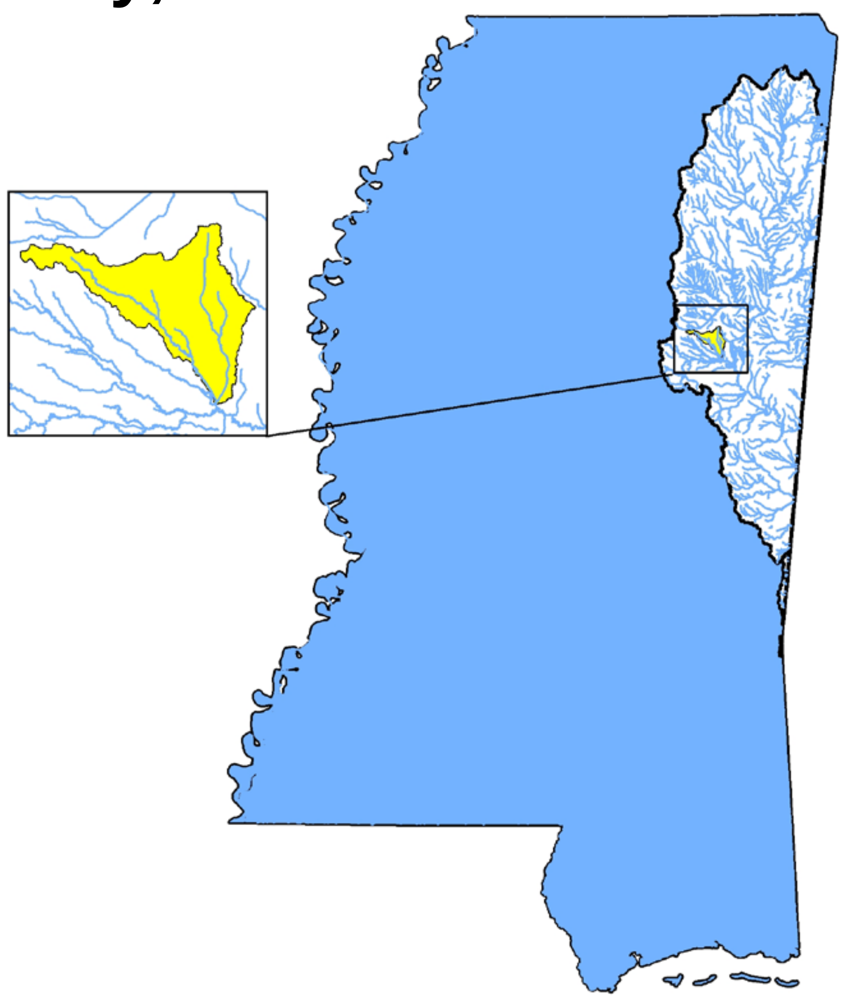
FINAL REPORT
December 2011

# Total Maximum Daily Load

## Biological Impairment Due to Organic Enrichment / Low Dissolved Oxygen For Hollis Creek

## Tombigbee River Basin

## Oktibbeha County, Mississippi



Prepared By

**Mississippi Department of Environmental Quality**
**Office of Pollution Control**
**Standards, Modeling and TMDL Branch**

**MDEQ**
**PO Box 2261**
**Jackson, MS 39225**
**(601) 961-5171**
**www.deq.state.ms.us**

Mississippi Department of
Environmental Quality

# FOREWORD

The report contains one or more Total Maximum Daily Loads (TMDLs) for water body segments found on Mississippi's current Section 303(d) List of Impaired Water Bodies. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, modifications to the water quality standards or criteria, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

**Conversion Factors**

| To convert from | To | Multiply by | To convert from | To | Multiply by |
|---|---|---|---|---|---|
| $mile^2$ | acre | 640 | acre | $ft^2$ | 43560 |
| $km^2$ | acre | 247.1 | days | seconds | 86400 |
| $m^3$ | $ft^3$ | 35.3 | meters | feet | 3.28 |
| $ft^3$ | gallons | 7.48 | $ft^3$ | gallons | 7.48 |
| $ft^3$ | liters | 28.3 | hectares | acres | 2.47 |
| cfs | gal/min | 448.8 | miles | meters | 1609.3 |
| cfs | MGD | 0.646 | tonnes | tons | 1.1 |
| $m^3$ | gallons | 264.2 | μg/l * cfs | gm/day | 2.45 |
| $m^3$ | liters | 1000 | μg/l * MGD | gm/day | 3.79 |

| Fraction | Prefix | Symbol | Multiple | Prefix | Symbol |
|---|---|---|---|---|---|
| $10^{-1}$ | deci | d | 10 | deka | da |
| $10^{-2}$ | centi | c | $10^2$ | hecto | h |
| $10^{-3}$ | milli | m | $10^3$ | kilo | k |
| $10^{-6}$ | micro | : | $10^6$ | mega | M |
| $10^{-9}$ | nano | n | $10^9$ | giga | G |
| $10^{-12}$ | pico | p | $10^{12}$ | tera | T |
| $10^{-15}$ | femto | f | $10^{15}$ | peta | P |
| $10^{-18}$ | atto | a | $10^{18}$ | exa | E |

# TABLE OF CONTENTS

# FIGURES



# TABLES

# TMDL INFORMATION PAGE

**Table 1. Listing Information**

| Name | ID | County | HUC | Cause | Stressors |
|---|---|---|---|---|---|
| **Hollis Creek** | 812211 | Oktibbeha | 03160108 | Biological Impairment | Organic Enrichment / Low Dissolved Oxygen |
| Location: Near Starkville from headwaters to the Noxubee River | | | | | |

**Table 2. Water Quality Standards**

| Parameter | Beneficial use | Water Quality Criteria |
|---|---|---|
| **Dissolved Oxygen** | Aquatic Life Support | DO concentrations shall be maintained at a daily average of not less than 5.0 mg/l with an instantaneous minimum of not less than 4.0 mg/l |

**Table 3. NPDES Facilities**

| NPDES ID | Facility Name | Permitted Discharge (MGD) | Receiving Water |
|---|---|---|---|
| MS0029178 | Starkville Country Club | 0.009 | Skinner Creek thence Hollis Creek |
| MS0036145 | Starkville POTW | 10 | Hollis Creek |
| MS0053180 | Montgomery Quarters, LLC, Mobile Home Park | 0.03 | Unnamed Tributary thence Hollis Creek |
| MS0055671 | Grand Oaks Subdivision | 0.04 | Skinner Creek thence Hollis Creek |

**Table 4. Total Maximum Daily Load**

| Pollutant | WLA (lbs/day) | LA (lbs/day) | MOS | TMDL (lbs/day) |
|---|---|---|---|---|
| TBODu | 2,713.65 | 0* | Implicit | 2,713.65 |

*No LA during critical condition

# EXECUTIVE SUMMARY

This TMDL is for Hollis Creek which was placed on the Mississippi 2010 Section 303(d) List of Impaired Water Bodies due to monitoring which indicated biological impairment. Total Nitrogen (TN), Total Phosphorous (TP), and organic enrichment / low dissolved oxygen are the probable primary stressors. The nutrients will be addressed in a separate TMDL. This TMDL will provide an allocation for Total Biological Oxygen Demand (TBODu) in the watershed.

The Hollis Creek Watershed is located in HUC 03160108 near Starkville. Hollis Creek flows for 11.3 miles in a in a southerly direction from its headwaters near Starkville to the confluence with the Noxubee River.

**Figure 1. Hollis Creek**

# INTRODUCTION

## 1.1 Background

The identification of water bodies not meeting their designated use and the development of total maximum daily loads (TMDLs) for those water bodies are required by Section 303(d) of the Clean Water Act and the Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (40 CFR part 130). The TMDL process is designed to restore and maintain the quality of those impaired water bodies through the establishment of pollutant specific allowable loads. This TMDL has been developed for the 2010 §303(d) listed segment shown in Figure 2.

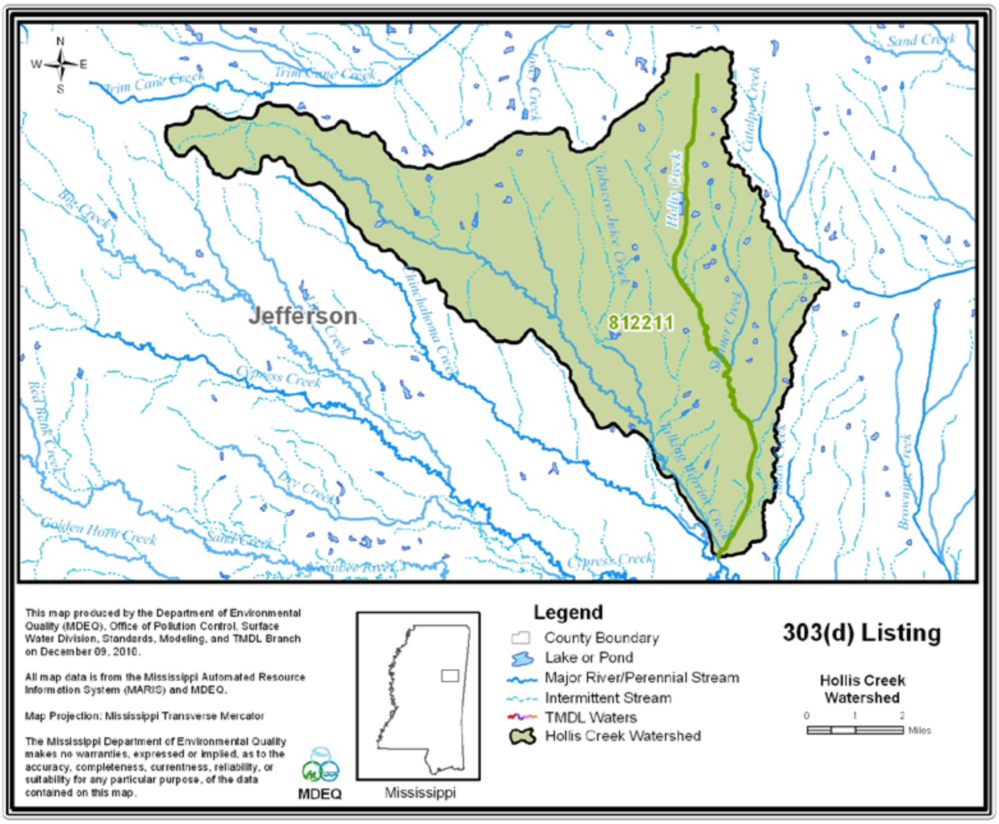



**Figure 2. Hollis Creek §303(d) Segment**

MDEQ began a biological monitoring program, the M-BISQ, to monitor streams throughout the state to confirm water quality based on the health of the biology in the stream. Hollis Creek was confirmed as impaired based on the biological monitoring.

## 1.2 Stressor Identification

The impaired segment was listed due to failure to meet minimum water quality criteria for aquatic use support based on biological sampling (MDEQ, 2003). Because of these results, a detailed assessment of the watershed and potential pollutant sources, called a stressor identification report, was developed for Hollis Creek. The purpose of the stressor identification process is to identify the stressors and their sources most likely causing degradation of instream biological conditions. The results indicate that TN, TP, and organic enrichment were probable primary stressors for Hollis Creek (MDEQ, 2010). This TMDL will address organic enrichment; TN and TP will be addressed in a separate TMDL

## 1.3 Applicable Water Body Segment Use and Standard

The water use classifications are established by the State of Mississippi in the document *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2007). The designated beneficial use for the listed segment is fish and wildlife.

The water quality standard applicable to the use of the water body and the pollutant of concern is defined in the *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2007).

# WATER BODY ASSESSMENT

## 2.1 Hollis Creek Water Quality Data

Dissolved oxygen data for the Hollis Creek Watershed were gathered and are shown in Table 5. Data exist for the §303(d)-listed segment of Hollis Creek based on samples collected during the §303(d)/M-BISQ monitoring project, MDEQ's nutrient criteria development monitoring, and as part of MDEQ's ambient monitoring program. The locations of the water quality monitoring stations are shown in Figure 3.

**Table 5. Hollis Creek Dissolved Oxygen Data**

| Station | Program | Water Body | Date | Time | DO (mg/l) | DO (% Sat) |
|---|---|---|---|---|---|---|
| 1018 | MBISQ | Hollis Creek | 2/14/2006 | 15:30 | 13.63 | 119.0 |
| 190 | MBISQ | Hollis Creek | 2/14/2001 | 07:46 | 9.34 | 89.2 |
| 190 | Nutrient | Hollis Creek | 3/25/2004 | 14:30:00 | 10.09 | 106.7 |
| 190 | Nutrient | Hollis Creek | 4/14/2004 | 8:30:00 | 12.26 | 104.3 |
| 190 | Nutrient | Hollis Creek | 8/19/2004 | 9:00:00 | 6.07 | 71.3 |
| 190 | Nutrient | Hollis Creek | 9/14/2004 | 14:00:00 | 5.65 | 66.1 |
| 190 | Nutrient | Hollis Creek | 3/11/2005 | 7:30:00 | 10.51 | 95.8 |
| 190 | Nutrient | Hollis Creek | 4/21/2005 | 10:50:00 | 8.1 | 86 |
| 190 | Nutrient | Hollis Creek | 8/23/2005 | 14:05:00 | 4.33 | 53.3 |
| 190 | Nutrient | Hollis Creek | 9/28/2005 | 15:05:00 | 9.71 | 117.2 |
| 190 | Nutrient | Hollis Creek | 10/10/2005 | 16:05:00 | 9.27 | 99.6 |
| TB59 | Ambient | Hollis Creek | 6/15/1999 | 10:00:00 | 8.89 | 105.4 |
| TB59 | Ambient | Hollis Creek | 4/10/2000 | 11:50:00 | 13.2 | 130.4 |
| TB59 | Ambient | Hollis Creek | 4/10/2001 | 11:30:00 | 10.62 | 124.1 |
| TB59 | Ambient | Hollis Creek | 5/21/2001 | 11:30:00 | 10.94 | 129.2 |
| TB59 | Ambient | Hollis Creek | 6/20/2001 | 10:25:00 | 11.22 | 135.6 |
| TB59 | Ambient | Hollis Creek | 7/18/2001 | 10:35:00 | 12.35 | 149.2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| TB59 | Ambient | Hollis Creek | 9/18/2001 | 10:30:00 | 12.8 | 148.8 |
| TB59 | Ambient | Hollis Creek | 10/22/2001 | 11:30:00 | 12.11 | 128.4 |
| TB59 | Ambient | Hollis Creek | 11/6/2001 | 10:30:00 | 14.89 | 143.6 |

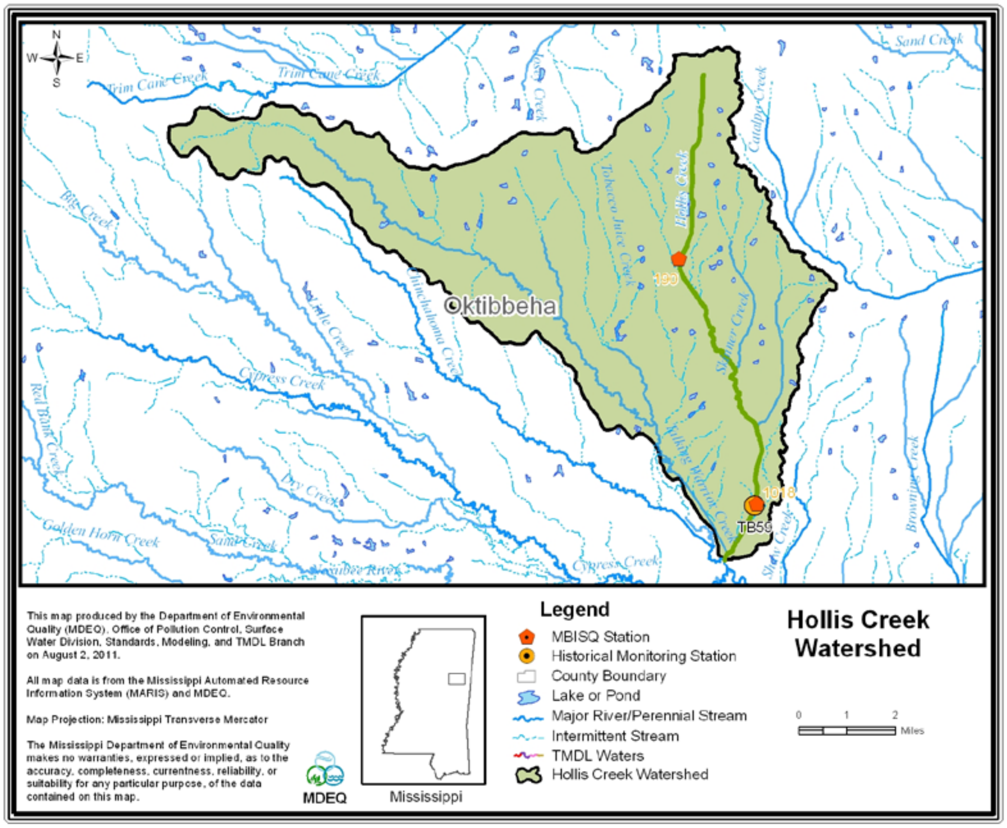



**Figure 3. Hollis Creek Water Quality Monitoring Stations**

## 2.2 Assessment of Point Sources

The locations of the M-BISQ sites and the ambient water quality station are approximately located at river mile 7.4 of Hollis Creek and river mile 1.4 of Hollis Creek respectively. Talking Warrior Creek is a tributary of Hollis Creek which enters Hollis Creek at approximately river mile 0.2. Therefore, the point sources present in the Talking Warrior Creek portion of the watershed are not contributing to any impairment found at the water quality stations.

There are 4 NPDES point sources in the watershed included in the TMDL as shown in Figure 4 below. One of these facilities, Starkville POTW, is a major facility (permitted flow > 1.0 MDG.) Table 6 lists the point sources and their permitted flows and BOD limits.

**Table 6. Point Sources**

| NPDES | Facility | Flow (MGD) | CBOD5 (mg/l) | NH3-N (mg/l) |
|---|---|---|---|---|
| MS0036145 | Starkville POTW | **10.0** | **10** | **2** |
| MS0029178 | Starkville Country Club | **0.009** | **30** | **2.645** |
| MS0053180 | Montgomery Quarters, LLC, Mobile Home Park | **0.03** | **30** | **NA** |
| MS0055671 | Grand Oaks Subdivison | **0.04** | **30** | **2** |

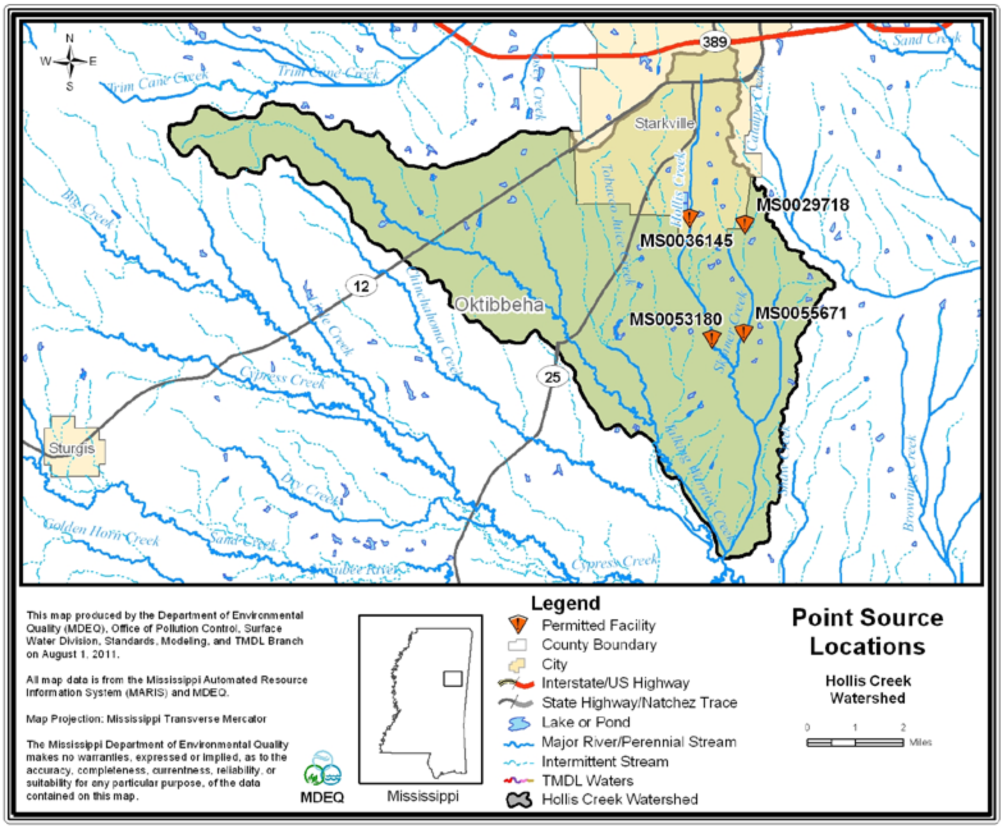



**Figure 4. Hollis Creek Point Sources**

## 2.3 Assessment of Non-Point Sources

Non-point loading of organic material in a water body results from the transport of the pollutants into receiving waters by overland surface runoff, groundwater infiltration, and atmospheric deposition.

The watershed contains mainly forest but also has different landuse types, including urban, water, and wetlands. The land use information for the watershed is based on the National Land Cover Database (NLCD). The landuse distribution for the Hollis Creek Watershed is shown in Table 7 and Figure 5.

**Table 7. Land Use Distribution (acres)**

| | Water | Urban | Forest | Scrub/Barren | Pasture | Cropland | Wetland |
|---|---|---|---|---|---|---|---|
| **Area (acres)** | 240.9 | 4,064.7 | 10,064.0 | 2,437.0 | 6,604.0 | 1,857.0 | 8,812.8 |
| **% Area** | 0.7% | 11.9% | 29.5% | 7.2% | 19.4% | 5.5% | 25.9% |

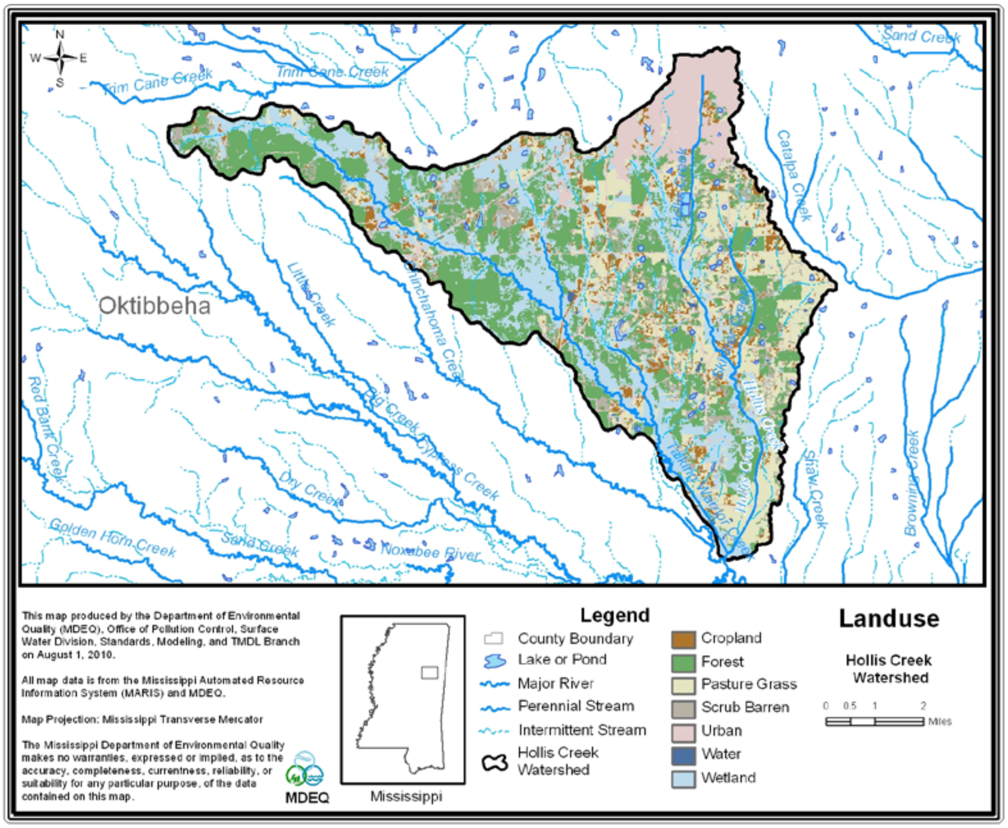



**Figure 5. Landuse in the Hollis Creek Watershed**

.

# MODELING PROCEDURE: LINKING THE SOURCES TO THE ENDPOINT

Establishing the relationship between the instream water quality target and the source loading is a critical component of TMDL development. It allows for the evaluation of management options that will achieve the desired source load reductions. The link can be established through a range of techniques, from qualitative assumptions based on sound scientific principles to sophisticated modeling techniques. Ideally, the linkage will be supported by monitoring data that allow the TMDL developer to associate certain water body responses to flow and loading conditions. In this section, the selection of the modeling tools, setup, and model application are discussed.

## 3.1 Modeling Framework Selection

A mathematical model, STeady Riverine Environmental Assessment Model (STREAM), for DO distribution in freshwater streams was used for developing the TMDL. The use of STREAM is promulgated in the *Wastewater Regulations for National Pollutant Discharge Elimination System (NPDES) Permits, Underground Injection Control (UIC) Permits, State Permits, Water Quality Based Effluent Limitations and Water Quality Certification* (MDEQ, 2010). This model has been approved by EPA and has been used extensively at MDEQ. A key reason for using the STREAM model in TMDL development is its ability to assess instream water quality conditions in response to point and non-point source loadings.

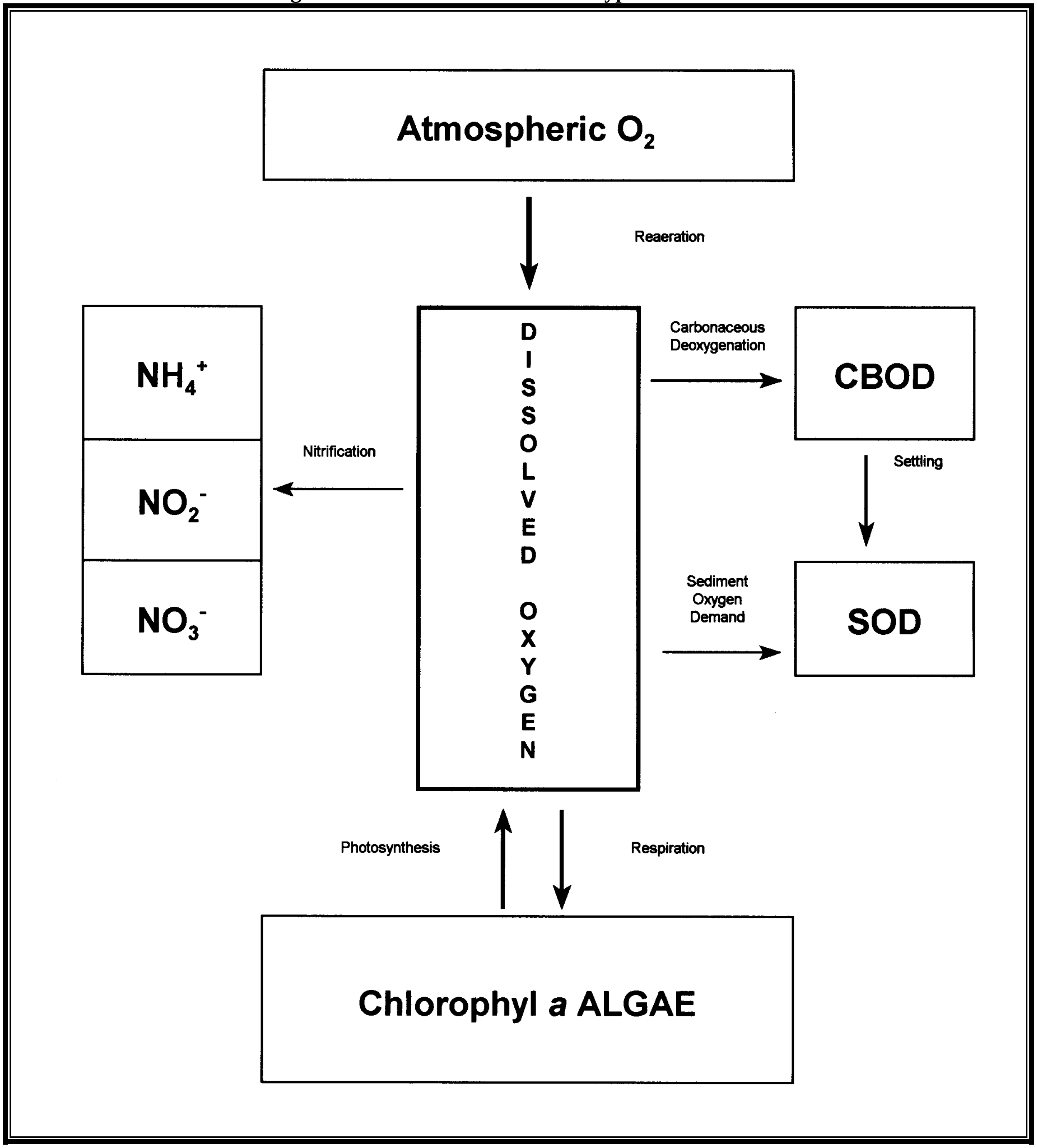
STREAM is a steady-state, daily average computer model that utilizes a modified Streeter-Phelps DO sag equation. Instream processes that may be simulated by the model include CBODu decay, nitrification, reaeration, sediment oxygen demand, and respiration and photosynthesis of algae. Figure 6 shows how these processes are related in a typical DO model. Reaction rates for the instream processes are input by the user and corrected for temperature by the model. The model output includes water quality conditions in each computational element for DO, CBODu, and $NH_3$-N concentrations. The hydrological processes simulated by the model include stream velocity and flow from point sources and spatially distributed inputs.

The model was set up to calculate reaeration within each reach using the Tsivoglou formulation. The Tsivoglou formulation calculates the reaeration rate, $K_a$ (day$^{-1}$ base *e*), within each reach according to Equation 2.

$$\mathbf{K_a = C*S*U} \qquad \textbf{(Eq. 2)}$$

C is the escape coefficient, U is the reach velocity in mile/day, and S is the average reach slope in ft/mile. The value of the escape coefficient is assumed to be 0.11 for streams with flows less than 10 cfs and 0.0597 for stream flows equal to or greater than 10 cfs. Reach velocities were calculated using an equation based on slope. The slope of each reach was estimated with the NHD Plus GIS coverage and input into the model in units of feet/mile.

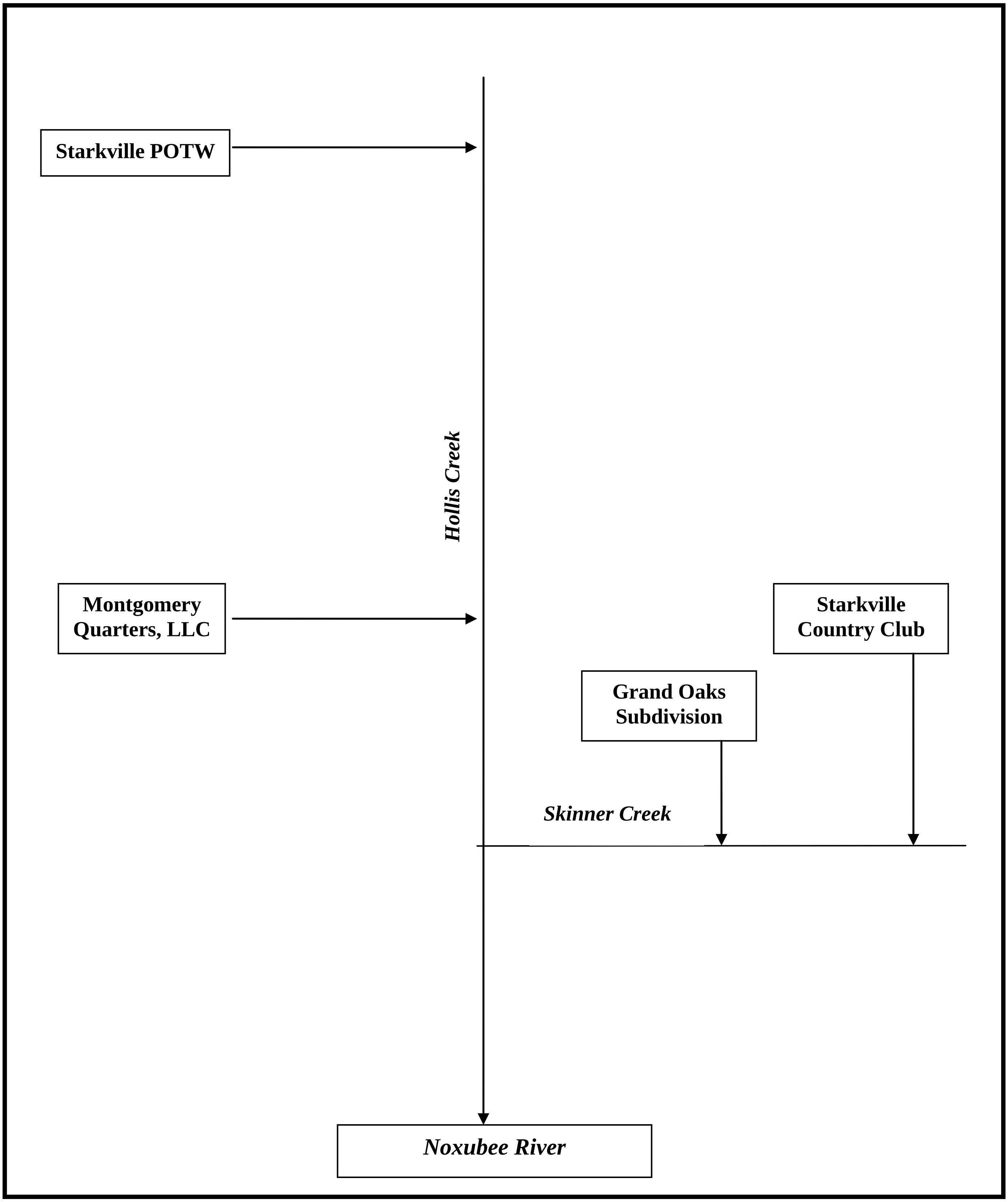
**Figure 6. Instream Processes in a Typical DO Model**




## 3.2 Model Setup

The model for this TMDL includes the §303(d) listed segment of Hollis Creek, beginning at the headwaters. A diagram showing the model setup is shown in Figure 7.

**Figure 7. Hollis Creek Model Setup (Note: Not to Scale)**



The water body was divided into reaches for modeling purposes. Reach divisions were made at locations where there is a significant change in hydrological and water quality characteristics, such as the confluence of a point source or tributary. Within each reach, the modeled segments were divided into computational elements of 0.1 mile. The simulated hydrological and water quality characteristics were calculated and output by the model for each computational element.

The STREAM model simulates flow and temperature at the critical conditions for this TMDL. Since the flow in Hollis Creek is less than 50 cfs, the water temperature used in the model is 26°C. The headwater instream DO is set to 85% of saturation at the stream temperature. The instream CBODu decay rate $K_d$ at 20°C is set to 0.3 $day^{-1}$ (base e). The model adjusts the $K_d$ rate based on temperature, according to Equation 3.

$$\mathbf{K_{d(T)} = K_{d(20°C)}(1.047)^{T-20}} \qquad \textbf{(Eq. 3)}$$

Where $K_d$ is the CBODu decay rate and T is the assumed instream temperature. The assumptions regarding the instream temperatures, background DO saturation, and CBODu decay rate are required by the *Empirical Stream Model Assumptions for Conventional Pollutants and Conventional Water Quality Models* (MDEQ, 2010). The rates for photosynthesis, respiration, and sediment oxygen demand were set to zero because data for these model parameters are not available.

Hollis Creek currently has no USGS flow gage. The critical condition for flow is the 7Q10 which for Hollis Creek is zero as determined from the USGS Water-Resources Investigation Report 90-4130 Low-Flow and Flow Duration Characteristics of Mississippi Streams (Telis, 1991). At a 7Q10 of zero, there is no nonpoint source loading, thus the LA for Hollis Creek is zero.

## 3.3 Source Representation

Both point and non-point sources may be represented in the model. The loads from the NPDES permitted point sources were added as a direct input into the appropriate reaches as a flow in MGD and concentration of $CBOD_5$ and ammonia nitrogen in mg/l.

Organic material discharged to a stream from an NPDES permitted point source is typically quantified as 5-day biochemical oxygen demand ($BOD_5$). $BOD_5$ is a measure of the oxidation of carbonaceous and nitrogenous material over a 5-day incubation period. However, oxidation of nitrogenous material, called nitrification, usually does not take place within the 5-day period because the bacteria that are responsible for nitrification are normally not present in large numbers and have slow reproduction rates (Metcalf and Eddy, 1991). Thus, $BOD_5$ is generally considered equal to $CBOD_5$. Because permits for point source facilities are written in terms of $CBOD_5$ while TMDLs are typically developed using CBODu, a ratio between the two terms is needed, Equation 4.

$$\mathbf{CBODu = CBOD_5 * fRatio} \qquad \textbf{(Eq. 4)}$$

The CBODu to $CBOD_5$ ratios are given in *Empirical Stream Model Assumptions for Conventional Pollutants and Conventional Water Quality Models* (MDEQ, 2010). These values are recommended for use by MDEQ regulations when actual field data are not available. The value of the ratio depends on the wastewater treatment type.

In order to convert the ammonia nitrogen ($NH_3$-N) loads to an oxygen demand, a factor of 4.57 pounds of oxygen per pound of ammonia nitrogen ($NH_3$-N) oxidized to nitrate nitrogen ($NO_3$-N) was used. Using this factor is a conservative modeling assumption because it assumes that all of the ammonia is converted to nitrate through nitrification. The oxygen demand caused by nitrification of ammonia is equal to the NBODu load. The sum of CBODu and NBODu is equal to the point source load of TBODu. The permitted load of TBODu from the existing point source to be used in the STREAM model is given in Table 8.

**Table 8. Point Sources, Current Permitted Model Inputs**

| NPDES | Facility | Flow (MGD) | CBODu (lbs/day) | NBODu (lbs/day) | TBODu (lbs/day) |
|---|---|---|---|---|---|
| MS0029178 | Starkville Country Club | 0.009 | 3.38 | 0.91 | 4.28 |
| MS0036145 | Starkville POTW | 10 | 1,918.20 | 762.28 | 2,680.48 |
| MS0053180 | Montgomery Quarters, LLC, Mobile Home Park | 0.03 | 11.26 | 6.86 | 18.12 |
| MS0055671 | Grand Oaks Subdivision | 0.04 | 15.01 | 3.05 | 18.06 |
| | Total | | 1,947.85 | 773.09 | 2,720.94 |

Direct measurements of background concentrations of CBODu were not available for Hollis Creek. Because there were no data available, the background concentrations of CBODu and $NH_3$-N were estimated based on *Empirical Stream Model Assumptions for Conventional Pollutants and Conventional Water Quality Models* (MDEQ, 2010). According to these regulations, the background concentration used in modeling for $BOD_5$ is 1.33 mg/l and for $NH_3$-N is 0.1 mg/l. Non-point source flows are typically included in the model to account for water entering due to groundwater infiltration, overland flow, and small, unmeasured tributaries. However, there are no non-point source flows entering the water body at the critical 7Q10 condition is used for this study.

## 3.4 Model Calibration

The model used to develop the Hollis Creek TMDL was not calibrated due to the limited amount of instream monitoring data collected during critical conditions. Future monitoring is required to improve the accuracy of the model and the results.

## 3.5 Model Results

Once the model setup was complete, the model was used to predict water quality conditions in Hollis Creek. The model was run under regulatory load conditions. Under regulatory load conditions, the loads from the NPDES permitted point sources were based on their current location and loads shown in Table 9.

### 3.5.1 Regulatory Load Scenario

As shown in the figure, the model predicts that the DO does not go below the standard of 5.0 mg/l in Hollis Creek using the permit based allowable loads, thus no TBODu reductions are needed for the two facilities that discharge to Hollis Creek, Starkville POTW and Montgomery Quarters, LLC to meet the current TMDL. However, the predicted DO in Skinner Creek does drop below the standard of 5.0 mg/l and reductions are necessary to the TBODu loading from the two facilities that discharge to Skinner, Starkville Country Club and Grand Oaks Subdivision. The regulatory load scenario model results for Hollis Creek and Skinner Creek are shown in Figures 8 and 9 respectively.

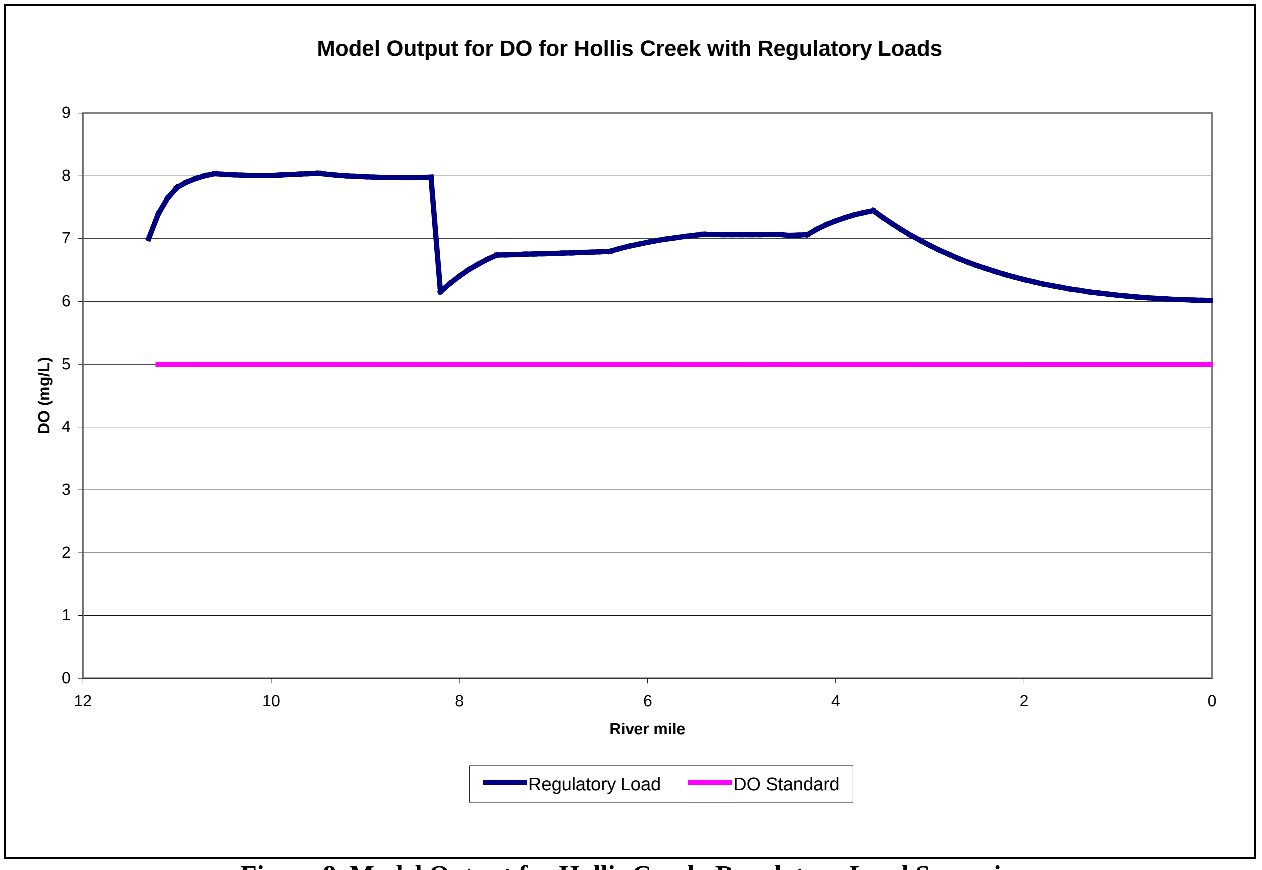



**Figure 8. Model Output for Hollis Creek, Regulatory Load Scenario**

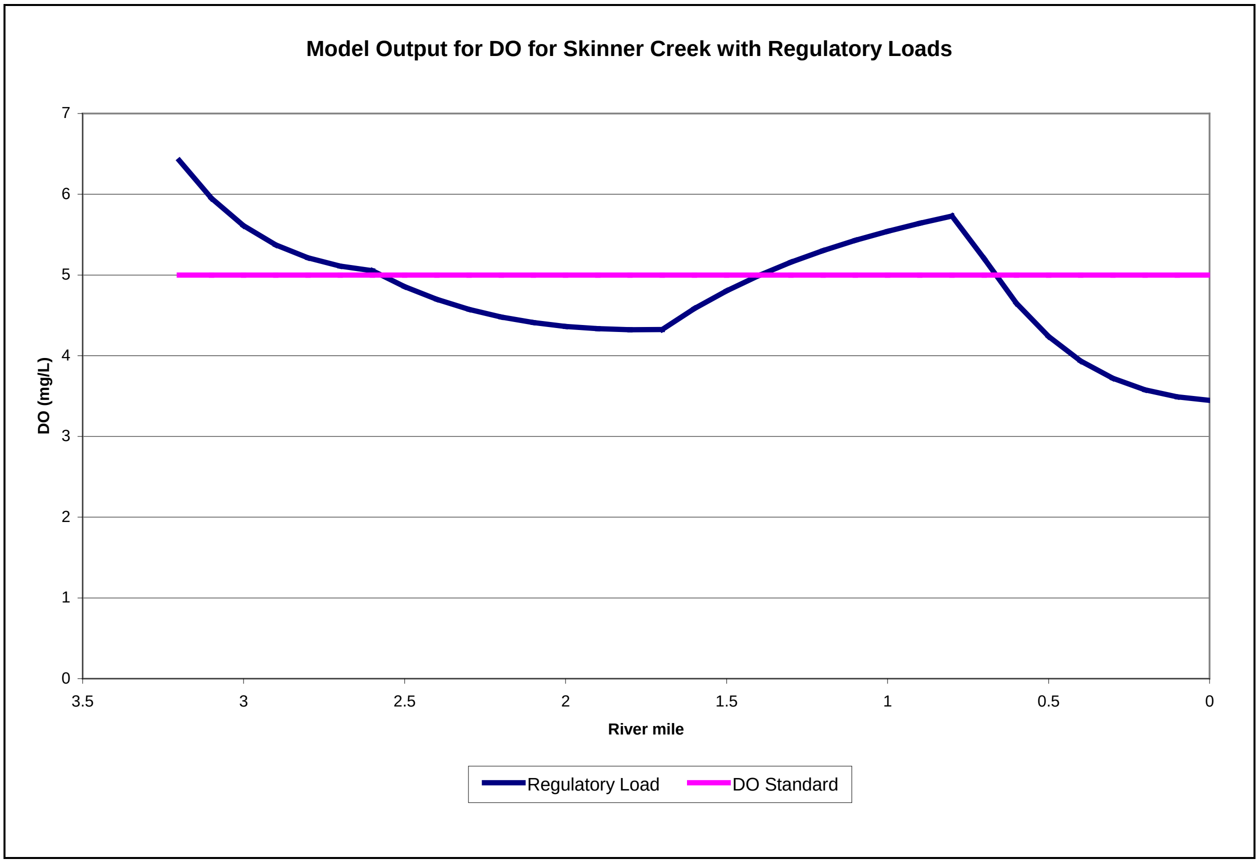



**Figure 9. Model Output for Skinner Creek, Regulatory Load Scenario**

### 3.5.2 Maximum Load Scenario

The graph of the regulatory model output shows that the predicted DO does fall below the DO standard in Skinner Creek during critical conditions. Thus, reductions of the loads of TBODu are necessary. Calculating the maximum allowable load of TBODu involved decreasing the model loads until the modeled DO remained at or above 5.0 mg/l. The non-point source loads in this model were already removed based on a 7Q10 flow of zero so no non-point source reductions were possible. Thus, the permitted limits were decreased until the modeled DO was 5.0 mg/L. The decreased loads were then used to develop the allowable maximum daily load for this report. The maximum load scenario model results for Skinner Creek are shown in Figure 10.

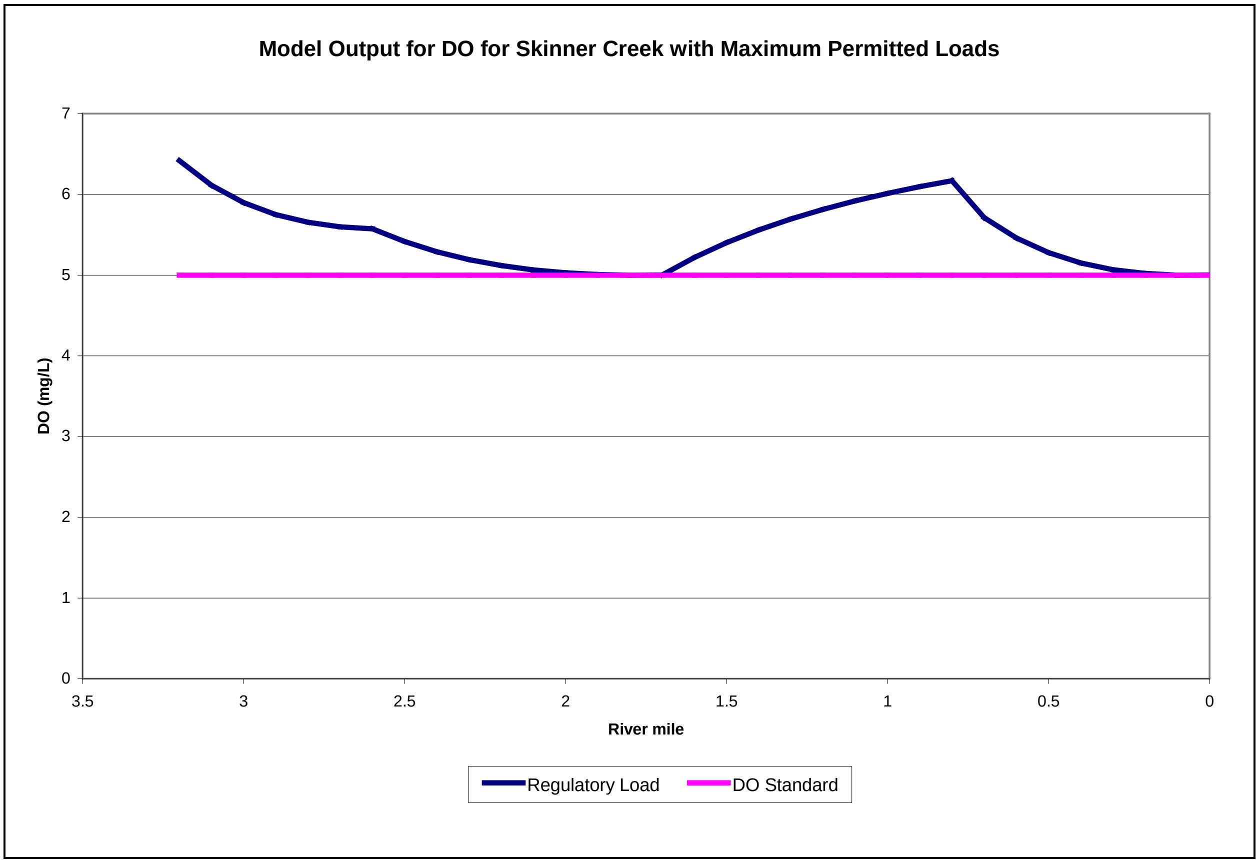



**Figure 10. Model Output for Skinner Creek, Maximum Load Scenario**

**Table 9. Point Sources, Maximum Permitted Loads**

| NPDES | Facility | Flow (MGD) | CBODu (lbs/day) | NBODu (lbs/day) | TBODu (lbs/day) |
|---|---|---|---|---|---|
| MS0029178 | Starkville Country Club | 0.009 | 2.59 | 0.91 | 3.50 |
| MS0036145 | Starkville POTW | 10 | 1,918.20 | 762.28 | 2,680.48 |
| MS0053180 | Montgomery Quarters, LLC, Mobile Home Park | 0.03 | 11.26 | 6.86 | 18.12 |
| MS0055671 | Grand Oaks Subdivision | 0.04 | 8.51 | 3.05 | 11.56 |
| | Total | | 1,940.56 | 773.09 | 2,713.65 |

# ALLOCATION

## 4.1 Wasteload Allocation

Model results indicate that reductions are needed from two of the point sources. The wasteload allocations for this TMDL are given in Table10. Table 9 shows TBODu reductions are needed from the Starkville Country Club and Grand Oaks Subdivision to help Skinner Creek meet water quality standards.

**Table 10. Wasteload Allocation for TBODu**

| Permit | Facility | Flow MGD | $CBOD_5$ mg/L | CBODu lbs/day | $NH_3$-N mg/L | NBODu lbs/day | TBODu lbs/day |
|---|---|---|---|---|---|---|---|
| **MS0029178** | **Starkville Country Club** | **0.009** | **23** | **2.59** | **2.645** | **0.91** | **3.50** |
| **MS0036145** | **Starkville POTW** | **10** | **10** | **1,918.20** | **2** | **762.28** | **2,680.48** |
| **MS0053180** | **Montgomery Quarters, LLC** | **0.03** | **30** | **11.26** | **6** | **6.86** | **18.12** |
| **MS0055671** | **Grand Oaks Subdivision** | **0.04** | **17** | **8.51** | **2** | **3.05** | **11.56** |

## 4.2 Load Allocation

The load allocation for the TBODu TMDL is has been set to zero because there are no non-point source flows entering the water body at the critical 7Q10 condition which is used for DO modeling.

## 4.3 Incorporation of a Margin of Safety

The margin of safety is a required component of a TMDL and accounts for the uncertainty about the relationship between pollutant loads and the quality of the receiving water body. The two types of MOS development are to implicitly incorporate the MOS using conservative model assumptions or to explicitly specify a portion of the total TMDL as the MOS. The MOS selected for this model is implicit.

## 4.4 Calculation of the TMDL

The STREAM model was used to calculate the TBODu TMDL. These allocations are established to attain the applicable water quality standards.

**Table 11. TMDL Loads**

| | WLA lbs/day | LA lbs/day | MOS | TMDL lbs/day |
|---|---|---|---|---|
| TBODu | **2,713.65** | **0** | **Implicit** | **2,713.65** |

## 4.5 Seasonality and Critical Condition

This TMDL accounts for seasonal variability by requiring allocations that ensure year-round protection of water quality standards, including during critical conditions.

# CONCLUSION

The model results indicate that Hollis Creek is meeting water quality standards for dissolved oxygen at the present loading of TBODu, however reductions are needed to the current loading of TBODu to Skinner Creek for it to meet water quality standards. The limited dissolved oxygen data that are available for Hollis Creek do not indicate dissolved oxygen depletion.

## 5.1 Next Steps

MDEQ's Basin Management Approach and Nonpoint Source Program emphasize restoration of impaired waters with developed TMDLs. During the watershed prioritization process to be conducted by the Tombigbee River Basin Team, this TMDL will be considered as a basis for implementing possible restoration projects. The basin team is made up of state and federal resource agencies and stakeholder organizations and provides the opportunity for these entities to work with local stakeholders to achieve quantifiable improvements in water quality. Together, basin team members work to understand water quality conditions, determine causes and sources of problems, prioritize watersheds for potential water quality restoration and protection activities, and identify collaboration and leveraging opportunities. The Basin Management Approach and the Nonpoint Source Program work together to facilitate and support these activities.

The Nonpoint Source Program provides financial incentives to eligible parties to implement appropriate restoration and protection projects through the Clean Water Act's Section 319 Nonpoint Source (NPS) Grant Program. This program makes available around $1.6M each grant year for restoration and protections efforts by providing a 60% cost share for eligible projects.

Mississippi Soil and Water Conservation Commission (MSWCC) is the lead agency responsible for abatement of agricultural NPS pollution through training, promotion, and installation of BMPs on agricultural lands. USDA Natural Resource Conservation Service (NRCS) provides technical assistance to MSWCC through its conservation districts located in each county. NRCS assists animal producers in developing nutrient management plans and grazing management plans. MDEQ, MSWCC, NRCS, and other governmental and nongovernmental organizations work closely together to reduce agricultural runoff through the Section 319 NPS Program.

Mississippi Forestry Commission (MFC), in cooperation with the Mississippi Forestry Association (MFA) and Mississippi State University (MSU), have taken a leadership role in the development and promotion of the forestry industry Best Management Practices (BMPs) in Mississippi. MDEQ is designated as the lead agency for implementing an urban polluted runoff control program through its Stormwater Program. Through this program, MDEQ regulates most construction activities. Mississippi Department of Transportation (MDOT) is responsible for implementation of erosion and sediment control practices on highway construction.

Due to this TMDL, projects within this watershed will receive a higher score and ranking for funding through the basin team process and Nonpoint Source Program described above.

## 5.2 Public Participation

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in the statewide newspaper. The public will be given an opportunity to review the TMDLs and submit comments. MDEQ also distributes all TMDLs at the beginning of the public notice to those members of the public who have requested to be included on a TMDL mailing list. Anyone wishing to become a member of the TMDL mailing list should contact Greg Jackson at Greg_Jackson@deq.state.ms.us.

All comments should be directed to Greg_Jackson@deq.state.ms.us or Greg Jackson, MDEQ, PO Box 2261, Jackson, MS 39225. All comments received during the public notice period and at any public hearings become a part of the record of this TMDL and will be considered in the submission of this TMDL to EPA Region 4 for final approval.

# REFERENCES


Davis and Cornwell. 1988. *Introduction to Environmental Engineering.* McGraw-Hill.

MDEQ. 2007. *Mississippi's Plan for Nutrient Criteria Development*. Office of Pollution Control.

MDEQ. 2007. *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*. Office of Pollution Control.

MDEQ. 2010. *Wastewater Regulations for National Pollutant Discharge Elimination System (NPDES) Permits, Underground Injection Control (UIC) Permits, State Permits, Water Quality Based Effluent Limitations and Water Quality Certification.* Office of Pollution Control.

MDEQ. 2010. *Stressor Identification Report for Hollis Creek*. Office of Pollution Control.

Metcalf and Eddy, Inc. 1991. *Wastewater Engineering: Treatment, Disposal, and Reuse 3rd ed*. New York: McGraw-Hill.

MFC. 2000. *Mississippi's BMPs: Best Management Practices for Forestry in Mississippi*. Publication # 107.

NRCS. 2000. *Field Office Technical Guide Transmittal No. 61*.

Telis, Pamela A. 1992. *Techniques for Estimating 7-Day, 10-Year Low Flow Characteristics for Ungaged Sites on Water bodys in Mississippi*. U.S. Geological Survey, Water Resources Investigations Report 91-4130.

Thomann and Mueller. 1987. *Principles of Surface Water Quality Modeling and Control*. New York: Harper Collins.

USEPA. 1997. *Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/ Eutrophication*. United States Environmental Protection Agency, Office of Water, Washington, D.C. EPA 823-B-97-002.

USEPA. 1999. *Protocol for Developing Nutrient TMDLs*. EPA 841-B-99-007. Office of Water (4503F), United States Environmental Protection Agency, Washington D.C. 135 pp.

USEPA. 2000. Nutrient Criteria Technical Guidance Manual Rivers and Streams. United States Environmental Protection Agency, Office of Water, Washington, D.C. EPA-822-B-00-002.