APPENDIX 1

A-1. HEIZER CREEK

A-1.1 Watershed Information

Heizer Creek is in the central portion of the Lower Kanawha River watershed and drains approximately 25.3 square miles (16,220 acres), as shown in Figure A-1-1. The dominant land use is forest, which covers 69.3 percent of the watershed. Other prominent land use types are pasture (13.3 percent) and abandoned mine land (12.3 percent). All other individual land cover types account for less than 5.1 percent of the total watershed area. There are nine impaired streams in the watershed, including Heizer Creek. Figure A-1-2 shows the impaired segments and the causative pollutants for each.

Before establishing Total Maximum Daily Loads (TMDLs), WVDEP monitored each of the impaired streams in the Lower Kanawha River watershed to characterize water quality and to refine impairment listings. Monthly samples were taken at 25 stations throughout the Heizer Creek watershed from July 1, 2002, through June 30, 2003. Monitoring suites at each site were determined based on the types of impairments observed in each stream. Streams impaired by metals and low pH were sampled monthly and analyzed for a suite of parameters (including total iron, dissolved iron, total aluminum, dissolved aluminum, total suspended solids, selenium, pH, sulfate, and specific conductance). Monthly samples from streams impaired by fecal coliform bacteria were analyzed for fecal coliform bacteria, pH, and specific conductance. In addition, benthic macroinvertebrate assessments were performed at specific locations on the biologically impaired streams during the pre-TMDL monitoring period. Instantaneous flow measurements were also taken at strategic locations during that period.

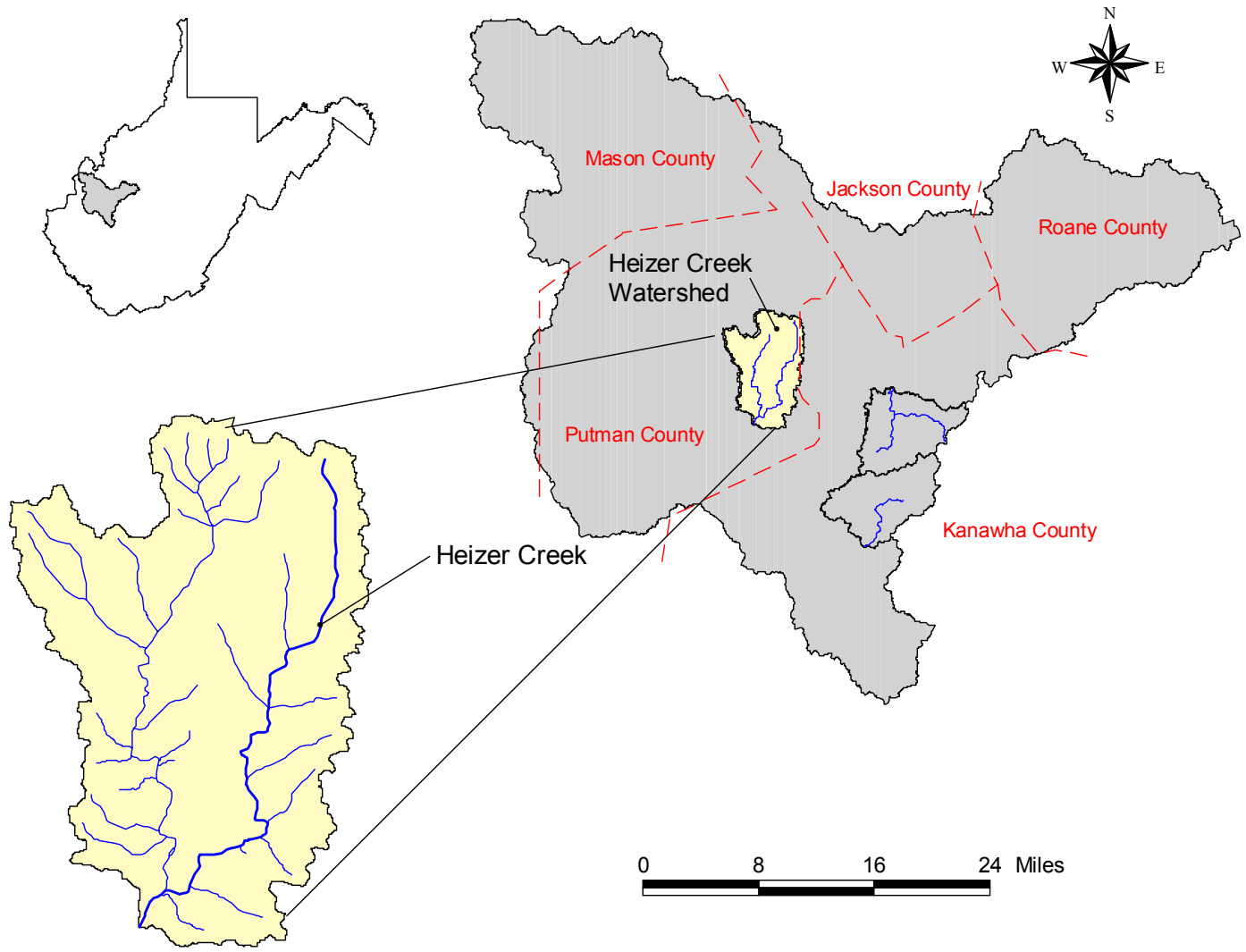


Figure A-1-1. Location of the Heizer Creek watershed.

Stream	Aluminum	Iron	pH	Biological
Heizer Creek	X	X		
Manila Creek	X	X	X	X
Coal Hollow	X	X	X	
UNT/Heizer Creek RM 2.3	X	X	X	
Sulphur Hollow	X	X	X	
UNT/Manila Creek RM 2.3 (#4 Hollow)	X	X	X	
Washington Hollow		X		
Alcocks Hollow	X	X	X	
UNT/Manila Creek RM 3.2		X		

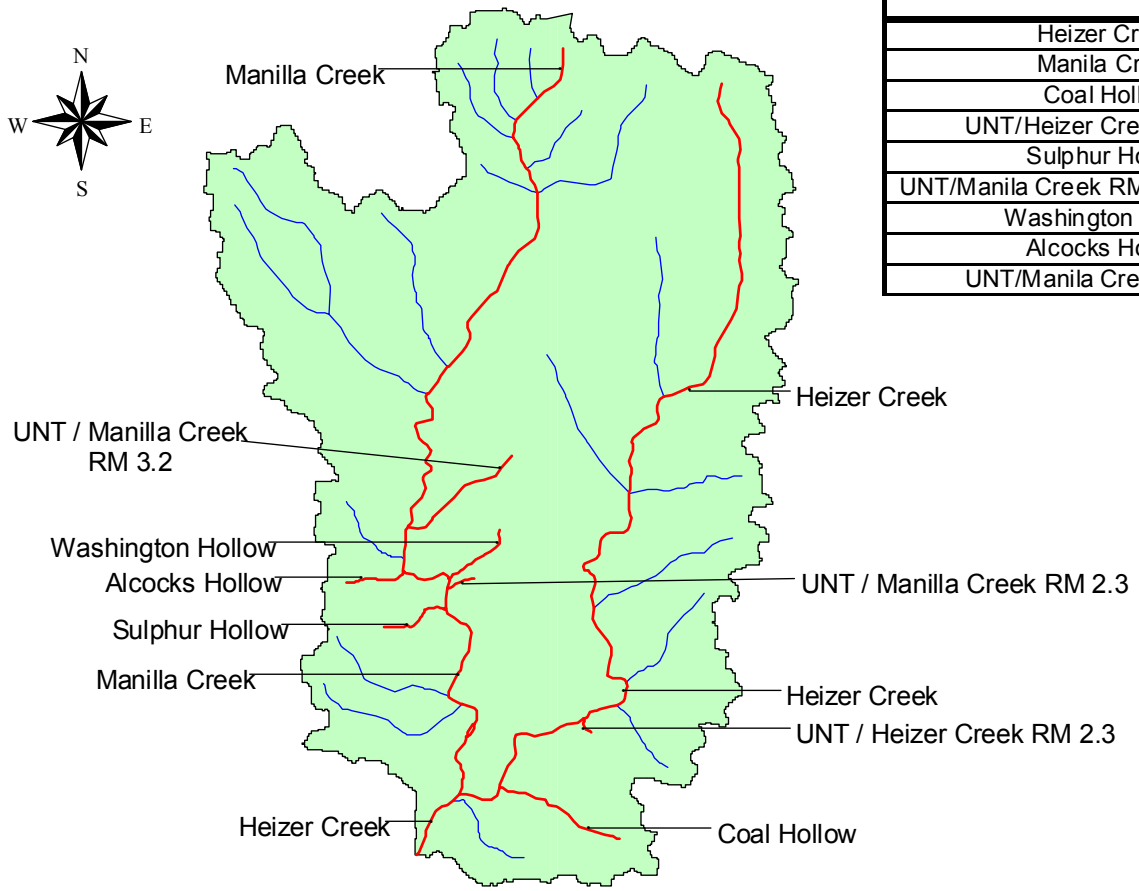


Figure A-1-2. Impaired waterbodies in the Heizer Creek watershed.

A-1.2 Metals and pH Sources

This section identifies and examines the potential sources of aluminum, iron, and pH impairment in the Heizer Creek watershed. Sources are classified as point sources (specific sources subject to a permit) or nonpoint sources (diffuse sources). Dischargers with mining- and non-mining-related permits are considered metals and pH point sources. Metals and pH nonpoint sources are diffuse, non-permitted sources such as abandoned or forfeited mine sites.

Pollution sources were identified using statewide geographic information system (GIS) coverages of point and nonpoint sources, and through field reconnaissance. As part of the TMDL process, WVDEP documented pollution sources by describing the pollution source in detail, collecting Global Positioning System (GPS) data, and if necessary, collecting a water quality sample for laboratory analysis. WVDEP personnel recorded physical descriptions of the pollutant sources, such as the number of outfalls, the source of the outfalls, and the general condition of the stream in the vicinity of each outfall. They compiled these records and electronically plotted them on maps using GIS software. This information was used in conjunction with other information to characterize pollutant sources. Significant metals sources in the watershed are shown in Figure A-1-3.

Based on scientific knowledge of sediment/metals interaction and knowledge of West Virginia's soils, it is reasonable to conclude that sediments contain high levels of aluminum and iron. Control of sediment-producing sources might be necessary to meet water quality criteria for dissolved aluminum and total iron during critical high flow conditions. Although some of these sediment-producing sources are not displayed in Figure A-1-3 (e.g., harvested forest areas and unpaved roads), specific details relative to these sources are discussed in section A-1.2.2.

A-1.2.1 Metals Point Source Inventory

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

No metals-related NPDES permits are present in the Heizer Creek watershed.

A-1.2.2 Metals Nonpoint Source Inventory

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

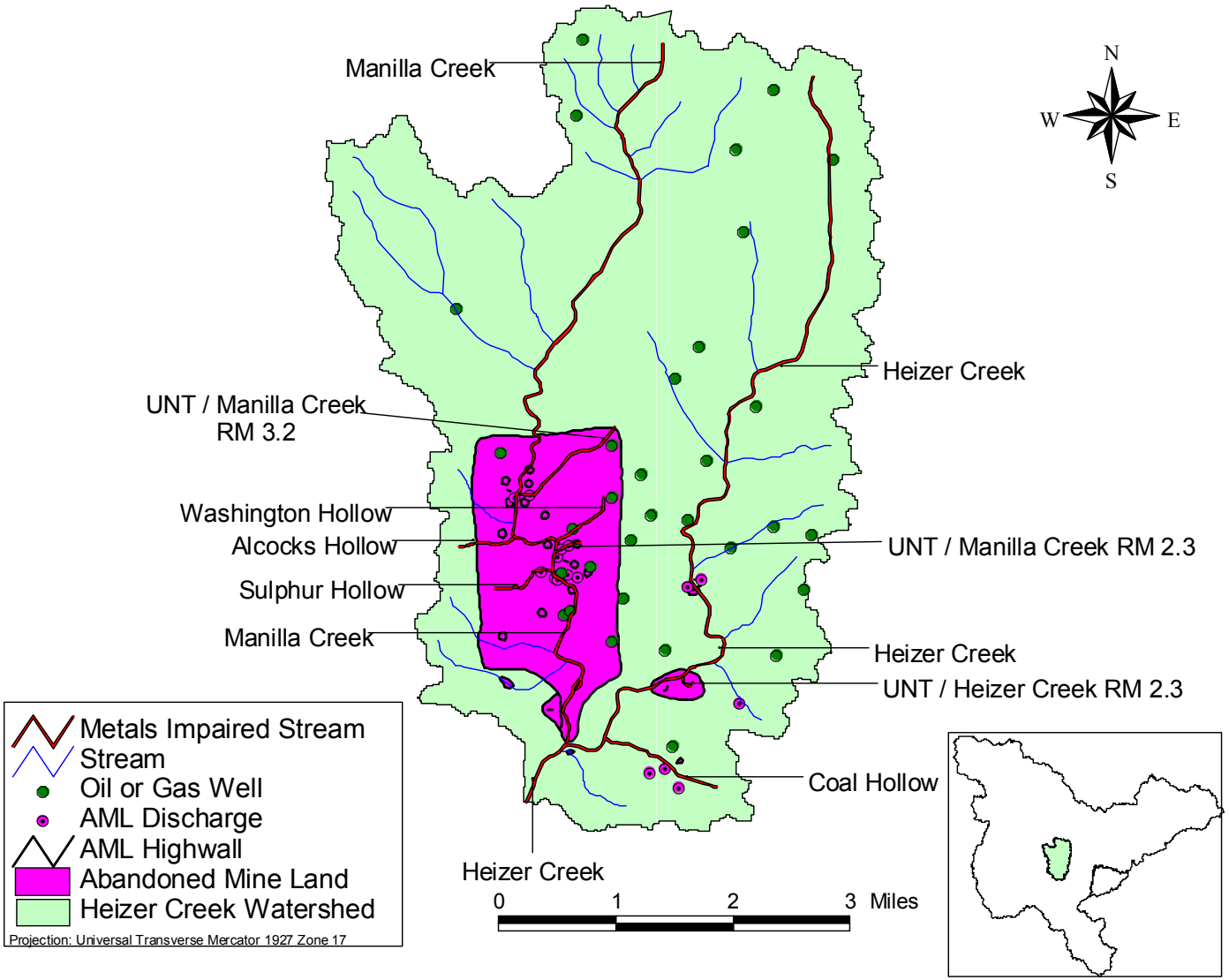
Abandoned Mine Lands and Bond Forfeiture Sites

Based on the identification of a number of abandoned mining activities in the Heizer Creek watershed, abandoned mine lands are a significant non-permitted source of metals and pH impairment in the watershed. WVDEP's Office of Abandoned Mine Lands identified the locations of abandoned mine lands in the Heizer Creek watershed. In addition, source-tracking efforts by WVDEP's Division of Water and Waste Management identified and characterized 23 abandoned mine sources (discharges, seeps, and collapsed portals).

WVDEP's Division of Land Restoration, Office of Special Reclamation, provided bond forfeiture information and data. This information included the status of both land reclamation and water treatment activities. No bond forfeiture sites are present in the Heizer Creek watershed.

Land-Disturbing Activities

Based on the GAP 2000 land use coverage, there are less than 20 acres of agricultural area in the Heizer Creek watershed. There are three active logging operations. The disturbed areas associated with these operations are estimated to cover 273 acres (1.7 percent) of the total watershed area. The watershed contains 32 active oil and gas wells, which, based on the survey by WVDEP's Office of Oil and Gas, are estimated to comprise 128 acres (0.8 percent). The length and area of paved roads were calculated using the Census 2000 TIGER/Line files roads coverage for West Virginia. Information on unpaved roads from TIGER was supplemented by digitizing any unpaved roads on topographic maps that were not included in the TIGER shapefile. There are 23.2 miles of paved roads and 166.0 miles of unpaved roads in the Heizer Creek watershed.



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

Figure A-1-3. Metals sources in the Heizer Creek watershed.

A-1.2 Stressors of Biologically Impaired Streams

The Heizer Creek watershed has one biologically impaired stream for which TMDLs have been developed. This stream is identified in Table A-1-1 along with the biological stressors of the stream's benthic communities and the TMDLs required to address these impairments. A stressor identification process was used to evaluate and identify the primary stressors of impaired benthic communities. Refer to the main report for a detailed description of the stressor identification process.

Table A-1-1. Primary stressors of the biologically impaired stream in the Heizer Creek watershed

Stream	Biological Stressors	TMDLs Required
Manila Creek	Metals toxicity (aluminum, iron) pH toxicity (acidity)	Aluminum Iron pH

TMDLs for each specific biological stressor are shown in Table A-1-5. Sediment TMDLs are required only when the stressor identification process indicates that a sedimentation problem is impairing the biological community.

A-1.3 TMDLs for the Heizer Creek Watershed

A-1.3.1 TMDL Development

TMDLs and source allocations were developed for impaired streams in the Heizer Creek watershed. A top-down methodology was followed to develop these TMDLs and allocate loads to sources. Headwaters were analyzed first because they have a profound effect on downstream water quality. Loading contributions were reduced from applicable sources for these waterbodies, and TMDLs were developed. Refer to Section 7.4 of the main report for a detailed description of the allocation methodologies used in developing the pollutant-specific TMDLs.

The TMDLs for iron, aluminum, and pH are shown in Tables A-1-2 through A-1-5. The TMDLs for iron and aluminum are presented as annual average loads, in terms of pounds per year. All TMDLs are presented as average annual loads because they were developed to meet TMDL endpoints under a range of conditions observed throughout the year.

As stated in Section 7.3, a surrogate approach was used to develop pH TMDLs. It was assumed that reducing metals concentrations to TMDL endpoints would result in compliance with the pH water quality standard. To verify this assumption, the Dynamic Equilibrium In-stream Chemical Reactions model (DESC-R) was run for an extended period under TMDL conditions—conditions where TMDL endpoints for metals were met. A median equilibrium pH was calculated based on the daily equilibrium pH output from DESC-R. The results, shown in Table A-1-4, are the TMDLs for the pH-impaired streams in the watershed. Refer to the Technical Report for a detailed description of the pH modeling approach.

A-1.4 TMDL Tables: Metals and pH

Table A-1-2. Iron TMDLs for the Heizer Creek watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
Heizer Creek	WVKP-1	Heizer Creek	Iron	13,528	NA	712	14,240
Heizer Creek	WVKP-1-A	Manila Creek	Iron	5,939	NA	313	6,251
Heizer Creek	WVKP-1-A.3	Coal Hollow	Iron	320	NA	17	337
Heizer Creek	WVKP-1-A.6	UNT/Heizer Creek RM 2.3	Iron	32	NA	2	34
Heizer Creek	WVKP-1-A-0.4	Sulphur Hollow	Iron	93	NA	5	98
Heizer Creek	WVKP-1-A-0.48	UNT/Manila Creek RM 2.3 (#4 Hollow)	Iron	253	NA	13	266
Heizer Creek	WVKP-1-A-0.5	Washington Hollow	Iron	119	NA	6	125
Heizer Creek	WVKP-1-A-0.6	Alcocks Hollow	Iron	69	NA	4	72
Heizer Creek	WVKP-1-A-0.8	UNT/Manila Creek RM 3.2	Iron	400	NA	21	421

NA = not applicable; UNT = unnamed tributary.

Table A-1-3. Aluminum TMDLs for the Heizer Creek watershed

Major Watershed	Stream Code	Stream Name	Metal	Load Allocation (lb/yr)	Wasteload Allocation (lb/yr)	Margin of Safety (lb/yr)	TMDL (lb/yr)
Heizer Creek	WVKP-1	Heizer Creek	Aluminum	6,710	NA	353	7,063
Heizer Creek	WVKP-1-A	Manila Creek	Aluminum	3,887	NA	205	4,092
Heizer Creek	WVKP-1-A.3	Coal Hollow	Aluminum	178	NA	9	187
Heizer Creek	WVKP-1-A.6	UNT/Heizer Creek RM 2.3	Aluminum	22	NA	1	23
Heizer Creek	WVKP-1-A-0.4	Sulfur Hollow	Aluminum	339	NA	18	357
Heizer Creek	WVKP-1-A-0.48	UNT/Manila Creek RM 2.3 (#4 Hollow)	Aluminum	222	NA	12	234
Heizer Creek	WVKP-1-A-0.6	Alcocks Hollow	Aluminum	49	NA	3	52

NA = not applicable; UNT = unnamed tributary.

Table A-1-4. pH TMDLs for the Heizer Creek watershed

Major Watershed	Stream Code	Stream Name	Parameter	pH* (Under TMDL conditions)
Heizer Creek	WVKP-1-A	Manila Creek	pH	8.54
Heizer Creek	WVKP-1-A.3	Coal Hollow	pH	8.67
Heizer Creek	WVKP-1-A.6	UNT/Heizer Creek RM 2.3	pH	8.34
Heizer Creek	WVKP-1-A-0.4	Sulphur Hollow	pH	7.39
Heizer Creek	WVKP-1-A-0.48	UNT/Manila Creek RM 2.3 (#4 Hollow)	pH	7.82
Heizer Creek	WVKP-1-A-0.6	Alcocks Hollow	pH	8.65

UNT = unnamed tributary.

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

A-1.5 TMDL Tables: Biological

Table A-1-5. Biological TMDLs for the Heizer Creek watershed

Stream	Biological Stressor	Parameter	Load Allocation	Wasteload Allocation	Margin of Safety	TMDL	Units
Manila Creek WVKP-1-A	Metals Toxicity	Aluminum	3,887	NA	205	4,092	lb/yr
		Iron	5,939	NA	313	6,251	lb/yr
	pH Toxicity	pH	Not Applicable			8.54	Standard Units