Final Report

Iron and Manganese TMDLs for the Unnamed Tributary at Sharon Steel, West Virginia

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1.0 Problem Understanding

The Unnamed Tributary to the Monongahela River (also known as the Unnamed Tributary at Sharon Steel) is located within the Monongahela River watershed (HUC 05020003) in the city of Fairmont in northern West Virginia (Figure 1-1). The stream has been placed on West Virginia's 1998 303(d) list for iron and manganese impairments with a priority ranking of high. The Unnamed Tributary is located in the southern portion of the watershed and is approximately 0.5 miles in length, all of which is impaired. The Unnamed Tributary flows west between two inactive industrial areas that are now Superfund sites. The two Superfund sites are Big John's Salvage (AKA, Reilly Tar and Chemical Plant) and Sharon Steel (AKA, Fairmont Coke Works) (Figure 1-2). Note that the Unnamed Tributary was digitized based on hardcopy maps of the area. The predominant land uses in the 187-acre watershed were identified based in the West Virginia GAP 2000 Land Use Database. The major land uses in the watershed are forested and barren land. Table 1-1 presents the 1998 303(d) list information for the Unnamed Tributary.

Table 1-1. 1998 303(d) list information for the Unnamed Tributary at Sharon Steel

Stream Name	Stream Code	Designated Use	Pollutants	Primary Source of Impairment	Stream Length
Unnamed Tributary to the Monongahela River	M-23.5	Aquatic Life	Iron, Manganese	Sharon Steel-Fairmont, West Virginia	0.5

The EPA's *Water Quality Planning and Management Regulations* (40 CFR 130) require states to develop Total Maximum Daily Loads (TMDLs) for waters that are exceeding water quality standards. In settlement of the TMDL lawsuit in West Virginia, iron and manganese TMDLs were developed by EPA for the Unnamed Tributary to the Monongahela River at Sharon Steel (hereafter referred to as the Unnamed Tributary), which was included on West Virginia's 1998 303(d) list of impaired waters. This report presents the TMDLs for the listed segment of the Unnamed Tributary.

In general, the impairment and hydrology of the Unnamed Tributary is heavily influenced by the Big John's Salvage and Sharon Steel Superfund sites. One hundred and sixty five potential pollutants (including iron and manganese) have been identified in surface water samples from the watershed of the Unnamed Tributary. Some of the additional pollutants have been identified in high concentrations in the surface waters of the watershed, but iron and manganese are the only pollutants listed on the 303(d) list. This TMDL will not focus on the additional 163 potential pollutants identified in the watershed since the majority of the land in the watershed consists of the Sharon Steel and Big John Salvage Superfund sites, which are being cleaned up under the Comprehensive Environmental Resource Compensation and Liabilities Act (CERCLA). At this time it is anticipated that the additional pollutants identified in the watershed will be dealt with during the clean up of the two sites, thereby eliminating the need to develop TMDLs for the additional potential pollutants. However, a review(s) of the watershed will be conducted both during and following the completion of the Superfund cleanup to identify the need for the development of any additional TMDLs for the Unnamed Tributary. This TMDL focuses on the pollutants listed on the 1998 303(d) list (iron and manganese), but the additional pollutants identified in the Unnamed Tributary and at the Superfund sites include the following:

- polynuclear aromatic hydrocarbons (PAHs)
- phenolics
- metals — aluminum, barium, beryllium, boron, chromium, cobalt, copper, nickel, silver, vanadium, zinc, antimony, arsenic, cadmium, lead, mercury, selenium, thallium, and tin
- Organic compounds—acid extractable organics, base/neutral extractable organics, and purgeable organics

The iron and manganese reductions required by this TMDL may result in the reduction of other metals as well. Further study and application of treatment technologies in addition to those driven by this TMDL may be necessary. A data analysis for the additional pollutants identified in the watershed that have numeric water quality criteria is also presented in this report (Appendix B). The majority of the land in the watershed consists of Sharon Steel and Big John's Salvage, therefore, the following descriptions of the two sites provide the best description of the watershed.

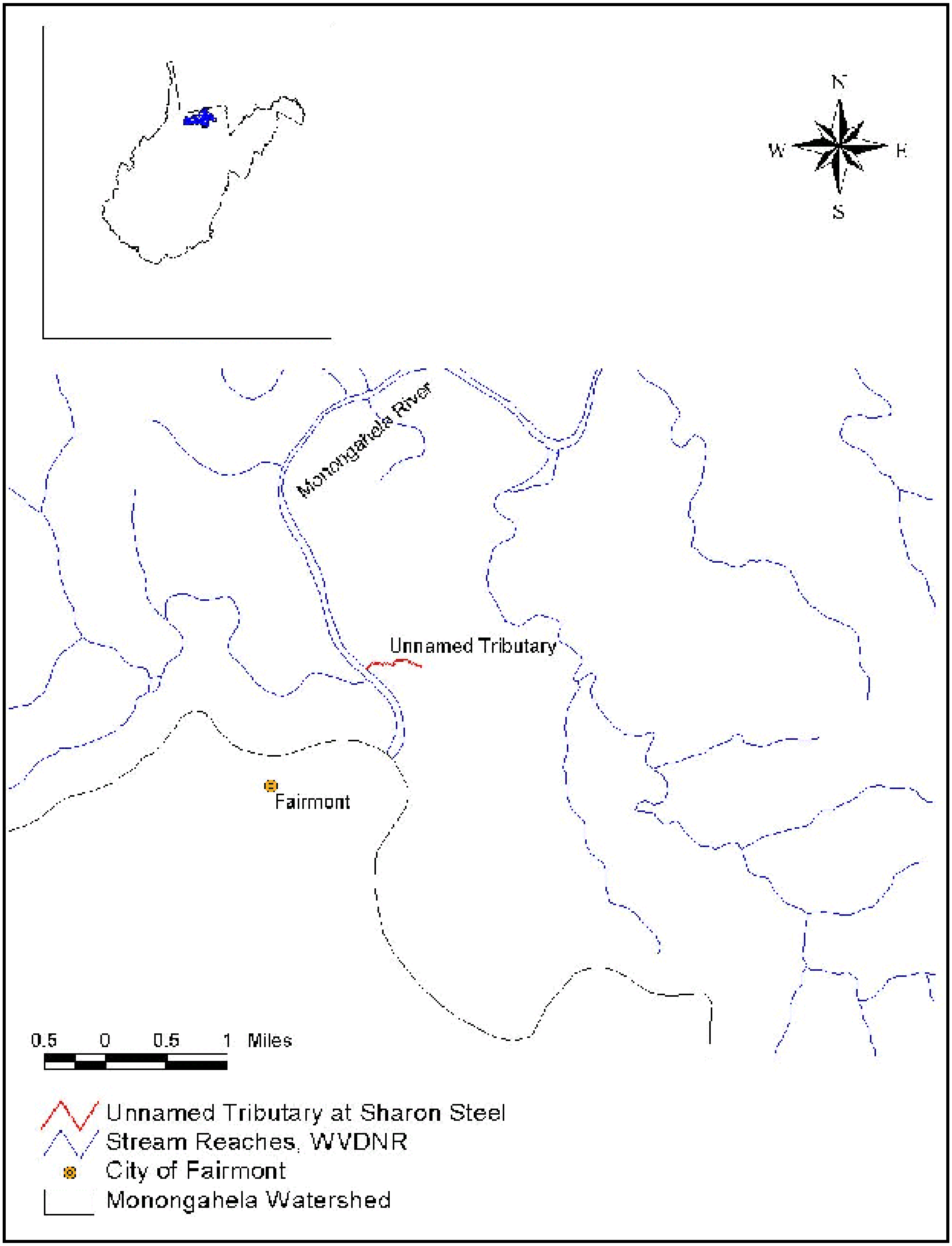
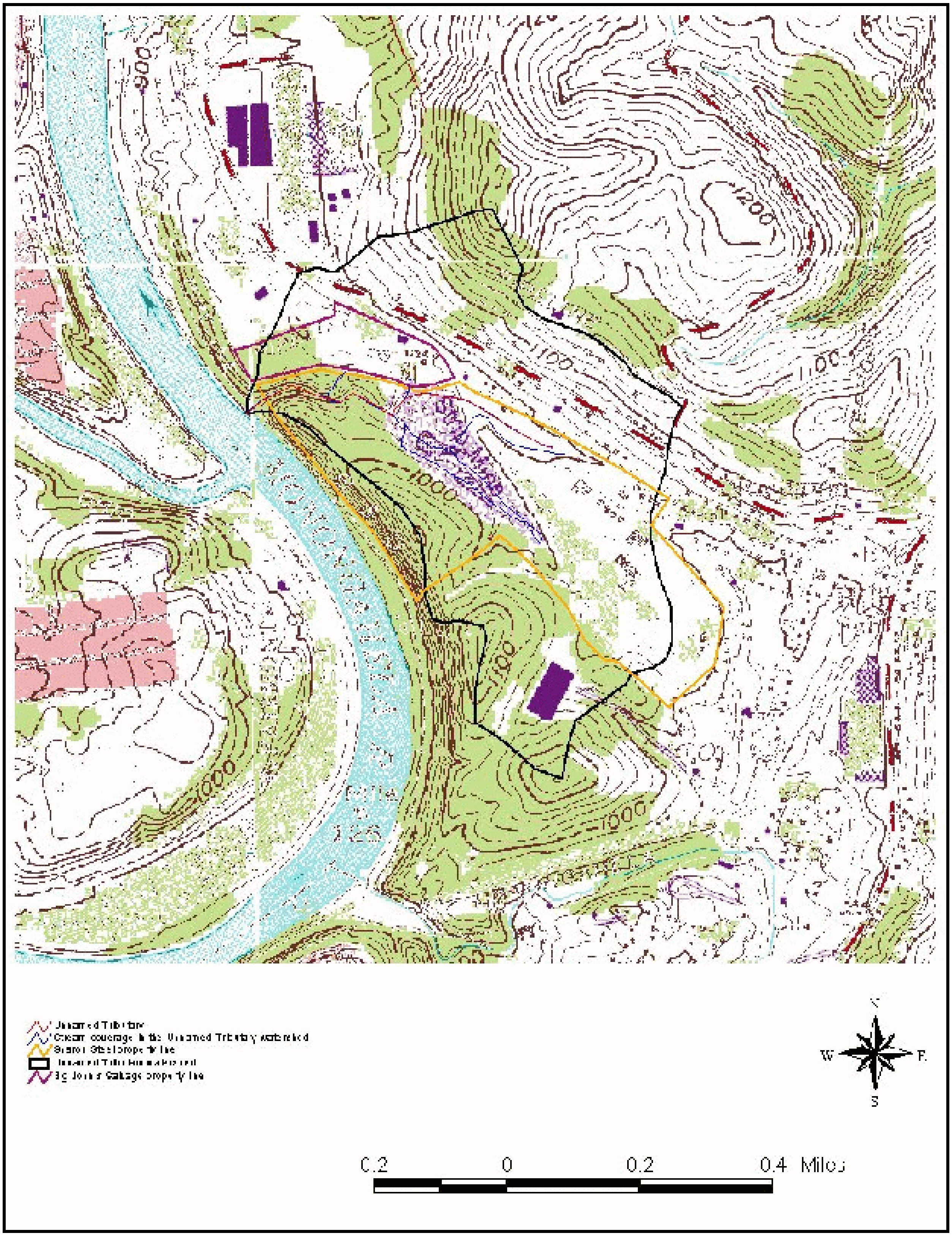


Figure 1-1. Location of the Unnamed Tributary at Sharon Steel in the Monongahela River watershed



Source: USGS 1998

Figure 1-2. Location of the Unnamed Tributary between Sharon Steel and Big John's Salvage

1.1 Description of Sharon Steel

Sharon Steel was used as a by-product coke plant for many years. Coke is a solid residue consisting mainly of carbon, derived from bituminous coal from which the volatile constituents are driven off by baking in an oven at high temperatures. The site produced toluene, other chemical substances, and coke for the steel industry (IT Corporation , 2000). Sharon Steel is located on the east side of the town of Fairmont, Marion County, West Virginia, about twenty miles south of Morgantown, WV. See Figure 1-2. The site encompasses approximately 100 acres of land adjacent to the Monongahela River. Approximately 49 acres of the site were developed for industrial use and the remaining 51 acres on the west side of the site consist of an undeveloped woodland that crests and then drops steeply to the Monongahela River.

The former Big John's Salvage is located immediately north of the site. The western drainage from Sharon Steel shares a common drainage system (the Unnamed Tributary) with Big John's Salvage. Residential areas are located within 200 feet of the north and east sides of the Sharon Steel site.

Surface water leaves the site to the northwest, via the Unnamed Tributary to the Monongahela River. There are four surface water channels on the site that drain into the Unnamed Tributary and may contribute iron and manganese to the impaired waterbody. The headwaters of the first surface water channel are on the hillside west of the site and the channel enters the Unnamed Tributary below the limestone drainage ditch (formerly the oxidation impoundment). This surface water channel receives runoff from the hillside southwest of the site. See number 8 in Figure 1-3.

The second surface water channel flows from southeast to northwest along the south landfill, and then into the limestone drainage ditch. This surface water channel receives runoff from northeast of the first surface water channel and a majority of the runoff from the south face of the south landfill. See number 7 in Figure 1-3.

The third surface water channel also flows southeast to northwest, and receives runoff from the north face of the north landfill before being directed into the limestone drainage ditch. The discharging liquid has a pH of less than 2 prior to treatment in the limestone channel. See number 6 in Figure 1-3.

The fourth surface water channel collects discharge from a subsurface drainage system from the residential area to the east of the site. The channel runs parallel to the third channel for a short distance and merges with a small tributary from Big John's Salvage, then joins the Unnamed Tributary below the limestone drainage ditch. This channel receives runoff from the residential areas. Figure 1-3 presents the locations of each of the four surface water channels that drain Sharon Steel. See number 5 in Figure 1-3.

1.2 Description of Big John's Salvage

The Big John Salvage site existed as the Reilly Tar and Chemical Corporation from 1925 until 1973 (Weston, 1999). Crude tar waste from the nearby coke operations was processed at the plant. Crude tar was pumped from tank cars to storage tanks, and later separated by distillation and condensation processes. Waste generated during the process was retained in a pond near the southern property line. This pond also received wastes from three on-site sewers and several surface water channels. All cooling waters, acid wastes, and tar wastes were supposed to pass through the pond. Discharge from the retention pond flowed through a pipe in the center of the pond that emptied into the Unnamed Tributary.

Big John's Salvage is located in Fairmont, Marion County, WV on the east bank of the Monongahela River. See Figure 1-2. The site is approximately 20 acres in size and is surrounded to the north and east by deciduous forest. The Sharon Steel Superfund site borders the site to the south and the Monongahela River borders the site to the west. There are three surface water channels that flow from Big John's Salvage. These surface water channels are known as the west, middle, and east tributaries. Numbers 1, 2, and 3 in Figure 1-3 represent the locations of the three channels in the watershed of the Unnamed Tributary. Surface water runoff from the site flows in a southerly direction into the Unnamed Tributary.

1.3 The Unnamed Tributary

The Unnamed Tributary accepts flow from the limestone drainage ditch at Sharon Steel, on-site surface water channels from Sharon Steel and Big John's Salvage, and off-site sources. The waters forming the tributary are primarily surface drainage from the northern half of the site and surface drainage from Big John's Salvage. A small percentage is drainage collected from residential yards at the eastern side of the site. The main body of the tributary runs west for approximately 1,600 feet, dropping roughly 60 feet, to the Monongahela River. Before entering the Monongahela River, the Unnamed Tributary flows into an engineered detention/sedimentation pond that contains overflow pipes. The structure was installed in March 2001.

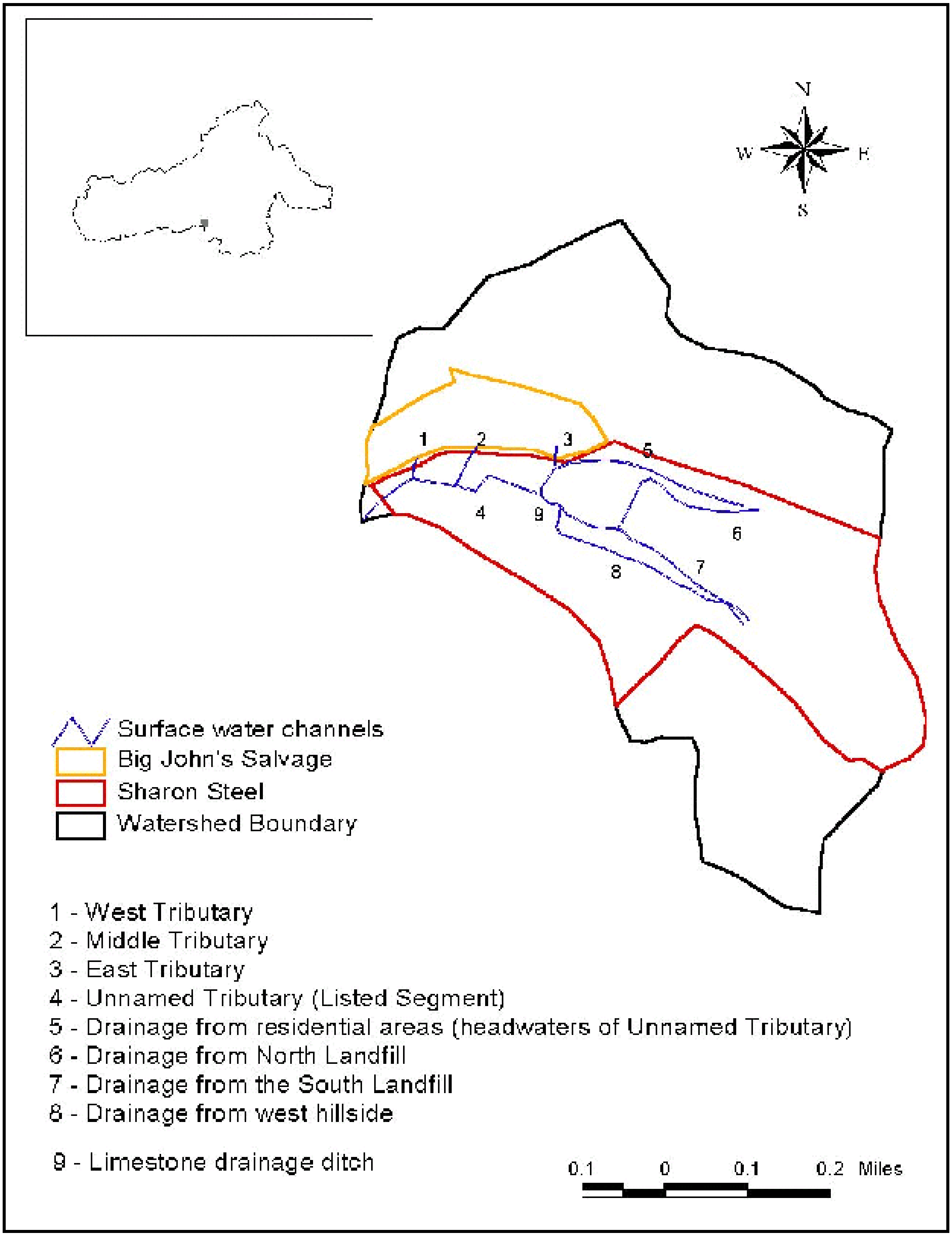


Figure 1-3. Location of surface water channels in the watershed of the Unnamed Tributary

2.0 Water Quality Standards

West Virginia's *Requirements Governing Water Quality Standards* (WVSQS, 1999) have defined water quality criteria for surface waters as a numeric constituent concentration or a narrative statement representing a quality of water that supports a designated use or uses of the waterbody. Total iron and manganese are given numeric criteria under the Aquatic Life and Human Health use designation categories. The Unnamed Tributary has been designated as having Aquatic Life and Human health uses (WVDEP, 1998) (Table 2-1).

Table 2-1. Applicable West Virginia water quality criteria

POLLUTANT	USE DESIGNATION					
	Aquatic Life				Human Health	
	B1, B4		B2		C[3]	A[4]
	Acute [a]	Chronic [b]	Acute [a]	Chronic [b]		
Iron, Total (mg/L)	-	1.5	-	0.5	-	1.5
Manganese, Total (mg/L)	-	-	-	-	-	1.0

Source: WVSQS, 1999; B1 = Warm water fishery streams, B4 = Wetlands, B2 = Trout waters, C = Water contact recreation—this category includes swimming, fishing, water skiing and certain types of pleasure boating such as sailing in very small craft and outboard motor boats, A = Water Supply, Public—This category is used to describe waters which, after conventional treatment, are used for human consumption.

[a] Not to be exceeded

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

[3] These criteria have been calculated to protect human health from toxic effects through fish consumption, unless otherwise noted.

[4] These criteria have been calculated to protect human health from toxic effects through drinking water and fish consumption, unless otherwise noted

There are over 20 surface water sampling points within the watershed of the Unnamed Tributary that were sampled between 1998 and 1999. Thirteen of these sampling points were used for TMDL development because they have location descriptions and could be directly associated with either the Big John's Salvage or Sharon Steel Superfund sites. Examination of the iron and manganese data for the listed segment confirms that water quality criteria were exceeded. Tables A-1, A-2, A-3, and A-4 in Appendix A summarize applicable water quality data for sampling points used in TMDL development for the Unnamed Tributary.

3.0 Source Assessment

This section examines and identifies the potential sources of iron and manganese in the watershed of the Unnamed Tributary. A wide range of data were used to identify potential sources and to characterize the relationship between point and nonpoint source discharges and in-stream response at monitoring stations.

3.1 Data Inventory

A wide range of data and information were reviewed for potential use in the development of TMDLs for the watershed of the Unnamed Tributary. The categories of data used include physiographic data that describe the physical conditions of the watershed and environmental monitoring data that identify potential pollutant sources and their contribution. Table 3-1 shows the various data types and data sources reviewed in the watershed.

Table 3-1. Inventory of data and information used for the source assessment of the watershed

Data Category	Description	Data Source(s)
Watershed Physiographic Data	Land Use (WV GAP 2000)	USGS
	Weather Information	National Climatic Data Center
Environmental Monitoring Data	303(d) Listed Water	WVDEP
	Water Quality Monitoring Data	USEPA (Superfund data)

Section 3.2 describes the available in-stream water quality data for the impaired watershed. Data from monitoring wells, groundwater seeps, soils, and sediment on the two Superfund sites were also analyzed to determine metals sources in the watershed and are summarized in the Data Review Report for the Unnamed Tributary at Sharon Steel (Tetra Tech, 2001).

3.2 Water Quality Data

3.2.1 In-stream Water Quality Data

In-stream water quality data from EPA's Superfund database were analyzed to characterize potential sources of iron and manganese to the impaired watershed. The water quality samples at the two Superfund sites were used to support water quality analysis of iron and manganese in the watershed.

Tables 3-2 through 3-3 present a summary of the available surface water quality data for iron and manganese in the watershed of the Unnamed Tributary that were used in TMDL development. The 13 water quality samples were used to assess loadings of iron and manganese from each of the Superfund sites. Each table presents the sampling stations with known locations at each facility for iron and manganese. There is only one observation at each sampling point. Figure 3-1 presents the location of in-stream water quality sampling points with known locations at Sharon Steel and Big John's Salvage.

The samples were taken in the Unnamed Tributary as well as the surface water channels from the two Superfund sites.

Table 3-2. Summary of surface water iron and manganese observations at the Sharon Steel Superfund site used in TMDL development

Pollutant	Number of Samples	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	Average Concentration (mg/L)	Standard Deviation (mg/L)
Iron	9	13	619	150	183
Manganese	9	0.56	16	7	5

Table 3-3. Summary of surface water iron and manganese observations at the Big John's Salvage Superfund site used in TMDL development

Pollutant	Number of Samples	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	Average Concentration (mg/L)	Standard Deviation (mg/L)
Iron	4	1.39	204	54	100
Manganese	4	0.0536	3.35	1.4	1.5

Water quality samples from Sharon Steel surface runoff exhibited very low pH values, which is often related to metals concentrations in the water column. Five of six available pH samples taken at stations SS10 through SS15 at Sharon Steel were exceeding water quality criteria for pH. The pH values range from 2.79 to 6.89 and can be attributed to the assumed extremely low pH discharges from the Superfund site (WVDEP and Superfund 2001). Naturally high concentrations of iron and manganese have been observed in the soils and bedrock in the watershed and the low pH conditions could be contributing to the increased iron an manganese concentrations in the Unnamed Tributary and contributing drainage ditches by leaching the metals from soils and bedrock. There are exceedances of the pH water quality criteria, however, the Unnamed Tributary was not listed for pH impairment. The only pollutants on the West Virginia 1998 303(d) list for the Unnamed Tributary are iron and manganese, therefore, the TMDLs presented in this report were developed to address only the iron and manganese impairments (See Section 1.0).

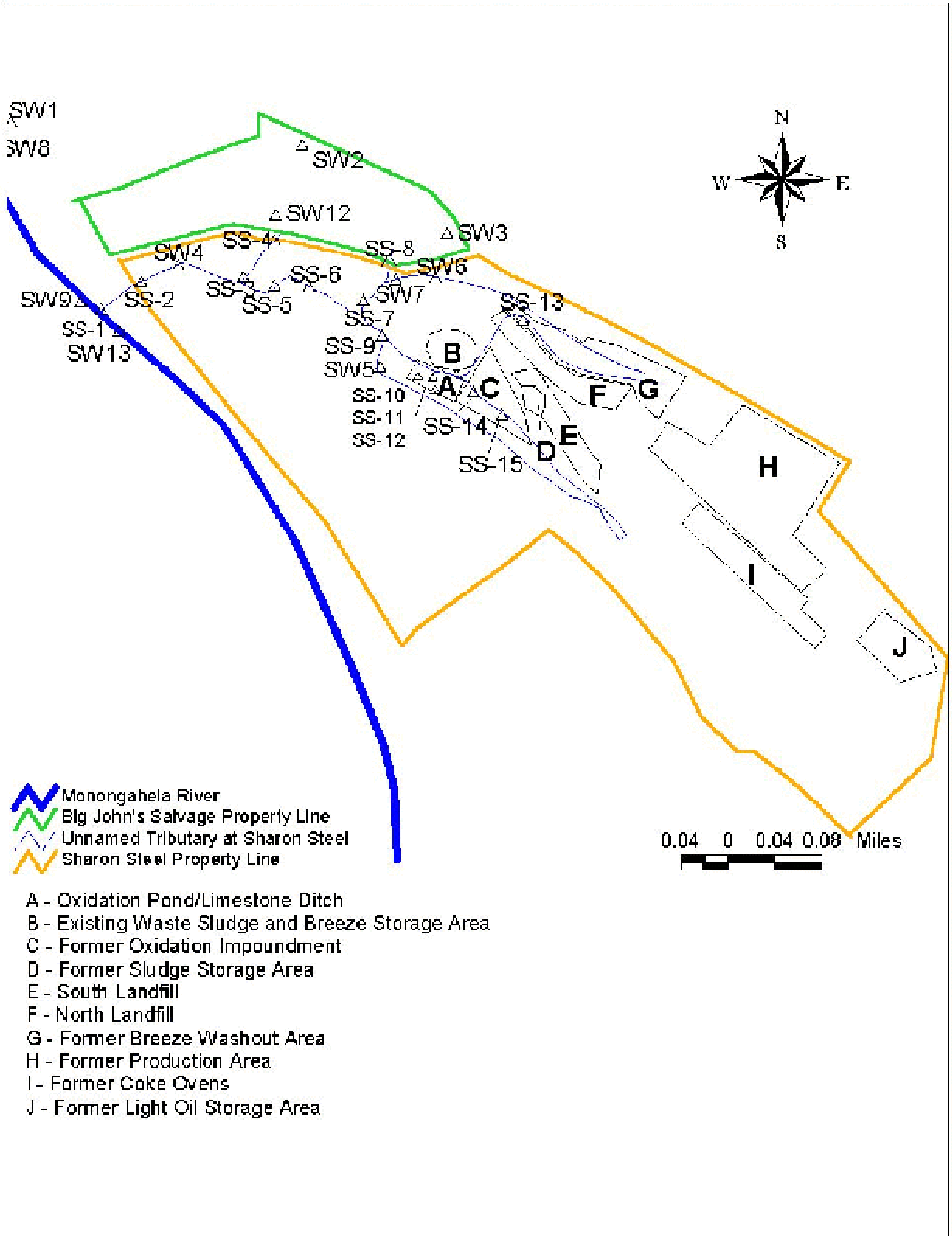


Figure 3-1. Location of in-stream water quality sampling points at Big John's Salvage and Sharon Steel

3.2.2 In-stream Water Quality Data Analysis

The data used for watershed assessment are from 1998 and 1999, but there is no corresponding flow data for that time period. In order to determine critical conditions in the watershed, iron and manganese observations versus flow were observed during the only time period available. Iron and manganese surface water samples were collected at Sharon Steel by WVDEP during high flow and low flow periods on May 8, 1994 and February 17, 1994, respectively. The high and low flow conditions for these two dates however, is qualitative and was based on best professional judgement. The exact locations of the sampling sites are unknown, but they include samples from the Unnamed Tributary as well as the surface water channels from Sharon Steel. The sampling points that have both iron and manganese samples for high and low flow were compared to determine whether the critical conditions for iron and manganese occur at high or low flow in the watershed. The comparisons are shown in Tables 3-4 and 3-5.

Table 3-4. Summary of iron concentrations at high flow versus low flow at Sharon Steel

	Number of Samples	Minimum Total Iron Concentration (mg/L)	Maximum Total Iron Concentration (mg/L)	Average Total Iron Concentration (mg/L)	Standard Deviation of Total Iron Concentrations (mg/L)
High Flow	12	0.49	160	31.99	44.23
Low Flow	12	0.43	880	175.17	292.65

Table 3-5. Summary of manganese concentrations at high flow versus low flow at Sharon Steel

	Number of Samples	Minimum Total Manganese Concentration (mg/L)	Maximum Total Manganese Concentration (mg/L)	Average Total Manganese Concentration (mg/L)	Standard Deviation of Total Manganese Concentrations (mg/L)
High Flow	12	0.19	4.2	1.67	1.36
Low Flow	12	0.11	40	5.03	11.25

The iron and manganese concentrations in surface water samples tended to be significantly higher under low flow conditions than high flow conditions (Tables 3-4 and 3-5). Based on the limited data with corresponding flow observations, low flow appears to be the critical condition for both iron and manganese. However, it must be noted that the data collected in 1994 may not adequately represent stream conditions after the 1996 EPA removal actions at the Sharon Steel site.

3.3 Flow Data

There are no quantitative flow data available for the Unnamed Tributary. Flow data are needed to characterize contributions from various sources under various conditions and assess the assimilative capacity under different conditions. For the purposes of TMDL development in the watershed of the

Unnamed Tributary, flow was estimated using the Hydrological Simulation Program - C++ (HSPC), part of EPA Region 3's Mining Data Analysis System (MDAS). The estimation of flow in the watershed is explained in greater detail in Section 4.1 of this TMDL report.

3.4 Meteorological Data

Meteorological data was used to support estimation of flow conditions for this TMDL. The weather data along with flow and water quality data can be used to consider meteorological influences on flow and concentrations of iron and manganese during various conditions. The meteorological data was obtained from the Terra Alta No. 2 (ID: 8777) weather station. The station is located southeast of the Monongahela River watershed and has continuous hourly weather data for the period of 9/1/1970 through present. The Terra Alta weather station was used for modeling flow in the watershed of the Unnamed Tributary due to the lack of flow data available. The Terra Alta station was the best available weather data and had previously been used in the calibration process for the Monongahela River TMDL project, therefore, it was used for the Unnamed Tributary.

3.5 Point Sources

For the purpose of TMDL development for the watershed of the Unnamed Tributary, the Sharon Steel and Big John's Salvage Superfund sites that have already been described in Sections 1.1 and 1.2 are considered to be point sources. Table 3-6 presents the areas of Big John's Salvage and Sharon Steel contributing flow to the watershed.

Table 3-6. Contributing land use areas of Big John's Salvage and Sharon Steel

Land Use	Land Use Area at Big John's Salvage (acres)	Land Use Area at Sharon Steel (acres)
Forest	2.9	30.2
Pasture	2.3	2.3
Barren	7.7	46.5
Total	**12.9**	**79.0**

3.6 Nonpoint Sources

In addition to point sources, nonpoint sources may also contribute to water quality impairments in the watershed. Nonpoint sources represent contributions from diffuse, non-permitted sources. The predominant land uses in the watershed are barren and forest land based on the GAP 2000 land use data. The GAP 2000 land use categories were reclassified into five land use categories that best describe the watershed conditions and dominant source categories. These land uses as well as others may contribute nonpoint source metal loads to the receiving stream. Table 3-6 presents the land use areas for land uses not associated with either Big John's Salvage or Sharon Steel. Figure 3-2 presents the land use distribution in the entire watershed of the Unnamed Tributary.

Table 3-7. Land use distribution of non-Superfund land uses in the watershed of the Unnamed Tributary

Land Use	Area (acres)
Forest	49.94
Pasture	3.98
Urban (Residential)	11.69
Barren	29.37
Total	**94.98**

Background iron and manganese conditions in the watershed were assumed to be representative of nonpoint source loading to the watershed. Since no background data upstream of the Superfund sites were available, a reference watershed with background iron and manganese data was used to estimate background conditions in the impaired watershed.

The reference watershed was Laurel Run, which is also located in the Monongahela River watershed, approximately 17 miles west of the Unnamed Tributary. Laurel Run is an unimpaired, entirely forested watershed that was assumed to be a good representative of background conditions in the nearby Unnamed Tributary's watershed. The iron and manganese concentrations observed at the Laurel Run watershed were applied to the watershed of the Unnamed Tributary to estimate background conditions in the impaired watershed.

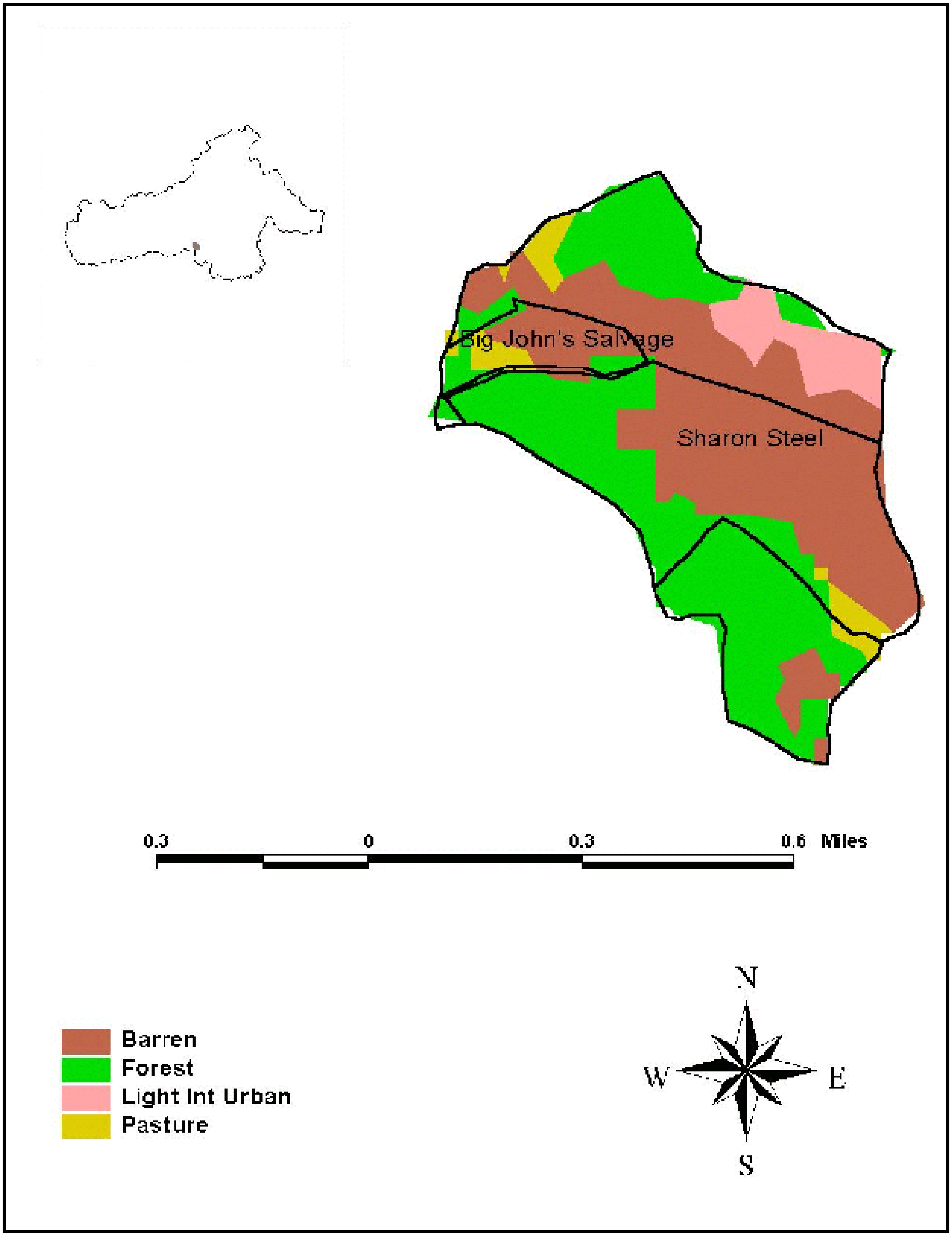


Figure 3-2. Land use distribution in the watershed of the Unnamed Tributary

4.0 Technical Approach

Establishing the relationship 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 for the Unnamed Tributary at Sharon Steel.

4.1 TMDL Approach

Selection of the appropriate approach required consideration of the following:

- Expression of water quality criteria
- Dominant processes
- Scale of analysis

The relevant criteria for iron and manganese were presented in Section 2. Numeric criteria, such as those applicable here, require evaluation of magnitude, frequency, and duration. For metals, the West Virginia criteria are expressed as total metals. This dictates that the methodology predict the total iron and manganese concentrations in the water column of the receiving water. Thresholds of a numeric measure are evaluated for frequency of exceedance (e.g., not to exceed more than once every 3 years on average). Acute standards typically require evaluation over short time periods and violations may occur under variable flow conditions. Chronic criteria require the evaluation of the response over a four-day averaging period. The approach must permit representation of in-stream concentrations under a variety of flow conditions, in order to evaluate critical periods for comparison to chronic and acute criteria. The Unnamed Tributary is designated as having Aquatic Life and Human Health uses. The West Virginia Human Health water quality criteria for iron and manganese are more stringent than the Aquatic Life criteria, therefore, the Human Health criteria were used in developing TMDLs for the Unnamed Tributary.

The approach must also consider the dominant processes regarding pollutant loadings and in-stream fate. For the watershed of the Unnamed Tributary, the primary sources contributing to iron and manganese impairments are two point sources (the Big John’s Salvage and Sharon Steel Superfund sites). Loading processes for nonpoint sources or land-based activities are typically rainfall-driven and thus relate to surface runoff and subsurface discharge to a stream. Point source discharges may or may not be dependent on rainfall. Based on evaluation of iron and manganese observation data from the two sites at high flow and low flow periods (based on qualitative determination of high and low flow by WVDEP), natural influences are not a significant source of iron and manganese to the watershed, but the loadings from the Superfund sites do appear to be significant under low flow conditions. The

Superfund facilities appear to be the dominant pollutant source in the watershed.

Based on the considerations described above, analysis of the monitoring data, and review of the Superfund site literature, a simple approach was used to develop the source-response linkage in the watershed of the Unnamed Tributary. A complex model was not necessary to develop this particular TMDL because of the small size and resulting short residence time of the Unnamed Tributary, no transformations or attenuation of iron and manganese, a lack of observed flow data for the Unnamed Tributary, very limited amounts of water quality data (not enough to calibrate and validate a watershed model), and because the two Superfund sites that compose approximately 50% of the entire 187-acre watershed are the only known sources of elevated levels of iron and manganese to the watershed.

4.1.1 Flow Simulation

Due to the lack of large quantities of water quality data and lack of any flow data, the Hydrologic Simulation Program - C++ (HSPC) model associated with the Mining Data Analysis System (MDAS) was used to estimate flow in the watershed. The HSPC is a dynamic watershed model that is capable of simulating nonpoint source flow and pollutant loading as well as in-stream flow and pollutant transport. Algorithms in HSPC are identical to those in EPA's Hydrologic Simulation Program-FORTRAN (HSPF).

The HSPC was configured to estimate flow for the watershed of the Unnamed Tributary based on the soils and land uses identified in the watershed and the precipitation data from the Terra Alta No. 2 weather station.

Meteorological data were a critical component of the flow estimation. Appropriate representation of precipitation, wind speed, potential evapotranspiration, cloud cover, temperature, and dewpoint are required to develop a valid model. Meteorological data were accessed from the Terra Alta weather station for the years 1998-1999 in order to correspond with the available water quality data from the Superfund sites.

HSPC determines the surface flow, groundwater flow, and interflow from each of the land use categories represented in the model. These flows were in turn, summed to determine a total flow from each of the land uses in the watershed. The flows from each land use were then summed to determine the total flow in the watershed. The flows from each of the Superfund sites were also determined by multiplying the unit area flow for each land use by the area of the corresponding land use in both of the Superfund sites.

Hydrologic processes were represented in the HSPC using algorithms from the PWATER (water budget simulation for pervious segments) and IWATER (water budget simulation for impervious land segments) modules of HSPF (Bicknell et al., 1996). Parameters associated with infiltration, groundwater flow, and overland flow were designated during model calibration for the pH and Metals TMDLs for the Monongahela River Watershed, which is currently under development. In addition to using the calibrated Monongahela River watershed hydrology, the runoff coefficient was determined for each land use based on the following equation:

Runoff Coefficient = Volume of Flow/Volume of Rainfall

The runoff coefficient for each land use was calculated based on the continuous flow output from HSPC and the rainfall data for 1998-1999 from the Terra Alta weather station. The runoff coefficients were all within the range of acceptable runoff coefficients for particular percent impervious values (Novotny and Olem 1994). See Table 4-1 for flow statistics in the watershed of the Unnamed Tributary at Sharon Steel for the years 1998-1999.

Table 4-1. Flow statistics for the watershed of the Unnamed Tributary at Sharon Steel (1998-1999)*

Origin of Flow	Average Flow (cfs)	Minimum Flow (cfs)	Maximum flow (cfs)
Flow from entire 187-acre watershed	0.374	0.00216	4.88
Flow from Big John's Salvage (area within the watershed boundary)	0.0254	0.000151	0.346
Flow from Sharon Steel (area within the watershed boundary)	0.155	0.00092	2.06

* Note that 1998-1999 was a drought year and is not representative of normal conditions in the watershed. The flow conditions for 1998-199 were modeled based on the availability of water quality data from that time period.

The flow was used to determine allowable loadings of iron and manganese in the watershed based on water quality criteria for iron and manganese as well as to determine the exceedances of the West Virginia water quality standards. The determination of allowable iron and manganese loadings is discussed in greater detail in Section 5.0.

4.2 Nonpoint Source Representation

The flows from each of the land uses were summed to obtain a total flow for the entire watershed. These flows and a reference watershed were used to determine background loading of iron and manganese to the watershed. Since no background data upstream of the Superfund sites were available, a reference watershed with background iron and manganese data was used to estimate background conditions in the impaired watershed. The iron and manganese concentrations observed at the Laurel Run watershed were applied to the watershed of the Unnamed Tributary and used to determine background loading by multiplying the concentrations of iron and manganese in Laurel Run by the flow from the impaired watershed. Background loadings of iron and manganese are the only known contributing nonpoint sources in the watershed and are therefore assumed to be equivalent to the entire nonpoint source loading to the watershed.

4.3 Point Source Representation

For the purpose of TMDL development for the watershed of the Unnamed Tributary, the Superfund sites are considered to be point sources, but were represented as nonpoint sources based on the fact that there is no specific discharge point at the two facilities. Nonpoint source representation required the determination of the unit area flow from each land use category and applying it to the corresponding land use areas in each of the Superfund sites. The flows from each land use were summed in order to determine iron and manganese contributions from the two sources.

5.0 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 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 waterbody. Conceptually, this definition is denoted by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

In order to develop iron and manganese TMDLs for the Unnamed Tributary listed on West Virginia's 1998 303(d) list, the following approach was taken:

- Define TMDL endpoints
- Define margin of safety
- Determine background conditions
- Determine the TMDL and source allocations

5.1 TMDL Endpoints

TMDL endpoints represent in-stream water quality targets used in quantifying TMDLs and their individual components. Different TMDL endpoints are necessary for each impairment type (i.e., iron and manganese). West Virginia's numeric water quality criteria for iron and manganese (identified in Section 2) was used to identify endpoints for TMDL development. Based on qualitative flow observations (see Section 3.2.2), low flow periods were assumed to be the critical conditions in the watershed. TMDL endpoints were determined for the 7Q10 low flow of 0 cfs. The TMDL endpoints applied were the 'not to exceed' Human Health criteria for iron and manganese of 1.5 mg/L and 1.0 mg/L, respectively. A TMDL endpoint for pH between 6 and 9 (West Virginia water quality criteria) is also considered based on the relationship between pH and metals in the watershed (see Section 3.2.1). Components of the TMDLs for iron and manganese are presented as concentrations in terms of milligrams per liter in this report.

5.2 Background Conditions

No water quality observations representing background conditions in the watershed were available, so a reference watershed method was used to estimate iron and manganese loading from background sources in the watershed. Section 4.2 describes the reference watershed method and how it was used to determine the background concentrations of iron and manganese in the watershed.

Predicted background concentrations of iron and manganese for the impaired watershed were compared directly to the TMDL endpoints. The background concentrations of iron and manganese were used to represent loading from nonpoint sources in the watershed.

5.3 TMDLs and Allocations

Loading contributions were reduced from applicable sources for the Unnamed Tributary and TMDLs were developed. Background concentrations of iron and manganese were well below the TMDL endpoints for iron and manganese in the watershed, so nonpoint sources in the watershed did not require a reduction. The iron and manganese concentrations from the two Superfund sites and pH values from Sharon Steel were exceeding the West Virginia State water quality criteria. If the Superfund sites were not located in the watershed, it is assumed that in-stream iron and manganese concentrations and pH values would meet the state water quality criteria. Therefore, the two Superfund sites are the only sources that require a reduction in loading.

The following general methodology was used when allocating to sources for the Unnamed Tributary at Sharon Steel TMDL:

- Nonpoint sources in the watershed did not appear to be contributing excessive loads of iron and manganese to the watershed and, therefore, are not required to reduce loadings.
- The WLAs were determined by setting the allocation at the water quality criteria for iron and manganese as well as the water quality criteria for pH.

The TMDLs for the Unnamed Tributary are presented in Table 5-1.

Table 5-1. Iron, manganese, and pH TMDLs for the Unnamed Tributary at Sharon Steel

Source	TMDL			MOS	WLA			LA		
	Iron (mg/L)	Manganese (mg/L)	pH		Iron (mg/L)	Manganese (mg/L)	pH	Iron (mg/L)	Manganese (mg/L)	pH
Sharon Steel	1.5	1.0	6-9	implicit	1.5	1.0	6-9	N/A	N/A	N/A
Big John's Salvage	1.5	1.0	6-9	implicit	1.5	1.0	6-9	N/A	N/A	N/A
Nonpoint Sources	1.5	1.0	6-9	implicit	N/A	N/A	N/A	0	0	0

5.3.1 Wasteload Allocations (WLAs)

Wasteload allocations (WLAs) were assigned to the two Superfund sites. Based on a site visit and discussion with WVDEP and the Superfund Remedial Project Managers, it was assumed that the two

Superfund sites were the only point sources of iron and manganese in the watershed and were the sole reason for exceedances of the iron and manganese water quality criteria. The WLAs are presented as concentrations, in terms of milligrams per liter at a 7Q10 flow of 0 cfs. The WLAs for each site are 1.5 mg/L and 1.0 mg/L for iron and manganese, respectively and pH values between 6 and 9 based on the assumption that a discharge concentration meeting the water quality criteria will result in meeting the water quality criteria in the Unnamed Tributary as well. It is assumed that after implementation of wastewater treatment systems at the Superfund sites, that the sites will essentially function as point source discharges and will continue to discharge during 7Q10 conditions of 0 cfs.

5.3.2 Load Allocation (LAs)

Load allocations (LAs) were assigned to the background contribution of iron and manganese to the watershed from the existing land uses based on the background conditions in the reference watershed Laurel Run. Since a 7Q10 flow of 0 cfs would result in an absence of flow from nonpoint sources because of their dependence on rainfall and runoff processes, the LA is equivalent to 0 pH and 0 mg/L for both iron and manganese.

5.3.3 Margin of Safety

In meeting the West Virginia water quality criteria for iron, manganese, and pH at the end of pipe for the Sharon Steel and Big John's Salvage Superfund sites, there will be no excessive contribution of the pollutants of concern to the Unnamed Tributary at the low flow 7Q10 conditions where the assimilative capacity is lowest. This results in the inclusion of an implicit margin of safety. Determination of an explicit margin of safety is not necessary for this particular TMDL because in presenting the allocations as a concentration at the water quality criteria for iron, manganese, and pH the sources will comply with the water quality standards and there will be no uncertainty involved.

5.3.4 Seasonal Variation

A TMDL must consider seasonal variation in the derivation of the allocation. For the Unnamed Tributary watershed iron and manganese TMDLs, seasonal variation was considered in the formulation of the flow estimation. By using continuous flow simulation (estimating flow over a period of several years), seasonal hydrologic and source loading variability was inherently considered. The metals concentrations estimated on a daily time-step were compared to TMDL endpoints.

6.0 Monitoring Plan

Follow-up monitoring of the Unnamed Tributary of the Monongahela River is recommended. Future monitoring can be used to evaluate water quality conditions, changes or trends in water quality conditions, and contribute to an improved understanding of the source loading behavior. The following monitoring activities are recommended for this TMDL.

West Virginia DEP should continue monitoring the impaired segments of the Unnamed Tributary of Monongahela (tributaries) via its established Watershed Management monitoring approach in 2002, 2007 and beyond.

West Virginia DEP should continue monitoring in advance of, during, and after installation of reclamation activities affecting water quality at abandoned mine sites.

West Virginia DEP should consider additional stations and more frequent sampling of water quality in the impaired reaches, and continue to encourage participation by active watershed organizations.

West Virginia DEP should emphasize the use of proper Quality Assurance Quality Control (QA/QC) protocols to avoid potential sample contamination during water sample collection and transfer

7.0 Reasonable Assurance

This TMDL will not focus on the 163 pollutants in addition to iron and manganese identified in the watershed since the majority of the land in the watershed consists of the Sharon Steel and Big John Salvage Superfund sites which are being cleaned up under the Comprehensive Environmental Resource Compensation and Liabilities Act (CERCLA). At this time it is anticipated that the additional pollutants identified in the watershed will be dealt with during the clean up of the two sites, thereby eliminating the need to develop TMDLs for the additional potential pollutants. However, a review(s) of the watershed will be conducted both during and following the completion of the Superfund cleanup to identify the need for the development of any additional TMDLs for the Unnamed Tributary.

References

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Appendix A
Water Quality Data from
Sharon Steel and Big John's Salvage

Table A-1. Surface water iron observations at Sharon Steel used in TMDL development

Sample ID	Number of Observations	Total Iron (mg/L)	Date of Sample	Sample Location	Agency
SS9	1	61.4	12/22/98	Unnamed Tributary downstream of the oxidation pond	IT Corporation for Exxon Mobil
SS10	1	168	12/21/98	Oxidation pond	IT Corporation for Exxon Mobil
SS11	1	147	12/21/98	Oxidation pond	IT Corporation for Exxon Mobil
SS12	1	147	12/21/98	Oxidation pond	IT Corporation for Exxon Mobil
SS13	1	63	12/18/98	Surface water channel on east side of Sharon steel	IT Corporation for Exxon Mobil
SS14	1	619	12/17/98	Surface water channel in the Former Oxidation Impoundment	IT Corporation for Exxon Mobil
SS15	1	13	12/17/98	Surface water channel in the Former Oxidation Impoundment	IT Corporation for Exxon Mobil
SW5	1	71.7	3/9/99	South branch of Unnamed Tributary	USEPA
SW7	1	60.9	3/9/99	South branch of Unnamed Tributary	USEPA

Table A-2. Surface water iron observations at Big John's Salvage used in TMDL development

Sample ID	Number of Observations	Total Iron (mg/L)	Date of Sample	Sample Location	Agency	Comments[a]
SS3	1	1.84	12/22/98	Tributary from Big John's Salvage	IT Corporation for Exxon Mobil	
SS4	1	9.53	12/22/98	Tributary from Big John's Salvage	IT Corporation for Exxon Mobil	
SS8	1	204	12/23/98	Tributary from Big John's Salvage	IT Corporation for Exxon Mobil	
SW12	1	1.39	3/10/99	On-site waste pond	USEPA	K

[a] K=Analyte present. Reported value may be biased high. Actual value is expected to be lower.

Table A-3. Surface water manganese observations at Sharon Steel

Sample ID	Number of Observations	Total Manganese (mg/L)	Date of Sample	Sample Location	Agency
SS9	1	3.35	12/22/98	Unnamed Tributary downstream of the oxidation pond	IT Corporation for Exxon Mobil
SS10	1	8.9	12/21/98	Oxidation pond	IT Corporation for Exxon Mobil
SS11	1	8.5	12/21/98	Oxidation pond	IT Corporation for Exxon Mobil
SS12	1	8.7	12/21/98	Oxidation pond	IT Corporation for Exxon Mobil
SS13	1	9.3	12/18/98	Surface water channel on east side of Sharon steel	IT Corporation for Exxon Mobil
SS14	1	16	12/17/98	Surface water channel in the Former Oxidation Impoundment	IT Corporation for Exxon Mobil
SS15	1	0.56	12/17/98	Surface water channel in the Former Oxidation Impoundment	IT Corporation for Exxon Mobil
SW5	1	2.75	3/9/99	South branch of Unnamed Tributary	USEPA
SW7	1	4.38	3/9/99	South branch of Unnamed Tributary	USEPA

Table A-4. Surface water manganese observations at Big John's Salvage

Sample ID	Number of Observations	Total Manganese (mg/L)	Date of Sample	Sample Location	Agency
SS3	1	.348	12/22/98	Tributary from Big John's Salvage	IT Corporation for Exxon Mobil
SS4	1	2.04	12/22/98	Tributary from Big John's Salvage	IT Corporation for Exxon Mobil
SS8	1	3.35	12/23/98	Tributary from Big John's Salvage	IT Corporation for Exxon Mobil
SW12	1	0.0536	3/10/99	On-site waste pond	USEPA

APPENDIX B

Data Analysis for Pollutants Identified in the Watershed of the Unnamed Tributary at Sharon Steel

Iron and manganese are the pollutants of concern listed on the West Virginia 1998 303(d) list for the Unnamed Tributary at Sharon Steel, but 163 additional pollutants have been identified and sampled at the Big John's Salvage and Sharon Steel Superfund sites in the watershed of the Unnamed Tributary. All of the pollutants with numeric West Virginia state water quality criteria were analyzed and it was determined whether or not and by how much the pollutants were exceeding the state water quality criteria using surface water data collected at the locations presented in Table B-1. Data analysis was provided for data obtained from the Big John's Salvage and Sharon Steel sites for February 1994, May 1994, December 1998, October 2000, and March 2001. There was only one sample taken at each location, therefore, the samples were initially compared to the acute human health and aquatic life water quality criteria. If acute human health or aquatic life water quality criteria do not exist for a particular parameter, then the sample was compared to the chronic criteria, even though no continuous data were available. Tables B-2 through B-7 present the numeric water quality criteria, the sample results, and the percent exceedance of the standards for inorganics, organics, and polynulclear aromatic hydrocarbons (PAHs) sampled at the Big John's Salvage and Sharon Steel Superfund sites. If a parameter was sampled for and not detected, it was not included in the following tables. A hardness value of 100 $CaCO_2$ was assumed for water quality criteria based on hardness as $CaCO_2$ because there are no hardness observations in the watershed. If a sample did not have a corresponding location description it was not included in the summary tables.

Table B-1. Surface water sample location sites at the Big John's Salvage Superfund site 2000 and 2001

Sample Number	Sample Location Description
MCO2G9, MCO2HO, CO2J3, CO2J4	From impoundments' outfall between the impoundment and the Monongahela River
MCO2H1, CO2J2	From the Unnamed Tributary #1 at the mouth of the impoundment
MCO3C5, CO4Q2,	From the confluence of the east tributary and the Unnamed Tributary #1
MCO3C6, CO4Q3	From the confluence of the middle tributary and the Unnamed Tributary #1
MCO3C8, CO4Q5	From the confluence of the west Tributary and the Unnamed Tributary #1
MCO3D1, CO4R0	From the Unnamed Tributary #2
MCDO3D2, CO4R1	From the outfall of the impoundment
MCDO3E6, CO4L2	From the east tributary

Sample Number	Sample Location Description
MCO3E8, CO4L4	From the east tributary
MCO3F0, CO4L6	From the Unnamed Tributary #1
MCO3G4, CO4N0	From the mouth of the impoundment in the Unnamed Tributary #1
SW001	Low flow; Oily seepage emanating from the bank northeast of the light storage area in the northeast of the Sharon Steel site
SW002	Low flow; The leachate emanating beneath the site fence northeast of the facility boiler house building
SW003	Low flow; Junction box just east of the gas purifier tanks
SW004	Low flow; Yellow seep north and upgradient of the junction box (SW003) east of the gas purifier tanks
SW005	Low flow; Blue seep north and upgradient of SW004
SW006	Low flow; Storm culvert pipe that crosses beneath Suncrest Blvd and empties into creek that flows south of SW003
SW007	Low flow; Storm culvert pipe that crosses beneath Suncrest Blvd and empties east of breeze washout area
SW008	Low flow; A leachate seep from bottom of north slope of the North Landfill
SW009	Low flow; a leachate seep from bottom of north slope of the North landfill downgradient from SW008
SW010	Low flow; Storm sewer sulver that crosses Suncrest Blvd and empties into culvert at the far west end of the breeze washout
SW011	Low flow; Surface water ditch that flows into culvert leading to SW012. The ditch is in the north side of the west end of North Landfill
SW012; SW012A	Low flow; Stainless steel trough at the culvert exit under the North Landfill
SW013	Low flow; Leachate flowing from southwest base of North Landfill. Leachate flows down to Unnamed Trib and enters Monongahela River
SW014	Low flow; NPDES outfall #1 at oxidation pond #2

Sample Number	Sample Location Description
SW015	Low flow; Outfall of the 24 inch bypass line west of the oxidation ponds
SW016	Low flow; Inlet of the 24 inch bypass line west of the oxidation ponds
SW017	Low flow; Effluent from Oxidation Pond #1 into Oxidation Pond #2
SW018	Low flow; Outfall of NPDES systrem which flows under South Landfill before it flows into Oxidation Pond #1
SW019; SW019A	Low flow; Open junction box southeast of Oxidation Pond #1
SW020	Low flow; From spring upstream of SW019 originating from three culverts located in the southeast side of site at base of old RxR grade
SW021	Low flow; Last of three connected surface drainage culverts located at base of old RxR grade upstream of SW020
SW022	Low flow; Last manhole in NPDES system (Soda ash manhole). Located downstream of SW024 and SW025
SW023	Low flow; Surface water drainage into the second manhole southeast and upstream of the treatment manhole (SW022)
SW024	Low flow; Manhole east of building AU. Upstream and northeast of SW022
SW025	Low flow; The first manhole southeast and upstream of SW 022
SW026	Low flow; Surface water runoff ditch at southeast corner of site approximately 300 feet south of building BA
SW027	Low flow; Storm sewer culvert that crosses Suncrest Blvd and empties into breeze washout area
MCO3F3	
SP-01	Sedimentation pond

Table B-2. Surface water quality samples and analysis for inorganics at the Big John's Salvage Superfund site

Sample Number		MCO2G9			MCO2HO			MCO2H1		
Date		3/19/01			3/19/01			3/19/01		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	15,900		2,020%	16,700		2,127%	24,000		3,100%
Antimony	14 (HH)	[2.9]	B							
Barium	1,000 (HH)	[33.0]			[34.6]			[29.8]		
Beryllium	130 (AL)	[2.0]			[2.0]			[2.9]		
Beryllium	.0077(HH)	[2.0]		25,874%	[2.0]		25,874%	[2.9]		37,562%
Copper	1,000 (HH)	26.5			27.8			49.4		
Copper	17 (AL)	26.5		56%	27.8		64%	49.4		191%
Iron	1500 (AL)	67,800		4420%	72,000		4700%	106,000		6967%
Lead	50 (HH)	25.6			27.3			32.7		
Lead	64.6 (AL)	25.6			27.3			32.7		
Manganese	1,000 (AL)	3,300		230%	3,490		249%	4,300		330%
Mercury	2.4 (AL)	0.61			0.9			0.24	K	
Nickel	510 (HH)	69.8			73.4			107		
Nickel	1415 (AL)	69.8			73.4			107		
Thallium	1.7 (HH)				[7.0]		312%	[9.0]		429%
Zinc	114 (AL)	305		168%	322		182%	467		310%

Table B-2. Continued

Sample Number		MCO3C5			MCO3C6			MCO3C8		
Date		1/30/01			1/30/01			1/31/01		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	9,080		1,111%	55,300		7,273%	17,400		2,220%
Antimony	14 (HH)				[3.5]			[8.2]		
Arsenic	50 (HH)	[5.5]			31.7			63.4		27%
Barium	1,000 (HH)	[141]			793			216		
Beryllium	0.0077 (HH)	[0.98]	B	12,627%	5.1		66,134%	[1.2]	B	15,484%
Beryllium	130 (AL)	[0.98]	B		5.1			[1.2]	B	
Copper	1,000 (HH)	[20.9]			130			198		
Copper	17 (AL)	[20.9]		23%	130		665%	198		1065%

Sample Number		MCO3C5			MCO3C6			MCO3C8		
Date		1/30/01			1/30/01			1/31/01		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Cyanide	22 (AL)	17.5			[7.2]			11.5		
Iron	1500 (AL)	15500		933%	105,000		6900%	26,600		1673%
Lead	50 (HH)	16.5			189		278%	511		922%
Lead	64.6 (AL)	16.5			189		193%	511		691%
Manganese	1,000 (AL)	704			6,430		543%	289		
Mercury	2.4 (AL)	0.37			11.2 +		367%	172 +		7,067%
Nickel	510 (HH)	[20.9]			126			70		
Nickel	1415 (AL)	[20.9]			126			70		
Thallium	1.7 (HH)				12.9		659%	282		16,488%
Zinc	114(AL)	55.9			409		259%			

Table B-2 Continued

Sample		MCO3D1			MCO3D2			MCO3E6		
Date		2/1/01			2/1/01			10/5/00		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	[104]	B		1,180		57%	11,600		1,447%
Arsenic	50 (HH)	[5.4]							UL	
Barium	1,000 (HH)	[39.5]			[51.2]			[22.1]		
Beryllium	0.0077 (HH)	[0.12]	B	1,458%	[0.43]	B	5,484%	[4.7]		60,939%
Beryllium	130 (AL)	[0.12]	B		[0.43]	B		[4.7]		
Cadmium	5 (HH)				[2.1]					
Cadmium	3.7 (AL)				[2.1]					
Copper	1,000 (HH)	[1.8]	B		[5.7]			[8.2]		
Copper	17 (AL)	[1.8]	B		[5.7]			[8.2]		
Cyanide	22 (AL)	[1.2]	B		72.2		228%	58.9	L	168%
Iron	1500 (AL)	[84.9]			19,500		1200%	417,000		27700%
Lead	50 (HH)	[2.4]			7.6			4.0	B	
Lead	64.6 (AL)	[2.4]			7.6			4.0	B	
Manganese	1,000 (AL)	20.5			1810		81%	34,000 +		3,300%
Mercury	2.4 (AL)				0.79					

Sample		MCO3D1			MCO3D2			MCO3E6		
Date		2/1/01			2/1/01			10/5/00		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Nickel	510 (HH)	[1.5]			[29.6]			59.2		
Nickel	1415 (HH)	[1.5]			[29.6]			59.2		
Zinc	114 (AL)		UL		133		17%	92		

Table B-2 Continued

Sample Number		MCO3E8			MCO3F0			MCO3G4		
Date		10/5/00			10/5/00			10/6/00		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	375			49,800		6,540%	41,000		5,367%
Barium	1,000 (HH)	[87.4]			[28.2]			[34.6]		
Beryllium	130 (AL)				8.3			6.8		
Beryllium	.0077 (HH)				8.3		107,692%	6.8		88,212%
Copper	1,000 (HH)	[3.2]			40.4			33.7		
Copper	17 (AL)	[3.2]			40.4		138%	33.7		98%
Cyanide	22 (AL)	[9.1]			123		459%	23.8		8%
Iron	1500 (HH)	16,600		1007%	262,000		17367%	167,000		11033%
Lead	50 (HH)	6.5			8.2			56.4		13%
Lead	64.6 (AL)	6.5			8.2			56.4		
Manganese	1,000 (AL)	2,610		161%	14,800 +		1,380%	11,700 +		1,070%
Nickel	510 (HH)				219			178		
Nickel	1415 (AL)				219			178		
Zinc	114	[13.0]			626		449%	511		348%

AL = Aquatic life standard
HH = Human health standard
[] = Analyte present. As values approach the IDL the quantitation may not be accurate.
B = Not detected substantially above the level reported in laboratory or field blanks.
K = Analyte present. Reported values may be biased high. Actual value is expected to be lower.
+ = Result reported from diluted analysis.
UL = Not detected, quantitation limit is probably higher.

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

Table B-3. Surface water quality samples and analysis for inorganics at the Sharon Steel Superfund site

Sample Number		SW001			SW002			SW003		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)		ND		2.6			5		
Barium	1,000 (HH)	0.044			0.022			0.023		
Cyanide	22 (AL)		ND		40		82%	90		309%
Iron	1500 (AL)	9.4			5.3			10		
Manganese	1000 (AL)	1.1			0.53			0.39		
Zinc	114 (AL)	0.04			0.18			0.22		

Table B-3 Continued

Sample		SW004			SW005			SW006		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	8.3			6.3				ND	
Barium	1,000 (HH)	0.017			0.013			0.019		
Cyanide	22 (AL)	100		355%		R			ND	
Iron	1500 (AL)	39.0			4.9			0.39		
Manganese	1000 (AL)	0.94			0.57			0.01		
Nickel	510 (HH)	0.08				ND			ND	
Nickel	1415 (AL)	0.08				ND			ND	
Zinc	114(AL)	0.69			0.08			0.05		

Table B-3 Continued

Sample		SW007			SW008			SW009		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)		ND		25			25		
Barium	1,000 (HH)	0.029			0.007			0.23		
Copper	1000 (HH)		ND		0.04			0.17		
Copper	17 (AL)		ND		0.04			0.17		
Cyanide	22 (AL)		ND		60		173%	130		491%
Iron	1500 (AL)	0.21			87			91		
Lead	50 (HH)		ND			ND		0.49		
Lead	64.6 (AL)		ND			ND		0.49		
Manganese	1000 (AL)	0.01			2.8			1		
Nickel	510 (HH)		ND		0.07			0.04		
Nickel	1415 (HH)		ND		0.07			0.04		
Zinc	114 (AL)	0.04			0.45			0.27		

Table B-3 Continued

Sample		SW010			SW011			SW012		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	5.2			0.18			14		
Barium	1,000 (HH)	0.03			0.051			0.015		
Copper	1000 (HH)		ND			ND		0.03		
Copper	17 (AL)		ND			ND		0.03		
Cyanide	22 (AL)		ND		40		82%	40		82%
Iron	1500 (AL)	2			0.37			37		
Manganese	1000 (AL)	0.8				ND		1.4		
Zinc	114 (AL)	0.01			0.08			0.29		

Table B-3 Continued

Sample		SW012A			SW013			SW014		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	14			50.00			42		
Barium	1,000 (HH)	0.015			0.035			0.021		
Beryllium	.0077 (HH)		ND		0.022		186%	0.006		
Beryllium	130 (AL)		ND		0.022			0.006		
Copper	1000 (HH)	0.04				ND		0.17		
Copper	17 (AL)	0.04				ND		0.17		
Cyanide	22 (AL)	70		218%	100		355%	60		173%
Iron	1500 (AL)	37			880			260		
Manganese	1000 (AL)	1.4			40			4		
Nickel	510 (HH)		ND		0.3			0.31		
Nickel	1415 (HH)		ND		0.3			0.31		
Zinc	114 (AL)	0.29			0.44			0.16		

Table B-3 Continued

Sample		SW015			SW016			SW017		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	2.6			2.3			83		
Barium	1,000 (HH)	0.043			0.041			0.025		
Beryllium	0.0077 (HH)		ND			ND		0.012		56%
Beryllium	130 (AL)		ND			ND		0.012		
Copper	1000 (HH)		ND			ND		0.41		
Copper	17 (AL)		ND			ND		0.41		
Cyanide	22 (AL)		ND			ND		60		173%
Iron	1500 (AL)	14			12			500		
Manganese	1000 (AL)	0.47			0.45			7		
Nickel	510 (HH)	0.03			0.03			0.6		

Sample		SW015			SW016			SW017		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Nickel	1415 (AL)	0.03			0.03			0.6		
Zinc	114 (AL)	0.07			0.08			2		

Table B-3 Continued

Sample		SW018			SW019			SW019A		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	91			3.8			3.7		
Barium	1,000 (HH)	0.024			0.061			0.031		
Beryllium	0.0077 (HH)	0.014		82%		ND			ND	
Beryllium	130 (AL)	0.014				ND			ND	
Copper	1000 (HH)	0.3			0.01				ND	
Copper	17 (AL)	0.3			0.01				ND	
Cyanide	22 (AL)	120		445%	50		127%	40		82%
Iron	1500 (AL)	670			27			27		
Manganese	1000 (AL)	8.2			0.55			0.55		
Nickel	510 (HH)	0.72			0.04			0.04		
Nickel	1415 (HH)	0.72			0.04			0.04		
Zinc	114 (AL)	2.2			0.02			0.09		

Table B-3 Continued

Sample		SW020			SW021			SW022		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	4.5			0.33			0.19		
Barium	1,000 (HH)	0.028			0.024			0.031		
Cyanide	22 (AL)	40		82%	40		82%	70		218%

Sample		SW020			SW021			SW022		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Iron	1500 (AL)	41			1			1.3		
Manganese	1000 (AL)	0.59			0.37			0.32		
Nickel	510 (HH)	0.06				ND			ND	
Nickel	1415 (AL)	0.06				ND			ND	
Zinc	114 (AL)	0.11			0.07			1.4		

Table B-3 Continued

Sample		SW023			SW024			SW025		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)		ND		2.7			1.4		
Barium	1,000 (HH)	0.013			0.069			0.05		
Copper	1000 (HH)		ND		0.02				ND	
Copper	17 (AL)		ND		0.02				ND	
Cyanide	22 (AL)		ND		770		3400%	20		
Iron	1500 (AL)	0.08			17			22		
Manganese	1000 (AL)	0.01			0.89			3.3		
Zinc	114 (AL)	0.02			2.9			1.0		

Table B-3 Continued

Sample		SW026			SW027			SW001		
Date		2/17/94			2/17/94			5/8/94		
Analyte	West Virginia water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	0.61			0.58			9.6		

Sample		SW026			SW027			SW001		
Date		2/17/94			2/17/94			5/8/94		
Analyte	West Virginia water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Barium	1,000 (HH)	0.017			0.03			0.08		
Iron	1500 (AL)	0.43			1			17		
Manganese	1000 (AL)	0.11			0.07			3.6		
Zinc	114 (AL)	0.12			0.02			0.22		

Table B-3 Continued

Sample		SW002			SW004			SW005		
Date		5/8/94			5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	2.4			4.0			2.5		
Barium	1,000 (HH)	0.03			0.03			0.02		
Cyanide	22 (AL)	100		355%	780		3445%	420		1809%
Iron	1500 (AL)	2			10			8		
Manganese	1000 (AL)	0.42			1.6			0.86		
Zinc	114 (AL)	0.16			0.22			0.11		

Table B-3 Continued

Sample		SW008			SW009			SW013		
Date		5/8/94			5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	14			16			24		
Barium	1,000 (HH)	0.02			0.02			0.02		
Copper	1000 (HH)	0.01			0.07				ND	
Copper	17 (AL)	0.01			0.07				ND	
Cyanide	22 (AL)	110		400%	80		264%	90		309%
Iron	1500 (AL)	46			55			32		

Sample		SW008			SW009			SW013		
Date		5/8/94			5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Manganese	1000 (AL)	4.2			1.3			0.58		
Nickel	510 (HH)	0.04				ND			ND	
Nickel	1415 (AL)	0.04				ND			ND	
Zinc	114 (AL)	0.3			0.25			0.25		

Table B-3 Continued

Sample		SW014			SW015			SW018		
Date		5/8/94			5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	12			1.5			23		
Barium	1,000 (HH)	0.03			0.03			0.02		
Copper	1000 (HH)	0.03	ND			ND		0.1		
Copper	17 (AL)	0.03	ND			ND		0.1		
Cyanide	22 (AL)	60		173%		ND		140		536%
Iron	500 (AL)	37			2.1			160		
Manganese	1000 (AL)	1.7			0.27	ND		2.1		
Nickel	510 (HH)	0.06	ND			ND		0.18		
Nickel	1415 (AL)	0.06	ND			ND		0.18		
Zinc	114 (AL)	0.36			0.09			0.62		

Table B-3 Continued

Sample		SW020			SW026		
Date		5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	3.4			0.97		
Barium	1,000 (HH)	0.02			0.02		

Sample		SW020			SW026		
Date		5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Iron	1500 (AL)	14			0.49		
Manganese	1000 (AL)	0.19				ND	
Zinc	114 (AL)	0.11			0.07		

Table B-3 Continued

Sample		SP-01		
Date		6/5/95		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance
Aluminum	750 (AL)	168		
Barium	1,000 (HH)	90.3		
Cadmium	5 (HH)	3.37		
Cadmium	3.7 (AL)	3.37		
Cyanide	22 (AL)	31.6		44%
Iron	1500 (AL)	224		
Lead	50 (HH)	72.7		45%
Lead	64.6 (AL)	72.7		13%
Manganese	1000 (AL)	4,700		370%
Nickel	510 (HH)	23.9		
Nickel	1415 (AL)	23.9		
Zinc	114 (AL)	328		188%

J = Analyte present. As values approach the IDL the quantitation may not be accurate.
R = Unusable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.
UJ = Not detected, quantitation limit may be inaccurate or imprecise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
ND = Not detected

Table B-4. Surface water quality samples and analysis for organics at the Big John's Salvage Superfund site

Sample Number		CO2J2			CO2J3			CO2J4		
Date		3/19/01			3/19/01			3/19/01		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Benzene	0.66 (HH)	10		1,415%	10		1,415%	11		1,567%
Phenol	10,200 (AL)	6	J		8	J		10	J	
Phenol	3,500 (HH)	6	J		8	J		10	J	
Toluene	6,800 (HH)	2	J		2	J		2	J	

Table B-4 Continued

Sample Number		CO4Q2			CO4Q3			CO4Q5		
Date		1/30/01			1/30/01			1/31/01		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
1,2-Dichloroethane	0.035 (HH)				1	B	2,757%			
bis-(2-Ethylexyl) phthalate	3.0 (AL)	2	B					3	B	
Di-n-butylphthalate	3.0 (AL)							1	J	
Di-n-octylphthalate	3.0 (AL)							1	J	
Toluene	6,800 (HH)				1	J				

Table B-4 Continued

Sample		CO4R0			CO4R1			CO4L2		
Date		2/1/01			2/1/01			10/5/00		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
1,2-Dichloroethane	0.035 (HH)	1	B	2,757%						
Benzene	0.66 (HH)				71		10,658%	830		125,658%
Phenol	10,200 (AL)				10			62	J	
Phenol	3,500 (HH)				10			62	J	
Toluene	6,800 (HH)				11			49	J	

Table B-4 Continued

Sample		CO4L4			CO4L6			CO4N0		
Date		10/5/00			10/5/00			10/6/00		
Analyte	West Virginia water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Benzene	0.66 (HH)	4	J		12					
Ethylbenzene	3,100 (HH)	6	J							
Phenol	10,200 (AL)	2	J		3	J				
Phenol	3,500 (HH)	2	J		3	J				
Toluene	6,800 (HH)	8	J		2	J				

AL = Aquatic life standard
HH = Human health standard
J = Analyte present. Reported value may not be accurate or precise.
B = Not detected substantially above the level reported in laboratiry or field banks.

Table B-5. Surface water quality samples and analysis for organics at the Sharon Steel Superfund site

Sample		SW001			SW002			SW003		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Benzene	0.66 (HH)	16000		2424142%		ND			ND	
Ethylbenzene	3,100 (HH)	50				ND			ND	
Phenol	10,200 (AL)	110				ND			ND	
Phenol	3,500 (HH)	110				ND			ND	
Tolulene	6,800 (HH)	3900				ND			ND	

Table B-5 Continued

Sample		SW007			SW008			SW009		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Benzene	0.66 (HH)		ND			ND		150		22627%

Sample		SW007			SW008			SW009		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Ethylbenzene	3,100 (HH)		ND			ND		19		
Tolulene	6,800 (HH)		ND			ND		70		

Table B-5 Continued

Sample		SW012A			SW013			SW014		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Benzene	0.66 (HH)		ND		1000		151415%	28		4142%

Table B-5 Continued

Sample		SW015			SW016			SW017		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Benzene	0.66 (HH)		ND			ND		40		5961%

Table B-5 Continued

Sample		SW018			SW019			SW019A		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Benzene	0.66 (HH)	54		8082%		ND			ND	

Sample		SW018			SW019			SW019A		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Phenol	10,200 (AL)	14				ND			ND	
Phenol	3,500 (HH)	14				ND			ND	
Tolulene	6,800 (HH)	10				ND			ND	

Table B-5 Continued

Sample		SW020			SW021			SW022		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Phenol	10,200 (AL)		ND			ND		69		
Phenol	3,500 (HH)		ND			ND		69		

Table B-5 Continued

Sample		SW026			SW027			SW001		
Date		2/17/94			2/17/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Benzene	0.66 (HH)		ND			ND		11000		1666567%
Ethylbenzene	3,100 (HH)		ND			ND		53		
Phenol	10,200 (AL)		ND			ND		52		
Phenol	3,500 (HH)		ND			ND		52		

Sample		SW026			SW027			SW001		
Date		2/17/94			2/17/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Tolulene	6,800 (HH)		ND			ND		510		

Table B-5 Continued

Sample		SW008			SW009			SW013		
Date		5/8/94			5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Benzene	0.66 (HH)		ND		120		18082%		ND	
Tolulene	6,800 (HH)		ND		77				ND	

Table B-5 Continued

Sample		SW014			SW015			SW018		
Date		5/8/94			5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Benzene	0.66 (HH)		ND			ND		34		5052%

ND = Not detected.

Table B-6. Surface water quality samples and analysis for polynulclear aromatic hydrocarbons (PAHs) at the Big John's Salvage Superfund site

Sample Number		CO2J2			CO2J3			CO2J4		
Date		3/19/01			3/19/01			3/19/01		
Analyte	**West Virginia water Quality Standards (ug/L)**	**Sample Result (ug/L)**	**Flag**	**Percent Exceedance**	**Sample Result (ug/L)**	**Flag**	**Percent Exceedance**	**Sample Result (ug/L)**	**Flag**	**Percent Exceedance**
Acenapthene	0.0028 (HH)	2	J	71,329%	4	J	142,757%	3	J	107,043%
Anthracene	0.0028 (HH)				1	J	35,614%	1	J	35,614%
Fluoranthene	0.0028 (HH)	1	J	35,614%	3	J	107,043%	2	J	71,329%
Napthalene	0.0028 (HH)	10		357,043%	8	J	285,614%	9	J	321,329%
Phenanthrene	0.0028 (HH)	3	J	107,043%	5	J	178,471%	5	J	178,471%
Pyrene	0.0028 (HH)				2	J	71,329%	2	J	71,329%
Dibenzofuran	0.0028 (HH)	2	J	71,329%	3	J	107,043%	3	J	107,043%

Table B-6 Continued

Sample Number		CO4Q2			CO4Q3			CO4Q5		
Date		1/30/01			1/30/01			1/31/01		
Analyte	**West Virginia Water Quality Standards (ug/L)**	**Sample Result (ug/L)**	**Flag**	**Percent Exceedance**	**Sample Result (ug/L)**	**Flag**	**Percent Exceedance**	**Sample Result (ug/L)**	**Flag**	**Percent Exceedance**
Acenapthene	0.0028 (HH)	7	J	249,900%	19		678,471%	2	J	71,329%
Acenapthylene	0.0028 (HH)				2	J	71,329%			
Anthracene	0.0028 (HH)	1	J	35,614%	1	J	35,614%	1	J	35,614%
Benzo (a) anthracene	0.0028 (HH)							1	J	35,614%
Chrysene	0.0028 (HH)							1	J	35,614%
Fluoranthene	0.0028 (HH)				1	J	35,614%	4	J	142,757%
Phenanthrene	0.0028 (HH)							2	J	71,329%
Pyrene	0.0028 (HH)							3	J	107,043%
Benzo (g,h,i) perylene	0.0028 (HH)							3	J	107,043%
Indeno (1,2,3-cd) pyrene	0.0028 (HH)							1	J	35,614%
Dibenzofuran	0.0028 (HH)	3	J	107,043%	9	J	321,329%			

Table B-6 Continued

Sample Number		CO4R0			CO4R1			CO4L2		
Date		2/1/01			2/1/01			10/5/00		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Acenapthene	0.0028 (HH)				6	J	214,186%	3	J	107,043%
Anthracene	0.0028 (HH)							4	J	142,757%
Benzo (a) anthracene	0.0028 (HH)	10	J	357,043%					UJ	
Benzo (a) pyrene	0.0028 (HH)	10	J	357,043%					UJ	
Benzo (b) fluoranthene	0.0028 (HH)	8	J	285,614%					UJ	
Benzo (k) fluoranthene	0.0028 (HH)	12	J	428,471%					UJ	
Chrysene	0.0028 (HH)	11	J	392,757%					UJ	
Fluoranthene	0.0028 (HH)	17	J	607,043%	1	J	35,614%	3	J	107,043%
Napthalene	0.0028 (HH)				29		1,035,614%	44	J	1,571,329%
Phenanthrene	0.0028 (HH)	6	J	214,186%	5	J	178,471%	16	J	571,329%
Pyrene	0.0028 (HH)	15	J	535,614%				2	J	71,329%
Benzo (g,h,i) perylene	0.0028 (HH)	6	J	214,186%					UJ	
Indeno (1,2,3-cd) pyrene	0.0028 (HH)	6	J	214,186%					UJ	
Dibenzofuran	0.0028 (HH)				5	J	178,471%	9	J	321,329%

Table B-6 Continued

Sample Number		CO4L4			CO4L6			CO4N0		
Date		10/5/00			10/5/00			10/6/00		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Acenapthene	0.0028 (HH)	130 +	J	4,642,757%	7	J	249,900%	8	J	285,614%
Anthracene	0.0028 (HH)	13	J	464,186%	2	J	71,329%	2	J	71,329%
Benzo (a) anthracene	0.0028 (HH)	4	J	142,757%		UJ				
Benzo (a) pyrene	0.0028 (HH)	2	J	71,329%		UJ				
Benzo (b)	0.0028 (HH)	3	J	107,043%		UJ				

Sample Number		CO4L4			CO4L6			CO4N0		
Date		10/5/00			10/5/00			10/6/00		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
fluoranthene										
Benzo (k) fluoranthene	0.0028 (HH)	1	J	35,614%		UJ				
Chrysene	0.0028 (HH)	4	J	142,757%		UJ				
Fluoranthene	0.0028 (HH)	34	J	1,214,186%	3	J	107,043%	4	J	142,757%
Napthalene	0.0028 (HH)	120 +	J	4,285,614%	4	B	142,757%			
Phenanthrene	0.0028 (HH)	59	J	2,107,043%	10	J	357,043%	8	J	285,614%
Pyrene	0.0028 (HH)	20	J	714,186%	2	J	71,329%	3	J	107,043%
Indeno (1,2,3-cd) pyrene	0.0028 (HH)	1	J	35,614%		UJ				
Dibenzofuran	0.0028 (HH)	70	J	2,499,900%	3	J	107,043%			

HH = Human health standard
J = Analyte present. Reported value may not be accurate or precise.
UJ = Not detected, quantitation limit may be inaccurate or imprecise.
B = Not detected substantially above the level reported in laboratory or field blanks.
+ = Result reported from 4x dilution

Table B-7. Surface water quality samples and analysis for polynulclear aromatic hydrocarbons (PAHs) and pH at the Sharon Steel Superfund site

Sample		SW001			SW002			SW003		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Naphthalene	0.0028 (HH)	310		11071329%		ND			ND	
Sample pH	6-9 (AL, HH)	6.48			4.81		119%	3.93		207%

Table B-7 Continued

Sample		SW004			SW005			SW006		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance
Sample pH	6-9 (AL,HH)	3.85		215	3.60		240	8.65		

Table B-7 Continued

Sample		SW007			SW008			SW009		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance
Sample pH	6-9 (AL,HH)	8.50			2.40		360%	2.01		399%

Table B-7 Continued

Sample		SW010			SW011			SW012		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Naphthalene	0.0028 (HH)		ND			ND		14		499900%
Sample pH	6-9 (AL, HH)	7.14			7.15			1.95		405%

Table B-7 Continued

Sample		SW012A			SW013			SW014		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Naphthalene	0.0028 (HH)	17		607043%		ND		50		1785614%
Sample pH	6-9 (AL, HH)	2.38		362%	3.51		249%	2.83		317%

Table B-7 Continued

Sample		SW015			SW016			SW017		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance
Sample pH	6-9 (AL,HH)	7.52			3.25		275%	2.60		340%

Table B-7 Continued

Sample		SW018			SW019			SW019A		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Dibenzofuran	0.0028 (HH)	10		357043%		ND			ND	
Naphthalene	0.0028 (HH)	190		6785614%		ND			ND	
Phenanthrene	0.0028 (HH)	10		357043%		ND			ND	
Sample pH	6-9 (AL, HH)	3.08		292%	3.09		291%	3.08		292%

Table B-7 Continued

Sample		SW020			SW021			SW022		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Naphthalene	0.0028 (HH)		ND			ND		66		2357043%
Sample pH	6-9 (AL, HH)	2.91		309%	7.28			10.53		77%

Table B-7 Continued

Sample		SW023			SW024			SW025		
Date		2/17/94			2/17/94			2/17/94		
Analyte	West Virginia Water Quality Standards	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance
Sample pH	6-9 (AL, HH)	7.84			7.55			7.01		

Table B-7 Continued

Sample		SW026			SW027			SW001		
Date		2/17/94			2/17/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Naphthalene	0.0028 (HH)		ND			ND		210		7499900%
Sample pH	6-9 (AL, HH)	7.29			7.62			6.68		

Table B-7 Continued

Sample		SW002			SW004			SW005		
Date		5/8/94			5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance
Sample pH	6-9 (AL, HH)	6.02			5.89		11%	3.51		249%

Table B-7 Continued

Sample		SW008			SW009			SW013		
Date		5/8/94			5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance
Sample pH	6-9 (AL, HH)	1.65		435%	1.78		422%	1.48		452%

Table B-7 Continued

Sample		SW014			SW015			SW018		
Date		5/8/94			5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards (ug/L)	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance	Sample Result (ug/L)	Flag	Percent Exceedance
Naphthalene	0.0028 (HH)		ND			ND		120		4285614
Sample pH	6-9 (AL, HH)	3.08		292%	4.36		164%	2.57		343%

Table B-7 Continued

Sample		SW020			SW026		
Date		5/8/94			5/8/94		
Analyte	West Virginia Water Quality Standards	Sample Result	Flag	Percent Exceedance	Sample Result	Flag	Percent Exceedance
Sample pH	6-9 (AL, HH)	4.80		120%	7.18		

ND = Not detected.