CIBA-GEIGY FACILITY
CRANSTON, RHODE ISLAND

Stabilization
Collaborative Initiative
Interim Report

March 1992

SEMS DocID 658504

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DISCLAIMER

The information presented in this document summarizes information available at the time of publication. In some instances where information was not available, information from standard references may have been used. This document does not represent the final analysis of the facility. The purpose of this document is to assist EPA Region I in evaluating the technical viability of stabilizing current or potential release of hazardous waste or hazardous constituents. The information contained herein was obtained through EPA's Regional Office and Federal and State agencies.

This document does not represent EPA's final position or conclusions for this facility.

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1.0 INTRODUCTION

CIBA-GEIGY Corporation manufacturing facility in Cranston, Rhode Island, was partly occupied by the Alrose Chemical Company from 1930 to 1954. In 1954, the Geigy Chemical Company of New York purchased the facility from the Alrose Chemical Company and operated the facility as the new chemical manufacturing plant for the Geigy Chemical Company.

In 1970, the Geigy Chemical Company merged with Ciba Corporation of Summit, New Jersey, to form the CIBA-GEIGY Corporation (incorporated in the State of New York). CIBA-GEIGY Corporation is a diversified company that is engaged principally in the discovering, development, manufacturing, and marketing of a wide variety of special purpose pharmaceuticals and chemical products throughout the United States.

After the merger, the Cranston plant was used as a production facility for manufacturing organic chemicals on a batch basis. Major product categories (and the decades in which they were produced) included:

1950s --	agricultural products, and leather and textile auxiliaries
1960s --	plastics additives, optical brighteners, pharmaceuticals, and textile auxiliaries
1970s --	pharmaceuticals, agricultural products, plastics additives, textile auxiliaries and bacteriostats
1980s --	pharmaceuticals and plastics additives

Raw materials and intermediates associated with the facility are listed in Table 1-1. Final products are listed in Table 1-2.

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TABLE 1-1. RAW MATERIALS AND INTERMEDIATES, CIBA-GEIGY FACILITY, CRANSTON, RHODE ISLAND

Methylene chloride, technical	TMHP Dry
bis(2-Chloroethyl)ether	Aminoethyl ethanolamine (AEEA)
Chlorobenzene	Soltrol 10
Methyl ethyl ketone (2-butanone)	Phenyl alpha-naphthylamine
Copper acetate	AMPS monomer (reaction grade)
Silver nitrate	Isopropylamine
Acrylonitrile, 35-45 ppm inhibitor	Chlorotoluene (Halso 99)
Chromium sulfate	Dioctadecyl hydrogen phosphite
Toluene	Phenylhydrazine
Ethyl cellosolve (Ethylene glycol monoethyl ether)	Methyl styrenated phenol
	1,2-Diaminocclohexane
Xylene	Penicillin-V-sulfoxide benzhy
Hydroquinone	Dimethylaminopropyl chloride
o-Nitroaniline (ONA)	n-Octylamine
Ethylene glycol (1,2-ethanediol)	Allyloxyphenol
N-methyl-2-pyrolidone	Irgatan F liquid, new
Hydrazine sulfate	Deriphat 160C
Ethanol	Actinol FA-1
Hydrogen cyanamide 50 percent	Vinyl butyl ether
Ethyl acrylate, 25 ppm inhibitor	2,4-di-t-amylphenol
Hexylene glycol	Perfluoroalkylethyl iodide FCG600
Ethylene chlorohydrin	Perfluoroalkylethyl iodide FCG800
p-Cresol	Perfluoroalkylethyl iodide
Methanol	Isopropanol
Special naphtholite	Acetone
Nitrosyl sulfuric acid	Naphthalene
Phenol	Disobutylene
Triethylene glycol	Glutethimide
Diethanolamine	p-Toluene sulfinate, sodium
Polyethylene glycol 400	Capric acid,
Trichloroacetic acid	Pamoic acid, disodium salt
t-Butyl alcohol	Acetic acid
Methyl acetoacetate	Dimethylsebacate
Oxalic acid, crystal ACS	Azobenzene, technical
Butyl cellosolve (Ethylene glycol monobutyl ether)	Heptane
	Oleic acid
Malic acid	Amsco (mineral spirits)

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TABLE 1-2. FINAL PRODUCTS CIBA-GEIGY FACILITY, CRANSTON, RHODE ISLAND

I. ADDITIVES GROUP

Tinuvins

Tinuvin P
Tinuvin 144
Tinuvin 326
Tinuvin 327
Tinuvin 328
Tinuvin 440
Tinuvin 770
Tinuvin 900

Irganoxes

Irganox 565
Irganox 858
Irganox 1010
Irganox 1035
Irganox 1076
Irganox 1093
Irganox 1300

Irgastabs

Irgastab 2002

III. AGRICULTURAL CHEMICALS GROUP

Triazine Herbicides

Propazine
Simazine

II. CHEMICALS GROUP

Irgasans

Irgasan CF-3
Irgasan DP300

Miscellaneous Chemicals

Gycotan (Alkyphenoxyfulfones)
Dicrylate (Acrylamide/acrylate polymers)
Nonisol (Polyethylene glycol aliphatic esters)
Amine O (Alkyl imidazole)
Tinofix, Gycofix (Dicyandiamide-formaldehyde condensation products)
Irgapadol, Alrosol, Alrowet (Fatty acid esters/amids)
Phenidone (phenylpyrazolidones)

Tinopals

Tinopal 4BM
Tinopal RBS

IV. PHARMACEUTICALS GROUP

Chlorthalidone (Hygroton)
Phenylbutazone (Butazolidin)
Imipramine (Tofranil)
Desipramine (pertofrane)
Hydrochlorothiazide
Baclofen (Lioresal)
Carbamzaepine (Tegretol)

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As of May 1986, CIBA-GEIGY had ceased all chemical manufacturing operations at the facility and began decommissioning and razing the plant.

As part of decommissioning and razing the facility, significant environmental and waste management activities were conducted in accordance with (1) the closure plan developed by CIBA-GEIGY and submitted to both the U.S. EPA and the Rhode Island Department of Environmental Management (RIDEM) in the RCRA Part B Permit Application Submission, and (2) the Phase-Down Plan developed by CIBA-GEIGY. Decommissioning included the removal of materials, residues, and wastes, as well as the proper disposal of hazardous wastes. Decommissioning also included cleaning (or otherwise preparing) equipment and structures for removal and/or demolition. Rubble was disposed of off-site at an approved landfill. Useable equipment was sold.

Based on the location of known or suspected releases, the geographic setting, and the former plant layout, the facility has been divided into three on-site study areas: the Production Area, the Wastewater Treatment Area, and the Warwick Area.

Figure 1-1 presents SWMU, AOC and AAOI locations.

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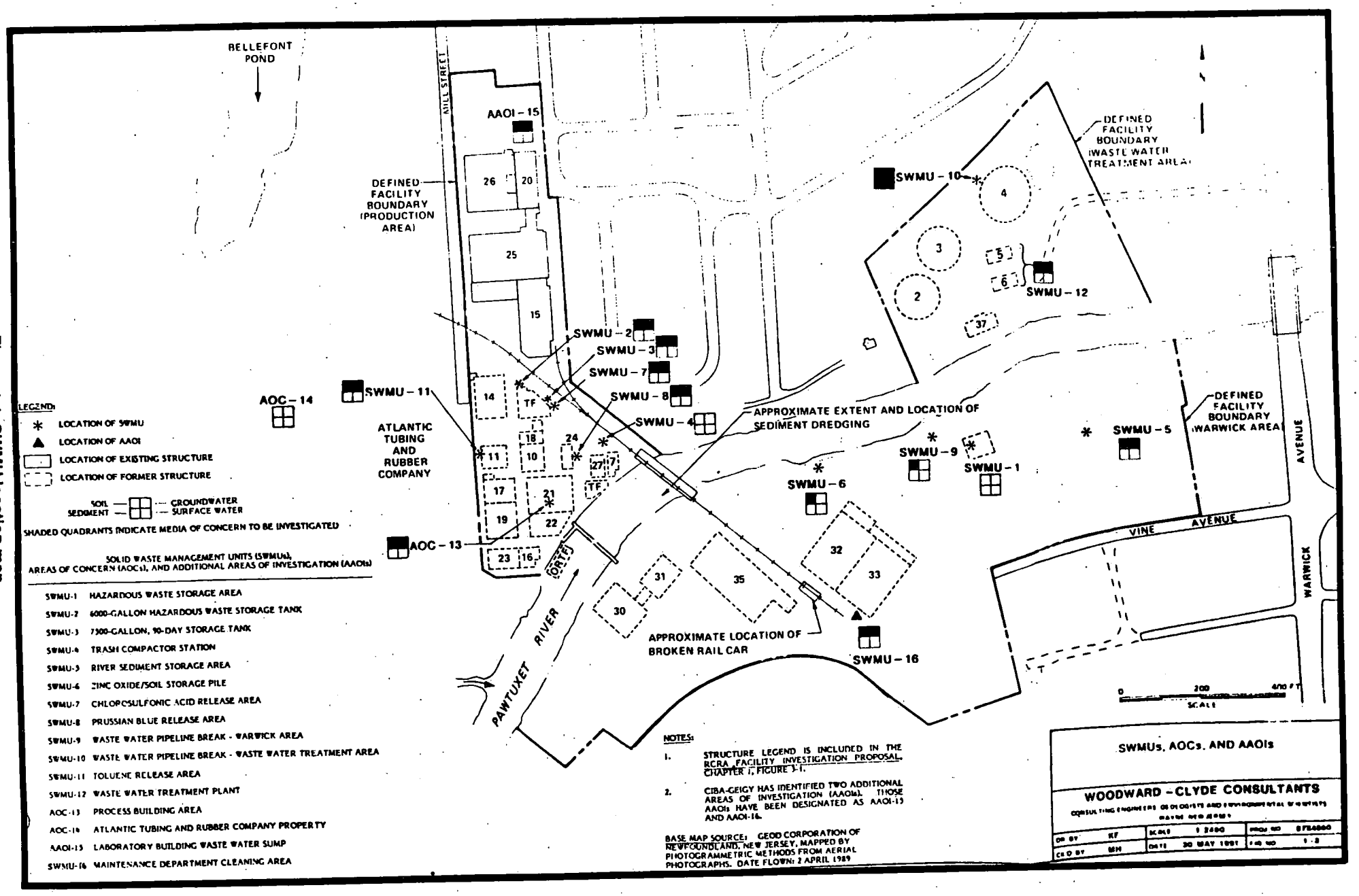

Figure 1-1. SWMU location map

2.0 SITE DESCRIPTION/ENVIRONMENTAL SETTING

2.1 Climatology

Table 2-1 presents the meteorological data for the facility.

TABLE 2-1. METEOROLOGICAL DATA	
Average Monthly Precipitation (inches):	3.5
Average Number of Days per Month with Precipitation:	10
Average Temperature (°F):	50.5
Average Monthly Pan Evaporation (in):	NA
Average Wind Erosion Velocity (mph):	4-12
Severity of 25-year, 24-hour Storm (in):	NA

NA - not available

The direction the majority of the wind comes from is the northwest. Calm winds of 3 mph constitute 10.2 percent of all winds.

2.2 Local Geology/Soils

The unconsolidated deposits in the vicinity of the site generally have thicknesses that range from 50 to 100 feet (Bierschenk, 1959). The typical stratigraphy in areas near the facility (Bierschenk 1959), consists of a layer of fill that is underlain by a layer of sand and gravel of variable thickness, which in turn is underlain by a layer of silt. Surface exposures of the Rhode Island Formation do not occur near the CIBA-GEIGY facility. Cross-sectional information of the site is shown Figures 3-3 through 3-5 of the CIBA-GEIGY Phase I Interim Report, which is available for review at the conference.

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Tables 2-2 through 2-4 present the soil parameters for the three sections of the site.

TABLE 2-2. SOIL PARAMETERS - PRODUCTION AREA		
Soil Layer	**Depth of Soil Layer (ft)**	**Textural Classification**
1	No consistent layer	Interbedded sands, silts, gravels, and clays
2	Variable composition and thickness (30 ft to 60 ft below ground)	Glacial till
3	60 ft below ground (avg)	Bedrock

TABLE 2-3. SOIL PARAMETERS - WARWICK AREA		
Soil Layer	**Depth of Soil Layer (ft)**	**Textural Classification**
1	30	Interbedded and laterally discontinuous sands, silts and clays
2	varying thickness and composition	Till
3	50-60 ft below ground	Weathered or jointed bedrock

TABLE 2-4. SOIL PARAMETERS - WASTEWATER TREATMENT AREA		
Soil Layer	**Depth of Soil Layer (ft)**	**Textural Classification**
1	30	Interbedded discontinuous sands, silts and clays
2	30-50 below ground	Till
3	45-60 below ground	Bedrock

2.3 Hydrologic Setting

The site is adjacent to, and extends both north and south of, the Pawtuxet River, within the Pawtuxet River Basin. The basin has a total land area of about 230 square miles (147,200 acres) and is the largest drainage basin in Rhode Island (Metcalf & Eddy, 1983). The Pawtuxet River flows from west to east through the site. Bellefont Pond lies to the west and northwest of the Production Area. The pond drains to the south by means of a stream which flows through culverts for much of its length. That stream enters the Pawtuxet River from the north about 300 feet upstream of the Production Area.

The 11.7-mile-long main stem of the Pawtuxet River is formed near River Point in West Warwick by the confluence of the north branch and south branch of the Pawtuxet River. The north branch originates at the outlet of the Scituate Reservoir and flows in a southeasterly direction for about 6 miles to the confluence with the south branch. The Scituate Reservoir is a water supply reservoir owned and operated by the City of Providence. Releases from the Scituate Reservoir depend on the water supply needs of Providence (but a minimum release of 10 million gallons per day is required to maintain base flow).

The western point of the drainage basin is relatively undeveloped. However, the lower reaches of both branches, and especially the main stem of the Pawtuxet River, flow through highly developed residential, industrial, and commercial areas. In addition to the two reservoir dams and the Pawtuxet Cove Dam at the river's mouth, there are small mill dams along both branches and along the main stem of the Pawtuxet River.

Some sections of the facility are within the 100-year flood plain (Federal Emergency Management Agency, 1982 and 1984). The entire Warwick Area and about half of

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the Wastewater Treatment Area are within the 100-year flood plain. About 10 percent of the Production Area along the river is within the 100-year flood plain.

Table 2-5 presents information pertinent to Pawtuxet River measured at gauging stations in the vicinity. Table 2-6 indicates an increase of sedimentation in the 1970s.

TABLE 2-5. PAWTUXET RIVER

USGS Gauging Station Location	One-year-in-ten average seven day low flow	Drainage area	Range of mean monthly discharges
Washington (south branch)	16 cfs	64 square miles	24 cfs (August 1974) 593 cfs (April 1983)
Cranston (main stem)	74 cfs	200 square miles	75 cfs (July 1957) 1788 cfs (April 1983)

TABLE 2-6. SEDIMENTATION RATES FOR PAWTUXET RIVER

Location	Sedimentation rate (inch/year) for 1979	Sediment rate (in/yr) 1970's
near CIBA-GEIGY	0.8	Not available
1 mile downstream	1.25	0.2-0.4

Note: The apparent change in sediment rates may be related to highway construction activities during the late 1970's.

These rates were collected near the river margins. Data for the channel center is not available.

The rates presented in Table 2-6 should be viewed as typical deposition rates over the last 20 to 30 years. Variations in these rates occurred by stream position and over

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time. Human activities (e.g., bridge construction), climatic conditions, and morphologic river changes also contributed to variations in these rates.

Ground water underlying the facility discharges to surface water, so both the runoff and ground water discharge pathways could introduce contaminants to surface water.

Table 2-7 shows information about the Pawtuxet river as it flows through the facility property.

TABLE 2-7. SURFACE WATER BODY PARAMETERS

Water Body of Concern	Distance Down-gradient	Stream Parameters		Lake Parameters		
		Average Flow Rate (cfs)	Average Velocity (m/s)	Surface Area (hectares)	Average Water Depth (m)	Sediment Delivery Fraction
Pawtuxet River	Onsite	0.088	0.14	11.7 miles long	N/A	N/A

2.4 Hydrogeologic/Topographical Setting

Ground Water/Topography

The facility is relatively flat with gentle slopes towards the river.

Ground water flows generally towards the river. A plan showing the Shallow Overburden Water Table Contours is in the CIBA-GEIGY Phase I Interim report and will be available for review at the conference.

Locally, ground water occurs in consolidated fluvial and glaciofluvial sediments, and in the underlying consolidated sedimentary, metamorphic, and igneous rocks. The fluvial deposits are thin and discontinuous, and would not yield adequate water volumes to wells. The glaciofluvial sediments vary from moderate-to-high yield (75 to 1,600 gallons per minute, or gpm) outwash deposits to poor yield (generally less than 2 gpm) till deposits (Bierschenk, 1959). The outwash deposits afford most of the water currently pumped and potentially available. The yield of consolidated rocks is variable depending on such factors as the fracture/joint density and size and the interconnection of fractures/joints. However, the nature and thickness of overlying deposits appears to influence the yield of the consolidated rocks.

Bedrock was encountered beneath the facility at depths ranging from about 53 to 108 feet, therefore yields averaging 80 gpm may be available from bedrock beneath the facility. However, bedrock overlain by till is expected to yield significantly less water.

The depth to water in consolidated rock wells reflects the land surface topography. The water level appears to have little relation to the depth at which the water-bearing fractures/joints are encountered, suggesting that there is an interconnection between the unconsolidated deposits and the underlying consolidated rocks.

Generally, ground water levels are above stream levels, indicating that streams such as the Pawtuxet River are gaining streams (Bierschenk, 1959). Along most reaches of their courses, gaining streams are being fed by ground water and can maintain base flow during periods of little or no rainfall.

A summary of aquifer characteristics can be found in Table 2-8.

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TABLE 2-8. AQUIFER CHARACTERISTICS			
	Area		
	Production	**WWT**	**Warwick**
Aquifer Material			
Hydraulic Gradient	0.005	0.016	0.010
Hydraulic Conductivity of Aquifer (ft/day)	1.5-2.0	NA	NA
Porosity of Aquifer Material	0.3	0.3	0.3
Bulk Density of Aquifer Material (g/cm^3)	NA	NA	NA
Fraction of Organic Carbon in Aquifer Material	NA	NA	NA
Thickness of Aquifer Material (ft)	NA	NA	NA
Depth to Water Table (ft)	Production Area, approximately 5.0′	WWT Area, approximately 3.0′	Warwick Area approximately 5.0′
Ground Water Recharge (in/yr)	21 252 MAIN 10-15"	21	21
Ground Water Movement (ft/year)	2-180 1-65 ft	6-190	4-120

NA - Not Available

A bulkhead, constructed of sheet steel piling, borders the entire south side of the Production Area. The bulkhead is about 360 feet long and extends about 25 feet below grade. The bulkhead is anchored by 2-inch steel rods at 10 foot intervals to an underground concrete beam (dead man). The dead man runs the entire length of the bulkhead. The bulkhead penetrates about 20 feet into the unconsolidated aquifer.

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Stratigraphic borings advanced at the facility has revealed three hydrostratigraphic units - the bedrock aquifer, till, and the overburden aquifer.

Bedrock Aquifer. The lower unit is a sedimentary rock that has undergone low-grade metamorphism. The unit can be characterized as a fractured rock aquifer, and is the deepest aquifer both locally and regionally. The aquifer is confined by the till and/or clay and silt layers in the overburden deposits.

Data collected suggest two possible configurations for ground water flow within the bedrock aquifer. The first is that flow is toward the river from both the south and north, implying a hydraulic connection with the river; the second is that flow is toward the south-southwest. Since the confined nature of the aquifer implies that there is no hydraulic connection with the river, a south-southwesterly flow direction is considered more likely (RFI, CIBA GEIGY).

Upward vertical gradients (both in and between units) were observed in nested piezometers and monitoring wells. The upward vertical gradients ranged from 0.003 to 0.05 feet per foot (ft/ft), indicating that there is some potential for leakage from the bedrock aquifer to the overburden aquifer. However, the amount of flow is expected to be minor because of the low permeability of the confining layers. No downward vertical gradients were observed, so the possibility of contaminants migrating from the overburden aquifer to the bedrock aquifer is minimal.

Steep gradients also were observed in the Wastewater Treatment Area and in the off-site area between the Wastewater Treatment Area and the Production Area. These steep gradients are attributable to bedrock highs. Bedrock highs effectively reduce the overburden aquifer thickness, constricting flow and causing steeper hydraulic gradients in their vicinity. Steep gradients in the northern portion of the Wastewater Treatment Area are attributable to a large and abrupt change in topography (essentially a 30-foot cliff).

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Till. The bedrock is overlain by a till. The till appears to act as an aquitard between the bedrock aquifer and the overlying glaciofluvial and fluvial sediments. However, because the till is discontinuous there is some potential for good hydraulic connection between the two aquifers where the till is absent.

Overburden Aquifer. The overburden aquifer is comprised of intercalated clays, clayey silts, silty sands, sands, and fill. The unit can be subdivided into three general units:

1. an upper unit composed of sands, silts, and man-made fill (sand/fill unit);
2. an intermediate layer of silt (silt unit); and
3. a lower unit composed of fine sand and silty fine sand (fine sand unit).

This subdivision is not continuous across the entire site - considerable interfingering of clays and sands occurs. The clay layers within the overburden deposits may function as semi-confining layers where they are laterally continuous and sufficiently thick.

The equipotential lines are mostly parallel with the river, with all ground water flow directed toward and discharging to the river. The horizontal hydraulic gradient in the Warwick Area is relatively flat (about 0.005 ft/ft). In the Production Area, the gradient is relatively flat in the north but steepens dramatically near the river (about 0.02 ft/ft). Clustered piezometers and wells adjacent to the bulkhead show that the water table elevations are higher in those wells closest to the bulkhead. This pattern of water table elevations reflects a ground water divide - an equipotential line across which ground water does not flow (because of the influence of discharge zones, not because of a physical barrier). Near the bulkhead, ground water flows downward under the bulkhead and subsequently discharges to the river.

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Hydrogeological Summary. The following conclusions formed the basis of the Phase I conceptual hydrogeological model (1991) of the site (CIBA-GEIGY Phase I Interim Report):

- The bedrock aquifer appears to be confined. Although the flow direction is ambiguous, ground water appears to flow through the bedrock aquifer in a south-southwesterly direction.

- The overburden aquifer is complex and appears to range from being unconfined to semi-confined, and may be fully confined locally.

- Ground water flow in the overburden aquifer is complex and depends on both the site stratigraphy and artificial structures (i.e., the bulkhead); in general, ground water flows toward and discharges to the Pawtuxet River.

- The overburden aquifer appears to have upward vertical gradients except at the bulkhead, where ground water appears to flow downward (under the bulkhead) before discharging to the river. Thus, the bulkhead creates a ground water divide. The bulkhead also appears to force ground water from the Production Area toward the south bank of the river.

- Ground water elevations are higher than the river water level elevations.

- The ground water hydrochemistry is similar in both the shallow and deep portions of the overburden aquifer in the Production Area, further indicating that the aquifer is unconfined. The ground water hydrochemistry also confirms that the aquifer receives significant recharge from rainfall.

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2.5 Sensitive Locations

Table 2-9 provides information on whether the facility is located in a geologically sensitive location considered to pose an increased threat of contamination from hazardous waste management facilities. The Pawtuxet River flows through the site, Bellefont Pond lies north-northwest of the Production area, and marshlands are located onsite.

TABLE 2-9. GENERAL GEOLOGIC SETTING	
Seismic Impact Areas	No
Karst Terrain	No
Floodplains	100 yr on site
Poor Foundation Conditions	NA
Complex Hydrogeology	Yes
Areas Susceptible to Mass Movements	NA
Ground Water Vulnerability/Resource Value	Yes

NA - Not Available

2.6 Background Concentrations

The background concentrations presented in Table 2-10 are from an analysis performed on one sample upgradient from the Production Area.

TABLE 2-10. BACKGROUND DATA (SOIL)	
Constituent	**Concentration (ppm)**
fluoranthene	6.1
chrysene	3.7
benzo(b)fluoranthene	3.4
benzo(a)pyrene	2.1
phenanthrene	4.2
anthracene	1.2
butylbenzylphthalate	22.0

However, recent investigation has identified additional background levels. These are presented in Table 2-11. Additional concentrations are presented in Attachment A.

TABLE 2-11. BACKGROUND DATA - SURFICIAL SOIL: INORGANIC DATA SUMMARY - 1991	
Inorganics	**Background Soil Range (ppm)**
Antimony	0.58*-0.65**
Arsenic	5.2-36.9
Barium	12.1-275
Beryllium	0.25-0.77
Cadmium	0.52-0.78
Calcium	560-1,440
Chromium	6.2-20
Cobalt	1.8-7
Copper	3.8-22.9
Iron	7,240-28,300
Lead	11.8-471
Magnesium	683-2,450

TABLE 2-11 (CONTINUED)	
Inorganics	**Background Soil Range**
Manganese	53.2-476
Mercury	0.047*-0.81
Nickel	1.5*-13.3
Potassium	349-786
Selenium	0.32*-0.67
Silver	0.77*-1**
Sodium	77*-230
Thallium	0.32*-0.53**
Tin	7.7*-102
Vanadium	11.3-27.3
Zinc	17.4-219
Cyanide	0.45*-3

*These lower values are detection limits, not concentrations detected.
**These upper values are detection limits, not concentrations detected.

3.0 POTENTIAL RECEPTOR IDENTIFICATION

3.1 Present and Future Land Uses

3.1.1 On-Site Land Use

The facility is located along the north and south banks of the Pawtuxet River in Cranston (Providence County) and Warwick (Kent Country) Rhode Island. The defined area of the facility is about 31 acres (13 acres north of the Pawtuxet River in Cranston and 18 acres south of the river in Warwick).

The site is predominantly in use by the facility. The land use on-site is distributed as presented in Table 3-1.

TABLE 3-1. ON-SITE LAND USE

Land Use	% of total
Woodland	20
Bare Soil or Dirt Roads	25
Hard-Surface Roads	10
Paved Surfaces (including Buildings, roads)	35
Water (e.g., ponds, lakes, surface impoundments, and wetlands)	10

3.1.2 Surrounding Land Use

The facility is bordered to the north and south by residential areas, to the east by commercial areas, and to the west by both an open space area, formerly the property of the Atlantic Tubing and Rubber Company. The Atlantic Tubing and Rubber Company manufacturing process waste included rubber, plastic, and polyvinyl chloride.

3.1.3 Ground Water Use

No active water supply wells are believed to exist on-site currently. Ground water is not known to be withdrawn from the facility. No drinking water wells are known to be within 1 mile of the site. Four wells believed to be about 300 feet deep, are located roughly 300 feet east of the Wastewater Treatment Area and just north of the Warwick Avenue bridge. Three other wells are reported to be 12 to 22 feet deep, are located at least a quarter mile from the facility. It is not known if any of these wells are still in use.

Table 3-2 presents sensitive populations identified by the Consent Order that will be considered possible receptor locations. Table 3-3 presents other water uses within 15 miles of the site.

TABLE 3-2. SURROUNDING LAND USES		
Land Use	**Pertinent Information**	**Nearest Distance to Facility (mile)**
Industrial	20 acres	Atlantic Tubing and Rubber Co. (adjacent)
Commercial	15 acres	adjacent
Residential	136 acres	within 0.5 miles
Hospitals	1 General Hospital	within 3 miles
Forest/Field	23 acres	within 0.3 miles
Elementary School	3	within 3 miles
Other School	3 High Schools	within 3 miles
Wetlands	Bellefont Pond	0.05 mile
Park	4 Parks/Playgrounds	1 mile
Surface Water	Bellefond Pond	0.05 mile
Other: Nursing Home	3 Elderly Housings	within 3 miles

TABLE 3-3. OTHER WATER USES WITHIN 15 MILES DOWNSTREAM OF FACILITY (PAWTUXET RIVER)	
Distance from Facility (miles)	**Water Use**
Downstream < 1 mile	estuarial cove
Approximately 15 miles (upstream)	Scituate Reservoir

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TABLE 3-4. TYPES AND PROXIMITIES OF SENSITIVE/VALUABLE ENVIRONMENTS	
Type of Sensitive or Valuable Environment	**Distance from Facility (m)**
Wetlands	adjacent
National Park	N/A
Areas Identified Under Coastal Zone Management Act	N/A
Scenic Areas Identified Under National Estuary Program	N/A
Critical Areas Identified Under Clean Lakes Program	N/A
National Seashore Recreational Area	N/A
National Lakeshore Recreational Area	N/A
National Forest	N/A

N/A - Not Applicable

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4.0 RESULTS OF SWMU INVESTIGATIONS

This section presents the results of previous investigations conducted at the CIBA-GEIGY facility. Three main areas of concern are identified on site: The Production Area, the Warwick Area, and the Wastewater Treatment Area. This document is organized by these three areas. The SWMUs (Solid Waste Management Unit) are grouped under each area. Each section includes a subsection "Recent Investigations". These recent investigations were conducted in 1991 and the highest concentrations found are presented in this section. The entire data summaries are included in Attachments A, B, C, D and E.

All action levels listed are Subpart S action levels.

Table 4-1 identifies these areas and a brief description of their characteristics.

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TABLE 4-1. SUMMARY OF GENERAL UNIT/DISPOSAL AREA CHARACTERISTICS

SWMU Number	SWMU Name	SWMU Area	Description	Releases to the Environment						
				GW	SW	Sediment	Air	Soil	None	* Unknown
2	6,000-gallon hazardous waste storage tank	Production Area	The 6,000-gallon above ground tank was used to provide storage of process wastes containing acetone, toluene, monochlorobenzene, isopropanol, naphtha, xylene, heptane, methanol and water. The carbon steel tank was 17 ft high, had diameter of 8 ft, and was enclosed by an 8,000-gallon capacity dike (14.5 ft x 19 ft x 4 ft high).	X				X		
3	7,500-gallon 90-day accumulation tank	Production Area	The vertical above ground tank, which had a capacity of 7,500 gallons, was used to store flammable liquids for periods of less than 90 days. The stainless steel tank was 17 ft high, had a diameter of 8.5 ft, and was enclosed by a 25,000-gallon dike (approximately 28 ft x 29 ft x 4 ft high).	X				X		
4	Trash compactor station	Production Area	The trash compactor station had two compactors of 30 and 55 cubic yard capacity, and only handled packaging material paper wastes and washed fiber drums. The trash compactor area (21 ft x 36 ft) was concrete lined and drained to the wastewater treatment plant.						X	
7	Chlorosulfonic Acid Spill Area	Production Area	Approximately 500 gallons of chlorosulfonic acid were spilled over an area about 10 ft by 20 ft.	X				X		
8	Prussian Blue Spill Area	Production Area	Blue-stained soil, believed to be from Prussian Blue, resulted from a spill of unknown quantity. About 300 cubic yards of that soil were excavated and subsequently removed.	X				X		
11	Toluene Wastewater Release Area	Production Area	The estimated loss of toluene associated with this SWMU is between 9 and 90 pounds. The loss occurred via a subsurface sump associated with Building 11.	X				X		
13	Process Building Area	Production Area	Chemical manufacturing took place from 1930 to 1986. All of the structures have been raised	X	X			X		

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TABLE 4-1 (CONTINUED)

SWMU Number	SWMU Name	SWMU Area	Description	Releases to the Environment						
				GW	SW	Sediment	Air	Soil	None	* Unknown
15	Laboratory Building Wastewater Sump	Production Area	The gravity sump pump was used during normal operations in the laboratory building, and drained to sanitary sewer lines that discharged into the Cranston POTW.							X
1	Hazardous waste storage area	Warwick Area		--	--	--	--	--	X	
5	River sediment storage area	Warwick Area	Approximately 6,630 cubic yards of sediment dredged from the Pawtuxet River was piled in this area. The sediment was dredged as part of the removal of the original cofferdam/ wastewater outfall. The sediment was removed from the site in 1976. The natural grade of this area was restored in 1977.	X						
6	Zinc oxide/soil pile	Warwick Area	Approximately 25 cubic yards of soil containing about 10 percent zinc oxide residue exists on site. The zinc oxide residue was from an incident involving a broken railcar. The soil pile is approximately 50 ft long by 7 ft wide by 2 ft high.					X		
9	Wastewater Pipeline Break - Warwick Area	Warwick Area	A break in the main raw waste transfer line resulted in the discharge of about 24,000 gallons of wastewater. The wastewater entered the surface water runoff catchment system and discharged to the Pawtuxet River. The wastewater typically contained halogenated and non-halogenated solvents and other organic compounds routinely used in the chemical manufacturing process.	X	X	X		X		

TABLE 4-1 (CONTINUED)

SWMU Number	SWMU Name	SWMU Area	Description	Releases to the Environment						
				GW	SW	Sediment	Air	Soil	None	* Unknown
16	Maintenance Department Cleaning Area	Warwick Area	Production equipment was steam cleaned here. Rinse water was not collected (or analyzed) and probably drained to the nearby surface water catch basin.	X				X		
10	Wastewater Pipeline Break-Wastewater Treatment Area	Wastewater Treatment Area	A break in an underground wastewater line resulted in a discharge of about 50,000 gallons. The discharge flowed into a small on-site pond and then diverted to the Pawtuxet River. The pH of the released wastewater was 8.5; the chemical oxygen demand (COD) was 1,010 ppm. This discharge contained acetone (31 pounds), isopropyl alcohol (45 pounds), toluene (7 pounds), xylene (1.7 pounds), zinc (0.25 pounds), and nitrobenzene (0.125 pounds).	X	X	X		X		
12	Wastewater Treatment Plant Area	Wastewater Treatment Area	This area formerly was occupied by the wastewater treatment plant. Biological trickling towers were used and periodic sump overflows from these towers resulted in discharges to the river. Influent to the trickling towers routinely contained volatile and semi-volatile organic compounds. Additional releases from SWMU-12 in excess of the NPDES permit requirements have been reported for zinc, BOD, and phenols. For two releases, chloroform was discharged to the river.	X	X	X		X		

*Under investigation.

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4.1 The Production Area

4.1.1 SWMU-2: 6,000-Gallon Hazardous Waste Storage Tank

4.1.1.1 Background

SWMU-2 was a 6,000-gallon above ground hazardous waste storage tank located in the tank farm just south of the railroad tracks in the Production Area. The tank stored liquid hazardous waste mixtures generated at the facility including process wastewater containing acetone, toluene, monochlorobenzene, isopropanol, naphtha, xylene, heptane, and methanol. The carbon steel vertical tank was 8 feet in diameter and 17 feet high; it was supported by a one-foot thick reinforced concrete slab, and was surrounded by a secondary containment dike with a capacity of 8,000 gallons.

Liquid hazardous wastes were transferred regularly from SWMU-2 to railroad cars for off-site disposal. No releases from SWMU-2 were known or suspected during its period of operation. The hazardous waste storage tank, including the pumps and piping associated with loading the tank cars, were inspected regularly. Drainage from the diked enclosure originally flowed to the facility's wastewater treatment plant. However, in compliance with federal hazardous waste storage requirements, this drainage line was sealed off; subsequently, water from the sump within the dike was pumped out for off-site disposal.

SWMU-2 was used from 1981 through 1986 (when the facility was decommissioned). Closure of SWMU-2 was performed by OH Materials.

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4.1.1.2 Analytical Results

No releases from SWMU-2 are known or suspected. CIBA-GEIGY believes that trace concentrations of some wastes, stored in the tank farm and found in shallow soils downslope of SWMU-2, resulted from wastewater releases in the Production Area (AOC-13) rather than from operation of SWMU-2. No conceptual release model can be developed that will distinguish among releases from SWMU-2, SWMU-3, and AOC-13. Table 4-2 presents constituent concentrations found in SWMU-2. Table 4-3 presents ground water data.

TABLE 4-2. CONSTITUENT CONCENTRATIONS IN SOIL IN UNIT SWMU 2

Constituent	Concentration (ppm)
Total Volatile Organic Compound	up to 0.13
Total Semi-volatile compounds	34
PCB	0.85
Dioxins/Furans	0.0012
Pesticides/Herbicides	0.0067

TABLE 4-3. CONSTITUENT CONCENTRATIONS IN GROUND WATER IN UNIT SWMU 2

Constituent	Concentration (ppb)
VOCs	2.2
Semi-volatiles	ND
PCBs	ND
Dioxins/Furans	ND
Pesticides/Herbicides	0.11

4.1.1.3 Integrity of Containment Systems

The tank has been removed.

4.1.1.4 Known, Suspected, or Potential Releases

Releases resulting from the transfer of liquid water to the railroad cars (if any) would not have impacted the surficial soils in the vicinity of the release because the area was paved. Surface water runoff from heavy rains could have transported hazardous waste downslope (toward the river or to the surface runoff collection system).

4.1.2 SWMU-3: 7,500-Gallon, 90-Day Accumulation Tank

4.1.2.1 Background

The above-ground 7,500-gallon accumulation tank was located in the same tank farm as SWMU-2. The stainless steel accumulation tank was used to store flammable liquids for periods of less than 90 days. The vertical tank was 8.5 feet in diameter and 17 feet high, and was enclosed (along with three other tanks) by a containment dike having a capacity of 25,000 gallons.

The accumulation tank operated during 1985 and 1986 (until the facility was decommissioned). No releases were known or suspected during the period of operation. Liquid wastes from SWMUs-2 and -3 were pumped into 10,000-gallon railroad cars for weekly shipment to an off-site disposal facility. Approximately 260,000 gallons of wastes were loaded each year.

Closure of SWMU-3 was performed by OH Materials in 1986.

4.1.2.2 Analytical Results

One test pit was excavated and an odor encountered at seven and eight feet. Ground water seeping into the test pit at eight feet had a visible sheen. Table 4-4 and 4-5 shows the maximum concentrations found in soil and ground water.

TABLE 4-4. CONSTITUENT CONCENTRATIONS IN SOIL IN UNIT SWMU 3

Constituent	Concentration (ppm)
VOCs	9.4
Semi-volatiles	1.2
PCBs	4.3
Dioxins/Furans	0.0011
Pesticides/Herbicides	0.18

TABLE 4-5. CONSTITUENT CONCENTRATIONS IN GROUND WATER IN UNIT SWMU 3

Constituent	Concentration (ppb)
VOCs	2,400
Semi-volatiles	1,100
PCBs	30
Dioxins/Furans	--
Pesticides/Herbicides	0.047

4.1.2.3 Integrity of Contaminant Systems

No investigation had been performed on the integrity of the tank.

4.1.2.4 Known, Suspected or Potential Releases

No releases from the 90-day accumulation tank are known or suspected. Releases resulting from the transfer of ignitable liquid waste to the railroad cars (if any) would not have impacted the surficial soils in the vicinity of the release because the area was paved. Surface water runoff from heavy rains could have transported ignitable waste downslope (toward the river or to the surface water runoff collection system).

4.1.3 SWMU-4: Trash Compactor Station

No known releases.

4.1.4 SWMU-7: Chlorosulfonic Acid Spill Area

4.1.4.1 Background

SWMU-7 is an area (about 10 feet wide by 20 feet long) where, in 1961, approximately 500 gallons of chlorosulfonic acid were spilled from a trailer truck. Soils within the spill area were neutralized and subsequently excavated to accommodate new tank farm foundations in the Production Area. It is not known what was used to neutralize the spill or how much soil was removed.

4.1.4.2 Analytical Results

Table 4-6 shows the maximum concentrations found in soils and ground water.

TABLE 4-6. CONSTITUENT CONCENTRATIONS IN SOIL IN UNIT SWMU 7	
Constituent	**Concentration (ppm)**
VOCs	4.6
Semi-volatiles	2.4
PCBs	13
Dioxins/Furans	0.0027
Pesticides/Herbicides	0.44

4.1.5 SWMU-8: Prussian Blue Spill Area

4.1.5.1 Background

Blue stained soil was excavated in 1961 while constructing the foundation for the new tank farm. Approximately 300 cubic yards of soil were removed and replaced with new fill for the storage tank foundation. No information exists regarding the release at SWMU-8. However, it is believed that the blue soil was first noticed around 1956. Laboratory analysis to confirm the presence of Prussian Blue was not performed. Reports of the incident, including the method used to determine the report of the release, are no longer available.

In the 1960s, during the installation of the wastewater piping system another quantity of blue stained soil was excavated just east of Building 24. It is not known where the excavated materials were removed to.

4.1.5.2 Analytical Results

Tables 4-7 and 4-8 show the sampling results of SWMU 8.

TABLE 4-7. CONSTITUENT CONCENTRATIONS IN SOIL IN UNIT SWMU 8	
Constituent	**Concentration (ppm)**
VOCs	400
Semi-volatiles	2.7
PCBs	12
Dioxins/Furans	0.0007
Pesticides/Herbicides	0.1

TABLE 4-8. CONSTITUENT CONCENTRATIONS IN GROUND WATER IN UNIT SWMU 8	
Constituent	**Concentration (ppm)**
VOCs	870
Semi-volatiles	27
PCBs	--
Dioxins/Furans	--
Pesticides/Herbicides	2.4

4.1.6 SWMU-11: Toluene Wastewater Release

4.1.6.1 Background

SWMU-11 was a subsurface sump beneath Building 11 from which toluene was released. Building 11, a facility production building, was razed in October 1983. During demolition, ground water samples taken from beneath the building's sump contained less than 1 ppm of toluene. The subsurface sump - SWMU-11 - was made of concrete, had a capacity of 300 gallons, and functioned as an overflow reservoir.

CIBA-GEIGY estimated that the toluene loss was between 9 and 90 pounds (based on normal building flow conditions and the probable concentration of toluene in the waste stream).

4.1.6.2 Analytical Results

Tables 4-9 and 4-10 show the soil and ground water sampling results.

TABLE 4-9. CONSTITUENT CONCENTRATIONS IN SOIL IN UNIT SWMU 11

Constituent	Concentration (ppm)
VOCs	1,200
Semi-volatiles	390
PCBs	9
Dioxins/Furans	0.11
Pesticides/Herbicides	0.71

TABLE 4-10. CONSTITUENT CONCENTRATIONS IN GROUND WATER IN UNIT SWMU 11

Constituent	Concentration (ppb)
VOCs	150,000
Semi-volatiles	2,300
PCBs	--
Dioxins/Furans	0.015
Pesticides/Herbicides	3

4.1.7 AOC-13: Process Building Area

4.1.7.1 Background

Chemical manufacturing took place at the site from 1930 to 1986. Most of the chemical manufacturing operations were located in the southern half of the Production Area. This entire area has been identified as AOC-13. All of the structures in this area have been razed and much of the area has been regraded.

4.1.7.2 Analytical Results

Tables 4-11 and 4-12 show the sampling results for AOC-12.

TABLE 4-11. CONSTITUENT CONCENTRATIONS IN GROUND WATER IN AOC-13

Constituent	Concentration (ppm)
VOCs	0.42
Semi-volatiles	33
PCBs	77
Dioxins/Furans	0.0028
Pesticides/Herbicides	0.016

TABLE 4-12. CONSTITUENT CONCENTRATIONS IN GROUND WATER IN AOC-13	
Constituent	**Concentration (ppb)**
VOCs	21,000
Semi-volatiles	240
PCBs	--
Dioxins/Furans	--
Pesticides/Herbicides	1.4

4.1.8 AAOI-15: Laboratory Building Wastewater Sump

4.1.8.1 Background

AAOI-15 is a wastewater sump located in the northern part of the Production Area near Building 20. The gravity sump was used during normal operations in the laboratory building, and drained to sanitary sewer lines that discharged to the Cranston POTW. Design information about the sump is not available currently.

4.1.9 Recent Investigations

Sampling was conducted in 1991 and results presented in Table 4-13 through 4-15. These tables identify the highest concentrations found in the Production Area, the location of the sample, and the action level. A table of all the results are located in Attachment B.

TABLE 4-13. PRODUCTION AREA - SUMMARY[1] OF INORGANICS IN SOILS				
Contaminant	**Concentration (ppm)**	**Depth (ft)**	**Location**	**Action Level (ppm)**
Beryllium	3.8	2-4	AAOI-15	0.2
Calcium	45,600	0-2	SWMU-8	NA
Cobalt	8.6	8-10	SWMU-2	NA
Copper	25.6	6-8	SWMU-2	NA
Iron	29,900	6-8	SWMU-2	NA
Magnesium	4,640	6-8	SWMU-2	NA
Nickel	21	6-8	SWMU-2	2,000
Potassium	1,100	4-6	SWMU-8	NA
Sodium	350	5-7	SWMU-11	NA
Zinc	339	0-2	SWMU-8	NA

[1]The contaminants listed exceeded background soil range
NA - Not Available

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TABLE 4-14. PRODUCTION AREA - SUMMARY OF INORGANICS IN GROUND WATER

Contaminant (total)	Concentration (ppb)	Location[1]	Action Level[2] (ppb)
Arsenic	45.6	SWMU-8	50
Barium	362	SWMU-8	1,000
Calcium	107,000	SWMU-8	NA
Chromium	125	SWMU-8	50 (chromium VI)
Cobalt	47	SWMU-8	NA
Copper	134	SWMU-8	NA
Iron	94,400	SWMU-8	NA
Lead	154	SWMU-8	50
Magnesium	14,200	SWMU-8	NA
Manganese	6,270	SWMU-8	NA
Mercury	2.3	SWMU-8	2
Nickel	115	SWMU-8	700[3]
Vanadium	77	SWMU-8	NA
Zinc	717	SWMU-8	NA
Cyanide	38.7	SWMU-8	NA

[1]Highest hits were found in MW13-S, 1/10/91 except for cyanide which was detected in MW13-S 4/22/91.
[2]MCL values used except where noted.
[3]Subpart S Action Level for water.

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TABLE 4-15. PRODUCTION AREA - SUMMARY OF ORGANICS IN SOILS				
Contaminant	**Concentration (ppm)**	**Depth (ft)**	**Location**	**Action Level (ppm)**
Ethylbenzene	50	0-2	SWMU-8	8,000
m and p xylene	400	0-2	SWMU-8	200,000[1]
o-xylene	27	3-7	SWMU-11	200,000[1]
Toluene	1,200	3-5	SWMU-11	20,000
Irgasan DP-300[2]	390	2-4	SWMU-11	NA
Total phenols	6.2	5-7	SWMU-11	50,000
P-phenylenediamine	15	4-6	SWMU-11	NA
PCB (1260)	13	3-7	SWMU-7	NA
Dioxin/furan	0.11	4-6	SWMU-11	NA
Organophosphorus Pesticides	0.019	NA	SWMU-8	NA
Organochlorine Pesticides	1.28	NA	SWMU-11	NA
Herbicides	0.045	NA	SWMU-8	NA

[1]Total xylene
[2]Fingerprint compound
NA - Not Available

4.2 The Warwick Area

4.2.1 SWMU-1: Hazardous Waste Storage Area

This SWMU has no known release.

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4.2.2 SWMU-5: River Sediment Storage Area

4.2.2.1 Background

SWMU-5 was a storage area for river sediment. In 1971, sediment was dredged from the Pawtuxet River from the reach between the Production Area's pedestrian and vehicular bridges. Approximately 6,630 cubic yards of sediment were stockpiled until December 1976, when the material was removed from the facility. The area was brought back to grade in 1977. The sediment occupied an irregularly shaped area. Historical maps and other documents do not provide definitive information about the shape and location of SWMU-5. The river sediments were not chemically analyzed during the dredging and storage operation.

4.2.2.2 Soil and Ground Water Analytical Results

Tables 4-16, 4-17 and 4-18 present the results of sampling.

TABLE 4-16. CONSTITUENT CONCENTRATIONS IN SOIL IN UNIT SWMU 5

Constituent	Concentration (ppb)
VOCs	3.6
Semi-volatiles	140
PCBs	170
Dioxins/Furans	0.0011
Pesticides/Herbicides	2,200

TABLE 4-17. CONSTITUENT CONCENTRATIONS IN GROUND WATER (OVERBURDEN AQUIFER) IN UNIT SWMU 5	
Constituent	**Concentration (ppb)**
VOCs	3,500
Semi-volatiles	35
PCBs	--
Dioxins/Furans	--
Pesticides/Herbicides	0.44

TABLE 4-18. CONSTITUENT CONCENTRATIONS IN GROUND WATER (BEDROCK AQUIFER) IN UNIT SWMU 5	
Constituent	**Concentration (ppb)**
VOCs	--
Semi-volatiles	2
PCBs	--
Dioxins/Furans	--
Pesticides/Herbicides	0.017

4.2.3 SWMU-6: Zinc Oxide/Soil Pile

4.2.3.1 Background

SWMU-6 is a soil pile containing residues of zinc oxide. In the late 1960s, 140,000 pounds of zinc oxide spilled from a broken rail car that was on the siding near Buildings 32 and 33 in the Warwick Area. The zinc oxide was transferred to another rail car. The spilled zinc oxide was cleaned up, and paved areas were swept as part of

normal plant maintenance. After the spill, road sweepings from in and around the railroad spur in the Warwick Area contained some zinc oxide residue. Those sweepings were used to form a drainage berm now identified as SWMU-6.

The soil berm was not removed during decommissioning activities and remains stored on-site at its original location. The soil pile, approximately 50 feet long by 7 feet wide by 2 feet high, contains about 25 cubic yards of material. The pile contains about 10 percent zinc oxide and can be identified by the lack of vegetative growth.

4.2.3.2 Soil Analytical Results

Table 4-19 presents data from soils..

TABLE 4-19. CONSTITUENT CONCENTRATIONS IN SOIL IN UNIT SWMU 6

Constituent	Concentration (ppm)
VOCs	--
Semi-volatiles	8.3
PCBs	0.13
Dioxins/Furans	--
Pesticides/Herbicides	0.046

4.2.3.3 Integrity of Containment Systems

SWMU-6 has no containment systems.

4.2.4 SWMU-9: Wastewater Pipeline Break

4.2.4.1 Background

SWMU-9 was the site of a wastewater pipeline break in 1982 in the Warwick Area. Remedial measures were taken to reduce flow in the line and permit repairs. Approximately 24,000 gallons of raw waste escaped over a four-hour period. The raw waste entered the surface water runoff catchment system and discharged into the Pawtuxet River.

Laboratory analysis of the material spilled was not performed after the release. The influent to the wastewater treatment plant typically contained halogenated and non-halogenated solvents and other organic compounds (e.g., materials routinely used in the chemical manufacturing process). The pH of the treatment plant's effluent normally varied from 4 to 12. The pH of the river both upstream an downstream of the spill's entry was measured by CIBA-GEIGY personnel; both readings had a pH of 6.

4.2.4.2 Analytical Results

Table 4-20 presents soil sample results for SWMU 9.

TABLE 4-20. CONSTITUENT CONCENTRATIONS IN SOIL IN UNIT SWMU 9	
Constituent	**Concentration (ppm)**
VOCs	0.047
Semi-volatiles	28
PCBs	0.18
Dioxins/Furans	0.00027
Pesticides/Herbicides	0.013

4.2.5 AAOI-16: Maintenance Department Cleaning Area

4.2.5.1 Background

The maintenance department cleaning area (AAOI-16) was located near the southwest corner of former Building 23. Production machinery (such as portable filters) was brought to this area and steam cleaned. Rinse water was not collected (or analyzed) and probably drained to the nearby surface water catch basin.

No releases are known to have occurred.

4.2.6 Recent Investigations

Sampling conducted in 1991 is presented in Tables 4-21 through 4-25. These tables identify the highest concentrations found in the Warwick Area, the location and depth of the samples, and the action levels. A table of all the results are located in Attachment C.

TABLE 4-21. WARWICK AREA - ORGANICS IN SOIL (18" - 24")			
Contaminant	**Concentration (ppm)**	**Location**	**Action Level (ppm)**
bis(2-ethylhexyl)phthalate	140	SWMU-15	50
PCB (1248)	170	SWMU-15	NA
PCB (1254)	36	SWMU-15	NA
Methoxychlor	2,200	SWMU-15	NA

NA - Not Available

TABLE 4-22. WARWICK AREA - SUMMARY OF ORGANICS IN GROUND WATER			
Contaminant	**Concentration (ppb)**	**Location**	**Action Level (ppb)**
Benzene	35	SWMU-5	5
Chlorobenzene	3,500	SWMU-5	2
Tetrachloroethene	9.7	SWMU-5	NA
Toluene	31	SWMU-5	20
1,1,1-trichloroethane	34	AAOI-16	200
4-chloroaniline	21	SWMU-5	NA
Propazine[1]	35	SWMU-5	NA
Tinuvin[1] 327	4	SWMU-5	NA
Total phenols	13	SWMU-5	NA

[1]Fingerprint compounds
NA - Not Available

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TABLE 4-23. WARWICK AREA - SUMMARY[1] OF INORGANICS IN GROUND WATER			
Contaminant	**Concentration (ppb)**	**Location**	**Action Level (ppb)**
Cadmium	17.8	MW-11S	10
Iron	52,400	MW-17S	NA
Manganese	902	MW-17D	NA

[1]Contaminants shown exceed background limits.
NA - Not Available

TABLE 4-24. WARWICK AREA - SUMMARY OF ORGANICS IN SOILS				
Contaminant	**Concentration (ppb)**	**Depth (ft)**	**Location**	**Action Level (ppb)**
Tinuvin 327[1]	83	0.5-1	SWMU-6	NA
Safrole[1]	28	0.5-1	SWMU-9	NA

[1]Fingerprint compounds
NA - Not Available

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TABLE 4-25. WARWICK AREA - SUMMARY[1] OF INORGANICS IN SOIL (18″ - 24″)			
Contaminant	**Concentration (ppm)**	**Location**	**Action Level (ppm)**
Antimony	41.8	SWMU-5	30
Barium	1,270	SWMU-5	400 (ionic)
Beryllium	1.6	SWMU-5	0.2
Cadmium	6.9	SWMU-5	40
Calcium	3,730	SWMU-5	NA
Chromium	357	SWMU-5	40 (chromium VI)
Copper	1,960	SWMU-5	NA
Magnesium	2,480	SWMU-5	NA
Mercury	0.94	SWMU-5	NA
Nickel	36	SWMU-5	2,000
Potassium	1,520	SWMU-5	NA
Zinc	13,300	SWMU-5	NA
Cyanide	9.4	SWMU-5	2,000

[1]Values shown exceed background ranges.
NA - Not Available

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TABLE 4-26. WARWICK AREA - SUMMARY[1] OF INORGANICS IN SOILS				
Contaminant	**Concentration (ppm)**	**Depth (ft)**	**Location**	**Action Level (ppm)**
Beryllium	0.78	0.5-1	SWMU-9	0.2
Cadmium	2.3	0.5-1	SWMU-6	40
Calcium	2,170	0.5-1	SWMU-9	NA
Chromium	20.7	0.5-1	SWMU-9	40 (chromium VI)
Cobalt	7.8	0.5-1	SWMU-6	NA
Copper	31.9	0.5-1	SWMU-9	NA
Magnesium	5,360	0.5-1	SWMU-9	NA
Mercury	4.5	0.5-1	AAOI-16	NA
Nickel	14.7	0.5-1	SWMU-6	2,000
Potassium	4,630	0.5-1	SWMU-9	NA
Zinc	2,390	0.5-1	SWMU-6	NA

[1]Contaminants shown exceed background ranges.
NA - Not Available

4.3 The Wastewater Treatment Area

4.3.1 SWMU-10: Wastewater Pipeline Break

4.3.1.1 Background

SWMU-10 was the site of a wastewater pipeline break in the Wastewater Treatment Area. In September 1983, an underground pipeline feeding one of three equalization tanks ruptured. Pre-treated neutralized wastewater from the equalization tanks normally passed through a clarifier before discharging to the Cranston publicly owned

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treatment works (POTW). The break occurred at a "Y" splice located before the equalization tanks and five feet below the ground surface. About 40,000 gallons of wastewater escaped in the 50-minute period before the flow could be shut off. The discharge flowed east, around the 1.5 million gallon equalization tank, into a small pond and then was diverted to the Pawtuxet River.

The pH of the released wastewater was 8.5; the chemical oxygen demand (COD) was 1,010 ppm. This discharge contained the following estimated quantities: acetone (31 pounds), isopropyl alcohol (45 pounds), toluene (7 pounds), xylene (1.7 pounds), zinc (0.25 pounds), and nitrobenzene (0.125 pounds). On the day of the release, surface water samples of the river were collected by RIDEM. Toluene was detected in both the upstream (1.1 ppm) and downstream (2.0 ppm) samples.

4.3.1.2 Soil and Ground Water Analytical Results

Tables 4-27 through 4-30 present data from the RFI Phase I data.

TABLE 4-27. CONSTITUENT CONCENTRATIONS IN SOIL IN UNIT SWMU 10

Constituent	Concentration (ppm)
VOCs	0.036
Semi-volatiles	0.54
PCBs	0.057
Dioxins/Furans	0.00016
Pesticides/Herbicides	0.0082

TABLE 4-28. CONSTITUENT CONCENTRATIONS IN GROUND WATER IN UNIT SWMU 10	
Constituent	**Concentration (ppb)**
VOCs	4.6
Semi-volatiles	14
PCBs	--
Dioxins/Furans	--
Pesticides/Herbicides	0.011

TABLE 4-29. CONSTITUENT CONCENTRATIONS IN SURFACE WATER IN UNIT SWMU 10	
Constituent	**Concentration (ppb)**
VOCs	7.0
Semi-volatiles	--
PCBs	--
Dioxins/Furans	--
Pesticides/Herbicides	0.079

TABLE 4-30. CONSTITUENT CONCENTRATIONS IN SEDIMENTS IN UNIT SWMU 10	
Constituent	**Concentration (ppm)**
VOCs	0.24
Semi-volatiles	5.8
PCBs	--
Dioxins/Furans	--
Pesticides/Herbicides	0.079

Subsurface soil samples (MW-7 and MW-9) taken from the release area and downgradient of the pipe break contained various volatile and semi-volatile compounds in trace concentrations. Volatiles and semi-volatiles also were detected in trace concentrations in the ground water collected beneath SWMU-10. Downgradient of the spill, ground water sample MW-7 detected a trace of bis(2-ethylhexyl)phthalate (4 ppb).

Leakage from the line would have impacted the subsurficial soils in the vicinity of the release. Constituents of Concern may have infiltrated into the deeper soil horizons before discharging into the pond.

4.3.2 SWMU-12: Wastewater Treatment Area

4.3.2.1 Background

SWMU-12 was a permitted wastewater treatment plant which began operation in November 1975 and continued through July 1983. SWMU-12 operated until the facility was decommissioned and razed in 1986.

Biological trickling towers were used at the facility from 1970 to 1983. Occasional sump overflows from these towers resulted in discharges to the river. Influent to the trickling towers routinely contained volatile and semi-volatile organic compounds. Additional releases from SWMU-12 also have been documented. Discharges have been reported for zinc, BOD, and phenols. For two release events, chloroform were discharged to the river.

4.3.2.2 Soil and Ground Water Contamination

Soil and ground water samples were collected from SWMU-12 during the Preliminary Investigation. Three soil samples were collected to determine if soil within the Wastewater Treatment Area has been impacted by SWMU-12. Two of these samples were collected downslope of SWMU-12 (along the northern bank of the river). The third sample was collected upslope (near the 1.5 million gallon equalization tank). Analytical results indicated trace levels of volatile and semi-volatile organic compounds in all three soil samples. Ground water samples were collected from these monitoring wells to evaluate ground water quality in this area. Volatile and semi-volatile organic compounds were detected in all three monitoring wells. In particular, sample MW-8S contained 10,000 ppb of methylene chloride. Table 4-16 presents data collected.

Periodic sump overflows from the trickling towers appear to have impacted the surficial soil in the vicinity of SWMU-12. Constituents of Concern may have migrated into the Pawtuxet River, or may have infiltrated to deeper soil horizons.

4.3.3 Recent Investigations

Sampling was conducted in 1991 and results are presented in Tables 4-31 through 4-34. These tables identify the highest concentrations found in the Wastewater Treatment Area, the location of the samples and the action level. A table of all the results are located in Attachment D.

TABLE 4-31. WASTEWATER TREATMENT AREA - SUMMARY OF ORGANIC DATA IN SOILS				
Contaminant	**Concentration (ppm)**	**Depth (ft)**	**Location**	**Action Level (ppm)**
Chlorobenzene	13	0.5-2	SWMU-12	2,000
m and p xylene	8.2	0.5-2	SWMU-12	200,000 (total)
Toluene	8.7	0.5-2	SWMU-12	20,000
Dioxins/furans	128	0.5-2	SWMU-12	NA
Irgason DP-300	340	0.5-2	SWMU-12	NA
PAHs	45.6	0.5-2	SWMU-12	NA
Total phenol	5.7	0.5-2	SWMU-12	NA
PCBs	0.21	0.5-2	SWMU-12	NA
Organophosphorus pesticides	0.80	0.5-2	SWMU-12	NA
Organochlorine pesticides	5.9	0.5-2	SWMU-12	NA

NA - Not Available

TABLE 4-32. WASTEWATER TREATMENT AREA - SUMMARY[1] OF INORGANIC DATA IN SOILS				
Contaminant	**Concentration (ppm)**	**Depth (ft)**	**Location**	**Action Level (ppm)**
Beryllium	0.81	2-4	SWMU-10	0.20
Calcium	19,600	0.5-2	SWMU-12	NA
Chromium	20.5	0.5-2	SWMU-12	NA
Copper	98	0.5-2	SWMU-12	NA
Potassium	1,170	2-4	SWMU-10	NA
Silver	2.5	0.5-2	SWMU-12	200
Sodium	303	0.5-2	SWMU-12	NA
Zinc	840	0.5-2	SWMU-12	NA

[1]Contaminants listed are those above background ranges.
NA - Not Available

TABLE 4-33. WASTEWATER TREATMENT AREA - SUMMARY OF ORGANIC DATA IN GROUND WATER			
Contaminant	**Concentration (ppb)**	**Location**	**Action Level (ppb)**
Chlorobenzene	14	SWMUs 10 & 12	700
Chloroform	4.6	SWMUs 10 & 12	6
Ethylbenzene	4.9	SWMUs 10 & 12	4,000
m and p xylene	23	SWMUs 10 & 12	NA
o-xylene	11	SWMUs 10 & 12	NA
Toluene	30	SWMUs 10 & 12	10,000
1,1-dichloroethane	2.4	SWMUs 10 & 12	NA
1,1,1-trichloroethane	4.2	SWMUs 10 & 12	200 (MCL)
Aniline	86	SWMUs 10 & 12	NA
4-chloroaniline	6	SWMUs 10 & 12	NA
1,2-dichlorobenzene	2	SWMUs 10 & 12	NA
Irgasan DP-300	670	SWMUs 10 & 12	NA
Propazine	170	SWMUs 10 & 12	NA
Tofranil	5	SWMUs 10 & 12	NA
Phenol	61	SWMUs 10 & 12	20,000
4-methylphenol	67	SWMUs 10 & 12	NA
2,4-dichlorophenol	29	SWMUs 10 & 12	100
bis(2-ethylhexyl) phthalate	130	SWMUs 10 & 12	3
Butazolidin	20	SWMUs 10 & 12	NA
Organochlorine pesticides	1.6	SWMUs 10 & 12	NA

NA - Not Available

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TABLE 4-34. WASTEWATER TREATMENT AREA - SUMMARY[1] OF INORGANICS IN GROUND WATER			
Contaminants (total)	**Concentration (ppb)**	**Location**	**Action Level[2] (ppb)**
Arsenic	52.4	MW-7S	50
Chromium	69.7	MW-15S	50 (chromium VI)
Iron	27,400	MW-15S	NA
Manganese	1,970	MW-15S	NA

[1]Contaminants shown exceed the background range.
[2]MCL
NA - Not Available

4.4 Pawtuxet River Area

4.4.1 Background

Originally, discharges from the facility to the Pawtuxet River occurred through the cofferdam/wastewater outfall associated with the Production Area.

That structure was used until the on-site wastewater treatment plant began operation. As part of the operation of the wastewater treatment plant, CIBA-GEIGY was permitted to discharge treated water to the Pawtuxet River.

Other regular discharges to the Pawtuxet River included water from the cooling tower. Cooling water sprayed onto drums stored in the Warwick Area discharged to the Pawtuxet River.

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4.4.2 Previous Analytical Results

As part of the Facility Assessment, sediment quality was investigated. Four sediment samples were collected from the Pawtuxet River near the site. The samples were analyzed for metals, volatile and semi-volatile organic compounds, and pesticides/PCBs. Two of those samples also were analyzed for dioxin (TCDD) and furan (TCDF). The depth intervals for the samples are not reported. Table 4-35 presents this information.

4.4.3 Recent Investigations

Sampling was conducted in 1991 and results are presented in Attachment E.

TABLE 4-35. CONSTITUENT CONCENTRATIONS AND PHYSICAL STATE OF WASTES IN UNIT "PAWTUXET RIVER AREA"			
Constituent Name	**Concentration**	**Physical State**	**Action level (ppm)**
Chromium	1,080 ppm	Sediment (upstream of Production Area)	400 (chromium VI)
Lead	369 ppm	Sediment (upstream of Production Area)	NA
Mercury	23 ppm	Sediment (upstream of Production Area)	20
Zinc	2,280 ppm	Sediment (upstream of Production Area)	4,000 (zinc cyanide)
PAH	57.15 ppm	Sediment (upstream of Production Area)	NA
Beryllium	2.0 ppm	Sediment (adjacent to the Wastewater Treatment Area)	0.2
Dieldrin	0.89 ppm	Sediment (adjacent to the Warwick Area, upstream of the Wastewater Treatment Area).	0.04
Arsenic	9.3 ppm	NA	80
Barium	222 ppm	NA	4,000
Iron	21,100 ppm	NA	NA
Magnesium	3,610 ppm	NA	NA
Vanadium	943 ppm	NA	NA
Toluene	0.23 ppm	NA	2,000
Tetrachloroethylene	1.7 ppm	NA	10
2-butanone	0.74 ppm	NA	NA
Polycyclic Aromatic Hydrocarbons (PAH)	57.15 ppm	NA	NA

NA - not available

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ATTACHMENT A

RECENT INVESTIGATIONS FOR BACKGROUND DATA

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Table 10-2. Background Locations - Surficial Soil: Inorganic Data Summary

	SF-BG-BP	SF-BG-BP	SF-BG-ND	SF-BG-ND	SF-BG-PH	SF-BG-PH	SF-BG-WS	SF-BG-WS	Background Soil Range
date:	12/3/90	3/21/91	12/3/90	3/21/91	12/3/90	3/21/91	12/3/90	3/21/91	
depth:	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	
INORGANICS									
antimony	< 0.65		< 0.63		< 0.58		< 0.64		0.58*-0.65**
arsenic	8.4 J	12.8	36.9	17.1	5.2	8.6	18.4	13.6	5.2-36.9
barium	49.1	275	17.9	18.2	12.1	13	24.2	18.5	12.1-275
beryllium	0.73	0.77	0.4	0.51	0.25	0.26	0.53	0.44	0.25-0.77
cadmium	0.52	0.78	< 0.46	< 0.49	< 0.38	< 0.46	< 0.44	< 0.5	0.52-0.78
calcium	1200 J	1440 J	715 J	817 J	636 J	560 J	1240 J	803 J	560-1,440
chromium	11.8	20	7.3	8	7.4	6.2	13	11	6.2-20
cobalt	5.2	7	1.9	2.2	2.7	1.8	5	5.1	1.8-7
copper	14.3	22.9	5.6	10.1	3.8	5.2	5.7	8.8	3.8-22.9
iron	13800	28300 J	8590	8230 J	8620	7240	14100	13300 J	7,240-28,300
lead	90 J	471	166 J	43.4	11.8 J	23.3	24 J	22.1	11.8-471
magnesium	1520 J	2450	703 J	713	1390 J	683	1770 J	1910	683-2,450
manganese	379 J	476 J	137 J	140 J	106 J	53.2 J	152 J	177 J	53.2-476
mercury	0.28	0.81	< 0.066	0.06	< 0.047	< 0.053	< 0.053	< 0.053	0.047*-0.81
nickel		13.3	< 1.9	6.2	< 1.5	4.6	< 1.8	9.5	1.5*-13.3
potassium	561 J	786 J	364 J	349 J	457 J	404 J	589 J	524 J	349-786
selenium	< 0.46	0.67	< 0.45	0.49	< 0.41	< 0.52	< 0.45	< 0.32	0.32*-0.67
silver	< 0.86	< 0.86	< 0.93	< 0.98	< 0.77	< 0.93	< 0.88	< 1	0.77*-1**
sodium	86	230	93	211	< 77	197	< 88	182	77*-230
thallium	< 0.46	< 0.53	< 0.45	< 0.49	< 0.41	< 0.52	< 0.45	< 0.32	0.32*-0.53**
tin	97.2	102	< 9.3	< 9.8	< 7.7	< 9.3	< 8.8	< 10	7.7*-102
vanadium	19.3	27.3 J	12.7	12.8 J	11.3	16.1 J	23.7	20.5 J	11.3-27.3
zinc	79	219	22.7	20.9	17.4	26.8	25.8	25.9	17.4-219
cyanide	< 0.55	3	< 0.56	< 0.49	< 0.52	< 0.48	< 0.57	< 0.45	0.45*-3

all concentrations in mg/kg (ppm).
* these lower values are detection limits, not concentrations detected.
** these upper values are detection limits, not concentrations detected.
J - estimated concentration.
< - below detection limit.

Table 10-3. Background Locations - Groundwater: Organic Data Summary

	MW-18S	MW-18S	MW-19S	MW-19S	RW-4	RW-4
date:	1/11/91	4/18/91	1/10/91	4/16/91	1/14/91	4/22/91
VOLATILE ORGANICS						
toluene						3.5 J
Total Volatile Organics						3.5
SEMI-VOLATILE ORGANICS						
PAHs						
fluoranthene			2 J			
naphthalene	1 J					
phenanthrene			3 J			
pyrene			2 J			
Total	1		7			
Phthalates						
diethylphthalate	1 J					
Total	1					
Total Semi-Volatile Organics	2		7			
ORGANOCHLORINE PESTICIDES						
aldrin	0.042				0.013 J	
alpha-BHC	0.016		0.01			
endosulfan II					0.0041 J	
heptachlor epoxide	0.063					
4,4'-DDE			0.0081 J			
4,4'-DDT			0.024			
Total Pesticides	0.121		0.04		0.017	
TOTAL No. OF TICs *	2		1	1	3	2

all concentrations in ug/l (ppb).
* indicates the number, not the concentration, of TICs.
J - estimated concentration.

Table 10-4. Background Locations - Groundwater: Inorganic Data Summary

	MW-18S				MW-19S				RW-4				Maximum Contaminant Level
date:	1/11/91		4/18/91		1/10/91		4/16/91		1/14/91		4/22/91		
	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	
INORGANICS													
arsenic		59.7 J		12.2 J		61.7		24.1				6.8	50
barium	18	335	28.9	93.1	13	359	10.8	222	17	25	35.4	96.2	1000
beryllium		2.1				3.5							
calcium	29300	45400	28500	25600	34400	44900	29600	40000	12700	13200	18100	20200	
chromium		83	10.1	131 J		154		56.2		16		25.4	50
cobalt		31		14.3		52		24.8				24.5	
copper		123		23.7		125		67.5				62.6	
iron		64200	121	14400		111000	216	39500	3200	7260	8360	41700	300*
lead				10.5 J		45.8		24.1		26.9		47	50
magnesium	3210	16400	2230	4500	4330	28000	2800	12400	2490	3040	5170	11400	
manganese	349	4220	286	971	92	1750	188	875	829	813	1920	2240	50*
nickel		86	139	210 J		142	197	202		38		53.9	
potassium	5250	16200	4040	4960	3610	14800		5950	4780	4590		3240 J	
sodium	30200	32200	19800	16700	10300	13800	8390	10400	9920	10800	17000	16400	
vanadium		62				115		46.1					
zinc		171		51				152	20	47	35.6	148	5000*

all concentrations reported in ug/l (ppb).
* - secondary drinking water standard.
all shaded values exceed Maximum Contaminant Levels.
J - estimated concentration.

Table 10-1. Background Locations - Surficial Soil: Organic Data Summary

	SF-BG-SP	SF-BG-SP	SF-BG-ND	SF-BG-ND	SF-BG-PH	SF-BG-PH	SF-BG-WS	SF-BG-WS
date:	12/3/90	3/21/91	12/3/90	3/21/91	12/3/90	3/21/91	12/3/90	3/21/91
depth:	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"
VOLATILE ORGANICS								
benzene		0.043 J						
chloroform				0.032 J				
methylene chloride	0.12		0.064 J		0.058 J		0.078 J	
toluene	0.026	1.2 J		0.04 J		0.17 J		0.027 J
2-butanone			0.064	0.17 J	0.058 J			
Total Volatile Organics	0.15	1.2	0.128	0.24	0.116	0.17	0.078	0.027
SEMI-VOLATILE ORGANICS								
Dioxins/Furans (1)								
dibenzofuran	1.5	9.7 J	0.061 J	0.043 J				
Total	1.5	9.7	0.061	0.043				
PAHs								
acenaphthene	0.82 J	5.4 J	0.063 J	0.051 J				
acenaphthylene	0.28 J	0.61 J						
anthracene	4.2	20 J	0.18 J	0.15 J	0.041 J			
benzo(a)anthracene	6.6	28 J	0.82 J	0.67	0.32 J			
benzo(a)pyrene	5	22 J	0.64 J	0.61	0.37 J			
benzo(b)fluoranthene	8.2	36 J	1.4	0.91	0.6 J			
benzo(g,h,i)perylene	3.7	12 J	0.52 J	0.4 J	0.49 J			
benzo(k)fluoranthene	8.6	43 J	1.4	1.1	0.63 J			
chrysene	6.3	30 J	1.1	0.97	0.43 J			0.14 J
dibenz(a,h) anthracene	1 J	3.7 J						
fluoranthene	14	57 J	2.1	1.6	0.74 J	0.23 J	0.096 J	0.18 J
fluorene	1.7	9.4 J	0.1 J	0.088 J				
indeno(1,2,3-cd) pyrene	4.6	14 J	0.79 J	0.31 J	0.57 J			
naphthalene	0.88 J	7.3 J	0.041 J	0.023 J				
phenanthrene	12	69 J	1.7	1.3	0.42 J	0.12 J	0.052 J	0.081 J
pyrene	12	56 J	1.9	1.5	0.61 J	0.21 J	0.1 J	0.2 J
2-methylnaphthalene	0.57 J	4.5 J						
Total	90	416	12.6	9.7	5.2	0.56	0.2	0.6
Miscellaneous								
p-phenylenediamine						5.9		
Total						5.9		
Total Semi-Volatile Organics	92	428	12.8	9.7	5.2	6.5	0.2	0.6
ORGANOCHLORINE PESTICIDES								
beta-BHC		0.26 J						
dieldrin				0.0041		0.0014		
endosulfan sulfate			0.0061					
endrin								0.00027 J
endrin aldehyde								0.001
isodrin	0.0032							
kepone				0.055				
4,4'-DDD				0.00078		0.0035		0.0031
4,4'-DDE		0.38			0.0011	0.012	0.025 J	0.025
4,4'-DDT				0.0041		0.013	0.028 J	0.024
Total	0.0032	0.64	0.0061	0.064	0.0011	0.030	0.053	0.053
ORGANOPHOSPHOROUS PESTICIDES								
disulfoton			0.0024 J					
ethyl parathion			0.0041 J				0.0034 J	
methyl parathion	0.0046 J		0.0026 J		0.0039 J		0.0044 J	
Total	0.0046		0.0092		0.0039		0.0078	
HERBICIDES								
dinoseb						0.0027 J		
Total						0.0027		
Total Pesticides/Herbicides	0.0078	0.64	0.0154	0.064	0.0050	0.033	0.061	0.053
TOTAL No. OF TICs	11	14	4	13	13	30	9	13

all concentrations in mg/kg (ppm).
(1) - detected by method 8270 (semi-volatiles).
* indicates the number, not the concentration, of TICs.
J - estimated concentration.

ATTACHMENT B

RECENT INVESTIGATIONS FOR PRODUCTION AREA

Table 6-2. Production Area Soil Borings: Organic Data Summary

	SWMU-2					SWMU-3					SWMU-7				SWMU-8					SWMU-11					AAOI-15		
	B-2A	B-2B	B-2C	B-2D	B-2D	B-3A	B-3A	B-3B	B-3C	B-3D	B-7A	B-7B	B-7C	B-7C	B-8A	B-8B	B-8D	B-8C	B-8C-DUP	B-11A	B-11B	B-11B-DUP	B-11D	B-11C	55 MW-16S	55 MW-16S	B-15A
date	11/15/90	11/15/90	3/14/91	3/14/91	3/15/91	11/20/90	3/15/91	11/13/90	3/15/91	3/15/91	11/20/90	11/20/90	3/15/91	3/15/91	11/20/90	11/20/90	3/14/91	3/14/91	3/14/91	12/5/90	11/20/90	11/20/90	3/15/91	3/15/91	12/5/90	3/14/91	3/14/91
depth	8-10	5-6	6-8	6-8	6-8	6-8	5-6	4-6	7-8	6-8	2-4	0-2	2-3	4-5	0-2	0-2	0-2	4-5	6-8	3-5	3-7	3-7	3-7	5-7	8-10	8-10	2-4
VOLATILE ORGANICS																											
chlorobenzene																											
ethylbenzene						5.9	0.04	5.5		0.03 J	0.04 J	0.12	0.021 J	0.067 J	0.28	50	0.020 J	0.082 J	0.052 J	18 J	29 J	19 J	14	0.15 J			
m&p-xylene		0.029 J				33	8.1	24			0.21	0.43	0.15		1.1	400	0.14	0.19	0.18	58	120	87	53	2.1			
o-xylene		0.0087 J				9.4	1.9	5.8		0.02 J	0.1	0.11	0.046 J	0.025 J	3.23	120	0.05 J	0.053 J	0.054 J	14 J	27 J	19 J	11 J	2.7		0.0082 J	
styrene										0.014 J		0.049 J															
toluene	3.07 J		0.018 J						0.041 J	0.085 J	0.53 J	4.6 J	0.024 J	0.034 J	4.4 J	4.6 J		0.042 J	0.1 J	1200	700 J	430 J	530 J	14 J		0.014 J	0.016 J
1,4-dioxane							4 J																				
2-butanone		0.13 J						0.13 J		0.29 J				0.3 J													
Total Volatile Organics	9.079	0.17	0.018			48	15	38	0.041	0.44	0.9	5.3	0.25	0.4	6.1	575	0.22	0.34	0.4	1,291	878	565	608	28		0.0222	0.016
SEMI VOLATILE ORGANICS																											
Benzene																											
nitrobenzene																											
1,2,4-trichlorobenzene															0.12 J		0.14 J						0.28 J				
1,2-dichlorobenzene																				0.19 J			0.64 J	0.49 J			
Total																	0.12 J						0.76 J				
Dioxins/Furans(1)															0.12		0.28			0.19			1.69	0.49			
DCDD																											
dibenzofuran																								0.6 J			
DCDF															0.068 J								0.14 J	0.4 J			
TRCDF		0.38 J				0.81 J		0.53 J		1.2 J	0.83 J		2.4		1.2 J					1.8 J	2 J	1.5 J		15			
Total		0.38				0.81		0.53		1.2	0.83		2.4		1.2					35	150	110	270	84			
Fingerprint Compounds															1.2					37	182	113	279	100			
Irgasan DP-300																											
Tinuvin 327						0.49 J											0.57 J			84 J	280	220	45 J	300 J			
Total						0.49											0.57			84	280	220	45	300			
PAHs																											
acenaphthene																											
anthracene															0.15 J									0.26 J			
benzo(a)anthracene															0.38 J		0.18 J	0.19 J	0.08 J				0.21 J	0.65 J			0.016 J
benzo(a)pyrene															1.2	1 J	0.60 J	0.62 J	0.34 J				0.51 J			0.14 J	1.2
benzo(b)fluoranthene								0.12 J		0.68 J					1.3		0.55 J	0.61 J	0.32 J							0.11 J	1.2
benzo(g,h,i)perylene															2.1	1.9 J	0.80 J	0.83 J	0.47 J				0.41 J			0.22 J	2.2
benzo(k)fluoranthene								0.18 J		0.8 J					0.87 J		0.43 J	0.54 J	0.30 J								0.06 J
chrysene															2.7	2.4 J	1.10	1.2	0.8 J				0.49 J			0.29 J	2.6
dibenz(a,h)anthracene															1.4	1.2 J	0.66 J	0.69 J	0.37 J				0.38 J			0.18 J	1.9
fluoranthene		0.15 J						0.085 J	0.31 J	0.52 J	0.083 J		0.31 J	0.48 J	0.3 J			0.22 J									0.11 J
fluorene															2.4	1.8 J	1.30	1 J	0.52 J	0.1 J	1.2 J	0.80 J	0.81 J	0.24 J		0.29 J	3.2
indeno(1,2,3-cd)pyrene															0.098 J									0.18 J			0.075 J
naphthalene		0.18 J						0.081 J	0.089 J	0.22 J	0.059 J		0.092 J	0.17 J	0.9 J		0.32 J	0.43 J									0.07 J
phenanthrene		0.11 J								0.19 J	0.046 J			0.19 J	0.095 J	0.68 J				0.29 J	0.68 J	0.38 J					
pyrene		0.16 J						0.083 J	0.37 J	0.67 J	0.11 J		0.34 J	0.86 J	1.2	1.1 J	0.77 J	0.72 J	0.31 J	0.075 J	1 J	0.63 J	0.75 J	0.54 J		0.16 J	1.5
Total		0.60						0.53	0.77	3.1	0.30		0.74	1.50	2.1	1.7 J	1.10	1 J	0.54 J	0.12 J			0.74 J	0.28 J		0.37 J	2.6
Phenols															17.3	12	2.93	3	3.9	0.6 J	3	1.81	4.10	2.13		1.66	18.6
phenol																											
2,4-dimethylphenol														0.24 J									0.54 J	0.15 J			
2,4-dichlorophenol						0.18 J		0.26 J																			
2,6-dichlorophenol																				3.8	6.2 J	4.2 J	3.4	2.6			
4-methylphenol					3.4						0.1 J													2.6			
Total					3.4	0.18		0.26			0.1			0.24										0.13 J			
																				3.8	6.2	4.3	3.9	3.7			

Table 6-2. Production Area Soil Borings: Organic Data Summary

	SWMU-2					SWMU-3					SWMU-7				SWMU-8					SWMU-11					AOI-15		
	B-2A	B-2B	B-2C	B-2D	B-2D	B-3A	B-3A	B-3B	B-3C	B-3D	B-7A	B-7B	B-7C	B-7D	B-8A	B-8B	B-8C	B-8C	B-8C DUP	B-11A	B-11B	B-11B-DUP	B-11B	B-11C	33 MW-15S	33 MW-15S	9-15A
date	[illegible]	[illegible]	3/14/91	3/14/91	3/15/91	11/20/90	3/13/91	11/15/90	3/13/91	3/13/91	11/20/90	11/20/90	3/12/91	3/13/91	[illegible]	[illegible]	3/14/91	3/14/91	3/14/91	12/6/90	11/20/90	[illegible]/20/90	3/15/91	3/15/91	12/5/90	3/14/91	3/14/91
depth	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6-8	[illegible]	5-6	2-4	4-6	2-4	0-2	0-2	4-6	0-2	0-2	0-2	4-6	4-6	3-5	[illegible]	3-7	3-7	5-7	8-10	8-10	2-4
Phthalates																											
butylbenzylphthalate											0.13 J				0.11 J												
di-n-butylphthalate											0.043 J																
diethylphthalate																											
Total											0.18				0.11						0.67 J	0.61 J					
Miscellaneous																					0.67	0.61					
bis(2-ethylhexyl)phthalate																											
Total																			0.29 J					15			
Total Semi-Volatile Organics		0.96			3.4	1.48		1.32	0.77	4.3	1.4		3.1	1.74	18.6	12	6.74	8	4.2	125.1	442	338	325	513		1.94	18.9
PCBs																											
1254		0.96	0.21	0.78	0.19 J		4.3	3.6	1.4	3.4		5.2	6	0.51	1.8		12 J	3.5 J	1.5 J				8				
1260						3.3					13 J																
Total		0.96	0.21	0.78	0.19	3.3	4.3	3.6	1.4	3.4	13	5.2	6	0.51	1.8		12	3.5	1.5				8				
DIOXINS/FURANS(2)																											
TCDD									0.0001 J																		
HXCDD																											
TCDF		0.0012		0.00019	0.00046	0.0011		0.00035		0.0008	0.0012	0.0016	0.0027 J		0.00036	0.00046		0.00062 J									
PECDF													0.000084				0.0007	0.00013	0.00019	0.033	0.034	0.036	0.027	0.11			
Total		0.0012		0.00019	0.00046	0.0011		0.00035	0.0001	0.0008	0.0012	0.0016	0.0028		0.00036	0.00046	0.0007	0.00095	0.00019	0.033	0.034	0.036	0.027	0.11			
ORGANOPHOSPHOROUS																								0.000073			
PESTICIDES																											
disulfoton						0.0095 J																					
ethyl parathion																											
famphur																								0.013 J			
methyl parathion	0.0067 J	0.0058 J						0.0058 J			0.007 J	0.0062 J			0.0056 J				0.018 J								
Total	0.0067	0.0058				0.0095		0.0058			0.007	0.0062			0.0056				0.018			0.0057 J			0.0048 J		
ORGANOCHLORINE																						0.0057		0.013	0.0044		
PESTICIDES																											
aldrin																											
alpha-BHC	0.0013										0.44 J																
alpha-chlordane									0.18									0.018 J									
beta-BHC																										0.0083	
delta-BHC																		0.1 J									
endrin aldehyde	0.0019 J																							0.088 J		0.0047	
gamma-BHC	0.0019		0.0016		0.0028 J			0.015		0.02				0.008												0.0025	
gamma-chlordane	0.0021																	0.008								0.0015	
heptachlor																											
heptachlor epoxide							0.0037 J						0.014 J	0.008									0.042 J				0.029
isodrin																										0.022	0.064
methoxychlor																					0.22	0.24					
4,4-DDD																											0.022
4,4'-DDE																								0.23 J			
4,4-DDT																					0.71 J						
Total	0.0071		0.0016		0.0028 J		0.0037	0.015	0.18	0.02	0.44		0.014	0.014				0.2			0.35	0.35					0.031
HERBICIDES																					1.26	0.58	0.042	0.02		0.039	0.057
dinoseb									0.0054 J	0.0055 J			0.0007 J														0.223
2,4-D																		0.028 J			0.0082 J		0.016 J				
2,4,5-T					0.0058 J													0.017 J									
2,4,5-TP(Silvex)																	0.006 J						0.0072 J				
Total					0.0058 J				0.0054	0.0055			0.0007				0.006	0.045			0.0082		0.023				
Total Pesticides/Herbicides	0.0138	0.0058	0.0016		0.0086	0.0095	0.0037	0.021	0.19	0.03	0.45	0.0062	0.023	0.014	0.0056		0.006	0.2	0.018		1.29	0.93	0.065	0.33	0.0048	0.039	0.223
TOTAL # OF TICs		4	6	2	11	22	17	9	4	4	10	1	10	4	13	18	13	18		13	4	5	3	27		2	4

all concentrations in mg/kg (ppm).
(1) detected by method 8270 (semi-volatiles).
(2) detected by method 8280 (dioxins/furans).
* indicates the number, not the concentration, of TICs.
J - estimated concentration.

Table 6-3. Production Area Soil Borings: Inorganic Data Summary

	SWMU-2					SWMU-3					SWMU-7				SWMU-8					SWMU-11					AACI-15			Background Soil Range
	B-2A	B-2B	B-2B	B-2C	B-2D	B-3A	B-3A	B-3B	B-3C	B-3D	B-7A	B-7B	B-7B	B-7C	B-8A	B-8B	B-8B	B-8C	B-8C-DUP	B-11A	B-11B	B-11B-DUP	B-11B	B-11C	SS-MW-16S	SS-MW-16S	B-15A	
date:	11/15/90	11/19/90	3/14/91	3/14/91	3/15/91	11/20/90	3/18/91	11/19/90	3/15/91	3/15/91	11/20/90	11/20/90	3/15/91	3/15/91	11/20/90	11/20/90	3/14/91	3/14/91	3/14/91	12/7/90	11/20/90	11/20/90	3/15/91	3/15/91	12/3/90	3/14/91	3/14/91	
depth:	8' - 10'	6' - 8'	6' - 8'	6' - 8'	6' - 8'	6' - 8'	6' - 8'	6' - 8'	2' - 4'	6' - 8'	2' - 4'	0 - 2'	0 - 2'	4' - 6'	0 - 2'	0 - 2'	0 - 2'	4' - 6'	4' - 6'	3' - 5'	3' - 7'	3' - 7'	3' - 7'	5' - 7'	8' - 10'	8' - 10'	2' - 4'	
INORGANICS																												
arsenic	3.0 J	11.3 J	1.5	4.8	15	5.6 J	5.4 J	8.6 J	10.4 J	8.5 J	2.5 J	4.2 J	5.3 J	9.5 J	8.1 J	2.5 J	9.2	7	8.8	5.9 J	6.9 J	6.3 J	3.3	4.5	5.8 J	4.3	11.2	5.2-36.9
barium	11.5	24.1	20.1	32.4	35	14.5	7.8 J	12.2	25.9 J	41 J	15	21	29.4 J	14.4 J	27.8	37.1	49.5	25.6	39.4	16.2	25.2	32.4	25.5	21.4	13.9	10.7	23.4	12.1-275
beryllium	0.34	0.56		0.2	0.38	0.31		0.4	0.33 J	0.4 J	0.25	0.38	0.3 J	0.23 J	0.64	0.69	0.53	0.33	0.53	0.47	0.49	0.61	0.39	0.27		0.22	3.8	0.25-0.77
cadmium		0.56								0.52		0.60	0.59						0.57									0.52-0.78
calcium	584 J	2120 J	608	4450	762	1180 J	829 J	682 J	987 J	24600 J	5070 J	5590 J	10700 J	747 J	6170 J	8440 J	45600	173	3560	104 J	4910 J	5840 J	7770	1040	929 J	673	1180	560-1,440
chromium	12.6	16.6	1.6 J	7 J	15.3 J	9.9	7.8 J	11	7.4 J	9.4 J	4.9	6	8.5 J	6.6 J	6.3	8.3	12.9 J	0.6 J	12.7 J	4.3	8.2	7.6	6.8 J	19 J	4.5	4.5 J	9.2	6.2-20
cobalt	8.6	7.7		3.2	7.8	4.3	3.6	5.0	3.8	3.2	1.4	2.6	2.3	3.1	2.6	2.4	4.3		6	2.5	4.5	3.9	2.3	3	2.9	2.8	4	1.8-7
copper	13.2	25.6	1.5 J	7.2 J	19.4 J	18.2	9.3	9.5	9.4	8.4	11.8	6.7	11.1	8.7	6.5	11.2	19.7 J	0.81 J	13 J	1.8	8.0	6.6	8.4 J	5.8 J	2.6	5.6 J	9.8 J	3.8-22.9
iron	17800	23900	1900	9830	29900	10400	11000 J	13600	9940 J	10600	4350	7170	8490 J	9920	7240	8030	11600	925	17200	9500	10300	11100	8840	15000	10600	9440	10600	7,240-28,300
lead	11	13.6 J	8.1 J	15 J	15.5 J	11	5.3	11	19.6	13.7	17	15	23.6	16.9	19	23	16 J	7.1 J	9.6 J	6.1 J	11	12	6.8 J	4.3 J	3.3 J	3 J	20.5 J	11.8-471
magnesium	3500 J	4210 J	201 J	1660 J	4640	1730 J	1710	2490 J	1290	1760	706 J	1230 J	2600	1310	1120 J	1170 J	2580 J	108 J	2240 J	900 J	1340 J	1530 J	1220	1100	1190 J	930 J	[illegible] J	683-2,450
manganese	243 J	330 J	17 J	121 J	240 J	128 J	107 J	211 J	190 J	178 J	63.4 J	122 J	145 J	91.1 J	110 J	133 J	179 J	15.2 J	254 J	141 J	200 J	284 J	159 J	120 J	106 J	151 J	211 J	53.2-476
mercury									0.06	0.24	0.11	0.15	0.26	0.16	0.11	0.25	0.62	0.33			0.34	0.33	0.18	1.6			0.11	0.047*-0.81
nickel	17.6	19.4		8	21	9.1	7.6	11.2	7.2	7.4	6.8	5.9	8.4	7.3	3.7	5.1	7.2		11.4		5.2	5.2	4	4.8		3.8	6.3	1.5*-13.3
potassium	307 J	528 J	386 J	433 J	711 J	417 J	328	448 J	417	1210	551 J	739 J	645	445	696 J	685 J	1000 J	73 J	1100 J	536 J	658 J	871 J	637 J	1040 J	828 J	603 J	648 J	349-786
sodium			180	187	268		141		149	219			150	156			234		316				331	350		181	184	77*-230
vanadium	10.6	15.6	3.8	10.4	17.9	12.4		9.1			4.9	9.7			7.5	8.4	16.5		14.5	6.9	8.5	7.7	8.8	7.2	6.4	6.4	14.7	11.3-27.3
zinc	70.8 J	58.6	2.2 J	26.1 J	49.1 J	144 J		38.8 J		318	49.5 J	87.2 J	178		136 J	339 J	321 J	3.2 J	68	30.1	39.9 J	51.8 J	38.2 J	28.2 J	20.6	21 J	41.2 J	17.4-219
cyanide									13.6 J	1 J			0.82 J	11.1 J	1.7	1.2	1											0.45-3

all concentrations in mg/kg (ppm).
all shaded values exceed the Background Soil Range.
* these lower values are detection limits, not concentrations detected.
J - estimated concentration.

Table 6-5. Production Area Groundwater: Inorganic Data Summary

	SWMU-2								SWMUs 3 & 7								SWMU-8				SWMU-11				Maximum Contaminant Level
	MW-10D		MW-10D		MW-10S		MW-10S		MW-12D		MW-12D		MW-12S		MW-12S		MW-13S		MW-13S		MW-4S		MW-4S		
date:	1/10/91		4/17/91		1/10/91		4/17/91		1/11/91		4/22/91		1/10/91		4/22/91		1/10/91		4/22/91		1/14/91		4/19/91		
	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	
Inorganics																									
antimony																									
arsenic		4.3				6.7		10.4								5.8	3.4	45.6	4.8	9.1	5	6	6.5	8.6	50
barium	35	65	30.2	131	18	82	12.4	72.5	23	41	31.2	43.9	17	24	16.3	35.6	76	362	80.5	99.9	41	43	34.8	39.5	1000
beryllium																		3.3							
cadmium																									10
calcium	38100	38400	32300	35000	65700	61800	32900	34600	24900	23500	22800	22600	59200	58500	52000	48400	96800	107000	94700	79700	50900	51600	46600	43300	
chromium		30		95.3 J		58		60.3		15						17.3		125		51.5					50
cobalt				25.3		15		10.5										47							
copper		21		58.2		46		50.4								24.9		134							
iron		13700	153	42400	358	31300	166	21300	979	12200	3210	9540	18600	23200	15100	32400	9950	94400	5450	15600	18000	17700	17900	20300	300*
lead			4.4	31.9 J		38.7	7	40.2 J						11.8				154							50
magnesium	6990	8660	5790	12300	3130	6280	2170	4420	4540	5680	4860	5840	5590	5810	4280	5270	6660	14200	6100	5930	5670	5700	5610	5480	
manganese	4380	4340	3320	3880	626	878	30.3	314	573	640	455	526	3990	3920	3540	3470	4740	6270	3970	3490	2690	2460	2930	2680	50*
mercury																		2.3							2
nickel		41		103 J	25	77		51.3 J		32		21.4				28.4		115		40.2					
potassium	3770	4830		4420	3330	4240			9460	6590	4320 J		5930	5700	5620 J	5140 J	26500	30700	37700 J	31100 J	6320	6200	5930	5520	
selenium																									10
silver																									
sodium	24500	26100	22300	24400	21200	22000	20400	21800	37500	34000	31100	30200	32000	32600	40500	38200	146000	140000	111000	95500	58700	58100	43500	41600	
vanadium				27.2														77							
zinc				96.3				44.7		29		52.7				64		717		89.2					5000*
cyanide	NA		NA		NA		NA		NA		NA		NA	11.7	NA		NA		NA	38.7	NA		NA		

all concentrations in ug/l (ppb).
* - secondary drinking water standard.
all shaded values exceed Maximum Contaminant Levels.
J - estimated concentration.
NA - Not Analyzed

Table 6-5. Production Area Groundwater: Inorganic Data Summary

	SWMU-11								AOC-13														Maximum Contaminant Level
	MW-14S		MW-14S-DUP		MW-14S		MW-14S-DUP		MW-1S		MW-1S		MW-1S-DUP		MW-1D		MW-1D		MW-2S		MW-2S		
date:	1/14/91		1/14/91		4/15/91		4/13/91		12/6/90		4/23/91		4/23/91		12/6/90		4/23/91		4/15/91		4/23/91		
	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	
Inorganics																							
antimony																							
arsenic	14.9	15.9	14.4	17.2	11	11.8 J	9.1	10.7 J	4.1	6		4.5 J							13.4 J	23 J		25	
barium	37	60	39	65	55.4	67	53.8	80.3	121	74	70.3	87.4	71.4	80.8	5.3	7.0		5.0 J	6.2	12.7	5.5	16.8 J	50
beryllium															14	23	17.8	19.5	201	262	258	402	1000
cadmium					8.1 J	9.4 J																	
calcium	52700	50400	53300	53600	52500	48800	53600	51800	74600	73500	82400	86100	83600	77900	11700	13200	17000	18300	68600	65900	61300	61200	10
chromium		14		15		17.1 J		24.5 J				16.5										12.4	
cobalt					13.2 J	12.8		13.6							18	19		11.4					50
copper						25		23.8								54				23		38.8	
iron	4930	11200	4230	11600	4640	8990	3890	13000	867	2170	2100	5880	199	5620	13800	16000	26700	31800	1170	6580	2110	11100	300*
lead		7.5		8.8		5.8 J		8.1 J											8.5	26.6		40	50
magnesium	4320	5080	4410	5400	4980	5350	5000	6400	5590	5600	4900	5170	5010	5620	2610	3420	4340	4870	3460	3320	2970	3120	
manganese	3050	2880	3060	3030	4420	3980	4450	4240	1320	1320	1550	1570	1600	1560	3810	3710	4030	4150	156	157	135	1520	50*
mercury																							
nickel						20.2 J		31.1 J															2
potassium	5590	5410	5640	5980	7130	6830	7440	7470	10100 J	10700 J	9400	9570	9840	9030								22.9	
selenium																			12700	12200	13600	14000	
silver					26 J	25.8 J	14.9 J	13.4 J															10
sodium	54500	51500	56000	55800	113000	104000	116000	110000	101000	101000	54000	55000	56200	48800	25800	28100	27200	27000	21400	20400	21200	21100	
vanadium																							
zinc		25		38	29.1 J	47.9		43.2										23.9		340	38.6	99.3	5000*
cyanide	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	22.1	NA	19.8	

all concentrations in ug/l (ppb).
* - secondary drinking water standard.
all shaded values exceed Maximum Contaminant Levels.
J - estimated concentration.
NA - Not Analyzed

Table 6-5. Production Area Groundwater: Inorganic Data Summary

	AOC-13										AAOI-15												Maximum Contaminant Level
	MW-3S		MW-3S-DUP		MW-3S		RW-1		RW-1		MW-5S		MW-5S		MW-16D		MW-16D		MW-16S		MW-16S		
date:	1/11/91		1/11/91		4/19/91		1/15/91		4/23/91		1/15/91		4/22/91		1/14/91		4/22/91		1/14/91		4/22/91		
	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	
Inorganics																							
antimony																							
arsenic	5.8 J	68.2 J	6.7 J	56 J		57.6						4.1								8.6	4.2	5.9	50
barium	33	52	32	50	29.1	58.2	17	48	21.4	33	33	65	53.2	90.3	245	251	135	137	27	67	21.7	49.8	1000
beryllium						2.7																	
cadmium																							10
calcium	23000	22400	21800	22000	23200	23200	15200	49200	24400	33600	17200	19200	32700	21500	309000	317000	195000	201000	47600	48700	49200	43500	
chromium						25.8								17.9	24	32	24.6	25.5		22		26.6	50
cobalt						27.3																	
copper																							
iron	9160	40500	9260	38500	8420	47500		601		251		4620		6900		739		138	368	12600	2260	10200	300*
lead						27.1	51.9	14.9			4.7	12.3				4.6				5.6			50
magnesium	3250	3380	3130	3280	3560	4040	6410	7730	7280	7400	2100	2490	3470	3600					2220	3900	2070	3110	
manganese	1370	1320	1290	1280	1440	1450	10	280	212	291		913		1230		15			368	647	7340	6470	50*
mercury																							2
nickel																				25	22.5	24.3	
potassium	3700	3330	3410	3300	3260	3400	12300	10300	5190	6200			3180 J		10800	10600	5720 J	5850	4900	6780			
selenium																							10
silver																							
sodium	23800	23200	22800	23200	22900	22600	19400	18200	15100	15700	14800	18200	18700	16900	29000	29100	30500	31200	23500	24100	16200	14200	
vanadium																							
zinc						24.9		20				27		41.3						44	28.2	46	5000*
cyanide	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	15.6	NA		

all concentrations in ug/l (ppb).
* - secondary drinking water standard.
all shaded values exceed Maximum Contaminant Levels.
J - estimated concentration.
NA - Not Analyzed

Table 6-6. Production Area Surficial Soil: Organic Data Summary

	AOC-13																					
grid location:	SF-A13-A47(S)	SF-A13-A25(S)	SF-A13-A40(S)	SF-A13-C27(S)	SF-A13-C41(S)	SF-A13-E45(S)	SF-A13-G47(S)	SF-A13-J30(S)	SF-A13-J35(S)	SF-A13-J40(S)	SF-A13-J40(S)	SF-A13-L32(S)	SF-A13-L37(S)	SF-A13-O10(S)	SF-A13-O10(S)	SF-A13-O25(S)	SF-A13-O25(S)-DUP	SF-A13-Q27(S)	SF-A13-T10(S)	SF-A13-T10(S)	SF-A13-Y5(S)	SF-A13-Y5(S) DUP
date:	3/15/91	11/13/90	11/14/90	3/14/91	3/14/91	11/14/90	3/14/91	11/14/90	11/14/90	11/14/90	3/14/91	3/15/91	3/15/91	11/14/90	3/14/91	12/6/90	12/6/90	3/15/91	11/14/90	3/14/91	11/14/90	11/14/90
depth:	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"	6"-12"
VOLATILE ORGANICS																						
chlorobenzene		0.28		0.088 J	0.032 J			0.047 J	0.074 J		0.037 J								0.086 J			
chloroform																				0.034 J		
ethylbenzene				0.032 J							0.047 J				0.0063 J	0.058 J	0.048 J			0.038 J		
m&p xylene	0.025 J	0.051 J	0.027 J	0.12		0.029 J	0.0072 J	0.054 J	0.046 J		0.17	0.026 J		0.045 J	0.023 J	0.27	0.23	0.067 J	0.068 J	0.1 J		
o - xylene		0.032 J	0.014 J	0.061 J		0.013 J		0.026 J	0.023 J		0.11	0.0093 J		0.025 J	0.012 J	0.054 J	0.046 J	0.032 J	0.022 J	0.031 J		
styrene				0.039 J																		
tetrachloroethene							0.069 J										0.052 J					
toluene		0.13	0.049 J	0.26 J	0.023 J	0.035 J	0.022 J	0.046 J	0.046 J		0.42 J				0.018 J				0.027 J	0.039 J		
trichlorofluoromethane				0.33							0.071 J							0.29				
Total Volatile Organics	0.025	0.49	0.090	0.93	0.055	0.077	0.098	0.173	0.189		0.86	0.035		0.070	0.059	0.38	0.38	0.39	0.203	0.2		
SEMI-VOLATILE																						
ORGANICS																						
Benzenes																						
1,2 dichlorobenzene											0.12 J											
1,4 dichlorobenzene							0.24 J															
Total							0.24				0.12											
Dioxins/Furans (1)																						
dibenzofuran				0.097 J							0.073 J							0.13 J				
TRCDF		3.9 J	3.3 J						1.3 J									2.7 J				
Total		3.9	3.3	0.097					1.3		0.073							2.8				
Fingerprint Compounds																						
Irgasan DP-300				1.4 J														4.2 J				
Tinuvin 327								5.2 J														
Total				1.4				5.2										4.2				
PAHs																						
acenaphthene				0.18 J														0.14 J				
acenaphthylene																				0.043 J		
anthracene		1.6 J	0.56 J	0.28 J	0.26 J		0.054 J		0.29 J	0.21 J	0.14 J							0.23 J	0.38 J	0.16 J		
benzo(a)anthracene		3.1 J	1.6 J	0.98 J	1.1	0.84 J	0.3 J		1.1 J	0.76 J	0.57 J	0.34 J			1.6	0.16 J	0.28 J	0.44 J	0.92 J	1.3		
benzo(a)pyrene		2.2 J	1.7 J	0.79 J	1.1	1.1 J	0.34 J		1.1 J	0.72 J	0.59 J				1.7	0.2 J	0.27 J			1.3		
benzo(b)fluoranthene		3.9 J	2.8 J	1.3	1.4	2.1 J	0.52 J		0.87 J		0.89 J				4.3	0.38 J	0.53 J	0.73 J	2 J	2		
benzo(g,h,i)perylene			1.7 J	0.72 J	1.1		0.31 J		0.89 J	0.79 J	0.67 J				2.9					0.99 J		
benzo(k)fluoranthene		4.9 J	3.5 J	1.6	1.8	1.9 J	0.66 J		1.1 J		1.1				5.5	0.45 J	0.67 J	0.88 J	1.8 J	2.6		
chrysene		3.2 J	2 J	1.1	1.1	1.4 J	0.32 J		1.1 J	0.91 J	0.66 J				2	0.19 J	0.31 J	0.45 J	1.3 J	1.5		
dibenz(a,h)anthracene					0.26 J						0.2 J			0.68 J	0.68 J					0.32 J		
fluoranthene		8.4 J	3.9 J	1.9	2	1.9 J	0.46 J	0.83 J	2.3 J	1.6 J	0.91 J	0.46 J	0.34 J		1.1	0.14 J	0.35 J	0.62 J	2.2 J	2.1		
fluorene				0.078 J							0.051 J							0.11 J		0.048 J		
indeno(1,2,3-cd) pyrene			1.1 J	0.55 J	0.83 J		0.29 J		0.68 J		0.48 J				2.3		0.28 J			0.66 J		
naphthalene			0.29 J			0.24 J			0.26 J	0.24 J						0.18 J	0.21 J		0.43 J			
phenanthrene		5 J	1.9 J	0.81 J	0.94 J	0.77 J	0.21 J		0.8 J	0.76 J	0.52 J	0.18 J	0.2 J				0.079 J	0.62 J	1.4 J	0.8 J		
pyrene		6.0 J	2.7 J	2.3	2.2	1.2 J	0.49 J		1.7 J	1.1 J	1 J	0.5 J	0.34 J		1.3	0.14 J	0.35 J	0.74 J	1.3 J	2.3		
2-methylnaphthalene																		0.38 J				
Total		38	24	12.6	14	11.5	4.0	0.83	12.2	7.1	6	1.5	0.9	0.68	23	1.8	3.31	5.34	12	16		
Phenols																						
phenol																				0.63 J		
4-methylphenol																				0.24 J		
Total																				0.87		

Table 6-6. Production Area Surficial Soil: Organic Data Summary

	AOC-13																						
grid location:	SF-A13-AA7(S)	SF-A13-A25(S)	SF-A13-A40(S)	SF-A13-C27(S)	SF-A13-C41(S)	SF-A13-E43(S)	SF-A13-G47(S)	SF-A13-J30(S)	SF-A13-J35(S)	SF-A13-J40(S)	SF-A13-J40(S)	SF-A13-L32(S)	SF-A13-L37(S)	SF-A13-O10(S)	SF-A13-O10(S)	SF-A13-O25(S)	SF-A13-O25(S)-DUP	SF-A13-Q27(S)	SF-A13-T10(S)	SF-A13-T10(S)	SF-A13-Y5(S)	SF-A13-Y5(S)-DUP
date:	3/15/91	11/15/90	11/14/90	3/14/91	3/14/91	11/14/90	3/14/91	11/14/90	11/14/90	11/14/90	3/14/91	3/15/91	3/15/91	11/14/90	3/14/91	12/6/90	12/6/90	3/15/91	11/14/90	3/14/91	11/14/90	11/14/90
depth:	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"	6'-12"
Phthalates																						
bis(2-ethylhexyl) phthalate		2.2 J	2.2 J			2.8 J		1.7 J	1.8 J	4.1 J												0.15 J
butylbenzylphthalate			33			0.57 J			0.84 J	0.83 J									1.2 J			
di-n-butylphthalate			0.65 J					1.3 J	0.56 J	0.4 J												
dimethylphthalate									0.25 J													
Total		2.2	36			3.4		3.0	3.5	5.3									1.2			0.15
Miscellaneous																						
bis(2 chloroethyl)ether																						
butazolidin					5.2 J															0.68 J		
Total					5.2															0.68		
Total Semi-Volatiles		44	63	14.1	19	14.8	4.2	9.0	16.9	12.4	6	1.5	0.9	0.68	23	1.8	3.31	12.4	13	18		0.15
DIOXINS/FURANS (2)																						
TCDF		0.0023	0.0016	0.0011 J	0.000098	0.00057		0.00079	0.00049	0.00087	0.001 J		0.00014 J	0.00033	0.0017 J			0.0026	0.0015	0.00026 J		
PECDF			0.0001			0.00016																
HXCDF											0.00012											
Total		0.0023	0.0017	0.0011	0.000098	0.00073		0.00079	0.00049	0.0009	0.001		0.00014	0.00033	0.0017			0.0026	0.0015	0.00026		
PCBs																						
1254	0.99	29	25	75	14	51	6.5	22	37	51	77	22	4.7	4	5.3	1.4 J	1.9 J	30	2.7	1.8		
Total	0.99	29	25	75	14	51	6.5	22	37	51	77	22	4.7	4	5.3	1.4	1.9	30	2.7	1.8		
ORGANOPHOSPHOROUS																						
PESTICIDES																						
famphur										0.016 J												
methyl parathion																					0.0065	
sulfotepp						0.0094 J																
Total						0.0094				0.016											0.0065	
ORGANOCHLORINE																						
PESTICIDES																						
aldrin																					0.0035 J	
alpha-BHC																			0.0099 J		0.0016 J	
alpha-chlordane																					0.0097 J	
delta-BHC																					0.0024 J	
endrin aldehyde																						0.001 J
gamma-BHC																0.0033 J	0.0025 J				0.0033 J	
gamma-chlordane																					0.0075 J	
kepone																						0.015 J
4,4'-DDD																					0.0033 J	
Total																0.0033	0.0025		0.0099		0.0313	0.016
HERBICIDES																						
dinoseb								0.004 J		0.0024 J												
2,4-D																	0.0076 J					
Total								0.004		0.0024							0.0076					
Total Pesticides/Herbicides						0.0094		0.004		0.016						0.0033	0.0101		0.0099		0.0378	0.016
TOTAL No. OF TICs *		1	12	16	10	14	6	2	17	23	21	16	10	2	8			15		3	1	1

all concentrations in mg/kg (ppm).

(1) - detected by method 8270 (semi-volatiles).

(2) - detected by method 8280 (dioxins/furans)

* indicates the number, not the concentration of, TICs.

J - estimated concentration.

Table 6-7. Production Area Surficial Soil: Inorganic Data Summary

	AOC-13																						Background Soil Range
grid location:	SF-A13-A47(S)	SF-A13-A25(S)	SF-A13-A40(S)	SF-A13-C27(S)	SF-A13-C41(S)	SF-A13-E45(S)	SF-A13-G47(S)	SF-A13-J30(S)	SF-A13-J35(S)	SF-A13-J40(S)	SF-A13-J40(S)	SF-A13-L32(S)	SF-A13-L37(S)	SF-A13-O10(S)	SF-A13-O10(S)	SF-A13-O25(S)	SF-A13-O25(S)-DUP	SF-A13-Q27(S)	SF-A13-T10(S)	SF-A13-T10(S)	SF-A13-Y5(S)	SF-A13-Y5(S)-DUP	
date:	3/15/91	11/15/90	11/14/90	3/14/91	3/14/91	11/14/90	3/14/91	11/14/90	11/14/90	11/14/90	3/14/91	3/15/91	3/15/91	11/14/90	3/14/91	12/6/90	12/6/90	3/15/91	11/14/90	3/14/91	11/14/90	11/14/90	
depth:	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	
INORGANICS																							
arsenic	4.7	9.4 J	9.4 J	125	8.4	7.9 J	7.6	5.6 J	5.8 J	8.5 J	11.5	4.9	2	7.6 J	4.8	7.3 J	5.3 J	8.9	6.6 J	7.2	1 J	1.9 J	5.2-36.9
barium	11.6	92.3 J	99.9 J	83.3	88.7	101 J	29.7	51.7 J	80.1 J	106 J	90.5	71.9	19.9	44.5 J	29.9	25.3	41	61.3	39.2 J	37.6	6 J	4.6 J	12.1-275
beryllium	0.17	0.61	0.73	0.44	0.43	0.47	0.29	0.51	0.49	0.37	0.41	0.36	0.21	0.51	0.261	0.31	0.50	0.36	0.35	0.37	0.26	0.27	0.25-0.77
cadmium		1.1	3.9	1.7	0.67	1.1	0.5	0.64	1.2	1.5	1.1	0.41		0.85				0.37	0.52				0.52-0.78
calcium	708	47500 J	44200 J	38700	13500	42500 J	7470	25400 J	46200 J	54400 J	58500	18900	4740	4740 J	4920	3830 J	1390 J	31300	9740 J	3760	207 J	250	560-1,440
chromium	3.3 J	15.8 J	26.5 J	16.9 J	9.72 J	14.7 J	9 J	9.4 J	18.6 J	30 J	30.7 J	8.2 J	2.5 J	16 J	9.3 J	9.2	11.8	11.3 J	12.6 J	26.7 J	0.90 J		6.2-20
cobalt	2.2	4.4	6	4.4	3.1	3.9	3.3	3.2	3.9	4.6	4.6	4.2	2.3	4	2.7	2.7	4.2	3.3	3.2	3			1.8-7
copper	5.9 J	54.4	46.9	34.4 J	12.6 J	17.9	11.6 J	37.7	16.7	23.8	23.5 J	12.7 J	4.6 J	76.1	18.9 J	9.3	14.4	7.6 J	11.1	17 J			3.8-22.9
iron	7210	10900 J	21300 J	14400	10300	12000 J	9820	9070 J	12000 J	14600 J	13700	9390	5890	19400 J	11400	8640	14500	11900	9790 J	10200	4450 J	3390 J	7,240-28,300
lead	10.2 J	69.5	162	88.3 J	59.7 J	93	29.6 J	378	55.7	87.5	262 J	49.6 J	5.9 J	24.8	20.4 J	23.8 J	12.9 J	51.9 J	26.8	27.8 J			11.8-471
magnesium	1110	3080	3860	2560 J	3510 J	4210	1860 J	1740	2880	3690	5360 J	1690	827	1420	1180 J	1350 J	2100 J	2280	1930	1410 J	183	158	683-2,450
manganese	155 J	239 J	359 J	200 J	238 J	204 J	160 J	150 J	224 J	205 J	230 J	149 J	96 J	258 J	125 J	136 J	220 J	157 J	134 J	123 J	68.4 J	42.9 J	53.2-476
mercury		0.31	0.75	0.47	0.24	0.74	1.5	0.22	0.65	1.2	3.1	0.21		0.96	1.4			0.44	0.22	0.14			0.047*-0.81
nickel	3.1	12.4 J	26.6 J	18.9	5.2	11.4	6.3	10.2 J	9 J	18.7 J	9.8	5	3.1	15.9 J	8.1			10.8	10.4 J	6.2			1.5*-13.3
potassium	990 J	1030 J	1240 J	1100 J	836 J	932 J	763 J	1100 J	1100 J	1260 J	1250 J	1100 J	927 J	499 J	472 J	502 J	603 J	994 J	631 J	806 J	389 J		349-786
sodium	140			312	254		192				329	213	174		180	90.2		248		192			77*-230
vanadium	5.4	17.2	108	31.9	11.8	16.5	9.6	18.8	16.6	14.9	18.1	9.9	5.4	20.1	10.8	10.8	15.2	35	10.1	13			11.3-27.3
zinc	22.7 J	215 J	236 J	261 J	98.1 J	163 J	42.1 J	333 J	245 J	185 J	206 J	641 J	24.1 J	100 J	68.8 J	33.3	44.9	509 J	759 J	239 J	20.6 J	13.5 J	17.4-219
tin			25.6																				7.7*-102
cyanide		0.78				3.5		0.79				0.56		3.8		12.6 J	8.7 J		4.6				0.45 – 3

all concentrations in mg/kg (ppm).
all shaded values exceed the Background Soil Range.
* these lower values are detection limits, not concentrations detected.
J - estimated concentration.

ATTACHMENT C

RECENT INVESTIGATIONS FOR WARWICK AREA

RECYCLED PAPER ENFORCEMENT CONFIDENTIAL

Table 8-1. Warwick Area (SWMU-5) Surficial Soil: Organic Data Summary

	SWMU-5														
	SF S5 A-2(D)	SF S5 B-3(D)	SF S5 C-1 (D)	SF S5 C-1 (D)	SF S5 C-1 (D) DUP	SF S5 C-2 (D)	SF S5 C-2 (D)	SF S5 C-3 (D)	SF S5 C-4 (S)	SF S5 D-2(D)	SF S5 D-3 (D)	SF S5 E-3 (D)	SF S5 YY3 (S)	SF S5 ZZ3(D)	SF S5 ZZ3(D)DUP
date:	3/19/91	3/19/91	11/15/90	3/19/91	3/19/91	11/15/90	3/19/91	11/15/90	3/19/91	11/15/90	11/15/90	3/19/91	3/19/91	3/19/91	3/19/91
depth:	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	6" - 12"	18" - 24"	18" - 24"	18" - 24"	6" - 12"	18" - 24"	18" - 24"
VOLATILE ORGANICS															
acetone	0.32 J														
benzene															
chlorobenzene												0.034 J			
chloroform			0.043 J	2.6	2.9	3.6	1.2	2		0.12	0.82			1.7	
ethylbenzene												0.048 J			
m&p xylene	0.042 J			0.026 J	0.037 J	0.065 J	0.03 J	0.041 J				0.027 J			
o-xylene					0.015 J	0.046 J	0.017 J	0.022 J				0.07 J			
tetrachloroethene				0.031 J	0.04 J	0.044 J	0.073 J	0.037 J				0.041 J			
toluene			0.1 J	0.18 J	0.49 J	1	1 J	1	0.32 J	0.12	0.083 J	0.24		0.35	
trichloroethene				0.041 J	0.035 J						0.36	0.54 J	0.3 J	1.8 J	
1,1-dichloroethane					0.031 J							0.13			
2-butanone				0.23 J	0.22 J		0.18 J					0.044 J			
Total Volatile Organics	0.36		0.1	3.1	3.8	5	3	3	0.32	0.24	1.24	1.17	0.3	3.9	
SEMI-VOLATILE ORGANICS															
Anilines															
2-nitroaniline															
4-chloroaniline			1.6 J			7.4 J	0.98 J	0.31 J			5.4 J			1.4	
Total			1.6			7.4	2.3	0.31			5.4			1.4	
Benzenes															
nitrobenzene							0.48 J					0.18 J			
1,2-dichlorobenzene							0.48					0.18			
Total															
Dioxins/Furans (1)															
dibenzofuran				0.2 J	0.29 J			0.068 J							
Total				0.2	0.29			0.068							
Fingerprint Compounds															
Tinuvin 327						18 J	3.7 J	0.57 J			4.1 J			6.4	
Total						18	3.7	0.57			4.1			6.4	
PAHs															
acenaphthene				0.16 J	0.23 J										
acenaphthylene					0.078 J										
anthracene				0.25 J	0.35 J		0.16 J	0.089 J	0.2 J			0.2 J		0.19 J	
benzo (a) anthracene		0.41 J	1.2 J	1.2 J	1.4	1.1 J	0.94 J	0.53 J	0.43 J		1.6 J	1 J		0.93 J	
benzo (a) pyrene			1.7 J	1.2 J	1.3		1.1 J	0.53 J			1.5 J	1.1 J		0.98 J	
benzo(b) fluoranthene			2.6 J	2.6	2.6	1.9 J	2.2	1 J			2.8 J	1.6		1 J	
benzo(g,h,i,) perylene					1 J		1.2 J	0.52 J				0.96 J		0.92 J	
benzo (k) fluoranthene			3.4 J	3.2	3.3	2.4 J	2.7	1.3			3.6 J	1.9		1.2	
chrysene			2 J	1.6	2.3	1.6 J		0.75 J	0.43 J		2.3 J	1.2 J		1.3	
fluoranthene		0.65 J	3.6 J	2.1	2.9	2.6 J	1.5	1.3	0.85 J		3.7 J	2		1.7	
fluorene				0.23 J	0.4 J			0.052 J						0.19 J	
indeno(1,2,3-cd)pyrene					1 J		0.76 J	0.4 J				0.88 J		0.75 J	
naphthalene		0.12 J	1.9 J	1.2 J	1.5	3.2 J	2.1	0.42 J	0.13 J		1.2 J	0.43 J	0.14 J	2.5	
phenanthrene		0.36 J	1.7 J	1.4	2	1.4 J	0.64 J	0.72 J	0.72 J		1.4 J	0.81 J		1 J	
pyrene		0.76 J	3 J	2.8	3.2	2 J	1.5	1.1 J	0.77 J		3 J	1.7		1.7	
2-methylnaphthalene				0.36 J	0.45 J		0.17 J							0.25 J	
Hetero PAH															
3,3-dimethylbenzidine															
Total		2.30	21	18.3	24	16	15.0	9	3.5		21	14	0.14	21	
Phenols															
phenol		0.42 J	0.89 J		0.22 J									0.35 J	
Total		0.42	0.89		0.22									0.35	

Table 8-1. Warwick Area (SWMU-5) Surficial Soil: Organic Data Summary

	SWMU-5														
	SF 55 A-2(D)	SF 55 B-3(D)	SF 55 C-1 (D)	SF 55 C-1 (D)	SF 55 C-1 (D) DUP	SF 55 C-2 (D)	SF 55 C-2 (D)	SF 55 C-3 (D)	SF 55 C-4 (S)	SF 55 D-2(D)	SF 55 D-3 (D)	SF 55 E-3 (D)	SF 55 YY3 (S)	SF 55 ZZ3(D)	SF 55 ZZ3(D)DUP
date:	3/19/91	3/19/91	11/15/90	3/19/91	3/19/91	11/15/90	3/19/91	11/15/90	3/19/91	11/15/90	11/15/90	3/19/91	3/19/91	3/19/91	3/19/91
depth:	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	6" - 12"	18" - 24"	18" - 24"	18" - 24"	6" - 12"	18" - 24"	18" - 24"
Phthalates															
bis(2-ethylhexyl)phthalate			110			27		2			140				
butylbenzylphthalate								0.78 J							
di-n-butylphthalate								0.057 J							
di-n-octylphthalate			18			6.6 J		0.2 J			23				
Total			128			34		3			163				
Miscellaneous															
bis(2-chloroethyl) ether							0.33 J	0.43 J							
n-nitro-di-n-propylamine														0.17 J	
phenacetin														1 J	
Total							0.33	0.43						1	
Total Semi-Volatile Organics		2.72	152	18.5	25	75	21.8	13	3.5		194	14	0.14	31	
DIOXINS/FURANS (2)															
TCDF			0.00077	0.00027 J	0.00028 J	0.00015	0.00016 J			0.00062	0.00031			0.00071 J	0.00071 J
PECDF			0.00026				0.00013				0.00012			0.00014	0.00014 J
HXCDF			0.00052	0.00035	0.00037 J	0.0011	0.00045 J				0.0002			0.0005 J	0.0005 J
Total			0.00155	0.00062	0.00065	0.0013	0.00074			0.00062	0.0006			0.0014	0.0014
PCBs															
1248					170 J		49							160 J	
1254		12		38 J					0.073				0.71		
Total		12		38	170		49		0.073				0.71	160	
ORGANOPHOSPHOROUS PESTICIDES															
disulfoton							0.007	0.0077 J							
phorate					0.0083 J			0.0096 J							
sulfotepp											0.0041 J				
thionazin						0.0058 J									
Total					0.0083	0.0058	0.007	0.0173			0.0041				
ORGANOCHLORINE PESTICIDES															
aldrin			0.13 J							1.1	1 J				
alpha-BHC								0.076		0.15	0.27 J				
delta-BHC			0.26 J										0.0034		
dieldrin											0.91 J	0.018			
endosulfan sulfate								0.29 J		0.28 J					
endrin								0.065		0.12	0.54 J				
endrin aldehyde								3.5							
gamma-BHC														1.2 J	
gamma chlordane								0.21		0.5					
heptachlor epoxide								0.25		1.2		0.08			
isodrin											0.65 J				
methoxychlor		1.8			32 J	2200	1100 J	3.3				2.5		320 J	
4,4'-DDE			0.22 J									0.041			
4,4'-DDD										0.41					
4,4'-DDT	0.00096 J							0.51							
Total	0.00096	1.8	0.61		32	2200	1100	8.2		3.8	4	2.6	0.0034	321	
HERBICIDES															
dinoseb							0.072								
2,4,5-T							0.0095 J								
2,4,5 - TP (Silvex)			0.11				0.34				0.21	0.02 J			
Total			0.11				0.42				0.21	0.02			
Total Pesticides/Herbicides	0.00096	1.8	0.72		32	2200	1100	8.2		3.8	4	2.7	0.0034	321	
TOTAL NonPOP TICs	7	11	20	29	29	30	28	30	6	1	30	11	4	22	

all concentrations in mg/kg (ppm).
(1) - detected by method 8270 (semi-volatiles).
(2) - detected by method 8280 (dioxins/furans).
* indicates the number, not the concentration, of TICs.
J - estimated concentration.

Table 8-2. Warwick Area (SWMU-5) Surficial Soil: Inorganic Data Summary

	SWMU-5														Background Soil Range
	SF S5 A-2 (D)	SF S5 B-3 (D)	SF S5 C-1 (D)	SF S5 C-1 (D)	SF S5 C-1 (D) DUP	SF S5 C-2 (D)	SF S5 C-2 (D)	SF S5 C-3 (D)	SF S5 C-4 (D)	SF S5 D-2(D)	SF S5 D-3 (D)	SF S5 E-3 (D)	SF S5 YY-3(S)	SF S5 ZZ-3(S)	
date:	3/19/91	3/19/91	11/15/90	3/19/91	3/19/91	11/15/90	3/19/91	11/15/90	3/19/91	11/15/90	11/15/90	3/19/91	3/19/91	3/19/91	
depth:	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	18" - 24"	6" - 12"	6" - 12"	
Inorganics															
antimony			0.88 J	1.4 J	1.7 J		1.1 J				0.86 J	41.8 J		1.4 J	0.58*-0.65**
arsenic	8.2 J	10.2 J	8.2 J	15.3 J	16.1 J	12 J	12.6 J	9.4 J	9.3 J	9 J	11 J	12.5 J	8 J	14.8 J	5.2-36.9
barium	11.8 J	119 J	101 J	56.4 J	78.5 J	122 J	162 J	113 J	18.1 J	207 J	112 J	1270 J	15 J	81 J	12.1-275
beryllium	0.67 J	0.52 J	1.3	0.79 J	0.93 J	1.6	1 J	0.76	0.47 J	0.62	1.1	0.34 J	0.77 J	1.1 J	0.25-0.77
cadmium	0.53	0.65	6.9	4.5	4.6	5.7	6.8	1.4		1.8	6.3	1.2		3.1	0.52-0.78
calcium	1110 J	2330 J	1800 J	1530 J	1910 J	2140 J	2150 J	2320 J	1040 J	2480 J	1700 J	3730 J	1580 J	1650 J	560-1,440
chromium	8.1 J	16.3 J	357 J	172 J	227 J	240 J	325 J	25.2 J	5.8 J	58.7 J	257 J	34.4 J	5.2 J	264 J	6.2-20
cobalt	3	3.7	5.4	4.7	5.4	5.8	4.8	4.1	3.1	6.4	4.6	3.6	2.6	4.1	1.8-7
copper	2.9	18.6	352	126	177	215	211	103	6.9	86	182	42.8	3.9	1960	3.8-22.9
iron	8990	12900	13600 J	9660	11500	16000 J	14300	10300 J	11100	14400 J	13900 J	13900	9030	17000	7,240-28,300
lead	5.2	30.9	116	160	191	173	215	428	44.7	271	156	87.2	4.6	158	11.8-471
magnesium	949	1320	1670	1370	1550	2060	1600	1160	1040	2480	1580	1540	1040	1490	683-2,450
manganese	189 J	210 J	210 J	167 J	235 J	228 J	268 J	173 J	162 J	233 J	165 J	200 J	227 J	181 J	53.2-476
mercury		0.13	0.42	0.5	0.64	0.94	0.89	0.17		0.21	0.54	0.45		0.62	0.047*-0.81
nickel	4.7	9.2	17.9 J	11.5	13.2	36 J	19.3	17.4 J	5	14 J	17.4 J	11.2	4.3	26	1.5*-13.3
potassium	331	630	716 J	597	786	1180 J	739	443 J	411	1520 J	879 J	529	350	716	349-786
sodium	135	137		152	155		192		123			215	142	159	77*-230
vanadium			16.2			18.2		12.2		22	15.2				11.3-27.3
zinc	268		13300 J	16800	11300	8530 J	16100	2210 J		1830 J	8750 J	654		2850	17.4-219
tin			20.7	16 J	14.6 J	14.7	18.2 J					37.8 J		18.2 J	7.7*-102
cyanide			9.4		5.8 J	7.5	8.5 J	1.2		2.6	7.5			4 J	0.45-3

all concentrations in mg/kg (ppm).
all shaded values exceed the Background Soil Range.
* these lower values are detection limits, not concentrations detected.
** these upper values are detection limits, not concentrations detected.
J - estimated concentration.

Table 8-3. Warwick Area Groundwater: Organic Data Summary

	SWMU-5							AAOI-16			
	MW-6S	MW-6S	MW-11S	MW-11S	MW-11S-DUP	RW-3	RW-3	MW-17D	MW-17D	MW-17S	MW-17S
date:	1/7/91	4/15/91	1/8/91	4/18/91	1/8/91	1/7/91	4/16/91	1/8/91	4/15/91	1/8/91	4/15/91
VOLATILE ORGANICS											
benzene			35	13 J	31						
chlorobenzene	1.8 J	1.1 J	3500	780 J	3100						
ethylbenzene			2.7 J		2.4 J						
m&p xylene			1.8 J		1.6 J						
o-xylene			0.8 J		1 J						
tetrachloroethene			8.4	4 J	9.7						
toluene			31		30			2 J			
trichloroethene			2 J		2.1 J					2.1 J	1.3 J
1,1-dichloroethane			2.1 J		2.2 J					4.1 J	
1,1,1-trichloroethane										34	23
Total Volatile Organics	1.8	1.1	3584	797	3180			2		40	24
SEMI-VOLATILE ORGANICS											
Anilines											
aniline			7 J	2 J	6 J						
o-toluidine			6 J		5 J						
4-chloroaniline			21	5 J	21						
Total			34	7	32						
Fingerprint Compounds											
Propazine	35 J	15 J	7 J		6 J						
Tinuvin 327	3 J		4 J	1 J	3 J						
Total	38	15	11	1	9						
PAHs											
fluoranthene						1 J	1 J				
naphthalene			4 J	1 J	4 J						
pyrene						2 J	0.94 J				
Total			4	1	4	3	2				
Phenols											
phenol				3 J	6 J						
2-chlorophenol			11 J	6 J	7 J						
Total			11	9	13						
Phthalates											
di-n-octylphthalate			1 J			1 J					
Total			1			1					
Miscellaneous											
bis(2-chloroethyl)ether				2 J	5 J						
2,2'-oxybis (1-chloropropane)			28		26						
Total			28	2	31						
Total Semi-Volatile Organics	38	15	89	20	89	4	2				
ORGANOPHOSPHOROUS PESTICIDES											
dimethoate	0.44 J										
Total	0.44										
ORGANOCHLORINE PESTICIDES											
aldrin	0.028		0.089		0.092			0.025			
alpha-BHC			0.037 J					0.015			
delta-BHC						0.017					
gamma-BHC		0.14 J						0.018			
gamma chlordane	0.016										
4,4'-DDT					0.07 J			0.023			
Total	0.044	0.14	0.126		0.16	0.017		0.081			
HERBICIDES											
dinoseb				0.04 J							
2,4,5-T			0.11 J								
2,4-D					0.17 J						
Total			0.11	0.04	0.17						
Total Pesticides/Herbicides	0.48	0.14	0.24	0.04	0.33	0.017		0.081			
TOTAL No. OF TICs *	9	3	18	12	21	9	7	6	2	2	3

all concentrations in ug/l (ppb).

* indicates the number, not the concentration, of TICs.

J- estimated concentration.

Table 8-4. Warwick Area Groundwater: Inorganic Data Summary

	MW-6S				MW-11S				MW-11S-DUP		MW-17D				MW-17S				RW-3				Maximum Contaminant Level
date:	1/7/91		4/15/91		1/8/91		4/18/91		1/8/91		1/8/91		4/15/91		1/8/91		4/15/91		1/7/91		4/16/91		
	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	
INORGANICS																							
arsenic		5.7				10.6		24.6 J		16.1		11.2	10.3	16.5		44.9		23.6		4.4		4.6	50
barium	39	81	34.6	45.6	20	31	18.6	33.5	20	42	34	44	39.9	75.7	58	138	37.6	70.2	190	200	305	298	1000
beryllium				2.4			3.5	2.8															
cadmium							11.6 J	17.9 J															10
calcium	34300 J	34400 J	31300	33000	30300 J	30700 J	24900	23700	32300 J	33800 J	33500 J	35100 J	42600	45500	16700 J	20600 J	17000	17700	190000 J	203000 J	332000	328000	
chromium							12.3	41.4 J						12.8				19.2				10.8	50
cobalt								10.7								10							
copper								49.6		31				23		43							
iron	5040 J	20600 J	5700	9650	5380 J	14600 J	3100	26500	6490 J	23100 J		4530 J	53.8	14600		52400 J	52.6	22400		698 J		200	300*
lead								17 J						7.9				8.3			3.4	5.7	50
magnesium	2520	3600	2170	2310	2960	3310	3050	3500	3170	4010	3550	4510	5970	6710	2250	5740	2440	3820					
manganese	343	427	424	449	456	475	281	302	487	581	149	273	600	902	581	1330	417	720		15			50*
potassium	5590	6230	4970 J	5260	3250	3380	3140	3060	3560	4100	17100	15400		3290	13800	17000	5550 J	6720	11100	11000	11800 J	11700	
silver							14.1 J	10.5 J															
sodium	14200	14900	12700	13000	9900	11700	11700	12300	10600	12400	16900	18100	13400	15100	21900	24500	19100	19800	61300	61800	34600	34500	
vanadium																22							
zinc	93 J	291 J	144 J	185	1520 J	1960 J	1530 J	2160	1680 J	2590 J		31 J		358		82 J		125					5000*

all concentrations in ug/l (ppb).
* - secondary drinking water standard.
all shaded values exceed Maximum Contaminant Levels.
J - estimated concentration.

Table 8-5. Warwick Area Soils: Organic Data Summary

c774A

	SWMU-6				SWMU-9						AAOI-16			MISCELLANEOUS	
	SF S6	SF S6	SF S6 A-1	SF S6 B-1	SF S9 B-2(S)	SF S9 C-1(S)	SF S9 C-1(S)	SF S9 C-2(S)	SF S9 ZZ1 (S)	SF S9 ZZ2 (S)	SS-MW-17S	SS-MW-17S	B-16A	SS-D22-A	SS-B22-B
date:	11/14/90	3/12/91	3/12/91	3/12/91	11/15/90	11/15/90	3/12/91	11/15/90	3/12/91	3/12/91	12/5/90	3/13/91	3/13/91	12/5/90	12/5/90
depth:	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	4" - 6"		
VOLATILE ORGANICS															
toluene					0.047 J			0.04 J	0.029 J	0.032			0.028 J		
Total Volatile Organics					0.047			0.04	0.029	0.032			0.028		
SEMI-VOLATILE ORGANICS															
Fingerprint Compounds															
Tinuvin 327	8.3 J	2.6 J			6.1										
Total	8.3	2.6			6.1									NA	NA
PAHs															
chrysene										0.43					
fluoranthene										0.73					
phonanthrene										0.34					
pyrene										0.7					
Total										2.2				NA	NA
Phthalates															
bis(2-ethylhexyl)phthalate					0.29 J	0.1 J				0.38					
butylbenzylphthalate										0.51					
Total					0.29	0.1				0.89				NA	NA
Miscellaneous															
safrole			2.3	0.7 J					4.2	28 J					
Total			2.3	0.7					4.2	28				NA	NA
Total Semi-Volatile Organics	8.3	2.6	2.3	0.7	6.4	0.1			4.2	31				NA	NA
DIOXINS/FURANS (2)															
TCDF					0.00027										
Total					0.00027									NA	NA
PCBs															
1254		0.13	0.099				0.032		0.062	0.18		0.15	0.029		
Total		0.13	0.099				0.032		0.062	0.18		0.15	0.029	NA	NA
ORGANOPHOSPHOROUS PESTICIDES															
disulfoton						0.0059 J									
ethyl parathion						0.0064 J		0.0056 J							
Total						0.0123		0.0056						NA	NA
ORGANOCHLORINE PESTICIDES															
alpha-BHC		0.0017						0.001 J					0.0016		
beta-BHC		0.0096										0.0091			
delta-BHC												0.002	0.0022		
dieldrin						0.0028		0.0019							
endrin	0.0037				0.0032	0.0031									
endrin aldehyde	0.0029				0.012			0.0021 J							
gamma-BHC								0.0017	0.0014						
gamma chlordane	0.0072				0.013										
heptachlor								0.0032							
heptachlor epoxide								0.0022							
isodrin					0.0072										
methoxychlor	0.048														
4,4'-DDE	0.0067														
4,4'-DDT						0.0036 J		0.003							
Total	0.067	0.0113			0.035	0.0095		0.015	0.0014			0.011	0.0038	NA	NA
Total Pesticides	0.067	0.0113			0.035	0.0218		0.021	0.0014			0.011	0.0038	NA	NA
TOTAL No. OF TICs		2			7	1				12		2	16		

all concentrations in mg/kg (ppm).
(1) - detected by method 8270 (semi-volatiles).
(2) - detected by method 8280 (dioxins/furans).
* indicates the number, not the concentration, of TICs.
J - estimated concentration
NA - Not Analyzed

Table 8-6. Warwick Area Soils: Inorganic Data Summary

	SWMU-6				SWMU-9						AAOI-16			Background Soil Range
	SF S6	SF S6	SF S6-A1	SF S6-B1	SF S9 B-2(S)	SF S9 C-1(S)	SF S9 C-1(S)	SF S9 C-2(S)	SF S9 ZZ-1(S)	SF S9 ZZ-2(S)	SS-MW-17S	SS-MW-17S	B-16A	
date:	11/14/90	3/12/91	3/12/91	3/12/91	11/15/90	11/15/90	3/12/91	11/15/90	3/12/91	3/12/91	12/5/90	3/13/91	3/13/91	
depth:	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	6" - 12"	4' - 6'	
Inorganics														
arsenic	5.6 J	6.8	16.2	13.7	7.1 J	2.4 J	4.2	9.3 J	9.9	10.2	6.8 J	3.7	7.3	5.2-36.9
barium	17.3 J	16.4	17.8	18.6	34.6 J	7.3 J	7.6	85.5 J	21.4	20.3	13.4	12	11.2	12.1-275
beryllium	0.37	0.62	0.34	0.32	0.58	0.46	0.49	0.78	0.36	0.34	0.59	0.43	0.52	0.25-0.77
cadmium	0.57	2.3												0.52-0.78
calcium	563 J	872	690	772	1060 J	363 J	575	2170 J	1140	1320	786 J	756	579	560-1,440
chromium	7.4 J	7.6 J	9.9 J	9.8 J	7.9 J	1.3 J	2.7 J	20.7 J	8.9 J	10.6 J	5.8	4 J	5.9 J	6.2-20
cobalt	4.8	3.8	7.2	7.8	3.6	1.1	1	7.6	6.4	6.6	3.5	2.9	7.7	1.8-7
copper	20.3	12.8 J	17.7 J	14.7 J	7.3		3.3 J	31.9	12.9 J	14.1 J	6.4	4.8 J	5.5 J	3.8-22.9
iron	11700 J	11400	20000	17600	9900 J	4610 J	5430	14100 J	15600	15100	9430	8240	9400	7,240-28,300
lead	18.7	43.8 J	10.7 J	7 J	32.9	124	2.8 J		7.2 J	17 J	4.7 J	5.6 J	3.6 J	11.8-471
magnesium	1820	1430 J	3080 J	2880 J	1410	280	349 J	5360	2450 J	2490 J	1300 J	681	1140	680-2,450
manganese	209 J	191 J	246 J	273 J	204 J	83.4 J	119 J	416 J	318 J	292 J	290 J	254 J	403 J	53.2-476
mercury												4.8		0.047*-0.61
nickel	8.6 J	6.1	14.1	14.7	5.8 J			13.9 J	11.2	12.4			6.1	1.5*-13.3
potassium	398 J	529 J	341 J	364 J	979 J	364 J	410 J	4630 J	446 J	494 J	612 J	576 J	459 J	349-788
sodium		169	118	152			142		172	217		196	181	77*-230
vanadium	10.1	12.7	12.5	12.4	10.5	1.7	3.1	15.9	14.5	19.6	5.9	11.5	8.5	11.3-27.3
zinc	850 J	2390 J	56.7 J	111 J	56.6 J	24.8 J	29.6 J	70.6 J	35.7 J	39.8 J	44.3	28.3 J	65.4 J	17.4-219
cyanide	0.99	0.8											1.7	0.45-3

all concentrations in mg/kg (ppm).
all shaded values exceed the Background Soil Range.
* these lower values are detection limits, not concentrations detected.
J - estimated concentration.

ATTACHMENT D

RECENT INVESTIGATIONS FOR WASTEWATER TREATMENT AREA

RECYCLED PAPER ENFORCEMENT CONFIDENTIAL

Table 7-1. Waste Water Treatment Area Soil Borings: Organic Data Summary

	SWMU-10						SWMU-12							
	B-10A	B-10B	B-10C	B-10C	B-10D	B-10E	SF-S12-A1	SF-S12-A1	SF-S12-A2	SF-S12-A3	SF-S12-B2	SF-S12-B3	SF-S12-C2	SF-S12-C2
date:	12/5/90	12/5/90	12/5/90	3/13/91	3/13/91	3/13/91	11/20/90	3/13/91	12/5/90	3/13/91	11/20/90	3/13/91	11/20/90	3/13/91
depth:	2' - 4'	2' - 4'	2' - 4'	2' - 4	2' - 4'	2' - 4'	6' - 24'	6' - 24'	6' - 24'	6' - 24'	6' - 24'	6' - 24'	6' - 24'	6' - 24'
VOLATILE ORGANICS														
chlorobenzene							2.6	13	0.024 J	0.093 J	0.046 J	0.062 J		
ethylbenzene							0.44	2.1			0.024 J			
m&p xylene							1.2	8.2	0.031 J	0.058 J	0.092 J	0.052 J		
o-xylene							0.4	3.1	0.016 J		0.032 J			
toluene					0.036 J		1.6 J	8.7 J		0.34 J	0.58 J	0.33 J	0.25 J	0.035 J
Total Volatile Organics					0.036		6.2	35	0.071	0.49	0.77	0.44	0.25	0.035
SEMI-VOLATILE ORGANICS														
Dioxins/Furans (1)														
dibenzofuran							1.1 J			0.4 J				
DCDF							7.2 J				0.2 J	3.6 J		
TRCDF							120	25 J	1.8 J	15	3.6	64 J	0.58 J	
Total							128	25	1.8	15	3.8	68	0.58	
Fingerprint Compounds														
Irgasan DP-300							340	52 J		5.6 J		26 J		
Propazine							28 J							
Tinuvin 327							26 J						0.5 J	
Total							394	52		5.6		26	0.5	
PAHs														
acenaphthene										0.6 J				
anthracene									0.38 J	1.5 J				
benzo(a)anthracene									0.8 J	3.9			0.16 J	0.49 J
benzo(a)pyrene										3.6			0.15 J	0.44 J
benzo(b)fluoranthene								0.68 J		3.2			0.22 J	0.46 J
benzo(g,h,i) perylene										2.5 J				
benzo(k)fluoranthene								0.83 J		3.8			0.28 J	0.55 J
chrysene								0.53 J	0.88 J	4.1	0.099 J		0.16 J	0.55 J
dibenz(a,h)anthracene							17							
fluoranthene							0.63 J	0.82 J	2.1 J	6.9	0.085 J	0.24 J	0.24 J	0.68 J
fluorene										0.51 J				
ideno(1,2,3-cd) pyrene										2.1				
naphthalene							2.5 J	0.38 J		0.73 J	0.071 J	0.13 J		
phenanthrene							0.48 J	0.43 J	1.5 J	5.1	0.053 J		0.063 J	0.31 J
pyrene								0.79 J	1.5 J	6.8	0.097 J	0.3 J	0.26 J	0.92 J
2-methylnaphthalene							0.5 J			0.26 J				
Total							21	4.44	7.2	45.4	0.415	0.7	1.35	4.40
Phenols														
phenol					0.12 J		1.8 J	0.27 J						
2-methylphenol							1.8 J							
4-methylphenol								0.29 J						
2,4-dichlorophenol							2.1 J	0.72 J		0.5 J		0.38 J		
Total					0.12		5.7	1.28		0.5		0.38		
Phthalates														
bis(2-ethylhexyl) phthalate					0.39 J	0.54 J								
butylbenzylphthalate													0.15 J	
diethylphthalate							1.7 J				0.099 J		0.075 J	
di-n-butylphthalate						0.41 J								
di-n-octylphthalate													0.16 J	
Total					0.39	0.95	1.7				0.099		0.39	
Total Semi-Volatile Organics					0.51	0.95	551	63	9.0	67	4.3	99	3.0	4.40

Table 7-1. Waste Water Treatment Area Soil Borings: Organic Data Summary

	SWMU-10						SWMU-12							
	B-10A	B-10B	B-10C	B-10C	B-10D	B-10E	SF-S12-A1	SF-S12-A1	SF-S12-A2	SF-S12-A3	SF-S12-B2	SF-S12-B3	SF-S12-C2	SF-S12-C2
date:	12/5/90	12/5/90	12/5/90	3/13/91	3/13/91	3/13/91	11/20/90	3/13/91	12/5/90	3/13/91	11/20/90	3/13/91	11/20/90	3/13/91
depth:	2' - 4'	2' - 4'	2' - 4'	2' - 4'	2' - 4'	2' - 4'	6' - 24'	6' - 24'	6' - 24'	6' - 24'	6' - 24'	6' - 24'	6' - 24'	6' - 24'
DIOXINS/FURANS (2)														
PECDD														
TCDF												0.0001		
PECDF						0.00016	0.088	0.057	0.0026	0.014	0.0026	0.03	0.00084	0.00055
HXCDF								0.00035				0.00024		
								0.0008						
Total						0.00016	0.088	0.058	0.0026	0.014	0.0026	0.03	0.00084	0.00055
PCBs														
1254						0.057								0.21
Total						0.057								0.21
ORGANOPHOSPHOROUS PESTICIDES														
dimethoate											0.026 J			
ethyl parathion			0.0019 J						0.0025 J			0.054 J		
famphur		0.0068 J						0.77 J				0.014 J		
methyl parathion	0.0082 J						0.032		0.0038 J					
phorate								0.017 J						
sulfotepp								0.012 J				0.004 J		
thionazin		0.0063 J												
Total	0.0082	0.0129	0.0019				0.032	0.80	0.0063		0.026	0.072		
ORGANOCHLORINE PESTICIDES														
aldrin		0.0012 J												
alpha-BHC													0.0012	0.0021
beta-BHC														0.016
delta-BHC											0.026 J			
dieldrin					0.0012			0.17		0.082 J			0.0077	
endrin aldehyde							0.23 J					0.82 J		
gamma-BHC			0.0013 J			0.0021								
gamma chlordane							3.9 J					4.6 J	0.079	
heptachlor												0.12 J		0.0045
kepone					0.0054 J									
4,4'-DDD								0.32		0.098 J		0.13 J		
4,4'-DDE										0.26 J		0.19 J	0.012	
4,4'-DDT													0.0075	
Total	4.3	0.0012	0.0013		0.0066	0.0021	4.3	0.49		0.44	0.026	0.9	0.107	0.020
HERBICIDES														
2,4,5-T							0.046	0.033				0.031		
Total							0.046	0.033				0.031		
Total Pesticides/Herbicides	0.0082	0.0141	0.0032		0.0066	0.0021	4.3	1.32	0.0063	0.44	0.052	4.0	0.107	0.020
			1	11	13	12		29	13	26	23	21	16	7

all concentrations in mg/kg (ppm).
(1) - detected by method 8270 (semi-volatiles).
(2) - detected by method 8280 (dioxins/furans).
* indicates the number, not the concentration, of TICs.
J - estimated concentration.

Table 7-2. Waste Water Treatment Area Soil Borings: Inorganic Data Summary

	SWMU-10						SWMU-12								Background Soil Range
	B-10A	B-10B	B-10C	B-10C	B-10D	B-10E	SF-S12-A1	SF-S12-A1	SF-S12-A2	SF-S12-A3	SF-S12-B2	SF-S12-B3	SF-S12-C2	SF-S12-C2	
date:	12/5/90	12/5/90	12/5/90	3/13/91	3/13/91	3/13/91	11/20/90	3/13/91	12/5/90	3/13/91	11/20/90	3/13/91	11/20/90	3/13/91	
depth:	2' - 4'	2' - 4'	2' - 4'	2' - 4'	2' - 4'	2' - 4'	6" - 24"	6" - 24"	6" - 24"	6" - 24"	6" - 24"	6" - 24"	6" - 24"	6" - 24"	
INORGANICS															
arsenic	4.2 J	3.2 J	2.9 J	5.3	4.7	4.5	8.1 J	11.7	5.8 J	8.2	7.7 J	5.2	9.5 J	9.9	5.2-36.9
barium	32	18.5	19.2	12.4	12.7	13.8	75.2	39.1	28.9	40.2	36.1	16.9	36.3	16.4	12.1-275
beryllium	0.66	0.69	0.64	0.71	0.81	0.75	0.61	0.52	0.48	0.44	0.40	0.28	0.52	0.35	0.25-0.77
cadmium							0.74								0.52-0.78
calcium	2480 J	1170 J	1100 J	763	733	924	9700 J	17700	2700 J	19600	2600 J	1680	1400 J	738	560-1,440
chromium	8.4	7.7	7.0	5.5 J	4.8 J	5.8 J	20.5	15.1 J	14.4	10.8 J	10.5	8.6 J	13	5.8 J	6.2-20
cobalt	3.9	3.9	4.5	3.5	4.5	4.3	4.0	4.2	4.7	3.7	4.4	2.8	3.6	2.5	1.8-7
copper	4.5	5.5	6.0	9.1 J	10.1 J	9.5 J	36.6	44.4 J	40.5	98 J	33.6	26.9 J	15.9	9.1 J	3.6-22.9
iron	11500	12800	11200	10100	13300	13300	15400	15800	11500	10900	10100	8370	12800	8470	7,240-28,300
lead	9.8 J	7.1 J	8.1 J	5.4 J	5.9 J	14.5 J	64	48.5 J	36.8 J	78.9 J	23	45.8 J	13	30.2 J	11.8-471
magnesium	1270 J	1990 J	1530 J	1370	1260	1400	1510 J	1440	1780 J	1240	1960 J	978	1400 J	879	683-2,450
manganese	148 J	185 J	167 J	177 J	168 J	159 J	488 J	215 J	216 J	138 J	183 J	109 J	158 J	73.6 J	53.2-476
mercury							0.14	0.3	0.08	0.47	0.06				0.047*-0.81
nickel				5	4.5	5.4	12.4	12		8.6	13.2	8.6	7.7	5.7	1.5*-13.3
potassium	1010 J	1170 J	1020 J	602 J	918 J	902 J	654 J	842 J	941 J	996 J	1100 J	535 J	569 J	384 J	349-786
silver								2.5 J		1.1 J		1.3 J			0.77*-1.0**
sodium				139	157	215		275		383		198	116	148	77*-230
vanadium	10.3	7.7	6.7	7.9	6.9	7.4	10.6	12.6	14.4	13	15	7.9	12	9.6	11.3-27.3
zinc	59.9	50.3	33.9	40.6 J	66.9 J	53 J	438 J	840 J	80.8	438 J	154 J	378 J	135 J	87.4 J	17.4-219
cyanide				0.43		0.98		0.37		0.62			1.7		0.45-3

all concentrations in mg/kg (ppm).
all shaded values exceed the Background Soil Range.
* these lower values are detection limits, not concentrations detected.
** these upper values are detection limits, not concentrations detected.
J - estimated concentration.

Table 7-3. Waste Water Treatment Area Groundwater: Organic Data Summary

	SWMUs10 & 12											
	MW-7S	MW-7S	MW-8S	MW-8S	MW-9S	MW-9S	RW-2	RW-2	MW-15D	MW-15D	MW-15S	MW-15S
date:	1/9/91	4/17/91	1/8/91	4/17/91	1/9/91	4/16/91	1/10/91	4/17/91	1/9/91	4/16/91	1/9/91	4/18/91
VOLATILE ORGANICS												
chlorobenzene			2.4 J								14	11
chloroform					4.6 J	3.8						
ethylbenzene											4.9 J	3 J
m&p xylene											23	13
o-xylene											11	6
toluene						1.7 J					30	
1,1 - dichloroethane			1 J	2.4 J							1.4 J	
1,1,1-trichloroethane				1.7 J					4.2 J			
Total Volatile Organics			3	6.1	4.6	5.5			4.2		84	33
SEMI-VOLATILE ORGANICS												
Anilines												
aniline											76	86
4-chloroaniline											4 J	6 J
Total											80	92
Benzenes												
1,2 - dichlorobenzene											2 J	1 J
Total											2 J	1
Fingerprint Compounds												
Irgasan DP-300									26 J		670	230
Propazine											170	78
Tofranil												5 J
Total									26		840	313
PAHs												
anthracene			1 J	0.62 J								
benzo(a)anthracene			1 J	1.8 J								
benzo(a)pyrene				1.4 J								
benzo(b)fluoranthene			1 J	2.3 J								
benzo(k)fluoranthene			2 J	2.9 J								
chrysene			1 J	1.9 J								
fluoranthene			3 J	4.2 J								
naphthalene	13				14				12		14	2 J
phenanthrene			1 J	1.1 J								
pyrene			3 J	2.2 J								
2-methylnaphthalene	4 J				4 J				4 J		6 J	
Total	17		13	18.4	18				16		20	2

Table 7-3. Waste Water Treatment Area Groundwater: Organic Data Summary

	SWMUs10 & 12											
	MW-7S	MW-7S	MW-8S	MW-8S	MW-9S	MW-9S	RW-2	RW-2	MW-15D	MW-15D	MW-15S	MW-15S
date:	1/9/91	4/17/91	1/8/91	4/17/91	1/9/91	4/16/91	1/10/91	4/17/91	1/9/91	4/16/91	1/9/91	4/18/91
Phenols												
phenol											61	49
4-methylphenol											67	41
2,4-dichlorophenol											10	29
Total											138	119
Phthalates												
bis(2-ethylhexyl) phthalate								36		130		
di-n-butylphthalate												1 J
di-n-octylphthalate								1.1 J				
diethylphthalate												1 J
Total								37		130		2
Miscellaneous												
acetophenone												3 J
butazolidin											20 J	7 J
n-nitrosodimethylamine											6 J	
Total												
Total Semi-Volatile Organics	17		13	18.4	18			37	42	130	1106	538 J
ORGANOCHLORINE PESTICIDES												
aldrin			0.0054 J			0.011						
alpha BHC			0.012						0.015			
alpha-chlordane	0.0031 J											
delta-BHC	0.012						0.012				0.4	
dieldrin			0.022						0.016		0.47	
endrin aldehyde												1.6 J
gamma chlordane	0.0062 J						0.074					
heptachlor				0.045								
isodrin			0.0088 J						0.014		0.14	
4,4'-DDE			0.012									
4,4'-DDT		0.007 J										
Total	0.021	0.007	0.060	0.045		0.011	0.086		0.045		1.0	1.6
HERBICIDES												
dinoseb							0.038 J					
Total							0.038					
Total Pesticides/Herbicides	0.021	0.007	0.060	0.045		0.011	0.124		0.045		1.0	1.6
	10	8	4	5	4			2	11	1	20	22

all concentrations in ug/l (ppb).
* indicates the number, not the concentration, of TICs.
J - estimated concentration.

Table 7-4. Waste Water Treatment Area Groundwater: Inorganic Data Summary

	MW-15D				MW-15S				RW-2				MW-7S				MW-8S				MW-9S				Maximum Contaminant Level
date:	1/9/91		4/16/91		1/9/91		4/18/91		1/10/91		4/17/91		1/9/91		4/17/91		1/8/91		4/17/91		1/9/91		4/16/91		
	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	
Inorganics																									
arsenic		7.2		8.9	14.7	26.7	12.7	36.5 J	5.2	8.5	6.5	17.8		33.9		52.4		5.5							50
barium	19	38	47.2	71.5	64	111	103	137	163	56	215	93.1	48	95	48.2	83.8	45	94	33.4	46.7	18	28	18.1	28	1000
beryllium				2.7																					
calcium	40400	47400	32200	37800	53400	53800	49900	51700	17500	24500	24000	33300	17600	18200	18700	18800	33400 J	37400 J	33500	33300	10500	10600	10200	11300	
chromium				15.5		31		69.7 J						25		18.3 J				35.7 J					50
cobalt							10.8 J	19.5																	
copper								26.8										29							
iron		4950	8420	23100	2730	27400	11400	36100	2650	9880	4620	19200	9550	70500	5850	63000	8480 J	24500 J	7480	12200		1390		2500	300*
lead				6.5				8.5 J				33.8 J				8.9 J				19.5 J					50
magnesium	3080	3680	4560	6380	3640	7210	4700	6690	2980	4290	4090	7670	4680	5700	4790	4970	5280	5800	6290	6690	1610	1680	1560	1970	
manganese	24	328	814	858	1370	1680	1790	1970	537	732	724	1160	679	993	871	890	1910	1340	1340	1410	405	625	206	534	50*
nickel				30.9		43	44.8	81.1 J																	
potassium					13600	13800	14200	14300	6580	6140							7580	8240	6180 J	6160	3750	3850	3560	3790	
silver							10.4 J	15.4 J																	
sodium	11400	11500	11000	12800	30600	30300	29000	29000	21800	23300	20600	19600	11100	12900	11000	11700	18700	22100	16500	16900	16700	16400	15800	17100	
zinc				170				119			90.8 J	52.1				30.3	25 J	102 J		67.6					5000*

all concentrations in ug/l (ppb).

* - secondary drinking water standard.

all shaded values exceed Maximum Contaminant Levels.

J - estimated concentration.

Table 7-5. Waste Water Treatment Area Surface Water: Organic Data Summary

	SW-01P	SW-01P
date:	11/27/90	3/29/91
VOLATILE ORGANICS		
2-hexanone		7 J
Total Volatile Organics		7
ORGANOCHLORINE PESTICIDES		
aldrin	0.016	
kepone		0.079
4,4'-DDE	0.012	
Total Pesticides	0.028	0.079

all concentrations in ug/l (ppb).
J - estimated concentration.

Table 7-6. Waste Water Treatment Area Surface Water: Inorganic Data Summary

	SW - 01P		SW - 01P		Maximum Contaminant Level
date:	11/27/90		3/29/91		
	dissolved	total	dissolved	total	
Inorganics					
barium	73	37	23	30	1000
calcium	14900	15700	11600	12300	
iron	220	1800	157	850	300*
lead	6.4	29		7.9 J	50
magnesium	1920	2000	1470	1650	
manganese	22	47	22	49	50*
potassium	4430 J	4200 J			
sodium	27700	28300	16100	16800	
zinc	46	65	33	48	5000*

all concentrations in ug/l (ppb).
* - secondary drinking water standard.
all shaded values exceed Maximum Contaminant Levels.
J - estimated concentration.

Table 7-7. Waste Water Treatment Area Sediment: Organic Data Summary

	SD - 01P	SD - 02P	SD - 01P
date:	11/29/90	11/29/90	3/29/91
VOLATILE ORGANICS			
chlorobenzene			0.12 J
toluene			0.24
Total Volatile Organics			0.36
SEMI-VOLATILE ORGANICS			
Dioxins/Furans (1)			
DCDF	0.4 J	2.2 J	3 J
TRCDF	1.4 J	5.8	5
Total	1.8	8.0	8
Fingerprint Compounds			
Tinuvin 327	0.23 J	0.51 J	
Total	0.23	0.51	
PAHs			
benzo(a)anthracene	0.18 J		0.16 J
benzo(a)pyrene			0.14 J
benzo(b)fluoranthene	0.32 J	0.46 J	0.25 J
benzo(k)fluoranthene	0.34 J	0.48 J	0.28 J
chrysene	0.22 J	0.25 J	0.24 J
fluoranthene	0.34 J	0.41 J	0.53 J
ideno(1,2,3-cd)pyrene			0.16 J
phenanthrene	0.2 J	0.23 J	0.2 J
pyrene	0.41 J	0.5 J	0.25 J
Total	2.0	2.3	2.2
Phthalates			
bis(2-ethylhexyl) phthalate	1.1 J	0.78 J	
4-chlorophenyl-phenylether		0.19 J	0.28 J
Total	1.1	0.97	0.28
Total Semi-Volatile Organics	5.1	11.8	10
DIOXINS/FURANS (2)			
TCDF	0.0034 J	0.01	0.0069
Total	0.0034	0.01	0.0069
ORGANOCHLORINE PESTICIDES			
endrin			0.002
kepone		0.079	0.057 J
4,4'-DDD	0.014 J		0.013 J
4,4'-DDE			0.022 J
4,4'-DDT			0.0097 J
Total Pesticides	0.014	0.079	0.104

all concentrations in mg/kg (ppm).
(1) - detected by method 8270 (semi-volatiles).
(2) - detected by method 8280 (dioxins/furans).
J - estimated concentration.

Table 7-8. Waste Water Treatment Area Sediment: Inorganic Data Summary

	SD - 01P	SD - 02P	SD - 01P	Background
date:	11/29/90	11/29/90	3/29/91	Soil Range
Inorganics				
arsenic	5.9 J	4.3 J	10.7	5.2-36.9
barium	28 J	23 J	41.6 J	12.1-275
beryllium	0.53	0.37	0.5 J	0.25-0.77
cadmium			0.57 J	0.52-0.78
calcium	1550 J	1130 J	3040 J	560-1,440
chromium	8.9 J	6.5 J	8 J	6.2-20
cobalt	3.2 J	2.5 J	3.3	1.8-7
copper	15.9 J	13.7 J	19.2 J	3.8-22.9
iron	8000	6370	7650	7,240-28,300
lead	50.5	32.8	103 J	11.8-471
magnesium	1090 J	906 J	975	683-2,450
manganese	94.3 J	72.2 J	176	53.2-476
nickel			6.7 J	1.5*-13.3
potassium	441	360	400	349-786
sodium			266	77*-230
vanadium	11.9	8.8	10.7	11.3-27.3
zinc	142	161 J	236 J	17.4-219

all concentrations in mg/kg (ppm).
all shaded values exceed the Background Soil Range.
* these lower values are detection limits, not concentrations detected.
J - estimated concentration.

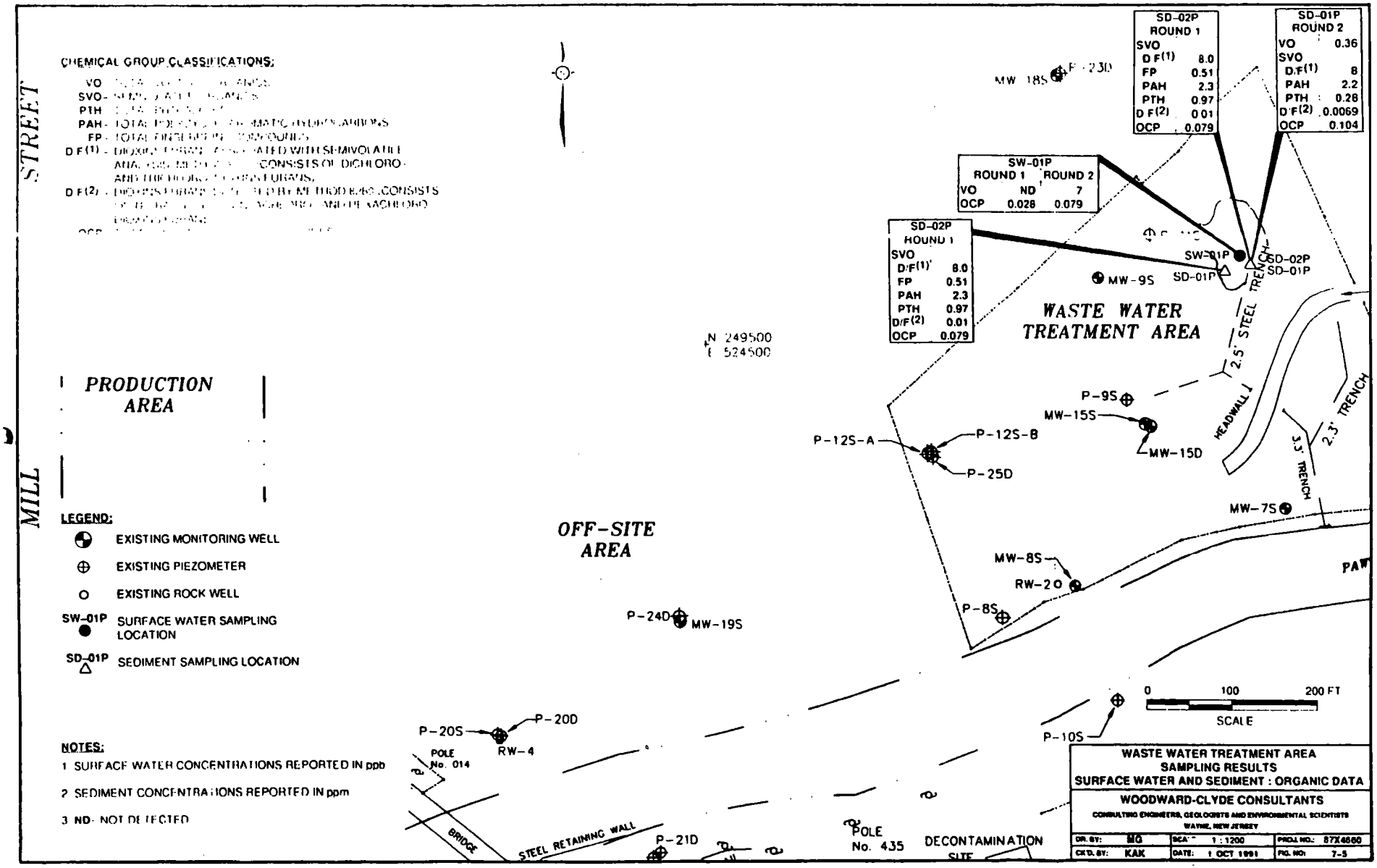
Table 7-9. Summary of the Waste Water Treatment Area Release Characterization: Soil

Fraction	SWMU-10			SWMU-12		
	Range of total concentration (N = 6) (ppm)	Mean total concentration (N = 6) (ppm)	Median total concentration* (N = 6) (ppm)	Range of total concentration (N = 8) (ppm)	Mean total concentration (N = 8) (ppm)	Median total concentration* (N = 8) (ppm)
VOC's	ND - 0.036	0.006	ND	0.035 - 35	5.4	0.5
Semi-Volatiles	ND - 0.95	0.08	ND	2.63 - 551	102	38
PCB's	ND - 0.057	0.009	ND	ND - 0.21	0.03	ND
Dioxins/Furans	ND - 0.00016	0.00003	ND	0.00055 - 0.088	0.025	0.008
Pesticides/Herbicides	ND - 0.0141	0.0057	0.0049	0.0063 - 6	1.5	0.27

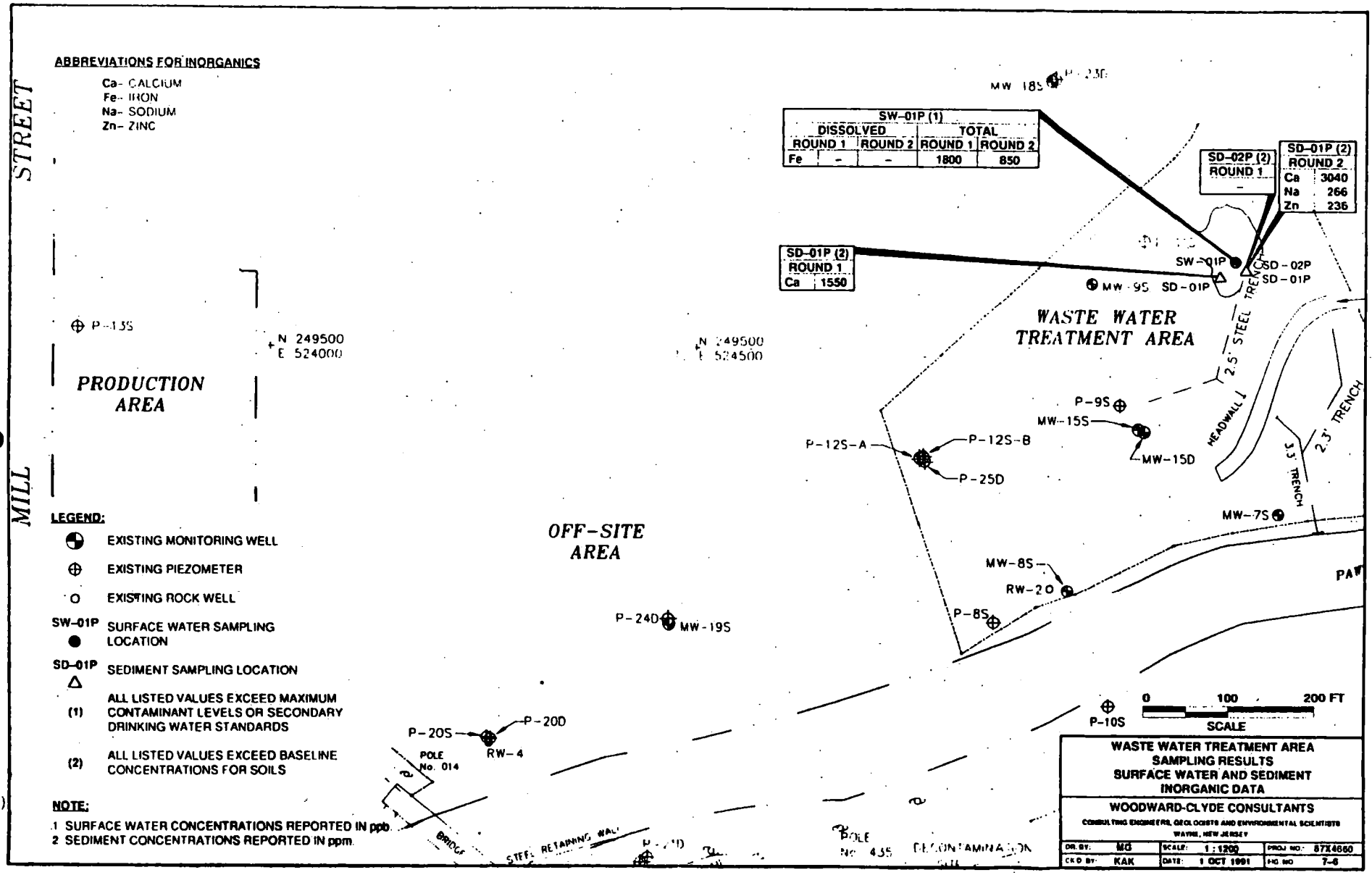
NOTES:

* - Median is the average of middle two samples.

ND - Not Detected



CHEMICAL GROUP CLASSIFICATIONS:
VO
SVO
PTH
PAH
FP
D F(1)
D F(2)
OCP
SD-02P ROUND 1
SVO
D F(1) 8.0
FP 0.51
PAH 2.3
PTH 0.97
D F(2) 0.01
OCP 0.079
SD-01P ROUND 2
VO 0.36
SVO
D/F(1) 8
PAH 2.2
PTH 0.28
D/F(2) 0.0069
OCP 0.104
SW-01P ROUND 1 ROUND 2
VO ND 7
OCP 0.028 0.079
SD-02P ROUND 1
SVO
D/F(1) 8.0
FP 0.51
PAH 2.3
PTH 0.97
D/F(2) 0.01
OCP 0.079
MW-18S
F-23D
SW-01P
SD-01P
SD-02P
SD-01P
MW-9S
WASTE WATER TREATMENT AREA
2.5' STEEL TRENCH
HEADWALL
3.3' TRENCH
2.3' TRENCH
N 249500
E 524500
PRODUCTION AREA
MILL STREET
P-9S
MW-15S
MW-15D
P-12S-A
P-12S-B
P-25D
MW-7S
OFF-SITE AREA
MW-8S
RW-2O
P-8S
P-24D
MW-19S
P-10S
0 100 200 FT
SCALE
P-20S
P-20D
RW-4
POLE No. 014
BRIDGE
STEEL RETAINING WALL
P-21D
POLE No. 435
DECONTAMINATION SITE
LEGEND:
EXISTING MONITORING WELL
EXISTING PIEZOMETER
EXISTING ROCK WELL
SW-01P SURFACE WATER SAMPLING LOCATION
SD-01P SEDIMENT SAMPLING LOCATION
NOTES:
1 SURFACE WATER CONCENTRATIONS REPORTED IN ppb
2 SEDIMENT CONCENTRATIONS REPORTED IN ppm
3 ND- NOT DETECTED
WASTE WATER TREATMENT AREA
SAMPLING RESULTS
SURFACE WATER AND SEDIMENT : ORGANIC DATA
WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY
DR. BY: MG
SCALE: 1 : 1200
PROJ. NO.: 87X4660
CK'D. BY: KAK
DATE: 1 OCT 1991
FIG. NO: 7-5


ABBREVIATIONS FOR INORGANICS
Ca- CALCIUM
Fe- IRON
Na- SODIUM
Zn- ZINC
STREET
MILL
PRODUCTION AREA
N 249500
E 524000
N 249500
E 524500
OFF-SITE AREA
WASTE WATER TREATMENT AREA
SW-01P (1)
DISSOLVED ROUND 1 ROUND 2
TOTAL ROUND 1 ROUND 2
Fe - - 1800 850
SD-01P (2) ROUND 1
Ca 1550
SD-02P (2) ROUND 1
-
SD-01P (2) ROUND 2
Ca 3040
Na 266
Zn 236
SW-01P
SD-02P
SD-01P
MW-9S
MW-18S
P-13S
P-9S
MW-15S
MW-15D
P-12S-A
P-12S-B
P-25D
MW-7S
MW-8S
RW-2O
P-8S
P-24D
MW-19S
P-20S
P-20D
RW-4
POLE No. 014
P-10S
STEEL TRENCH
2.5' STEEL TRENCH
HEADWALL
2.3' TRENCH
3.3' TRENCH
BRIDGE
STEEL RETAINING WALL
POLE No. 435
DECONTAMINATION
0 100 200 FT
SCALE
LEGEND:
EXISTING MONITORING WELL
EXISTING PIEZOMETER
EXISTING ROCK WELL
SW-01P SURFACE WATER SAMPLING LOCATION
SD-01P SEDIMENT SAMPLING LOCATION
(1) ALL LISTED VALUES EXCEED MAXIMUM CONTAMINANT LEVELS OR SECONDARY DRINKING WATER STANDARDS
(2) ALL LISTED VALUES EXCEED BASELINE CONCENTRATIONS FOR SOILS
NOTE:
1 SURFACE WATER CONCENTRATIONS REPORTED IN ppb.
2 SEDIMENT CONCENTRATIONS REPORTED IN ppm.
WASTE WATER TREATMENT AREA
SAMPLING RESULTS
SURFACE WATER AND SEDIMENT
INORGANIC DATA
WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY
DR. BY: MG
SCALE: 1:1200
PROJ NO: 87X4660
CKD BY: KAK
DATE: 1 OCT 1991
FIG NO 7-6

ATTACHMENT E

RECENT INVESTIGATIONS FOR PAWTUXET AREA

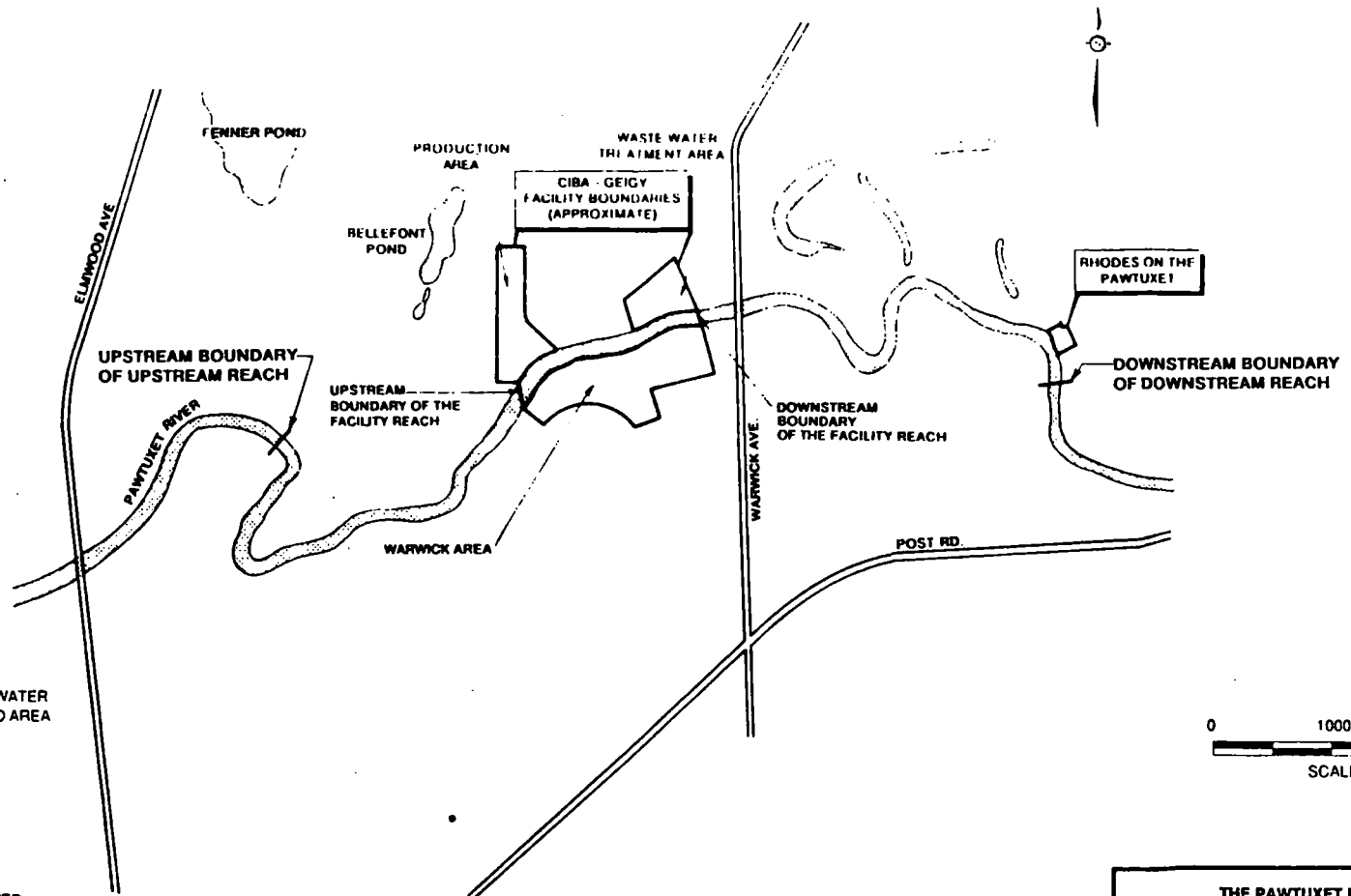
RECYCLED PAPER ENFORCEMENT CONFIDENTIAL

Table 9-3. Baseline Concentrations for Inorganics in River Surface Water[1]

Inorganic	Fraction Dissolved (ppb)	Fraction Total (ppb)
barium	14	16
calcium	11,700	11,600
iron	270	590
lead	—	23
magnesium	1620	1630
manganese	130	140
nickel	—	26
potassium[2]	3110	—
sodium	33,200	32,600
zinc	—	25
cyanide	—	19

NOTES:

1. The surface water sampling methodology is discussed in detail in Appendix L.
2. The dissolved concentration of potassium is an estimated value.



LEGEND

MAJOR SURFACE WATER BODIES IN MAPPED AREA

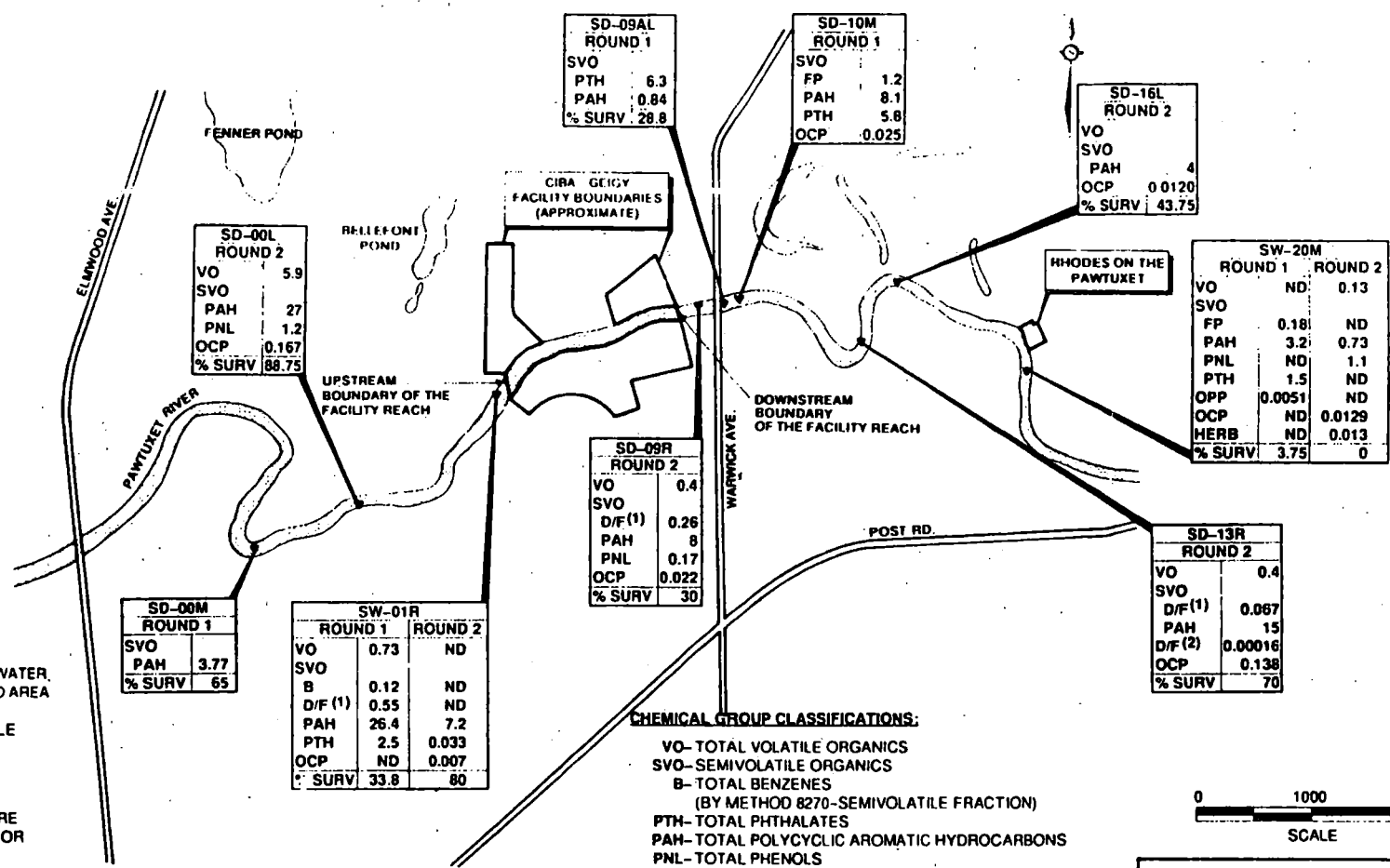
NOTE:
SEDIMENT SAMPLES WERE ANALYZED FOR APPENDIX IX COMPOUNDS AND BIOASSAY

BASE MAP SOURCE:
AERIAL PHOTOGRAPHS BY GEOD CORPORATION OF NEWFOUNDLAND, NEW JERSEY.
DATE FLOWN: 2 APRIL 1989.

THE PAWTUXET RIVER REACHES: UPSTREAM, FACILITY, AND DOWNSTREAM

WOODWARD – CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR. BY:	MG	SCALE:	1 : 12000	PROJ. NO.	87X4860
CK'D BY:	KAK	DATE:	1 OCT 1991	FIG. NO.	5-2



SD-00L ROUND 2	
VO	5.9
SVO	
PAH	27
PNL	1.2
OCP	0.167
% SURV	88.75

SD-09AL ROUND 1	
SVO	
PTH	6.3
PAH	0.84
% SURV	28.8

SD-10M ROUND 1	
SVO	
FP	1.2
PAH	8.1
PTH	5.8
OCP	0.025

SD-16L ROUND 2	
VO	
SVO	
PAH	4
OCP	0.0120
% SURV	43.75

SW-20M	ROUND 1	ROUND 2
VO	ND	0.13
SVO		
FP	0.18	ND
PAH	3.2	0.73
PNL	ND	1.1
PTH	1.5	ND
OPP	0.0051	ND
OCP	ND	0.0129
HERB	ND	0.013
% SURV	3.75	0

SD-09R ROUND 2	
VO	0.4
SVO	
D/F(1)	0.26
PAH	8
PNL	0.17
OCP	0.022
% SURV	30

SD-13R ROUND 2	
VO	0.4
SVO	
D/F(1)	0.067
PAH	15
D/F(2)	0.00016
OCP	0.138
% SURV	70

SD-00M ROUND 1	
SVO	
PAH	3.77
% SURV	65

SW-01R	ROUND 1	ROUND 2
VO	0.73	ND
SVO		
B	0.12	ND
D/F (1)	0.55	ND
PAH	26.4	7.2
PTH	2.5	0.033
OCP	ND	0.007
% SURV	33.8	80

LEGEND

MAJOR SURFACE WATER BODIES IN MAPPED AREA

SD-00M ▼ SEDIMENT SAMPLE LOCATION

NOTES:

1. SOME SEDIMENT SAMPLES WERE COLLECTED DURING ROUND 1 OR ROUND 2 ONLY, AS NOTED.
2. ND- NOT DETECTED.
3. ALL CONCENTRATIONS REPORTED IN PARTS PER MILLION (ppm).

BASE MAP SOURCE:

AERIAL PHOTOGRAPHS BY GEOD CORPORATION OF NEWFOUNDLAND, NEW JERSEY. DATE FLOWN: 2 APRIL 1989.

CHEMICAL GROUP CLASSIFICATIONS:

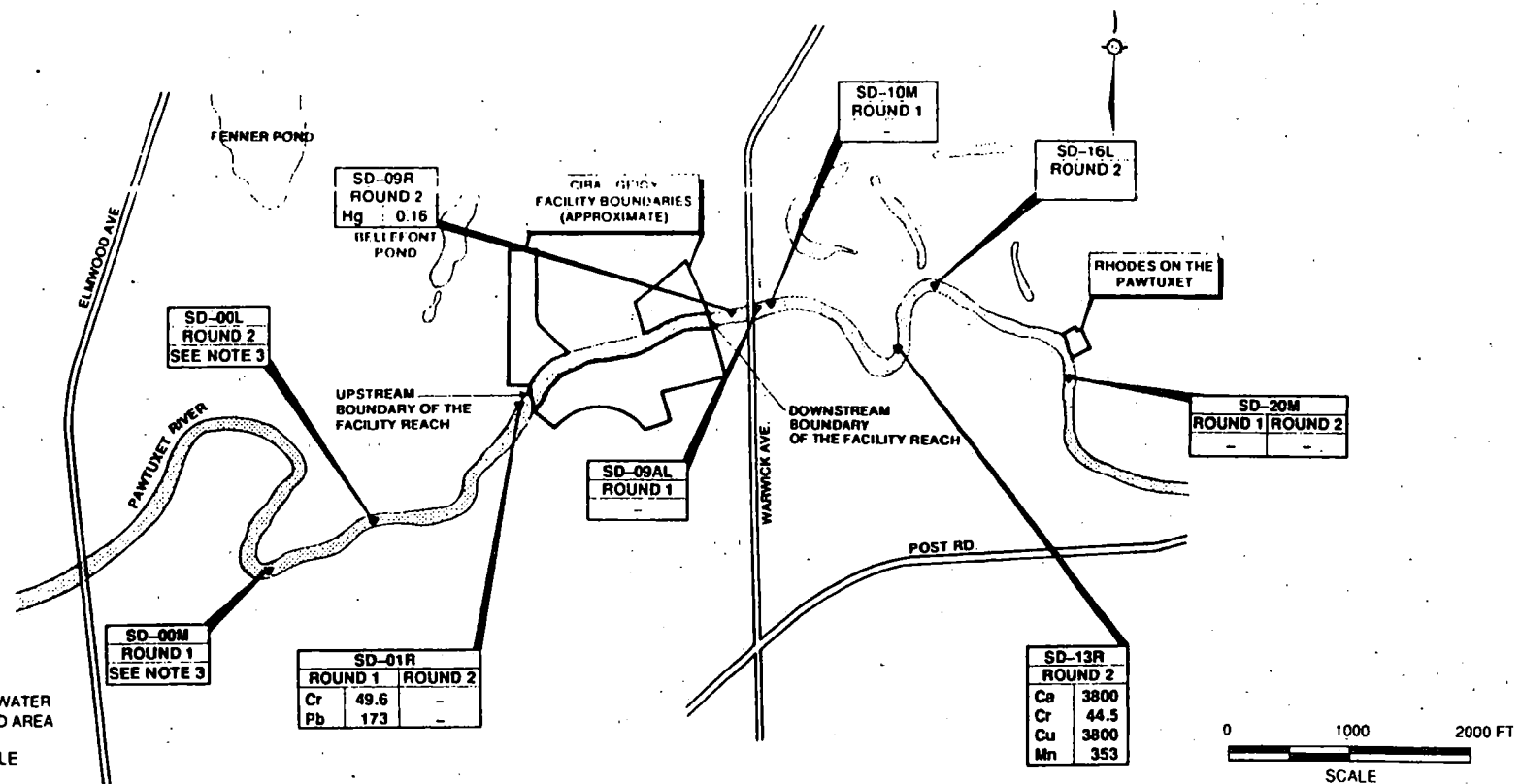
VO- TOTAL VOLATILE ORGANICS
SVO- SEMIVOLATILE ORGANICS
B- TOTAL BENZENES (BY METHOD 8270-SEMIVOLATILE FRACTION)
PTH- TOTAL PHTHALATES
PAH- TOTAL POLYCYCLIC AROMATIC HYDROCARBONS
PNL- TOTAL PHENOLS
FP- TOTAL FINGERPRINT COMPOUNDS
D/F (1) - DIOXINS/FURANS ASSOCIATED WITH SEMIVOLATILE ANALYSIS-METHOD 8270 (CONSISTS OF DICHLORO- AND TRICHLORO-DIOXINS/FURANS AND DIBENZOFURAN)
HERB- TOTAL HERBICIDES
OPP- TOTAL ORGANOPHOSPHOROUS PESTICIDES
OCP- TOTAL ORGANOCHLORINE PESTICIDES
% SURV- PERCENT SURVIVAL RATE OF MIDGE LARVAE C. TENTANS, 10 DAY ACUTE BIOASSAY TEST

0 1000 2000 FT
SCALE

UPSTREAM AND DOWNSTREAM REACH SAMPLING RESULTS
SEDIMENT : ORGANIC DATA AND BIOASSAY DATA

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR. BY: MC BAS	SCALE: 1 : 12000	PROJ. NO.: 87X4660
CK'D. BY: KAK	DATE: 1 OCT 1991	FIG. NO: 9-5



ABBREVIATIONS FOR METALS:

Ca- CALCIUM
Cr- CHROMIUM
Cu- COPPER
Pb- LEAD
Mn- MANGANESE

LEGEND

MAJOR SURFACE WATER BODIES IN MAPPED AREA

SD-00M SEDIMENT SAMPLE LOCATION

— DID NOT EXCEED BASELINE

NOTES:

1. ALL CONCENTRATIONS REPORTED IN PARTS PER MILLION (ppm).
2. ALL LISTED CONCENTRATIONS EXCEED BASELINE.
3. USED TO ESTABLISH BASELINE CONCENTRATIONS.

BASE MAP SOURCE:

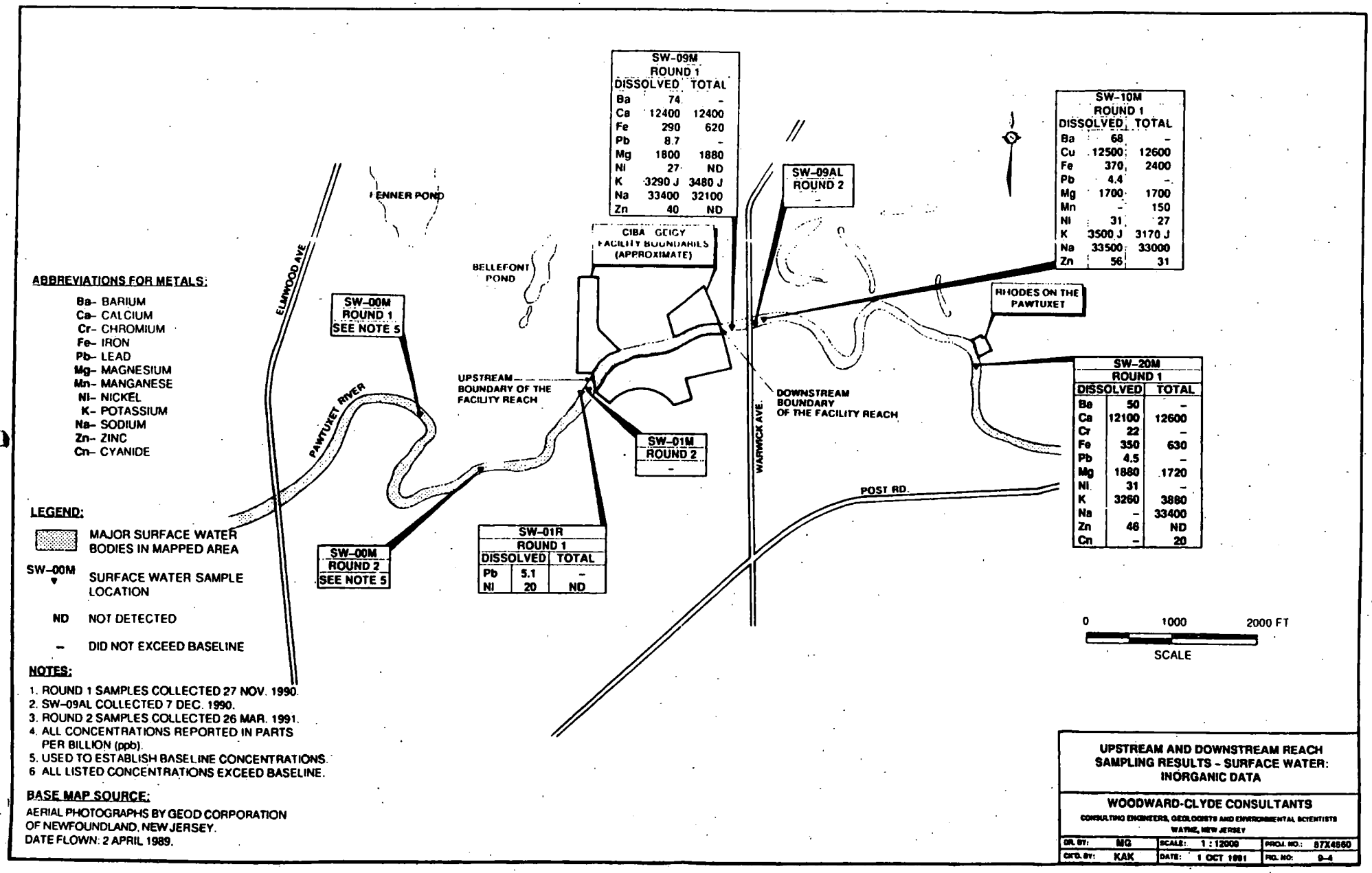
AERIAL PHOTOGRAPHS BY GEOD CORPORATION OF NEWFOUNDLAND, NEW JERSEY. DATE FLOWN. 2 APRIL 1989.

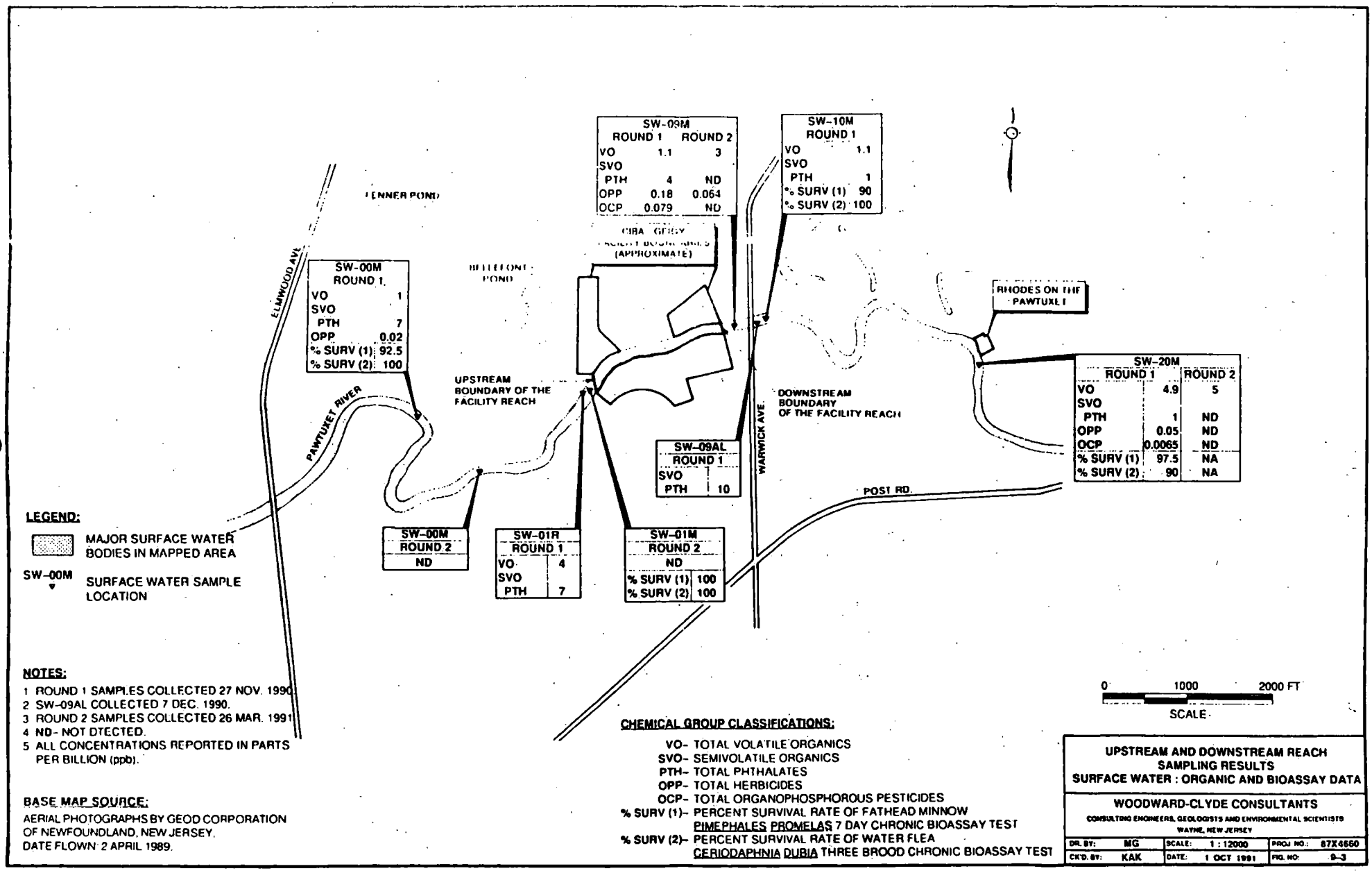
UPSTREAM AND DOWNSTREAM REACH SAMPLING RESULTS – SEDIMENT : INORGANIC DATA

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR. BY: MG BAS	SCALE: 1 : 12000	PROJ. NO.: 87X4560
CK'D. BY: KAK	DATE: 1 OCT 1991	FIG. NO: 9-8


SW-09M
ROUND 1
DISSOLVED TOTAL
Ba 74 -
Ca 12400 12400
Fe 290 620
Pb 8.7 -
Mg 1800 1880
Ni 27 ND
K 3290 J 3480 J
Na 33400 32100
Zn 40 ND
SW-10M
ROUND 1
DISSOLVED TOTAL
Ba 68 -
Cu 12500 12600
Fe 370 2400
Pb 4.4 -
Mg 1700 1700
Mn - 150
Ni 31 27
K 3500 J 3170 J
Na 33500 33000
Zn 56 31
SW-09AL
ROUND 2
-
CIBA GEIGY
FACILITY BOUNDARIES
(APPROXIMATE)
FENNER POND
BELLEFONT POND
ELMWOOD AVE
PAWTUXET RIVER
SW-00M
ROUND 1
SEE NOTE 5
UPSTREAM BOUNDARY OF THE FACILITY REACH
SW-01M
ROUND 2
-
WARWICK AVE.
DOWNSTREAM BOUNDARY OF THE FACILITY REACH
RHODES ON THE PAWTUXET
SW-20M
ROUND 1
DISSOLVED TOTAL
Ba 50 -
Ca 12100 12600
Cr 22 -
Fe 350 630
Pb 4.5 -
Mg 1880 1720
Ni 31 -
K 3260 3880
Na - 33400
Zn 46 ND
Cn - 20
POST RD.
SW-00M
ROUND 2
SEE NOTE 5
SW-01R
ROUND 1
DISSOLVED TOTAL
Pb 5.1 -
Ni 20 ND
0 1000 2000 FT
SCALE
ABBREVIATIONS FOR METALS:
Ba- BARIUM
Ca- CALCIUM
Cr- CHROMIUM
Fe- IRON
Pb- LEAD
Mg- MAGNESIUM
Mn- MANGANESE
Ni- NICKEL
K- POTASSIUM
Na- SODIUM
Zn- ZINC
Cn- CYANIDE
LEGEND:
MAJOR SURFACE WATER BODIES IN MAPPED AREA
SW-00M
SURFACE WATER SAMPLE LOCATION
ND NOT DETECTED
- DID NOT EXCEED BASELINE
NOTES:
1. ROUND 1 SAMPLES COLLECTED 27 NOV. 1990.
2. SW-09AL COLLECTED 7 DEC. 1990.
3. ROUND 2 SAMPLES COLLECTED 26 MAR. 1991.
4. ALL CONCENTRATIONS REPORTED IN PARTS PER BILLION (ppb).
5. USED TO ESTABLISH BASELINE CONCENTRATIONS.
6. ALL LISTED CONCENTRATIONS EXCEED BASELINE.
BASE MAP SOURCE:
AERIAL PHOTOGRAPHS BY GEOD CORPORATION OF NEWFOUNDLAND, NEW JERSEY.
DATE FLOWN: 2 APRIL 1989.
UPSTREAM AND DOWNSTREAM REACH SAMPLING RESULTS - SURFACE WATER: INORGANIC DATA
WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY
DR. BY: MG
SCALE: 1 : 12000
PROJ. NO.: 87X4660
CK'D. BY: KAK
DATE: 1 OCT 1991
FIG. NO: 9-4



LEGEND:

MAJOR SURFACE WATER BODIES IN MAPPED AREA

SW-00M SURFACE WATER SAMPLE LOCATION

NOTES:

1 ROUND 1 SAMPLES COLLECTED 27 NOV. 1990
2 SW-09AL COLLECTED 7 DEC. 1990.
3 ROUND 2 SAMPLES COLLECTED 26 MAR. 1991
4 ND- NOT DTECTED.
5 ALL CONCENTRATIONS REPORTED IN PARTS PER BILLION (ppb).

BASE MAP SOURCE:

AERIAL PHOTOGRAPHS BY GEOD CORPORATION OF NEWFOUNDLAND, NEW JERSEY. DATE FLOWN 2 APRIL 1989.

CHEMICAL GROUP CLASSIFICATIONS:

VO- TOTAL VOLATILE ORGANICS
SVO- SEMIVOLATILE ORGANICS
PTH- TOTAL PHTHALATES
OPP- TOTAL HERBICIDES
OCP- TOTAL ORGANOPHOSPHOROUS PESTICIDES
% SURV (1)- PERCENT SURVIVAL RATE OF FATHEAD MINNOW PIMEPHALES PROMELAS 7 DAY CHRONIC BIOASSAY TEST
% SURV (2)- PERCENT SURVIVAL RATE OF WATER FLEA CERIODAPHNIA DUBIA THREE BROOD CHRONIC BIOASSAY TEST

UPSTREAM AND DOWNSTREAM REACH SAMPLING RESULTS
SURFACE WATER : ORGANIC AND BIOASSAY DATA

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR. BY:	MG	SCALE:	1 : 12000	PROJ NO.:	87X4660
CK'D. BY:	KAK	DATE:	1 OCT 1991	FIG. NO:	9-3

Table 9-1. Pawtuxet River Surface Water Samples: Organic Data Summary

	UPSTREAM REACH				FACILITY REACH							DOWNSTREAM REACH					
	SW-00M	SW-00M	SW-01M	SW-01R	SW-03M	SW-04M	SW-04M-DUP	SW-06M	SW-06M-DUP	SW-07M	SW-08M	SW-09A	SW-09M	SW-09M	SW-10M	SW-20M	SW-20M
date:	11/27/90	3/26/91	3/26/91	11/27/90	11/27/90	3/26/91	3/26/91	11/27/90	11/27/90	11/27/90	11/27/90	12/7/90	11/27/90	3/26/91	11/27/90	11/27/90	3/26/91
VOLATILE ORGANICS																	
chlorobenzene	1 J			1 J	1.2 J			1.2 J	1.2 J	1.1 J	1 J		1.1 J		1.1 J	1.1 J	
chloroform						4 J								2 J			
iodomethane																	2 J
m&p-xylene				1.3 J	1.6 J			1.2 J	0.9 J							1.6 J	1 J
o-xylene				0.5 J	0.5 J			0.5 J	0.3 J							0.7 J	
toluene				1.3 J	1.3 J	2 J		1.1 J	0.8 J					1 J		1.5 J	2 J
Total Volatile Organics	1			4	4.6	6		4.0	3.2	1.1	1		1.1	3	1.1	4.9	6
SEMI-VOLATILES ORGANICS																	
Phthalates																	
bis(2-ethylhexyl) phthalate	7 J			7 J	1 J			1 J	2 J	3 J	5 J		4 J		1 J	1 J	
di-n-octyl-phthalate												10					
Total Semi-Volatile Organics	7			7	1			1	2	3	5	10	4		1	1	
ORGANOPHOSPHOROUS PESTICIDES																	
dimethoate									0.16 J					0.064 J			
disulfoton								0.022 J								0.02 J	
ethyl parathion											0.029 J						
famphur									0.078 J	0.073 J							
methyl parathion	0.02 J												0.18			0.025 J	
Total	0.02							0.022	0.24	0.073	0.029		0.18	0.064		0.05	
ORGANOCHLORINE PESTICIDES																	
beta-BHC										0.048	0.038		0.052				
dieldrin								0.0077 J									
4,4'-DDE					0.0082 J											0.0065 J	
4,4'-DDT											0.025		0.027				
Total					0.0082			0.0077		0.048	0.063		0.079			0.0065	
Total Pesticides	0.02				0.0082			0.0297	0.24	0.121	0.092		0.26	0.064		0.05	
TOTAL NO. OF TICs	7	4	3	9	2	3	2	4	4	3	1	6	3	3	2	2	7

all concentrations in ug/l (ppb).
* indicates the number, not the concentration, of TICs.
J - estimated concentration.

Table 9-7. Pawtuxet River Sediment Samples: Inorganic Data Summary

	UPSTREAM REACH				FACILITY REACH																			DOWNSTREAM REACH						
	SD-00L	SD-00M	SD-01R	SD-01R	SD-02L	SD-02L	SD-02R	SD-02R	SD-03L	SD-03L	SD-03R	SD-03R-DUP	SD-03R	SD-04R	SD-05L	SD-05M	SD-06R	SD-07L	SD-07L	SD-07LDUP	SD-08M	SD-08M	SD-08AL	SD-09R	SD-10M	SD-13R	SD-16L	SD-20M	SD-20M
date	3/28/91	11/28/90	11/29/90	3/26/91	11/28/90	2/26/91	11/28/90	2/26/91	11/28/90	3/27/91	11/25/90	11/28/90	3/26/91	3/27/91	11/29/90	3/26/91	11/29/90	11/29/90	3/26/91	3/26/91	11/29/90	3/27/91	12/7/90	3/27/91	11/28/90	3/27/91	3/29/91	11/29/90	3/29/91
Inorganics																													
antimony			0.98 J				6.9 J	1.6 J			5.4 J	2.6 J																	
arsenic	18.5	9.6 J	6.2 J	5.2	23.5 J	38.2	33.7 J	23	1.6 J	12.8	17.7 J	19.6 J	23.3	11.1	2 J	3.5	3.9 J	8.6 J	18.3	21.1	3.2 J	4.6	2 J	6.9	2.2 J	10.5	4.4	2.9 J	4.4
barium	97.9 J	13.1 J	31.5 J	14.4 J	378 J	269 J	380 J	220 J	18.3 J	247 J	126 J	74.2 J	122 J	44.4 J	15.3 J	14.7 J	26.7 J	104 J	130 J	277 J	15.5 J	22.2 J	8.5	38.6 J	27 J	80.5 J	23.7 J	15.7 J	17.5 J
beryllium	2.1 J	0.5	0.59	0.42 J	4	3.6 J	4.2	2.3 J	0.5	2 J	2	0.72	2 J	0.91 J	0.83	0.48 J	0.66	1.6	2.8 J	4.9 J	0.5	0.57 J		0.81 J	0.57	1.7 J	0.69 J	0.49	0.64 J
cadmium	7.4 J		2.4		6.7	5.3 J	15.3	22 J	0.72	6.5 J	9.7	25.1	11 J	0.94 J			2	8.9	13.6 J	23.4 J				3.4 J	1.6	6.5 J			
calcium	2400 J	863 J	965 J	487 J	4830 J	3380 J	5720 J	3810 J	881 J	2460 J	3010 J	1970 J	2040 J	1350 J	710 J	522 J	657 J	1720 J	3070 J	4430 J	677 J	1480 J	340 J	1100 J	1250 J	3800 J	784 J	527 J	513 J
chromium	43.5 J	16.4 J	48.6 J	10.8 J	1260 J	715 J	384 J	585 J	13.9 J	64.8 J	463 J	457 J	305 J	81.7 J	15.6 J	19.5 J	23.1 J	55.7 J	77.2 J	130 J	14.6 J	15.4 J	5.6	21.9 J	15.9 J	44.5 J	19.4 J	9.3 J	11.9 J
cobalt	6.3	2.1 J	3.3 J	2.3	11 J	10.9	10.9 J	6.2	2.3 J	6.1	7.4 J	4.5 J	10.2	3.9	1.6 J	2	2.6 J	6.1 J	12.8	18	2.1 J	2.1	1.9	4	3.3	3.9	3.6	1.3 J	1.9
copper	87.6 J	9 J	66.4 J	27.3 J	1060 J	816 J	853 J	947 J	15.1 J	98.6 J	337 J	470 J	308 J	61.5 J	15.2 J	14.5 J	21.3 J	194 J	226 J	458 J	10.5 J		9.6	48.6 J	21.5 J	117 J	16.6 J	4 J	
iron	13800	7230	7700	4770	26000	22300	24300	23300	6010	16100	21300	18300	27700	9960	4570	5120	6360	12400	21800	32500	5660	7810	7300	6320	6810	11600	8550	5760	6750
lead	131 J	19.7	173	11 J	221	376 J	829	684 J	14.1	100 J	300	273	223	78.3 J	24.7	15 J	28.4	127	800 J	271 J	13	16.5 J	128 J	70.9 J	18.5	64.9 J	13.9 J	13.6	13.5 J
magnesium	2180	1570 J	974 J	608	3950 J	3730	3010 J	2250	688 J	2200	3720 J	1270 J	3200	1740	734 J	931	913 J	1370 J	2460	3070	688 J	1270	760 J	1430	1020 J	1380	1320	902 J	482
manganese	344	137 J	147 J	88.3	377 J	320	684 J	514	93.9 J	574	315 J	309 J	369	130	74.2 J	76	140 J	304 J	621	1270	88.8 J	144	120 J	129	194 J	353	198	79.9 J	198
mercury			0.14 J		0.83 J	2.8	0.39 J	)		0.25	0.88 J	0.88 J	1.4	0.091				0.34 J	0.35	0.48				0.16					
nickel	30.3 J		13.1	4.6 J	88.7	27.1 J	108	125 J		29.1 J	34.7	34.5	31.5 J	9.9 J		8.6 J		39.2	88.9 J	117 J		8.3 J		16 J		23.2 J	7.8 J		4.8 J
potassium	1440	472	380	300	1950	1920	1910	1080	588	1850	1880	779	2040	918	269	297		621	1650	1910	410	854		633	534	921	435	327	
silver					2.3	4.6 J	17.1	6.8 J										1.3	3.5 J	10.6 J									
sodium	448			148		544	653	748		716	552	481	581	298		124			902	630		244		225		423	158		178
vanadium	14.5	4.4	11.1	3.1	58.7	33.8	46.4	44	3.5	12.5	28.7	19.1	28.8	10.8	2.1	3.3	2.9	13.4	30.7	34.9	3.3	5	4.1	7.8	4.5	10.2	4.6		
zinc	229 J	35.2 J	139 J	89 J	2150 J	1570 J	1770 J	1450 J	43.4 J	821 J	12100 J	30300 J	13800 J	225 J	47 J	41.9 J	63.1 J	225 J	370 J	832 J	32.3 J	43.7 J	38	113 J	58.4 J	185 J	50.4 J	31.3 J	44.3 J
tin					58.8		75.2	23.9										18.3		58.6									
cyanide					22.1	23.6	31.4	13.2		2.8	12	10.6	3					1.1	1.3	2.1									

all concentrations in mg/kg (ppm).

J - estimated concentration.

Shaded values exceed baseline concentrations, as shown in Table 9-6.

Table 9-2 Pawtuxet River Surface Water Samples: Inorganic Data Summary

	UPSTREAM REACH								FACILITY REACH														DOWNSTREAM REACH												Baseline Level	
	SW-00M		SW-00M		SW-01R		SW-01M		SW-03M		SW-04M		SW-04M-DUP		SW-05M		SW-05M-DUP		SW-07M		SW-08M		SW-08A		SW-08M		SW-09M		SW-10M		SW-20M		SW-20M			
date	11/27/90		3/26/91		11/27/90		3/26/91		11/27/90		3/26/91		3/26/91		11/27/90		11/27/90		11/27/90		11/27/90		12/7/90		11/27/90		3/26/91		11/27/90		11/27/90		3/26/91			
	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total	dissolved	total
Inorganics																																				
barium	14	16	12	14	14	15	13	14	13	16	12	13	12	13	54	19	31	16	14	16	59	16	11	14	74	16	12	14	59	16	50	19	12	14	14	16
calcium	11700	11600	6620	6730	11700	11300	6560	6810	11700	11600	6660	6710	6620	6620	12000	11600	12000	11900	12000	12000	12200	12100	6660	7210	12400	12400	6760	6800	12200	12600	12100	12600	6640	6660	11700	11600
chromium																															23					
iron	270	560	140	424	160	640	109	377	170	560	109	369	109	367	169	650	510	670	1110	1360	190	660	67	440	600	600	127	395	370	3400	360	630	110	419	270	560
lead		23		3.5 J	6.11	4.9		3.9 J		3.9		3.7 J		3.3 J	13		13	7.3	5.8	12	3.7	3.8			47	8		3.4 J	140	10	43	6.1		3.7 J		23
magnesium	1620	1630	1160	1230	1620	1570	1160	1160	1640	1620	1160	1170	1170	1140	1670	1650	1660	1670	1660	1640	1660	1670	1260	1310	1660	1660	1160	1160	1160	1160	1160	1160	1160	1170	1620	1630
manganese	130	140	62	71	130	140	69	71	130	140	63	72	62	73	130	140	130	140	140	140	130	140	67	69	130	140	61	72	130	160	130	140	63	76	130	140
nickel		26			30				26							27		23	21	26	22	21			37					47	21	26				26
potassium	3110 J								3000 J	3000 J					3160	3160	3110 J	3170 J	3430 J	3430 J	3260 J	3430 J			3000 J	3000			3000 J	3170 J	3260 J	3300 J			3110	
silver										37																										
sodium	33700	35800	17400	17100	32700	31400	16800	16800	32700	32300	17600	17800	17400	17400	33700	32600	33100	33000	32600	32500	33600	34000	17600	16600	34400	33100	17300	17300	34000	34000	32500	33000	17400	17400	33200	32600
zinc		25													31		65				40				40				30	31	40					25
cyanide	NA	19	NA		NA	11	NA		NA	10	NA		NA		NA	14	NA	11	NA	11	NA	11	NA		NA	12	NA		NA	18	NA	30	NA		NA	19

all concentrations in ug/l (ppb).

all shaded values exceed Maximum Contaminant Levels.

* - secondary drinking water standards.

J - estimated concentration.

NA - Not Analyzed.