Final Total Maximum Daily Load for Pathogens
Little River Watershed, Lower Cumberland Basin, Kentucky

Kentucky Division of Water
Environmental and Public Protection Cabinet

March 2009

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This report is approved for release

Sandra L. Gruzesky, Director
Division of Water

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Date

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TMDL Synopsis

1. 303(d) Listed Waterbody Information:

State: Kentucky 8-Digit HUC: 05130205
Major River Basin: Lower Cumberland GNIS #: 496838, 499555, 503934

Waterbody	River Miles (RM)	Listing Year	County	Use Impairment(s)/ Status	Priority	Pollutant
Little River	30.0 – 31.4	1998	Trigg	Primary Contact Recreation (Partial Support)	First Priority	Pathogens
Little River	31.4 – 45.5	1998	Trigg / Christian	Primary Contact Recreation (Partial Support)	Second Priority	Pathogens
Little River	45.5 – 57.7	1998	Christian	Primary Contact Recreation (Nonsupport)	First Priority	Pathogens
North Fork Little River	0.0 – 0.3	2002	Christian	Primary Contact Recreation (Partial Support)	First Priority	Pathogens
North Fork Little River	0.3 – 7.0	2002	Christian	Primary Contact Recreation (Partial Support)	Second Priority	Pathogens
North Fork Little River	7.0 – 10.9	2002	Christian	Primary Contact Recreation (Nonsupport)	First Priority	Pathogens
North Fork Little River	10.9 – 16.1	2002	Christian	Primary Contact Recreation (Nonsupport)	First Priority	Pathogens
South Fork Little River	0.0 – 10.3	2002	Christian	Primary Contact Recreation (Nonsupport)	First Priority	Pathogens
South Fork Little River	10.3 – 20.3	2002	Christian	Primary Contact Recreation (Nonsupport)	First Priority	Pathogens

2. Pollutant Allocations for Each Impaired Segment Addressed in this TMDL:

Waterbody, Impaired River Miles (RM) [1]	Monitoring Station	WLA[1, 2, 6]		LA (Percent Reduction)[6]	Margin of Safety	TMDL[5] (Percent Reduction)
		Wastewater Treatment Plants (colonies/day)	MS4 (Percent Reduction) [7]			
Little River RM 30.0 – 31.4	LR004	1.34E+11[3]	0	69.7%	10%	69.7%
Little River RM 31.4 – 45.5	LR003	1.34E+11[3]	0	59.0%	10%	59.0%
Little River RM 45.5 – 57.7	LR001	1.34E+11[3]	0	63.4%	10%	63.4%
North Fork Little River RM 0.0 - 0.3	LCTMDL02	1.34E+11[3]	78.0%	78.0%	10%	78.0%
North Fork Little River RM 0.3 – 7.0	LCTMDL02	4.36E+10[4]	78.0%	78.0%	10%	78.0%
North Fork Little River RM 7.0– 10.9	NFLR001	4.36E+10[4]	0	96.0%	10%	96.0%
North Fork Little River RM 10.9 – 16.1	NFLR001	0	0	96.0%	10%	96.0%
South Fork Little River RM 0.0 – 10.3	LCTMDL01	0	83.3%	83.3%	10%	83.3%
South Fork Little River RM 10.3 – 20.3	SFLR001	0	0	96.4%	10%	96.4%

1. 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.
2. Any future permitted point source must meet permit limits based on the Water Quality Standards in 401 KAR 5:031, and must not cause or contribute to an existing impairment.
3. Daily allocations for the Wastewater Treatment Plants (WWTPs) discharging to these listed segments (i.e., both the Hammond Woods and Northside plants, at River Mile 0.3 and 10.9, respectively, of the North Fork Little River) are equal to their permit limit times their design flow. Therefore the Wasteload Allocation (WLA) for these segments (which are downstream of the discharge points from both WWTPs) is 1.34E+11 colonies/day. The future allocation for the planned expansion of Hammond Woods WWTP will also be its design flow multiplied by its permit limit, or 3.03E+11 colonies/day. These values were derived using the instantaneous Water Quality Criterion (WQC) of 400 colonies/100ml. The monthly average allocations for the existing WWTPs will be 50% of their daily allocations calculated as a geometric mean, based on the WQC of 200 colonies/100ml (as opposed to 400 colonies/100ml). Individual allocations for the WWTPs are presented in the next section of the TMDL Synopsis.
4. The WLA for these listed segments is equal to the permit limit times the design flow of the Northside WWTP only, or 4.36E+10 colonies/day.
5. Calculations expressing the TMDL as a daily load can be found in Appendix B.
6. In the event that compliance with the WQC is determined using E. Coli concentrations as opposed to fecal coliform concentrations, the final fecal coliform allocations can be converted to E. Coli by multiplying by the figure (240/400).
7. The Hopkinsville MS4, Permit Number KYG200009.

3. Individual WLAs for WWTPs

KPDES Wastewater Treatment Plant Discharges to Surface Water

Facility Name[1]	KPDES No.	Design Flow (MGD)	Facility Type	Permit Limits (colonies/100ml)		WLA (colonies/day)
				Monthly Average	Weekly Average	
Hopkinsville Hammond Woods	KY0066532	6.0	WWTP	200	400	9.04E+10
Hopkinsville Northside	KY0023388	2.88	WWTP	200	400	4.36E+10

[1] See *Section S.2: Pollutant Allocations for Each Impaired Segment Addressed in this TMDL* for the WLA for the Hopkinsville MS4 (KYG200009).

1.0 Introduction

Section 303(d) of the Clean Water Act requires each State to identify those waters within its boundaries for which required effluent limitations are not stringent enough to implement any water quality standard applicable to such waters. States must establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters.

Also, Section 303(d) requires each State to establish the Total Maximum Daily Load (TMDL) for the pollutants that cause the waterbody to fail to meet its designated uses. Such a load must be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.

During the April 15th, 2008 to May 23rd, 2008 public comment period for this TMDL, the Kentucky Division of Water (KDOW) received several comment stating the dataset used to develop the TMDL (which is from 2000-2002) was too old to be representative of current conditions in the watershed. To address these concerns about the age of the data, KDOW plans to resample the pathogen-impaired segments of the Little River watershed beginning in May of 2009. This sampling will allow KDOW to verify the impaired status of the streams currently listed for pathogens, and subsequently use the data to show that streams now either meet the Primary Contact Recreation (i.e., PCR or swimming) use and that implementation is not required, or to guide implementation. As such, a minimum number of samples will be collected if pollution is found above the WQC, and implementation will proceed. If the samples are consistently below the WQC, the status of the stream will be changed to fully supporting the PCR use. However, the segment may remain on the 303(d) if it is impaired by other pollutants, and sources will be required to meet the TMDL if another (downstream) segment is still impaired for pathogens. Regardless of the whether the streams are found meet the PCR use in 2009, all sources (save wildlife) must still discharge in a manner that does not cause or contribute to an impairment.

2.0 Problem Definition

Little River of the Cumberland River (Lake Barkley) and two of its tributaries located in Trigg and Christian Counties, Kentucky, are on Kentucky's 2006 303(d) List as being impaired for the PCR use due to pathogens. The listed tributaries are the North Fork Little River and South Fork Little River. The streams are shown in Figure 3.1. The suspected sources of impairment are described as municipal point sources, agriculture, and urban runoff/storm sewers.

3.0 Physical Setting

3.1 General Information

The Little River watershed is located in the 8-digit Hydrologic Unit Code (HUC) #05130205, in the Lower Cumberland River Basin. The Geographic Names Information System (GNIS)

numbers for the impaired waterbodies are as follows: Little River, 496838; North Fork Little River, 499555; and South Fork Little River, 503934. As shown on Figure 3.1, the headwaters of Little River separate into North Fork Little River and South Fork Little River, each of which is represented by a separate 11-digit HUC. This figure also shows Hopkinsville, Oak Grove and Lake Barkley for reference. Figure 3.2 shows the impaired segments. Figure 3.3 shows the location of Wastewater Treatment Plant (WWTP) outfalls and the sampling points where data were collected for the TMDL. Figure 3.4 shows the location of major roads in the watershed. See Table 3.1, below, for approximate values for elevation, length, area and slope for the major streams in the watershed. These values were obtained by comparing the National Hydrography Dataset (USGS, 1999) stream milepoints with elevations from the Digital Elevation Model (USGS, 2000) within a Geographical Information Systems framework. The watershed drainage areas were corrected based on karst drainage areas as shown in Table 3.2.

Table 3.1 Stream Configuration

Stream Name	Highest Elevation Point (ft msl) *	Lowest Elevation Point (ft msl) *	Length (mi) *	Slope (ft/mi) *	Drainage Area (mi^2)
Little River	499	400	26.6	3.7	248.9
North Fork Little River	745	499	17	14.5	58.3
South Fork Little River	771	499	19	14.3	54.3

*Little River statistics are for the portion of the river listed for pathogens, i.e., from RM 31.4 to 57.7. However, the drainage area for Little River includes that of North and South Forks.

Table 3.2 Differences in Mapped Basin Areas (KDOW, 2006a)

Sample Site	Stream	Watershed Area Based on Topography (mi^2)	Watershed Area Based on Mapped Karst Basin Areas (mi^2)	Percent Difference
LR001	Little River	134.7	133.6	-0.8
LR002	Little River	176.2	181.3	+2.9
LR003	Little River	198.5	200.6	+1.1
LR004	Little River	244.4	248.9	+1.8
NFLR001	North Fork Little River	39.6	38.0	-4.1
LCTMDL02	North Fork Little River	58.2	58.2	0.0
SFLR001	South Fork Little River	32.2	32.0	-0.6
SFLR002	South Fork Little River	48.6	46.1	-5.2
LCTMDL01	South Fork Little River	67.5	54.3 (+OF)*	-19.6

* (+OF) is the storm-related overflow discharge at the mouth of Rock Bridge Branch. This significantly increases the watershed area upstream of the KY 107 Bridge (i.e., the Johnston Spring/Rock Bridge Branch subwatershed within the South Fork Little River watershed).

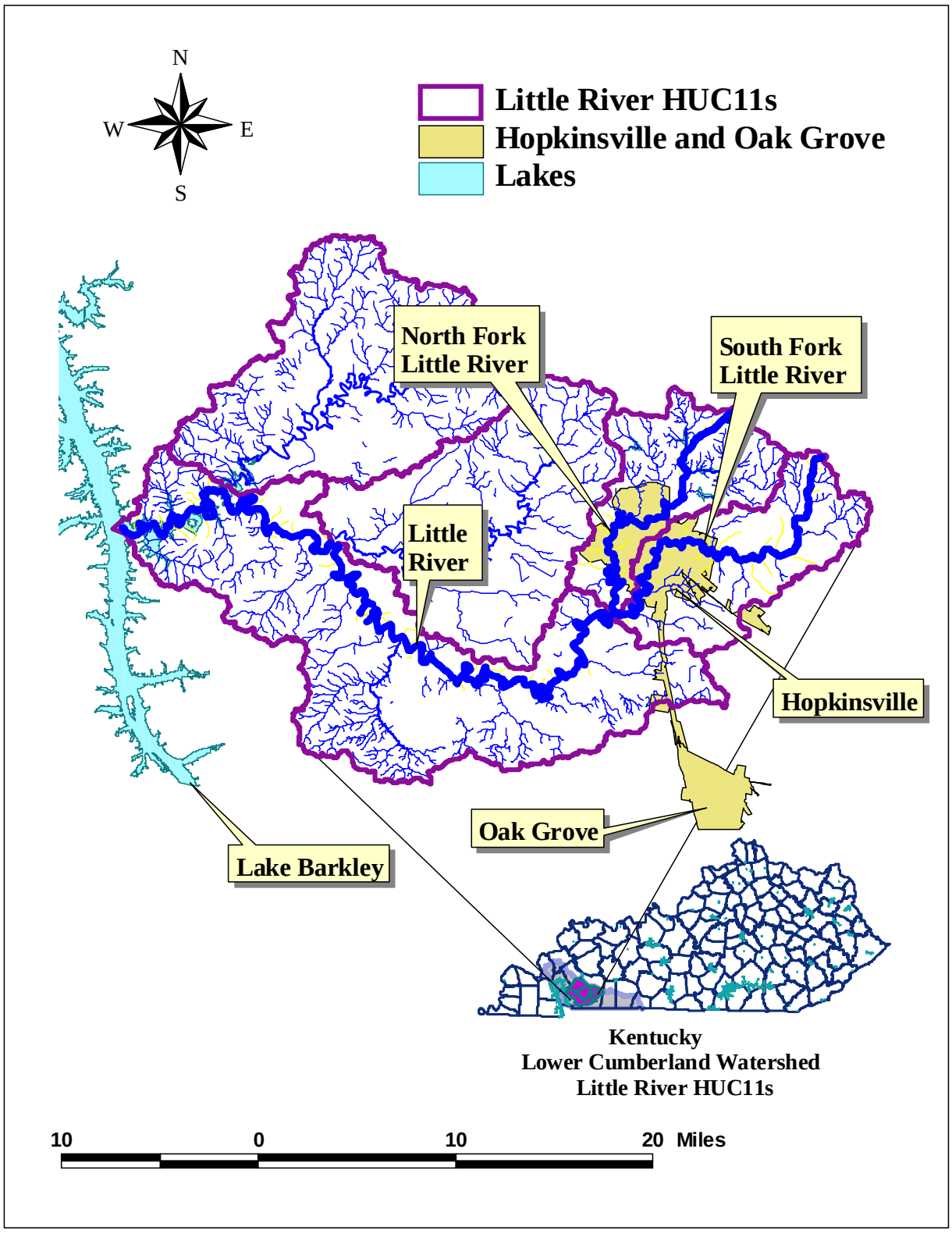

Figure 3.1 Location Map

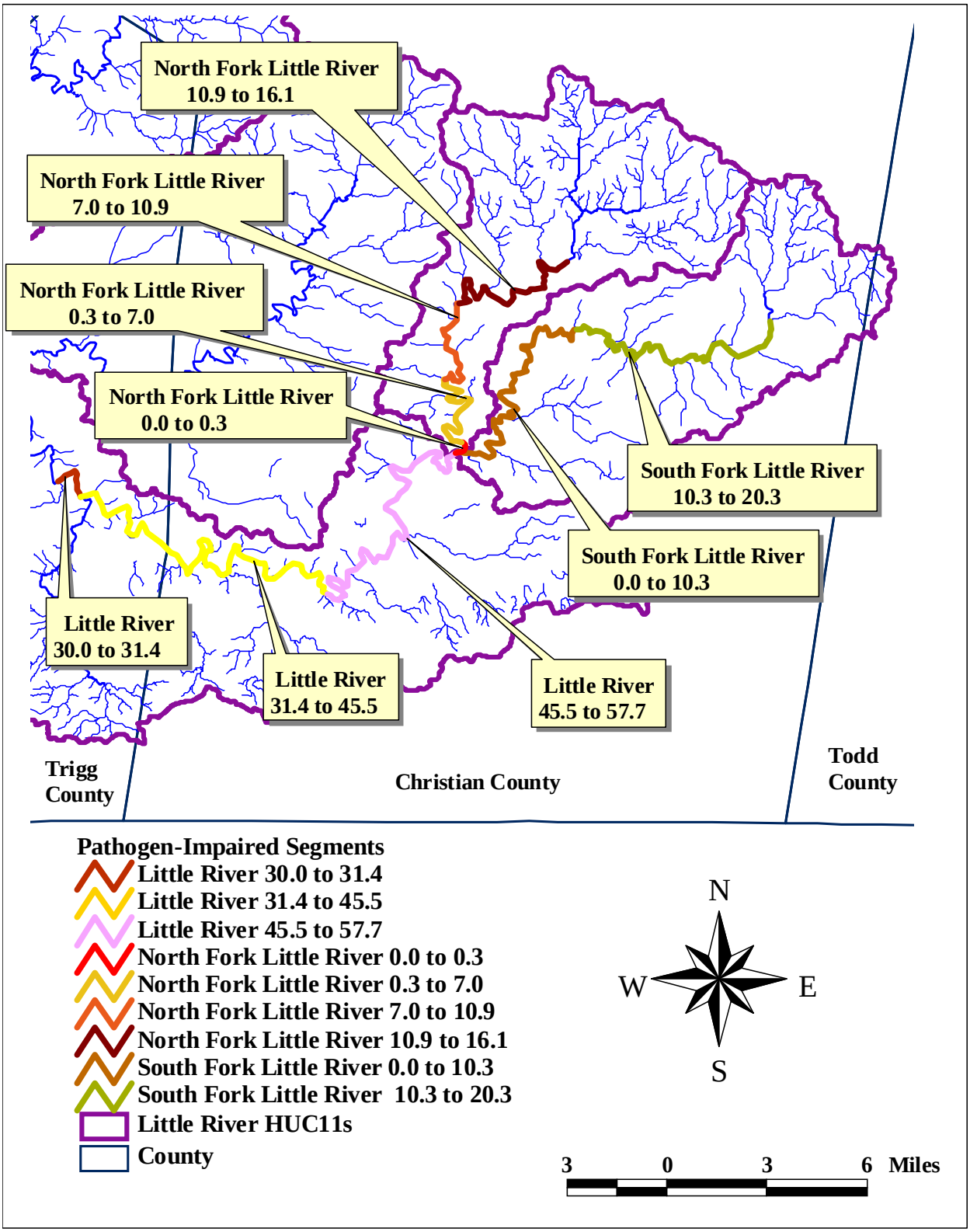

Figure 3.2 Pathogen-Impaired Segments

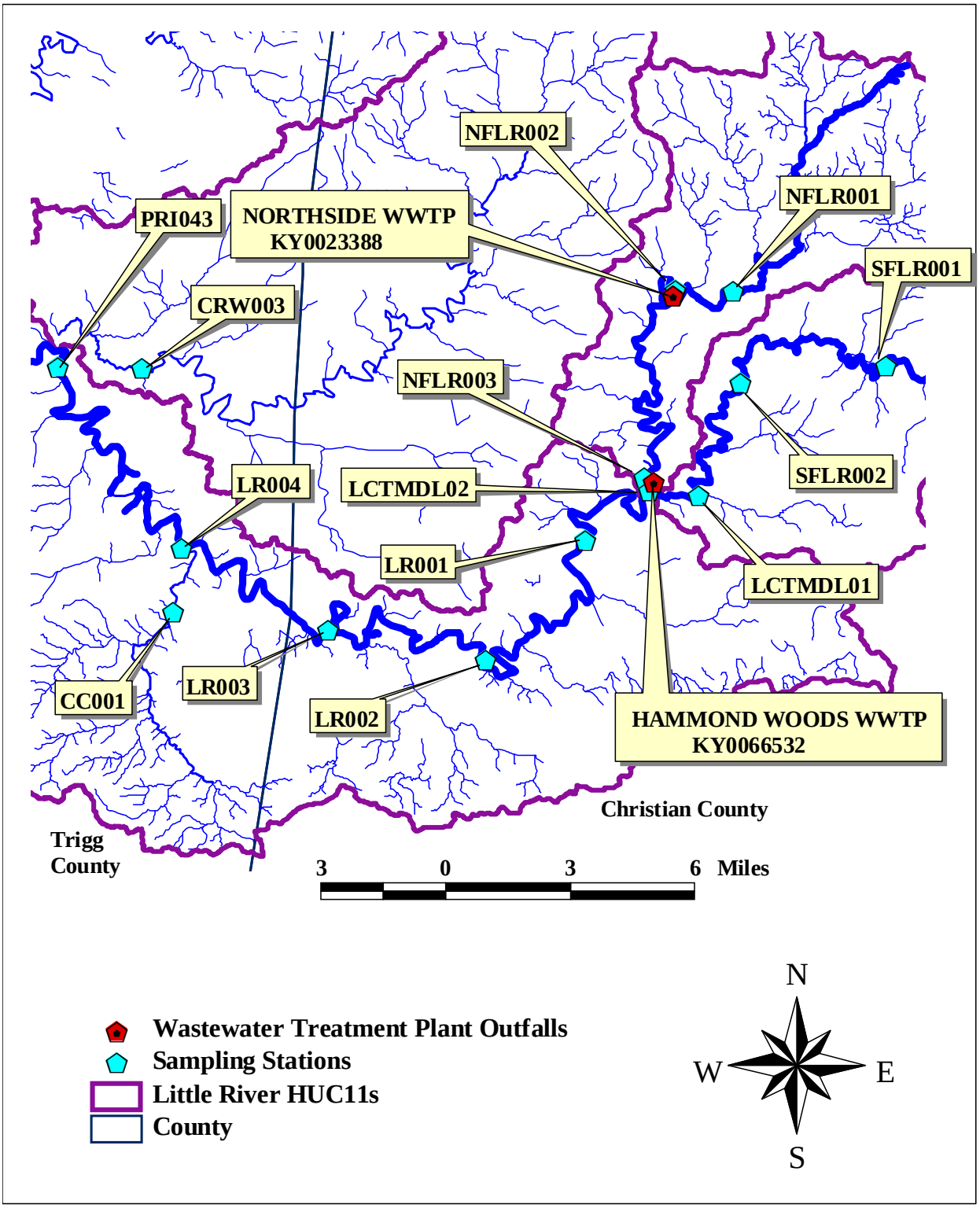

Figure 3.3 Sampling Stations and Wastewater Treatment Plant Outfalls

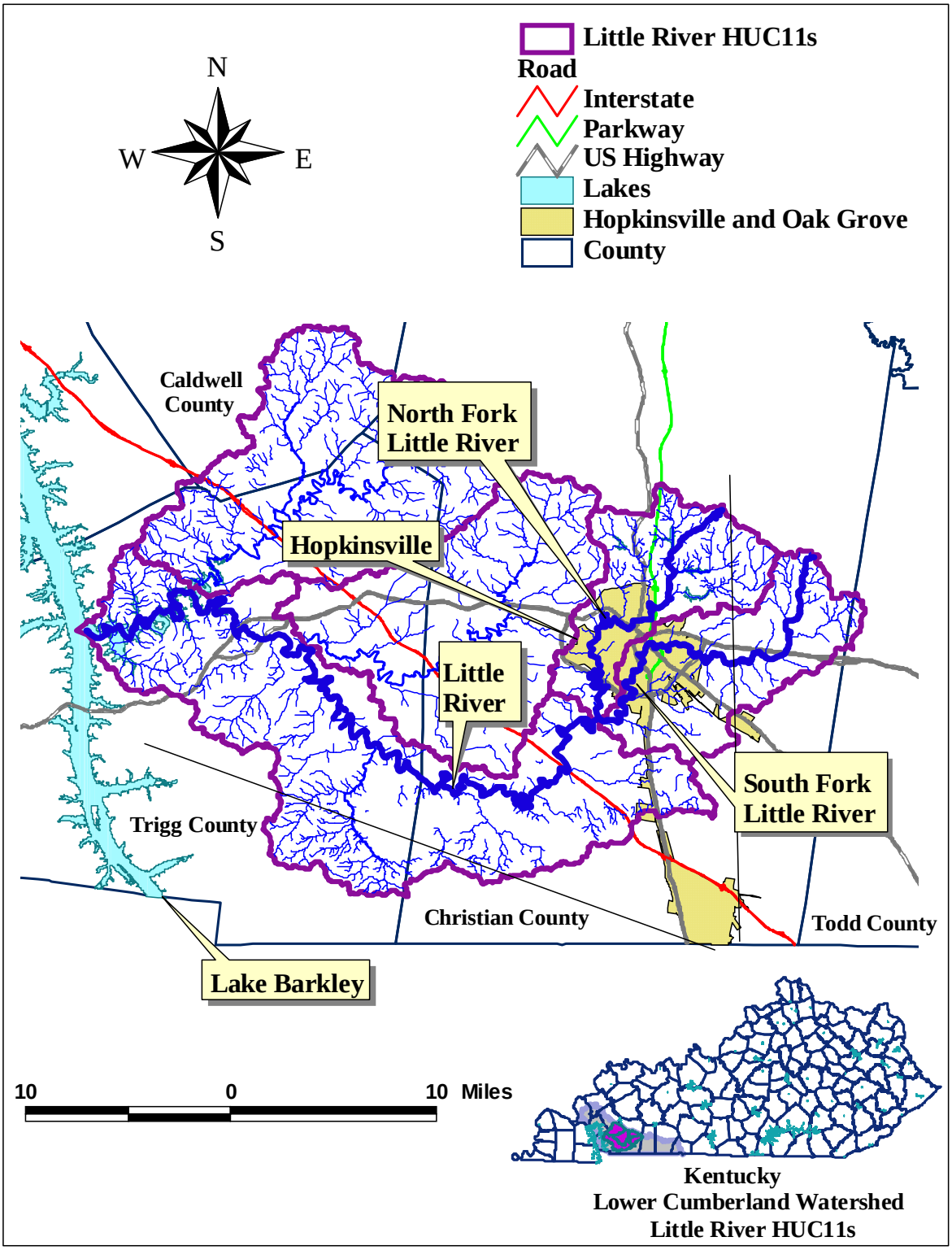

Figure 3.4 Watershed Map Showing the Location of Major Roads

3.2 Geology

According to the United States Geological Survey (USGS 1966, 1967), the Little River watershed is underlain by karstic limestone formations of late Mississippian age. Significant limestone units in the Little River watershed are the St. Louis and Ste. Genevieve Limestone. The St. Louis Limestone is composed of sequences of massively tabular limestones whereas the Ste. Genevieve Limestone is composed of thin-bedded, cherty limestones. On the northeastern side of the watershed these limestone layers are overlain by a thick sequence of limestone, sandstone and shale formations. Numerous karst features including sinkholes, sinking streams, and springs are present in the watershed. The exposure of the Ste. Genevieve Limestone at the land surface allows for water from streams to enter underground cavities through sinkholes. Water also enters the groundwater system through sinkholes developed in the sandstone layers.

3.3 Overall Land Use

The Little River watershed includes a diverse landscape of forest, agricultural areas, and urban areas around Hopkinsville and Cadiz, Kentucky. Landuse in the Little River watershed was determined using the 2001 National Land Cover Database (NLCD) landuse grid coverage, which is based on an analysis of Landsat photography of Kentucky (USGS, 2003). Landuse in the impaired watersheds is predominately agricultural, followed by forested land, see Figure 3.5. In the Little River and South Fork Little River watersheds most of the agricultural land is used for cropland followed by pastureland whereas in the North Fork Little River watershed the agricultural land is predominately pasture/hay followed by cropland. Corn grown for grain is the principal row crop harvested in the basin, followed by soybeans (USDA, 2002). The urban area of Hopkinsville represents about 13 percent of the landuse in the North Fork Little River watershed, and approximately 12 percent in the South Fork Little River watershed. However, Hopkinsville expects to grow at an annual rate of approximately 1% (R. Wenk, City of Hopkinsville, Personal Communication, 2007). See Tables 3.3 and 3.4 for a summary of current landuse by percentage and landuse by square mile. Landuse for the subwatersheds are tabulated at the downstream stations on the impaired segments.

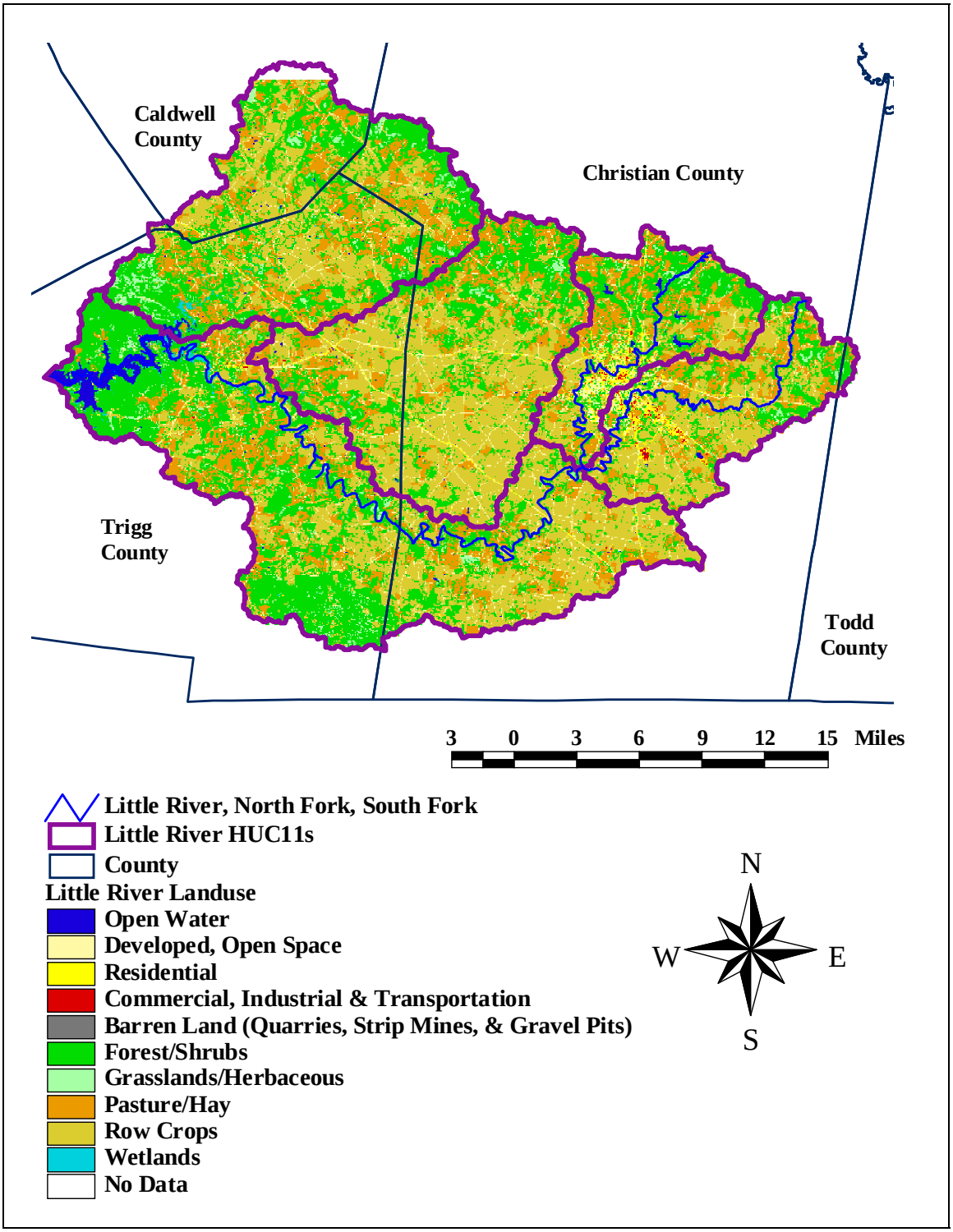

Figure 3.5 Little River Watershed Landuse

Table 3.3 Summary of Landuse by Percentage

Location	Percent						
Subwatershed Name	**Residential/ Urban**	**Barren Land (Quarries, Strip Mines & Gravel Pits)**	**Forest (Deciduous, Evergreen, Mixed and Shrubbery)**	**Grasslands/ Herbaceous**	**Pasture/Hay**	**Row Crops**	**Woody Wetlands**
Little River	8.9%	0.0%	31.5%	1.4%	20.7%	37.5%	0.0%
North Fork Little River	13.2%	0.0%	36.6%	1.5%	31.5%	17.2%	0.0%
South Fork Little River	12.1%	0.0%	25.8%	1.2%	23.1%	37.9%	0.0%

Table 3.4 Summary of Landuse by Square Mile

Location	Square Miles						
Subwatershed Name	**Residential/ Urban**	**Barren Land (Quarries, Strip Mines & Gravel Pits)**	**Forest (Deciduous, Evergreen, Mixed and Shrubbery)**	**Grasslands/ Herbaceous**	**Pasture/ Hay**	**Row Crops**	**Woody Wetlands**
Little River	22.48	0.01	79.30	3.63	52.18	94.43	0.01
North Fork Little River	7.45	0.01	20.63	0.82	17.73	9.71	0.00
South Fork Little River	8.15	0.00	17.42	0.81	15.62	25.60	0.00

4.0 Monitoring

The Little River from river mile (RM) 23.6 to 61.0 was first listed on the 1998 303(d) List as impaired for pathogens, nutrients, and siltation. This segment was identified as a First Priority Listing as it was not supporting one or more of its designated uses. In 2000, the monitoring network was expanded to include the major tributaries draining into Little River and additional stations on the river itself. The new data indicated the stream segment from RM 23.6 to 33.1 was fully supporting the PCR designated use and this segment was delisted from the 2002 303(d) list. Monitoring stations on the pathogen-listed streams are shown in Figure 3.3. A description of these monitoring locations is provided in Table 4.1. A statistical summary of fecal coliform data collected at these stations is provided in Table 4.2. Sampling data for stations with more than one sample are provided in Appendix A.

In addition to the sampling stations described above, data are included in Appendix A for three more stations which do not lie on impaired segments. Stations PRI043 (on Little River at RM 21.0), CC001 (on Casey Creek at RM 2.2) and CRW003 (on Sinking Fork at RM 4.1) are all

below the listed segments and fully support the PCR use, but their sampling data are included for informational purposes.

The river miles of almost all of the originally-listed stream segments have been changed since their original listing to reflect the National Hydrography Dataset (NHD). Two of the segments on North Fork Little River were combined (see Table 4.3).

5.0 Target Identification

The Water Quality Criteria (WQC) in 401 KAR 5:031 (Kentucky's Surface Water Standards) for the PCR use are based on both fecal coliform bacteria and E. coli bacteria. For this TMDL, the fecal coliform criterion was applied as the samples were not analyzed for E. coli. The WQC in 401 KAR 5:031 Section 7 (1)(a) states that, for the PCR designated use:

"[The] Fecal coliform content or Escherichia coli content shall not exceed 200 colonies per 100 ml or 130 colonies per 100 ml respectively as a geometric mean based on not less than five (5) samples taken during a thirty (30) day period. Content also shall not exceed 400 colonies per 100 ml in twenty (20) percent or more of all samples taken during a thirty (30) day period for fecal coliform or 240 colonies per 100 ml for Escherichia coli. These limits shall be applicable during the recreation season of May 1 through October 31."

There are insufficient fecal coliform measurements to calculate a 5-sample, 30-day geometric mean, so the latter criterion of 400 colonies per 100 ml was used as the WQC in order to calculate percent reductions to bring the watershed into compliance with the PCR designated use.

6.0 Source Identification

6.1 Permitted Sources

Permitted sources include all sources regulated by the Kentucky Pollutant Discharge Elimination System (KPDES) permitting program. The KPDES program regulates point sources, including stormwater discharges such as those regulated under the Municipal Separate Storm Sewer System (MS4) program, and WWTPs. As defined by 401 KAR 5:002, a point source is "any discernable, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, or concentrated animal feeding operation [CAFO], from which pollutants are or may be discharged. The term does not include agricultural and stormwater run-off or return flows from irrigated agriculture." KPDES is not the only permitting program for sources that may discharge to surface water within a watershed, or otherwise affect water quality or quantity. Other permitting examples include water withdrawal permits, permits to build structures within a floodplain, and permits to land apply effluent from wastewater treatment plants. However, for purposes of this TMDL, the definition of a permitted source as opposed to a non-permitted source is derived from the application of the KPDES program. A WasteLoad Allocation (WLA) is assigned to permitted point sources.

Table 4.1 Monitoring Stations on Pathogen-Impaired Segments

Station	Location	Station Location (River Mile)	Impaired Segment, River Mile (RM)	Latitude	Longitude	Sampling Period
LR001	Little River @ SR 345	53.0	Little River RM 45.5 – 57.7	36.7839	-87.5467	7/19/00 – 9/27/02
LR002	Little River @ SR 117	44.9	See note 1	36.7411	-87.5889	9/7/2000
LR003	Little River @ Binns Mill (SR 287)	37.2	Little River RM 31.4 – 45.5	36.7506	-87.6578	9/7/00 - 10/25/01
LR004	Little River @ SR 1253	31.4	Little River RM 30.0 – 31.4	36.7781	-87.7217	9/7/00 – 10/25/01
NFLR001	North Fork Little River above US41 bridge	13.1	North Fork Little River RM 7.0 – 10.9; RM 10.9 – 16.1	36.8715	-87.4847	9/6/00 – 9/27/02
LCTMDL02	North Fork Little River @ Gary Lane	0.2	North Fork Little River RM 0.0 – 0.3; RM 0.3 – 7.0	36.8018	-87.5138	4/11/00 – 9/27/02
NFLR002	@ Northside Wastewater Treatment Plant	0.3	See note 1	36.8705	-87.5103	9/6/00
NFLR003	@ Hammond Woods Wastewater Treatment Plant	10.6	See note 1	36.8051	-87.5149	9/6/00
SFLR001	South Fork Little River @ Edward Mills Rd.	14.1	South Fork Little River RM 10.3 – 20.3	36.8467	-87.4179	9/6/00 – 9/27/02
SFLR002	South Fork Little River @ US 41A	6.8	See note 2	36.8396	-87.481	9/6/00 – 9/27/02
LCTMDL01	South Fork Little River @ River Bend	2.3	South Fork Little River RM 0.0 – 10.3	36.7999	-87.4982	4/11/00 – 9/27/02

1. There are insufficient data available at this station to develop a TMDL, see Table 4.2 for a data summary for each station.
2. The data available at this station were not used to develop TMDL as a more robust dataset is available at a downstream station; the available data are provided for informational purposes and source characterization.

Table 4.2 Statistical Summary of Fecal Coliform Data

Station	No. of Obs.	% Exceeding Criteria (400 colonies/100ml)	Minimum (colonies/100mL)	Maximum (colonies/100mL)	Average (colonies/100mL)
Little River					
LR001	7	43%	57	1030	430
LR002	1	0%	160	160	160
LR003	4	50%	70	909	429
LR004	7	43%	90	1270	379
North Fork Little River					
NFLR001	8	50%	185	12000	2014
LCTMDL02	19	32%	37	2000	455
NFLR002	1	0%	10	10	130
NFLR003	1	0%	130	130	130
South Fork Little River					
SFLR001	8	37.5%	40	12000	1901
SFLR002	8	87.5%	380	12000	3333
LCTMDL01	19	36.8%	26	2400	597

Table 4.3 Impaired Segments as Revised Based on the NHD

Waterbody, Old River Miles	New River Miles
Little River 33.1 to 34.4	30.0 to 31.4
Little River 34.4 to 48.4	31.4 to 45.5
Little River 48.4 to 61.0	45.5 to 57.7
North Fork of Little River 0.0 to 0.3	Unchanged
North Fork of Little River 0.3 to 6.9	0.3 to 7.0
North Fork of Little River 6.9 to 11.6	7.0 to 10.9
North Fork of Little River 11.6 to 12.3	10.9 to 16.1
North Fork of Little River 12.3 to 18.6	
South Fork of Little River 0.0 to 10.5	0.0 to 10.3
South Fork of Little River 10.5 to 19.9	10.3 to 20.3

6.1.1 Wastewater Dischargers

The Hopkinsville Water Environment Authority (HWEA) operates a sanitary sewer collection and treatment system which serves all of the residences and businesses within the Hopkinsville corporate limits, the residential areas of Pembroke and a number of residents located in Christian County (Kentucky Infrastructure Authority, 2000). The collection system was established in 1986 and has experienced tremendous growth and improvements. Once wastewater is collected, it is pumped by one of the system's 70 or so pump stations to one of the system's two treatment facilities. The Hammond Woods treatment plant (which discharges to North Fork Little River at RM 0.3) is the system's largest facility and has a design capacity of 6 million gallons per day (MGD). According to Discharge Monitoring Report (DMR) data submitted by HWEA (USEPA, 2006), in 1999 the facility operated at 45 percent of its design capacity. The Hopkinsville Northside treatment plant (which discharges to North Fork Little River at RM 10.9) is the

system's other facility, has a 2.88 MGD capacity and in 1999 operated at 60 percent of capacity. Permit limits for these facilities are provided in Table 6.1.

DMR data between 1999 and 2004 show no violations of either the daily maximum or monthly average permit limits from either facility. In the past the City of Hopkinsville disposed of WWTP sludge by land application at the old landfill located in the North Fork Little River watershed; however, Hopkinsville currently trucks sludge to Hopkins County and land applies the sludge at a location 3 miles outside the city of Nebo, which is outside of the Little River watershed (B. Bickner, Personal Communication, 2006). Leaking sewer lines and malfunctioning pump stations are potential sources of pathogens especially after heavy rain events when infiltration and inflow processes overwhelm the sewer system, and releases have occurred from Sanitary Sewer Overflows (SSOs) in Hopkinsville. Since records have been kept in the Kentucky Department for Environmental Protection's (KDEP's) Notification and Complaints system (Not/Com, which contains records from 2000 through 2002, including the monitoring period for the data used in this report), releases have occurred from manholes, lift stations, and WWTP bypasses. Because Hopkinsville is not a combined sewer community, there are no Combined Sewer Overflows. HWEA has applied for a $1.5 million low interest loan for the rehabilitation and renovation of existing sanitary sewers within the North Fork watershed. This rehabilitation project will reduce the intensity and frequency of sewer overflows from obstructions, infiltration and inflow.

Table 6.1 KPDES Wastewater Facilities

Name	KPDES Permit Number	Design Flow (MGD)	Fecal Coliform Limits (colonies/100ml)	
			Daily Maximum	Monthly Average
Hopkinsville Hammond Woods WWTP	KY0066532	6.0	400	200
Hopkinsville Northside WWTP	KY0023388	2.88	400	200

Residential treatment units can also be permitted to discharge wastewater. However, there are no such permits active in the watershed (USEPA, 2007a).

6.1.2 MS4 Sources

Polluted stormwater runoff is often diverted and concentrated into MS4s where it ultimately discharges to surface waters with little or no treatment. MS4s are defined in 401 KAR 5:002, Section 1(184) as "a conveyance, or system of conveyances, including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains: 1. owned or operated by a state, city, town, county, district, associated or other public body…having jurisdiction over disposal of…storm water…that discharges to waters of the Commonwealth; 2. designed or used for collecting or conveying storm water; 3. which is not a combined sewer; 4. which is not part of a publicly-owned treatment works (POTW)."

The United States Environmental Protection Agency (USEPA) established Phase I of the National Pollutant Discharge Elimination System (NPDES) stormwater program in 1990 to address MS4s. Phase I included large and medium sized municipalities defined as having a population of 100,000 or more. In Kentucky Phase I was implemented in 1992 and included only Lexington-Fayette County and Louisville. Phase II of the stormwater rule began incorporating small MS4 entities (>50,000 or 1,000 people/mi^2) in 1999 with Kentucky's program beginning in 2003. Currently there are 210 communities in Kentucky targeted for the stormwater program. The City of Hopkinsville (KYG200009) meets the criteria for a small MS4 and is regulated under the Phase II stormwater program. See Figure 6.1 for a map of Hopkinsville's MS4 area. Permitted MS4s are responsible for developing a Stormwater Management Program (SWMP) that meets six requirements established by the federal NPDES program (KDOW, 2007a).

1) Public Education and Outreach
2) Public Participation/Involvement
3) Illicit Discharge Detection and Elimination
4) Construction Site Runoff Control
5) Post-Construction Runoff Control
6) Pollution Prevention/Good Housekeeping

According to the U.S. Census Bureau, in 2000 the population of Hopkinsville was 30,089 which equates to 1,252 people per square mile. In addition to population, karst area concerns and the potential for stormwater runoff from the MS4 to further degrade the impaired segments of the North Fork Little River are criteria for designating Hopkinsville as a Phase II MS4.

6.1.3 Agricultural Permitted Sources

Animal Feeding Operations (AFOs) are defined by 401 KAR 5:002 as a lot or facility where animals have been stabled, are currently stabled or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period; and where crops, vegetation forage growth, or post-harvest residues are not sustained over any portion of the lot or facility in the normal growing season. AFOs that will or are anticipated to discharge to the waters of the Commonwealth are required to obtain a Kentucky Pollutant Discharge Elimination System (KPDES) permit pursuant to 401 KAR 5:060, Section 10. "Discharge" means that *process wastewater* or water that comes into contact with the *production area* and discharges to the waters of the Commonwealth. *Process wastewater* means water directly or indirectly used in the operation of the AFO for any or all of the following: spillage or overflow from animal or poultry watering systems; washing, cleaning, or flushing pens, barns, manure pits, or other AFO facilities; direct contact swimming, washing, or spray cooling of animals; or dust control. Process wastewater also includes any water which comes into contact with any raw materials, products, or byproducts including manure, litter, feed, milk, eggs, or bedding.

If the animal feeding operation is managing the waste generated at the facility as a liquid, a construction permit must be obtained pursuant to 401 KAR 5:005.

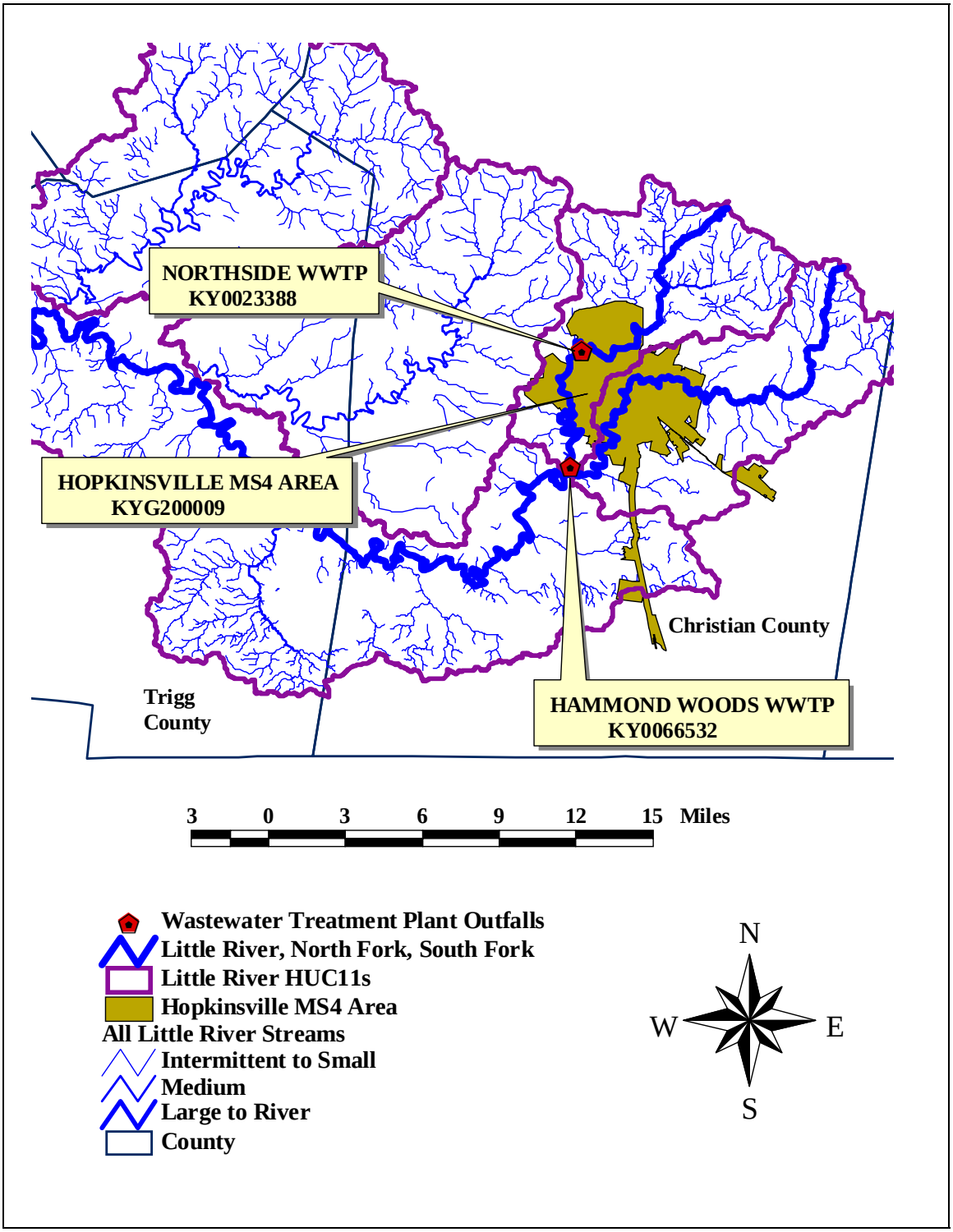

Figure 6.1 MS4 Area in the Little River Watershed

Currently, no AFOS have permits to discharge within the watershed (EPA, 2007a). AFOs that do not discharge and are not anticipated to discharge are discussed in Section 6.2.1.

Operations that are defined as a CAFOs pursuant to 401 KAR 5:060, Section 10, are required to obtain a KPDES permit. In order to be categorized as a CAFO, an operation must first meet the definition of an AFO. There is one additional requirement that defines an AFO as a CAFO. A CAFO actually discharges or intends to discharge to waters of the Commonwealth. 40 CFR 122.23 (b) defines the number of animals that comprise a CAFO. KPDES has the authority to designate smaller facilities as CAFOs if environmental circumstances warrant the designation.

Once defined as a CAFO, the operation can be permitted under a KPDES General Permit or a KPDES Individual Permit, depending upon the nature of the operation. Conditions of these permits include no discharge to surface water. The exception to the discharge prohibition is that holders of Individual Permits may discharge only during a 25-year (24-hour) or greater storm event.

There are no permitted CAFOs in the watershed (USEPA, 2007a).

6.2 Non-Permitted Sources

Non-permitted sources include all sources not permitted by the KPDES permitting program, and are often referred to as nonpoint sources. According to 401 KAR 5:002, nonpoint means "any source of pollutants not defined as a point source, as used in this chapter." While KPDES permits are not required for non-permitted sources, their loads to surface water are still regulated by laws such as the Kentucky Agricultural Water Quality Act (AWQA, KRS 224.71-100 through 224.71-145, i.e., implementation of individual agriculture water quality plans and corrective measures), the federal Clean Water Act (i.e., the TMDL process) and 401 KAR 5:037 (Groundwater Protection Plans (GPPs)), among others. Unlike permitted sources, non-permitted sources typically discharge pollutants to surface water in response to rain events (MS4s are a notable exception, as they are a permitted source that discharges pathogens to surface water in response to rain events through a system of storm drains, curbs, gutters, etc.). Non-permitted sources for pathogens exist in the watershed, and fall into various categories including agriculture, properly functioning Onsite Sewage Treatment and Disposal systems (OSTDs), failing OSTDs, household pets and natural background, which in the case of pathogens in a rural watershed means wildlife. Straight pipes are a type of non-permitted source that may exist in the watershed, but none are known to exist with certainty. These non-permitted sources are correlated to landuse. A Load Allocation (LA) is assigned to non-permitted sources.

6.2.1 Kentucky No Discharge Operating Permits

As stated in 401 KAR 5:005, facilities with agricultural waste handling systems or that dispose of their effluent by spray irrigation but do not discharge to surface waters are required to obtain a Kentucky No Discharge Operating Permit (KNDOP) from KDOW prior to construction and operation. These operations handle liquid waste in a storage component of the operation (e.g. lagoon, pit, or tank) and land apply the waste via spray irrigation or injection to cropped acreages. Land application of the waste that results in runoff into a stream is prohibited.

Facilities that handle animal waste as a liquid are required to submit a Short Form B, construction plans, and a Comprehensive Nutrient Management Plan to the Division of Water. Also included in KNDOP requirements are golf courses which land apply treated wastewater via spray irrigation, typically from a holding pond. Some industrial operations also spray irrigate.

AFOs that do not discharge or intend to discharge obtain KNDOP permits. Fifty AFOs are present in the watershed, mostly within the southern portion of the Little River basin, with dairy facilities comprising the majority of these operations. Their locations are shown on Figure 6.2 (KDOW, 2006b).

6.2.2 Agriculture

The Kentucky AWQA was passed by the 1994 General Assembly. The law focuses on the protection of surface water and groundwater resources from agricultural and silvicultural activities. The Act created the Kentucky Agriculture Water Quality Authority (KAWQA), a 15-member peer group made up of farmers and representatives from various agencies and organizations. The Act requires all farms greater than 10 acres in size to adhere to the Best Management Practices (BMPs) specified in the Kentucky Agriculture Water Quality Plan. Specific BMPs have been designated for all operations.

The U.S. Department of Agriculture (USDA) compiles agricultural statistics at the county level and reports results every five years in Agricultural Census reports. Select agricultural statistics reported in 2002 for Trigg and Christian counties are shown in Table 6.2.

Table 6.2 Agricultural Statistics (2002)

Statistic	County	
	Trigg	Christian
Farms (number/acres)	425 / 122,943	1,267 / 342,180
Cattle and Calves Inventory (farms/ total number)	235 / 16,310	599 / 37,849
Beef Cows (farms/total number)	208 / 8,738	444 / 15,191
Milk Cows (farms/total number)	12 / 128	95 / 3,077
Hogs and Pigs (farms/ total number)	12 / 2,781	47 / 12,414
Layers 20 weeks old or older (farms/total number)	10 / 750	54 / 99,956
Broilers & other meat-type chickens sold (farm/total number)	1 / (D)*	10 / 1,891,352
Corn for grain (acres)	19,491	70,221
Wheat for grain (acres)	9,090	39,906
Soybeans for beans (acres)	14,354	58,591

*Withheld by USDA to avoid disclosing data for individual farms.

Christian County was the top ranked county in Kentucky for cash receipts from crops: the County was ranked first in the state for corn and winter wheat production, and third for soybeans. For dark fire tobacco production, Christian County was ranked third and Trigg County was ranked fifth (USDA, 2002). Crops may be sources of pathogens if manure is used as a fertilizer.

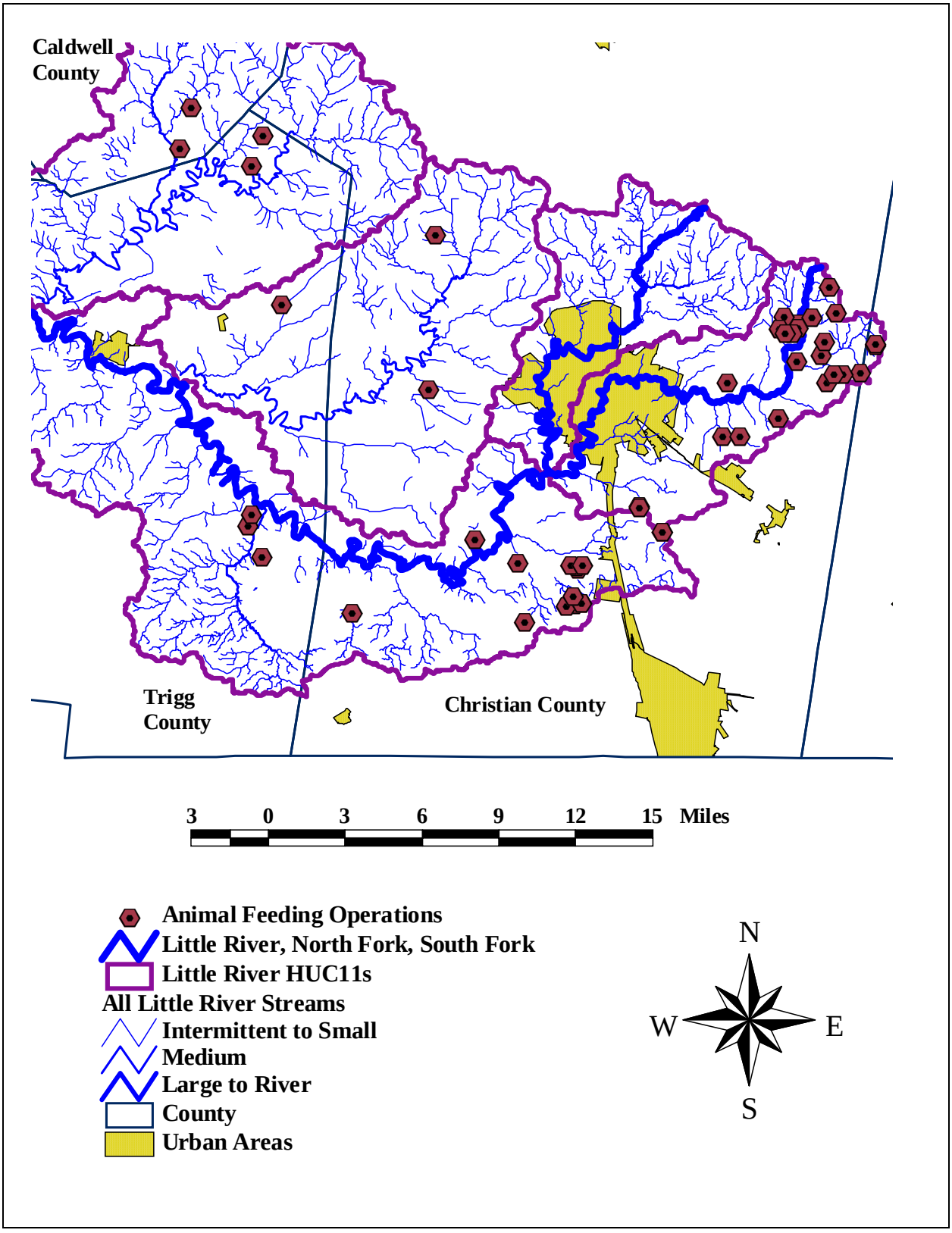

Figure 6.2 Location of Animal Feeding Operations (AFOs)

6.2.3 Human Waste Contribution

Human waste disposal is of particular concern in rural areas. Areas not served by sewers either employ an OSTD or do not treat sewage at all. OSTDs including septic tanks are commonly used in areas where providing a centralized sewage collection and treatment system is not cost effective or practical. When properly sited, designed, constructed, maintained, and operated, septic systems are an effective means of disposing and treating domestic waste. The effluent from a well-functioning OSTD is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, they can be a source of nutrients (nitrogen and phosphorus), pathogens, and other pollutants to both groundwater and surface water.

The urban areas surrounding Hopkinsville are sewered, whereas other rural areas in the watershed are on OSTDs. Failing OSTDs are likely sources of pathogens due to the porous nature of the karst formations underlying the watershed. The USDA Natural Resources Conservations Service (NRCS) publishes county soil surveys and rates the performance of septic tank absorption fields, defined as the area in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Soil ratings are based on soil properties, site features, and the observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of septic tank effluents. Soils in the study area are mostly of the Crider, Pembroke, and Baxter series. USDA rates these soil series as slightly to moderately limited for installation of septic tank absorption fields due to slope and restricted permeability (USDA 1980, 1981). Based on the soil ratings and the prevailing karst formations it is likely many of the septic systems in the watershed are not functioning properly.

A type of non-permitted source that may exist in the Little River watershed is straight pipes, which are discrete conveyances that discharge sewage, gray water (i.e., water from household sinks, laundry, etc.) and stormwater to the surface waters of the Commonwealth without treatment. Although straight pipes meet the definition of a point source as defined in 401 KAR 5:002, EPA considers them to be part of the LA as they are a non-permitted source.

See Section 6.1.1 and 6.1.2, under Permitted Sources, for a discussion of human waste contribution from WWTPs, SSOs, and the MS4 area.

6.2.4 Household Pets

Although household pets undoubtedly exist in the watershed, their contribution to the LA is deemed to be minimal compared to the other sources in the rural portions of the watershed. Pet waste may, however, be a larger relative contributor to pathogen runoff within the MS4 boundary (i.e., within the WLA).

6.2.5 Wildlife

Noting the high percentage of forest in all subwatersheds, wildlife undoubtedly contribute pathogens to the watershed. The Kentucky Department of Fish and Wildlife Resources states

there are an estimated 20 deer per square mile in Christian County and about 16 deer per square mile in Trigg County (D. Yancy, Personal Communication, 2006). Extrapolating this number to the forested areas in the Little River watershed results in about 1,380 deer, of which about 410 and 350 deer are from the North and South Fork Little River watersheds, respectively. Estimates of numbers of other types of animals are not available. As stated above, although wildlife contribute pathogens to surface water, such contributions represent natural background conditions and receive no reductions within a TMDL.

6.3 Illegal Sources. Both permitted and non-permitted sources can discharge pathogens to surface water illegally. This includes sources which are illegal simply by their existence, such as straight pipes, as well as legal sources that are operating illegally (e.g., outside of regulations, permit limits or conditions, etc., such as a WWTP bypass). Such sources receive no allocation of any kind in the TMDL process (see Section 7.0 for TMDL allocations).

In addition to straight pipes, another illegal source related to human waste disposal is failing OSTDs, which receive an allocation of zero. CSOs and SSOs are also illegal sources. As discussed in Section 6.1.2, the Hopkinsville MS4 area has only SSOs. SSOs are discharges without a permit, and receive a zero allocation.

Another potential illegal source is livestock on farms which have no BMPs as are required under the AWQA, as well as farms where BMPs are present but are insufficient or failing in a manner that causes or contributes to surface water impairment. Also included are KNDOPs, AFOs and CAFOs not in compliance with the appropriate regulations that cause or contribute to a surface water impairment.

KDOW expects the percent reductions calculated in Section 7.0 of the TMDL to begin with the elimination of illegal sources. This is intended to prevent legally operating sources from having to effect reductions in order to accommodate the pollutant loading of illegal sources.

Note this Section of the TMDL is not intended to summarize the universe of potential illegal sources that may discharge pollutants into surface waters, nor does it attempt to summarize the universe of legal sources that may be operating illegally. Instead, it gives examples of illegal sources known to be present in this watershed, or that could be present in the watershed (e.g., straight pipes) and sets the allocation for these (and other potential illegal sources) at zero.

7.0 TMDL

7.1 TMDL Equation

According to USEPA (2007b), A TMDL calculation is performed as follows:

$$TMDL = WLA + LA + MOS$$

Where:
TMDL = the maximum load the waterbody can assimilate while still meeting the WQC, which was defined in Section 5.0 as an instantaneous concentration of 400 colonies/100 ml.
WLA = the WasteLoad Allocation, which is the allowable loading of pollutants into the stream from KPDES-permitted point sources such as sewage treatment plants and MS4s.
LA = the Load Allocation, which is the allowable loading of pollutants into the stream from sources not permitted by KPDES and from natural background.
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 data or TMDL calculations.
TMDL Target = the TMDL minus the MOS

Percent reductions are applied to sources to bring existing conditions in line with the TMDL Target. After these reductions are calculated, the WLA (if any) and LA (if any) represent the final allocation for sources in the watershed (i.e., the allowable loading to the stream system for those sources).

The TMDL calculation must take into account seasonality and other factors that affect the relationship between pollutant inputs and the ability of the stream to meet its designated uses. This typically involves defining a critical condition, see below.

7.2 Critical Condition

The critical condition for nonpoint source pathogen loadings is typically an extended dry period followed by a rainfall runoff event. During the dry weather period, pathogens build up on the land surface, and are washed off by subsequent rainfall. The critical condition for point source loading typically occurs during periods of low streamflow when dilution is minimized. Because the Little River watershed contains both types of sources, and because the PCR use applies only during the recreational season, the critical period was defined as May through October.

7.3 Existing Conditions

Existing conditions are the pathogen concentrations present in the watershed at the time of the study. A percent reduction is applied to bring existing conditions in line with the TMDL Target (which is defined as the TMDL concentration minus the MOS, see Section 7.6.3) of 360 colonies/100ml. The existing conditions are expressed in terms of the samples that exceeded the target. Specifically, the 90^{th} percentile concentration of all samples above the WQC was selected to represent existing conditions. The 90^{th} percentile concentration means that 90 percent of the measured exceedances are lower than this concentration and 10 percent are higher. This approach reasons that if the 90^{th} percentile were reduced to a concentration that meets the TMDL Target, then there would be exceedances only 10% of the time, to the extent that the sampling data replicate actual conditions, even if all samples show exceedances. This percentage satisfies the PCR standard, which allows for 20% exceedances, as stated in Section 5.0. See Section 7.6.1 for further discussion of uncertainty in the TMDL calculations. The 90^{th} percentile concentrations of the exceedances (i.e., the existing conditions) for each listed segment are shown in Table 7.1.

Table 7.1 Existing Conditions

Waterbody	Monitoring Station	Existing Conditions (colonies/100ml)
Little River RM 30.0 – 31.4	LR004	1187
Little River RM 31.4 – 45.5	LR003	877
Little River RM 45.5 – 57.7	LR001	984
North Fork Little River RM 0.0 - 0.3	LCTMDL02	1635
North Fork Little River RM 0.3 – 7.0	LCTMDL02	1635
North Fork Little River RM 7.0 – 10.9	NFLR001	9000
North Fork Little River RM 10.9 – 16.1	NFLR001	9000
South Fork Little River RM 0.0 – 10.3	LCTMDL01	2160
South Fork Little River RM 10.5 – 20.3	SFLR001	10000

Note the existing conditions represent loads from all sources, including non-permitted sources, MS4 and other permitted sources. Further discussion of the MS4 and other permitted source contribution is found in Section 7.4.1.1.

7.4 WLA and LA

The WLA and LA represent the final pollutant loading allocations that are allowed in the watershed. The WLA and LA are different than the existing permitted sources load and the existing non-permitted sources load, which are initial loadings to the watershed (and are causing the impairment, either individually or in sum), not final allocations (which are set at a level that will ameliorate the impairment).

Percent reductions are calculated that will bring the existing conditions in line with the final allocations. The available sampling data were insufficient to apportion the existing loading among the various sources. Therefore, the percent reduction necessary to achieve the allowable load was calculated for all sources as opposed to individual sources, even though some sources (e.g., wildlife) may not have controls implemented as a result of this TMDL. The exception is the WWTPs, which receive a numerical WLA as opposed to a percent reduction, because their design flow is known and can be used to calculate load, whereas flow data are not available for other sources.

7.4.1 WLA. The WLA is the allocation given to KPDES-permitted sources within the TMDL. The WLAs assigned to permitted wastewater treatment facilities are calculated based on permitted concentration limits and facility design flow (in units of MGD) using the following equation:

Load = Flow (MGD) * Concentration (colonies/100ml) * conversion factor

WLAs for the facilities listed in Table 6.1 are provided in Table 7.2. Using the facility information for Hopkinsville Hammond Woods WWTP (KY0066532) provided in Table 6.1, the WLAs for monthly average and daily maximum conditions are calculated as follows:

Monthly Average Load = 6 MGD * 200 colonies/100mL * 1E+06 * 3.785 L/gal * 1000mL/L

Monthly Average Load = 4.54E+10 colonies/day

Maximum Daily Load = 6 MGD * 400 colonies/100mL * 1E+06 * 3.785 L/gal * 1000mL/L
Maximum Daily Load = 9.08 E+10 colonies/day

Table 7.2 WasteLoad Allocations

Facility	WasteLoad Allocations (colonies/day)	
	Daily Maximum	Monthly Average
Hopkinsville Hammond Woods WWTP (KY0066532)	9.08E+10	4.54E+10
Hopkinsville Northside WWTP (KY0023388)	4.36E+10	2.18E+10

The Maximum Daily Load calculations were used to set the WLA for both WWTPs. However, KDOW expects compliance with the WQC to be determined by effluent pathogen concentration, as described in Section 5.0, not by load. The City of Hopkinsville has plans to combine the existing WWTPs (Northside will go offline, Hammond Woods will absorb its load) and expand overall capacity to 20 MGD. It is anticipated the new plant will service areas of Hopkinsville currently on septic systems and should result in improved water quality as much of the geographic area around Hopkinsville is ill-suited for septic disposal. Using the permit limits for the existing facilities and the increased design flow, the new facility will receive monthly average and daily maximum WLA values of 1.514E+11 colonies/day and 3.028E+11 colonies/day, respectively. During low flow conditions it is unlikely the new facility will operate at design flow. Based on a review of the DMR data, the existing facilities currently operate between 40 and 60 percent of capacity during low flow conditions.

The WLA also includes allocations for the MS4 area. CAFOs are also included under the WLA, but no permitted CAFOs exist in the watershed at this time.

7.4.1.1 WLA Reductions

No reductions are assigned to the WWTPs because their WLAs are calculated based on their permit limits, which are set at the WQC, and a WWTP in compliance with its permit cannot cause or contribute to an impairment. Any potential illegal operating condition, such as a WWTP failing to adequately treat its effluent, receives an allocation of zero. As stated above, KDOW expects SSOs to be 100% eliminated in order to effect the WLA allocated to the WWTPs by this TMDL.

Although the MS4 is permitted as a point source by regulation, it is assigned the same percent reduction as the non-permitted sources in the watershed (see LA Reductions in Section 7.4.2.1) because loading from both types of sources typically occurs in response to rainfall events, and unlike WWTP discharge permits, the MS4 stormwater permit does not set end-of-pipe limits, and flow data are not available from this source.

Any potential illegal permitted source or operation, such as agricultural operations not in compliance with applicable AFO or CAFO regulations, receives an allocation of zero.

7.4.2 LA. The LA is where non-permitted sources (e.g., nonpoint sources, or those sources not permitted by KPDES) receive their allocation within the TMDL. In the case of the Little River watershed, non-permitted sources include agriculture, possible straight pipes, wildlife, OSTDs and rural household pets.

7.4.2.1 LA Reductions

Failing OSTDs and straight pipes are illegal and should be eliminated. In the course of eliminating any existing straight pipes or failing OSTDs, the pollutant load carried could be routed to functional OSTDs, to an existing WWTP, or possibly to a future KPDES-permitted point source such as a package treatment plant. If the former, the load will be reduced between 99% and 99.9%, after pathogen losses in the soil column are accounted for (USEPA, 2002). If the latter, the permitted point source must conform to the requirements for point sources as described in Section 7.4.1.

Also, discharges from facilities not in compliance with KNDOP regulations or BMP requirements under the AWQA are illegal: These sources therefore receive no allocation, and are expected to come into compliance with the appropriate regulations. As stated above, KDOW expects implementation to begin with illegal sources in order to avoid legal sources having to effect reductions to accommodate the pollutant input of the illegal sources.

The contribution from household pets in rural areas is deemed to be minimal; therefore no reduction is expected for this source. Loading from wildlife is considered to be natural background and does not receive a reduction within the TMDL. If all sources (WLA and LA, excepting wildlife) are in compliance (i.e., WWTPs are meeting end-of-pipe limits, the MS4 is in compliance with the conditions of its permit, and farms are in compliance with BMP requirements), then no further reductions will be required from these sources if a stream fails to meet the PCR use solely due to contributions from wildlife.

7.5 Calculation of the TMDL Target and Percent Reductions by Station

The “percent reduction” approach was used to express the TMDL for the Little River watershed. The percent reduction required to meet the WQC was calculated based on the difference between the existing conditions and the TMDL Target. Thus the reduction is the percent difference between the 90^{th} percentile of fecal coliform concentrations collected during the recreation season that exceed the TMDL Target (which is defined as the WQC minus the MOS, or 360 colonies/100ml, see Section 7.6.3) and the TMDL Target. This equation is presented below:

$$\text{Percent Reduction (\%)} = [\ (\text{existing concentration} - \text{target}) / \text{existing concentration}\ ] * 100$$

As stated above, the WWTPs already discharge at a permit limit that meets the WQC, so no percent reduction is applied to these sources. A percent reduction was calculated for each sampling station, then this reduction was applied to one or more impaired segments.

7.6 Margin Of Safety

As stated, the MOS can be an implicit or explicit additional reduction applied to the WLA, LA or to both types of sources that accounts for uncertainties in the data or TMDL calculations. Below is a discussion of uncertainty and other factors accounted for by the MOS.

7.6.1 Accounting for Uncertainty in the MOS

The reductions needed to achieve the TMDL Target were calculated using the samples which showed exceedances of the WQC, which included only two to seven samples per station. This is a very small dataset for which to calculate reductions, and this increases the uncertainty involved. Also, some data (such as the 8/27/01 sample for NFLR001) were reported with a data qualifier of ">" (i.e., the "greater than" symbol), meaning the dilution used was inadequate to characterize the true value of the sample, but the value likely exceeds the number reported. See Appendix A for TMDL data. Therefore an implicit and explicit MOS will be implemented to account for the small size of the dataset and the use of ">" qualified data. However, regardless of the procedure used to estimate percent reductions for each sampling station, reductions from existing conditions ultimately must be effected within the watershed only until all stream segments meet the PCR use, or until all sources save wildlife are in compliance. However, once the WQC is met, all sources (save wildlife) must continue to discharge at a load that meets the WQC.

7.6.2 Other Factors Accounted for by the MOS

Only samples which showed exceedances of the criterion were used to calculate the percent reductions at each station, as opposed to using all the data, which creates an implicit MOS. Using the 90^{th} percentile of all exceedances is a conservative assumption because if the 90^{th} percentile concentrations of the exceedances were reduced to the TMDL target of 360 colonies/100ml, the instream concentrations would only exceed the target value 10% of the time, to the extent that the sampling data represent actual conditions, even if all the samples showed exceedances, which was not the case at any station.

7.6.3 Determination of the MOS

To account for the use of ">"-flagged data and for the small dataset, an explicit MOS of 10% will be applied to the final reductions at all stations, see Table 7.3. This results in a TMDL Target of 360 colonies/100ml after subtracting 10% of the 400 colonies/100ml WQC, as stated in Section 7.2.2. This is in addition to the implicit MOS from using the 90^{th} percentile of only the exceedances to calculate percent reductions.

7.7 TMDL Summary by Station

Below is a table defining the TMDLs for the pathogen-impaired streams in the watershed. To comply with federal requirements, an example methodology for converting the TMDL, LA and MOS to a daily load can be found in Appendix B.

Table 7.3 TMDL Allocations

Waterbody, Impaired River Miles (RM) [1]	Monitoring Station	WLA [1, 2, 6]		LA (Percent Reduction) [6]	Margin of Safety	TMDL [5] (Percent Reduction)
		Wastewater Treatment Plants (colonies/day)	MS4 (Percent Reduction) [7]			
Little River RM 30.0 – 31.4	LR004	1.34E+11 [3]	0	69.7%	10%	69.7%
Little River RM 31.4 – 45.5	LR003	1.34E+11 [3]	0	59.0%	10%	59.0%
Little River RM 45.5 – 57.7	LR001	1.34E+11 [3]	0	63.4%	10%	63.4%
North Fork Little River RM 0.0 - 0.3	LCTMDL02	1.34E+11 [3]	78.0%	78.0%	10%	78.0%
North Fork Little River RM 0.3 – 7.0	LCTMDL02	4.36E+10 [4]	78.0%	78.0%	10%	78.0%
North Fork Little River RM 7.0– 10.9	NFLR001	4.36E+10 [4]	0	96.0%	10%	96.0%
North Fork Little River RM 10.9 – 16.1	NFLR001	0	0	96.0%	10%	96.0%
South Fork Little River RM 0.0 – 10.3	LCTMDL01	0	83.3%	83.3%	10%	83.3%
South Fork Little River RM 10.3 – 20.3	SFLR001	0	0	96.4%	10%	96.4%

1. Although 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.
2. Any future permitted point source must meet permit limits based on the Water Quality Standards in 401 KAR 5:031, and must not cause or contribute to an existing impairment.
3. Daily allocations for the WWTPs discharging to these listed segments (i.e., both the Hammond Woods and Northside plants, at River Mile 0.3 and 10.9, respectively, of the North Fork Little River) are equal to their permit limit times their design flow. Therefore the WLA for these segments (which are downstream of the discharge points from both WWTPs) is 1.34E+11 colonies/day. The future allocation for the planned expansion of Hammond Woods WWTP will also be its design flow multiplied by its permit limit, or 3.03E+11 colonies/day. These values were derived using the instantaneous WQC of 400 colonies/100ml. The monthly average allocations for the existing WWTPs will be 50% of their daily allocations calculated as a geometric mean, based on the WQC of 200 colonies/100ml (as opposed to 400 colonies/100ml). Individual allocations for the WWTPs are presented in Table 7.2 and in the TMDL synopsis.
4. The WLA for these listed segments is equal to the permit limit times the design flow of the Northside WWTP only, or 4.36E+10 colonies/day.
5. Calculations expressing the TMDL as a daily load can be found in Appendix B.
6. In the event that compliance with the WQC is determined using E. Coli concentrations as opposed to fecal coliform concentrations, the final fecal coliform allocations can be converted to E. Coli by multiplying by the figure (240/400).
7. The Hopkinsville MS4, Permit Number KYG200009.

8.0 Implementation

Section 303(e) of the Clean Water Act and 40 CFR Part 130, Section 130.5, require states to have a continuing planning process (CPP) composed of several parts specified in the Act and the regulation. The CPP provides an outline of agency programs and the available authority to address water issues. Under the CPP umbrella, the Watershed Management Branch of KDOW will provide technical support and leadership with developing and implementing watershed plans to address water quality and quantity problems and threats. Developing watershed plans enables more effective targeting of limited restoration funds and resources, thus improving environmental benefit, protection and recovery.

Watershed plans provide an integrative approach for identifying and describing how, when, who and what actions should be taken in order to meet water quality standards. At this time, a comprehensive watershed restoration plan for the Little River watershed has not been developed. This TMDL provides pathogen allocations and reduction goals that may assist with developing a detailed watershed plan to guide watershed restoration efforts.

A Watershed Plan for the Little River watershed should address both point and nonpoint sources of pollution in the watershed and should build on existing efforts as well as evaluate new approaches. Because of the specific landscape and location of the impairments in the Little River watershed, a Watershed Plan should incorporate restoration and protection mechanisms available under the AWQA, GPPs, Hopkinsville's stormwater KPDES permit and wastewater KPDES permits. A comprehensive Watershed Plan should consider both voluntary and regulatory approaches to meet water quality standards. When such a plan is developed, pollutant trading may be a viable management strategy to consider for meeting the TMDL load reduction goals.

While a watershed plan does not yet exist for the Little River, water pollution control initiatives are underway including sewer and stormwater management actions and agricultural BMP implementation. Actions to reduce pathogen loadings in the Little River watershed have been diverse, extensive and sustained. For this reason, a follow-up pathogen assessment is recommended in order to more accurately gauge the current status of pathogen levels in the Little River watershed

8.1 Ongoing Activities

In 1999, the Little River watershed was selected as one of the five Clean Water Action Plan (CWAP) projects in Kentucky. These CWAPs were selected for focused and targeted nonpoint source control efforts by multiple agencies. From 1999 through 2002, the Division of Water and the Division of Conservation provided $1,077,307 in Clean Water Act Section 319(h) Nonpoint Source (NPS) Grant funds for efforts in the Little River watershed. Unfortunately, two of the seven projects were never initiated. One, the Little River Action Plan, was a project to install BMPs. This project never began due to the withdrawal of local support for the project. The second, Little River Watershed Implementation Plan Development, was to develop a comprehensive watershed plan. This project fell through due to a lack of understanding of the watershed. The remaining five projects focused on improving our understanding of the

watershed and included development of a pathogen TMDL (NPS Project # 99-25), determining the baseline biological conditions of the Little River (NPS Project # 99-26), conducting dye tracing to delineate the groundwater flows in the watershed (NPS Project # 99-27), a continuation of biological data collection (NPS Project # 00-20) and, finally, an extensive investigation of the concentrations and estimated loads and yields of nutrients and suspended sediment in addition to occurrence, distribution, loads, and yields of selected pesticides was conducted during 2003-2004 (NPS Project # 01-17). Of the $1,077,307 allocated to the Little River watershed, these five projects totaled $505,107 in federal financial assistance.

Volunteer monitoring has also occurred in the Little River watershed. Pathogen levels in Little River, North Fork Little River, and South Fork Little River have been monitored continuously since 1999 by Four Rivers Watershed Watch. Three times per year, water samples are collected at sites on Lake Barkley, Little River, and Muddy Fork (a tributary of Sinking Creek). Physical measurements, such as temperature, pH, dissolved oxygen, and Secchi depth (lake samples only) are collected. Stream monitoring also includes macroinvertebrate and habitat assessments. Water samples are routinely tested for E. coli, fecal coliform, selected pesticides, and nutrients. Data from annual monitoring are routinely used to help identify problems in the watershed and to assist with prioritizing streams for restoration and protection activities.

In addition to surface and groundwater assessments, much work has been accomplished regarding implementing pathogen control measures. As stated in Section 6.2.2, the AWQA (KRS 224.71-100 through 224.71-145) focuses on the protection of surface water and groundwater resources from agricultural and silvicultural activities. The Act requires all farms greater than 10 acres in size to adhere to the BMPs specified in the Kentucky Agriculture Water Quality Plan. Specific BMPs have been designated for all operations. Producers in the Little River watershed have invested tremendous resources into developing and implementing individual Agriculture Water Quality Plans. State and Federal financial support have been provided to assist producers with implementing the BMPs specified in their Agriculture Water Quality Plans.

The Kentucky Soil Erosion and Water Quality Cost Share Program has provided cost-share assistance to landowners for agricultural BMP installation in Christian, Todd and Trigg Counties; these are the counties which contain portions of the Little River watershed. The cost-share Program began in 1995 and is administered through the Kentucky Division of Conservation. Local oversight is provided by the county Conservation Districts, with technical assistance provided by the United States Department of Agriculture-Natural Resources and Conservation Service. Since 1995, the Division of Conservation has approved 358 applications from producers in Christian, Todd and Trigg Counties (KDOC, 2007). These approved applications exceed $3.1 million in state cost-share assistance for BMP implementation (KDOC, 2007). Specifically, 132 applications were approved for Christian County totaling $1,310,345. 114 applications were approved for Todd County totaling $725,052, and 112 applications were approved for Trigg County totaling $1,076,573. During calendar year 2007, the types of BMPs approved include heavy use area protection (35), rotational grazing systems (7), pasture and hayland erosion control (5), sinkhole protection (3), agricultural waste control facilities (2) and cropland erosion control systems (2).

In addition to pollution control activities in rural areas, activities are underway in the more developed urban areas as well. As stated, the City of Hopkinsville meets the criteria for a small MS4 and is regulated under the Phase II stormwater program (permit # KYG200009). The Six Minimum Measures that are part of the MS4 program include: (1) Public Education and Outreach, (2) Public Participation/Involvement, (3) Illicit Discharge Detection and Elimination, (4) Construction Site Runoff Control, (5) Post-Construction Runoff Control and (6) Pollution Prevention/Good Housekeeping. The city is actively engaged in stormwater management measures that will reduce runoff pollution. In 2005 the city established the Hopkinsville Surface and Stormwater Utility, which is responsible for implementing projects to reduce flooding and for identifying stormwater sources that degrade water quality.

The City of Hopkinsville also has plans to combine the existing WWTPs (Northside will go offline, Hammond Woods will absorb its load) and expand overall capacity to 20 MGD. It is anticipated the new plant will service areas of Hopkinsville with OSTDs and should result in improved water quality as much of the geographic area around Hopkinsville is ill-suited for OSTDs. Using the permit limits for the existing facilities and the proposed increased design flow, the new facility would receive monthly average and daily maximum WLA values of 1.514E+11 and 3.028E+11 colonies/day, respectively. During low flow conditions it is unlikely the new facility will operate at design flow. Based on a review of the DMR data, the existing facilities currently operate between 40 and 60 percent of capacity during low flow conditions.

8.2 Public Participation

This TMDL was published for a 30-day public notice period beginning April 15th, 2008 and ending May 23rd, 2008. A notification was sent to all newspapers in the Commonwealth of Kentucky and an advertisement was placed in four newspapers in the watershed area; these were the *Kentucky New Era* (Hopkinsville), the *Cadiz Record* (Cadiz), the *Todd County Standard* (Elkton), and the *Courier* (Fort Campbell).

All comments received during the public notice period have been incorporated into the administrative record for this TMDL. After consideration of each comment received, revisions were made to the TMDL report and responses were prepared and mailed or emailed to each person or agency which commented during the public notice process (KDOW received most comments via email, with only an email return address provided).

As stated in Section 1.0, during the public notice period, the Kentucky Division of Water (KDOW) received several comment stating the dataset used to develop the TMDL was too old to be representative of current conditions in the watershed. To address these concerns about the age of the data, KDOW plans to resample the pathogen-impaired segments of the Little River watershed beginning in May of 2009. This sampling will allow KDOW to verify the impaired status of the streams currently listed for pathogens, and subsequently use the data to show that streams now either meet the Primary Contact Recreation (i.e., PCR or swimming) use and that implementation is not required, or to guide implementation. As such, a minimum number of samples will be collected if pollution is found above the WQC, and implementation will proceed. If the samples are consistently below the WQC, the status of the stream will be changed to fully supporting the PCR use. However, the segment may remain on the 303(d) if it is impaired by

other pollutants, and sources will be required to meet the TMDL if another (downstream) segment is still impaired for pathogens. Regardless of the whether the streams are found meet the PCR use in 2009, all sources (save wildlife) must still discharge in a manner that does not cause or contribute to an impairment.

9.0 References

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Appendix A. Data

Below are the data used to develop the TMDL. Data flagged with a greater than symbol (“>”) represents the lowest dilution analyzed of a sample, and these data were used for TMDL development as listed, although the actual concentration is likely higher.

Table A.1 Station LR001 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
LR001	Little River @ Hwy345	53.0	9/7/00	220
LR001	Little River @ Hwy345	53.0	7/10/01	57
LR001	Little River @ Hwy345	53.0	7/19/01	110
LR001	Little River @ Hwy345	53.0	7/26/01	360
LR001	Little River @ Hwy345	53.0	8/27/01	436
LR001	Little River @ Hwy345	53.0	9/19/01	1030
LR001	Little River @ Hwy345	53.0	10/25/01	800

Table A.2 Station LR002 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
LR002	Little River @ Hw117	44.9	9/7/00	160
Note this station was not used in the TMDL				

Table A.3 Station LR003 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
LR003	Little River @ Binns Mill	37.2	9/7/00	70
LR003	Little River @ Binns Mill	37.2	7/26/01	590
LR003	Little River @ Binns Mill	37.2	8/27/01	909
LR003	Little River @ Binns Mill	37.2	10/25/01	145

Table A.4 Station LR004 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
LR004	Little River @ Hwy 1253	31.4	9/7/00	90
LR004	Little River @ Hwy 1253	31.4	7/10/01	117
LR004	Little River @ Hwy 1253	31.4	7/19/01	90
LR004	Little River @ Hwy 1253	31.4	7/26/01	320
LR004	Little River @ Hwy 1253	31.4	8/27/01	1270
LR004	Little River @ Hwy 1253	31.4	9/19/01	330
LR004	Little River @ Hwy 1253	31.4	10/25/01	436

Table A.5 Station NFLR001 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
NFLR001	North Fork Little River above US 41	13.1	9/6/00	250
NFLR001	North Fork Little River above US 41	13.1	6/5/2001	280
NFLR001	North Fork Little River above US 41	13.1	7/10/2001	185
NFLR001	North Fork Little River above US 41	13.1	7/19/2001	570
NFLR001	North Fork Little River above US 41	13.1	7/26/2001	520
NFLR001	North Fork Little River above US 41	13.1	8/27/2001	>12000
NFLR001	North Fork Little River above US 41	13.1	9/19/2001	>2000
NFLR001	North Fork Little River above US 41	13.1	10/25/2001	309

Table A.6 Station LCTMDL02 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
LCTMDL02	North Fork Little River at Gary Lane	0.2	5/9/00	142
LCTMDL02	North Fork Little River at Gary Lane	0.2	5/25/00	>2000
LCTMDL02	North Fork Little River at Gary Lane	0.2	6/19/00	320
LCTMDL02	North Fork Little River at Gary Lane	0.2	6/29/00	170
LCTMDL02	North Fork Little River at Gary Lane	0.2	7/18/00	157
LCTMDL02	North Fork Little River at Gary Lane	0.2	7/25/00	220
LCTMDL02	North Fork Little River at Gary Lane	0.2	8/22/00	97
LCTMDL02	North Fork Little River at Gary Lane	0.2	8/30/00	180
LCTMDL02	North Fork Little River at Gary Lane	0.2	9/6/00	500
LCTMDL02	North Fork Little River at Gary Lane	0.2	9/19/00	67
LCTMDL02	North Fork Little River at Gary Lane	0.2	10/17/00	37
LCTMDL02	North Fork Little River at Gary Lane	0.2	10/31/00	81
LCTMDL02	North Fork Little River at Gary Lane	0.2	6/5/01	183
LCTMDL02	North Fork Little River at Gary Lane	0.2	7/10/01	137
LCTMDL02	North Fork Little River at Gary Lane	0.2	7/19/01	550
LCTMDL02	North Fork Little River at Gary Lane	0.2	7/26/01	350
LCTMDL02	North Fork Little River at Gary Lane	0.2	8/27/01	964
LCTMDL02	North Fork Little River at Gary Lane	0.2	9/19/01	1270
LCTMDL02	North Fork Little River at Gary Lane	0.2	10/25/01	1218

Table A.7 Station SFLR001 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
SFLR001	South Fork Little River at Edwards Mill Rd	14.1	9/6/00	40
SFLR001	South Fork Little River at Edwards Mill Rd	14.1	6/5/01	330
SFLR001	South Fork Little River at Edwards Mill Rd	14.1	7/10/01	64
SFLR001	South Fork Little River at Edwards Mill Rd	14.1	7/19/01	130
SFLR001	South Fork Little River at Edwards Mill Rd	14.1	7/26/01	480
SFLR001	South Fork Little River at Edwards Mill Rd	14.1	8/27/01	164
SFLR001	South Fork Little River at Edwards Mill Rd	14.1	9/19/01	>2000
SFLR001	South Fork Little River at Edwards Mill Rd	14.1	10/25/01	>12000

Table A.8 Station SFLR002 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
SFLR002	South Fork Little River at US 41A	6.8	9/6/00	5000
SFLR002	South Fork Little River at US 41A	6.8	6/5/01	380
SFLR002	South Fork Little River at US 41A	6.8	7/10/01	1033
SFLR002	South Fork Little River at US 41A	6.8	7/19/01	590
SFLR002	South Fork Little River at US 41A	6.8	7/26/01	590
SFLR002	South Fork Little River at US 41A	6.8	8/27/01	>12000
SFLR002	South Fork Little River at US 41A	6.8	9/19/01	>6000
SFLR002	South Fork Little River at US 41A	6.8	10/25/01	1073
Note this station was not used in the TMDL				

Table A.9 Station LCTMDL01 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
LCTMDL01	South Fork Little River at River Bend	1.3	5/9/00	154
LCTMDL01	South Fork Little River at River Bend	1.3	5/25/00	>2000
LCTMDL01	South Fork Little River at River Bend	1.3	6/19/00	667
LCTMDL01	South Fork Little River at River Bend	1.3	6/29/00	570
LCTMDL01	South Fork Little River at River Bend	1.3	7/18/00	260
LCTMDL01	South Fork Little River at River Bend	1.3	7/25/00	220
LCTMDL01	South Fork Little River at River Bend	1.3	8/22/00	122
LCTMDL01	South Fork Little River at River Bend	1.3	8/30/00	115
LCTMDL01	South Fork Little River at River Bend	1.3	9/6/00	120
LCTMDL01	South Fork Little River at River Bend	1.3	9/19/00	105
LCTMDL01	South Fork Little River at River Bend	1.3	10/17/00	37
LCTMDL01	South Fork Little River at River Bend	1.3	10/31/00	26
LCTMDL01	South Fork Little River at River Bend	1.3	6/5/01	93
LCTMDL01	South Fork Little River at River Bend	1.3	7/10/01	200
LCTMDL01	South Fork Little River at River Bend	1.3	7/19/01	90
LCTMDL01	South Fork Little River at River Bend	1.3	7/26/01	570
LCTMDL01	South Fork Little River at River Bend	1.3	8/27/01	1600
LCTMDL01	South Fork Little River at River Bend	1.3	9/19/01	>2000
LCTMDL01	South Fork Little River at River Bend	1.3	10/25/01	2400

Table A.10 Station CC001 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
CC001	Casey Creek at Roaring Springs Road	2.2	9/6/00	240
CC001	Casey Creek at Roaring Springs Road	2.2	7/10/01	320
CC001	Casey Creek at Roaring Springs Road	2.2	7/19/01	30
CC001	Casey Creek at Roaring Springs Road	2.2	7/26/01	390
CC001	Casey Creek at Roaring Springs Road	2.2	8/27/01	945
CC001	Casey Creek at Roaring Springs Road	2.2	9/19/01	380
CC001	Casey Creek at Roaring Springs Road	2.2	10/25/01	77
Note this station was not used in the TMDL				

Table A.11 Station PRI043 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
PRI043	Little River at Highway 272	24.4	5/9/00	210
PRI043	Little River at Highway 272	24.4	6/19/00	185
PRI043	Little River at Highway 272	24.4	7/18/00	51
PRI043	Little River at Highway 272	24.4	8/22/00	75
PRI043	Little River at Highway 272	24.4	9/7/00	200
PRI043	Little River at Highway 272	24.4	9/19/00	80
PRI043	Little River at Highway 272	24.4	10/17/00	72
Note this station was not used in the TMDL				

Table A.12 Station CRW003 Sampling Data

Station Name	Stream Name	River Mile	Collection Date	Fecal Coliform (colonies/100 ml)
CRW003	Sinking Fork at Kings Chapel Road	4.1	5/9/00	90
CRW003	Sinking Fork at Kings Chapel Road	4.1	6/19/00	103
CRW003	Sinking Fork at Kings Chapel Road	4.1	7/18/00	123
CRW003	Sinking Fork at Kings Chapel Road	4.1	8/22/00	68
CRW003	Sinking Fork at Kings Chapel Road	4.1	9/19/00	60
CRW003	Sinking Fork at Kings Chapel Road	4.1	10/17/00	42
CRW003	Sinking Fork at Kings Chapel Road	4.1	6/5/01	67
Note this station was not used in the TMDL				

Appendix B. Calculating Daily Loads

The TMDLs for the impaired stream segments expressed in Table 7.3 as a percent reduction could be expressed as daily loads by estimating the instream flows using a USGS gage and a weighted drainage area ratio approach. For example, streamflow data are available from three USGS gages in the Little River watershed (USGS, 2007). These are 03438000 (Little River at Cadiz, Kentucky), 3437400 (North Fork Little River near Gary Lane Bridge), and 3437600 (South Fork Little River at KY 107). The gages were matched by stream to the existing impaired segments, and the 50th percentile flow measured at the gage was used for calculating the daily TMDLs. The 50th percentile flow represents average conditions. For 03438000, Little River at Cadiz, a large dataset was available, and the 50th percentile flow was computed using data from the sampling period to present, i.e., 1990 forward. A smaller dataset was available for 03437400 and 03437600, from 3/20/03 to 11/10/04, and all of the available data were used. The ratio of the drainage area at the station representing the impaired segment to the drainage area at the USGS gage was multiplied by the 50th percentile flow at the gage to estimate the flow in the impaired segment. For segments with discharge from a KPDES permitted facility, the facility design flow was subtracted from the estimated streamflow to determine the final non-KPDES flow.

Table B.1 50th Percentile Flows at Each Impaired Segment

Impaired Segment, River Mile	Monitoring Station	USGS Gage	Drainage Area Ratio, (Segment/ Gage)	50th Percentile Flow at Gage (cfs)	Estimated Streamflow (cfs)	KPDES Flow (cfs)	Final Non-KPDES Flow (cfs)
Little River RM 30.0 – 31.4	LR004	03438000 Little River at Cadiz, Kentucky	1.00	182	182.0	13.7	168.3
Little River RM 31.4 – 45.5	LR003		0.81	182	147.4	13.7	133.7
Little River RM 45.5 – 57.7	LR001		0.54	182	98.3	13.7	84.6
North Fork Little River RM 0.0 - 0.3	LCTMDL02	03437400 North Fork Little River near Gary Lane Bridge	0.87	50	43.5	13.7	29.8
North Fork Little River RM 0.3 – 7.0	LCTMDL02		0.87	50	43.5	4.5	39
North Fork Little River RM 7.0 – 10.9	NFLR001		0.65	50	32.5	4.5	28
North Fork Little River RM 10.9 – 16.1	NFLR001		0.65	50	32.5	N/A	32.5
South Fork Little River RM 0.0 – 10.3	LCTMDL01	03437600 South Fork Little River at KY 107	0.81	80	17.6	N/A	17.6
South Fork Little River RM 10.3 – 20.3	SFLR001		0.59	80	47.2	N/A	47.2

The TMDL components listed below were then expressed in terms of daily load by using the flows shown in Table B.1. The TMDL is the WQC of 400 colonies/100ml multiplied by the Estimated Flow. The MOS is set at 10% of the TMDL. The WLA is the KPDES Flow multiplied by 400 colonies/100ml. The LA is the Final Non-KPDES Streamflow multiplied by 400 colonies/100ml minus the MOS. All values have been expressed in units of colonies/day.

Table B.2 TMDLs Expressed as a Daily Load

Impaired Segment, River Mile	WLA colonies/day	LA colonies/day	MOS colonies/day	TMDL colonies/day
Little River RM 30.0– 31.4	1.34E+11	1.34E+12	1.64E+11	1.64E+12
Little River RM 31.4 – 45.5	1.34E+11	1.04E+12	1.31E+11	1.31E+12
Little River RM 45.5 – 57.7	1.34E+11	6.09E+11	8.26E+10	8.26E+11
North Fork Little River RM 0.0 – 0.3	1.34E+11	1.28E+11	2.91E+10	2.91E+11
North Fork Little River RM 0.3 – 7.0	4.35E+10	2.99E+11	3.81E+10	3.81E+11
North Fork Little River RM 7.0 – 10.9	4.35E+10	2.03E+11	2.73E+10	2.73E+11
North Fork Little River RM 10.9 – 16.1	N/A	2.86E+11	3.17E+10	3.17E+11
South Fork Little River RM 0.0 – 10.3	N/A	1.55E+11	1.72E+10	1.72E+11
South Fork Little River RM 10.3 – 20.3	N/A	4.15E+11	4.61E+10	4.61E+11

Another possible approach to converting the TMDL to a daily load is to measure the instream flow and the WWTP flows and multiply the sum of these by the WQC to generate load.

The calculations in this Appendix are an example that applies at the given flow values only: Nothing in this Appendix should be construed as setting a compliance limit other than the WQC. Also, nothing in this Appendix should be construed in a manner that denies KPDES-permitted dischargers the right to discharge at a load equal to their permitted discharge limit times their permitted effluent concentration limit. Also, KDOW expects compliance with the WQC to be determined by concentration, not by load; Table B.2 has been provided to insure the TMDL complies with Federal requirements that TMDLs be expressed in terms of daily load (Friends of the Earth, Inc., v. EPA, et. al., 2006).