TMDL SYNOPSIS

S.1 Impaired Waterbodies

State: Kentucky
Major River Basin: Tennessee, Mississippi, Cumberland River Basin
USGS HUC8: 05130101
Counties: Laurel
Pollutant of Concern: *E. coli*, Fecal Coliform
Impaired Use: Primary Contact Recreation
Suspected Sources: Non-Point Source, Source Unknown, Municipal (Urbanized High Density Area), Municipal Point Source Discharges, Sanitary Sewer Overflows (Collection System Failures)

Table S.1 Impaired Waterbodies Addressed in this TMDL Document

Waterbody, Segment	GNIS[1] Number	County	Support Status	Pollutant[2]	Suspected Source(s)
Laurel River 26.35 to 33.95	KY513263_03	Laurel	Nonsupport	*E. coli*	Non-Point Source
Lick Creek 0.0 to 3.65	KY513397_01	Laurel	Nonsupport	*E. coli*	Source Unknown
Little Laurel River 0.0 to 8.4	KY513497_01	Laurel	Partial Support	*E. coli*	Source Unknown
Little Laurel River 8.4 to 12.7	KY513497_02	Laurel	Nonsupport	*E. coli*	Source Unknown
Little Laurel River 12.7 to 14.8	KY513497_03	Laurel	Nonsupport	Fecal Coliform	Source Unknown
Little Laurel River 14.8 to 23.0	KY513497_04	Laurel	Nonsupport	*E. coli*	Source Unknown
Sallys Branch 0.0 to 2.90	KY515184_01	Laurel	Nonsupport	*E. coli*	Source Unknown
Sampson Branch 0.0 to 4.70	KY515208_01	Laurel	Nonsupport	*E. coli*	Source Unknown
UT of Little Laurel River at 16.05 RM[3] 0.0 to 1.4	KY513497-16.05_01	Laurel	Nonsupport	*E. coli*	Municipal (Urbanized High Density Area)

Waterbody, Segment	GNIS[1] Number	County	Support Status	Pollutant[2]	Suspected Source(s)
Whitley Branch 0.0 to 1.0	KY516339_01	Laurel	Nonsupport	*E. coli*	Municipal Point Source Discharges
Whitley Branch 1.1 to 2.6	KY516339_02	Laurel	Nonsupport	Fecal Coliform	Sanitary Sewer Overflows (Collection System Failures)

[1] GNIS = Geographic Names Information System.

[2] While some waterbodies are listed for fecal coliform, these data are not available due to recordkeeping issues. Because of this, and to maintain consistency with the sampling protocol used to develop the TMDL, all TMDLs are presented in terms of E. coli. Kentucky has dual criteria for bacteria impairments, allowing TMDLs to be written in terms of either fecal coliform or E. coli.

[3] RM = River Mile.

S.2 TMDL Target (Numeric or Narrative)

Table S.2 TMDL Targets by Impaired Waterbody

Waterbody, Segment	GNIS[1] Number	TMDL Target
Laurel River 26.35 to 33.95	KY513263_03	216 *E. coli* colonies/100ml which must be met in at least 80% of all observations within a 30-day period during the Primary Contact Recreational season of May through October. This is based on the 240 colonies/100ml instantaneous Water Quality Criterion, incorporating an explicit Margin of Safety of 10%.
Lick Creek 0.0 to 3.65	KY513397_01	
Little Laurel River 0.0 to 8.4	KY513497_01	
Little Laurel River 8.4 to 12.7	KY513497_02	
Little Laurel River 12.7 to 14.8	KY513497_03	
Little Laurel River 14.8 to 23.0	KY513497_04	
Sallys Branch 0.0 to 2.90	KY515184_01	
Sampson Branch 0.00 to 4.70	KY515208_01	
UT of Little Laurel River at 16.05 RM[2] 0.0 to 1.4	KY513497-16.05_01	
Whitley Branch 0.0 to 1.0	KY516339_01	
Whitley Branch 1.1 to 2.6	KY516339_02	

[1] GNIS = Geographic Names Information System.
[2] RM = River Mile.

S.3 TMDL Equation and Calculations

According to EPA (1991), a TMDL calculation is performed as follows:

$$TMDL = WLA + LA + MOS$$
(Equation S.1)

The WLA has three components:

$$WLA = SWS\text{-}WLA + MS4\text{-}WLA + Future\ Growth\text{-}WLA$$
(Equation S.2)

Definitions:
TMDL: the WQC, expressed as a load.
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. For this report, the MOS is both implicit and explicit.
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 Sanitary Wastewater Systems (SWSs) and Municipal Separate Storm Sewer Systems (MS4s).
SWS-WLA: the WLA for KPDES-permitted sources which have discharge limits for pathogen indicators (including wastewater treatment plants, package plants and home units, which are referred to as Sanitary Wastewater Systems, or SWSs).
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). Also includes the allocation for KPDES-permitted sources that existed but were not known at the time the TMDL was written.
Remainder: the TMDL minus the MOS and minus the SWS-WLA (also equal to Future Growth-WLA plus the MS4-WLA and the LA).
MS4-WLA: the WLA for KPDES-permitted Municipal Separate Storm Sewer Systems (MS4 permittees can include cities, counties, roads and right-of-ways owned by the Kentucky Transportation Cabinet (KYTC), universities and military bases).
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: the time period when the pollutant conditions are expected to be at their worst.
Critical Flow: the flow(s) used to calculate the TMDL as a load.
Existing Conditions: the load that exists in the watershed at the time of TMDL development (i.e., sampling) and is causing the impairment.
Load: concentration * flow * conversion factor.
Concentration: colonies per 100 milliliters (colonies/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/day); it is derived from the calculation of the following components: (28.31685L/ft^3 * 86400seconds/day * 1000ml/L)/(100ml) and is equal to 24,465,758.4.

Calculation Procedure:

1) The MOS, if an explicit value, is calculated and subtracted from the TMDL first, giving the TMDL Target;
2) The SWS-WLA is calculated and subtracted from the TMDL Target, leaving the Remainder;
3) The Future Growth-WLA is calculated and subtracted from the Remainder;
4) If there is a MS4 present upstream of the impaired segment, the MS4-WLA is subtracted from the Remainder based on percent developed landcover within the MS4 permitted boundary, leaving the LA.

TMDL calculations for individual impaired waterbodies are shown in Table S.3. SWSs with discharges within Laurel and Little Laurel River watersheds have SWS-WLAs as described in Table S.4.

Table S.3 Final TMDL Allocations

Waterbody, Segment, GNIS ID	TMDL (*E. coli* colonies/ day) [1]	MOS (*E. coli* colonies/ day)	SWS-WLA (*E. coli* colonies/ day) [2]	Future Growth-WLA (*E. coli* colonies/ day)	LA (*E. coli* colonies/ day)
Laurel River 26.35 to 33.95 KY513263_03	4.95E+11	4.95E+10	8.99E+07	4.45E+09	4.41E+11
Lick Creek 0.0 to 3.65 KY513397_01	4.99E+10	4.99E+09	0.00E+00	8.98E+08	4.40E+10
Little Laurel River 0.0 to 8.4 KY513497_01	4.14E+11	4.14E+10	4.55E+10	1.63E+10	3.10E+11
Little Laurel River 8.4 to 12.7 KY513497_02	2.60E+11	2.60E+10	4.55E+10	9.42E+09	1.79E+11
Little Laurel River 12.7 to 14.8 KY513497_03	2.22E+11	2.22E+10	4.55E+10	7.70E+09	1.46E+11
Little Laurel River 14.8 to 23.0 KY513497_04	1.40E+11	1.40E+10	4.54E+07	5.05E+09	1.21E+11
Sallys Branch 0.0 to 2.90 KY515184_01	2.17E+10	2.17E+09	0.00E+00	5.87E+08	1.90E+10
Sampson Branch 0.0 to 4.70 KY515208_01	5.23E+10	5.23E+09	0.00E+00	2.35E+09	4.47E+10

Waterbody, Segment, GNIS ID	TMDL (*E. coli* colonies/ day) [1]	MOS (*E. coli* colonies/ day)	SWS-WLA (*E. coli* colonies/ day) [2]	Future Growth-WLA (*E. coli* colonies/ day)	LA (*E. coli* colonies/ day)
UT[3] of Little Laurel River at 16.05 RM[4] 0.0 to 1.4 KY513497-16.05_01	1.82E+10	1.82E+09	0.00E+00	8.19E+08	1.56E+10
Whitley Branch 0.0 to 1.0 KY516339_01	6.71E+10	6.71E+09	4.54E+10	7.51E+08	1.43E+10
Whitley Branch 1.1 to 2.6 KY516339_02	1.70E+10	1.70E+09	0.00E+00	7.66E+08	1.46E+10

[1] The TMDL applies only during the May through October Primary Contact Recreational season, as described in 401 KAR 10:031.

[2] WLAs for the Sanitary Wastewater Systems (SWSs, e.g., Wastewater Treatment Plants (WWTPs)) discharging to a listed segment are equal to their permit limit times their design flow. These values were derived using the *E. coli* Water Quality Criterion (WQC) of 240 colonies/100ml so the allocated load is in units of colonies/day. See Table S.4 for allocations for individual SWSs. According to 401 KAR 10:031, individual SWSs may be permitted to discharge either fecal coliform or *E. coli;* Cornerstone Christian School and Johnson Elementary report in terms of *E. coli* but the London STP reports in terms of fecal coliform. However, it was necessary to report the WLA for all SWSs in terms of *E. coli* so their allocations were consistent with the monitoring protocol used to develop the TMDL. Although the WLA is in terms of *E. coli*, this does not change the permit limits for any given facility; facilities permitted in terms of fecal coliform should continue to report in those units.

Although Concentrated Animal Feeding Operations (CAFOs) receive their allocations within the WLA, there are no permitted CAFOs present in the watershed. Any future CAFO cannot legally discharge to surface water, and therefore receives a WLA of zero. The only exception is holders of a CAFO Individual Permit can discharge during a 25-year or greater storm event.

[3] UT = Unnamed Tributary.

[4] RM = River Mile.

Table S.4 Sanitary Wastewater Systems

Facility	KPDES Permit	Receiving Waterbody	Design Discharge (mgd[1])	Permit Limit (*E. coli* colonies/ 100ml)	WLA (*E. coli* colonies/ day)	Latitude	Longitude
Cornerstone Christian School	KY0026581	UT to Laurel River at 27.9, near mouth	0.0099	240	8.99E+07	37.019722	-84.073056
London STP[2]	KY0021270	Whitley Branch at RM[3] 1.0	5.0	240	4.55E+10	37.105000	-84.069722
Johnson Elementary School	KY0026557	RM 1.0 of the UT to Little Laurel River at RM 19.7	0.005	240	4.54E+07	37.158709	-84.051250

[1] mgd = millions of gallons per day.
[2] STP = sewage treatment plant.
[3] RM = river mile.

S.4 Translation of WLAs into Permit Limits

WLAs for Sanitary Wastewater Systems (SWSs) were given in Table S.4. SWS-WLAs will be translated into KPDES permit limits as an *E. coli* effluent gross limit of 130 colonies/100ml as a monthly average and 240 colonies/100ml as a maximum weekly average or as a fecal coliform effluent gross limit of 200 colonies/100ml as a monthly average and 400 colonies/100ml as a maximum weekly average.

There are currently no Municipal Separate Storm Sewer Systems (MS4s) in the watershed. Future MS4-WLAs will be addressed through the KDOW storm water permitting program.