Alabama Department of Environmental Management

Tennessee River Basin

Rivers and Reservoirs Monitoring Program

Big Nance Creek Embayment
Wilson Reservoir
Intensive Basin Survey 2015

WILL-1: Big Nance Creek immediately upstream of AL Hwy 101 bridge (Lawrence Co 34.77935/-87.39315)

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 Big Nance 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 Big Nance Creek embayment (WILL-1) during the 2015 growing season (Apr-Oct). This is the fourth basin assessment of the Tennessee River since ADEM began sampling on a basin rotation. 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 previous data and established criteria.

A consumption advisory was issued by the Alabama Department of Public Health in 2010 for mercury in fish from Big Nance Creek. As a result, Big Nance Creek from the embayment to its source is listed on the 2014 Alabama's Clean Water Act (CWA) §303(d) list of impaired waters for not meeting its water use classifications.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Big Nance Creek is classified as a *Fish & Wildlife (F&W)* stream located in the Eastern Highland Rim ecoregion (71g). Based on the 2006 National Land Cover Dataset, land use within the 197 mi^2 watershed is predominantly agriculture [hay/pasture (37%) and crops (9%)] (Fig. 3). As of January 28, 2016, ADEM has issued a total of 32 NPDES permits within the watershed. Four of those permits are located within 10 mi of the station (Fig. 2).

SITE DESCRIPTION

The Big Nance Creek embayment at WILL-1 is located just downstream of the Joe Wheeler Reservoir dam and upstream of State Highway 101. It is a clear, shallow embayment. The mean depth for Big Nance Creek is 2.0 m (Table 2) at the sampling location.

Figure 1. Photo of Big Nance Creek at WILL-1

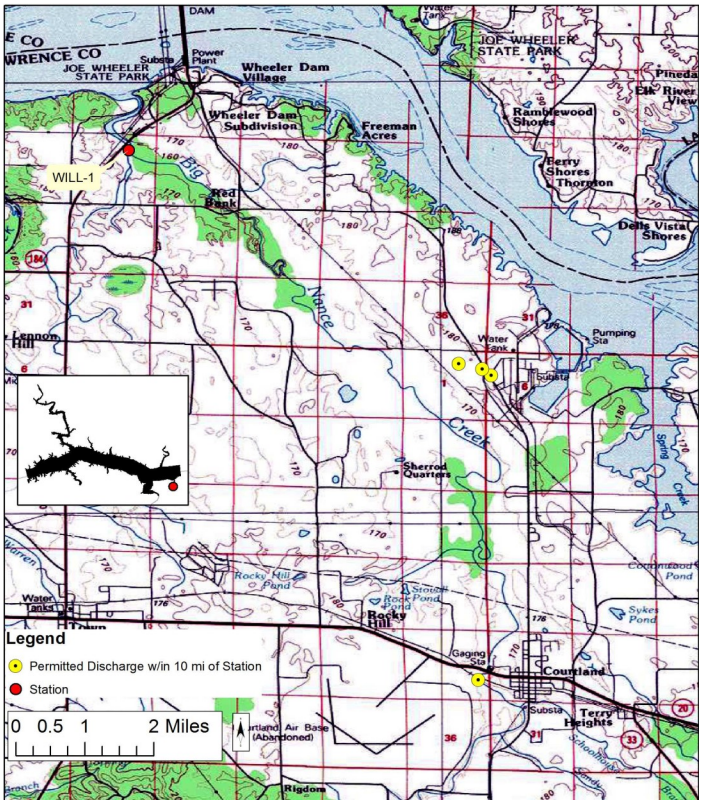


Figure 2. Map of Big Nance Creek embayment of Wilson Reservoir. Though additional permits may occur in the watershed (Table 1), only permitted discharges within 10 miles upstream of the station are displayed on the map.

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 compared.

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

Basin		Tennessee R
Drainage Area (mi^2)		197
Ecoregion[a]		71g
% Land use		
Open Water		1%
Developed	Open Space	5%
	Low Intensity	1%
	Medium Intensity	<1%
	High Intensity	<1%
Barren Land		<1%
Forest	Deciduous Forest	18%
	Evergreen Forest	5%
	Mixed Forest	4%
Shrub/Scrub		7%
Herbaceous		4%
Hay/Pasture		37%
Cultivated Crops		9%
Wetlands	Woody	7%
	Emergent Herb.	<1%
# NPDES outfalls[b]	TOTAL	32
Construction Stormwater		11
Mining		0
Small Mining		2
Industrial General		17
Industrial Individual		0
No Exposure		0
Municipal		2
Underground Injection Control		0

a. Eastern Highland Rim

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

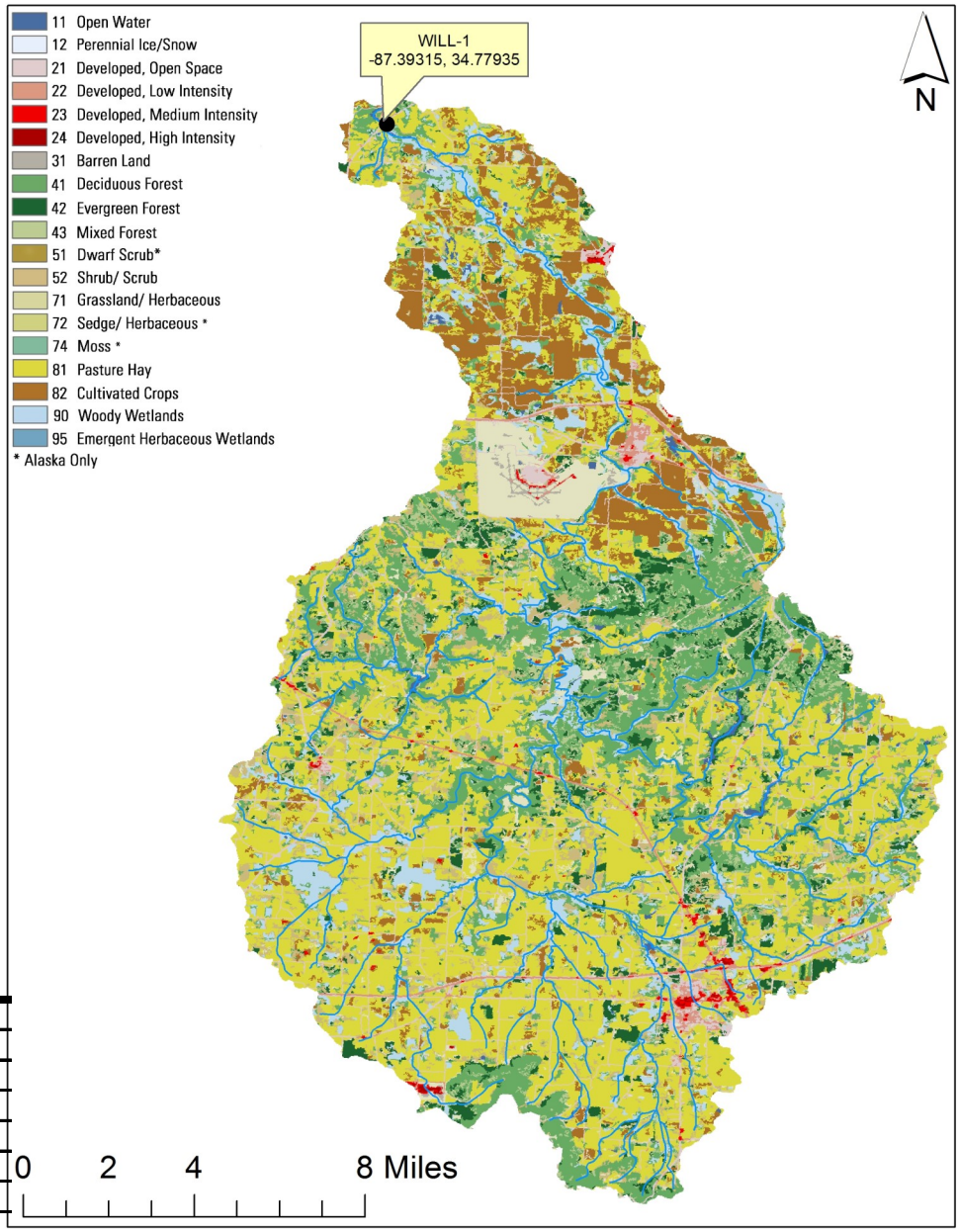


Figure 3. Land use within the Big Nance Creek watershed at WILL-1.

The mean growing season TN value was higher in 2015 than in any prior year (Fig. 4). Monthly TN concentrations were highest in July and variable month to month, always remaining at or above 1.0 mg/L.

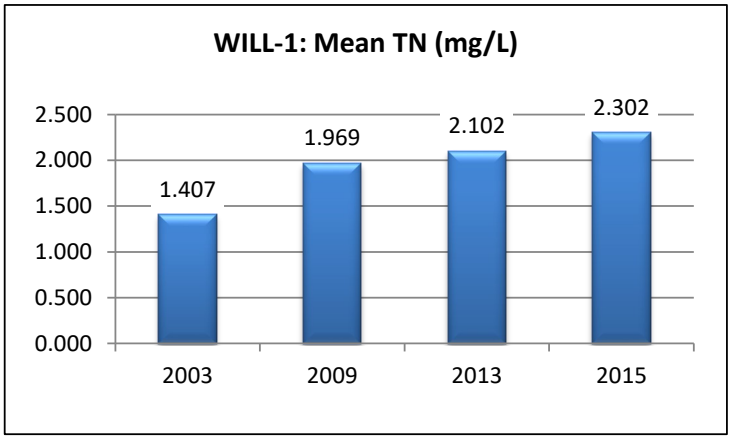
Mean growing season TP concentration was lower in 2015 compared to any previous sampling years (Fig. 4). The highest monthly TP concentration was reached in April.

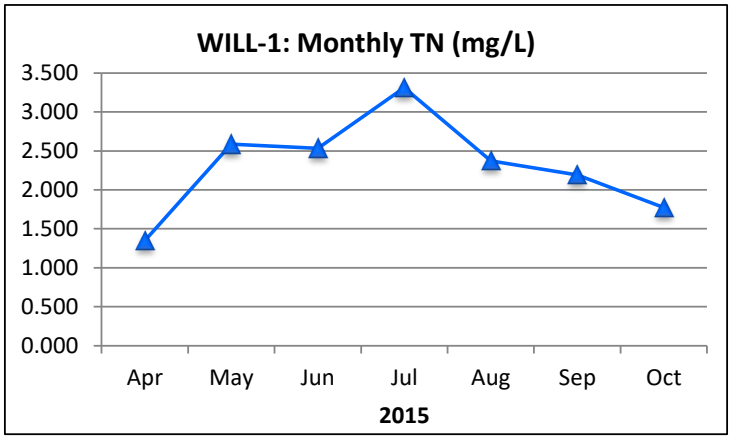
In 2015, the growing season mean chl *a* value was the lowest since 2009 (Fig. 4). Monthly chl *a* concentrations were variable with the highest concentration occurring in September.

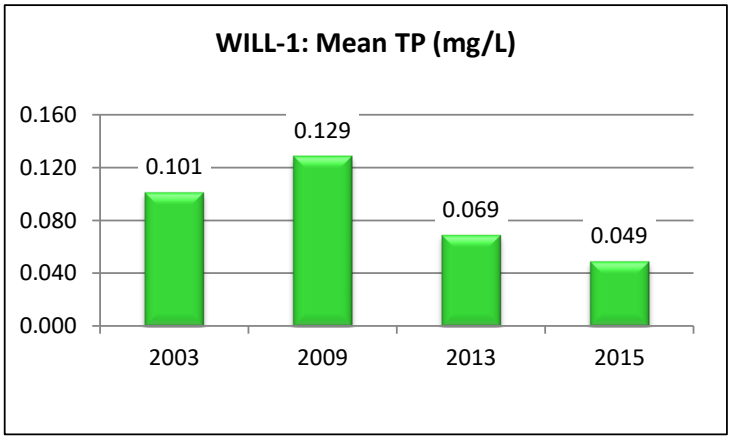
Mean TSI was mesotrophic in 2015. Mean TSI values were similar each year with the exception of eutrophic conditions in 2009. Monthly TSI in Big Nance Creek was mesotrophic in June, July, and September (Fig. 4).

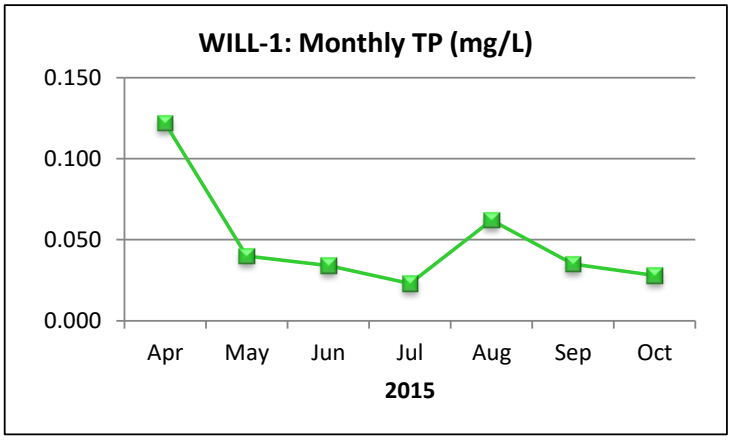
The mean growing season TSS value was higher in 2015 than 2013 but lower compared to 2003-2009 (Fig. 5). The monthly TSS concentration was highest in April

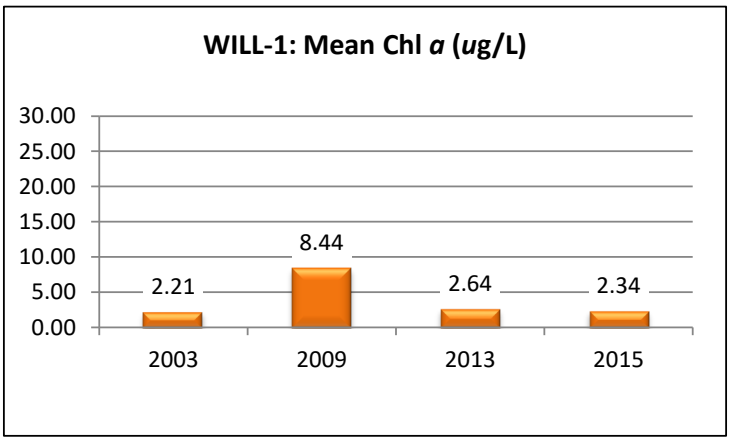
The DO concentration in the WILL-1 station was above the ADEM criteria limit of 5.0 mg/l at 5.0 ft (1.5 m) in all months (ADEM Admin. Code R. 335-6-10-.09) (Fig. 6).

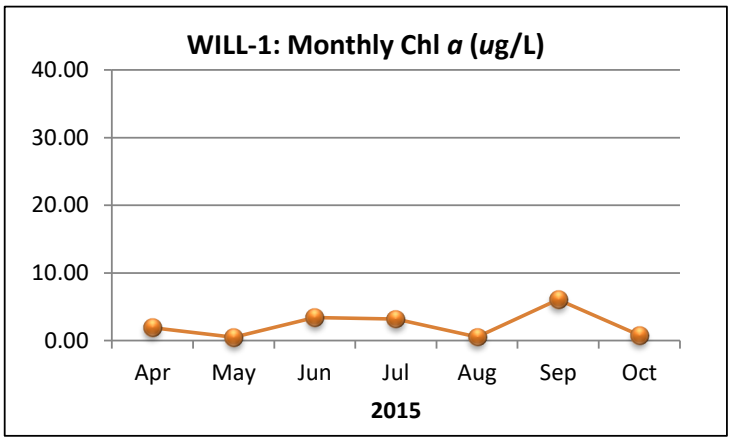


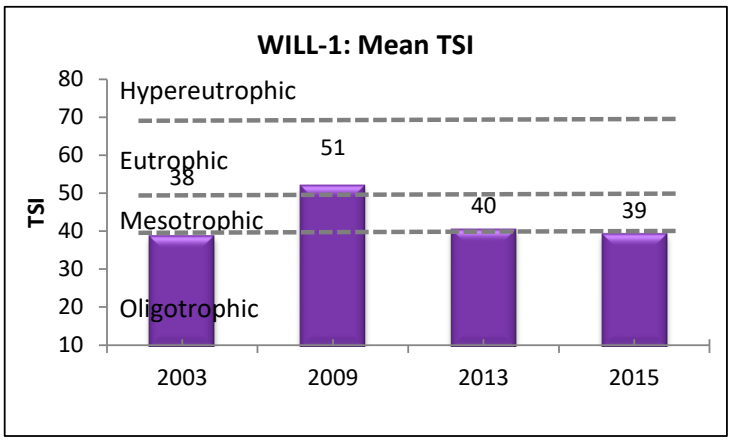












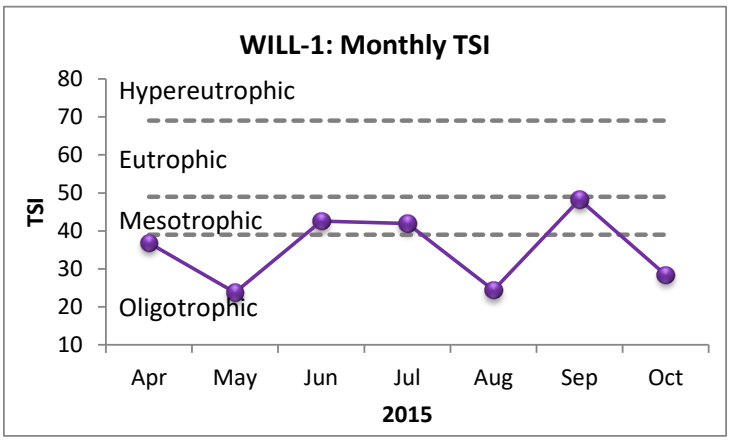
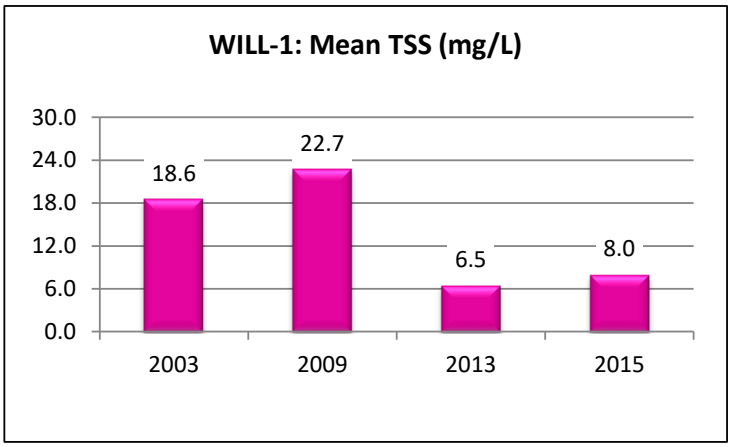


Figure 4. Mean growing season (2003-2015) and monthly (April-October, 2015) TN, TP, chl *a* and TSI measured in the Big Nance Creek embayment of Wilson Reservoir**.** Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.



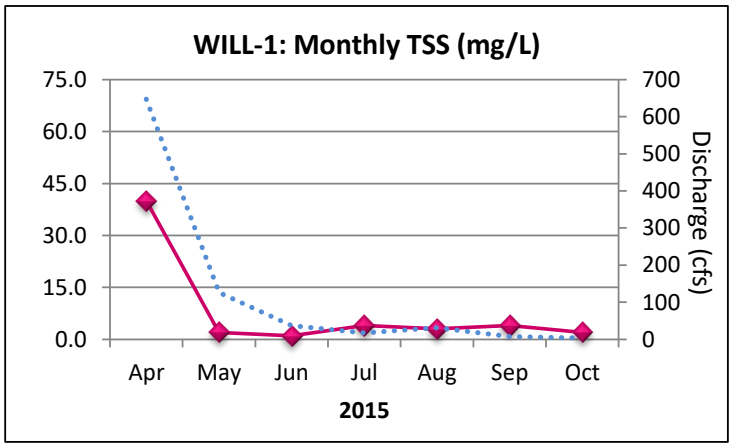


Figure 5. Mean growing season and monthly TSS measured in the Big Nance Creek embayment of Wilson Reservoir.

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-1	N		Min	Max	Med	Mean	SD
Physical							
Turbidity (NTU)	7		3.7	51.4	5.0	11.3	17.7
Total Dissolved Solids (mg/L)[J]	7		120.0	178.0	163.0	155.6	21.7
Total Suspended Solids (mg/L)	7		1.0	40.0	3.0	8.0	14.2
Hardness (mg/L)	4		80.3	159.0	139.0	129.3	34.3
Alkalinity (mg/L)	7		77.9	150.4	127.0	125.7	23.2
Photic Zone (m)	7		1.49	2.20	1.98	1.90	0.25
Secchi (m)	7		0.36	2.20	1.91	1.71	0.62
Bottom Depth (m)	7		1.7	2.4	2.0	2.0	0.2
Chemical							
Ammonia Nitrogen (mg/L)	7	<	0.010	0.072	0.034	0.036	0.022
Nitrate+Nitrite Nitrogen (mg/L)	7		0.619	2.620	1.643	1.852	0.734
Total Kjeldahl Nitrogen (mg/L)[J]	7	<	0.064	0.730	0.591	0.451	0.309
Total Nitrogen (mg/L)[J]	7	<	1.349	3.310	2.373	2.302	0.626
Dis Reactive Phosphorus (mg/L)[J]	7		0.009	0.058	0.019	0.026	0.018
Total Phosphorus (mg/L)	7		0.023	0.122	0.035	0.049	0.034
CBOD-5 (mg/L)[J]	7	<	2.0	2.1	1.0	1.2	0.4
Chlorides (mg/L)	7		2.7	5.1	4.5	4.3	0.8
Biological							
Chlorophyll a (mg/m³)	7	<	0.53	6.05	1.90	2.34	2.04
E. coli (MPN/DL)	3		17	45	28	30	13

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

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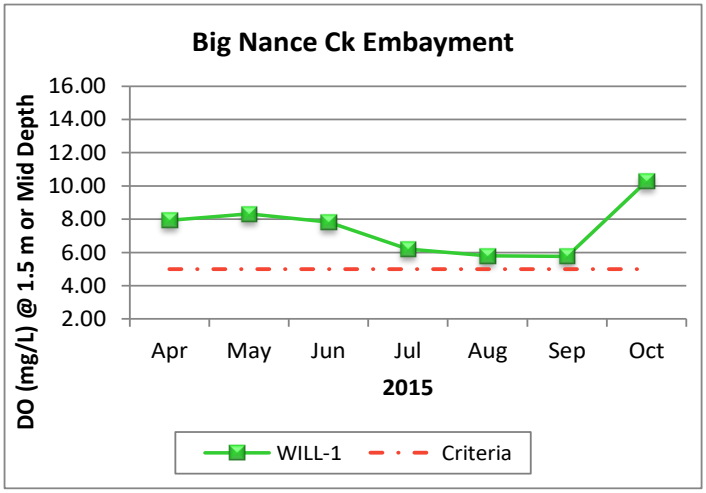

Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for Big Nance Creek embayment station of Wilson Reservoir collected April-October

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