APPENDIX 3

A-3. LITTLE COAL RIVER

A-3.1 Watershed Information

Little Coal River is in the northwestern portion of the Coal River watershed and drains approximately 117.8 square miles (75,394 acres), as shown in Figure A-3-1. The dominant landuse in the watershed is forest, which covers 81.8 percent of the watershed. Other important landuse types include mining land (6.6 percent), agriculture (3.6 percent) and urban/residential (2.3 percent). All other individual land cover types account for less than 5.7 percent of the total watershed area. There are 18 impaired streams, including Little Coal River, in the watershed. Figure A-3-2 shows the impaired segments and the pollutants for which each is listed as impaired.

Before establishing Total Maximum Daily Loads (TMDLs), WVDEP performed monitoring in each of the impaired streams in the Coal River watershed to better characterize water quality and refine impairment listings. Monthly samples were taken at 47 stations (station locations can be viewed using the ArcExplorer project) throughout the Little Coal River watershed from July 1, 2002, through June 30, 2003. Monitoring suites at each site were determined based on the types of impairments observed in each stream. Streams impaired by metals and low pH were sampled monthly and analyzed for a suite of parameters including acidity, alkalinity, total iron, dissolved iron, total aluminum, dissolved aluminum, total suspended solids, pH, sulfate, total selenium, total manganese, and specific conductance. Monthly samples from streams impaired by fecal coliform bacteria were analyzed for fecal coliform bacteria, pH, and specific conductance. In addition, benthic macroinvertebrate assessments were performed at specific locations on the biologically impaired streams during the pre-TMDL monitoring period. Instantaneous flow measurements were also taken at strategic locations during pre-TMDL monitoring.

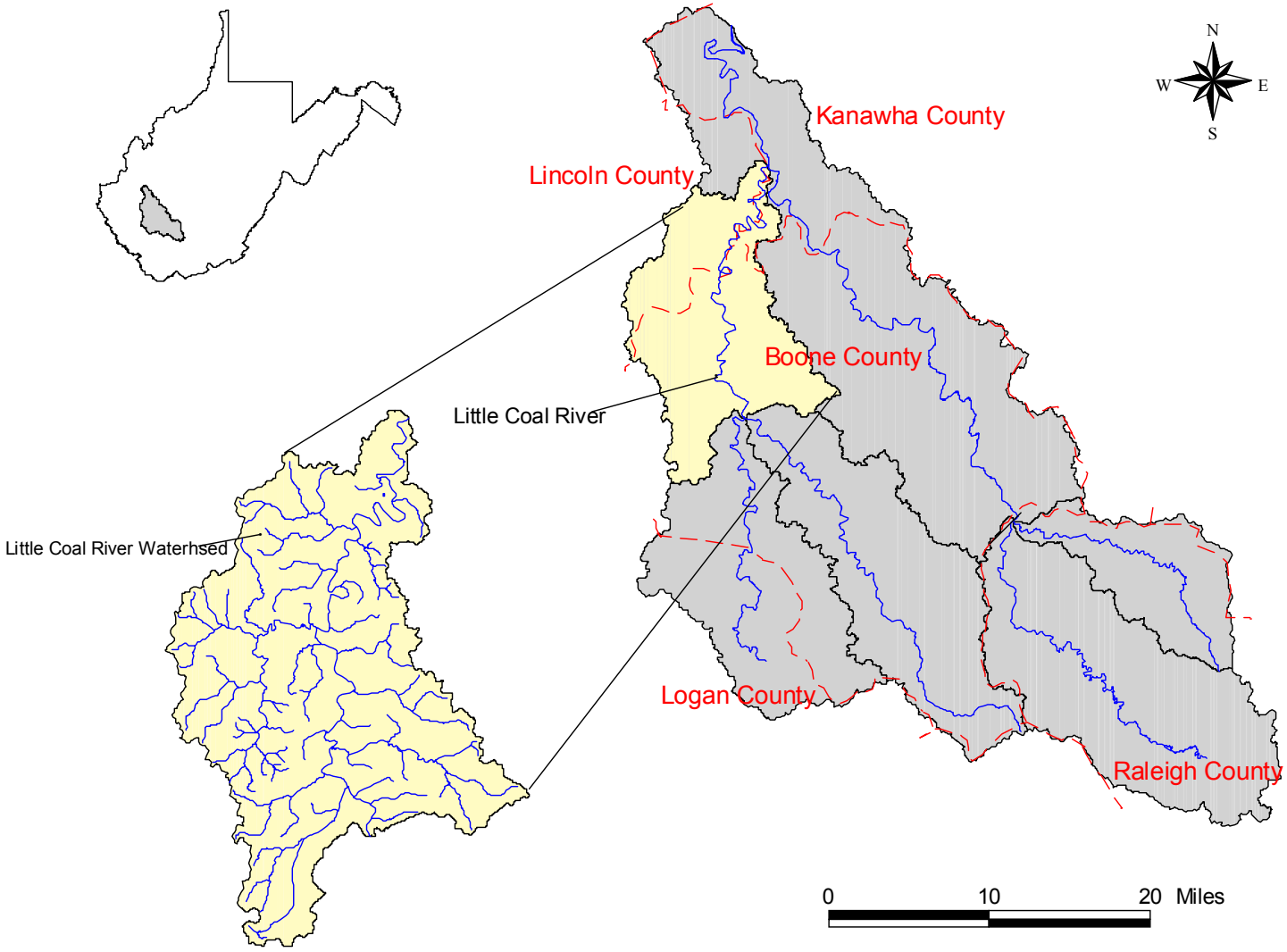
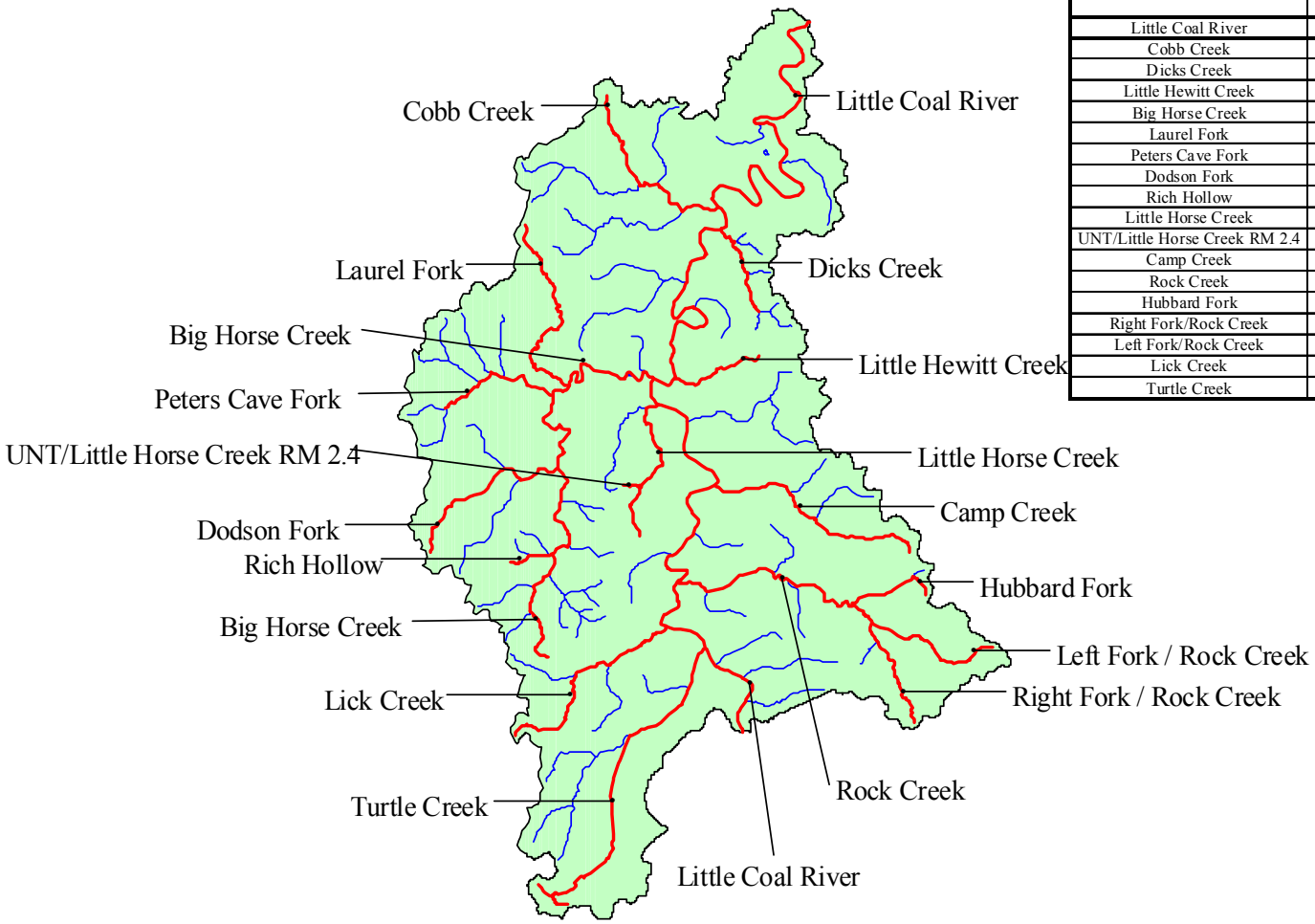


Figure A-3-1. Location of the Little Coal River watershed.



Stream	Aluminum	Iron	pH	Biological	Fecal Coliforms	Sediment
Little Coal River					X	
Cobb Creek					X	
Dicks Creek		X				
Little Hewitt Creek	X	X	X			
Big Horse Creek		X		X	X	X
Laurel Fork		X			X	
Peters Cave Fork		X			X	
Dodson Fork		X		X	X	X
Rich Hollow		X				
Little Horse Creek		X		X	X	X
UNT/Little Horse Creek RM 2.4					X	
Camp Creek					X	
Rock Creek				X	X	
Hubbard Fork				X	X	
Right Fork/Rock Creek				X	X	
Left Fork/Rock Creek				X	X	
Lick Creek				X	X	
Turtle Creek				X	X	

Figure A-3-2. Waterbodies and impairments under TMDL development in the Little Coal River watershed.

A-3.2 Metals and pH Sources

This section identifies and examines the potential sources of aluminum, iron, and pH impairment in the Little Coal River watershed. Sources can be classified as point sources (specific sources subject to a permit) or non-point sources (diffuse sources). Mining- and non-mining-related permitted discharges are considered metals and pH point sources. Metals and pH non-point sources are diffuse, non-permitted sources such as abandoned or forfeited mine sites.

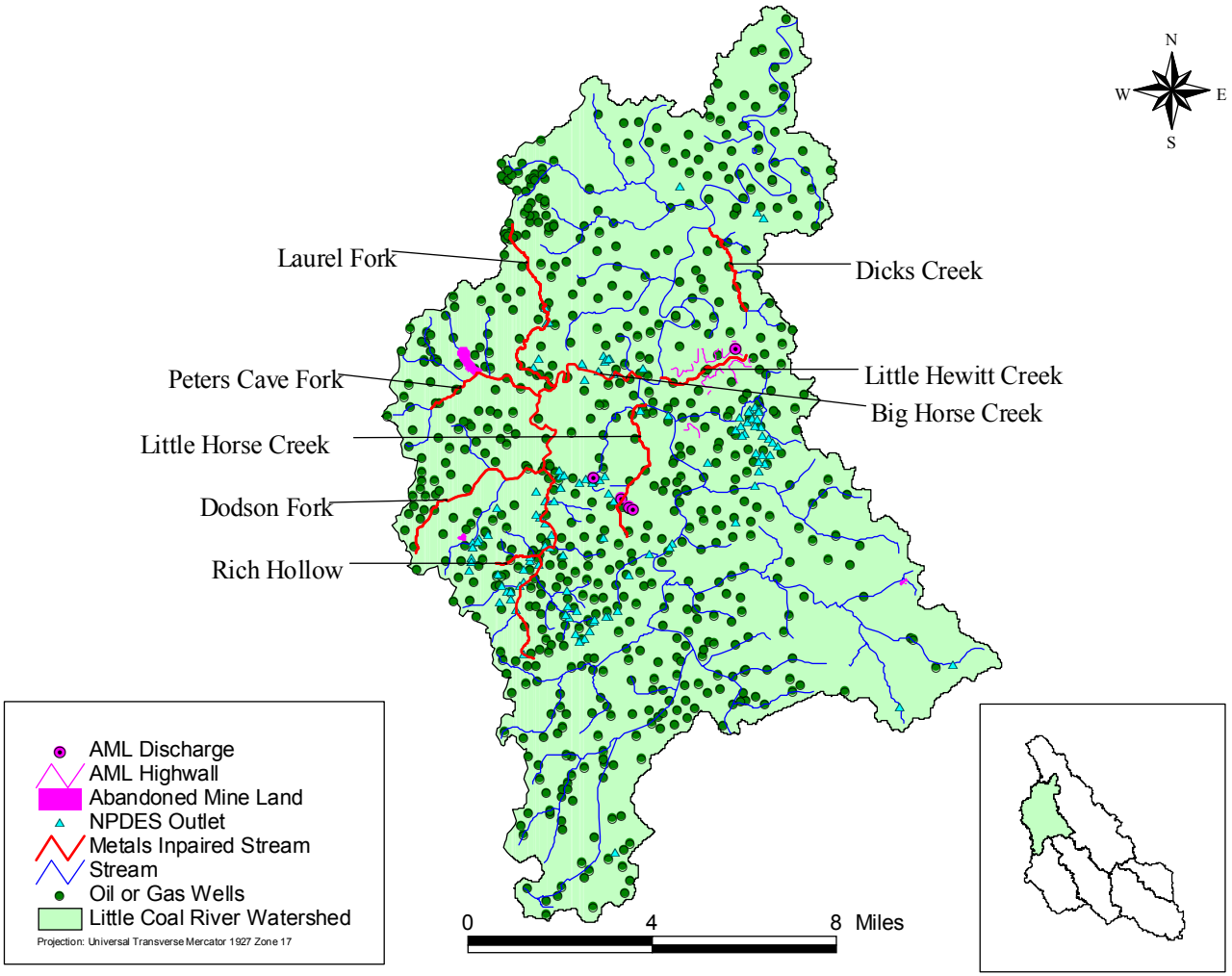
Pollutant sources were identified using statewide geographic information system (GIS) coverages of point and non-point sources, and through field reconnaissance. As part of the TMDL process, WVDEP documented pollution sources by describing the pollutant source in detail, collecting Global Positioning System data, and if necessary, collecting a water quality sample for laboratory analysis. WVDEP personnel recorded physical descriptions of the pollutant sources, such as the number of outfalls, the source of the outfalls, and the general condition of the stream in the vicinity of each outfall. These records were compiled and electronically plotted on maps using GIS software. This information was used in conjunction with other information to characterize pollutant sources. Significant metals sources in the watershed are shown in Figure A-3-3.

On the basis of scientific knowledge of sediment/metals interaction and knowledge of West Virginia's soils, it is reasonable to conclude that sediments contain high levels of aluminum and iron. Control of sediment-producing sources might be necessary to meet water quality criteria for dissolved aluminum and total iron during critical high flow conditions. Although some of these sediment-producing sources are not shown in Figure A-3-3 (e.g., harvested forest areas, agricultural areas, and unpaved roads), specific details relative to these sources are discussed in section A-3.2.2.

A-3.2.1 Metals Point Source Inventory

As described in the main report, the National Pollutant Discharge Elimination System (NPDES) program, established under Clean Water Act sections 318, 402, and 405, requires permits for the discharge of pollutants from point sources. Metals and pH point sources can be classified into two major categories: permitted non-mining point sources and permitted mining point sources.

In the Little Coal River watershed, all NPDES permits for metals effluents are related to mining. WVDEP's HPU GIS coverage was used to determine the locations of the mining permits; the detailed permit information came from WVDEP's ERIS database system. There are 123 mining-related NPDES outlets in the Little Coal River watershed. The permits related to these outlets are listed in the Technical Report, which shows the name of each responsible party and the total number of outlets that discharge to the Little Coal River watershed. The Technical Report also contains specific data for each permitted outlet (including effluent type, drainage areas, and pump capacities) and permit limits for each of the mining-related NPDES outlets.



NOTE: Some mapped features in close proximity to each other may plot as one location on the map.

Figure A-3-3. Metals sources in the Little Coal River watershed.

A-3.2.2 Metals Non-point Source Inventory

In addition to point sources, non-point sources also contribute to metals-related water quality impairments in the Little Coal River watershed. Non-point sources are diffuse, non-permitted sources. Abandoned mine lands and facilities that were subject to the Surface Mining Control and Reclamation Act of 1977, and forfeited their bonds or abandoned operations can be significant non-permitted source of metals. Non-mining land disturbance activities can also be a non-point source of metals, causing metals to enter waterbodies as a component of sediment. Examples of such land-disturbing activities are agriculture, forestry, oil and gas wells, and the construction and use of roads. The applicable land-disturbing activities in the Little Coal River watershed are discussed below.

Abandoned Mine Lands and Bond Forfeiture Sites

Based on the identification of a number of abandoned mining activities in the Little Coal River watershed, abandoned mine lands are a significant non-permitted source of metals and pH impairment in the watershed. WVDEP's Office of Abandoned Mine Lands identified the locations of abandoned mine lands in the Little Coal River watershed. In addition, source-tracking efforts by WVDEP's Division of Water and Waste Management identified and characterized five abandoned mine sources (i.e. discharges, seeps, streams, and ponds).

WVDEP's Division of Land Restoration, Office of Special Reclamation, provided bond forfeiture information and data. This information included the status of both land reclamation and water treatment activities. In the Little Coal River watershed, revoked mines or bond forfeiture sites are not present.

Land-Disturbing Activities

Based on the GAP 2000 landuse coverage, agricultural areas consist of 2,718 acres (3.6 percent) in the Little Coal River watershed. There are six active logging operations in the watershed. The disturbed areas associated with these operations are estimated to cover 1,311 acres (1.7 percent) of the total watershed area. The watershed contains 383 active oil and gas wells, which, based on the survey by WVDEP's Office of Oil and Gas, are estimated to comprise 529 acres (0.7 percent). The length and area of paved roads were calculated using the Census 2000 TIGER/Line files roads coverage for West Virginia. Information on unpaved roads from TIGER was supplemented by digitizing any unpaved roads shown on topographic maps that were not included in the TIGER shapefile. There are 197.8 miles of paved roads and 597.0 miles of unpaved roads in the Little Coal River watershed.

A-3.3 Fecal Coliform Bacteria Sources

This section identifies and examines the potential sources of fecal coliform bacteria in the Little Coal River watershed. Sources can be classified as point sources (specific sources subject to a permit) or non-point sources (diffuse sources). Point sources of fecal coliform bacteria are classified by several different types of sewage permits and the point source discharges regulated in them. Non-point sources are diffuse, non-permitted sources.

A-3.3.1 Fecal Coliform Bacteria Point Sources

Permitted sources of fecal coliform bacteria that experience effluent overflows or that do not comply with permit limits can cause occasional high loadings of fecal coliform bacteria in receiving streams. In the Little Coal River watershed there are 50 discharge permits: 34 are for home aeration units, 9 are general sewage permits, 2 are for individual publicly owned treatment works (POTWs), and 5 are for Boone County Public Sewer District (PSD) combined sewer overflow (CSO) outlets. Three of the Boone County PSD CSO outlets (C003, C004, C005) did not have any historical overflows according to Boone County PSD data; therefore, fecal coliform reductions are not required for these outlets.

A-3.3.2 Non-point (Non-permitted) Fecal Coliform Bacteria Sources

Pollutant source-tracking by WVDEP personnel identified scattered areas of high population density without access to public sewers in the Little Coal River watershed. Human sources of fecal coliform bacteria from these areas include sewage discharges from failing septic systems, and possible direct discharges of sewage from residences (straight pipes). The West Virginia Bureau for Public Health estimates the septic tank failure rate in this area to be 70 percent in the first 10 years after installation (WV Bureau for Public Health 2003). An analysis of census data from the 1990 Census combined with WVDEP source-tracking information yielded an estimate of 5,740 people living in the unsewered homes in the Little Coal River watershed. Figure A-3-4 shows the estimated distribution of the unsewered population in the watershed.

Stormwater runoff is another potential non-point source of fecal coliform bacteria in both residential/urban and rural areas. Runoff from residential areas can deliver the waste of pets and wildlife to the waterbody. In addition, rural stormwater runoff can transport significant loads of bacteria from livestock pastures, livestock and poultry feeding facilities, and manure storage and application. Given the small portion of total land area in the Little Coal River watershed that consists of agricultural areas, stormwater runoff from these areas is not considered to be a significant non-point source of fecal coliform bacteria. Therefore, fecal coliform bacteria reductions from agricultural landuses are not required. However, stormwater runoff from residential areas is a source of fecal coliform bacteria in the Little Coal River watershed. Twelve of the 39 subwatersheds that compose the Lower Coal River watershed require residential reductions.

A certain “natural background” contribution of fecal coliform bacteria can be attributed to deposition by wildlife in forested areas. Accumulation rates for fecal coliform bacteria in forested areas were developed using reference numbers from past TMDLs, incorporating wildlife estimates obtained from the Division of Natural Resources. Although wildlife contributions of fecal coliform bacteria were considered in modeling, they were not found to be a significant source.

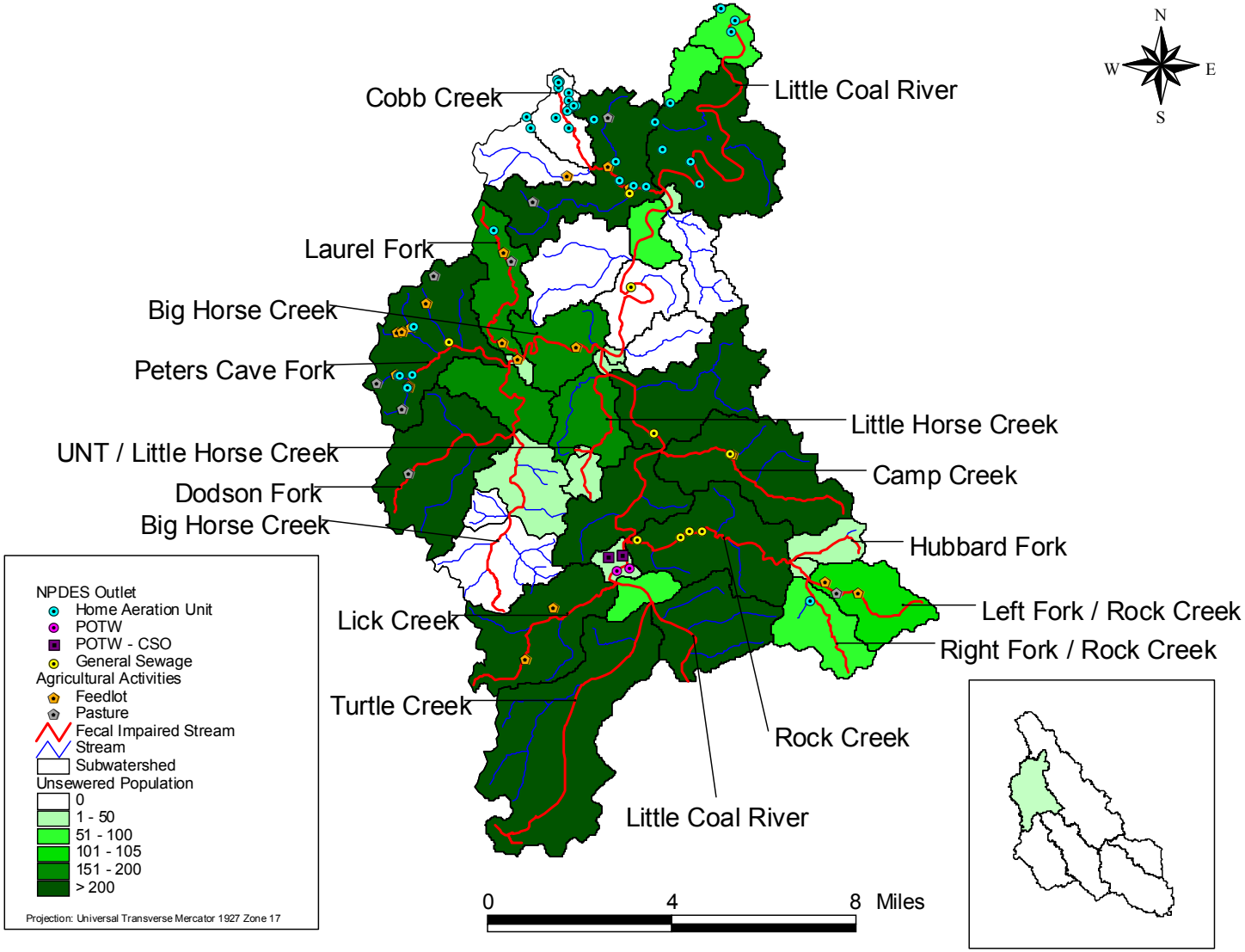


Figure A-3-4. Fecal coliform sources in the Little Coal River watershed.

A-3.4 Stressors of Biologically Impaired Streams

The Little Coal River watershed has nine biologically impaired streams for which TMDLs have been developed. These streams are identified in Table A-3-1 along with the biological stressors of the streams' benthic communities and the TMDLs required to address these impairments. A stressor identification process was used to evaluate and identify the primary stressors of impaired benthic communities. Refer to the main report for a detailed description of the stressor identification process.

Table A-3-1. Primary stressors of biologically impaired streams in the Little Coal River watershed

Stream	Biological Stressors	TMDLs Required
Big Horse Creek	Sedimentation	Sediment
Dodson Fork	Organic enrichment Sedimentation	Fecal coliform Sediment
Little Horse Creek	Organic enrichment Sedimentation	Fecal coliform Sediment
Rock Creek	Organic enrichment	Fecal coliform
Hubbard Fork	Organic enrichment	Fecal coliform
Right Fork/Rock Creek	Organic enrichment	Fecal coliform
Left Fork/Rock Creek	Organic enrichment	Fecal coliform
Lick Creek	Organic enrichment	Fecal coliform
Turtle Creek	Organic enrichment	Fecal coliform

TMDLs for each specific biological stressor are shown in Table A-3-6. Sediment TMDLs are required only when the stressor identification process indicates that a sedimentation problem is impairing the biological community. Sediment TMDLs are presented for Big Horse creek, Dodson Fork and Little Horse Creek. Refer to Section A-3.2.2 for additional sediment source information.

A-3.5 TMDLs for the Little Coal River Watershed

A-3.5.1 TMDL Development

TMDLs and source allocations were developed for impaired streams in the Little Coal River watershed. A top-down methodology was followed to develop these TMDLs and allocate loads to sources. Headwaters were analyzed first because they have a profound effect on downstream water quality. Loading contributions were reduced from applicable sources for these waterbodies, and TMDLs were developed. Refer to Section 7.5 of the main report for a detailed description of the allocation methodologies used in developing the pollutant-specific TMDLs.

The TMDLs for iron, aluminum, pH, fecal coliform bacteria, and sediment are shown in Tables A-3-2 through A-3-6. The TMDLs for iron and aluminum are presented as annual average loads, in pounds per year. The TMDLs for sediment are presented in tonnes per year. The TMDLs for fecal coliform bacteria are presented in number of colonies per year. All TMDLs are presented as average annual loads because they were developed to meet TMDL endpoints under a range of conditions observed throughout the year.

As stated in Section 7.4.1, a surrogate approach was used to develop pH TMDLs. It was assumed that reductions in metals concentrations to TMDL endpoints would result in compliance with the pH water quality standard. To verify this assumption, the Dynamic Equilibrium In-stream Chemical Reactions model (DESC-R) was run for an extended period under TMDL conditions—conditions in which TMDL endpoints for metals were met. A median equilibrium pH was calculated based on the daily equilibrium pH output from DESC-R. The results, shown in Table A-3-4, are the TMDLs for the pH-impaired streams in the watershed. Refer to the Technical Report for a detailed description of the pH modeling approach.

A-3.6 TMDL Tables: Metals and pH

Table A-3-2. Iron TMDLs for the Little Coal River watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lbs/yr)	Wasteload Allocation (lbs/yr)	Margin of Safety (lbs/yr)	TMDL (lbs/yr)
Little Coal River	WVKC-10-F	Dicks Creek	Iron	2,599	NA	137	2,736
Little Coal River	WVKC-10-H	Little Hewitt Creek	Iron	1,638	NA	86	1,725
Little Coal River	WVKC-10-I	Big Horse Creek	Iron	24,943	32,752	3,037	60,731
Little Coal River	WVKC-10-I-2	Laurel Fork	Iron	2,498	1,030	186	3,713
Little Coal River	WVKC-10-I-3	Peters Cave Fork	Iron	5,971	NA	314	6,285
Little Coal River	WVKC-10-I-6	Dodson Fork	Iron	5,647	4,758	548	10,952
Little Coal River	WVKC-10-I-8	Rich Hollow	Iron	157	2,448	137	2,742
Little Coal River	WVKC-10-J	Little Horse Creek	Iron	3,456	1,136	242	4,833

NA = not applicable.

Table A-3-3. Aluminum TMDLs for the Little Coal River watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lbs/yr)	Wasteload Allocation (lbs/yr)	Margin of Safety (lbs/yr)	TMDL (lbs/yr)
Little Coal River	WVKC-10-H	Little Hewitt Creek	Aluminum	251	NA	13	264

NA = not applicable.

Table A-3-4. pH TMDLs for the Little Coal River watershed

Major Watershed	Stream Code	Stream Name	Parameter	pH* (Under TMDL conditions)
Little Coal River	WVKC-10-H	Little Hewitt Creek	pH	8.63

*Predicted pH assumes that all metals (aluminum, iron) meet TMDL endpoints.

A-3.7 TMDL Tables: Fecal Coliform Bacteria

Table A-3-5. Fecal coliform bacteria TMDLs for the Little Coal River watershed

Major Watershed	Stream Code	Stream Name	Parameter	Load Allocation (counts/yr)	Wasteload Allocation (counts/yr)	Margin of Safety (counts/yr)	TMDL (counts/yr)
Little Coal River	WVKC-10	Little Coal River	Fecal coliform	3.07E+14	3.10E+12	1.63E+13	3.27E+14
Little Coal River	WVKC-10-E	Cobb Creek	Fecal coliform	6.30E+12	3.21E+10	3.34E+11	6.67E+12
Little Coal River	WVKC-10-I	Big Horse Creek	Fecal coliform	2.18E+13	1.02E+10	1.15E+12	2.30E+13
Little Coal River	WVKC-10-I-2	Laurel Fork	Fecal coliform	2.82E+12	1.38E+09	1.48E+11	2.97E+12
Little Coal River	WVKC-10-I-3	Peters Cave Fork	Fecal coliform	6.36E+12	8.85E+09	3.35E+11	6.71E+12
Little Coal River	WVKC-10-I-6	Dodson Fork	Fecal coliform	2.70E+12	NA	1.42E+11	2.84E+12
Little Coal River	WVKC-10-J	Little Horse Creek	Fecal coliform	1.50E+12	NA	7.91E+10	1.58E+12
Little Coal River	WVKC-10-J-8	UNT/Little Horse Creek RM 2.4	Fecal coliform	2.84E+10	NA	1.50E+09	2.99E+10
Little Coal River	WVKC-10-L	Camp Creek	Fecal coliform	2.68E+12	2.77E+10	1.42E+11	2.85E+12
Little Coal River	WVKC-10-N	Rock Creek	Fecal coliform	7.90E+12	4.98E+10	4.18E+11	8.37E+12
Little Coal River	WVKC-10-N-2	Hubbard Fork	Fecal coliform	8.38E+11	NA	4.41E+10	8.82E+11
Little Coal River	WVKC-10-N-3	Right Fork/Rock Creek	Fecal coliform	1.26E+12	1.66E+09	6.63E+10	1.33E+12
Little Coal River	WVKC-10-N-4	Left Fork/Rock Creek	Fecal coliform	1.83E+12	NA	9.61E+10	1.92E+12
Little Coal River	WVKC-10-O	Lick Creek	Fecal coliform	3.30E+12	NA	1.74E+11	3.48E+12
Little Coal River	WVKC-10-P	Turtle Creek	Fecal coliform	5.05E+12	NA	2.66E+11	5.32E+12

UNT = unnamed tributary; NA = not applicable.

A-3.8 TMDL Tables: Biological

Table A-3-6. Biological TMDLs for the Little Coal River watershed

Stream	Biological Stressor	Parameter	Load Allocation	Wasteload Allocation	Margin of Safety	TMDL	Units
Big Horse Creek WVKC-10-I	Sedimentation	Sediment	3372.9	1253.1	243.5	4869.4	tonnes/yr
Dodson Fork WVKC-10-I-6	Organic enrichment	Fecal coliform	2.70E+12	NA	1.42E+11	2.84E+12	counts/yr
	Sedimentation	Sediment	731.7	299.4	54.3	1085.4	tonnes/yr
Little Horse Creek WVKC-10-J	Organic enrichment	Fecal coliform	1.50E+12	NA	7.91E+10	1.58E+12	counts/yr
	Sedimentation	Sediment	364.4	193.5	29.4	587.2	tonnes/yr
Rock Creek WVKC-10-N	Organic enrichment	Fecal coliform	7.90E+12	4.98E+10	4.18E+11	8.37E+12	counts/yr
Hubbard Fork WVKC-10-N-2	Organic enrichment	Fecal coliform	8.38E+11	NA	4.41E+10	8.82E+11	counts/yr
Right Fork/ Rock Creek WVKC-10-N-3	Organic enrichment	Fecal coliform	1.26E+12	1.66E+09	6.63E+10	1.33E+12	counts/yr
Left Fork/Rock Creek WVKC-10-N-4	Organic enrichment	Fecal coliform	1.83E+12	NA	9.61E+10	1.92E+12	counts/yr
Lick Creek WVKC-10-O	Organic enrichment	Fecal coliform	3.30E+12	NA	1.74E+11	3.48E+12	counts/yr
Turtle Creek WVKC-10-P	Organic enrichment	Fecal coliform	5.05E+12	NA	2.66E+11	5.32E+12	counts/yr