

**Total Maximum Daily Load (TMDL) Synopsis**

**State:** Kentucky  
**Major River Basin:** South Fork Licking River  
**HUC8:** 05100102  
**Counties:** Bourbon, Harrison  
**Pollutant of Concern:** Bacteria

**Table S.1 Impaired Waterbodies Addressed in this Bacteria TMDL Document**

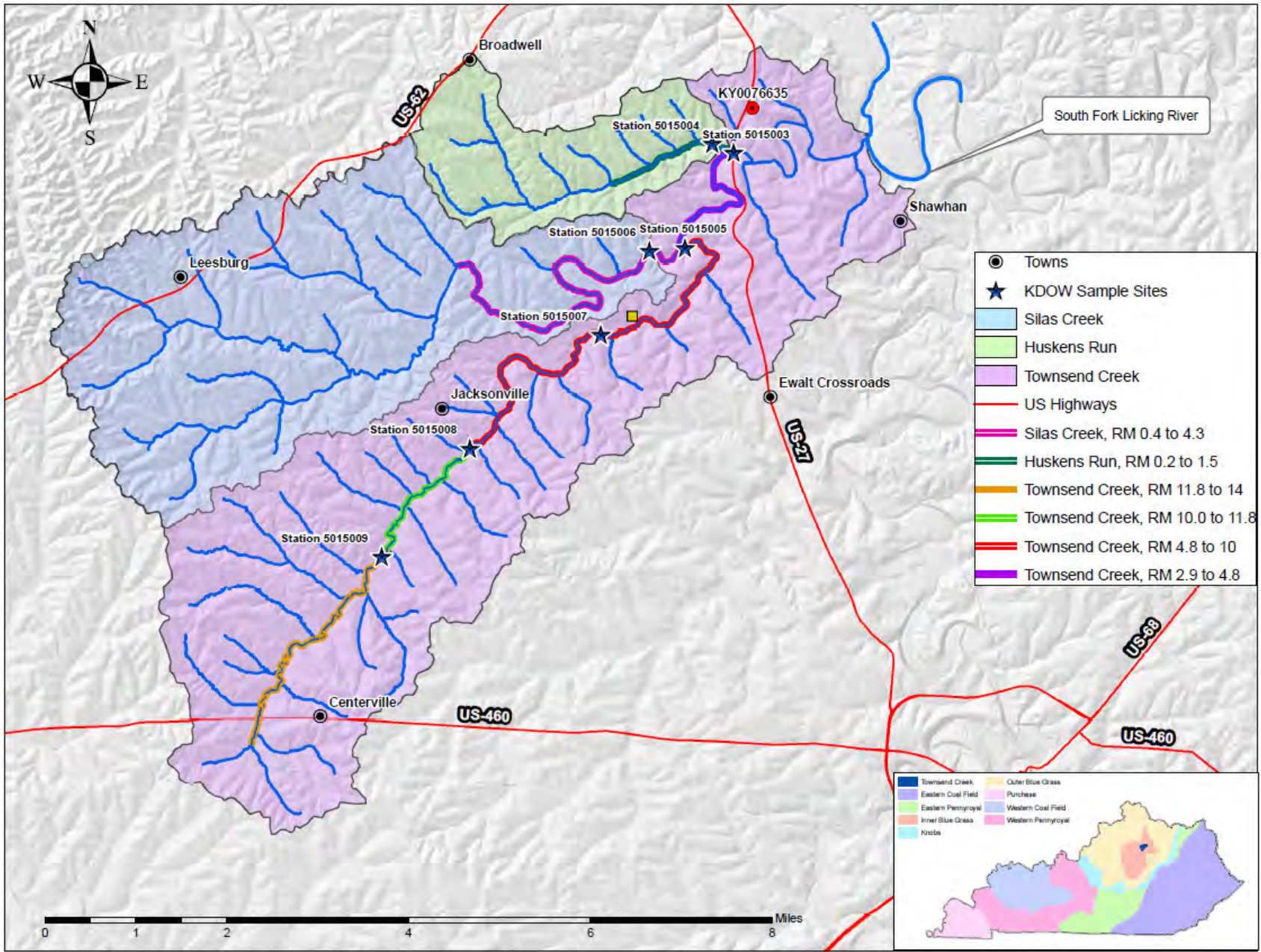
<b>Waterbody Name</b>	<b>Pollutant</b>	<b>County</b>	<b>GNIS Number</b>	<b>Suspected Sources</b>	<b>Impaired Use</b>
Townsend Creek 2.9 to 4.8 into South Fork Licking River	Fecal coliform	Bourbon	KY505401_02	Agriculture, Livestock, On-Site Sewage Treatment Systems, Unknown	Primary Contact Recreation (PCR; partial support)
Townsend Creek 4.8 to 10.0 into South Fork Licking River	Fecal coliform	Bourbon	KY505401_03	Agriculture, Livestock, On-Site Sewage Treatment Systems, Unknown	PCR (nonsupport)
Huskens Run 0.2 to 1.5 into Townsend Creek	Fecal coliform	Harrison	KY494854_01	Agriculture, Livestock, On-Site Sewage Treatment Systems, Unknown	PCR (nonsupport)
Townsend Creek 11.8 to 14.9 into South Fork Licking River	Fecal coliform	Bourbon	KY505401_05	Agriculture, Livestock, On-Site Sewage Treatment Systems, Unknown	PCR (nonsupport)

**Policy and Purpose to Water Quality:**

Section 303(d) of the Federal Clean Water Act declares that “each State shall identify those waters within its boundaries for which effluent limitations... are not stringent enough to implement any water quality standard applicable to such waters. The State shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters.... Each State shall establish for the waters identified in this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies... for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety.”

Kentucky Revised Statute (KRS) Chapter 224 states, “It is hereby declared to be the policy of this Commonwealth.... to provide a comprehensive program in the public interest for the prevention, abatement and control of pollution; to provide effective means for the execution and enforcement of such program; and to provide for cooperation with agencies of other states or of the federal government in carrying out these objectives.... the purposes of KRS Chapter 224: to safeguard from pollution the uncontaminated waters of the Commonwealth; to prevent the creation of any new pollution of the waters of the Commonwealth; and to abate any existing pollution.”

## Total Maximum Daily Load (TMDL) Synopsis



**Figure S.1 Location of the Townsend Creek Watershed, Sample Sites and Assessed Stream Segments**

**Kentucky Water Quality Criteria (WQC) for Fecal Coliform:**

Title 401 KAR 10:031 describe the standards used to “protect the surface waters of the Commonwealth, and thus protect water resources.” Fecal coliform bacteria are pathogen indicator organisms. Fecal coliform data are used to indicate the degree of support for primary contact recreation (PCR) use. The stream is assessed as fully supporting the PCR use if the fecal coliform content does not exceed the criterion of 400 colonies per 100 ml in less than 20 percent of samples; it was assessed as partially supporting the PCR use if the criterion was not met in 25-33 percent of samples, and as not supporting the PCR use if the criterion was not met in greater than 33 percent of samples. Streams assessed as either nonsupport or partial support are considered impaired. Stream segments were sampled once per month during the primary contact recreation season of May 1 through October 31, 2006.

**TMDL Endpoints (i.e., Water Quality Standard/ Fecal Coliform TMDL Target):**

The TMDL Target is defined as the WQC minus the Margin of Safety (MOS). The MOS can be an implicit or explicit additional reduction applied to the Waste Load allocation (WLA), Load Allocation (LA) or to both types of sources that accounts for uncertainties in the data or TMDL calculations. The TMDL Target is thus 360 colonies per 100ml (400 col/100ml minus a 10% MOS).

**TMDL Equation and Definitions:**

A TMDL calculation is performed as follows:

$$\text{TMDL} = \text{WLA} + \text{LA} + \text{MOS}$$

(Equation 1)

The WLA has three components:

$$\text{WLA} = \text{SWS-WLA} + \text{MS4-WLA} + \text{Future Growth-WLA}$$

(Equation 2)

Where:

**TMDL:** the WQC, expressed as a load. The WQC is defined in Section 5.0 as an instantaneous concentration of 400 colonies/100 ml.

**MOS:** the Margin of Safety, which can be an implicit or explicit additional reduction applied to sources of pollutants that accounts for uncertainties in the relationship between effluent limits and water quality.

**TMDL Target:** the TMDL minus the MOS.

**WLA:** the Wasteload Allocation, which is the allowable loading of pollutants into the stream from KPDES-permitted sources, such as SWSs and MS4s.

**SWS-WLA:** the WLA for KPDES-permitted sources, which have discharge limits for pathogens (including wastewater treatment plants, package plants and home units).

**Remainder:** the TMDL minus the MOS and minus the SWS-WLA (also equal to Future Growth-WLA plus the MS4-WLA and the LA).

**Future Growth-WLA:** the allowable loading for future KPDES-permitted sources, including new SWSs, expansion of existing SWSs, new storm water sources, and growth of existing storm water sources (such as MS4s).

## Total Maximum Daily Load (TMDL) Synopsis

**MS4-WLA:** the WLA for KPDES-permitted municipal separate storm water sewer systems (including cities, counties, universities and military bases).

**KYTC MS4-WLA:** the WLA for roads and right-of-ways that are present within designated MS4 boundaries and owned by the Kentucky Transportation Cabinet.

**University MS4-WLA:** the WLA for universities that are municipal separate storm sewer systems.

**Military MS4-WLA:** the WLA for military bases that are municipal separate storm sewer systems.

**LA:** the Load Allocation, which is the allowable loading of pollutants into the stream from sources not permitted by KPDES and from natural background.

**Seasonality:** Yearly factors that affect the relationship between pollutant inputs and the ability of the stream to meet its designated uses.

**Critical Condition:** When the pollutant conditions are expected to be at their worst.

**MAF:** the Mean Annual Flow as defined by USGS.

**Adjusted MAF:** the MAF plus SWS-WLA design flows (where applicable).

**Critical Flow:** the flow used to calculate the TMDL as a load (equivalent to the Adjusted MAF for MAF TMDLS)

**Existing Conditions:** the load that exists in the watershed at the time of TMDL development (i.e., sampling) that is causing the impairment.

**Percent Reduction:** the bacteria loading reduction needed to bring the existing conditions in line with the TMDL Target.

**Load:** Concentration \* Flow \* Conversion Factor

**Concentration:** colonies per 100 milliliters (col/100ml)

**Flow (i.e. stream discharge):** cubic feet per second (cfs)

**Conversion Factor:** the value that converts the product of Concentration and Flow to Load (in units of colonies per day); it is derived from the calculation of the following components:  $(28.31685\text{L}/\text{cf} * 86400\text{sec}/\text{day} * 1000\text{ml}/\text{L}) / (100\text{ml})$  and is equal to 24465758.4

### Calculation Procedure:

- 1) The MOS, if an explicit value, is calculated and subtracted from the TMDL first, giving the TMDL Target;
- 2) Percent reductions are calculated to show the difference between Existing Conditions and the TMDL Target;
- 3) The SWS-WLA (if applicable) is calculated and subtracted from the TMDL Target, leaving the Remainder;
- 4) The Future Growth-WLA is calculated and subtracted from the Remainder;
- 5) If there is a MS4 present upstream of the impaired segment, the Transportation-WLA (if applicable) is subtracted from the Remainder based on its area within the MS4;
- 6) The MS4-WLA (if applicable) is subtracted from the Remainder based on percent land use, leaving the LA.

There are no SWS's or MS4's discharging to an impaired segment in Townsend Creek, only future growth is represented in the WLA.

## Total Maximum Daily Load (TMDL) Synopsis

### TMDL Calculations:

Due to the absence of stream gages or in-stream flow data in the Townsend Creek Watershed, KDOW used the U.S. Geological Survey's (USGS's) Mean Annual Streamflow (MAF) values. The MAF values were calculated using a three-variable regression equation found in the USGS Water-Resources Investigations Report 02-4206 "Estimating Mean Annual Streamflow of Rural Streams in Kentucky" ([http://ky.water.usgs.gov/pubs/wrir\\_2002\\_4206.pdf](http://ky.water.usgs.gov/pubs/wrir_2002_4206.pdf)). The MAF values can be found on the Hydrology of Kentucky webpage (<http://kygeonet.ky.gov/kyhydro/main.htm>). Once obtained (and if applicable), major inputs (i.e. WWTP flow) and withdrawals were integrated to generate a critical flow. The critical flow is then multiplied by the WQC minus the MOS (10%) times the appropriate conversion factors to obtain the TMDL Target load. Allowable loadings from KPDES-permitted sources are then subtracted from the Target load to produce the Remainder. Future growth and MS4-WLA (if applicable) calculations are then performed and subtracted from the Remainder, leaving the LA.

The TMDL, allocations, and percent reductions for each impaired segment are provided in the table below. Percent reductions are for informational purposes only. In addition, bacteria-impaired segments addressed in this document could be converted to an *Escherichia coli* (*E. coli*) daily load by using the WQC for *E. coli* – these calculations are provided in Appendix A.

**Table S.2 TMDLs and Allocations**

TMDL <sup>(1)</sup>	MOS <sup>(2)</sup>	WLA <sup>(3)</sup>	Future Growth - WLA	LA	Mean Annual Flow (cfs)	Percent Reduction <sup>(4)</sup>
<b>Townsend Creek into South Fork Licking River RM 2.9-4.8</b>						
$4.29 \times 10^{11}$ col/day	$4.29 \times 10^{10}$ col/day	0.0 col/day	$3.86 \times 10^9$ col/day	$3.82 \times 10^{11}$ col/day	43.8	85%
<b>Townsend Creek into South Fork Licking River RM 4.8-10.0</b>						
$2.04 \times 10^{11}$ col/day	$2.04 \times 10^{10}$ col/day	0.0 col/day	$1.83 \times 10^9$ col/day	$1.81 \times 10^{11}$ col/day	20.8	87.23%
<b>Townsend Creek into South Fork Licking River RM 11.8-14.9</b>						
$9.59 \times 10^{10}$ col/day	$9.59 \times 10^9$ col/day	0.0 col/day	$8.63 \times 10^8$ col/day	$8.55 \times 10^{10}$ col/day	9.8	84.21%
<b>Huskens Run into Townsend Creek RM 0.2-1.5</b>						
$4.6 \times 10^{10}$ col/day	$4.6 \times 10^9$ col/day	0.0 col/day	$4.14 \times 10^8$ col/day	$4.10 \times 10^{10}$ col/day	4.7	85%

#### Notes:

- (1). TMDLs are expressed as daily loads of fecal colonies by multiplying the WQC by the mean annual streamflow (MAF) and the appropriate conversion factor. MAF is determined by the USGS. The TMDL is the sum of all components. Daily loads for *E. coli* are provided in Appendix A.
- (2). MOS is explicitly set at 10% of the Water Quality Criterion
- (3). Any future KPDES wastewater permitted sources must meet permit limits based on the Water Quality Criterion in 401 KAR 5:031, and must not cause or contribute to an existing impairment. WLA value is based on design flow and acute permit limits and represents the maximum one-day load that can be discharged to the stream segment.
- (4). Overall reduction needed during the 2006 PCR season to achieve the TMDL target of 360 colonies per 100ml. Percent reductions are provided for informational purposes only – see Appendix A.

## Total Maximum Daily Load (TMDL) Synopsis

### **KPDES Wastewater Discharges to Surface Waters Addressed in these Bacteria TMDLs:**

There are currently no KPDES-permitted wastewater sources discharging to an impaired segment within Townsend Creek therefore no KPDES permits were addressed in these TMDLs.

### **Translation of WLAs into Permit Limits**

There are currently no KPDES permitted sources discharging to an impaired segment in Townsend Creek. The Future Growth-WLA is reserved for future KPDES permitted sources and will be translated into new permits in the following manner.

All future SWS-WLAs will be translated into KPDES permit limits as an *E. coli* effluent gross limit of 130 colonies/100 ml as a monthly average and 240 colonies/100 ml as a maximum weekly average or as a fecal coliform effluent gross limit of 200 colonies/100 ml as a monthly average and 400 colonies/100 ml as a maximum weekly average.

Future MS4-WLAs will be addressed through the KDOW Storm Water permitting program.