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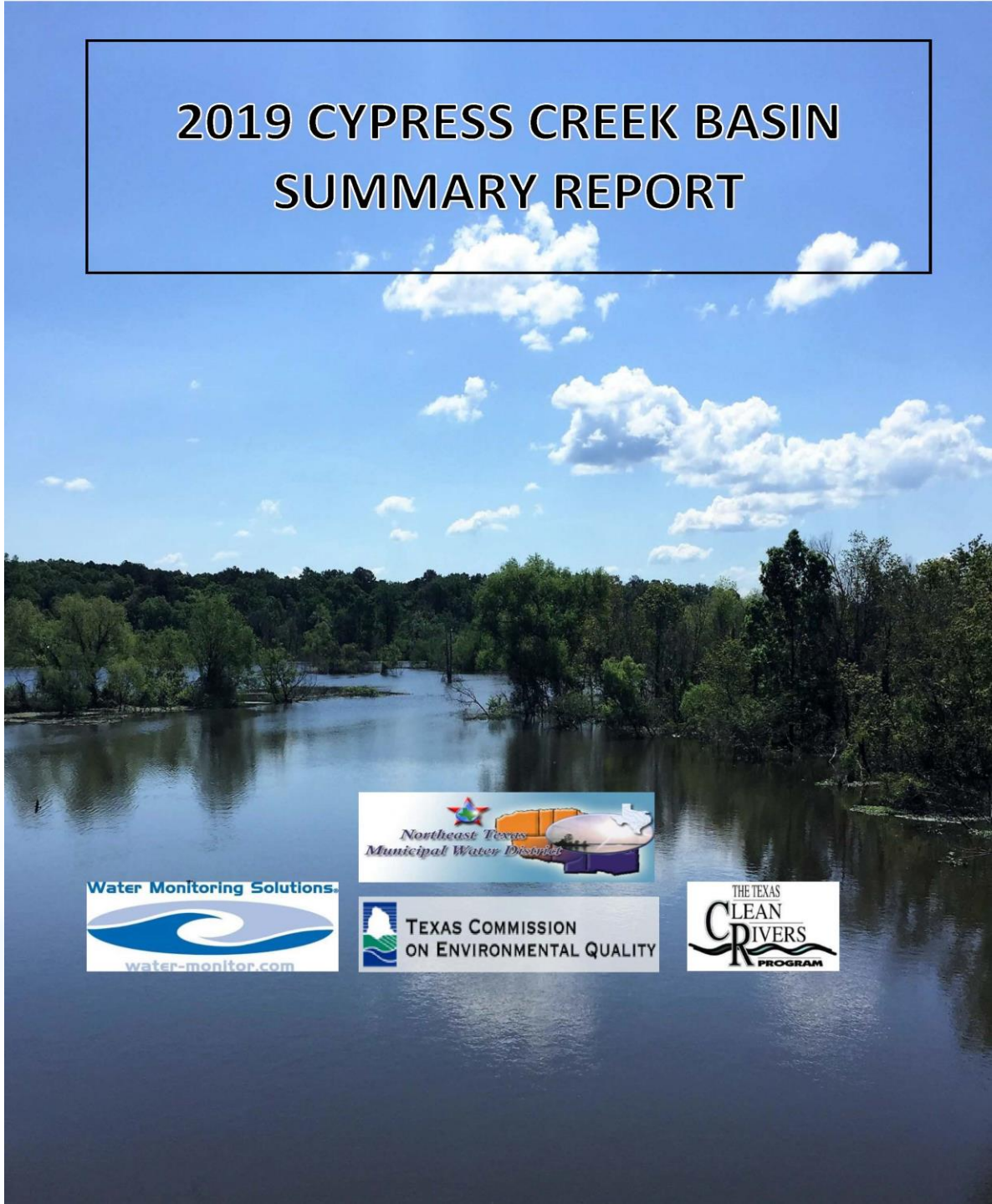
FY 2019 Cypress Creek Basin Summary Report

by Randy Rushin

Water Monitoring Solutions, Inc.

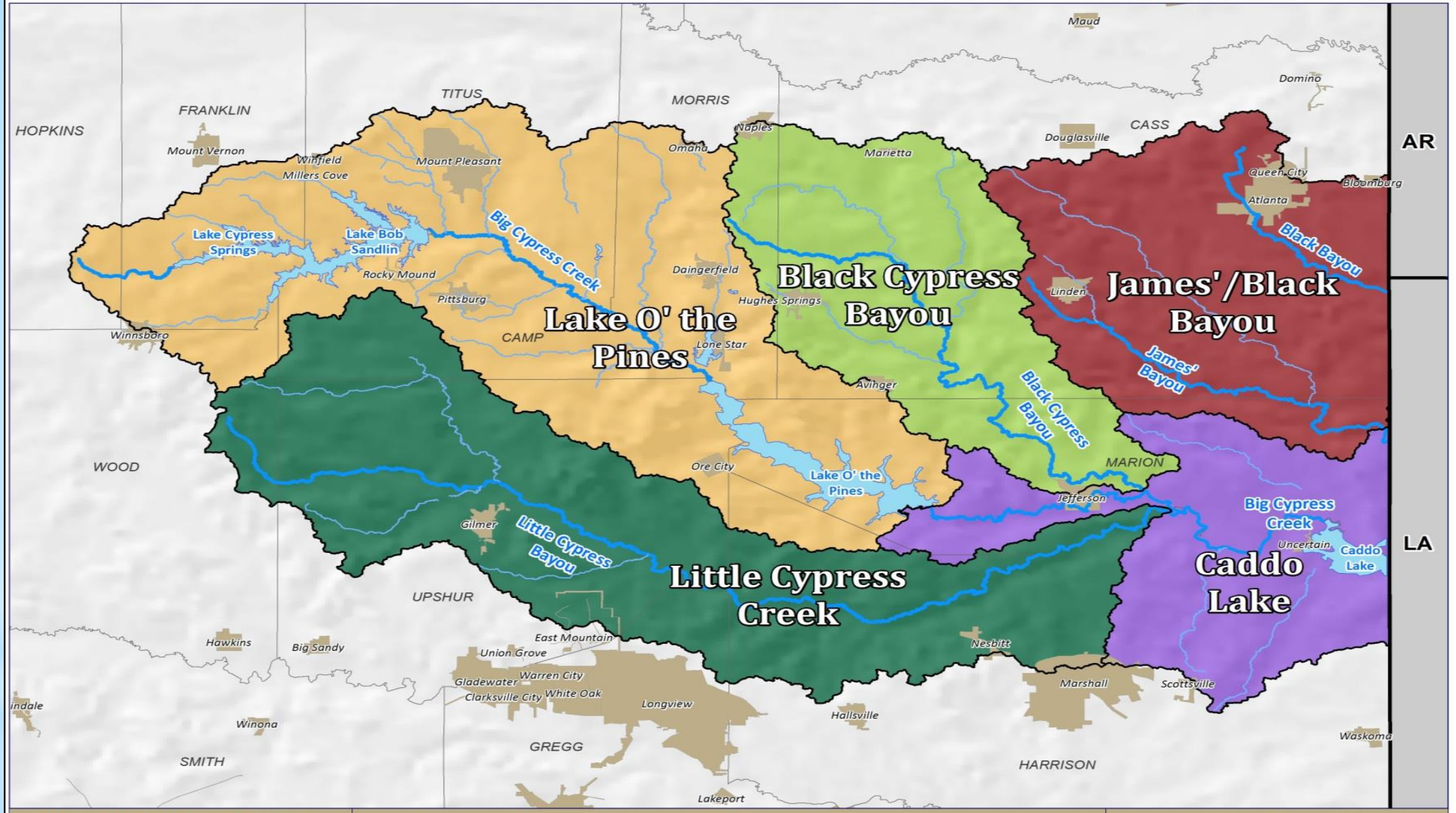


What is a Basin Summary Report?

- Completed every 5 - 6 years in each basin
- Compares recent water quality data to Integrated Report
- Involves a detailed discussion of data analysis findings
- Provides a comprehensive review of water quality data
- Serves to identify monitoring needs such as Special Studies, WPP, UAA, RUAA
- Aids in water quality planning and decision making

The BSR addresses these questions:

- Are there any long-term water quality trends?
- What are the water quality issues?
- What are the possible sources of these issues?
- What are the possible effects on water quality, water supplies, human contact, biota?
- What can be done to address or resolve these issues?



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Cypress Creek Basin Subwatersheds

February 2014

N

0 5 10 20

Miles

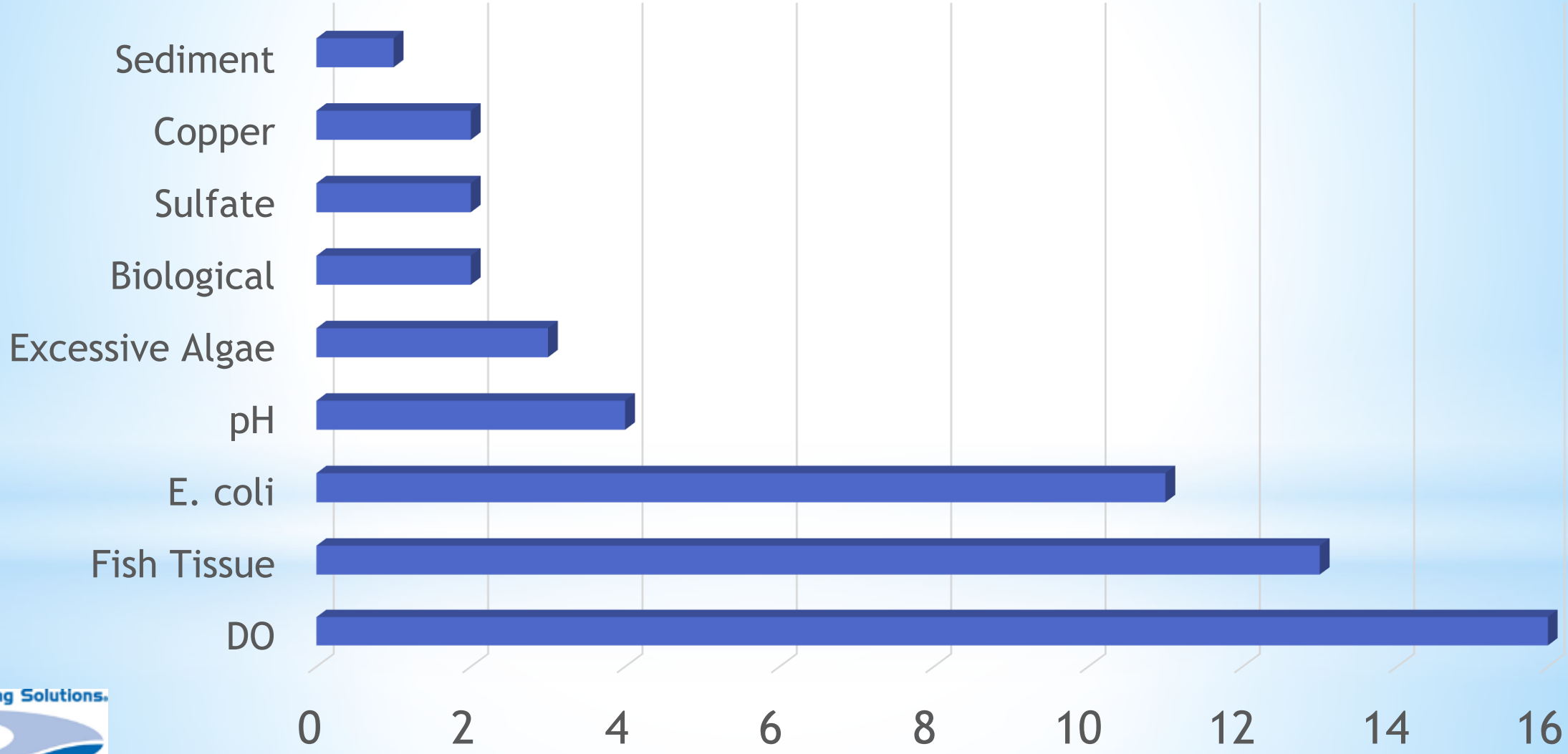
2016 DRAFT Integrated Report §303(d) Delistings

Segment	Description	Parameter(s)	Reason
0401	Caddo Lake – Goose Prairie	pH	Meets
0402	Big Cypress Creek below Lake O' the Pines	pH	TSWQS Standard Change
0407	James' Bayou	pH, DO	TSWQS Standard Change
0409	Little Cypress Creek/Bayou	DO	TSWQS Standard Change
0410	Black Cypress Creek	DO	TSWQS Standard Change

2016 DRAFT Integrated Report §303(d) New Listings

Segment	Description	Parameter(s)	Category
0403	Lake O' the Pines	pH	5c
0404A	Ellison Creek Reservoir	Dioxin in Tissue	5a
0405	Lake Cypress Springs	Excessive Algae	5c
0405A	Big Cypress Creek above LCS	Bacteria	5c
0409A	South Lilly Creek	Bacteria	5c

2016 DRAFT Integrated Report §303(d) Impairments



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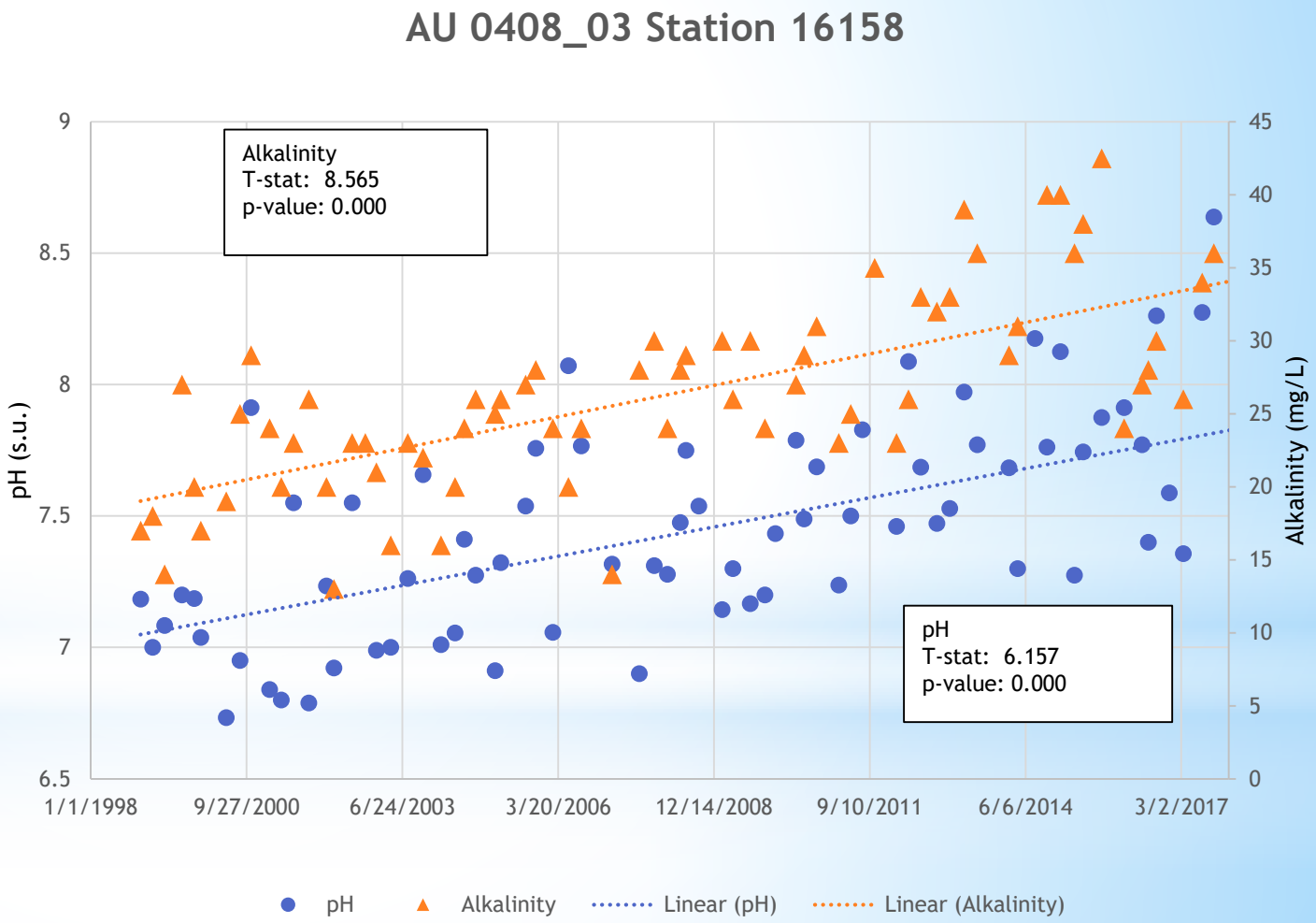
Trend Analysis

Site Selection Criteria:

- 10 or more years of data
- Regular sampling
- Min. 20 to 30 results

Statistically Significant:

- Linear Regression
- T-stat ≥|2|
- p-value of < 0.1 (90 percent confidence interval)
- $R^2 > 0.1$
- S Norm < 2
- K Norm < 3



Trend Analysis Results

Segment	Station	Secchi	DO	Sp. Cond *	pH	Alkalinity	TKN	Bacteria	TDS*
0402	15511			↑	↑	↑			
0403	10296	↓							↑
	16156				↑				
	10297				↑				
0404A	14473		↑						
0405	10312			↑					
	10313			↑					
	17548					↑	↑		
0408	16158			↑	↑	↑			
0409	10332							↓	

* Drought-related trend

Caddo Lake Flood Stage

Flood Stage = 172.0 feet MSL

1921 – 2014 Flood Stage

29 times or every 3.2 years

> 60% prior to LOP construction

March 2015 – March 2019

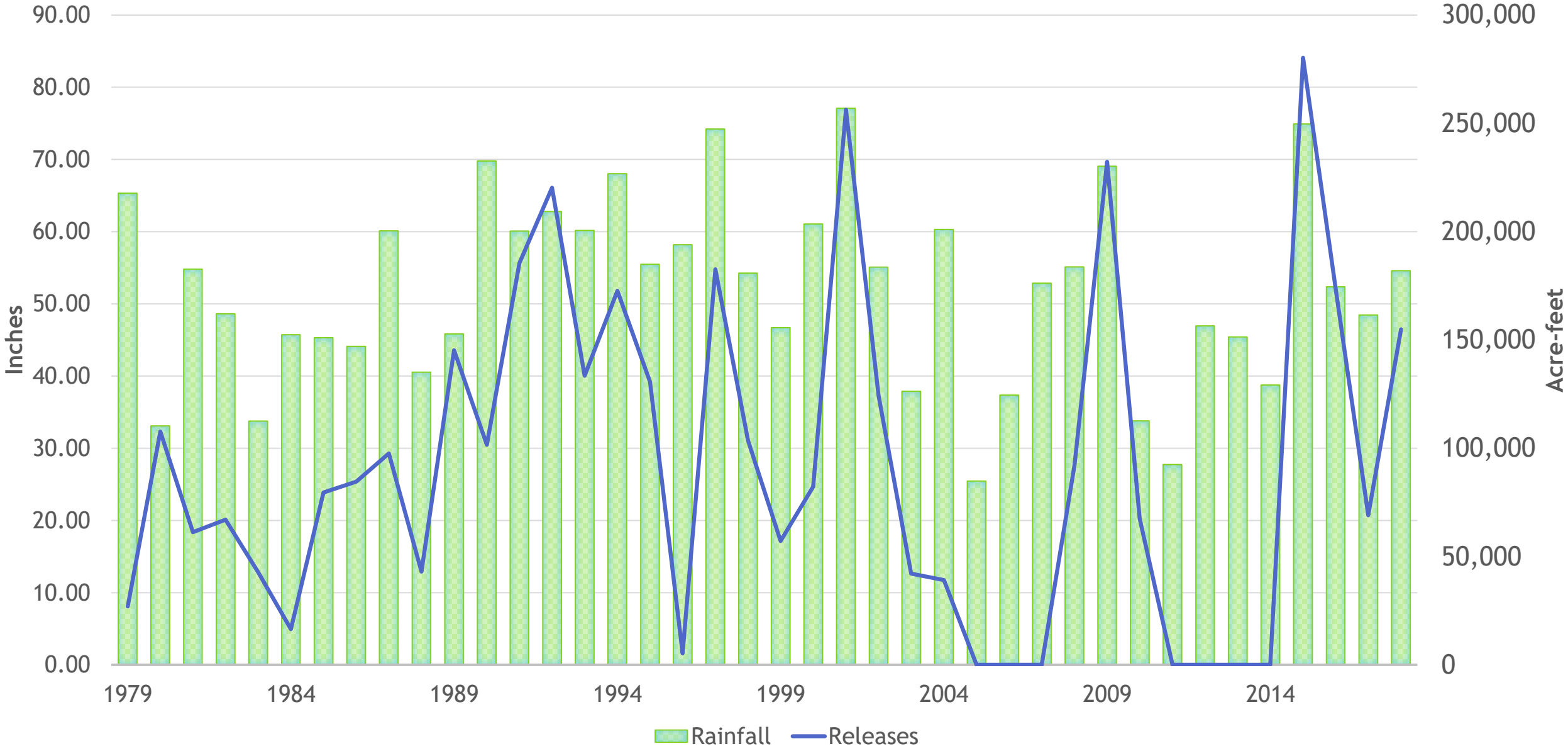
7 times in 48 months

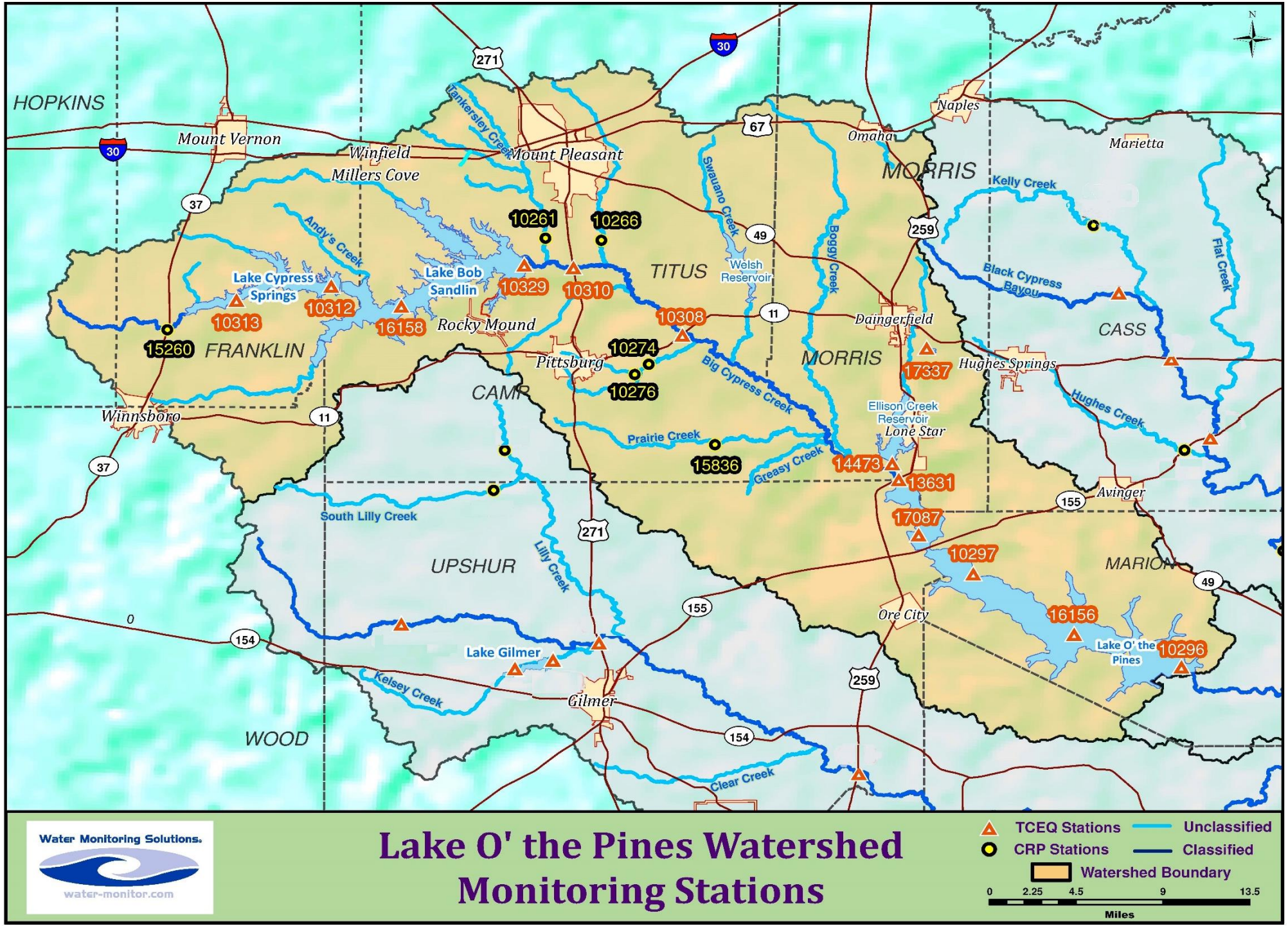
Previously never reached flood stage

more than 5 times in a single decade

Lake Bob Sandlin

Annual Rainfall and Releases





Lake O' the Pines Watershed Monitoring Stations


HOPKINS
Mount Vernon
Winfield
Millers Cove
Tankersley Creek
Mount Pleasant
271
30
67
49
37
11
Andy's Creek
Lake Cypress Springs
Lake Bob Sandlin
Swauano Creek
Welsh Reservoir
Boggy Creek
TITUS
10261
10266
10329
10310
10313
10312
16158
10308
15260
FRANKLIN
Rocky Mound
10274
10276
Pittsburg
Big Cypress Creek
CAMP
MORR
Winnsboro
Prairie Creek
15836
Greasy Creek
South Lilly Creek

Segment 0405 Lake Cypress Springs

Impairments:

- High pH
- Excessive Algal Growth

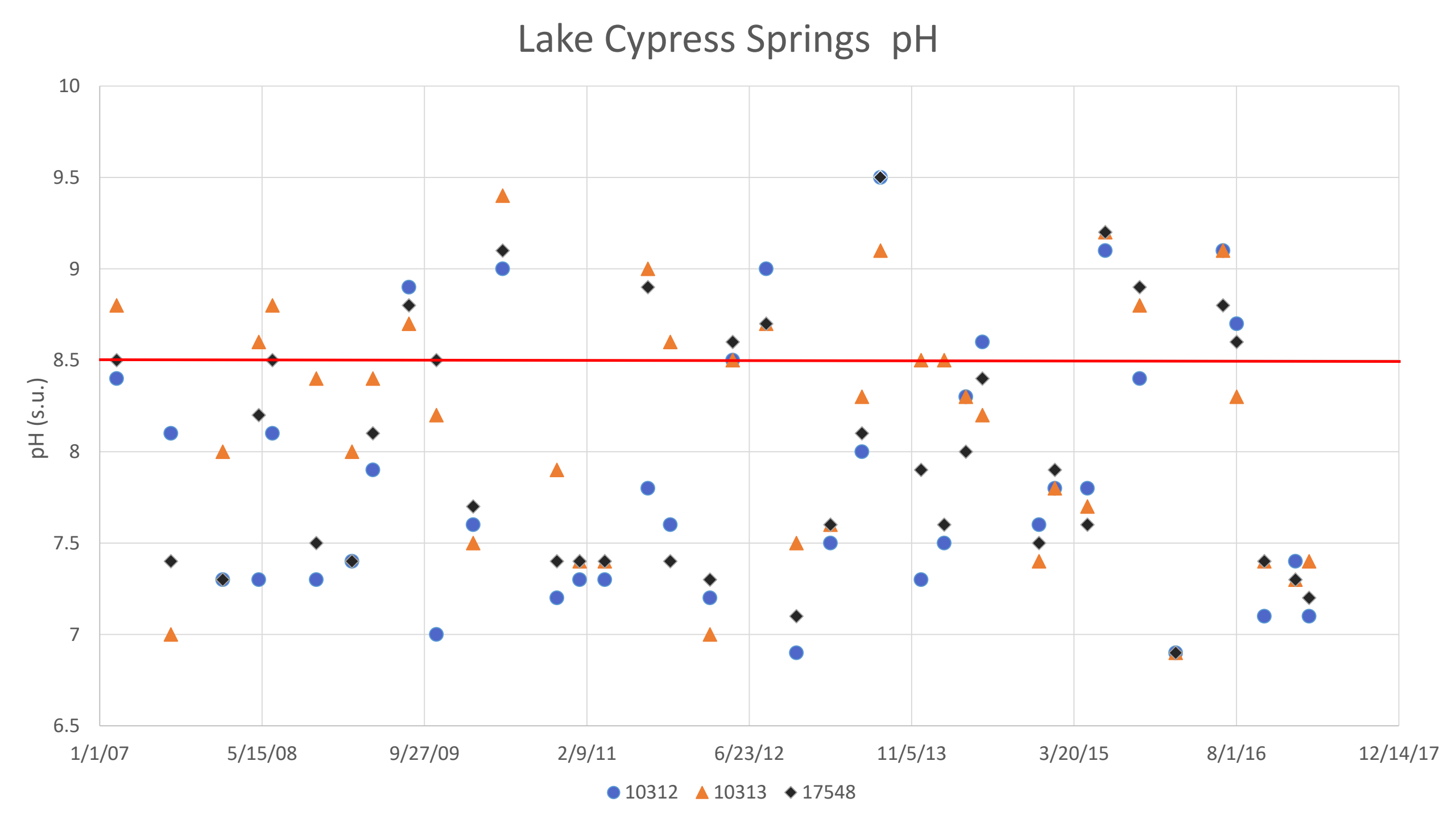
Segment 0405A Big Cypress Creek

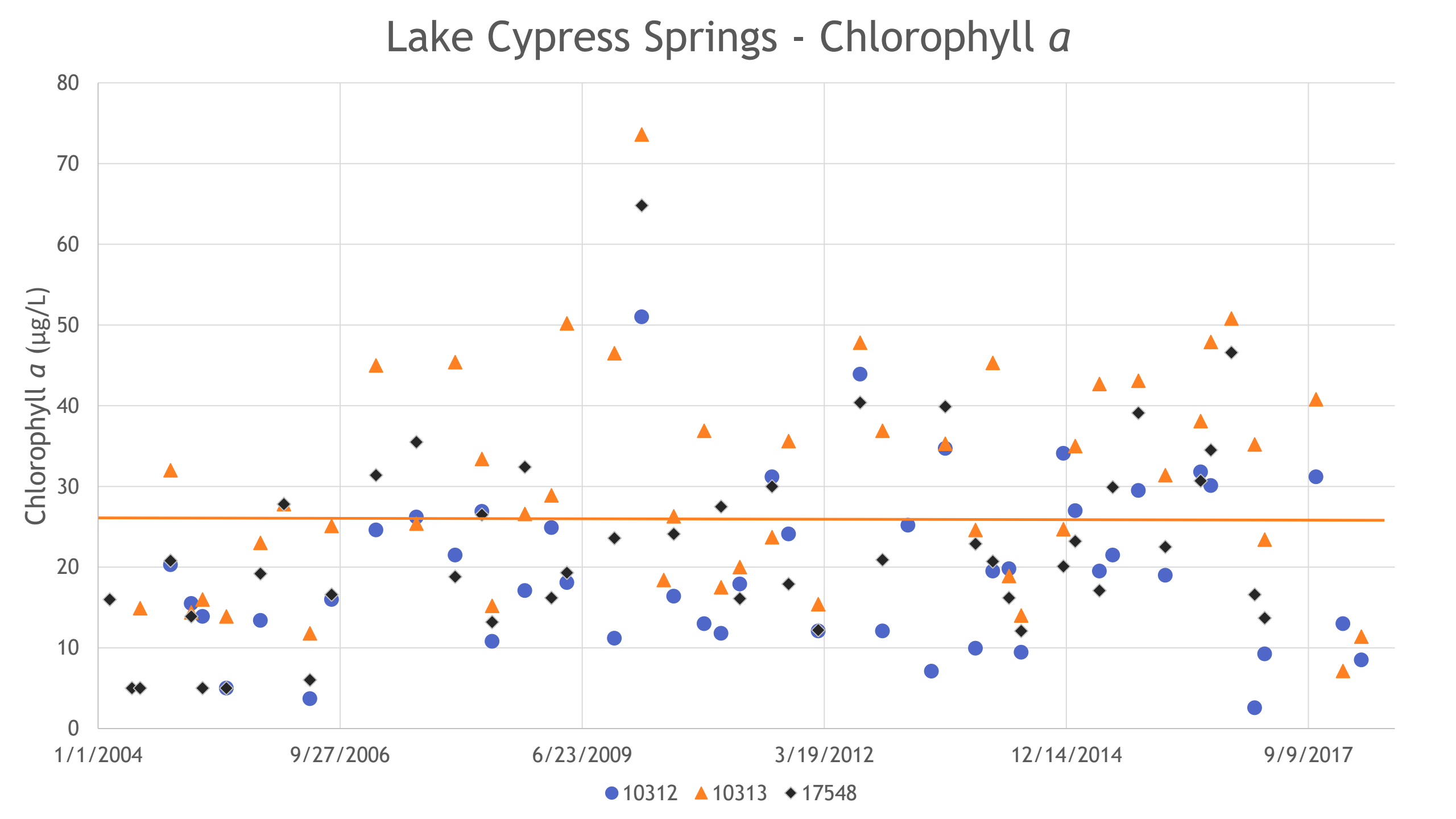
Impairments:

- DO Grab Minimum
- *E. coli*

Concerns:

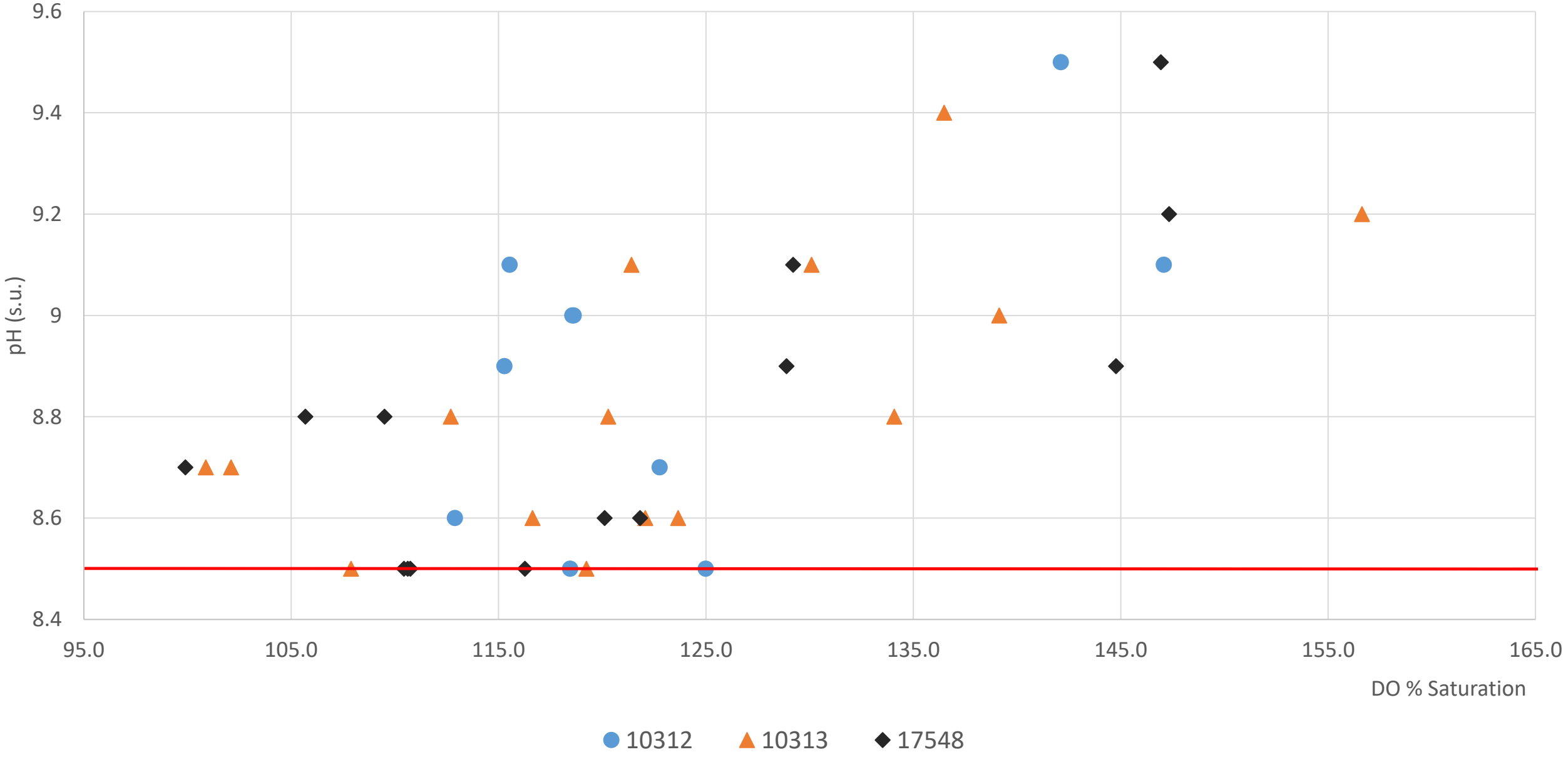
- Ammonia
- Chlorophyll *a*


Lake Cypress Springs pH
10
9.5
9
8.5
8
7.5
7
6.5
pH (s.u.)
1/1/07
5/15/08
9/27/09
2/9/11
6/23/12
11/5/13
3/20/15
8/1/16
12/14/17
10312
10313
17548

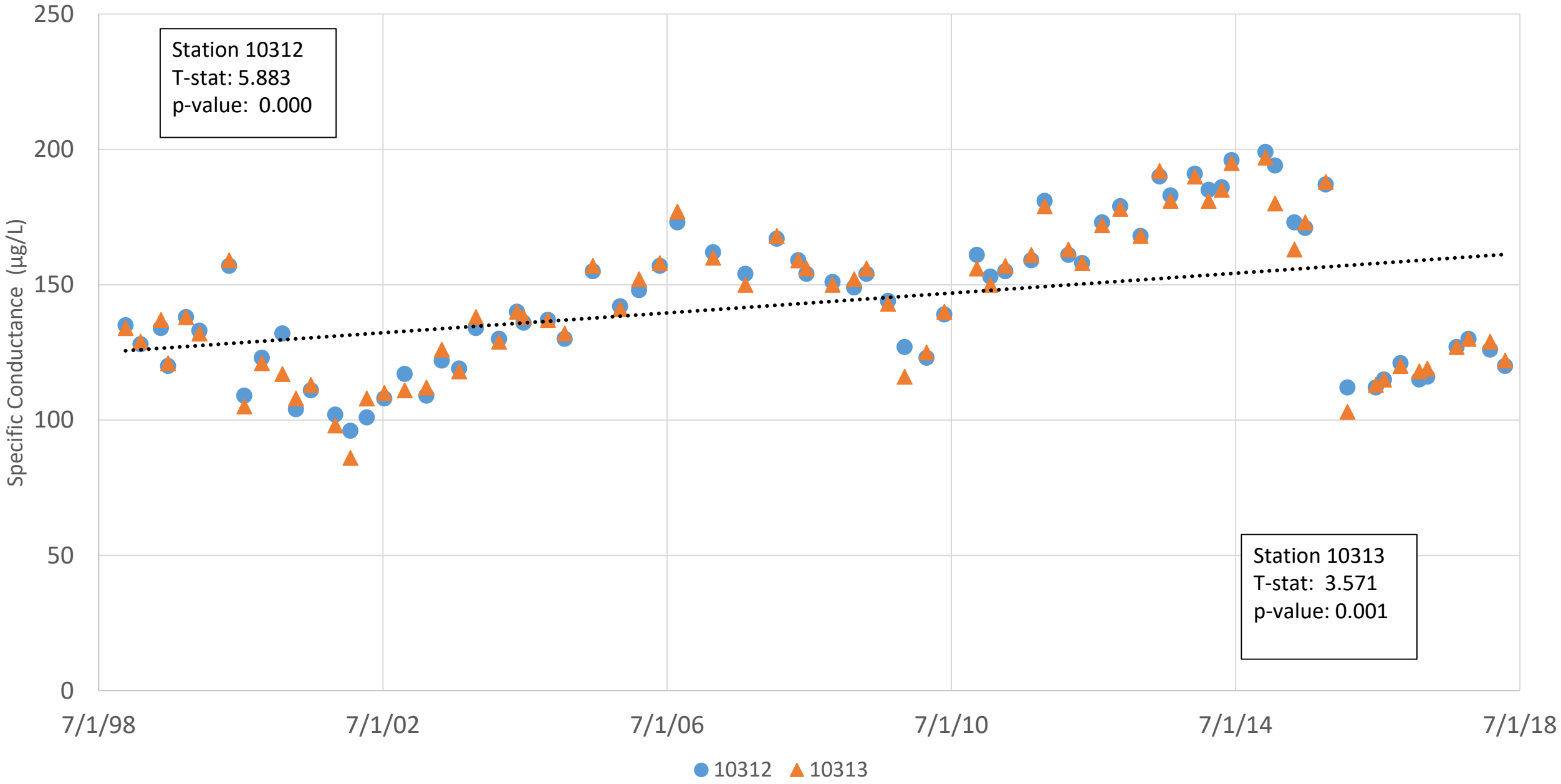

Lake Cypress Springs - Chlorophyll a
Chlorophyll a (µg/L)
80
70
60
50
40
30
20
10
0
1/1/2004
9/27/2006
6/23/2009
3/19/2012
12/14/2014
9/9/2017
10312
10313
17548

Lake Cypress Springs

High pH versus DO Percent Saturation



Lake Cypress Springs Specific Conductance Trends

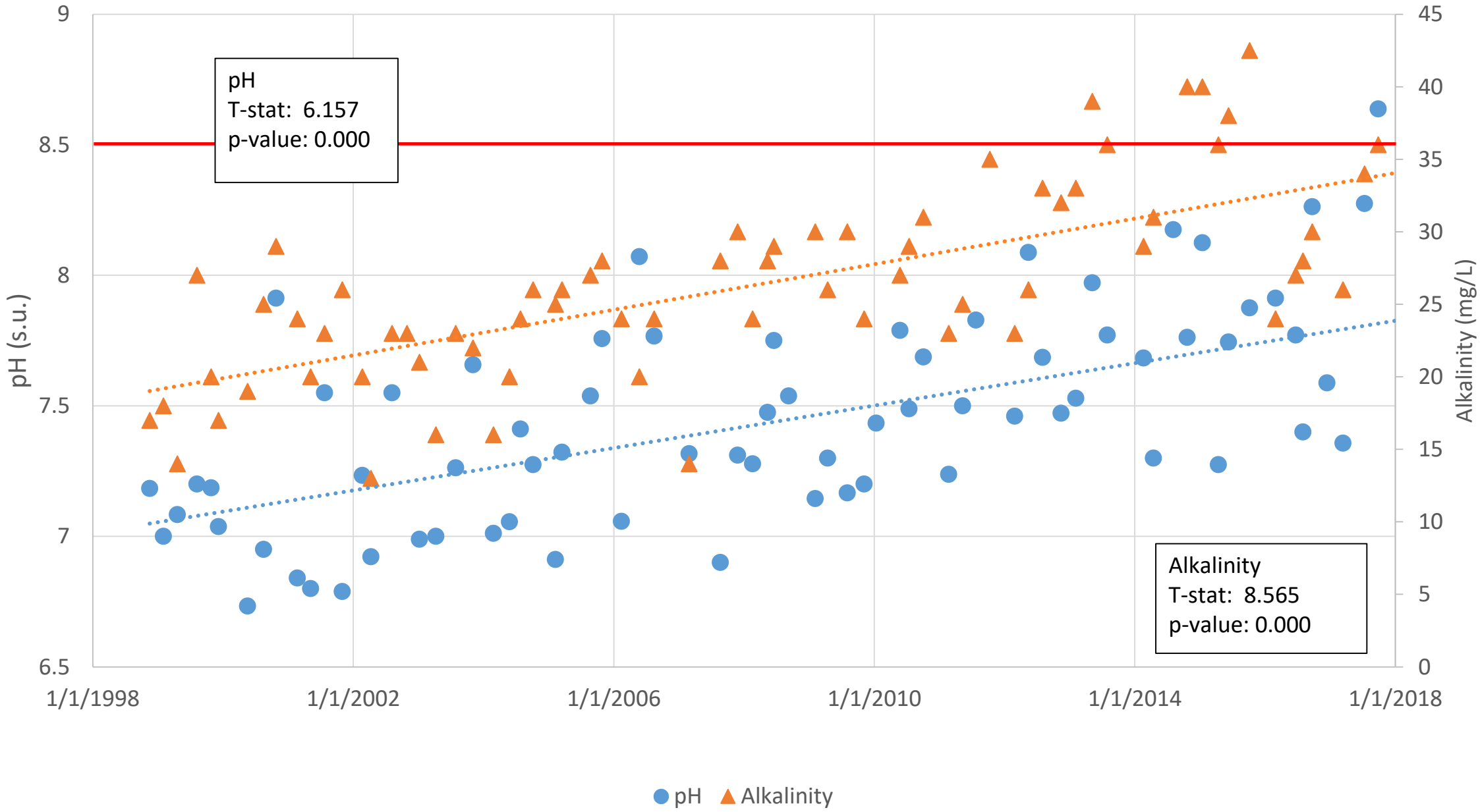


Segment 0408 Lake Bob Sandlin

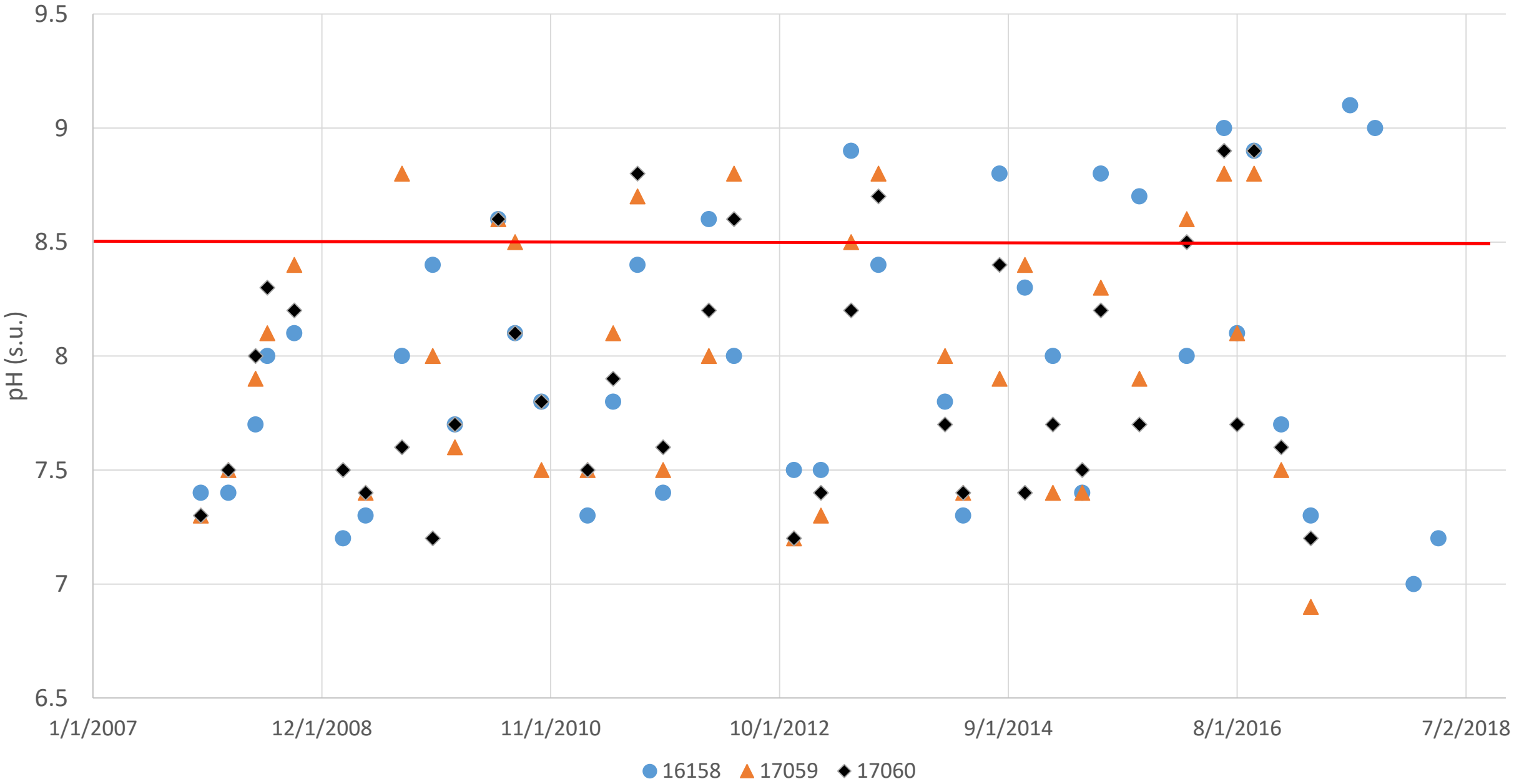
Impairments:
None

Concerns:
None

AU 0408_03 Station 16158 Trends

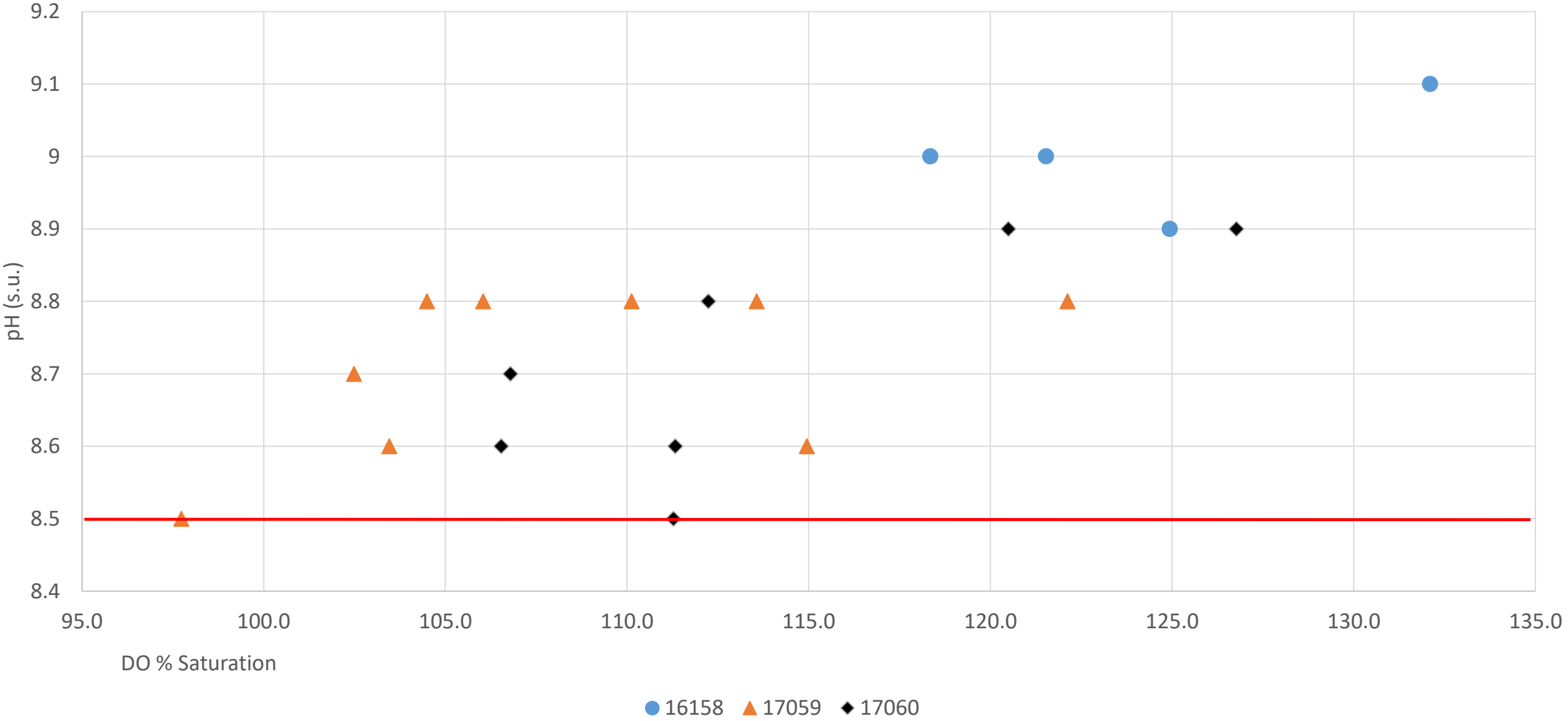


Lake Bob Sandlin pH



Lake Bob Sandlin

High pH versus DO % Saturation




HOPKINS
Mount Vernon
Winfield
Millers Cove
Tankersley Creek
Mount Pleasant
271
30
67
49
37
11
Andy's Creek
Lake Cypress Springs
Lake Bob Sandlin
Swauano Creek
Welsh Reservoir
Boggy Creek
TITUS
10261
10266
10329
10310
10313
10312
16158
10308
15260
FRANKLIN
Rocky Mound
10274
10276
Pittsburg
Big Cypress Creek
CAMP
MORR
Winnsboro
Prairie Creek
15836
Greasy Creek
South Lilly Creek

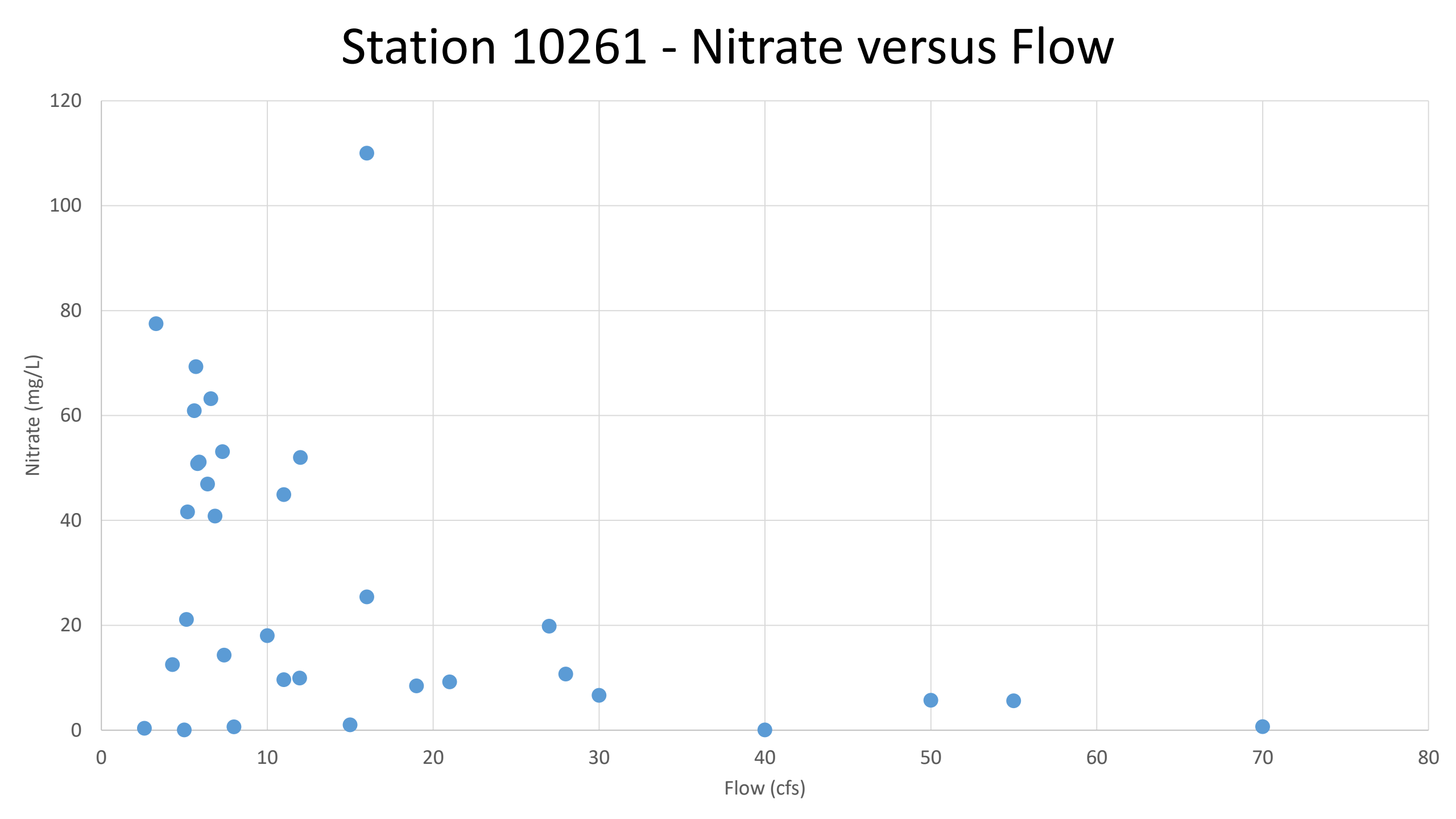
Segment 0404B Tankersley Creek

Impairments:

- *E. coli*

Concerns:

- Ammonia
- Nitrate
- Total Phosphorus


Station 10261 - Nitrate versus Flow
Nitrate (mg/L)
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
Flow (cfs)

Segment 0404 Big Cypress Creek below LBS

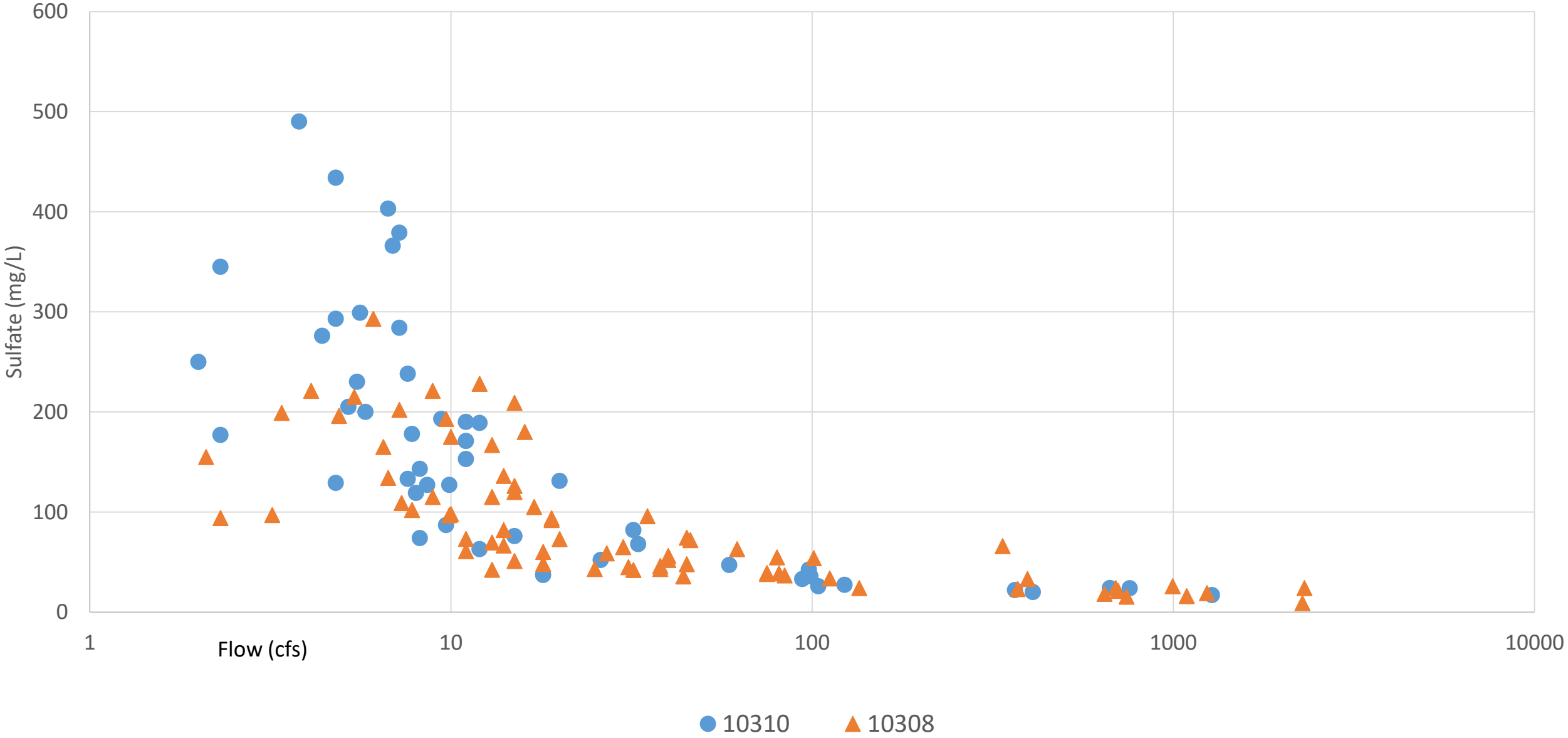
Impairments:

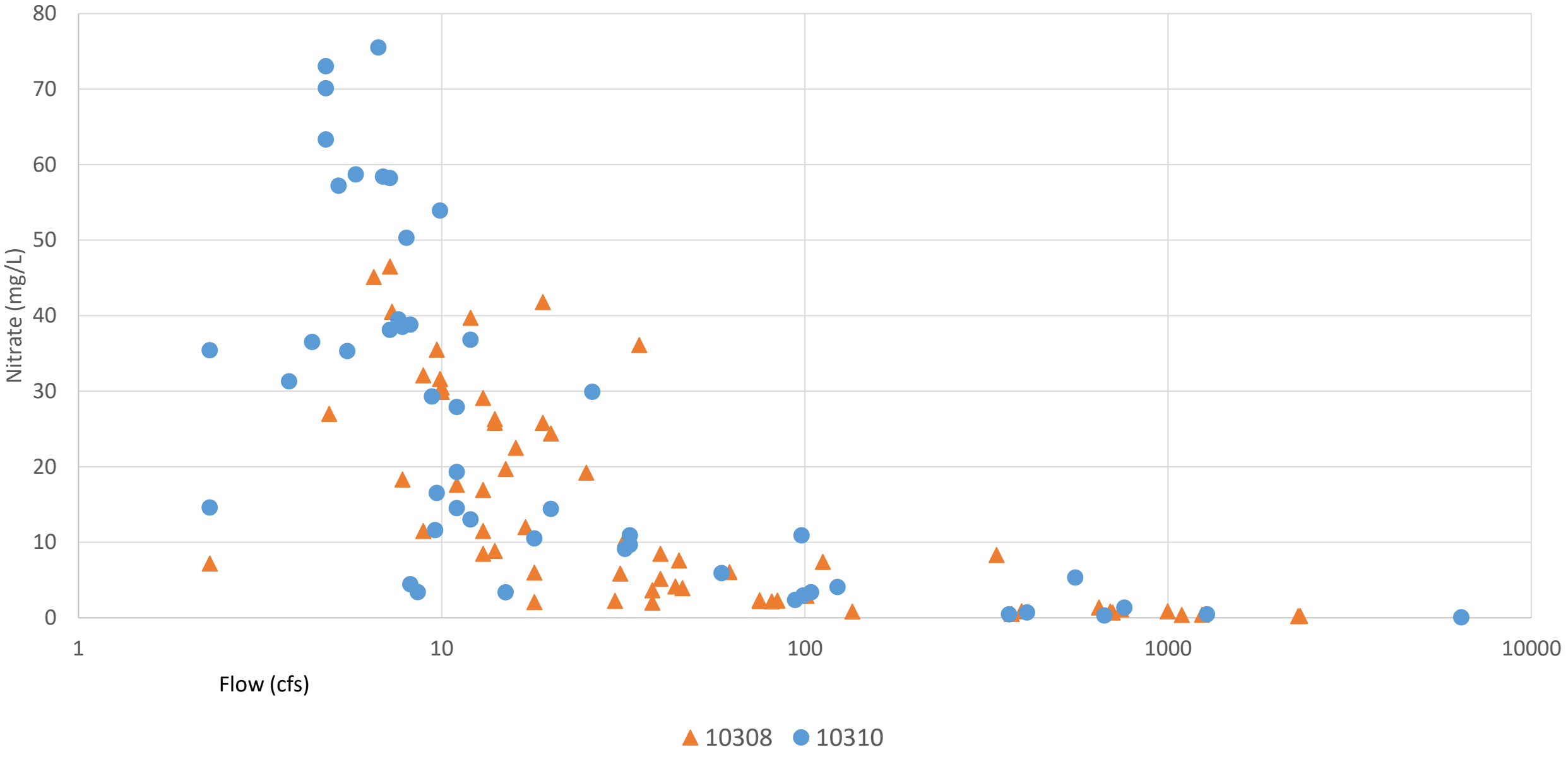
- Sulfate
- *E. coli*

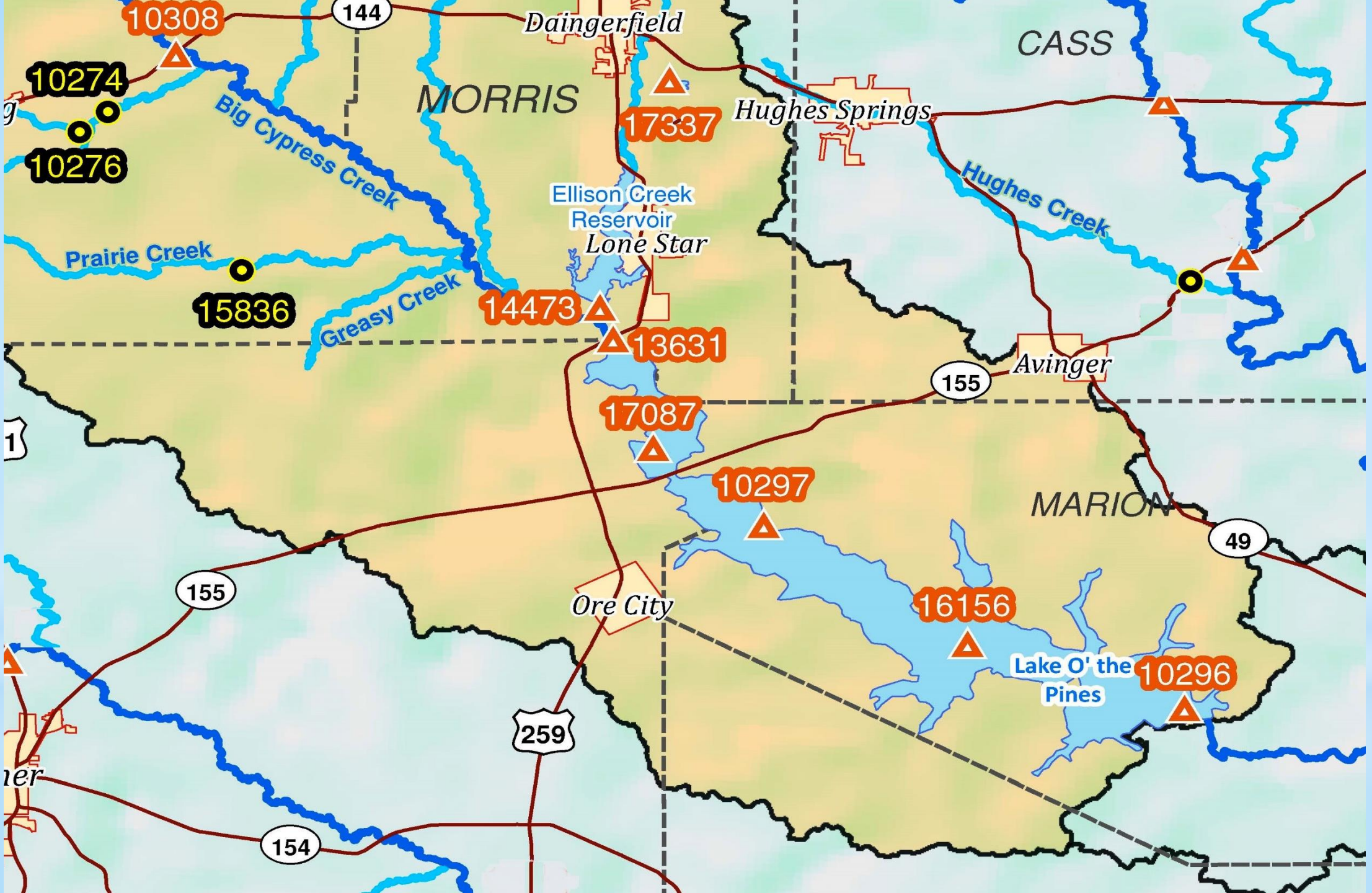
Concerns:

- Nitrate
- Total Phosphorus
- Chlorophyll *a*

AU 0404_02
Sulfate versus Flow




AU 0404_02
Nitrate versus Flow
Nitrate (mg/L)
80
70
60
50
40
30
20
10
0
1
10
100
1000
10000
Flow (cfs)
10308
10310


10308
144
Daingerfield
CASS
10274
MORRIS
17337
Hughes Springs
Big Cypress Creek
10276
Ellison Creek
Reservoir
Hughes Creek
Lone Star
Prairie Creek
15836
Greasy Creek
14473
13631
Avinger
155
17087
10297
MARION
49
155
Ore City
16156
Lake O' the
Pines
10296
259
154

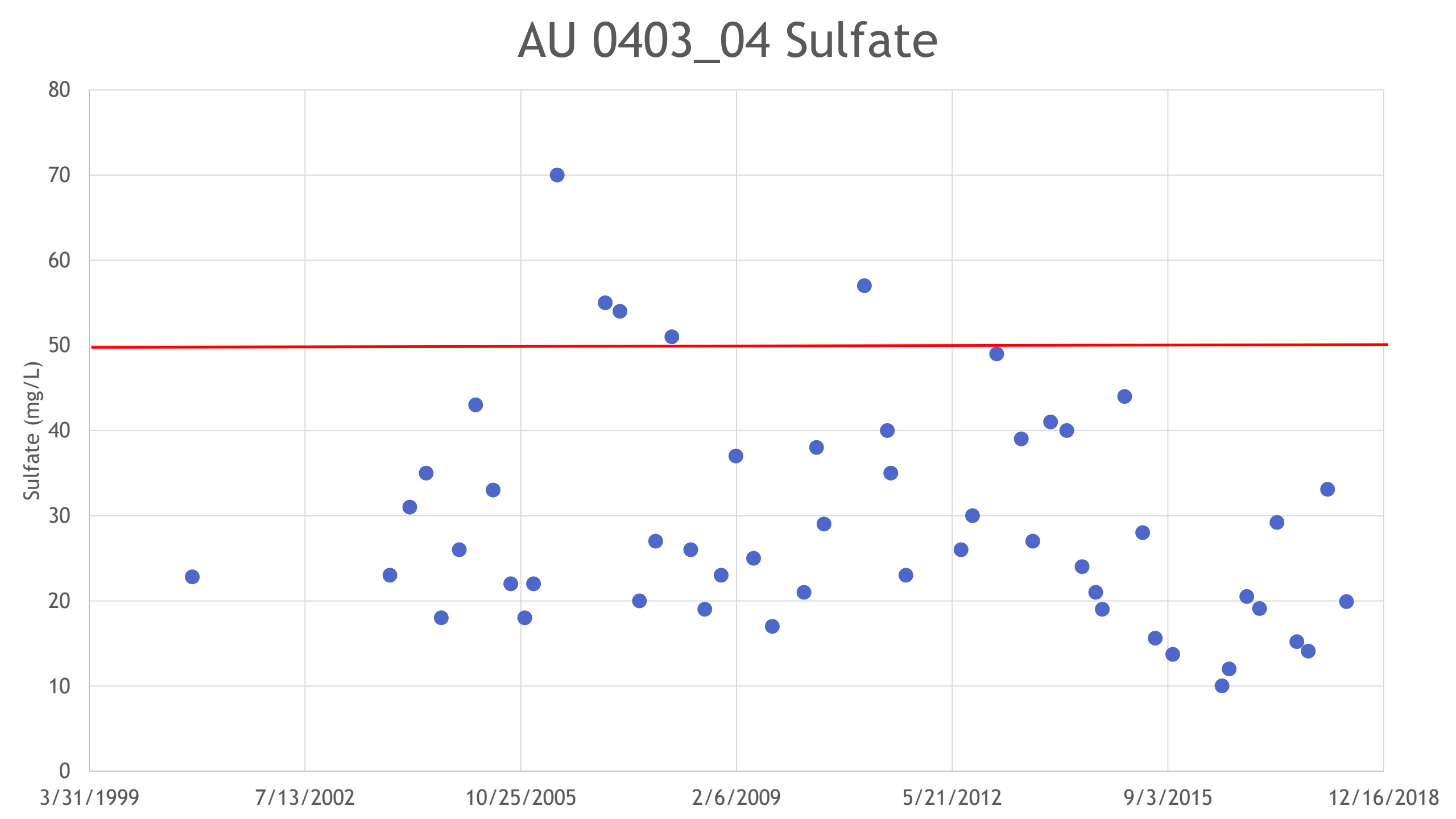
Segment 0403 Lake O' the Pines

Impairments:

- High pH (AU_02)
- 24 HR DO Minimum (AU_04)

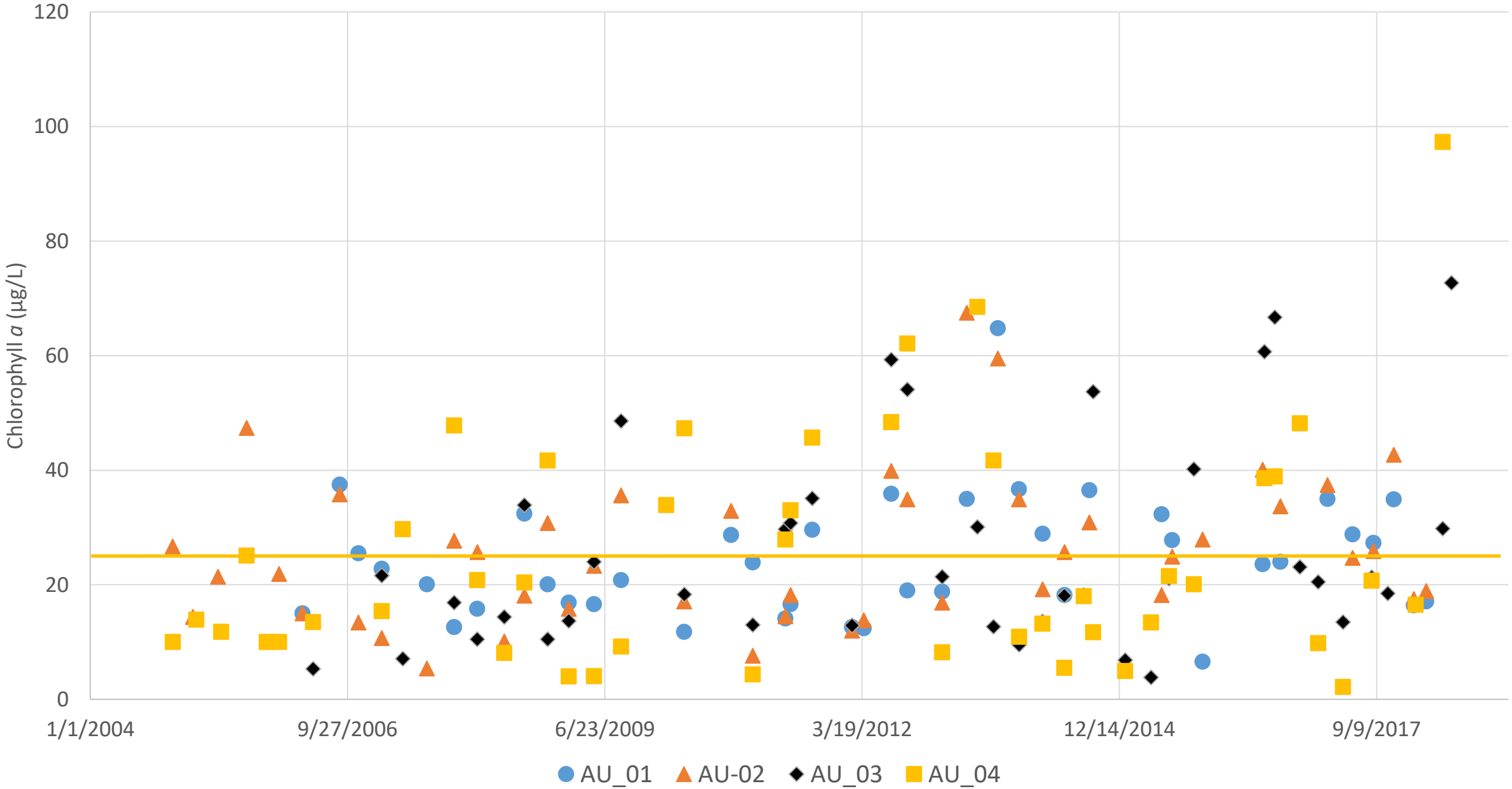
Concerns:

- High pH (AU_01)

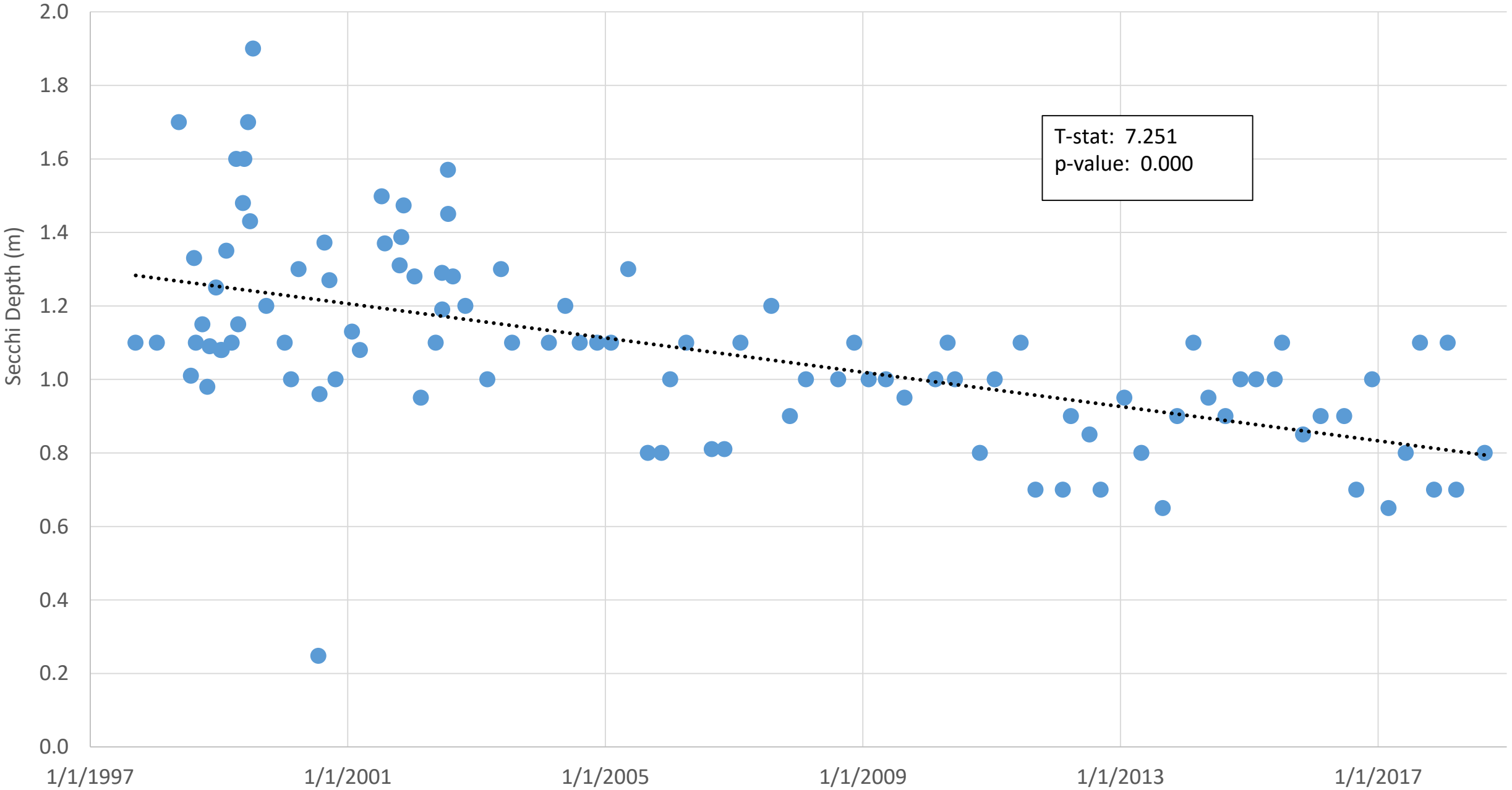

AU 0403_04 Sulfate
Sulfate (mg/L)
80
70
60
50
40
30
20
10
0
3/31/1999
7/13/2002
10/25/2005
2/6/2009
5/21/2012
9/3/2015
12/16/2018

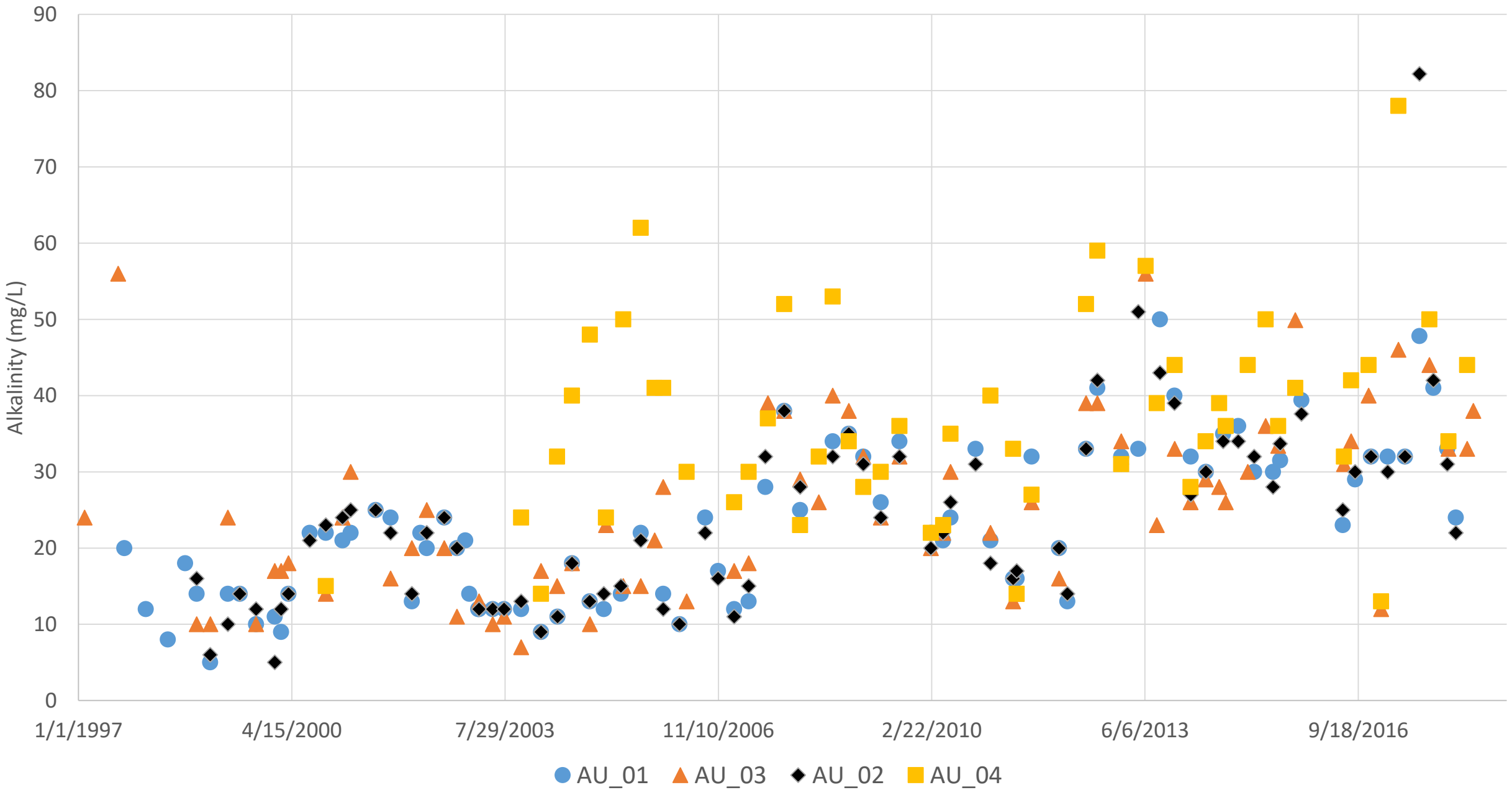
Percent of Samples Exceeded Screening Levels				
Parameter	**AU_01**	**AU_02**	**AU_03**	**AU_04**
Chlorophyll *a*	45%	48%	43%	52%
Nitrate	0%	0%	8%	26%
Total Phosphorus	0%	0%	0%	22%

Lake O' the Pines Chlorophyll *a*

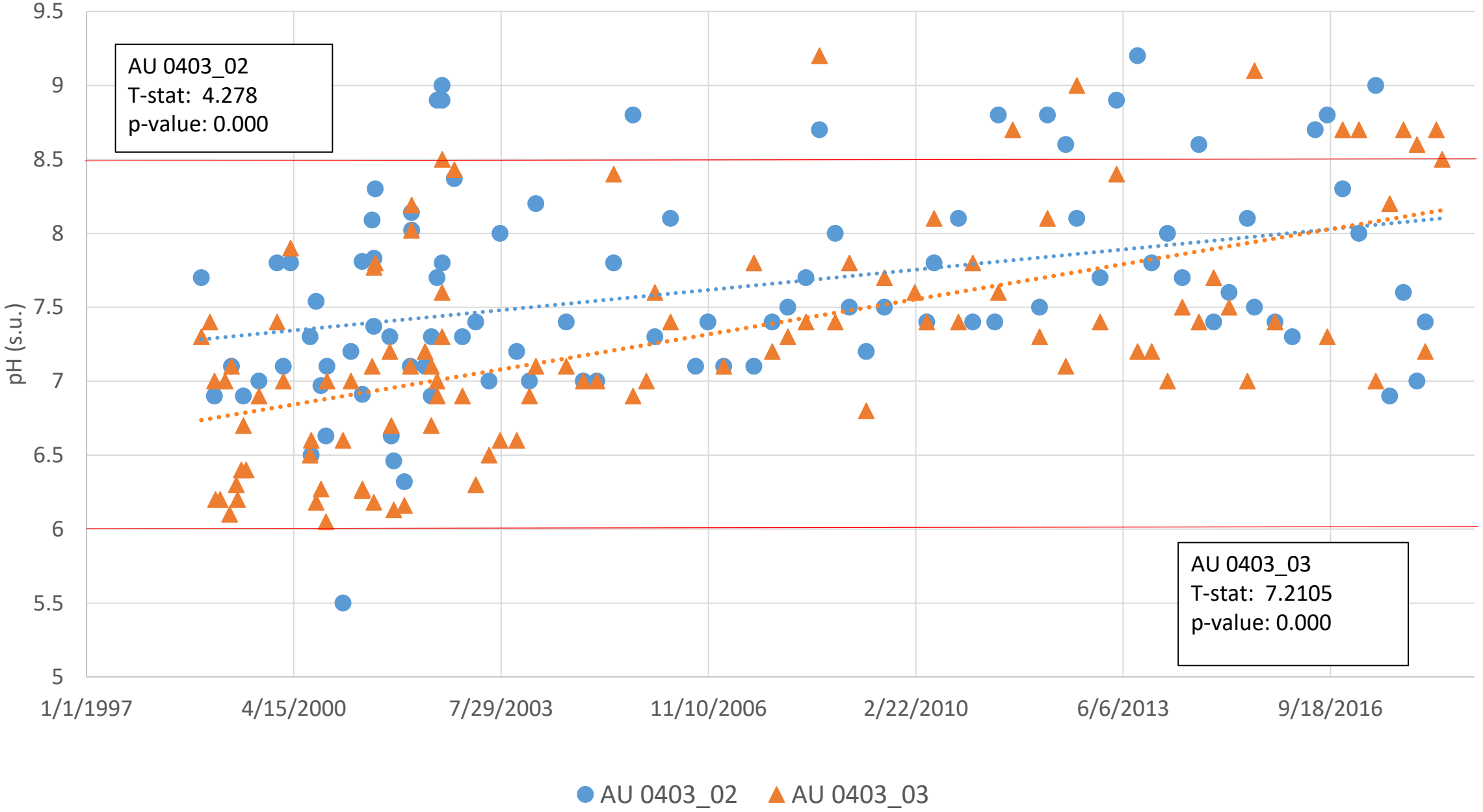


AU 0403_01 Transparency

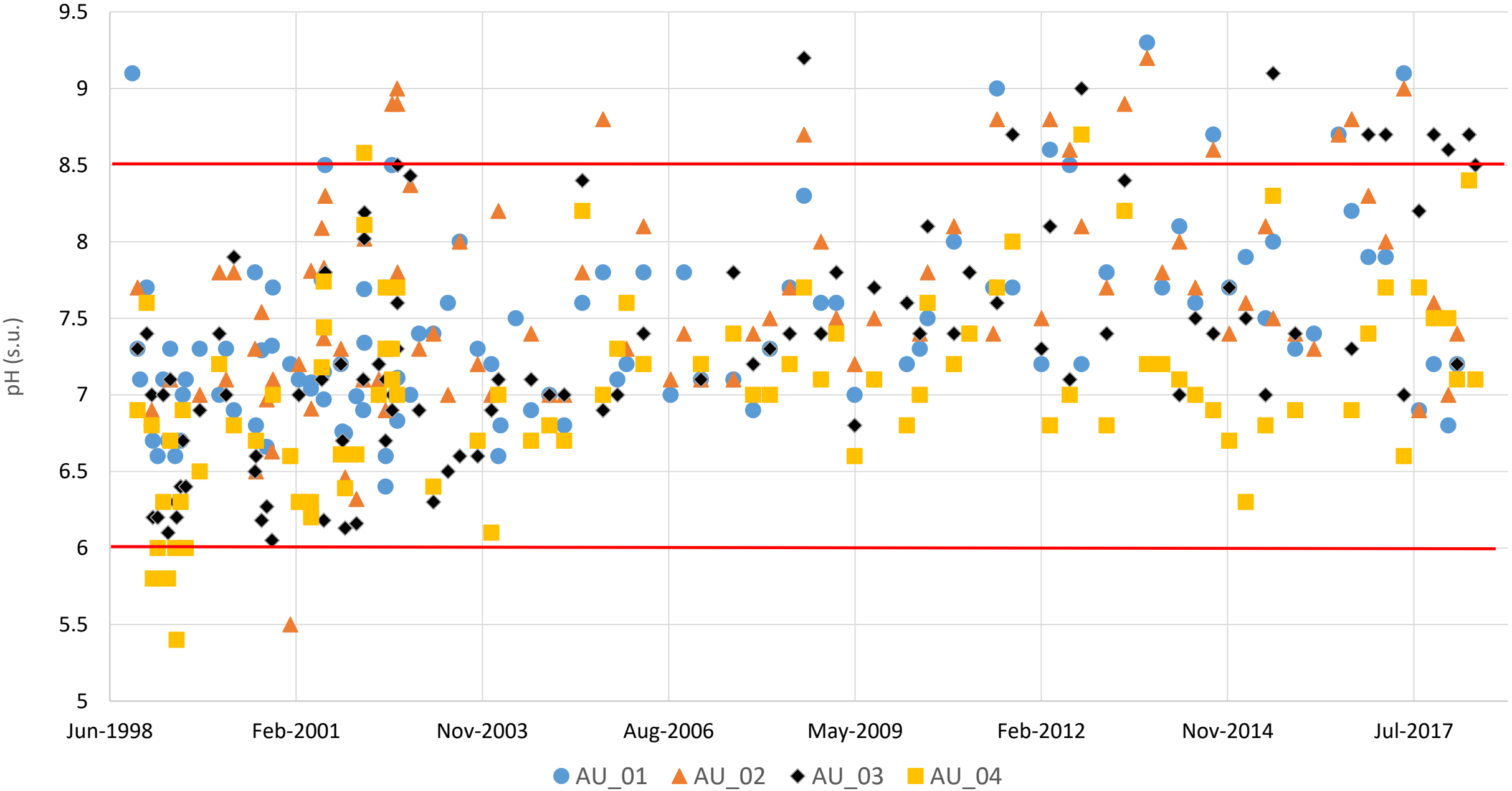



Lake O' the Pines Alkalinity
Alkalinity (mg/L)
90
80
70
60
50
40
30
20
10
0
1/1/1997
4/15/2000
7/29/2003
11/10/2006
2/22/2010
6/6/2013
9/18/2016
AU_01
AU_03
AU_02
AU_04

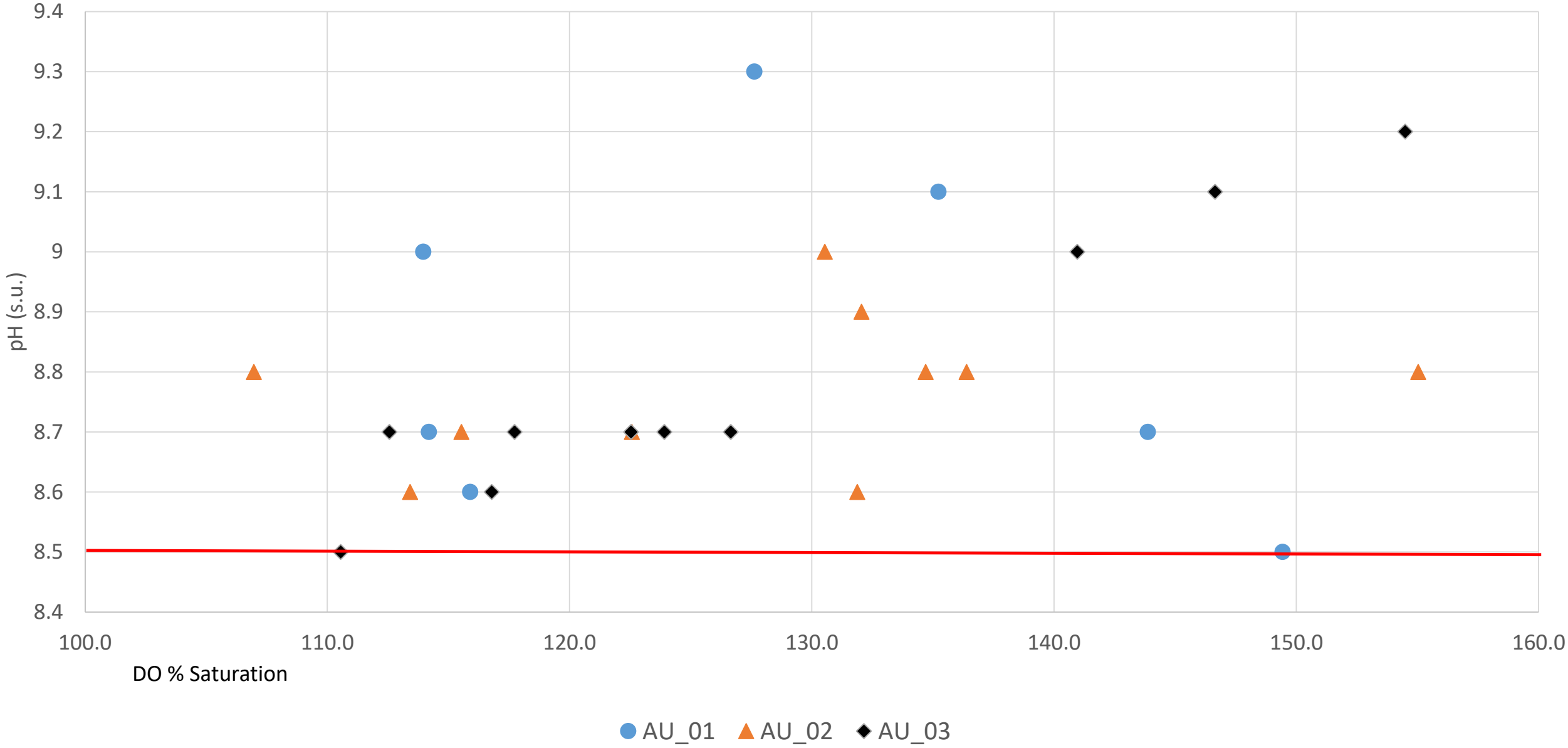
AU 0403_02 and AU 0403_03 pH Trends

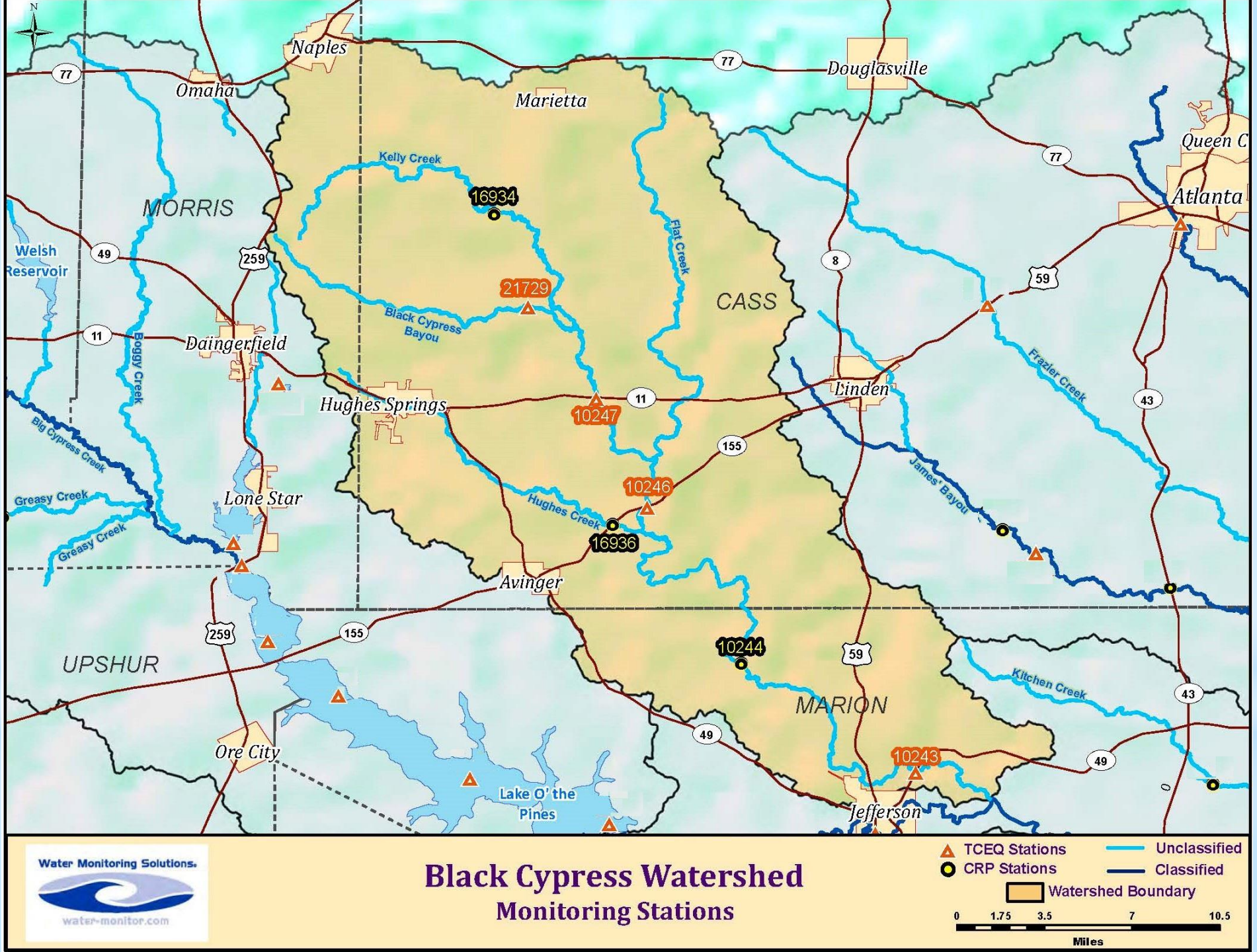


Lake O' the Pines pH by AU



Lake O' the Pines
High pH versus DO % Saturation




Naples
Omaha
Marietta
Douglasville
Queen C
Atlanta
Kelly Creek
16934
MORRIS
Welsh Reservoir
Flat Creek
21729
CASS
Black Cypress Bayou
Boggy Creek
Daingerfield
Hughes Springs
10247
Linden
Frazier Creek
Big Cypress Creek
Greasy Creek
Lone Star
Hughes Creek
10246
16936
James Bayou
Avinger
10244
UPSHUR
Kitchen Creek
MARION
Ore City
10243
Lake O' the Pines
Jefferson
77
49
259
11
155
8
59
43
Water Monitoring Solutions
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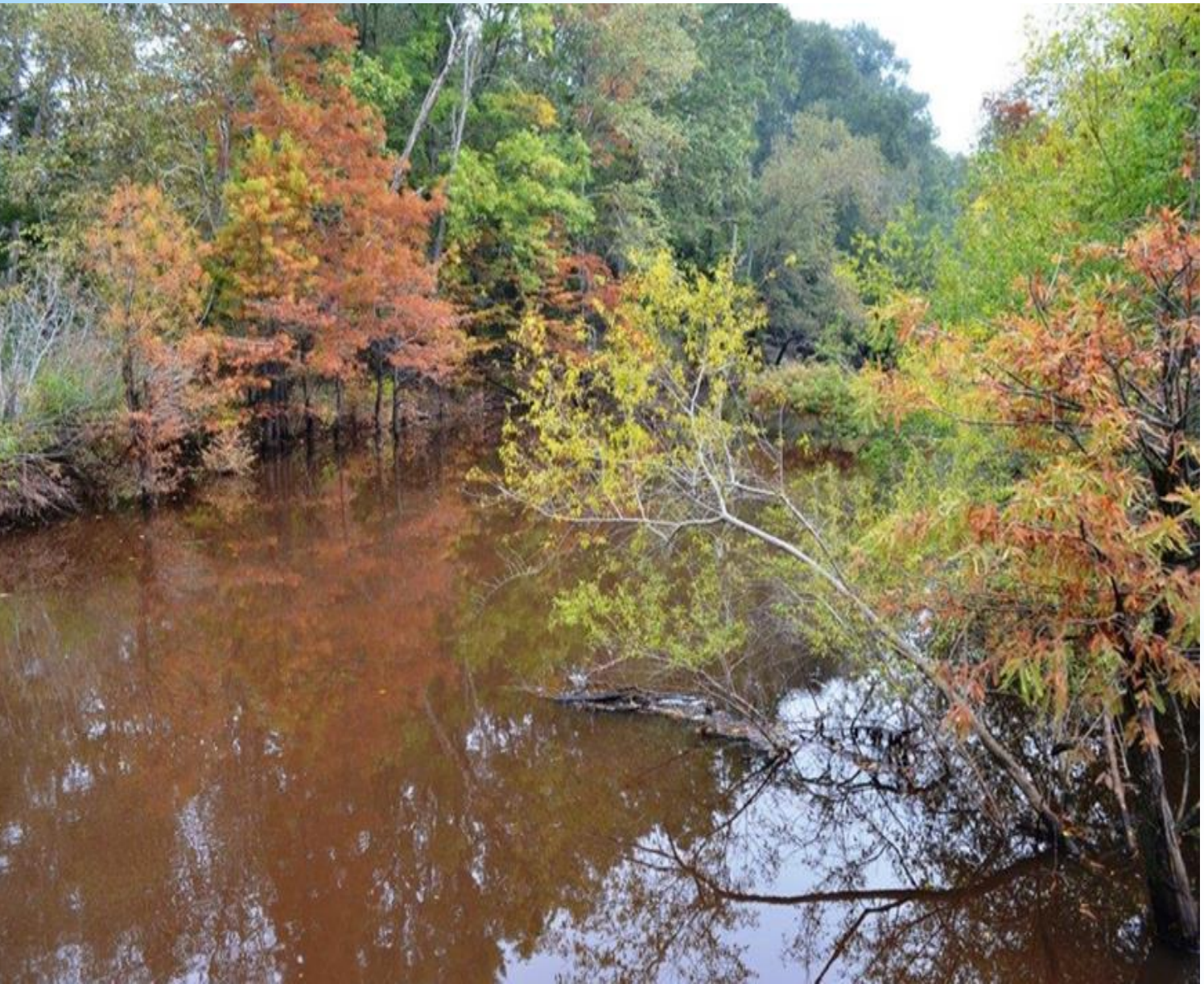
Black Cypress Watershed
Monitoring Stations
TCEQ Stations
CRP Stations
Unclassified
Classified
Watershed Boundary
0 1.75 3.5 7 10.5
Miles

Segment 0410 Black Cypress Creek/Bayou

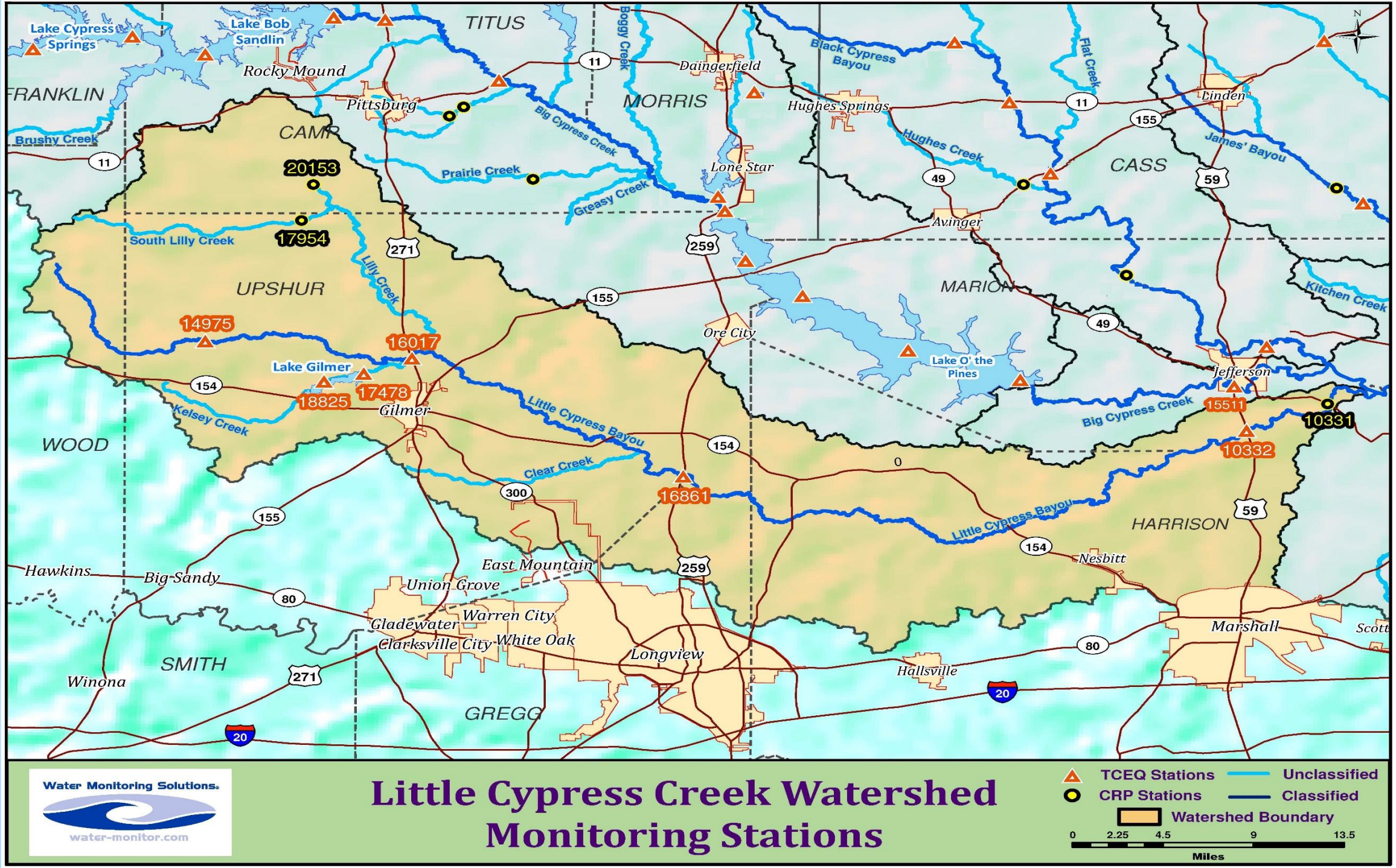


Impairments:

- Copper
- Mercury
- 24 HR DO
- *E. coli*

Concerns:

- Copper
- DO Grab/24 HR DO
- *E. coli*


Lake Cypress Springs
Lake Bob Sandlin
Rocky Mound
TITUS
Boggy Creek
Daingerfield
Black Cypress Bayou
Flat Creek
FRANKLIN
Pittsburg
MORRIS
Hughes Springs
Linden
Brushy Creek
CAMP
Big Cypress Creek
Hughes Creek
James' Bayou
CASS
20153
Prairie Creek
Lone Star
Greasy Creek
17954
Avinger
South Lilly Creek
Lilly Creek
UPSHUR
MARION
Kitchen Creek
14975
16017
Ore City
Lake Gilmer
Lake O' the Pines
Jefferson
18825
17478
Gilmer
Kelsey Creek
Little Cypress Bayou
15511
10331
Big Cypress Creek
WOOD
Clear Creek
10332
16861
Little Cypress Bayou
HARRISON
Nesbitt
Hawkins
Big Sandy
East Mountain
Union Grove
Gladewater
Warren City
Clarksville City
White Oak
Longview
Marshall
Scott
SMITH
Winona
Hallsville
GREGG
11
49
155
59
271
259
154
300
80
20
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Little Cypress Creek Watershed
Monitoring Stations
TCEQ Stations
CRP Stations
Unclassified
Classified
Watershed Boundary
0 2.25 4.5 9 13.5
Miles

Segment 0409 Little Cypress Creek/Bayou

Impairments:

- 24 HR DO
- *E. coli*

Concerns:

- DO Grab/24 HR DO
- *E. coli*

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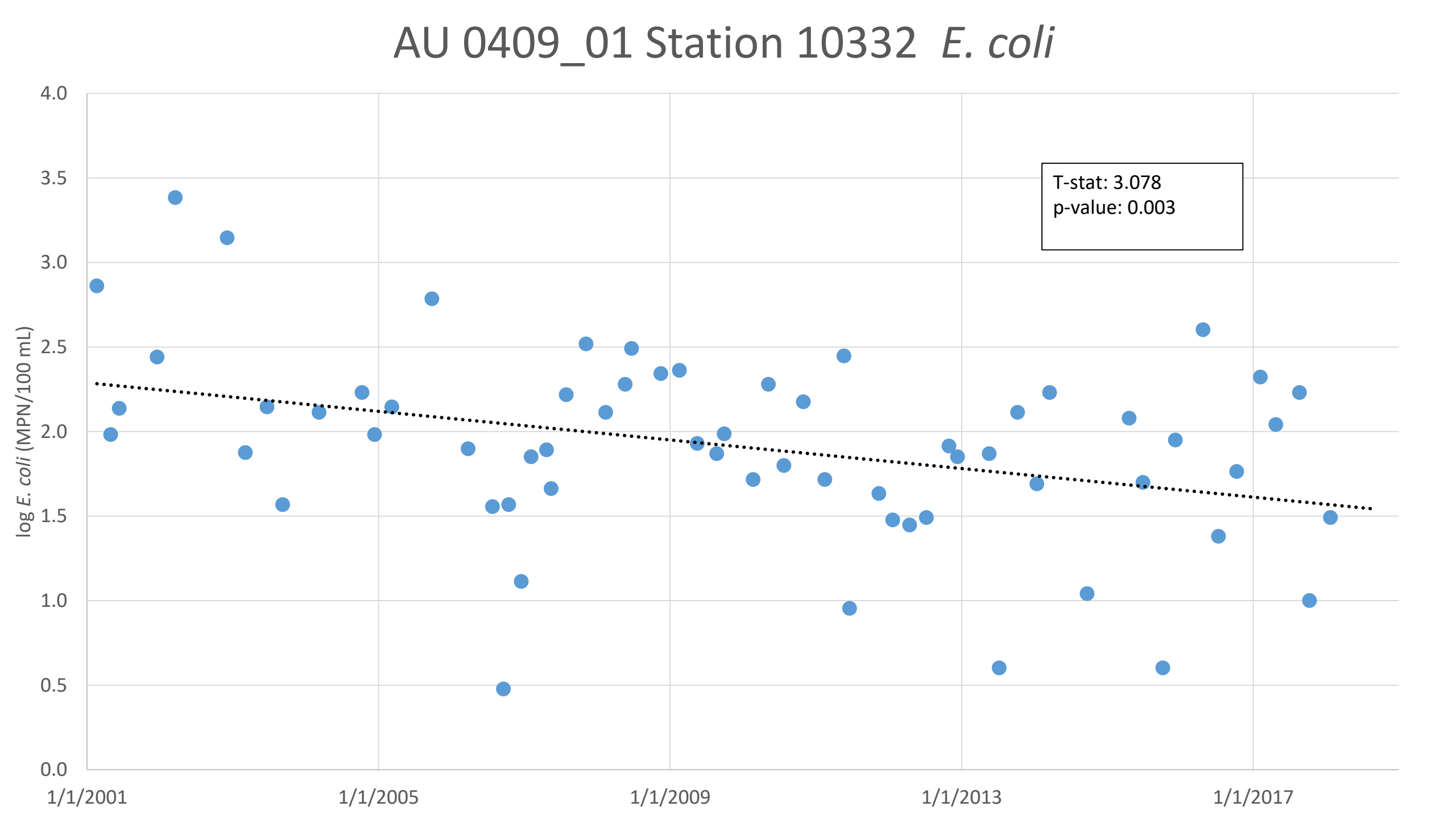
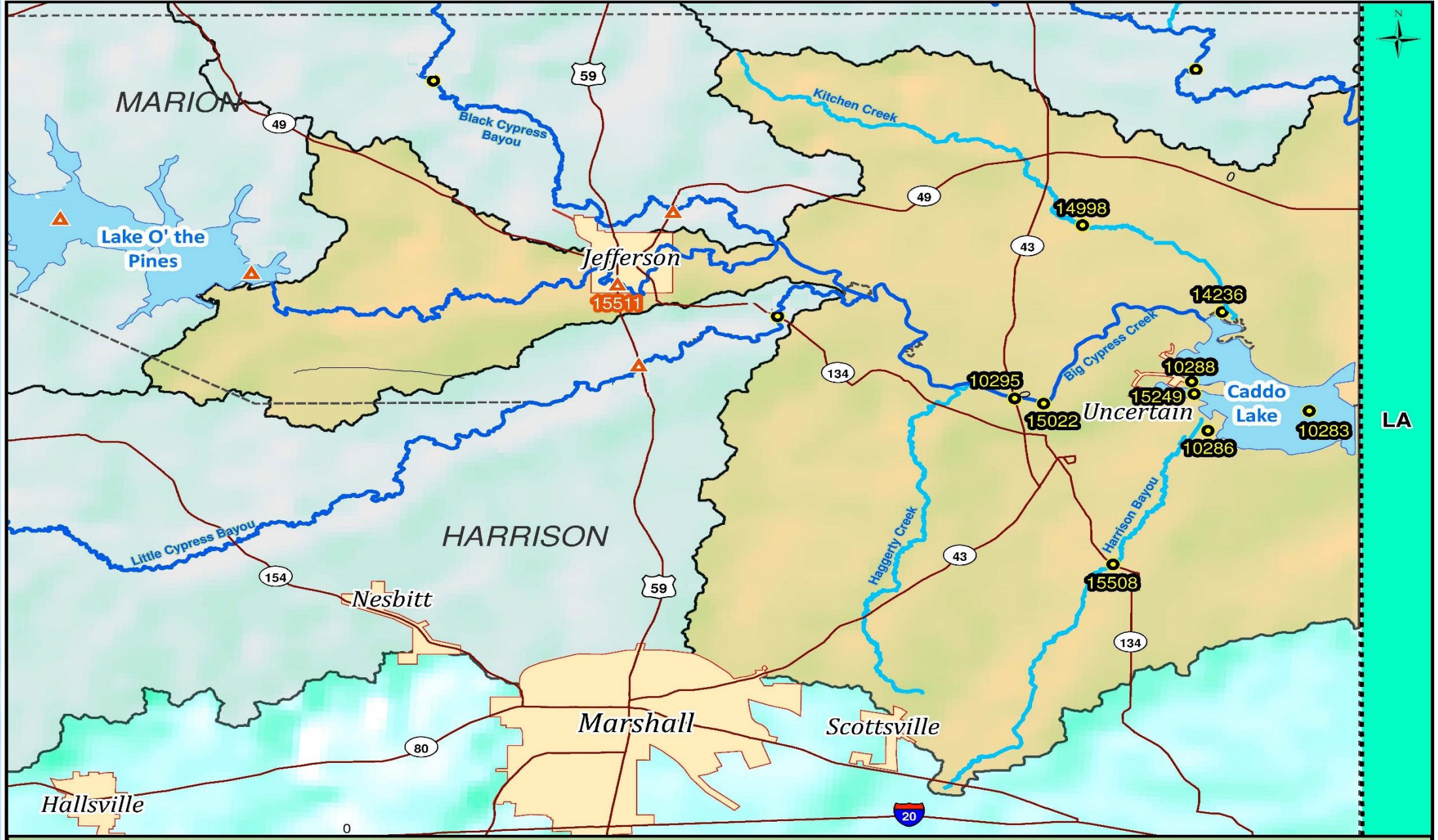

AU 0409_01 Station 10332 E. coli
T-stat: 3.078
p-value: 0.003
log E. coli (MPN/100 mL)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/2001
1/1/2005
1/1/2009
1/1/2013
1/1/2017



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Caddo Lake Watershed Monitoring Stations

TCEQ Stations
CRP Stations
Unclassified
Classified
Watershed Boundary
0 1.5 3 6 9

Segment 0402 Big Cypress Creek below LOP

Impairments:

- 24 HR DO
- Mercury

Concerns:

- Benthic Community
- DO Grab *(Hughes Creek)*

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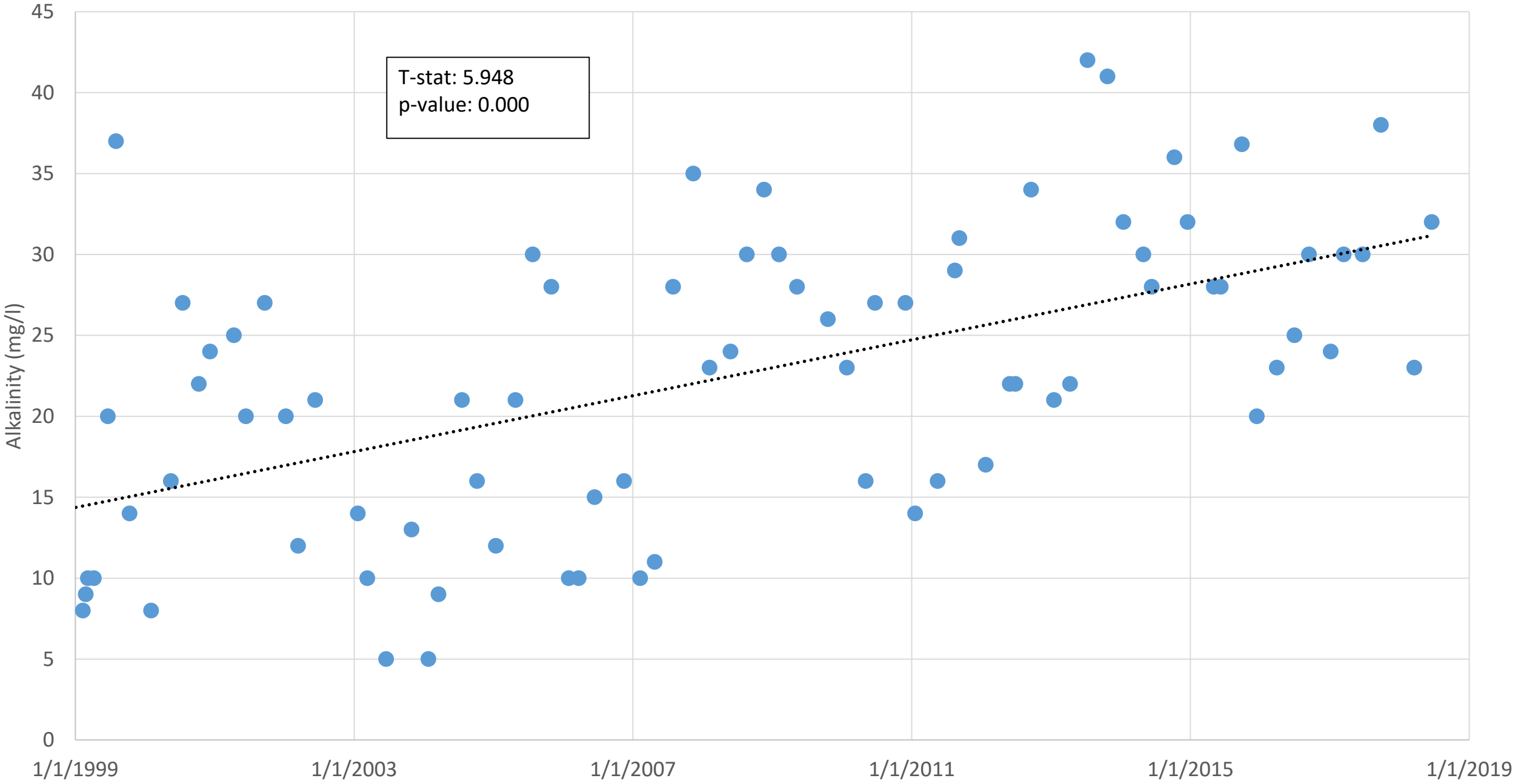
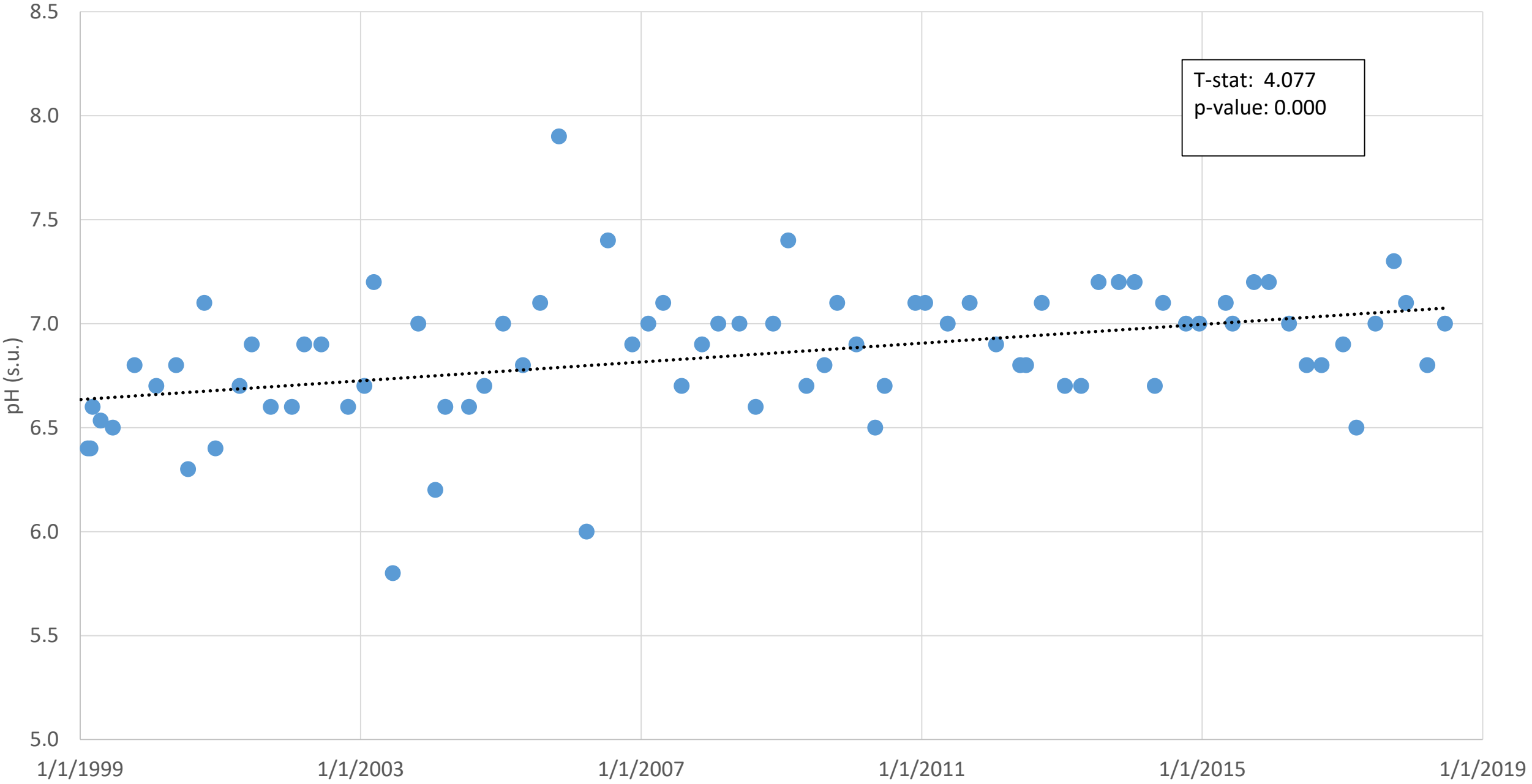
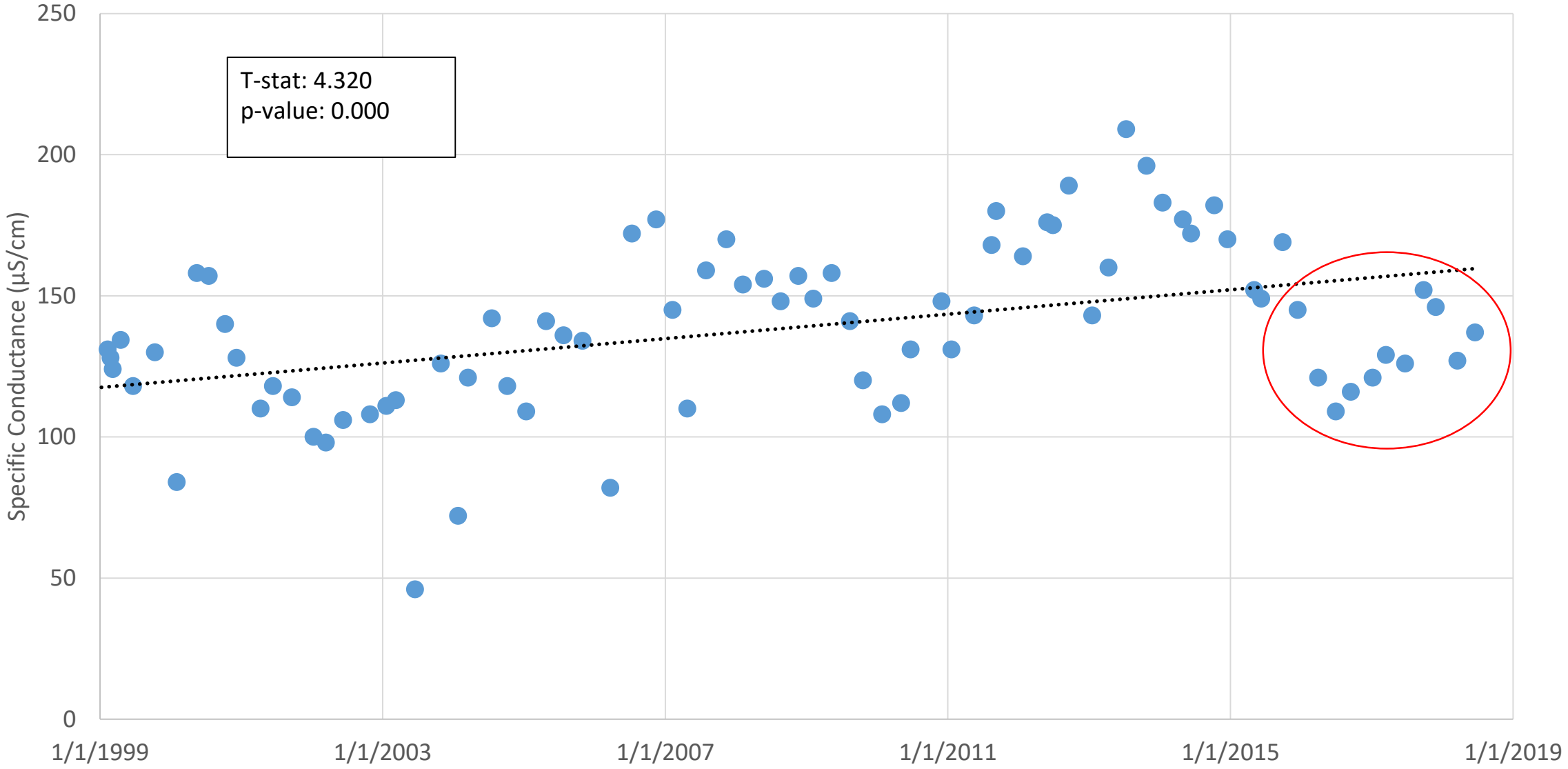
AU 0402_03 Station 15511 Alkalinity



AU 0402_03 Station 15511 pH



AU 0402_03 Station 15511 Specific Conductance



Segment 0401 Caddo Lake

Impairments:

- 24 HR DO/DO Grab
- Mercury

Concerns:

- DO Grab
- *E. coli (Harrison Bayou)*

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Caddo Lake DO Grab January 2010 - June 2018						
	Station	n	< 3 mg/L	%	< 5 mg/L	%
Clinton Lake	14236	94	33	35.1%	47	50.0%
Uncertain	15249	123	33	26.8%	56	45.5%
Harrison Bayou Arm	10286	91	21	23.1%	36	39.6%
Goose Prairie Arm	10288	83	23	27.7%	34	41.0%
Mid-lake	10283	130	0	0.0%	6	4.6%

Water Monitoring Solutions.

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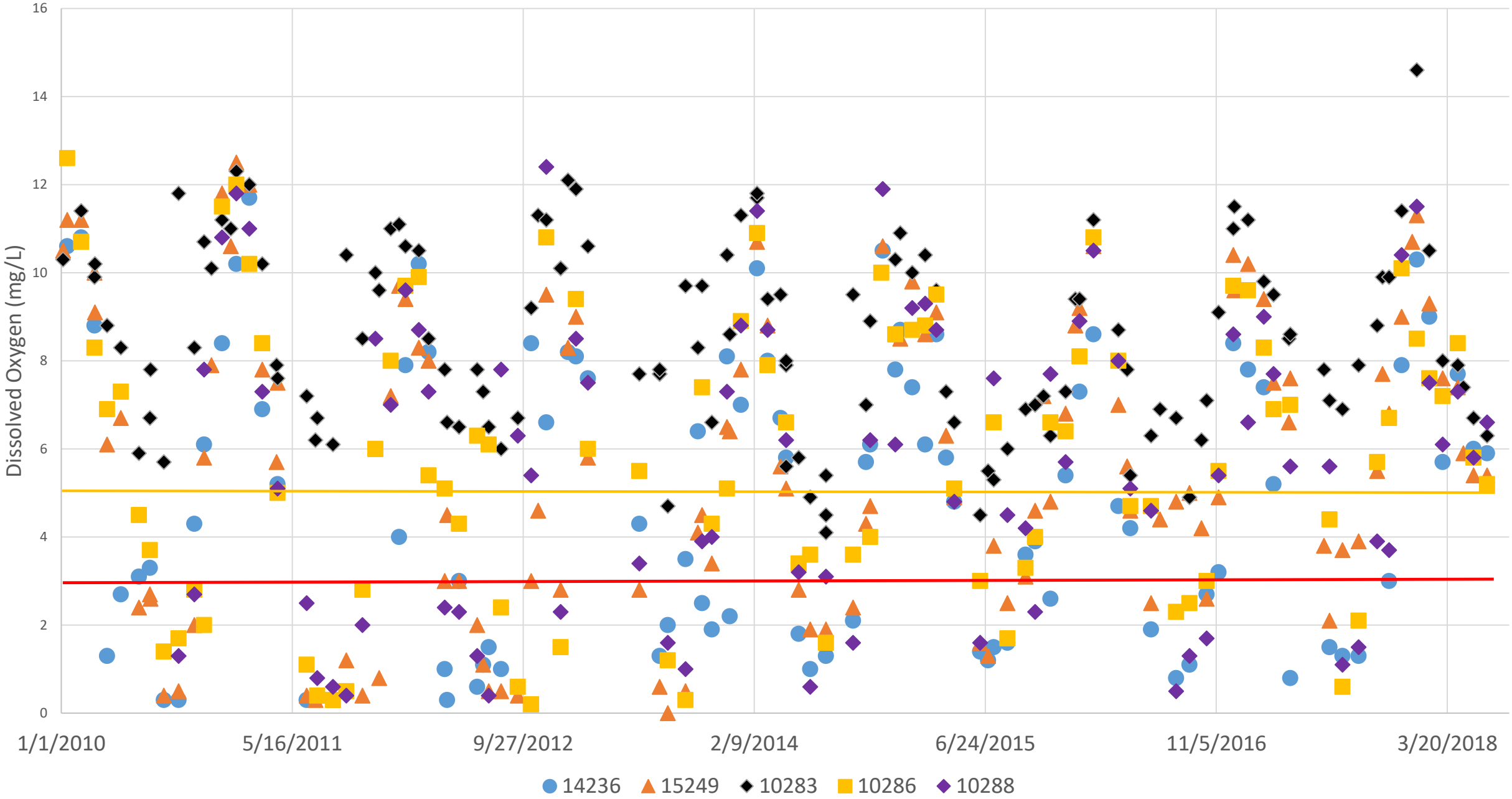
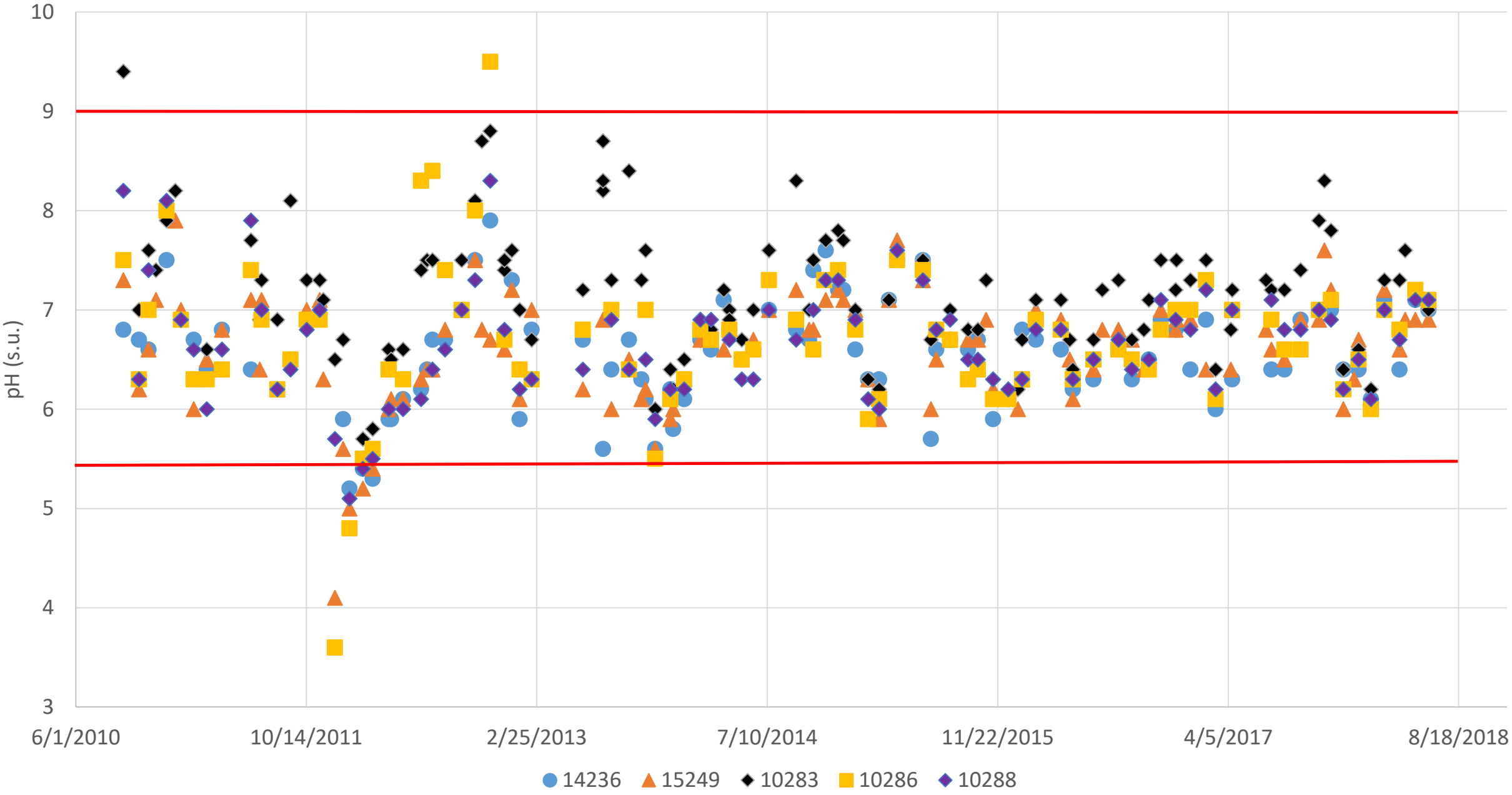
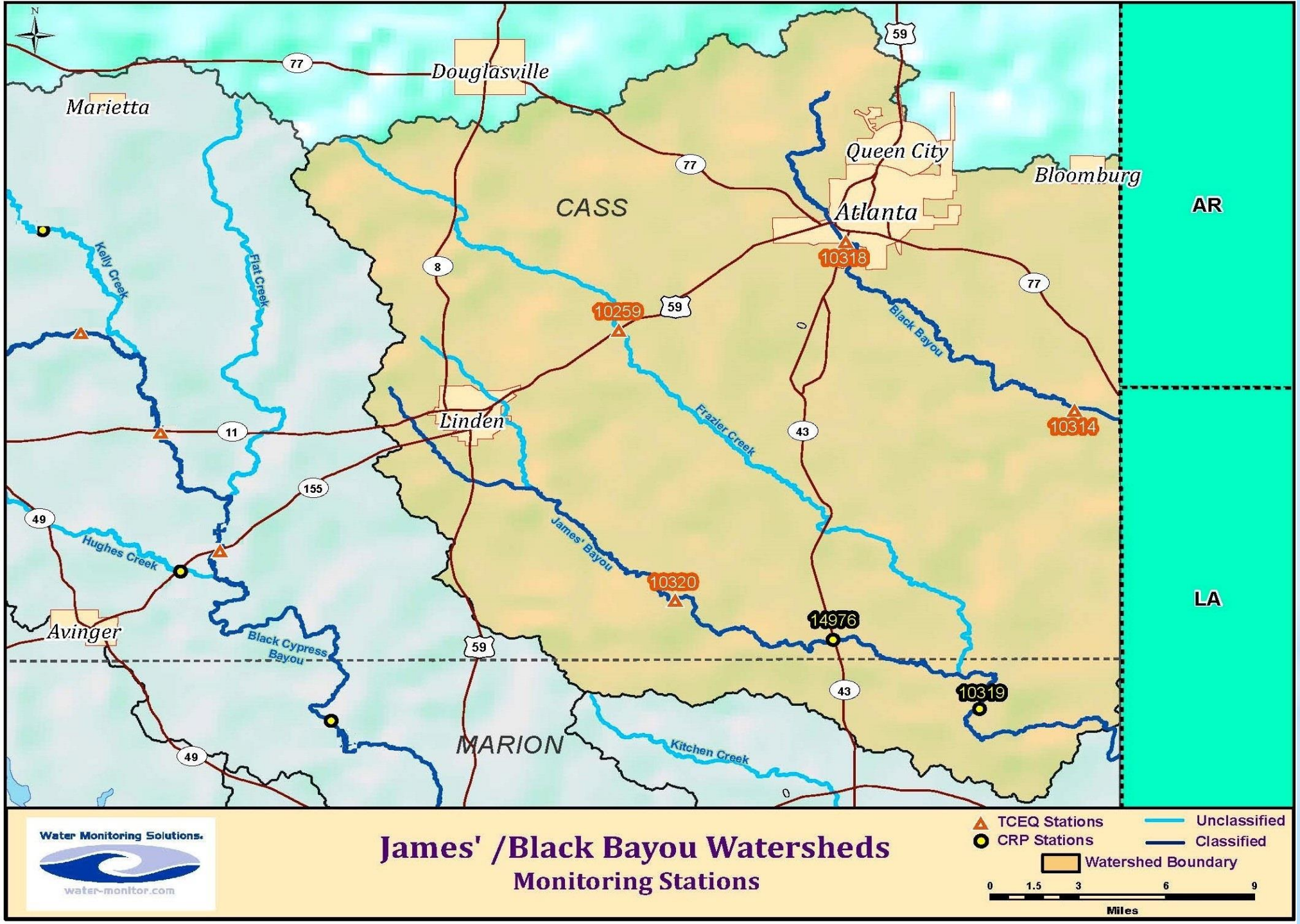
Caddo Lake Dissolved Oxygen Grab Samples



Caddo Lake pH




Douglasville
Marietta
Queen City
Bloomburg
CASS
Atlanta
AR
LA
Linden
Avinger
MARION
Kelly Creek
Flat Creek
Black Bayou
Frazier Creek
James' Bayou
Hughes Creek
Black Cypress Bayou
Kitchen Creek
10318
10259
10314
10320
14976
10319
77
59
8
11
155
49
43
0
Water Monitoring Solutions.
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James' /Black Bayou Watersheds
Monitoring Stations
TCEQ Stations
CRP Stations
Unclassified
Classified
Watershed Boundary
0 1.5 3 6 9
Miles

Station 14976 Jim's Bayou at SH 43	2016		2017	
	16-Jun	2-Aug	10-May	6-Jul
Fish	37 (Int.)	42 (High)	51 (High)	46 (High)
Benthos	22 (Int.)	28 (Int.)	23 (Int.)	26 (Int.)
Habitat	15 (Int.)	15 (Int.)	16.5 (Int.)	17.5 (Int.)

Conclusions and Recommendations

- The most common impairments were DO, *E. coli*, and Mercury in tissue
- Data support most impairments
- Low/No Flow associated with most low DO readings
- Effluent appears to be the source of Nutrients and Sulfate in Big Cypress Creek
- More RUAAs are needed to address *E. coli* impairments and concerns
- Increasing pH and chlorophyll may be an indication of eutrophication in Cypress Creek Basin reservoirs

Conclusions and Recommendations

Areas of Future Study:

- What is(are) the source(s) of Sulfate in Big Cypress Creek?
- How does high Sulfate affect Lake O' the Pines?
- Why is Alkalinity increasing throughout the Basin?
- Is increasing pH due to eutrophication?
- What are the DO and pH diel ranges?
- What effects does this have on the biota? Drinking water treatment?

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