Alabama Department of Environmental Management

Tennessee River Basin

Rivers and Reservoirs Monitoring Program

Cypress Creek Embayment
Pickwick Reservoir
Intensive Basin Survey 2009

PICL-1: Cypress Creek approx 0.5 mi upstream of AL Hwy 20 (Lauderdale Co 34.78814/-87.69709)

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 2009, ADEM monitored the Cypress Creek tributary embayment of Pickwick Reservoir as part of the intensive 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 Cypress Creek embayment (PICL-1) during the 2009 growing season (Apr-Oct). This is the second intensive basin assessment of the Tennessee River since ADEM began sampling on a basin rotation. Monthly and/or mean concentrations of 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 2009 were compared to ADEM's 2003 data and established criteria.

Figure 1. Photo of Cypress Creek at PICL-1

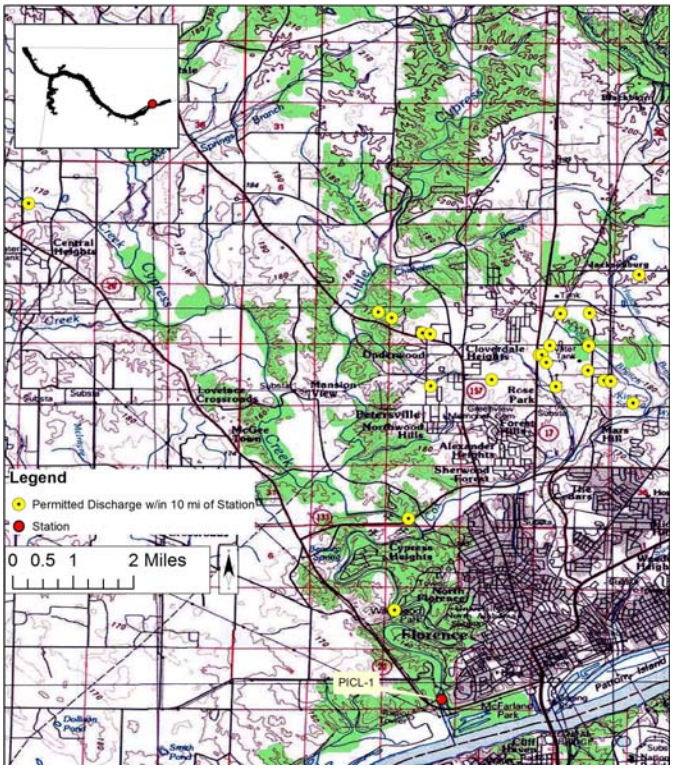


Figure 2. Map of Cypress Creek embayment of Pickwick Reservoir. Though additional permits may occur in the watershed (Table 1), only permitted discharges within 10 miles upstream of the station are displayed on the map.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Cypress Creek is classified as a *Public Water Supply /Fish & Wildlife (PWS/F&W)* stream located in the Interior Plateau ecoregion (71g). Based on the 2006 National Land Cover Dataset, land use within the 214 mi^2 watershed is a mixture of agriculture, forest and urban (Fig. 3). As of October 1, 2013, ADEM has issued a total of 50 NPDES permits within the watershed. Twenty-four of those permits are located within 10 mi of the station (Fig. 2).

SITE DESCRIPTION

The Cypress Creek embayment at PICL-1 is located just west of Florence, AL and flows in the Tennessee River at river mile 255. Cypress Creek has a mean bottom depth of 3.88 m (Table 2) at the sampling location and is just upstream of the McFarland Park fishing pier.

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 2009), Surface Water Quality Assurance Project Plan (ADEM 2008a), and Quality Management Plan (ADEM 2008b).

Mean growing season chl *a*, TSI, 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 2009 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

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

Basin		Tennessee R
Drainage Area (mi^2)		214
Ecoregion[a]		71g
% Land use		
Open Water		<1%
Developed	Open Space	8%
	Low Intensity	3%
	Medium Intensity	1%
	High Intensity	<1%
Barren Land		<1%
Forest	Deciduous Forest	30%
	Evergreen Forest	4%
	Mixed Forest	2%
Shrub/Scrub		11%
Herbaceous		2%
Hay/Pasture		25%
Cultivated Crops		11%
Wetlands	Woody	3%
	Emergent Herb.	<1%
# NPDES Permits[b]	TOTAL	50
401 Water Quality Certification		2
Construction Stormwater		28
Industrial General		15
Industrial Individual		2
Municipal Individual		2
Underground Injection Control		1

a. Interior Plateau

b. # NPDES permits downloaded from ADEM's NPDES Management System database, Oct 1, 2013.

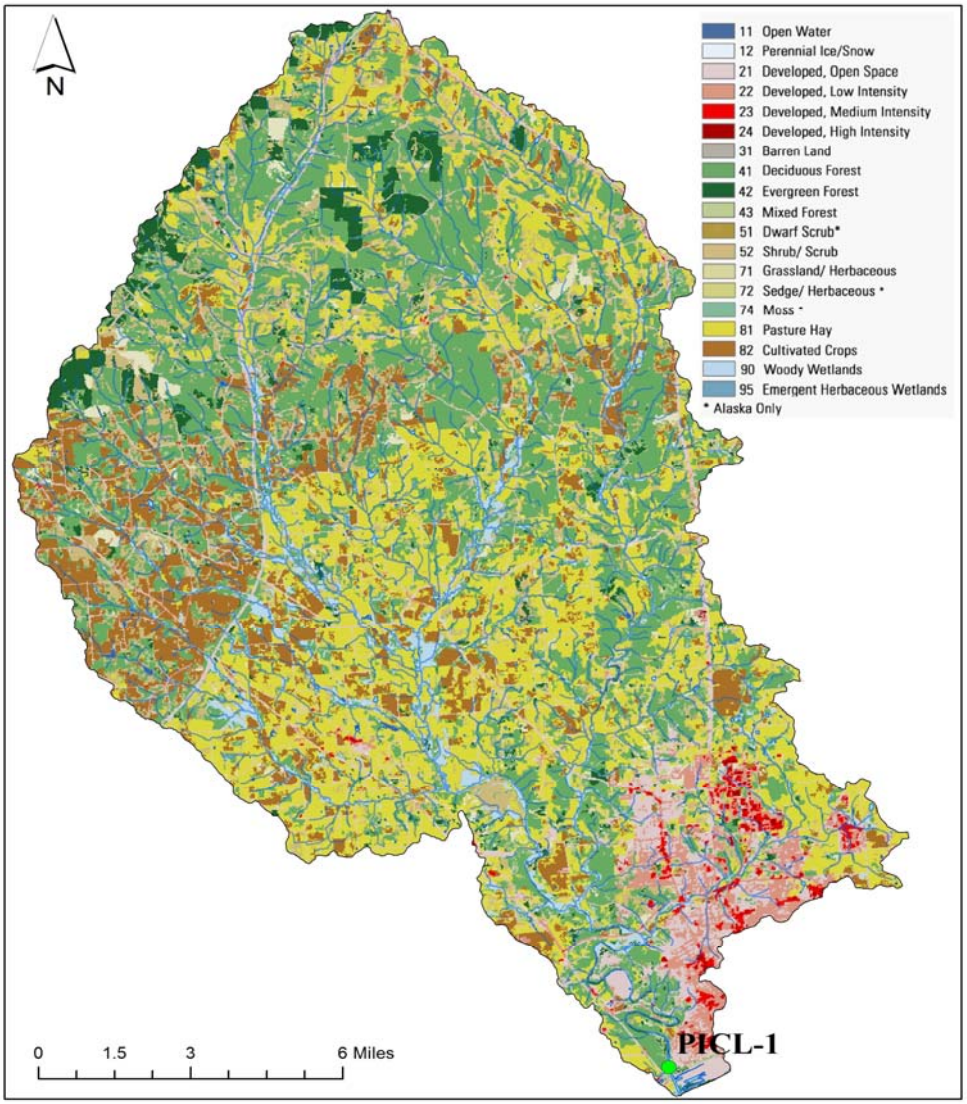


Figure 3. Land use within the Cypress Creek watershed at PICL-1.

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 Fig. 4-5 were set to maximum values reservoir-wide so all embayment reports on the same reservoir could be compared.

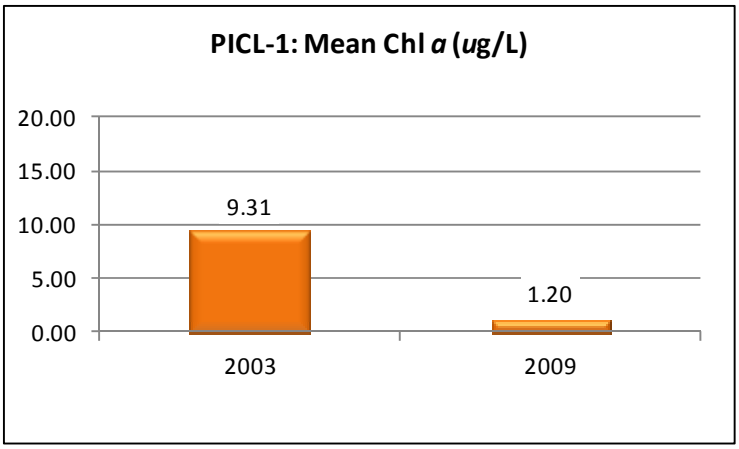
In 2009, the growing season mean chl *a* value was lower than 2003 (Fig. 4). Monthly chl *a* concentrations peaked in July but were generally very low.

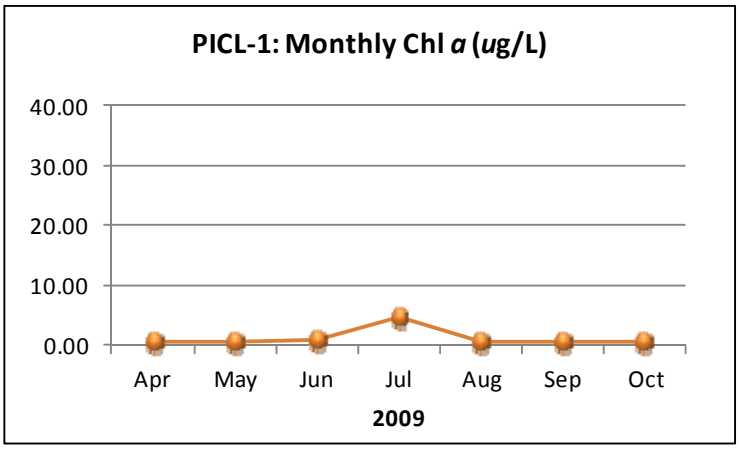
Mean TSI was oligotrophic in 2009, a drop in trophic status since 2003. Monthly TSI in Cypress Creek reached mesotrophic conditions in July and was oligotrophic all other months (Fig. 4).

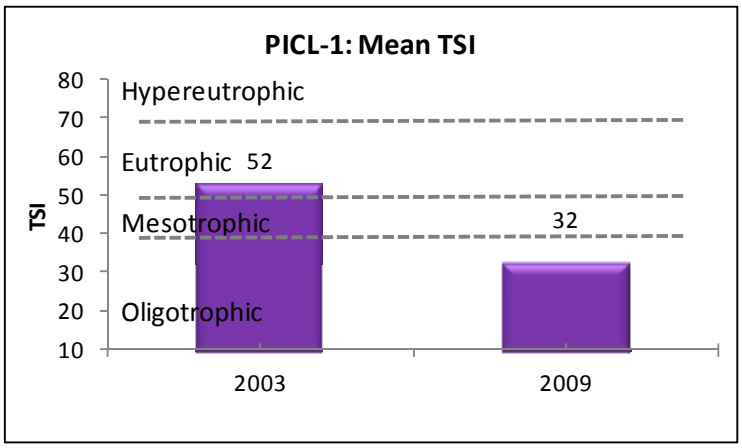
The mean growing season TSS value was higher in 2009 than 2003 (Fig. 4). Monthly TSS concentrations were variable peaking in April and August.

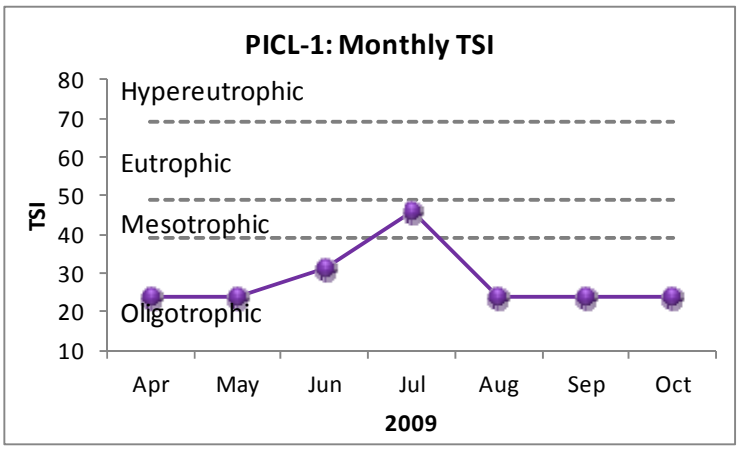
AGPT results show that PICL-1 was phosphorus limited in both 2003 and 2009 (Table 3). The mean maximum standing crop (MSC) value from both years were above the 5.0 m/L value that Raschke and Shultz (1987) defined as protective of reservoir and lake systems.

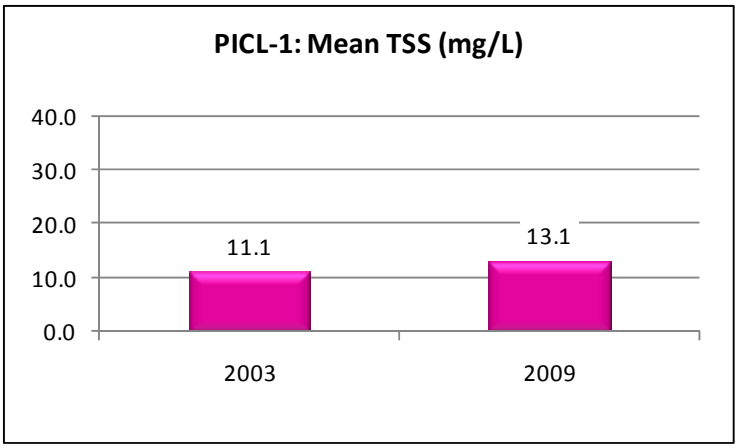
The DO concentrations in the PICL-1 station decreased April-August but remained above the ADEM criteria limit of 5.0 mg/l at 5.0 ft (1.5 m) in all months (ADEM Admin. Code R. 335-6-10-.09) (Fig. 5).











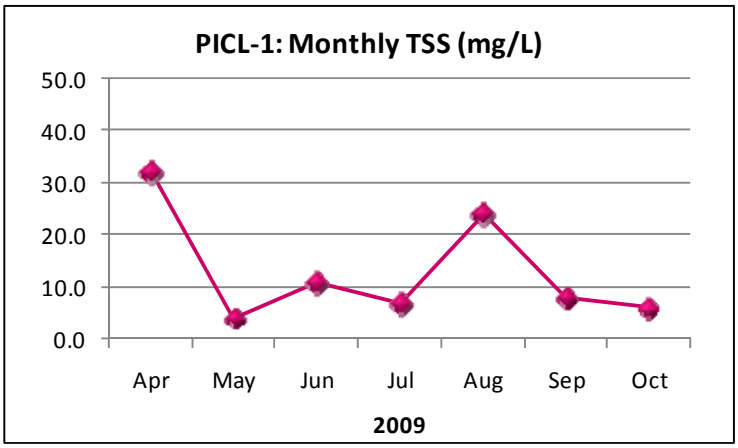


Figure 4. Mean growing season (2003-2009) and monthly (April-October, 2009) chl *a*, TSI, and TSS measured in the Cypress Creek embayment of Pickwick Reservoir**.** Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.

Table 2. Summary of water quality data collected April-October, 2009. 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.

PICL-1	N	Min	Max	Med	Mean	SD
Physical						
Turbidity (NTU)	7	4.2	13.9	6.4	7.8	3.8
Total Dissolved Solids (mg/L)	7	68.0	81.0	74.0	73.3	4.9
Total Suspended Solids (mg/L)	7	4.0	32.0	8.0	13.1	10.6
Hardness (mg/L)	3	28.0	72.9	48.6	49.8	22.5
Alkalinity (mg/L)[J]	7	34.6	62.2	50.0	48.6	12.1
Photic Zone (m)	7	2.91	4.83	3.55	3.63	0.62
Secchi (m)	7	1.25	2.43	1.49	1.65	0.43
Bottom Depth (m)	7	3.00	5.18	3.67	3.88	0.59
Chemical						
Nitrate+Nitrite Nitrogen (mg/L)[J]	7	< 0.003	3.422	1.568	1.607	1.346
Dissolved Reactive Phosphorus (mg/L)[J]	7	< 0.008	0.096	0.027	0.043	0.037
CBOD-5 (mg/L)	7	< 1.0	1.0	0.5	0.5	0.0
Chlorides (mg/L)	7	1.4	8.7	2.5	4.4	3.2
Biological						
Chlorophyll a (ug/L)	7	< 1.00	4.81	0.50	1.20	1.61
Fecal Coliform (col/100 mL)[J]	3	14	340	60	138	176

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).

Year	Mean MSC	Limiting Nutrient
8/19/2003	7.24	PHOSPHORUS
8/19/2009	9.08	PHOSPHORUS

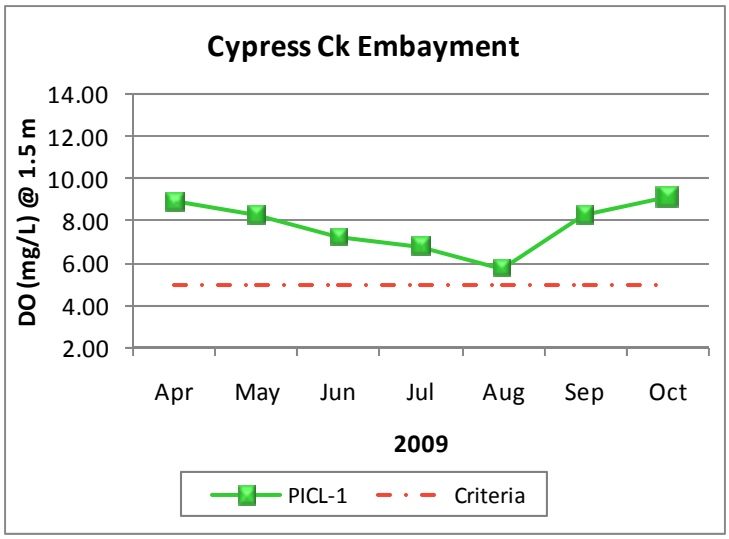


Figure 5. Monthly DO concentrations at 1.5 m (5 ft) for Cypress Creek embayment station of Pickwick Reservoir collected April-October 2009. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

REFERENCES

ADEM. 2008a. Quality Assurance Project Plan (QAPP) for Surface Water Quality Monitoring in Alabama. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 78 pp.

ADEM. 2008b. Quality Management Plan (QMP) for the Alabama Department of Environmental, Alabama Department of Environmental Management (ADEM), Montgomery, AL. 58 pp.

ADEM. 2009. Standard Operating Procedures Series #2000, Alabama Department of Environmental Management (ADEM), Montgomery, AL.

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.

FOR MORE INFORMATION, CONTACT:
Gina Curvin, ADEM Environmental Indicators Section
1350 Coliseum Boulevard, Montgomery, AL 36110
(334) 260-2783, gcurvin@adem.state.al.us