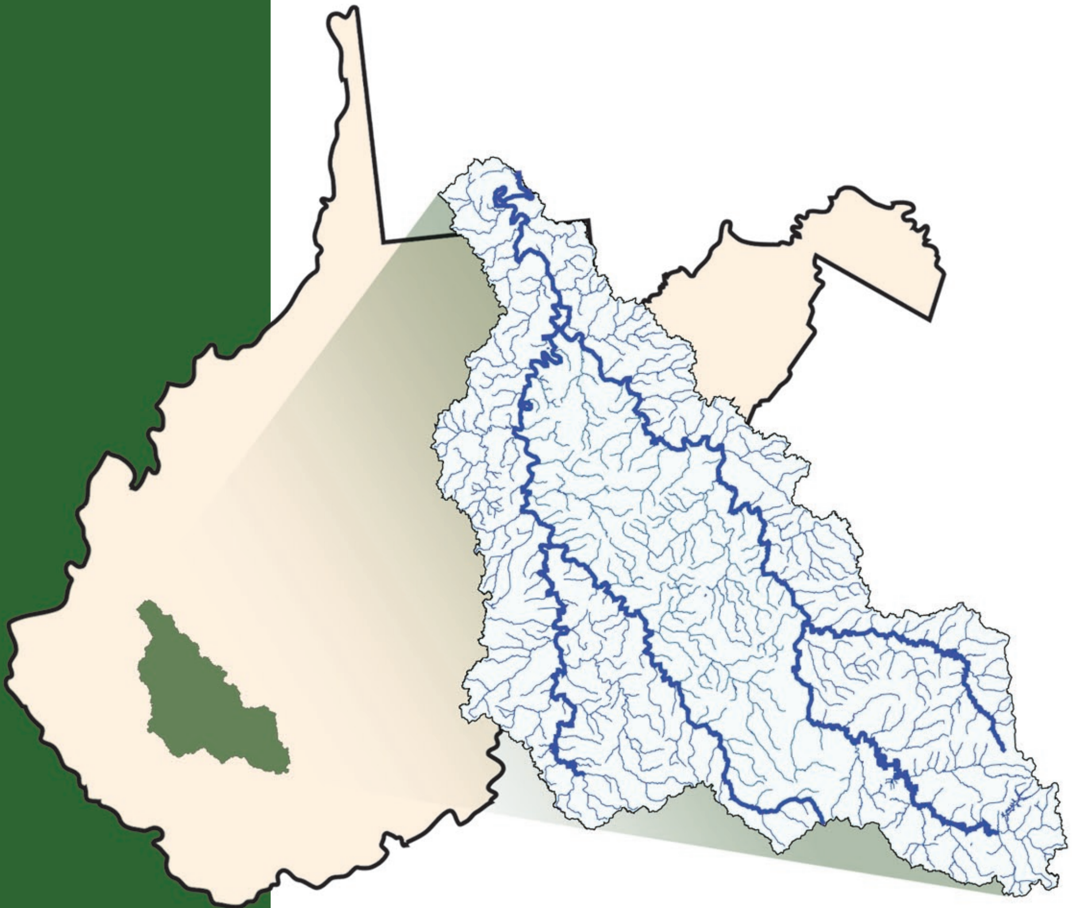

Final Approved Report

Total Maximum Daily Loads for Selected Streams in the Coal River Watershed, West Virginia

Prepared for:

West Virginia Department of Environmental Protection
Division of Water and Waste Management
Watershed Branch, TMDL Section

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Total Maximum Daily Loads for Selected Streams in the Coal River Watershed, West Virginia

Final Approved Report

September 2006

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2. Coal River
3. Little Coal River
4. Marsh Fork
5. Pond Fork
6. Spruce Fork

APPENDIX CONTENTS

ACRONYMS AND ABBREVIATIONS

7Q10	7-day, 10-year low flow
AMD	acid mine drainage
AML	abandoned mine land
AnnAGNPS	Annualized Agricultural Non-point Source
BMP	best management practice
BOD	biochemical oxygen demand
CFR	Code of Federal Regulations
CSO	combined sewer overflow
CSR	Code of State Rules
DEM	Digital Elevation Model
DESC-R	Dynamic Equilibrium In-stream Chemical Reactions model
DMR	[WVDEP] Division of Mining and Reclamation
DNR	Department of Natural Resources
DO	dissolved oxygen
DWWM	[WVDEP] Division of Water and Waste Management
ERIS	Environmental Resources Information System
FCLES	Fecal Coliform Loading Estimation Spreadsheet
FS	Forest Service
GAP	Gap Analysis Program Land Cover Program
GIS	geographic information system
gpd	gallons per day
GPS	global positioning system
GWLF	Generalized Watershed Loading Functions
HAU	Home Aeration Unit
LA	load allocation
MF	membrane filter counts per test
MOS	margin of safety
µg/L	micrograms per liter
mL	milliliter
MDAS	Mining Data Analysis System
MPN	most probable number
MS4	Municipal Separate Storm Sewer System
NED	National Elevation Dataset
NOAA-NCDC	National Oceanic and Atmospheric Administration, National Climatic Data Center
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NPS	non-point source
OOG	Office of Oil and Gas
ORSANCO	Ohio River Valley Water Sanitation Commission
OWR	Office of Water Resources

POTW	publicly owned treatment works
PSD	public service district
SMCRA	Surface Mining Control and Reclamation Act
SSO	sanitary sewer overflow
STATSGO	State Soil Geographic database
TMDL	Total Maximum Daily Load
TSS	total suspended solids
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UT	unnamed tributary
WAP	Watershed Assessment Program
WLA	wasteload allocation
WVDEP	West Virginia Department of Environmental Protection
WVSCI	West Virginia Stream Condition Index
WVU	West Virginia University

EXECUTIVE SUMMARY

The Coal River watershed is in southwestern West Virginia and encompasses approximately 891 square miles. The majority of the watershed lies within Boone and Raleigh counties. Smaller portions of the watershed lie in Kanawha, Lincoln, Logan, Putnam, and Fayette counties. Major tributaries include Marsh Fork, Clear Fork, Pond Fork, Spruce Fork, Little Coal River, and Coal River.

This report includes Total Maximum Daily Loads (TMDLs) for various impaired streams in the Coal River watershed. A TMDL establishes the maximum allowable pollutant loading for a waterbody to comply with water quality standards, distributes the load among pollutant sources, and provides a basis for actions needed to restore water quality.

In West Virginia water quality standards are codified at Title 47 of the *Code of State Rules* (CSR), Series 2, and titled *Legislative Rules Department of Environmental Protection, Requirements Governing Water Quality Standards*. The standards include designated uses of West Virginia waters and numeric and narrative criteria to protect those uses. The West Virginia Department of Environmental Protection routinely assesses use support by comparing observed water quality data to criteria and reports impaired waters every 2 years as required by section 303(d) of the Clean Water Act ("303(d) list"). The act requires that TMDLs be developed for listed impaired waters. This report presents TMDLs for many of the impairments identified on the 2004 Section 303(d) List, and for additional impaired or threatened waters determined subsequently.

West Virginia's final 2004 section 303(d) list includes 127 impaired streams in the Coal River watershed. The impairments are related to numeric water quality criteria for fecal coliform bacteria, dissolved aluminum, total iron, total manganese, total selenium, and pH. Many of the listed waters are also biologically impaired based on the narrative water quality criterion of 47 CSR 2–3.2.i, which prohibits the presence of wastes in state waters that cause or contribute to significant adverse impacts on the chemical, physical, hydrologic, and biological components of aquatic ecosystems.

Since 1997, the U.S. Environmental Protection Agency (EPA), Region 3, has developed West Virginia TMDLs under the settlement of a 1995 lawsuit, *Ohio Valley Environmental Coalition, Inc., West Virginia Highlands et al.* v. *Browner et al*. The lawsuit resulted in a consent decree between the plaintiffs and EPA. The consent decree established a rigorous schedule for TMDL development and required TMDLs for the impaired waters on West Virginia's 1996 section 303(d) list. The schedule included TMDL development dates that extend through March 2008. This report accommodates the timely development of the remaining Coal River watershed TMDLs as required by the consent decree.

Impaired waters were organized into six TMDL subwatersheds. Those subwatersheds were further divided into 299 subwatersheds for modeling purposes. The second subwatershed delineation provided a basis for georeferencing pertinent source information and monitoring data and presenting the TMDLs.

The Mining Data Analysis System (MDAS) was used to represent the source-response linkage for total aluminum, manganese, iron, and fecal coliform bacteria. MDAS is a comprehensive data management and modeling system that is capable of representing loads from non-point and point sources in the watershed and simulating in-stream processes. TMDLs for pH impairments were developed using a surrogate approach where it was assumed that reducing instream metal (iron and aluminum) concentrations, allowing for attainment of water quality criteria (or TMDL endpoints), would also result in attainment of the water quality standard for pH. This assumption was verified by applying the Dynamic Equilibrium In-stream Chemical Reactions (DESC-R) model. MDAS was also linked with DESC-R to address dissolved aluminum TMDLs in the watershed. West Virginia's numeric water quality criteria and an explicit margin of safety were used to identify endpoints for TMDL development.

Sediment TMDLs were developed under a reference watershed approach. The Generalized Watershed Loading Functions (GWLF) watershed-loading model was integrated with a stream routing model (Tetra Tech Stream Module) that examined stream bank erosion and depositional processes. Load reductions for sediment-impaired waters were based on the sediment loading present in the unimpaired reference watershed.

Sources contributing to metals and pH impairments include an array of non-point sources (diffuse sources), as well as discrete point sources (permitted discharges). Most of the point sources in the watershed that discharge metals are mining-related. The most significant non-point sources are abandoned mine lands and bond forfeiture sites, but land disturbance activities that introduce excess sediment are additional problematic sources of metals in the watershed.

Both point and non-point sources contribute to the fecal coliform bacteria impairments in the watershed. By far, the most significant non-point sources are those related to the inadequate treatment of sewage. Failing onsite systems and direct discharges of untreated sewage often result in exceedances to the fecal coliform criterion. Precipitation runoff from residential areas is another non-point source of fecal coliform bacteria. Agricultural sources of fecal coliform bacteria are rare because only minimal agricultural landuse is present in the watershed.

Point sources of sediment include permitted mining activities and stormwater discharges from construction sites greater than 1 acre. Non-point sources of sediment include abandoned mine lands, bond forfeiture sites, roads, oil and gas operations, timbering, agriculture, and urban and residential land disturbance. The presence of individual non-point source categories and their relative significance vary by subwatershed.

Biological integrity/impairment is based on a rating of the stream's benthic macroinvertebrate community using the multimetric West Virginia Stream Condition Index. The first step in TMDL development for biologically impaired waters is stressor identification. Section 6 discusses the stressor identification process. Identified causative stressors to the benthic communities include metals toxicity, pH toxicity, organic enrichment, sedimentation, and ionic toxicity.

Stressor identification was followed by stream-specific determinations of the pollutants for which TMDLs must be developed. The biological stressors, metals and pH toxicity, were identified in waters that also violated water quality criteria for iron, aluminum, or pH. It was determined that implementation of those pollutant-specific TMDLs would address the biological impairment. Where organic enrichment was identified as the biological stressor, the waters also demonstrated violations of the numeric criteria for fecal coliform bacteria. It was determined that implementation of fecal coliform TMDLs would remove untreated sewage and thereby reduce the organic and nutrient loading causing the biological impairment. Sediment TMDLs were developed where the stressor identification process indicated sedimentation as a causative stressor. Available information regarding the pollutants that cause ionic toxicity and their associated impairment thresholds were insufficient in this TMDL development timeframe. TMDL development has been deferred, and the waters have been retained on the 303(d) list.

The main section of the report describes the TMDL development and modeling processes, identifies impaired streams and existing pollutant sources, discusses future growth, provides assurance that the TMDLs are achievable, and documents the public participation associated with the process. The main report also contains a detailed discussion of the allocation methodologies applied for various impairments. The employed methodologies prescribe allocations that achieve water quality criteria throughout the watershed. Various provisions attempt to achieve equity between categories of sources, and target pollutant reductions from the most problematic sources. Nonpoint source reductions were not specified beyond that of natural (background) levels. Similarly, point source reductions were no more stringent than numeric water quality criteria.

The subwatershed appendices focus on the impaired waters and applicable TMDLs (sum of wasteload allocations + sum of load allocations + margin of safety) in specified subwatersheds. Applicable TMDLs are displayed in Section 4 of each appendix. Accompanying spreadsheets provide applicable TMDLs, wasteload allocations to individual point sources, and example allocations of loads to categories of non-point sources that achieve the TMDL load allocations. Also provided is an interactive ArcExplorer geographic information system (GIS) project that allows for the exploration of spatial relationships among the source assessment data. This accommodates expedient determination of subwatershed allocations.

An additional report and spreadsheet are provided relative to the temporary revision of the dissolved aluminum water quality criteria for warmwater fisheries. Please see Section 2.2 for details regarding the criteria revision and related implementation guidance.

The TMDLs presented herein, and others developed for the Lower Kanawha River and the North Branch/Potomac River watersheds, represents the second major group of West Virginia TMDLs developed by WVDEP. Considerable resources were used to acquire recent water quality and pollutant source information upon which the TMDLs are based. The TMDL modeling is among the most sophisticated available and incorporates sound scientific principles. TMDL outputs are presented in various formats to assist user comprehension and facilitate use in implementation.

1. REPORT FORMAT

This report consists of a main section, appendices, a supporting GIS application, and spreadsheet data tables. The main section describes the overall TMDL development process for the Coal River watershed, identifies impaired streams, and outlines the source assessment of metals, pH, fecal coliform, and biological stressors. It also describes the modeling process and Total Maximum Daily Load (TMDL) allocations and lists measures that will be taken to ensure that the TMDLs are met. The main section is followed by six appendices that describe specific conditions in each of the six subwatersheds for which TMDLs were developed. The applicable TMDLs are displayed in Section 5 of each appendix. The main section and appendices are supported by a compact disc containing an interactive ArcExplorer GIS project that provides further details on the data and allows the user to explore the spatial relationships among the source assessment data. With this tool, users can magnify streams and other features of interest. Also included on the CD are spreadsheets (in Microsoft Excel format) that provide the data used during the TMDL development process, as well as detailed source allocations associated with successful TMDL scenarios. A Technical Report that describes the detailed technical approaches used throughout the TMDL development process is also included.

2. INTRODUCTION

The West Virginia Department of Environmental Protection (WVDEP), Division of Water and Waste Management (DWWM), is responsible for the protection, restoration, and enhancement of the state's waters. Along with this duty comes the responsibility for TMDL development in West Virginia.

2.1 Total Maximum Daily Loads

Section 303(d) of the federal Clean Water Act and the U.S. Environmental Protection Agency's (USEPA) Water Quality Planning and Management Regulations (at Title 40 of the *Code of Federal Regulations* [CFR] Part 130) require states to identify waterbodies that do not meet water quality standards and to develop appropriate TMDLs. A TMDL establishes the maximum allowable pollutant loading for a waterbody to achieve compliance with applicable standards. It also distributes the load among pollutant sources and provides a basis for the actions needed to restore water quality.

A TMDL is composed of the sum of individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for non-point sources, and natural background levels. In addition, the TMDL must include a margin of safety (MOS), implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. TMDLs can be expressed in terms of mass per time or other appropriate units. Conceptually, this definition is denoted by the following equation:

$$\text{TMDL} = \text{sum of WLAs} + \text{sum of LAs} + \text{MOS}$$

Since 1997, West Virginia's TMDLs have been developed by USEPA Region 3, under the settlement of a 1995 lawsuit, *Ohio Valley Environmental Coalition, Inc., West Virginia Highlands et al.* v. *Browner et al*. The lawsuit resulted in a consent decree between the plaintiffs and USEPA. The consent decree established a rigorous schedule for TMDL development and required TMDLs for the impaired waters on West Virginia's 1996 section 303(d) list. The schedule included TMDL development dates that extend through March 2008. WVDEP's TMDL program accommodates the timely development of the remaining TMDLs required by the consent decree.

WVDEP is developing TMDLs in concert with a geographically based approach to water resource management in West Virginia—the Watershed Management Framework. Adherence to the Framework ensures efficient and systematic TMDL development. Each year, TMDLs are developed in specific geographic areas. The Framework dictates that in 2005 TMDLs should be pursued in Hydrologic Group B, which includes the Coal River watershed. Figure 2-1 depicts the hydrologic groupings of West Virginia's watersheds; the legend includes the year of each TMDL finalization target.

WVDEP is committed to implementing a TMDL process that reflects the requirements of the TMDL regulations, provides for the achievement of water quality standards, and ensures that ample stakeholder participation is achieved in the development and implementation of TMDLs. A 48-month development process enables the agency to carry out an extensive data generating and gathering effort to produce scientifically defensible TMDLs. It also allows ample time for modeling, report finalization, and frequent public participation opportunities.

The TMDL development process begins with pre-TMDL water quality monitoring and source identification and characterization. Informational public meetings are held in the affected watersheds. Data obtained from pre-TMDL efforts are compiled, and the impaired waters are modeled to determine baseline conditions and the gross pollutant reductions needed to achieve water quality standards. WVDEP then presents its allocation strategies in a second public meeting, after which Final TMDL reports are developed. The draft TMDL is advertised for public review and comment, and a third informational meeting is held during the public comment period. Public comments are addressed, and the draft TMDL is submitted to USEPA for approval. The TMDLs in this report are scheduled to be finalized by December 2005.

This report presents TMDLs for many of the impairments identified on the 2004 Section 303(d) List, and for additional impaired or threatened waters determined subsequently. All remaining Coal River impairments for which USEPA committed to TMDL development by 2008 are addressed.

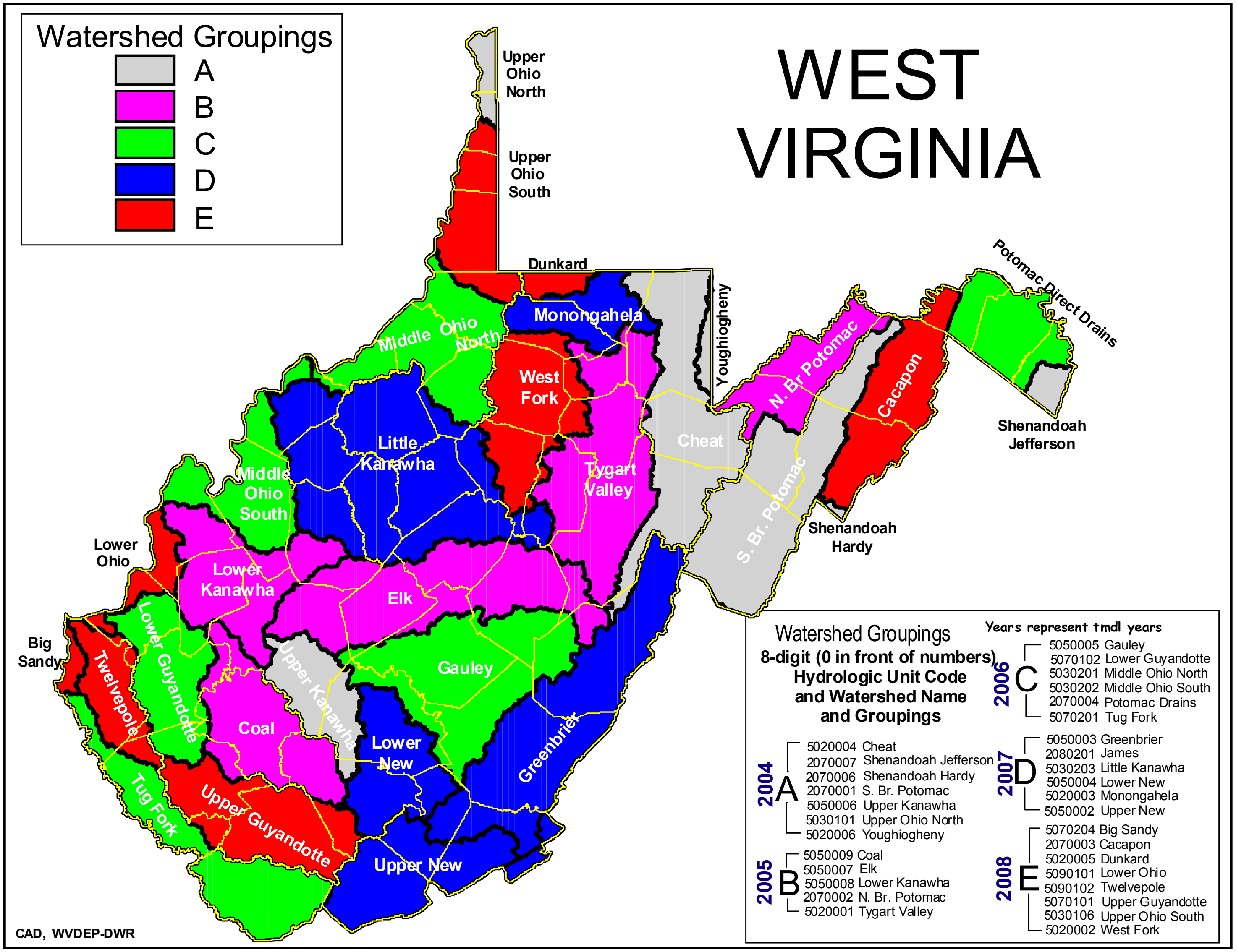


Figure 2-1. Hydrologic groupings of West Virginia's watersheds.

2.2 Water Quality Standards

The determination of impaired waters involves comparing in-stream conditions to applicable water quality standards. In West Virginia water quality standards are codified at Title 47 of the *Code of State Rules* (CSR), Series 2, titled *Legislative Rules Department of Environmental Protection, Requirements Governing Water Quality Standards*. These standards can be obtained online from the West Virginia Secretary of State internet site (http://www.wvsos.com/csr/verify.asp?TitleSeries=47-02).

Water quality standards consist of three components: designated uses; narrative and/or numeric water quality criteria necessary to support those uses; and an antidegradation policy. Appendix E of the Standards contains the numeric water quality criteria for a wide range of parameters, while Section 3 contains the narrative water quality criteria.

Designated uses include: aquatic life protection, water contact recreation, and public water supply. Most of the waterbodies in the Coal River watershed are designated as warmwater fisheries. Clear Fork above Dorothy, Hopkins Fork, Marsh Fork above Sundial, and Stephens Lake are the only waterbodies in the Coal River watershed considered troutwaters. For the impaired waters of this report, West Virginia numeric water quality criteria for warmwater fisheries and troutwaters vary only with respect to iron. Only Hopkins Fork, Clear Fork above Dorothy and Marsh Fork above Sundial are impaired with respect to the troutwater iron criterion.

The Standards include numeric criteria for aquatic life protection for dissolved aluminum, total iron, total selenium, and pH. Human health protection criteria are provided for fecal coliform bacteria, total manganese, total selenium, and pH. Numeric criteria are shown in Table 2-1.

Table 2-1. West Virginia water quality criteria

POLLUTANT	USE DESIGNATION				
	Aquatic Life				Human Health
	Warmwater Fisheries		Troutwaters		Contact Recreation/Public Water Supply
	Acute[a]	Chronic[b]	Acute[a]	Chronic[b]	
Aluminum, dissolved (μg/L)	750	87	750	87	--
Iron, total (mg/L)	--	1.5	--	0.5	1.5
Manganese, total (mg/L)	--	--	--	--	1.0[c]
Selenium, total (ug/L)	20	5	20	5	10
pH	No values below 6.0 or above 9.0	No values below 6.0 or above 9.0	No values below 6.0 or above 9.0	No values below 6.0 or above 9.0	No values below 6.0 or above 9.0

	USE DESIGNATION
Fecal coliform bacteria	**Human Health Criteria** Maximum allowable level of fecal coliform content for Primary Contact Recreation (either MPN [most probable number] or MF [membrane filter counts/test]) shall not exceed 200/100 mL as a monthly geometric mean based on not less than 5 samples per month; nor to exceed 400/100 mL in more than 10 percent of all samples taken during the month.

[a] One-hour average concentration not to be exceeded more than once every 3 years on the average.

[b] Four-day average concentration not to be exceeded more than once every 3 years on the average.

[c] Not to exceed 1 mg/L within the five-mile zone upstream of known public or private water supply intakes used for human consumption.

Source: West Virginia Water Quality Standards, 2005.

All West Virginia waters are subject to the narrative criteria in Section 3 of the Standards. That section, titled "Conditions Not Allowable in State waters," contains various general provisions related to water quality. The narrative water quality criterion at Title 47 CSR Series 2 – 3.2.i prohibits the presence of wastes in state waters that cause or contribute to significant adverse impacts on the chemical, physical, hydrologic, and biological components of aquatic ecosystems. This provision is the basis for "biological impairment" determinations. Biological impairment signifies a stressed aquatic community, and it is discussed in detail in Section 6.

On January 9, 2006, EPA approved a revision to the dissolved aluminum criteria. The warmwater chronic aquatic life protection criterion is changed from 87 µg/L to 750 µg/L from the date of approval until July 4, 2007. During that period, the 750 µg/L criterion is effective for Clean Water Act purposes in warmwater fisheries. If no further legislative action is taken, the 87 µg/L criterion will again become applicable.

At the time TMDLs in this report were originally developed, EPA had not approved this revision, and draft dissolved aluminum TMDLs were presented based upon the previously applicable, 87 µg/L criterion. In response to EPA's approval action, DEP reevaluated the impairment status of Coal River Watershed streams and developed alternative TMDLs, load allocations and wasteload allocations pursuant to the 750 µg/L warmwater dissolved aluminum criterion. Those TMDLs and allocations are presented in the Dissolved Aluminum Addendum documents.

Because of the temporary nature of the criterion value, the draft aluminum TMDLs for warmwater fisheries that were based upon the 87 µg/L criterion remain a component of this document. All displays of aluminum impairments contained in this main report, the appendix reports and the "Coal Metals TMDL Allocations" spreadsheet relate to the 87 µg/L criterion. However, those TMDLs are viable only if the warmwater criterion reverts to the 87 µg/L value in the future. The TMDLs and allocations that are actionable at this time are those presented in the Dissolved Aluminum Addendum and the "Coal River Dissolved Aluminum Addendum TMDL_Allocations" spreadsheet.

On June 29, 2005, EPA approved a revision to the West Virginia Water Quality Standards that altered the zone of applicability of the manganese water quality criterion for the public water supply designated use. The criterion is now applicable only in the five-mile zone upstream of known public or private water supply intakes used for human consumption. The revision necessitated DEP's identification of intakes and revaluation of prior impairment decisions.

DEP secured the Bureau of Public Health's (BHP) database of water supply intakes and determined locations where surface waters are currently used for human consumption. County sanitarians and BPH regional offices were also contacted to seek their guidance relative to any existing intakes that may not be contained in the database. DEP regional office field personnel were similarly queried.

Based upon the intake locations derived from the aforementioned sources, five-mile distances were delineated in an upstream direction along watercourses to determine streams within the zone of applicability of the criterion. DEP then assessed compliance with the criterion by reviewing available water quality monitoring results from streams within the zone and evaluated the base condition portrayed by the TMDL model. TMDLs are presented for waters where the criterion is applicable and where sampling and/or modeling indicate impairment relative to the criterion.

After reevaluation, the criterion was determined to not be applicable to the majority of waters that were previously identified as impaired relative to manganese. Identified intakes include those operated by the City of Saint Albans, Lincoln PSD at Alum Creek and Boone Raleigh PSD at Whitesville. The source water for all intakes is the Coal River. No waters within the five-mile zones of the Saint Albans or Lincoln PSD intakes are manganese impaired. The Boone Raleigh PSD intake creates a zone of manganese applicability in the headwaters of the Coal River subwatershed and the lower reaches of Marsh Fork and Clear Fork watersheds. Available information demonstrates that Coal River, Marsh Fork and Clear Fork are not manganese impaired. However, Little Marsh Fork (WVKC-46-A) and its tributary Brushy Fork (WVKC-46-A-4) are within the zone of applicability and have been determined to be impaired relative to manganese. As such, manganese TMDLs are presented for Little Marsh Fork and Brushy Fork.

3. WATERSHED DESCRIPTION AND DATA INVENTORY

3.1 Watershed Description

The Coal River watershed, U.S. Geological Survey (USGS) 8-digit hydrologic unit code (05050009), lies mostly within Boone and Raleigh counties and also in portions of Kanawha, Lincoln, Logan, Putnam, and Fayette counties in southern West Virginia, as shown in Figure 3-1. The Coal River watershed, a component of the Kanawha River watershed, encompasses nearly 891 square miles. The Coal River runs through the eastern portion of the watershed. Major tributaries include Marsh Fork, Clear Fork, Pond Fork, Spruce Fork, Little Coal River, and Coal River. The average elevation in the watershed is 1,487 feet. The highest point is at 3,196 feet on Pilot Knob, which is in the southern portion of the watershed, on the boundary of Boone and Raleigh counties. The minimum elevation is 564 feet at the mouth of the Coal River near Saint Albans.

Landuse and land cover estimates were obtained from vegetation data gathered from the West Virginia Gap Analysis Land Cover Project (GAP). The Natural Resource Analysis Center and the West Virginia Cooperative Fish and Wildlife Research Unit of West Virginia University (WVU) produced the GAP coverage. The GAP database for West Virginia was derived from satellite imagery taken during the early 1990s, and it includes detailed vegetative spatial data. Additional information regarding the GAP spatial database is provided in the appendices of the Technical Report. The categories for vegetation cover were consolidated to create six landuse categories, summarized in Table 3-1.

As Table 3-1 shows, the dominant landuse type in the Coal River watershed is forest, which constitutes 91.5 percent of the total landuse area. Other important landuse types are urban/residential (2.4 percent), pasture (2.8 percent), and barren/mining land (2.5 percent). Individually, all other land cover types compose less than 0.8 percent of the total watershed area.

The total population for the entire Coal River watershed, derived from the 2000 U.S. Census data, is approximately 64,000 people.

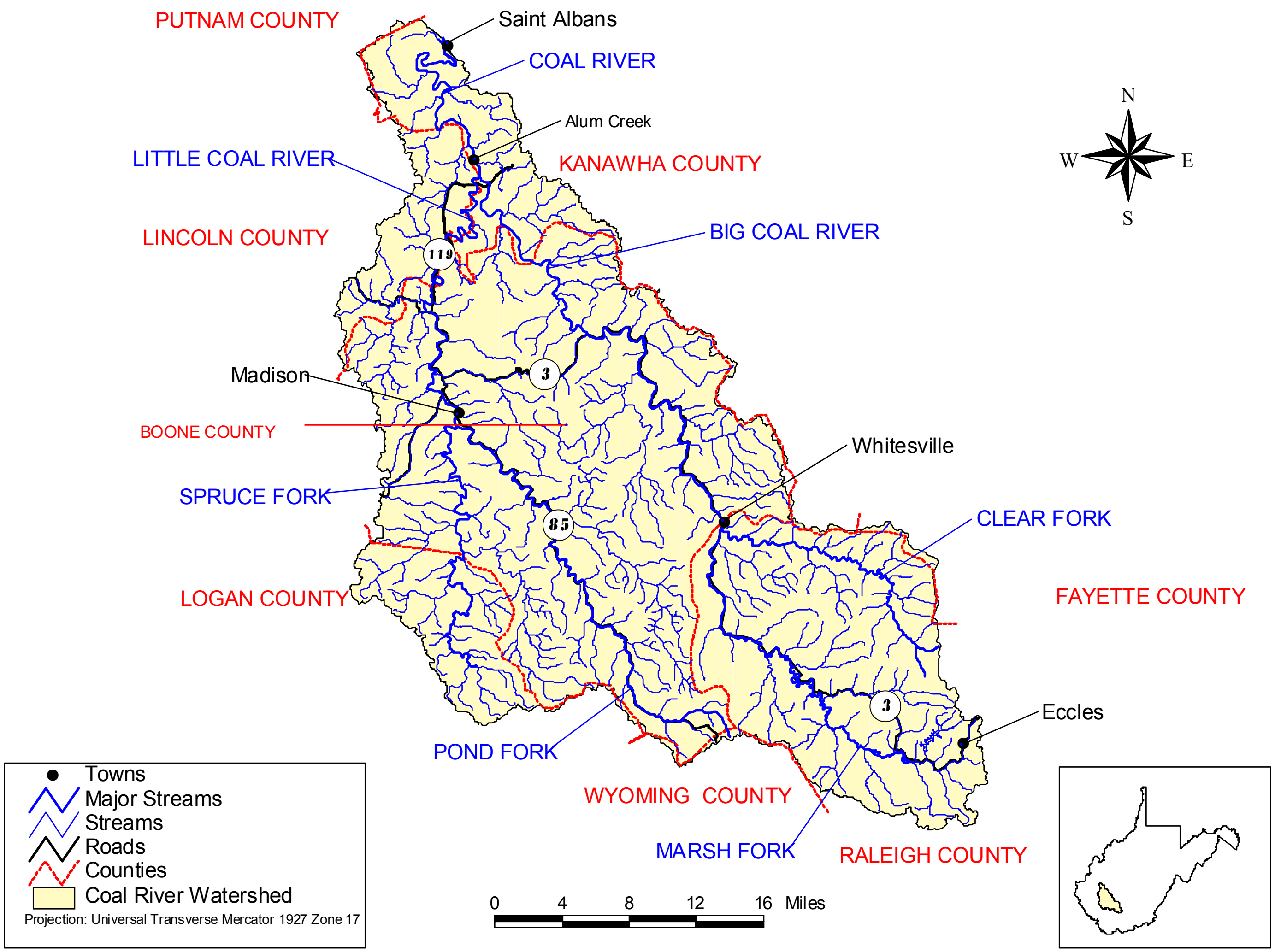


Figure 3-1. Location of the Coal River watershed.

Table 3-1. Landuse according to GAP analysis for the Coal River watershed

Landuse Type	Area of Watershed		
	Acres	Square Miles	Percentage
Agriculture	543.5	0.8	0.1
Barren/Mining	14,347.8	22.4	2.5
Forest	521,546.2	814.9	91.5
Pasture	16,100.2	25.2	2.8
Urban/Residential	13,807.1	21.6	2.4
Water	3,544.5	5.5	0.6
Total	569,889.5	890.5	100.0

3.2 Data Inventory

Various sources of data were used in the TMDL development process. The data were used to identify and characterize sources of pollution and to establish the water quality response to those sources. Review of the data included a preliminary assessment of the watershed's physical and socioeconomic characteristics and current monitoring data. Table 3-2 identifies the data used to support the TMDL assessment and modeling effort for the Coal River watershed. These data describe the physical conditions of the watershed, the potential pollutant sources and their contributions, and the impaired waterbodies for which TMDLs need to be developed. Prior to TMDL development, WVDEP collected comprehensive water quality data throughout the watershed. This pre-TMDL monitoring effort contributed the largest amount of water quality data to the process and is summarized in the Technical Report. The geographic information is provided in the ArcExplorer GIS project included on the CD version of this report.

3.3 Impaired Waterbodies

WVDEP conducted extensive water quality monitoring from July 2002 through June 2003 in the Coal River watershed. The results of that effort were used to confirm the impairments of waterbodies identified on previous 303(d) lists and to identify other impaired waterbodies that were not previously listed as such.

In this TMDL development effort, modeling at baseline conditions demonstrated additional pollutant impairments to those identified via monitoring. The prediction of impairment through modeling is validated by applicable federal guidance for 303(d) listing. Despite best efforts, WVDEP could not perform water quality monitoring and source characterization at frequencies or sample location resolution sufficient to comprehensively assess water quality under the terms of applicable water quality standards, and modeling was needed to complete the assessment. Also, the baseline condition portrayal of the cumulative impact of multiple point sources discharging at existing permit limits sometimes resulted in model prediction of impairment. Where existing pollutant sources were predicted to cause noncompliance with a particular criterion, the subject water was characterized as impaired for that pollutant.

TMDLs were developed for impaired waters in six subwatersheds (Figure 3-2): Marsh Fork, Clear Fork, Pond Fork, Spruce Fork, Little Coal River, and Coal River. The impaired waters for which TMDLs have been developed are presented in Table 3-3. The table includes the stream code, subwatershed, stream name, and impairments for each stream.

Table 3-2. Datasets used in TMDL development

Type of Information		Data Sources
Watershed physiographic data	Stream network	West Virginia Division of Natural Resources (DNR)
	Landuse	WV Gap Analysis Project (GAP)
	Counties	U.S. Census Bureau
	Cities/populated places	U.S. Census Bureau
	Soils	State Soil Geographic Database (STATSGO) U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) soil surveys
	Cataloging Unit boundaries	U.S. Geological Survey (USGS)
	Topographic and digital elevation models (DEMs)	National Elevation Dataset (NED)
	Dam locations	USGS
	Roads	U.S. Census Bureau TIGER, WVU WV Roads
	Water quality monitoring station locations	U.S. Census Bureau, WVDEP, USEPA STORET
	Meteorological station locations	National Oceanic and Atmospheric Administration, National Climatic Data Center (NOAA-NCDC)
	Permitted facility information	WVDEP Division of Water and Waste Management (DWWM), WVDEP Division of Mining and Reclamation (DMR)
	Timber harvest data	USDA, Forest Service (FS)
	Oil and gas operations coverage	WVDEP Office of Oil and Gas (OOG)
	Abandoned mining coverage	WVDEP DMR
Monitoring data	Historical Flow Record (daily averages)	USGS
	Rainfall	NOAA-NCDC
	Temperature	NOAA-NCDC
	Wind speed	NOAA-NCDC
	Dew point	NOAA-NCDC
	Humidity	NOAA-NCDC
	Cloud cover	NOAA-NCDC
	Water quality monitoring data	USEPA STORET, WVDEP
	National Pollutant Discharge Elimination System (NPDES) data	WVDEP DMR, WVDEP DWMM
	Discharge Monitoring Report data	WVDEP DMR, Mining Companies
	Abandoned mine land data	WVDEP DMR, WVDEP DWMM
Regulatory or policy information	Applicable water quality standards	WVDEP
	Section 303(d) list of impaired waterbodies	WVDEP, USEPA
	Non-point Source Management Plans	WVDEP

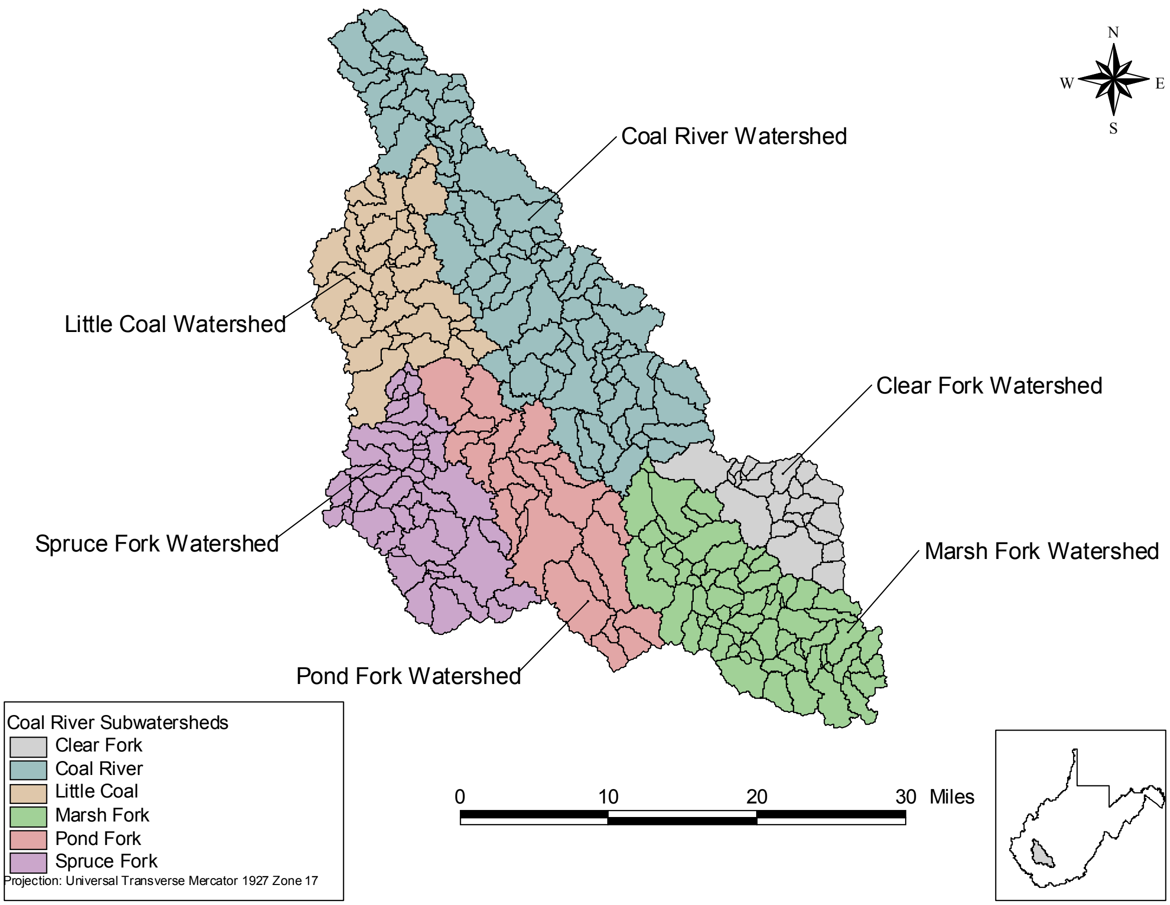


Figure 3-2. The six subwatersheds of the Coal River watershed.

Table 3-3. Waterbodies and impairments for which TMDLs have been developed

Subwatershed	Stream Code	Stream Name	Dis Al	Fe	Mn	pH	Se	Bio	FC	Sed
Marsh Fork	WVKC-46	Marsh Fork		X					X	
	WVKC-46-A	Little Marsh Fork	X	X	X					
	WVKC-46-A-4	Brushy Fork	X	X	X					
	WVKC-46-B	Ellis Creek		X						
	WVKC-46-C	Hazy Creek		X						
	WVKC-46-E	Stink Run		X					X	
	WVKC-46-F	Horse Creek		X						
	WVKG-46-G	Peachtree Creek		X						
	WVKG-46-G-1	Drews Creek		X						
	WVKC-46-G-2	Martin Fork	X	X		X				
	WVKC-46-G-3	Millers Fork		X						
	WVKC-46-H	Dry Creek							X	
	WVKC-46-I	Rock Creek		X					X	
	WVKC-46-I.7	Flat Branch							X	
	WVKC-46-I-1	Righthand Fork							X	
	WVKC-46-J	Sandlick Creek		X				X	X	X
	WVKC-46-J-2	Bee Branch	X			X				
	WVKC-46-J-3	Right Fork/Sandlick Creek						X	X	X
	WVKC-46-J-4	Wingrove Branch		X					X	
	WVKC-46-J-7	Harper Branch		X						
	WVKC-46-K	Cove Creek		X					X	
	WVKC-46-K-2	UNT/Cove Creek RM 1.2							X	
	WVKC-46-L	Breckenridge Creek							X	
	WVKC-46-L-1	UNT/Breckenridge Creek RM 2.7							X	
	WVKC-46-M	Spanker Branch							X	
	WVKC-46-N	Maple Meadow Creek		X				X	X	
	WVKC-46-N.9	Claypool Hollow							X	
	WVKC-46-N-1	Rockhouse Fork		X					X	
	WVKC-46-O	Dingess Branch		X					X	
	WVKC-46-P	Surveyor Creek		X				X	X	X
	WVKC-46-Q	Millers Camp Branch	X	X				X	X	X
	WVKC-46-Q-0.1	Clay Branch							X	
	WVKC-46-Q-1	Stephens Branch		X						
	WVKC-46-Q-3	Shockley Branch		X						
	WVKC-46-Q-4	Laurel Branch		X						

Table 3-3. (continued)

Subwatershed	Stream Code	Stream Name	Al	Fe	Mn	pH	Se	Bio	FC	Sed
Marsh Fork (continued)	WVKC-46-Q-5	Jehu Branch		X						
Clear Fork	WVKC-47	Clear Fork	X	X				X	X	
	WVKC-47-E	Sycamore Creek		X					X	
	WVKC-47-F	Stonecoal Branch	X	X		X		X		X
	WVKC-47-G	Long Branch	X	X						
	WVKC-47-G-1	Dow Fork	X	X		X				
	WVKC-47-I	Fulton Creek		X						
	WVKC-47-K	White Oak Creek		X				X	X	
	WVKC-47-K-1	Left Fork/White Oak Creek		X						
	WVKC-47-L	Toney Fork		X					X	
	WVKC-47-L-1	Buffalo Fork		X						
	WVKC-47-N	McDowell Branch		X					X	
	WVKC-47-P.5	Lick Run		X				X	X	X
Pond Fork	WVKC-10-U	Pond Fork	X	X				X	X	X
	WVKC-10-U-3	Robinson Creek	X	X						
	WVKC-10-U-4	Jacks Branch		X						
	WVKC-10-U-5	Bull Creek		X						
	WVKC-10-U-7	West Fork	X	X				X		X
	WVKC-10-U-7-B	Whites Branch		X					X	
	WVKC-10-U-7-I	James Creek		X			X			
	WVKC-10-U-8	Casey Creek		X			X	X		X
	WVKC-10-U-9	Beaver Pond Branch		X			X			
	WVKC-10-U-21	Lacey Branch		X						
Spruce Fork	WVKC-10-T	Spruce Fork	X	X					X	
	WVKC-10-T-1	Sparrow Creek							X	
	WVKC-10-T-2	Laurel Branch							X	
	WVKC-10-T-3	Low Gap Creek							X	
	WVKC-10-T-5	Hunters Branch	X	X		X				
	WVKC-10-T-7	Sixmile Creek							X	
	WVKC-10-T-8	Bias Branch		X				X	X	
	WVKC-10-T-9	Hewett Creek	X	X					X	
	WVKC-10-T-9-A	Meadow Fork							X	
	WVKC-10-T-9-B	Missouri Fork						X	X	
	WVKC-10-T-9-B.5	Isom Branch							X	
	WVKC-10-T-9-C	Craddock Fork		X					X	
	WVKC-10-T-9-C-2	Sycamore Branch							X	

Table 3-3. (continued)

Subwatershed	Stream Code	Stream Name	Al	Fe	Mn	pH	Se	Bio	FC	Sed
Spruce Fork (continued)	WVKC-10-T-9-D	Baldwin Fork		X				X	X	X
	WVKC-10-T-10	Stollings Branch							X	
	WVKC-10-T-11	Spruce Laurel Fork	X	X				X		X
	WVKC-10-T-11-F	Sycamore Fork		X						
	WVKC-10-T-11-K	Dennison Fork		X						
	WVKC-10-T-13	Rockhouse Creek		X					X	
	WVKC-10-T-15	Beech Creek		X			X			
	WVKC-10-T-15-A	Left Fork/Beech Creek		X			X			
	WVKC-10-T-16	Seng Camp Creek		X						
	WVKC-10-T-19	Trace Branch		X			X			
	WVKC-10-T-22	White Oak Branch		X						
	WVKC-10-T-25	Laurel Fork		X						
	WVKC-10-T-24	Brushy Fork		X						
Little Coal River	WVKC-10	Little Coal River							X	
	WVKC-10-E	Cobb Creek							X	
	WVKC-10-F	Dicks Creek		X						
	WVKC-10-H	Little Hewitt Creek	X	X		X				
	WVKC-10-I	Big Horse Creek		X				X	X	X
	WVKC-10-I-2	Laurel Fork		X					X	
	WVKC-10-I-3	Peters Cave Fork		X					X	
	WVKC-10-I-6	Dodson Fork		X				X	X	X
	WVKC-10-I-8	Rich Hollow		X						
	WVKC-10-J	Little Horse Creek		X				X	X	X
	WVKC-10-J-8	UNT/Little Horse Creek RM 2.4							X	
	WVKC-10-L	Camp Creek							X	
	WVKC-10-N	Rock Creek						X	X	
	WVKC-10-N-2	Hubbard Fork						X	X	
	WVKC-10-N-3	Right Fork/Rock Creek						X	X	
	WVKC-10-N-4	Left Fork/Rock Creek						X	X	
	WVKC-10-O	Lick Creek						X	X	
	WVKC-10-P	Turtle Creek						X	X	
Coal River	WVKC	Coal River							X	
	WVKC-2	Browns Creek						X	X	X
	WVKC-4	Smith Creek						X	X	X
	WVKC-4-C	Little Smith Creek						X	X	
	WVKC-5	Falls Creek							X	

Table 3-3. (continued)

Subwatershed	Stream Code	Stream Name	Al	Fe	Mn	pH	Se	Bio	FC	Sed
Coal River (continued)	WVKC-8	Fuquay Creek							X	
	WVKC-9	Crooked Creek						X	X	
	WVKC-11	Alum Creek							X	
	WVKC-11-A	UNT/Alum Creek RM 1.5							X	
	WVKC-11-B	Little Alum Creek							X	
	WVKC-13	Brier Creek							X	
	WVKC-19	Lick Creek						X	X	
	WVKC-14	Fork Creek		X						
	WVKC-16	Bull Creek		X						
	WVKC-21-A	Honeycamp Fork		X						
	WVKC-21	Brush Creek		X				X	X	X
	WVKC-21-C	Ridgeview Hollow		X				X	X	X
	WVKC-24	Drawdy Creek		X					X	
	WVKC-26	Short Creek							X	
	WVKC-27	Toneys Branch		X					X	
	WVKC-29	Joes Creek		X					X	
	WVKC-29-A	Left Fork/Joes Creek							X	
	WVKC-31	Laurel Creek	X	X					X	
	WVKC-31-A	Sandlick Creek		X				X	X	X
	WVKC-31-B	Hopkins Fork		X					X	
	WVKC-31-B-2	Big Jarrells Creek		X					X	
	WVKC-31-B-3	Logan Fork		X						
	WVKC-31-C	Cold Fork	X	X		X				
	WVKC-31-G	Little Laurel Creek		X						
	WVKC-31-H	Mudlick Fork		X						
	WVKC-32	Horse Branch	X	X		X				
	WVKC-33	Haggle Branch	X	X		X				
	WVKC-34	Jakes Branch		X						
	WVKC-35	White Oak Creek	X	X			X			
	WVKC-35.8	UNT/Coal River RM 52.7	X	X		X				
	WVKC-35-D	Threemile Branch	X	X		X				
	WVKC-35-E	Left Fork/White Oak Creek	X	X			X			
	WVKC-39	Little Elk Creek	X	X						
	WVKC-42	Seng Creek		X			X		X	
	WVKC-43	Elk Run		X						

Note: UNT = unnamed tributary.

WVDEP attempted to develop the TMDLs necessary to address all impairments in each listed waterbody. However, circumstances prevented TMDL development for Raines Fork (WVKC-47-E-4), where biological impairment was identified after pre-TMDL monitoring and TMDL development. In other instances, the biological stressor identification process did not singularly identify causative pollutants or tolerance thresholds. All waters and impairments excluded from TMDL development in this effort have been retained on West Virginia's Section 303(d) list of impaired waters.

4. METALS AND pH SOURCE ASSESSMENT

This section identifies and examines the potential sources of aluminum, iron, manganese, selenium, and pH impairments in the Coal River watershed. Sources can be classified as point (permitted) or non-point (nonpermitted) sources.

A point source, according to 40 CFR 122.3, is any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, and vessel or other floating craft from which pollutants are or may be discharged. 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. For purposes of this TMDL, NPDES-permitted discharge points are considered point sources.

Non-point sources of pollutants are diffuse, nonpermitted sources. They most often result from precipitation-driven runoff. For the purposes of these TMDLs only, wasteload allocations are given to NPDES-permitted discharge points, and load allocations are given to discharges from activities that do not have an associated NPDES permit, such as mine forfeiture sites and abandoned mine lands, including tunnel discharges, seeps, and surface runoff. The decision to assign load allocations to abandoned and reclaimed mine lands does not reflect any determination by WVDEP or USEPA as to whether there are, in fact, unpermitted point source discharges within these landuses. In addition, by establishing these TMDLs with mine drainage discharges treated as load allocations, WVDEP and USEPA are not determining that these discharges are exempt from NPDES permitting requirements.

The physiographic data discussed in the previous section enabled the characterization of pollutant sources. As part of the TMDL development process, WVDEP performed additional field-based source-tracking activities; the resulting information was supplemental to the other available source characterization data. WVDEP staff recorded physical descriptions of pollutant sources and the general condition of the stream in the vicinity of the sources. WVDEP collected global positioning system (GPS) data and water quality samples for laboratory analysis as necessary to characterize the sources and their impacts. Source-tracking information was compiled and electronically plotted on maps using GIS software. Detailed information, including the locations of pollutant sources, is provided in the subwatershed appendices, the Technical Report, and the ArcExplorer project on the CD version of this TMDL report.

4.1 Metals and pH Point Sources

Metals and pH point sources are classified by the mining- and non-mining-related permits issued by WVDEP. The following sections discuss the potential impacts and the characterization of these source types.

4.1.1 Mining Point Sources

The Surface Mining Control and Reclamation Act of 1977 (SMCRA, Public Law 95-87) and its subsequent revisions were enacted to establish a nationwide program to protect the beneficial uses of land or water resources, protect public health and safety from the adverse effects of current surface coal mining operations, and promote the reclamation of mined areas left without adequate reclamation prior to August 3, 1977. The SMCRA requires a permit for development of new, previously mined, or abandoned sites for the purpose of surface mining. Permittees are required to post a performance bond that will be sufficient to ensure the completion of reclamation requirements by a regulatory authority in the event that the applicant forfeits its permit. Mines that ceased operations before the effective date of SMCRA (often called "pre-law" mines) are not subject to the requirements of the SMCRA.

SMCRA Title IV is designed to provide assistance for the reclamation and restoration of abandoned mines; whereas, Title V states that any surface coal mining operations must be required to meet all applicable performance standards. Some general performance standards include the following:

- Restoring the land affected to a condition capable of supporting the uses that it was capable of supporting prior to any mining
- Backfilling and compacting (to ensure stability or to prevent leaching of toxic materials) to restore the approximate original contour of the land, including all highwalls
- Minimizing disturbances to the hydrologic balance and to the quality and quantity of water in surface water and groundwater systems both during and after surface coal mining operations and during reclamation by avoiding acid or other toxic mine drainage

Untreated mining-related point source discharges from deep, surface, and other mines typically have low pH values (i.e. they are acidic) and contain high concentrations of metals (iron, aluminum, and manganese). Mining-related activities are commonly issued NPDES discharge permits that contain effluent limits for total iron, total manganese, nonfilterable residue, and pH. Most permits also include effluent monitoring requirements for total aluminum. WVDEP's Division of Mining and Reclamation (DMR) provided a spatial coverage of the mining-related NPDES permit outlets. The discharge characteristics, related permit limits and discharge data for these NPDES outlets were acquired from West Virginia's ERIS database system. The spatial coverage was used to determine the location of the permit outlets. Additional information was needed, however, to determine the areas of the mining activities. WVDEP DMR also provided spatial coverage of the mining permit areas and related SMCRA Article 3 permit information. This information includes both active and inactive mining facilities, which are classified by type of mine and facility status. The mines are classified into eight different categories: coal surface mine, coal underground mine, haul road, coal preparation plant, coal reprocessing, prospective mine, quarry, and other. The haul road and prospective mine categories represent mining access roads and potential coal mining areas.

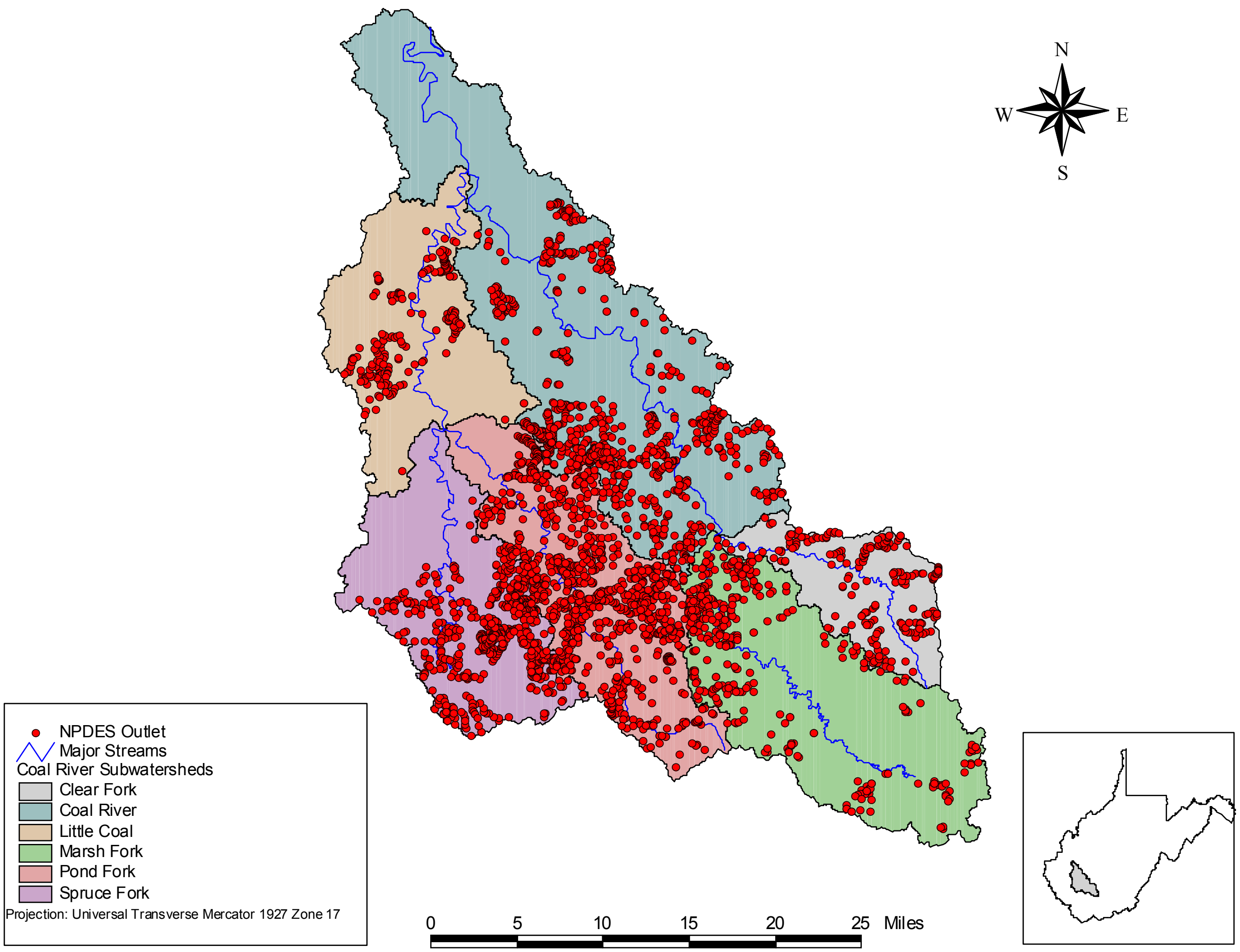
WVDEP DWWM personnel used the information contained in the SMCRA Article 3 and NPDES permits to further characterize the mining point sources. Information gathered included type of discharge, pump capacities, and drainage areas (including total and disturbed areas). Using this information, the mining point sources were then represented in the model and assigned individual wasteload allocations for metals.

In the six TMDL watersheds, there are 240 mining-related NPDES permits, with 2661 associated outlets. A complete list of the permits and outlets is provided in Appendix F of the Technical Report. Figure 4-1 illustrates the extent of the mining NPDES outlets in the watershed.

4.1.2 Non-mining Point Sources

WVDEP DWWM controls water quality impacts from non-mining activities with point source discharges through the issuance of NPDES permits. WVDEP's OWRNPDES GIS coverage was used to determine the locations of these sources, and detailed permit information was obtained from WVDEP's ERIS database.

Non-mining point sources of metals may include the wastewater discharges from water treatment plants and industrial manufacturing operations. In addition, the discharges from construction activities that disturb more than 1 acre of land are legally defined as point sources. The sediment introduced from such discharges can contribute metals. All other non-mining NPDES permits (i.e., the wastewater discharges) must discharge at a pH between 6.0 and 9.0. Based on the types of activities and the minimal flow of their discharges, these permitted non-mining sources are believed to be negligible. Under these TMDLs, these minor discharges are assumed to operate under their current permit limits and will be assigned WLAs that allow them to discharge at their current permit limits.



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

Figure 4-1. Mining NPDES outlets in the six selected subwatersheds of the Coal River watershed.

4.1.3 Construction Stormwater Permits

WVDEP issued a general NPDES permit (permit WV0115924) to regulate stormwater flowing into streams from discharges associated with construction activities. Registration under the permit is required for construction activities with a land disturbance of greater than 1 acre. These permits require that the site have properly installed best management practices ((BMPs), such as silt fences, sediment traps, seeding and mulching, and riprap) to prevent or reduce erosion and sediment runoff. Both the land disturbance and the permitting process associated with construction activities are transient. After construction is completed and sites are stabilized, water quality impacts are minimized. Individual registrations under the general permit are typically limited to a period of less than 1 year. There are three construction stormwater permits, one each in Marsh Fork, Spruce Fork and Pond Fork watersheds. Because the total disturbed area associated with these permits is small and the disturbance is of short duration, they were considered a negligible source of metals.

4.2 Metals and pH Non-point Sources

In addition to point sources, non-point sources can contribute to water quality impairments related to metals and pH. Abandoned mine lands (AML) contribute acid mine drainage (AMD), which produces low pH and high metals concentrations in surface and subsurface water. Similarly, facilities that were subject to the Surface Mining Control and Reclamation Act of 1977 during active operations and subsequently forfeited their bonds and abandoned operations can be a significant source of metals and low-pH. Also, land disturbing activities that introduce excess sediment are additional non-point sources of metals.

4.2.1 Abandoned Mine Lands

WVDEP's Office of Abandoned Mine Lands & Reclamation (AML&R) was created in 1981 to manage the reclamation of lands and waters affected by mining prior to passage of SMCRA in 1977. AML&R's mission is to protect public health, safety, and property from past coal mining and to enhance the environment through the reclamation and restoration of land and water resources. The AML program is funded by a fee placed on coal. Allocations from the AML fund are made to state and tribal agencies through the congressional budgetary process.

WVDEP's Office of AML&R identified locations of AMLs in the Coal River watershed. In addition, source-tracking efforts by WVDEP DWWM and AML&R identified additional AML sources (discharges, seeps, portals, culverts, refuse piles, diversion ditches, and ponds). Field data, such as GPS locations, water samples, and flow measurement, were collected to locate these sources and characterize their impact on water quality. Based on this work, AMLs represent a significant source of metals in selected subwatersheds of the Coal River watershed.

Abandoned mine lands were modeled in the Coal River TMDLs. A total of 3,756 acres of AML area, 55 AML seeps, and 346 miles of highwall were identified in the Coal River watershed and incorporated into the TMDL model.

4.2.2 Bond Forfeiture

As stated previously, mining permittees are required to post a performance bond to ensure the completion of reclamation requirements. When a bond is forfeited, WVDEP assumes the responsibility for the reclamation requirements. The Office of Special Reclamation in WVDEP's Division of Land Restoration made information and data associated with bond forfeiture sites available. There are six bond forfeiture sites in the Coal River watershed.

4.2.3 Sediment Sources

On the basis of previous watershed modeling (e.g., *Metals and pH TMDLs for the Elk River Watershed* [USEPA 2001] and *Metals, pH, and Fecal Coliform TMDLs for the Upper Kanawha River Watershed, West Virginia [WVDEP 2005]*), which evaluated sediment/metal interactions and general soil properties in West Virginia, it was concluded that certain sediments contain high levels of aluminum, iron, and to a lesser extent, manganese (Watts et al. 1994). Land disturbance can increase sediment loading to impaired waters, and the control of sediment-producing sources might be necessary to meet water quality criteria for metals during high-flow conditions. Potential sediment-related non-point sources of metals are forestry operations, oil and gas operations, roads, agriculture, and barren lands. The number and size of these sources in the Coal River watershed are summarized below and presented in detail in the appendices of this report.

Forestry

The West Virginia Bureau of Commerce's Division of Forestry provided information on forest industry sites (registered logging sites) in the Coal River watershed. This information included the harvested area and the subset of land disturbed by roads and landings for 34 registered logging sties in the watershed.

West Virginia recognizes the water quality issues posed by sediment from logging sites. In 1992, the West Virginia Legislature passed the Logging Sediment Control Act. The act requires the use of BMPs to reduce sediment loads to nearby waterbodies. Without properly installed BMPs, logging and associated access roads can increase sediment loading to streams.

According to the Division of Forestry, illicit logging operations account for approximately an additional 2.5 percent of the total harvested forest (registered logging sites) throughout West Virginia. These illicit operations do not have properly installed BMPs and can contribute to sediment to streams.

Oil and Gas

The WVDEP Office of Oil and Gas (OOG) is responsible for monitoring and regulating all actions related to the exploration, drilling, storage, and production of oil and natural gas in West Virginia. It maintains records on more than 40,000 active and 25,000 inactive oil and gas wells, manages the Abandoned Well Plugging and Reclamation Program. The OOG also ensures that surface water and groundwater are protected from oil and gas activities.

Oil and gas data incorporated into the TMDL model were obtained from the WVDEP OOG GIS coverage. There are 1,354 active oil and gas wells in the watersheds addressed in this report.

Runoff from unpaved access roads to these wells and the disturbed areas around the wells might contribute sediment to adjacent streams.

Roads

Heightened stormwater runoff from paved roads can increase erosion potential. Unpaved roads can contribute sediment through precipitation-driven runoff. Roads that traverse stream paths elevate the potential for direct deposition of sediment. Road construction and repair can further produce increased sediment loads if BMPs are not properly employed.

Information on roads was obtained from various sources, including the 2000 TIGER/Line shapefiles from the U.S. Census Bureau and the WV Roads GIS coverage prepared by WVU. Unpaved roads that were not included in either GIS coverage were digitized from topographic maps.

Agriculture

Agricultural activities can contribute sediment loads to nearby streams; however, there is very little agricultural activity in the Coal River watershed. Row crop agriculture occurs on approximately 0.1 percent of the watershed, as shown by the GAP data (Table 3-1) and source-tracking efforts throughout the watershed.

Other Land-Disturbing Activities

As stated previously, WVDEP issues general NPDES permits to regulate sediment contributions to streams from discharges associated with construction activities that have surface disturbances greater than 1 acre. Construction activities disturbing less than 1 acre are not subject to construction stormwater permitting. There are three construction stormwater permits in the watershed.

4.3 Selenium Sources

As shown previously in Table 3-3, there are nine waterbodies listed as impaired pursuant to West Virginia’s water quality criteria for selenium (Table 2-1): James Creek, Casey Creek, Beaver Pond Branch, Beech Creek, Left Fork/Beech Creek, Trace Branch, White Oak Creek, Left Fork/White Oak Creek, and Seng Creek. These impaired waterbodies are shown in Figure 4-2.

These streams were listed based on data collected by WVDEP (from July 2002 through June 2003) during the pre-TMDL stream monitoring effort. As shown in Table 4-1, 157 observations were taken on these nine streams and 65 violated the chronic aquatic life criterion for total selenium (5.0 ug/L), 10 observations violated the acute aquatic life criterion (20.0 ug/L), and 15 observations violated the Human Health not-to-exceed criterion of 10 ug/L.

Table 4-1. Water quality observations for selenium in the Coal River watershed were collected for the TMDL development process.

Watershed	Stream Name	DNR Code	Mile Point	Total Observations	Non-Detect Observations	Total Selenium (ug/L)			Water Quality Criteria Violations		
						Ave	Min	Max	5 ug/L	20 ug/L	10 ug/L
Coal River	White Oak Creek	WVKC-35	0.1	14	14	ND	ND	ND	0	0	0
Coal River	White Oak Creek	WVKC-35	2.7	11	8	7.0	6.0	8.0	3	0	0
Coal River	White Oak Creek	WVKC-35	3.9	11	2	8.6	6.0	20.0	8	1	0
Coal River	White Oak Creek	WVKC-35	5.7	8	1	7.6	7.0	9.0	7	0	0
Coal River	Left Fork/White Oak Creek	WVKC-35-E	0.0	10	2	10.1	6.0	20.0	5	2	1
Coal River	Left Fork/White Oak Creek	WVKC-35-E	3.7	1	0	7.0	7.0	7.0	1	0	0
Coal River	Seng Creek	WVKC-42	0.0	14	4	7.1	6.0	9.0	10	0	0
Coal River	Seng Creek	WVKC-42	3.9	11	0	15.8	8.0	30.0	4	2	5
Pond Fork	Beaver Pond Branch	WVKC-10-U-9	0.0	7	0	13.3	7.0	22.0	2	1	4
Pond Fork	Casey Creek	WVKC-10-U-8	0.0	10	5	6.0	6.0	6.0	5	0	0
Pond Fork	James Creek	WVKC-10-U-7-I	0.0	10	1	7.5	6.0	11.0	8	0	1
Spruce Fork	Beech Creek	WVKC-10-T-15	0.0	12	8	7.3	6.0	9.0	4	0	0
Spruce Fork	Beech Creek	WVKC-10-T-15	1.7	11	10	6.0	6.0	6.0	1	0	0
Spruce Fork	Beech Creek	WVKC-10-T-15	3.6	11	11	ND	ND	ND	0	0	0
Spruce Fork	Left Fork/Beech Creek	WVKC-10-T-15-A	0.0	11	1	23.5	7.0	53.0	3	4	3
Spruce Fork	Trace Branch	WVKC-10-T-19	0.0	5	0	7.3	5.3	10.0	4	0	1

Source: WVDEP, DWWM

ND = Non-detect

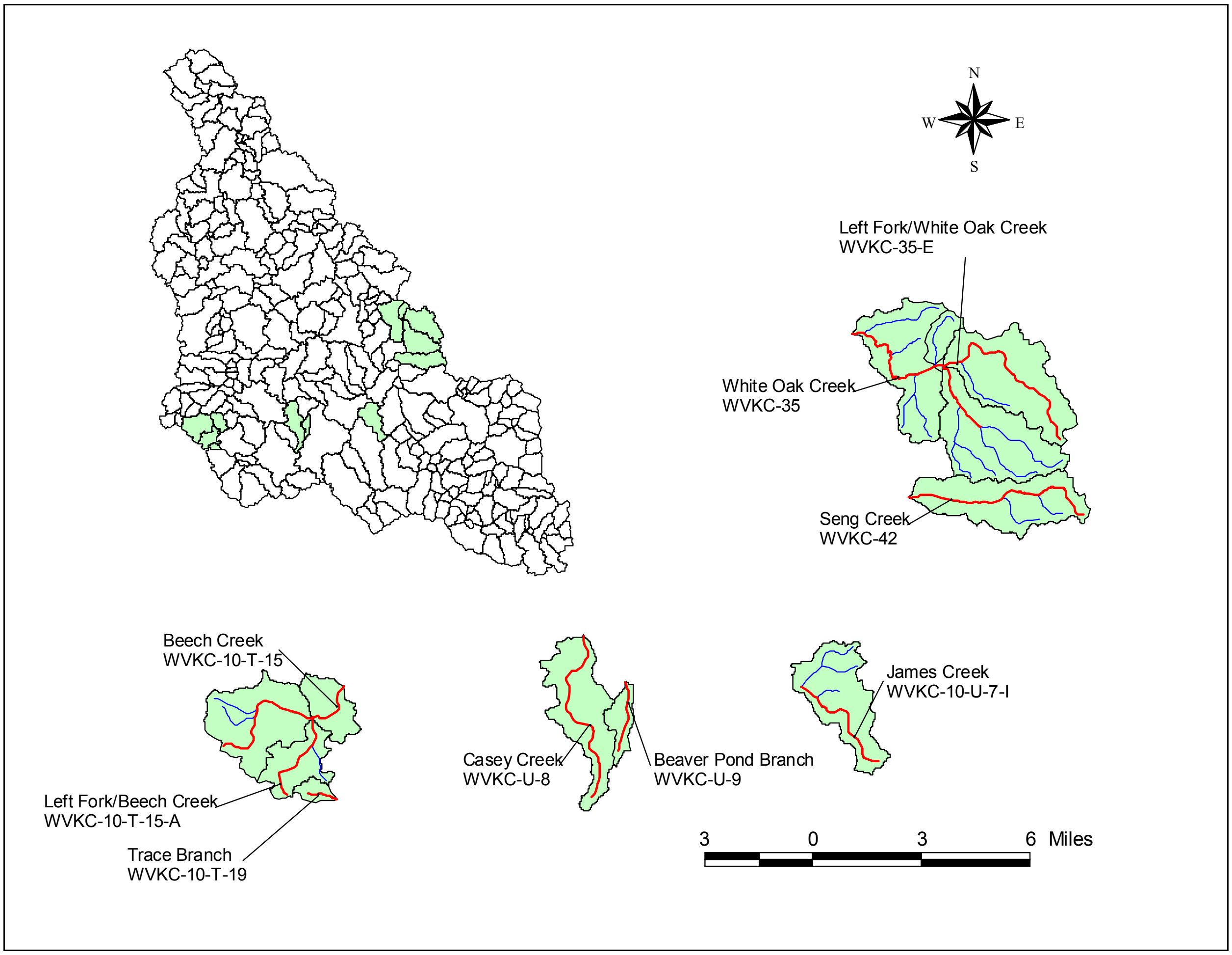


Figure 4-2. Location of the selenium impaired watersheds

Selenium is a naturally occurring element that is found in Cretaceous marine sedimentary rocks, coal and other fossil fuel deposits (Dreher, 1992; CCREM 1987; USEPA 1987; Haygarth 1994). When such deposits are mined, mobilization of selenium is typically enhanced from crushing of ore and waste materials along with the resulting increase in surface area of material exposed to weathering processes. Studies have shown that selenium mobilization appears to be associated with various disturbance activities associated with surface coal mining in Wyoming and western Canada (Dreher and Finkelman 1992; McDonald and Strosher 1998). In West Virginia, coals that contain the highest selenium concentrations are found in a region of south central West Virginia where the Allegheny and upper Kanawha Formations of the Middle Pennsylvanian are mined (WVGES 2002). As shown in Figure 4-3, some of the highest selenium concentrations (8 to 12 ppm) were found in the central portion of the Coal River watershed where the selenium impaired streams are located.

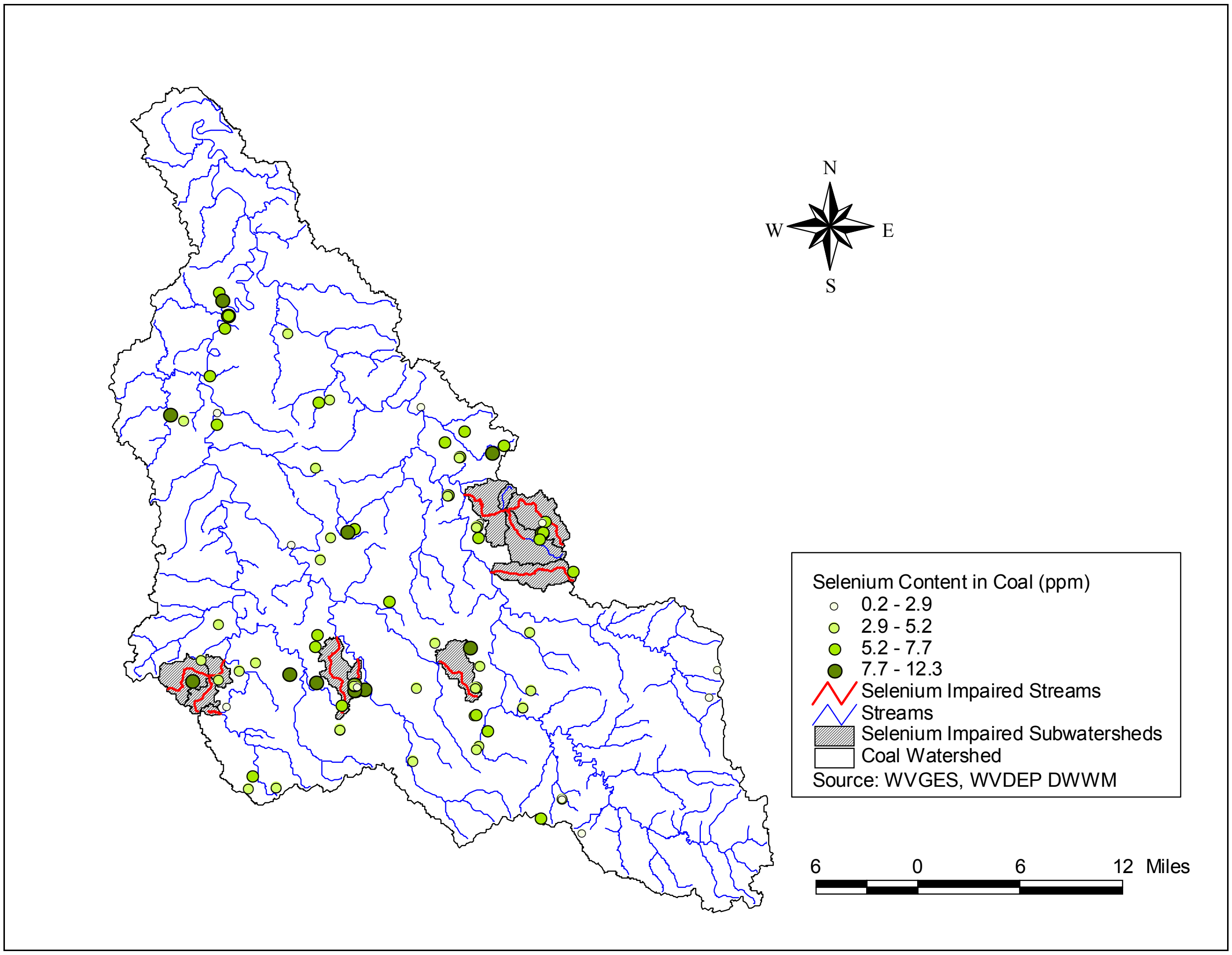


Figure 4-3. Selenium content in coal in the Coal River watershed

Although WVDEP monitored selenium throughout the Coal River watershed, elevated instream concentrations were identified only in the aforementioned waters. Extensive surface mining operations exist in the watersheds of the selenium impaired streams, and in the headwater areas, active mining is the dominant landuse. Given the high selenium content of coals in this region, and the prevalence of mining activity, subsurface disturbances associated with the extensive surface mining operations is the likely cause of the selenium impairment. Furthermore, in the cases in which stream samples were taken at different locations throughout an impaired stream, the samples nearest the headwaters showed higher selenium concentrations than those at the mouth of the stream. This is due to natural attenuation and increased dilution of selenium as it travels downstream from the source in the headwaters. Figures 4-6 and 4-7 illustrate the decreasing trend in selenium concentration in the downstream direction in Seng Creek. Figures 4-4 and 4-5 illustrate the impact of the highly contaminated headwater, Left Fork of Beech Creek, on the mainstem of Beech Creek.

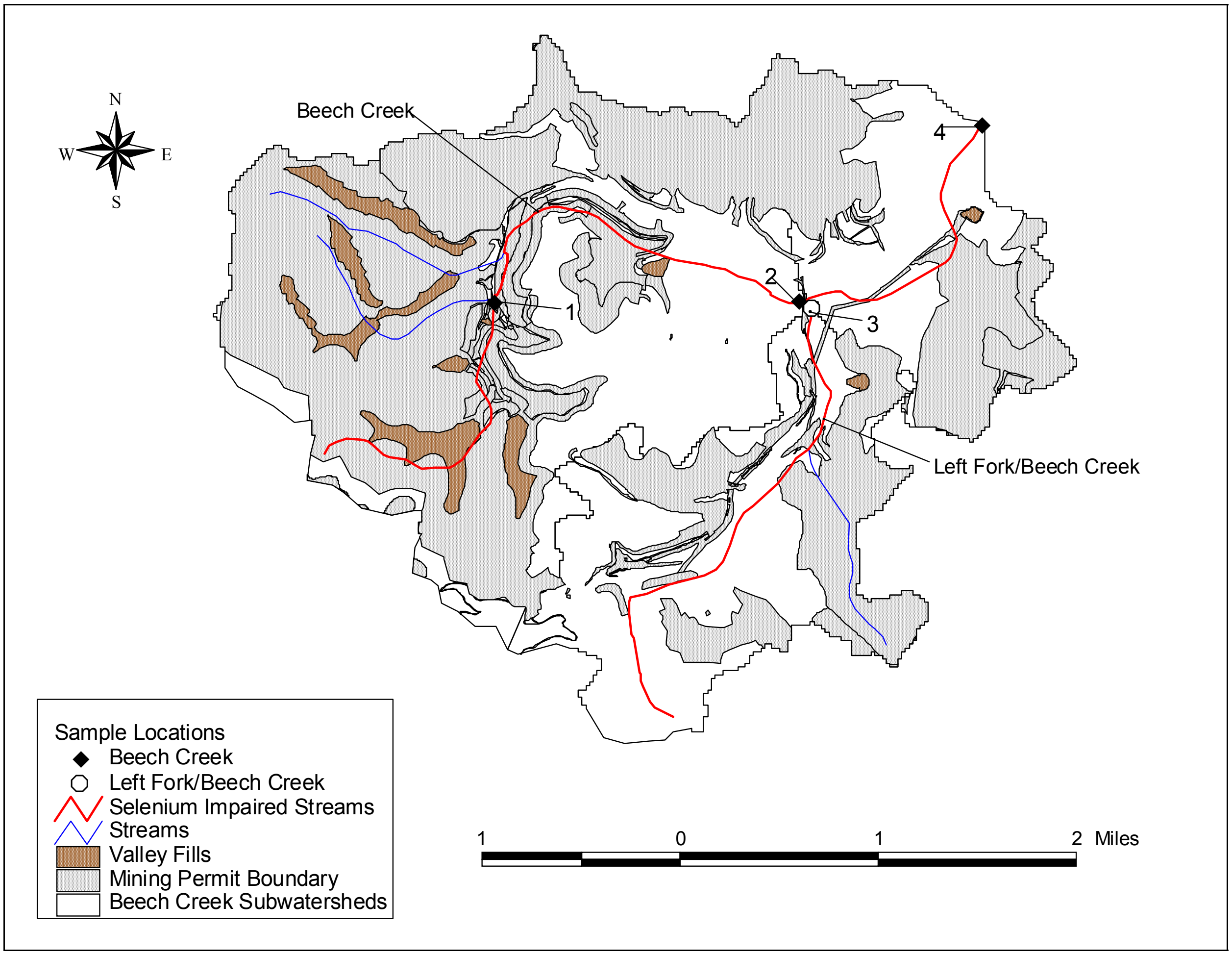


Figure 4-4. Selenium sampling stations in the Beech Creek watershed

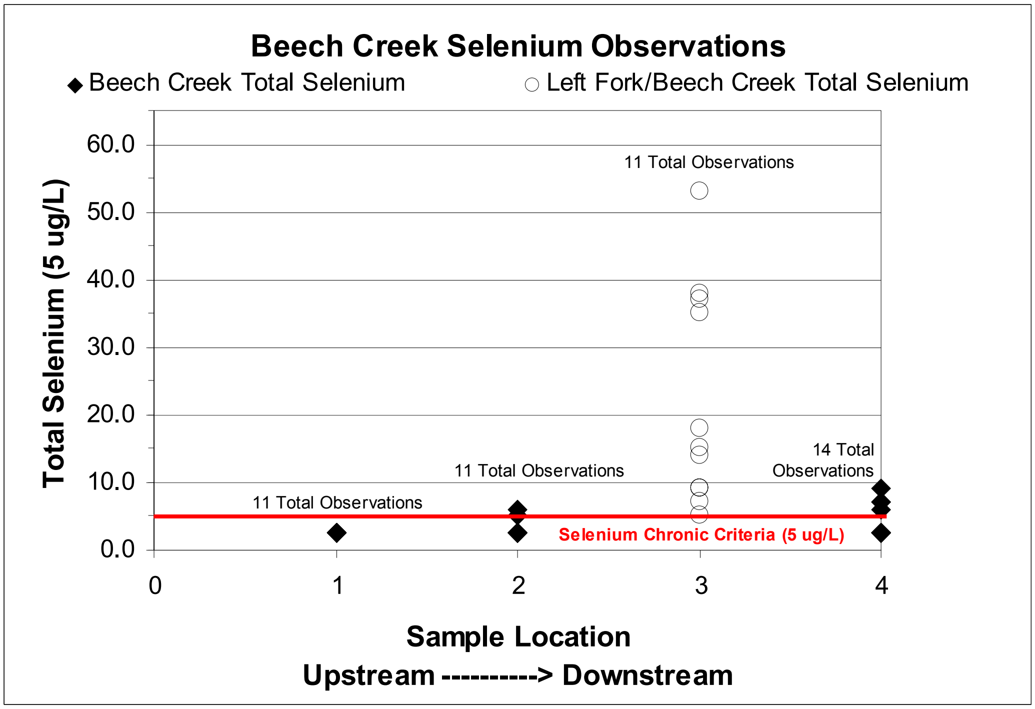


Figure 4-5. Selenium water quality data for Beech Creek watershed

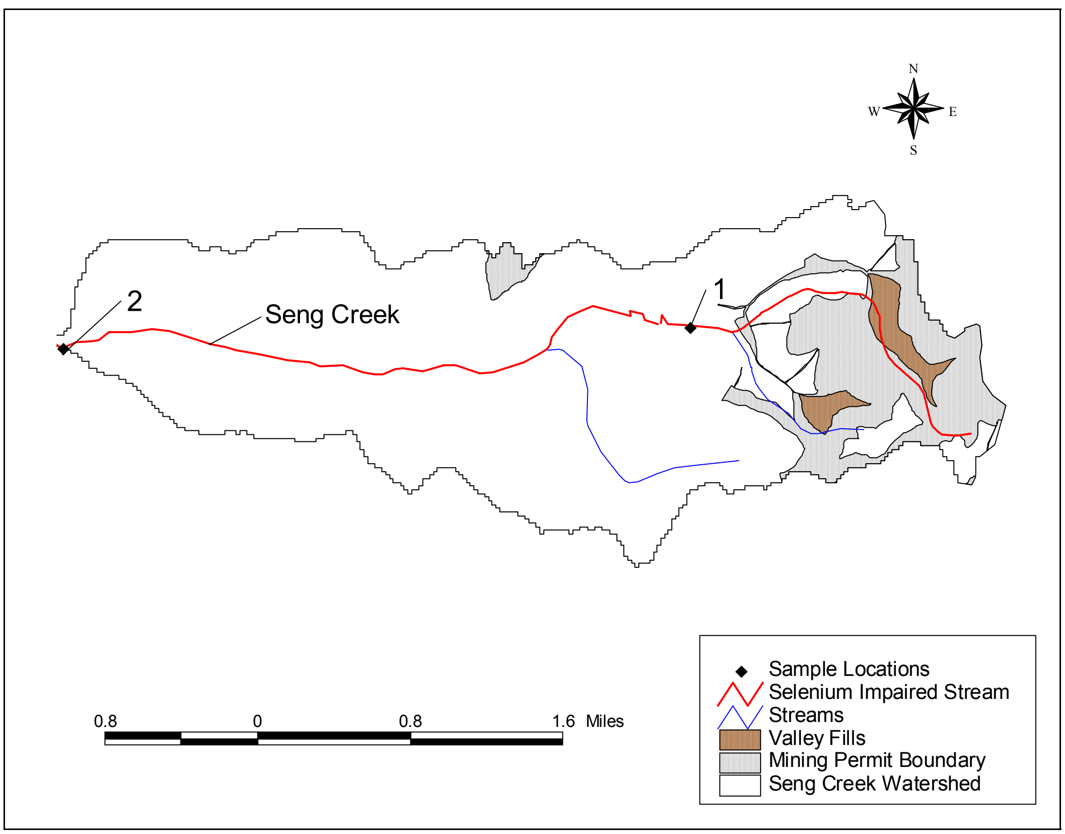


Figure 4-6. Selenium sampling stations in the Seng Creek watershed

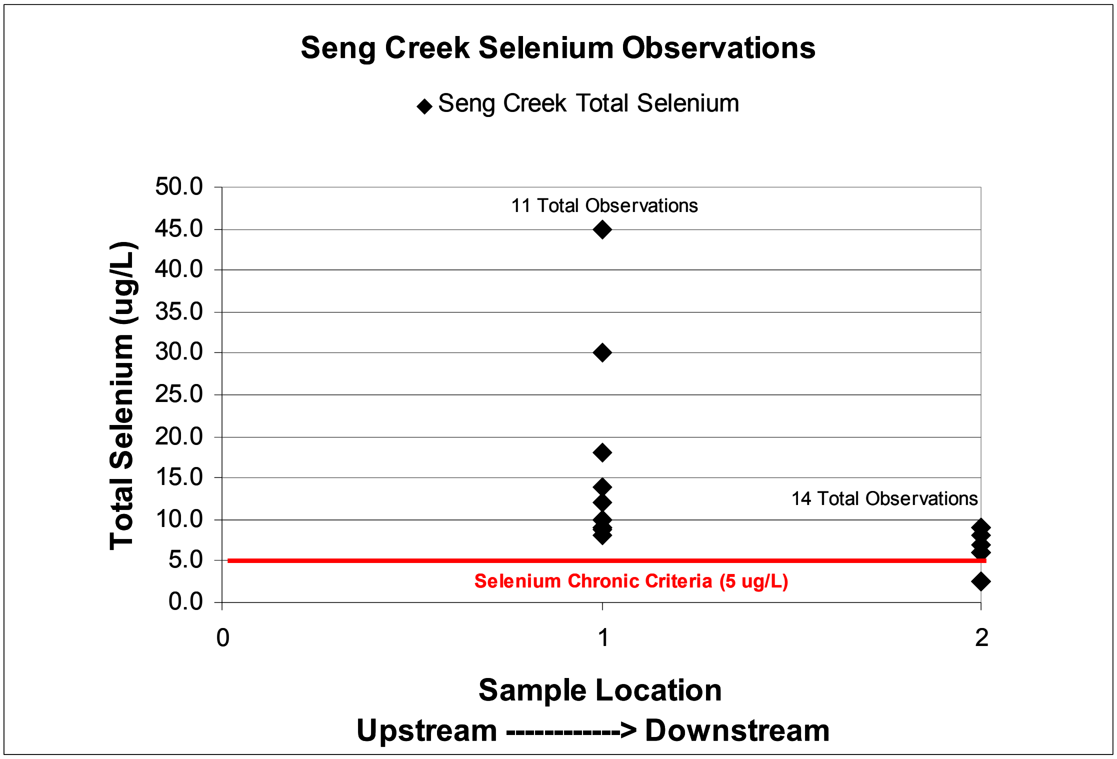


Figure 4-7. Selenium water quality data for Seng Creek watershed

5. FECAL COLIFORM SOURCE ASSESSMENT

5.1 Fecal Coliform Point Sources

The most significant fecal coliform point sources are the permitted discharges from sewage treatment plants. These facilities (including publicly and privately owned treatment works, combined sewer overflows, and home aeration units) are regulated by NPDES permits. Permits require effluent disinfection and compliance with strict fecal coliform limitations (200 counts/100 milliliters [average monthly] and 400 counts/100 mL [maximum daily]). However, noncompliant discharges and collection system overflows can contribute loadings of fecal coliform bacteria to receiving streams. The following sections discuss the specific types of fecal coliform point sources that were identified in the Coal River watershed.

5.1.1 Individual NPDES Permits

WVDEP issues individual NPDES permits to both publicly owned and privately owned wastewater treatment facilities. Publicly owned treatment works (POTWs) are relatively large facilities with extensive wastewater collection systems, whereas private facilities are usually used in smaller applications such as subdivisions and shopping centers.

Two POTWs discharge treated effluent into the fecal coliform-impaired waters of the Coal River watershed. POTWs include those operated by Boone County PSD under WV/NPDES Permit number WV0035939 and Boone-Raleigh PSD under WV/NPDES Permit number WV0086525. POTW effluents are not a significant source of fecal coliform bacteria because they are permitted to discharge only at limits more stringent than water quality criterion.

5.1.2 Overflows

Combined sewer overflows (CSOs) are outfalls from POTW sewer systems that were designed to carry untreated domestic waste and surface runoff. CSOs contain fecal coliform bacteria and are permitted to discharge only during precipitation events. Sanitary sewer overflows (SSOs) are unpermitted overflows that occur as a result of excessive infiltration and/or inflow to POTW separate sanitary collection systems.

There are five CSOs associated with permit number WV0035939 that discharge into the Little Coal River and one SSO associated with permit number WV0086525 that discharges into the Coal River.

5.1.3 Municipal Separate Storm Sewer Systems

USEPA's stormwater permitting regulations require municipalities to obtain permit coverage for all stormwater discharges from municipal separate storm sewer systems (MS4s). There is one designated MS4 municipality, the City of Saint Albans, in the watershed. Saint Albans' MS4 has discharges in the Coal River watershed, and the City has filed a Notice of Intent for MS4 permit issuance. The area within the corporate limits is assumed to be subject to MS4 stormwater permitting.

5.1.4 General Sewage Permits

General sewage permits are designed to cover similar discharges from numerous individual owners and facilities throughout the state. General Permit WV0103110 regulates small, privately owned sewage treatment plants ("package plants") that have a design flow of less than 50,000 gallons per day (gpd). General Permit WV0107000 regulates Home Aeration Units (HAUs). HAUs are small sewage treatment plants primarily used by individual residences where site considerations preclude typical septic tank and leach field installation. Both general permits contain fecal coliform effluent limitations identical to those in individual NPDES permits for sewage treatment facilities. Within the watersheds addressed by this report, 56 facilities are registered under the "package plant" general permit and 217 are registered under the "HAU" general permit.

5.2 Fecal Coliform Non-point Sources

5.2.1 On-site Treatment Systems

Overall, failing septic systems and straight pipes represent the most significant non-point source of fecal coliform bacteria in the Coal River watershed. According to the West Virginia Bureau for Public Health, the failure rate for septic systems in the watershed is estimated to be 70 percent during the first 10 years after installation. Information collected during source-tracking efforts by WVDEP yielded an estimate of 32,783 persons in the watershed that are not served by centralized sewage collection and treatment systems.

For the purposes of this TMDL, discharges from activities that do not have an associated NPDES permit, such as failing septic systems and straight pipes, are considered non-point sources. The decision to assign load allocations to those sources does not reflect a determination by WVDEP or USEPA as to whether they are, in fact, nonpermitted point source discharges. In addition, by establishing these TMDLs with failing septic systems and straight pipes treated as non-point sources, WVDEP and USEPA are not determining that such discharges are exempt from NPDES permitting requirements.

5.2.2 Stormwater Runoff

Stormwater runoff represents another non-point source of fecal coliform bacteria in residential and urbanized areas. Runoff from residential and urbanized areas during storm events can be a significant source, delivering bacteria from the waste of pets and wildlife to the waterbody. GAP2000 landuse was used to determine the number of acres of residential and urbanized areas in the Coal River watershed. Reference numbers were used to determine fecal accumulation rates for these areas.

Stormwater runoff from rural areas can transport significant loads of bacteria from livestock pastures, livestock and poultry feeding facilities, and manure storage and application. Natural background sources such as wildlife can also contribute bacteria loadings through runoff during storm events.

5.2.3 Agriculture

Agricultural activities can contribute fecal coliform bacteria to receiving streams through surface runoff or direct deposition. Grazing livestock and land application of manure result in the deposition and accumulation of bacteria on land surfaces. Then, bacteria are available for wash-off and transport during rain events. In addition, livestock with unrestricted access can deposit feces directly into streams.

Based on GAP 2000 landuse data, it was determined that agriculture is not prevalent in the impaired portions of the Coal River watershed. Although agriculture is not widespread, source-tracking efforts identified isolated instances of pastures and feedlots near impaired segments that potentially have significant localized impacts on in-stream bacteria levels. Livestock counts from the 1997 Census of Agriculture (USDA, 1997) were used to develop accumulation rates for agricultural sources of fecal coliform bacteria.

5.2.4 Natural Background (Wildlife)

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 West Virginia’s Division of Natural Resources (DNR). On the basis of the low fecal accumulation rates for forested areas, wildlife is not considered to be a significant non-point source of fecal coliform bacteria in the Coal River watershed.

6. BIOLOGICAL IMPAIRMENT AND STRESSOR IDENTIFICATION

Initially, TMDL development in biologically impaired waters requires identification of the pollutants that cause the stress to the biological community. Sources of those pollutants are often analogous to those already described: mine drainage, untreated sewage, and sediment. The Technical Report discusses biological impairment and the stressor identification (SI) process in detail.

6.1 Introduction

Assessment of the biological integrity of a stream is based on a survey of the stream's benthic macroinvertebrate community. Benthic macroinvertebrate communities are rated using a multimetric index developed for use in wadeable streams of West Virginia. The West Virginia Stream Condition Index (WVSCI; Gerritsen et al., 2000) is composed of six metrics that were selected to maximize discrimination between streams with known impairments and reference streams. In general, streams with WVSCI scores of less than 60.6 points, on a normalized 0–100 scale, are considered biologically impaired.

Biological assessments are useful in detecting impairment, but they might not clearly identify the causes of impairment, which must be determined before TMDL development can proceed. USEPA developed *Stressor Identification: Technical Guidance Document* (Cormier et al. 2000) to assist water resource managers in identifying stressors and stressor combinations that cause biological impairment. Elements of the stressor identification process were used to evaluate and identify the primary stressors to the impaired benthic communities. In addition, custom analyses of biological data were performed to supplement the framework recommended by the guidance document.

The general stressor identification process entailed reviewing available information, forming and analyzing possible stressor scenarios, and implicating causative stressors. The stressor identification method provides a consistent process for evaluating available information. TMDLs were established for the responsible pollutants at the conclusion of the stressor identification process. As a result, the TMDL process established a link between the impairment and benthic community stressors.

6.2 Data Review

WVDEP generated the primary data used in stressor identification through its pre-TMDL monitoring program. The program included water quality monitoring, benthic sampling, and habitat assessment. In addition, the biologists' comments regarding stream condition and potential stressors and sources were captured and considered. Other data sources were: source-tracking data, WVDEP mining activities data, GAP2000 landuse information, Natural Resources

Conservation Service (NRCS) STATSGO soils data, NPDES point source data, and literature sources.

6.3 Candidate Causes/Pathways

The first step in the stressor identification process was to develop a list of candidate causes, or stressors. The candidate causes responsible for biological impairments are listed below:

- Metals contamination (including metals contributed through soil erosion) causes toxicity.
- Acidity (low pH) causes toxicity.
- High sulfates and increased ionic strength cause toxicity.
- Increased total suspended solids (TSS)/erosion and altered hydrology cause sedimentation and other habitat alterations.
- Altered hydrology causes higher water temperature, resulting in direct impacts.
- Altered hydrology, nutrient enrichment, and increased biochemical oxygen demand (BOD) cause reduced dissolved oxygen (DO).
- Algal growth causes food supply shift.
- High levels of ammonia cause toxicity (including increased toxicity due to algal growth).
- Chemical spills cause toxicity.

A conceptual model was developed to examine the relationship between candidate causes and potential biological effects. The conceptual model (Figure 6-1) depicts the sources, stressors, and pathways that affect the biological community.

6.4 Stressor Identification Results

The stressor identification process determined the primary causes of biological impairment. Biological impairment was linked to a single stressor in some cases and multiple stressors in others. The stressor identification process identified the following stressors for the biologically impaired waters of the Coal River watershed:

- Metals toxicity
- pH toxicity
- Sedimentation

- Organic enrichment (the combined effects of oxygen-demanding pollutants, nutrients, and the resultant algal and habitat alteration)
- Ionic toxicity

After stressors were identified, WVDEP determined the pollutants for which TMDLs were required to address the impairment.

The stressor identification process identified metals toxicity and pH toxicity as biological stressors in waters that also demonstrated violations of the iron, aluminum, or pH water quality criteria for protection of aquatic life. WVDEP determined that implementation of those pollutant-specific TMDLs would address the biological impairment.

Where organic enrichment was identified as the biological stressor, the waters also demonstrated violations of the numeric criteria for fecal coliform bacteria. The predominant source of fecal coliform bacteria in the watershed is inadequately treated sewage. WVDEP determined that implementation of fecal coliform TMDLs would remove untreated sewage and thereby reduce the organic and nutrient loading causing the biological impairment. Therefore, fecal coliform TMDLs will serve as a surrogate where organic enrichment was identified as a stressor.

Where the stressor identification process indicated sedimentation as a causative stressor, WVDEP developed sediment TMDLs.

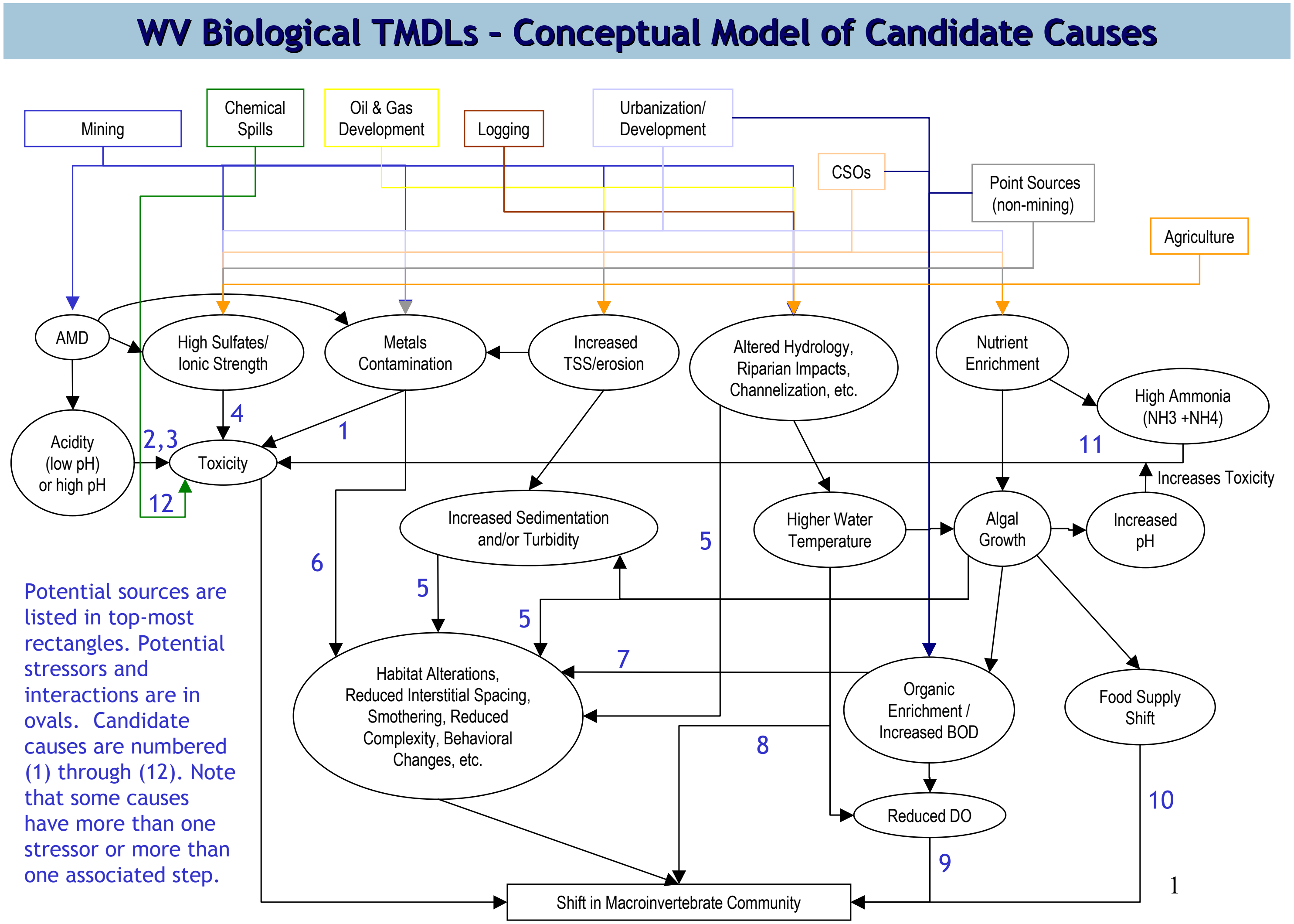


Figure 6-1. Conceptual model of candidate causes and potential biological effects.

In certain waters (James Branch, Ellis Creek, Rockhouse Creek, Toney Fork, Buffalo Fork, Left Fork/Beach Creek, and Seng Creek), the stressor identification process determined ionic toxicity as the primary stressor. Information available regarding the causative pollutants and their associated impairment thresholds is insufficient for biological TMDL development at this time. Therefore, WVDEP is deferring biological TMDL development and retaining those waters on the Section 303(d) list. Table 6-1 summarizes the primary stressors' contributions to biological impairment in the Coal River watershed.

Table 6-1. Primary stressors of biologically impaired streams in the Coal River watershed

Major Watershed	Stream	Biological Stressors	TMDLs Developed
Marsh Fork	Sandlick Creek	Metal toxicity (iron) Sedimentation	Iron Sediment
	Right Fork/Sandlick Creek	Organic enrichment Sedimentation	Fecal coliform Sediment
	Maple Meadow Creek	Metal toxicity (iron) Organic enrichment	Iron Fecal coliform
	Surveyor Creek	Organic enrichment Sedimentation	Fecal coliform Sediment
	Millers Camp Branch	Sedimentation	Sediment
Clear Fork	Clear Fork	Organic enrichment	Fecal coliform
	Stonecoal Branch	Metals toxicity (iron) pH toxicity (acidity) Sedimentation	Iron pH Sediment
	White Oak Creek	Organic enrichment	Fecal coliform
	Lick Run	Metal toxicity (iron) Sedimentation	Iron Sediment
Pond Fork	Pond Fork	Organic enrichment Sedimentation	Fecal coliform Sediment
	West Fork	Sedimentation	Sediment
	Casey Creek	Sedimentation	Sediment
Spruce Fork	Bias Branch	Organic enrichment	Fecal coliform
	Missouri Fork	Organic enrichment	Fecal coliform
	Baldwin Fork	Organic enrichment Sedimentation	Fecal coliform Sediment
	Spruce Laurel Fork	Metals toxicity (iron) Sedimentation	Iron Sediment
Little Coal River	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

Major Watershed	Stream	Biological Stressors	TMDLs Developed
Coal River	Browns Creek	Organic enrichment Sedimentation	Fecal coliform Sediment
	Smith Creek	Organic enrichment Sedimentation	Fecal coliform Sediment
	Little Smith Creek	Organic enrichment	Fecal coliform
	Crooked Creek	Organic enrichment	Fecal coliform
	Lick Creek	Organic enrichment	Fecal coliform
	Brush Creek	Organic enrichment Sedimentation	Fecal coliform Sediment
	Ridgeview Hollow	Organic enrichment Sedimentation	Fecal coliform Sediment
	Sandlick Creek	Organic enrichment Sedimentation	Fecal coliform Sediment

7. MODELING PROCESS

Establishing the relationship between the in-stream water quality targets and source loadings is a critical component of TMDL development. It allows for the evaluation of management options that will achieve the desired source load reductions. The link can be established through a range of techniques, from qualitative assumptions based on sound scientific principles to sophisticated modeling techniques. Ideally, the linkage will be supported by monitoring data that allow the TMDL developer to associate certain waterbody responses with flow and loading conditions. This section presents the approach taken to develop the linkage between sources and in-stream response for TMDL development in the Coal River watershed.

7.1 Modeling Technique for Metals, pH, and Fecal Coliform Bacteria

Selection of the appropriate analytical technique for TMDL development was based on an evaluation of technical and regulatory criteria. The following key technical factors were considered in the selection process:

- Scale of analysis.
- Point and non-point sources.
- Metals, pH, and fecal coliform bacterial impairments are temporally variable and occur at low, average, and high flow conditions.
- Time-variable aspects of land practices have a large effect on in-stream metals and bacteria concentrations.
- Metals and bacteria transport mechanisms are highly variable and often weather-dependent.

The primary regulatory factor that initiated the selection process was West Virginia's water quality criteria. According to 40 CFR Part 130, TMDLs must be designed to implement applicable water quality standards. The applicable water quality standards for metals, pH, and fecal coliform bacteria in West Virginia are presented in Section 2, Table 2-1. Compliance with the criteria requires attaining conditions that protect against both short-term (acute) effects and long-term (chronic) effects. West Virginia water quality criteria are applicable at all stream flows greater than the 7-day, 10-year low flow (7Q10). The approach or modeling technique must permit representation of in-stream concentrations under a variety of flow conditions to evaluate critical flow periods for comparison to chronic and acute criteria.

The TMDL development approach must also consider the dominant processes affecting pollutant loadings and in-stream fate. For the Coal River watershed, primary sources contributing to metals, pH, and fecal coliform impairments include an array of point and non-point sources. Non-point sources are typically rainfall-driven with pollutant loadings primarily related to surface runoff. Point source discharges might or might not be induced by rainfall.

A variety of modeling tools were used to develop the TMDLs, including the Mining Data Analysis System (MDAS), the Dynamic Equilibrium In-stream Chemical Reactions model (DESC-R), and the Fecal Coliform Loading Estimation Spreadsheet (FCLES).

MDAS is a system designed to support TMDL development for areas affected by non-point and point sources. The MDAS component most critical to TMDL development is the dynamic watershed model because it provides the linkage between source contributions and in-stream response. MDAS is used to simulate watershed hydrology and pollutant transport as well as stream hydraulics and in-stream water quality. It is capable of simulating different flow regimes and pollutant loading variations. Metals and fecal coliform bacteria were modeled using MDAS.

Metals are modeled in MDAS in the total recoverable form. Therefore, it was necessary to link MDAS with DESC-R to appropriately address dissolved aluminum TMDLs for the Coal River watershed. DESC-R was also used to represent the source-response linkage for pH. The model selection process, modeling methodologies, and technical approaches are discussed further in the Technical Report.

FCLES (Fecal Tool) is a spreadsheet tool used to quantify non-point source bacteria accumulation rates based on watershed-specific information. FCLES is a Microsoft Excel spreadsheet tool that estimates the fecal coliform bacteria contribution from multiple sources. Inputs to the Fecal Tool can be generated manually or by using various functions of the Watershed Characterization System. Output from the Fecal Tool is used as input to MDAS. The tool estimates the monthly accumulation rate of fecal coliform bacteria on four landuses (cropland, forest, residential, and pastureland), as well as the asymptotic limit for that accumulation should no washoff occur. The tool also estimates the direct input of fecal coliform bacteria to streams from grazing agricultural animals and failing septic systems. The Fecal Tool provides starting values for model input; however, a thorough calibration of the model is still necessary.

7.1.1 MDAS Setup

Configuration of the MDAS model involved subdivision of the Coal River watershed into modeling units. Flow and water quality for those units were continuously simulated using meteorological, landuse, point source loading, and stream data.

The watershed was broken into six separate watershed units based on the watershed groupings of impaired streams shown in Figure 3-2. These subwatersheds were further subdivided to allow evaluation of water quality and flow at pre-TMDL monitoring stations**.** This subdivision process also ensures a proper stream network configuration within the basin. The 299 total subwatershed delineations across all of the six watersheds are shown in Figure 7-1.

Modeled landuses contributing to metals loads include forest, cropland, pasture, urban/residential pervious lands, urban/residential impervious lands, barren areas, roads, harvested forest, and abandoned mines. These sources were represented explicitly by consolidating existing GAP2000 landuse categories to create model landuse groupings. Several additional landuse categories were created to account for recent land disturbance activities (e.g., harvested forest, oil and gas operations, unpaved roads, and active mining) that are not represented in the GAP2000 landuse coverage. The process of consolidating and updating the modeled landuses is explained in further detail in the Technical Report. Other sources, such as AML seeps identified by WVDEP's source-tracking efforts, were modeled as direct, continuous-flow sources in the model.

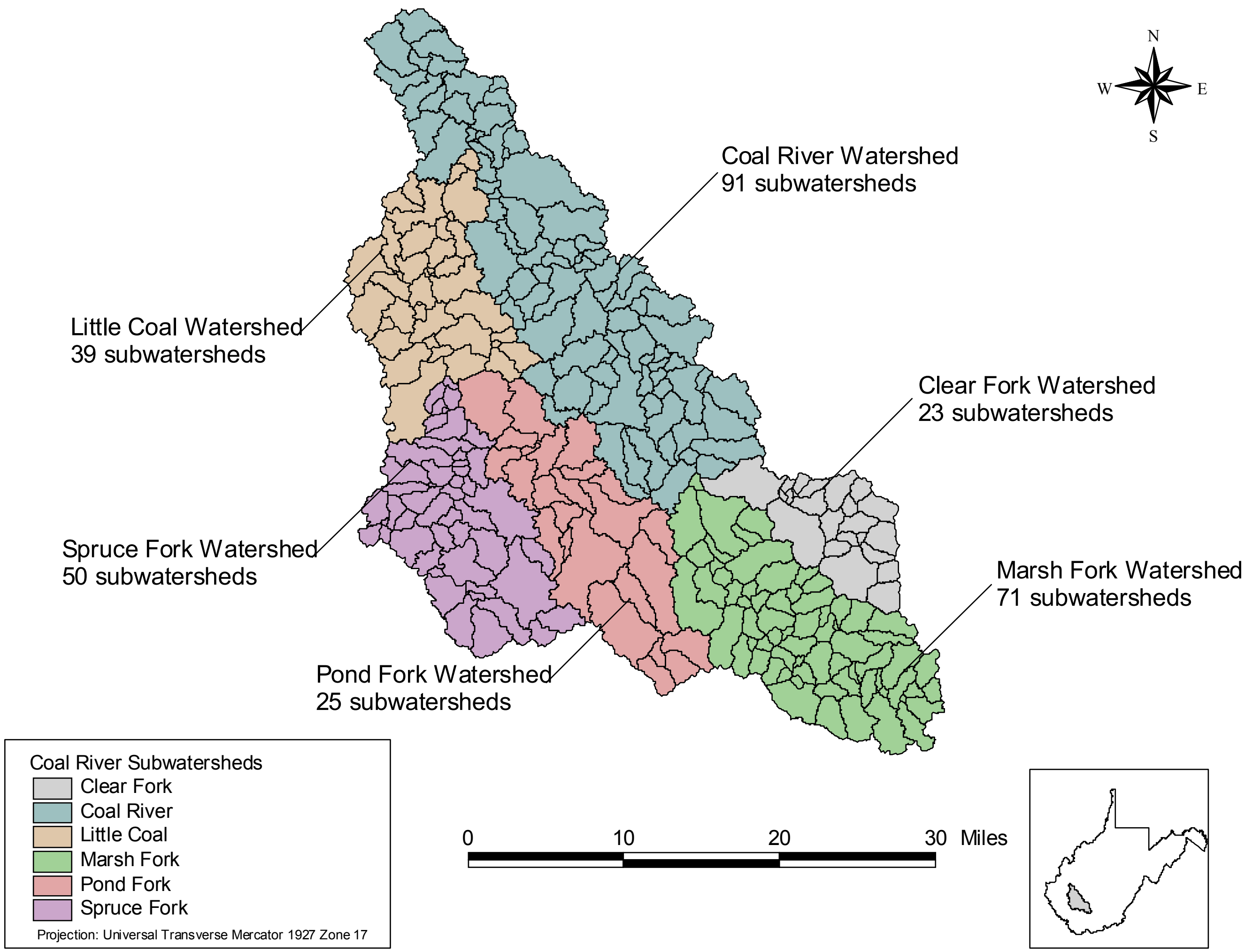


Figure 7-1. Coal River subwatershed delineation.

Modeled landuses contributing bacteria loads include pasture, cropland, urban/residential pervious lands, urban/residential impervious lands, and forest (including barren and wetlands). Other sources, such as failing septic systems, straight pipes, and permitted sources, were modeled as direct, continuous-flow sources in the model. The basis for the initial loading rates for landuses and direct sources are described in the Technical Report. The initial estimates were further refined during the model testing (calibration).

7.1.2 Hydrology Calibration

Hydrology and water quality calibration were performed in sequence because water quality modeling is dependent on an accurate hydrology simulation. Typically, hydrology calibration involves a comparison of model results to in-stream flow observations from USGS flow gauging stations throughout the watershed. There is one USGS flow gauging station in the Coal River watershed with adequate data records for hydrology calibration. A USGS gauging station operated on Rock Creek from 1979 to 1984. Hydrology calibration was based on observed data from that station and the landuses present in the watershed at that time. Key considerations for hydrology calibration included the overall water balance, the high-flow/low-flow distribution, storm flows, and seasonal variation. The model was calibrated to the observed data recorded on the Rock Creek watershed from March 1, 1979, to February 28, 1980. The hydrology was validated for the longer time period of October 1, 1979, to September 30, 1984. Final adjustments to model hydrology were based on flow measurements obtained during WVDEP's pre-TMDL monitoring in the Coal River watershed. Further description and a summary of the results of the hydrology calibration and validation are presented in the Technical Report.

7.1.3 Water Quality Calibration

Following hydrology calibration, the water quality was calibrated by comparing modeled versus observed in-stream metals and fecal coliform bacteria concentrations. The water quality calibration consisted of executing the MDAS model, comparing the model results to available observations, and adjusting water quality parameters within reasonable ranges. Ranges were based on previous watershed modeling experience in West Virginia (*pH and Metals TMDLs for the Tug Fork River Watershed* [USEPA 2002] and *Metals, pH, and Fecal Coliform TMDLs for the Upper Kanawha River Watershed, West Virginia* [WVDEP 2005]). Parameters for background conditions were established using observations from undisturbed areas.

As stated in Section 7.1, it was necessary to link MDAS with DESC-R to appropriately address dissolved aluminum TMDLs in the Coal River watershed. DESC-R was calibrated by adjusting water quality parameters to match the observed in-stream water quality data. Further description and a summary of the results of the DESC-R water quality calibration and validation are presented in the Technical Report.

7.2 Modeling Technique for Sediment

Stressor identification results indicated a need to reduce the contribution of excess sediment to certain biologically impaired streams in the Coal River watershed, as discussed in Section 6. As a result, sediment TMDLs were developed by integrating a watershed loading model that quantified land-based loads and a stream routing model that examined stream bank erosion and depositional processes.

Selection of this modeling system for the development of sediment TMDLs was based on the evaluation of available technical and regulatory criteria. The key technical factors listed in Section 7.1 were also considerations in the model selection process for sediment TMDL development. Adequately representing erosion processes and non-point source loads in the watershed was a primary concern in selecting the appropriate modeling system.

Narrative criteria are included in West Virginia's water quality standards (Title 47 CSR 2–3.2.i), as discussed in Section 2 of this report. The narrative water quality criterion prohibits the presence of wastes in state waters that cause or contribute to significant adverse impacts on the chemical, physical, hydrologic, and biological components of aquatic ecosystems. This provision is the basis for "biological impairment" determinations. WVDEP assesses compliance with the narrative criteria by monitoring the benthic macroinvertebrate community. Sediment reductions are required to restore water quality and habitat conditions in many of the biologically impaired streams in the Coal River watershed.

A reference watershed approach was used to establish the acceptable level of sediment loading for each impaired stream on a watershed-specific basis. This approach was based on selecting a non-impaired watershed that shares similar landuse, ecoregion, and geomorphologic characteristics with the impaired watershed. Stream conditions in the reference watershed are assumed to be representative of the conditions needed for the impaired stream to attain its designated uses. Given these parameters and a non-impaired WVSCI score, the Spicelick Fork watershed in the Left Fork/Joes Creek subwatershed was selected as the reference watershed. The location of the Spicelick Fork watershed is shown in Figure 7-2.

Sediment loading rates were determined for impaired and reference watersheds. Both point and non-point sources were considered in the analysis, and numeric endpoints were based on the calculated sediment loading from the reference watershed. Sediment load reductions necessary to meet these endpoints and TMDL allocations were then determined. TMDL allocation scenarios were based on an analysis of the degree to which contributing sources could be reasonably reduced.

TMDLs were developed using BasinSim 1.0 (Dai et al., 2000), the Generalized Water Loading Functions (GWLF) model (Haith and Shoemaker, 1997), and the Stream Module (Tetra Tech, 2003). A variety of GIS tools, local watershed data, and observations were used to develop the input data needed for modeling and TMDL development.

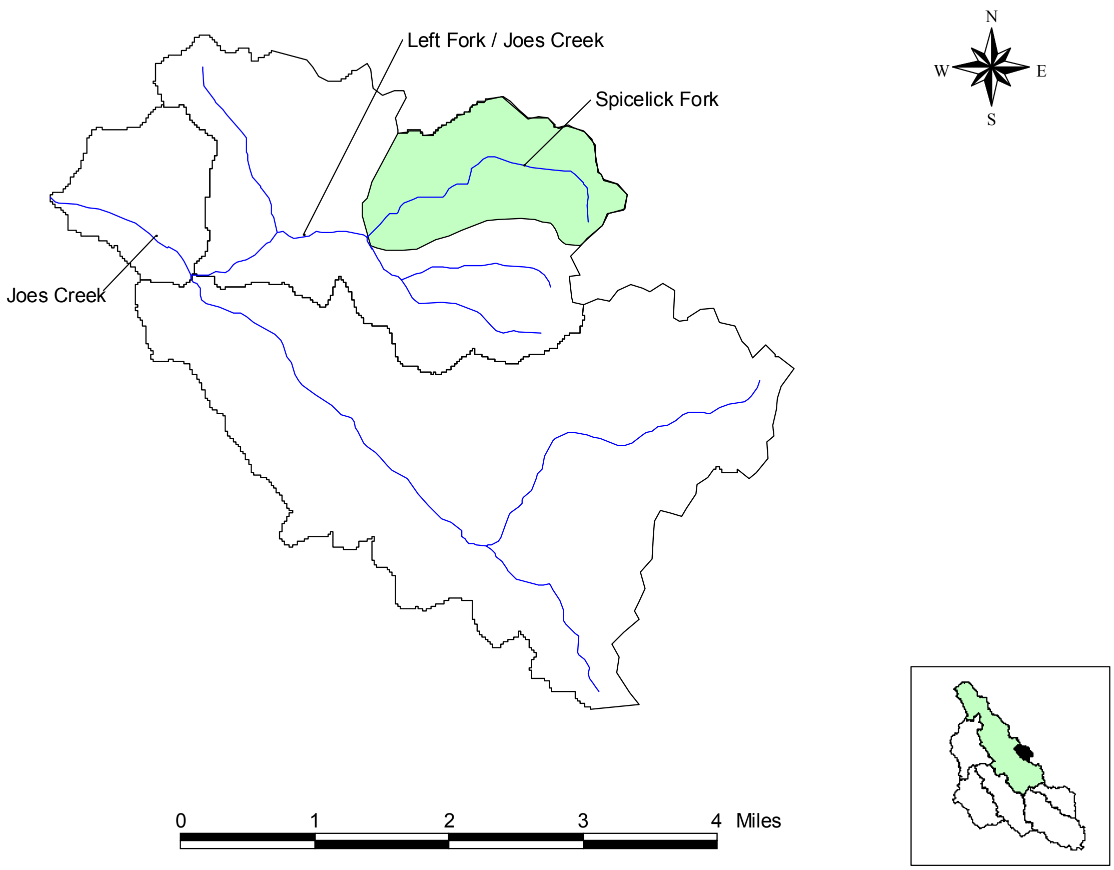


Figure 7-2. Location of the reference stream, Spicelick Fork watershed.

The GWLF model was used to estimate the sediment loads contributed by each modeled watershed. GWLF is a continuous-simulation model that simulates runoff, sediment, and nutrient loadings. GWLF modeling was accomplished using the BasinSim 1.0 watershed simulation program. BasinSim 1.0 is a Windows-based GIS platform that facilitates the execution of the GWLF model and development of model input data.

The Stream Module was used to model sediment transport/routing and stream bank erosion/deposition processes. The stream bank erosion simulation module employed the algorithm used in the Annualized Agricultural Non-point Source (AnnAGNPS) model (Bingner and Theurer 2000). Subwatershed loads calculated by GWLF and point source loads were input into the Stream Module to calculate the sediment loading to each stream channel and the load routed downstream. The Technical Report provides more detailed discussions on the technical approaches used for sediment modeling.

7.2.1 GWLF/Stream Module Setup

The GWLF/Stream Module was configured for each impaired and reference stream in the Coal River watershed. Modeled watersheds were subdivided to simulate hydrologic and sediment loading characteristics using available meteorological, landuse, point source loading, and stream data. Stream channel observational data provided by WVDEP were used to set up the Stream Module for the simulation of stream routing and erosion/deposition processes.

A continuous simulation period of 10 years (January 1, 1991 to September 30, 2001) is used in the hydrologic simulation analysis. An important factor driving model simulations is precipitation data. The pattern and intensity of rainfall affects erosion and the contribution of sediment from the land to the stream. In the GWLF model, the non-point source load calculation is affected by terrain conditions, such as the amount of forested land, land slope, soil erosion potential, and land disturbance activities, used in each modeled watershed. Various parameters can be adjusted in the model to account for these conditions and practices.

Modeled landuses include forest (including wetlands), cropland, pasture, urban/residential pervious lands, urban/residential impervious lands, barren areas, roads, oil and gas operations, harvested forest, surface mines, deep mines, and abandoned mines.

7.2.2 Hydrology Calibration

Hydrology calibration and water quality calibration were performed in sequence because water quality modeling was dependent on an accurate hydrology simulation. The modeling period was determined on the basis of the availability of weather and flow data that were collected during the same period. The USGS flow gauge (03198500) on Coal River at Ashford was used for hydrology calibration. Further description, and a summary of the results of the hydrology calibration and validation are presented in the Technical Report. The model was calibrated to the observed data recorded on the Coal River watershed from January 1, 1991, to July 31, 2001.

7.2.3 Water Quality Calibration

GWLF is an empirical model that was developed based on established relationships between rainfall, erosion, and sediment transport. The Universal Soil Loss Equation (USLE) and runoff curve numbers developed by the NRCS form the basis of the GWLF model. Given proper model setup and sediment source representation, water quality calibration is usually not required for this empirically based model. Water quality calibration was performed, however, to verify the accurate representation of landuses in each watershed and the parameter values used in model simulations. GWLF predicted average annual and monthly sediment loads for each modeled watershed. Those results were compared to available water quality data (TSS and turbidity data) and habitat data collected by WVDEP for each stream.

7.3 Selenium TMDL Approach

As discussed in Section 7-1, the TMDL approach must consider the dominant processes regarding pollutant loadings and in-stream fate. A pollutant flow analysis was performed using measured flow data and the observed in-stream concentrations from pre-TMDL monitoring in order to evaluate critical flow periods for comparison to water quality criteria for selenium. Figures 7-3 and 7-4 show measured in-stream selenium concentrations with corresponding flow data that were collected from selenium impaired streams and the entire Coal River watershed, respectively. Corresponding flow data were available for only 26 % of the total selenium observations in the entire Coal River watershed and 25% for the selenium impaired streams. Furthermore, a large percentage of these samples (43% for selenium impaired streams and 90% for all data in the Coal River watershed), selenium concentrations were measured below the method detection limits of 5.0 ug/L. For the purposes of this analysis, all non-detect samples were represented at 2.5 ug/L. Using this limited dataset of detectable selenium concentrations with corresponding observed flow data, it was concluded that selenium concentration decreases with increased stream flow.

For the impaired tributaries in the Coal River watershed, the primary sources contributing to selenium impairments are assumed to be the point sources associated with mining activity. To address the perceived low-flow critical condition, WLAs for all mining point sources have been assigned equal to the value of water quality criteria. “Criteria end-of-pipe” allocations are also protective at higher flow conditions.

Nonpoint sources associated with surface disturbances (i.e., barren areas, unpaved roads, harvested forest, and oil and gas well operations) were considered to be negligible sources of selenium because these land disturbances typically do not disturb subsurface strata that contain selenium and because they were not significantly present in the selenium impaired watersheds. Furthermore, in other parts of the Coal River where such land uses are extremely prevalent, selenium impairment was not identified.

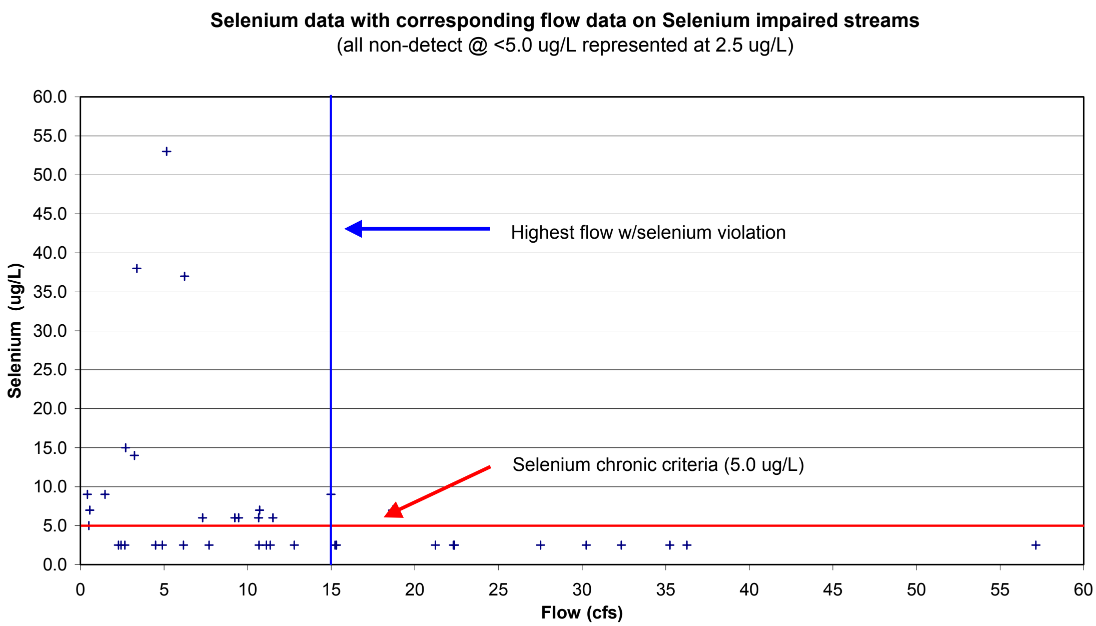


Figure 7-3. Selenium data with corresponding flow data on Selenium impaired streams

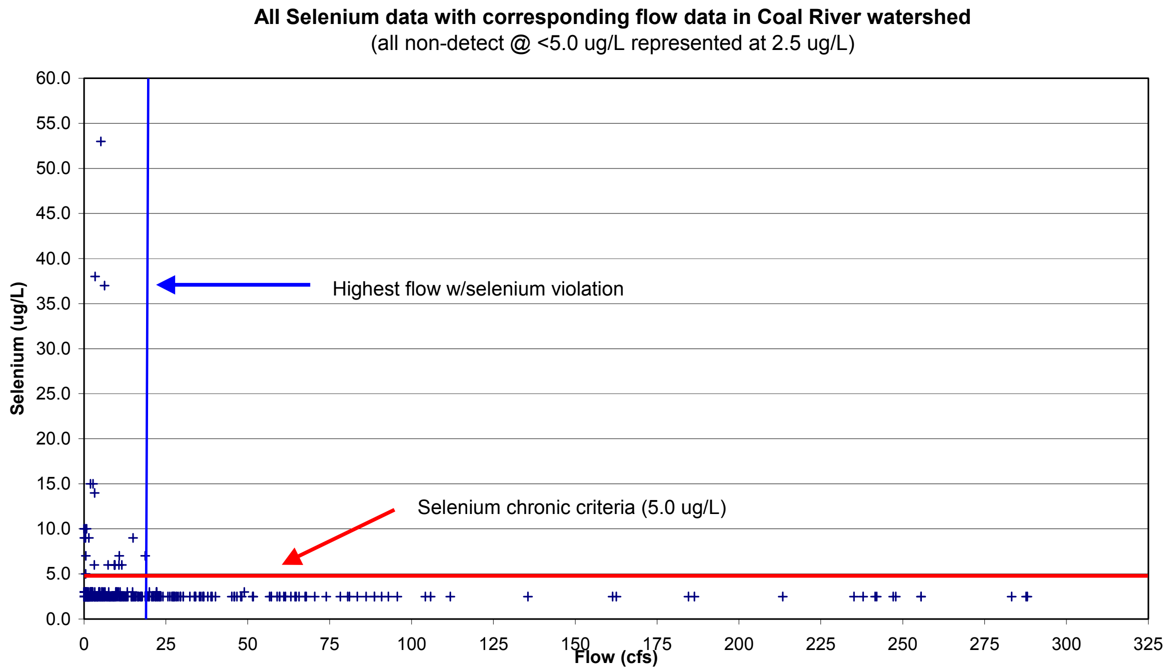


Figure 7-4. All Selenium data with corresponding flow data in Coal River watershed

7.4 Allocation Analysis

As explained in Section 2, a TMDL is composed of the sum of individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for non-point sources, and natural background levels. In addition, the TMDL must include a margin of safety (MOS), implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. TMDLs can be expressed in terms of mass per time or other appropriate units. Conceptually, this definition is denoted by the equation:

$$\text{TMDL} = \text{sum of WLAs} + \text{sum of LAs} + \text{MOS}$$

To develop aluminum, iron, manganese, selenium, pH, fecal coliform bacteria, and sediment TMDLs for each of the waterbodies listed in Table 3-3 of this report, the following approach was taken:

- Define TMDL endpoints.
- Simulate baseline conditions.

- Assess source loading alternatives.
- Determine the TMDL and source allocations.

7.4.1 TMDL Endpoints

TMDL endpoints represent the water quality targets used to quantify TMDLs and their individual components. Different TMDL endpoints are necessary for dissolved aluminum, total iron, total manganese, selenium, pH, fecal coliform bacteria, and sediment. West Virginia's numeric water quality criteria for the subject pollutants (identified in Section 2) and an explicit MOS were used to identify endpoints for TMDL development. The TMDL endpoint for troutwaters (Hopkins Fork, Clear Fork above Dorothy and Marsh Fork above Sundial) is developed with respect to the troutwater iron criterion. Where applicable, TMDLs are presented as average annual loads because they were developed to meet TMDL endpoints under a range of conditions observed throughout the year. Analysis of available data indicated that critical conditions occur during both high- and low-flow events. To appropriately address the low- and high-flow critical conditions, the TMDLs were developed using continuous simulation (modeling over a period of several years that captured precipitation extremes), which inherently considers seasonal hydrologic and source loading variability.

Dissolved Aluminum, Total Iron, Total Manganese, and Total Selenium
The TMDL endpoints for dissolved aluminum were selected as 712.5 micrograms per liter (µg/L; based on the 750 µg/L acute criterion for aquatic life minus a 5 percent MOS) and 82.7 µg/L (based on the 87 µg/L chronic criterion for aquatic life minus a 5 percent MOS). The endpoint for total iron in warmwater fisheries was selected as 1.425 mg/L (based on the 1.5 mg/L criterion for aquatic life in warmwater fisheries minus a 5 percent MOS). The endpoint for total iron in troutwaters was selected as 0.425 mg/L (based on the 0.5 mg/L criterion for aquatic life in troutwaters minus a 5 percent MOS). The endpoint for total manganese was selected as 0.95 mg/L (based on the 1.0 mg/L criterion for human health minus a 5 percent MOS). Components of the TMDLs for aluminum, iron, and manganese are presented as average annual loads in pounds of pollutant per year.

In meeting the West Virginia water quality criterion for selenium at the end-of-pipe for the surface mining point sources, there will be no excessive contribution of selenium to the streams in the Coal River watershed at the low flow 7Q10 conditions where the assimilative capacity is lowest. This results in the inclusion of an implicit margin of safety. Determination of an explicit margin of safety is not necessary for these particular TMDLs because in presenting the allocations as a concentration at the water quality criteria for selenium the sources will comply with the water quality standards and there will be no uncertainty involved.

Fecal Coliform Bacteria
The endpoint for fecal coliform bacteria was selected as the instantaneous endpoint of 380 counts/100 mL (based on the 400 counts/100 mL criterion for human health minus a 5 percent MOS) and the geometric mean endpoint of 190 counts/100 mL (based on the 200 counts/100 mL geometric mean criterion minus a 5 percent MOS). The instantaneous criterion is more stringent and more difficult to obtain; however, both criteria are satisfied in this TMDL. Components of

the TMDLs for fecal coliform bacteria are presented as average annual loads in terms of total counts (fecal coliform colonies) pollutant per year.

pH

The water quality criteria for pH allow no values below 6.0 or above 9.0. With respect to acid mine drainage, pH is not a good indicator of the acidity in a waterbody and can be a misleading characteristic. Water with near-neutral pH (~ 7) but containing elevated concentrations of dissolved ferrous (Fe^{2+}) ions can become acidic after oxidation and precipitation of the iron (PADEP 2000). Therefore, a more practical approach to meeting the water quality criteria for pH is to use the concentration of metal ions as a surrogate for pH. It was assumed that reducing in-stream metals (iron and aluminum) concentrations to meet water quality criteria (or TMDL endpoints) would result in meeting the water quality standard for pH. This assumption was verified by applying DESC-R. By executing DESC-R under TMDL conditions (conditions in which TMDL endpoints for metals were met), the equilibrium pH could be predicted. The Technical Report contains a detailed description of the pH modeling approach. The TMDLs for the pH-impaired streams are presented as the median equilibrium pH that is calculated based on the daily equilibrium pH output (6-year simulation period associated with the design precipitation from January 1, 1987 through December 31, 1992) from DESC-R.

Sediment

The endpoints for the sediment TMDLs were based on the simulated reference watershed sediment loading (from the Spicelick Fork of the Left Fork /Joes Creek watershed). A 5 percent MOS was applied to the reference sediment load, and the sediment load reductions necessary to meet those endpoints were then determined. TMDL allocation scenarios were developed based on an analysis of the degree to which contributing sources could be reasonably reduced. Components of the TMDLs for sediment are presented as average annual loads in tonnes of pollutant per year.

Margin of Safety

A 5 percent explicit MOS was used to counter uncertainty in the modeling process. Long-term water quality monitoring data were used for model calibration. Although these data represented actual conditions, they were not of a continuous time series and might not have captured the full range of in-stream conditions that occurred during the simulation period. The explicit 5 percent MOS also accounts for those cases where monitoring might not have captured the full range of in-stream conditions.

An implicit margin of safety was included in selenium TMDLs where wasteload allocations were prescribed for the surface mining point sources at water quality criteria at the end-of-pipe. Under these conditions, there will be no excessive contribution of selenium to the streams in the Coal River watershed at the low flow 7Q10 conditions where the assimilative capacity is lowest. Determination of an explicit margin of safety is not necessary for these particular TMDLs because in presenting the allocations as a concentration at the water quality criteria for selenium the sources will comply with the water quality standards and there will be no uncertainty involved. As discussed previously, an implicit margin of safety is applied in selenium TMDLs.

7.4.2 Baseline Conditions and Source Loading Alternatives

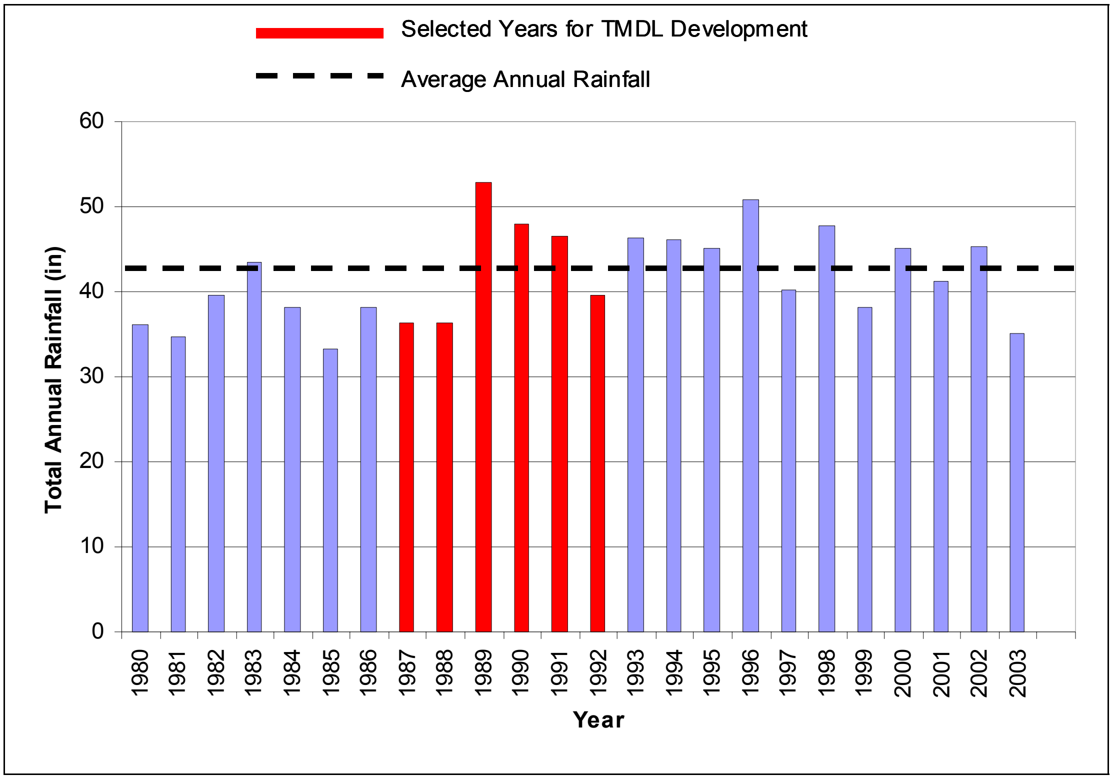
The calibrated model provides the basis for performing the allocation analysis. The first step is to simulate baseline conditions, which represent existing non-point source loadings and point sources loadings at permit limits. Baseline conditions allow for an evaluation of in-stream water quality under the highest expected loading conditions.

Baseline Conditions for MDAS

The MDAS model was run for baseline conditions using hourly precipitation data for a representative 6-year simulation period (January 1, 1987 through December 31, 1992). The precipitation experienced over this period was applied to the landuses and pollutant sources as they existed at the time of TMDL development. Predicted in-stream concentrations were compared directly to the TMDL endpoints. Using the model linkage described in Section 7.1, total aluminum was simulated using MDAS, and DESC-R was used to compare predicted dissolved aluminum concentrations to the TMDL endpoint. This comparison allowed for the evaluation of the magnitude and frequency of exceedances under a range of hydrologic and environmental conditions, including dry periods, wet periods, and average periods.

Permitted conditions for mining facilities were represented during baseline conditions using precipitation-driven flow estimations and the metals concentrations presented in Table 7-1. Permitted conditions for fecal coliform bacteria point sources were represented during baseline conditions using the design flow for each facility and the monthly average effluent limitation of 200 counts/100 mL.

Figure 7-5 presents the annual rainfall totals for the years 1980 through 2003 at the Charleston Yeager Airport weather station in Charleston, West Virginia. The years 1987 to 1992 are highlighted to indicate that a range of precipitation conditions was used for TMDL development in the Coal River watershed.



Note: Rainfall totals for 2003 are from 1/1/2003 through 7/31/2003

Figure 7-5. Annual precipitation totals and percentile ranks for the Charleston Yeager Airport weather station in Charleston, West Virginia.

Table 7-1. Metals concentrations used in representing permitted conditions for mines

Pollutant	Technology-based Permits	Water Quality-based Permits
Aluminum, total	3.95 mg/L (98th percentile DMR values)	3.95 mg/L (98th percentile DMR values)
Iron, total	3.2 mg/L	1.5 mg/L
Manganese, total	2.0 mg/L	1.0 mg/L

Baseline Conditions for GWLF

The calibrated GWLF model provided the basis for performing the allocation analysis. The first step was to simulate baseline conditions, which allowed for an evaluation of in-stream water quality under the highest expected loading conditions. The pollutant loadings from non-point sources were modeled based on precipitation and runoff; non-mining point sources were represented at design flow and the TSS limits of their permits. The GWLF model was run for baseline conditions using daily precipitation data for the representative period discussed earlier. The precipitation data were applied to the landuses and pollutant sources that existed at the time of TMDL development. The resultant predicted watershed loadings were then compared directly

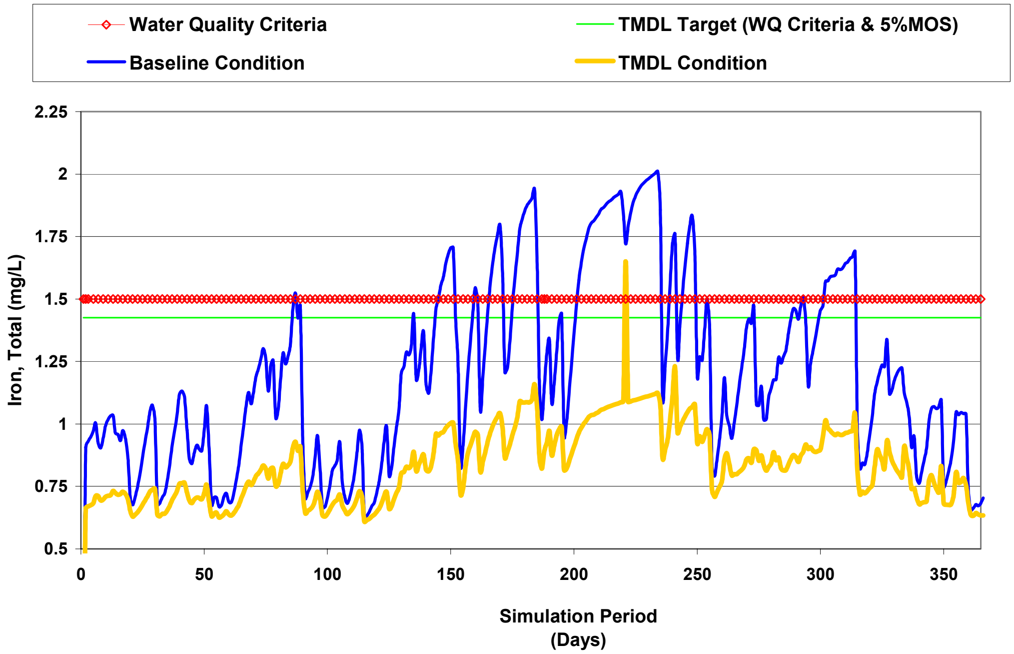


Figure 7-6. Example of baseline and TMDL conditions for total iron.

7.5 TMDLs and Source Allocations

7.5.1 Dissolved Aluminum, Total Iron, Total Manganese, and pH TMDLs

TMDLs and source allocations were developed on a subwatershed basis for each of the six watersheds in the Coal River watershed shown in Figure 3-3. A top-down methodology was followed to develop these TMDLs and allocate loads to sources. Headwaters were analyzed first because their loading affects downstream water quality. Loading contributions were reduced from applicable sources in these waterbodies, and TMDLs were developed. The loading contributions of unimpaired headwaters and the reduced loadings for impaired headwaters were then routed through downstream waterbodies. Using this method, contributions from all sources were weighted equitably. Reductions in sources affecting impaired headwaters ultimately led to improvements downstream and effectively decreased necessary loading reductions from downstream sources. Non-point source reductions did not result in loadings less than natural conditions, and point source allocations were not more stringent than numeric water quality criteria.

The following general methodology was used when allocating to sources for the Coal River watershed TMDLs. In certain subwatershed dominated by permitted discharges, DEP may have altered the general allocation approach to a sensitivity analysis.

to the TMDL endpoint. Similar to MDAS, this comparison allowed evaluation of sediment loadings under a range of hydrologic and environmental conditions, including dry, wet, and average periods.

Source Loading Alternatives

Simulating baseline conditions allowed for the evaluation of each stream's response to variations in source contributions under a variety of hydrologic conditions. This sensitivity analysis gave insight into the dominant sources and the mechanisms by which potential decreases in loads would affect in-stream pollutant concentrations. The loading contributions from abandoned mines and other non-point sources were individually adjusted; the modeled in-stream concentrations were then evaluated.

Multiple allocation scenarios were run for the impaired waterbodies. Successful scenarios were those which achieved the TMDL endpoints under all flow conditions throughout the modeling period. For dissolved aluminum scenario development, the DESC-R output was compared directly to the TMDL endpoint. If the predicted dissolved aluminum concentrations exceeded the TMDL endpoint, the total aluminum sources represented in MDAS were reduced. The averaging period and allowable exceedance frequency associated with West Virginia water quality criteria were considered in these assessments. In general, loads contributed by sources that had the greatest impact on in-stream concentrations were reduced first. If additional load reductions were required to meet the TMDL endpoints, less significant source contributions were subsequently reduced.

Figure 7-6 shows an example of model output for a baseline condition and a successful TMDL scenario.

For watersheds with AMLs but no permitted point sources, AML loads were reduced first, until in-stream water quality criteria were met or until conditions no less than those of undisturbed forest. If further reductions were required, the loads from sediment sources (harvested forest, burned forest, barren land, oil and gas operations, and roads) were reduced until water quality criteria were met.

- For watersheds with AMLs and point sources, point sources were set at the precipitation induced load defined by the permit limits and AML loads were subsequently reduced. Loads from AMLs and revoked-permit mines were reduced (point sources were not reduced) until in-stream water quality criteria were met, if possible. If further reduction was required once loads from AMLs and revoked-permit mines were reduced, sediment sources were reduced. If even further reduction was required, the technology based permitted point source discharge limits were reduced.

- For watersheds where dissolved aluminum TMDLs were developed, source allocations for total iron and manganese were developed first because their total in-stream concentrations (primarily iron) significantly reduce pH and consequently increase dissolved aluminum concentrations. If the dissolved aluminum TMDL endpoint was not attained after source reductions to iron and manganese, the total aluminum source loadings were reduced based on the methodology described above.

Wasteload Allocations

WLAs were calculated for all permitted mining operations. Exceptions to this method were limestone quarries and those with a Completely Released or Phase Two Released SMCRA permit classification. Programmatic reclamation was assumed to have restored those permitted areas. The TMDLs assign WLAs that afford continued operation under those terms and conditions. Loading from revoked-permit facilities was assumed to be a non-point source contribution based on the absence of a permittee.[1]

The WLAs for individual NPDES permits for aluminum, iron, and manganese are shown in the allocation spreadsheets associated with this report. The dissolved aluminum TMDLs were based on a dissolved aluminum TMDL endpoint; however, sources were represented in terms of total aluminum. Wasteload allocations for aluminum are also provided in total metal form. The WLAs are presented as annual loads, in pounds per year and as constant concentrations. The concentration allocations can be converted to monthly averages and daily maximum effluent limitations using USEPA's *Technical Support Document for Water Quality-based Toxics Control* (USEPA 1991). WLA concentration ranges are as follows: aluminum: 0.75–3.72 mg/L, iron: 1.5–3.2 mg/L, manganese: 1.0–2.0 mg/L.

[1] The decision to assign load allocations to abandoned and reclaimed mine lands does not reflect any determination by WVDEP as to whether there are unpermitted point source discharges within these landuses. In addition, in establishing these TMDLs with mine drainage discharges treated as load allocations, WVDEP is not determining that these discharges are exempt from NPDES permitting requirements.

In certain instances, prescribed wasteload allocations may be less stringent than existing effluent limitations. However, the TMDLs are not intended to relax effluent limitations that were developed under alternative bases.

WVDEP's implementation of the antidegradation provisions of the Water Quality Standards may result in more stringent allocations than those resulting from the TMDL process. Whereas TMDLs prescribe allocations that minimally achieve water quality criteria (100 percent use of a stream's assimilative capacity). The antidegradation provisions of the standards are designed to maintain the existing quality of high-quality waters and may result in more stringent allocations that limit the use of remaining assimilative capacity.

TMDL allocations reflect pollutant loadings that are necessary to achieve water quality criteria at distinct locations (i.e., the pour points of delineated subwatersheds). In the permitting process, effluent limitation development is based on the achievement/maintenance of water quality criteria at the point of discharge. Water quality-based effluent limitation development in the permitting process may dictate more stringent effluent limitations for upstream discharge locations.

Load Allocations (LAs)
Load Allocations (LAs) were made for the dominant source categories as follows,

- AMLs, including abandoned mines (surface and deep) and highwalls
- Revoked permits: loading from revoked-permit facilities/bond forfeiture sites
- Sediment sources: metals loading associated with sediment contributions from barren land, harvested forest, burned forest, oil and gas well operations, and roads
- Other non-point sources: urban/residential, agricultural, and forested land contributions (loadings from other non-point sources were not reduced)

The LAs for aluminum, iron, and manganese are presented in the allocation spreadsheets associated with this report. The dissolved aluminum TMDLs are based on a dissolved aluminum TMDL endpoint; however, sources are represented in terms of total aluminum. The LAs for aluminum are also provided in the form of total metal. The LAs are presented as annual loads (pounds per year) because they were developed to meet TMDL endpoints under a range of flow conditions.

The iron, manganese, and aluminum TMDLs are presented in Appendix A for the impaired streams within each of the Coal River watersheds.

As stated in Section 7.4.1, a surrogate approach was used for the pH TMDLs where it was assumed that reducing in-stream metals (iron and aluminum) concentrations to meet water quality criteria (or TMDL endpoints) would result in attainment of the water quality criterion. This assumption was verified by running DESC-R for an extended period (6 years) under conditions where TMDL endpoints for metals were met. A long-term daily average equilibrium pH was calculated based on the daily equilibrium pH output from DESC-R. These results are shown in Appendix A for the pH-impaired streams within each of the selected Coal River watersheds. Refer to the Technical Report for a detailed description of the pH modeling approach.

Selenium TMDLs

The following general methodology was used in allocating to sources for the selenium TMDLs in the Coal River Watershed:

- Non-point sources in the watershed did not appear to be contributing excessive loads of selenium to the watershed and, therefore, are not required to reduce loadings.

- The WLAs were determined by assigning water quality criteria at the end-of-pipe (5.0 ug/L) to all surface mining operations discharging in the selenium impaired watersheds.

The selenium TMDLs are presented in Appendix A for the impaired streams within Coal River, Pond Fork, and Spruce Fork watersheds. The WLAs for selenium are presented in the allocation spreadsheets associated with this report.

7.5.2 Fecal Coliform Bacteria TMDLs

TMDLs and source allocations were developed for impaired segments of selected steams and their tributaries on a subwatershed basis for each of the six watersheds in the Coal River watershed shown in Figure 3-2. As described in Section 7.5.1, a top-down methodology was followed to develop these TMDLs and allocate loads to sources.

The following general methodology was used when allocating loads to sources for the fecal coliform bacteria TMDLs. All point sources in the watershed were set at the permit limit (200 counts/100 mL monthly average). Because West Virginia Bureau for Public Health regulations prohibit discharge of raw sewage into surface waters, all illicit, non-disinfected discharges of human waste (from failing septic systems and straight pipes) were eliminated.

Sanitary sewer overflows (SSOs) are illegal under NPDES regulations; all such discharges were also eliminated. If further reduction was necessary, combined sewer overflows (CSOs) and non-point source loadings from agricultural lands and residential areas were subsequently reduced until in-stream water quality criteria were met.

Wasteload Allocations (WLAs)

WLAs were developed for all facilities permitted to discharge fecal coliform bacteria, including MS4s, as described below. Applicable fecal coliform effluent limitations are more stringent than water quality criteria; therefore, all permitted fecal coliform sources were represented by the monthly average fecal coliform limit of 200 counts/100 mL and no reductions were applied. The WLAs for individual NPDES permits for fecal coliform bacteria are shown in the Fecal Allocation spreadsheets associated with this report. The fecal coliform bacteria WLAs are presented as annual loads, in counts per year. They are presented on an annual basis (as an average annual load) because they were developed to meet TMDL endpoints under a range of conditions observed throughout the year.

Municipal Separate Storm Sewer System (MS4)
USEPA's stormwater permitting regulations require municipalities to obtain permit coverage for all stormwater discharges from municipal separate storm sewer systems (MS4s). There is one designated MS4 municipality in the six TMDL watersheds within the Coal River watershed: the City of Saint Albans. This municipality has filed a Notice of Intent for MS4 permit issuance; the area within the corporate limits is therefore assumed to be subject to MS4 stormwater permitting. The City of Saint Albans MS4 system was provided a fecal coliform wasteload allocation that is presented in Table 7-2. Stormwater permits and their relationship to TMDLs are discussed further in the appendices of the Technical Report.

Table 7-2. Individual fecal coliform MS4 WLAs for the City of Saint Albans

Town	Parameter	Baseline WLA (counts/yr)	WLA (counts/yr)	% Reduction
City of Saint Albans	Fecal Coliform	1.49E+13	1.46E+13	1.9

Load Allocations (LAs)
LAs were assigned as required to the following the source categories:

- Pasture/Grassland — including pasture, successional grasslands, and croplands
- Onsite Sewage Systems — loading from all illicit, non-disinfected discharges of human waste (including failing septic systems and straight pipes)
- Residential — loading associated with urban/residential runoff
- Background and Other Non-point Sources — loading associated with wildlife sources from forested land (contributions/loadings from wildlife sources were not reduced)

The fecal coliform bacteria LAs are presented as annual loads, in counts per year, in the spreadsheets associated with this report. The fecal coliform bacteria TMDLs are presented in the subwatershed appendices for the impaired streams within each of the Coal subwatersheds.

7.5.3 Sediment TMDLs

When allocating to landuse-based sediment sources, a unit area loading approach was used to establish equitable source allocations. This approach was based on the assumptions that point sources subject to water pollution control permits provide the highest degree of sediment control. Activities that are subject to programmatic BMPs contribute less sediment than do uncontrolled sources. Therefore, sediment sources were reduced systematically in a stepwise fashion until the TMDL endpoint was achieved, as follows:

Step 1: Loads from uncontrolled sediment sources (barren areas, burned forest, and unpaved roads) were reduced to the unit area loading of programmatic BMP sources (harvested forest and oil and gas operations).

Step 2: If further reductions were required, loads from uncontrolled sediment sources and programmatic BMP sources were together reduced to the unit area loading of point sources.

Step 3: If even further reductions were required to meet the TMDL endpoint, loads from all sediment sources were reduced to the extent necessary to achieve the reference watershed loading. These sediment source reductions were based on their relative contribution to the overall sediment load.

After the land-use-based sources were reduced, sediment produced from in-stream processes (bank erosion/deposition) were evaluated for each sediment-impaired stream. The Stream Module predicted bank erosion based upon the soil characteristics and slope of the subwatershed and the rating of bank erosion severity by WVDEP. The Stream Module output displayed the sediment load exiting each subwatershed after accounting for both bank erosion and deposition. This allowed interpretation of the significance of bank erosion at the subwatershed level. If, after reduction of land-use-based sediment loadings to those of the reference watershed, the Stream Module predicted an excess sediment load exiting the modeled subwatershed, then sediment load allocations were prescribed for bank erosion.

Load allocations were not prescribed in other subwatersheds with lesser predicted severity of bank erosion. The lack of load allocations for bank erosion should not be construed to prohibit stream restoration projects that are designed to improve instream or riparian zone habitat, or to mitigate existing sediment bed loads.

Wasteload Allocations (WLAs)
WLAs were made for all permitted mining operations except limestone quarries and those with a Completely Released or Phase Two Released SMCRA permit classification. Programmatic reclamation was assumed to have restored those permitted areas.

Sediment modeling of active mining operations represented the contemporaneous reclamation practices employed by the industry and the removal efficiency associated with treatment structures. WLAs are presented as average annual loads and concentrations in the allocation spreadsheets associated with this report.

Within the sediment-impaired watersheds, there are sources that have sewage permits. Wasteload allocations for sewage treatment facilities recognize the 30 mg/L monthly average TSS effluent limitations contained in permits. Under this TMDL, the wasteload allocations for these sources do not require pollutant reductions and are authorized to continue operation under existing permit conditions. The WLAs are presented as average annual loads, in tonnes per year and are shown in the allocation spreadsheets associated with this report.

At the time of TMDL development, there were three construction stormwater permits in the sediment-impaired watersheds. A provision for future growth related to construction activity is provided and explained in Section 8.

Load Allocations
LAs were assigned as required to the following non-point source categories:

- Pasture/Grassland — including pasture, succession grasslands, and croplands
- Barren land areas — including barren and burned forest areas
- Harvested forest — including skid roads and landing areas
- Residential — sediment loading associated with urban/residential runoff
- Roads — including paved and unpaved roads
- In-stream processes — bank erosion and deposition
- Other non-point sources — forested land (loadings from other non-point sources were not reduced)

The sediment LAs are presented as average annual loads, in tonnes per year, and are shown in the allocation spreadsheets associated with this report.

7.5.4 Seasonal Variation

The TMDL must consider seasonal variation. For the Coal River watershed metals and fecal coliform TMDLs, seasonal variation was considered in the formulation of the modeling analysis. Continuous simulation (modeling over a period of several years that captured precipitation extremes) inherently considers seasonal hydrologic and source loading variability**.** The metals and fecal coliform concentrations simulated on a daily time step by the model were compared to TMDL endpoints. Allocations that met these endpoints throughout the modeling period were developed.

7.5.5 Critical Conditions

TMDL developers must select the environmental conditions that will be used for defining allowable loads. Many TMDLs are designed around the concept of a “critical condition.” The critical condition is the set of environmental conditions, which, if met, will ensure the attainment of objectives for all other conditions. Non-point source loading is typically precipitation-driven. In-stream impacts tend to occur during wet weather and storm events that cause surface runoff to carry pollutants to waterbodies. During dry periods little or no land-based runoff occurs, and elevated in-stream pollutant levels may be due to point sources (Novotny and Olem 1994). Analysis of water quality data for the Coal River watershed shows high pollutant concentrations during both high and low flow, indicating that there are both point and non-point source impacts. Both high-flow and low-flow periods were taken into account during TMDL development by using a long period of weather data that represented wet, dry, and average flow periods.

8. FUTURE GROWTH AND WATER QUALITY TRADING

8.1 Metals and pH

This TMDL does not include specific future growth allocations to each subwatershed. However, the absence of specific future growth allocations does not prohibit new mining in the subwatersheds for which iron, aluminum, manganese, and selenium TMDLs have been developed. Pursuant to 40 CFR 122.44(d)(1)(vii)(B), effluent limits must be "consistent with the assumptions and requirements of any available wasteload allocation for the discharge...." In addition, the federal regulations generally prohibit issuance of a permit to a new discharger "if the discharge from its construction or operation will cause or contribute to the violation of water quality standards." A discharge permit for a new discharger could be issued under the following scenarios:

1. A new facility could be permitted anywhere in the watershed, provided that effluent limitations are based on the achievement of water quality standards at end-of-pipe for the pollutants of concern in the TMDL.

   NPDES permitting rules mandate effluent limitations for metals to be prescribed in the total recoverable form. For iron, manganese, and selenium, the West Virginia water quality criteria are in total recoverable form and may be directly implemented. Because aluminum water quality criteria are in dissolved form, a dissolved/total pollutant translator is needed to determine effluent limitations. A new facility could be permitted in the watershed of a dissolved aluminum-impaired stream if total aluminum effluent limitations are based on the dissolved aluminum, chronic, aquatic life protection criterion and a dissolved/total aluminum translator equal to 1.0.

2. Remining (under an NPDES permit) could occur without a specific allocation to the new permittee, provided that the requirements of existing State remining regulations are met. Remining activities will not worsen water quality and in some instances may result in improved water quality in abandoned mining areas.

3. Reclamation and release of existing permits could provide an opportunity for future growth provided that permit release is conditioned on achieving discharge quality better than the WLA prescribed by the TMDL.

8.2 Fecal Coliform Bacteria

This TMDL does not include specific future growth allocations to each subwatershed. However, the absence of specific future growth allocations does not prohibit new development in the subwatersheds for which fecal coliform TMDLs have been developed or preclude permitting of new sewage treatment facilities.

In many cases, the implementation of the TMDLs will consist of providing public sewer service to unsewered areas. The NPDES permitting procedures for sewage treatment facilities include technology-based fecal coliform effluent limitations that are more stringent than applicable water quality criteria. Therefore, a new sewage treatment facility may be permitted anywhere in the watershed, provided that the permit includes monthly average and maximum daily fecal coliform limitations of 200 counts/100 mL and 400 counts/100 mL, respectively. Furthermore, WVDEP will not authorize construction of combined collection systems or permit overflows from newly constructed collection systems.

8.3 Sediment

New mining point sources may be permitted anywhere in the sediment-impaired watersheds provided that the permit contains an annual average TSS effluent limitation of 120 mg/L. This value represents the most stringent WLA assigned to existing mining sources and is comparable to the background sediment loading associated with undisturbed forest. Consequently, WVDEP has concluded that discharges in compliance with this limitation will not cause or contribute to a violation of water quality standards.

Non-mining point source discharges are assigned technology-based TSS effluent limitations that would not cause biological impairment. For example, NPDES permits for sewage treatment and industrial manufacturing facilities contain monthly average TSS effluent limitations between 30 and 60 mg/L. New non-mining point sources may also be permitted in the sediment-impaired watersheds with the implementation of applicable technology-based TSS requirements.

In addition to the three construction stormwater permits in the sediment-impaired watersheds, specific future growth allowances are provided. In general, the successful TMDL allocation scenarios allow for 0.5 percent of the area of sediment-impaired watersheds to be disturbed subject to the terms and conditions of the Construction Stormwater General Permit. At least 10 acres are provided in smaller watersheds. The reserved acreage is expected to accommodate future development in the subject watersheds. If development projects are proposed in excess of the acreage provided, they may be permitted by implementing controls beyond those afforded by the general permit. Larger areas may be permitted if it can be demonstrated that tighter controls will result in a loading condition commensurate with the general permit area allocations provided in Table 8-1.

Table 8-1. Future growth for construction stormwater permits

Subwatershed	Sediment-impaired Stream	Total Watershed Area (acres)	Future Growth Area – 0.5% Total Watershed Area (Acres)
Clear Fork	Lick Run	1,145	10.0
Clear Fork	Stonecoal Branch	356	10.0
Coal River	Browns Creek	7,060	35.3
Coal River	Brush Creek	5,882	29.4
Coal River	Ridgeview Hollow	357	10.0
Coal River	Sandlick Creek (WVKC-31-A)	3,983	19.9
Coal River	Smith Creek	4,465	23.3

Subwatershed	Sediment-impaired Stream	Total Watershed Area (acres)	Future Growth Area – 0.5% Total Watershed Area (Acres)
Little Coal River	Big Horse Creek	18,964	94.8
Little Coal River	Dodson Creek	4,215	21.1
Little Coal River	Little Horse Creek	2,293	11.5
Marsh Fork	Millercamp Branch	11,401	57.0
Marsh Fork	Sandlick Creek (WVKC-46-J)	12,930	64.7
Marsh Fork	Right Fork/Sandlick Creek	2,848	14.2
Marsh Fork	Surveyor Creek	4,223	21.1
Pond Fork	Pond Fork	88,000	440.0
Pond Fork	Casey Creek	3,089	15.4
Pond Fork	West Fork	27,067	139.3
Spruce Fork	Baldwin Fork	1,846	10.0
Spruce Fork	Spruce Laurel Fork	20,442	102.2

8.4 Water Quality Trading

This TMDL neither prohibits nor authorizes trading in the watersheds addressed in the document. WVDEP generally endorses the concept of trading and recognizes that it might become an effective tool for TMDL implementation. However, significant regulatory framework development is necessary before large-scale trading in West Virginia can be realized. Furthermore, WVDEP supports program development assisted by a consensus-based stakeholder process. Before the development of a formal trading program, it is conceivable that the regulation of specific point source-to-point source trading might be feasible under the framework.

9. PUBLIC PARTICIPATION

9.1 Public Meetings

Informational public meetings were held on September 28, 2004 at Sherman High School, Boone County, WV, and on September 30, 2004 at Saint Albans High School, Kanawha County, WV. Detailed information was presented relative to WVDEP's proposed allocation strategies. Three public meetings will be held to present the draft TMDLs: September 27, 2005, at Sherman High School in Seth; September 28, 2005 at Saint Albans High School; and the final public meeting at Scott High School in Madison. All meetings start at 7:00 PM.

9.2 Public Notice and Public Comment Period

The availability of draft TMDLs was advertised in local newspapers on various dates between September 12, 2005 and September 15, 2005. Interested parties may submit comments during the public comment period, which begins on September 16, 2005 and ends October 17, 2005. The electronic documents are available on the WVDEP's internet site at http://www.dep.state.wv.us/

9.3 Response Summary

Special Note: This Section discusses DEP response to comments received after the public notice of the original Draft Coal River Watershed TMDLs in September 2005. In July 2006, DEP provided public notice of revised, draft dissolved aluminum TMDLs (Coal River Watershed Dissolved Aluminum TMDL Addendum) and an additional public comment period. DEP responses to comments received pursuant to the dissolved aluminum addendum are contained within that document.

The West Virginia Department of Environmental Protection (WVDEP) is pleased to provide this response to comments on the draft TMDLs. The WVDEP appreciates the efforts commenters have put forth to improve the West Virginia TMDL development process. The following entities provided written comments on the draft TMDLs:

- West Virginia Coal Association
- Massey Coal Services, Inc.
- Vernon Haltom
- United States Environmental Protection Agency Region 3

Comments have been compiled and responded to in this response summary. Comments and comment summaries are in boldface and italic. Agency responses appear in plain text.

Comments received from the United States Environmental Protection Agency Region 3 included various suggested typographical /editorial revisions. Although not individually detailed in this summary, WVDEP considered all such comments and revised both the main report and subwatershed appendices, as appropriate.

1) Two commenters expressed concern relative to the presentation of TMDLs for streams/impairments not included on the West Virginia 2004 Section 303(d) list. One contended that the practice constitutes an illegal extension of the 303(d) list and that streams must be "listed" prior to TMDL development. One questioned if DEP has amended or plans to amend the 2004 Section 303(d) list to include the subject waters. Both commenters requested identification of streams not included on the 303(d) list for which TMDLs are presented.

Given the large number of impaired West Virginia waters and the limited resources for TMDL development, DEP's program must focus on efficiency. When working in a specific geographical area, all impaired waters and all impairments of those waters are attempted to be addressed. Although DEP's pre-TMDL monitoring activities are among the most robust efforts implemented nationally, monitoring frequency, duration and sample location resolution are insufficient to comprehensively assess water quality consistent with the exposure duration and exceedence frequency components of applicable water quality criteria. Water quality modeling is therefore necessary.

DEP has decided to present TMDLs for all named and coded waters where predictive modeling indicates that existing pollutant reductions are needed to ensure compliance with water quality criteria. The majority of the predicted impairments are consistent with impairment decisions based upon the review of monitoring data. In certain instances, the subject waters were not monitored for the pollutants of concern during the pre-TMDL monitoring effort, but receive source loadings (point and/or nonpoint) predicted to cause impairment. In others waters, the modeling predicts impairment at the baseline condition where permitted discharges are represented to contribute loadings authorized by existing permit limits.

The 303(d) list identifies impaired waters for which TMDLs must be developed. There is no prohibition against TMDL development for waters that are not listed. Evaluation of the results of predictive modeling is mandated by 40 CFR 130.7(b)(5)(ii) and the prediction of impairment through modeling is validated by applicable federal guidance for 303(d) listing. Where predictive modeling indicates that discharge in accordance with existing permit limits would cause violation of water quality criteria, water quality is threatened and the water is subject to 303(d) listing and TMDL development pursuant to 40 CFR 130.7(b)(5).

The watershed modeling associated with the Coal River TMDLs incorporates a "top down" approach where headwaters are analyzed first and pollutant loadings are transferred to downstream subwatersheds. The predicted pollutant loads in unimpaired headwater segments are directly transferred downstream. Where the model predicts criterion violations in the headwater segment, problematic pollutant sources are appropriately reduced within that subwatershed and the reduced load is transferred downstream. In this way, DEP can demonstrate criterion compliance in tributary segments and equitably prescribe pollutant reductions throughout the watershed. Under a protocol that prohibits TMDLs and allocations representing pollutant reductions in "unlisted" tributaries, unreduced problematic loadings would have to be transferred downstream. At a minimum, this will place increased burden on existing downstream sources. In some instances, it would preclude criterion compliance in the downstream segment.

Even if the aforementioned allocation obstacles could be rectified, DEP believes it is prudent to recognize the results of the modeling and present the TMDLs now, rather than delay development. Application of our allocation philosophy results in the targeting of the most problematic sources. In the alternative, DEP/EPA permitting protocol (new or reissuance) for discharges into impaired waters where TMDLs are not yet developed requires the imposition of effluent limitations based upon achieving water quality criteria "end-of-pipe". In streams and subwatersheds where both point and nonpoint sources exist, the permitting process would maximize pollutant reduction from point sources, even if abandoned mine lands and other nonpoint sources of metals are the most prevalent problematic pollutant sources.

When the Draft Coal River Watershed TMDLs were initially presented to the public, the West Virginia 2006 Section 303(d) List had not yet been drafted. EPA's approval of the dissolved aluminum criterion revision caused delayed finalization of the TMDLs. The 2006 Section 303(d) List has since been drafted and advertised for public comment. The waters and impairments that are the subject of this comment have been identified on the Draft 2006 Section 303(d) List.

The 303(d) list identifies waters for which TMDLs must be developed. As a general practice, impaired waters are removed from the list upon TMDL development and categorized in the Integrated Report as Category 4A waters. Category 4A waters are those that are impaired or threatened for which TMDLs have been developed. All impaired waters in the Coal River Watershed with approved TMDLs will ultimately be classified in Category 4A of the Integrated Report.

2) Specific objections to the presentation of manganese TMDLs for Little Marsh Fork (WVKC-46-A) and Brushy Fork (WVKC-46-A-4) were received. Commenters stated the streams were not included on the 2004 Section 303(d) list and that water quality monitoring results do not demonstrate violations of the manganese criterion.

After EPA approval of the manganese criterion revision on June 29, 2005, DEP expended considerable effort to identify the locations of water supply intakes and zones of applicability of the criterion, and to review the water quality status relative to manganese within those zones. That review eliminated the need for TMDL development for the vast majority of previously identified manganese-impaired waters within the Coal River watershed.

A zone of manganese criterion applicability extends to Little Marsh Fork and Brushy Fork. Contrary to the comment, Brushy Fork was included on the 2004 Section 303(d) list as manganese-impaired. Little Marsh Fork was not listed in 2004 based upon water quality monitoring results but a manganese TMDL is presented based upon the results of predictive modeling. Predictive modeling results were also used to demonstrate the unimpaired conditions of Big Coal River, Marsh Fork, Clear Fork and Sycamore Creek relative to manganese in this zone of applicability of the criterion.

The water quality standards do not prescribe an averaging period for Category A or C water quality criteria nor an allowable exceedence frequency. This creates a very stringent TMDL condition for manganese in waters where the criterion is applicable. In the Little Marsh watershed, landuse under active mining represents over 73% of the drainage area. Of the active mining area, 82% is subject to technology-based limitations for manganese (2.0 mg/L monthly average, 4.0 mg/L daily maximum). The baseline condition predictions relative to point source impacts in the watershed are reasonable given the high percentage of landuse in active mining and the prevalence of technology-based manganese effluent limitations applicable to existing outlets.

The Draft manganese TMDLs accurately reflect the five-mile zone of criterion applicability above the Boone Raleigh PSD water supply intake. The TMDLs are necessary because manganese reductions from existing sources are needed to ensure attainment of the criterion.

3) The classification and model representation of NPDES permitted discharges as point sources and all others as nonpoint sources were questioned.

The commenters have confused model representation of sources with the prescription of load and wasteload allocations, and incorrectly perceived that all NPDES permitted discharges were represented as continuous flow point sources and all others were represented as precipitation-driven nonpoint sources. In the TMDL process, nonpoint sources are given load allocations and point sources are given wasteload allocations. Functionally, certain point sources are precipitation-induced while others are continuous discharges. Similarly, AML seeps are continuous discharges while runoff from disturbed land is precipitation-induced.

Using "effluent type" information contained in WVDEP's Environmental Resources Information System (ERIS) database, the various NPDES permitted outlets were characterized as precipitation-induced or continuous flow and represented accordingly. For precipitation-induced discharges, the baseline condition incorporated existing effluent limitations, design precipitation, total and disturbed drainage area, treatment pond design, efficiency and clean-out requirements, and the contemporaneous reclamation requirements implemented by the industry. For NPDES outlets categorized as continuous discharges, the baseline condition incorporated effluent limitations and available flow or pump capacity information. Whether represented as precipitation-induced or continuous discharges, all outlets were granted wasteload allocations because they are point source discharges subject to NPDES permitting requirements.

The report portrayal of nonpoint sources is true – most are precipitation-driven, but some are not. Many nonpoint sources were represented based upon surface area and design precipitation. Seeps from abandoned mine lands were represented as continuous sources with flow and pollutant characteristics as determined by DEP source tracking activities.

Discharges from inadequate onsite residential sewage treatment systems were also represented as continuous discharges. Both categories are treated as nonpoint sources and granted load allocations, but are represented as continuous discharges, not directly influenced by precipitation.

4) It was contended that DEP's determination of biological impairment is improper because the West Virginia Stream Condition Index (WVSCI) has not been the subject of formal rulemaking.

DEP's position has not changed relative to its responsibility to identify waters where available data indicates a significant adverse impact to the biological component of an aquatic ecosystem (47CSR2 § 3.2.i). The WVSCI uses metrics that are both validated and widely used nationally when assessing the biologic health of aquatic systems. The rating of observed benthic macroinvertebrate communities using the WVSCI is an appropriate methodology for assessing the narrative criterion and EPA expects its application in West Virginia 303(d) listing and TMDL development processes.

5) Two commenters requested additional insight to the stressor identification process for biological impairment and stated that all relevant data used in the determinations should be made available for review.

A discussion of the stressor identification process is provided in Section 6 of the Main Report. Additional information is presented in Chapter 7 and Appendix J of the Technical Report. The process is based largely upon the application of a strength of evidence approach that considers water quality monitoring data, habitat evaluations, field notes from monitoring and source tracking personnel, and the tolerances and morphology of the benthic organisms collected. In response to the comment, DEP reorganized, and clarified the habitat and biological data presented in Appendix H of the Technical Report. Appendix H, Invertebrate Data tab includes the macroinvertebrate assemblage data for all biological samples collected in the Coal River watershed.

6) Biological impairment stressor identification was questioned in five specific waters. A review of the stressor identification results for all biologically impaired waters was also requested to ensure that identified stressors are reasonable.

The requested comprehensive and stream specific reviews were conducted, and certain revisions were made. DEP reactions to stressor identification comments for specific waters are provided below. Additionally, the stressor identification results for Pond Fork (WVKC-10-U) and Clear Fork (WVKC-47) were also revised, consistent with the rationale described in the response to Comment No. 8. The reevaluation did not result in stressor identification revision to the remaining biologically-impaired waters.

7) The stressor identification results for Rockhouse Creek (WVKC-10-T-13) and Spruce Laurel Fork (WVKC-10-T-11) were questioned. Instream TSS water quality monitoring results at various locations were provided to support a contention that sedimentation is not a significant biological stressor of those waters. Another commenter cautioned that a relationship between water column TSS concentration and excessive sediment accumulation does not always exist.

DEP re-reviewed the physical, chemical, and biological data related to these streams. Following this examination, the DEP agrees that sedimentation is not the primary stressor associated with the biological impairment of Rockhouse Creek. Although increased sedimentation may have secondary impacts on the benthic biota, assemblage composition and field observation do not indicate a macroinvertebrate community that is depressed primarily due to excessive fine sediments. Secondary impacts are also attributed to organic enrichment. However, the available chemical data from Rockhouse Creek exhibits concentrations of ions, known to be detrimental to biological components and indicates that the most likely primary cause of biological impairment is ionic stress. The attributes of the benthic assemblage are also supportive of this conclusion, as the communities representing the two sample locations are composed largely of organisms with known tolerances to increased ions. Therefore, in similarity to other streams where ionic toxicity was identified as the primary stressor to the biological community, the WVDEP will defer TMDL development for biological impairment and retain this stream on the 303(d) list. This is due to insufficient information regarding the causative pollutants of ionic toxicity and their associated impairment.

In regard to the sediment-based biological impairment of Spruce Laurel Fork, it was concluded that elevated sediments are a significant stressor to the benthic community. In particular, three biological (macroinvertebrate) collections, each having WVSCI scores designating impairment, were indicative of stress due to sedimentation. The samples demonstrated increased numbers of hard-bodied organisms, like Elmid beetles, which have morphologies conducive to excess sediment. In addition, certain ubiquitous organisms, such as Hydropsychid caddisfiles, are conspicuous by their absence at one location, which often indicates a niche vacancy produced by sedimentation. In support of the decision to pursue development of a sediment-related biological TMDL, quantifiable field observations of substrate embeddedness and sediment deposition (via EPA-based RBP protocol) confirm a condition problematic to macroinvertebrate colonization. As such, the WVDEP will retain the sediment TMDL for the purposes of addressing the biological impairment in Spruce Laurel Fork.

Additionally, the commenter argued that in-stream TSS values are consistent with and indicators of sedimentation stress to biological communities, and provided TSS monitoring results as evidence that sedimentation stress is not occurring in the subject waters. WVDEP urges caution with such correlations. Although TSS values are excellent indicators of short-term or acute conditions that may impact resident biota, they are not always consistent with sediment deposition and accumulation, which causes chronic disruption or displacement of sensitive organisms. Benthic macroinvertebrates, as a whole, are well adapted to precipitation-driven pulse perturbations—this is realized through their persistence in harsh or dynamic environments. However, the processes surrounding long-term sedimentation create habitat conditions to which certain species are not able to tolerate. In this scenario, actual measurements of substrate quality, like RBP embeddedness and sediment deposition, are much more reliable in depicting sediment-related stress to the benthic community.

8) The stressor identification conclusions targeting dissolved aluminum as a stressor for the biological impairments of Millers Camp Branch (WVKC-46-Q), West Fork (WVKC-U-7) and Spruce Laurel Fork (WVKC-10-T-11) were questioned. The commenter expressed an opinion that exceedence of the previously applicable 0.087 mg/L dissolved aluminum chronic aquatic life protection criterion is not sufficient evidence of adverse impact to benthic macroinvertebrate communities.

DEP re-reviewed the physical, chemical, and biological data related to these streams, and agrees with the commenter that dissolved aluminum is not the primary cause of biological impairment of the subject waters. In Millers Camp Branch, sedimentation and organic enrichment are considered to be the most significant stressors that must be addressed to facilitate recovery of the benthic macroinvertebrate community. In West Fork/Pond Fork and Spruce Laurel Fork, the communities are most significantly stressed by excess sediment.

Although elevated levels of dissolved aluminum cannot be completely eliminated as a potential stressor, DEP also cannot definitively conclude that instream concentrations greater than 87 μg/L are causing impairment of benthic macroinvertebrate communities. Significant stressor identification is complicated in waters where multiple perturbations are present and where exceedences of numeric water quality criteria for aquatic life protection are co-occurring. In some scenarios, the exceedence of numeric aquatic life protection criteria is completely consistent with adverse impact to benthic organisms, and there is a natural tendency to identify a pollutant as a significant stressor when the numeric aquatic life protection criterion for that pollutant is exceeded. However, there are circumstances where low-level exceedences of numeric criterion are not necessarily indicative of most significant biological stressor. The draft document identification of dissolved aluminum as a biological stressor erroneously resulted from the need to develop aluminum-specific TMDLs in these waters, pursuant to the 87 µg/L chronic criterion that was effective when the draft TMDLs were developed. After reconsideration, DEP agrees that the magnitudes of dissolved aluminum concentrations in these waters are not severe enough to cause the realized biological impairment. As such, aluminum has been removed from the stressor identification results for Millers Camp Branch, West Fork and Spruce Laurel Fork. Similar scenarios were also identified and rectified in two other waters Pond Fork (WVKC-10-U) and Clear Fork (WVKC-47).

9) The stressor identification conclusion that dissolved aluminum and iron are stressors for the biological impairment of Clear Fork (WVKC-47) was questioned. The commenter contends that sediment is the most likely stressor of Clear Fork.

The biological condition of Clear Fork typifies a multiple stressor scenario. Initially, the stressor identification process assigned the most significant stressors to the benthic fauna of Clear Fork as metals toxicity and organic enrichment. After additional review, it was determined that organic enrichment, acting collectively with other low-level stressors, is the most significant stressor to the stream's benthic macroinvertebrate community.

Organic enrichment, resulting from inadequate or absent sewage treatment in the watershed, affects nearly the entire stream, particularly at downstream monitoring locations; however, of the eight benthic samples collected from Clear Fork during pre-TMDL monitoring, only two exhibited WVSCI scores that indicate biological impairment. These stations are located downstream of problematic tributaries contributing excess dissolved aluminum, iron, and/or low pH to the watershed, and having TMDL-prescribed reductions to those pollutants necessary to achieve both numeric and narrative water quality criteria. In combination with such stressors, organic enrichment can produce a number of biological community attributes, which adds complexity to the stressor identification process. For example, certain Dipterans proliferate in areas of nutrient addition, while other taxa may be entirely displaced by the same degree of perturbation. In this instance, the inclusion of other stressors, like toxic metals, may further suppress the community and result in an assemblage dominated by a few taxa, but having several other organisms in low abundance. Assemblages with attributes typical of this multiple stressor scenario colonize monitoring stations in Clear Fork, downstream of the problematic tributaries. Furthermore, recovery of the benthic community was realized, albeit gradually, with increasing distance from these problematic tributaries; a biological response that typically indicates a dilution of harmful pollutants.
Although levels of dissolved aluminum were elevated, which caused several violations of the 87 µg/L chronic aquatic life protection criterion, it is unlikely that the exceedances, which were of relatively low magnitude, were significantly causative of the biological impairment.

Violations of the State's total iron chronic aquatic life protection criterion were significant and potentially problematic to the benthic community. However, the total iron values were correlated to elevated total suspended solids (TSS), a documentation of the sediment-bound metals relationship, but not necessarily indicative of deposited sediments that are more harmful to macroinvertebrate assemblages. In high gradient streams like Clear Fork, it is not uncommon for elevated levels of suspended solids to pass though the waterbody with minimal accumulation/deposition. In Clear Fork, this is evidenced by the optimal RBP sediment deposition and embeddedness measurements observed at the impaired stations. Furthermore, the relative low abundance of fines-tolerant organisms (e.g. Elmid 'riffle' beetles) at those stations indicates communities not significantly limited by excessive sediment.

Therefore, the identified stressors relating to Clear Fork's biological impairment have been revised and are now limited to the most significant stressor - organic enrichment. To address this stressor, WVDEP determined that implementation of the Clear Fork fecal coliform TMDL would remove untreated sewage and thereby reduce the organic and nutrient loading causing the biological impairment.

Although not specifically identified as significant stressors of biological impairment, it is important to note that the TMDL process is not forsaking reduction of pollutants that may contribute synergistic biological impacts. It is expected that the prescribed pollutant reductions associated with the independently necessary TMDLs in Stonecoal Branch and Dow Fork will not only ameliorate stress to the benthic communities within the streams themselves, but also facilitate recovery of the macroinvertebrate communities in Clear Fork downstream of the tributaries' influence. Furthermore, implementation of the Clear Fork iron TMDL (again, independently-necessary pursuant to the troutwater numeric iron criterion) would be expected to positively impact the macroinvertebrate community.

10) The implication of point source discharges associated with mining activity as the primary sources of identified selenium impairments was questioned. Clarification was requested regarding the portrayal of selenium impairments as low-flow critical. One commenter stated that six of the nine impaired streams have AML areas in the vicinity of stream monitoring locations.

Selenium impairment is assumed to be associated with the disturbance of subsurface strata containing selenium. In West Virginia, coals that contain the highest selenium concentrations are found in a region of south central West Virginia where the Allegheny and Upper Kanawha Formations of the Middle Pennsylvanian are mined (WVGES 2002). Some of the highest coal selenium concentrations are found in the central portion of the Coal River watershed where significant active mining and the selenium impaired streams are located.

The weight of evidence suggests that the mobilization of selenium is enhanced from crushing of ore and waste materials along with the resulting increase in surface area of material exposed to weathering processes. Division of Mining and Reclamation (DMR) geologists believe that the dark shale strata immediately bracketing coal seams are of particular concern. DMR is implementing new operating requirements to identify non-coal strata with elevated selenium content and to handle such material in a manner that minimizes opportunities for selenium mobilization.

The pre-TMDL monitoring effort included more than 200 sites in the Coal River watershed where selenium was monitored. Selenium impairment has been identified in only nine waters. Land use in those watersheds is dominated by active mining operations. Conversely, nonpoint sources with associated surface disturbances are much more prevalent in other Coal River subwatersheds where selenium impairment was not identified. As such, there is no current evidence that nonpoint source activities exhibiting surface or near surface disturbances are significant sources of selenium.

DEP reevaluated information for AML areas and seeps in the selenium- impaired watersheds. In the Beech Creek, Left Fork Beech Creek, and Trace Branch watersheds, only small lengths of AML highwall have been identified. AML seeps were identified present only in the White Oak watershed. No AML areas or seeps were identified in the Beaver Pond Branch, Casey Creek and James Creek watersheds. Moderate amounts of AML area and highwall were identified in the Seng Creek watershed. As a part of the reevaluation, DEP resampled the AML seeps in the White Oak watershed for selenium. The selenium concentration in one seep, located in tributary Little White Oak, was < 1 µg/L. The selenium concentration in the other, located in Moccasin Hollow of Left Fork, was 1 µg/L. In contrast, selenium Discharge Monitoring Reports for permitted outlets in the White Oak watershed consistently show average monthly selenium concentrations well in excess of the criteria, and maximum daily values as high as 40 µg/L. Discharge Monitoring Reports demonstrating elevated selenium concentrations in permitted discharges are also available in Seng Creek, Trace Branch, James Creek, Beech Creek and Left Fork Beech watersheds.

Section 7.3 accurately identifies the paucity of monitoring results with matched flow observations and detectable selenium concentrations, and Figures 7-3 and 7-4 reflect this very limited dataset. The lack of a more robust dataset does not negatively influence selenium TMDL development. For the reasons discussed above, DEP is confidant that the proper sources are targeted, and that the level of control necessary to achieve criteria during low flow conditions (i.e. criteria end-of-pipe for active mining point sources) is also protective during higher flow periods.

The prescribed allocations for point source discharges in the selenium-impaired watersheds are based upon the achievement of the chronic aquatic life protection selenium criterion “end-of-pipe”. The permitted discharges from instream treatment structures are waters of the state where numeric water quality criteria are applicable. As such, selenium “criteria end-of-pipe” limitations for such discharges are appropriate regardless of receiving water impairment status, and many discharges in the impaired watersheds already have final effluent limitations equal to the wasteload allocations prescribed by the TMDLs. DEP is confident that the prescribed wasteload allocations are necessary to ensure compliance with the existing criterion.

11) One commenter noted that pre-TMDL selenium monitoring results were not presented for review.

This oversight has been corrected by including all selenium pre-TMDL monitoring results in Appendix H of the Technical Report.

12) Clarification of the basis for presentation of a selenium wasteload allocation for permitted discharges in the Threemile Branch watershed was requested.

The selenium WLA for permit WV0093050 is displayed in the TMDL Allocation Spreadsheet because the Threemile Branch subwatershed (3502) is an upstream tributary of Whiteoak Creek (WVKC-35), which is selenium impaired.

13) A commenter requested that Selenium TMDLs be displayed on the "TMDLs_Metals" page in the "Coal Metals TMDL Allocations" spreadsheet.

The "Coal Metals TMDL Allocations" spreadsheet has been updated as requested.

14) One commenter questioned the presentation of TMDLs as average annual loads in light of concentration-based TMDL endpoints and requested implementation direction for point sources in the NPDES permitting process.

Except for selenium, metal TMDLs and load allocations for nonpoint sources are presented as annual average loadings. For consistency and comparability, wasteload allocations for permitted point sources are similarly presented. In addition, wasteload allocations are also presented as equivalent concentrations. This convention has been used in all West Virginia metals TMDLs developed to date. Point source implementation is to be based upon the concentration-based wasteload allocations and the effluent limitation derivation procedures of EPA's Technical Support Document for Water Quality Based Toxics Control. For iron, aluminum and manganese, applicable concentration-based wasteload allocations are expressed on the "Mining WLAs Metals" and "Mining Pumped WLAs Metals" tabs of the "Coal Metals TMDL Allocation Spreadsheet". For selenium, all point source discharges in selenium-impaired watersheds are subject to a 5.0 µg/L wasteload allocation as depicted on the "Mining Selenium WLAs" tab of the spreadsheet.

15) It was contended that the baseline conditions predicted by modeling are not presented for review.

The Coal River Watershed TMDL modeling generated baseline and TMDL model outputs for 299 subwatersheds for multiple pollutants. The baseline condition predictions are presented throughout the allocation spreadsheets. The TMDL tab summarizes baseline and TMDL loadings for impaired streams for point and nonpoint sources. The LA tab presents baseline and allocation loadings for categories of nonpoint sources for each model subwatershed. The various WLA tabs display baseline and wasteload allocation loadings and concentrations for all NPDES permit/model subwatershed combinations.

16) A complete description of alternative, evaluated TMDL scenarios was requested, as well as the rationale for final scenario selection.

TMDL allocation was not accomplished by selection from multiple scenarios. Instead, the allocation methodologies described in Section 7 of the report were pursued. Deviation occurred only when application of the methodology resulted in the prescription of pollutant reduction of sources or categories of sources that had negligible effect on water quality improvement.

Allocation methodologies were presented at two public meetings in the Coal River watershed in Fall 2004. During those meetings, the agency heard comments that all TMDL pollutant reduction should be directed toward active mining because precipitation-induced discharges and spills are causing the most significant adverse impacts to water quality. DEP did not alter its allocation philosophy/methodology in response to those comments for a variety of reasons:

- Water quality impacts related to spills are noncompliance events that are to be addressed by NPDES permit enforcement. The role of the TMDL is to prescribe wasteload allocations that are protective of water quality standards.
- TMDLs eliminate the applicability of technology-based, alternative precipitation limitations. Consistent compliance with wasteload allocations will minimize precipitation-induced adverse impacts to water quality.
- Abandoned mine lands, bond forfeiture sites and surface disturbing nonpoint sources are often a significant cause of impairment. Pollutant reductions from those sources are needed to protect water quality, exclusive of the loading contribution from active mining operations.

17) Concern was expressed relative to the high percentage total aluminum reductions determined necessary for attainment of the 87 µg/L dissolved aluminum water quality criterion. The attainability and necessity of such reductions were questioned. DEP was urged to continue to work toward a scientifically sound aluminum criterion. One commenter expressed an opinion that aluminum TMDLs should be based upon a 750 µg/L dissolved aluminum endpoint instead of the 87 µg/L.

TMDLs must be based upon the applicable water quality standards at the time of development. Throughout the development process, and at the time of preparation of the draft TMDLs, the effective dissolved aluminum, chronic, warmwater and troutwater, aquatic life protection criteria were 87 µg/L. The revision of the warmwater dissolved aluminum criterion was pending EPA approval and was not effective for Clean Water Act purpose. As such, the draft TMDLs and the resultant stringent allocations that were presented were appropriate.

On January 9, 2006, EPA approved a revision to the dissolved aluminum criteria. The warmwater chronic aquatic life protection criterion is changed from 87 µg/L to 750 µg/L from the date of approval until July 4, 2007. During that period, the 750 µg/L criterion is effective for Clean Water Act purposes in warmwater fisheries. In response, DEP recalled draft TMDLs in the North Branch Potomac, Lower Kanawha and Coal River watersheds that were pending EPA approval. DEP reevaluated the impairment status of streams and developed alternative TMDLs, load allocations and wasteload allocations pursuant to the 750 µg/L warmwater dissolved aluminum criterion. The revised draft documents contain dissolved aluminum TMDLs and allocations pursuant to both the 87 µg/L and the 750 µg/L criteria. The revised documents allow TMDL implementation to occur now, based upon the approved criteria revision, and also retain the previously advertised TMDLs and allocations that would be effective if criterion reverts to the 87 µg/L value in the future.

18) The basis of the 120 mg/L, annual average, Total Suspended Solids future growth provision was questioned. The commenter mentioned the 40 CFR 434 technology-based TSS limitations (35 mg/L average monthly, 70 mg/L maximum daily), and the

associated alternative precipitation limitations for settleable solids that are applicable to certain discharges from surface mines and asked if alternative precipitation limitations will continue to be available under the TMDL. Also included was an assumption that dischargers would be allowed to include zero discharge days in calculating the annual average concentration.

The 120 mg/L allocation is the most stringent given to existing active mining operations in TMDLs developed by DEP to date. WVDEP has concluded that discharges in compliance with this limitation will not cause or contribute to a violation of water quality standards. The future growth provision is identical to that contained in the Upper Kanawha River Watershed sediment TMDLs that have been approved by EPA. In the absence of this provision, new facilities could be permitted only via the recycling of allocations from existing facilities, after reclamation and permit release.

Implementation of the TSS wasteload allocation for mining point sources in sediment-impaired watersheds will be accomplished by the addition of an annual average TSS effluent limitation in the NPDES permit. Permits will continue to contain the average monthly and maximum daily TSS technology-based limitations and the authorization of alternative settleable solids limitations during qualifying precipitation events. But TSS self-monitoring will always be required, with the results to be used in an annual assessment of compliance with the TSS wasteload allocation of the TMDL. “Zero discharge” days cannot be factored into the annual assessment.

19) Additional information was requested concerning the modeling approach used to address pH impairments.

The selected modeling approach was developed to represent the dynamic and diverse watershed conditions affecting pH and dissolved metal concentrations. pH is an intensity factor that describes free hydrogen concentrations produced by many different processes. Factors that influence pH in natural streams unaffected by high metals loading include redox reactions of nutrients, organic acid/base reactions caused by decaying natural organic matter, CO2 fluctuations by respiratory activity of microbes and plants (including algae and macrophytes), and inflow of alkalinity and CO2 from groundwater/interflow. In mining impacted streams, pH is additionally influenced by acid and metal loadings from surface and subsurface sources.

In order to represent these complex chemical conditions in the model, alkalinity was assigned to characterize the cumulative effect of the chemical constituents and buffer the acidity generated by metal hydrolysis and hydrogen generating reactions. Alkalinity can be generated by many different chemical species including calcite dissolution, dissolved CO2 gas, nitrogen species, phosphorus species, organic acid and many others. However, most alkalinity is generated by bicarbonate and carbonate ions that occur naturally. Alkalinity values were selected during model calibration process based on the range (minimum and maximum) of observed alkalinity measured throughout the watershed. This alkalinity selection methodology was a key component in the sensitivity analysis during the model calibration process where the best representative alkalinity value was selected based on the daily simulation of in-stream metals concentrations in MDAS. The observed in-stream alkalinity was assumed to include any additional alkalinity added during treatment processes.

Highly oxygenated streams, such as shallow mountain streams, can effectively change a redox status of a metal and cause the metal to precipitate. Oxidation and hydrolysis reactions can generate acidity when metals are discharged to streams from subsurface sources. Oxidation reaction of iron is represented by assigning various ratios of ferric and ferrous iron during the iterative model calibration process to determine the best-fit ratio of incoming ferric and ferrous iron. The model counteracts the generated acidity from these incoming sources by utilizing the representative alkalinity (described above) as a buffer attempting to maintain pH conditions that existed prior to the hydrolysis and oxidation reactions.

Furthermore, pH TMDLs were developed using a surrogate approach where it was assumed that reducing in-stream metals (iron and aluminum) to meet water quality criteria (or TMDL endpoints) would result in meeting the water quality standard for pH. This assumption was verified by applying the modeling approach described above. By executing the model under TMDL conditions (conditions in which TMDL endpoints for metals were met), the resulting equilibrium pH was predicted. In all cases, this equilibrium pH was compliant with pH water quality criteria and further reductions to metals sources were not necessary.

20) General comments were provided indicating disappointment in the level of effort that was given to data analysis, model development, and model calibration, and concern that the models used do not accurately predict instream water chemistry.

Contrary to the opinion of the commenter, TMDL development for the Coal River watershed consisted of a very substantial effort over a duration of 2 years. The technical work was completed by a team of highly qualified scientists and engineers that possess a breadth of experience in watershed/water quality modeling with a high level of TMDL development experience. Extreme care and diligence were taken to thoroughly examine and analyze the myriad of available data that included many types and formats originating from various sources (including data collected and submitted by industry).

The sophisticated modeling efforts were supported by carefully crafted technical approaches designed to utilize the best available data while incorporating sound scientific principles to establish representative conditions throughout the Coal River watershed.

The goal of the modeling calibration was to determine a set of parameters to best describe the hydrologic and water quality processes in the Coal River watershed. The hydrology and water quality calibration process first objective is not to match every sampled point, but to adequately replicate processes occurring in the watershed and streams. The purpose of directly comparing modeled results with data is to assess that the model is simulating low flow, mean flow, and storm peaks within observed ranges.

Composite analysis of the available in-stream data (pre-TMDL monitoring data, in-stream Discharge Monitoring Report data, WVDEP DMR trend station data, etc.) from all monitoring stations was performed to establish low-flow, high-flow and seasonal trends. Background values were established by using a composite of samples from watersheds that were minimally disturbed, according to the landuse coverage. In addition, the sediment-metals relationship was determined, and applied to those watersheds where metals-sediment correlation was observed.

For the abandoned mine lands, the concentrations were based on the source tracking monitoring. Values for permitted mines used for calibration were based on DMR data, although it is important to note that those were changed to represent permitted conditions during the allocation process (Baseline Conditions). From these composite analyses, 16 separate water quality parameter groups representing more than 720 landuse/pollutant-specific parameter combinations were developed for the 299 subwatersheds.

Graphical results of model performance were evaluated at many different locations throughout the Coal River watershed following each water quality simulation. Model parameters were further adjusted following iterations to improve model performance. Graphical results for each location were too numerous to display in the Technical report. Therefore, representative examples were displayed in Appendix G of the Technical report. The commenter noted inconsistencies with labeling of the graphical result that have been corrected.

Although error statistics are often used in evaluating model calibration, their use, particularly for water quality calibration, is not recommended for this modeling effort. Making a "point-by-point" comparison (i.e. a comparison of a water quality observation for a given date and time versus the modeled value for the same date and time) will likely result in poor statistical results, because the precise timing of all physical, chemical, and biological phenomenon are likely not perfect in a model. Most of the available data for calibration were instantaneous grab samples, not continuous or composite sampling. Instantaneous grab sample data only permits comparison during a snapshot in time, and this snapshot is representative of only a single condition. Although multiple water quality data are available at many locations, they are not necessarily representative of all conditions (which are, in fact, simulated by the model because it is continuous). The lack of local weather gages increases model error in terms of amount and timing of water flowing through the system. The sparse weather gage network particularly increases model error during storm events. Modeled continuous flow discharges (i.e. point sources, AML seeps) are simplifications that also increase model error, since they have the potential to have variable flow and water quality.

Looking at a time series plot of modeled versus observed data provides more insight into the nature of the system and is more useful in water quality calibration, in particular, than a statistical comparison. Trends in the observed data and cause-effect relationships between various parameters can be replicated with a model, although precise values at each and every point in time may not be. As long as the trends, relationships, and magnitudes are well represented, and thus the underlying physics and kinetics are also being represented, a model is successful and can be used for simulating management alternatives. It is important to note that only EPA approved public domain models were applied during this effort. All models are openly coded and available to anyone who is interested.

21) Additional information was requested regarding modeling considerations relative to metals/sediment correlation. Based upon statements contained in Section 4.2.3, the commenter also questioned the transfer of information from the Elk River and Upper Kanawha River TMDLs to the Coal River, without a demonstration of similar geomorphology.

Section 4.2.3 points out that West Virginia soils can contain metals and that sources of sediment are potential sources of iron, aluminum and manganese. The reference to the Elk and Upper Kanawha TMDLs are examples of past TMDL development efforts where metals/sediment relationships were evaluated. The relationships determined in those TMDLs were not applied in the Coal River watershed. The metals/sediment relationships for this effort were determined directly from available Coal River watershed monitoring data (See Technical Report Appendix C) and resulted in the creation of sixteen different default groups that were applied at the subwatershed level.

22) Identification of the point sources that were modeled as subject to technology-based effluent limitations and those that were modeled as subject to water quality-based effluent limitation was requested. The commenter also asked if any "credit" was given for existing discharges with more stringent antidegradation-based effluent limitations.

Model representations of point sources under baseline and TMDL conditions were based upon permit information contained DEP's ERIS database. Effluent limitation data are presented in Appendix D of the Technical Report. Using the limitation information, outlets were represented as either "Technology-based" (existing iron and manganese effluent limitations consistent with 40CFR434 guidelines) or "Water Quality-based" (existing iron and manganese effluent limitations based upon achieving 47CSR2 water quality criteria end-of-pipe). This categorization methodology accurately represents 95% of the permitted discharges, and the magnitude of the modeling effort precludes representation of permitted discharges exactly equal to every possible existing limitation set. If existing limitations were more stringent than "criteria end-of-pipe" the discharges were represented under the "Water Quality-based" format. If existing limitations fell between "criteria end-of-pipe" and effluent guidelines, the discharges were represented under the "Technology-based" format. It is important to note that "credit" for discharges with antidegradation-based effluent limitations is directly provided in model calibration through the use of Discharge Monitoring Report data.

The discussion presented in Section 7.5.1 recognizes the limited instances where existing effluent limitations are more stringent than TMDL allocations. In the TMDL process, specified pollutant reductions are not greater than necessary to comply with criteria (i.e 100% assimilative capacity use) and prescribed wasteload allocations cannot be more stringent than effluent limitations reflecting the achievement of water quality criteria end-of-pipe. Section 7.5.1 cautions against using TMDL allocations to relax alternatively-based (e.g. antidegradation) existing effluent limitations.

10. REASONABLE ASSURANCE

Reasonable assurance for maintenance and improvement of water quality in the affected watershed rests primarily with three separate programs. Two of these programs are wholly within WVDEP, and the third program is a cooperative effort involving many state and federal agencies. Within WVDEP, the programs involved in the effort include the NPDES Permitting Program and the Abandoned Mine Lands Program. In addition, WVDEP is involved with the West Virginia Watershed Management Framework, which includes many state and federal agencies dealing with the protection and restoration of water resources. The Framework process allows the resources of many entities to focus on the protection and/or restoration of water quality in selected streams.

Historically, mine drainage research has been a conducted by scientists at West Virginia University, the West Virginia Division of Natural Resources, the United States Office of Surface Mining, the National Mine Land Reclamation Center, the National Environmental Training Laboratory, and other agencies and individuals within West Virginia. In addition, USEPA 319 Grant funding has been used to address issues resulting from acid mine drainage.

10.1 Permit Reissuance

WVDEP's Division of Water and Waste Management is responsible for issuing non-mining NPDES permits within the State. The Division of Mining and Reclamation develops NPDES permits for mining activities. As part of the permit review process, permit writers have the responsibility to incorporate the required TMDL wasteload allocations into new or reissued permits. Both the permitting and TMDL development processes have been synchronized with the Watershed Management Framework cycle, such that TMDLs are completed just before the permit expiration/reissuance time frames. Existing permit reissuance in the Coal River watershed is scheduled to begin in July 2006 for non-mining facilities and in January 2007 for mining facilities. Therefore, the wasteload allocations for existing activities will be promptly implemented. New facilities will be permitted in accordance with future growth provisions.

Existing sewage treatment facilities already have permit limitations for fecal coliform bacteria that satisfy the wasteload allocations of the TMDLs. A new MS4 permitting program is being implemented to address stormwater impacts from urbanized areas. DWWM also oversees a program to control discharges from combined sewer overflows (CSOs). The CSO pollutant reductions specified will be implemented at the time of reissuance of the NPDES permit for the affected POTW.

10.2 Watershed Management Framework Process

The Watershed Management Framework consists of a group of state and federal agencies whose goal is to develop and implement watershed management strategies through a cooperative, long-range planning effort. The Framework is incorporated by reference into West Virginia's Continuing Planning Process. The Framework consists of representatives from the following partner agencies:

Bureau for Public Health
Department of Highways
Department of Environmental Protection
State Conservation Agency
Division of Forestry
Division of Natural Resources
West Virginia University Extension Services
ORSANCO (Ohio River Valley Water Sanitation Commission)
U.S. Geological Survey
U.S. Office of Surface Mining
Monongahela National Forest
U.S. Environmental Protection Agency
Natural Resources Conservation Service
U.S. Army Corps of Engineers
U.S. Department of Agriculture

The principal area of focus for the Framework is correcting problems related to non-point source pollution. Each of the partner agencies has placed a greater emphasis on identification and correction of non-point source pollution. The combined resources of these agencies are used to address all different types of non-point source pollution through both public education and on-the-ground projects. The Framework also incorporates as part of its priority selection criteria, the state's list of impaired waters under Section 303(d).

Among other things, the Framework includes a management schedule for integration and implementation of TMDLs. In 2000, the schedule for TMDL development under Section 303(d) was merged with the Framework process. Chapter 3.2.2 of the Framework, entitled "Developing and Implementing Integrated Management Strategies," identifies a six-step process for developing integrated management strategies and action plans for achieving the state's water quality goals. Step 3 of that process includes "identifying point source and/or non-point source management strategies - or Total Maximum Daily Loads - predicted to best meet the needed [pollutant] reduction." Following development of the TMDL, Steps 5 and 6 provide for preparation, finalization, and implementation of an "action plan" that implements the TMDL and any other appropriate water quality improvement strategy.

The Framework uses the 5-year Watershed Cycle to identify watersheds where restoration efforts will be focused. Each year Framework agencies meet to prioritize watersheds within a certain Hydrologic Group. Development of "action plans" for priority watersheds is based on the efforts of local project teams. These teams are composed of Framework members and stakeholders having interest in or residing in the watershed. Team formation is based on the type of impairments occurring or protections needed within the watershed. In addition, teams have the ability to use the TMDL recommendations to help plan future activities. The team's goal is to develop a project plan that allows the most efficient use of resources from all involved parties.

10.3 Public Sewer Projects

Within WVDEP's Division of Water and Waste Management, the Engineering and Permitting Branch's Engineering Section is charged with the responsibility of evaluating sewer projects and providing funding, where available, for those projects. All municipal wastewater loans issued through the State Revolving Fund (SRF) program are subject to a detailed engineering review of the engineering report, design report, construction plans, specifications, and bidding documents. The staff performs periodic on-site inspections during construction to ascertain the progress of the project and compliance with the plans and specifications. Where the community does not use SRF funds to undertake a project, the staff still performs engineering reviews for the agency on all POTWs prior to permit issuance or modification. A list of funded and pending water and wastewater projects in West Virginia can be found at http://www.wvinfrastructure.com/projects/index.html.

10.4 AML Projects

Within WVDEP, the primary entity that deals with abandoned mine drainage issues is the Division of Land Restoration. Within the Division, the Office of Abandoned Mine Lands and Reclamation was created in 1981 to manage the reclamation of lands and waters affected by mining prior to passage of the Surface Mining Control and Reclamation Act (SMCRA) in 1977. A fee placed on coal mined in West Virginia funds the Office of AML&R's budget. Allocations from the AML fund are made to state and tribal agencies through the congressional budgetary process. AML&R has recently increased its emphasis on correcting water quality problems at sites that were primarily chosen for protection of public health, safety, and property. This new emphasis on improving water quality, in conjunction with Framework participation, will aid in the cleanup of sites already selected for remediation activities.

10.5 Special Reclamation Projects

The Office of Special Reclamation is part of the Division of Land Restoration. Since August 1997 Special Reclamation has been mandated by the State of West Virginia to protect public health, safety, and property by reclaiming and treating water on all bond-forfeited coal mining sites in an expeditious and cost-effective manner. Funding for this program is obtained from collection of forfeited bonds, civil penalties, and the Special Reclamation Tax placed on mined coal. Table 10-1 displays six bond forfeiture sites in the watersheds addressed in this report.

Table 10-1. Coal River watershed bond forfeiture sites with water treatment needs

Original Permittee	Permit No.	TMDL Watershed	Subwatershed ID	Stream
Bickford Mining Inc.	U-44-83	Marsh Fork	4612	Horse Creek
Bickford Mining	U-78-85	Marsh Fork	4612	Horse Creek
E.C. Coal Mining Co.	U-207-83	Clear Fork	4718	Toney Fork
Pups Creek Coals, Inc.	S-3006-94	Marsh Fork	4666	Shockley Branch
J & N Processing Company, LLC	O-58-83	Marsh Fork	4654	Maple Meadow Creek
Lodestar Energy, Inc.	S-3016-92	Clear Fork	4717	Buffalo Fork

11. MONITORING PLAN

The following monitoring activities are recommended:

11.1 NPDES Compliance

WVDEP's Division of Water and Waste Management has the responsibility to ensure that NPDES permits contain effluent limitations as prescribed by the TMDL wasteload allocations and to assess and compel compliance. Permits contain effluent self-monitoring and reporting requirements that are periodically reviewed by WVDEP. WVDEP also inspects treatment facilities and independently monitors NPDES discharges. The combination of these efforts will ensure implementation of the TMDL wasteload allocations.

11.2 Non-point Source Project Monitoring

All non-point source restoration projects should include a monitoring component specifically designed to document resultant local improvements in water quality. These data may also be used to predict expected pollutant reductions from similar future projects.

11.3 TMDL Effectiveness Monitoring

TMDL effectiveness monitoring should be performed to document water quality improvements after significant implementation activity has occurred because little change in water quality would otherwise be expected. Full TMDL implementation will take significant time and resources, particularly with respect to the abatement of non-point source impacts. WVDEP will continue monitoring on the rotating basin cycle and will include a specific TMDL effectiveness component in waters where significant TMDL implementation has occurred.

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