FINAL
Total Maximum Daily Load
Nutrients

Puppy Creek
AL03170008-0205-102
Nutrients

Alabama Department of Environmental Management
Water Quality Branch
Water Division
January 2008

Figure 1.1: Map of Puppy Creek Watershed

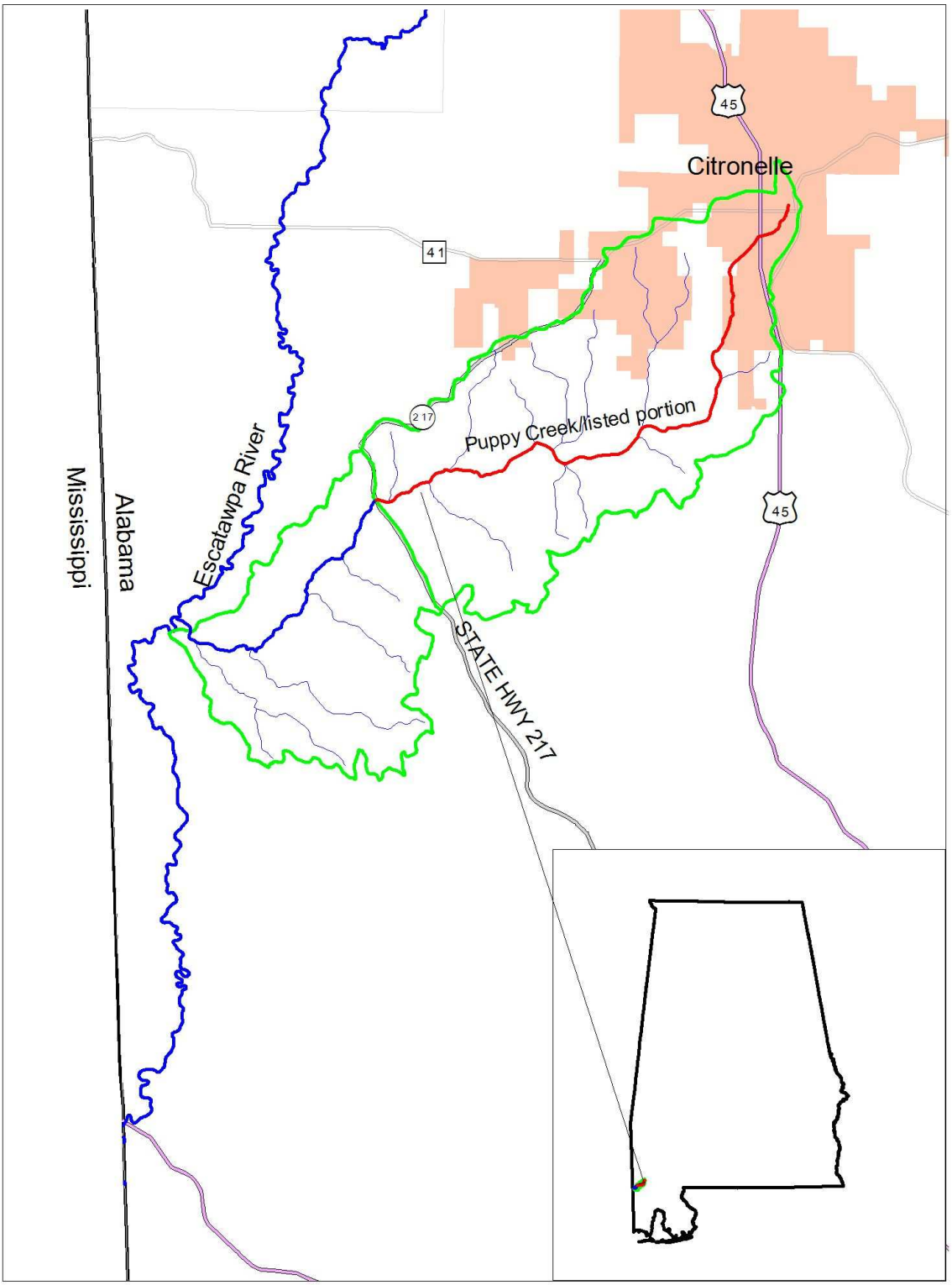


Table of Contents *Page*

1.0 Executive Summary 4

2.0 Basis for §303(d) Listing 5

2.1 Introduction 5
2.2 Problem Definition 6
2.3 Water Quality Criteria 6

3.0 TMDL Technical Basis 7

3.1 Water Quality Target Identification 7
3.2 Source Assessment 10
3.3 Landuse 12
3.4 Data Availability and Analysis 14

4.0 Total Maximum Daily Load Development for Puppy Creek 17

4.1 TMDL Numeric Targets 17
4.2 Existing/Baseline Conditions 18
4.3 Critical Conditions 18
4.4 Margin of Safety 19
4.5 Seasonal Variation 19
4.6 TMDL Calculation Method and Results 20

5.0 Follow Up Monitoring 21

6.0 Public Participation 22

Appendices
A References 23
B Water Quality Data 24

Tables
3.3.1 Landuse in the Puppy Creek Watershed 12
3.4.1 ADEM Station Location Descriptions 15

Figures
Figure 1.1 Map of Puppy Creek Watershed 2
Figure 3.2.1 Point Sources in the Puppy Creek Watershed 11
Figure 3.3.1 Landuse in the Puppy Creek Watershed 13
Figure 3.4.1 Map of ADEM Sampling Stations 16

1.0 Executive Summary

The Alabama Department of Environmental Management (ADEM) has identified Puppy Creek of the Escatawpa River Basin as being impaired for nutrients. Puppy Creek, a tributary to the Escatawpa River, was originally listed on Alabama's 303(d) list in 1992, 1994, and 1996 for nutrients, organic enrichment/dissolved oxygen (OE/DO), and pathogens (fecal coliform). The original listing for OE/DO and pathogens is based on data provided by ADEM's 1991 Clean Water Strategy (CWS) Reports. Although there is no clear indication of why Puppy Creek was originally listed for nutrients, its listing was likely based on anecdotal evidence, such as the presence of periphyton or significant diurnal DO changes. In 1996, ADEM completed a Total Maximum Daily Load (TMDL) which addressed the OE/DO impairment within Puppy Creek and this TMDL was approved by the Environmental Protection Agency (EPA) in 1997. Puppy Creek was therefore listed on Alabama's 303(d) list in 1998, 2000, 2002 and 2004 for nutrients and pathogens. In 2002, ADEM completed a TMDL which addressed pathogens impairment within Puppy Creek and this TMDL was approved by the EPA in 2005. Puppy Creek remains on the 2006 303(d) list for nutrients. This report will address the nutrient impairment within Puppy Creek. A map of the Puppy Creek watershed can be found in Figure 1.1. 303(d) listing details for Puppy Creek are shown below:

Waterbody ID	Waterbody Name	Counties	Uses	Causes	Sources	Size	Support Status
AL/03170008-0205-102	Puppy Creek	Mobile	Fish and Wildlife (F&W)	Nutrients	Urban Run-off /storm sewers	11.32 miles	Non

The pollutant of concern for the impaired segment is nutrients. Nutrients are of concern due to their ability to promote algal growth, which in turn affects the dissolved oxygen balance through photosynthesis, respiration, and the regeneration of organic materials. Target pollutants for nutrient impaired waterbodies are chosen on a case by case basis. For Puppy Creek, only total phosphorus (TP) is included in this TMDL. The existing total nitrogen (TN) concentration in Puppy Creek is estimated to be lower than the reference condition concentration; therefore, TN does not appear to contribute to the existing nutrient impairment in Puppy Creek. Downstream uses are also not expected to be impacted by the existing TN loads. Supporting calculations for TN are included in Appendix B.

Establishing a TP target that fully supports the designated uses of Puppy Creek is part of the lengthy and complex process of TMDL development. The nutrient target was developed using a "reference condition" approach using data from eco-region 65(f), Southern Pine Plains and Hills, and taking the 75^{th} percentile of this data to calculate the target concentrations. The TP target concentration for Puppy Creek is 0.022 mg/L.

Following are the TMDL results for the Puppy Creek Nutrient TMDL :

Polluant	Existing loads		Allowable loads		Reductions	
	WLA	LA	WLA	LA	WLA	LA
TP (lbs/day)	*	0.34	0.0	0.13	100%**	62%

* not calculated due to nutrient data not being reported from facility

** discharger under administrative order for removal

TMDL = WLA + LA + MOS*			
Polluant	**TMDL**	**WLA**	**LA**
TP (lbs/day)	0.13	0.00	0.13

*** implicit MOS**

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 uses and to determine the total maximum daily load (TMDL) for pollutants causing use impairment. The TMDL process establishes the allowable loading of pollutants 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 Alabama Department of Environmental Management (ADEM) has identified Puppy Creek of the Escatawpa River Basin as being impaired for nutrients. Puppy Creek, a tributary to the Escatawpa River, was originally listed on Alabama's 303(d) list in 1992, 1994, and 1996 for nutrients, organic enrichment/dissolved oxygen (OE/DO), and pathogens (fecal coliform). The original listing for OE/DO and pathogens is based on data provided by ADEM's 1991 Clean Water Strategy (CWS) Report. Although there is no clear indication of why Puppy Creek was originally listed for nutrients, its listing was likely based on anecdotal evidence, such as the presence of periphyton or significant diurnal DO changes. In 1996, ADEM completed a Total Maximum Daily Load (TMDL) which addressed the OE/DO impairment within Puppy Creek and this TMDL was approved by the Environmental Protection Agency (EPA) in 1997. Puppy Creek was therefore listed on Alabama's 303(d) list in 1998, 2000, 2002 and 2004 for nutrients and pathogens. In 2002, ADEM completed a TMDL which addressed pathogens impairment within Puppy Creek and this TMDL was approved by the EPA in 2005. Puppy Creek remains on the 2006 303(d) list for nutrients. This report will address the nutrient impairment within Puppy Creek.

2.2 Problem Definition

Waterbody Impaired:	Puppy Creek from Alabama Highway 217 to its source.
Waterbody length:	11.32 miles
Waterbody drainage area:	28.11 square miles
Water Quality Standard Violation:	Narrative criteria (nutrients)
Pollutants of Concern:	Total Phosphorus
Water Use Classification:	Fish and Wildlife

Usage of waters in the Fish and Wildlife category is described as follows 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.

2.3 Water Quality Criteria

ADEM's decision to list Puppy Creek as being impaired for nutrients was authorized under ADEM's Water Quality Standards Program, which employs both numeric and narrative criteria to ensure adequate protection of designated uses for surface waters of the State. Numeric criteria typically have quantifiable endpoints for given parameters such as pH, dissolved oxygen, or a toxic pollutant, whereas narrative criteria are qualitative statements that establish a set of desired conditions for all State waters.

These narrative criteria are more commonly referred to as "free from" criteria that enable States a regulatory avenue to address pollutants or problems that may be causing or contributing to a use impairment that otherwise cannot be evaluated against any numeric criteria. Typical pollutants that fall under this category are nutrients and siltation. Historically, in the absence of established numeric nutrient criteria, ADEM and/or EPA would use available data and information coupled with best professional judgment to determine overall use support for a given waterbody. Narrative criteria continue to serve as a basis for determining use attainability and subsequently listing/delisting of waters from Alabama's §303(d) List. ADEM's Narrative Criteria are shown in ADEM's Administrative Code 335-6-10-.06 as follows:

335-6-10-.06 **Minimum Conditions Applicable to All State Waters**. *The following minimum conditions are applicable to all State waters, at all places and at all times, regardless of their uses:*

(a) State waters shall be free from substances attributable to sewage, industrial wastes or other wastes that will settle to form bottom deposits which are unsightly, putrescent or interfere directly or indirectly with any classified water use.

(b) State waters shall be free from floating debris, oil, scum, and other floating materials attributable to sewage, industrial wastes or other wastes in amounts sufficient to be unsightly or interfere directly or indirectly with any classified water use.

(c) State waters shall be free from substances attributable to sewage, industrial wastes or other wastes in concentrations or combinations, which are toxic or harmful to human, animal or aquatic life to the extent commensurate with the designated usage of such waters.

3.0 Technical Basis for TMDL Development

3.1 Water Quality Target Identification

ADEM continues its efforts to develop comprehensive numeric nutrient criteria for all surface waters throughout Alabama, including rivers/streams, lakes/reservoirs, wetlands, and coastal/estuarine waters. However, until numeric nutrient criteria or some form of quantitative interpretations of ADEM's narrative criteria are developed, the Department will continue to use all available data and information coupled with best professional judgment to make informed decisions regarding overall use support and when establishing targets for TMDLs.

Typically, development of a water quality criterion for a given pollutant involves extensive research using information from many areas of aquatic toxicology. For example, development of numeric criteria for toxic pollutants, such as mercury, involves

numerous toxicological studies such as dose/response relationships, bioaccumulation studies, fate and transport studies, and an understanding of both the acute and chronic effects to aquatic life. As part of the toxicological evaluations, EPA performs uncertainty analysis to help guide selection of the recommended water quality criterion for a given pollutant. For toxic pollutants, the more uncertainty revealed during the evaluation, the more conservative (i.e. the lower the value) the recommended criterion becomes.

Nutrients such as phosphorus and nitrogen are essential elements to aquatic life, but can be undesirable when present at sufficient concentrations to stimulate excessive plant growth. Even though these pollutants are generally considered nontoxic (the exception being un-ionized ammonia toxicity to aquatic life), they can impact aquatic life due to their indirect effects on water quality, either when in overabundance or when availability is limited.

ADEM's water quality criteria applying to nutrients are narrative, therefore a numerical translator is needed to define the TMDL target. Based on the historical data collected on Puppy Creek, there is evidence that designated uses are impaired by nutrient over-enrichment. However some uncertainty remains in the exact quantification of the nutrient target due to the complexity of the relationship of cause and effect and the state of the science. This is a very common dilemma in nutrient water quality management, and often warrants an alternate approach. EPA recommends, in the absence of sufficient "effects-based" information, a reference condition approach for determining protective nutrient criteria. With this approach, a numerical value can be empirically developed that can be assumed to inherently protect uses supported in the reference waters. This approach can provide an initial target while continuing studies will allow further evaluation of the cause and effect relationships that might result in refinement of the initial target.

In developing a nutrient target for the Puppy Creek Nutrient TMDL, ADEM has chosen to use a "reference condition" approach for determining the appropriate levels of nutrients necessary to support designated uses. This approach is based on using ambient water quality data from candidate reference streams that are located in characteristically similar regions of Alabama known as ecoregions. An ecoregion is defined as a relatively homogeneous area defined by similar climate, landform, soil, potential natural vegetation, hydrology and other ecologically relevant variables (USEPA, 2000b). "Reference streams" are defined as waterbodies that have been relatively undisturbed or minimally-impacted that can serve as examples of the natural biological integrity of a particular ecoregion. These "reference streams" can be monitored over time to establish a baseline to which other waters can be compared. Reference streams are not necessarily pristine or undisturbed by humans, however they do represent waters within Alabama that are healthy and fully support their designated uses, to include protection of aquatic life. The reference streams selected for a particular analysis depends primarily on the available number of reference streams and associated data within a particular ecoregion. Therefore, the total number of reference sites selected and the aerial scale (i.e. Ecoregion Level III, Level IV) used to represent a reference condition will often vary on a case-by-case basis. ADEM believes that the "reference condition" approach used to determine

appropriate nutrient targets for the Puppy Creek TMDL, is reasonable, scientifically defensible, protective of designated uses, and consistent with USEPA guidance.

Target pollutants for nutrient impaired waterbodies are chosen on a case by case basis. For Puppy Creek, only total phosphorus (TP) is included in this TMDL. The existing total nitrogen (TN) concentration in Puppy Creek is estimated to be lower than the reference condition concentration; therefore, TN does not appear to contribute to the existing nutrient impairment in Puppy Creek. Downstream uses are also not expected to be impacted by the existing TN loads.

In developing and establishing reference conditions from best available data, frequency distributions are recommended by the *Nutrient Criteria Technical Guidance Manual for Rivers and Streams* (USEPA, 2000b) as the preferred method for setting nutrient criteria. ADEM typically utilizes the 90^{th} percentile of the data distributions from the ecoregion reference sites to establish targets; however, due to the limited number of available reference sites within ecoregion 65(f), the 75^{th} percentile of the data distributions was utilized to establish a more conservative target in this TMDL.

If the TP concentrations of the subject impaired stream are relatively the same or below reference condition levels, then the stream is considered not to be impaired for nutrients. If TP concentrations within the impaired stream are shown to be above reference conditions, then other water quality data and information are used in the evaluation. The additional data and information that can be used includes, but is certainly not limited to, diurnal dissolved oxygen readings, algal biomass measurements (periphyton or suspended algae), habitat assessments, and macroinvertebrate and fish community indices.

The following specific steps were employed to determine the Puppy Creek TP target:

1. Ecological reference stations located in the same level IV ecoregion as Puppy Creek were identified. The whole watershed is included in Ecoregion 65(f) representing the **Southern Pine Plains and Hills** region.

2. Data from the reference stations in ecoregion 65(f) was organized into a spreadsheet where the 75^{th} percentile of all the TP data was calculated. This approach was considered to be appropriate in this TMDL due to the limited number of ecoreference stations (2) from which the target was established. These two stations are HLB-1 and BRE-1. Location information for these stations can be found under Table 3.4.1. There may be some variability in the specific application of the process for developing number nutrient targets, based on the variability in the data sets encountered from waterbody to waterbody.

3. Ecoreference station data employed to determine the TP target can be found in Appendix B.

3.2 Source Assessment

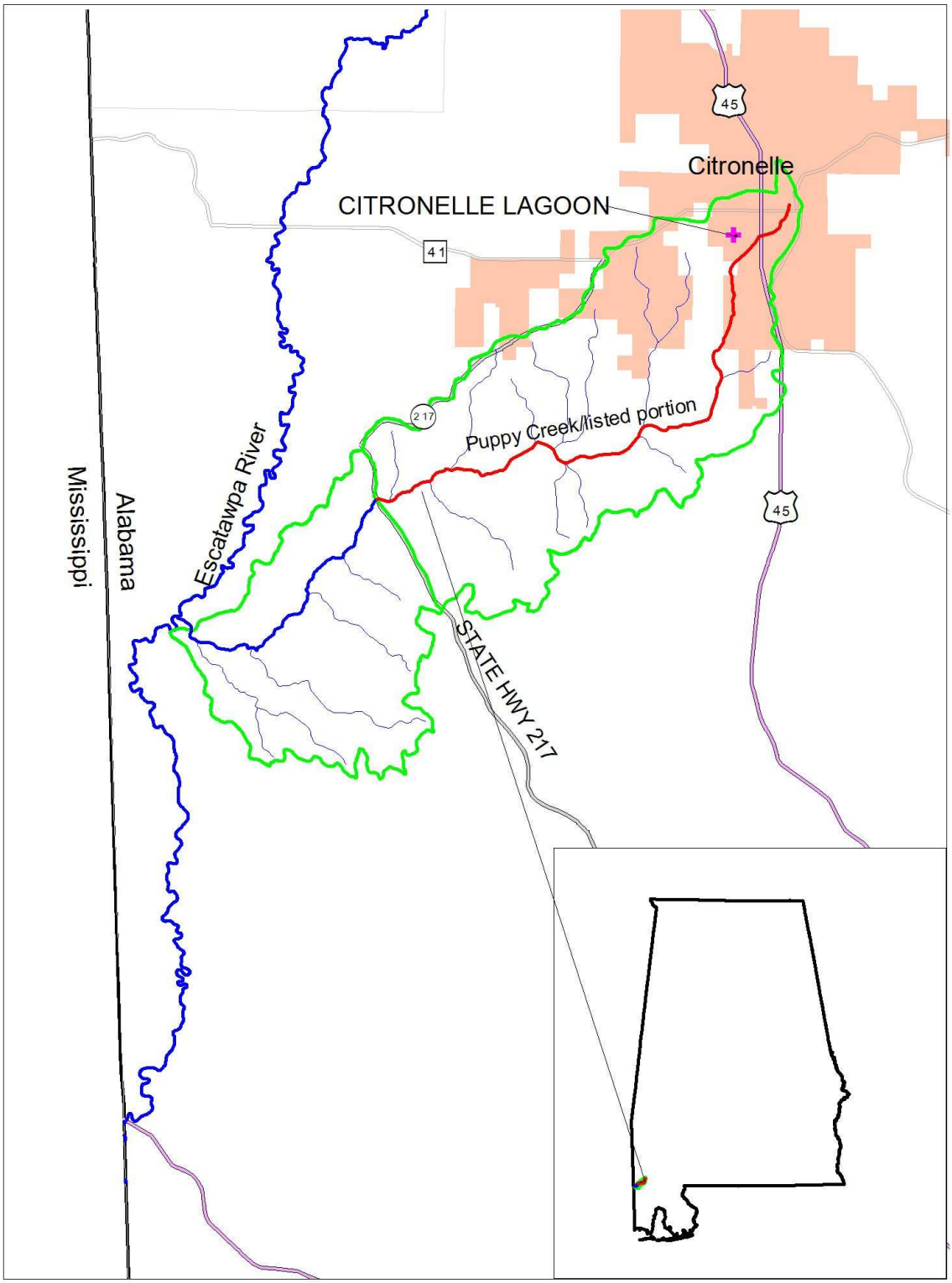
Point Sources in the Puppy Creek Watershed:
Point source considerations typically represent discharges from wastewater treatment plants, industrial operations, concentrated flows, etc. These operations generally result in some type of loading to the receiving stream. These loadings could be temperature, nutrients, organic matter, etc. There is one point source in the Puppy Creek watershed, the Citronelle Lagoon. The facility's NPDES permit number is AL0060887 and is currently permitted for a design flow of 0.36 mgd. Water quality data collected above and below the Citronelle Lagoon discharge location indicates the point source is a source of nutrients to Puppy Creek.

On December 20, 2006, ADEM issued an Administrative Order against South Alabama Utilities (Citronelle Lagoon) for NPDES permit violations. The Order requires the facility to remove its surface discharge from Puppy Creek. The facility's current permit does not include a TP or TN limit.

Puppy Creek is not included in any Municipal Separate Storm Sewer Systems (MS4) area.

Figure 3.2.1 is a map of the watershed, showing permitted point sources.

Figure 3.2.1: Point Source in the Puppy Creek Watershed



3.3 Landuse

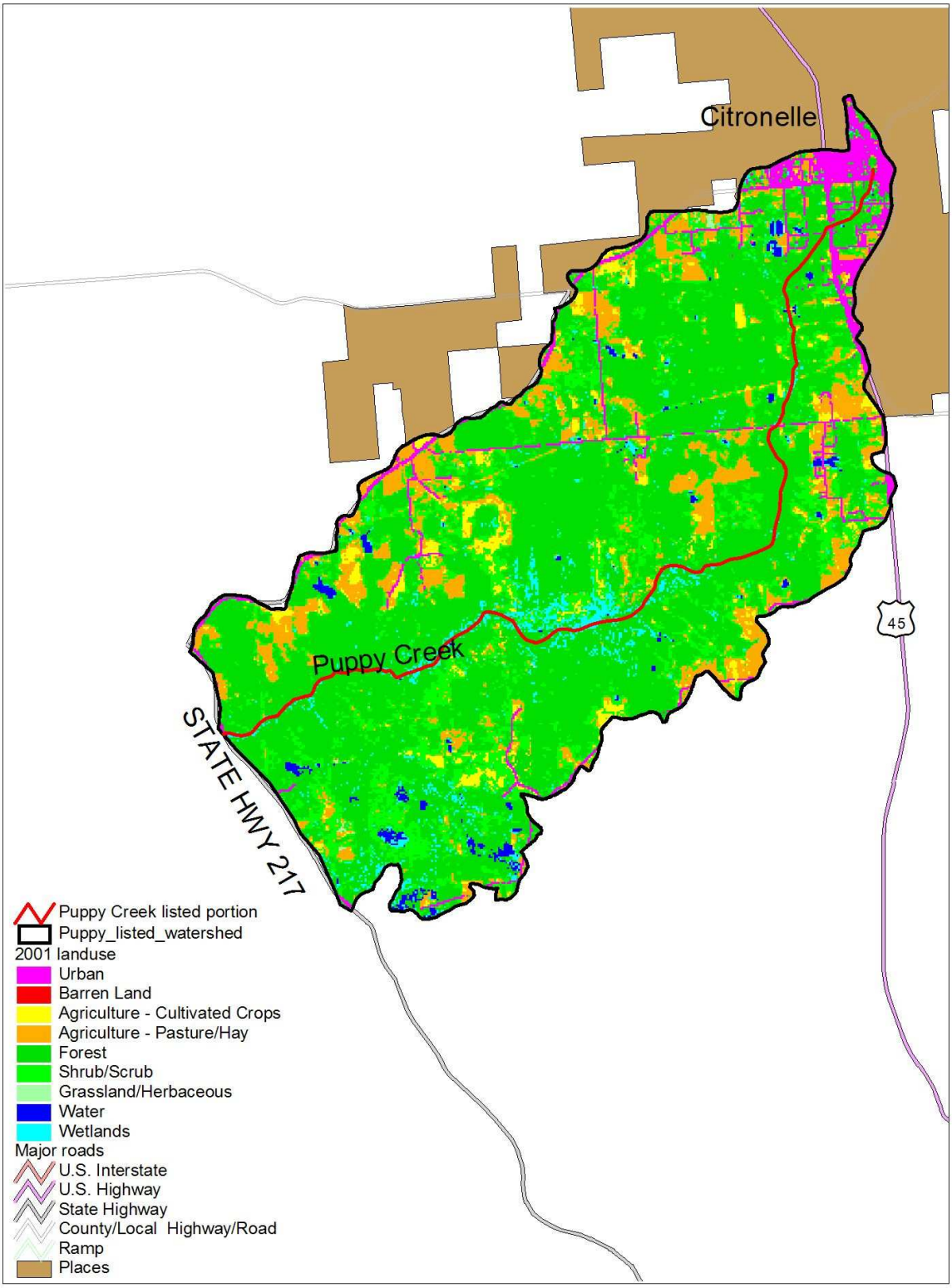
Nonpoint Sources in the Puppy Creek Watershed:
Shown in Table 3.3.1 is a summary of the land usage in the Puppy Creek watershed. The land use map of the watershed is presented in Figure 3.3.1. The predominate land uses within the watershed are agriculture, forest, and shrub/scrub lands (National Land Cover Dataset (NLCD), 2001).

Each landuse has the potential to contribute to the nutrient loading in the watershed due to nutrients on the land surface that potentially can be washed off into the receiving waters of the watershed. Possible non-point source contributions of impairment could include failing septic systems, and agricultural runoff.

Table 3.3.1: Landuse in the Puppy Creek Watershed

2001 nlcd name	Puppy Creek (sq. miles)	Puppy Creek (%)
Open Water	0.30	1%
Developed Open Space	1.06	4%
Developed Low Intensity	0.22	1%
Developed Medium Intensity	0.09	0%
Developed High Intensity	0.02	0%
Deciduous Forest	0.97	3%
Evergreen Forest	10.88	39%
Mixed Forest	4.87	17%
Shrub/Scrub	4.57	16%
Grassland/Herbaceous	0.05	0%
Pasture/Hay	3.22	11%
Cultivated Crops	0.98	3%
Woody Wetlands	0.82	3%
Emergent Herbaceous Wetlands	0.06	0%
total	28.11	100%
Aggregate Landuse	**(sq. miles)**	**(%)**
all developed	1.39	5%
all agricultural	4.21	15%
all forest	17.54	62%
other	4.97	18%
total	28.11	100%

Figure 3.3.1: 2001 Landuse in the Listed Portion of the Puppy Creek Watershed



3.4 Data Availability and Analysis

During the period of 1989 thru 1991 a Water Quality Demonstration Study (WQDS) was conducted on Puppy Creek to assess the effects of an upgrade to the Citronelle' WWTP. Data collected for the WQDS can be viewed in Appendix B. The complete report can be viewed at the following link:

http://www.adem.state.al.us/FieldOps/WQReports/Citronelle89&91.pdf

Data from Puppy Creek was collected in 1991 for the Alabama Clean Water Strategy sampling efforts, at two stations. Puppy Creek was sampled again in 1996 under Alabama's 1996 Clean Water Strategy. Four stations were sampled during three different months during 1996. Locations of the sampling stations can be found under Table 3.4.1. Data from this sampling period can be found in Appendix B. Puppy Creek was sampled again in 2001 and 2006 under Alabama's §303(d) sampling program. The sampling station locations are detailed in Table 3.4.1. Data from these sampling periods can also be found in Appendix B. Only the 2006 data is used in the development of this TMDL since it the most recent data and is expected to be the most representative of the current conditions of Puppy Creek.

Several habitat assessments have been conducted on Puppy Creek. A summary of these is located in Appendix B.

No biological assessment has been conducted in Puppy Creek upstream of Hwy 217, the end of the 303(d) listed segment. The stream is very braided and wetland conditions exist. The Department has not yet developed methodology for evaluating these types of streams.

Table 3.4.1: ADEM 303d Sampling Station Location Descriptions

Station Number	Waterbody Name	County	Location Description	Latitude	Longitude
PPYM-1	Puppy Creek	Mobile	Puppy Creek at Mobile Co. Rd. 21 near mouth.	30.9842	-88.4011
PPYM-2	Puppy Creek	Mobile	Puppy Creek at AL Hwy 217 crossing	31.018	-88.3476
PPYM-3	Puppy Creek	Mobile	Puppy Creek at Russell Road crossing	31.0563	-88.268
PPYM-4	Puppy Creek	Mobile	Puppy Creek approx 0.5 mile downstream of Citronelle WWTP at pipeline crossing.	31.0614	-88.2694
PPYM-5	Puppy Creek	Mobile	Puppy Creek just upstream of the Citronelle WWTP.	31.064	-88.2711

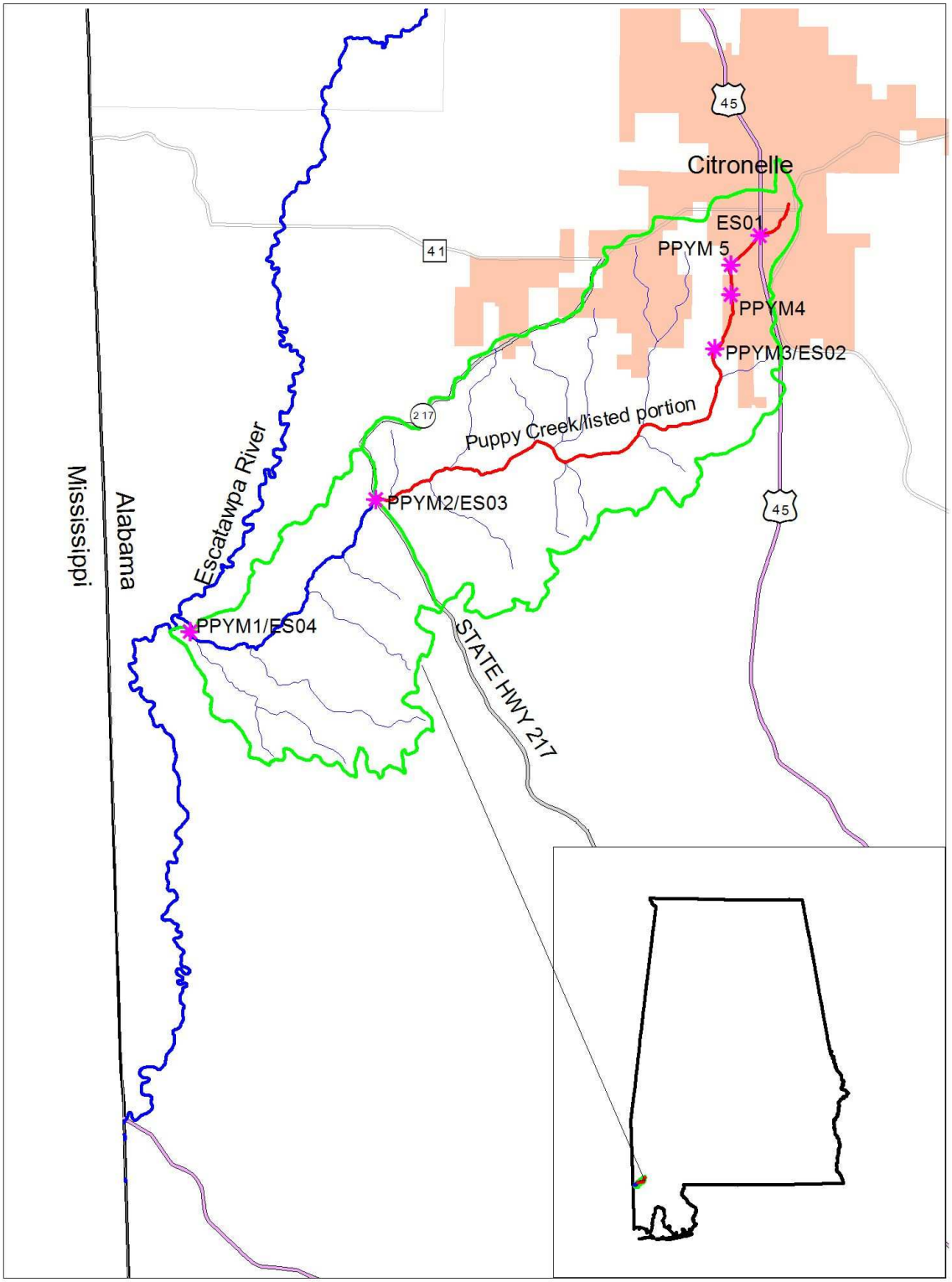
1996 Escatawpa River Basin CWS Stations				
Station	**Waterbody Name**	**Station Description**	**Latitude**	**Longitude**
ES01	Puppy Creek	AL Hwy 45	31.08297	-88.238111
ES02	Puppy Creek	Russell Road SE 1/4, Sec. 11, T1N, R3W	31.05583	-88.25
ES03	Puppy Creek	AL Hwy 217	31.01778	-88.348138
ES04	Puppy Creek	Mobile Co. Rd. 21	30.98411	-88.401194

Water Quality Ddemonstration Study Stations				
Station	**Waterbody Name**	**Station Description**	**Latitude**	**Longitude**
PC-1	Puppy Creek	AL Hwy 45	31.08297	-88.238111
PC-2A	Puppy Creek	Russell Road SE 1/4, Sec. 11, T1N, R3W	31.05583	-88.25
PC-1A	Puppy Creek	~100 Yards US of WWTP	31.07794	-88.24522
PC-1B	Puppy Creek	~0.5 miles DS of WWTP	31.06972	-88.24547

Ecoreference Stations – Ecoregion 65(f):

Station_ID	Stream Name	Station_description	Latitude	Longitude
BRE-1	Bear Creek	Bear Creek on dirt trail off Escambia Co Rd 51 approximately 0.7 miles upstream of confluence with Blackwater River (off old Rand Rd)	31.03334	-86.70961
HLB-1	Halls Creek	Halls Creek @ AL. Hwy 59. North of Stockton just upstream of bridge	31.05264	-87.83701

Figure 3.4.1: Map of ADEM Sampling Stations



4.0 Total Maximum Daily Load Development for Puppy Creek

This section presents the TMDL developed to address nutrients for Puppy Creek. A TMDL is the total amount of a pollution load that can be assimilated by the receiving water while still achieving water quality standards. TMDLs can be expressed in terms of mass per time or by other appropriate measures. TMDLs are comprised of the sum of individual waste load allocations (WLAs) for point sources, load allocations (LAs) for non-point sources, and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the following equation:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

In order to develop the TMDL, the following steps will be defined:

1. Numeric Target for TMDL
2. Existing/Baseline Conditions
3. Critical Conditions
4. Margin of Safety
5. Seasonal Variation
6. TMDL Calculation Method and Results

4.1 TMDL Numeric Target

The TMDL endpoint represents the in-stream water quality target used in quantifying the load reduction that maintains water quality standards. The TMDL endpoint can be a combination of water quality standards, both numeric and narrative, and surrogate parameters that would ensure the standards are being met.

Target pollutants for nutrient impaired waterbodies are chosen on a case by case basis. For Puppy Creek, only total phosphorus (TP) is included in this TMDL. The existing total nitrogen (TN) concentration in Puppy Creek is estimated to be lower than the reference condition concentration; therefore, TN does not appear to contribute to the existing nutrient impairment in Puppy Creek. Downstream uses are also not expected to be impacted by the existing TN loads.

Establishing a TP target that fully supports the designated uses of Puppy Creek is part of the lengthy and complex process of TMDL development. The nutrient target was developed using a “reference condition” approach using data from eco-region 65(f) and taking the 75^{th} percentile of this data to calculate the target concentration. The TP target concentrations for Puppy Creek is 0.022 mg/L.

4.2 Existing/Baseline Conditions

The results of using in-stream data provide the existing condition for Puppy Creek. Existing conditions for non-point source loading for Puppy Creek will be based on the most recent data collected in 2006. Station PPYM-5 was selected as the most appropriate location for non-point source (NPS) load calculations because it is upstream of any point source discharge; therefore, it has no influence from point sources. Data and calculations for NPS loads is included in Section 4.6.

Since the TMDL for Puppy Creek has no WLA, no existing load will be calculated for the point source. In addition, calculation of an existing load from the point source would be difficult due to very limited TP data from the Citronelle Lagoon discharge.

4.3 Critical Conditions

It is important when developing a TMDL that it is protective of water quality over a range of possible conditions that might occur within the listed segment. In EPA's Nutrient Criteria Technical Guidance Manual: Rivers and Streams, it states that 'Nutrient and algal problems are frequently seasonal in streams and rivers, so sampling periods can be targeted to the seasonal periods associated with nuisance problems.' ADEM has determined that the seasonal period associated with nutrient enrichment that results in nuisance algal problems for Puppy Creek is the growing season of April through October. Typically, critical conditions specify a flow that will represent an extreme low flow regime or a loading that represents a high possible value. If the growing season median concentration is less than the target concentration, then the loading to the system is said to be protective of water quality. However, if the growing season median concentration is greater than the target, then the loading may not be protective of water quality. This loading, therefore, needs to be reduced until the target concentration is met. The loading that is referred to in this system is total phosphorus.

Critical conditions employed for this TMDL include the growing season months (April-October) for algal populations.

4.4 Margin of Safety

There are two methods for incorporating a MOS in the analysis: a) by implicitly incorporating the MOS using conservative model assumptions to develop allocations; b) by explicitly specifying a portion of the TMDL as the MOS and using the remainder for allocations.

The MOS in this TMDL is implicit since the total phosphorus target was derived using ecological reference streams, which are considered to represent least impacted conditions. Also, a mass balance procedure was employed to estimate allowable TP loads to Puppy Creek. Since no algal uptake is considered in this approach, the allowable TP loads will be conservative.

4.5 Seasonal Variation

The TP numeric target is a single value which represents the range of values measured over multiple-year growing seasons at the designated reference sites. Therefore, application and interpretation of the nutrient target for Puppy Creek should consider that ambient TP concentrations may exceed the target at times while still maintaining conditions similar to those in streams that fully support the designated use of aquatic life, as long as the growing season median concentration is maintained. Application of the proposed nutrient target of 0.022 mg/L for TP must consider the methodology of the ecoregion reference stream approach that was used to develop the target. Ecoregion reference stream site data was assessed on a growing-season basis that accounts for natural variability. Therefore, it would be inappropriate to expect Puppy Creek not to exhibit natural variability during the growing season including higher, as well as lower, levels of phosphorus while attaining the growing season median target value. The April-October growing season was determined to be the appropriate time frame for managing TP to control periphyton in Puppy Creek. It was determined that winter reductions (i.e., non-growing season) would not be necessary since high flows, cool temperatures, and low availability of substrate and light, limit algal production. Application of the TP target may be reviewed based on future research as effects-based links become more tangible. It is a valid observation that certain streamflow will combine to result in TP levels higher and lower than the target.

4.6 TMDL Calculation Method and Results

4.6.1 Waste Load Allocation (WLA)

Based on information provided in Section 3.2 there will be no WLA component of the TMDL. Currently there is one point source, the Citronelle Lagoon, discharging to Puppy Creek. As previously indicated, this facility was issued an Administrative Order which requires the removal of the surface water discharge. .

4.6.2 Load Allocation (LA)

The LA for the Puppy Creek watershed was calculated based upon water quality data collected at station PPYM-5 located just upstream of the Citronelle Lagoon discharge. Station PPYM-5 was determined to be the most representative of non-point source (NPS) loading to Puppy Creek since it is not influenced from the WWTP discharge. It was determined that the ADEM 303(d) 2006 data set for PPYM-5 would be most representative of current NPS loadings to Puppy Creek. The 2006 data set is the most current data collected on Puppy Creek and monthly samples were collected through the growing season.

After the data set was chosen, TP loads were calculated for each sampling event. The median load value was then calculated from the growing season months (April – October). The median TP load value is considered to be the existing TP load allocation (LA) for Puppy Creek. The allowable LA was calculated using the same hydraulic conditions as used to compute the existing LA and the in-stream target value described in Section 4.1.1. The percent reductions were calculated from the existing load to the allowable load. Following are the monthly and median LA existing loads, LA allowable load, and the percent reduction needed to meet the allowable load:

Station_ID	Date	Stream Flow (cfs)	Total-P (mg/l)	Total-P (lbs/day)
PPYM-5*	3/22/2006	0.8	0.069	0.30
PPYM-5	4/18/2006	0.5	0.065	0.18
PPYM-5	5/10/2006	1.1	0.058	0.34
PPYM-5	6/21/2006	no visible flow	N/A	N/A
PPYM-5	7/20/2006	no visible flow	N/A	N/A
PPYM-5	8/10/2006	no visible flow	N/A	N/A
PPYM-5**	9/13/2006	100	0.043	23.18
PPYM-5	10/4/2006	no visible flow	N/A	N/A
Growing Season median load				0.34
* this sample included for info but was not used in calculations				
**flow was too dangerous to measure so an estimated value of 100 cfs was applied to calculate load				
	Target concentration		0.022	
		Allowable load		0.13
		Percent Reduction		62%

A summary table depicting values described above is shown below.

Polluant	Existing loads WLA	Existing loads LA	Allowable loads WLA	Allowable loads LA	Reductions WLA	Reductions LA
TP (lbs/day)	*	0.34	0.0	0.13	100%**	62%

* not calculated due to nutrient data not being reported from facility

** discharger under administrative order for removal

4.6.3 TMDL

The WLA and the LA components of the TMDL employ the same hydraulic conditions as used to calculate the allowable load discussed above. The TMDL values are shown below.

TMDL = WLA + LA + MOS*			
Polluant	**TMDL**	**WLA**	**LA**
TP (lbs/day)	0.13	0.00	0.13

*** implicit MOS**

5.0 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. The goal is to continue to monitor §303(d) listed waters. This monitoring will occur in each basin according to the following schedule:

Monitoring Schedule for Alabama's Major River Basins

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 WLA reductions and best management practices in the watershed.

6.0 Public Participation

As part of the public participation process, this TMDL will be placed on public notice and made available for review and comment. A public notice will be 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 will be made available on ADEM's Website: www.adem.state.al.us. The public can also request hard or electronic copies of the TMDL by contacting Ms. Daphne Smart at 334-271-7827 or dsmart@adem.state.al.us. The public will be given an opportunity to review the TMDL and submit comments to the Department in writing. At the end of the comment period, all written comments received during the public notice period will become part of the administrative record. ADEM will consider all comments received during the comment period by the public prior to final completion of this TMDL and subsequent submission to EPA Region 4 for final approval.

Appendix A

References

United States Environmental Protection Agency. 1991. Guidance for Water Quality-Based Decisions: The TMDL Process, Office of Water, EPA 440/4-91-001.

Alabama Clean Water Strategy Water Quality Assessment Report, 1996.

United States Environmental Protection Agency. 1999. Protocol for Developing Nutrient TMDLs, Office of Water, EPA 841-B-99-007.

USEPA 2000a. Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria. Rivers and Streams in Ecoregion XI. United States Environmental Protection Agency, Office of Water. EPA 822-B-00-020.

USEPA 2000b. Nutrient Criteria Technical Guidance Manual: River and Streams. United States Environmental Protection Agency, Office of Water. EPA 822-B-00-002.

Appendix B
Water Quality Data

Water Quality Demonstration Study Data

TABLE 1
WATER QUALITY DEMONSTRATION STUDY
PUPPY CREEK AT CITRONELLE, ALABAMA
DATA COLLECTED PRIOR TO UPGRADE

DATE	LOCATION	TIME	TEMP AIR	TEMP H2O	D.O.	pH	ALK	BOD5	TSS	TDS	HARD	COD	NH3-N	NO3-N	TKN	PO4-P	FLOW
07/27/89	@	1030				7.1	149	19	21	288	32	111	8.02	0.10	6.6	0.84	
10/13/89	WWTP	1015	22	22	4.7	7.7	163	27	35	168	25	179	3.09	0.03	10.	5.20	0.12
AVERAGE			22	22	4.7	7.4	156	23	28	228	29	145	5.55	0.07	8.7	3.02	0.12
07/27/89	PC-1A	1130			6	6.8	27	1	3	134	48	19	<0.05	0.06	0.3	0.10	0.86
10/13/89		1030	22	20	5.5	6	29	<1	6	160	47	10	0.4	0.31	0.8	0.12	0.36
AVERAGE			22	20	5.7	6.4	28	--	5	147	48	15	---	0.19	0.5	0.11	0.61
07/27/89	PC-1B	1200			3.6	6.1	21	<1	2	224	51	25	<0.05	0.21	0.5	0.13	
10/13/89		1155	22	20	2.8	6.2	50	<1	1	189	41	20	<0.05	0.64	0.7	0.33	0.48
AVERAGE			22	20	3.2	6.1	36	--	2	206	46	23	---	0.43	0.6	0.23	0.48
			C	C	ppm	S.U.	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	cfs

TABLE 2
WATER QUALITY DEMONSTRATION STUDY
PUPPY CREEK AT CITRONELLE, ALABAMA
DATA COLLECTED AFTER UPGRADE

DATE	LOCATION	TIME	TEMP AIR	TEMP H2O	D.O.	pH	SPEC COND	SAL	TURB	ALK	BOD5	CL	TSS	TDS	HARD	COD	NH3-N	NO3-N	TKN	PO4-P	FLOW	FECA COLI
07/17/91	@	1030		28	6.6	6.8	201			69	13		18	157	20	128	<0.01	<0.005	5.25	0.608	0.27	
08/14/91	WWTP	1200		27	5.9	7.2	220	0	42	68	17	19	35	177	28	84	0.32	<0.005	4.78	1.033	0.44	
09/25/91		1100	20	23	6.9	7.1	250	0	14.5	92	10		3	186	19	82	2.58	0.033	1	0.999	0.49	
10/28/91		1005	27	22	7.7	7.2	306	0	14.5	117	16		16	222	43	96	0.75	0.067	4.3	0.967	0.49	
AVERAGE			24	25	6.7	7.0	244	0	23.6	87	14	19	18	186	28	98	---	---	3.832	0.901	0.42	
07/17/91	PC-1	1225	29	25	3.8	6.2	102	0	8.7	29	1.6		2	73	32	28	0.16	0.025	0.87	0.081	0.96	2300
08/14/91		1324		24	5.1	6.2	92	0	12.4	24	<1	6	4	68	34	13	0.18	0.2	1.53	0.068	0.86	580
09/25/91		1130	20	21	4.5	6.3	84	0	9.4	19	1.9		1	36	22	22	0.27	0.048	0.92	0.078	1.33	5267
10/28/91		1040	25	21	3.2	6.3	119	0	13	35	2		4	65	37	19	0.44	0.075	1.2	0.103	0.54	1200
AVERAGE			25	23	4.1	6.2	99	0	10.8	27	---	6	3	61	31	21	0.26	0.087	1.13	0.082	0.92	2337
07/17/91	PC-2A	1325	30	26	6.3	6.2	123	0	7.8	21	<1		1	74	28	21	<0.01	0.082	1.39	0.074	1.23	13
08/14/91		1030		26	6.8	6.2	122	0	8.5	21	<1	19	1	88	32	23	0.06	0.58	1.51	0.092	1.3	140
09/25/91		1245	17	21	6	6.1	126	0	12	9	1.1		1	62	28	23	<0.01	0.105	<0.05	0.052	1.82	2800
10/28/91		1200	25	21	5.2	6.4	168	0	20	29	2.2		44	91	41	26	<0.01	0.043	1.2	0.092	1.03	467
AVERAGE			24	24	6.0	6.2	135	0	12.0	20	---	19	12	79	32	23	---	0.202	---	0.077	1.35	885
			C	C	ppm	S.U.	umho	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	cfs	org 100

1991 Clean Water Strategy data

Table ES-3

ESCATAWPA RIVER BASIN SAMLPING DATA

Station	Date	Time	H_2O Temp. (deg. C)	pH (S.U.)	D.O. (mg/l)	Cond.	$CBOD_5$ (mg/l)	NH_3-N (mg/l)	TKN (mg/l)	NO_2+NO_3-N (mg/l)	PO_4-P (mg/l)	T-PO_4 (mg/l)	bacteria org/100ml
Puppy Creek (F&W) ES01	June 26	09:30	23.0	6.2	5.2	81	1.5	0.10	0.49	0.10	0.09		>1200
	July 17	12:25	25.0	6.2	**3.8**	102	1.6	0.16	0.87	0.02	0.08		**2300**
	August 14	13:25	24.0	6.2	5.1	92	<1.0	0.18	1.53	0.20	0.07		580
	Sept 25	11:30	21.0	6.3	**4.5**	84	1.9	0.27	0.92	0.05	0.08		**5267**
	Oct 28	10:40	21.0	6.3	**3.2**	119	2.0	0.44	1.20	0.07	0.10		1200
Puppy Creek (F&W) ES02	June 26	10:40	23.0	6.0	6.0	86	1.0	<0.01	0.50	0.08	0.11		600
	July 17	13:25	26.0	6.3	6.3	123	<1.0	<0.01	1.39	0.08	0.07		133
	August 14	10:30	24.0	6.2	6.8	122	<1.0	0.06	1.50	0.06	0.09		140
	Sept 25	12:45	21.0	6.2	6.0	126	1.1	<0.01	<0.05	0.10	0.05		**2800**
	Oct 28	12:00	21.0	6.4	5.2	168	2.2	<0.01	1.20	0.04	0.09		467

1996 CWS data

Station		ES01	ES01	ES01	ES02	ES02	ES02	ES03	ES03	ES03	ES04	ES04
Sampling Date		6/12/1996	9/23/1996	10/16/1996	6/12/1996	9/23/1996	10/16/1996	6/12/1996	9/23/1996	10/16/1996	6/12/1996	9/23/1996
Sampling Time		10:50 AM	11:15 AM	10:30 AM	11:20 AM	11:45 AM	10:10 AM	11:50 AM	12:00 PM	8:45 AM	12:15 PM	12:30 PM
Total Water Depth	ft	0.5	0.5	0.5	1.3	0.5	1.5	1	1	1	1	1.5
Depth of Sample	ft	0.25	0.25	0.25	0.25	0.25	0.7	0.25	0.5	0.5	0.25	0.75
Air Temperature	℃	30	24	22	30	30	22	27	30	20	30	30
Water Temperature	℃	23	21	18	22	20	18	24	21	17	24	21
pH	s.u.	6.3	6.4	6.3	6.6	6.6	6.6	6.6	6.6	6.4	6	6
Dissolved Oxygen	mg/L	4.4	4.6	6	4.9	5.9	7	8.5	8.6	9	8.1	8.6
Conductivity	mmhos	102	90	94	146	157	179	43	51	56	37	39
Cond at 25 ℃	mmhos	93	92	100	133	143	190	41	47	62	34	36
Turbidity	ntu	24	18.3	21	7.5	5.6	3.8	7.2	5.8	3.9	6.6	6.3
BOD5	mg/L	2.1	2K	1	1.4	2K	1K	1.2	2K	1.2	1.2	2K
NH3-N	mg/L	0.147	0.11	0.01	0.06	0.04	0.02	0.01K	0.01K	0.01	0.01K	0.04
TKN	mg/L	0.68	0.91	1.3	0.63	0.71	1.2	0.04	0.4	0.88	0.29	0.17
NO2+NO3-N	mg/L	0.005K	0.005K	0.005K	0.005K	0.087	0.049	0.005K	0.005K	0.055	0.032	0.162
PO4-P	mg/L	0.113	0.078	0.042	0.144	0.068	0.014	0.022	0.005	0.005	0.015	0.005
Fecal Coliform	MPN	194	56	90	160L	43	67	160L	62	106	160L	97

ADEM 2001 303(d) data

Station Number	Date	Flow (cfs)	Total P (mg/l)	T-PO4 out of range	Total N (mg/l)
PPYM-1	4/16/2001	55.6	0.07		0.598
PPYM-1	5/16/2001	12.5	0.037		0.506
PPYM-1	6/21/2001	28.6	0.05		0.308
PPYM-1	8/9/2001	45.1	0.004	LDL	0.336
PPYM-1	8/15/2001	3.2	0.09		0.672
PPYM-1	8/16/2001	38.9	0.004	LDL	0.431
PPYM-2	4/16/2001	32.4	0.07		0.592
PPYM-2	5/17/2001	3.9	0.052		0.232
PPYM-2	6/20/2001	34.2	0.05		0.204
PPYM-2	8/9/2001	30.1	0.004	LDL	0.391
PPYM-2	8/15/2001	45.2	0.004	LDL	0.319
PPYM-2	8/16/2001	40.2	0.004	LDL	0.329
PPYM-3	4/17/2001	6.3	0.22		0.472
PPYM-3	5/16/2001	1.5	0.273		2.003
PPYM-3	6/20/2001	5.6	0.17		1.082
PPYM-3	8/14/2001	8.4	0.09		2.616
PPYM-4	4/16/2001	2.1	0.29		2.178
PPYM-4	5/16/2001	1.3	0.653		2.769
PPYM-4	6/20/2001	2.8	0.26		1.544
PPYM-4	8/14/2001	3.2	0.26		2.102
PPYM-4	8/15/2001	2.8	0.28		1.916
PPYM-5	4/16/2001	2.9	0.13		0.153
PPYM-5	5/16/2001	.5	0.085		0.251
PPYM-5	6/20/2001	2.2	0.1		0.206
PPYM-5	8/14/2001	1.4	0.05		0.213
PPYM-5	8/15/2001	1.4	0.07		0.374

ADEM 2006 303(d) data

Station_ID	Date	Stream Flow (cfs)	Reason No Flow	Total-P (mg/l)	Total-N (mg/l)
PPYM-1	3/22/2006	27.4		0.004	0.406
PPYM-1	4/18/2006	16.5		0.189	0.677
PPYM-1	5/10/2006	109.5		0.054	0.486
PPYM-1	6/21/2006	10.3		0.029	2.463
PPYM-1	6/21/2006	10.3		0.03	4.95
PPYM-1	7/20/2006	20.3		0.016	0.673
PPYM-1	8/10/2006	36.1		0.028	1.11
PPYM-1	9/13/2006		flow conditions dangerous	0.041	1.26
PPYM-1	10/4/2006	11		0.01	0.758
					0
PPYM-2	3/22/2006	17.5		0.066	0.5
PPYM-2	4/18/2006	6.1		0.123	0.347
PPYM-2	5/10/2006	77.1		0.057	0.423
PPYM-2	6/21/2006	3.3		0.034	4.405
PPYM-2	7/20/2006	5.9		0.016	0.655
PPYM-2	8/10/2006	26.8		0.022	0.674
PPYM-2	9/13/2006		flow conditions dangerous	0.046	1.178
PPYM-2	10/4/2006	4.5		0.053	0.307
					0
PPYM-3	3/22/2006	2.6		0.151	0.941
PPYM-3	4/18/2006	1.2		0.29	1.085
PPYM-3	5/10/2006	4.8		0.205	0.773
PPYM-3	6/21/2006	0.8		0.32	3.132
PPYM-3	7/20/2006	0.6		0.404	1.536
PPYM-3	8/10/2006	3.4		0.269	1.109
PPYM-3	9/13/2006		flow conditions dangerous	0.112	1.24
PPYM-3	10/4/2006	0.7		0.395	1.339
					0
PPYM-4	3/22/2006	3.7		0.219	1.434
PPYM-4	4/18/2006		visible but not detectable	0.424	1.569
PPYM-4	5/10/2006		visible but not detectable	0.421	1.321
PPYM-4	6/21/2006		visible but not detectable	0.83	3.405
PPYM-4	7/20/2006		visible but not detectable	1.13	2.185
PPYM-4	8/10/2006		not wadeable (too deep)	0.462	1.142
PPYM-4	9/13/2006		not wadeable (too deep)	0.24	1.507
PPYM-4	10/4/2006		not wadeable (too deep)	0.917	2.361
					0
PPYM-5	3/22/2006	0.8		0.069	0.617
PPYM-5	4/18/2006	0.5		0.065	0.806
PPYM-5	5/10/2006	1.1		0.058	0.335
PPYM-5	6/21/2006		no visible flow	N/A	N/A
PPYM-5	7/20/2006		no visible flow	N/A	N/A
PPYM-5	8/10/2006		no visible flow	N/A	N/A
PPYM-5	9/13/2006		flow conditions dangerous	0.043	0.871
PPYM-5	10/4/2006		no visible flow	N/A	N/A

Habitat Assessments

Station Number	Date	Instream habitat quality	Sediment deposition	Sinuosity	Bank and vegetative Stability	Riparian Measurements	G/P % Max HA Score	Assessment (% Max HA Score)
PPYM001	5/2/2001	44	66	40	55	91	59	Good
PPYM001	5/17/2001	42	68	43	48	95	57	Good
PPYM001	3/6/2002	42	68	35	60	85	58	Good
PPYM002	5/2/2001	24	69	33	55	95	54	Good
PPYM002	5/17/2001	29	65	40	48	95	53	Good
PPYM002	3/6/2002	22	78	20	55	100	55	Good
PPYM003	5/2/2001	65	86	83	88	95	82	Excellent
PPYM003	3/6/2002	65	85	85	90	95	82	Excellent
PPYM004	5/2/2001	48	70	88	81	88	73	Excellent
PPYM004	3/6/2002	48	75	75	83	93	74	Excellent
PPYM005	5/2/2001	48	74	68	75	98	70	Excellent
PPYM005	3/6/2002	42	75	75	78	100	71	Excellent

Ecoreference Data

Station_ID	Date	Total-P (mg/l)	Total-N (mg/l)
BRE-1	7/23/1991	0.02	0.92
BRE-1	7/23/1991	0.03	0.62
BRE-1	8/27/1991	0.02	1
BRE-1	7/8/1992	0.004	0.804
BRE-1	7/8/1992	0.14	0.721
BRE-1	6/10/1993	0.007	0.757
BRE-1	6/10/1993	0.011	0.779
BRE-1	5/3/1995	0.007	0.36
BRE-1	5/3/1995	0.014	0.36
BRE-1	5/28/1998	0.004	0.57
BRE-1	7/14/1998	0.005	0.43
BRE-1	10/5/1998	0.01	0.29
BRE-1	5/19/1999	0.007	0.523
BRE-1	6/14/1999	0.008	0.336
BRE-1	6/24/1999	0.007	0.634
BRE-1	9/15/1999	0.007	0.98
BRE-1	9/4/2001	0.004	0.52
BRE-1	4/7/2004	0.02	0.472
BRE-1	5/13/2004	0.029	0.491
BRE-1	6/30/2004	0.042	0.157
BRE-1	7/22/2004	0.005	0.565
BRE-1	8/11/2004	0.024	0.371
BRE-1	9/15/2004	0.094	0.637
BRE-1	10/14/2004	0.03	0.306
HLB-1	7/23/1991	0.03	0.53
HLB-1	7/7/1992	0.006	0.345
HLB-1	6/8/1993	0.012	0.763
HLB-1	6/14/1994	0.009	0.354
HLB-1	4/27/1995	0.1	0.18
HLB-1	10/2/1997	0.004	0.23
HLB-1	5/27/1998	0.004	0.25
HLB-1	7/14/1998	0.004	0.4
HLB-1	10/5/1998	0.008	0.18
HLB-1	5/13/1999	0.005	0.467
HLB-1	6/1/1999	0.012	0.634
HLB-1	6/21/1999	0.008	0.422
HLB-1	7/13/1999	0.04	0.65
HLB-1	9/2/1999	0.005	0.23
HLB-1	9/4/2001	0.01	0.234
HLB-1	4/8/2004	0.022	0.193
HLB-1	4/8/2004	0.022	0.252
HLB-1	5/10/2004	0.017	1.113
HLB-1	6/3/2004	0.015	0.398
HLB-1	7/8/2004	0.009	0.167
HLB-1	7/8/2004	0.009	0.179
HLB-1	8/26/2004	0.012	0.46
HLB-1	9/22/2004	0.036	0.392
HLB-1	10/26/2004	0.018	0.286
HLB-1	4/4/2006	0.014	0.153
HLB-1	5/2/2006	0.022	0.196
HLB-1	5/2/2006	0.016	0.179
HLB-1	6/7/2006	0.023	0.34
HLB-1	7/5/2006	0.023	0.427
HLB-1	8/1/2006	0.01	0.382
HLB-1	9/12/2006	0.004	0.451
HLB-1	10/3/2006	0.008	0.174
75th percentile		**0.022**	**0.58**

TN load calculations

Station_ID	Date	Stream Flow (cfs)	TN (mg/l)	TN (lbs/day)
PPYM-5*	3/22/2006	0.8	0.617	2.66
PPYM-5	4/18/2006	0.5	0.806	2.17
PPYM-5	5/10/2006	1.1	0.335	1.99
PPYM-5	6/21/2006	no visible flow	N/A	N/A
PPYM-5	7/20/2006	no visible flow	N/A	N/A
PPYM-5	8/10/2006	no visible flow	N/A	N/A
PPYM-5**	9/13/2006	100	0.871	469.49
PPYM-5	10/4/2006	no visible flow	N/A	N/A
Growing Season median load				2.17
* this sample included for info but was not used in calculations				
**flow was too dangerous to measure so an estimated value of 100 cfs was applied to calculate load				
Ecoregion 75th percentile concentration			0.58	
		Allowable load		3.44
		Percent Reduction		N/A