Total Maximum Daily Load
For the Chartiers Creek Watershed
Pennsylvania

Prepared for Pennsylvania
Department of Environmental Protection
and
EPA Region 3

Prepared by
Tetra Tech, Inc.
Fairfax, Virginia

April 2003

Table of Contents

List of Tables

List of Figures

Summary of the Chartiers Creek TMDLs

1. These TMDLs were developed for Chartiers Creek watershed, a tributary to the Ohio River. The watershed is located in Allegheny and Washington Counties in western Pennsylvania. The watershed drains approximately 260 square miles of land area southwest of Pittsburgh, PA. The mainstem of Chartiers Creek flows north for approximately 35 miles where it joins the Ohio River, downstream of the confluence of the Allegheny and Monongahela Rivers in Pittsburgh. The major tributaries of Chartiers Creek include Little Chartiers Creek, Chartiers Run, Brush Run, Millers Run, Robinson Run, North Branch Robinson Run, and Campbells Run. Protected stream uses in the watershed include aquatic life, water supply, and recreation.

2. Chartiers Creek and several tributaries are listed on Pennsylvania's 303(d) list for impairments caused by metals. TMDLs for the Chartiers Creek watershed were developed to address use impairments caused by aluminum, iron, manganese and pH. The impairments were attributed to acid mine drainage (AMD) and resource extraction (RE).

3. The TMDL endpoints for aluminum, iron and manganese were selected as 712.5 ug/l, 1.425 mg/l, and 0.95 mg/l, respectively. These endpoints were based on the applicable water quality criteria and a five percent margin of safety.

4. In order to ensure attainment and maintenance of water quality standards in the Chartiers Creek watershed, mean annual loading of aluminum, iron, and manganese will need to be limited to 67,334 lbs/yr, 210,995 lbs/yr and 190,386 lbs/yr, respectively.

   The major components of the Brush Run watershed TMDLs are summarized below:

Metal	LA (lbs/yr)	WLA (lbs/yr)	MOS (lb/yr)	TMDL (lb/yr)	Percent Reduction
Aluminum	67,334	2,766	3,689	73,790	50.7%
Iron	210,995	4,581	11,346	226,922	2.1%
Manganese	190,386	2,994	10,178	203,558	81.1%

5. The current mean annual loads for aluminum, iron and manganese to the Chartiers Creek watershed need to be reduced. Overall, a 50.7% reduction in aluminum loads, 2.1% reduction in iron loads, and 81.1% reduction in manganese loads is needed for the stream to meet the TMDL. The reduction values vary for individual stream segments within the watershed depending on their impairment situation.

6. The Watershed Analysis Risk Management Framework (WARMF) was used to model and develop TMDLs for the Chartiers Creek watershed. WARMF is a decision support system designed for a watershed approach to TMDL calculation (Herr et al., 2001, Systech, 2001).

7. The most significant non-point sources of metals in the Chartiers Creek watershed is AMD from abandoned mines. Other contributing sources are barren lands and urban areas.

8. There is one active permitted mine in the Chartiers Creek watershed. The Eighty-Four Mining Company operates Mine No. 84 in the upper Little Chartiers Creek watershed and discharges under NPDES permit PA0213608. There are seven outlets located within the Little Chartiers Creek watershed that have NPDES permits to discharge metals (aluminum, iron and manganese). The Allegheny Ludlum – Houston Plant is a non-mining point source of metals in the Chartiers Creek watershed. It is classified as a minor discharger. The facility is permitted under NPDES permit PA000273 to discharge iron, on a “measure and report” basis. WLAs were developed for these point sources.

9. Five percent of the Chartiers Creek aluminum, iron and manganese TMDLs were set-aside as a margin of safety (MOS). The MOS is that portion of the pollutant loading that is reserved to account for any uncertainty in the data and computational methodology used for the analysis. The MOS for the aluminum, iron and manganese TMDLs were set at 3,689 lbs/yr, 11,346 lbs/yr, and 10,178 lbs/yr, respectively.

1.0 Introduction

The Clean Water Act at Section 303(d) and its implementing regulations (Water Quality and Planning and Management Regulations at 40 CFR 130) require a Total Maximum Daily Load (TMDL) to be developed for those waterbodies identified as impaired by the state where technology-based and other required controls did not provide for the attainment of water quality standards. Twenty-five stream segments have been included on Pennsylvania's 1996 and 1998 Section 303(d) list due to metals impairments (Table 1-1). These listed waterbodies include part of the Chartiers Creek mainstem and 24 additional stream segments in the watershed. Locations of these stream segments are shown in Appendix A. The metals impairments result from acid drainage from abandoned coal mines. The objective of this study was to develop TMDLs that addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum) for impaired waterbodies in the Chartiers Creek watershed.

Table 1-1. Pennsylvania's Section 303(d) Sub-List

State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	2.0	NA[1]	36786	Campbells Run		WWF	305(b) Report	RE	Metals
1998	2.0	NA[4]	36786	Campbells Run		WWF	305(b) Report	RE	Metals
1996	0.8	4686	36787	Unt Campbells Run		WWF	305(b) Report	RE	Metals
1998	0.8	4686	36787	Unt Campbells Run		WWF	SWMP	AMD	Metals
1996	6.5	4681	36777	Chartiers Creek	25	WWF	305(b) Report	RE	Metals
1998	19.92[2]	4681	36777	Chartiers Creek		WWF	SWMP	AMD	Metals
1998	3.11	971001-1040-TVP	37135 37139	UNT's Chartiers Creek	41	WWF	UP	UR/SS AMD AMD	Siltation Metals Siltation

[1] Listing did not have a Segment Id. Listed on Part C of the 1998 303(d) List.

[2] Some stream miles were duplicated on the 1998 303(d) List due to overlapping of segment IDs.

State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1998	3.2	971024-0940-ALF	37043 37050	Chartiers Run UNT Chartiers Run		WWF	UP	AMD Cn HM HM AMD Cn	S/TDS/C Siltation Siltation OHA Metals OHA
1998	5.97	971024-1030-ALF	37051 37052 37055	UNT's Chartiers Run	47	WWF	UP	AMD Cn AMD HM HM Cn	Metals OHA S/TDS/C OHA Siltation Siltation
1998	4.11	971028-1000-ALF	37052 37058 to 37061	UNT's Chartiers Run	48	WWF	UP	Ag Ag Ag HM HM	Siltation Nutrients Turbidity Turbidity pH
1996	1	5846	63300	Half Crown Run		WWF	305(b) Report	RE	Metals
1998	1.1	5846	63300	Half Crown Run		WWF	SWMP	AMD	Metals
1998	6.19	971009-1050-TVP	36989 37001 37002 37003 37015	UNT's Little Chartiers Creek	71	WWF	UP	AMD AMD	Suspended Solids Metals
1998	6.35	971009-1245-TVP	36989 37004 to 37009	UNT's Little Chartiers Creek	72	WWF	UP	UR/SS AMD AMD	Siltation Suspended Solids Metals
1996	2.5	4688	36827	Millers Run		WWF	305(B) Report	RE RE	Suspended Solids Metals

State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1998	5.13	4688	36827	Millers Run		WWF	SWMP	AMD AMD	Suspended Solids Metals
1996	6.0	5842, 5843	63294	N. Br. Robinson Run		WWF	305(B) Report	RE	Other Inorganics, Metals
1998	2.42	5842	63294	N. Br. Robinson Run		WWF	SWMP	AMD AMD	Metals Other Inorganics
1998	1.55	5843	63294	N. Br. Robinson Run		WWF	SWMP	AMD	Metals
1996	4.2	5845, 6610	63295	UNT N. Br. Robinson Run		WWF	305(B) Report	RE	Metals
1998	1.85	5845	63295	UNT N. Br. Robinson Run		WWF	SWMP	AMD	Metals
1998	1.5	6610	63295	UNT N. Br. Robinson Run		WWF	SWMP	AMD	Metals

WWF = Warm Water Fishes
SWMP = Surface Water Monitoring Program
AMD = Abandoned Mine Drainage
Ag = Agriculture
Cn = Construction
HM = Habitat Modification
UR/SS = Urban Runoff/Storm Sewers
OHA = Other Habitat Alterations
S/TDS/C = Salinity/TDS/Chlorides

The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.

Segments addressed in this TMDL

All of the discharges in the watershed originate from abandoned mines and will be treated as non-point sources. The distinction between non-point and point sources is determined on the basis of whether or not there is a responsible party for the discharge. Where there is no responsible party the discharge is considered to be a non-point source. Two point sources in the watershed including one active mining operation. Each point source that is permitted to discharge metals (aluminum, iron, and manganese) will receive a waste load allocation based on permit discharge limits. Each segment on the 1996 and 1998 Section 303(d) list will be addressed as a separate TMDL. These TMDLs will be expressed as long-term, average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations.

Clean Water Act Requirements

Section 303(d) of the Clean Water Act requires states, territories, and authorized tribes to establish water quality standards. The water quality standards identify the uses for each waterbody and the scientific criteria needed to support that use. Uses include designations for drinking water supply, contact recreation (swimming), and aquatic life support. Minimum goals set by the Clean Water Act require that all waters be “fishable” and “swimmable.”

Additionally, the federal Clean Water Act and the U.S. Environmental Protection Agency’s (USEPA) implementing regulations (40 CFR 130) require:

- States to develop lists of impaired waters for which current pollution controls are not stringent enough to meet water quality standards (the list is used to determine which streams need TMDLs);

- States to establish priority rankings for waters on the lists based on severity of pollution and the designated use of the waterbody; states must also identify those waters for which TMDLs will be developed and a schedule for development;

- States to submit the list of waters to USEPA every two years (April 1 of the even numbered years);

- States to develop TMDLs, specifying a pollutant budget that meets state water quality standards and allocate pollutant loads among pollution sources in a watershed, e.g., point and nonpoint sources;

- That the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving water body and must consider seasonal variation in the derivation of the allocation; and

- USEPA to approve or disapprove state lists and TMDLs within 30 days of final submission.

Despite these requirements, states, territories, authorized tribes, and USEPA have not developed many TMDLs since 1972. Beginning in 1986, organizations in many states filed lawsuits against the USEPA for failing to meet the TMDL requirements contained in the federal Clean Water Act and its implementing regulations. While USEPA has entered into consent agreements with the plaintiffs in several states, many lawsuits still are pending across the country.

In the cases that have been settled to date, the consent agreements require USEPA to backstop TMDL development, track TMDL development, review state monitoring programs, and fund studies on issues of concern (e.g., AMD, implementation of nonpoint source Best Management Practices (BMPs), etc.).

303(d) Listing Process

Prior to developing TMDLs for specific waterbodies, there must be sufficient data available to assess which streams are impaired and should be on the Section 303(d) list. With guidance from the USEPA, the states have developed methods for assessing the waters within their respective jurisdictions.

The primary method adopted by the Pennsylvania Department of Environmental Protection (Pa. DEP) for evaluating waters changed between the publication of the 1996 and 1998 303(d) lists. Prior to 1998, data used to list streams were in a variety of formats, collected under differing protocols. Information also was gathered through the Section 305(b) reporting process. Pa. DEP is now using the Unassessed Waters Protocol (UWP), a modification of the USEPA Rapid Bioassessment Protocol II (RPB-II), as the primary mechanism to assess Pennsylvania’s waters. The UWP provides a more consistent approach to assessing Pennsylvania’s streams.

The assessment method requires selecting representative stream segments based on factors such as surrounding land uses, stream characteristics, surface geology, and point source discharge locations. The biologist selects as many sites as necessary to establish an accurate assessment for a stream segment; the length of the stream segment can vary between sites. All the biological surveys included kick-screen sampling of benthic macroinvertebrates, habitat surveys, and measurements of pH, temperature, conductivity, dissolved oxygen, and alkalinity. Benthic macroinvertebrates are identified to the family level in the field.

After the survey is completed, the biologist determines the status of the stream segment. The decision is based on the performance of the segment using a series of biological metrics. If the stream is determined to be impaired, the source and cause of the impairment is documented. An impaired stream must be listed on the state’s Section 303(d) list with the documented source and cause. A TMDL must be developed for the stream segment. A TMDL is for only one pollutant. If a stream segment is impaired by two pollutants, two TMDLs must be developed for that stream segment. In order for the process to be more effective, adjoining stream segments with the same source and cause listing are addressed collectively, and on a watershed basis.

2.0 Water Quality Standards

Water Quality Standards consist of three components: designated and existing uses; narrative and/or numerical water quality criteria necessary to support those uses; and an anti-degradation statement. Furthermore, water quality standards serve two purposes. The first is establishing the water quality goals (or use designations) for a specific waterbody. The second is establishing targets for water quality-based treatment controls and strategies beyond the technology-based levels of treatment required by section 301(b) and 306 of the Act (US EPA, 1991). Tables 2-1 and 2-2 summarize the applicable use designations and water standards for the Chartiers Creek watershed.

Table 2-1. Summary of designated uses for the Chartiers Creek watershed

Symbol	Protected Use
Aquatic Life	
CWF	Cold Water Fishes—Maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat.
WWF	Warm Water Fishes—Maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.
MF	Migratory Fishes—Passage, maintenance and propagation of anadromous and catadromous fishes and other fishes which ascend to flowing waters to complete their life cycle.
TSF	Trout Stocking—Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.
Water Supply	
PWS	Potable Water Supply—Used by the public as defined by the Federal Safe Drinking Water Act, 42 U.S.C.A. § 300F, or by other water users that require a permit from the Department under the Pennsylvania Safe Drinking Water Act (35 P. S. § § 721.1—721.18), or the act of June 24, 1939 (P. L. 842, No. 365) (32 P. S. § § 631—641), after conventional treatment, for drinking, culinary and other domestic purposes, such as inclusion into foods, either directly or indirectly.
IWS	Industrial Water Supply—Use by industry for inclusion into nonfood products, processing and cooling.
LWS	Livestock Water Supply—Use by livestock and poultry for drinking and cleansing.
AWS	Wildlife Water Supply—Use for waterfowl habitat and for drinking and cleansing by wildlife.
IRS	Irrigation—Used to supplement precipitation for growing crops.

Table 2-2. Applicable water quality standards for the Chartiers Creek watershed

Parameter	Symbol	Criteria	Critical Use
Aluminum	Al	Maximum 0.75 mg/L as total recoverable	CWF, WWF, TSF, MF
Iron	Fe_1	Daily (30-day) average 1.5 mg/l as total recoverable.	CWF, WWF, TSF, MF
	Fe_2	Maximum 0.3 mg/L as dissolved.	PWS[1]
Manganese	Mn	Maximum 1.0 mg/L as total recoverable.	PWS[2]
pH	pH	From 6.0 to 9.0 inclusive.	CWF, WWF, TSF, MF

1 – Water quality standard derived for health or esthetic reasons

2 – Water quality standard derived for health or esthetic reasons -

3.0 Watershed Description and History

The Chartiers Creek watershed is located within the Ohio North watershed (HUC 05030101) in southwestern Pennsylvania. The watershed drains an approximately approximately 260 square miles (166,400 acres) area southwest of Pittsburgh, PA (Figure 3-1). The headwaters of the Chartiers Creek begin near Lagonda, PA in Washington County. The mainstem of Chartiers Creek flows north for approximately 35 miles where it discharges into the Ohio River, downstream of the confluence of the Allegheny and Monongahela Rivers in Pittsburgh. The major tributaries of Chartiers Creek include Little Chartiers Creek, Chartiers Run, Brush Run, Millers Run, Robinson Run, North Branch Robinson Run, and Campbells Run (Figure 3-2).

Figure 3-1. Location of the Chartiers Creek watershed

The upper reaches of the creek flow primarily through agricultural and forested regions before entering communities near Washington. Below Canonsburg, the relatively unpolluted Little Chartiers Creek meets the main stem of Chartiers Creek. Acid mine drainage impacts water quality primarily downstream of this point though deep and surface mines exist through much of the watershed (Chen et al., 2001).

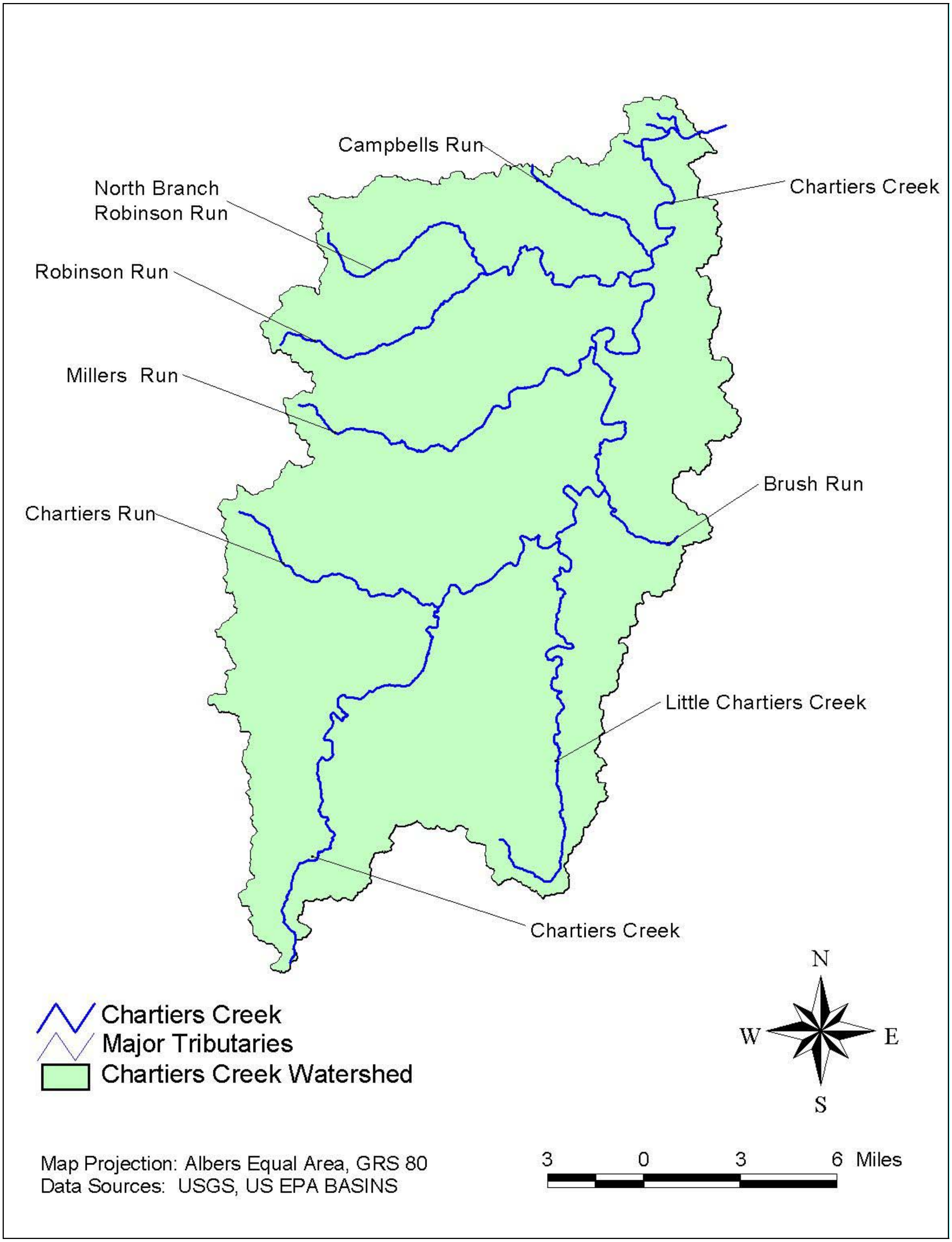


Figure 3-2. Chartiers Creek and its major tributaries

4.0 Source Assessment

The waterbodies in the Chartiers Creek watershed that are impaired due to aluminum, iron, and manganese are heavily influenced by acid mine drainage (AMD). Sources such as acid mine drainage, point, and nonpoint sources are discussed below

4.1 Acid Mine Drainage

AML locations were identified by using data and information provided by PA DEP McMurray District Office and included coal status reports which detail existing and previous mining activity, mine operators, maps of coal crop lines (location where the coal seam intersects the ground surface), locations of strip mines and surface mines, and coal seam contour lines. A complete description of the information used to indentify and characterize AMLs in the Chartiers Creek watershed can be found in the Adaptation of WARMF to Calculate TMDL for Chartiers Creek Watershed in Pennsylvania (Chen et al. 2001) report, which is shown in Appendix B.

4.2 Point Sources

Point sources, according to 40 CFR 122.3, are defined as 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, under Clean Water Act Sections 318, 402, and 405, requires permits for the discharge of pollutants from point sources. Point sources can be classified into two major categories: permitted non-mining point sources and permitted mining point sources.

4.2.1 Permitted Non-Mining Point Sources

Data regarding non-mining point sources were retrieved from EPA's Permit Compliance System (PCS) and PA DEP. Only one non-mining point source located in the Chartiers Creek watershed is permitted to discharge iron, aluminum or manganese. Information regarding the point source is shown Table 4-1. It was assumed that discharges from all other point sources do not contain aluminum, iron and manganese since they are not permitted to discharge these metals. Therefore, these point sources were not considered as potential sources of the metals impairment in the Chartiers Creek watershed.

Table 4-1. Nonmining point sources in the Chartiers Creek watershed

NPDES ID	FACILITY NAME	PERMIT TYPE	ACTIVE/ INACTIVE	MAJOR ID	RECEIVING WATER	PERMIT ISSUE DATE	PERMIT EXPIRE DATE	PERMIT LIMITS	AVE FLOW (MGD)
PA0002739	ALLEGHENY LUDLUM HOUSTON PLANT	STANDARD	ACTIVE	MINOR	CHARTIERS CREEK	8/28/95	8/28/00	FE (REPORT ONLY)	0.032

Sources: PA DEP, USEPA PCS

4.2.2 Permitted Mining Point Sources

Untreated mining related discharges, from deep, surface, and other mines, typically contain low pH values and high concentrations of metals (iron, aluminum, and manganese). Consequently, mining related activities are issued discharge permits for aluminum, iron, manganese, and pH.

There is only one active permitted mines in the Chartiers Creek watershed. The Eighty-Four Mining Company operates Mine No. 84 (formerly known as Somerset Mine#60) in the upper Little Chartiers Creek watershed and discharges under NPDES permit PA0213608. There are seven outlets located within the Little Chartiers Creek watershed that have NPDES permits to discharge metals (aluminum, iron and manganese). The NPDES outlets are shown in Table 4-2 and Figure 4-1.

Table 3-2. Permit limits for Mine No. 84 (NPDES PA0213608)

NPDES ID	Outlet	Receiving Stream	Total Iron (mg/L)			Total Manganese (mg/L)			Total Aluminum (mg/L)		
			Ave[1]	Max[2]	Inst[3]	Ave[1]	Max[2]	Inst[3]	Ave[1]	Max[2]	Inst[3]
PA0213608	004	Trib. Little Chartiers Creek	3.0	6.0	7.0	2.0	4.0	5.0	-	-	-
PA0213608	013	Unt. Little Chartiers Creek	2.2	4.4	5.5	1.4	2.8	3.5	0.8	1.5	1.9
PA0213608	015	Trib. Little Chartiers Creek	3.0	6.0	7.0	2.0	4.0	5.0	1.8	3.6	4.5
PA0213608	016	Unt. Little Chartiers Creek	3.0	6.0	7.0	2.0	4.0	5.0	1.0	2.0	2.5
PA0213608	017	Trib. Little Chartiers Creek	3.0	6.0	7.0	2.0	4.0	5.0	-	-	-
PA0213608	018	Unt. Little Chartiers Creek	3.0	6.0	7.0	2.0	4.0	5.0	2.0	4.0	5.0
PA0213608	020	Unt. Little Chartiers Creek	3.0	6.0	7.0	2.0	4.0	5.0	2.0	4.0	5.0

Source: PADEP
1- Monthly average discharge concentration
2- Daily maximum discharge concentration
3- Instantaneous maximum discharge concentration

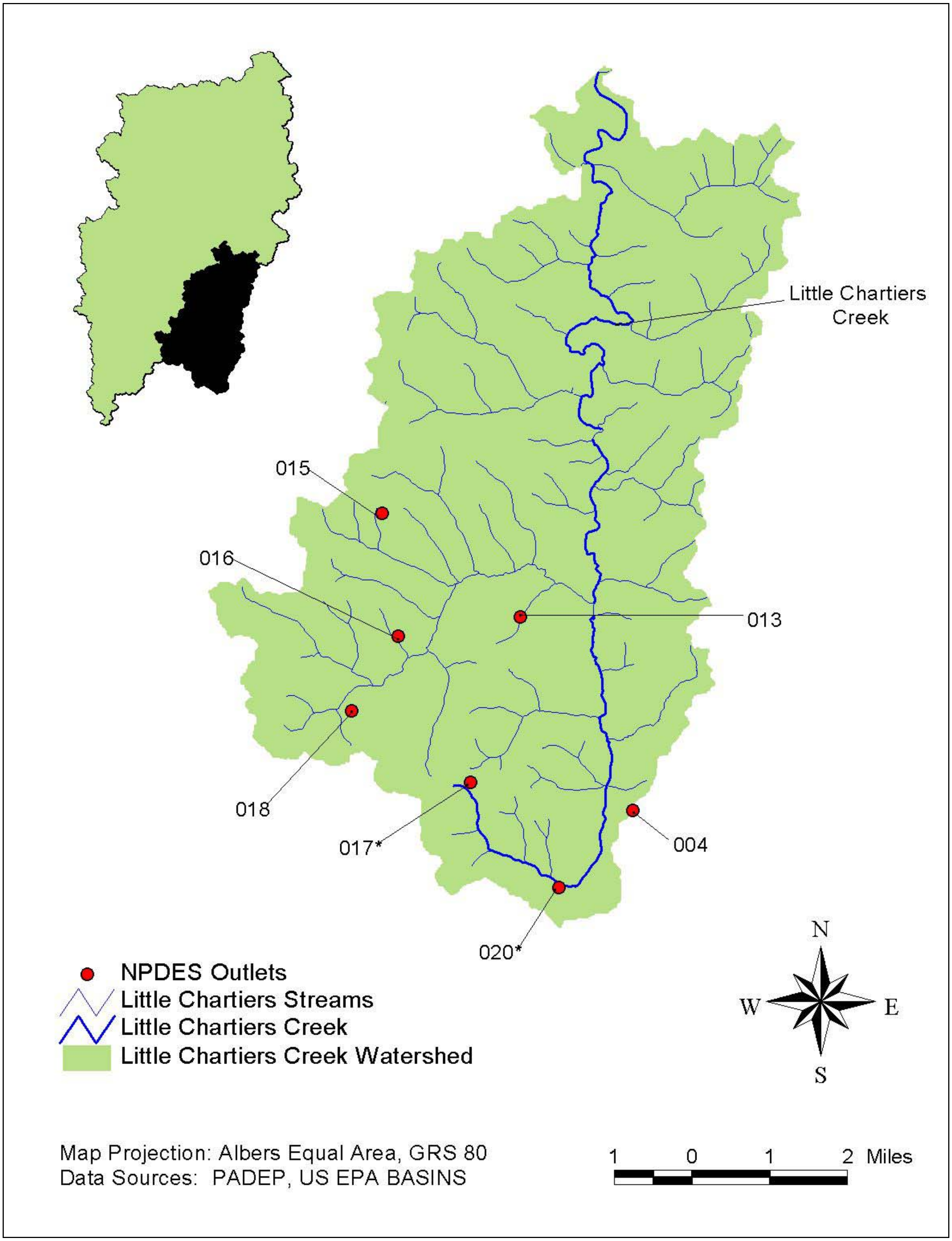


Figure 4-1. Mining-related NPDES locations

4.3 Nonpoint Sources

In addition to abandoned mines and point sources, nonpoint sources also contribute to water quality impairments in the Chartiers Creek watershed. The *Adaptation of WARMF to Calculate TMDL for Chartiers Creek Watershed in Pennsylvania* (Chen et al. 2001) report identified other potential contributing nonpoint sources. Figure 4-2 presents potential nonpoint and point sources in the Chartiers Creek watershed.

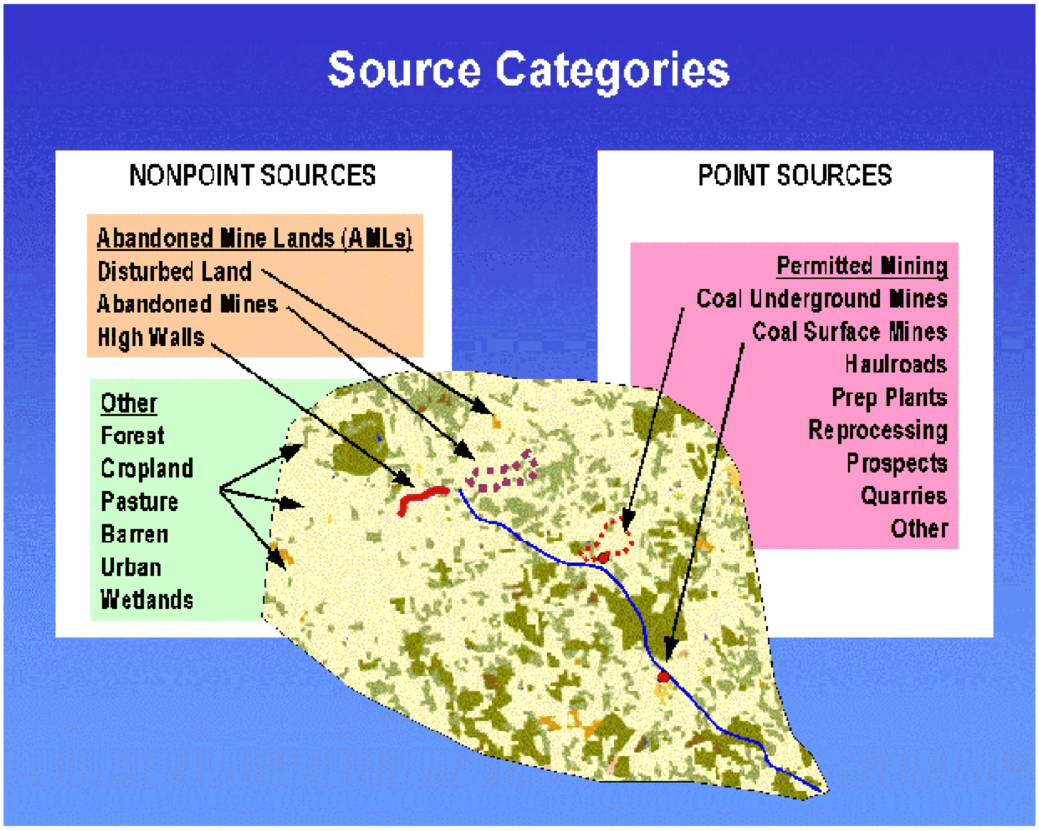


Figure 4-2. Potential sources contributing to impairments in the Chartiers watershed

The land uses in the Chartiers Creek watershed were identified based on the USGS's MRLC land use data (representative of the mid-1990s) (Chen et al. 2001). According to the MRLC land use data, the predominant land uses in the watershed are forestland, agricultural land, and low-intensity residential land, which constitute approximately 49%, 33%, and 15 percent of the watershed area, respectively. The MRLC landuses distribution is shown in Table 3-3 and Figure 3-3. For representation in the watershed modeling process, fourteen MRLC land use categories were reclassified into 10 categories that best describe the watershed conditions and dominant source categories. The 14 original land uses from the MRLC coverage and the ten regrouped land uses are described in Table 3-4.

Table 4-3. MRLC Landuse Distribution

MRLC Landuse Category	Area (acres)	% of total area
Open Water	254.7	0.1
Low Intensity Residential	25988.6	14.6
High Intensity Residential	1154.9	0.7
Commercial/Industrial/Transportation	2650.5	1.5
Quarries/Strip Mines/Gravel Pits	1074.4	0.6
Transitional	623.5	0.4
Deciduous Forest	67838.6	38.0
Evergreen Forest	1184.6	0.7
Mixed Forest	18394.0	10.3
Pasture/Hay	54910.8	30.8
Row Crops	3092.6	1.7
Urban/Recreations Grasses	1368.2	0.8
Woody Wetlands	19.4	0.1
Emergent Herbaceous Wetland	27.7	0.1
Total	**178582.5**	**100.0**

Table 4-4. Modeled landuse categories

Modeled Landuse Category	MRLC Landuse Category
Water	Open Water
Residential (LID)	Low Intensity Residential
	Urban/Recreational Grasses
Commercial-Industrial(HID)	High Intensity Residential
	Commercial-Industrial-Transportation
Strip mines	Quarries-Mines-Pits
Deciduous Forest	Deciduous Forest
Evergreen Forest	Evergreen Forest
Mixed Forest	Mixed Forest
	Woody Wetlands
Pasture	Pasture/Hay
	Emergent Herbaceous Wetland
Row Crops	Row Crops
Barren	Transitional

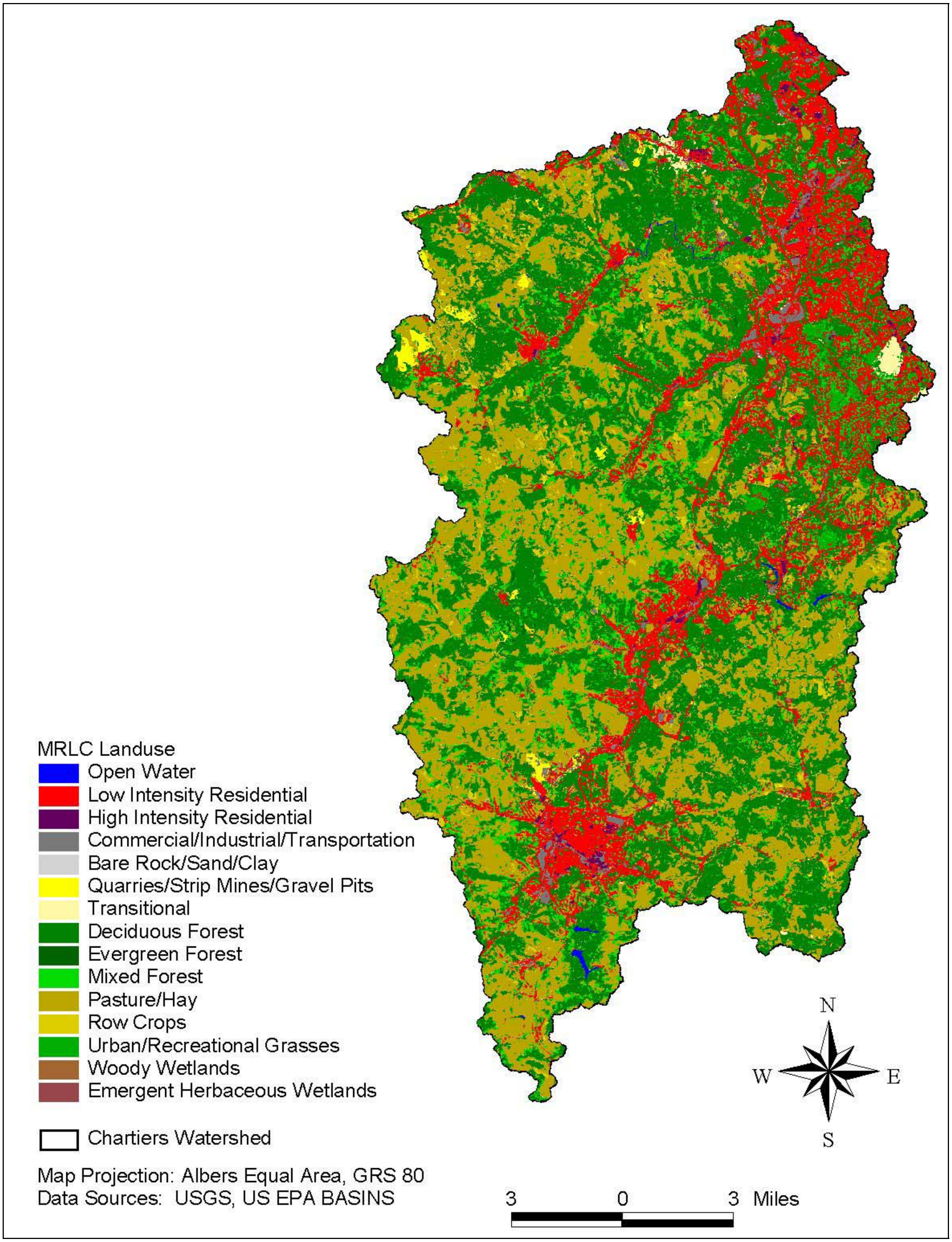


Figure 3-3. MRLC Landuse distribution in the Chartiers Creek watershed

5.0 Technical Approach

Establishing the relationship or link between the in-stream water quality targets and source loadings is a critical component of TMDL development. It allows for 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 to flow and loading conditions. The objective of this section is to present the approach taken to develop the linkage between sources and in-stream response for TMDL development in the Chartiers Creek watershed.

5.1 Watershed Analysis Risk Management Framework (WARMF) Overview

WARMF was used to develop TMDLs for the Chartiers Creek watershed. WARMF is a decision support system designed for a watershed approach to TMDL calculation (Herr et al., 2001, Systech, 2001). The system consists of engineering, data, consensus, TMDL, and knowledge modules integrated into a Windows-based graphical user interface (GUI).

WARMF contains catchment, river, and reservoir models that use meteorology, air quality, managed flow, observed hydrology and water quality, and point source data to support TMDL development on a subwatershed basis. Refer to *Users' Guide to WARMF* (Herr et al., 2001) for a more detailed discussion of simulated processes and model parameters.

5.2 Model Configuration

The *Adaptation of WARMF to Calculate TMDL for Chartiers Creek Watershed in Pennsylvania* (Chen et al. 2001) describes the modeling approach for the Chartiers watershed in detail. Configuration of the WARMF involved subdivision of the Chartiers watershed into modeling units and continuous simulation of flow and water quality for these units using meteorological, land use, stream, mining, and pollutant-specific data. Pollutants that were simulated include metals, dissolved and suspended solids, carbon, nutrients, fecal coliform, dissolved oxygen, alkalinity, and pH.

5.3 Model Calibration

After the model was configured, calibration was performed at multiple locations throughout the Chartiers watershed. Calibration refers to the adjustment or fine-tuning of modeling parameters to reproduce observations. Model calibration focused on two main areas: hydrology and water quality. A description and results of the hydrology and water quality calibration are presented on pages 4-1 through 4-35 in the report *Adaptation of WARMF to Calculate TMDL for Chartiers Creek Watershed in Pennsylvania* (Chen et al. 2001).

6.0 Allocation Analysis

A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards. TMDLs can be expressed in terms of mass per time or by other appropriate measures. TMDLs are comprised of the sum of individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving water body. Conceptually, this definition is denoted by the equation:

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

In order to develop aluminum, iron, and manganese TMDLs for each of the waterbodies in the Chartiers watershed listed on the 1996 and 1998 Pennsylvania Section 303(d) lists, the following approach was taken:

- Define TMDL Endpoints
- Simulate Existing Conditions
- Estimate Point Source Contributions
- Determine the TMDL Allocations

6.1 TMDL Endpoints

TMDL endpoints represent the in-stream water quality targets used in quantifying TMDLs and their individual components. Different TMDL endpoints are necessary for each impairment type (i.e., aluminum, iron, and manganese). Pennsylvania's numeric water quality criteria for aluminum, iron, and manganese (identified in Section 2) and an explicit Margin of Safety (MOS) were used to identify endpoints for TMDL development.

6.1.1 Aluminum, Iron, and Manganese

The TMDL with the MOS endpoint for aluminum was selected as 712.5 ug/L (based on the 750 ug/L criteria for Aquatic Life minus a 5% MOS). The TMDL with the MOS for iron was selected 1.425 mg/L (based on the 1.5 mg/L criteria for Aquatic Life minus a 5% MOS). The TMDL with the MOS for manganese was selected as 0.95 mg/L (based on the 1.0 mg/L criteria for Public Water Supply minus a 5% MOS).

Components of the TMDLs for aluminum, iron and manganese are presented in terms of mass per time in this report.

6.1.2 Margin of Safety

An implicit MOS was included in TMDL development through application of a dynamic model for simulating daily loading over a wide range of hydrologic and environmental conditions, and through the use of conservative assumptions in model calibration and scenario development. In addition to this implicit margin of safety, a 5% explicit MOS was used to account for uncertainty in the monitoring data. Long-term water quality monitoring data were used for model calibration, however these data were not continuous time series and may not have captured the full range of in-stream conditions that occurred during the simulation period.

6.2 Existing Conditions

The calibrated model provided the basis for performing the allocation analysis. The first step in this analysis involved simulation of existing conditions. Existing conditions represent current conditions in the watershed.

The calibrated model was run for the period September 1, 1993 through August 30, 1999 to represent existing conditions or current conditions in the watershed. This was the starting point for the allocation analysis. Predicted in-stream concentrations of aluminum, iron, and manganese, for the impaired waterbodies in the Chartiers Creek watershed were compared directly to the TMDL endpoints. This comparison allowed evaluation of the expected magnitude and frequency of exceedances under a range of hydrologic and environmental conditions, including dry periods, wet periods, and average periods.

6.3 TMDL Allocations

A top-down methodology was followed to develop the TMDLs and allocate loads to sources. Impaired headwaters were first analyzed, because their impact frequently had a profound effect on down-stream water quality. The WARMF TMDL module was run in order to estimate the TMDL for each impaired segment. This module is described in *User's Guide to WARMF* (Herr et al., 2001).

Each TMDL represents the total load from all up-stream sources that are predicted to attain the water quality criteria for the entire modeling period (1993-1999). The TMDL endpoints were assigned the values as identified in Section 6.1 when running the TMDL module. When appropriate, the averaging period was considered during these assessments (*e.g.*, a 30-day average was used for total iron).

After running the TMDL module for headwaters, the module was then run for subsequent down-stream impaired waters. Therefore, when TMDLs were developed for down-stream impaired waterbodies, up-stream contributions that impact up-stream impaired waterbodies were represented under allocation conditions. Thus, impaired up-stream waterbodies were assumed to meet water quality criteria prior to calculation of TMDLs for down-stream waterbodies. Using this method, contributions from all sources were weighted equitably. In some situations, reductions in sources impacting impaired headwaters ultimately led to improvements far down-stream. This effectually decreased required loading reductions from many potential down-stream sources.

6.3.1 TMDLs for Small Unnamed Tributaries

A number of small impaired tributaries listed on Pennsylvania's Section 303(d) list were not explicitly represented in the WARMF model, but as a part of a larger subwatershed. As a result, the larger subwatershed was further delineated to determine the drainage areas for each tributary. The tributaries and their larger subwatersheds are shown in Table 6-1. In order to develop TMDLs for the small unnamed tributaries, the WARMF model was run for existing conditions (9/1/1993-8/30/1999) for the larger subwatershed. Similarly, the WARMF TMDL module was run in order to estimate the TMDL for the larger subwatershed. Existing and TMDL conditions were for the small unnamed tributaries were determined by area-weighing the resulting loadings from the larger subwatershed.

Table 6-1. Section 303(d) listed streams not explicitly represented in the WARMF model

PA Stream Code	Stream Name	Delineated Area (Acrea)	WARMF Subwatershed ID	Area (acres)
37001	Unnamed Tributary Little Chartiers Creek	815.2	736	1742.7
37002	Unnamed Tributary Little Chartiers Creek	157.3	736	1742.7
37003	Unnamed Tributary Little Chartiers Creek	171.7	736	1742.7
37004	Unnamed Tributary Little Chartiers Creek	417.6	756	1814.7
37005	Unnamed Tributary Little Chartiers Creek	198.7	756	1814.7
37006	Unnamed Tributary Little Chartiers Creek	160.4	756	1814.7
37007	Unnamed Tributary Little Chartiers Creek	175.1	756	1814.7
37008	Unnamed Tributary Little Chartiers Creek	86.4	756	1814.7
37009	Unnamed Tributary Little Chartiers Creek	222.4	756	1814.7
63869	Unnamed Tributary Chartiers Creek	110.4	988	1734.5

6.3.2 Wasteload Allocations (WLAs)

As stated in Section 4, there is one non-mining point source in the Chartiers Creek watershed that is permitted to discharge aluminum, iron, and or manganese. The NPDES permit (PA0002739) under which Allegheny Ludlum discharges does not have permit limits assigned for metals (aluminum, iron, and manganese), but has “monitor only” requirement for iron for one outlet (005) discharging to Chartiers Run. The WLA for NPDES permit PA0002739 was computed by the WARMF model using discharge monitoring record data from 1996-1999.

The WARMF configuration of the Chartiers Creek watershed does not explicitly simulate contributions from individual permitted mining sources in the watershed, therefore contributions from applicable permitted sources were estimated based on the available information on permitted facilities. This was required to support allocation to individual WLAs as required by TMDL regulations.

Because flow contributions from most permitted mining facilities in the watershed are directly related to hydrologic processes, it is assumed that their contributions will follow a similar pattern as the overall predicted watershed flow. The flow from the permitted mine was estimated as a percentage of its corresponding watershed’s flow. The percentage was based on the ratio of the mine’s area (based on GIS coverages provided by PADEP) to the area of the watershed in which it is located. WLAs were computed by using the estimated flow and the monthly average permit limits for each outlet (shown in Table 3-2). As shown in Table 3-2, outlets 004 and 017 do not have permit limits for aluminum, while the remaining five outlets have a monthly average limit of 2.0 mg/L. For consistency, the aluminum monthly average permit limit for outlets 004 and 017 was assumed to be 2.0 mg/L. For TMDL purposes these point sources are assumed to be compliant with water quality criteria.

Tables 6-2 through 6-4 present the sum of the WLAs for each of the 25 impaired waterbodies in the Chartiers watershed. The WLAs for aluminum, iron and manganese are presented as annual loads, in terms of pounds per year. Tables 6-2 through 6-4 also present the sum of the WLAs within the major tributary watersheds (Mouth of Robinson Run, Mouth of Little Chartiers Creek, and Chartiers Run). Table 6-5 presents the annual load by individual facility (for aluminum, iron and manganese). Loadings were derived by comparing continuous model simulation (on a daily time step) over a period of several years to meet TMDL endpoints, which allowed for seasonal hydrologic and source loading variability to be considered. For this reason, the loads are presented on an annual basis (as an average annual load).

6.3.3 Load Allocations (LAs)

Load allocations (LAs) were made as gross allotments including a combination of abandoned mine land, rural, and urban land uses.

Each of the 25 waterbody’s LAs for aluminum, iron, and manganese is presented in Tables 6-2 through 6-4. The LAs are presented as annual loads, in terms of pounds per year. Loadings were derived by comparing continuous model simulation (on a daily time step) over a period of several years to meet TMDL endpoints, which allowed for seasonal hydrologic and source loading variability to be considered. For this reason, the loads are presented on an annual basis (as an average annual load). In some cases, additional nonpoint source reductions, other than from listed watersheds were required to be reduced in order to meet water quality criteria downstream (Chartiers Creek mainstem). Therefore, Tables 6-2 through 6-4 also present the sum of the LAs within the major tributary watersheds (Mouth of Robinson Run, Mouth of Little Chartiers Creek, and Chartiers Run). Figures 6-1 through 6-3 show where such reductions are required to maintain compliance with water quality criteria in the Chartiers Creek mainstem.

Table 6-1. TMDLs, load, and waste load allocations for aluminum

PA Stream Code	Stream Name	LA Total Aluminum (lb/yr)	WLA Total Aluminum (lb/yr)	MOS Total Aluminum (lb/yr)	TMDL Total Aluminum (lb/yr)	% Reduction
36777	Mouth of Chartiers Creek	67,334	2,766	3,689	73,790	50.7%
36786	Campbells Run	1,277	0	67	1,344	0.0%
36787	Unt Campbells Run	484	0	25	509	0.0%
36794	Mouth of Robinson Run	15,820	0	833	16,652	87.2%
63294	North Branch Robinson Run	1,751	0	92	1,843	95.9%
63295	UNT N. Br. Robinson Run	343	0	18	361	95.2%
63300	Half Crown Run	575	0	30	605	95.2%
36827	Mouth of Millers Run	15,595	0	821	16,415	0.0%
36943	Mouth of Little Chartiers Creek	25,089	2,766	1,466	29,321	0.0%
37015	UNT Little Chartiers Creek	179	0	9	188	0.0%
37001	UNT Little Chartiers Creek	1,573	0	83	1,656	0.0%
37002	UNT Little Chartiers Creek	304	0	16	319	0.0%
37003	UNT Little Chartiers Creek	330	25	19	374	0.0%
36989	UNT Little Chartiers Creek	6,251	659	364	7,274	0.0%
37004	UNT Little Chartiers Creek	289	0	15	304	0.0%
37005	UNT Little Chartiers Creek	137	0	7	145	0.0%
37006	UNT Little Chartiers Creek	111	0	6	117	0.0%
37007	UNT Little Chartiers Creek	121	0	6	127	0.0%
37008	UNT Little Chartiers Creek	60	0	3	63	0.0%
37009	UNT Little Chartiers Creek	154	0	8	162	0.0%
37043	Mouth Chartiers Run	5,588	0	294	5,882	0.0%
37050	UNT Chartiers Run	1,916	0	101	2,017	0.0%
37051	UNT Chartiers Run	84	0	4	89	0.0%
37055	UNT Chartiers Run	1,942	0	102	2,044	0.0%
37052	UNT Chartiers Run	665	0	35	700	0.0%
63869	UNT Chartiers Creek	1,238	0	65	1,303	0.0%
37135	UNT Chartiers Creek	1,811	0	95	1,907	0.0%
37139	UNT Chartiers Creek	752	0	40	792	0.0%

Note: Watershed maps that indicate the impaired waterbodies are located in Appendix A

Table 6-2. TMDLs, load, and waste load allocations for iron

PA Stream Code	Stream Name	LA Total Iron (lb/yr)	WLA Total Iron (lb/yr)	MOS Total Iron (lb/yr)	TMDL Total Iron (lb/yr)	% Reduction
36777	Mouth of Chartiers Creek	210,995	4,581	11,346	226,922	2.1%
36786	Campbells Run	12,460	0	656	13,116	0.0%
36787	Unt Campbells Run	3,845	0	202	4,048	0.0%
36794	Mouth Robinson Run	39,435	0	2,076	41,510	67.6%
63294	North Branch Robinson Run	10,852	0	571	11,423	70.9%
63295	UNT N. Br. Robinson Run	1,437	0	76	1,513	68.6%
63300	Half Crown Run	2,537	0	134	2,671	64.5%
36827	Mouth of Millers Run	8,409	0	443	8,851	0.0%
36943	Mouth of Little Chartiers Creek	844	4,517	282	5,643	0.0%
37015	UNT Little Chartiers Creek	1	0	< 1	1	37.3%
37001	UNT Little Chartiers Creek	17	0	1	18	0.0%
37002	UNT Little Chartiers Creek	3	0	< 1	3	0.0%
37003	UNT Little Chartiers Creek	< 1	75	4	79	0.0%
36989	UNT Little Chartiers Creek	276	1,318	84	1,678	0.0%
37004	UNT Little Chartiers Creek	16	0	1	17	0.0%
37005	UNT Little Chartiers Creek	7	0	< 1	8	0.0%
37006	UNT Little Chartiers Creek	6	0	< 1	6	0.0%
37007	UNT Little Chartiers Creek	7	0	< 1	7	0.0%
37008	UNT Little Chartiers Creek	3	0	< 1	3	0.0%
37009	UNT Little Chartiers Creek	8	0	< 1	9	0.0%
37043	Mouth of Chartiers Run	28,223	64	1,572	29,859	64.6%
37050	UNT Chartiers Run	22,885	0	1,271	24,157	51.7%
37051	UNT Chartiers Run	310	0	17	327	74.8%
37055	UNT Chartiers Run	4,454	0	247	4,701	74.1%
37052	UNT Chartiers Run	485	0	27	512	74.8%
63869	UNT Chartiers Creek	329	0	18	348	5.0%
37135	UNT Chartiers Creek	45	0	2	47	0.0%
37139	UNT Chartiers Creek	18	0	1	19	0.0%

Note: Watershed maps that indicate the impaired waterbodies are located in Appendix A

Table 6-3. TMDLs, load, and waste load allocations for manganese

PA Stream Code	Stream Name	LA Total Manganese (lb/yr)	WLA Total Manganese (lb/yr)	MOS Total Manganese (lb/yr)	TMDL Total Manganese (lb/yr)	% Reduction
36777	Mouth of Chartiers Creek	190,386	2,994	10,178	203,558	81.1%
36786	Campbells Run	7,224	0	380	7,604	37.0%
36787	Unt Campbells Run	2,637	0	139	2,776	4.7%
36794	Mouth of Robinson Run	63,661	0	3,351	67,012	77.7%
63294	North Branch Robinson Run	17,501	0	921	18,422	81.7%
63295	UNT N. Br. Robinson Run	1,705	0	90	1,794	86.1%
63300	Half Crown Run	2,782	0	146	2,928	87.4%
36827	Outh of Millers Run	5,749	0	303	6,051	54.3%
36943	Mouth of Little Chartiers Creek	2,029	2,994	264	5,288	0.0%
37015	UNT Little Chartiers Creek	5	0	< 1	5	0.0%
37001	UNT Little Chartiers Creek	19	0	1	20	0.0%
37002	UNT Little Chartiers Creek	4	0	< 1	4	0.0%
37003	UNT Little Chartiers Creek	1	50	3	54	0.0%
36989	UNT Little Chartiers Creek	312	862	62	1,235	0.0%
37004	UNT Little Chartiers Creek	5	0	< 1	5	0.0%
37005	UNT Little Chartiers Creek	2	0	< 1	2	0.0%
37006	UNT Little Chartiers Creek	2	0	< 1	2	0.0%
37007	UNT Little Chartiers Creek	2	0	< 1	2	0.0%
37008	UNT Little Chartiers Creek	1	0	< 1	1	0.0%
37009	UNT Little Chartiers Creek	3	0	< 1	3	0.0%
37043	Mouth of Chartiers Run	32,098	0	1,689	33,787	94.1%
37050	UNT Chartiers Run	9,164	0	482	9,647	93.5%
37051	UNT Chartiers Run	422	0	22	444	95.8%
37055	UNT Chartiers Run	6,391	0	336	6,727	94.5%
37052	UNT Chartiers Run	707	0	37	744	95.0%
63869	UNT Chartiers Creek	297	0	16	312	62.4%
37135	UNT Chartiers Creek	15	0	1	16	95.2%
37139	UNT Chartiers Creek	27	0	1	28	80.7%

Note: Watershed maps that indicate the impaired waterbodies are located in Appendix A

Table 6-5. Wasteload Allocations for each facility in the Chartiers Creek watershed.

NPDES Permit ID	Receiving Stream	WLA Total Aluminum (lb/yr)	WLA Total Iron (lb/yr)	WLA Total Manganese (lb/yr)
PA0213608	Tributaries of Little Chartiers Creek	2,766	4,517	2,994
PA0002739	Chartiers Run	-	64	-

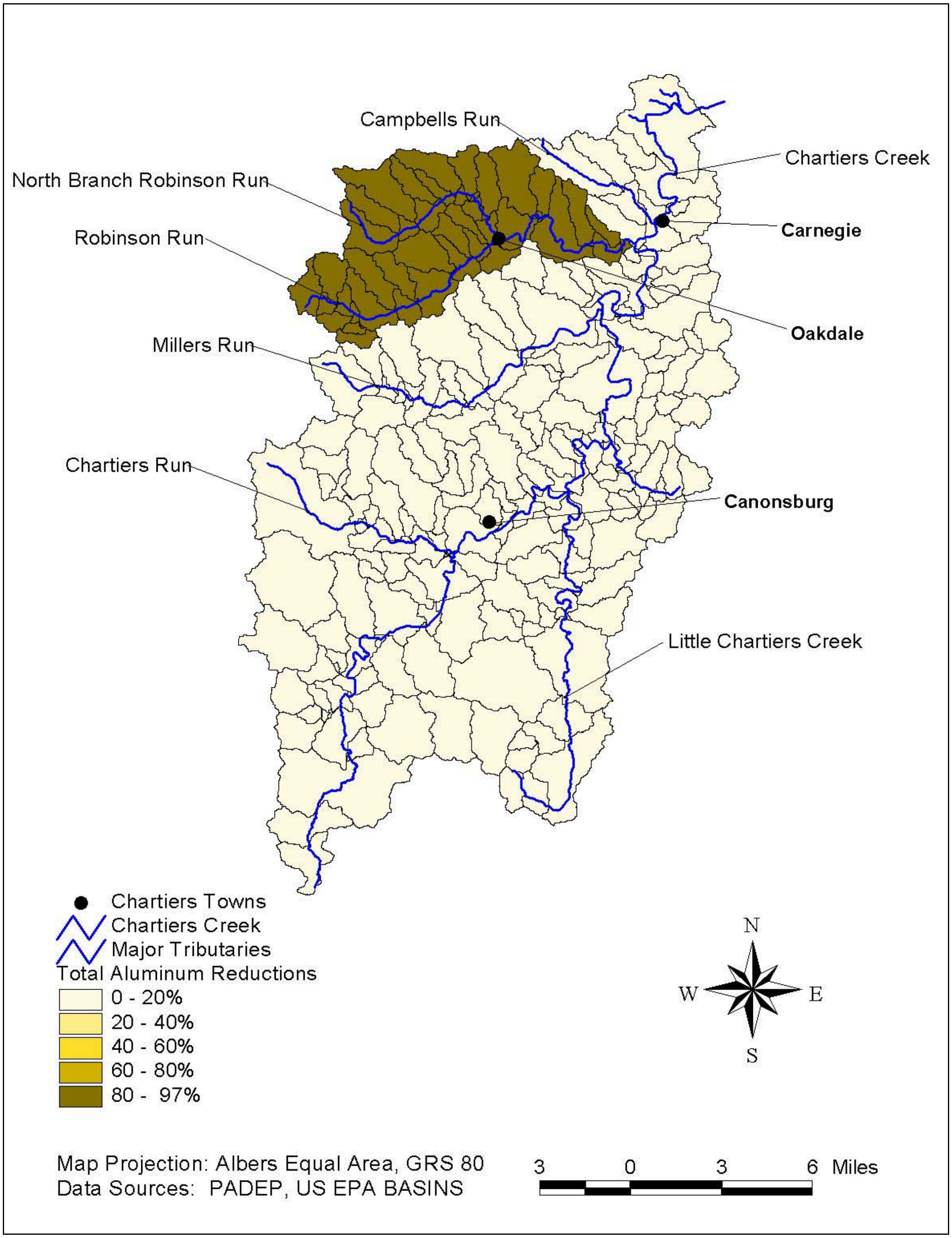


Figure 6-1. Total aluminum reductions for the Chartiers Creek watershed

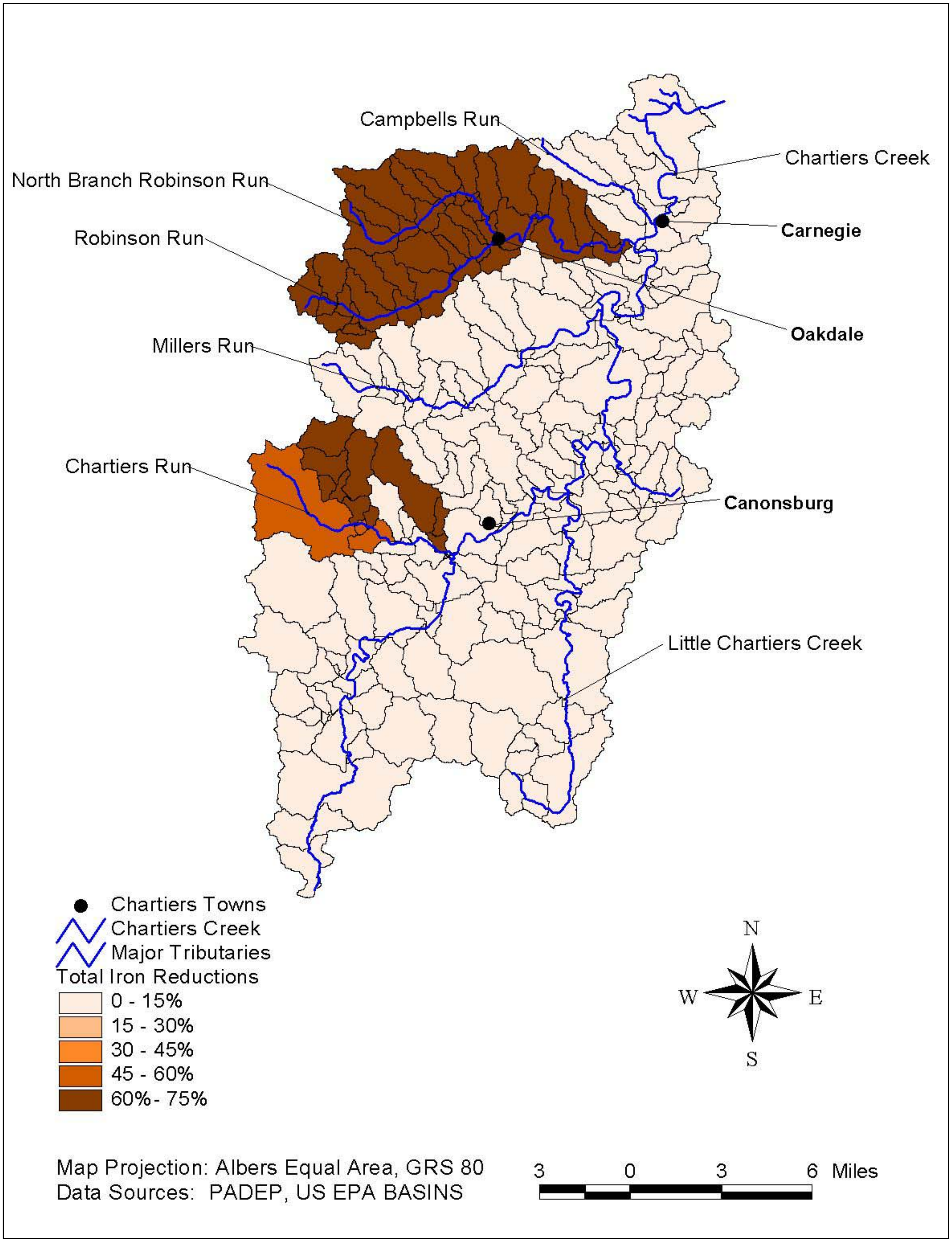


Figure 6-2. Total iron reductions for the Chartiers Creek watershed

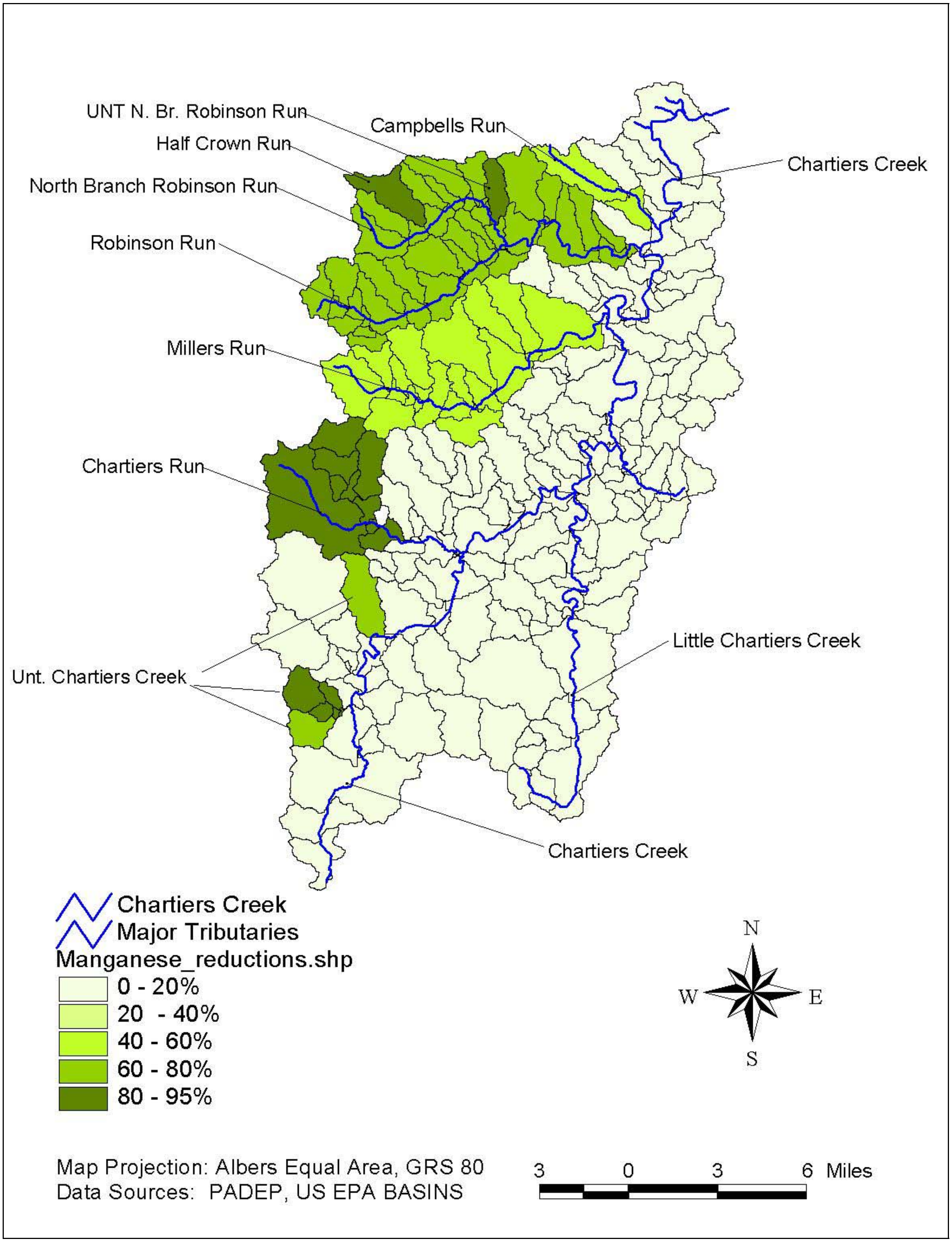


Figure 6-3. Total mangansese reductions for the Chartiers Creek watershed

6.3.4 Seasonal Variation

A TMDL must consider seasonal variation in the derivation of the allocation. For the Chartiers watershed metals TMDLs, seasonal variation was considered in the formulation of the modeling analysis. By using continuous simulation modeling over a period of several years, seasonal hydrologic and source loading variability was considered. The metals concentrations simulated on a daily time step by the model were compared to the TMDL endpoints. An allocation which meets these endpoints throughout the year was developed. Water quality criteria for aluminum, iron and manganese does not vary seasonally, however it must be met throughout the year.

7.0 Recommendations

Projects to Address the Affects of Abandoned Mines

There are several projects within the Chartiers Creek Watershed that address the affects of abandoned coal mines. The goal of these projects is to improve the water quality in the Chartiers Creek Watershed.

In 1995 the Scott Conservancy and Chartiers Valley High School were awarded an EPA 319 Grant for the Scrubgrass Run Project. The Scrubgrass Run discharge is an alkaline-iron discharge. The average iron concentration is 70 mg/l with average flows between 250-300 gpm. An approximate 1.0-acre passive treatment system was constructed. The Scrubgrass Treatment System removed approximately 20,000 pounds of iron per year or approximately 50 pounds per day when it was first constructed.

In September 1998, the Scott Conservancy was awarded an EPA 104(b)(3) grant to upgrade the Scrubgrass Treatment System. A Maelstrom Oxidizer was installed in order to increase the efficiency of the treatment and precipitate the iron oxides and hydroxides more rapidly. With this new system installed, the dissolved iron averaged 80.5 mg/l in the influent and 37.3 mg/l in the effluent—a 54% reduction. When the oxidizer was first installed the iron removal rate was increased to about 101 pounds per day or about a 100% increase in efficiency. The project was completed in September 2000.

On November 1, 2000, the Scott Conservancy, Inc., was awarded an EPA 319 Grant for remediation and improvement of the Scrubgrass Run AMD Treatment System. The project is for the removal of accumulated iron sludge, the deepening and enlargement of the treatment ponds, and to incorporate features that will facilitate future iron sludge removal. Completion date for this project is September 30, 2003.

On October 31, 2001, the Borough of Green Tree was awarded a Growing Greener Grant to develop a comprehensive restoration and protection plan for Whiskey Run. The plan will contain restoration and protection recommendations for AMD discharges, stream bank stabilization and erosion control, and repair of a sanitary sewer line, if found to be a problem. The Grant was completed on June 30, 2002. The final report submittal is pending.

On September 15, 2001, the Chartiers Nature Conservancy was awarded a Growing Greener Grant to conduct an evaluation of mine discharges in the Lower Chartiers Creek Watershed. Substantial mine discharges will be identified, mapped, and characterized by measuring flows and chemistry on a monthly basis over a 12-month period. Detailed mine maps will be obtained and digitized into a GIS format. The digitized database will be used to model the mine water hydrology of the watershed. The data and information will be used to develop treatment recommendations for the restoration of the Chartiers Creek Watershed. Currently eight major discharges are being studied: Presto Sygan (Thoms Run), Gladden (Millers Run), Coal Run, McLaughlin Run, Woodville (Chartiers Creek Back Channel), Scrubgrass Run, Hope Hollow (Georges Run), and Whiskey Run. Project completion date is June 30, 2003.

On August 7, 2002, the Allegheny Land Trust was awarded a Growing Greener Grant for the design of a passive treatment system to treat the Wingfield Pines discharge. The mine discharge is alkaline with an average iron concentration of 15 mg/l. The flow averages between 1,500-2,000 gpm. Treatment of this discharge should eliminate approximately 46 tons of iron loading per year. The grant is scheduled to terminate on June 30, 2004.

8.0 Public Participation

A notice of availability for comments on the draft Brush Run watershed TMDLs was published in the PA Bulletin and on PA DEP's web page. In addition, a public meeting was held on January 15, 2003 at the Chartiers Valley High School, Bridgeville, PA to address any outstanding concerns regarding the draft TMDLs. A 60-day period (ending on February 15, 2003) was provided for the submittal of comments.

Notice of final TMDL approvals will be posted on PA DEP's website.

References

Chen, C.W., C. Loeb, and J. Herr. 2001. *Adaptation of WARMF to Calculate TMDL for Chartiers Creek Watershed in Pennsylvania*.

Evangelou, V.P. 1998. Environmental Soil and Water Chemistry. John Wiley, New York.

Herr, J. . Weintraub and C.W. Chen. 2001. User's Guide to WARMF (Documentation of, L Graphical User Interface).

Stumm and Morgan. 1996. Aquatic Chemistry. John Wiley, New York.

Systech Engineering, Inc. 2001. Watershed Analysis Risk Management Framework: A Decision Support System for Watershed Approach and TMDL Calculation. Palo Alto, CA.

USEPA. 1998. Water Quality Planning and Management (40 CFR 130).

9.0 Appendix A

Streams Listed on Pennsylvania’s 1998 Section 303(d)

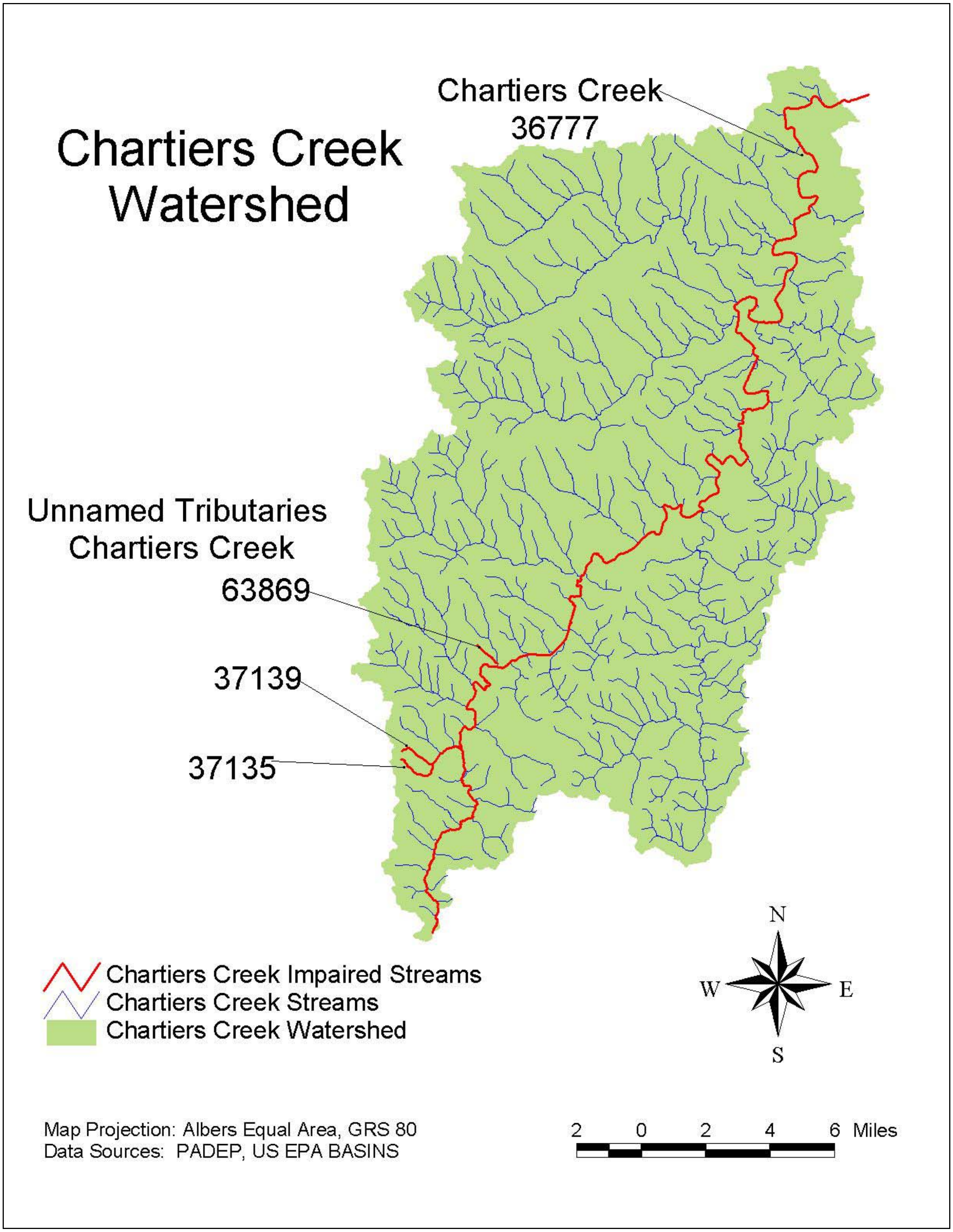


Figure A-1. Chartiers Creek Watershed

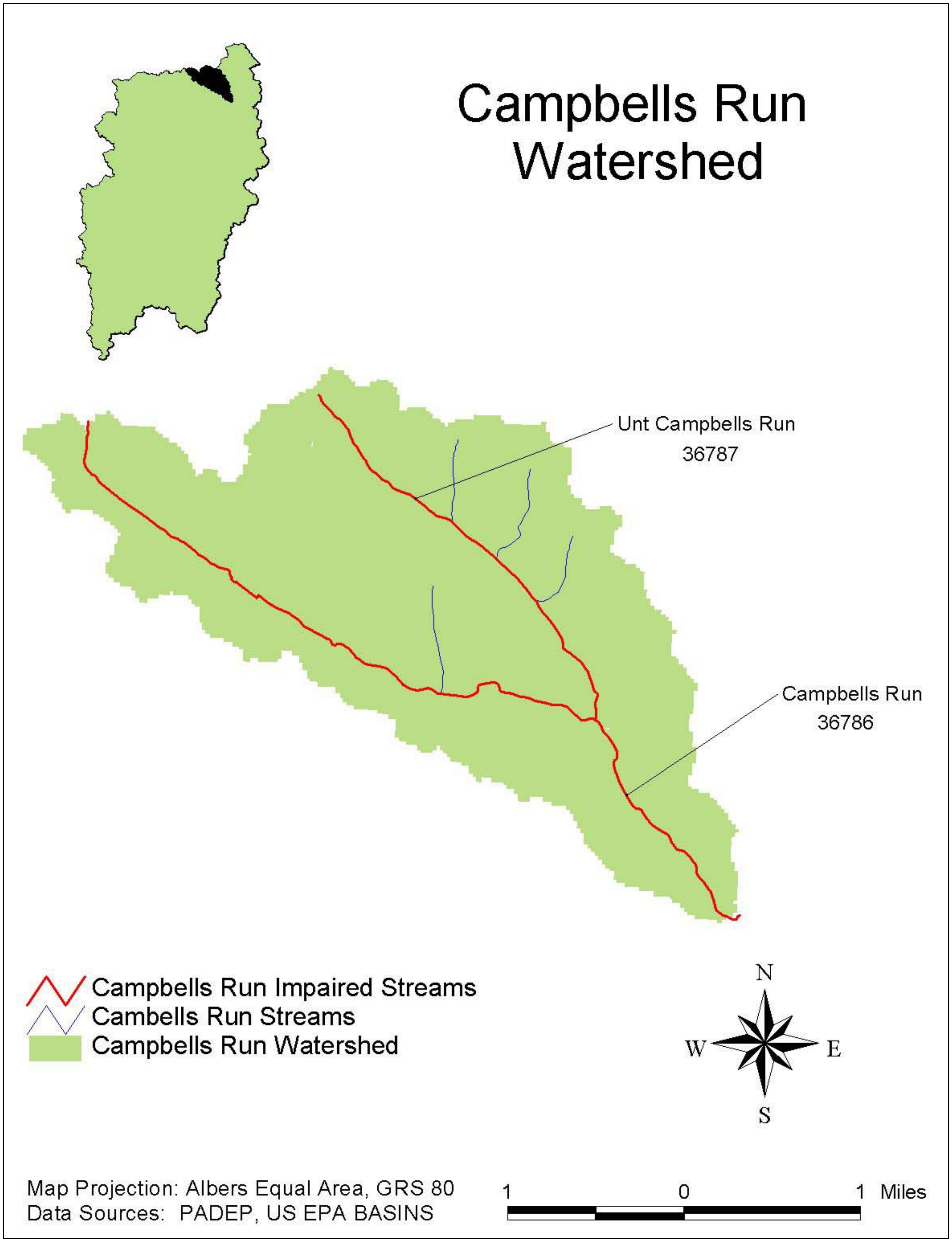


Figure A-2. Campbells Run Watershed

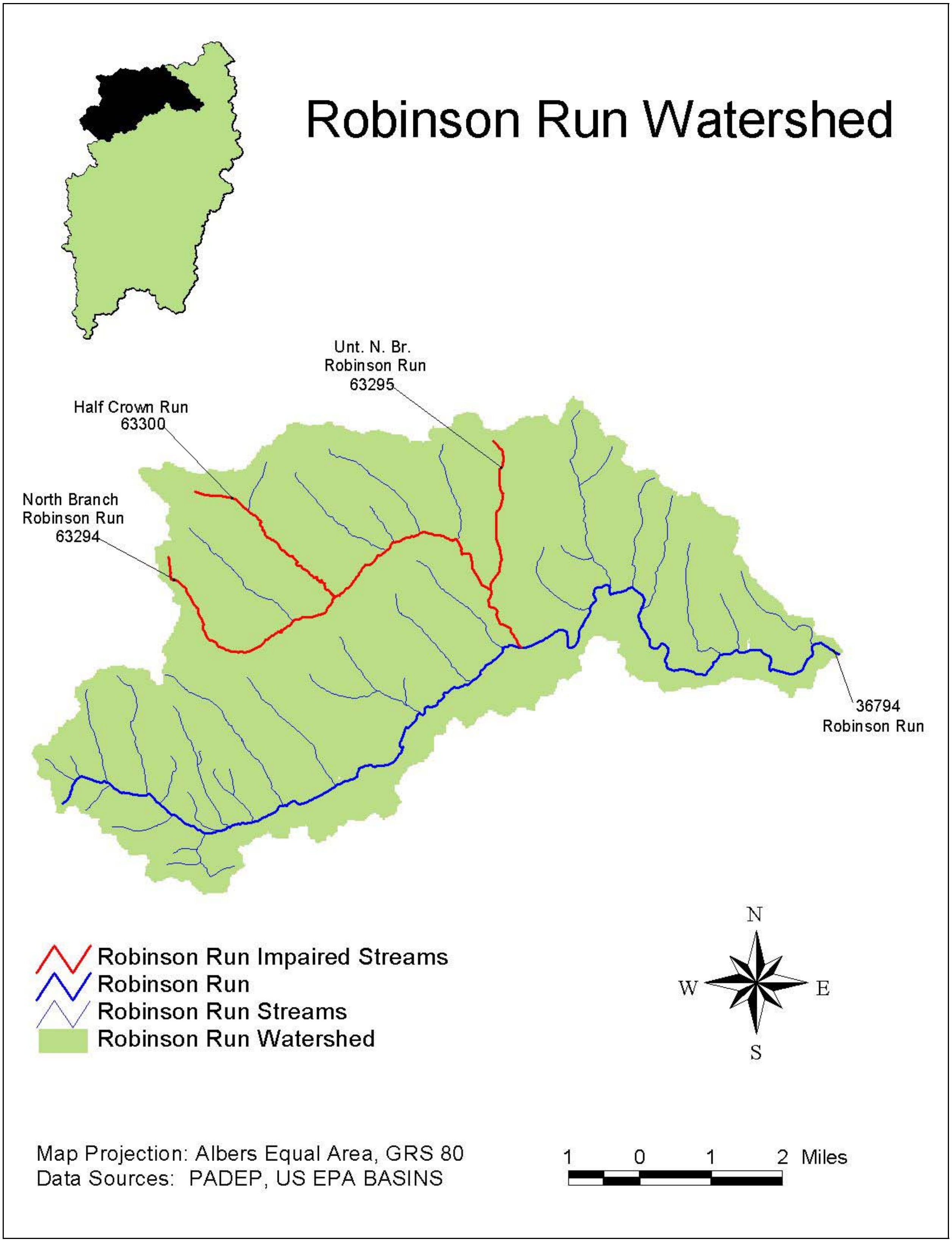


Figure A-3. Robinson Run Watershed

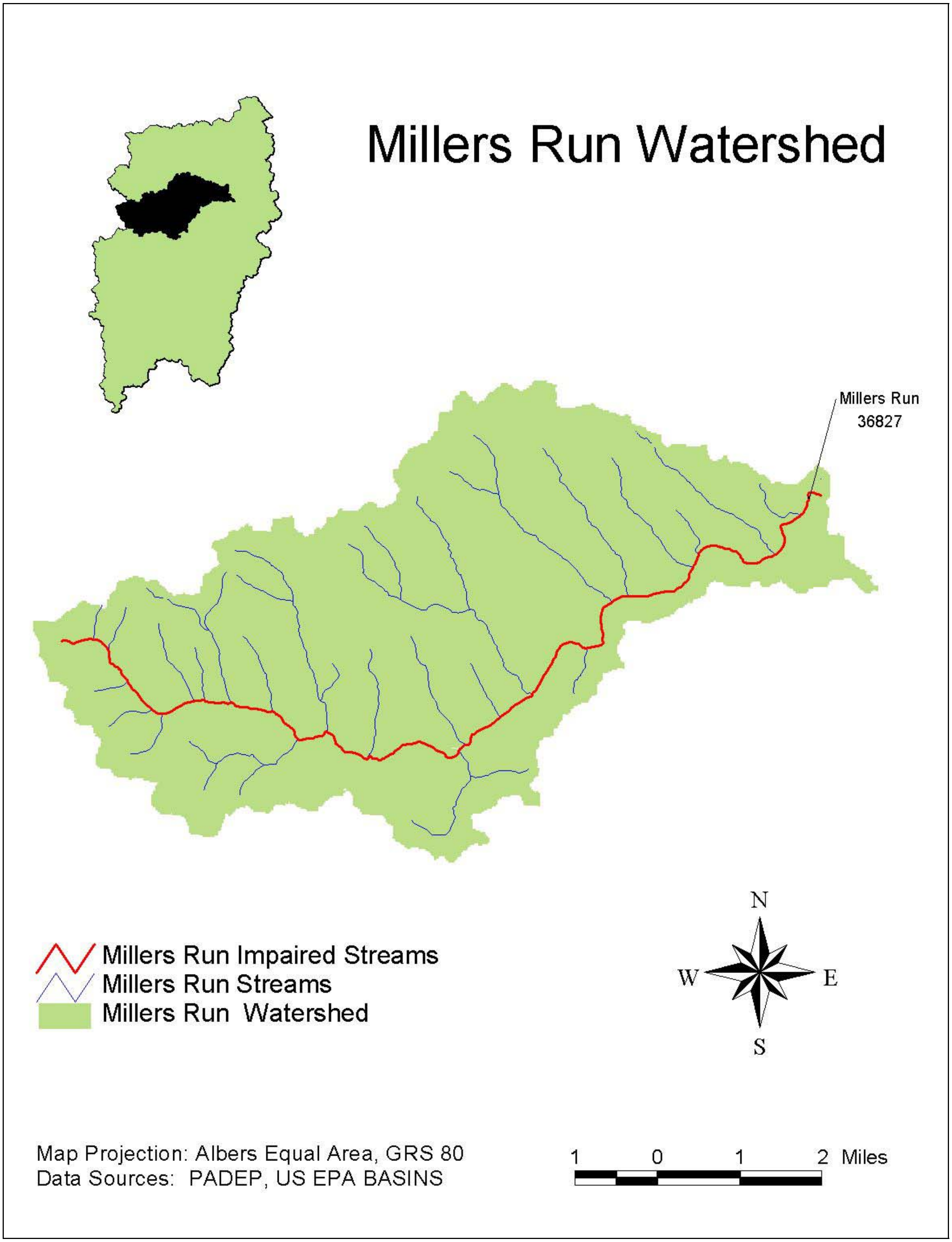


Figure A-4. Millers Run Watershed

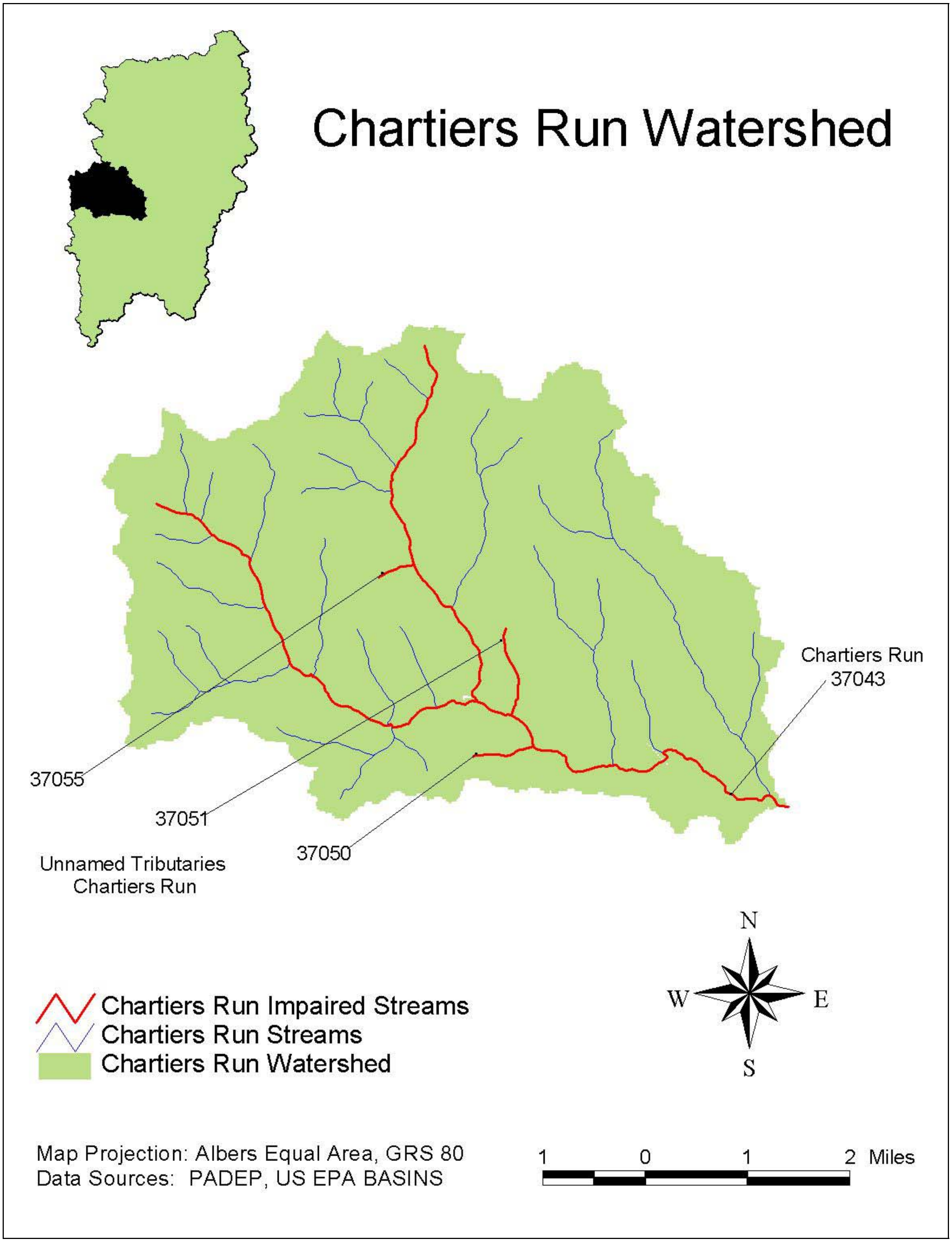


Figure A-5. Chartiers Run Watershed

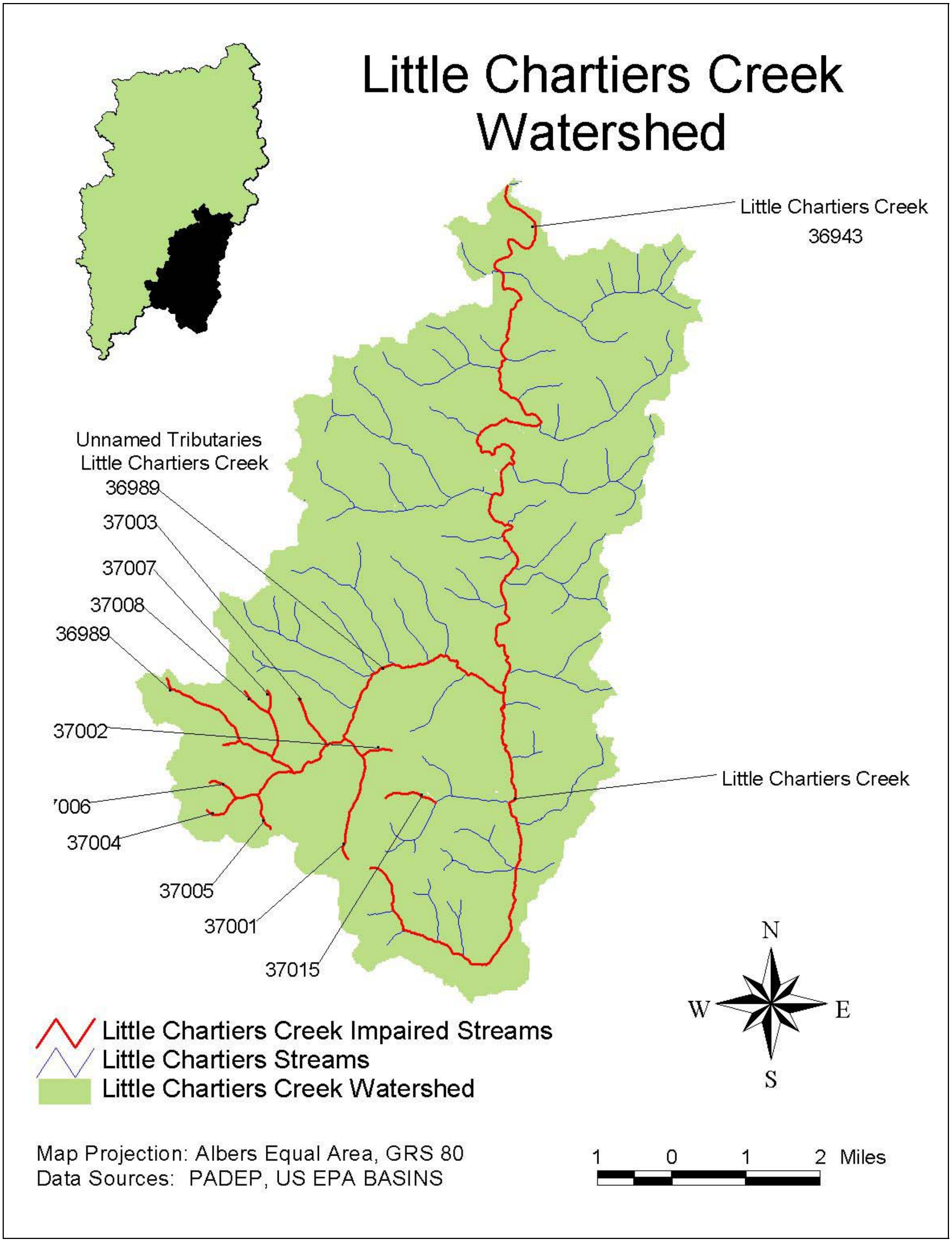


Figure A-6. Little Chartiers Watershed

10.0 Appendix B

AMD Methodology, The pH Method, And Surface Mining Control and Reclamation Act

AMD Methodology

Two approaches are used for the TMDL analysis of AMD-affected stream segments. Both of these approaches use the same statistical method for determining the instream allowable loading rate at the point of interest. The difference between the two is based on whether the pollution sources are defined as discharges that are permitted or have a responsible party, which are considered point sources. Nonpoint sources are then any pollution sources that are not point sources.

For situations where all of the impact is due to nonpoint sources, the equations shown below are applied using data for a point in the stream. The load allocation made at that point will be for all of the watershed area that is above that point. For situations where there are only point-source impacts or a combination of point and nonpoint sources, the evaluation will use the point-source data and perform a mass balance with the receiving water to determine the impact of the point source.

TMDLs and load allocations for each pollutant were determined using Monte Carlo simulation. Allocations were applied uniformly for the watershed area specified for each allocation point. For each source and pollutant, it was assumed that the observed data were log-normally distributed. Each pollutant source was evaluated separately using @Risk[1] by performing 5,000 iterations to determine any required percent reduction so that the water quality criteria will be met instream at least 99 percent of the time. For each iteration, the required percent reduction is:

PR = maximum {0, (1-Cc/Cd)} where (1)

PR = required percent reduction for the current iteration
Cc = criterion in mg/l
Cd = randomly generated pollutant source concentration in mg/l based on the observed data

Cd = RiskLognorm(Mean, Standard Deviation) where (1a)

Mean = average observed concentration
Standard Deviation = standard deviation of observed data

The overall percent reduction required is the 99th percentile value of the probability distribution generated by the 5,000 iterations, so that the allowable long-term average (LTA) concentration is:

[1] @Risk – Risk Analysis and Simulation Add-in for Microsoft Excel, Palisade Corporation, Newfield, NY, 1990-1997.

LTA = Mean * (1 – PR99) where (2)
LTA = allowable LTA source concentration in mg/l

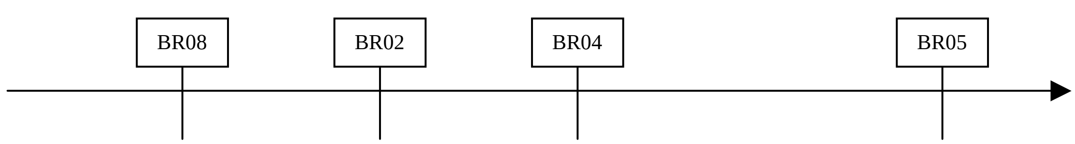
Once the required percent reduction for each pollutant source was determined, a second series of Monte Carlo simulations were performed to determine if the cumulative loads from multiple sources allow instream water quality criteria to be met at all points at least 99 percent of the time. The second series of simulations combined the flows and loads from individual sources in a step-wise fashion, so that the level of attainment could be determined immediately downstream of each source. Where available data allowed, pollutant-source flows used were the average flows. Where data were insufficient to determine a source flow frequency distribution, the average flow derived from linear regression was used.

In general, these cumulative impact evaluations indicate that, if the percent reductions determined during the first step of the analysis are achieved, water quality criteria will be achieved at all upstream points, and no further reduction in source loadings is required.

Where a stream segment is listed on the Section 303(d) list for pH impairment, the evaluation is the same as that discussed above; the pH method is fully explained in this Attachment. An example calculation from the Swatara Creek TMDL, including detailed tabular summaries of the Monte Carlo results, is presented for the Lorberry Creek TMDL in Attachment C. Information for the TMDL analysis performed using the methodology described above is contained in the TMDLs by segment section of this report in Attachment D.

Accounting for Upstream Reductions in AMD TMDLs

In AMD TMDLs, sample points are evaluated in headwaters (most upstream) to stream mouth (most downstream) order. As the TMDL evaluation moves downstream the impact of the previous, upstream, evaluations must be considered. The following examples are from the Beaver Run AMD TMDL (2003):



In the first example BR08 is the most upstream sample point and BR02 is the next downstream sample point. The sample data, for both sample points, are evaluated using @Risk (explained above) to calculate the existing loads, allowable loads, and a percentage reduction for aluminum, iron, manganese, and acidity (when flow and parameter data are available).

Any calculated load reductions for the upstream sample point, BR08, must be accounted for in the calculated reductions at sample point BR02. To do this (see table A) the allowable load is subtracted from the existing load, for each parameter, to determine the total load reduction.

Table A	Alum.	Iron	Mang.	Acidity
BR08	(#/day)	(#/day)	(#/day)	(#/day)
existing load=	3.8	2.9	3.5	0.0
allowable load=	3.8	2.9	3.5	0.0
Total Load Reduction=	**0.0**	**0.0**	**0.0**	**0.0**

In table B the Total Load Reduction BR08 is subtracted from the Existing loads at BR02 to determine the Remaining Load. The Remaining Load at BR02 has the previously calculated Allowable Loads at BR02 subtracted to determine any load reductions at sample point BR02. This results in load reductions for aluminum, iron and manganese at sample point BR02.

Table B. Necessary Reductions at Beaver Run BR02

	Al (#/day)	Fe (#/day)	Mn (#/day)	Acidity (#/day)
Existing Loads at BR02	13.25	38.44	21.98	6.48
Total Load Reduction BR08	0.00	0.00	0.00	0.00
Remaining Load (Existing Load at BR02 - BR08)	13.25	38.44	21.98	6.48
Allowable Loads at BR02	2.91	9.23	7.03	6.48
Percent Reduction	78.0%	76.0%	68.0%	NA
Additional Removal Required at BR02	10.33	29.21	14.95	0.00

At sample point BR05 this same procedure is also used to account for calculated reductions at sample points BR08 and BR02. As can be seen in Tables C and D this procedure results in additional load reductions for iron, manganese and acidity at sample point BR04.

At sample point BR05 (the most downstream) no additional load reductions are required, see Tables E and F.

Table C	Alum.	Iron	Mang.	Acidity
BR08 & BR02	(#/day)	(#/day)	(#/day)	(#/day)
Total Load Reduction=	**10.33**	**29.21**	**14.95**	**0.0**

Table D. Necessary Reductions at Beaver Run BR04				
	Al (#/day)	Fe (#/day)	Mn (#/day)	Acidity (#/day)
Existing Loads at BR04	12.48	138.80	54.47	38.76
Total Load Reduction BR08 & BR02	10.33	29.21	14.95	0.00
Remaining Load (Existing Load at BBR04 - TLR Sum	2.15	109.59	39.53	38.76
Allowable Loads at BR04	8.99	19.43	19.06	38.46
Percent Reduction	NA	82.3%	51.8%	0.8%
Additional Removal Required at BR04	0.00	90.16	20.46	0.29

Table E	Alum.	Iron	Mang.	Acidity
BR08 BR02 &BR04	(#/day)	(#/day)	(#/day)	(#/day)
Total Load Reduction=	10.3	29.2	14.9	0.0

Table F. Necessary Reductions at Beaver Run BR05				
	Al (#/day)	Fe (#/day)	Mn (#/day)	Acidity (#/day)
Existing Loads at BR05	0.0	31.9	22.9	4.1
Total Load Reduction BR08, BR02 & BR04	10.3	119.4	35.4	0.3
Remaining Load (Existing Load at BBR05 - TLR Sum	NA	NA	NA	3.8
Allowable Loads at BR05	0.0	20.4	15.1	4.1
Percent Reduction	NA	NA	NA	NA
Additional Removal Required at BR05	0.0	0.0	0.0	0.0

Although the evaluation at sample point BR05 results in no additional removal this does not mean there are no AMD problems in the stream segment BR05 to BR04. The existing and allowable loads for BR05 show that iron and manganese exceed criteria and, any abandoned mine discharges in this stream segment will be addressed.

Method for Addressing Section 303(d) Listings for pH

There has been a great deal of research conducted on the relationship between alkalinity, acidity, and pH. Research published by the Pa. Department of Environmental Protection demonstrates that by plotting net alkalinity (alkalinity-acidity) vs. pH for 794 mine sample points, the resulting pH value from a sample possessing a net alkalinity of zero is approximately equal to six (Figure 1). Where net alkalinity is positive (greater than or equal to zero), the pH range is most commonly six to eight, which is within the USEPA's acceptable range of six to nine and meets Pennsylvania water quality criteria in Chapter 93.

The pH, a measurement of hydrogen ion acidity presented as a negative logarithm, is not conducive to standard statistics. Additionally, pH does not measure latent acidity. For this reason, and based on the above information, Pennsylvania is using the following approach to address the stream impairments noted on the Section 303(d) list due to pH. The concentration of acidity in a stream is at least partially chemically dependent upon metals. For this reason, it is extremely difficult to predict the exact pH values, which would result from treatment of abandoned mine drainage. Therefore, net alkalinity will be used to evaluate pH in these TMDL calculations. This methodology assures that the standard for pH will be met because net alkalinity is a measure of the reduction of acidity. When acidity in a stream is neutralized or is restored to natural levels, pH will be acceptable. Therefore, the measured instream alkalinity at the point of evaluation in the stream will serve as the goal for reducing total acidity at that point. The methodology that is applied for alkalinity (and therefore pH) is the same as that used for other parameters such as iron, aluminum, and manganese that have numeric water quality criteria.

Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. Net alkalinity is alkalinity minus acidity, both being in units of milligrams per liter (mg/l) $CaCO_3$. The same statistical procedures that have been described for use in the evaluation of the metals is applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for mine waters is not a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

There are several documented cases of streams in Pennsylvania having a natural background pH below six. If the natural pH of a stream on the Section 303(d) list can be established from its upper unaffected regions, then the pH standard will be expanded to include this natural range. The acceptable net alkalinity of the stream after treatment/abatement in its polluted segment will be the average net alkalinity established from the stream's upper, pristine reaches added to the acidity of the polluted portion in question. Summarized, if the pH in an unaffected portion of a stream is found to be naturally occurring below six, then the average net alkalinity for that portion (added to the acidity of the polluted portion) of the stream will become the criterion for the polluted portion. This "natural net alkalinity level" will be the criterion to which a 99 percent confidence level will be applied. The pH range will be varied only for streams in which a natural unaffected net alkalinity level can be established. This can only be done for streams that have upper segments that are not impacted by mining activity. All other streams will be required to reduce the acid load so the net alkalinity is greater than zero 99% of time.

Reference: *Rose, Arthur W. and Charles A. Cravotta, III 1998. Geochemistry of Coal Mine Drainage. Chapter 1 in Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania. Pa. Dept. of Environmental Protection, Harrisburg, Pa.*

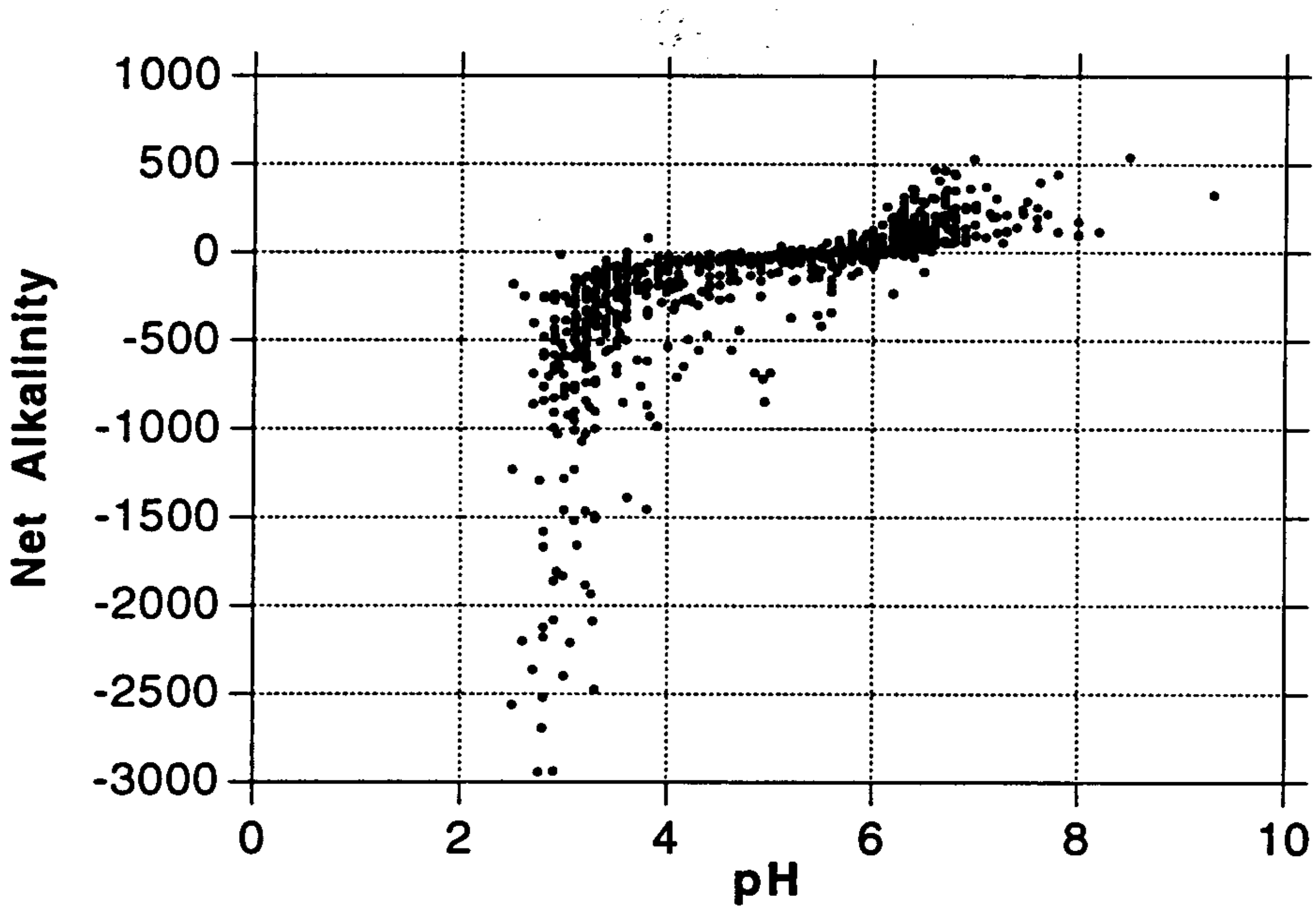


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Surface Mining Control and Reclamation Act

The Surface Mining Control and Reclamation Act of 1977 (SMCRA, Public Law 95-87) and its subsequent revisions were enacted to established a nationwide program to, among other things, protect the beneficial uses of land or water resources, and pubic health and safety from the adverse effects of current surface coal mining operations, as well as promote the reclamation of mined areas left without adequate reclamation prior to August 3, 1977. SMCRA requires a permit for the 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 the regulatory authority in the event that the applicant forfeits. Mines that ceased operating by the effective date of SMCRA, (often called "pre-law" mines) are not subject to the requirements of SMCRA.

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

- Restoring the affected land to a condition capable of supporting the uses which it was capable of supporting prior to any mining,

- Backfilling and compacting (to insure stability or to prevent leaching of toxic materials) in order to restore the approximate original contour of the land with all highwalls being eliminated, and topsoil replaced to allow revegetation, and

- Minimizing the disturbances to the hydrologic balance and to the quality and quantity of water in surface and ground water systems both during and after surface coal mining operations and during reclamation by avoiding acid or other toxic mine drainage.

For purposes of these TMDLs, point sources are identified as NPDES-permitted discharge points, and nonpoint sources include discharges from abandoned mine lands, including but not limited to, tunnel discharges, seeps, and surface runoff. Abandoned and reclaimed mine lands were treated in the allocations as nonpoint sources because there are no NPDES permits associated with these areas. In the absence of an NPDES permit, the discharges associated with these land uses were assigned load allocations.

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

Related Definitions

Pre-Act (Pre-Law) - Mines that ceased operating by the effective date of SMCRA and are not subject to the requirements of SMCRA.

Bond – A instrument by which a permittee assures faithful performance of the requirements of the acts, this chapter, Chapters 87-90 and the requirements of the permit and reclamation plan.

Postmining pollution discharge – A discharge of mine drainage emanating from or hydrologically connected to the permit area, which may remain after coal mining activities have been completed, and which does not comply with the applicable effluent requirements described in Chapters 87.102, 88.92, 88.187, 88.292, 89.52 or 90.102. The term includes minimal-impact postmining discharges, as defined in Section of the Surface Mining Conservation and Reclamation Act.

Forfeited Bond – Bond money collected by the regulatory authority to complete the reclamation of a mine site when a permittee defaults on his reclamation requirements.

11.0 Appendix C

Excerpts Justifying Changes Between the 1996, 1998, Draft 2000 and 2002 Section 303(d) Lists

The following are excerpts from the Pennsylvania DEP Section 303(d) narratives that justify changes in listings between the 1996, 1998, draft 2000, and 2002 list. The Section 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.

In the 1996 Section 303(d) narrative, strategies were outlined for changes to the listing process. Suggestions included, but were not limited to, a migration to a Global Information System (GIS), improved monitoring and assessment, and greater public input.

The migration to a GIS was implemented prior to the development of the 1998 Section 303(d) list. As a result of additional sampling and the migration to the GIS some of the information appearing on the 1996 list differed from the 1998 list. Most common changes included:

1. mileage differences due to recalculation of segment length by the GIS;
2. slight changes in source(s)/cause(s) due to new EPA codes;
3. changes to source(s)/cause(s), and/or miles due to revised assessments;
4. corrections of misnamed streams or streams placed in inappropriate SWP subbasins; and
5. unnamed tributaries no longer identified as such and placed under the named watershed listing.

Prior to 1998, segment lengths were computed using a map wheel and calculator. The segment lengths listed on the 1998 Section 303(d) list were calculated automatically by the GIS (ArcInfo) using a constant projection and map units (meters) for each watershed. Segment lengths originally calculated by using a map wheel and those calculated by the GIS did not always match closely. This was the case even when physical identifiers (e.g., tributary confluence and road crossings) matching the original segment descriptions were used to define segments on digital quad maps. This occurred to some extent with all segments, but was most noticeable in segments with the greatest potential for human errors using a map wheel for calculating the original segment lengths (e.g., long stream segments or entire basins).

The most notable difference between the 1998 and Draft 2000 Section 303(d) lists are the listing of unnamed tributaries in 2000. In 1998, the GIS stream layer was coded to the named stream level so there was no way to identify the unnamed tributary records. As a result, the unnamed tributaries were listed as part of the first downstream named stream. The GIS stream coverage used to generate the 2000 list had the unnamed tributaries coded with the DEP's five-digit stream code. As a result, the unnamed tributary records are now split out as separate records on the 2000 Section 303(d) list. This is the reason for the change in the appearance of the list and the noticeable increase in the number of pages. After due consideration of comments from EPA and PADEP on the 2000 Section 303(d) list, the 2002 Pa Section 303(d) list was written in a manner similar to the 1998 Section 303(d) list.

12.0 Appendix D

Original Table 1

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	Not on 1996 303(d) List			Allison Hollow					
1998	1.76	971029-0845-ALF	37086	Allison Hollow		WWF	UP	Ag AMD HM HM	Nutrients S/TDS/C Siltation Turbidity
2000	1.76	971205-1000-ALF	37086	Allison Hollow		WWF	UP	AMD AMD Ag CSO HM HM UR/SS UR/SS	Metals SS Nutrients OE/LDO Nutrients Siltation Nutrients Siltation
2002	26.5[2]	971205-1000-ALF	37086 37132 37077 36777 37043	Allison Hollow, Arnold Hollow, Catfish Creek, Chartiers Creek, Chartiers Run		WWF	SWAP	AMD AMD Ag CSO HM HM UR/SS UR/SS	Metals SS Nutrients OE/LDO Nutrients Siltation Nutrients Siltation
1996	Not on 1996 303(d) List			Allison Hollow					
1998	2.61	971029-1000-ALF	37086 37087 37088 37089	Allison Hollow	1	WWF	UP	HM HM	Turbidity Siltation
2000	2.61	971029-1000-ALF	37086 37087 37088 37089	Allison Hollow		WWF	UP	HM HM	Turbidity Siltation

[2] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2002	No additional assessment			Allison Hollow					
1996	Not on 1996 303(d) List			Allison Hollow					
1998	0.68	971029-1100-ALF	37086	Allison Hollow	2	WWF	UP	Ag Ag Ag HM HM	Nutrients Siltation Turbidity Turbidity Siltation
2000	No additional assessment								
2002	No additional assessment								
1996	Not on 303(d) list			Arnold Hollow					
1998	Not on 303(d) list			Arnold Hollow					
2000	0.82	971205-1000-ALF	37077	Arnold Hollow		WWF	UP	AMD AMD Ag CSO HM HM UR/SS UR/SS	Metals SS Nutrients OE/LDO Nutrients Siltation Nutrients Siltation
2002	26.5[3]	971205-1000-ALF	37077 37132 37086 36777 37043	Allison Hollow, Arnold Hollow, Catfish Creek, Chartiers Creek, Chartiers Run		WWF	SWAP	AMD AMD Ag CSO HM HM UR/SS UR/SS	Metals SS Nutrients OE/LDO Nutrients Siltation Nutrients Siltation

[3] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	0.9	4691	36873	Brush Run		WWF	SWMP	UR/SS UR/SS	Suspended Solids Nutrients
1998	0.65	4691	36873	Brush Run		WWF	UP	UR/SS UR/SS	Suspended Solids Nutrients
2000	Included under 971010-1300-ALF Listing			Brush Run					
2002	Included under 971010-1300-ALF Listing			Brush Run					
1996	0.4	4693	36938	Brush Run (Unt)		WWF	SWMP	UR/SS UR/SS	Suspended Solids Nutrients
1998	0.52	4693	36938	Brush Run (Unt)		WWF	UP	UR/SS UR/SS	Nutrients Suspended Solids
2000	Included under 971010-1300-ALF Listing			Brush Run (Unt)		WWF	UP	HM	Nutrients Siltation Turbidity
2002	Included under 971010-1300-ALF Listing								
1996	Not on 1996 303(d) List			Brush Run					
1998	2.47	971006-1315-ALF	36873	Brush Run	4	WWF	UP	HM HM HM	Turbidity Siltation Nutrients
2000	1.65	971006-1315-ALF	36873	Brush Run	4	WWF	UP	HM HM HM	Turbidity Siltation Nutrients
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	1.19	971006-1440-ALF	36874	Brush Run	13	WWF	UP	HM HM	Turbidity Nutrients
2000	No additional assessment								
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1998	3.74	971007-1000-ALF	36874 36876 36875 36877 36878	Brush Run	14	WWF	UP	HM HM	Siltation Nutrients
2000	3.24	971007-1000-ALF	36874 36876 36875 36877 36878	Brush Run		WWF	UP	HM HM	Nutrients Siltation
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	2.01	971007-1120-ALF	36874 36879 36921	Brush Run	15	WWF	UP	HM HM	Nutrients Siltation
2000	No additional assessment			Brush Run	15	WWF	UP	HM HM	Nutrients Siltation
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	4.91	971007-1300-ALF	36873 36927 36928 36931 36930	Brush Run	5	WWF	UP	Cn HM HM Cn	Turbidity Nutrients Siltation Siltation
2000	4.11	971007-1300-ALF	36873 36927 36928 36931 36930	Brush Run	5	WWF	UP	Cn HM HM Cn	Turbidity Nutrients Siltation Siltation
2002	3.8	971007-1300-ALF	36873	Brush Run	5	WWF	UP	Cn HM	Turbidity Nutrients

Table 1. 303(d) Sub-List

State Water Plan (SWP) Subbasin: 20-F Ohio River

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Index No.	Designated Use	Data Source	Source	EPA 305(b) Cause Code
			36927 36928 36931 36930					HM Cn	Siltation Siltation
1996	Not on 1996 303(d) List			Brush Run					
1998	1.56	971007-1430-ALF	36922 36923	Brush Run	16	WWF	UP	HM HM HM	Nutrients Siltation Turbidity
2000	No additional assessment								
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	1.91	971009-0930-ALF	36926 36925	Brush Run	17	WWF	UP	Cn Cn HM HM	Turbidity Siltation OHA Nutrients
2000	1.43	971009-0930-ALF	36926 36925	Brush Run	17	WWF	UP	Cn Cn HM HM	Turbidity Siltation OHA Nutrients
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	1.09	971009-1030-ALF	36873 36932	Brush Run	6	WWF	UP	HM HM HM	OHA Turbidity Nutrients
2000	No additional assessment								
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	1.77	971009-1200-ALF	36873	Brush Run	7	WWF	UP	HM	OE/LDO

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
		1200-ALF	36924 36925					HM	OHA
2000	1.18	971009-1200-ALF	36873 36924 36925	Brush Run	7	WWF	UP	HM HM	OE/LDO OHA
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	1.58	971010-1145-ALF	36873 36937	Brush Run	8	WWF	UP	HM HM HM	Turbidity Nutrients OHA
2000	1.18	971010-1145-ALF	36873 36937	Brush Run	8	WWF	UP	HM HM HM	Turbidity Nutrients OHA
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	0.36	971010-1300-ALF	36873 36938	Brush Run	9	WWF	UP	HM HM HM	Turbidity Siltation Nutrients
2000	1.54	971010-1300-ALF	36873 36938	Brush Run	9	WWF	UP	HM HM HM	Turbidity Siltation Nutrients
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	2.65	971010-1430-ALF	36933 36934 36935 36936	Brush Run	18	WWF	UP	Cn Cn Cn Cn Cn	Flow Alteration Turbidity Suspended Solids Siltation OHA
2000	No additional assessment			Brush Run	18				

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	2.09	970808-1030-ALF	37039	Brush Run	19	WWF	UP	Ag UR/SS OSW UR/SS Ag AMD	Nutrients Nutrients Nutrients Siltation Siltation S/TDS/C
2000	1.15	970808-1030-ALF	37039	Brush Run	19	WWF	UP	Ag UR/SS OSW UR/SS Ag AMD	Nutrients Nutrients Nutrients Siltation Siltation S/TDS/C
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	2.15	970808-1145-ALF	37036	Brush Run		WWF	UP	Ag Ag SU	Nutrients OE/LDO Nutrients
2000	2.15	971023-1400-ALF	37036	Brush Run		WWF	UP	Ag HM HM HM Ag OSW	Nutrients Siltation Turbidity OHA Siltation OE/LDO
2002	10.9[4]	971023-1400-ALF	37036 37048 37049 37047 37044 37046	Brush Run, Chartiers Run, Plum Run		WWF	SWAP	Ag HM HM HM Ag OSW	Nutrients Siltation Turbidity OHA Siltation OE/LDO

[4] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	Not on 1996 303(d) List			Brush Run					
1998	2.54	970808-1220-ALF	37040	Brush Run	20	WWF	UP	Ag SU	Nutrients Nutrients
2000	1.6	970808-1220-ALF	37040	Brush Run		WWF	UP	CRA GRA	Nutrients Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Brush Run					
1998	4.64	970903-1200-ALF	37036 37037 37038	Brush Run	10	WWF	UP	Ag Ag Ag	OE/LDO Nutrients Siltation
2000	3.33	970903-1200-ALF	37036 37037 37038	Brush Run		WWF	UP	Ag Ag Ag	OE/LDO Nutrients Siltation
2002	No additional assessment								
1996	Not on 1996 303(d) List			Brush Run					
1998	1.31	971022-1345-ALF	37036	Brush Run	11	WWF	UP	HM HM	Nutrients OHA
2000	No additional assessment								
2002	5.5[3]	971022-1345-ALF	37036 37032 37033 37034	Brush Run, Chartiers Creek	11	WWF	SWAP	HM HM	Nutrients OHA
1996	2.0	NA[4]	36786	Campbells Run		WWF	305(b) Report	RE	Metals
1998	2.0	NA[4]	36786	Campbells Run		WWF	305(b) Report	RE	Metals

[4] Listing did not have a Segment Id. Listed on Part C of the 1998 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2000	4.38	971126-0845-ALF	36786 36791	Cambells Run		WWF	UP	AMD AMD OSW UR/SS	Metals SS Nutrients Nutrients
2002	No additional assessment								
2000	1.51	971204-1045-ALF	36786	Cambells Run		WWF	UP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
2002	21.8[5]	971204-1045-ALF	36786 36777 36794 36797 36784	Cambells Run, Chartiers Creek, Robinson Run, Scrubgrass Run, Whiskey Run		WWF	SWAP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
1996	0.8	4686	36787	Unt Campbells Run		WWF	305(b) Report	RE	Metals
1998	0.8	4686	36787	Unt Campbells Run		WWF	SWMP	AMD	Metals
2000	4.07	971126-0940-ALF	36787 36788 36789 36790	Unt Campbells Run		WWF	UP	AMD AMD AMD UR/SS	Metals S/TDS/C SS Nutrients
2002	No additional assessment								
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								

[5] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List

State Water Plan (SWP) Subbasin: 20-F Ohio River

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Index No.	Designated Use	Data Source	Source	EPA 305(b) Cause Code
2000	3.46	971124-1340-TVP	37132 37133	Catfish Creek		WWF	UP	HM UR/SS	Siltation Nutrients
2002	4.6[6]	971124-1340-TVP	37132 37133 37144	Catfish Creek, Chartiers Creek		WWF	SWAP	HM UR/SS	Siltation Nutrients
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	1.68	971205-1000-ALF	37132	Catfish Creek		WWF	UP	AMD AMD Ag CSO HM HM UR/SS UR/SS	Metals SS Nutrients OE/LDO Nutrients Siltation Nutrients Siltation
2002	26.5[6]	971205-1000-ALF	37132 37086 37077 36777 37043	Allison Hollow, Arnold Hollow, Catfish Creek, Chartiers Creek, Chartiers Run		WWF	SWAP	AMD AMD Ag CSO HM HM UR/SS UR/SS	Metals SS Nutrients OE/LDO Nutrients Siltation Nutrients Siltation
1996	6.5	4681	36777	Chartiers Creek	25	WWF	305(b) Report	RE	Metals
1998	19.92[7]	4681	36777	Chartiers Creek		WWF	SWMP	AMD	Metals

[6] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

[7] Some stream miles were duplicated on the 1998 303(d) List due to overlapping of segment ids.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2000	1.7	4681	36777	Chartiers Creek		WWF	SWMP	AMD	Metals
1998	2.41	970930-0940-TVP	36777 37157 37158	Chartiers Creek	27	WWF	UP	UR/SS Other Other	Nutrients Siltation Nutrients
2000	3.81	970930-0940-TVP	36777 37157 37158	Chartiers Creek	27	WWF	UP	GRA LD SRR	Nutrients Nutrients Siltation
2002	No additional assessment						SWAP		
1998	16.52	971001-0900-TVP	36777	Chartiers Creek	28	WWF	UP	UR/SS Ag UR/SS Ag	Siltation Nutrients Nutrients Siltation
2000	No additional assessment								
2002	No additional assessment						SWAP		
2000	21.07	971205-1000-ALF	37043	Chartiers Creek		WWF	UP	AMD AMD Ag CSO HM HM UR/SS UR/SS	Metals SS Nutrients OE/LDO Nutrients Siltation Nutrients Siltation
2002	26.5[8]	971205-1000-ALF	37043 37132 37086 37077 36777	Allison Hollow, Arnold Hollow, Catfish Creek, Chartiers Creek, Chartiers Run		WWF	SWAP	AMD AMD Ag CSO HM HM UR/SS UR/SS	Metals SS Nutrients OE/LDO Nutrients Siltation Nutrients Siltation

[8] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	Not on 1996 303(d) List			Chartiers Creek					
1998	Not on 1998 303(d) List			Chartiers Creek					
2000	11.5	970902-1125-ALF	36777	Chartiers Creek		WWF	UP	AMD AMD AMD AMD	Metals OE/LDO S/TDS/C Turbidity
2002	No additional assessment			Chartiers Creek		WWF	SWAP		
1996	Not on 1996 303(d) List			Chartiers Creek					
1998	9.55	970926-0954-TVP	37121 37124 to 37131	Chartiers Creek	39	WWF	UP	SU	Nutrients
2000	No additional assessment						UP		
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Creek					
1998	6.48	970930-1310-TVP	37136 37137 37138	Chartiers Creek	40	WWF	UP	Ag Ag	Nutrients Siltation
2000	4.23	970930-1310-TVP	37136 37137 37138	Chartiers Creek	40	WWF	UP	Ag Ag	Nutrients Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Creek					
1998	3.11	971001-1040-TVP	37135 37139	Chartiers Creek	41	WWF	UP	UR/SS AMD AMD	Siltation Metals Siltation

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Creek					
1998	5.5	971022-1345-ALF	36777	Chartiers Creek		WWF	UP	HM HM	Nutrients OHM
2000	4.23	971022-1345-ALF	36777	Chartiers Creek		WWF	UP	HM HM	Nutrients OHM
2002	5.5[9]	971022-1345-ALF	36777 37036 37032 37033 37034	Brush Run, Chartiers Creek		WWF	SWAP	HM HM	Nutrients OHM
1996	Not on 1996 303(d) List			Chartiers Creek					
1998	Not on 1998 303(d) List			Chartiers Creek					
2000	1.14	971124-1340-ALF	37144	Chartiers Creek		WWF	UP	HM UR/SS	Siltation Nutrients
2002	4.6[10]	971124-1340-ALF	37133 37132 37144	Catfish Creek, Chartiers Creek		WWF	SWAP	HM UR/SS	Siltation Nutrients
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	16.42	971204-1045-ALF	36777	Chartiers Creek			UP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS

[9] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2002	21.8[10]	971204-1045-ALF	36777 36786 36794 36797 36784	Cambells Run, Chartiers Creek, Robinson Run, Scrubgrass Run, Whiskey Run		WWF	SWAP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	3.15	971124-0915-ALF	37105 37106 37107 37108	Chartiers Creek		WWF	UP	UR/SS Ag	Nutrients Nutrients
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	5.4	971124-1030-ALF	37109 37110 63869	Chartiers Creek		WWF	UP	Ag Ag AMD AMD	Siltation Nutrients Metals SS
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	1.06	971022-0930-ALF	36777	Chartiers Creek		WWF	UP	HM HM	Nutrients OHA
2002	3.6[10]	971022-0930-ALF	36777 36940 36941 36942	Chartiers Creek, McPherson		WWF	SWAP	HM HM	Nutrients OHA

[10] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	4.39	971204-1300-ALF	36781 36782 36939	Chartiers Creek		WWF	UP	Ag Cn	Nutrients Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	5.90	971204-0950-ALF	36777	Chartiers Creek		WWF	UP	AMD AMD AMD AMD	S/TDS/C Metals Siltation SS
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	5.57	971029-1200-ALF	36777 37035	Chartiers Creek		WWF	UP	HM HM HM	Siltation Nutrients Turbidity
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	2.86	971003-0940-ALF	36777	Chartiers Creek		WWF	UP	HM HM	Siltation Turbidity
2002	3[11]	971003-0940-ALF	36777 36823	Chartiers Creek, Thoms Run			SWAP		
1996	Not on 1996 303(d) List			Chartiers Creek					
1998	1.21	971022-1500-ALF	37031	Chartiers Creek	34	WWF	UP	HM	Turbidity

[11] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	Miles	Segment ID	DEP Stream Code	Stream Name	Index No.	Designated Use	Data Source	Source	EPA 305(b) Cause Code
		1500-ALF		Creek				HM HM HM	Nutrients Siltation OHM
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Creek					
1998	1.8	971023-1020-ALF	37041 37042	Chartiers Creek	35	WWF	UP	HM HM	OHM Nutrients
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Creek					
1998	6.55	971029-1415-ALF	37078 to 37085	Chartiers Creek	36	WWF	UP	HM HM	Turbidity Siltation
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Run					
1998	0.37	971023-1130-ALF	37043	Chartiers Run		WWF	UP	HM Cn HM Cn HM	Turbidity Siltation Nutrients Turbidity Siltation
2000	0.24	971023-1130-ALF	37043	Chartiers Run		WWF	UP	HM Cn HM Cn HM	Turbidity Siltation Nutrients Turbidity Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Run					
1998	2.84	971023-1300-ALF	37043	Chartiers Run		WWF	UP	HM	OHA

Table 1. 303(d) Sub-List

State Water Plan (SWP) Subbasin: 20-F Ohio River

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Index No.	Designated Use	Data Source	Source	EPA 305(b) Cause Code
								OSW OSW HM	Nutrients OE/LDO Siltation
2000	0.66	971023-1300-ALF	37043	Chartiers Run		WWF	UP	HM OSW OSW HM	OHA Nutrients OE/LDO Siltation
2002	2.4[12]	971023-1300-ALF	37043 37044	Chartiers Run, Plum Run		WWF	SWAP	HM OSW OSW HM	OHA Nutrients OE/LDO Siltation
1996	Not on 1996 303(d) List			Chartiers Run					
1998	4.17	971023-1400-ALF	37047 37048 37049	Chartiers Run		WWF	UP	Ag Ag OSW HM HM HM	Siltation Nutrients OE/LDO OHA Siltation Turbidity
2000	No additional assessment								
2002	10.9[12]	971023-1400-ALF	37036 37048 37049 37047 37044 37046	Brush Run, Chartiers Run, Plum Run		WWF	SWAP	Ag Ag OSW HM HM HM	Siltation Nutrients OE/LDO OHA Siltation Turbidity
1996	Not on 1996 303(d) List			Chartiers Run					
1998	Not on 1998 303(d) List			Chartiers Run					
2000	1.29	971205-	37043	Chartiers		WWF	UP	AMD	Metals

[12] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
		1000-ALF		Run				AMD Ag CSO HM HM UR/SS UR/SS	SS Nutrients OE/LDO Nutrients Siltation Nutrients Siltation
2002	26.5[13]	971205-1000-ALF	37043 37132 37086 37077 36777	Allison Hollow, Arnold Hollow, Catfish Creek, Chartiers Creek, Chartiers Run		WWF	SWAP	AMD AMD Ag CSO HM HM UR/SS UR/SS	Metals SS Nutrients OE/LDO Nutrients Siltation Nutrients Siltation
1996	Not on 1996 303(d) List			Chartiers Run					
1998	3.2	971024-0940-ALF	37043 37050	Chartiers Run		WWF	UP	AMD Cn HM HM AMD Cn	S/TDS/C Siltation Siltation OHA Metals OHA
2000	2.3	971024-0940-ALF	37043 37050	Chartiers Run		WWF	UP	AMD Cn HM HM AMD Cn	S/TDS/C Siltation Siltation OHA Metals OHA
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Run					

[13] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	Miles	Segment ID	DEP Stream Code	Stream Name	Index No.	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1998	5.97	971024-1030-ALF	37051 37052 37055	Chartiers Run	47	WWF	UP	AMD Cn AMD HM HM Cn	Metals OHA S/TDS/C OHA Siltation Siltation
2000	2.91	971024-1030-ALF	37051 37052 37055	Chartiers Run	47	WWF	UP	AMD Cn AMD HM HM Cn	Metals OHA S/TDS/C OHA Siltation Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Run					
1998	20.93	971024-1145-ALF	37043 37062 to 37075	Chartiers Run	51	WWF	UP	Agr Ag HM HM Ag	Siltation Turbidity OHA Siltation Nutrients
2000	17.68	971024-1145-ALF	37043 37062 to 37075	Chartiers Run	51	WWF	UP	Agr Ag HM HM Ag	Siltation Turbidity OHA Siltation Nutrients
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Run					

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1998	2.7	971028-0840-ALF	37053 37054	Chartiers Run	50	WWF	UP	OSW HM HM	OE/LDO Siltation Turbidity
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Run					
1998	4.11	971028-1000-ALF	37052 37058 to 37061	Chartiers Run	48	WWF	UP	Ag Ag Ag HM HM	Siltation Nutrients Turbidity Turbidity pH
2000	2.76	971028-1000-ALF	37052 37058 to 37061	Chartiers Run	48	WWF	UP	Ag Ag Ag HM HM	Siltation Nutrients Turbidity Turbidity pH
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Chartiers Run					
1998	3.86	971028-1100-ALF	37052 37056 37057	Chartiers Run	49	WWF	UP	AMD HM HM	S/TDS/C Turbidity Siltation
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Coal Run					
1998	0.8	970822-1100-ALF	36858	Coal Run		WWF	UP	AMD SU	S/TDS/C Unknown Toxicity
2000	Included under 970822-1100-ALF Listing for Miller Run								

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2000	Included under 970822-1100-ALF Listing for Miller Run								
1996	Not on 1996 303(d) List			Coal Run					
1998	3.83	970902-1300-ALF	36858 36860 36861	Coal Run	52	WWF	UP	Ag Ag	Nutrients Siltation
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Coal Run					
1998	1.18	970903-0900-ALF	36859	Coal Run	54	WWF	UP	Cn Cn Cn SU SU	Suspended Solids Siltation Turbidity OE/LDO Nutrients
2000	1.18	970903-0900-ALF	36859	Coal Run		WWF	UP	GC LD	Nutrients Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Coal Run					
1998	2.53	970903-1000-ALF	36858	Coal Run	53	WWF	UP	Cn Cn Cn	Turbidity Siltation Suspended Solids
2000	No additional assessment								
2002	No additional assessment								
1996	Not on 1996 303(d) List			Dolphin Run					
1998	2.21	970819-0930-ALF	36832	Dolphin Run	55	WWF	UP	SM SM AMD AMD	Turbidity S/TDS/C Turbidity S/TDS/C
2000	No additional assessment								

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2002	16.6[14]	970819-0930-ALF	36832 36833 36827	Dolphin Run, Fishing Run, Millers Run		WWF	SWAP	AMD AMD	Turbidity S/TDS/C
1996	Not on 1996 303(d) List			Fishing Run					
1998	3.47	970819-0930-ALF	36833 36834	Fishing Run		WWF	UP	AMD SM AMD SM	Turbidity S/TDS/C S/TDS/C Turbidity
2000	No additional assessment								
2002	16.6[15]	970819-0930-ALF	36832 36833 36827	Fishing Run, Dolphin Run, Millers Run		WWF	SWAP	AMD AMD	Turbidity S/TDS/C
1996	Not on 1996 303(d) List			Fink Run					
1998	Not on 1998 303(d) List								
2000	1.75	971203-1200-ALF	63303	Fink Run		WWF	UP	AMD CSO UR/SS	Metals OE/LDO
2002	6.2[15]	971203-1200-ALF	63303 63294 36794	Fink Run, North Branch Robinson Run, Robinson Run		WWF	UP	AMD CSO UR/SS	Metals OE/LDO Nutrients
1996	Not on 1996 303(d) List								
1998	0.6	970926-1150-TVP	33001	Cross Creek Watershed		WWF	UP	AMD AMD	Metals SS

[14] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

[15] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
								UR/SS	Siltation
2000	3.79	970926-1150-TVP	37111 to 37114	Georges Run		WWF	UP	AMD AMD UR/SS	Metals SS Siltation
2002	No additional assessment								
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	1.75	971125-0830-ALF	36795	Georges Run		WWF	UP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
2002	4.9[15]	971125-0830-ALF	36795 36797 36808 36798	Georges Run, Painters Run, Scrubgrass Run		WWF	SWAP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
1996	Not on 1996 303(d) List			Graesers Run					
1998	3.39	971002-1150-ALF	36820 36821 36811	Graesers Run		WWF	UP	HM HM HM	Turbidity Nutrients Siltation
2000	No additional assessment								
2002	4.1[16]	971002-1150-ALF	36820 36821 36811	Graesers Run, McLaughlin Run		WWF	UP	HM HM HM	Turbidity Nutrients Siltation
1996	1	5846	63300	Half Crown Run		WWF	305(b) Report	RE	Metals
1998	1.1	5846	63300	Half Crown Run		WWF	SWMP	AMD	Metals

[16] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List

State Water Plan (SWP) Subbasin: 20-F Ohio River

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Index No.	Designated Use	Data Source	Source	EPA 305(b) Cause Code
2000	3.55	971124-1500-RBS	63300 63301	Half Crown Run		WWF	UP	AMD Natural Sources	Metals Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	0.74	971126-1130-RBS	63292	Lintons Run		WWF	UP	SU	Cause Unknown
2002	6.4[16]	971126-1130-RBS	63292 63290 63291 36794 63293	Lintons Run, Pinkertons Run, Robinson Run		WWF	SWAP	SU	Cause Unknown
1996	Not on 1996 303(d) List			Little Chartiers Creek					
1998	7.01	971001-1450-TVP	36943	Little Chartiers Creek		WWF	UP	UR/SS UR/SS	Nutrients Siltation
2000	New survey record								
2002	New survey record								
1996	Not on 1996 303(d) List			Little Chartiers Creek					
1998	2.59	971007-1320-TVP	36970	Little Chartiers Creek	68	WWF	UP	UR/SS Other	Siltation Nutrients
2000	1.34	971007-1320-TVP	36970	Little Chartiers Creek		WWF	UP	CRA GRA LD	Nutrients Nutrients Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Little Chartiers Creek					

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1998	3.8	971008-1030-TVP	36972 36973 36974	Little Chartiers Creek	70	WWF	UP	Cn UR/SS	Siltation Nutrients
2000	No additional assessment								
2002	No additional assessment								
1996	Not on 1996 303(d) List			Little Chartiers Creek					
1998	2.0	971008-1330-TVP	36970 36976	Little Chartiers Creek	69	WWF	UP	UR/SS Other	Nutrients Nutrients
2000	No additional assessment								
2002	No additional assessment								
1996	Not on 1996 303(d) List			Little Chartiers Creek					
1998	6.19	971009-1050-TVP	36989 37001 37002 37003 37015	Little Chartiers Creek	71	WWF	UP	AMD AMD	Suspended Solids Metals
2000	5.17	971009-1050-TVP	36989 37001 37002 37003 37015	Little Chartiers Creek	71	WWF	UP	AMD AMD	Suspended Solids Metals
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Little Chartiers					

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
				Creek					
1998	6.35	971009-1245-TVP	36989 37004 to 37009	Little Chartiers Creek	72	WWF	UP	UR/SS AMD AMD	Siltation Suspended Solids Metals
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Little Chartiers Creek					
1998	5.72	971010-1400-TVP	36956 36957 36958	Little Chartiers Creek	66	WWF	UP	UR/SS Cn	Siltation Siltation
2000	3.15	971010-1400-TVP	36956 36957 36958	Little Chartiers Creek	66	WWF	UP	UR/SS Cn	Siltation Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Little Chartiers Creek					
1998	2.92	971022-0930-TVP	36943 37024 to 37027	Little Chartiers Creek	62	WWF	UP	UR/SS Other	Siltation Nutrients
2000	2.92	971022-0930-TVP	36943 37024 to 37027	Little Chartiers Creek	62	WWF	UP	LD ROV ROV SRR SRR	Siltation Nutrients Siltation Nutrients Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Little Chartiers Creek					

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1998	2.28	971022-1210-TVP	36943 37028 37029	Little Chartiers Creek	63	WWF	UP	UR/SS Other	Siltation Nutrients
2000	2.28	971022-1210-TVP	36943 37028 37029	Little Chartiers Creek	63	WWF	UP	GC LD SRR	Siltation Siltation Nutrients
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	14.10	971205-1230-ALF	36943	Little Chartiers Creek		WWF	UP	HM HM UR/SS	Nutrients Unknown Toxicity Nutrients
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	2.01	971204-1500-ALF	63866 36944	Little Chartiers Creek		WWF	UP	CSO HM	OE/LDO Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	8.27	971205-1345-ALF	36960 36962 36963 36965 to 36969	Little Chartiers Creek		WWF	UP	HM HM UR/SS	Nutrients Siltation Nutrients

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			McLaughlin Run					
1998	2.35	971001-1200-ALF	36815 36816 36817	McLaughlin Run	73	WWF	UP	HM HM HM	Siltation Nutrients OHA
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			McLaughlin Run					
1998	0.77	971001-1300-ALF	36811	McLaughlin Run	74	WWF	UP	HM HM	Nutrients Siltation
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			McLaughlin Run					
1998	3.75	971001-1430-ALF	36811 to 36814	McLaughlin Run	75	WWF	UP	Hydromod HM HM	W/FV Siltation Turbidity
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			McLaughlin Run					
1998	2.55	971002-0945-ALF	36811 36818 36819	McLaughlin Run	76	WWF	UP	Hydromod Hydromod HM HM	Flow Alteration OHA Flow Alterations OHA
2000	2.26	971002-0945-ALF	36811 36818 36819	McLaughlin Run	76	WWF	UP	Hydromod Hydromod HM HM	Flow Alteration OHA Flow Alterations OHA

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			McLaughlin Run					
1998	0.46	971002-1045-ALF	36822	McLaughlin Run	77	WWF	UP	HM HM HM	Nutrients Siltation Turbidity
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			McLaughlin Run					
1998	0.68	971002-1150-ALF	36811	McLaughlin Run		WWF	UP	HM HM HM	Nutrients Siltation Turbidity
2000	No additional assessment								
2002	4.1[17]	971002-1150-ALF	36811 36820 36821	Graesers Run, McLaughlin Run		WWF	SWAP	HM HM HM	Nutrients Siltation Turbidity
1996	Not on 1996 303(d) List			McPherson Creek					
1998	2.51	971022-0930-ALF	36940 36941 36942	McPherson Creek	78	WWF	UP	HM HM	Nutrients OHA
2000	No additional assessment								
2002	3.6[17]	971022-0930-ALF	36940 36941 36942 36777	McPherson Creek, Chartiers Creek			SWAP	HM HM	Nutrients OHA
1996	2.5	4688	36827	Millers Run		WWF	305(B) Report	RE RE	Suspended Solids Metals

[17] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1998	5.13	4688	36827	Millers Run		WWF	SWMP	AMD AMD	Suspended Solids Metals
2000	Included in 970819-0930-ALF and 970822-1100-ALF Listings								
2002	Included in 970819-0930-ALF and 970822-1100-ALF Listings								
1996	Not on 1996 303(d) List			Millers Run					
1998	1.3	970723-0840-TVP	36827	Millers Run	79	WWF	UP	Ag Ag	Siltation Nutrients
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Millers Run					
1998	2.88	970723-1000-TVP	36827 36843 36845	Millers Run	80	WWF	UP	Ag UR/SS Ag UR/SS	Nutrients Siltation Siltation Nutrients
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Millers Run					
1998	3.04	970723-1200-TVP	36827 36847 to 36849	Millers Run	81	WWF	UP	AMD Ag UR/SS Ag	S/TDS/C Nutrients Nutrients Siltation
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Millers Run					
1998	3.62	970723-1315-TVP	36827 36850	Millers Run	82	WWF	UP	Ag Ag	Nutrients Siltation
2000	2.02	970723-1315-TVP	36827	Millers Run	82	WWF	UP	Ag Ag	Nutrients Siltation

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
			36850						
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Millers Run					
1998	3.37	970818-1300-ALF	36839 36840	Millers Run	83	WWF	UP	HM HM	Siltation Turbidity
2000	2.79	970818-1300-ALF	36839 36840	Millers Run	83	WWF	UP	HM HM	Siltation Turbidity
2002	No additional assessment					SWAP			
1996	Not on 1996 303(d) List			Millers Run					
1998	3.0	970819-0830-ALF	36827 36841 36842	Millers Run	84	WWF	UP	HM Cn HM Cn	Siltation Siltation Turbidity Turbidity
2000	No additional assessment								
2002	No additional assessment					SWAP			
1996	Not on 1996 303(d) List			Millers Run					
1998	6.7	970819-0930-ALF	36827	Millers Run		WWF	UP	AMD AMD SM SM	S/TDS/C Turbidity S/TDS/C Turbidity
2000	10.92	970819-0930-ALF	36827 to 36834	Millers Run		WWF	UP	AMD AMD SM SM	S/TDS/C Turbidity S/TDS/C Turbidity
2002	16.6[16]	970819-0930-ALF	36827 to 36834	Dolphin Run, Fishing Run, Millers Run		WWF	SWAP	AMD AMD	S/TDS/C Turbidity

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	Not on 1996 303(d) List			Millers Run					
1998	4.46	970822-0830-ALF	36851 to 36853	Millers Run	88	WWF	UP	Ag Ag	Nutrients Siltation
2000	3.39	970822-0830-ALF	36851 to 36853	Millers Run	88	WWF	UP	Ag Ag	Nutrients Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Millers Run					
1998	5.97	970822-0920-ALF	36827 36854 to 36857 63760 63761	Millers Run	85	WWF	UP	Ag UR/SS Ag Ag	Siltation Siltation Nutrients Turbidity
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Millers Run					
1998	3.66	970822-1010-TVP	36844 36845 36846	Millers Run	87	WWF	UP	Ag Ag Ag	Nutrients Siltation Turbidity
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Millers Run					
1998	0.89	970822-1100-ALF	36827 36835	Millers Run	86	WWF	UP	AMD SU	S/TDS/C Unknown Toxicity
2000	1.66	970822-1100-ALF	36827 36835	Millers Run	86	WWF	UP	AMD AMD OSW	Metals SS Nutrients
2002	No additional assessment						SWAP		
1996	6.0	5842, 5843	63294	N. Br. Robinson Run		WWF	305(B) Report	RE	Other Inorganics, Metals

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1998	2.42	5842	63294	N. Br. Robinson Run		WWF	SWMP	AMD AMD	Metals Other Inorganics
2000	2.85	971123-1115-RBS	63294	N. Br. Robinson Run		WWF	UP	AMD AMD	Metals Siltation
2002	No additional assessment						SWAP		
1998	1.55	5843	63294	N. Br. Robinson Run		WWF	SWMP	AMD	Metals
2000	5.4	971124-1430-RBS	63294 63297 63298 63299	N. Br. Robinson Run		WWF	UP	AMD	Metals
2002	No additional assessment						SWAP		
2000	1.05	971126-1030-RBS	63294	N. Br. Robinson Run		WWF	UP	AMD	Metals
2002	No additional assessment						SWAP		
1996	4.2	5845, 6610	63295	N. Br. Robinson Run (Unt.)		WWF	305(B) Report	RE	Metals
1998	1.85	5845	63295	N. Br. Robinson Run (Unt.)		WWF	SWMP	AMD	Metals
2000	Included under 971124-1430-RBS Listing								
2002	Included under 971124-1430-RBS Listing								
1998	1.5	6610	63295	N. Br. Robinson Run (Unt.)		WWF	SWMP	AMD	Metals
2000	2.23	971124-1330-RBS	63295	N. Branch Robinson Run		WWF	UP	AMD	Metals
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1998	Not on 1998 303(d) List								
2000	1.06	971124-1300-RBS	63294	N. Br. Robinson Run		WWF	UP	AMD	Metals
2002	2.9[18]	971124-1300-RBS	63294 36794	N. Br. Robinson Run, Robinson Run		WWF	SWAP	AMD	Metals
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	2.84	971126-1000-RBS	63294 63302	N. Br. Robinson Run		WWF	UP	AMD Natural Sources	Metals Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	0.94	971203-1200-ALF	63294	N. Br. Robinson Run		WWF	UP	AMD CSO UR/SS	Metals OE/LDO Nutrients
2002	6.2[18]	971203-1200-ALF	63294 63303 36794	Fink Run, N. Br. Robinson Run, Robinson Run		WWF	SWAP	AMD CSO UR/SS	Metals OE/LDO Nutrients
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	1.45	971124-1400-RBS	63296	N. Branch Robinson Run		WWF	UP	AMD	Metals
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Painters					

[18] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
				Run					
1998	1.56	971003-1100-ALF	36803 36810	Painters Run	96	WWF	UP	HM HM	Siltation Turbidity
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Painters Run					
1998	5.88	971003-1230-ALF	36803 to 36807 36809	Painters Run	97	WWF	UP	HM HM HM	Turbidity Suspended Solids Siltation
2000	4.97	971003-1230-ALF	36803 to 36807 36809	Painters Run	97	WWF	UP	HM HM HM	Turbidity Suspended Solids Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	0.92	971125-0830-ALF	36808	Painters Run		WWF	UP	AMD AMD AMD AMD	Siltation S/TDS/C Metals SS
2002	4.9[19]	971125-0830-ALF	36808 36795 36797 36798	Georges Run, Painters Run, Scrubgrass Run		WWF	SWAP	AMD AMD AMD AMD	Siltation S/TDS/C Metals SS
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	3.32	971126-1130-RBS	63290	Pinkertons Run		WWF	UP	SU	Cause Unknown

[19] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2002	6.4	971126-1130-RBS	63290 63291 63292 63293	Lintons Run, Pinkertons Run, Robinson		WWF	SWAP	SU	Cause Unknown
1996	2.1	4697	37044	Plum Run		WWF	305(b) Report	Ag Ag	Nutrients SS
1998	4.22	4697	37044	Plum Run		WWF	SWMP	Ag Ag	Suspended Solids Nutrients
2000	Included under 971023-1400-ALF Listing								
2002	Included under 971023-1400-ALF Listing								
1996	Not on 1996 303(d) List			Plum Run					
1998	1.1	971023-1300-ALF	37044 37045	Plum Run		WWF	UP	HM HM OSW OSW	OHA Siltation OE/LDO Nutrients
2000	1.74	971023-1300-ALF	37044 37045	Plum Run		WWF	UP	HM HM OSW OSW	OHA Siltation OE/LDO Nutrients
2002	2.4[20]	971023-1300-ALF	37044 37045 37043	Chartiers Run, Plum Run		WWF	SWAP	HM HM OSW OSW	OHA Siltation OE/LDO Nutrients
1996	Not on 1996 303(d) List			Plum Run					
1998	1.0	971023-1400-ALF	37044 37046 to 37049	Plum Run		WWF	UP	HM HM OSW HM	OHA Siltation OE/LDO Turbidity

[20] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
								Ag Ag	Siltation Nutrients
2000	4.61	971023-1400-ALF	37044 37046 to 37049	Plum Run		WWF	UP	HM HM OSW HM Ag Ag	OHA Siltation OE/LDO Turbidity Siltation Nutrients
2002	10.9[20]	971023-1400-ALF	37044 37046 to 37049	Brush Run, Chartiers Run, Plum Run		WWF	SWAP	HM HM OSW HM Ag Ag	OHA Siltation OE/LDO Turbidity Siltation Nutrients
1996	Not on 1996 303(d) List								
1998	Not 0n 1998 303(d) List								
2000	2.01	971126-1100-RBS	63307	Robb Run		WWF	UP	AMD	Metals
2002	7[20]	971126-1100-RBS	63307 36794 63304 to 63306	Robb Run, Robinson Run		WWF	SWAP	AMD	Metals
1996	Not on 1996 303(d) List			Robinson Run					
1998	Not on 1998 303(d) List			Robinson Run					
2000	0.82	971123-1200-RBS	36794	Robinson Run		WWF	UP	AMD	Metals
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2000	3.45	971124-1030-RBS	36794 63318 63319	Robinson Run		WWF	UP	AMD OSW	Metals Nutrients
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	3.65	971124-1100-RBS	36794 63321 to 63324	Robinson Run		WWF	UP	AMD	Metals
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	1.17	971124-1130-RBS	36794 63317	Robinson Run		WWF	UP	Natural Sources OSW	Siltation Nutrients
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	6.31	971124-1230-RBS	36794 63309 to 63314	Robinson Run		WWF	UP	AMD	Metals
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	1.89	971124-1300-RBS	36794	Robinson Run		WWF	UP	AMD	Metals

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2002	2.9[21]	971124-1300-RBS	36794 63294	N. Br. Robinson Run, Robinson Run		WWF	SWAP	AMD	Metals
1996	Not on 1996 303(d) List			Robinson Run					
1998	Not on 1998 303(d) List			Robinson Run					
2000	3.14	971126-1100-RBS	36794	Robinson Run		WWF	UP	AMD	Metals
2002	7[22]	971126-1100-RBS	36794 63304 to 63307	Robb Run, Robinson Run		WWF	SWAP	AMD	Metals
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	2.36	971126-1130-RBS	36794	Robinson Run		WWF	UP	SU	Cause Unknown
2002	6.4[22]	971126-1130-RBS	36794 63290 63291 63292 63293	Lintons Run, Pinkertons Run, Robinson Run		WWF	SWAP	SU	Cause Unknown
1996	Not on 1996 303(d) List			Robinson Run					
1998	Not on 1998 303(d) List			Robinson Run					

[21] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

[22] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	Miles	Segment ID	DEP Stream Code	Stream Name	Index No.	Designated Use	Data Source	Source	EPA 305(b) Cause Code
2000	4.33	971126-1200-RBS	36794	Robinson Run		WWF	UP	AMD OSW	Metals Nutrients
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	3.48	971203-1200-ALF	36794	Robinson Run		WWF	UP	UR/SS CSO AMD	Nutrients OE/LDO Metals
2002	6.2[22]	971203-1200-ALF	36794	Fink Run, N. Br. Robinson Run, Robinson Run		WWF	SWAP	UR/SS CSO AMD	Nutrients OE/LDO Metals
1996	Not on 1996 303(d) List			Robinson Run					
1998	Not on 1998 303(d) List			Robinson Run					
2000	2.12	971204-1045-ALF	36794 63295	Robinson Run		WWF	UP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
2002	21.8[23]	971204-1045-ALF	36794 36786 36777 36797 36784	Cambells Run, Chartiers Creek, Robinson Run, Scrubgrass Run, Whiskey Run		WWF	SWAP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
2000	2.67	971124-0930-RBS	63308	Robinson Creek		WWF	UP	AMD	Metals
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	1.68	971124-1000-RBS	63314 63315 63316	Robinson Creek		WWF	UP	Cn	Siltation
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	2.21	971125-0830-ALF	36797 36798	Scrubgrass Run		WWF	UP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
2002	4.9[23]	971125-0830-ALF	36797 36795 36808	Georges Run, Painters Run, Scrubgrass Run		WWF	SWAP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
1996	Not on 1996 303(d) List			Scrubgrass Run					
1998	Not on 1998 303(d) List			Scrubgrass Run					
2000	0.68	971204-1045-ALF	36797	Scrubgrass Run		WWF	UP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
2002	21.8[24]	971204-1045-ALF	36794	Cambells Run		WWF	SWAP	AMD	Metals

[23]Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
		1045-ALF	36777 36784 36786 36797	Run, Chartiers Creek, Robinson Run, Scrubgrass Run, Whiskey Run				AMD AMD AMD	S/TDS/C Siltation SS
1996	Not on 1996 303(d) List								
1998	1.63	970828-1330-ALF	36824	Thoms Run		TSF	UP	SM UR/SS AMD UR/SS HM	S/TDS/C OE/LDO Turbidity Nutrients Siltation
2000	No additional assessment			Thoms Run					
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Thoms Run					
1998	2.02	970828-1425-ALF	36823	Thoms Run		TSF	UP	OSW UR/SS UR/SS OSW Other Other	Nutrients OE/LDO Nutrients OE/LDO OE/LDO Nutrients
2000	2.02	970828-1425-ALF	36823	Thoms Run		TSF	UP	OSW	Nutrients OE/LDO
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List			Thoms Run					
1998	2.69	970829-1130-ALF	36823 36825 36826	Thoms Run		TSF	UP	SM HM OSW AMD	S/TDS/C Siltation Nutrients S/TDS/C

[24] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
								HM SU	Turbidity Nutrients
2000	No additional assessment								
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	0.1	971003-0940-ALF	36823	Thoms Run		TSF	UP	HM HM	Siltation Turbidity
2002	3[24]	971003-0940-ALF	36823 36777	Chartiers Creek, Thoms Run		TSF	SWAP	HM HM	Siltation Turbidity
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	1.14	971125-0915-ALF	36784	Whiskey Run		WWF	UP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
2002	No additional assessment						SWAP		
1996	Not on 1996 303(d) List								
1998	Not on 1998 303(d) List								
2000	1.1	971204-1045-ALF	36784	Whiskey Run		WWF	UP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS
2002	21.8[25]	971204-1045-ALF	36794 36777 36784 36786 36797	Cambells Run, Chartiers Creek, Robinson Run, Scrubgrass Run, Whiskey		WWF	SWAP	AMD AMD AMD AMD	Metals S/TDS/C Siltation SS

Table 1. 303(d) Sub-List									
State Water Plan (SWP) Subbasin: 20-F Ohio River									
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Index No.**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
				Run Whiskey Run					
1996	76 (acres)			Canonsburg Lake		WWF	305(b) Report	Agriculture	Nutrients
1998	No additional assessment								
2000	76	861001-0000-LAK		Canonsburg Lake		WWF	305(b) Report	Agriculture	Nutrients
2002	No additional assessment								

HQ = High Quality Water

EV = Exceptional Value Water
WWF = Warm Water Fishes
CWF = Cold Water Fishes
TSF = Trout Stocked Fishes
SWMP = Surface Water Monitoring Program
UA = Unassessed Project
AMD = Abandoned Mine Drainage
UR/SS = Urban Runoff/Storm Sewers
HW = Habitat Modification
Ag = Agriculture
Cn = Construction
OSW = On Site Wastewater
SU Source = Unknown
SM = Subsurface Mining
Hydromod = Hydromodification
OHA = Other Habitat Alterations
S/TDS/C = Salinity/TDS/Chlorides
OE/LDO = Organic Enrichment/Low DO
W/FV = Water/Flow Variability
SS = Suspended Solids
GRA = Grazing Related Agriculture
LD = Land Development
SRR = Small Residential Runoff
SWAP = Surface Water Assessment Program
GC = Golf Course
ROV = Removal of Vegetation

[25] Listings with the same segment id from the 2000 Draft 303(d) List are combined into one listing on the 2002 Draft 303(d) List.

13.0 Appendix E

Comment and Response

ENCLOSURE

EPA Comment on the Metals AMD Total Maximum Daily Load (TMDL) for
Chartiers Creek PN Version dated December 2002

Executive Summary

The TMDLs for Brush Run and Plum Run included an executive summary. Please add an executive summary to this TMDL.

The Chen report or portions of it should be provided as an appendix.

1. The Chen report *Adaptation of WARMF to Calculate TMDL for Chartiers Creek Watershed in Pennsylvania* (Chen et al. 2001) is a separate pdf and enclosed.

Introduction

Page: 4
States are required to submit Section 303(d) lists every two years. Another bullet should be added to the Clean Water Act (CWA) requirements stating that TMDLs must include a Margin of Safety (MOS) and account for seasonal variation and critical conditions.

The following bullet was added:

- That the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving water body and must consider seasonal variation in the derivation of the allocation

Page: 5
Please provide a reference where additional information on the Unassessed Waters Protocol can be found. How are the sources of biological impairments determined?

- Details on the PA DEP Unassessed Waters Protocol can be obtained by contacting the Division of Water Quality Assessment and Standards, Water Quality Assessment and Monitoring Section.

Water Quality Standards

Page: 7
Please mention if the standard is derived for health or aesthetic reasons.

- Has been added to the report.

Source Assessment

Page: 11
Please include a statement in the *Permitted Non-Mining Point Sources* section that it was assumed that facilities, which were not permitted to discharge iron, aluminum, or manganese, were not discharging these pollutants. For permit number PA0002739 identify the pollutant(s) discharged, and whether or not facility is in operation or has a current permit.

The following text was added:

- It was assumed that discharges from all other point sources do not contain aluminum, iron and manganese since they are not permitted to discharge these metals. Therefore, these point sources were not considered as potential sources of the metals impairment in the Chartiers Creek watershed.

Page: 13
How were the locations of abandoned mine lands determined? Approximately how many abandoned mines exist within the watershed? How was the loading for an abandoned mine determined?

The following text was added:

AML locations were identified by using data and information provided by PA DEP McMurray District Office and included coal status reports which detail existing and previous mining activity, mine operators, maps of coal crop lines (location where the coal seam intersects the ground surface), locations of strip mines and surface mines, and coal seam contour lines. A complete description of the information used to indentify and characterize AMLs in the Chartiers Creek watershed can be found in the *Adaptation of WARMF to Calculate TMDL for Chartiers Creek Watershed in Pennsylvania* (Chen et al. 2001) report, which is shown in Appendix B.

Page: 16
What gage was the stream hydrology modeled to? What was the time period of the calibration? How did the simulated flow data compare to the observed data? Please include figures from the Chen report to document the calibration of the model.

The Chen report *Adaptation of WARMF to Calculate TMDL for Chartiers Creek Watershed in Pennsylvania* (Chen et al. 2001) is a separate pdf.

Added text :

A description and results of the hydrology and water quality calibration are presented on pages 4-1 through 4-35 in the report *Adaptation of WARMF to Calculate TMDL for Chartiers Creek Watershed in Pennsylvania* (Chen et al. 2001), which is presented in Appendix B.

Page: 17
Please include the proper characters in the web version of the TMDL Report for summation in the TMDL equation and bullet the steps of the TMDL approach. Include the date of the Section 303(d) list that identified Chartiers Creek as impaired.

The proper characters have been included and 1998 was added to:
In order to develop aluminum, iron, and manganese TMDLs for each of the waterbodies in the Chartiers watershed listed on the 1998 Pennsylvania Section 303(d) list, the following approach was taken

Please explain why it is reasonable to express the TMDLs, LAs, and WLAs as mass per year instead of per day. (EPA Region III was sued for approving/establishing TMDLs on the Anacostia River in the District of Columbia as mass per year.)

The following text was added

Loadings were derived by comparing continuous model simulation (on a daily time step) over a period of several years to meet TMDL endpoints, which allowed for seasonal hydrologic and source loading variability to be considered. For this reason, the loads are presented on an annual basis (as an average annual load).

Page: 18
Include a description of the conservative assumptions that made-up the implicit margin of safety (MOS). Was the WARMF model used to develop the watershed allocations?

Tetra Tech is working on a detailed description of the allocation procedure, it is not available at this time.

Page: 20
Outlets 004 and 017 were assumed to be discharging aluminum at 2.0 mg/L. Please describe any data used to verify this assumption.

The following text was added:

As shown in Table 3-2, outlets 004 and 017 do not have permit limits for aluminum, while the remaining five outlets have a monthly average limit of 2.0 mg/L. For consistency, the aluminum monthly average permit limit for outlets 004 and 017 was assumed to be 2.0 mg/L.

Discharge monitoring data for these outlets is not available.

Page: 20
Describe what land uses the reductions were applied to.

TMDL allocations for the Chartiers Creek watershed were based on the results of the WARMF TMDL module. The TMDL module reduces all nonpoint source loadings equally. Furthermore, the WARMF model does not track pollutants by landuse as described by the email correspondence with Systech, Inc. that is shown below.

Jon,

I talked to my coworker Joel about your 'yield differences' question, and I'll try not to confuse you in conveying his explanation. I should actually fax you a short mathematical explanation because its more clear so let me know if a fax would help.

I'll start from the beginning; in a given catchment, each land use has a set of loading rates (in something like kg/ha/month) for nutrients, BOD, fecal coliform, etc. These loading rates are applied over a given area of the catchment (LandUseArea = CatchmentSize x LandUse%).

It would seem logical that the loading yield (mass/area/time, e.g. kg/ha/yr) for a particular land use would not vary if the land use area were to change since by definition the yield is an area-weighted or area-normalized loading rate.

In WARMF, pollutants (nutrients, BOD, FC, etc.) are applied to the appropriate land use, and then these pollutants enter the soil (or wash off in overland flow). Then the shallow ground water infiltration flows through the catchment to the river. When the pollutants enter the soil, they are collectively mixed as the soil is no longer affiliated with a land use. Instead of tracking the pollutants through the soil by land use area (using area-weighting or area-normalizing as mentioned above), the pollutants are tracked through the soil by percent of mass from a particular land use. For example, if say 100 kg of PO4 total enters the soil, WARMF keeps track of the percent of PO4 mass that originated from each land use. Thus the model uses a 'mass-weighting' instead of an area-weighting to track pollutants. The mass-weighting can change significantly when the mass loading rates vary significantly by land use.

I'll try to give an example below in which changing the land use also changes the yield:

1. We have a catchment with 100% deciduous forest. There is 200 kg/ha/yr of PO4 applied to the deciduous land use, and 100 kg/ha/yr of net PO4 assimilation (root uptake, adsorption, other sources/sinks in the soil). Thus we have 100 kg/ha/yr entering the soil--100% of which is from decid.
*The resulting yield from decid is **100kg/ha/yr**.*
2. We change the catchment from 100% Decid to 50%Grass and 50%Decid. Lets say there is 50 kg/ha/yr of PO4 applied to grass, and the same 200kg/ha/yr applied to Decid. This is a total of 250kg/ha/yr of PO4 applied to the catchment. We again have say 100kg/ha/yr of PO4 assimilation. Thus we have a net 150kg/ha/yr of PO4 entering the soil. However, 80% is from Decid (ratio of Decid mass divided by the total PO4 mass: 200/250 = 0.8) and the remaining

20% of the mass from grassland. So 80% of the net 150kg/ha/yr equals ***125kg/ha/yr from Decid*** *compared to the* ***100kg/ha/yr from Decid*** *in scenario no. 1. Between scenarios, the application rate of 200kg/ha/yr from Decid did not change, but the ratio of mass from Deciduous did change.*

In summary, the yield of a given nutrient changes because WARMF mixes the pollutants in the soil and because the model uses mass-weighting to keep track of the pollutants instead of area-weighting or another method. Mass weighting makes sense to me because assimilation in the soil is independent of land use composition.

As far as your second question, I tested 3 catchment simulations similar to yours, and I got consistent results regardless of the breakpoint locations, number of breakpoints, or number of subwatershed that were run. Results were exactly the same at the downstream river segment no matter how I divided things upstream. For the sake of this problem, do a couple quick test runs, and email a plot comparing results at segment 672. (You can copy the WARMF time series output plot to the windows clipboard by hitting 'Alt-PrintScreen'--I use this keystroke to dump WARMF plots into Word documents all the time)

Let me know the results of your tests, and also if you have any questions about the "mass-weighted" yield explanation.

Hope this clears things up a bit,

Curtis