Alabama Department of Environmental Management

Tennessee River Basin

Rivers and Reservoirs Monitoring Program

Town Creek Embayment
Wilson Reservoir
Intensive Basin Survey 2015

WILL-3: Town Creek approx 1 mi downstream of CR 314 bridge (Colbert Co 34.77306/-87.43028)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) began monitoring lake water quality statewide in 1985, followed by a second statewide survey in 1989. In 1990, the Reservoir Water Quality Monitoring Program [now known as the Rivers and Reservoirs Monitoring Program (RRMP)] was initiated by ADEM.

The current objectives of this program are to provide data that can be used to assess current water quality conditions, identify trends in water quality conditions and to develop Total Maximum Daily Loads (TMDLs) and water quality criteria. Descriptions of all RRMP monitoring activities are available in ADEM's 2012 Monitoring Strategy (ADEM 2012).

In 2015, ADEM monitored the Town Creek tributary embayment of Wilson Reservoir as part of the basin assessment of the Tennessee River under the RRMP. This site was selected using historical data and previous assessments. The purpose of this report is to summarize data collected in the Town Creek embayment (WILL-3) during the 2015 growing season (Apr-Oct). This is the forth basin assessment of the Tennessee River since ADEM began sampling. Monthly and/or mean concentrations of nutrients [total nitrogen (TN); total phosphorus (TP)], algal biomass/productivity [cholorphyll *a* (chl *a)*; algal growth potential testing (AGPT)], sediment [total suspended solids (TSS)], and trophic state [Carlson's trophic state index (TSI)] from 2015 were compared to ADEM's 2003 data and established criteria.

Figure 1. Photo of Town Creek at WILL-3

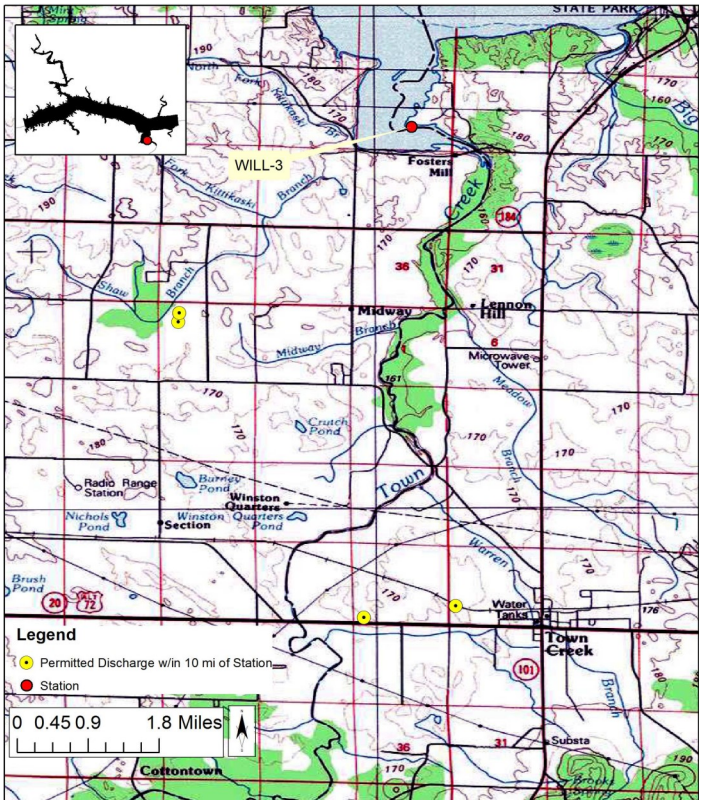


Figure 2. Map of Town Creek embayment of Wilson Reservoir. Though additional permitted facilities may occur in the watershed (Table 1), only those discharges within 10 miles upstream of the station are displayed on the map.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Town Creek is classified as a *Fish & Wildlife (F&W)* stream located in the Interior Plateau ecoregion (71g). Based on the 2006 National Land Cover Dataset, land use within the 246 mi^2 watershed is predominantly agriculture [hay/pasture (36%) and crops (14%)] (Fig. 3). As of January 28, 2016, ADEM has issued a total of 21 NPDES permits within the watershed. Four of those permits are located within 10 mi of the station (Fig. 2).

SITE DESCRIPTION

The Town Creek embayment at WILL-3 is located east of Muscle Shoals, AL near the Doublehead Resort. It is a fairly wide embayment at the sampling location with emergent vegetation in the shallow areas and along the bank. Town Creek flows into the Tennessee River at river mile 273 and has a mean bottom depth of 2.3 m (Table 2) at the sampling location.

METHODS

Water quality assessments were conducted at monthly intervals, April-October. All samples were collected, preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures (ADEM 2015), Surface Water Quality Assurance Project Plan (ADEM 2012), and Quality Management Plan (ADEM 2013).

Mean growing season TN, TP, chl *a*, and TSS were calculated to evaluate water quality conditions. Monthly concentrations of these parameters were graphed with ADEM's previously collected data to help interpret the 2015 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

RESULTS

The following discussion of results is limited to those parameters which directly affect trophic status or parameters which have established criteria. Results of all water chemistry analyses are presented in Table 2. The axis ranges of the graphs in Figs. 4-6 were set to maximum values reservoir-wide so all embayment reports on the same reservoir could be compared.

Table 1: Summary of Watershed **WILL-3**

Basin		Tennessee R
Drainage Area (mi^2)		246
Ecoregion[a]		71g
% Land use		
Open Water		1%
Developed	Open Space	4%
	Low Intensity	<1%
	Medium Intensity	<1%
	High Intensity	<1%
Barren Land		<1%
Forest	Deciduous Forest	17%
	Evergreen Forest	6%
	Mixed Forest	3%
Shrub/Scrub		9%
Herbaceous		2%
Hay/Pasture		36%
Cultivated Crops		14%
Wetlands	Woody	8%
	Emergent Herb.	<1%
#NPDES outfalls[b]	TOTAL	21
Construction Stormwater		2
Mining		7
Small Mining		3
Industrial General		6
Industrial Individual		0
No Exposure		0
Municipal		3
Underground Injection Control		0

a. Eastern Highland Rim

b. #NPDES outfalls downloaded from ADEM's NPDES Management System database, Jan 28, 2016.

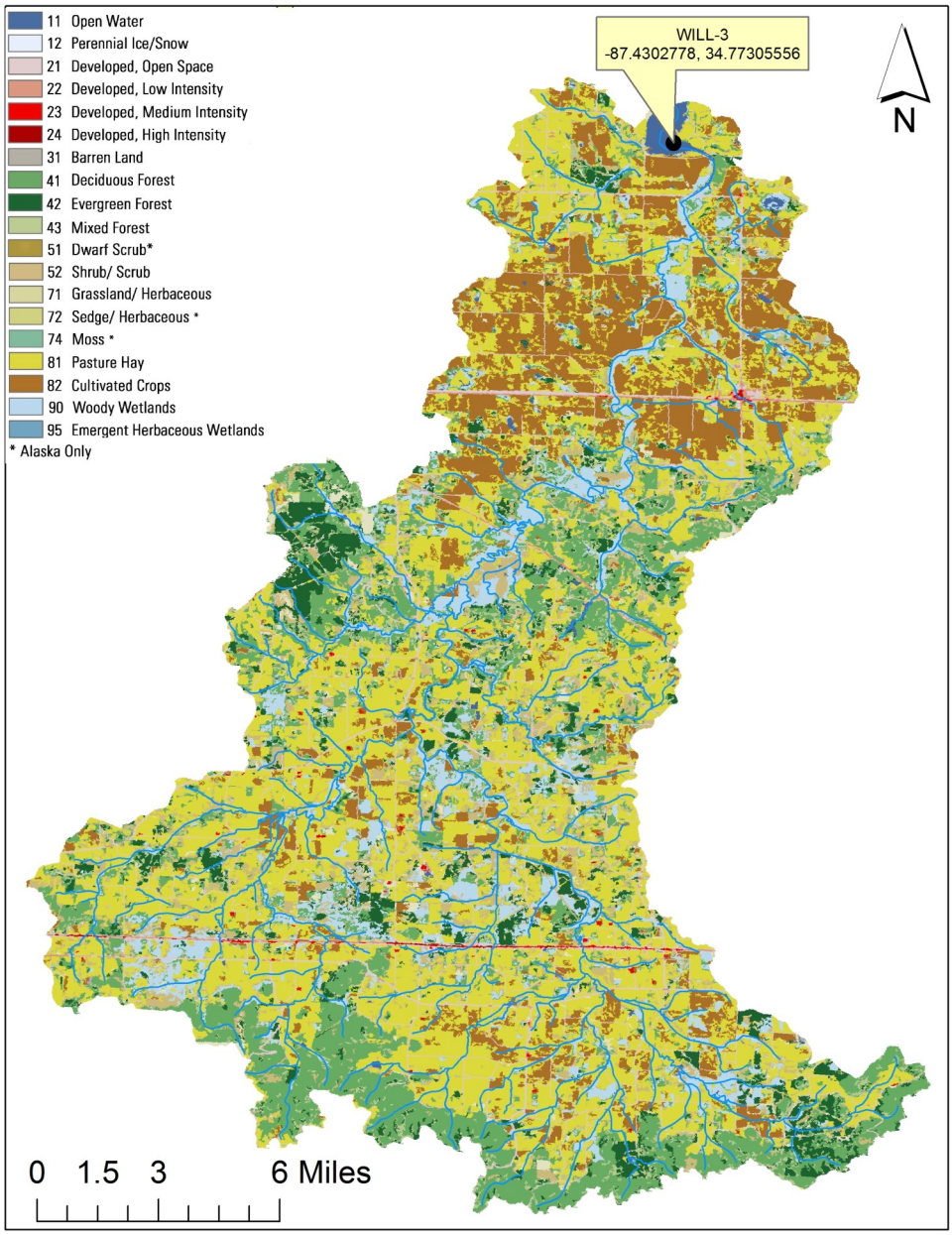


Figure 3. Land use within the Town Creek watershed at WILL-3.

The mean growing season TN value was lower in 2015 than in 2013 (Fig. 4). Monthly TN concentrations were highest in May, and August.

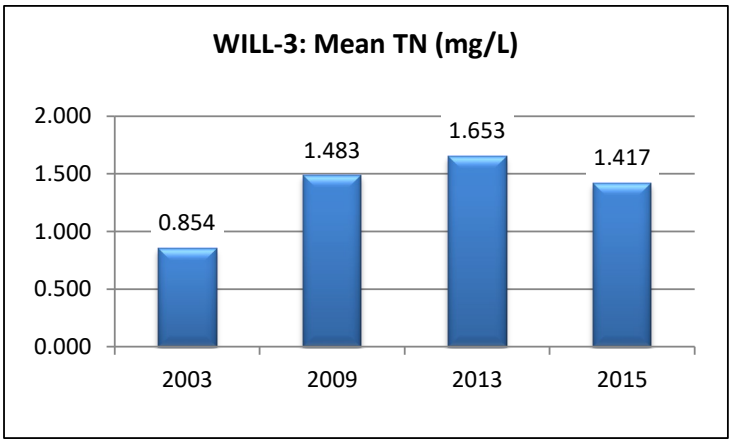
Mean growing season TP concentration values were similar in 2015 and 2013 (Fig. 4). Monthly TP concentration was highest in April and decreased throughout the remainder of the growing season.

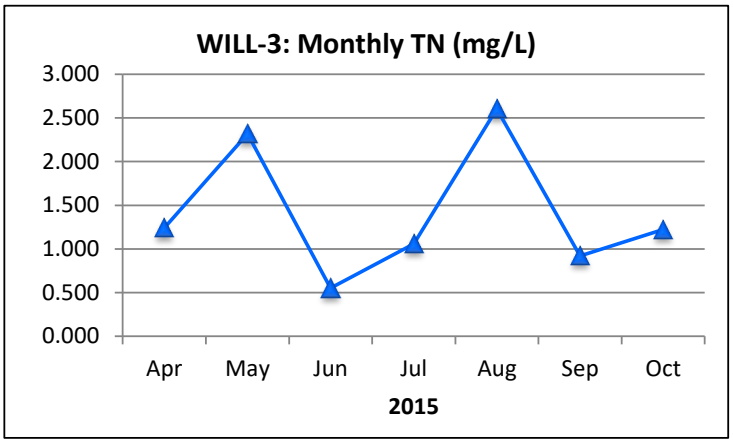
In 2015, the growing season mean chl *a* value was higher than 2013 (Fig. 4). Monthly chl *a* concentrations peaked in August. July, August, and September were also considerably higher compared to April-June.

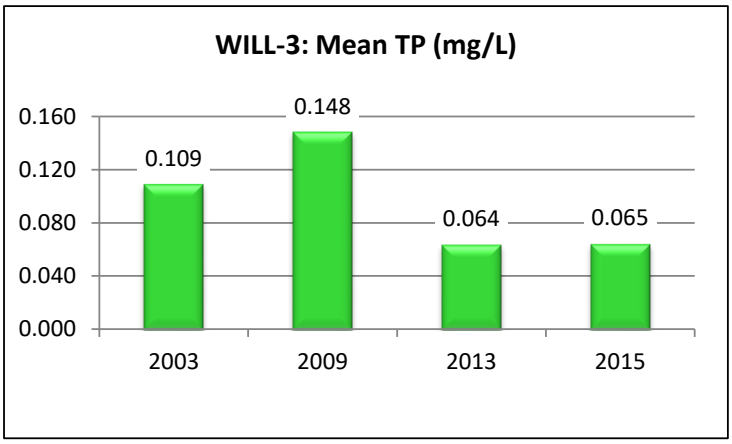
Mean TSI was eutrophic in 2015 and similar to previous years. Monthly TSI in Town Creek was eutrophic May, July, September, and October (Fig. 4). Hypereutrophic conditions occurred in August.

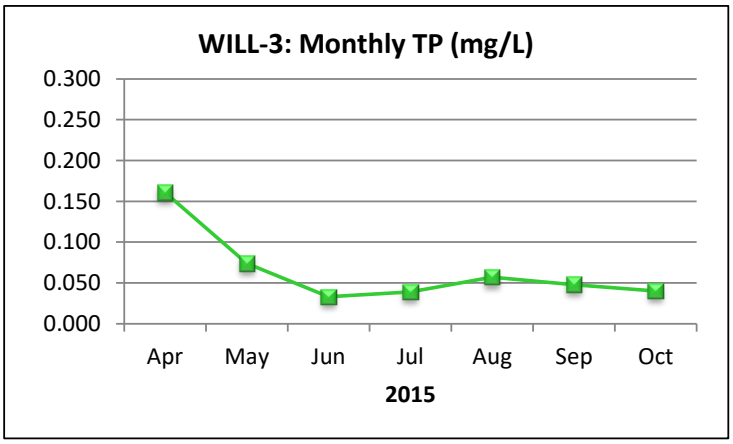
The mean growing season TSS value was higher in 2015 than 2013 (Fig. 5). Monthly TSS concentrations were highest in April and July.

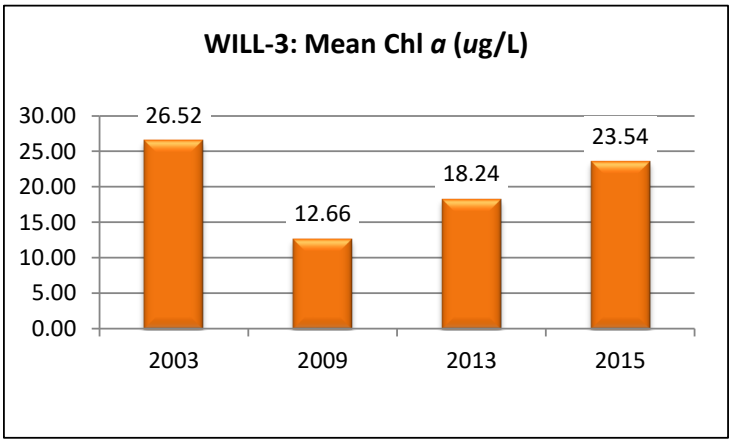
The DO concentration in the WILL-3 station was above the ADEM criteria limit of 5.0 mg/L at 5.0 ft (1.5 m) in most months. The DO concentration did fall below the criteria limit in September (3.97 mg/L) then recovered in October (ADEM Admin. Code R. 335-6-10-.09) (Fig. 6).

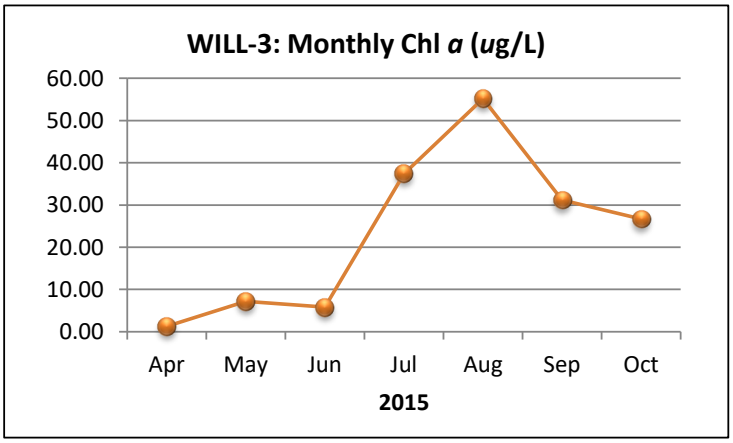


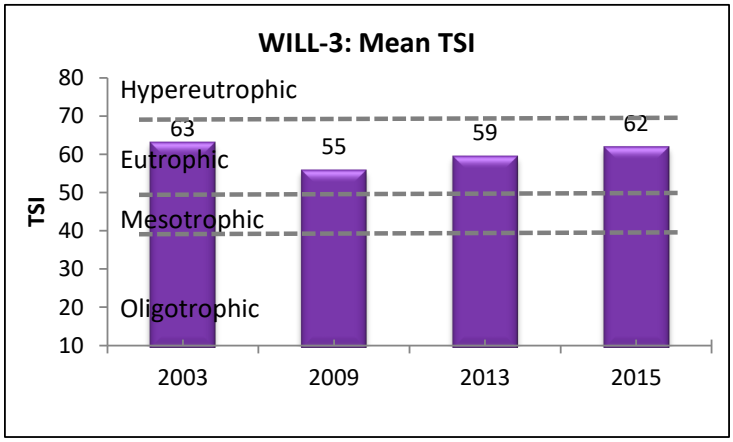












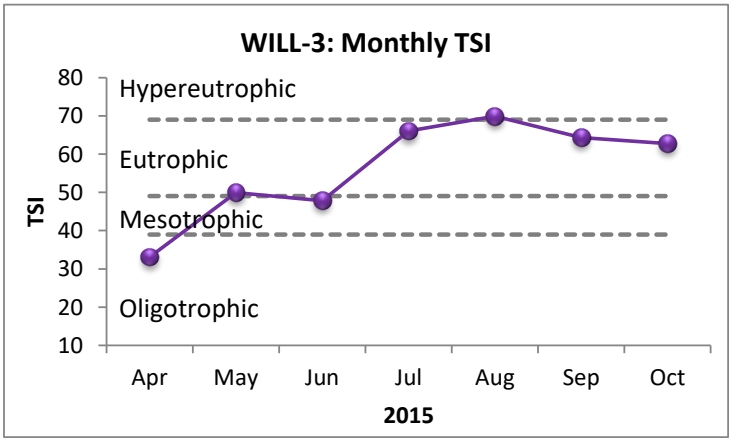
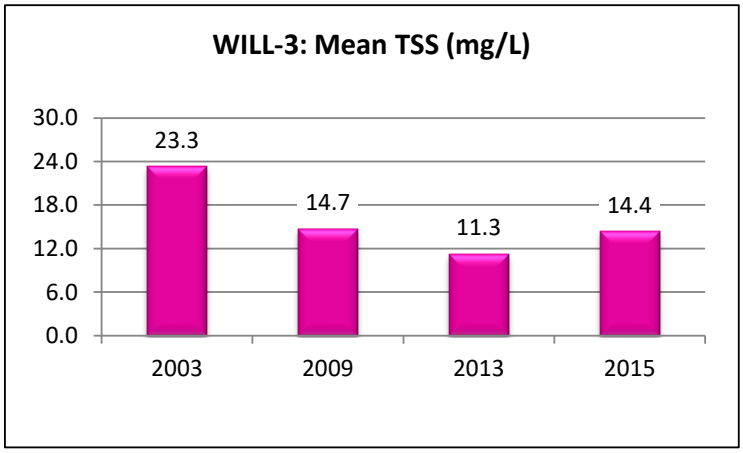


Figure 4. Mean growing season (2003-2015) and monthly (April-October, 2015) TN, TP, chl *a* and TSI measured in the Town Creek embayment of Wilson Reservoir**.** Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.



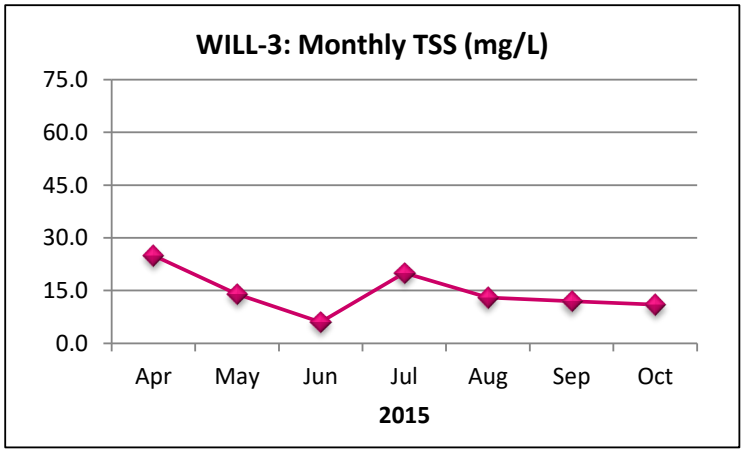


Figure 5. Mean growing season and monthly TSS measured in the Town Creek embayment of Wilson Reservoir.

Table 2. Summary of water quality data collected April-October, 2015. Minimum (Min) and maximum (Max) values calculated using minimum detection limits. Median (Med), mean, and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

WILL-3	N		Min	Max	Med	Mean	SD
Physical							
Turbidity (NTU)	7		8.9	30.6	12.8	15.3	7.1
Total Dissolved Solids (mg/L)	7		78.0	120.0	114.0	107.0	14.8
Total Suspended Solids (mg/L)	7		6.0	25.0	13.0	14.4	6.2
Hardness (mg/L)	4		70.9	103.0	85.6	86.3	13.9
Alkalinity (mg/L)[J]	7		66.8	93.8	78.7	80.6	9.1
Photic Zone (m)	7		1.24	2.44	2.20	1.98	0.51
Secchi (m)	7		0.44	1.50	0.66	0.78	0.34
Bottom Depth (m)	7		1.5	3.2	2.2	2.3	0.6
Chemical							
Ammonia Nitrogen (mg/L)[J]	7	<	0.007	0.148	0.017	0.040	0.053
Nitrate+Nitrite Nitrogen (mg/L)[J]	7		0.009	0.465	0.158	0.172	0.168
Total Kjeldahl Nitrogen (mg/L)	7		0.535	2.440	0.902	1.245	0.742
Total Nitrogen (mg/L)[J]	7		0.552	2.605	1.222	1.417	0.754
Dis Reactive Phosphorus (mg/L)[J]	7		0.004	0.086	0.011	0.022	0.029
Total Phosphorus (mg/L)[J]	7		0.033	0.161	0.048	0.065	0.045
CBOD-5 (mg/L)[J]	7	<	2.0	3.0	1.0	1.8	1.0
Chlorides (mg/L)	7		2.1	8.9	6.5	6.5	2.3
Biological							
Chlorophyll a (mg/m³)	7		1.30	55.20	26.70	23.54	19.75
E. coli (MPN/DL)[J]	3		1	5	2	3	2

J= one or more of the values is an estimate; N= # samples.

FOR MORE INFORMATION, CONTACT:
Scott Hicks, ADEM Environmental Indicators Section
1350 Coliseum Boulevard, Montgomery, AL 36110
(334) 260-2786, shicks@adem.alabama.gov

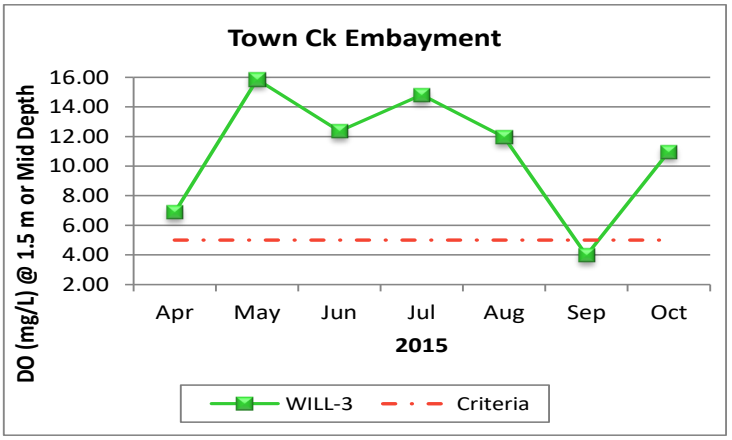


Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for Town Creek embayment station of Wilson Reservoir collected April-October 2015. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

REFERENCES

ADEM. 2015. Standard Operating Procedures Series #2000, Alabama Department of Environmental Management (ADEM), Montgomery, AL.

ADEM. 2013. Quality Management Plan (QMP) for the Alabama Department of Environmental, Alabama Department of Environmental Management (ADEM), Montgomery, AL. 58 pp.

ADEM. 2012. Quality Assurance Project Plan (QAPP) for Surface Water Quality Monitoring in Alabama. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 78 pp.

ADEM. 2012. State of Alabama Water Quality Monitoring Strategy June 19, 2012. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 88 pp. http://www.adem.alabama.gov/programs/water/wqsurvey/2012WQMonitoringStrategy

Alabama Department of Environmental Management Water Division (ADEM Admin. Code R. 335-6-10-.09). 2010. Specific Water Quality Criteria. Water Quality Program. Chapter 10. Volume 1. Division 335-6.

Alabama Department of Environmental Management Water Division (ADEM Admin. Code R. 335-6-10-.11). 2010. Water Quality Criteria Applicable to Specific Lakes. Water Quality Program. Chapter 10. Volume 1. Division 335-6.

Carlson, R.E. 1977. A trophic state index. Limnology and Oceanography. 22(2):361-369.

Raschke, R.L. and D.A. Schultz. 1987. The use of the algal growth potential test for data assessment. Journal of Water Pollution Control Federation 59(4):222-227.