2015 Dannelly Reservoir Report

Rivers and Reservoirs Monitoring Program

Alabama Department of Environmental Management

Field Operations Division
Environmental Indicators Section
Aquatic Assessment Unit
December 2017

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LIST OF ACRONYMS

A&I	Agricultural and Industrial Water Supply Use Classification
ADEM	Alabama Department of Environmental Management
AGPT	Algal Growth Potential Test
CHL *a*	Chlorophyll *a*
DO	Dissolved Oxygen
F&W	Fish and Wildlife
MAX	Maximum
MDL	Method Detection Limit
MIN	Minimum
MSC	Mean Standing Crop
NTU	Nephelometric Turbidity Units
OAW	Outstanding Alabama Waters
ONRW	Outstanding National Resource Water
PWS	Public Water Supply
QAPP	Quality Assurance Project Plan
RRMP	Rivers and Reservoirs Monitoring Program
S	Swimming and Other Whole Body Water-Contact Sports
SD	Standard Deviation
SOP	Standard Operating Procedures
TEMP	Temperature
TN	Total Nitrogen
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TSI	Trophic State Index
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
COE	United States Army Corp of Engineers

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INTRODUCTION

Dannelly Reservoir was created with the construction of Millers Ferry Lock and Dam. Construction of the reservoir began in 1963 and was completed in 1974 by the United States Army Corps of Engineers (COE). The reservoir covers approximately 17,200 acres and stretches from Benton, Alabama to just northwest of Camden, Alabama. Dannelly provides hydroelectricity to the area and also provides a number of recreational opportunities such as camping, hiking, fishing, and hunting.

The Alabama Department of Environmental Management (ADEM) monitored Dannelly Reservoir as part of the 2015 assessment of the Alabama, Coosa, and Tallapoosa (ACT) River basins under the Rivers and Reservoirs Monitoring Program (RRMP). 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 RRMP) was initiated by the Field Operations Division of the 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).

A specific water quality criterion for nutrient management was implemented in 2004 at one location on Dannelly Reservoir (Table 1). This criterion represents the maximum growing season mean (April-October) chlorophyll *a* (chl *a*) concentration allowable while still fully supporting Dannelly Reservoir's Swimming and Fish & Wildlife (S/F&W) use classifications.

The purpose of this report is to summarize data collected at eight stations in Dannelly Reservoir during the 2015 growing season and to evaluate trends in mean lake trophic status and nutrient concentrations using ADEM's historic dataset. Monthly and mean concentrations of nutrients [total nitrogen (TN); total phosphorus (TP)], algal biomass/productivity (chl *a*);, sediment [total suspended solids (TSS)], and trophic state [Carlson's trophic state index (TSI)] were compared to ADEM's historical data and established criteria.

METHODS

Sampling stations were selected using historical data and previous assessments (Fig. 1). Specific location information can be found in Table 1. Dannelly was sampled in the dam forebay, mid reservoir, upper reservoir, and Alabama River mile 220. Three tributary embayments were also monitored: Cahaba R, Bogue Chitto Ck and Pine Barren Ck.

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).

Growing season mean TN, TP, chl *a*, and TSS were calculated to evaluate water quality conditions at each site. For mainstem stations, monthly concentrations of these parameters were graphed with the closest available COE flow data and ADEM's previously collected data to help interpret the 2015 results.

Figure 1. Dannelly Reservoir with 2015 sampling locations. A description of each sampling location is provided in Table 1.

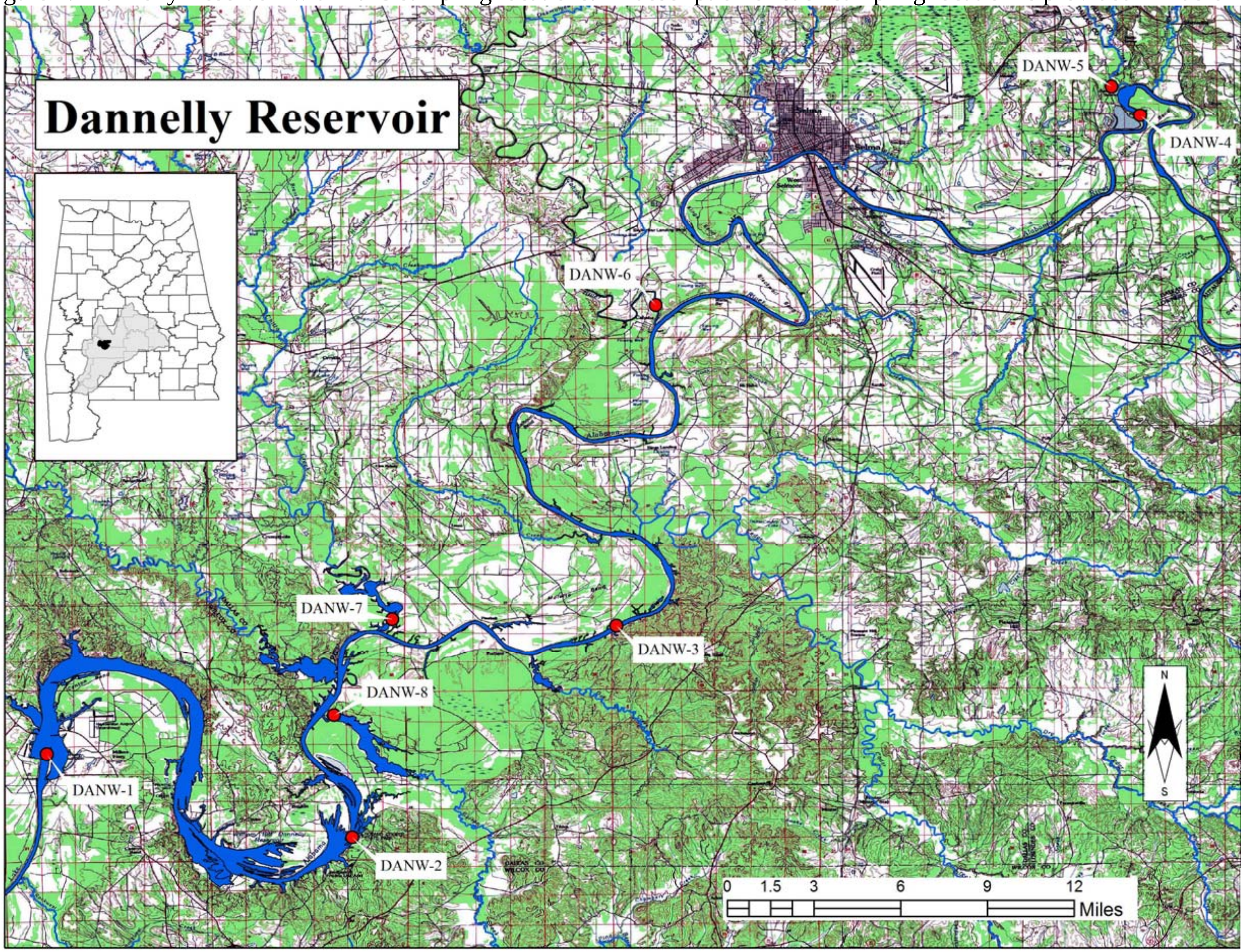


Table 1. Descriptions of the 2015 monitoring stations in Dannelly Reservoir.

HUC	County	Station Number	Report Designation	Waterbody Name	Station Description	Chl *a* Criteria	Latitude	Longitude
Dannelly Reservoir								
031502030701	Wilcox	**DANW-1	Lower	Alabama R	Deepest point, main river channel, dam forebay.	17 μg/L	32.1035	-87.3986
031502030701	Wilcox	DANW-2	Mid	Alabama R	Deepest point, main river channel, immediately. upstream of Roland Cooper State Park.		32.0619	-87.2457
031502030203	Dallas	DANW-3	Upper	Alabama R	Deepest point, main river channel, immediately upstream of Elm Bluff Park.		32.1680	-87.1136
031502011204	Dallas	DANW-4	ARM 220	Alabama R	Deepest point, main river channel, upstream of paper mill discharge.		32.4240	-86.8514
031502020902	Dallas	DANW-6	Cahaba R	Cahaba R	Deepest point, main river channel, Cahaba River embayment, approximately 0.5 miles upstream of lake confluence.		32.3289	-87.0937
031502030308	Dallas	DANW-7	Bogue Chitto Ck	Bogue Chitto Ck	Deepest point, main creek channel of Bogue Chitto Creek embayment, approximately 0.5 miles upstream of lake confluence.		32.1713	-87.2257
031502030506	Dallas	DANW-8	Pine Barren Ck	Pine Barren Ck	Deepest point, main creek channel, Pine Barrens Creek embayment, approximately 0.5 miles upstream of lake confluence.		32.1231	-87.2548

**Growing season mean Chl a criterion implemented at this station in 2004

RESULTS

Growing season mean graphs for TN, TP, chl *a* and TSS are provided in this section (Figs. 2 & 3). Monthly graphs for TN, TP, chl *a*, TSS, DO and TSI are also provided (Figs. 4-8 and 11). Mean monthly discharge is included in monthly graphs for TN, TP, chl *a*, TSS and TSI as an indicator of flow and retention time in the months sampled. Depth profile graphs of temperature, DO and conductivity appear in Figures 9-10. Summary statistics of all data collected during 2015 are presented in Appendix Table 1. The table contains the minimum, maximum, median, mean and standard deviation of each parameter analyzed

Stations with the highest concentrations of nutrients, chlorophyll and TSS are noted in the paragraphs to follow. Though stations with lowest concentrations may not always be mentioned, review of the graphs that follow will indicate these stations that may be potential candidates for reference waterbodies and watersheds.

In 2015, the highest growing season mean TN value was calculated for the Bogue Chitto Ck station (Fig. 2). Growing season mean TN values at the mainstem stations were some of the highest since 2002. Since 2005, Cahaba R and Bogue Chitto Ck stations show an increasing trend in mean TN concentrations. Pine Barren Ck station decreased compared to 2010. Monthly TN graphs show all mainstem stations were similar to historic means in most months during the 2015 growing season (Fig. 4). Historic highs occurred at the lower station in April, September, and October.

In 2015, the highest growing season mean TP value was calculated for the Bogue Chitto Ck station (Fig. 2). Growing season mean TP concentrations at all mainstem stations were lower in 2015 than previous years. Mean concentrations in all tributaries decreased from 2010 to 2015 and were the lowest since 2000. Monthly TP concentrations at all mainstem stations were below historic means April-October (Fig. 5). Historic lows occurred in April-July at the ARM 220 station. Monthly concentrations were also at historic lows in June and September at the upper station. The lower station had one historic low that occurred in June.

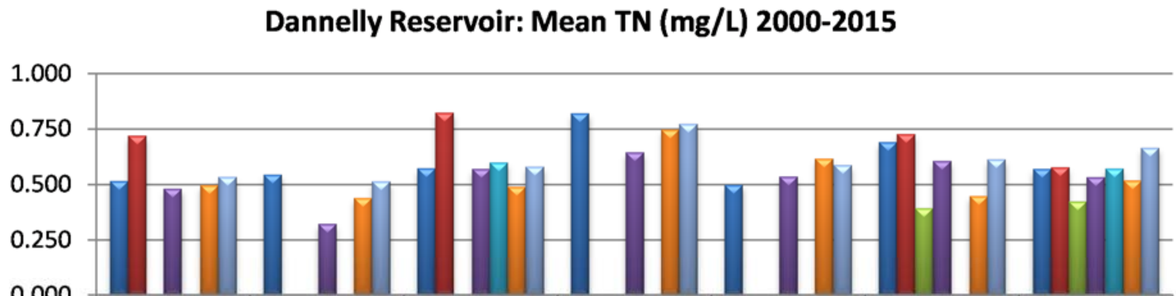
In 2015, the highest growing season mean chl. *a* was calculated for the Bogue Chitto Ck station (Fig. 3). Growing season mean chl *a* concentrations at the mainstem stations were the lowest since 2000. The ARM 220 station showed a minimal increase compared to 2010 but was much lower than concentrations measured in 2000. Concentrations in the Cahaba R. and Bogue Chitto Ck stations decreased from 2010-2015, while the mean chl *a* concentration at the Pine Barren Ck station increased. The mean chl *a* concentration in lower Dannelly was below the established criterion. Monthly chl. *a* concentrations at the upper, mid and lower stations were below mean historic values in most months, reaching historic lows 3 of 7 months (Fig. 6). Highest monthly concentrations occurred in July and August at the ARM 220 station preceded by historic lows in May and June.

In 2015, the highest growing season mean TSS value was calculated for the ARM 220 station (Fig. 3). Mean concentrations increased at all stations compared to 2010 and was at least twice the previoud concentrations at ARM 220, upper, and mid stations. Monthly TSS was highest in April at the ARM 220 station which was also a historic high (Fig. 7). A historic high monthly TSS concentration was measured in May at the mid and upper stations. All other monthly concentrations were at or below historic means.

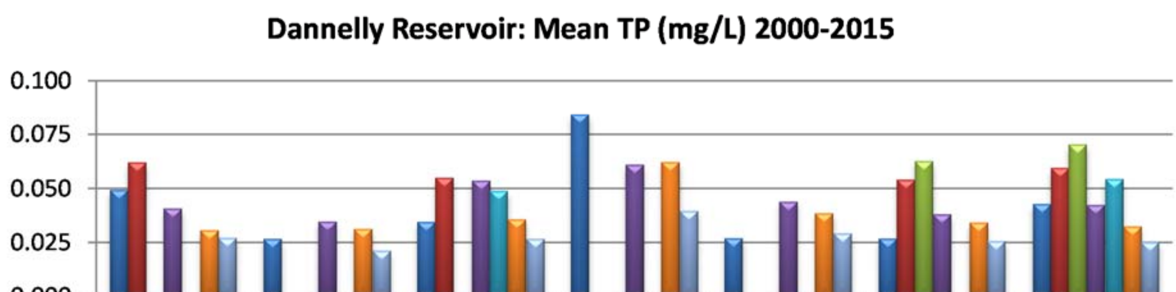
DO concentrations at the Bogue Chitto Ck station were below the ADEM criteria limit of 5.0 mg/L at 5.0 ft (1.5 m) April-May and October and at the mid station in August (ADEM Admin. Code R. 335-6-10-.09) (Fig. 8). DO concentrations remained above the criteria in all other months for all stations although the Pine Barren Ck station was close May-September. Concentration of all the mainstem stations were above the criteria limit with the exception of the mid station in July. Depth profiles of the lower and mid stations show each location was mixed most of the sampling season (Figs. 9 & 10). However, the lower station was stratified below 2 m in June and July. Highest temperatures were reached in July at both stations.

TSI values were calculated using monthly chl *a* concentrations and Carlson's Trophic State Index. The Bogue Chitto Ck and Pine Barren Ck stations had the highest trophic state, bordering hypereutrophic in August and July-Aug, respectively (Fig. 11). TSI values at all stations were generally eutrophic July-October.

Figure 2. Growing season mean TN and TP measured in Dannelly Reservoir, April-October, 2000-2015. Bar graphs consist of mainstem and embayment stations, illustrated from upstream to downstream as the graph is read from left to right.



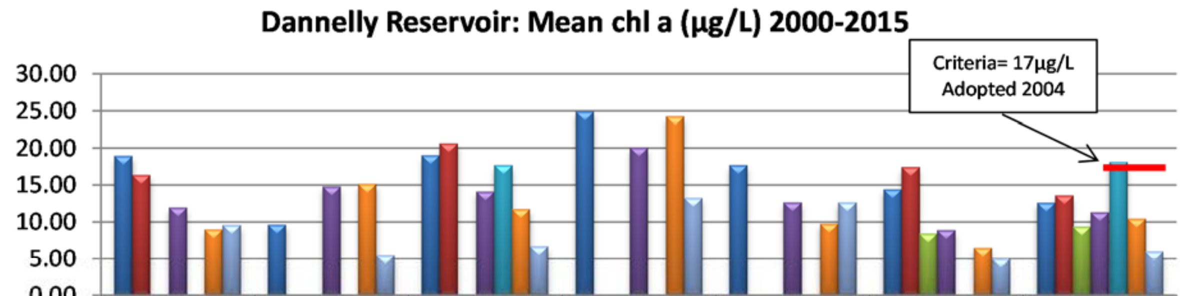
	ARM 220	Cahaba R	Upper	Bogue Chitto Ck	Pine Barren Ck	Mid	Lower
2000	0.516*	0.545	0.573	0.821	*0.499	* 0.691	0.570
2002	0.720		0.824			0.728	0.578
2003						0.394	0.424
2005	0.482	0.322	0.570	0.645	0.536	0.607	0.533
2008			0.600				0.572
2010	0.497	0.439	0.490	0.748	0.617	0.448	0.518
2015	0.534	0.514	0.581	0.774	0.587	0.614	0.666



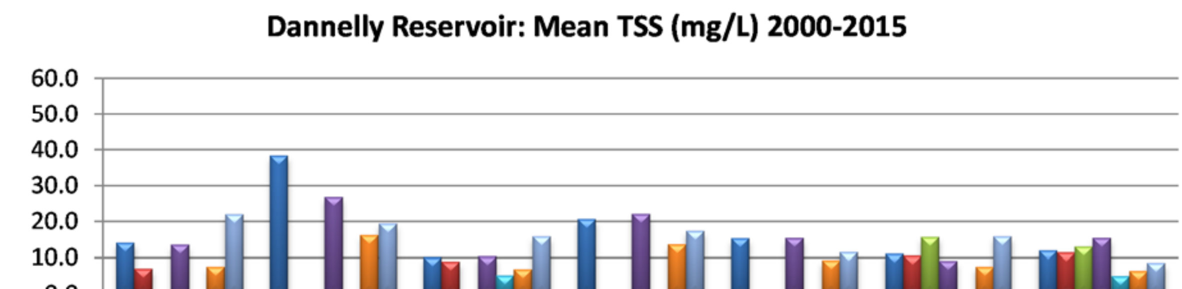
	ARM 220	Cahaba R	Upper	Bogue Chitto Ck	Pine Barren Ck	Mid	Lower
2000	0.049*	0.027	0.034	0.084	*0.027	* 0.027	0.043
2002	0.062		0.055			0.054	0.060
2003						0.063	0.070
2005	0.041	0.035	0.054	0.061	0.044	0.038	0.042
2008			0.049				0.054
2010	0.031	0.031	0.036	0.062	0.038	0.034	0.032
2015	0.027	0.021	0.027	0.040	0.029	0.026	0.025

*Mean of April/June/August only.

Figure 3. Growing season mean chl a and TSS measured in Dannelly Reservoir, April-October, 2000-2015. Bar graphs consist of mainstem and embayment stations, illustrated from upstream to downstream as the graph is read from left to right. Chl *a* criteria applies to the growing season mean of the lower station only.



	ARM 220	Cahaba R	Upper	Bogue Chitto Ck	Pine Barren Ck	Mid	Lower
2000	18.96*	9.62	*19.04	24.93	* 17.69	* 14.41	12.63
2002	16.38		20.65			17.44	13.61
2003						8.44	9.37
2005	11.95	14.80	14.14	20.06	12.66	8.90	11.32
2008			17.70				18.16
2010	9.00	15.16	11.75	24.27	9.77	6.48	10.45
2015	9.58	5.48	6.69	13.28	12.65	5.00	6.01



	ARM 220	Cahaba R	Upper	Bogue Chitto Ck	Pine Barren Ck	Mid	Lower
2000	14.14*	38.33	*10.14	20.67	* 15.33	* 11.14	12.00
2002	7.00		9.00			10.57	11.43
2003						15.73	13.07
2005	13.57	26.86	10.43	22.14	15.43	9.14	15.43
2008			5.14				5.00
2010	7.57	16.29	6.86	13.71	9.29	7.57	6.43
2015	22.1	19.4	15.9	17.4	11.6	15.9	8.6

*Mean of April/June/August only.

Figure 4. Monthly TN concentrations of the mainstem stations measured in Dannelly Reservoir, April-October 2015. Each bar graph depicts monthly changes in each station. The historic mean and min/max range are also displayed for comparison. The "n" value equals the number of data points included in the monthly historic calculations. TN was plotted vs. the closest discharge (COE Alabama River at Millers Ferry L& D near Camden, AL).

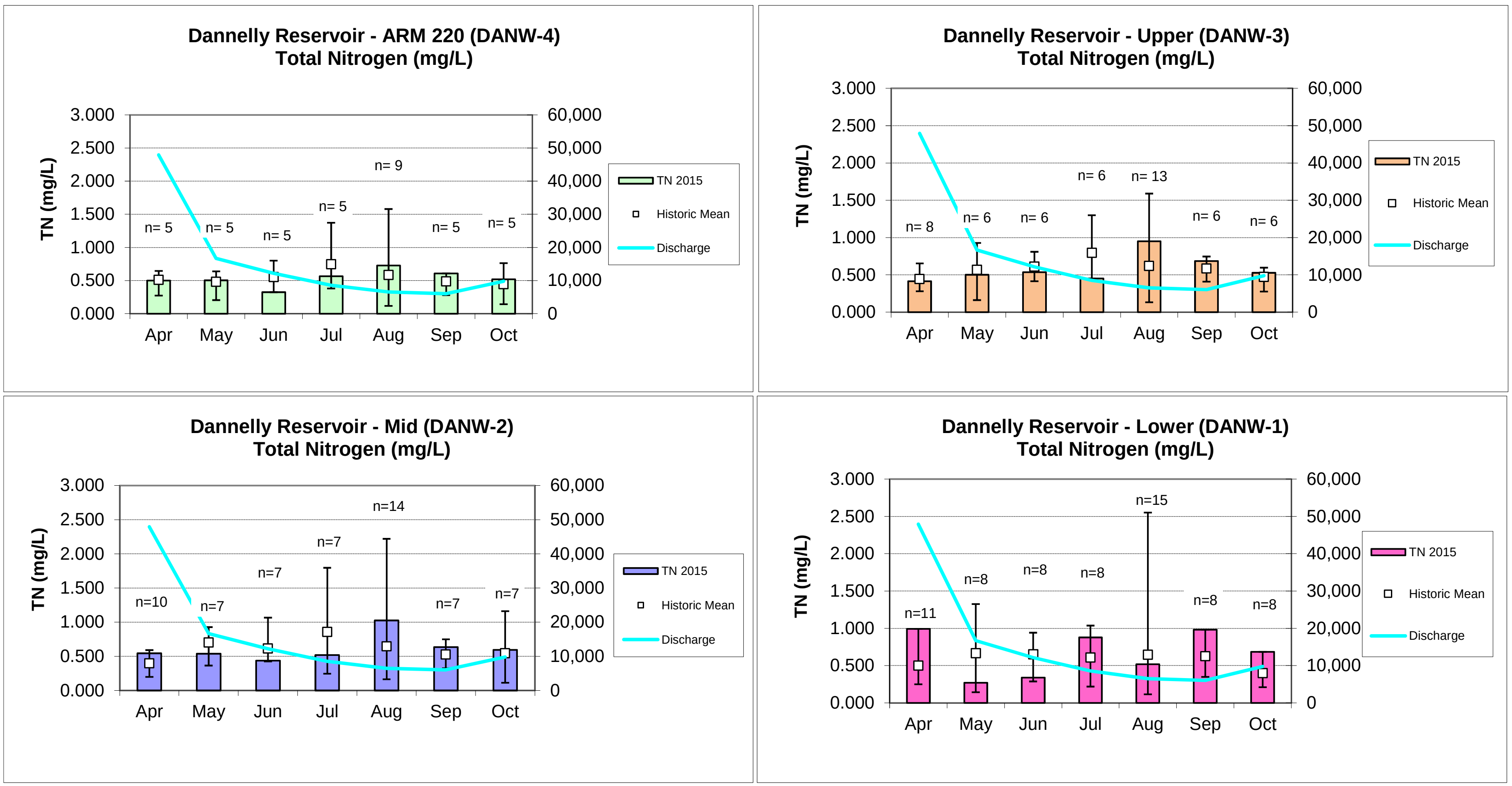


Figure 5. Monthly TP concentrations of the mainstem stations measured in Dannelly Reservoir, April-October 2015. Each bar graph depicts monthly changes in each station. The historic mean and min/max range are also displayed for comparison. The “n” value equals the number of data points included in the monthly historic calculations. TP was plotted vs. the closest discharge (COE Alabama River at Millers Ferry L&D near Camden, AL).

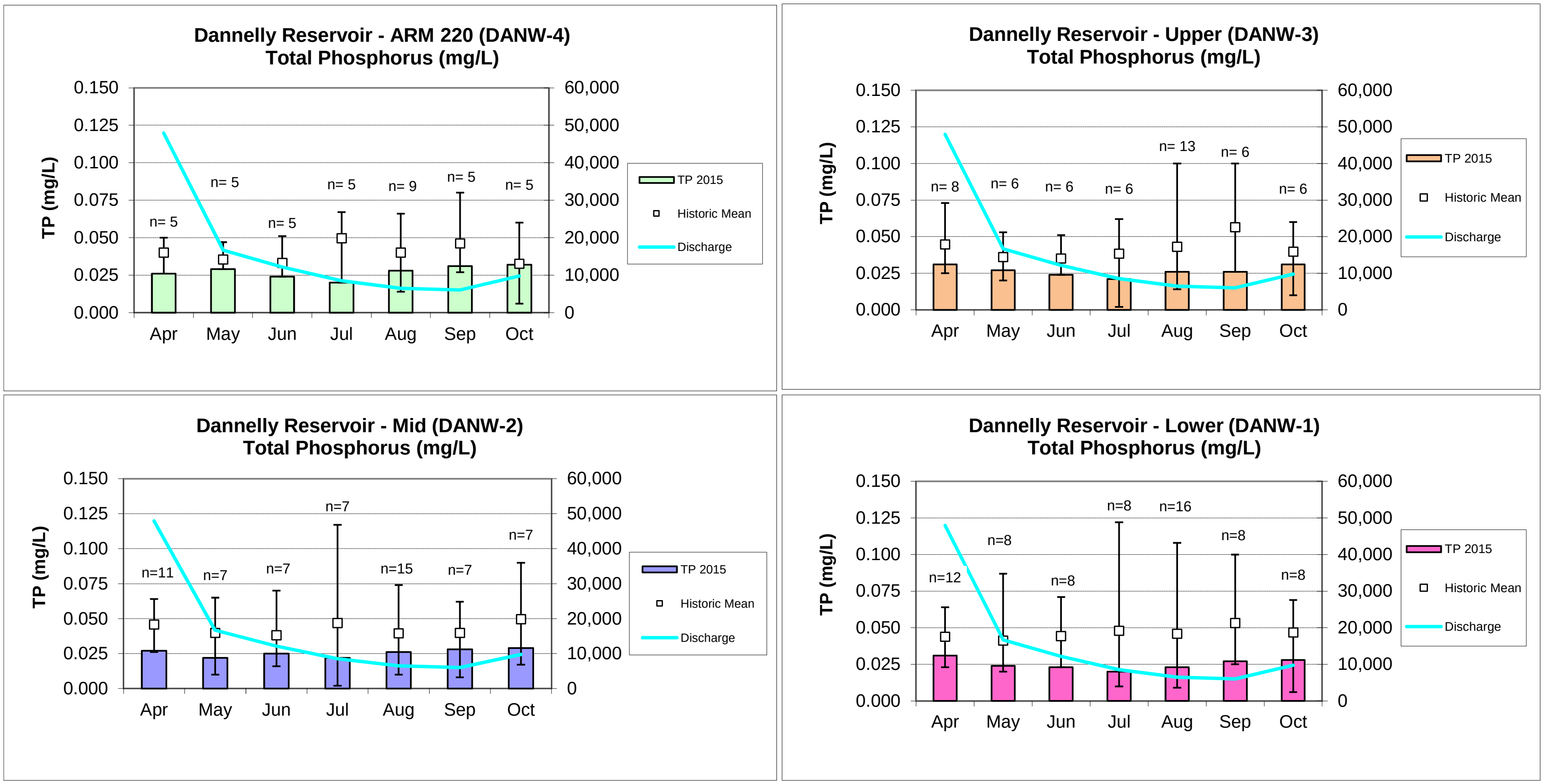


Figure 6. Monthly chl *a* concentrations of the mainstem stations measured in Dannelly Reservoir, April-October 2015**.** Each bar graph depicts monthly changes in each station**.** The historic mean and min/max range are also displayed for comparison. The "n" value equals the number of data points included in the monthly historic calculations. Chl *a* was plotted vs. the closest discharge (COE Alabama River at Millers Ferry L&D near Camden, AL).

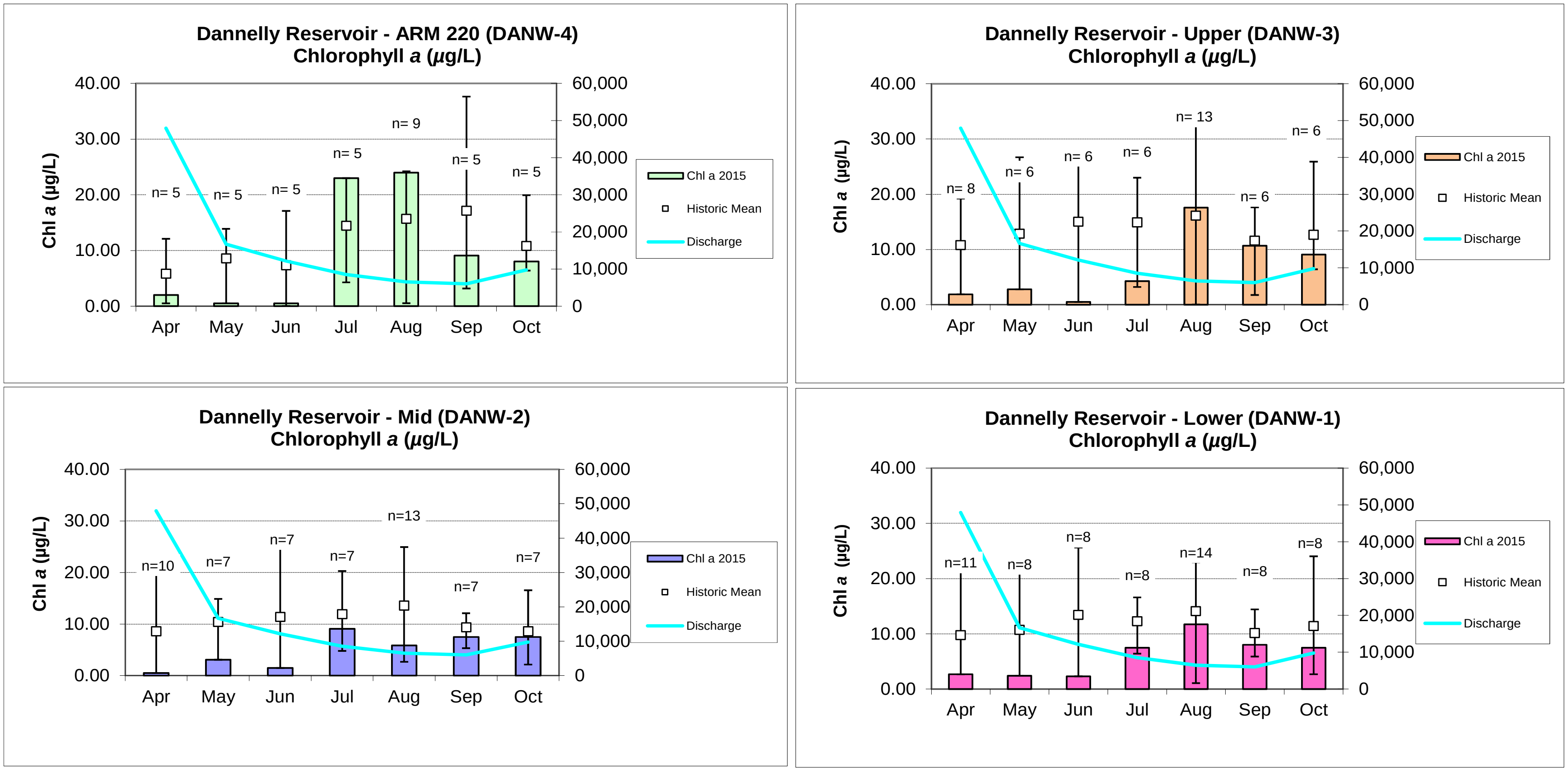


Figure 7. Monthly TSS concentrations of the mainstem stations measured in Dannelly Reservoir, April-October 2015. Each bar graph depicts monthly changes in each station. The historic mean and min/max range are also displayed for comparison. The "n" value equals the number of data points included in the monthly historic calculations. TSS was plotted vs. the closest discharge (COE Alabama River at Millers Ferry L&D near Camden, AL).

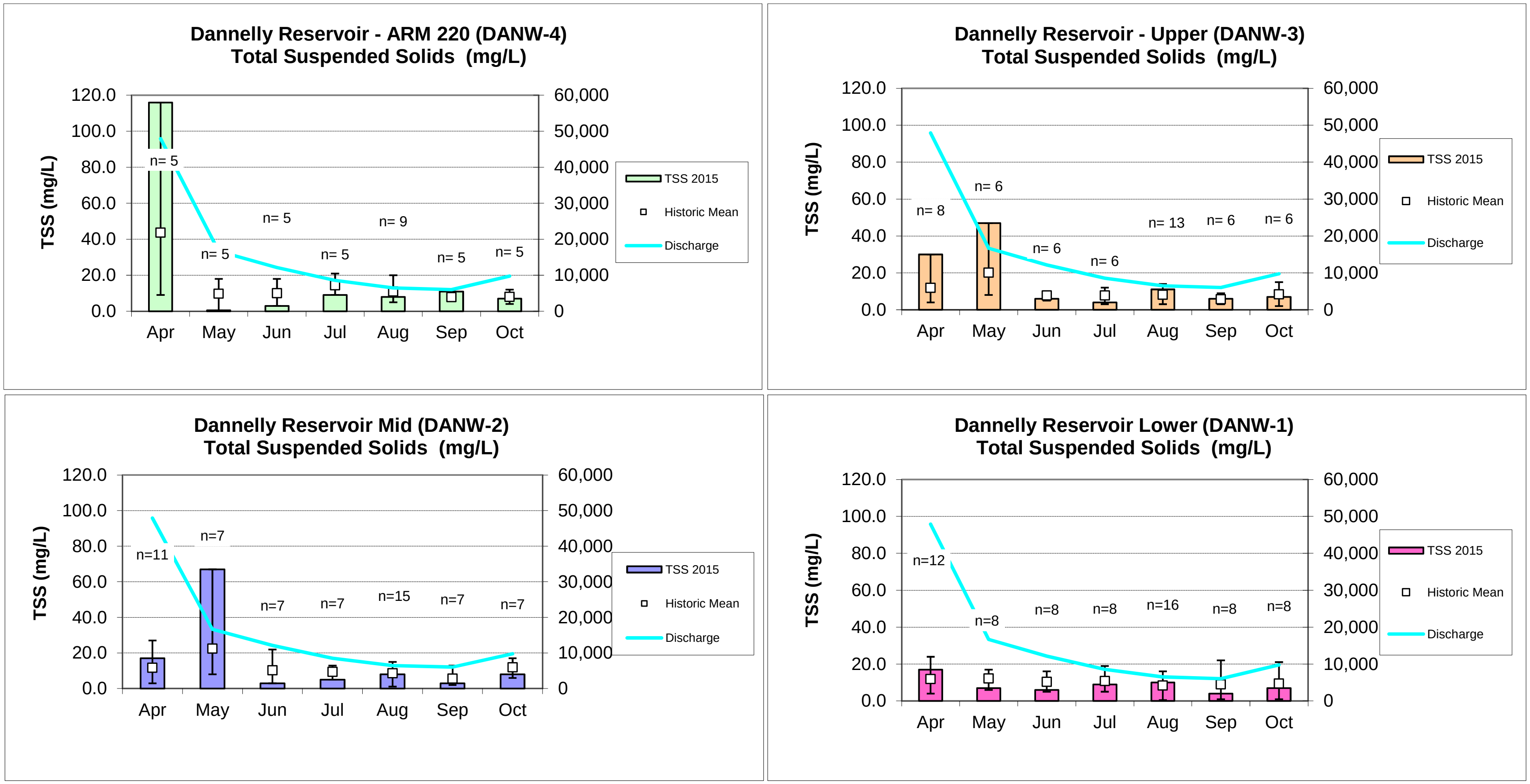


Figure 8. Monthly DO concentrations at 1.5 m (5 ft) for Dannelly Reservoir stations collected April-October 2015. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth (ADEM 2010). In tributaries, when total depth was less than 3 m, criteria apply to the mid-depth reading.

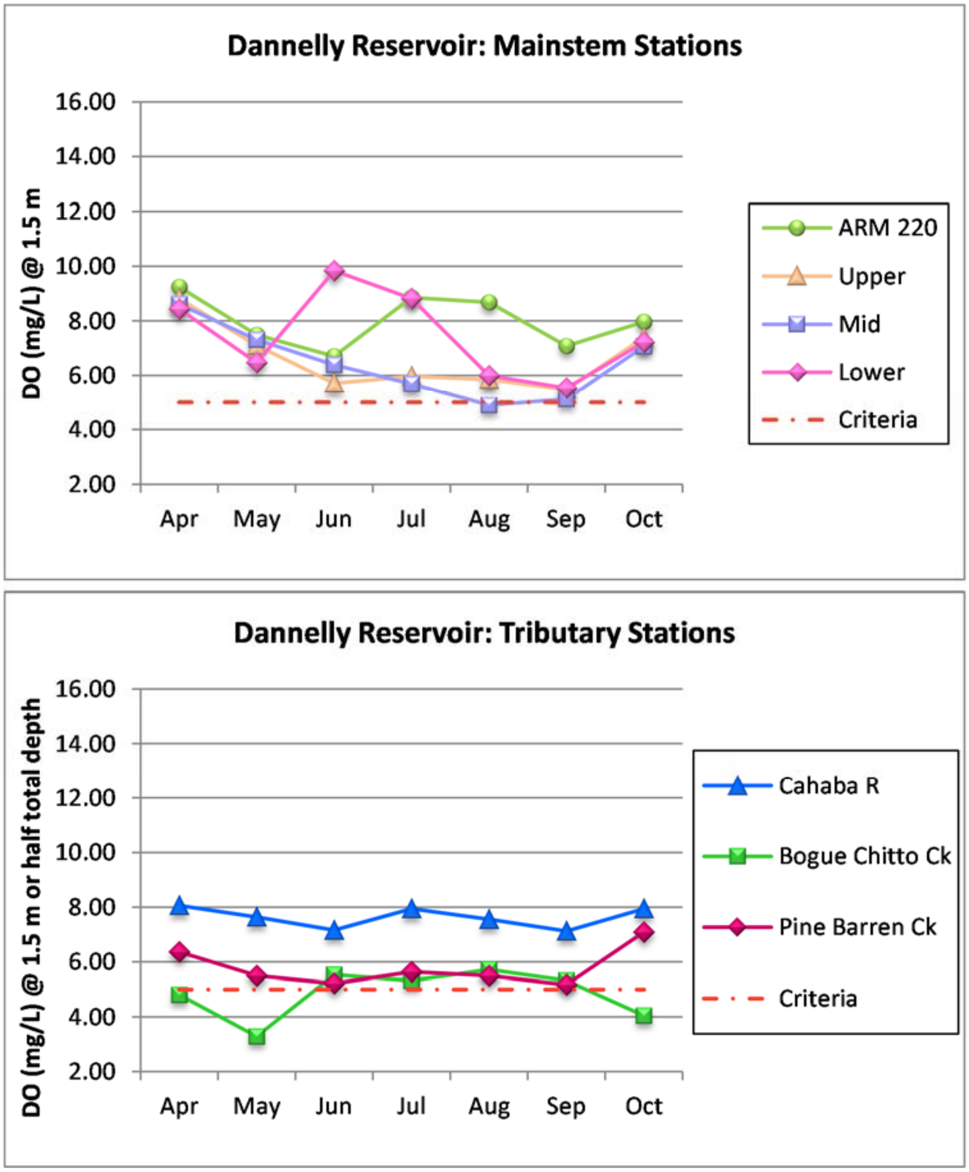


Figure 9. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in the lower Dannelly Reservoir station, April-October 2015.

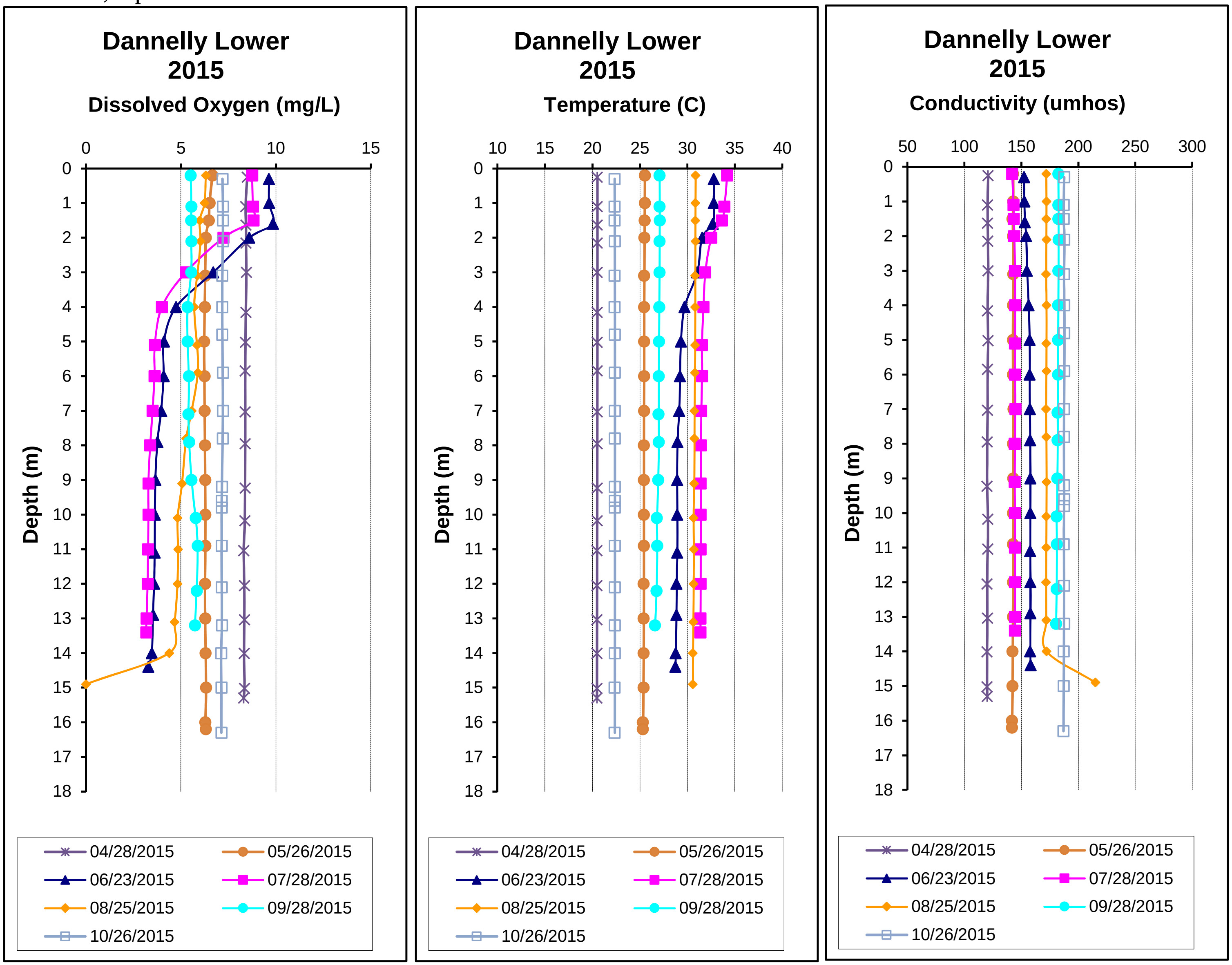


Figure 10. Monthly depth profiles of dissolved oxygen (mg/L), temperature (C), and conductivity (umhos) in the mid Dannelly Reservoir station, April-October 2015.

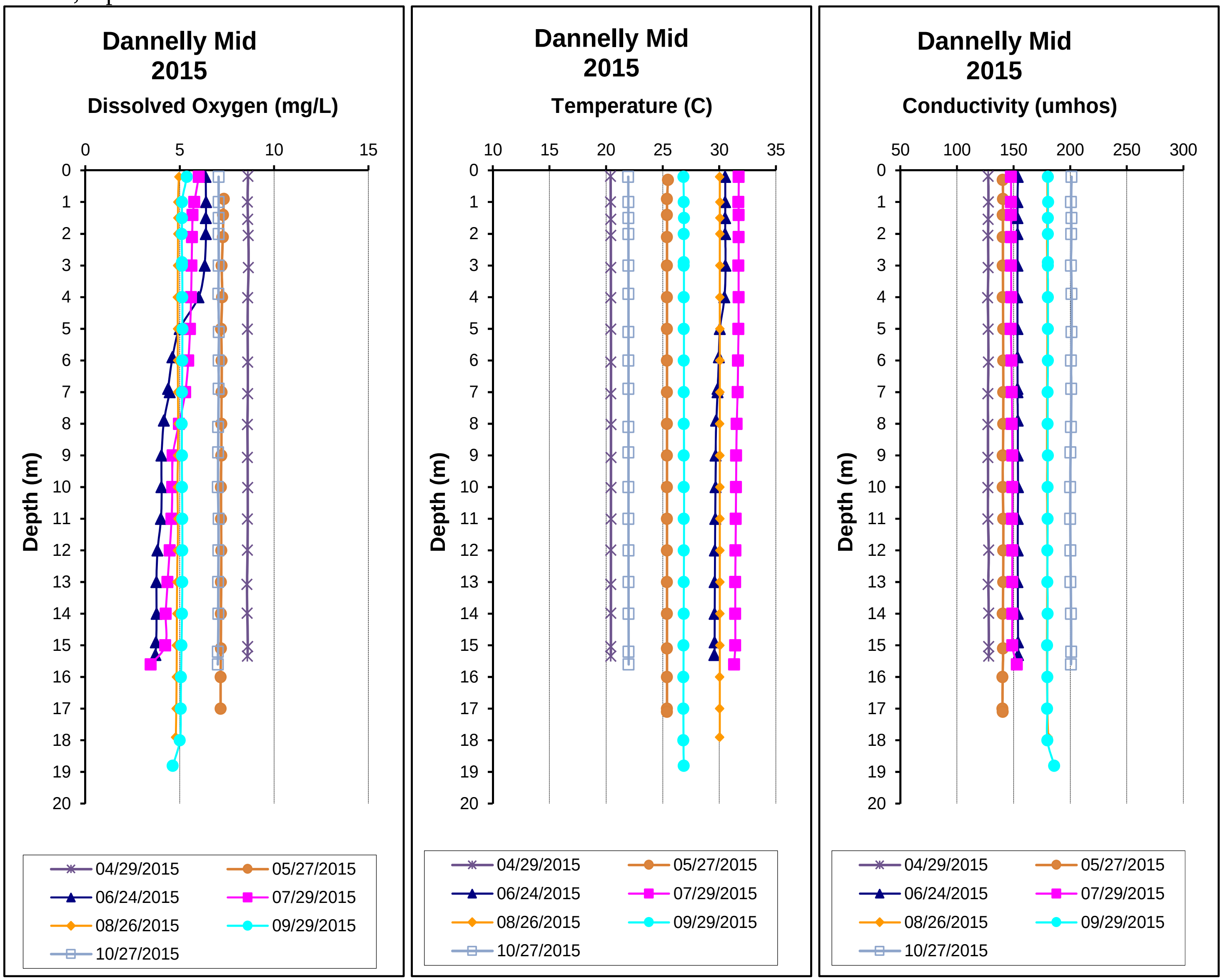
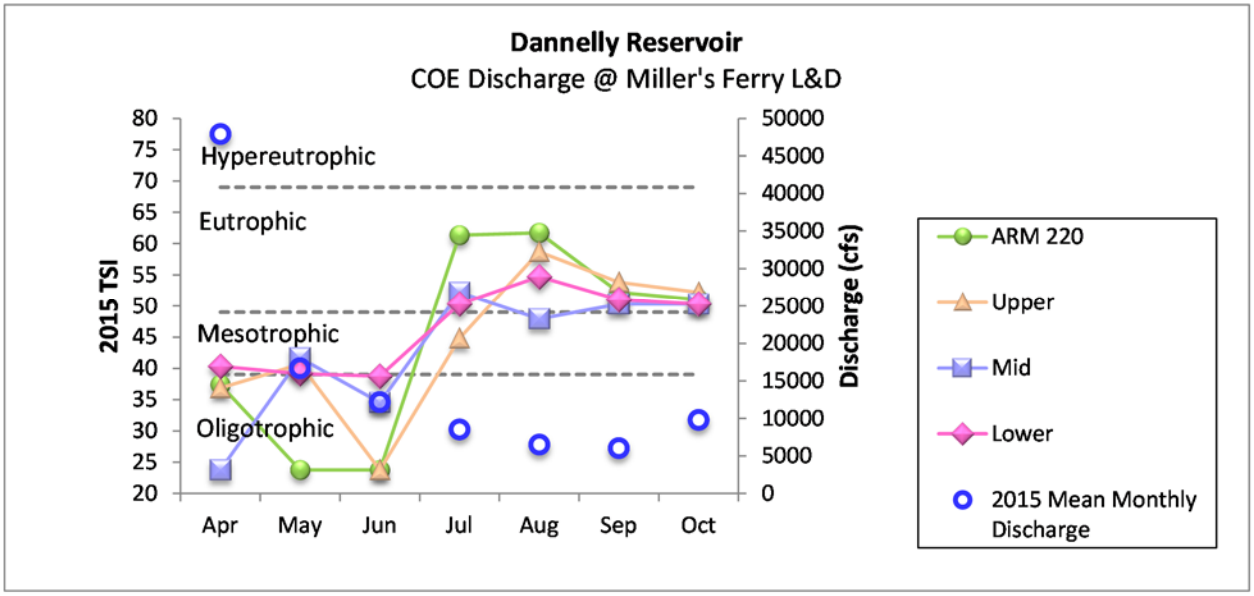
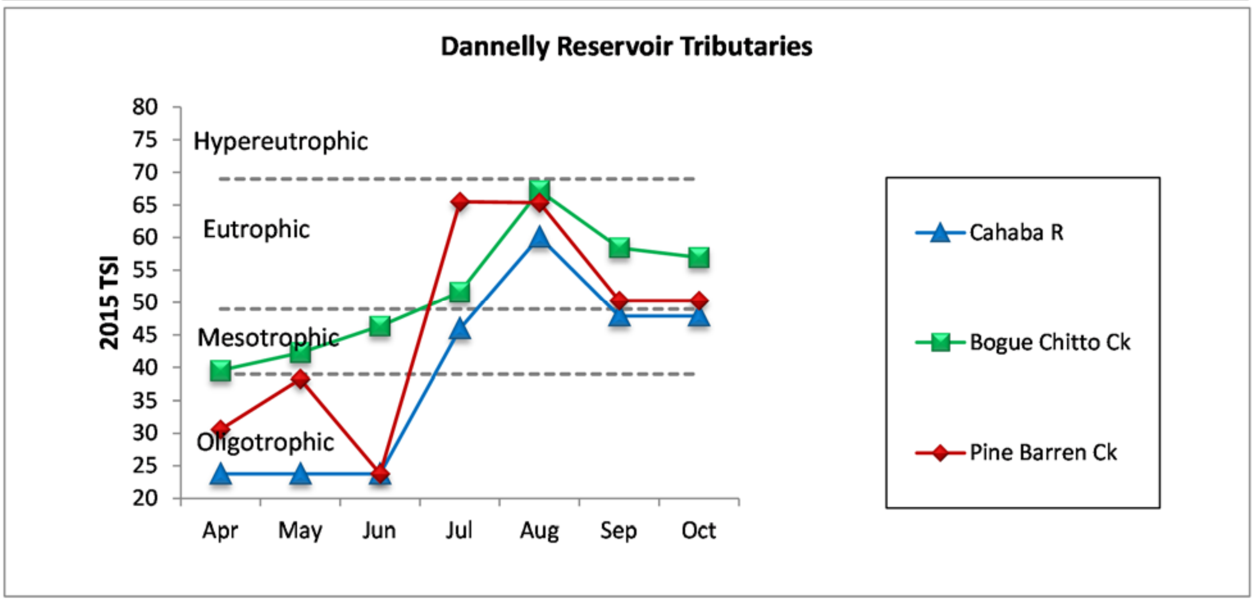


Figure 11. Monthly TSI values calculated for mainstem and tributary Dannelly Reservoir stations using chl *a* concentrations and Carlson's Trophic State Index calculation. TSI for mainstem stations were plotted vs. closest discharge (COE Alabama River at Millers Ferry L&D near Camden, AL).





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APPENDIX

Appendix Table 1. Summary of water quality data collected April-October, 2015. Minimum (min) and maximum (max) values calculated using minimum detection limits when results were less than this value. Median (med), mean, and standard deviation (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

Station	Parameter	N		Min	Max	Med	Mean	SD
DANW-1	Physical							
	Turbidity (NTU)	7		7.1	13.9	10.0	9.5	2.5
	Total Dissolved Solids (mg/L)	7		77.0	106.0	93.0	92.6	11.7
	Total Suspended Solids (mg/L)	7		4.0	17.0	7.0	8.6	4.2
	Hardness (mg/L)	4		52.7	68.9	60.0	60.4	7.6
	Alkalinity (mg/L)	7		45.6	68.5	57.9	57.8	8.1
	Photic Zone (m)	7		2.65	3.52	2.97	3.09	0.34
	Secchi (m)	7		0.75	1.15	0.98	0.99	0.14
	Bottom Depth (m)	7		13.2	16.3	14.9	14.8	1.2
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.010	0.029	0.005	0.014	0.012
	Nitrate+Nitrite Nitrogen (mg/L)[J]	7		0.004	0.149	0.080	0.069	0.048
	Total Kjeldahl Nitrogen (mg/L)	7		0.188	0.900	0.602	0.597	0.283
	Total Nitrogen (mg/L)[J]	7		0.270	0.992	0.684	0.666	0.299
	Dissolved Reactive Phosphorus (mg/L)[J]	7		0.003	0.011	0.007	0.007	0.003
	Total Phosphorus (mg/L)	7		0.020	0.031	0.024	0.025	0.004
	CBOD-5 (mg/L)	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		4.0	9.5	6.5	6.9	1.8
	Biological							
	Chlorophyll a (mg/m^3)	7		2.30	11.70	7.48	6.01	3.62
	E. coli (MPN/DL)[J]	3		1	2	1	1	1
DANW-2	Physical							
	Turbidity (NTU)	7		4.8	16.1	8.4	8.8	3.6
	Total Dissolved Solids (mg/L)	7		82.0	116.0	102.0	100.9	13.4
	Total Suspended Solids (mg/L)	7		3.0	67.0	8.0	15.9	23.0
	Hardness (mg/L)	4		54.7	69.4	59.8	60.9	7.0
	Alkalinity (mg/L)	7		48.4	72.2	56.3	58.6	8.8
	Photic Zone (m)	7		2.52	4.31	2.92	3.09	0.58
	Secchi (m)	7		0.88	1.79	0.93	1.11	0.33
	Bottom Depth (m)	7		15.3	18.8	15.6	16.5	1.4
	Chemical							
	Ammonia Nitrogen (mg/L)[J]	7	<	0.010	0.062	0.024	0.030	0.026
	Nitrate+Nitrite Nitrogen (mg/L)	7		0.047	0.164	0.100	0.106	0.038
	Total Kjeldahl Nitrogen (mg/L)	7		0.358	0.892	0.471	0.507	0.179
	Total Nitrogen (mg/L)	7		0.438	1.026	0.545	0.614	0.192
	Dissolved Reactive Phosphorus (mg/L)[J]	7		0.004	0.014	0.007	0.008	0.004
	Total Phosphorus (mg/L)	7		0.022	0.029	0.026	0.026	0.003
	CBOD-5 (mg/L)	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		4.1	9.9	7.5	7.2	2.0
	Biological							
	Chlorophyll a (mg/m^3)	7	<	1.00	9.08	5.87	5.00	3.31
	E. coli (MPN/DL)	3	<	1	2	1	1	1

Station	Parameter	N	Min	Max	Med	Mean	SD
DANW-3	**Physical**						
	Turbidity (NTU)	7	5.5	22.4	8.1	9.9	5.8
	Total Dissolved Solids (mg/L)	7	79.0	115.0	95.0	98.0	14.1
	Total Suspended Solids (mg/L)	7	4.0	47.0	7.0	15.9	16.4
	Hardness (mg/L)	4	53.2	67.0	60.0	60.0	5.9
	Alkalinity (mg/L)	7	46.2	71.7	59.2	59.6	9.0
	Photic Zone (m)	7	2.03	3.65	3.18	3.09	0.56
	Secchi (m)	7	0.73	1.34	1.08	1.07	0.24
	Bottom Depth (m)	7	11.2	13.6	12.6	12.4	0.9
	Chemical						
	Ammonia Nitrogen (mg/L)[J]	7	0.018	0.058	0.031	0.032	0.013
	Nitrate+Nitrite Nitrogen (mg/L)	7	0.061	0.165	0.112	0.114	0.035
	Total Kjeldahl Nitrogen (mg/L)	7	0.250	0.827	0.425	0.467	0.188
	Total Nitrogen (mg/L)	7	0.415	0.951	0.528	0.581	0.184
	Dissolved Reactive Phosphorus (mg/L)[J]	7	0.003	0.015	0.006	0.007	0.004
	Total Phosphorus (mg/L)	7	0.021	0.031	0.026	0.027	0.004
	CBOD-5 (mg/L)	7	< 2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7	3.9	9.9	8.3	7.6	2.2
	Biological						
	Chlorophyll a (mg/m³)	7	< 1.00	17.60	4.27	6.69	6.10
	E. coli (MPN/DL)	3	1	2	1	1	1
DANW-4	**Physical**						
	Turbidity (NTU)	7	5.4	12.2	8.0	8.3	2.5
	Total Dissolved Solids (mg/L)	7	67.0	107.0	83.0	87.1	13.1
	Total Suspended Solids (mg/L)	7	< 1.0	116.0	8.0	22.1	41.6
	Hardness (mg/L)	4	45.3	60.3	52.2	52.5	6.4
	Alkalinity (mg/L)	7	41.3	61.1	50.1	51.2	7.6
	Photic Zone (m)	7	2.25	4.20	3.52	3.45	0.70
	Secchi (m)	7	0.74	1.41	1.30	1.14	0.27
	Bottom Depth (m)	7	3.9	5.7	4.6	4.6	0.6
	Chemical						
	Ammonia Nitrogen (mg/L)	7	< 0.007	0.076	0.005	0.023	0.028
	Nitrate+Nitrite Nitrogen (mg/L)	7	0.057	0.175	0.132	0.125	0.042
	Total Kjeldahl Nitrogen (mg/L)	7	0.195	0.670	0.367	0.409	0.148
	Total Nitrogen (mg/L)	7	0.324	0.727	0.518	0.534	0.122
	Dissolved Reactive Phosphorus (mg/L)[J]	7	< 0.004	0.016	0.009	0.009	0.005
	Total Phosphorus (mg/L)	7	0.020	0.032	0.028	0.027	0.004
	CBOD-5 (mg/L)	7	< 2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7	4.3	11.0	6.7	7.5	2.3
	Biological						
	Chlorophyll a (mg/m³)	7	< 1.00	24.00	8.01	9.58	10.11
	E. coli (MPN/DL)	3	2	13	10	8	6

Station	Parameter	N		Min	Max	Med	Mean	SD
DANW-6	**Physical**							
	Turbidity (NTU)	7		13.3	66.2	17.1	24.4	18.7
	Total Dissolved Solids (mg/L)	7		91.0	151.0	127.0	121.9	23.3
	Total Suspended Solids (mg/L)	7		10.0	52.0	13.0	19.4	15.4
	Hardness (mg/L)	4		63.1	120.0	89.1	90.3	23.8
	Alkalinity (mg/L)	7		50.8	103.0	77.8	82.0	17.6
	Photic Zone (m)	7		0.98	2.86	2.55	2.25	0.64
	Secchi (m)	7		0.28	0.83	0.67	0.64	0.20
	Bottom Depth (m)	7		3.3	4.6	3.5	3.6	0.5
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.007	0.041	0.005	0.010	0.014
	Nitrate+Nitrite Nitrogen (mg/L)	7		0.074	0.284	0.199	0.177	0.090
	Total Kjeldahl Nitrogen (mg/L)	7		0.215	0.494	0.289	0.338	0.116
	Total Nitrogen (mg/L)	7		0.326	0.749	0.480	0.514	0.154
	Dissolved Reactive Phosphorus (mg/L)[J]	7	<	0.004	0.011	0.006	0.006	0.003
	Total Phosphorus (mg/L)	7		0.014	0.038	0.020	0.021	0.008
	CBOD-5 (mg/L)	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		2.5	6.3	4.9	4.6	1.4
	Biological							
	Chlorophyll a (mg/m^3)	7	<	1.00	20.30	4.81	5.48	7.01
	E. coli (MPN/DL)	3		4	23	7	11	9
DANW-7	**Physical**							
	Turbidity (NTU)	8		9.1	28.0	15.5	16.5	6.8
	Total Dissolved Solids (mg/L)	7		79.0	140.0	100.0	105.4	19.8
	Total Suspended Solids (mg/L)	7		9.0	25.0	18.0	17.4	6.8
	Hardness (mg/L)	4		60.3	81.1	70.3	70.5	8.8
	Alkalinity (mg/L)	7		57.4	72.7	68.5	66.8	5.8
	Photic Zone (m)	7		1.51	2.77	2.22	2.11	0.46
	Secchi (m)	7		0.44	1.04	0.75	0.71	0.24
	Bottom Depth (m)	8		5.3	5.9	5.6	5.6	0.2
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.007	0.068	0.005	0.030	0.032
	Nitrate+Nitrite Nitrogen (mg/L)	7		0.021	0.077	0.047	0.046	0.020
	Total Kjeldahl Nitrogen (mg/L)	7		0.491	1.100	0.607	0.727	0.242
	Total Nitrogen (mg/L)	7		0.519	1.140	0.666	0.774	0.242
	Dissolved Reactive Phosphorus (mg/L)[J]	7		0.006	0.015	0.010	0.010	0.004
	Total Phosphorus (mg/L)	7		0.025	0.068	0.034	0.040	0.016
	CBOD-5 (mg/L)	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		6.1	9.5	7.3	7.6	1.3
	Biological							
	Chlorophyll a (mg/m^3)	7		2.50	41.80	8.54	13.28	13.76
	E. coli (MPN/DL)	3		1	3	2	2	1

Station	Parameter	N		Min	Max	Med	Mean	SD
DANW-8	Physical							
	Turbidity (NTU)	7		7.0	21.3	14.1	14.0	5.7
	Total Dissolved Solids (mg/L)	7		75.0	115.0	94.0	97.0	15.8
	Total Suspended Solids (mg/L)	7		5.0	19.0	11.0	11.6	4.8
	Hardness (mg/L)	4		53.0	70.4	64.4	63.0	7.3
	Alkalinity (mg/L)	7		50.8	71.7	56.8	59.2	7.3
	Photic Zone (m)	7		1.67	3.30	2.43	2.33	0.58
	Secchi (m)	7		0.50	1.22	0.90	0.81	0.29
	Bottom Depth (m)	7		7.3	8.4	7.6	7.7	0.4
	Chemical							
	Ammonia Nitrogen (mg/L)	7	<	0.010	0.059	0.038	0.036	0.020
	Nitrate+Nitrite Nitrogen (mg/L)	7		0.034	0.096	0.070	0.063	0.029
	Total Kjeldahl Nitrogen (mg/L)[J]	7		0.117	1.150	0.460	0.525	0.338
	Total Nitrogen (mg/L)[J]	7		0.151	1.184	0.530	0.587	0.332
	Dissolved Reactive Phosphorus (mg/L)[J]	7		0.004	0.014	0.007	0.008	0.004
	Total Phosphorus (mg/L)	7		0.021	0.037	0.029	0.029	0.006
	CBOD-5 (mg/L)	7	<	2.0	2.0	1.0	1.0	0.0
	Chlorides (mg/L)	7		3.2	9.5	7.2	6.7	2.3
	Biological							
	Chlorophyll a (mg/m^3)	7	<	1.00	35.20	7.48	12.65	15.50
	E. coli (MPN/DL)	3		3	12	4	6	5

J=one or more of the values provided are estimated; < = Actual value is less than the detection limit