

Shoal Creek Embayment Wilson Reservoir Intensive Basin Survey 2015

WILL-4: Shoal Creek immediately upstream of US Hwy 72 bridge (Lauderdale Co 34.85183/-87.56932)

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 Shoal 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 Shoal Creek embayment (WILL-4) during the 2015 growing season (Apr-Oct). This is the fourth 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 [chlorophyll *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 Shoal Creek at WILL-4

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Shoal Creek is classified as a *Swimming/Fish & Wildlife (S/F&W)* stream located in the Western Highland Rim ecoregion (71f). Based on the 2006 National Land Cover Dataset, land use within the 419 mi² watershed is predominantly forest (57%) (Fig. 3). As of January 28, 2016, ADEM has issued a total of 12 NPDES permits within the watershed. Four of those permits are located within 10 mi of the station (Fig. 2).

SITE DESCRIPTION

The Shoal Creek at WILL-4 is a deep, urbanized embayment located just east of Florence, AL. It has a mean bottom depth of 13.1 m (Table 2) at the sampling location and is just upstream of US Highway 72. Residential houses and a marina surround the sampling site.

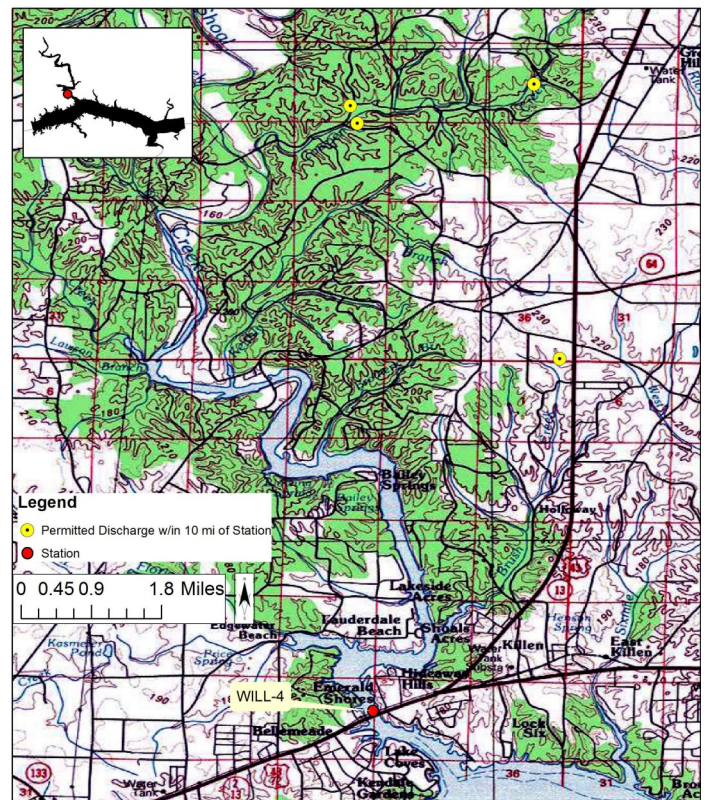


Figure 2. Map of Shoal Creek embayment of Wilson Reservoir. Though additional permitted facilities may occur in the watershed (Table 1), only those discharges within 10 miles upstream of the station are displayed on the map.

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

Table 1: Summary of Watershed WILL-4

Basin	Tennessee R
Drainage Area (mi ²)	419
Ecoregion ^a	71f
% Land use	
Open Water	1%
Developed	Open Space 5%
	Low Intensity 1%
	Medium Intensity <1%
	High Intensity <1%
Barren Land	<1%
Forest	Deciduous Forest 48%
	Evergreen Forest 5%
	Mixed Forest 4%
Shrub/Scrub	7%
Herbaceous	4%
Hay/Pasture	23%
Cultivated Crops	3%
Wetlands	Woody 1%
	Emergent Herb. <1%
# NPDES outfalls ^b	TOTAL 12
Construction Stormwater	9
Mining	0
Small Mining	0
Industrial General	1
Industrial Individual	0
No Exposure	0
Municipal	2
Underground Injection Control	0

a. Western Highland Rim

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

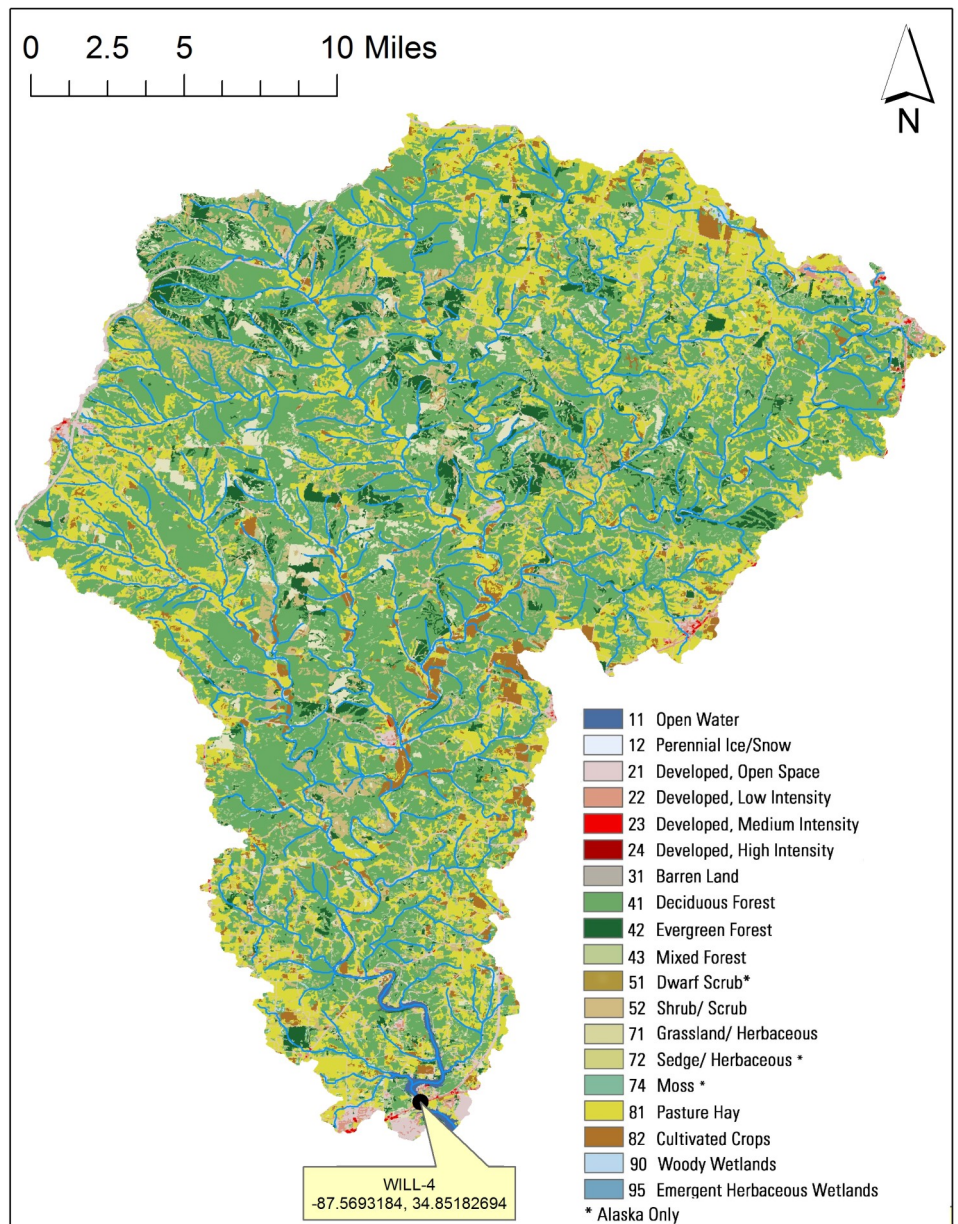


Figure 3. Land use within the Shoal Creek watershed at WILL-4.

The mean growing season TN value was higher in 2015 than any previous year (Fig. 4). Monthly TN concentration was highest in October.

Mean TP concentration was lower in 2015 compared to preceding growing seasons (Fig. 4). Monthly TP concentrations gradually increased April-September.

In 2015, the mean chl *a* value was also lower compared to previous years (Fig. 4). Monthly chl *a* concentrations began increasing in July and August, peaked in September, and then decreased in October.

Similar to previous Mean TSI values Shoal Creek was eutrophic in 2015 (Fig. 4). Monthly TSI in Shoal Creek was eutrophic July-October.

The mean growing season TSS value was lower in 2015 than prior years (Fig. 5). Monthly TSS concentration had a small peak in June and was low most other months sampled.

The DO concentration in the WILL-4 station was above the ADEM criteria limit of 5.0 mg/l at 5.0 ft (1.5 m) in all months (ADEM Admin. Code R. 335-6-10-.09) (Fig. 6). However, concentrations were near the limit in June and August.

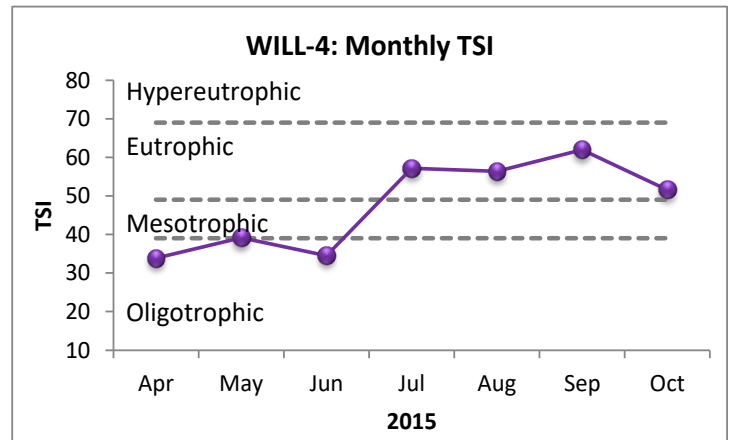
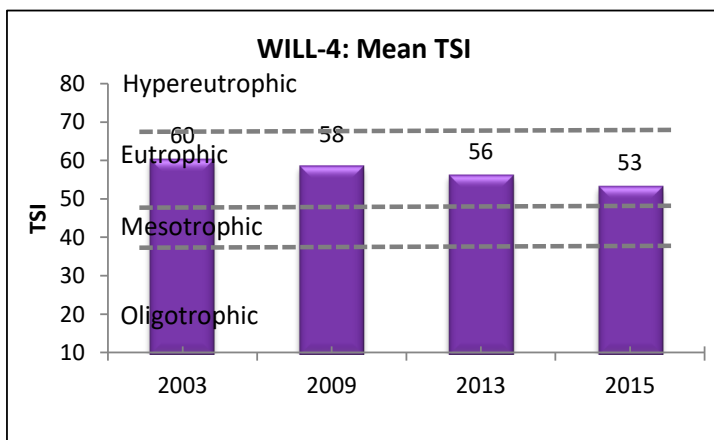
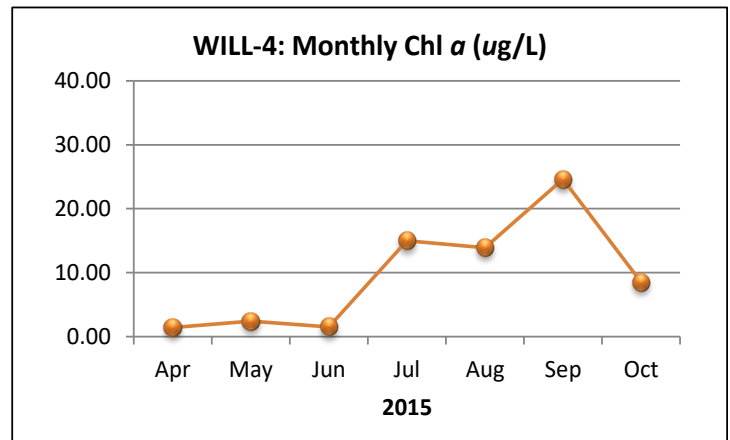
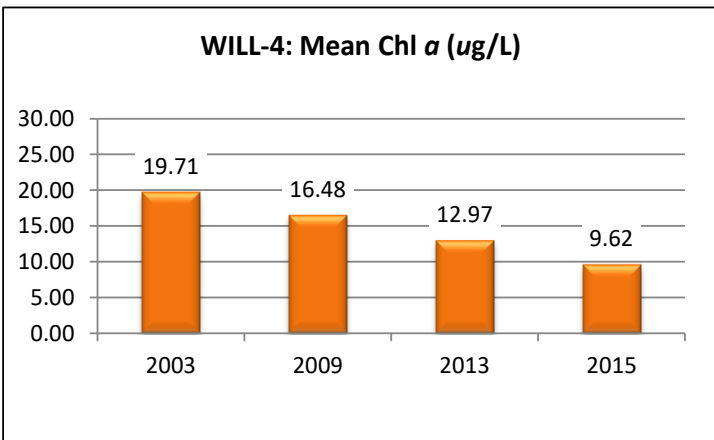
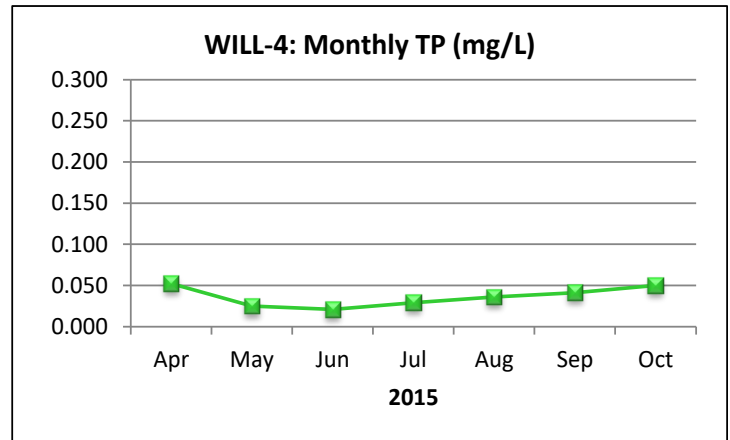
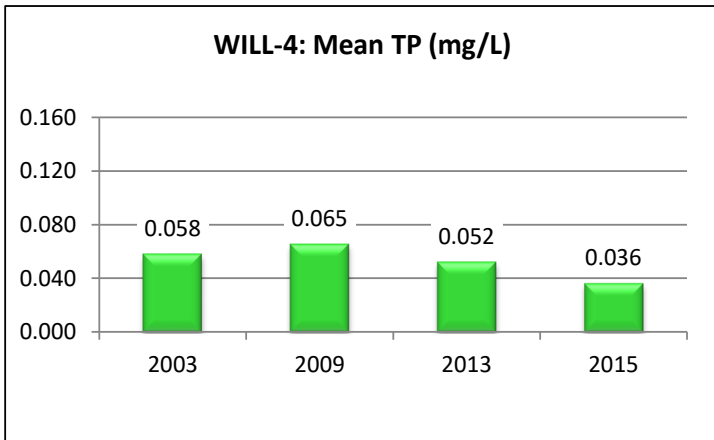
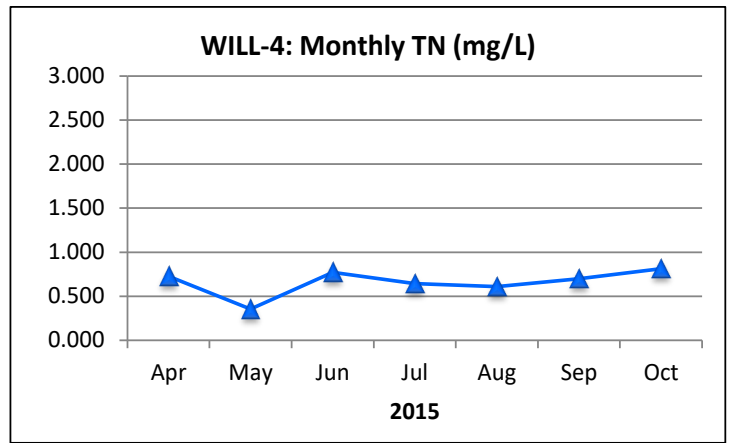
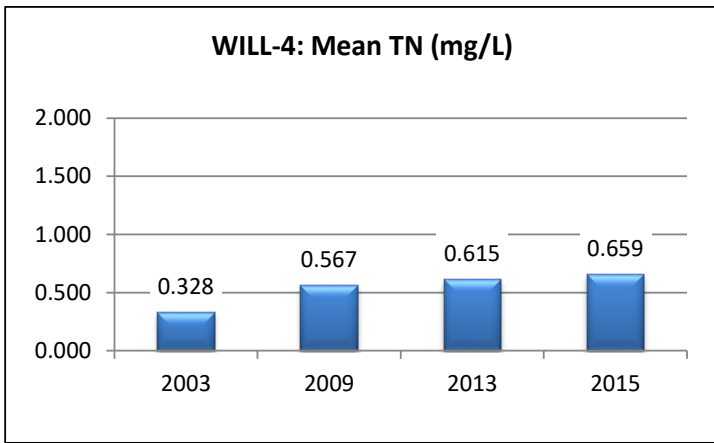


Figure 4. Mean growing season (2003-2015) and monthly (April-October, 2015) TN, TP, chl *a* and TSI measured in the Shoal Creek embayment of Wilson Reservoir. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.

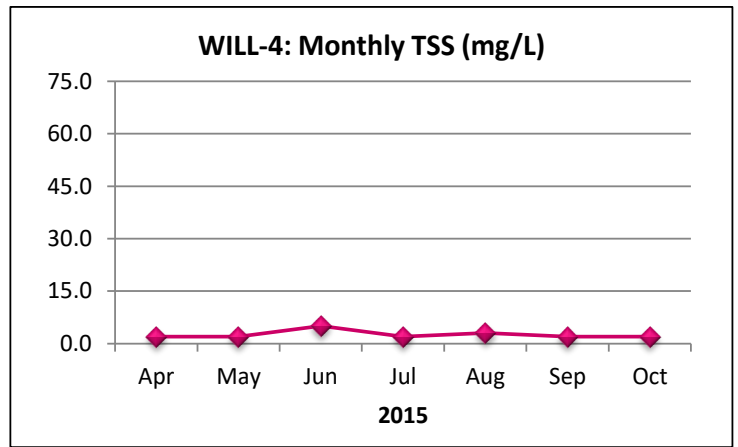
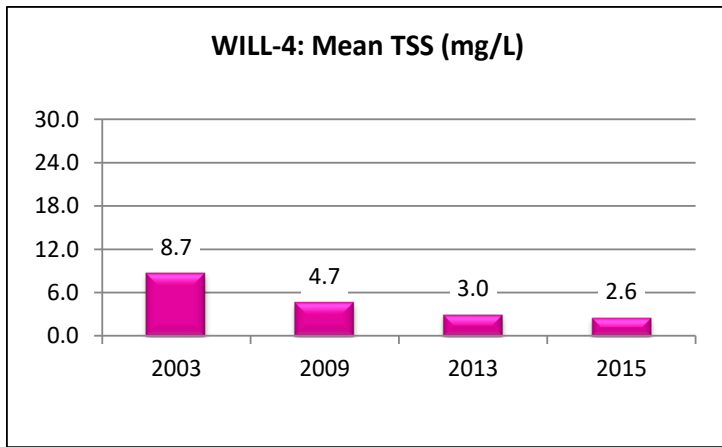


Figure 5. Mean growing season and monthly TSS measured in the Shoal Creek embayment of Wilson Reservoir.

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-4	N	Min	Max	Med	Mean	SD
Physical						
Turbidity (NTU)	7	2.9	4.8	3.4	3.6	0.7
Total Dissolved Solids (mg/L)	7	72.0	120.0	94.0	96.7	17.0
Total Suspended Solids (mg/L) ^J	7	2.0	5.0	2.0	2.6	1.1
Hardness (mg/L)	4	63.7	87.6	68.2	71.9	11.1
Alkalinity (mg/L)	7	57.4	78.2	66.5	66.8	7.1
Photic Zone (m)	7	4.16	6.26	5.30	5.16	0.72
Secchi (m)	6	1.51	2.01	1.62	1.66	0.18
Bottom Depth (m)	7	12.4	13.7	13.2	13.1	0.5
Chemical						
Ammonia Nitrogen (mg/L)	7	< 0.010	0.246	0.025	0.054	0.086
Nitrate+Nitrite Nitrogen (mg/L) ^J	7	0.015	0.405	0.050	0.117	0.145
Total Kjeldahl Nitrogen (mg/L)	7	0.265	0.757	0.594	0.542	0.183
Total Nitrogen (mg/L) ^J	7	0.353	0.811	0.699	0.659	0.152
Dis Reactive Phosphorus (mg/L) ^J	7	0.003	0.032	0.012	0.015	0.010
Total Phosphorus (mg/L) ^J	7	0.021	0.052	0.036	0.036	0.012
CBOD-5 (mg/L) ^J	7	< 2.0	2.0	1.0	1.0	0.0
Chlorides (mg/L)	7	4.5	9.6	7.3	7.4	1.6
Biological						
Chlorophyll a (mg/m ³)	7	1.40	24.60	8.54	9.62	8.74
E. coli (MPN/DL) ^J	3	< 1	2	1	1	1

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

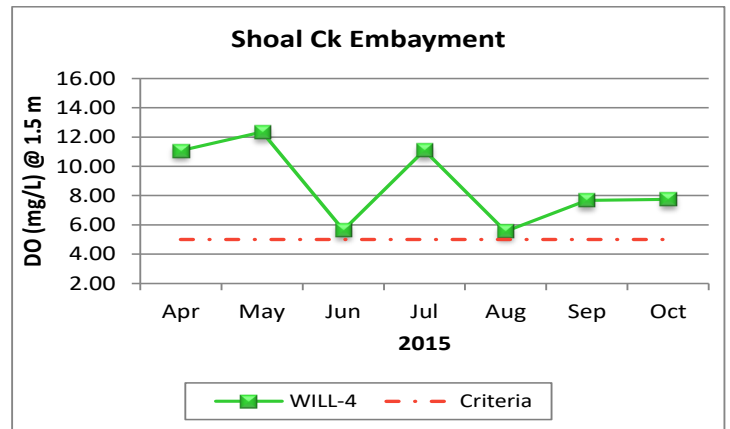


Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for Shoal Creek embayment station of Wilson Reservoir collected April-October 2015. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

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