Final
Total Maximum Daily Load for E. coli
8 Stream Segments within the Bacon Creek Watershed
Hardin, Hart, and Larue Counties, Kentucky
May, 2011

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Kentucky
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Kentucky Department for Environmental Protection
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This report is approved for release

Sandra L. Gruzesky, P.E., Director
Division of Water

6/3/11
Date

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Glossary of Acronyms

ADD	Area Development District
AFO	Animal Feeding Operation
BMP	Best Management Practices
BST	Bacteria Source Tracking
CAFO	Confined Animal Feeding Operation
CFR	Code of Federal Regulations
COE	Corps of Engineers
CPP	Continuing Planning Process
CSO	Combined Sewer Overflow
DMR	Discharge Monitoring Report
GNIS	Geographic Names Information System
HUC	Hydrologic Unit Code
KAR	Kentucky Administrative Regulations
KDOW	Kentucky Division of Water
KGS	Kentucky Geological Survey
KRS	Kentucky Revised Statutes
KIA	Kentucky Infrastructure Authority
KNDOP	Kentucky No Discharge Operating Permit
KPDES	Kentucky Pollution Discharge Elimination System
LA	Load Allocations
LTCP	Long Term Control Plan
MAF	Mean Annual Flow
MGD	Million Gallons per Day
MHP	Mobile Home Park
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer Systems
NLCD	National Land Cover Database
OSTDS	On Site Sewage Treatment and Disposal System
PCR	Primary Contact Recreation
POTW	Publicly Owned Treatment Works
RM	River Mile
SOP	Standard Operating Procedures
SWS	Sanitary Wastewater System
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WBID	Waterbody Identification Number
WBP	Watershed Based Plan
WLA	Waste Load Allocation
WQC	Water Quality Criteria
WQS	Water Quality Standard
WWTP	Wastewater Treatment Plant

Total Maximum Daily Load Synopsis

State: Kentucky
Major River Basin: Green
USGS HUC8: 05110001
Counties: Hardin, Hart, and Larue
Impaired Use(s): Primary Contact Recreation
Pollutants of Concern: E. coli, Fecal Coliform (expressed as an E. coli load)

The Bacon Creek watershed is located primarily in Hart County, with minor extensions into Hardin and Larue Counties. It is located south of Upton, north of Munfordville, and has the city of Bonnieville in its midst. Interstate 65 and 31W traverse the middle of the Bacon Creek watershed, while 31E traverses the headwaters of the watershed from North to South (Figure S.1).

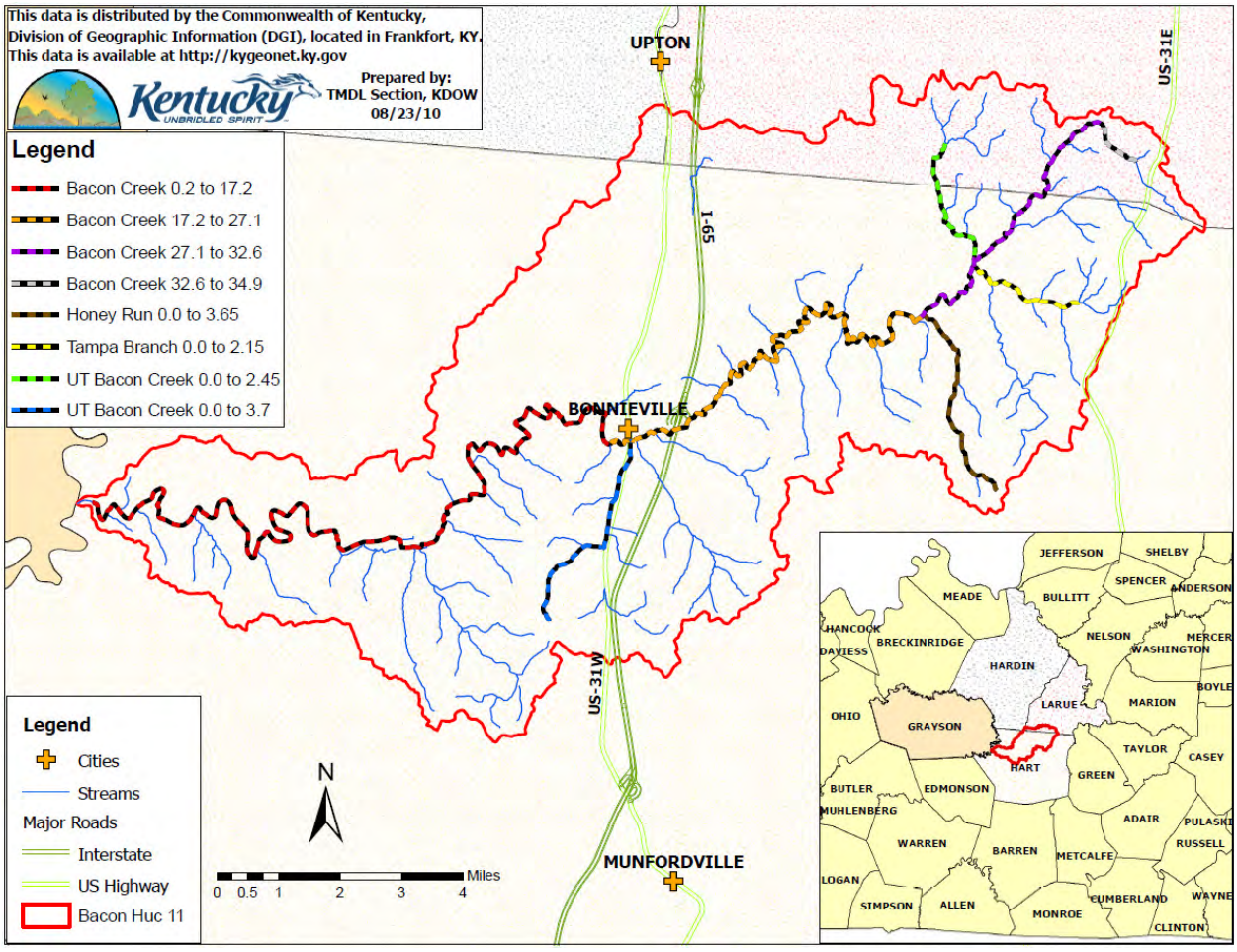

Figure S.1 Location of Bacon Creek Watershed in Hardin, Hart, and Larue Counties

The headwaters of Bacon Creek were monitored for the pathogen indicators fecal coliform and Escherichia coli (E. coli) for a 319(h) Watershed Based Plan project during 2004 -2006. The Kentucky Division of Water (KDOW) provided funding for additional fecal coliform sampling at

some of the sites during 2007. Additionally, KDOW staff collected E. coli samples on the lower portions of Bacon Creek during 2007. This document contains the monitoring results and describes Total Maximum Daily Load (TMDL) development for pathogen indicators in the Bacon Creek watershed as required under Section 303(d) of the Clean Water Act. Table S.1 indicates the pathogen indicator impaired segments for which TMDLs are developed in this document.

Table S.1 Impaired Waterbodies Addressed in this TMDL Document

Waterbody & Segment	Total Size	Waterbody ID	County	Assessment Category[2]	Use[3]	Impairment	Suspected Source(s)
Bacon Creek 0.2 to 17.2	17 miles	KY486197_01	Hart	5-NS	PCR	Escherichia coli[1]	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)
Bacon Creek 17.2 to 27.1	9.9 miles	KY486197_02	Hart	5-NS	PCR	Escherichia coli[1] , Fecal Coliform[4]	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)
Bacon Creek 27.1 to 32.6	5.5 miles	KY486197_03	Hart	5-NS	PCR	Escherichia coli[1] , Fecal Coliform[4]	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)
Bacon Creek 32.6 to 34.9	2.3 miles	KY486197_04	Larue	5-NS	PCR	Escherichia coli[1]	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)
Honey Run 0.0 to 3.65	3.65 miles	KY494483_01	Hart	5-NS	PCR	Fecal Coliform[1, 4]	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)
Tampa Branch 0.0 to 2.15	2.15 miles	KY504931_01	Hart	5-NS	PCR	Fecal Coliform[1, 4]	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)
UT to Bacon Creek at RM 17.8, 0.0 to 3.7	3.7 miles	KY486187-17.8_01	Hart	5-NS	PCR	Escherichia coli[1]	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)
UT to Bacon Creek at RM 28.9, 0.0 to 2.45	2.45 miles	KY48619-28.9_01	Larue	5-NS	PCR	Escherichia coli[1]	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)

Note: [1]Indicates a new listing not on the draft 2010-303(d) list.
[2]Assessment Category 5-NS indicates that the segment is nonsupporting and that a TMDL is required for the use.
[3]PCR is the Primary Contact Recreation use.
[4]TMDLs for fecal coliform are expressed as an E. coli load.

Kentucky Water Quality Criterion (WQC):

According to 401 KAR 10:031,

"The following criteria shall apply to waters designated as primary contact recreation use during the primary contact recreation season of May 1 through October 31: 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."

TMDL Components and Target:

A TMDL calculation is performed as follows:

TMDL = WLA + LA + MOS

Where TMDL = the Water Quality Criterion. This is defined as an instantaneous concentration of 240 colonies/100 ml for E. coli.

WLA = the Waste Load Allocation. For this TMDL document, there are three types of WLAs: Sanitary Wastewater System (SWS) WLAs for loadings from Kentucky Pollutant Discharge Elimination System (KPDES)-permitted sanitary wastewater systems, Municipal Separate Storm Sewer Systems (MS4s) WLAs for loadings from permitted MS4 entities and a Future Growth WLA for future loadings from expanding and new KPDES-permitted sources.

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. For this TMDL an explicit MOS of 10% was applied (i.e. 24 E. coli colonies/100ml) and an implicit MOS was incorporated by calculating SWS WLAs at their maximum design capacity.

TMDL Target = the TMDL minus the MOS (i.e. 216 E. coli colonies/100ml).

TMDL Methodology:

Mean Annual Flows (MAFs): MAFs were determined at the downstream end of each impaired segment. This MAF was adjusted by adding the design flow of SWS dischargers (of pathogen indicators) in the watershed above the downstream-most point of the segment (yielding the Adjusted MAF). This adjusted MAF was used to convert concentrations of E. coli or fecal coliform into loads.

Existing Loads: For sample sites located on each segment, the sample with the greatest concentration of E. coli was used as the existing concentration for that segment. Existing loads were calculated as:

Greatest Concentration (colonies/100ml)	×	Adjusted MAF (cfs)	×	Conversion Factor .0244657584	=	Existing Load (billion colonies/day)

where the conversion factor converts cfs to ml/day and colonies to billion colonies.

Total TMDL: Total TMDLs were calculated for each segment using the criteria of 240 E. coli colonies/100 ml:

240 E. coli (colonies/100ml)	×	Adjusted MAF (cfs)	×	Conversion Factor .0244657584	=	Total TMDL (billion colonies/day)

MOS: A 10% explicit MOS (24 E. coli colonies/100ml) was set. Additionally, an implicit MOS was incorporated by setting flows for SWS sources at their design capacity. The explicit MOS load for each segment was calculated as:

24 E. coli (colonies/100ml)	×	Adjusted MAF (cfs)	×	Conversion Factor .0244657584	=	MOS (billion colonies/day)

Target Load: The Target Load was calculated for each segment by subtracting the explicit MOS from the Total TMDL (Target Load = Total TMDL – MOS).

Percent Reduction: The Percent Reduction (%) for each segment was calculated as:

Percent Reduction (%) = [(Existing Load – Target Load) / Existing Load] * 100.

Calculation of SWS WLAs: The SWS WLAs were calculated based on the permitted concentration limits expressed in terms of E. coli limits and facility design flow (in units of cfs) using the following equation:

240 E. coli (colonies/100ml)	×	Design Flow (cfs)	×	Conversion Factor .0244657584	=	WLA (billion colonies/day)

The design flow in million gallons per day (MGD) was multiplied by 1.54723 to convert days to seconds and million gallons to cubic feet to yield design flow in cfs.

Calculation of Remainder: The Remainder is not part of the TMDL; however, it is used in the TMDL calculations. It is determined as the Target Load minus the sum of all SWS WLAs.

Calculation of MS4 WLA: The MS4 WLA was determined as:

MS4 WLA = Remainder x Percent Developed,

where Percent Developed is the percent of developed land cover classes (developed open space, developed low intensity, developed medium intensity, and developed high intensity) within the MS4 boundary. This was determined as:

Percent Developed= (sum of developed land cover classes within the MS4 in acres) / (total acres within MS4 boundary).

Calculation of Future Growth WLA: Future growth is represented by a portion of the TMDL Target that is reserved for new or expanding KPDES-permitted sources. It is calculated as:

Future Growth WLA = Remainder x Future Growth WLA %,

where the Future Growth WLA % is determined according to Table S.2 and the Percent Developed Land Cover Classes (developed open space, developed low intensity, developed medium intensity, and developed high intensity) is determined as:

Percent Developed Land Cover Classes = (sum developed land cover classes in acres within watershed) / (total acres within watershed) x 100.

Table S.2 Future Growth WLA %

Percent Developed Land Cover Classes	Future Growth WLA %
≥25%	5
≥20% – <25%	4
≥15% – <20%	3
≥10% – <15%	2
≥5% – <10%	1
<5%	0.5

Calculation of LA: Load Allocations are calculated as LA= Remainder - MS4 WLA - Future Growth WLA.

The available sampling data were insufficient to apportion the existing loading among the various LA sources; therefore, it is lumped to all LA sources.

TMDLs for Impaired Segments:

TMDLs and loading allocations are summarized for each segment in Table S.3.

Translation of WLA Limits into Permit Limits:

All WLAs will be translated into KPDES permit limits as an E. coli effluent gross limit of 130 colonies/100 ml as a monthly average and 240 colonies/100 ml as a maximum weekly average.

Table S.3 TMDLs for Impaired Segments

Loads are in units of billion E. coli colonies/day	Percent Reduction is expressed as a percentage		Bacon Creek 0.2 to 17.2	Bacon Creek 17.2 to 27.1	Bacon Creek 27.1 to 32.6	Bacon Creek 32.6 to 34.9	Honey Run 0.0 to 3.65	Tampa Branch 0.0 to 2.15	UT to Bacon Creek 0.0 to 2.45	UT to Bacon Creek 0.0 to 3.7
		Existing Load	67371.1627	37535.6988	11181.2405	129.1007	2338.9363	5118.4568	488.1408	846.0871
		Total TMDL	**668.2542**	**372.3164**	**133.3349**	**10.0272**	**22.3128**	**45.2127**	**25.2487**	**44.0384**
		MOS	**66.8254**	**37.2316**	**13.3335**	**1.0027**	**2.2313**	**4.5213**	**2.5249**	**4.4038**
		TMDL Target	601.4288	335.0848	120.0014	9.0245	20.0815	40.6914	22.7238	39.6345
AI #	KPDES #	% reduction	99.11	99.11	98.93	93.01	99.14	99.21	95.34	95.32
2555	KY0089761	**SWS WLA**	**0.0454**	**0.0454**	**0.0454**	**0.0454**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
		remainder	601.3834	335.0393	119.9560	8.9791	20.0815	40.6914	22.7238	39.6345
		Future Growth WLA[(1)]	**3.0069**	**3.3504**	**1.1996**	**0.1796**	**0.1004**	**0.4069**	**0.2272**	**0.3963**
75043	KYG200003	**MS4 WLA**[(2)]	**0.0000**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
		Total WLA	**3.0523**	**3.3958**	**1.2450**	**0.2250**	**0.1004**	**0.4069**	**0.2272**	**0.3963**
		LA	**598.3765**	**331.6889**	**118.7564**	**8.7995**	**19.9811**	**40.2845**	**22.4966**	**39.2382**

Notes: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[(2)] N/A indicates that there is no MS4 in the subwatershed.

1.0 Introduction

Section 303(d) of the Clean Water Act (1972) requires states to identify waters within their boundaries that have been assessed and are not currently meeting their designated uses (per 401 KAR [Kentucky Administrative Regulations] 10:026 and 10:031) and that require a Total Maximum Daily Load (TMDL). States must establish a priority ranking for such waters, taking into account their intended uses and the severity of the pollutant. Section 303(d) also requires that states produce a list of this information termed the 303(d) list. This list is submitted to the United States Environmental Protection Agency (USEPA) during even-numbered years and each submittal replaces the previous list. 303(d) information for Kentucky can be found in the *2008 Integrated Report to Congress on the Condition of Water Resources in Kentucky Volume II. 303(d) List of Surface Waters* (Kentucky Division of Water [KDOW], 2008a) and can be obtained at: http://water.ky.gov.

States are required to develop TMDLs for the listed pollutants that cause a waterbody to fail to meet its designated uses. The TMDL process establishes the allowable amount (i.e. "load") of pollutant a waterbody can naturally assimilate while continuing to meet the water quality criteria (WQC) for each designated use. The pollutant load must be established at a level necessary to implement the applicable WQC with seasonal variations and a margin of safety (MOS) which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality. This total load is then divided among different sources of the pollutant in a watershed. Information from USEPA on TMDLs can be found at: http://www.epa.gov/owow/tmdl.

By providing bacteria allocations and reductions, this TMDL can provide an analytical foundation for identifying, planning, and implementing water quality-based controls to reduce bacteria pollution from identified sources. The ultimate goal is the restoration and maintenance of water quality in the waterbody so that designated uses are met.

2.0 Problem Definition

The Clean Water Act requires states to designate uses for surface waters within their jurisdiction. The designated uses assigned to waterbodies in Kentucky can be found in 401 KAR 10:026 and includes primary contact recreation (PCR). 401 KAR 10:001 defines PCR waters as those "waters suitable for full body contact recreation during the recreation season of May 1 through October 31." 401 KAR 10:031 establishes standards that are "minimum requirements that apply to all surface waters in the Commonwealth of Kentucky in order to maintain and protect them for designated uses." The pathogen-related WQC in 401 KAR 10:031 are based upon those proposed by USEPA (U.S. EPA, 1986) and, at the levels established, would cause an estimated occurrence of illness in 8 out of 1000 swimmers in fresh waters.

The term pathogen refers to bacteria, viruses, or other biological agents (such as parasites) that can cause disease. Because it is currently resource intensive, difficult, and a potential health hazard to detect most pathogens in water, other organisms are used to indicate whether the presence of pathogens is likely in waters. Like EPA's proposed criteria, Kentucky uses Escherichia coli (E. coli) and fecal coliform bacteria as indicator organisms of pathogens. E. coli and fecal coliform are found in the fecal waste of humans and warm-blooded animals (birds and mammals). The presence of these bacteria in a waterbody indicates that contamination from human or animal wastes has likely occurred and that pathogens may be present.

2.1 Watershed Description

The Bacon Creek watershed is located primarily in Hart County, with minor extensions into Hardin and Larue Counties. It is located south of Upton, north of Munfordville, and has the city of Bonnieville in its midst. Interstate 65 and 31W traverse the middle of the Bacon Creek watershed, while 31E traverses the headwaters of the watershed from North to South. A map depicting the location of the Bacon Creek watershed is shown in Figure 2.1.

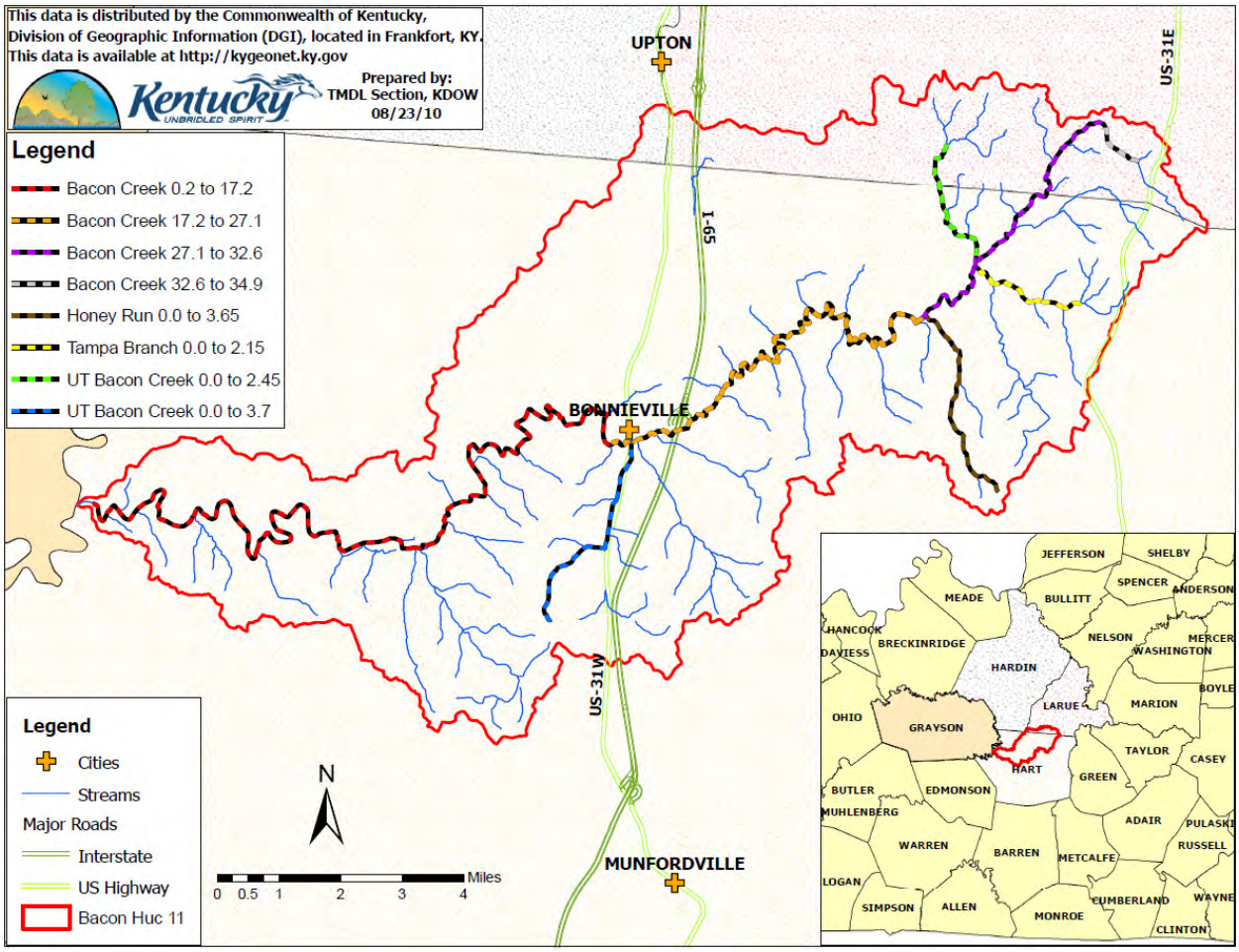

Figure 2.1 Location of Bacon Creek Watershed in Hardin, Hart, and Larue Counties

2.2 303(d) Listing History

Bacon Creek from river miles (RM) 0.0 to 31.2 was first listed as impaired for pathogens on the 1996-303(d) list (KDOW, 1997). This initial listing was carried forward to the 2004 303(d) list when the segment was split into three, RM 0.0 to 17.2, RM 17.2 to 26.3, and RM 26.3 to 31.2 (KDOW, 2005). During the 2008 listing cycle, these pathogen listings were more correctly identified with the indicator organism used, fecal coliform, and the river miles were corrected to reflect the National Hydrography Data Set yielding three fecal coliform impaired segments from RM 0.2 to 17.2, RM 17.2 to 27.1, and RM 27.1 to 32.6 (KDOW, 2008a). These listings were carried forward on the draft 2010 303(d) list to yield the listings shown in Table 2.1 (KDOW, 2010).

Table 2.1 Draft 2010-303(d) Listings for Fecal Coliform in the Bacon Creek Watershed

Waterbody & Segment	Pollutant	County	Waterbody ID	Suspected Source(s)	Impaired Use (Support Status)
Bacon Creek 0.2 to 17.2 into Nolin River	Fecal Coliform	Hart	KY486197_01	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	Primary Contact Recreation (Nonsupport)
Bacon Creek 17.2 to 27.1 into Nolin River	Fecal Coliform	Hart	KY486197_02	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	Primary Contact Recreation (Nonsupport)
Bacon Creek 27.1 to 32.6 into Nolin River	Fecal Coliform	Hart	KY486197_03	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	Primary Contact Recreation (Nonsupport)

3.0 Physical Setting

Bacon Creek is located Hardin (population 94,174), Hart (population 17,445) and Larue (population 13,373) Counties, and has the city of Bonnieville (population 354) in its midst (U.S. Census Bureau, 2007). Figure 2.1 showed the location of the Bacon Creek watershed. The Bacon Creek watershed is in the Green River Basin, United States Geological Survey (USGS) 6-digit hydrologic unit code (HUC) # 051100. The system of HUCs was developed by the USGS to identify specific watersheds (all the land area that drains to a particular stream) (USGS, 2004). The larger the HUC number, the smaller the watershed and the more specific the identification of a watershed to one particular stream.

The Bacon Creek watershed is in the Western Pennyroyal physiographic region, in the Level III Ecoregions of the Interior Plateau and Interior River Valley and Hills (Figure 3.1). Information from Woods, et. al.(2002) indicate that the Interior Plateau and Interior River Valley and Hills are dominated by dissected uplands, knobs, a few deeply incised master streams, and large areas of karst and by nearly level lowlands dominated by agriculture and forested hills, respectively. The Bacon Creek watershed is approximately 90.5 square miles in area. The HUC14s that are in Bacon Creek are shown in Figure 3.2 and the areas of each are in Table 3.1.

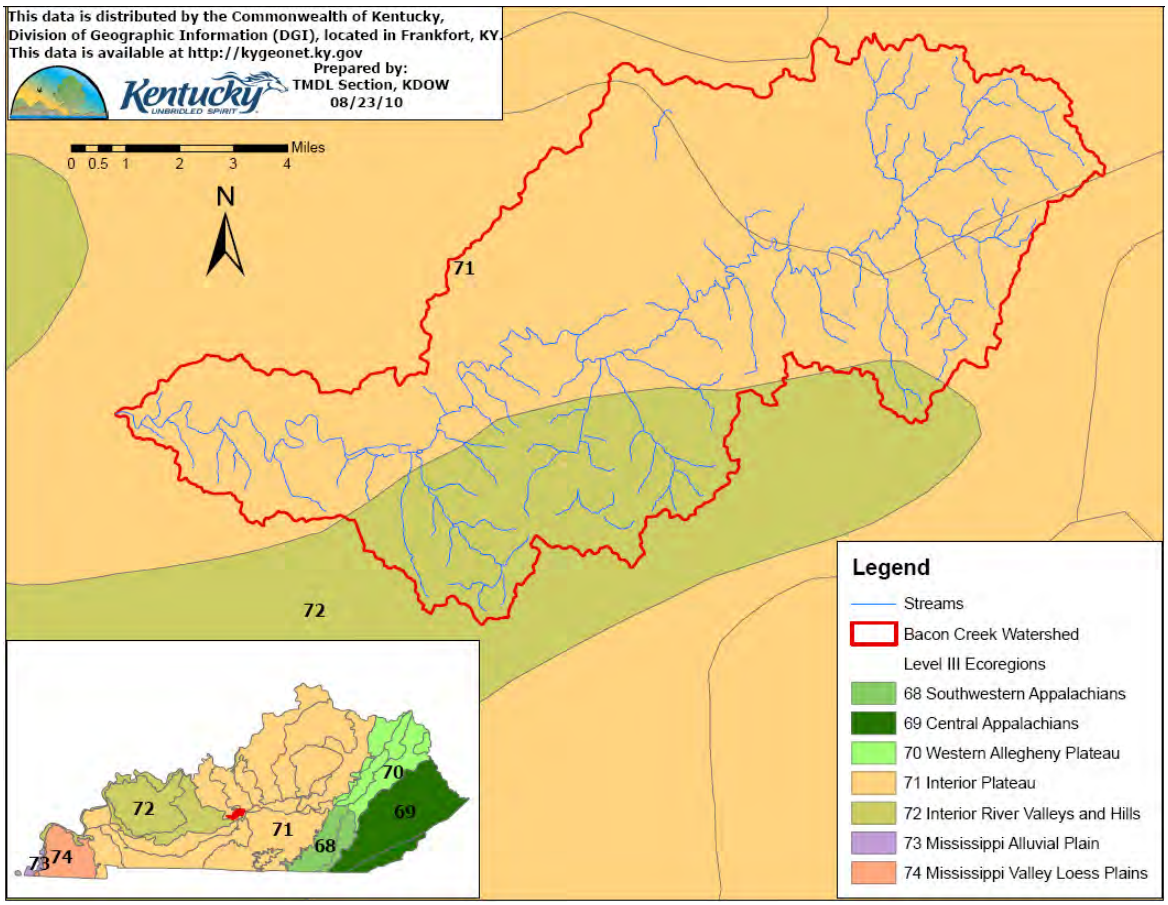

Figure 3.1 Level III Ecoregions in Kentucky (after Woods et. al., 2002)

Table 3.1 Areas of HUC14s in the Bacon Creek Watershed

HUC14	NAME	SQUARE MILES	ACRES
05110001-150-010	Bacon Creek	11.73	7508.36
05110001-150-070	Bacon Creek	68.83	44049.53
05110001-150-050	Bacon Creek	1.04	666.13
05110001-150-030	Tampa Branch	3.11	1989.81
05110001-150-040	Martis Branch	0.10	64.26
05110001-150-020	Martis Branch	2.94	1879.70
05110001-150-060	Honey Run	2.70	1725.17
Totals		90.45	57,882.96

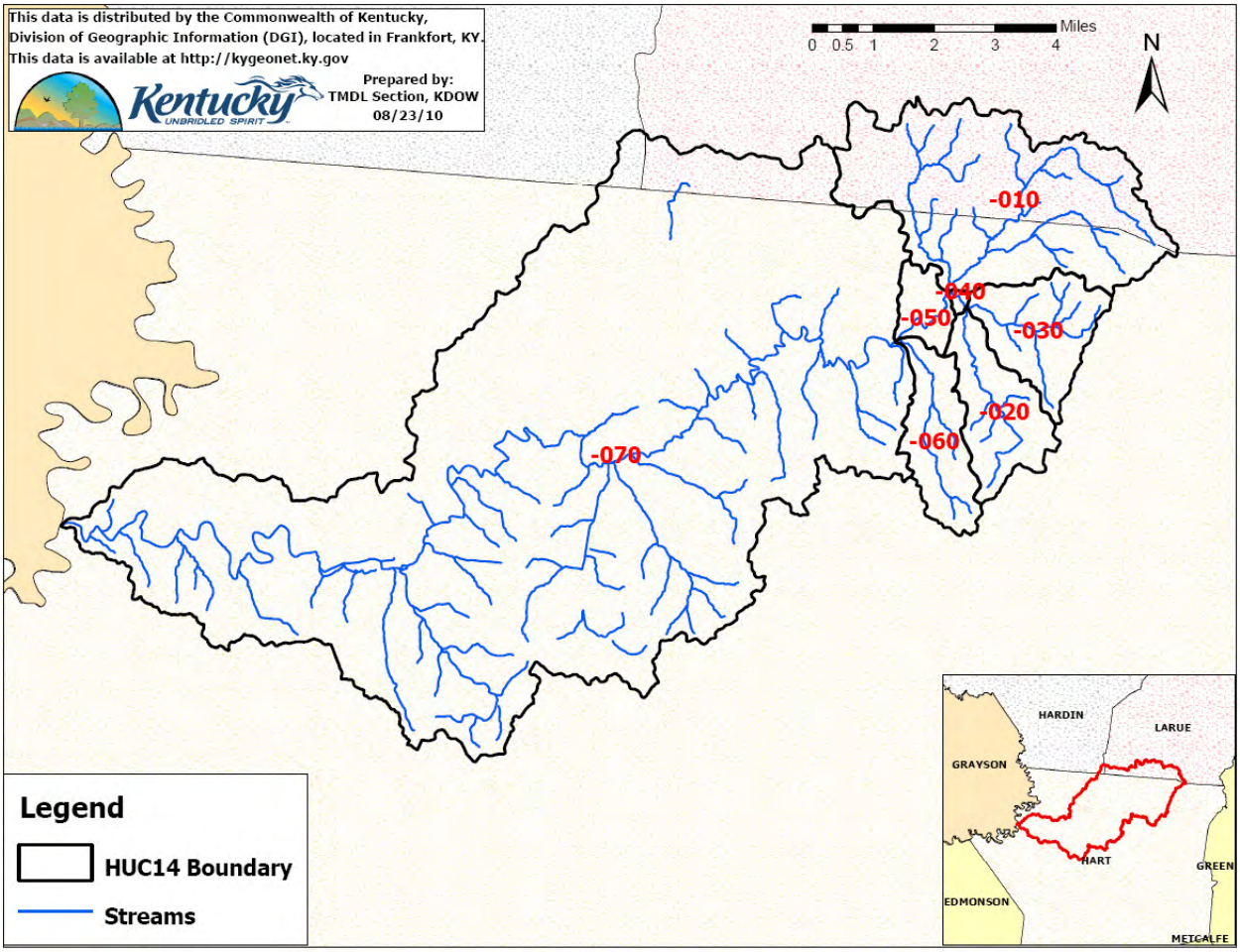

Figure 3.2 HUC 14s in the Bacon Creek Watershed (last 3 digits of 14 digit HUC shown)

3.1 Hydrology

The Bacon Creek watershed headwater tributaries begin in Larue County at its southern boundary with Hart County and flow westward to its confluence with the Nolin River Lake in Hart County. KDOW follows the Strahler (1952) method for stream order determination where small upstream segments with no tributaries are first order. When two first order streams merge, they form a second order stream segment; two second order segments merge to form a third order segment; and so on. In this method, a first order segment merging with a second order segment results in a continuation of the second order segment; order only increases when segments with the same order merge or if a tributary to a main segment has a larger order. First order streams tend to be small and carry little flow except during wet weather events while larger stream orders indicate larger systems with greater flow. At its confluence with Nolin River Lake, Bacon Creek is a fourth order stream.

Two historic USGS gaging stations were located in the Bacon Creek watershed (Figure 3.3). Flow gaging at Station #03310400 (Bacon Creek near Priceville) was discontinued after September, 1994; however this gage was reactivated during September 2010. This station is located at RM 7.5 of Bacon Creek, immediately above a sinking reach of stream (see Section 3.2) and has a surface drainage area of 85.40 square miles, with an actual contributing area of 54.40 square miles (USGS, 2010a). Station #03310380 (Bacon Creek at Highway 31W) located near Bonnieville has been inactive since 1980 (USGS, 2010b).

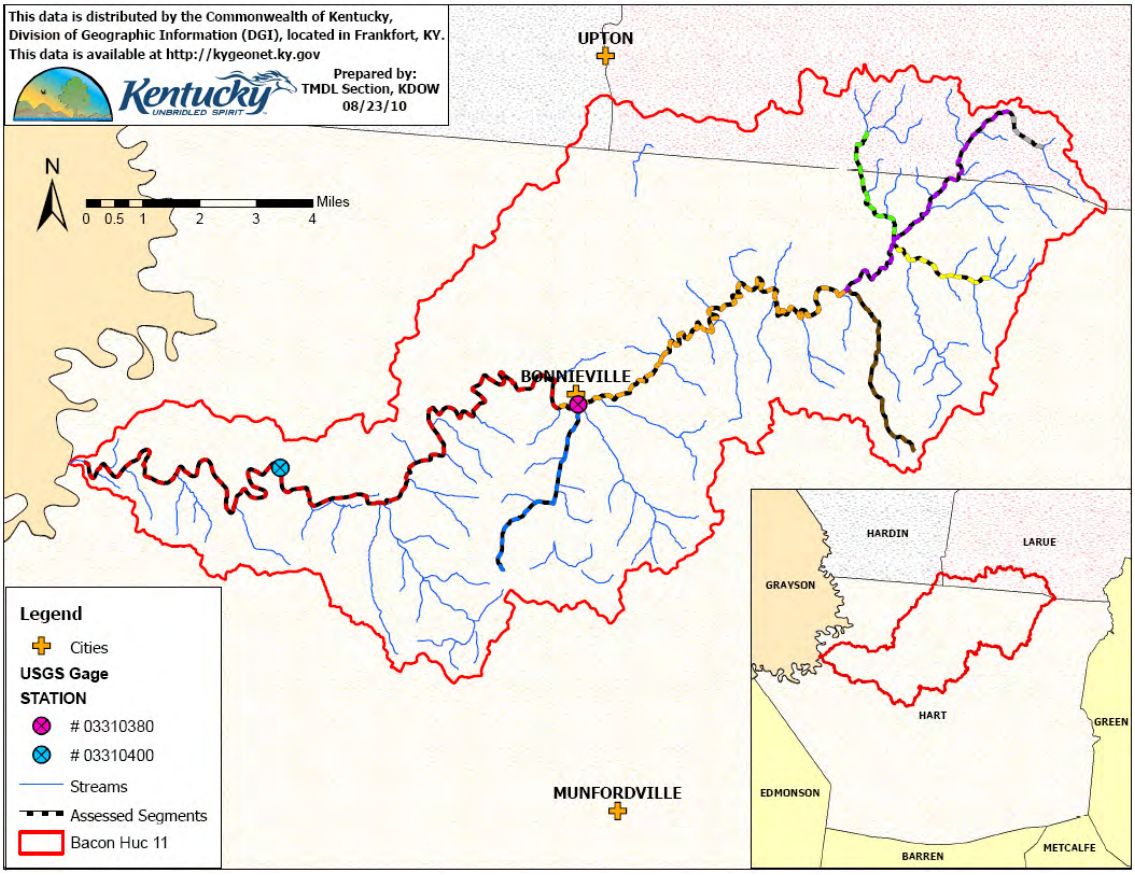

Figure 3.3 Location of Historic USGS Gages in Bacon Creek Watershed
Note: Different assessed segments are shown by varying the color of the white hatch marks.

There are two permitted water withdrawals in the Bacon Creek watershed. Both of these are groundwater withdrawals. Table 3.2 displays KDOW water withdrawal permit information while Figure 3.4 shows the location of the withdrawals. Information was obtained from the KDOW water withdrawal permits.

Table 3.2 Information for KDOW Permitted Water Withdrawals

AI #	Name	Latitude	Longitude	Withdrawal (MGD)	Withdrawal (cfs)	Source Description
85382	Bonnieville Stone LLC	37.34111	-85.9111	Jan-Feb <=0.00 Mar-Dec<=0.06	Jan-Feb <=0.00 Mar-Dec <=0.0928	Groundwater Well
1669	Hanson Aggregates Midwest Inc.	37.45216	-85.89189	<=0.288	<=0.4456	Groundwater Well

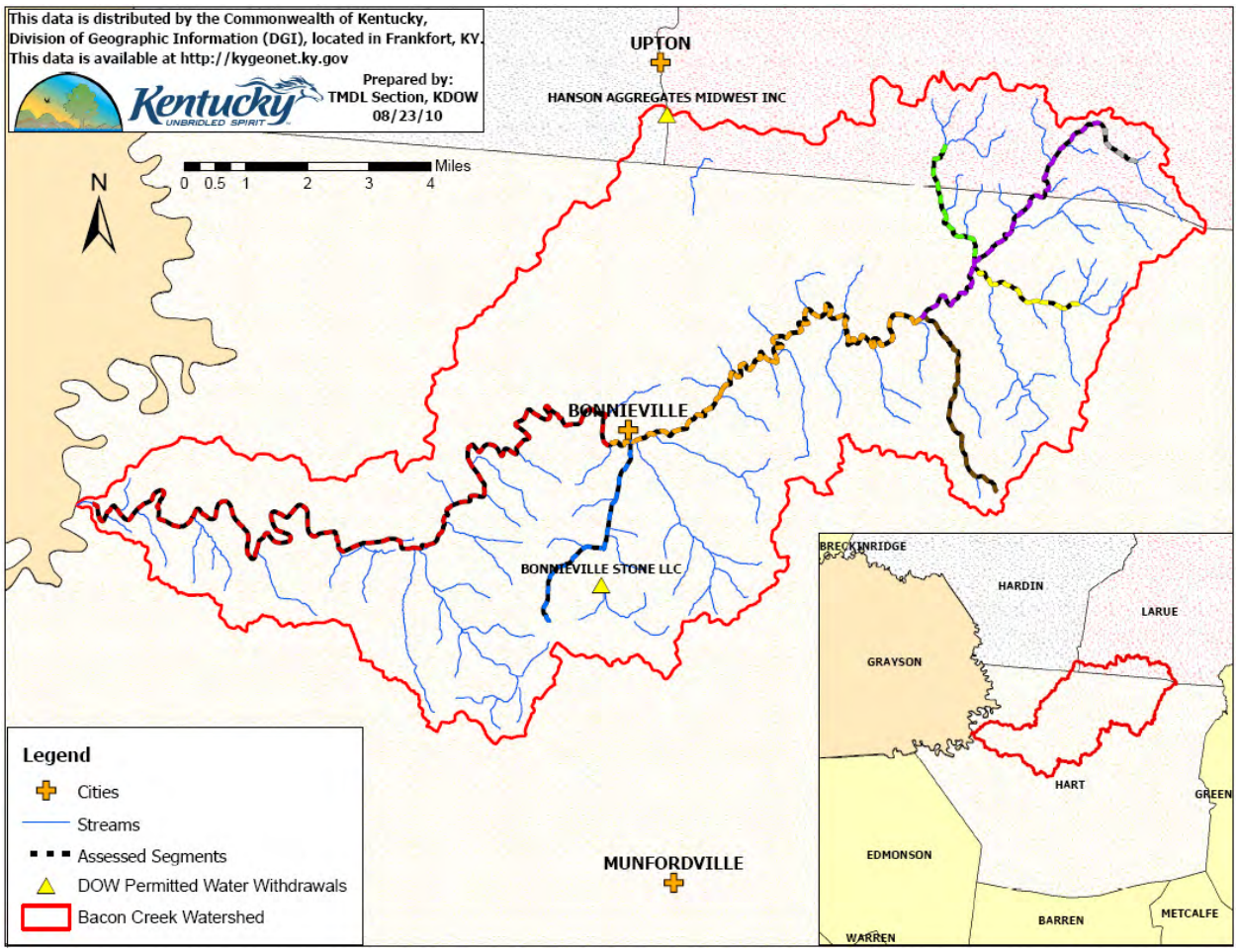

Figure 3.4 Location of KDOW Permitted Water Withdrawals in the Bacon Creek Watershed
Note: Different assessed segments are shown by varying the color of the white hatch marks.

3.2 Karst

Bacon Creek watershed has extensive karst development, with about 79% misbehaved karst (Blair 2010, Figure 3.5) and sinkhole development (Figure 3.6). The majority of the northern portion of the watershed is without surface streams. Official watershed boundaries may not be accurate in well-developed karst regions. Although groundwater drainage generally follows topographic basin boundaries, this is not always true. Subsurface drainage transfer between surface watersheds in a karst region does occur, which increases or decreases the actual boundaries of an affected stream basin. The USGS gage information for #03310400 indicates that the actual contributing area is 63.7% of the surface watershed boundary (54.4 square mile divided by 85.4 square miles). According to the dye trace information, movement of water appears to be out of the Bacon Creek watershed. A reach of losing stream occurs at Bacon Creek RM 7.3 that moves surface water to the Nolin River (KDOW, 2010b). KDOW and the Kentucky Geological Survey (KGS) maintain a Karst Atlas of groundwater tracing data and delineated basins that can be downloaded at http://kygeonet.ky.gov. This work is ongoing and data is updated as information becomes available (KDOW, 2008b).

Karst topography can create geological hazards such as sudden surface collapse (due to sinkholes), flooding (if a karst pathway becomes clogged with debris or overloaded due to improper surface flow routing), and soil erosion. Karst topography also creates a concern for groundwater and surface water contamination. Areas underlain by karst hydrology can have rapid groundwater flow rates, with complex routes. Storm water and associated pollutants can quickly percolate through soils and sinkholes with little or no filtration or attenuation of the contaminants. Groundwater velocities within conduits are commonly measured in thousands of feet per day instead of the typical rate of inches or feet per year in non-karst.

Karst pathways can serve as underground tributaries to surface water, and thus can serve as a transport pathway for pollutants to streams. Improper waste management activities (i.e. dumping into sinkholes, poorly installed or failing onsite treatment and disposal systems) or improper best management practices (i.e. lack of buffer strips around sinkholes in agricultural fields) can lead to direct contamination of water supplies. Karst also provides a challenge for nonpoint source pollution management as its pathways have long been regarded as “nature’s sewer system”. Sinkhole plains, sinking streams, and springs provide a direct connection between surface water and groundwater systems.

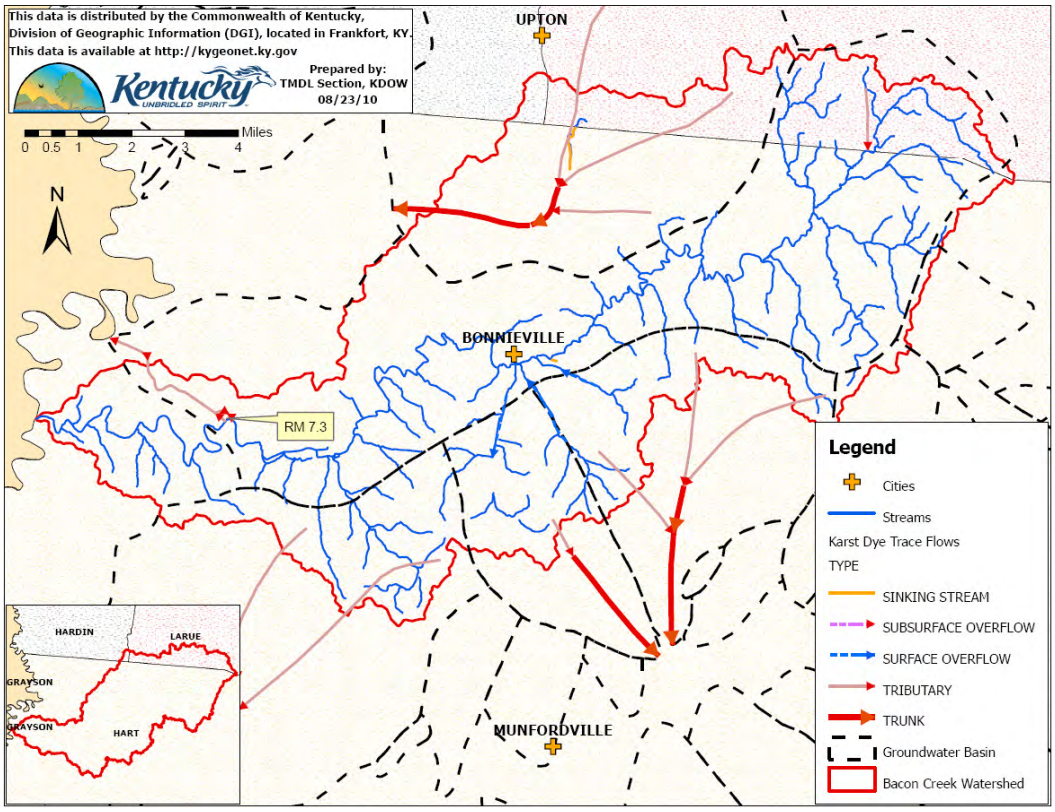

Figure 3.5 Karst Flows into and out of the Bacon Creek Watershed

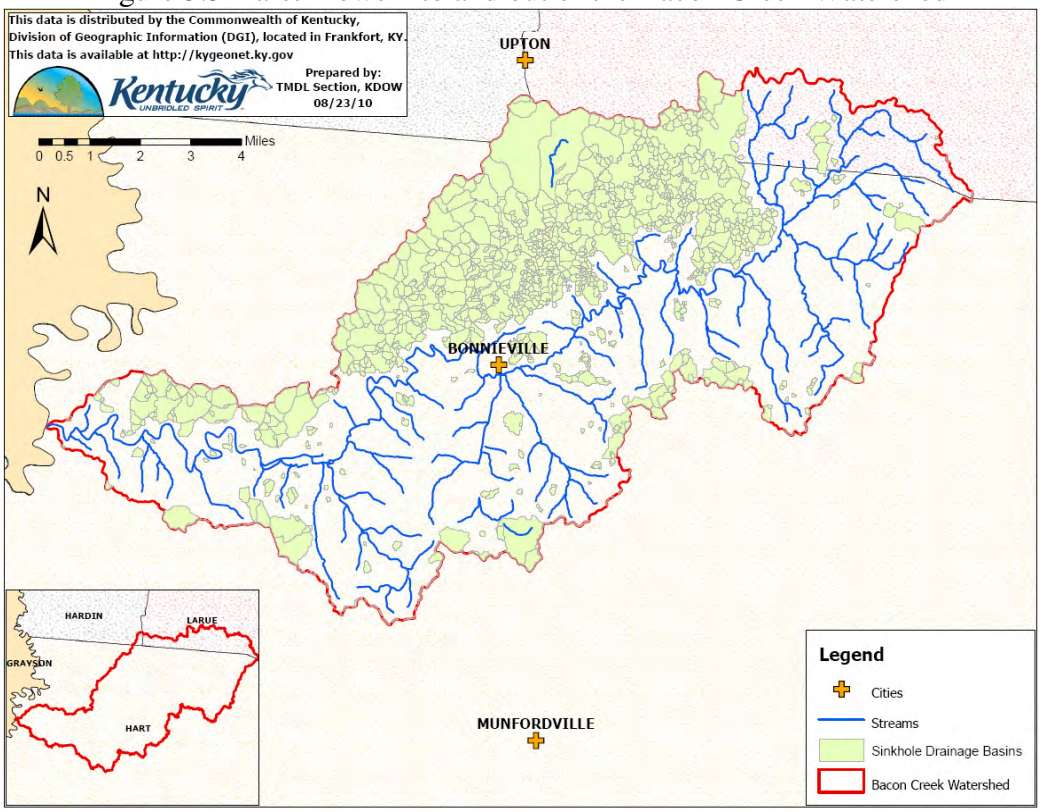

Figure 3.6 Sinkhole Occurrence in Bacon Creek Watershed

3.3 Geology

The Bacon Creek watershed is underlain by Upper Mississippian rock that developed 360 to 325 million years ago and consists of limestones, shales, and sandstones (KGS, 2010). The major members of the Upper Mississippian rock in Bacon Creek are the Saint Louis Limestone, Saint Genevieve Limestone, Beaver Bend and Paoli Limestones, and the Girkin formation (Figure 3.7). Information about the Upper Mississippian rocks can be found at: http://pubs.usgs.gov/pp/p1151h/miss.html (McDowell, 1986).

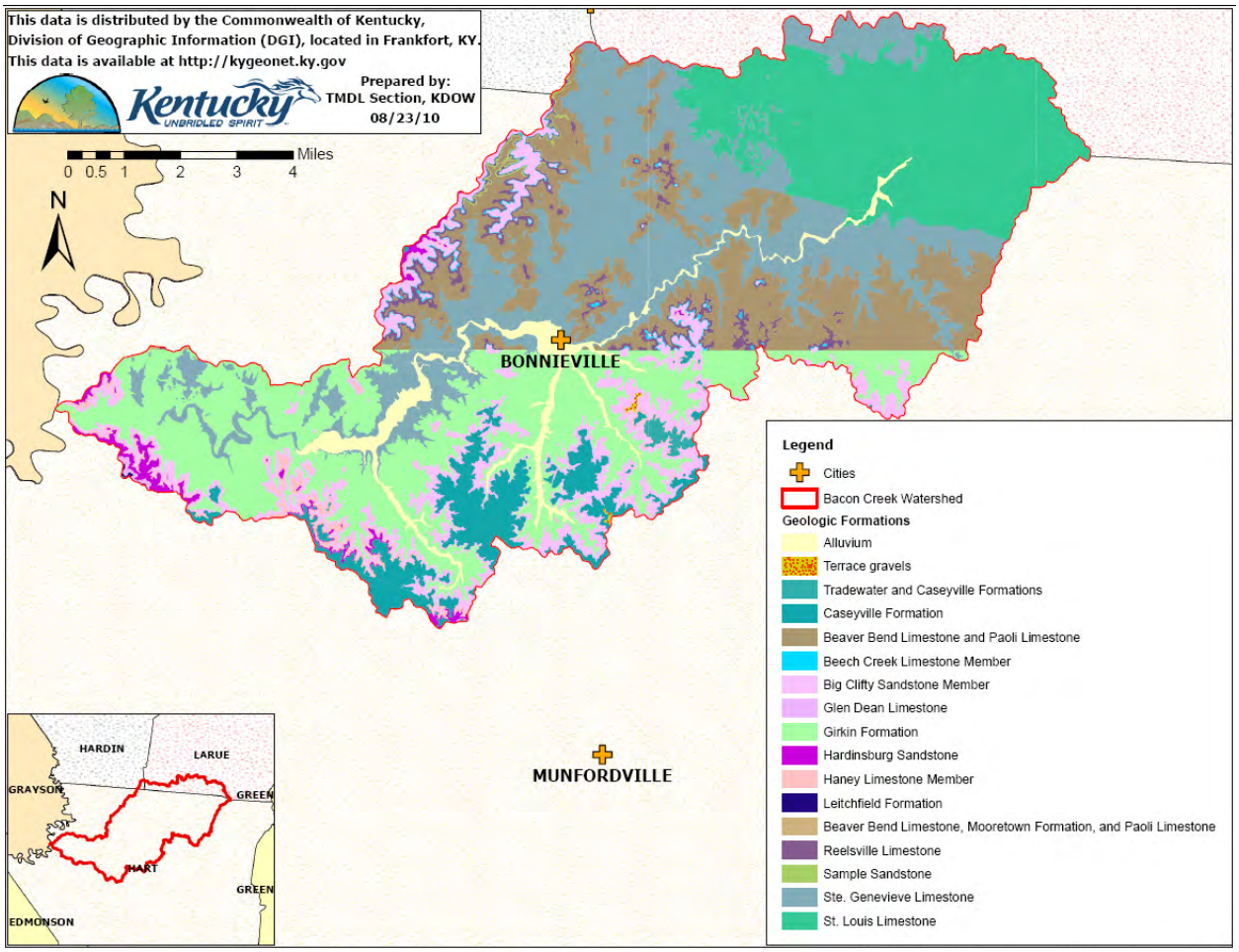

Figure 3.7 Upper Mississippian Rock in the Bacon Creek Watershed

3.4 Soils

The major soils found in the Bacon Creek watershed include the Caneyville loams and rock outcrops, Crider loams, Jefferson-Lily-rock outcrops, Riney loams, Sonora loams, and Vertrees loams. Figure 3.8 shows the soil formations found in the watershed. Suitability of the soil types for septic tanks and sewage lagoons are indicated to be somewhat to very limited (Table 3.3). Information on soils can obtained from the U.S. Department of Agriculture (USDA) Web Soil Survey at URL http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

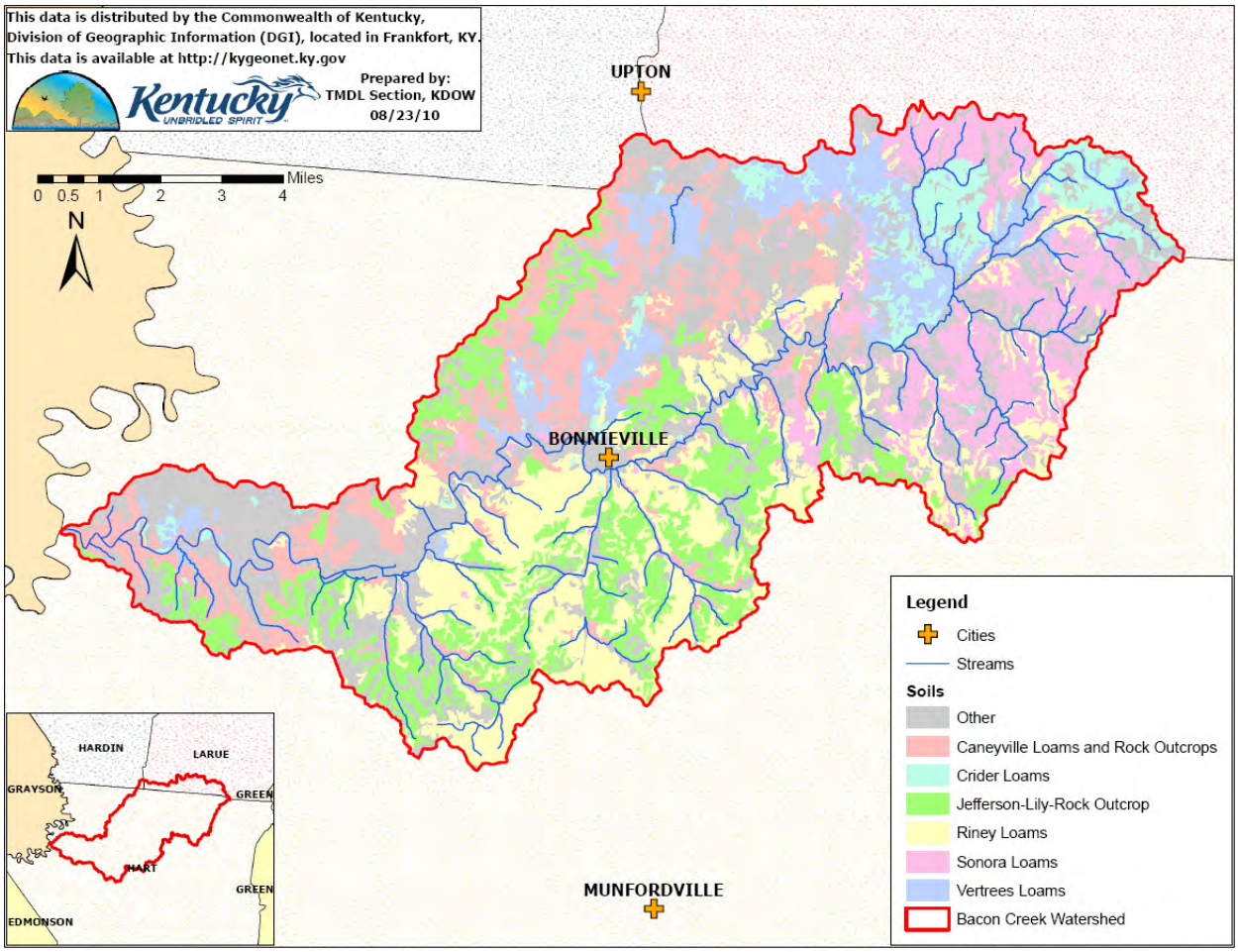

Figure 3.8 Soil Types in the Bacon Creek Watershed

Table 3.3 Soil Suitability for Septic and Sewage Lagoons in the Bacon Creek Watershed

Soil Type	Septic Tank Absorption Fields Rating	Sewage Lagoons Rating
Allegheny loam, 0 to 2 percent slopes, rarely flooded	Somewhat limited	Somewhat limited
Allegheny loam, 2 to 6 percent slopes, rarely flooded	Somewhat limited	Somewhat limited
Allegheny loam, 6 to 12 percent slopes, rarely flooded	Somewhat limited	Very limited
Caneyville silt loam, very rocky, 20 to 30 percent slopes	Very limited	Very limited
Caneyville silt loam, very rocky, 6 to 20 percent slopes	Very limited	Very limited
Caneyville silty clay loam, very rocky, 6 to 20 percent slopes, severely eroded	Very limited	Very limited
Caneyville-Rock outcrop complex, 20 to 30 percent slopes	Very limited	Very limited
Caneyville-Rock outcrop complex, 6 to 20 percent slopes	Very limited	Very limited
Canmer clay loam, 12 to 20 percent slopes, severely eroded	Very limited	Very limited
Canmer silt loam, 12 to 20 percent slopes, eroded	Very limited	Very limited
Canmer silt loam, 2 to 6 percent slopes	Somewhat limited	Somewhat limited
Canmer silt loam, 20 to 30 percent slopes	Very limited	Very limited
Canmer silt loam, 6 to 12 percent slopes, eroded	Somewhat limited	Very limited
Crider silt loam, 2 to 6 percent slopes	Somewhat limited	Somewhat limited
Crider silt loam, 2 to 6 percent slopes, eroded	Somewhat limited	Somewhat limited
Crider silt loam, 6 to 12 percent slopes	Somewhat limited	Very limited
Crider silt loam, 6 to 12 percent slopes, eroded	Somewhat limited	Very limited
Elk silt loam, 2 to 6 percent slopes	Very limited	Very limited
Elk silt loam, 2 to 6 percent slopes, rarely flooded	Somewhat limited	Somewhat limited
Frederick silt loam, 12 to 20 percent slopes, eroded	Very limited	Very limited
Frederick silt loam, 2 to 6 percent slopes, eroded	Somewhat limited	Somewhat limited
Frederick silt loam, 6 to 12 percent slopes, eroded	Somewhat limited	Very limited
Fredonia-Hagerstown-Vertrees complex, rocky, 6 to 20 percent slopes, severely eroded	Very limited	Very limited
Fredonia-Hagerstown-Vertrees silt loams, rocky, 6 to 20 percent slopes	Very limited	Very limited
Fredonia-Rock outcrop complex, 6 to 20 percent slopes	Very limited	Very limited
Frondorf-Lenberg silt loams, 12 to 20 percent slopes	Very limited	Very limited
Frondorf-Lenberg silt loams, 6 to 12 percent slopes	Very limited	Very limited
Gatton silt loam, 2 to 6 percent slopes	Very limited	Somewhat limited
Grigsby fine sandy loam, occasionally flooded	Very limited	Very limited
Gullied land	Very limited	Very limited
Hagerstown silt loam, 2 to 6 percent slopes	Somewhat limited	Somewhat limited
Hagerstown silt loam, 6 to 12 percent slopes	Somewhat limited	Very limited

Soil Type	Septic Tank Absorption Fields Rating	Sewage Lagoons Rating
Hagerstown-Fredonia-Vertrees silt loams, rocky, 2 to 6 percent slopes	Very limited	Somewhat limited
Huntington silt loam	Very limited	Very limited
Jefferson-Lily-Rock outcrop complex, 12 to 20 percent slopes	Very limited	Very limited
Jefferson-Lily-Rock outcrop complex, 20 to 30 percent slopes	Very limited	Very limited
Lawrence silt loam	Very limited	Very limited
Lawrence silt loam, occasionally flooded	Very limited	Very limited
Lenberg silt loam, 6 to 12 percent slopes	Very limited	Very limited
Lily loam, 12 to 20 percent slopes	Very limited	Very limited
Lily loam, 2 to 6 percent slopes	Very limited	Very limited
Lily loam, 6 to 12 percent slopes	Very limited	Very limited
Lindside silt loam	Very limited	Very limited
Lindside silt loam, occasionally flooded	Very limited	Very limited
Melvin silt loam	Very limited	Very limited
Melvin silt loam, ponded	Very limited	Very limited
Newark silt loam	Very limited	Very limited
Newark silt loam, occasionally flooded	Very limited	Very limited
Nicholson silt loam, 0 to 2 percent slopes	Very limited	Somewhat limited
Nicholson silt loam, 2 to 6 percent slopes	Very limited	Somewhat limited
Nolichucky loam, 12 to 20 percent slopes, eroded	Very limited	Very limited
Nolichucky loam, 2 to 6 percent slopes, eroded	Somewhat limited	Somewhat limited
Nolichucky loam, 6 to 12 percent slopes, eroded	Somewhat limited	Very limited
Nolin silt loam	Very limited	Very limited
Nolin silt loam, depressional, frequently flooded	Very limited	Very limited
Nolin silt loam, occasionally flooded	Very limited	Very limited
Otwell silt loam, 0 to 2 percent slopes, rarely flooded	Very limited	Somewhat limited
Pits, quarries	Not rated	Not rated
Riney loam, 12 to 20 percent slopes	Very limited	Very limited
Riney loam, 20 to 30 percent slopes	Very limited	Very limited
Riney loam, 6 to 12 percent slopes	Somewhat limited	Very limited
Riney loam, karst, 12 to 20 percent slopes, eroded	Very limited	Very limited
Riney loam, karst, 2 to 6 percent slopes	Very limited	Very limited
Riney loam, karst, 20 to 30 percent slopes	Very limited	Very limited
Riney loam, karst, 6 to 12 percent slopes, eroded	Very limited	Very limited
Riney loam, ridge, 12 to 20 percent slopes, eroded	Very limited	Very limited
Riney loam, ridge, 6 to 12 percent slopes, eroded	Very limited	Very limited

Soil Type	Septic Tank Absorption Fields Rating	Sewage Lagoons Rating
Riney sandy clay loam, 6 to 20 percent slopes, severely eroded	Somewhat limited	Very limited
Rock outcrop-Caneyville complex, 12 to 30 percent slopes	Not rated	Not rated
Rock outcrop-Corydon complex, 12 to 30 percent slopes	Not rated	Not rated
Sonora silt loam, 2 to 6 percent slopes	Somewhat limited	Somewhat limited
Sonora silt loam, 6 to 12 percent slopes	Somewhat limited	Very limited
Sonora silt loam, 6 to 12 percent slopes, severely eroded	Somewhat limited	Very limited
Tilsit silt loam, 2 to 6 percent slopes	Very limited	Somewhat limited
Tilsit silt loam, 6 to 12 percent slopes	Very limited	Very limited
Vertrees silt loam, 12 to 20 percent slopes	Very limited	Very limited
Vertrees silt loam, 12 to 20 percent slopes, eroded	Very limited	Very limited
Vertrees silt loam, 2 to 6 percent slopes, eroded	Very limited	Somewhat limited
Vertrees silt loam, 20 to 30 percent slopes	Very limited	Very limited
Vertrees silt loam, 6 to 12 percent slopes	Very limited	Very limited
Vertrees silt loam, 6 to 12 percent slopes, eroded	Very limited	Very limited
Vertrees silty clay loam, 6 to 12 percent slopes, severely eroded	Very limited	Very limited
Vertrees silty clay loam, 6 to 20 percent slopes, severely eroded	Very limited	Very limited
Waynesboro clay loam, 12 to 20 percent slopes, severely eroded	Very limited	Very limited
Waynesboro clay loam, 6 to 12 percent slopes, severely eroded	Somewhat limited	Very limited
Waynesboro loam, 12 to 20 percent slopes	Very limited	Very limited
Waynesboro loam, 6 to 12 percent slopes	Somewhat limited	Very limited
Wellston silt loam, 12 to 20 percent slopes	Very limited	Very limited
Wellston silt loam, 2 to 6 percent slopes	Somewhat limited	Somewhat limited
Wellston silt loam, 6 to 12 percent slopes	Somewhat limited	Very limited

3.5 Faults

The presence of faults in a watershed has the potential to influence groundwater/surface water flow. Typically, surface water flow will parallel a fracture zone for a distance before sinking off a non-soluble bedrock into a soluble limestone bedrock, near a fault. In the same way, groundwater flow may parallel a fracture zone for a distance before emerging as a spring near the contact (fault) between the soluble limestone and non-soluble bedrock. Faults in the Bacon Creek watershed are shown in Figure 3.9.

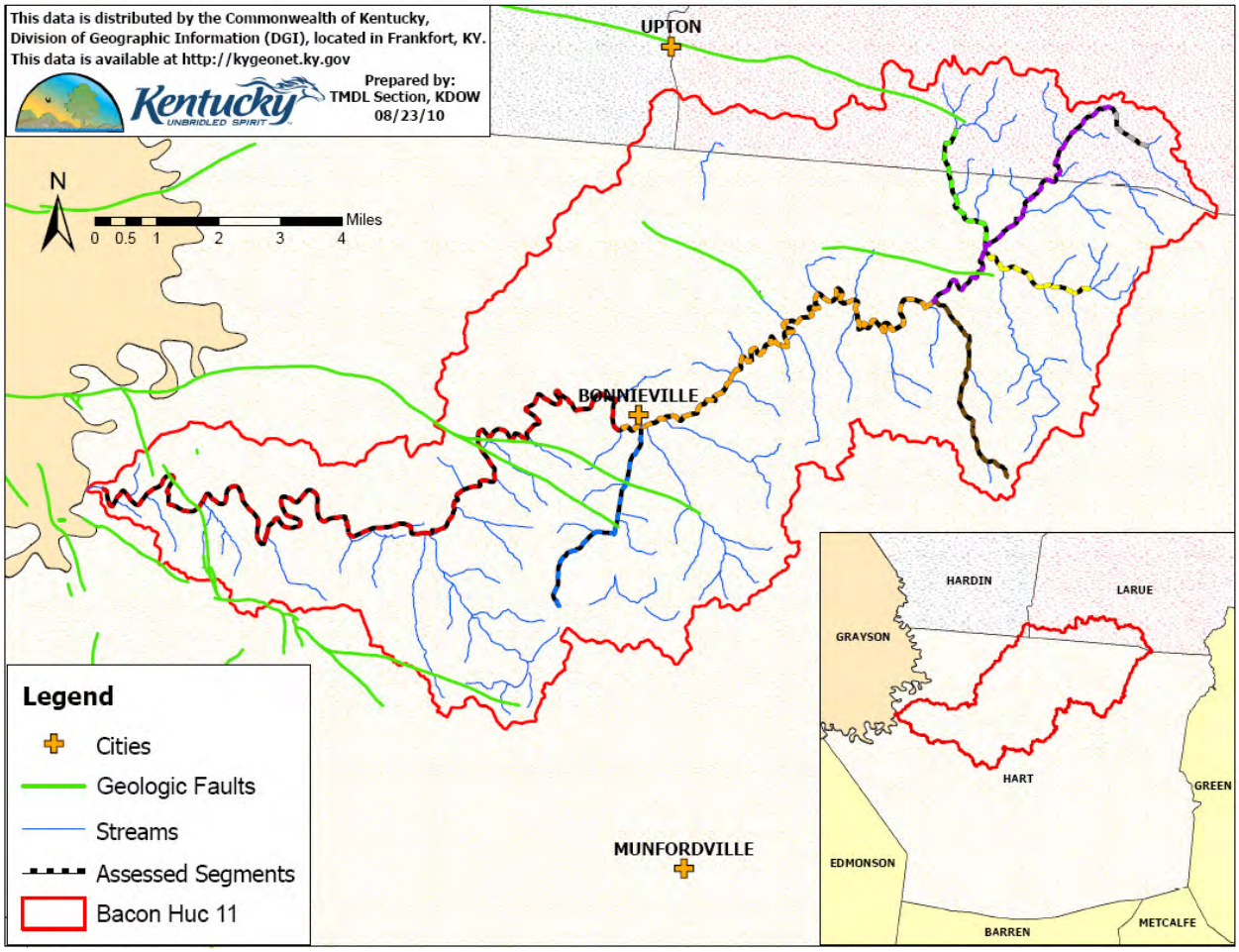

Figure 3.9 Faults in the Bacon Creek Watershed

Note: Different assessed segments are shown by varying the color of the white hatch marks.

3.6 Land Cover Distribution

The 2001 National Land Cover Dataset (USGS, 2003) was used to determine the land cover within the Bacon Creek watershed. The 2001 National Land Cover Database (NLCD) Land Cover Class Definitions are in Appendix A. Table 3.4 lists the percent land cover by class within the watershed. For the land cover tables, all forms of developed area (i.e., high-, medium- and low-intensity developed area, as well as developed open space), were aggregated, as were all forms of forest. This was done to simplify the source analysis. Land cover is shown graphically in Figure 3.10. The land cover figure indicates that the headwaters and mainstem of Bacon Creek and the Dixie Highway corridor tend to have agricultural development (pasture/hay and cultivated crops) while the remainder tends to be forested.

Table 3.4 Bacon Creek Watershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area
Open Water	63.38	0.10	0.11
Developed	2579.18	4.03	4.45
Barren Land	82.73	0.13	0.14
Forest/ Shrubland	34885.73	54.51	60.24
Grassland/Herbaceous	2333.87	3.65	4.03
Pasture/ Hay	15156.81	23.68	26.17
Cultivated Crops	2755.76	4.31	4.76
Wetlands	50.93	0.08	0.09
Totals	57908.40	90.48	100.00

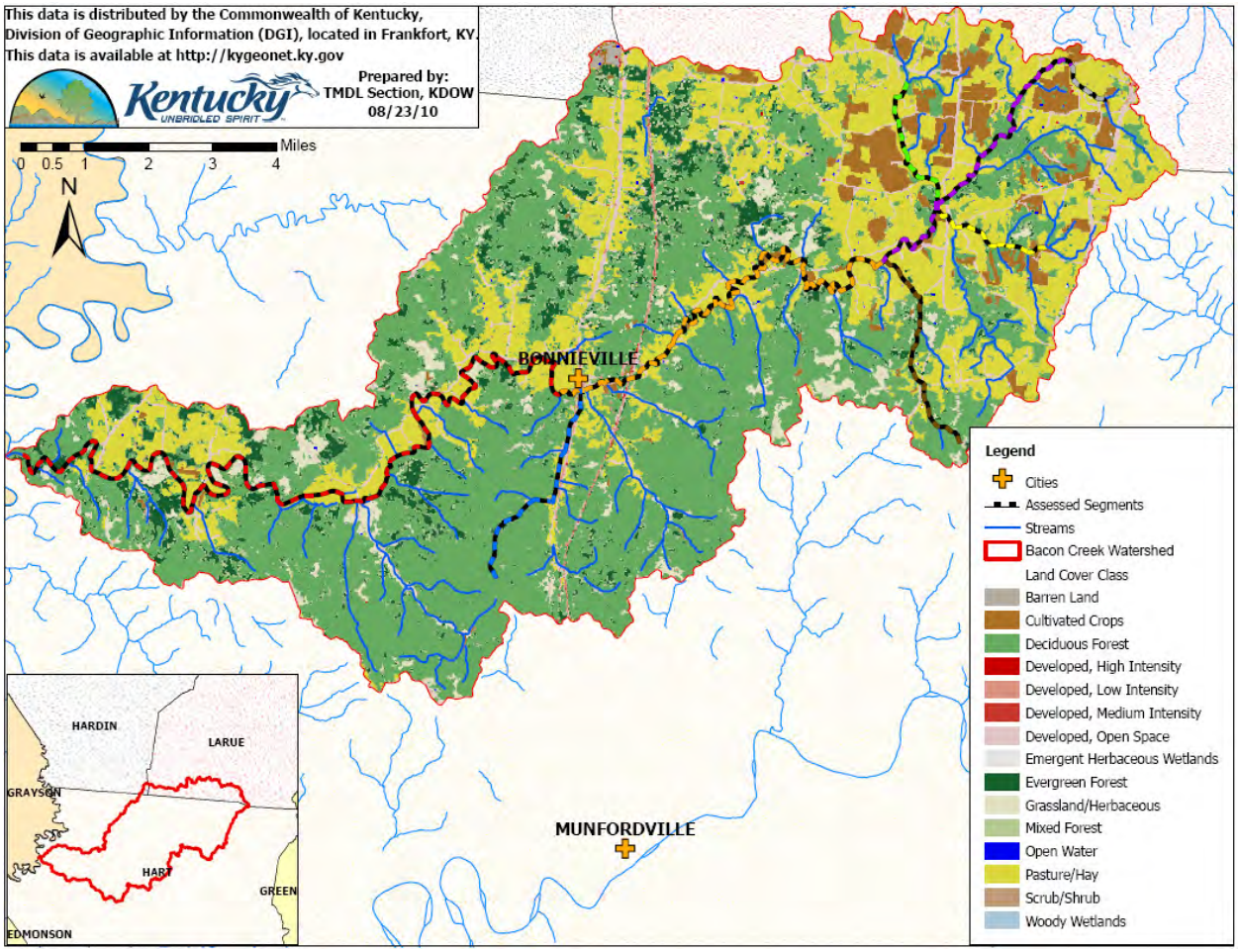

Figure 3.10 Land Cover in the Bacon Creek Watershed

Note: Different assessed segments are shown by varying the color of the white hatch marks.

4.0 Monitoring

This section relays historical and recent monitoring in the Bacon Creek watershed. Only bacteria sites with data that passed KDOW quality assurance procedures and validation tests are shown in the figures below. Only validated data collected during the PCR season are summarized in the tables below. Additional data collected outside of the PCR season or that failed the sample validation process is available for many of the sites but is not presented in this Section. Full data sets, including sample site latitude and longitude, are presented in Appendix B.

The Huntington District Corps of Engineers (COE) and KDOW have historic sample sites on Bacon Creek (STORET, 2010). The COE collected fecal coliform data at site 2NRR14001 from 1973 until 1987 while KDOW collected fecal coliform data at site PRI020 from 1980 until 1997. Figure 4.1 shows these historic sample site locations, while Table 4.1 summarizes the bacteria data. Site PRI020 is in the same location as the USGS gage station #03310400 (see Section 3.1). Because of the long historical record at this gage and a significant amount of data at PRI020 (albeit outdated), load duration curves were developed for this site for informational purposes only. Figure 4.2 shows the load duration curve for year-round data from PRI020 from 1980 until 1994, when the gage no longer recorded flow. The allowable load for the curve in Figure 4.2 was set at the instantaneous secondary contact recreation criteria of 2000 fecal coliform colonies/100 ml. Figure 4.3 shows the load duration curve for PCR season data from PRI020 from 1980 until 1994, when the gage no longer recorded flow. The allowable load for the curve in Figure 4.3 was set at the PCR criteria of 400 fecal coliform colonies/100 ml. For both Figures, any sample point plotting above the line represents an exceedance. Additional information about load duration curves can be found in EPA, 2007 and Cleland, 2008.

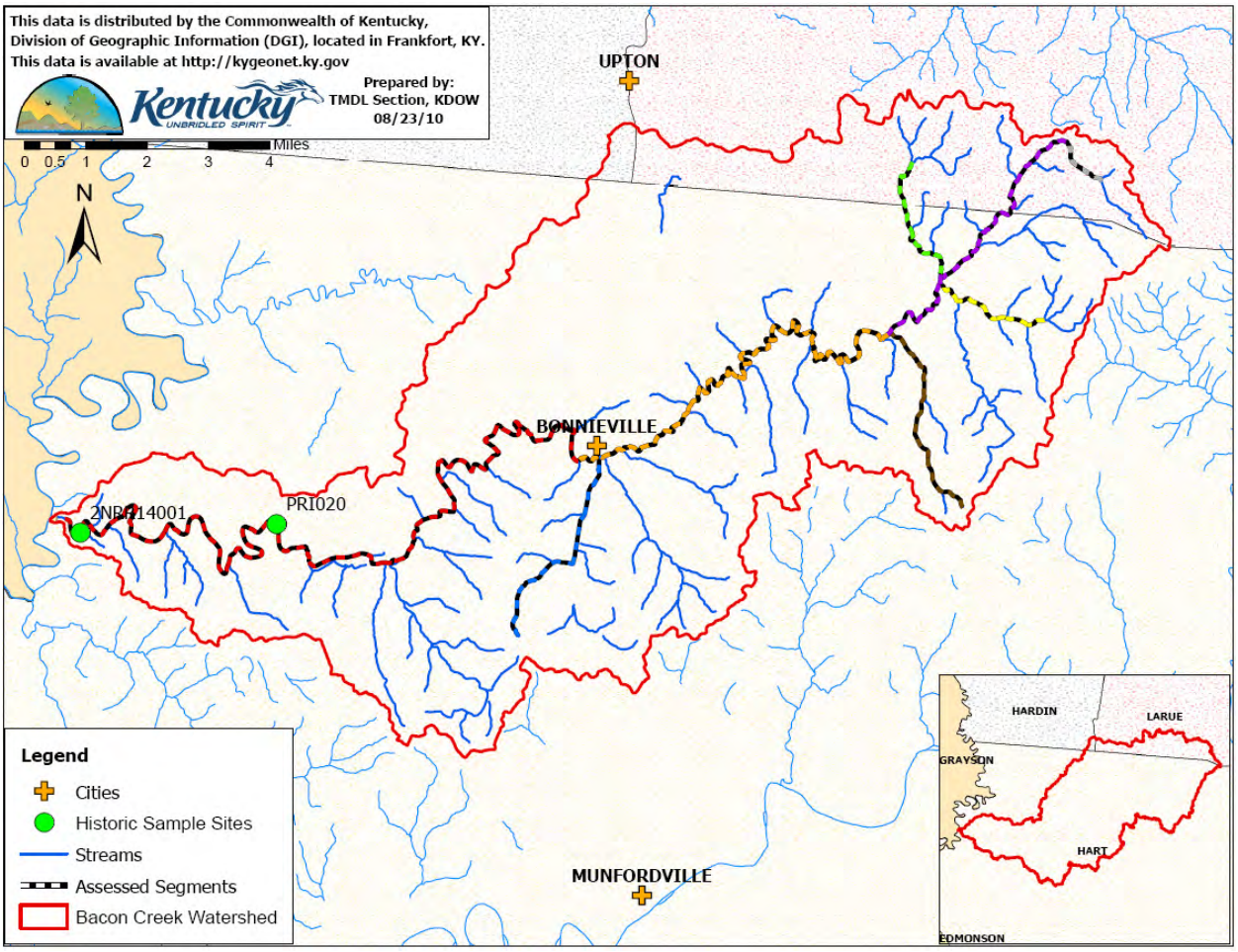

Figure 4.1 Historic Sample Sites in the Bacon Creek Watershed
Note: Different assessed segments are shown by varying the color of the white hatch marks.

Table 4.1 Fecal Coliform Data Summary for Historic Sample Sites in Bacon Creek Watershed

Station Name	Number of Observations	% Exceeding WQC (400 colonies/100ml)	Minimum (colonies/ 100 ml)	Maximum (colonies/ 100 ml)	Average (colonies/ 100 ml)
2NNR14001	7	42.9	26	3700	845
PRI020	93	19.4	23	>13,000	719

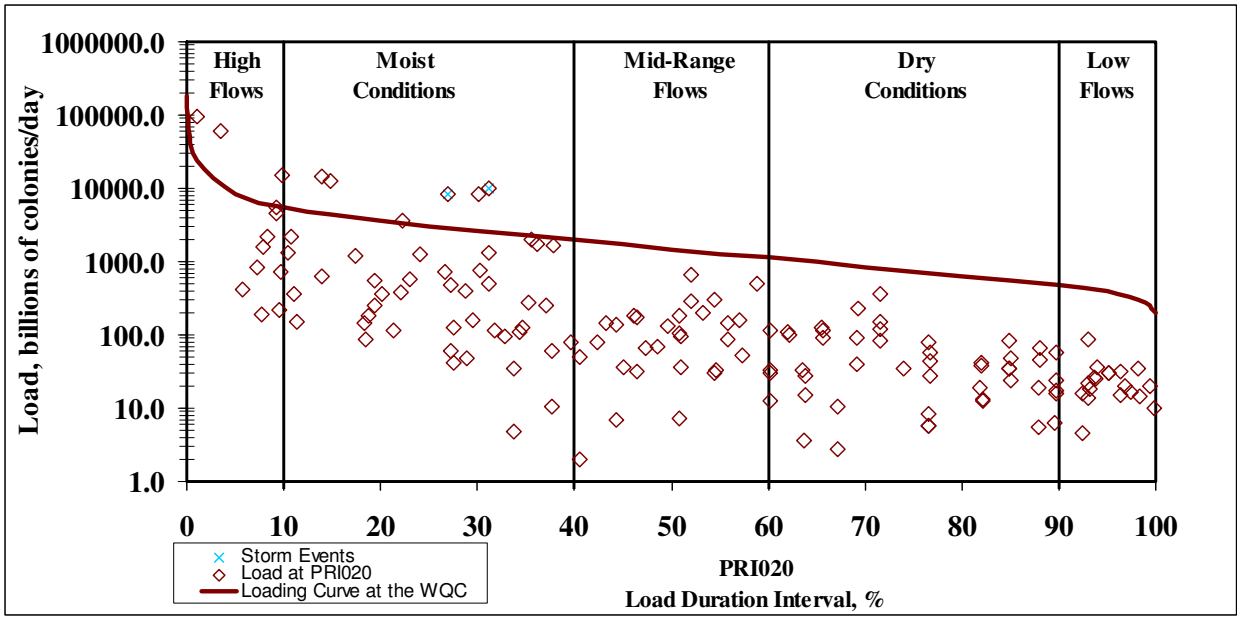

Figure 4.2 Load Duration Curve for PRI020 based upon Year-Round Data

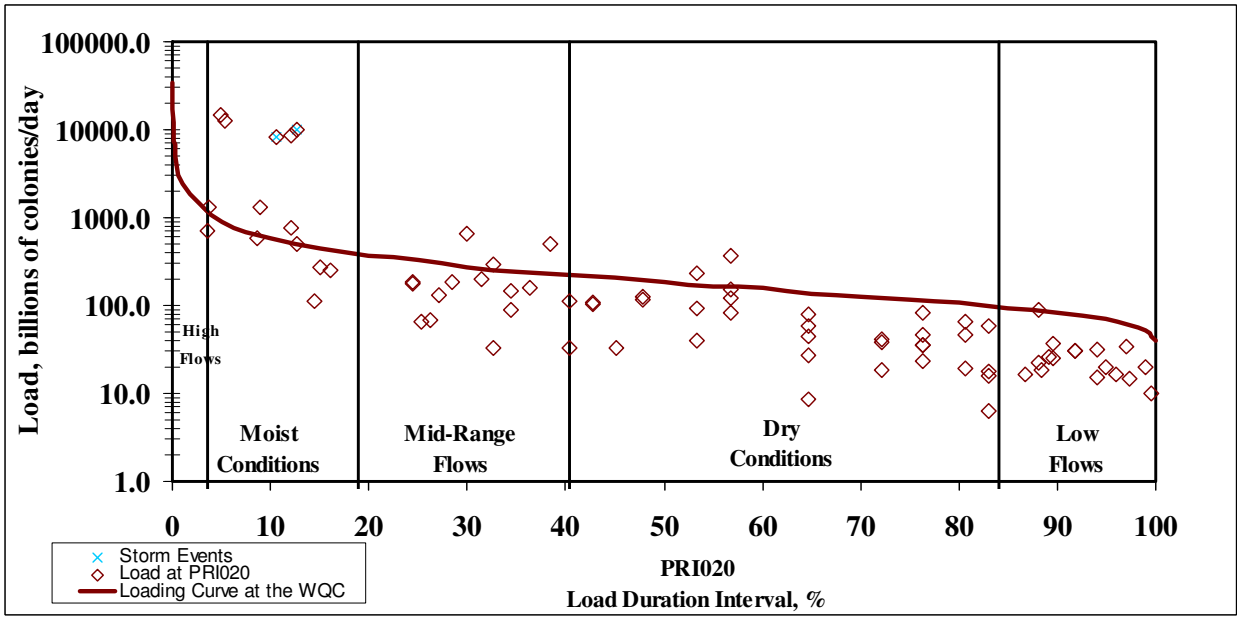

Figure 4.3 Load Duration Curve for PRI020 based upon PCR Data

To collect preliminary data for a 319(h) Watershed Based Plan (WBP) project, the headwaters of Bacon Creek was monitored for fecal coliform and E. coli during the 2004 PCR season. The seven sample sites from this monitoring effort are shown in Figure 4.4 while a bacteria data summary is presented in Table 4.2.

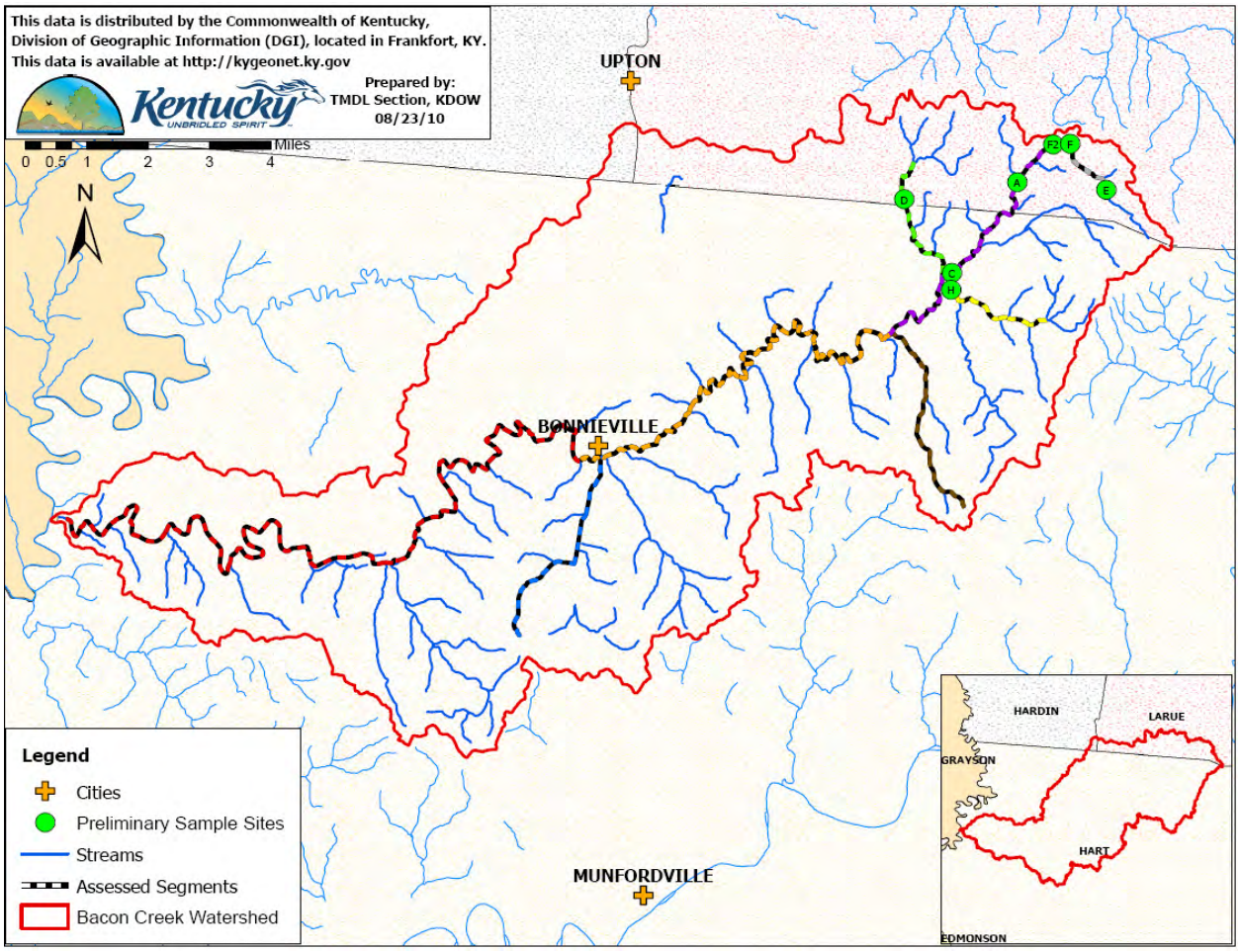

Figure 4.4 Preliminary Project Sample Sites

Note: Different assessed segments are shown by varying the color of the white hatch marks.

Table 4.2 Bacteria Data Summary for Preliminary Project Sites

Station Name	Number of Observations	% Exceeding WQC (400 FC[1] or 240 EC[1] colonies/100ml)	Minimum (colonies/ 100 ml)	Maximum (colonies/ 100 ml)	Average (colonies/ 100 ml)
A	5 (FC), 4 (EC)	100 (FC & EC)	2000 (FC), 2310 (EC)	6000 (FC), 4140 (EC)	3564 (FC), 2958 (EC)
C	1 (FC), 0 (EC)	0 (FC)	270 (FC)	270 (FC)	N/A[2]
D	5 (FC), 4 (EC)	100 (FC & EC)	818 (FC), 610 (EC)	5545 (FC), 4640 (EC)	1900 (FC), 2128 (EC)
E	2 (FC & EC)	50 (FC & EC)	84 (FC), <100 (EC)	2727 (FC), 970 (EC)	1406 (FC), 535 (EC)
F	2 (FC & EC)	100 (FC & EC)	909 (FC), 840 (EC)	3727 (FC), 3090 (EC)	2318 (FC), 1965 (EC)
F2	1 (FC & EC)	0 (FC & EC)	273 (FC), 100 (EC)	273 (FC), 100 (EC)	N/A[2]
H	1 (FC & EC)	0 (FC), 100 (EC)	91 (FC), 300 (EC)	91 (FC), 300 (EC)	N/A[2]

Notes: [1] FC indicates fecal coliform while EC indicates E. coli
[2] N/A indicates insufficient samples to calculate an average

319(h) WBP fecal coliform sampling occurred at six sites during 2005 and 2006 (Figure 4.5). A data summary from this sampling is presented in Table 4.3. This project was extended to include bacterial source tracking (BST) at eight sites during 2010. This was performed to identify the percentage of coliform bacteria from humans versus all other sources. The BST sample sites are shown in Figure 4.6 while a data summary is presented in Table 4.4.

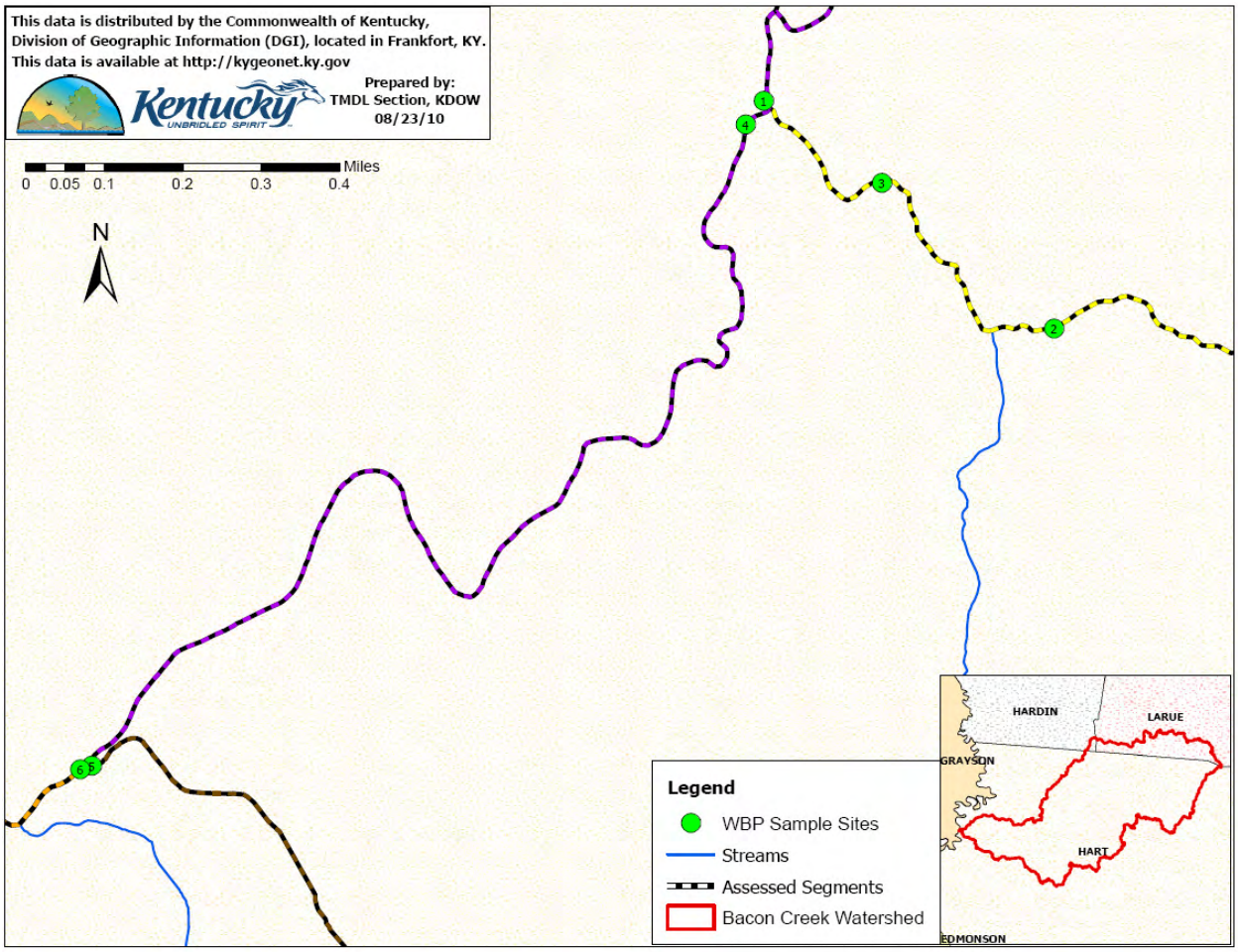

Figure 4.5 WBP Sample Sites

Note: Different assessed segments are shown by varying the color of the white hatch marks.

Table 4.3 Fecal Coliform Data Summary for WBP Sites

Station Name	Number of Observations	% Exceeding WQC (400 colonies/100ml)	Minimum (colonies/ 100 ml)	Maximum (colonies/ 100 ml)	Average (colonies/ 100 ml)
1	10	90	328	15,000	3,612
2	11	36.4	94	2,500	615
3	10	60.0	94	27,000	3,419
4	9	100.0	492	20,000	4,510
5	11	90.1	355	5,000	1,673
6	11	72.7	131	13,000	2,111

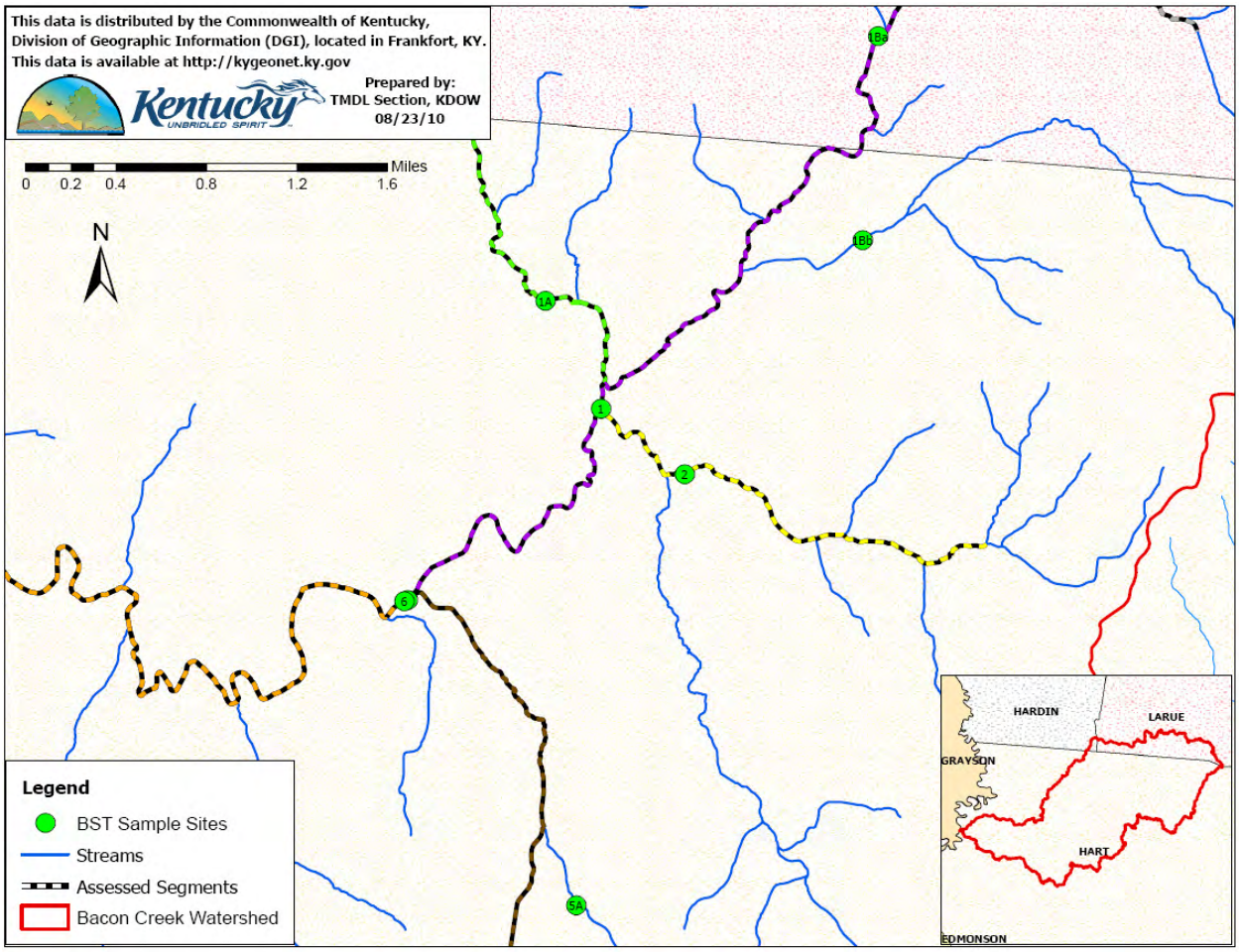

Figure 4.6 BST Sample Sites

Note: Site 5 is under site 6 (see Figure 4.5 for greater detail). Different assessed segments are shown by varying the color of the white hatch marks.

Table 4.4 E. coli Data Summary for BST Sites

Station Name	Number of Observations	% Exceeding WQC (240 colonies/100ml)	E. coli colonies/100 ml	% Human Bacteria
1	1	100	1,169	46.5
1A	1	100	1,274	N/A[1]
1Ba	1	100	3,076	N/A[1]
1Bb	1	100	241	51.1
2	1	100	359	100
5	1	100	583	94.1
5A	1	100	3076	12.1
6	1	100	350	7.3

Note: [1] N/A indicates that the % human bacteria could not be determined.

To facilitate additional assessment of and TMDL development for Bacon Creek, KDOW provided funding to Western Kentucky University for additional fecal coliform sampling at the six WBP sites during the 2007 PCR season. Additionally, during the 2007 PCR season, KDOW staff collected E. coli samples at seven sites on the downstream portion of Bacon Creek. Figure 4.7 shows the sample sites from these TMDL monitoring efforts, (see Figure 4.5 for greater detail of the upstream sites). A data summary from this TMDL monitoring is presented in Table 4.5.

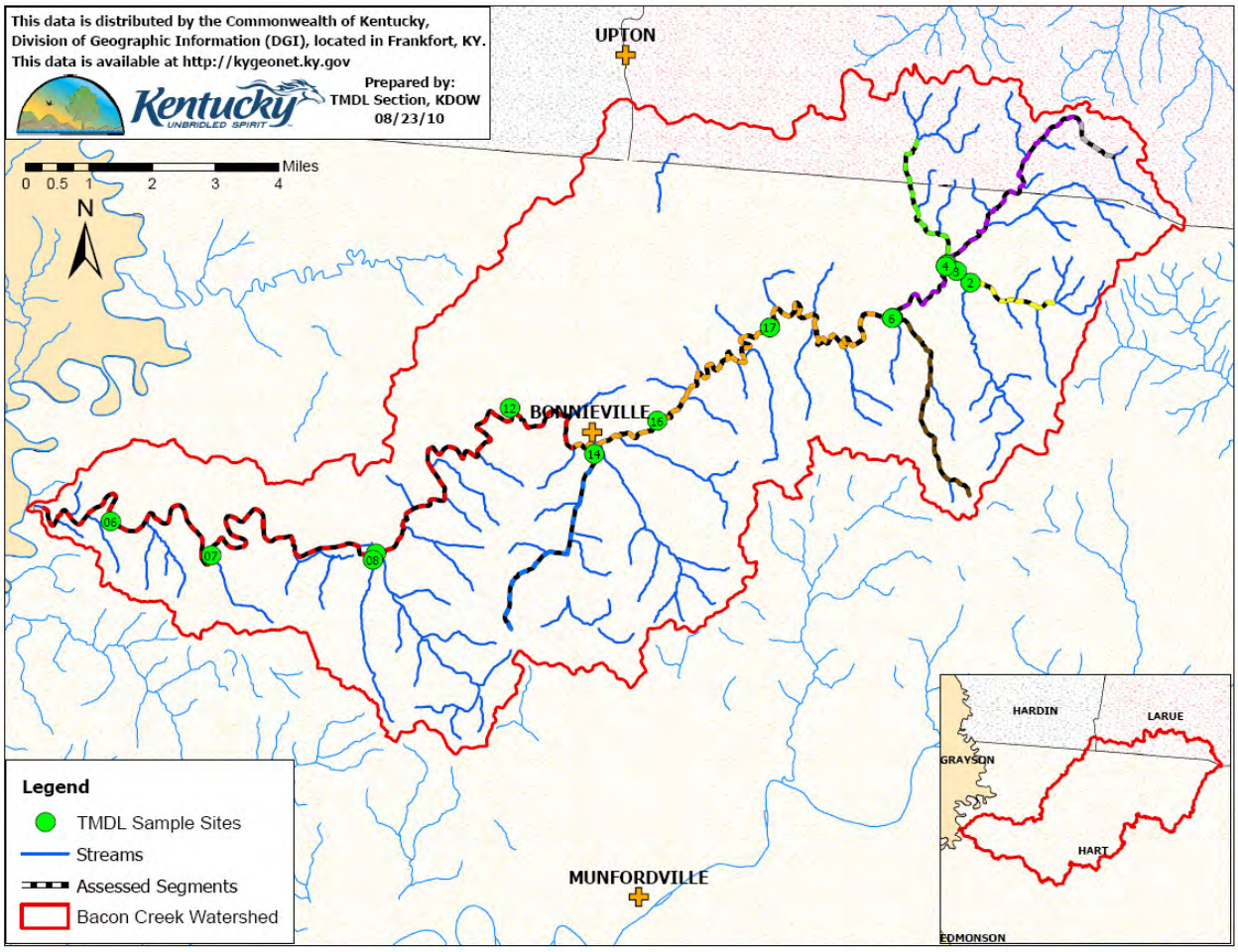

Figure 4.7 TMDL Sample Sites

Note: Only the last two digits of the DOW sites are labeled on the map. Site 09 is under site 08, site 1 is under site 4, and site 5 is under site 6. Different assessed segments are shown by varying the color of the white hatch marks.

Table 4.5 Bacteria Data Summary for TMDL Sites

Station Name	Number of Observations	% Exceeding WQC (400 FC[1] or 240 EC[1] colonies/100ml)	Minimum (colonies/ 100 ml)	Maximum (colonies/ 100 ml)	Average (colonies/ 100 ml)
1	5	80 (FC)	200 (FC)	1180 (FC)	669 (FC)
2	5	40 (FC)	200 (FC)	880 (FC)	448 (FC)
3	3	100 (FC)	520 (FC)	1040 (FC)	711 (FC)
4	3	100 (FC)	460 (FC)	1377 (FC)	846 (FC)
5	5	80 (FC)	100 (FC)	2500 (FC)	8198 (FC)
6	5	60 (FC)	250 (FC)	1040 (FC)	598 (FC)
DOW03025006	12	50 (EC)	85 (EC)	>24196 (EC)	2358 (EC)
DOW03025007	11	36.4 (EC)	86 (EC)	5794 (EC)	774 (EC)
DOW03025008	08	0 (EC)	147 (EC)	161 (EC)	154 (EC)
DOW03025009	12	41.7 (EC)	84 (EC)	17329 (EC)	1665 (EC)
DOW03025012	12	66.7 (EC)	63 (EC)	9804 (EC)	1152 (EC)
DOW03025014	8	87.5 (EC)	96 (EC)	4611 (EC)	1503 (EC)
DOW03025016	11	45.5 (EC)	41 (EC)	24196 (EC)	2378 (EC)
DOW03025017	12	66.7 (EC)	120 (EC)	>24196 (EC)	2318 (EC)

Note: [1]FC indicates fecal coliform while EC indicates E. coli.

Validated bacteria data from the preliminary project, WBP, and TMDL monitoring was used to perform stream assessment according to 305(b) listing requirements. Assessment results indicated that several additional stream segments within the watershed are impaired for the PCR use due to the pathogen indicators E. coli or fecal coliform. No assessed stream segments were found to be fully supporting for the PCR use. Assessments from this monitoring were not included in the 2010 305(b) listing cycle, which focused on the Big Sandy-Little Sandy-Tygarts Basin and Kentucky River Basin Management Units (KDOW, 2010c). The proposed listings from these assessments are shown in Table 4.6.

Table 4.6 Proposed Listings in the Bacon Creek Watershed

Waterbody & Segment	Impairment	County	Waterbody ID	Suspected Source(s)	Impaired Use (Support Status)[2]	Sites on Impaired Segment
Bacon Creek 0.2 to 17.2 into Nolin River	E. coli[1]	Hart	KY486197_01	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	PCR[3] (NS)	DOW03025006, DOW03025007, DOW03025009, DOW03025012
Bacon Creek 17.2 to 27.1 into Nolin River	E. coli[1] , Fecal Coliform[4]	Hart	KY486197_02	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	PCR (NS)	DOW03025016, DOW03025017, 6
Bacon Creek 27.1 to 32.6 into Nolin River	E. coli[1] , Fecal Coliform[4]	Hart	KY486197_03	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	PCR (NS)	1, 4, A, C, F2
Bacon Creek 32.6 to 34.9 into Nolin River	E. coli[1]	Larue	KY486197_04	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	PCR (NS)	F
Honey Run 0.0 to 3.65 into Bacon Creek	Fecal Coliform[1,4]	Hart	KY494483_01	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	PCR (NS)	5
Tampa Branch 0.0 to 2.15 into Bacon Creek	Fecal Coliform[1,4]	Hart	KY504931_01	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	PCR (NS)	2, 3
UT to Bacon Creek at RM 17.8, 0.0 to 3.7	E. coli[1]	Hart	KY486187-17.8_01	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	PCR (NS)	DOW03025014
UT to Bacon Creek at RM 28.9, 0.0 to 2.45	E. coli[1]	Larue	KY48619-28.9_01	Agriculture, On-Site Treatment Systems (Septic Systems and Similar Decentralized Systems)	PCR (NS)	1A, D

Note: [1]Indicates a new listing not on the draft 2010 303(d) list.
[2]Support Status NS indicates that the segment is nonsupporting and that a TMDL is required for the use.
[3]PCR is the Primary Contact Recreation use.
[4]TMDLs for fecal coliform are expressed as an E. coli load.

Data from the preliminary project, WBP, BST, and TMDL sites that were on a PCR impaired stream segment was used in TMDL development. Figure 4.8 shows the sample sites used for TMDL development while Table 4.7 summarizes this data set. Sample site 1Ba was in the same location as site A while site H was in the same location as site 3, thus data from site 1Ba or site H was combined under site A or site 3, respectively. Greater detail of sites in the upper watershed is shown in Figure 4.9.

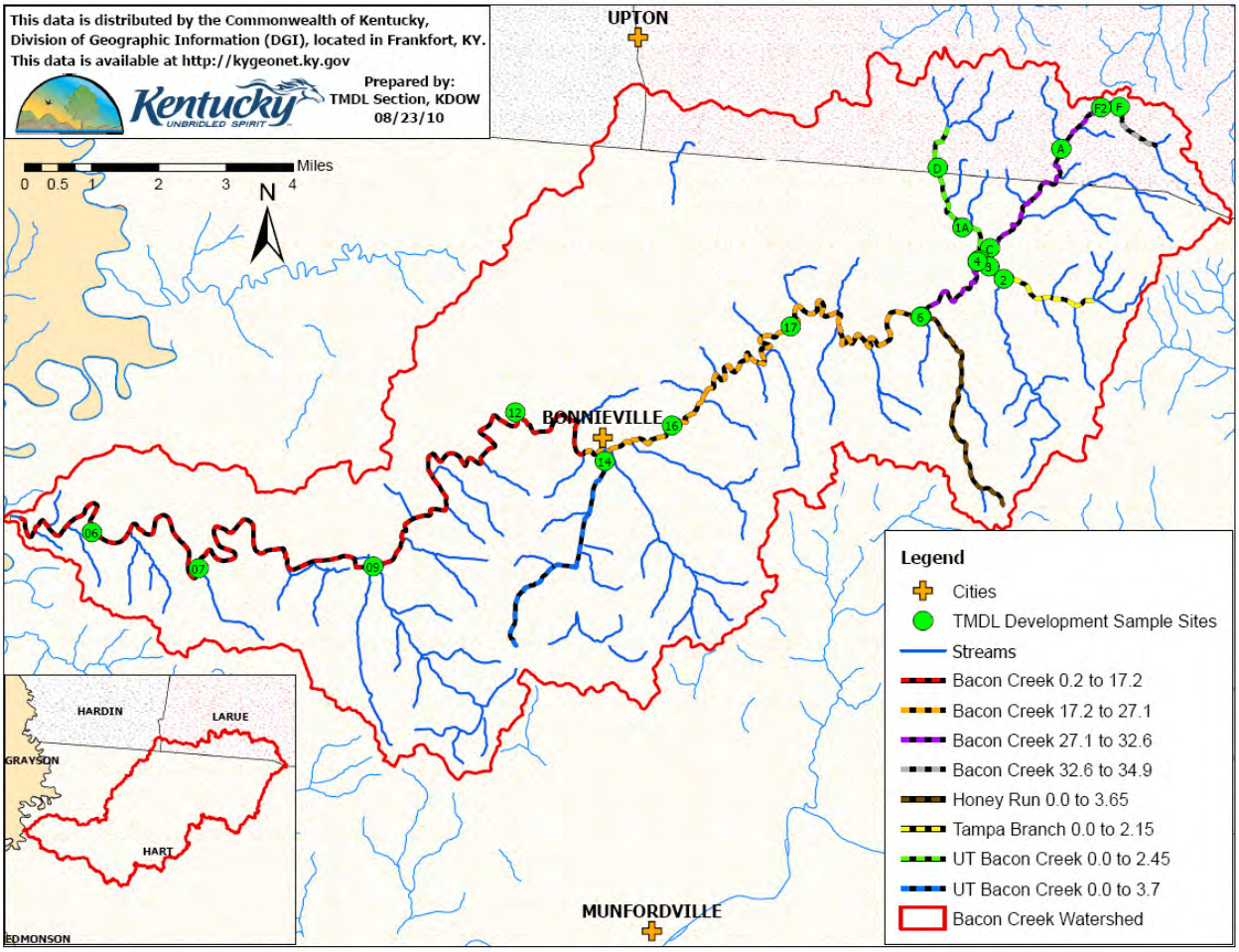

Figure 4.8 TMDL Development Sample Sites

Notes: Only the last two digits of DOW sites are labeled on the map. Site 1 is under Site 4 while Site 5 is under Site 6. Greater detail of sites in the upper watershed is shown in Figure 4.9. Different assessed segments are shown by varying the color of the white hatch marks.

Table 4.7 Bacteria Data Summary for TMDL Development Sites

Station Name	Number of Observations	% Exceeding WQC (400 FC[1] or 240 EC[1] colonies/100ml)	Minimum (colonies/ 100 ml)	Maximum (colonies/ 100 ml)	Average[2] (colonies/ 100 ml)
A	5 (FC), 5 (EC)	100 (FC & EC)	2000(FC), 2310 (EC)	6000 (FC), 4140 (EC)	3564 (FC), 2981 (EC)
1A	1 (EC)	100 (EC)	1274 (EC)	1274 (EC)	N/A
C	1 (FC)	0 (FC)	270 (FC)	270 (FC)	N/A
D	5 (FC), 4 (EC)	100 (FC & EC)	818 (FC), 610 (EC)	5545 (FC), 4640 (EC)	1900 (FC), 2128 (EC)
F	2 (FC & EC)	100 (FC & EC)	909 (FC), 840 (EC)	3727 (FC), 3090 (EC)	2318 (FC), 1965 (EC)
F2	1 (FC & EC)	0 (FC & EC)	273 (FC), 100 (EC)	273 (FC), 100 (EC)	N/A
1	15 (FC), 1 (EC)	86.7 (FC), 100 (EC)	200 (FC), 1169 (EC)	15000 (FC), 1169 (EC)	2631 (FC), N/A (EC)
2	16 (FC), 1(EC)	37.5 (FC), 100(EC)	50 (FC), 359 (EC)	2500 (FC), 359 (EC)	563 (FC), N/A (EC)
3	14 (FC), 1 (EC)	64.3 (FC), 100 (EC)	91 (FC), 300 (EC)	27000 (FC), 300 (EC)	2601 (FC), N/A (EC)
4	12 (FC)	100 (FC)	460 (FC)	20000 (FC)	3594 (FC)
5	16 (FC), 1 (EC)	87.5 (FC), 100 (EC)	100 (FC), 583 (EC)	25000 (FC), 583 (EC)	3712 (FC), N/A (EC)
6	16 (FC), 1 (EC)	68.9 (FC), 100 (EC)	131 (FC), 350 (EC)	13000 (FC), 350 (EC)	1638 (FC), N/A (EC)
DOW03025006	12 (EC)	50 (EC)	85 (EC)	>24196 (EC)	2358 (EC)
DOW03025007	11 (EC)	36.4 (EC)	86 (EC)	5794 (EC)	774 (EC)
DOW03025009	12 (EC)	41.7 (EC)	84 (EC)	17329 (EC)	1665 (EC)
DOW03025012	12 (EC)	66.7 (EC)	63 (EC)	9804 (EC)	1152 (EC)
DOW03025014	8 (EC)	87.5 (EC)	96 (EC)	4611 (EC)	1503 (EC)
DOW03025016	11 (EC)	45.5 (EC)	41 (EC)	24196 (EC)	2378 (EC)
DOW03025017	12 (EC)	66.7 (EC)	120 (EC)	>24196 (EC)	2318 (EC)

Notes: [1]FC indicates fecal coliform while EC indicates E. coli.
[2]N/A indicates that there were insufficient samples to calculate an average.

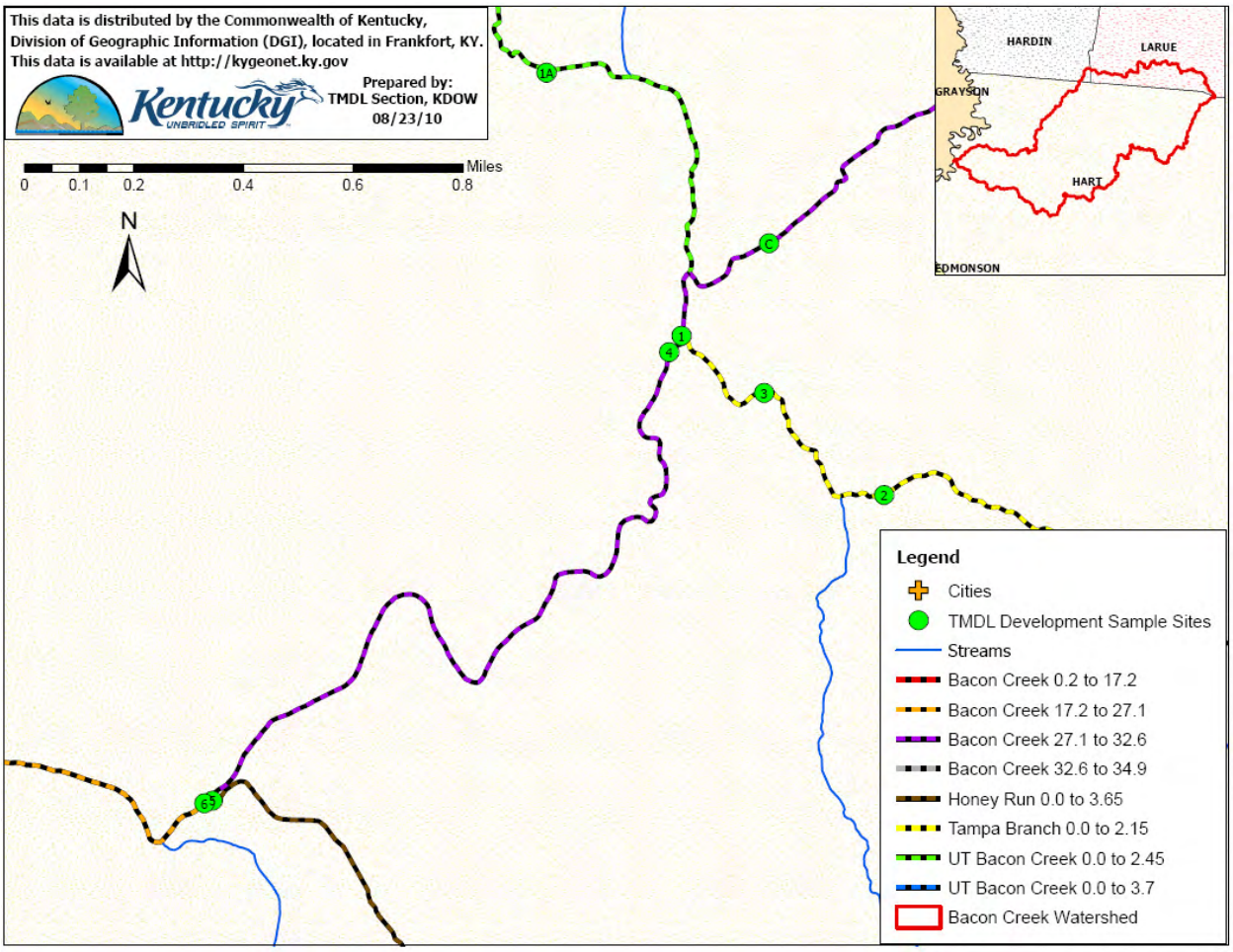

Figure 4.9 Detail of TMDL Development Sample Sites in Upper Watershed
Note: Different assessed segments are shown by varying the color of the white hatch marks.

5.0 Source Identification

For regulatory purposes, the sources of E. coli or fecal coliform in a watershed can be placed into two broad categories: Kentucky Pollution Discharge Elimination System (KPDES)-permitted and non KPDES-permitted sources. A KPDES-permitted source requires a KPDES discharge permit, a Stormwater permit, or a Municipal Separate Storm Sewer System (MS4) permit from KDOW. KPDES discharge permits include wastewater treatment facilities that discharge directly to a stream, facilities discharging storm water, and some agricultural operations. The KPDES is not the only permitting program that may affect water quality or quantity within a watershed; other permitting examples include water withdrawal permits, permits to build structures within a floodplain, permits to construct an on-site sewage treatment and disposal system (OSTDS), and permits to land apply waste from sewage treatment plants. However, within the framework of the TMDL process a KPDES-permitted source is defined as one regulated under the KPDES program.

A non KPDES-permitted source does not include surface or ground water dischargers regulated by the KPDES program but does include nonpoint sources of pollution. Nonpoint sources of pollution are caused by runoff from precipitation over or through the ground and are correlated to land use.

5.1 KPDES-Permitted Sources

Permitted sources include all sources regulated by the KPDES permitting program. In 401 KAR 10:001, KDOW adopted the definition of a point source per 33 U.S.C. 1362(14) as "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 or vessel or other floating craft, from which pollutants are or may be discharged." However, 401 KAR 10:001 exempts "agricultural storm water run-off or return flows from irrigated agriculture" from the definition of a point source. A Waste Load Allocation (WLA) is assigned to KPDES-permitted sources.

5.1.1 Sanitary Wastewater Planning

Kentucky regulation 401 KAR 5:006 specifies wastewater-planning requirements for regional areas. Municipal wastewater treatment facilities are required to prepare 20-year regional planning documents under certain conditions as described in regulation. Additionally, 401 KAR 5:005 requires that construction permits only be issued for wastewater treatment and conveyance facilities if the construction is compatible with the facilities plan.

There are several sanitary wastewater-planning areas in the Bacon Creek watershed (Figure 5.1). Three of these are expected to merge into one planning area under the Caveland Environmental Authority. These are City of Bonnieville, Caveland Environmental Authority-Upton, and Caveland Environmental Authority. Information in Figure 5.1 was the best available at the time of document writing, but is expected to be outdated shortly after publication of this document (KDOW, 2010d).

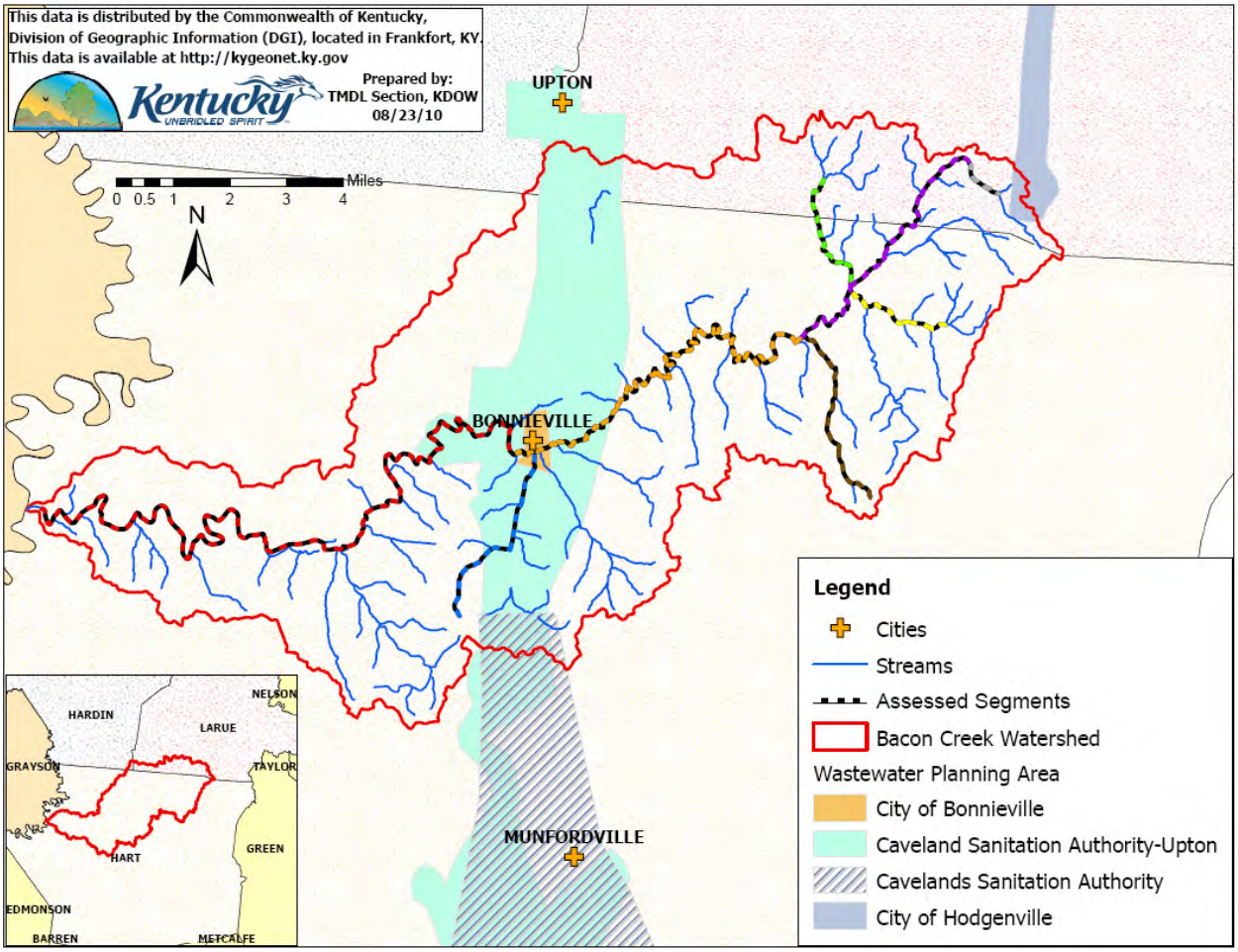

Figure 5.1 Wastewater Planning Areas in the Bacon Creek Watershed
Note: Different assessed segments are shown by varying the color of the white hatch marks.

5.1.2 Sanitary Wastewater Systems (SWS)

The KPDES program issues discharge permits to facilities that treat sanitary wastewater, among other types. These facilities can be large publicly owned treatment works (POTWs) that service thousands of households and businesses, small, privately operated package facilities that service one business or one residential development, or a home unit that services an individual residence.

One KPDES-permitted sanitary wastewater discharge is located within the Bacon Creek watershed, Spring Park Mobile Home Park (MHP) (Table 5.1 and Figure 5.2). There are certainly other KPDES-permitted facilities in the watershed; however, those identified in this section treat sanitary wastewater and contribute an E. coli or fecal coliform load to an impaired segment. The facility in Table 5.1 receives an SWS-WLA. Information about permitted sources was obtained from the application for permit submitted by the permitted entity and from the KPDES-permit. Discharge Monitoring Report (DMR) information was obtained from the USEPA Permit Compliance System database (U.S.EPA, 2010) and the TEMPO database maintained by the Department for Environmental Protection.

Table 5.1 KPDES-permitted Source of E. coli in the Bacon Creek Watershed

KPDES #	Name	Type	AI #	Latitude	Longitude
KY0089761	Spring Park MHP	Mobile Home Site	2555	37.44111	-85.755

Note: AI # indicates Agency Interest number, an internal identification number.

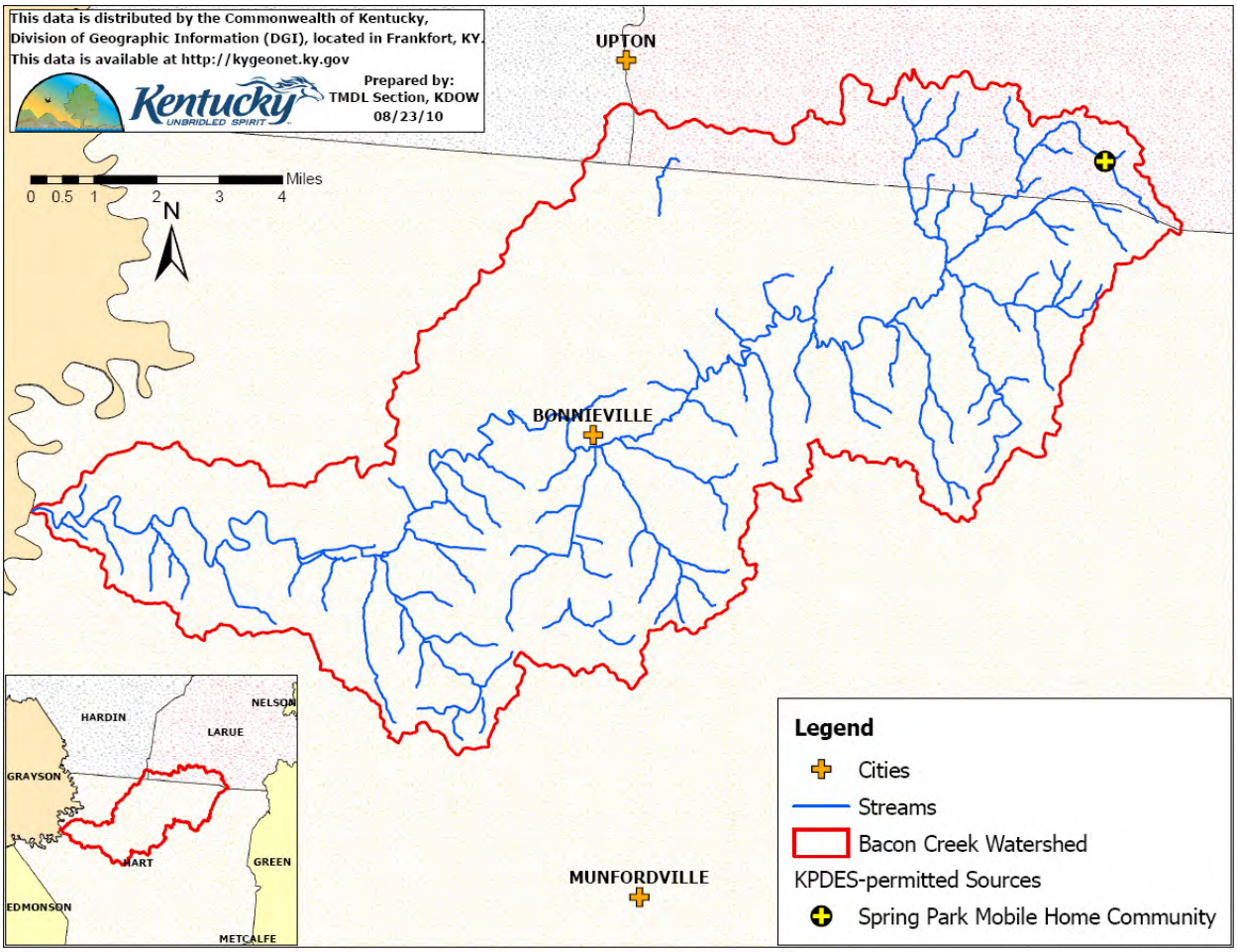

Figure 5.2 KPDES-permitted Source of E. coli in the Bacon Creek Watershed

Spring Park MHP, permit # KY0089761 (effective 7/1/2007 – 6/30/2012)

Spring Park MHP has a 0.005 MGD package treatment plant with effluent treated by extended aeration and disinfection. This facility, which is expected to serve up to 25 homes, is not located within a sanitary wastewater planning area. The effluent is discharged to RM 33.45 of Bacon Creek, while solids are disposed of in dumpsters and landfilled. KPDES permit limits for this discharge are: E. coli effluent gross limit of 130 colonies/100 ml as a monthly average and 240 colonies/100 ml as a maximum weekly average. Spring Park MHP is required to submit DMRs on a quarterly basis and a review of DMRs from the quarters ending September 2007 through June 2010 indicate six exceedances (out of twelve) of the maximum permit limit for E. coli (240 colonies/100 ml). Prior to July 2007, this facility's permit limits were: fecal coliform effluent gross limit of 200 colonies/100 ml as a monthly average and 400 colonies/100 ml as a maximum weekly average. DMRs for the quarters ending March 2005 through June 2007 indicate seven

exceedances (out of ten) of the maximum permit limit for fecal coliform (400 colonies/100 ml). DMR information for this facility is compiled in Appendix C. This facility was issued a notice of violation in August 2010 for violations including exceeding permit limits for coliform bacteria.

Horse Cave Wastewater Treatment Plant (WWTP) KPDES permit # KY0091561 (effective 11/01/2005 – 6/30/2009)

Horse Cave WWTP is a 0.280 MGD SWS owned and operated by the Caveland Environmental Authority. The effluent is discharged at RM 218.97 of the Green River, while sludge is disposed of at the Glasgow Landfill. Although it is outside the Bacon Creek watershed, this facility serves approximately 364 residents in the City of Bonnieville. Sewer lines extend from Bonnieville to the Horse Cave WWTP and the Caveland Environmental Authority is responsible for these lines (Figure 5.3) (See Section 5.3 Illegal Sources, below). The effluent is treated by comminutor, grit channel, two parallel oxidation ditches, two parallel clarifiers, and ultraviolet light disinfection. As of November 2010, a draft renewal permit was under development for this facility and expected KPDES permit limits for this discharge are: E. coli effluent gross limit of 130 colonies/100 ml as a monthly average and 240 colonies/100 ml as a maximum weekly average.

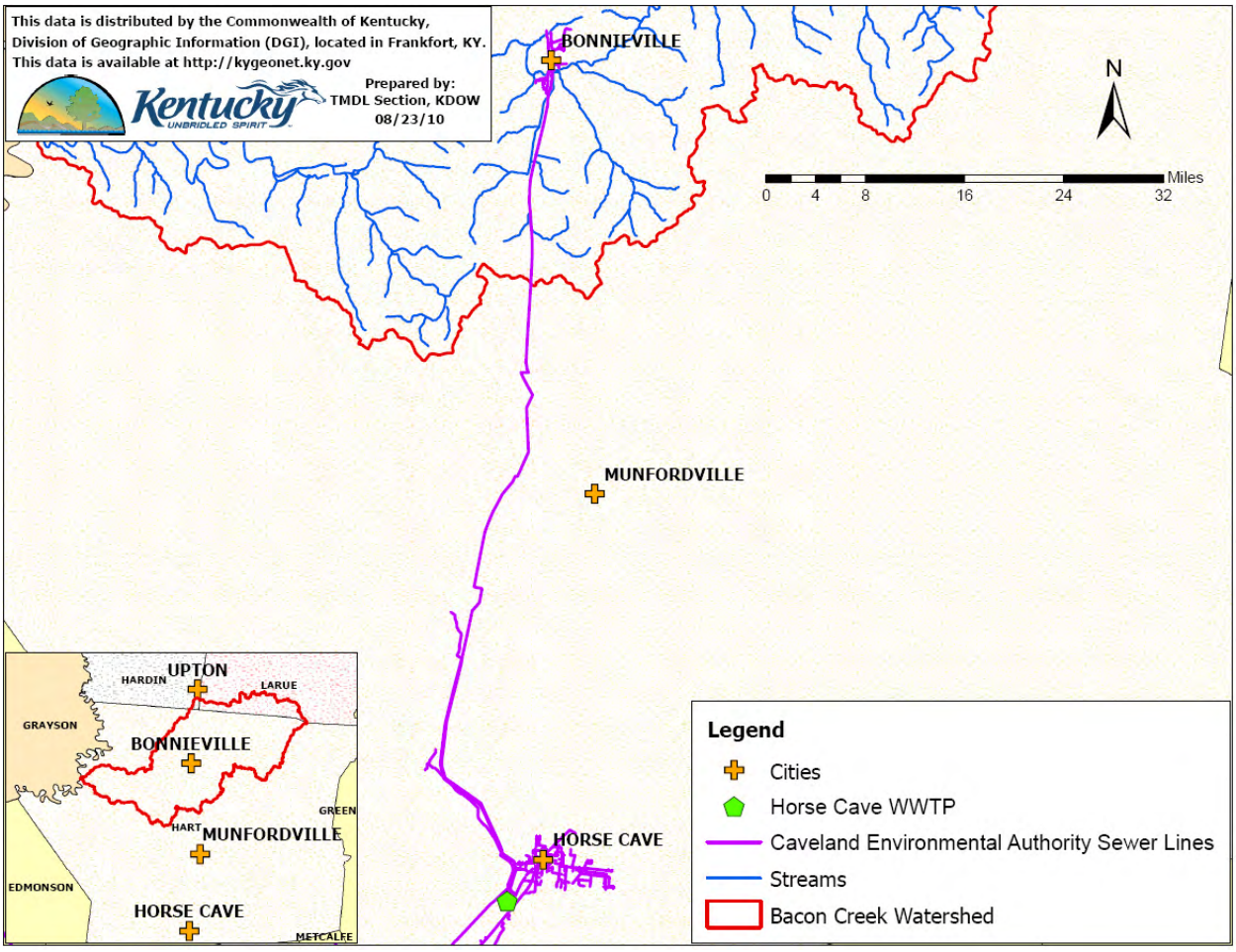

Figure 5.3 Sewer Lines between City of Bonnieville and Horse Cave WWTP

5.1.3 KPDES MS4 Storm Water

401 KAR 5:002 adopts the definition of MS4s contained in 40 C.F.R. 122.26 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):

i. *Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of the United States;*
ii. *Designed or used for collecting or conveying storm water;*
iii. *Which is not a combined sewer; and*
iv. *Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2."*

USEPA has categorized MS4 communities into three: small, medium, and large. The medium and large categories are regulated under the Phase I Storm Water program. Large systems, such as the cities of Lexington and Louisville, have populations in excess of 250,000. Medium systems have populations in excess of 100,000 but less than 250,000. However, there are currently no medium-sized systems in Kentucky. Phase I systems have five-year permitting cycles and have annual reporting requirements, including monitoring. The small MS4 category includes all MS4s not covered under Phase I. Since this category covers a large number of systems, only a select group are regulated under the Phase II rule, either being automatically included based on population (i.e., having a total population over 10,000 or a population per square mile in excess of 1000) or on a case-by-case basis due to the potential to cause adverse impact on surface water(s). Water quality monitoring is not a requirement of Phase II MS4s, unless the waterbody has an approved TMDL and the MS4 causes or contributes to the impairment for which the TMDL was written. In addition to cities and counties, other public entities can hold a MS4 permit; including the Kentucky Transportation Cabinet, which is responsible for stormwater runoff from interstates, parkways, U.S. highways, and state routes under their control within a MS4 area.

A small portion of Hardin County (KPDES permit # KYG200003), a Phase II MS4 area, exists within the Bacon Creek watershed (Figure 5.4). However, there are no surface streams leading from this MS4 area to Bacon Creek or its tributaries and groundwater in this area is directed out of the watershed, away from the surface streams (see Section 3.2). It was therefore concluded that no stormwater generated by the Hardin County MS4 area would actually reach Bacon Creek or its tributaries and that Hardin County MS4 does not cause or contribute to the PCR impairments in the Bacon Creek watershed. For this reason, the Hardin County MS4 is assigned a MS4 WLA of 0 colonies/100ml within the Bacon Creek watershed. There are no other MS4 stormwater permits in the watershed.

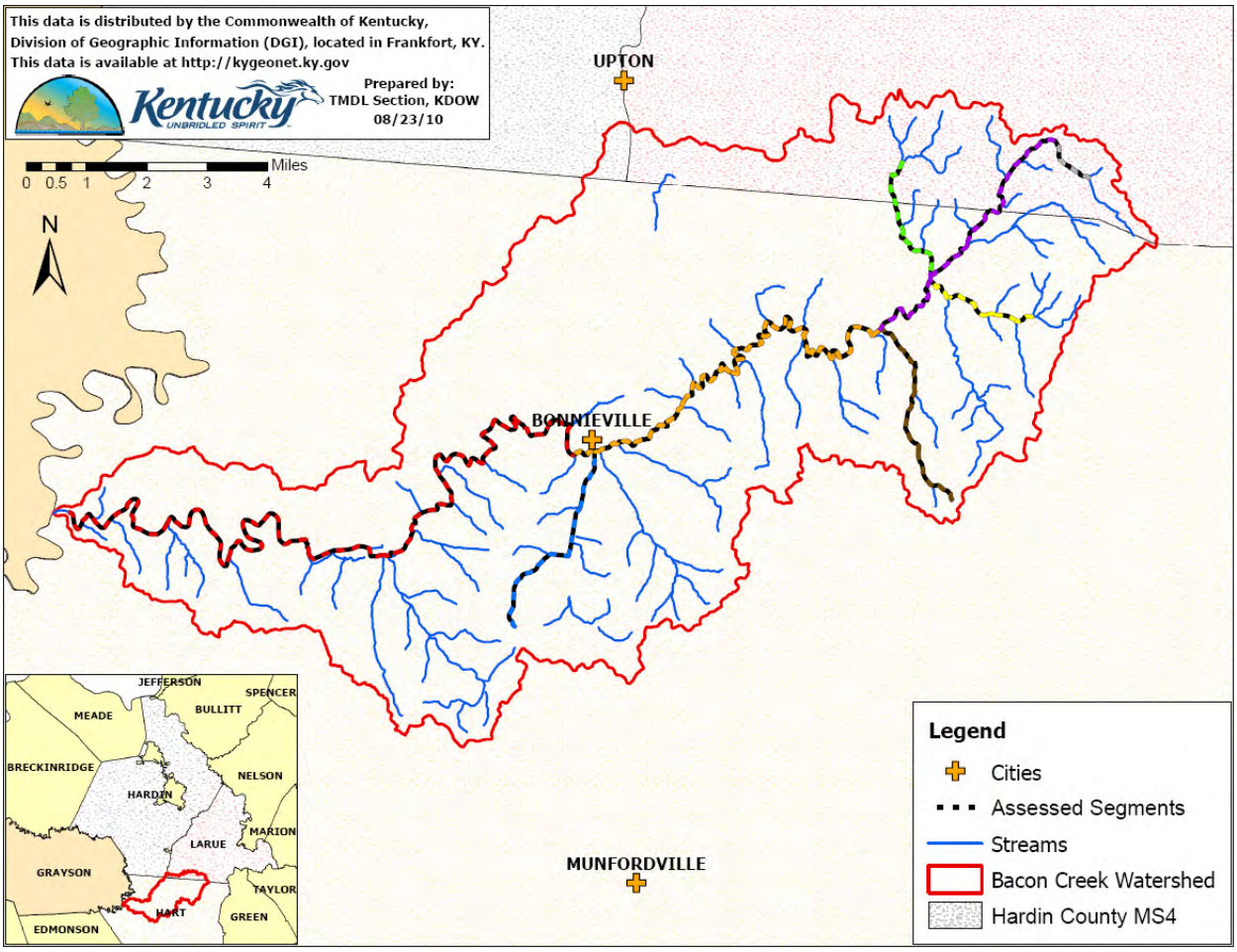

Figure 5.4 Hardin County Phase II MS4 Area

Note: Different assessed segments are shown by varying the color of the white hatch marks.

5.1.4 KPDES-Permitted Combined Sewer Overflows (CSO)s

Combined Sewer Overflows (CSOs) are discharges from combined sewers, (i.e., sewers that carry both sanitary and storm water flow in the same pipe). In accordance with USEPA's CSO Control Policy (USEPA, 1994), KDOW has signed Consent Decrees or Consent Judgments with all CSO communities in Kentucky. Within each Consent Decree, Judgment Communities are required to submit a Long Term Control Plan (LTCP) as the blueprint by which CSOs must be remediated (e.g., through separation of combined sewers, treatment of their discharge, and/or reduction in frequency, duration or volume, etc.) until they meet the water quality standard (WQS). KDOW then approves or disapproves the LTCP. Individual CSOs are given outfall numbers under the community's KPDES permit. There are no combined sewers in the Bacon Creek watershed; therefore, a waste load allocation to permitted CSOs does not apply.

5.1.5 Confined Animal Feeding Operations (CAFOs)

Operations that are defined as a CAFO pursuant to 401 KAR 5:002 are required to obtain a KPDES permit. 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 both types of permits include no discharge to surface waters. However, holders of a KPDES Individual Permit may discharge to surface waters during a 25-year (24-hour) or greater storm event. There are no known CAFOs in the Bacon Creek watershed.

5.1.6 Future Growth

The Future Growth WLA is a portion of the allowable load that is set aside for expansion of existing KPDES-permitted sources or new KPDES-permitted sources in the watershed. This could include new or expanded WWTPs, new package plants, or possibly new home units. This is not a required element in TMDLs, but is optional. Reserving a future growth WLA component in a TMDL allows growth to occur in the watershed without needing to re-open the TMDL to allocate wasteloads to these new or expanded sources. Any KPDES-permitted source of E. coli or fecal coliform not identified in this document will receive a TMDL load from the future growth WLA and must meet permit limits based on the WQS in 401 KAR 10:031.

5.2 Non-KPDES 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 10:001, nonpoint means "any source of pollutants not defined as a point source." While non-permitted sources are legal despite not having permits, their loads to surface water are still regulated by laws such as the Kentucky Agricultural Water Quality Act (1994), federal Clean Water Act (i.e., the TMDL process) and 401 KAR 5:037 (Groundwater Protection Plans), among others. Non-permitted sources typically discharge pollutants to surface water in response to precipitation events.

Non-permitted sources for E. coli (and fecal coliform) exist in the watershed, and fall into various categories including agriculture, impacts directly attributable to humans, household pets and natural background such as from wildlife. All sources not regulated by the KPDES program will be allocated a pollutant load under the Load Allocation (LA) portion of the TMDL.

5.2.1 Human Waste Disposal

Human waste disposal is of particular concern in rural areas. One way to determine locations of potential un-sewered residential areas is to examine the difference between the locations of drinking water lines and sewer lines (Figure 5.5). This figure demonstrates that the majority of the Bacon Creek watershed is not serviced by a sewer system. Either the un-sewered areas have OSTDS (i.e. septic tanks or other systems) or sewage is discharged via straight pipes.

The Kentucky Infrastructure Authority (KIA) compiled a report titled "Water Resource Development: A Strategic Plan for Wastewater Treatment" (KIA, 2000) with data from the Regional Area Development Districts (ADDs). This report indicates that the percent of

households serviced by sewers (as of 1999) was approximately 20-35% for Hart and Larue Counties. Non-permitted 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 OSTDS is comparable to secondarily treated wastewater from a SWS. When not functioning properly, they can be a source of E. coli (or fecal coliform) and other pollutants (e.g., nitrogen and phosphorus) to both groundwater and surface water. The soils information presented in Section 3.4 indicates that the soils in the Bacon Creek watershed are not ideal for installation of properly functioning septic systems.

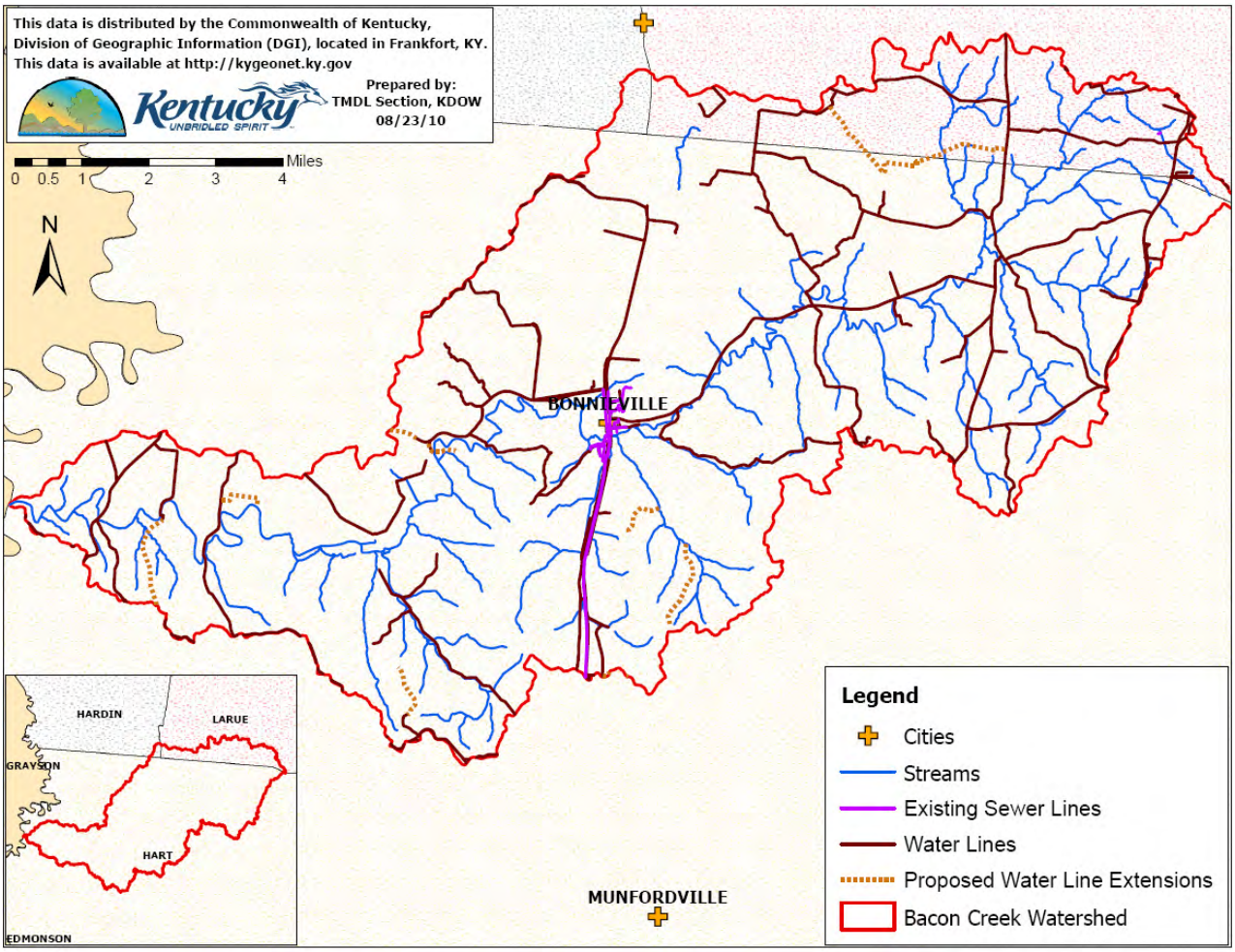

Figure 5.5 Sewer Lines and Existing and Proposed Water Lines in the Bacon Creek Watershed

5.2.2 Agriculture

The Kentucky Agriculture Water Quality Act (KRS [Kentucky Revised Statutes] 224.71-100 through 224.71-140) 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, 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 USDA compiles agricultural statistics at the county level and reports results every five years in Agricultural Census reports. Selected agricultural statistics reported in 2007 for the counties in the Bacon Creek watershed are shown in Table 5.2 (USDA, 2007).

Table 5.2 Agricultural Statistics (2007)

Statistic	County		
	Hardin	Hart	Larue
Farms [# farms (acres)]	1,588 (222,267)	1,455 (195,706)	811 (125,432)
Cattle and Calves Inventory [#farms (total # animals)]	835 (37,715)	870 (45,739)	469 (26,069)
Beef [#farms (total # animals)]	752 (20,355)	723 (21,994)	433 (13,782)
Milk Cows [#farms (total # animals)]	41 (1,635)	93 (3,149)	15 (823)
Hogs and Pigs [#farms (total # animals)]	20 (5,400)	38 (275)	9 (D)
Sheep and Lambs [#farms (total # animals)]	33 (1,643)	41 (1,005)	23 (696)
Layers 20 weeks old or older [#farms (total # animals)]	77 (2,024)	108 (13,724)	36 (1,478)
Broilers & other meat-type chickens sold [#farms (total # animals)]	5 (D)	4 (154)	2 (D)
Total Cropland [#farms (total acres)]	1,309 (121,817)	1,235 (82,651)	685 (71,976)
Corn for grain [#farms (total acres)]	163 (25,894)	88 (2,978)	85 (13,410)
Wheat for grain [#farms (total acres)]	31 (1,970)	3 (136)	18 (1,539)
Corn for silage [#farms (total acres)]	43 (1,503)	63 (1,650)	36 (1,359)

D = Withheld by USDA to avoid disclosing data for individual farms.

5.2.3 Kentucky No Discharge Operating Permit (KNDOP)

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 KNDOP from the 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 to 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 KDOW. Also included in KNDOP requirements are golf courses that land apply treated wastewater via spray irrigation, typically from a holding pond. Some industrial operations also spray-irrigate. There are three KNDOPs, all dairy farms, in the Bacon Creek watershed (Table 5.3 and Figure 5.6).

Table 5.3 KNDOPs in Bacon Creek Watershed

AI #	Facility Name	Latitude	Longitude	KNDOP #
9947	Walters Dairy Farm	37.400276	-85.839165	3025027
10176	Reed Smith Dairy Farm	37.446667	-85.801944	3025033
9952	Webb Dairy Farm	37.370000	-86.029442	3025025

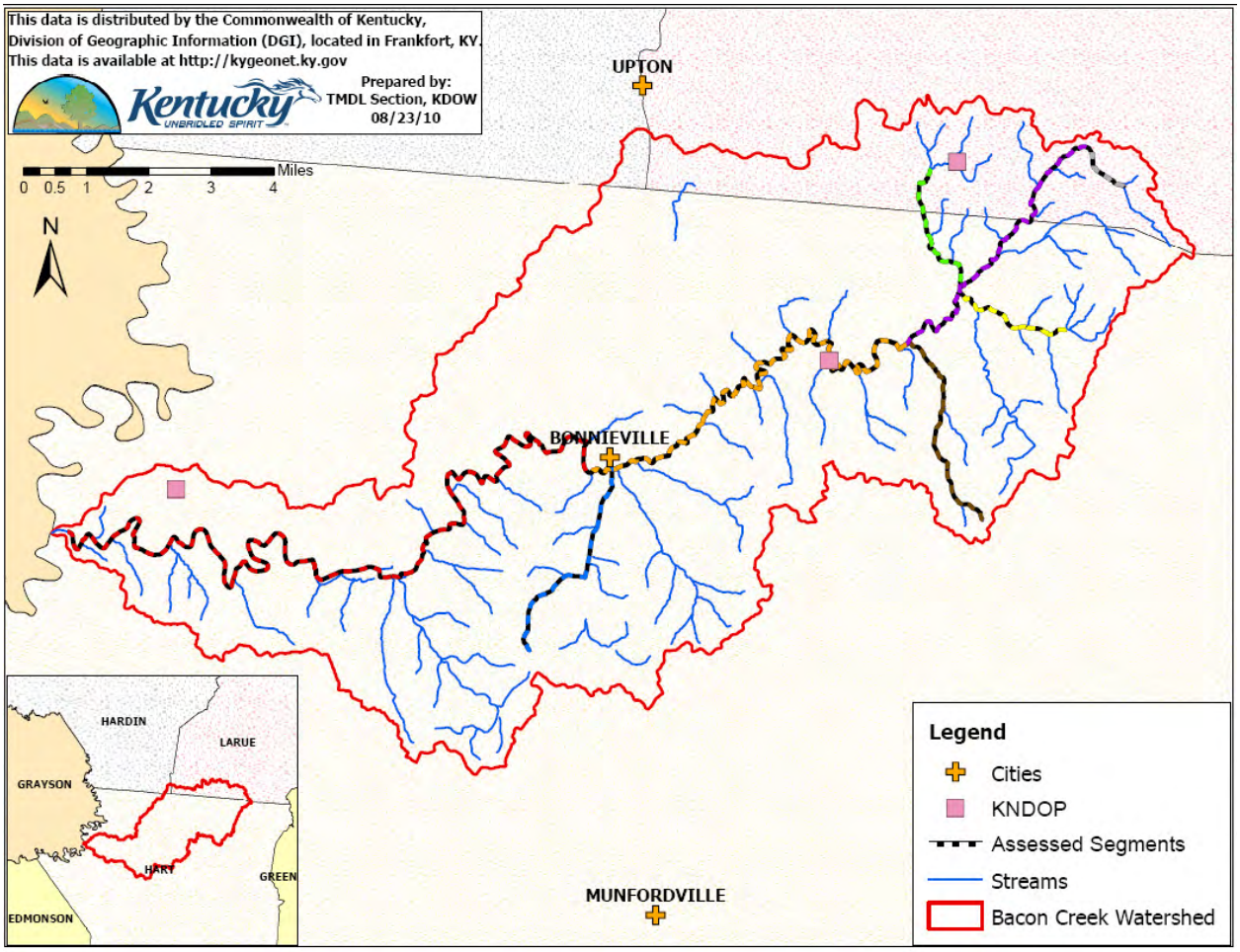

Figure 5.6 KNDOP Facilities in Bacon Creek Watershed

Note: Different assessed segments are shown by varying the color of the white hatch marks.

5.2.4 Wildlife

Wildlife undoubtedly contributes E. coli (or fecal coliform) to the Bacon Creek watershed, noting the high percentage of forest. Table 5.4 shows the estimates of deer population and density by county in the Bacon Creek watershed, as provided by the Kentucky Department of Fish and Wildlife Resources (Kentucky Department of Fish and Wildlife Resources, 2006). Estimates on numbers of other types of animals are not available; however, a wildlife management area exists at the mouth of Bacon Creek (Figure 5.7). Although wildlife contributes E. coli (or fecal coliform) to surface water, such contributions represent natural background conditions, and do not receive a reduction as part of the TMDL.

Table 5.4 Deer Density in Counties of Bacon Creek Watershed

County	Deer Per Square Mile	Total Number of Deer
Hardin	14	6478
Hart	14	4562
Larue	23	3,983

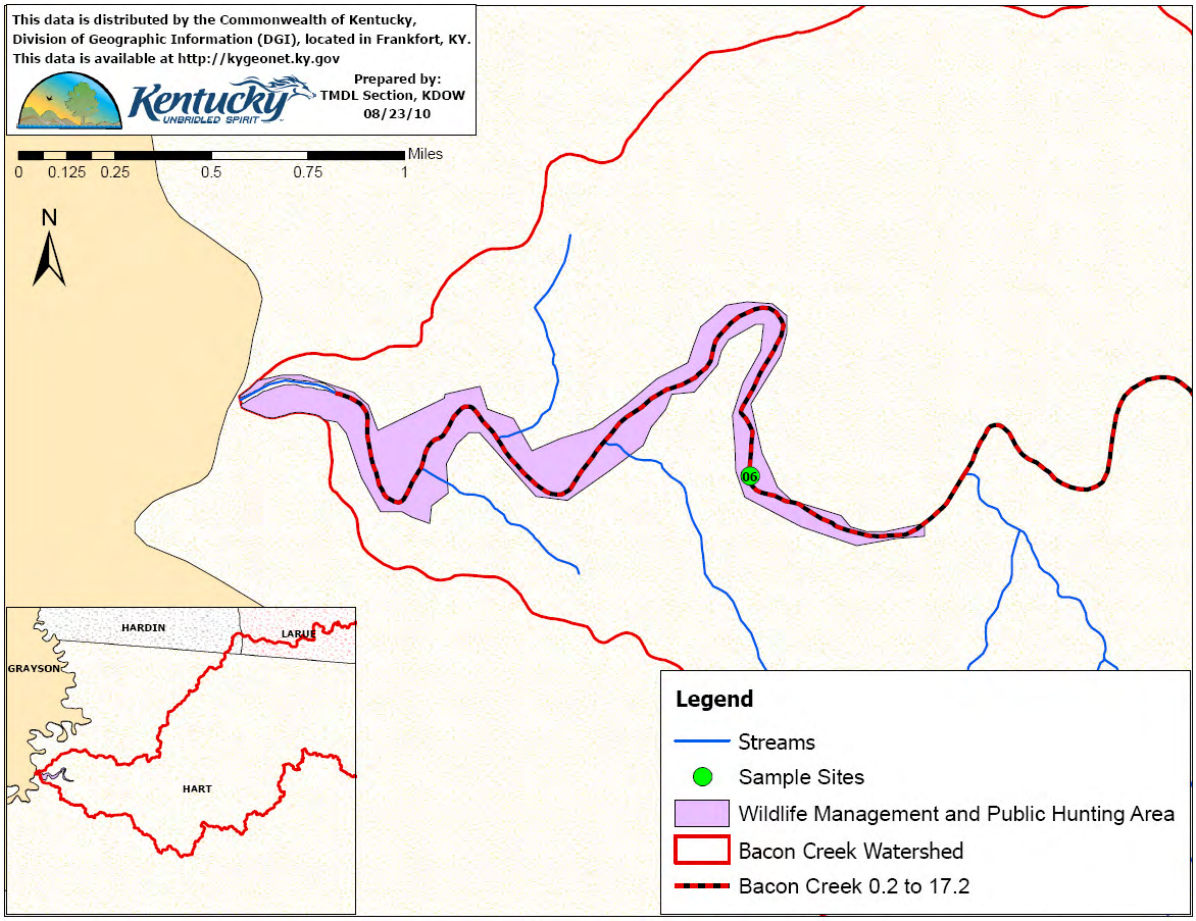

Figure 5.7 Wildlife Management Area in the Bacon Creek Watershed
Note: Different assessed segments are shown by varying the color of the white hatch marks.

5.2.5 Household Pets

Although household pets undoubtedly exist in this watershed, their contribution to the impairment is deemed to be minimal compared to other sources. However, pet waste may be a larger contributor to bacteria runoff in areas where there is a greater density of households and impermeable surfaces.

5.3 Illegal Sources

Both KPDES-permitted and non KPDES-permitted sources can discharge bacteria to surface water illegally. This includes sources that are illegal simply by their existence, such as straight-pipes and Sanitary Sewer Overflows which receive no allocation. There may also be legal sources that are operating illegally (e.g., outside of regulations, permit limits or conditions, etc.), such as a WWTP bypass or a failing OSTDS, which receive no allocation above that of a properly functioning system.

Another potential illegal source is livestock on farms that have no BMPs (as required under the Agriculture Water Quality Act 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, animal feeding operations (AFOs) and CAFOs not in compliance with the appropriate regulations that cause or contribute to a surface water impairment.

KDOW expects implementation of these TMDLs 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.

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 or that could be present in the watersheds (e.g., failing septic systems).

6.0 Water Quality Criterion

The WQC in 401 KAR 10:031 for the PCR use are based on both fecal coliform bacteria and E. coli bacteria. For this TMDL, the E. coli criterion was applied. Per 401 KAR 10:031:

"The following criteria shall apply to waters designated as primary contact recreation use during the primary contact recreation season of May 1 through October 31:

> *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."*

There are insufficient E. coli measurements to calculate a 5-sample, 30-day geometric mean, so the instantaneous E. coli criteria of 240 colonies per 100 ml was applied to calculate allowable loadings to bring the watershed into compliance with the PCR designated use. Because Kentucky has a dual standard for the PCR designated use, development of TMDLs using the E. coli criteria is sufficient to provide TMDLs for fecal coliform listed segments and visa versa (i.e., development of E. coli TMDLs will protect the PCR use regardless of whether a segment is impaired for E. coli, fecal coliform, or both indicators). For fecal coliform impaired segments in the Bacon Creek watershed, TMDLs are expressed as an E. coli load.

7.0 Total Maximum Daily Load

7.1 TMDL Equations and Definitions

A TMDL calculation is performed as follows:

TMDL = WLA + LA + MOS

For this document, the WLA has three components:

WLA = SWS WLA + MS4 WLA + Future Growth WLA

Definitions:

TMDL = the WQC, expressed as a load. The WQC was defined in Section 6.0 as an instantaneous concentration of 240 colonies/100 ml.
MOS = the Margin of Safety, which can be an implicit or explicit additional reduction applied to sources of pollutants that accounts for uncertainties in the relationship between effluent limits and water quality.
TMDL Target = the TMDL minus the MOS.
WLA = the Wasteload Allocation, which is the allowable loading of pollutants into the stream from KPDES-permitted sources such as wastewater treatment plants and MS4s. In order to differentiate between the two types of KPDES-permitted sources, allocations of the WLA are referred to as the **SWS WLA** and the **MS4 WLA**.
Remainder = the TMDL Target minus the MOS and minus the SWS WLA.
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).
MS4 WLA= The allowable loading for MS4 permitted entities.
LA = the Load Allocation, which is the allowable loading of pollutants into the stream from sources not permitted by KPDES and from natural background.
Seasonality= Yearly factors that affect the relationship between pollutant inputs and the ability of the stream to meet its designated uses.
Critical Condition= When the pollutant condition is expected to be at its worst.
MAF = The Mean Annual Flow as defined by USGS.
Adjusted MAF = The MAF plus SWS design flows.
Critical Flow = the flow used to calculate the TMDL as a load (equals the Adjusted MAF for MAF TMDLs).
Existing Condition = the load that exists in the watershed at the time of TMDL development (i.e., sampling) and is causing the impairment.
Percent Reduction = the reduction needed to bring the existing condition in line with the TMDL Target.
Load = Concentration * Flow * Conversion Factor in billions of colonies per day
Concentration = colonies per 100 milliliters (colonies/100ml)
Flow (i.e. stream discharge) = cubic feet per second (cfs)
Conversion Factor = (28.247L/cf * 86400sec/day * 1000ml/L)/ (100ml *1 billion colonies)
= 0.0244657584

Calculation Procedure:

1) The explicit MOS is calculated and subtracted from the TMDL first, giving the TMDL Target;
2) Percent reductions are calculated to show the difference between Existing Conditions and the TMDL Target;
3) The SWS WLA is calculated and subtracted from the TMDL Target, leaving the Remainder;
4) The Future Growth WLA is calculated and subtracted from the Remainder;
5) The MS4-WLA (if any) is subtracted from the Remainder based on percent landcover, leaving the LA.

7.2 TMDL

Because colonies of E. coli are expressed as a concentration, a method must be used to convert the allowable concentration to an allowable load. Loads are divided from this load to the MOS, WLA, and LA. TMDLs were calculated for each segment using the criteria of 240 E. coli as:

240 (colonies/100ml)	×	Adjusted MAF (cfs)	×	Conversion Factor .0244657584	=	TMDL (billion colonies/day)

7.3 Margin of Safety

There are two methods for incorporating a MOS in the TMDL analysis: implicitly include the MOS using conservative assumptions, or explicitly set aside a (numerical) portion of the TMDL as the MOS. For this TMDL, a 10% explicit MOS (24 E. coli colonies/100 ml) was set. Additionally, an implicit MOS was incorporated by setting flows for SWS sources at their design capacity. The explicit MOS load for each segment was calculated as:

24 (colonies/100ml)	×	Adjusted MAF (cfs)	×	Conversion Factor .0244657584	=	MOS (billion colonies/day)

7.4 TMDL Target

The TMDL Target is defined as the load at the WQC minus the explicit MOS load. It is calculated for each segment by subtracting the explicit MOS from the Total TMDL (Target Load = Total TMDL– MOS). It can also be calculated as:

216 (colonies/100ml)	×	Adjusted MAF (cfs)	×	Conversion Factor .0244657584	=	TMDL Target (billion colonies/day)

7.5 WLA

The WLA is the portion of the TMDL allocated to KPDES-permitted sources within the watershed(s).

7.5.1 SWS WLAs

The SWS WLA is the allocation given to KPDES-permitted point sources (except MS4 stormwater sources) within the TMDL. The SWS WLAs were calculated based on the permitted concentration limits expressed in terms of E. coli limits and facility design flow (in units of cfs) using the following equation:

240	×	Design Flow	×	Conversion Factor	=	SWS WLA
(colonies/100ml)		(cfs)		.0244657584		(billion colonies/day)

The design flow in MGD was multiplied by 1.54723 to convert days to seconds and million gallons to cubic feet to yield design flow in cfs.

7.5.2 Remainder

The Remainder is not part of the TMDL; however, it is used in the TMDL calculations. It is determined as the TMDL Target minus the sum of all SWS WLAs.

7.5.3 Future Growth WLA

Because the WLA must account for all KPDES-permitted sources, TMDLs will often account for future growth of these sources (i.e., an increase in the number of KPDES-permitted sources or in the loading per discharger) in order to avoid having to re-open the TMDL and change the WLA when new or expanding sources come online. Future growth is represented by a portion of the TMDL Target which is set aside (i.e., is neither part of the LA nor part of the WLA for current/known sources). It can also account for existing storm water sources that are later discovered to discharge the pollutant of concern, even though this fact was not known at the time the TMDL was written. Of course, any and all of the sources mentioned above must meet the WQC and KDOWs permitting requirements. The amount set aside for future growth is determined by the following formula, which assumes that growth occurs more rapidly in developed areas than in rural areas:

Future Growth WLA = Remainder x Future Growth WLA %,

where the Future Growth WLA % is determined according to Table 7.1 and the Percent Developed Land Cover Classes (developed open space, developed low intensity, developed medium intensity, and developed high intensity) is determined as:

Percent Developed Land Cover Classes = (sum developed land cover classes in acres within watershed) / (total acres within watershed) x 100.

Table 7.1 Future Growth WLA Formula

Percent Developed Land Cover Classes	Future Growth WLA %
≥25%	5
≥20% – <25%	4
≥15% – <20%	3
≥10% – <15%	2
≥5% – <10%	1
<5%	0.5

7.5.4 Hardin County MS4 WLA

The MS4 WLA was determined as:

MS4 WLA = Remainder x Percent Developed,

where Percent Developed is the percent of developed land cover classes (sum of developed open space, developed low intensity, developed medium intensity, and developed high intensity) within the MS4 boundary. This was determined as:

Percent Developed= (sum of developed land cover classes within the MS4 in acres) / (total acres within MS4 boundary).

As stated in Section 5.1.3, because there is no surface or groundwater connection between the Hardin County MS4 area and Bacon Creek or its tributaries, it was concluded that no stormwater generated by the Hardin County MS4 area would actually reach Bacon Creek or its tributaries. For this reason, the Hardin County MS4 does not cause or contribute to the PCR impairments in the Bacon Creek watershed and is assigned a MS4 WLA of 0 colonies/100 ml within the watershed.

7.6 LA

The LA is where non-KPDES-permitted sources (e.g., nonpoint sources, or those sources not permitted by KPDES) receive their allocation within the TMDL. Load Allocations are calculated for each segment as follows:

LA= Remainder - Future Growth WLA - MS4 WLA.

The available sampling data were insufficient to apportion the existing loading among the various LA sources; therefore, it is lumped to all LA sources.

7.7 Seasonality

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. In Kentucky regulations, the PCR use is defined to apply to the period beginning May 1 and ending October 31. For this TMDL, seasonality is considered because samples were collected to provide data over the entire PCR season.

7.8 Critical Condition

The critical condition for nonpoint source E. coli and fecal coliform loadings is typically an extended dry period followed by a rainfall runoff event. During dry weather, pathogen indicators build up on the land surface and are washed off by subsequent rainfall. Conversely, the critical condition for point source loading typically occurs during periods of low stream flow when dilution is minimized. Sampling was performed during both types of conditions (during or following rain events and during extended dry periods). The Bacon Creek watershed contains both types of sources; therefore, the critical condition for each impaired segment is defined by the sample showing the greatest concentration.

7.9 Existing Conditions

Although not a part of the TMDL equation, existing loads were determined using the monitoring data collected. Existing loads provide a basis by which to determine the percent reduction that would have been required to meet the TMDL limits at the time of sample collection. For sample sites located on each segment, the sample with the greatest concentration of E. coli was used as the existing concentration for that segment. This provides a worst-case scenario for percent reduction calculations (i.e., the percent reduction is the greatest required to bring existing loads to the TMDL loading requirements). Existing loads were calculated as:

Greatest Concentration (colonies/100ml)	×	Adjusted MAF (cfs)	×	Conversion Factor .0244657584	=	Existing Load (billion colonies/day)

where the conversion factor converts cfs to ml/day and colonies to billion colonies.

7.10 Percent Reduction

A percent reduction is not part of the TMDL calculation, however, for informational purposes, a percent reduction was calculated for each segment to show the percent reduction that would have been required at the time the samples were taken in order to meet the TMDL Target. The percent reduction was calculated as:

Percent Reduction (%) = [(Existing Load – TMDL Target) / Existing Load] * 100

While providing additional information, the percent reduction calculation is not equivalent to the TMDL. The TMDL is the load that the waterbody can assimilate while still meeting its PCR use. The percent reduction is a determination of how much the measured concentration exceeded the TMDL Target at the time the samples were taken. It does not determine the percent reduction needed at any other time, as the in-stream concentrations are likely to be different. Unlike the calculated percent reductions, the TMDL is a constant based upon the WQC whereas the percent reduction changes based on in-stream concentrations.

Regardless of the procedure used to estimate percent reductions for each segment, reductions from existing conditions ultimately must be effected within a given watershed only until all

stream segments meet the PCR use, or until all sources save wildlife are discharging in compliance with the WQC. However, once the WQC is met, all sources (save wildlife) must continue to discharge at a concentration that meets the WQC.

7.11 TMDLs Calculated as a Daily Load

Federal guidelines of the Clean Water Act require a TMDL to be expressed in terms of a daily load. Due to the limited amount of data available, particularly the absence of stream gages active during the sampling events, a method was developed utilizing the WQC and MAF as outlined in the *Pathogen TMDL [Standard Operating Procedure] SOP* (KDOW, 2009) to convert bacteria concentrations to loads. The USGS has generated MAF values for streams across Kentucky using the equation found in the USGS Water-Resources Investigations Report 02-4206 "Estimating Mean Annual Streamflow of Rural Streams in Kentucky" (http://ky.water.usgs.gov/pubs/wrir_2002_4206.pdf). The MAF values can be found on the Hydrology of Kentucky webpage (http://kygeonet.ky.gov/kyhydro/main.htm). The MAF was determined at the downstream end of each impaired segment. Once obtained, SWS dischargers (of pathogen indicators) in the watershed above the downstream-most point of a segment were added to the MAFs to generate an Adjusted MAF), which is also the critical flow.

7.12 Translation of Fecal coliform Concentrations into E. coli Concentrations

The validated data set included fourteen pairs of fecal coliform and E. coli data collected at the same time (Table 7.2). Regression analysis was performed and the best-fit trendline for the data was determined (Figure 7.1). The resulting equation was then used to translate all fecal coliform concentrations into E. coli concentrations so that all TMDLs could be expressed in terms of E. coli loads. The data sets in Section 8 and Appendix D include the translated E. coli data.

Table 7.2 Paired Fecal Coliform and E. coli Data

Fecal Coliform (colonies/100 ml)	E. coli (colonies/100ml)
3727	3090
909	840
273	100
4091	4140
2000	2430
3545	2950
2182	2310
5545	4640
818	610
909	980
84	100
91	300
909	2280
2727	970

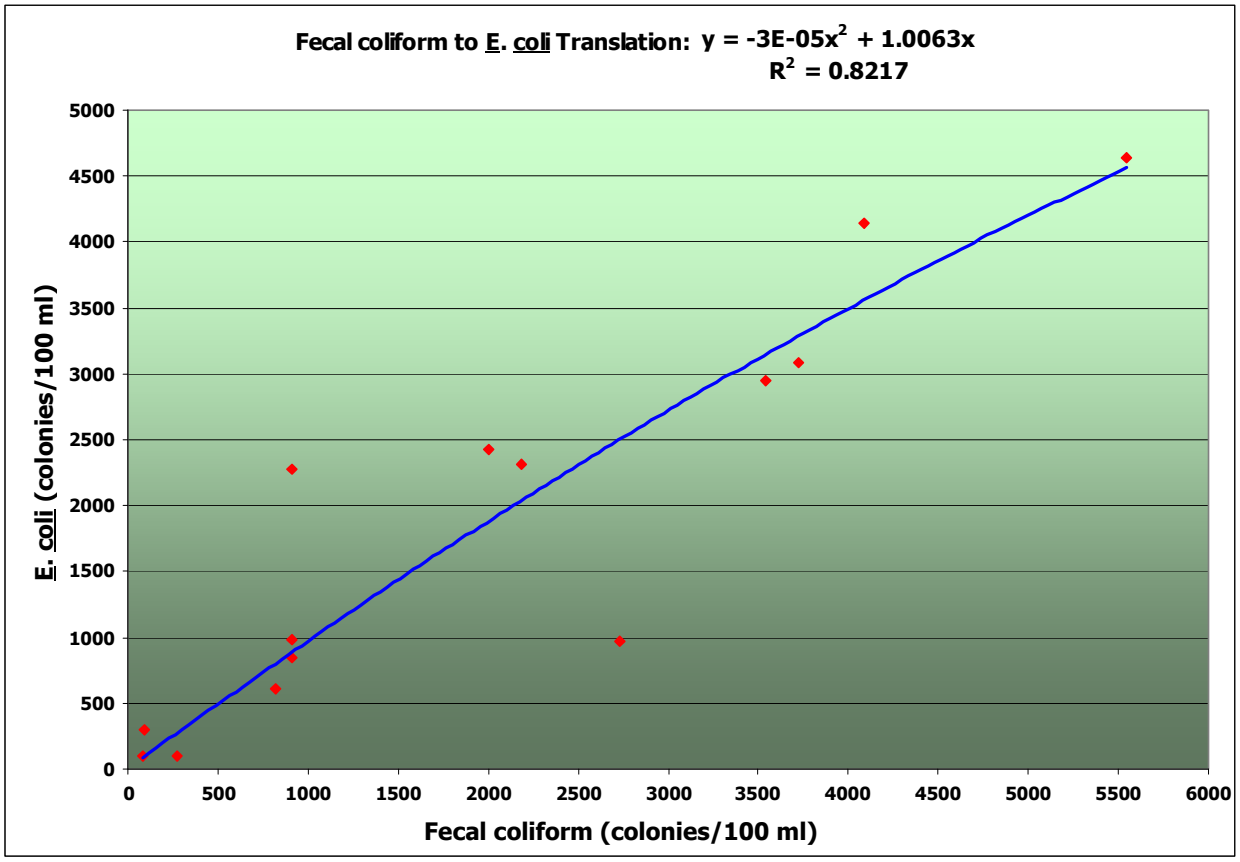

Figure 7.1 Best-Fit Trendline for Translation of Fecal Coliform into E. coli

7.13 Additional Calculations

In addition to segment TMDLs, TMDLs were also calculated for each site. The methodology in Section 7.2 – 7.12 was followed except MAF is determined at the sample site as opposed to the downstream-most point of a segment and the greatest concentration is determined from that sample site.

In addition, calculations of instantaneous loads and unit area loads were performed on the sample data if flow was available. This provides information about actual loadings observed in the watershed at the time of sampling. Instantaneous loads were calculated on each sample result (if flow was also measured) as follows:

Observed E. coli Concentration (colonies/100ml)	×	Observed Flow (cfs)	×	Conversion Factor .0244657584	=	Instantaneous Load (billion colonies/day)

These instantaneous loads were then converted to unit area loads in million colonies/day/acre by dividing by the watershed area (in acres) and multiplying by 1000 to convert from billion colonies/day to million colonies/day. This provides information about how much load is coming from each acre of land in the subwatershed above the sample site. This varies as the bacteria concentrations change across sample dates. By comparing unit area loads across sites on one sample date, subwatersheds that contribute greater loadings of bacteria can be identified. Site specific TMDLs and Unit Area Loadings are presented in Appendix D.

8.0 TMDL Calculations

8.1 Data Validation

Data collected for this TMDL was validated as follows:

- Samples collected outside the PCR months of May through October were eliminated from the data sets.
- A 0.5 Log relative difference between a sample and its duplicate was used to validate the bacteria sample data. All paired bacteria samples and duplicates passed this validation.
- Other than the above validation, Quality Assurance/Quality Control Samples (e.g., duplicates) were not considered during TMDL analysis.
- If a field blank had bacteria detected (other than with a less than value), all samples collected on that same date were removed from the data set.
- Some samples were reported using either the *less than* (denoted using the "<") symbol or the *greater than* (denoted using the ">") symbol, indicating the true concentration was unknown but was either below or above the reported value, respectively. For these samples, the reported value was used verbatim. For *greater than* values, the exact value of the exceedance is unknown and likely higher than the number reported, however the sample still provides insight into the status of the waterbody at the time the sample was taken.
- Samples collected from a stream that had no flow were removed from the data sets.
- Samples collected in backwater areas were removed from the data sets.
- Estimated discharge data was eliminated from consideration in the analysis.

See Appendix B for the full dataset.

8.2 Individual Stream Segment Analysis

Data collection and analysis from various sources (including Federal, State and local government and public entities) was carried out for each individually listed stream segment and its associated drainage area. Most of the data collected for the development of this document can be accessed and downloaded from the KYGEONET (http://kygeonet.ky.gov/kyhydro/main.htm). In this section, descriptions of each impaired subwatershed are presented along with tables of land cover, general subwatershed information, sample data, and TMDL allocations. For all sample data tables, a red highlight indicates an exceedance of the instantaneous WQS (240 E. coli or 400 fecal coliform colonies/100 ml. The land cover table for each segment includes the percentage used to calculate the Future Growth WLA. The Waterbody Identification Number (WBID) is included in the table of general information about the impaired segment. This number is a unique identifier assigned to all assessed waters in KY.

The TMDL tables include KPDES-permitted source information and TMDL allocations and can be interpreted as follows:

> The columns with the blue highlight indicate the TMDL allocations. The rows with green highlight indicate KPDES permit information and the design capacity (in cfs) that

feeds into the WLA calculation for each KPDES-permitted source. The WLA (in blue) for a particular KPDES-permitted source is on the same row as the information for the KPDES-permitted source (in green). The purple highlight indicates the sum of KPDES flow inputs that were added to the MAF.

Only the TMDL table for impaired segments is shown in this Section. However, for informational purposes, a TMDL table for each site on an impaired segment is shown in Appendix D.

8.2.1 TMDL Summary for Bacon Creek RM 0.2 to 17.2

Bacon Creek at RM 0.2 is a fourth order stream located in Hart County (Figure 8.1). Information about Bacon Creek from RM 0.2 to 17.2, including WBID, and MAF is shown in Table 8.1. The WBID number for all sites is a unique identifier issued by the Division of Water for all assessed segments. It is based upon the USGS Geographic Names Information System (GNIS) (USGS, 1999) with a KY in front of the GNIS number and a _## where ## is a segment identification number. To save space, the KY has been left off the beginning of the WBID #. Site information is presented in Table 8.2. Bacon Creek at RM 0.2 has a catchment of 57,902 acres (90.5 square miles) with a 60 % forested, 30.9 % agricultural (cultivated crops plus pasture/hay), and 4.5 % developed land cover (Table 8.3).

This subwatershed is sewered in the area around and south of Bonnieville (see Figure 5.3). It has one SWS in the headwaters for which MAF was adjusted. Sampling data from sites 06, 07, 09, and 12 is presented in Table 8.4, and the TMDL allocations in Table 8.5.

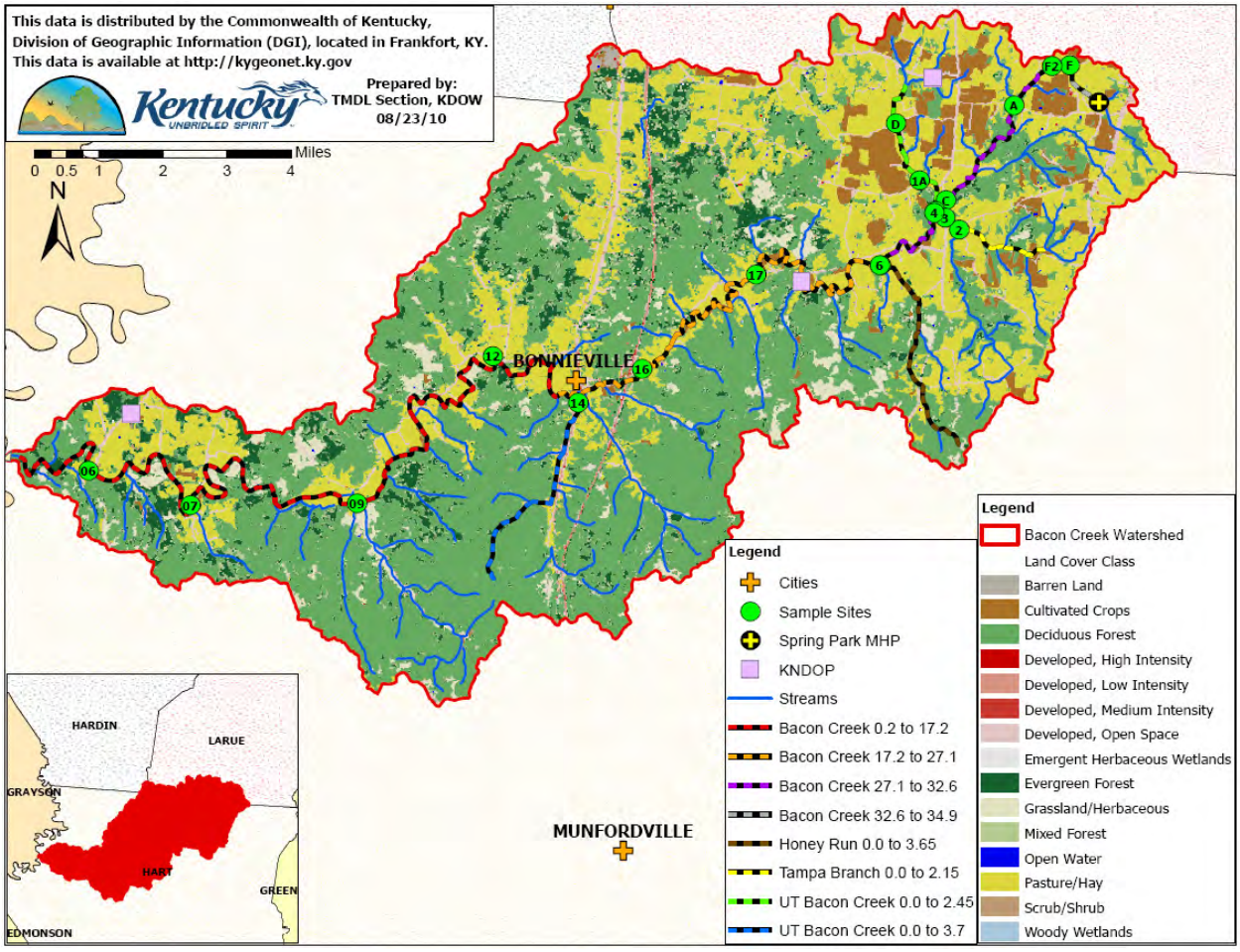

Figure 8.1 Bacon Creek Watershed above RM 0.2

Note: Site 1 is under site 4 while site 5 is under site 6.

Table 8.1 Bacon Creek RM 0.2 to 17.2 Segment Information

Stream	Stream Segment	WBID #	County	Acres	Square Miles	Stream Order
Bacon Creek	Bacon Creek 0.2 to 17.2	486197_01	Hart	57,901.96	90.47	4th
RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Adjusted MAF (cfs)			
0.2	113.8	0.0077	113.8077			

Table 8.2 Bacon Creek RM 0.2 to 17.2 Site Information

Site Number	Map Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude
DOW03025006	06	2.55	37.35691	-86.04155
DOW03025007	07	5.35	37.34916	-86.01263
DOW03025009	09	10.1	37.34968	-85.96532
DOW03025012	12	15.5	37.38318	-85.92691

Table 8.3 Bacon Creek RM 0.2 to 17.2 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	63.384	0.099	0.11	
Developed	2579.17	4.030	4.45	0.5
Barren Land	82.73	0.129	0.14	
Forest/Shrubland	34880.04	54.500	60.24	
Grassland/Herbaceous	2333.861	3.647	4.03	
Pasture/Hay	15156.76	23.682	26.18	
Cultivated Crops	2755.75	4.306	4.76	
Wetlands	50.26	0.079	0.09	
Totals	57901.96	90.47	100.00	

Table 8.4 Bacon Creek RM 0.2 to 17.2 Data (Sites 06, 07, 09, and 12)

site 06			site 09	
Collection Date	E. coli (colonies/100 ml)		Collection Date	E. coli (colonies/100 ml)
05/17/07	101		05/17/07	86
05/22/07	101		05/22/07	84
06/13/07	156		06/13/07	236
06/26/07	1095		06/26/07	211
07/11/07	888		07/11/07	305
07/20/07	650		07/20/07	309
08/09/07	359		08/09/07	213
08/23/07	85		08/23/07	279
09/06/07	121		09/06/07	175
09/26/07	211		09/26/07	201
10/23/07	>24196		10/23/07	17329
10/30/07	336		10/30/07	546
site 07			site 12	
Collection Date	E. coli (colonies/100 ml)		Collection Date	E. coli (colonies/100 ml)
05/22/07	131		05/17/07	150
06/13/07	88		05/22/07	186
06/26/07	197		06/13/07	222
07/11/07	602		06/26/07	523
07/20/07	683		07/11/07	313
08/09/07	187		07/20/07	860
08/23/07	86		08/09/07	241
09/06/07	156		08/23/07	63
09/26/07	201		09/06/07	295
10/23/07	5794		09/26/07	767
10/30/08	389		10/23/07	9804
			10/30/07	399
Greatest Concentration (E. coli colonies/100 ml)	24196			

Table 8.5 TMDL Calculations for Bacon Creek RM 0.2-17.2

TMDL Table					E. coli (billion colonies/day)	
					67371.1627	Existing Load
					668.2542	**Total TMDL**
					66.8254	**MOS**
					601.4288	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	99.11	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077362	601.3834	remainder
					3.0069	**Future Growth WLA**[(1)]
75043	KYG200003	Hardin County Fiscal Court	Government-County Agency/ Organization	N/A[(2)] stormwater	**0.0000**	**MS4 WLA**
					598.3765	**LA**

Notes: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[(2)]N/A indicates that the permit is for stormwater and a design capacity does not apply.

8.2.2 TMDL Summary for Bacon Creek RM 17.2 to 27.1

Bacon Creek at RM 17.2 is a fourth order stream located in Hart County (Figure 8.2). Information about Bacon Creek from RM 17.2 to 27.1, including its WBID and MAF is shown in Table 8.6. Site information is presented in Table 8.7. Bacon Creek at RM 17.2 has a catchment of 34,887 acres (54.5 square miles) with a 54 % forested, 37.9 % agricultural, and 5.1 % developed land cover (Table 8.8).

This subwatershed is sewered in the area around and south of Bonnieville (see Figure 5.3). It has one SWS in the headwaters for which MAF was adjusted. Sampling data from sites 16, 17, and 6 is presented in Table 8.9, and the TMDL allocations in Table 8.10.

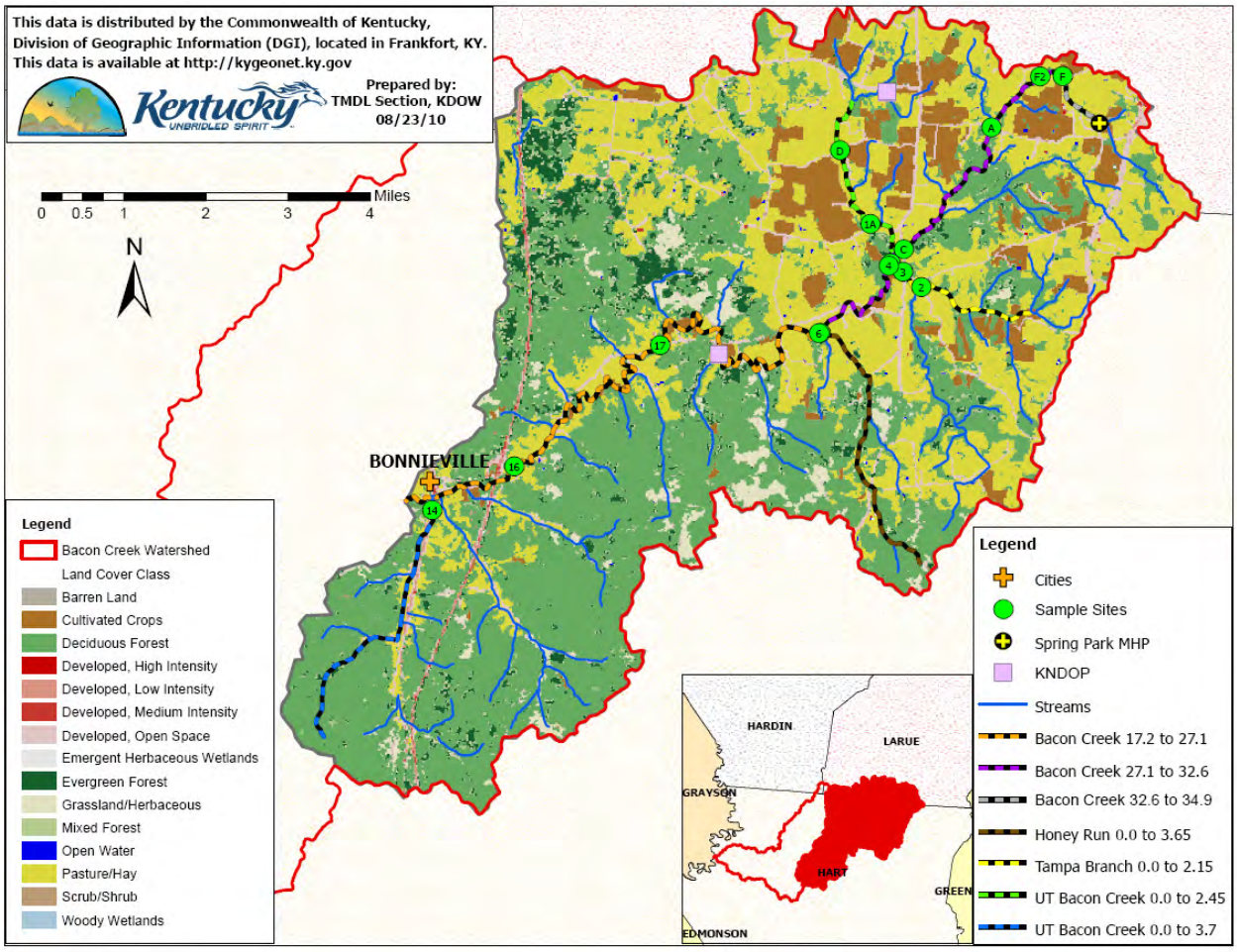

Figure 8.2 Bacon Creek Watershed above RM 17.2

Note: Site 1 is under site 4 while site 5 is under site 6.

Table 8.6 Bacon Creek RM 17.2 to 27.1 Segment Information

Stream	Stream Segment	WBID #	County	Acres	Square Miles	Stream Order
Bacon Creek	Bacon Creek 17.2 to 27.1	486197_02	Hart	34,886.52	54.51	4th
RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Adjusted MAF (cfs)			
17.2	63.4	0.007736	63.4077			

Table 8.7 Bacon Creek RM 17.2 to 27.1 Site Information

Site Number	Map Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude
DOW03025016	16	19.05	37.38037	-85.88449
DOW03025017	17	22.5	37.40182	-85.85226
6	6	27.1	37.403991	-85.817089

Table 8.8 Bacon Creek RM 17.2 to 27.1 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	49.04	0.08	0.14	
Developed	1776.48	2.78	5.09	1.0
Barren Land	7.356	0.01	0.02	
Forest/Shrubland	18715.38	29.24	53.65	
Grassland/Herbaceous	1097.90	1.72	3.15	
Pasture/Hay	10572.85	16.52	30.31	
Cultivated Crops	2652.35	4.14	7.60	
Wetlands	15.16	0.02	0.04	
Totals	34886.52	54.51	100.00	

Table 8.9 Bacon Creek RM 17.2 to 27.1 Data (Sites 16 and 17)

site 16			site 6		
Collection Date	E. coli (colonies/ 100 ml)		Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)
			05/24/05	600	604*
05/22/07	96		06/14/05	1,182	1189*
06/13/07	130		07/12/05	750	755*
06/26/07	358		08/09/05	738	743*
07/11/07	350		09/13/05	246	248*
07/20/07	301		10/11/05	1,246	1254*
08/09/07	74		05/10/06	600	604*
08/23/07	63		06/13/06	4500	4528*
09/06/07	41		08/08/06	131	132*
09/26/07	175		09/14/06	13000	13082*
10/23/07	24196		10/12/06	230	231*
10/30/07	369		5/8/2007	787	792*
			6/27/2007	311	313*
site 17			7/10/2007	1040	1047*
Collection Date	E. coli (colonies/ 100 ml)		8/16/2007	600	604*
05/17/07	249		10/12/2007	250	252*
05/22/07	120		6/28/2010		350
06/13/07	160				
06/26/07	321				
07/11/07	556				
07/20/07	408				
08/09/07	331				
08/23/07	171				
09/06/07	122				
09/26/07	657				
10/23/07	>24196				
10/30/07	521				
Greatest Concentration (E. coli colonies/ 100 ml)	24196				

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table 8.10 TMDL Calculations for Bacon Creek RM 17.2 to 27.1

TMDL Table					E. coli (billion colonies/day)	
					37535.6988	Existing Load
					372.3164	**Total TMDL**
					37.2316	**MOS**
					335.0848	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	99.1073	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077362	335.0393	remainder
					3.3504	**Future Growth WLA**[(1)]
					331.6889	**LA**

Note: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.

8.2.3 TMDL Summary for Bacon Creek RM 27.1 to 32.6

Bacon Creek at RM 27.1 is a fourth order stream located in Hart and Larue Counties (Figure 8.3). Information about Bacon Creek from RM 27.1 to 32.6, including its WBID and MAF is shown in Table 8.11. Site information is presented in Table 8.12. Bacon Creek at RM 27.1 has a catchment of 12,113 acres (18.9 square miles) with a 26.7 % forested, 66.2 % agricultural, and 6.6 % developed land cover (Table 8.13).

This subwatershed is un-sewered. It has one SWS in the headwaters for which MAF was adjusted. Sampling data from sites 1, 4, A, C, and F2 is presented in Table 8.14, and the TMDL allocations in Table 8.15.

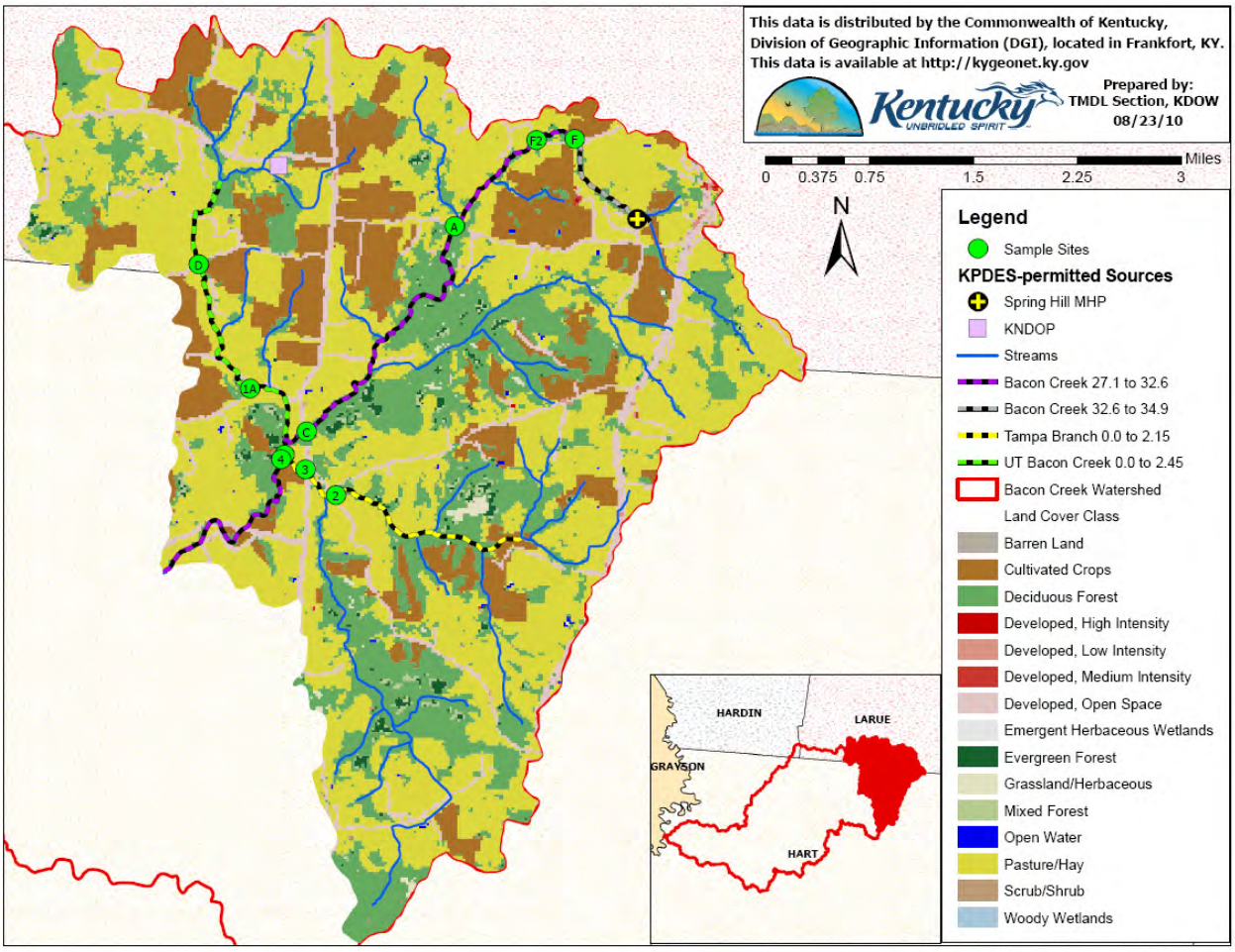

Figure 8.3 Bacon Creek Watershed above RM 27.1

Note: Site 1 is under site 4.

Table 8.11 Bacon Creek RM 27.1 to 32.6 Segment Information

Stream	Stream Segment	WBID #	County	Acres	Square Miles	Stream Order
Bacon Creek	Bacon Creek 27.1 to 32.6	486197_03	Hart	12,113.38	18.93	4th
MAF (cfs)	RM of MAF Determination	+ to MAF (cfs)	Adjusted MAF (cfs)			
22.7	27.1	0.007736	22.7077			

Table 8.12 Bacon Creek RM 27.1 to 32.6 Site Information

Site #	Map Site #	Sample Point RM	Sample Site Latitude	Sample Site Longitude
1	1	28.8	37.416376	-85.801261
4	4	28.75	-85.801671	37.415939
A	A	31.35	37.440372	-85.778963
C	C	29.1	37.418823	-85.798358
F2	F2	32.3	37.44937	-85.76824

Table 8.13 Bacon Creek RM 27.1 to 32.6 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	19.74	0.03	0.16	
Developed	797.61	1.25	6.58	1.0
Barren Land	2.69	0.00	0.02	
Forest/Shrubland	3229.26	5.05	26.66	
Grassland/Herbaceous	42.63	0.07	0.35	
Pasture/Hay	6010.92	9.39	49.62	
Cultivated Crops	2007.38	3.14	16.57	
Wetlands	3.14	0.00	0.03	
Totals	12113.38	18.93	100.00	

Table 8.14 Bacon Creek RM 27.1 to 32.6 Data (Sites 1, 4, A, C, and F2)

site 1				site A		
Collection Date	Fecal Coliform (colonies/100 ml)	E. coli (colonies/100 ml)		Collection Date	Fecal Coliform (colonies/100 ml)	E. coli (colonies/100 ml)
06/14/05	787	792*		09/21/04	6000	6038*
07/12/05	8,333	8385*		09/28/04	4091	4140
08/09/05	1,818	1829*		10/07/04	2000	2430
09/13/05	656	660*		10/13/04	3545	2950
10/11/05	328	330*		10/20/04	2182	2310
05/10/06	3500	3522*		6/28/2010		3,076
06/13/06	4100	4126*				
08/08/06	1060	1067*		site C		
09/14/06	15000	15095*		Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)
10/12/06	540	543*		09/21/04	270	272*
5/8/2007	1180	1187*				
6/27/2007	960	966*		site F2		
7/10/2007	443	446*		Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)
8/16/2007	560	564*		10/07/04	273	100
10/12/2007	200	201*				
6/28/2010		1,169				
site 4						
Collection Date	Fecal Coliform (colonies/100 ml)	E. coli (colonies/100 ml)				
06/14/05	1,180	1187*				
07/12/05	8,667	8722*				
08/09/05	1,909	1921*				
09/13/05	492	495*				
05/10/06	20000	20126*				
06/13/06	2700	2717*				
08/08/06	900	906*				
09/14/06	4200	4226*				
10/12/06	540	543*				
5/8/2007	1377	1386*				
6/27/2007	700	704*				
7/10/2007	460	463*				
Greatest Concentration (E. coli colonies/ 100 ml)	20126*					

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table 8.15 TMDL Calculations for Bacon Creek RM 27.1 to 32.6

TMDL Table					E. coli (billion colonies/day)	
					11181.2405	Existing Load
					133.3349	**Total TMDL**
					13.3335	**MOS**
					120.0014	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	98.93	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**KPDES WLA**
			Addition to MAF (sum of cfs)	0.0077362	119.9560	remainder
					1.1996	**Future Growth WLA**[(1)]
					118.7564	**LA**

Note: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.

8.2.4 TMDL Summary for Bacon Creek RM 32.6 to 34.9

Bacon Creek at RM 32.6 is a second order stream located in Larue County (Figure 8.4). Information about Bacon Creek from RM 32.6 to 34.9, including its WBID and MAF is shown in Table 8.16. Site information is presented in Table 8.17. Bacon Creek at RM 32.6 has a catchment of 824 acres (1.3 square miles) with a 21 % forested, 67.4 % agricultural, and 10.91 % developed land cover (Table 8.18).

This subwatershed is un-sewered. It has one SWS in the headwaters for which MAF was adjusted. Sampling data from site F is presented in Table 8.19, and the TMDL allocations in Table 8.20.

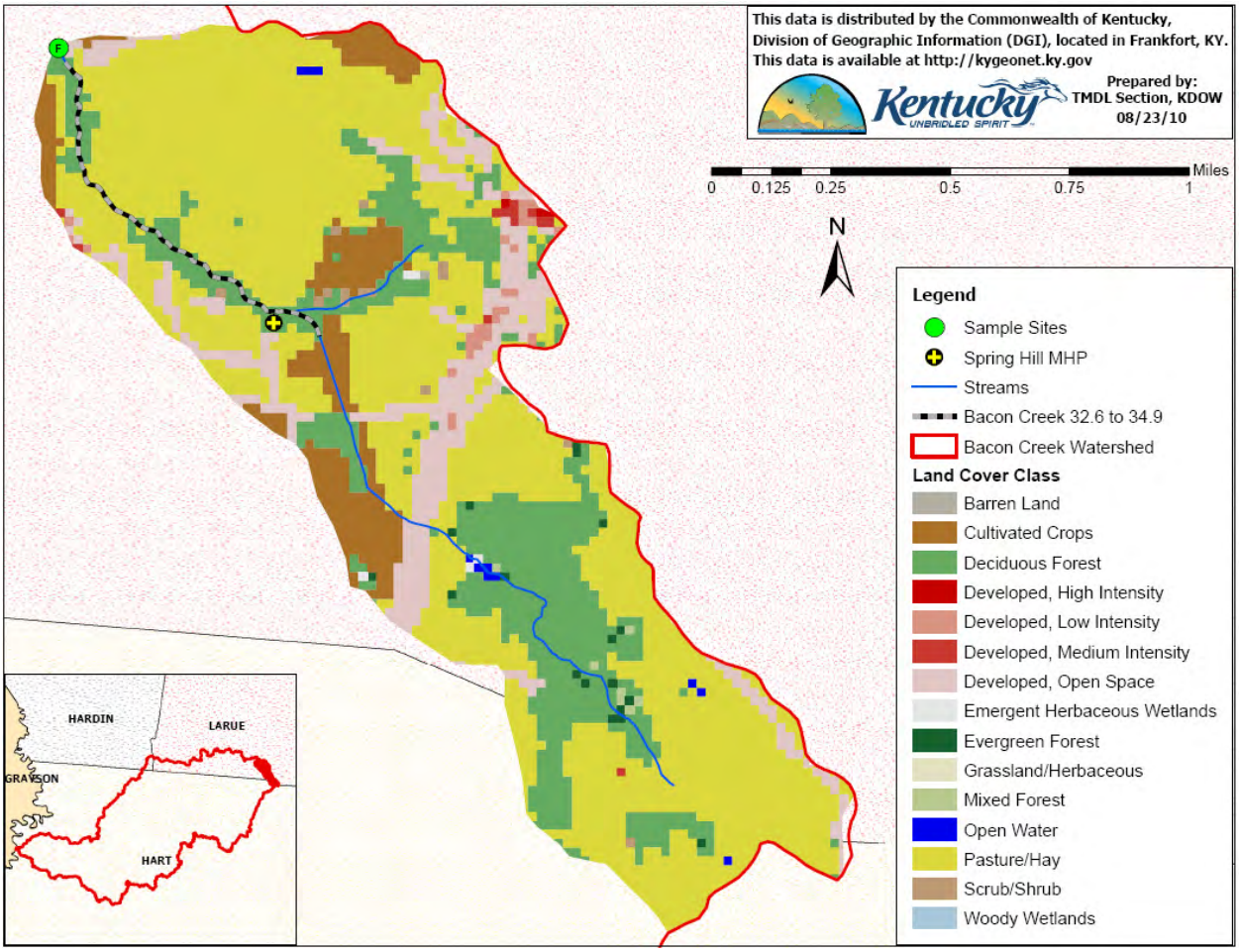

Figure 8.4 Bacon Creek Watershed above RM 32

Table 8.16 Bacon Creek RM 32.6 to 34.9 Segment Information

Stream	Stream Segment	WBID #	County	Acres	Square Miles	Stream Order
Bacon Creek	Bacon Creek 32.6 to 34.9	486197_04	Larue	824.18	1.29	2nd
MAF (cfs)	RM of MAF Determination	+ to MAF (cfs)	Adjusted MAF (cfs)			
1.7	32.6	0.007736	1.7077			

Table 8.17 Bacon Creek RM 32.6 to 34.9 Site Information

Site Number	Map Site Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude
F	F	32.65	37.449489	-85.76321

Table 8.18 Bacon Creek RM 32.6 to 34.9 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	2.46	0.00	0.30	
Developed	89.59	0.14	10.87	2.0
Barren Land	0.22	0.00	0.03	
Forest/Shrubland	175.16	0.27	21.25	
Grassland/Herbaceous	0.00	0.00	0.00	
Pasture/Hay	487.72	0.76	59.18	
Cultivated Crops	67.92	0.11	8.24	
Wetlands	1.12	0.00	0.14	
Totals	824.18	1.29	100.00	

Table 8.19 Bacon Creek RM 32.6 to 34.9 Data (Site F)

site F		
Collection Date	Fecal Coliform (colonies/100 ml)	E. coli (colonies/100 ml)
10/13/04	3727	3090
10/20/04	909	840
Greatest Concentration (E. coli colonies/100 ml)	3090	

Table 8.20 TMDL Calculations for Bacon Creek RM 32.6 to 34.9

TMDL Table					E. coli (billion colonies/day)	
					129.1007	Existing Load
					10.0272	**Total TMDL**
					1.0027	**MOS**
					9.0245	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	93.01	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	8.9791	remainder
					0.1796	**Future Growth WLA**[(1)]
					8.7995	**LA**

Note: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.

8.2.5 TMDL Summary for Honey Run RM 0.0 to 3.65

Honey Run is a second order stream located in Hart County (Figure 8.5). Information about Honey Run, including its WBID and MAF is shown in Table 8.21. Site information is presented in Table 8.22. Honey Run has a catchment of 1,726 acres (2.7 square miles) with a 58 % forested, 36.7 % agricultural, and 4.5 % developed land cover (Table 8.23).

This subwatershed is un-sewered and contains no SWSs. Sampling data from site 5 is presented in Table 8.24, and the TMDL allocations in Table 8.25.

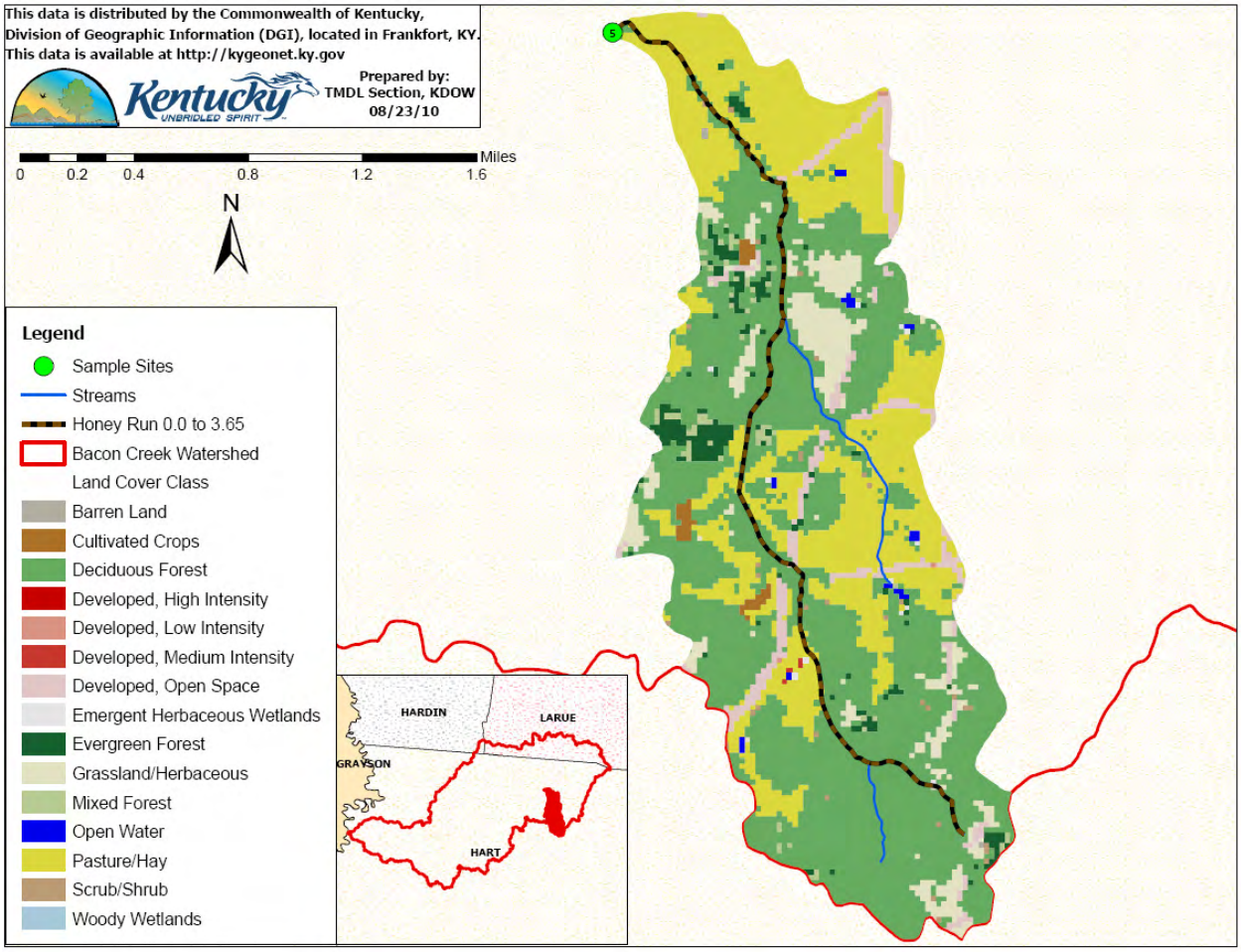

Figure 8.5 Honey Run Watershed above RM 0.0

Table 8.21 Honey Run 0.0 to 3.65 Segment Information

Stream	Stream Segment	WBID #	County	Acres	Square Miles	Stream Order
Honey Run	Honey Run 0.0 to 3.65	494483_01	Hart	1,725.94	2.70	2nd
MAF (cfs)	RM of MAF Determination	+ to MAF (cfs)	Adjusted MAF (cfs)			
3.8	0	0	3.8			

Table 8.22 Honey Run 0.0 to 3.65 Site Information

Site Number	Map Site Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude
5	5	0.0	37.404055	-85.816818

Table 8.23 Honey Run 0.0 to 3.65 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	5.80	0.01	0.34	
Developed	78.25	0.12	4.53	0.5
Barren Land	0.67	0.00	0.04	
Forest/Shrubland	993.83	1.55	57.58	
Grassland/Herbaceous	111.47	0.17	6.46	
Pasture/Hay	521.66	0.82	30.22	
Cultivated Crops	11.37	0.02	0.66	
Wetlands	2.90	0.00	0.17	
Totals	1725.94	2.70	100.00	

Table 8.24 Honey Run 0.0 to 3.65 Data (Site 5)

site 5		
Collection Date	Fecal Coliform (colonies/100 ml)	E. coli (colonies/100 ml)
05/24/05	355	357*
06/14/05	3,400	3421*
07/12/05	750	755*
08/09/05	525	528*
09/13/05	1,545	1555*
10/11/05	1,066	1073*
05/10/06	5000	5032*
06/13/06	2000	2013*
08/08/06	420	423*
09/14/06	940	946*
10/12/06	2400	2415*
5/8/2007	1492	1501*
6/27/2007	2400	2415*
7/10/2007	25000	25158*
8/16/2007	12000	12076*
10/12/2007	100	101*
6/28/2010		583
Greatest Concentration (E. coli colonies/ 100 ml)	25158*	

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table 8.25 TMDL Calculations for Honey Run 0.0 to 3.65

					E. coli (billion colonies/day)	
TMDL Table					2338.9363	Existing Load
					22.3128	**Total TMDL**
					2.2313	**MOS**
					20.0815	TMDL Target
			Type	Design Capacity (cfs)	99.14	% reduction
AI number	KPDES #	Discharger Facility Name	N/A[2]	N/A[2]	**0.0000**	**SWS WLA**
N/A[2]	N/A[2]	N/A[2]	Addition to MAF (sum of cfs)	0.0000000	20.0815	remainder
					0.1004	**Future Growth WLA[1]**
					19.9811	**LA**

Notes: [1]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[2]N/A indicates that there is no SWS in the subwatershed, thus the information is not applicable.

8.2.6 TMDL Summary for Tampa Branch RM 0.0 to 2.15

Tampa Branch is a third order stream located in Hart County (Figure 8.6). Information about Tampa Branch from RM 0.0 to 2.15, including its WBID and MAF is shown in Table 8.26. Site information is presented in Table 8.27. Tampa Branch has a catchment of 3,935 acres (3 square miles) with a 35 % forested, 58.4 % agricultural and 5.5 % developed land cover (Table 8.28).

This subwatershed is un-sewered and contains no SWSs. Sampling data from sites 2 and 3 is presented in Table 8.29, and the TMDL allocations in Table 8.30.

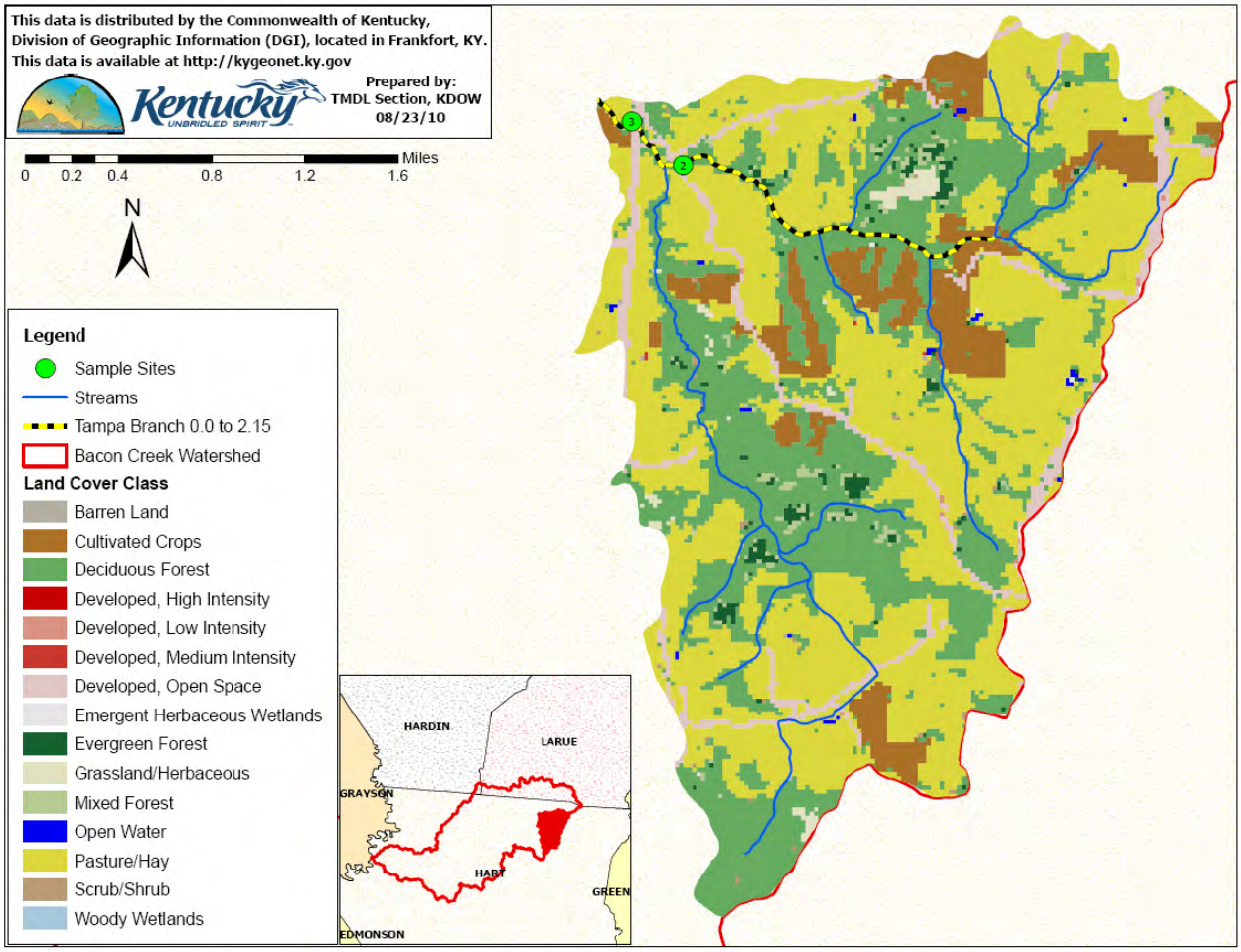

Figure 8.6 Tampa Branch Watershed above RM 0.0

Table 8.26 Tampa Branch RM 0.0 to 2.15 Segment Information

Stream	Stream Segment	WBID #	County	Acres	Square Miles	Stream Order
Tampa Branch	Tampa Branch 0.0 to 2.15	504931_01	Hart	1,900.65	2.97	3rd
MAF (cfs)	RM of MAF Determination	+ to MAF (cfs)	Adjusted MAF (cfs)			
7.7	0	0	7.7			

Table 8.27 Tampa Branch RM 0.0 to 2.15 Site Information

Site Number	Map Site Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude
2	2	0.55	37.412083	-85.794500
3	3	0.2	37.414817	-85.798517

Table 8.28 Tampa Branch RM 0.0 to 2.15 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	8.24	0.01	0.21	
Developed	217.84	0.34	5.54	1.0
Barren Land	1.11	0.01	0.03	
Forest/Shrubland	1376.56	2.15	34.98	
Grassland/Herbaceous	28.73	0.05	0.73	
Pasture/Hay	1950.58	3.05	49.56	
Cultivated Crops	351.27	0.55	8.93	
Wetlands	1.11	0.00	0.03	
Totals	3935.46	6.15	100.00	

Table 8.29 Tampa Branch RM 0.0 to 2.15 Data (Sites 2 and 3)

site 2				site 3		
Collection Date	Fecal Coliform (colonies/100 ml)	E. coli (colonies/100 ml)		Collection Date	Fecal Coliform (colonies/100 ml)	E. coli (colonies/100 ml)
05/24/05	155	156*		09/28/04	91	300
06/14/05	394	396*		05/24/05	655	659*
07/12/05	313	315*		06/14/05	2,727	2744*
08/09/05	328	330*		07/12/05	1,063	1070*
09/13/05	50	50*		08/09/05	311	313*
10/11/05	94	95*		09/13/05	94	95*
05/10/06	2500	2516*		10/11/05	100	101*
06/13/06	1636	1646*		05/10/06	27000	27170*
08/08/06	720	725*		06/13/06	1545	1555*
09/14/06	460	463*		09/14/06	480	483*
10/12/06	114	115*		10/12/06	213	214*
5/8/2007	279	281*		5/8/2007	573	577*
6/27/2007	520	523*		6/27/2007	1040	1047*
7/10/2007	880	886*		7/10/2007	520	523*
8/16/2007	361	363*				
10/12/2007	200	201*				
6/28/2010		359				
Greatest Concentration (E. coli colonies/ 100 ml)	27170*					

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table 8.30 TMDL Calculations for Tampa Branch RM 0.0 to 2.15

TMDL Table						
					E. coli (billion colonies/day)	
					5118.4568	Existing Load
					45.2127	**Total TMDL**
					4.5213	**MOS**
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	40.6914	TMDL Target
N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	99.21	% reduction
			Addition to MAF (sum of cfs)	0.0000	**0.0000**	**SWS WLA**
					40.6914	remainder
					0.4069	**Future Growth WLA[1]**
					40.2845	**LA**

Notes: [1]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[2]N/A indicates that there is no SWS in the subwatershed, thus the information is not applicable.

8.2.7 TMDL Summary for UT to Bacon Creek RM 0.0 to 2.45

UT Bacon Creek 0.0 to 2.45 enters Bacon Creek at RM 28.9. It is a third order stream located in Hart County (Figure 8.7). Information about UT Bacon Creek RM 0.0 to 2.45, including its WBID and MAF is shown in Table 8.31. Site information is presented in Table 8.32. UT Bacon Creek RM 0.0 to 2.45 has a catchment of 2,962 acres (4.6 square miles) with a 16 % forested, 76.4 % agricultural, and 7.4 % developed land cover (Table 8.33).

This subwatershed is un-sewered and contains no SWSs. Sampling data from sites D and 1A is presented in Table 8.34, and the TMDL allocations in Table 8.35.

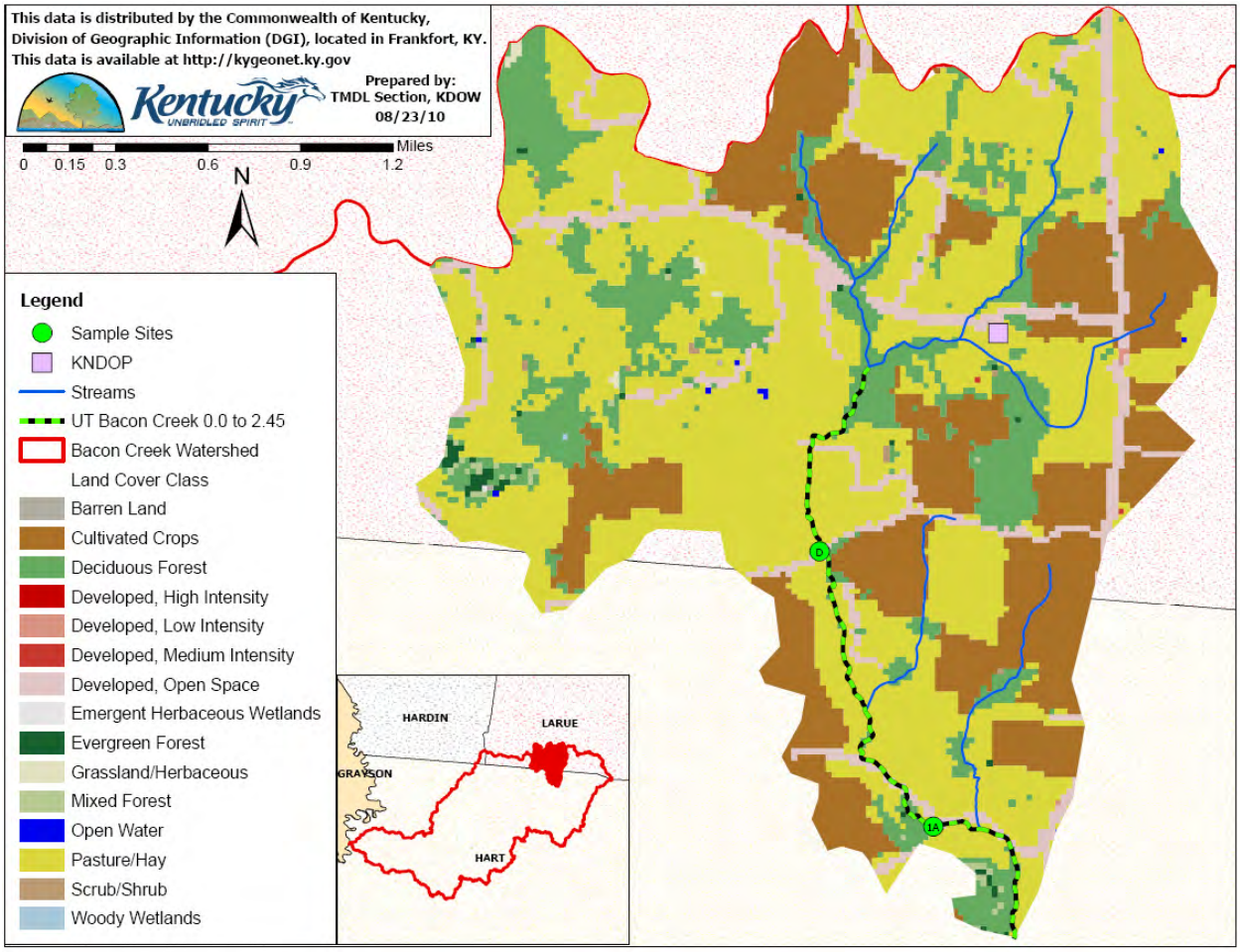

Figure 8.7 UT to Bacon Creek RM 0.0 to 2.45 above RM 0.0

Table 8.31 UT to Bacon Creek RM 0.0 to 2.45 Segment Information

Stream	Stream Segment	WBID #	County	Acres	Square Miles	Stream Order
UT Bacon Creek	UT Bacon Creek 0.0 to 2.45	48619-28.9_01	Larue	2,962.14	4.63	3rd
MAF (cfs)	RM of MAF Determination	+ to MAF (cfs)	Adjusted MAF (cfs)			
4.3	0	0	4.3			

Table 8.32 UT to Bacon Creek RM 0.0 to 2.45 Site Information

Site Number	Map Site Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude
D	D	1.75	37.436342	-85.812496
1A	1A	0.6	37.423333	-85.80575

Table 8.33 UT to Bacon Creek RM 0.0 to 2.45 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	2.24	0.00	0.08	
Developed	219.87	0.34	7.42	1.0
Barren Land	0.45	0.00	0.02	
Forest/Shrubland	471.51	0.74	15.92	
Grassland/Herbaceous	3.58	0.01	0.12	
Pasture/Hay	1524.35	2.38	51.46	
Cultivated Crops	739.70	1.16	24.97	
Wetlands	0.45	0.00	0.02	
Totals	2962.14	4.63	100.00	

Table 8.34 UT to Bacon Creek RM 0.0 to 2.45 Data (Site D)

site D				site 1A		
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)		Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)
09/21/04	1320	1328*		6/28/2010		1,274
09/28/04	5545	4640				
10/07/04	909	2280				
10/13/04	818	610				
10/20/04	909	980				
Greatest Concentration (E. coli colonies/ 100 ml)	4640					

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table 8.35 TMDL Calculations for UT to Bacon Creek RM 0.0 to 2.45

TMDL Table					E. coli (billion colonies/day)	
					488.1408	Existing Load
					25.2487	**Total TMDL**
					2.5249	**MOS**
					22.7238	TMDL Target
AI #	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	95.34	% reduction
N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	**0.0000**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0000	22.7238	remainder
					0.2272	**Future Growth WLA[1]**
					22.4966	**LA**

Note: [1]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[2]N/A indicates that there is no SWS in the subwatershed, thus the information is not applicable.

8.2.8 TMDL Summary for UT to Bacon Creek RM 0.0 to 3.7

UT Bacon Creek RM 0.0 to 3.7 enters Bacon Creek at RM 17.8. It is a second order stream located in Hart County (Figure 8.8). Information about UT Bacon Creek RM 0.0 to 3.7, including its WBID and MAF is shown in Table 8.36. Site information is presented in Table 8.37. UT Bacon Creek RM 0.0 to 3.7 has a catchment of 3,766 acres (5.9 square miles) with a 86 % forested, 6.1 % agricultural, and 5.6 % developed land cover (Table 8.38).

This subwatershed is sewered in the area south of Bonnieville (see Figure 5.3). It has no SWSs. Sampling data from site 14 is presented in Table 8.39, and the TMDL allocations in Table 8.40.

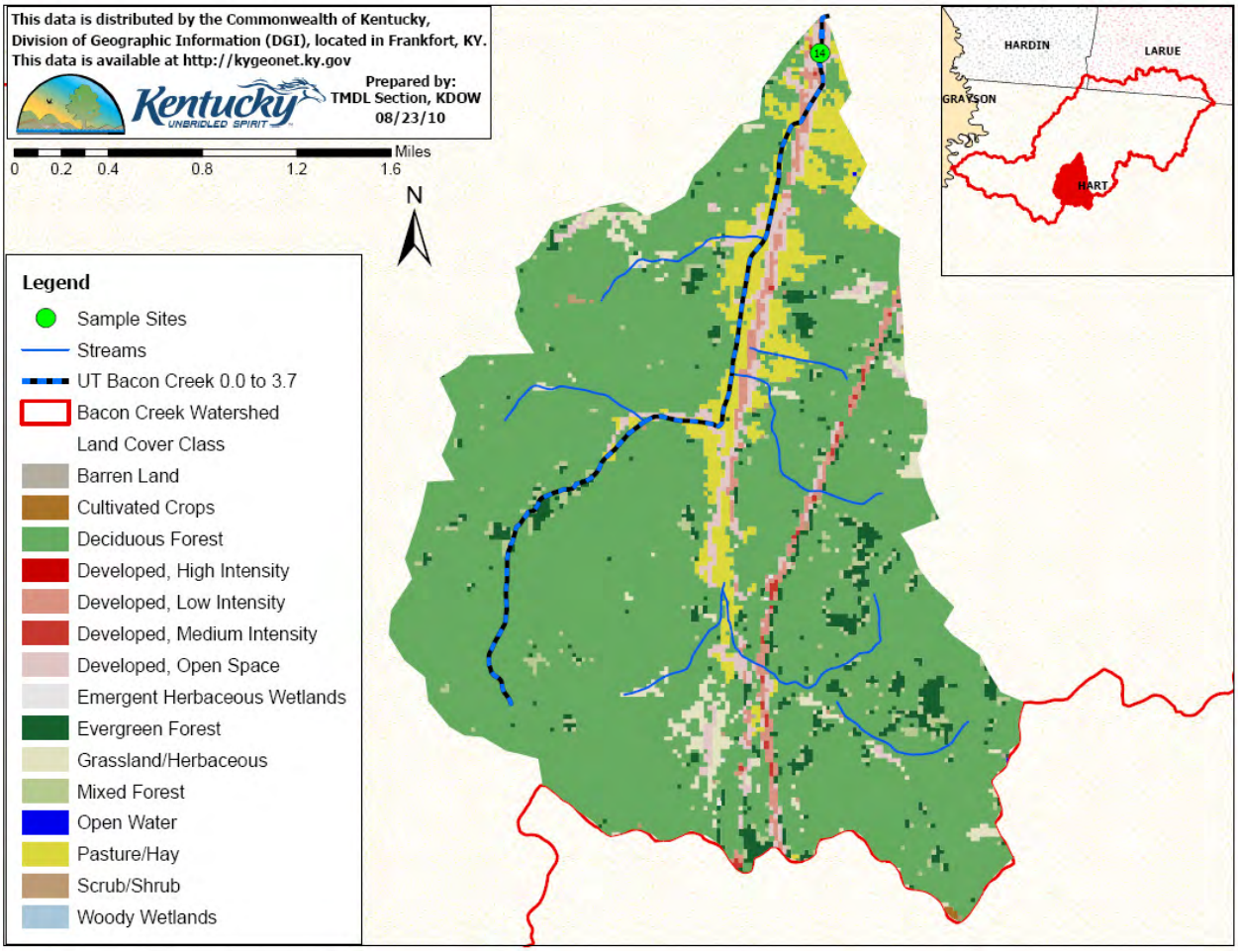

Figure 8.8 UT to Bacon Creek RM 0.0 to 3.7 Watershed above RM 0.0

Table 8.36 UT to Bacon Creek RM 0.0 to 3.7 Segment Information

Stream	Stream Segment	WBID #	County	Acres	Square Miles	Stream Order
UT Bacon Creek	UT Bacon Creek 0.0 to 3.7	486187-17.8_01	Hart	3,766.14	5.88	2nd
MAF (cfs)	RM of MAF Determination	+ to MAF (cfs)	Adjusted MAF (cfs)			
7.5	0	0	7.5			

Table 8.37 UT to Bacon Creek RM 0.0 to 3.7 Site Information

Site Number	Map Site Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude
DOW03025014	14	0.2	37.37265	-85.90265

Table 8.38 UT to Bacon Creek RM 0.0 to 3.7 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	0.22	0.00	0.01	
Developed	212.14	0.33	5.63	1.0
Barren Land	0.45	0.00	0.01	
Forest/Shrubland	3230.44	5.05	85.78	
Grassland/Herbaceous	91.14	0.14	2.42	
Pasture/Hay	228.85	0.36	6.08	
Cultivated Crops	1.34	0.00	0.04	
Wetlands	1.56	0.00	0.04	
Totals	3766.14	5.88	100.00	

Table 8.39 UT to Bacon Creek RM 0.0 to 3.7 Data (Site 14)

site 14	
Collection Date	E. coli (colonies/100ml)
05/17/07	96
06/12/07	774
06/26/07	870
07/11/07	1956
07/20/07	2359
08/09/07	573
10/23/07	4611
10/30/07	784
Greatest Concentration (E. coli colonies/100 ml)	4611

Table 8.40 TMDL Calculations for UT to Bacon Creek RM 0.0 to 3.7

TMDL Table					E. coli (billion colonies/day)	
					846.0871	Existing Load
					44.0384	**Total TMDL**
					4.4038	**MOS**
					39.6345	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	95.3155	% reduction
N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	**0.0000**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0000	39.6345	remainder
					0.3963	**Future Growth WLA[1]**
					39.2382	**LA**

Notes: [1]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[2]N/A indicates that there is no SWS in the subwatershed, thus the information is not applicable.

8.3 Summary for all TMDLs and Allocations

A TMDL Summary matrix is presented in Table 8.41. The Total WLA (SWS WLA+ MS4 WLA + Future Growth WLA) is included in this table.

Table 8.41 TMDL Summary Matrix

Loads are in units of billion E. coli colonies/day	Percent Reduction is expressed as a percentage		Bacon Creek 0.2 to 17.2	Bacon Creek 17.2 to 27.1	Bacon Creek 27.1 to 32.6	Bacon Creek 32.6 to 34.9	Honey Run 0.0 to 3.65	Tampa Branch 0.0 to 2.15	UT to Bacon Creek 0.0 to 2.45	UT to Bacon Creek 0.0 to 3.7
		Existing Load	67371.1627	37535.6988	11181.2405	129.1007	2338.9363	5118.4568	488.1408	846.0871
		Total TMDL	**668.2542**	**372.3164**	**133.3349**	**10.0272**	**22.3128**	**45.2127**	**25.2487**	**44.0384**
		MOS	**66.8254**	**37.2316**	**13.3335**	**1.0027**	**2.2313**	**4.5213**	**2.5249**	**4.4038**
		TMDL Target	601.4288	335.0848	120.0014	9.0245	20.0815	40.6914	22.7238	39.6345
AI #	KPDES #	% reduction	99.11	99.11	98.93	93.01	99.14	99.21	95.34	95.32
2555	KY0089761	**SWS WLA**	**0.0454**	**0.0454**	**0.0454**	**0.0454**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
		remainder	601.3834	335.0393	119.9560	8.9791	20.0815	40.6914	22.7238	39.6345
		Future Growth WLA[(1)]	**3.0069**	**3.3504**	**1.1996**	**0.1796**	**0.1004**	**0.4069**	**0.2272**	**0.3963**
75043	KYG200003	**MS4 WLA**[(2)]	**0.0000**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
		Total WLA	**3.0523**	**3.3958**	**1.2450**	**0.2250**	**0.1004**	**0.4069**	**0.2272**	**0.3963**
		LA	**598.3765**	**331.6889**	**118.7564**	**8.7995**	**19.9811**	**40.2845**	**22.4966**	**39.2382**

Notes: [(1)] Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[(2)] N/A indicates that there is no MS4 in the subwatershed.

8.4 Translation of WLA Limits into Permit Limits

All SWS WLAs will be translated into KPDES permit limits as an E. coli effluent gross limit of 130 colonies/100 ml as a monthly average and 240 colonies/100/ml as a maximum weekly average.

9.0 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.

9.1 Kentucky Watershed Management Framework

A Watershed Management Framework approach to Water Quality Management (WQM) was adopted by the KDOW in 1998. The plan divides Kentucky's major drainage basins into five groups of basins, which are cycled through a five year staggered process which involves monitoring, assessment, prioritization, plan development, and plan implementation. The major basin that the Bacon Creek watershed lies within is the Green River basin. In 2003, Bacon Creek was listed as a first priority watershed using the watershed management framework process. As part of the process, a basin coordinator is assigned to each river basin to work with the citizens of the basin to develop a local Watershed Management Team associated with each priority watershed. For more information about the Green River basin see: http://water.ky.gov/watershed/Pages/GreenandTradewaterRiversBasin.aspx.

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. As a product of the prioritization process of the watershed management framework, in 2005 the Kentucky Waterways Alliance received funding through a Clean Water Act Section 319(h) Nonpoint Source Implementation grant. KWA developed a watershed plan for Bacon Creek, which was accepted in 2009. This TMDL provides pathogen allocations and reduction goals that may be different than those outlined in the watershed plan. The plan should be revised to incorporate the information presented in the TMDL and the strategy of restoration efforts updated.

The watershed plan for Bacon Creek addresses both point and nonpoint sources of pollution in the watershed and builds on existing efforts as well as offering new approaches. Based on sampling data, land use information, local knowledge, and confirmation of local support, two priority subwatersheds were selected for implementation of best management practices (BMPs). These priority areas include the Upper Bacon Creek and Honey Run subwatersheds.

9.2 Non-Governmental Organizations

There are several Non-Governmental Organizations (NGO) operating in the Bacon Creek watershed that may help to implement the TMDL, particularly with regard to nonpoint source issues. These organizations include the Upper Green River Watershed Watch and Kentucky Waterways Alliance.

9.2.1 Upper Green River Watershed Watch

The Upper Green River Watershed Watch is a citizen's water monitoring effort that relies exclusively on volunteers to provide administration, training, and volunteer and equipment coordination. The volunteers measure basic parameters of stream health to determine whether streams meet important "uses" under the Clean Water Act including aquatic life, human recreation, and drinking water.

Several water quality parameters have been monitored by Watershed Watch in Bacon Creek. Three times per year, water samples are collected from 8 sites in the Bacon Creek watershed. Volunteers collect physical measurements, such as temperature, pH, dissolved oxygen, and conductivity. Stream monitoring also includes macroinvertebrate and habitat assessments. One time annually, water samples are tested for bacteria (E. coli), and once annually for selected pesticides. Data from annual monitoring is routinely used to help identify problems in the watershed, and assist with prioritizing streams for restoration and protection activities.

9.2.2 Kentucky Waterways Alliance

The formation of Kentucky Waterways Alliance (KWA) was the result of a series of meetings sponsored by the Kentucky Environmental Quality Commission. The KWA has a mission to protect and restore Kentucky's waterways and their watersheds through alliances for watershed stewardship. This includes strengthening community and governmental stewardship for the restoration and preservation of Kentucky's water resources. The KWA promotes networking, communication and mutual support among groups, government agencies, and businesses working on waterway issues.

10.0 Public Participation

This TMDL was published for a 65-day public comment period beginning March 16, 2011 and ending May 19, 2011. A public meeting to present the findings of this TMDL was held at the Bonnieville City Hall on May 12, 2011. The public comment period was extended beyond the original close date of April 16, 2011 to allow the public an opportunity to provide comments after the public meeting was held. The public notice was distributed electronically through the 'Press Release' mailing list maintained by the Governor's Office of media outlets across the Commonwealth and advertisements were purchased in two local newspapers, the Hart County News (circulation 4840) in Horsecave, KY and the LaRue County Herald News (circulation 4269) in Hodgenville, KY. Additionally, the public notice was distributed electronically through the 'Nonpoint Source Pollution Control' mailing list. No public comments were received on this TMDL document.

11.0 References

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Appendix A. Land Cover Definitions

Table A.1 National Land-Cover Database Class Descriptions (taken from Homer et. al., 2004)

11. **Open Water** - All areas of open water, generally with less than 25% cover of vegetation or soil.

21. **Developed, Open Space** - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes

22. **Developed, Low Intensity** - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.

23. **Developed, Medium Intensity** - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.

24**. Developed, High Intensity** - Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to100 percent of the total cover.

31. **Barren Land (Rock/Sand/Clay)** - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.

41. **Deciduous Forest** - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.

42. **Evergreen Forest** - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

43. **Mixed Forest** - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.

52. **Shrub/Scrub** - Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage, or trees stunted from environmental conditions.

71. **Grassland/Herbaceous** - Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

81. **Pasture/Hay** - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.

82. **Cultivated Crops** - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.

90. **Woody Wetlands** - Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

95. **Emergent Herbaceous Wetlands** - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Appendix B. Monitoring Data

Tables B.1 through B.42 display the monitoring data summarized in Section 4. For all monitoring data tables, a red highlight indicates an exceedance of the WQC (400 fecal coliform or 240 E. coli colonies/100ml), a tan highlight indicates that the sample was a replicate, an orange highlight indicates the sample was collected outside the PCR season, while a yellow highlight indicates that bacteria was detected in the field blank. Because data with a peach, orange or yellow highlight does not pass the validation process, it is not included in the data summary in Section 4 nor is it used in TMDL calculations.

B.1 Historic Data

Because more recent data was available, the historic data was not used in TMDL development.

Table B.1 COE Site 2NNR14001 Bacon Creek (latitude 37.35667, longitude 86.05667)

Date	Total Coliform (colonies/100ml)	Fecal Coliform (colonies/100 ml)	Flow (cfs)
8/10/73	4000		28
11/29/73	3100		166
3/12/75	5500		553
7/26/77	21000		
7/26/77		3700	22
7/1/82		26	
6/26/85		280	24
8/21/85		120	
7/17/86		660	
9/12/86		1050	
6/15/87		76	

Table B.2 KDOW Site PRI020 Bacon Creek at Priceville (latitude 37.35889, longitude -85.99833)

Date	Fecal coliform (colonies/100 ml)	Instantaneous flow (cfs)	Mean Daily Flow (cfs)
2/12/80	<4		48
3/25/80	1900		119
4/23/80	76		78
5/21/80	820		64
6/18/80	230		26
7/24/80	920		29
8/26/80	200		17
9/24/80	360		17
10/28/80	170		11

Date	Fecal coliform (colonies/100 ml)	Instantaneous flow (cfs)	Mean Daily Flow (cfs)
11/25/80	88		
12/16/80	40		13
1/28/81	<20		9
2/25/81	36		55
3/25/81	10		30
4/28/81	500		59
5/27/81	580		53
6/24/81	290		28
7/22/81	200		23
8/25/81	240		11
9/16/81	260		20
10/13/81	72		9
11/10/81	42		13
12/10/81	23		19
1/10/83	160		
1/11/83	160	36	
2/15/83	68	70	
3/15/83	45	27	
4/12/83	480	132	
5/10/83	250	116	
6/14/83	230	44	
7/12/83	240	20	
8/9/83	160	12	
9/13/83	170	8	
9/23/83	170		
10/12/83	150	8	
11/8/83	64		
1/26/84	2200	67	
2/15/84	830	109	
3/14/84	42	58	
4/11/84	200	73	
5/15/84	480	111	
6/13/84	210	34	
7/11/84	840	24	
8/7/84	520	18	
9/11/84	400	9	
10/11/84	80	12	

Date	Fecal coliform (colonies/100 ml)	Instantaneous flow (cfs)	Mean Daily Flow (cfs)
11/13/84	1040	52	
12/13/84	110	46	
1/9/85	140	46	
2/19/85	300	91	
3/12/85	80	46	
4/9/85	38	38	
5/13/85	190	25	
9/17/85	150	6	
10/9/85	95	7	
11/21/85	190	20	
12/10/85	53	21	
1/21/86	30	21	
2/19/86	1600	117	
3/10/86	50	30	
4/23/86	85	25	
5/12/86	75	14	
6/9/86	400	32	
7/8/86	120	13	
8/13/86	150	8	
9/9/86	220		
10/13/86	95	6	
11/11/86	1600	45	
12/10/86	8000	316	
1/20/87	130	34	
2/10/87	7	22	
3/17/87	1800	54	
4/22/87	340	58	
5/13/87	170	30	
6/9/87	290	17	
7/13/87	>8000	44	
8/12/87	120	9	
9/15/87	83	7	
10/12/87	84	7	
11/18/87	20	12	
12/15/87	1600	39	
1/12/88	8	36	
2/9/88	47	77	

Date	Fecal coliform (colonies/100 ml)	Instantaneous flow (cfs)	Mean Daily Flow (cfs)
3/14/88	30	48	
4/14/88	93	51	
5/10/88	50	27	
6/13/88	65	10	
7/12/88	100	9	
8/9/88	70	11	
9/12/88	280	12	
10/12/88	160	26	
11/10/88	400	19	
12/7/88	86	38	
1/10/89	700	126	
2/28/89	250	138	
3/28/89	100	76	
4/10/89	280	93	
5/24/89	>6500	51	
6/21/89	>6500	94	
7/11/89	240	46	
8/16/89	450	18	
9/12/89	120	15	
10/10/89	130	13	
11/28/89	140	28	
12/20/89	6	20	
1/17/90	10	32	
2/14/90	140	107	
3/14/90	2	40	
4/10/90	52	40	
5/22/90	5800	92	
6/19/90	250	30	
7/11/90	92	18	
8/15/90	72	10	
9/11/90	120	9	
1/14/91	78	228	
3/14/91	120	151	
4/9/91	30	146	
5/23/91	140	109	
6/11/91	200	98	
7/16/91	220	80	

Date	Fecal coliform (colonies/100 ml)	Instantaneous flow (cfs)	Mean Daily Flow (cfs)
8/22/91	240	65	
9/11/91	870	112	
10/30/91	65	11	
11/19/91	100	10	
12/11/91	300	56	
1/15/92	5500	112	
2/11/92	22	23	
3/16/92	230	69	
4/13/92	90	57	
5/11/92	58	23	
6/9/92	360	66	
7/14/92	80	33	
8/12/92	88	32	
9/23/92	5900	56	
10/14/92	23	15	
11/10/92	16	15	
12/14/92	54	23	
1/20/93	58	43	
2/16/93	620	70	
3/8/93	60	103	
4/12/93	80	49	
5/11/93	220	35	
6/14/93	260	25	
7/12/93	120	13	
8/11/93	84	9	
10/12/93	26		
11/10/93	16		
12/20/93	43		
2/15/94	60		
3/15/94	110		
4/12/94	12000		
5/10/94	96		
6/15/94	210		
7/19/94	120		
8/9/94	59		
9/13/94	110		
10/10/94	84		

Date	Fecal coliform (colonies/100 ml)	Instantaneous flow (cfs)	Mean Daily Flow (cfs)
11/16/94	160		
12/15/94	340		
1/12/95	93		
2/14/95	23		
3/14/95	120		
4/11/95	64		
5/10/95	>13000		
6/14/95	350		
7/12/95	75		
8/16/95	170		
9/13/95	1760		
7/24/96	450		
8/20/96	280		
9/18/96	260		
6/10/97	480		
7/16/97	110		
8/13/97	260		
9/10/97	540		
10/15/97	60		

B.2 Preliminary Project Sample Data

Table B.3 Preliminary Project Sample Data Field Blanks

Date	Fecal coliform (colonies/100ml)	E. coli (colonies/100 ml)
09/21/04	<4	<100
09/28/04	<4	<100
10/07/04	<4	<100
10/13/04	<4	<100
10/20/04	<4	<100

Table B.4 Preliminary Project Site A (latitude 37.440372, longitude -85.778963)

Date	Fecal coliform (colonies/100ml)	E. coli (colonies/100 ml)
09/21/04	6000	
09/28/04	4091	4140
10/07/04	2000	2430
10/13/04	3545	2950
10/20/04	2182	2310

Table B.5 Preliminary Project Site C (latitude 37.418823, longitude -85.798358)

Date	Fecal coliform (colonies/100ml)
09/21/04	270

Table B.6 Preliminary Project Site D (latitude 37.436342, longitude -85.812496)

Date	Fecal coliform (colonies/100ml)	E. coli (colonies/100 ml)
09/21/04	1320	
09/28/04	5545	4640
10/07/04	909	2280
10/13/04	818	610
10/20/04	909	980

Table B.7 Preliminary Project Site E (latitude 37.438566, longitude -85.75253)

Date	Fecal coliform (colonies/100ml)	E. coli (colonies/100 ml)
10/13/04	2727	970
10/20/04	84	<100

Note: This site is not on an assessed segment, therefore it is not used in TMDL development.

Table B.8 Preliminary Project Site F (latitude 37.449489, longitude -85.76321)

Date	Fecal coliform (colonies/100ml)	E. coli (colonies/100 ml)
10/13/04	3727	3090
10/20/04	909	840

Table B.9 Preliminary Project Site F2 (latitude 37.44937, longitude -85.76824)

Date	Fecal coliform (colonies/100ml)	E. coli (colonies/100 ml)
10/07/04	273	100

Table B.10 Preliminary Project Site H (latitude 37.414858, longitude -85.798517)

Date	Fecal coliform (colonies/100ml)	E. coli (colonies/100 ml)
09/28/04	91	300

Note: This site is in the same location as site 3, therefore data from this site was combined and reported under site 3 for TMDL development.

B.3 Watershed Based Plan (WBP) Sample Data

Table B.11 WBP Field Blanks

Date	Fecal coliform (colonies/100ml)
05/24/05	<6
06/14/05	<6
07/12/05	<63
08/09/05	<16
09/13/05	<1
10/11/05	<1
07/11/06	TNTC[1]

Note: [1]TNTC indicates that the bacteria were too numerous to count.

Table B.12 WBP Site 1(latitude 37.416376, longitude -85.801261)

Date	Fecal coliform (colonies/100ml)
05/24/05	2600
05/24/05	1600
06/14/05	787
07/12/05	8333
08/09/05	1818
09/13/05	656
10/11/05	328
05/10/06	3500
05/10/06	3600
06/13/06	4100
07/11/06	5600
08/08/06	1060
09/14/06	15000
10/12/06	540

Table B.13 WBP Site 2 (latitude 37.412159, longitude -85.79525)

Date	Fecal coliform (colonies/100ml)
05/24/05	155
06/14/05	394
07/12/05	313
07/12/05	500
08/09/05	328
09/13/05	50
10/11/05	94
05/10/06	2500
06/13/06	1636
06/13/06	818
07/11/06	230
08/08/06	720
09/14/06	460
10/12/06	114

Table B.14 WBP Site 3 (latitude 37.414858, longitude -85.798517)

Date	Fecal coliform (colonies/100ml)
05/24/05	655
06/14/05	2727
06/14/05	3182
07/12/05	1063
08/09/05	311
09/13/05	94
10/11/05	100
05/10/06	27000
06/13/06	1545
07/11/06	660
07/11/06	740
08/08/06	361
09/14/06	480
10/12/06	213

Table B.15 WBP Site 4 (latitude 37.415939, longitude -85.801671)

Date	Fecal coliform (colonies/100ml)
05/24/05	818
06/14/05	1180
07/12/05	8667
08/09/05	1909
08/09/05	3455
09/13/05	492
10/11/05	180
05/10/06	20000
06/13/06	2700
07/11/06	1273
08/08/06	900
08/08/06	760
09/14/06	4200
10/12/06	540

Table B.16 WBP Site 5 (latitude 37.404055, longitude -85.816818)

Date	Fecal coliform (colonies/100ml)
05/24/05	355
06/14/05	3400
07/12/05	750
08/09/05	525
09/13/05	1545
09/13/05	2909
10/11/05	1066
05/10/06	5000
06/13/06	2000
07/11/06	2600
08/08/06	420
09/14/06	940
09/14/06	960
10/12/06	2400

Table B.17 WBP Site 6 (latitude 37.403991, longitude -85.817089)

Date	Fecal coliform (colonies/100ml)
05/24/05	600
06/14/05	1182
06/14/05	2000
07/12/05	750
08/09/05	738
09/13/05	246
10/11/05	1246
10/11/05	1426
05/10/06	600
06/13/06	4500
07/11/06	131
08/08/06	131
09/14/06	13000
10/12/06	230
10/12/06	295

B.4 Bacteria Source Tracking Sample Data

An N/A in the % Human Bacteria column indicates that the percentage could not be calculated due to a non-detect in Human Bacteria column.

Table B.18 BST Field Blanks

Date	E. coli (colonies/100 ml)
4/7/2010	<1
4/8/2010	<1
4/15/2010	<1
6/28/2010	<10

Table B.19 BST Site 1 (latitude 37.416376, longitude -85.801261)

Date	E. coli (colonies/100 ml)	Human Bacteria (colonies/100 ml)	Total Bacteria (colonies/100 ml)	% Human Bacteria	Flow (cfs)
4/7/2010	161	589	68200	0.86	14.831
4/8/2010	1250	278	14100	1.97	13.684
4/15/2010	146	471	51800	0.91	12.278
6/28/2010	1169	23331	50199	46.48	8.026

Table B.20 BST Site 1A (latitude 37.423333, longitude -85.80575)

Date	E. coli (colonies/100 ml)	Human Bacteria (colonies/100 ml)	Total Bacteria (colonies/100 ml)	% Human Bacteria	Flow (cfs)
4/7/2010	905	<100	19800	N/A	4.420
4/8/2010	3076	925	8590	10.77	4.513
4/15/2010	1664	<100	25500	N/A	2.497
6/28/2010	1274	<899	22704	N/A	1.333

Table B.21 BST Site 1Ba (latitude 37.440372, longitude -85.778963)

Date	E. coli (colonies/100 ml)	Human Bacteria (colonies/100 ml)	Total Bacteria (colonies/100 ml)	% Human Bacteria	Flow (cfs)
4/7/2010	15531	4100	182000	2.25	5.140
4/8/2010	5172	110	20100	0.55	1.897
4/15/2010	5475	<100	188000	N/A	4.524
6/28/2010	3076	<899	110991	N/A	0.780

Note: This site is in the same location as site A, therefore data from this site was combined and reported under site A for TMDL development.

Table B.22 BST Site 1Bb (latitude 37.427233, longitude -85.780217)

Date	E. coli (colonies/100 ml)	Human Bacteria (colonies/100 ml)	Total Bacteria (colonies/100 ml)	% Human Bacteria	Flow (cfs)
4/7/2010	203	577	8060	7.16	3.484
4/8/2010	355	145	2190	6.62	2.041
4/15/2010	120	<100	31800	N/A	1.249
6/28/2010	241	4228	8282	51.05	1.607

Note: This site is not on an assessed segment, therefore it is not used in TMDL development.

Table B.23 BST Site 2 (latitude 37.412159, longitude -85.794525)

Date	E. coli (colonies/100 ml)	Human Bacteria (colonies/100 ml)	Total Bacteria (colonies/100 ml)	% Human Bacteria	Flow (cfs)
4/7/2010	86	<100	9890	N/A	1.858
4/8/2010	262	196	2320	8.45	4.040
4/15/2010	30	<100	7100	N/A	1.417
6/28/2010	359	7370	7370	100.00	1.390

Table B.24 BST Site 5 (latitude 37.404055, longitude -85.816818)

Date	E. coli (colonies/100 ml)	Human Bacteria (colonies/100 ml)	Total Bacteria (colonies/100 ml)	% Human Bacteria	Flow (cfs)
4/7/2010	197	1000	8080	12.38	2.598
4/8/2010	738	739	7880	9.38	2.967
4/15/2010	96	<100	6100	N/A	2.211
6/28/2010	583	53253	56578	94.12	0.768

Table B.25 BST Site 5A (latitude 37.384417, longitude -85.803233)

Date	E. coli (colonies/100 ml)	Human Bacteria (colonies/100 ml)	Total Bacteria (colonies/100 ml)	% Human Bacteria	Flow (cfs)
4/7/2010	420	<100	10300	N/A	5.112
4/8/2010	3255	<100	11200	N/A	
4/15/2010	327	<100	13100	N/A	
6/28/2010	3076	2139	17658	12.11	0.257

Note: This site is not on an assessed segment, therefore it is not used in TMDL development.

Table B.26 BST Site 5B (latitude 37.376833, longitude -85.805383)

Date	E. coli (colonies/100 ml)	Human Bacteria (colonies/100 ml)	Total Bacteria (colonies/100 ml)	% Human Bacteria	Flow (cfs)
4/7/2010	158	<100	4090	N/A	0.024
4/8/2010	2755	<100	4680	N/A	0.150
4/15/2010	73	<100	9800	N/A	0.788
6/28/2010[1]	3255	5164	8536	60.50	

Note: [1]The June sample was collected when the stream was not flowing. Because none of the samples associated with this site passed the data validation process, it is not presented in the summary tables in Section 4 nor is it shown on maps.

Table B.27 BST Site 6 (latitude 37.403991, longitude -85.817089)

Date	E. coli (colonies/100 ml)	Human Bacteria (colonies/100 ml)	Total Bacteria (colonies/100 ml)	% Human Bacteria	Flow (cfs)
4/7/2010	256	1220	91400	1.33	27.570
4/8/2010	650	281	12200	2.30	28.336
4/15/2010	135	<100	104000	N/A	39.305
6/28/2010	350	6174	84511	7.31	6.954

B.5 TMDL Sample Data

Table B.28 TMDL Field Blanks (for sites 1 through 6 only)

Date	Fecal coliform (colonies/100ml)	E. coli (colonies/100 ml)
5/8/2007	<2	
6/27/2007	<1	
7/10/2007	<1	
8/16/2007	<2	
9/14/2007	182	
10/12/2007	<2	

Table B.29 TMDL Site DOW03025006 (latitude 37.35691, longitude -86.04155)

Date	E. coli (colonies/100 ml)	Flow (cfs)
5/17/07	101	
5/22/07	101	6.500
6/13/07	156	2.758
6/26/07	1095	1.823
7/11/07	888	2.569
7/20/07	650	1.996
8/9/07	359	0.529
8/23/07	85	0.748
9/6/07	121	1.241
9/26/07	211	0.507
10/23/07	>24196	9.573
10/30/07	336	17.640

Table B.30 TMDL Site DOW03025007 (latitude 37.34916, longitude -86.01263)

Date	E. coli (colonies/100 ml)	Flow (cfs)
5/22/07	131	10.619
6/13/07	88	3.144
6/26/07	197	2.211
7/11/07	602	2.115
7/20/07	683	1.899
8/9/07	187	0.590
8/23/07	86	0.658
9/6/07	156	0.044
9/26/07	201	0.734
9/26/07	199	
10/23/07	5794	57.902
10/30/08	389	18.363

Table B.31 TMDL Site DOW03025008 (latitude 37.34823, longitude -85.96616)

Date	E. coli (colonies/100 ml)	Flow (cfs)
5/17/07	147	
5/22/07	161	0.048

Note: This site is not on an assessed segment, therefore it is not used in TMDL development.

Table B.32 Site TMDL DOW03025009 (latitude 37.34968, longitude -85.96532)

Date	E. coli (colonies/100 ml)	Flow (cfs)
5/17/07	86	
5/22/07	84	24.528
6/13/07	236	15.194
6/26/07	211	13.549
7/11/07	305	13.498
7/20/07	309	11.647
8/9/07	213	7.543
8/23/07	279	2.002
8/23/07	265	
9/6/07	175	5.557
9/26/07	201	5.574
10/23/07	17329	25.890
10/30/07	546	22.314

Table B.33 TMDL Site DOW030250012 (latitude 37.38318, longitude -85.92691)

Date	E. coli (colonies/100 ml)	Flow (cfs)
5/17/07	150	
5/22/07	186	20.288
6/13/07	222	10.134
6/26/07	523	8.816
7/11/07	313	13.258
7/20/07	860	8.004
7/20/07	624	8.226
8/9/07	241	5.082
8/23/07	63	4.941
9/6/07	295	4.359
9/26/07	767	4.506
10/23/07	9804	
10/30/07	399	17.453

Table B.34 TMDL Site DOW030250014 (latitude 37.37265, longitude -85.90265)

Collection Date	E. coli (colonies/100 ml)	Flow (cfs)
5/17/07	96	
6/12/07	774	0.142
6/26/07	870	0.257
7/11/07	1956	0.250
7/11/07	2481	
7/20/07	2359	0.141
8/9/07	573	0.036
10/23/07	4611	1.236
10/30/07	784	0.113
10/30/07	1222	0.177

Table B.35 TMDL Site DOW030250016 (latitude 37.38037, longitude -85.88449)

Date	E. coli (colonies/100 ml)	Flow (cfs)
5/22/07	96	17.417
6/13/07	130	9.221
6/26/07	358	8.895
7/11/07	350	7.636
7/20/07	301	7.780
8/9/07	74	2.536
8/23/07	63	4.145
9/6/07	41	3.651
9/26/07	175	4.218
10/23/07	24196	19.220
10/30/07	369	14.049

Table B.36 TMDL Site DOW030250017 (latitude 37.40182, longitude -85.85226)

Date	E. coli (colonies/100 ml)	Flow (cfs)
5/17/07	249	
5/22/07	120	13.571
5/22/07	138	
6/13/07	160	7.598
6/26/07	321	5.774
7/11/07	556	6.282
7/20/07	408	6.685
8/9/07	331	3.323
8/23/07	171	3.693
9/6/07	122	5.144
9/6/07	134	
9/26/07	657	3.843
10/23/07	>24196	6.431
10/23/07	>24196	
10/30/07	521	5.965

Table B.37 TMDL Site 1 (latitude 37.416376, longitude -85.801261)

Date	Fecal coliform (colonies/100ml)
5/8/2007	1180
6/27/2007	960
7/10/2007	443
8/16/2007	560
9/14/2007	333
10/12/2007	200

Table B.38 TMDL Site 2 (latitude 37.412159, longitude -85.794525)

Date	Fecal coliform (colonies/100ml)
5/8/2007	279
6/27/2007	520
7/10/2007	880
8/16/2007	361
9/14/2007	152
10/12/2007	200

Table B.39 TMDL Site 3 (latitude 37.414858, longitude -85.798517)

Date	Fecal coliform (colonies/100ml)
5/8/2007	573
6/27/2007	1040
7/10/2007	520
8/16/2007	246
9/14/2007	76
10/12/2007	200

Table B.40 TMDL Site 4 (latitude 37.415939, longitude -85.801671)

Date	Fecal coliform (colonies/100ml)
8/16/2007	480
5/8/2007	1377
6/27/2007	700
7/10/2007	460
10/12/2007	100
9/14/2007	227

Table B.41 TMDL Site 5 (latitude 37.404055, longitude -85.816818)

Date	Fecal coliform (colonies/100ml)
5/8/2007	1492
6/27/2007	2400
7/10/2007	25000
8/16/2007	12000
9/14/2007	333
10/12/2007	100

Table B.42 TMDL Site 6 (latitude 37.403991, longitude -85.817089)

Date	Fecal coliform (colonies/100ml)
5/8/2007	787
6/27/2007	311
7/10/2007	1040
8/16/2007	600
9/14/2007	379
10/12/2007	250

Appendix C. Discharge Monitoring Report Data for Spring Park MHP

Table C.1 displays the DMR data for Spring Park MHP for the quarters ending March 2005 through June 2010. A red highlight indicates an exceedance of the WQC.

Table C.1 Spring Park MHP DMR Information

Monitoring Period End Date	Maximum Concentration (E. coli colonies/100 ml: the 7-Day Geometric Average Maximum is 240 colonies/100 ml)	Average Concentration (E. coli colonies/100 ml: the 30-Day Geomean Maximum is 130 colonies/100 ml)
6/30/2010	113	113
3/31/2010	8000	8000
12/31/2009	4000	89
9/30/2009	4000	4000
6/30/2009	1150	48
3/31/2009	3500	3500
12/31/2008	59	59
9/30/2008	13	13
6/30/2008	21	21
3/31/2008	1200	1200
12/31/2007	7	7
9/30/2007	50	50
Monitoring Period End Date	Maximum Concentration (Fecal coliform colonies/100 ml: the 7-Day Geometric Average Maximum is 400 colonies/100 ml)	Average Concentration (Fecal coliform colonies/100 ml: the 30-Day Geomean Maximum is 200 colonies/100 ml)
6/30/2007	>600	>600
3/31/2007	>600	>600
12/31/2006	170	170
9/30/2006	>600	>600
6/30/2006	>600	>600
3/31/2006	>600	>600
12/31/2005	<10	<10
9/30/2005	<10	<10
6/30/2005	>600	>600
3/31/2005	360	360

Appendix D. Site Specific TMDLs

Data collection and analysis from various sources (including Federal, State and local government and public entities) was carried out for each stream site and its associated drainage area. Most of the data collected for the development of this appendix can be accessed and downloaded from the KYGEONET (http://kygeonet.ky.gov/kyhydro/main.htm). In this appendix, descriptions of each subwatershed above a sample site are presented along with tables of land cover, general subwatershed information, sample data, instantaneous and unit area loads, and site-specificTMDL allocations. The unit area load information should be used with caution because the acreage for the subwatershed above each site is based upon the surface water boundary, not on the actual contributing area. Note that the site specific TMDLs do not set TMDLs for impaired segments, which are presented in Section 8. For all sample data tables, a red highlight indicates an exceedance of the instantaneous WQS (240 E. coli or 400 fecal coliform colonies/100 ml). The land cover table for each segment includes the percentage used to calculate the Future Growth WLA. The Waterbody Identification Number (WBID) is included in the table of general information about the impaired segment. This number is a unique identifier assigned to all assessed waters in KY.

The TMDL tables include KPDES-permitted source information and TMDL allocations and can be interpreted as follows:

> The columns with the blue highlight indicate the TMDL allocations. The rows with green highlight indicate KPDES permit information and the design capacity (in cfs) that feeds into the WLA calculation for each KPDES-permitted source. The WLA (in blue) for a particular KPDES-permitted source is on the same row as the information for the KPDES-permitted source (in green). The purple highlight indicates the sum of KPDES flow inputs that were added to the MAF.

D.1 Site DOW03025006 (06)

Bacon Creek at site DOW03025006 (site 06) is a fourth order stream located in Hart County (Figure D.1). Information about site 06 including MAF is shown in Table D.1. The subwatershed above site 06 has a catchment of 56,926 acres (89 square miles) with a 60% forested, 31.3 % agricultural, and 4.5 % developed land cover (Table D.2).

This subwatershed is sewered in the area around and south of Bonnieville (see Figure 5.3). It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site 06 is presented in Table D.3, while the TMDL allocations are in Table D.4.

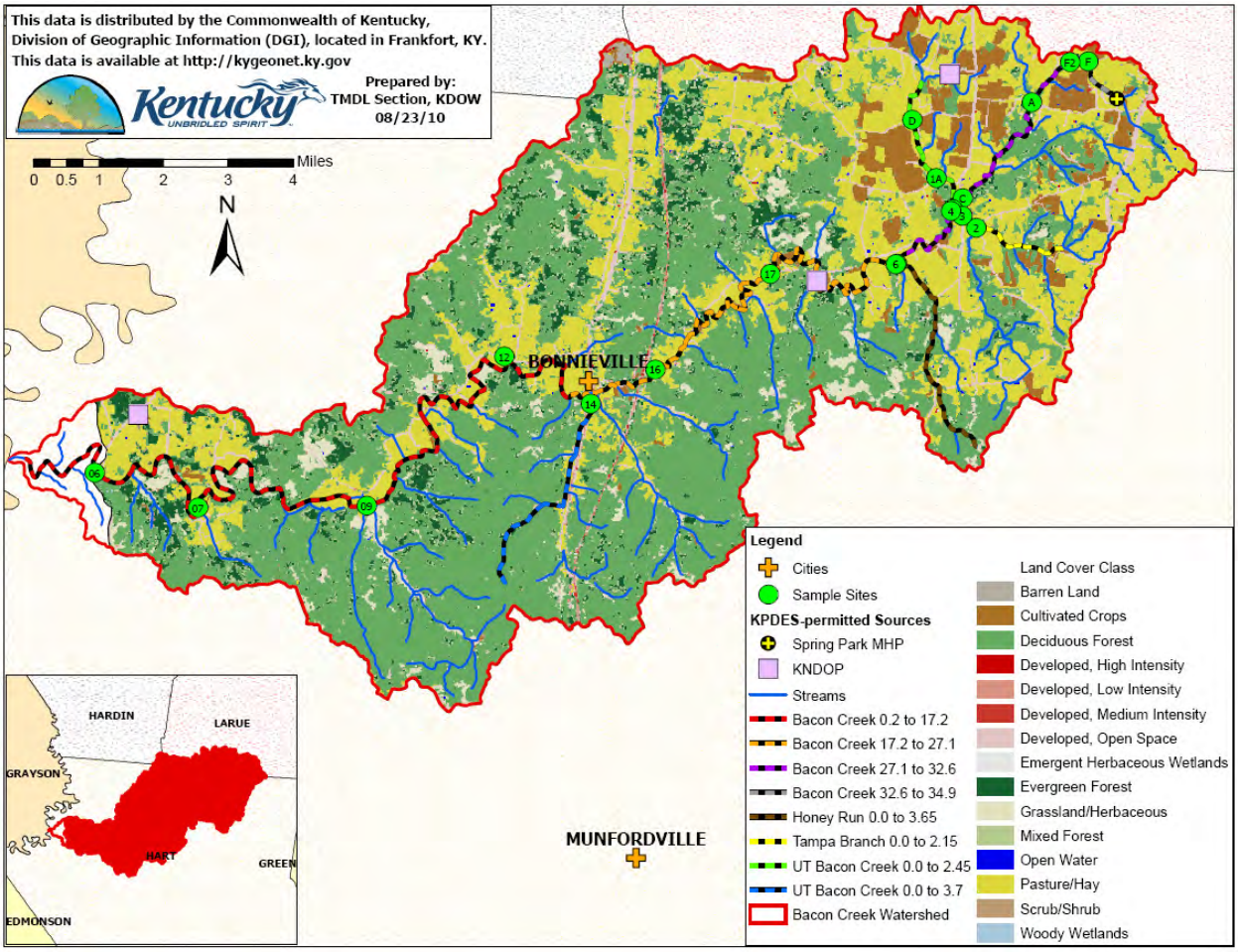

Figure D.1 Subwatershed above Site 06

Note: Site 1 is under site 4 while site 5 is under site 6.

Table D.1 Site 06 Subwatershed Information

Site #	Map #	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
DOW03025006	06	2.55	37.3569	-86.04155	2.55	111.4	0.00774	111.4077

Table D.2 Site 06 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	62.86	0.10	0.11	
Developed	2551.26	3.99	4.48	0.50
Barren Land	82.48	0.13	0.14	
Forest/ Shrubland	34135.79	53.34	59.96	
Grassland/Herbaceous	2256.79	3.53	3.96	
Pasture/ Hay	15054.08	23.52	26.44	
Cultivated Crops	2747.87	4.29	4.83	
Wetlands	35.22	0.06	0.06	
Total	56926.34	88.95	100.00	

Table D.3 Site 06 Data

site 06				
Collection Date	E. coli (colonies/100 ml)	Flow (cfs)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/day/acre)
05/17/07	101			
05/22/07	101	6.500	16.06	0.28
06/13/07	156	2.758	10.53	0.18
06/26/07	1095	1.823	48.84	0.86
07/11/07	888	2.569	55.81	0.98
07/20/07	650	1.996	31.74	0.56
08/09/07	359	0.529	4.65	0.08
08/23/07	85	0.748	1.56	0.03
09/06/07	121	1.241	3.67	0.06
09/26/07	211	0.507	2.62	0.05
10/23/07	>24196	9.573	5666.96	99.55
10/30/07	336	17.640	145.01	2.55
Greatest Concentration (E. coli colonies/ 100 ml)	24196			

Table D.4 Site 06 TMDL

TMDL Table					E. coli (billion colonies/ day)	
					65950.4263	Existing Load
					654.1619	**Total TMDL**
					65.4162	**MOS**
					588.7457	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	99.11	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	588.7003	remainder
					2.9435	**Future Growth WLA**[(1)]
75043	KYG200003	Hardin County Fiscal Court	Government-County Agency/ Organization	N/A[(2)] stormwater	**0.0000**	**MS4 WLA**
					585.7568	**LA**

Notes: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[(2)]N/A indicates that the permit is for stormwater and a design capacity does not apply.

D.2 Site DOW03025007 (07)

Bacon Creek at site DOW03025007 (site 07) is a fourth order stream located in Hart County (Figure D.2). Information about site 07 including MAF is shown in Table D.5. The subwatershed above site 07 has a catchment of 54,373 acres (85 square miles) with a 60% forested, 31.2 % agricultural, and 4.5 % developed land cover (Table D.6).

This subwatershed is sewered in the area around and south of Bonnieville (see Figure 5.3). It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site 07 is presented in Table D.7, while the TMDL allocations are in Table D.8.

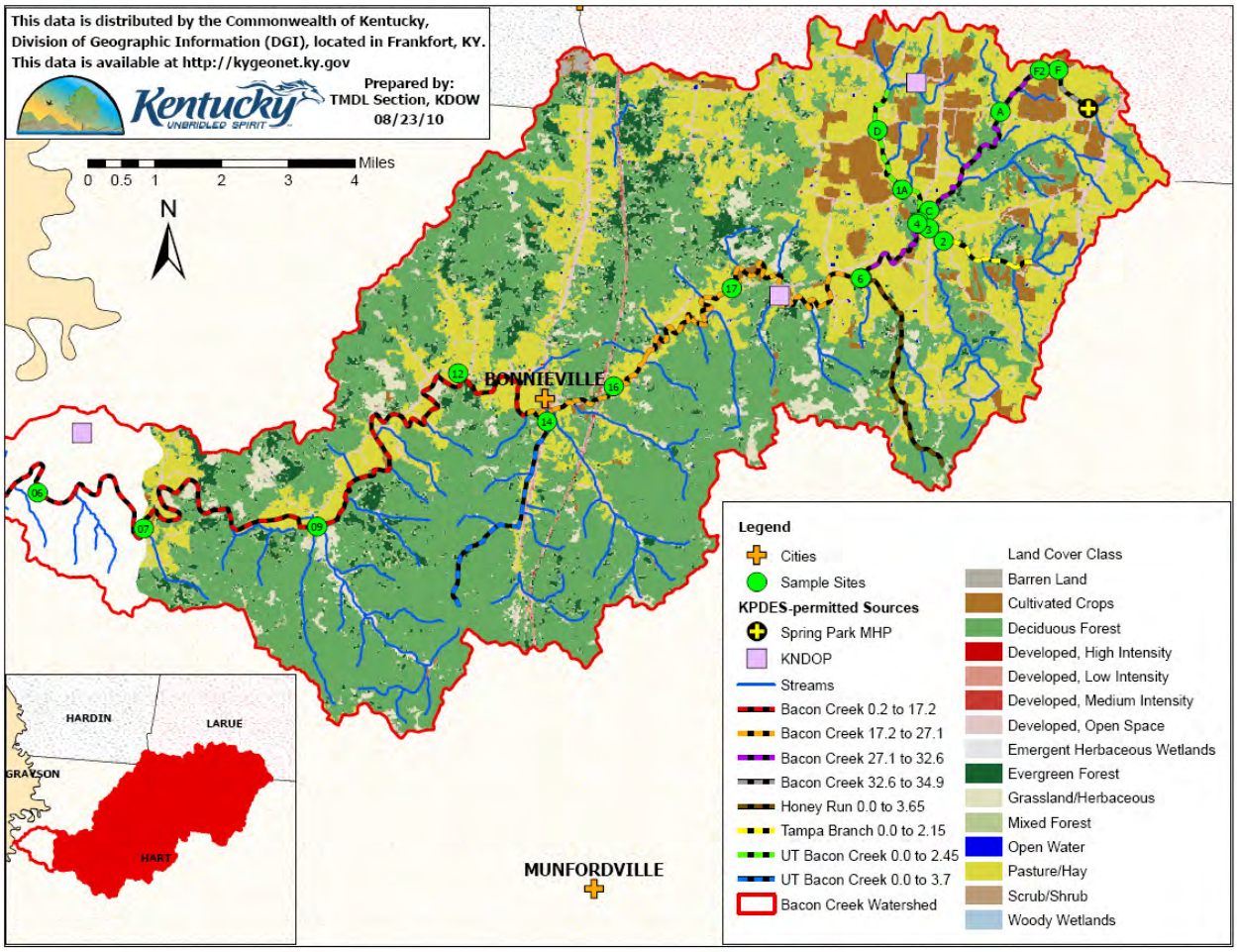

Figure D.2 Subwatershed above Site 07

Note: Site 1 is under site 4 while site 5 is under site 6.

Table D.5 Site 07 Subwatershed Information

Site Number	Map Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
DOW03025007	07	5.35	37.34916	-86.01263	5.35	106.8	0.00774	106.8077

Table D.6 Site 07 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	62.348	0.099	0.11	
Developed	2469.64	3.859	4.54	0.5
Barren Land	81.72	0.128	0.15	
Forest/Shrubland	32675.55	51.056	60.09	
Grassland/Herbaceous	2110.470	3.298	3.88	
Pasture/Hay	14227.08	22.230	26.17	
Cultivated Crops	2717.69	4.246	5.00	
Wetlands	28.95	0.045	0.05	
Total	54373.45	84.96	100.00	

Table D.7 Site 07 Data

Site 07				
Collection Date	E. coli (colonies/100 ml)	Flow (cfs)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/day/acre)
05/22/07	131	10.619	34.03	0.63
06/13/07	88	3.144	6.77	0.12
06/26/07	197	2.211	10.66	0.20
07/11/07	602	2.115	31.15	0.57
07/20/07	683	1.899	31.73	0.58
08/09/07	187	0.590	2.70	0.05
08/23/07	86	0.658	1.38	0.03
09/06/07	156	0.044	0.17	0.00
09/26/07	201	0.734	3.61	0.07
09/26/07	199		0.00	0.00
10/23/07	5794	57.902	8207.88	150.95
10/30/08	389	18.363	174.76	3.21
Greatest Concentration (E. coli colonies/ 100 ml)	5794			

Table D.8 TMDL for Site 07

TMDL Table					E. coli (billion colonies/day)	
					15140.4883	Existing Load
					627.1517	**Total TMDL**
					62.7152	**MOS**
					564.4366	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	96.27	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	564.3911	remainder
					2.8220	**Future Growth WLA**[(1)]
75043	KYG200003	Hardin County Fiscal Court	Government-County Agency/ Organization	N/A[(2)] stormwater	**0.0000**	**MS4 WLA**
					561.5692	**LA**

Notes: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[(2)]N/A indicates that the permit is for stormwater and a design capacity does not apply.

D.3 Site DOW03025009 (09)

Bacon Creek at site DOW03025009 (site 09) is a fourth order stream located in Hart County (Figure D.3). Information about site 09 including MAF is shown in Table D.9. The subwatershed above site 09 has a catchment of 49,305 acres (77 square miles) with a 59% forested, 32.7 % agricultural, and 4.8 % developed land cover (Table D.10).

This subwatershed is sewered in the area around and south of Bonnieville (see Figure 5.3). It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site 09 is presented in Table D.11, while the TMDL allocations are in Table D.12.

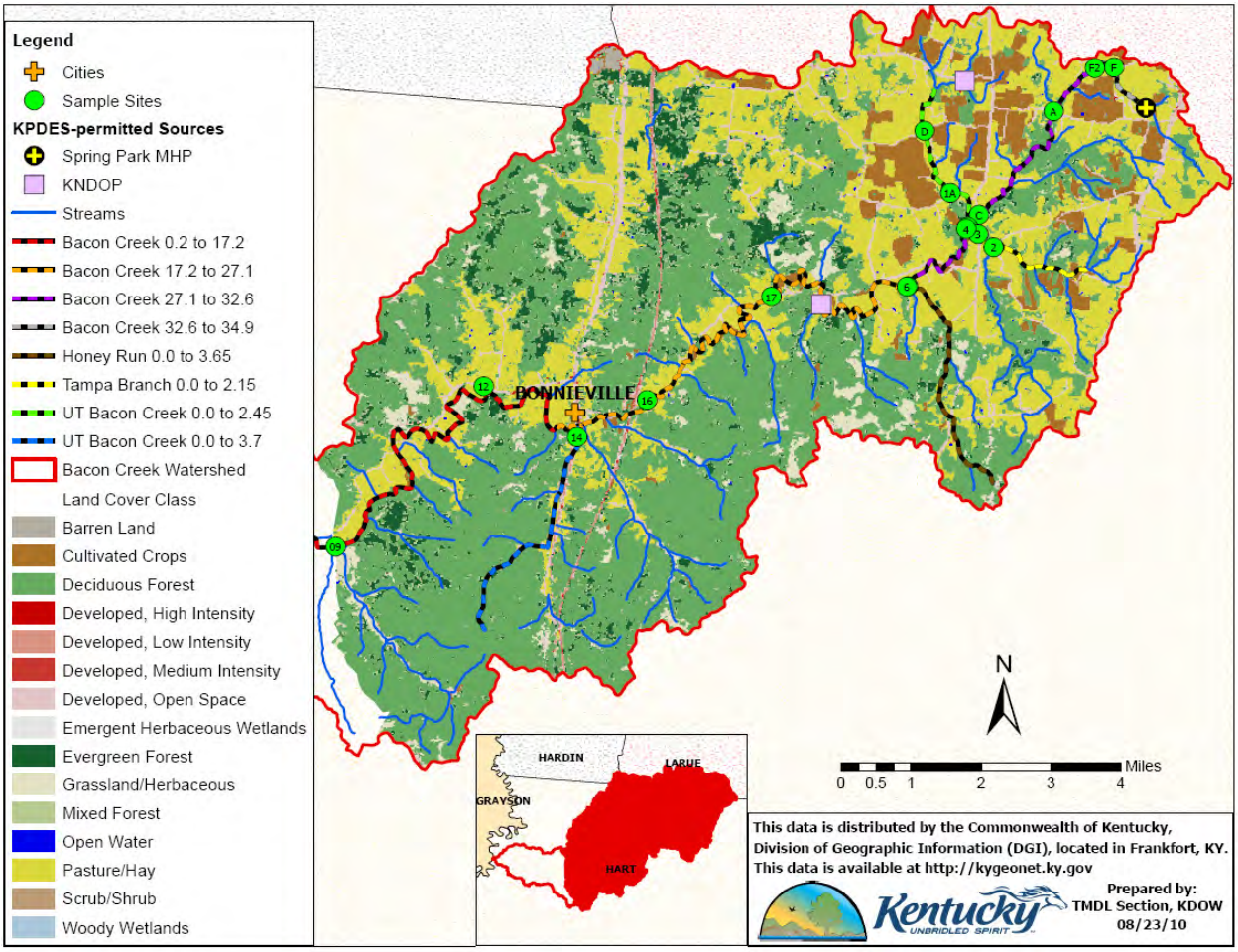

Figure D.3 Subwatershed above Site 09

Note: Site 1 is under site 4 while site 5 is under site 6.

Table D.9 Site 09 Subwatershed Information

Site Number	Map Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
DOW03025009	09	10.1	37.34968	-85.96532	10.1	96.9	0.00774	96.9077

Table D.10 Site 09 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	60.167	0.099	0.12	
Developed	2366.56	3.698	4.80	0.5
Barren Land	80.00	0.125	0.16	
Forest/Shrubland	28849.13	45.077	58.51	
Grassland/Herbaceous	1791.191	2.799	3.63	
Pasture/Hay	13435.71	20.993	27.25	
Cultivated Crops	2697.93	4.216	5.47	
Wetlands	24.51	0.038	0.05	
Total	49305.21	77.04	100.00	

Table D.11 Site 09 Data

Site 09				
Collection Date	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/day/acre)
05/17/07	86			
05/22/07	84	24.528	50.41	1.02
06/13/07	236	15.194	87.73	1.78
06/26/07	211	13.549	69.94	1.42
07/11/07	305	13.498	100.72	2.04
07/20/07	309	11.647	88.05	1.79
08/09/07	213	7.543	39.31	0.80
08/23/07	279	2.002	13.67	0.28
09/06/07	175	5.557	23.79	0.48
09/26/07	201	5.574	27.41	0.56
10/23/07	17329			
10/30/07	546	22.314	298.08	6.05
Greatest Concentration (E. coli colonies/ 100 ml)	17329			

Table D.12 TMDL for Site 09

TMDL Table					E. coli (billion colonies/day)	
					41085.6944	Existing Load
					569.0211	**Total TMDL**
					56.9021	**MOS**
					512.1190	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	98.75	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**KPDES WLA**
			Addition to MAF (sum of cfs)	0.0077	512.0736	remainder
					2.5604	**Future Growth WLA**[(1)]
75043	KYG200003	Hardin County Fiscal Court	Government-County Agency/ Organization	N/A[(2)] stormwater	**0.0000**	**MS4 WLA**
					509.5132	**LA**

Notes: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[(2)]N/A indicates that the permit is for stormwater and a design capacity does not apply.

D.4 Site DOW03025012 (12)

Bacon Creek at site DOW03025012 (site 12) is a fourth order stream located in Hart County (Figure D.4). Information about site 12 including MAF is shown in Table D.13. The subwatershed above site 12 has a catchment of 39,657 acres (62 square miles) with a 54% forested, 37.4% agricultural, and 5.4 % developed land cover (Table D.14).

This subwatershed is sewered in the area around and south of Bonnieville (see Figure 5.3). It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site 12 is presented in Table D.15, while the TMDL allocations are in Table D.16.

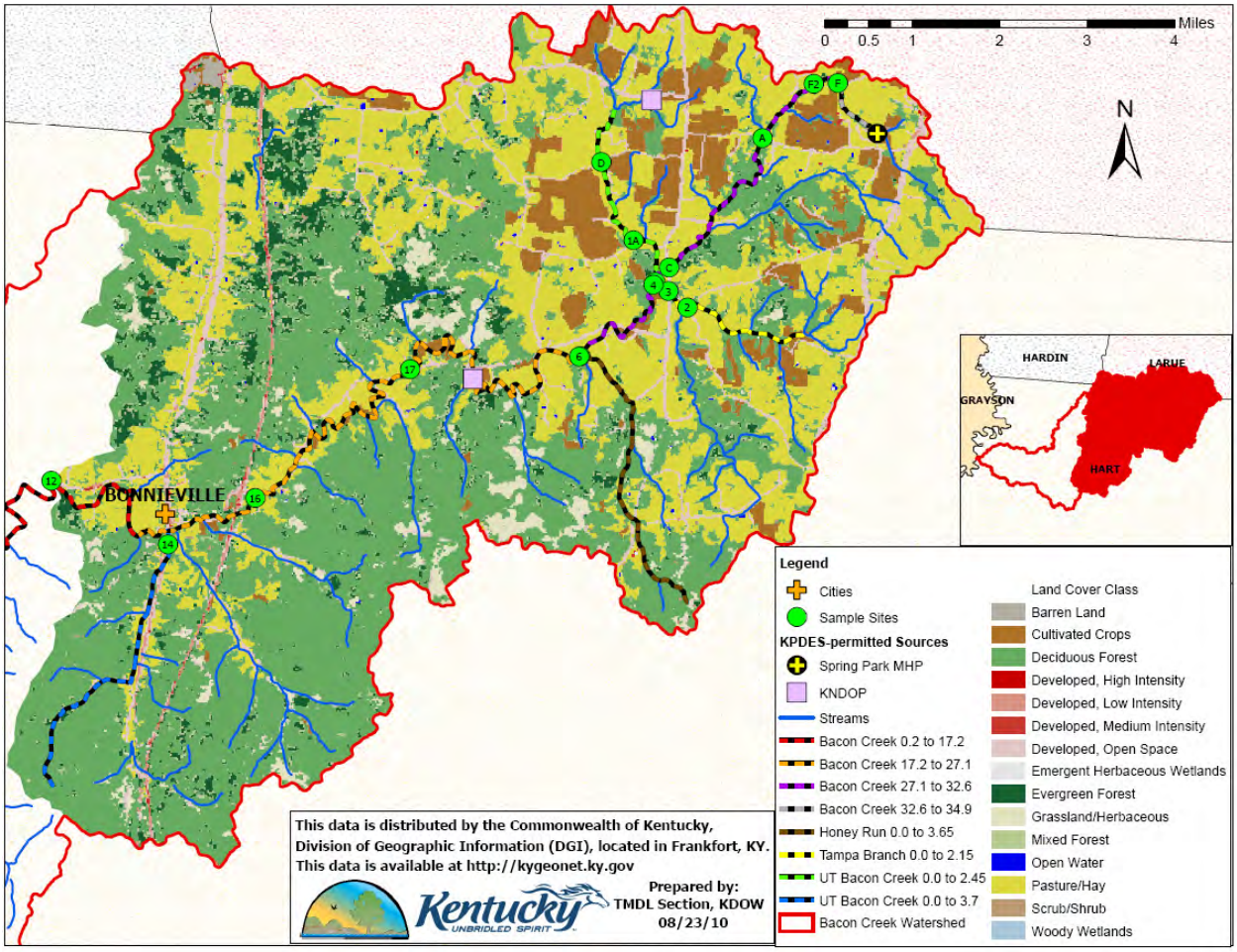

Figure D.4 Subwatershed above Site 12

Note: Site 1 is under site 4 while site 5 is under site 6.

Table D.13 Site 12 Subwatershed Information

Site Number	Map Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
DOW03025012	12	15.5	37.38318	-85.92691	15.5	77.2	0.00774	77.2077

Table D.14 Site 12 Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	52.812	0.083	0.13	
Developed	2132.97	3.333	5.38	1.0
Barren Land	75.76	0.118	0.19	
Forest/Shrubland	21318.81	33.311	53.76	
Grassland/Herbaceous	1247.874	1.950	3.15	
Pasture/Hay	12130.89	18.955	30.59	
Cultivated Crops	2679.59	4.187	6.76	
Wetlands	18.50	0.029	0.05	
Total	39657.20	61.96	100.00	

Table D.15 Site 12 Data

Site12				
Collection Date	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/day/acre)
05/17/07	150			
05/22/07	186	20.288	92.32	2.33
06/13/07	222	10.134	55.04	1.39
06/26/07	523	8.816	112.81	2.84
07/11/07	313	13.258	101.53	2.56
07/20/07	860	8.004	168.41	4.25
08/09/07	241	5.082	29.96	0.76
08/23/07	63	4.941	7.62	0.19
09/06/07	295	4.359	31.46	0.79
09/26/07	767	4.506	84.56	2.13
10/23/07	9804		0.00	0.00
10/30/07	399	17.453	170.37	4.30
Greatest Concentration (E. coli colonies/ 100 ml)	9804			

Table D.16 TMDL for Site 12

TMDL Table					E. coli (billion colonies/day)	
					18519.2248	Existing Load
					453.3470	**Total TMDL**
					45.3347	**MOS**
					408.0123	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	97.80	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	407.9669	remainder
					4.0797	**Future Growth WLA**[(1)]
75043	KYG200003	Hardin County Fiscal Court	Government-County Agency/ Organization	N/A[(2)] stormwater	**0.0000**	**MS4 WLA**
					403.8872	**LA**

Notes: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[(2)]N/A indicates that the permit is for stormwater and a design capacity does not apply.

D.5 Site DOW03025014 (14)

KDOW considers a site to be coterminous with the end of a segment if the MAF is the same, there is 1% or less of a difference in area between the two subwatersheds defined by the end of the segment and the sampling site, and there are no SWS discharges or MS4 entities between the site and the end of the segment. Thus, site 14 is coterminous with stream segment UT Bacon Creek RM 0.0 to 3.7 and subwatershed information and TMDL allocations can be found in Section 8.2.8. Sampling data, instantaneous load, and unit area load from site 14 is presented in Table D.17.

Table D.17 Site 14 Data

site 14				
Collection Date	E. coli (colonies/100ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal Coliform colonies/day)
05/17/07	96			
06/12/07	774	0.142	2.69	0.72
06/26/07	870	0.257	5.47	1.46
07/11/07	1956			
07/20/07	2359	0.141	8.14	2.17
08/09/07	573	0.036	0.50	0.13
10/23/07	4611	1.236	139.44	37.17
10/30/07	784	0.113	2.17	0.58
Greatest Concentration (E. coli colonies/ 100 ml)	4611			

D.6 Site DOW03025016 (16)

Bacon Creek at site DOW03025016 (site 16) is a fourth order stream located in Hart County (Figure D.5). Information about site 16 including MAF is shown in Table D.18. The subwatershed above site 16 has a catchment of 24,903 acres (39 square miles) with a 43% forested, 48.6 % agricultural, and 5.2 % developed land cover (Table D.19).

This subwatershed is un-sewered. It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site 16 is presented in Table D.20, while the TMDL allocations are in Table D.21.

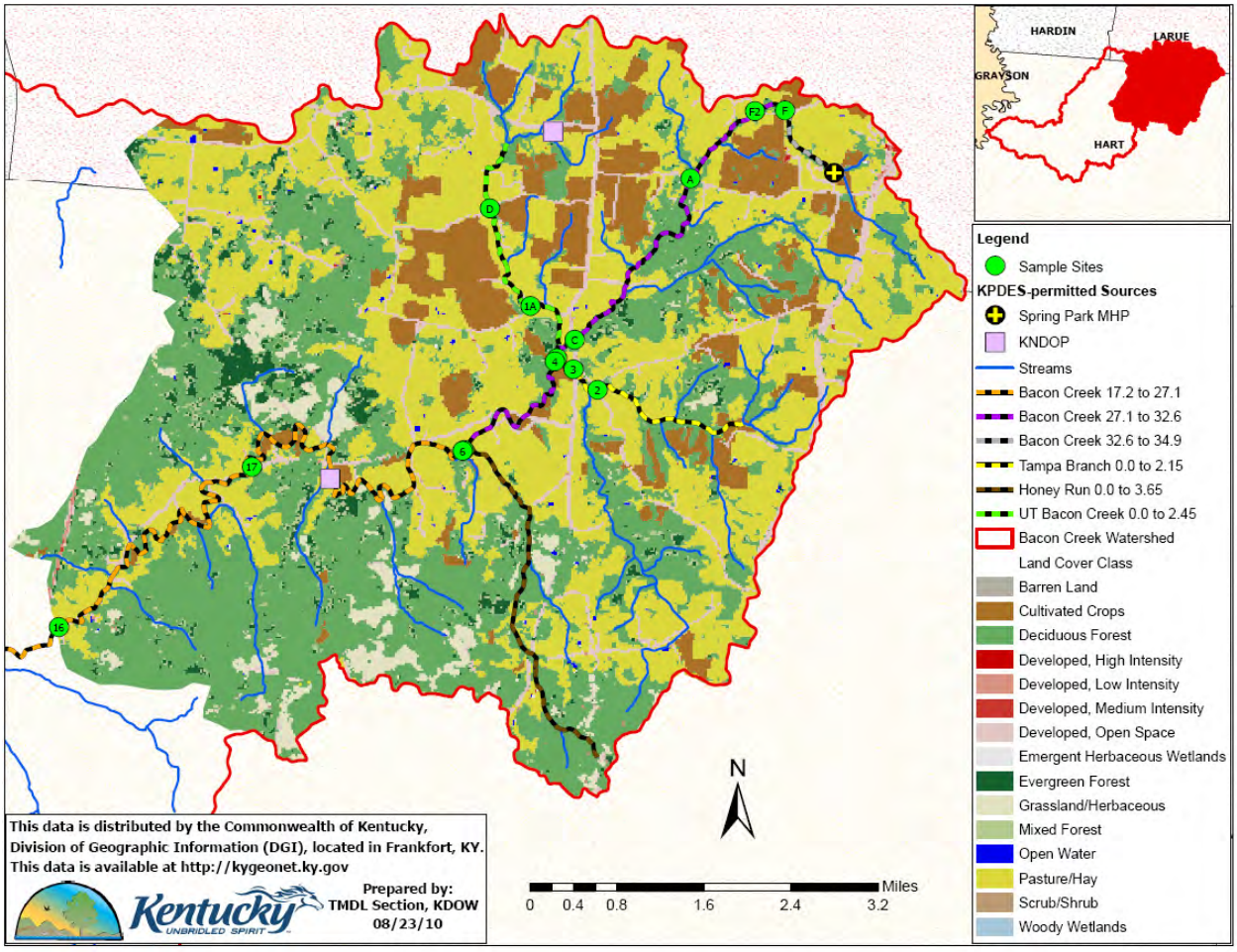

Figure D.5 Subwatershed above Site 16

Note: Site 1 is under site 4 while site 5 is under site 6.

Table D.18 Site 16 Subwatershed Information

Site Number	Map Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
DOW03025016	16	19.05	37.38037	-85.88449	19.05	47.7	0.00774	47.7077

Table D.19 Site 16 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	45.922	0.072	0.18	
Developed	1291.39	2.018	5.19	1.0
Barren Land	6.24	0.010	0.03	
Forest/Shrubland	10586.12	16.541	42.51	
Grassland/Herbaceous	868.504	1.357	3.49	
Pasture/Hay	9497.15	14.839	38.14	
Cultivated Crops	2597.26	4.058	10.43	
Wetlands	10.48	0.016	0.04	
Total	24903.06	38.91	100.00	

Table D.20 Site 16 Data

site 16				
Collection Date	E. coli (colonies/100 ml)	Flow (cfs)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/day/acre)
05/22/07	96	17.417	40.91	1.64
06/13/07	130	9.221	29.33	1.18
06/26/07	358	8.895	77.91	3.13
07/11/07	350	7.636	65.39	2.63
07/20/07	301	7.780	57.29	2.30
08/09/07	74	2.536	4.59	0.18
08/23/07	63	4.145	6.39	0.26
09/06/07	41	3.651	3.66	0.15
09/26/07	175	4.218	18.06	0.73
10/23/07	24196			
10/30/07	369	14.049	126.83	5.09
Greatest Concentration (E. coli colonies/ 100 ml)	24196			

Table D.21 TMDL for Site 16

TMDL Table					E. coli (billion colonies/day)	
					28241.7150	Existing Load
					280.1294	**Total TMDL**
					28.0129	**MOS**
					252.1165	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	99.11	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	252.0711	remainder
					2.5207	**Future Growth WLA**[(1)]
					249.5503	**LA**

Note: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.

D.7 Site DOW03025017 (17)

Bacon Creek at site DOW03025017 (site 17) is a fourth order stream located in Hart County (Figure D.6). Information about site 17 including MAF is shown in Table D.22. The subwatershed above site 17 has a catchment of 21,445 acres (33.5 square miles) with a 38% forested, 53.5 % agricultural, and 5.5 % developed land cover (Table D.23).

This subwatershed is un-sewered. It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site 17 is presented in Table D.24, while the TMDL allocations are in Table D.25.

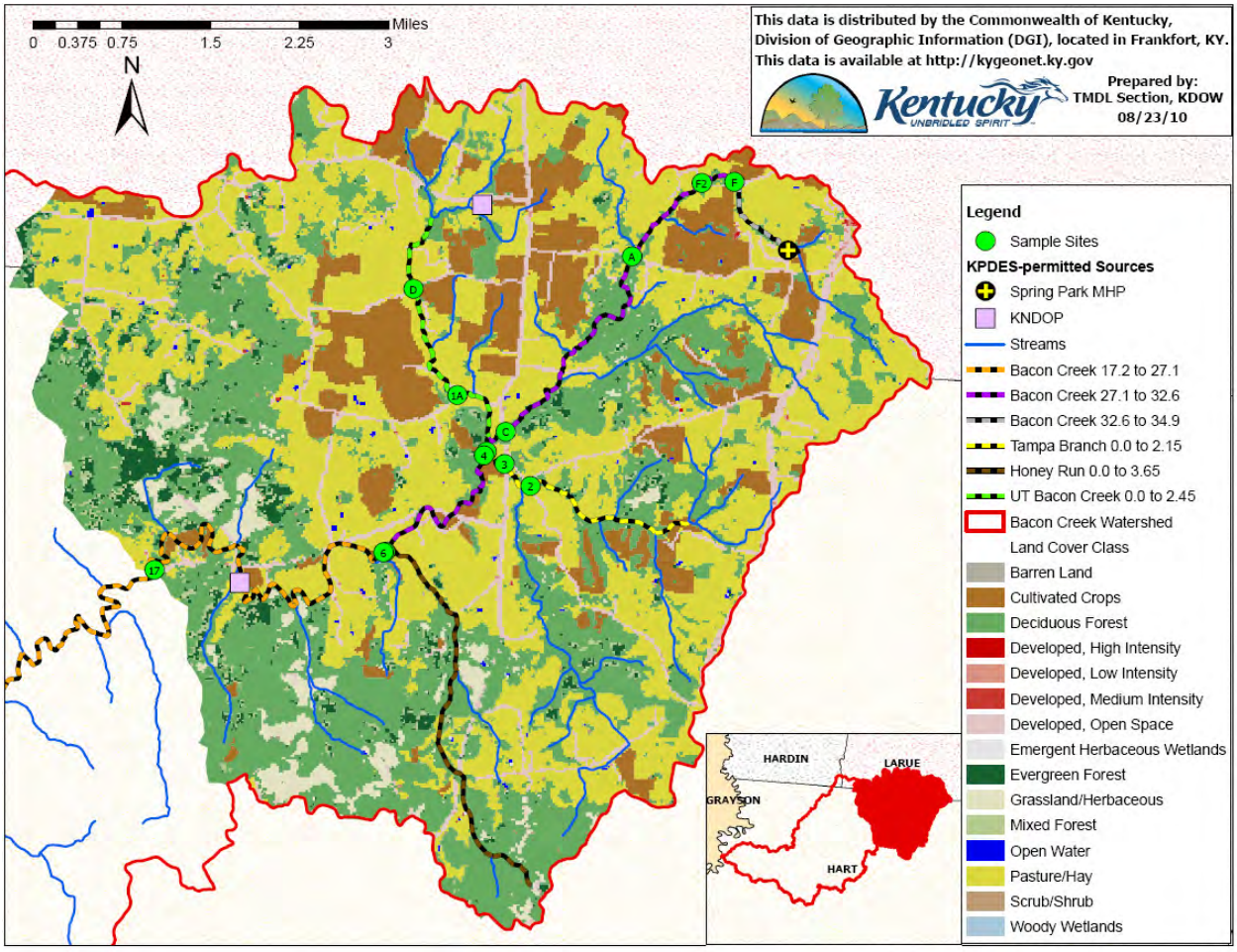

Figure D.6 Subwatershed above Site 17

Note: Site 1 is under site 4 while site 5 is under site 6.

Table D.22 Site 17 Subwatershed Information

Site Number	Map Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
DOW03025017	17	22.5	37.40182	-85.85226	22.5	40.6	0.00774	40.6077

Table D.23 Site 17 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	43.018	0.099	0.20	
Developed	1183.78	1.850	5.52	1.0
Barren Land	5.80	0.009	0.03	
Forest/Shrubland	8043.74	12.568	37.51	
Grassland/Herbaceous	692.972	1.083	3.23	
Pasture/Hay	8889.83	13.890	41.45	
Cultivated Crops	2577.08	4.027	12.02	
Wetlands	8.69	0.014	0.04	
Total	21444.91	33.54	100.00	

Table D.24 Site 17 Data

Site17				
Collection Date	E. coli (colonies/100 ml)	Flow (cfs)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/day/acre)
05/17/07	249			
05/22/07	120	13.571	39.84	1.86
06/13/07	160	7.598	29.74	1.39
06/26/07	321	5.774	45.35	2.11
07/11/07	556	6.282	85.45	3.98
07/20/07	408	6.685	66.73	3.11
08/09/07	331	3.323	26.91	1.25
08/23/07	171	3.693	15.45	0.72
09/06/07	122			
09/26/07	657	3.843	61.77	2.88
10/23/07	>24196			
10/30/07	521			
Greatest Concentration (E. coli colonies/100 ml)	24196			

Table D.25 TMDL for Site 17

TMDL Table					E. coli (billion colonies/day)	
					24038.7032	Existing Load
					238.4398	**Total TMDL**
					23.8440	**MOS**
					214.5958	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	99.11	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	214.5504	remainder
					2.1455	**Future Growth WLA**[(1)]
					212.4049	**LA**

Note: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.

D.8 Site 1

Bacon Creek at site 1 is a fourth order stream located in Hart County (Figure D.7). Information about site 1 including MAF is shown in Table D.26. The subwatershed above site 1 has a catchment of 7,512 acres (11.7 square miles) with a 23% forested, 69.5 % agricultural, and 7.2 % developed land cover (Table D.27).

This subwatershed is un-sewered. It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site 1 is presented in Table D.28, while the TMDL allocations are in Table D.29.

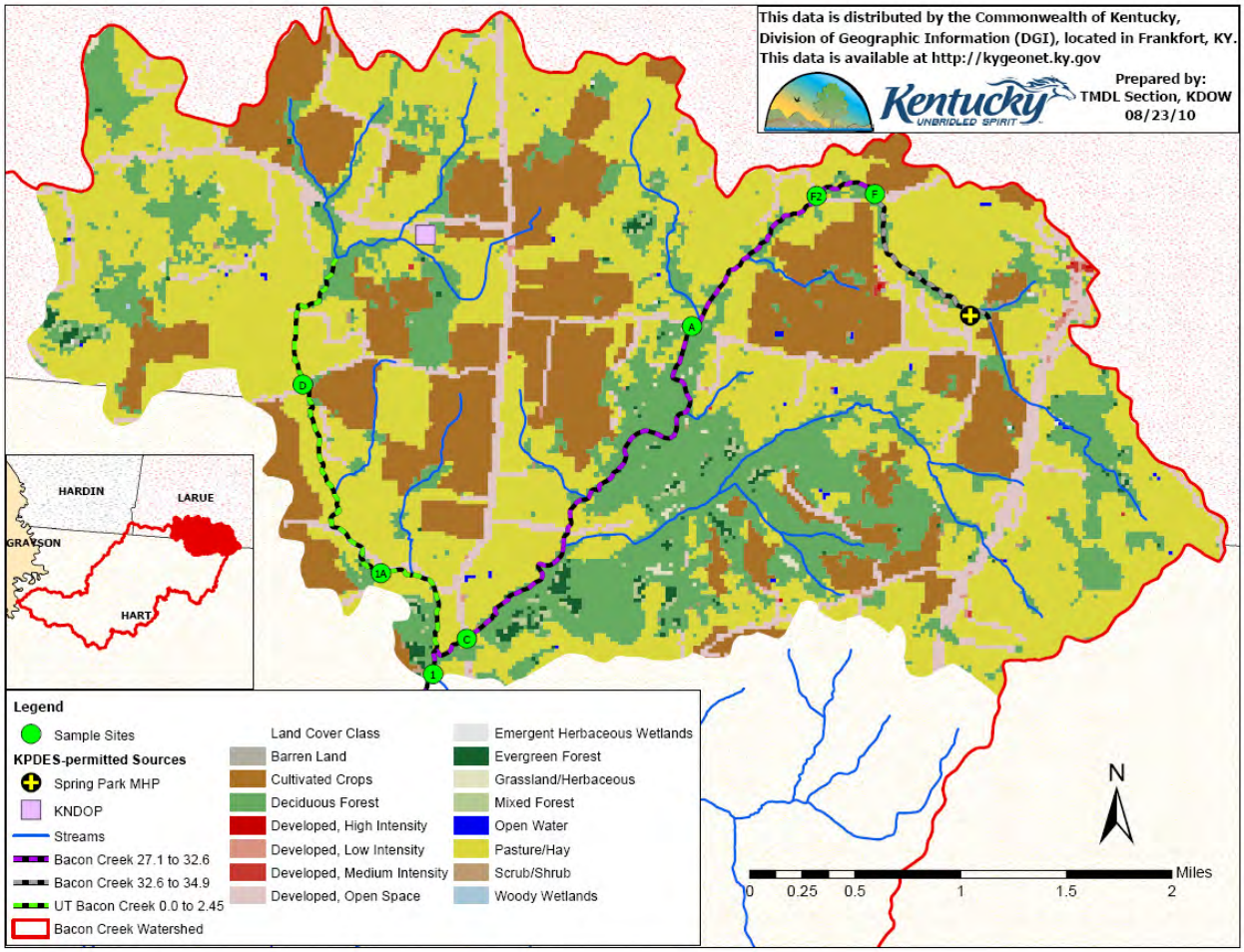

Figure D.7 Subwatershed above Site 1

Table D.26 Site 1 Subwatershed Information

Site #	Map Site #	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
1	1	28.8	37.416376	-85.801261	28.8	13.5	0.007736	13.5077

Table D.27 Site 1 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	9.616	0.015	0.13	
Developed	537.37	0.840	7.15	1.0
Barren Land	1.34	0.002	0.02	
Forest/Shrubland	1727.26	2.699	22.99	
Grassland/Herbaceous	14.983	0.023	0.20	
Pasture/Hay	3662.28	5.722	48.76	
Cultivated Crops	1556.64	2.432	20.72	
Wetlands	2.01	0.003	0.03	
Total	7511.50	11.74	100.00	

Table D.28 Site 1 Data

site 1							
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/ day/acre)
06/14/05	787	792*	8.29	159.60	21.25	160.60	21.38
07/12/05	8,333	8385*	5.91	1204.05	160.29	1211.63	161.30
08/09/05	1,818	1829*	3.65	162.25	21.60	163.27	21.74
09/13/05	656	660*	8.37	134.38	17.89	135.23	18.00
10/11/05	328	330*	2.76	22.15	2.95	22.29	2.97
05/10/06	3500	3522*	24.89	2131.53	283.77	2144.96	285.56
06/13/06	4100	4126*	20.63	2069.81	275.55	2082.85	277.29
08/08/06	1060	1067*	3.93	101.91	13.57	102.56	13.65
09/14/06	15000	15095*	15.83	5808.39	773.27	5844.99	778.14
10/12/06	540	543*	14.83	195.89	26.08	197.12	26.24
5/8/2007	1180	1187*					
6/27/2007	960	966*					
7/10/2007	443	446*					
8/16/2007	560	564*					
10/12/2007	200	201*					
6/28/2010		1,169	8.03			229.66	30.57
Greatest Concentration (E. coli colonies/100 ml)	15095*						

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table D.29 TMDL for Site 1

TMDL Table					E. coli (billion colonies/day)	
					4988.5504	Existing Load
					79.3145	**Total TMDL**
					7.9314	**MOS**
					71.3830	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	98.57	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	71.3376	remainder
					0.7134	**Future Growth WLA**[(1)]
					70.6242	**LA**

Note: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.

D.9 Site 2

Tampa Branch at site 2 is a third order stream located in Hart County (Figure D.8). Information about site 2 including MAF is shown in Table D.30. The subwatershed above site 2 has a catchment of 1,931 acres (3 square miles) with a 29% forested, 64.7 % agricultural, and 5.1 % developed land cover (Table D.31).

This subwatershed is un-sewered and contains no SWSs. Sampling data, instantaneous load, and unit area load from site 2 is presented in Table D.32, while the TMDL allocations are in Table D.33.

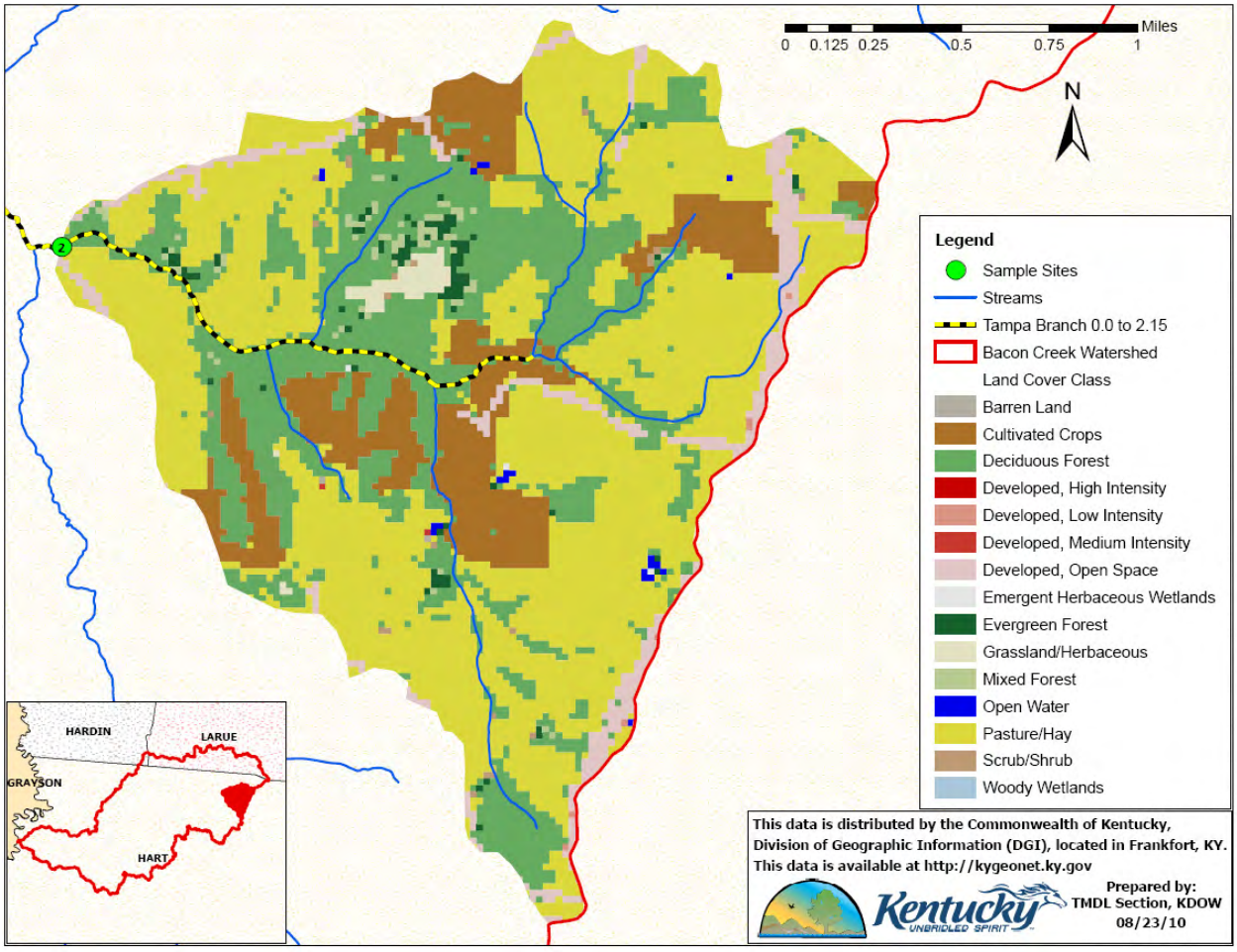

Figure D.8 Subwatershed above Site 2

Table D.30 Site 2 Subwatershed Information

Site #	Map Site #	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
2	2	0.55	37.412159	-85.794525	0.55	3.9	0	3.9

Table D.31 Site 2 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	4.914	0.008	0.25	
Developed	98.95	0.155	5.12	1.0
Barren Land	0.45	0.001	0.02	
Forest/Shrubland	559.97	0.875	28.99	
Grassland/Herbaceous	16.082	0.025	0.83	
Pasture/Hay	996.43	1.557	51.59	
Cultivated Crops	253.97	0.397	13.15	
Wetlands	0.67	0.001	0.03	
Total	1931.43	3.02	100.00	

Table D.32 Site 2 Data

site 2							
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/ day/acre)
05/24/05	155	156*	1.56	5.92	3.06	5.95	3.08
06/14/05	394	396*	1.10	10.60	5.49	10.66	5.52
07/12/05	313	315*	0.55	4.21	2.18	4.23	2.19
08/09/05	328	330*	0.29	2.31	1.19	2.32	1.20
09/13/05	50	50*	0.99	1.21	0.63	1.22	0.63
10/11/05	94	95*	0.48	1.10	0.57	1.11	0.57
05/10/06	2500	2516*	4.67	285.56	147.85	287.36	148.78
06/13/06	1636	1646*	2.27	90.97	47.10	91.55	47.40
08/08/06	720	725*	0.79	13.83	7.16	13.92	7.21
09/14/06	460	463*	0.68	7.62	3.95	7.67	3.97
10/12/06	114	115*	0.75	2.10	1.09	2.12	1.10
5/8/2007	279	281*					
6/27/2007	520	523*					
7/10/2007	880	886*					
8/16/2007	361	363*					
10/12/2007	200	201*					
6/28/2010		359	1.39			12.21	6.32
Greatest Concentration (E. coli colonies/100 ml)	2516*						

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table D.33 TMDL for Site 2

TMDL Table					E. coli (billion colonies/day)	
					240.0678	Existing Load
					22.8999	**Total TMDL**
					2.2900	**MOS**
					20.6100	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	91.41	% reduction
N/A[(2)]	N/A[(2)]	N/A[(2)]	N/A[(2)]	N/A[(2)]	**0.0000**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0000	20.6100	remainder
					0.2061	**Future Growth WLA[(1)]**
					20.4039	**LA**

Notes: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[(2)]N/A indicates that there is no SWS in the subwatershed, thus the information is not applicable.

D.10 Site 3

KDOW considers a site to be coterminous with the end of a segment if the MAF is the same, there is 1% or less of a difference in area between the two subwatersheds defined by the end of the segment and the sampling site, and there are no SWS discharges or MS4 entities between the site and the end of the segment. Thus, site 3 is coterminous with stream segment Tampa Branch RM 0.0 to 2.15 and subwatershed information and TMDL allocations can be found in Section 8.2.6. Sampling data, instantaneous load, and unit area load from site 3 is presented in Table D.34.

Table D.34 Site 3 Data

site 3							
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/ day/acre)
09/28/04	91	300					
05/24/05	655	659*	6.65	106.57	27.08	107.24	27.25
06/14/05	2,727	2744*	2.19	145.92	37.08	146.83	37.31
07/12/05	1,063	1070*	1.41	36.59	9.30	36.82	9.36
08/09/05	311	313*	0.91	6.94	1.76	6.98	1.77
09/13/05	94	95*	1.63	3.75	0.95	3.77	0.96
10/11/05	100	101*	1.48	3.63	0.92	3.66	0.93
05/10/06	27000	27170*	11.59	7654.42	1944.99	7702.64	1957.24
06/13/06	1545	1555*	2.52	95.24	24.20	95.84	24.35
09/14/06	480	483*	3.10	36.41	9.25	36.63	9.31
10/12/06	213	214*	5.20	27.11	6.89	27.28	6.93
5/8/2007	573	577*					
6/27/2007	1040	1047*					
7/10/2007	520	523*					
Greatest Concentration (E. coli colonies/ 100 ml)	27170*						

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

D.11 Site 4

Bacon Creek at site 4 is a fourth order stream located in Hart County (Figure D.9). Information about site 4 including MAF is shown in Table D.35. The subwatershed above site 4 has a catchment of 11,447 acres (17.9 square miles) with a 27% forested, 65.7 % agricultural, and 6.6 % developed land cover (Table D.36).

This subwatershed is un-sewered. It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site 4 is presented in Table D.37, while the TMDL allocations are in Table D.38.

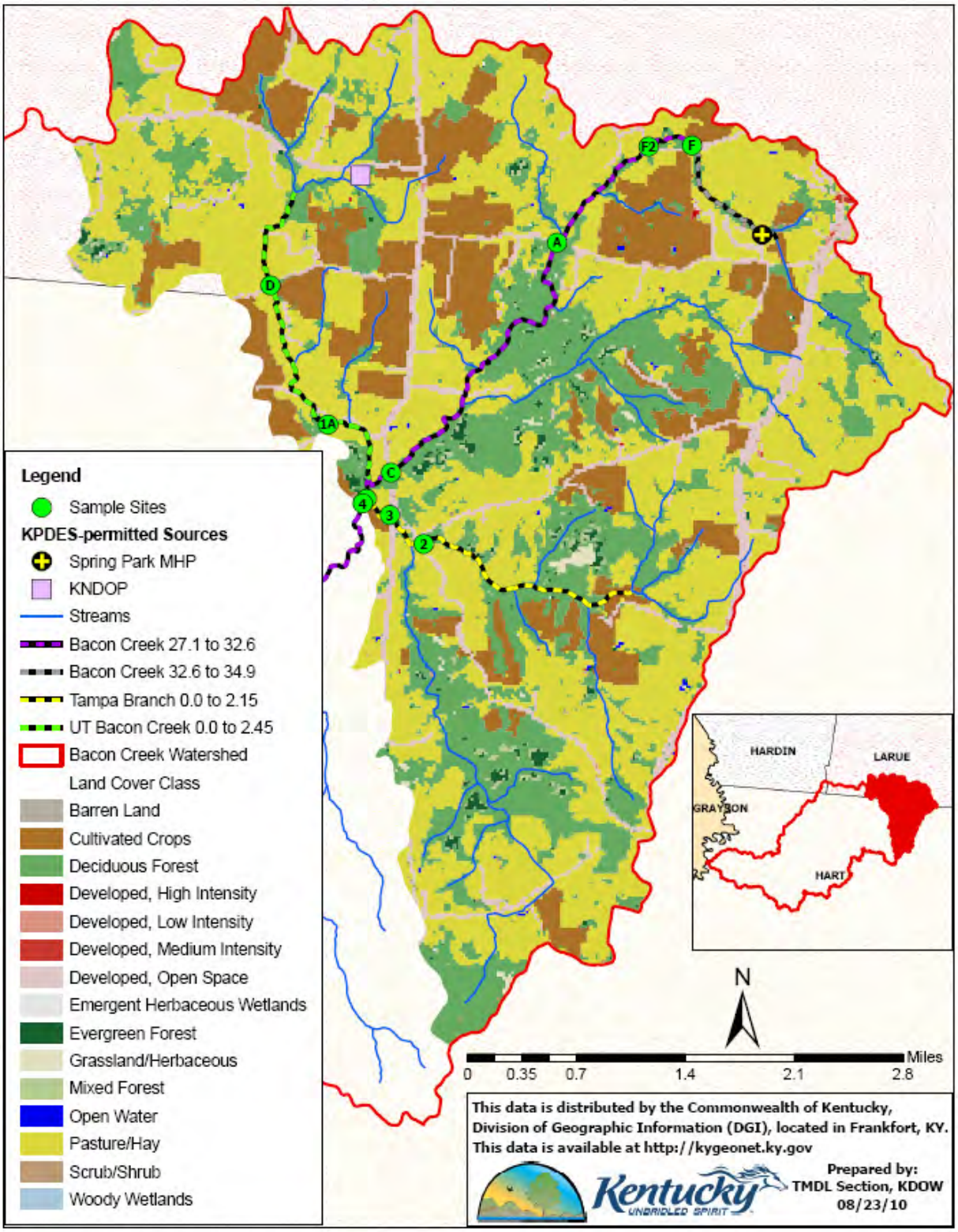

Figure D.9 Subwatershed above Site 4

Note: Site 1 is under site 4.

Table D.35 Site 4 Subwatershed Information

Site #	Map Site #	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
4	4	28.75	37.415939	-85.801671	28.75	21.3	0.00774	21.3077

Table D.36 Site 4 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	17.892	0.028	0.16	
Developed	753.92	1.178	6.59	1.0
Barren Land	2.46	0.004	0.02	
Forest/Shrubland	3106.02	4.853	27.13	
Grassland/Herbaceous	43.835	0.068	0.38	
Pasture/Hay	5610.65	8.767	49.01	
Cultivated Crops	1909.06	2.983	16.68	
Wetlands	3.13	0.005	0.03	
Total	11446.96	17.89	100.00	

Table D.37 Site 4 Data

site 4							
Collection Date	Fecal Coliform (colonies/ 100ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/ day/acre)
06/14/05	1,180	1187*	12.75	368.01	32.15	370.326	32.3515
07/12/05	8,667	8722*	2.24	475.12	41.51	478.117	41.768
08/09/05	1,909	1921*	2.75	128.44	11.22	129.248	11.2911
09/13/05	492	495*	13.01	156.58	13.68	157.568	13.7651
05/10/06	20000	20126*	14.98	7331.16	640.45	7377.35	644.481
06/13/06	2700	2717*	20.45	1350.81	118.01	1359.32	118.749
08/08/06	900	906*	2.50	55.16	4.82	55.5033	4.84874
09/14/06	4200	4226*	7.52	772.27	67.46	777.134	67.89
10/12/06	540	543*	15.17	200.37	17.50	201.637	17.6149
5/8/2007	1377	1386*					
6/27/2007	700	704*					
7/10/2007	460	463*					
Greatest Concentration (E. coli colonies/100 ml)	20126*						

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table D.38 TMDL for Site 4

TMDL Table					E. coli (billion colonies/day)	
					10491.8835	Existing Load
					125.1144	**Total TMDL**
					12.5114	**MOS**
					112.6029	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	98.93	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	112.5575	remainder
					1.1256	**Future Growth WLA**[(1)]
					111.4319	**LA**

Note: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.

D.12 Site 5

KDOW considers a site to be coterminous with the end of a segment if the MAF is the same, there is 1% or less of a difference in area between the two subwatersheds defined by the end of the segment and the sampling site, and there are no SWS discharges or MS4 entities between the site and the end of the segment. Thus, site 5 is coterminous with stream segment Honey Run RM 0.0 to 3.65 and subwatershed information and TMDL allocations can be found in Section 8.2.5. Sampling data, instantaneous load, and unit area load from site 5 is presented in Table D.39.

Table D.39 Site 5 Data

site 5							
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/ day/acre)
05/24/05	355	357*	1.02	8.85	5.13	8.91	5.16
06/14/05	3,400	3421*	0.70	58.32	33.79	58.69	34.01
07/12/05	750	755*	0.51	9.37	5.43	9.43	5.46
08/09/05	525	528*	0.25	3.27	1.89	3.29	1.91
09/13/05	1,545	1555*	1.28	48.47	28.08	48.78	28.26
10/11/05	1,066	1073*	0.52	13.48	7.81	13.56	7.86
05/10/06	5000	5032*	3.06	374.07	216.73	376.43	218.10
06/13/06	2000	2013*	1.94	94.71	54.88	95.31	55.22
08/08/06	420	423*	0.74	7.65	4.43	7.70	4.46
09/14/06	940	946*	0.88	20.18	11.69	20.31	11.77
10/12/06	2400	2415*	1.49	87.53	50.71	88.08	51.03
5/8/2007	1492	1501*					
6/27/2007	2400	2415*					
7/10/2007	25000	25158*					
8/16/2007	12000	12076*					
10/12/2007	100	101*					
6/28/2010		583	0.77			10.98	6.36
Greatest Concentration (E. coli colonies/ 100 ml)	25158*						

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

D.13 Site 6

Bacon Creek at site 6 is a fourth order stream located in Hart County (Figure D.10). Information about site 6 including MAF is shown in Table D.40. The subwatershed above site 6 has a catchment of 13,839 acres (21.6 square miles) with a 30.5% forested, 61.8 % agricultural, and 6.3 % developed land cover (Table D.41).

This subwatershed is un-sewered. It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site 6 is presented in Table D.42, while the TMDL allocations are in Table D.43.

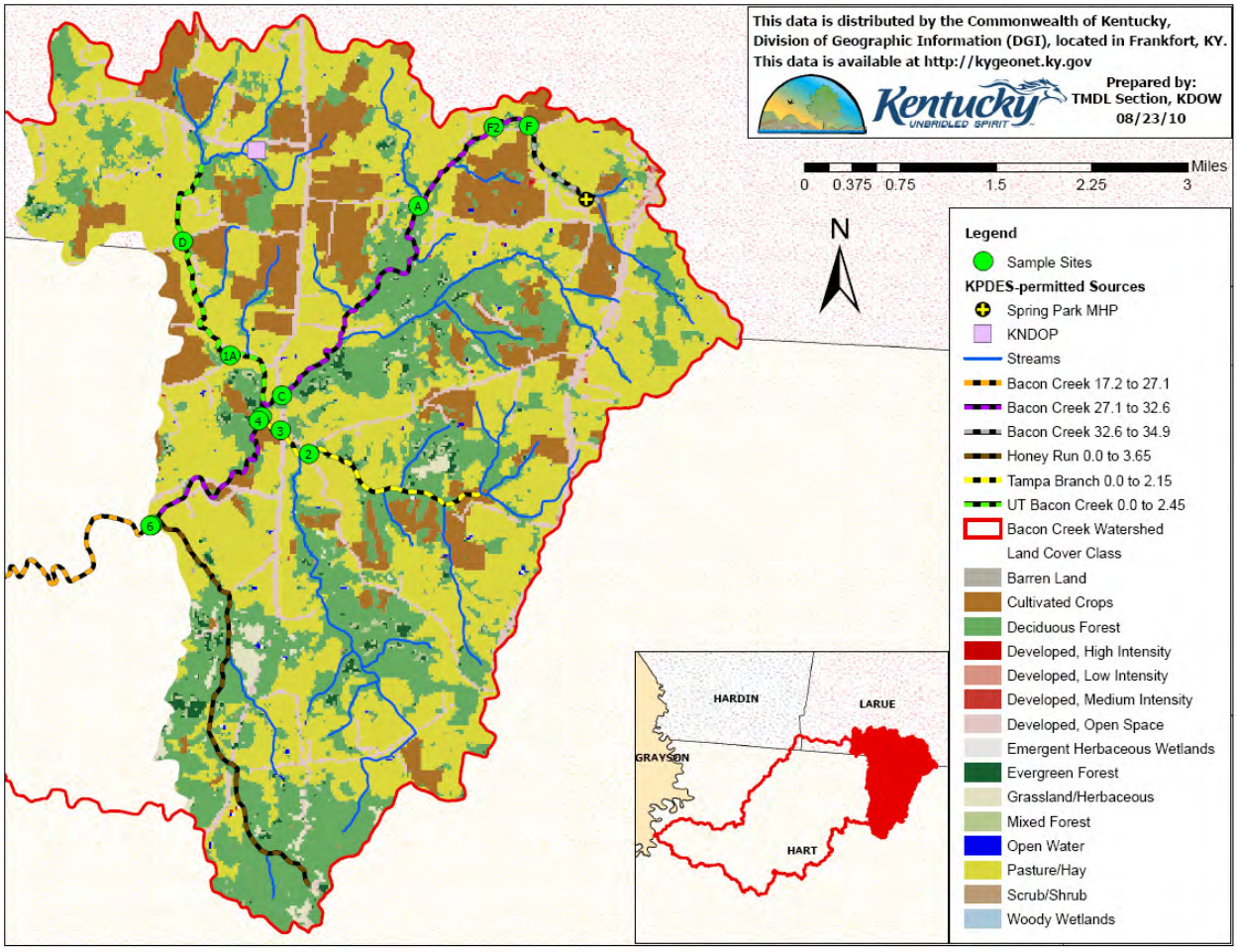

Figure D.10 Subwatershed above Site 6

Note: Site 1 is under site 4 while site 5 is under site 6.

Table D.40 Site 6 Subwatershed Information

Site Number	Map Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
6	6	27.1	37.403991	-85.817089	26.5	0.00774	26.5077

Table D.41 Site 6 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	25.532	0.040	0.18	
Developed	874.80	1.367	6.32	1.0
Barren Land	3.36	0.005	0.02	
Forest/Shrubland	4219.68	6.593	30.49	
Grassland/Herbaceous	157.222	0.246	1.14	
Pasture/Hay	6537.47	10.215	47.24	
Cultivated Crops	2015.22	3.149	14.56	
Wetlands	6.05	0.009	0.04	
Total	13839.32	21.62	100.00	

Table D.42 Site 6 Data

site 6							
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/ day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/ day)	Unit Area Load (million E. coli colonies/ day/acre)
05/24/05	600	604*	15.73	230.84	16.68	232.30	16.79
06/14/05	1,182	1189*	8.80	254.51	18.39	256.12	18.51
07/12/05	750	755*	10.39	190.63	13.77	191.83	13.86
08/09/05	738	743*	7.86	141.83	10.25	142.72	10.31
09/13/05	246	248*	20.29	122.13	8.82	122.90	8.88
10/11/05	1,246	1254*	16.95	516.81	37.34	520.07	37.58
05/10/06	600	604*	35.25	517.49	37.39	520.75	37.63
06/13/06	4500	4528*	60.83	6696.94	483.91	6739.13	486.96
08/08/06	131	132*	13.87	44.45	3.21	44.73	3.23
09/14/06	13000	13082*	15.03	4781.42	345.50	4811.55	347.67
10/12/06	230	231*	42.02	236.42	17.08	237.91	17.19
5/8/2007	787	792*					
6/27/2007	311	313*					
7/10/2007	1040	1047*					
8/16/2007	600	604*					
10/12/2007	250	252*					
6/28/2010		350	6.95			59.51	4.30
Greatest Concentration (E. coli colonies/ 100 ml)	13082*						

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table D.43 TMDL for Site 6

TMDL Table					E. coli (billion colonies/day)	
					8484.0939	Existing Load
					155.6476	**Total TMDL**
					15.5648	**MOS**
					140.0829	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	98.35	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	140.0375	remainder
					1.4004	**Future Growth WLA**[(1)]
					138.6371	**LA**

Note: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.

D.14 Site 1A

UT Bacon Creek 0.0 to 2.45 at site 1A is a third order stream located in Hart County (Figure D.11). Information about site 1A including MAF is shown in Table D.44. The subwatershed above site 1A has a catchment of 2,656 acres (4.2 square miles) with a 16% forested, 75.9 % agricultural, and 7.5% developed land cover (Table D.45).

This subwatershed is un-sewered and contains no SWSs. Sampling data, instantaneous load, and unit area load from site 1A is presented in Table D.46, while the TMDL allocations are in Table D.47.

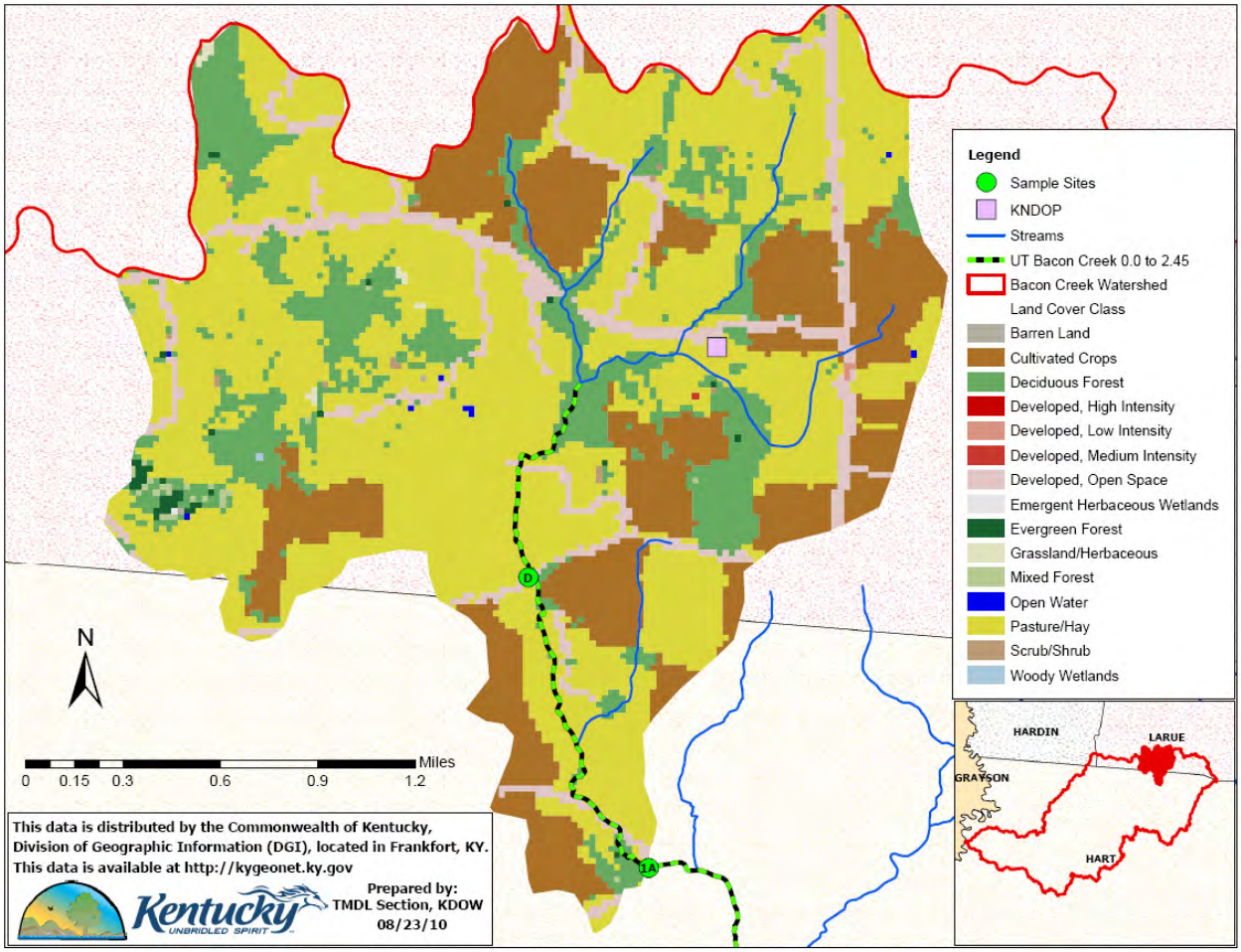

Figure D.11 Subwatershed above Site 1A

Table D.44 Site 1A Subwatershed Information

Site Number	Map Site Number	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
1A	1A	0.6	37.4233	-85.8058	0.6	3.7	0	3.7

Table D.45 Site 1A Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	2.01	0.00	0.08	
Developed	200.04	0.31	7.53	1.00
Barren Land	0.45	0.00	0.02	
Forest/Shrubland	434.08	0.68	16.34	
Grassland/Herbaceous	3.80	0.01	0.14	
Pasture/Hay	1415.03	2.21	53.27	
Cultivated Crops	600.56	0.94	22.61	
Wetlands	0.45	0.00	0.02	
Total	2656.42	4.15	100.00	

Table D.46 Site 1A Data

site 1A				
Collection Date	E. coli (colonies/100 ml)	Flow (cfs)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/day/acre)
6/28/2010	1,274	12.75	397.32	149.57
Greatest Concentration (E. coli colonies/ 100 ml)	1274			

Table D.47 TMDL for Site 1A

TMDL Table					E. coli (billion colonies/day)	
					115.3267	Existing Load
					21.7256	**Total TMDL**
					2.1726	**MOS**
					19.5530	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	83.05	% reduction
N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	**0.0000**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0000	19.5530	remainder
					0.1955	**Future Growth WLA[1]**
					19.3575	**LA**

Notes: [1]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[2]N/A indicates that there is no SWS in the subwatershed, thus the information is not applicable.

D.15 Site A

Bacon Creek at site A is a second order stream located in Larue County (Figure D.12). Information about site 1 including MAF is shown in Table D.48 The subwatershed above site 1 has a catchment of 1,842 acres (2.9 square miles) with a 16% forested, 76.5 % agricultural, and 6.8% developed land cover (Table D.49).

This subwatershed is un-sewered. It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site A is presented in Table D.50, while the TMDL allocations are in Table D.51.

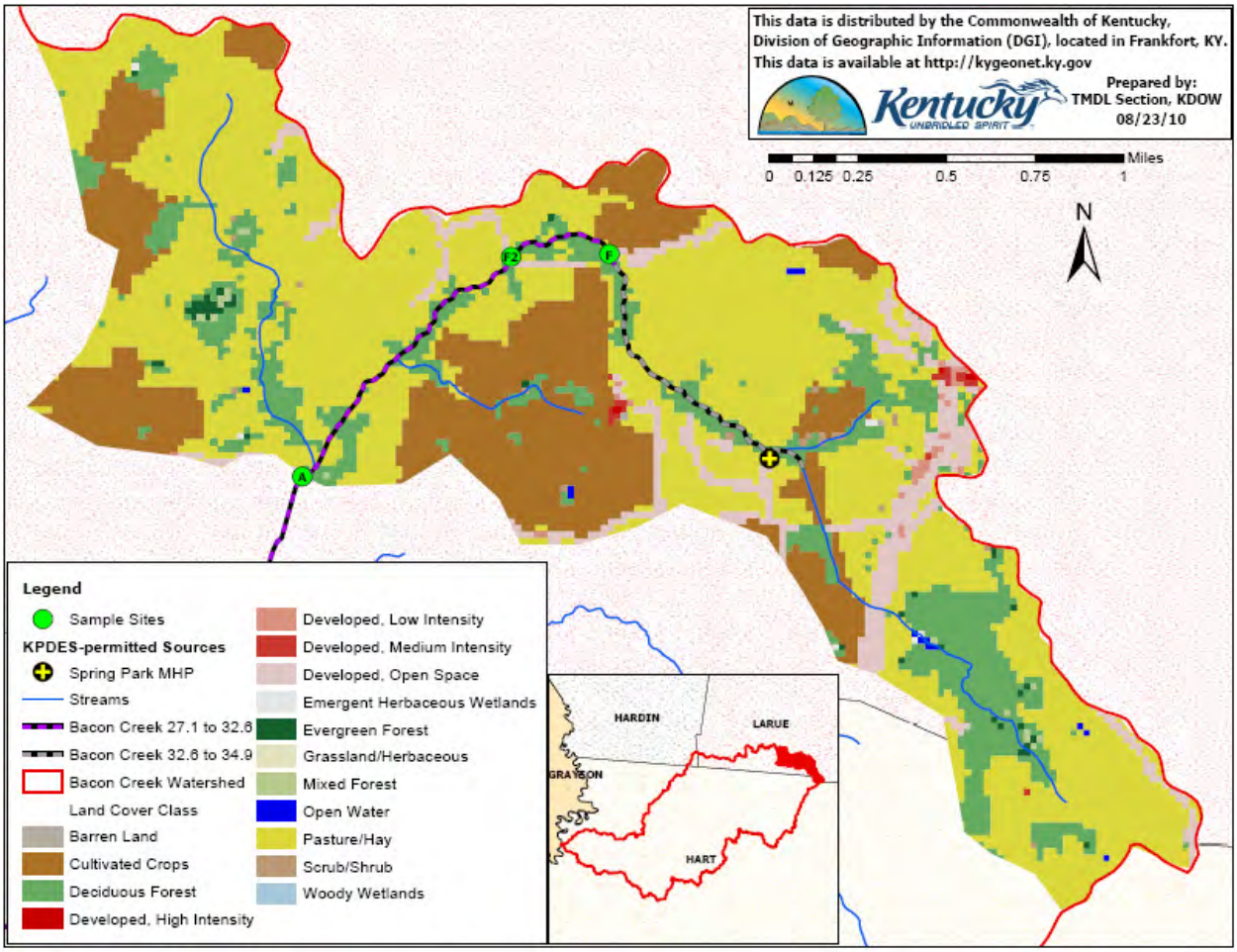

Figure D.12 Subwatershed above Site A

Table D.48 Site A Subwatershed Information

Site #	Map Site #	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
A	A	31.35	37.4404	-85.77896	31.35	3.7	0.00774	3.7077

Table D.49 Site A Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	3.129	0.005	0.17	
Developed	125.84	0.197	6.83	1.0
Barren Land	0.45	0.001	0.02	
Forest/Shrubland	301.74	0.471	16.38	
Grassland/Herbaceous	0.000	0.000	0.00	
Pasture/Hay	998.87	1.561	54.22	
Cultivated Crops	410.81	0.642	22.30	
Wetlands	1.56	0.002	0.08	
Total	1842.40	2.88	100.00	

Table D.50 Site A Data

site A							
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/ day/acre)
09/21/04	6000	6038*					
09/28/04	4091	4140					
10/07/04	2000	2430					
10/13/04	3545	2950					
10/20/04	2182	2310					
6/28/2010		3,076	0.78			58.70	31.86
Greatest Concentration (E. coli colonies/ 100 ml)	6038*						

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table D.51 TMDL for Site A

TMDL Table					E. coli (billion colonies/day)	
					547.7225	Existing Load
					21.7710	**Total TMDL**
					2.1771	**MOS**
					19.5939	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	96.42	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	19.5485	remainder
					0.1955	**Future Growth WLA**[(1)]
					19.3530	**LA**

Note: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.

D.16 Site C

Bacon Creek at site C is a third order stream located in Hart County (Figure D.13). Information about site C including MAF is shown in Table D.52 The subwatershed above site C has a catchment of 4,478 acres (4 square miles) with a 27% forested, 65.3 % agricultural, and 7% developed land cover (Table D.53).

This subwatershed is un-sewered. It has one SWS in the headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site C is presented in Table D.54, while the TMDL allocations are in Table D.55.

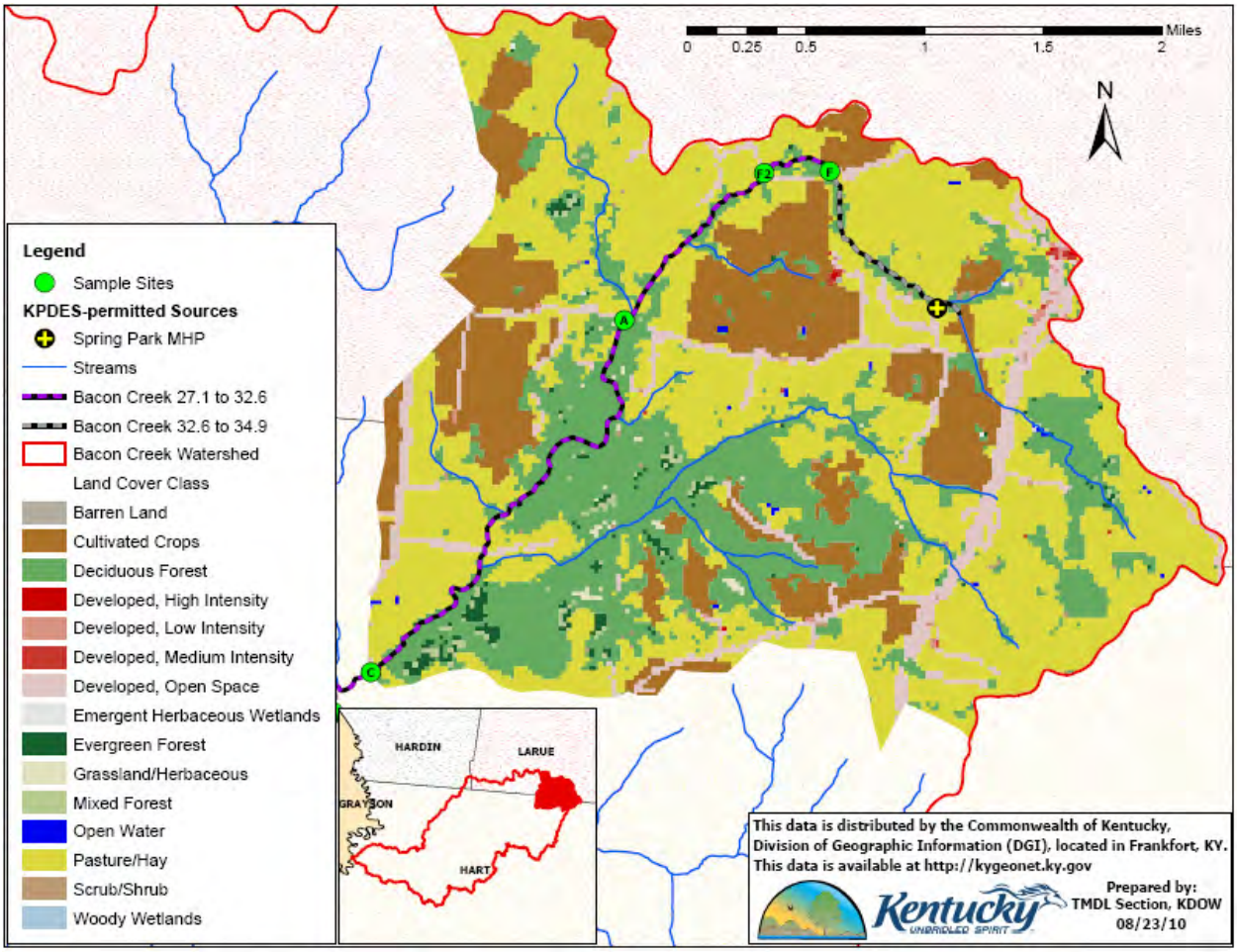

Figure D.13 Subwatershed above Site C

Table D.52 Site C Subwatershed Information

Site #	Map Site #	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
C	C	29.1	37.4188	-85.79836	29.1	9	0.00774	9.0077

Table D.53 Site C Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	6.932	0.011	0.15	
Developed	311.96	0.487	6.97	1.0
Barren Land	0.89	0.001	0.02	
Forest/Shrubland	1220.57	1.907	27.26	
Grassland/Herbaceous	11.181	0.017	0.25	
Pasture/Hay	2094.29	3.272	46.77	
Cultivated Crops	830.11	1.297	18.54	
Wetlands	1.57	0.002	0.03	
Total	4477.50	7.00	100.00	

Table D.54 Site C Data

site C							
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/ day/acre)
09/21/04	270	272*					
Greatest Concentration (E. coli colonies/ 100 ml)	272*						

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table D.55 TMDL for Site C

TMDL Table					E. coli (billion colonies/day)	
					59.9437	Existing Load
					52.8915	**Total TMDL**
					5.2891	**MOS**
					47.6023	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	20.59	% reduction
2555	KY0089761	Spring Park MHP	Operator of Residential Mobile Home Sites	0.0077362	**0.0454**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0077	47.5569	remainder
					0.4756	**Future Growth WLA**[(1)]
					47.0813	**LA**

Note: [(1)]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.

D.17 Site D

Bacon Creek at site D is a third order stream located in Larue County (Figure D.14). Information about site D including MAF is shown in Table D.56. The subwatershed above site D has a catchment of 1,311 acres (2 square miles) with a 13% forested, 77.9 % agricultural, and 8.7% developed land cover (Table D.57).

This subwatershed is un-sewered and contains no SWSs. Sampling data, instantaneous load, and unit area load from site D is presented in Table D.58, while the TMDL allocations are in Table D.59.

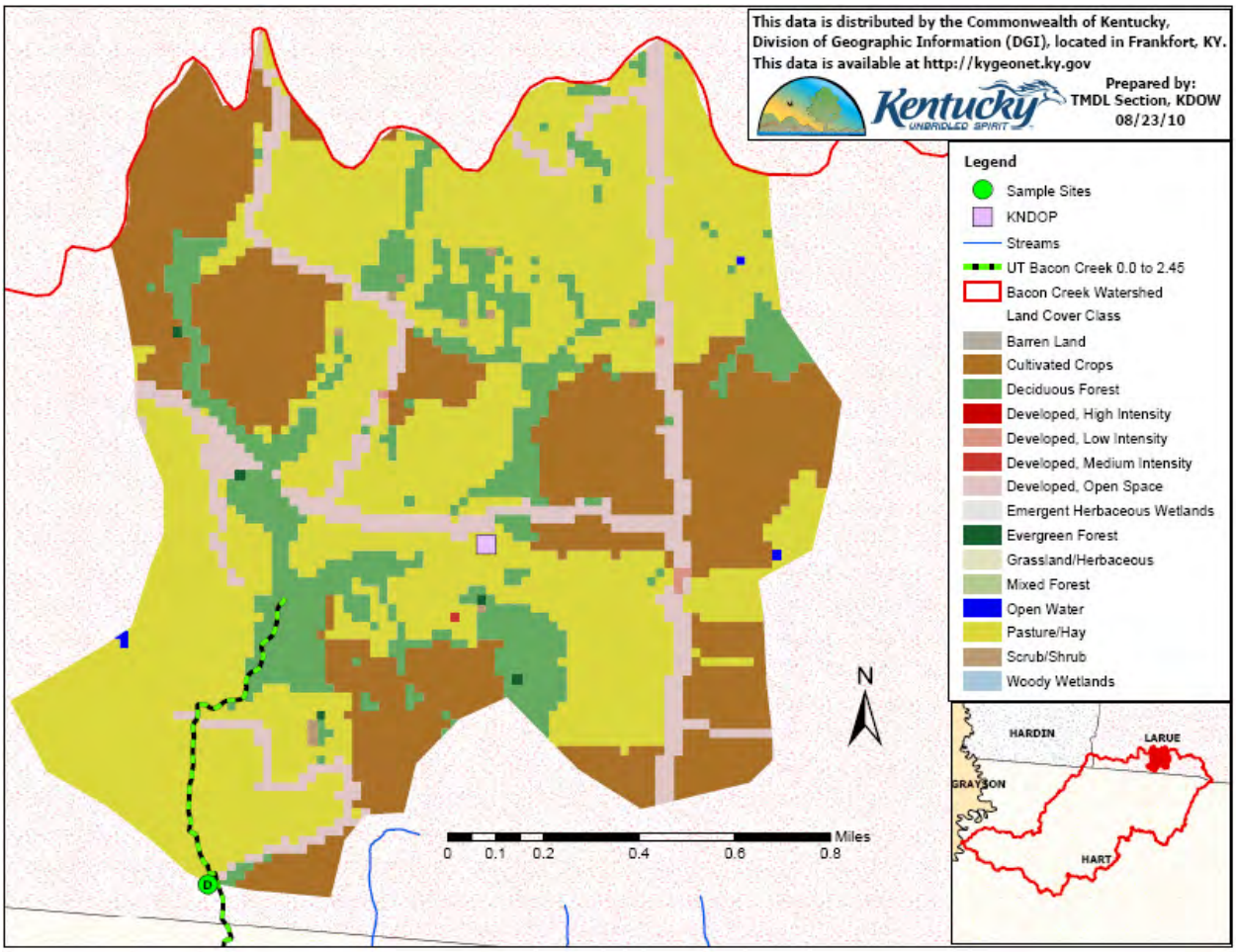

Figure D.14 Subwatershed above Site D

Table D.56 Site D Subwatershed Information

Site #	Map Site #	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
D	D	1.75	37.4363	-85.8125	1.75	2.8	0	2.8

Table D.57 Site D Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	0.669	0.001	0.05	
Developed	114.46	0.179	8.73	1.0
Barren Land	0.00	0.000	0.00	
Forest/Shrubland	174.25	0.272	13.29	
Grassland/Herbaceous	0.000	0.000	0.00	
Pasture/Hay	641.22	1.002	48.92	
Cultivated Crops	380.18	0.594	29.00	
Wetlands	0.00	0.000	0.00	
Total	1310.78	2.05	100.00	

Table D.58 Site D Data

D							
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/ day/acre)
09/21/04	1320	1328*					
09/28/04	5545	4640					
10/07/04	909	2280					
10/13/04	818	610					
10/20/04	909	980					
Greatest Concentration (E. coli colonies/100 ml)	4640						

Note: *Indicates that the E. coli is translated from the fecal coliform concentration.

Table D.59 TMDL for Site D

TMDL Table					E. coli (billion colonies/day)	
					317.8591	Existing Load
					16.4410	**Total TMDL**
					1.6441	**MOS**
					14.7969	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	95.34	% reduction
N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	**0.0000**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0000	14.7969	remainder
					0.1480	**Future Growth WLA[1]**
					14.6489	**LA**

Notes: [1]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[2]N/A indicates that there is no SWS in the subwatershed, thus the information is not applicable.

D.18 Site F

Bacon Creek at site F is a second order stream located in Larue County (Figure D.15). Information about site F including MAF is shown in Table D.60. The subwatershed above site F has a catchment of 823 acres (1.3 square miles) with a 21% forested, 67.6 % agricultural, and 10.7% developed land cover (Table D.61).

This subwatershed is un-sewered. It has one SWS in its headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site F is presented in Table D.62, while the TMDL allocations are in Table D.63.

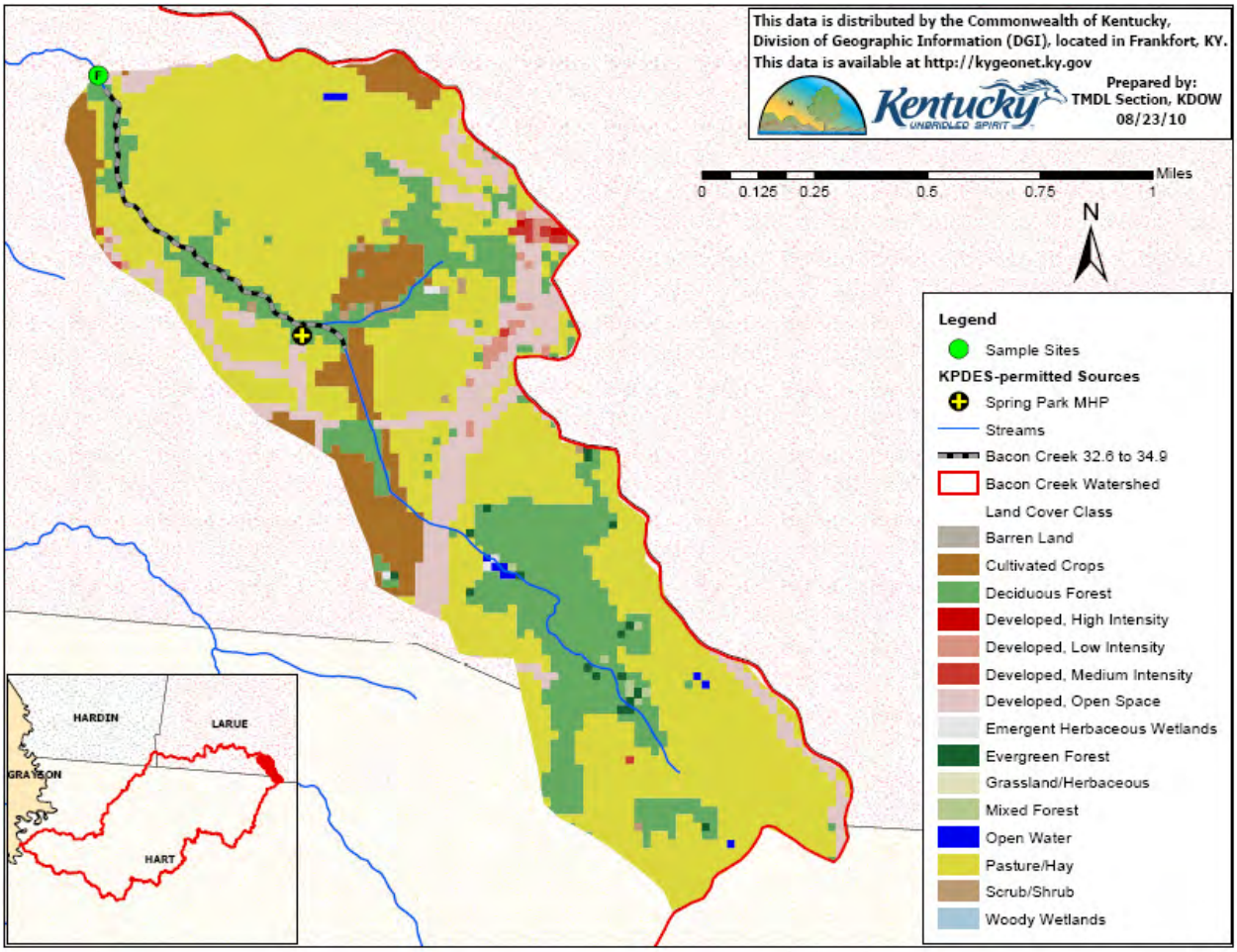

Figure D.15 Subwatershed above Site F

Table D.60 Site F Subwatershed Information

Site #	Map Site #	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
F	F	32.65	37.4495	-85.763	32.65	1.7	0.00774	1.7077

Table D.61 Site F Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	2.467	0.004	0.30	
Developed	88.36	0.138	10.73	2.0
Barren Land	0.22	0.000	0.03	
Forest/Shrubland	174.93	0.273	21.25	
Grassland/Herbaceous	0.000	0.000	0.00	
Pasture/Hay	487.33	0.761	59.19	
Cultivated Crops	68.85	0.108	8.36	
Wetlands	1.12	0.002	0.14	
Total	823.28	1.29	100.00	

Table D.62 Site F Data

site F							
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/ day/acre)
10/13/04	3727	3090					
10/20/04	909	840					
Greatest Concentration (E. coli colonies/ 100 ml)	3090						

Table D.63 TMDL for Site F

TMDL Table					E. coli (billion colonies/day)	
					129.1035	Existing Load
					10.0275	**Total TMDL**
					1.0027	**MOS**
					9.0247	TMDL Target
AI number	KPDES #	Discharger Facility Name	Type	Design Capacity (cfs)	93.01	% reduction
N/A[2]	N/A[2]	N/A[2]	N/A[2]	N/A[2]	**0.0000**	**SWS WLA**
			Addition to MAF (sum of cfs)	0.0000	9.0247	remainder
					0.1805	**Future Growth WLA[1]**
					8.8442	**LA**

Notes: [1]Any expanding or future KPDES-permitted point source will receive its WLA from the Future Growth WLA and must meet permit limits based on the Water Quality Standards in 401 KAR 10:031.
[2]N/A indicates that there is no SWS in the subwatershed, thus the information is not applicable.

D.19 Site F2

Bacon Creek at site F2 is a second order stream located in Larue County (Figure D.16). Information about site F2 including MAF is shown in Table D.64. The subwatershed above site F2 has a catchment of 908 acres (1.4 square miles) with a 20% forested, 68.4 % agricultural, and 10.8% developed land cover (Table D.65).

This subwatershed is un-sewered. It has one SWS in its headwaters for which MAF was adjusted. Sampling data, instantaneous load, and unit area load from site F2 is presented in Table D.66. Because there were no exceedances of the water quality criterion, a TMDL is not calculated for this site.

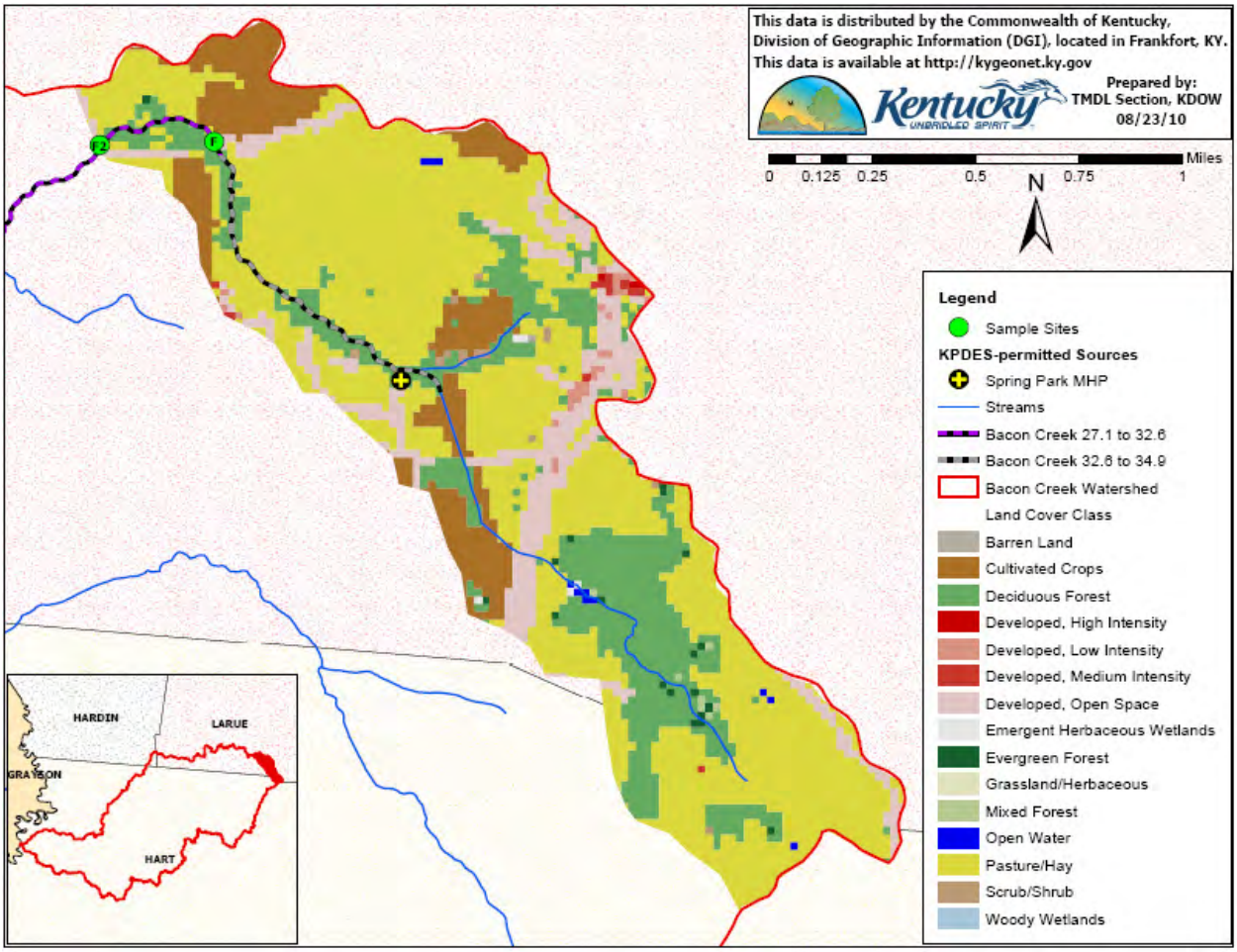

Figure D.16 Subwatershed above Site F2

Table D.64 Site F2 Subwatershed Information

Site #	Map Site #	Sample Point RM	Sample Site Latitude	Sample Site Longitude	RM of MAF Determination	MAF (cfs)	+ to MAF (cfs)	Final MAF (cfs)
F2	F2	32.3	37.4494	-85.76824	32.3	1.8	0.00774	1.8077

Table D.65 Site F2 Subwatershed Land Cover

Land Cover	Watershed Acres	Watershed Square Miles	% of Total Area	Future Growth WLA %
Open Water	2.466	0.004	0.27	
Developed	97.53	0.152	10.75	2.0
Barren Land	0.22	0.000	0.02	
Forest/Shrubland	185.65	0.290	20.45	
Grassland/Herbaceous	0.000	0.000	0.00	
Pasture/Hay	519.95	0.812	57.29	
Cultivated Crops	100.67	0.157	11.09	
Wetlands	1.12	0.002	0.12	
Total	907.62	1.42	100.00	

Table D.66 Site F2 Data

site F2							
Collection Date	Fecal Coliform (colonies/ 100 ml)	E. coli (colonies/ 100 ml)	Flow (cfs)	Instantaneous Load (billion Fecal coliform colonies/day)	Unit Area Load (million Fecal coliform colonies/ day/acre)	Instantaneous Load (billion E. coli colonies/day)	Unit Area Load (million E. coli colonies/ day/acre)
10/07/04	273	100					
Greatest Concentration (E. coli colonies/ 100 ml)	100						