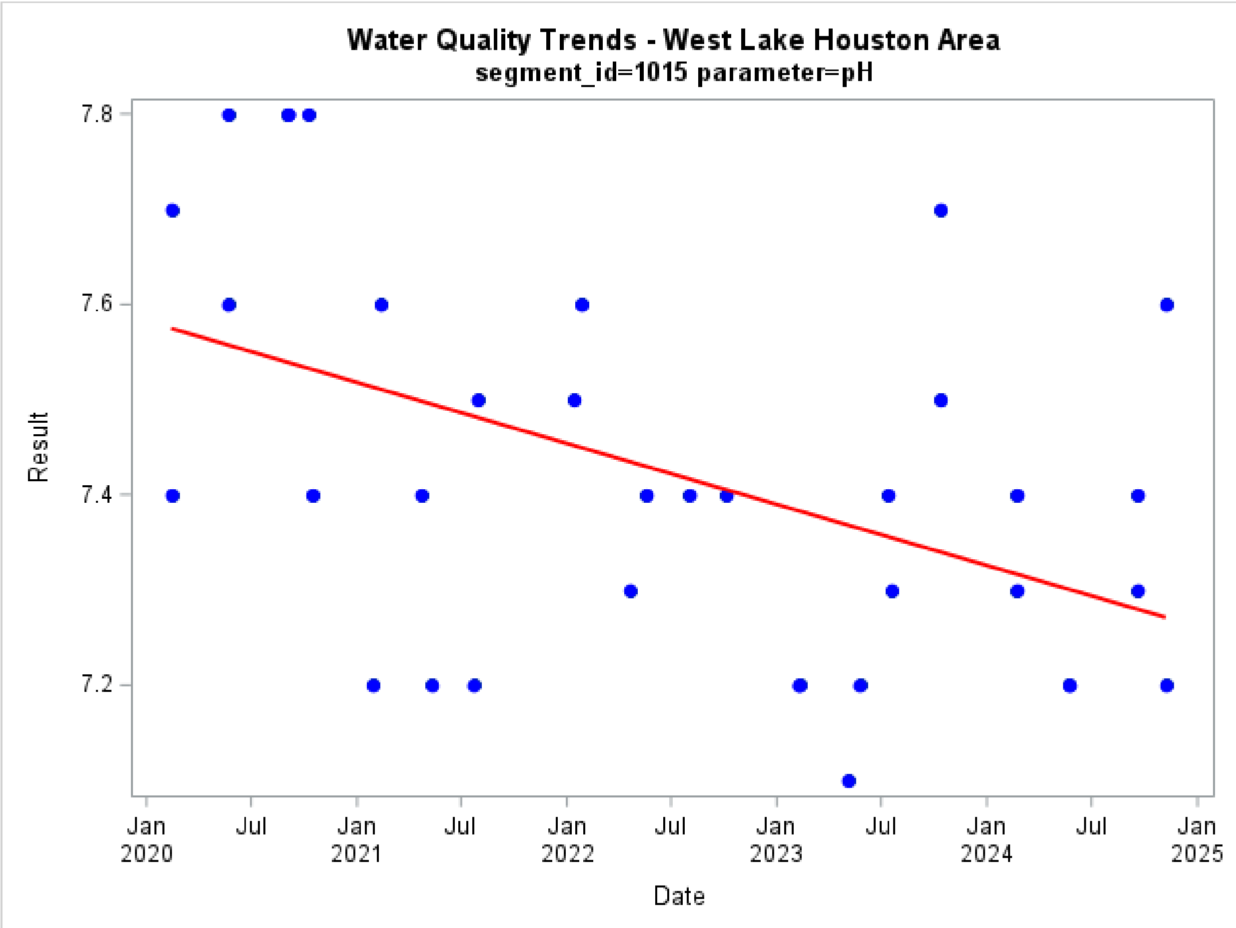


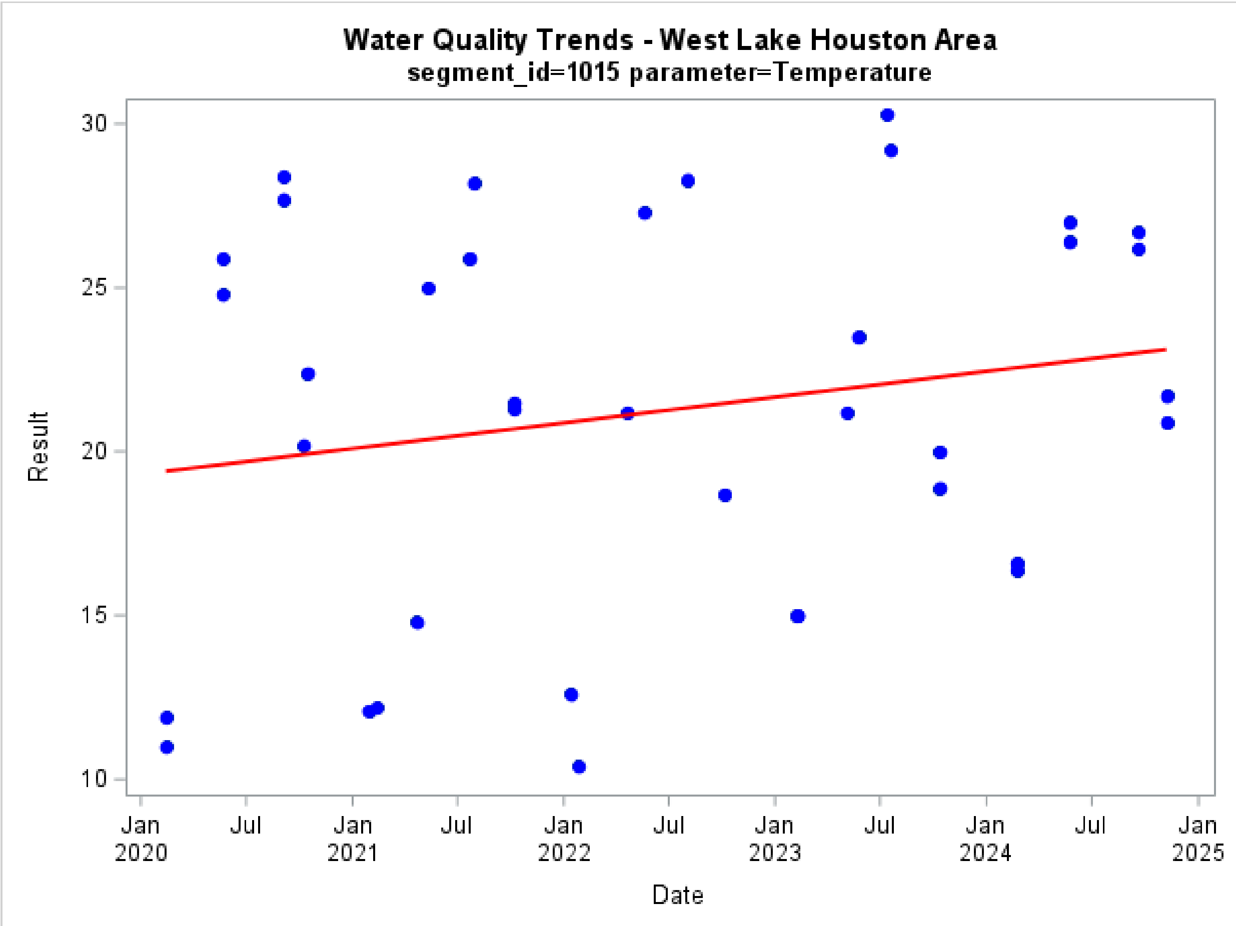

Water Quality Trends - West Lake Houston Area
segment_id=1015 parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
10
8
6
4
2
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

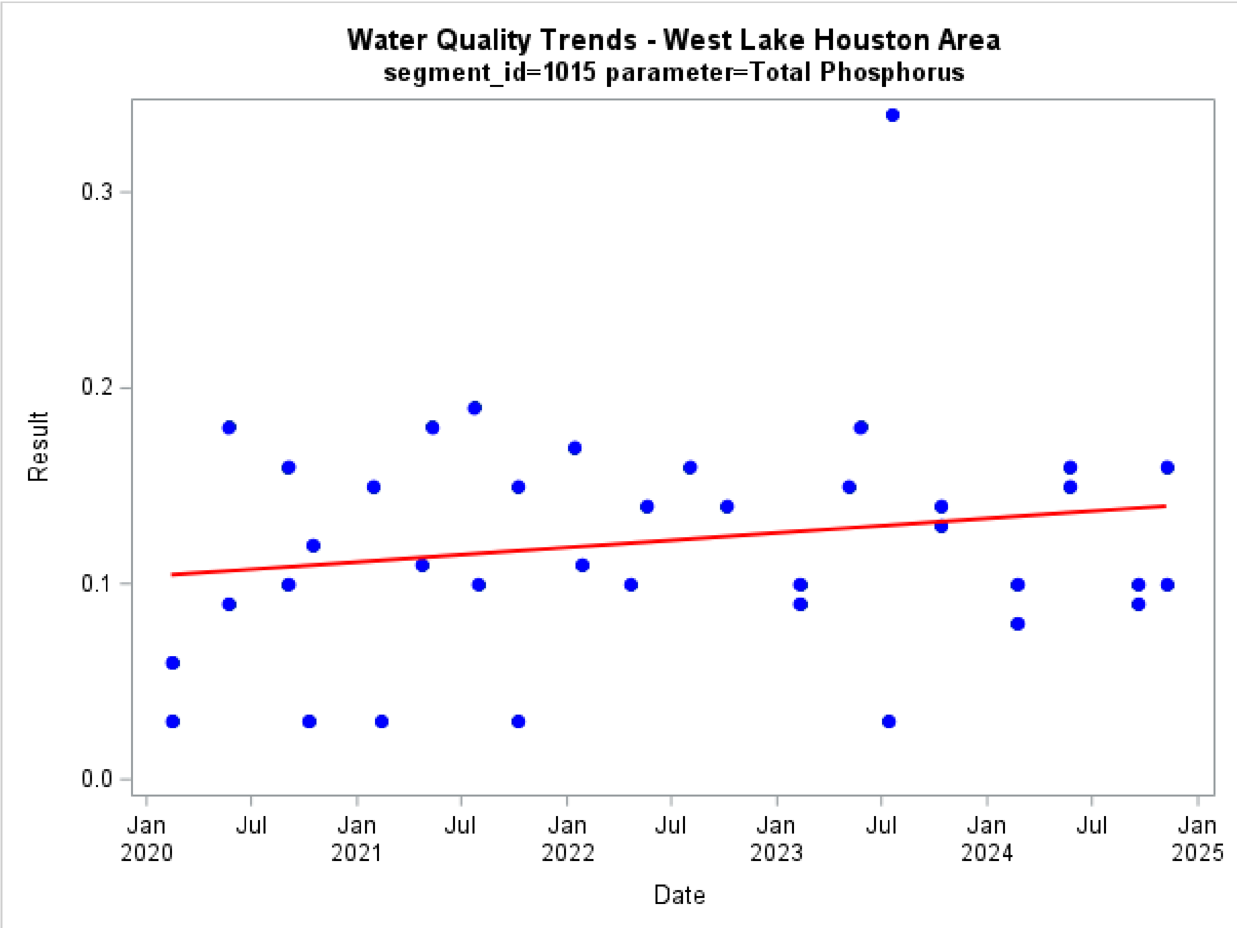

Water Quality Trends - West Lake Houston Area
segment_id=1015 parameter=E. Coli
Result
2500
2000
1500
1000
500
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

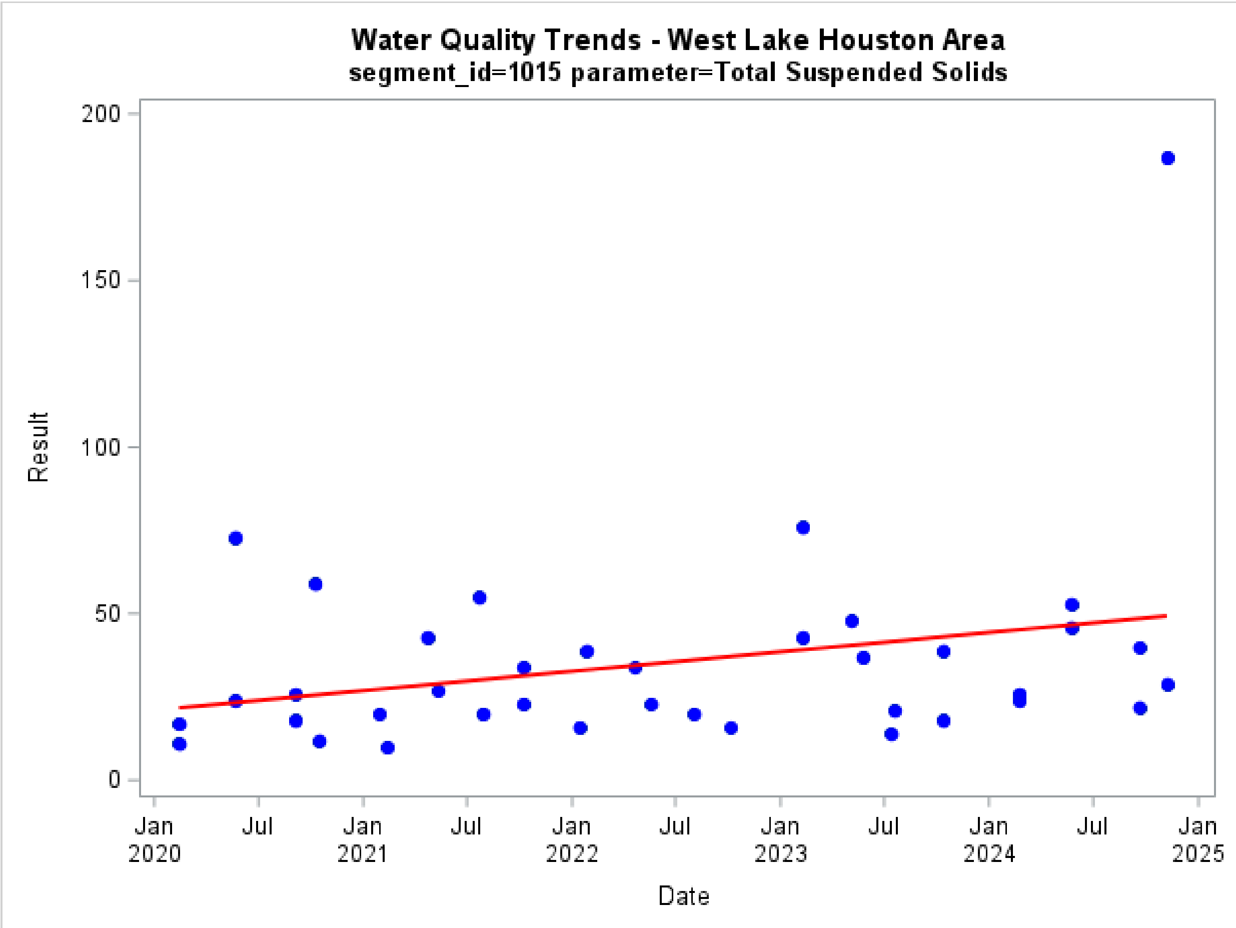

Water Quality Trends - West Lake Houston Area
segment_id=1015 parameter=Instantaneous Flow
Result
200
150
100
50
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1015 parameter=Nitrate-N
Result
0.0
0.2
0.4
0.6
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1015 parameter=pH
Result
7.8
7.6
7.4
7.2
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

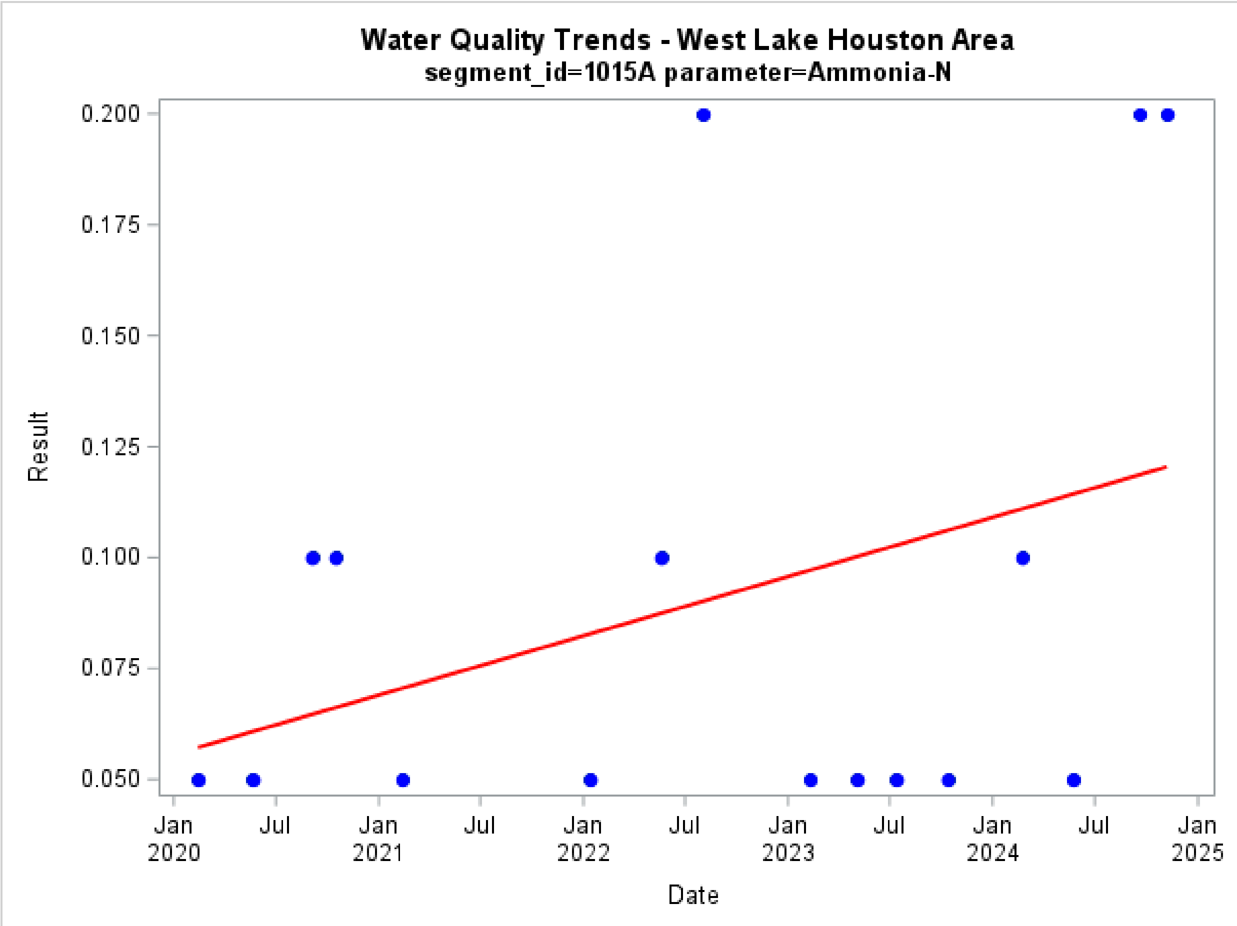

Water Quality Trends - West Lake Houston Area
segment_id=1015 parameter=Temperature
Result
30
25
20
15
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

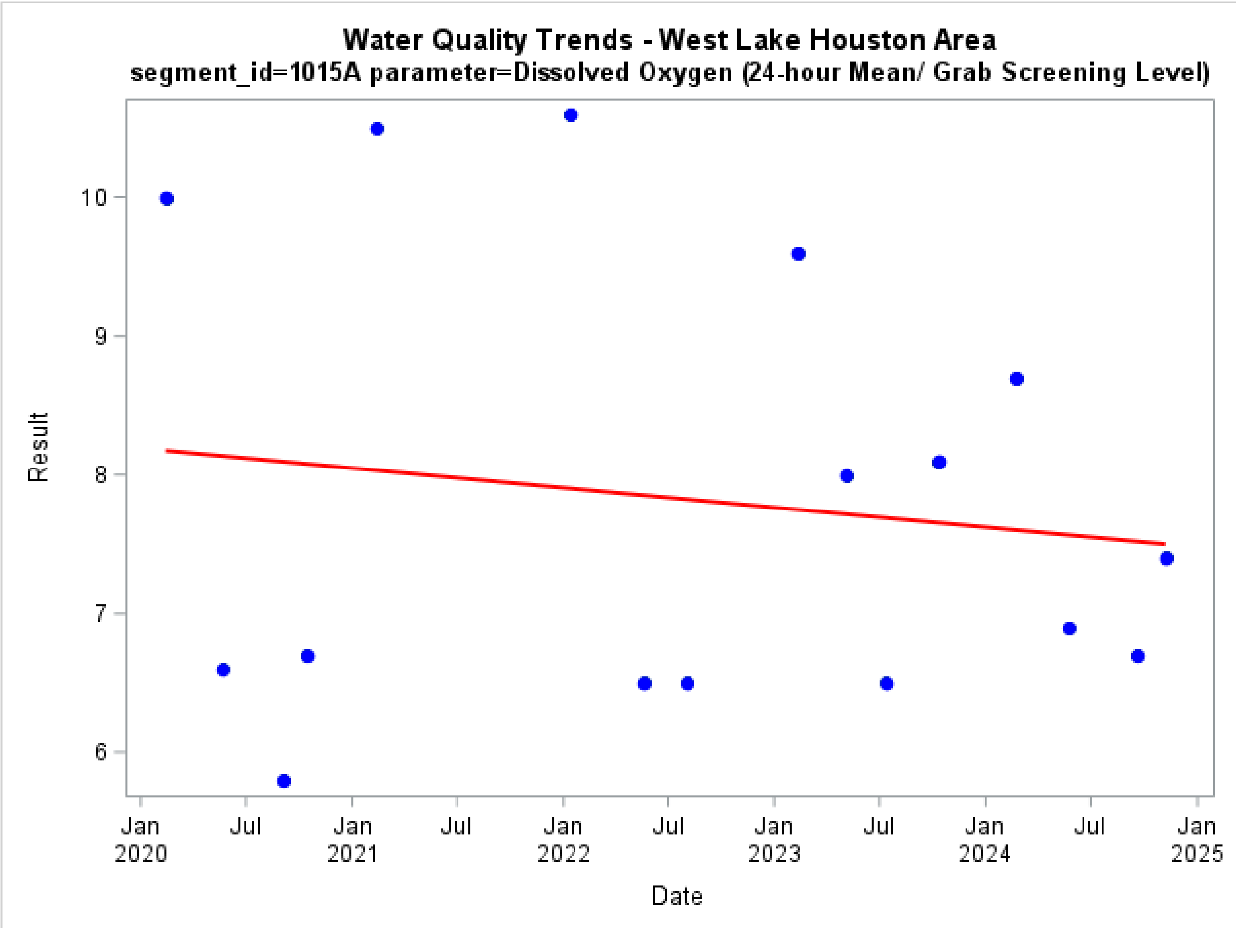

Water Quality Trends - West Lake Houston Area
segment_id=1015 parameter=Total Phosphorus
Result
0.0
0.1
0.2
0.3
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

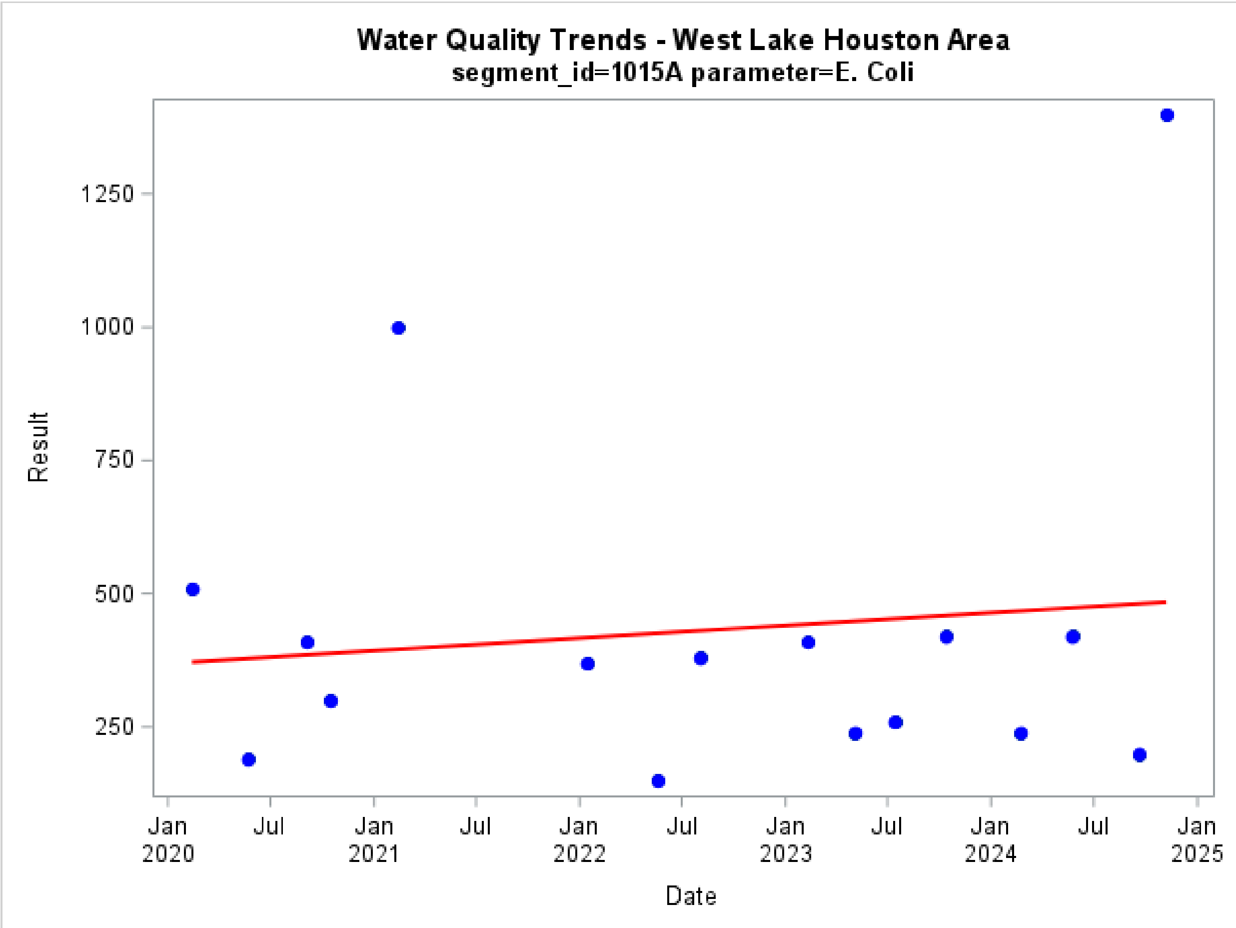


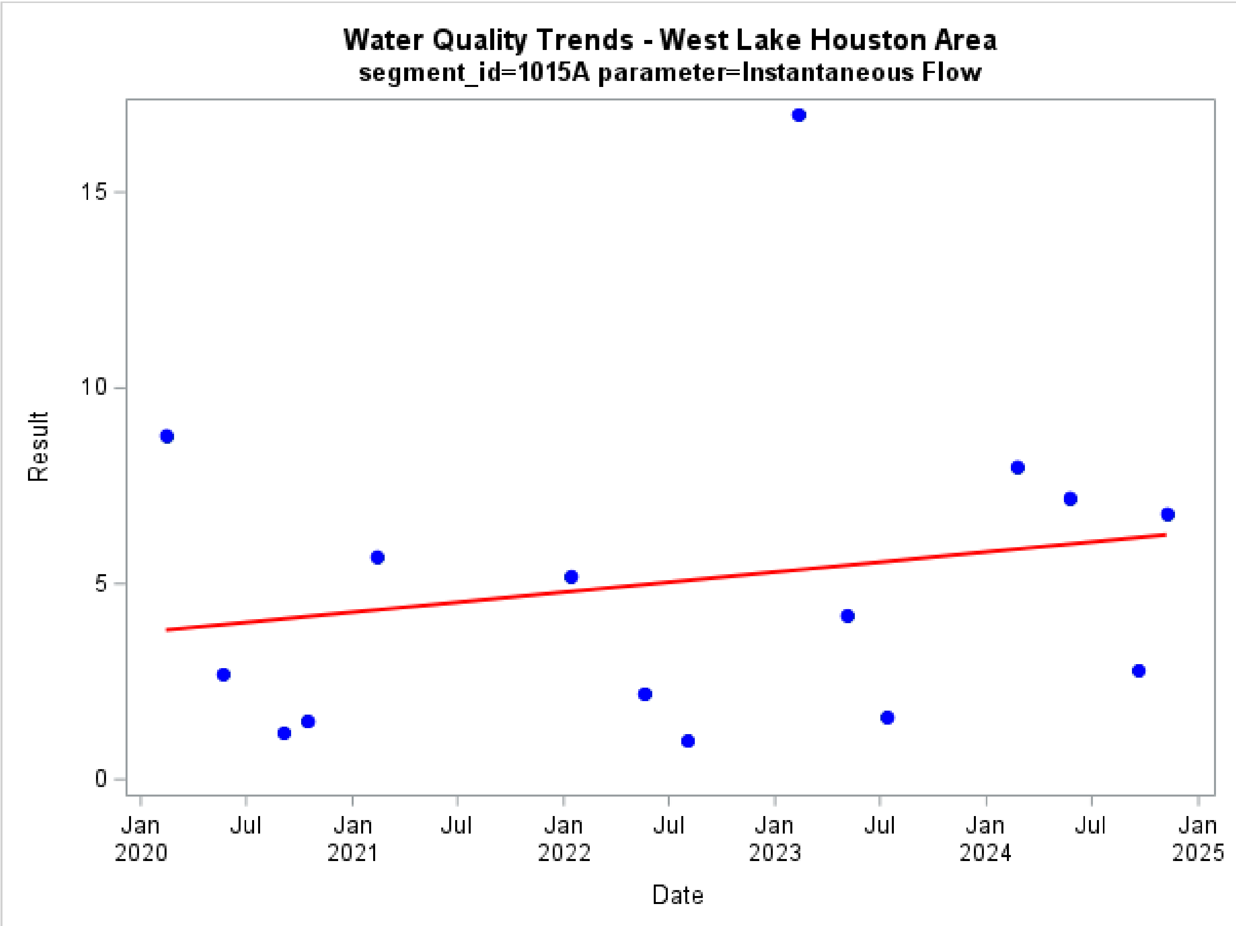
Water Quality Trends - West Lake Houston Area
segment_id=1015 parameter=Total Suspended Solids
Result
200
150
100
50
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

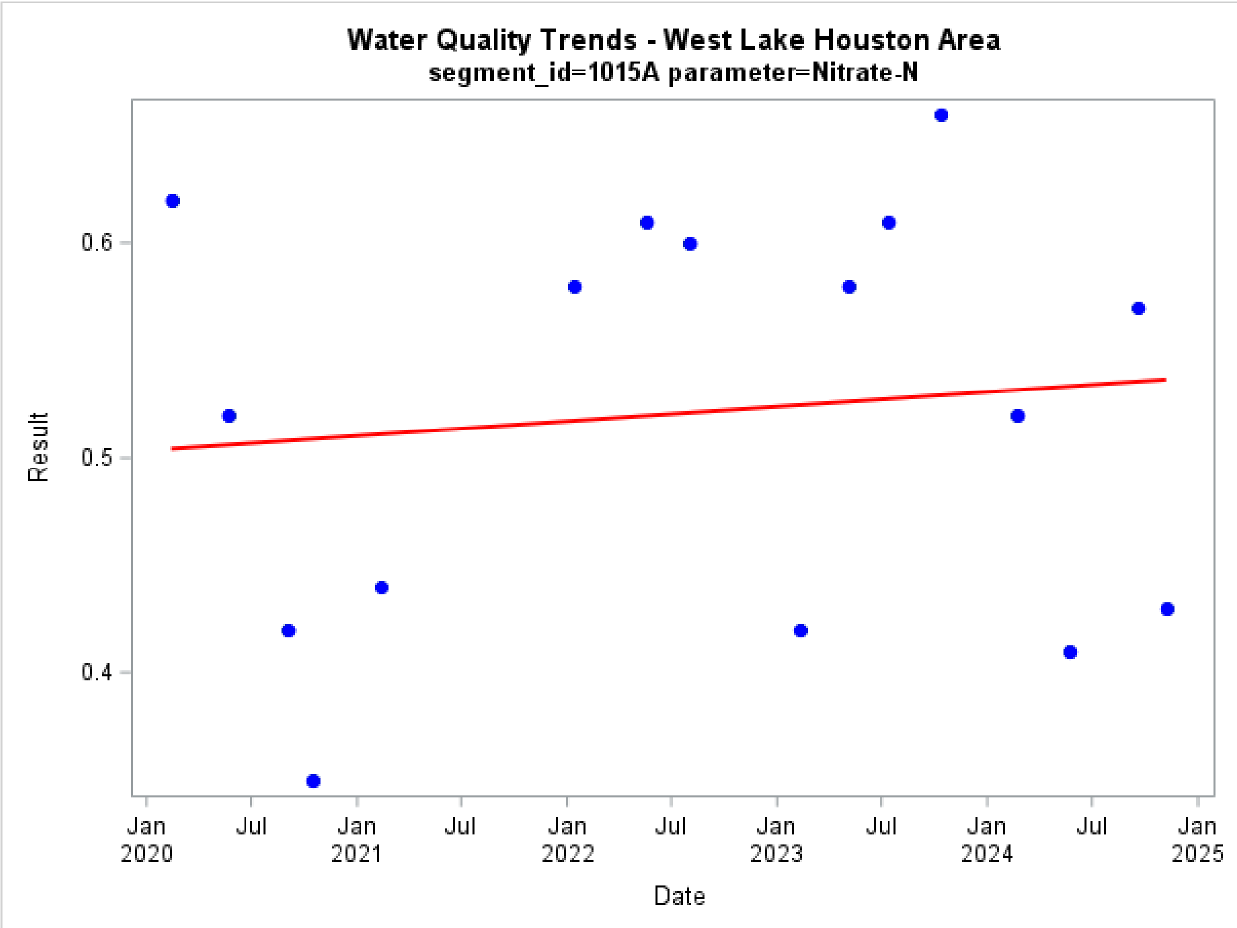
Mound Creek (1015A)



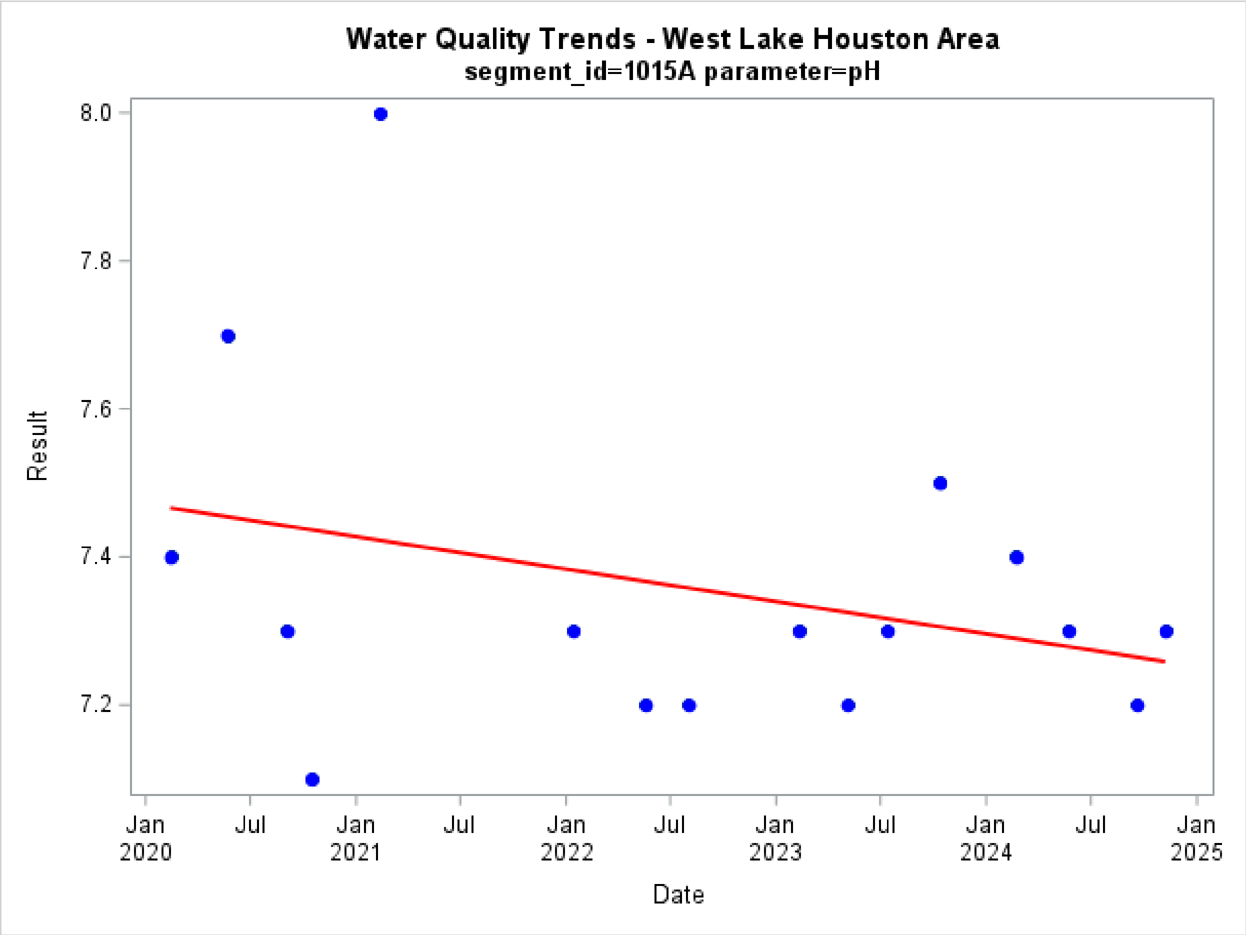

Water Quality Trends - West Lake Houston Area
segment_id=1015A parameter=Dissolved Oxygen (24-hour Mean/ Grab Screening Level)
Result
10
9
8
7
6
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

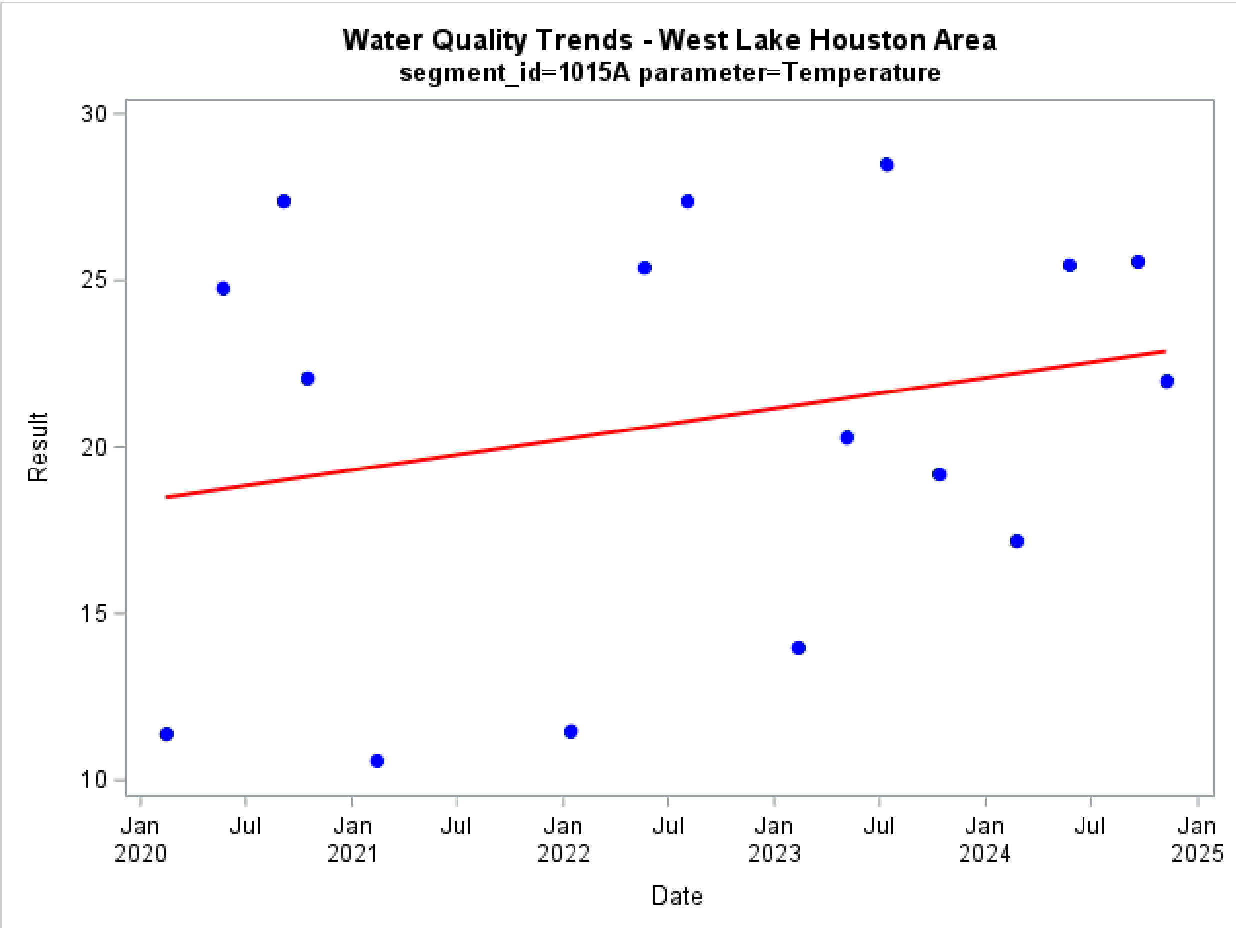

Water Quality Trends - West Lake Houston Area
segment_id=1015A parameter=E. Coli
Result
1250
1000
750
500
250
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

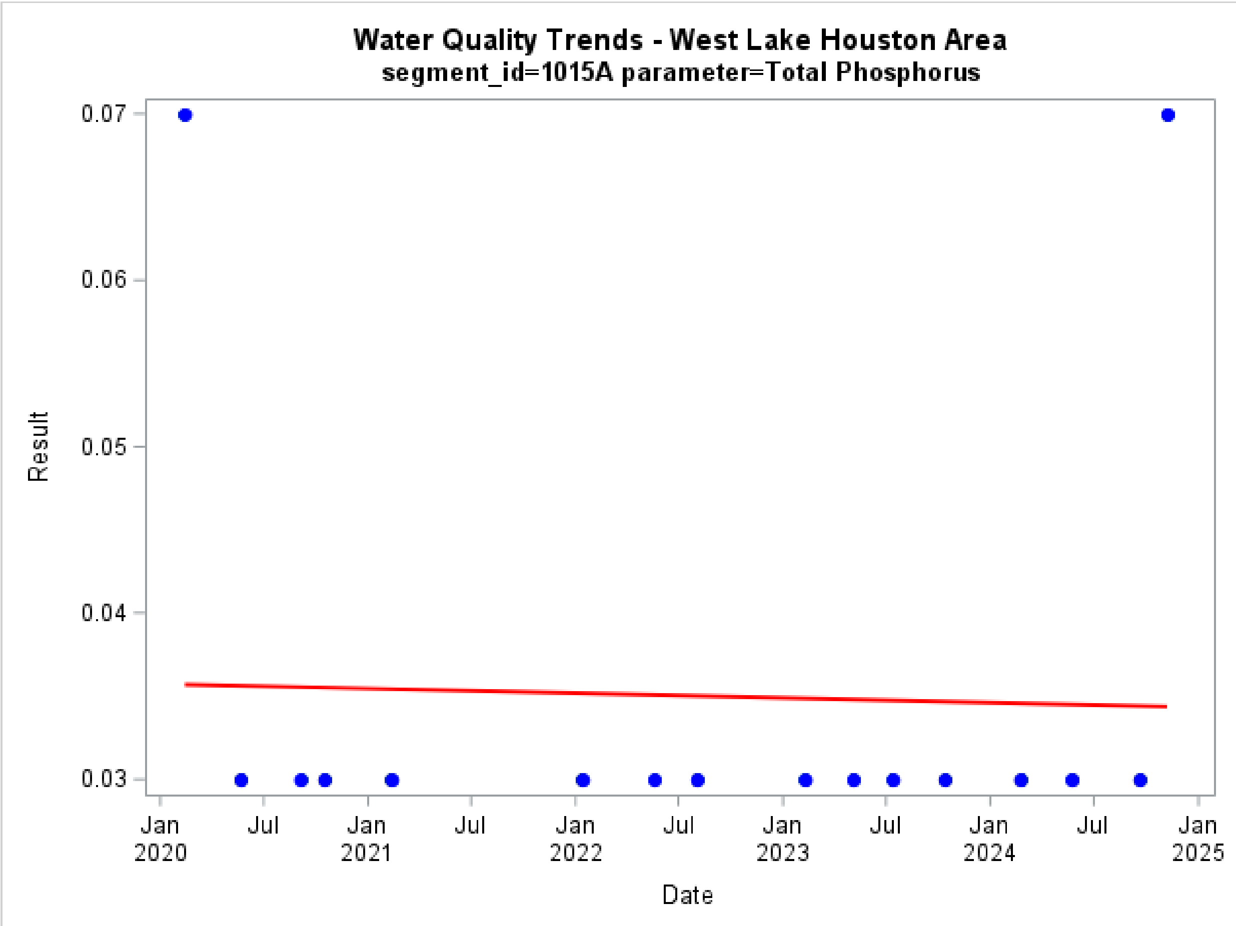

Water Quality Trends - West Lake Houston Area
segment_id=1015A parameter=Instantaneous Flow
Result
15
10
5
0
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

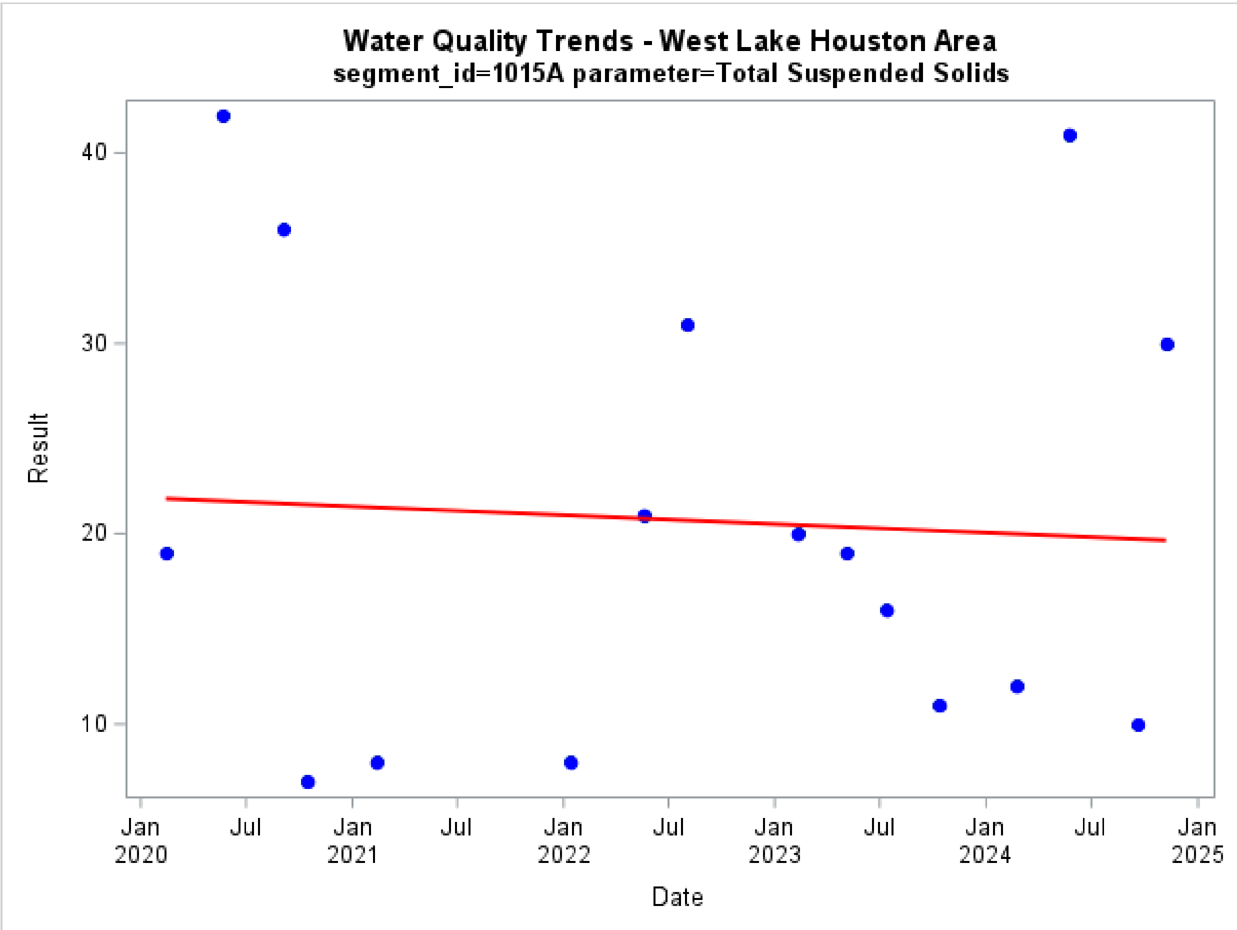


Water Quality Trends - West Lake Houston Area
segment_id=1015A parameter=Nitrate-N
Result
0.6
0.5
0.4
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1015A parameter=pH
8.0
7.8
7.6
7.4
7.2
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1015A parameter=Temperature
30
25
20
15
10
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1015A parameter=Total Phosphorus
0.07
0.06
0.05
0.04
0.03
Result
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date


Water Quality Trends - West Lake Houston Area
segment_id=1015A parameter=Total Suspended Solids
Result
40
30
20
10
Jan 2020
Jul
Jan 2021
Jul
Jan 2022
Jul
Jan 2023
Jul
Jan 2024
Jul
Jan 2025
Date

APPENDIX B: FIELD SURVEY DATA

Tables showing the contents of ArcGIS Survey123 observations recorded during field surveys conducted on July 1, 2025.

West Fork San Jacinto River Watershed

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
11243	1004	7/1/2025	8:09	30°12′39″N 95°23′51″W	8:17	30°12′39″N 95°23′51″W	0
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
Medium	Fair	Brownish	None	Cloudy	Calm	Ripples	Low
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	Yes	30°12′39″N 95°23′52″W, very sandy					
Is wildlife present?	Yes	30°12′39″N 95°23′51″W, deer or hog tracks? Movement in shrubs.					
Is active construction present?	Yes	Many new subdivisions advertised within a mile of site					
Additional Notes	-	Bridge observation only, not a dump site but fair amount of trash					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
11181	1004D	7/1/2025	8:40	30°14′29″N 95°22′58″W	8:45	30°14′29″N 95°22′58″W	0
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
Medium	Good	Brownish	None	Cloudy	Calm	Ripples	Low
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	No						
Is wildlife present?	Yes	30°14′29″N 95°22′58″W, swallows under bridge, animal tracks on banks					
Is active construction present?	Yes	Not far from WFSJR site, lots of new home construction					
Additional Notes	-	Not a dump site but trash present, only made observations on bank and under bridge, banks too steep for safe movement					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
16626	1004E	7/1/2025	9:16	30°16′59″N 95°26′23″W	9:22	30°16′59″N 95°26′23″W	80
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
Low	Good	Clear	None	Cloudy	Calm	Ripples	Normal
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	Yes	30°16′59″N 95°26′23″W					
Is wildlife present?	Yes	Tracks on banks, 30°16′59″N 95°26′23″W					
Is active construction present?	Yes	30°16′59″N 95°26′23″W					
Additional Notes	-	Construction of new roadway south of 336, not able to access exact CRP location, trash present					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
20731	1004J	7/1/2025	10:08	30°19′17″N 95°30′26″W	10:15	30°19′17″N 95°30′27″W	150
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
Low	Good	Clear	None	Partly Cloudy	Calm	Ripples	Low
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	Yes	30°19′18″N 95°30′29″W					
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	Yes	30°19′18″N 95°30′29″W					
Is wildlife present?	Yes	30°19′17″N 95°30′27″W, tracks on banks					
Is active construction present?	No						
Additional Notes	-	In a quiet neighborhood, signs of recreation, outfalls (?) at bridge crossing on both sides of stream, no signs of sewage					

Spring Creek Watershed

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
11323	1008	7/1/2025	11:25	30°5′57″N 95°42′8″ W	11:48	30°5′13″N 95°45′47″ W	
Observed Turbidity	**Water Clarity**	**Water Color**	**Water Odor**	**Present Weather**	**Wind Intensity**	**Water Surface**	**Flow Severity**
High	Poor	Brownish	None	Partly Cloudy	Slight	Ripples	Normal
Source Survey Question	**Response**	**Notes**					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	No						
Is wildlife present?	Yes	Saw great blue heron downstream of Robert cemetery road, too far to get picture.					
Is active construction present?	No						
Additional Notes		Drove to next two upstream crossings at Mueschke Rd and Robert Cemetery Rd, some minor dumping at both. In between sites counted 5 new subdivisions and one new construction site. Chosen downstream site might have been slightly more turbid than upstream					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
21957	1008A	7/1/2025	9:24	30°11′11″N 95°40′54″W	9:36	30°11′9″N 95°40′55″ W	
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
High	Poor	Brownish	None	Partly Cloudy	Slight	Calm	Normal
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	No						
Is wildlife present?	Yes	Possible beaver dam about 150m upstream of bridge at 149.					
Is active construction present?	No						
Additional Notes		Formerly braided channel blocked off with sediment on the right channel s few years ago, not naturally but by unknown entity. Unknown cable coming down right bank by former channel. Drove to next upstream crossing at 1488, and a lot of construction around creek, both on the road 1488 and what appears to be construction sites for new neighborhoods.					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
16630	1008B	7/1/2025	7:44	30°11′38″N 95°29′18″W	7:54	30°11′38″N 95°29′18″W	
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
Low	Good	Clear	None	Partly Cloudy	Calm	Ripples	Normal
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	No						
Is wildlife present?	Yes	Dragonflies, spiders, fish small and medium sized,					
Is active construction present?	No						
Additional Notes		Riparian area still natural vegetation, though lack of trees and presence of elephant ears. Surrounding area is a well utilized city park so partially developed within the surrounding area.					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
16627	1008C	7/1/2025	8:21	30°8′6″N 95°28′45″W	8:34	30°8′7″N 95°28′46″W	20
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
Medium	Fair	Brownish	None	Partly Cloudy	Calm	Calm	Normal
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	Yes	WWTF outfall DS of sample/observation point. There is a small (trickle) ditch on the US LRB of footbridge.					
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	No						
Is wildlife present?	Yes	30°8′7″N 95°28′46″W Gar, songbirds.					
Is active construction present?	No						
Additional Notes		Walked down to RB waters edge Aprox 20 meters DS of footbridge. Then walked to footbridge. Can observe Aprox 40 meters US of footbridge. Golf course observed on US RB.					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
16631	1008E	7/1/2025	8:27	30°11′26″N 95°29′28″W	8:40	30°11′24″N 95°29′29″W	
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
Medium	Good	Clear	None	Partly Cloudy	Calm	Ripples	Normal
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	Yes	30°11′25″N 95°29′28″W. USGS team out at site working to clear rocks and sediment from around gage. Said there is a lot of sediment deposition in channel recently from somewhere. Also a lot of golf balls brought downstream and deposited on LB					
Is wildlife present?	Yes	Small fish, dragonflies, swallow nests under bridge					
Is active construction present?	No						
Additional Notes		No visible pipes but open top ditch tributaries from left and right banks upstream. Bird waste on left bank under bridge, slight smell. Apple snail egg sack in pylon on left bank under bridge. Segment is bear branch 1008E.					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
11185	1008H	7/1/2025	8:55	30°6′52″N 95°30′25″W	9:03	30°6′52″N 95°30′25″W	0
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
High	Poor	Brownish	None	Partly Cloudy	Slight	Calm	Normal
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	Yes	Pipe from the RB US of bridge Aprox 20 meters. Likely from dry retention basin on RB.					
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	Yes	US RB erosion at bend in creek Aprox 300 m US of bridge.					
Is wildlife present?	Yes	Turtles in water, songbirds overhead.					
Is active construction present?	No						
Additional Notes		WWTF observed on desktop review US LB, cannot see it from bridge. There is a plant nursery located immediately on US LB. Air occasionally smells of effluent.					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
20462	1008I	7/1/2025	10:28	30°7′1″N 95°41′21″ W	11:07	30°7′42″N 95°42′1″ W	
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
High	Poor	Brownish	None	Clear	Slight	Ripples	Normal
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	No						
Is a dump site present?	Yes	May not be a dump site, but some cable on left bank and some litter, not historically a dump site					
Is erosion and/or deposition present in the channel?	No						
Is wildlife present?	No						
Is active construction present?	No						
Additional Notes		Water level new normal, but has been about 1-2 ft higher than historical normal for about at least a year, possibly not draining fast enough with multiple heavy rain events. Drove to next two upstream crossings, couldn't see first. Second had debris/tree partially blocking stream. In between sites in the watershed observed small old neighborhoods, several new constructions, and an area of manufactured homes with a treatment plant. Several signs for septic companies so homes might be on septic.					

Survey_Sites	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
20463	1008J	7/1/2025	12:00	30°6′2″N 95°45′39″ W	12:20	30°6′57″N 95°46′28″ W	
Observed Turbidity	**Water Clarity**	**Water Color**	**Water Odor**	**Present Weather**	**Wind Intensity**	**Water Surface**	**Flow Severity**
Medium	Good	Brownish	None	Partly Cloudy	Calm	Ripples	Normal
Source Survey Question	**Response**	**Notes**					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	Yes	Tree debris deposited in drainage culvert at bridge					
Is wildlife present?	Yes	Small fish present					
Is active construction present?							
Additional Notes		Drove to next upstream crossing as well, only item of note possible previous fence line					

Cypress Creek Watershed

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
11324	1009	7/1/2025	7:21	30°1′50″N 95°19′49″W	7:33	30°1′50″N 95°19′49″W	0
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
High	Poor	Brownish	None	Partly Cloudy	Calm	Calm	Normal
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	Yes	30°1′50″N 95°19′49″W debris on bridge pilings, large trees have been trimmed/cleared. Appears to be Sandy substrate, mid channel island US of bridge.					
Is wildlife present?	Yes	30°1′50″N 95°19′49″W water Snake, Herron, domestic horses on the right bank. Swallows under bridge.					
Is active construction present?	No						
Additional Notes		Observed ~250 meters US from the bridge. Walked along bridge to observe both banks. Large horse trail riding business on the US RB. Many horse riding trails along the RB. Unknown if direct access to water. Stables and holding pens are approx 20-40m from waterway. Golf course on the LB both US and DS. There is a small tributary on the US LB approx 40 meters from the bridge. Air smells of manure.					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
17496	1009C	7/1/2025	10:24	29°59′23″N 95°35′35″W	10:43	29°59′28″N 95°35′54″W	644
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
Medium	Good	Brownish	None	Partly Cloudy	Calm	Calm	Normal

Source Survey Question	Response	Notes
Are outfalls or pipes present?	Yes	29°59′25″N 95°35′36″W Sanitary sewer manhole with broken cap ring on US LB. (photo) strong smell of sewage in air. Several outfall pipes observed on both banks US of bridge. The large outfall on the US LB drains an open top ditch.
Is a dump site present?	No	
Is erosion and/or deposition present in the channel?	Yes	Debris collecting on piling that supports pipe over waterway US of bridge. Some minor erosion observed on RB Aprox 30 meters DS of the pipe observed with a moist interior on the RB.
Is wildlife present?	Yes	Turtles, songbirds
Is active construction present?	No	
Additional Notes		Pedestrian walkway along waterbody. Followed it Aprox.650 meters US. Observed large pipe on opposite bank of: 29°59′28″N 95°35′52″W that appeared wet inside. Can hear backyard chickens in neighborhood. Using aerial imagery observed some kind of clarifying tank which is upstream of the flowing open top ditch that outfalls on the US LB by the bridge.

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
17481	1009D	7/1/2025	9:31	30°1′59″N 95°30′28″W	9:53	30°2′8″N 95°30′35″W	644
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
Medium	Good	Brownish	None	Partly Cloudy	Calm	Ripples	Normal
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	Yes	Many pipes observed on both banks. Walked US Aprox __ meters from bridge to the bend in the creek. Then can see furthe upstream approx ___ meters to next bend.					
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	No						
Is wildlife present?	Yes	White egret, turtles. Domestic dogs observed visually and by sound in the yards of homes that back up to creek, all fenced, no direct access.					
Is active construction present?	No						
Additional Notes		Walked Aprox meters along pedestrian trail in LB US. Tributary flows in on LB US approx 120 meters from bridge. Water from trib is clear and flowing steady (photo) no odor. Observed WWTF on LB of tributary Aprox 300 meters upstream of confluence. Also a school is located US of the WWTF, desktop review. None of the observed pipes on the main water body or trib. appeared to be flowing.					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
20456	1009E	7/1/2025	11:36	30°1′20″N 95°43′31″W	11:41	30°1′20″N 95°43′31″W	0
Observed Turbidity	**Water Clarity**	**Water Color**	**Water Odor**	**Present Weather**	**Wind Intensity**	**Water Surface**	**Flow Severity**
High	Poor	Brownish	None	Partly Cloudy	Calm	Calm	Normal
Source Survey Question	**Response**	**Notes**					
Are outfalls or pipes present?	Yes	Pipes appear to be draining roadside ditches on all four corners of bridge. Not observed flowing.					
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	No						
Is wildlife present?	Yes	Turtle observed					
Is active construction present?	No						
Additional Notes		Observations made form bridge, very limited view, can only see Aprox 50 meters UD of bridge. Banks very overgrown. Water very turbid and light colored (Latte color) as if construction sediment is entering waterway, no observed construction activities.					

Lake Creek Watershed

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
11367	1015	7/1/2025	11:12	30°15′10″N 95°34′54″W	11:16	30°15′9″N 95°34′54″W	50
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
High	Poor	Brownish	Fishy	Partly Cloudy	Calm	Calm	Low
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	Yes	30°15′10″N 95°34′54″W					
Is wildlife present?	Yes	30°15′10″N 95°34′54″W, tracks along banks					
Is active construction present?	No						
Additional Notes	-	Residents warned of alligator sometimes observed in creek but none sighted. RV park potential source of pollution					

Survey Site	Segment	Survey Date	Start Time of Survey	Start Coordinates	End Time of Survey	End Coordinates	Distance Walked (meters)
17937	1015A	7/1/2025	10:56	30°16′1″N 95°34′15″W	10:54	30°16′2″N 95°34′15″W	50
Observed Turbidity	Water Clarity	Water Color	Water Odor	Present Weather	Wind Intensity	Water Surface	Flow Severity
Low	Good	Reddish	None	Partly Cloudy	Calm	Calm	Low
Source Survey Question	Response	Notes					
Are outfalls or pipes present?	No						
Is a dump site present?	No						
Is erosion and/or deposition present in the channel?	No						
Is wildlife present?	Yes	Birds heard and seen but not photographed					
Is active construction present?	Yes	30°16′2″N 95°34′15″W, ongoing construction at site					
Additional Notes	-	none					