

## Appendix M Tradewater River Basin

**HUC 8:** 05140205

**Level IV Ecoregions:** Green River-Southern Wabash Lowlands, Caseyville Hills, Crawford-Mammoth Cave Uplands

**Drainage Area Within Kentucky:** 942.8 square miles

**Counties:** Caldwell, Christian, Crittenden, Hopkins, Union, Webster

**Major Cities:** Madisonville, Princeton, Providence, Dawson Springs, Sturgis, Earlington, Clay

The Tradewater River basin is located in far western Kentucky.

The Tradewater River originates in Christian Co., Ky., near Kelly. It flows northwest through Christian Co. and a small portion of Hopkins Co. before forming the border between Caldwell and Hopkins counties. Near Olney, the Tradewater turns north and at its confluence with Donaldson Creek near river mile 63.1 becomes a sixth order stream at a 1:100,000 scale. The river resumes its northwestward course and forms the border between Crittenden Co. on its left bank and Webster and Union counties on its right. After flowing for 135 miles, the Tradewater River discharges into the Ohio River near river mile 873.

Table M.1. provides a summary of the stream segments in the Tradewater basin that have been included on the 303(d) list for impairment due to either fecal coliform or *E. coli*. The locations of the stream segments are shown in Figure M.1.

**Table M.1 Bacteria-impaired Stream Segments in the Tradewater Basin**

Waterbody Name	Waterbody ID	Impaired Use (Support Status)	Pollutant	Suspected Source(s)	Year of TMDL Public Notice
Clear Creek 26.2 to 26.5	KY489610_03	PCR (nonsupport)	Fecal Coliform	Sanitary Sewer Overflows (Collection System Failures)	2018
Cypress Creek 0.0 to 3.3	KY490527_01	PCR (nonsupport)	<i>E. coli</i>	Non-Point Source, Upstream Source	2018
Cypress Creek 0.0 to 3.3	KY490527_01	SCR (partial support)	Fecal Coliform	Non-Point Source, Upstream Source	2018
Donaldson Creek 0.0 to 14.2	KY490999_01	PCR (nonsupport)	<i>E. coli</i>	Non-Point Source	2018
Donaldson Creek 0.0 to 14.2	KY490999_01	SCR (partial support)	Fecal Coliform	Non-Point Source	2018
Tradewater River 0.0 to 16.8	KY505460_01	PCR (nonsupport)	Fecal Coliform	Agriculture	2018
Vaughn Ditch 0.0 to 3.25	KY505996_01	PCR (nonsupport)	<i>E. coli</i>	Upstream Source	2018

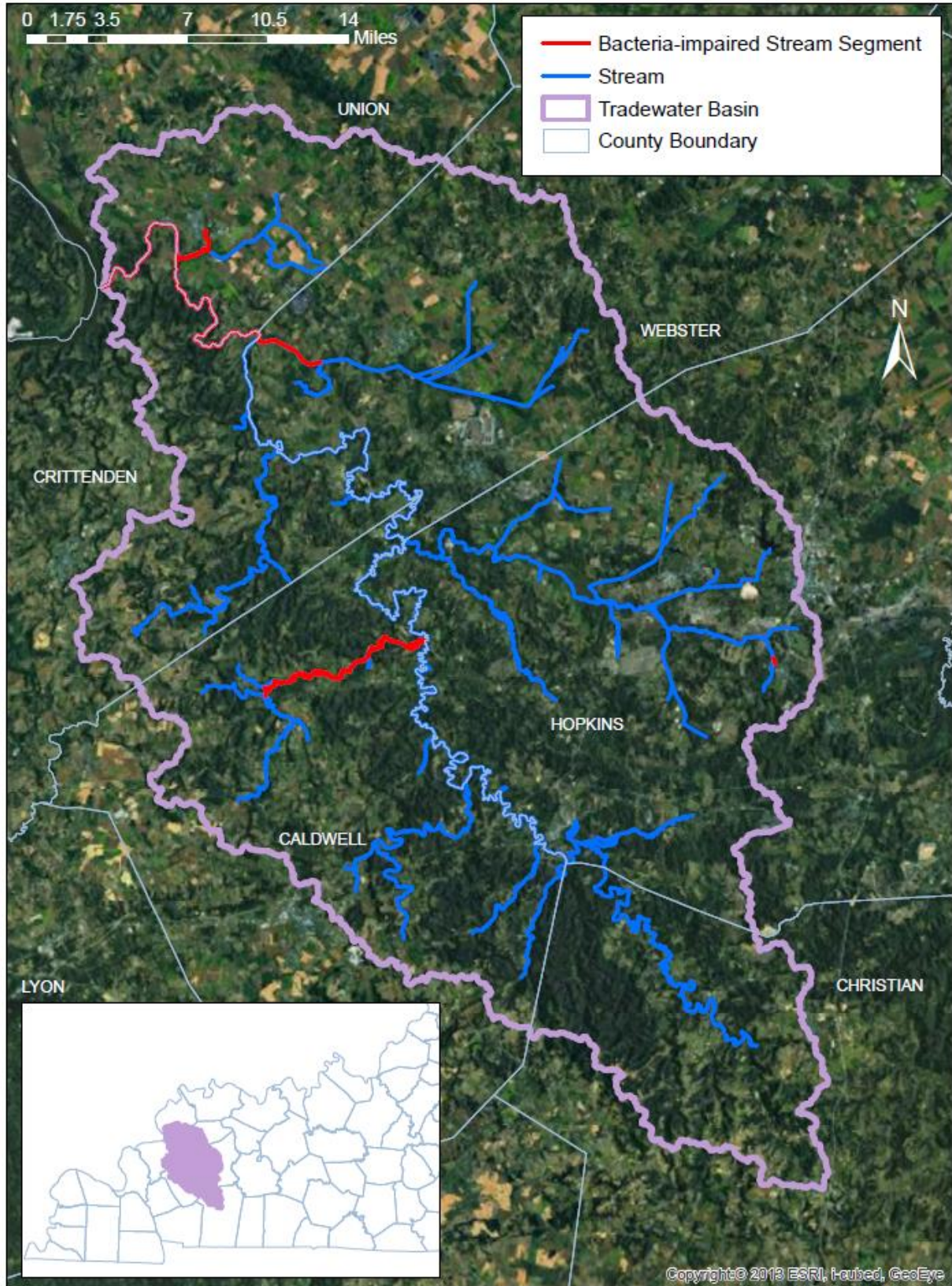


Figure M.1 Location of the Tradewater Basin and Bacteria-impaired Streams (March 2017)

Land cover data is summarized in Table M.2 and its geographic distribution is shown in Figure M.2. Deciduous forest is the predominant class of land cover in the Tradewater basin, accounting for 46 percent. The next three classes by magnitude are cultivated crops, pasture/hay and evergreen forest. Land cover classes are described in Appendix P.

**Table M.2 Land Cover Classes in the Tradewater Basin (NLCD 2011)**

<b>Land Cover</b>	<b>Percent of Total Area</b>	<b>Square Miles</b>	<b>Acres</b>
Open Water	0.89	8.41	5,382.67
Developed, Open	3.13	29.49	18,874.72
Developed, Low Intensity	0.44	4.14	2,650.86
Developed, Medium Intensity	0.13	1.26	807.27
Developed, High Intensity	0.06	0.55	353.15
Barren Land (Rock, Sand, Clay)	0.12	1.12	715.64
Deciduous Forest	46.22	435.72	278,858.98
Evergreen Forest	5.85	55.18	35,312.96
Mixed Forest	0.03	0.27	173.46
Shrub/Scrub	0.08	0.75	477.24
Grassland/Herbaceous	3.84	36.23	23,187.49
Pasture/Hay	10.30	97.07	62,126.04
Cultivated Crops	24.29	229.03	146,576.48
Woody Wetlands	2.76	26.01	16,643.95
Emergent Herbaceous Wetlands	1.86	17.57	11,247.71

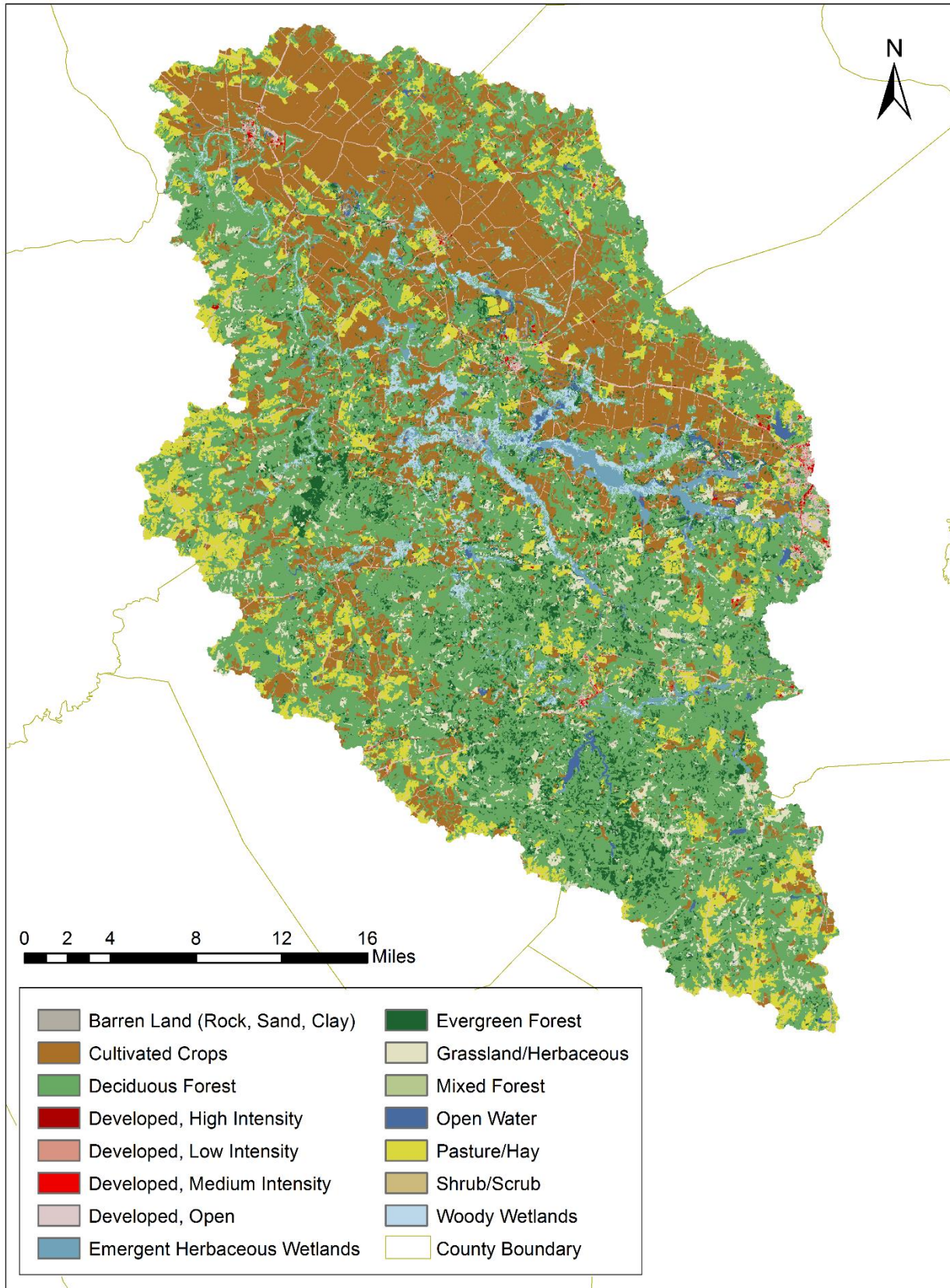


Figure M.2 Land Cover Classes in the Tradewater Basin (NLCD 2011)

**Section M.1 Clear Creek 26.2 to 26.5****Waterbody ID:** KY489610\_03**Receiving Water:** Tradewater River**Impaired Use:** PCR**Support Status:** nonsupport**Indicator Bacteria:** fecal coliform**HUC 12:** 051402050201**County:** Hopkins

Sampling data from Clear Creek 26.2 to 26.5 is not available. This segment was first included on the 303(d) list in 1998. The City of Earlington owns and operates a sewage collection system (KYP000043) which transfers sewage to the Madisonville WWTP. The transfer point, a pump station, is located along this segment. On February 25, 1998, the Division of Water issued a Notice of Violation to the City of Earlington for failure to report a spill or discharge from a sewage system and degrading the waters of the Commonwealth. A subsequent Agreed Order outlined the corrective measures required. The City of Earlington's Kentucky Inter-System Operating Permit (KYP000043), which authorizes the collection system and pump station, prohibits discharges to surface water; thus the system does not receive a WLA. There are no KPDES-permitted discharges into this segment of Clear Creek. The City of Madisonville does have MS4 storm water permit coverage for areas in the watershed, but the discharges occur upstream of the segment and are therefore included in the allocations for upstream loads to the segment.

The TMDL allocations for Clear Creek 26.2 to 26.5 are presented in Table M.1-1. The location of the segment within the Richland Creek-Clear Creek watershed is shown in Figure M.1-1.

**Table M.1-1 Clear Creek 26.2 to 26.5 TMDL Allocations<sup>(1)</sup>**

TMDL <sup>(2)</sup>	Allocations for Direct Loads to the Segment	Allocations for Upstream Loads to the Segment <sup>(4)</sup>	MOS <sup>(5)</sup>
	LA <sup>(3)</sup>		
$Q_S \times WQC \times CF$	$\sum(Q_{LA} \times WQC \times CF)$	$\sum(Q_{Upstream} \times WQC \times CF)$	Implicit

<sup>(1)</sup>All loads are colonies/day of either *E. coli* or fecal coliform. The recreational use bacterial WQCs are found in 401 KAR 10:031. CF is the conversion factor (24,465,758.4 s-ml/ft<sup>3</sup>-day) to change the product of bacterial concentration (colonies/100 ml) and flow (ft<sup>3</sup>/s) into a load (colonies/day). The symbol “ $\sum$ ” indicates that the total allocation is the sum of all the individual allowable loads.

<sup>(2)</sup> $Q_S$  is the flow (ft<sup>3</sup>/s) in the segment.

<sup>(3)</sup> $Q_{LA}$  is the flow (ft<sup>3</sup>/s) in the segment due to a LA source.

<sup>(4)</sup> $Q_{Upstream}$  is the flow contribution (ft<sup>3</sup>/s) from upstream of the segment. This load includes both WLA and LA sources upstream of the impaired segment.

<sup>(5)</sup>The following assumptions provide an implicit MOS:

(a)Upstream bacterial concentrations are at the maximum allowable limit; there is no dilution capacity from these areas.

(b)There is no bacteria die-off; in reality bacteria concentrations diminish downstream from their source. Thus, bacteria loads to the upper portion of a segment will diminish prior to reaching the lower portion of the segment.

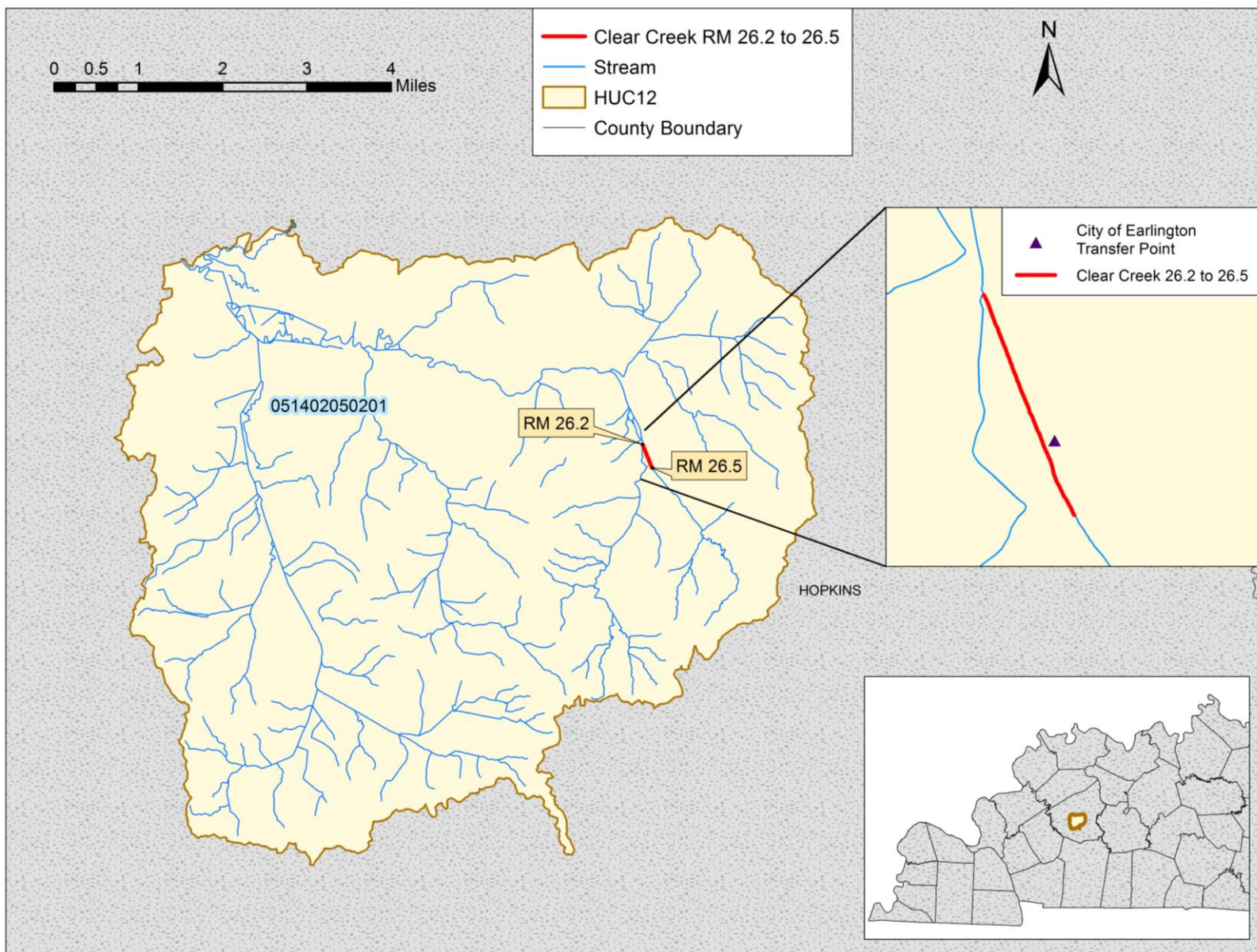


Figure M.1-1 Location of Clear Creek 26.2 to 26.5

**Section M.2 Cypress Creek 0.0 to 3.3****Waterbody ID:** KY490527\_01**Receiving Water:** Tradewater River**Impaired Uses:** PCR, SCR**Support Status:** nonsupport (PCR), partial support (SCR)**Indicator Bacteria:** *E. coli*, fecal coliform**HUC 12:** 051402050504, 051402050505**County:** Union

The Division of Water has collected samples from station GRN 002, located at river mile 2.2, since 2001. The station is sampled five to six times during the PCR season as part of the Division's five-year rotating schedule for basin monitoring (see also Section 7.2.1, Kentucky Watershed Management Framework). Table M.2-1 summarizes information about this sampling station; Table M.2-2 provides a summary of the data collected from this station.

**Table M.2-1 Division of Water Sample Site Location**

Station Name	Latitude	Longitude	Stream Segment	River Mile
GRN 002	37.5304	-87.9751	Cypress Creek 0.0-3.3	2.2

**Table M.2-2 Division of Water Sample Data Summary<sup>(1)</sup>**

Station Name	Indicator Bacteria	Number of Observations	Percent Exceeding WQC <sup>2</sup>	Minimum (colonies/100 ml)	Maximum (colonies/100 ml)	Average (colonies/100 ml)
GRN 002	fecal coliform	14	15.4	121	60,000	6,384
GRN 002	<i>E. coli</i>	12	75.0	11	2,420	1,010

<sup>(1)</sup>The full data set for samples collected at GRN 002 may be obtained by submitting a request of records under the Kentucky Open Records Act (KORA) to [DEP.KORA@ky.gov](mailto:DEP.KORA@ky.gov) or by fax to 502-564-9232. The DEP KORA point of contact may also be reached at 502-564-3999.

<sup>(2)</sup>2,000 colonies/100 ml for fecal coliform; 240 colonies/100 ml for *E. coli*.

The TMDL allocations for Cypress Creek 0.0 to 3.3 are presented in Table M.2-3. There are no KPDES-permitted discharges into this segment of Cypress Creek. The location of the segment within the Cypress Creek and Caney Creek-Tradewater River watersheds is shown in Figure M.2-1.



**Table M.2-3 Cypress Creek 0.0 to 3.3 TMDL Allocations<sup>(1)</sup>**

TMDL <sup>(2)</sup>	Allocations for Direct Loads to the Segment	Allocations for Upstream Loads to the Segment <sup>(4)</sup>	Allocations for Tributary Loads to the Segment <sup>(5)</sup>	MOS <sup>(6)</sup>
	LA <sup>(3)</sup>			
$Q_S \times WQC \times CF$	$\sum(Q_{LA} \times WQC \times CF)$	$\sum(Q_{Upstream} \times WQC \times CF)$	$\sum(Q_{Tributary} \times WQC \times CF)$	Implicit

<sup>(1)</sup>All loads are colonies/day of either *E. coli* or fecal coliform. The recreational use bacterial WQCs are found in 401 KAR 10:031. CF is the conversion factor (24,465,758.4 s-ml/ft<sup>3</sup>-day) to change the product of bacterial concentration (colonies/100 ml) and flow (ft<sup>3</sup>/s) into a load (colonies/day). The symbol “ $\Sigma$ ” indicates that the total allocation is the sum of all the individual allowable loads.

<sup>(2)</sup> $Q_S$  is the flow (ft<sup>3</sup>/s) in the segment.

<sup>(3)</sup> $Q_{LA}$  is the flow (ft<sup>3</sup>/s) in the segment due to a LA source.

<sup>(4)</sup> $Q_{Upstream}$  is the flow contribution (ft<sup>3</sup>/s) from upstream of the segment. This load includes both WLA and LA sources upstream of the impaired segment.

<sup>(5)</sup> $Q_{Tributary}$  is the flow contribution (ft<sup>3</sup>/s) from a tributary to the segment. This load includes both WLA and LA sources on tributaries to the impaired segment.

<sup>(6)</sup>The following assumptions provide an implicit MOS:

(a)Upstream and tributary bacterial concentrations are at the maximum allowable limit; there is no dilution capacity from these areas.

(b)There is no bacteria die-off; in reality bacteria concentrations diminish downstream from their source. Thus, bacteria loads to the upper portion of a segment will diminish prior to reaching the lower portion of the segment.

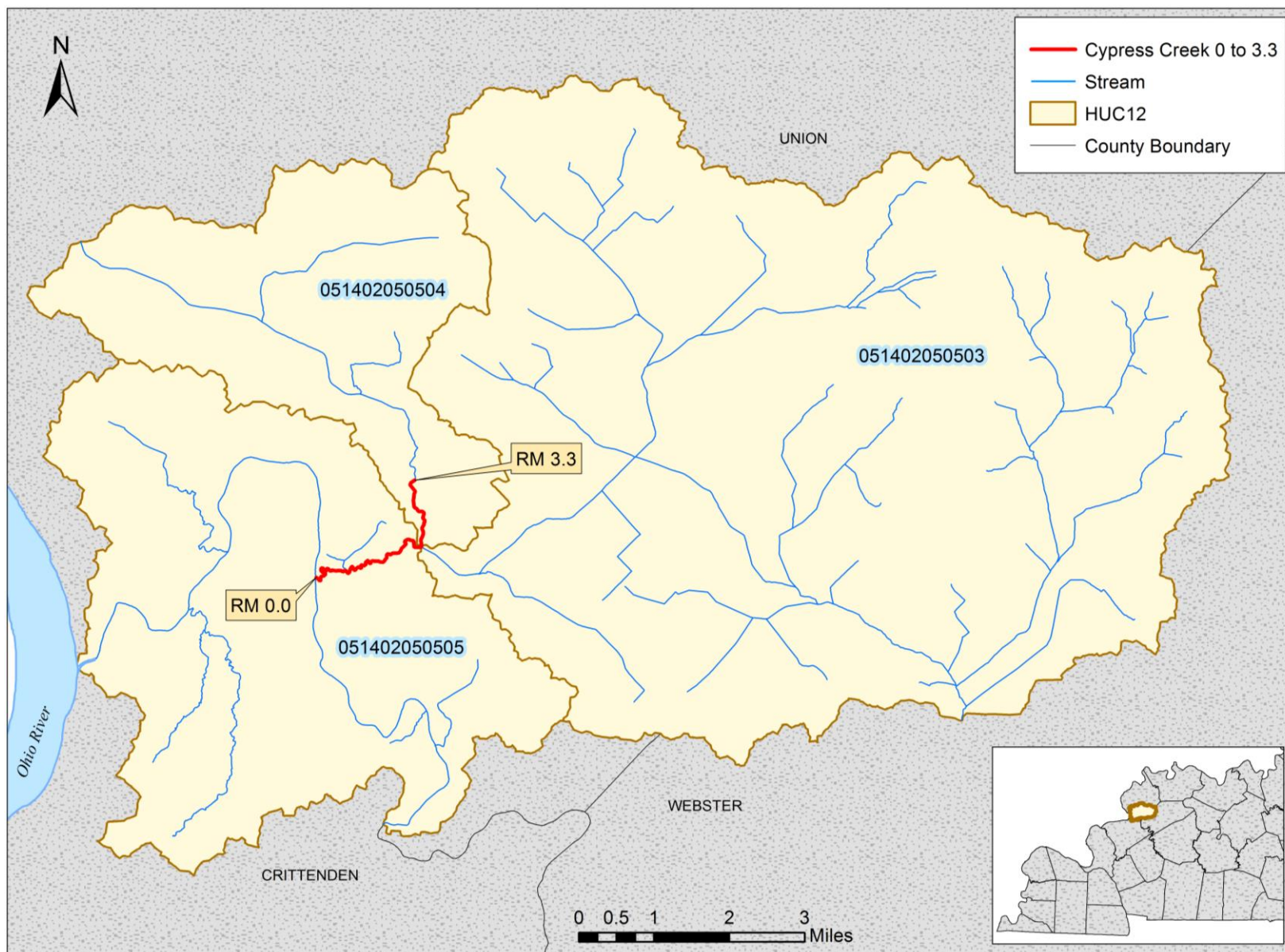


Figure M.2-1 Location of Cypress Creek 0.0 to 3.3

**Section M.3 Donaldson Creek 0.0 to 14.2****Waterbody ID:** KY490999\_01**Receiving Water:** Tradewater River**Impaired Uses:** PCR, SCR**Support Status:** nonsupport (PCR), partial support (SCR)**Indicator Bacteria:** *E. coli*, fecal coliform**HUC 12:** 051402050304**County:** Caldwell

The Division of Water has collected samples from station GRN 005, located at river mile 2.3, since 2001. The station is sampled five to six times during the PCR season as part of the Division's five-year rotating schedule for basin monitoring (see also Section 7.2.1, Kentucky Watershed Management Framework). Table M.3-1 summarizes information about this sampling station; Table M.3-2 provides a summary of the data collected from this station.

**Table M.3-1 Division of Water Sample Site Location**

Station Name	Latitude	Longitude	Stream Segment	River Mile
GRN 005	37.284	-87.8103	Donaldson Creek 0.0-14.2	2.3

**Table M.3-2 Division of Water Sample Data Summary<sup>(1)</sup>**

Station Name	Indicator Bacteria	Number of Observations	Percent Exceeding WQC <sup>2</sup>	Minimum (colonies/100 ml)	Maximum (colonies/100 ml)	Average (colonies/100 ml)
GRN 005	fecal coliform	14	7.1	19	45,000	3,478
GRN 005	<i>E. coli</i>	12	33.3	11	579	215

<sup>(1)</sup>The full data set for samples collected at GRN 005 may be obtained by submitting a request of records under the Kentucky Open Records Act (KORA) to [DEP.KORA@ky.gov](mailto:DEP.KORA@ky.gov) or by fax to 502-564-9232. The DEP KORA point of contact may also be reached at 502-564-3999.

<sup>(2)</sup>2,000 colonies/100 ml for fecal coliform; 240 colonies/100 ml for *E. coli*.

The TMDL allocations for Donaldson Creek 0.0 to 14.2 are presented in Table M.3-3. There are no KPDES-permitted discharges into this segment of Donaldson Creek. The location of the segment within the Lower Donaldson Creek watershed is shown in Figure M.3-1.

**Table M.3-3 Donaldson Creek 0.0 to 14.2 TMDL Allocations<sup>(1)</sup>**

TMDL <sup>(2)</sup>	Allocations for Direct Loads to the Segment	Allocations for Upstream Loads to the Segment <sup>(4)</sup>	Allocations for Tributary Loads to the Segment <sup>(5)</sup>	MOS <sup>(6)</sup>
	LA <sup>(3)</sup>			
$Q_S \times WQC \times CF$	$\sum(Q_{LA} \times WQC \times CF)$	$\sum(Q_{Upstream} \times WQC \times CF)$	$\sum(Q_{Tributary} \times WQC \times CF)$	Implicit

<sup>(1)</sup>All loads are colonies/day of either *E. coli* or fecal coliform. The recreational use bacterial WQCs are found in 401 KAR 10:031. CF is the conversion factor (24,465,758.4 s-ml/ft<sup>3</sup>-day) to change the product of bacterial concentration (colonies/100 ml) and flow (ft<sup>3</sup>/s) into a load (colonies/day). The symbol “ $\Sigma$ ” indicates that the total allocation is the sum of all the individual allowable loads.

<sup>(2)</sup> $Q_S$  is the flow (ft<sup>3</sup>/s) in the segment.

<sup>(3)</sup> $Q_{LA}$  is the flow (ft<sup>3</sup>/s) in the segment due to a LA source.

<sup>(4)</sup> $Q_{Upstream}$  is the flow contribution (ft<sup>3</sup>/s) from upstream of the segment. This load includes both WLA and LA sources upstream of the impaired segment.

<sup>(5)</sup> $Q_{Tributary}$  is the flow contribution (ft<sup>3</sup>/s) from a tributary to the segment. This load includes both WLA and LA sources on tributaries to the impaired segment.

<sup>(6)</sup>The following assumptions provide an implicit MOS:

(a)Upstream and tributary bacterial concentrations are at the maximum allowable limit; there is no dilution capacity from these areas.

(b)There is no bacteria die-off; in reality bacteria concentrations diminish downstream from their source. Thus, bacteria loads to the upper portion of a segment will diminish prior to reaching the lower portion of the segment.

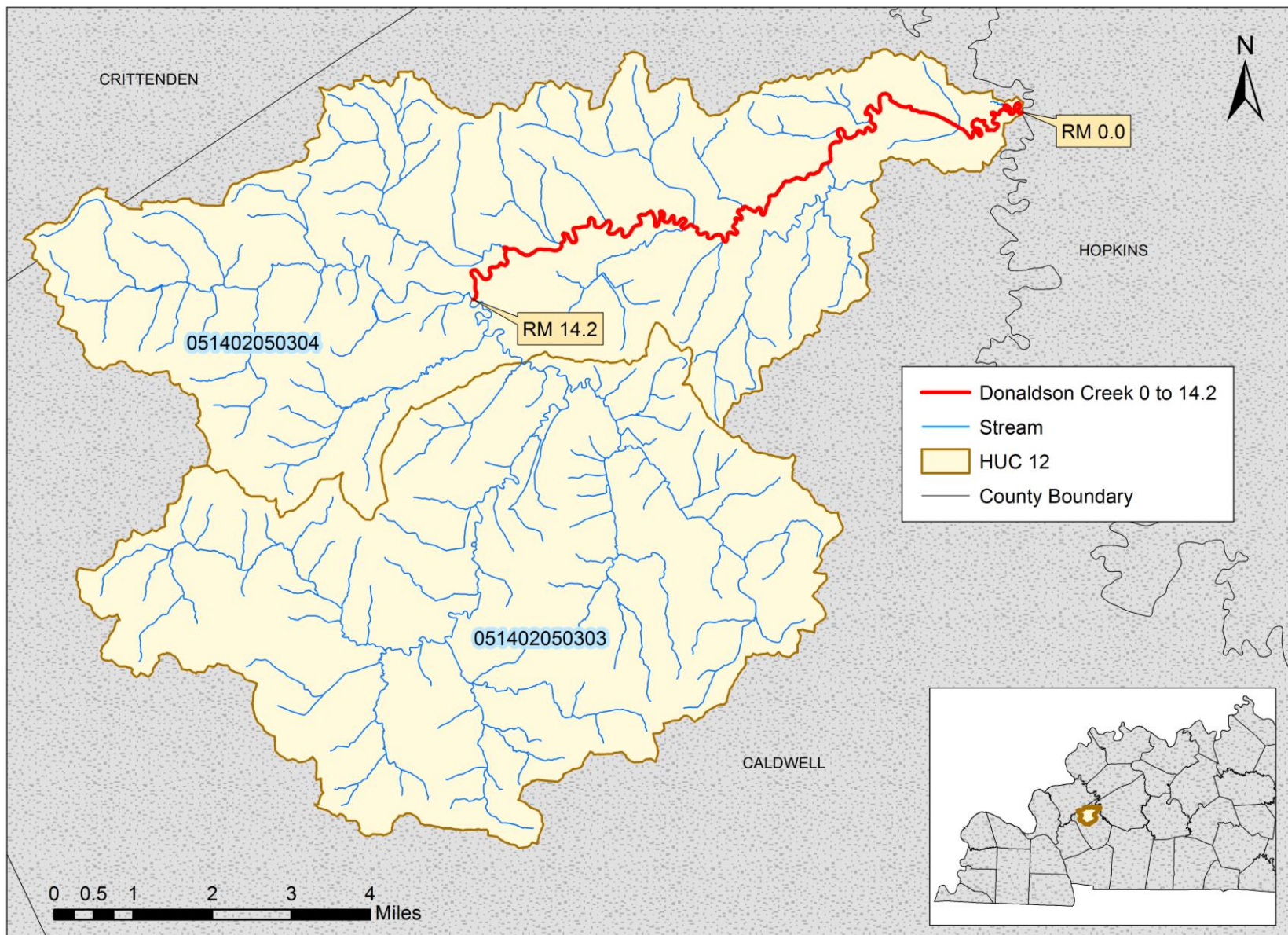


Figure M.3-1 Location of Donaldson Creek 0.0 to 14.2

**Section M.4 Tradewater River 0.0 to 16.8****Waterbody ID:** KY505460\_01**Receiving Water:** Ohio River**Impaired Use:** PCR**Support Status:** nonsupport**Indicator Bacteria:** fecal coliform**HUC 12:** 051402050502, 051402050505**County:** Crittenden, Union, Webster

The Division of Water collected samples from station PRI 053, located at river mile 15.25, from 1991 until 2003. The station was sampled five or more times during the PCR season each year from 1991-99, in 2001 and in 2003. The Ohio River Sanitation Commission (ORSANCO) collected samples from two locations along this segment, TR1.2 and TR6.8, as part of a survey of Ohio River tributaries. ORSANCO sampled at TR1.2 between 2004 and 2008 and at TR6.8 between 2007 and 2012. Table M.4-1 summarizes information about these sampling stations; Table M.4-2 provides a summary of the data collected from the stations.

**Table M.4-1 Sample Site Locations**

Station Name	Latitude	Longitude	Stream Segment	River Mile
PRI053	37.4794444	-87.9536111	Tradewater River 0.0-16.8	15.25
TR1.2	37.518139	-88.045494	Tradewater River 0.0-16.8	1.2
TR6.8	37.52928333	-87.998815	Tradewater River 0.0-16.8	6.8

**Table M.4-2 Sample Data Summary<sup>(1)</sup>**

Station Name	Indicator Bacteria	Number of Observations	Percent Exceeding WQC <sup>2</sup>	Minimum (colonies/100 ml)	Maximum (colonies/100 ml)	Average (colonies/100 ml)
PRI053	fecal coliform	71	7.0	10	800	156
TR1.2	<i>E. coli</i>	51	19.6	4	448	117
TR6.8	<i>E. coli</i>	13	38.5	20	5,255	729

<sup>(1)</sup>The full data set for samples collected at the listed stations may be obtained by submitting a request of records under the Kentucky Open Records Act (KORA) to [DEP.KORA@ky.gov](mailto:DEP.KORA@ky.gov) or by fax to 502-564-9232. The DEP KORA point of contact may also be reached at 502-564-3999.

<sup>(2)</sup>400 colonies/100 ml for fecal coliform; 240 colonies/100 ml for *E. coli*.

The TMDL allocations for Tradewater River 0.0 to 16.8 are presented in Table M.4-3. There are no

KPDES-permitted discharges into this segment of the Tradewater River. The location of the segment within the Lower Tradewater River watershed is shown in Figure M.4-1.

**Table M.4-3 Tradewater River 0.0 to 16.8 TMDL Allocations<sup>(1)</sup>**

TMDL <sup>(2)</sup>	Allocations for Direct Loads to the Segment	Allocations for Upstream Loads to the Segment <sup>(4)</sup>	Allocations for Tributary Loads to the Segment <sup>(5)</sup>	MOS <sup>(6)</sup>
	LA <sup>(3)</sup>			
$Q_S \times WQC \times CF$	$\sum(Q_{LA} \times WQC \times CF)$	$\sum(Q_{Upstream} \times WQC \times CF)$	$\sum(Q_{Tributary} \times WQC \times CF)$	Implicit

<sup>(1)</sup>All loads are colonies/day of either *E. coli* or fecal coliform. The recreational use bacterial WQCs are found in 401 KAR 10:031. CF is the conversion factor (24,465,758.4 s-ml/ft<sup>3</sup>-day) to change the product of bacterial concentration (colonies/100 ml) and flow (ft<sup>3</sup>/s) into a load (colonies/day). The symbol “ $\sum$ ” indicates that the total allocation is the sum of all the individual allowable loads.

<sup>(2)</sup> $Q_S$  is the flow (ft<sup>3</sup>/s) in the segment.

<sup>(3)</sup> $Q_{LA}$  is the flow (ft<sup>3</sup>/s) in the segment due to a LA source.

<sup>(4)</sup> $Q_{Upstream}$  is the flow contribution (ft<sup>3</sup>/s) from upstream of the segment. This load includes both WLA and LA sources upstream of the impaired segment.

<sup>(5)</sup> $Q_{Tributary}$  is the flow contribution (ft<sup>3</sup>/s) from a tributary to the segment. This load includes both WLA and LA sources on tributaries to the impaired segment.

<sup>(6)</sup>The following assumptions provide an implicit MOS:

- (a)Upstream and tributary bacterial concentrations are at the maximum allowable limit; there is no dilution capacity from these areas.
- (b)There is no bacteria die-off; in reality bacteria concentrations diminish downstream from their source. Thus, bacteria loads to the upper portion of a segment will diminish prior to reaching the lower portion of the segment.

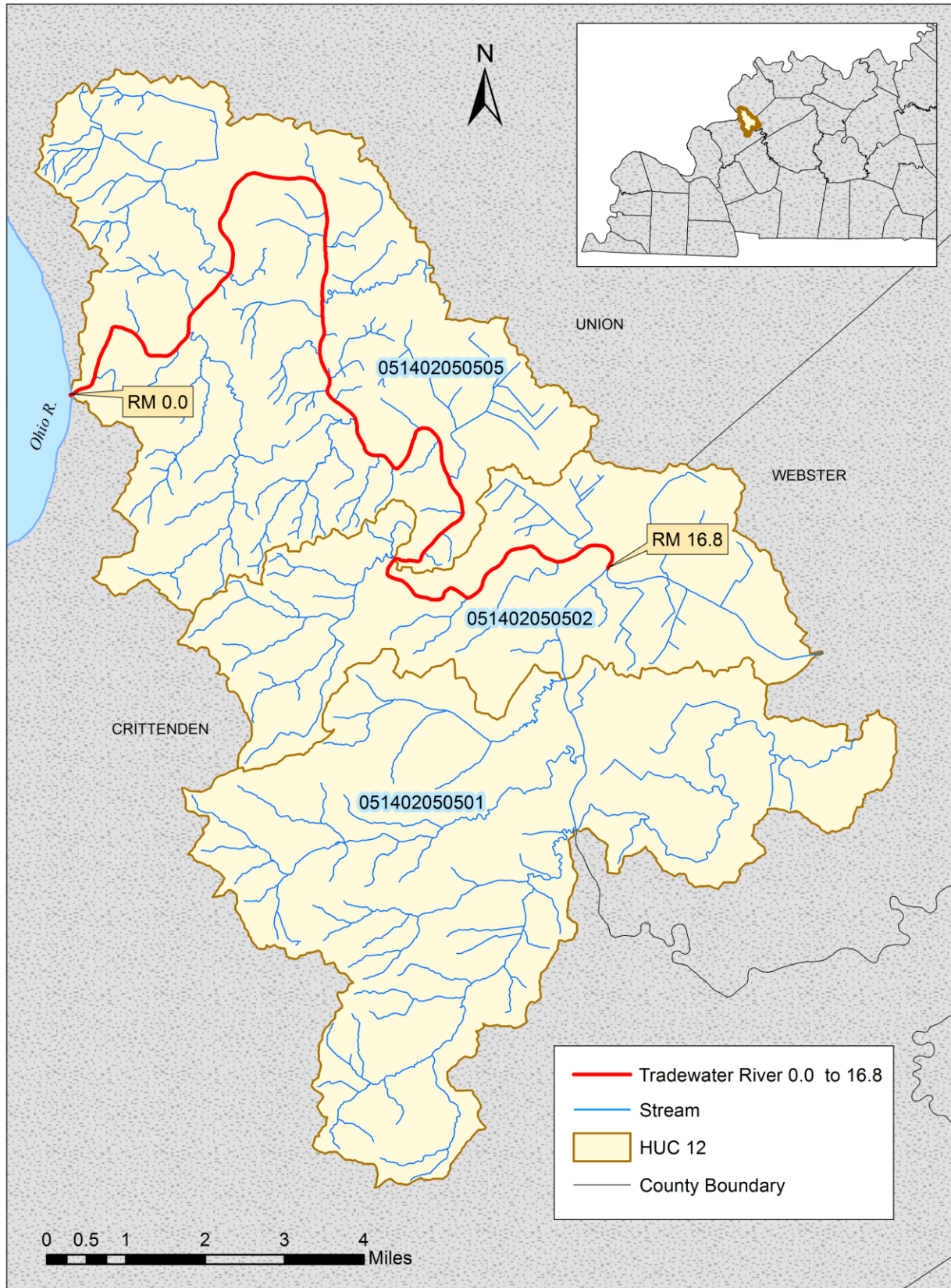


Figure M.4-1 Location of Tradewater River 0.0 to 16.8



**Section M.5 Vaughn Ditch 0.0 to 3.25****Waterbody ID:** KY505996\_01**Receiving Water:** Tradewater River**Impaired Use:** PCR**Support Status:** nonsupport**Indicator Bacteria:** *E. coli***HUC 12:** 051402050502**County:** Webster

The Division of Water has collected samples from station GRN 003, located at river mile 2.3, since 2001. The station is sampled five to six times during the PCR season as part of the Division's five-year rotating schedule for basin monitoring (see also Section 7.2.1, Kentucky Watershed Management Framework). Table M.5-1 summarizes information about this sampling station; Table M.5-2 provides a summary of the data collected from this station.

**Table M.5-1 Division of Water Sample Site Location**

Station Name	Latitude	Longitude	Stream Segment	River Mile
GRN 003	37.463433	-87.898336	Vaughn Ditch 0.0-3.25	2.3

**Table M.5-2 Division of Water Sample Data Summary<sup>(1)</sup>**

Station Name	Indicator Bacteria	Number of Observations	Percent Exceeding WQC <sup>2</sup>	Minimum (colonies/100 ml)	Maximum (colonies/100 ml)	Average (colonies/100 ml)
GRN 003	fecal coliform	13	46.2	33	60,000	4,869
GRN 003	<i>E. coli</i>	12	33.3	15	2,420	484

<sup>(1)</sup>The full data set for samples collected at GRN 003 may be obtained by submitting a request of records under the Kentucky Open Records Act (KORA) to [DEP.KORA@ky.gov](mailto:DEP.KORA@ky.gov) or by fax to 502-564-9232. The DEP KORA point of contact may also be reached at 502-564-3999.

<sup>(2)</sup>400 colonies/100 ml for fecal coliform; 240 colonies/100 ml for *E. coli*.

The TMDL allocations for Vaughn Ditch 0.0 to 3.25 are presented in Table M.5-3. There are no KPDES-permitted discharges into this segment of Vaughn Ditch. The location of the segment within the Long Branch-Tradewater River and Craborchard Creek-Vaughn Ditch watersheds is shown in Figure M.5-1.

**Table M.5-3 Vaughn Ditch 0.0 to 3.25 TMDL Allocations<sup>(1)</sup>**

TMDL <sup>(2)</sup>	Allocations for Direct Loads to the Segment	Allocations for Upstream Loads to the Segment <sup>(4)</sup>	Allocations for Tributary Loads to the Segment <sup>(5)</sup>	MOS <sup>(6)</sup>
	LA <sup>(3)</sup>			
$Q_S \times WQC \times CF$	$\sum(Q_{LA} \times WQC \times CF)$	$\sum(Q_{Upstream} \times WQC \times CF)$	$\sum(Q_{Tributary} \times WQC \times CF)$	Implicit

<sup>(1)</sup>All loads are colonies/day of either *E. coli* or fecal coliform. The recreational use bacterial WQCs are found in 401 KAR 10:031. CF is the conversion factor (24,465,758.4/day) to change the product of bacterial concentration (colonies/100 ml) and flow (ft<sup>3</sup>/s) into a load (colonies/day). The symbol “ $\sum$ ” indicates that the total allocation is the sum of all the individual allowable loads.

<sup>(2)</sup> $Q_S$  is the flow (ft<sup>3</sup>/s) in the segment.

<sup>(3)</sup> $Q_{LA}$  is the flow (ft<sup>3</sup>/s) in the segment due to a LA source.

<sup>(4)</sup> $Q_{Upstream}$  is the flow contribution (ft<sup>3</sup>/s) from upstream of the segment. This load includes both WLA and LA sources upstream of the impaired segment.

<sup>(5)</sup> $Q_{Tributary}$  is the flow contribution (ft<sup>3</sup>/s) from a tributary to the segment. This load includes both WLA and LA sources on tributaries to the impaired segment.

<sup>(6)</sup>The following assumptions provide an implicit MOS:

- (a)Upstream and tributary bacterial concentrations are at the maximum allowable limit; there is no dilution capacity from these areas.
- (b)There is no bacteria die-off; in reality bacteria concentrations diminish downstream from their source. Thus, bacteria loads to the upper portion of a segment will diminish prior to reaching the lower portion of the segment.

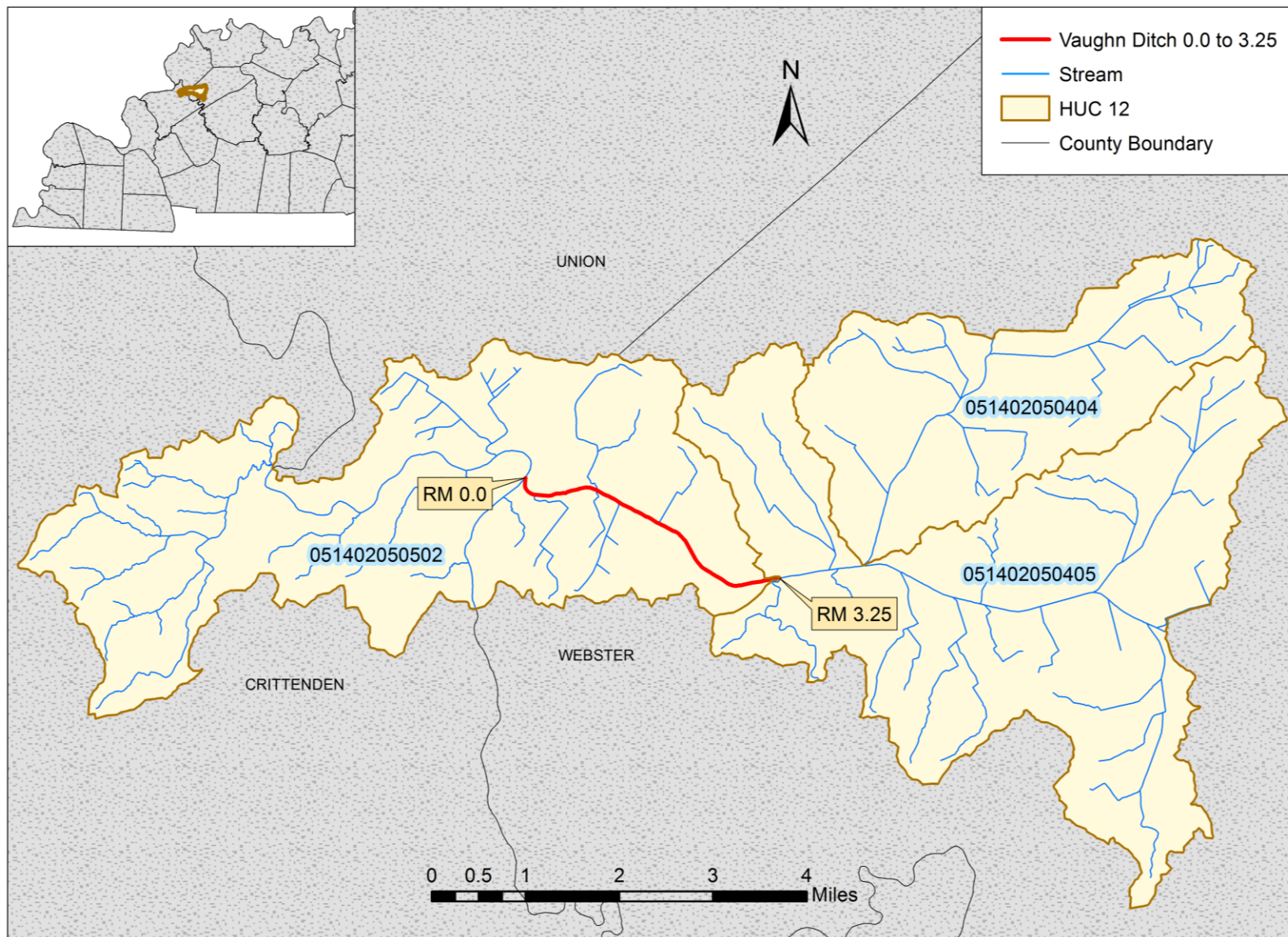


Figure M.5-1 Location of Vaughn Ditch 0.0 to 3.2