Final

Total Maximum Daily Load (TMDL)
for
Tallapoosa River
Waterbody ID # AL/03150108-0504-103
Low Dissolved Oxygen/Organic Loading

(2nd Edition)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
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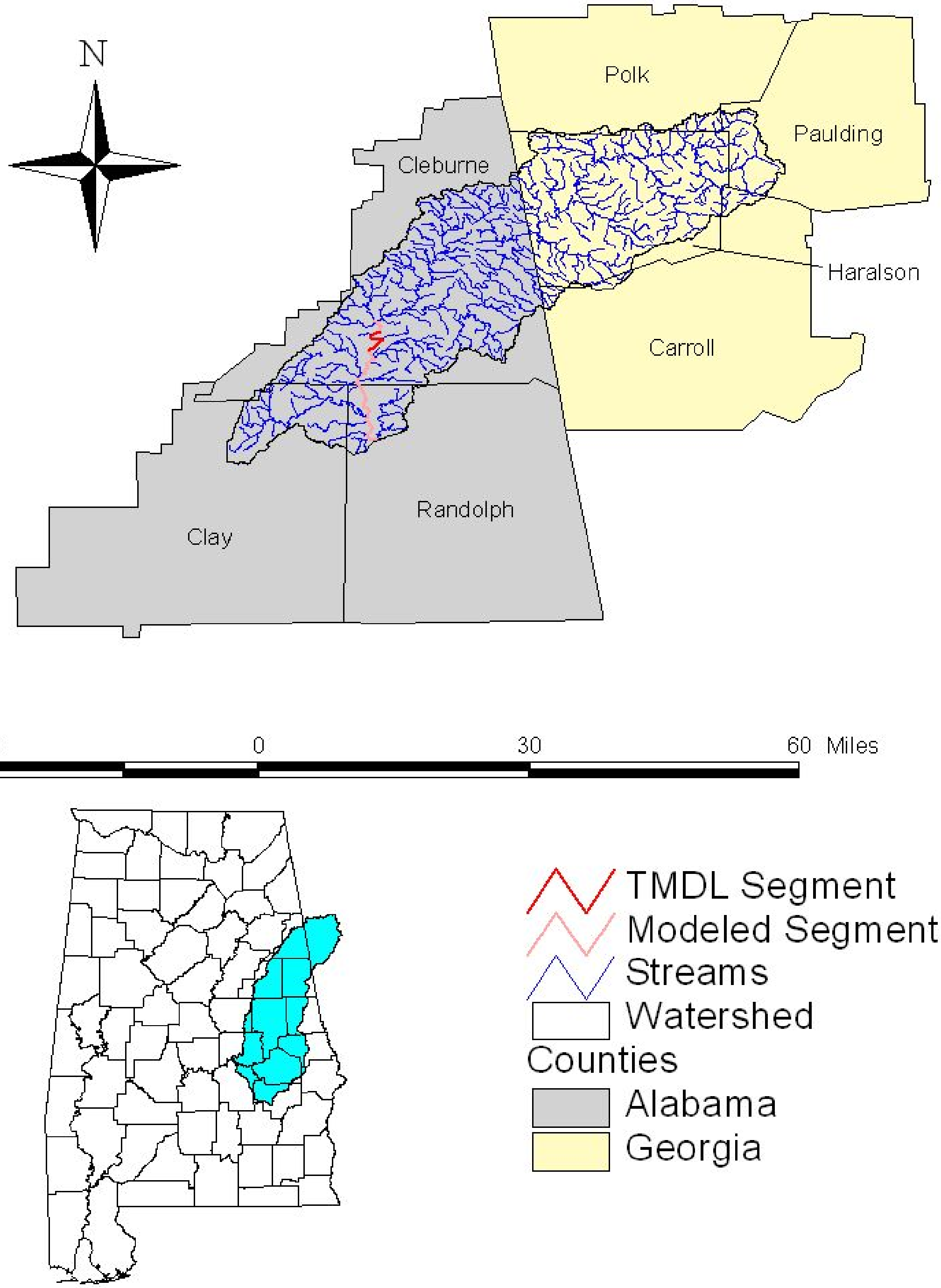
Tallapoosa River Basin



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1.0 Executive Summary

This report summarizes the organic enrichment/low dissolved oxygen (OE/DO) Total Maximum Daily Load (TMDL) which was developed for the impaired segment of the Tallapoosa River which was originally listed on the State of Alabama's 1996 Section 303(d) List(s) of Impaired Waterbodies. The organic enrichment/low dissolved oxygen (OE/DO) TMDL for the listed segment of the Tallapoosa River was previously developed by ADEM in October 2001 and subsequently approved by Environmental Protection Agency's (EPA) Region 4 in October 2002. Since that time, ADEM has received new data and information that warranted the originally approved 2001 OE/DO TMDL to be revised in order to reflect the new data and information that was received. The primary information received that warranted the TMDL to be revised, was an agreement reached between the owners/operators of the Howle and Turner Dam and owners/operators of the Heflin WWTP and Tyson Poultry facilities which, when put into effect, changed the instream flow conditions within the listed segment of the Tallapoosa River. By agreement, Howle and Turner Dam gates are to remain continuously open, resulting in greater flows/velocities within the river and effectively allowing both the Heflin WWTP and Tyson Poultry facilities to operate under NPDES permit limits that are less stringent than the previously proposed limits set fourth in the 2001 OE/DO TMDL. These limits, while less stringent, are considered both realistic and achievable, and will effectively result in the desired minimum instream dissolved oxygen (DO) criterion of 5 mg/l for the listed segment of the of the Tallapoosa River to be attained.

The impaired or listed segment of the Tallapoosa River is located entirely within Cleburne County near Heflin, Alabama, and extends from County Road 19 to County Road 36. The Tallapoosa River has a Fish & Wildlife (F&W) stream use classification and has remained on the State of Alabama's §303(d) use impairment list since 1996 due to OE/DO impairment.

Water quality data collected in 1992 identified dissolved oxygen violations within the impaired listed segment of the Tallapoosa River. Stream flows conditions observed during the DO violations were typically at, or below, the $7Q_{10}$ (the minimum 7-day average flow that occurs once in 10 years on average) level. In that DO violations occurred during summer months when flows were significantly lower and temperatures were considerably higher, a steady state modeling approach was selected for TMDL development.

The following report summarizes the results of the revised OE/DO TMDL developed for the impaired segment of the Tallapoosa River which is currently in Category 4a. In accordance with ADEM water quality standards, a minimum instream DO concentration of 5.0 mg/l is required for streams classified as Fish and Wildlife. For purposes of this TMDL, a minimum DO level of 5.0 mg/l will be sought during implementation. The Margin of Safety (MOS) chosen for development of the Tallapoosa River TMDL is implicit in that conservative model input conditions were selected and used. Conservative conditions are characterized by higher temperatures, lower flows, and lower

DO concentrations which are considered the most representative of worse case or critical conditions.

A summary of TMDL results for the listed segment of the Tallapoosa River is provided in Table 1-1 through 1-4 below. Ultimate Carbonaceous Biochemical Oxygen Demand ($CBOD_u$) and Nitrogenous Biochemical Oxygen Demand (NBOD) are recognized as principle causes of low dissolved oxygen concentrations. $CBOD_u$ represents the total oxygen demand required to degrade carbonaceous organic matter. NBOD represents the amount of oxygen or potential oxygen demand utilized by bacteria in converting ammonia to nitrate.

Table 1-1: TMDL by Source – Summer (May-November) – Dam Open

Pollutant	Point Source Loads (WLA) (lbs./day)	Non-point Source Loads (LA) (lbs./day)
$CBOD_u$	1100.9	917.4
NBOD	971.9	180.1
Total	2072.8	1097.5

Table 1-2: TMDL by Source – Winter (December-April) - Dam Open

Pollutant	Point Source Loads (WLA) (lbs./day)	Non-point Source Loads (LA) (lbs./day)
$CBOD_u$	1376.1	4282.6
NBOD	2058.1	3702.1
Total	3434.2	7984.7

Table 1-3: TMDL by Source – Summer (May-November) – Dam Closed

Pollutant	Point Source Loads (WLA) (lbs./day)	Non-point Source Loads (LA) (lbs./day)
$CBOD_u$	229.0	673.6
NBOD	98.1	186.2
Total	327.1	859.8

Table 1-4: TMDL by Source – Winter (December-April) - Dam Closed

Pollutant	Point Source Loads (WLA) (lbs./day)	Non-point Source Loads (LA) (lbs./day)
$CBOD_u$	1,517.0	4,431.1
NBOD	1,182.2	3,694.1
Total	2,699.2	8,125.2

2.0 Basis for §303(d) Listing

2.1 Introduction

Section 303(d) of the Clean Water Act (CWA) as amended by the Water Quality Act of 1987 and EPA's Water Quality Planning and Management Regulations [(Title 40 of the Code of Federal Regulations (CFR), Part 130)] require states to identify waterbodies which are not meeting water quality standards applicable to their designated use classifications. The identified waters are prioritized based on severity of pollution with respect to designated use classifications. Total maximum daily loads (TMDLs) for all pollutants causing violation of applicable water quality standards are established for each identified water. Such loads are established at levels necessary to achieve the applicable water quality standards taking into account seasonal variations and margins of safety. The TMDL process establishes the allowable loading of pollutants, or other quantifiable parameters for a waterbody, based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and non-point sources and restore and maintain the quality of their water resources (USEPA, 1991).

The Tallapoosa River was originally identified by the State of Alabama as impaired due to organic loading (i.e., CBODu and NBOD), for a length of 4.3 miles, within the 1996 §303(d) list(s) of impaired waters and remained on the 1998 and 2000 lists. In 2001 ADEM developed and EPA approved an OE/DO TMDL for the Tallapoosa River. In 2002 the waterbody was removed from the list and placed in category 4a due to the OE/DO TMDL being Developed and approved. As of July 2006 the waterbody remains in category 4a. This TMDL report was prepared to address the revisions which have been made since the original TMDL was developed.

The TMDL developed for Tallapoosa River illustrates the steps that can be taken to address a waterbody impaired by low dissolved oxygen levels. The TMDL is consistent with a phased-approach: estimates are made of needed pollutant reductions, load reduction controls are implemented, and water quality is monitored for plan effectiveness. Flexibility is built into the plan so that load reduction targets and control actions can be reviewed if monitoring indicates continuing water quality problems.

2.2 Problem Definition

The headwater drainage area of the impaired or listed studied reach of the Tallapoosa River is estimated at approximately 526 square miles. Dry weather incremental flows to the studied reach are therefore considered relatively insignificant. Water quality data collected for the reach during 1993 and 1999, confirm that low instream DO concentrations occur primarily during summer months (May through November). Water quality data collected in August and September 1993 at Sampling Station TALL-4 (also designated as Point F) revealed a 25.0% DO violation rate. Subsequent sampling at the same monitoring station revealed a 55.6 % DO violation rate on September 15, 1999, as well as, a 100% DO violation rate on September 16, 1999. Sampling conducted at Sampling Station TALL-3 on September 15, 1999, also revealed a 37.5 % DO violation or non-compliance rate.

Low in-stream DO concentrations typically result from the decay of oxygen demanding waste derived from point and non-point sources, algal respiration, and/or sediment oxygen demand.

While the previous 2001 OE/DO TMDL for the Tallapoosa River did address the above concerns and was ultimately approved by EPA Region IV, a subsequent agreement reached between owners/operators of the Howle and Turner Dam and owners/operators of the Heflin WWTP and Tyson Poultry facilities required a revised and updated assessment of the listed segment that would both address and incorporate proposed changes in stream flow conditions. By agreement, Howle and Turner Dam gates are to remain continuously open, resulting in significantly greater stream flows and effectively allowing both the Heflin WWTP and Tyson Poultry facilities to operate under NPDES permitted effluent parameter limits that are considerably less stringent than the previously proposed limits set fourth in the 2001 OE/DO TMDL. These limits, while less stringent, are considered both realistic and achievable, and will effectively result in the desired minimum instream DO criterion of 5 mg/l for the listed segment of the Tallapoosa River to be attained.

<u>Waterbody Impaired:</u>	Tallapoosa River – from Dam at Cleburne Co Rd 36 to Cleburne Co. Rd. 19.
<u>Water Quality Criteria Violation:</u>	Dissolved Oxygen
<u>Pollutant of Concern:</u>	Organic Enrichment ($CBOD_u$/NBOD)
<u>Water Use Classification:</u>	Fish and Wildlife

The impaired stream segment, Tallapoosa River, is classified as Fish and Wildlife. Usage of waters in this classification is described in ADEM Admin. Code R. 335-6-10-.09(5)(a), (b), (c), and (d).

(a) Best usage of waters:

Fishing, propagation of fish, aquatic life, and wildlife, and any other usage except for swimming and water-contact sports or as a source of water supply for drinking or food processing purposes.

(b) Conditions related to best usage:

The waters will be suitable for fish, aquatic life and wildlife propagation. The quality of salt and estuarine waters to which this classification is assigned will also be suitable for the propagation of shrimp and crabs.

(c) Other usage of waters:

It is recognized that the waters may be used for incidental water contact and recreation during June through September, except that water contact is strongly discouraged in the vicinity of discharges or other conditions beyond the control of the Department or the Alabama Department of Public Health.

(d) Conditions related to other usage:

The waters, under proper sanitary supervision by the controlling health authorities, will meet accepted standards of water quality for outdoor swimming places and will be considered satisfactory for swimming and other whole body water-contact sports.

<u>Applicable Dissolved Oxygen Criteria:</u>

Alabama's water quality standards (ADEM Admin. Code R. 335-6-10-.09-(5)(e)(4.)) state that for a diversified warm water biota, including game fish, daily dissolved oxygen concentrations shall not be less than 5 mg/l at all times; except under extreme conditions due to natural causes, it may range between 5 mg/l and 4 mg/l, provided that the water quality is favorable in all other parameters. The normal seasonal and daily fluctuations shall be maintained above these levels. In no event shall the dissolved oxygen level be less than 4 mg/l due to discharges from existing hydroelectricgeneration impoundments. All new hydroelectric generation impoundments, including addition of new hydroelectric generation units to existing impoundments, shall be designed so that the discharge will contain at least 5 mg/l dissolved oxygen where practicable and technologically possible. The Environmental Protection Agency, in cooperation with the State of Alabama and parties responsible for impoundments, shall develop a program to improve the design of existing facilities.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

The minimum allowable dissolved oxygen concentration in a stream classified as Fish and Wildlife is 5.0 mg/l. For the purpose of this TMDL, a minimum dissolved oxygen level of 5.0 mg/l will be implemented allowing for an implicit margin of safety resulting from conservative assumptions used in the dissolved oxygen model. The target $CBOD_u$ and NBOD concentrations are concentrations that, in concert with the nitrification of ammonia, will not deplete the dissolved oxygen concentration below this level as a result of the decaying process.

3.2 Source Assessment

3.2.1. General Sources of $CBOD_u$ and NBOD

Both point and non-point sources may contribute $CBOD_u$ and NBOD (i.e., organic loading) to a given waterbody. Potential sources of organic loading are numerous and often occur in combination. In rural areas, storm runoff from row crops, livestock pastures, animal waste application sites, and feedlots can transport significant loads of organic loading. Nationwide, poorly treated municipal sewage comprises a major source of organic compounds that are hydrolyzed to create additional organic loading. Urban storm water runoff, sanitary sewer overflows, and combined sewer overflows can be significant sources of organic loading.

All potential sources of organic loading in the watershed were identified based on an evaluation of current land use/cover information on watershed activities (e.g., agricultural management activities). The source assessment was used as the basis of development of the model and ultimate analysis of the TMDL allocations. The organic loading within the watershed included both point and non-point sources.

3.2.2. Point Sources in the Tallapoosa River Watershed

ADEM maintains a current database of existing NPDES permitted facilities and GIS location coordinates for each permitted facility. This database incorporates all municipal, semi-public/private, and industrial, industrial storm water discharges, mining operations, and concentrated animal feeding operations (CAFOs). Table 3-1 lists the NPDES permitted wastewater treatment facilities which were identified as significant point source contributors that discharge directly to or upstream of the impaired segment. Tables 3-2, 3-3, and 3-4 provide a summary of Summer and Winter effluent parameter limits for both facilities. Limits in effect prior to 2001 TMDL development, limits proposed as a result of the 2001 TMDL, and limits proposed as a result of the this TMDL are all presented.

Table 3-1. Contributing Point Sources in the Tallapoosa River Watershed.

NPDES Permit	Type of Facility (e.g., CAFO, Industrial, Municipal, Semi-Public/Private, Mining, Industrial Storm Water)	Facility Name	Significant Contributor (Yes/No) [% $7Q_{10}$]
AL0056146	Municipal	Heflin WWTP	YES [2.1%]
AL0002810	Industrial	Tyson Poultry	YES [3.4%]

Note: Storm water discharges, if listed in the above table, were marked as not being significant contributors since the discharge cannot cause nor contribute to a water quality violation. These discharges also would not occur during low flow conditions. However, storm water contributions are taken into account indirectly through SOD component. Construction storm water discharges are not listed as these discharges do not occur during low flow and generally do not contribute directly to the organic loading.

Table 3-2. Pre-2001 TMDL : Existing NPDES Permit Limits for Point Sources

NPDES Permit	Facility Name	Permit Limitations - Summer						Permit Limitations - Winter					
		Qw (MGD)	$CBOD_5$ (MG/L)		NH_3-N (MG/L)		DO (MG/L)	Qw (MGD)	$CBOD_5$ (MG/L)		NH_3-N (MG/L)		DO (MG/L)
		Max	Max	Avg	Max	Avg	Min	Max	Max	Avg	Max	Avg	Min
AL0056146	Heflin WWTP	0.6	N/A	30	N/A	20*	2*	0.6	N/A	45	N/A	20*	2*
AL0002810	Tyson Poultry	1	N/A	29	N/A	2.44	1	1	N/A	29	N/A	2.44	1

Notes: n/a = not applicable
* = the numbers were assumed for modeling purposes

Table 3-3. Final 2001 TMDL : Proposed NPDES Permit Limits for Point Sources

NPDES Permit	Facility Name	Permit Limitations - Summer						Permit Limitations - Winter					
		Qw (MGD)	$CBOD_5$ (MG/L)		NH_3-N (MG/L)		DO (MG/L)	Qw (MGD)	$CBOD_5$ (MG/L)		NH_3-N (MG/L)		DO (MG/L)
		Max	Max	Avg	Max	Avg	Min	Max	Max	Avg	Max	Avg	Min
AL0056146	Heflin WWTP	0.6	N/A	4	N/A	1	6	0.6	N/A	25	N/A	10	6
AL0002810	Tyson Poultry	1	N/A	4	N/A	0.5	6.5	1	N/A	25	N/A	10	6
AL0056146*	Heflin WWTP	0.6	N/A	10	N/A	1	5	0.6	N/A	25	N/A	20	5
AL0002810*	Tyson Poultry	1	N/A	25	N/A	20	5	1	N/A	25	N/A	20	5

Notes: n/a = not applicable
* = alternative method (i.e. Tyson Poultry outfall relocated to below the dam.)

Table 3-4. Draft 2006 TMDL : Proposed NPDES Permit Limits for Point Sources

NPDES Permit	Facility Name	Permit Limitations - Summer						Permit Limitations - Winter					
		Qw (MGD)	$CBOD_5$ (MG/L)		NH_3-N (MG/L)		DO (MG/L)	Qw (MGD)	$CBOD_5$ (MG/L)		NH_3-N (MG/L)		DO (MG/L)
		Max	Max	Avg	Max	Avg	Min	Max	Max	Avg	Max	Avg	Min
AL0056146*	Heflin WWTP	0.6	N/A	20	N/A	15	0	0.6	N/A	25	N/A	20	0
AL0002810*	Tyson Poultry	0.75	N/A	20	N/A	5	1	0.75	N/A	25	N/A	20	1
AL0056146**	Heflin WWTP	0.6	N/A	4	N/A	1	6	0.6	N/A	25	N/A	10	6
AL0002810**	Tyson Poultry	0.75	N/A	4	N/A	0.5	6.5	0.75	N/A	25	N/A	10	6

Notes: n/a = not applicable
* = Howle and Turner Dam Open
** = Howle and Turner Dam Closed

3.2.3. Non-Point Sources in the Tallapoosa River Watershed

A detailed summary of land use characterization for the Tallapoosa River watershed is summarized in Table 3-5, on the following page, along with a land use map of the watershed presented in Figure 3-1. Land use activities were derived from the 2001 Multi-Resolution Land Characterization (MRLC) Consortium's 2001 National Land Cover Dataset (NLCD). The Tallapoosa River watershed is represented by three different subdivisions of the overall watershed: the portion of the watershed in Georgia;

the upper section of the watershed within Alabama which included the 303(d) listed impaired segment of the Tallapoosa River and which was used in establishing head water conditions for TMDL model development; and the lower section of the Tallapoosa River watershed in Alabama which was utilized in developing parameter concentrations and pollutant loadings for the downstream segments of the model. Land use characterization for the portion of Tallapoosa River watershed within Georgia is provided for informational purposes only and was not used in either TMDL development or as a source from which potentially needed reductions in pollutant loadings would be sought. Predominant land uses for the portion of the watershed in Georgia consisted of forest, pasture/hay, row crops, other and water, with corresponding percentages of 74.61%, 17.00%, 7.86%, and 0.52% respectively. Primary land uses for the upper section of the watershed within Alabama likewise consisted of forest, pasture/hay, row crops, other and water but with corresponding percentages of 83.03%, 10.17%, 0.06%, and 0.32% respectively. Principal land uses for the lower portion of watershed in Alabama again consisted of forest, pasture/hay, row crops, other and water, with corresponding percentages of 83.61%, 9.73%, 0.02%, and 1.88% respectively.

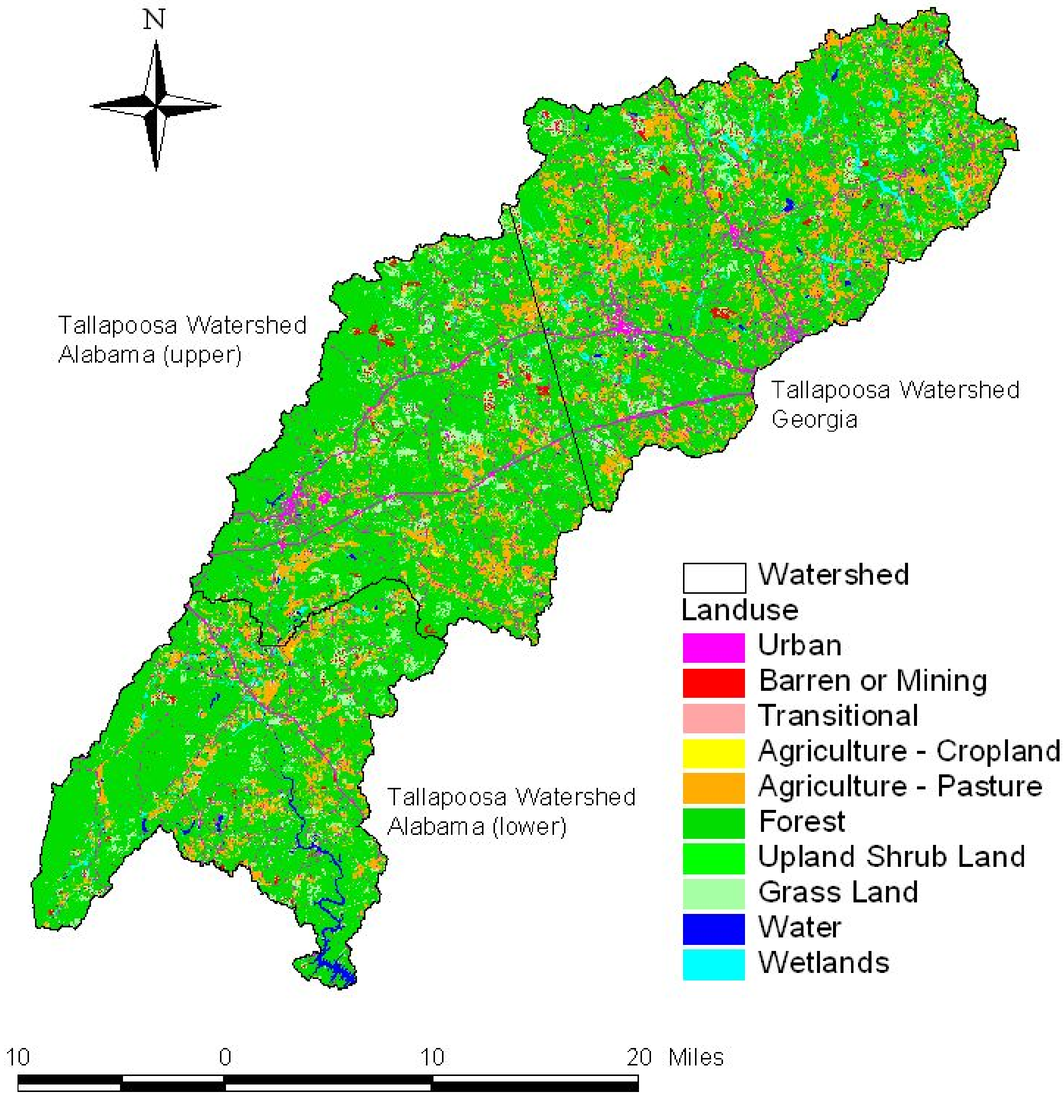
Table 3-5. Land Use in the Tallapoosa River Watershed.

LAND USE	UPPER	LOWER	GEORGIA	TOTAL
Urban	3.91%	5.32%	6.83%	5.58%
Barren Land	0.85%	1.10%	1.03%	1.00%
Crop	0.02%	0.06%	0.00%	0.02%
Pasture/Hay	9.73%	10.17%	17.00%	12.92%
Forest	73.38%	71.33%	61.85%	67.90%
Shrub/Scrub	1.97%	3.04%	3.13%	2.79%
Grassland	7.12%	7.71%	7.04%	7.27%
Water	1.88%	0.32%	0.52%	0.82%
Wetlands	1.14%	0.96%	2.59%	1.69%
Total	100.00%	100.00%	100.00%	100.00%

For the purpose of this TMDL, the predominant land uses of Tallapoosa River are forest, pasture/hay, row crops and urban are assumed to make up 100% of the watershed. Each land use has the potential to contribute to the organic loading in the watershed due to organic material on the land surface that potentially can be washed off into the receiving waters of the watershed. Information on agricultural and management activities and watershed characteristics were obtained through coordination with the ADEM Mining and Non-Point Section, the Alabama Cooperative Extension System, and the USDA-Natural Resources Conservation Service (NRCS).

The major sources of organic enrichment from non-point sources within the Tallapoosa River watershed are forest, pasture/hay, row crops and urban land uses. Compared to other land uses organic enrichment from forested land is normally considered to be small. This is because forested land tends to serve as a filter of pollutant originating within its drainage areas. However, organic loading can originate from forested areas due to the presence of wild animals such as deer, raccoons, turkeys, waterfowl, etc. Control of these sources is usually limited to land management best management practices (BMPs) and may be impracticable in most cases. In contrast to forested land, agricultural land can be a major source of organic loading. Runoff from pastures, animal operations, improper land application of animal wastes, and animals with access to streams are all mechanisms that can introduce organic loading to waterbodies.

Figure 3-1. Land Use Map for the Tallapoosa River Watershed. (2001 NLCD, USGS)



3.3 Loading Capacity – Linking Numeric Water Quality Targets and Pollutant Sources

EPA regulations define loading, or assimilative capacity, as the greatest amount of loading that a waterbody can receive without violating water quality standards (40 CFR Part 130.2(f)).

Alabama's water quality standards (ADEM Admin. Code R. 335-6-10-.09-(5)(e)(4.)) state that for a diversified warm water biota, including game fish, daily dissolved oxygen concentrations shall not be less than 5 mg/l at all times; except under extreme conditions due to natural causes, it may range between 5 mg/l and 4 mg/l, provided that the water quality is favorable in all other parameters. The normal seasonal and daily fluctuations shall be maintained above these levels.

Using the D.O. water quality criterion of 5.0 mg/l as the numerical target, a TMDL model analysis was performed at critical conditions (i.e., summer) to determine the loading capacity for the watershed. This was accomplished through a series of simulations aimed at meeting the dissolved oxygen target limit by varying source contributions. The final acceptable simulation represented the TMDL (and loading capacity of the waterbody). If point sources were identified in the watershed, an additional model analysis was performed for the winter to determine the loading capacity during higher flow conditions.

In the TMDL model analysis, the pollutant concentrations from forestland were assumed to be at normal background concentrations. Specific values for background pollutant concentrations are as follows: 2 mg/l $CBOD_u$, 0.11 mg/l ammonia as nitrogen (NH_3N), and 0.22 mg/l total organic nitrogen (TON). Pollutant concentrations for the other land uses in the watershed were assigned in proportion to measured concentrations and were set in the TMDL model at levels necessary to maintain dissolved oxygen concentrations greater than, or equal to, 5 mg/l. The model predictions for instream pollutant concentrations were then compared to actual field data. The model velocities and reaeration coefficients were adjusted in those cases where the field data indicated significant discrepancies from the model predictions.

3.4 Data Availability and Analysis

3.4.1. <u>Watershed Characteristics</u>

A. <u>General Description:</u> The Tallapoosa River, located in Cleburne County, is a tributary to the Alabama River. The Tallapoosa River is a part of the Tallapoosa River basin. Tallapoosa River is a part of the USGS (United States Geological Survey) 03150108 cataloging unit and the NRCS (Natural Resources Conservation Service) 110 sub-watershed. Cataloging unit 03150108 includes the Tallapoosa River basin. NRCS sub-watershed number 110 represents the Upper Tallapoosa River watershed.

The impaired portion of the Tallapoosa River begins approximately 2 miles south of Heflin, Alabama in section 28 T16S, R10E and existents to County Road 36 section

17 T17S, R10E. It has a length of 4.3 miles and a total drainage area of 591.3 square miles. Tallapoosa River has a use classification of Fish & Wildlife (F&W).

Geological Description: The physiographic setting of Southern Cleburne and northern Randolph Counties is the Northern Piedmont Upland district of the Piedmont Province. The province is characterized by a well dissected upland developed on metamorphosed sedimentary and igneous rocks. Land surface within this district ranges from about 1,100 feet above sea level in north Cleburne County to about 500 feet above sea level near Mitchell Lake on the Coosa River.

The geologic environment of southern Cleburne and northwestern Randolph Counties consists of igneous and metamorphic rocks of Precambrian to late Paleozoic age with Quaternary alluvial deposits along the Tallapoosa River. Several major faults and lines of metamorphic discontinuity that cut the metamorphic units are present with the Hollins line fault and the Enitachopca line crossing through southern Cleburne County and northern Randolph County respectively. These faults are interpreted as major structural discontinuities resulting from the movement of one grade of metamorphic rock over another. They are indicative of the major tectonic forces that have influenced the geologic materials in the area. In addition to these major faults/discontinuities, the area shows evidence of more localized smaller scale faulting and fracturing as displayed in straight stream segments and near right angle bends in the Tallapoosa River and other streams

The igneous and metamorphic rocks that occur within the drainage basin are made up of the Hephlin Phyllite, Lay Dam Formation, Jemison Chert, Hillabee Greenstone Ketchepedrakee Amphibolite, Poe Bridge Mountain Group and the Mad Indian Group. These formations are made up of phyllites, amphibolite, schists, gneiss and other metamorphic rocks. As these materials weather, they form a saprolite, which is decomposed untransported material that has weathered from the bedrock and retains some of the characteristics of the original material. The saprolite, which may be nonexistent or as much as 100 feet thick, acts to absorb rainfall and runoff. However, since the saprolite is generally shallow and interconnected fractures within these formations are generally not significant, groundwater within the saprolite is expected to follow topographic features and discharge locally to surface water.

C. Eco-region Description: The Tallapoosa River consists of the Southern Inner Piedmont of Alabama which is mostly higher in elevation with more relief than 45b, but has less elevation and relief and has different rocks and soils than 45d. Covering most of the Ashland Plateau, the rolling to hilly region is a moderately to well dissected upland with schist, gneiss, and granite bedrock. Madison soils are typical over the more micaceous saprolite and rocks, and these soils are more common in 45a than in 45b. This ecoregion is drained mostly by the Tallapoosa River, and in the west, by tributaries to the lower Coosa River. The region is mostly forested, with major forest types of oak-pine and oak-hickory. Native pines include loblolly, short leaf, and some longleaf. Open areas are mostly in pasture, although there are some small areas of cropland. Hay, cattle, and poultry are the main agricultural products.

The northern boundary generally coincides with the beginning of the Lay Dam geologic formation of 45d in the east, and the Ridge and Valley boundary (67) to the west. The southwest boundary is the Fall Line transition zone to the Coastal Plain of ecoregion 65. The southeastern boundary with 45b is similar to the southern boundary of the Northern Piedmont Upland physiographic region (Sapp and Emplaincourt 1975), and to the Opelika Plateau forest habitat region northern boundary (Hodgkins et al. 1976).

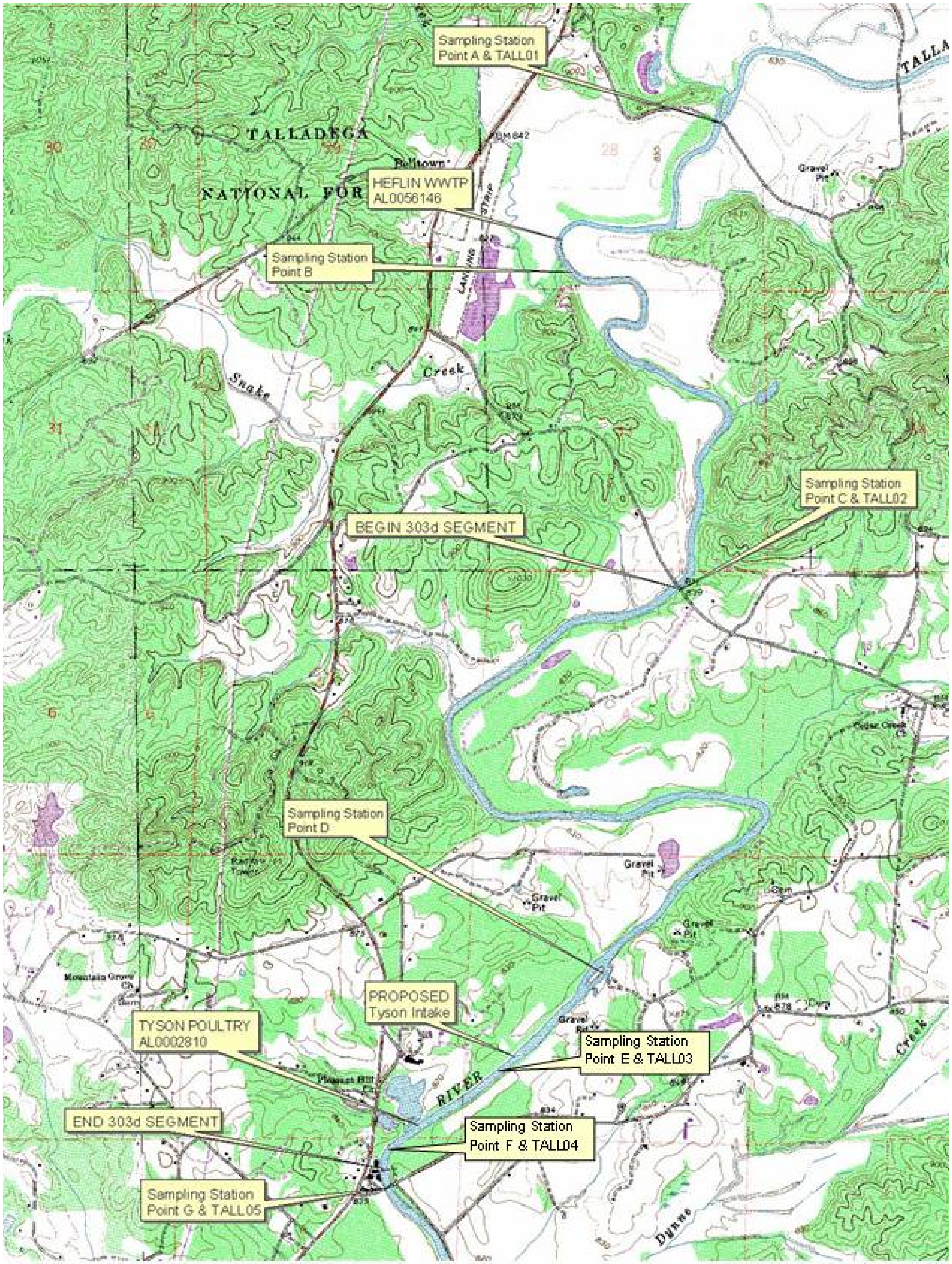
D. Other Notable Characteristics: The Howle and Turner Dam is located at the beginning of segment 7 in the modeled reach at river mile 1.1. Howle and Turner Dam has a height of approximately 8 feet.

3.4.2 Available Water Quality and Biological Data

Water Quality and biological data for the Tallapoosa River is available for the period of 1992 through 2000. The data was collected by the Alabama Department of Environmental Management. A complete listing of the available data can be found in the Appendix B of this report.

A map indicating the location of sampling points relative to applicable point source discharges is presented in Figure 3-2.

Figure 3-2. Map of Sampling Locations for the Tallapoosa River Watershed.



3.4.3. <u>Flow data</u>

For the purpose of this TMDL, annual $7Q_{10}$ stream flows for the summer season and annual $7Q_2$ stream flows for the winter season are employed. These flows represent worst-case scenarios for seasonal model evaluations. The use of worst-case conditions, in turn, creates a margin of safety in the final results.

The $7Q_{10}$ flow represents the minimum 7-day flow that occurs, on average, over a 10-year recurrence interval. Likewise, the $7Q_2$ is the minimum 7-day flow that occurs, on average, over a 2-year period.

Both flows (i.e., $7Q_{10}$ and $7Q_2$) can be calculated for the model using gage data from the United States Geological Survey (USGS) or by using the Bingham Equation. The USGS continuous-record station (02412000) on the Tallapoosa River near Heflin, Alabama can be found on page 64 of a publication from the USGS entitled, Low-Flow and Flow-Duration Characteristics of Alabama Streams, Report 93-4186. The Bingham Equation can be found on page 3 of a publication from the Geological Survey of Alabama entitled, Low-Flow Characteristics of Alabama Streams, Bulletin 117.

The equations used to calculate the $7Q_{10}$ and $7Q_2$ flows based on continuous USGS gaging records for the stream and any associated tributaries are as follows:

Low flow at Heflin WWTP (Beginning of Model)

$$7Q_{10}\,(\text{cfs}) = \frac{(7Q_{10}\ @\ \text{USGS Station (cfs)})}{(\text{Drainage Area @ USGS Station (mi}^2))} * (\text{Watershed Drainage Area (mi}^2))$$

$$7Q_{10} = \frac{(38)}{(448)} * (526)$$

$$7Q_{10} = 44.6\ \text{cfs}$$

$$7Q_2\,(\text{cfs}) = \frac{(7Q_2\ @\ \text{USGS Station (cfs)})}{(\text{Drainage Area @ USGS Station (mi}^2))} * (\text{Watershed Drainage Area (mi}^2))$$

$$7Q_{10} = \frac{(96)}{(448)} * (526)$$

$$7Q_{10} = 112.7\ \text{cfs}$$

The calculated flows were distributed over the Tallapoosa River in the form of tributary flow or incremental inflow (identified on the modeled reach schematic as IF). The IF was distributed in proportion to the length of each segment. The $7Q_{10}$ and $7Q_2$ flows for the tributaries can be found in Figure 4-1.

3.5 Critical Conditions

Summer months (May – November) are generally considered critical conditions for dissolved oxygen in streams. This can be explained by the nature of storm events in the summer versus the winter. Periods of low precipitation allow for slower in-stream velocity, which increases the organic loading residence time and decreases stream re-aeration rates. This increased time permits more decay to occur which depletes the stream's dissolved oxygen supply. Reaction rates for $CBOD_u$ and NBOD (i.e., organic loading) are temperature dependent and high summertime temperatures increase the decay process, which depletes the dissolved oxygen even further.

In winter, frequent low intensity rain events are more typical and do not allow for the build-up of organic loading on the land surface, resulting in a more uniform loading rate. Higher flows and lower temperatures create less residence time and lower decay rates..

3.6 Margin of Safety (MOS)

There are two basic methods of incorporating the MOS (USEPA, 1991): 1) implicitly, using conservative model assumptions, or 2) explicitly, specifying a portion of the TMDL as the MOS.

The MOS is implicit in this TMDL process through the use of conservative model input parameters (**temperature, flow and D.O. concentrations**). Conservative temperature values are employed through the use of the highest average maximum temperature that would normally occur under critical stream flow conditions. The $7Q_{10}$ stream flow employed for summer, reflects the lowest flows that would normally occur under critical conditions. Finally, the D.O. concentration for incremental flow was set at 70% of the saturation concentration at the given temperature, which is 15% lower than the 85% normally assumed in a typical waste load allocation.

3.7 Seasonal Variation

The regulations require that a TMDL be established with consideration of seasonal variations. Since impairments occurred only during the summer months and not during other times of the year, a seasonal variation in the TMDL was not necessary.

4.0 Water Quality Model Development

4.1 Water Quality Model Selection and Setup

Since the impairment noted by the available data occurred during periods of low flow, a steady-state modeling approach was adopted as appropriate to represent the relevant conditions in the impaired waterbody. The steady state surface water quality model (SWQM) developed by ADEM was selected to develop to OE/DO TMDL for the following reasons:

- It is a simplified approach without unnecessary complexity.
- It conforms to ADEM standard practices for developing wasteload allocations.
- It lends itself to being developed with limited data, which is the present situation for this waterbody.
- It has the ability to handle tributary inputs and both point and non-point source inputs.

The SWQM model also provides a complete spatial view of a stream, upstream to downstream, giving differences in stream behavior at various locations along the modeled reach. The model computes dissolved oxygen using a modified form of the Streeter-Phelps equation. The modified Streeter-Phelps equation takes into account the oxygen demand due to carbonaceous decay plus the oxygen demand generated from the nitrification process (ammonia decay). Each stream reach is divided into twenty elements, with each element assumed to be the functional equivalent of a completely mixed reactor.

The following assumptions were used in the TMDL models:

- D.O. concentrations for incremental flow were assumed @ 70% of the saturated value at the given temperature. **(MOS)**
- Incremental and tributary loading were apportioned to correlate with the land usage of the drainage basin.
- Ratios for $CBOD_u/NH_3OD_u$ and $CBOD_u/TONOD_u$ were calculated using water quality data for the waterbody or estimated during the calibration process. These ratios were assigned in the estimation of loading parameters for incremental flow and tributaries for all land uses, except forest and open water.
- $CBOD_U/CBOD_5$ ratio used for nonpoint sources was 1.5.
- NH_3OD_u is equal to 4.57 times the ammonia nitrogen concentration.
- $TONOD_u$ is equal to 4.57 times the organic nitrogen concentration.
- Background conditions were assumed for forest incremental flow.
  Background conditions are typically the following ranges: 2-3 mg/l $CBOD_u$, 0.2-1 mg/l NH_3ODu, 1-2 mg/l $TONOD_u$.

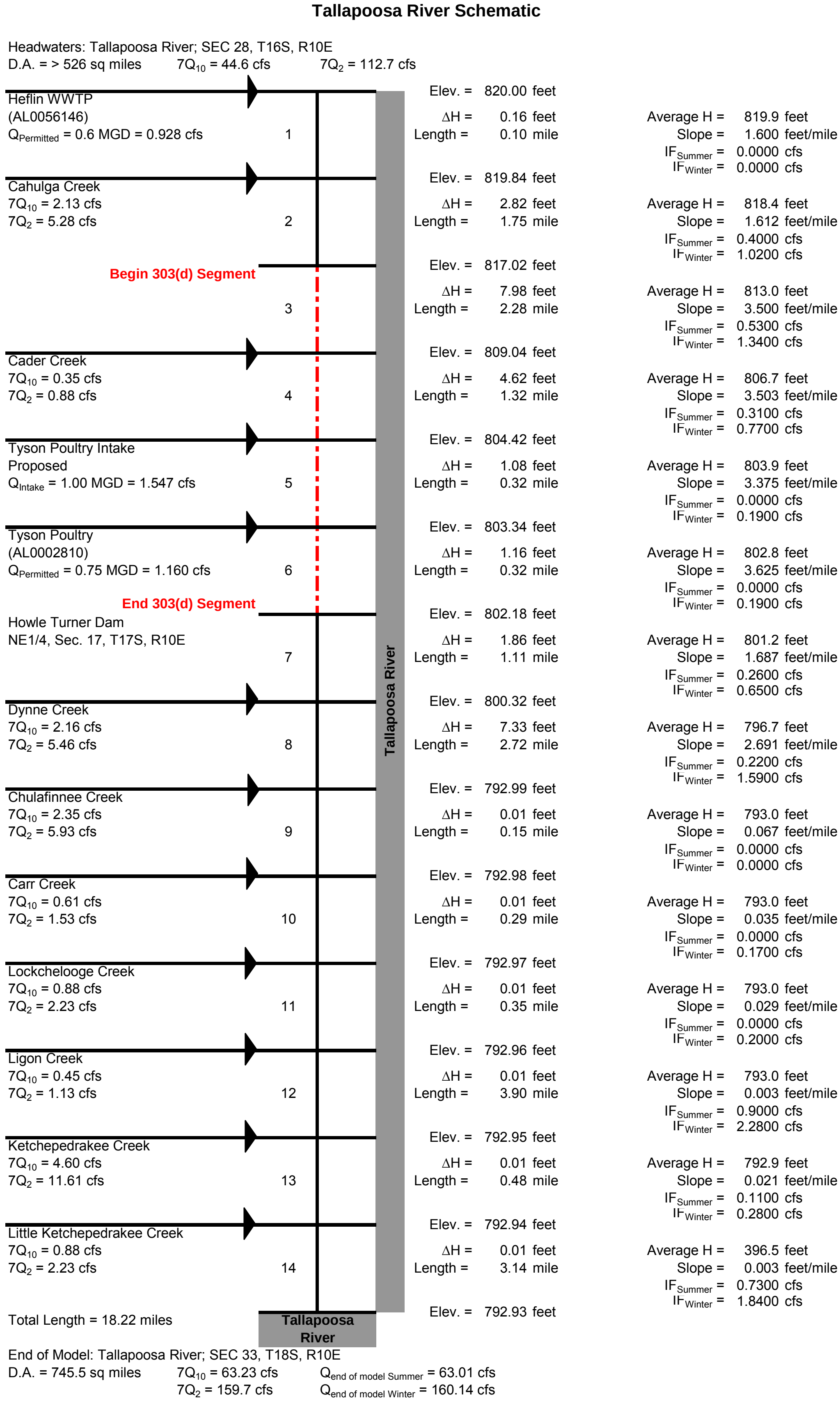
4.1.1. <u>SOD Representation</u>: Sediment oxygen demand (SOD) can be an important part of the oxygen demand budget in shallow streams. However, for shallow streams with steep slopes and rocky substrate, the SOD component is generally small. These hydrogeological conditions are representative of the Tallapoosa River. Therefore, it is believed, that the SOD for this stream is minimal. In the absence of available field SOD measurements for the waterbody, SOD data was obtained from EPA Region IV's SOD database. The EPA SOD database represents mixed land uses and varying degrees of point source activity. Various SOD values ranging from 0.025 to 0.055 gm-O2/ft2/day were applied to the Tallapoosa River model. The numbers were determined from the EPA SOD database for a stream with a sand and gravel bottom, which is similar to the characteristics in the Tallapoosa River.

4.1.2. <u>Calibration Data:</u> The model calibration period was determined from an examination of the available field data (ref: Appendix) during the period of September 16, 1999. The combination of the lowest, steady flow period with the lowest dissolved oxygen defined the critical modeling period. The stream conditions (i.e., D.O., temperature) during this period were incorporated into the calibrated model TMDL spreadsheet.

4.2 Water Quality Model Summary

The model reach used for each season was longer than the impaired segment length. The summer model reach consisted of 14 segments. The impaired portion of the summer model reach consists of segments 3, 4, 5, and 6. The length of the impaired portion is 4.3 miles. Total distance of the summer model reach is 18.2 miles. The winter model reach consisted of 14 segments. The impaired portion of the winter model reach consists of segments 3, 4, 5, and 6. The length of the impaired portion is the same as that for summer. Total distance of the winter model reach is 18.2 miles. A schematic diagram of the model is presented in Figure 4-1. Assumed instream seasonal temperatures are based on historical model development.

Figure 4-1. Schematic of the Modeled Reach.



4.3 Existing Conditions

The model used to develop the subject 2006 TMDL is based upon the previous calibrated model which was developed for the 2001 OE/DO TMDL. No recent or additional water quality data, however, has been collected within the impaired segment since the proposed opening and/or removal of the Howle and Turner Dam. Updated land use data for the Tallapoosa River watershed was available from the 2001 Multi-Resolution Land Characterization (MRLC) Consortium's 2001 National Land Cover Dataset (NLCD). The 2001 land cover/use data was incorporated into the previously calibrated water quality model to more accurately reflect loads coming from nonpoint sources. In addition, stream flow conditions were also revised in the model to reflect the proposed opening or removal of Howle and Turner Dam located within the modeled reach.

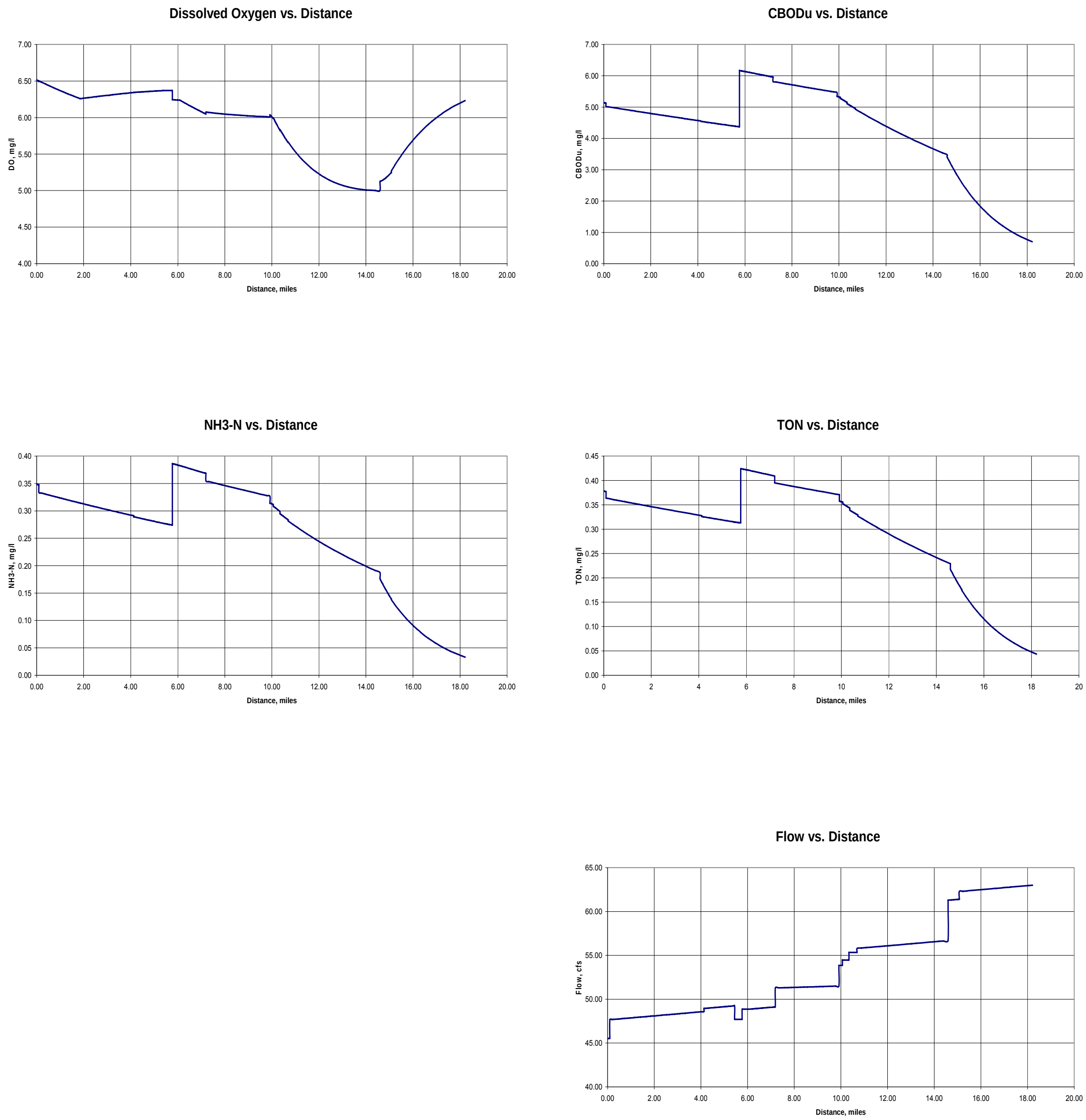
2006 Summer Existing Model Flow Parameters

Description	Flow (cfs)	DO (mg/l)	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	Temp (^oC)
Headwater	44.6	6.650	2.7500	0.0436	0.0738	28.0
Heflin WWTP	0.928	0.000	120.00	15.000	15.000	28.0
Cahulga Creek	2.13	6.650	2.7500	0.0436	0.0738	28.0
Cedar Creek	0.35	6.650	2.7500	0.0436	0.0738	28.0
Tyson Poultry	1.16	1.000	80.000	5.0000	5.0000	28.0
Dynne Creek	2.16	6.650	2.6348	0.0430	0.0738	28.0
Chulafinnee Creek	2.35	6.650	2.6348	0.0430	0.0738	28.0
Carr Creek	0.61	6.650	2.6348	0.0430	0.0738	28.0
Lockchelooge Creek	0.88	6.650	2.6348	0.0430	0.0738	28.0
Ligon Creek	0.45	6.650	2.6348	0.0430	0.0738	28.0
Ketchepedrakee Creek	4.60	6.650	2.6348	0.0430	0.0738	28.0
Little Ketchepedrakee Creek	0.88	6.650	2.6348	0.0430	0.0738	28.0
Conditions @ Lowest D.O.	56.6915	5.0010	3.4793	0.1875	0.2291	28.0
Flow @ End of Model	63.0115	6.2322	0.6980	0.0331	0.0435	28.0

2006 Summer Existing Incremental Flow Parameters

Sections	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	DO (mg/l)	Total Flow (cfs)	Temp. (^oC)
1	0.0000	0.0000	0.0000	0.0000	0.00	28.0
2	2.7500	0.0436	0.0738	5.4800	0.40	28.0
3	2.7500	0.0436	0.0738	5.4800	0.53	28.0
4	2.7500	0.0436	0.0738	5.4800	0.31	28.0
5	0.0000	0.0000	0.0000	0.0000	0.00	28.0
6	0.0000	0.0000	0.0000	0.0000	0.00	28.0
7	2.6348	0.0430	0.0738	5.4800	0.26	28.0
8	2.6348	0.0430	0.0738	5.4800	0.22	28.0
9	0.0000	0.0000	0.0000	0.0000	0.00	28.0
10	0.0000	0.0000	0.0000	0.0000	0.00	28.0
11	0.0000	0.0000	0.0000	0.0000	0.00	28.0
12	2.6348	0.0430	0.0738	5.4800	0.90	28.0
13	2.6348	0.0430	0.0738	5.4800	0.11	28.0
14	2.6348	0.0430	0.0738	5.4800	0.73	28.0

Figure 4-2. 2006 Summer Existing Model Predictions.



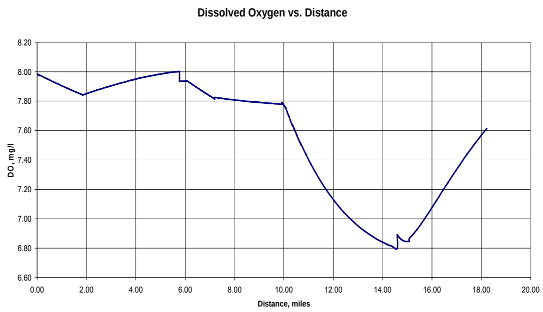
2006 Winter Existing Model Flow Parameters

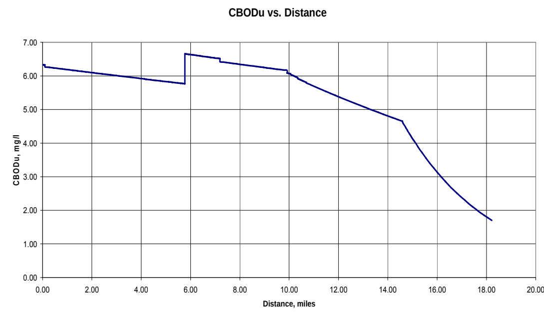
Description	Flow (cfs)	DO (mg/l)	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	Temp (^oC)
Headwater	112.7	8.050	5.1500	0.3176	0.6239	18.0
Heflin WWTP	0.928	0.000	150.00	20.000	20.000	18.0
Cahulga Creek	5.38	8.050	5.1500	0.3176	0.6239	18.0
Cedar Creek	0.88	8.050	5.1500	0.3176	0.6239	18.0
Tyson Poultry	1.16	1.000	100.00	20.000	20.000	18.0
Dynne Creek	5.46	8.050	4.4081	0.3176	0.6239	18.0
Chulafinnee Creek	5.93	8.050	4.4081	0.3176	0.6239	18.0
Carr Creek	1.53	8.050	4.4081	0.3176	0.6239	18.0
Lockchelooge Creek	2.23	8.050	4.4081	0.3176	0.6239	18.0
Ligon Creek	1.13	8.050	4.4081	0.3176	0.6239	18.0
Ketchepedrakee Creek	11.61	8.050	4.4081	0.3176	0.6239	18.0
Little Ketchepedrakee Creek	2.23	8.050	4.4081	0.3176	0.6239	18.0
Conditions @ Lowest D.O.	144.2	6.556	5.4336	0.5866	0.7479	18.0
Flow @ End of Model	160.1	6.237	2.0313	0.2830	0.2776	18.0

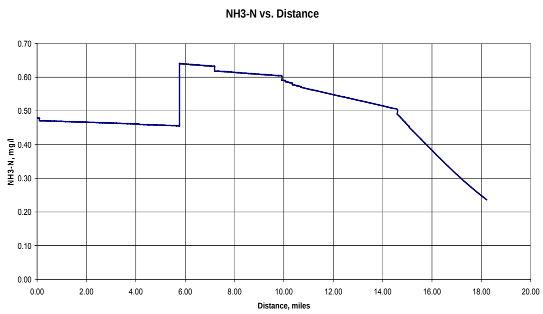
2006 Winter Existing Incremental Flow Parameters

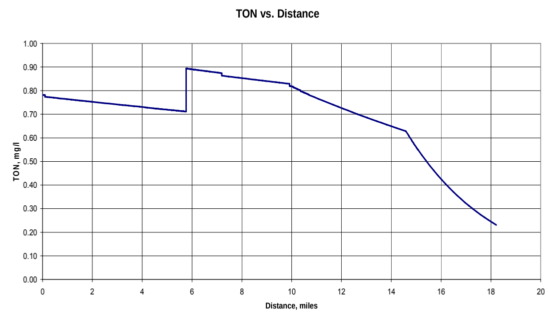
Sections	$CBOD_U$ (mg/l)	NH_3N (mg/l)	TON (mg/l)	DO (mg/l)	Total Flow (cfs)	Temp. (^oC)
1	0.0000	0.0000	0.0000	0.0000	0.00	18.0
2	5.1500	0.3176	0.6239	8.0500	1.02	18.0
3	5.1500	0.3176	0.6239	8.0500	1.34	18.0
4	5.1500	0.3176	0.6239	8.0500	0.77	18.0
5	5.1500	0.3176	0.6239	0.0000	0.19	18.0
6	5.1500	0.3176	0.6239	0.0000	0.19	18.0
7	4.4081	0.3176	0.6239	8.0500	0.65	18.0
8	4.4081	0.3176	0.6239	8.0500	1.59	18.0
9	0.0000	0.0000	0.0000	0.0000	0.00	18.0
10	4.4081	0.3176	0.6239	0.0000	0.17	18.0
11	4.4081	0.3176	0.6239	0.0000	0.20	18.0
12	4.4081	0.3176	0.6239	8.0500	2.28	18.0
13	4.4081	0.3176	0.6239	8.0500	0.28	18.0
14	4.4081	0.3176	0.6239	8.0500	1.84	18.0

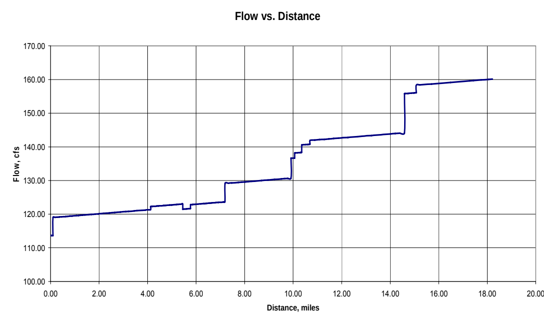
Figure 4-3. 2006 Winter Existing Model Predictions.


Dissolved Oxygen vs. Distance
DO, mg/l
8.20
8.00
7.80
7.60
7.40
7.20
7.00
6.80
6.60
0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00 16.00 18.00 20.00
Distance, miles


CBODu vs. Distance
CBODu, mg/l
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00 16.00 18.00 20.00
Distance, miles


NH3-N vs. Distance
NH3-N, mg/l
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00 16.00 18.00 20.00
Distance, miles


TON vs. Distance
TON, mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0 2 4 6 8 10 12 14 16 18 20
Distance, miles


Flow vs. Distance
Flow, cfs
170.00
160.00
150.00
140.00
130.00
120.00
110.00
100.00
0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00 16.00 18.00 20.00
Distance, miles

4.4 Allowable Conditions

The final simulation may hereafter be referred to as the "TMDL model". During model simulation, the non-point source loadings of various land use activities from the 2006 existing model were proportionally reduced in order to bring the impaired reach of the Tallapoosa River into compliance with the minimum instream DO concentration of 5 mg/l which is applicable for the Tallapoosa River. The existing model had no violations so the TMDL model is identical to the existing model.

4.5 Loading Reduction Analysis

Combined total organic loadings for CBODu and NBOD were determined for both the existing conditions and the allowable (TMDL) conditions for the impaired portion of the Tallapoosa River. These loadings were determined for two different scenarios, namely with the Howle & Turner dam open versus closed. Based on the modeling predictions it was determined that with dam open, no pollutant load reductions of CBODu and NBOD from both point and nonpoint sources were needed to protect the F&W DO criterion of 5.0 mg/L. However, with the dam gates closed, the model predicted significant reductions of CBODu and NBOD from point and nonpoint sources in order to meet the DO criterion of 5.0 mg/L. The primary reason for this difference is that when the gates are open, water can freely flow down the river thus adding significant velocity and reaeration to the system, in turn, providing much more assimilative capacity.

Table 4-1 and 4-4 summarizes the existing loads, allowable loads, and resulting point and nonpoint source reductions required to achieve an instream dissolved oxygen concentration of 5.0 mg/l for both the dam open and dam closed scenarios. All loads are represented by their $CBOD_u$ and NBOD components.

Table 4-1. Required Load Reductions for Point and Non-Point Sources – Summer Period (Dam Open Scenario).

Existing Loads[1]		TMDL[1]		% Reductions	
WLA (Point Sources)	LA (Nonpoint Sources)	WLA (Point Sources)	LA (Nonpoint Sources)	WLA (Point Sources)	LA (Nonpoint Sources)
(lbs/day)	(lbs/day)	(lbs./day)	(lbs./day)	%	%
2072.8	1097.5	2072.8	1097.5	0%	0%

Notes: 1 = $CBOD_u$ + NBOD

Table 4-2. Required Load Reductions for Point and Non-Point Sources – Summer Period (Dam Closed Scenario).

Existing Loads[1]		TMDL[1]		% Reductions	
WLA (Point Sources)	LA (Nonpoint Sources)	WLA (Point Sources)	LA (Nonpoint Sources)	WLA (Point Sources)	LA (Nonpoint Sources)
(lbs/day)	(lbs/day)	(lbs./day)	(lbs./day)	%	%
2072.8	1097.5	327.1	859.8	84.2%	21.7%

Notes: 1 = $CBOD_u$ + NBOD

Table 4-3. Required Load Reductions for Point and Non-Point Sources – Winter Period (Dam Open Scenario).

Existing Loads[1]		TMDL[1]		% Reductions	
WLA (Point Sources)	LA (Nonpoint Sources)	WLA (Point Sources)	LA (Nonpoint Sources)	WLA (Point Sources)	LA (Nonpoint Sources)
(lbs/day)	(lbs/day)	(lbs./day)	(lbs./day)	%	%
3434.2	7984.7	3434.2	7984.7	0%	0%

Notes: 1 = $CBOD_u$ + NBOD

Table 4-4. Required Load Reductions for Point and Non-Point Sources – Winter Period (Dam Closed Scenario).

Existing Loads[1]		TMDL[1]		% Reductions	
WLA (Point Sources)	LA (Nonpoint Sources)	WLA (Point Sources)	LA (Nonpoint Sources)	WLA (Point Sources)	LA (Nonpoint Sources)
(lbs/day)	(lbs/day)	(lbs./day)	(lbs./day)	%	%
3434.2	7984.7	2699.2	8125.2	21.4%	0%

Notes: 1 = $CBOD_u$ + NBOD

5.0 TMDL Conclusions

A summary of the TMDL for the various scenarios is presented in the following tables. Point source allocations to the impaired segment have been and will continue to be monitored, evaluated, and reassessed through ADEM's NPDES permitting program. NPDES permit limits are presented in Table 5-5. Continuous stream flow of the Tallapoosa through Howle and Turner Dam has allowed stream conditions to return to a more natural state and resulted in increased stream velocities, improved instream DO levels, and maintain instream water quality.

Table 5-1: TMDL by Source – Summer (May-November) – Dam Open

Pollutant	Point Source Loads (WLA) (lbs./day)	Non-point Source Loads (LA) (lbs./day)
$CBOD_u$	1100.9	917.4
NBOD	971.9	180.1
Total	2072.8	1097.5

Table 5-2: TMDL by Source – Winter (December-April) - Dam Open

Pollutant	Point Source Loads (WLA) (lbs./day)	Non-point Source Loads (LA) (lbs./day)
$CBOD_u$	1376.1	4282.6
NBOD	2058.1	3702.1
Total	3434.2	7984.7

Table 5-3: TMDL by Source – Summer (May-November) – Dam Closed

Pollutant	Point Source Loads (WLA) (lbs./day)	Non-point Source Loads (LA) (lbs./day)
$CBOD_u$	229.0	673.6
NBOD	98.1	186.2
Total	327.1	859.8

Table 5-4: TMDL by Source – Winter (December-April) - Dam Closed

Pollutant	Point Source Loads (WLA) (lbs./day)	Non-point Source Loads (LA) (lbs./day)
$CBOD_u$	1,517.0	4,431.1
NBOD	1,182.2	3,694.1
Total	2,699.2	8,125.2

Point source allocations to the impaired segment have been and will continue to be monitored, evaluated, and reassessed through ADEM's NPDES permitting program. NPDES permit limits for the point sources are presented in Table 5-5.

Table 5-5. Required NPDES Permit Limits for Point Sources to Acheive TMDL

NPDES Permit	Facility Name	Permit Limitations - Summer						Permit Limitations - Winter					
		Qw (MGD)	$CBOD_5$ (MG/L)		NH_3-N (MG/L)		DO (MG/L)	Qw (MGD)	$CBOD_5$ (MG/L)		NH_3-N (MG/L)		DO (MG/L)
		Max	Max	Avg	Max	Avg	Min	Max	Max	Avg	Max	Avg	Min
AL0056146*	Heflin WWTP	0.6	N/A	20	N/A	15	0	0.6	N/A	25	N/A	20	0
AL0002810*	Tyson Poultry	0.75	N/A	20	N/A	5	1	0.75	N/A	25	N/A	20	1
AL0056146**	Heflin WWTP	0.6	N/A	4	N/A	1	6	0.6	N/A	25	N/A	10	6
AL0002810**	Tyson Poultry	0.75	N/A	4	N/A	0.5	6.5	0.75	N/A	25	N/A	10	6

Notes: n/a = not applicable
* = Howle and Turner Dam Open
** = Howle and Turner Dam Closed

6.0 Follow Up Monitoring

ADEM has adopted a basin approach to water quality management; an approach that divides Alabama's fourteen major river basins into five groups. Each year, the ADEM water quality resources are concentrated in one of the basin groups. One goal is to continue to monitor §303(d) listed waters. This monitoring will occur in each basin according to the following schedule:

River Basin Group	Schedule
Cahaba / Black Warrior	2007
Tennessee	2008
Choctawhatchee / Chipola / Perdido-Escambia / Chattahoochee	2009
Tallapoosa / Alabama / Coosa	2010
Escatawpa / Upper Tombigbee / Lower Tombigbee / Mobile	2011

Monitoring will help further characterize water quality conditions resulting from the implementation of best management practices in the watershed.

7.0 Public Participation

As part of the public participation process, this TMDL was placed on public notice and made available for review and comment. The public notice was prepared and published in the four major daily newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who have requested to be on ADEM's postal and electronic mailing distributions. In addition, the public notice and subject TMDL was made available on ADEM's Website: www.adem.state.al.us. The public can also request paper or electronic copies of the TMDL by contacting Mr. Chris Johnson at 334-271-7827 or clj@adem.state.al.us. The public was given an opportunity to review the TMDL and submit comments to the Department in writing. At the end of the public review period, all written comments received during the public notice period became part of the administrative record. ADEM considered all comments received by the public prior to finalization of this TMDL and subsequent submission to EPA Region 4 for final review and approval.

List of Appendices

Appendix A References

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Appendix B Water Quality Data

Tallapoosa River, near Heflin, AL

Points		Location of Points		Latitude		Longitude
A		NE 1/4, Sec 28, T16S, R10E		33°36'23"		85°35'17"
B		SW 1/4, Sec 28, T16S, R10E		33°35'52"		85°35'44"
C		NE 1/4, Sec 4, T17S, R10E		33°34'55"		85°35'29"
D		NW 1/4, Sec 9, T17S, R10E		33°35'43"		85°35'46"
E		SW 1/4, Sec 9, T17S, R10E		33°33'26		85°36'10"
F		NE 1/4, Sec 17, T17S, R10E		33°33'12"		85°36'34"
G		NE 1/4, Sec 17, T17S, R10E		33°33'03"		85°36'35"
H		NE 1/4, Sec 29, T17S, R10E		33°31'17"		85°36'49"
I		SW 1/4, Sec 29, T17S, R10E		33°30'48"		85°37'13"
J		NW 1/4, Sec 5, T18S, R10E		33°29'41"		85°37'23"
K		NE 1/4, Sec 8, T18S, R10E		33°28'28"		85°36'49"
L		SE 1/4, Sec 20, T18S, R10E		33°26'16"		85°36'39"

Station	Location
TALL01	Tallapoosa River at abandoned bridge at end of dirt road in NE ¼, Sec. 28, T16S, R10E.
TALL02	Tallapoosa River at Cleburne County Road 19 in NE ¼, Sec. 4, T17S, R10E.
TALL03 Note: A canoe is needed to sample this station.	Tallapoosa River approximately 200 feet upstream of Tyson Poultry discharge in SW ¼, Sec. 9, T17S, R10E.
TALL04 Note: A canoe is needed to sample this station.	Tallapoosa River approximately 100 feet upstream of mill dam in NE ¼, Sec. 17, T17S, R10E.
TALL05	Tallapoosa River at Cleburne County Road 36 approximately 100 feet downstream of mill dam in NE ¼, Sec. 17, T17S, R10E.

Tallapoosa River Water Quality Study 9/15/99-9/16/99

Field Parameters											
Station	Date	Time	Depth (m)	Air Temp (°C)	Water Temp (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (umhos)	Turbidity (ntu)	Flow (cfs)
TALL-1	990915	15:50	0.6092	30	24.67	7.78	6.67	42	13	27.7
TALL-2	990915	15:20	0.1524	32.5	23.23	7.06	6.54	70	17	----
TALL-3	990915	12:47	0.1	33.5	24.29	7.48	6.95	63		----
			0.5		23.84	9.38	7.08	64		
			1		23.38	6.75	6.77	65		
			1.5		23.31	6.37	6.65	65	17	
			2		23.29	6.01	6.59	66		
			2.5		23.26	4.99	6.52	66		
			3		23.27	4.19	6.46	66		
			3.5		23.28	3.96	6.42	66		
TALL-4	990915	14:00	0.1	35	25.41	8.01	6.68	101		----
			0.5		23.78	6.65	6.59	102		
			1		23.58	5.62	6.53	99		
			1.5		23.47	5.07	6.49	92	15	
			2		23.41	4.44	6.45	87		
			2.5		23.38	3.53	6.43	78		
			3		23.4	3.1	6.4	81		
			3.5		23.4	2.78	6.37	80		
			4		23.4	2.74	6.36	80		
TALL-5	990915	11:30	0.1524	27	23.96	7.52	6.48	93	18	40.2
TALL-1	990916	10:00	0.4572	20.5	21.58	6.98	6.87	43	13	----
TALL-2	990916	9:30	0.1524	21.5	21.26	6.08	6.77	89	16	----
TALL-3	990916	7:51	0.1	16	22.95	5.81	6.96	62		----
			0.5		22.99	5.74	6.68	61		
			1		22.99	5.53	6.75	61		
			1.5		22.99	5.61	6.68	61	19	
			2		22.99	5.65	6.57	61		
			2.5		22.98	5.68	6.57	61		
			3		22.98	5.78	6.57	61		
			3.5		22.98	5.78	6.56	61		
TALL-4	990916	8:40	0.1	19.5	23.12	4.83	6.59	79		----
			0.5		23.15	4.84	6.46	79		
			1		23.15	4.84	6.43	79		

Tallapoosa River Water Quality Study 9/15/99-9/16/99 Continued

Field Parameters

Station	Date	Time	Depth (m)	Air Temp (^oC)	Water Temp (^oC)	Dissolved Oxygen (mg/L)	pH	Conductivity (umhos)	Turbidity (ntu)	Flow (cfs)
TALL-4	990916		1.5		23.15	4.79	6.41	79	28	
			2		23.15	4.8	6.41	80		
			2.5		23.15	4.78	6.41	80		
			3		23.13	4.82	6.42	82		
			3.5		23.11	4.76	6.43	82		
TALL-5	990916	7:15	0.1524	11	22.94	7.29	6.85	80	23	----

Tallapoosa River Water Quality Report 9/15/99-9/16/99 Chemical Results

Station	***Date***	***Time***	***TDS mg/L***	***TSS mg/L***	***NH3-N mg/L***	***TKN mg/L***	***NO3/NO2 mg/L***	***Total-P mg/L***	***BOD5 mg/L***	***TOC mg/L***	***Fecal Coliform colonies/100 mL***
TALL-1	990915	15:50	61	18	<0.015	<0.15	0.16	0.07	0.7	2.24	----
TALL-2	990915	15:20	69	24	<0.015	<0.15	0.14	0.2	0.6	2.54	----
TALL-3	990915	12:47	75	26	<0.015	0.35	0.14	0.15	6.6	4.7	----
TALL-4	990915	14:00	108	21	0.09	0.39	1.41	0.42	4	5.35	----
TALL-5	990915	11:30	90	24	<0.015	<0.15	0.75	0.23	1.2	2.76	----
TALL-1	990916	10:00	77	20	<0.015	<0.15	0.15	0.08	1.9	2.22	31
TALL-2	990916	9:30	73	28	<0.015	0.17	0.15	0.27	0.5	2.93	73
TALL-3	990916	7:51	55	18	0.03	0.34	0.13	0.12	0.3	3.58	26
TALL-4	990916	8:40	59	7	<0.015	<0.15	0.83	0.31	2.4	3.04	32
TALL-5	990916	7:15	89	43	<0.015	<0.15	1.07	0.38	0.8	3.06	40

Tallapoosa River Water Quality Study 1992-1993

Station	Date	Time	Air Temp., °C	Total Depth, m	Sample Depth, m	Water Temp., °C	Dissolved Oxygen, mg/l	pH, s.u.	Conductivity, mmhos/cm	Flow, cfs
A	7/28/92	1845								202.8
A	7/29/92	740	22.5	0.8	0.4	25.1	6.92	5.84	40	212.6
A	7/29/92	1334	27.0	1.0	0.5	26.1	7.09	6.51	39	
A	7/30/92	835	24.0	0.4	0.2	25.2	6.80	6.21	40	193.8
A	7/30/92	1415		0.4	0.2	27.0	7.17	6.33	39	191.2
A	7/31/92	845								183.2
A	8/31/93	1325	29.5	1.4	0.7	26.9	7.63	6.26	41	
A	8/31/93	1540								87.6
A	9/1/93	645	17.0	0.2	0.1	24.8	6.75	5.92	40	
A	9/1/93	1030								79.3
A	9/1/93	1300	30.0	0.2	0.1	26.7	6.98	6.34	40	
A	9/1/93	1459								81.3
A	9/2/93	655	22.0	0.3	0.2	25.5	6.62	5.79	40	
A	9/2/93	945								76.2
A	9/2/93	1240	28.5	0.2	0.1	26.6	6.80	6.11	40	
A	9/3/93	946								68.9
C	7/29/92	804	25.0	0.8	0.4	25.1	6.78	6.20	45	
C	7/29/92	1357	35.0	0.8	0.4	26.2	7.06	6.58	46	
C	7/30/92	855	25.0	0.8	0.4	25.1	6.72	6.18	45	
C	7/30/92	1445		0.9	0.5	26.9	7.13	6.42	47	
C	8/31/93	1340	36.0	0.4	0.2	26.8	7.17	6.21	45	
C	9/1/93	710	18.0	0.6	0.3	24.9	6.62	5.82	48	
C	9/1/93	1312	30.0	0.4	0.2	26.4	6.95	6.34	45	
C	9/2/93	705	22.0	0.5	0.3	25.6	6.42	5.94	53	
C	9/2/93	1255	33.5	0.4	0.2	26.3	6.67	6.16	48	
D	7/28/92	2000	24.0	1.5	0.7	26.6	6.25	3.95	43	
D	7/30/92	1345		1.5	0.7	26.9	6.29	6.20	48	
E	7/28/92	1852	25.0	0.7	0.3	27.2	5.94	6.34	45	
E	7/29/92	840	29.5	3.4	1.7	26.1	5.95	6.19	45	
E	7/29/92	1413	31.0	3.4	1.5	26.4	6.08	6.41	48	
E	7/30/92	915	25.5	3.5	1.5	25.9	6.15	6.08	45	
E	7/30/92	1515		3.0	1.5	26.4	6.17	6.23	48	
E	8/31/93	1400	31.0	3.5	0.0	31.0	6.47	6.29	45	
E	8/31/93	1400	31.0	3.5	0.5	27.8	6.24	6.27	45	
E	8/31/93	1400	31.0	3.5	1.0	26.9	5.57	6.23	46	
E	8/31/93	1400	31.0	3.5	1.5	26.8	5.37	6.23	46	
E	8/31/93	1400	31.0	3.5	2.0	26.8	5.33	6.22	46	
E	8/31/93	1400	31.0	3.5	2.5	26.7	5.28	6.22	46	
E	8/31/93	1400	31.0	3.5	3.0	26.7	5.22	6.21	46	
E	8/31/93	1400	31.0	3.5	3.5	26.8	5.15	6.22	46	
E	9/1/93	740	20.0	3.6	0.0	26.4	5.64	6.13	46	
E	9/1/93	740	20.0	3.6	0.5	26.4	5.60	6.13	46	
E	9/1/93	740	20.0	3.6	1.0	26.4	5.65	6.12	46	
E	9/1/93	740	20.0	3.6	1.5	26.3	5.61	6.11	46	
E	9/1/93	740	20.0	3.6	2.0	26.3	5.69	6.10	46	

Tallapoosa River Water Quality Study 1992-1993 Continued

Station	Date	Time	Air Temp., °C	Total Depth, m	Sample Depth, m	Water Temp., °C	Dissolved Oxygen, mg/l	pH, s.u.	Conductivity, mmhos/cm	Flow, cfs
E	9/1/93	740	20.0	3.6	2.5	26.3	5.71	6.08	45	
E	9/1/93	740	20.0	3.6	3.0	26.3	5.72	6.07	45	
E	9/1/93	740	20.0	3.6	3.5	26.2	5.28	5.97	46	
E	9/1/93	1335	30.0	3.6	0.0	31.0	6.54	6.36	46	
E	9/1/93	1335	30.0	3.6	0.5	27.1	5.78	6.38	46	
E	9/1/93	1335	30.0	3.6	1.0	26.7	5.52	6.34	46	
E	9/1/93	1335	30.0	3.6	1.5	26.5	5.45	6.31	46	
E	9/1/93	1335	30.0	3.6	2.0	26.5	5.43	6.30	46	
E	9/1/93	1335	30.0	3.6	2.5	26.5	5.36	6.25	46	
E	9/1/93	1335	30.0	3.6	3.0	26.5	5.13	6.25	46	
E	9/1/93	1335	30.0	3.6	3.5	26.4	5.14	6.24	46	
E	9/2/93	735	26.0	3.5	0.0	26.7	6.57	6.03	38	
E	9/2/93	735	26.0	3.5	0.5	26.8	6.54	6.16	46	
E	9/2/93	735	26.0	3.5	1.0	26.8	6.51	6.18	46	
E	9/2/93	735	26.0	3.5	1.5	26.5	5.27	6.13	46	
E	9/2/93	735	26.0	3.5	2.0	26.3	5.01	6.11	47	
E	9/2/93	735	26.0	3.5	2.5	26.2	4.81	6.09	47	
E	9/2/93	735	26.0	3.5	3.0	26.1	4.67	6.06	47	
E	9/2/93	735	26.0	3.5	3.5	26.1	4.59	6.08	47	
E	9/2/93	1315	31.0	3.4	0.0	28.3	7.47	6.34	46	
E	9/2/93	1315	31.0	3.4	0.5	27.2	6.64	6.36	46	
E	9/2/93	1315	31.0	3.4	1.0	26.8	5.97	6.31	46	
E	9/2/93	1315	31.0	3.4	1.5	26.6	5.43	6.28	46	
E	9/2/93	1315	31.0	3.4	2.0	26.4	5.09	6.21	47	
E	9/2/93	1315	31.0	3.4	2.5	26.4	4.66	6.17	47	
E	9/2/93	1315	31.0	3.4	3.0	26.2	4.34	6.11	48	
E	9/2/93	1315	31.0	3.4	3.4	26.2	4.26	6.14	48	
F	7/28/92	1825	28.0	2.0	1.0	27.2	5.81	6.22	47	
F	7/29/92	1015	32.0	3.7	0.0	26.6	5.64	6.22	49	
F	7/29/92	1015	32.0	3.7	0.5	26.4	5.73	6.20	49	
F	7/29/92	1015	32.0	3.7	1.0	26.4	5.75	6.20	48	
F	7/29/92	1015	32.0	3.7	1.5	26.3	5.70	6.17	48	
F	7/29/92	1015	32.0	3.7	2.0	26.3	5.68	6.19	48	
F	7/29/92	1015	32.0	3.7	2.5	26.3	5.66	6.18	48	
F	7/29/92	1015	32.0	3.7	3.0	26.3	5.66	6.17	48	
F	7/29/92	1015	32.0	3.7	3.5	26.3	5.57	6.17	48	
F	7/29/92	1505	32.0	3.8	0.0	27.4	6.23	6.44	53	
F	7/29/92	1505	32.0	3.8	0.5	27.1	6.12	6.40	49	
F	7/29/92	1505	32.0	3.8	1.0	26.5	5.91	6.35	51	
F	7/29/92	1505	32.0	3.8	1.5	26.4	5.83	6.31	51	
F	7/29/92	1505	32.0	3.8	2.0	26.4	5.79	6.29	50	
F	7/29/92	1505	32.0	3.8	2.5	26.4	5.75	6.28	50	
F	7/29/92	1505	32.0	3.8	3.0	26.3	5.78	6.27	50	
F	7/29/92	1505	32.0	3.8	3.5	26.3	5.62	6.27	50	
F	7/30/92	945	29.5	4.0	0.0	26.1	5.93	6.24	48	

Tallapoosa River Water Quality Study 1992-1993 Continued

Station	Date	Time	Air Temp., °C	Total Depth, m	Sample Depth, m	Water Temp., °C	Dissolved Oxygen, mg/l	pH, s.u.	Conductivity, mmhos/cm	Flow, cfs
F	7/30/92	945	29.5	4.0	0.5	25.9	5.89	6.14	48	
F	7/30/92	945	29.5	4.0	1.0	25.9	5.89	6.13	48	
F	7/30/92	945	29.5	4.0	1.5	25.8	5.87	6.13	49	
F	7/30/92	945	29.5	4.0	2.0	25.9	5.84	6.13	49	
F	7/30/92	945	29.5	4.0	2.5	25.9	5.87	6.13	49	
F	7/30/92	945	29.5	4.0	3.0	25.9	5.84	6.14	49	
F	7/30/92	945	29.5	4.0	3.5	25.9	5.82	6.13	49	
F	7/30/92	945	29.5	4.0	4.0	25.9	5.73	6.14	49	
F	7/30/92	1545		4.0	0.0	29.0	6.12	6.36	51	
F	7/30/92	1545		4.0	0.5	27.8	6.26	6.30	53	
F	7/30/92	1545		4.0	1.0	26.6	6.07	6.26	50	
F	7/30/92	1545		4.0	1.5	26.3	6.03	6.22	50	
F	7/30/92	1545		4.0	2.0	26.3	5.99	6.21	50	
F	7/30/92	1545		4.0	2.5	26.3	5.95	6.19	50	
F	7/30/92	1545		4.0	3.0	26.2	5.97	6.18	50	
F	7/30/92	1545		4.0	3.5	26.2	5.92	6.19	50	
F	7/30/92	1545		4.0	4.0	26.2	5.86	6.16	50	
F	8/31/93		31.0	3.5	0.0	29.9	7.25	6.29	57	
F	8/31/93		31.0	3.5	0.5	27.5	5.87	6.37	54	
F	8/31/93		31.0	3.5	1.0	27.0	5.40	6.33	54	
F	8/31/93		31.0	3.5	1.5	26.9	5.24	6.31	53	
F	8/31/93		31.0	3.5	2.0	26.9	4.88	6.27	53	
F	8/31/93		31.0	3.5	2.5	26.8	4.38	6.22	50	
F	8/31/93		31.0	3.5	3.0	26.8	3.83	6.16	50	
F	8/31/93		31.0	3.5	3.5	26.7	2.56	6.15	51	
F	9/1/93	805	20.0	3.5	0.0	26.5	5.51	6.15	56	
F	9/1/93	805	20.0	3.5	0.5	26.5	5.48	6.15	56	
F	9/1/93	805	20.0	3.5	1.0	26.5	5.38	6.13	56	
F	9/1/93	805	20.0	3.5	1.5	26.5	5.26	6.13	58	
F	9/1/93	805	20.0	3.5	2.0	26.5	5.24	6.14	59	
F	9/1/93	805	20.0	3.5	2.5	26.5	5.32	6.16	62	
F	9/1/93	805	20.0	3.5	3.0	26.2	5.32	6.14	61	
F	9/1/93	805	20.0	3.5	3.5	26.5	1.06	6.08	54	
F	9/1/93	1405	30.0	3.3	0.0	29.3	7.49	6.47	55	
F	9/1/93	1405	30.0	3.3	0.5	27.0	6.05	6.42	54	
F	9/1/93	1405	30.0	3.3	1.0	26.8	5.29	6.35	54	
F	9/1/93	1405	30.0	3.3	1.5	26.7	5.35	6.30	52	
F	9/1/93	1405	30.0	3.3	2.0	26.6	5.09	6.27	52	
F	9/1/93	1405	30.0	3.3	2.5	26.6	4.83	6.24	53	
F	9/1/93	1405	30.0	3.3	3.0	26.6	4.51	6.19	51	
F	9/1/93	1405	30.0	3.3	3.3	26.6	4.08	6.18	51	
F	9/2/93	800	26.0	3.8	0.0	27.0	6.55	6.24	68	
F	9/2/93	800	26.0	3.8	0.5	27.0	6.41	6.27	70	
F	9/2/93	800	26.0	3.8	1.0	26.7	5.37	6.21	59	
F	9/2/93	800	26.0	3.8	1.5	26.4	4.79	6.17	47	

Tallapoosa River Water Quality Study 1992-1993 Continued

Station	Date	Time	Air Temp., °C	Total Depth, m	Sample Depth, m	Water Temp., °C	Dissolved Oxygen, mg/l	pH, s.u.	Conductivity, mmhos/cm	Flow, cfs
F	9/2/93	800	26.0	3.8	2.0	26.3	4.54	6.12	47	
F	9/2/93	800	26.0	3.8	2.5	26.3	4.47	6.10	47	
F	9/2/93	800	26.0	3.8	3.0	26.3	4.30	6.06	47	
F	9/2/93	800	26.0	3.8	3.5	26.3	3.72	6.07	47	
F	9/2/93	800	26.0	3.8	3.8	26.2	2.57	6.03	49	
F	9/2/93	1340	31.0	3.5	0.0	28.0	7.98	6.53	67	
F	9/2/93	1340	31.0	3.5	0.5	27.4	6.65	6.54	64	
F	9/2/93	1340	31.0	3.5	1.0	26.8	5.56	6.33	75	
F	9/2/93	1340	31.0	3.5	1.5	26.5	4.38	6.19	54	
F	9/2/93	1340	31.0	3.5	2.0	26.4	4.19	6.13	48	
F	9/2/93	1340	31.0	3.5	2.5	26.3	4.18	6.13	48	
F	9/2/93	1340	31.0	3.5	3.0	26.3	4.05	6.12	48	
F	9/2/93	1340	31.0	3.5	3.5	26.3	3.75	6.12	48	
G	7/28/92	1745	28.5	1.0	0.5	27.2	6.40	6.28	48	
G	7/29/92	940	28.5	0.5	0.3	26.4	7.34	6.23	47	
G	7/29/92	1300								227.3
G	7/29/92	1532	30.0	1.0	0.5	26.7	7.37	6.67	48	
G	7/30/92	1025	28.0	0.8	0.4	26.0	7.40	6.23	48	
G	7/30/92	1615		0.8	0.4	26.8	6.31	6.26	48	
G	7/31/92	850								184.8
G	8/31/93	1030								87.4
G	8/31/93	1520	35.0	0.1	0.1	27.4	6.88	6.48	53	
G	9/1/93	840	24.0	0.2	0.1	26.4	5.84	6.15	56	84.6
G	9/1/93	1440	34.0	0.2	0.1	27.0	5.89	6.30	53	
G	9/2/93	715								83.7
G	9/2/93	830	27.0	0.1	0.1	26.6	5.79	6.03	56	
G	9/2/93	1420	32.0	0.2	0.1	26.9	6.05	6.29	59	
G	9/3/93	750								76.3
H	7/28/92	1725	28.0	1.0	0.5	27.1	6.93	6.44	48	
H	7/29/92	1056	30.0	1.0	0.5	26.6	6.95	6.27	49	
H	7/29/92	1600	31.5	1.0	0.5	27.4	7.15	6.61	47	
H	7/30/92	1055	28.0	1	0.5	26.0	6.94	6.23	50	
H	8/31/93	1535	35.0	0.6	0.3	28.1	6.95	6.42	52	
H	9/1/93	855	27.0	0.7	0.3	24.9	6.15	6.14	53	
H	9/1/93	1450	33.5	0.7	0.3	27.2	6.70	6.42	52	
H	9/2/93	850	26.0	0.6	0.3	25.9	6.07	6.12	53	
H	9/2/93	1430	32.5	0.6	0.3	27.3	6.46	6.31	55	
I	7/28/92	1646	28.5	1.0	0.5	27.2	6.86	6.39	48	
I	7/29/92	1117	31.0	1.1	0.6	26.4	6.62	6.45	48	
I	7/29/92	1619	28.5	1.0	0.5	27.6	7.05	6.57	49	
I	7/30/92	1120	29.5	1	0.5	26.1	6.82	6.40	52	
I	7/30/92	1700		1.1	0.5	27.9	7.20	6.48	48	
I	8/31/93	1553	32.5	0.4	0.2	27.6	6.74	6.36	54	
I	9/1/93	915	26.0	0.7	0.3	25.4	6.23	6.07	53	
I	9/1/93	1510	32.0	0.6	0.3	26.7	6.43	6.41	55	

Tallapoosa River Water Quality Study 1992-1993 Continued

Station	Date	Time	Air Temp., °C	Total Depth, m	Sample Depth, m	Water Temp., °C	Dissolved Oxygen, mg/l	pH, s.u.	Conductivity, mmhos/cm	Flow, cfs
I	9/2/93	926	26.0	0.4	0.2	26.3	6.08	5.98	53	
I	9/2/93	1455	30.0	0.4	0.2	27.1	6.38	6.38	54	
J	7/28/92	1559	29.0	0.9	0.45	26.9	6.24	6.32	48	
J	7/29/92	1141	30.0	1.0	0.5	26.1	6.38	6.48	48	
J	7/29/92	1635	31.0	1.0	0.5	27.3	6.77	6.53	47	
J	7/30/92	1135	29.5	1.1	0.5	26.1	6.70	6.30	51	
J	7/30/92	1715		0.9	0.5	27.8	6.86	6.37	50	
J	8/31/93	1600	32.5	0.4	0.2	27.8	6.98	6.50	50	
J	9/1/93	925	27.0	0.5	0.2	26.2	6.68	6.34	51	
J	9/1/93	1520	31.5	0.4	0.2	27.5	6.96	6.49	51	
J	9/2/93	940	25.0	0.3	0.2	26.6	6.51	6.16	51	
J	9/2/93	1505	28.5	0.3	0.2	27.5	6.75	6.44	51	
K	7/28/92	1506	26.5	2.2	1.1	26.7	6.33	6.31	47	
L	7/28/92	1352	31.5	5.0	1.5	29.2	8.20	6.50	42	
L	7/29/92	1203	32.0	4.5	2.3	28.1	6.93	6.68	43	
L	7/29/92	1704	30.0	4.8	1.5	28.8	8.53	7.08	42	
L	7/29/92	1704	30.0	4.8	2.4	27.6	6.40	6.56	45	
L	7/30/92	1225	32.0	5.2	1.5	29.3	8.57	7.50	41	
L	7/30/92	1225	32.0	5.2	2.6	27.8	6.73	6.70	45	
L	7/30/92	1745		5.0	1.5	28.5	8.26	6.92	43	
L	7/30/92	1745		5.0	2.5	28.4	7.72	6.74	43	
L	8/31/93	1645	35.0	3.2	1.6	29.8	8.75	7.35	42	
L	9/1/93	950	30.0	3.3	1.6	28.4	7.51	6.48	43	
L	9/1/93	1545	30.0	3.4	1.7	29.6	8.40	7.15	43	
L	9/2/93	1005	27.0	3.2	1.6	28.7	7.41	6.33	42	
L	9/2/93	1530	33.0	3.1	1.5	29.3	8.05	6.79	43	

Appendix C Water Quality Model Input and Output Files