

Dry Branch Embayment Wheeler Reservoir Intensive Basin Survey 2015

Tennessee River Basin

WHEL-7: Dry Branch immediately downstream stream of Alt. Hwy 72 bridge (Morgan Co 34.62081/-

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 Dry Branch tributary embayment of Wheeler 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 at WHEL-7 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 historical data and established criteria.



Figure 1. Photo of Dry Branch at WHEL-7.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Dry Branch is classified as a *Fish & Wildlife (F&W)* stream located in the Eastern Highland Rim ecoregion (71g). Based on the 2011 National Land Cover Dataset, land use within the very small 10 mi² watershed is predominantly developed (83%) (Fig. 3). As of January 28, 2016, ADEM has issued a total of 91 NPDES permits within the watershed. All of those permits are located within 10 mi upstream of the station (Fig. 2).

SITE DESCRIPTION

Draining into Wheeler Reservoir near river mile 303, the Dry Branch embayment is located near the center of downtown Decatur, AL. Nearly the entire watershed is contained within its city limits. It is a shallow embayment with a mean bottom depth of 1.87 m (Table 2) at the sampling location. There is no aquatic vegetation present in this embayment.

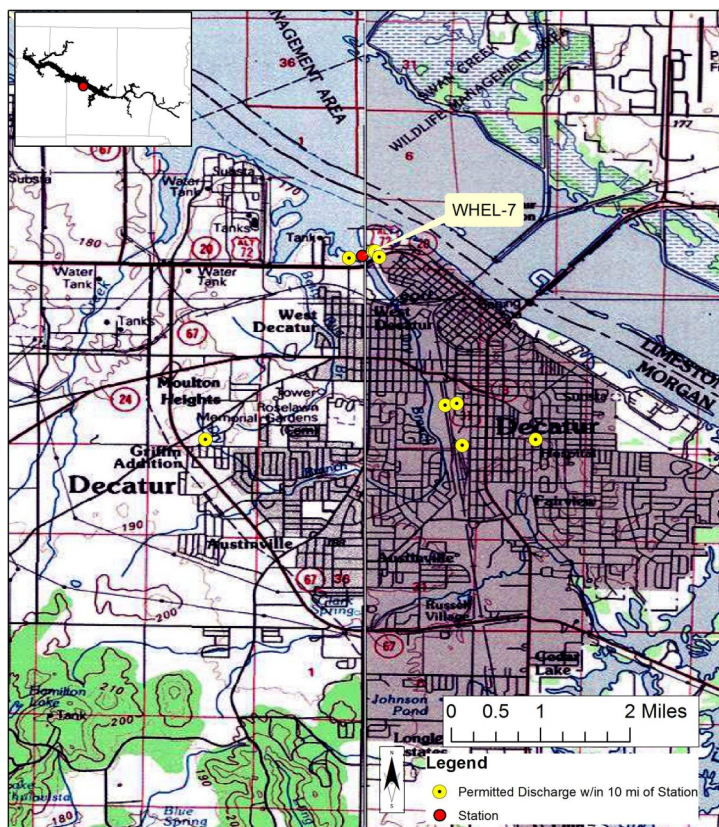


Figure 2. Map of Dry Branch embayment of Wheeler Reservoir. Though additional permitted facilities may occur in the watershed (Table 1), only those within 10 miles upstream of the station are displayed on the map.

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.

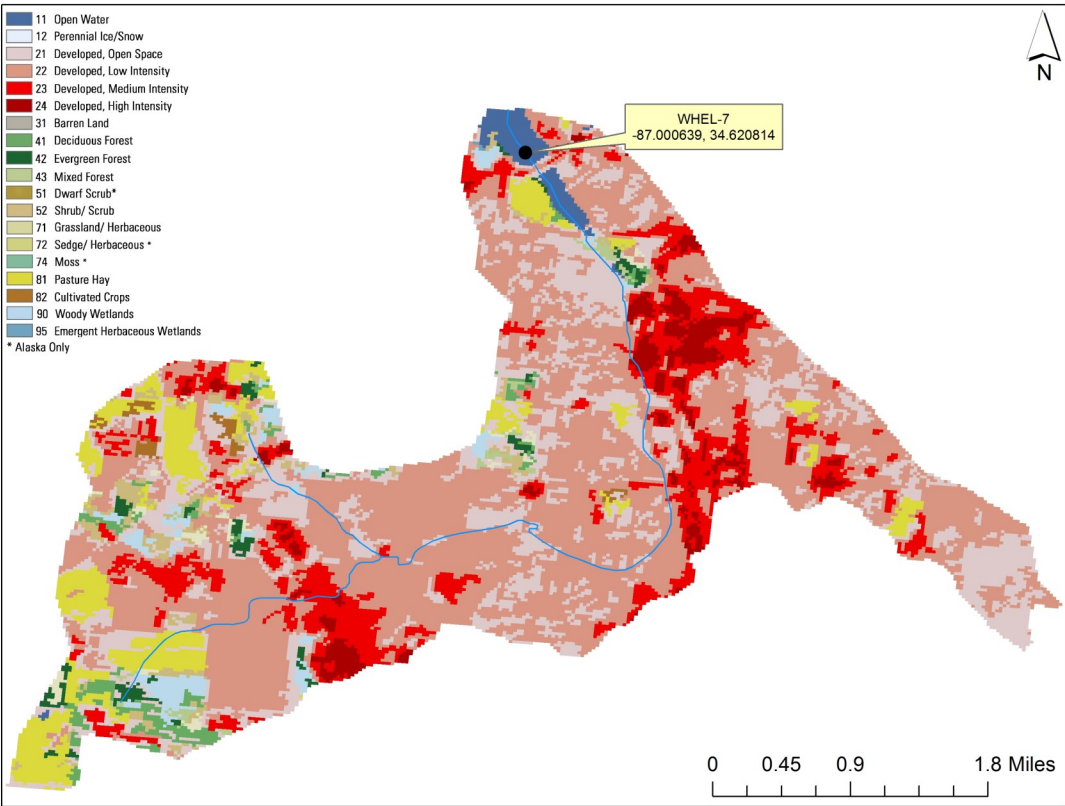


Figure 3. Land use within the Dry Branch watershed at WHEL-7.

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.

Mean growing season TN values increased from 2003 through 2013 (Fig. 4). While a slight decline was measured in 2015 values remained twice those measured in 2003. Monthly TN concentrations were highest in August.

Mean growing season TP values have decreased from 2003 through 2015 (Fig. 4). Monthly TP concentrations were highest in May although concentrations were generally similar April-October.

Mean growing season chl *a* values have declined since monitoring began (Fig. 4). Values in 2015 were 1/3 of those measured in 2003. Monthly chl *a* concentrations were highest in August.

Mean TSI values remained eutrophic in 2015 but have declined since 2003 (Fig. 4). Monthly TSI values in Dry Branch were mesotrophic April through June and eutrophic July through October.

After declining from 2003 to 2009 the mean growing season TSS value has remained steady through 2015 (Fig. 5). Monthly TSS concentrations were highest in May and August.

No AGPT sample was collected from Dry Branch in 2015. Results from 2003-2013 are shown in Table 3.

DO concentrations in the Dry Branch station remained above the ADEM criteria limit (ADEM Admin. Code R. 335-6-10-.09) of 5.0 mg/L at 5.0 ft (1.5 m) April through October (Fig. 6).

Table 1: Summary of Watershed		WHEL-7
Basin		Tennessee R
Drainage Area (mi ²)		10
Ecoregion ^a		71g
% Land use		
Open Water		1%
Developed	Open Space	21%
	Low Intensity	46%
	Medium Intensity	12%
	High Intensity	4%
Barren Land		<1%
Forest	Deciduous Forest	2%
	Evergreen Forest	1%
	Mixed Forest	<1%
Shrub/Scrub		2%
Herbaceous		1%
Hay/ Pasture		7%
Cultivated Crops		1%
Wetlands	Woody	2%
	Emergent Herb.	<1%
# NPDES outfalls ^b		TOTAL 91
Construction Stormwater		72
Industrial General		15
Underground Injection Control		4

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



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

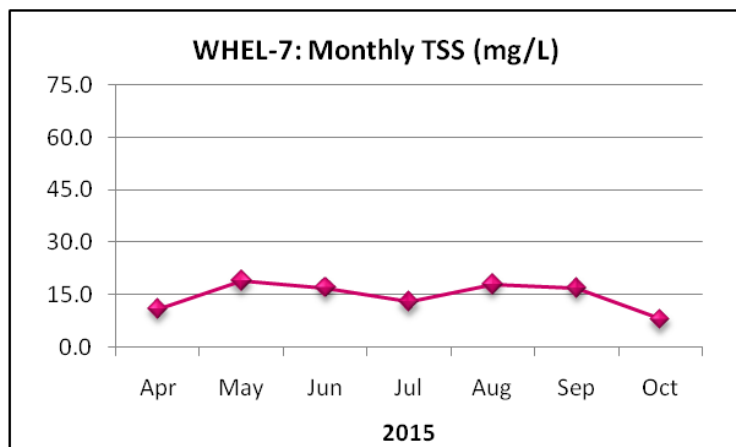
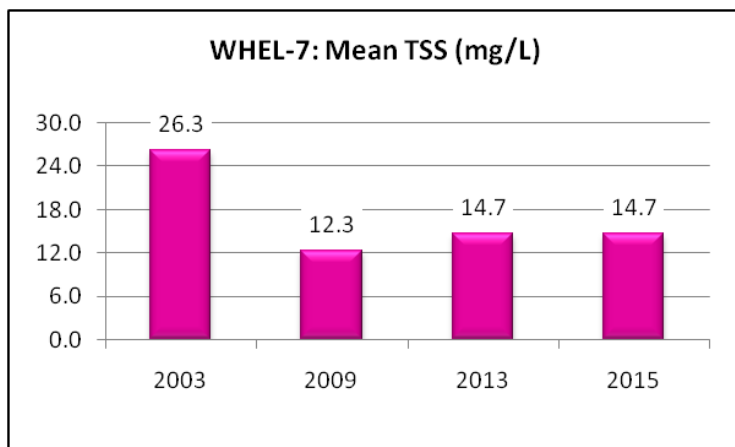


Figure 5. Mean growing season and monthly TSS measured in the Dry Branch embayment of Wheeler Reservoir.

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.

WHEL-7	N	Min	Max	Med	Mean	SD
Physical						
Turbidity (NTU)	7	9.1	16.5	12.1	13.2	2.9
Total Dissolved Solids (mg/L)	7	88.0	124.0	113.0	109.4	12.9
Total Suspended Solids (mg/L)	7	8.0	19.0	17.0	14.7	4.1
Hardness (mg/L)	4	70.1	88.9	82.3	80.9	8.3
Alkalinity (mg/L)	7	63.2	79.7	73.6	72.4	5.7
Photic Zone (m)	7	1.20	2.25	1.90	1.81	0.36
Secchi (m)	7	0.54	1.08	0.73	0.74	0.18
Bottom Depth (m)	7	1.00	2.25	1.95	1.87	0.34
Chemical						
Ammonia Nitrogen (mg/L) ^J	7	< 0.010	0.076	0.018	0.022	0.025
Nitrate+Nitrite Nitrogen (mg/L) ^J	7	< 0.001	0.132	0.005	0.028	0.049
Total Kjeldahl Nitrogen (mg/L)	7	0.577	1.520	0.714	0.854	0.327
Total Nitrogen (mg/L) ^J	7	< 0.686	1.521	0.722	0.882	0.306
Dissolved Reactive Phosphorus (mg/L) ^J	7	< 0.003	0.006	0.003	0.004	0.002
Total Phosphorus (mg/L)	7	0.026	0.058	0.035	0.038	0.010
CBOD-5 (mg/L) ^J	7	< 2.0	3.0	1.0	1.3	0.8
Chlorides (mg/L)	7	4.4	8.9	7.4	7.3	1.6
Biological						
Chlorophyll a (ug/L)	7	3.80	21.40	7.34	9.98	6.46
E. coli (col/100mL)	3	< 1	131	1	44	75

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

Table 3. Algal growth potential test results (expressed as mean MSC) dry weights of *Selenastrum capricornutum* in mg/L) and limiting nutrient status. MSC values below 5 mg/L are considered to be protective in reservoirs and lakes (Raschke and Schultz 1987).

WHEL-7	MSC	Limiting Nutrient
8/20/2003	5.52	NITROGEN
8/19/2009	3.32	NITROGEN
8/21/2013	3.6	NITROGEN

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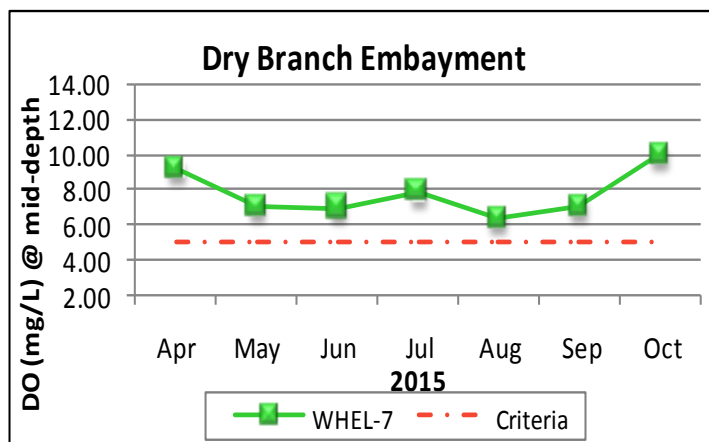


Figure 6. Monthly DO concentrations at mid-depth for Dry Branch embayment station of Wheeler Reservoir collected April-October 2015. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

REFERENCES

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- 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.