APPENDIX 2

A-2. PETERS CREEK

A-2.1 Watershed Information

Peters Creek is in the northwestern portion of the Gauley River watershed and drains approximately 52 square miles (33,292 acres), as shown in Figure A-2-1. The dominant landuse in the watershed is forest, which covers 86.9 percent of the watershed. Other important landuse types include grassland (6.4 percent), barren land (3.9 percent), and urban/residential (2.1 percent). All other individual land cover types account for less than 1 percent of the total watershed area. WVDEP identified the mainstem of Peters Creek upstream of Buck Garden Creek as a troutwater. There are 16 impaired streams in the watershed, including Peters Creek, that are addressed in this TMDL development effort. Figure A-2-2 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 Gauley River watershed to better characterize water quality and refine impairment listings. Monthly samples were taken at 32 stations (station locations can be viewed using the ArcExplorer project) throughout the Peters Creek watershed from July 1, 2003, through June 30, 2004. 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, 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 during the pre-TMDL monitoring period. Instantaneous flow measurements were also taken at strategic locations during pre-TMDL monitoring.

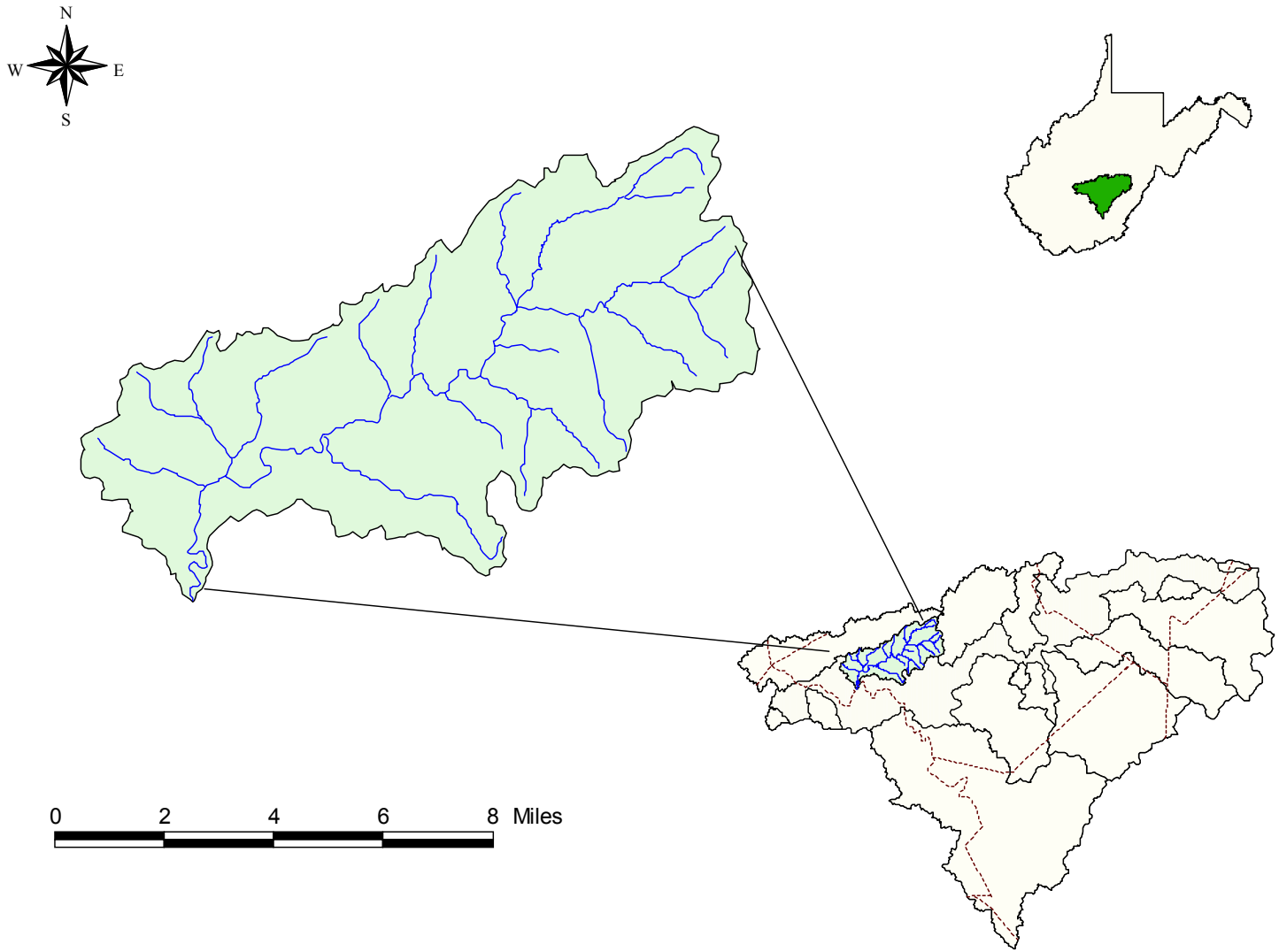
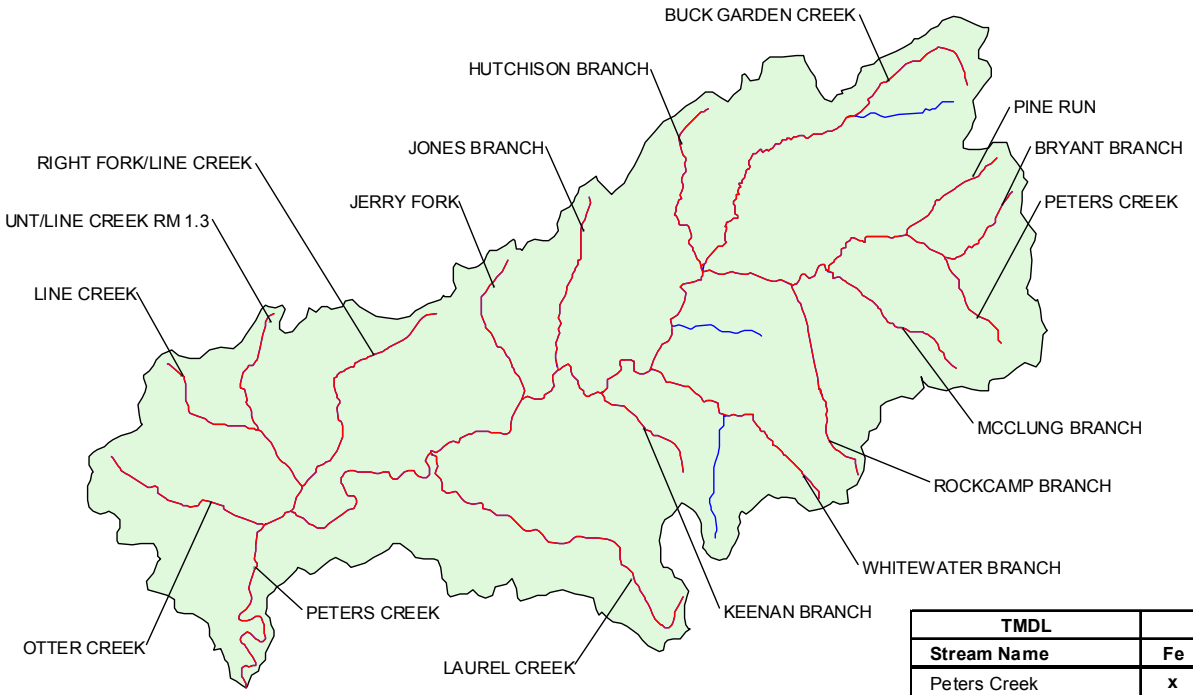


Figure A-2-1. Location of the Peters Creek watershed



TMDL	Impairment					
Stream Name	**Fe**	**Al**	**pH**	**Se**	**FC**	**BIO**
Peters Creek	x				x	
Otter Creek	x				x	
Line Creek					x	
Right Fork/Line Creek	x					
UNT/Line Creek RM 1.3		x	x			
Laurel Creek					x	
Jerry Fork	x					
Jones Branch	x				x	
Keenan Branch					x	
Whitewater Branch					x	
Buck Garden Creek	x				x	
Hutchison Branch	x				x	
Rockcamp Branch	x					
McClung Branch	x				x	
Pine Run	x					
Bryant Branch	x					

Figure A-2-2. Waterbodies and impairments under TMDL development in the Peters Creek watershed

A-2.2 Metals and pH Sources

This section identifies and examines the potential sources of iron, aluminum, and pH impairment in the Peters Creek 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 potential metals and pH point sources. Metals and pH non-point sources are non-permitted sources such as abandoned or forfeited mine sites.

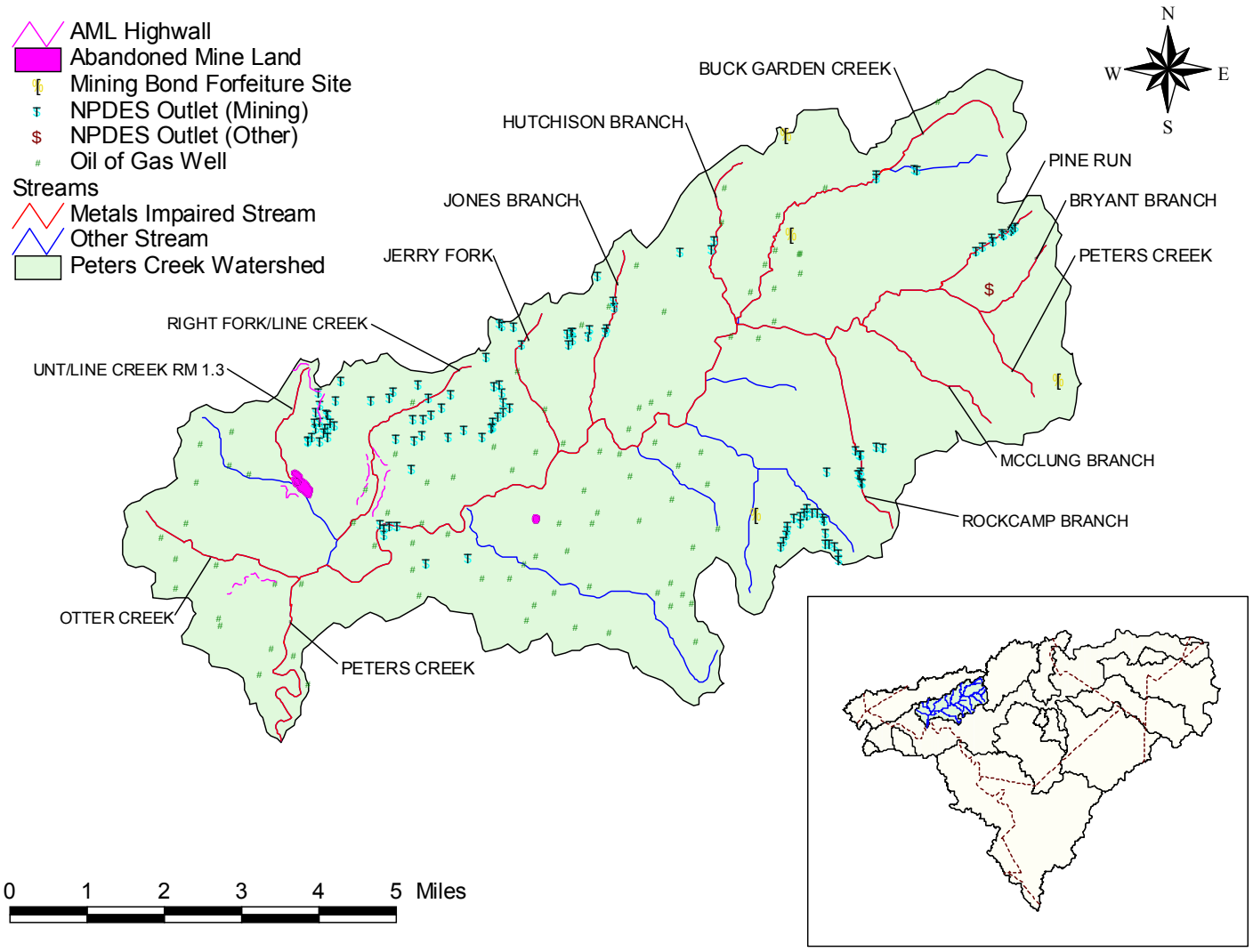
Pollutant sources were identified using statewide geographic information system (GIS) coverages of point and non-point sources, and through field reconnaissance. As part of the TMDL process, WVDEP documented pollution sources by describing the pollutant source in detail, collecting Global Positioning 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-2-3.

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 were determined necessary to meet water quality criteria for total iron during critical high-flow conditions. Although some of these sediment-producing sources are not shown in Figure A-2-3 (e.g., agricultural areas and unpaved roads), specific details relative to these sources are discussed in section A-2.2.2.

A-2.2.1 Metals Point Source Inventory

As described in the TMDL 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 Peters Creek watershed there are 32 mining-related NPDES outlets. 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. 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 Peters Creek 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. Because NPDES permits contain effluent limitations and/or monitoring requirements, the discharges from mining activities were determined to be contributing point sources of iron and aluminum. There is one non-mining point source present in the watershed. The Multi-Sector Stormwater General Permit regulates a discharge from the facility that is subject to a benchmark value for iron.



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

Figure A-2-3. Metals sources in the Peters Creek watershed

A-2.2.2 Metals Non-point Source Inventory

In addition to point sources, non-point sources also contribute to metals-related water quality impairments in the Peters Creek 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 a 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 disturbance activities are agriculture, forestry, oil and gas wells, and the construction and use of roads. The applicable land-disturbing activities in the Peters Creek watershed are discussed below.

Abandoned Mine Lands and Bond Forfeiture Sites
Based on the identification of a number of abandoned mining activities in the Peters Creek 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 Peters Creek watershed.

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. There are four bond forfeiture sites that comprise approximately 237 acres in the Peters Creek watershed.

Land-Disturbing Activities
Based on the GAP 2000 landuse coverage, there are only 55 acres of row crop agriculture in the Peters Creek watershed, representing 0.2 percent of the total area. During the pre-TMDL sampling period there were 109 acres of active timber harvest in the watershed. The watershed contains 93 active oil and gas wells, which, based on the survey by WVDEP's Office of Oil and Gas, are estimated to comprise 128.3 acres (0.4 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 81.4 miles of paved roads and 65.5 miles of unpaved roads in the Peters Creek watershed.

A-2.3 Fecal Coliform Bacteria Sources

This section identifies and examines the potential sources of fecal coliform bacteria in the Peters Creek watershed. Sources can be classified as either point sources or non-point sources. Potential point sources include effluent discharges of sewage treatment facilities and collection system overflows. Potential non-point sources of fecal coliform bacteria include failing or nonexistent on-site sewage disposal systems, stormwater runoff from pasture and cropland, direct deposition of wastes from livestock, and stormwater runoff from residential and urban areas.

A-2.3.1 Fecal Coliform Bacteria Point Sources

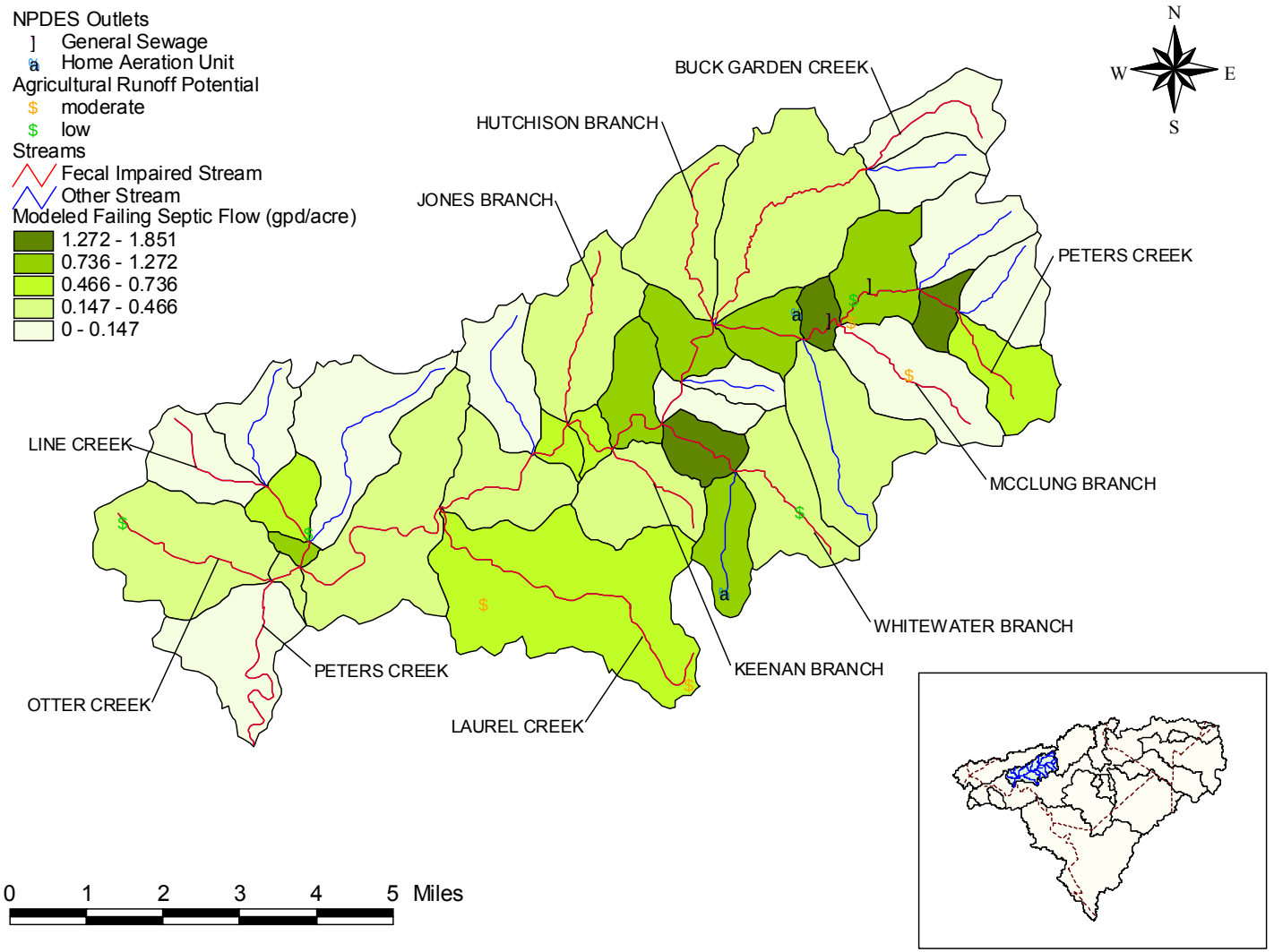
Permitted sources of fecal coliform bacteria that experience effluent overflows or that do not comply with permit limits can cause occasional high loadings of fecal coliform bacteria in receiving streams. In the Peters Creek watershed there are four discharge permits. Two permits are general sewage permits for home aeration units serving private residences. The other two permits are general sewage permits for package plants.

A-2.3.2 Fecal Coliform Bacteria Non-point Sources

Pollutant source-tracking by WVDEP personnel identified scattered areas of high population density without access to public sewers in the Peters Creek 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). WVDEP source-tracking information yielded an estimate of 640 unsewered homes in the Peters Creek watershed. A septic system failure rate derived from geology and soil type was applied to the number of unsewered homes to calculate non-point source fecal coliform loading from failing septic systems. Figure A-2-4 shows the geographic distribution of estimated failing septic system non-point sources 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 Peters Creek watershed that consists of agricultural areas, stormwater runoff from these areas is not considered a significant non-point source of fecal coliform bacteria, except in one modeled subwatershed. Stormwater runoff from residential areas is not a significant source of fecal coliform bacteria in the Peters Creek watershed. However, WVDEP source tracking determined that the primary source of fecal coliform in the Peters Creek watershed is from failing septic systems and/or straight pipe discharges. As a result, 28 subwatersheds require reductions to failing onsite septic systems in the Peters Creek watershed.

A certain “natural background” contribution of fecal coliform bacteria can be attributed to deposition by wildlife in forest and grassland areas. Accumulation rates for fecal coliform bacteria in those areas were developed using reference numbers from past TMDLs, incorporating wildlife estimates obtained from the Division of Natural Resources. In addition, WVDEP conducted storm sampling on a 100 percent forested subwatershed (Shrewsbury Hollow) within the Kanawha State Forest, Kanawha County, West Virginia to determine wildlife contributions of fecal coliform. Although wildlife contributions of fecal coliform bacteria were considered in modeling, they were not found to be a significant source and reductions were not prescribed.



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

Figure A-2-4. Fecal coliform sources in the Peters Creek watershed.

A-2.5 TMDLs for the Peters Creek Watershed

A-2.5.1 TMDL Development

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 7.6 of the TMDL Report for a detailed description of the allocation methodologies used in developing the pollutant-specific TMDLs.

The TMDLs for iron, aluminum, pH, and fecal coliform bacteria are shown in Tables A-2-2 through A-2-5. The TMDLs for iron and aluminum are presented as annual average loads, in pounds 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 the TMDL Report, 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 where 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-2-3, 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-2.6 TMDL Tables: Metals and pH

Table A-2-2. Iron TMDLs for the Peters Creek watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lbs/day)	Wasteload Allocation (lbs/day)	Margin of Safety (lbs/day)	TMDL (lbs/day)
Peters Creek	WVKG-13	Peters Creek	Iron	199.9	74.5	14.4	288.9
Peters Creek	WVKG-13-B	Otter Creek	Iron	7.5	0.2	0.4	8.1
Peters Creek	WVKG-13-C-1	Right Fork/Line Creek	Iron	0.8	25.0	1.4	27.1
Peters Creek	WVKG-13-F	Jerry Fork	Iron	3.8	4.4	0.4	8.6
Peters Creek	WVKG-13-G	Jones Branch	Iron	3.5	14.3	0.9	18.7
Peters Creek	WVKG-13-K	Buck Garden Creek	Iron	41.3	1.7	2.3	45.2
Peters Creek	WVKG-13-K-1	Hutchison Branch	Iron	10.2	2.2	0.7	13.0
Peters Creek	WVKG-13-L	Rockcamp Branch	Iron	6.5	0.8	0.4	7.8
Peters Creek	WVKG-13-M	McClung Branch	Iron	5.2	0.1	0.3	5.6
Peters Creek	WVKG-13-N	Pine Run	Iron	3.1	1.7	0.3	5.1
Peters Creek	WVKG-13-O	Bryant Branch	Iron	4.0	0.1	0.2	4.4

Table A-2-3. Aluminum TMDLs for UNT/Line Creek RM 1.3

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lbs/day)	Wasteload Allocation (lbs/day)	Margin of Safety (lbs/day)	TMDL (lbs/day)
Peters Creek	WVKG-13-C-3	UNT/Line Creek RM 1.3	Aluminum	3.5	0.1	0.2	3.8

Table A-2-4. pH TMDLs for the Peters Creek watershed

Major Watershed	Stream Code	Stream Name	Parameter	pH* (Under TMDL conditions)
Peters Creek	WVKG-13-C-3	UNT/Line Creek RM 1.3	pH	7.16

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

A-2.7 TMDL Tables: Fecal Coliform Bacteria

Table A-2-5. Fecal coliform bacteria TMDLs for the Peters Creek watershed

Major Watershed	Stream Code	Stream Name	Parameter	Load Allocation (counts/day)	Wasteload Allocation (counts/day)	Margin of Safety (counts/day)	TMDL (counts/day)
Peters Creek	WVKG-13	Peters Creek	Fecal coliform	1.33E+11	1.40E+08	7.03E+09	1.41E+11
Peters Creek	WVKG-13-B	Otter Creek	Fecal coliform	6.19E+09	NA	3.26E+08	6.52E+09
Peters Creek	WVKG-13-C	Line Creek	Fecal coliform	1.12E+10	NA	5.91E+08	1.18E+10
Peters Creek	WVKG-13-E	Laurel Creek	Fecal coliform	1.46E+10	NA	7.70E+08	1.54E+10
Peters Creek	WVKG-13-G	Jones Branch	Fecal coliform	4.73E+09	NA	2.49E+08	4.98E+09
Peters Creek	WVKG-13-H	Keenan Branch	Fecal coliform	2.99E+09	NA	1.57E+08	3.15E+09
Peters Creek	WVKG-13-J	Whitewater Branch	Fecal coliform	9.96E+09	3.77E+06	5.24E+08	1.05E+10
Peters Creek	WVKG-13-K	Buck Garden Creek	Fecal coliform	1.74E+10	NA	9.14E+08	1.83E+10
Peters Creek	WVKG-13-K-1	Hutchison Branch	Fecal coliform	5.69E+09	NA	2.99E+08	5.99E+09
Peters Creek	WVKG-13-M	McClung Branch	Fecal coliform	5.54E+09	NA	2.91E+08	5.83E+09

NA = not applicable; UNT = unnamed tributary.